SEN00237-09

Shop Manual

ARTICULATED
DUMP TRUCK

HM300-2

SERIAL NUMBERS 2001 and up

ecot3

KOMATSU

ARTICULATED DUMP TRUCK

HM300-2

Machine model	Serial number
HM300-2	2001 and up

00 Index and foreword

Index

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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HM300-2 Articulated dump truck

Form No. SEN00324-09

ARTICULATED DUMP TRUCK

HM300-2

Machine model	Serial number
HM300-2	2001 and up

00 Index and foreword

Foreword and general information

Safety notice

(Rev. 2008/08)

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. In addition, read this manual and understand its contents before starting the work.**

1) Before carrying out any greasing or repairs, read all the safety labels stuck to the machine. For the locations of the safety labels 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.
9) Avoid continuing work for long hours and take rests at proper intervals to keep your body in good condition. Take rests in specified safe places.

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

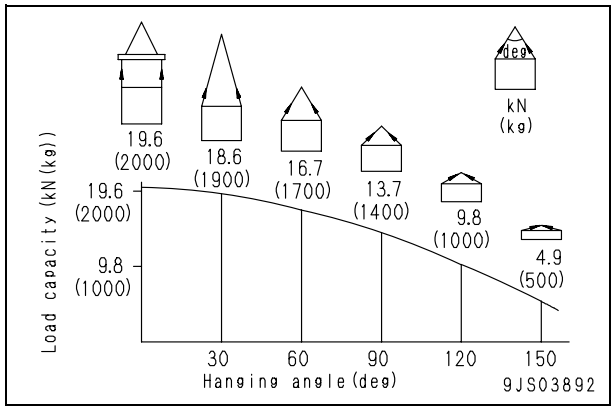
1) Before adding oil or making any repairs, park the machine on a hard and level ground, and apply the parking brake and block the wheels or tracks to prevent the machine from moving.
2) Before starting work, lower the work equipment (blade, ripper, bucket, etc.) to the ground. If this is not possible, 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

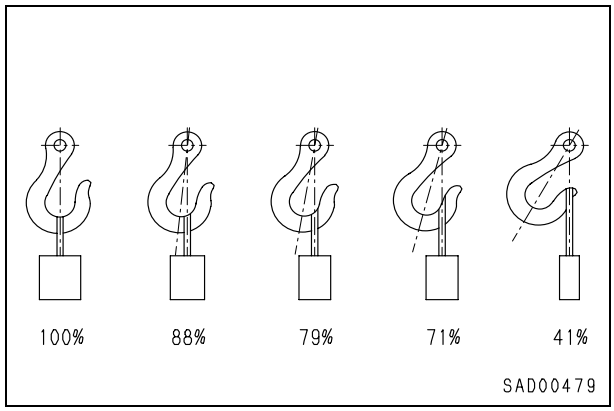
1) Before disconnecting or removing components of the oil, water, or air circuits, first release the pressure completely from the circuit. When removing the oil filler cap, a drain plug, or an oil pressure pickup plug, loosen it slowly to prevent the oil from spurting out.
2) The coolant and oil in the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

⚠ **For the environment, the air conditioner of this machine uses the refrigerant (air conditioner gas: R134a) which has fewer factors of the depletion of the ozone layer. However, it does not mean that you may discharge the refrigerant into the atmosphere as it is. Be sure to recover the refrigerant when disconnecting the refrigerant gas circuit and then reuse it.**

★ Ask professional traders for collecting and filling operation of refrigerant (R134a).

★ Never release the refrigerant (R134a) to the atmosphere.

⚠ **If the refrigerant gas gets in your eyes or contacts your skin, you may lose your sight and your skin may be frozen. Accordingly, put on safety glasses, safety gloves and safety clothes when recovering or adding the refrigerant.**
Refrigerant gas must be recovered and added by a qualified person.

2) Connection

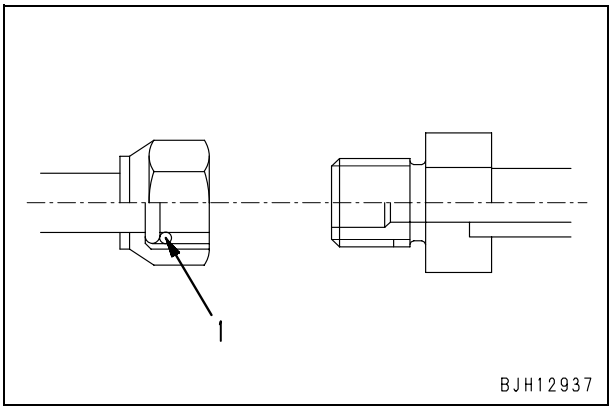
1] When installing the air conditioner circuit hoses and tubes, take care that dirt, dust, water, etc. will not enter them.

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, VALEO THERMAL SYSTEMS: 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 chapter explains the criteria for replacing or reusing products and parts in the machine maintenance work. The following terms are used to explain the criteria.

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:

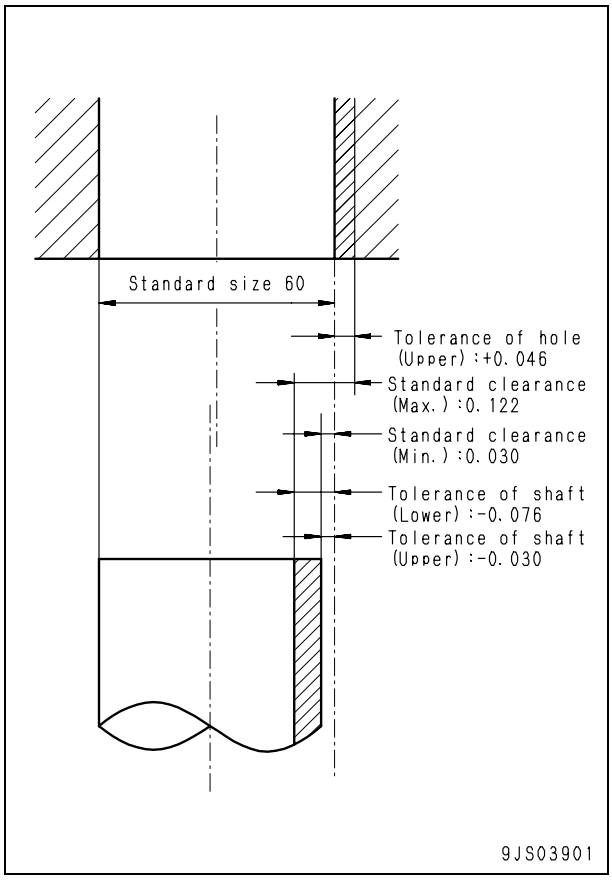
Standard size	Tolerance
120	–0.022 –0.126

★ 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 or allowable dimension

- 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, it must be replaced or repaired.
- The performance and function of a product lowers while it is used. A value which the product can be used without causing a problem is called the “allowable value” or “allowable dimension”.
- 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 of electric equipment and hydraulic component

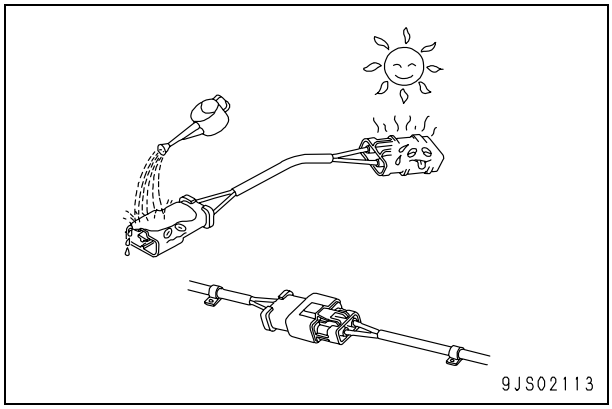
To maintain the performance of the machine over a long period, and to prevent failures or other troubles before they occur, correct “operation“, “maintenance and inspection“, “troubleshooting“, and “repairs” must be carried out. This section deals particularly with correct repair procedures for mechatronics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

Points to remember when handling electric equipment

1. Handling wiring harnesses and connectors

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

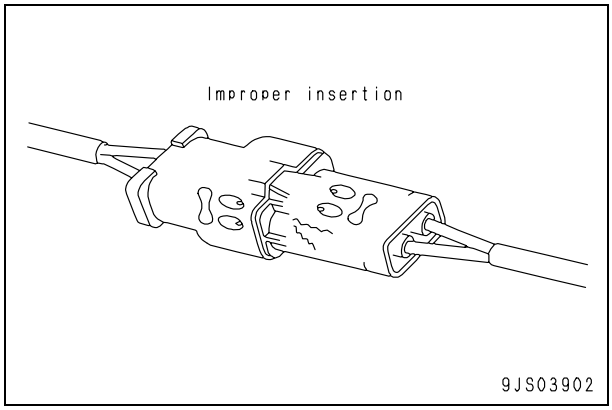
Compared with other electrical components fitted in boxes or cases, wiring harnesses are more likely to be affected by the direct effects of rain, water, heat, or vibration. Furthermore, during inspection and repair operations, they are frequently removed and installed again, so they are likely to suffer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



2. Main failures occurring in wiring harness

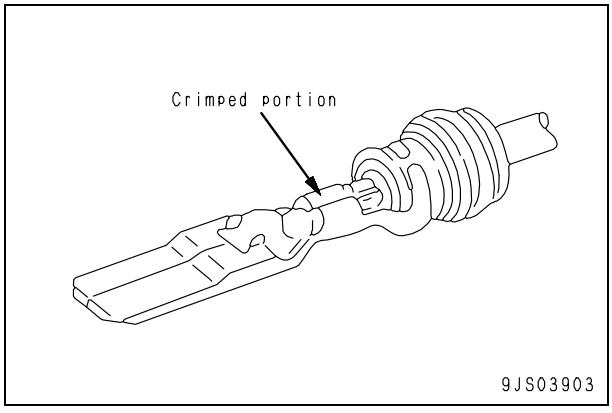
1) Defective contact of connectors (defective contact between male and female)

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

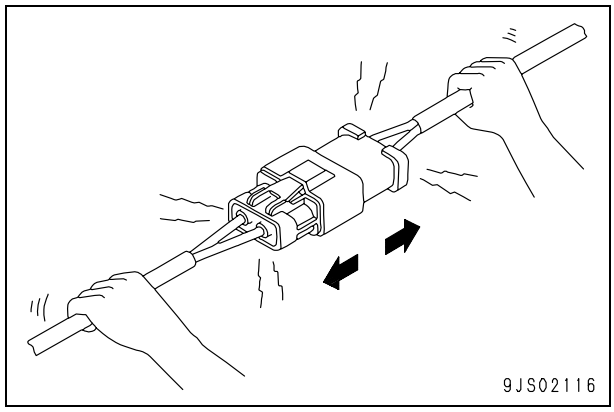


2) Defective crimping or soldering of connectors

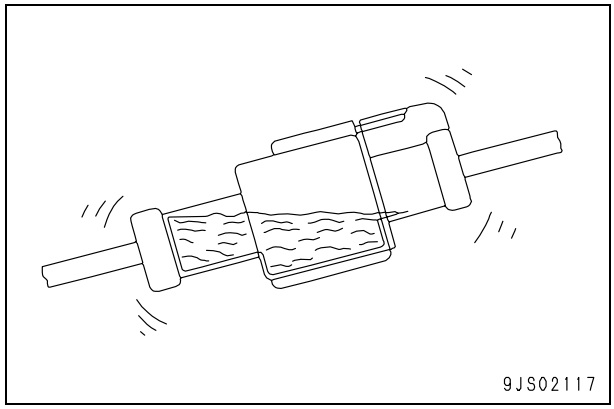
The pins of the male and female connectors are in contact at the crimped terminal or soldered portion, but if there is excessive force brought to bear on the wiring, the plating at the joint will peel and cause improper connection or breakage.



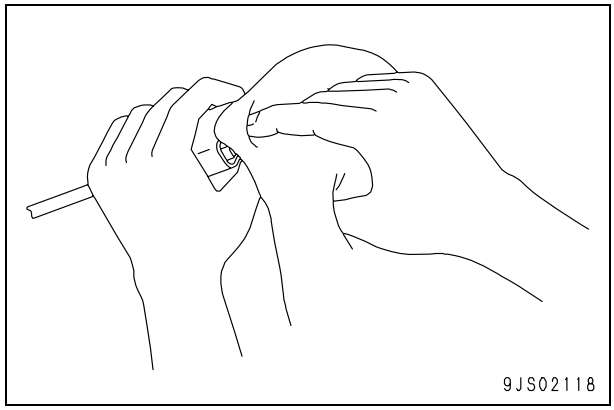
3) Disconnections in wiring
If the wiring is held and the connectors are pulled apart, or components are lifted with a crane with the wiring still connected, or a heavy object hits the wiring, the crimping of the connector may separate, or the soldering may be damaged, or the wiring may be broken.



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



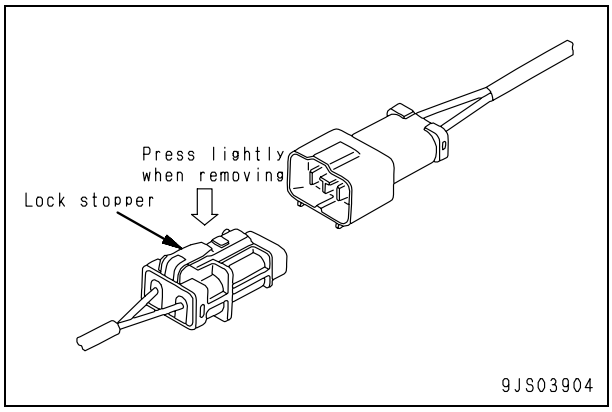
5) Oil or dirt stuck to connector
If oil or grease are stuck to the connector and an oil film is formed on the mating surface between the male and female pins, the oil will not let the electricity pass, so there will be defective contact. If there is oil or grease stuck to the connector, wipe it off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



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

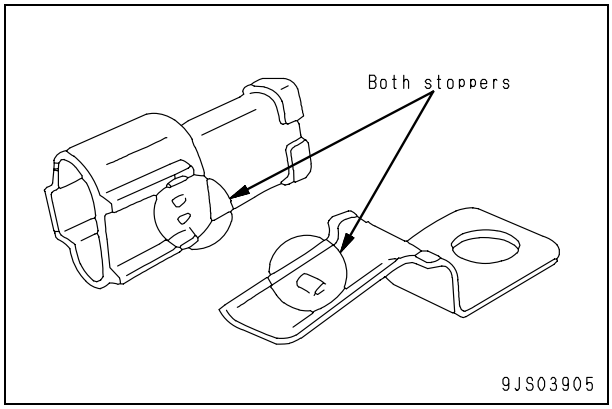
1) Disconnecting connectors

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

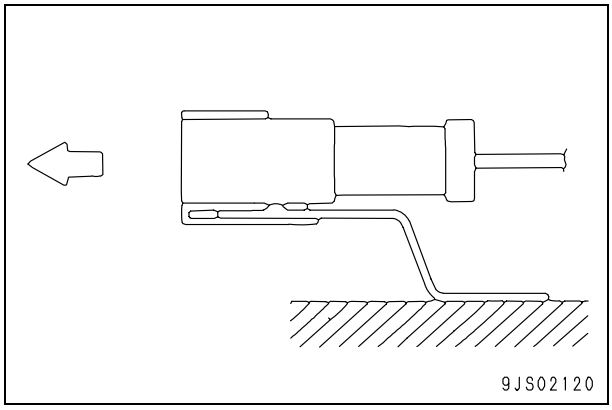


2] When removing from clips

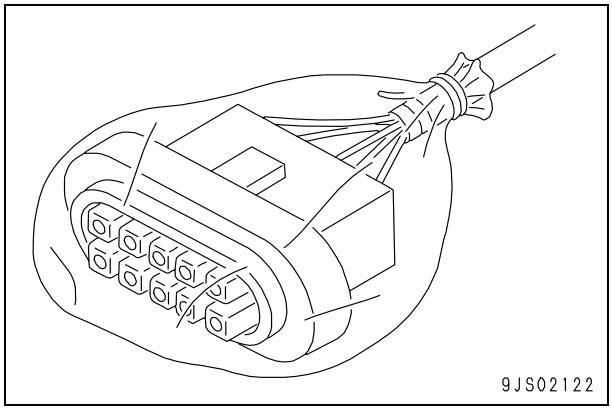
- Both of the connector and clip have stoppers, which are engaged with each other when the connector is installed.



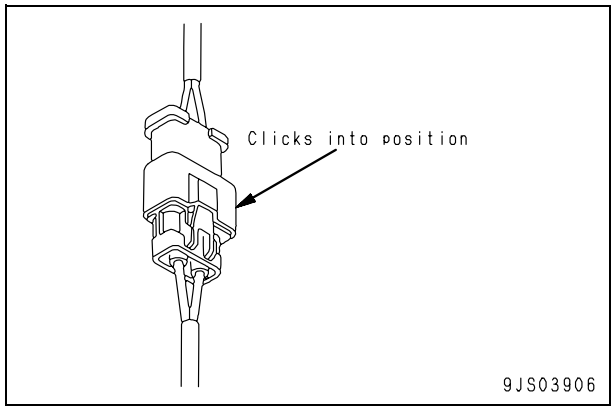
- When removing a connector from a clip, pull the connector in a parallel direction to the clip for removing stoppers.
★ If the connector is twisted up and down or to the left or right, the housing may break.

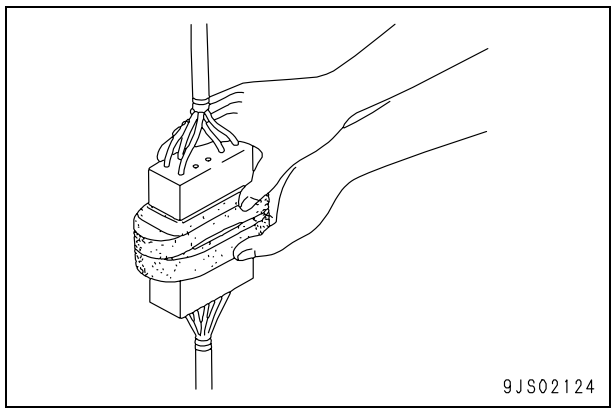


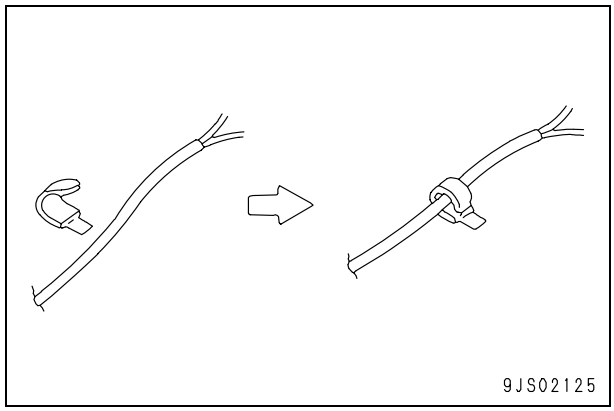
3] Action to take after removing connectors
After removing any connector, cover it with a vinyl bag to prevent any dust, dirt, oil, or water from getting in the connector portion.
★ If the machine is left disassembled for a long time, it is particularly easy for improper contact to occur, so always cover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



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

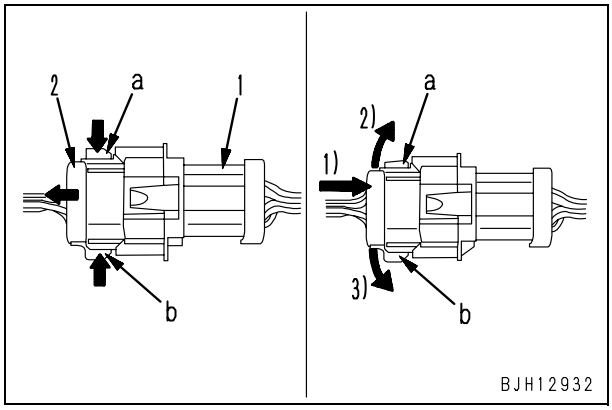




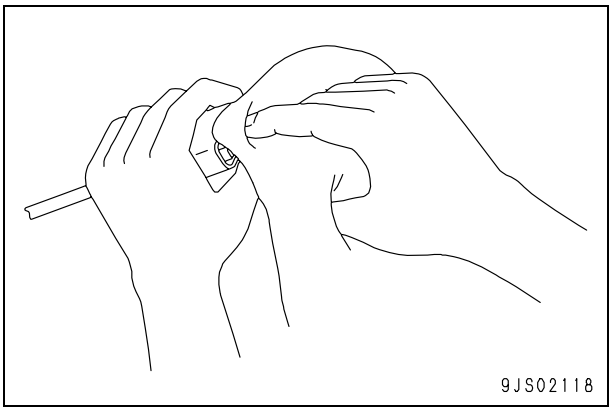


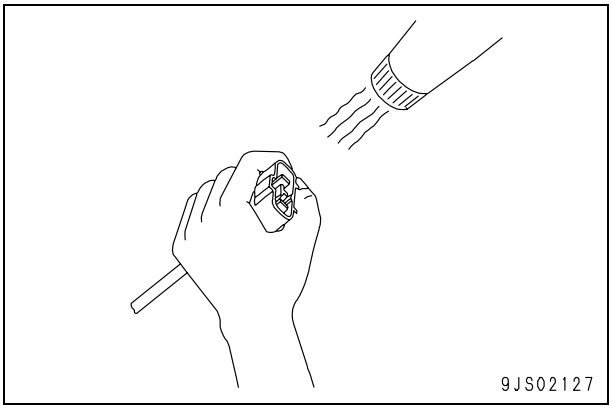
3) Heavy duty wire connector (DT 8-pole, 12-pole)
Disconnection (Left of figure)
While pressing both sides of locks (a) and (b), pull out female connector (2).
Connection (Right of figure)
1] Push in female connector (2) horizontally until the lock clicks.
Arrow: 1)
2] Since locks (a) and (b) may not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

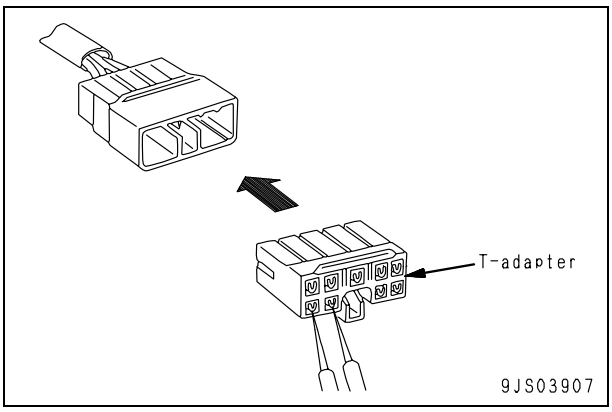
- Disconnection
- Connection (Example of incomplete setting of (a))



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

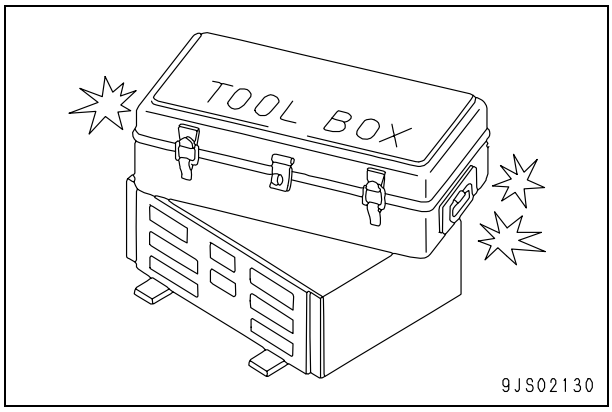


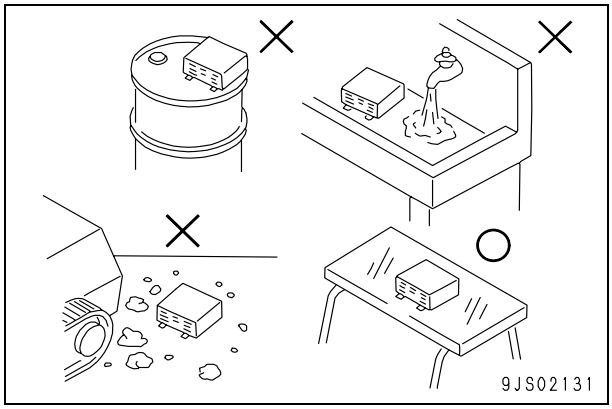




4. Handling controller

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





5. Points to remember when troubleshooting electric circuits

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

Points to remember when handling hydraulic equipment

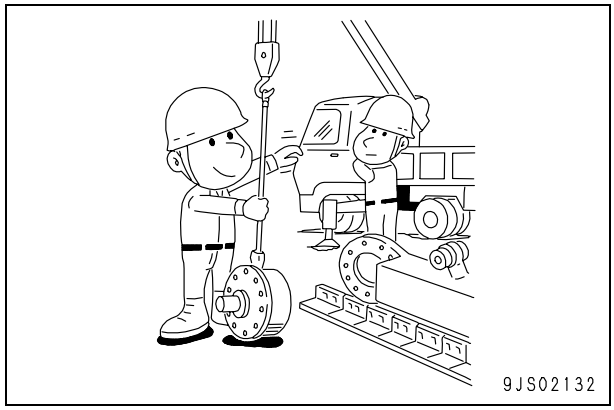
With the increase in pressure and precision of hydraulic equipment, the most common cause of failure is dirt (foreign material) in the hydraulic circuit. When adding hydraulic oil, or when disassembling or assembling hydraulic equipment, it is necessary to be particularly careful.

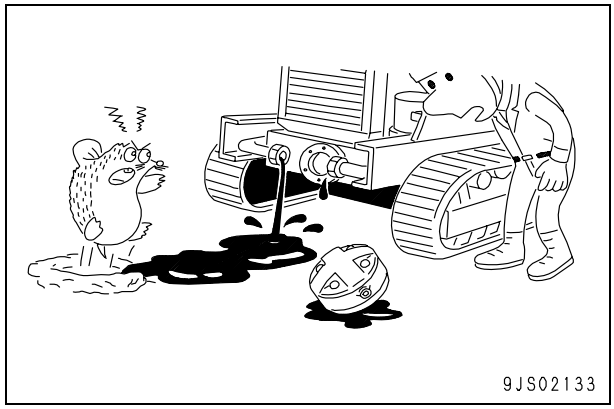
1. **Be careful of the operating environment.**
   Avoid adding hydraulic oil, replacing filters, or repairing the machine in rain or high winds, or places where there is a lot of dust.

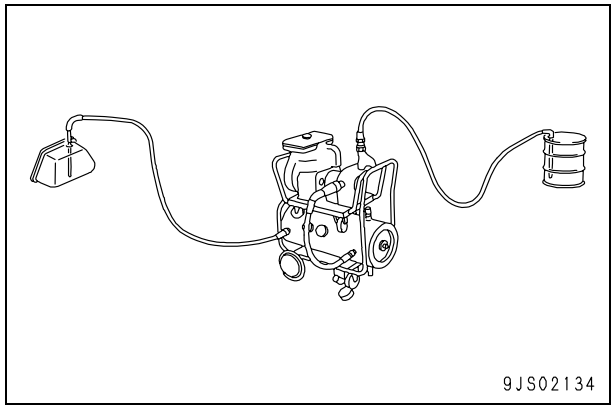
2. **Disassembly and maintenance work in the field**
   If disassembly or maintenance work is carried out on hydraulic equipment in the field, there is danger of dust entering the equipment. It is also difficult to check the performance after repairs, so it is desirable to use unit exchange. Disassembly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

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

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





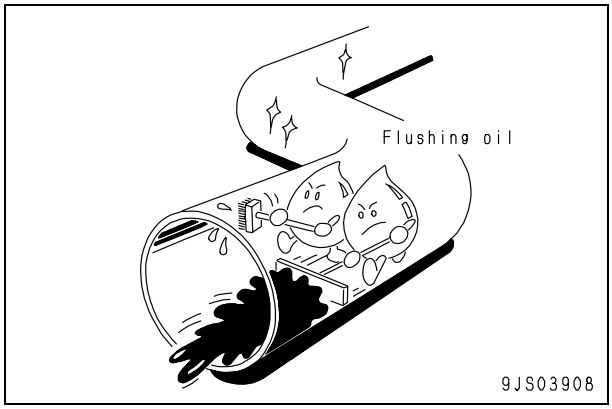


5. Change hydraulic oil when the temperature is high

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

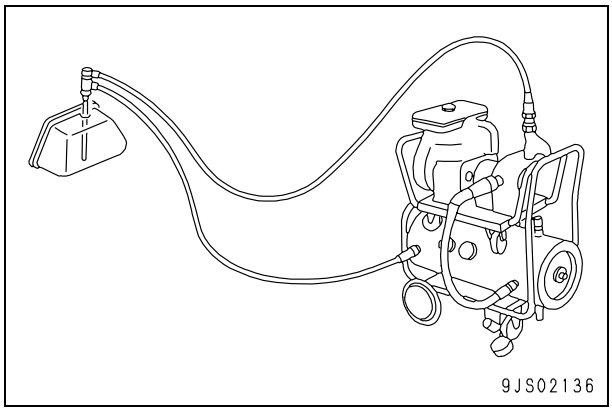
6. Flushing operations

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



7. Cleaning operations

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



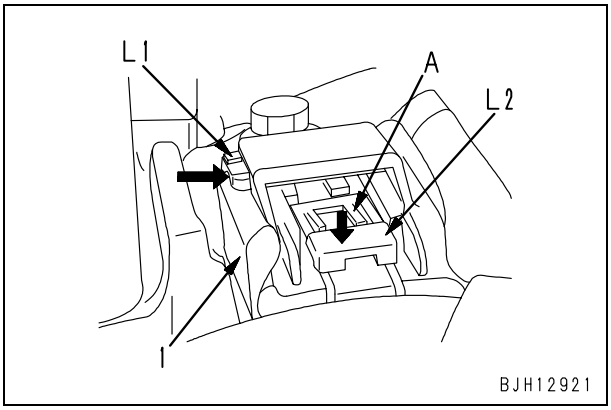
Handling of connectors newly used for engines

★ Mainly, following engines are object for following connectors.
- 95E-5
- 107E-1
- 114E-3
- 125E-5
- 140E-5
- 170E-5
- 12V140E-3

1. Slide lock type (FRAMATOME-3, FRAMATOME-2)
- 95 – 170, 12V140 engines
  - Various pressure sensors and NE speed sensor

Examples)
Intake air pressure sensor in intake manifold: PIM (125, 170, 12V140 engines)
Oil pressure sensor: POIL (125, 170, 12V140 engines)
Oil pressure switch (95, 107, 114 engines)
Ne speed sensor of flywheel housing: NE (95 – 170, 12V140 engines)
Ambient pressure sensor: PAMB (125, 170, 12V140 engines)

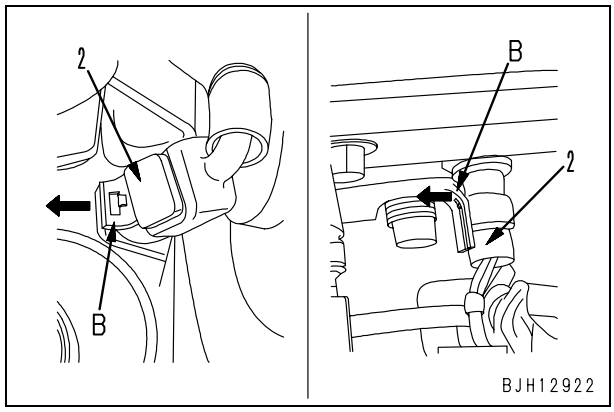
Disconnect connector (1) according to the following procedure.
1) Slide lock (L1) to the right.
2) While pressing lock (L2), pull out connector (1) toward you.
   ★ Even if lock (L2) is pressed, connector (1) cannot be pulled out toward you, if part A does not float. In this case, float part A with a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



2. Pull lock type (PACKARD-2)
- 95 – 170, 12V140 engines
  - 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.



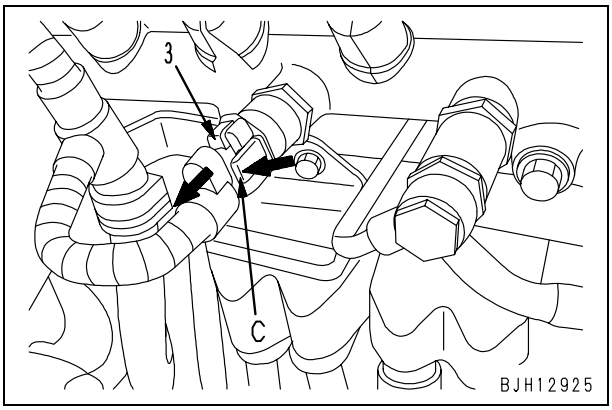
3. Push lock type

- 95, 107, 114 engines
  Example)
  Fuel pressure sensor in common rail
  (**BOSCH-03**)

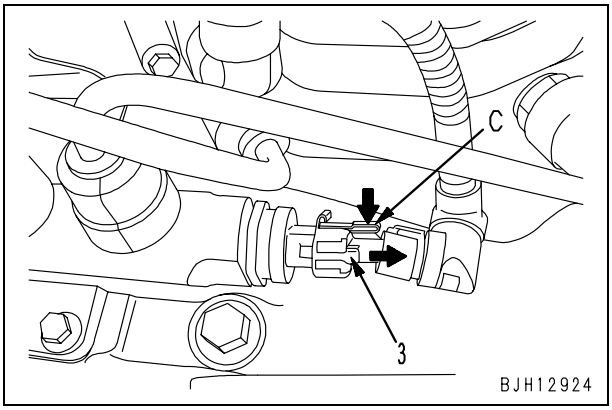
Disconnect connector (3) according to the following procedure.

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

- 114 engine

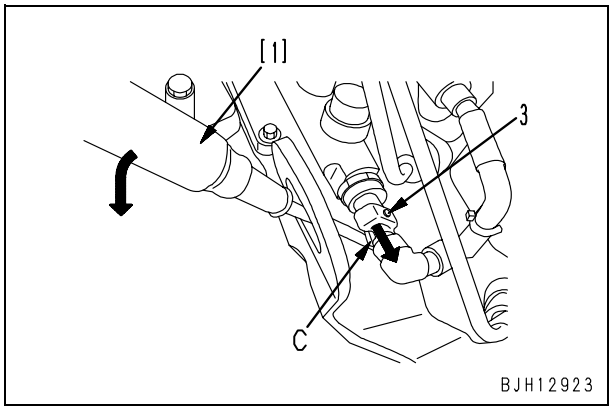


- 107 engine



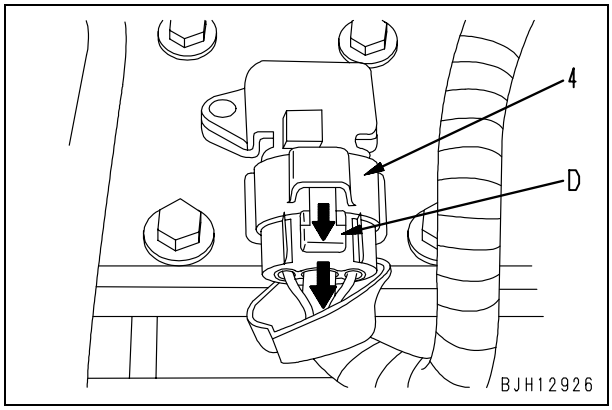
★ If the lock is on the underside, use flat-head screwdriver [1] since you cannot insert your fingers.

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 engines
  Example)
  Intake air pressure/temperature sensor in intake manifold
  (**SUMITOMO-04**)

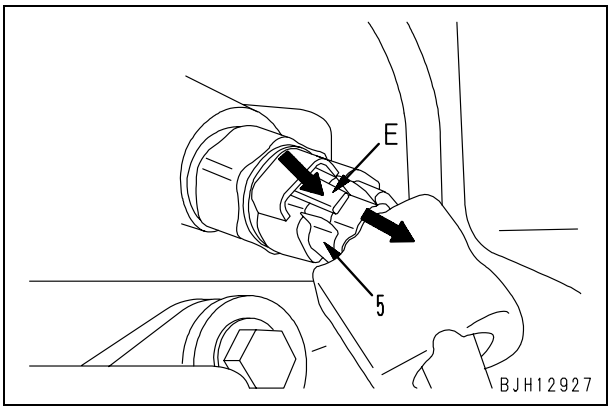
3) While pressing lock (D), pull out connector (4) in the direction of the arrow.



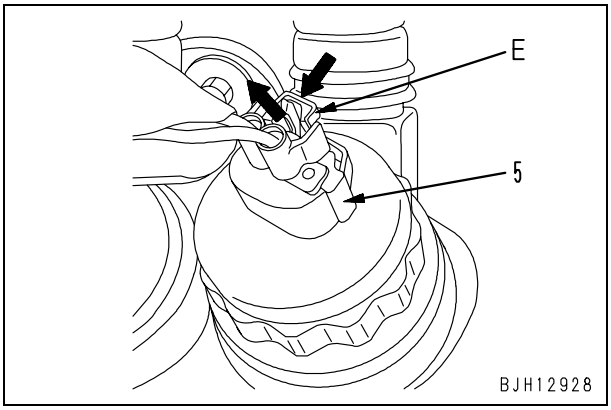
- 95, 125 – 170, 12V140 engines

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

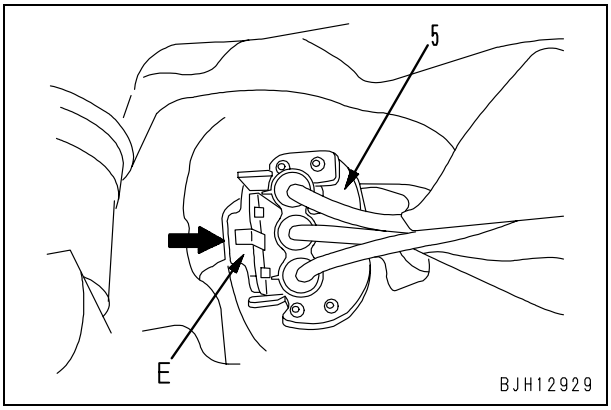
Example)
Fuel pressure sensor in common rail: PFUEL etc. (**AMP-3**)



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.

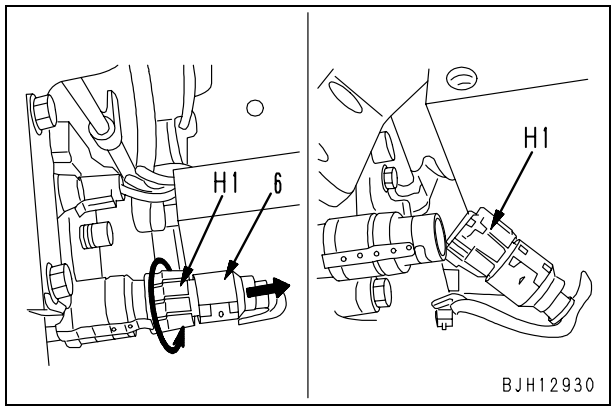


4. Turn-housing type (Round green connector)

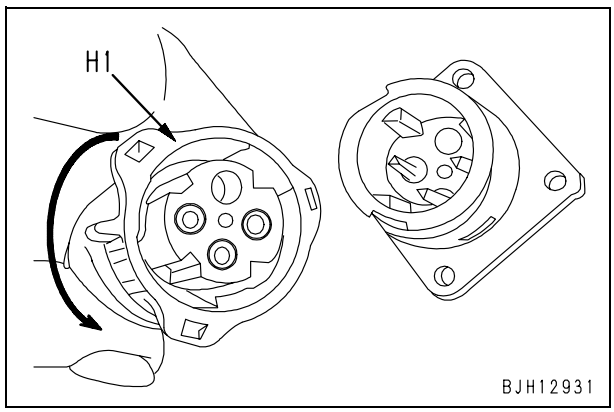
- 140 engine

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.



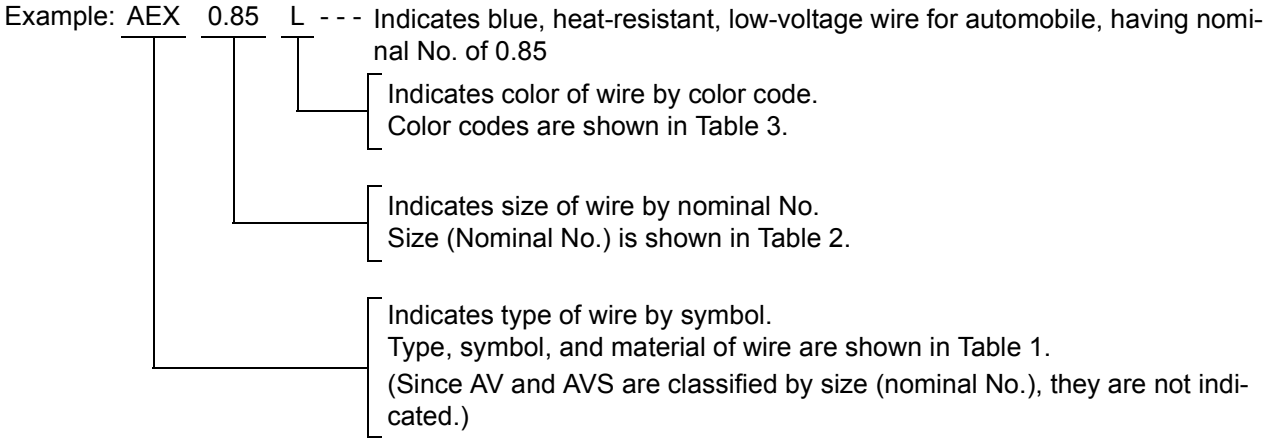
2) Connect the connector according to the following procedure.
   1] Insert the connector to the end, while setting its groove.
   2] Turn housing (H1) in the direction of the arrow until it “clicks”.



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		

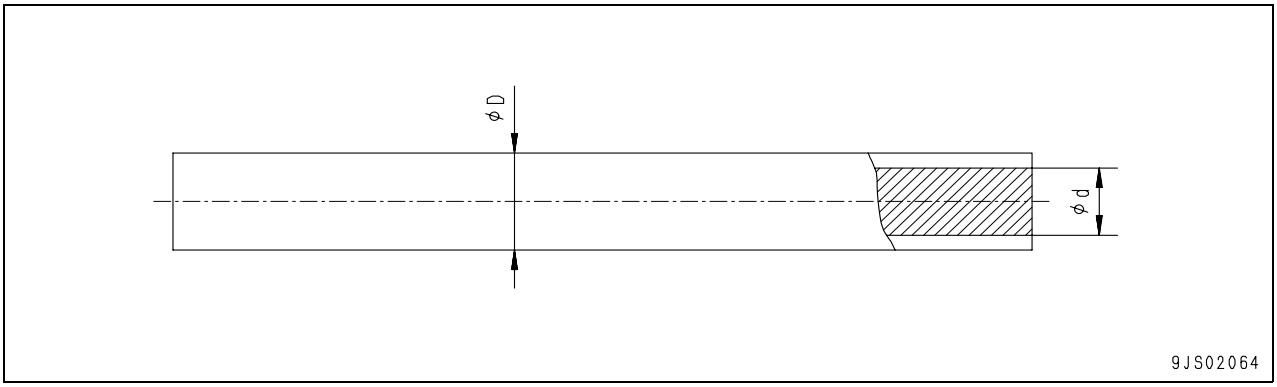
2. Dimensions

(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

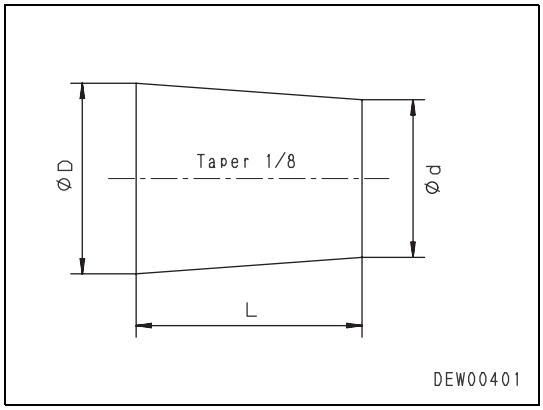
Nominal number	Plug (nut end)	Sleeve nut (elbow end)
02	07376-70210	02789-20210
03	07376-70315	02789-20315
04	07376-70422	02789-20422
05	07376-70522	02789-20522
06	07376-70628	02789-20628
10	07376-71034	07221-21034
12	07376-71234	07221-21234

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



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

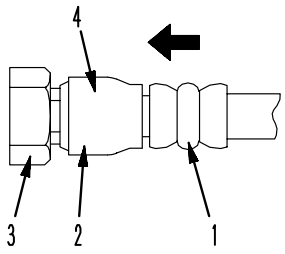


Fig. 2

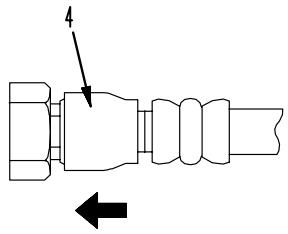
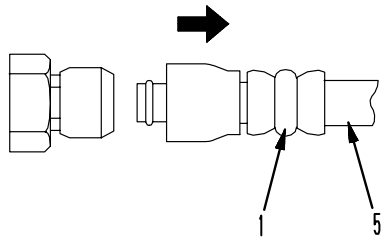


Fig. 3



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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

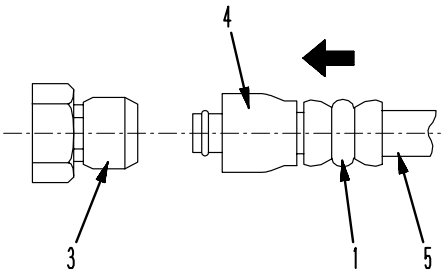
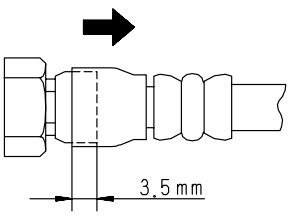


Fig. 5



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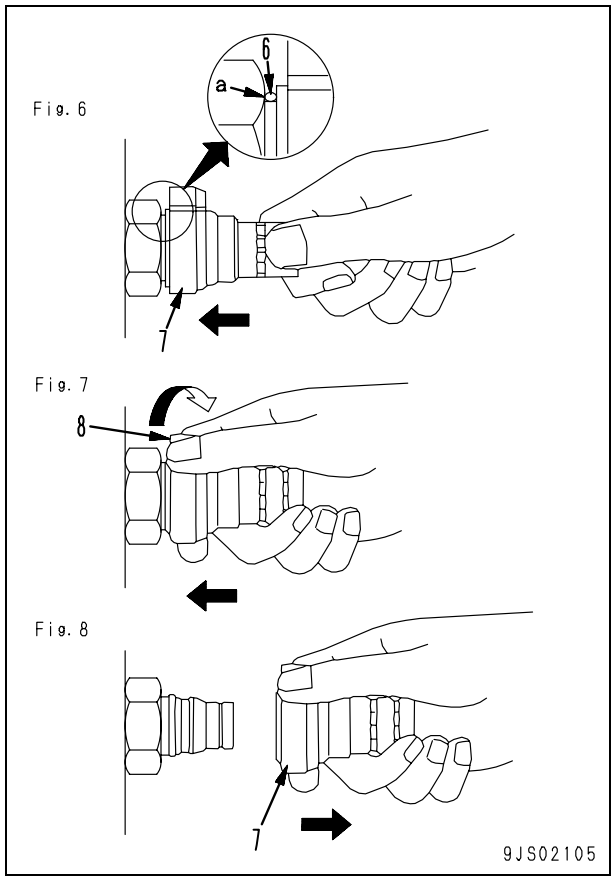
Type 2

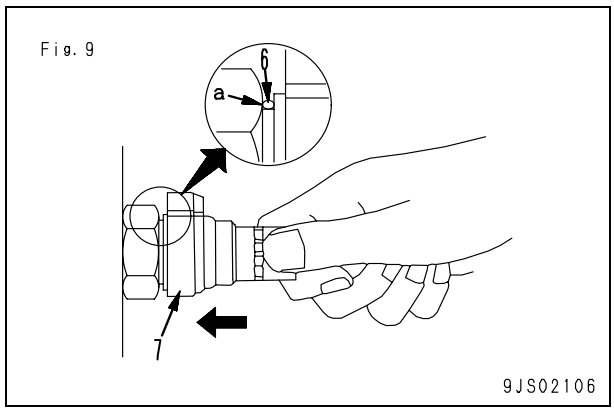
1. Disconnection

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

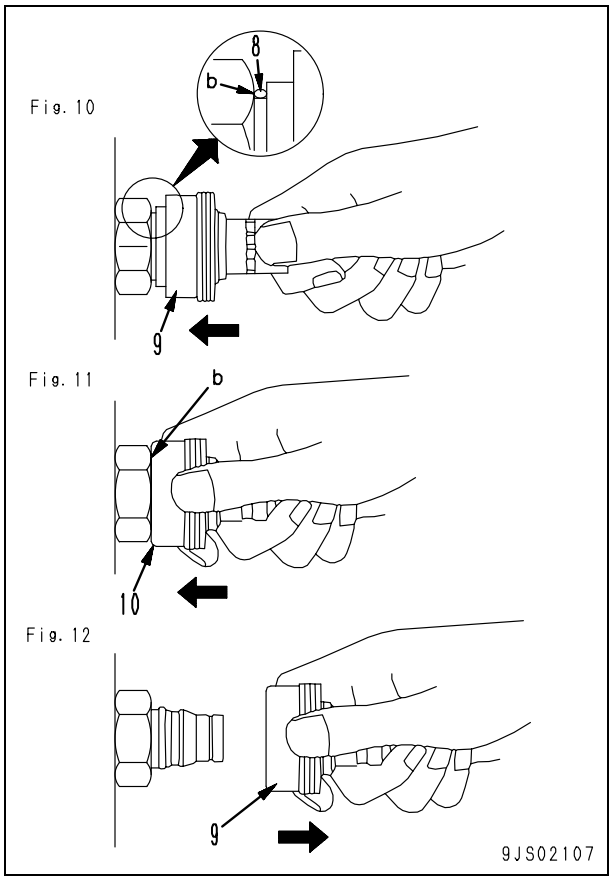
- Hold the tightening portion and push body (7) straight until sliding prevention ring (6) contacts contact surface (a) of the hexagonal portion at the male end. (Fig. 9)



Type 3

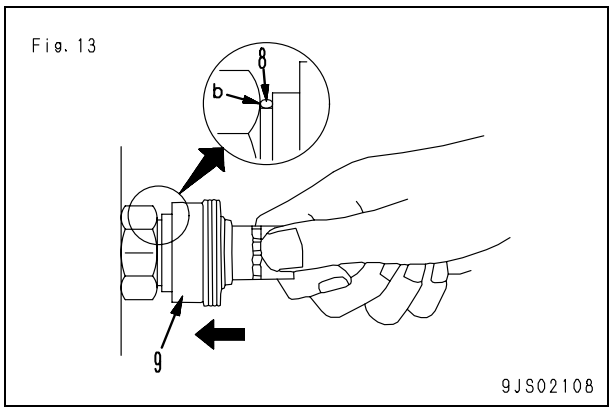
1. Disconnection

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.

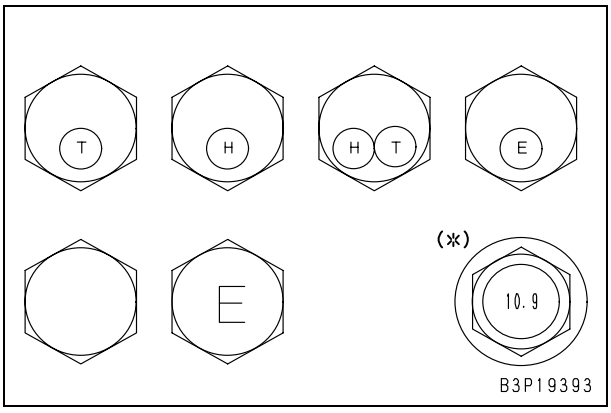
★ The following table applies to the bolts in Fig. A.

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	157 – 196	16 – 20
16	24	245 – 309	25 – 31.5
18	27	343 – 427	35 – 43.5
20	30	490 – 608	50 – 62
22	32	662 – 829	67.5 – 84.5
24	36	824 – 1,030	84 – 105
27	41	1,180 – 1,470	120 – 150
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

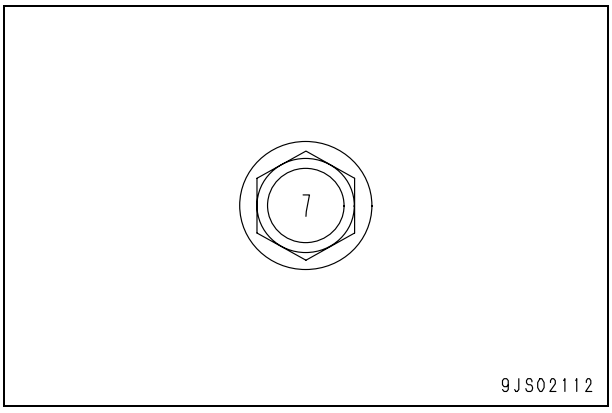
★ The following table applies to the bolts in Fig. B.

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



Remarks: The widths across flats against the thread diameters of flanged bolts (marks with "*") in Fig. A are the ones indicated in the table for bolts shown in Fig. B.
(Values of tightening torques shown in the table for Fig. A are applied.)

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 face seal joints

★ Tighten the face seal joints (sleeve nut type) made of plated steel pipes for low pressure service to be used for engines etc. to the torque shown in the following table.

★ Apply the following torque to the face seal joint while their threaded parts are coated with engine oil (wetted).

Outer diameter of pipe (mm)	Width across flats (mm)	Tightening torque Nm {kgm}		Face seal	
		Range	Target	Nominal No. – Number of threads, type of thread	Thread diameter (mm) (Reference)
8	19	14 – 16 {1.4 – 1.6}	15 {1.5}	9/16-18UN	14.3
10	22	24 – 27 {2.4 – 2.7}	25.5 {2.6}	11/16-16UN	17.5
12	24 (27)	43 – 47 {4.4 – 4.8}	45 {4.6}	13/16-16UN	20.6
15 (16)	30 (32)	60 – 68 {6.1 – 6.8}	64 {6.5}	1-14UN	25.4
22 (20)	36	90 – 95 {9.2 – 9.7}	92.5 {9.4}	1-3/16-12UN	30.2

Reference: The face seal joints of the dimensions in ( ) are also used, depending on the specification.

7. 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	—	—

8. 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

9. 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.

	Tightening torque			
Material	In cast iron or steel		In aluminum	
Thread size (inch)	Nm	kgm	Nm	kgm
1/16	15 ± 2	1.53 ± 0.20	5 ± 1	0.51 ± 0.10
1/8	20 ± 2	2.04 ± 0.20	15 ± 2	1.53 ± 0.20
1/4	25 ± 3	2.55 ± 0.31	20 ± 2	2.04 ± 0.20
3/8	35 ± 4	3.57 ± 0.41	25 ± 3	2.55 ± 0.31
1/2	55 ± 6	5.61 ± 0.61	35 ± 4	3.57 ± 0.41
3/4	75 ± 8	7.65 ± 0.82	45 ± 5	4.59 ± 0.51

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

HM300-2 Articulated dump truck
Form No. SEN00325-03

ARTICULATED DUMP TRUCK

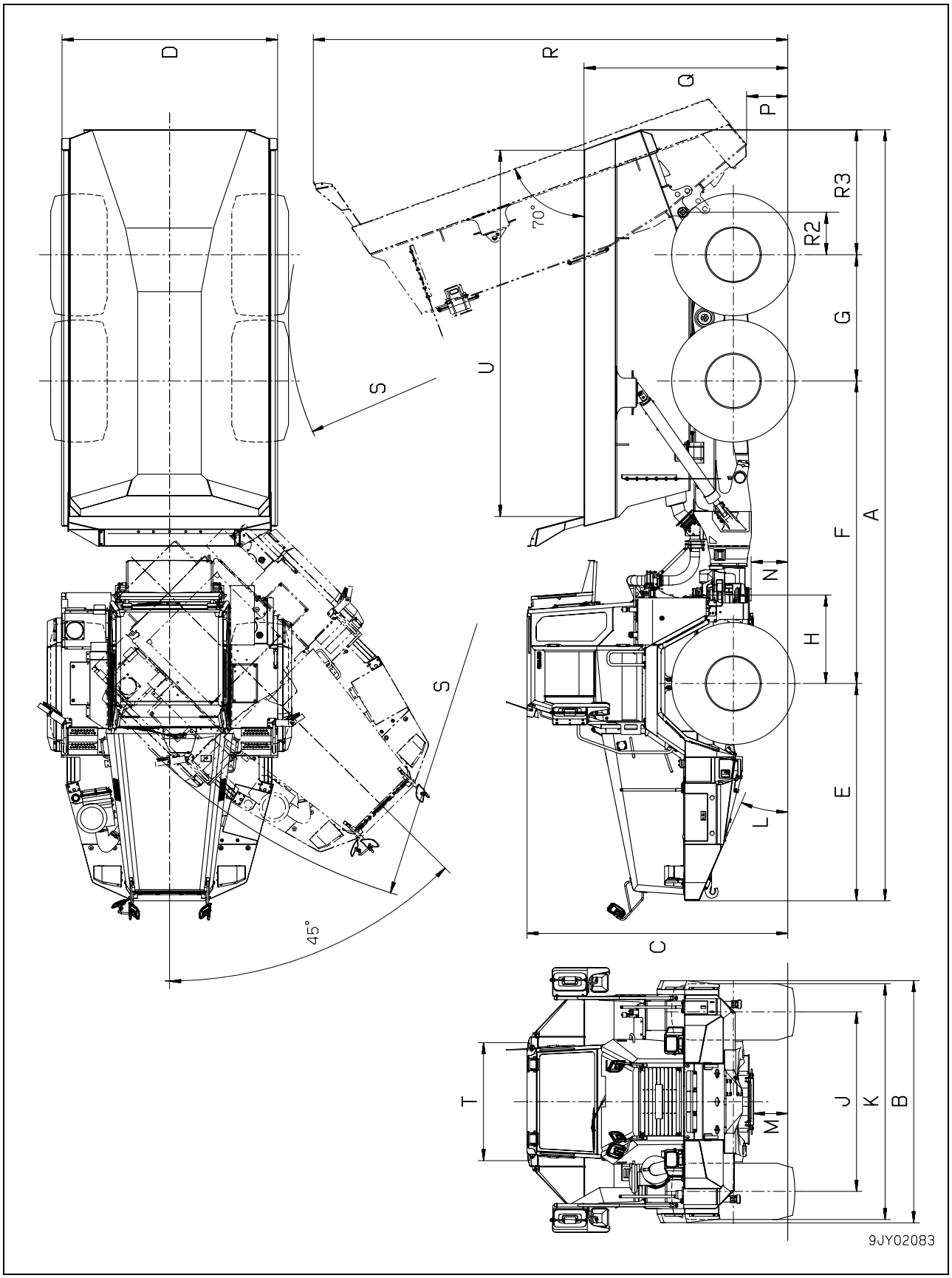
HM300-2

Machine model	Serial number
HM300-2	2001 and up

01 Specification

Specification and technical data

Specification drawings



Specifications

Machine model				HM300-2
Serial number				2001 and up
Weight	Unloaded		kg	24,040
	Max. payload		kg	27,300
	Overall weight		kg	51,340
	Weight	Unloaded (front wheel)	kg	13,640
		(center wheel)	kg	5,860
		(rear wheel)	kg	5,120
		Fully loaded (front wheel)	kg	15,785
		(center wheel)	kg	18,430
		(rear wheel)	kg	17,705
Performance	Dump body capacity	Struck	m^3	12.9
		Heaped (2:1)	m^3	16.6
	Max. travel speed		km/h	58.6
	Gradeability (sin θ)			0.45
	Min turning radius (front wheel/rear wheel) (S)		mm	7,960/4,010
	Dumping angle (angle to ground)		deg.	70
Dimensions	Overall length (A)		mm	10,440
	Overall width (B)		mm	2,900
	Overall height (C)		mm	3,520
	Body width (D)		mm	2,900
	Front over bank (E)		mm	2,935
	Wheelbase (front wheel – center wheel) (F)		mm	4,100
	Wheelbase (center wheel – rear wheel) (G)		mm	1,710
	Flexural center – front wheel (H)		mm	1,200
	Tread (J)	Front tires	mm	2,280
		Center tires	mm	2,280
		Rear tires	mm	2,280
	Entire width of tire (K)	Front wheel	mm	2,900
		Center wheel	mm	2,900
		Rear wheel	mm	2,900
	Approach angle (L)		deg.	24
	Minimum ground clearance (M)	Front wheel	mm	585
		Center wheel	mm	525
		Rear wheel	mm	520
	Ground clearance (N) (Articulate section)		mm	510
	Minimum ground clearance (dump body lower edge) (P)		mm	600
	Dump body loading height (when body is raised) (Q)		mm	2,790
	Dump body height (when body is raised) (R)		mm	6,430
	Rear axis – axis pin (R2)		mm	580
	Rear axis – dump body rear edge (when body is raised) (R3)		mm	1,695
	Cab width (T)		mm	1,600
	Body length (U)		mm	4,965

Machine model				HM300-2
Serial number				2001 and up
Engine	Model			Komatsu SAA6D125E-5
	Type			4-cycle, water-cooled, in-line 6 cylinder, direct injection, with turbocharger and air-cooled aftercooler
	No. of cylinders – Bore x stroke		mm	6–125 x 150
	Piston displacement		ℓ{cc}	11.04{11,040}
	Flywheel horsepower		kW/rpm{HP/rpm}	254/2,000 {340/2,000}
	Max. torque		Nm/rpm{kgm/rpm}	1,706/1,400 {174/1,400}
	Fuel consumption (rated)		g/kWh{g/HPh}	212 {156}
	Starting motor			7.5kW
	Alternator			24V 50A
	Battery			12V 136Ah x 2
Power train	Torque converter	Type		3-element, 1-stage, 2-phase
		Lock-up clutch		Hydraulically-actuated, wet-type, single-disc clutch
	Transmission	Type		TORQFLOW multiple-axle transmission, fully automatic, electrically-hydraulically actuated, force-feed type pump lubrication type
		No. of speeds		F6, R2
	Reduction gear	Type		Spiral bevel gear, splash lubrication
		Reduction ratio		3.154
		Differential type		Straight bevel gear, splash lubrication
	Final drive	Type		Planetary gear, splash lubrication
		Reduction ratio		4.667
Travel system	Type			Fully hydraulic
Suspension	Axle type	Front axle		Full floating suspension (De Dion type)
		Center axle		Full floating suspension
		Rear axle		Full floating suspension
	Suspension method	Front axle		Hydropneumatic type
		Rear axle		Hydropneumatic type
Tires	Size and No.	Front tire		23.5 R25 x 2
		Center tire		23.5 R25 x 2
		Rear tire		23.5 R25 x 2
	Tire inflation pressure		kPa {kg/cm^2}	440 {4.5}

Machine model				HM300-2
Serial number				2001 and up
Brakes	Main brake	Front wheel		Independent front and center system brake, sealed, wet- type, multiple disc, hydraulically operated type
		Center wheel		Independent front and center system brake, sealed, wet- type, multiple disc, hydraulically operated type
	Parking brake			Spring-boosted, caliper disc type
	Retarder			Independent front and center system brake, sealed, wet- type, multiple disc, hydraulically operated type
Hydraulic system	Hydraulic pump, motor	For steering, hoist Type Discharge amount (ℓ /min) (when engine is at rated speed of 2000 rpm)		Gear pump 218 + 55
		For hoist control Type Discharge amount (ℓ /min) (when engine is at rated speed of 2000 rpm)		Gear pump 14.1
		For transmission, brake cooling Type Discharge amount (ℓ /min) (when engine is at rated speed of 2000 rpm)		Gear pump 168
		For brake cooling Type Discharge amount (ℓ /min) (when engine is at rated speed of 2000 rpm)		Gear pump 180
		For brake Type Discharge amount (ℓ /min) (when engine is at rated speed of 2000 rpm)		Gear pump 40
	Cylinders	Hoist cylinder Type		2-stage piston type (only 2nd stage double-acting)
		No. – bore (1st–2nd) x stroke		2–(140 mm-100 mm) x 2,897 mm
		Steering cylinder Type		Piston type, double acting
		No. – bore x stroke		2–110 mm x 420 mm

Weight table

⚠ This weight table is a guide for use when transporting or handling components.

Unit: kg

Machine model	HM300-2
Serial number	2001 and up
Engine assembly	1,280
Output shaft assembly	65
Cooling assembly	228
Fuel tank (individual part)	219
Torque converter assembly	112
Transmission assembly	935
Drive shaft assembly	183
Front axle assembly	1,162
Differential	302
Final drive	802
Center axle assembly	1,451
Differential	301
Final drive	836
Rear axle assembly	895
Differential	194
Final drive	423
Front suspension cylinder	70
Rear suspension cylinder	54
Oscillation hitch assembly	634
Front frame	1,220
Rear frame	1,596
Cab (including interior components)	1,090
Operator’s seat	65
Steering cylinder (each)	56
Hoist cylinder (each)	183
Flow amp valve	29
Hoist valve	34
Hydraulic tank	187
Hydraulic pump (SDR(30) 100 + (20)25 + SB(1)6)	30
Hydraulic pump (SDR(30)75)	18
Hydraulic pump (SDR(30)80 + SA(1)18)	22
Hydraulic pump (SBL(1)26)	8
Body assembly	3,453

Fuel, coolant and lubricants

Reservoir	Fluid Type	Ambient Temperature, degrees Celsius -22 -4 14 32 50 68 86 104 122 °F -30 -20 -10 0 10 20 30 40 50 °C	Recommended Komatsu Fluids
Engine oil pan	Engine oil	(Note.1)	Komatsu EOS0W30
		(Note.1)	Komatsu EOS5W40
			Komatsu EO10W30DH
			Komatsu EO15W40DH
			Komatsu EO30DH
Transmission Case (incl. brake oil tank)	Power train oil (Note.2)		TO10
Hydraulic tank	Power train oil		TO10
	Hydraulic oil		HO46-HM HO-MVK
Front suspension Rear suspension	Hydraulic oil		HO-MVK
Front differential case Center differential case Rear differential case Front final drive case Center final drive case Rear final drive case	Axle oil		AXO80
Grease fitting	Hyper grease (Note.3)		G2-T, G2-TE
	Lithium EP grease		G2-LI
	Lithium grease		G2-LI-S
	Lithium grease		GLT2-LI
Cooling system	Supercoolant AF-NAC (Note.4)		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

- ASTM: American Society of Testing and Material

Capacity \ Reservoir		Engine oil pan	Transmission case (Incl. brake system tank)	Hydraulic tank	Front suspension (each)	Rear suspension (each)	Front differential Case
Specified	ℓ	44	165	171	3	2.2	14.0
	US gal	11.62	43.59	45.18	0.79	0.58	3.70
Refill	ℓ	37	77.5	120	3	2.2	14.0
	US gal	9.78	20.48	31.70	0.79	0.58	3.70

Capacity \ Reservoir		Front final drive case (each)	Center differential case	Center final drive case (each)	Rear differential case	Rear final drive case (each)	Fuel tank	Cooling system
Specified	ℓ	4.5	25	4.0	25	5.0	384	65
	US gal	1.19	6.61	1.06	6.61	1.32	101.45	17.17
Refill	ℓ	4.0	24.5	3.5	25	4.5	–	59
	US gal	1.06	6.47	0.92	6.61	1.19	–	15.59

Notice
Always use diesel oil for the fuel.
To ensure good fuel consumption characteristics and exhaust gas characteristics, the engine mounted on this machine uses an electronically controlled high-pressure fuel injection device. This device requires high precision parts and lubrication, so if low viscosity fuel with low lubricating ability is used, the durability may drop markedly.

Note 1: HTHS (High-Temperature High-Shear Viscosity 150°C), specified by ASTM D4741 must be equal to or higher than 3.5 mPa-S. Komatsu EOS0W30 and EOS5W40 are the most suitable oils.

Note 2: Powertrain oil has different properties from engine oil. Be sure to use the recommended oils.

Note 3: Hyper grease (G2-T, G2-TE) has a high performance.
When it is necessary to improve the lubricating ability of the grease in order to prevent squeaking of pins and bushings, the use of G2-T or G2-TE is recommended.

Note 4: Supercoolant (AF-NAC)
1) Coolant has the important function of anticorrosion as well as antifreeze.
Even in the areas where freezing is not an issue, the use of antifreeze coolant is essential.
Komatsu machines are supplied with Komatsu Supercoolant AF-NAC. Komatsu Supercoolant AF-NAC has excellent anticorrosion, antifreeze and cooling propertiesand can be used continuously for 2 years or 4000 hours.
Komatsu Supercoolant AF-NAC is strongly recommended wherever available.
2) For details of the ratio when diluting super coolant with water, see "Mixing rate of water and antifreeze".
Supercoolant AF-NAC may be supplied in premix. In this case, always top off with premix solution. (never dilute with water)
3) To maintain the anticorrosion properties of Supercoolant AF-NAC, always keep the density of Supercoolant between 30% and 68%.

Mixing rate of water and antifreeze

Min. atmospheric temperature	°C	-10	-15	-20	-25	-30
	°F	14	5	-4	-13	-22
Amount of antifreeze	Liters	17.5	20.5	23.5	26.5	29.5
	US gal	4.62	5.42	6.21	7.00	7.79
Amount of water	Liters	41.5	38.5	35.5	32.5	29.5
	US gal	10.97	10.17	9.38	8.59	7.80
Volume ratio	%	30	35	40	45	50

HM300-2 Articulated dump truck

Form No. SEN00327-01

ARTICULATED DUMP TRUCK

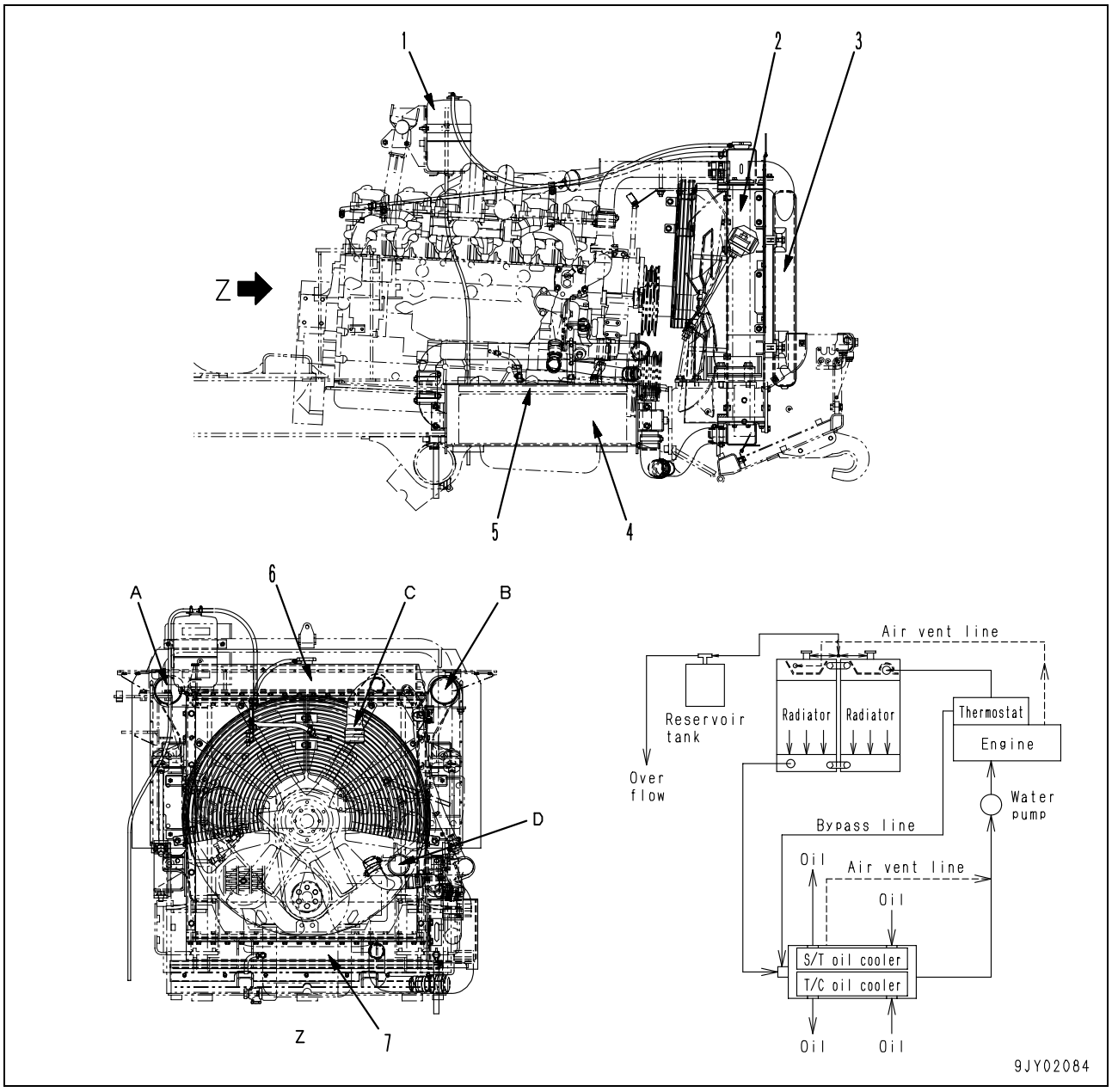
HM300-2

Machine model	Serial number
HM300-2	2001 and up

10 Structure, function and maintenance standard

Engine and cooling system

Radiator, oil cooler, aftercooler



1. Reservoir tank
2. Radiator
3. Aftercooler
4. Torque converter oil cooler
5. Steering oil cooler
6. Upper tank
7. Lower tank

A: To intake manifold
B: From turbocharger
C: From thermostat
D: To water pump

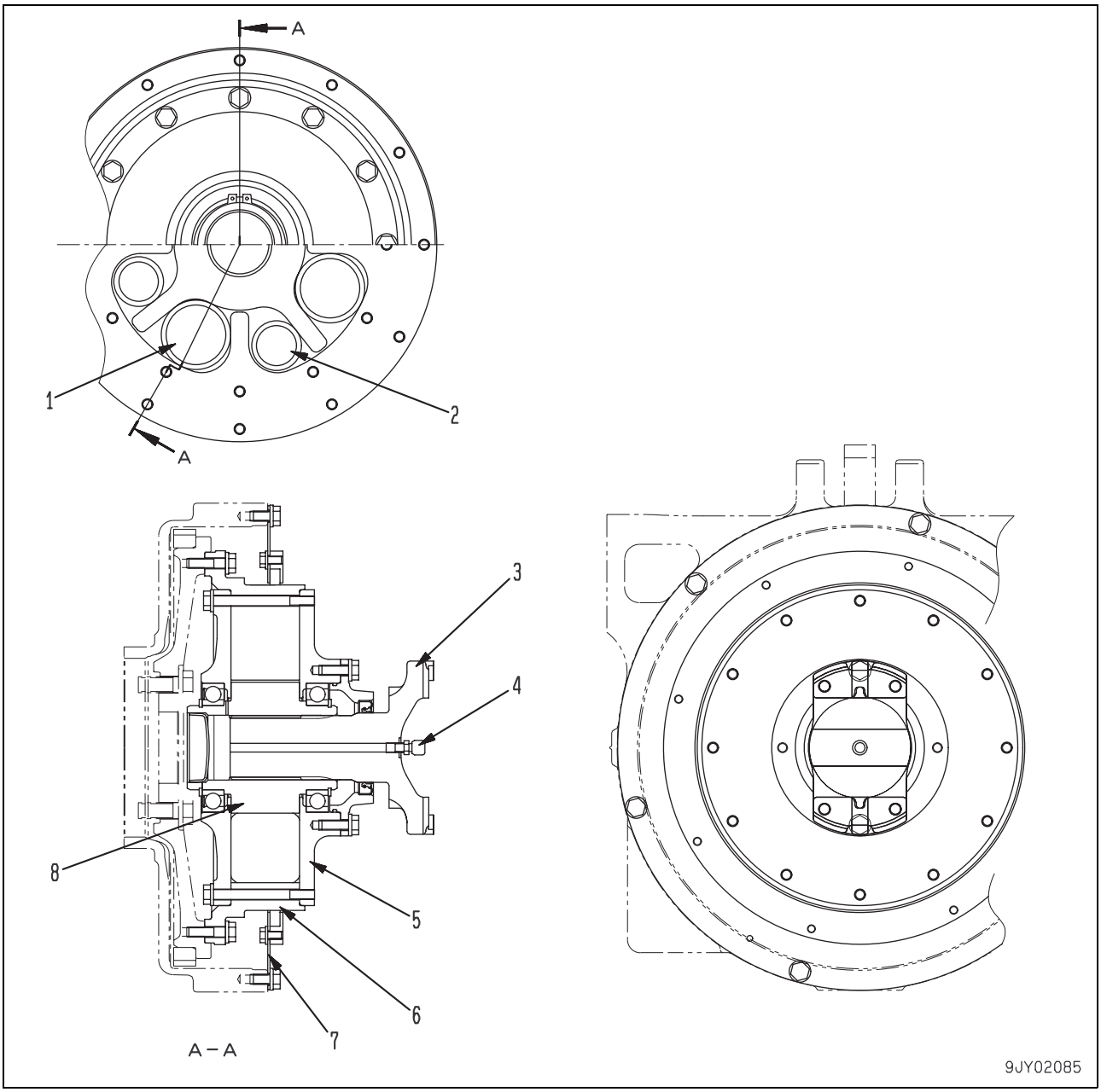
Specifications

Radiator
- Core type: Aluminum louver four lines
- Total heat dissipation area: 80.36m^2

Torque converter oil cooler
- Core type: PTO-LS
- Total heat dissipation area: 4.065m^2

Steering oil cooler
- Core type: PTO-LS
- Total heat dissipation area: 0.497m^2

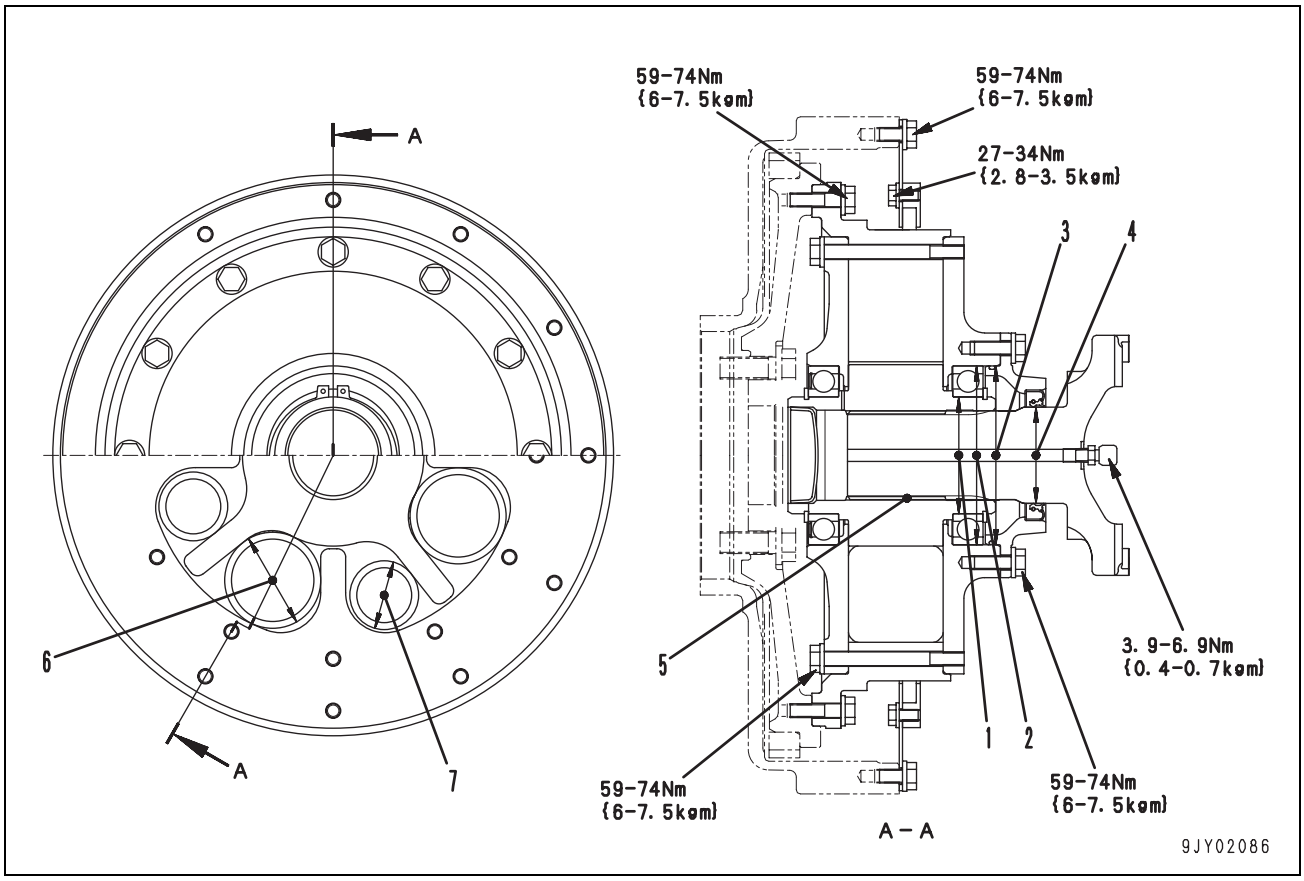
Output shaft



1. Rubber cushion (large)
2. Rubber cushion (small)
3. Coupling shaft
4. Breather
5. Flange
6. Outer body
7. Cover
8. Inner body

Function

The output shaft is installed to the engine flywheel, and absorbs the twisting vibration caused by changes in the engine torque.



Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance between bearing and inner body	Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
		85	+0.025 +0.003	0 -0.020	-0.045 – -0.013	–	
2	Clearance between bearing and flange	130	0 -0.018	-0.020 -0.045	-0.045 – -0.002	–	
3	Clearance between retainer and flange	130	+0.006 -0.034	+0.060 +0.020	-0.014 – -0.094	–	
4	Wear of shaft and oil seal contact surface	Standard size		Tolerance		Repair limit	Replace
		70		0 -0.074		-0.12	
5	Backlash at spline portion	Standard backlash			Backlash limit		
		0.071 – 0.177			0.35		
6	Deterioration and cracks in rubber	Initial size			Repair limit		
		70			At min. width: Min. 63 mm There must be no cracks		
7	Deterioration and cracks in rubber	50			At min. width: Min. 48 mm There must be no cracks		

HM300-2 Articulated dump truck

Form No. SEN00329-01

ARTICULATED DUMP TRUCK

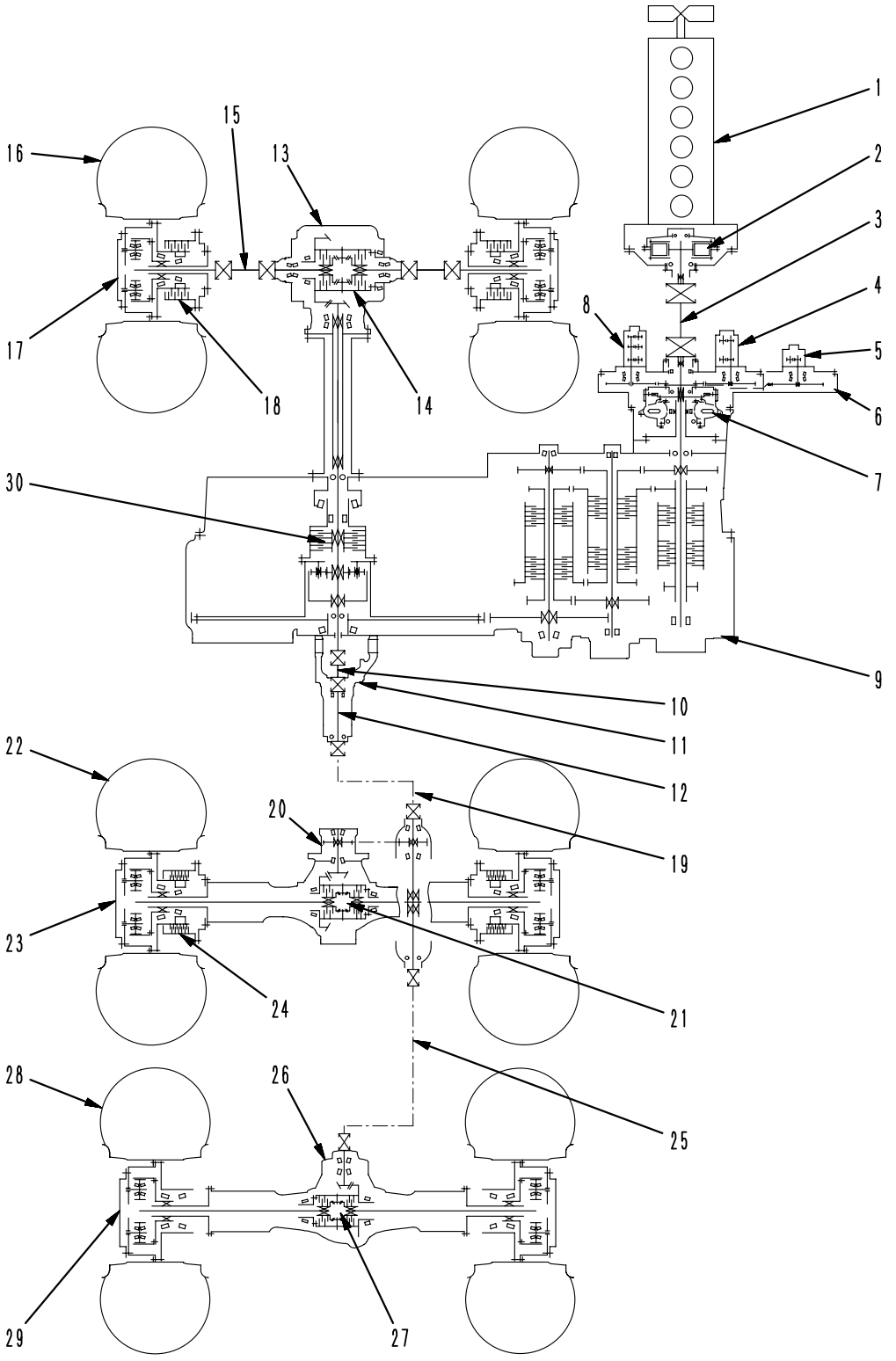
HM300-2

Machine model	Serial number
HM300-2	2001 and up

10 Structure, function and maintenance standard

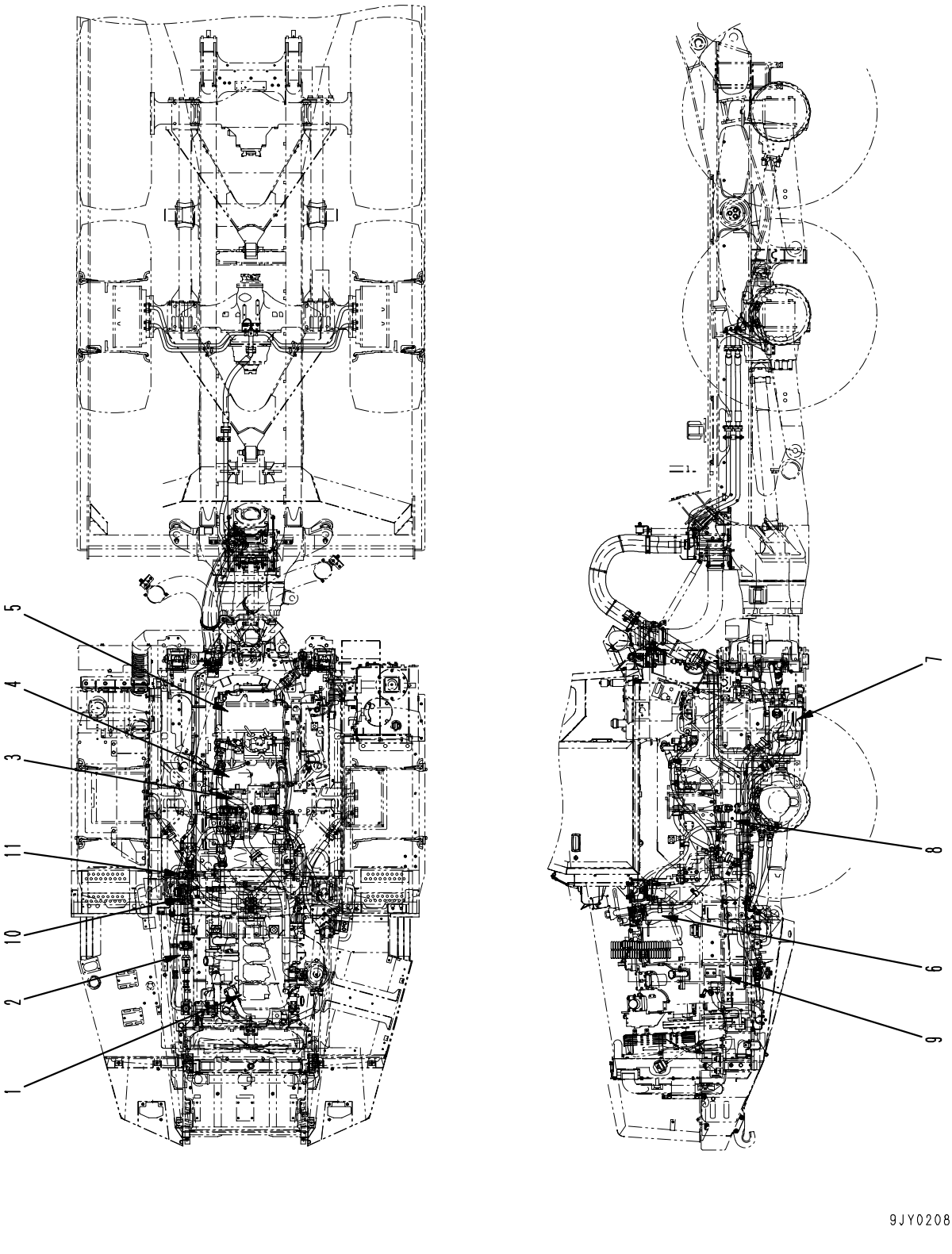
Power train, Part 1

Power train skeleton



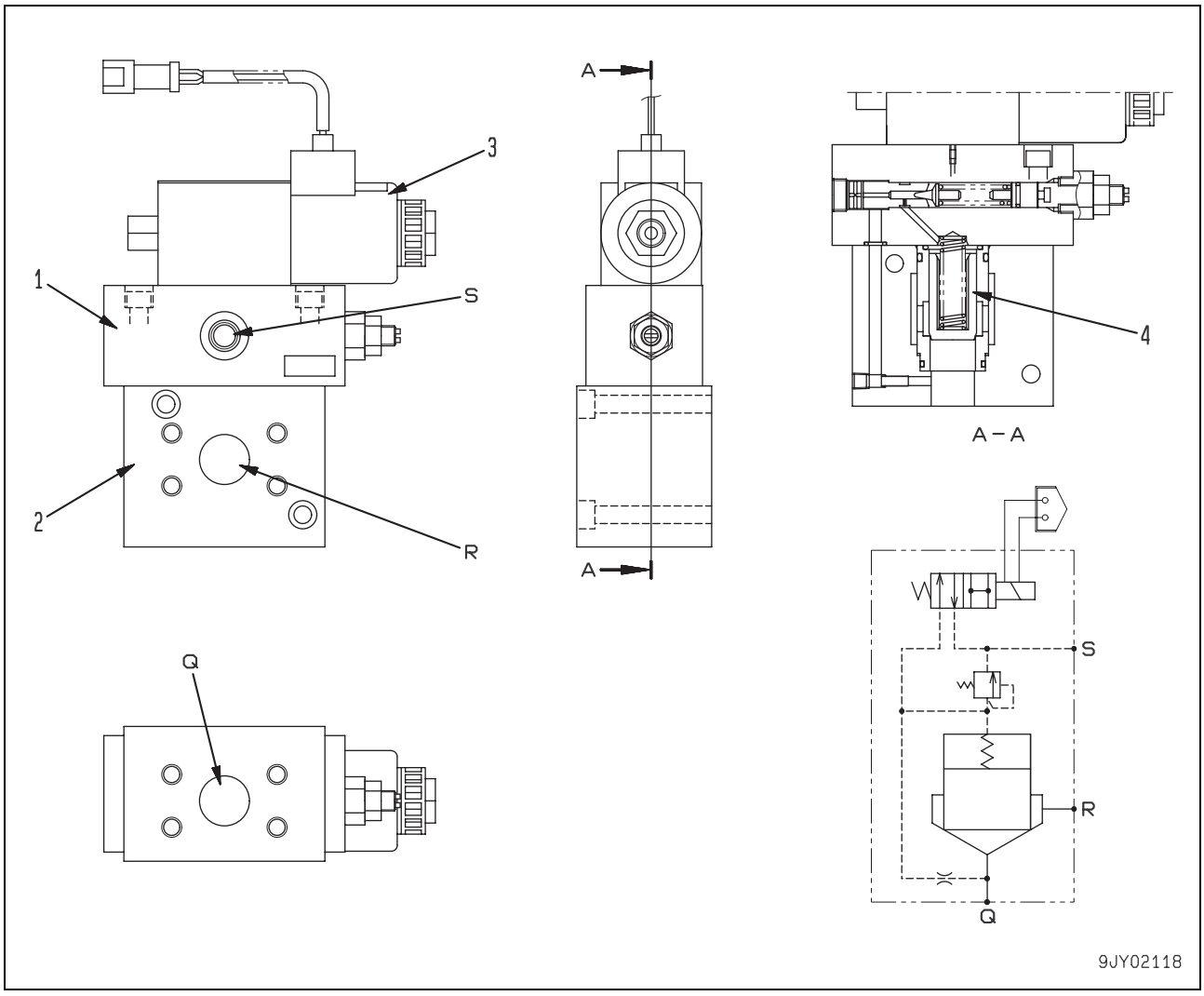
1. Engine
2. Output shaft
3. Front drive shaft
4. Center brake cooling and brake system pump (SDR(30)80+SA(1)18)
5. Power train, front brake cooling pump (SDR(30)75)
6. PTO
7. Torque converter
8. Steering, hoist control pump (SDR(30)100+(20)25+SB(1)6)
9. Transmission
10. Center drive shaft
11. Oscillation hitch
12. Drive shaft (hitch)
13. Front differential
14. Front limited slip differential
15. Front drive shaft
16. Tire
17. Final drive (front)
18. Brake (front)
19. Rear drive shaft (front)
20. Center differential
21. Center limited slip differential
22. Tire
23. Final drive (center)
24. Brake (center)
25. Rear drive shaft (rear)
26. Rear differential
27. Rear limited slip differential
28. Tire
29. Final drive (rear)
30. Interaxle differential lock

Torque converter and transmission hydraulic piping



1. Engine
2. Oil cooler
3. Center brake cooling and brake system pump (SDR(30)80+SA(1)18)
4. Torque converter
5. Transmission
6. Transmission oil filter
7. Brake system tank
8. Power train, front brake cooling pump (SDR(30)75)
9. Transmission oil filter
10. Brake cooling oil control valve (center)
11. Brake cooling oil control valve (front)

Brake cooling oil control valve (BCV)



1. Pilot relief valve assembly
2. Body
3. Solenoid valve
4. Main valve spool

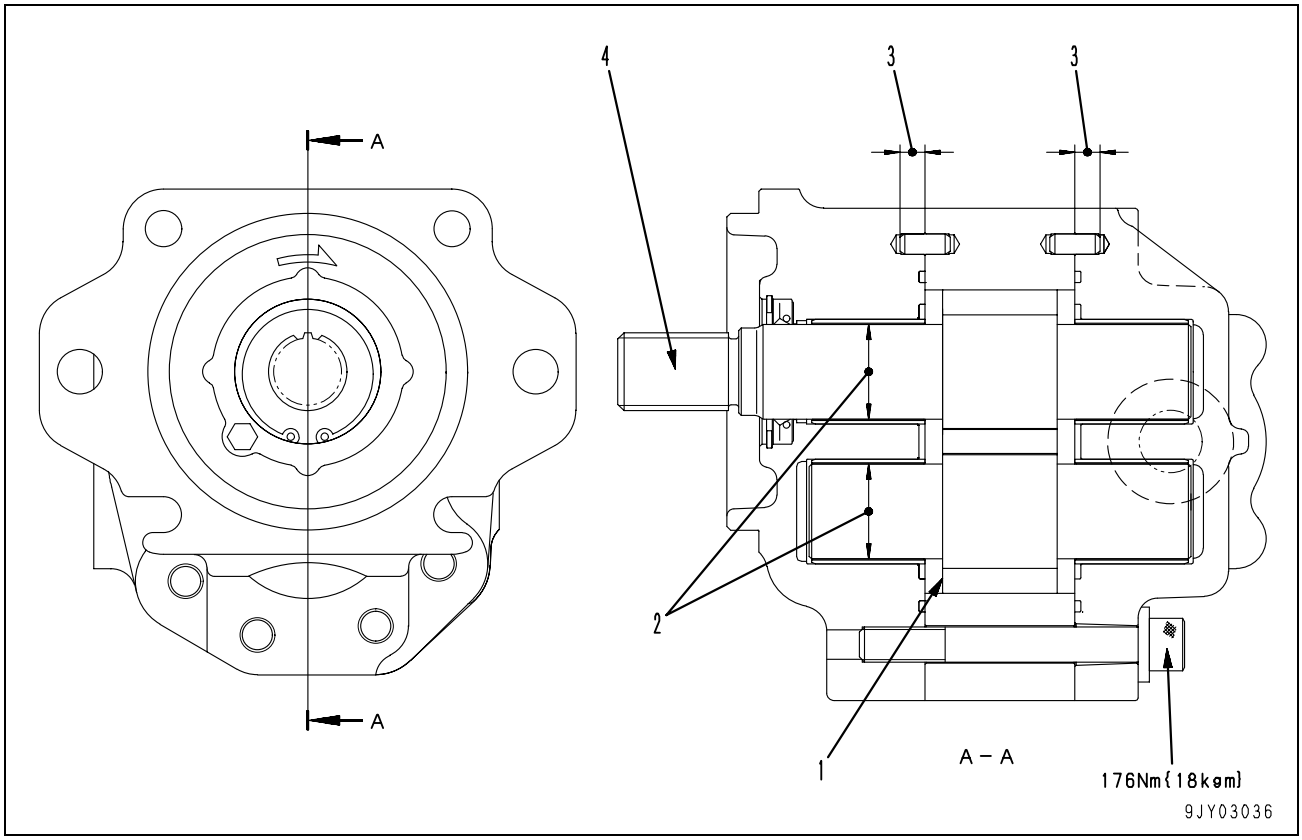
S: To transmission
Q: From transmission
R: To oil cooler

Function

- When the retarder is not being used, this valve bypasses part of the brake cooling oil to reduce the power loss when traveling.
- The main valve spool is actuated by switching the solenoid vavle ON/OFF.
  If any abnormal pressure is generated in the hydraulic circuit, the pilot relief valve is actusted, and this actuates the main relief valve, so the brake cooling valve also acts as an unload valve.

Power train pump

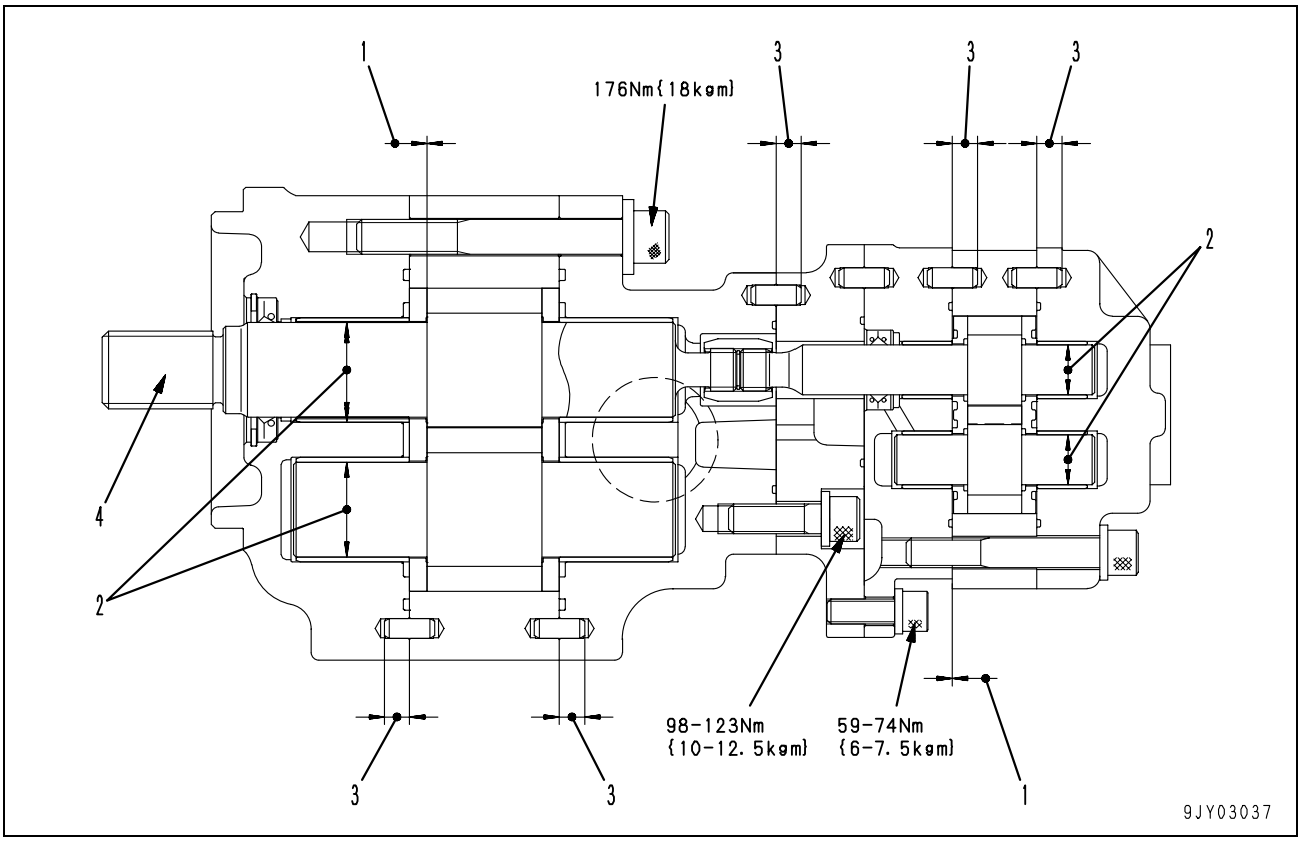
Power train, front brake cooling pump
SDR(30)75



Unit: mm

No.	Check item	Criteria					Remedy
1	Side clearance	Model		Tolerance		Repair limit	Replace
		SDR(30)-75		0.16 – 0.20		0.24	
2	Clearance between inside diameter of plain bearing and outside of diameter of gear shaft	SDR(30)-75		0.06 – 0.131		0.20	
3	Depth for knocking in pin	Model	Standard size	Tolerance		Repair limit	
		SDR(30)-75	10	0 -0.5		–	
4	Rotating torque of spline shaft	6.9 – 11.8 Nm {0.7 – 1.2 kgm}					–
–	Delivery Oil: EO10-CD Oil temperature: 45–55°C	Model	Rotating speed (rpm)	Discharge pressure {MPa (kg/cm^2)}	Standard delivery (ℓ/min)	Delivery limit (ℓ/min)	
		SDR(30)-75	2,500	20.6 {210}	172.3	159.2	

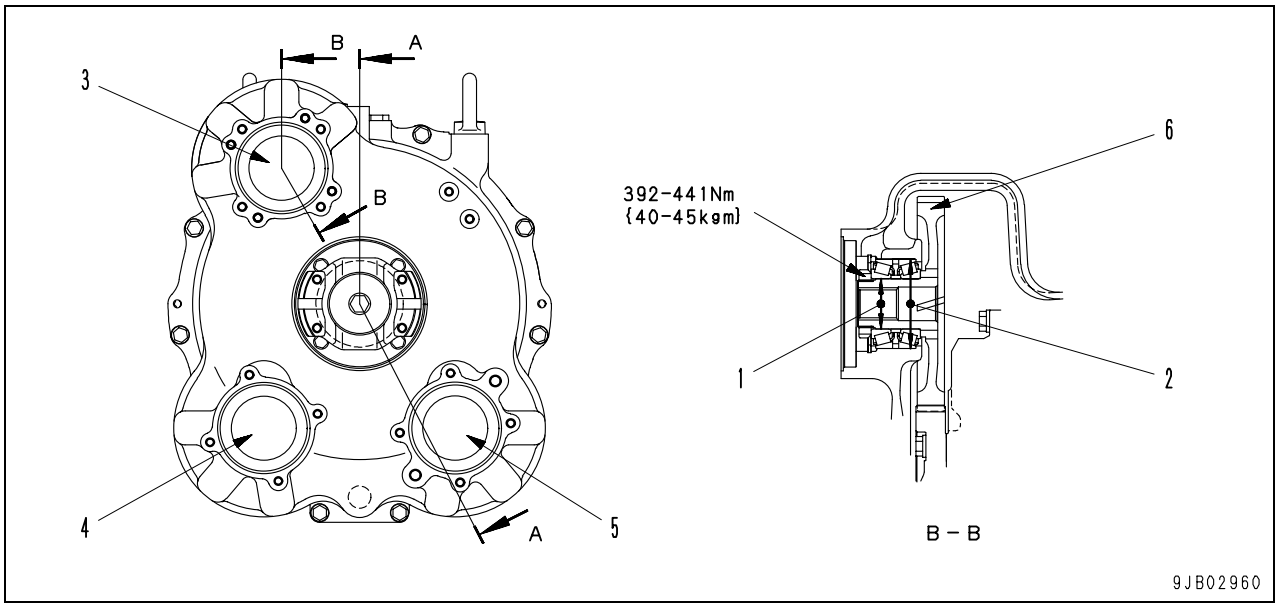
Center brake cooling, brake cooling system pump
SDR(30)+SA(1)18



Unit: mm

No.	Check item	Criteria				Remedy
1	Side clearance	Model	Tolerance	Repair limit		Replace
		SDR(30)-80	0.16 – 0.20	0.24		
		SA(1)-18	0.15 – 0.16	0.19		
2	Clearance between inside diameter of plain bearing and outside of diameter of gear shaft	SDR(30)-80	0.06 – 0.131	0.20		
		SA(1)-18	0.06 – 0.149			
3	Depth for knocking in pin	Model	Standard size	Tolerance	Repair limit	
		SDR(30)-80	10	0 -0.5	–	
		SA(1)-18				
4	Rotating torque of spline shaft	15.6 – 28.4 Nm {1.6 – 2.9 kgm}				–
–	Delivery Oil: EO10-CD Oil temperature: 45–55°C	Model	Rotating speed (rpm)	Discharge pressure {MPa (kg/cm^2)}	Standard delivery (ℓ/min)	Delivery limit (ℓ/min)
		SDR(30)-80	2,500	20.6 {210}	184.5	170.4
		SA(1)-18		24.5 {250}	40.5	36.3

Torque converter



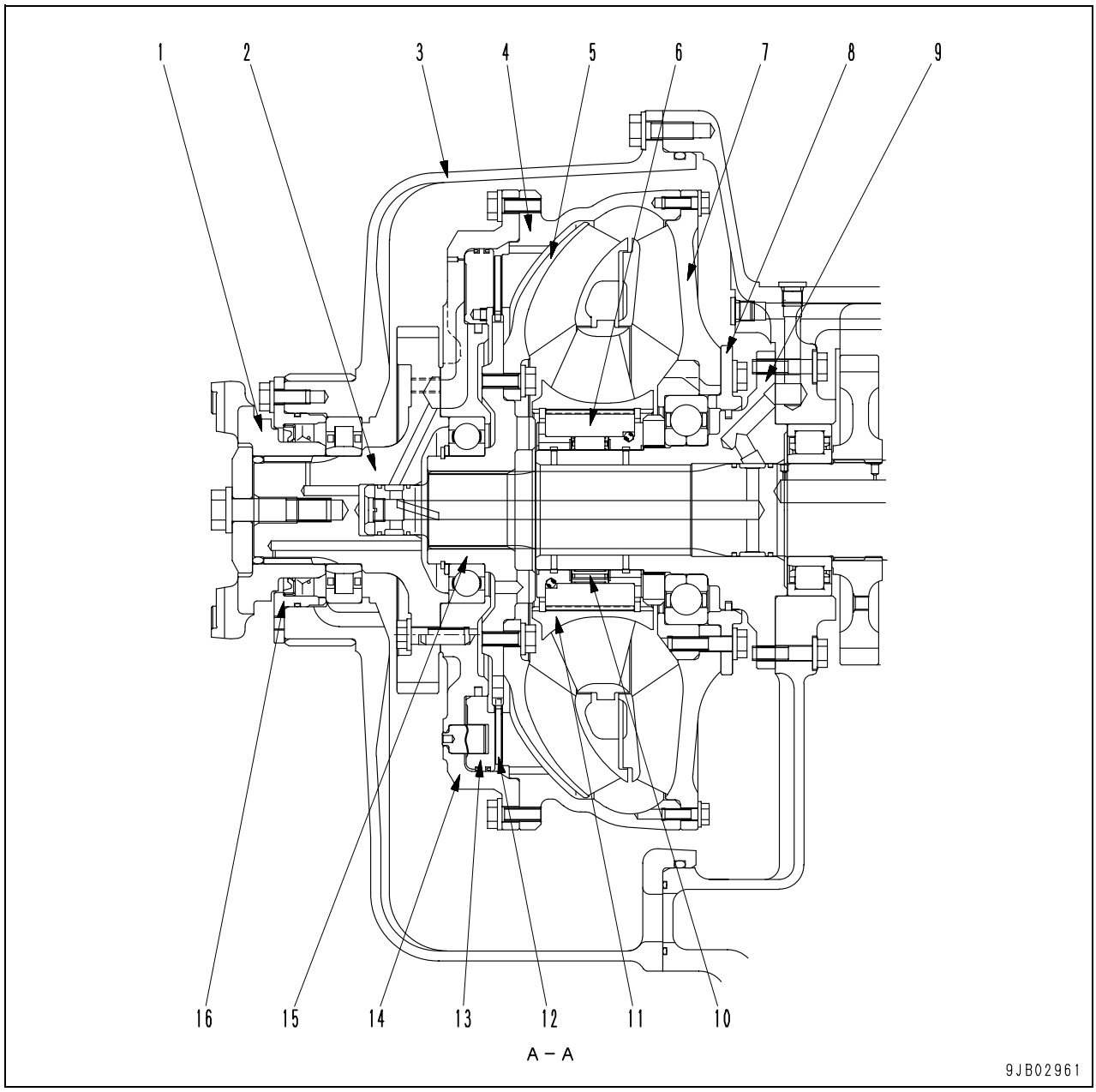
Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between PTO gear and bearing	50	+0.018 +0.002	0 -0.012	-0.030 – -0.002	—	Replace
2	Clearance between bearing and case	90	0 -0.015	+0.004 -0.018	-0.018 – 0.019	—	

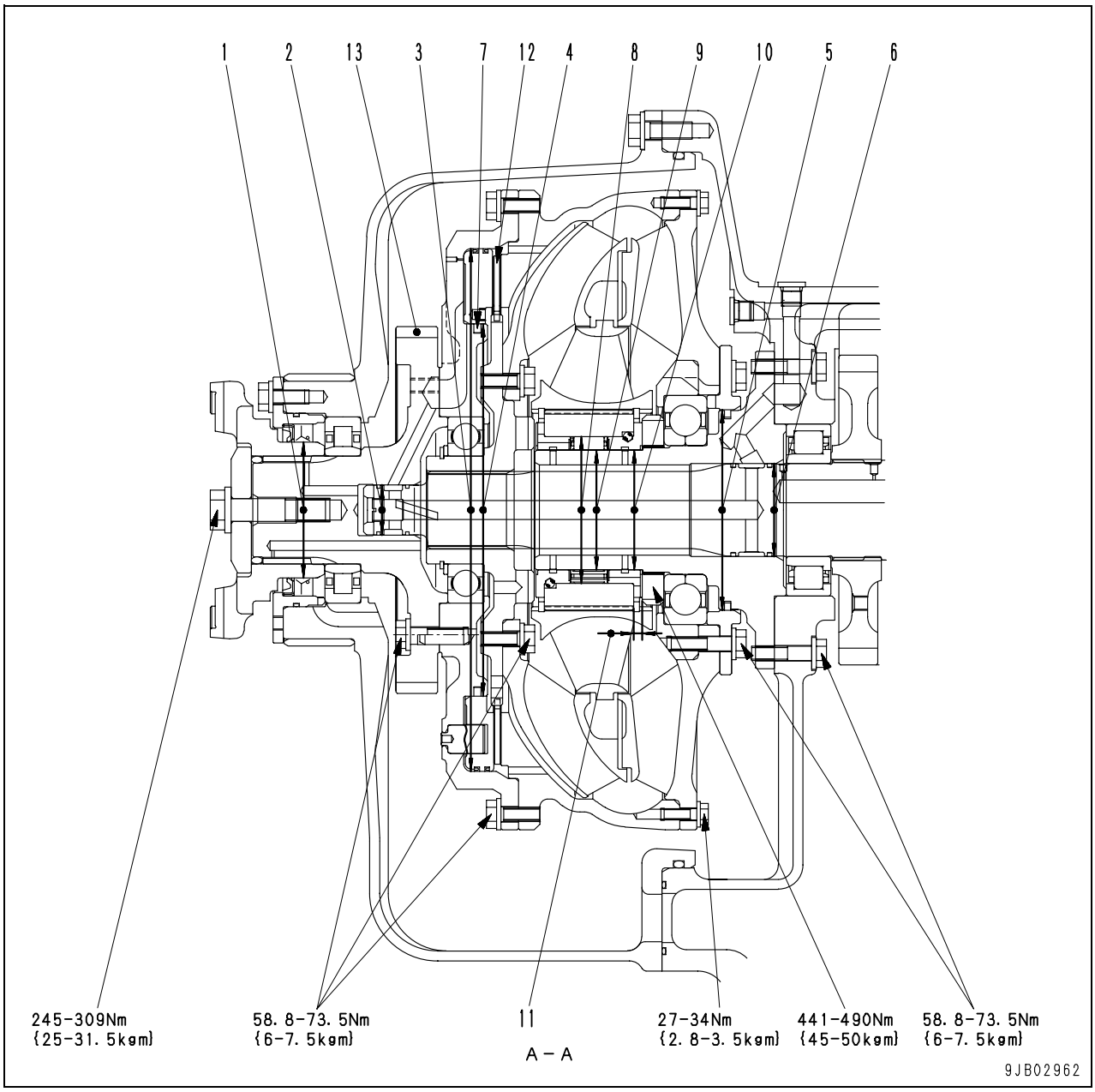
3. Steering, hoist control pump installation port
4. Center brake cooling, brake system pump installation port
5. Power train, front brake cooling pump installation port
6. PTO gear (number of teeth: 66)

Specifications

Type:	3-element, 1-stage, 2-phase with modulation and lockup clutch
Lockup clutch:	Wet type single-disc clutch hydraulic control (with modulation valve)
Stall torque ratio:	2.53



1. Coupling
2. Input shaft (number of teeth: 78)
3. Case
4. Drive case
5. Turbine
6. Race
7. Pump
8. Retainer
9. Stator shaft
10. Free wheel
11. Stator
12. Lockup clutch disc
13. Lockup clutch piston
14. Lockup clutch housing
15. Boss
16. Retainer

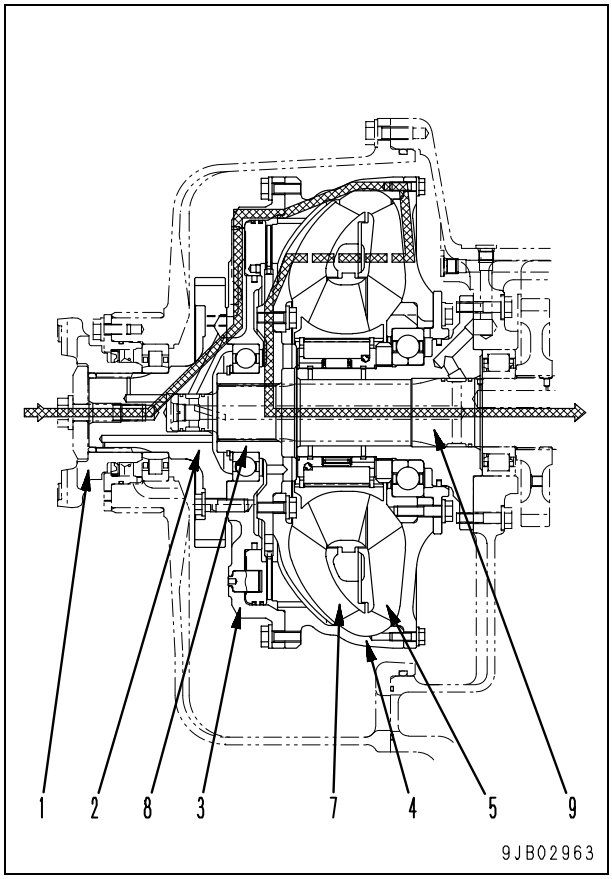

1
2
13
3
7
12
4
8
9
10
5
6
245-309Nm
{25-31.5kgm}
58.8-73.5Nm
{6-7.5kgm}
11
A-A
27-34Nm
{2.8-3.5kgm}
441-490Nm
{45-50kgm}
58.8-73.5Nm
{6-7.5kgm}
9JB02962

Unit: mm

No.	Check item		Criteria			Remedy
			Standard size	Tolerance	Repair limit	
1	Outside diameter of oil seal contact surface of coupling		95	0 -0.087	94.8	Replace
2	Inside diameter of seal ring contact surface of input shaft		35	+0.025 0	35.5	
3	Inside diameter of seal ring contact surface of clutch housing		365	+0.089 0	365.5	
4	Inside diameter of seal ring contact surface of clutch piston		260	+0.081 0	260.1	
5	Inside diameter of seal ring contact surface of retainer		140	+0.040 0	140.5	
6	Inside diameter of seal ring contact surface of stator shaft		65	+0.030 0	65.5	
7	Wear of clutch housing seal ring	Width	5	-0.01 -0.04	4.5	
		Thickness	6	±0.15	5.85	
8	Inside diameter of race free wheel transmission surface		102.555	±0.008	102.585	
9	Outer diameter of stator shaft free wheel transmission surface		83.6	+0.004 -0.009	83.57	
10	Inside diameter of sliding portion of bushing		83.71	+0.015 0	83.79	
11	Thickness of sliding portion of bushing		6	±0.05	5.5	
12	Thickness of clutch disc		5	±0.1	4.5	
13	Backlash between input shaft and PTO gear		0.18 – 0.46			

Power transmission route

When lockup clutch is “disengaged“

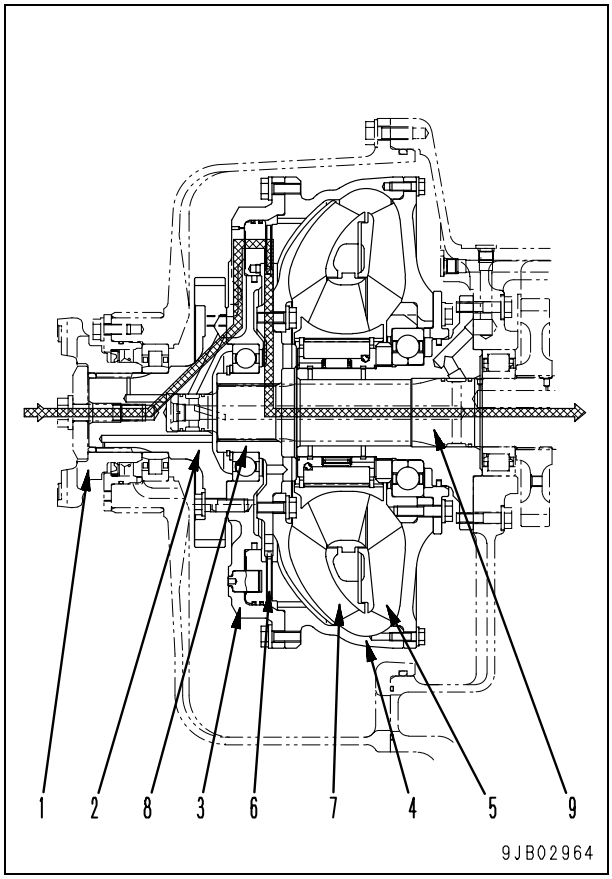


Drive case (4) is disconnected from boss (8) and turbine (7) and lockup torque converter works as an ordinary torque converter.

The power from engine
↓
Drive shaft
↓
Coupling (1)
↓
Input shaft (2), clutch housing (3), drive case (4) and pump (5) rotate together
↓
Oil is used as medium
↓
Turbine (7) and boss (8)
↓
Transmission input shaft (9)

- The power transmitted to input shaft (2) is also used as power for driving the pump after being transmitted through PTO gear.

When lockup clutch is “engaged“

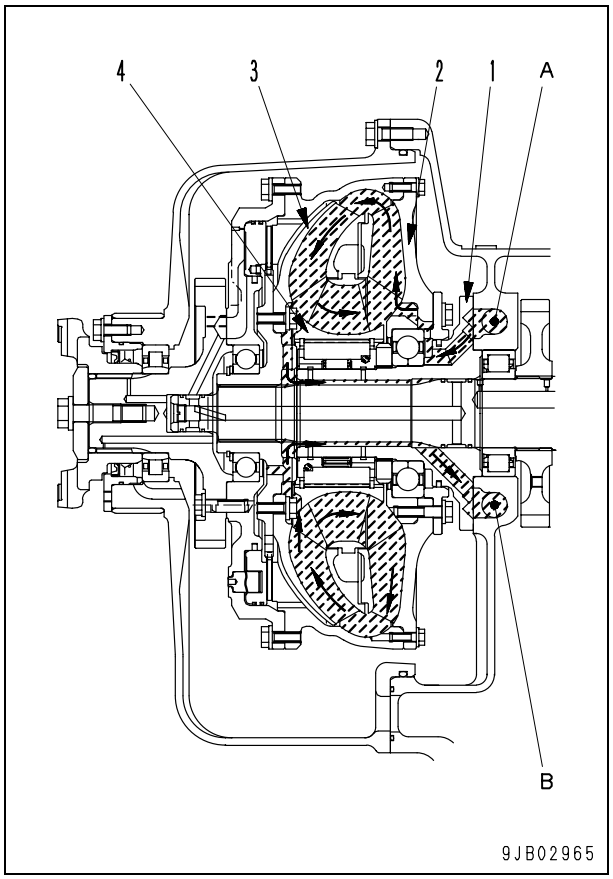


Drive case (4) is connected to boss (8) and turbine (7) and lockup torque converter is locked up.

The power from engine
↓
Drive shaft
↓
Coupling (1)
↓
Input shaft (2), clutch housing (3), drive case (4) and pump (5) rotate together
↓
Lockup clutch (6)
↓
Boss (8)
↓
Transmission input shaft (9)

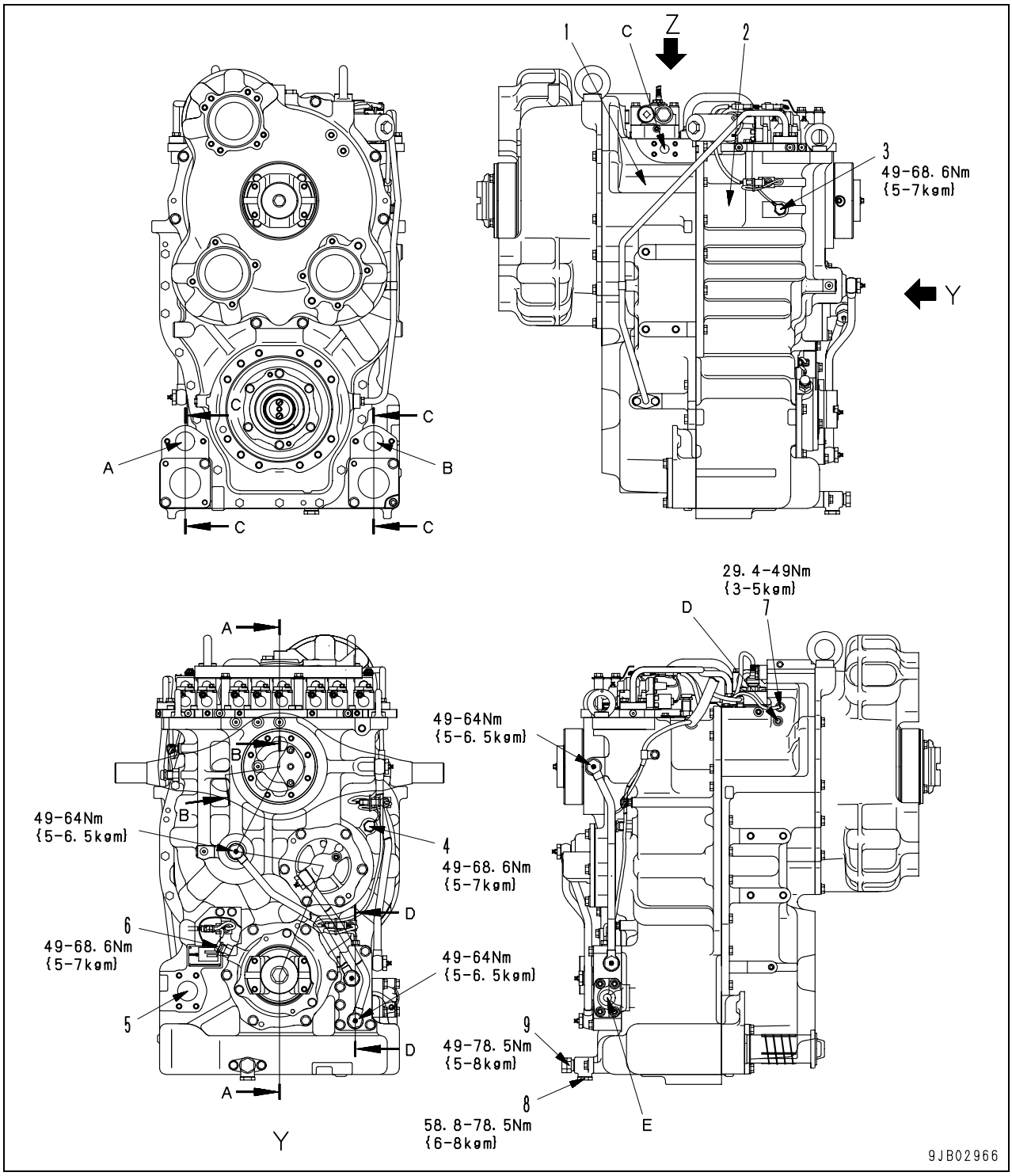
- The power transmitted to input shaft (2) is also used as power for driving the pump after being transmitted through PTO gear.

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. It then flows into inlet port (A), goes through the oil passages of stator shaft (1), and flows into pump (2).
- The oil is given centrifugal force by pump (2) and flows into turbine (3) to transfer 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.

Transmission



A: To center brake cooling,
brake system pump
B: To power train,
front brake cooling pump
C: From transmission oil filter
D: Torque converter outlet oil pressure pick-up port
E: From return filter

1. Transmission case (front)
2. Transmission case (rear)
3. Transmission intermediate shaft speed sensor
4. Differential input speed sensor
5. Oil filler tube mounting port
6. Differential output speed sensor
7. Torque converter outlet oil temperature sensor
8. Drain plug
9. Drain valve

Outline

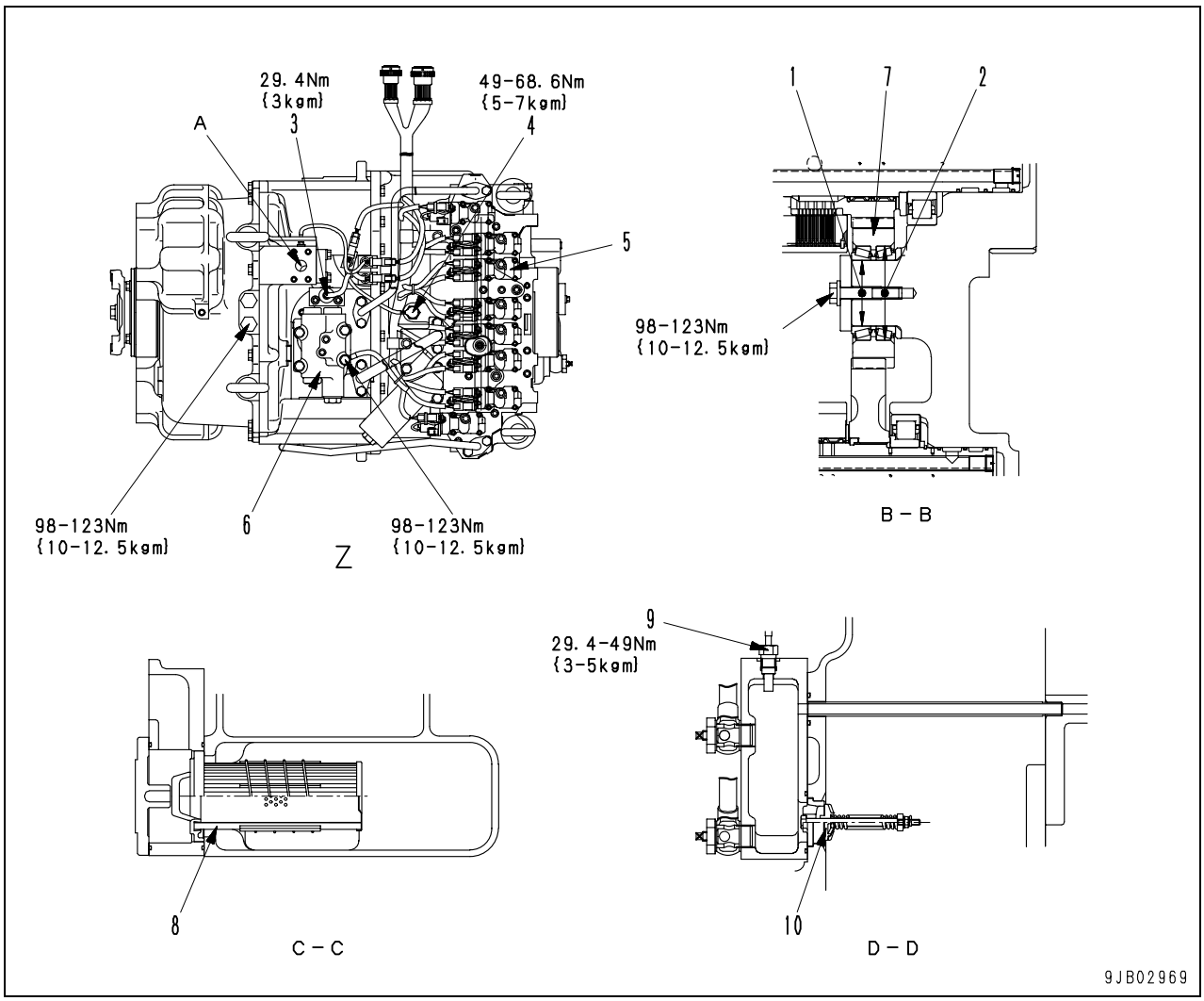
- The transmission adopted is a “forward 6-gear speed and reverse 2-gear speed“ transmission which consists of the counter-shaft type, constant mesh spur gear mechanisms and the disc clutches.
- The transmission selects one rotation direction and rotation speed by fixing the counter-shaft type, constant mesh spur gear mechanisms and 2 out of 6 sets disc clutch with the oil pressure by ECMV operation.
- The transmission transfers the power received by the transmission input shaft to the output shaft while changing the gear speed (forward 1st-6th or reverse 1st-2nd) by any combination of the FL, FH, R clutches and 3 speed clutches.
- The gear is automatically shifted with automatic transmission based on the engine speed changes.

Number of plates and discs used

Clutch No.	Number of plates	Number of discs
FL clutch	11	10
R clutch	11	10
FH clutch	11	10
1st clutch	13	12
3rd clutch	10	9
2nd clutch	10	9

Combinations of clutches at respective gear speeds and reduction ratio

Gear speed	Operated clutches	Reduction ratio
Forward 1st	FL x 1st	6.477
Forward 2nd	FH x 1st	4.103
Forward 3rd	FL x 2nd	2.717
Forward 4th	FH x 2nd	1.721
Forward 5th	FL x 3rd	1.130
Forward 6th	FH x 3rd	0.716
Neutral	—	—
Reverse 1st	R x 1st	5.789
Reverse 2nd	R x 2nd	2.429

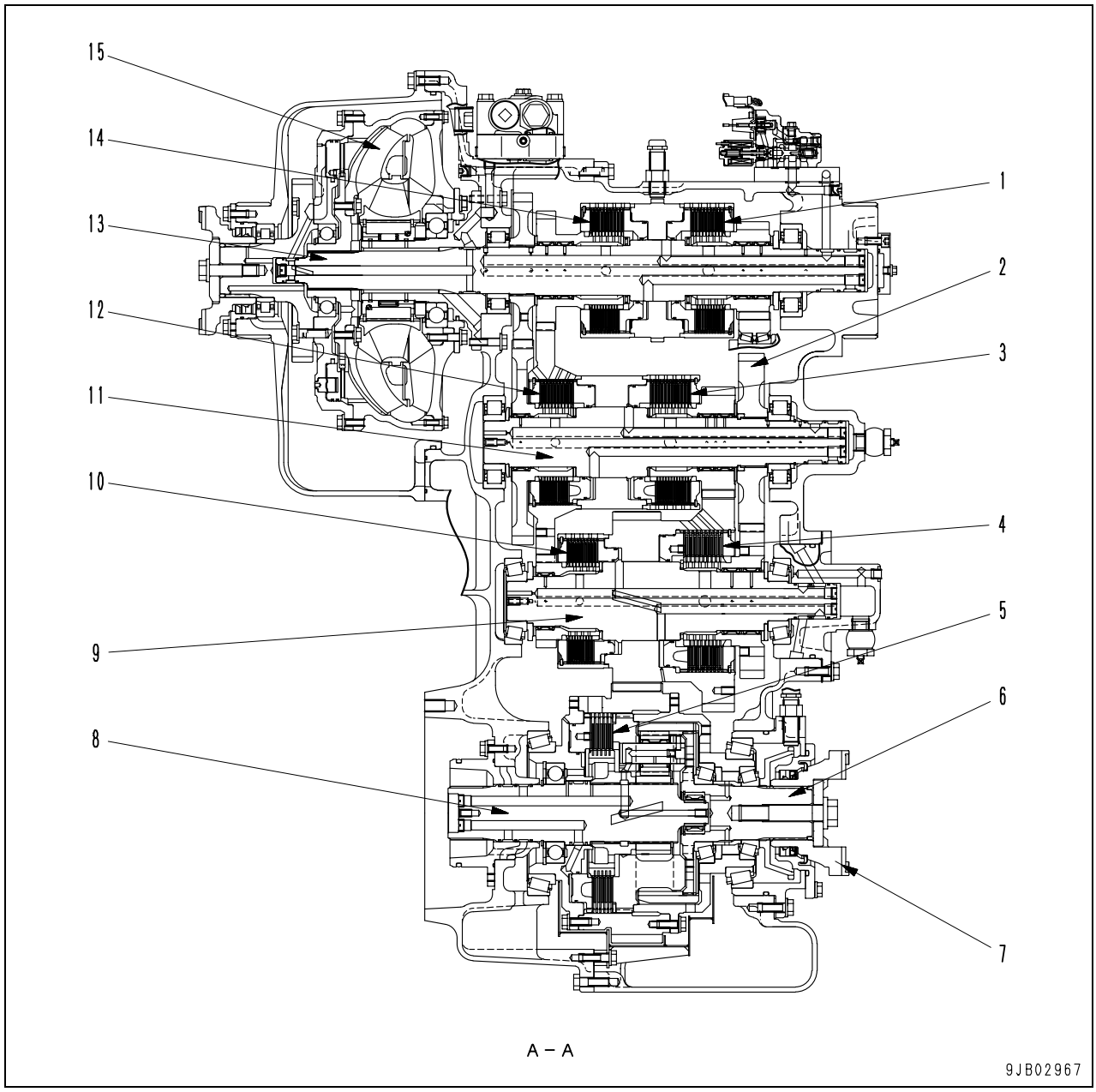


Unit: mm

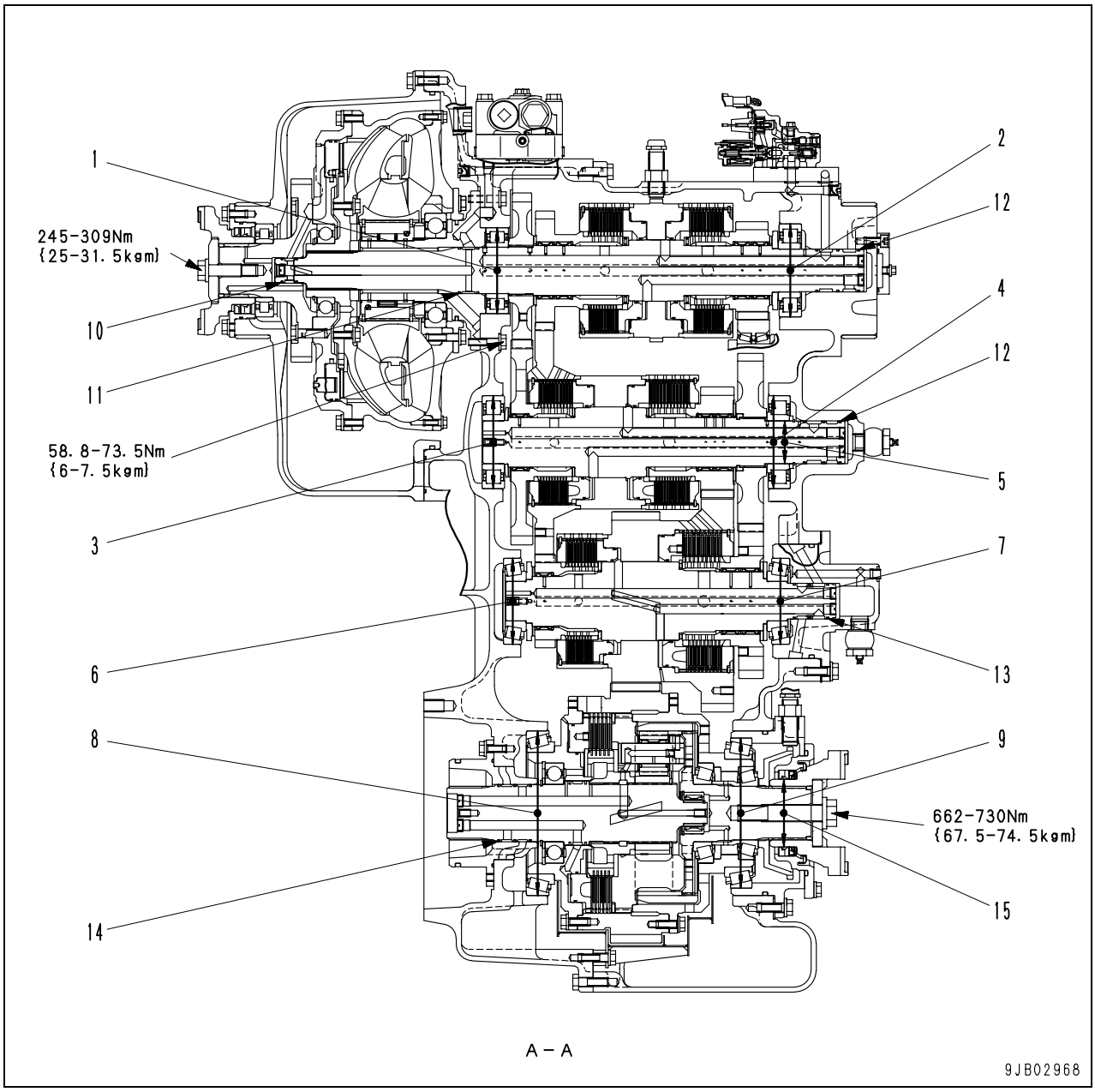
No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between bearing and case	70	+0.032 +0.002	0 -0.015	-0.047– -0.002	—	Replace
2	Clearance between R idler gear and bearing	100	0 -0.015	-0.049 -0.073	-0.073 – -0.034	—	

3. Torque converter intermediate oil pressure sensor
4. Transmission input shaft speed sensor
5. Transmission control valve
6. Main relief, torque converter relief valve
7. R idler gear (number of teeth: 33)
8. Strainer
9. Power train lubricating oil temperature sensor
10. Lubricating oil relief valve

A: To front brake



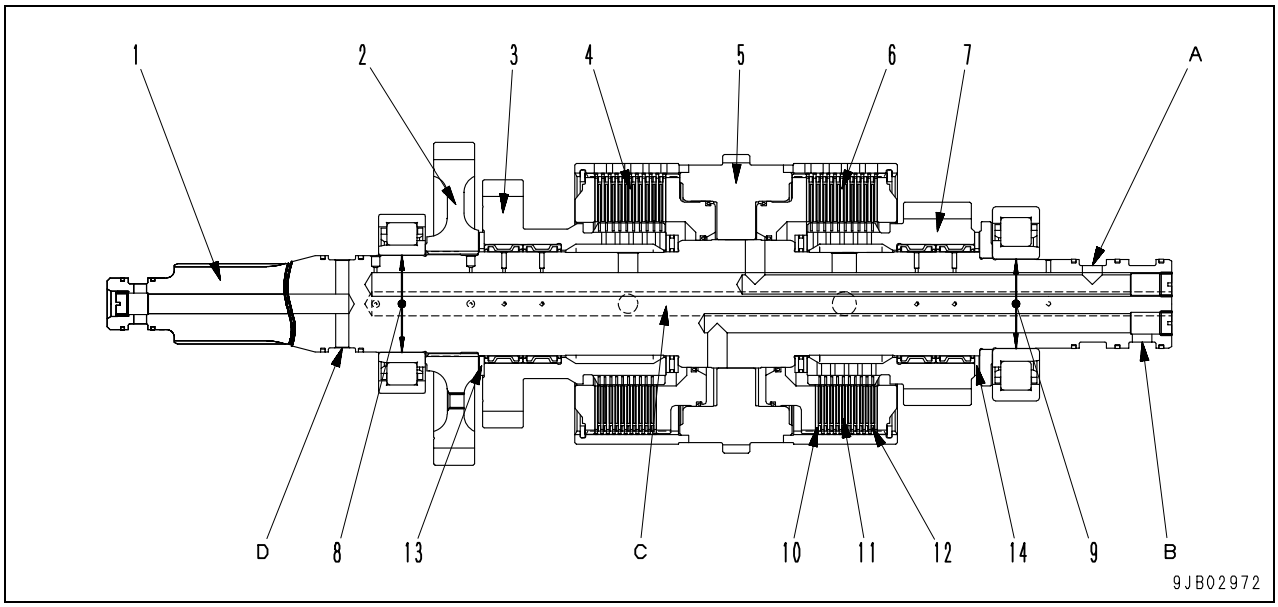
1. R clutch
2. Upper gear (number of teeth: 53)
3. 1st clutch
4. 2nd clutch
5. Differential lock clutch
6. Rear output shaft
7. Rear coupling
8. Front output shaft
9. Lower shaft
10. 3rd clutch
11. Upper shaft
12. FH clutch
13. Input shaft
14. FL clutch
15. Torque converter


1
2
12
245-309Nm
{25-31.5kgm}
4
10
12
11
58.8-73.5Nm
{6-7.5kgm}
5
3
7
6
13
8
9
662-730Nm
{67.5-74.5kgm}
15
14
A – A
9JB02968

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between FL, R clutch bearing and case (front)	120	0 -0.015	-0.010 -0.045	-0.045 – 0.005	—	Replace
2	Clearance between FL, R clutch bearing and case (rear)	130	0 -0.018	-0.012 -0.052	-0.052 – 0.006	—	
3	Clearance between FH, 1st clutch bearing and case (front)	130	0 -0.018	-0.012 -0.052	-0.052 – 0.006	—	
4	Clearance between FH, 1st clutch bearing and case (rear)	130	0 -0.018	-0.012 -0.052	-0.052 – 0.006	—	
5	Clearance between FH, 1st clutch bearing and upper shaft (rear)	60	+0.054 +0.044	0 -0.015	-0.069 – -0.044	—	
6	Clearance between 2nd, 3rd clutch bearing and case (front)	120	0 -0.018	-0.010 -0.045	-0.045 – 0.008	—	
7	Clearance between 2nd, 3rd clutch bearing and case (rear)	120	0 -0.018	-0.015 -0.045	-0.045 – 0.003	—	
8	Clearance between differential lock clutch bearing and case (front)	230	0 -0.030	-0.014 -0.060	-0.060 – 0.016	—	
9	Clearance between differential lock clutch bearing and case (rear)	210	0 -0.030	+0.013 -0.033	-0.033 – 0.017	—	
		Standard size		Tolerance		Repair limit	
10	Width of input shaft seal ring groove	2.5		+0.18 +0.10		2.7	
11	Width of input shaft seal ring groove	3.2		+0.076 0		3.5	
12	Inside diameter of seal ring contact surface of input and upper shafts (rear)	60		+0.050 0		60.1	
	Width of input and upper shafts seal ring grooves (rear)	3.2		+0.076 0		3.5	
13	Inside diameter of seal ring contact surface of lower shaft (rear)	50		+0.050 0		50.1	
	Width of lower shaft seal ring groove (rear)	3.2		+0.076 0		3.5	
14	Inside diameter of seal ring contact surface of front output shaft	80		+0.030 0		80.1	
	Width of front output shaft seal ring groove	3.2		+0.076 0		3.5	
15	Outside diameter of oil seal contact surface of rear coupling	95		0 -0.087		94.8	

FL, R clutch



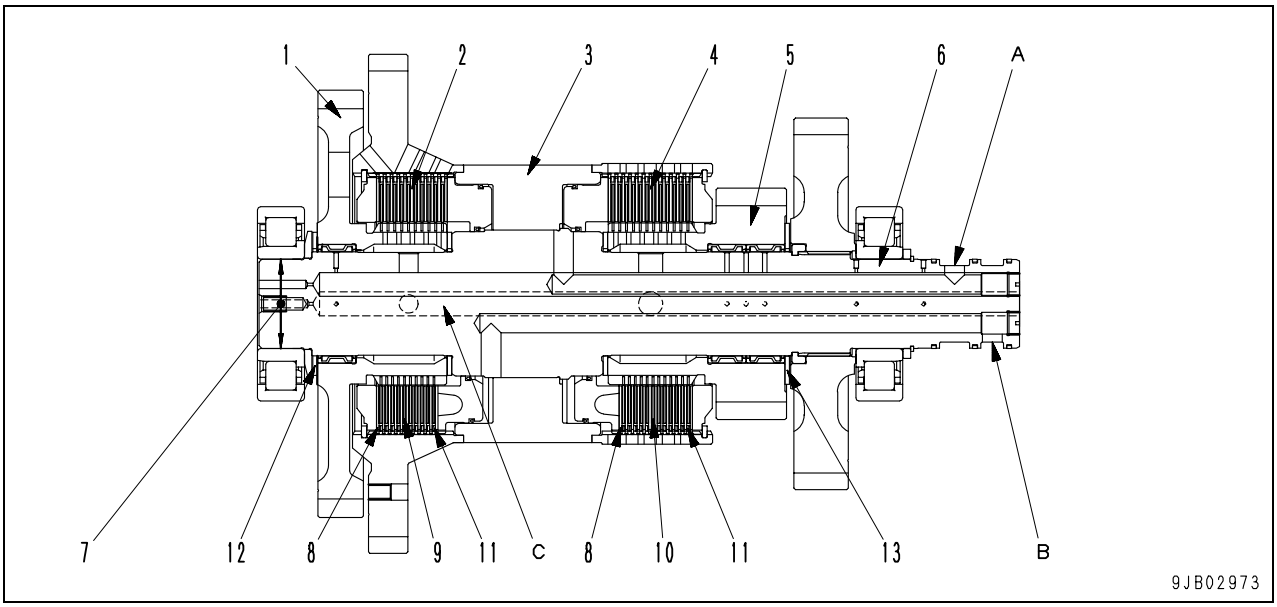
A: R clutch oil port
B: FL clutch oil port
C: Lubrication oil port
D: Lockup clutch oil port

1. Input shaft
2. Input gear (number of teeth: 41)
3. FL clutch gear (number of teeth: 34)
4. FL clutch
5. FL, R cylinder (number of teeth: 78)
6. R clutch
7. R clutch gear (number of teeth: 28)

Unit: mm

No.	Check item		Criteria					Remedy
8	Clearance between FL, R shaft and bearing (front)		Standard size	Tolerance		Standard clearance	Clearance limit	Replace
				Shaft	Hole			
			65	+0.033 +0.022	0 -0.015	-0.048 – -0.022	—	
9	Clearance between FL, R shaft and bearing (rear)		60	+0.033 +0.022	0 -0.015	-0.048 – -0.022	—	
10	Clutch plate	Thickness	Standard size: 1.7	Tolerance: ±0.05		Repair limit: 1.5		
		Strain	Standard size: —	Tolerance: 0.05		Repair limit: 0.15		
11	Clutch disc	Thickness	Standard size: 2.2	Tolerance: ±0.08		Repair limit: 1.75		
		Strain	Standard size: —	Tolerance: 0.10		Repair limit: 0.25		
12	Wave spring load [Test height: 2.2 mm]		1,010 N {103 kg}	±101 N {±10.3 kg}		859 N {87.6 kg}		
13	Thickness of thrust washer (FL clutch)		3	±0.1		2.7		
14	Thickness of thrust washer (R clutch)		3	±0.1		2.7		

FH, 1st clutch



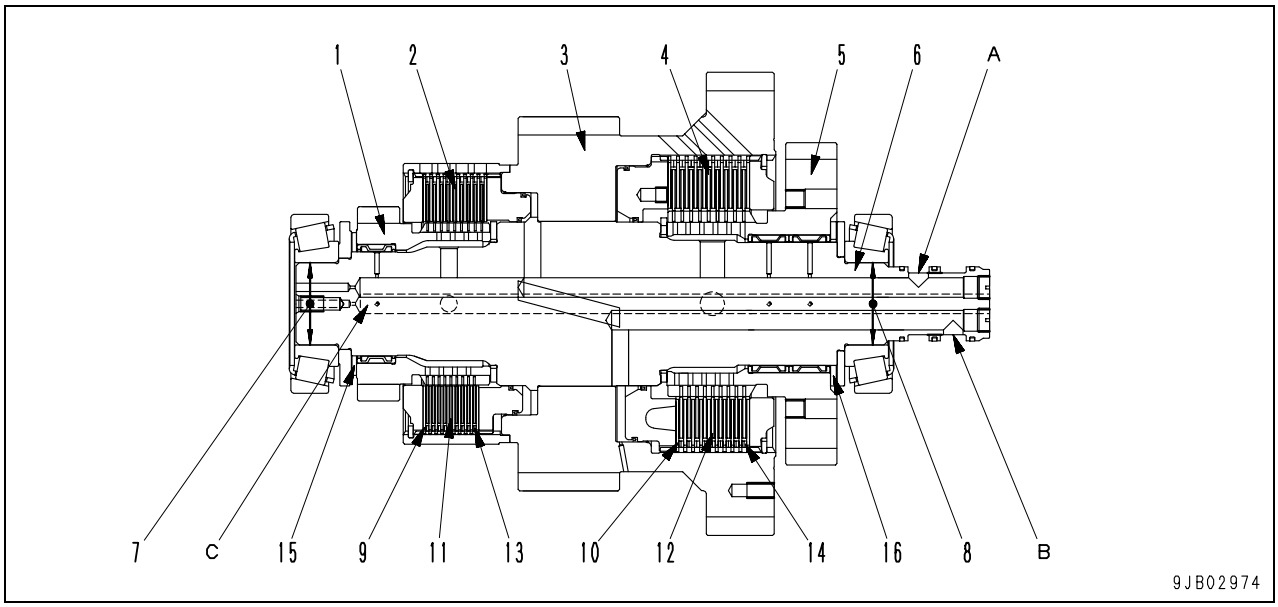
A: 1st clutch oil port
B: FH clutch oil port
C: Lubrication oil port

1. FH clutch gear (number of teeth: 55)
2. FH clutch
3. FH, 1st cylinder (number of teeth: 72)
4. 1st clutch
5. 1st clutch gear (number of teeth: 29)
6. Upper shaft

Unit: mm

No.	Check item		Criteria					Remedy
7	Clearance between FH, 1st shaft and bearing (front)		Standard size	Tolerance		Standard clearance	Clearance limit	Replace
				Shaft	Hole			
			60	+0.033 +0.022	0 -0.015	-0.048 – -0.022	—	
8	Clutch plate		Standard size	Tolerance		Repair limit		
		Thickness	1.7	±0.05		1.5		
		Strain	—	0.05		0.15		
9	Clutch disc (FH clutch)	Thickness	2.2	±0.08		1.75		
		Strain	—	0.10		0.25		
10	Clutch disc (1st clutch)	Thickness	2.2	±0.08		1.8		
		Strain	—	0.10		0.25		
11	Wave spring load [Test height: 2.2 mm]		1,010 N {103 kg}	±101 N {±10.3 kg}		859 N {87.6 kg}		
12	Thickness of thrust washer (FH clutch)		3	±0.1		2.7		
13	Thickness of thrust washer (1st clutch)		3	±0.1		2.7		

2nd, 3rd clutch



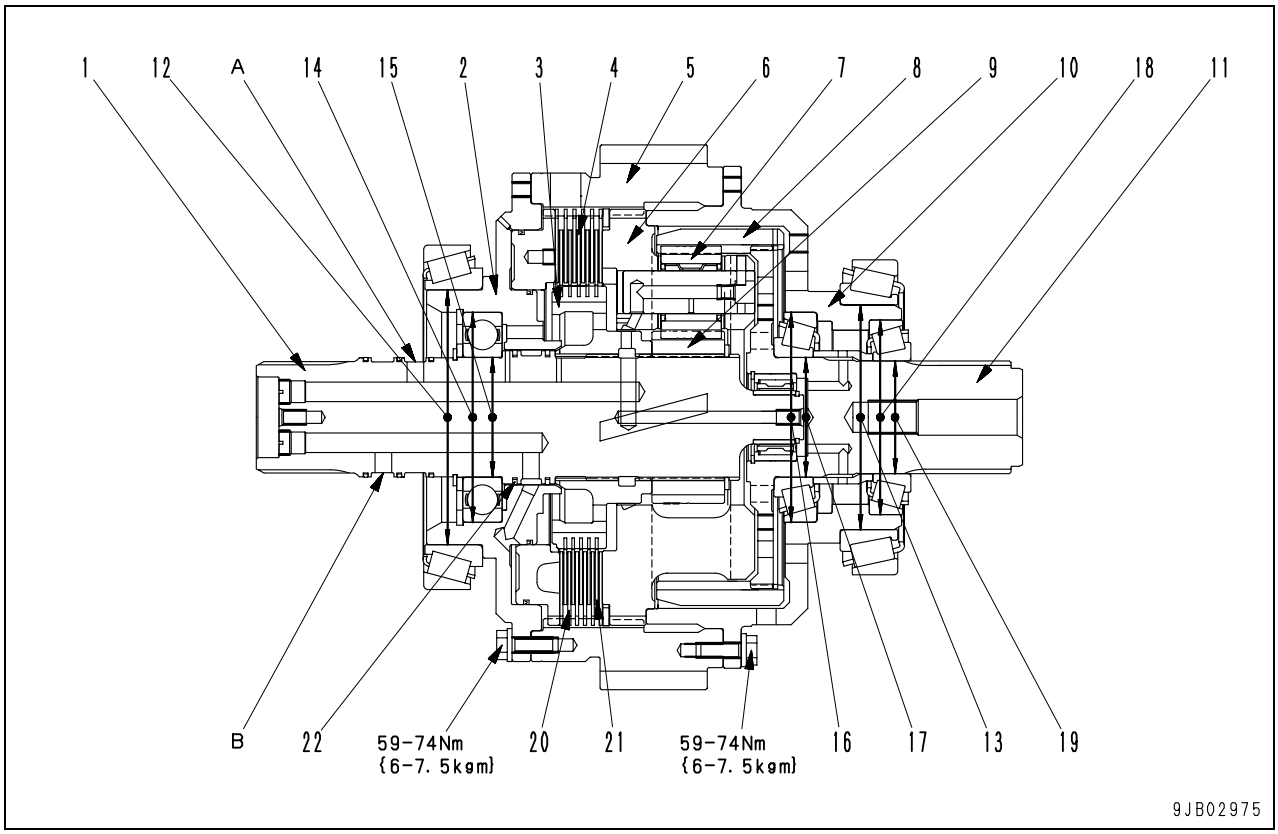
A: 3rd clutch oil port
B: 2nd clutch oil port
C: Lubrication oil port

1. 3rd clutch gear (number of teeth: 26)
2. 3rd clutch
3. 2nd, 3rd cylinder (number of teeth: 60, 46)
4. 2nd clutch
5. 2nd clutch gear (number of teeth: 46)
6. Lower shaft

Unit: mm

No.	Check item		Criteria					Remedy
7	Clearance between 2nd, 3rd shaft and bearing (front)		Standard size	Tolerance		Standard clearance	Clearance limit	Replace
				Shaft	Hole			
			55	+0.035 +0.020	0 -0.015	-0.050 – -0.020	—	
8	Clearance between 2nd, 3rd shaft and bearing (rear)		55	+0.035 +0.020	0 -0.015	-0.050 – -0.020	—	
9	Clutch plate (3rd clutch)		Standard size	Tolerance		Repair limit		
		Thickness	1.7	±0.05		1.5		
		Strain	—	0.05		0.15		
10	Clutch plate (2nd clutch)	Thickness	2.0	±0.05		1.8		
		Strain	—	0.05		0.15		
11	Clutch disc (3rd clutch)	Thickness	2.2	±0.08		1.75		
		Strain	—	0.10		0.25		
12	Clutch disc (2nd clutch)	Thickness	3.2	±0.08		2.75		
		Strain	—	0.10		0.25		
13	Wave spring load (3rd clutch) [Test height: 2.2 mm]		1,010 N {103 kg}	±101 N {±10.3 kg}		859 N {87.6 kg}		
14	Wave spring load (2nd clutch) [Test height: 3.8 mm]		1,270 N {130 kg}	±115 N {±11.7 kg}		1,090 N {111 kg}		
15	Thickness of thrust washer (3rd clutch)		3	±0.1		2.7		
16	Thickness of thrust washer (2nd clutch)		4	±0.1		3.7		

Differential lock clutch



A: Lubrication oil port
B: Differential lock clutch oil port

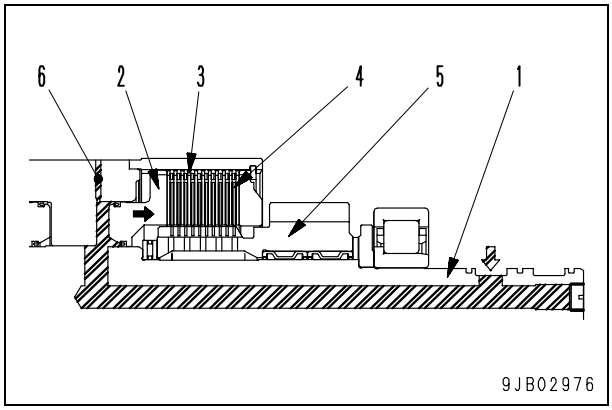
1. Front output shaft
2. Front housing
3. Clutch hub
4. Differential lock clutch
5. Output gear (number of teeth: 68)
6. Carrier
7. Planetary gear (number of teeth: 22)
8. Ring gear (number of teeth: 88)
9. Sun gear (number of teeth: 44)
10. Rear housing
11. Rear output shaft

Unit: mm

No.	Check item		Criteria					Remedy
12	Clearance between front housing and bearing		Standard size	Tolerance		Standard clearance	Clearance limit	Replace
				Shaft	Hole			
			170	+0.065 +0.040	0 -0.025	-0.090 – -0.040	—	
13	Clearance between rear housing and bearing		150	+0.080 +0.055	0 -0.025	-0.105 – -0.055	—	
14	Clearance between front housing and bearing		140	0 -0.018	-0.020 -0.045	-0.045 – -0.002	—	
15	Clearance between front output shaft and bearing (front)		80	+0.030 +0.011	0 -0.015	-0.045 – -0.011	—	
16	Clearance between rear housing and bearing (large)		140	0 -0.020	-0.035 -0.075	-0.075 – -0.015	—	
17	Clearance between rear output shaft and bearing (large)		80	+0.024 +0.011	0 -0.015	-0.039 – -0.011	—	
18	Clearance between rear housing and bearing (small)		130	0 -0.020	-0.035 -0.075	-0.075 – -0.015	—	
19	Clearance between rear output shaft and bearing (small)		75	+0.024 +0.011	0 -0.015	-0.039 – -0.011	—	
			Standard size		Tolerance		Repair limit	
20	Clutch plate	Thickness	2.0		±0.05		1.8	
		Strain	—		0.05		0.15	
21	Clutch disc	Thickness	3.2		±0.10		2.75	
		Strain	—		0.20		0.25	
22	Inside diameter of seal ring contact surface of front housing		90		+0.035 0		90.1	
	Width of front output shaft seal ring groove		3.0		+0.15 +0.10		3.3	
	Wear of front output shaft seal ring	Width	3.0		-0.01 -0.03		2.7	
		Thickness	3.7		±0.12		3.3	

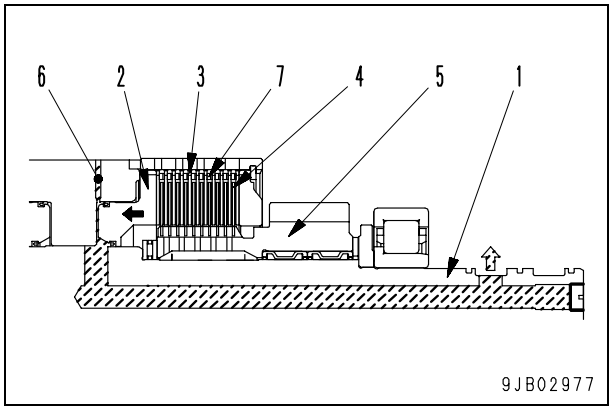
Operation of the disc clutch

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 cluch 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)

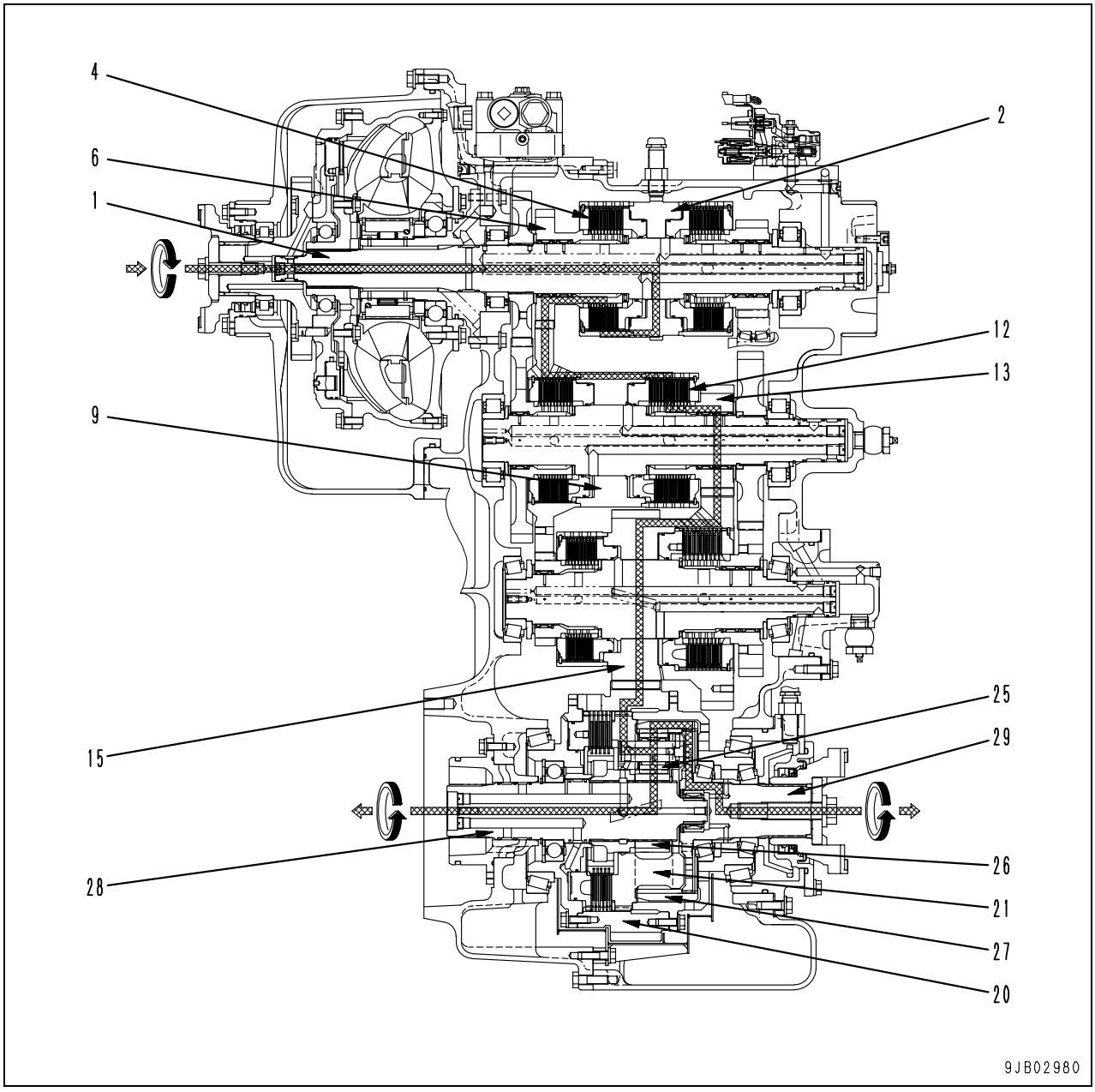


- When the oil sent from the ECMV is shut off, pressure of the oil acting on the back face of piston (2) goes down.
- Piston (2) is pushed back to the left by the tension of wave spring (7).
- The friction force between plates (3) and discs (4) is eliminated and shaft (1) and clutch gear (5) are released.
- 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 configured only for the 2nd, differential lock clutch.

Power transmitting route

Forward 1st speed



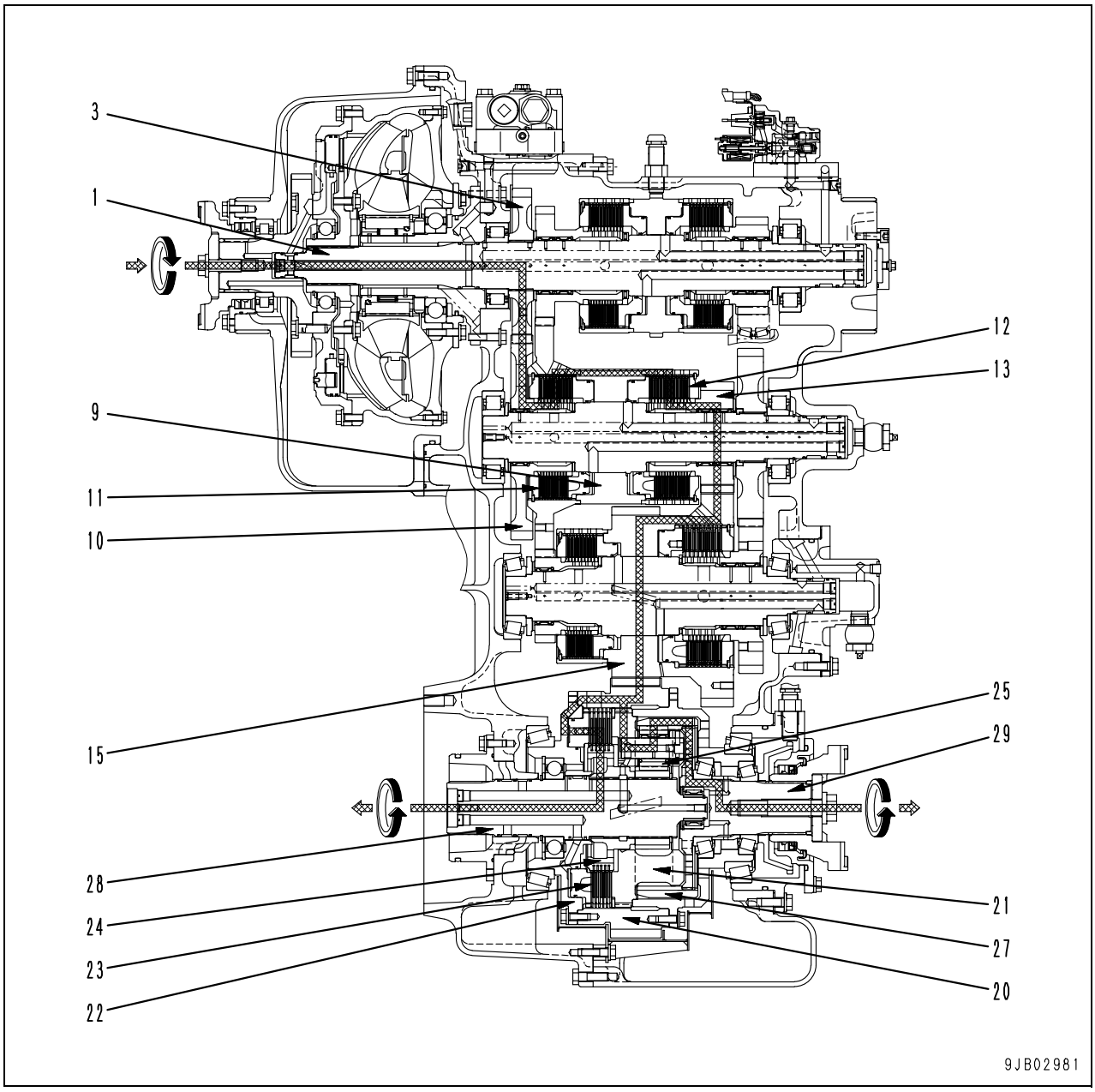
★ The diagram above shows the situation when the differential lock is "off".

FL clutch (4) and 1st clutch (12) are fixed hydraulically.

The power from the torque converter
↓
Input shaft (1)
↓
FL and R cylinders (2)
↓
FL clutch (4)
↓
FL clutch gear (6)
↓
FL and 1st cylinders (9)
↓
1st clutch (12)
↓
1st clutch gear (13)
↓
2nd and 3rd cylinders (15)
↓
Output gear (20)
(The operation when differential lock is turned "OFF" is explained below)
↓
Carrier (21)
↓
Planetary gear (25) → ↓
↓ Ring gear (27)
Sun gear (26) ↓
↓ Rear output shaft (29)
Front output shaft (28)

★ If the differential lock is "on", see Forward 2nd speed.

Forward 2nd speed



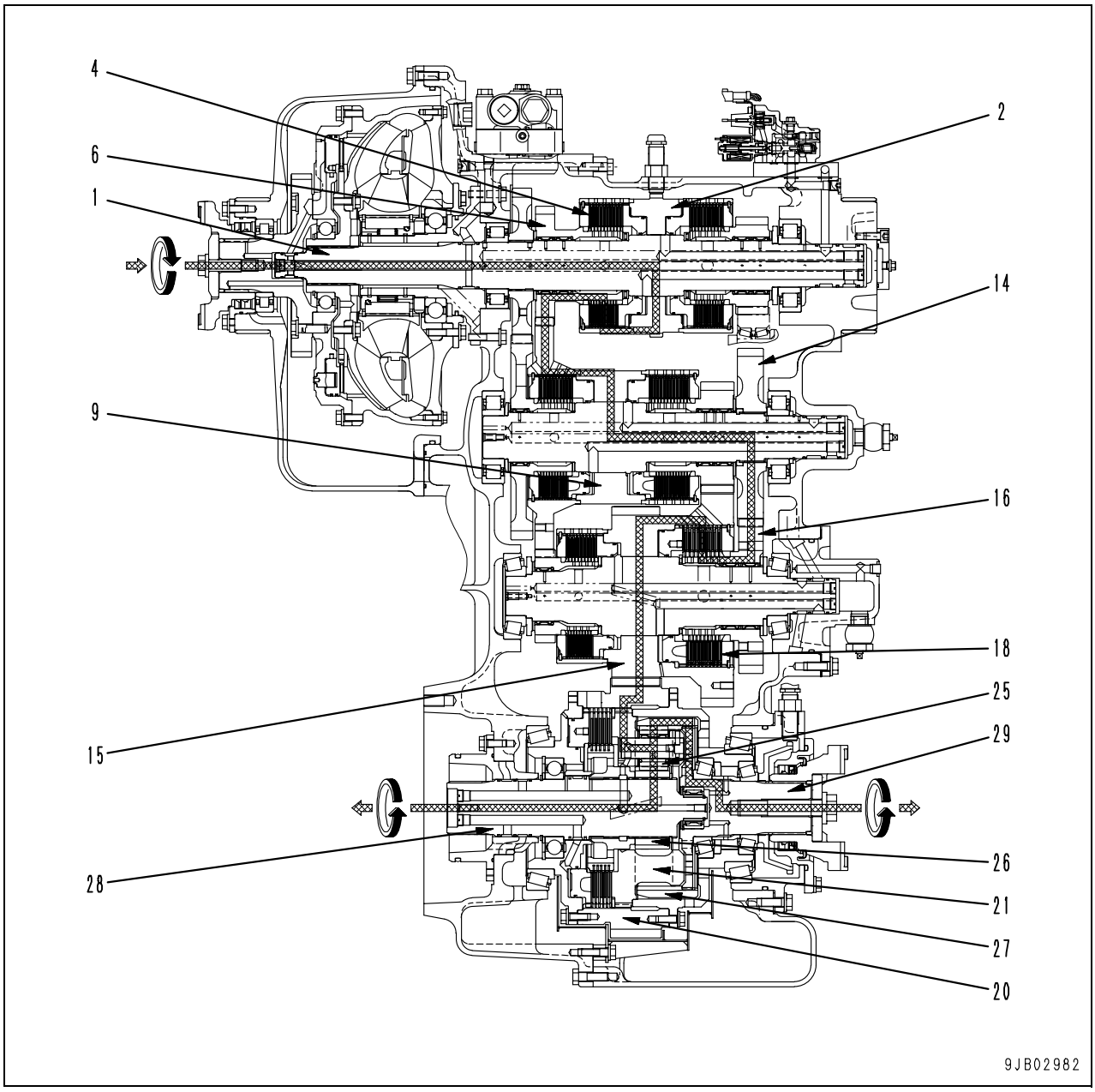
★ The diagram above shows the situation when the differential lock is "on".

FH clutch (11) and 1st clutch (12) are fixed hydraulically.

The power from the torque converter
↓
Input shaft (1)
↓
Input gear (3)
↓
FH clutch gear (10)
↓
FH clutch (11)
↓
FH and 1st cylinders (9)
↓
1st clutch (12)
↓
1st clutch gear (13)
↓
2nd and 3rd cylinders (15)
↓
Output gear (20)
(The operation when differential lock is turned "ON" is explained below)
↓
Carrier (21) → ↓
↓
Front housing (22)
↓
Differential lock clutch (23) → Planetary gear (25)
↓ ↓
Clutch hub (24) → Ring gear (27)
↓ ↓
Front output shaft (28) → Rear output shaft (29)

★ If the differential lock is "off", see Forward 1st speed.

Forward 3rd speed



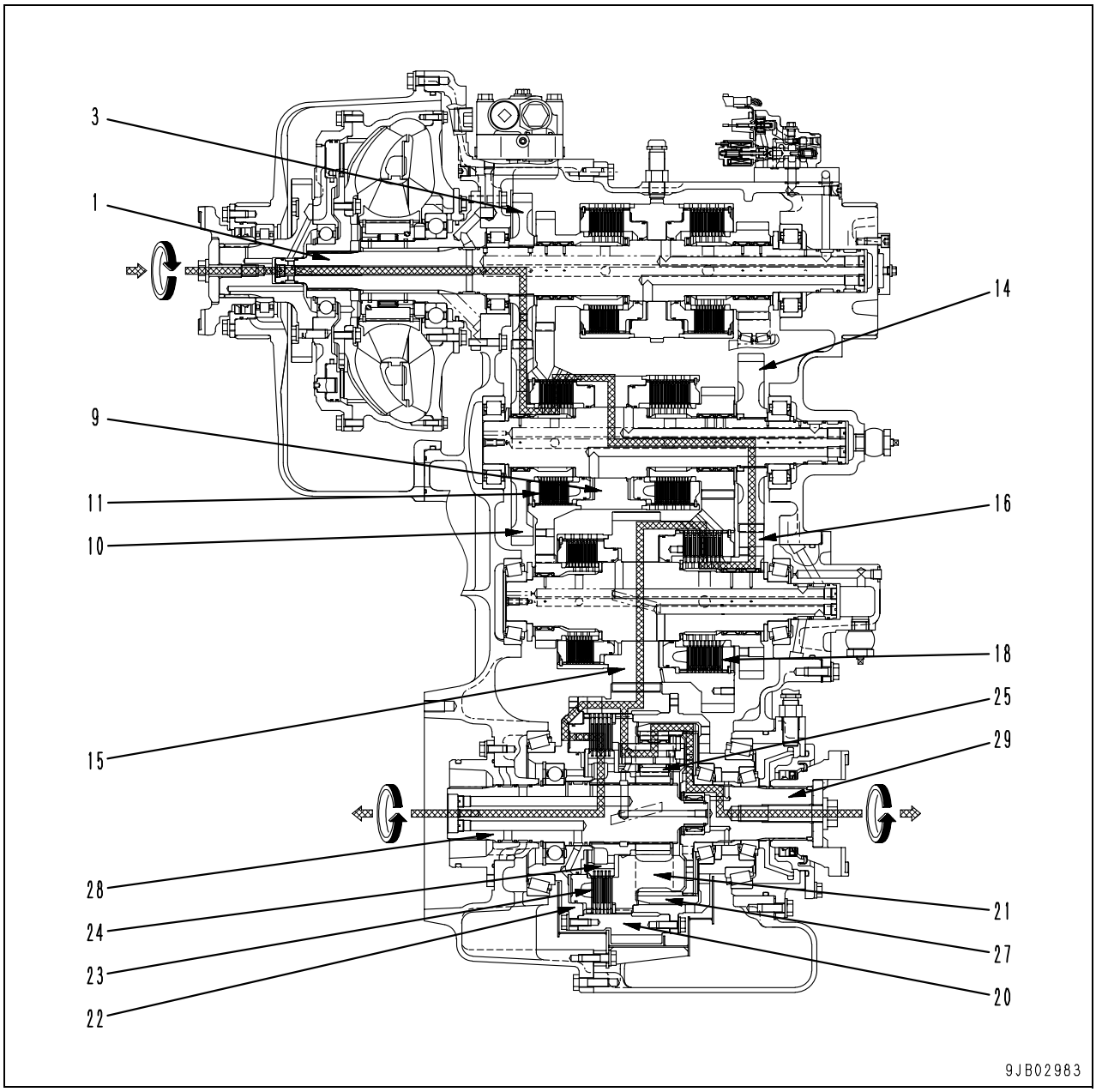
★ The diagram above shows the situation when the differential lock is "off".

FL clutch (4) and 2nd clutch (18) are fixed hydraulically.

The power from the torque converter
↓
Input shaft (1)
↓
FL and R cylinders (2)
↓
FL clutch (4)
↓
FL clutch gear (6)
↓
FH and 1st cylinders (9)
↓
Idler gear (14)
↓
2nd clutch gear (16)
↓
2nd clutch (18)
↓
2nd and 3rd cylinders (15)
↓
Output gear (20)
(The operation when differential lock is turned "OFF" is explained below)
↓
Carrier (21)
↓
Planetary gear (25) → ↓
↓ Ring gear (27)
Sun gear (26) ↓
↓ Rear output shaft (29)
Front output shaft (28)

★ If the differential lock is "on", see Forward 2nd speed.

Forward 4th speed



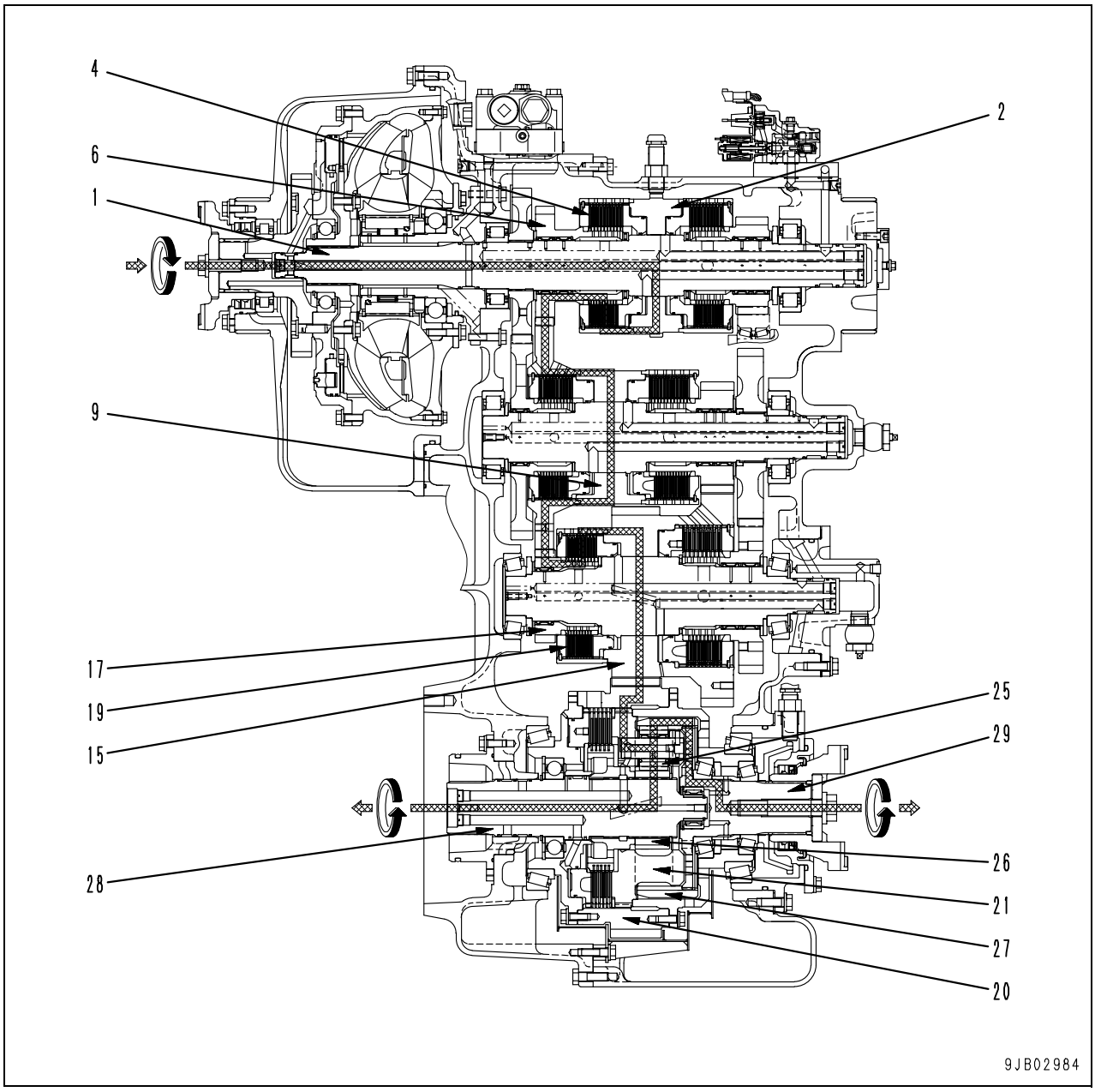
★ The diagram above shows the situation when the differential lock is "on".

FH clutch (11) and 2nd clutch (18) are fixed hydraulically.

The power from the torque converter
↓
Input shaft (1)
↓
Input gear (3)
↓
FH clutch gear (10)
↓
FH clutch (11)
↓
FH and 1st cylinders (9)
↓
Idler gear (14)
↓
2nd clutch gear (16)
↓
2nd clutch (18)
↓
2nd and 3rd cylinders (15)
↓
Output gear (20)
(The operation when differential lock is turned "ON" is explained below)
↓
Carrier (21) → ↓
↓
Front housing (22)
↓
Differential lock clutch (23) → Planetary gear (25)
↓ ↓
Clutch hub (24) → Ring gear (27)
↓ ↓
Front output shaft (28) → Rear output shaft (29)

★ If the differential lock is "off", see Forward 1st speed.

Forward 5th speed



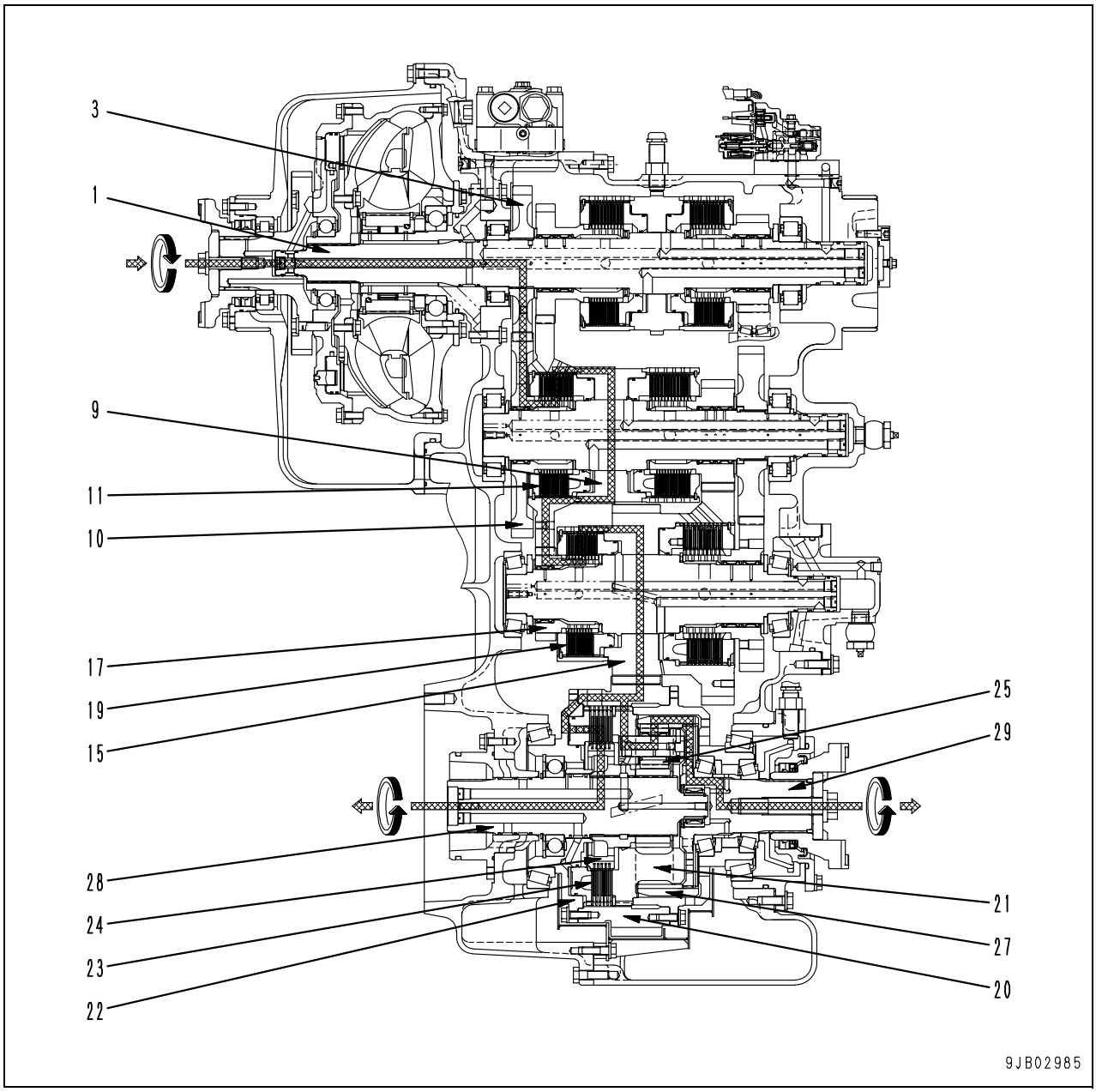
★ The diagram above shows the situation when the differential lock is "off".

FL clutch (4) and 3rd clutch (19) are fixed hydraulically.

The power from the torque converter
↓
Input shaft (1)
↓
FL and R cylinders (2)
↓
FL clutch (4)
↓
FL clutch gear (6)
↓
FH and 1st cylinders (9)
↓
3rd clutch gear (17)
↓
3rd clutch (19)
↓
2nd and 3rd cylinders (15)
↓
Output gear (20)
(The operation when differential lock is turned "OFF" is explained below)
↓
Carrier (21)
↓
Planetary gear (25) → ↓
↓
Sun gear (26) → Ring gear (27)
↓ ↓
Front output shaft (28) → Rear output shaft (29)

★ If the differential lock is "on", see Forward 2nd speed.

Forward 6th speed



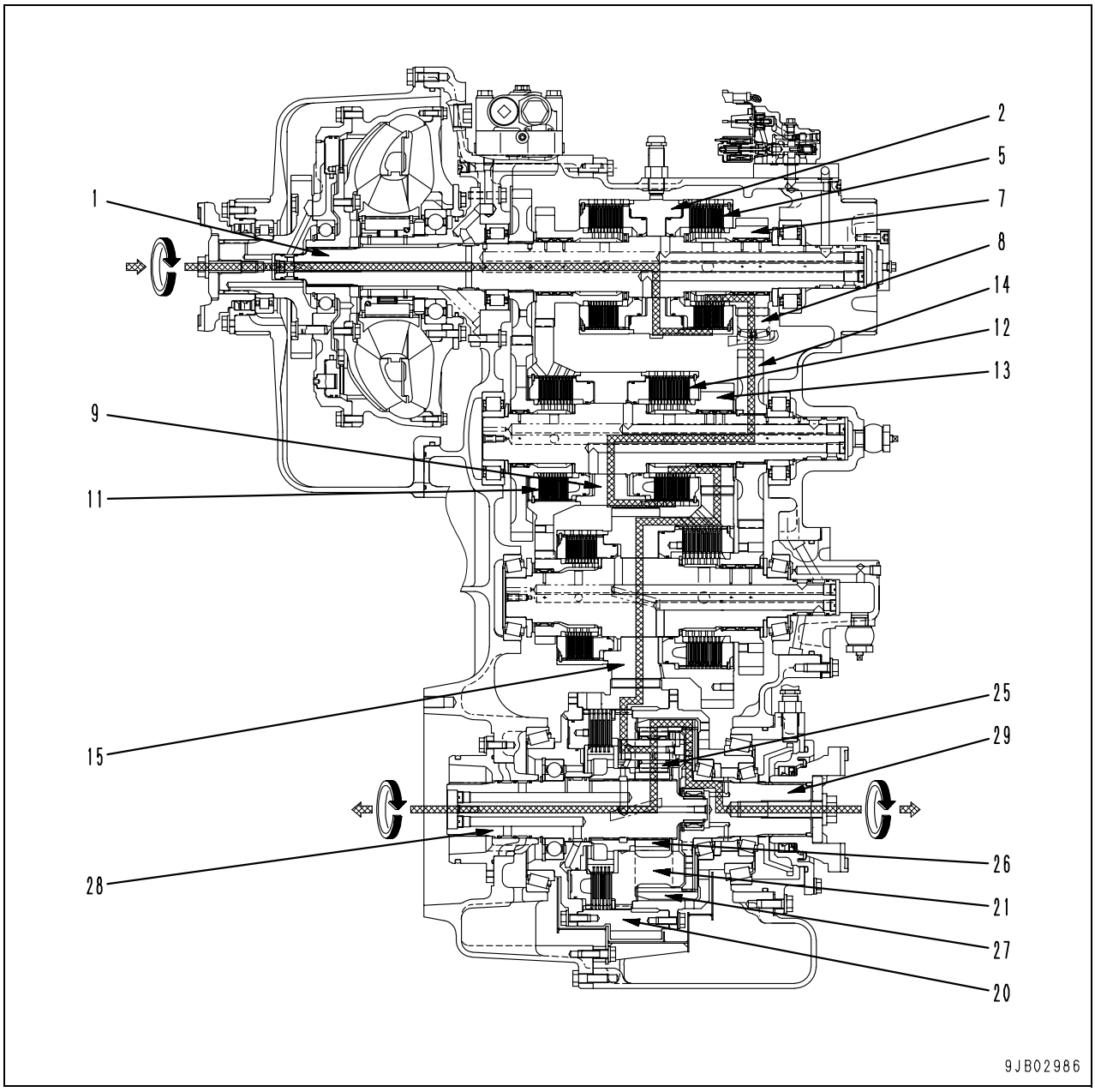
★ The diagram above shows the situation when the differential lock is "on".

FH clutch (11) and 3rd clutch (19) are fixed hydraulically.

The power from the torque converter
↓
Input shaft (1)
↓
Input gear (3)
↓
FH clutch gear (10)
↓
FH clutch (11)
↓
FH and 1st cylinders (9)
↓
3rd clutch gear (17)
↓
3rd clutch (19)
↓
2nd and 3rd cylinders (15)
↓
Output gear (20)
(The operation when differential lock is turned "ON" is explained below)
↓
Carrier (21) → ↓
↓
Front housing (22)
↓
Differential lock clutch (23) → Planetary gear (25)
↓ ↓
Clutch hub (24) → Ring gear (27)
↓ ↓
Front output shaft (28) → Rear output shaft (29)

★ If the differential lock is "off", see Forward 1st speed.

Reverse 1st speed



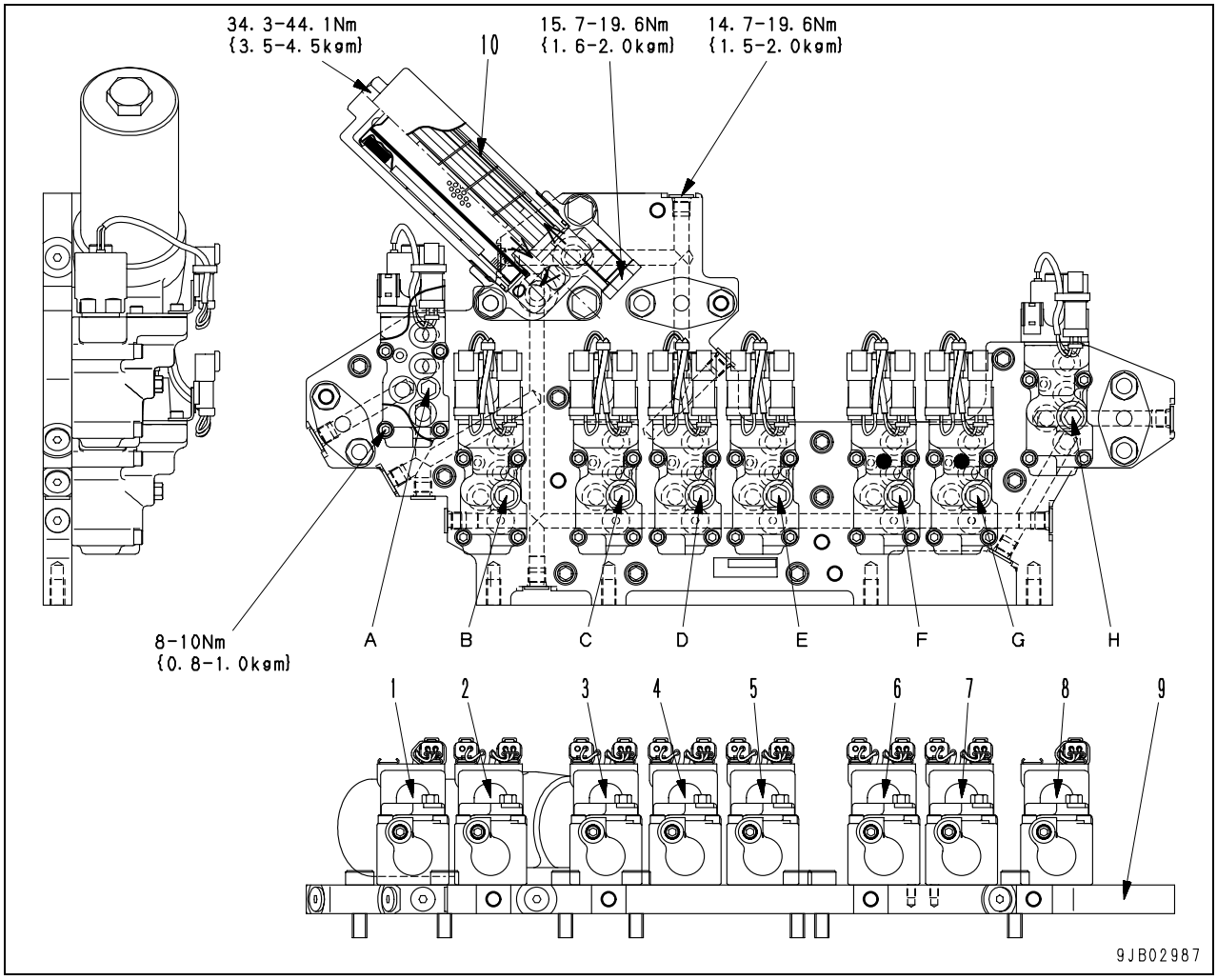
★ The diagram above shows the situation when the differential lock is "off".

R clutch (5) and 1st clutch (12) are fixed hydraulically.

The power from the torque converter
↓
Input shaft (1)
↓
FL and R cylinders (2)
↓
R clutch (5)
↓
R clutch gear (7)
↓
R idler gear (8)
(Output rotation is reversed through R idler gear (8).)
↓
Upper gear (14)
↓
FH and 1st cylinders (9)
↓
1st clutch (12)
↓
1st clutch gear (13)
↓
2nd and 3rd cylinders (15)
↓
Output gear (20)
(The operation when differential lock is turned "OFF" is explained below)
↓
Carrier (21)
↓
Planetary gear (25) → ↓
↓
Sun gear (26) — Ring gear (27)
↓ ↓
Front output shaft (28) — Rear output shaft (29)

★ If the differential lock is "on", see Forward 2nd speed.

Transmission control valve



A: Differential lock clutch oil pressure pick-up port
B: FH clutch oil pressure pick-up port
C: 1st clutch oil pressure pick-up port
D: FL clutch oil pressure pick-up port
E: R clutch oil pressure pick-up port
F: 3rd clutch oil pressure pick-up port
G: 2nd clutch oil pressure pick-up port
H: Lockup clutch oil pressure pick-up port

1. Differential lock clutch ECMV
2. FH clutch ECMV
3. 1st clutch ECMV
4. FL clutch ECMV
5. R clutch ECMV
6. 3rd clutch ECMV
7. 2nd clutch ECMV
8. Lockup clutch ECMV
9. Seat
10. Last chance filter

Operation table of ECMV

ECMV / Gear speed	FL	FH	R	1st	2nd	3rd	L/U	D/L
F1	○			○			○	○
F2		○		○			○	○
F3	○				○		○	○
F4		○			○		○	
F5	○					○	○	
F6		○				○	○	
R1			○	○				○
R2			○		○			○
N								○

L/U: Lockup clutch ECMV
D/L: Differential lock clutch ECMV

Outline

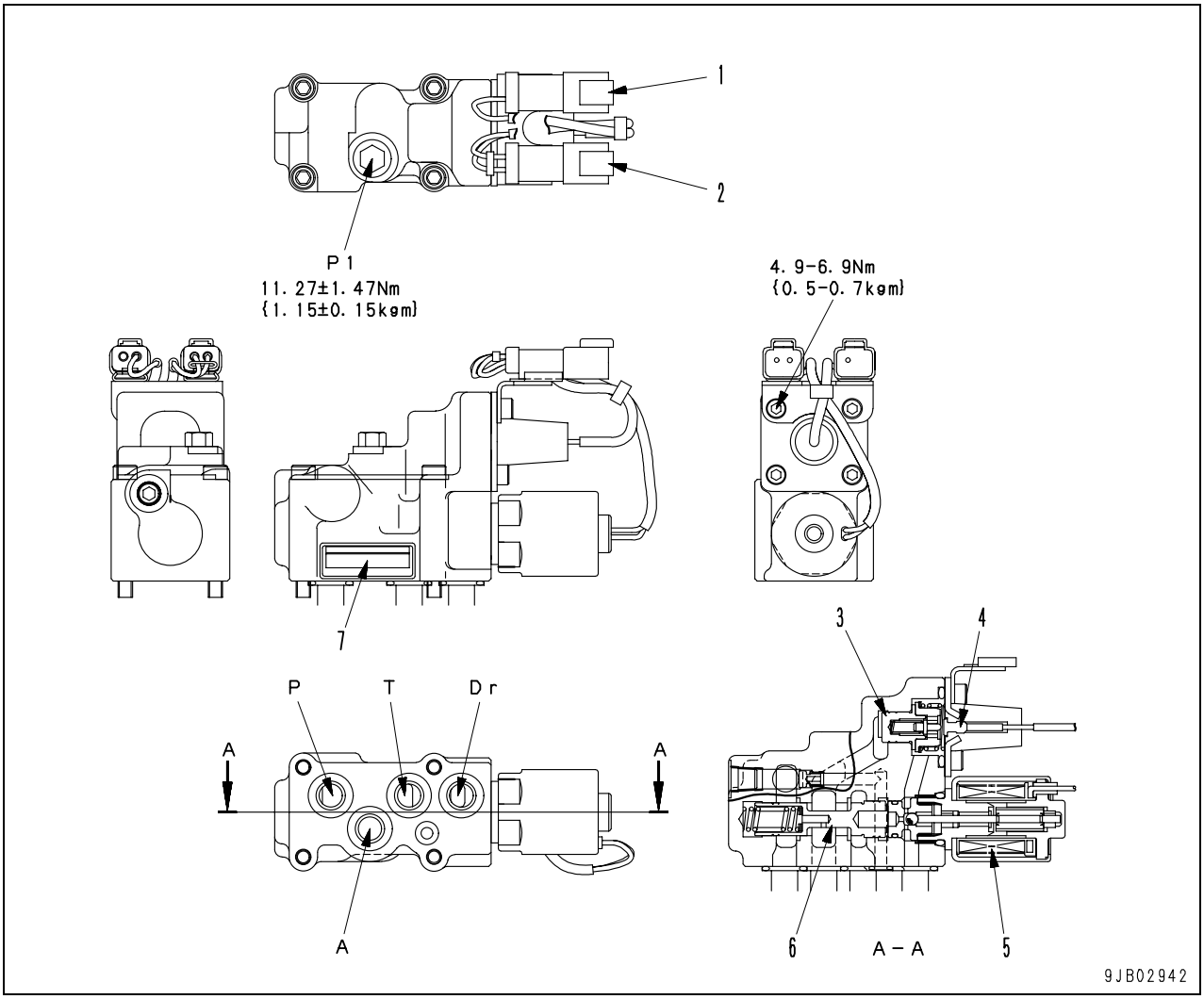
- Lockup clutch ECMV operates when traveling forward at the speed higher than the set speed of transmission controller.
- Differential lock clutch ECMV operates in the 3rd or lower gear speeds.

ECMV

★ ECMV: Abbreviation for Electronic Control Modulation Valve

For FL, FH, R, 1st, 2nd, 3rd 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 pick-up 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)

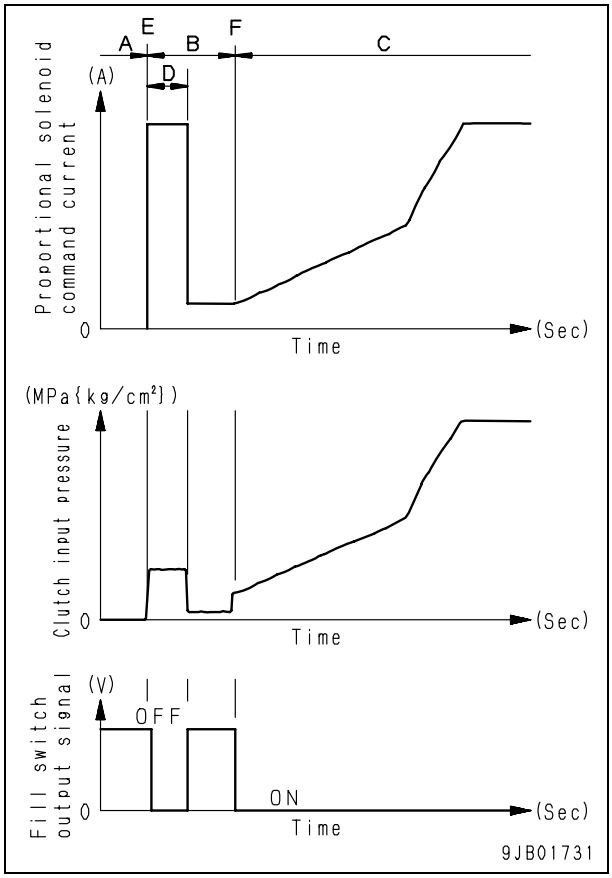
*1:

Operated clutches	Stamp of the nameplates
FL, FH, R, 1st	L*******
2nd, 3rd	A*******

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.



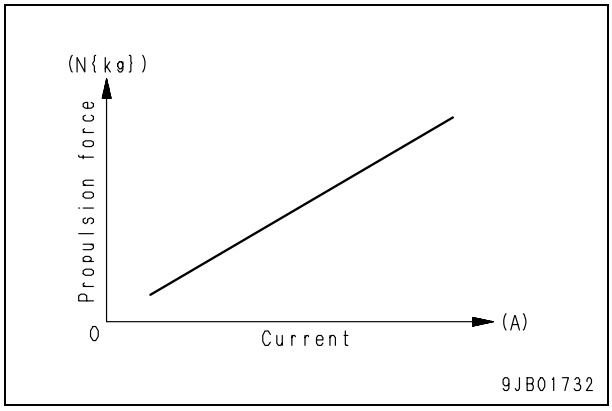
Range A: Before shifting gear (When draining)
Range B: During filling
Range C: Pressure regulation
Range D: During filling (During triggering)
Point E: Start of filling
Point F: Finish of filling

★ 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).

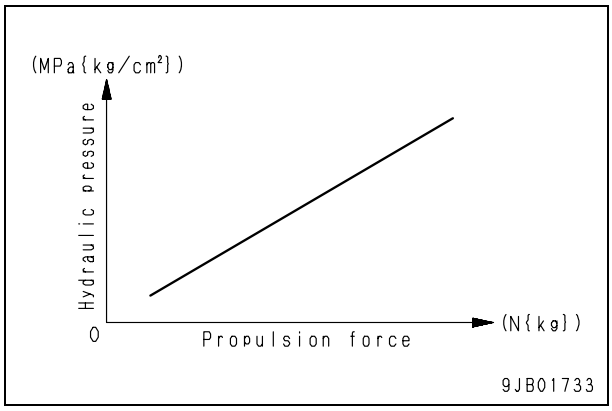
ECMV and proportional solenoid

- 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

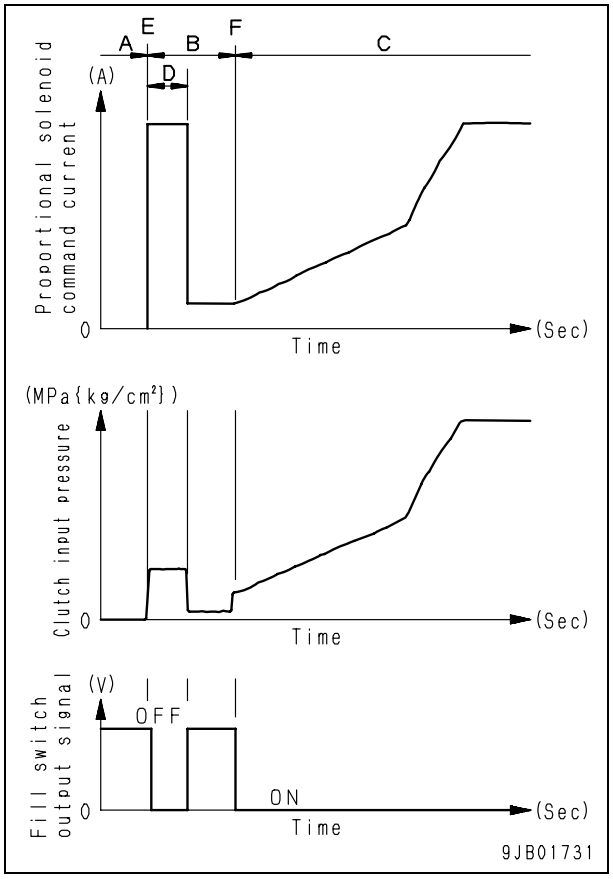


ECMV and fill switch

- 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

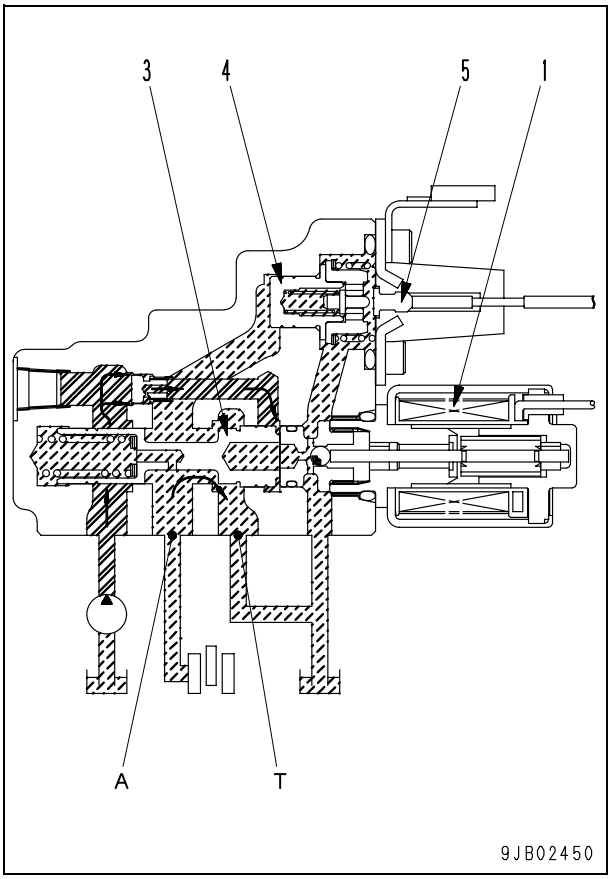
- ECMV is controlled with the command current sent from the controller to the proportional solenoid and the fill switch output signal.
  The relationship between the proportional solenoid command current of ECMV, clutch input pressure, and fill switch output signal is shown below.



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

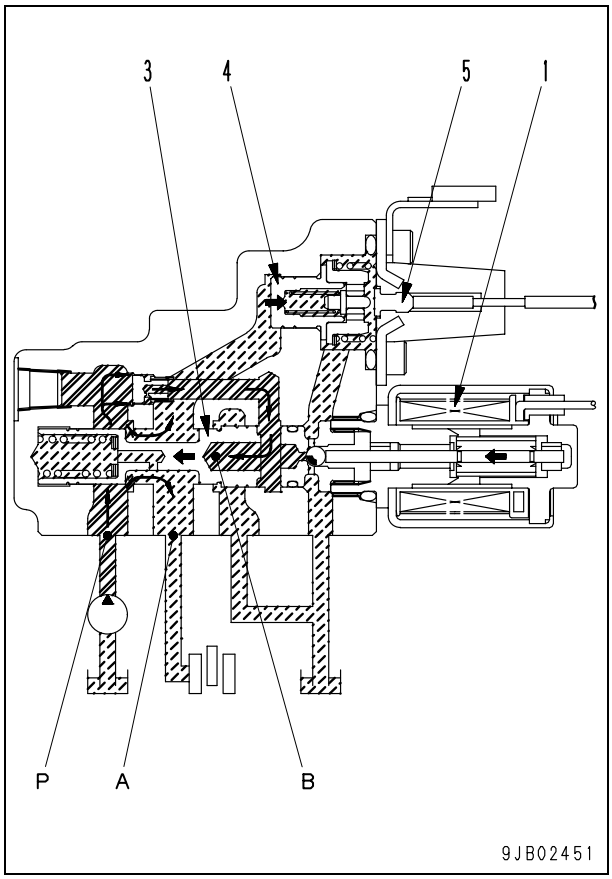
★ The logic is so made that the controller will not recognize completion of filling even if the fill switch is turned “on“ during triggering (Range D).

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



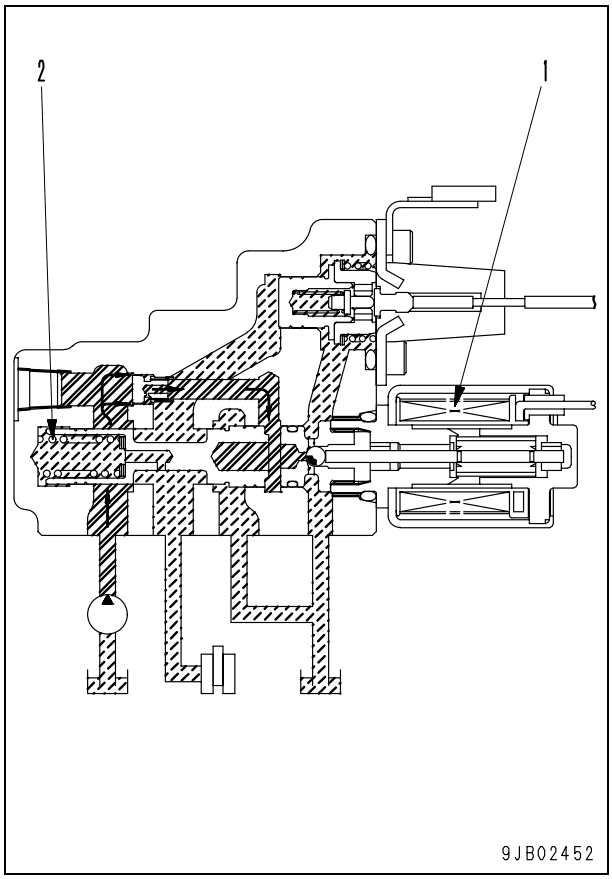
- Under the condition where any current is not sent to proportional solenoid (1), pressure control valve (3) drains the oil from clutch port (A) through drain port (T).
  Also at this time, fill switch (5) is turned “off“ because oil pressure is not applied to pressure detection valve (4).

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).

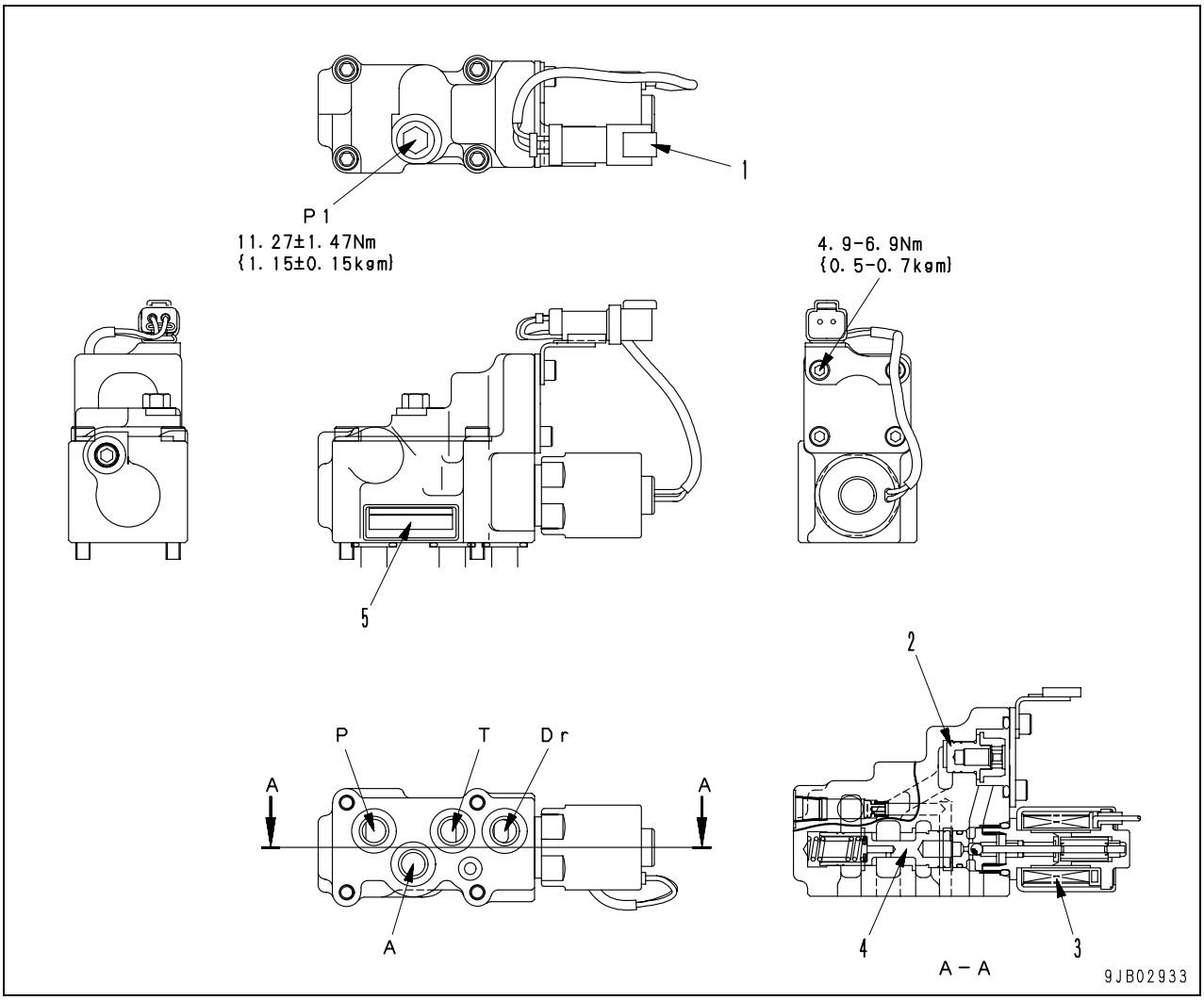
Pressure regulation (Range C in chart)



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

For lockup, differential lock clutch

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



A: To clutch
P: From pump
T: Drain
Dr: Drain
P1: Clutch oil pressure pick-up port

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

*1:

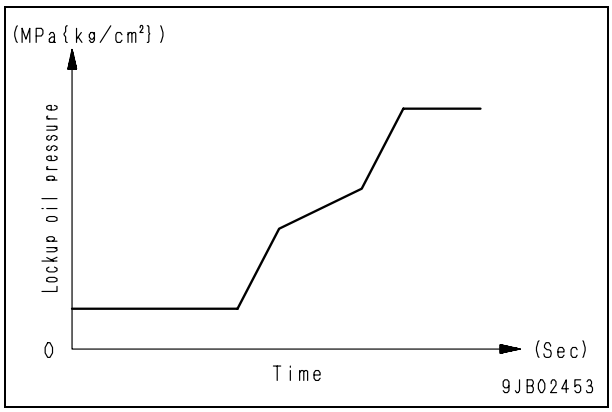
Operated clutches	Stamp of the nameplates
Lockup, differential lock	K*******

Outline

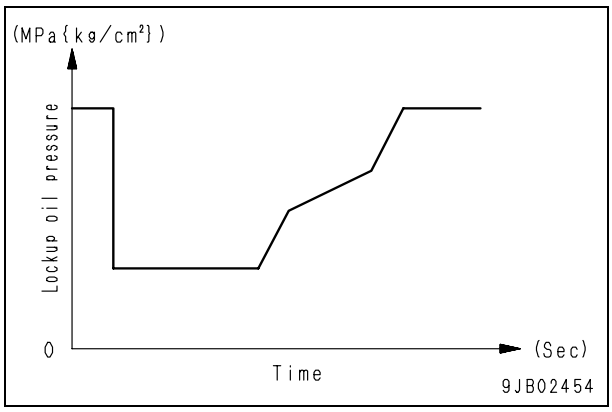
ECMV for lockup clutch

- This valve acts to set the lockup clutch oil pressure to the set pressure, and also to switch the lockup clutch.
  It forms a modulation wave pattern, so the lockup clutch is engaged smoothly to reduce the shock when shifting gear. In addition, it prevents generation of peak torque in the power train. As a result, it provides a comfortable ride for the operator and greatly increases the durability of the power train.

Torque converter travel → direct travel



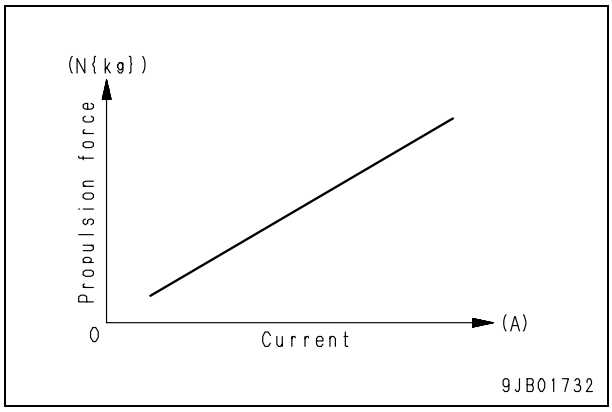
When shifting gear (direct travel)



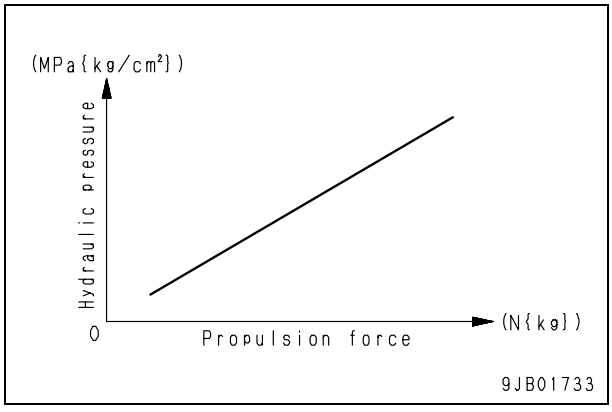
ECMV for differential lock clutch

- 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

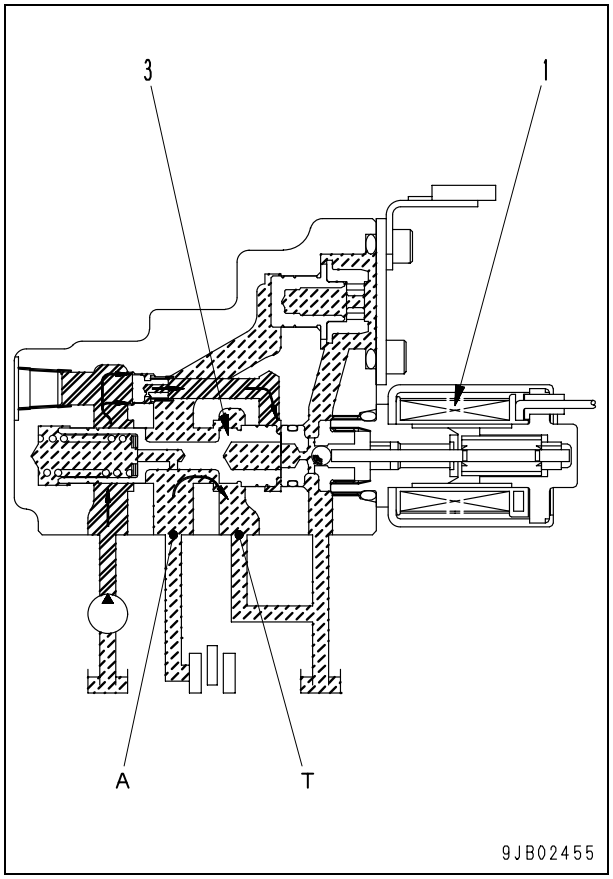


Propulsion force - hydraulic pressure characteristics of proportional solenoid



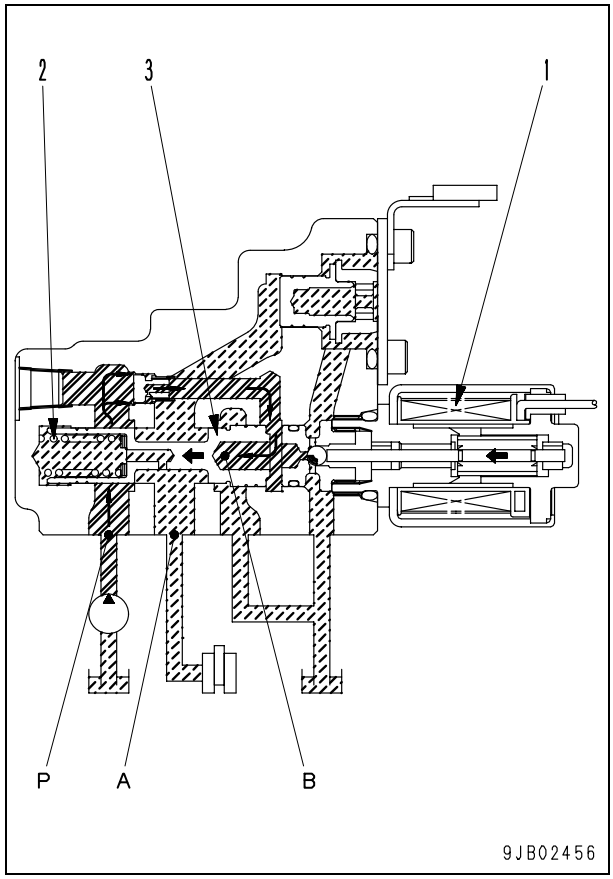
Operation

When clutch is “disengaged“ (Released)



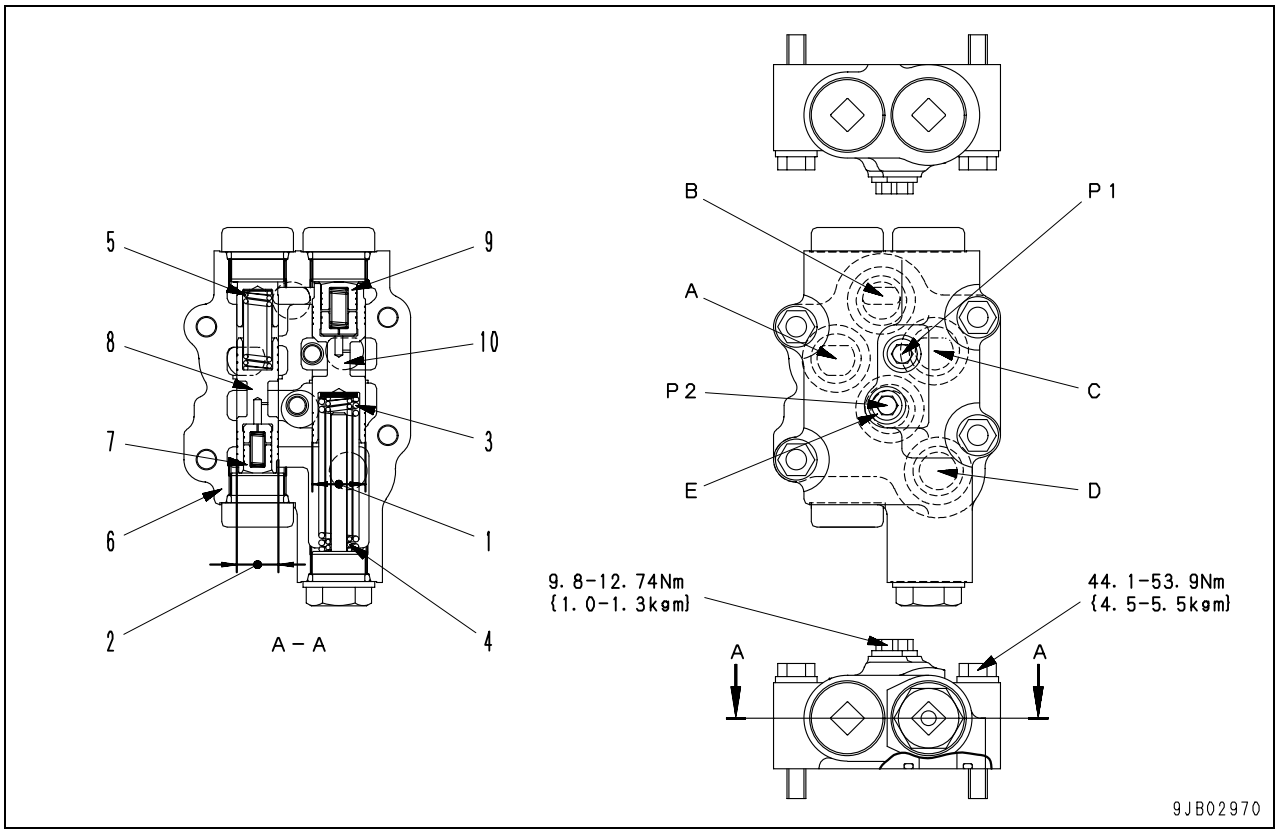
- Under the condition where any current is not sent to proportional solenoid (1), pressure control valve (3) drains the oil from clutch port (A) through drain port (T).

When clutch is “engaged“ (fixed)



- If current is applied 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, the circuit between pump port (P) and clutch port (A) opens, and oil starts to fill the clutch.
- When the clutch is filled with oil, the propulsion force of the solenoid, the propulsion force generated by the oil pressure in the clutch port, and the tension of pressure control valve spring (2) come into balance, and the pressure is adjusted.

Main relief, torque converter relief valve



Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance between main relief valve and the 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	
		108	79.5	275 N {28.0 kg}	104.8	261 N {26.6 kg}	
4	Main relief valve spring (inside)	108	79.5	326 N {33.2 kg}	104.8	309 N {31.5 kg}	
5	Torque converter relief valve spring	50	41	173 N {17.6 kg}	48.5	164 N {16.7 kg}	

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

A: Drain (Torque converter relief)
B: Drain
C: From pump
D: Drain
E: To torque converter
P1: Main relief oil pressure pick-up port
P2: Torque converter relief oil pressure pick-up port

Outline

Torque converter relief valve

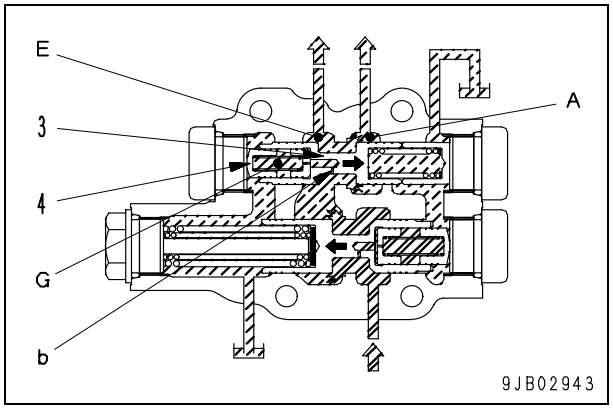
The torque converter relief valve maintains the oil pressure in the torque converter inlet circuit always below the set pressure in order to protect the torque converter from abnormally high pressure.
Set pressure: 0.91 MPa {9.31 kg/cm²}
(Cracking pressure)

Main relief valve

The main relief valve is keeping each oil pressure of the transmission and the brake below the set pressure.
Set pressure: 2.55 MPa {26.0 kg/cm²}
(Engine at rated rotation)

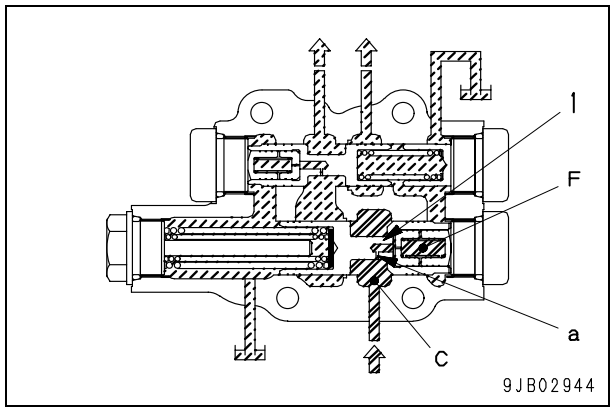
Operation

Operation of torque converter relief valve

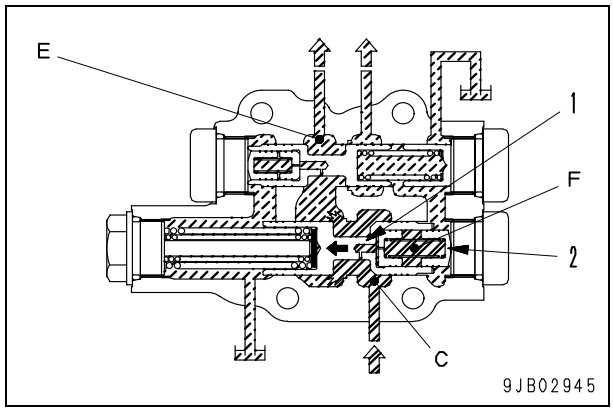


- The oil from the main relief valve flows through port (E) to the torque converter, and at the same time, also flows through orifice (b) of torque converter relief valve (3) to chamber (G).
- When the oil pressure on the torque converter exceeds the set pressure, the oil in chamber (G) pushes piston (4), the reaction force of which moves torque converter relief valve (3) to the right to open port (E) and port (A).
  Then the oil in port (E) is drained from port (A) to the oil tank.

Operation of main relief valve



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



- When the oil pressure in the circuit exceeds the set pressure, the oil in chamber (F) pushes piston (2), the reaction force of which moves spool (1) to the left to open port (C) and port(E).
  Then the oil from the pump flows through port (E) into the torque converter.

HM300-2 Articulated dump truck

Form No. SEN00330-01

ARTICULATED DUMP TRUCK

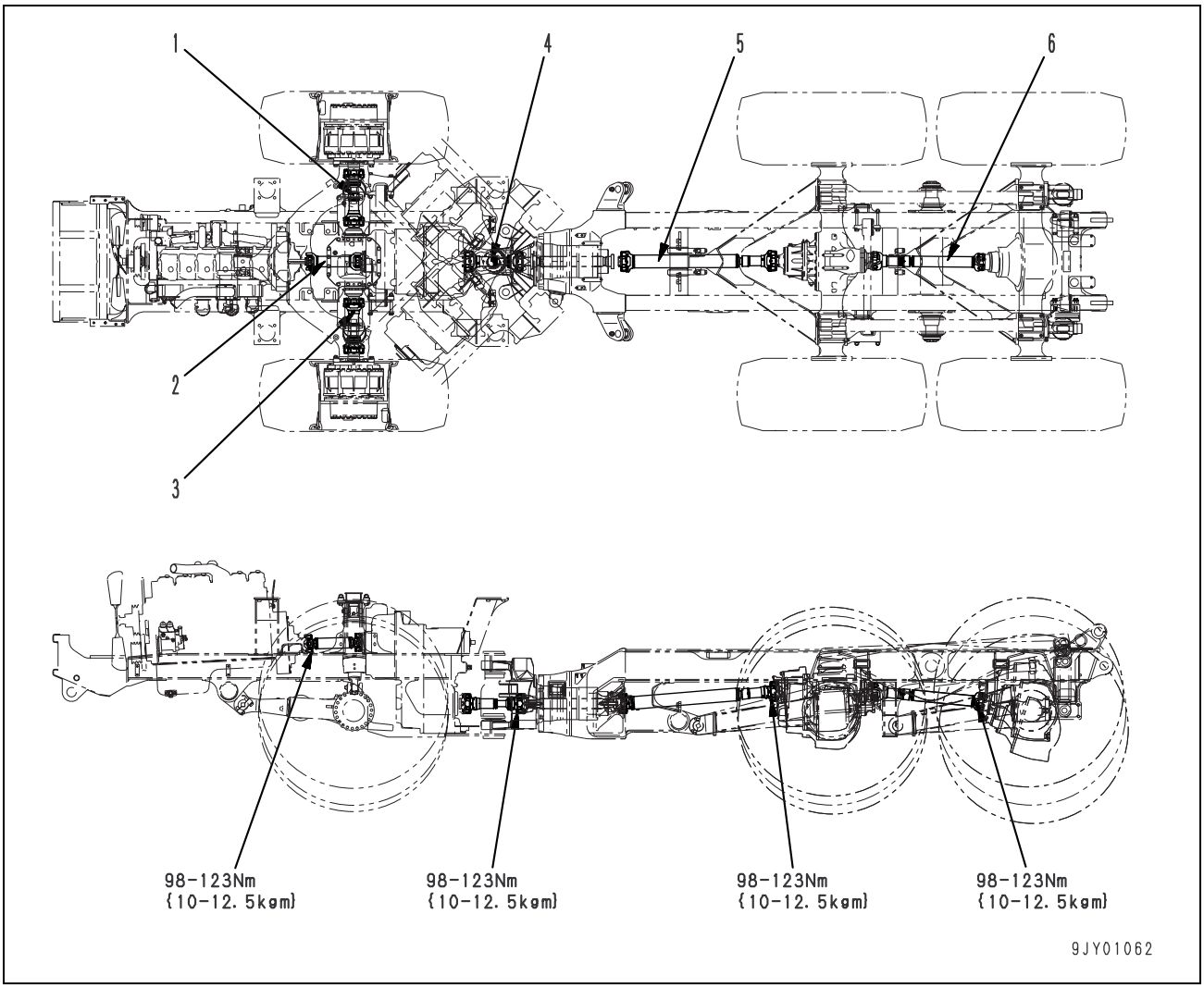
HM300-2

Machine model	Serial number
HM300-2	2001 and up

10 Structure, function and maintenance standard

Power train, Part 2

Drive shaft



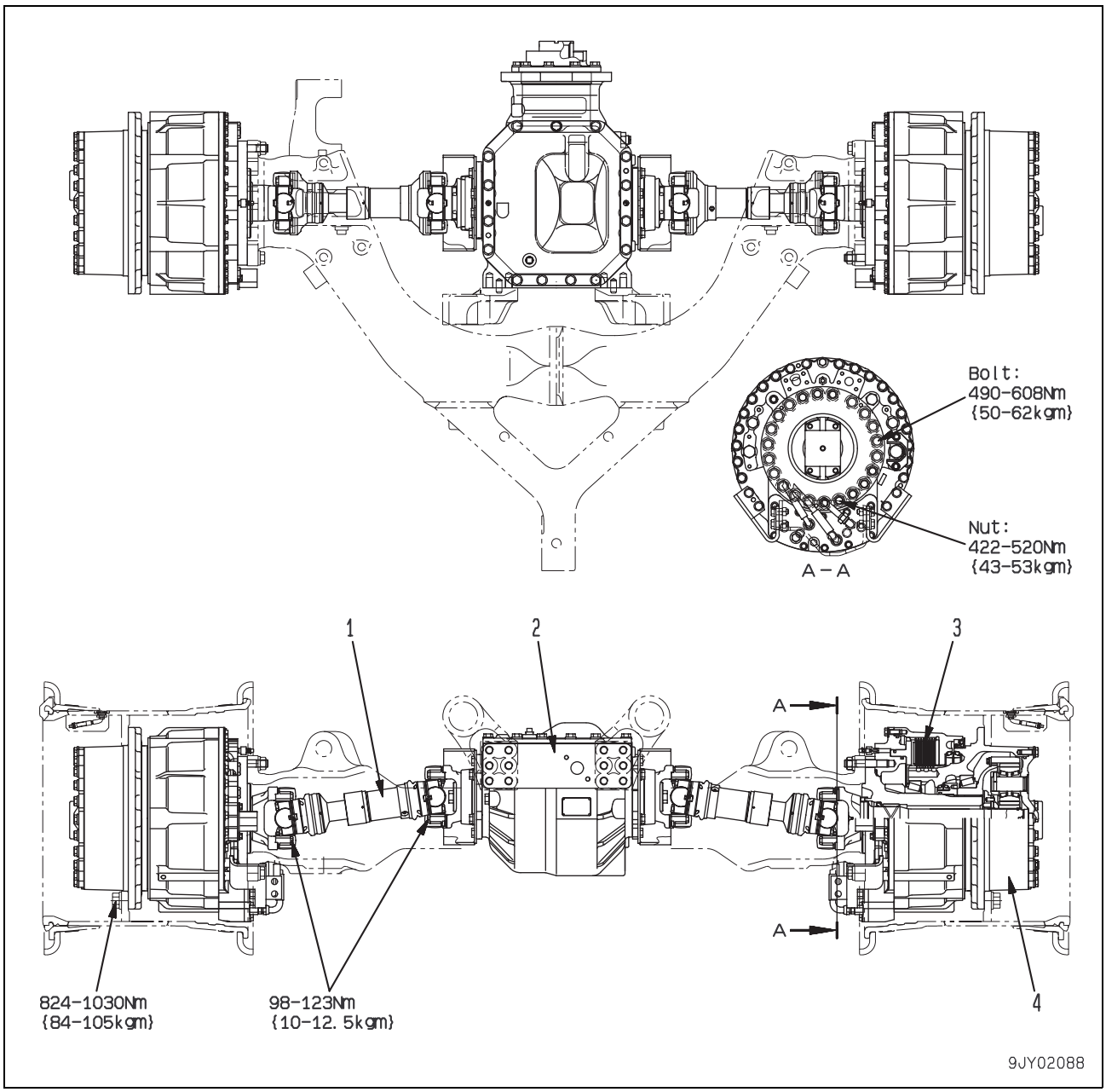
1. Drive shaft (right)
2. Front drive shaft
3. Drive shaft (left)
4. Center drive shaft
5. Rear drive shaft (front)
6. Rear drive shaft (rear)

Outline

- The power from the engine goes from the output shaft through front drive shaft (2), the transmission, and the differential, and is transmitted to final drive by right and left drive shafts (1) and (3). The rest of the power passes through center drive shaft (4) and the oscillation hitch, and is transmitted by rear drive shafts (5) and (6) to the center and rear axles.
- The drive shaft does not only transmit the power but also has the following function.
  When the machine articulates or receives impacts from the ground and other things during travel and operation, the positions of the engine, transmission, and each axle change.
  The drive shaft has the universal joints and sliding joints to absorb the change of angles and lengths and transmit the power without damaging the parts even when the positions of the components change and impacts are given to the machine.

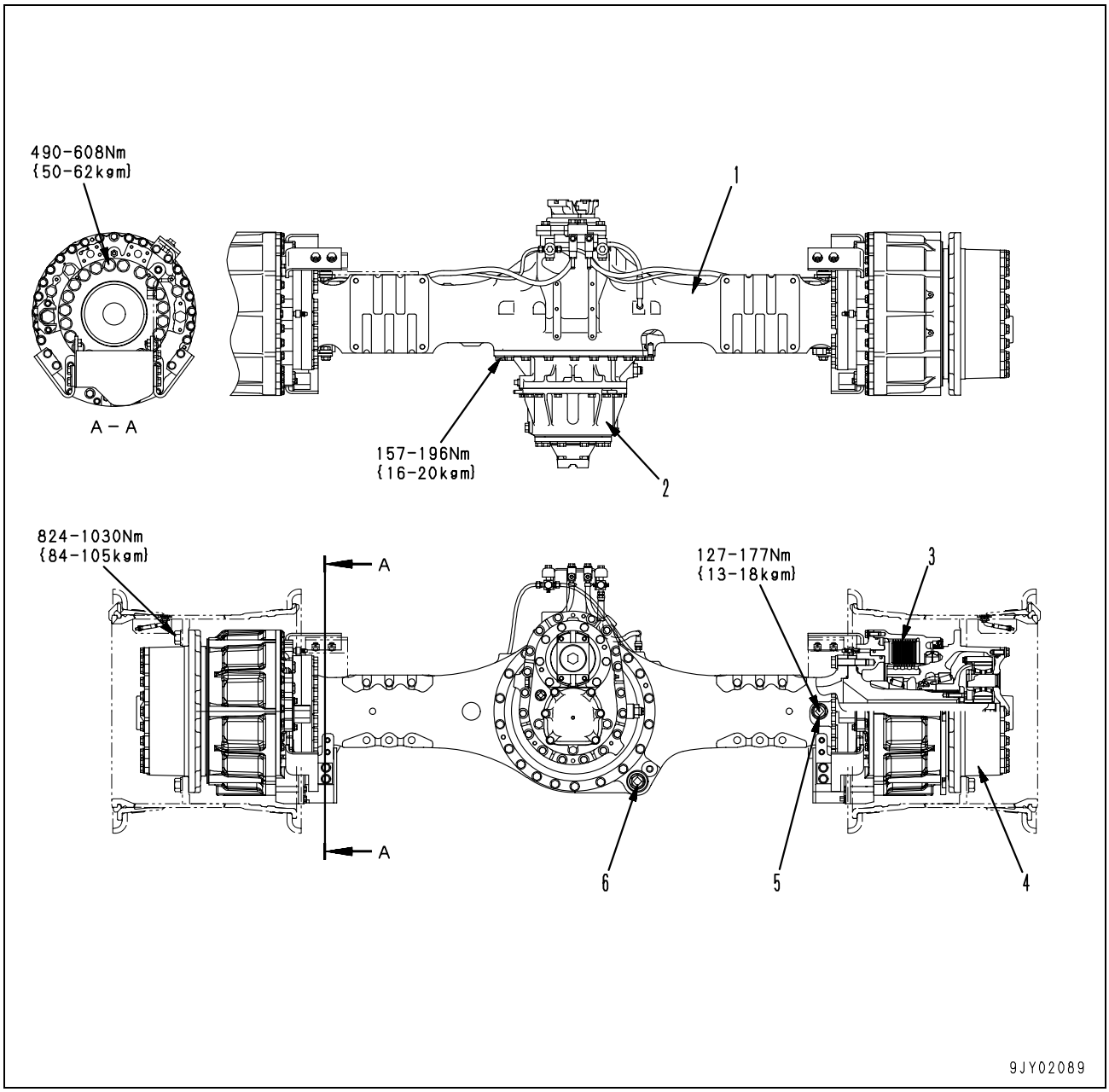
Axle

Front



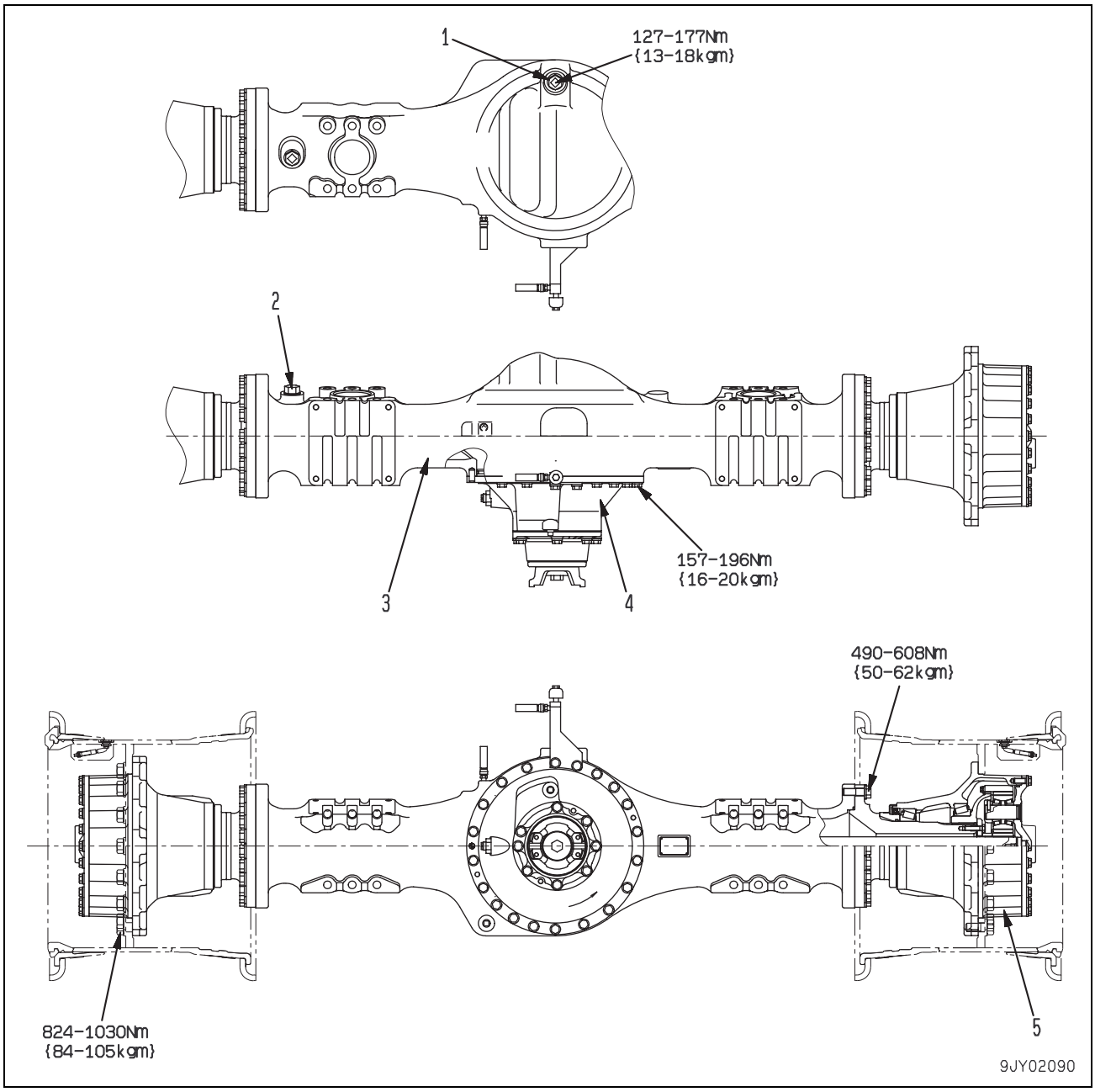
1. Drive shaft
2. Front differential
3. Brake
4. Final drive

Center



1. Center axle housing
2. Center differential
3. Brake
4. Final drive
5. Oil filler port used as oil level plug
6. Drain plug

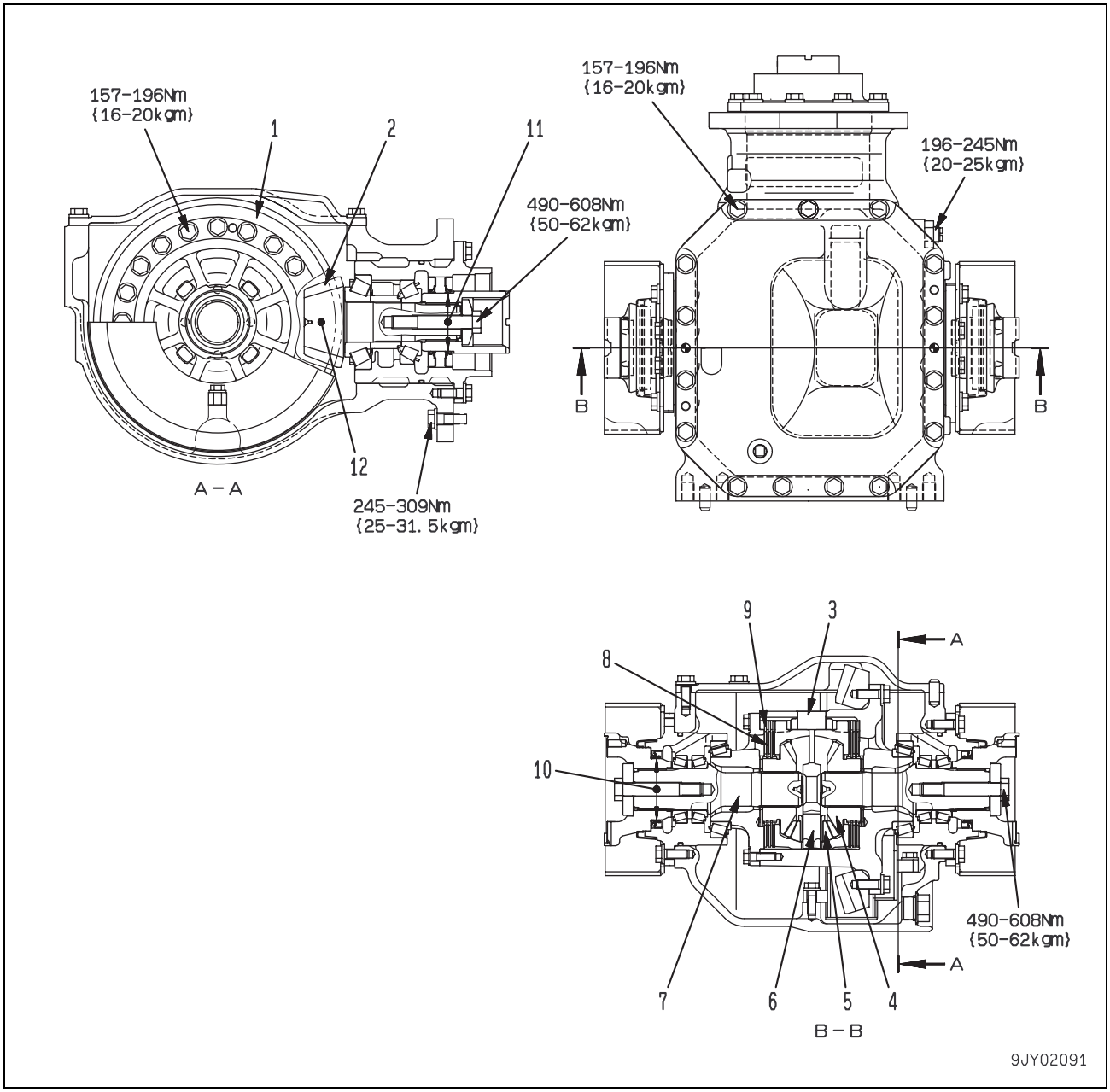
Rear



1. Drain plug
2. Oil filler port used as oil level plug
3. Rear axle housing
4. Rear differential
5. Final drive

Differential

Front

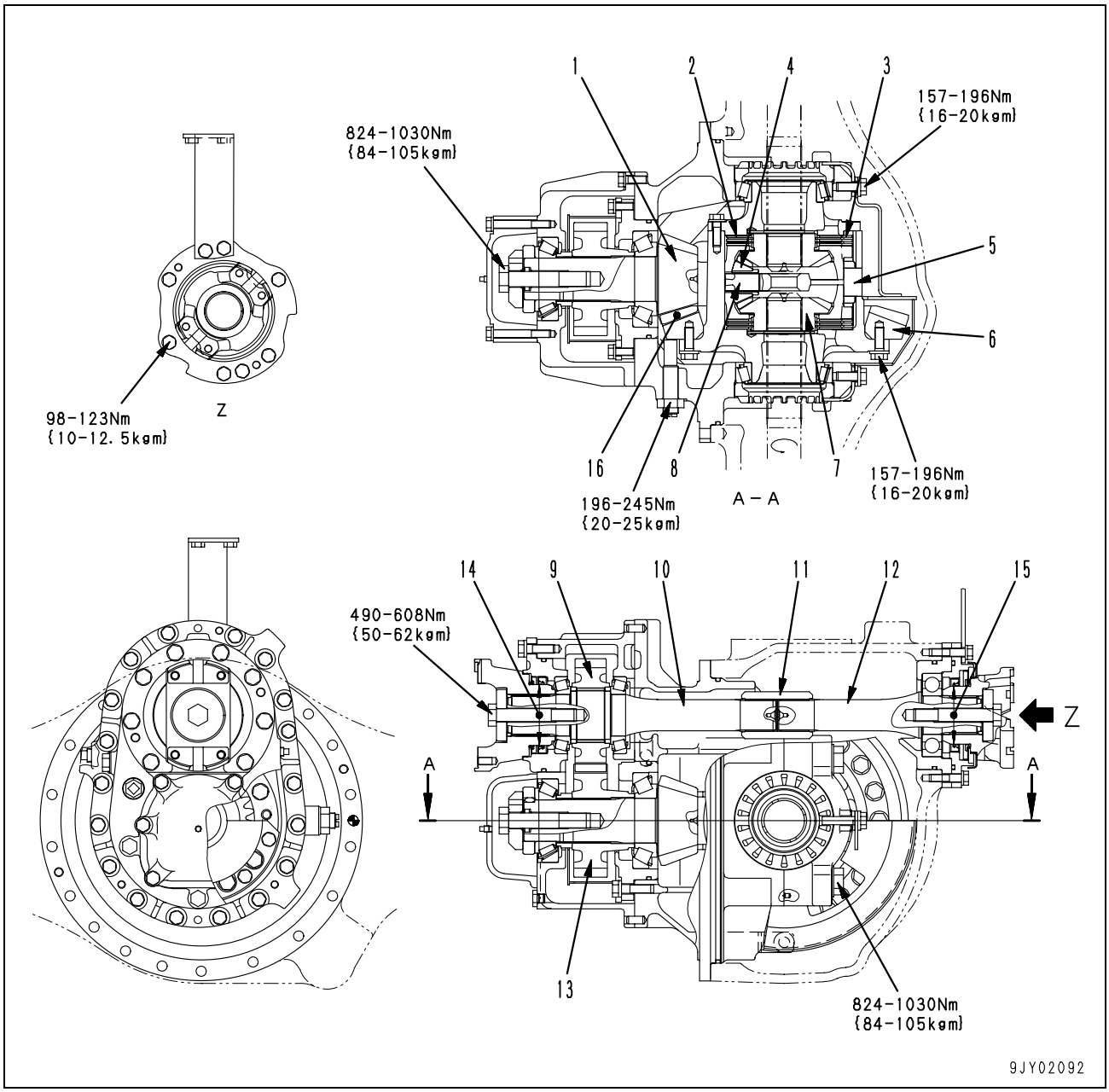


1. Bevel gear (Number of teeth: 41)
2. Bevel pinion (Number of teeth: 13)
3. Limited slip differential
4. Side gear (Number of teeth: 24)
5. Pinion gear (Number of teeth: 12)
6. Shaft
7. Drive shaft
8. Disc
9. Plate

Unit: mm

No.	Check item	Criteria			Remedy
10	Wear of coupling oil seal contact surface	Standard size	Tolerance	Repair limit	Repair or replace
		95	0 -0.087	94.9	
11	Wear of coupling oil seal contact surface	90	0 -0.087	89.9	
12	Backlash between bevel gear and pinion	0.36 – 0.55 (in circumferential direction at outside diameter)			Adjust

Center

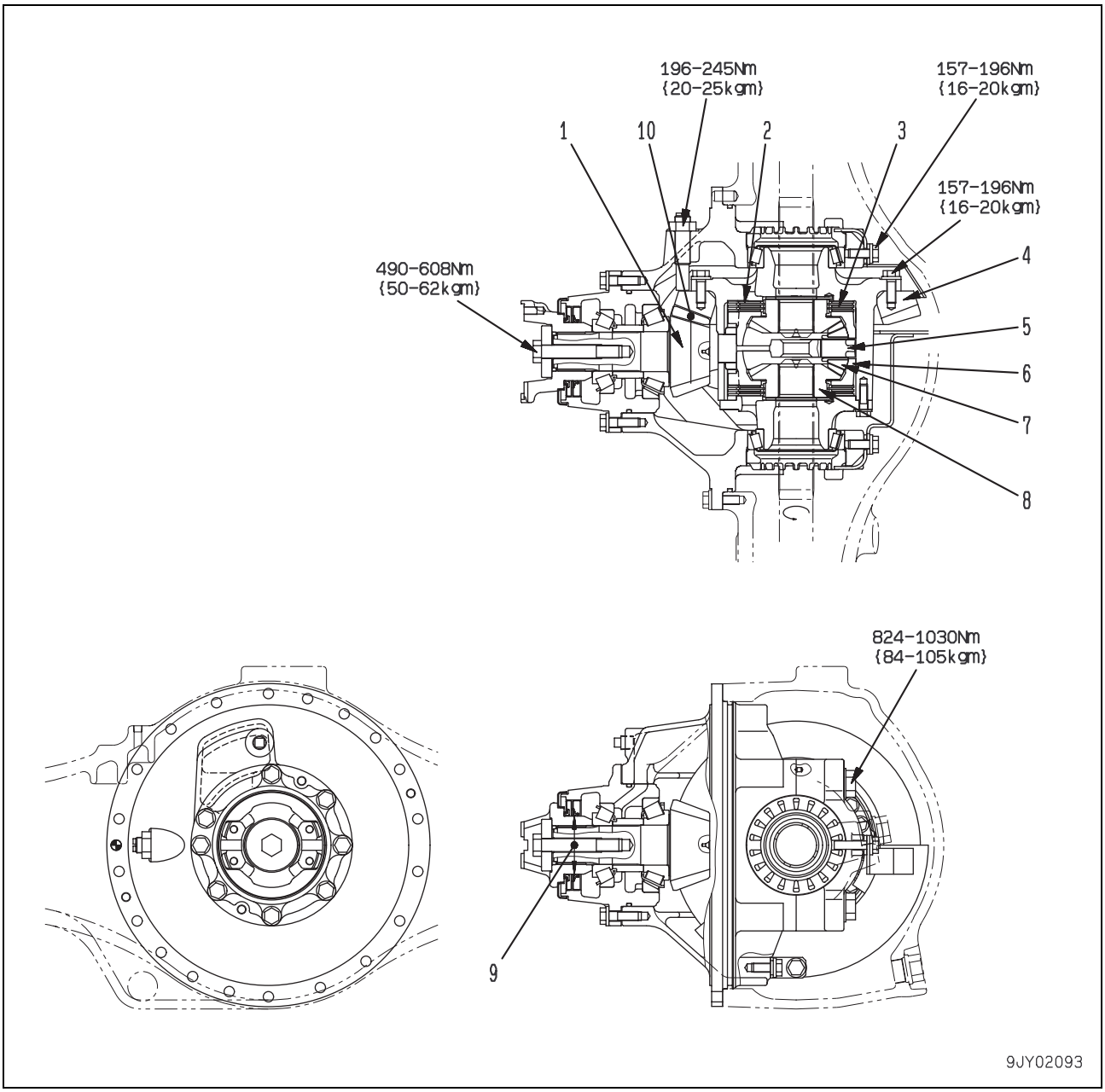


1. Bevel pinion (Number of teeth: 13)
2. Disc
3. Plate
4. Pinion gear (Number of teeth: 12)
5. Limited slip differential
6. Bevel gear (Number of teeth: 41)
7. Side gear (Number of teeth: 24)
8. Shaft
9. Gear (Number of teeth: 27)
10. Shaft
11. Coupling
12. Shaft
13. Gear (Number of teeth: 27)

Unit: mm

No.	Check item	Criteria			Remedy
14	Wear of coupling oil seal contact surface	Standard size	Tolerance	Repair limit	Repair or replace
		95	0 -0.087	94.9	
15	Wear of coupling oil seal contact surface	90	0 -0.087	89.9	Repair or replace
16	Backlash between bevel gear and pinion	0.36 – 0.55 (in circumferential direction at outside diameter)			Adjust

Rear

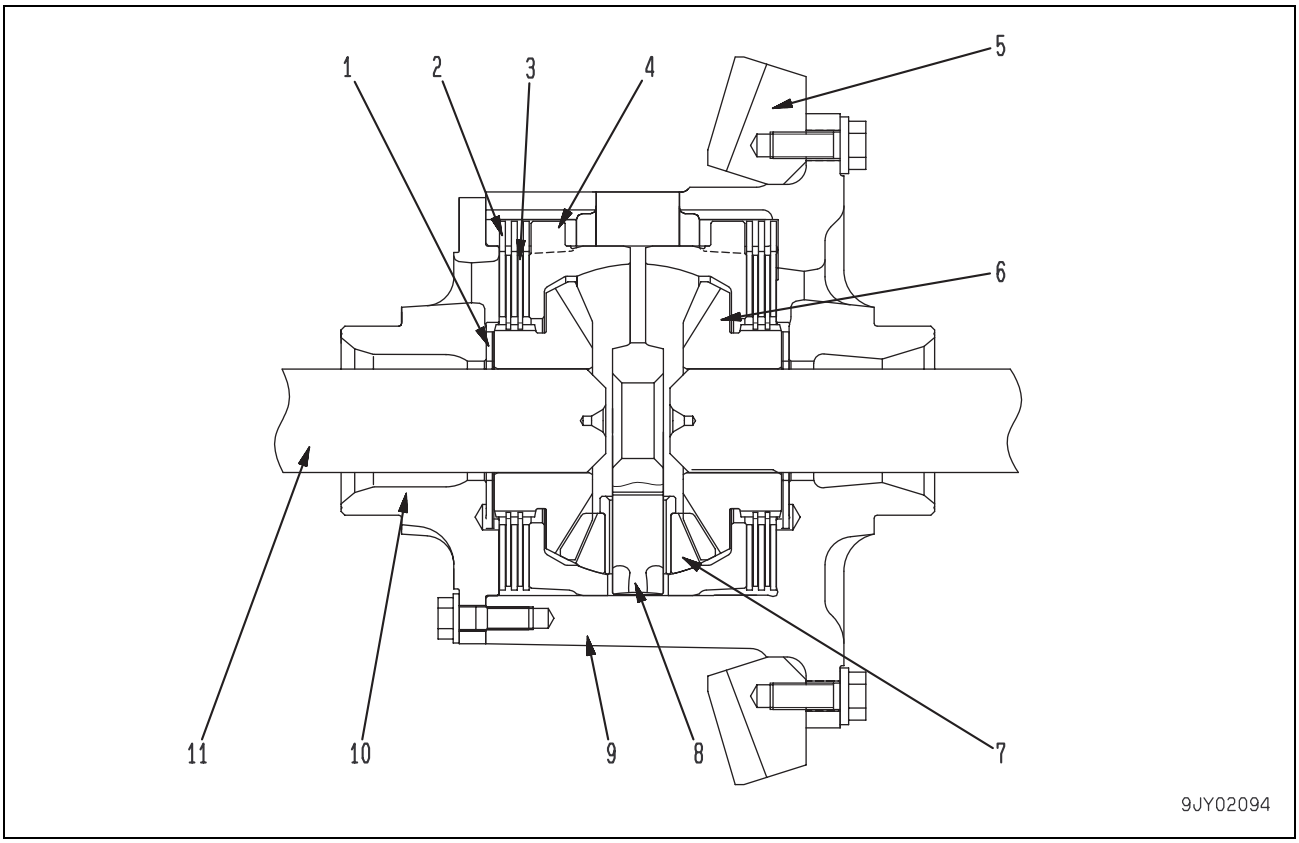


1. Bevel pinion (Number of teeth: 13)
2. Plate
3. Disc
4. Bevel gear (Number of teeth: 41)
5. Shaft
6. Limited slip differential
7. Pinion gear (Number of teeth: 12)
8. Side gear (Number of teeth: 24)

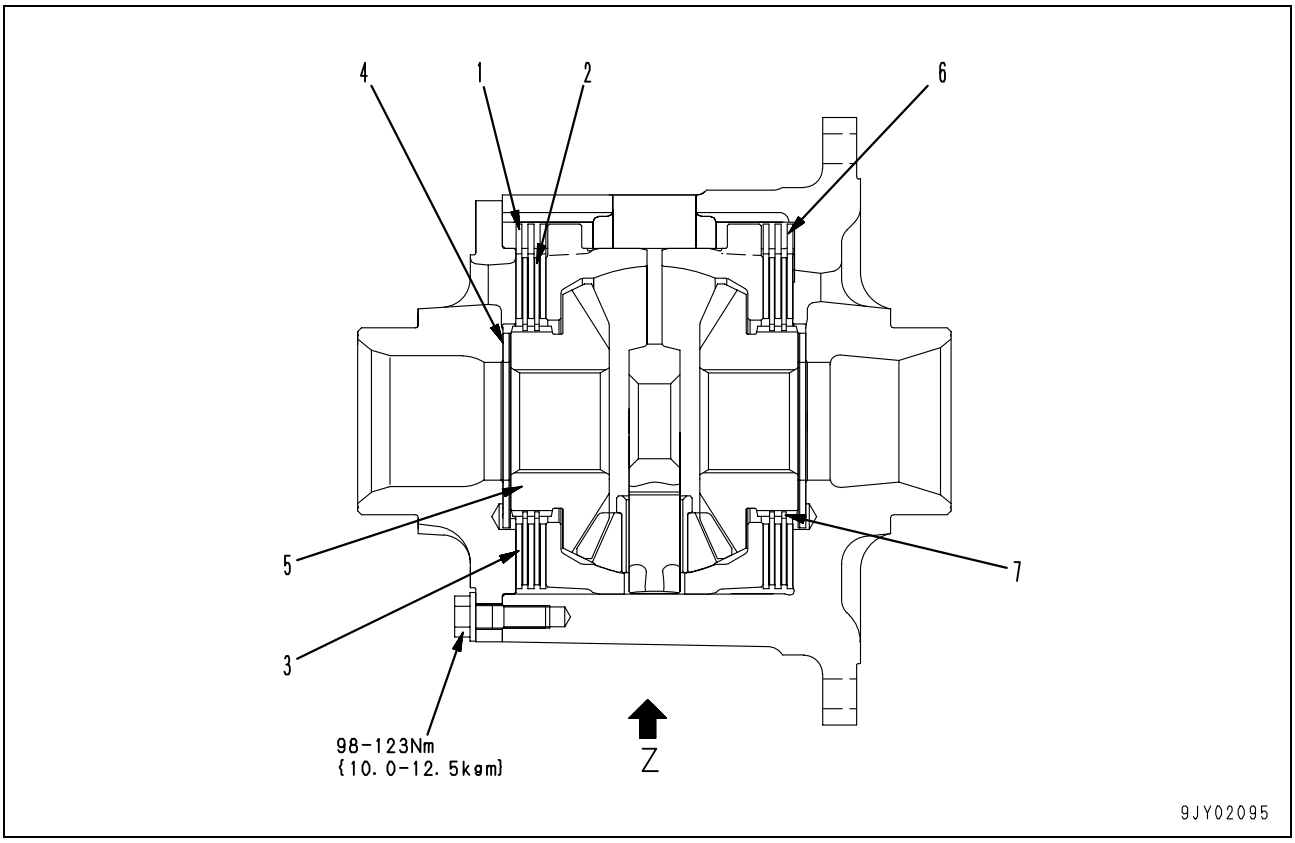
Unit: mm

No.	Check item	Criteria			Remedy
9	Wear of coupling oil seal contact surface	Standard size	Tolerance	Repair limit	Repair or replace
		90	0 -0.087	89.9	
10	Backlash between bevel gear and pinion	0.36 – 0.55 (in circumferential direction at outside diameter)			Adjust

Limited slip differential



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



Unit: mm

No.	Check item	Criteria			Remedy
		Standard size	Tolerance	Repair limit	
1	Plate thickness	3.1	± 0.02	2.3	Replace
		3.2			
2	Disc thickness	3.2	± 0.07	3.1	
3	Clearance between disc and plate (Total on both sides)	0.2 – 0.75			
4	Washer thickness	4	± 0.05	3.8	
		4.1			
5	End play of side gear in axial direction (Each side)	0.15 – 0.35			
6	Backlash between case and plate	0.4 – 0.7			
7	Backlash between side gear and disc	0.13 – 0.36			

Operation of limited slip differential

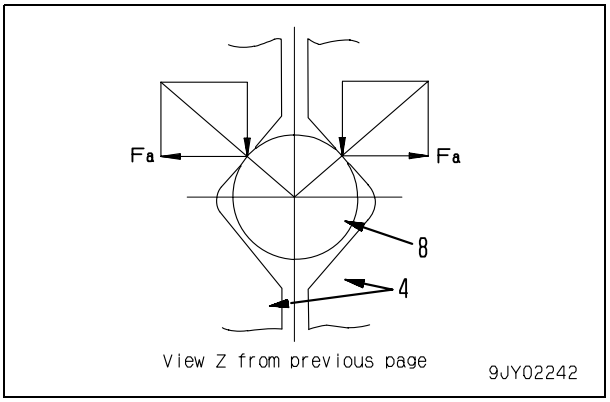
The power transmitted from the transmission goes from bevel gear (5) to case (9), pressure ring (4), shaft (8), pinion gear (7), side gear (6), and is then divided and sent to left and right shafts (11). A brake mechanism consisting of disc (2) and plate (3) is assembled at the rear face of side gear (6), and the brake torque is generated in proportion to the torque transmitted from pressure ring (4) to shaft (8).

In order for this brake torque to act to suppress the rotation in relation to side gear (6) and case (9), it is made difficult for left and right side gears (6) to rotate mutually, and the action of the differential is suppressed.

Mechanism for generation of brake torque of left and right side gears (6)

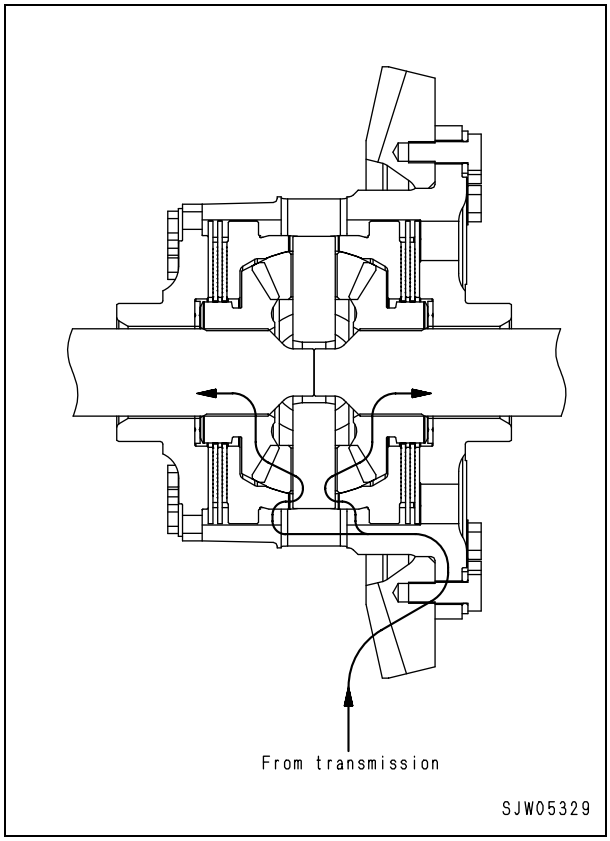
Shaft (8) is supported by the cam surface cut into the mating surfaces of left and right pressure rings (4). The power (= torque) transmitted from pressure ring (4) to shaft (8) is transmitted by the cam surface, but force (Fa) to separate left and right pressure rings (4) is generated in proportion to the torque transmitted by the angle of this cam surface.

This separation load (Fa) acts as a brake on the rear face of left and right side gears (6) and generates brake torque.



When travelling in a straight line

1. **When there is no imbalance between drive force of left and right wheels.**
   (The road surface condition (friction coeffident) for the left and right wheels and the load on the wheels are uniform.)
   The power from the transmission is divided uniformly to the left and right by the side gear. Under these conditions, the limit for wheel slip for the left and right wheels is the same, so even if the power from the transmission exceeds the wheel slip limit, the wheels on both sides slip and the differential is not actuated.
   No load is applied to the brake at the rear surface of the side gear.

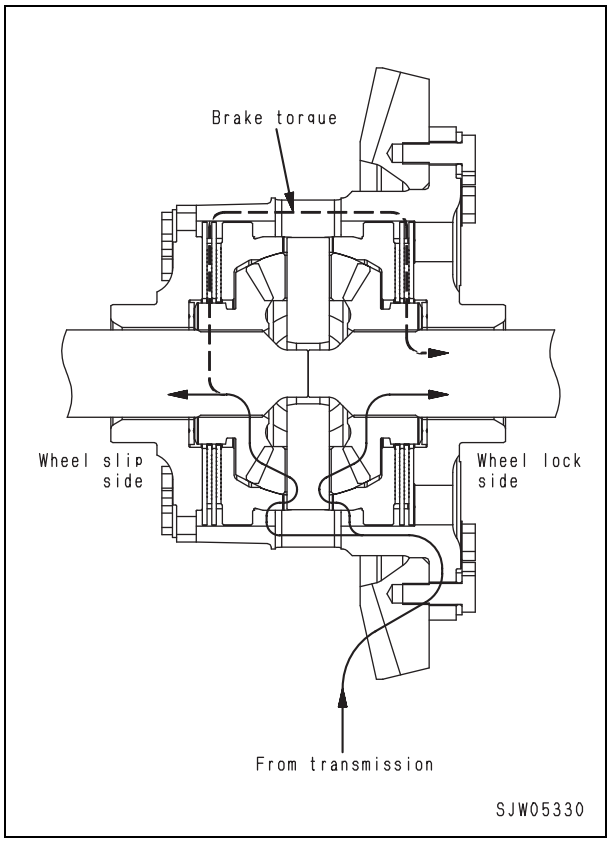


2. When there is imbalance between drive force of left and right wheels

(The road surface condition (friction coefficient) for the left and right wheels and the load on the wheels are not uniform and the wheel on one side tends to slip more than the wheel on the other side.)

Example:
When wheel on one side is on soft ground surface.

The power from the transmission is divided uniformly to the left and right by the side gear.
However, if the divided drive force exceeds the wheel slip limit on the side where the wheel is slipping, a drive force equal to the excess is sent through the brake at the rear face of the side gear and the case to the brake on the opposite side (side where wheel is locked), and is supplied to the wheel on the side which is locked.
If this excess drive force becomes greater than the braking force, the differential starts to be actuated.

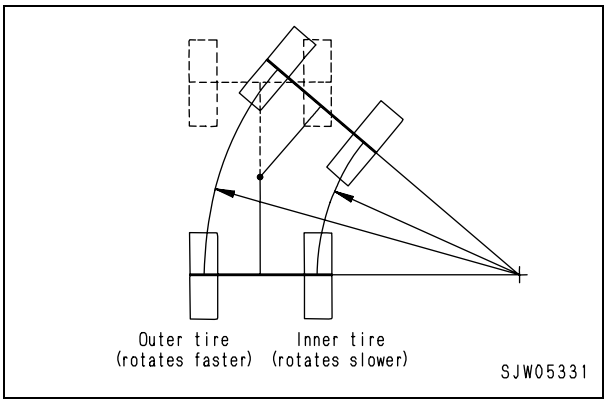


Difference in wheel drive force for each type of differential when wheel on one side is slipping

	Wheel drive force (taken as 1 for wheel that is slipping)		
	Slipping wheel	Locked wheel	Total (proportional)
Limited slip differential	1	2.64	3.64 (1.82)
Normal differential	1	1	2 (1)

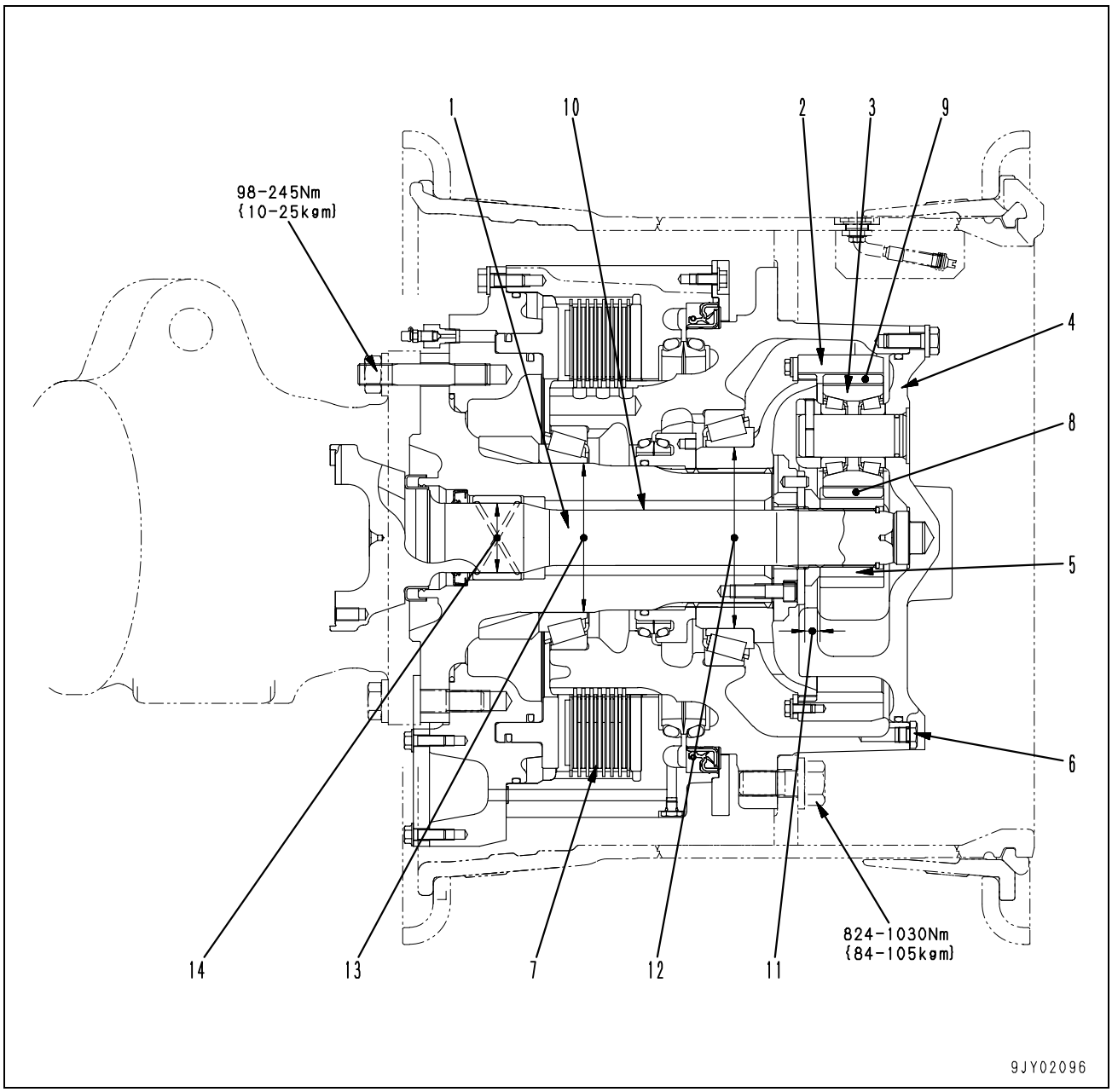
On road surfaces where the wheel on one side is likely to slip, the limited slip differential increases the drive force 1.82 times that of the normal differential supplied as standard.

<When turning>
The side gear built into the limited slip differential is the same as the gear used on the normal differential, so the difference in rotation of the inside and outside wheels generated when turning can be generated smoothly.



Final drive

Front

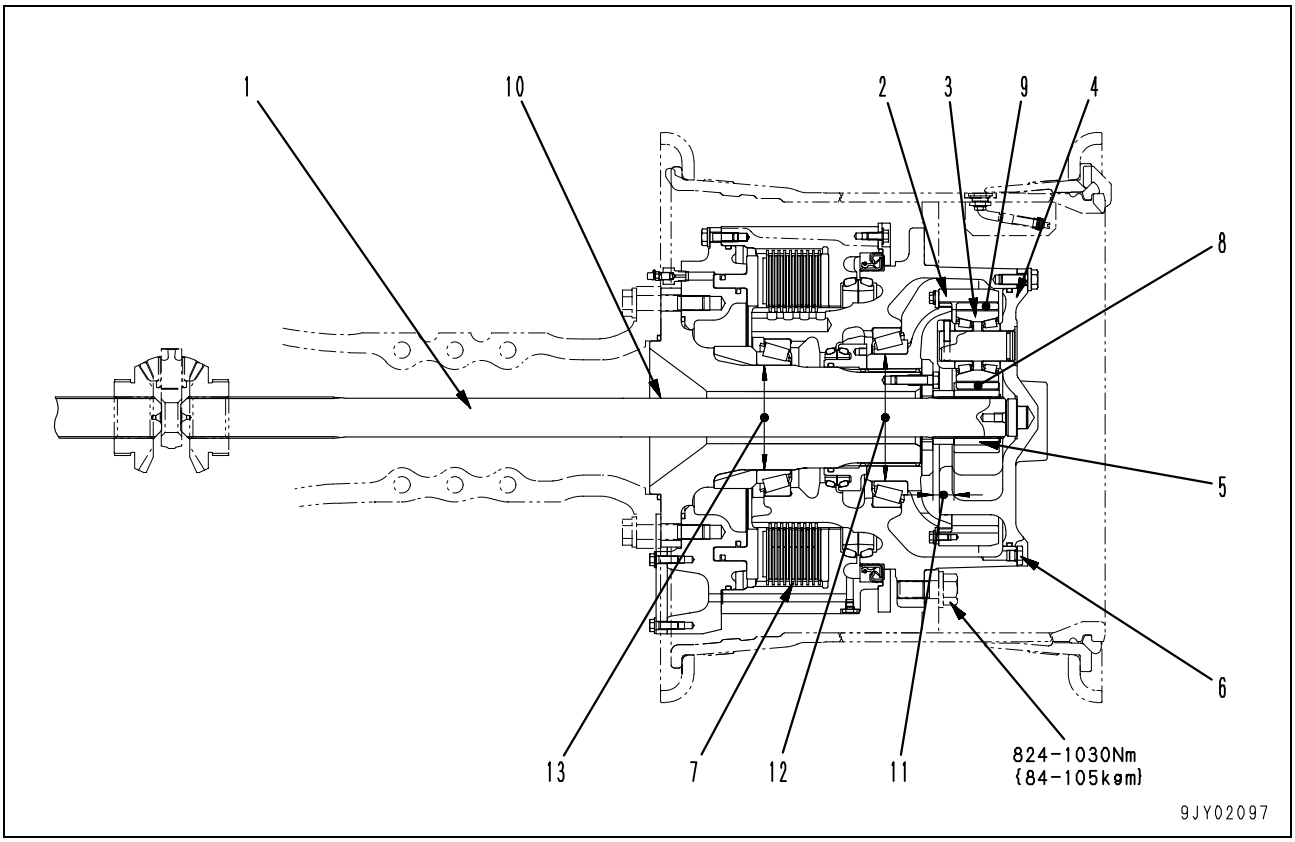


1. Shaft
2. Ring gear (Number of teeth: 66)
3. Planetary gear (Number of teeth: 23)
4. Planetary carrier
5. Sun gear (Number of teeth: 18)
6. Drain plug
7. Brake

Unit: mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="6">Criteria</th><th>Remedy</th></tr>
<tr><td>8</td><td>Backlash between planetary gear and sun gear</td><td colspan="6">0.17 – 0.41</td><td rowspan="2">Replace</td></tr>
<tr><td>9</td><td>Backlash between planetary gear and ring gear</td><td colspan="6">0.20 – 0.55</td></tr>
<tr><td>10</td><td>Curvature of shaft</td><td colspan="6">Repair limit: 0.7TIR</td><td>Repair or replace</td></tr>
<tr><td rowspan="2">11</td><td rowspan="2">Thickness of spacer</td><td colspan="2">Standard size</td><td colspan="2">Tolerance</td><td colspan="2">Repair limit</td><td rowspan="2">Replace</td></tr>
<tr><td colspan="2">14</td><td colspan="2">± 0.1</td><td colspan="2">13.5</td></tr>
<tr><td>12</td><td>Wear of outside diameter of portion of ring gear hub inserted into bearing</td><td colspan="2">170</td><td colspan="2">+0.040
+0.015</td><td colspan="2">170</td><td rowspan="2">Repair</td></tr>
<tr><td>13</td><td>Wear of outside diameter of portion of axle tube inserted into bearing</td><td colspan="2">140</td><td colspan="2">-0.030
-0.055</td><td colspan="2">139.83</td></tr>
<tr><td rowspan="2">14</td><td rowspan="2">Clearance between shaft (outside diameter) and bushing</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td><td rowspan="2">Replace</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>65</td><td>0
-0.013</td><td>+0.337
+0.251</td><td>0.251 –
0.350</td><td>0.4</td></tr>
</table>

Center

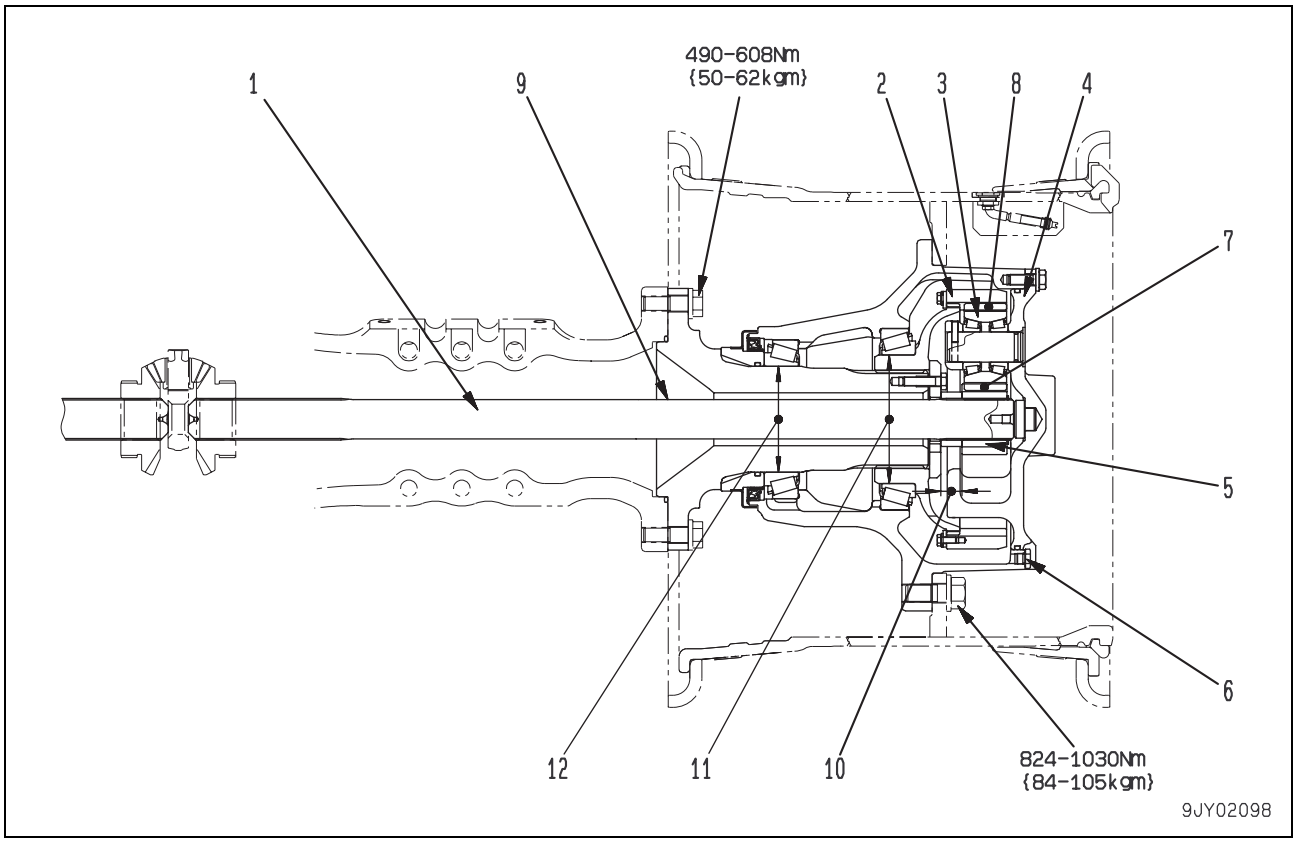


1. Shaft
2. Ring gear (Number of teeth: 66)
3. Planetary gear (Number of teeth: 23)
4. Planetary carrier
5. Sun gear (Number of teeth: 18)
6. Drain plug
7. Brake

Unit: mm

No.	Check item	Criteria			Remedy
8	Backlash between planetary gear and sun gear	0.17 – 0.41			Replace
9	Backlash between planetary gear and ring gear	0.20 – 0.55			
10	Curvature of shaft	Repair limit: 1.5TIR			Repair or replace
11	Thickness of spacer	Standard size	Tolerance	Repair limit	Replace
		28	± 0.1	27.5	
12	Wear of outside diameter of portion of ring gear hub inserted into bearing	170	+0.040 +0.015	170	Repair
13	Wear of outside diameter of portion of axle tube inserted into bearing	140	-0.030 -0.055	139.83	

Rear



1. Shaft
2. Ring gear (Number of teeth: 66)
3. Planetary gear (Number of teeth: 23)
4. Planetary carrier
5. Sun gear (Number of teeth: 18)
6. Drain plug

Unit: mm

No.	Check item	Criteria			Remedy
7	Backlash between planetary gear and sun gear	0.17 – 0.41			Replace
8	Backlash between planetary gear and ring gear	0.20 – 0.55			
9	Curvature of shaft	Repair limit: 1.5TIR			Repair or replace
10	Thickness of spacer	Standard size	Tolerance	Repair limit	Replace
		28	± 0.1	27.5	
11	Wear of outside diameter of portion of ring gear hub inserted into bearing	170	+0.040 +0.015	170	Repair
12	Wear of outside diameter of portion of axle tube inserted into bearing	140	-0.030 -0.055	139.83	

Function

- The final drive uses a planetary gear mechanism to reduce the speed in order to give a large drive force, and transmits this drive force to the tires.

Operation

- The power from the differential passing through shaft (1) is transmitted to sun gear (5) and then goes to planetary gear (3).
  The planetary gear rotates on the inside of fixed ring gear (2) and transmits the reduced speed to planetary carrier (4). This power is then transmitted to the wheels that are installed to the planetary carrier.

HM300-2 Articulated dump truck

Form No. SEN00417-01

ARTICULATED DUMP TRUCK

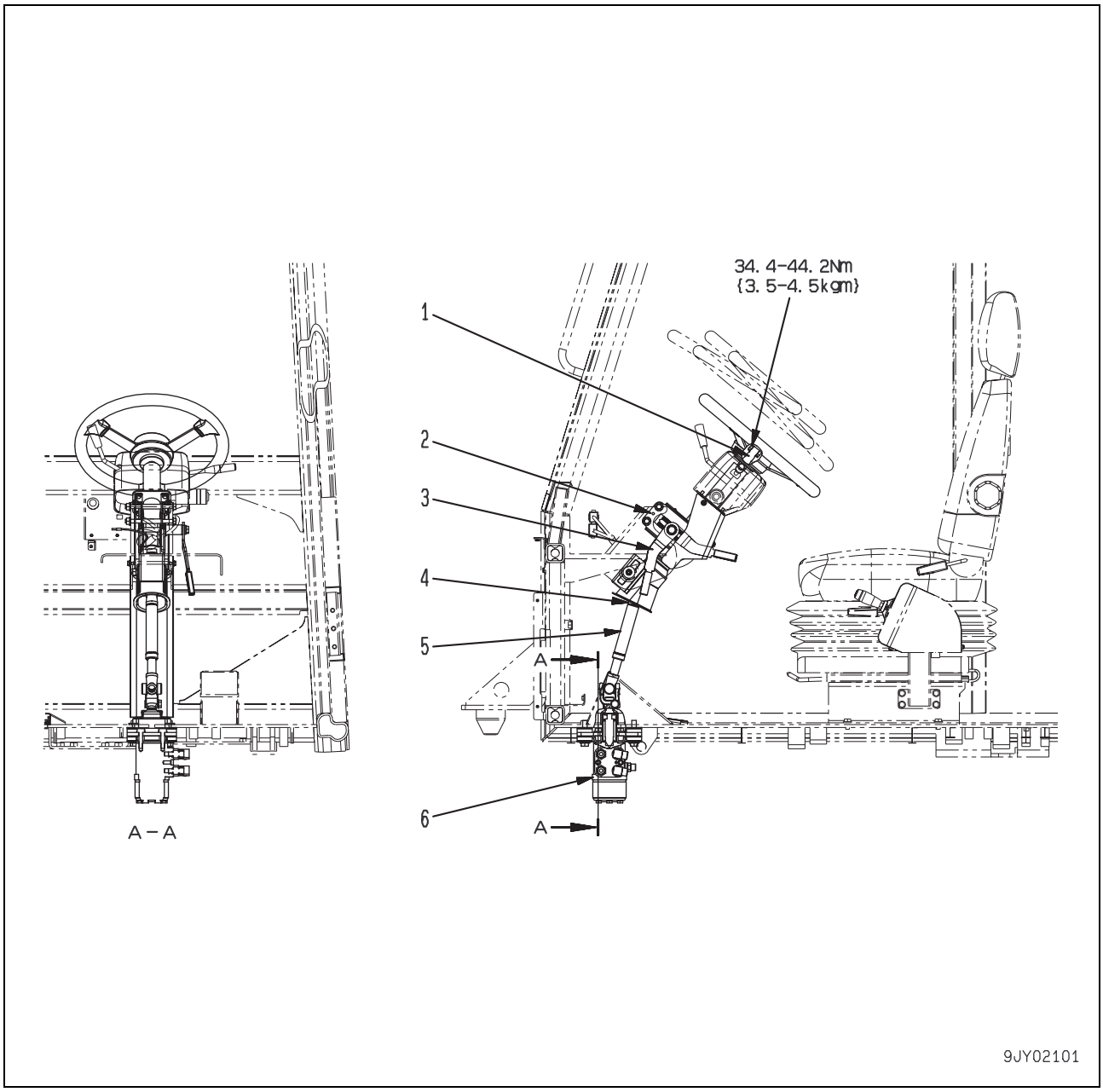
HM300-2

Machine model	Serial number
HM300-2	2001 and up

10 Structure, function and maintenance standard

Steering system

Steering column



1. Steering shaft
2. Steering column
3. Lock lever
4. Yoke
5. Joint shaft
6. Steering valve

HM300-2 Articulated dump truck

Form No. SEN00331-01

ARTICULATED DUMP TRUCK

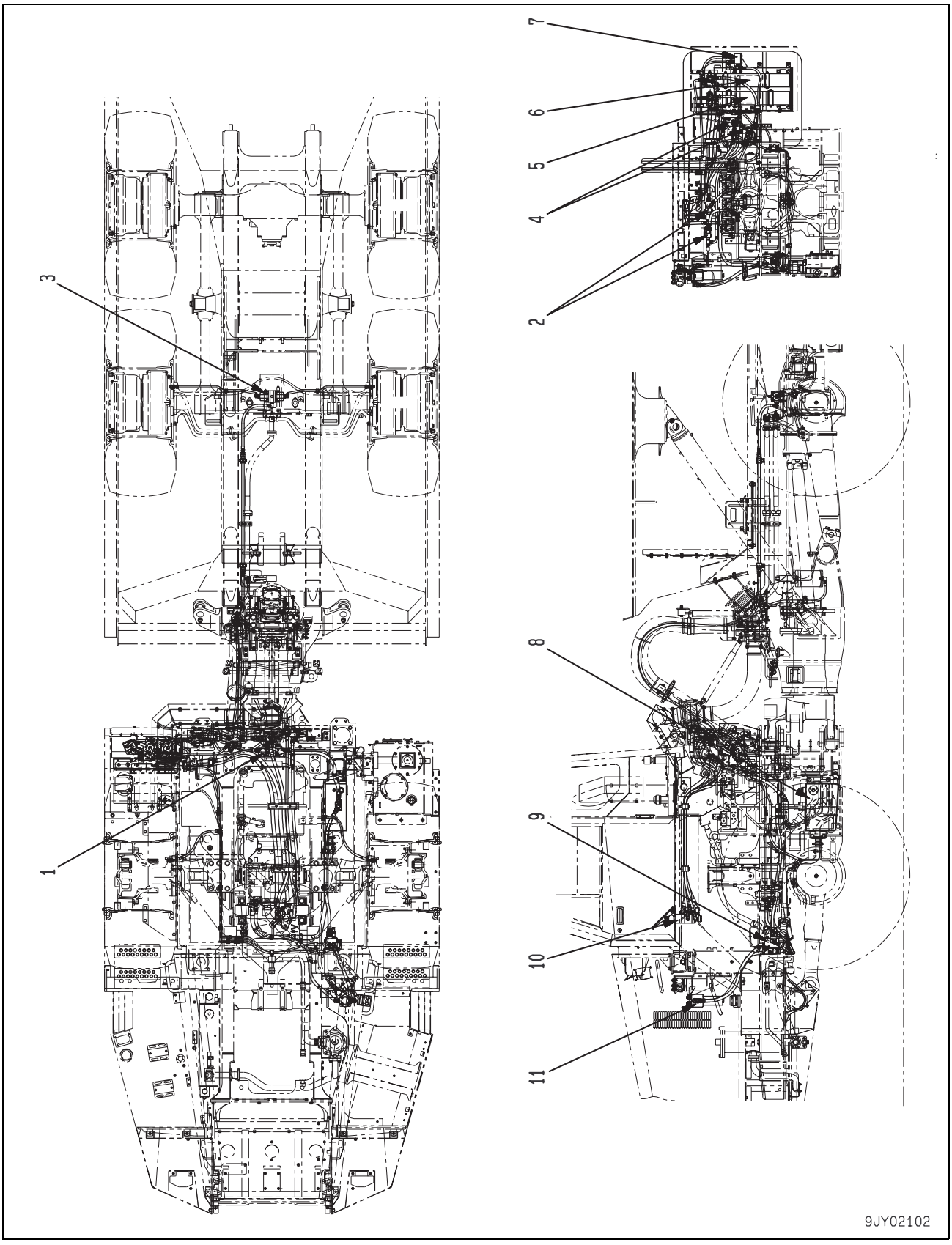
HM300-2

Machine model	Serial number
HM300-2	2001 and up

10 Structure, function and maintenance standard

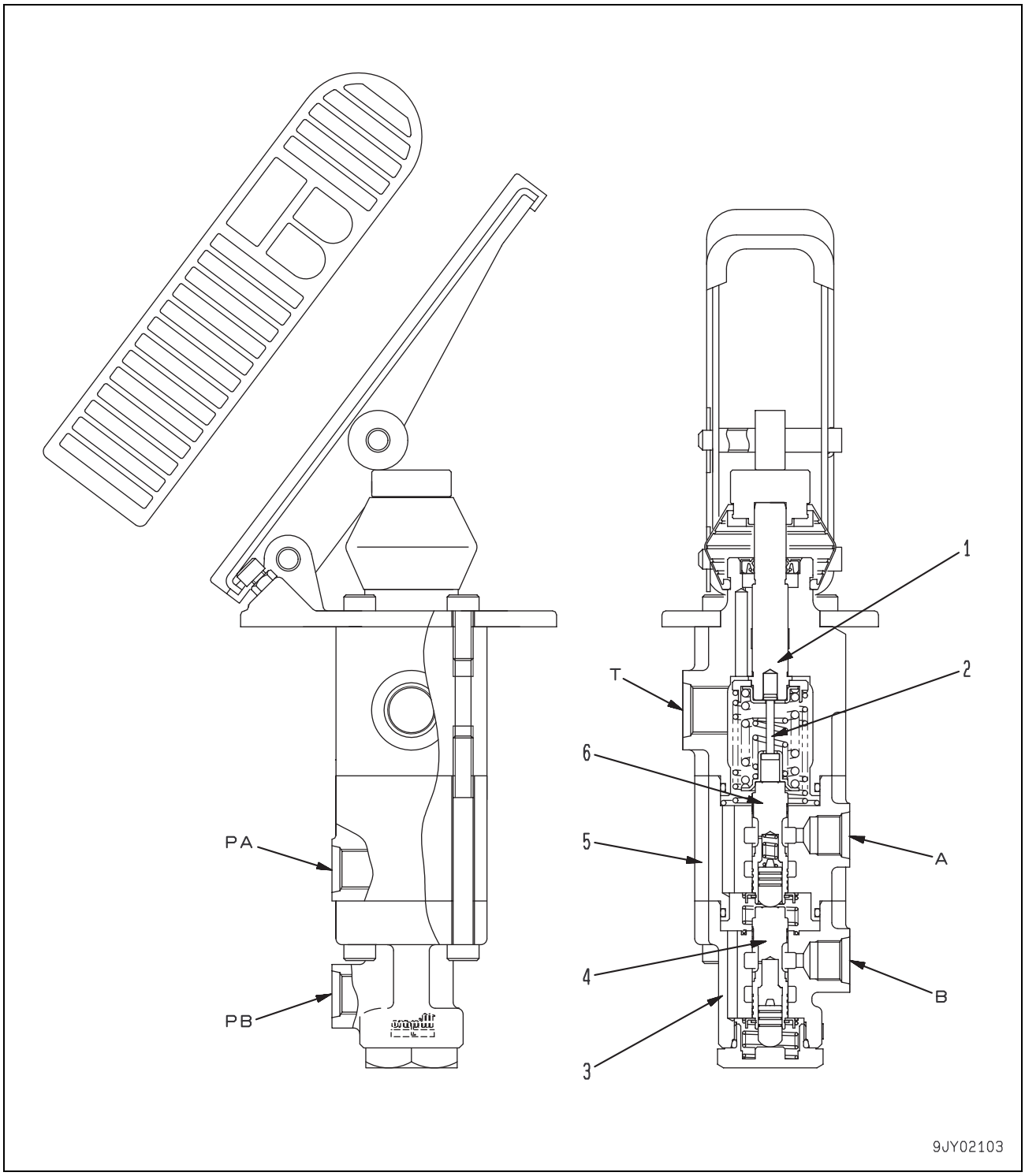
Brake system

Brake piping



1. Slack adjuster (Front)
2. Shuttle valve
3. Slack adjuster (center)
4. Proportional reducing valve
5. Accumulator (for center)
6. Accumulator (for front)
7. Parking brake solenoid valve
8. Brake system tank
9. Accumulator charge valve
10. Brake valve
11. Brake filter

Brake valve



1. Pilot piston
2. Rod
3. Lower cylinder
4. Spool
5. Upper cylinder
6. Spool

A: To center brake
B: To front brake
T: To brake system tank
PA: From center accumulator
PB: From front accumulator

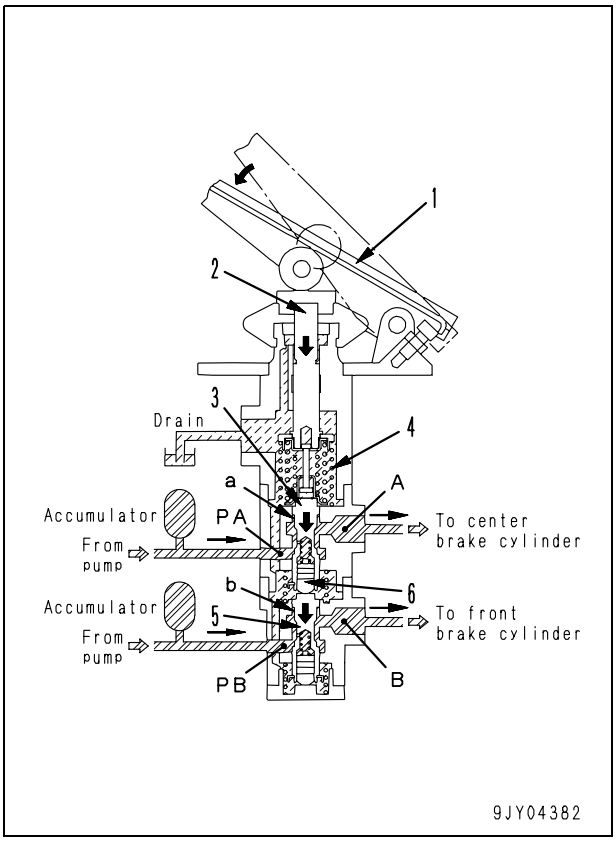
Operation

Upper portion

- When brake pedal (1) is depressed, the operating force is transmitted to spool (3) through rod (2) and spring (4). When spool (3) goes down, drain port (a) is closed, and the oil from the pump and accumulator flows from port (PA) to port (A) and actuates the center brake cylinders.

Lower portion

- When brake pedal (1) is depressed, the operating force is transmitted to spool (3) through rod (2) and spring (4). When spool (3) goes down, spool (5) is also pushed down by plunger (6). When this happens, drain port (b) is closed, and the oil from the pump and accumulator flows from port (PB) to port (B) and actuates the front brake cylinders.

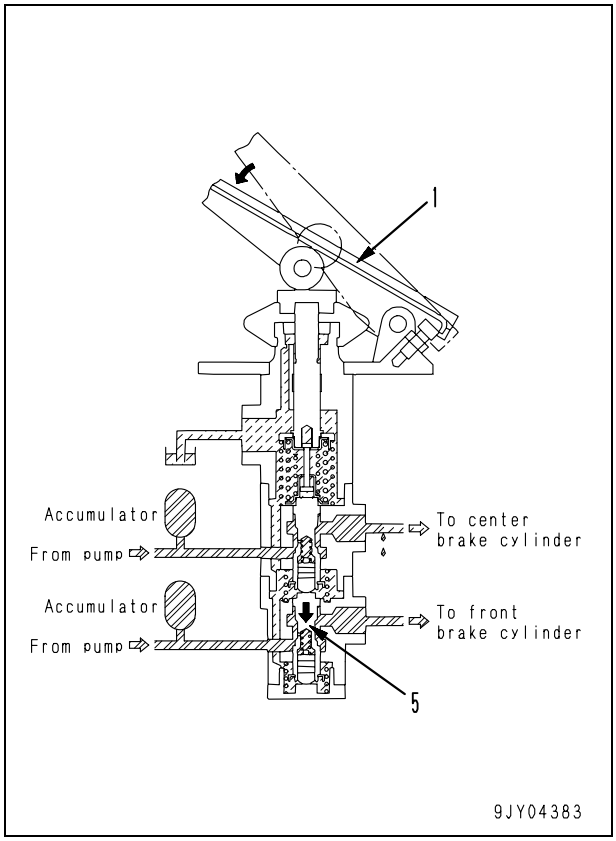


Applying brake when upper valve fails

- Even if there is leakage of oil in the upper piping, spool (5) is moved down mechanically when pedal (1) is depressed, and the lower portion is actuated normally.
  The upper portion of center brake is not actuated.

Applying brake when lower valve fails

- Even if there is leakage of oil in the lower piping, the upper portion of brake is actuated normally.

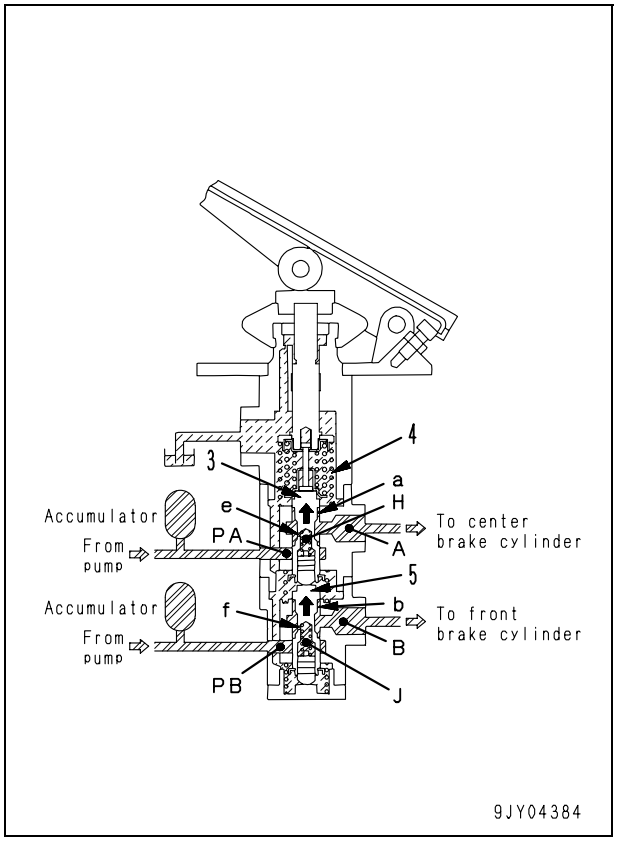


When actuation is balanced
Upper portion

- When oil fills the center brake cylinders and the pressure between port (PA) and port (A) becomes high, the oil entering port (H) from orifice (e) of spool (3) pushes against spring (4). It pushes up spool (3) and shuts off the circuit between port (PA) and port (A). When this happens, drain port (a) stays closed, so the oil entering the brake cylinder is held and the brake remains applied.

Lower portion

- When spool (3) in the upper portion moves up and the circuit between port (PA) and port (A) is shut off, oil also fills the front brake cylinder at the same time, so the pressure in the circuit between port (PB) and port (B) rises. The oil entering port (J) from orifice (f) of spool (5) pushes up spool (5) by the same amount that spool (3) moves, and shuts off port (PB) and port (B). Drain port (b) is closed, so the oil entering the brake cylinder is held, and the brake is applied.
- The pressure in the space in the upper portion is balanced with the operating force of the pedal, and the pressure in the space in the lower portion is balanced with the pressure in the space in the upper portion. When spools (3) and (5) move to the end of their stroke, the circuits between ports (PA) and (A) and between ports (PB) and (B) are fully opened, so the pressure in the space in the upper and lower portions and the pressure in the left and right brake cylinders is the same as the pressure from the pump.
  Therefore, up to the point where the piston moves to the end of its stroke, the effect of the brake can be adjusted by the amount that the pedal is depressed.



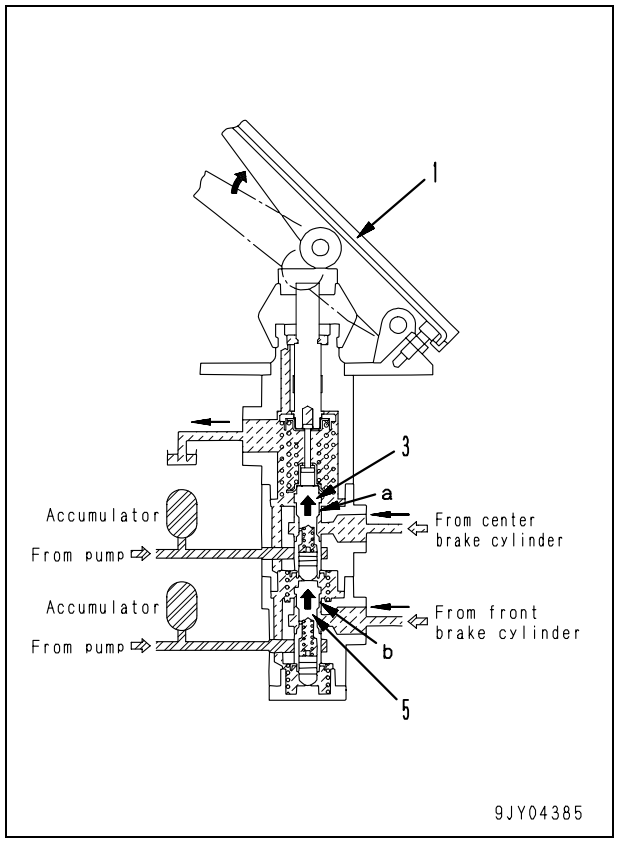
Brake released

Upper portion

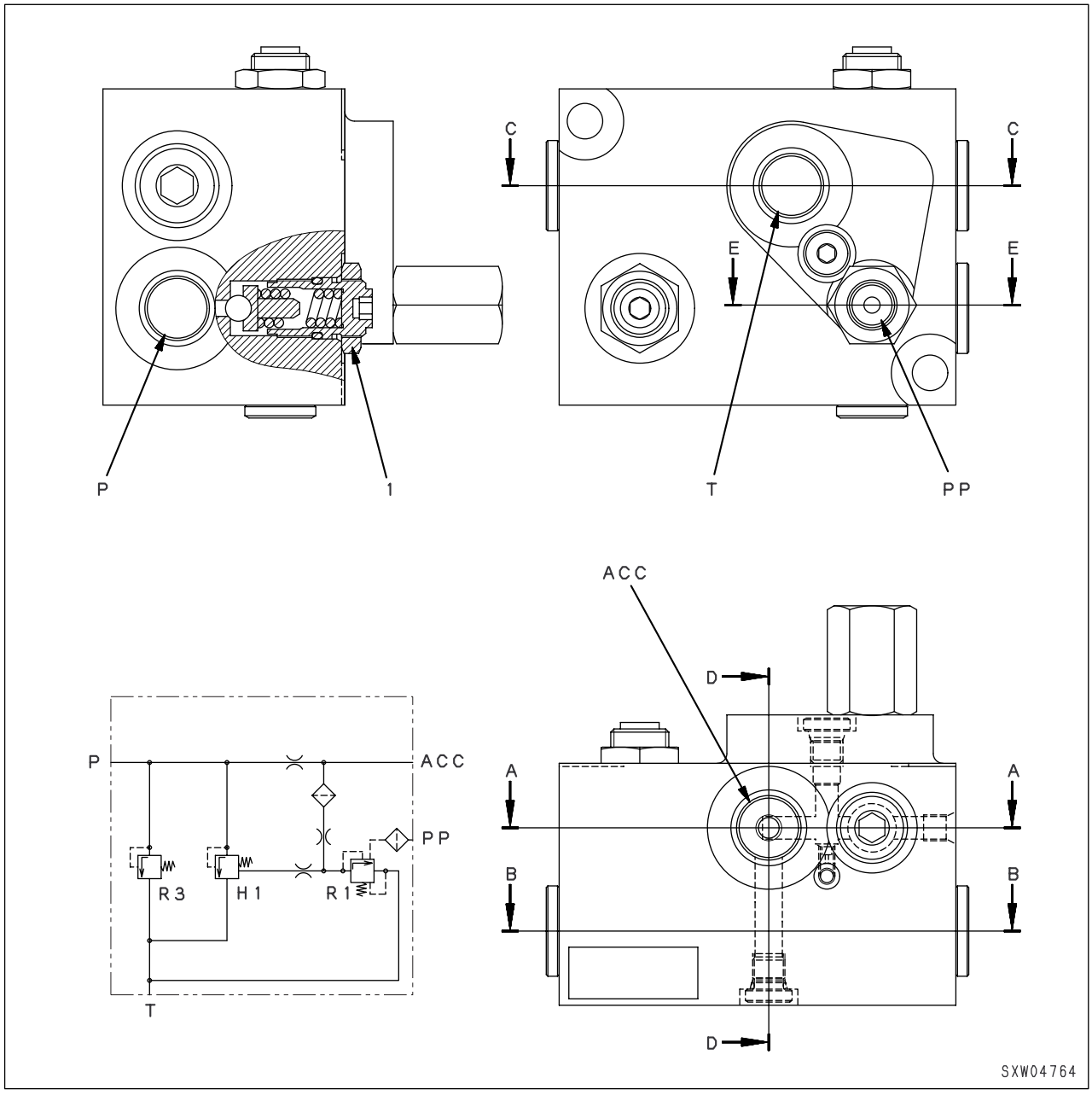
- When pedal (1) is released and the operating force is removed from the top of the spool, the back pressure from the brake cylinder and the force of the spool return spring move spool (3) up. Drain port (a) is opened and the oil from the brake cylinder flows to the brake system tank return circuit to release the center brake.

Lower portion

- When the pedal is released, spool (3) in the upper portion moves up. At the same time, the back pressure from the brake cylinder and the force of the spool return spring move spool (5) up. Drain port (b) is opened and the oil from the brake cylinder flows to the brake system tank return circuit to release the front brake.



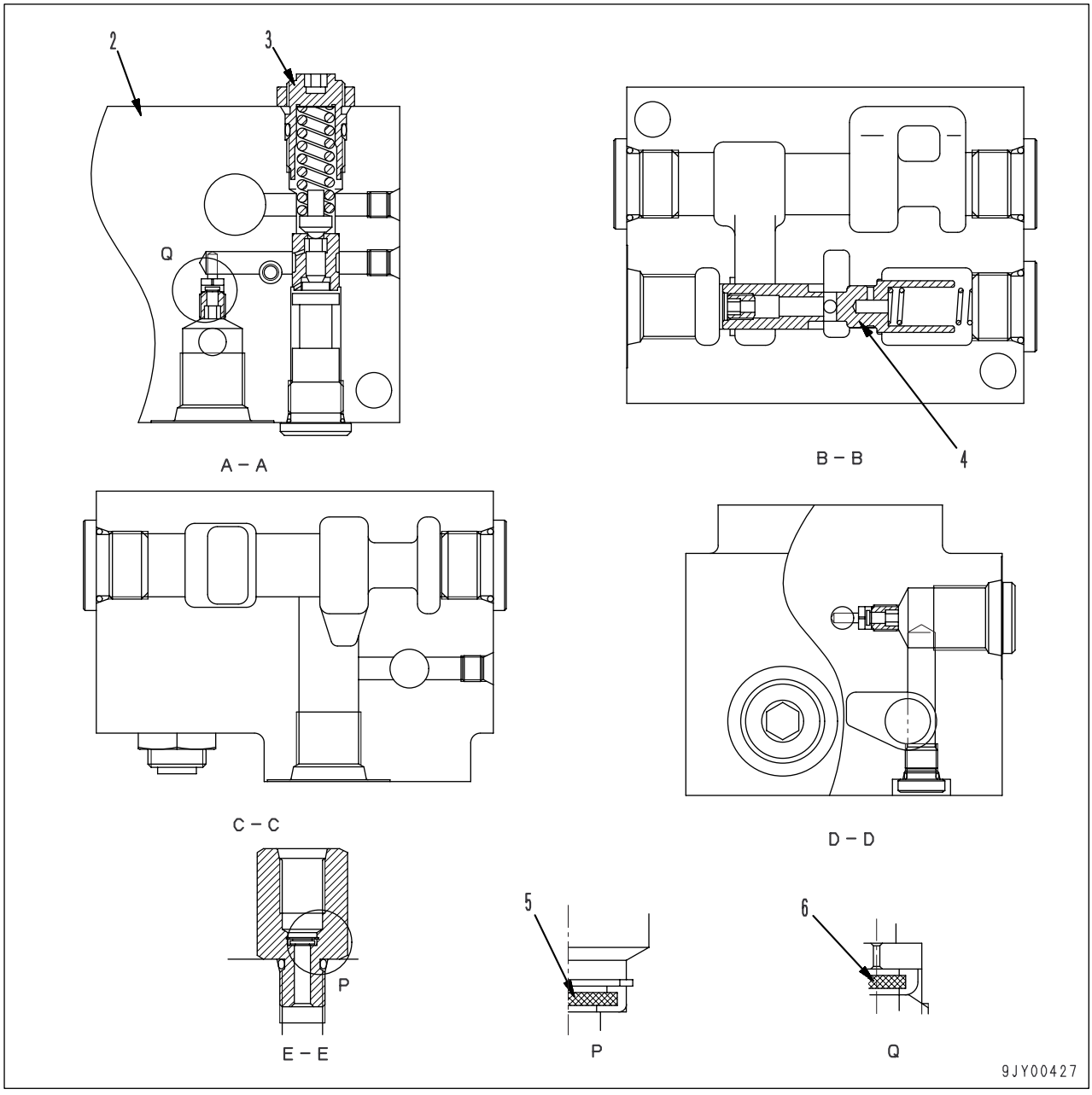
Accumulator charge valve



ACC. To accumulator
P. From hydraulic pump
PP. To accumulator
T. To brake system tank

Function

- The accumulator charge valve is actuated to maintain the oil pressure from the pump at the specified pressure and to store it in the accumulator.
- When the oil pressure reaches the specified pressure, the oil from the pump is connected to the drain circuit to reduce the load of the pump.

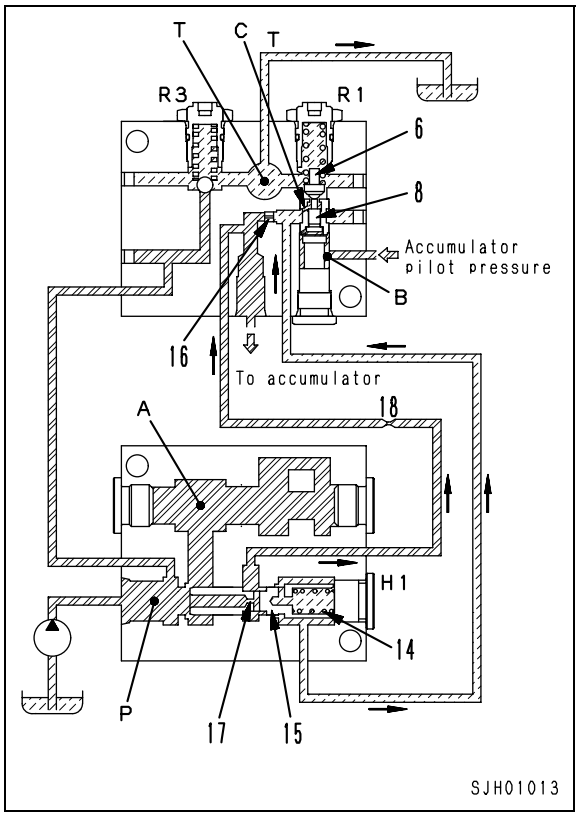


1. Main relief valve (R3)
2. Valve body
3. Relief valve (R1)
4. Relief valve (H1)
5. Filter
6. Filter

Operation

1. When no oil is being supplied to accumulator (cut-out condition)

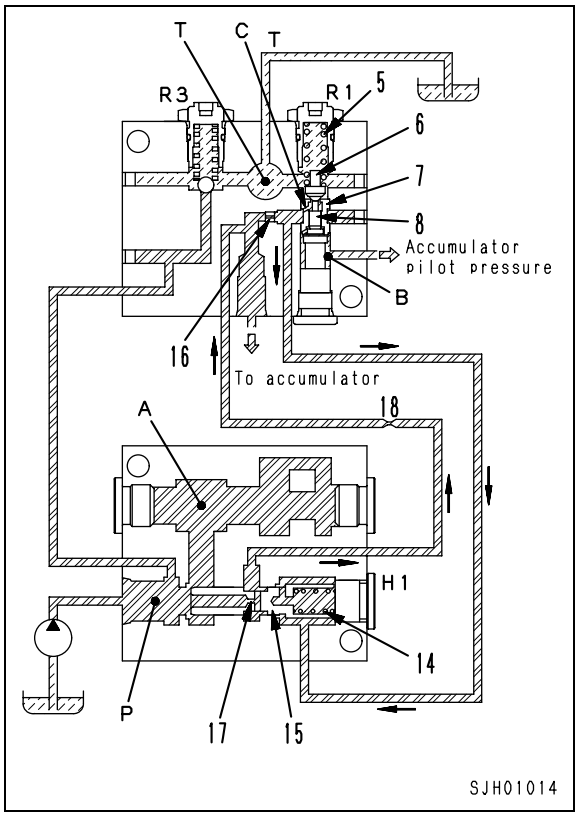
- The pressure at port (B) is higher than the set pressure of relief valve (R1), so piston (8) is forcibly pushed up by the oil pressure at port (B). Poppet (6) is opened, so port (C) and port (T) are short circuited.
- The spring chamber at the right end of spool (15) is connected to port (C) of relief valve (R1), so the pressure becomes the oil tank pressure. The oil from the pump enters port (P), pushes spool (15) to the right at a low pressure equivalent to the load on spring (14).
  It also passes through orifices (17), (18) and (16), and flows to the oil tank.



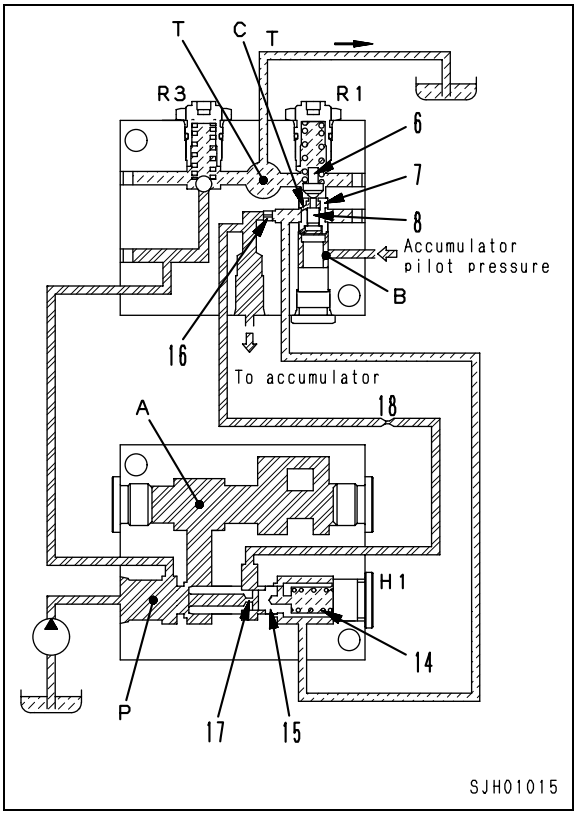
2. When oil supplied to accumulator

1) Cut-in condition

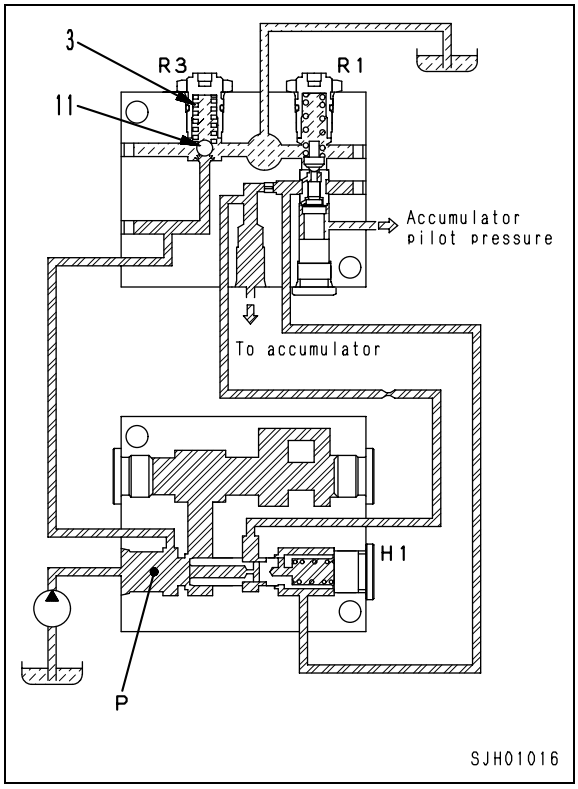
- When the pressure at port B is lower than the set pressure of relief valve (R1), piston (8) is pushed back down by spring (5).
  Valve seat (7) and poppet (6) are brought into tight contact, and port (C) and port (T) are shut off.
- The spring chamber at the right end of spool (15) is also shut off from port (T), so the pressure rises, and the pressure at port (P) also rises in the same way.
- When the pressure at port (P) goes below the pressure at port (B) (accumulator pressure), the supply of oil to the accumulator starts immediately. In this case, it is decided by the size (area) of orifice (17) and the pressure difference (equivalent to the load on spring (14)) generated on both sides of the orifice. A fixed amount is supplied regardless of the engine speed.



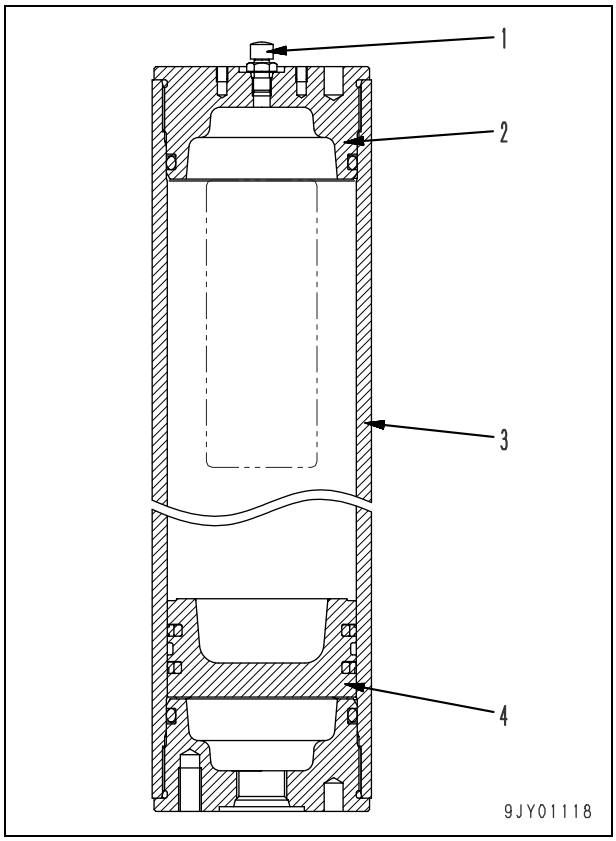
2) When cut-out pressure is reached
- When the pressure at port (B) (accumulator pressure) reaches the set pressure of relief valve (R1), poppet (6) separates from valve seat (7), so an oil flow is generated and the circuit is relieved.
- When the circuit is relieved, a pressure difference is generated above and below piston (8), so piston (8) moves up, poppet (6) is forcibly opened, and port (C) and port (T) are short circuited.
- The spring chamber at the right end of spool (15) is connected to port (C) of relief valve (R1), so the pressure becomes the brake oil tank pressure.
- The pressure at port (P) drops in the same way to a pressure equivalent to the load on spring (14), so the supply of oil to port (B) is stopped.



3. Main relief valve (R3)
- When the pressure at port (P) (pump pressure) increases above the set pressure of the relief valve, the oil from the pump pushes up ball (11) against spring (3) and flows in the tank circuit. As a result, the maximum pressure in the brake circuit is regulated and the circuit is protected.



Accumulator



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

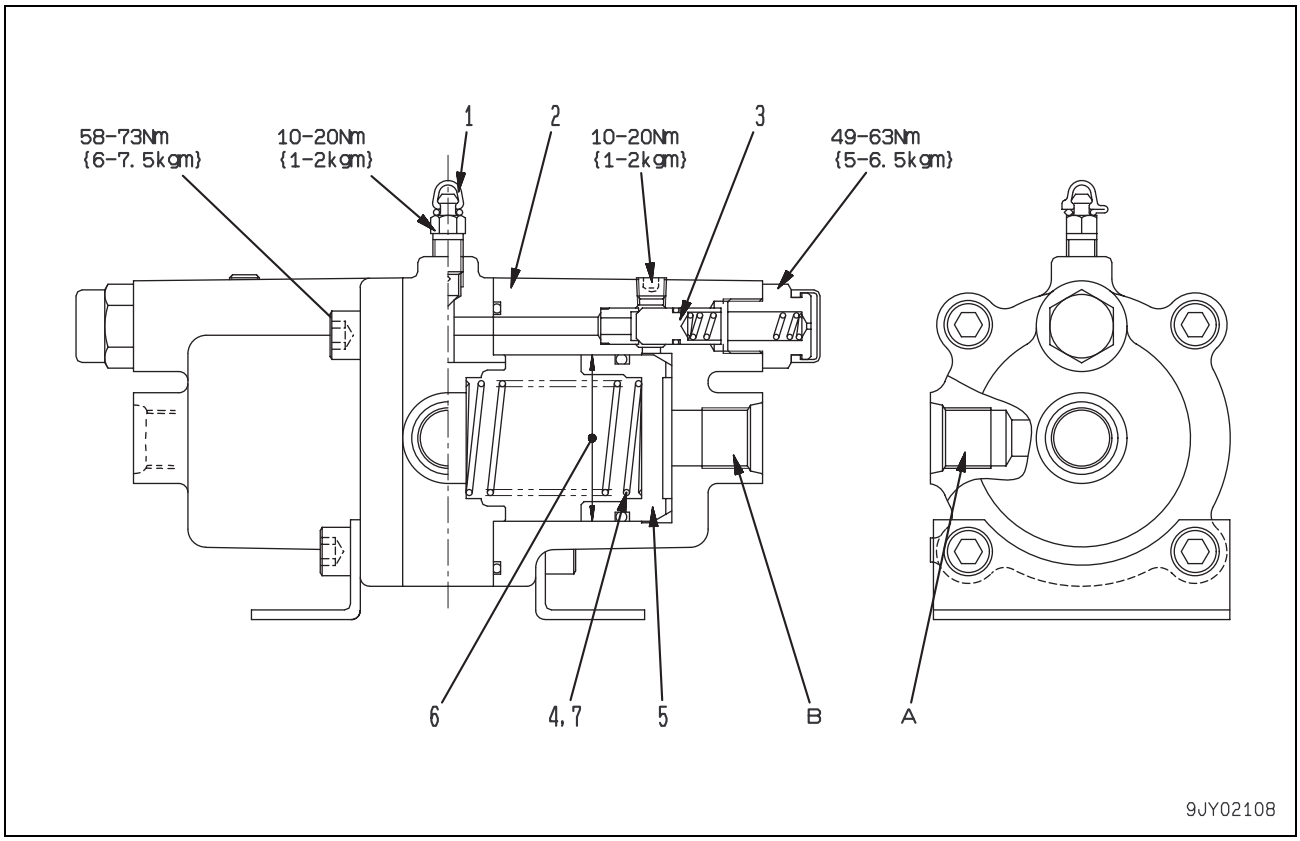
Function

- The accumulator is installed between the accumulator charge valve and the brake valve. It is charged with nitrogen gas between cylinder (3) and free piston (4), and uses the compressibility of the gas to absorb the pulse of the hydraulic pump or to maintain the braking force and to make it possible to operate the machine if the engine stops.

Specifications

Gas used:	Nitrogen gas
Gas capacity:	4,000 cc
Charging pressure:	4.4 ± 0.15 MPa
	{45 ± 1.5 kg/cm^2} (at 20 ± 5 °C)

Slack adjuster



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

A: Inlet port
B: Outlet port

Unit: mm

No.	Check item		Criteria					Remedy
6	Clearance between body and piston	Front	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
				Shaft	Hole			
			55	-0.030 -0.076	+0.074 0	0.030 – 0.150	0.25	
		Center	55	-0.030 -0.076	+0.074 0	0.030 – 0.150	0.25	
7	Slack adjuster spring	Front	Standard size			Repair limit		
			Free length	Installed length	Installed load	Free length	Installed load	
			198	58	39.8 N {4.1 kg}	–	–	
		Center	198	60	39.2 N {4.0 kg}	–	–	

Specifications

Piston actuation oil pressure:

$0.01\,^{+0.01}_{0}$ MPa {$0.1\,^{+0.1}_{0}$ kg/cm^2}

Check valve cracking pressure:

1.74 ± 0.05 MPa {17.8 ± 0.5 kg/cm^2}

Check valve closing pressure:

1.09 ± 0.05 MPa {11.1 ± 0.5 kg/cm^2}

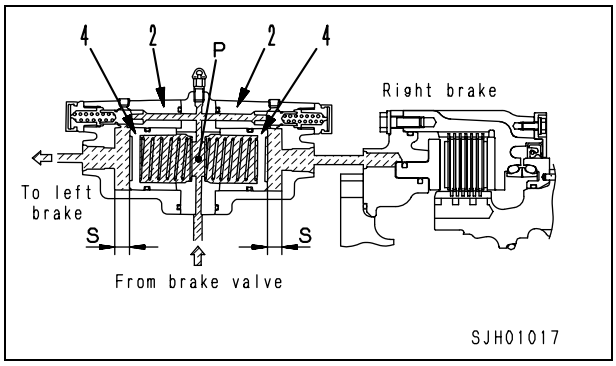
Function

- The slack adjuster is installed in the brake oil line from the brake valve to the brake piston. It acts to keep a constant time lag when the brake is operated.

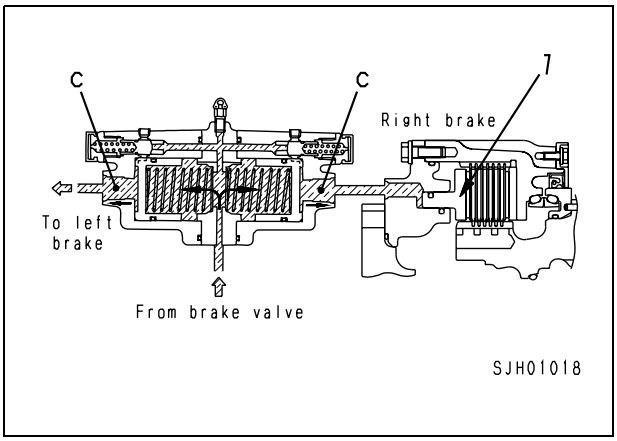
Operation

1. When brake pedal is depressed

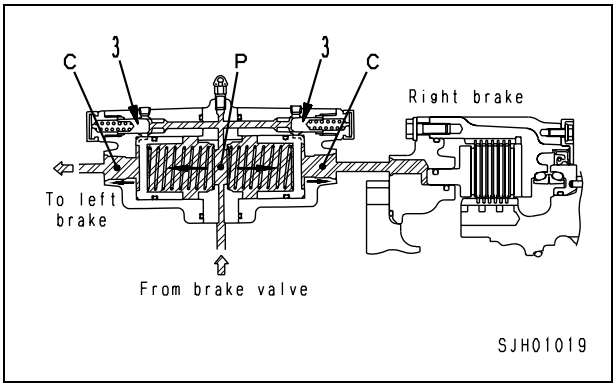
- Before the brake is depressed, piston (4) is returned by the distance of stroke (S) (full stroke). When the brake pedal is depressed, the oil discharged from the brake valve flows from port (P) of the slack adjuster and is divided to left and right cylinders (2), where it moves piston (4) by stroke (S) to the left and right.



- As a result, brake piston (7) moves by an amount equal to stroke (S). When this happens, the relationship between the brake piston and disc is simply that the clearance becomes 0. No braking force is generated.

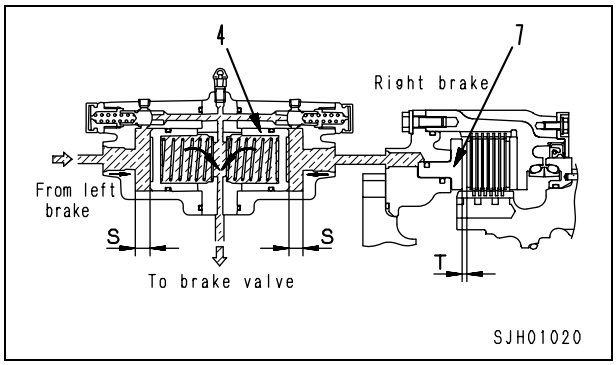


- If the brake pedal is depressed further, and the oil pressure discharged from the brake valve goes above to the set pressure, check valve (3) opens and the pressure is applied to port (C) to act as the braking force.
  Therefore, when the brake is applied, the time lag is a fixed value.



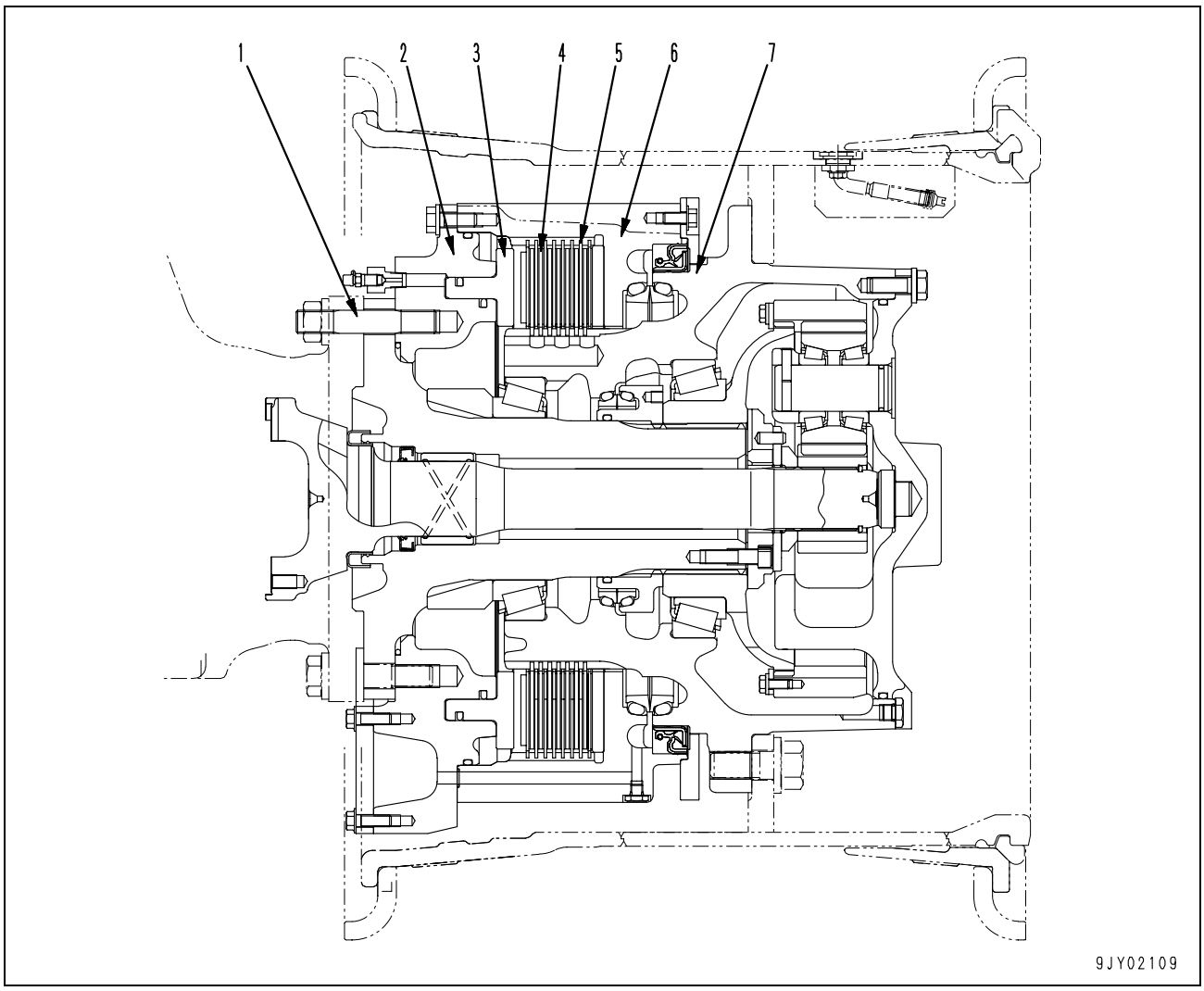
2. When brake pedal is released

- When the brake is released, piston (4) returns because of the brake cooling oil pressure by an amount equivalent to the oil for stroke (S), and the brake is released again.
  In other words, return stroke (T) of brake piston (7) is determined by the amount of oil for stroke (S) of the slack adjuster. The time lag of the brake is always kept constant regardless of the wear of the brake disc.

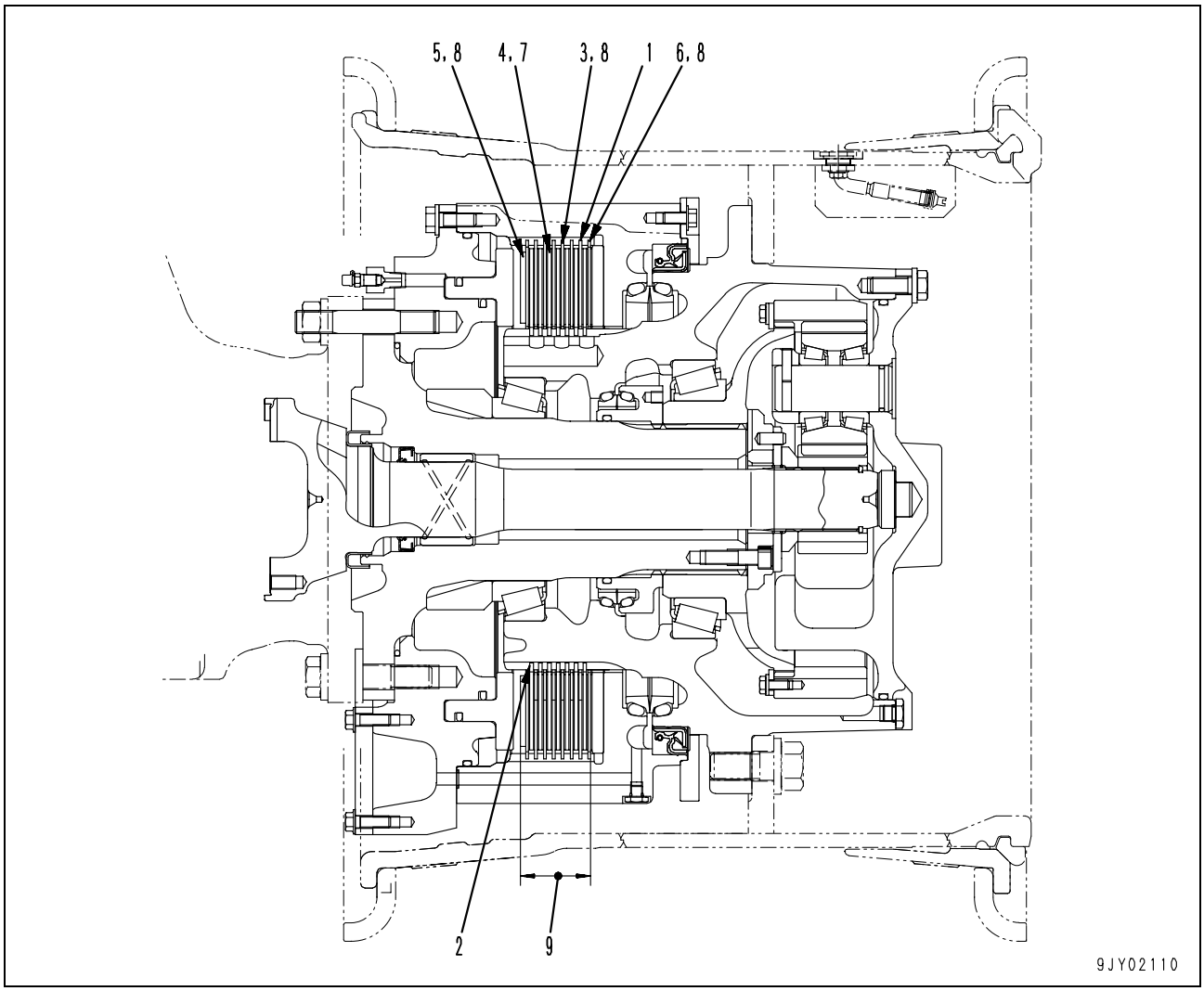


Brake

Front



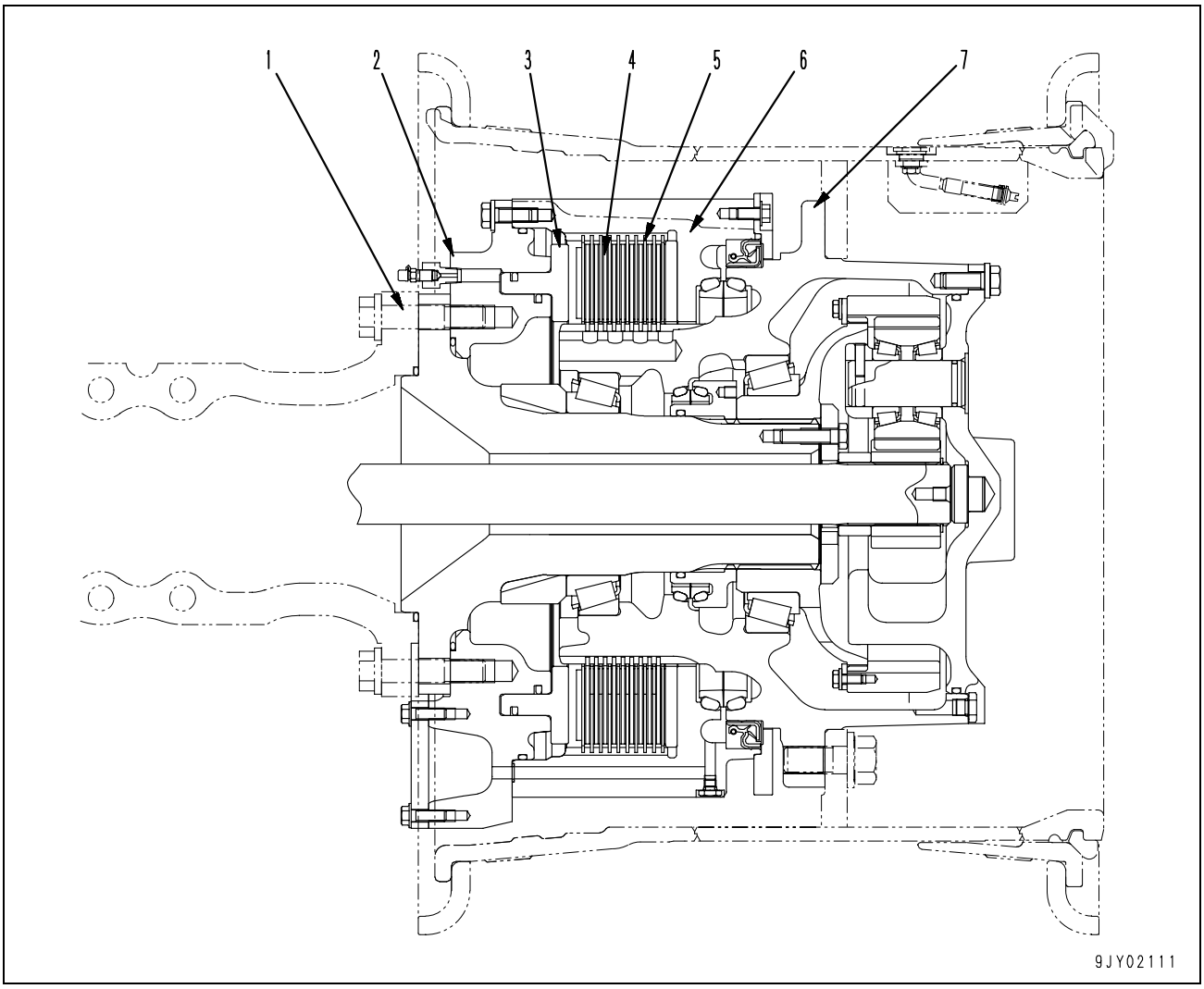
1. Stud bolt
2. Cylinder
3. Brake piston
4. Disc
5. Plate
6. Outer gear (Number of teeth: 148)
7. Hub gear (Number of teeth: 96)



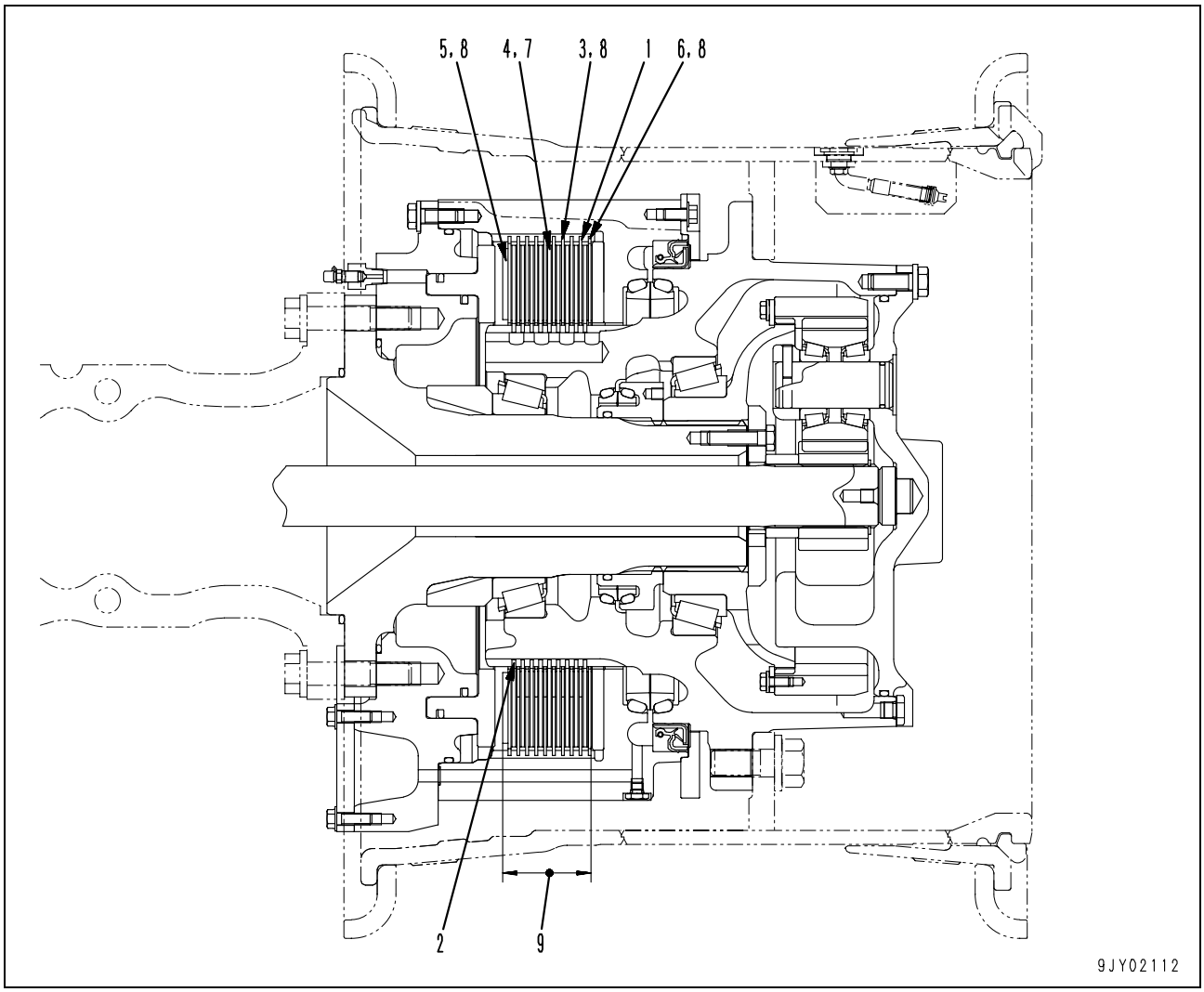
Unit: mm

No.	Check item	Criteria		Remedy
1	Backlash between outer gear and plate	Standard backlash	Repair limit	Replace
		0.22 – 0.56	1.1	
2	Backlash between hub gear and disc	0.17 – 0.52	1.1	
3	Thickness of plate	Standard size	Repair limit	
		2.4	2.15	
4	Thickness of disc	5.2	4.7	
5	Thickness of damper	6.9	5.1	
6	Thickness of damper	3.45	2.55	
7	Distortion of disc friction surface	Standard distortion	Repair limit	
		Max 0.45	0.7	
8	Distortion of plate and damper friction surface	Max 0.50	0.7	
9	Assemble thickness of plate and disc	Standard size	Repair limit	
		61.2	56.7	

Center



1. Bolt
2. Cylinder
3. Brake piston
4. Disc
5. Plate
6. Outer gear (Number of teeth: 148)
7. Hub gear (Number of teeth: 96)



Unit: mm

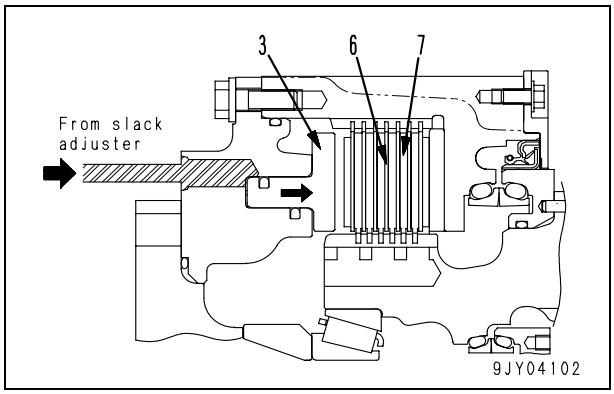
No.	Check item	Criteria		Remedy
1	Backlash between outer gear and plate	Standard backlash	Repair limit	Replace
		0.22 – 0.56	1.1	
2	Backlash between hub gear and plate	0.17 – 0.52	1.1	
3	Thickness of plate	Standard size	Repair limit	
		2.4	2.15	
4	Thickness of disc	5.2	4.7	
5	Thickness of damper	6.9	5.1	
6	Thickness of damper	3.45	2.55	
7	Distortion of disc friction surface	Standard distortion	Repair limit	
		Max 0.45	0.7	
8	Distortion of plate and damper friction surface	Max 0.50	0.7	
9	Assemble thickness of plate and disc	Standard size	Repair limit	
		76.4	70.9	

Function

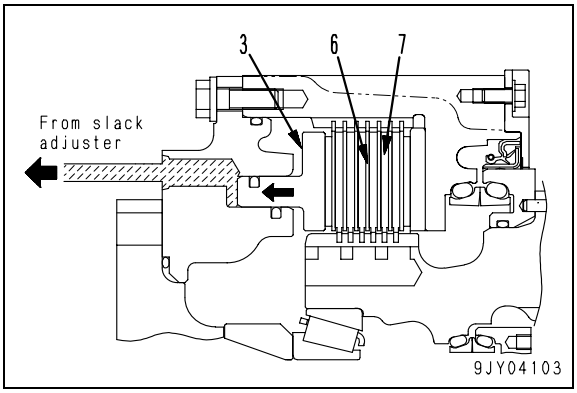
- There are wet-type multiple disc brakes installed to the front and center axles.

Operation

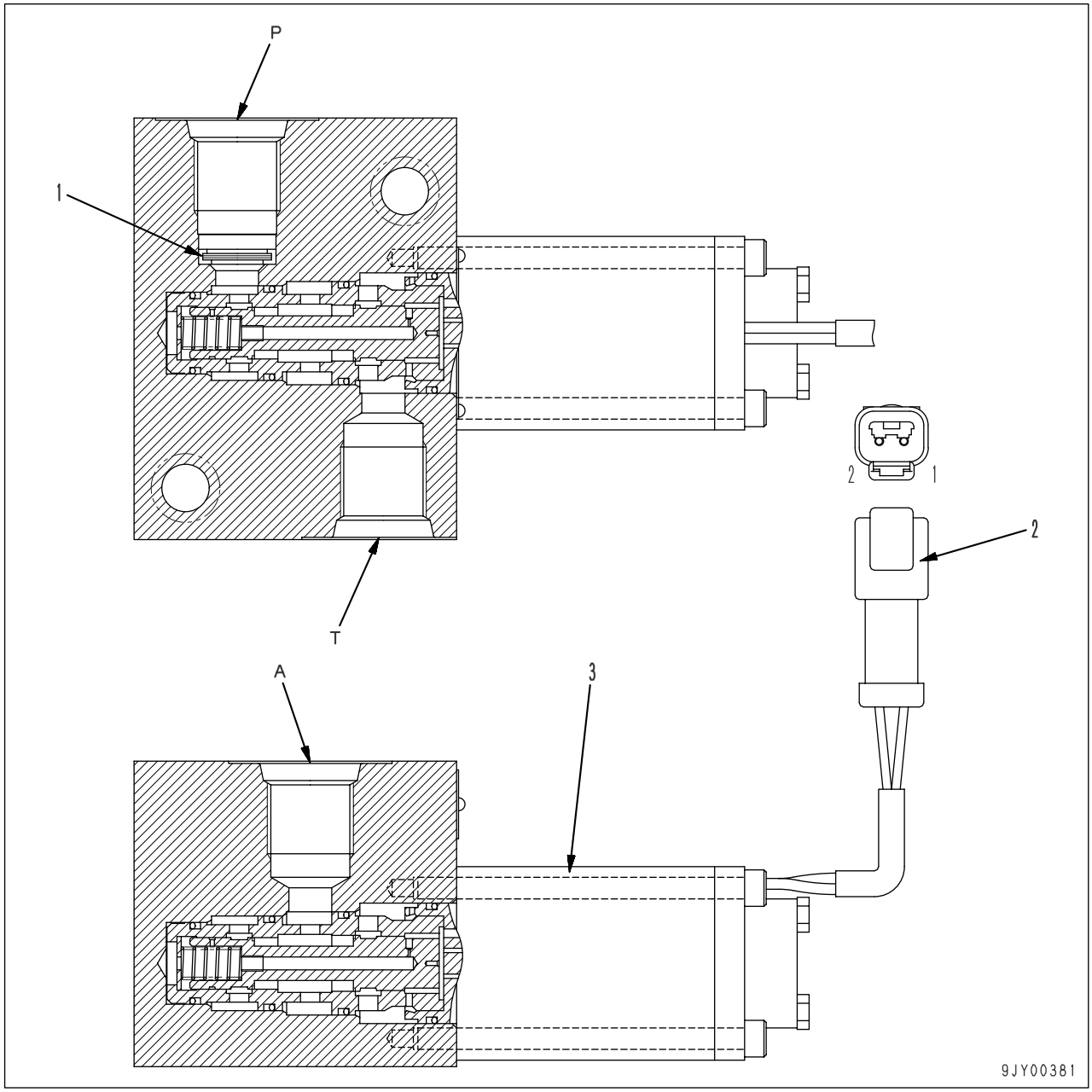
- When the brake pedal is depressed, pressure oil from the brake valve moves brake piston (3) to the right in the direction of the arrow. This presses disc (7) and plate (6) together and generates friction between the disc and plate. The wheel is rotating together with the disc, so this friction reduces the travel speed and stops the machine.



- When the brake pedal is released, the pressure at the back face of brake piston (3) is released, so the piston is moved to the left in the direction of the arrow by the internal pressure, and this releases the brake.



Proportional reducing valve



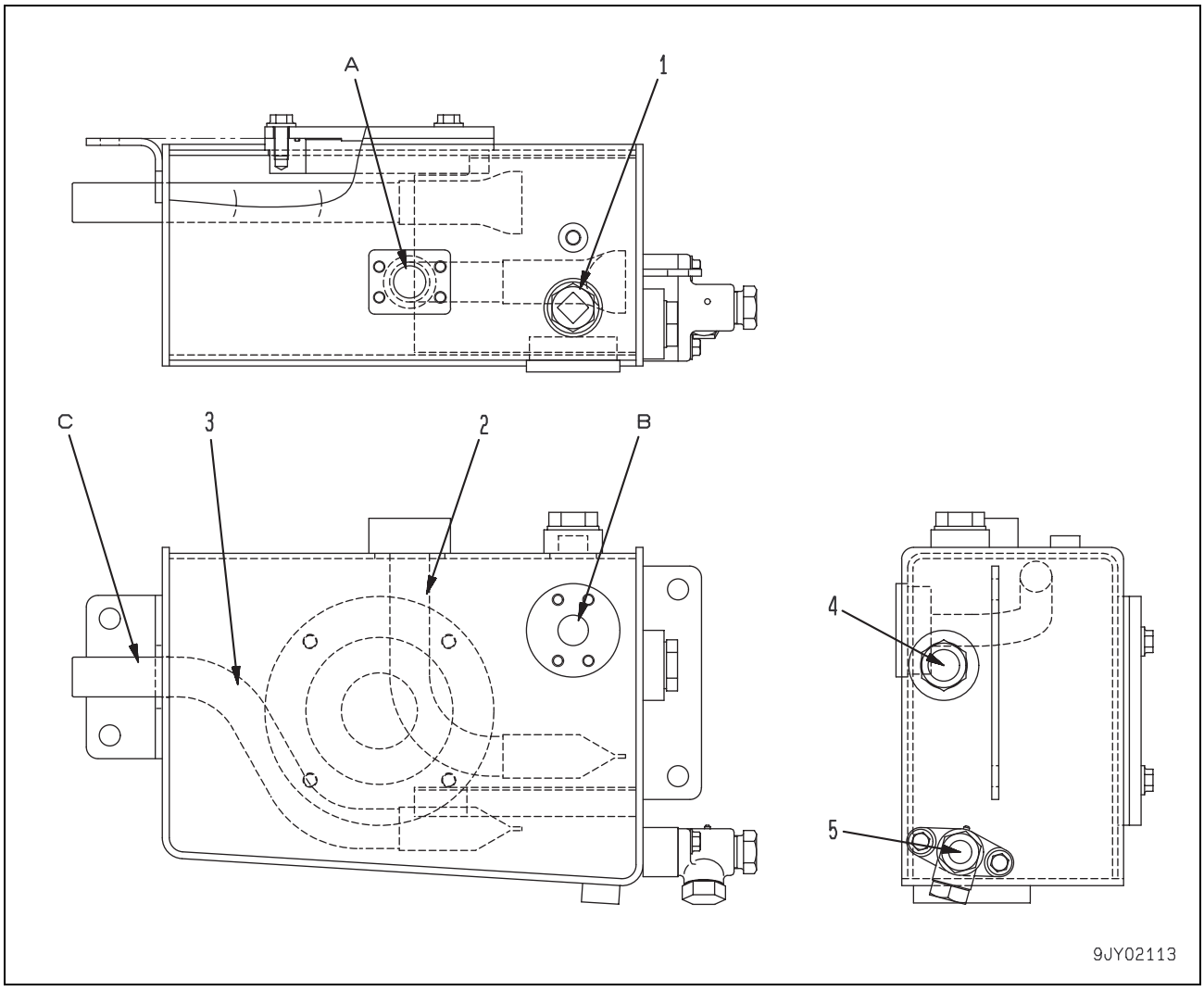
1. Filter
2. Connector
3. Solenoid assembly

A: To brake valve
P: From accumulator
T: To brake system tank

Function

- The proportional reducing valve is a valve used for retarder control. It is installed between the brake valve and the system tank in the brake circuit.
  It varies the discharge pressure of the pressure oil in accordance with the turning angle of the retarder control lever, so the retarder control can be carried out as desired.

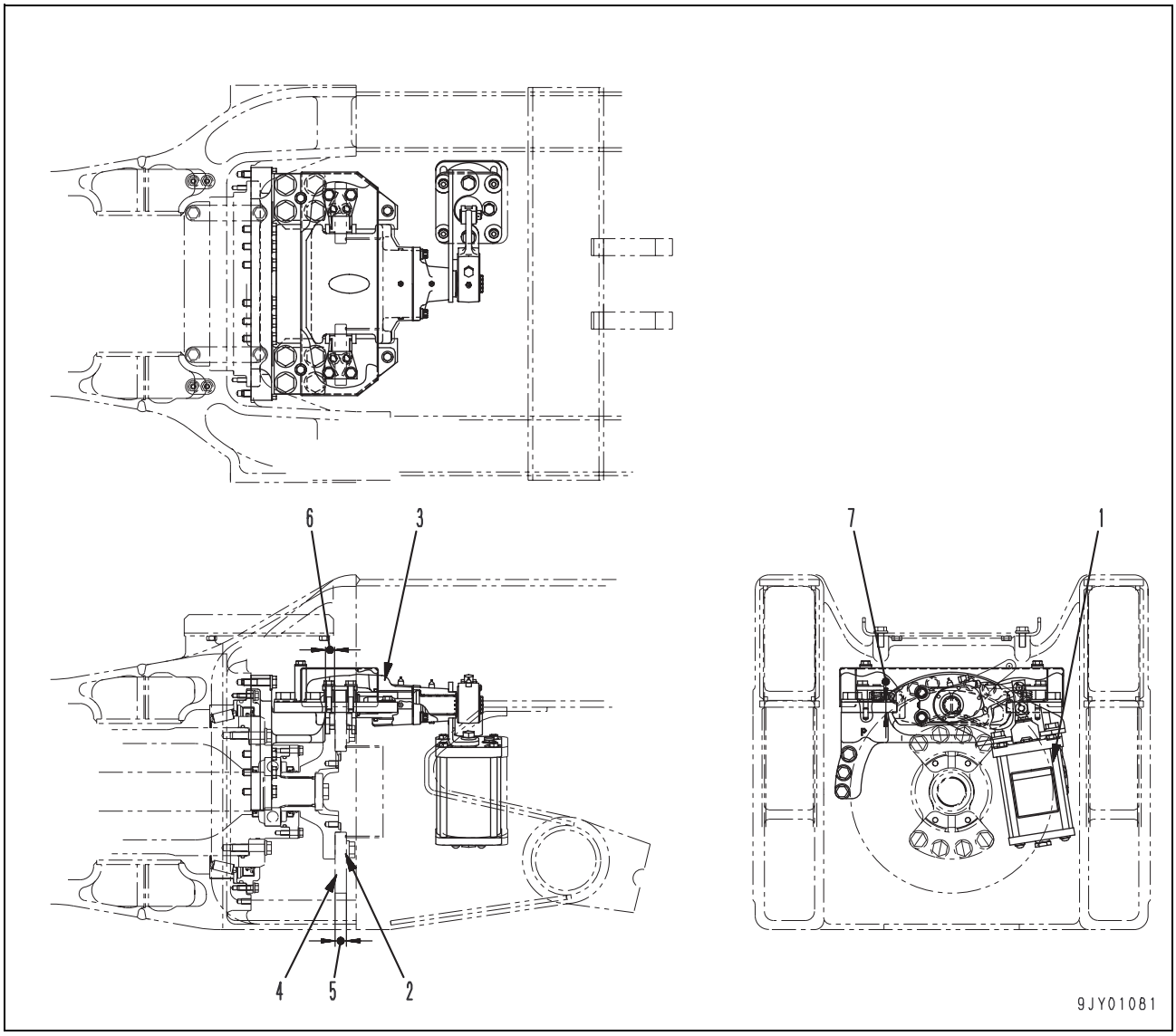
Brake system tank



1. Plug
2. Inlet tube
3. Outlet tube
4. Oil gauge
5. Valve

A: From accumulator charge valve, brake valve
B: To transmission
C: To hydraulic pump

Parking brake



1. Spring cylinder
2. Parking brake disc
3. Parking brake caliper

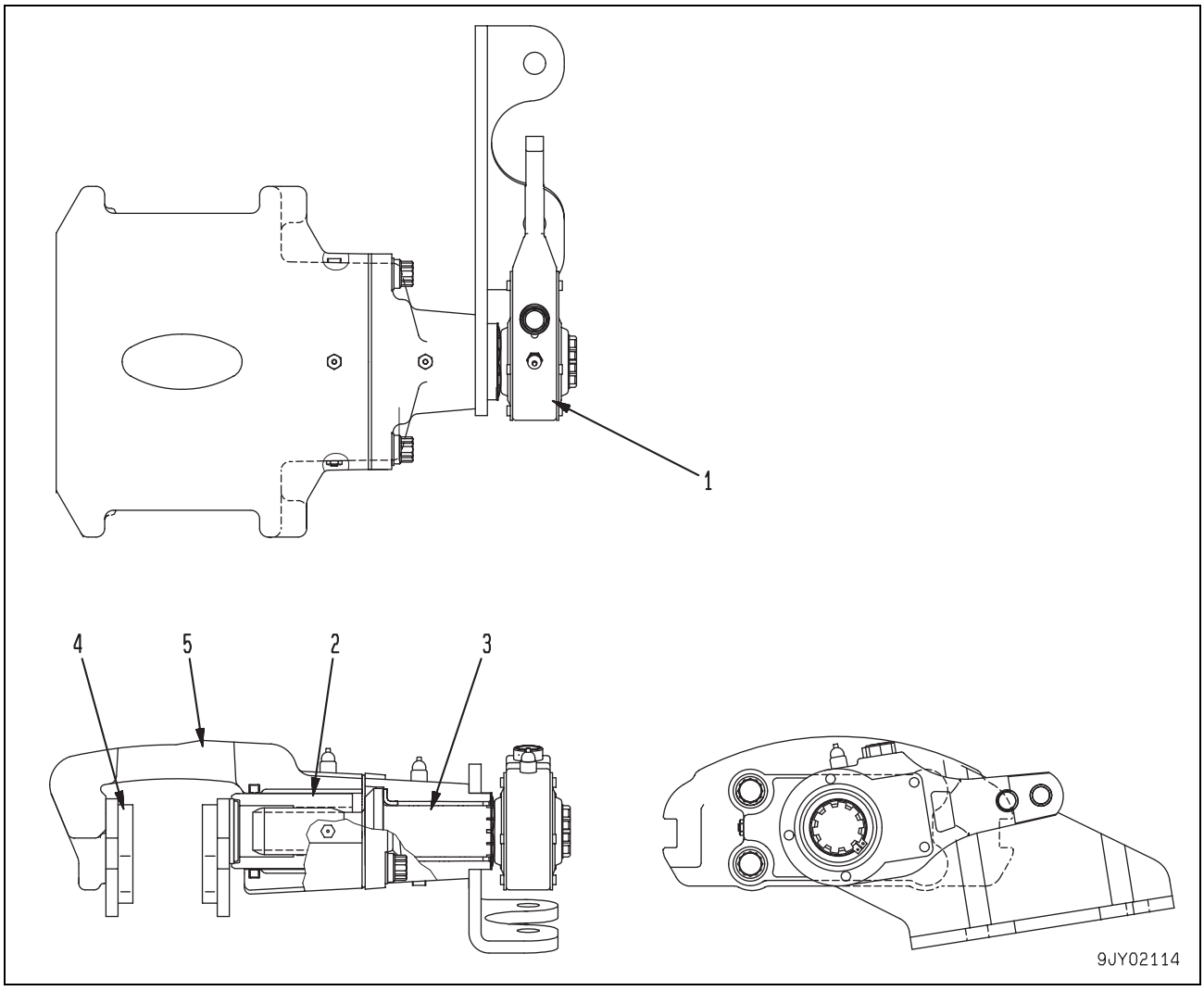
Function

- The parking brake is the disc type and installed to the rear of the oscillation hitch.
- It is actuated mechanically by the force of the spring inside the spring cylinder and is released by hydraulic pressure.
- The parking brake calipers are fixed to the oscillation hitch.
  The disc is installed to the oscillation hitch shaft output coupling and rotates together with the coupling.

Unit: mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="4">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">4</td><td rowspan="2">Face runout of disc</td><td colspan="2">Standard size</td><td colspan="2">Repair limit</td><td rowspan="2">Repair or replace</td></tr>
<tr><td colspan="2">0.4</td><td colspan="2">0.8</td></tr>
<tr><td rowspan="2">5</td><td rowspan="2">Thickness of disc</td><td colspan="2" rowspan="2">25</td><td colspan="2">Min. 20</td><td>Rebuid (Thickness of disc must not be under 20 mm)</td></tr>
<tr><td colspan="2">Max. 20</td><td rowspan="2">Replace</td></tr>
<tr><td>6</td><td>Thickness of pad (including thickness of plate)</td><td colspan="2">20</td><td colspan="2">10</td></tr>
<tr><td rowspan="4">7</td><td rowspan="4">Clearance between blade and brake assembly</td><td>Standard dimen-sion of blade</td><td>Tolerance</td><td>Standard clearance</td><td>Clearance limit</td><td rowspan="4">Repair or replace</td></tr>
<tr><td>22.3</td><td>0
-0.3</td><td rowspan="3">1.0 ± 0.4</td><td rowspan="3">1.5</td></tr>
<tr><td>Standard dimension of brake assembly</td><td>Tolerance</td></tr>
<tr><td>23</td><td>+0.4
-0.1</td></tr>
</table>

Parking brake caliper

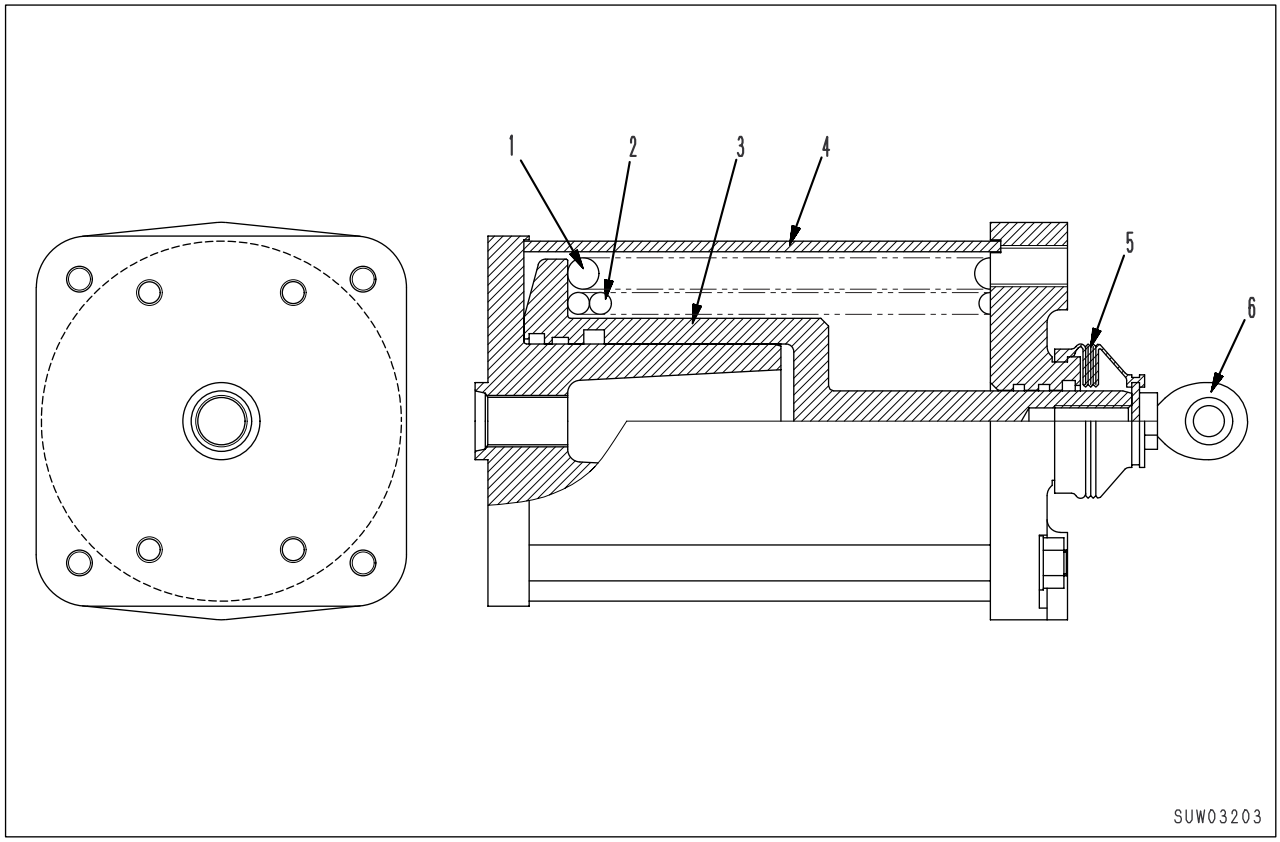


1. Adjuster
2. Piston
3. Piston shaft
4. Pad
5. Caliper

Outline

- A piston guide is installed to caliper (5). Piston (2) and piston shaft (3) are inserted, and the rotation of piston shaft (3) moves piston (2) in the axial direction to bring pad (4) into tight contact.
- Adjuster (1) is joined by a spline to the spline side of piston shaft (3).
  Pad (4) is inserted together with caliper (5) into the caliper mounting plate and is held in position.

Spring cylinder

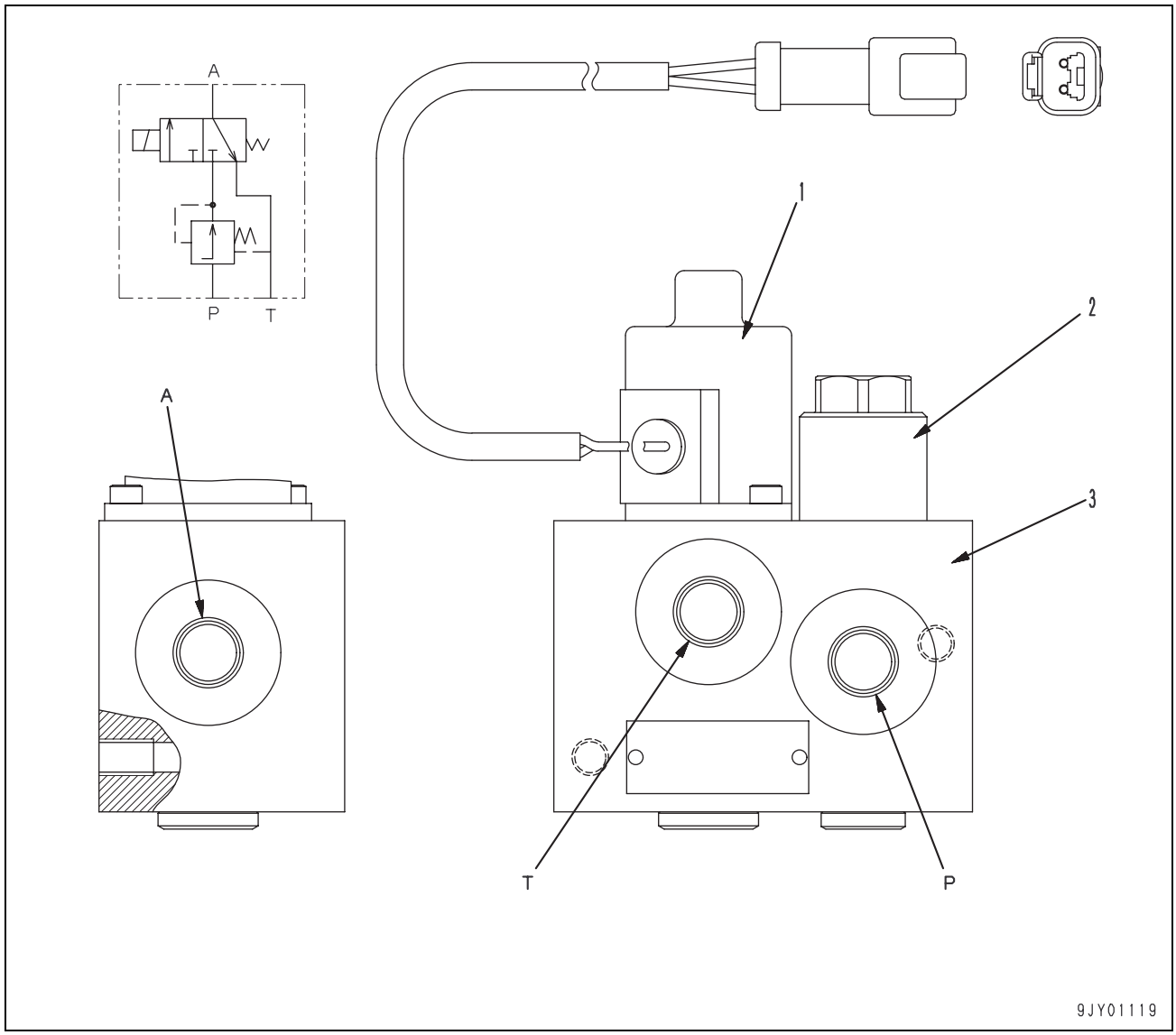


1. Outer spring
2. Inner spring
3. Piston
4. Cylinder
5. Boot
6. Rod

Outline

- The oil pressure from the parking brake solenoid valve pushes the spring and releases the parking brake.
  When the engine is stopped, the parking brake is applied by springs (1) and (2), so the machine is prevented from moving.

Parking brake solenoid



1. Solenoid valve assembly
2. Relief valve
3. Block

A: Outlet port
P: Inlet port
T: Drain port

Function

- The parking brake solenoid valve is installed between the secondary brake valve and parking brake.
  If the parking brake switch is set to "Travel", the solenoid valve is energized and the brake oil pressure is sent to the parking brake spring cylinder to release the parking brake.
  If the parking brake switch is set to "Park", the solenoid valve is de-energized and the brake oil pressure is relieved from the parking brake spring cylinder to operate the parking brake.

HM300-2 Articulated dump truck

Form No. SEN00332-02

ARTICULATED DUMP TRUCK

HM300-2

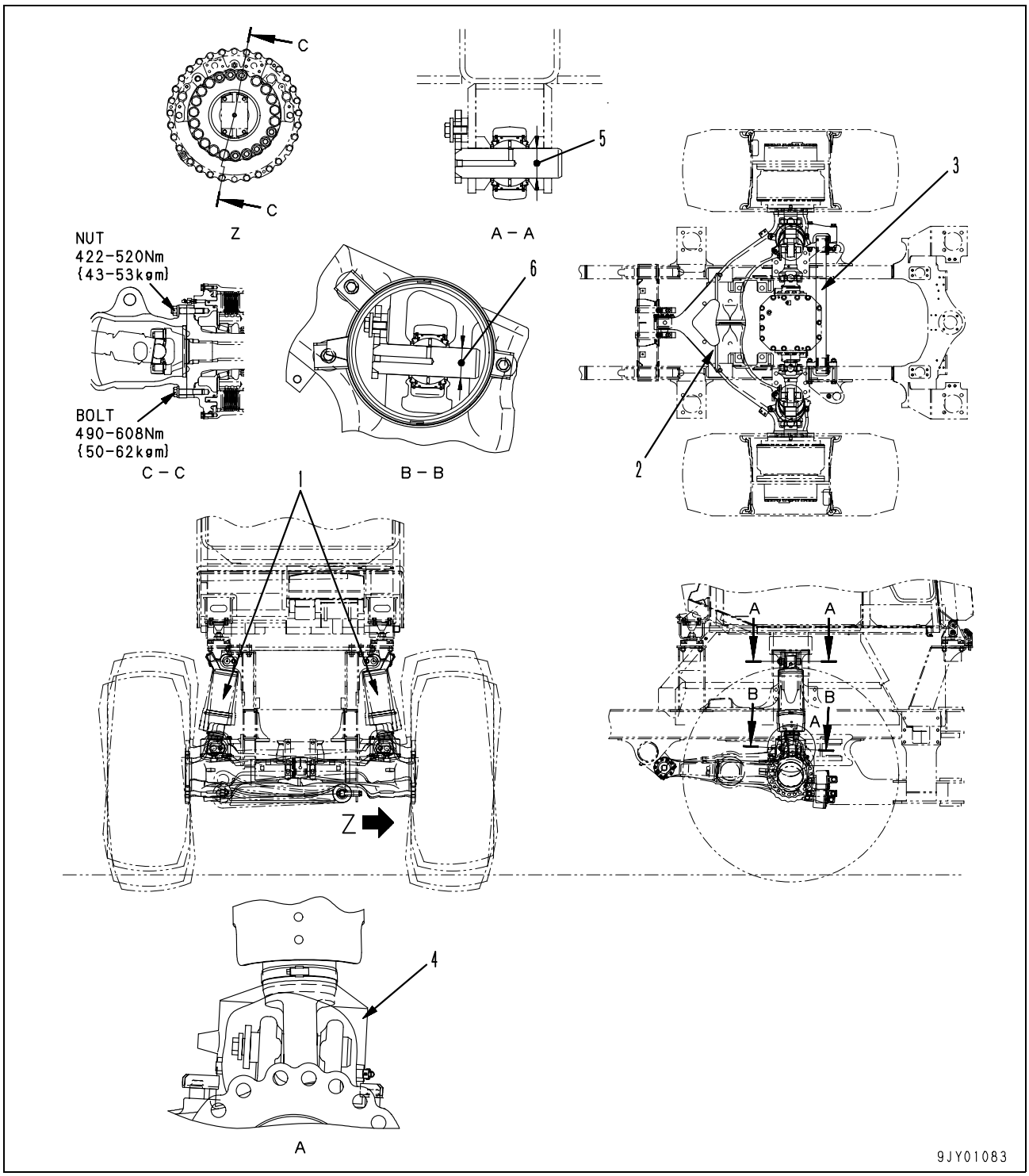
Machine model	Serial number
HM300-2	2001 and up

10 Structure, function and maintenance standard

Undercarriage and frame

Suspension

Front

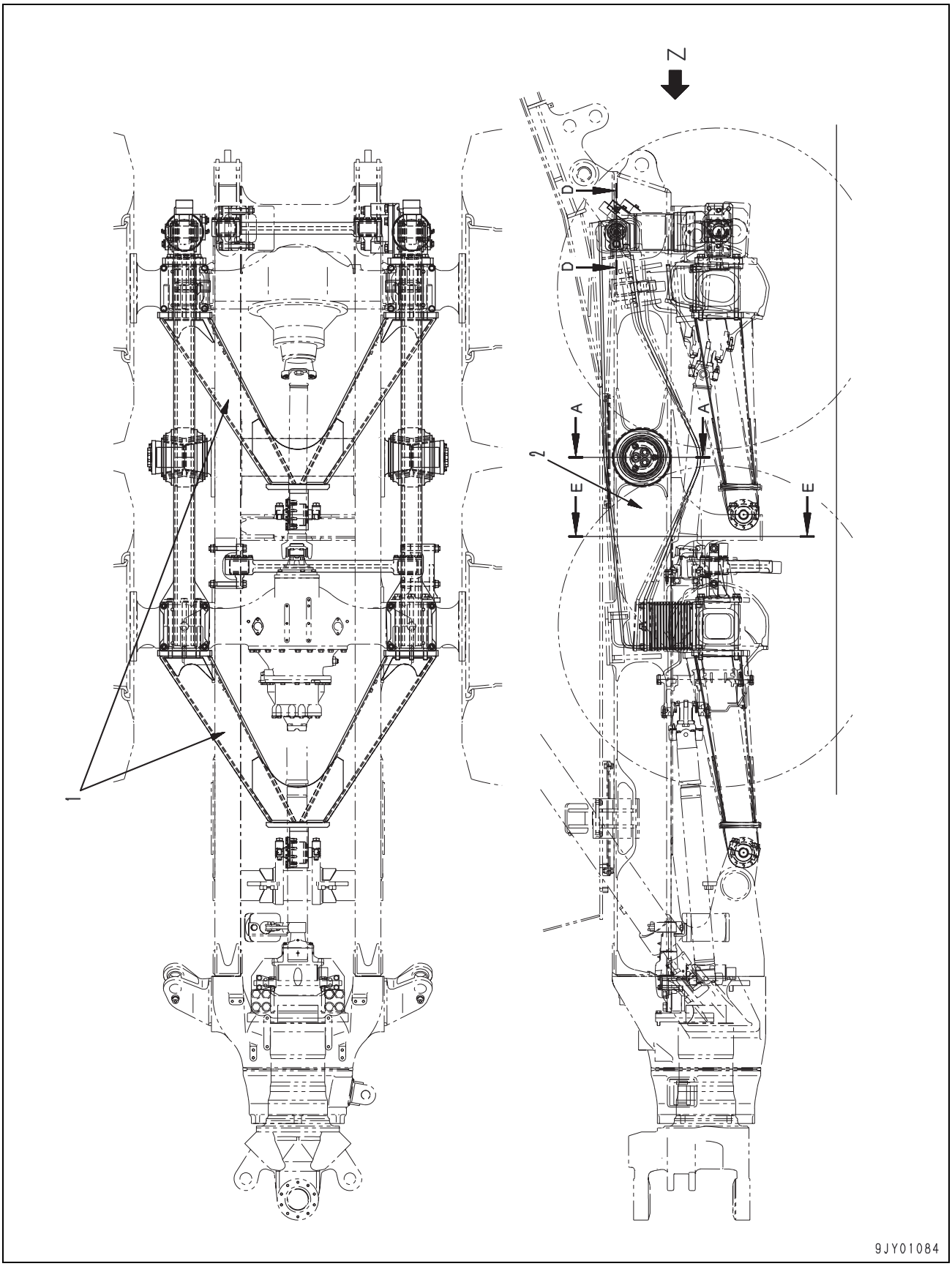


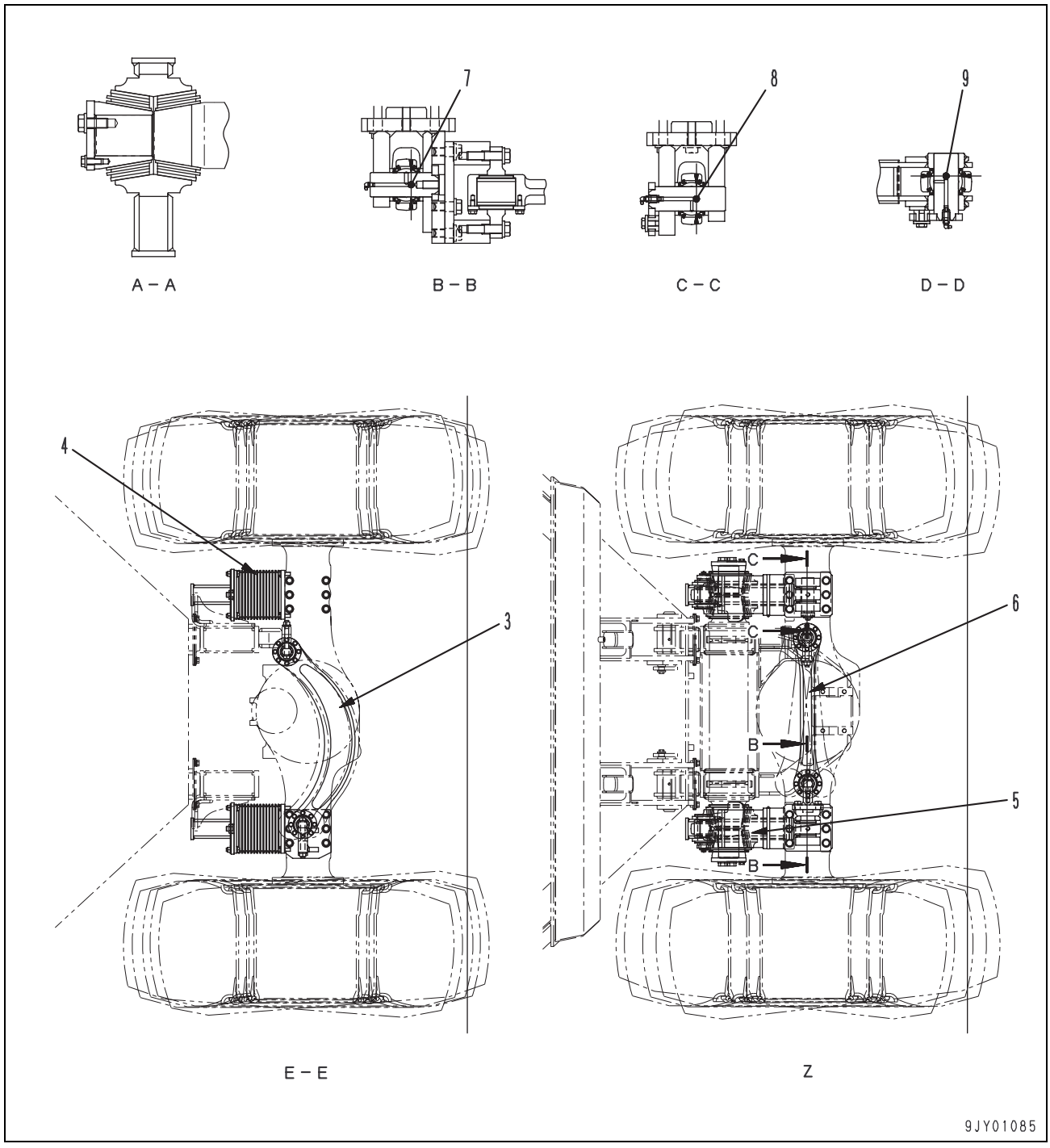
1. Front suspension cylinder
2. Arm
3. Lateral rod
4. Dust cover

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
5	Clearance between pin and bushing	45	-0.025 -0.064	+0.039 0	0.025 – 0.103	0.3	Replace
6	Clearance between pin and bushing	45	-0.025 -0.064	+0.039 0	0.025 – 0.103	0.3	

Rear





1. Arm
2. Equalizer bar
3. Lateral rod (center)
4. Spring
5. Rear suspension cylinder
6. Lateral rod (rear)

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
7	Clearance between pin and bushing	60	-0.030 -0.076	+0.046 0	0.030 – 0.122	0.3	Replace
8	Clearance between pin and bushing	60	-0.030 -0.076	+0.046 0	0.030 – 0.122	0.3	
9	Clearance between pin and bushing	60	-0.030 -0.076	+0.046 0	0.030 – 0.122	0.3	

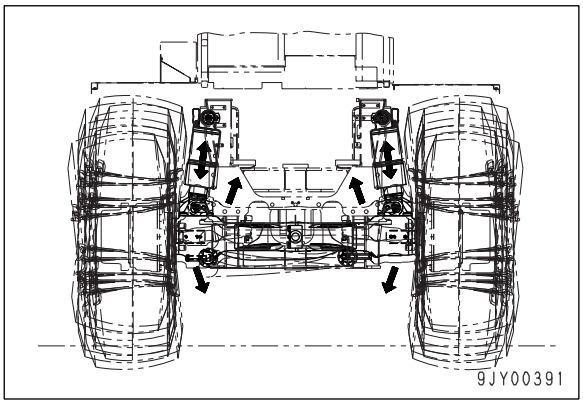
Outline

- The suspension supports the weight of the machine. It also reduces any impact caused by unevenness in the road surface and provides a comfortable ride for the operator. By ensuring that all the tires are always in contact with the road surface, it maintains the stability of the machine, and also fulfills the operating performance by ensuring that the machine can carry out acceleration, braking, and turning.
- The suspension cylinders reducing the impact from the road surface are a hydropneumatic type. The inside of the suspension cylinder is charged (sealed) with oil and nitrogen gas. In this way, the compression and expansion of the nitrogen gas and oil act as a spring and shock absorber, and is used to absorb the load from the road surface.

Function

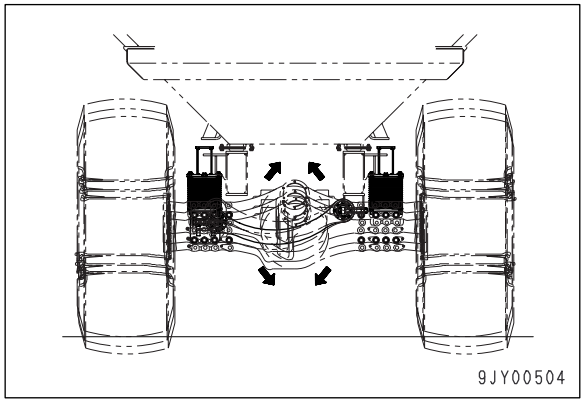
1. Front suspension

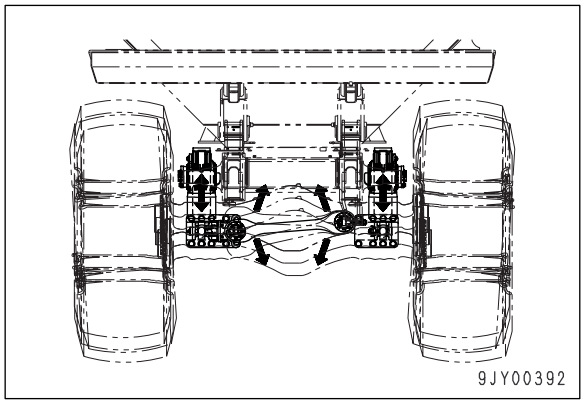
The front suspension cylinder has the function of a shock absorber and spring. It is joined to the arm and main frame by a spherical bearing, and the arm oscillates according to the extension and retraction of the front suspension cylinder.
The main frame and arm are connected by a lateral rod and receive the lateral load.



2. Center, rear suspension

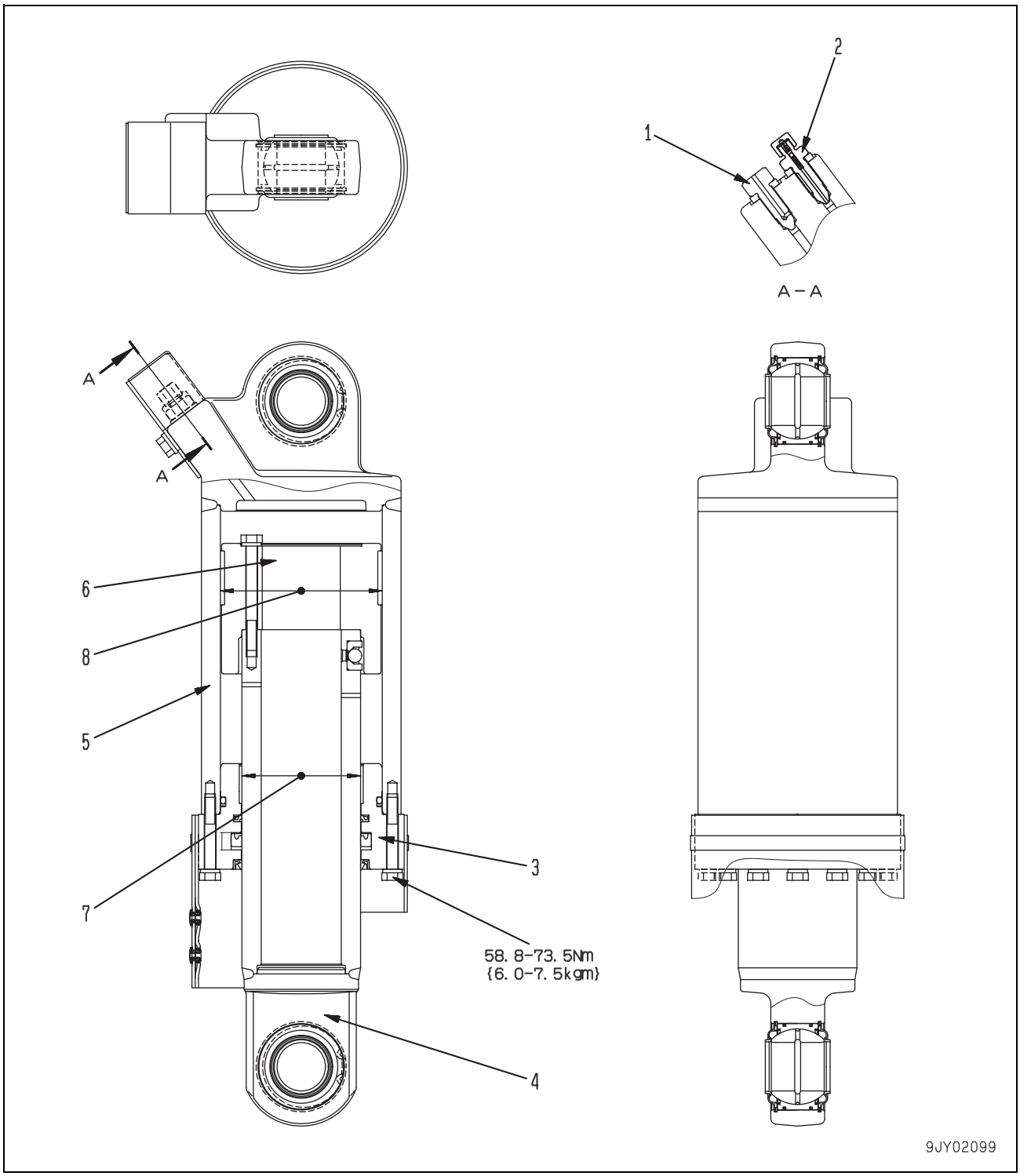
The center axle and rear axle are both fixed to arms. The center axle is joined to the equalizer bar through a spring, and the rear axle is joined to the equalizer bar through the rear suspension cylinder. The arm and equalizer bar oscillate in accordance with the condition of the road surface to keep the wheels in contact with the road surface.
The main frame and arm are connected by a lateral rod and receive the lateral load.





Suspension cylinder

★ This diagram shows front suspension cylinder.



1. Oil level valve
2. Feed valve
3. Flange
4. Rod
5. Cylinder
6. Piston

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
7	Clearance between piston rod and bushing	110	-0.036 -0.090	+0.235 +0.060	0.096 – 0.325	0.4	Replace
8	Clearance between cylinder and wear ring	150	0 -0.21	+0.100 0	0 – 0.31	0.8	

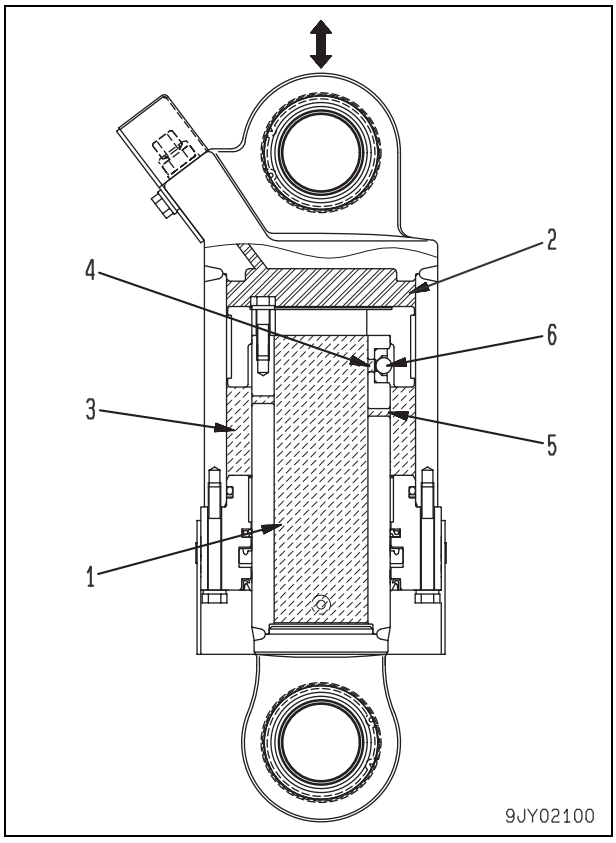
Structure and operation

The suspension cylinder has the function of both a shock absorber and spring.

When a fixed amount of oil is sent from oil chamber (1) through orifices (4) and (5) to cavity (3), the oil is throttled by the orifices and a shock-absorbing effect is obtained.

1. Retracting action
   When the machine is traveling and it hits a bump or object on the road, the wheels are pushed up, and the cylinder rod is pushed inside the cylinder.
   When this happens, the nitrogen gas inside chamber (2) is compressed, the oil in chamber (1) is sent through both orifices (4) and (5) to cavity (3), and cavity (3) is filled more quickly than when extending.

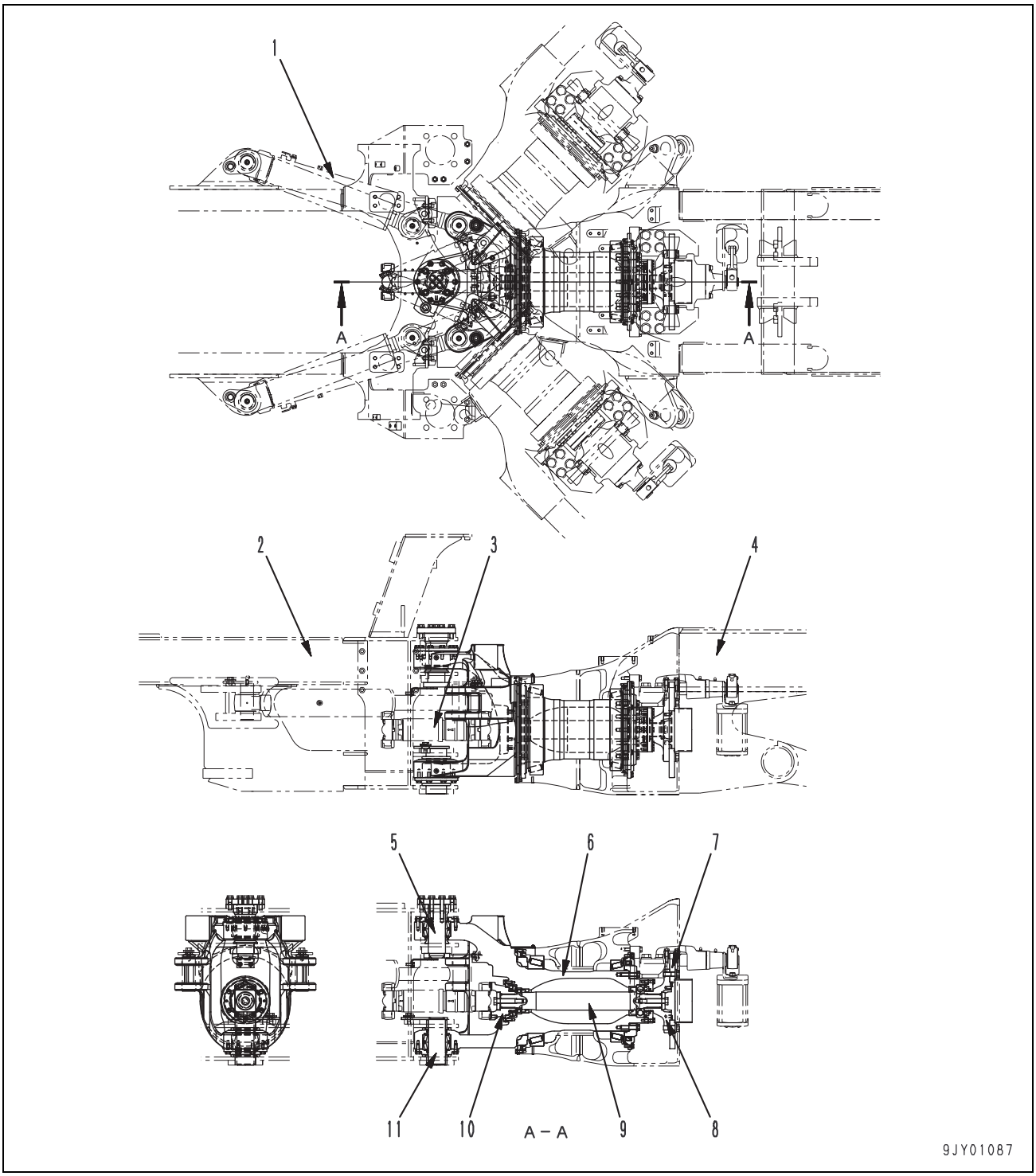
2. Extending action
   When the machine has passed any bump or object on the road surface, the cylinder rod is pushed up by the weight of the wheels and axle and the pressure of the nitrogen inside chamber (2).
   As a result, the amount of oil in cavity (3) is reduced, and pressure is applied to the oil remaining in cavity (3).
   This pressurized oil closes orifice (4) with check ball (6), and is sent to chamber (1) through only orifice (5), so the flow of oil passing through the orifice is controlled so that it is less than during retraction.
   In this way, the amount of oil returning to chamber (1) is restricted to provide a shock absorbing effect.



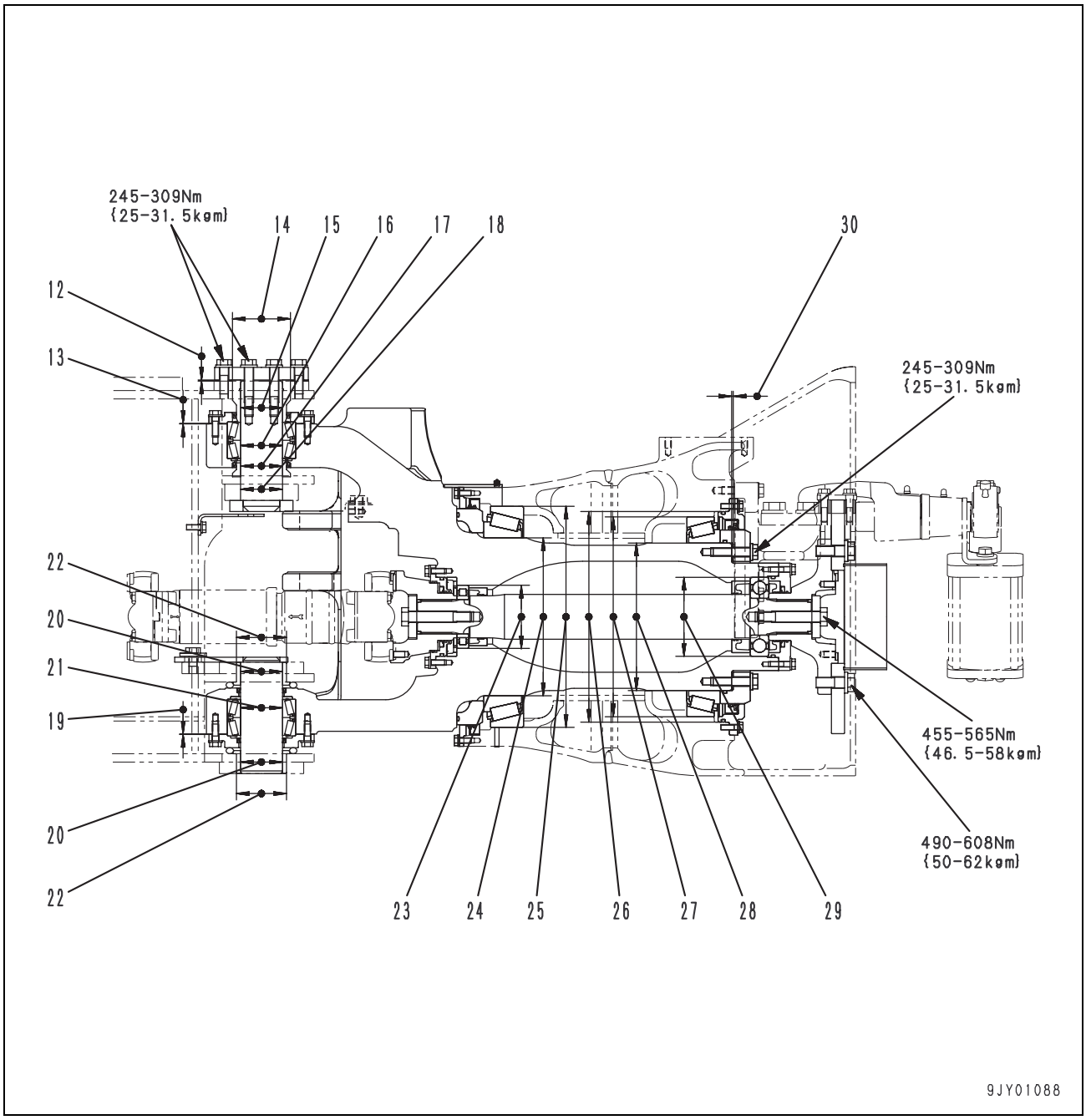
★ This diagram shows rear suspension cylinder.

1. Oil chamber
2. Nitrogen gas chamber
3. Cavity
4. Orifice
5. Orifice
6. Check ball

Oscillation hitch



1. Steering cylinder
2. Front frame
3. Center drive shaft
4. Rear frame
5. Pin
6. Hitch frame
7. Disc
8. Coupling
9. Shaft
10. Coupling
11. Pin


245-309Nm
{25-31.5kgm}
14
15
16
17
18
30
12
13
245-309Nm
{25-31.5kgm}
22
20
21
19
20
22
455-565Nm
{46.5-58kgm}
490-608Nm
{50-62kgm}
23
24
25
26
27
28
29
9JY01088

Unit: mm

No.	Check item	Criteria					Remedy
12	Standard shim thickness	2					Replace
13	Standard shim thickness	1					
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
14	Clearance between bushing and front frame	110	-0.036 -0.090	+0.054 0	0.036 – 0.144	–	
15	Clearance between shaft and bushing	80	-0.030 -0.049	+0.046 0	0.030 – 0.095	0.5	
16	Clearance between shaft and bearing	80	-0.030 -0.049	0 -0.015	0.015 – 0.049	0.5	
17	Clearance between shaft and bushing	80	-0.030 -0.049	+0.046 0	0.030 – 0.095	0.5	
18	Clearance between front frame and shaft	80	-0.030 -0.049	+0.046 0	0.030 – 0.095	–	
19	Standard shim thickness	1					
20	Clearance between bushing and pin	80	-0.030 -0.049	+0.046 0	0.030 – 0.095	0.5	
21	Clearance between pin and bearing	80	-0.030 -0.049	0 -0.015	0.015 – 0.049	0.5	
22	Clearance between front frame and bushing	95	+0.089 +0.054	+0.054 0	-0.089 – 0	–	
23	Clearance between hitch frame and bearing	120	0 -0.015	0 -0.035	-0.035 – 0.015	–	
24	Clearance between hitch frame and bearing	300	0 -0.052	0 -0.035	-0.035 – 0.052	–	
25	Clearance between rear frame and bearing	420	0 -0.045	-0.017 -0.080	-0.080 – 0.028	–	
26	Clearance between rear frame and retainer	400	-0.018 -0.075	+0.057 0	0.018 – 0.122	–	
27	Clearance between rear frame and bearing	380	0 -0.040	-0.016 -0.073	-0.073 – 0.024	–	
28	Clearance between bearing and hitch frame	280	-0.056 -0.108	0 -0.035	0.021 – 0.108	–	
29	Clearance between hitch frame and bearing	150	0 -0.018	-0.012 -0.052	-0.052 – 0.006	–	
30	Standard shim thickness	3					

Outline

- The front frame and the rear frame are connected by the oscillation hitch.
- Front frame (2) is connected with bearings and pins (5) and (11); rear frame (4) is connected with a spacer, retainer, and bearing. This makes it possible for the front and rear frames to articulate and oscillate.
- In addition, the output from the transmission is transmitted from center drive shaft (3) to coupling (10). It is then transmitted from coupling (8) through the rear drive shaft to the rear axle.

HM300-2 Articulated dump truck

Form No. SEN00333-01

ARTICULATED DUMP TRUCK

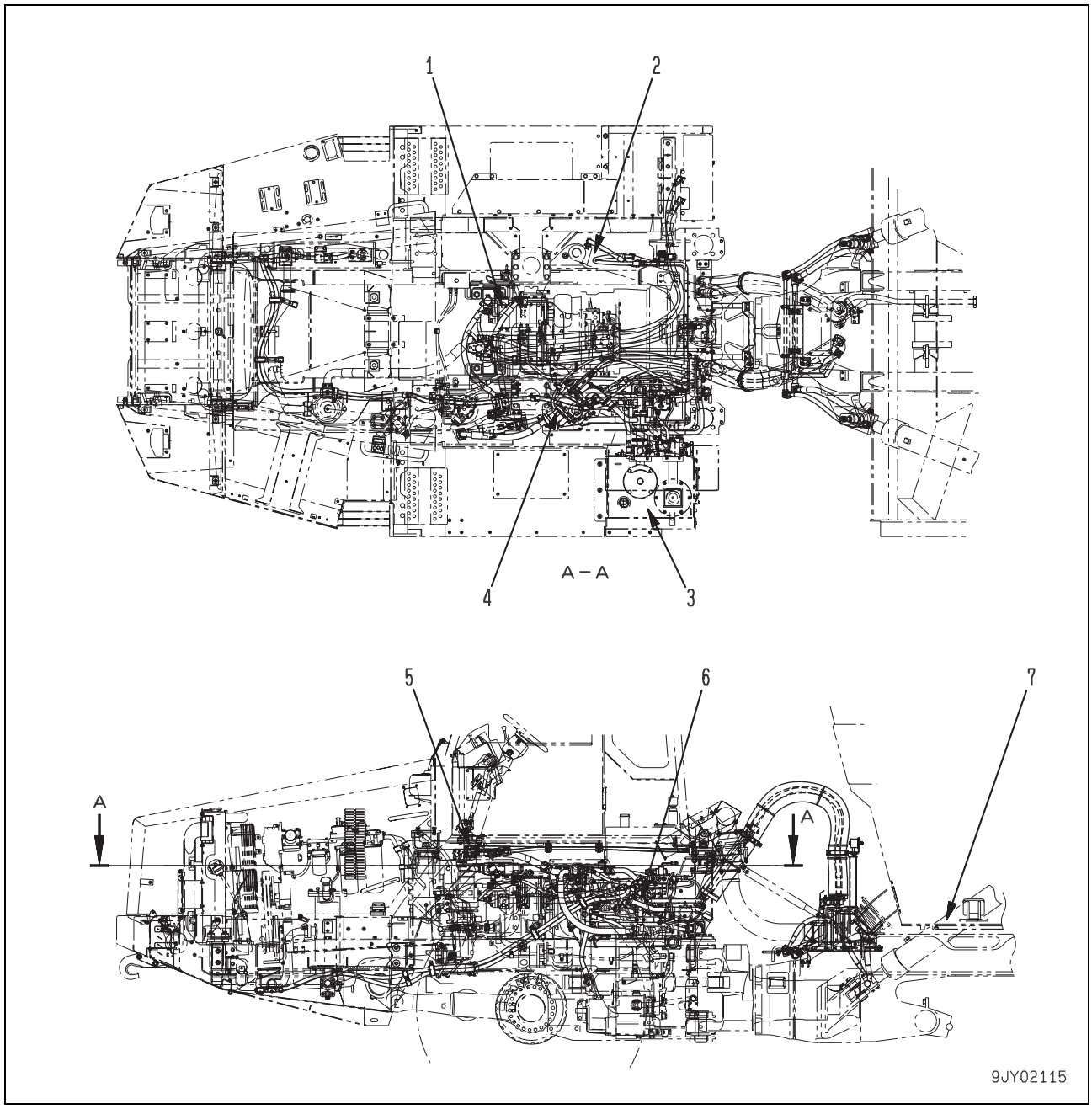
HM300-2

Machine model	Serial number
HM300-2	2001 and up

10 Structure, function and maintenance standard

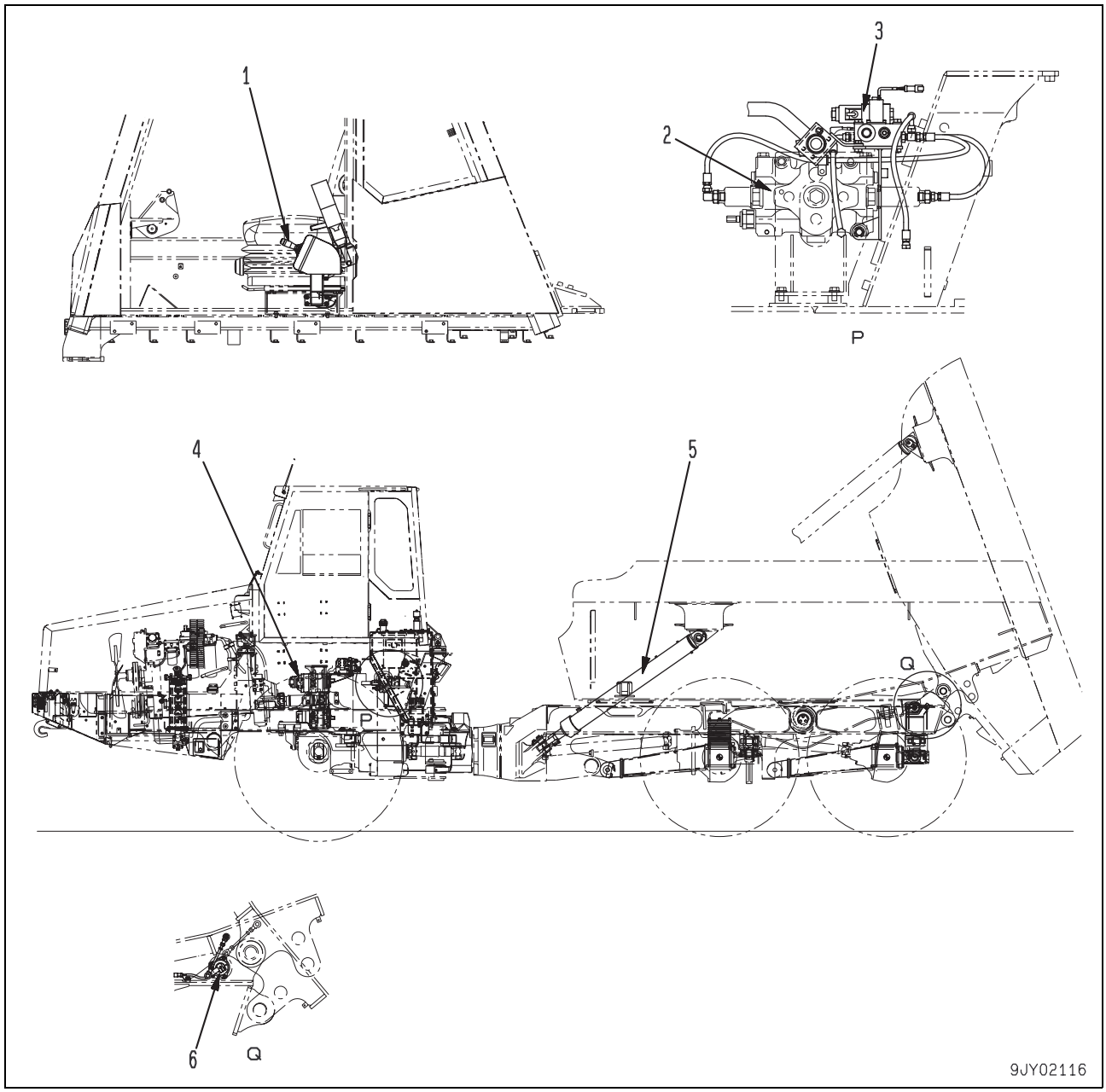
Hydraulic system

Steering, hoist oil pressure piping diagram



1. Steering, hoist control pump (SDR(30)100+(20)25+SB(1)6)
2. Steering cylinder
3. Hydraulic tank
4. Flow amp valve
5. Steering valve
6. Hoist valve
7. Hoist cylinder

Dump body control

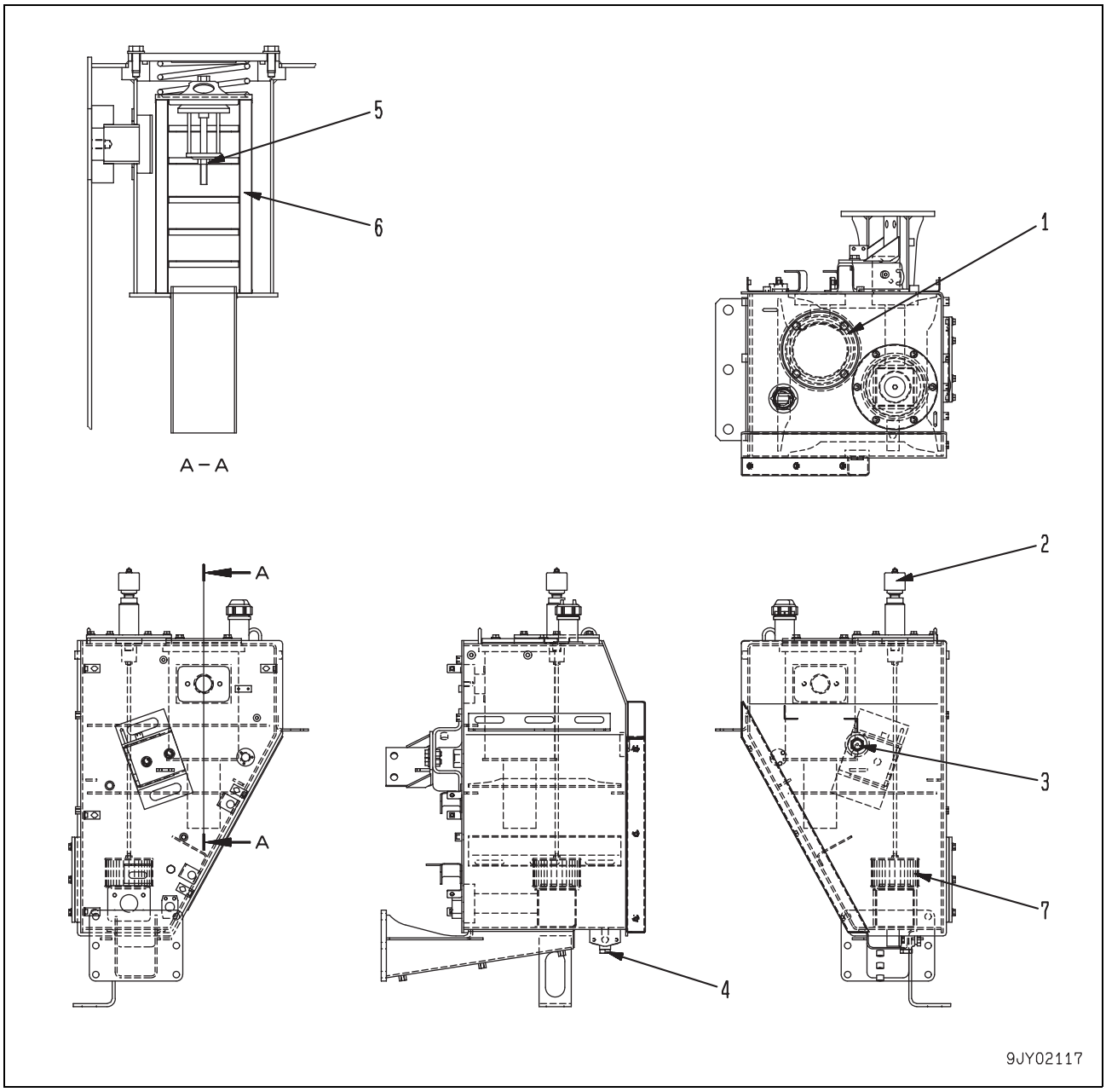


1. Dump control lever
2. Hoist valve
3. EPC valve
4. Steering, hoist control pump (SDR(30)100+(20)25+SB(1)6)
5. Hoist cylinder
6. Body position sensor

Function

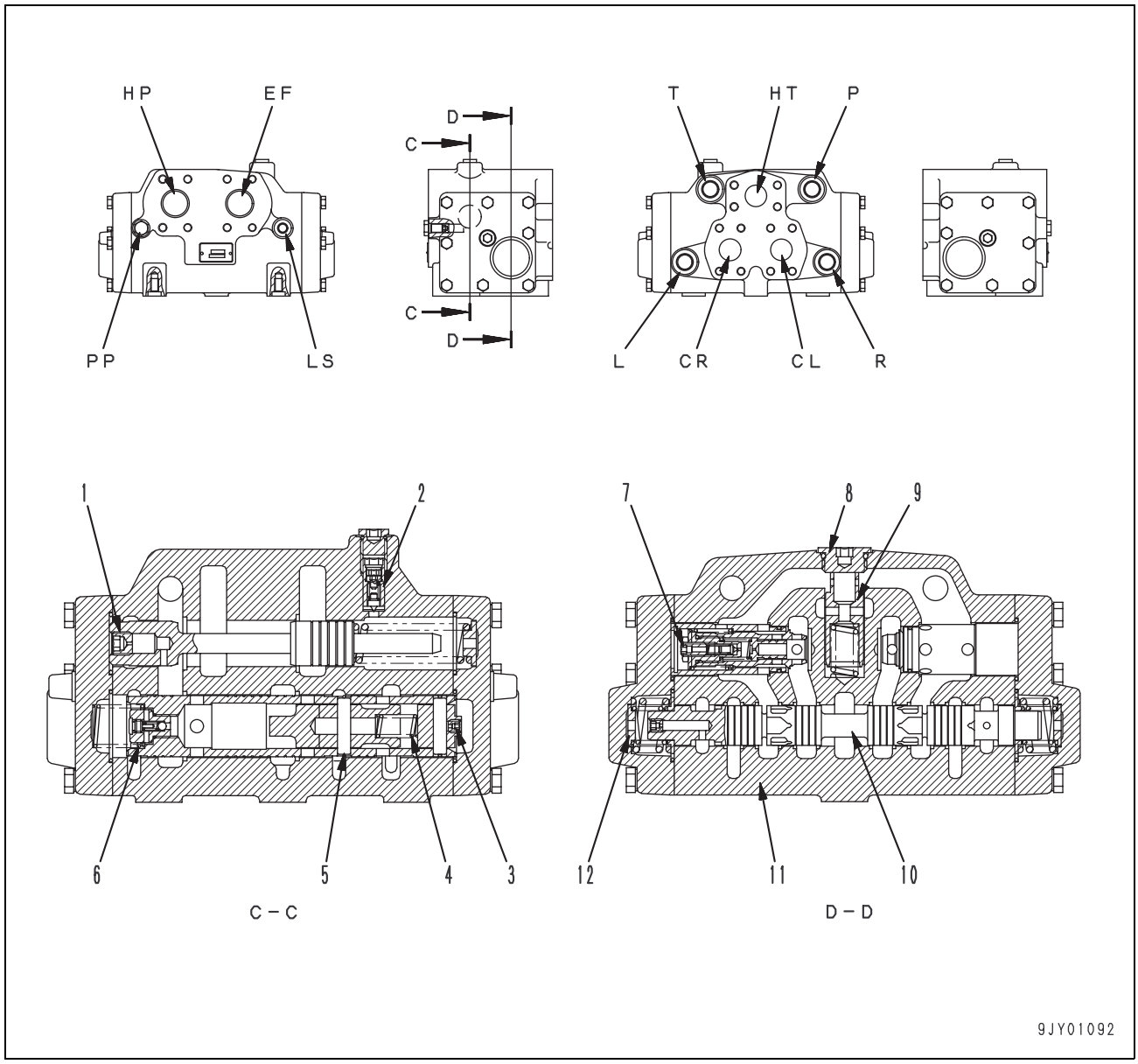
- This control is carried out by the body position sensor. The body position sensor senses the position of the dump body and the retarder controller controls it.
- The signal from the dump control lever is controlled by the retarder controller, and actuates the EPC valve. The pilot pressure generated by the EPC valve moves the spool of the hoist valve and controls the hoist cylinder.

Hydraulic tank and filter



1. Hydraulic oil filter
2. Breather
3. Oil level gauge
4. Drain plug
5. Bypass valve
6. Element
7. Strainer

Flow amp valve

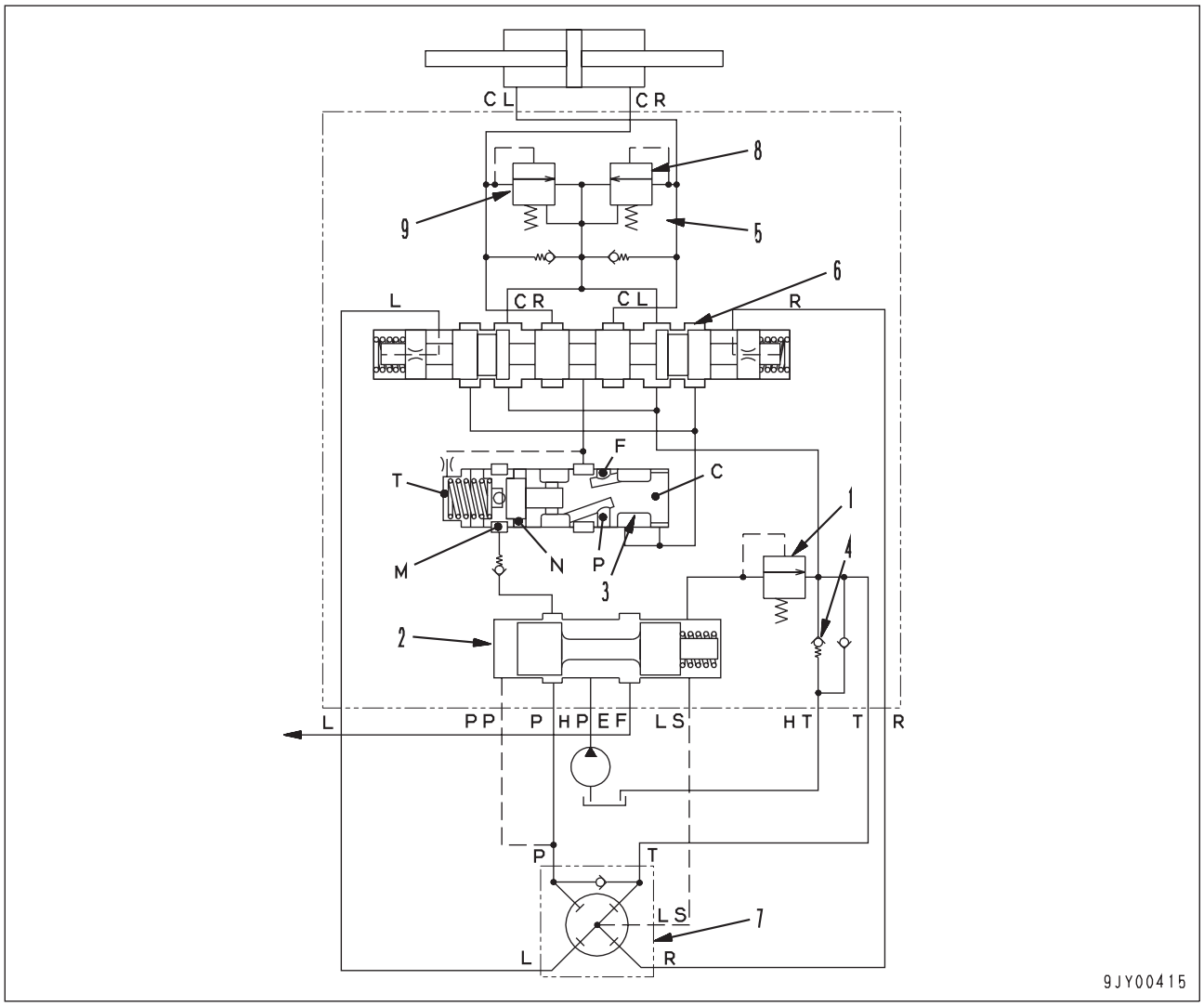


1. Valve
2. Relief valve
3. Orifice
4. Spring
5. Pin
6. Valve
7. Valve
8. Plug
9. Valve
10. Spool
11. Valve body
12. Stopper

CL: To steering cylinder
L: To steering valve
P: To steering valve
PP: From steering valve
HP: From hydraulic pump
LS: From steering valve
HT: From hoist valve
T: To steering valve
EF: To hoist valve
R: From steering valve
CR: To steering cylinder

Outline

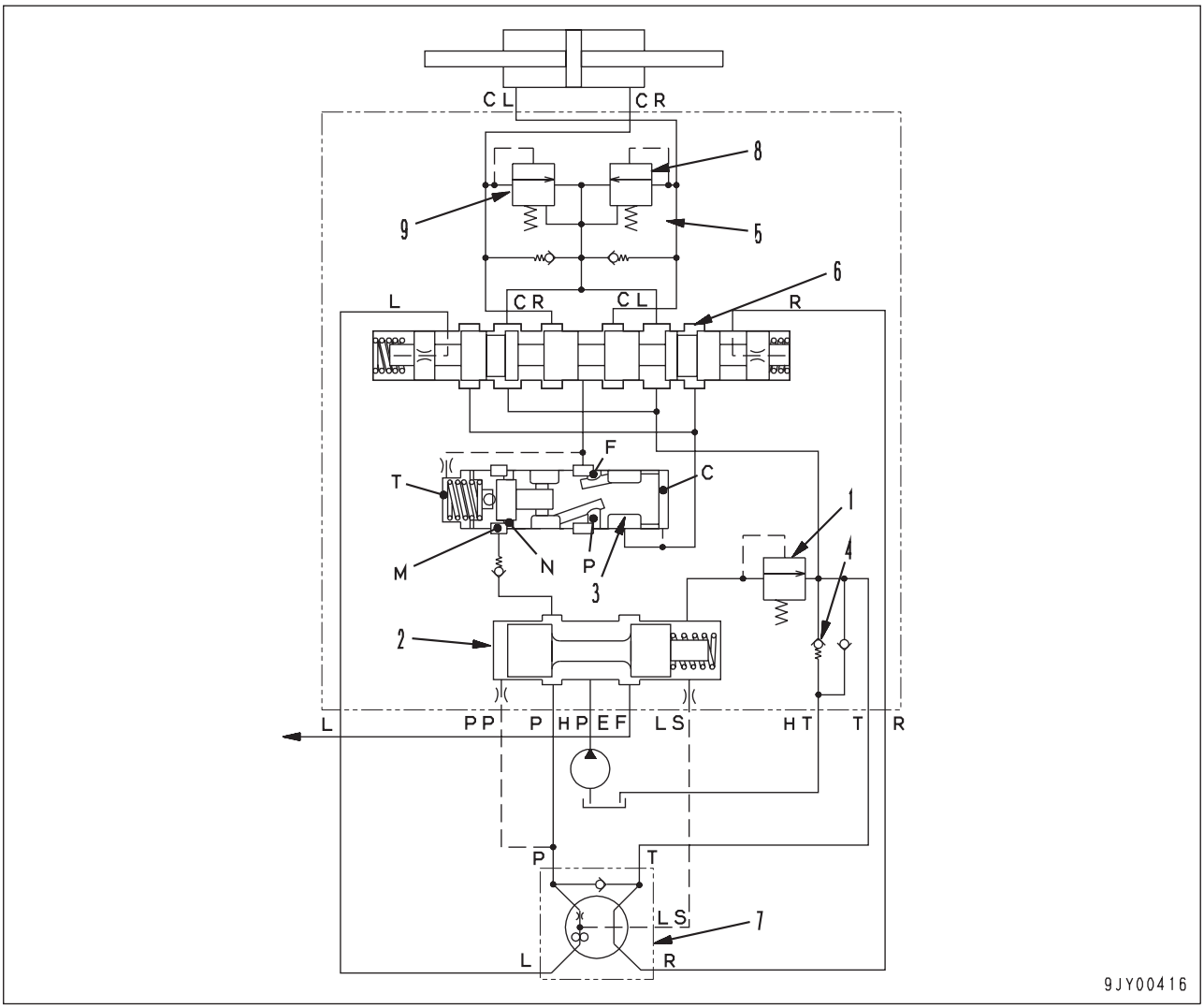
- The flow amp valve consists of the directional valve, amplifying stage, priority valve, relief valve, pressure control valve, and suction valve.
- It amplifies the oil flow sent from ports (L) and (R) of the steering unit by the specified ratio. The amplified oil then goes from ports (CL) and (CR) of the flow amp valve and flows to the steering cylinder.
  The amplified oil flow is proportional to the amount the steering wheel is turned.



Operation

1. At neutral

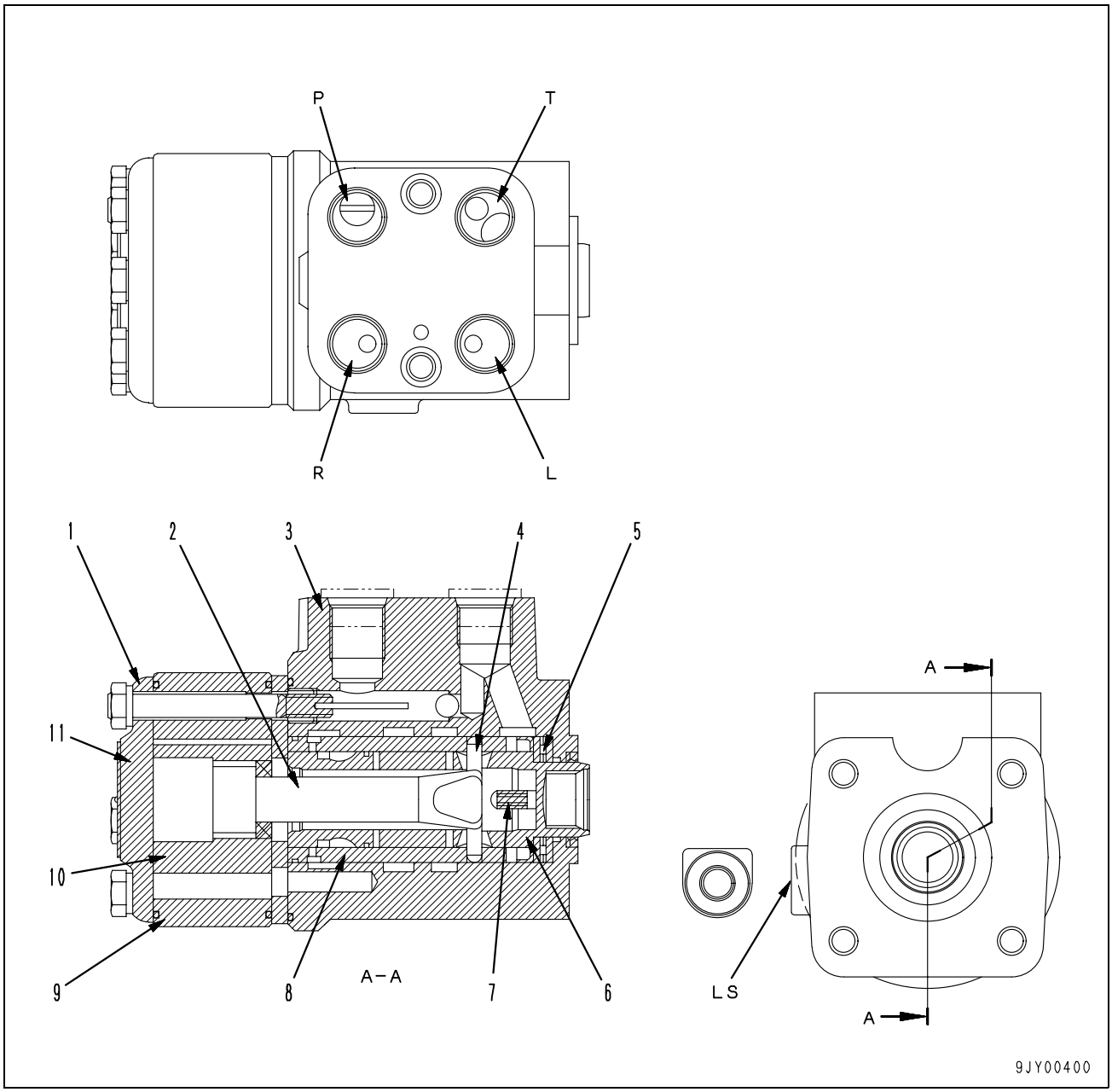
- Port (P) of steering unit (7) is closed and the flow amp valve is closed at chamber (M) of pressure control valve (3).
- Ports (L), (R), and (T) of steering unit (7) are connected to each other, so the oil passes through port (T) of the flow amp valve and is drained to the hydraulic tank.
  By connecting in this way, directional valve (6) is always held at the neutral position by the springs on both sides. For this reason, at the neutral position, the reaction or impact from the steering cylinder is not transmitted to steering unit (7).
- For priority valve (2) also, the oil is drained from relief valve (1).
  Before starting, priority valve (2) is pushed strongly to the left by the spring, so in reality, port (EF) of the flow amp valve is almost closed.
- At the same time as the engine starts, oil flows to port (HP) of the flow amp valve and then flows to port (P) of steering unit (7). At the same time, the pilot pressure that is connected to port (PP) suddenly rises. As a result of balancing with the spring and moving to the right, port (EF) opens and the oil flows to the hoist piping.



2. When turning

- When steering unit (7) is actuated, the oil sent from port (P) of priority valve (2) passes through ports (P) and (L) of steering unit (7) and enters port (L) of directional valve (6).
  At the same time, oil from priority valve (2) also enters chamber (M) of pressure control valve (3).
- When the oil entering directional valve (6) rises to a pressure greater than the force of the spring, it pushes the spool to the right, and enters chamber (C) of pressure control valve (3). When it rises to a pressure greater than the force of the spring in chamber (C) also, it pushes the spool to the left.
- The oil that is already in chamber (M) of pressure control valve (3) enters chamber (N) when the spool is pushed to the left by the action of steering unit (7). It then flows from port (P), goes out from port (CL) of directional valve (6), and flows from suction valve (5) to the bottom end of the steering cylinder.
- The oil at the steering cylinder head end goes out from suction valve (5). It then goes from port (CR) of directional valve (6) through check valve (4) and is drained to the hydraulic tank from port (HT) of the flow amp valve.
- If there are rocks on the road or the the road surface is uneven, and any abnormal external force is applied to the tires and steering cylinder, relief valves (8) and (9) of suction valve (5) open at a pressure of 29.1 ± 1.0 MPa {285.5 ± 10 kg/cm^2}, so the oil passes through directional valve (6) and is drained to the hydraulic tank.

Steering valve

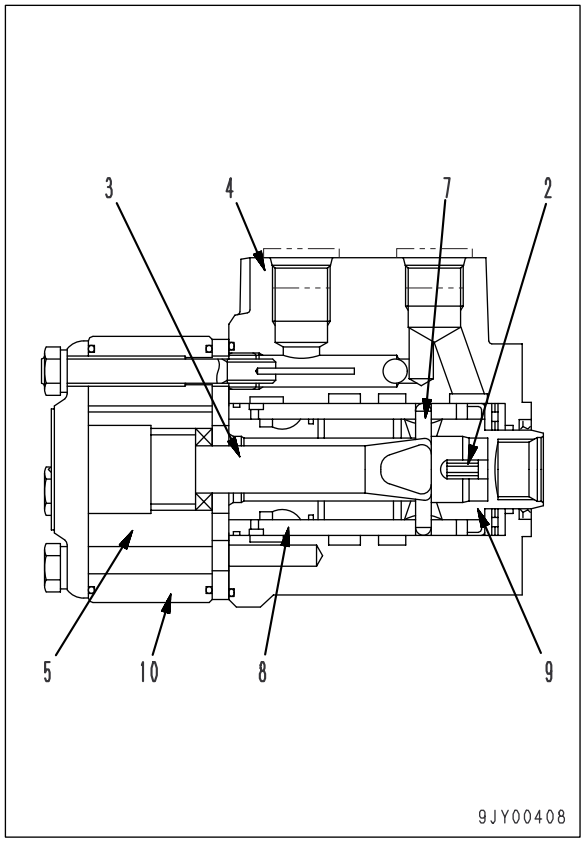


1. Cover
2. Drive shaft
3. Valve body
4. Center pin
5. Bearing
6. Spool
7. Centering spring
8. Sleeve
9. Stator
10. Rotor
11. Lower cover

L: To flow amp valve
LS: To flow amp valve
P: From flow amp valve
R: To flow amp valve
T: To flow amp valve

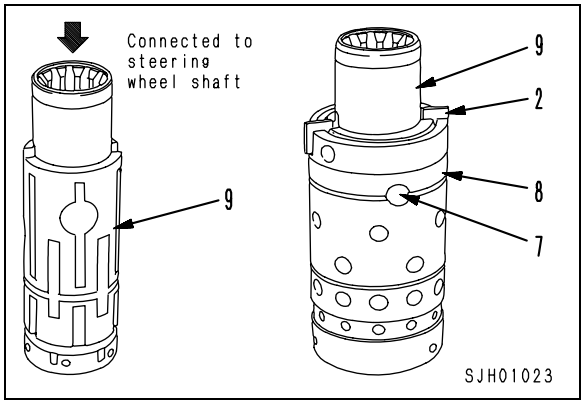
Outline

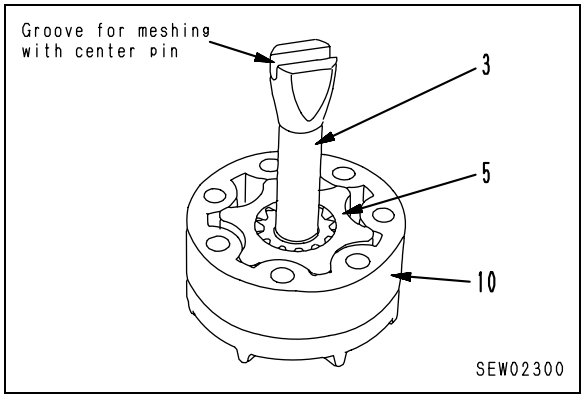
- The steering valve is connected directly to the steering wheel shaft. If the steering wheel is operated, the steering valve operates the steering valve by using the oil from the PPC pump as the pilot pressure. Then, the oil from the steering pump is sent to the right or left steering cylinder through the steering valve to change the travel direction of the machine.
- The steering valve, broadly speaking, consists of the following components: rotary type spool (9) and sleeve (8), which have the function of selecting the direction, and the Girotor set (a combination of rotor (5) and stator (10)), which acts as hydraulic motor during normal steering operations, and as a hand pump (in fact, the operating force of the steering wheel is too high, so it cannot be operated) when the steering pump or engine have failed and the supply of oil is stopped.



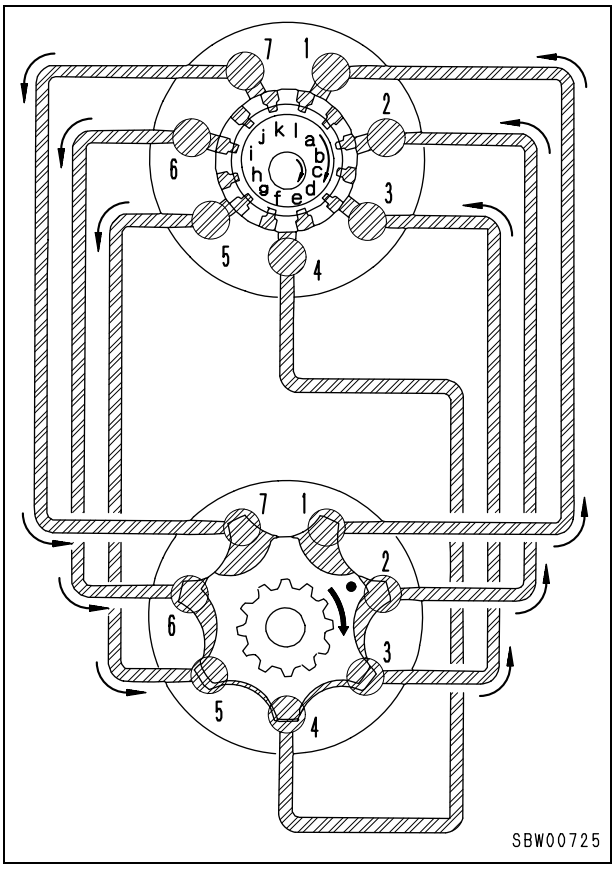
Structure

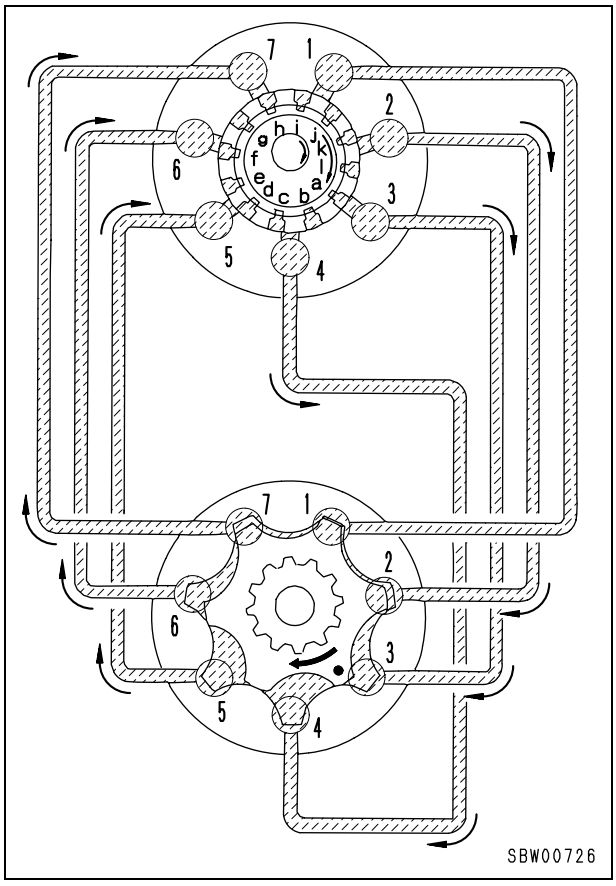
- Spool (9) is connected to the drive shaft of the steering wheel, and is connected to sleeve (8) by center pin (7) (this is not touching the spool when the steering wheel is at the neutral position) and centering spring (2).
- Drive shaft (3) is meshed at the top with center pin (7) and forms one unit with sleeve (8). The bottom is meshed with the spline of rotor (5) of the Gerotor set.
- Valve body (4) has five ports. These are connected to the pump circuit, tank circuit, steering cylinder head end, bottom end, and flow amp valve pilot end. In addition, the port at the pump end and the port at the tank end are connected by the check valve inside the body. If there is any failure in the pump or engine, this check valve acts to suck in oil directly from the tank.



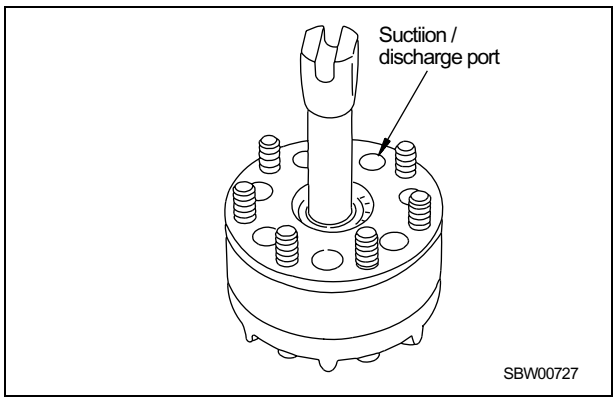


Connection between hand pump and sleeve





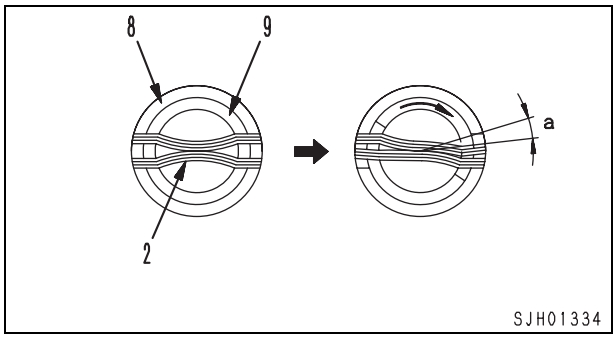
- The diagrams above show the connections with the sleeve ports used to connect the suction and discharged ports of the Girotor.
- If the steering wheel has been turned to the right, ports (a), (c), (e), (g), (i) and (k) are connected by the vertical grooves in the spool to the pump side. At the same time, ports (b), (d), (f), (h), (j) and (l) are connected to the head end of the left steering cylinder in the same way.
  In the condition in diagram above left, ports (1), (2) and (3) are the discharge ports of the Girotor set.
  They are connected to ports (l), (b) and (d) so the oil is sent to the cylinder.
  Ports (5), (6) and (7) are connected and the oil flows in from the pump.
  If the steering wheel is turned 90°, the condition changes to the condition shown in diagram above right. In this case, ports (1), (2) and (3) are the suction ports, and are connected to ports (i), (k) and (c). Ports (5), (6) and (7) are discharge ports, and are connected to ports (d), (f) and (h).

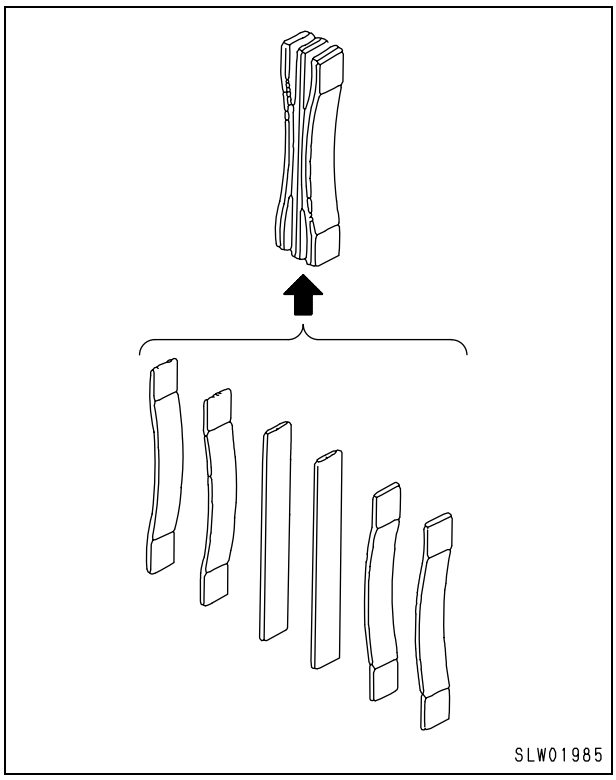


- In this way, the ports of the Girotor acting as discharge ports are connected to ports which are connected to the end of the steering cylinder. The ports acting as suction ports are connected to the pump circuit.
- Adjusting delivery in accordance with angle of steering wheel:
  For every 1/7 turn of the steering wheel, the inner teeth of the Girotor gear advance one position so the oil flow from the pump is adjusted by this movement. In this way, the oil delivered from the pump is directly proportional to the amount the steering wheel is turned.

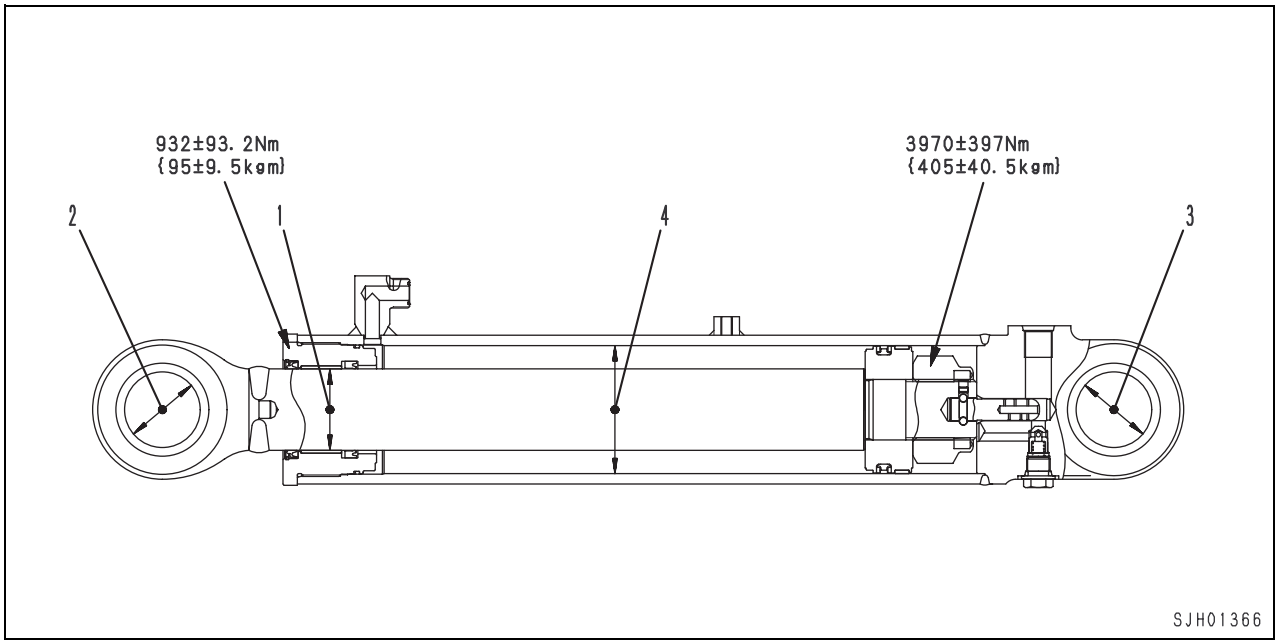
Function of center spring

- Centering spring (2) consists of four layers of leaf springs crossed to form an X shape.
  The springs are assembled in spool (9) and sleeve (8) as shown in the diagram on the right. When the steering wheel is turned, the spring is compressed and a difference in rotation (angle variation (a) arises between the spool and the sleeve.
  Because of this, the ports in the spool and sleeve are connected and oil is sent to the cylinder. When the turning of the steering wheel is stopped, the Girotor also stops turning, so no more oil is sent to the cylinder and the oil pressure rises.
  To prevent this, when the turning of the steering wheel is stopped, the action of the centering spring only allows it to turn by an amount equal to the difference in angle of rotation (angle variation (a) of the sleeve and spool, so the steering wheel returns to the NEUTRAL position.





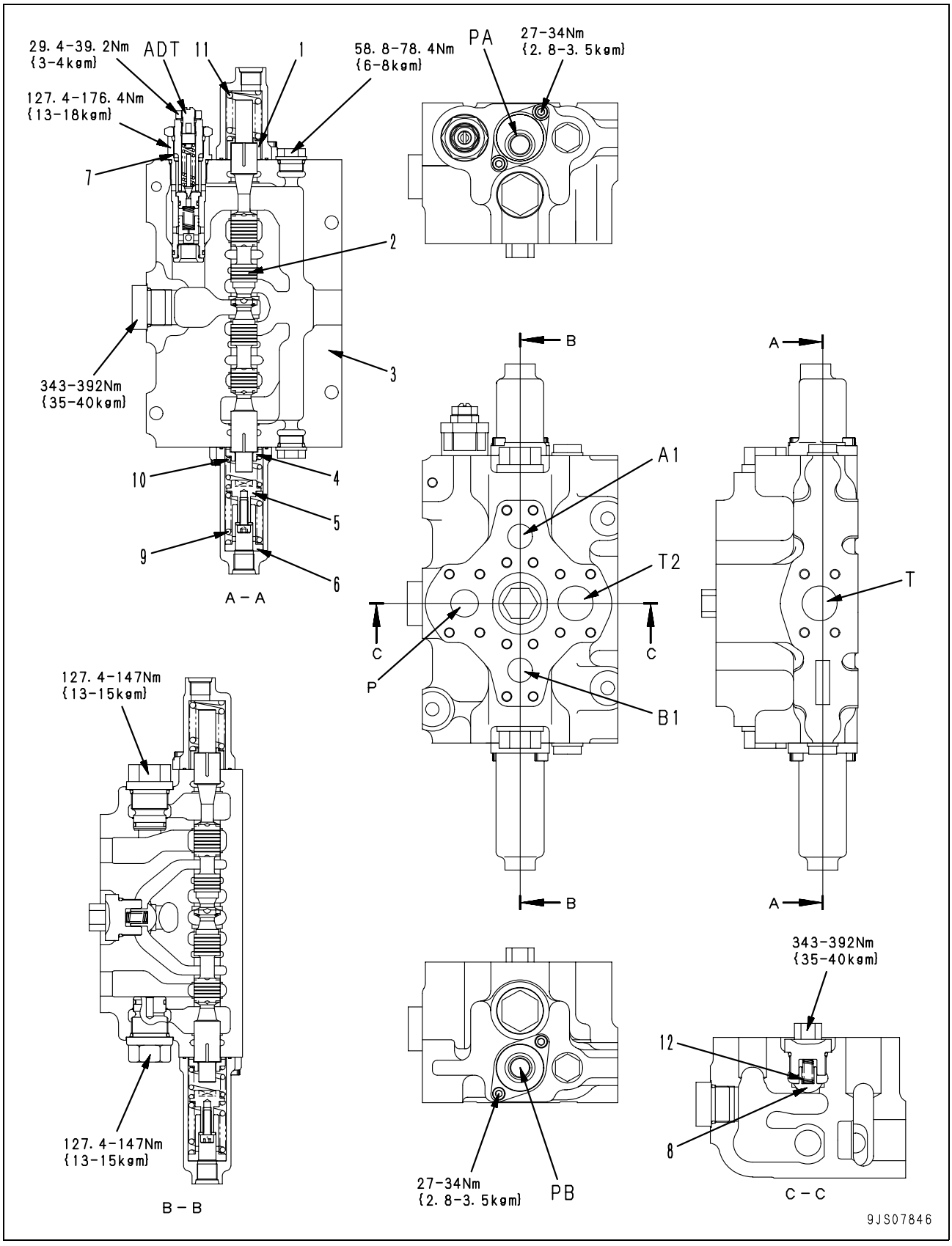
Steering cylinder



Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance between piston rod and bushing	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		70	-0.030 -0.104	+0.271 +0.075	0.105 – 0.375	0.675	
2	Clearance between piston rod support shaft and bushing	65	-0.030 -0.076	+0.174 +0.100	0.130 – 0.250	1.0	
3	Clearance between cylinder bottom support shaft and bushing	65	-0.030 -0.076	+0.174 +0.100	0.130 – 0.250	1.0	
4	Cylinder bore	Standard size		Tolerance		Repair limit	
		110		+0.15 +0.05		–	

Hoist valve



★ ADT: Set pressure is increased or decreased by 4.2 MPa {42.8 kg/cm^2} per turn.

A1: To hoist cylinder bottom
B1: To hoist cylinder head
P: From steering control valve
PA: From EPC valve (LOWER, FLOAT)
PB: From EPC valve (RAISE)
T: To tank

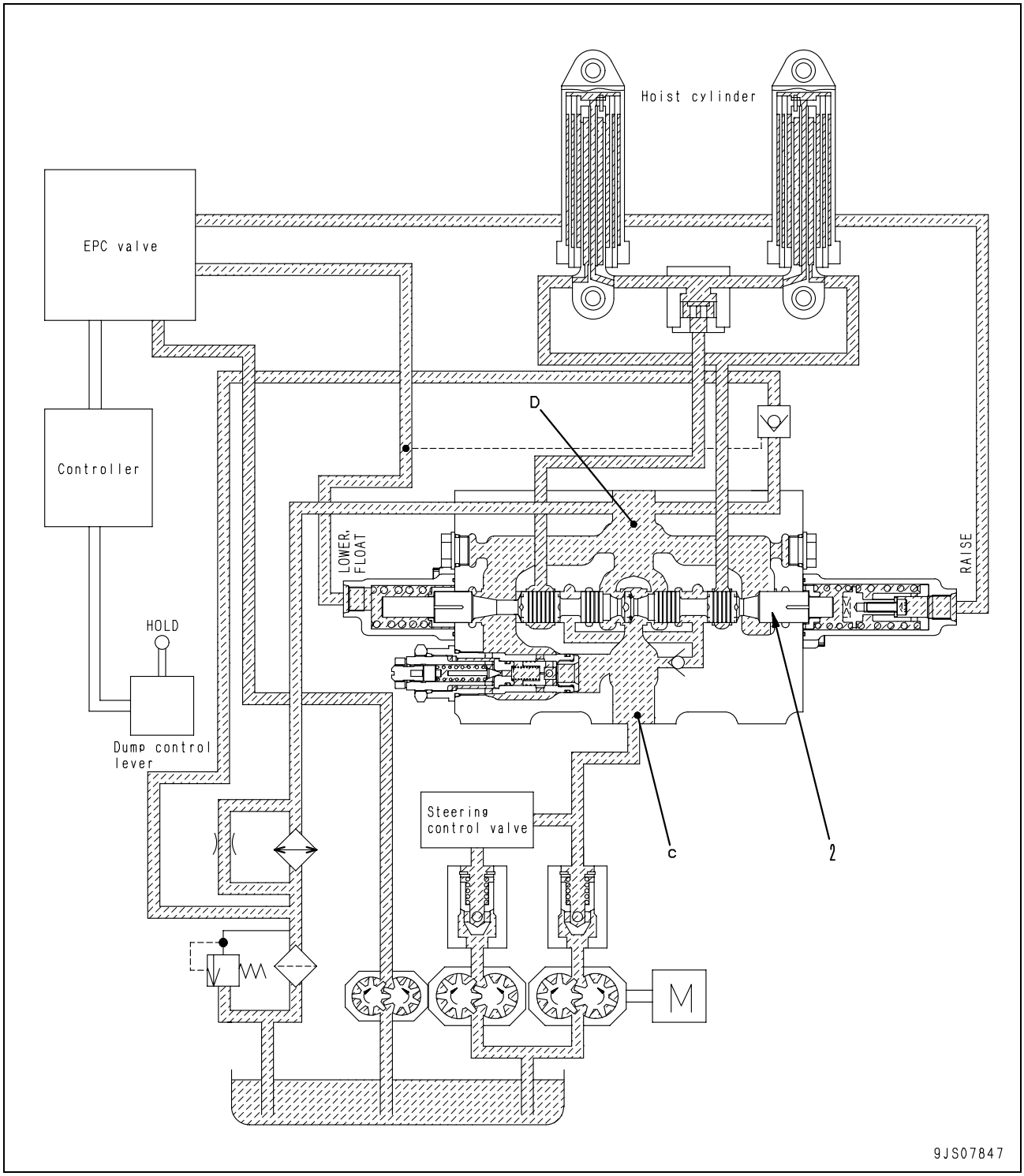
1. Retainer
2. Spool
3. Body
4. Retainer
5. Retainer
6. Retainer
7. Relief valve
8. Check valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
9	Spool return spring (FLOAT)	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring
		34.2 x 36	32	125 N {12.7 kg}	—	100 N {10.2 kg}	
10	Spool return spring (LOWER)	73 x 36.5	53.5	981 N {100 kg}	—	785 N {80 kg}	
11	Spool return spring (RAISE)	51.3 x 34.5	47	525 N {53.5 kg}	—	420 N {42.8 kg}	
12	Check valve spring	32.6 x 10.9	24.5	44.1 N {4.5 kg}	—	35.3 N {3.6 kg}	

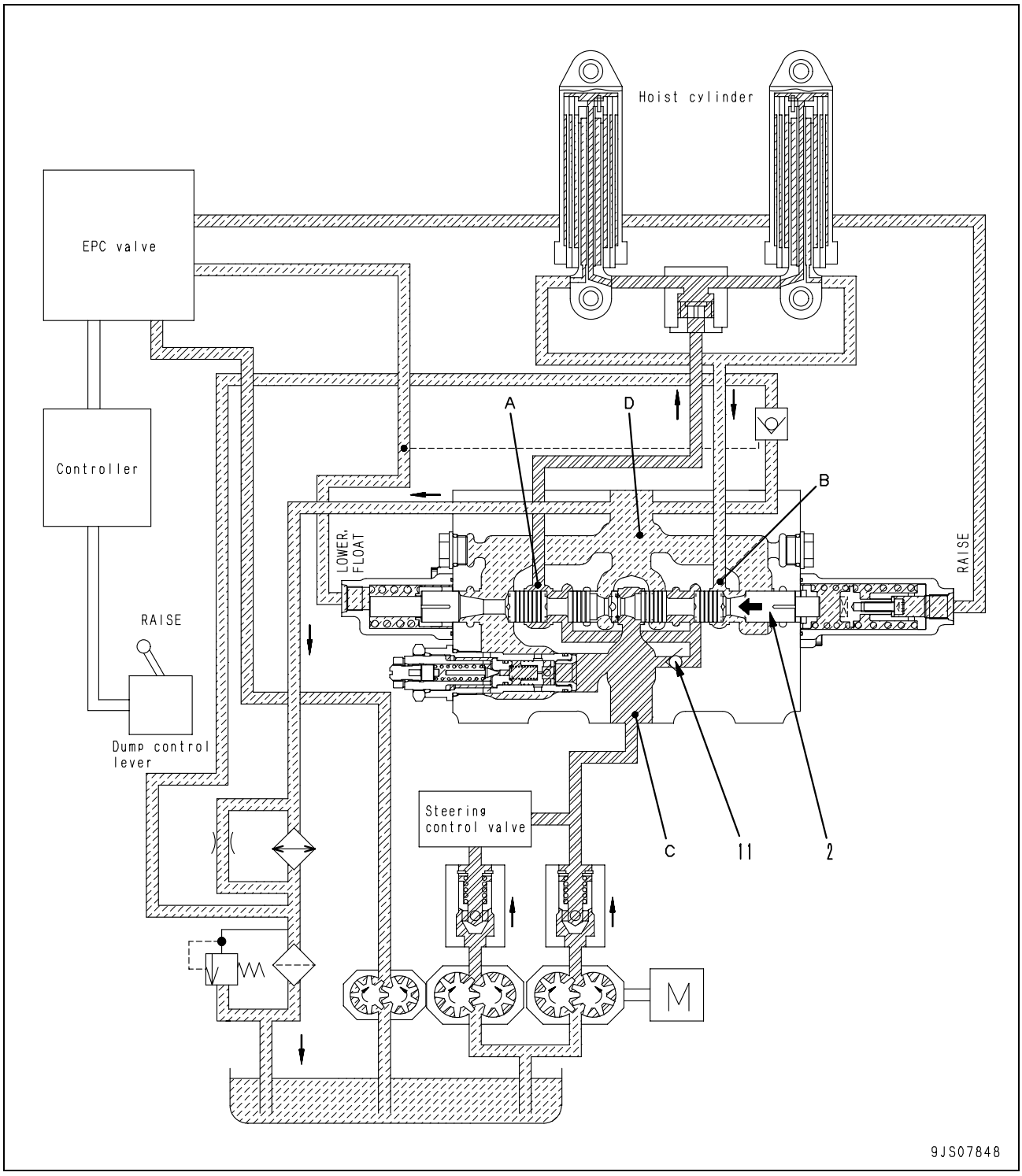
Operation

1. When hoist valve is in "HOLD" position



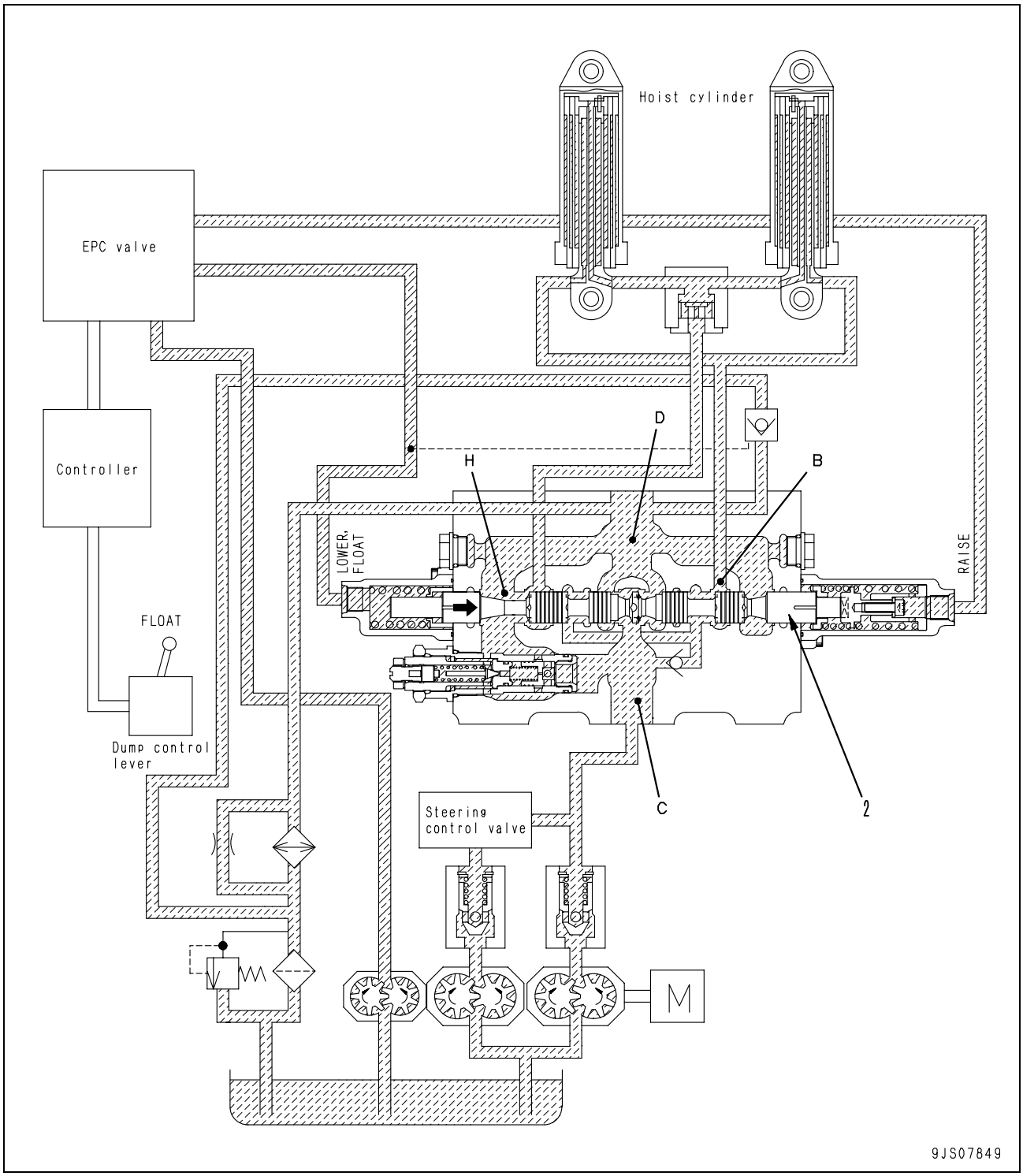
- The pressurized oil from the steering control valve flows in chamber (C). Since the passage to the hoist cylinder is blocked by hoist spool (2), the pressurized oil flows through chamber (D) to the tank.
- Since the port to the hoist cylinder is blocked on both bottom side and head side, the hoist cylinder is held in the current position.

2. When hoist valve is in "RAISE" position



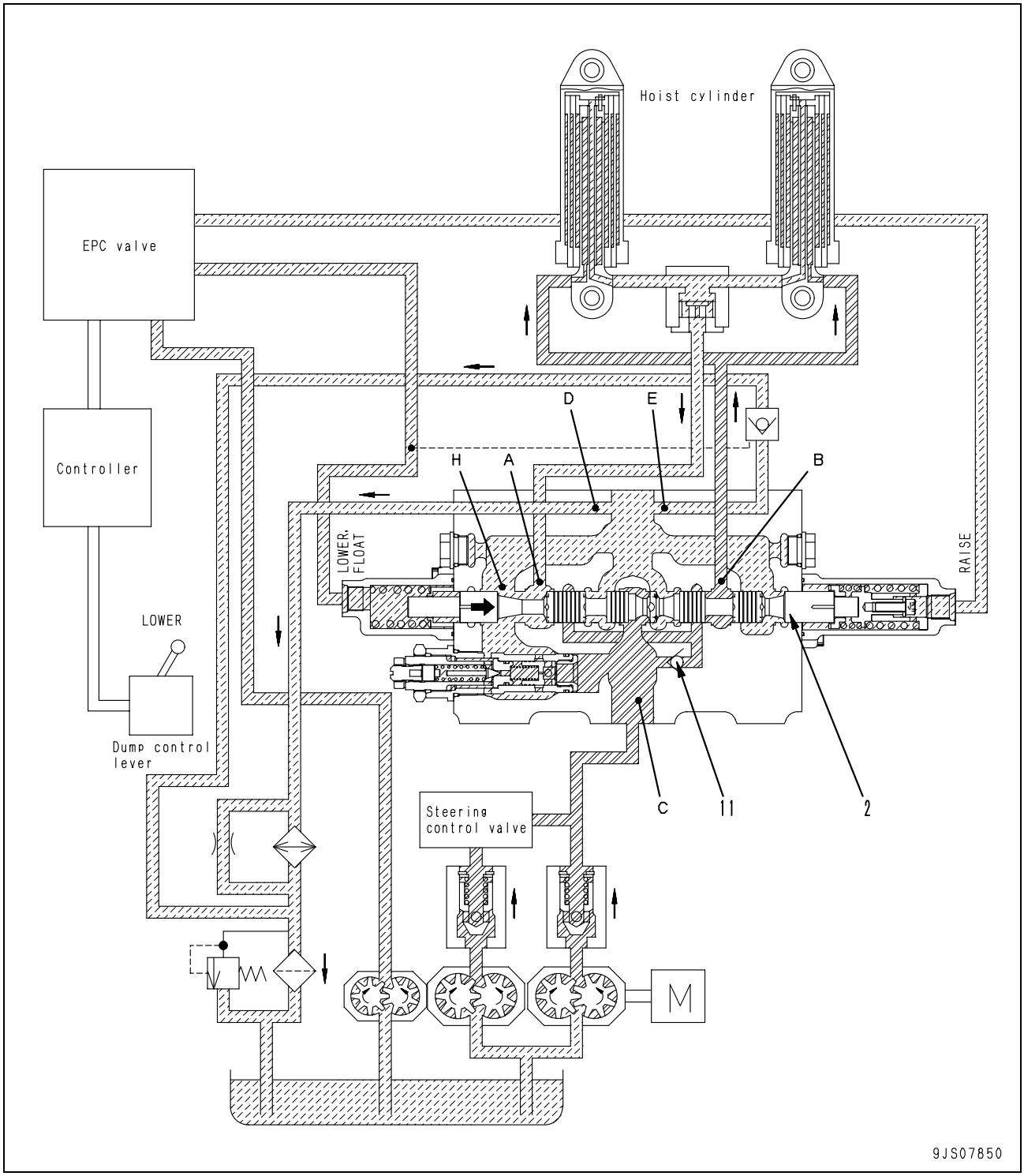
- If the dump control lever in the cab is set in the "RAISE" position, the pressurized oil from the EPC valve moves hoist spool (2) to the left.
- Accordingly, the pressurized oil flows through chamber (C), opens check valve (11), and enters chamber (A).
- The pressurized oil flows through chamber (A) to the bottom side of the hoist cylinder to extend the hoist cylinder and raise the body.
- The pressurized oil returning from the head side flows through chambers (B) and (D) to the tank.

3. When hoist valve is in "FLOAT" position



- If the dump control lever in the cab is set in the "FLOAT" position, the pressurized oil from the EPC valve moves hoist spool (2) to the right. Then, chamber (C) is connected to chamber (D), and chambers (B) and (H) are connected to chamber (D).
- The pressurized oil from the steering control valve flows through chambers (C) and (B) to the hoist cylinder. A part of it flows through chambers (C) and (D) to the steering oil cooler, too.
- Since the bottom side and head side of the hoist cylinder are connected by the hoist valve, the hoist cylinder is free.

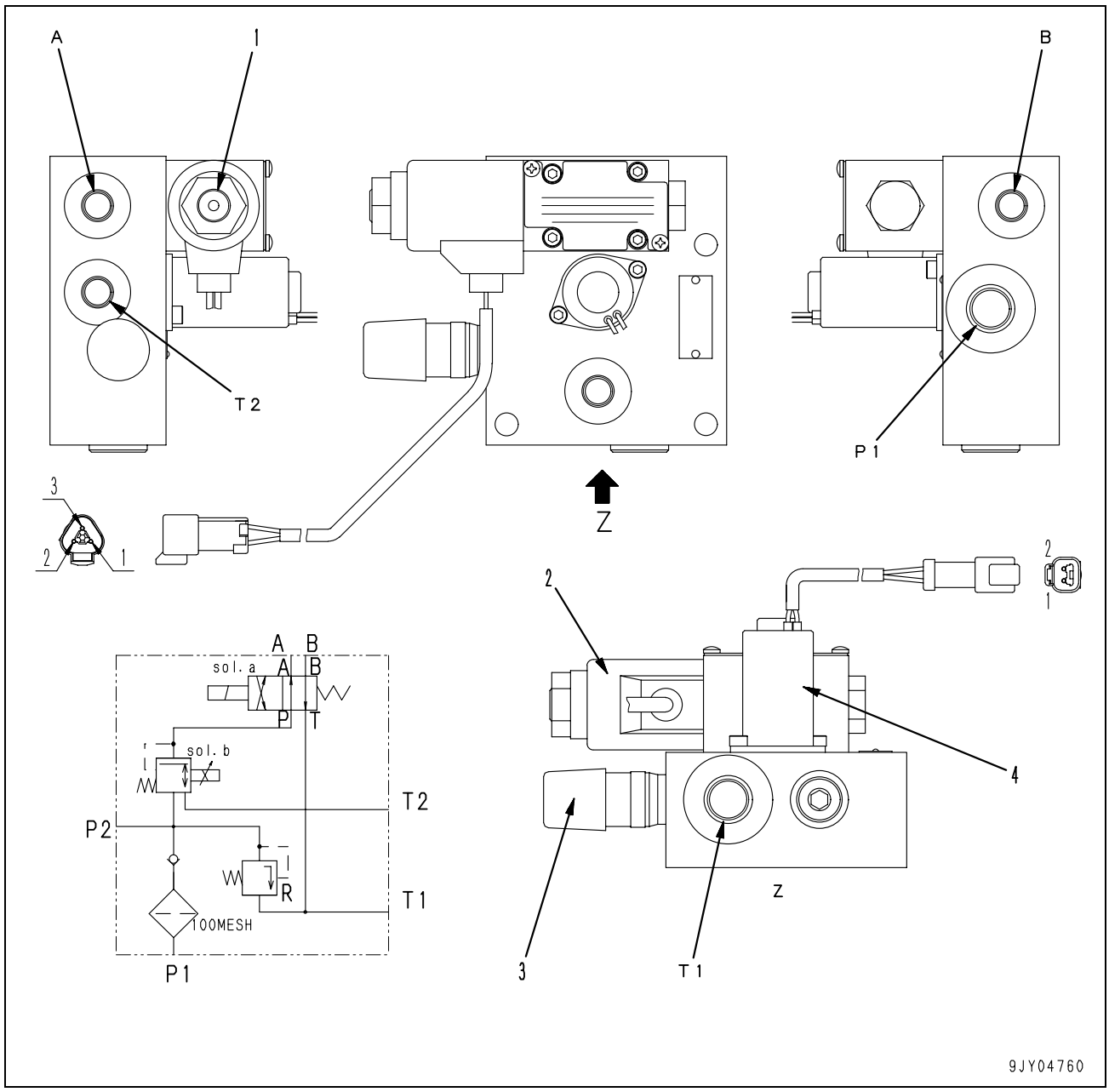
4. When hoist valve is in "LOWER" position



- If the dump control lever in the cab is moved from the "FLOAT" position to the "LOWER" position, the pressurized oil from the EPC valve moves hoist spool (2) to the right further from the "FLOAT" position. Accordingly, the pressurized oil flows through chamber (C), opens check valve (11), and enters chamber (B).
- The pressurized oil flows through chamber (B) to the head side of the hoist cylinder to retract the hoist cylinder and lower the body.
- The pressurized oil returning from the head side of the hoist cylinder flows through chamber (A) to chamber (H).
- When the dump body is lowered, the output pressure of the EPC valve rises and becomes greater than the cracking pressure of the pilot check valve. As a result, the return oil from chamber (H) returns to the tank through two lines: one from chamber (D) to the tank, and the other from chamber (E) to the tank.

Dump control valve (EPC valve)

Serial No.: 2001 – 2714



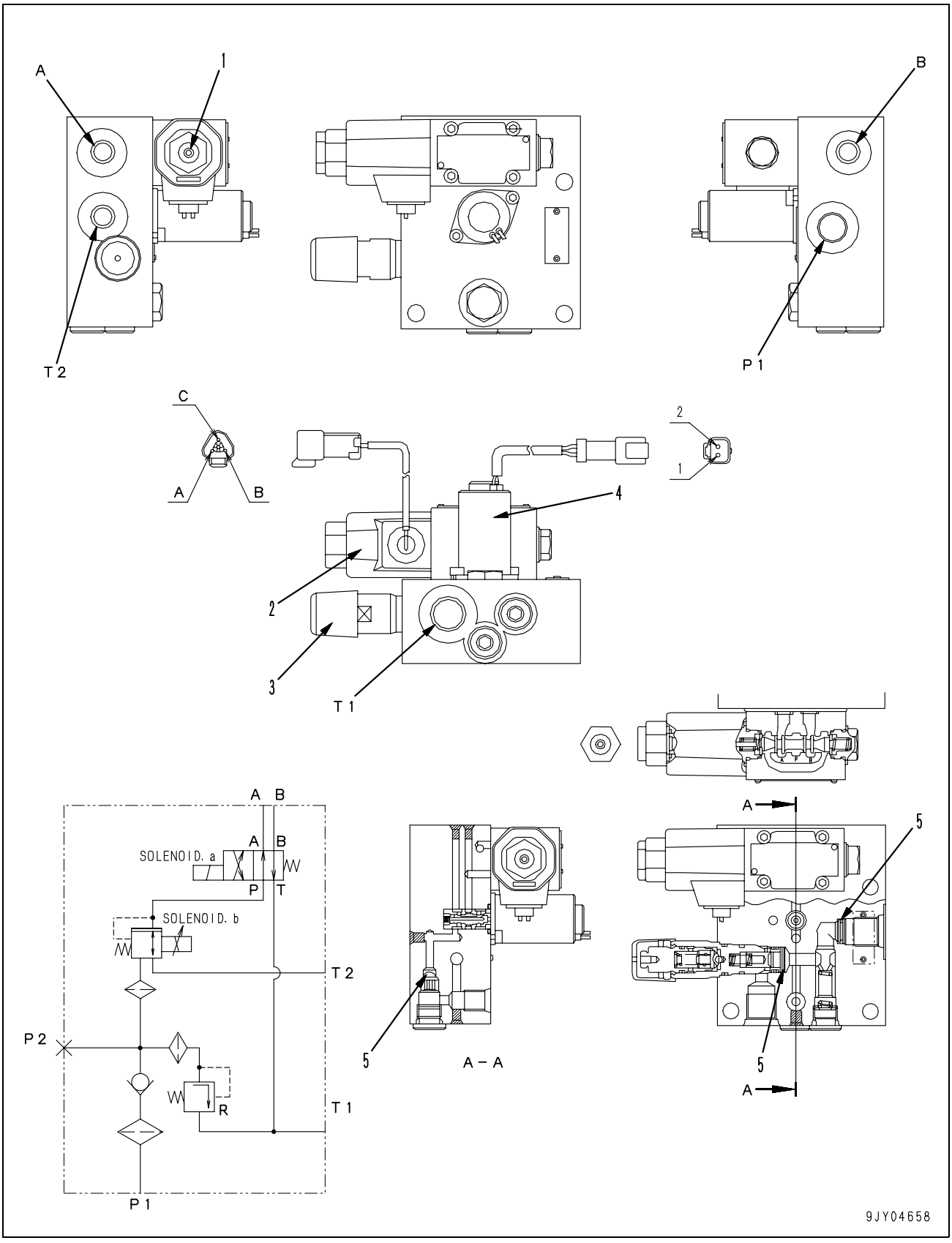
1. Manual operation button
2. Solenoid assembly (Solenoid a)
3. Relief valve (R)
4. Solenoid assembly (Solenoid b)

A: To hoist valve (RAISE side)
B: To hoist valve (LOWER side)
P1: From hydraulic pump
P2: Pick up port
T1: To hydraulic tank
T2: To hydraulic tank

Function

- With the EPC valve, the oil from the hydraulic pump is controlled by the retarder controller. It is then sent to the spool of the hoist valve, and switches the pilot pressure to control the hoist valve.

Serial No.: 2715 and up



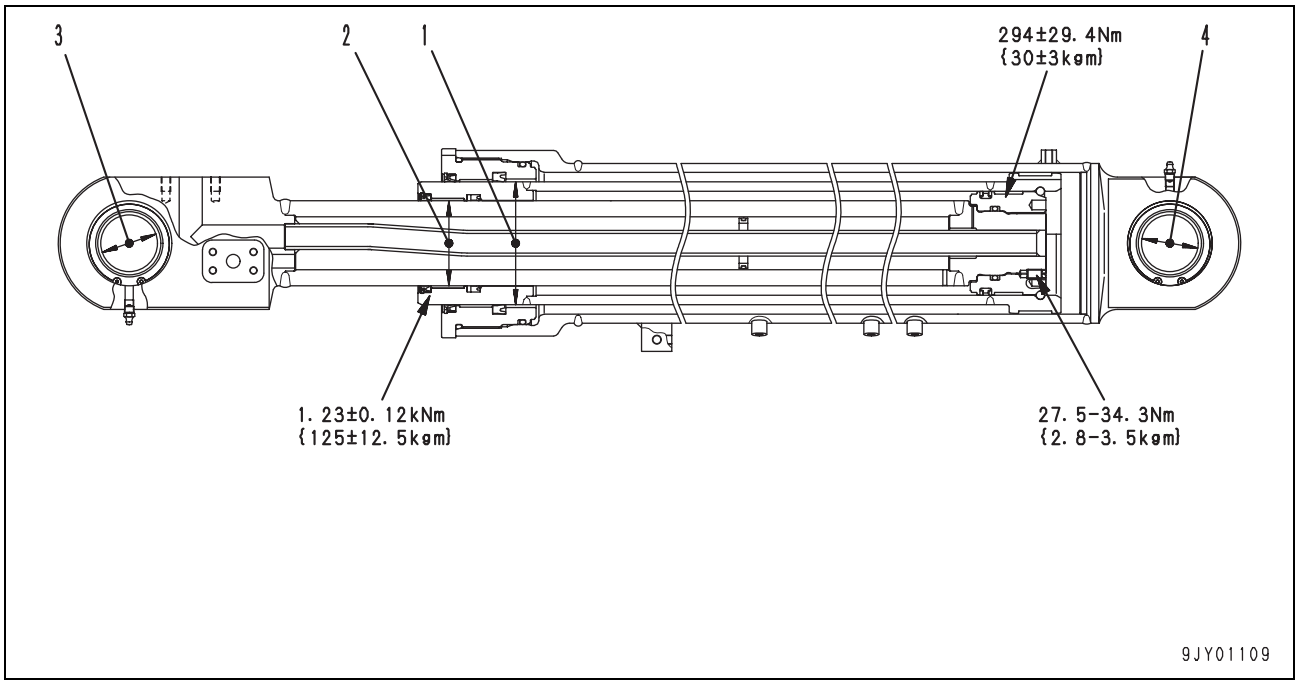
1. Manual operation button
2. Solenoid assembly (Solenoid a)
3. Relief valve (R)
4. Solenoid assembly (Solenoid b)
5. Strainer

A: To hoist valve (RAISE side)
B: To hoist valve (LOWER side)
P1: From hydraulic tank
P2: Pick up port
T1: To hydraulic tank
T2: To hydraulic tank

Function

- The EPC valve sends the oil from the hydraulic pump to the hoist valve spool to change the pilot pressure and control the hoist valve.

Hoist cylinder

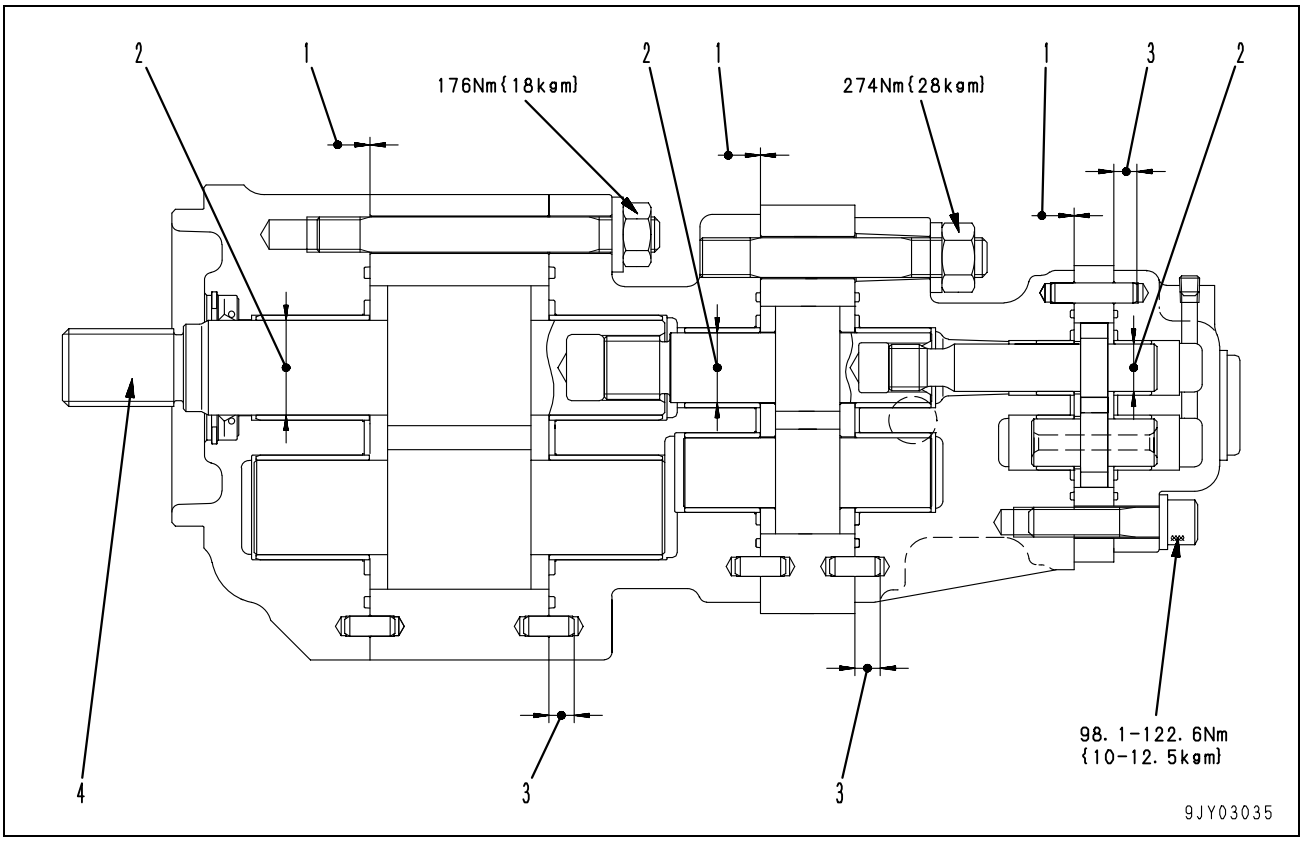


Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between cylinder and bushing	120	-0.036 -0.123	+0.277 +0.062	0.098 – 0.400	0.700	Replace
2	Clearance between piston rod and bushing	80	-0.030 -0.104	+0.271 +0.061	0.091 – 0.375	0.675	
3	Clearance between piston rod support pin and bushing	60	-0.030 -0.076	+0.004 -0.019	0.011 – 0.080	1.0	
4	Clearance between cylinder support pin and bushing	60	-0.030 -0.076	+0.004 -0.019	0.011 – 0.080	1.0	

Hydraulic pump

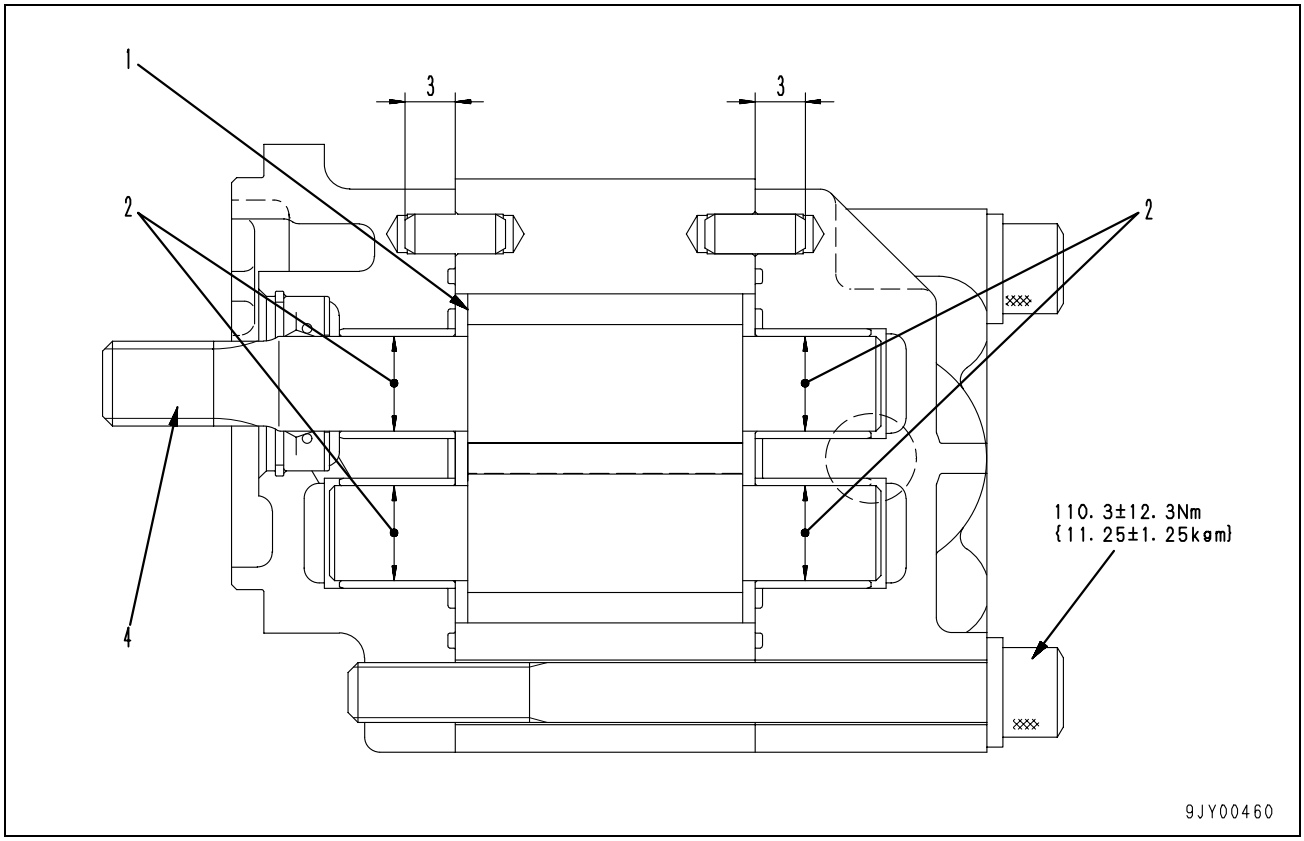
Steering , hoist and pilot pump
SDR(30)100+(20)25+SB(1)6



Unit: mm

No.	Check item	Criteria				Remedy
1	Side clearance	Model	Tolerance	Repair limit		Replace
		SDR(30)-100	0.16 – 0.20	0.24		
		SDR(20)-25				
		SB(1)-6	0.10 – 0.15	0.19		
2	Clearance between inside diameter of plain bearing and outside of diameter of gear shaft	SDR(30)-100	0.06 – 0.131	0.20		
		SDR(20)-25	0.06 – 0.132			
		SB(1)-6	0.06 – 0.119			
3	Depth for knocking in pin	Model	Standard size	Tolerance	Repair limit	
		SDR(30)-100	10	0 -0.5	–	
		SDR(20)-25	9.1	±0.3		
		SB(1)-6				
4	Rotating torque of spline shaft	11.8 – 23.5 Nm {1.2 – 2.4 kgm}				–
–	Delivery Oil: EO10-CD Oil temperature: 45–55°C	Model	Rotating speed (rpm)	Discharge pressure {MPa (kg/cm^2)}	Standard delivery (ℓ/min)	Delivery limit (ℓ/min)
		SDR(30)-100	2,500	20.6 {210}	230.9	213.4
		SDR(20)-25			55.4	51.7
		SB(1)-6			13.8	12.6

Emergency steering pump
SBL(1)26



Unit: mm

No.	Check item	Criteria				Remedy
1	Side clearance	Standard clearance		Clearance limit		Replace
		0.10 – 0.15		0.19		
2	Clearance between inside diameter of plain bearing and outside diameter of gear shaft	0.060 – 0.119		0.20		
3	Depth for knocking in pin	Standard size	Tolerance		Repair limit	
		10	0 -0.5		–	
4	Rotating torque of spline shaft	2.0 – 4.9 Nm {0.2 – 0.5 kgm}				–
–	Delivery Oil: EO10-CD Oil temperature: 45–55°C	Rotating speed (rpm)	Discharge pressure {MPa (kg/cm^2)}	Standard delivery (ℓ/min)	Delivery limit (ℓ/min)	
		3,500	20.6 {210}	67.6	62.4	

HM300-2 Articulated dump truck

Form No. SEN00334-02

ARTICULATED DUMP TRUCK

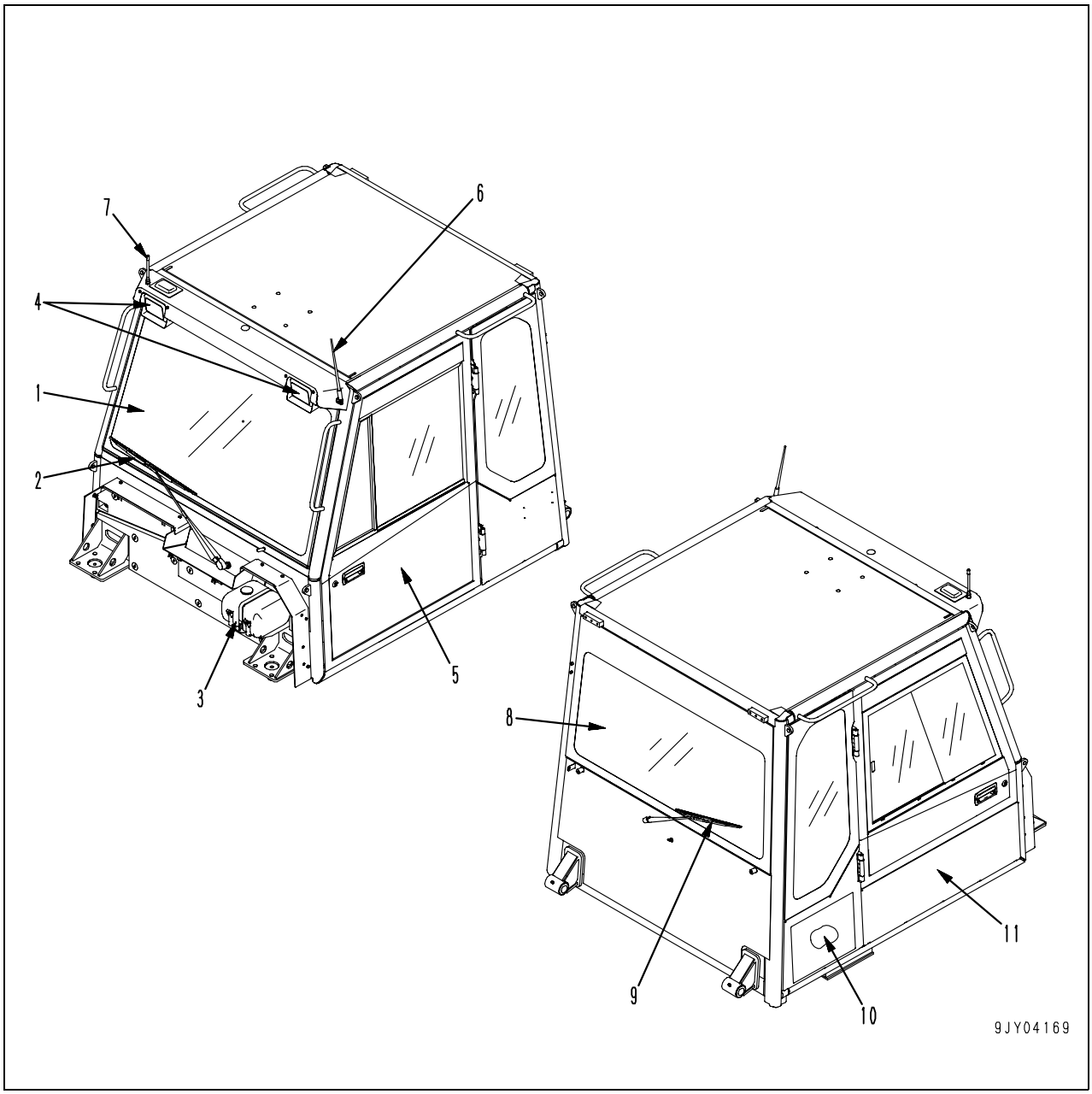
HM300-2

Machine model	Serial number
HM300-2	2001 and up

10 Structure, function and maintenance standard

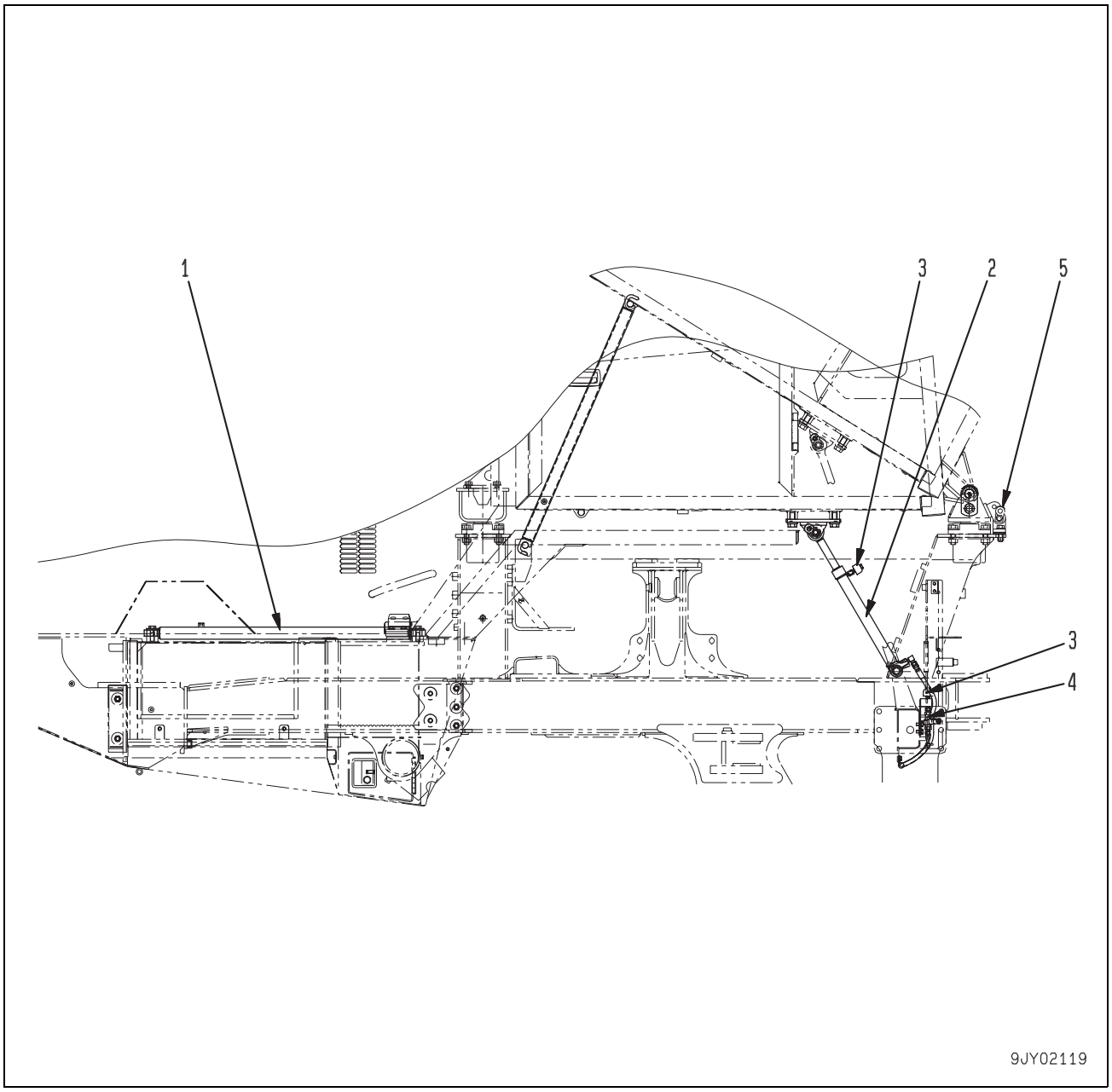
Cab and its attachments

ROPS cab



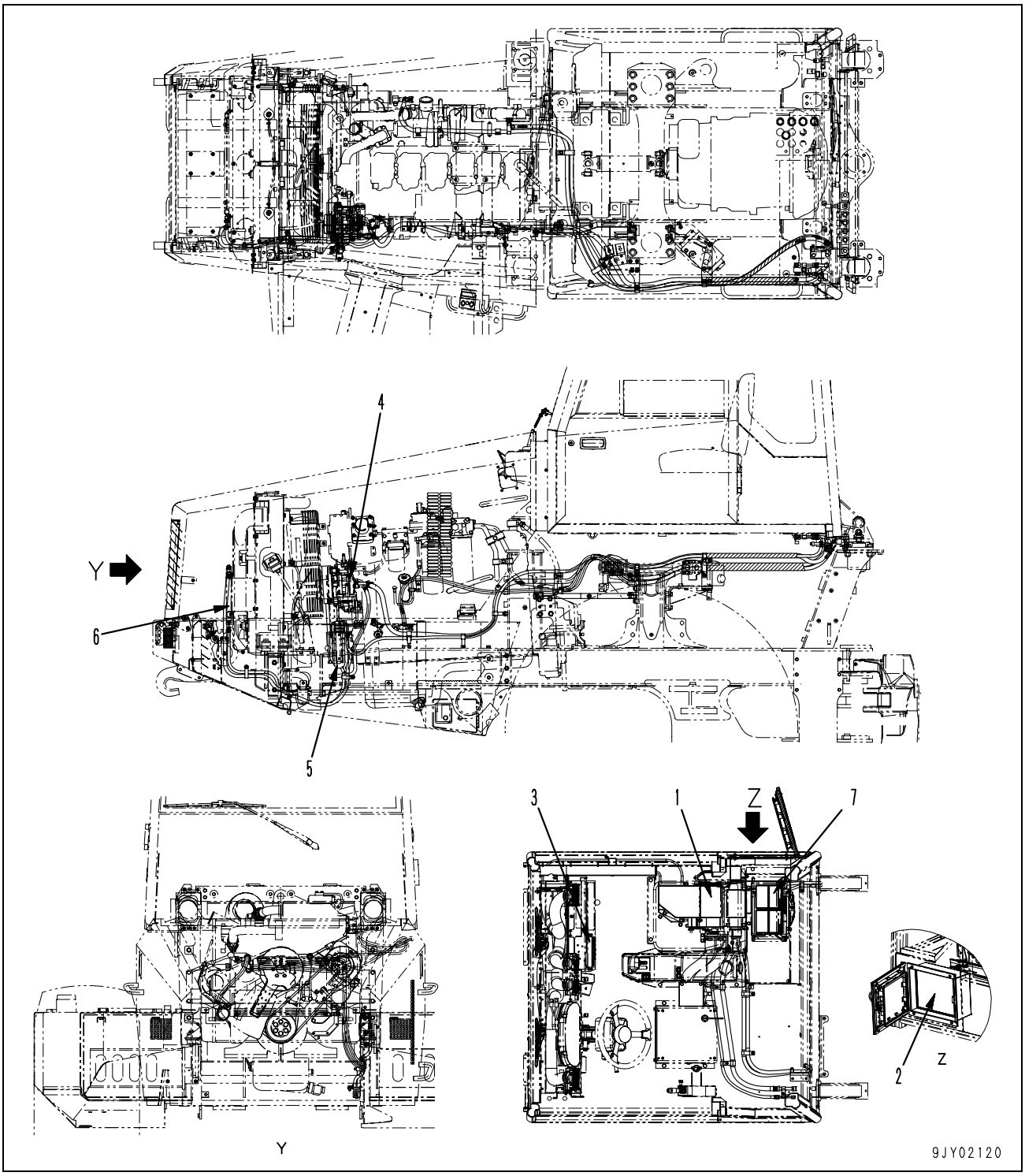
1. Front glass
2. Front wiper
3. Washer tank
4. Front working lamp
5. Door (left)
6. Radio antenna
7. KOMTRAX GPS antenna (if equipped)
8. Rear glass
9. Rear wiper
10. Air conditioner fresh air filter
11. Door (right)

Cab tilt



1. Tilt stopper bar
2. Tilt cylinder (if equipped)
3. Breather
4. Adapter
5. Pin

Air conditioner



1. Air conditioner unit
2. FRESH filter
3. Control panel
4. Compressor
5. Receiver dryer
6. Condenser
7. RECIRC filter

Function

- The air conditioner makes a pleasant operating environment for the operator and acts to reduce fatigue.

Specifications

Refrigerant used	HFC134a (R134a)
Refrigerant refilling level (g)	1,200 ± 50

Refrigerant flow system

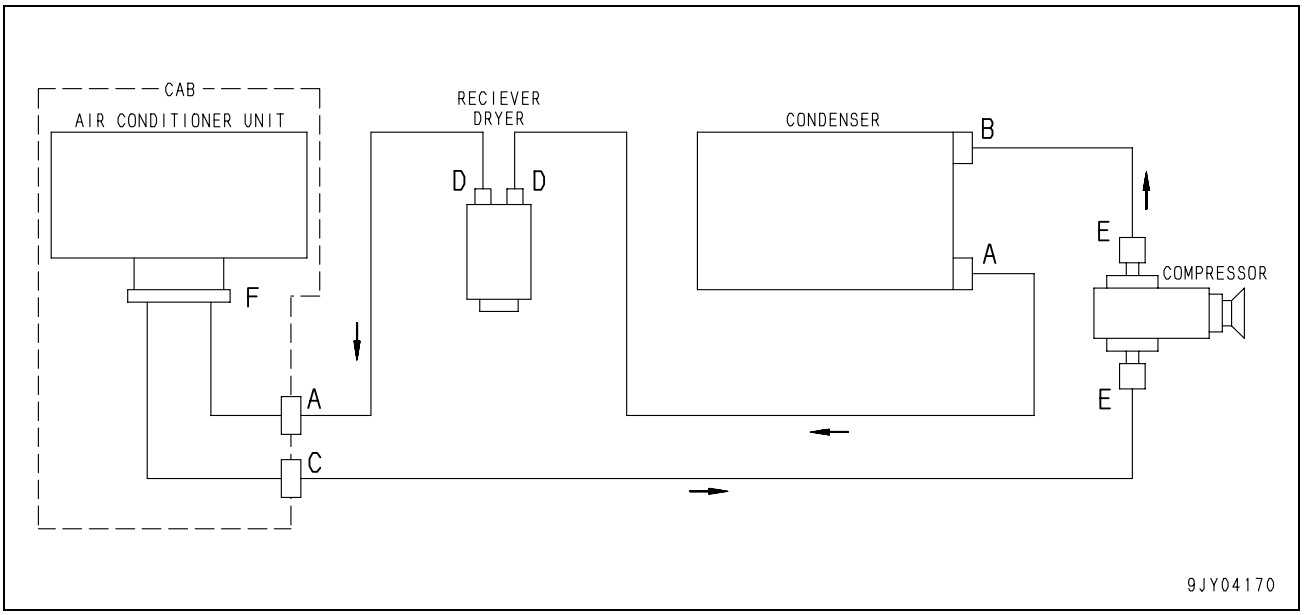
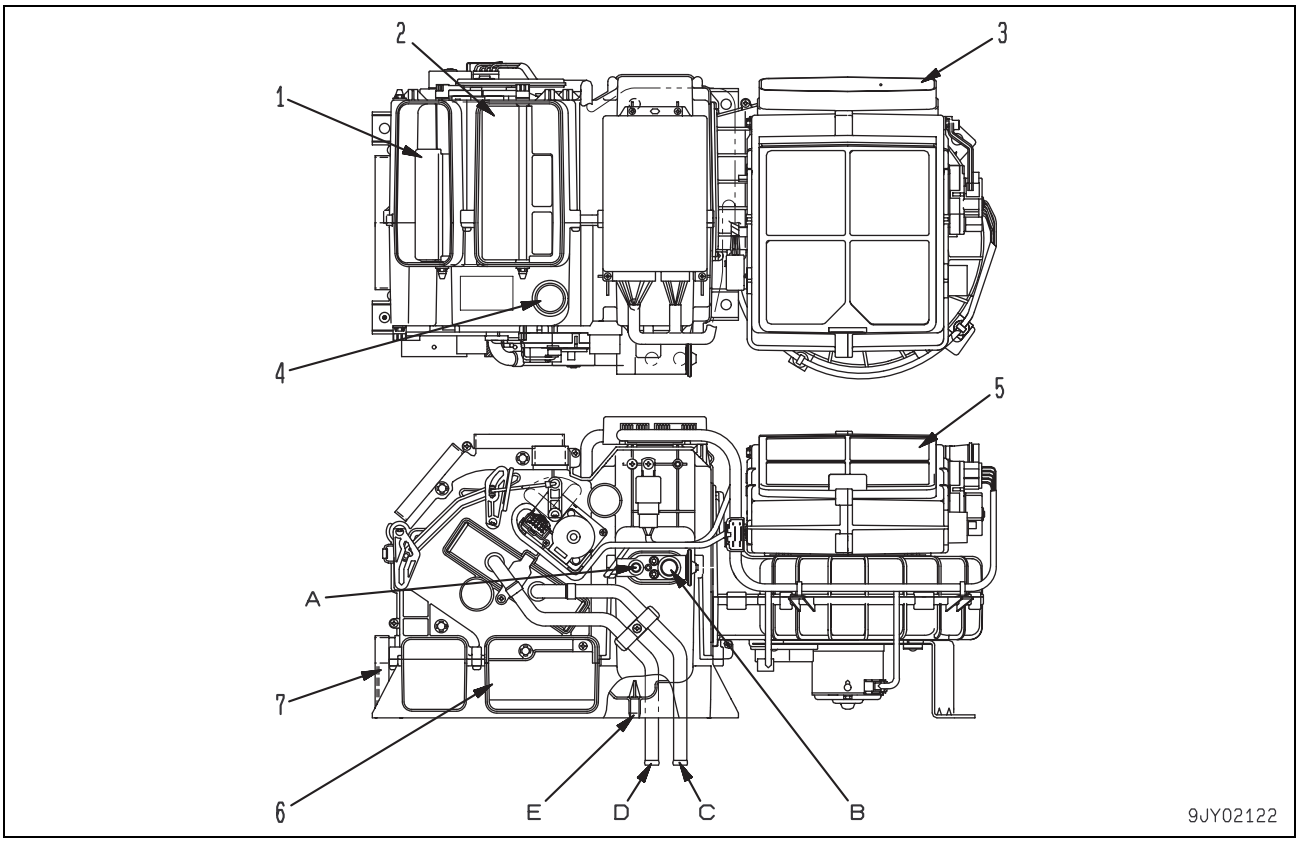


Table of tightening torque for refrigerant piping adapter

No.	Check item	Criteria	Remedy
A	• Condenser refrigerant outlet side • Connecting part to cab (Between receiver drier and air conditioner unit)	12 – 15 Nm {1.2 – 1.5 kgm} (Screw size: M16 x 1.5)	Retighten
B	• Condenser refrigerant inlet side	20 – 25 Nm {2.0 – 2.5 kgm} (Screw size: M22 x 1.5)	
C	• Connecting part to cab (Between air conditioner unit and compressor)	30 – 35 Nm {3.0 – 3.5 kgm} (Screw size: M24 x 1.5)	
D	• Receiver refrigerant piping lock bolt	8 – 12 Nm {0.8 – 1.2 kgm} (Screw size: M6 bolt of receiver)	
E	• Compressor refrigerant piping lock bolt	20 – 25 Nm {2.0 – 2.5 kgm} (Screw size: M8 bolt of compressor)	
F	• Air conditioner unit refrigerant piping lock bolt	8 – 12 Nm {0.8 – 1.2 kgm} (Screw size: M6 bolt of air conditioner unit)	

Air conditioner unit



1. Face outlet port
2. Face outlet port
3. Ambient air inlet port
4. Hot and cool box duct connecting port
5. Internal air inlet port
6. Foot outlet port
7. Defroster output port

A: Refrigerant gas inlet side
B: Refrigerant gas outlet side
C: Hot water outlet port
D: Hot water inlet port
E: Drain port

Outline

- The vertical air conditioner unit on which evaporator and heater core 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 and to adjust the spurting out temperature.

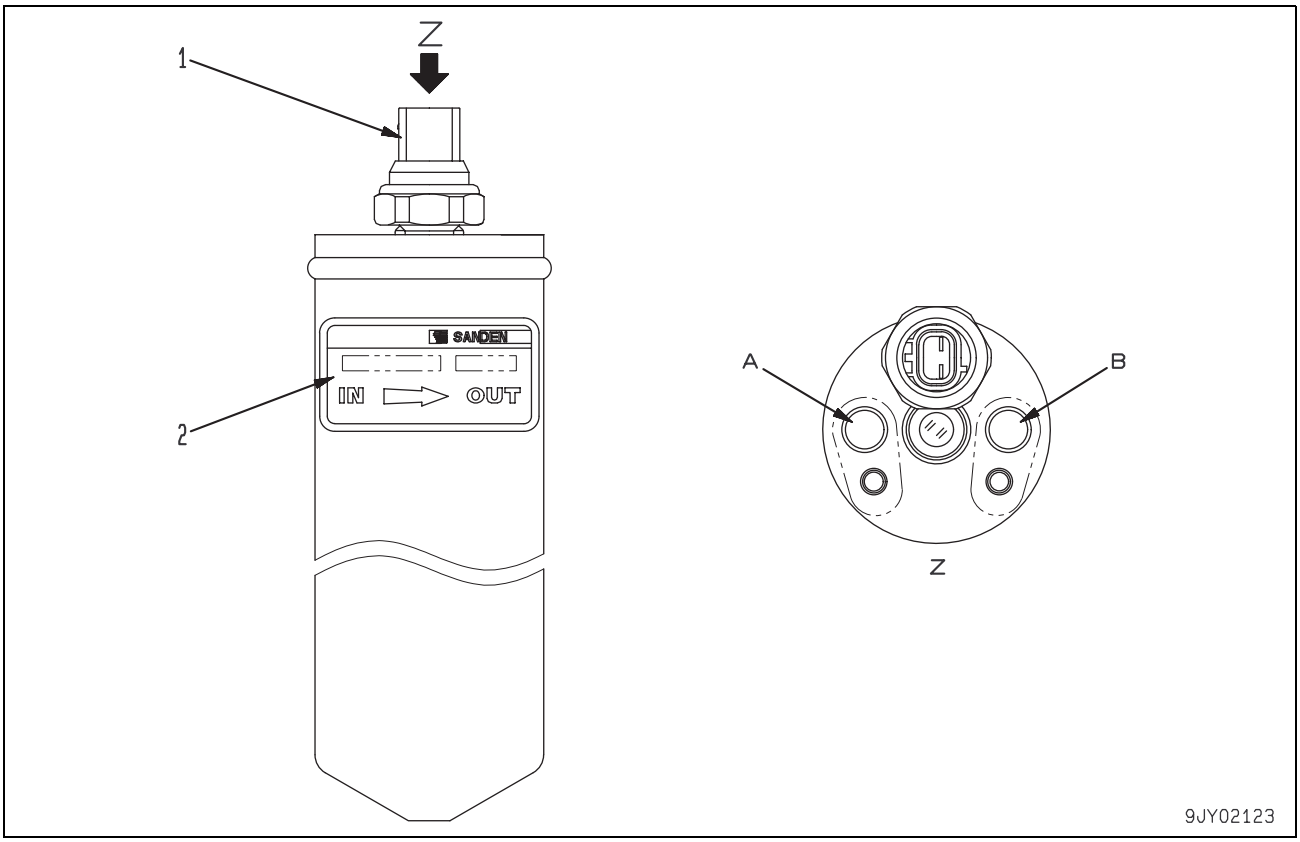
Cooler

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

Heater

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

Receiver dryer



1. Pressure switch
2. Label

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

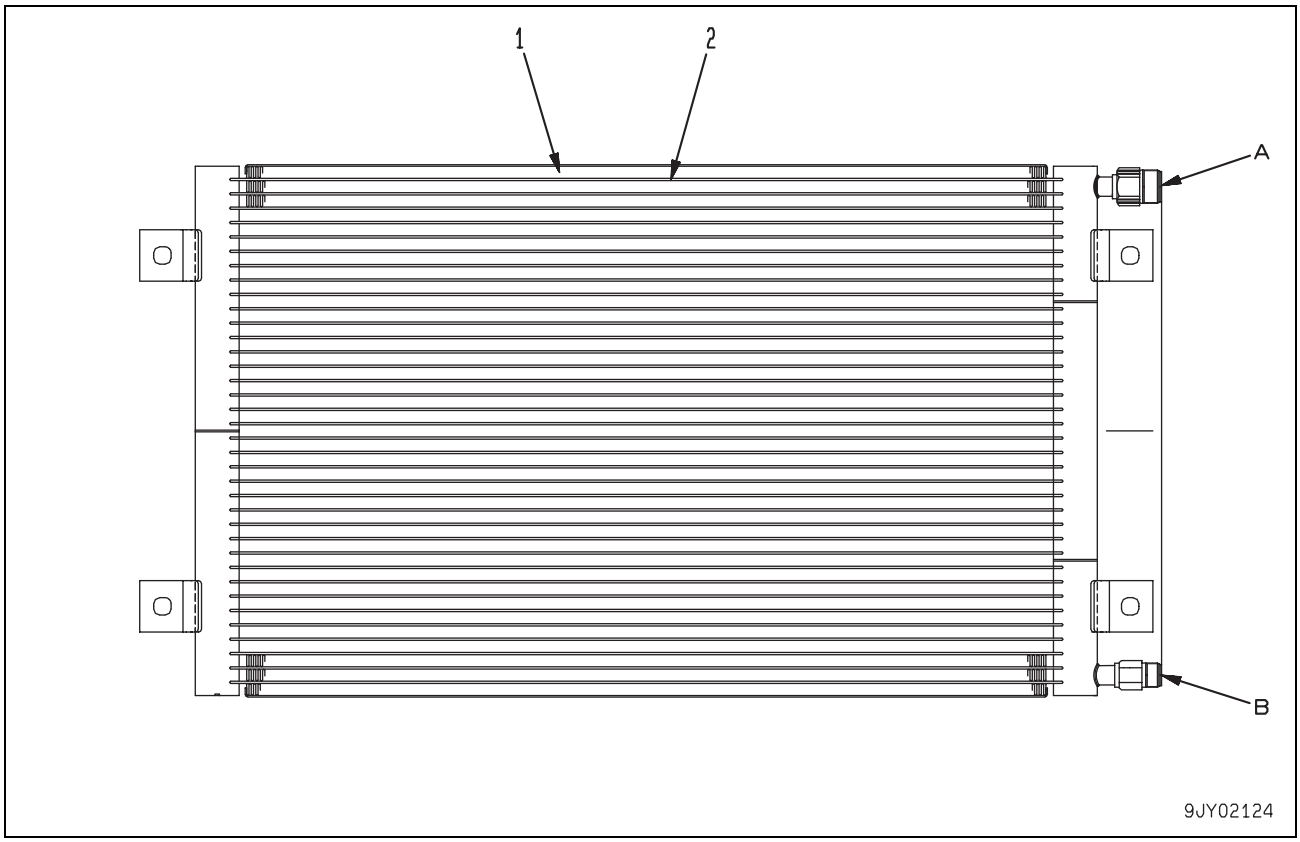
Function

- 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 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 allows inspecting flow of the refrigerant.

Specifications

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

Condenser



1. Fin
2. Tube

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

Function

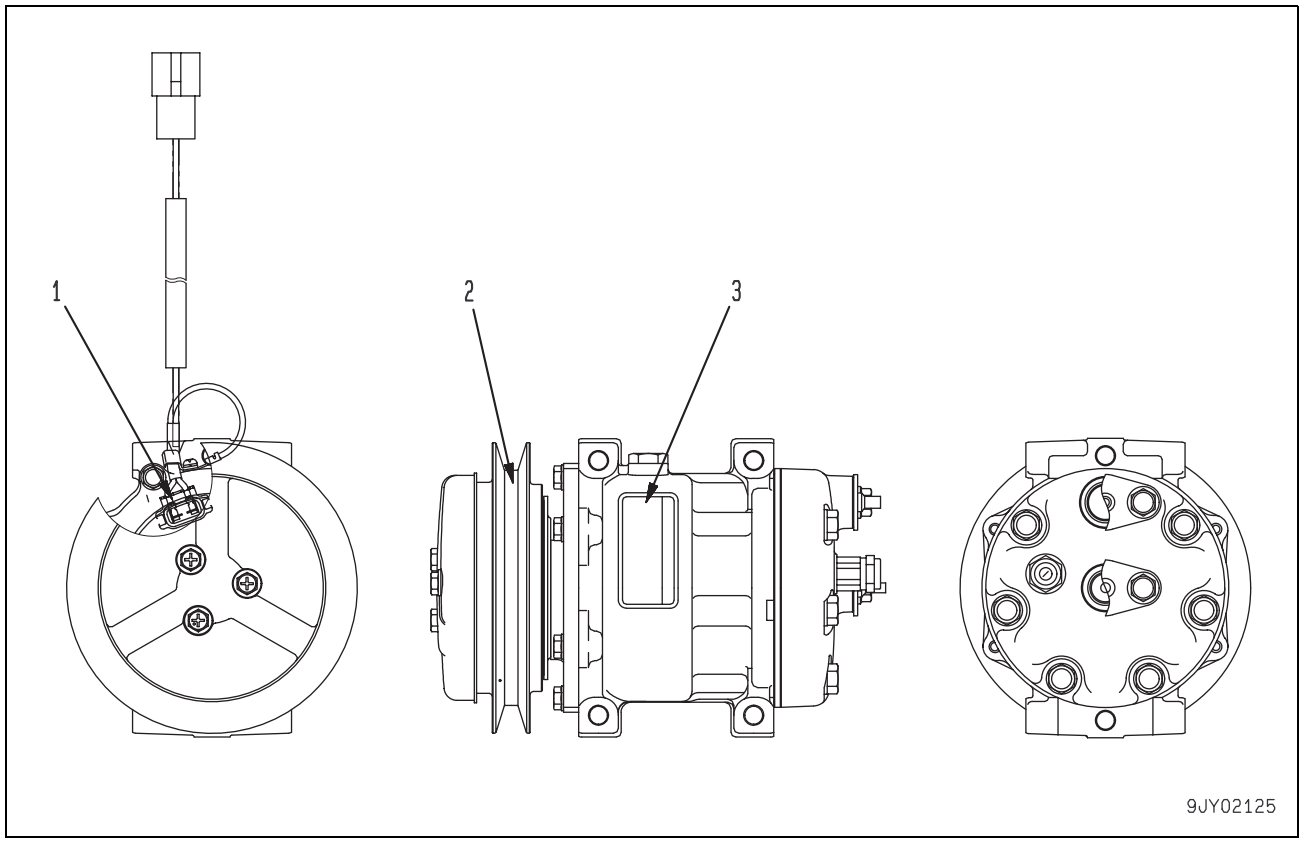
- The condenser cools and liquefies the high-pressure and high-temperature refrigerant gas compressed by the compressor.

★ 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}

Compressor



1. Diode
2. Pulley
3. Label

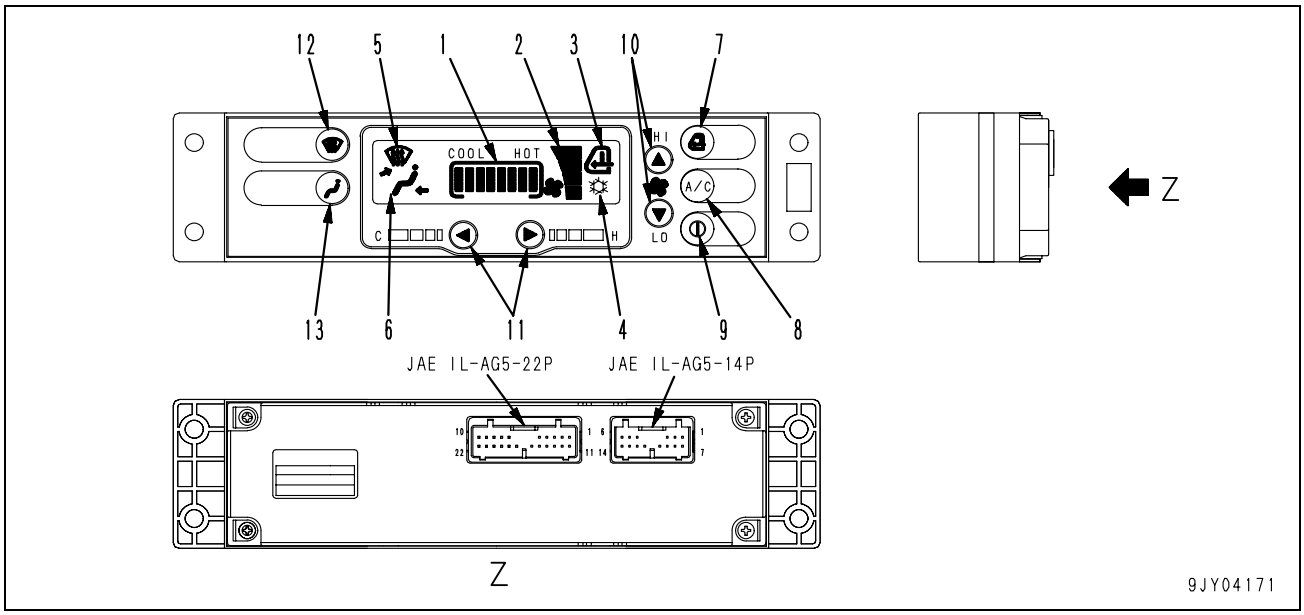
Function

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

Specifications

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

Air conditioner panel



Display section

No.	Display type	Display item	Display range	Display method	Display color	Remarks
1	Gauges	Outlet air temperature	See above figure	All segments of current level and below light up (Display in 8 levels).	Black	LCD
2		Air flow rate	See above figure	All segments of current level and below light up (Display in 4 levels).		
3	Pilot	RECIRC and FRESH air	RECIRC or FRESH air	RECIRC or FRESH is displayed according to RECIRC/FRESH selector switch position.		
4		Air conditioner	Turning "ON" of air conditioner switch	When air conditioner switch is turned "ON", lamp lights up.		
5		DEF air flow	Turning "ON" of DEF switch	When DEF switch is turned "ON", lamp lights up.		
6		Mode	FACE, FACE/FOOT of FOOT mode	FACE, FACE/FOOT or FOOT air outlet is displayed according to mode selector switch position.		

Switch section

No.	Name	Function	Operation
7	RECIRC/FRESH switch	Switch to select RECIRC or FRESH air (Pilot display on display section changes according to setting)	RECIRC ↑ ↓ FRESH
8	Air conditioner switch	Switch to turn ON and OFF air-conditioning function.	OFF ⟷ ON
9	ON/OFF switch	Switch to turn ON and OFF main power supply for air conditioner ON: Setting in "OFF" state is displayed on display section. OFF: Display section is turned OFF and fan is stopped.	OFF ⟷ ON
10	Fan switch	Switch to control air flow from fan (Control in 4 levels [LO, M1, M2, HI])	LO ⟷ HI
11	Temperature control switch	Switch to control outlet air temperature (Control in 8 levels)	Low temperature ↑ ↓ High temperature
12	DEF switch	Switch to turn ON and OFF defroster	OFF ⟷ ON
13	Mode selector switch	Switch to change air outlet position (3 modes [FACE, FACE/FOOT, FOOT]) If pressed in DEF mode, setting before DEF mode is selected.	FACE ⟵ ↓ FACE/FOOT ↓ FOOT ⟶

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

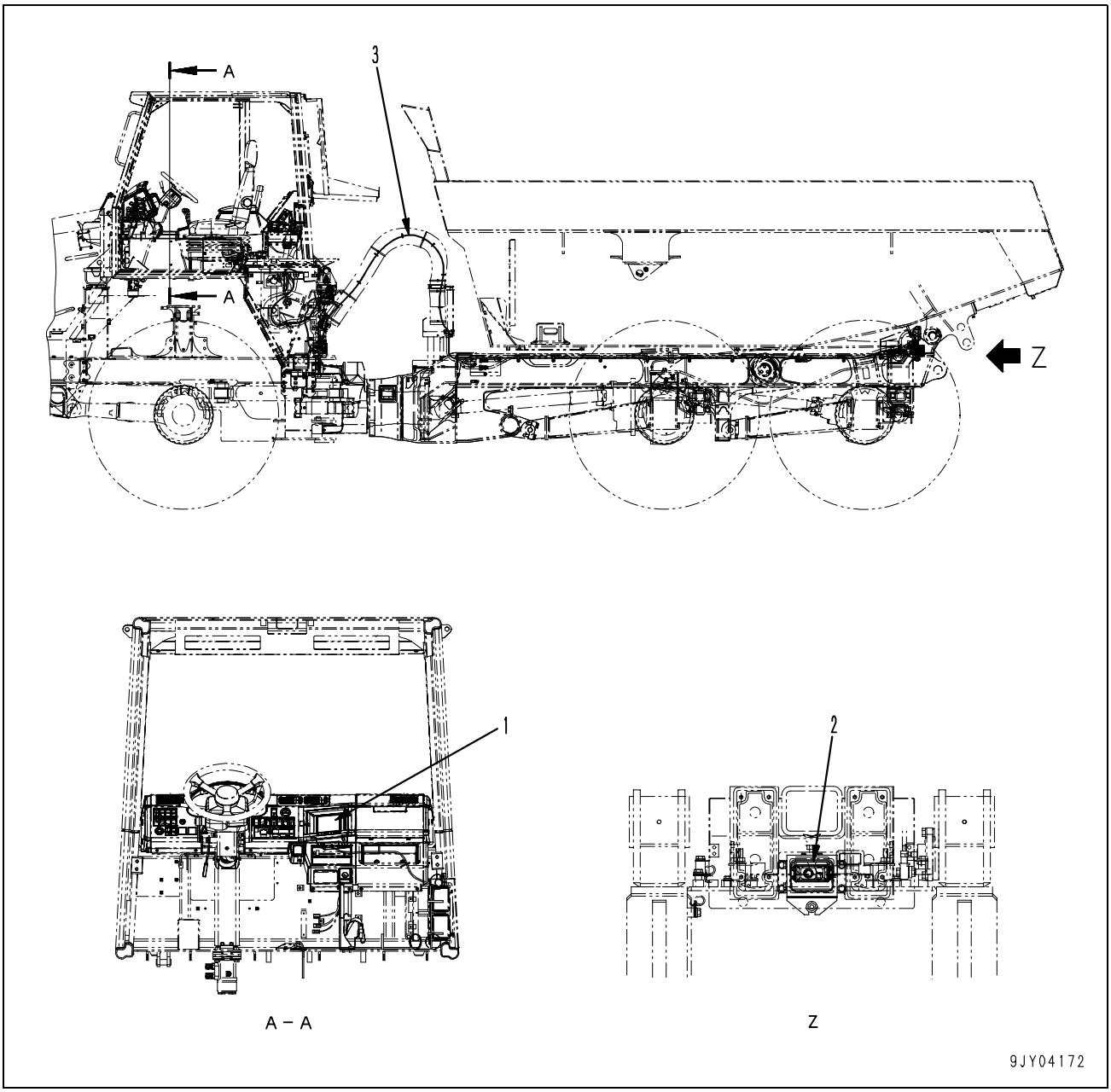
JAE IL-AG5-14P

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

JAE IL-AG5-22P

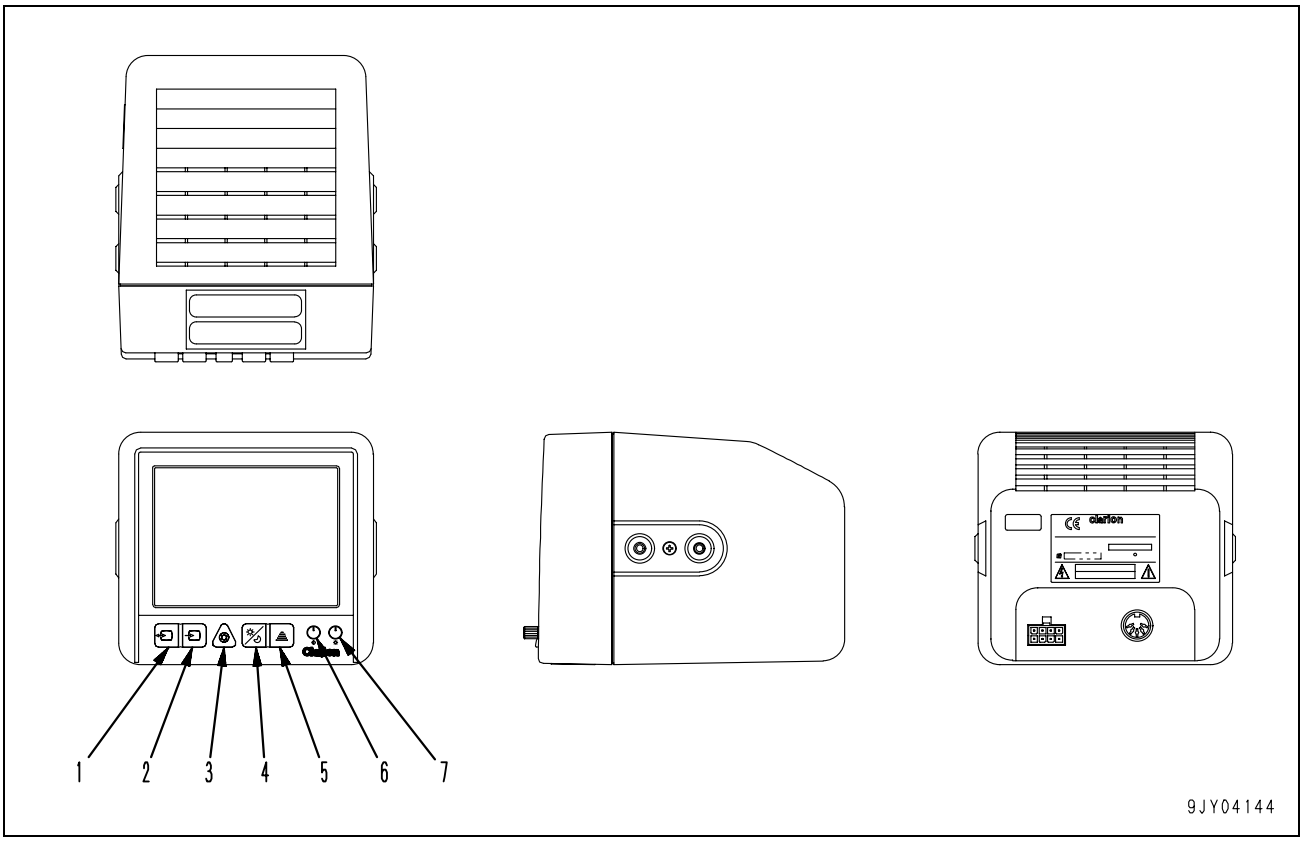
Pin No.	Signal name	Input/output signals
1	NC	—
2	NC	—
3	Blower motor relay	Input
4	Internal/external air changeover damper actuator output 1	Output
5	Internal/external air changeover damper actuator output 2	Output
6	Mode selector actuator output 2	Output
7	Mode selector actuator output 1	Output
8	Air mix damper actuator output 2	Output
9	Air mix damper actuator output 1	Output
10	Actuator potentiometer power supply (5V)	—
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	—

Rear view monitor
(If equipped)



1. Monitor
2. Camera
3. Cable

Monitor

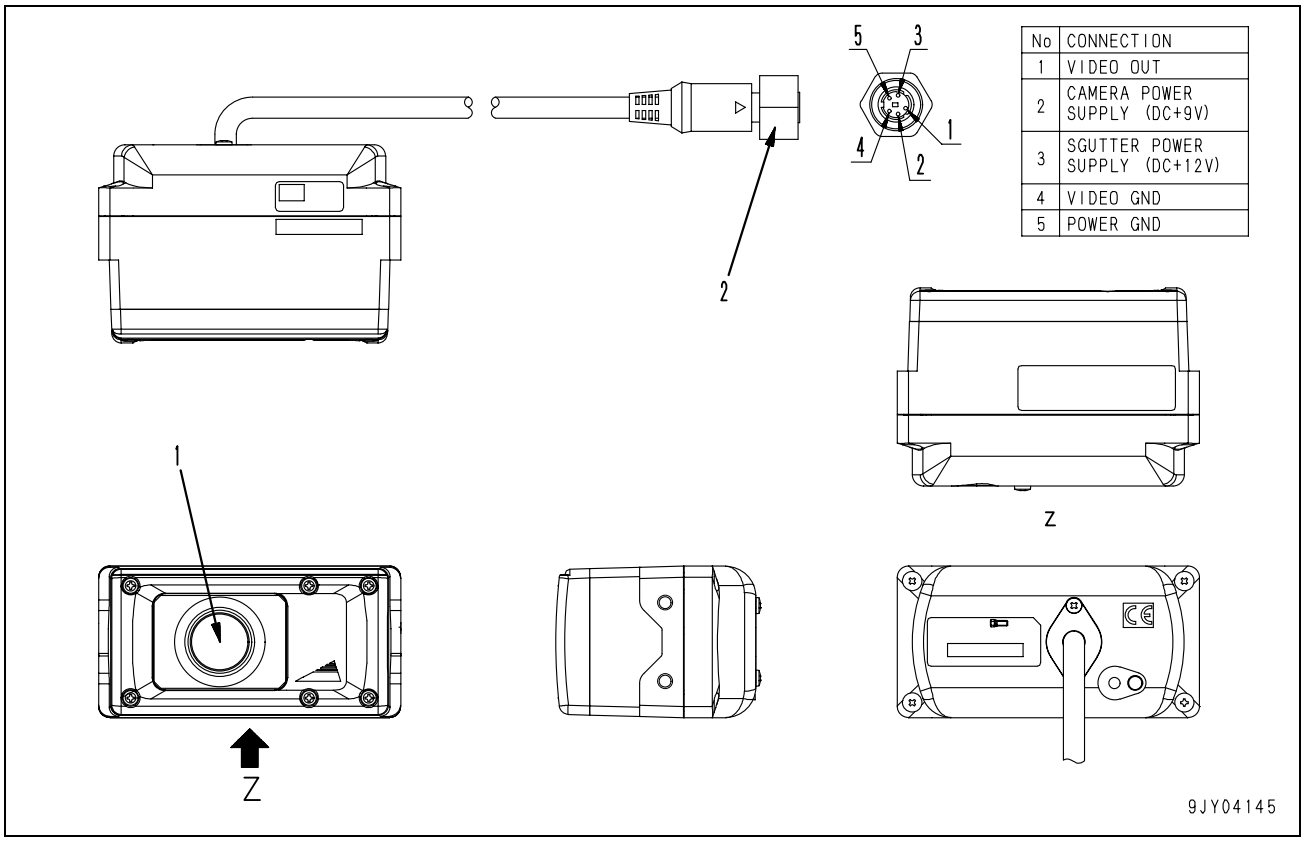


1. Auto switch
2. Manual switch
3. Zoom/Iris switch
   (Reverse light compensation switch)
4. Bright/Dim light selector switch
5. Mark switch
6. Contrast adjustment knob
7. Brightness adjustment knob

Specifications

TV signal method:
As per Japanese standard TV method
Scanning method: 2:1 Interlace method
CRT: 4.5 inch, black and white, 90-deg. deflection
Resolution:
Horizontal 400 lines and vertical 300 lines
Power supply voltage: DC 24/12 V

Camera



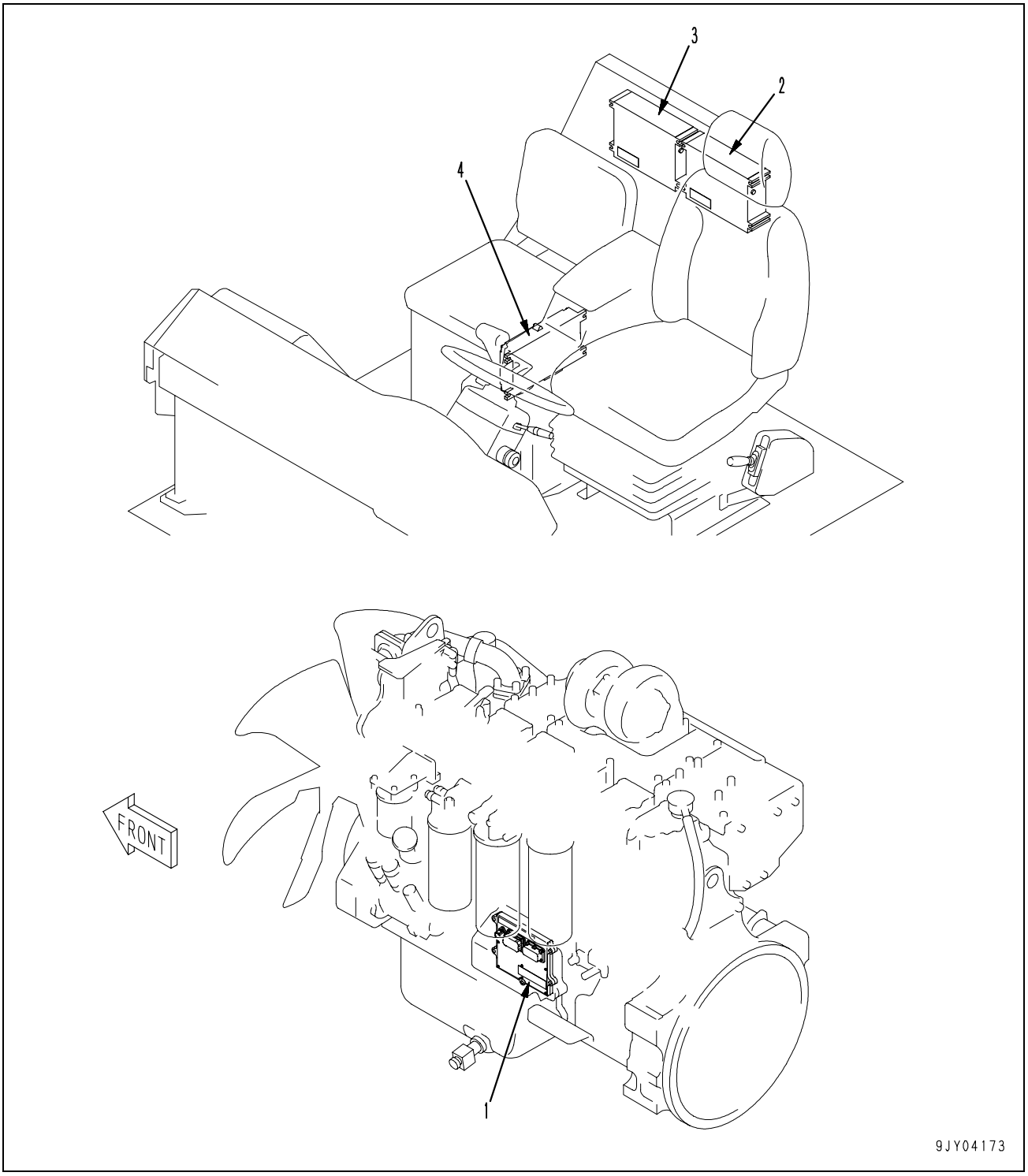
1. Camera
2. Connector

Specifications

TV signal method:
As per Japanese standard TV method
Scanning method: 2:1 Interlace method
Image sensor:
1/4 inch color CCD with 250,000 pixels
Lens: 1.7 mm, 1:2.8
Angle of view: Horizontal; Approx. 118 deg.,
Vertical; Approx. 97.6 deg.
Electronic zoom: Approx. 1.4 power
Using luminance range:
Min. luminance of object; 3 lux
Power supply voltage:
DC 5.5 V – 99.5 V for main unit
(supplied by monitor)
Power consumption: Max. 120 mA

Controller related

Controller layout



1. Engine controller
2. Transmission controller
3. Retarder controller
4. KOMTRAX terminal (if equipped)

HM300-2 Articulated dump truck

Form No. SEN00335-01

ARTICULATED DUMP TRUCK

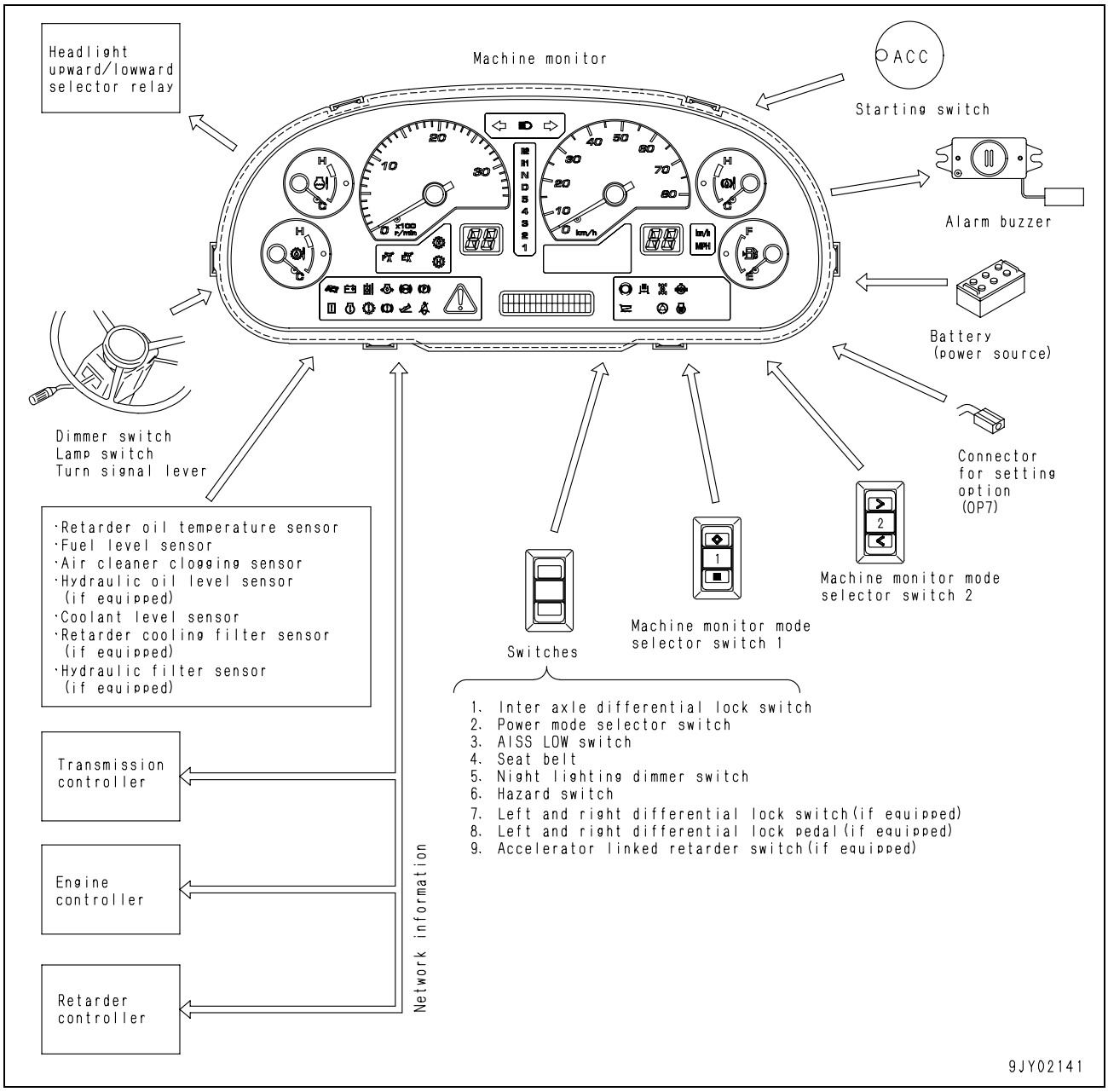
HM300-2

Machine model	Serial number
HM300-2	2001 and up

10 Structure, function and maintenance standard

Electrical system, Part 1

Machine monitor system



Network data

1. From machine monitor to each controller
- Switch sensor data
- Option setting data
- Model selection data

2. From each controller to machine monitor
- Display data related to each controller
- Service mode data
- Troubleshooting data

Outline

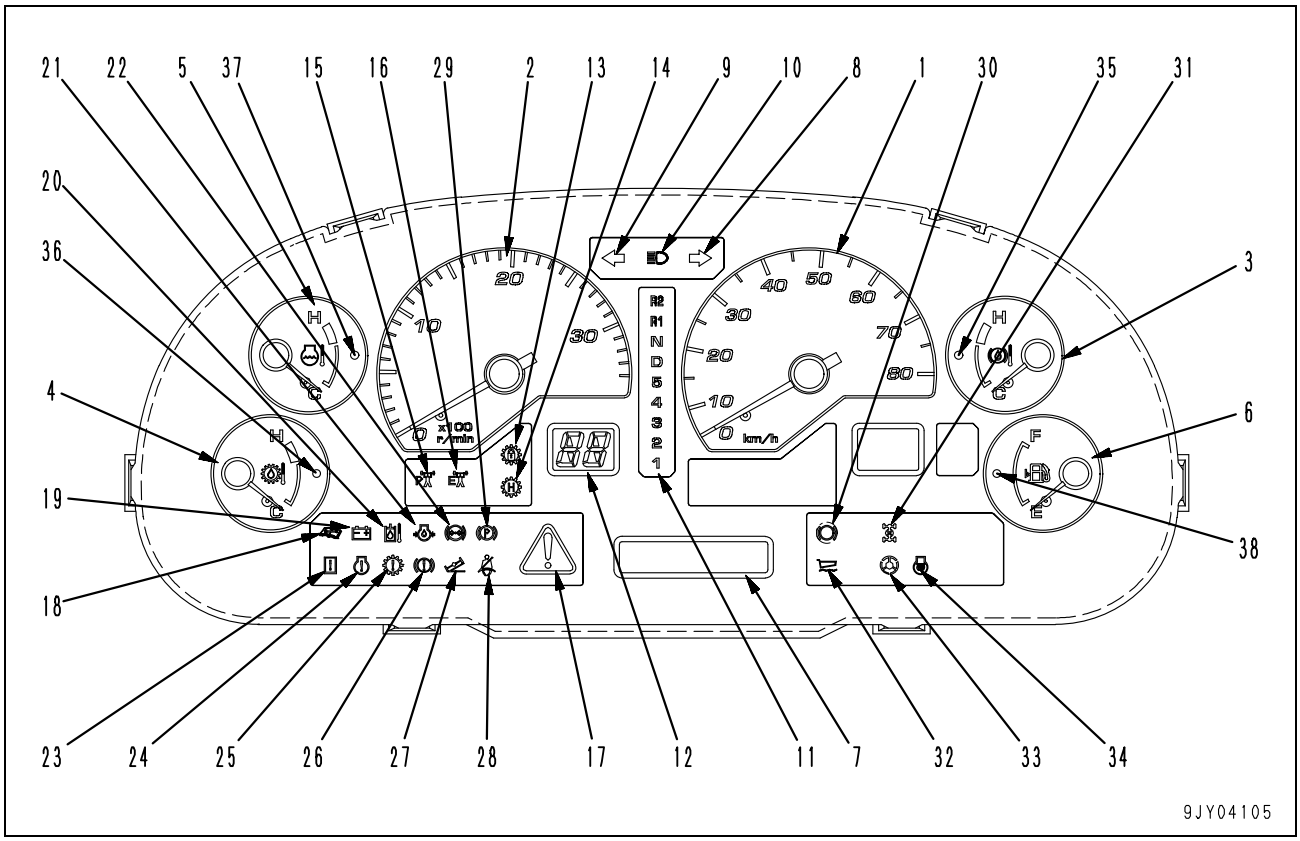
- In the machine monitor system, each controller on the network monitors and controls the machine condition with the sensors installed to various parts of the machine, and then sends the result as the network information to the machine monitor, which displays the information to notify the operator of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

- There are two types of display on the machine monitor: the normal mode and the service mode.

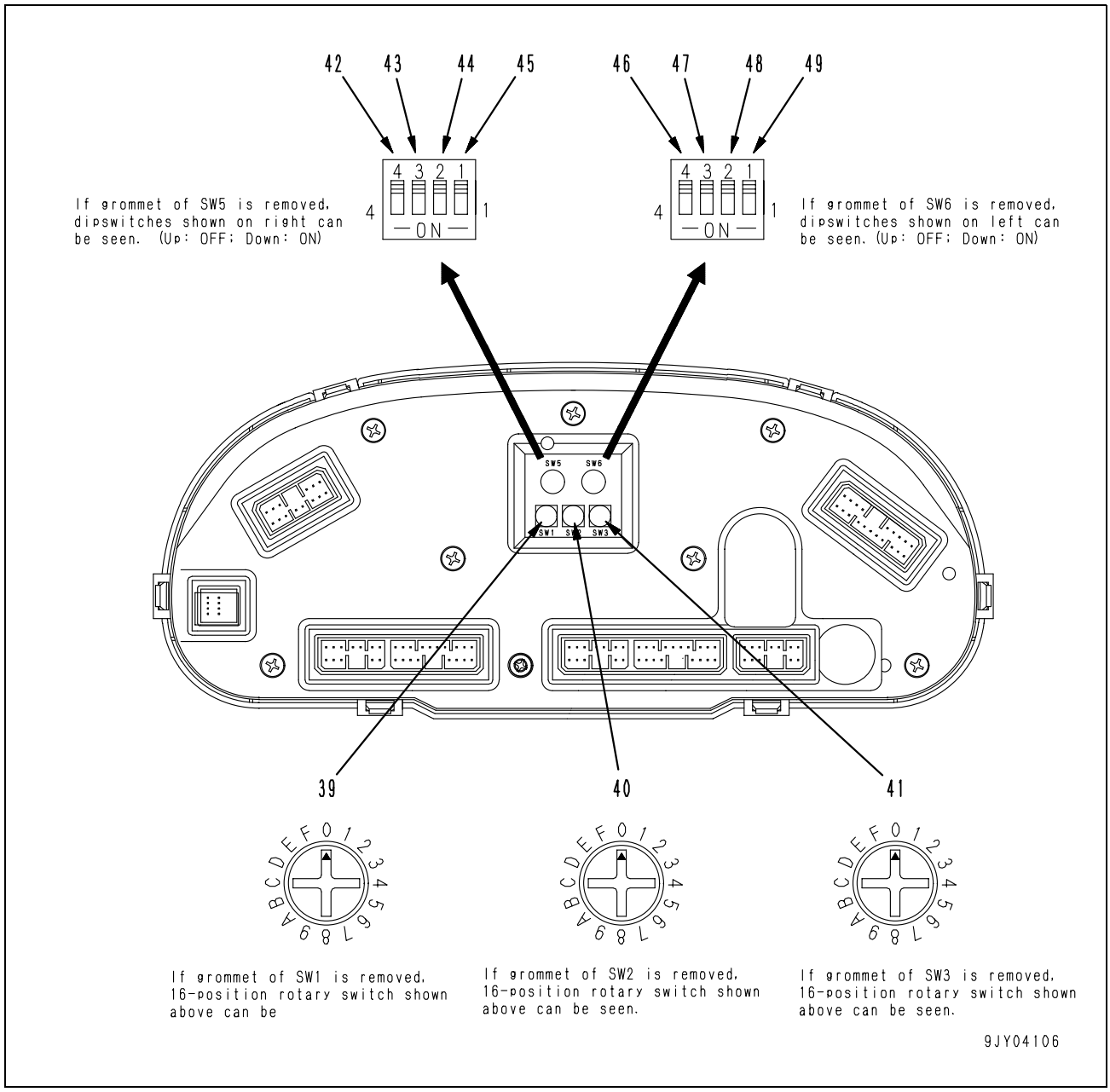
- The items that are always displayed for the operator are the normal mode items. Their main content is as follows.
  1. Normal display items
     - Meters (speedometer, tachometer)
     - Gauges (engine coolant temperature, torque converter oil temperature, retarder oil temperature, fuel gauge)
     - Pilot display
     - Service meter, odometer (character display)
  2. Items displayed when there is abnormality
     Caution, action code display (while an action code is being displayed, press machine monitor mode selector switch (>). A failure code (6-digit) is then displayed.)
  3. Maintenance monitor function
     When the filter, oil replacement interval is reached, the item needing replacement is displayed in the character display.
  4. Others
     In combination with the character display and the machine monitor mode selector switch, which is used to operate the character display, the following items can be displayed, set, and adjusted.
     1) Dumping counter (if equipped)
     2) Display reverse travel distance measurement value
     3) Reset filter and oil replacement interval
     4) Input telephone number
     5) Select language

- To make it easier to carry out troubleshooting of the controllers on the network (including the monitor panel itself), a service mode function is provided. Its main content is as follows.
  1. Displaying failure history data for electrical equipment system
     - Displays electrical equipment system failure occurrence data from each controller that is saved in machine monitor
     - Deletes data from memory
  2. Displaying failure history data for machine
     Displays machine failure occurrence data from each controller that is saved in machine monitor.
  3. Real-time monitor
     Takes input, output signal, and calculation values recognized by each controller on network and displays them in real time
  4. Reduced cylinder mode
     This function is used to stop the supply of fuel sprayed from the fuel injector to each of the cylinders. This function is used for the purpose of, for example, determining the cylinder where there is defective combustion.
  5. No injection cranking
     This function is used to lubricate an engine without starting the engine to drive a machine after a long-term storage.
  6. Adjusting function
     This function is used to correct installation errors of sensors, solenoid valves, and compensate production tolerances of parts and components. This function is also used to change control characteristic data in response to user's request.
  7. Maintenance monitor
     This function is used to change filter and oil replacement interval and stop the function.
  8. Operation information display function
     This function is used to display fuel consumption amount per operation hour.
  9. Option selection function
     This function is used to select controller information and optional equipment to be operated.
  10. Model selection function
      Input model information to be mounted.
  11. Initialize
      This function is used to set the machine monitor when the machine is shipped from the factory.

Machine monitor



1. Speedometer
2. Engine tachometer
3. Retarder oil temperature gauge
4. Torque converter oil temperature gauge
5. Engine coolant temperature gauge
6. Fuel gauge
7. Character display
8. Turn signal pilot lamp (R.H.)
9. Turn signal pilot lamp (L.H.)
10. Front lamp high beam pilot lamp
11. Gear shift lever position pilot lamp
12. Shift indicator
13. Lockup pilot lamp
14. Shift hold pilot lamp
15. Power mode pilot lamp (power mode)
16. Power mode pilot lamp (economy mode)
17. Central warning lamp
18. Maintenance caution lamp
19. Battery charge circuit caution lamp
20. Steering oil temperature caution lamp
21. Engine oil pressure caution lamp
22. Brake oil pressure caution lamp
23. Machine monitor, option system caution lamp
24. Engine system caution lamp
25. Transmission system caution lamp
26. Retarder system caution lamp
27. Tilt caution lamp
28. Seat belt caution lamp
29. Parking brake pilot lamp
30. Retarder pilot lamp
31. Inter-axle differential lock pilot lamp
32. Dump body pilot lamp
33. Emergency steering pilot lamp
34. Preheating pilot lamp
35. Retarder oil temperature caution lamp
36. Torque converter oil temperature caution lamp
37. Engine coolant temperature caution lamp
38. Fuel level caution lamp



39. Rotary switch [SW1]
40. Rotary switch [SW2]
41. Rotary switch [SW3]
42. Dipswitch [SW5-4]
43. Dipswitch [SW5-3]
44. Dipswitch [SW5-2]
45. SI Spec. Non-SI Spec. selection switch [SW5-1]
46. Dipswitch [SW6-4]
47. Dipswitch [SW6-3]
48. Dipswitch [SW6-2]
49. Dipswitch [SW6-1]

★ Do not change the setting of the rotary switches and dipswitches on the back side of the machine monitor.

Machine monitor normal display functions

○: Lights up △: Sounds intermittently
☆: ○ shows that all lamps light up for approx. 2 seconds after starting → all off for 1 second

No.	Display item	Display category	Device	Color	Display range/ conditions	Method of display	Related actuation		☆ Immediately after starting switch is turned ON	Remarks
							Central warning lamp	Alarm buzzer		
1	Travel speed	Meter	Movement	Scale: White Background color: Black	0 - 80 km/h or 0 - 50 mph (MPH display is only when non-SI spec. is used)	Analog display	—	—	—	
		Backlight	LED	Amber	When small lamps light up	Lights up when actuated	—	—	○	
2	Engine speed	Meter	Movement	Scale: White, red Background color: Black	0 - 3400 rpm (red zone: More than 2500 rpm)	Analog display (*)	○	△	—	* When engine speed is 2,350 rpm or higher, buzzer and central warning lamp operate.
		Backlight	LED	Amber	When small lamps light up	Lights up when actuated	—	—	○	
3 36	Brake cooling oil temperature	Gauge	Movement	Scale: White, red Background color: Black	50 - 150°C (red zone: More than 120°C)	Analog display	—	—	—	
		Caution	LED	Red	When temperature is more than 120°C	Lights up when abnormal	○	△	○	
		Backlight	LED	Amber	When small lamps light up	Lights up when actuated	—	—	○	
4 37	Torque converter oil temperature	Gauge	Movement	Scale: White, red Background color: Black	50 - 135°C (red zone: More than 120°C)	Analog display	—	—	—	
		Caution	LED	Red	When temperature is more than 120°C	Lights up when abnormal	○	△	○	
		Backlight	LED	Amber	When small lamps light up	Lights up when actuated	—	—	○	
5 38	Engine coolant temperature	Gauge	Movement	Scale: White, red Background color: Black	50 - 135°C (red zone: More than 102°C)	Analog display	—	—	—	
		Caution	LED	Red	When temperature is more than 102°C	Lights up when abnormal	○	△	○	
		Backlight	LED	Amber	When small lamps light up	Lights up when actuated	—	—	○	
6 39	Fuel gauge	Gauge	Movement	Scale: White Background color: Black	EMPTY-FULL	Analog display	—	—	—	
		Caution	LED	Red	When below specified level (amount of fuel remaining in tank is less than 75 ℓ)	Lights up when actuated	—	—	○	
		Backlight	LED	Amber	When small lamps light up	Lights up when actuated	—	—	○	
7	Service meter (normal display items)	Service meter	LED	Display letters: Black Background color: Green	0 - 65535.0h * Displayed on top line of character display	Actuated when engine is running Ratio of movement to time 1:1	—	—		When time exceeds 65535.0h, stops at 65535.0h
	Odometer (normal display items)	Odometer			0 - 999999.9km * Displayed on bottom line of character display	Actuated when traveling	—	—		When distance exceeds 999999.9km, stops at 999999.9km

No	Display item	Display category	Device	Color	Display range/ conditions	Method of display	Related actuation		Immediately after starting switch is turned ON	Remarks
							Central warning lamp	Alarm buzzer		
7	Action code	Action code			When abnormality or failure occurs on machine * Displayed on top and bottom lines of character display	When abnormality or failure occurs on machine, top line shows action code; bottom line displays remedy or nature of failure	—	—	Note	Note: Top line displays "KOMATSU", bottom displays "SYSTEM CHECK"
	Failure code	Failure code			When there is abnormality or failure, press mode switch ">". * Displayed on top and bottom lines of character display	Top line displays failure code (6 digit) and controller that detected problem; bottom line displays system that is abnormal or nature of abnormality	—	—		See Operation & Maintenance Manual for details of failure display
	Other displays	Reverse travel distance meter, filter, oil replacement time reset, telephone No. setting, language selection			Press machine monitor mode selector switch "◇"	Operate machine monitor mode selector switch ">" or "<" to switch screen				See Operation & Maintenance Manual for details of failure display
	Night lighting	Backlight	LED	Green	When small lamps light up	Brightness reduced one level when small lamps light up	—	—	○	
8	Right turn signal	Pilot	LED	Green	When operated	When operated: Lights up When not operated: Goes out	—	—	○	
9	Left turn signal		LED	Green	When operated	When operated: Lights up When not operated: Goes out	—	—	○	
10	High beam		LED	Blue	When operated	When operated: Lights up When not operated: Goes out	—	—	○	
11 (R2)	Gear shift lever position R2		LED	Green	When gear shift lever is at R2	Lights up (*)	—	—	○	* Flashes when neutral safety is actuated
11 (R1)	Gear shift lever position R1		LED	Green	When gear shift lever is at R1	Lights up (*)	—	—	○	* Flashes when neutral safety is actuated
11 (N)	Gear shift lever position N		LED	Orange	When gear shift lever is at N	Lights up	—	—	○	
11 (D)	Gear shift lever position D		LED	Green	When gear shift lever is at D	Lights up (*)	—	—	○	* Flashes when neutral safety is actuated
11 (5)	Gear shift lever position 5		LED	Green	When gear shift lever is at 5	Lights up (*)	—	—	○	* Flashes when neutral safety is actuated
11 (4)	Gear shift lever position 4		LED	Green	When gear shift lever is at 4	Lights up (*)	—	—	○	* Flashes when neutral safety is actuated
11 (3)	Gear shift lever position 3		LED	Green	When gear shift lever is at 3	Lights up (*)	—	—	○	* Flashes when neutral safety is actuated
11 (2)	Gear shift lever position 2		LED	Green	When gear shift lever is at 2	Lights up (*)	—	—	○	* Flashes when neutral safety is actuated
11 (1)	Gear shift lever position 1		LED	Green	When gear shift lever is at 1	Lights up (*)	—	—	○	* Flashes when neutral safety is actuated
12	Shift indicator		LED	Back-ground color: Gray	F1,F2,F3,F4,F5,F6,N, R1,R2 * According to shift range signal received from transmission controller * When alarm is actuated when making emergency escape, "E-" and "N" are displayed in turn	When shift range signal is received from transmission controller	—	—	○ All light up	
	Night lighting		LED	Amber						

No	Display item	Display category	Device	Color	Display range/ conditions	Method of display	Related actuation		Immediately after starting switch is turned ON	Remarks
							Central warning lamp	Alarm buzzer		
13	Lockup	Pilot	LED	Green	When torque converter lockup is actuated and transmission is set to direct drive	When operated: Lights up When not operated: Goes out	—	—	○	
14	Shift hold		LED	Green	When shift hold switch is operated	When operated: Lights up When not operated: Goes out	—	—	○	
15	Output mode (high power mode)		LED	Green	High power mode	High power mode: Lights up When not actuated: Goes out	—	—	○	
16	Output mode (economy mode)		LED	Green	Economy mode	Economy mode: Lights up When not actuated: Goes out	—	—	○	
17	Central warning lamp	Caution	LED	Red	When there is abnormality in system	Lights up when abnormal	○	△	○	
18	Maintenance caution		LED	Red	When warning is issued for maintenance system, or when filter, oil replacement interval has passed	Lights up or flashes	—	—	○	Note 1: Lamp lights up and at same time action code E01 and location for warning is displayed on character display Note 2: See Operation and Maintenance Manual for details of applicable item
19	Battery charge circuit caution		LED	Red	When there is abnormality in charge circuit	Lights up when abnormal	○	△	○	
20	Steering oil temperature caution		LED	Red	When steering oil temperature rises	Lights up when abnormal	○	△	○	
21	Engine oil pressure caution		LED	Red	When engine oil pressure drops	Lights up when abnormal	○	△	○	
22	Brake oil pressure caution		LED	Red	When brake oil pressure drops	Lights up when abnormal	○(Note)	△(Note)	○	Note: Actuated only when alternator R terminal = ON
23	Machine monitor or option system caution		LED	Red	When there is abnormality in machine monitor or option controller system	Lights up when abnormal	△	△	○	Actually only used when failure occurs in machine monitor
24	Engine system caution		LED	Red	When there is abnormality in engine control system	Lights up when abnormal	△	△	○	
25	Transmission system caution		LED	Red	When there is abnormality in transmission control system	Lights up when abnormal	△	△	○	
26	Retarder system caution		LED	Red	When there is abnormality in retarder control system	Lights up when abnormal	△	△	○	
27	Tilt caution		LED	Red	When dump body is raised and there is excessive tilt to left or right	Lights up when abnormal	○	△	○	
28	Seat belt caution		LED	Red	When seat belt is not fastened	When actuated: Lights up When not actuated: Goes out	—	—	○	

No	Display item	Display category	Device	Color	Display range/ conditions	Method of display	Related actuation		Immediately after starting switch is turned ON	Remarks
							Central warning lamp	Alarm buzzer		
29	Parking brake pilot lamp	Pilot		Red	When parking brake is applied	Lights up when applied	○(Note)	△(Note)	○	Note: Actuated when parking brake is applied and gear shift lever is at position other than N
30	Retarder pilot lamp			Orange	When retarder brake is applied	Lights up when applied	—	—	○	
31	Inter-axle differential lock pilot lamp		LED	Orange	Lights up when inter-axle differential lock is operated	When operated: Lights up When not operated: Goes out	—	—	○	
32	Body pilot lamp		LED	Red	For details, see Operation and Maintenance Manual	When operated: Lights up When not operated: Goes out	○(Note)	△(Note)	○	Note: Actuated when gear shift lever is at position other than N
33	Emergency steering pilot lamp		LED	Red	Lights up when emergency steering is actuated	When operated: Lights up When not operated: Goes out	—	—	○	
34	Preheating pilot lamp		LED	Red	Lights up when electric heater for engine preheating is actuated	When operated: Lights up When not operated: Goes out	—	—	○	

Table of signals for each monitor connector

No.	HM series monitor panel				Specification
	CN	PIN	I/O	A/D	
1	CN1	1	—	—	—
2	CN1	2	—	—	—
3	CN1	3	—	—	—
4	CN1	4	—	—	NSW power supply (+24V)
5	CN1	5	—	—	NSW power supply (+24V)
6	CN1	6	—	—	SW power supply (+24V)
7	CN1	7	—	—	SW power supply (+24V)
8	CN1	8	—	—	—
9	CN1	9	—	—	GND
10	CN1	10	—	—	GND
11	CN1	11	O	D	D_OUT_3, (Sync 200mA)
12	CN1	12	O	D	D_OUT_2, (Sync 200mA)
13	CN1	13	O	D	D_OUT_1, (Sync 200mA)
14	CN1	14	O	D	D_OUT_0, (Sync 200mA)
15	CN1	15	—	—	Sensor power output (+24 V, 100 mA)
16	CN1	16	—	—	Sensor power output (+5 V, 100 mA)
17	CN1	17	—	—	GND
18	CN1	18	—	—	GND
19	CN1	19	—	—	GND
20	CN1	20	—	—	GND
21	CN2A	1	I	D	D_IN_0 (+24 V, 5mA, PULL DOWN)
22	CN2A	2	I	D	D_IN_2 (+24 V, 5mA, PULL DOWN)
23	CN2A	3	I	D	D_IN_4 (+24 V, 5mA, PULL DOWN)
24	CN2A	4	I	D	D_IN_6 (+24 V, 5mA, PULL DOWN)
25	CN2A	5	I	D	D_IN_8 (+24 V, 5mA, PULL DOWN)
26	CN2A	6	I	D	D_IN_10 (+24 V, 5mA, PULL DOWN)
27 *1	CN2A	7	I	D	D_IN_12 (NSW+24 V, 5mA, PULL DOWN)
28 *1	CN2A	8	I	D	D_IN_14 (NSW+24 V, 5mA, PULL DOWN)

*1: NSW +24V input port is active even if the setting is made to KEY OFF when power is supplied directly from battery.

Signal and model				Remarks
Signal name	Model name			
	HM300	HM350	HM400	
—	—	—	—	
—	—	—	—	
—	—	—	—	
BAT DIRECT +24V	O	O	O	Directly from battery
BAT DIRECT +24V	O	O	O	Directly from battery
POWER SUPPLY +24V	O	O	O	In-cab power supply
POWER SUPPLY +24V	O	O	O	In-cab power supply
—	—	—	—	(–): NON CONNECT
POWER SUPPLY GND	O	O	O	
POWER SUPPLY GND	O	O	O	
—	—	—	—	
—	—	—	—	
BUZZER	O	O	O	Alarm buzzer
HEAD LIGHT H/L CHANGE	O	O	O	Head lamp Hi/Low change
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
HI BEAM	O	O	O	
AISS SW	O	O	O	
—	—	—	—	
PASSING SW	O	O	O	
CONNECTOR CHECK	O	O	O	Used to detect improper connector connection
PANEL MODE SW2-1	O	O	O	Mode SW2 upper side
RIGHT TURN	O	O	O	
PANEL MODE SW1-1	O	O	O	Mode SW1 upper side

No.	HM series monitor panel				Specification
	CN	PIN	I/O	A/D	
29	CN2A	9	—	—	GND
30	CN2A	10	I	D	D_IN_1 (+24 V, 5mA, PULL DOWN)
31	CN2A	11	I	D	D_IN_3 (+24 V, 5mA, PULL DOWN)
32	CN2A	12	I	D	D_IN_5 (+24 V, 5mA, PULL DOWN)
33	CN2A	13	I	D	D_IN_7 (+24 V, 5mA, PULL DOWN)
34	CN2A	14	I	D	D_IN_9 (+24 V, 5mA, PULL DOWN)
35	CN2A	15	I	D	D_IN_11 (+24 V, 5mA, PULL DOWN)
36 *1	CN2A	16	I	D	D_IN_13 (NSW+24 V, 5mA, PULL DOWN)
37 *1	CN2A	17	I	D	D_IN_15 (NSW+24 V, 5mA, PULL DOWN)
38	CN2A	18	I	A	A_IN_0 (0 – 30 V)
39 *2	CN2B	1	I	D	D_IN_16 (GND, 5mA, PULL UP)
40 *2	CN2B	2	I	D	D_IN_18 (GND, 5mA, PULL UP)
41 *2	CN2B	3	I	D	D_IN_20 (GND, 5mA, PULL UP)
42 *2	CN2B	4	I	D	D_IN_22 (GND, 5mA, PULL UP)
43	CN2B	5	I	D	D_IN_24 (+24 V, 5mA, PULL DOWN)
44	CN2B	6	—	—	GND
45 *2	CN2B	7	I	D	D_IN_17 (GND, 5mA, PULL UP)
46 *2	CN2B	8	I	D	D_IN_19 (GND, 5mA, PULL UP)
47 *2	CN2B	9	I	D	D_IN_21 (GND, 5mA, PULL UP)
48 *2	CN2B	10	I	D	D_IN_23 (GND, 5mA, PULL UP)
49	CN2B	11	I	D	D_IN_25 (+24 V, 5mA, PULL DOWN)
50	CN2B	12	I	A	A_IN_1 (0 – 30 V)
51	CN3A	1	I	D	D_IN_26 (+24 V, 5mA, PULL DOWN)
52	CN3A	2	I	D	D_IN_28 (+24 V, 5mA, PULL DOWN)
53	CN3A	3	I	D	D_IN_30 (+24 V, 5mA, PULL DOWN)

*1: NSW +24V input port is active even if the setting is made to KEY OFF when power is supplied directly from battery.
*2: Setting is made to PULL UP.

Signal and model				Remarks
Signal name	Model name			
	HM300	HM350	HM400	
GND	○	○	○	
—	—	—	—	Accelerator linked retarder switch upper side
—	—	—	—	
FR DIFF LOCK SW	○	○	○	Front and rear differential lock switch
ENGINE MODE SW	○	○	○	
PANEL MODE SW1-2	○	○	○	Mode SW 1 lower side
PANEL MODE SW2-2	○	○	○	Mode SW 2 upper side
LEFT TURN	○	○	○	
—	—	—	—	
—	—	—	—	
—	—	—	—	
AIR CLEANER	○	○	○	Air cleaner clogging
HYD OIL LEVEL	○	○	○	Hydraulic oil level
COOLANT LEVEL	○	○	○	Coolant level
REOSTAT +24 V	○	○	○	Night lighting dimmer switch ON/OFF recognition
SENSOR GND	○	○	○	
RETARD COOLING FILTER	○	○	○	Retarder cooling filter clogging (option)
—	—	—	—	
—	—	—	—	
—	—	—	—	
SEAT BELT	○	○	○	
REOSTAT	○	○	○	Night lighting luminance adjustment
LR DIFF LOCK FOOT SW	○	○	○	Left and right differential lock foot switch
LR DIFF LOCK SW1	○	○	○	Left and right differential lock 3 position switch
LR DIFF LOCK SW2	○	○	○	Left and right differential lock 3 position switch

No.	HM series monitor panel				Specification
	CN	PIN	I/O	A/D	
54 *2	CN3A	4	I	D	D_IN_32 (GND, 5mA, PULL UP)
55 *2	CN3A	5	I	D	D_IN_34 (GND, 5mA, PULL UP)
56 *2	CN3A	6	I	D	D_IN_36 (GND, 5mA, PULL UP)
57 *2	CN3A	7	I	D	D_IN_38 (GND, 5mA, PULL UP)
58	CN3A	8	I	P	P_IN_0 (0.5Vp-p)
59	CN3A	9	—	—	GND
60	CN3A	10	I	D	D_IN_27 (+24 V, 5mA, PULL DOWN)
61	CN3A	11	I	D	D_IN_29 (+24 V, 5mA, PULL DOWN)
62	CN3A	12	I	D	NC
63 *2	CN3A	13	I	D	D_IN_33 (GND, 5mA, PULL UP)
64 *2	CN3A	14	I	D	D_IN_35 (GND, 5mA, PULL UP)
65 *2	CN3A	15	I	D	D_IN_37 (GND, 5mA, PULL UP)
66 *2	CN3A	16	I	D	D_IN_39 (GND, 5mA, PULL UP)
67	CN3A	17	I	P	P_IN_1 (0.5Vp-p)
68	CN3A	18	—	—	NC
69	CN3B	1	I	A	A_IN_2 (Low resistance input)
70	CN3B	2	I	A	A_IN_4 (High resistance input)
71	CN3B	3	I	A	A_IN_6 (Low resistance input)
72	CN3B	4	I	A	A_IN_8 (0 – 5 V)
73	CN3B	5	I	A	A_IN_10 (0 – 5 V)
74	CN3B	6	—	—	SGND
75	CN3B	7	I	A	A_IN_3 (High temperature input)
76	CN3B	8	I	A	A_IN_5 (High temperature input)
77	CN3B	9	I	A	A_IN_7 (0 – 5 V)
78	CN3B	10	I	A	A_IN_9 (0 – 5 V)
79	CN3B	11	—	—	GND
80	CN3B	12	—	—	NC
81	CN4	1	—	—	S_NET (+)
82	CN4	2	—	—	S_NET (+)
83	CN4	3	—	—	CAN (+)

*2: Setting is made to PULL UP.

Signal and model				Remarks
Signal name	Model name			
	HM300	HM350	HM400	
—	—	—	—	
CONNECTOR CHECK 2	O	O	O	NON CONNECT, Used to detect improper connector connection
—	—	—	—	
—	—	—	—	
—	—	—	—	
GND	O	O	O	GND
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
OP7	O	O	O	for service
—	—	—	—	
—	—	—	—	
—	—	—	—	
RETARD OIL TEMP (MIDDLE)	O	O	O	Retarder oil temperature sensor (center)
FUEL LEVEL	O	O	O	Fuel level sensor
—	—	—	—	
—	—	—	—	
ANALOG GND	O	O	O	
RETARD OIL TEMP (FRONT)	O	O	O	Retarder oil temperature sensor (front)
RETARD OIL TEMP (REAR)	—	—	O	Retarder oil temperature sensor (rear)
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
CAN (+)	O	O	O	

No.	HM series monitor panel				Specification
	CN	PIN	I/O	A/D	
84	CN4	4	—	—	S_NET (+)
85	CN4	5	—	—	S_NET (+)
86	CN4	6	—	—	GND
87	CN4	7	—	—	GND
88	CN4	8	—	—	CAN (–)
89	CN4	9	—	—	NC
90	CN4	10	—	—	NC
91	CN4	11	—	—	NC
92	CN4	12	—	—	NC
93	CN5	1	—	—	NC
94	CN5	2	—	—	RS232C_1_RTS
95	CN5	3	—	—	RS232C_1_RD
96	CN5	4	—	—	RS232C_2_RD
97	CN5	5	—	—	RS232C_2_RTS
98	CN5	6	—	—	NC
99	CN5	7	—	—	NC
100	CN5	8	—	—	RS232C_1_CTS
101	CN5	9	—	—	RS232C_1_TX
102	CN5	10	—	—	RS232C_1_SG
103	CN5	11	—	—	RS232C_2_SG
104	CN5	12	—	—	RS232C_2_TX
105	CN5	13	—	—	RS232C_2_CTS
106	CN5	14	—	—	NC
107	CN6	1	—	—	—
108	CN6	2	—	—	—
109	CN6	3	—	—	—
110	CN6	4	—	—	—
111	CN6	5	—	—	—
112	CN6	6	—	—	—
113	CN6	7	—	—	—
114	CN6	8	—	—	—

Signal and model				Remarks
Signal name	Model name			
	HM300	HM350	HM400	
—	—	—	—	
—	—	—	—	
—	—	—	—	
— (CAN SHIELD GND)	—	—	—	
CAN (–)	○	○	○	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	

★ Switch input on monitor panel board

No.	SW	Position	I/O	A/D	Specification
1	SW1	0	I	D	Rotary switch (16 positions)
2	SW1	1	I	D	
3	SW1	2	I	D	
4	SW1	3	I	D	
5	SW1	4	I	D	
6	SW1	5	I	D	
7	SW1	6	I	D	
8	SW1	7	I	D	
9	SW1	8	I	D	
10	SW1	9	I	D	
11	SW1	A	I	D	
12	SW1	B	I	D	
13	SW1	C	I	D	
14	SW1	D	I	D	
15	SW1	E	I	D	
16	SW1	F	I	D	
17	SW2	0	I	D	Rotary switch (16 positions)
18	SW2	1	I	D	
19	SW2	2	I	D	
20	SW2	3	I	D	
21	SW2	4	I	D	
22	SW2	5	I	D	
23	SW2	6	I	D	
24	SW2	7	I	D	
25	SW2	8	I	D	
26	SW2	9	I	D	
27	SW2	A	I	D	
28	SW2	B	I	D	
29	SW2	C	I	D	
30	SW2	D	I	D	
31	SW2	E	I	D	
32	SW2	F	I	D	

Signal name	Model name			Remarks
	HM300	HM350	HM400	
—	—	—	—	Reserved
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	Reserved
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	

No.	SW	Position	I/O	A/D	Specification
33	SW3	0	I	D	Rotary switch (16 positions)
34	SW3	1	I	D	
35	SW3	2	I	D	
36	SW3	3	I	D	
37	SW3	4	I	D	
38	SW3	5	I	D	
39	SW3	6	I	D	
40	SW3	7	I	D	
41	SW3	8	I	D	
42	SW3	9	I	D	
43	SW3	A	I	D	
44	SW3	B	I	D	
45	SW3	C	I	D	
46	SW3	D	I	D	
47	SW3	E	I	D	
48	SW3	F	I	D	
49	SW5	1	I	D	Dip switch (2 positions)
50	SW5	2	I	D	Dip switch (2 positions)
51	SW5	3	I	D	
52	SW5	4	I	D	
53	SW6	1	I	D	
54	SW6	2	I	D	
55	SW6	3	I	D	
56	SW6	4	I	D	

Signal name	Model name			Remarks
	HM300	HM350	HM400	
—	—	—	—	Reserved
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
ON: SI specification OFF: Non-SI specification	○	○	○	Do not the switch setting.
—	—	—	—	Reserved
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	
—	—	—	—	

HM300-2 Articulated dump truck

Form No. SEN00336-01

ARTICULATED DUMP TRUCK

HM300-2

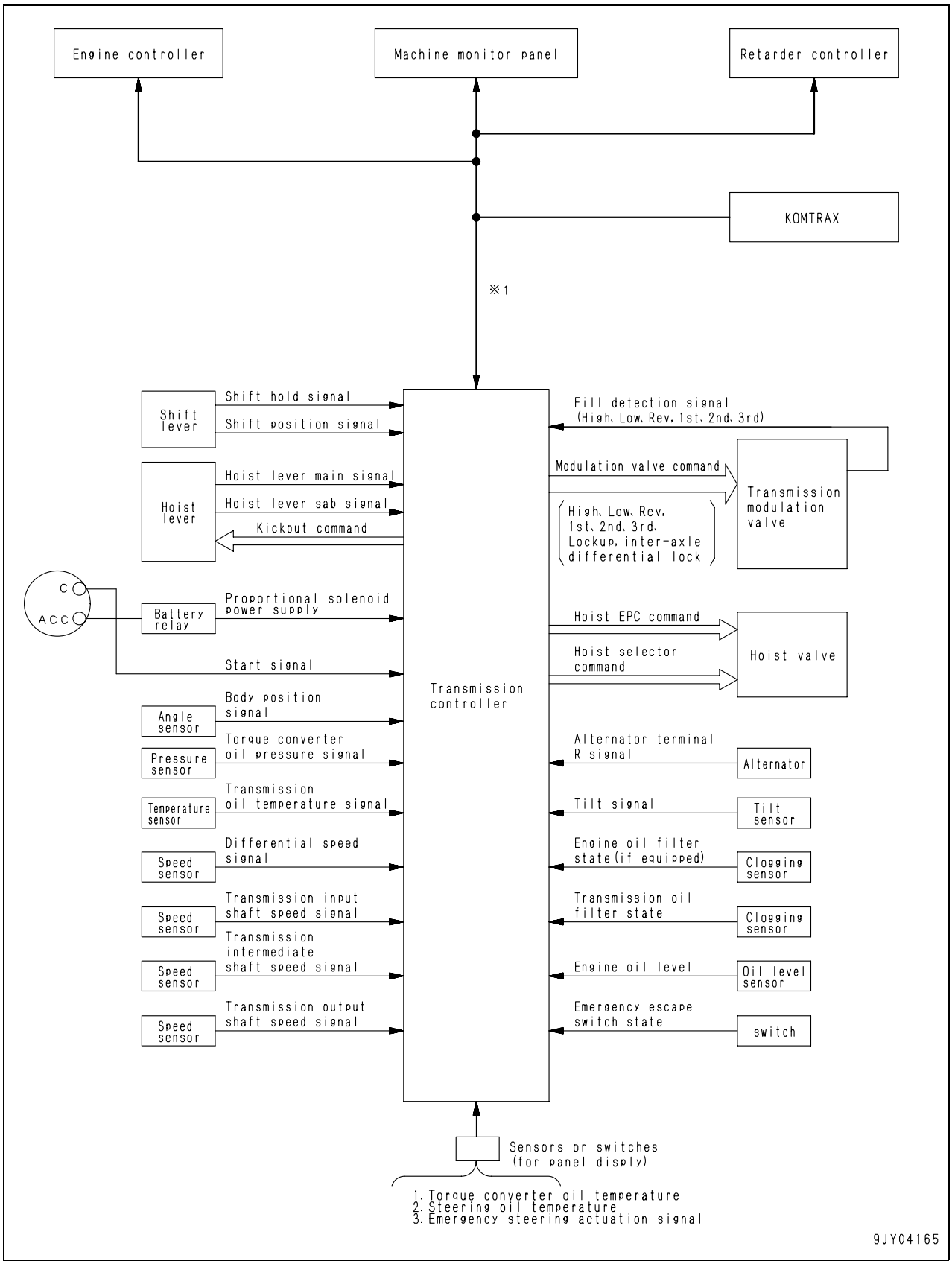
Machine model	Serial number
HM300-2	2001 and up

10 Structure, function and maintenance standard

Electrical system, Part 2

Automatic shift control system

(Transmission control system with all-range electronic modulation)



* For details of the network communication, see the next page.

Outline

- The transmission controller receives the shift position signal for the gear shift lever, the accelerator position signal for the accelerator pedal, the speed signal for the transmission, and the other signals from the switches and sensors. It then automatically controls the transmission and shifts it to the optimum speed range.
- In addition to the shift control, the transmission controller also controls the torque converter lock-up solenoid and operates the brake, the inter-axle differential lock, the hoist, and the others to prevent overrun.
  Each clutch pack of the each transmission clutch and torque converter lock-up clutch is equipped with an electronically controlled modulation valve, and each clutch pack is independently controlled.
  By this operation, the initial pressure, build-up ratio and torque-off time of each clutch are controlled according to the machine condition to reduce the gear shift shock, prevent gear shift hunting and improve the durability of the clutch.
- The hoist EPC valve (proportional solenoid valve) and hoist selector valve (ON/OFF valve) are controlled to operate the body according to the dump control lever position.
- The transmission shift controller uses the signals from the switches and sensors to operate the machine monitor displays and caution and pilot lamps, and transmits these data to the network.

Data items transmitted from transmission controller to network.

RTCDB1 (Machine monitor, retarder controller, and others) (Updated every 10 msec.)

No.	Item
1	Transmission output shaft speed
2	Brake command value (front wheel)
3	Brake command value (rear wheel)

RTCDB1 (special to +83) (Updated every 10 msec.)

No.	Item
1	Throttle correction value
2	Throttle lower limit
3	Throttle upper limit
4	2nd method throttle
5	HSI line / brake point speed
6	Torque curve select
7	ABS reference type
8	Droop switch
9	ABS droop trim

RTCDB2 (Machine monitor, retarder controller, and others) (Updated every 100 msec.)

No.	Item
1	Gear speed
2	Shift lever position
3	Torque converter oil temperature
4	Emergency escape state
5	Overrun alarm command
6	Neutral safety alarm command
7	Lockup operation state
8	Transmission controller option setting abnormality state
9	Transmission controller model setting abnormality state
10	KEY SW C terminal state
11	Alternator R terminal state
12	Emergency steering operation state
13	Accumulator oil pressure drop state (front, rear)
14	Engine speed
15	Engine coolant temperature
16	Float caution command
17	Body seating state
18	Parking brake operation state
19	Retarder brake operation state
20	RCM controller option setting abnormality state
21	RCM controller model setting abnormality state
22	Shift hold state
23	Rear tipping alarm command
24	Inter-axle differential lock operation state
25	Right and left differential lock operation command
26	Engine preheat
27	Body positioner voltage
28	Momentary fuel consumption
29	Input shaft speed
30	Output shaft speed
31	L/U clutch command
32	HL clutch engagement command
33	HL clutch release command
34	SP clutch engagement command
35	SP clutch release command

RTCDB2 (special to engine controller) (Updated every 100 msec.)

No.	Item
1	Automatic warm cancel flag

Data items sent from network to transmission controller

RTCDB1 (Updated every 10 msec.)

No.	Item
1	Engine speed
2	Accelerator position
3	Retarder switch (front) state
4	Retarder switch (rear) state

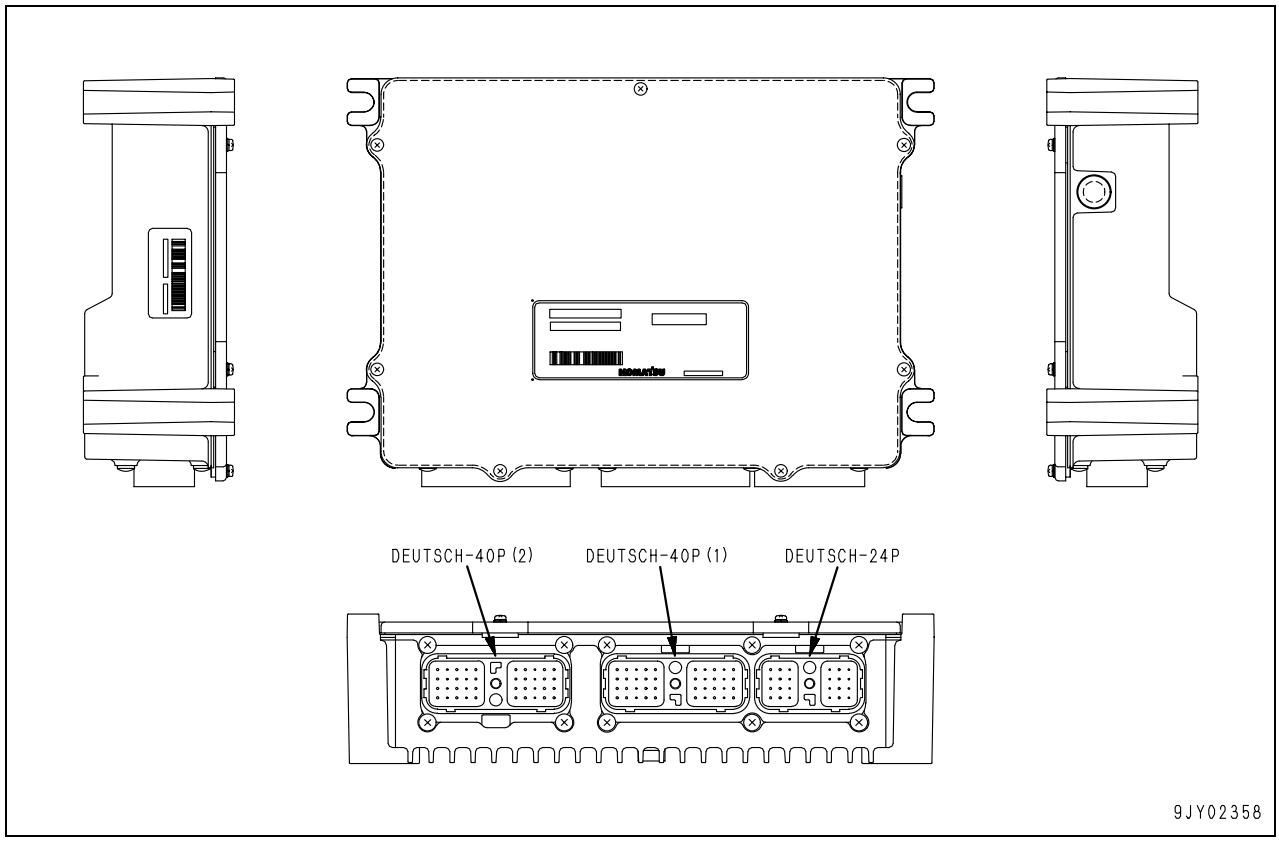
RTCDB2 (Updated every 100 msec.)

No.	Item
1	Service meter
2	Engine mode switch
3	Parking brake state
4	Retarder brake state
5	Brake pedal (service brake) state
6	AISS inhibit switch
7	Engine coolant temperature
8	RCM controller option setting abnormality state
9	RCM controller model setting abnormality state
10	Accumulator oil pressure drop state (front, rear)
11	Inter-axle differential lock switch
12	Accelerator linked retarder switch 1
13	Accelerator linked retarder switch 2
14	Accelerator pedal abnormality flag
15	Right and left differential lock switch 1 (pressed up)
16	Right and left differential lock switch 2 (pressed down)
17	Right and left differential lock foot switch
18	Retarder oil temperature (front)
19	Retarder oil temperature (mid)
20	Retarder oil temperature (rear) * HM 400-2 only

RPC-k (irregularly updated)

No.	Item
1	Model selection information
2	Option selection information [Option item] a. Maximum gear speed setting b. Maximum gear speed setting for the Body-up state c. Accelerator linked retarder provided/not provided d. Maintenance sensor provided/not provided e. Parking brake interlock provided/not provided f. Economy output change function E1/E2

Transmission controller



Outline

- The transmission controller controls the transmission system.
  It has the following features and functions.
  1. The gear shifting patter is set in the power mode or economy mode.
  2. In the braking mode, the brake is used and the gear shifting point is heightened to increase the brake cooling pump speed. Accordingly, the retarder cooling effect is increased and the engine is used as a brake efficiently.
  3. It controls the brake through the retarder controller for the torque converter lockup solenoid valve and overrun prevention.
  4. It controls the inter-axle differential lock solenoid valve.
  5. To reduce the gear shift shocks, the throttle correction command is output to the engine controller to adjust the engine speed during gear shifting operation.
  6. Speed sensors are installed to 3 places of the transmission input shaft, intermediate shaft and output shaft to sense slip of the transmission clutch and protect the transmission when the hydraulic system has a trouble.
  7. It connects to the network and shares various data with other controllers.
  8. It receives the model selection data (what model it is mounted on) through the network.
  9. The self-diagnostic function is installed for each of the input and output systems.
  10. The self-diagnostic function is displayed on the monitor.
  11. If a trouble is detected, its contents are sent to the network.
  12. It uses the machine monitor to display if the failure is still existing.
  13. It provides an escape function for use when there is a failure in the electrical system.

Input and output signals

DEUTSCH-24P [ATC1]

Pin No.	Signal name	Input/output signal
1	Hoist lever potentiometer 2	Input
2	Body position	Input
3	T/M oil temperature	Input
4		—
5		Input
6	Shift lever position N	Input
7	Shift lever position 1	Input
8		Input
9	Torque converter oil temperature	Input
10		—
11		Input
12	Shift hold	Input

Pin No.	Signal name	Input/output signal
13	Machine inclination angle	Input
14	Steering oil temperature	Input
15	Alternator (R) terminal	Input
16	Sensor power supply	Output
17		Input
18	Emergency steering operation 1	Input
19	Torque converter oil pressure	Input
20		Input
21	GND (for sensor)	—
22	Sensor power supply (5V)	Output
23	Memory clear (hoist)	Input
24	Start	Input

DEUTSCH-40P(1) [ATC2]

Pin No.	Signal name	Input/output signal
1		Output
2		Input
3	Engine oil filter condition (if equipped)	Input
4		Input
5	Shift lever position 5	Input
6	Shift lever position 1	Input
7	Emergency escape	Input
8		Output
9		Output
10	T/M output rotation sensor	Input
11		Output
12		—
13	Engine oil level	Input
14		Output
15	Shift lever position D	Input
16	Shift lever position 2	Input
17		Input
18		Output
19		Output
20	T/M intermediate shaft speed	Input

Pin No.	Signal name	Input/output signal
21		Input/output
22	Network Low	Input/output
23		Input/output
24		Input
25	Shift lever position R1	Input
26	Shift lever position 3	Input
27		Input
28		Input
29	GND (for output shaft speed input, differential gear speed)	—
30	T/M output shaft speed	Input
31		—
32	Network High	Input/output
33		Input/output
34		—
35	Shift lever position R2	Input
36	Shift lever position 4	Input
37	T/M oil filter condition	Input
38		Input
39	GND (for input shaft speed input, intermediate shaft speed input)	—
40	T/M input shaft speed	Input

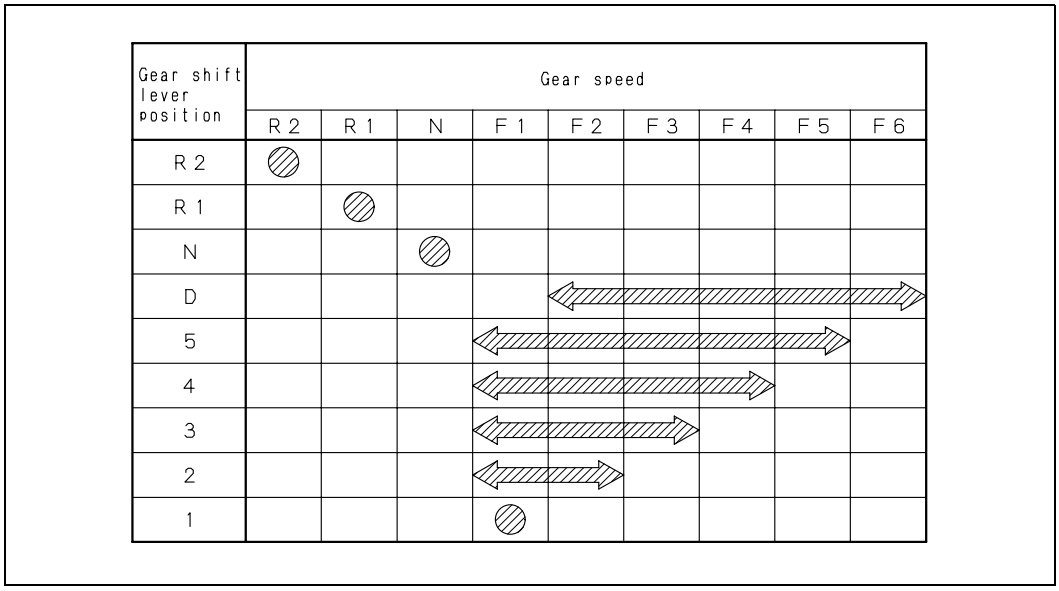
DEUTSCH-40P(2) [ATC3]

Pin No.	Signal name	Input/output signal
1	Power supply 24V	Input
2	Proportional solenoid power supply 24V	Input
3	ECM output Low, 2nd, Hoist, Epc, Kichou (-)	Input
4		Output
5	ECMV 2nd (+)	Output
6	ECMV lockup (+)	Output
7		Output
8	Torque converter oil pressure sensor power supply (24V)	Output
9	Fill switch 2nd	Input
10		Input
11	Power supply 24V	Input
12	Proportional solenoid power supply 24V	Input
13	ECMV output High, 1st, Hoist, Change (-)	Input
14	Key SW ACC	Input
15	ECMV 3rd (+)	Output
16	ECMV Low (+)	Output
17	Hoist selector valve	Output
18		Output
19	Fill switch 3rd	Input
20	Fill switch Low	Input

Pin No.	Signal name	Input/output signal
21	GND	Input
22	Proportional solenoid power voltage 24V	Input
23	ECM Rev, 3 rd, lockup, Inter-axle differential lock (-)	Input
24	Key SW ACC	Input
25	ECMV Rev (+)	Output
26	ECMV High (+)	Output
27		Output
28	Hoist EPC valve	Output
29	Fill switch Rev	Input
30	Fill switch High	Input
31	GND	Input
32	GND	Input
33	GND	Input
34		—
35	ECMV inter-axle differential lock (+)	Output
36	ECMV 1st (+)	Output
37		Output
38	Kick-out solenoid (hoist)	Output
39		Input
40	Fill switch 1st	Input

Gear shift lever position and automatic gearshifting range

- The relationship between each gearshift position and the automatic gearshifting range is as shown in the table below.



Gearshifting characteristics

- Shifting the transmission up and down is carried out according to the shift map saved in the controller memory.
  There are four types of shift map, depending on the condition of the input signals.
  The settings for each mode are as shown in the table below.

Mode	Set conditions
Braking mode	Brake signal ON
Coasting mode	When the following conditions are fulfilled 1. Brake signal OFF 2. Accelerator idle
Power mode	When the following conditions are fulfilled 1. Brake signal OFF 2. Accelerator pedal depressed 3. Power mode selector switch is at power
Economy mode	When the following conditions are fulfilled 1. Brake signal OFF 2. Accelerator pedal depressed 3. Power mode selector switch is at economy

Braking mode:
The shift-down point and the shift-up point are both raised, the engine speed is maintained at a higher level, and the amount of cooling oil for the retarder is ensured to provide greater effect when the engine is used as a brake.

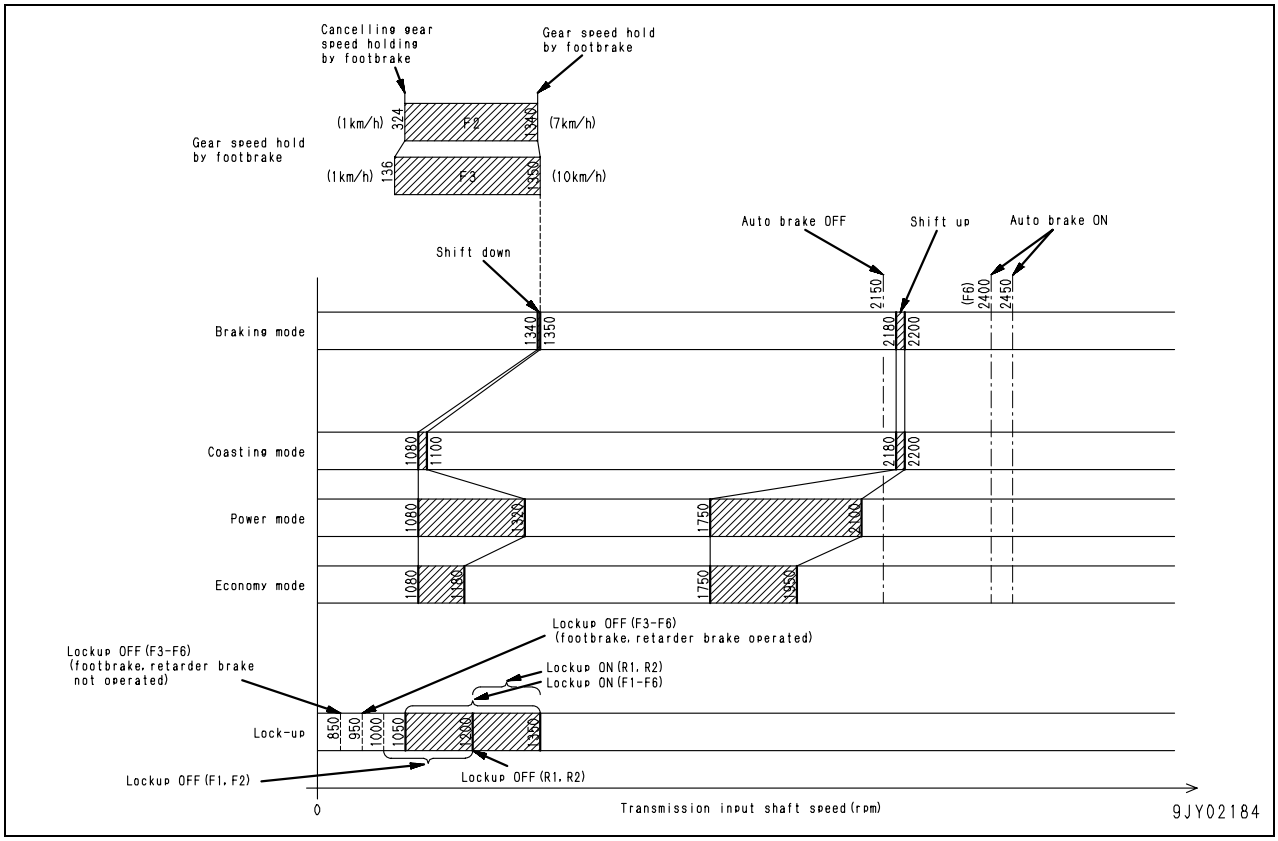
Coasting mode:
The difference between the shift-down point and the shift-up point is increased to reduce the number of unnecessary gear shifting operations.

Power mode:
The power mode uses the power of the machine to the maximum to provide the maximum payload. However, when the machine is unloaded or has only a light load (high acceleration), an acceleration sensitive type variable shifting point is used. This detects the acceleration of the machine and shifts the transmission up sooner to provide better acceleration and to reduce the fuel consumption, noise, and transmission shock.

Economy mode:
When the machine is being used under light load, such as when traveling unloaded or on flat ground, the shift-up point and shift-down point are both lowered, the engine speed is maintained at a lower level, and the fuel consumption, noise, and transmission shock are reduce. In this mode, the maximum engine output is limited.

Automatic gearshifting graph

- The shift-up/shift-down points, the torque converter lock-up ON/OFF points, and the automatic braking (for overrun prevention) ON/OFF points of each mode are as shown in the figure below.



Note:

1. Power mode
- The optimum shift-up point is selected between 2,100 and 1,750 rpm according to the accelerating condition of the machine and gear speed.
- The optimum shift-down point is selected between 1,080 and 1,320 rpm according to the accelerator pedal position and gear speed.

2. Economy mode
- The optimum shift-up point is selected between 1,950 and 1,750rpm according to the accelerating condition of the machine and gear speed.
- The optimum shift-down point is selected between 1,080 and 1,180 rpm according to the accelerator pedal position and gear speed.

3. Braking mode (foot brake)
- If the travel speed lowers below 10 km/h on the 3rd speed or 7 km/h on the 2nd speed while the foot brake is applied, the gear speed at that time (F3, F2) is held.
  Accordingly, if the machine travels downhill with the foot brake applied and the engine speed kept low by the lockup, the brake cooling oil flow becomes insufficient and the engine overheats easily.
- If the travel speed lowers below 1 km/h or the foot brake is not applied or the lockup is kept turned on for a long period, the lockup is turned off and a gear speed proper for the travel speed is selected.

4. Lockup
- The optimum lock-up ON point is selected between 1,050 and 1,350 rpm according to the torque converter inlet speed (engine speed) and outlet speed (transmission input shaft speed).
- The lockup OFF point when traveling in R1 or R2 is 1,200 rpm. The lockup OFF point when traveling F1 or F2 is selected between 1,200 and 1,000 rpm according to the accelerator position. The lockup OFF point when traveling in F3 to F6 with the foot brake or retarder brake applied is 950 rpm, with the foot brake or retarder brake not applied, it is 850 rpm.
- When the machine moves off downhill with the accelerator pedal released, the lockup is not engaged until the accelerator pedal is depressed or the foot brake is applied.

5. The auto brake ON point when traveling in F6 is 2,400 rpm.

Gear shift lever positions and method of shifting

1) Gear shift lever position D

• When shifting up (in power mode)

I) When the gear shift lever is set at position D, the transmission is set to F2 torque converter range.

II) When the accelerator pedal is depressed, the engine speed rises and accelerates. When the transmission input shaft speed reaches 1050 - 1,350 rpm, the lockup clutch is engaged, so the torque converter is directly engaged and the transmission is set to direct travel.

III) As the engine speed rises further and reaches 1,780-2,080 rpm, the transmission shifts up to F3.
While the transmission is shifting up, the engine speed is also lowered (a command is output to the engine controller) in order to reduce the shock when shifting gear.

IV) Immediately after shifting up, the engine speed momentarily goes down, but as the machine accelerates, it rises again and the transmission shifts up to F4 to F6 in the same way as in III) above.

• When shifting down (in power mode)

I) When the load increases and the engine speed drops to 1,080 - 1,320 rpm, the transmission shifts down one speed.
(For example, when traveling in F6, the transmission shifts down to F5.)
While the transmission is shifting down, the engine speed is also raised (a command is output to the engine controller) in order to reduce the shock when shifting gear.

II) As the engine speed goes down further and the transmission shifts down to F2, the torque converter lockup clutch is disengaged and the transmission enters the torque converter drive.

★ The set speed and operating condition in the above explanation are subject to change, depending on the travel condition. For details, see the automatic gear shifting graph.

2) Gear shift lever positions 5, 4, 3, 2, 1
The method of shifting automatically from F1 to F5 (F4, F3, F2) is the same as for "gear shift lever position D" above.

3) Gear shift lever positions R1, R2
These gear shift lever positions are for reverse travel.
The safety functions related to travel in reverse are the directional inhibitor and reverse safety. If the operation is not correct, gearshifting is restricted.

4) Gear shift lever position N
At the neutral position, none of the transmission clutches are actuated.

Shift hold function

• If the hold switch on the gear shift lever is pushed once, the current gear speed is held. If the hold switch is pressed once again or the gear shift lever is operated, the gear speed can be changed. If the travel speed lowers excessively while the gear speed is held, the gear is shifted down. When the travel speed rises again, however, the original gear speed is held.

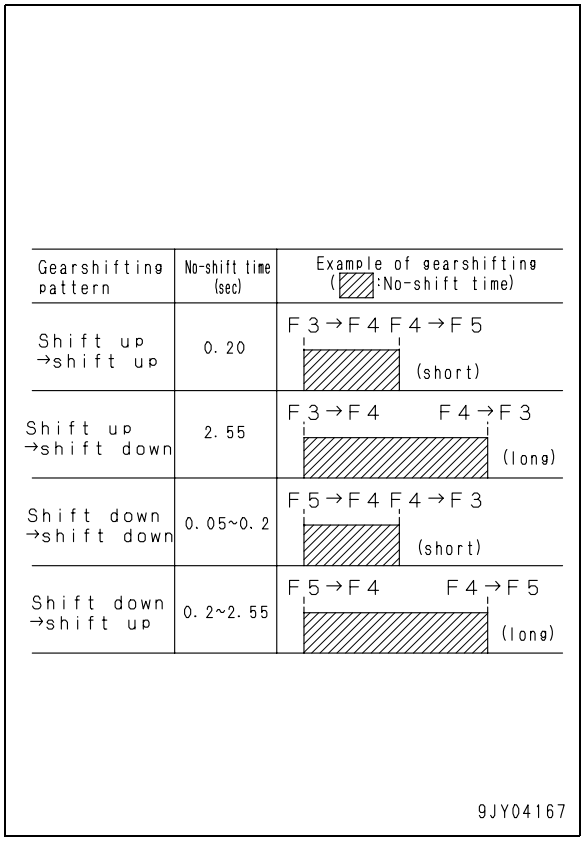
Time when gear cannot be shifted

No-shift time

• In the automatic shift range, no-shift time is secured during each gear shifting operation to prevent a malfunction caused by transient change of the speed at the gear shifting operation. The gear is not shifted in this no-shift time.

• The no-shift time is controlled finely for each gear shift pattern by the all-range electronic modulation system.

The no-shift time for each gear shift pattern is roughly shown below.



Parking brake interlock function (if equipped)
Functional outline
When the parking brake is applied, the transmission is set in neutral, regardless of the gear shift lever position.
This function works only when options are set.

Actuation condition:
Parking brake = ON

Release condition:
1. Parking brake = OFF and the shift lever position = N
2. Parking brake = ON, the engine speed is more than 500 rpm, and the gear shift lever is operated N → D → N → D → N → D → N within five seconds

★ When the transmission needs to be set in a gear speed other than "N" with the parking brake applied for inspection, the parking brake interlock must be released under release condition 2.

Safety functions
1) Down-shift inhibitor function
   If gear shift lever is operated D → 5 - 1, 5 → 4 - 1, 4 → 3 - 1, 3 → 2 -1, 2 → 1
   For example, when traveling in D (F6), even if the gear shift lever is operated to 4, the transmission does not shift directly F6 → F4. It shifts down F6 → F5 → F4 according to the travel speed.
   (Even if the operator makes a mistake in operation of the gear shift lever, the transmission does not skip a gear speed. This is to prevent overrunning of the engine.)
2) Neutral safety function
   This circuit prevents the engine from starting if the gear shift lever is not at the N position, even if the starting switch is turned to the START position.
   (This is a safety circuit to prevent the machine from moving unexpectedly when the engine is started.)
3) Directional inhibit function
   When traveling in reverse at a speed of more than 4.0 km/h, even if the gear shift lever is operated to D or positions 5 to 1, the transmission will not be shifted immediately to travel forward. The engine speed is lowered to reduce the travel speed, and when the travel speed goes below 4.0 km/h, the transmission is shifted to FORWARD.
   (To prevent overload on power train, to improve durability and reliability)

   When traveling forward at a speed of more than 2.0 km/h, even if the gear shift lever is operated to positions R1 or R2, the transmission will not be shifted immediately to travel in reverse. The speed range is shifted to N and the engine speed is lowered to reduce the travel speed. When the travel speed goes below 2.0 km/h, the transmission is shifted to REVERSE.

   When traveling in reverse at a speed of more than 7.6 km/h with the gear shift lever at position R2, even if the gear shift lever is operated from R2 to R1, the transmission does not shift to R1. When the travel speed goes below 2.0 km/h, the transmission is shifted to R1.
   After the travel speed goes below 2.0 km/h, if the gear shift lever is operated again from R2 to R1, the transmission shifts to R1.

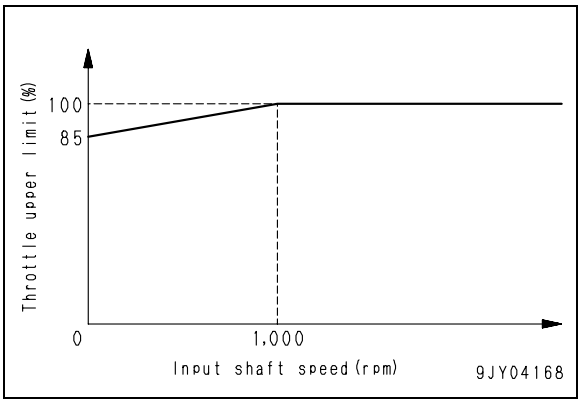
   After the machine is stopped on a slope with the gear shift lever at the N position, if it starts and travels forward or in reverse at a speed of more than 4.0 km/h with the gear shift lever kept at the N position, the transmission is kept at N even if the gear shift lever is set to any position from the N position.
   When the travel speed goes below 4.0 km/h, it is permitted to move the machine off.
   (To prevent overload on power train, to improve durability and reliability)
4) Power train overrun prevention rear brake function
   If the engine speed rises to more than 2,400 rpm (more than 2,350 rpm in F6), the central warning lamp flashes and the alarm buzzer sounds.
   If the engine speed rises to more than 2,450 rpm (more than 2,400 rpm in F6), the retarder brake is automatically actuated.
   (To prevent overrun of engine, torque converter, and transmission, to improve durability and reliability)

5) REVERSE safety
When the dump control lever is at the "RAISE" position and "the body is seated" or when the dump control lever is not in the "FLOAT OUTPUT" position and the body is not seated, the machine does not travel in reverse.
(Turnover prevention function)
However, if the gear shift lever is at the R1 position and the shift hold switch is pressed, it is possible to travel in reverse while the switch being pressed, even if the dump body is not fully lowered.

6) Speed range limit function when dump body is raised
After dumping the load, if the body is not completely lowered, shifting up is limited.
If the gear shift lever is at D, the machine starts in F2. If the former is at positions 5 to 1, the latter starts in F1. The gear is not shifted up until the body is completely lowered.

Self-diagnostic function
- The controller carries out self-diagnosis of the system and displays abnormalities.
- The details of the self-diagnosis are displayed on a monitor.
- If any abnormality is detected by the self-diagnosis function, the abnormality data is transmitted to the network and is displayed as an action code on the machine monitor. The transmission system caution, warning lamp, or alarm buzzer may also be actuated.

Overload prevention traction force limit function
- To prevent overload on power train, there is provided a function to restrict the upper limit of the throttle for each speed ranges "F1" and "R1".
The details are shown in the diagram blow.



Transmission controller list of real-time monitoring display contents

The input and output signal states of the transmission controller can be checked with the real-time monitoring function of the machine monitor.
Real-time monitoring display items related to transmission controller and contents displayed in normal state are as follows.

No.	Item	ID number	Displayed spec.	Data contents
1	Software part number	20201	VERSION	Mass production software part number is output
2	Application version	20223	VERSION (APP)	Software version No. is output (Soft logic part version No.)
3	Data version	20224	VERSION (DATA)	Software version No. is output (Soft data part version No.)
4	Transmission input shaft speed	31200	T/M SPEED:IN	Input shaft speed is output
5	Transmission intermediate shaft speed	31300	T/M SPEED:MID	Intermediate shaft speed is output
6	Transmission output shaft speed	31400	T/M SPEED:OUT	Output shaft speed is output
7	Transmission differential shaft speed	31402	T/M DIFF OUT	Differential shaft speed is output
8	Alternator R	04301	ALTERNATOR R	Alternator R terminal input state (A_IN_0) is output
9	Torque converter oil temperature	30100	T/C OIL TEMP	Torque converter oil temperature (A_IN_1) is output
10	Torque converter oil temperature	30101	T/C OIL TEMP	Torque converter oil temperature (A_IN_1) voltage is output
11	Transmission oil temperature	32500	T/M OIL TEMP	Transmission oil temperature is output

Data range	Remarks
Depending upon software part number	
Depending upon software version No.	
Depending upon software version No.	
x1 [min-1] (0 – 32767 [min-1]) ---- [Other than above]	
x1 [min-1] (0 – 32767 [min-1]) ---- [Other than above]	
x1 [min-1] (0 – 32767 [min-1]) ---- [Other than above]	
x1 [min-1] (0 – 32767 [min-1]) ---- [Other than above]	
0: OFF 1: ON	
x1 [°C] (0 – 150 [°C]) ---- [Other than above]	
x1 [mV] (0.00 – 5.00 [V]) ---- [Other than above] 4.72 V = 0°C 4.33 V = 30°C 3.55 V = 60°C 2.20V = 100°C 1.61 V = 120°C	
x1 [°C] (0 – 150 [°C]) ---- [Other than above]	

No.	Item	ID number	Displayed spec.	Data contents
12	Transmission oil temperature	32501	T/M OIL TEMP	Transmission oil temperature voltage is output
13	Steering oil temperature	32701	STRG OIL TEMP	Steering oil temperature (A_IN_4) is output
14	Steering oil temperature	32702	STRG OIL TEMP	Steering oil temperature (A_IN_4) voltage is output
15	Torque converter oil pressure	32600	T/C OIL PRESS	Torque converter oil pressure (A_IN_3) conversion value is output
16	Torque converter oil pressure	32605	T/C OIL PRESS	Torque converter oil pressure (A_IN_3) of input voltage is output
17	Clutch FILL SW	38921	FILL HLR123	Every each clutch of FILL SW recognition condition of each clutch is output
18	Solenoid output (H)	31600	ECMV H DIR	ECMV output command current to HIGH clutch is output

Data range	Remarks
x1 [mV] (0.00 – 5.00 [V]) ---- [Other than above] 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	
x1 [°C] (0 – 150 [°C]) ---- [Other than above]	
x1 [mV] (0.00 – 5.00 [V]) ---- [Other than above] 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	
x1 [MPa] (0.00 – 5.00 [MPa]) ---- [Other than above]	
x1 [mV] (0.00 – 5.00 [V]) ---- [Other than above]	
Corresponding data is displayed by [1 (ON), 0 (OFF)] just under HLR123. Example 010100: When in F1 001010: When in R2 000000: When in N 100010: When in F4	H: H Fill SW recognition [1:ON, 0:OFF] L: L Fill SW recognition [1:ON, 0:OFF] R: R Fill SW recognition [1:ON, 0:OFF] 1: One Fill SW recognition [1:ON, 0:OFF] 2: Two Fill SW recognition [1:ON, 0:OFF] 3: Three Fill SW recognition [1:ON, 0:OFF]
x1 [mA] (0 – 1000 [mA]) ---- [Other than above]	

No.	Item	ID number	Displayed spec.	Data contents
19	Solenoid output (L)	31601	ECMV L DIR	ECMV output command current to LOW clutch is output
20	Solenoid output (1st)	31602	ECMV 1 DIR	ECMV output command current to 1st clutch is output
21	Solenoid output (2nd)	31603	ECMV 2 DIR	ECMV output command current to 2nd clutch is output
22	Solenoid output (3rd)	31604	ECMV 3 DIR	ECMV output command current to 3rd clutch is output
23	Solenoid output (R)	31606	ECMV R DIR	ECMV output command current to REV clutch is output
24	Solenoid output (L/U)	31609	ECMV LU DIR	ECMV output command current to L/U clutch is output
25	Solenoid output (DIFF)	31607	ECMV D DIR	ECMV output command current to differential is output
26	Angle sensor	32900	ANGLE SENSOR	Angle sensor input (A_IN_8) angle conversion value is output
27	Angle sensor	32902	ANGLE SENSOR	Angle sensor input (A_IN_8) voltage is output
28	Brake output (front wheel) command value	33807	BK OUTP DIR F	
29	Brake output (Rear wheel) command value	33808	BK OUTP DIR R	
30	Throttle modified value	36000	THROTTLE MOD	Throttle modified value to be sent to engine controller is output
31	Body positioner	34603	BODY POSITION	A_IN_6

Data range	Remarks
x1 [mA] (0 – 1000 [mA]) ---- [Other than above]	
x1 [mA] (0 – 1000 [mA]) ---- [Other than above]	
x1 [mA] (0 – 1000 [mA]) ---- [Other than above]	
x1 [mA] (0 – 1000 [mA]) ---- [Other than above]	
x1 [mA] (0 – 1000 [mA]) ---- [Other than above]	
x1 [mA] (0 – 1000 [mA]) ---- [Other than above]	
x1 [mA] (0 – 1000 [mA]) ---- [Other than above]	
x1 [°] (-25.0 – +25.0 [°]) ---- [Other than above]	
x1 [mV] (0.00 – 5.00 [V]) ---- [Other than above]	
x1 [%] (0 – +100.0 [%]) ---- [Other than above]	
x1 [%] (0 – +100.0 [%]) ---- [Other than above]	
x1 [%] (-100.0 – +100.0 [%]) ---- [Other than above]	
x1 [mV] (0.00 – 5.00 [V]) ---- [Other than above] Seating condition: 0.32 V – 0.64 V (When shipped from factory 0.52 V)	

No.	Item	ID number	Displayed spec.	Data contents
32	Dump lever (hoist lever) potentiometer 1	34506	DUMP LEVER 1	A_IN9
33	Dump lever (hoist lever) potentiometer 2	34507	DUMP LEVER 2	A_IN10
34	Body seating	34600	BODY SEATING	Body seating condition is output
35	Seating control command γ (Hi)	45100	S CNT DIR H	
36	Seating control command γ (Lo)	45101	S CNT DIR L	
37	Seating condition calibration value (α)	45200	S CAL A	
38	Cylinder stopper calibration value (β)	45300	S CAL B	
39	Seating control time (Hi)	45400	S CNT TIME H	
40	Hoist EPC output	45601	HOIST EPC DIR	SOL_OUT4
41	Seating control time (Lo)	45401	S CNT TIME L	

Data range	Remarks
x1 [mV] (0.00 – 5.00 [V]) Lower: 0.3 V – 1.57 V Float: 1.47 V – 2.01 V Adjustment mode: 1.91 V – 2.30 V Hold: 2.29 V – 3.30 V Raise: 2.60 V – 3.50 V Raise END: 3.40 V – 4.70 V ---- [Other than above]	
x1 [mV] (0.00 – 5.00 [V]) Lower: 4.7 V – 3.43 V Float: 3.53 V – 2.99 V Adjustment mode: 3.09 V – 2.70 V Hold: 2.71 V – 1.70 V Raise: 2.40 V – 1.50 V Raise END: 1.60 V – 0.30 V ---- [Other than above]	
0: Other than seating 1: Seating	
x1 [mA] (0 – 1000 [mA]) ---- [Other than above]	
x1 [mA] (0 – 1000 [mA]) ---- [Other than above]	
x1 [mV] (0.00 – 5.00 [V]) ---- [Other than above]	
x1 [mV] (0.00 – 5.00 [V]) ---- [Other than above]	
x1 [s] (0.0 – 10.00 [s]) ---- [Other than above]	
x1 [mA] (0 – 1000 [mA]) ---- [Other than above]	
x1 [s] (0.0 – 10.00 [s]) ---- [Other than above]	

No.	Item	ID number	Displayed spec.	Data contents
42	Low clutch trigger modification value	38900	TRIGGER MOD L	Low clutch trigger modification value is output (all oil temperature mode)
43	High clutch trigger modification value	38901	TRIGGER MOD H	High clutch trigger modification value is output (all oil temperature mode)

Data range	Remarks
Hexadecimal numbers show below Display of 8 characters AABBCCDD AA: Low temperature correction value [x10 msec] BB: Medium temperature correction value [x10 msec] CC: Normal temperature correction value [x10 msec] DD: High temperature correction value [x10 msec] 00000000 – FFFFFFFF [00000000 – FFFFFFFF] (Each range: -1.28 (80) – +1.27 (7F) [sec]) 7F=127 (MAX) 01=1 00=0 FF=-1 FE=-2 80=-128 (MIN)	
Hexadecimal numbers show below Display of 8 characters AABBCCDD AA: Low temperature correction value [x10 msec] BB: Medium temperature correction value [x10 msec] CC: Normal temperature correction value [x10 msec] DD: High temperature correction value [x10 msec] 00000000 – FFFFFFFF [00000000 – FFFFFFFF] (Each range: -1.28 (80) – +1.27 (7F) [sec]) 7F=127 (MAX) 01=1 00=0 FF=-1 FE=-2 80=-128 (MIN)	

No.	Item	ID number	Displayed spec.	Data contents
44	1st clutch trigger modification value	38902	TRIGGER MOD 1	1st clutch trigger modification value is output (all oil temperature mode)
45	2nd clutch trigger modification value	38903	TRIGGER MOD 2	2nd clutch trigger modification value (all oil temperature mode)

Data range	Remarks
Hexadecimal numbers show below Display of 8 characters AABBCCDD AA: Low temperature correction value [x10 msec] BB: Medium temperature correction value [x10 msec] CC: Normal temperature correction value [x10 msec] DD: High temperature correction value [x10 msec] 00000000 – FFFFFFFF [00000000 – FFFFFFFF] (Each range: -1.28 (80) – +1.27 (7F) [sec]) 7F=127 (MAX) 01=1 00=0 FF=-1 FE=-2 80=-128 (MIN)	
Hexadecimal numbers show below Display of 8 characters AABBCCDD AA: Low temperature correction value [x10 msec] BB: Medium temperature correction value [x10 msec] CC: Normal temperature correction value [x10 msec] DD: High temperature correction value [x10 msec] 00000000 – FFFFFFFF [00000000 – FFFFFFFF] (Each range: -1.28 (80) – +1.27 (7F) [sec]) 7F=127 (MAX) 01=1 00=0 FF=-1 FE=-2 80=-128 (MIN)	

No.	Item	ID number	Displayed spec.	Data contents
46	3rd clutch trigger modification value	38904	TRIGGER MOD 3	3rd clutch trigger modification value (all oil temperature mode)
47	Reverse clutch trigger modification value	38906	TRIGGER MOD R	Reverse clutch trigger modification value (all oil temperature mode)

Data range	Remarks
Hexadecimal numbers show below Display of 8 characters AABBCCDD AA: Low temperature correction value [x10 msec] BB: Medium temperature correction value [x10 msec] CC: Normal temperature correction value [x10 msec] DD: High temperature correction value [x10 msec] 00000000 – FFFFFFFF [00000000 – FFFFFFFF] (Each range: -1.28 (80) – +1.27 (7F) [sec]) 7F=127 (MAX) 01=1 00=0 FF=-1 FE=-2 80=-128 (MIN)	
Hexadecimal numbers show below Display of 8 characters AABBCCDD AA: Low temperature correction value [x10 msec] BB: Medium temperature correction value [x10 msec] CC: Normal temperature correction value [x10 msec] DD: High temperature correction value [x10 msec] 00000000 – FFFFFFFF [00000000 – FFFFFFFF] (Each range: -1.28 (80) – +1.27 (7F) [sec]) 7F=127 (MAX) 01=1 00=0 FF=-1 FE=-2 80=-128 (MIN)	

No.	Item	ID number	Displayed spec.	Data contents
48	Trigger initial learning flag	38922	TRIG HLR123	Trigger time initial learning flag state for each clutch is output [H, L, R, 1, 2, 3] 8 characters are displayed in following order [HLR123] H: H flag [1:ON, 0:OFF] L: L flag [1:ON, 0:OFF] R: R flag [1:ON, 0:OFF] 1: One flag [1:ON, 0:OFF] 2: Two flag [1:ON, 0:OFF] 3: Three flag [1:ON, 0:OFF]
49	Fill time (L)	41800	FILL TIME L	Low clutch fill time is output (Last gear shifting condition) x10 [msec] (0 – 2.55 [sec], No fill :0)
50	Fill time (H)	41801	FILL TIME H	HIGH clutch fill time is output (Last gear shifting condition) x10 [msec] (0 – 2.55 [sec], No fill :0)
51	Fill time (1)	41802	FILL TIME 1	1st clutch fill time is output (Last gear shifting condition) x10 [msec] (0 – 2.55 [sec], No fill :0)
52	Fill time (2)	41803	FILL TIME 2	2nd clutch fill time is output (Last gear shifting condition) x10 [msec] (0 – 2.55 [sec], No fill :0)
53	Fill time (3)	41804	FILL TIME 3	3rd clutch fill time is output (Last gear shifting condition) x10 [msec] (0 – 2.55 [sec], No fill :0)
54	Fill time (R)	41806	FILL TIME R	REV clutch fill time is output (Last gear shifting condition) x10 [msec] (0 – 2.55 [sec], No fill :0)
55	Throttle lower limit output	44201	THROT LIMIT LO	Throttle lower limit to be sent to engine controller is output x0.1 [%] (0 – +100.0 [%])
56	Throttle higher limit output	44200	THROT LIMIT HI	Throttle upper limit to be sent to engine controller is output x0.1 [%] (0 – +100.0 [%])

Data range	Remarks
Corresponding clutch learning flag ON/OFF state is displayed by [1 or 0] just below HLR123. HLR123 1111111 (All clutches have been learned) HLR123 0000000 (No clutch has been learned)	
x10 [msec] (0 – 2550 [msec]) ---- [Other than above]	
x10 [msec] (0 – 2550 [msec]) ---- [Other than above]	
x10 [msec] (0 – 2550 [msec]) ---- [Other than above]	
x10 [msec] (0 – 2550 [msec]) ---- [Other than above]	
x10 [msec] (0 – 2550 [msec]) ---- [Other than above]	
x10 [msec] (0 – 2550 [msec]) ---- [Other than above]	
x0.1 [%] (0 – +100.0 [%]) ---- [Other than above]	
x0.1 [%] (0 – +100.0 [%]) ---- [Other than above]	

No.	Item	ID number	Displayed spec.	Data contents
57	Input signal D_IN_0-7	40905	D-IN--0------7	Input signal condition is output
58	Input signal D_IN_8-15	40906	D-IN--8-----15	Input signal condition is output
59	Input signal D_IN_16-23	40907	D-IN-16-----23	Input signal condition is output

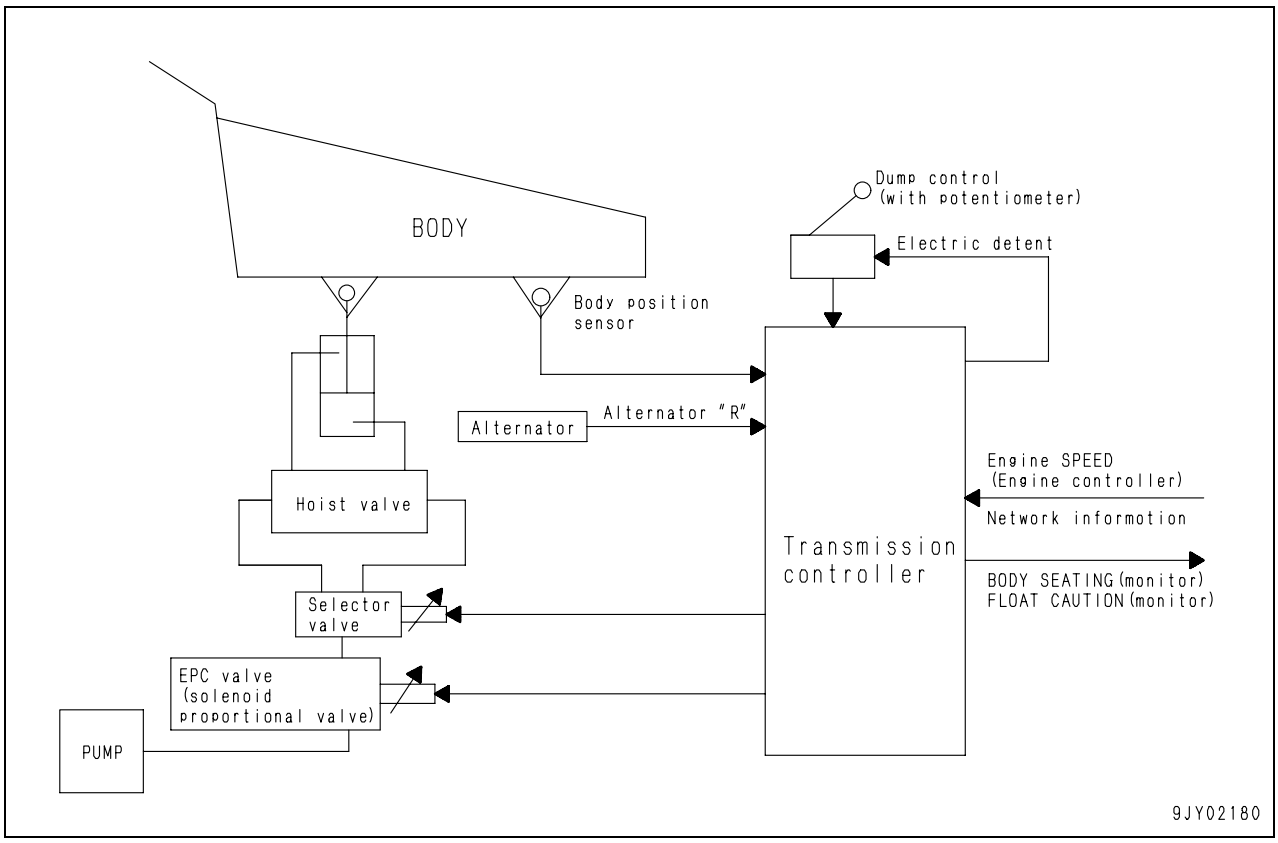
Data range	Remarks
0***: Emergency steering not operated (HM400) Always0 (HM300, HM350) **1*****: Emergency steering operated (HM400) ****1***: Cranking *****0**: Emergency steering not operated *****1**: Emergency steering operated ******0*: Shift hold SW=OFF ******1*: Shift hold SW=ON *******1: Shift lever N	D_IN_2: Emergency steering relay 2 (HM400 only) D_IN_4: C terminal signal D_IN_5: Emergency steering relay 1 D_IN_6: Shift hold SW D_IN_7: Shift lever N
*1******: L fill **1*****: H fill ***1****: 1ST fill ****1***: 2nd fill *****1**: 3rd fill ******1*: R fill Example 01010000: When in F1 00001010: When in R2 00000000: When in N 00100100: When in F6	D_IN_9: Fill signal L D_IN_10: Fill signal H D_IN_11: Fill signal 1st D_IN_12: Fill signal 2nd D_IN_13: Fill signal 3rd D_IN_14: Fill signal R
10000000: Shift lever R2 01000000: Shift lever R1 00100000: Shift lever D 00010000: Shift lever 5 00001000: Shift lever 4 00000100: Shift lever 3 00000010: Shift lever 2 00000001: Shift lever 1	D_IN_16: Shift range R2 D_IN_17: Shift range R1 D_IN_18: Shift range D D_IN_19: Shift range 5 D_IN_20: Shift range 4 D_IN_21: Shift range 3 D_IN_22: Shift range 2 D_IN_23: Shift range 1

No.	Item	ID number	Displayed spec.	Data contents
60	Input signal D_IN_24-31	40908	D-IN-24-----31	Input signal condition is output
61	Input signal D_IN_32	40942	D-IN-32	Input signal condition is output
62	Output signal D_OUT_0-7	40949	D-OUT-0------7	ON/OFF output state of SOL_OUT_0 - 7. When power supply output is set, 0 is displayed.
63	Output signal D_OUT_8-15	40950	D-OUT-8-----15	Corresponds to SOL_OUT_8, 9, 10A, 10B, 11A, 11B, SIG_OUT_0 and SIG_OUT1. When power supply output is set, 0 is displayed.
64	Output signal D_OUT_16-23	40951	D-OUT-16----23	Corresponds to SIG_OUT_2, 3, HSW_OUT_0, 1, BATT_RY_OUT. When power supply output is set, 0 is displayed.

Data range	Remarks
0*******: TM oil filter clogging ****0***: Dropped engine oil level *****0**: Engine oil filter clogging	D_IN_24: TM filter SW D_IN_27: Emergency escape SW D_IN_28: Engine oil level D_IN_29: Engine oil filter SW
*	Not used
*1**0*00: Hoist selector valve ON ****0100: Hoist lever kick-out ON	D_OUT_1: Hoist selector valve D_OUT_5: Hoist lever kick-out solenoid
*	Not used
*	Not used

Hoist control function

Hoist control system diagram



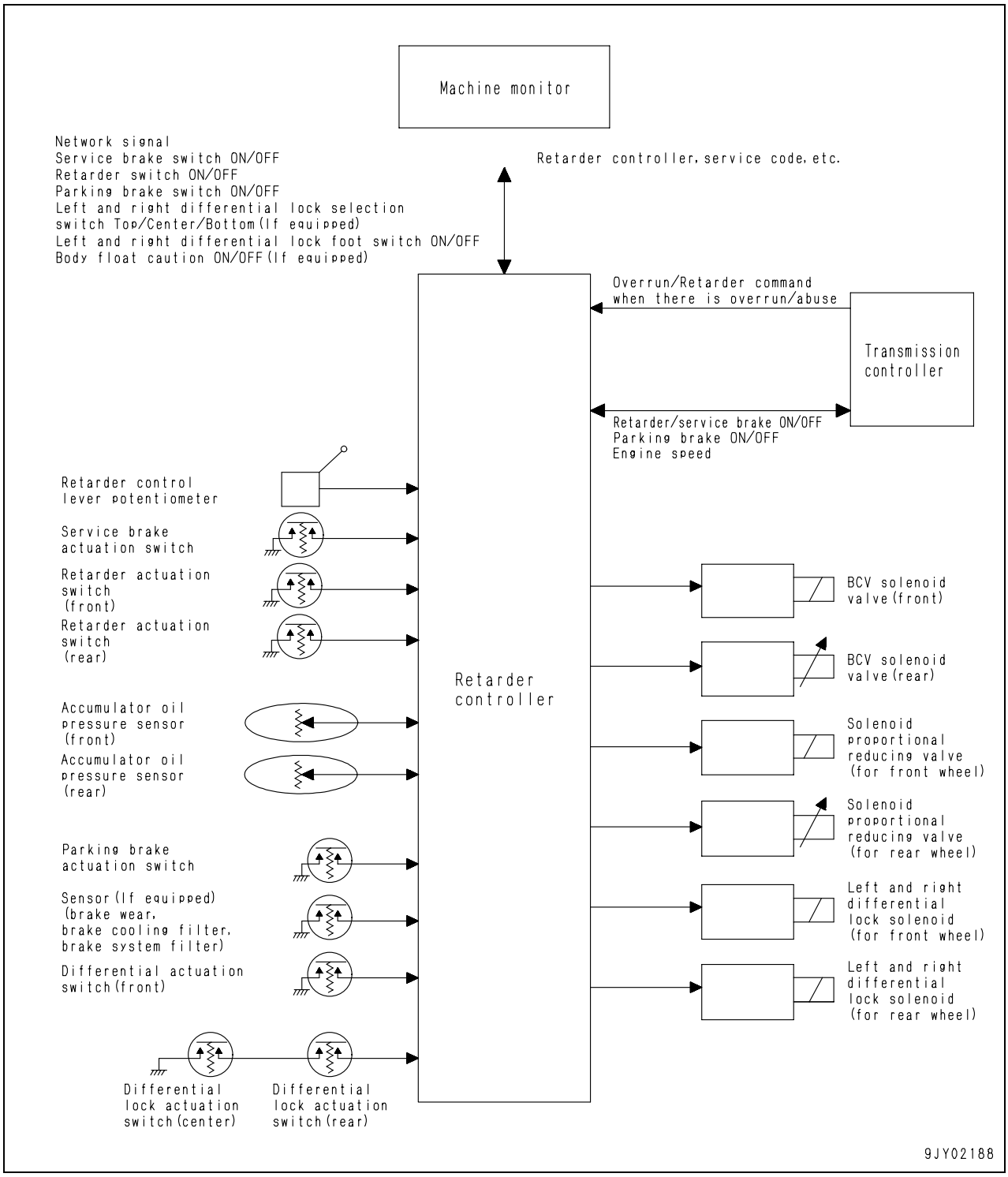
1. Hoist control function
   When the engine is running, the EPC valve (solenoid proportional valve) and selector valve are controlled according to the operation of the dump control lever and operate the dump body.
2. Lever positioner function
   The dump control lever has four positions: RAISE, HOLD, FLOAT, and LOWER.
   If the dump control lever is operated to the RAISE position, the dump body is raised, and when the top of the dump body reaches the set position of the body position sensor, the lever is returned to the HOLD position.
3. Body seating speed control
   When the dump body is lowered and reaches the position just before it is seated, the area of opening of the EPC valve is throttled to control the lowering speed of the dump body and reduce the shock when the dump body comes into contact with the chassis.
4. Control when starting switch is turned to ON, OFF, or START
   Starting switch at ON:
   The output is set to HOLD, regardless of the position of the lever.
   If the engine is not started, even if the hoist lever is operated, the condition remains at HOLD.
   Starting switch at OFF:
   The hoist valve is closed and the dump body is held in position regardless of the position of the lever.
   Engine started:
   Immediately after the engine is started, the output is set to HOLD, regardless of the position of the lever. After the lever is moved to the HOLD position, it becomes possible to carry out normal operations.
5. Float caution function
   In the case of "NOT FLOAT OUTPUT" or "NOT SEATED", the float caution lamp on the monitor panel lights up.
   "FLOAT OUTPUT" and "SEATED" → Float caution OFF
   "NO FLOAT OUTPUT" or "NOT SEATED" → Float caution ON

6. Reverse inhibit function
   Information on permission and prohibition of reverse travel is judged.
   "NOT RAISE" and "SEATED" or "FLOAT OUTPUT" and "NOT SEATED" → Reverse travel is permitted.
   "RAISE" and "SEATED" or "NOT FLOAT OUTPUT" and "NOT SEATED" → Reverse travel is prohibited.
   Or "RAISE" and "SEATED"

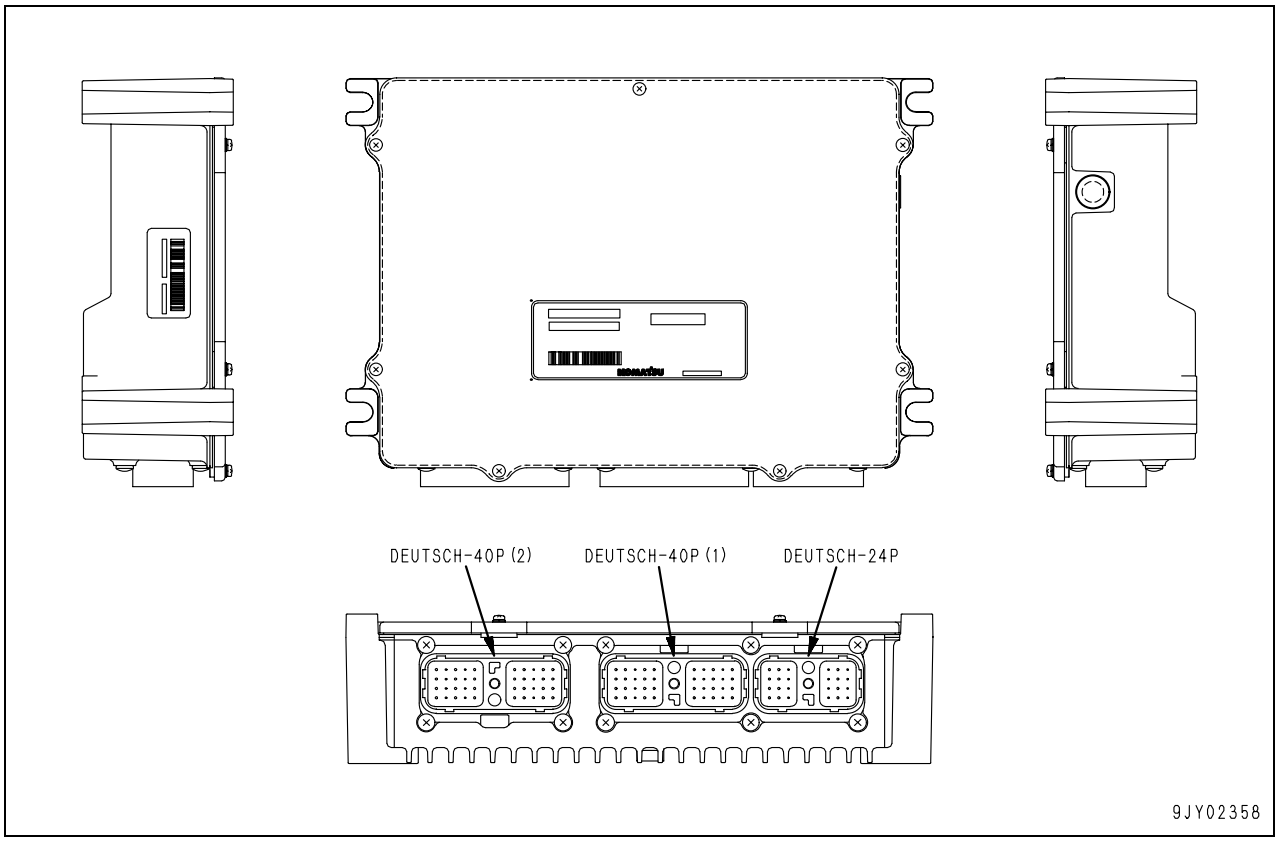
7. Calibration function
   To absorb any inherent error in the dump body potentiometer, calibration is carried out to recognize the dump body seating and the body cylinder stopper condition.

   After adjusting the installation of the body potentiometer or after replacing the transmission controller, carry out calibration in the following order.
   Order of dump control calibration (hydraulic oil temperature: 80 - 90°C)
   (1) Lower the dump body completely and run the engine. Change the lever from HOLD to FLOAT and check the float caution lamp goes off.
   (2) Operate the lever to the RAISE position and raise the dump body until it contacts the stopper. Keep the lever at the RAISE position with the cylinder at the stopper position for at least 5 seconds.
   (3) Lower the dump body completely and keep the lever at HOLD for at least 5 seconds.
   (4) Run the engine at low idle and operate RAISE → FLOAT with the dump body raised to the maximum height, then lower the dump body completely. Repeat this operation 10 times.
   (5) Run the engine at high idle and operate RAISE → FLOAT with the dump body raised to the maximum height, then lower the dump body completely. Repeat this operation 10 times.

Retarder control system



Retarder controller



Outline

The retarder controller has the following functions.

1. Retarder control
   The solenoid proportional valve for the front and rear wheels is controlled according to the operating angle of the retarder control lever and actuates the retarder brake.

2. Overrun prevention, retarder control when there is transmission abuse
   The solenoid proportional valve for the front and rear wheels is controlled based on the command (Analog command) from the transmission controller and actuates the retarder brake by a fixed amount.

3. Left and right differential lock control
   The left and right differential lock is actuated when the low speed range (F1, F2, F3, R1, R2) is selected based on the setting of the left and right differential lock selector switch, and the differential lock foot switch is ON.

4. BCV (brake cooling valve) control
   The BCV control transmits a command to the BCV valve to lower the cooling flow and reduce horse power loss when service brake and retarder brake are not actuated.

5. Transmission of network data
   1) Retarder actuation, parking brake actuation, accumulator oil pressure drop warning, and other data are transmitted to the monitor panel.
   2) The overrun prevention, retarder command when there is abuse, and other data sent from the transmission controller are received.

Input and output signals

DEUTSCH-24P [BRC1]

Pin No.	Signal name	Input/output signal
1	Accumulator oil pressure (rear)	Input
2		Input
3		Input
4	GND(SIG)	—
5	Retarder switch (rear)	Input
6		Input
7	Accumulator oil pressure (front)	Input
8		Input
9		Input
10	GND(SIG)	—
11	Retarder switch (front)	Input
12		Input

Pin No.	Signal name	Input/output signal
13		Input
14	Retarder lever	Input
15	Alternator (R) terminal	Input
16	SENS PWR	Output
17	Service brake oil pressure switch	Input
18	Validation switch 2	Input
19		Input
20		Input
21	GND (Analog)	—
22	POT PWR	Output
23		Input
24	Validation switch 1	Input

DEUTSCH-40P(1) [BRC2]

Pin No.	Signal name	Input/output signal
1		Output
2		Input
3		Input
4	232C R x D	Input
5		Input
6		Input
7		Input
8		Output
9		Output
10		Input
11		Output
12	CAN_SH	—
13		Input
14	232C T x D	Output
15		Input
16		Input
17	Memory clear switch	Input
18		Output
19		Output
20		Input

Pin No.	Signal name	Input/output signal
21	S-NET	Input/output
22	CAN0_L	Input/output
23	CAN1_L	Input/output
24	FWE switch	Input
25		Input
26		Input
27		Input
28		Input
29	GND (pulse)	—
30		Input
31	GND (S_NET GND)	—
32	CAN0_H	Input/output
33	CAN1_H	Input/output
34	GND (232C GND)	—
35	Key switch C (engine start)	Input
36		Input
37		Input
38		Input
39	GND (pulse)	—
40		Input

DEUTSCH-40P(2) [BRC3]

Pin No.	Signal name	Input/output signal
1	VB (controller PWR)	Input
2	VIS (solenoid PWR)	Input
3	SOL_COM (solenoid common GND)	Input
4		Output
5		Output
6	Retarder valve (front)	Output
7	Differential solenoid (front)	Output
8		Output
9	Parking brake pressure switch	Input
10	Differential pressure switch (front)	Input
11	VB (controller PWR)	Input
12	VIS (solenoid PWR)	Input
13	SOL_COM (solenoid common GND)	Input
14	Key SIG	Input
15		Output
16	Retarder valve (rear)	Output
17	Differential solenoid (rear)	Output
18		Output
19		Input
20	Differential pressure switch (rear)	Input

Pin No.	Signal name	Input/output signal
21	GND (controller GND)	Input
22	VIS (solenoid PWR)	Input
23	SOL_COM (solenoid common GND)	Input
24	Key SIG	Input
25		Output
26		Output
27	Brake cooling valve (front)	Output
28		Output
29		Input
30		Input
31	GND (controller GND)	Input
32	GND (controller GND)	Input
33	GND (controller GND)	Input
34	Reservoir	—
35		Output
36		Output
37	Brake cooling valve (center)	Output
38		Output
39		Input
40		Input

Retarder controller list of real-time monitoring display contens

The input and output signal states of the retarder controller can be checked with the real-time monitoring function of the machine monitor.
Real-time monitoring display items related to retarder controller and contents displayed in normal state are as follows.

No.	Item	ID number	Displayed spec.	Data contents
1	Part No. of software	20214	VERSION	Mass production software part number is output
2	Application version	20231	VERSION (APP)	Software version No. is output (soft logic part version No.)
3	Data version	20232	VERSION (DATA)	Software version No. is output (soft data part version No.)
4	Alternator R	4302	ALTERNATOR R	Alternator R terminal input state (A_IN_0) is output
5	Accumulator oil pressure (front)	35500	ACC OIL PRE F	Front accumulator oil pressure (A_IN_9) conversion value is output
6	Accumulator oil pressure (front)	35506	ACC OIL PRE F	Front accumulator oil pressure (A_IN_9) voltage is output
7	Accumulator oil pressure (rear)	35501	ACC OIL PRE R	Rear accumulator oil pressure (A_IN_9) conversion value is output
8	Accumulator oil pressure (rear)	35507	ACC OIL PRE R	Rear accumulator oil pressure (A_IN_9) voltage is output
9	Brake output (front wheel)	33807	BK OUTP DIR F	SOL_OUT6
10	Brake output (rear wheel)	33806	BK OUTP DIR R	SOL_OUT7
11	Retard lever	33900	RETARD LEVER	A_IN_4

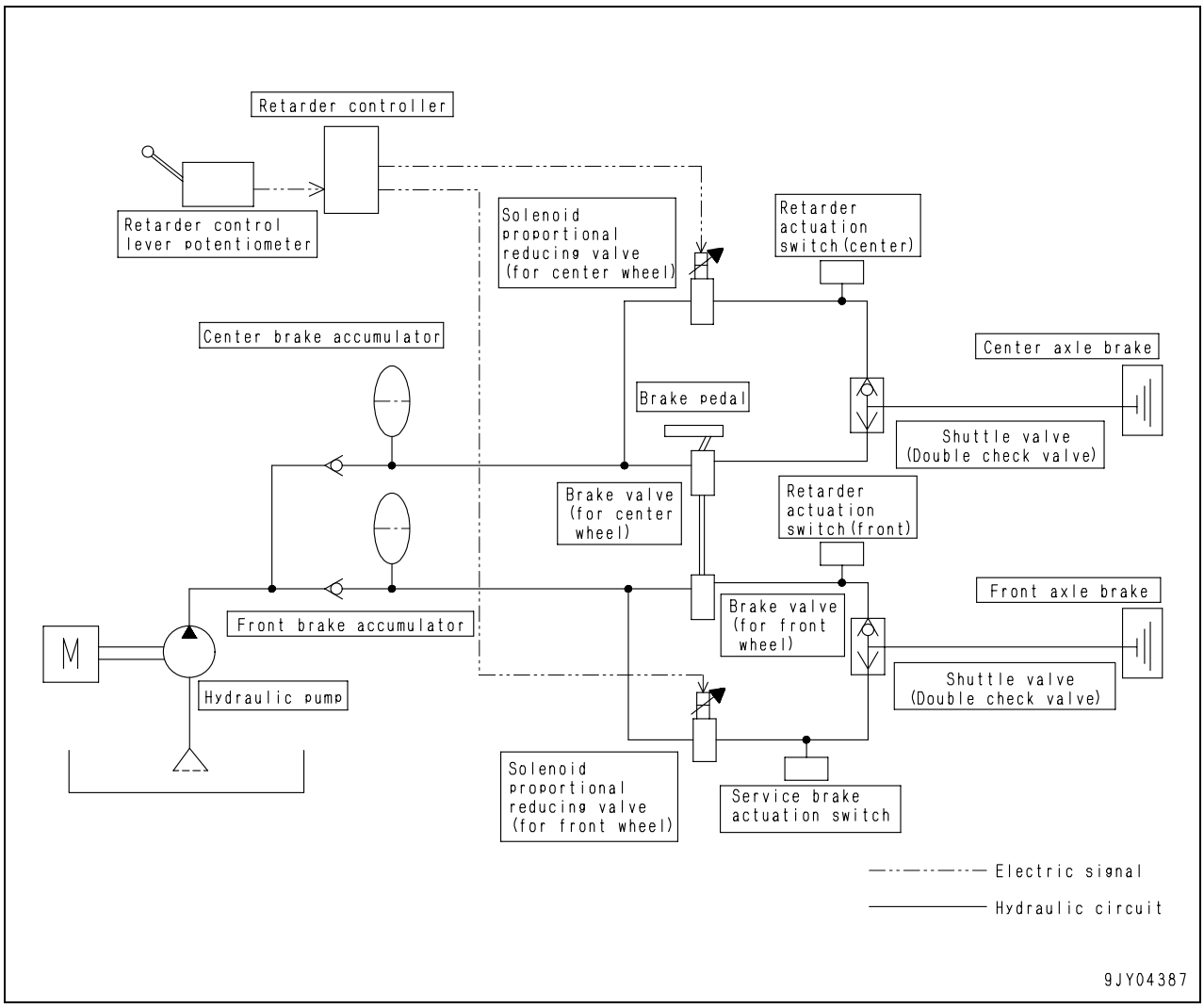
Data range	Remarks
Depending upon software part number.	
Depending upon software version No.	
Depending upon software version No.	
ON [1: Operate] OFF [0]	
x1 [MPa] (0.00 – 50.0 [MPa]) ---- [Other than above]	
x10 [mV] (0.00 – 5.00 [V]) ---- [Other than above]	
0.00 – 99.99 ---- [Other than above]	
x10 [mV] (0.00 – 5.00 [V]) ---- [Other than above]	
x1 [mA] (0 – 1000 [mA]) ---- [Other than above]	
x1 [mA] (0 – 1000 [mA]) ---- [Other than above]	
x10 [mV] (0.00 – 5.00 [V]) ---- [Other than above]	

No.	Item	ID number	Displayed spec.	Data contents
12	Input signal D_IN_0--7	40932	D-IN--0------7	Input signal state of D_IN_0 – D_IN_7 are output as they are.
13	Input signal D_IN_8--15	40933	D-IN--8-----15	Input signal state of D_IN_8 – D_IN_15 are output as they are.
14	Input signal D_IN_16-23	40934	D-IN-16-----23	Input signal state of D_IN_16 – D_IN_23 are output as they are.
15	Input signal D_IN_24-31	40935	D-IN-24-----31	Input signal state of D_IN_24 – D_IN_31 are output as they are.
16	Input signal D_IN_32	40943	D-IN-32-----39	Input signal state of D_IN_32 – D_IN_39 are output as they are.
17	Output signal D_OUT_0-7	40955	D-OUT--0------7	D_OUT_0 – 7 refer to SOL_OUT_0 – 7 of CR710.
18	Output signal D_OUT_8-15	40956	D-OUT--8-----15	D_OUT_8 – 15 refer to SOL_OUT_8, 9, 10A, 10B, 11A, 11B, SIG_OUT_0 and SIG_OUT_1 of CR710.
19	Output signal D_OUT_23	40957	D-OUT-16-----23	D_OUT_16 – 23 refer to SIG_OUT_2, 3, HSW_OUT_0, 1 and BATTRY_OUT of CR710. D_OUT_21, 22 and 23 are not used.

Data range	Remarks
01010101 [1.0 is displayed under corresponding display (number)] Input signal ON [1], Input signal OFF [0], 0 is displayed on unused part	See signal table
01010101 [1.0 is displayed under corresponding display (number)] Input signal ON [1], Input signal OFF [0], 0 is displayed on unused part	See signal table
01010101 [1.0 is displayed under corresponding display (number)] Input signal ON [1], Input signal OFF [0], 0 is displayed on unused part	See signal table
01010101 [1.0 is displayed under corresponding display (number)] Input signal ON [1], Input signal OFF [0], 0 is displayed on unused part	See signal table
0 or 1 [1.0 is displayed under corresponding display (number)] Input signal ON [1], Input signal OFF [0], 0 is displayed on unused part	See signal table
01010101 [1.0 is displayed under corresponding display (number)] Input signal ON [1], Input signal OFF [0], 0 is displayed on unused part	See signal table
01010101 [1.0 is displayed under corresponding display (number)] Input signal ON [1], Input signal OFF [0], 0 is displayed on unused part	See signal table
01010101 [1.0 is displayed under corresponding display (number)] Input signal ON [1], Input signal OFF [0], 0 is displayed on unused part	See signal table

Retarder control function

Retarder control system diagram

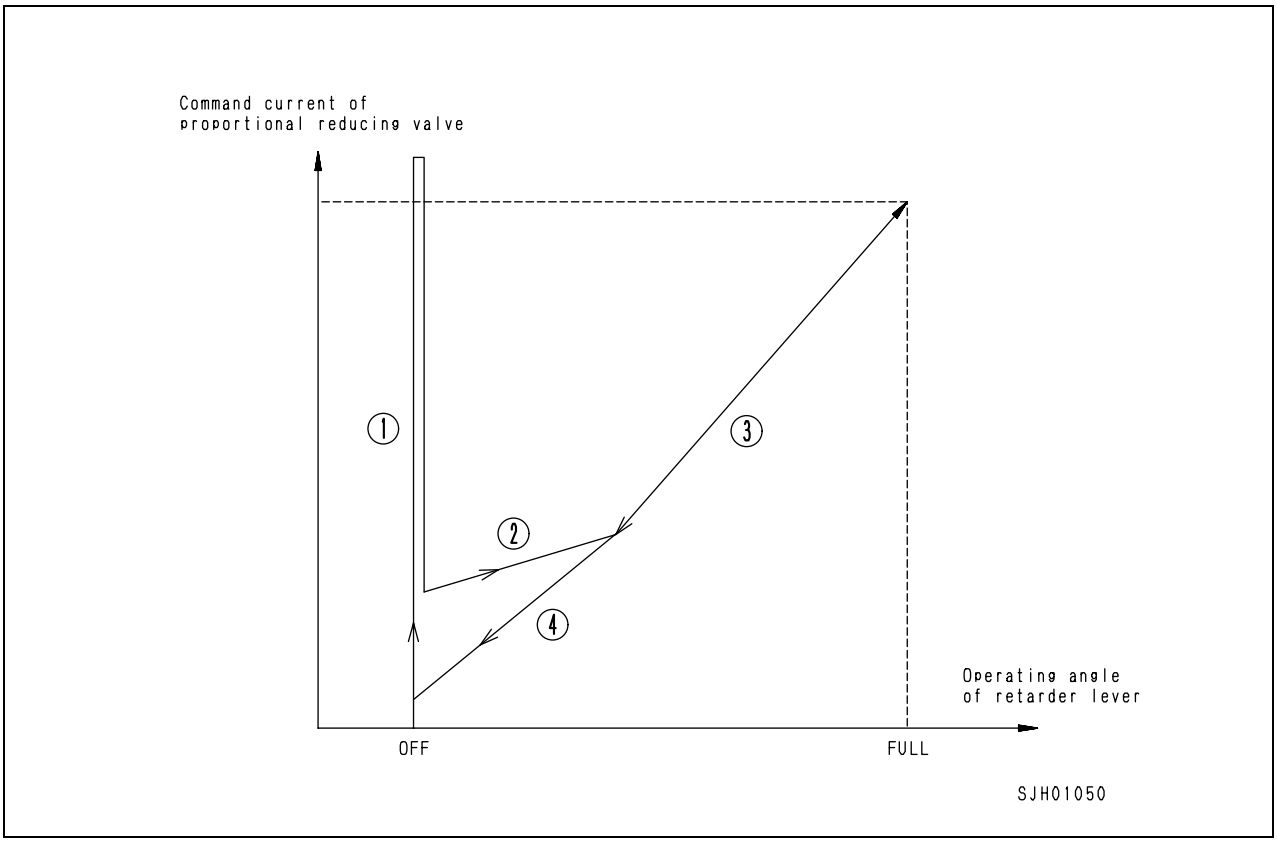


Retarder lever control

- The operating angle of the retarder lever is detected by the potentiometer and a current corresponding to this is output to the solenoid proportional reducing valve for the front and rear wheels to actuate the retarder.

- Overrun prevention, retarder control when there is transmission abuse
- The solenoid proportional reducing valve for the front and rear wheels is controlled based on the command (Analog command) from the transmission controller and actuates the retarder by a fixed amount.

Relationship between retarder lever potentiometer and output to solenoid proportional reducing valve



(1) To improve the initial response of the solenoid proportional reducing valve, the output (trigger output) is set to a high value.
(2) To make the actuation of the hydraulic pressure smooth in the low pressure range, the output is set to a high value.
(3) In the range where the retarder is normally used, the output is proportional to the angle of the lever.
(4) To make the opening of the hydraulic pressure smooth in the low pressure range, the output is set to a low value.

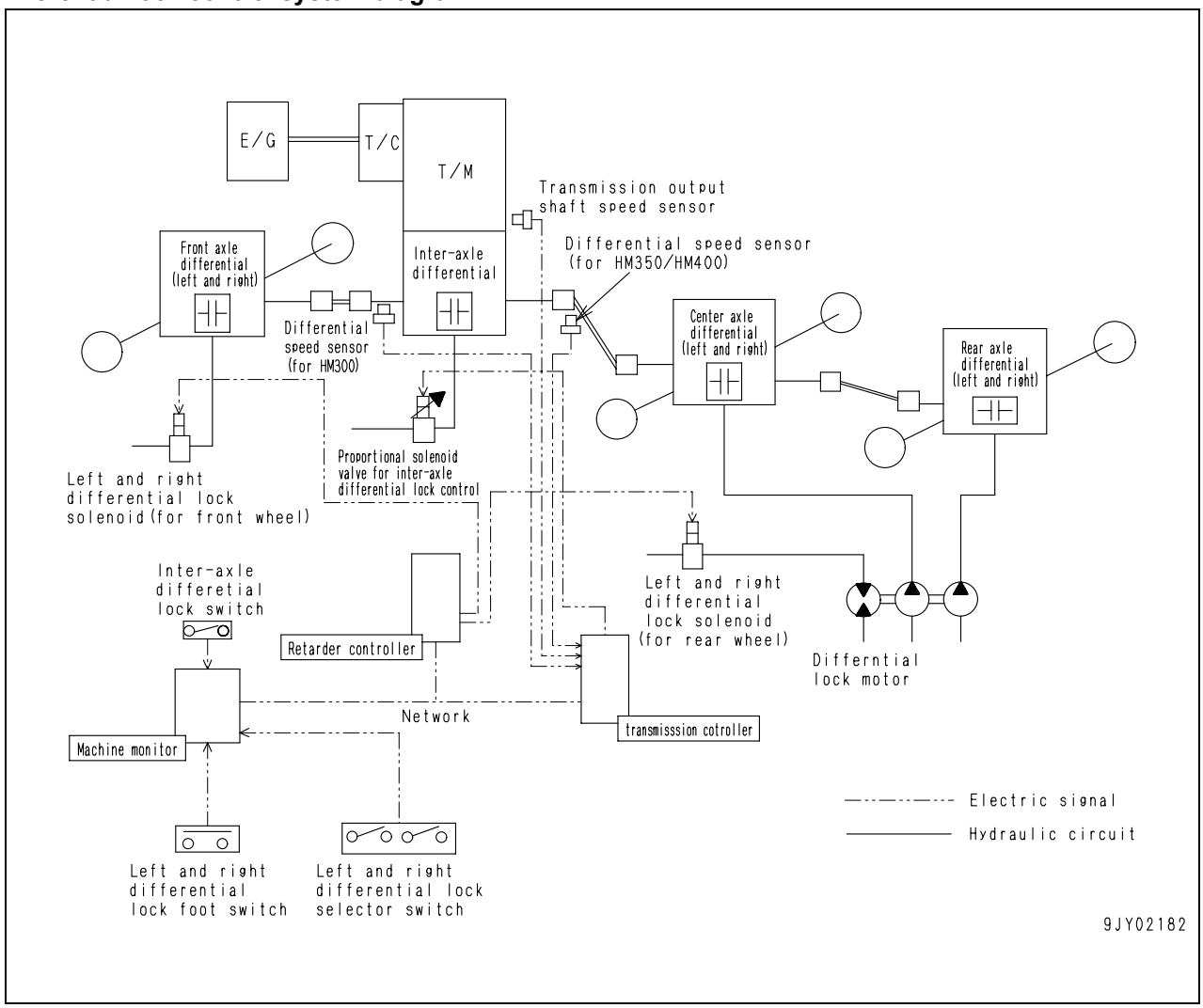
Inter-axle differential lock output
- Left and right differential lock output
- The left and right differential lock command is transmitted as ON/OFF signal from the retarder controller to actuate the left and right differential lock solenoid (front wheel, rear wheel).

Retarder control lever
- The manual retarder potentiometer and lever validation switches 1 and 2 are built into the lever.
- The manual retarder potentiometer output is a voltage signal matching the position of the lever and is sent to the retarder controller.
- The lever validation switches output the ON/OFF data for the lever position to the retarder controller.

Dump control lever
- The dump control lever potentiometer and lever kick-out solenoid are built into the dump control lever.
- The dump control lever potentiometer output is a voltage signal matching the position of the lever and is sent to the retarder controller.
- The lever kick-out solenoid fixes the lever at the RAISE position when it receives the ON signal from the retarder controller and returns the lever to the HOLD position when it receives the OFF signal.

Differential lock control function

Differential lock control system diagram



1. Inter-axle differential lock control
   The inter-axle differential lock is actuated automatically, or manually by turning the inter-axle differential lock switch ON/OFF.

   - Manual differential lock:
     In the low speed ranges (F1, F2, F3, R1, R2) or N, the inter-axle command is output when the differential lock switch is ON.

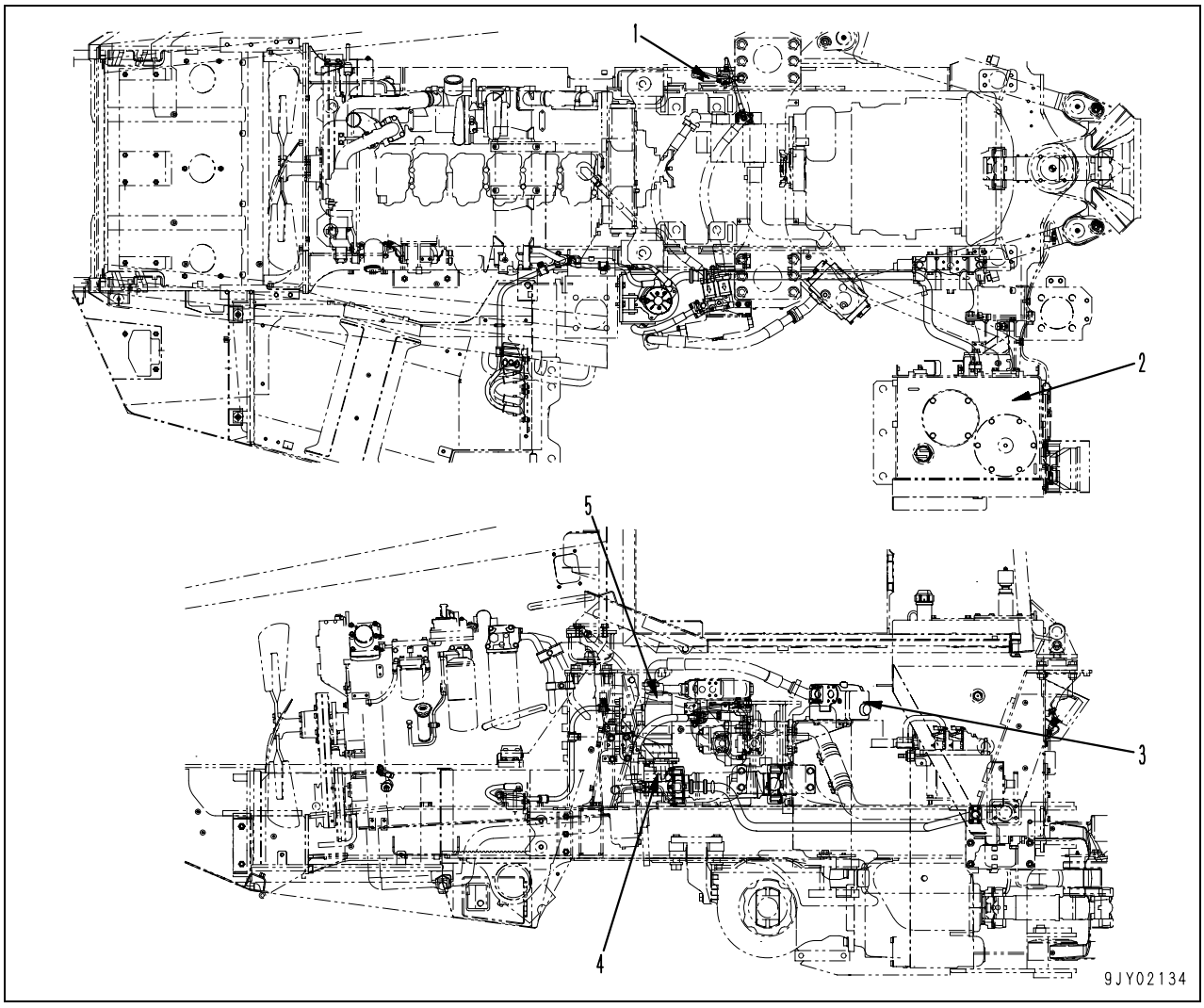
   - Emergency braking control (automatic):
     The inter-axle differential lock command is output when the travel speed is more than 35 km/h and the brake is ON.

   - Brake ON control (automatic):
     The inter-axle differential lock command is output according to the difference in speed between the front and rear axles when the brake is ON.

   - Control (automatic) when there is variation in transmission output shaft speed:
     The inter-axle differential lock command is output when the variation in the transmission output shaft speed exceeds the set value.
     ★ The inter-axle differential lock is actuated when electric current is output to the solenoid proportional valve.

2. Left and right differential lock control (controlled by the retarder controller)
   Depending on the setting of the left and right differential lock selector switch, one of the following is selected:
   (1) rear wheel left and right differential lock ON;
   (2) front and rear wheel left and right differential lock ON; or
   (3) front and rear wheel left and right differential lock OFF.
   If (1) or (2) is selected, the differential lock foot switch is pressed, and the speed range is low (F1, F2, F3, R1, R2), the differential lock command is output.

Auto emergency steering system

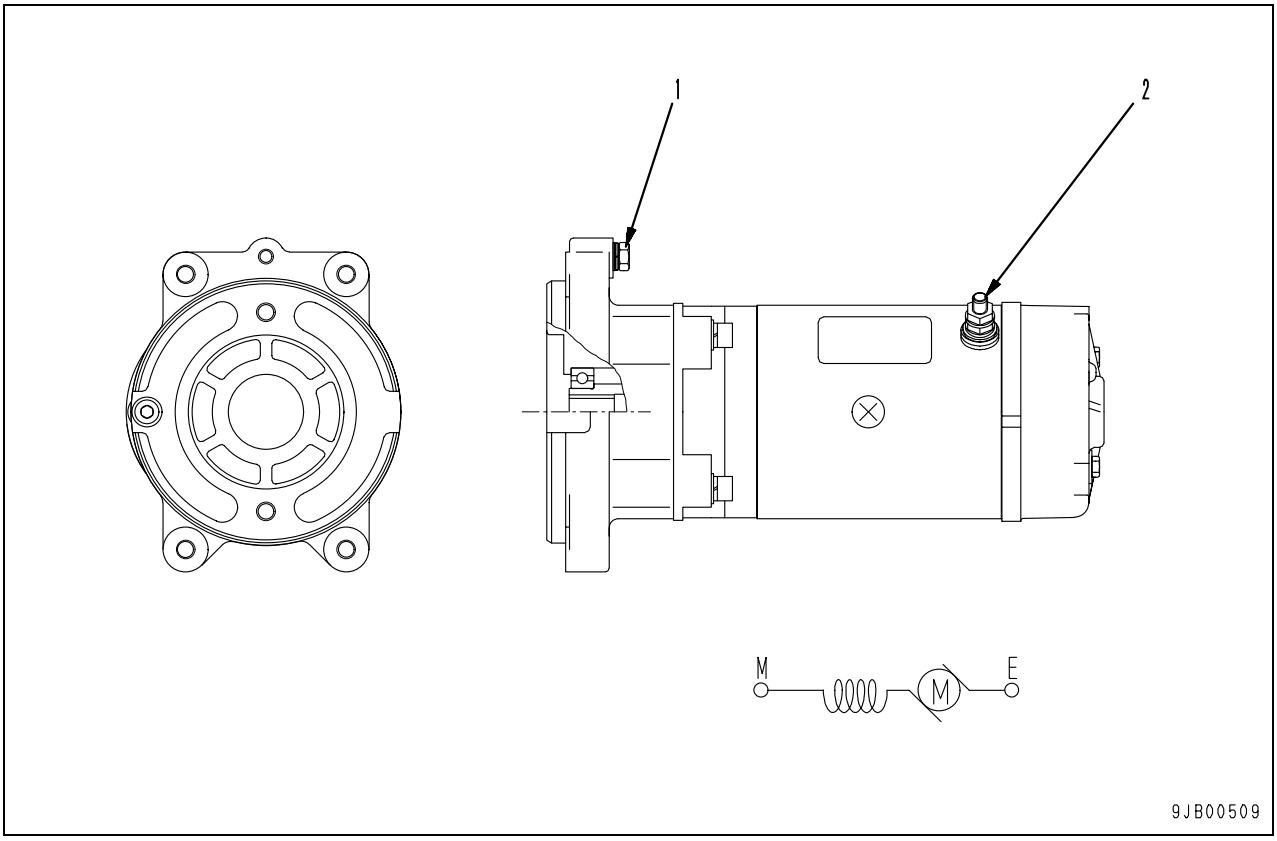


1. Steering oil pressure sensor
2. Hydraulic tank
3. Flow amp valve
4. Emergency steering pump
5. Emergency steering motor

Outline

- If the engine stops or an abnormality occurs in the hydraulic pump when the machine is traveling, and the oil in the steering circuit goes below the specified oil pressure, the auto emergency steering system automatically actuates the emergency steering pump to ensure the steering oil pressure and to make it possible to operate the steering. It is also possible to operate it manually.

Emergency steering motor



1. Terminal E
2. Terminal M

Function

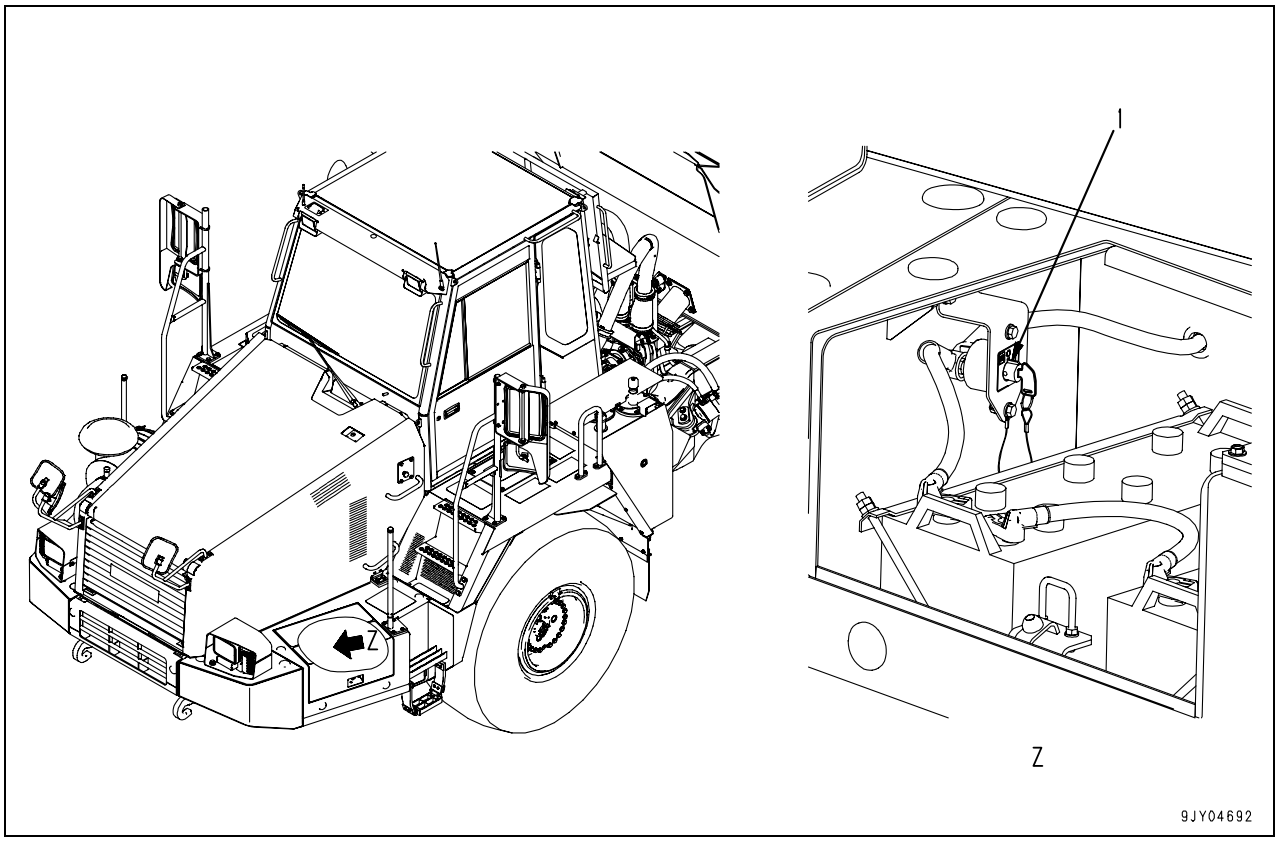
- If there is an abnormal drop in the oil pressure in the steering circuit, the emergency steering motor receives a signal from the transmission controller and drives the emergency pump.

Specifications

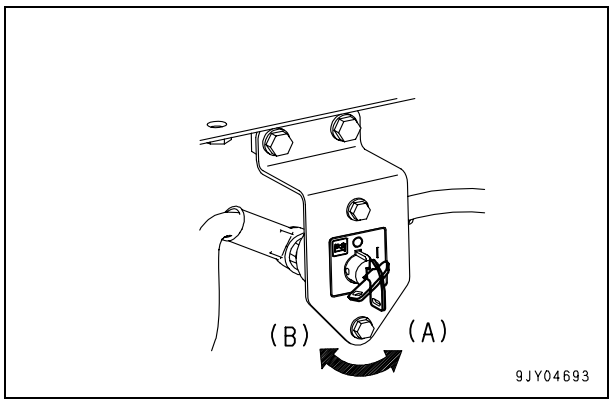
Type	DC motor
Rated voltage	24V
Rated output	0.9kW

Battery disconnector switch

EU spec.



1. Battery disconnector switch



A (0): OFF
B (1): ON

Function

When the option "battery disconnect switch" is equipped

- When the battery disconnect switch is equipped and the switch is OFF (the contact is opened), the starting switch B terminal, respective controllers, and other constant power supplies are all cut out, and the state is the same as when the battery is not connected.
- The battery disconnect switch is usually used for substitution to take off the minus terminal of the battery, when the machine is stored for a long time (a month or longer), when the electrical system is repaired, or when electrical welding is performed.

When the battery disconnect switch is turned off, all the electrical system of the machine will be inoperative.

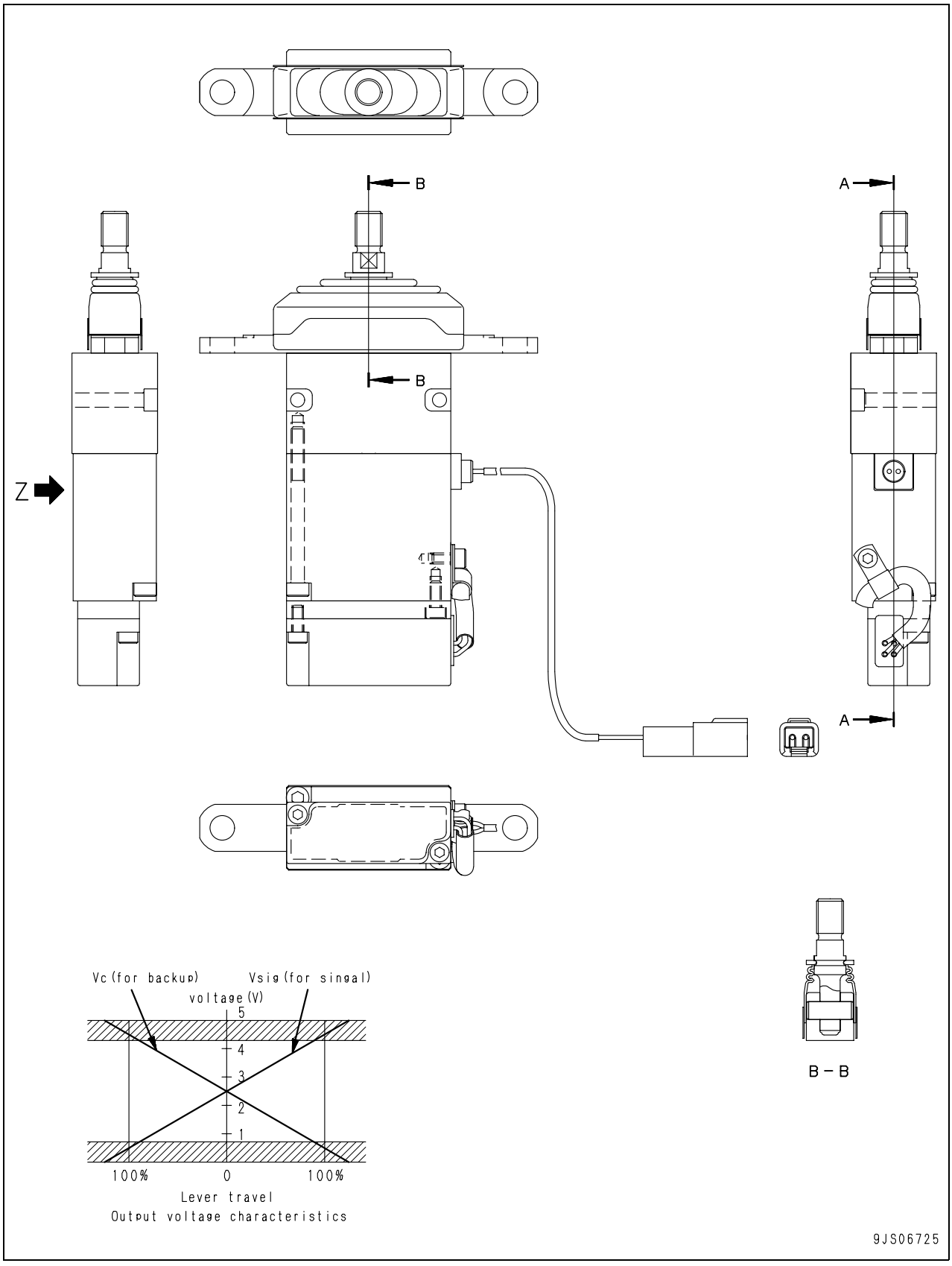
- The clock of the monitor/radio and reception preset memory of radio will be lost, and need to be set again when using them.
- Such functions as room lamp, step lamp, and hazard lamp cannot be used either.

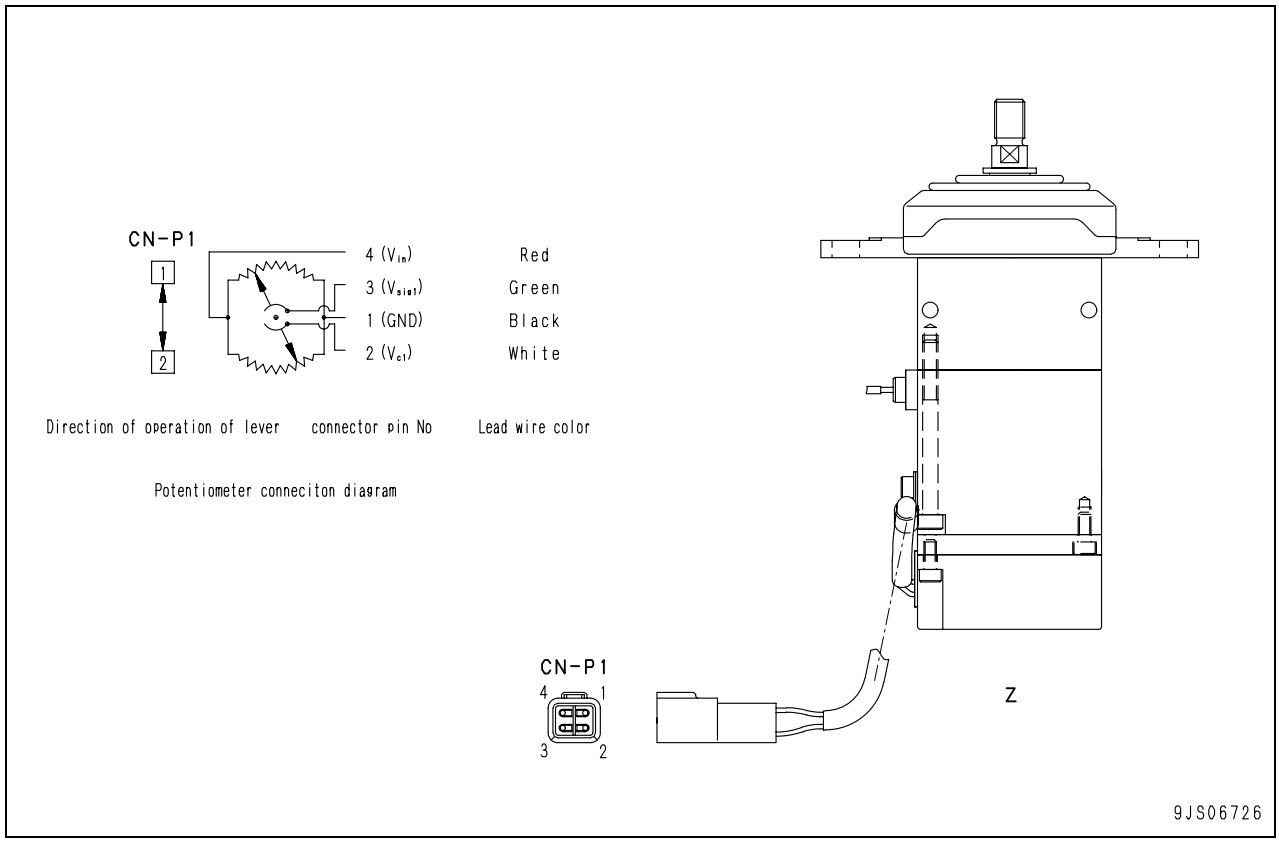
⚠ Important

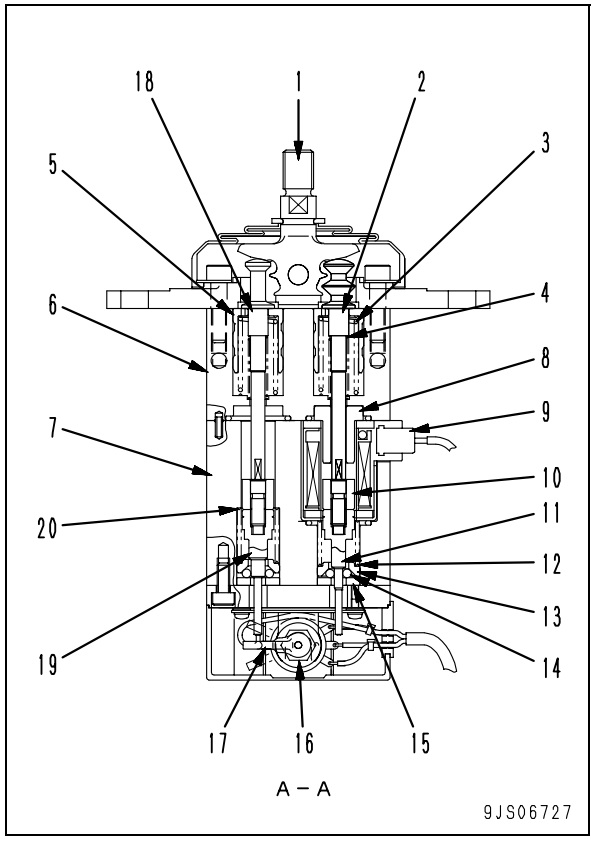
Do not turn off the battery disconnect switch while the engine is rotating and immediately after the engine has stopped.

If the battery disconnect switch is turned off while the alternator is generating electricity, the generated current has nowhere to go, leading to overvoltage of the electrical system of the machine, which may cause serious damage to the electrical system such as electric devices or controllers.

Dump control lever







1. Lever
2. Rod
3. Spring
4. Spring
5. Retainer
6. Body
7. Body
8. Bushing
9. Solenoid
10. Nut
11. Rod
12. Detent spring
13. Retainer
14. Ball
15. Seat
16. Potentiometer
17. Lever
18. Rod
19. Rod
20. Detent spring

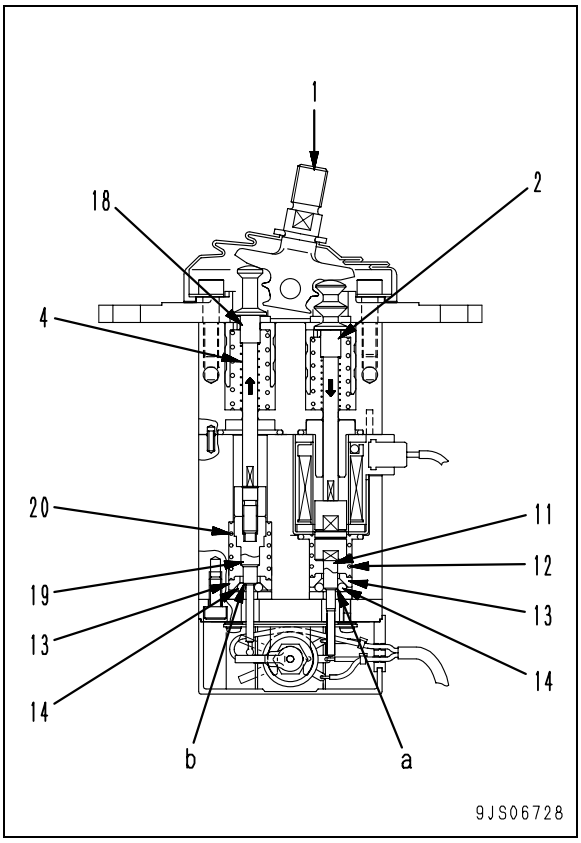
Function

- If lever (1) is operated, rod (18) moves up and down to rotate potentiometer (16) according to the operation stroke of the lever.
- The operation angle (stroke) of the control lever is sensed with the potentiometer and it is output in the form of signal voltage to the controller.
- One potentiometer is installed to output 2 opposite signal voltages shown in "Output voltage characteristics".

Operation

1. **When dump control lever is set in "FLOAT" position**

- If rod (2) on the LOWER side is pushed and moved down with lever (1), ball (14) touches projection (a) of rod (11) on the stroke. (Before start of mechanical detent)
- If rods (2) and (11) are pushed further, ball (14) pushes up retainer (13) held on detent spring (12) and escapes out to go over projection (a) of rod (11).
- At this time, rod (18) on the opposite side is pushed up by spring (4) and ball (14) is moved to the small diameter side of projection (b) of rod (19) by retainer (13) held on detent spring (20).
- Even if the operator releases the lever, rod (18) is held by projection (b) of rod (19) and ball pressing force, and consequently the lever is held in the "FLOAT" position.

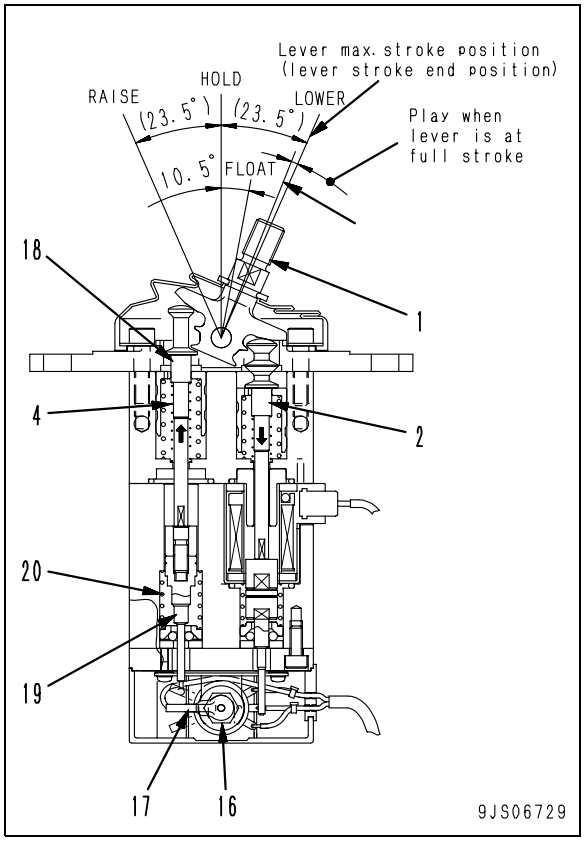


2. When dump control lever is returned from "FLOAT" position

- To return lever (1) from the "FLOAT" position, push it down with a force larger than the holding force of rod (19), detent spring (20), retainer (13) and ball (14).

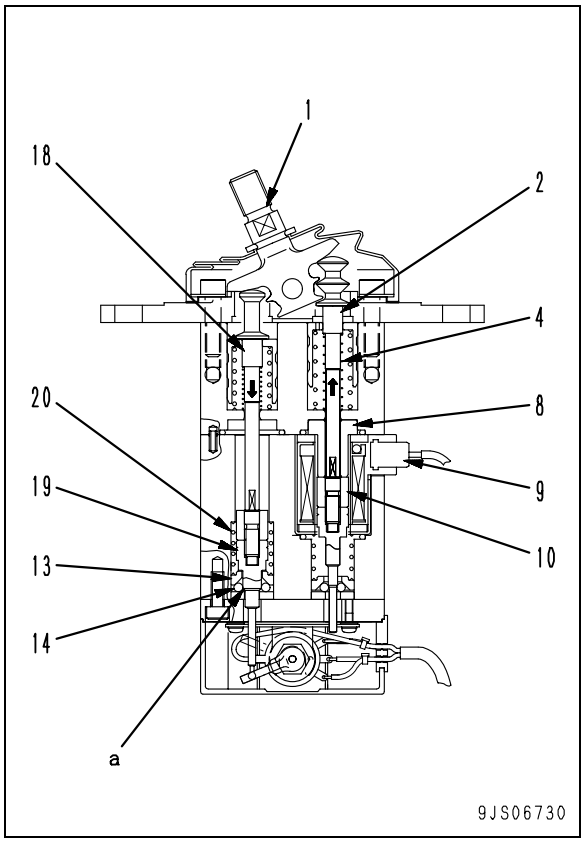
3. When dump control lever is set in "LOWER" position

- If lever (1) is leaned further from the "FLOAT" position, it is set in the "LOWER" position.
- Rod (18) is pushed up by spring (4) according to the operation stroke of lever (1).
- Since lever (17) and rod (19) installed to the turning shaft of potentiometer (16) are connected to each other, potentiometer (16) outputs voltages according to the vertical stroke of the rod.



4. When dump control lever is set in "RAISE" position

- If rod (18) on the RAISE side is pushed and moved down with lever (1), ball (14) touches projection (a) of rod (19) on the stroke. (Before start of electric detent)
- If rods (18) and (19) are pushed further, ball (14) pushes up retainer (13) held on detent spring (20) and escapes out to go over projection (a) of rod (19).
- At this time, rod (2) on the opposite side is pushed up by spring (4).
- If rod (2) is pushed up while current is flowing in solenoid (9), nut (10) is attracted by bushing (8).
- As a result, rod (2) is kept pushed up. Accordingly, even if the operator releases the lever, the lever is held in the "RAISE" position.



5. When dump control lever is returned from "RAISE" position

- To return lever (1) from the "RAISE" position, push it down with a force larger than the attraction of the solenoid. It is also returned to the "HOLD" position when the solenoid power supply is turned "OFF" and the "RAISE" operation is reset.

HM300-2 Articulated dump truck

Form No. SEN00418-02

ARTICULATED DUMP TRUCK

HM300-2

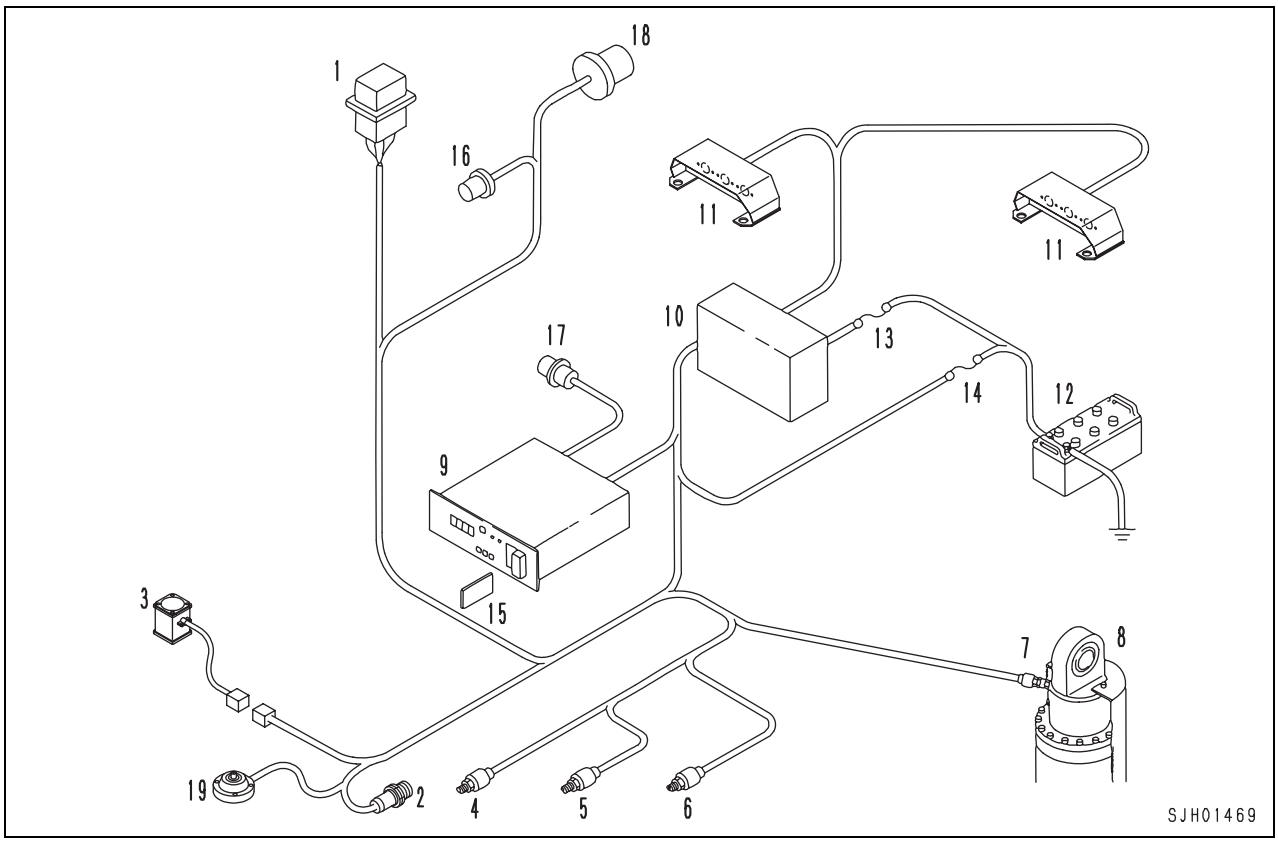
Machine model	Serial number
HM300-2	2001 and up

10 Structure, function and maintenance standard

Electrical system, Part 3

Payload meter (Card type)

Structure of system



1. Shift lever neutral detection switch (relay)
2. Body sensor
3. Inclinometer
4. Pressure sensor (for front left)
5. Pressure sensor (for front right)
6. Pressure sensor (for rear left)
7. Pressure sensor (for rear right)
8. Suspension cylinder
9. Payload meter
10. Lamp drive relay
11. External display lamp
12. Battery
13. Fuse (for external display lamp)
14. Fuse (for controller)
15. Memory card
16. Travel signal sensor
17. RS232C output (PC cable communication) socket
18. Battery charge signal (alternator terminal R)
19. Articulate angle sensor

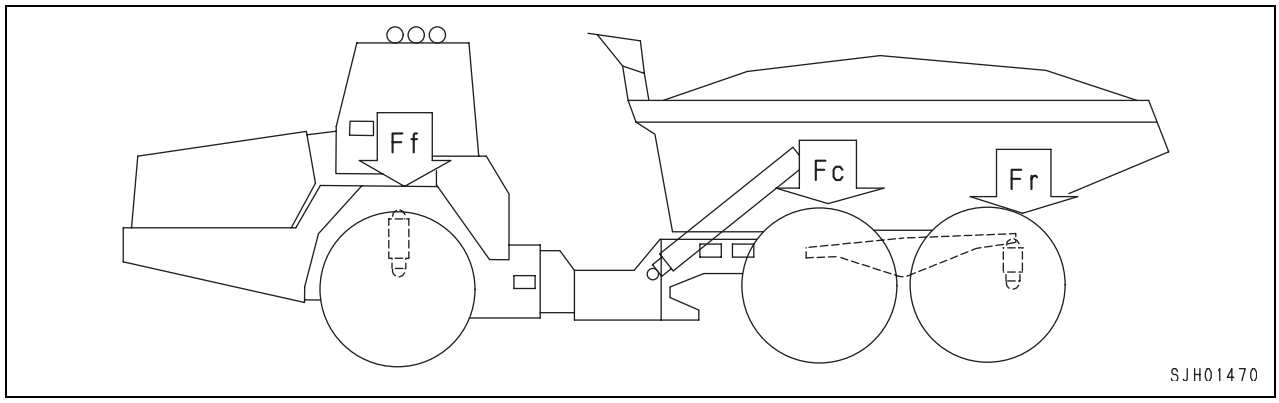
Principle of calculation

1. Outline

The articulate dump truck is suspended by 6 wheels, front, central and rear pair of wheels. The front & rear wheels are suspended by hydro-pneumatic suspension cylinder. The force Fr, which the rear wheel suspends is equal as the force Fc, which the central wheel suspends because the central and rear wheels are suspended by the equalizer bar.

The suspended force F = Ff + Fc + Fr = Ff + 2 × Fr

The force Ff = Af × Pf (Af: Suspension cylinder cross section, Pf: Suspension gas pressure)



2. Measurement of weight when empty (calibration)

Drive the empty truck in the second gear at full throttle for 30 seconds. The payload meter measures the average of supported load F (empty truck) and uses it as the weight when empty.

The reason why the weight is measured while the truck is traveling is that the frictional resistance of the suspension cylinders must be averaged by driving the truck and extracting and retracting the cylinders. The weight measured when empty is saved as a calibration data in the memory in the controller.

3. Measurement of weight when full

Payload is measured by subtracting the suspended force F (empty) when empty from the suspended force F (loaded) when loaded.

The payload meter has 3 measurement methods in which the timing to measure the payload is different.

1) Loading (during loading)
2) Traveling (during traveling)
3) Dumping (just before dumping)

These 3 methods are executed for each cycle. The result of the one method can be recorded for the cycle data. The method to be recorded can be selected by the switch operation (service check mode). Which method to be selected has to be considered the site conditions and the customer's needs.

Basically the accuracy of traveling method (default setting) is the best for normal conditions.

4. Correction on slope

If the dump truck is loaded on a slope, the measured weight is different from the weight measured on a level ground. To solve this problem, the longitudinal inclination of the dump track is measured and measured weight is corrected according to the inclination angle. Correction range of inclination angle: ± 5°

Method of using accurately

1. Suspension cylinder length

The payload meter calculate the payload by the signal of the suspension cylinder pressure sensors. Please maintained the length of the suspension cylinder to be within nominal length.

2. Calibration run

Calibration run has to be carried out when

1) The dump truck is shipped to the site
2) The dump body is modified (the weight of the dump truck is changed)
3) The gas of the suspension cylinder is maintained
4) Periodically (each season)

A flat, level and straight 100 m course is necessary for calibration travel. If the course is not flat, level or straight, the calibration accuracy travel lowers. This affects the accuracy of payload calculation.

3. Traveling method

When the traveling method is selected to be stored,

1) The accuracy of traveling method depends on the road condition. The more flat the road is, the more accurate. Please maintained the road conditions to get the higher accuracy.
2) The accuracy of traveling method depends on the distance of traveling. The longer the distance is, the more accurate. It needs 100m measurement at shortest to get accuracy. The traveling measurement is carried out only when the dump truck speed exceeds 8 km/h and the incline of the road is within ± 5°. The haul road has to contain more than 100 m which meets the condition above for Traveling method.
3) Rapid acceleration, braking and steering cause that the accuracy might be worre.

4. Dumping method (same as payload meter II for rigid dump truck)

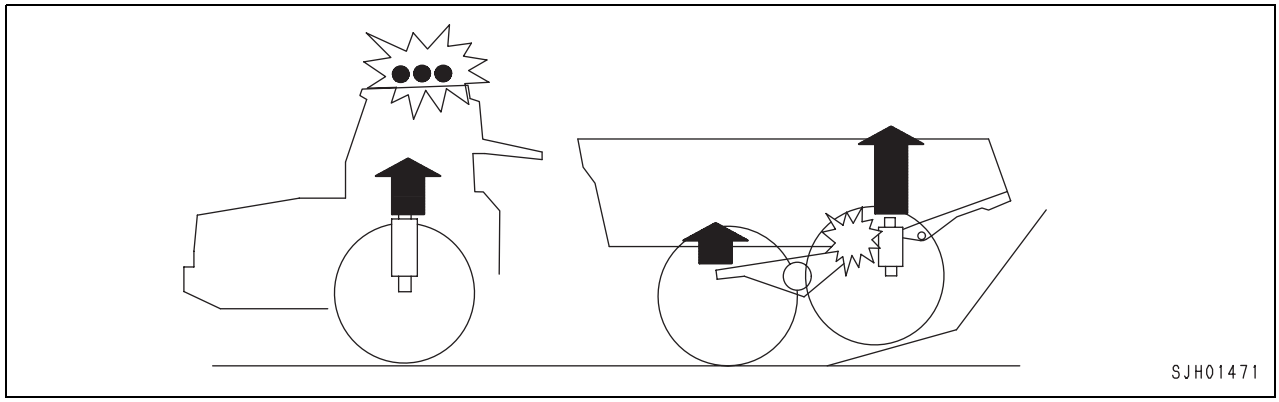
When the dumping method is selected,

1) The ground in the dumping area has to be well maintained.
2) The incline of the loading spot has to be within ± 5°. If the incline exceeds ± 5°, the accuracy is getting worse.
3) Do not hit the dump truck to the wheel stopper too much. If the dump truck is hit to the wheel stopper too much, the calculated payload might be much higher than the actual payload.
4) When the dump truck is stopped, please activate the parking brake and release the service brake or retarder brake.
5) Please wait for raising the body until the pitching of the dump truck by braking is suspended. Normally wait for dumping for 3 to 5 seconds to get accuracy after the parking brake is activated and the service brake or retarder brake is released.

5. Loading method

To keep the accuracy of loading method (including external display lamps)

1) The better maintained the ground of loading spot is, the more accurate.
2) The incline of the loading spot has to be within ± 5°. If the incline exceeds ± 5°, the accuracy is getting worse.
3) Stop the dump truck gently. Do not change the shift to neural position until the dump truck is stopped completely.
4) When the dump truck is stopped, please activate the parking brake and release the service brake or retarder brake. Please stop the dump truck gently.
5) Do not load the material before the dump truck is stopped completely.
6) The controller recognize the loading is finished when the dump truck travels more than 5m after the loading is stared.
7) The equalizer bar hit the stopper
   - If the equalizer bar hit the stopper, the accuracy would become very bad.
   - The payload meter detect this hit when the empty dump truck stops at the loading spot. The payload meter detects the equalizer bar to be hit the stopper, then the error code 'F-FL' is displayed in the payload meter display, and all the external display lamps are flashed.
   - Do not load when all the external display lamps are flashed.
   - If the error code 'F-FL' comes out, please move the dump truck forward a little bit and stop until the 'F-FL' disappears.
   - When move the dump truck forward, please shift the transmission to drive range. When stop the dump truck, please shift the transmission to neutral range after the dump track is completely stopped.



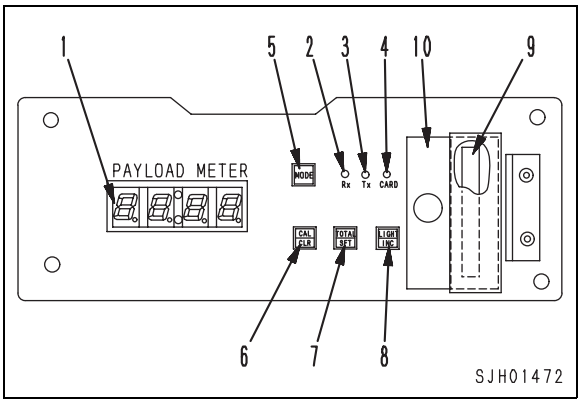
6. Download

1) The payload meter stores the cycle data for 2,900 cycles (normally more than 1 month operation). If the number of cycles exceeds 2,900, the newest data is overwritten on the oldest data. Please download the data periodically and clear the all data before overwriting.

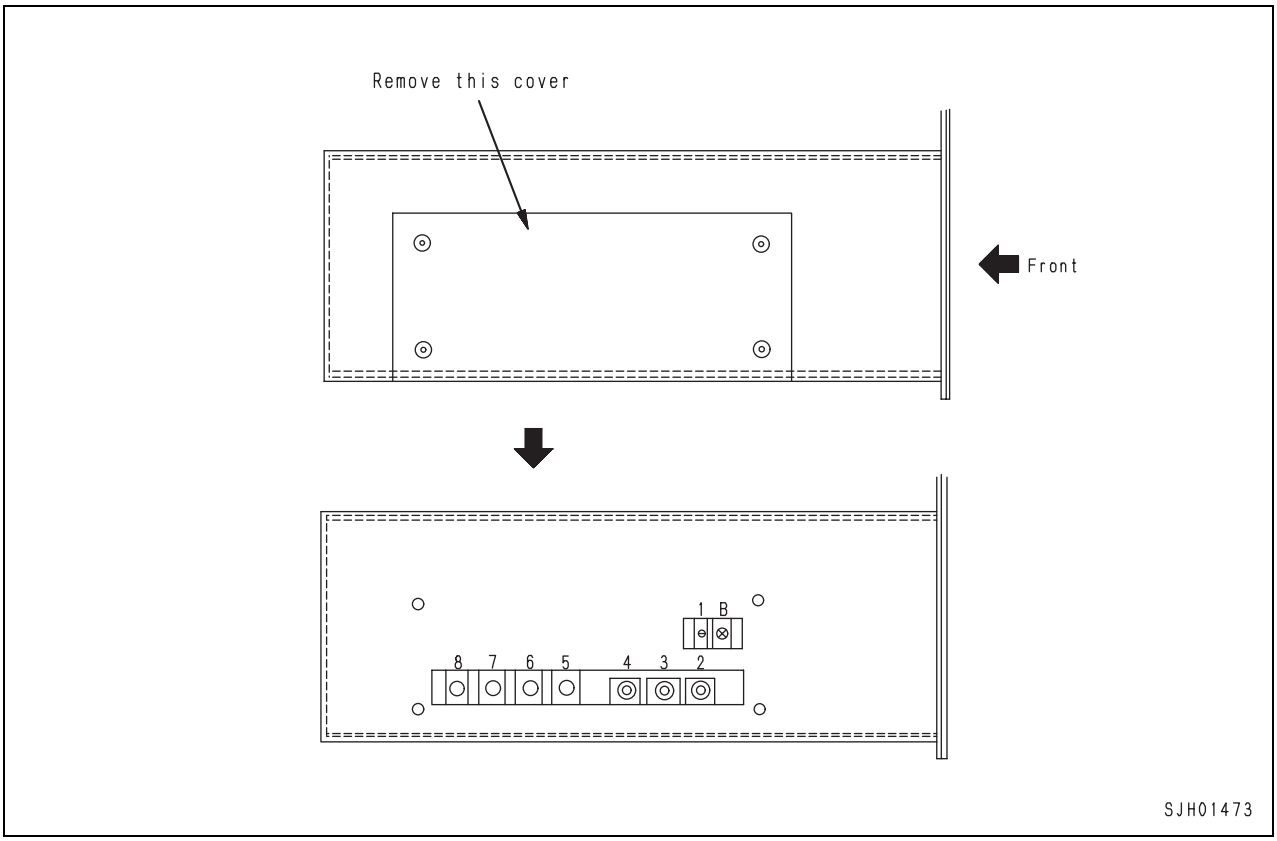
General locations of payload meter

1. Display
2. Communication "receiving" lamp (Rx busy)
3. Communication "transmitting" lamp (Tx busy)
4. Memory card access lamp (CARD busy) (not used)
5. Mode switch
6. Calibration/clear switch (CAL/CLR)
7. Total/shift switch (TOTAL/SFT)
8. Light/increment switch (LIGHT/INC)
9. Memory card (not used)
10. Cover

★ Communication "transmitting" lamp (3) also lights up when the communication cable is not connected to a PC or when there is defective connection.
★ When not inserting or removing memory card (9), keep cover (10) closed.



Left face

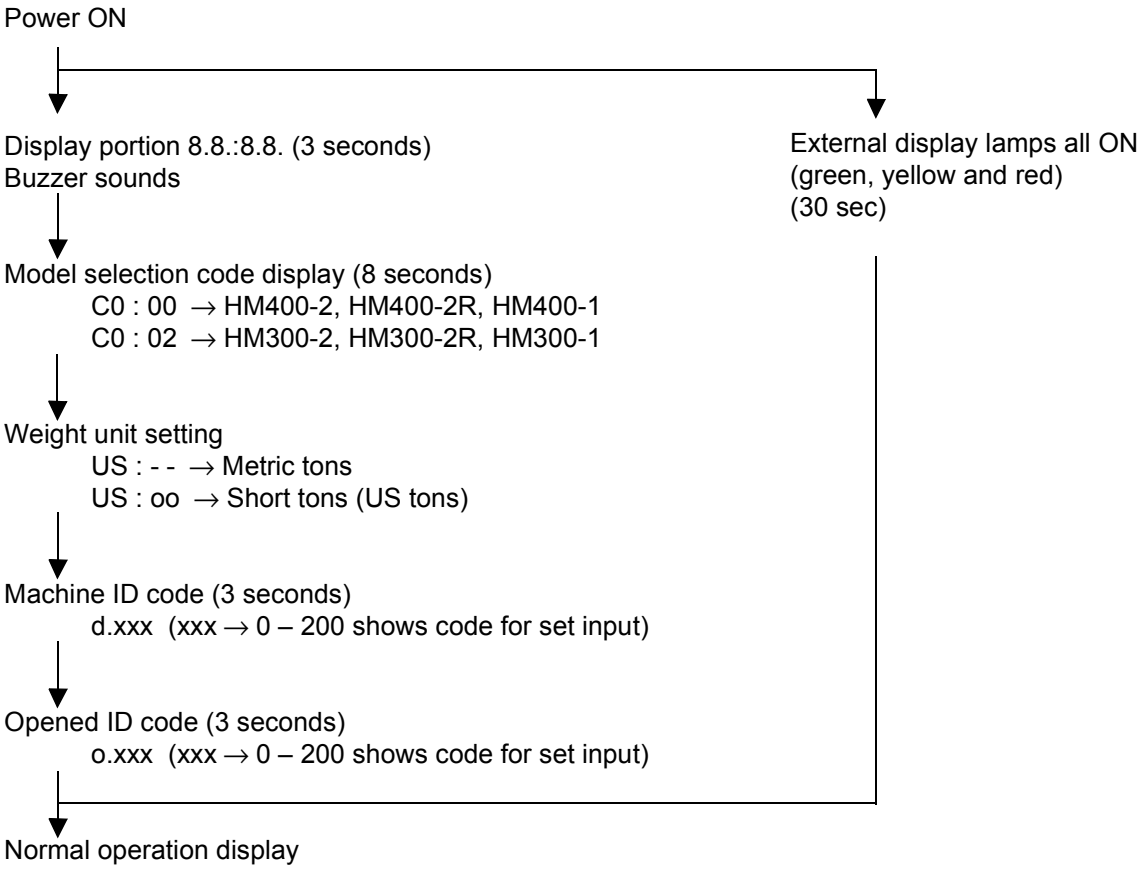


★ The switches are adjusted before the machine is shipped.
Do not touch any other switch.

Basic functions

1. Power ON

When the power is turned ON, all functions are checked and displayed.



2. Measuring empty weight (calibration)

The weight of the dump truck when empty is measured and this is used as the calibration data.
These data are retained even when the power is turned OFF.

3. Normal operation display

Display during normal operations

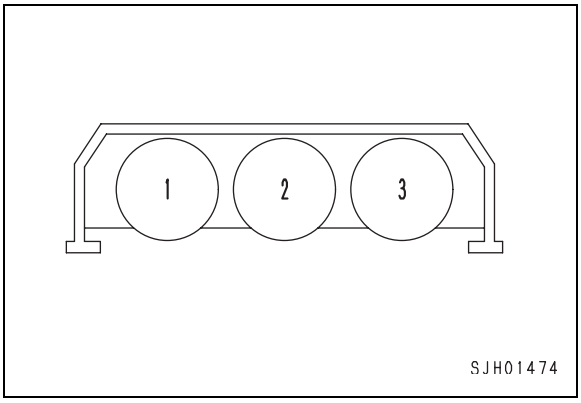
Condition of the machine		Gearshift lever position	Dump body position	Payload meter display	External display lamps
When empty	Stopped	N	Seated	Time	OFF
	Traveling	Except N	Seated	Time	OFF
During loading	Stopped	N	Seated	Payload [ton]	Payload display and display of estimate
	Traveling (*1)	Except N	Seated	Traveling distance [m]	OFF
When loaded	Stopped	N	Seated	Payload [ton]	Payload display
	Traveling	Except N	Seated	Time	OFF
When dumping		N	Seated → Unseated	Total payload (*2) [100 ton]	OFF
When abnormality is happened	—	—	—	See "Error code table"	

*1. When load is less than 50% of correct weight, display shows 0 t.
*2. The aggregate weight display is shown in units of 100 t. (rounded to the nearest 100)

4. External display lamp drive (estimated display)

The chart on the below shows the payload display level for the external display lamps during the normal operation display.
This threshold can be modified by the key operation in the service check mode.

	Color of lamp	HM300-2, HM300-2R
1	Green	13.7 tons and up
2	Yellow	24.6 tons and up
3	Red	28.7 tons and up



The estimated display shows the estimation of the total payload when one more load is added. The applicable lamp flashes to prevent overload.
If current payload is 20 ton and the last bucket was 5 ton for example, the green lamp is turned on from the table. The estimated payload for next bucket is 25 ton. Then the yellow lamp is flashed.
If the red lamp is flashed, one more bucket reaches over the red threshold and it will be overloaded.

5. Content of memory
(for details, see Operation and Maintenance Manual)

1) Cycle data
- The period between one dumping operation and the next dumping operation is taken as one cycle and the data are recorded.
- The cycle data are recorded when the dumping is finished.
- The maximum limit for cycle data in memory is 2,900 cycles.
- Cycle data is recorded for more than 2,600 cycles, the error message 'L:FUL' is coming out in the display.

Item	Unit	Range	
Engine operation number	Integer	1 – 65,535	Displays value and set value at time of dumping
Month	Month	1 – 12	
Day	Day	1 – 31	
Time hour	Hour	Displayed as 0 – 23	
Time minute	Minute	0 – 59	
Machine ID	Integer	0 – 200	
Open ID	Integer	0 – 200	
Payload	t (Metric ton) or US ton (Short ton)	0 – 6,553.5	
Warning items/cycle			

2) Engine ON/OFF data
- Each time the engine was stopped and started is recorded.
- The maximum limit in memory for engine ON/OFF data is 115.
- If the data is over 105, the error message 'E:FUL' is coming out. In this case, please download the data and clear the data.

Item	Unit	Range	
Engine operation number	Integer	1 – 65,535	Consecutive number for operation of engine
Year (last 2 digits)	Year	0 – 99	Shows when engine was switched ON
Month	Month	1 – 12	
Day	Day	1 – 31	
Time hour	Hour	Displayed as 0 – 23	
Time minute	Minute	0 – 59	
Year (last 2 digits)	Year	0 – 99	Shows when engine was switched OFF
Month	Month	1 – 12	
Day	Day	1 – 31	
Time hour	Hour	Displayed as 0 – 23	
Time minute	Minute	0 – 59	
Aggregate payload	t (Metric ton) or US ton (Short ton)	0 – 9,999,000	Total value between engine ON and engine OFF
Total number of cycles	Times	0 – 9,999	

3) Abnormality, warning data

★ Each time a payload meter abnormality or warning is generated or cancelled is recorded.
The maximum limit in memory for abnormality or warning data is 230 generated/cancelled sets.

Item	Unit	Range	
Engine operation number when error code was generated	Integer	1 – 65,535	Shows when error code was generated
Frequency of generation after engine is switched ON	Times	1 – 255	
Year (last 2 digits)	Year	0 – 99	
Month	Month	1 – 12	
Day	Day	1 – 31	
Time hour	Hour (0 – 23)	Displayed as 0 – 23	
Time minute	Minute	0 – 59	
Engine operation number when cancelled	Integer	0 – 65,535	Shows when error code was cancelled
Year (last 2 digits)	Year	0 – 99	
Month	Month	1 – 12	
Day	Day	1 – 31	
Time hour	Hour (0 – 23)	Displayed as 0 – 23	
Time minute	Minute	0 – 59	

6. Forced display of aggregate payload, total number of cycles
By operating the [TOTAL/SFT] switch of payload meter, it is possible to carry out forcible display of these items. For details, see the Operation and Maintenance Manual.

7. Operator check mode
By operating the switch of payload meter, it is possible to carry out the following items.
For details, see the Operation and Maintenance Manual.
1) Data all clear
2) Machine ID setting
3) Open ID setting
4) Time, date correction

8. Dimming of display portion
It is possible to adjust the brightness of payload meter display portion to 10 levels with the [LIGHT/INC] switch

9. Downloading saved data
It is possible to download any data recorded in payload meter to a PC through a cable (RS232C) For details, see the PC software manual provided by Komatsu.

10. Service check mode
By operating the switches of payload meter, it is possible to forcibly carry out display, setting, and correction of the following items.

a) Detailed calibration data display
The display shows the date, suspension pressure, etc. when the latest calibration was carried

b) Data all clear (service area)
This forcibly deletes all the calibration data and analog data, except for the latest calibration data.
★ Before clearing the data, always download the data to a PC or carry out (a) Card dump.

c) Input signal condition display
This displays some of the signal conditions for the sensors input to payload meter and the present recognition condition of the payload meter.

d) Forced initialization
This forcibly deletes all the data in payload meter. Payload meter becomes just same as the one when the controller is shipped from the factory.
- Before carrying out this operation, check the time and date. Always carry out the operation with the machine unloaded. Do not carry out the operation unless necessary.
- If this is carried out, the calibration data as well as each setting are cleared. The inclinometer calibration and the calibration run are necessary to be done again.

e) Parameter setting
This allows to modify the parameter setting.

Display	Item	Unit	Default	Min	Max
1. ***5***	Loading completion travel distance	m	5	5	999
2. 1***0***	Loading start threshold	%	10	5	25
3. 0.***0***	Payload offset	ton	0.0	-5.0	5.0
4.10***0***	Payload gain	%	100	80	120
5. 0.***0***	Loading payload offset	ton	0.0	-5.0	5.0
6. 0***5***	Travel mode min. speed	km/h	8	1	20
7. 0***5***	Travel mode max incline	deg	5	5	10
8. 5***0***	Green lamp threshold (X1)	%	50	50	X2
9.09***0***	Orange lamp threshold (X2)	%	90	X1	X3
A.10***5***	Red lamp threshold (X3)	%	105	X2	120
b. ***2***	Store mode	—	2	1	3
C. 2.***0***	Stopper-hit threshold	ton	2.0	2.0	5.0
d. 5***0***	Dump completion threshold	%	50	10	50
E. 1.***0***	Stable payload threshold	ton	2.0	0.5	3.0
F. ***0***	External display lamps check mode	—	0	0	3
H.00***0***	Machine Code (0: HM400, 2: HM300)	—	0	0	0
J.00***0***	payload unit (0: ton,1: short ton)	—	0	0	1
L.00***0***	Area code (1: Australia, 0: other)	—	0	0	1
P.10***0***	C1	%	100	80	120
U.10***0***	C2	%	100	80	120
G.10***0***	C3	%	100	80	120
y.10***0***	C4	%	100	80	120

1) Loading completion travel distance
If the truck moves this distance after loading, payload meter recognize the loading is completed. After the recognize of loading completion, the estimate function of the external display doesn't work. The default setting is 5 m.

2) Loading start threshold
If the calculated payload becomes over this threshold, payload meter recognizes the loading is started. And the difference between the current payload and the last payload is over this threshold, payload meter recognizes one more bucket is loaded. The default is 10%. This default setting is for 8-bucket load or less. If the bucket of the loader or excavator is too small for this truck, the count of buckets might be less than actual. In this case, this setting has to be modified less value (7 to 8%).

3) Payload offset, payload gain

If the calculated payload is different from the payload measured with the scale, the former can be adjusted by this setting and the following setting (Payload gain). However, only the download data can be adjusted by this setting, and the payload displayed on the payload meter cannot be adjusted.

(The adjusted payload) = (Payload gain) × (Calculated payload) + (Payload off set)

To modify these setting, do not set the value by few data because the data has deviation. To do this, at least 5 cycles measuremet is necessary.

If the error is almost constant, regardless of the payload, "Payload offset" must be changed. For example, if the payload meter indicates 1 ton heavier than each of the actual loads of 19.1 ton (70%) and 27.3 ton (100%), "Payload offset" must be set to "-1.0".

If the error depends on the payload, both of "Payload offset" and "Payload gain" must be changed. For example, if the payload meter indicates 1 ton heavier than the 70% actual load and 2 ton heavier than the 100% actual load, "Payload gain" must be set to "89" (27.3 – 19.1)/(29.3 – 20.1%) and "Payload offset" must be set to "1.2" (27.3 – 0.89 x 29.3).

4) Loading payload offset

If the payload calculated at the loading time has an error but the saved payload is free of error, the display of the payload at the loading time can be adjusted by this setting. Normally the ground condition impacts to the accuracy of the paylaod when loading. Please check the ground condition first.

5) Travel mode min. speed

Payload meter calculates the paylaod by averaging the data during the traveling in the traveling mode. Normally the ground condition is very rough when the vehicle speed is low. If the ground condition is very rough, the accuracy tends to be worse. Payload meter averages the data only when the vehicle speed is over this threshold. The default setting is 8 km/h. This setting is proper for almost all road conditions. But if the truck speed is very slow for a long time and the accuracy of traveling mode is not good enough, this threshold can be modified to less value (5 – 6 km/h).

6) Travel mode max incline

Payload meter calculates the paylaod by averaging the data during the traveling in the traveling mode. Normally when the slope is steep, the accuracy tends to be worse. Payload meter averages the data only when the slope is less steep than this thireshold. The default setting is 5 degree. This setting is proper for almost all road conditions. But if the major part of the haul load has more than 5 degree slope and the accuracy of traveling mode is not good enough, this threshold can be modifed to larger value (7 – 8 degree).

7) Green/Yellow/Red lamp threshold

As default, the green is set to 50%, yellow 90%, and red 105% similarly to a rigid dump truck. If these are set severer, for example, if the green is set to 80%, yellow 95%, and red 105%, more accurate display is obtained. Do not set a threshold value higher than 105% to the red, however.

8) Store mode

Payload meter has 3 measurement methods as described before. But only 1 measurement method is stored and can be downloaded. A mode of one type that meets the jobsite condition and customer's needs must be recommended to the customer and must be set in the payload meter controller.

Guideline is

- Traveling mode is the most accurate. If not any special reason, choose traveling mode.
- If the haul road is very rough or very short (less than 200 m) and the dumping area is well maintained, choose Dumping mode.
- If the customer wants to store the payload displayed during loading, choose loading mode.

9) Stopper-hit threshold

If the equalizer bar hits to the stopper, the accuracy of the payload when loading becomes very bad as described before. Payload meter recognize the hitting if the calculated payload is over this threshold when the empty vehicle stops at the loading spot. The default setting is 2 ton. If payload meter recognize the hitting, the error message 'F-FL' is coming out. If this detection is too sensitive, this threshold can be modifed to the higher value (3.0 ton). But this causes the fail to detect the hitting. Please take care when the setting is modified.

10) Dump completion threshold
Payload meter recognize the dump completion when the paylaod becomes under this threshold during the dumping. There is no need to modify this parameter.

11) Stable payload threshold
The calculated payload changes dynamically when loading. Payload meter waits for the calculation until the calculated payload becomes stable. This threshold is the one payload meter recognize the calculated payload to be stable. This setting (2 ton) is proper for almost all conditions. This impacts to the accuracy of the estimated display of the external display lamps. If the function is strange, this setting can be modified to be less value (1 ton). In this case, the time delay to display the lamps after loading might be longer.

12) Externa display lamps check mode
This is used for the local installation of payload meter. See LOCAL INSTALLATION.

13) Machine Code
This is used for the local installation of payload meter. See LOCAL INSTALLATION.
"0" denotes HM400-2, HM400-2R or HM400-1.
"2" denotes HM300-2, HM300-2R or HM300-1.

14) Payload unit
This is used for the local installation of payload meter. See LOCAL INSTALLATION.
Payload meter has 2 units for payload display. '0' means 'metric ton', '1' means 'short ton (US ton)'.

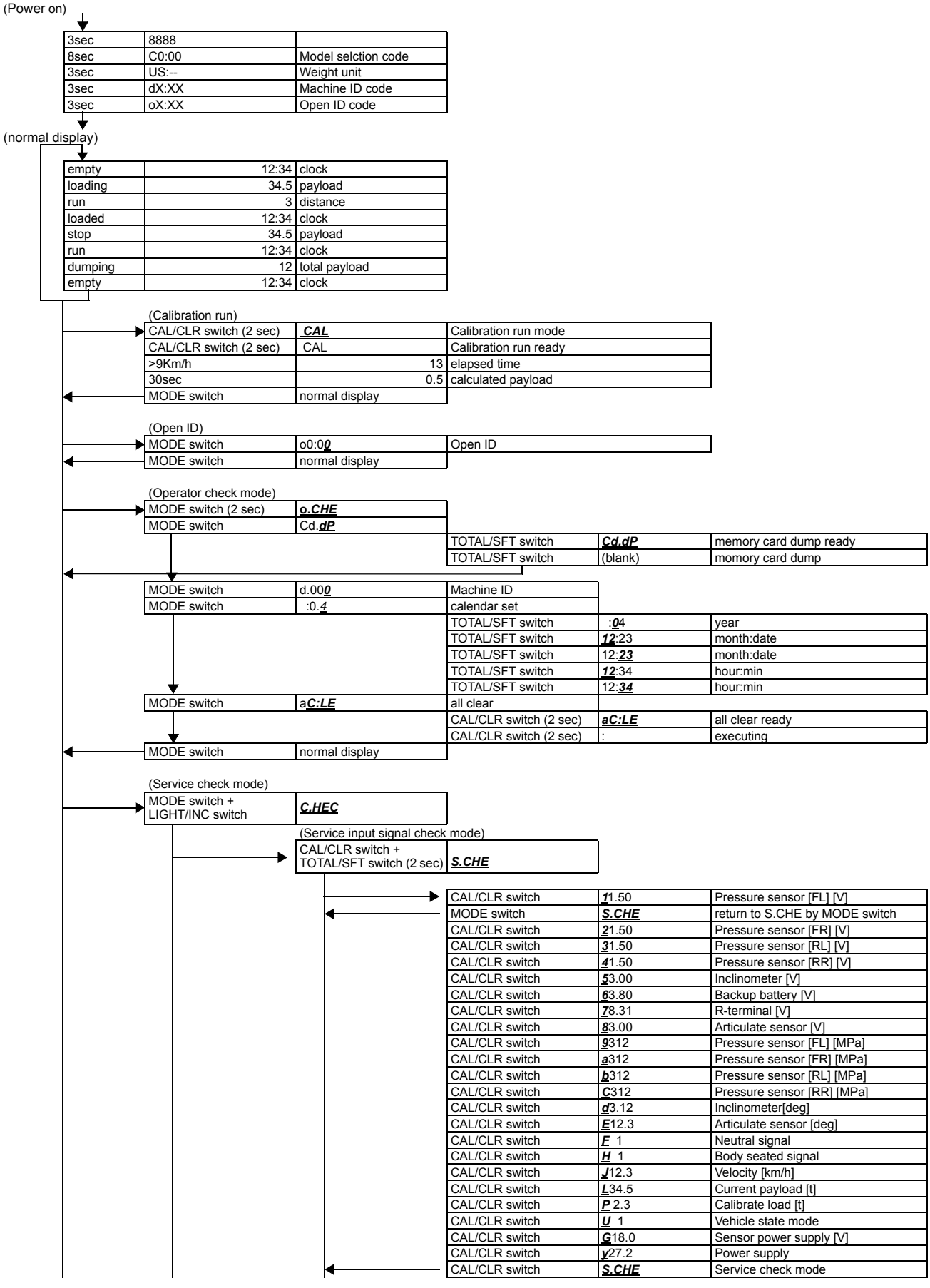
15) Area code
This is used for the local installation of payload meter. See LOCAL INSTALLATION.
If the area is in Australia, it has to be set '1' and to be set '0' for the other area. It impacts to the open ID in the download data. If the area code is set '1' (Australia), the open ID is not recorded in the download data.

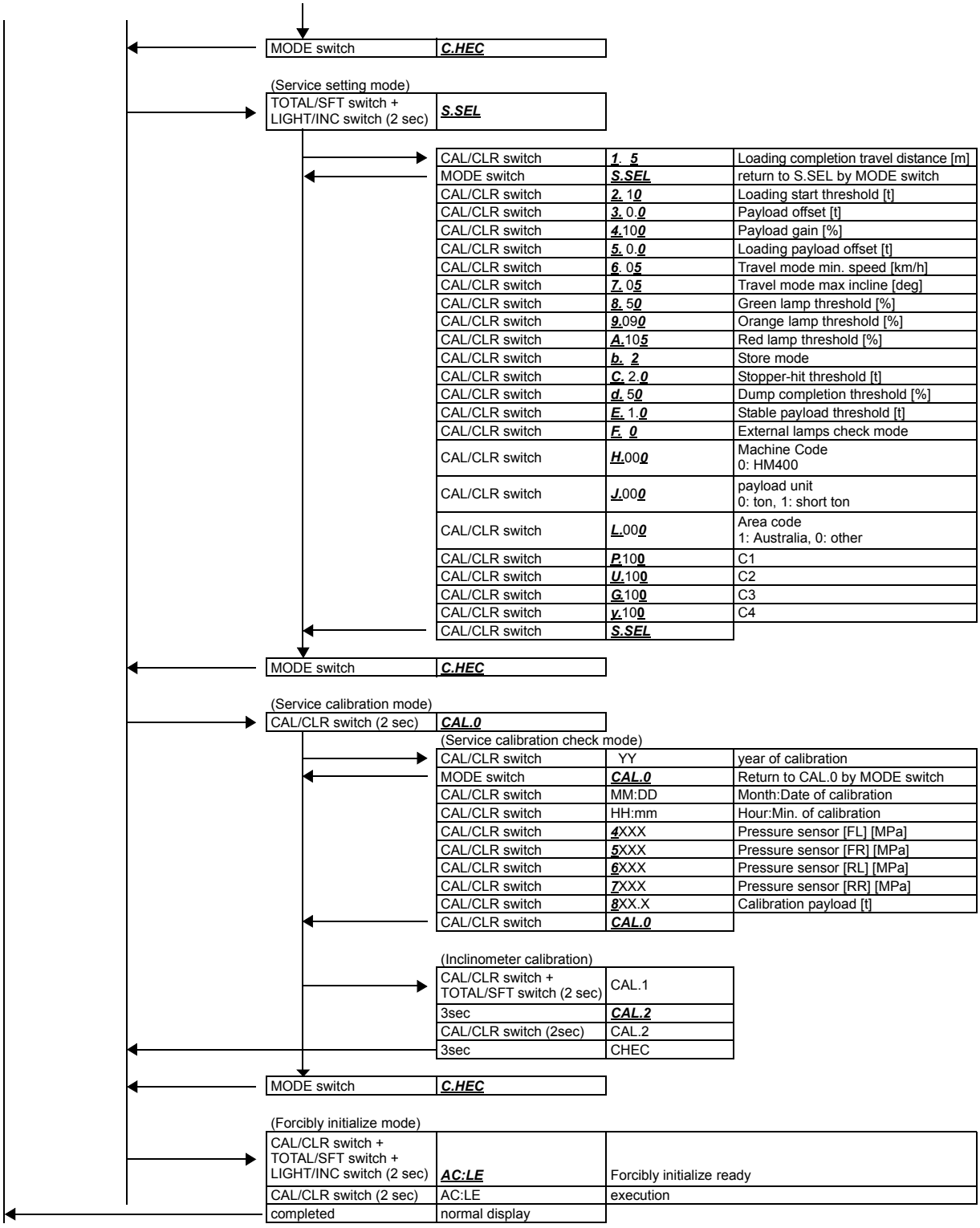
16) C1, C2, C3, C4
The formaulation to calculate the payload is described simply as below.
(Calculated paylaod) = C1 x (Sum of the front suspension cylinder pressure) + C2 x (Sum of the rear suspension cylinder pressure) + C3 x (incline) + C4 (offset)
This setting can modify these parameter. These parameters are set for each machine. If sufficient accuracy is not obtained by changing the parameters for 'payload offset' and 'payload gain', the above parameters need to be changed. Do not change these settings without checking with the design department.

Model	Set value			
	C1	C2	C3	C4
HM400-1/HM400-2	100	100	100	100
HM300-1	100	100	100	100
HM300-2	105	105	105	100

Key operation

The chart below describes the key operation tree.





MODE switch	***C.HEC***	
(Service setting mode)		
TOTAL/SFT switch + LIGHT/INC switch (2 sec)	***S.SEL***	
CAL/CLR switch	***1. 5***	Loading completion travel distance [m]
MODE switch	***S.SEL***	return to S.SEL by MODE switch
CAL/CLR switch	***2.*** 1***0***	Loading start threshold [t]
CAL/CLR switch	***3.*** 0.***0***	Payload offset [t]
CAL/CLR switch	***4.***10***0***	Payload gain [%]
CAL/CLR switch	***5.*** 0.***0***	Loading payload offset [t]
CAL/CLR switch	***6.*** 0***5***	Travel mode min. speed [km/h]
CAL/CLR switch	***7.*** 0***5***	Travel mode max incline [deg]
CAL/CLR switch	***8.*** 5***0***	Green lamp threshold [%]
CAL/CLR switch	***9.***09***0***	Orange lamp threshold [%]
CAL/CLR switch	***A.***10***5***	Red lamp threshold [%]
CAL/CLR switch	***b. 2***	Store mode
CAL/CLR switch	***C.*** 2.***0***	Stopper-hit threshold [t]
CAL/CLR switch	***d.*** 5***0***	Dump completion threshold [%]
CAL/CLR switch	***E.*** 1.***0***	Stable payload threshold [t]
CAL/CLR switch	***F. 0***	External lamps check mode
CAL/CLR switch	***H.***00***0***	Machine Code 0: HM400
CAL/CLR switch	***J.***00***0***	payload unit 0: ton, 1: short ton
CAL/CLR switch	***L.***00***0***	Area code 1: Australia, 0: other
CAL/CLR switch	***P.***10***0***	C1
CAL/CLR switch	***U.***10***0***	C2
CAL/CLR switch	***G.***10***0***	C3
CAL/CLR switch	***v.***10***0***	C4
CAL/CLR switch	***S.SEL***	
MODE switch	***C.HEC***	
(Service calibration mode)		
CAL/CLR switch (2 sec)	***CAL.0***	
(Service calibration check mode)		
CAL/CLR switch	YY	year of calibration
MODE switch	***CAL.0***	Return to CAL.0 by MODE switch
CAL/CLR switch	MM:DD	Month:Date of calibration
CAL/CLR switch	HH:mm	Hour:Min. of calibration
CAL/CLR switch	***4***XXX	Pressure sensor [FL] [MPa]
CAL/CLR switch	***5***XXX	Pressure sensor [FR] [MPa]
CAL/CLR switch	***6***XXX	Pressure sensor [RL] [MPa]
CAL/CLR switch	***7***XXX	Pressure sensor [RR] [MPa]
CAL/CLR switch	***8***XX.X	Calibration payload [t]
CAL/CLR switch	***CAL.0***	
(Inclinometer calibration)		
CAL/CLR switch + TOTAL/SFT switch (2 sec)	CAL.1	
3sec	***CAL.2***	
CAL/CLR switch (2sec)	CAL.2	
3sec	CHEC	
MODE switch	***C.HEC***	
(Forcibly initialize mode)		
CAL/CLR switch + TOTAL/SFT switch + LIGHT/INC switch (2 sec)	***AC:LE***	Forcibly initialize ready
CAL/CLR switch (2 sec)	AC:LE	execution
completed	normal display	

Key operation and the display includes
1) Power on procedure
2) Normal display
3) Calibration run mode
4) Open ID input
5) Operator check mode
6) Service check mode

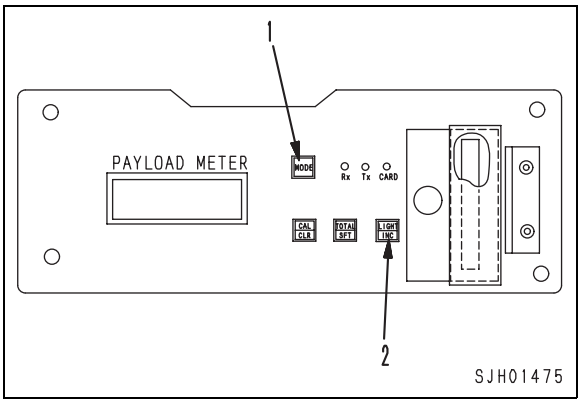
1) to 5) are explained in Operation and Maintenance Manual. The key switch operation for 6)Service check mode is explained in this section.

Service check mode

Service check mode has
1) Service input signal check mode
2) Service calibration data mode
3) Service setting mode
4) Forcibly initialize mode

1) To enter the service check mode
When the display is in normal display mode, press [MODE] switch (1) and [LIGHT/INC] switch (2) simultaneously for more than 2 seconds, 'CHEC' is flashing. This means service check mode.

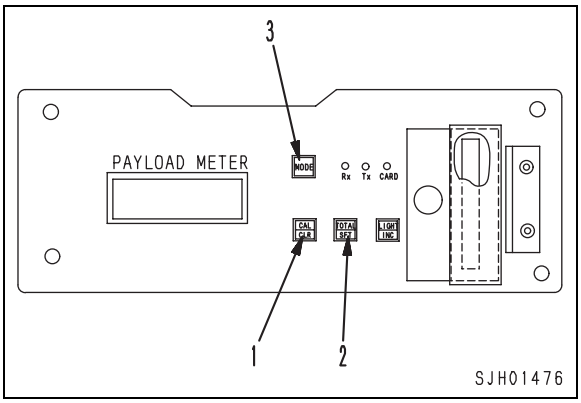
2) To return to the normal display mode
Press [MODE] switch (1), then the display is returned to normal display.



1. Service input signal check mode

1) To enter the service input signal check mode

- When the display is in service check mode ('CHEC' is flashed), press [CAL/CLR] switch (1) and [TOTAL/SFT] switch (2) simultaneously for more than 2 seconds.
- 'S.CHE' is flashed. This means the service input signal check mode.



2) To check the signal input

- Then press [CAL/CLR] switch (1), then '1X.XX' (the most left digit is flashed) is displayed. The most left digit flashed shows the number of the item. X.XX means the voltage of the pressure sensor for the front left suspension cylinder.
- Press [CAL/CLR] switch (1) to see the next content according to the table. When [CAL/CLR] is pressed at the last content of power supply voltage 'y27.2', the display is returned to 'S.CHE'.
- If you want to check the signal again, press [CAL/CLR] switch (1) again.

Display	Contents
11.50	Pressure sensor [FL][V]
21.50	Pressure sensor [FR][V]
31.50	Pressure sensor [RL][V]
41.50	Pressure sensor [RR][V]
53.00	Inclinometer [V]
63.80	Backup battery [V]
78.31	R-terminal [V]
83.00	Articulate sensor [V]
9312	Pressure sensor [FL] [MPa]
a312	Pressure sensor [FR] [MPa]
b312	Pressure sensor [RL] [MPa]
C312	Pressure sensor [RR] [MPa]
d3.12	Inclinometer [deg]
E12.3	Articulate sensor [deg]
F 1	Neutral signal
H 1	Body seated signal
J12.3	Velocity [km/h]
L34.5	Current payload [t]
P 2.3	Calibrate load [t]
U 1	Vehicle state mode
G18.0	Sensor power supply [V]
y27.2	Power supply

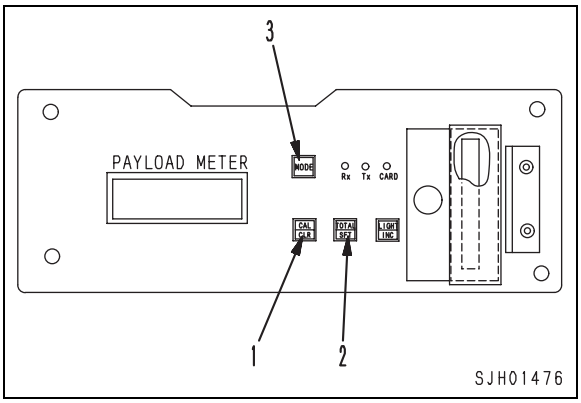
3) To return to the service check mode

Press [MODE] switch (3) at any process above, the display is returned to service check mode and 'CHEC' is flashed

2. Service calibration data mode

1) To enter the service calibration data mode

- When the display is in the service check mode ('CHEC' is flashed), press [CAL/CLR] switch (1) for more than 2 seconds.
- 'CAL0' is flashed. This means the service calibration data mode.



2) To check the calibration data

- Then press [CAL/CLR] switch (1), then 'XX' is displayed. XX means the year of the calibration executed.
- Press [CAL/CLR] switch (1) to see the next content according to the table. When [CAL/CLR] switch (1) is pressed at the last content of calibration paylaod [8XX.X], the display is returned to 'CAL0'.
- If you want to check the signal again, press [CAL/CLR] switch (1) again.

Display	Content
YY	Year of calibration
MM:DD	Month:Date of calibration
HH:mm	Hour:Min. of calibration
4XXX	Pressure sensor [FL] [MPa]
5XXX	Pressure sensor [FR] [MPa]
6XXX	Pressure sensor [RL] [MPa]
7XXX	Pressure sensor [RR] [MPa]
8XX.X	Calibration payload [t]

3) To return to the service check mode

Press [MODE] switch (3) at any process above. 'CHEC' is flahsed and the display is returned to the service check mode.

4) To enter the inclinometer calibration mode

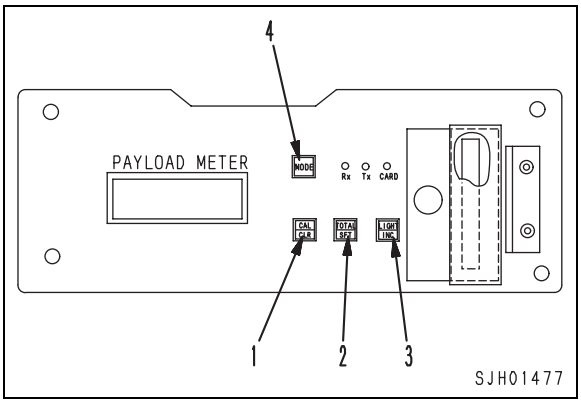
- When the display is 'CAL0' flashed, press [CAL/CLR] switch (1) and [TOTAL/SFT] switch (2) simultaneously for more than 2 seconds.
- 'CAL1' is flashed. See LOCAL INSTALLATION about the detail of this procudure.

Key operation	Display
CAL/CLR switch + TOTAL/SFT switch (2 sec)	CAL.1
3sec	***CAL.2***
CAL/CLR switch (2 sec)	CAL.2
3sec	CHEC

3. Service setting mode

1) To enter service setting mode

- When the display is in the service check mode ('CHEC' is flashed), press [TOTAL/SFT] switch (2) and [LIGHT/INC] switch (3) simultaneously for more than 2 seconds.
- '5.5EL' is flashed. Press [CAL/CLR] switch (1) to move to the next item.



2) To modify the parameter setting

- The most left digit flashed shows the number of the item selected. The 3 right digits are the parameter value. The flashed digit in this 3 digits is the one which is selected to be modified.
- Press [TOTAL/SFT] switch (2) to change the digit to be modified. The flashed digit moves from right to left. Press [LIGHT/INC] switch (3) to increase the value one by one.
- If [LIGHT/INC] switch (3) is pressed when the flashed digit is '9', then change to '0'.

Display	Item
1. ***5***	Loading completion travel distance [m]
2. 1***0***	Loading start threshold [t]
3. 0.***0***	Payload offset [t]
4.10***0***	Payload gain [%]
5. 0.***0***	Loading payload offset [t]
6. 0***5***	Travel mode min. speed [km/h]
7. 0***5***	Travel mode max incline [deg]
8. 5***0***	Green lamp threshold [%]
9.09***0***	Orange lamp threshold [%]
A.10***5***	Red lamp threshold [%]
b. ***2***	Store mode
C. 2.***0***	Stopper-hit threshold [t]
d. 5***0***	Dump completion threshold [%]
E. 1.***0***	Stable payload threshold [t]
F. ***0***	External display lamps check mode
H.00***0***	Machine Code 0: HM400, 2: HM300
J.00***0***	Payload unit 0: ton, 1: short ton
L.00***0***	Area code 1: Australia, 0: other
P.10***0***	C1
U.10***0***	C2
G.10***0***	C3
y.10***0***	C4

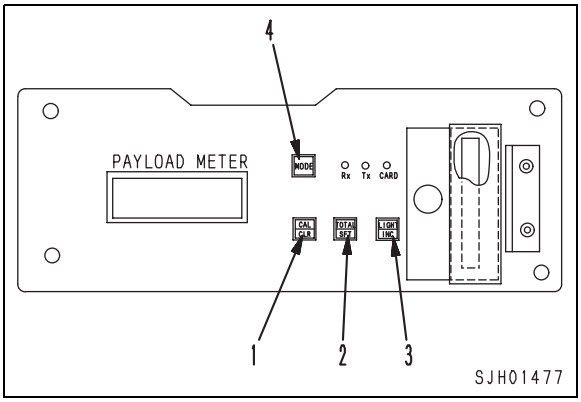
3) To return to service check mode

Press [MODE] switch (4) then 'CHEC' is flashed and the display is returned to the service check mode.

4. Forcibly initialization mode

- Press [CAL/CLR] switch (1), [TOTAL/SFT] switch (2) and [LIGHT/INC] switch (3) simultaneously for more than 2 seconds, then 'ACLE' is flashed.
- This means the forcibly initialize mode is ready. Press [CAL/CLR] switch (1) for more than 2 seconds, 'ACLE' is lighted up and the forcibly initialize mode is started.
- If you want to cancel the process when 'ACLE' is flashed, press [MODE] switch (4) then 'CHEC' is flashed.
- Several seconds after the forcibly initialize mode is started, power on process is started. It means that the forcibly initialization is completed.

★ Do not carry out this forcibly initialize mode if not necessary. All the data including the calibration data is cleared.
★ After the execution of this mode, all procedure for local installation is necessary.



Error code table

NO.	Content	Explanation	Problems if this happen	Panel display	External display lamps	Error code recorded	Trouble shooting	Remarks
1	Drop in backup battery voltage	Battery voltage lower than the nominal	When engine is shut off, stored data might be lost	F-09 flashes	—	000-009	Change the battery to new one	
2	Disconnection at R terminal	Voltage of R-terminal out of range	It impacts to the function and performance of payload meter	F-18 flashes	—	000-018	Check the signal condition display check the connector PM1, D01A, D01B	
3	Abnormality in sensor power source(18V)	Voltage of sensor power lower than the nominal	It impacts to the accuracy	F-20 flashes	ALL flash	000-020	Check the signal condition display check the connector PM2 or the harness for Suspension pressure sensors.	(*1)
4	Short circuit or disconnection in front left suspension pressure sensor system	Voltage of pressure sensor out of range	It impacts to the accuracy	F-21 flashes	ALL flash	000-021	Check the signal condition display check the connector SUFL, JPLM, PM2	(*1)
5	Short circuit or disconnection in front right suspension pressure sensor system	Voltage of pressure sensor out of range	It impacts to the accuracy	F-22 flashes	ALL flash	000-022	Check the signal condition display check the connector SUFR, JPLM, PM2	(*1)
6	Short circuit or disconnection in rear left suspension pressure sensor system	Voltage of pressure sensor out of range	It impacts to the accuracy	F-23 flashes	ALL flash	000-023	Check the signal condition display check the connector SURL, JPLM, PM2	(*1)
7	Short circuit or disconnection in rear right suspension pressure sensor system	Voltage of pressure sensor out of range	It impacts to the accuracy	F-24 flashes	ALL flash	000-024	Check the signal condition display check the connector SURR, JPLM, PM2	(*1)
8	Short circuit with power source for front left suspension pressure sensor system	Voltage of pressure sensor out of range	It impacts to the accuracy	F-25 flashes	ALL flash	000-025	Check the signal condition display check the connector SUFL, JPLM, PM2	(*1)
9	Short circuit with power source for front right suspension pressure sensor system	Voltage of pressure sensor out of range	It impacts to the accuracy	F-26 flashes	ALL flash	000-026	Check the signal condition display check the connector SUFR, JPLM, PM2	(*1)
10	Short circuit with power source for rear left suspension pressure sensor system	Voltage of pressure sensor out of range	It impacts to the accuracy	F-27 flashes	ALL flash	000-027	Check the signal condition display check the connector SURL, JPLM, PM2	(*1)
11	Short circuit with power source for rear right suspension pressure sensor system	Voltage of pressure sensor out of range	It impacts to the accuracy	F-28 flashes	ALL flash	000-028	Check the signal condition display check the connector SURR, JPLM, PM2	(*1)

NO.	Content	Explanation	Problems if this happen	Panel display	External display lamps	Error code recorded	Trouble shooting	Remarks
12	Short circuit or disconnection in inclinometer system	Voltage of inclinometer out of range	It impacts to the accuracy	F-31 flashes	ALL flash	000-031	Check the signal condition display check the connector PCL, JPLM, PM2	(*1)
13	Short circuit in green external display lamp	—	External display lamp doesn't work correctly	F-41 flashes	ALL flash	000-041	Check the relay RPM,RPMG or harness	
14	Short circuit in yellow external display lamp	—	External display lamp doesn't work correctly	F-42 flashes	ALL flash	000-042	Check the relay RPM,RPMY or harness	
15	Short circuit in red external display lamp	—	External display lamp doesn't work correctly	F-43 flashes	ALL flash	000-043	Check the relay RPM,RPMR or harness	
16	Cycle data memory FULL	Cycle data is recorded for more than 2,600 cycles	Old data is over-written	L:FUL flashes	—	000-011	Download the cycle data and clear the data	(*2)
17	Engine data memory FULL	Engine data is recorded for more than 105 times	Old data is over-written	E:FUL flashes	—	000-012	Download the Engine data and clear the data	(*3)
18	Calibration run not yet carried out	—	Payload meter doesn't work.	F.CAL flashes	ALL flash	—	Carry out the calibration run	
19	Inclinometer calibration not yet carried out	—	Payload meter doesn't work.	F.ICL flashes	ALL flash	—	Carry out the inclinometer calibration	
20	Equalizer bar hit to the stopper	—	Accuracy when loading becomes very bad	F-FL flashes	ALL flash	—	Move the vehicle for the equalizer bar not to be hit to the stopper	(*4)
21	Too much articulated when dumping	—	Accuracy when dumping becomes bad	F-AC flashes	ALL flash	—	Steer the vehicle straight	(*5)

*1. Calibration run cannot be carried out when this has occurred.

*2. Cycle data memory FULL.
1) If more than 2,600 cycles are recorded (less than 300 cycles remaining), L:FUL flashes.

2) If more cycle are recorded. Cycles 2,901 and 2,902 are recorded, the older cycle data is deleted in turn to make space to recorded the new cycle.

3) If this warning occur, please download the data and clear the all data (see Forcibly initialization mode)

*3. Engine ON/OFF data
1) If more than 105 sets are recorded (less than 10 sets remaining) : E:FUL flashes.

2) If more sets are recorded, sets 116 and 117 are recorded, the oldest ON/OFF data is deleted in turn to make space to record the new set.

3) This warning occur, please download the data and clear the all data (see Forcibly initialization mode)

*4. Equalizer bar hit the stopper
   1) If the equalizer bar hit the stopper, the accuracy would become very bad. The payload meter detect this hit when the empty dump truck is stopped at the loading spot.

   2) If the error code ‘F-FLEis displayed in the payload meter display panel, please move forward the dump truck a little bit and stop the dump truck until the ‘F-FLdisappears. When move the dump truck forward, please shift the transmission to drive range. When stop the dump truck, please shift the transmission to Neutral range after the dump truck is completely stopped.

*5. Too much articulated when dumping
   When the dumping mode is selected, the payload is calculated just before dumping. If the dump truck is articulated too much, the accuracy tends to worse. The articulated angle is more than 22.5 degree (half of full range), this fault code is activated. If this fault code is activated, please steer the dump truck to be straight.

Local installation

1. Preparation

1) Before this procedure is carried out, check the suspension length. If the suspension length is out of nominal range, charge or discharge the suspension gas and check the suspension length again to be within nominal range. This process is very important to keep the accuracy of payload meter. This process has to be done very carefully.

2) Check the dump body to be empty. If mud is on the dump body or on the chassis, clean it. It impacts the accuracy.

3) The procedure below has to be carried out with Installation checklist for articulate dump truck payload meter.

4) Calibration needs about 120m straight course with flat and horizontal ground.

5) The more straight, the more accurate. The more flat and horizontal, the more accurate.

6) Park the dump truck on the flat and horizontal ground.

7) Set the articulate straight. Mark the dump truck position on the ground.

8) Turn off engine.

- If 'press switch' without 'for more than 2 seconds' in the direction below, press switch for 0.5 seconds to 1 seconds.
- If you make a mistake of switch operation, MODE switch is effective for recovering in most situations.
- If you fail to the procedure below, turn off the key and start from the beginning again.

2. Payload meter controller check

1) Turn on the key switch.

2) Display '8.8.:8.8.' and buzzer sounds for 3 seconds.

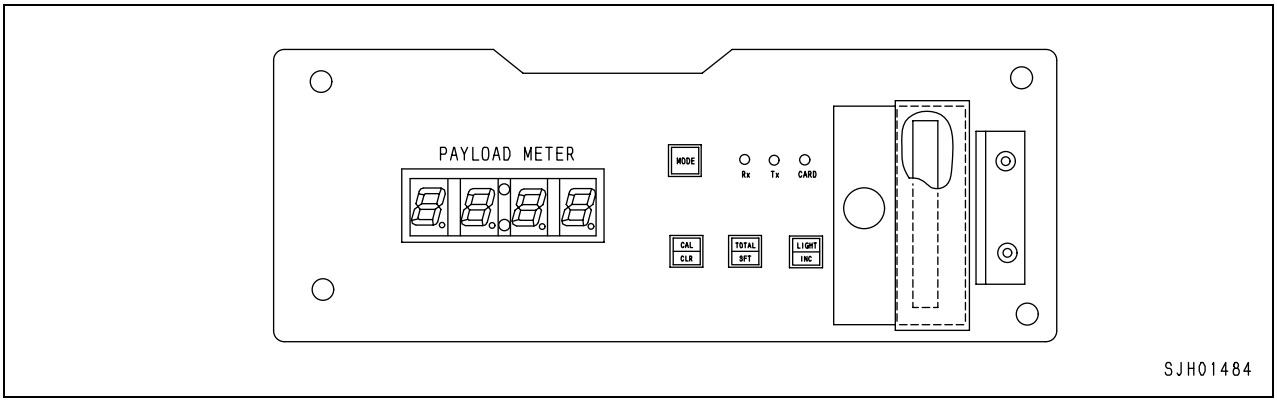
3) Display 'C0:00' (it means machine model code = 0 [HM400-2]) for about 8 seconds. Buzzer sounds 1 second again (error detection for F.ICL, and F.CAL).

4) Display 'd0:00' (it means machine ID = 0) for 3 seconds.

5) Display 'o0:00' (it means open ID = 0) for 3 seconds.

6) Display 2 fault codes, 'F.ICL (inclinometer is not calibrated)' and 'F.CAL (calibration run is not executed)' alternately. 'F-.FL' might be flashed, it's no problem.

7) If there are the other fault codes displayed, please check.



3. External display lamp check

1) Press [MODE] switch and [LIGHT/INC] switch simultaneously for more than 2 seconds. The display flashes 'CHEC' (it means service check mode).

2) Press [TOTAL/SFT] switch and [LIGHT/INC] switch simultaneously for more than 2 seconds. The display flashes 'S.SEL' (it means service setting mode).

3) Press [CAL/CLR] switch 15 times. The display is changing from '1._ _ 5' to 'f._ _ 0' ('f' means 'external display lamp check mode'). The symbol '_' above means the 'space'.

4) Make sure that all the external lamps has to be flashed (it means error 'F.CAL' and 'F.ICL' to be detected).

5) Press [LIGHT/INC] switch. The display is 'f._ _ 1'. Make sure that only the green lamp has to be turned on.

6) Press [LIGHT/INC] switch. The display is 'f._ _ 2'. Make sure that only the yellow lamp has to be turned on.

7) Press [LIGHT/INC] switch. The display is 'f._ _ 3'. Make sure that only the red lamp has to be turned on.

8) Press [LIGHT/INC] switch. The display is 'f._ _ 0'. Make sure that all the lamps has to be flashed.

9) If the lamps does not work correctly, please check the connector around the lamps or around the relay circuit.

4. Setting

1) Press [CAL/CLR] switch. The display is 'H.__0' ('H' means 'machine code setting mode' and '0' means HM400-2 and '2' means HM300-2). If you want to change the machine code to '2', press 'TOTAL/SFT' switch twice, then the display is 'H.__2' (HM300).

Machine model	Model
0	HM400-1, HM400-2
2	HM300-1, HM300-2

2) Press [CAL/CLR] switch. The display is 'J._ _ 0' ('J' means 'payload weight unit setting mode'. '0' means metric ton unit). If you want to change the unit to short ton, press [TOTAL/SFT] switch, then the display is 'J._ _ 1' (short ton).

3) Press [CAL/CLR] switch. The display is 'L._ _ 0' ('L' means 'area setting mode'. '0' means 'except Australia'). If the area is Australia, press [TOTAL/SFT] switch, then the display is 'L._ _ 1' (Australia).

4) Press [CAL/CLR] switch. The display is 'P.100' ('P' means 'machine C1 setting mode). If you want to change the C1 value to '105', press 'LIGHT/INC' switch 5 times, then the display is 'P.105'.
Press [CAL/CLR] switch. The display is 'U.100' ('U' means 'machine C2 setting mode). If you want to change the C2 value to '105', press 'LIGHT/INC' switch 5 times, then the display is 'U.105'.
Press [CAL/CLR] switch. The display is 'G.100' ('G' means 'machine C3 setting mode). If you want to change the C3 value to '105', press 'LIGHT/INC' switch 5 times, then the display is 'G.105'.

Model	Set value			
	C1	C2	C3	C4
HM400-1/HM400-2	100	100	100	100
HM300-1	100	100	100	100
HM300-2	105	105	105	100

5) Press [MODE] switch. The display flashes 'CHEC' (it means service check mode).

5. Input signal check

1) Start engine.

2) Press [CAL/CLR] switch and [TOTAL/SFT] switch simultaneously for more than 2 seconds. The display flashes 'S.CHE' (it means service input signal check mode).

3) Press [CAL/CLR] switch. The display is '1X . XX' ('1' is flashed). The right 3 digit shows the voltage of front left suspension pressure sensor. Write down the value on the check sheet.). If the value is out of range, check the wiring or sensor install.

4) Press [CAL/CLR] switch. The display is '2X . XX' ('2' is flashed). The right 3 digit shows the voltage of front right suspension pressure sensor. Write down the value on the check sheet.). If the value is out of range, check the wiring or sensor install.

5) Press [CAL/CLR] switch. The display is '3X . XX' ('3' is flashed). The right 3 digit shows the voltage of rear left suspension pressure sensor. Write down the value on the check sheet.). If the value is out of range, check the wiring or sensor install.

6) Press [CAL/CLR] switch. The display is '4X . XX' ('4' is flashed). The right 3 digit shows the voltage of rear right suspension pressure sensor. Write down the value on the check sheet.). If the value is out of range, check the wiring or sensor install.

7) Press [CAL/CLR] switch. The display is '5X . XX' ('5' is flashed). The right 3 digit shows the voltage of Inclinometer.). If the value is out of range, check the wiring or sensor install.

8) Press [CAL/CLR] switch. The display is '6X . XX' ('6' is flashed). The right 3 digit shows the voltage of the backup battery. Write down the value on the check sheet.). If the value is out of range, the backup battery has to be replaced to new one.

9) Press [CAL/CLR] switch. The display is '7X . XX' ('7' is flashed). The right 3 digit shows the voltage of R terminal. The voltage of R terminal has to be more than 24V, but the maximum value of this display is around 8.3V. If the display is around 8.3V, it's OK. If the value is out of range, check the wiring.

10) Press [CAL/CLR] switch. The display is '8X . XX' ('8' is flashed). The right 3 digit shows the voltage of articulate sensor. (write down the value on the check sheet.). If the value is out of range, check the wiring or sensor install.

11) Press [CAL/CLR] switch 6 times. The display is 'F_ _ 1' ('F' is flashed). The most right digit shows the neutral signal (1 : neutral, 0 : other). Move the shift lever to 'D' range. The display on payload meter has to be 'F_ _ 0'. Return the shift lever to 'N' range. The display on payload meter has to be 'F_ _ 1'. (Check on the check sheet.). If the value is not correct, check the wiring.

12) Press [CAL/CLR] switch. The display is 'H_ _ 1' ('H' is flashed). The most right digit shows the body seated signal (1 : seated, 0 : not seated). Raise the dump body and the display on payload meter has to be 'H_ _ 0'. Lower the dump body and the display on payload meter has to become 'H_ _ 1'. (Check on the check sheet.). If the value is not correct, check the wiring or sensor install.

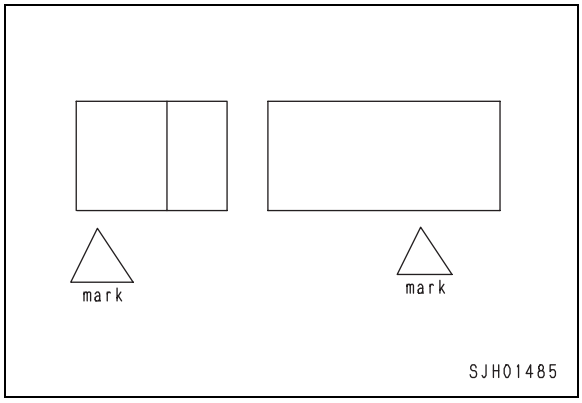
13) Press [CAL/CLR] switch. The display is 'J_ _.0' ('J' is flashed). The most right digit shows the velocity. Put the shift lever to 2nd position and move the vehicle with full throttle pedal. The display on payload meter has to be around 12 Km/h. (Check on the check sheet.). If the value is not correct, check the wiring.

14) Press [MODE] switch. The display flashes 'CHEC'. Press [Mode] switch again. Display 2 error codes, 'F.ICL(inclinometer is not calibrated)' and 'F.CAL(calibration run is not executed)' alternately. 'F-.FL' might be flashed, it's no problem.

6. Inclinometer & articulate sensor calibration

1) Start engine.

2) Inclinometer will be calibrated by measuring 2 opposite direction of the vehicle and by averaging sensor inputs of these 2 times. The longitudinal incline of the ground must be canceled. But the more horizontal the ground is, the more accurate. Please find the flat and horizontal area for this calibration. The accuracy of the inclinometer impacts the accuracy of payload meter. This process has to be done very carefully.



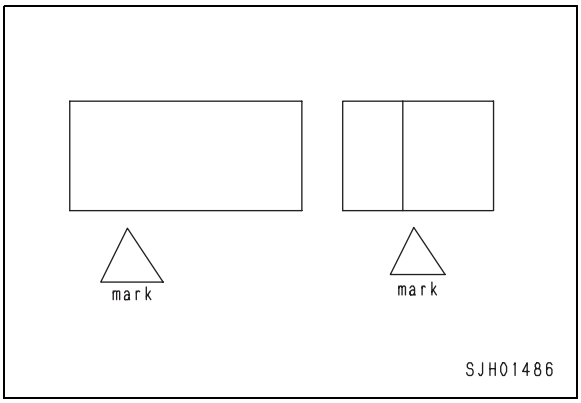
3) Make sure the articulate to be straight. The articulate sensor will be calibrated as 'straight' at this position. Please set the articulate to be straight carefully.

4) Press [MODE] switch and [LIGHT/INC] switch simultaneously for more than 2 seconds. The display flashes 'CHEC' (it means service check mode).

5) Press [CAL/CLR] switch for more than 2 seconds. The display flashes 'CAL.0' (service calibration data check mode)

6) Press [CAL/CLR] switch and [TOTAL/SFT] switch simultaneously for more than 2 seconds. 'CAL.1' (it means Inclinometer calibration mode) will be displayed and the calibration for Inclinometer and articulate sensor are executed for 3 seconds. 'CAL.2' will be flashed after 3 seconds.

7) Turn around the dump truck and park the dump truck with opposite direction on the exactly same position above.



8) Press [CAL/CLR] switch for more than 2 seconds. 'CAL.2' will be turned on and the calibration for Inclinometer and articulate sensor are calibrated for 3 seconds again for opposite direction. 'CHEC' will be flashed after the calibration is finished.

9) Press [MODE] switch. The error code 'F.ICL' must be turned off and only 'F.CAL' is flashed. This means the inclinometer calibration was successfully finished. 'F-.FL' might be flashed, it's no problem.

7. Calibration run

1) The weight of the empty dump truck has to be calibrated because the weight of empty dump truck might be different by the vessel and attachment options.

2) Park the dump truck on the flat and horizontal ground. Calibration run needs about 100 m straight and flat course.

3) Press [CAL/CLR] switch for more than 2 seconds. ' CAL.' will be flashed.

4) If you are ready to start, press [CAL/CLR] switch. ' CAL' will be lighted up.

5) Shift the transmission to 2nd range.

6) Press throttle pedal full. After the velocity becomes over 9Km/h, the display counts up the elapsed time (seconds). Calibration run needs 30 seconds run.

7) After 30 seconds counted up, the current calculated payload [ton] will be displayed.

8) Stop the dump truck gently, shift the transmission to neutral, turn on the parking brake and release the retarder brake or service brake. Do not change the transmission to neutral before the dump truck is stopped.

9) Write down the current payload. The displayed payload has to be around 0 ton because the dump truck is empty.

10) Press [MODE] switch, then the display has to be 'clock'. If 'F.-FL' is still flashed, please move the dump truck and stop it gently. 'F.-FL' must be distinguished. Do not change the transmission to neutral before the dump truck is stopped.

11) Write down the current payload.

12) All external display lamp has to be turned off.

13) This calibration run has to be done periodically by the customer. Please induce the way to do it to the customer.

8. Clock set

1) Clock is set for Japanese standard time. The date and the hour might be modified to the local time.

2) Press [MODE] switch for more than 2 seconds. The display flashes 'oCHE' (it means operator check mode).

3) Press [MODE] switch. The display is 'd000' (it means machine ID).

4) Press [MODE] switch. The display is '_ _ YZ' ('Z' is flashed, YZ means lower 2 digits of year. 'YZ' for 2003 is '03').

5) If 'Z' has to be corrected, press [LIGHT/INC] switch, then 'Z' is increased.

6) Press [TOTAL/SFT] switch. The display is '_ _ YZ' ('Y' is flashed, YZ means lower 2 digits of year. 'YZ' for 2003 is '03').

7) If 'Y' has to be corrected, press [LIGHT/INC] switch, then 'Y' is increased.

8) Press [TOTAL/SFT] switch. The display is 'MM:dd' ('MM' is flashed, MM means month, dd means day).

9) If 'MM' has to be corrected, press [LIGHT/INC] switch, then 'MM' is increased.

10) Press [TOTAL/SFT] switch. The display is 'MM:dd' ('dd' is flashed, MM means month, dd means day).

11) If 'dd' has to be corrected, press [LIGHT/INC] switch, then 'dd' is increased.

12) Press [TOTAL/SFT] switch. The display is 'HH.mm' ('HH' is flashed, HH means hour, mm means minutes).

13) If 'HH' has to be corrected, press [LIGHT/INC] switch, then 'HH' is increased.

14) Press [TOTAL/SFT] switch. The display is 'HH:mm' ('mm' is flashed).

15) If 'mm' has to be corrected, press [LIGHT/INC] switch, then 'mm' is increased.

16) Press [MODE] switch. The display is 'A.CLE' ('CLE' is flashed).

17) Press [MODE] switch. The clock has to be displayed.

9. Set store mode

1) This payload meter has 3 measurement method, dumping method, traveling method and loading method, are implemented. These 3 methods are carried out for corresponding stage of each cycle. But only the payload by 1 method is stored and can be downloaded. Which mode to record can be set with the switch of the payload meter controller.

2) Each method has its pros and cons. The method to be recorded has to be decided by the site condition and the customers request.

3) The general guide line is as below
   (1) Traveling method is the most accurate for almost site.
   (2) If all the haul road is very rough or the distance of haul road is less than 200 m,
      a. If the ground of the dumping area is flat and the incline is less than ±5°., dumping method can be selected.
      b. If the ground of the dumping area is not flat or the incline is more than ±5°., the dumping method cannot be selected.
   (3) If the customer wants to have the payload data at the loading spot, loading method can be selected.

4) Press [MODE] switch and [LIGHT/INC] switch simultaneously for more than 2 seconds. The display flashes 'CHEC' (it means service check mode).

5) Press [TOTAL/SFT] switch and [LIGHT/INC] switch simultaneously for more than 2 seconds. The display flashes 'S.SEL' (it means service setting mode).

6) Press [CAL/CLR] switch 11 times. The display is changing from '1._ _ 5' to 'b._ _ 2' ('b' means 'store mode setting', '2' means 'traveling method'). If you want to change the store mode, press [LIGHT/INC] switch. Then the display is changing to 'b._ _ 3' (loading method) → 'b _ _ 1' (dumping method) → 'b._ _ 2' (traveling mode). Write down the mode you set on the check sheet.

7) After the mode is selected, press [MODE] switch. The display flashes 'CHEC' (it means service check mode).

8) Press [MODE] switch again. The display shows the clock.

10. Trial test

1) Try 1 cycle including loading, traveling and dumping with almost 100% payload.

2) See "Method of using accurately".

3) Check the display working correctly as the table below.

Condition of machine		Gearshift lever position	Dump body position	Payload display panel	External display lamp
When empty	Stopped	N	Seated	Time	OFF
	Traveling	Except N	Seated	Time	OFF
During loading	Stopped	N	Seated	Payload	Payload display and display of estimate
	Traveling (*1)	Except N	Seated	Traveling distance	OFF
When loaded	Stopped	N	Seated	Payload	Payload display
	Traveling	Except N	Seated	Time	OFF
When dumping		N	Seated → Unseated	Total payload (*2)	OFF
When abnormality is happened	—	—	—	See "Error code table"	

*1. When load is less than 50% of correct weight, display shows 0 t.
*2. The aggregate weight display is shown in units of 100 t. (rounded to the nearest 100)

4) Download the data. Check the data in the cycle data (payload, dumping time) to be correct.

11. Data clear

1) Press [MODE] switch for more than 2 seconds. The display flashes 'oCHE' (it means operator check mode).

2) Press [MODE] switch. The display is 'd000' (it means machine ID).

3) Press [MODE] switch. The display is '_ _ YZ' ('Z' is flashed, YZ means lower 2 digits of year. 'YZ' for 2003 is '03').

4) Press [MODE] switch. The display is 'A.CLE' ('CLE' is flashed).

5) Press [CAL/CLR] switch for more than 2 seconds. The display is 'A.CLE' ('A.CLE' is flashed).

6) Press [CAL/CLR] switch for more than 2 seconds. The display is 'A.CLE' ('A.CLE is lighted up). All clear of the cycle data and fault history will be started.

7) After all clear, the display becomes clock set.

8) Turn off engine.

HM300-2 Articulated dump truck

Form No. SEN04841-00

ARTICULATED DUMP TRUCK

HM300-2

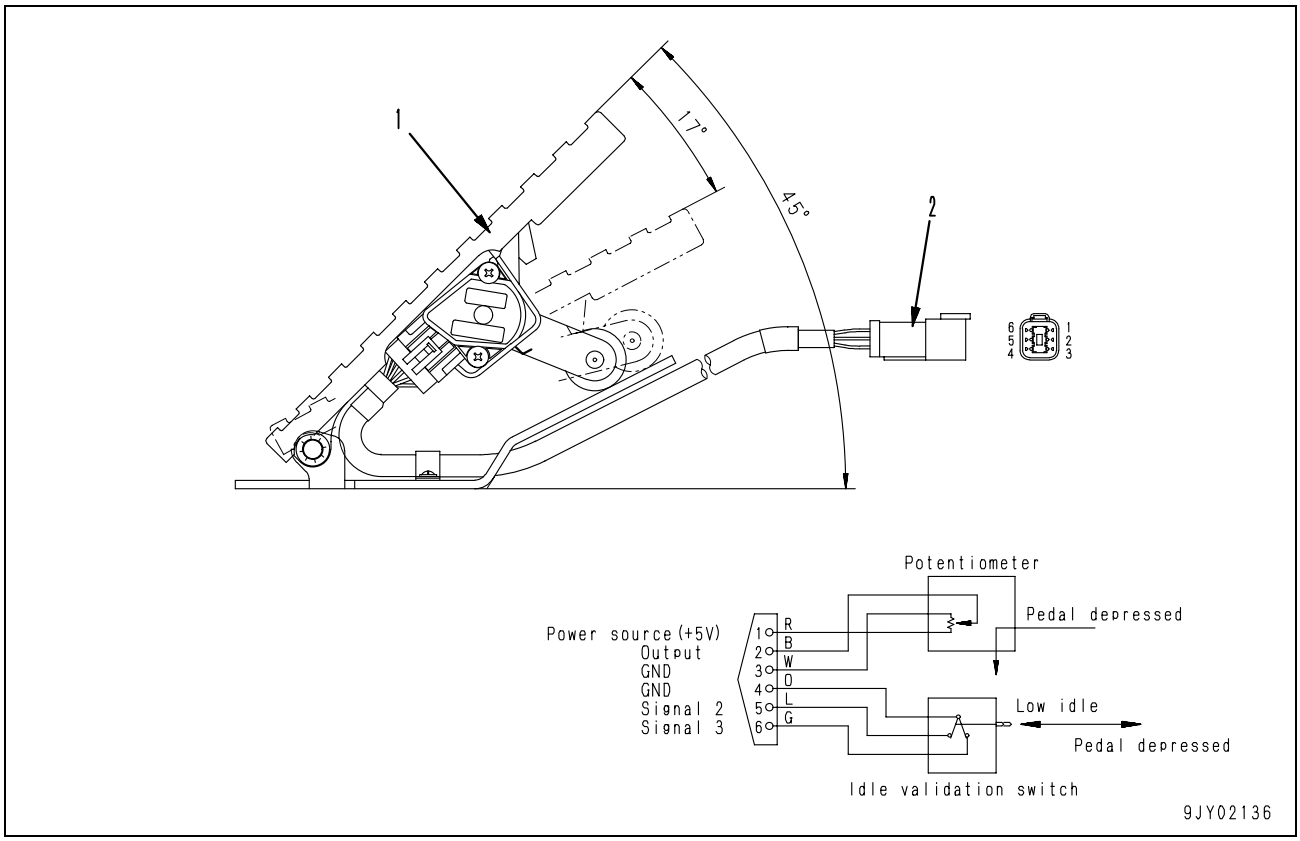
Machine model	Serial number
HM300-2	2001 and up

10 Structure, function and maintenance standard

Electrical system, Part 4

Sensors, switches

Accelerator sensor
Serial No.: 2001 – 2241



1. Pedal
2. Connector

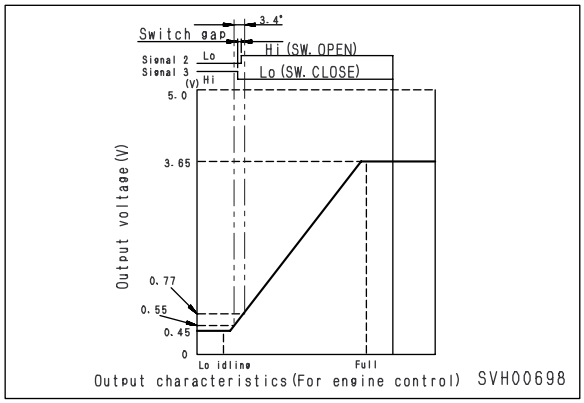
Outline

Accelerator signal

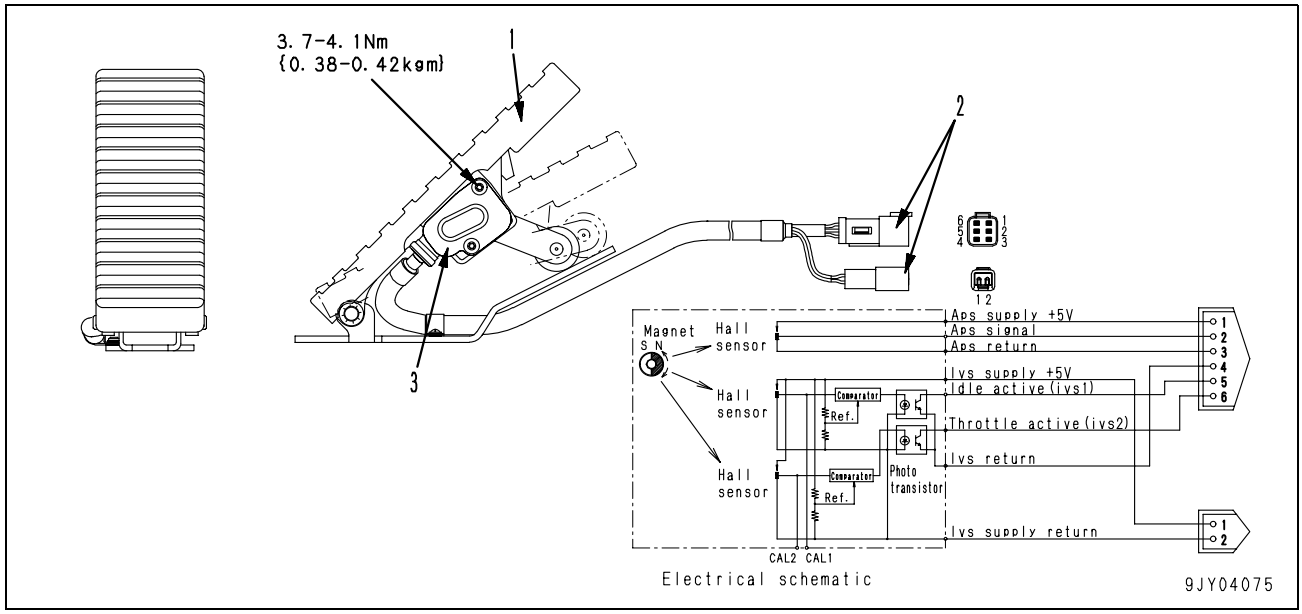
- This is installed under the operator's cab. The accelerator pedal and accelerator sensor are connected by a link. When the accelerator pedal is depressed, the movement is passed through the link and rotates the shaft of the potentiometer inside the accelerator sensor.
  As a result, the resistance changes. A fixed voltage is impressed between the No. 1 – 3 pins of the potentiometer. A voltage signal corresponding to the angle of the accelerator pedal is sent from the No. 2 pin to the engine controller.

Idle validation signal

- This is installed under the accelerator pedal.
  When the accelerator pedal is released, signal 2 (No. 5 pin) is connected to the ground; when the accelerator pedal is depressed, signal 3 (No. 6 pin) is connected to the ground.
  The engine controller then detects the condition.



Serial No.: 2242 and up



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.

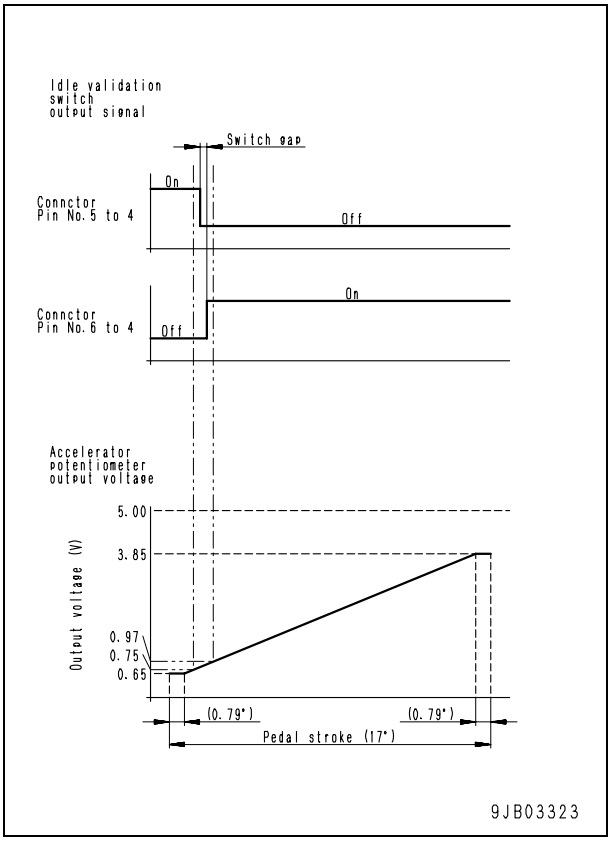
Accelerator signal

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

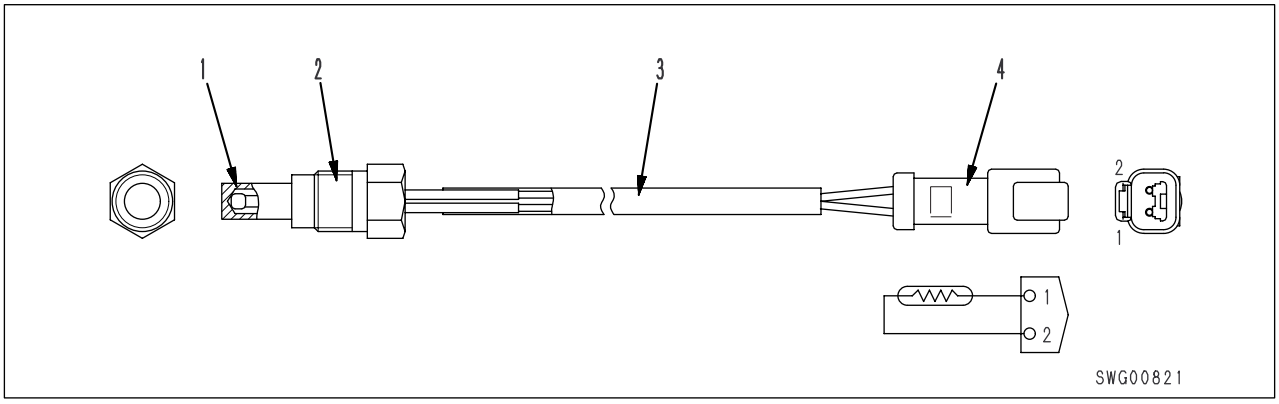
Idle validation signal

- 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



Retarder oil temperature sensor

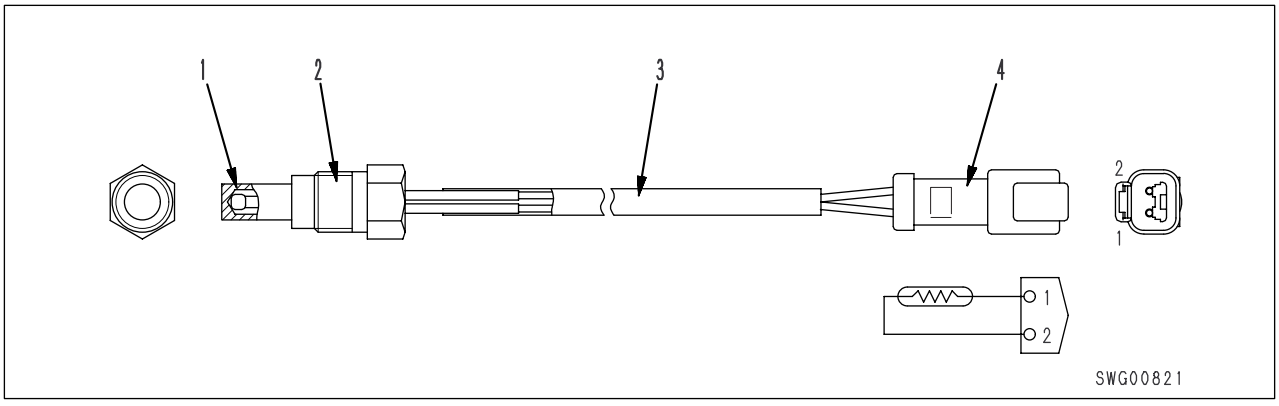


1. Thermistor
2. Plug
3. Wiring harness
4. Connector

Function

- The retarder oil temperature sensor is installed on the retarder pipe. It converts a temperature change into a change of thermistor resistance, and transmits a signal to the transmission controller. The transmission controller transmits the signal via the network to the machine monitor panel, and the machine monitor panel displays a temperature level. The temperature level displayed on the monitor panel reaches a predetermined position, the lamp flashes and the warning buzzer sounds.

Steering oil temperature sensor

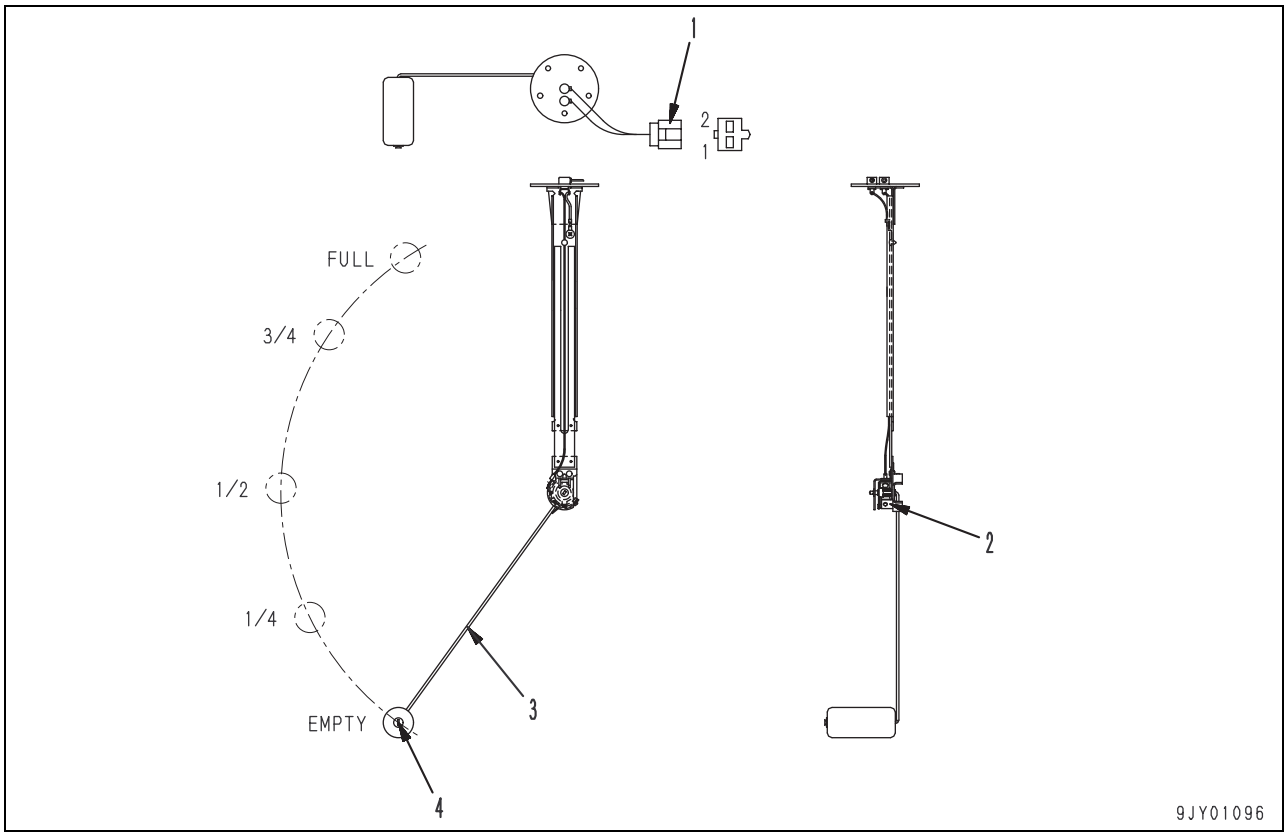


1. Sensor
2. Terminal
3. Wiring harness
4. Connector

Function

- The steering oil temperature sensor is installed to the steering and hoist piping. The sensor portion detects the temperature, and when the oil temperature goes above the specified level, the warning lamp lights up and a message is displayed on the character display of the monitor panel.

Fuel level sensor

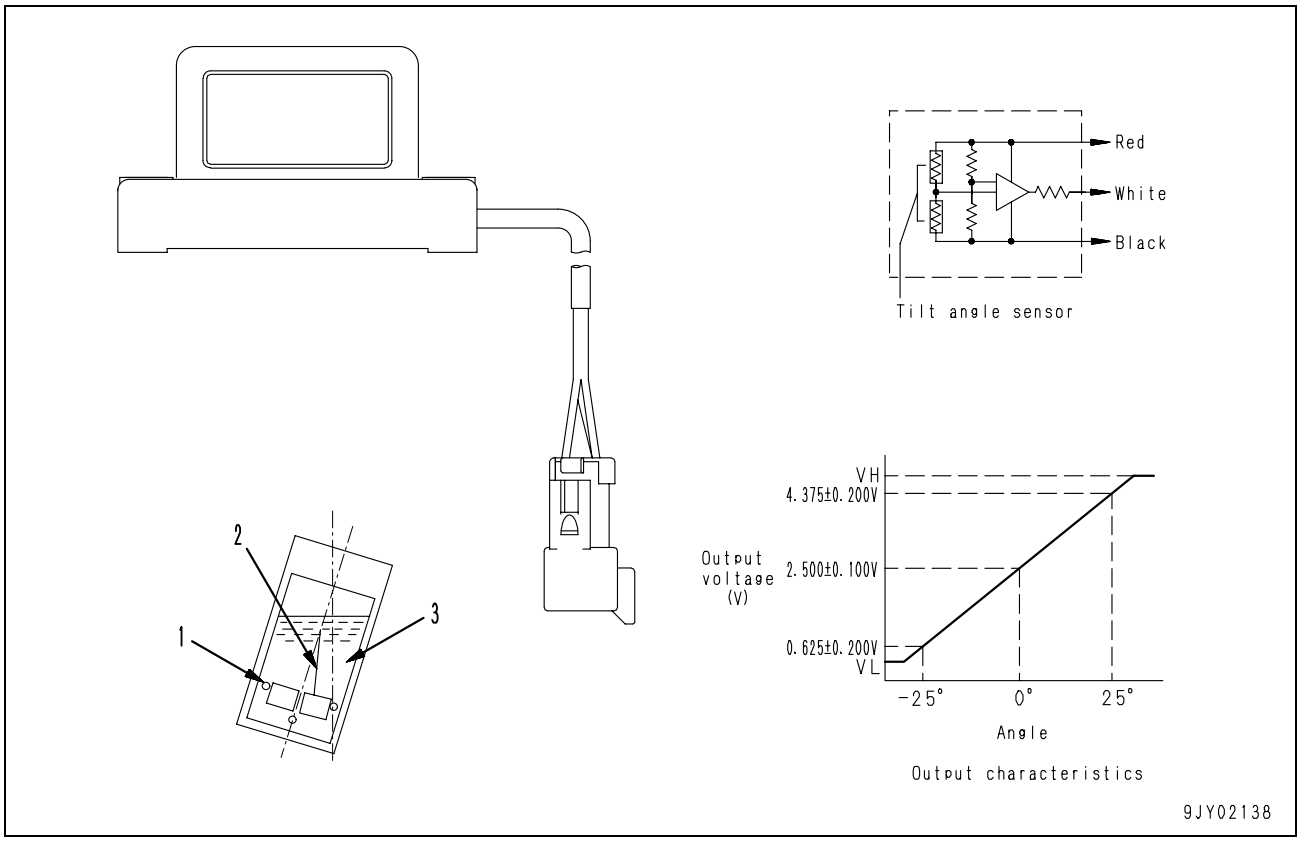


1. Connector
2. Wire resistor
3. Arm
4. Float

Function

- The fuel sensor is installed to the side face of the fuel tank. The float moves up and down according to the fuel level. This movement of the float is transmitted by the arm and actuates a variable resistance. This sends a signal to the monitor panel to indicate the remaining fuel level. When the display of the monitor panel reaches a certain level, a warning lamp flashes.

Tilt sensor

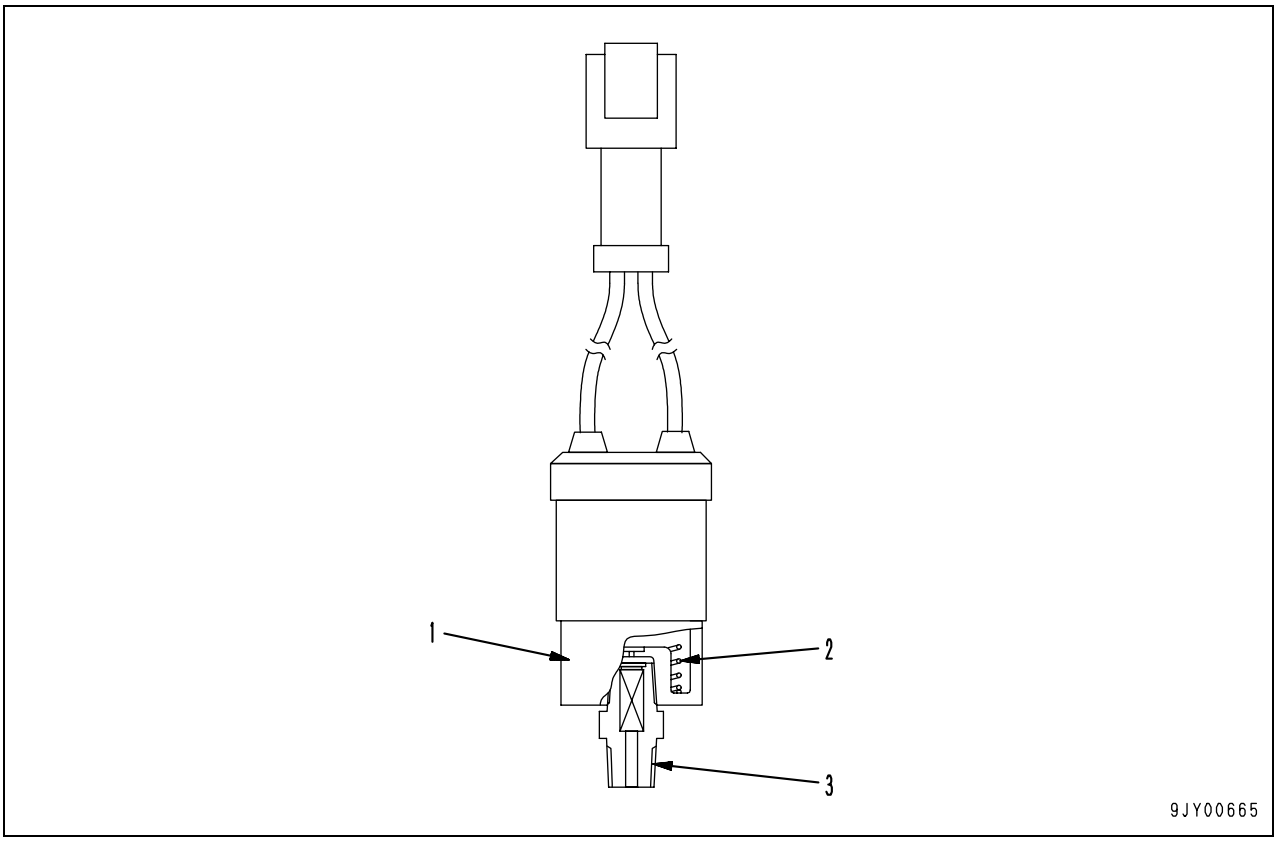


1. Magnetic resistance particle
2. Leaf spring
3. Damper oil

Function

- The tilt sensor is installed to the rear of the chassis. A magnet supported by a leaf spring is installed to a case charged with damper oil. It uses the position in relation to the magnetic resistance element to detect the tilt angle of the chassis.
  The magnet is supported by the leaf spring, so it does not detect the front-to-rear tilt of the chassis.

Air cleaner clogging sensor

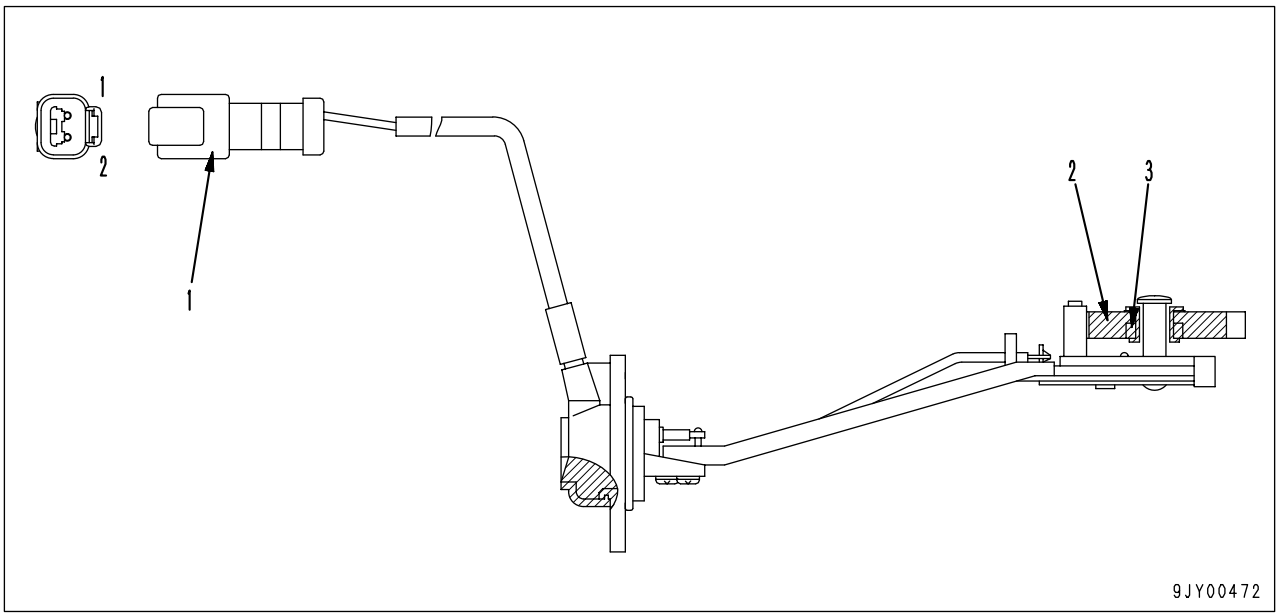


1. Indicator
2. Spring
3. Adapter

Function

- The air cleaner clogging sensor is installed to the outlet port of the air cleaner. If the air cleaner becomes clogged and reaches the set pressure (negative pressure), the maintenance warning lamp lights up to warn of the abnormality.

Hydraulic oil level sensor

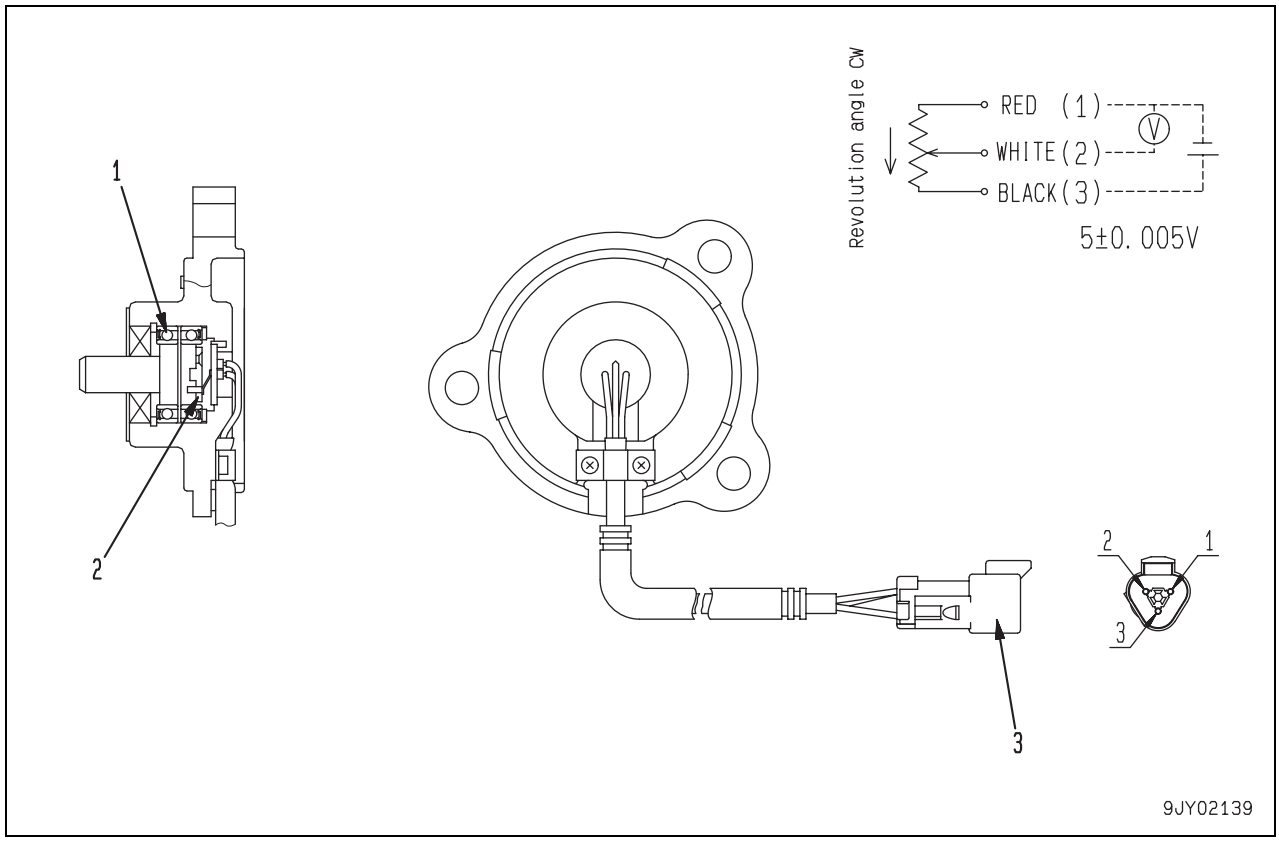


1. Connector
2. Float
3. Switch

Function

- The hydraulic oil level sensor is installed to the side face of the hydraulic tank. When the oil goes below the specified level, the float goes down, the switch is turned OFF, and the maintenance caution lamp lights up to warn of the abnormality.

Body position sensor

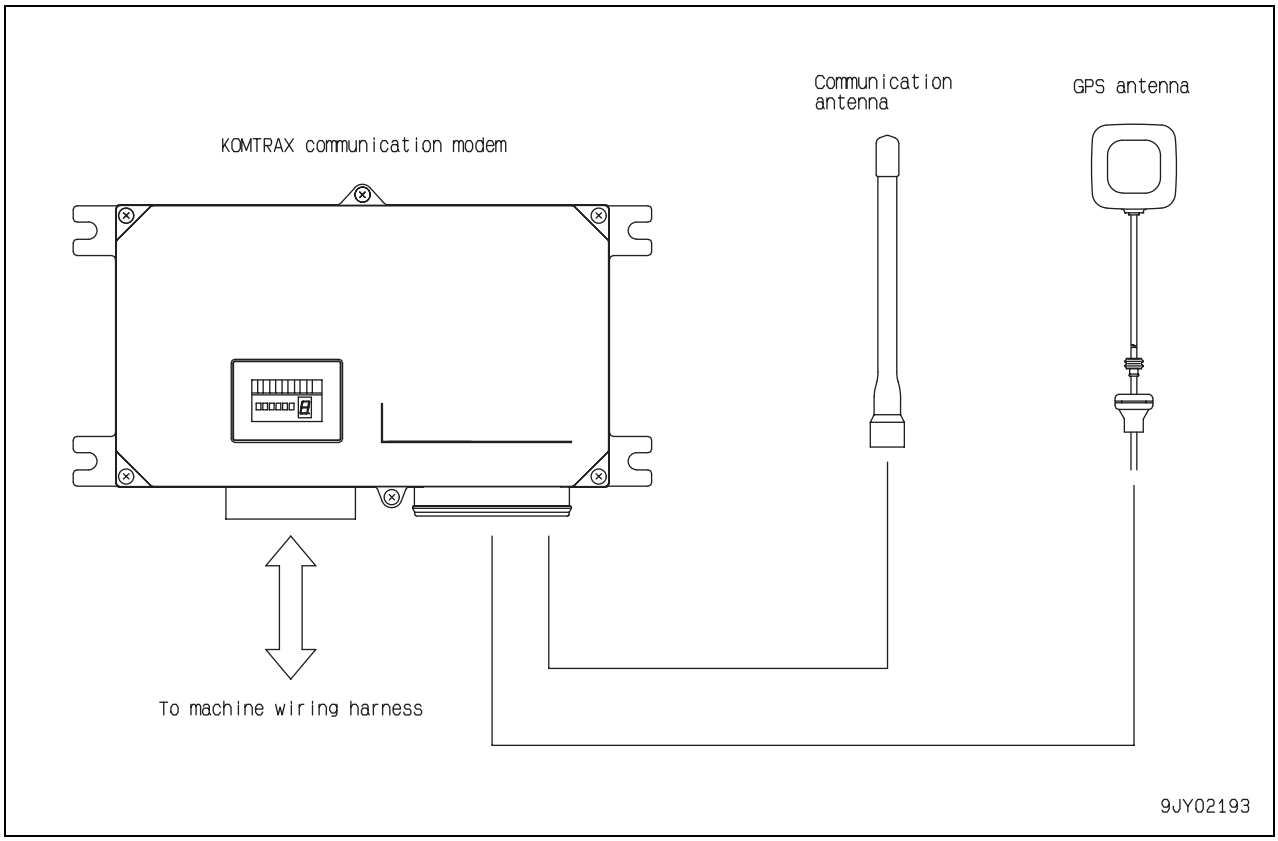


1. Bearing
2. Brush assembly
3. Connector

Function

- The body position sensor is installed to the rear of the chassis. When the angle of the dump body changes, the shaft rotates through the link installed to the dump body, and the dump body angle is detected.

KOMTRAX terminal system (If equipped)



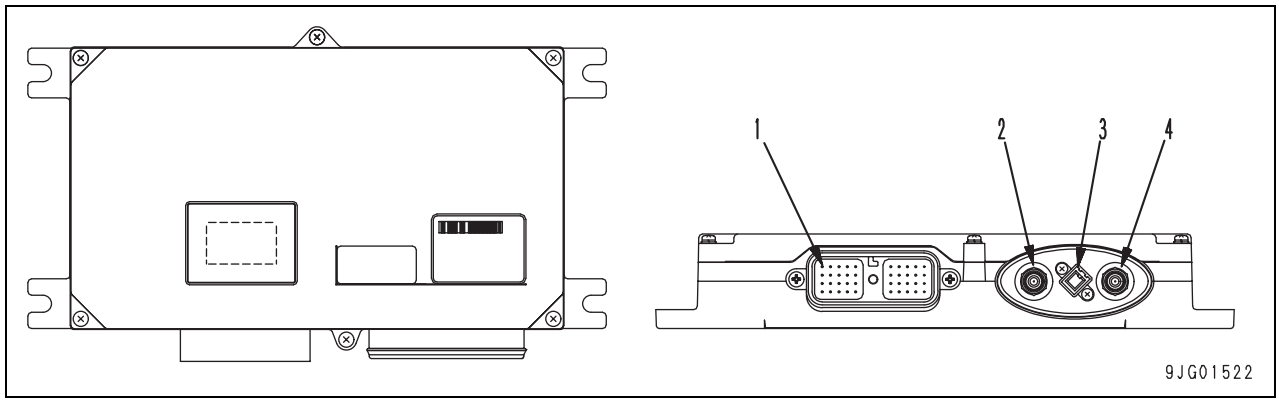
- The KOMTRAX terminal transmits various kinds of machine information wirelessly. Persons to operate the KOMTRAX can refer to the information at office to provide various kinds of services for customers.

  ★ To provide the services, you need to make an arrangement for starting the KOMTRAX terminal service separately.

  Information transmittable from KOMTRAX terminal system includes the following.
  1. Travel history
  2. Service meter
  3. Position information
  4. Error history

  and others.

KOMTRAX communication modem



1. DRC connector (40 poles) connecting part
2. (Not connected)
3. GPS antenna connector connecting part
4. Orbcomm

Outline

- The KOMTRAX terminal can obtain various kinds of machine information from network signals or input signals in the machine, and transmit the information via the communication antenna. The terminal is equipped with a CPU (central processing unit), and has wireless communication and GPS functions as well.
- The terminal is provided with a LED lamp and a 7-segment display lamp as a display unit. The display unit is used for inspection and maintenance.

Input and output signals

- DRC connector

Pin No.	Signal name	Input/output
1	232C (OCH) control signal	Input
2	232C (OCH) control signal	Output
3	232C (OCH) control signal	Input
4	232C (OCH) receiving	Input
5	232C (OCH) transmitting	Output
6	CAN shield GND	—
7	CAN signal (L)	Input/output
8	CAN signal (H)	Input/output
9	S-NET shield GND	—
10	S-NET signal	Input/output
11	232C (OCH) shield GND	—
12	Writing signal	Input
13.	232C (ICH) receiving	Input
14.	232C (ICH) transmitting	Output
15.	232C (OCH) control signal	Output
16.	(if equipped)	Input
17.	(if equipped)	Input
18.	(if equipped)	Output
19.	(if equipped)	Output
20.	Relay output	Output

Pin No.	Signal name	Input/output
21	Inspection mode	Input
22	Inspection mode	Input
23	232C (OCH) control signal	Input
24	(if equipped)	Input
25	(if equipped)	Input
26	(if equipped)	Input
27	C terminal input (Hi side)	Input
28	R terminal input	Input
29	EXGND	—
30	(if equipped)	Output
31	(if equipped) (5V MAX)	Input
32	(if equipped) (5V MAX)	Input
33	232C (OCH) control signal	Input
34	(if equipped)	Input
35	(if equipped)	Output
36	ACC Input	Input
37	Power supply GND (if equipped)	—
38	Power supply GND (if equipped)	—
39	Permanent power supply (12V/24V)	Input
40	Permanent power supply (12V/24V)	Input

HM300-2 Articulated dump truck

Form No. SEN00419-02

ARTICULATED DUMP TRUCK

HM300-2

Machine model	Serial number
HM300-2	2001 and up

20 Standard value table
Standard service value table

Standard value table for engine

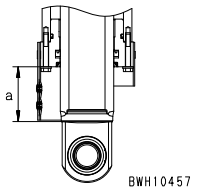
Machine model					HM300-2	
Engine					SAA6D125E-5	
Category	Item	Measurement conditions		Unit	Standard value for new machine	Service limit value
Engine	Engine speed	High idle	Power mode	rpm	2,200 ± 50	2,200 ± 50
			Economy mode		2,100 ± 50	2,100 ± 50
		Low idle	Power mode		970 ± 25	970 ± 25
			Economy mode		700 ± 50 %	700 ± 50 %
		Rated speed	Power mode		2,000	2,000
			Economy mode		1,600	1,600
	Air boost pressure	At rated output		kPa {mmHg}	Min. 107 {Min. 800}	87 {650}
	Exhaust temperature	Whole speed range (intake air temperature: 20°C)		°C	Max. 700	700
	Exhaust gas color	At sudden acceleration (Low → High)		% (Bosch index)	Max. 25 {Max. 2.5}	–
		At rated output		Bosch index	Max. 1.5	–
		At high idle		Bosch index	Max. 1.0	–
	Valve clearance	Intake valve		mm	0.33	–
		Exhaust valve		mm	0.71	–
	Compression pressure	Engine oil temperature: 40 – 60°C Engine speed: 200 – 250 rpm		MPa {kg/cm^2}	Min. 2.9 {Min. 30}	2.0 {20}
	EGR valve and bypass valve drive oil pressure		High idle	MPa {kg/cm^2}	Min. 1.43 {Min. 14.6}	Min. 1.43 {Min. 14.6}
			Low idle		Min. 1.18 {Min. 12}	Min. 1.18 {Min. 12}
	Blow-by pressure	At rated output Engine coolant temperature: Min. 70°C		kPa {mmH_2O}	Max. 1.47 {Max. 150}	Max. 2.94 {Max. 300}
	Engine oil pressure	At rated output Engine oil temperature: Min. 80°C	SAE0W30E0S SAE5W40E0S SAE10W30DH SAE15W40DH SAE30DH	MPa {kg/cm^2}	0.29 – 0.69 {3.0 – 7.0}	0.18 {1.8}
		At low idle Engine oil temperature: Min. 80°C		MPa {kg/cm^2}	Min. 0.05 {Min. 0.5}	0.03 {0.3}
	EGR valve and bypass valve drive oil pressure	At low idle		MPa {kg/cm^2}	Min. 1.18 {Min. 12.0}	Min. 1.18 {Min. 12.0}
		At high idle			Min. 1.43 {Min. 14.6}	Min. 1.43 {Min. 14.6}
	Oil temperature	All speed range (inside oil pan)		°C	90 – 110	120
	Fan belt tension	Deflection when pressed with finger force of approx. 58.8 N {6 kg}.		mm	13 – 16	13 – 16
	Alternator belt tension	Deflection when pressed with finger force of approx. 58.8 N {6 kg}.		mm	13 – 16	13 – 16

Standard value table for chassis

Machine model						HM300-2	
Category	Item		Measurement conditions		Unit	Standard value for new machine	Service limit value
Engine	Accelerator pedal	Operating effort	● Point 150mm from pedal fulcrum	Starting to depress	N {kg}	29.4 ± 4.9 {3.0 ± 0.5}	29.4 ± 4.9 {3.0 ± 0.5}
				Fully depressed		58.8 + 4.9/- 4.9 {6.0 + 0.49/- 0.49}	58.8 + 4.9/- 4.9 {6.0 + 0.49/- 0.49}
		Travel	● Point 150mm from pedal fulcrum		mm	45 ± 5	45 ± 5
	Engine speed	Torque converter lockup actuation speed	● Engine coolant temperature: Within operating range ● Torque converter oil temperature: Within operating range ● Hydraulic oil temperature: 45 – 55°C ★ Torque converter lockup is actuated in F3 – F6		rpm	1,050 ± 50	1,050 ± 50
		Torque converter lockup cancel speed		Brake ON		950 ± 50	950 ± 50
				Brake OFF		850 ± 50	850 ± 50
		Torque converter stall speed		Power mode		1,940 ± 100	1,940 ± 100
				Economy mode		1,780 ± 100	1,780 ± 100
		Transmission shift-up speed	● Engine coolant temperature: Within operating range ● Torque converter oil temperature: Within operating range ● Hydraulic oil temperature: 45 – 55°C ● Brake mode: Accelerator OFF or brake ON	Power mode Accelrator: Full Dump body: Unloaded	rpm	2,050 ± 50	2,050 ± 50
		Transmission shift-down speed				1,300 ± 50	1,300 ± 50
		Transmission shift-up speed		Brake mode		2,200 ± 50	2,200 ± 50
		Transmission shift-down speed				1,350 ± 50	1,350 ± 50
		Transmission downshift inhibit speed				1,550 ± 50	1,550 ± 50
		Overrun prevention actuation speed			rpm	2,450 ± 50	2,450 ± 50
		Overrun prevention cancel speed				2,150 ± 50	2,150 ± 50

Machine model						HM300-2	
Category	Item		Measurement conditions		Unit	Standard value for new machine	Service limit value
Power train	Gearshift lever	Operating effort	● Center of lever grip ● Between each position		N {kg}	21.6 ± 8.8 {2.2 ± 0.9}	Max. 19.6 {Max. 2.0}
		Travel			mm	24.0 ± 1	24.0 ± 2
	Oil pressure	Power train main relief pressure	● Torque converter oil temperature: Within operating range ● Gearshift lever: N	Low idle	MPa {kg/cm^2}	2.55 ± 0.2 {26 ± 2.0}	2.55 ± 0.2 {26 ± 2.0}
				High idle		2.55 ± 0.2 {26 ± 2.0}	2.55 ± 0.2 {26 ± 2.0}
		Torque converter inlet port pressure	● Torque converter oil temperature: Within operating range ● Engine speed: High idle		MPa {kg/cm^2}	0.91 ± 0.10 {9.3 ± 1.0}	0.91 ± 0.10 {9.3 ± 1.0}
		Torque converter outlet port pressure				0.54 ± 0.10 {5.5 ± 1.0}	0.54 ± 0.10 {5.5 ± 1.0}
		Torque converter lockup clutch pressure				2.16 ± 0.15 {22.0 ± 1.5}	2.16 ± 0.15 {22.0 ± 1.5}
		Transmission Lo clutch pressure	● Torque converter oil temperature: Within operating range ● Engine speed: High idle		MPa {kg/cm^2}	2.45 ± 0.15 {25.0 ± 1.5}	2.45 ± 0.15 {25.0 ± 1.5}
		Transmission Hi clutch pressure				2.45 ± 0.15 {25.0 ± 1.5}	2.45 ± 0.15 {25.0 ± 1.5}
		Transmission 1st clutch pressure			MPa {kg/cm^2}	2.45 ± 0.15 {25.0 ± 1.5}	2.45 ± 0.15 {25.0 ± 1.5}
		Transmission 2nd clutch pressure				2.35 ± 0.15 {24.0 ± 1.5}	2.35 ± 0.15 {24.0 ± 1.5}
		Transmission 3rd clutch pressure				2.45 ± 0.15 {25.0 ± 1.5}	2.45 ± 0.15 {25.0 ± 1.5}
		Transmission R clutch pressure				2.45 ± 0.15 {25.0 ± 1.5}	2.45 ± 0.15 {25.0 ± 1.5}
		Inter-axle differential lock clutch pressure				2.35 ± 0.15 {24.0 ± 1.5}	2.35 ± 0.15 {24.0 ± 1.5}
		Transmission lubricating pressure (reference)				0.1 ± 0.029 {1.0 ± 0.3}	0.1 ± 0.029 {1.0 ± 0.3}
	Travel speed	F1	● Flat ground ● Engine coolant temperature: Within operating range ● Torque converter oil temperature: Within operating range ● Dump body: Unloaded ● Travel resistance: 3.3%		km/h	6.8 ± 5%	6.8 ± 5%
		F2				10.7 ± 5%	10.7 ± 5%
		F3				16.1 ± 5%	16.1 ± 5%
		F4				25.3 ± 5%	25.3 ± 5%
		F5				38.1 ± 5%	38.1 ± 5%
		F6				58.1 ± 5%	58.1 ± 5%
		R1				7.6 ± 5%	7.6 ± 5%
		R2				18.0 ± 5%	18.0 ± 5%
	Tire inflation pressure		● Standard tire: 23.5 - R25 ● Dump body: Unloaded		MPa {kg/cm^2}	front 0.343 {3.50} center, rear 0.402 {4.1}	front 0.343 {3.50} center, rear 0.402 {4.1}

Machine model						HM300-2	
Category	Item			Measurement conditions	Unit	Standard value for new machine	Service limit value
Gas pressure	Accumulator	Nitrogen gas pressure	For front brake	● Gas temperature (atmosphere temperature): 20 ± 5°C	MPa {kg/cm^2}	4.4 ± 0.15 {45 ± 15}	4.4 ± 0.15 {45 ± 15}
			For rear parking brake			4.4 ± 0.15 {45 ± 15}	4.4 ± 0.15 {45 ± 15}
Brakes	Brake pedal	Operating effort		● Point 150mm from pedal fulcrum	N {kg}	Max. 294 {Max. 30.0}	Max. 294 {Max. 30.0}
		Travel			mm	44.5 ± 5	44.5 ± 5
	Retarder lever	Operating effort		● Point 10mm from tip of lever	N {kg}	5.9 – 9.8 {0.6 – 1.0}	3.0 – 14.7 {0.3 – 1.5}
		Travel			° (degree)	78 ± 1	78 ± 2
	Oil pressure	Charge valve cut-in pressure		● Wheel brake actuation pressure: Actuation pressure when brake is operated for first time after engine is stopped ● Drop in wheel brake actuation pressure: Drop in pressure 5 minutes after specified oil pressure (4.9 MPa {50 kg/cm^2}) is applied ● Parking brake release pressure: Engine at high idle Parking brake switch: ON Exhaust brake switch: ON	MPa {kg/cm^2}	11.77 + 0.29/0 {120 + 3.0/0}	11.77 + 0.29/0 {120 + 3.0/0}
		Charge valve cut-out pressure				20.59 + 0.98/- 0.5 {210 + 10/- 5}	20.59 + 0.98/- 0.5 {210 + 10/- 5}
		Wheel brake actuation pressure				4.9 ± 0.49 {50 ± 5}	4.9 ± 0.49 {50 ± 5}
		Drop in wheel brake actuation pressure				Max. 0.49 {Max. 5}	Max. 0.49 {Max. 5}
		Parking brake cancel pressure				3.92 ± 0.4 {40 ± 4.0}	3.92 ± 0.4 {40 ± 4.0}
	Wheel brake	Foot brake braking performance		● Engine speed: High idle ● Gearshift lever: D ● Torque converter stall speed	rpm	1,440	1,440
		Retarder brake braking performance				1,470	1,470
		Foot brake braking distance		● Flat, dry road surface ● When load is 27.3t ● Travel speed: 32km/h	m	Max. 22.3	Max. 22.3
	Parking brake	Braking performance		● Engine at high idle ● Gearshift lever: D ● Engine stall speed	rpm	1,540	1,540
		Braking slope angle		● When load is 27.3t ● Slope angle (sin θ)	%	Min. 25	Min. 25
	Emergency brake braking distance			● 9 ± 1% downhill slope ● When load is 27.3t ● Travel speed: 50 ± 3km/h	m	Max. 102	Max. 102

Machine model					HM300-2	
Category	Item		Measurement conditions	Unit	Standard value for new machine	Service limit value
Steering	Steering wheel	Operating effort	● Engine speed: Low idle ● Gearshift lever: N (stopped) ● Measure at circumference of steering wheel ● Operating effort: When turning at 10rpm ● Play: Until point where tires start to move ● No. of turns: Lock - lock ● Turning time: Lock - lock	N {kg}	Max. 29.4 {Max. 3.0}	Max. 35.3 {Max. 3.0}
		Play		mm	Max. 150	Max. 150
		No. of turns		Turns	4.3 ± 0.4	4.3 ± 0.6
		Turning time		Sec.	Max. 6	Min. 6
	Steering relief pressure		● Hydraulic oil temperature: 45 – 55°C ● Engine speed: High idle	MPa {kg/cm^2}	20.59 + 0.98/0 {210 + 10/0}	20.59 + 0.98/0 {210 + 10/0}
Suspension cylinder	Front	Installed length (**a**)	● Horizontal road surface ● Dump body: Unloaded 	mm	163 ± 10	163 ± 10
		Pressure		MPa {kg/cm^2}	5.88 ± 0.49 {60 ± 5.0}	5.88 ± 0.49 {60 ± 5.0}
	Rear	Installed length (**a**)		mm	101 ± 5	101 ± 5
		Pressure		MPa {kg/cm^2}	0.98 ± 0.15 {10 ± 1.5}	0.98 ± 0.15 {10 ± 1.5}
Dump	Dump lever operating effort		● Engine stopped ● Center of grip	HOLD → RAISE	N {kg}	Max. 29.4 {Max. 3.0}	Max. 35.3 {Max. 3.6}
				RAISE → HOLD		Must return smoothly when engine is at high idle	
				HOLD → FLOAT		Max. 29.4 {Max. 3.0}	Max. 35.3 {Max. 3.6}
				FLOAT → HOLD		Max. 29.4 {Max. 3.0}	Max. 35.3 {Max. 3.6}
				FLOAT → LOWER		Max. 29.4 {Max. 3.0}	Max. 35.3 {Max. 3.6}
				LOWER → FLOAT		Must return smoothly when engine is at 2,000rpm	
	Dump body	Lifting time	● Hydraulic oil temperature: 70 – 90°C ● Engine speed: High idle ● Lowering time when operating FLOAT		Sec.	12 ± 1.5	12 ± 1.5
		Lowering time				Max. 12.5	Max. 12.5
		Hydraulic drift	● Hydraulic oil temperature: 70 – 90°C ● Hold at point where No. 2 cylinder is extended 100mm ● Engine stopped ● Downward movement at tip of dump body over 5 minutes		mm	Max. 85	170

Machine model				HM300-2	
Category	Item	Measurement conditions	Unit	Standard value for new machine	Service limit value
Dump	Dump main relief pressure	● Hydraulic oil temperature: 45 – 55°C ● Engine speed: High idle	MPa {kg/cm^2}	20.59 + 0.98/0 {210 + 10/0}	20.59 + 0.98/0 {210 + 10/0}
	Dump pilot relief pressure	● Hydraulic oil temperature: 45 – 55°C ● Engine speed: High idle		3.4 ± 0.49 {35 ± 5}	3.4 ± 0.49 {35 ± 5}
		● Hydraulic oil temperature: 45 – 55°C ● Engine speed: Low idle (Reference value)		2.6 ± 0.49 {27 ± 5}	2.6 ± 0.49 {27 ± 5}

HM300-2 Articulated dump truck

Form No. SEN00416-03

ARTICULATED DUMP TRUCK

HM300-2

Machine model	Serial number
HM300-2	2001 and up

30 Testing and adjusting
Testing and adjusting, Part 1

Tools for testing, adjusting, and troubleshooting

Testing and adjusting item	Symbol		Part No.	Part name	Q'ty	Remarks
Testing intake air pressure (boost pressure)	A		799-201-2202	Boost gauge kit	1	-101 – 199.9 kPa {-760 – 1,500 mmHg}
Testing exhaust temperature	B		799-101-1502	Digital thermometer	1	-99.9 – 1,299°C
Testing exhaust color	C	1	799-201-9001	Handy smoke checker	1	Bosch index 0 – 9
		2	Commercially available	Smoke meter	1	
Adjusting valve clearance	D		Commercially available	Clearance gauge	1	
Testing compression pressure	E	1	795-502-1590	Compression gauge	1	0 – 6.9 MPa {0 – 70 kg/cm^2} Kit part No.: 795-502-1205
		2	795-471-1420	Adapter	1	For 125E-5
			6217-71-6112	Gasket	1	
Testing blow-by pressure	F		799-201-1504	Blow-by checker	1	0 – 4.9 kPa {0 – 500 mmH_2O}
Testing engine oil pressure	G	1	799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 6.0, 40, 60 MPa {25, 60, 400, 600 kg/cm^2}
			790-261-1204	Digital hydraulic tester	1	Pressure gauge: 60 MPa {600 kg/cm^2}
		2	799-401-2320	Gauge	1	Pressure gauge: 1.0 MPa {10 kg/cm^2}
Testing EGR valve and bypass valve drive oil pressure	R	1	799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 6, 40, 60 MPa {25, 60, 400, 600 kg/cm^2}
			790-261-1204	Digital hydraulic tester	1	Pressure gauge: 60 MPa {600 kg/cm^2}
		2	799-301-1190	● Nipple	1	
		3	799-101-5160	● Nipple	1	
Testing fuel pressure	H	1	799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 6, 40, 60 MPa {25, 60, 400, 600 kg/cm^2}
			790-261-1204	Digital hydraulic tester	1	Pressure gauge: 60 MPa {600 kg/cm^2}
		2	799-401-2320	Gauge	1	Pressure gauge: 1.0 MPa {10 kg/cm^2}
Method of tilting cab up	I		792-454-1100	Pump assembly	1	
Testing fuel return and leak amount	J	1	6151-51-8490	Spacer	1	Inner diameter: 14 mm
		2	6206-71-1770	Joint	1	Joint section diameter: 10 mm
		3	Commercially available	Hose	1	ϕ 5 mm × 2 – 3 m
		4	Commercially available	Hose	1	ϕ 15 mm × 2 – 3 m
		5	Commercially available	Measuring cylinder	1	
		6	Commercially available	Stopwatch	1	

Testing and adjusting item	Symbol		Part No.	Part name	Q'ty	Remarks
Testing power train oil pressure	K		799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 6, 40, 60 MPa {25, 60, 400, 600 kg/cm^2}
			790-261-1204	Digital hydraulic tester	1	Pressure gauge: 60 MPa {600 kg/cm^2}
			799-401-2320	Gauge	1	Pressure gauge: 1.0 MPa {10 kg/cm^2}
			799-101-5220	Nipple	1	M10 × P1.25
			07002-11023	O-ring	1	
			799-101-5260	Nipple	1	M12 × P1.5
			07002-11223	O-ring	1	
			799-101-5230	Nipple	1	M14 × P1.5
			07002-11423	O-ring	1	
Testing and adjusting brake oil pressure	L	1	799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 6, 40, 60 MPa {25, 60, 400, 600 kg/cm^2}
		1	790-101-1204	Digital hydraulic tester	1	Pressure gauge: 60 MPa {600 kg/cm^2}
		2	793-520-1805	Brake test kit	1	Pressure gauge: 0 – 19.6 MPa {600 kg/cm^2}
		3	799-401-3200	Adapter assembly	1	#3
Testing and adjusting steering circuit oil pressure	M		799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 6, 40, 60 MPa {25, 60, 400, 600 kg/cm^2}
			790-101-1204	Digital hydraulic tester	1	Pressure gauge: 60 MPa {600 kg/cm^2}
Testing and adjusting suspension cylinder	N	–	792-610-1000	Suspension tool assembly	1	● N1 to N3 are inner parts of 792-610-1100. ● N4 to N10 are inner parts of 792-610-1200. ● 792-610-1100 and 792-610-1200 are inner parts of 792-610-1000. ● 792-610-1000 includes tool box 792-610-1290.
		–	792-610-1100	●Pump assembly	1	
		1	792-610-1130	●●Pump	1	
		2	792-610-1110	●●Hose	1	
		3	792-610-2200	●●Joint	1	
		–	792-610-1200	●Charging tool assembly	1	
		4	07020-21732	●●Fitting	1	
		5	792-610-1140	●●Joint	1	
		6	792-610-1250	●●Valve assembly	1	
		7	792-610-1260	●●Nipple	1	
		8	792-610-1270	●●Hose	2	
		9	792-610-1280	●●Valve	2	
		10	792-610-1400	●●Regulator	1	
		11	792-610-1430	●●●Gauge	1	
		12	792-610-1440	●●●Gauge	1	
Gas pressure check and filling of the accumulator	P	1	792-610-1700	Gas charge tool	1	
		2	792-610-1310	Nipple (For Russia)	1	GOST
			792-610-1320	Nipple (For USA)	1	CGA No. 351
			792-610-1330	Nipple (For USA)	1	ASA B-571-1965
			792-610-1350	Nipple (For Germany)	1	DIN 477-1963 NEN 3268-1966 SIS-SMS 2235/2238
			792-610-1360	Nipple (For UK)	1	BS341 Part 1-1962

Testing and adjusting item	Symbol	Part No.	Part name	Q'ty	Remarks
Testing and adjusting dump circuit oil pressure	S	799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 6, 40, 60 MPa {25, 60, 400, 600 kg/cm^2}
		790-101-1204	Digital hydraulic tester	1	Pressure gauge: 60 MPa {600 kg/cm^2}
Operating effort	U	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}
Stroke and hydraulic drift	–	Commercially available	Scale	1	
Work equipment speed	–	Commercially available	Stopwatch	1	
Voltage and resistance	–	79A-264-0311	Tester	1	
Engine related controller, sensor and actuator diagnosis	–	799-601-4101 or 799-601-4201	T-adapter kit	1	
		799-601-4130	● T-adapter	1	For Ne sensor
		799-601-4330	● Socket	1	For G (Bkup) sensor
		799-601-4240	● Socket	1	For Atomospheric sensor
		799-601-4250	● Socket	1	For boost pressure sensor
		799-601-9420	● T-adapter	1	For common rail pressure sensor
		799-601-4150	● T-adapter	1	For oil pressure sensor
		795-799-5540	● Socket	1	For boost (intake) temperature sensor
		795-799-5530	● Socket	1	For coolant temperature sensor For fuel temperature sensor
		799-601-9430	● Socket	1	For supply pump PCV
		799-601-9020	● T-adapter	1	For EGR valve solenoid* For bypass valve solenoid
		799-601-4260	● T-adapter	1	For controller (4-pole)
		799-601-4211	● T-adapter	1	For controller (50-pole) (799-601-4101 only)
		799-601-4220	● T-adapter	1	For controller (60-pole) (799-601-4101 only)
		799-601-4350	● T-adapter	1	For 60-pole (799-601-4101 only)
		799-601-9030	● T-adapter	1	For EGR valve solenoid* For bypass valve stroke sensor
		799-601-9120	● T-adapter	1	DT12 For inter mediate connector to injectors*
Wiring harness diagnosis of machine (inter mediate connector with operator cab)	–	799-601-9000 or 799-601-9100	T-adapter kit	1	For HD30 adapter
		799-601-9320	● T-box	1	For HD • DT
		799-601-9220	● For HD30-18	1	14P
		799-601-9250	● For HD30-18 adapter	1	9P
		799-601-9290	● For HD30-24 adapter	1	31P

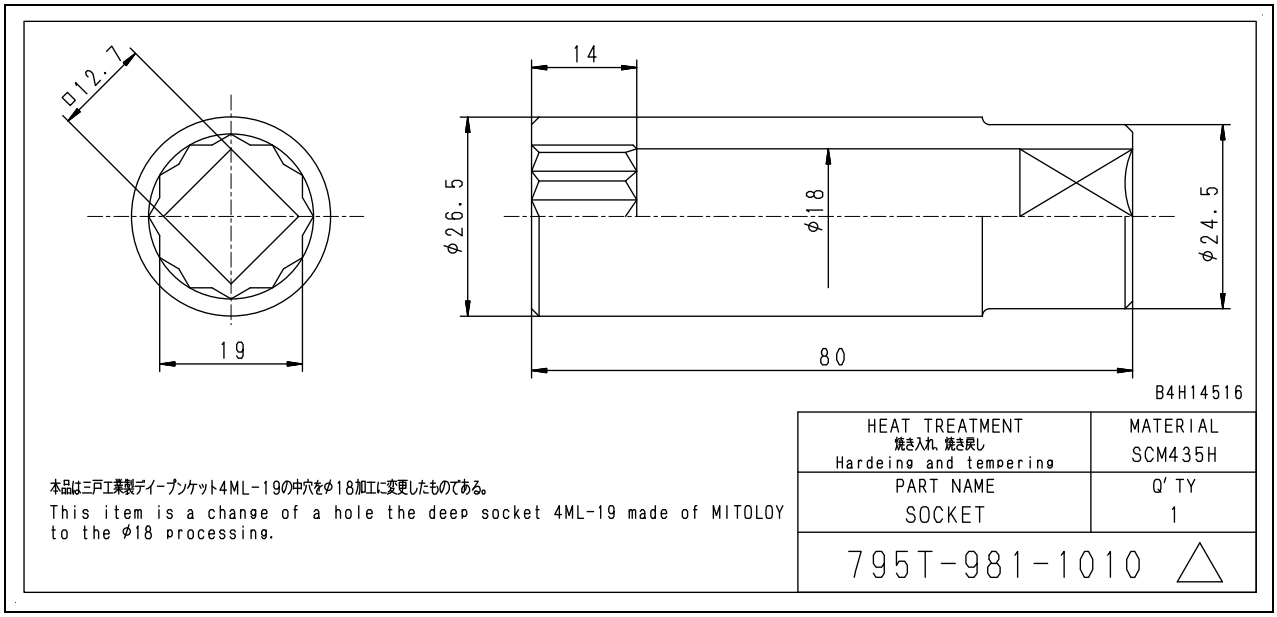
*: Included in 799-601-9000 and 799-601-9200

Testing/Adjusting item	Sym-bol	Part No.	Part name	Q'ty	Remarks
Wiring harness diagnosis of machine (inter mediate connector with opertor cab)	–	799-601-7000 or 799-601-7100 or 799-601-7400 or 799-601-8000	T-adapter kit	1	For X, SWP, M, S adapter
		799-601-7040	● For X adapter	1	X4P
		799-601-7050	● For SWP adapter	1	SW6P (799-601-8000 is not include)
		799-601-7060	● For SWP adapter	1	SW8P (799-601-8000 is not include)
		799-601-7090	● For M adapter	1	M2P
		799-601-7110	● For M adapter	1	M3P
		799-601-7120	● For M adapter	1	M4P
		799-601-7130	● For M adapter	1	M6P
		799-601-7140	● For S adapter	1	S8P
		799-601-7180	● For AMP040 adapter	1	A8P (799-601-7400 only)
		799-601-7310	For SWP adapter	1	SW12P
		799-601-7320	For SWP adapter	1	SW16P
		799-601-7360	For relay adapter	1	REL-5P
		799-601-7370	For relay adapter	1	REL-6P
		799-601-7500	T-adapter kit	1	For 070 adapter
		799-601-7520	● For 070 adapter	1	07-12P
		799-601-7540	● For 070 adapter	1	07-18P
		799-601-7550	● For 070 adapter	1	07-20P
		799-601-9000 or 799-601-9200	● T-adapter kit	1	For DT adapter
		799-601-9020	● For DT adapter	1	DT2P *%
		799-601-9030	● For DT adapter	1	DT3P
		799-601-9040	● For DT adapter	1	DT4P *%
		799-601-9050	● For DT adapter	1	DT6P
		799-601-9060	● For DT adapter (Gray)	1	DT8PGR
		799-601-9070	● For DT adapter (Black)	1	DT8PB
		799-601-9080	● For DT adapter (Green)	1	DT8PG
		799-601-9110	● For DT adapter (Gray)	1	DT12PGR
		799-601-9120	● For DT adapter (Black)	1	DT12PB
		799-601-9130	● For DT adapter (Green)	1	DT12PG
		799-601-9140	● For DT adapter (Brown)	1	DT12P
		799-601-9300	T-adapter kit	1	For DRC adapter
		799-601-9350	● For DRC adapter	1	DRC-40
		799-601-9360	● For DRC adapter	1	DRC-24
Removal and installation of engine coolant temperature sensor	–	Commercially available	Socket	1	21 mm deep socket (MITOLOY 4ML 21 or equivalent) Applicable engine serial No.: 560001-564999
		795T-981-1010	Socket	1	19 mm deep socket (MITOLOY 4ML 19 or equivalent) Applicable engine serial No.: 565000 and up

*: Included in 799-601-9000 and 799-601-9200
*%: Included in 799-601-4101 and 799-601-4201

Sketches of special tools

Note) Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.
Socket



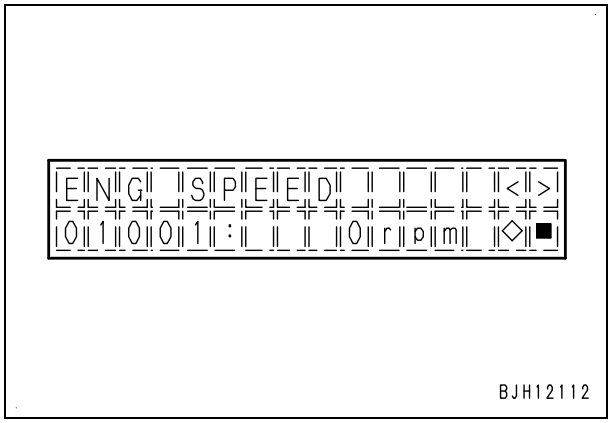
Testing engine speed

⚠ **Set chocks to the tires.**
⚠ **Before starting measurement, check that there is no one in the surrounding area.**

★ Test the engine speed under the following conditions.
- Coolant temperature: Within operating range
- Hydraulic oil temperature: 45 – 55°C
- Torque converter oil temperature: 60 – 80°C

1. **Testing engine speed (low idle and high idle)**
   1) Turn the starting switch ON and set the machine monitor in the real-time monitoring function (REAL-TIME MONITOR) of the service mode.
      - Monitoring system: **MONITOR PANEL**
      - Monitoring code: **01001 (ENG SPEED)**

      ★ For the operation method, see Testing and adjusting, "Special functions of machine monitor".



   2) Start the engine, set the measurement conditions, and measure the engine speed.

2. **Testing torque converter stall speed**
   ★ See "Testing torque converter stall speed" (mentioned later).

Testing intake air pressure (boost pressure)

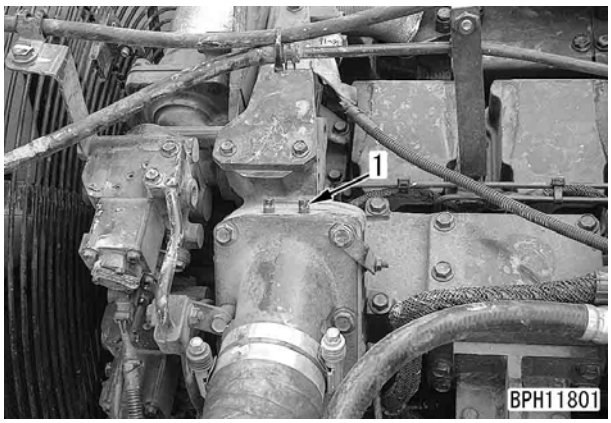
★ Testing instruments for intake air pressure

Symbol	Part No.	Part name
A	799-201-2202	Boost gauge kit

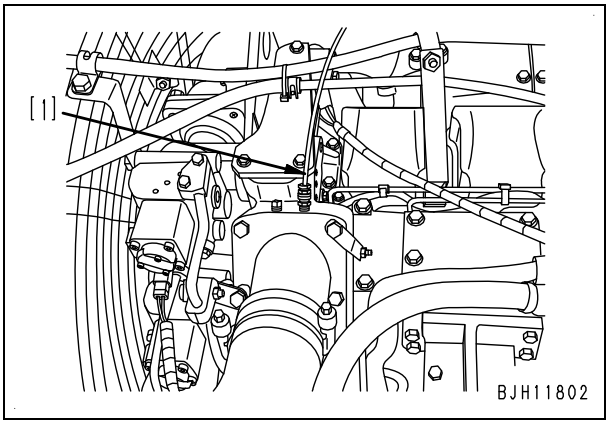
⚠ **When installing and removing the testing instrument, take care not to touch a hot part.**

1. Open the engine hood.

2. Remove the air boost pressure measurement plug (1).



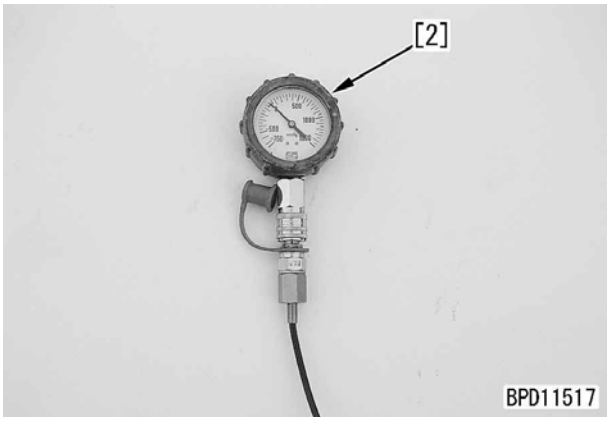
3. Install the nipple of boost gauge kit **A** and hose [1] and connect gauge [2].



4. Run the engine at mid-range speed or above to bleed the oil from inside the hose.
   - ★ Insert the connection of the hose and pressure gauge about half way, repeat the action to open the self-seal portion at the hose end, and bleed the oil.
   - ★ If Pm kit (A) is available, the air bleeding coupling (790-261-1130) in it may be used.
   - ★ If there is oil inside the hose, the gauge will not work, so always bleed the oil.

5. Turn the parking brake switch ON, depress the brake pedal, then set the gear shift lever to the D position.
   ⚠ **If the gearshift lever is operated to any position other than the D position, the machine may move off even if the brake is being depressed, so always measure at the D position.**

6. Depress the accelerator pedal gradually, run the engine at high idle and stall the torque converter, then measure the air supply pressure.
   ⚠ **There is danger of damage to the internal parts of the transmission, so never operate the gear shift lever to any position other than the D position during the stall operation.**
   - ★ After completing the measurement, lower the engine speed to low idle, then return the gearshift lever to the N position.



7. After completing the measurement, remove the measuring instrument and set to the original condition.

Testing exhaust temperature

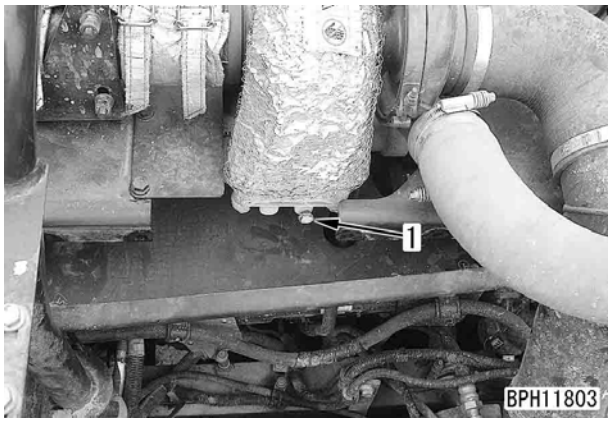
★ Testing instrument for exhaust temperature

Symbol	Part No.	Part name
B	799-101-1502	Digital thermometer

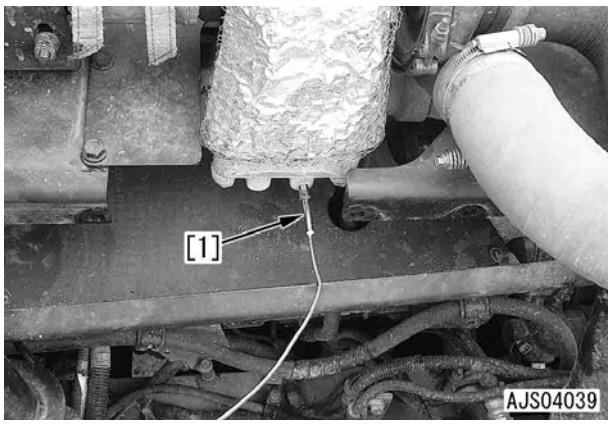
⚠ **Install and remove the testing instrument after the exhaust manifold is cooled.**

1. Open the engine hood and remove the turbocharger heat insulation cover.

2. Remove exhaust temperature measurement plug (1).



3. Install sensor [1] and connect it to digital thermometer **B**.
   ★ Clamp the wiring harness of the temperature gauge at a suitable place to prevent it from touching any hot part.



4. When testing the exhaust temperature at torque converter stall, implement below procedure.
   ★ To prevent the torque converter from overheating, use the full stall (torque converter stall + hydraulic relief) to stabilize the exhaust temperature, then stall only the torque converter and measure the temperature.
   1) Start the engine and raise the temperature of the coolant to the operating range.
   2) Turn the parking brake switch ON, depress the brake pedal, then set the gear shift lever to the D position.
      ⚠ **If the gear shift lever is operated to any position other than the D position, the machine may move off even if the brake is being depressed, so always measure at the D position.**
   3) Depress the accelerator pedal gradually, run the engine at high idle and stall the torque converter. At the same time, operate the dump lever to the LOWER position and relieve the oil pressure (full stall).
      ★ Continue until the exhaust temperature reaches the standard value of 650°.
      ⚠ **There is danger of damage to the internal parts of the transmission, so never operate the gear shift lever to any position other than the D position during the stall operation.**
   4) When the temperature stabilizes at near the target temperature, return the dump lever to NEUTRAL and measure the temperature with only the torque converter stalled.
      ★ The exhaust temperature will start to go down from the full stall condition, so measure the temperature when it stabilizes.
      ★ If the exhaust temperature does not go down but rises, make the set temperature at full stall higher.
      ★ After completing the measurement, lower the engine speed to low idle, then return the gear shift lever to the N position.

5) After completing measurement, remove the measuring equipment and set to the original condition.

5. Maximum exhaust temperature testing procedure during actual work.
   Measure the maximum exhaust temperature during actual work.
   ★ Set the digital temperature gauge to the PEAK mode. The maximum temperature is automatically recorded.

6. Detach the measurement tool after the measurement, and make sure that the machine is back to normal condition.

Testing exhaust gas color

★ Testing instrument for exhaust gas color

Symbol		Part No.	Part name
C	1	799-201-9001	Handy smoke checker
	2	Commercially available	Smoke meter

⚠ **When installing and removing the testing instrument, take care not to touch a hot part.**

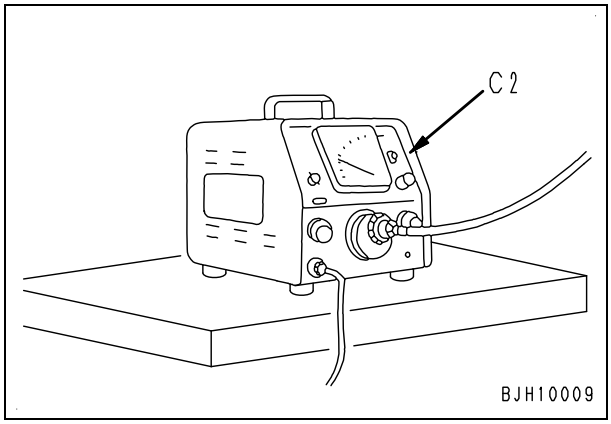
★ If an air source and a electric power source are not available in the field, use handy smoke checker **C1**. When recording official data, etc., use smoke meter **C2**.

1. **Testing with handy smoke checker C1**
   1) Stock a sheet of filter paper to smoke checker **C1**.
   2) Insert the exhaust gas intake pipe in the exhaust pipe.
   3) Start the engine and raise the temperature of the coolant to the operating range.
   4) Let the exhaust gas stay on the filtering paper by operating a handle of Handy Smoke Checker **C1**, when the engine speed is suddenly accelerated or kept at high idling.

   5) Remove the filter paper and compare it with the attached scale to make a judgement.

2. **Testing with smoke meter C2**
   1) Insert probe (1) of the Smoke Meter **C2** into the exhaust gas pipe outlet, and fasten it to the outlet with a clip.

   2) Connect the probe hose, accelerator switch outlet and air hose to the Smoke Meter **C2**.
      ★ Restrict the supplied air pressure below 1.5 MPa {15 kg/cm^2}.
   3) Connect the power cable to an outlet of power.
      ★ Before connecting the cable, check that the power switch of the smoke meter is turned OFF.
   4) Fit a filtering paper by loosening the suction pump cap nut.
      ★ Fit the filtering paper securely so that air may not leak.
   5) Turn ON the power switch of smoke meter **C2**.



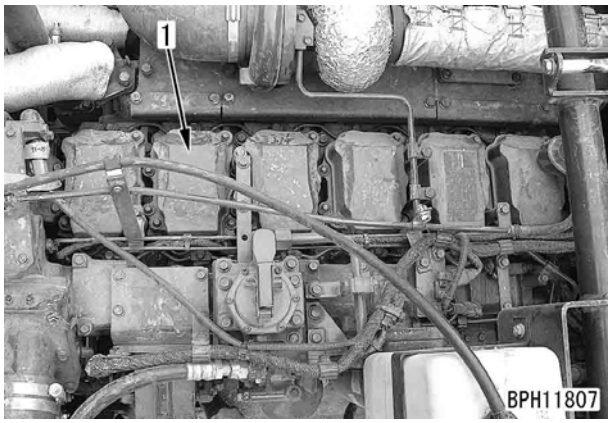
   6) Start the engine and raise the temperature of the coolant to the operating range.
   7) As increasing the engine speed rapidly or running it at high idle, press the accelerator switch of smoke meter **C2** and collect the exhaust gas with the filter paper.
   8) Put the polluted filtering paper on non-polluted filtering paper (more than 10 sheets) in the filtering paper holder, and read the indicated value.
   9) Detach the measurement tool after the measurement, and make sure that the machine is back to normal condition.

Adjusting valve clearance

★ Adjusting instrument for valve clearance

Symbol	Part No.	Part name
D	Commercially available	Clearance gauge

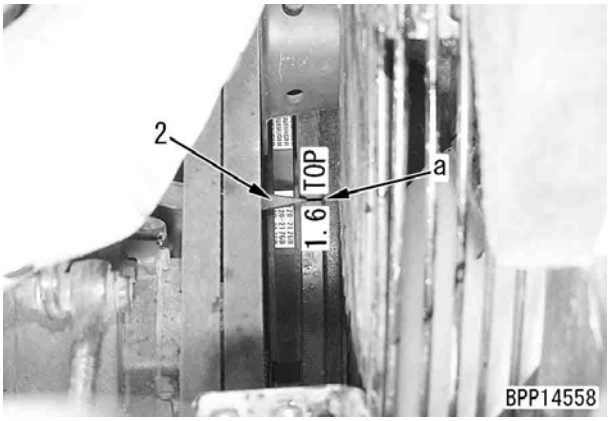
1. Open the engine hood and remove all cylinder head covers (1).



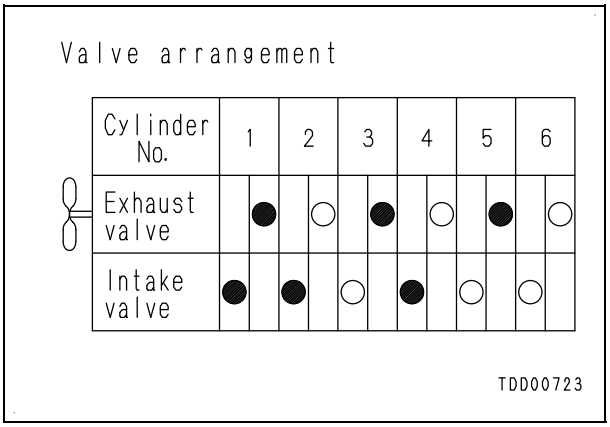
2. Remove belt protection cover and loosen the tension of the fan belt and alternator belt.
   ★ To confirm the timing mark.

3. Remove radiator under cover.

4. Rotate the crankshaft forward to bring the stamped "1.6TOP" line (a) of the damper to pointer (2) and set the No. 1 cylinder to the compression top dead center.
   ★ Rotate the crankshaft with the mounting bolt of the crank pulley (width across flats: 24 mm), and be sure to rotate it only forward to prevent the bolt from loosening.
   ★ When No. 1 cylinder is at the top dead center, its rocker arm can be manually moved as much as the valve clearance.If it cannot be moved, that means that No. 1 cylinder is not yet at the top dead center. In that case, rotate it by one more turn.

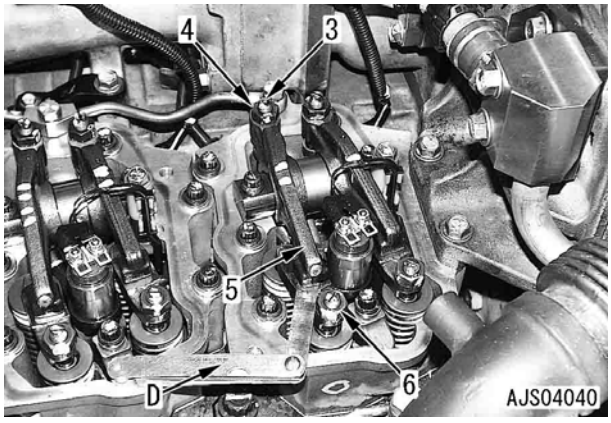


5. While No.1 cylinder is at compression top dead center, adjust the valve clearance of ● mark in the below figure according to the following procedure.



6. To adjust the valve clearance, insert feeler gauge **D** into clearance between rocker arm (5) and cross head (6), and adjust the valve clearance with adjustment screw (3).
   ★ With the clearance gauge inserted, turn the adjustment screw so that clearance gauge can move with a light force.
   ★ Valve clearance
   Intake valve: 0.33 mm
   Exhaust valve: 0.71 mm

7. While holding adjustment screw (3), tighten locknut (4).
   ⇦ Locknut:
   58.8 – 73.5 Nm {6.0 – 7.5 kgm}
   ★ After tightening the locknut, check the valve clearance again.



   - After finishing the adjustment of all the valves marked with ●, rotate the crankshaft 360° forward and align "1.6TOP" stamp line (a) of the damper to pointer (2) in order to set the No.6 cylinder to the compression top dead center.

8. While the No.6 cylinder is at the compression top dead center location, adjust the clearance of valve marked with ○ in the valve arrangement figure.
   ★ Procedure for the adjustment is as same as 6) and 7).
   ★ It is also allowed to adjust respective cylinders in the firing order by turning the crank shaft 120° at a time.
   - Firing order: 1 – 5 – 3 – 6 – 2 – 4

9. After finishing adjustment, return the removed parts.
   ⇦ Cylinder head cover mounting bolt:
   9.8 ± 1 Nm {1.0 ± 0.1 kgm}
   ★ Adjust the belt tension referring to "Testing and adjusting fan belt and alternator belt tension".

Testing compression pressure

★ Compression pressure measurement tools

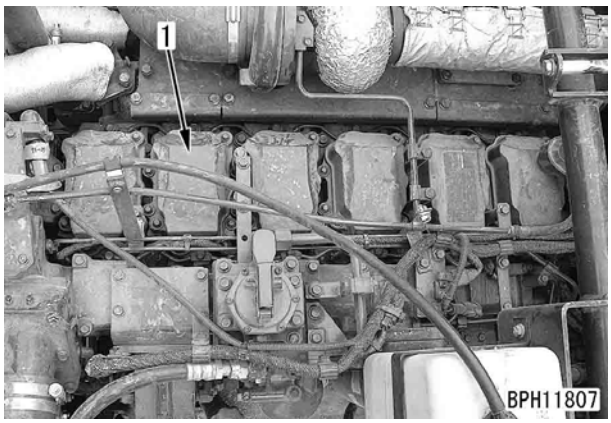
Symbol		Part No.	Part name
E	1	795-502-1590	Compression gauge
	2	795-471-1420	Adapter
		6217-71-6112	Gasket

⚠ **When testing the compression pressure, take care not to burn yourself on the exhaust manifold, muffler, etc. or get caught in a rotating part.**

★ Measure the compression pressure after the engine is warmed up.
(Engine oil temperature: 40 – 60°C)

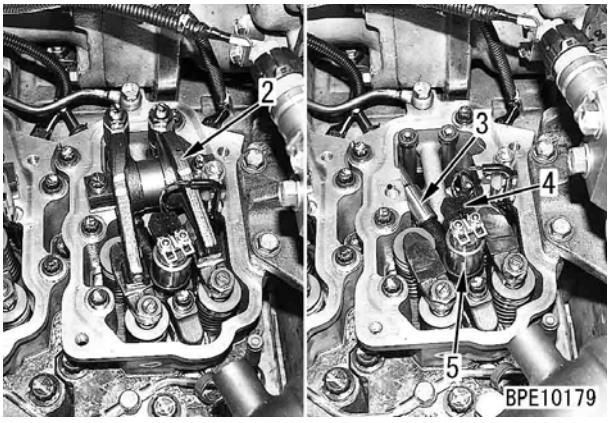
1. Open the engine hood.

2. Remove cylinder head cover (1).



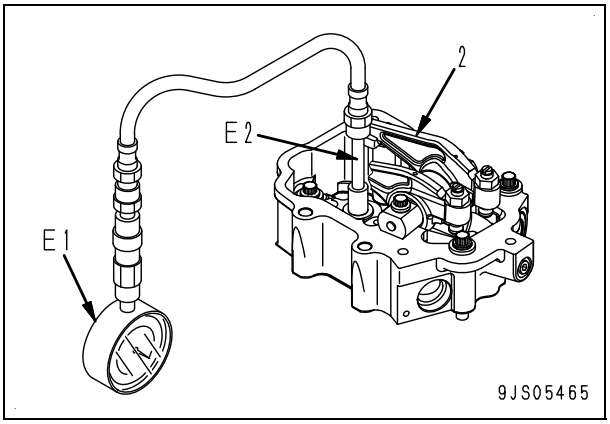
3. Set cylinder to be tested at compression top dead center and remove rocker arm assembly (2).
   ★ For the adjustment, refer to the section, "Adjustment of valve clearance".

4. Disconnect fuel high-pressure tube (3) and injector wiring harness (4) and remove injector (5).
   ★ Before disconnecting the fuel high-pressure tube, loosen all center clamps.
   ★ Disconnect the terminal of the injector wiring harness on the injector side and the bracket on the rocker housing side and pull them outside the rocker arm housing (Loosen the 2 terminal nuts alternately).
   ★ After removing holder from injector, lead a wire under the fuel pipe which comes out sideways from the injector and pull up the wire to remove injector (do not ply the upper part of the injector to remove it).

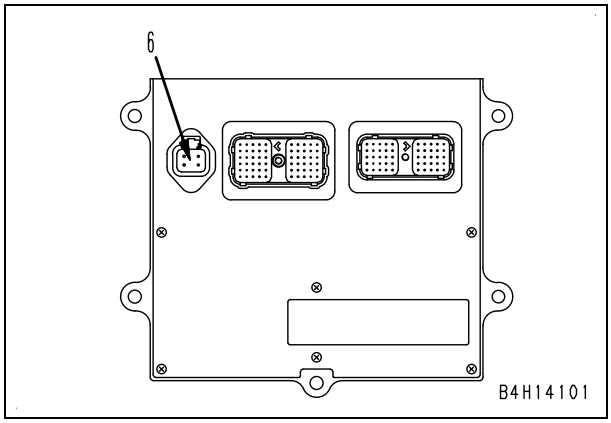


5. Install adaptor **E2** to mounting hole of injector and connect compression gauge **E1**.
   ★ Fit the gasket to the adapter end without fail
   ★ Fix the adapter with the injector holder.
   Holder mounting bolt:
   58.8 – 73.5 Nm {6.0 – 7.5 kgm}
   ★ Apply a little amount of engine oil to the connecting parts of the adapter and gauge so that air will not leak easily.

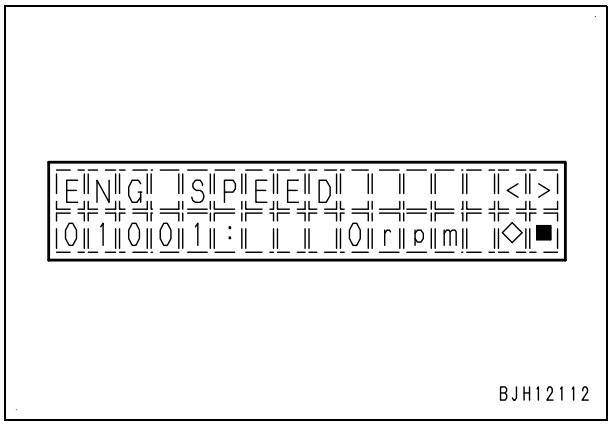
6. Install rocker arm assembly (2) and adjust valve clearance.
   Rocker arm assembly mounting bolt:
   58.8 – 73.5 Nm {6.0 – 7.5 kgm}
   ★ For the adjustment, refer to the section, "Adjustment of valve clearance".



7. Disconnect power supply connector **J3P** (6) of engine controller.
   ⚠ **Be sure to disconnect the connector. Otherwise, engine may start during the testing and this may create a dangerous condition.**
   ⚠ **Cover the controller side and the harness side with a vinyl sheet, etc. to prevent electric leakage and grounding fault.**

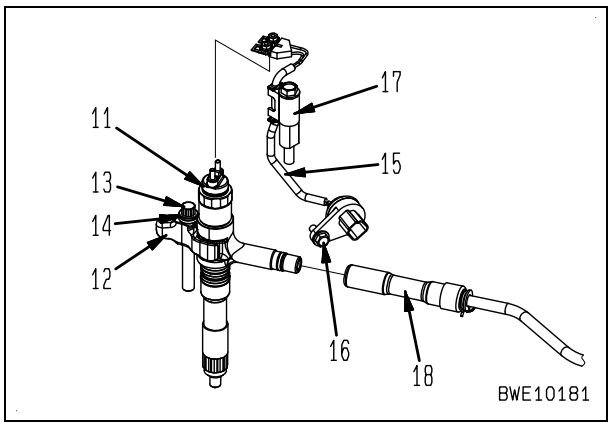


8. Turn the starting switch ON and set the monitor panel in the real-time monitoring function (REAL-TIME MONITOR) of the service mode.
   - Monitoring system: **MONITOR PANEL**
   - Monitoring code: **01001 (ENG SPEED)**
   - ★ For the operation method, see Testing and adjusting, "Special functions of machine monitor".



9. Rotate the engine with the starting motor and measure the compression pressure.
   - ★ Read the pressure gauge pointer when it is stabilized.

10. After finishing testing, remove the testing tools and return the removed parts.
   - ★ Install the injector, injector wiring harness, and fuel high-pressure tube according to the following procedure.
   1) Install O-ring and gasket to injector (11).
      - Replace the O-ring and gasket with new ones.
   2) Fit holder (12) to injector (11) to temporarily assemble them as a unit to the cylinder head.
   3) Set spherical washer (14) to mounting bolt (13) and tighten them to the cylinder head lightly.
      Spherical part of washer: **Engine oil (SAE30DH)**
   4) Tighten tube (18) injector (11) lightly.
   5) Tighten bolt (13) permanently.
      Mounting bolt: **58.8 – 73.5 Nm {6.0 – 7.5 kgm}**
   6) Tighten tube (18) permanently.
      Sleeve nut: **39.2 – 49 Nm {4 – 5 kgm}**
   7) Install wiring harness (15) to the rocker arm housing and fix it with mounting bolt (16).
   8) Insert wiring harness (15) into holder (17).
   9) Alternately tighten 2 nuts at wiring harness (15) end to injector (11).
      Nut: **2.0 – 2.4 Nm {0.2 – 0.24 kgm}**
   10) Tighten the clamping bolt of the fuel piping.
      Clamping bolt: **11.8 – 14.7 Nm {1.2 – 1.5 kgm}**



Rocker arm assembly mounting bolts: **58.8 – 73.5 Nm {6.0 – 7.5 kgm}**

★ Adjust valve clearance referring to "Adjusting valve clearance".

Cylinder head cover mounting bolt: **9.8 ± 1 Nm {1.0 ± 0.1 kgm}**

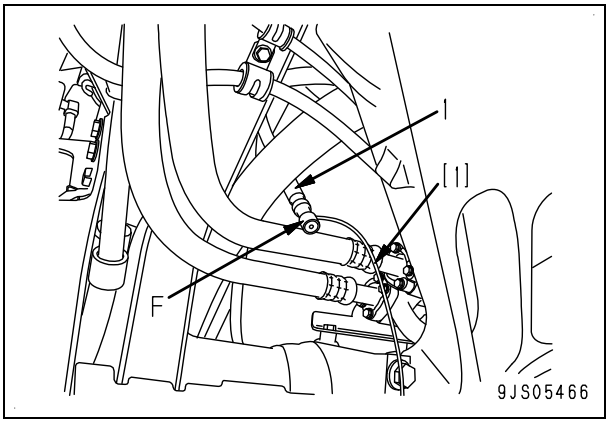
Testing blow-by pressure

★ Testing instrument for blow-by pressure

Symbol	Part No.	Part name
F	799-201-1504	Blow-by checker

1. Open the engine hood.

2. Install nozzle and hose [1] to blow-by hose (1) under the body and connect the hose to blow-by checker **F**.



3. Start the engine and raise the temperature of the coolant to the operating range.

4. Turn the parking brake switch ON, depress the brake pedal, then set the gear shift lever to the D position.
   ⚠ **If the gearshift lever is operated to any position other than the D position, the machine may move off even if the brake is being depressed, so always measure at the D position.**

5. Depress the accelerator pedal gradually, run the engine at high idle and stall the torque converter, then measure the blow-by pressure.
   ⚠ **There is danger of damage to the internal parts of the transmission, so never operate the gear shift lever to any position other than the D position during the stall operation.**
   ★ After completing the measurement, lower the engine speed to low idle, then return the gearshift lever to the N position.

6. Detach the measurement tool after the measurement, and make sure that the machine is back to normal condition.

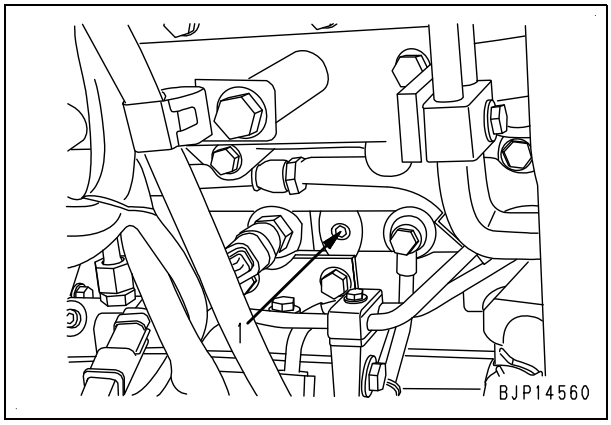
Testing engine oil pressure

★ Testing instrument engine oil pressure

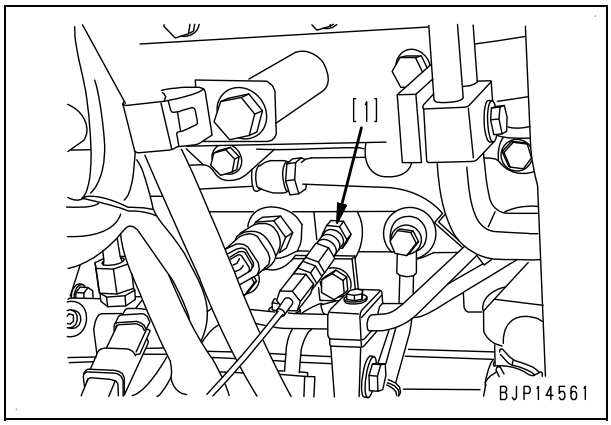
Symbol		Part No.	Part name
G	1	799-101-5002	Hydraulic tester
		790-261-1204	Digital hydraulic tester
	2	799-401-2320	Gauge

1. Open the engine hood.

2. Remove the oil pressure measurement plug (1) on the cylinder block.



3. Install nipple [1] of hydraulic tester **G1** and connect it to gauge **G2**.



4. Start the engine and raise the temperature of the engine to the operating range.

5. Measure the engine oil pressure at low idling and also at high idling.

6. Detach the measurement tool after the measurement, and make sure that the machine is back to normal condition.

Testing EGR valve and bypass valve drive oil pressure

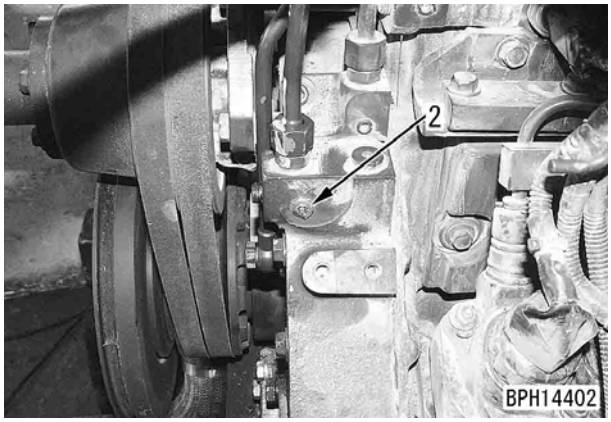
★ Testing instrument for EGR valve and bypass valve drive oil pressure

Symbol		Part No.	Part name
R	1	799-101-5002	Hydraulic tester
		790-261-1204	Digital hydraulic tester
	2	799-301-1190	● Nipple
	3	799-101-5160	● Nipple

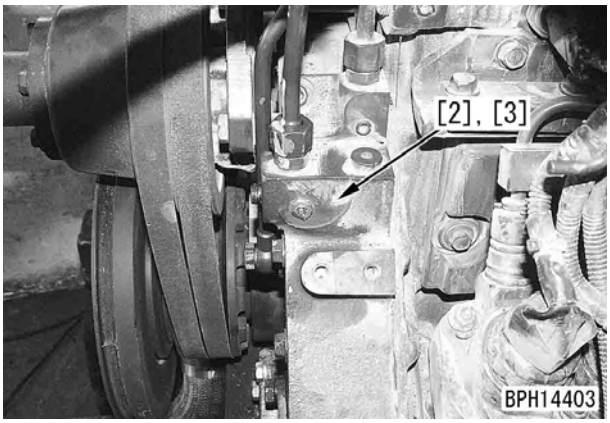
1. Open the engine hood.

2. Move air conditioner compressor (1) so that it will not be an obstacle to the work.

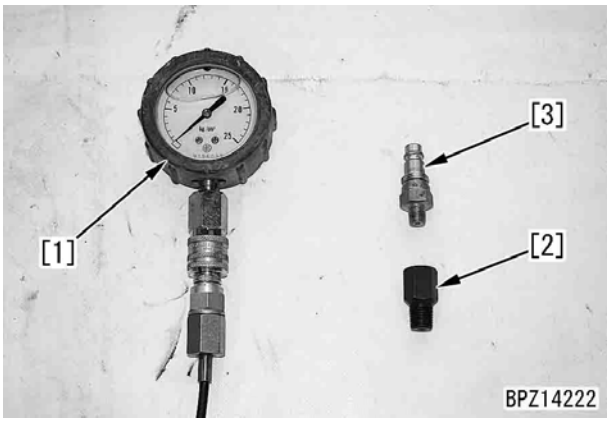
3. Removal oil pressure pickup plug (2).



4. Install nipples [2] and [3] of hydraulic tester **R** and connect hydraulic gauge [1] (2.5 MPa {25 kg/cm^2}).



5. Start the engine and measure the oil pressure while the engine is running at low idle and high idle.



6. After finishing measurement , remove the measuring instruments and return the removed parts.
   ★ Remove the gasket sealant sticking to the threaded part of the removed plug with a wire brush, apply adhesive or gasket sealant to it, and install it.
   Plug: **LT2 or LG-6**
   Plug: **16.7 – 37.2 Nm {1.7 – 3.8 kgm}**

Handling of fuel system devices

★ Precautions for checking 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 checking 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 replacing fuel filter cartridge
Be sure to use the Komatsu genuine fuel filter cartridge.
Since the common rail fuel injection system (CRI) consists of more precise parts than the conventional fuel injection pump and nozzle, it employs a high-efficiency special filter to prevent foreign matter from entering it.
If a filter other than the genuine one is used, the fuel system may have a trouble. Accordingly, never use such a filter.

Releasing residual pressure from 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:
Between Feed pump – Fuel filter – Fuel supply pump
High-pressure circuit:
Between Fuel supply pump – Common rail – Fuel 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 checking the fuel system and installing and removing its parts, the residual pressure in the fuel system must be released completely. Accordingly, observe the following.

⚠ **When inspecting the fuel line or removing or installing a equipment of fuel system, wait for at least 30 seconds after the engine is stopped to release the remaining pressure in the fuel system before starting operation. (There is still pressure remaining in the circuit, so do not start operations immediately after the engine is stopped.)**

Testing fuel pressure

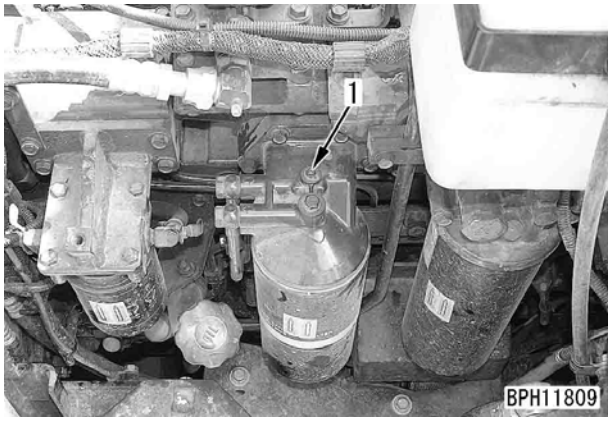
★ Testing tools for fuel pressure

Symbol		Part No.	Part name
H	1	799-101-5002	Hydraulic tester
		799-261-1204	Digital hydraulic tester
	2	799-401-2320	Gauge

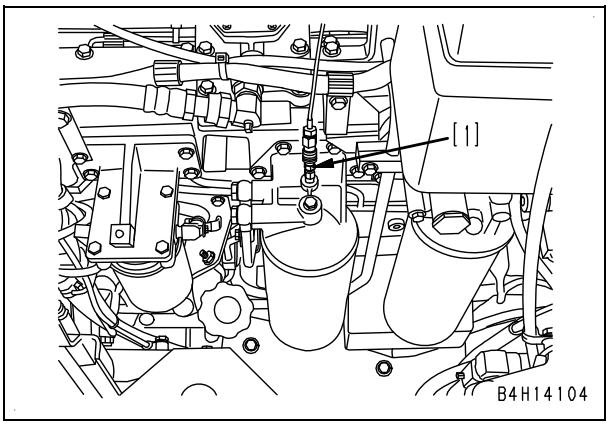
★ Measure the fuel pressure only for the low-pressure circuit between the feed pump-fuel filter-fuel supply pump.

⚠ **The high-pressure circuit between fuel supply pump-common rail-fuel injector is under extremely high pressure, so it cannot be measured.**

1. Remove fuel pressure inspection plug (1) located at the fuel filter head.

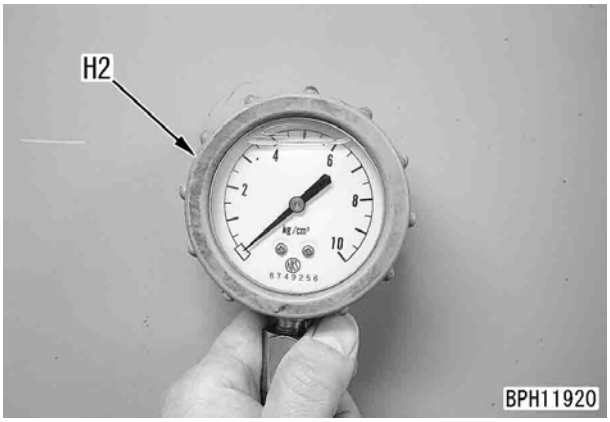


2. Install nipple [1] of hydraulic tester **H1**, and connect to gauge **H2**.



3. Start the engine and measure the fuel pressure with the engine running at high idle.
   ★ If the fuel pressure is in the following range, it is normal.

Engine speed	Fuel pressure
High idle	0.15 – 0.3 MPa {1.5 – 3 kg/cm^2}



4. After finishing testing, remove the testing tools and return the removed parts.

Handling during cylinder cut-out 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 from the 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.
   ★ See the section of “Special functions of machine monitor“ when turning on the cylinder cut-out operation.

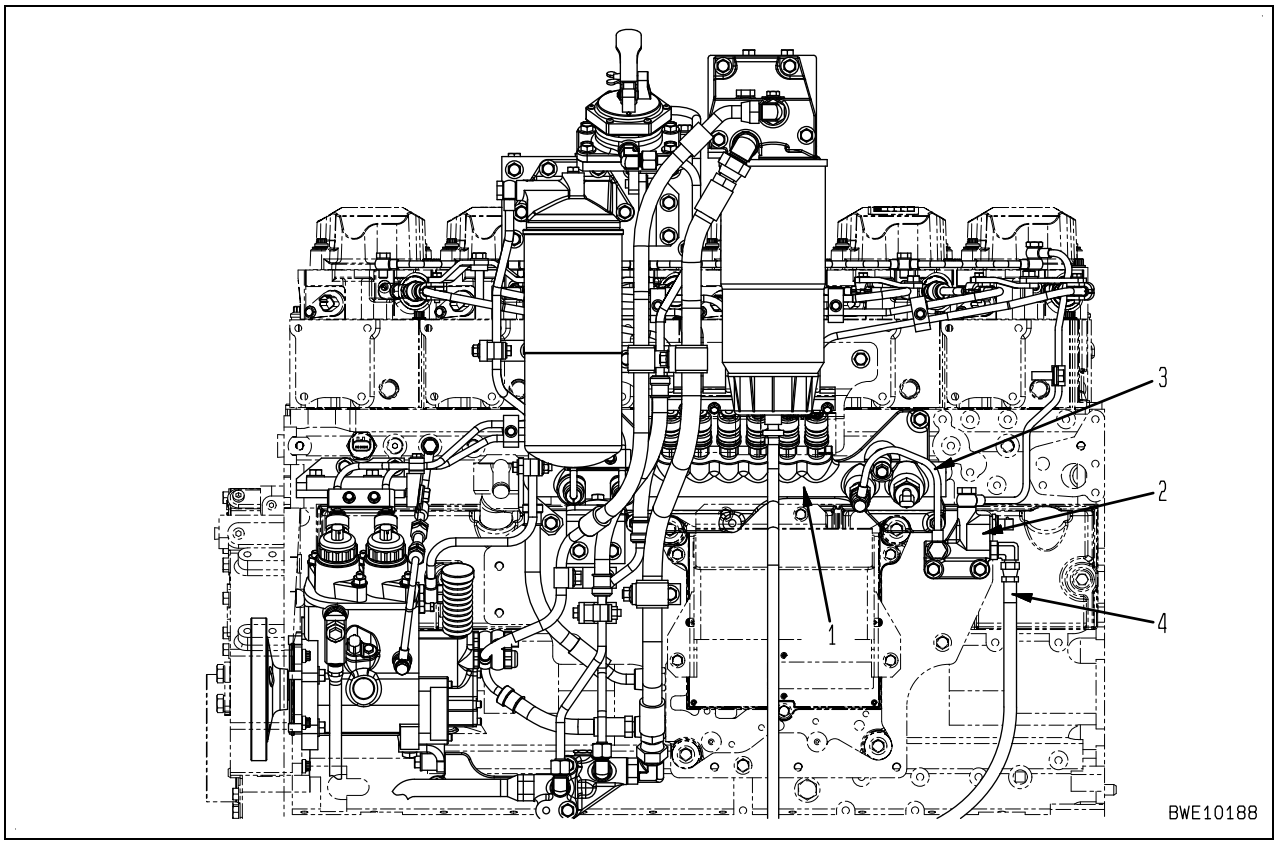
Handling during no injection cranking operation

★ 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.

- Before the engine is started after it or the engine unit has been stored for a long period, the no-injection cranking is performed to lubricate the engine parts and protect them from seizure.

★ See the section of “Special functions of machine monitor“ when turning on the no injection cranking operation.

Testing fuel return and leak amount

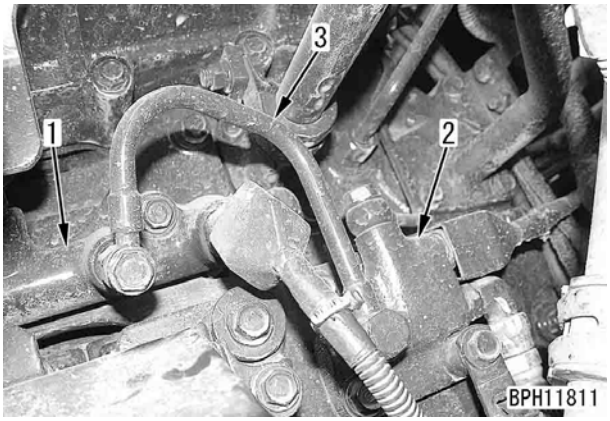


★ Testing instruments of fuel return and leak amount

Symbol		Part No.	Part name
J	1	6151-51-8490	Spacer
	2	6206-71-1770	Joint
	3	Commercially available	Hose
	4	Commercially available	Hose
	5	Commercially available	Measuring cylinder
	6	Commercially available	Stopwatch

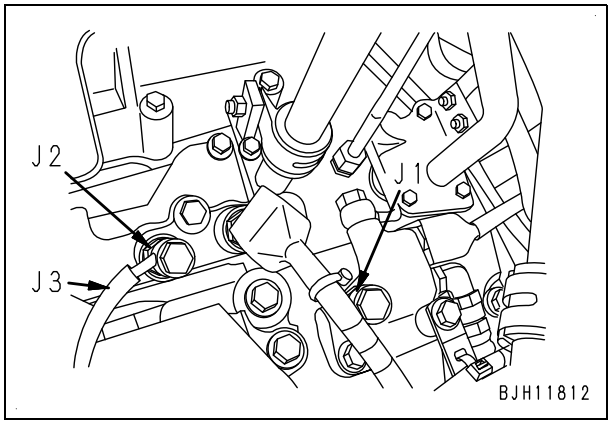
★ Since the fuel flows out during the check, prepare approx. 20 ℓ oil pan (receiver).

1. **Preparatory work**
   1) Remove tube (3) between common rail (1) and return block (2).



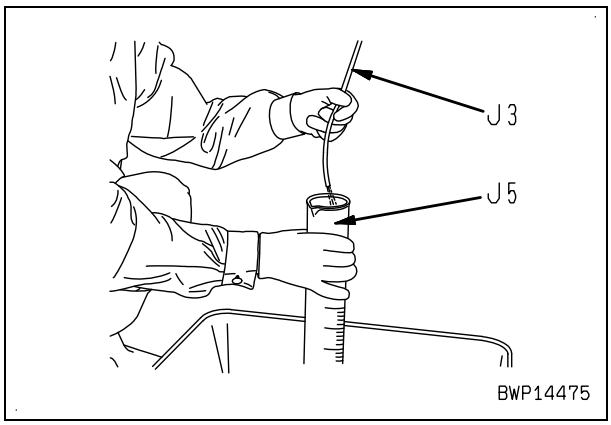
   2) Insert spacer **J1** to return block (2) side and retighten it with the currently removed joint bolt.
      ★ Be sure to provide a gasket to both ends of the spacer.
   3) Insert joint **J2** to common rail (1) side and tighten again the removed joint bolt.
      ★ Be sure to fit the gaskets to both ends of the joint.

4) Connect the inspection hose **J3** to the end of joint **J2**.
   ★ Bind connecting portion with wire so that the inspection hose should not come off.
   ★ Now the preparation for testing pressure limiter leak amount is completed.



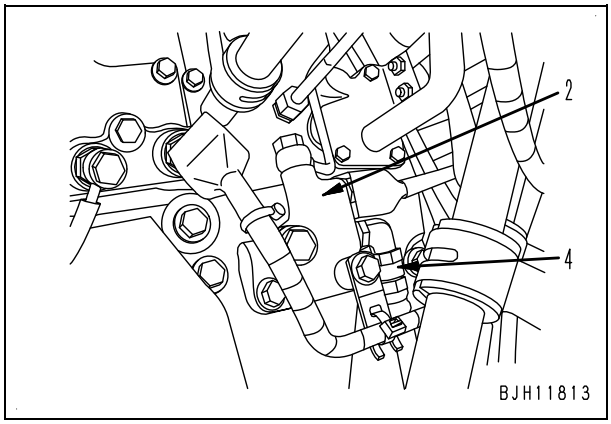
2. **Testing pressure limiter leakage amount**
   1) Adjust the route of inspection hose **J3** to remove its sag and insert the hose end into the oil pan (receiver).
   2) Referencing “Measuring engine speed“, set up the condition necessary for checking the engine speed.
   3) Start the engine and run it under the rated load (torque converter stall load).
   4) When the engine speed is stabilized, check the leakage amount per minute with measuring cylinder **J5**.
      ★ The leakage also can be judged by testing for twenty seconds and triples its leakage amount.
      ★ If the leakage from the pressure limiter is in the following range, it is normal.

Engine speed (rpm)	Leakage (cc/min)
Install torque converter	Max. 10

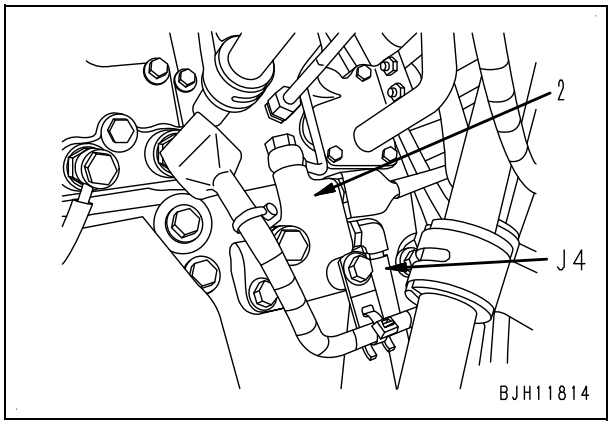


   5) When the testing is completed, stop the engine.

3. **Testing injector return amount**
   ★ During testing injector return amount, keep a hose end connected to pressure limiter and insert the other end to oil pan (receiver).
   ★ Disconnect both ends of injector return tube.
   1) Disconnect fuel return hose (4) from return block (2).
      ★ Install oil stopper plug to the fuel hose (4) side and fix hose.
      ● Plug: 07376-70315

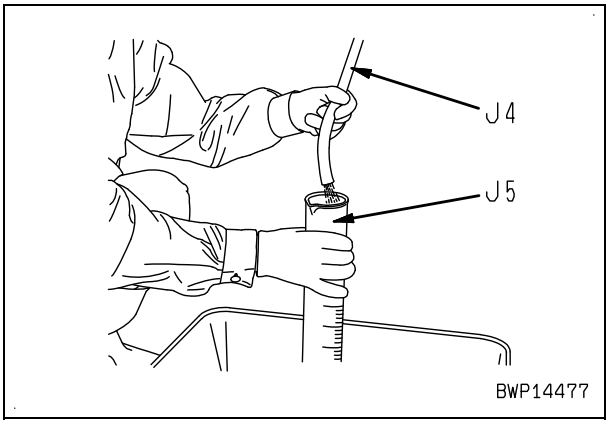


   2) Connect inspection hose **J4** to return block (2) side.
      ★ Bind connecting portion with wire so that the inspection hose should not come off.
   3) Adjust the route of inspection hose **J4** to remove its sag and insert the hose end into the oil pan (receiver).



4) Referencing “Testing engine speed“, set up the condition necessary for checking the engine speed.
5) Start the engine and run the engine at the rated output.
6) When the engine speed is stabilized, check the return amount per minute with measuring cylinder **J5**.
   ★ It also can be judged by testing for 20 seconds and triples its return amount.
   ★ If the supply pump is not supplying fuel, the engine speed may not rise. In this case, record the engine speed, too, during the test.
   ★ If the return rate (spill) from the injector is in the following range, it is normal.

Rated output speed (rpm)	Return (Spill) limit (cc/min)
1,600	960
1,700	1,020
1,800	1,080
1,900	1,140
2,000	1,200



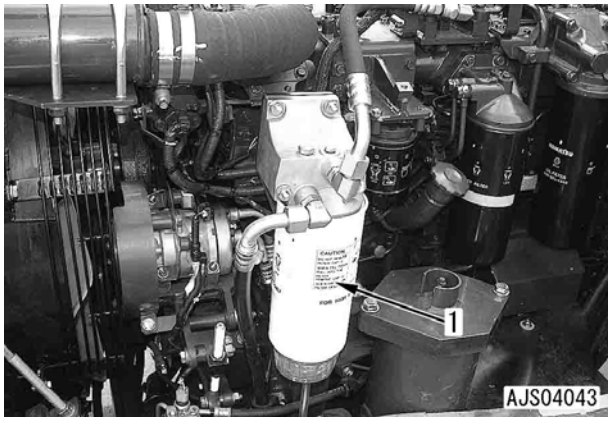
7) When the testing is completed, stop the engine.

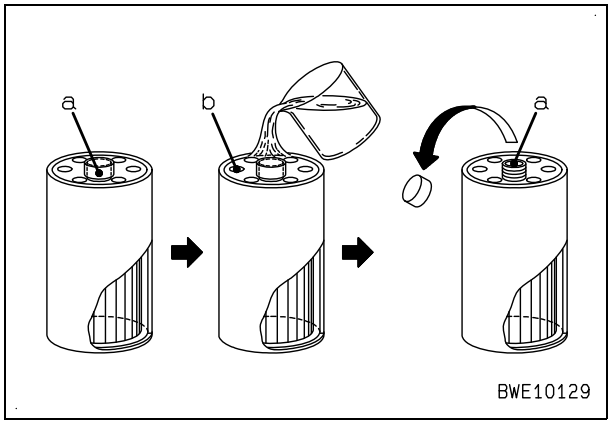
4. **Operations after completion of testing**
   If all the tests are completed, remove the instruments and set to the original condition.

Bleeding air from fuel circuit

★ If fuel is used up, or if a fuel circuit part is removed or installed, bleed air from the fuel circuit according to the following procedure.

1. Remove fuel pre-fuel filter (1) and fill it with fuel.
   ★ Fill the fuel filter with clean fuel and take care that dirt will not enter it.
   ★ Confirm the cap is installed to portion (a) (center hole) of the fuel pre-filter and add fuel from portion (b) (peripheral holes).
   ★ After filling the pre-fuel filter with fuel, remove the cap from part (a).
   ★ If clean fuel is not available, do not remove the filter. Operate the priming pump (5) to fill the filter with fuel.
   (Refer to procedures 4 and 5 for operations of priming pump.)
   ★ **Do not add fuel to fuel main filter (2) externally.**





2. Install fuel pre-filter (1) to filter head.
   ★ Apply engine oil thinly over the packing on the fuel pre-filter side.
   ★ After the packing of the fuel pre-filter touches the sealing face of the filter head, tighten the fuel pre-filter 3/4 turns.

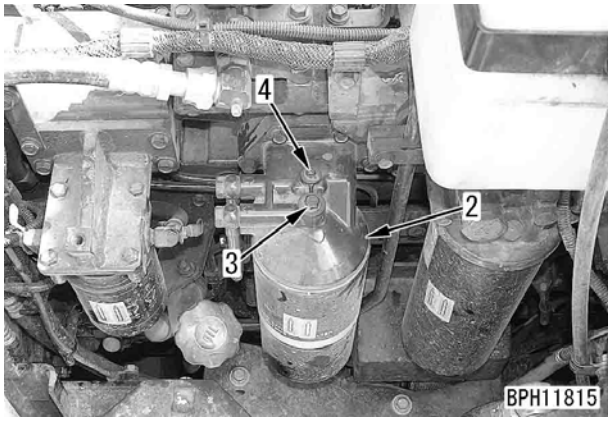
3. Loosen plug (3) at the top of fuel main filter (2) and remove plug (4).

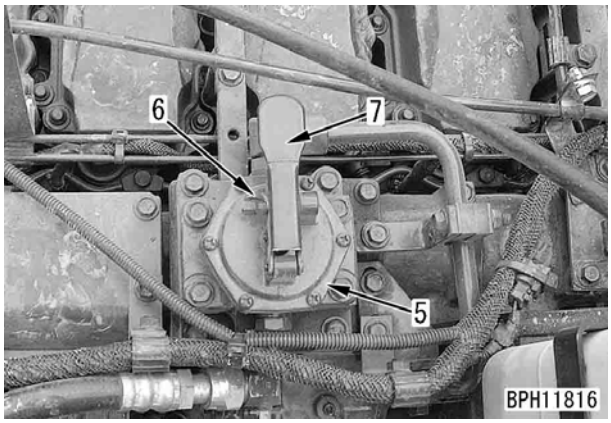
4. Loosen lever-fixing butterfly screw (6) of priming pump (5) to remove it from the tap.

5. While pushing lever (7) of the priming pump, carry out priming until fuel without bubbles flows out from plug (3). Then install plug (3).

6. Carry out priming once or twice additionally, and after confirming that fuel flows out from plug (4), tighten plug (4).

7. Then conduct approximately 20 times of additional priming and install butterfly screw (6) of priming pump.
   Butterfly screw tightening torque:
   11.7 Nm {1.2 kgm}





Testing fuel circuit for leakage

⚠ **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 and installing its components, check 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 a speed less than 1,000 rpm and stop it after its rotation 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 any fuel leakage is detected, repair it and inspect again from step 1.

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 any fuel leakage is detected, repair it and inspect again from step 1.

6. Run the engine at high idle.

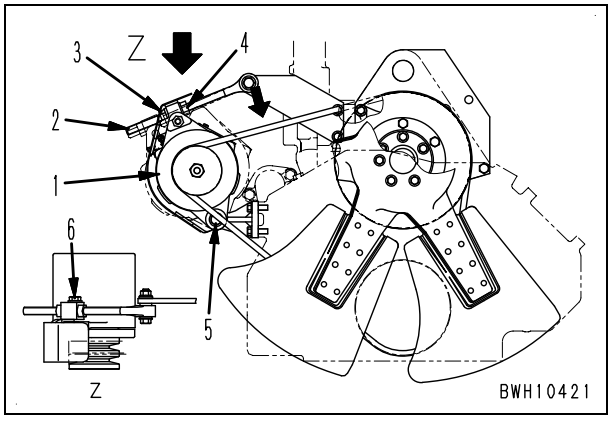
7. Inspect the fuel piping and devices for fuel leakage.
   ★ Check mainly around the high-pressure circuit parts coated with the color checker for fuel leakage.
   ★ If any fuel leakage is detected, repair it and inspect again from step 1.

8. Run the engine at high idle to apply load to the engine.
   ★ 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 any fuel leakage is detected, repair it and inspect again from step 1.
   ★ If no fuel leakage is detected, check is completed.

Testing and adjusting alternator belt tension

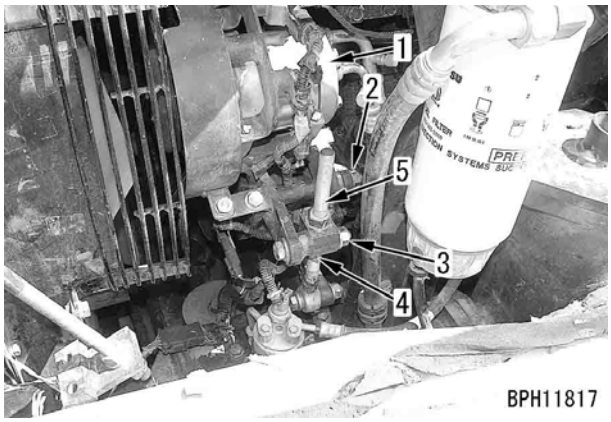
1. **Testing**
   Measure the deflection when the belt is pushed with a finger at the middle point (marked by the arrow) between the alternator pulley and fan pulley.
   ★ Pushing force:
   Approx. 58.8 N {Approx. 6 kg}
   ★ Deflection: 13 – 16 mm



2. **Adjusting**
   ★ If the deflection is out of the standard range, adjust it according to the following procedure.
   1) Loosen mounting bolt and nut (5) of alternator (1) and mounting bolt (6) of adjusting rod (2).
   2) Loosen locknut (3) and move alternator (1) by turning adjustment nut (4) to adjust the belt tension.
   3) Tighten locknut (3).
   4) Tighten mounting bolt and nut (5) of alternator (1) and mounting bolt (6) of adjusting rod (2).
      ★ After completing adjustment, check the tension of belt again.

Testing and adjusting air conditioner compressor belt tension

1. **Testing**
   Measure the deflection when the belt is pushed with a finger at the middle point between compressor pulley and crank pulley.
   ★ Pushing force:
   Approx. 98 N {Approx. 10 kg}
   ★ Deflection: 20 – 25 mm



2. **Adjusting**
   ★ If the deflection is out of the standard range, adjust it according to the following procedure.
   1) Loosen nut (2) of compressor assembly (1) mounting bolt and loosen nut (3) of adjusting rod mounting bolt.
   2) Loosen locknut (4) and move compressor assembly (1) by turning adjustment nut (5) to adjust the belt tension.
   3) Tighten locknut (4).
   4) Tighten nut (2) of compressor assembly (1) mounting bolt and tighten nut (3) of adjusting rod mounting bolt.
      ★ After completing adjustment, check the tension of belt again.

HM300-2 Articulated dump truck

Form No. SEN00667-04

ARTICULATED DUMP TRUCK

HM300-2

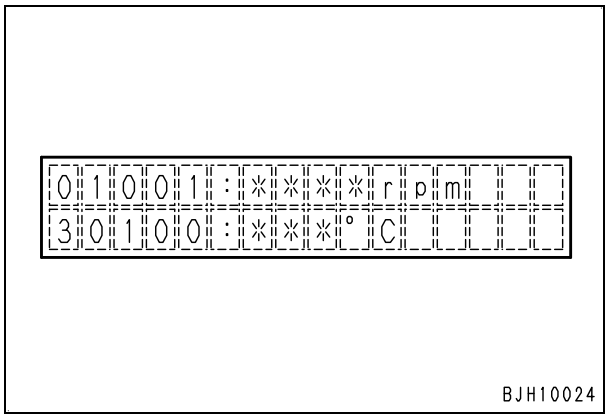
Machine model	Serial number
HM300-2	2001 and up

30 Testing and adjusting
Testing and adjusting, Part 2

Testing torque converter stall speed

⚠ **Stop the machine on level ground, turn the parking brake switch ON, and set chocks to the tires.**

1. Switch the machine monitor display to the monitoring function of service mode 1 and display the following 2 items at the same time with the monitoring function.
   ★ Monitoring items
   [1] **Code No. 01001**: Engine speed
   [2] **Code No. 30100**: Torque converter oil temperature
   ★ Refer to “Special functions of machine monitor (EMMS)“ for the operating method.



2. Start the engine and raise the temperature of the torque converter oil and hydraulic oil.
   ★ Torque converter oil temperature: 60 – 80 °C
   Hydraulic oil temperature: 45 – 55 °C

3. Turn the parking brake switch ON, depress the brake pedal, then set the gear shift lever to the D position.
   ★ If the gear shift lever is operated to any position other than the D position, the machine may move off even if the brake is being depressed, so always measure at the D position.

4. Depress the accelerator pedal gradually, run the engine at high idle and stall the torque converter to raise the torque converter oil temperature.
   ⚠ **There is danger of damage to the internal parts of the transmission, so never operate the gear shift lever to any position other than the D position during the stall operation.**

5. When the torque converter oil temperature goes above 90 °C, run the engine immediately at low idle and return the gear shift lever to the N position.
   ⚠ **Never operate the gear shift lever with the accelerator pedal depressed. Otherwise it may create a large shock and may also cause to shorten the service life of the machine.**

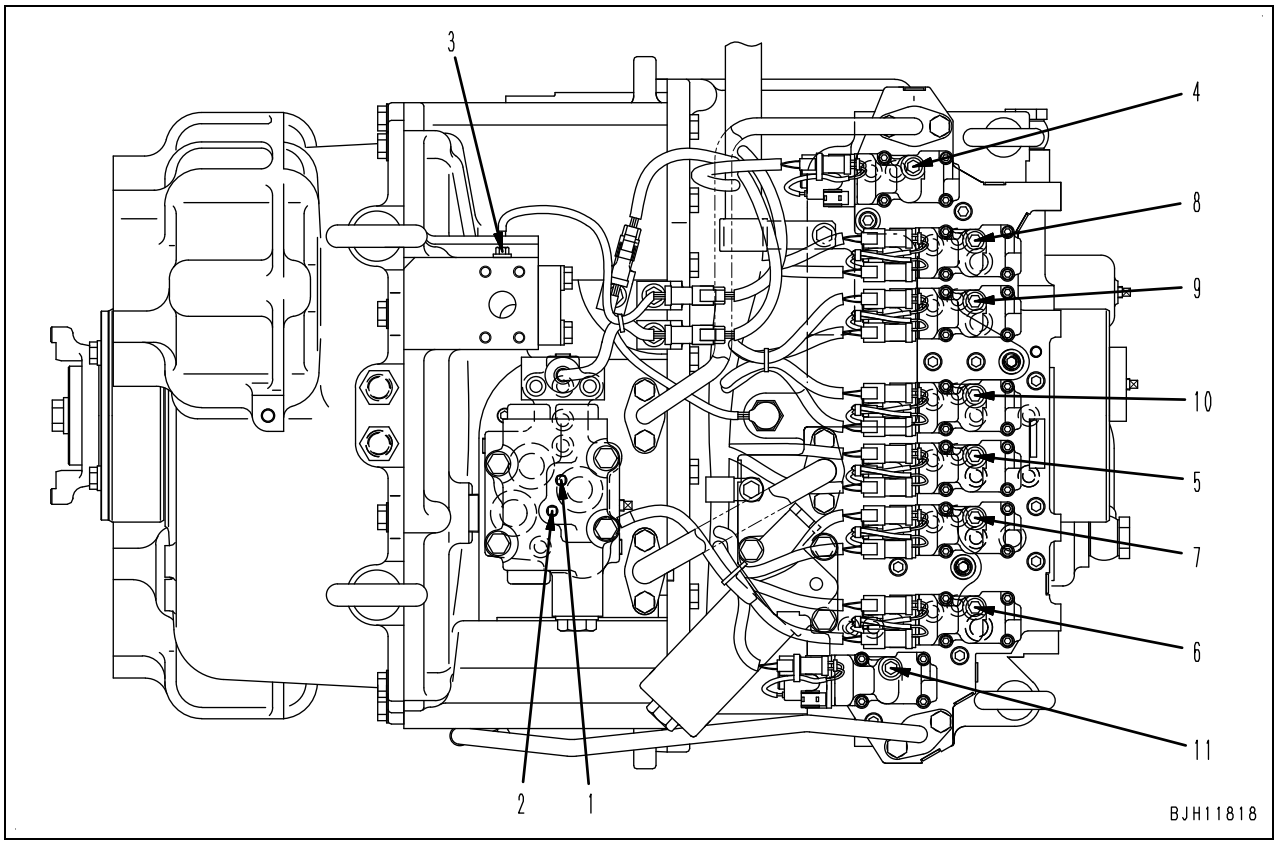
6. Run the engine at a medium speed, and when the torque converter oil temperature goes down to approx. 80 °C, run at low idle.
   ★ Keep the gear shift lever at the N position.

7. Repeat Steps 3 – 6 and equalize the oil temperature in the torque converter and transmission.

8. At the same time as repeating Steps 3 and 4, measure the stall speed when the torque converter oil temperature is 80 °C.
   ★ Measure the stall speed 2 – 3 times.

★ The stall speed may vary according to the following conditions, so always measure the stall speed at the time of delivery.
   1) Variations according to the engine serial number
   2) Variations due to atmospheric pressure and temperature
   3) Variations due to the torque consumed by accessories
   4) Variations due to characteristics of the torque converter
   5) Variations due to the method of measuring the stall

Testing power train oil pressure



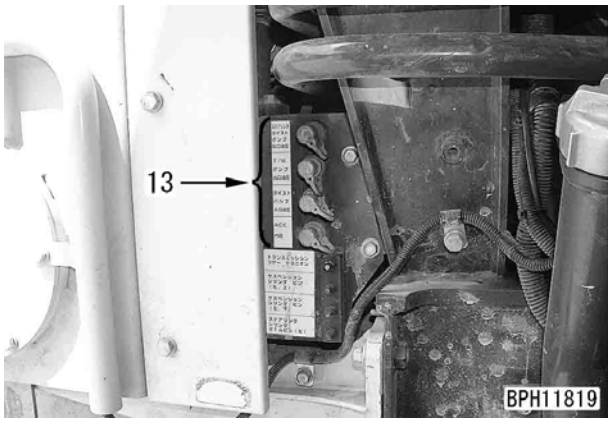
★ Testing tools for power train oil pressure

Sym-bol	Part number	Part name
K	799-101-5002	Hydraulic tester
	799-261-1204	Digital type Hydraulic tester
	799-401-2320	Hydraulic gauge
	799-101-5220	Nipple
	07002-11023	O-ring
	799-101-5260	Nipple
	07002-11223	O-ring
	799-101-5230	Nipple
	07002-11423	O-ring

★ **List of oil pressure measuring points and gauges to be used.**

No.	Oil pressure reading	Gauge (MPa {kg/cm^2})
1	Power train main relief pressure	6 {60}
2	Torque converter inlet pressure	6 {60}
3	Torque converter outlet pressure	1 {10}
4	Torque converter lock-up clutch pressure	6 {60}
5	Transmission Lo clutch pressure	6 {60}
6	Transmission Hi clutch pressure	6 {60}
7	Transmission 1st clutch pressure	6 {60}
8	Transmission 2nd clutch pressure	6 {60}
9	Transmission 3rd clutch pressure	6 {60}
10	Transmission R clutch pressure	6 {60}
11	Inter-axle differential lock clutch pressure	6 {60}

★ The transmission lubrication pressure is represented by the torque converter outlet port pressure, so there is no need to measure it.
★ (13): Remote measuring points

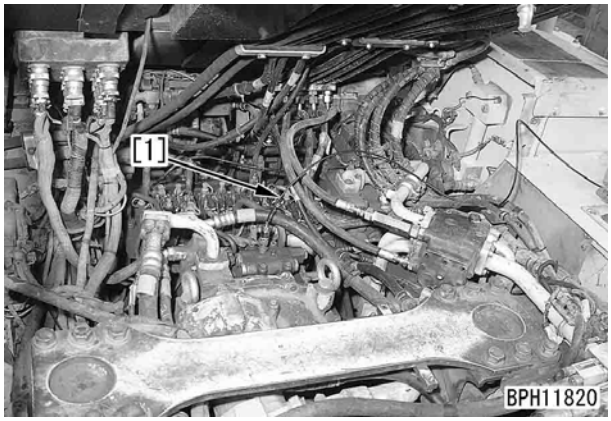


⚠ **Stop the machine on level ground, turn the parking brake switch ON, and set chocks to the tires.**
⚠ **Install and remove the measuring instruments after the oil temperature lowers fully.**
⚠ **When measuring the oil pressure while traveling, make sure that there is a wide travel area and pay attention to keep the safety in the surrounding area.**
★ When tilting the cab up or down, see “Method of tilting cab up“ for details.
★ When measuring ECMV-related hydraulic oil pressure, install and remove the nipple, hoses and gauge for the measurement from the rear underside of the cab.

Power train overall

1. Measuring power train main relief pressure

1) Tilt the cab up.
2) Remove oil pressure measurement plug (1), then install nipple and hose [1].
   ★ Pull the hose out to the rear of the transmission.



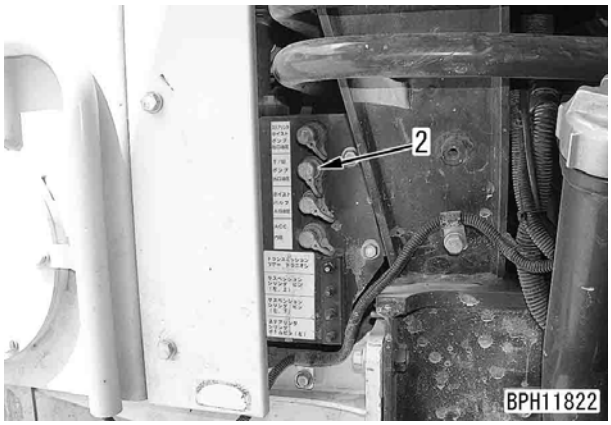
3) Tilt the cab down and return it to its original position.
4) Connect oil pressure gauge **K**.
5) Start the engine and raise the temperature of the torque converter oil to the operating range.
6) While keeping the gear shift lever at the N position, measure the oil pressure at low idle and high idle.

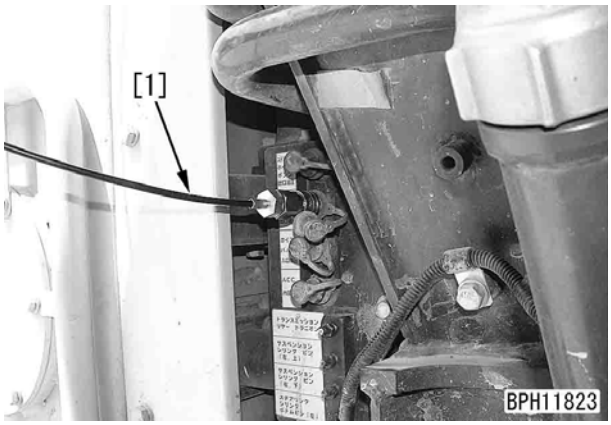
7) After finishing measurement, remove the measuring instrument and reinstall the removed parts.

Torque converter related

2. Measuring torque converter inlet pressure

1) Attach hose [1] for oil pressure measurement to hydraulic oil pressure measuring coupler (2).



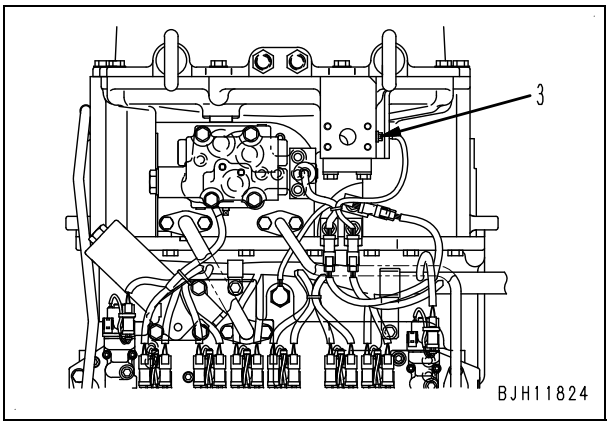


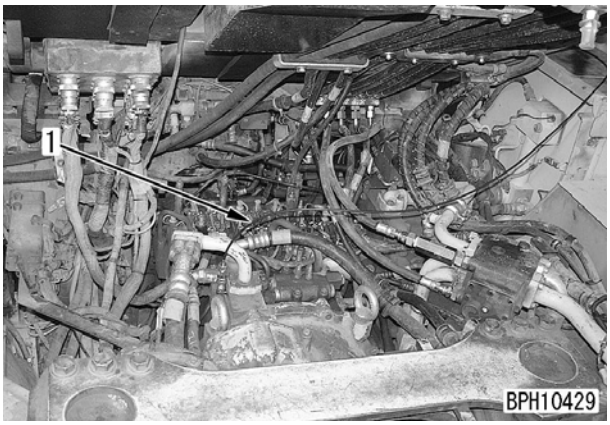
2) Connect oil pressure gauge **K**.
3) Start the engine and raise the temperature of the torque converter oil to the operating range.
4) While keeping the gear shift lever at the N position, measure the oil pressure at high idle.

5) After finishing measurement, remove the measuring instrument and reinstall the removed parts.

3. Measuring torque converter outlet pressure

1) Tilt the cab up.
2) Remove oil pressure measurement plug (3), then install nipple and hose [1].
   ★ Pull the hose out to the rear of the transmission.



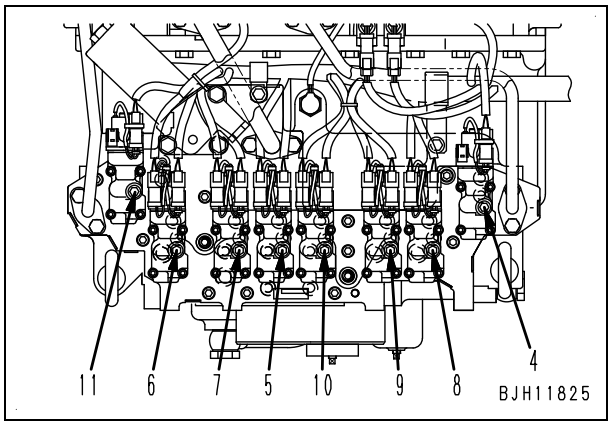


3) Tilt the cab down and return it to its original position.
4) Connect oil pressure gauge **K**.
5) Start the engine and raise the temperature of the torque converter oil to the operating range.
6) While keeping the gear shift lever at the N position, measure the oil pressure at high idle.

7) After finishing measurement, remove the measuring instrument and reinstall the removed parts.

4. Measuring torque converter lock-up clutch pressure

1) Remove oil pressure measuring plug (4), then install nipple and hose for measurement.



2) Connect oil pressure gauge **K**.
3) Start the engine and raise the temperature of the torque converter oil to the operating range.
4) Turn the parking brake OFF, depress the brake pedal, then set the gear shift lever to position 1.
5) Release the brake, travel at high idle, and measure the oil pressure when the lock-up pilot lamp lights up.

⚠ In F1, the maximum travel speed reaches to approx. 6.4 km/h, so travel the machine with enough care of the safety in the surrounding area.

6) After finishing measurement, remove the measuring instrument and reinstall the removed parts.

Transmission related

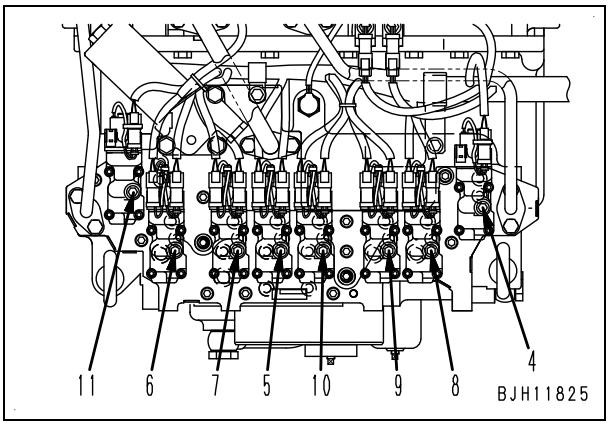
★ **Table of gear shift lever positions, speed ranges, and clutches actuated**

Gear shift lever										Travel speed	Clutch					
R3	R2	R1	N	D	5	4	3	2	1		Lo	Hi	1st	2nd	3rd	R
					○	○	○	○	○	F1	●		●			
				○	○	○	○	○		F2		●	◎			
				○	○	○	○			F3	◎			●		
				○	○	○				F4		◎		◎		
				○	○					F5	◎				●	
				○						F6		◎			◎	
			○							N						
		○								R1			◎			●
	○									R2				◎		◎
○										R3					◎	◎

★ The ○ mark indicates the travel speed ranges that are actuated for each position of the gear shift lever.
★ The ◎ mark and ● mark indicate the clutches that are actuated for each travel speed.
★ The ● mark indicates the travel gear speed when measuring the oil pressure for each clutch.

5. Measuring transmission Lo clutch pressure

1) Remove oil pressure measuring plug (5), then install nipple and hose for measurement.

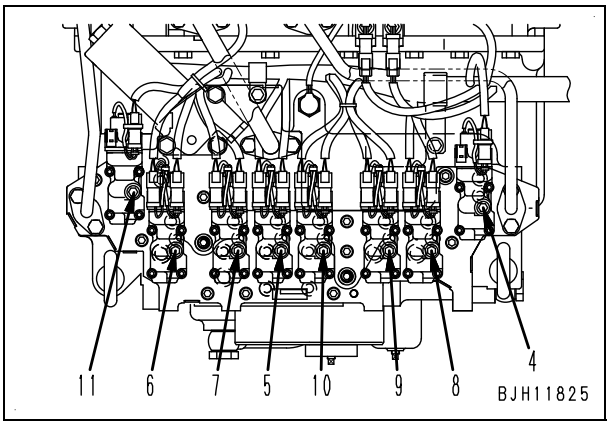


2) Connect oil pressure gauge **K**.
3) Start the engine and raise the temperature of the torque converter oil to the operating range.
4) Turn the parking brake OFF, depress the brake pedal, then set the gear shift lever to position 1.
5) Release the brake and measure the oil pressure when traveling at high idle.
   ⚠ **In F1, the maximum travel speed reaches to approx. 6.4 km/h, so travel the machine with enough care of the safety in the surrounding area.**

6) After finishing measurement, remove the measuring instrument and reinstall the removed parts.

6. Measuring transmission Hi clutch pressure

1) Remove oil pressure measuring plug (6), then install nipple and hose for measurement.

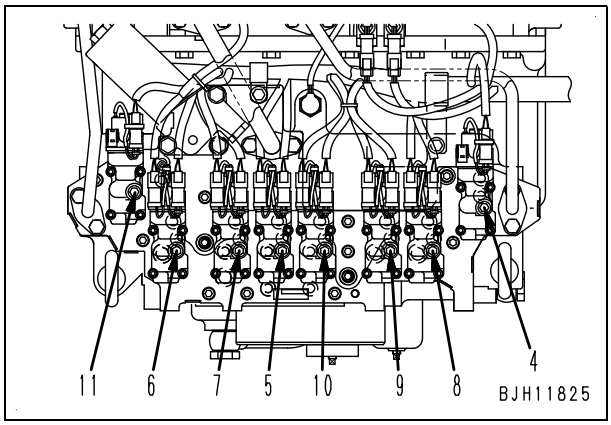


2) Connect oil pressure gauge **K**.
3) Start the engine and raise the temperature of the torque converter oil to the operating range.
4) Turn the parking brake OFF, depress the brake pedal, then set the gear shift lever to position 2.
5) Release the brake, travel at high idle, and measure the oil pressure when the shift indicator displays [2].
   ⚠ **In F2, the maximum travel speed reaches to approx. 10.2 km/h, so travel the machine with enough care of the safety in the surrounding area.**

6) After finishing measurement, remove the measuring instrument and reinstall the removed parts.

7. Measuring transmission 1st clutch pressure

1) Remove oil pressure measuring plug (7), then install nipple and hose for measurement.

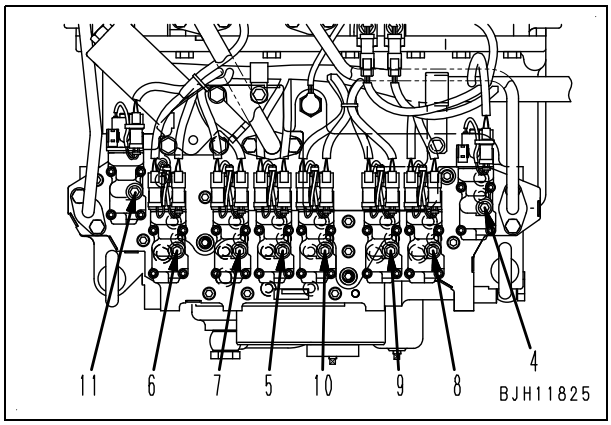


2) Connect oil pressure gauge **K**.
3) Start the engine and raise the temperature of the torque converter oil to the operating range.
4) Turn the parking brake OFF, depress the brake pedal, then set the gear shift lever to position 1.
5) Release the brake and measure the oil pressure when traveling at high idle.
   ⚠ **In F1, the maximum travel speed reaches to approx. 6.4 km/h, so travel the machine with enough care of the safety in the surrounding area.**

6) After finishing measurement, remove the measuring instrument and reinstall the removed parts.

8. Measuring transmission 2nd clutch pressure

1) Remove oil pressure measuring plug (8), then install nipple and hose for measurement.

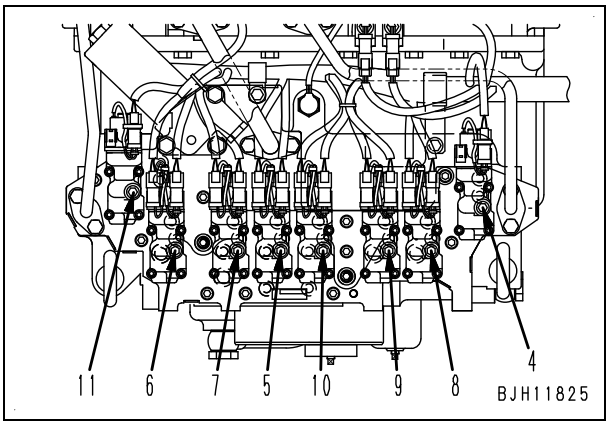


2) Connect oil pressure gauge **K**.
3) Start the engine and raise the temperature of the torque converter oil to the operating range.
4) Turn the parking brake OFF, depress the brake pedal, then set the gear shift lever to position 3.
5) Release the brake, travel at high idle, and measure the oil pressure when the shift indicator displays [3].
   ⚠ **In F3, the maximum travel speed reaches to approx. 15.4 km/h, so travel the machine with enough care of the safety in the surrounding area.**

6) After finishing measurement, remove the measuring instrument and reinstall the removed parts.

9. Measuring transmission 3rd clutch pressure

1) Remove oil pressure measuring plug (10), then install nipple and hose for measurement.

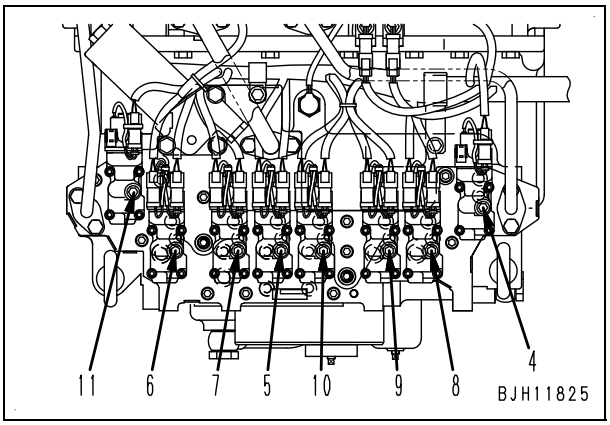


2) Connect oil pressure gauge **K**.
3) Start the engine and raise the temperature of the torque converter oil to the operating range.
4) Turn the parking brake OFF, depress the brake pedal, then set the gear shift lever to position 5.
5) Release the brake, travel at high idle, and measure the oil pressure when the shift indicator displays [5].
   ⚠ **In F5, the maximum travel speed reaches to approx. 36.8 km/h, so travel the machine with enough care of the safety in the surrounding area.**

6) After finishing measurement, remove the measuring instrument and reinstall the removed parts.

10. Measuring transmission reverse clutch pressure

1) Remove oil pressure measuring plug (7), then install nipple and hose for measurement.

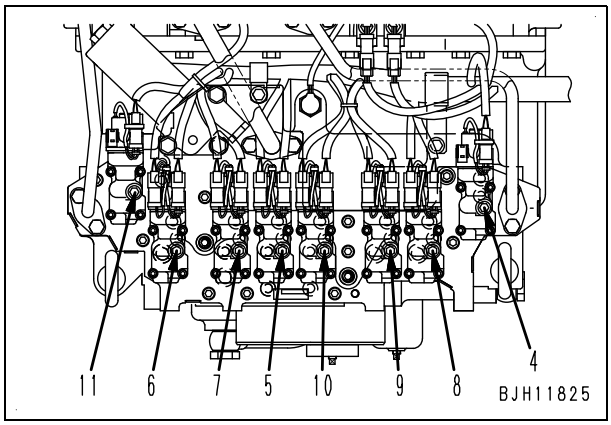


2) Connect oil pressure gauge **K**.
3) Start the engine and raise the temperature of the torque converter oil to the operating range.
4) Turn the parking brake OFF, depress the brake pedal, then set the gear shift lever to position **R1**.
5) Release the brake and measure the oil pressure when traveling at high idle.
   ⚠ **In R1, the maximum travel speed reaches to approx. 7.2 km/h, so travel the machine with enough care of the safety in the surrounding area.**

6) After finishing measurement, remove the measuring instrument and reinstall the removed parts.

11. Measuring inter-axle differential lock clutch pressure

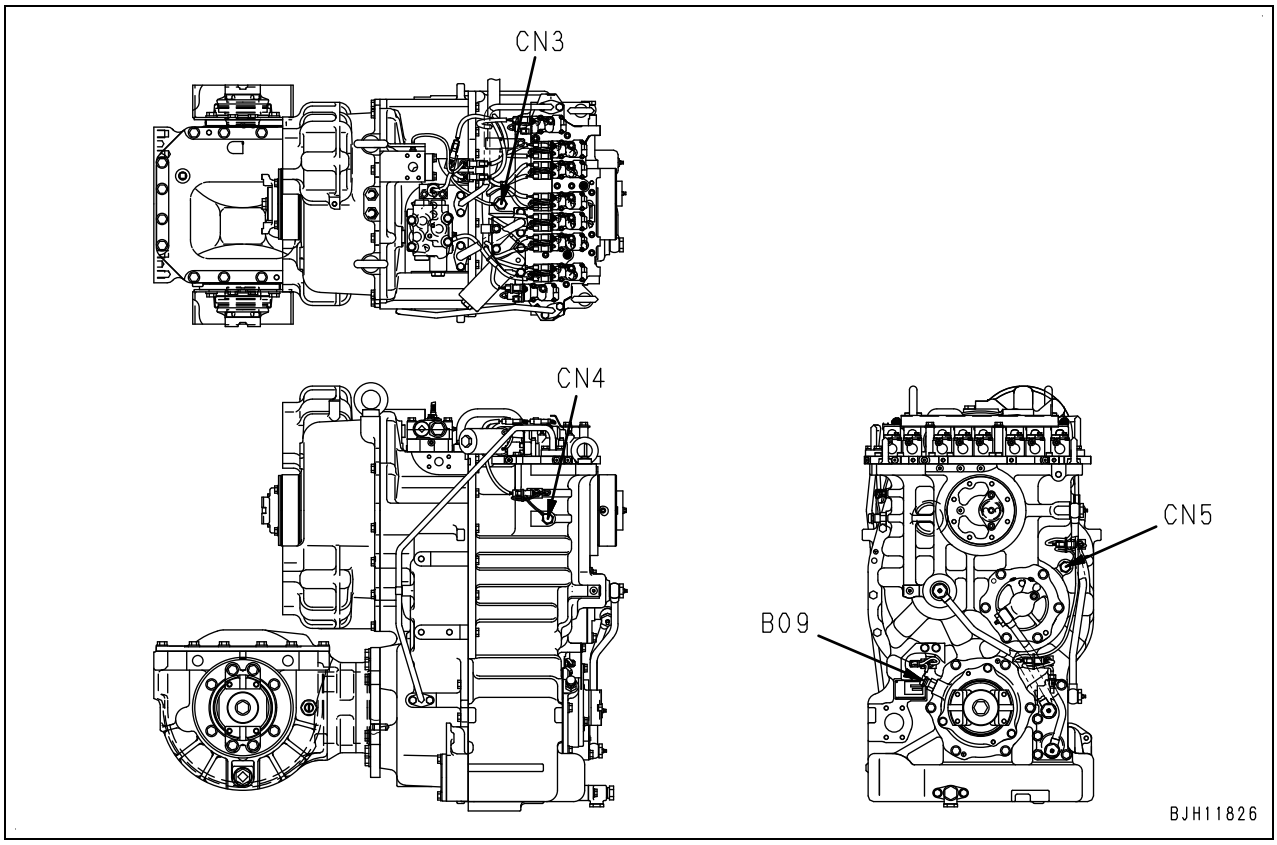
1) Remove oil pressure measuring plug (11), then install nipple and hose for measurement.



2) Connect oil pressure gauge **K**.
3) Start the engine and raise the temperature of the torque converter oil to the operating range.
4) While keeping the gear shift lever at the N position, move the inter-axle differential lock switch to the “MANUAL“ position.
5) Measure the oil pressure while the engine is running at high idle.

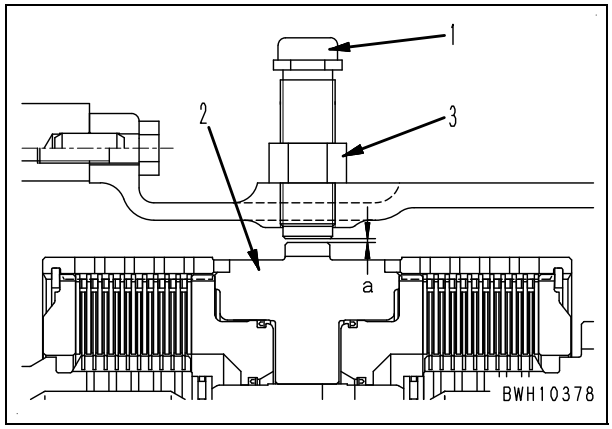
6) After finishing measurement, remove the measuring instrument and reinstall the removed parts.

Adjusting transmission speed sensor



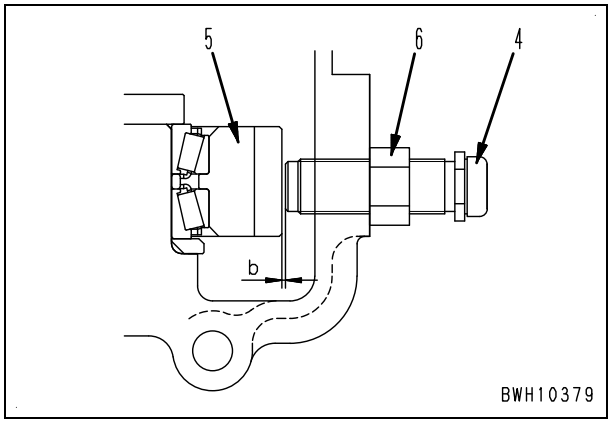
★ There are 4 speed sensors installed to the transmission. Adjust each sensor according to the following procedure.
CN3 : Input shaft speed sensor
CN4 : Intermediate shaft speed sensor
CN5 : Output shaft R speed sensor
B09 : Output shaft F speed sensor
★ For the input shaft speed sensor, tilt up the cab before carrying out adjustment.
★ For the intermediate shaft speed sensor and output shaft F speed sensor, remove the transmission and front differential assembly before carrying out adjustment.

1. **Adjusting input shaft speed sensor (CN3)**
   1) Remove input shaft speed sensor (1) and check that its tip is free from steel chips and flaws, and then reinstall it temporarily to the original position.
      Threaded portion:
      Gasket sealant (LG-5)
   2) Screw in sensor (1) until its tip touches the addendum of input shaft gear (2).
   3) Return sensor (1) by 1/2 – 1 turn from that position.
      ★ At this time, clearance (a) between the sensor tip and addendum is 0.75 – 1.5 mm.
   4) Tighten nut (3) with sensor (1) fixed.
      Nut: **49.0 – 68.6 Nm {5 – 7 kgm}**

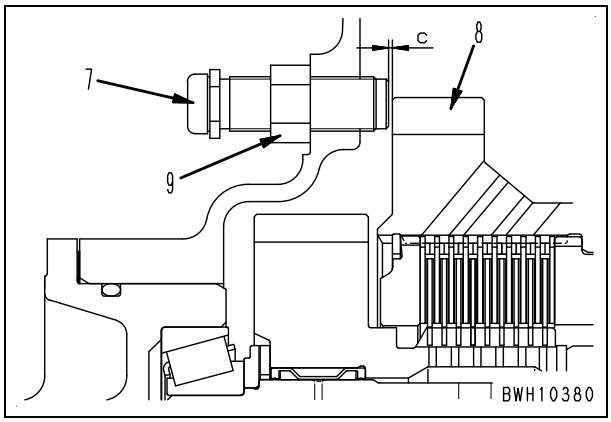


2. **Adjusting intermediate shaft speed sensor (CN4)**
   1) Remove intermediate shaft speed sensor (4) and check that its tip is free from steel chips and flaws, and then reinstall it temporarily to the original position.
      Threaded portion:
      Gasket sealant (LG-5)
   2) Screw in sensor (4) until its tip touches the addendum of intermediate shaft gear (5).

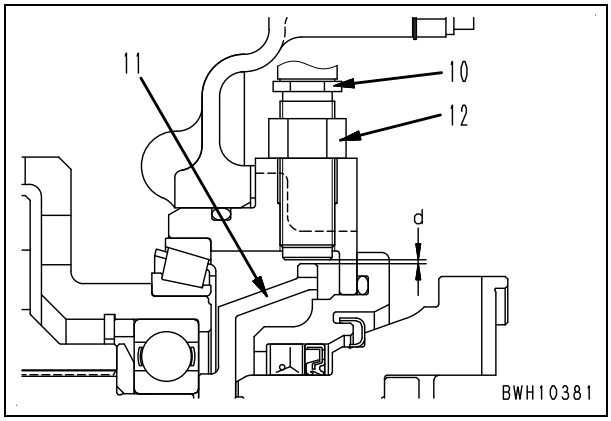
3) Return sensor (4) by 1/2 – 1 turn from that position.
   ★ At this time, clearance (b) between the sensor tip and addendum is 0.75 – 1.5 mm.
4) Tighten nut (6) with sensor (4) fixed.
   Nut: **49.0 – 68.6 Nm {5 – 7 kgm}**



3. **Adjusting output shaft R speed sensor (CN5)**
   1) Remove output shaft R speed sensor (7) and check that its tip is free from steel chips and flaws, and then reinstall it temporarily to the original position.
      Threaded portion:
      Gasket sealant (LG-5)
   2) Screw in sensor (7) until its tip touches the addendum of rear output shaft gear (8).
   3) Return sensor (7) by 1/2 – 1 turn from that position.
      ★ At this time, clearance (c) between the sensor tip and addendum is 0.75 – 1.5 mm.
   4) Tighten nut (9) with sensor (7) fixed.
      Nut: **49.0 – 68.6 Nm {5 – 7 kgm}**



4. **Adjusting output shaft F speed sensor (B09)**
   1) Remove output shaft F speed sensor (10) and check that its tip is free from steel chips and flaws, and then reinstall it temporarily to the original position.
      Threaded portion:
      Gasket sealant (LG-5)
   2) Screw in sensor (10) until its tip touches the addendum of front output shaft gear (11).
   3) Return sensor (10) by 1/2 – 1 turn from that position.
      ★ At this time, clearance (d) between the sensor tip and addendum is 0.75 – 1.5 mm.
   4) Tighten nut (12) with sensor (10) fixed.
      Nut: **49.0 – 68.6 Nm {5 – 7 kgm}**



5. **Confirming sensor input signal**
   After completing adjustment, confirm that each transmission shaft speed is displayed normally with the monitoring function of the machine monitor.
   ★ Refer to “Special functions of machine monitor (EMMS)“ for the monitoring function details.

Testing and adjusting brake oil pressure

★ Equipment for testing and adjusting brake oil pressure

Symbol		Part No.	Part name
L	1	799-101-5002	Hydraulic tester
		790-101-1204	Digital hydraulic tester
	2	793-520-1805	Brake test kit
	3	799-401-3200	Adapter assembly

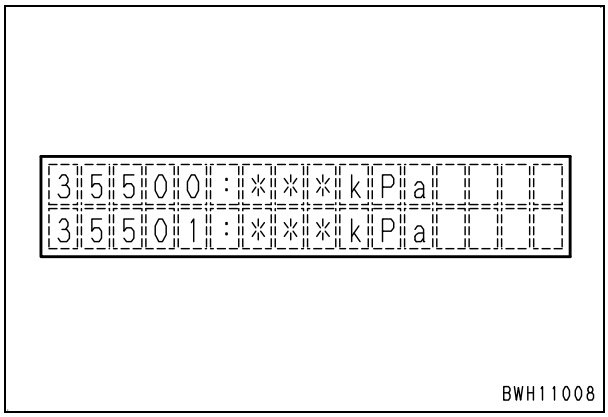
⚠ **Stop the machine on level ground, turn the parking brake switch ON, and set chocks to the tires.**

Testing

1. Testing ACC (accumulator) charge oil pressure

(Method using monitoring)

1) Set the machine monitor in service mode and display the following 2 items simultaneously with the monitoring function.
   - Monitoring system: **2 ITEMS**
   - Monitoring code: **35500 (ACC OIL PRESS F)**
   - Monitoring code: **35501 (ACC OIL PRESS R)**
   - ★ For the operating method, see "Special functions of machine monitor (EMMS)".



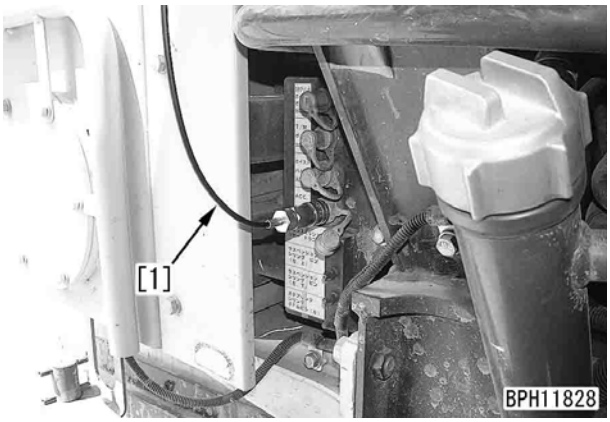
2) Start the engine.
3) Test the cut-in pressure at high idle.
   1] Press and release the brake pedal repeatedly to lower the oil pressure in the accumulator.
   2] Read the lower one of the ACC oil pressures (front or rear) when it starts rising after it reaches the bottom.
4) Test the cut-out pressure at high idle.
   - Read the ACC oil pressure (front or rear) when it stops rising at the highest point after the cut-in pressure.

Inspection

2. Measuring charge valve cut-in pressure and cut-out pressure

★ Measure the charge valve oil pressure at remote pressure pickup port (1).

1) Install hose [1] of hydraulic tester **L1** and connect oil pressure gauge [2].
   ★ If oil pressure gauges are of the analog type, use the one with rated pressure 40 MPa{400 kg/cm^2}.



2) Start the engine.
3) Measure the cut-in pressure at high idle.
   1] Pump the brake pedal repeatedly to gradually lower the pressure inside the accumulator.
   2] Measure the pressure at the point where the indicator of oil pressure gauge [2] stops going down and starts to go up again.

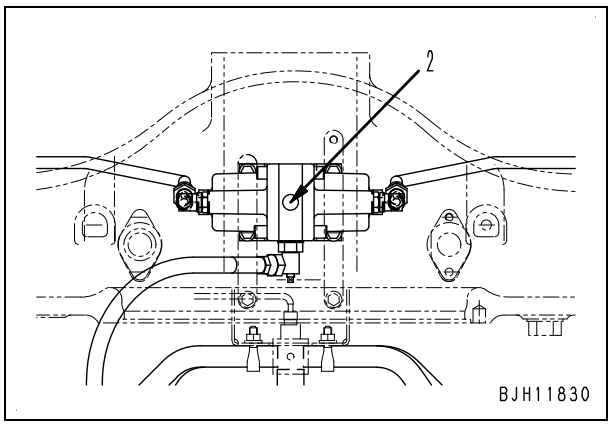
4) Measure the cut-out pressure at high idle. Measure the oil pressure when the pressure goes up after the cut-in and the indicator of pressure gauge [2] stops.

5) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

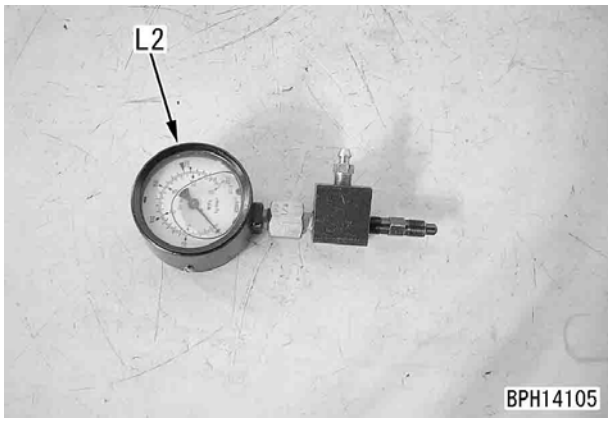
3. Testing wheel brake actuating pressure and drop in pressure

★ Implement the same procedure for the front brake circuit and center brake circuit.

1) Remove air bleeder (2) of the slack adjuster.



2) Install brake test kit **L2** and bleed the air from the brake circuit.
   ★ For details, see “Bleeding air from brake circuit“ section.

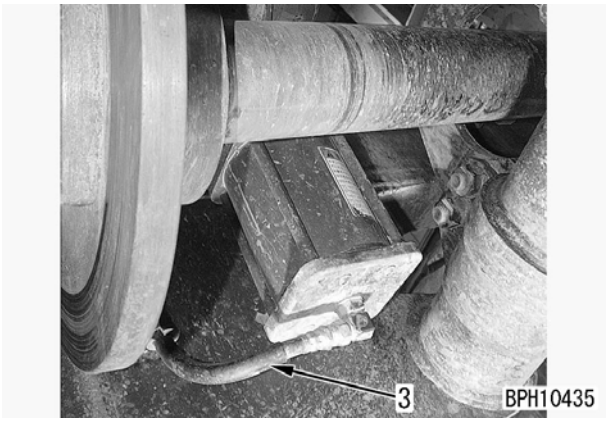


3) Measure the actuating pressure of the foot brake under the following conditions.
   1] Run the engine for several minutes at low idle to charge the accumulator, then stop the engine.
   2] Depress the brake pedal fully and measure the oil pressure.
4) Measure the actuating pressure of the retarder brake under the following conditions.
   1] Run the engine for several minutes at low idle to charge the accumulator, then stop the engine.
   2] Turn the starting switch ON.
   3] Pull the retarder lever fully and measure the oil pressure.
5) Measure the drop in pressure of the foot brake under the following conditions.
   ★ Check that the actuating pressure of both the foot brake and the retarder are normal before starting to measure.
   1] Run the engine for several minutes at low idle to charge the accumulator, then stop the engine.
   2] Depress the brake pedal fully and measure the oil pressure.
      ★ Keep the brake pedal depressed.
   3] Measure the oil pressure after 5 minutes and calculate the drop in pressure.

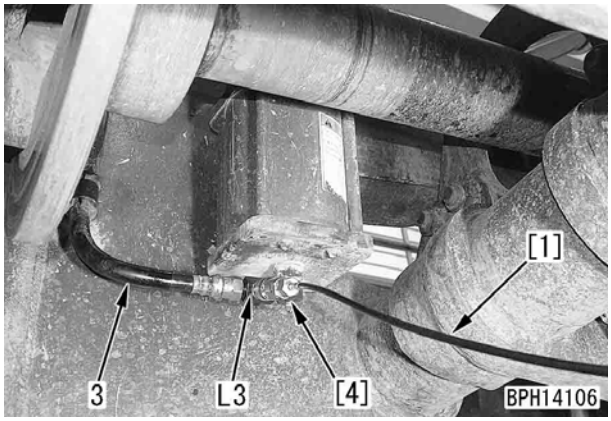
6) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.
   ★ Bleed the air from the brake circuit referring to “Bleeding air from brake circuit“ section.

4. Measuring actuating pressure of parking brake

1) Parking brake switch is ON.
2) Disconnect hose (3) of the parking brake cylinder.



3) Connect adapter assembly **L3** and install hose (3) again.
4) Install nipple [4] of hydraulic tester **L1** and hose [1] and connect oil pressure gauge [3].
   ★ Use the oil pressure gauge of 6 MPa {60 kg/cm^2}.



5) Start the engine and operate the parking brake switch several times at high idle to bleed air from the circuit.
6) Stop the engine and turn the starting switch ON.
7) Measure the oil pressure when parking brake switch is turned OFF.

8) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.
   ⚠ **Check that the parking brake switch is ON before carrying out the operation.**

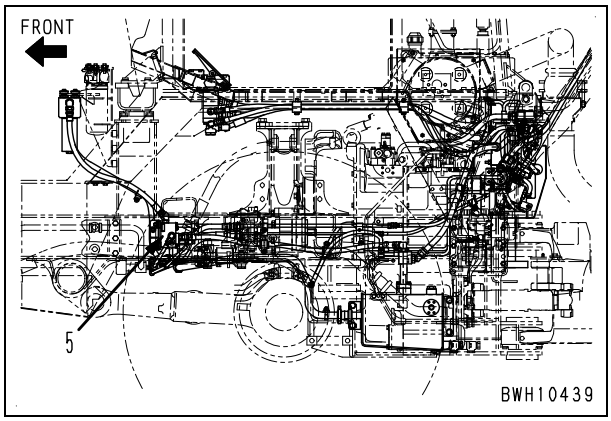
Adjustment

Adjusting charge valve cut-in pressure and cut-out pressure

★ If the charge valve cut-in pressure or cut-out pressure are not proper, adjust the R1 relief valve of charge valve (5) according to the following procedures.

★ Both cut-in pressure and cut-out pressure change by adjusting the R1 relief valve.

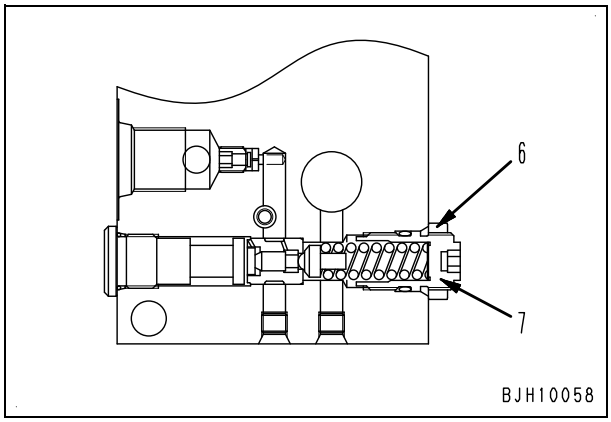
1. Remove the mudguard sheet in the left front tire housing.



2. Loosen locknut (6).

3. Turn adjustment screw (7) to adjust the oil pressure.
   ★ Adjustment screw:
   - When turned clockwise, the oil pressure is heightened.
   - When turned counterclockwise, the oil pressure is lowered.

4. While fixing adjustment screw (7), tighten locknut (8).
   Locknut: **10.2 Nm {1.0 kgm}**
   ★ After completing the adjustment, check the oil pressure again following to the procedure for measurement.



Testing of accumulator nitrogen gas pressure and procedure for charging accumulator with nitrogen gas

★ Testing instrument

Symbol	Part No.	Part name	Remarks
P1	792-610-1701	Gas charge tool	–
P2	792-610-1310	Nipple (For Russia)	GOST
	792-610-1320	Nipple (For USA)	CGA No. 351
	792-610-1330	Nipple (For USA)	ASA B-571-1965
	792-610-1350	Nipple (For Germany)	DIN 477-1963 NEN 3268-1966 SIS-SMS 2235/2238
	792-610-1360	Nipple (For UK)	BS 341 Part 1-1962

⚠ **Put on proper protection gear (goggles, leather gloves and protective clothes) so that the leaking nitrogen gas will not touch your skin or clothes and work on the windward side as long as possible.**

⚠ **When handling nitrogen gas in a room or another place which is not ventilated well, ventilate the work place forcibly and observe the Oxygen Deficiency Prevention Rules of the Labor Safety and Sanitation Law.**

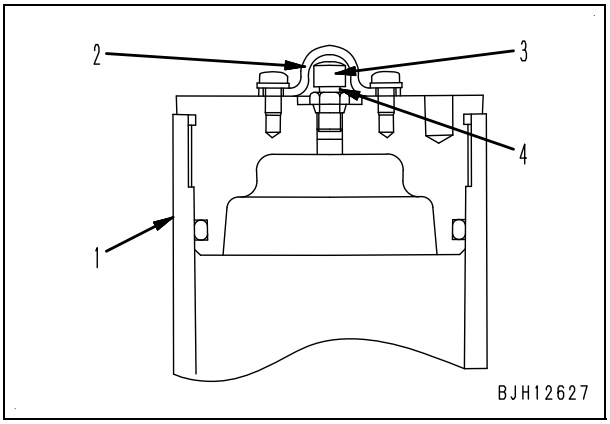
⚠ **Since the accumulator is charged with high-pressure nitrogen gas, wrong handling of it can cause an explosion and injury or death. When handling the accumulator, observe the following strictly.**

- Do not bring fire near the accumulator or put the accumulator in fire.
- Do not drill, weld or gas-cut the accumulator.
- Do not give impacts to the accumulator by hitting or rolling.
- When discarding accumulator, discharge it of the nitrogen gas.

Testing of accumulator nitrogen gas pressure

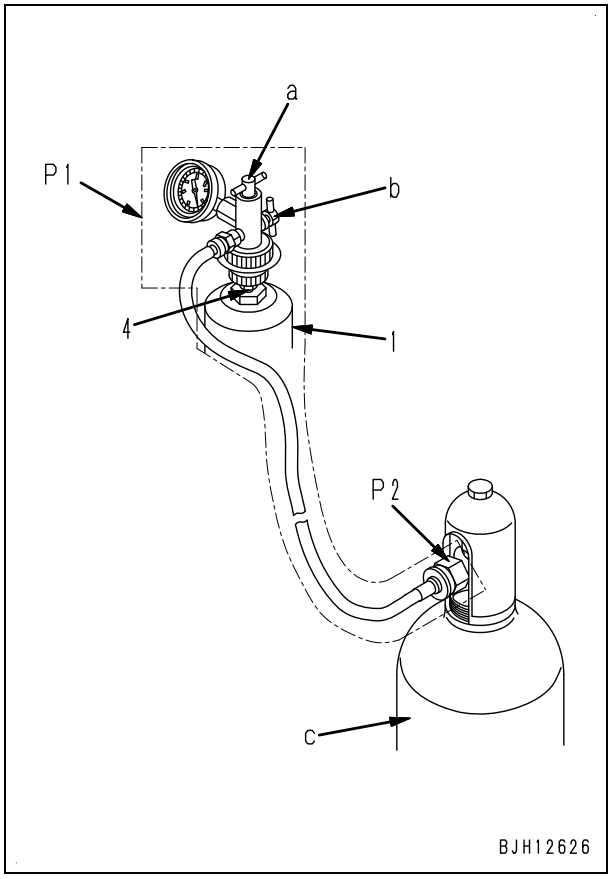
★ The nitrogen gas pressure in the accumulator disconnected from the machine can be measured according to the following procedure, too.

1. Stop the engine and press the brake pedal repeatedly to lower the oil pressure in the brake circuit to zero.
   ★ Generally, if the brake pedal is pressed 30 times, the reaction force to the brake pedal is lost and the oil pressure is lowered to zero.
2. Remove valve guard (2) and cap (3) from accumulator (1).



3. Connect gas charge tool **P1** to valve (4) of accumulator (1) according to the following procedure.
   ⚠ **When charging the accumulator with gas, install the attached O-ring to valve (4), tighten the gas charging tool, and check that gas is not leaking.**
   1) Turn handle (a) of gas charge tool **P1** to the left until it stops.
      - Nitrogen gas cylinder (c) must be connected even when you measure only the gas pressure.
      - Close the valve of nitrogen gas cylinder (c) and handle (b).
      - For connection of nitrogen gas cylinder (c) and gas charge tool **P1**, see "Procedure for charging accumulator with nitrogen gas".

2) Connect gas charge tool **P1** to valve (4) of accumulator (1).



4. Turn handle (a) of gas charge tool **P1** to the right slowly and read the gauge.
   ★ Since the indicated value varies with the ambient temperature, refer to the following table and check gas pressure.

   Accumulator charging gas pressure chart
   Standard gas pressure:

   4.41 MPa {45.0 kg/cm^2} at 20 °C

Ambient temperature (°C)	Gas pressure		Ambient temperature (°C)	Gas pressure	
	MPa	kg/cm^2		MPa	kg/cm^2
15	4.34	44.2	31	4.58	46.7
16	4.35	44.4	32	4.59	46.8
17	4.37	44.5	33	4.61	47.0
18	4.38	44.7	34	4.62	47.2
19	4.40	44.8	35	4.64	47.3
20	4.41	45.0	36	4.65	47.5
21	4.43	45.2	37	4.67	47.6
22	4.44	45.3	38	4.68	47.8
23	4.46	45.5	39	4.70	47.9
24	4.47	45.6	40	4.71	48.1
25	4.49	45.8	41	4.73	48.2
26	4.50	45.9	42	4.74	48.4
27	4.52	46.1	43	4.76	48.5
28	4.53	46.2	44	4.77	48.7
29	4.55	46.4	45	4.79	48.8
30	4.56	46.5			

Indicated gas pressure =
Standard gas pressure × ((273 + t)/(273 + 20))
(The unit of each value in the formula is °C.)
t = Gas temperature at time of charge (°C)
Reference: t may be assumed to be ambient temperature.

5. If the gas pressure is too high or too low, adjust it referring to "Procedure for charging accumulator with nitrogen gas".
   ★ Each time the pressure is measured, some nitrogen gas is discharged and the pressure lowers. Add nitrogen gas by the loss.

6. Remove gas charge tool **P1** from accumulator (1) and return the removed parts. See "Procedure for charging accumulator with nitrogen gas".

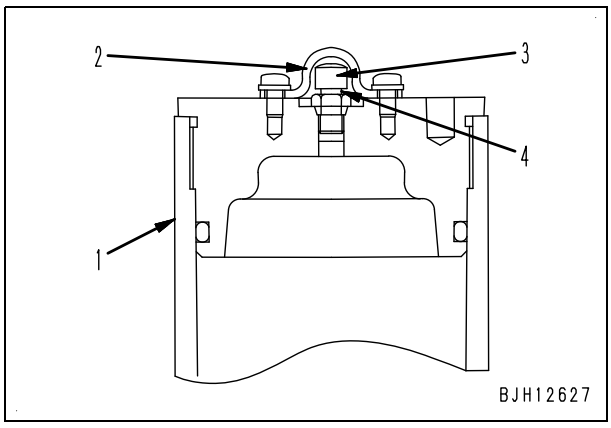
Procedure for charging accumulator with nitrogen gas

⚠ **When charging the accumulator with gas, install the attached O-ring to valve (4), tighten the gas charging tool, and check that gas is not leaking.**

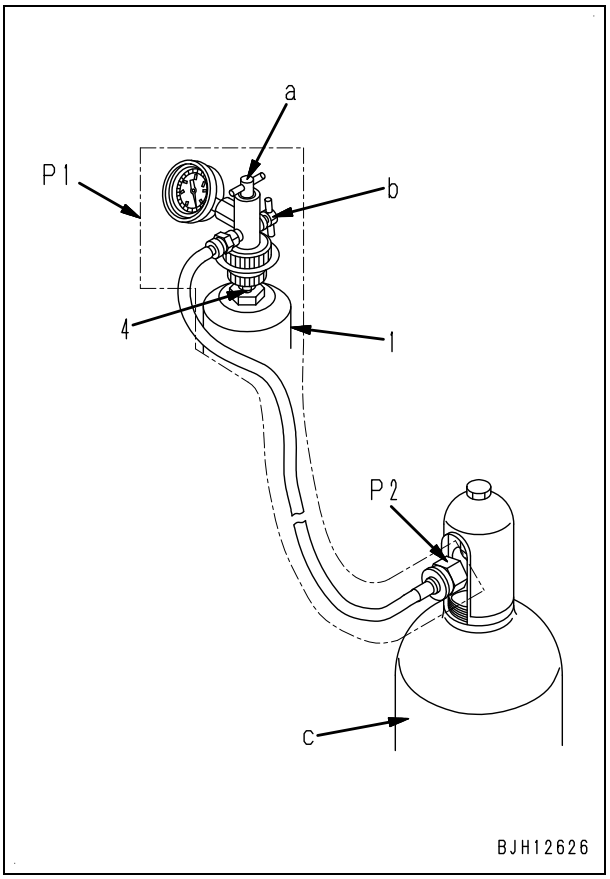
★ The disconnected from the machine can be charged with nitrogen gas according to the following procedure, too.

1. Stop the engine and press the brake pedal repeatedly to lower the oil pressure in the brake circuit to zero.
   ★ Generally, if the brake pedal is pressed 30 times, the reaction force to the brake pedal is lost and the oil pressure is lowered to zero.

2. Remove valve guard (2) and cap (3) from accumulator (1).



3. Connect gas charge tool **P1** and nitrogen gas cylinder (c) to valve (4) of accumulator (1) according to the following procedure.
   1) Turn handle (a) of gas charge tool **P1** to the left until it stops.
   2) Turn handle (b) to the left to open.
   3) Connect gas charge tool **P1** to valve (4) of accumulator (1).
   4) Connect gas charge tool **P1** and nitrogen gas cylinder (c).
      - There are 2 types of threads of nitrogen gas cylinders, W22-14 thread (mail screw, type A) and W23-14 thread (female screw, type B). When using a gas cylinder of W23-14 thread (female screw, type B), connect the hose by using the adapter. (The adapter is attached to gas charge tool **P1**.) [For Japan]
      - Use nipple **P2** to connect the hose, depending on the specification of the nitrogen gas cylinder. [For overseas]



4. Open nitrogen gas cylinder (c) slightly to discharge nitrogen gas at pressure of 0.19 – 0.29 MPa {2 – 3 kg/cm^2}.

5. After nitrogen gas starts flowing out of handle (b), close handle (b).

6. Turn handle (a) slowly to the right to open valve (4) of accumulator (1) gradually.
   ★ If handle (a) is turned too much, the valve core of the accumulator will be damaged and gas will leak. Accordingly, operate handle (a) carefully.

7. Open the valve of nitrogen gas cylinder (c) further to charge the accumulator with nitrogen gas.

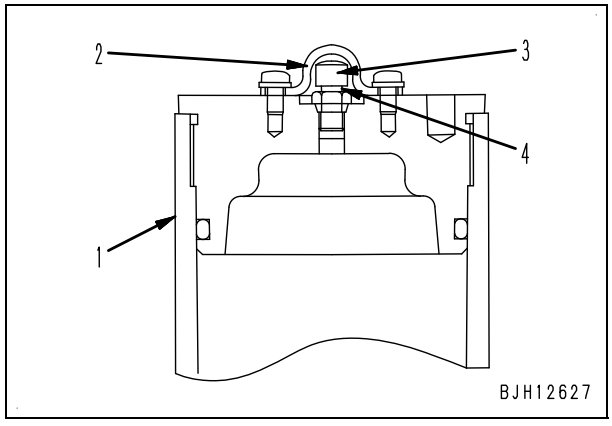
8. During the work, close the valve of nitrogen gas cylinder (c) and check the nitrogen gas pressure in the accumulator.
   ★ For the nitrogen gas pressure checking procedure, refer to Section 4 of "Testing of accumulator nitrogen gas pressure".

9. After the accumulator is charged to the standard pressure, close the valve of nitrogen gas cylinder (c).
   - If the accumulator is charged too much, turn handle (b) to the left slowly with the valve of nitrogen gas cylinder (c) closed to release the nitrogen gas gradually to adjust.

10. Remove gas charge tool **P1** from valve (4) of accumulator (1) according to the following procedure.
    1) Turn handle (a) to the left to close the valve of the accumulator.
    2) Turn handle (b) to the left to open and discharge nitrogen gas remaining in gas charge tool **P1** and hoses.
    3) Remove gas charge tool **P1** from valve (4) of the accumulator.

11. Apply soap water to valve (4) of the accumulator to check that nitrogen gas is not leaking.

12. Install cap (3) and valve guard (2) to accumulator (1).
    Cap: **9.8 – 12.7 Nm {1.0 – 1.3 kgm}**

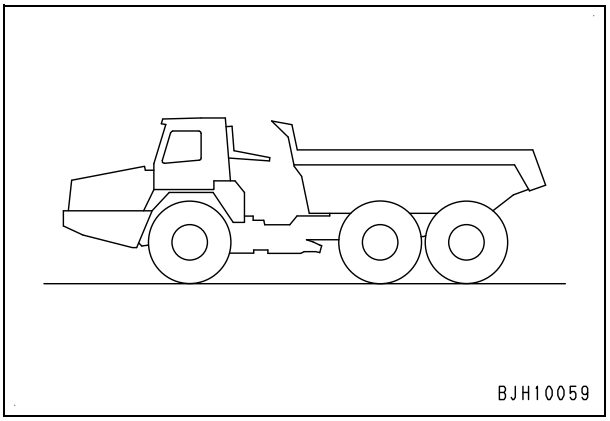


13. In a week after charging the accumulator with nitrogen gas, check that the nitrogen gas pressure has not lowered.
    ★ Check the functions in 5 minutes after stopping the engine. (If the engine is stopped for more than 5 minutes, the brake circuit pressure lowers and the functions cannot be checked accurately.)
    1) Stop the machine on a level place and set the parking brake switch in the "PARK" position.
    2) Start the engine and run it at medium speed for 1 minute and then stop it.
    3) Turn the starting switch to the ON position and press the brake pedal repeatedly. Count the number of presses until the brake oil pressure caution lamp lights up.
       - If number of presses is less than 5: Accumulator gas pressure may have lowered.
       - If number of presses is 5 or more: Accumulator gas pressure is normal.

Testing brake performance

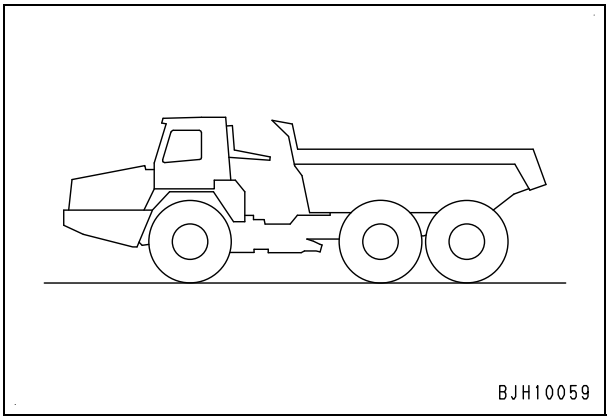
⚠ Stop the machine on level ground and turn the parking brake switch ON.

1. **Testing braking performance of foot brake**
   1) Start the engine and turn the parking brake switch OFF.
   2) Depress the brake pedal fully, then set the gear shift lever to the D position.
      ★ Do not set the gear shift lever to the position other than D, when testing the foot brake performance.
   3) Depress the accelerator pedal gradually and check that the machine does not move when the torque converter is stalled at the specified speed.



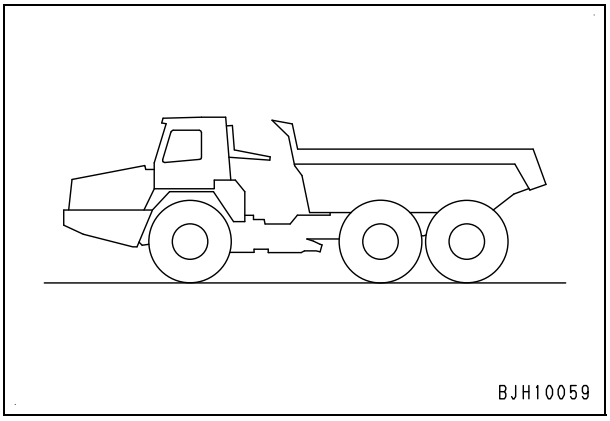
   4) After completing the test, run the engine at low idle and set the gear shift lever to the N position.

2. **Testing braking performance of retarder brake**
   1) Start the engine and turn the parking brake switch OFF.
   2) Pull the retarder lever fully, then set the gear shift lever to the D position.
      ★ Do not set the gear shift lever to the position other than D, when testing the retarder brake performance.
   3) Depress the accelerator pedal gradually and check that the machine does not move when the torque converter is stalled at the specified speed.



   4) After completing the test, run the engine at low idle and set the gear shift lever to the N position.

3. **Testing braking performance of parking brake**
   ⚠ If the machine starts to move, it can cause a serious personal injury. Should the machine start moving during the performance test, reduce the engine speed immediately, move the gear shift lever to the N position and depress the brake pedal.
   1) Turn the parking brake switch ON and start the engine.
   2) Set the gear shift lever to the D position.
      ★ Do not set the gear shift lever to the position other than D, when testing the foot brake performance.
   3) Depress the accelerator pedal gradually and check that the machine does not move when the torque converter is stalled at the specified speed.
   4) If the machine moves at a revolution lower than specified, adjust the clearance of the brake pad referring to "2. Adjusting pad clearance" in "Measuring wear of parking brake pad".

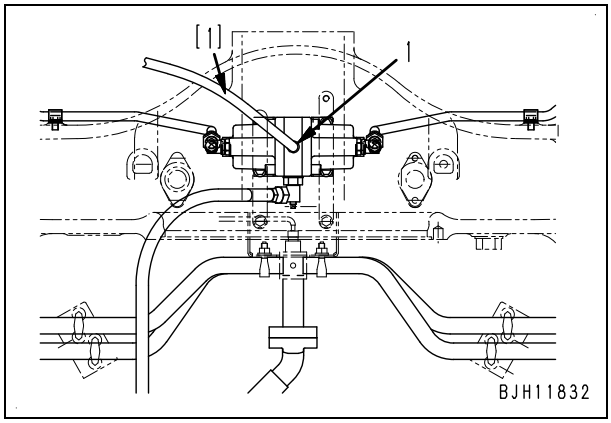


   5) After completing the test, run the engine at low idle and set the gear shift lever to the N position.

Bleeding air from brake circuit

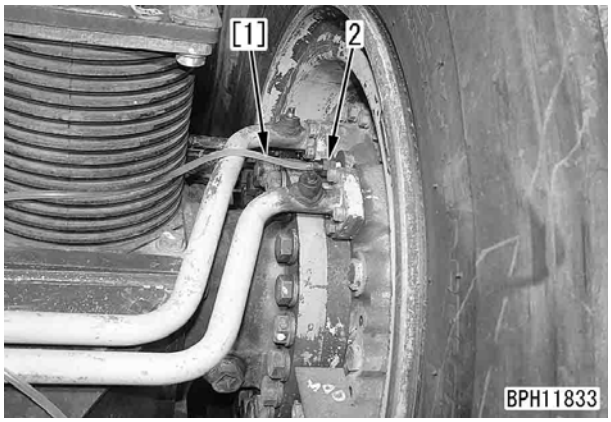
★ If a brake circuit part is removed and installed, bleed air from the brake circuit according to the following procedure.
★ When bleeding the air from the wheel brake circuit, always bleed the air from the slack adjuster section first, then bleed the air from the wheel brake section.

1. **Bleeding air from slack adjuster section of wheel brake circuit**
   ★ Implement the same procedure for the front brake circuit and center brake circuit. In case of bleeding the air from the front brake circuit, however, the brake oil pressure caution lamp may light up while bleeding the air. If that happens, tighten the air bleeder, accumulate hydraulic oil pressure in the accumulator by pumping the service brake pedal 8 to 10 times, and then bleed the air. Oil pressure accumulating signals are received from the rear (center) brake circuit. Hence the circuit is so designed that the oil pressure is not accumulated in the front brake (low pressure), even if the brake oil pressure caution lamp lights up. For this reason, air bleeding takes place without accumulating the oil pressure, resulting in not effective air bleeding.
   1) Connect air bleed hose [1] to air bleeder (1).



   2) Start the engine and run it at low idle.
   3) Bleed the air from the brake pedal circuit as follows.
      1] Depress the brake pedal fully and hold it in position.
      2] Loosen air bleeder (1) approx. 3/4 turn, then drain the oil mixed with the air.
      3] When no more air comes out with the oil, tighten air bleeder (1).
      Air bleeder:
      10 – 20 Nm {1 – 2 kgm}
   4) Bleed the air from the retarder brake circuit as follows.
      1] Pull the retarder lever fully and hold it in position.
      2] Loosen air bleeder (1) approx. 1/2 turn, then drain the oil mixed with the air.
      3] When no more air comes out with the oil, tighten air bleeder (1).
      Air bleeder:
      10 – 20 Nm {1 – 2 kgm}
   5) After completing the adjustment, set to the original condition.

2. **Bleeding air from wheel brake section of foot brake circuit.**
   ★ Implement the same procedure for the front brake circuit and center brake circuit.
   1) Connect air bleed hose [1] to air bleeder (2).



   2) Start the engine and run it at low idle.
   3) Depress the brake pedal fully and hold it in position.
   4) Loosen air bleeder (1) approx. 1/2 turn, then drain the oil mixed with the air.
   5) When no more air comes out with the oil, tighten air bleeder (1).

3. **Bleeding air from parking brake circuit**
   1) Start the engine and run it at low idle.
   2) Turn the parking brake switch ON and OFF several times.
      ★ The air is automatically bled with this operation.

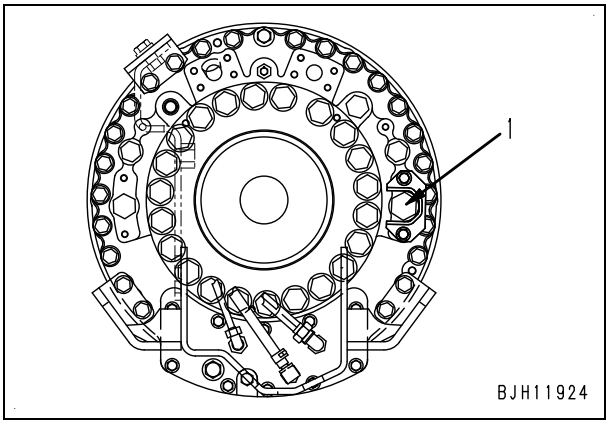
Testing wear of wheel brake disc

⚠ **Stop the machine on level ground, turn the parking brake switch ON, and set chocks to the tires.**
⚠ **Carry out the measure when the brake oil temperature is less than 60 °C.**
⚠ **When the disc comes close to the wear limit, carry out the measure more frequently. Be sure to test a braking performance of retarder brake at the same time.**

1. Check that the brakes other than parking brake are not being applied.

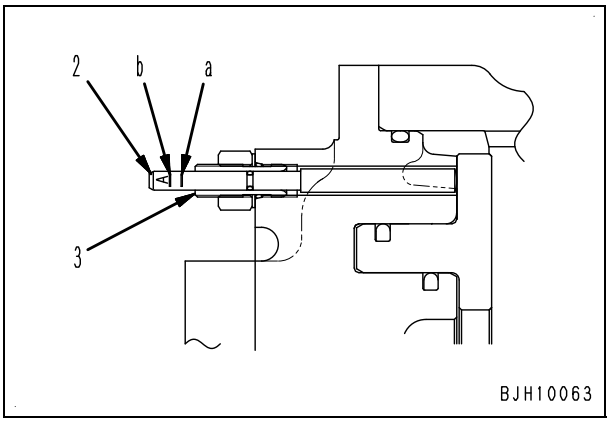
2. Turn the starting switch ON and check that the retarder oil pressure caution lamp has not lighted up.
   ★ If the lamp lights up, the oil pressure in the brake circuit has dropped, so start the engine and run it at approx. 2,000 rpm. When the lamp goes out, stop the engine.

3. Remove cap nut (1) of the gauge.



4. Depress the brake pedal fully and hold it in position.
   ★ If the engine is running, the brake cooling oil is actuated and the measuring cannot be carried out accurately, so always stop the engine before carrying out the measuring.

5. Push in rod (2) of the gauge until it contacts the piston and judge the amount of wear.
   ★ There are three lines (A, B and C) on the rod. For HM300-2 model, use mark A and mark B for the front brake and the center brake respectively.
   ★ With a new machine, the initial mark (a) on rod (2) is aligned with the end face of guide (3).
   The adjustment position may move out of alignment, so do not loosen the locknut of guide (3) except when replacing the disc.
   ★ Limit mark (b) indicates the wear limit for the disc.
   If limit mark (b) reaches the end face of guide (3), the disc has reached the wear limit.



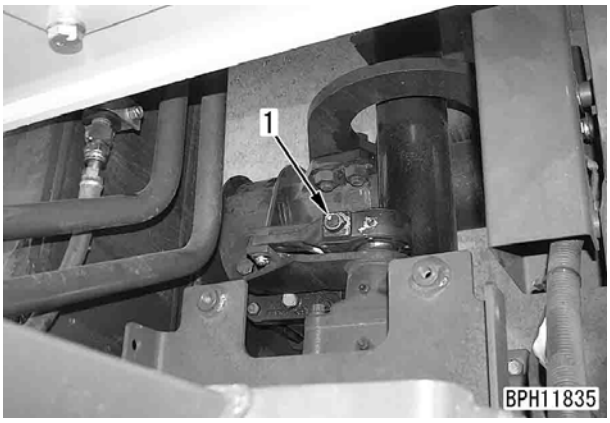
6. Install cap nut (1) of the gauge.
   Cap nut: **29.4 – 39.2 Nm {3 – 4 kgm}**

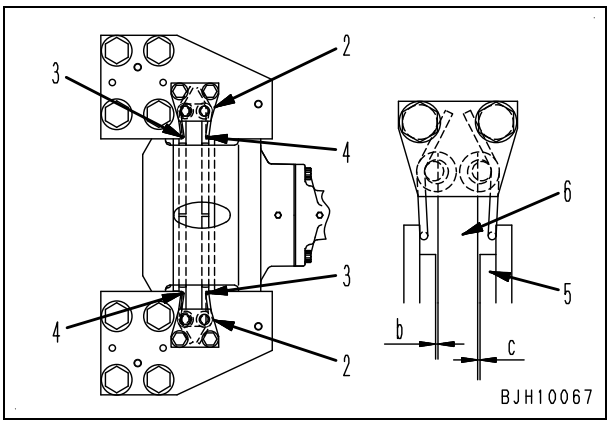
Testing wear of parking brake pad

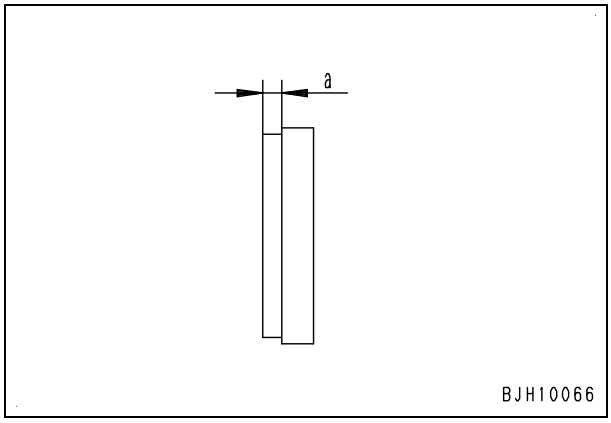
⚠ **Stop the machine on level ground, turn the parking brake switch ON, and set chocks to the tires.**

★ Before carrying out the measuring, start the engine and raise up the dump body to the stroke end. Then insert the lock pin and stop the engine.

1. **Measuring wear of pad**
   1) Turn the starting switch ON and the parking brake switch OFF to release the parking brake.
   2) Remove the top cover of the parking brake.
   3) Release the parking brake by turning adjustment nut (1) clockwise.
   4) Remove left and right brackets (2), then remove two each of springs (3) and (4).
   5) Remove two pads (5).
   6) Measure thickness (a) of pad (5).
      ★ Thickness limit of pad: 1.5 mm
      ★ If either the front or rear pad has reached the thickness limit, replace both pads at the same time.

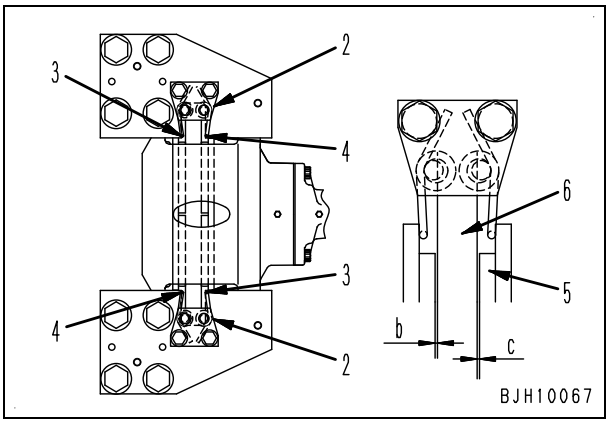


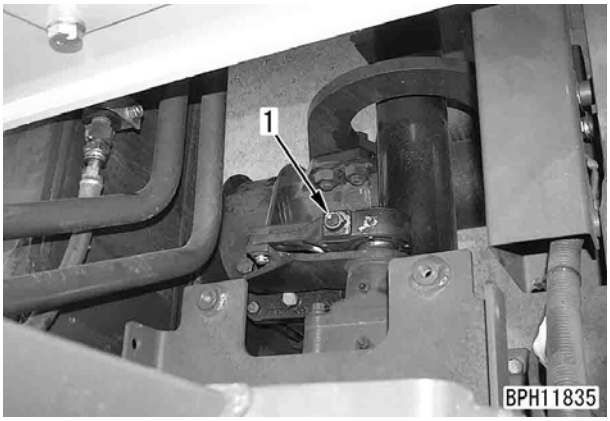




2. **Adjusting pad clearance**
   - ★ When the parking brake does not work properly, or when the brake pads were replaced with new ones, adjust the clearance of the brake pad in the following manner.
   - ⚠ **Keep hydraulic oil pressure at a high level while in adjustment so that the parking brake may not be automatically applied and also hang a warning tag on the parking brake switch so that nobody may operate the machine by mistake.**
   - ⚠ **Do not smear the surfaces of brake pads or brake discs with oil or grease.**

   1) Turn the starting switch ON and the parking brake switch OFF to release the parking brake.
   2) Install 2 pads (5).
   3) Install 2 each of springs (3) and (4) to left and right brackets (2), then install left and right brackets (2).
      - ★ There are two types of springs, so check the color, and be careful not to mistake the mounting position.
        Spring (3): Black
        Spring (4): Yellow
      - ★ Tighten the bracket mounting bolts temporarily by 2 – 3 turns.
   4) While pushing down lock (7), turn adjustment nut (1) counterclockwise until brake pad (5) comes into close contact with brake disc (6).
   5) While measuring clearance (b) and (c) between brake pad (5) and brake disc (6), push down lock (7) and turn adjustment nut (1) clockwise until the specified clearance in between is obtained.
      - ★ Standard clearance (total of (b) and (c)): 1.88 ± 0.08 mm





   6) Start the engine.
   7) Release the parking brake and check the clearance of the pad again.
      - ★ Clearance (total of (b) and (c)): 1.88 ± 0.08 mm
      - ★ If the clearance is not correct, carry out the adjustment again from Step 3).
   8) Tighten the mounting bolts of left and right brackets (2).
      - ★ Be careful not to let the mounting position move out of alignment.
   9) Check the clearance between pad (5) and disc (6) again.
      - ★ Standard clearance (total of (b) and (c)): 1.88 ± 0.08 mm
      - ★ If the clearance on one side is narrow, move the mounting position of the left and right brackets to adjust.

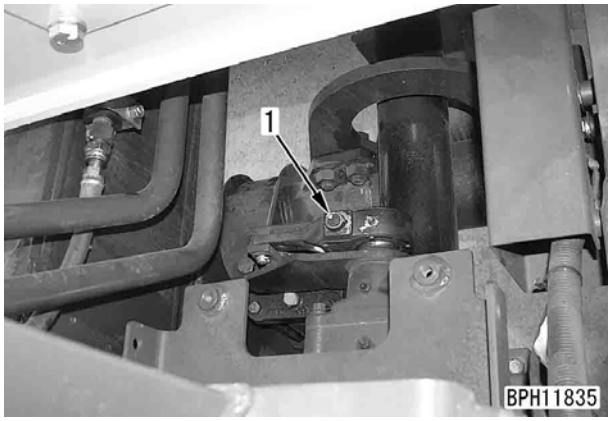
Method for emergency release of parking brake

★ If any problem occurs in the electrical system or hydraulic system of the parking brake and the parking brake is not released, it is possible to release the brake temporarily as follows.

⚠ **If any problem occurs in the hydraulic system, there is a strong possibility that the wheel brake will not work properly, so after releasing the parking brake, always tow the machine at low speed to a safe place.**

⚠ **When carrying out the operation to release the parking brake, stop the machine on level ground and check that the surrounding area is safe before starting the operation. If the parking brake must be released on a slope in an emergency or other unavoidable situation, set chocks to the tires securely.**

1. In order to create a gap between the pad and disc, turn the parking brake adjustment nut (1) clockwise while pushing down the lock of the nut.



2. Tow the machine to a safe place.
   ⚠ **After moving the machine, set chocks securely to the tires.**

Testing and adjusting steering circuit oil pressure

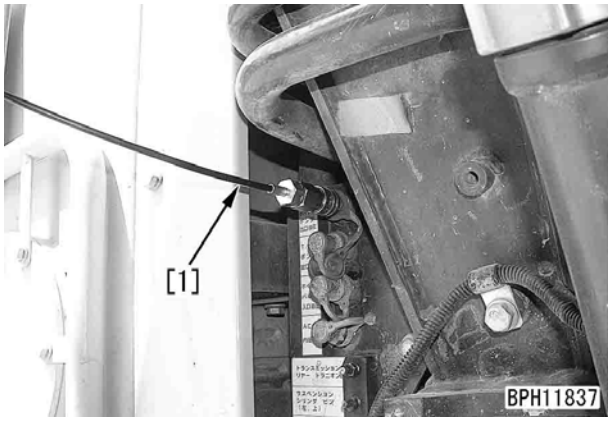
★ Equipments for testing and adjusting steering circuit oil pressure

Symbol	Part No.	Part name
M	799-101-5002	Hydraulic tester
	790-261-1204	Digital hydraulic tester

⚠ **Stop the machine on level ground, turn the parking brake switch ON, and set chocks to the tires.**

1. **Testing steering relief oil pressure**
   ★ Measure the steering relief pressure at remote pressure pickup port (1).

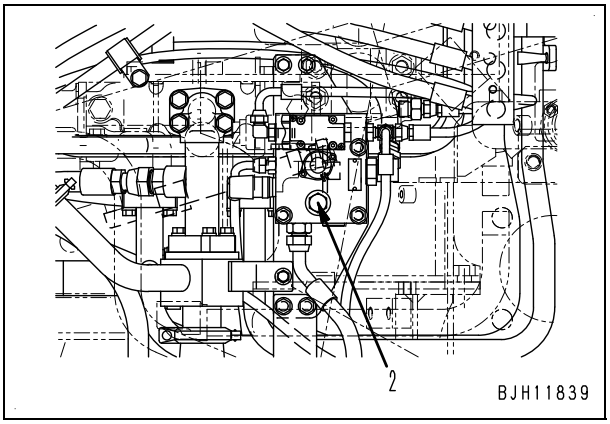
   1) Install hose [1] and connect oil pressure gauge M.
      ★ Use a 39.2 MPa {400 kg/cm^2} oil pressure gauge.



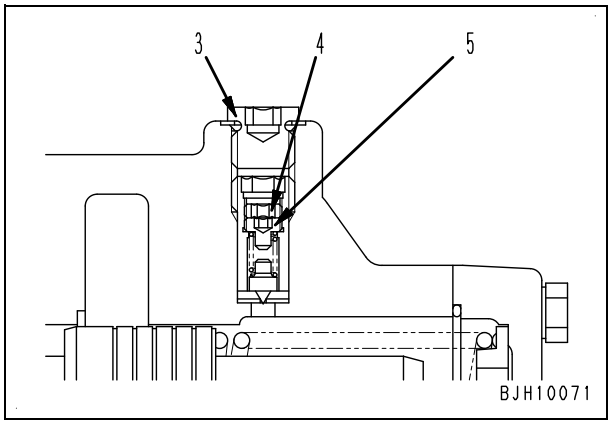
   2) Start engine and operate the steering up to either left or right stroke end.
   3) Measure the oil pressure when the steering circuit pressure is relieved with the engine at high idle.

   4) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

2. **Adjusting steering relief oil pressure**
   ★ Tilt up the cab. (See Testing and adjusting, "How to tilt up cab")
   ★ If the steering relief oil pressure is not correct, adjust relief valve (2) of the flow amp valve as follows.



1) Remove plug (3) and then locknut (4).
2) Turn adjustment screw (5) and adjust oil pressure.
   ★ Adjustment screw:
   - When turned clockwise, the oil pressure is heightened.
   - When turned counterclockwise, the oil pressure is lowered.
3) Tighten locknut (4) and install plug (3).
   ★ After completing the adjustment, check the oil pressure again following to the procedure for measurement.

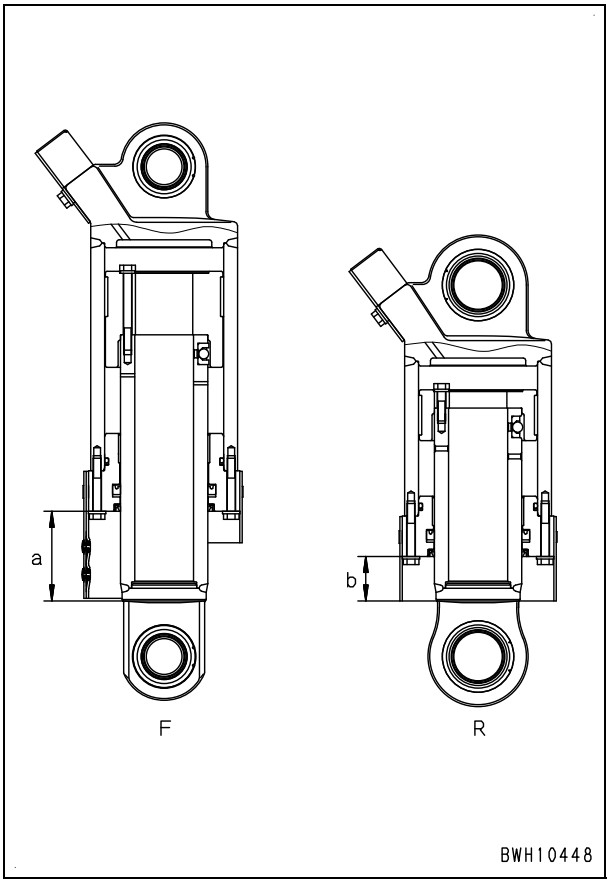


Testing and adjusting suspension cylinder

★ Equipment for testing and adjusting suspension cylinder

Symbol		Part No.	Part name
	—	792-610-1000	Suspension tool assembly
	—	792-610-1100	●Pump assembly
	1	792-610-1130	●●Pump
	2	792-610-1110	●●Hose
	3	792-610-2200	●●Joint
	—	792-610-1200	●Charging tool assembly
	4	07020-21732	●●Fitting
N	**5**	792-610-1140	●●Joint
	6	792-610-1250	●●Valve assembly
	7	792-610-1260	●●Nipple
	8	792-610-1270	●●Hose
	9	792-610-1280	●●Valve
	10	792-610-1400	●●Regulator
	11	792-610-1430	●●●Gauge
	12	792-610-1440	●●●Gauge

"**—**" : Kit tool Nos.



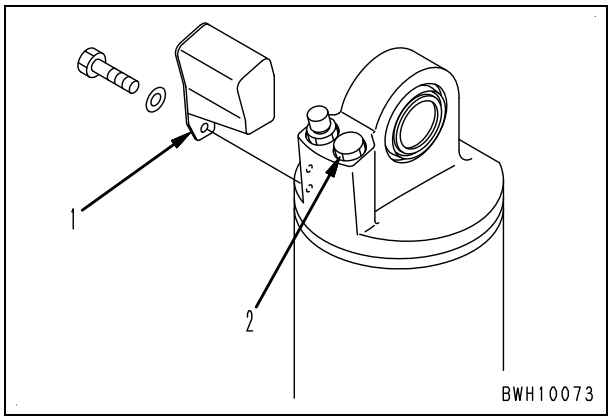
⚠ **Stop the machine on level ground, turn the parking brake switch ON, and set chocks to the tires.**

1. **Testing cylinder length**
   Test the installation length of the suspension cylinder under the following conditions.
   - On a level road surface
   - Stop engine.
   - Dump body unloaded

   ★ Installation dimension **a** of front cylinder:
   163 ± 10 mm
   Installation dimension **b** of rear cylinder:
   101 ± 5 mm

   ★ If the length of the cylinder is not correct, adjust it according to the steps 2 to 5.

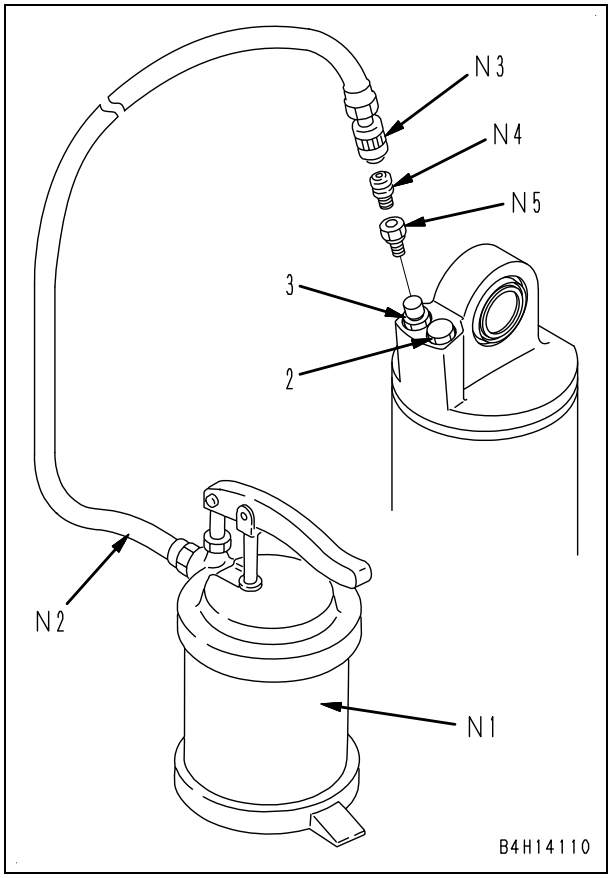
2. **Releasing nitrogen gas**
   1) Set a hydraulic jack under the frame of the machine and raise it until tires come slightly off the ground.
      ★ Use a 490 kN {50 ton} jack.
      ⚠ **Set the jack securely under the frame.**
      ★ When carrying out work at the front, jack up the front frame until front tires come slightly off the ground.
      ★ When carrying out work at the rear, jack up the frame until either center or rear tires come slightly off the ground.
   2) Remove cover (1).
   3) Loosen oil level valve (2) slowly, and when the nitrogen gas starts to come out, hold the valve in that position.
      ★ If oil spurts out from the valve together with the nitrogen gas, tighten the valve slightly until no more oil comes out and take time to release the nitrogen gas slowly.



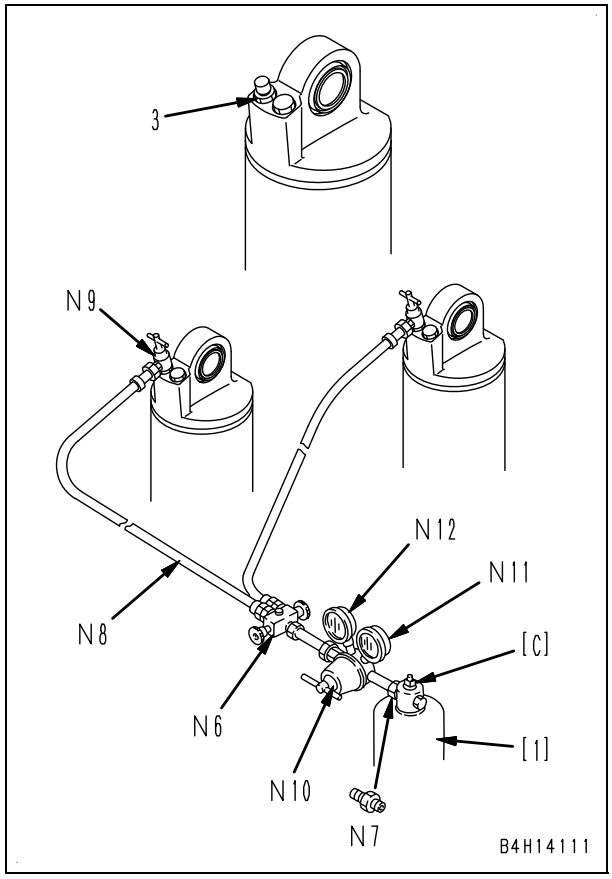
   4) Operate the hydraulic jack to lower the frame slowly until the suspension cylinder is retracted to the specified oil volume length.
      ⚠ **Operate the hydraulic jack carefully to prevent the suspension cylinder from being retracted too far and suffering damage.**
      ★ Specified front oil volume length **a**: 113 ± 3 mm
      ★ Specified rear oil volume length **b**: 57 ± 3 mm

3. **Adjusting oil level**
   ★ Adjust the oil level after completing the release of nitrogen gas.
   1) Check that the suspension cylinder is the specified oil volume length.
      ★ Specified front oil volume length **a**: 113 ± 3 mm
      ★ Specified rear oil volume length **b**: 57 ± 3 mm

      ⚠ **Operate the hydraulic jack carefully.**
   2) Remove oil level valve (2).
   3) Remove the valve body from air supply valve (3), then install joint **N5**.
   4) Install fitting **N4** to joint **N3**, then connect hose **N2** and pump **N1**.
   5) Operate pump **N1** to release the gas from the mounting port of oil level valve (2).
      ★ Keep sending oil to let the inside oil flow out from the mounting port until the oil without air bubbles flow out.
      ★ Front cylinder oil charge amount (reference): 3.0 ℓ
      ★ Rear cylinder oil charge amount (reference): 1.2 ℓ
   6) Install oil level valve (2).
      Oil level valve: **39.2 - 49.0 Nm {4 - 5 kgm}**
   7) Remove suspension tools **N1** - **N4**, then install air supply valve (3).
      Air supply valve: **39.2 - 49.0 Nm {4 - 5 kgm}**



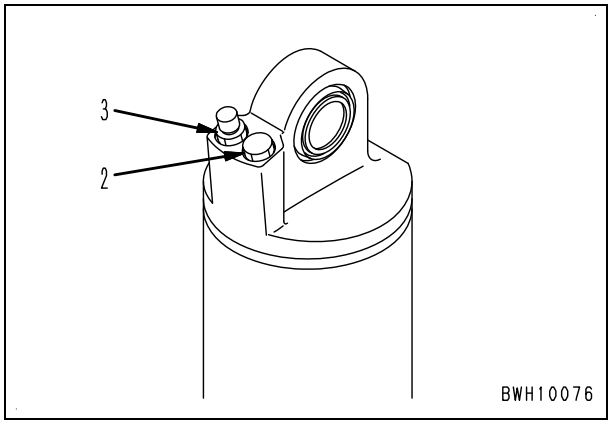
4. **Charging with nitrogen gas**
   - ★ Charge with nitrogen gas after completing the adjustment of oil level.
   1) Remove the cap at the top of air supply valve (3).
   2) Connect suspension tools **N6** - **N12** as shown in the diagram.
      - ★ Connect joint **N9** to the air supply valve.
      - ★ Before installing the regulator, blow the filter at the mouthpiece thoroughly with nitrogen gas (min. 0.98 MPa {10 kg/cm^2}) to prevent the entry of dirt or dust.
   3) Open the valve of nitrogen gas cylinder [1] and check the pressure (internal pressure of the cylinder) indicated by gauge **N11**.
      - ★ The indicated pressure must be higher than the internal pressure of the cylinder by at least 0.98 MPa {10 kg/cm^2}.
      - ★ Cylinder internal pressure
        (front): 5.88 MPa {60 kg/cm^2}
        (rear): 1.96 MPa {20 kg/cm^2}
   4) Turn the handle of regulator **N10** gradually to the left and set the pressure indicated in gauge **N12**.
      - ⚠ **Never charge the cylinder with nitrogen gas at a pressure of more than 3.9 MPa {40 kg/cm^2} and extend the cylinder fully to the stroke end.**
   5) Operating valve **N6** and the handle of joint **N9**, charge the suspension cylinders with nitrogen gas.
      - ★ Charge nitrogen gas into the left and right cylinders at the same time.
   6) When the length of the left and right cylinders reaches the specified installation length, turn the handle of regulator **N10** to the left to cease charging with nitrogen gas.
      - ★ Installation length **a** of front cylinder : 163 ± 10 mm
        Installation length **b** of rear cylinder : 101 ± 5 mm
   7) Return the handle of joint **N9** fully and discharge the gas inside the hose by loosening the air bleeding plug of valve **N6**.
   8) Disconnect suspension tools **N6** - **N12**.
      - ★ Be careful not to lose the O-ring of air supply valve.
   9) Install the cap at the top of air supply valve (3).
   10) Install the covers of suspension cylinders.



5. **Adjusting cylinder length**
   - ★ Adjust the cylinder length after completion of the nitrogen gas charging.
   - ★ Carry out the adjusting of cylinder lengths on a level road surface with the dump body unloaded.
   1) Move the machine about 15 m forward, and stop suddenly. Next, move in reverse and stop the machine suddenly at the original point. Repeat this procedure 3 to 4 times. Finally, apply the retarder brake a little at a time and stop gently.
      - ★ Stop the machine as gently as possible using a retarder brake in order to ease the sliding resistance (friction of packings and bushings) of cylinders.
   2) Measure the installed length of the cylinder.
      - ★ Installation length **a** of front cylinder : 163 ± 10 mm
        Installation length **b** of rear cylinder : 101 ± 5 mm
   3) If the installation length is too long, adjust by discharging nitrogen gas through oil level valve (2).
      - ★ Slightly loosen the oil level valve and discharge an amount of gas which will not make the cylinder move.

★ If gas is discharged to the point of making the cylinder move, the installed length may become shorter than the specified installation length.

4) After completing the adjustment, repeat steps 1) and 2) above and check the cylinder length again.
5) Check for any leakage of gas from oil level valve (2), air supply valve (3), and the cylinder's gland area.
   ★ Use soapy water to check for leakage of gas.



Note 1: Testing after changing oil and gas

If the machine is operated after changing the oil and gas, the gas merges with the oil inside the cylinder up to saturation point resulting in reducing the volume of gas, and sometimes lessening the length of the cylinder below the permissible value.

For this reason, test the installation length of the cylinder in 48 hours time after changing the oil and the gas, and adjust the gas if it is below the specified dimension.

Note 2: Testing cylinder length according to change in ambient temperature

Since the gas in the suspension expands or contracts according to the change in the ambient temperature when the machine is operating, the length of the cylinder changes.

For this reason, in regions where there are great temperature differences during the year, carry out daily inspections and adjust so that the installation length of the cylinder is within the specified range.

Method of tilting cab up

★ Equipment for tilt cylinder
(Uselessness for external crane)

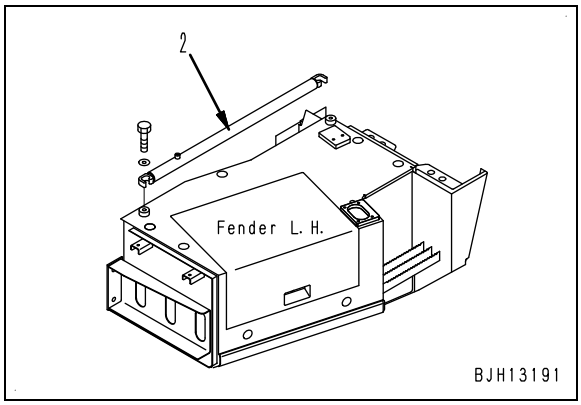
Symbol	Part number	Part name
I	792-454-1100	Pump assembly

⚠ **When tilting the cab, observe the following precautions to prevent a serious injury or fatal accident caused by fall of the cab.**
⚠ **To prevent interference between the cab and the dump body, set the steering in a straight ahead position and stop the machine on the level ground.**
⚠ **Lock the dump lever with the dump lever lock knob.**
⚠ **Turn the parking brake switch ON and chock the wheels.**
⚠ **Set the lock bar to the frame and lock front and rear frame.**
- Precautions in tilting cab

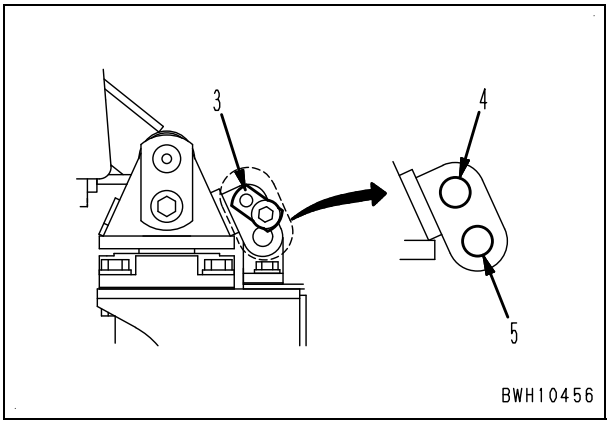
⚠ **When tilting the cab, check that the lock lever is fixed securely.**
⚠ **Do not start the engine while the cab is tilted.**
⚠ **When it is obliged to start the engine for testing etc., check that there is nobody under the cab.**
⚠ **Do not operate the gear shift lever or dump lever.**
⚠ **Do not give a large shock to the machine.**
⚠ **Do not tilt the cab while it is loaded.**

★ When carrying out inspection and maintenance work around the hydraulic pump or at the top of the torque converter or transmission, tilt the cab up to the rear of the machine as the following.
★ As there are the following two methods of tilting the cab up, select either method which matches the operating site conditions.
- Method using tilt cylinder
  - ★ The external hydraulic pump assembly **I** is necessary.
- Method using external crane

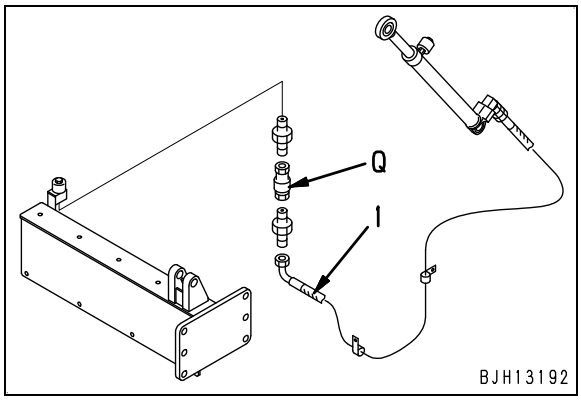
1. **Preparatory work**
   1) Open the engine hood.
   2) Take out a lock bar (2) from the storage place at engine left side.



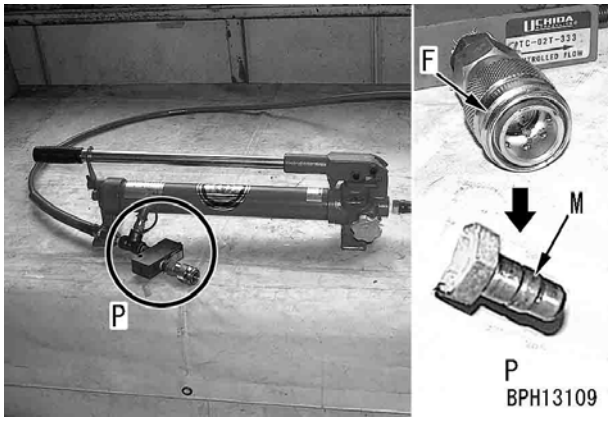
   3) Remove 4 mounting bolts from each of the left and right mounts at the front of cab.
   4))Move pin (3) at the cab rear mount from hole (4) to hole (5).



2. **Tilting cab up**
   Method using tilt cylinder
   ★ External hydraulic pump assembly **I** is necessary.
   1) Disconnect cylinder hose (1) at quick coupler (Q)



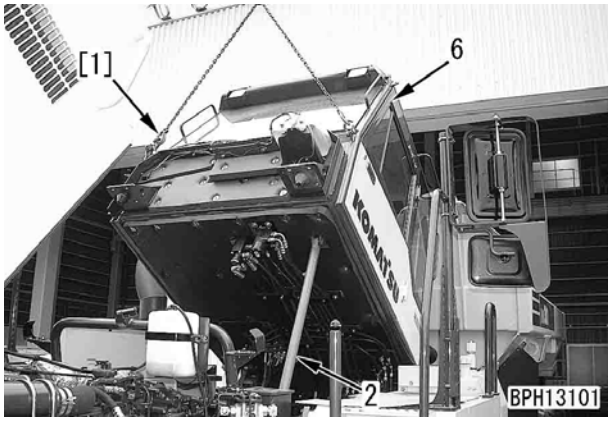
2) Exchange female quick coupler (F) to male quick coupler (M) of external hydraulic pump assembly.
   ★ It is possible to get male quick coupler (M) by removing it from (Q) on the machine.
   ★ Connecting adapter (Unit of male and female quick coupler (Q). Both machine side and tool side are same.): 56B-54-16391 (Size of hose connection end: RC 1/4)

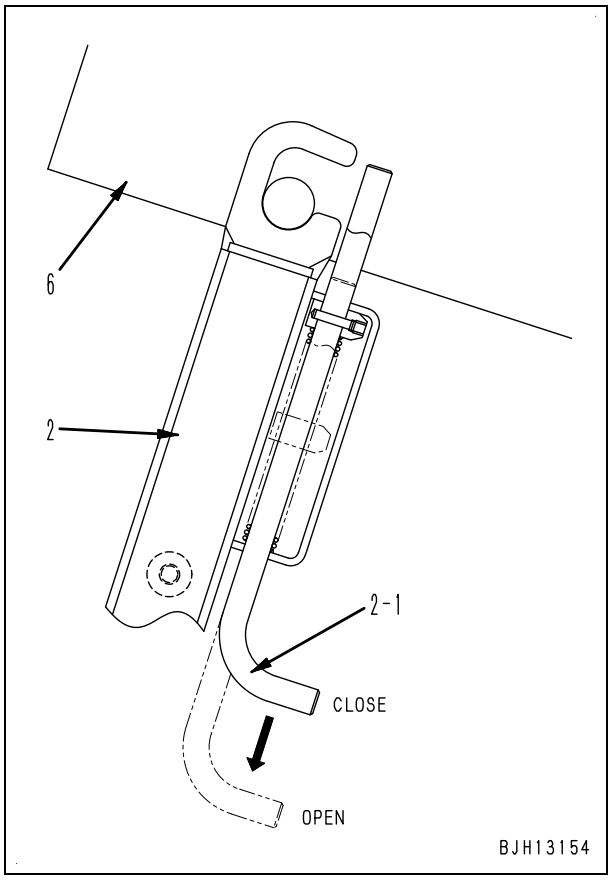


3) Connect cylinder hose (1) to the external hydraulic pump assembly.
4) Operate the external hydraulic pump and tilt the cab up.
   ★ Operate the pump within the specified pressure.
   Specified pump pressure:
   20.6 - 34.3 MPa {210 - 350 kg/cm^2}

Method using external crane
1) Fit sling [1] to the hook of the cab mount.
2) Raise the cab (6) to tilt it up.

3. **Fixing cab in position**
1) Pull lock lever (2-1) and set lock bar (2) with the care the direction of the lock bar (2) at the front left of the cab.
2) Lower the cab (6) slowly and fix it in the position.
   ⚠ **Check that the lock lever closes and the cab (6) is held securely in position by the lock bar (2).**
   ⚠ **When the cab is tilted up with the tilt cylinder, release its hydraulic pressure gradually, and lower the cab slowly.**
3) Remove the external pump or external crane.





4. **Tilting cab down**
   ★ Tilt the cab down in the reverse order for tilting the cab up.
   ★ After tilting the cab down, tighten the mounting bolts and return the lock bar to the storage place.

Testing and adjusting dump circuit oil pressure

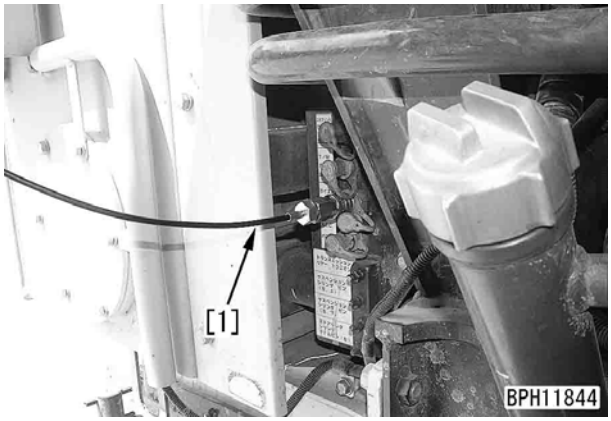
★ Equipments for testing and adjusting dump circuit oil pressure

Symbol	Part No.	Part name
S	799-101-5002	Hydraulic tester
	790-261-1204	Digital type hydraulic tester

⚠ Stop the machine on level ground, turn the parking brake switch ON, and set chocks to the tires.
⚠ Do not test the relief pressure with the cab tilted.

1. **Measuring dump main relief oil pressure**
   ★ Since the dump main circuit uses the same hydraulic pump (basic pressure) together with the steering circuit and the steering circuit is structured to have a priority over others, before measuring it, it is necessary to check that the steering circuit pressure is normal.
   ★ Measure the dump main relief pressure at remote pressure detection port (1).

   1) Install hose[1] and connect oil pressure gauge **S**.
      ★ Use a 40 MPa {400 kg/cm^2} oil pressure gauge.

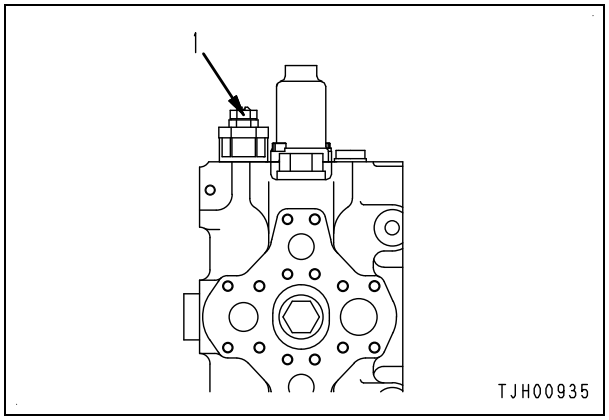


   2) Start the engine and operate the dump body up to either LOWER or RAISE stroke end.
   3) Operate the dump lever with the engine running at high idle and measure the oil pressure at RAISE relief or LOWER relief.

   4) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

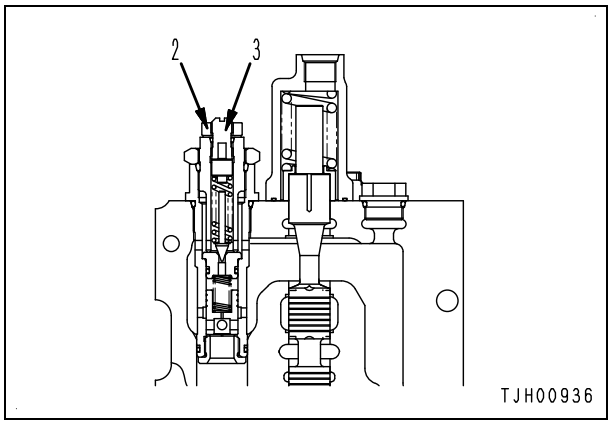
2. **Adjusting the dump main relief oil pressure**
   - Tilt operator cab up.
     (See, "Method of tilting cab up" in Testing and adjusting.)

   ★ If the dump main relief oil pressure is not normal, adjust it with relief valve (1) of hoist valve according to the following procedures.



   1) Loosen locknut (2) and adjust it turning adjustment screw (3).
      ★ Adjustment screw:
      - When turned clockwise, the oil pressure is heightened.
      - When turned counterclockwise, the oil pressure is lowered.

      ★ If the adjustment screw is rotated 1 turn, the pressure is heightened or lowered by 4.2 MPa {42.8 kg/cm^2}.

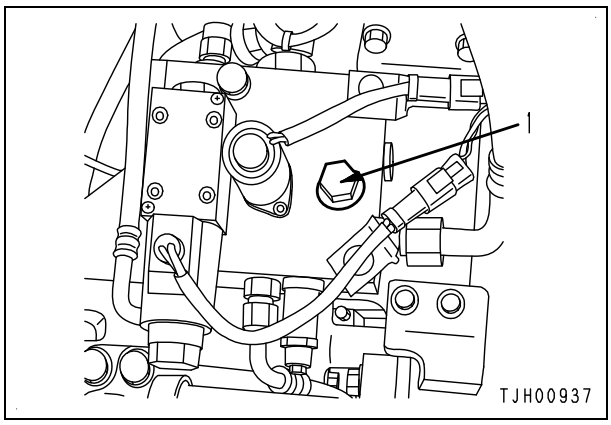


   2) While holding adjustment screw (3) with a screw driver, tighten locknut (2).
      Locknut tightening torque:
      29.4 – 39.2 Nm {3 – 4 kgm}

      ★ After completing the adjustment, check the oil pressure again following to the procedure for measurement.

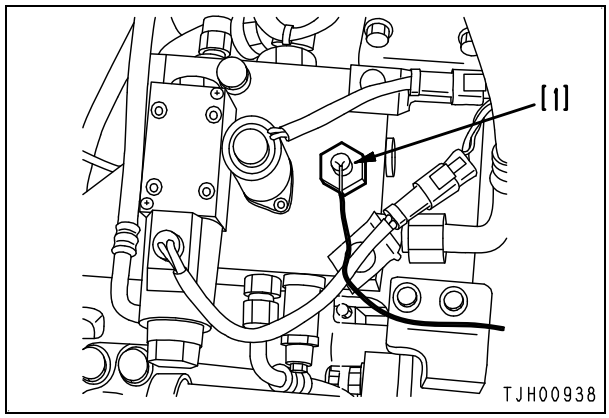
3. **Testing dump pilot relief oil pressure**
   - Tilt operator cab up.
     (See, "Method of tilting cab up" in Testing and adjusting.)

   1) Remove the hydraulic oil tank side cover.
   2) Remove oil pressure measurement plug (1).



   3) Install a nipple and hose[1], and connect oil pressure gauge **S**.

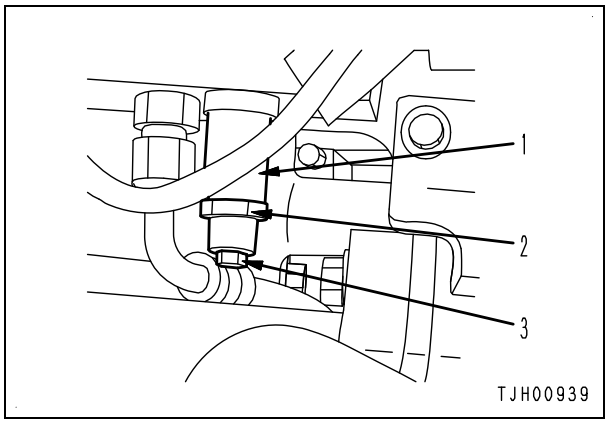
      ★ Use a 6 MPa {60 kg/cm^2} oil pressure gauge.



   4) Start the engine and measure the oil pressure with the engine running at high idle.(with the dump lever at neutral position)

   5) Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

4. **Adjusting the dump pilot relief oil pressure**
   ★ If the dump pilot relief oil pressure is not normal, adjust it with relief valve (1) according to the following procedures.



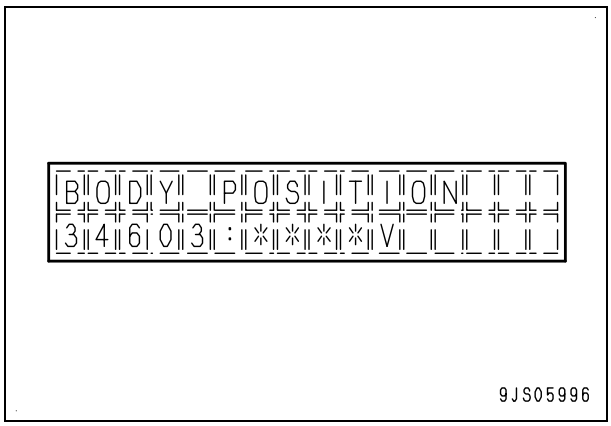
   1) Remove the cap, loosen locknut (2), and adjust it turning adjustment screw (3).
      ★ Adjustment screw:
      - When turned clockwise, the oil pressure is heightened.
      - When turned counterclockwise, the oil pressure is lowered.

      ★ If the adjustment screw is rotated 1 turn, the pressure is heightened or lowered by 1.8 MPa {18.6 kg/cm^2}.
   2) While holding adjustment screw (3), tighten locknut (2).
      Locknut tightening torque:
      40 Nm {4.1 kgm}
      ★ After completing the adjustment, check the oil pressure again following to the procedure for measurement.

Adjusting body positioner sensor

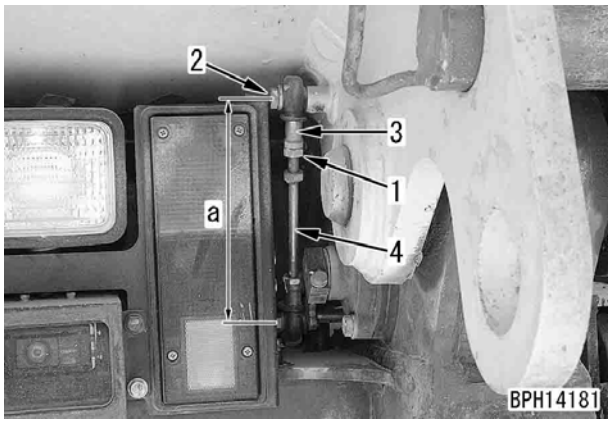
★ If the body positioner rod was once disconnected and connected again or the body positioner sensor was once removed and installed again, test and adjust the body positioner sensor according to following procedures.

1. **Checking the sensor input voltage**
   1) Switch the machine monitor display to the monitoring function of service mode 1 and let it display the body positioner sensor input voltage.
      ★ Monitoring items
      Code No. 34603: BODY POSITION
      ★ Refer to “Special functions of machine monitor (EMMS)“ for the operating method.



   2) Start the engine.
   3) Operate the dump lever and check the monitoring voltage when the dump lever is operated up to the LOWER and RAISE stroke ends.
      ★ LOWER stroke end: 0.40 – 0.60 V
      ★ Raise stroke end: 4.00 – 4.70 V

2. **Adjusting link length**
   ★ If the monitoring voltage is not within the normal range, adjust it with the link length according to the following procedures.
   1) Loosen locknut (1).
   2) Remove mounting bolt (2).
   3) Turn rod end (3) to adjust the length of the link (4).
      ★ Standard installed length (a): 220 mm
      ★ Do not reduce length (a) to below 218 mm.
      ★ Input voltage:
      - Becomes lower when the link becomes longer.
      - Becomes higher when the link becomes shorter.
      ★ Change in voltage per 1 turn of rod end: Approx. 0.04V
   4) Install mounting bolt (2).
   5) Tighten locknut (1).
   6) Following to the checking procedure above, verify the input voltage is within the normal range.



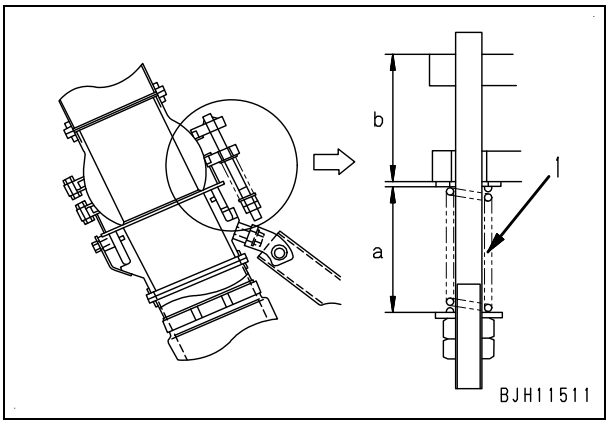
3. **System calibrating operation**
   1) Start the engine and raise the hydraulic oil temperature to 80 – 90 °C.
   2) While running the engine at low idle, lower the dump body to the lower stroke end and keep the dump lever in the "float" position for at least 5 seconds.
      ★ Check that the body pilot lamp is turned OFF.
   3) While running the engine at low idle, raise the dump body to the raise stroke end and keep the dump lever in the "raise" position for at least 5 seconds.
   4) While running the engine at low idle, lower the dump body to the lower stroke end.
   5) While running the engine at high idle, raise the dump body to the raise stroke end and then lower the engine speed to low idle and set the dump lever to the "lower" position. After the dump body starts lowering, return the dump lever to the "float" position and lower the dump body to the lower stroke end.
      ★ Repeat the above operation 5 – 10 times.
   6) While running the engine at high idle, raise the dump body to the raise stroke end and then keep the engine speed at high idle and set the dump lever to the "lower" position. After the dump body starts lowering, return the dump lever to the "float" position and lower the dump body to the lower stroke end.
      ★ Repeat the above operation 5 – 10 times.

Procedure for adjusting length of spring in body heating spherical joint

★ If the body heating bellows does not move smoothly while the machine is steered or oscillated, or if the bellows is replaced, adjust the length of the spring according to the following procedure.

1. Adjust length **a** of spring (1) to be 60 ± 1 mm. (On both front side and rear side)
   At this time, check that dispersion of dimension **b** of each stud is 1 mm or less.
   ★ Standard dimension **b** of stud: 58 mm (reference)

2. After completing the adjustment
   1) Check for a leakage of exhaust gas.
   2) Check that the spherical joint swivels smoothly without any sticking or scuffing.



Handling engine controller high voltage circuit

1. Disconnecting or connecting operation of the connector between the engine controller and the engine shall be performed only when the starting switch is in the OFF position.

2. Do not start the engine while the T adapter is inserted or connected to a connector between the engine controller and the engine for diagnosis.
   ★ You may turn the starting switch to the OFF or ON position but must not turn it to the START position.

Adjusting transmission controller

Adjusting transmission

★ After carrying out any of the following operations, adjust the transmission in order to tune the feeling of transmission and its controller.
- Transmission has been overhauled or replaced.
- Transmission control valve has been repaired or replaced.
- Transmission controller has been replaced.
- Power train speed sensor has been repaired or replaced.
- Transmission oil temperature sensor has been repaired or replaced.
- Transmission oil filter has been clogged abnormally and repaired.

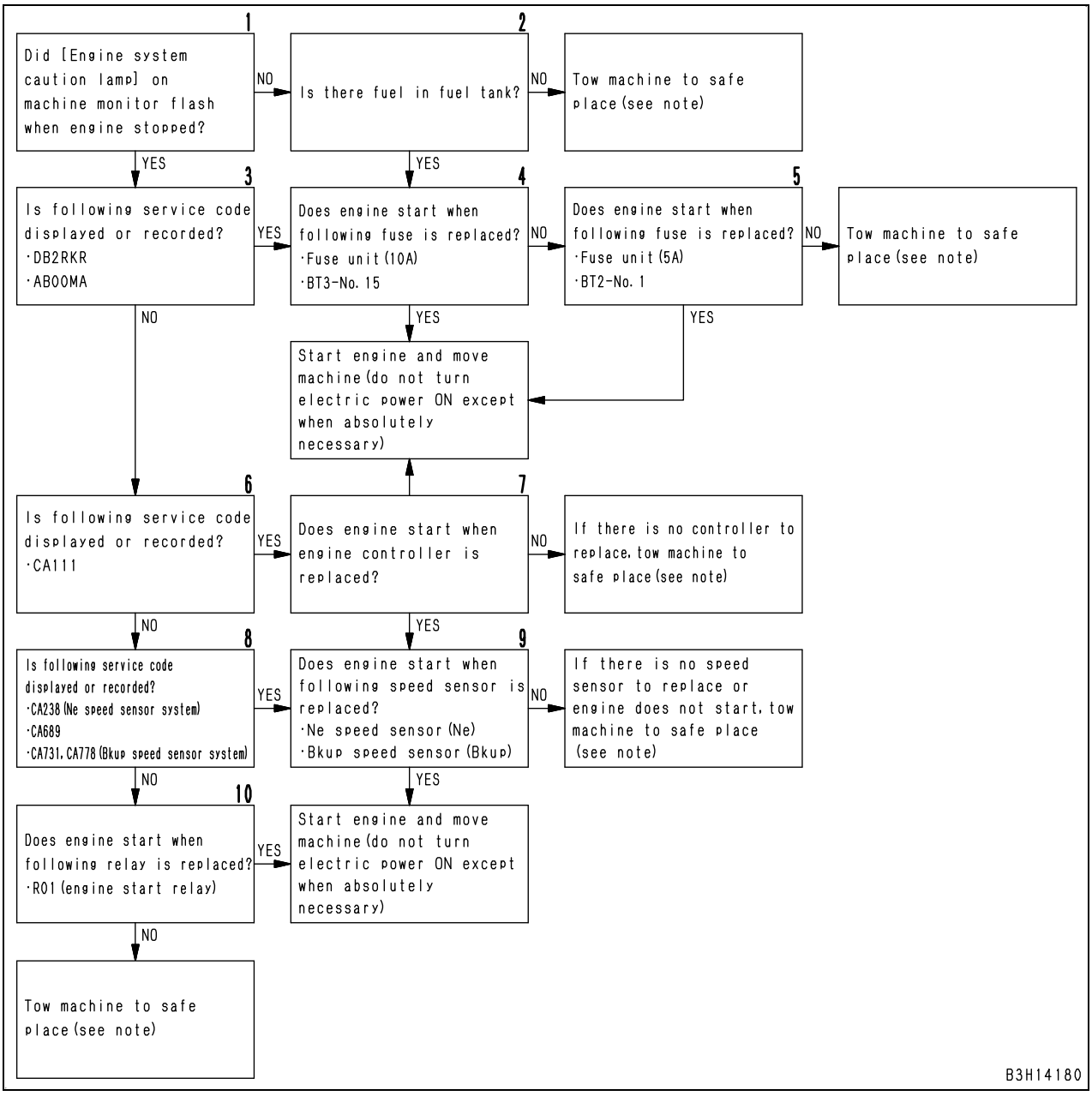
★ For the adjusting operation of the transmission, use the service function of the machine monitor.

★ Refer to “Special functions of machine monitor (EMMS)“ for the details of the operating method.

Method for emergency escape at electrical system failure

If any problem occurs in the electrical system of the engine or transmission control system, it may disable the engine to start or the machine to move off.
If such a problem occurs, temporarily restore the engine or transmission electrical system to move the machine to a safe place, then carry out regular troubleshooting.

1. **When any problem occurs in the engine control system and the engine cannot be started**
   ★ Decide the escape method according to the following flowchart.
   ★ Refer to “Special functions of machine monitor (EMMS)“ for the method of checking the failure code.



Note: If the engine cannot be started and the machine is towed, release the parking brake temporarily referring to “Method for emergency release of parking brake“, since it cannot be released by operating the switch.

2. When any problem occurs in the transmission control system and the machine cannot be started
   ★ Check the failure code, and determine an adequate escape procedure from following table.
   ★ Refer to “Special functions of monitor panel (EMMS)“ for the method of checking the failure code.

Failure code	Condition when failure occurs	Escape method	Lever position for speed range to move off after escape operation	Remarks
1500L0	Occurrence condition 2	Escape procedure 2	—	Occurrence condition 1: Speed range remains fixed, and when machine moves off again, transmission does not shift from the fixed speed range. If lever is positioned at N, transmission shifts to neutral. Occurrence condition 2: Transmission suddenly shifts to neutral while traveling. And after machine is stopped, lever does not shift the transmission from neutral and machine can not move off. Occurrence condition 3: Transmission suddenly shifts to neutral while traveling. Occurrence condition 4: After engine is started, transmission stays in neutral even if lever is operated, and machine can not move off. Occurrence condition 5: Response to lever becomes abnormal and lever does not work as operated. When lever is operated, transmission shifts to neutral. Occurrence condition 6: Speed range remains fixed, and when machine moves off again, the transmission does not shift from the fixed speed range. If lever is positioned at N, transmission shifts to neutral, and after that, it can not be shifted. Occurrence condition 7: Speed range is fixed with appropriate clutches applied for the travel. If appropriate clutches are not available for the travel, transmission shifts to neutral. If lever is positioned at N, transmission shifts to neutral. Note 1: Even when the machine condition is restored after a failure, the neutral condition is maintained until the lever is returned to the N position.
15G0MW	Occurrence condition 7	Escape procedure 1	D – 1: F2	
15H0MW	Occurrence condition 7	Escape procedure 1	D – 1: F1, R1 – R2: R1	
15J0MW	Occurrence condition 7	Escape procedure 1	D – 1: F2, R1 – R2: R1	
15K0MW	Occurrence condition 7	Escape procedure 3	D – 1: F3, R1 – R2: R2	
15L0MW	Occurrence condition 7	Escape procedure 3	D – 1: F2, R1 – R2: R1	
15M0MW	Occurrence condition 7	Escape procedure 3	D – 1: F2, R1 – R2: R1	
15SBL1	Occurrence condition 7	Escape procedure 1	R1 – R2: R1	
15SBMA	Occurrence condition 7	Escape procedure 1	D – 1: F2	
15SCL1	Occurrence condition 7	Escape procedure 1	D – 1: F2	
15SCMA	Occurrence condition 7	Escape procedure 1	D – 1: F1, R1 – R2: R1	
15SDL1	Occurrence condition 7	Escape procedure 1	D – 1: F1	
15SDMA	Occurrence condition 7	Escape procedure 1	D – 1: F2, R1 – R2: R1	
15SEL1	Occurrence condition 7	Escape procedure 1	D – 1: F2, R1 – R2: R1	
15SEMA	Occurrence condition 7	Escape procedure 1	D – 1: F3, R1 – R2: R2	
15SFL1	Occurrence condition 7	Escape procedure 1	D – 1: F3, R1 – R2: R2	
15SFMA	Occurrence condition 7	Escape procedure 1	D – 1: F2, R1 – R2: R1	
15SGL1	Occurrence condition 7	Escape procedure 1	D – 1: F5, R1 – R2: R3 or equivalent	
15SGMA	Occurrence condition 7	Escape procedure 1	D – 1: F2, R1 – R2: R1	
15SJMA	Occurrence condition 1	Escape procedure 1	D – 1: F2, R1 – R2: R1	
DAQ0KK	Occurrence condition 1	Escape procedure 5	Normal travel possible if display returns to normal (Note 1)	
DAQ2KK	Occurrence condition 1	Escape procedure 4	Normal travel possible if display returns to normal (Note 1)	
DAQ9KQ	Occurrence condition 4	Escape procedure 6	–	
DAQRKR	Occurrence condition 2	Escape procedure 5	Normal travel possible if display returns to normal (Note 1)	
DAQRMA	Occurrence condition 4	Escape procedure 1	D – 1: F2, R1 – R2: R1	
DB2RKR	Occurrence condition 1	Escape procedure 1	D – 1: F2, R1 – R2: R1	
DDTHKA	Occurrence condition 1	Escape procedure 1	D – 1: F2	
DDTJKA	Occurrence condition 1	Escape procedure 1	D – 1: F1	
DDTKKA	Occurrence condition 1	Escape procedure 1	D – 1: F2, R1 – R2: R1	
DDTLKA	Occurrence condition 1	Escape procedure 1	D – 1: F3, R1 – R2: R2	
DDTMKA	Occurrence condition 1	Escape procedure 1	D – 1: F5, R1 – R2: R3 or equivalent	
DDTNKA	Occurrence condition 1	Escape procedure 1	R1 – R2: R1	
DF10KA	Occurrence condition 5	Escape procedure 7	Normal travel possible if display returns to normal (Note 1)	
DF10KB	Occurrence condition 5	Escape procedure 7	Normal travel possible if display returns to normal (Note 1)	
DLF1KA	Occurrence condition 1	Escape procedure 1	D – 1: F2, R1 – R2: R1	
DLF1LC	Occurrence condition 1	Escape procedure 1	D – 1: F2, R1 – R2: R1	
DLF2KA	Occurrence condition 1	Escape procedure 1	D – 1: F2, R1 – R2: R1	

Failure code	Condition when failure occurs	Escape method	Lever position for speed range to move off after escape operation	Remarks
DLF2LC	Occurrence condition 1	Escape procedure 1	D – 1: F2, R1 – R2: R1	Note 1: Even when the machine condition is restored after a failure, the neutral condition is maintained until the lever is returned to the N position.
DLT3KA	Occurrence condition 6	Escape procedure 3	D – 1: F2, R1 – R2: R1	
DXH1KA	Occurrence condition 1	Escape procedure 1	D – 1: F2, R1 – R2: R1	
DXH1KB	Occurrence condition 1	Escape procedure 1	D – 1: F2, R1 – R2: R1	
DXH1KY	Occurrence condition 1	Escape procedure 1	D – 1: F2, R1 – R2: R1	
DXH2KA	Occurrence condition 7	Escape procedure 1	D – 1: F1, R1 – R2: R1	
DXH2KB	Occurrence condition 7	Escape procedure 1	D – 1: F1, R1 – R2: R1	
DXH2KY	Occurrence condition 7	Escape procedure 1	D – 1: F2	
DXH3KA	Occurrence condition 7	Escape procedure 1	D – 1: F2, R1 – R2: R1	
DXH3KB	Occurrence condition 7	Escape procedure 1	D – 1: F2, R1 – R2: R1	
DXH3KY	Occurrence condition 7	Escape procedure 1	D – 1: F1	
DXH4KA	Occurrence condition 7	Escape procedure 1	D – 1: F3, R1 – R2: R1	
DXH4KB	Occurrence condition 7	Escape procedure 1	D – 1: F3, R1 – R2: R1	
DXH4KY	Occurrence condition 7	Escape procedure 1	D – 1: F2, R1 – R2: R1	
DXH5KA	Occurrence condition 7	Escape procedure 1	D – 1: F2, R1 – R2: R1	
DXH5KB	Occurrence condition 7	Escape procedure 1	D – 1: F2, R1 – R2: R1	
DXH5KY	Occurrence condition 7	Escape procedure 1	D – 1: F3, R1 – R2: R1	
DXH6KA	Occurrence condition 7	Escape procedure 1	D – 1: F2, R1 – R2: R1	
DXH6KB	Occurrence condition 7	Escape procedure 1	D – 1: F2, R1 – R2: R1	
DXH6KY	Occurrence condition 7	Escape procedure 1	D – 1: F5, R1 – R2: R3 or equivalent	
DXH7KA	Occurrence condition 7	Escape procedure 1	D – 1: F2	
DXH7KB	Occurrence condition 7	Escape procedure 1	D – 1: F2	
DXH7KY	Occurrence condition 7	Escape procedure 1	R1 – R2: R1	

Escape procedure 1:

1. Stop traveling and return the gearshift lever to the N position.
2. Operate the gearshift lever again and move the machine off.
   - ★ When operating the gearshift lever, release the accelerator pedal.
   - ★ N → D – 1 or N → R1 – R2

Escape procedure 2:

Tow the machine.

★ Note: If the engine cannot be started and the machine is towed, release the parking brake temporarily referring to “Method for emergency release of parking brake“, since it cannot be released by operating the switch.

Escape procedure 3:

1. Stop traveling and return the gearshift lever to the N position.
2. Disconnect (pull out) emergency escape connectors **A1-M** (male) and **A1-F** (female) and then connect (insert) them again to set the machine in the emergency escape mode.
   - ★ Connectors **A1-M** and **A1-F** are installed in front of the transmission controller.
   - ★ Connect and disconnect the connectors with the starting switch ON or with the engine started.
3. Operate the gearshift lever and move the machine off again.
   - ★ When operating the gearshift lever, release the accelerator pedal.
   - ★ N → D – 1 or N → R1 – R2
   - ★ The emergency escape mode is maintained until the starting switch is turned OFF.

Escape procedure 4:
Check the circuit breaker and fuse, and if they are normal, replace the transmission controller.
- Circuit breaker: **No.64, 65(80A)**
- Fuse: **BT3-No. 14 (10A)**

Escape procedure 5:
Check the circuit breaker and fuse, and if they are normal, replace the transmission controller.
- Circuit breaker: **Inside battery housing (30A)**
- Fuse: **BT2-No. 22 (10A)**

Escape procedure 6:
Reset the model selection setting, thus reset the option items.
★ For details of checking the model selection setting, refer to “Adjusting transmission controller“.

Escape procedure 7:
Check the fuse, and if it is normal, replace the gear shift lever.
- Fuse: **BT3-No. 14 (10A)**

HM300-2 Articulated dump truck

Form No. SEN00668-05

ARTICULATED DUMP TRUCK

HM300-2

Machine model	Serial number
HM300-2	2001 and up

30 Testing and adjusting

Testing and adjusting, Part 3

Setting and adjusting various equipments

Setting items which are required after the replacement, disassembly and assembly, or additional installation of controller or sensor has been performed.

- When any part listed below has been replaced, disassembled and assembled or additionally installed, carry out the setting and initial adjustment of controller, sensor or solenoid etc.

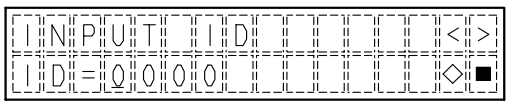
Replaced, disassembled and assembled, and additionally installed equipments and components	Necessary setting and adjustment items
Machine monitor	• Model selection setting (1-1) • Setting the optional equipment (1-2) • OFF setting a maintenance function of corrosion resistor (1-3) • Deletion of the electrical system failure history information (3-1) • Setting of service meter • Setting of integrated odometer • Setting of integrated reverse odometer
Transmission unit	• Adjusting a transmission ECMV electric current (2-1) • Reset the transmission initial learning and implement learning (2-2)
Transmission controller	• Model selection setting (1-1) • Setting the optional equipment (1-2) • Adjusting a transmission ECMV electric current (2-1) • Reset the transmission initial learning and implement learning (2-2) • Deletion of the electrical system failure history information (3-1)
Transmission ECMV solenoid	• Adjusting a transmission ECMV electric current (2-1) • Reset the transmission initial learning and implement learning (2-2)
Retarder controller	• Model selection setting (1-1) • Setting the optional equipment (1-2) • Deletion of the electrical system failure history information (3-1)
Body positioner sensor Body positioner rod	Refer to the adjusting body positioner sensor
KOMTRAX	• How to start using a KONTRAX terminal
Adding or removing an optional equipment	• Setting an optional equipment (1-2)

(Note) If the service meter, integrated odometer or integrated reverse odometer needs to be set, refer to the service news (AT06310).

Model selection setting (1-1)

★ Since setting is carried out in service mode, switch to service mode by the following special operation.

1) Checking screen display
   Check that the machine monitor is in the operator mode and the screen is displaying either of “service meter and integrated odometer“, “action code“ or “failure code“.
2) Displaying ID input initial screen
   Hold down the 2 switches on the left side of the dashboard simultaneously for 5 seconds to display the ID input initial screen (Fig. 1).
   - [■] switch and [<] switch
   ★ If the switch is pressed for over 5 seconds, a blank screen will appear. Confirm that the blank screen has been displayed then release the switch.

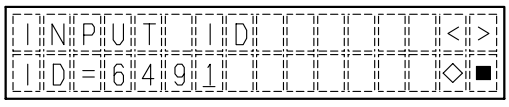


(Fig. 1) BJH10103

3) Input and confirmation of ID
Input the ID by operating each switch (Fig. 2).
★ ID: **6491**
- [>] switch: Number at cursor goes up
- [<] switch: Number at cursor goes down
- [◇] switch: Number at cursor is confirmed
- [■] switch: Returns to initial screen (See Note)

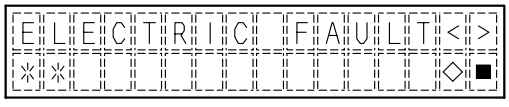
Note: When the cursor is at the left side, the screen returns to the normal screen (operator mode).
If the cursor is not at the left side, the cursor returns to the left side.

★ If the switches are not operated on the ID input screen for more than 60 seconds, the display returns automatically to the normal screen.



(Fig. 2) BJH10104

4) Displaying menu initial screen
After confirming all 4 digits of the ID, the menu initial screen of the service mode is displayed (Fig. 3).
★ Once the ID has been input and confirmed, it remains effective until the starting switch is turned OFF.



(Fig. 3) BJH10105

5) Depress the [<] or [>] switch while the menu initial screen is displayed, and the service menu is displayed repeatedly in the order of the following table. Select the model selection function (MACHINE).
- [>]: To proceed to next service menu.
- [<]: To return to previous service menu.

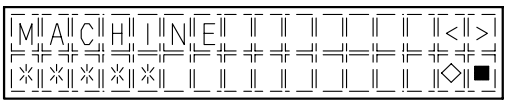
★ Displayed service menu:

Display	Function
ELECTRIC FAULT	Electrical system failure history display function
MACHINE FAULT	Mechanical system failure history display function
REAL-TIME MONITOR	Real-time monitoring function
CYLINDER CUT-OUT	Reduced cylinder mode
NO INJECTION	No injection cranking function
TUNING	Adjusting function
MAINTENANCE MONITOR	Filter and oil replacement time setting function
OPERATION INFO	Operation information display function
OPTIONAL SELECTION	Option selection function
MACHINE	Model selection function
INITIALIZE	Initialize function (exclusive function for factory)

★ As for the use of the service menu, besides model selection function, option selection function, and filter and oil replacement time setting function (part of function), refer to the section of "Special function of machine monitor".

★ In the "*****" part, the model presently set is displayed.

★ Even if the model presently set is correct, be sure to carry out the setting newly.

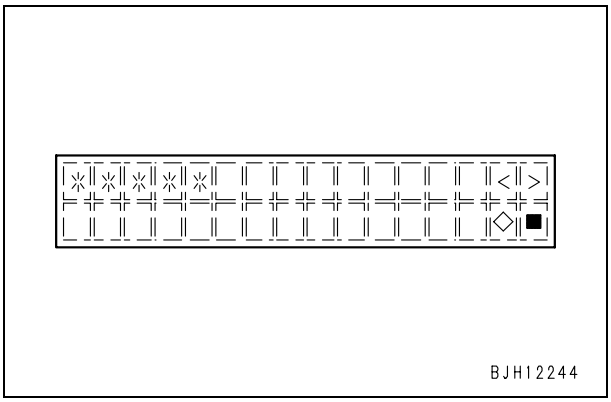


BJH12243

1] After selecting the model selection function, press [◇] switch for longer than 5 seconds and display the model selection setting screen.
- [◇]: Conduct the service menu.

★ Press [◇] switch for longer than 5 seconds, otherwise it will not change to model selection setting screen.

★ In the model selection setting screen, display only the model to be set at the [*] part.



2] Selecting and setting of model

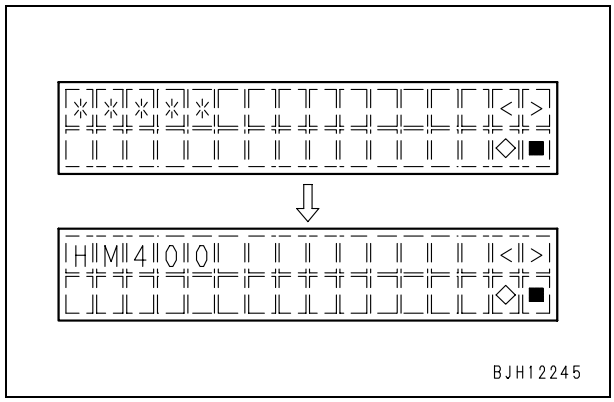
i) When pressing the [>] switch or [<] switch in the model selection setting screen, the model which can be set is displayed endlessly in the order shown in the below table, so select the applied model.
- [>] switch: To proceed to next model
- [<] switch: To return to previous model

★ Displayed model:

Display	Model
HM400	HM400-2
HM400TN	HM400-2 (Tunnel specifications)
HM350	HM350-2
HM350TN	HM350-2 (Tunnel specifications)
HM300	HM300-2
HM300TN	HM300-2 (Tunnel specifications)
HM250	HM250-2

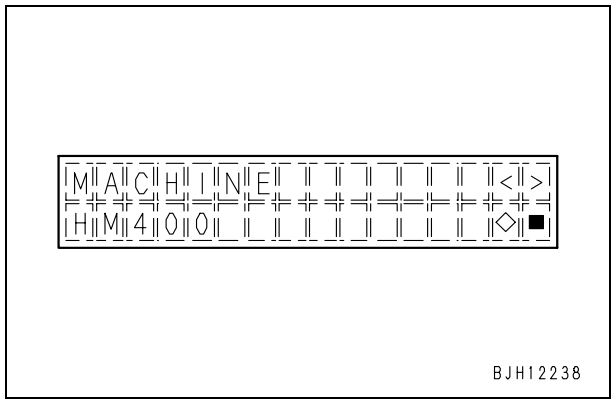
ii) After selecting the model in the model selecting screen, determine the model by pressing the [◇] switch.
- [◇]: Determine the setting.
- [■]: To cancel the setting

★ The below figure shows the example that HM400-2 has been selected.



3] Storing data in controller

i) After determining the model selection setting, check that the display automatically returned to the service menu screen and the selected model is surely displayed.



ii) Turn the starting switch OFF and keep that condition for longer than 15 seconds.

★ Unless the starting switch is turned off for longer than 15 seconds, the new data is not memorized in the controller.

iii) Turn the starting switch ON again.

★ After this operation the model setting becomes effective.

4] Carrying out option setting

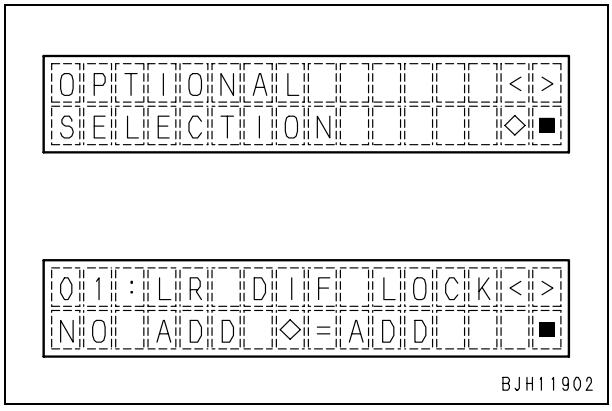
If once carrying out the model selection setting, all setting of option selection is reset, so continue to carry out the setting of option selection.

★ Refer to section "Setting of option selection (1-2)".

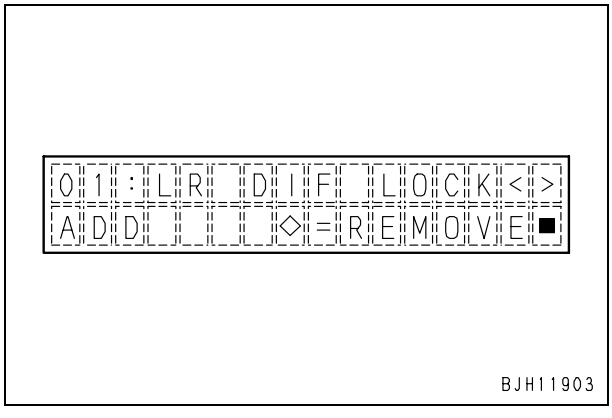
Check item	English display	Check item No.	Default	Selected content
Left-and-right differential lockup	LR DIF LOCK	1	HM300-2 HM300TN-2 is NO ADD	Select NO ADD and set.
Accelerator connected retarder	ACC RETARD	2	NO ADD	Be sure to select NO.
—	—	5	NO ADD	Fix to "No ADD".
—	—	6	NO ADD	Fix to "No ADD".
Tire size compensation	TIRE SIZE	8	0%	Set the speed compensation volume by tire size and select as below according to the tire. HM300/300TN-2 Japan (750/65-R25 E3) : 0% Except Japan (23.5-R25 E3) : +1% If speed display mismatch exists, adjust it with this function. Every time it is raised by 1%, compared to when it is 0%, the vehicle speed will go up 1%.
Maintenance sensor	SENSOR	10	NO ADD	Be sure to select NO.
—	—	11	NO ADD	Fix to "No ADD".
Select economy mode	E1 MODE	12	ADD	Be sure to select ADD.
Selection of unit (MPH or km/h)	SPEED(UNIT)	13	MPH	Select the unit as follows. • Use MPH: MPH • Use km/h: km/h This item is not displayed for the SI specification.

Setting option device (1-2)

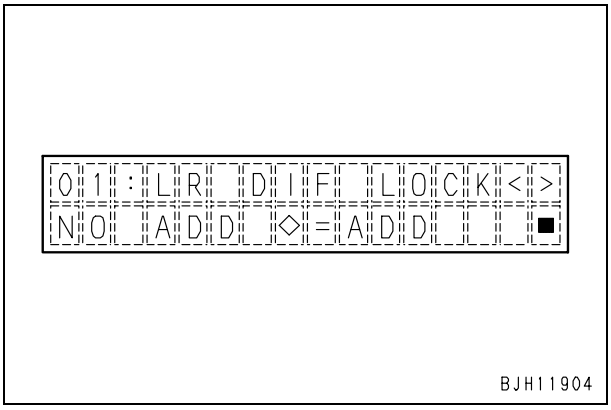
★ Confirm that the model selection is done before setting the option.
1) Setting will be done by the service mode, therefore refer to the adjustment of machine monitor (2) and switch to the service mode screen.
★ After changing the setting, as with the model selection setting, unless the starting switch is turned off for over 15 seconds, it will not be recorded.
2) Option device is as above.
3) Operate the [>], [<] switch from the service mode to display the option selection function screen, and press [◇] switch for over 5 seconds to change the display to setting screen.
★ Press [◇] switch for over 5 seconds otherwise it will not change to setting screen.
★ Be sure to start from check item No. 1 for option setting, also follow the below procedure to set check item No. 1.



★ Because the left-and-right differential lock of HM300 is “only without“, press [◇] switch from the upper screen to display the next screen.



4) Press [◇] switch from the upper screen again to display the next screen, and non-set operation of differential lock will be ended.

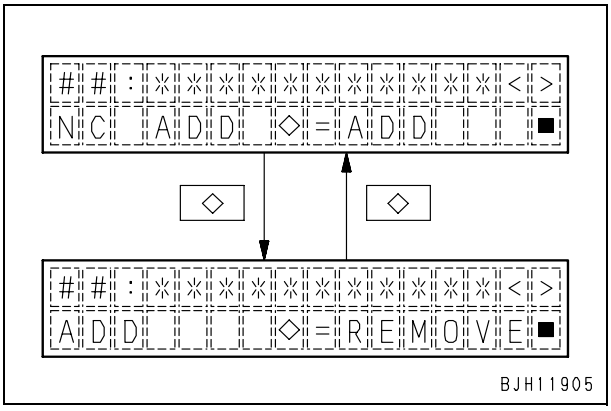


5) Press [>] switch from the above screen to move on to the next option setting.

★ Confirm the option device installation condition of the concerned machine, and set each check item in the order following the above table.

6) Display of option setting or not-setting.
   1] If an option is not selected, option not selected screen will be displayed (NO ADD is displayed on lower left).
   2] If option is set, option screen will be displayed.
   (ADD will be displayed on lower left)

   ★ Set / not set of each option is changed by pressing the [◇] switch, ADD and NO ADD will change every time the switch is pressed.

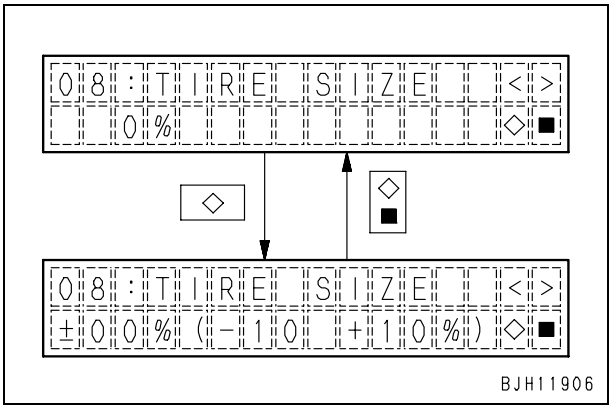


★ The setting of each option is carried out by following the same procedure for the above items 5) and 6).

7) Correction of tire size is as follows.
   1] By the option setting procedure, display the tire size adjustment screen, then input the tire size adjustment value.

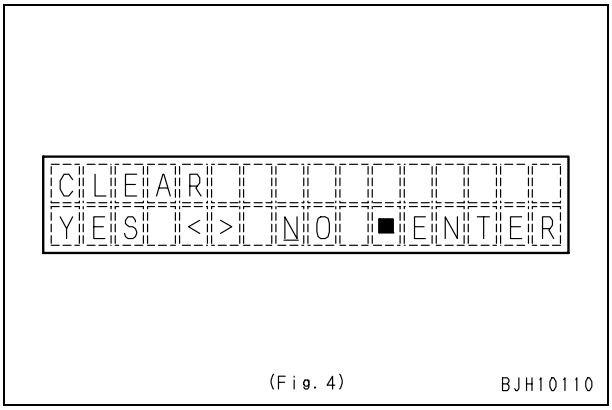
   ★ Input the value the same way as inputting the ID.

   2] Press the [◇] switch and set.



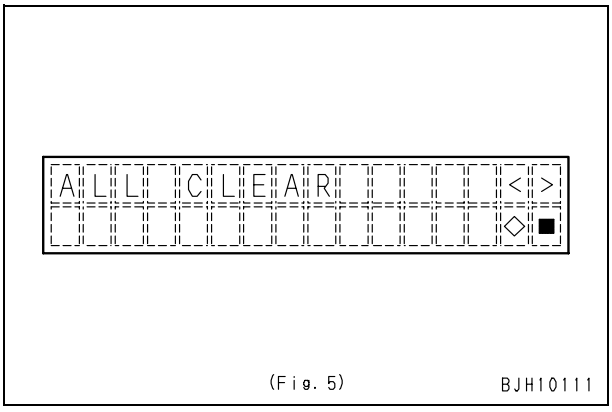
Deletion of electric system failure history information (3-1)

1) Press the [◇] switch once when the failure history information you wish to delete is displayed, and display the individual deletion screen (Fig. 4).
   - [◇] switch: Display the deletion screen
2) Execute the switch operation following the display screen. (Fig. 4).
   - [<] switch: Select YES
   - [>] switch: Select NO
   - [■] switch: Execute
   - ★ An information which is active currently (display is flashing) cannot be deleted.



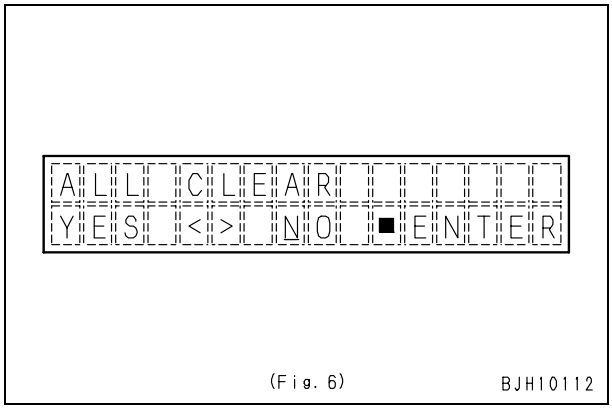
(Fig. 4) BJH10110

- Deletion of all the failure history information
  1) Press the [>] or [<] switch when the failure history information is displayed, and display all the deletion menu screen (Fig. 5).
  2) Press the [◇] switch once and display all deletion screen (Fig. 6).
     - [◇] switch: Implement all deletion menu.



(Fig. 5) BJH10111

3) Implement the switch operation following the display (Fig. 6).
   - [<] switch: Select YES
   - [>] switch: Select NO
   - [■] switch: Execute
   - ★ An information which is active currently (display is flashing) cannot be deleted.



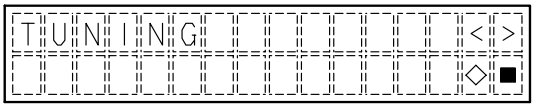
(Fig. 6) BJH10112

Transmission ECMV current control (2-1)

Machine monitor has the function of “adjusting the different operational feel of each ECMV to a constant level through the transmission controller“ and “learning function to keep certain gear shift feeling according to the change in individual wear of the transmission clutch“.

If power train related operation such as the following is carried out, execute the adjustment operation.

- If transmission is overhauled or changed
- If transmission valve is replaced
- Transmission controller has been replaced.
- When an abnormality occurred in the power train speed sensor and has been repaired (refer to the below table for failure code)
- If the transmission oil temperature sensor is troubled and repaired (refer to the below table for failure code)
- If the transmission oil filter is clogged and repaired (refer to the below table for failure code)



(Fig. 1) BJH10129

Failure code	Device name
DLF1KA	Transmission input shaft speed sensor
DLF1LC	
DLF2KA	Transmission intermediate shaft speed sensor
DLF2LC	
DLF3KA	Transmission output shaft R speed sensor
DGF1KX	Transmission valve oil temperature sensor
15B0NX	Transmission oil filter

To check, operate the machine monitor and machine body, and perform in order the following check items (Fig. 2).

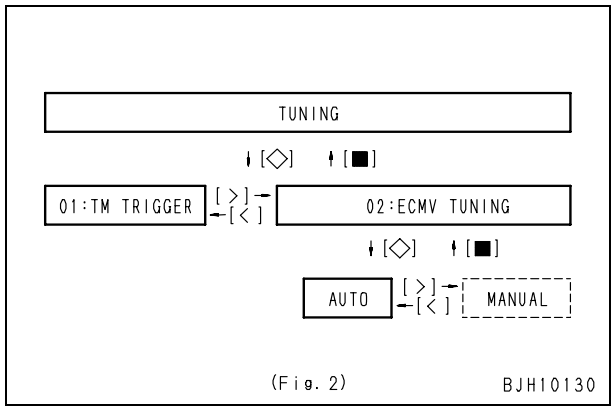
★ ( ) indicates each menu used for adjustment.

1] Adjusting individual difference of valves (02: AUTO for ECMV TUNING)

2] Resetting the stabilization of gear shifting feel learning data (01: TM TRIGGER)

3] The initial learning of stabilization of gear shifting feel (monitoring function)

★ [MANUAL] menu of [02: ECMV TUNING] is the function only used by plants and not used by services.

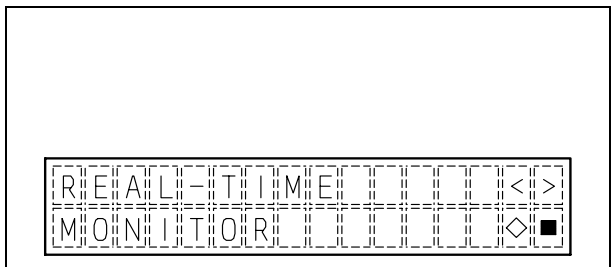


(Fig. 2) BJH10130

Preparatory work: ECMV oil temperature adjustment

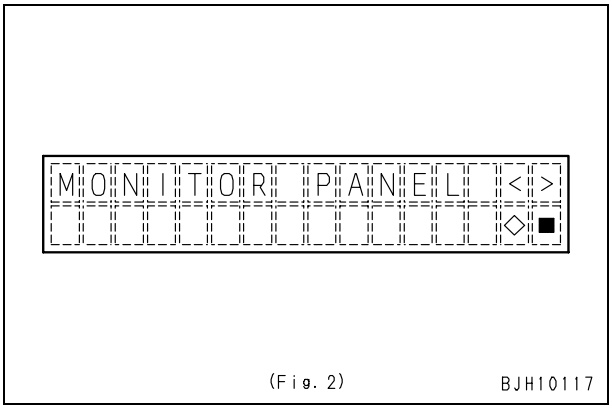
★ Adjusting operation should be carried out with specified oil temperature, confirming the machine is not displaying abnormality, adjust the ECMV oil temperature by following the next procedure.

1) Menu selection
Select [Machine information monitoring function] on service mode menu (Fig.1).

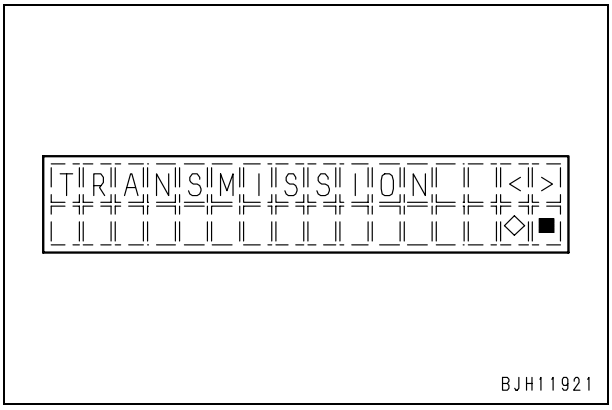


(Fig. 1) BJH10116

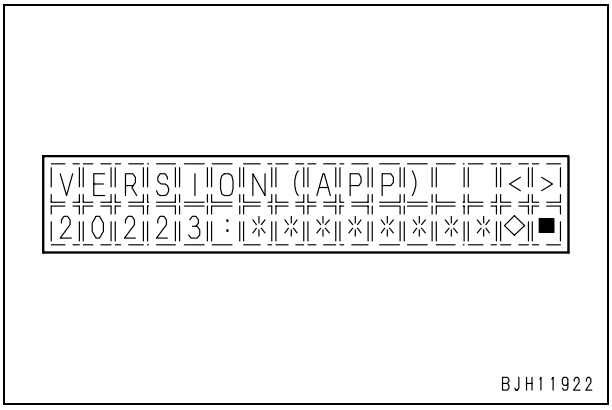
2) Sub menu display
With the menu selected, press the [◇] switch and display the initial screen of the sub menu (Fig. 2).
- [◇] switch: Execute the menu



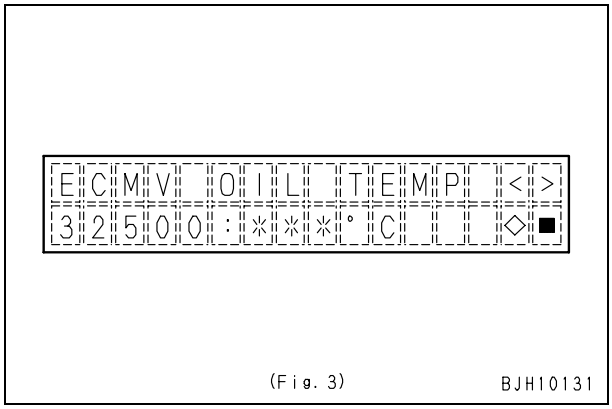
3) Operate the switch [<], [>], and align to the real time monitor selection screen of the transmission controller.



4) When the [◇] switch is pressed and set, the real time monitor application program version of the transmission controller is displayed.



5) Start the engine.
6) Refer to the 10. Real time monitoring function, and display “ECMV oil temperature“ (Fig.3).
- **TRANSMISSION** No. 8



7) Operate the torque converter stall, and raise the ECMV oil temperature up to 60 – 70°C.
★ Refer to the Measuring torque converter stall speed.
8) Keep it in low idle for 3 minutes, and confirm that the ECMV oil temperature is stable between 60 – 70°C, then carry out the adjustment.

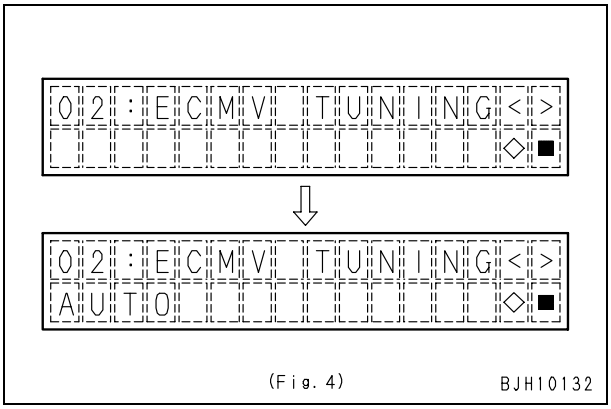
Transmission ECMV current adjustment procedure

★ Correcting objects are HIG, LOW, REV, 1ST, 2ND and 3RD, and when started the correction of all the above clutches will be automatically carried out.
★ Refer to “preparatory work“, and confirm the ECMV oil temperature is at the specified temperature.
★ Adjusting operation is automatically carried out for the Lo, Hi, R, 1st, 2nd, and 3rd valve, 4 times each.

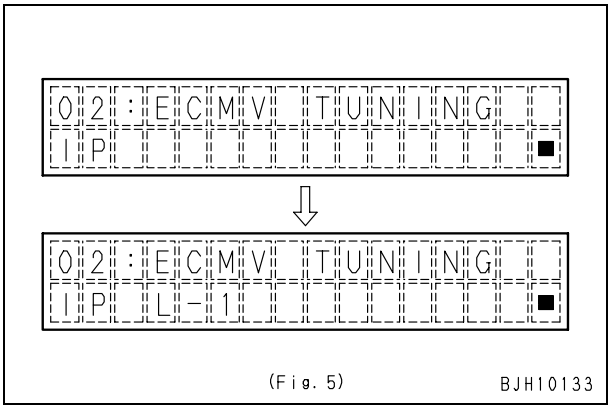
1) Turn the starting switch on, and set the machine to next condition.
- Parking brake switch: ON
- AISS LOW switch: LOW (low speed)
- Gear shift lever: N position
- Engine: Low idle
- Accelerator pedal: OFF (Release)

2) Operate the machine monitor, and display the adjustment menu screen (Fig.4).
- Adjustment menu: 02:
ECMV TUNING AUTO

3) When the [◇] switch is pressed to confirm the adjustment check item, the screen changes to automatic compensation or manual compensation selection screen, select the automatic compensation (screen below).



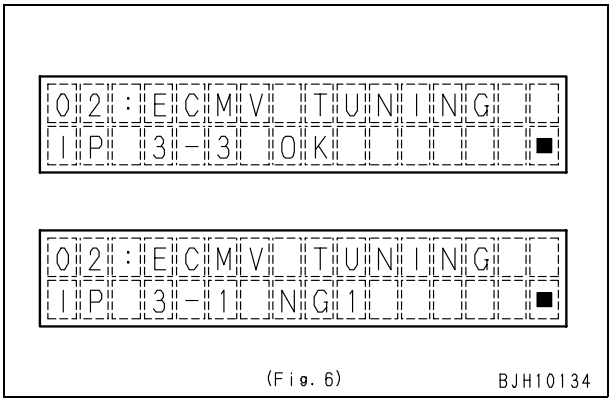
4) Re-confirm the machine condition, and press the [◇] switch which starts the adjustment, then the screen changes to IP ··· (Fig.5).
- [◇] switch: Execute the adjustment menu



★ Adjustments should be carried out continuously for 4 times to each objective clutch, and display the screen as shown in the below table.

No.	Valve	1st time	2nd time	3rd time	4th time
1	Lo	IP L-1	IP L-2	IP L-3	IP L-4
2	Hi	IP H-1	IP H-2	IP H-3	IP H-4
3	R	IP R-1	IP R-2	IP R-3	IP R-4
4	1st	IP 1-1	IP 1-2	IP 1-3	IP 1-4
5	2nd	IP 2-1	IP 2-2	IP 2-3	IP 2-4
6	3rd	IP 3-1	IP 3-2	IP 3-3	IP 3-4

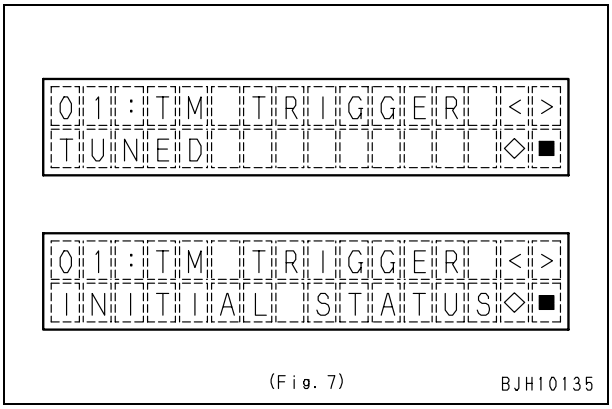
★ Normal and abnormal results are displayed for each adjustment, and correct following the display (Fig. 6).
- If “3-3 OK“ is displayed:
  Adjustment is done without error.
  (Adjustment value is recorded to the controller when turning off the starting switch.)
- If “NG1“ is displayed (out of correction condition):
  Adjust the ECMV oil temperature exactly, and confirm the machine setting condition again, then carry out from the procedure 1).
- If “NG2“is displayed (without fill):
  Carry out troubleshooting of failure code **[15S□MA] [DDT□KA]** and if the condition is confirmed to be normal, then start again from procedure 1).
- If “NG3“ is displayed (compensation value over):
  Carry out troubleshooting of failure code **[15S□L1]** and if the condition is confirmed to be normal, then start again from procedure 1).



Resetting and implementing learning of the transmission initial learning (2-2)

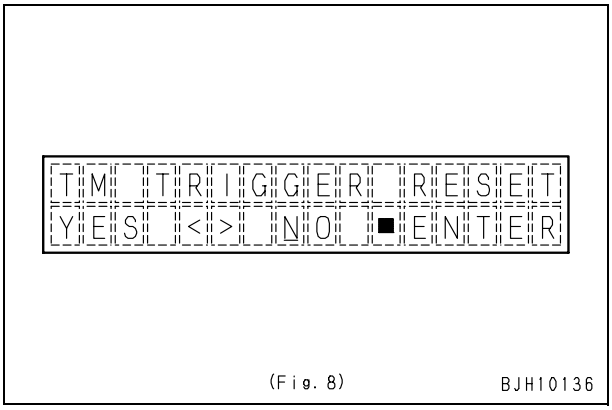
Resetting the stabilization of gear shifting feel learning data

1) Operate the machine monitor, then display the initialization menu screen from the service mode (Fig.7).
   - Initialization menu:**01: TM TRIGGER**
   - ★ Present initialization condition is displayed on lower screen.
     - Initialization is done: **INITIAL STATUS**
     - Initialization is not done: **TUNED**
   - ★ At the transmission adjustment, learning data is initialized by the next operation regardless of present initialization condition.
2) Press the [◇] switch on this screen and display the initialization operation screen (Fig. 7).
   - [◇] switch: Execute the initialization menu



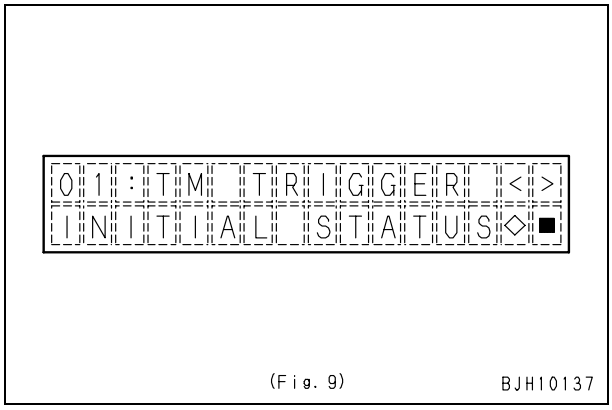
(Fig. 7) BJH10135

3) Carry out the switch operation following the display (Fig. 8).
   - [<] switch: Select YES
   - [>] switch: Select NO
   - [■] switch: Execute



(Fig. 8) BJH10136

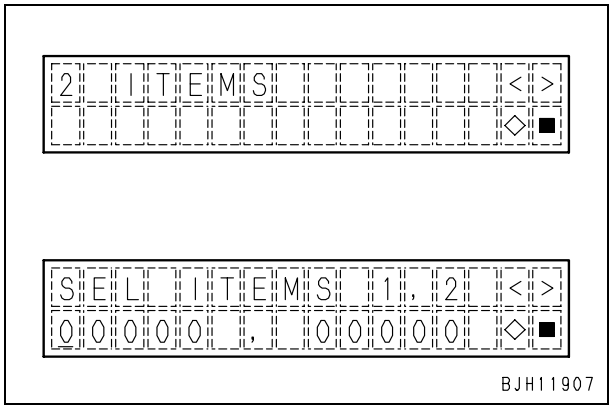
★ Confirm the initialization is completed display on lower screen after initialization.
   - Initialization is done: **INITIAL STATUS**



(Fig. 9) BJH10137

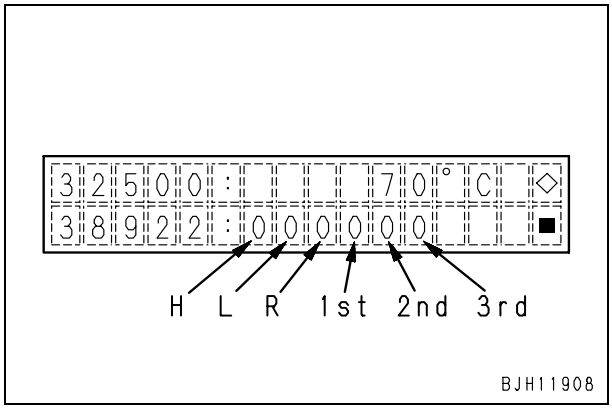
Beforehand preparation for transmission initial learning

★ Align 2 item display selection screen (upper screen) by [<], [>] switch operation from the real time monitor screen, press [◇] switch then input the monitoring code of the transmission control oil temperature and the trigger learning display.



BJH11907

Press the switch [◇] to determine 2 items display.

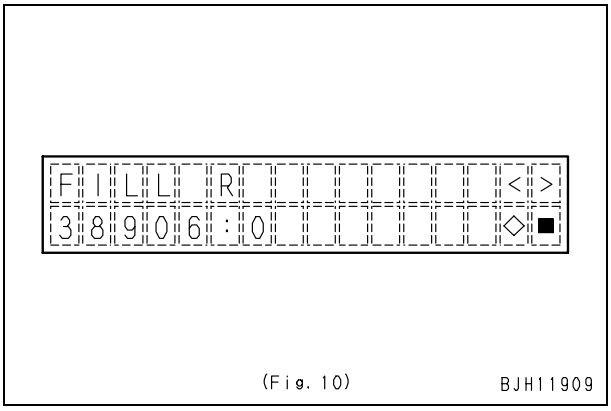


BJH11908

Initial learning of gear shift feel stabilization

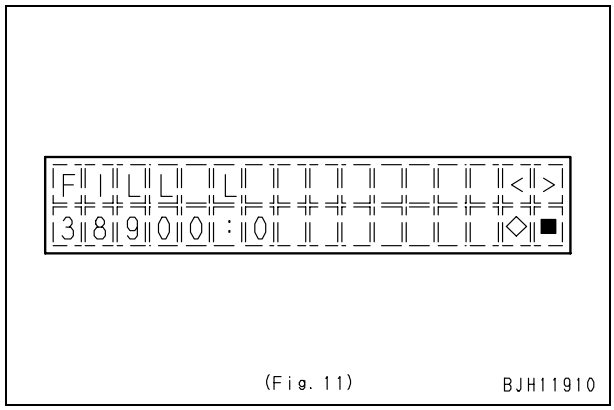
⚠ **Adjustment should be carried out in an area with sufficient traveling space, and pay attention to the surroundings for safety.**

1) Display the “R clutch fill condition“ by the real time monitoring function (Fig. 10).
   - **TRANSMISSION** No. 47

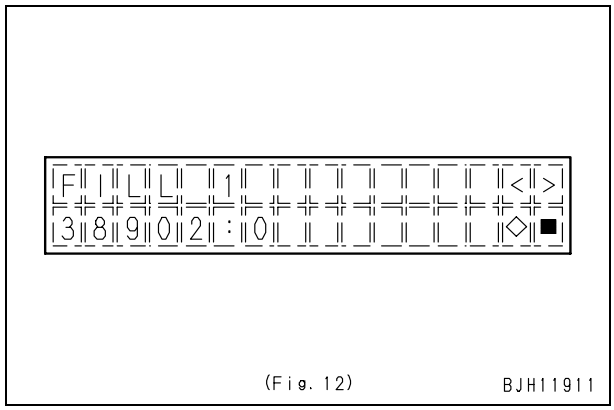


(Fig. 10) BJH11909

2) Keep the gear shift lever at N position for 10 seconds at the low idle, then operate the gear shift lever as follows.
   ★ Gear shift lever operation: N → R1 → N
3) Confirm the fill condition by the monitoring display
   ★ Move on to the next step if the display is “0“.
   ★ If the display is “1“, repeat procedure 2) until it becomes “0“.
4) Travel with the gear shift lever at D position, then shift up from F2 – F4.
   ★ Shift up: F2 → F3 → F4
   ★ Be careful not to shift up to F5.
   When shifted up to F5, redo from F2.
5) Release the accelerator pedal after traveling for 10 seconds at F4, then shift down from F4 – F2 at coasting traveling.
   ★ Shift down: F4 → F3 → F2
   ★ Do not operate the brake during the coasting travel.
6) Display both “Lo clutch fill condition“ and “1st clutch fill condition“ by the vehicle information monitoring function, then confirm the fill condition (Fig. 11. 12).
   - Lo clutch: **TRANSMISSION** No. 42
   - Hi clutch: **TRANSMISSION** No. 44
   ★ Correction is completed, if the display is “0“.
   ★ If the display is “1“, repeat procedures 4) and 5) until both becomes “0“.



(Fig. 11) BJH11910

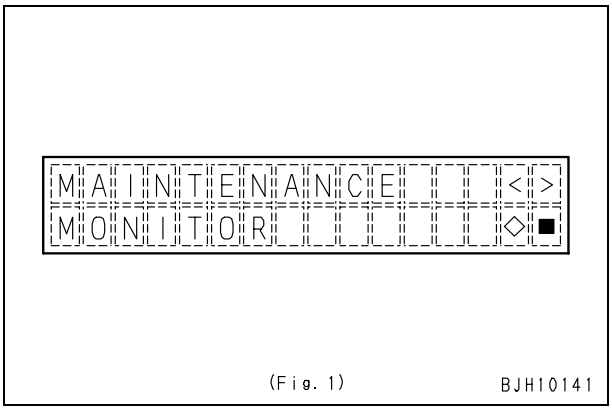


(Fig. 12) BJH11911

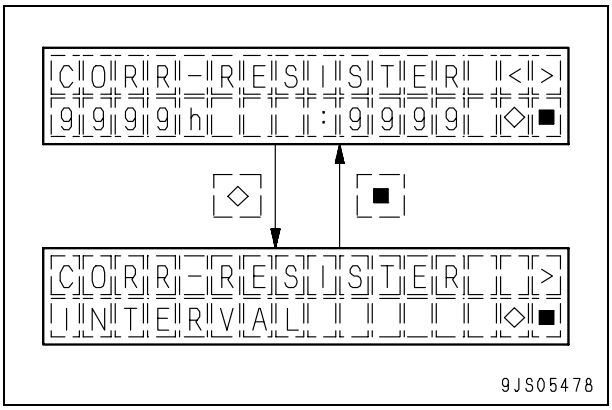
Off setting of maintenance function for corrosion resistor (1-3)

Turn off the maintenance function of corrosion resistor for the machine not installed with corrosion resistor.

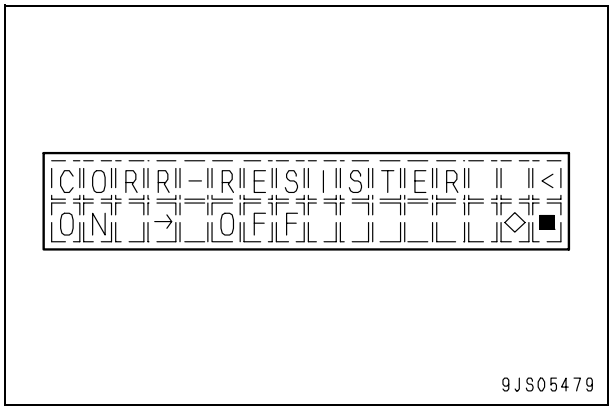
1) Menu selection
   Select maintenance function on service mode menu screen.
- Maintenance check item No.1 screen is displayed if [◇] switch is pressed.



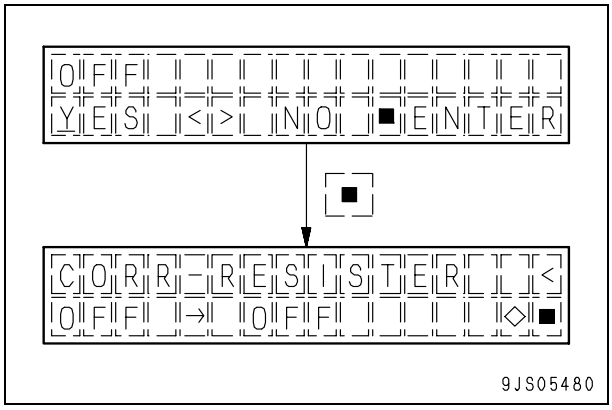
2) Press the [◇] switch then select the corrosion resistor check item.
3) Press the [◇] switch then display the maintenance interval change screen.



4) Press the [>] switch then display the by item timer deactivation/activation selection screen.

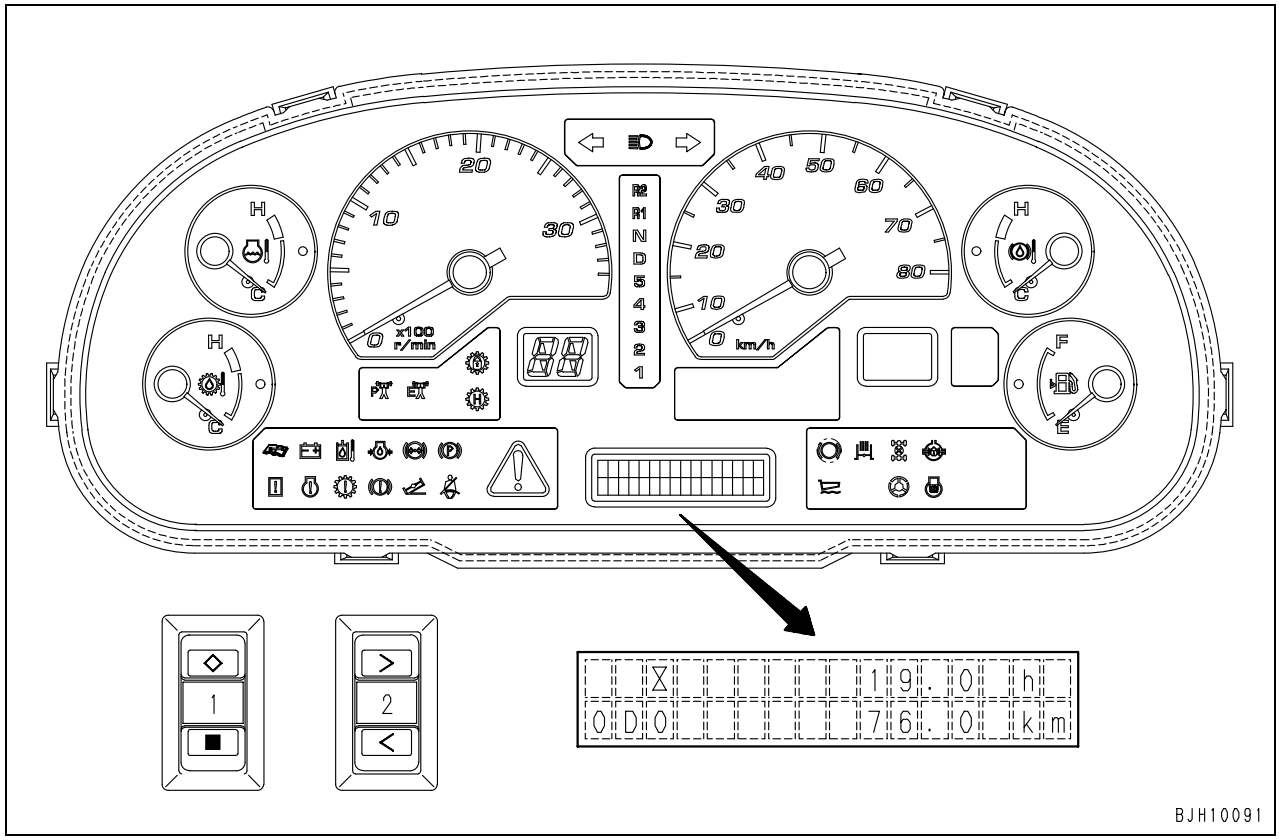


5) If [◇] switch is pressed on the selection screen of the by item timer deactivation, the display will become YES / NO, press the [<] switch to then move the cursor to YES, and press [■]switch.



6) Press [■] switch 3 times to return to the normal screen.

Special function of machine monitor (EMMS)



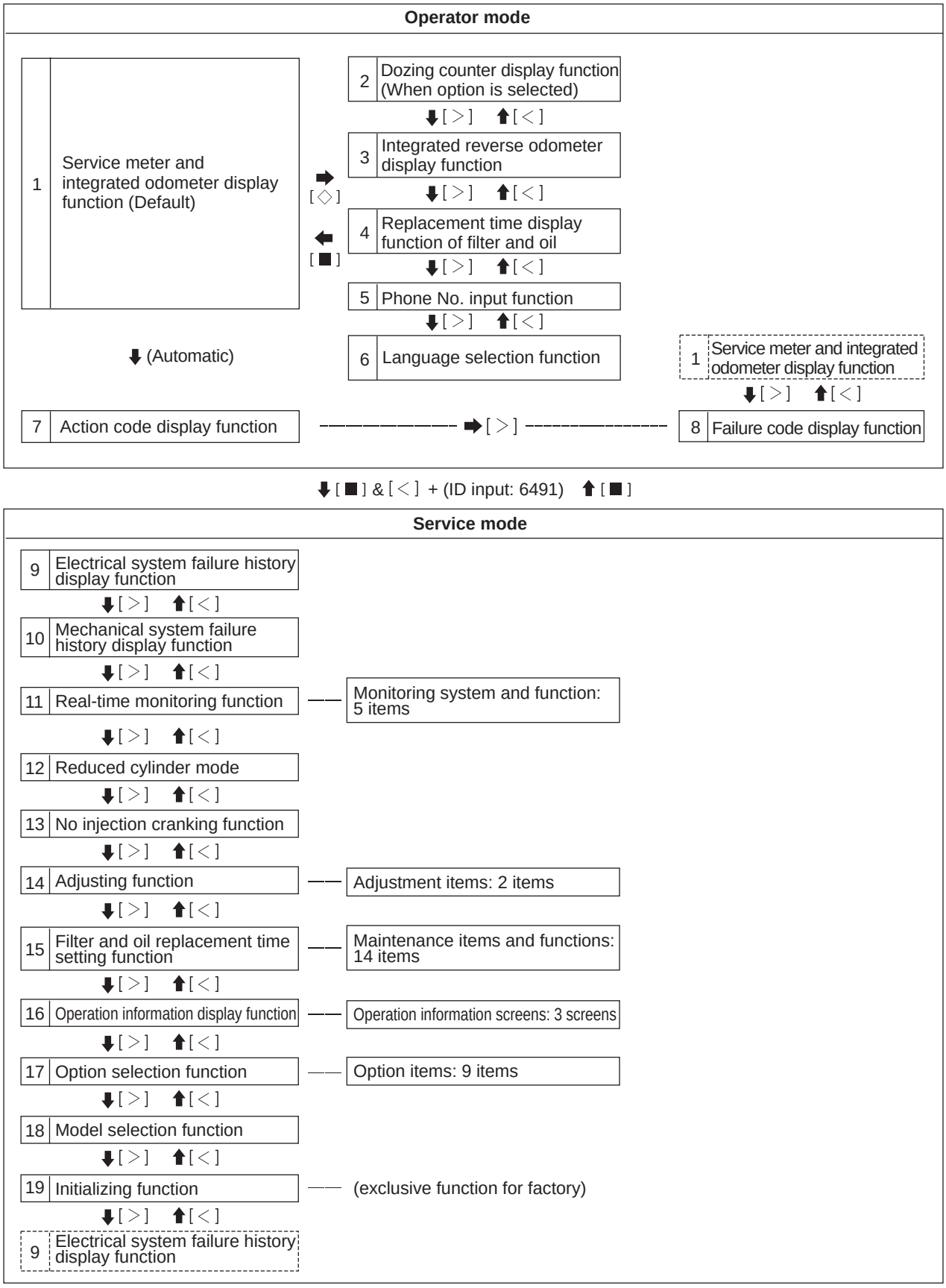
Normal function and special function of machine monitor (EMMS)

The machine monitor (EMMS) is equipped with normal and special functions, and displays various types of information to the character display at the center of the monitor section.
Some items are displayed automatically according to the internal setting of the machine monitor, and some are displayed according to the operation of the machine monitor switches.

1) Normal function: Operator mode
   With this function, an operator can view and change the items displayed normally or displayed by the operation of the switches.
2) Special function: Service mode
   With this function, a serviceman can display and change the displayed items by the specified switching operation for testing, adjusting and troubleshooting.

Operator mode			Service mode	
1	Replacement time display function of filter and oil		7	Electrical system failure history display function
2	Phone No. input function		8	Mechanical system failure history display function
3	Language selection function	↔	9	Real-time monitoring function
4	Action code display function		10	Reduced cylinder mode
5	Failure code display function		11	No injection cranking
6	Operation information display function		12	Filter and oil replacement time setting function

Function and flow of each mode



Operator mode

★ No. 2 – No. 6 is displayed endlessly by following the switch operation.
★ When a failure occurs, the screen changes automatically to No. 7 regardless of the displayed screen.
★ If the switch is not operated for over 30 seconds regardless of the display screen, the screen automatically;
  - Changes to No. 1. (If malfunction has not occurred.)
  - Changes to No. 7. (If malfunction has occurred.)
★ After moving from No. 8 to No. 1 by the switch operation, if no switch operation is performed for longer than 10 seconds, then it automatically moves to No. 7.

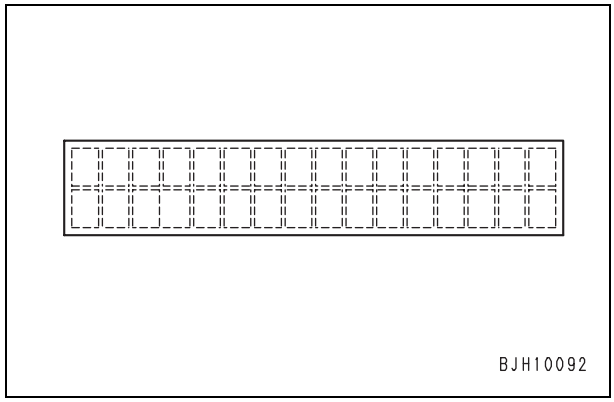
Service mode

★ No. 9 – No. 19 is displayed endlessly by following the switch operation.
★ By inputting and determining the ID once, it will be effective until the starting switch is turned off.

Character display portion

16 characters can be displayed on each upper and lower row of the character display section, and depending on the contents displays the combination of the next figures, letters, and symbols.

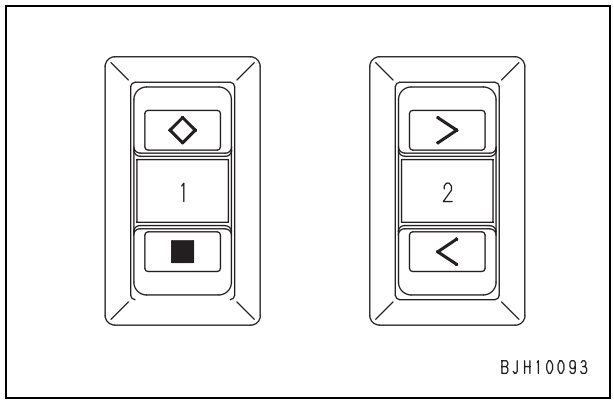
1) Arabic numbers: 1, 2, 3, . . .
2) Small letters: a, b, c, . . .
3) Capital letters: A, B, C, . . .
4) Katakana: A, I, U, . . . (Only for Japanese display)
5) Symbols: @, ?, $, . . .
6) Special letters:



Control switch section

All the display operation of the machine monitor is operated by the machine monitor mode selector switches (1) and (2).
Each switch of [◇], [■], [>], [<] is assigned to the following function.

1) ◇: Determine and execute
2) ■ : To cancel, release, and determine (only YES and NO screen)
3) > : To right, to next, to proceed, to increase (only when inputting Arabic numbers)
4) < : To left, to previous, to return, to decrease (only when inputting Arabic numbers)

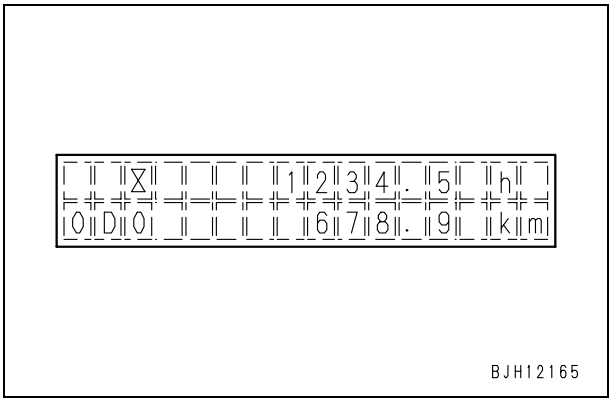


■ Operator mode (Outline)

1. Service meter and integrated odometer display function

When turning the starting switch ON, the speed meter and integrated odometer are displayed in the upper and lower row respectively.

★ For details, see operation manual.



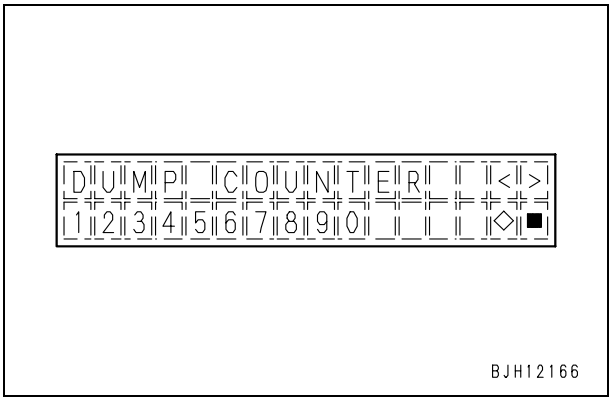
BJH12165

2. Dozing counter display function (When option is selected)

Display the dozing counter by operating the machine monitor switch.

★ Dozing counter is displayed only when the option selection is set to be effective in the service mode.

★ For details, see operation manual.

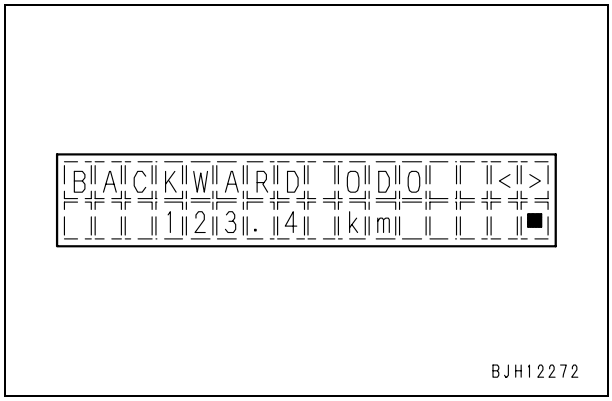


BJH12166

3. Integrated reverse odometer display function

Machine monitor displays the integrated reverse odometer by operating the switch.

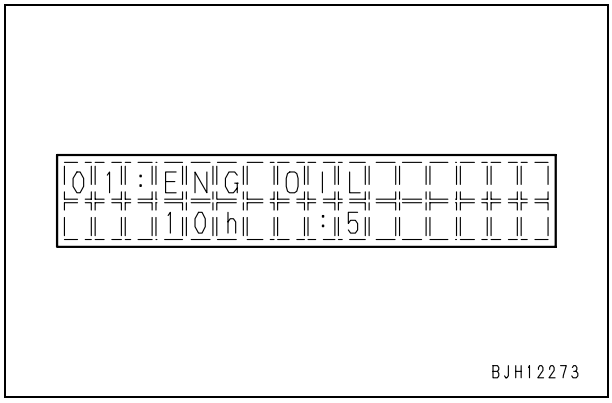
★ For details, see operation manual.



BJH12272

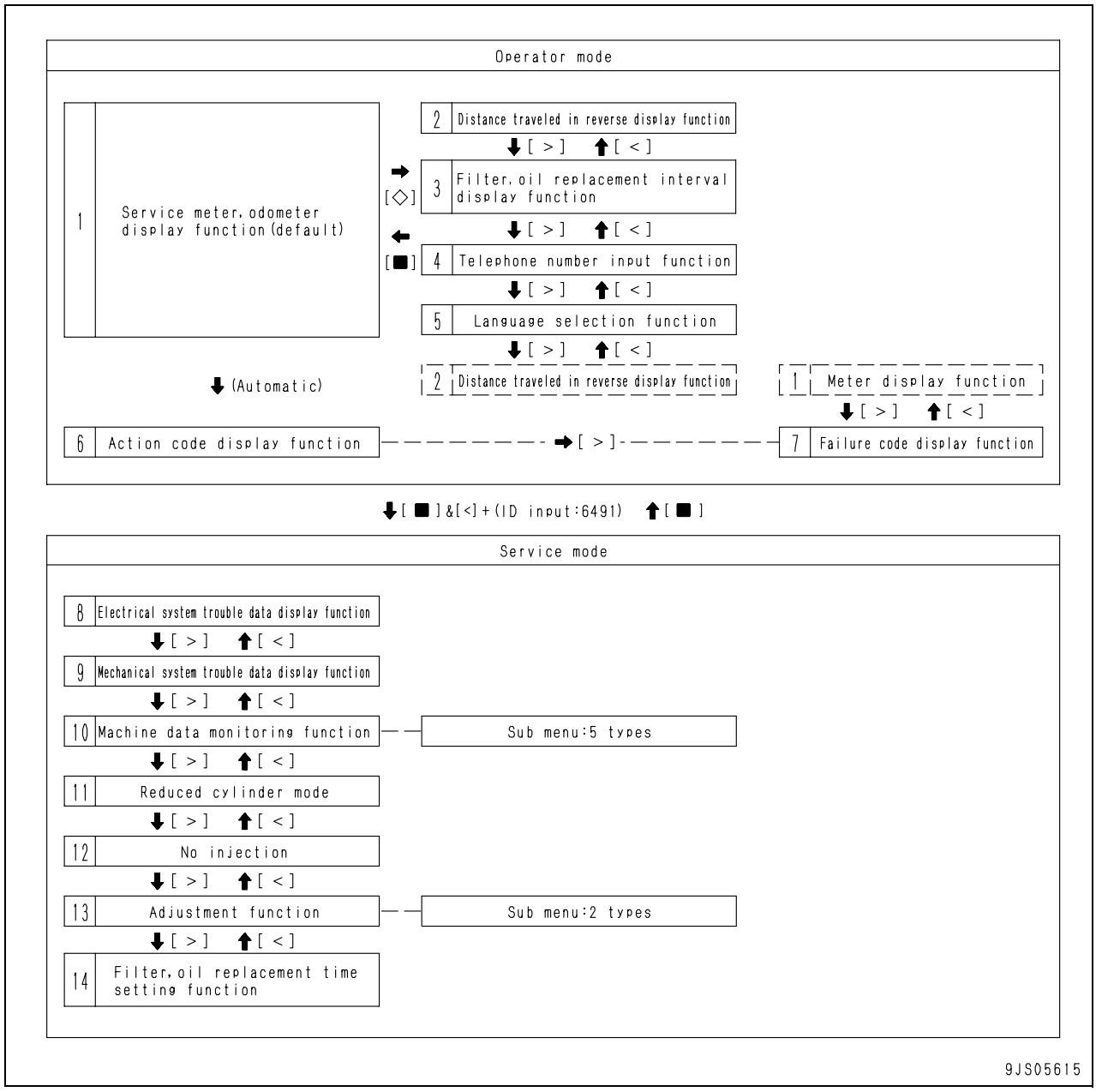
4. Filter and oil replacement time display function

1) Replacement time display of filter and oil (displayed automatically)
When the replacement interval for the various filters or oils approaches, the machine monitor automatically displays the information to remind an operator of maintenance.

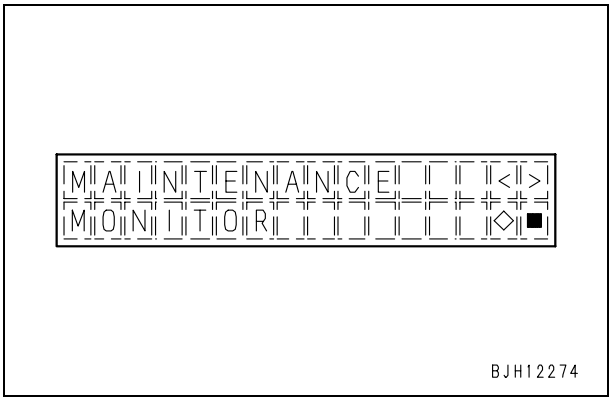


BJH12273

Flow of each mode and function

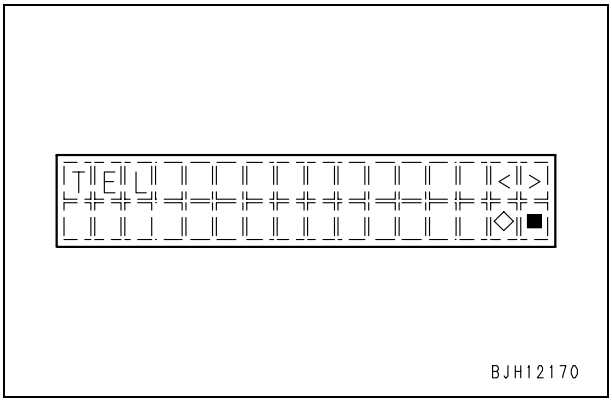


2) Reset of replacement time (selection menu)
The machine monitor can reset the interval time by operating the switch, if various filters and oils maintenances are finished.
★ For details, see operation manual.
★ Replacement interval time setting can be operated by the filter and oil replacement time setting function in the service mode.



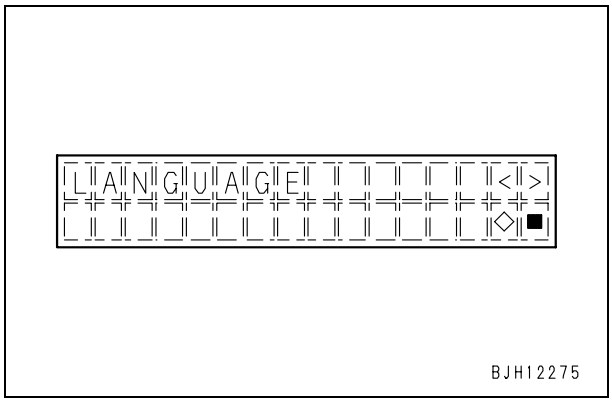
5. Phone No. input function

Phone No. set in the machine monitor can be inputted, corrected, and released by the switch operation.
★ Phone No. is displayed together with "CALL" when action code "E03" is displayed.
★ For details, see operation manual.



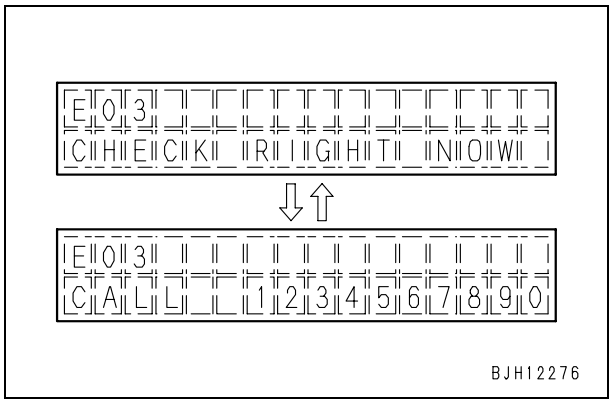
6. Language selection function

Display language of the machine monitor can be selected with the switch operation.
★ The Service mode function is not included in the display selection function, therefore always displayed in English.
★ For details, see operation manual.



7. Action code display function

When abnormal situations occur, the machine monitor automatically displays the action code depending on the extent of the abnormality in order to remind the operator of proper remedy.
★ Below figure shows the example of displaying action code "E03" and "CALL + phone No." alternately.
★ "CALL + phone No." is not displayed if the action code "E01" or "E02" is displayed.



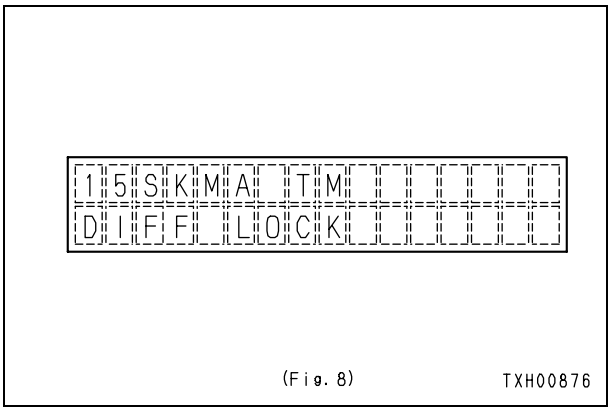
★ Action code and remedy requested for an operator

Action code	CALL + phone No.	Remedy requested for an operator
E01	None	• Test and maintenance when operation is finished or when the operator rotates.
E02	None	• If related to an over run is displayed: Travel keeping the engine speed and machine speed down. • If related to an overheat is displayed: Stop the machine and keep the engine with no-load medium speed running.
E03	Yes	• Stop the engine and machine immediately and contact the service personnel.

8. Failure code display function

By pressing the [>] switch once when action code is displayed on the machine monitor, present failure code is displayed (Fig. 8: example).

- [>] switch: Display failure code.



(Fig. 8) TXH00876

★ The failure codes which have been detected in the past are separated into electrical and mechanical systems and recorded as failure history (refer to service mode for a detail).

★ If there are more than one, other failure codes are displayed by pressing the [>] switch.

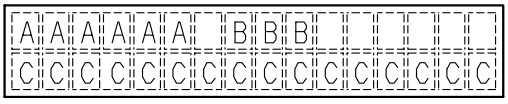
★ [After displaying all the failure codes by pressing the [>] switch, press [>] switch again to return to the service meter and travel distance integrating meter screen.
Press the [>] switch again, and the failure code is displayed from the beginning.
Also, if it is not operated for over 10 seconds, it automatically change to the action code display screen.

★ The following information is displayed in the service code display function (Fig. 9).
A: Failure code
(4 digits of a section code + 2 digits of a symptom code)
B: Controller code
(**MON**: Machine monitor)
(**ENG**: Engine controller)
(**TM**: Transmission controller)
(**BK**: Retarder controller)
C: Trouble occurring system

★ Refer to “Failure code table“ for details of displayed failure codes.

★ Be cautious of the partial difference in the displayed information for the failure code display function and the failure history display function (service mode).

★ Leaving the failure code display screen without any switch operation for over 30 seconds, it automatically returns to the action code display screen.



(Fig. 9) BJH10102

Failure code table

Failure codes	Failure contents	Applicable equipments	Action code	History classification
1500L0	Detecting dual engagement	TM	E03	Mechanical system
15B0NX	Transmission oil filter clogging	TM	E01	Mechanical system
15F0KM	R → F gear shift abuse 1	TM	–	Mechanical system
15F0MB	R → F gear shift abuse 2	TM	–	Mechanical system
15F7KM	Transmission forward clutch abuse	TM	–	Mechanical system
15G0MW	R clutch system failure (Slip is detected)	TM	E03	Electrical system
15G7KM	Transmission reverse clutch abuse	TM	–	Mechanical system
15H0MW	Hi clutch system failure (Slip is detected.)	TM	E03	Electrical system
15J0MW	Lo clutch system failure (Slip is detected.)	TM	E03	Electrical system
15K0MW	1st clutch system failure (Slip is detected.)	TM	E03	Electrical system
15L0MW	2nd clutch system failure (Slip is detected.)	TM	E03	Electrical system
15M0MW	3rd clutch system failure (Slip is detected.)	TM	E03	Electrical system
15SBL1	R clutch pressure control valve failure Ⅰ	TM	E03	Electrical system
15SBMA	R clutch pressure control valve failure Ⅱ	TM	E03	Electrical system
15SCL1	Hi clutch pressure control valve failure Ⅰ	TM	E03	Electrical system
15SCMA	Hi clutch pressure control valve failure Ⅱ	TM	E03	Electrical system
15SDL1	Lo clutch pressure control valve failure Ⅰ	TM	E03	Electrical system
15SDMA	Lo clutch pressure control valve failure Ⅱ	TM	E03	Electrical system
15SEL1	1st clutch pressure control valve failure Ⅰ	TM	E03	Electrical system
15SEMA	1st clutch pressure control valve failure Ⅱ	TM	E03	Electrical system
15SFL1	2nd clutch pressure control valve failure Ⅰ	TM	E03	Electrical system
15SFMA	2nd clutch pressure control valve failure Ⅱ	TM	E03	Electrical system
15SGL1	3rd clutch pressure control valve failure Ⅰ	TM	E03	Electrical system
15SGMA	3rd clutch pressure control valve failure Ⅱ	TM	E03	Electrical system
15SJMA	Lockup clutch pressure control valve failure Ⅱ	TM	E03	Electrical system
15SKMA	Inter axle differential lock-up clutch pressure control valve failure Ⅱ	TM	E01	Electrical system
2F00KM	Dragging of parking brake	TM	–	Mechanical system
2G42ZG	Decrease of accumulator oil pressure (Front)	BK	E03	Mechanical system
2G43ZG	Decrease of accumulator oil pressure (Rear)	BK	E03	Mechanical system
(989A00)	Engine over run prevention activated	MON	E02	–
989D00	Rear section tipping over alarm (Rising operation on slope)	MON	–	–
AA10NX	Clogged air cleaner	MON	E01	Mechanical system
AB00MA	Failure of battery charge circuit	TM	E03	Electrical system
B@BAZG	Engine oil pressure is too low.	ENG	E03	Mechanical system
B@BAZK	Engine oil level is too low.	TM	E01	Mechanical system
B@BCNS	Engine overheat	ENG	E02	Mechanical system
B@BCZK	Coolant level is too low.	MON	E01	Mechanical system
B@BFZK	Lowering of fuel level	MON	–	–
B@C6NS	Overheat of brake cooling oil temperature (Front)	MON	E02	Mechanical system
B@C8NS	Overheat of brake cooling oil temperature (Center)	MON	E02	Mechanical system
B@CENS	Overheat of torque converter fluid temperature	MON	E02	Mechanical system
B@HAZK	(Hydraulic tank oil: Level too low)	MON	E01	Mechanical system
B@JANS	Overheat of steering oil temperature	TM	E02	Mechanical system

Failure codes	Failure contents	Applicable equipments	Action code	History classification
CA111	Abnormality in engine controller	ENG	E03	Electrical system
CA115	Abnormal engine Ne and Bkup speed sensors	ENG	E03	Electrical system
CA122	Charge pressure sensor too high	ENG	E03	Electrical system
CA123	Charge pressure sensor too low	ENG	E03	Electrical system
CA131	Throttle sensor tool high	ENG	E03	Electrical system
CA132	Throttle sensor too low	ENG	E03	Electrical system
CA135	Engine oil pressure sensor too high	ENG	E01	Electrical system
CA141	Engine oil pressure sensor too low	ENG	E01	Electrical system
CA144	Coolant temperature sensor too high	ENG	E01	Electrical system
CA145	Coolant temperature sensor too low	ENG	E01	Electrical system
CA153	Charge temperature sensor too high	ENG	E01	Electrical system
CA154	Charge temperature sensor too low	ENG	E01	Electrical system
CA187	Sensor power source 2 too low	ENG	E03	Electrical system
CA221	Atmospheric pressure sensor too high	ENG	E01	Electrical system
CA222	Atmospheric pressure sensor too low	ENG	E01	Electrical system
CA227	Sensor power source 2 too high	ENG	E03	Electrical system
CA234	Engine overspeed	ENG	E02	Mechanical system
CA238	Abnormal power source for Ne speed sensor	ENG	E03	Electrical system
CA263	Fuel temperature sensor too high	ENG	E01	Electrical system
CA265	Fuel temperature sensor too low	ENG	E01	Electrical system
CA271	PCV1 short circuit	ENG	E03	Electrical system
CA272	PCV1 disconnection	ENG	E03	Electrical system
CA273	PCV2 short circuit	ENG	E03	Electrical system
CA274	PCV2 disconnection	ENG	E03	Electrical system
CA322	Disconnection or short circuit in injector #1 (L #1)	ENG	E03	Electrical system
CA323	Disconnection or short circuit in injector #5 (L #5)	ENG	E03	Electrical system
CA324	Disconnection or short circuit in injector #3 (L #3)	ENG	E03	Electrical system
CA325	Disconnection or short circuit in injector #6 (L #6)	ENG	E03	Electrical system
CA331	Disconnection or short circuit in injector #2 (L #2)	ENG	E03	Electrical system
CA332	Disconnection or short circuit in injector #4 (L #4)	ENG	E03	Electrical system
CA342	Abnormal engine controller data consistency	ENG	E03	Electrical system
CA351	Abnormal injector drive circuit	ENG	E03	Electrical system
CA352	Sensor power source 1 too low	ENG	E03	Electrical system
CA386	Sensor power source 1 too high	ENG	E03	Electrical system
CA431	Abnormal idle validation switch	ENG	E01	Electrical system
CA432	Abnormal process with idle validation	ENG	E03	Electrical system
CA441	Power source voltage too low	ENG	E03	Electrical system
CA442	Power source voltage too high	ENG	E03	Electrical system
CA449	Common rail pressure too high 2	ENG	E03	Electrical system
CA451	Common rail pressure sensor too high	ENG	E03	Electrical system
CA452	Common rail pressure sensor too low	ENG	E03	Electrical system
CA553	Common rail pressure too high 1	ENG	E03	Electrical system
CA554	Common rail pressure sensor: in range error	ENG	E03	Electrical system
CA559	Loss of pressure feed from supply pump 1	ENG	E03	Electrical system

Failure codes	Failure contents	Applicable equipments	Action code	History classification
CA689	Abnormal engine Ne speed sensor	ENG	E03	Electrical system
CA731	Abnormal engine Bkup speed sensor phase	ENG	E03	Electrical system
CA757	Loss of all engine controller data	ENG	E03	Electrical system
CA778	Abnormal engine Bkup speed sensor	ENG	E03	Electrical system
CA1117	Loss of partial data in engine controller	ENG	E03	Electrical system
CA1228	Abnormal EGR valve servo 1	ENG	E03	Electrical system
CA1625	Abnormal EGR valve servo 2	ENG	E03	Electrical system
CA1626	Short circuit of bypass valve solenoid drive	ENG	E03	Electrical system
CA1627	Disconnection in bypass valve solenoid drive	ENG	E03	Electrical system
CA1628	Abnormal bypass valve servo 1	ENG	E03	Electrical system
CA1629	Abnormal bypass valve servo 2	ENG	E03	Electrical system
CA1631	Bypass valve lift sensor too high	ENG	E03	Electrical system
CA1632	Bypass valve lift sensor too low	ENG	E03	Electrical system
CA1633	Abnormal KOMNET	ENG	E03	Electrical system
CA1642	EGR inlet pressure sensor too low	ENG	E01	Electrical system
CA1653	EGR inlet pressure sensor too high	ENG	E01	Electrical system
CA2185	Throttle sensor power source too high	ENG	E03	Electrical system
CA2186	Throttle sensor power source too low	ENG	E03	Electrical system
CA2249	Loss of pressure feed from supply pump 2	ENG	E03	Electrical system
CA2271	EGR valve lift sensor too high	ENG	E03	Electrical system
CA2272	EGR valve lift sensor too low	ENG	E03	Electrical system
CA2351	EGR valve solenoid drive short circuit	ENG	E03	Electrical system
CA2352	EGR valve solenoid drive disconnection	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
DAF9KM	Wrong connection of connector	MON	E03	Electrical system
DAFRKR	Abnormal CAN communication (machine monitor)	TM	E03	Electrical system
DAQ0KK	Power source voltage too low	TM	E03	Electrical system
DAQ0KT	Abnormal non volatile memory	TM	E01	Electrical system
DAQ2KK	Solenoid power supply system failure	TM	E03	Electrical system
(DAQ9KQ)	Inconsistent model selection (Transmission controller)	MON	E03	–
DAQRKR	Abnormal CAN communication (Transmission controller)	MON	E03	Electrical system
(DAQRMA)	Inconsistent option setting (Transmission controller)	MON	E03	–
DB10KT	Abnormal non volatile memory	BK	E03	Electrical system
DB12KK	Solenoid power supply system failure	BK	E03	Electrical system
DB13KK	Battery direct power supply too low	BK	E03	Electrical system
(DB19KQ)	Inconsistent model selection (Retarder controller)	MON	E03	–
(DB1QMA)	Inconsistent option setting (Retarder controller)	MON	E03	–
DB1RKR	Abnormal CAN communication (Retarder controller)	TM	E03	Electrical system
DB2RKR	Abnormal CAN communication (engine controller)	TM	E03	Electrical system
DD1ML4	Inconsistent signal of axle connected retarder switch	TM	E01	Electrical system
DDTHKA	Failure of flow detection valve for Hi clutch	TM	E03	Electrical system
DDTJKA	Failure of flow detection valve for Lo clutch	TM	E03	Electrical system
DDTKKA	Failure of flow detection valve for 1st clutch	TM	E03	Electrical system

Failure codes	Failure contents	Applicable equipments	Action code	History classification
DDTLKA	Failure of flow detection valve for 2nd clutch	TM	E03	Electrical system
DDTMKA	Failure of flow detection valve for 3rd clutch	TM	E03	Electrical system
DDTNKA	Failure of flow detection valve for R clutch	TM	E03	Electrical system
DF10KA	No lever signal input	TM	E03	Electrical system
DF10KB	Multiple lever signal input	TM	E03	Electrical system
DGF1KX	Transmission oil temperature out of range	TM	E03	Electrical system
DGR3KZ	Ground fault of brake oil temperature sensor (center) system	MON	E01	Electrical system
DGR3L8	Disconnection of brake oil temperature sensor (center) system	MON	E01	Electrical system
DGR4KZ	Ground fault of brake oil temperature sensor (front) system	MON	E01	Electrical system
DGR4L8	Disconnection of brake oil temperature sensor (front) system	MON	E01	Electrical system
DGR6KX	Steering oil temperature signal out of range	TM	E01	Electrical system
DGT1KX	Short circuit of torque converter oil temperature sensor system	TM	E01	Electrical system
DHT5KX	Disconnection, ground fault, and short circuit of torque converter fluid pressure sensor system	TM	E01	Electrical system
DHT5L6	Torque converter fluid pressure sensor failure	TM	E01	Electrical system
DHU2KX	Accumulator fluid pressure sensor (front) system failure	BK	E01	Electrical system
DHU3KX	Accumulator fluid pressure sensor (rear) system failure	BK	E01	Electrical system
DJF1KA	Disconnection of fuel level sensor system	MON	E01	Electrical system
DK51L5	Manual retarder potentiometer and RVS failure	BK	E03	Electrical system
DK52KX	Dump lever potentiometer failure 1	TM	E03	Electrical system
DK53L8	Dump lever potentiometer failure 2	TM	E03	Electrical system
DK54KX	Body positioner sensor failure	TM	E03	Electrical system
DKH0KX	Pitch angle sensor signal out of range	TM	E01	Electrical system
DLF1KA	Disconnection of Transmission input shaft speed sensor system	TM	E03	Electrical system
DLF1LC	Transmission input shaft speed sensor failure	TM	E03	Electrical system
DLF2KA	Disconnection of transmission intermediate shaft speed sensor system	TM	E03	Electrical system
DLF2LC	Transmission intermediate shaft speed sensor failure	TM	E03	Electrical system
DLF4KA	Disconnection of transmission differential speed sensor system	TM	E01	Electrical system
DLT3KA	Disconnection of transmission output shaft speed sensor system	TM	E03	Electrical system
DV00KB	Short circuit of buzzer output	MON	E01	Electrical system
DW72KZ	Kick out solenoid output system failure (disconnection or ground fault)	TM	E01	Electrical system
DW73KZ	Dump selector valve output system failure	TM	E03	Electrical system
DW78KZ	Rear wheel BCV command output system failure	BK	E01	Electrical system
DW79KZ	Front wheel BCV command output system failure	BK	E01	Electrical system
DX11K4	Rear wheels electromagnetic proportional pressure reducing valve failure 1	BK	E03	Electrical system
DX11KA	Disconnection of rear wheels electromagnetic proportional pressure reducing valve output system	BK	E03	Electrical system
DX11KB	Ground fault of rear wheels electromagnetic proportional pressure reducing valve output circuit	BK	E03	Electrical system
DX11KY	Hot short of rear wheels electromagnetic proportional pressure reducing valve output circuit	BK	E03	Electrical system
DX11MA	Rear wheels electromagnetic proportional pressure reducing valve failure 2	BK	E03	Electrical system

Failure codes	Failure contents	Applicable equipments	Action code	History classification
DX12K4	Front wheels electromagnetic proportional pressure reducing valve failure 1	BK	E03	Electrical system
DX12KA	Disconnection of rear wheels electromagnetic proportional pressure reducing valve output circuit	BK	E03	Electrical system
DX12KB	Ground fault of front wheels electromagnetic proportional pressure reducing valve output circuit	BK	E03	Electrical system
DX12KY	Hot short circuit of front wheels electromagnetic proportional pressure reducing valve output circuit	BK	E03	Electrical system
DX12MA	Front wheels electromagnetic proportional pressure reducing valve failure 2	BK	E03	Electrical system
DX13KA	Disconnection of Dump EPC valve output circuit	TM	E03	Electrical system
DX13KB	Ground fault of Dump EPC valve output circuit	TM	E03	Electrical system
DX13KY	Hot short circuit of Dump EPC valve output circuit	TM	E03	Electrical system
DXH0KA	Disconnection of inter axle differential lock-up clutch solenoid output circuit	TM	E01	Electrical system
DXH0KB	Ground fault of inter axle differential lock-up clutch solenoid output circuit	TM	E01	Electrical system
DXH0KY	Hot short circuit of inter axle differential lock-up clutch solenoid output circuit	TM	E03	Electrical system
DXH1KA	Disconnection of lockup clutch solenoid output circuit	TM	E03	Electrical system
DXH1KB	Ground fault of lock-up clutch solenoid output circuit	TM	E03	Electrical system
DXH1KY	Hot short circuit of lock-up clutch solenoid output circuit	TM	E03	Electrical system
DXH2KA	Disconnection of Hi clutch solenoid output circuit	TM	E03	Electrical system
DXH2KB	Ground fault of Hi clutch solenoid output circuit	TM	E03	Electrical system
DXH2KY	Hot short circuit of Hi clutch solenoid output circuit	TM	E03	Electrical system
DXH3KA	Disconnection of Lo clutch solenoid output circuit	TM	E03	Electrical system
DXH3KB	Ground fault of Lo clutch solenoid output circuit	TM	E03	Electrical system
DXH3KY	Hot short circuit of Lo clutch solenoid output circuit	TM	E03	Electrical system
DXH4KA	Disconnection of 1st clutch solenoid output circuit	TM	E03	Electrical system
DXH4KB	Ground fault of 1st clutch solenoid output circuit	TM	E03	Electrical system
DXH4KY	Hot short circuit of 1st clutch solenoid output circuit	TM	E03	Electrical system
DXH5KA	Disconnection of 2nd clutch solenoid output circuit	TM	E03	Electrical system
DXH5KB	Ground fault of 2nd clutch solenoid output circuit	TM	E03	Electrical system
DXH5KY	Hot short circuit of 2nd clutch solenoid output circuit	TM	E03	Electrical system
DXH6KA	Disconnection of 3rd clutch solenoid output circuit	TM	E03	Electrical system
DXH6KB	Ground fault of 3rd clutch solenoid output circuit	TM	E03	Electrical system
DXH6KY	Hot short circuit of 3rd clutch solenoid output circuit	TM	E03	Electrical system
DXH7KA	Disconnection of R clutch solenoid output circuit	TM	E03	Electrical system
DXH7KB	Ground fault of R clutch solenoid output circuit	TM	E03	Electrical system
DXH7KY	Hot short circuit of R clutch solenoid output circuit	TM	E03	Electrical system

★ Failure codes:
The failure code table is written in alphabetical order and also starting from small number.
The failure code in parentheses is not recorded in the failure history for both electrical system and mechanical system.

★ Applicable equipment:
Applicable equipment indicates in which controller system the failure has occurred.
MON : Machine monitor system
ENG : Engine controller system
TM : Transmission controller system
BK : Retarder controller system

★ Action codes:
Action codes indicate what is displayed in the operator mode when a failure is detected.

★ History classification:
History classification indicates in which system, either electrical system or mechanical system in the failure history display function, a failure has been recorded.

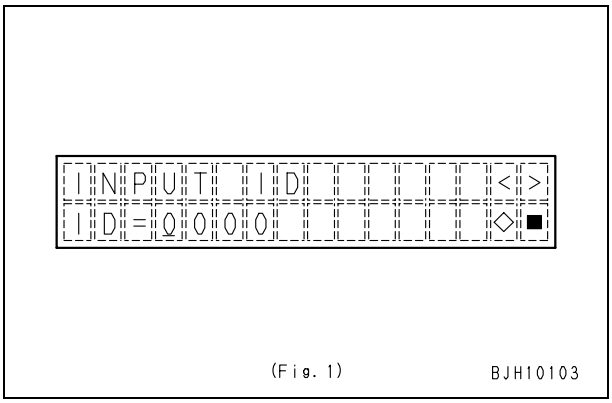
■ Service mode

Procedure for switching to service mode and screen display

★ When using the service mode, change the screen by the following special operation.

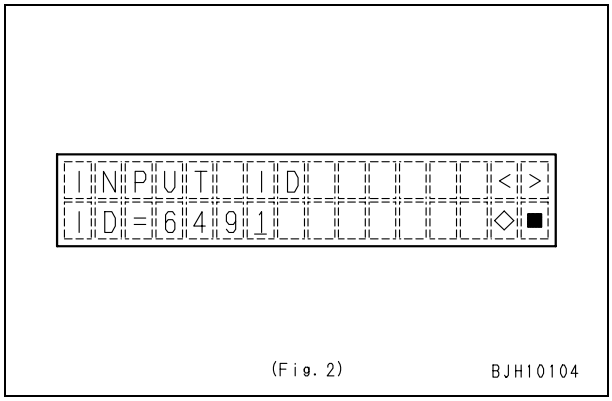
1) Confirming the screen display
Check that the machine monitor is in operator mode and the screen is displaying either of the "service meter and integrated odometer", "action code", or "failure code".

2) Displaying ID input initial screen
Press the following 2 switches at the same time for longer than 5 seconds to display the ID input screen (Fig. 1).
- [■] switch and [<] switch
- ★ If the switch is pressed for longer than 5 seconds, the character display section becomes blank. After confirming this condition, release the switch.



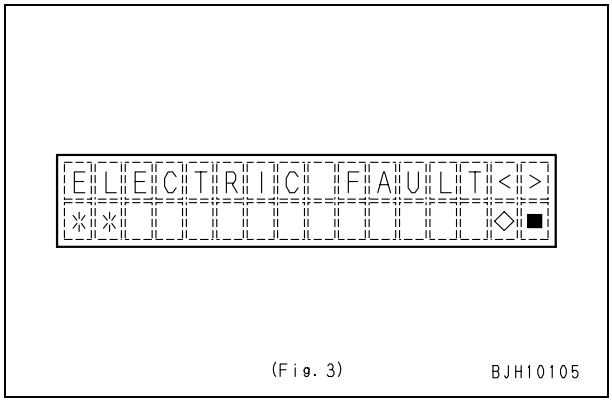
(Fig. 1) BJH10103

3) Input and determination of ID
After displaying ID input screen, operate [>], [<], [◇], and [■] switch and input 4 digits ID (Fig. 2).
- ★ ID: **6491**
- [>]: Number at the cursor increases.
- [<]: Number at the cursor decreases
- [◇]: Number at the cursor is determined
- [■]: Cursor moves to left end or the display returns to operator mode screen.
- ★ If the ID input screen is left without switch operation for longer than 60 seconds, it automatically returns to the operator mode screen.



(Fig. 2) BJH10104

4) Displaying service menu selection screen
After confirming all 4 digits of ID, display the service menu selection screen in the service mode (Fig. 3).
- ★ By inputting and determining the ID once, it will be effective until the starting switch is turned off.



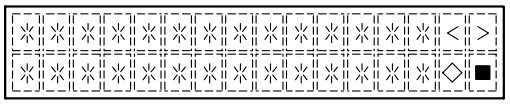
(Fig. 3) BJH10105

5) Selection of the service menu
If the [>] switch or [<] switch is pressed on the service menu selection screen, the service menu is displayed endlessly in the order of the following table, then select the menu that is used (Fig. 4).
- [>]: To proceed to next service menu.
- [<]: To return to previous service menu.

★ Displayed service menu:

No.	Display	Function
1	ELECTRIC FAULT	Electrical system failure history display function
2	MACHINE FAULT	Mechanical system failure history display function
3	REAL-TIME MONITOR	Real-time monitoring function
4	CYLINDER CUT-OUT	Reduced cylinder mode
5	NO INJECTION	No injection cranking function
6	TUNING	Adjusting function
7	MAINTENANCE MONITOR	Filter and oil replacement time setting function
8	OPERATION INFO	Operation information display function
9	OPTIONAL SELECTION	Option selection function
10	MACHINE	Model selection function
11	INITIALIZE	Initialize function (exclusive function for factory)

★ The service menu is displayed in the places marked with [*].



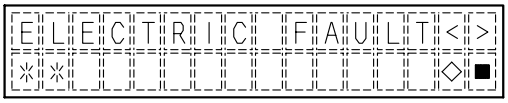
(Fig. 4) BJH10106

6) Finishing mode and function
The current mode and function can be finished by either of the following method, regardless of the current function and hierarchy.
- When continuing operations in another mode or function:
  Press the [■] switch and return to the mode screen to be used or menu screen to be used.
  ★ Note that if the [■] switch is pressed on the YES/NO screen, the function will be executed.
  ★ If you return to the operator mode screen by mistake, repeat the procedure from step 1 above (however there is no need to input the ID again).
- When completing all operations:
  Turn the starting switch OFF.

9. Electrical system failure history display function (ELECTRIC FAULT)

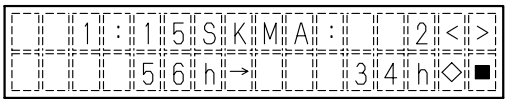
The machine monitor retains the data for problems that occurred in the electrical system in the past as failure history. They can be displayed as follows.

1) Selection of the service menu
Select electrical system failure history display function (ELECTRIC FAULT) in the service menu selection screen (Fig. 1).
★ The total number of failure history data items recorded in memory is displayed in the [* *] portion.



(Fig. 1) BJH10107

2) Failure history data display
With the service menu selected, press the [◇] switch and display the failure history data recorded in memory (Fig. 2: example).
- [◇]: Conduct the service menu.



(Fig. 2) BJH10108

3) Displayed failure history data
With the electrical system failure history display function, the following data can be displayed (Fig. 3).
1: Record number (recorded up to a maximum of 20 items)
A: Failure code (4-digits device code + 2-digits symptom code)
2: Number of occurrences (number of occurrences of same code in the past)
3: Elapsed time 1 (time elapsed on service meter since first occurrence)

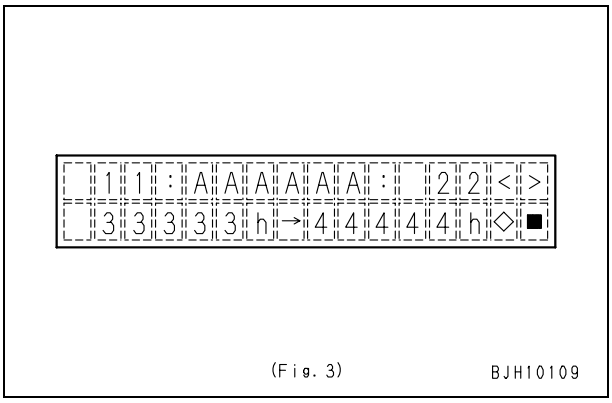
4: Elapsed time 2 (time elapsed on service meter since last occurrence)

★ Failure codes for problems that are still existing are shown on a flashing display.

★ Refer to failure code table of operator mode for details of displayed failure codes.

★ Note that with the failure history display function and failure code display function (operator mode) for the electrical system, the displayed data are partially different.

★ If the fault history is not recorded, "-" is displayed on the display section of **1**/**A**/**2**/**3**/**4**.



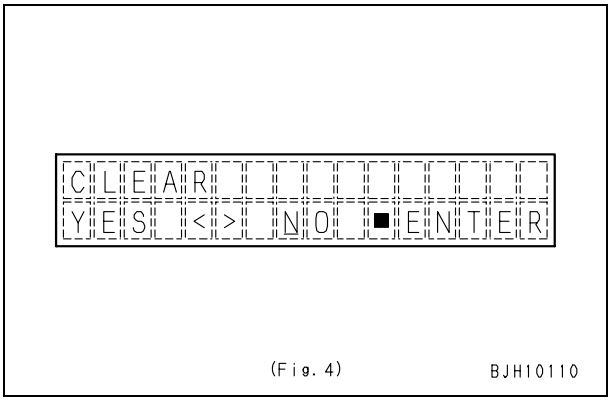
(Fig. 3) BJH10109

4) Switching failure history display
If the [>] switch or [<] switch is pressed during the display of failure history, the display switches to another failure history data recorded.
- [>]: To proceed to data for next record number
- [<]: Go back to data for previous record number

5) Deleting individual failure history data
1] With the failure history data to be deleted displayed, press the [◇] switch and display the individual deletion screen (Fig. 4).
- [◇]: Display the deletion screen

2] When the individual deletion screen is displayed, operate each switch of [<], [>] and [■].
- [<]: Select YES (move cursor)
- [>]: Select NO (move cursor)
- [■]: Execute YES or NO

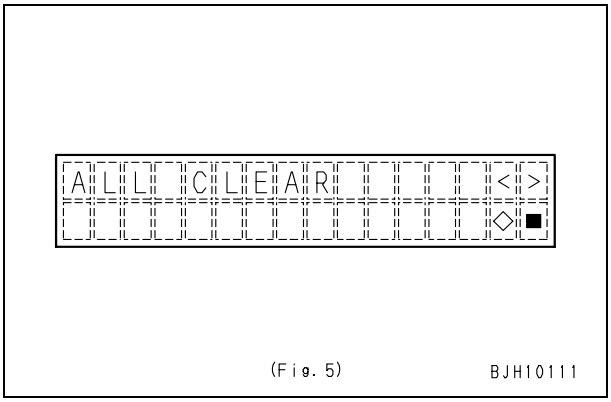
★ An information which is active currently (display is flashing) cannot be deleted.



(Fig. 4) BJH10110

6) Deletion of all the failure history information
1] With the failure history data displayed, press the [>] switch or [<] switch and display ALL CLEAR menu screen (Fig. 5).

★ The ALL CLEAR menu is displayed at the end of failure history data.

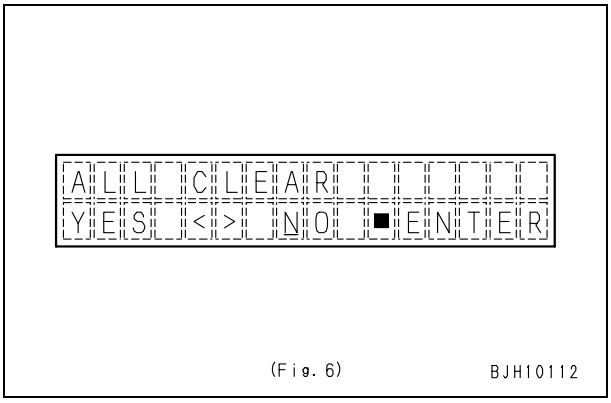


(Fig. 5) BJH10111

2] When the ALL CLEAR menu is displayed, press the [◇] switch and display the ALL CLEAR execution screen (Fig. 6).
- [◇]: Execute ALL CLEAR menu

3] When the ALL CLEAR execution screen is displayed, operate each switch of [<], [>] and [■] (Fig. 6).
- [<]: Select YES (move cursor)
- [>]: Select NO (move cursor)
- [■]: Execute YES or NO

★ An information which is active currently (display is flashing) cannot be deleted.

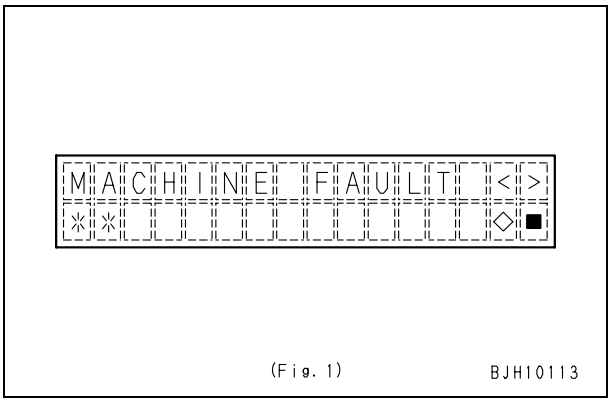


(Fig. 6) BJH10112

10. Mechanical system failure history display function (MACHINE FAULT)

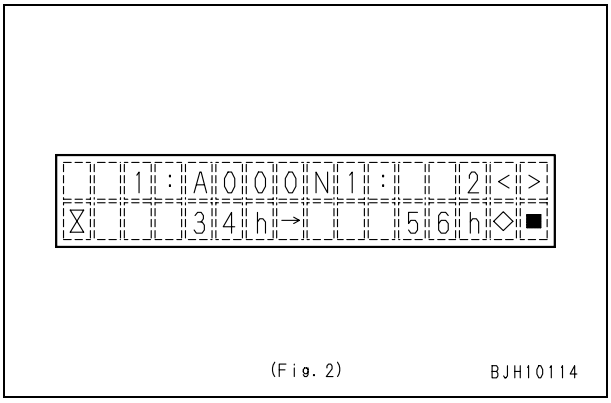
The machine monitor retains the data for problems that occurred in the mechanical system in the past as failure history. They can be displayed as follows.

1) Selection of the service menu
Select mechanical system failure history display function (MACHINE FAULT) in the service menu selection screen (Fig. 1).
★ The total number of failure history data items recorded in memory is displayed in the [* *] portion.



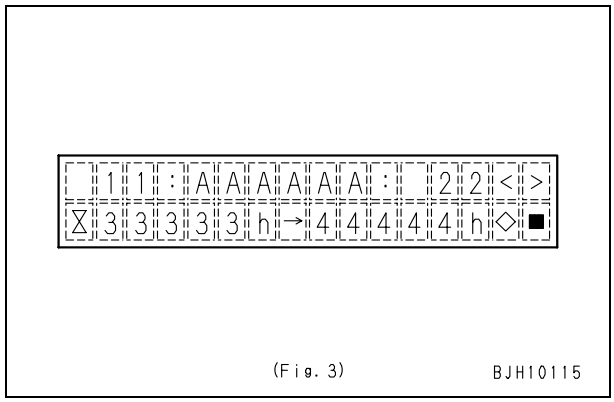
(Fig. 1) BJH10113

2) Failure history data display
With the service menu selected, press the [◇] switch and display the failure history data recorded in memory (Fig. 2:example).
● [◇]: Conduct the service menu.



(Fig. 2) BJH10114

3) Displayed failure history data
With the mechanical system failure history display function, the following data can be displayed (Fig. 3).
1: Record number
A: Failure code (4-digits device code + 2-digits symptom code)
2: Number of occurrences (number of occurrences of same code in the past)
3: Elapsed time 1 (time elapsed on service meter since first occurrence)
4: Elapsed time 2 (time elapsed on service meter since last occurrence)
★ Failure codes for problems that are still existing are shown on a flashing display.
★ Refer to failure code table of operator mode for details of displayed failure codes.
★ Note that with the failure history display function and failure code display function (operator mode) for the mechanical system, the displayed data are partially different.
★ If the fault history is not recorded, "-" is displayed on the display section of **1**/**A**/**2**/**3**/**4**.



(Fig. 3) BJH10115

4) Switching failure history display
If the [>] switch or [<] switch is pressed during the display of failure history, the display switches to another failure history data recorded.
● [>]: To proceed to data for next record number
● [<]: Go back to data for previous record number

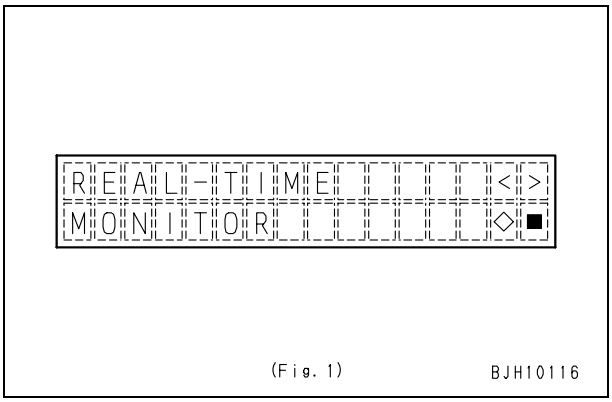
5) Deleting failure history data (not permitted)
★ The failure history data for the mechanical system cannot be deleted.

11. Real time monitoring function (REAL-TIME MONITOR)

The machine monitor can monitor the condition of the machine in real time through the signals from the sensors installed to various parts of the machine.
In the real time monitoring function, the following 2 types of display can be shown.

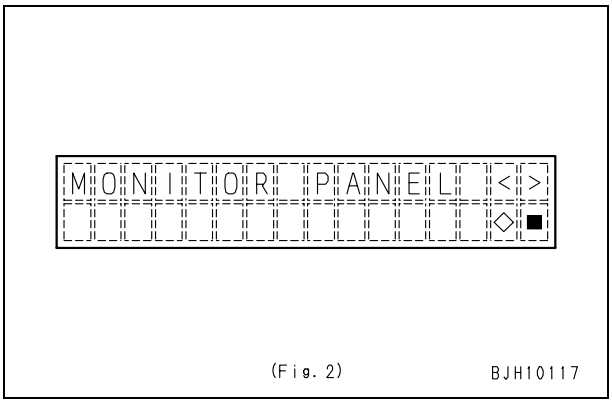
- 1 item independent display (for each controller)
- 2 items simultaneous display (code input)

1) Selection of the service menu
Select real time monitoring function (REAL-TIME MONITOR) in the service menu selection screen (Fig. 1).



(Fig. 1) BJH10116

2) Display and selection of monitoring system and function
1] With the service menu selected, press the [◇] switch to display the monitoring system and function selection screen (Fig. 2).
- [◇]: Conduct the service menu.



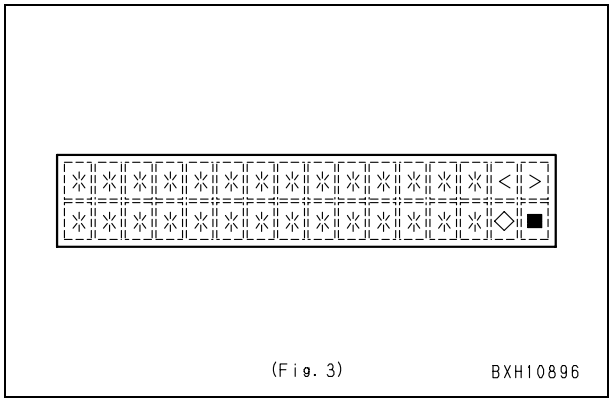
(Fig. 2) BJH10117

2] If the [>] switch or [<] switch is pressed on the monitoring system and function selection screen, the monitoring system and device is displayed endlessly in the following order, then select the system or function that is used (Fig. 3).
- [>]: To proceed to next monitoring system and function
- [<]: Go back to data for previous monitoring system and function

★ Monitoring system and function to be displayed:

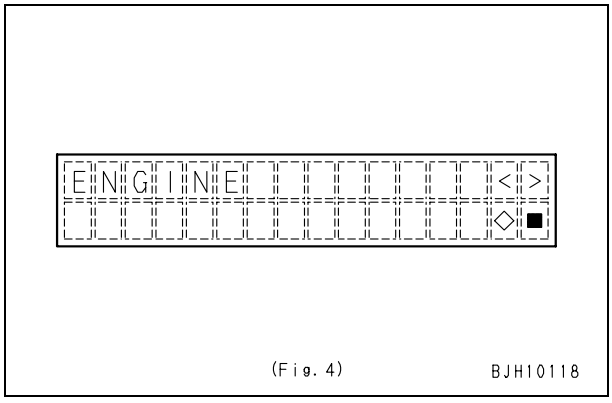
No.	Display	System and function
1	MONITOR PANEL	Machine monitor system
2	TRANSMISSION	Transmission controller system
3	ENGINE	Engine controller system
4	BRAKE	Retarder controller system
5	2 ITEMS	2 items simultaneous monitoring

★ Display monitoring system and function in the "*" section.



(Fig. 3) BXH10896

3) Setting 1 item individual monitoring
1] In the monitoring system and function selection screen, select the monitoring system (example: ENGINE) to be used (Fig. 4).

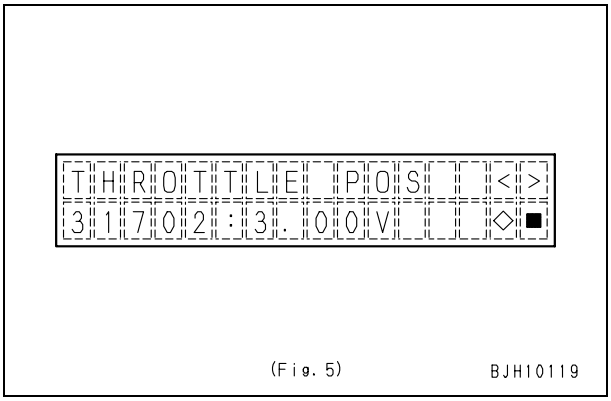


(Fig. 4) BJH10118

2] With the monitoring system selected, press the [◇] switch and display the monitoring display and item selection screen.
- [◇]: Implement 1 system individual monitoring

3] With the monitoring display and item selection screen displayed, press the [>] switch or [<] switch and select items to monitor (Fig. 5).
- [>]: To proceed to the next monitoring item
- [<]: Return to the previous monitoring item

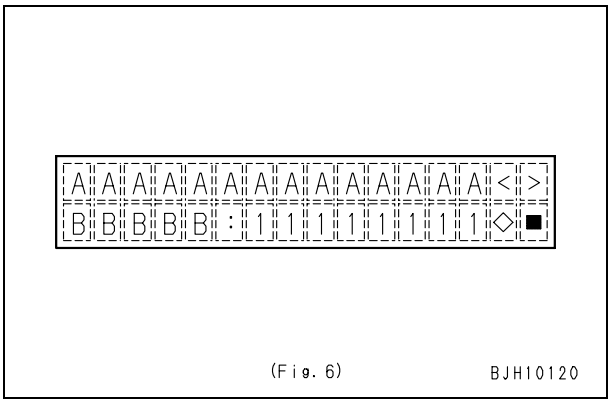
★ The monitored items are scroll-displayed due to internal setting.
★ If the switch is kept pressed, the monitoring items scroll at high speed.
★ In the monitoring display and item selection screen, the information of the monitored items are displayed on real time.



(Fig. 5) BJH10119

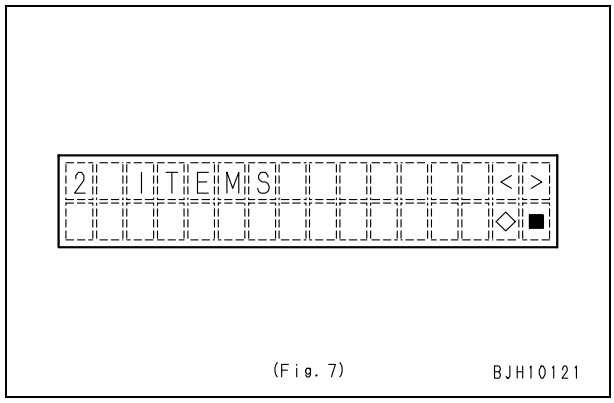
4] To hold or cancel monitoring data:
If the [◇] switch is pressed during monitoring, the monitor data is held and the [◇] mark flashes. If the [◇] switch is pressed again, hold is canceled and it becomes active again.
- [◇]: Hold and release of data

4) Display data for 1 item individual monitoring
On the 1 item individual monitoring display screen, the following data are displayed (Fig. 6).
A: Item display
B: Monitoring code (5-digit)
1: Monitoring data (including unit)
★ For details, see "Monitoring code table".



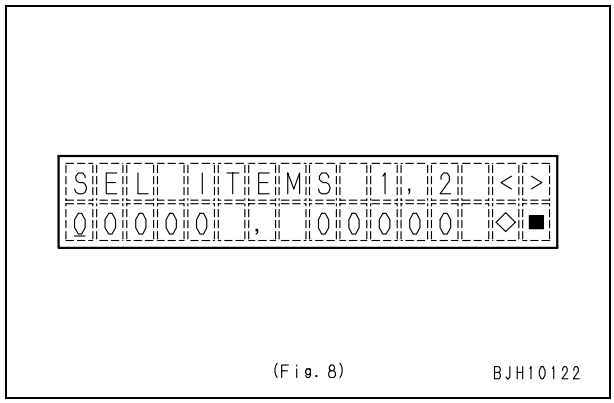
(Fig. 6) BJH10120

5) Setting 2 items simultaneous monitoring
1] Select 2 items simultaneous monitoring (2 ITEMS) in the monitoring system and function selection screen (Fig. 7).
2] With 2 items simultaneous monitoring selected, press the [◇] switch and display the monitoring code input screen (Fig. 8).
- [◇]: Implement 2 system individual monitoring



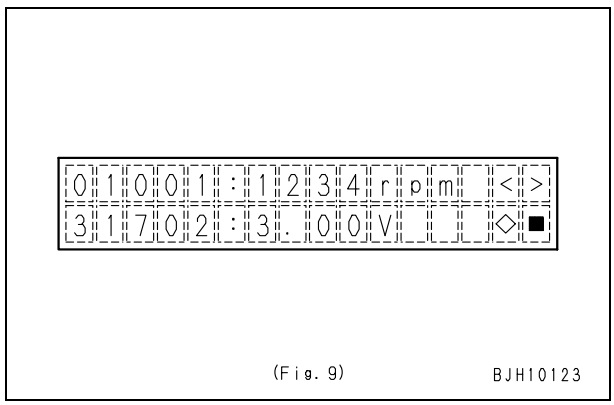
(Fig. 7) BJH10121

3] In the monitoring code input screen, operate each of the switches [>], [<], [◇] and [■], and directly input 2-digit monitoring codes.
- [>]: Number at the cursor increases.
- [<]: Number at the cursor decreases
- [◇]: Number at the cursor is determined
- [■]: Cursor moves to the left end / To return to the monitoring system and function selection screen.



(Fig. 8) BJH10122

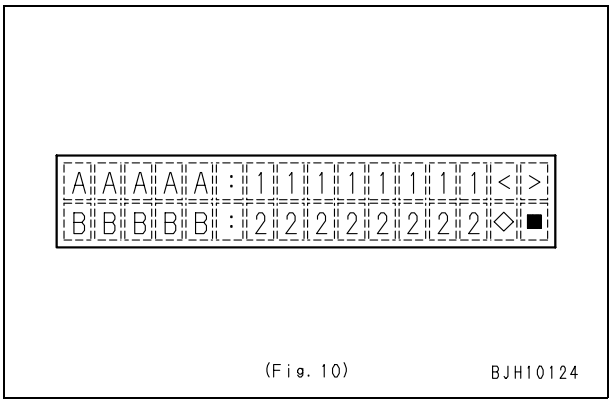
4] When both of the monitoring codes have been confirmed, the screen switches to the 2 items simultaneous monitoring display screen (Fig. 9:example).



(Fig. 9) BJH10123

5] To hold or cancel monitoring data:
If the [◇] switch is pressed during monitoring, the monitor data is held and the [◇] mark flashes.
If the [◇] switch is pressed again, hold is canceled and it becomes active again.
- [◇]: Hold and release of data

6) Display data for 2 items simultaneous monitoring
On the 2 item simultaneous monitoring display screen, the following data are displayed (Fig. 10).
A : Monitoring code 1
1 : Monitoring data 1 (including unit)
B : Monitoring code 2
2 : Monitoring data 2 (including unit)
★ For details, see "Monitoring code table".



(Fig. 10) BJH10124

Monitoring code table

MACHINE MONITOR [Machine monitor system]					
No.	Monitored item	Item display	Monitoring code	Display range	Unit
1	Engine speed	END SPEED	01001	0 – 65535	rpm
2	Resistance of fuel level sensor	FUEL SENSOR	04201	0 – 150	Ω
3	Voltage of fuel level sensor	FUEL SENSOR	04200	0.00 – 5.00	V
4	Brake oil temperature, F	BRAKE OIL TF	30201	0 – 160	°C
5	Voltage of brake oil temperature sensor, F	BRAKE OIL TF	30204	0.00 – 5.00	V
6	Brake oil temperature, M	BRAKE OIL TR	30203	0 – 160	°C
7	Voltage of brake oil temperature sensor, M	BRAKE OIL TR	30206	0.00 – 5.00	V
8	Input voltage of rheostat	RHEOSTAT	30300	0.00 – 5.00	V
9	Setting status of rotary switch (SW & SW2 & SW2)	SW1, SW2, SW3	30800	ON/OFF	Status display
10	Setting status of dip switch (SW5-1 & SW5-2)	SW5-1 & SW5-2	30900	ON/OFF, ON/OFF	Status display
11	Setting status of dip switch (SW5-3 & SW5-4)	SW5-3 & SW5-4	30901	0 – F, 0 – 0 – F, 0	Status display
12	Setting status of dip switch (SW6-1 & SW6-2)	SW6-1 & SW6-2	30902	ON/OFF, ON/OFF	Status display
13	Setting status of dip switch (SW6-3 & SW6-4)	SW6-3 & SW6-4	30903	ON/OFF, ON/OFF	Status display
14	Input signal D_IN _0-7	10000000 (headlamp = on) 01000000 (sw = on) 00100000 (AISS SW = on) 00000000 (not in use) 00000000 (not in use) 00000100 (sw = on) 00000010 (sw = on) 00000001 (sw = economy)	40900		Status display
15	Input signal D_IN_8-15	10000000 (always 1) 00000000 (monitor mode SW (■) = on 00100000 (monitor mode SW (>) = on 00010000 (monitor mode SW (<) = on 00001000 (right turning lamp = on) 00000100 (left turning lamp = on) 00000010 (monitor mode SW (◇) = on 00000000 (not in use)	40901		Status display
16	Input signal D_IN_16-23	00000000 (not in use) 01000000 (filter normal = 1) 00100000 (filter normal = 1) 00010000 (filter normal = 1) 00001000 (oil level normal = 1) 00000000 (not in use) 00000010 (coolant level normal = 1) 00000000 (not in use)	40902		Status display

MACHINE MONITOR [Machine monitor system]					
No.	**Monitored item**	**Item display**	**Monitoring code**	**Display range**	**Unit**
17	Input signal D_IN_24-31	10000000 (headlamp = on) 01000000 (seat belt = fastened) 00100000 (sw = on) 00000000 (not in use) 00001000 (sw = up) 00000000 (not in use) 00000010 (sw = down) 00000001 (sw = down)	40903		Status display
18	Input signal D_IN_32-39	00000000 (not in use) 00000000 (not in use) 00000000 (always 0) 00000000 (not in use) 00000000 (not in use) 00000000 (not in use) 00000000 (not in use) 00000000 (reserved for service OP7 = open)	40904		Status display
19	Input signal D_OUT_0-3	1000 (buzzer = on) 0000 (not in use) 0000 (not in use) 0000 (not in use)	40925		Status display
20	Application version	VERSION (APP)	20221	Numeral	Status display
21	Data version	VERSION (DATA)	20222	Numeral	Status display
22	Software product number	VERSION	20200	Numeral	Status display

TRANSMISSION [Transmission controller system]					
No.	Monitored item	Item display	Monitoring code	Display range	Unit
1	Transmission input shaft speed	T/M SPEED: IN	31200	0 – 32767	rpm
2	Transmission intermediate shaft speed	T/M SPEED: MID	31300	0 – 32767	rpm
3	Transmission output shaft speed	T/M SPEED: OUT	31400	0 – 32767	rpm
4	Transmission differential speed	T/M DIFF: OUT	31402	0 – 65535	Status display
5	Alternator terminal R	ALTERNATOR R	04301	ON [1 actuated] OFF [0]	°C
6	Torque converter oil temperature	T/C OIL TEMP	30100	0 – 160	V
7	Input voltage of torque converter oil temperature sensor	T/C OIL TEMP	30101	0.00 – 5.00	°C
8	Transmission oil temperature	T/M OIL TEMP	32500	0 – 160	V
9	Input voltage of transmission oil temperature sensor	T/M OIL TEMP	32501	0.00 – 5.00	°C
10	Steering oil temperature	STRG OIL TEMP	32701	0 – 160	V
11	Input voltage of steering oil temperature sensor	STRG OIL TEMP	32702	0.00 – 5.00	MPa
12	Torque converter oil pressure	T/C OIL PRESS	32600	0.00 – 5.00	V
13	Input voltage of torque converter oil pressure sensor	T/C OIL PRESS	32605	0.00 – 5.00	Status display
14	Clutch fill switch	FILL HLR 1 2 3	38922	State of fill switch recognized for each clutch is outputted	mA
15	Output command current for Hi clutch solenoid	ECMV H DIR	31600	0 – 1000	mA
16	Output command current for Lo clutch solenoid	ECMV L DIR	31601	0 – 1000	mA
17	Output command current for 1st clutch solenoid	ECMV 1 DIR	31602	0 – 1000	mA
18	Output command current for 2nd clutch solenoid	ECMV 2 DIR	31603	0 – 1000	mA
19	Output command current for 3rd clutch solenoid	ECMV 3 DIR	31604	0 – 1000	mA
20	Output command current for R clutch solenoid	ECMV R DIR	31606	0 – 1000	mA
21	Output command current for lock-up clutch solenoid	ECMV LU DIR	31609	0-1000	mA
22	Output command current for transmission clutch differential lock solenoid	ECMV D DIR	31607	0 – 1000	mA
23	Pitch angle sensor	ANGLE SENSOR	32900	-180 – +180	deg.
24	Input voltage of pitch angle sensor	ANGLE SENSOR	32902	0.00 – 5.00	V
25	Brake output current (front wheel)	BK OUTP DIR F	44900	0 – 1000	mA
26	Brake output current (rear wheel)	BK OUTP DIR R	44901	0 – 1000	mA

TRANSMISSION [Transmission controller system]					
No.	Monitored item	Item display	Monitoring code	Display range	Unit
27	Throttle correction value	THROTTLE MOD	36000	-100 – 100	%
28	Input voltage of body positioner	BODY POSITON	34603	0.00 – 5.00	V
29	Dump (hoist) lever position 1	DUMP LEVER 1	34506	0.00 – 5.00	V
30	Dump (hoist) lever position 2	DUMP LEVER 2	34507	0.00 – 5.00	V
31	Body seating	BODY SEATNG	34600	ON [1 seated] OFF [0]	Status display
32	Seating control command γ (Hi)	S CNT DIR H	45100	0 – 1000	mA
33	Seating control command γ (Lo)	S CNT DIR H	45101	0 – 1000	mA
34	Libration value in seated condition (α)	S CAL A	45200	0.00 – 5.00	V
35	Cylinder stopper calibration value (β)	S CAL B	45300	0.00 – 5.00	V
36	Seating control time (Hi)	S CNT TIME H	45400	0.00 – 10.00	S
37	Hoist EPC output	HOIT EPC RIR	45601	0 – 1000	mA
38	Seating control time (Lo)	S CNT TIME L	45401	0.00 – 10.00	S
39	Lo clutch trigger compensation value	TRIGGER MOOD L	38900	Lo clutch trigger compensation value is displayed.	Status display
40	Hi clutch trigger compensation value	TRIGGER MOOD H	38901	Hi clutch trigger compensation value is displayed	Status display
41	1st clutch trigger compensation value	TRIGGER MOOD 1	38902	1st clutch trigger compensation value is displayed	Status display
42	2nd clutch trigger compensation value	TRIGGER MOOD 2	38903	2nd clutch trigger compensation value is displayed	Status display
43	3rd clutch trigger compensation value	TRIGGER MOOD 3	38904	3rd clutch trigger compensation value is displayed	Status display
44	R clutch trigger compensation value	TRIGGER MOOD R	38906	R clutch trigger compensation value is displayed	Status display
45	Trigger initial learning flag	TRIG HLR 1 2 3	38922	ON/OFF status of corresponding clutch is displayed with 1 or 0	Status display
46	Lo clutch fill time	FIR TIME L	41800	0 – 2550	ms
47	Hi clutch fill time	FIR TIME H	41801	0 – 2550	ms
48	1st clutch fill time	FIR TIME 1	41802	0 – 2550	ms
49	2nd clutch fill time	FIR TIME 2	41803	0 – 2550	ms
50	3rd clutch fill time	FIR TIME 3	41804	0 – 2550	ms
51	R clutch fill time	FIR TIME R	41806	0 – 2550	ms
52	Throttle lower limit output	THROT LIMIT LO	44201	0.0 – 100.0	%
53	Throttle upper limit output	THROT LIMIT HI	44200	0.0 – 100.0	%

TRANSMISSION [Transmission controller system]					
No.	**Monitored item**	**Item display**	**Monitoring code**	**Display range**	**Unit**
54	Input signal D_IN_0-7	D-IN-0------7	40905	**0*****: Emergency steering is not actuated (HM400) Always 0 (HM300, HM350) **1*****: Emergency steering is actuated (HM400) ****1***: In cranking *****0**: Emergency steering is not actuated *****1**: Emergency steering is actuated ******0*: Shift hold SW=OFF ******1*: Shift hold SW=ON *******1: Gear shift lever N	Status display
55	Input signal D_IN_8-15	D-IN-8-----15	40906	*1******: L fill **1*****: H fill ***1****: 1st fill *****1**: 2nd fill *****1**: 3rd fill Example 01010000: at F1 00001010: at R2 00000000: at N 00100100: at F6	Status display
56	Input signal D_IN_16-23	D-IN-16-----23	40907	10000000: Gear shift lever R2 01000000: Gear shift lever R1 00100000: Gear shift lever D 00010000: Gear shift lever 5 00001000: Gear shift lever 4 00000100: Gear shift lever 3 00000010: Gear shift lever 2 00000001: Gear shift lever 1	Status display
57	Input signal D_IN_24-31	D-IN-24-----31	40908	0*******: TM oil filter is clogged ****0***: Engine oil level is falling *****0**: Engine oil filter is clogged	Status display
58	Input signal D_OUT_0-7	D-OUT-0------7	40949	*1**0*00: Hoist selector valve ON ****0100: Hoist lever kick-out ON	Status display
59	Application version	VERSION (APP)	20223	Numeral	Status display
60	Data version	VERSION (DATA)	20224	Numeral	Status display
61	Software product number	VERSION	20201	Numeral	Status display

BRAKE [Retarder controller system]					
No.	**Monitored item**	**Item display**	**Monitoring code**	**Display range**	**Unit**
1	Alternator R	ALTERNATOR R	04302	ON [1 actuated] OFF [0]	Status display
2	Front ACC oil pressure	ACC OIL PRE F	35500	0.00 – 99.99	MPa
3	Voltage of front ACC oil pressure sensor	ACC OIL PRE F	35506	0.00 – 5.00	V
4	Rear ACC oil pressure	ACC OIL PRE R	35501	0.00 – 99.99	MPa
5	Voltage of rear ACC oil pressure sensor	ACC OIL PRE R	35507	0.00 – 5.00	V
6	Front wheel brake output current	BK OUTP DIR F	33807	0 – 1000	mA
7	Rear wheel brake output current	BK OUTP DIR R	33806	0 – 1000	mA
8	Input voltage of retarder lever	RETARD LEVER	33900	0.00 – 5.00	V
9	Input signal D_IN_0-7	D-IN--0------7	40932	10000000: (Not in use) 01000000: Brake pedal switch (ON: 1) 00100000: Front retarder switch (ON: 1) 00010000: Rear retarder switch (ON: 1) 00001000: Idle validation switch 1 (ON: 1) 00000100: Idle validation switch 2 (ON: 1) 00000010: (Not in use) 00000001: (Not in use)	Status display
10	Input signal D_IN_8-15	D-IN--8-----15	40933	10000000: Front differential oil pressure switch (ON: 1) 01000000: Rear differential oil pressure switch (ON: 1) 00100000: (Not in use) 00010000: (Not in use) 00001000: Parking brake switch (ON: 1) 00000100: (Not in use) 00000010: (Not in use) 00000001: (Not in use)	Status display
11	Input signal D_IN_16-23	D-IN-16-----23	40934	10000000: Starting switch C terminal signal (when engine start: 1) 01000000: (Not in use) 00100000: (Not in use) 00010000: (Not in use) 00001000: (Not in use) 00000100: (Not in use) 00000010: (Not in use) 00000001: (Not in use)	Status display
12	Input signal D_IN_24-31	D-IN-24-----31	40935	10000000: (Not in use) 01000000: (Not in use) 00100000: (Not in use) 00010000: (Not in use) 00001000: (Not in use) 00000100: (Not in use) 00000010: (Not in use) 00000001: (Not in use)	Status display

BRAKE [Retarder controller system]					
No.	**Monitored item**	**Item display**	**Monitoring code**	**Display range**	**Unit**
13	Input signal D_IN_32	D-IN-32-----39	40943	10000000: (Not in use) 01000000: (Not in use) 00100000: (Not in use) 00010000: (Not in use) 00001000: (Not in use) 00000100: (Not in use) 00000010: (Not in use) 00000001: (Not in use)	Status display
14	Input signal D_OUT_0-7	D-OUT-0------7	40955	10000000: Left and right differential output (front) (when operating: 1) 01000000: Left and right differential output (rear) (when operating: 1) 00100000: BVC output (front) (when operating: 1) 00010000: BVC output (rear) (when operating: 1) 00001000: (Not in use) 00000100: (Not in use) 00000010: (Not in use) 00000001: (Not in use)	Status display
15	Input signal D_OUT_8-15	D-OUT-8-----15	40956	10000000: (Not in use) 01000000: (Not in use) 00100000: (Not in use) 00010000: (Not in use) 00001000: (Not in use) 00000100: (Not in use) 00000010: (Not in use) 00000001: (Not in use)	Status display
16	Input signal D_OUT_16-23	D-OUT-16----23	40957	10000000: (Not in use) 01000000: (Not in use) 00100000: (Not in use) 00010000: (Not in use) 00001000: (Not in use) 00000100: (Not in use) 00000010: (Not in use) 00000001: (Not in use)	Status display
17	Application version	VERSION (APP)	20231	Numeral	Status display
18	Data version	VERSION (DATA)	20232	Numeral	Status display
19	Software product number	VERSION	20214	Numeral	Status display

ENGINE [Engine controller system]					
No.	**Monitored item**	**Item display**	**Monitoring code**	**Display range**	**Unit**
1	Battery voltage	POWER SUPPLY	3200	0.0 – 480	V
2	Engine speed	ENG SPEED	1002	0 – 4000	rpm
3	Coolant temperature	COOLANT TEMP	4104	-40 – 210	°C
4	Voltage of coolant temperature sensor	COOLANT TEMP	4105	0.00 – 5.00	V
5	Engine oil pressure	ENG OIL PRESS	37200	-99.9 – 999.9	kPa
6	Voltage of engine oil pressure sensor	ENG OIL PRESS	37201	0.00 – 5.00	V
7	Engine oil temperature	ENG OIL TEMP	42700	-40 – 210	°C
8	Voltage of engine oil temperature sensor	ENG OIL TEMP	42702	0.00 – 5.00	V
9	Common rail pressure	RAIL PRESS	36400	0 – 400	MPa
10	Voltage of common rail pressure sensor	RAIL PRESS	36401	0.00 – 5.00	V
11	Atmospheric pressure	AMBIENT PRESS	37400	-99.9 – 999.9	kPa
12	Voltage of atmospheric pressure sensor	AMBIENT PRESS	37401	0.00 – 5.00	V
13	Intake air temperature	INTAKE TEMP	18400	-50 – 200	°C
14	Voltage of intake air temperature sensor	INTAKE TEMP	18401	0.00 – 5.00	V
15	Fuel temperature	FUEL TEMP	04204	-40 – 210	°C
16	Voltage of fuel temperature sensor	FUEL TEMP	04205	0.00 – 5.00	V
17	Boost temperature	CHG TEMP	18500	-50 – 200	°C
18	Input voltage of boost temperature sensor	CHG TEMP	18501	0.00 – 5.00	V
19	Boost pressure	CHG PRESS-A	36500	-99.9 – 999.9	kPa
20	Input voltage of boost pressure sensor	CHG PRESS-A	36501	0.00 – 5.00	V
21	EGR valve differential pressure	EGR DIF PRESS	17900	0.00 – 99.99	mm
22	Voltage of EGR valve differential pressure sensor	EGR DIF PRESS	17901	0.00 – 5.0	V
23	EGR valve inlet pressure	EGR IN PRESS-A	18000	-99.9 – 999.9	kPa
24	Voltage of EGR valve inlet pressure sensor	EGR IN PRESS-A	18001	0.00 – 5.0	V
25	EGR valve position	EGR VALVE POS	18100	0.00 – 99.99	mm
26	Voltage of EGR valve position sensor	EGR VALVE POS	18101	0.00 – 5.00	V
27	Engine output torque	OUTPUT TORQUE	18700	-24000 – 24000	Nm
28	Approximate torque	TORQUE RATIO	36700	0 – 100	%
29	Final accelerator opening angle	FINAL THROTTLE	31706	0 – 100	%
30	Instantaneous fuel consumption	FUEL RATE	37300	0.0 – 999.9	L/H
31	Command for final injection amount (unit of weight)	INJECT COMMAND	18600	0 – 1000	mg
32	Final injection timing	INJECT TIMING	36300	-180 – 180	CA
33	Accelerator pedal opening angle	THROTTLE POS	31701	0 – 100	%
34	Voltage of accelerator pedal sensor	THROTTLE POS	31702	0.00 – 5.00	V
35	Bypass valve position	BPS VALVE POS	18200	0.00 – 99.99	mm
36	Input voltage of bypass valve position sensor	BPS VALVE POS	18201	0.00 – 5.00	V
37	Idle validation signal 1	IVS 1	18300	ON/OFF	Status display
38	Idle validation signal 2	IVS 2	18301	ON/OFF	Status display
39	Controller inside temperature	ECM IN TEMP	18900	-40 – 210	°C

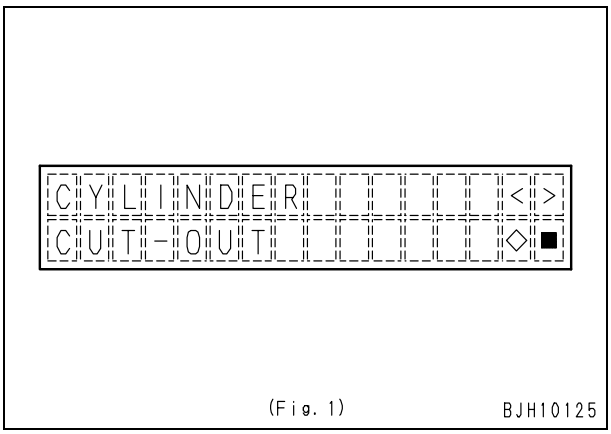
ENGINE [Engine controller system]					
No.	Monitored item	Item display	Monitoring code	Display range	Unit
40	Command for final common rail pressure PFM	PRESS COMMAND	36200	0 – 400	MPa
41	PCV valve closing timing (from BTDC)	PCV TIMING	17201	-180 – 180	CA
42	Engine mode selection	POWER MODE	17500	0 – 4	Status display
43	Selected model name (upper 8 digits)	MACHINE ID (H)	00400	Upper 8 digits of 16 characters	Status display
44	Selected model name (lower 8 digits)	MACHINE ID (L)	00401	Lower 8 digits of 16 characters	Status display
45	BUILD version	BUILD VER	20216	Numeral (8 characters)	Status display
46	Calibration version	CAL VER	20217	Numeral (8 characters)	Status display
47	Hardware S/N	ECM S/N	20400	0 – 499999999	Status display

12. Reduced cylinder mode (CYLINDER CUT-OUT)

As one method of troubleshooting for the engine, the machine monitor has a reduced cylinder function that can set the desired cylinder to the no injection condition.

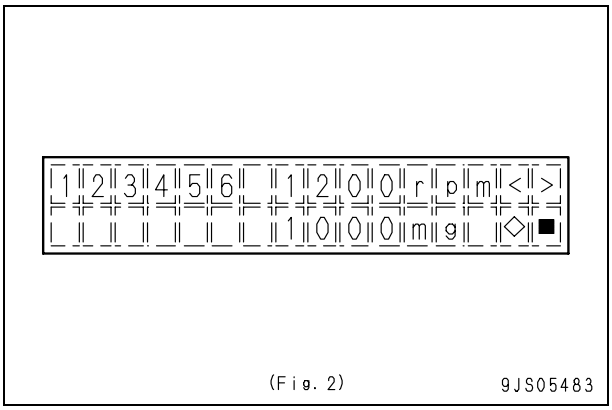
1) Starting engine
   - ★ Use this function while the engine is running, because a defective cylinder is determined depending on the engine speed in the reduced cylinder mode.

2) Menu selection
   1] Select the reduced cylinder mode on the menu screen of the service mode (Fig. 1).



(Fig. 1) BJH10125

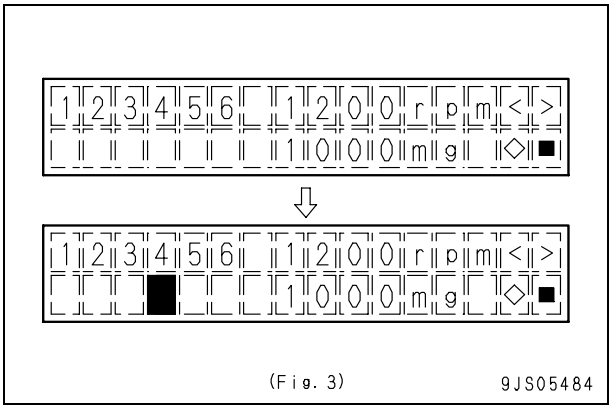
   2] With the menu selected, press the [◇] button and display the cylinder selection screen (Fig. 2: example).
   - [◇] button: Runs menu
   - ★ The cylinder No. and engine speed are displayed at the same time.
   - A command for final injection amount [mg] is displayed under the engine speed.



(Fig. 2) 9JS05483

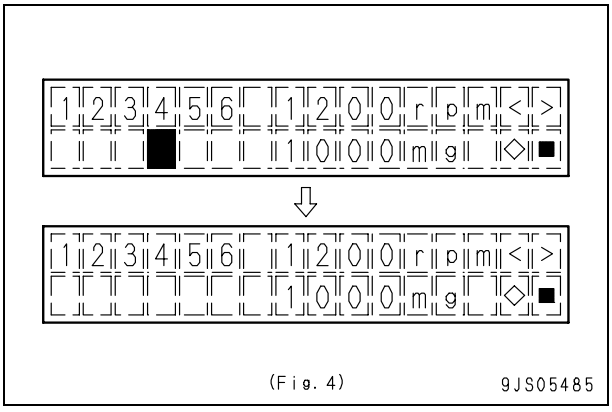
3) Setting cut-out cylinder
   Operate each button to select the cylinder to be cut out (Fig. 3: example).
   - [>] button: Selector cursor moves to the right.
   - [<] button: Selector cursor moves to the left.
   - [◇] button: Cylinder is confirmed.
   - [■] button: Returns to menu screen

★ When the [◇] button is used to confirm the cut-out cylinder, communication is carried out between the machine monitor and engine controller. During this time, the cylinder No. flashes. After completion of the communication, the segment under the cylinder No. becomes black to show that the cylinder has been cut out.
★ A single cylinder or multiple cylinders can be cut out.



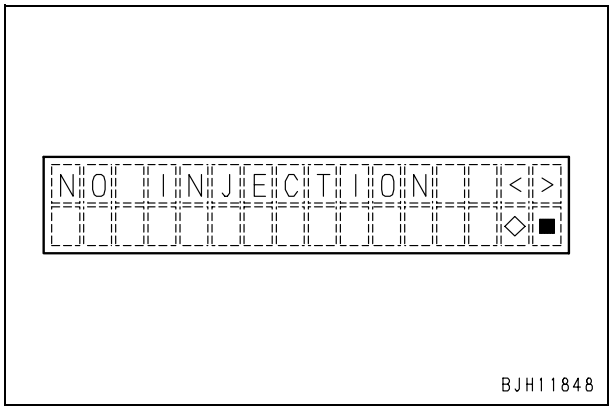
(Fig. 3) 9JS05484

4) Canceling cylinder cut-out
★ Cancel the cylinder cut-out in the same way as when setting the cut-out (Fig. 4: example).



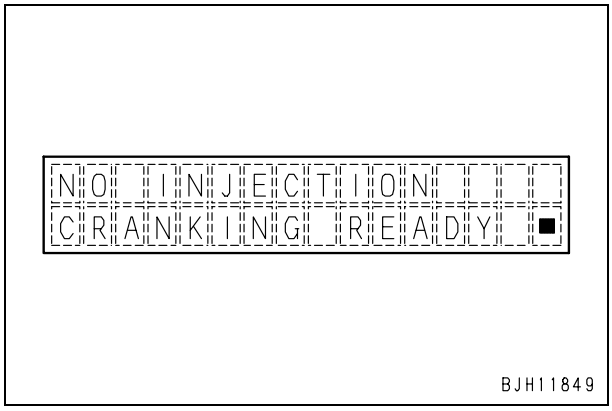
(Fig. 4) 9JS05485

13. No injection cranking (NO INJECTION)
In order to crank without starting the engine, the machine monitor has the function of no injection cranking where the fuel injection for all the cylinders is stopped.
★ This setting must be done after stopping the engine.
1) Menu selection
1] Select the no injection cranking mode on the menu screen of the service mode.



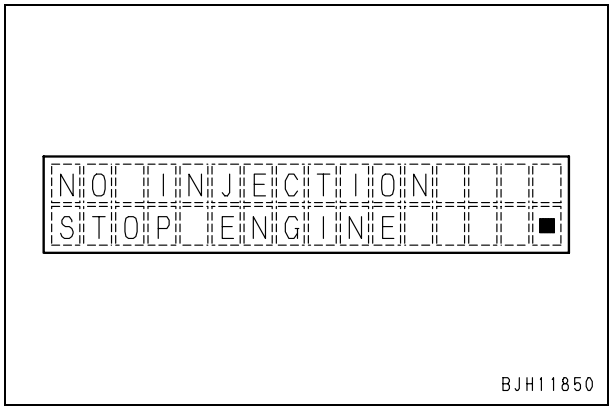
BJH11848

2] With the menu selected, press the [◇] button and display the no injection command screen, which is displayed until the cancel operation is carried out.



BJH11849

3] If the operation in step 1] is conducted while the engine is running, the following screen is displayed to instruct to stop the engine.
★ "STOP ENGINE" flashes.



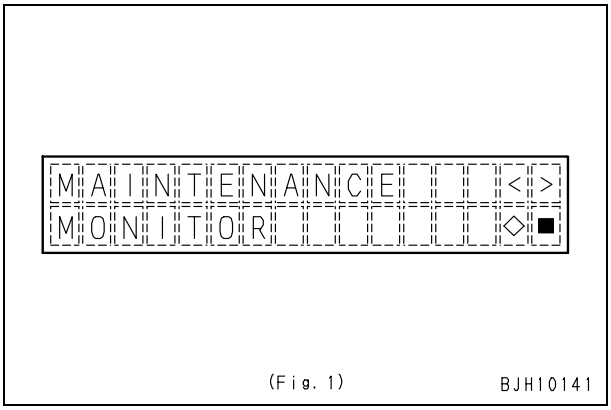
BJH11850

4] Canceling no injection cranking
★ Operate the cancel button [■] for cancellation.

14. Filter and oil replacement time setting function (MAINTENANCE MONITOR)

The machine monitor can set the maintenance interval for filters and oil, which forms the basis for the filter and oil replacement time display. Also, it has the function to deactivate the setting.

1) Menu selection
Select the filter and oil replacement time setting function on the menu screen of the service mode (Fig. 1).

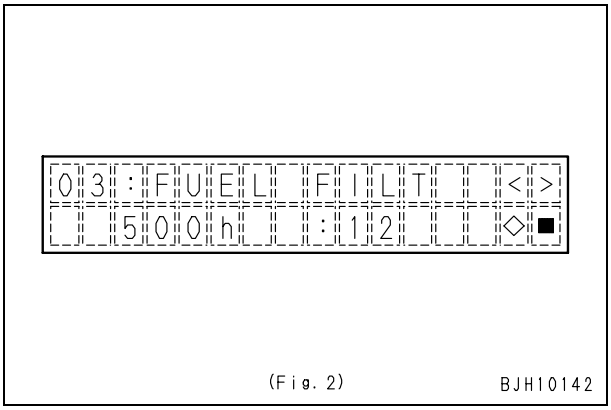


(Fig. 1) BJH10141

2) Selecting filter and oil replacement time set items
1] With the menu selected, press the [◇] button and display the initial screen of the set item (Fig. 2).
- [◇] button: Runs menu

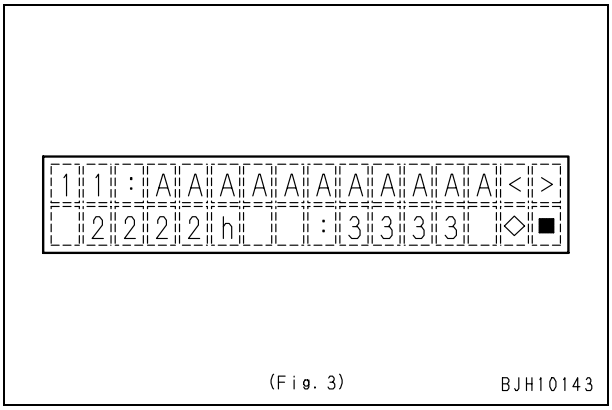
2] Press the [>] button or [<] button to select the item to be set.
- [>] button: Goes on to next item
- [<] button: Goes back to previous item

★ The set items are displayed endlessly in the internal set order (for details, see “Table of filter and oil replacement time set items“.)



(Fig. 2) BJH10142

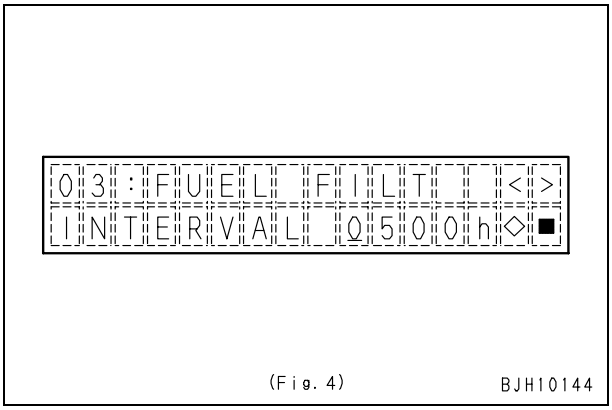
3) Contents of filter and oil replacement time set item display
If the maintenance items are selected, the following contents are displayed (Fig. 3).
1: Code (2 digits)
A: Filter and oil replacement time set items
2: Remaining time to set replacement time
3: Number of times of replacement up to present



(Fig. 3) BJH10143

4) Changing the interval
1] With the set item selected, press the [◇] button and display the interval input screen (Fig. 4: example).
- [◇] button: Executes change function

★ The presently set interval is displayed on the screen.

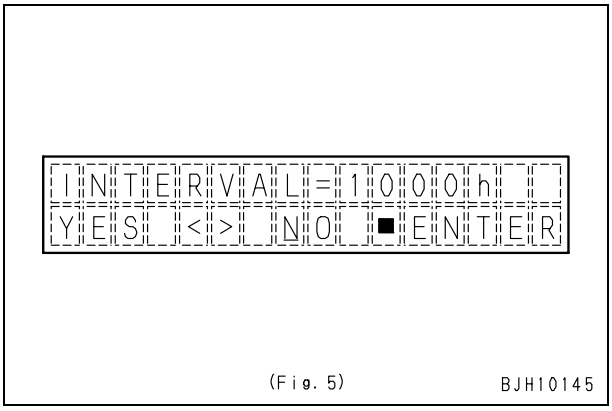


(Fig. 4) BJH10144

2] Operate the buttons to input the interval (Fig. 4).
- [>] button: Number at cursor goes up
- [<] button: Number at cursor goes down
- [◇] button: Number at cursor is confirmed
- [■] button: Returns to item selection screen

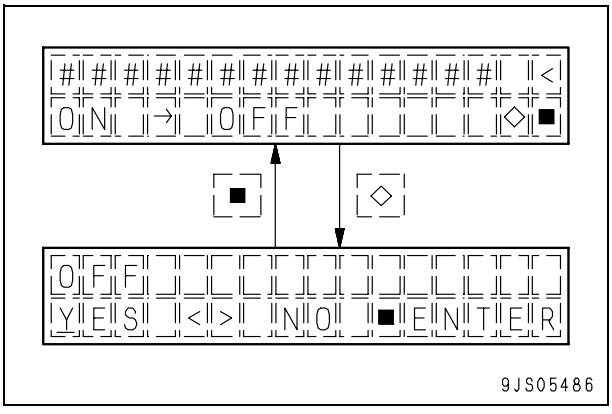
★ The time must always be input with 4 digits. For numbers of less than 4 digits, input 0s at the beginning.

3] When all the interval times are confirmed, the change confirmation screen is displayed, so operate the buttons according to the screen display (Fig. 5).
- [<] button: Selects YES
- [>] button: Select NO
- [■] button: Run



(Fig. 5) BJH10145

5) Selecting deactivation/activation of timer by each item
1] If the timer “by item“ is in the activated condition, “(ON → OFF)“ is displayed on the bottom line.
2] If the timer “by item“ is in the deactivated condition, “(OFF → ON)“ is displayed on the bottom line.
3] Default is “(ON)“, where the timer function is activated.



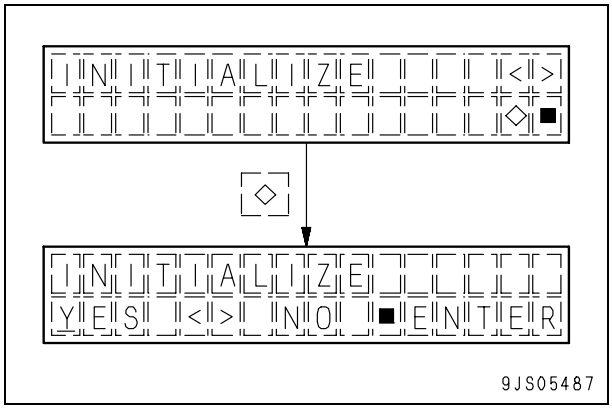
9JS05486

4] When the [◇] button is pressed, “(OFF)“ is displayed on the top line if the timer “by item“ is set to be deactivated, and “(ON)“ is displayed on the top line if the timer “by item“is set to be activated.

5] Select YES/NO using the [<] and [>] buttons.
The cursor (_) flashes at the selected side, and by pressing the [■] button, the setting is executed in the case of YES, or canceled in the case of NO. Then the display returns to the maintenance item selection screen.
★ The cursor initially shows NO (not change) in order to prevent reset by mistake.

6] Set activation or deactivation of the timer by each maintenance item.

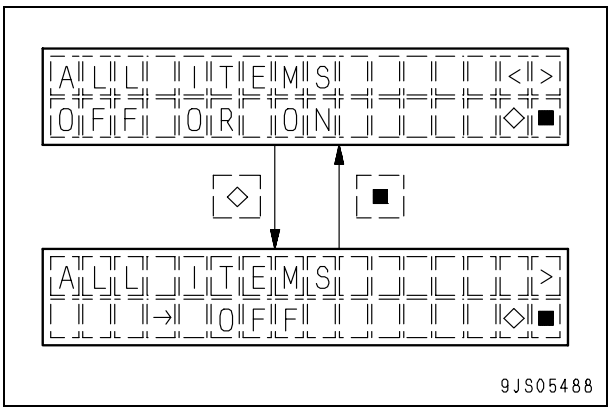
6) Default value setting
1] Select YES or NO using the [<] and [>] buttons on the above screen.
2] The cursor (_) flashes at the selected side, and by pressing the [■] button, the setting is executed in the case of YES, or canceled in the case of NO. Then the display returns to the maintenance monitor selection screen.
★ The cursor initially shows NO (not change) in order to prevent reset by mistake.



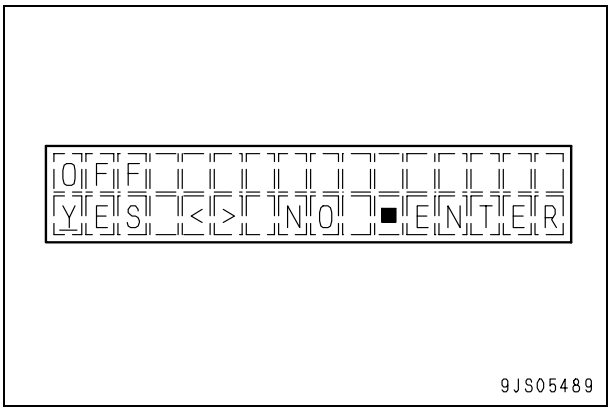
9JS05487

3] When default value setting is executed
Targeted for all the items regardless individual activation or deactivation settings, the interval times which have been changed, if any, are reset to the default values.
★ The timer remaining time is to be [Default value – Elapsed time since last replacement].
However, the number of resets is kept intact with no incrementation.
(The individual setting of activation and deactivation is set to “activated“.)

7) Selecting deactivation or activation of timer for all items
   1] Press the [◇] button on the screen for selecting deactivation or activation of the timer for all the items, and the display changes to the “timer deactivation for all the items“ screen.



   2] If the deactivation for all the items is to be selected, press the [◇] button on the screen in step 1] to display the following screen, and select YES with the [>] and [<] buttons.



   ★ When deactivation for all items is executed
   If the [■] button is pressed, the timer function for all the items is deactivated, and the display returns to the maintenance monitor selection screen.
   The individual setting for each item is also set to “deactivated“.
   ★ When cancelled
   The operation is cancelled and the display returns to the maintenance monitor selection screen.
   3] If the activation for all the items is to be selected, select the "all items ON" screen with the [>] and [<] buttons from the screen in step 1], and confirm it with the [◇] button.
   4] Select YES or NO with the [<] and [>] buttons.
   The cursor (_) flashes at the selected side.
   ★ The cursor initially shows NO (not change) in order to prevent reset by mistake.
   ★ When activation for all items is executed
   When the [■] button is pressed, the remaining interval times for all the items become invalid regardless of individual activation or deactivation settings.The timer remaining time for each item is reset to the initial interval time.
   However, the number of resets is kept intact with no incrementation, and the display returns to the maintenance screen.
   (The individual setting for each item is also set to “activated“.)
   ★ When cancelled
   The operation is cancelled and the display returns to the maintenance monitor selection screen.

Table of filter and oil replacement time set items

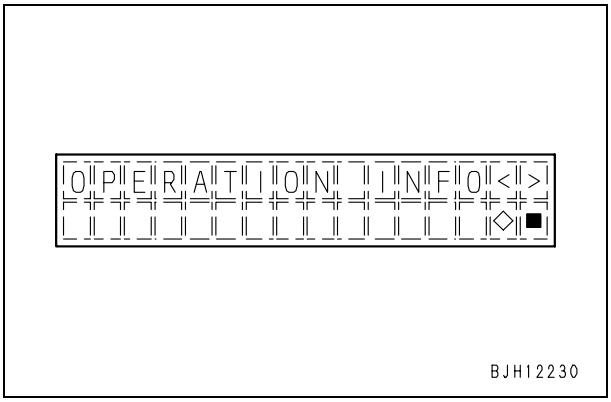
No.	Check item	Code	Display	Replacement time
1	Fuel pre-filter	41	P FUEL FILT	500
2	Engine oil	01	ENG OIL	500
3	Engine oil filter	02	ENG FILT	500
4	Transmission oil	12	TM OIL	1000
5	Transmission oil filter	13	TM FILT	1000
6	Fuel filter	03	FUEL FILT	1000
7	Corrosion resistor	06	CORR RES	1000
8	Brake oil	17	BK OIL	1000
9	Brake oil filter	14	BK OIL FIL	1000
10	Brake cooling oil filter	16	BK C FIL	1000
11	Hydraulic oil filter	04	HYD FILT	2000
12	Differential case oil	11	DIFF OIL	2000
13	Final drive oil	08	FNL OIL	2000
14	Hydraulic oil	10	HYD OIL	4000

15. Operation information display function (OPERATION INFO)

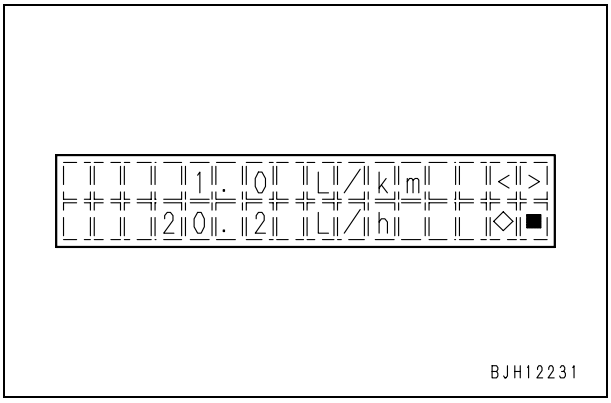
Machine monitor can display the fuel consumption per mile and per time, the fuel consumption per any accumulated time and the travel distance, and the fuel consumption during any accumulated time and its accumulated time.

★ Fuel consumption value is the integration of the targeted injection rate signal which is sent from the engine controller. It is not the measurement of the actual fuel consumption. Therefore the displayed fuel consumption is used as a guide value.

1) Selection of the service menu
Select the operation information display function (OPERATION INFO) on the service menu selection screen.



2) Displaying the operation information
With the service menu selected, press the [◇]switch and display the operation information and item selection screen.
- [◇]: Conduct the service menu.



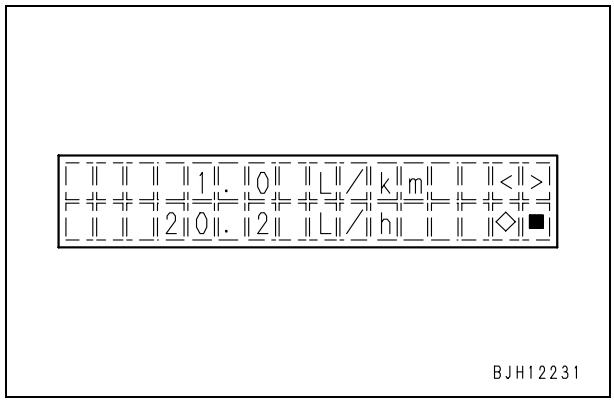
3) Selecting displayed information
With the operation information and item selection screen displayed, operate the [>] switch or the [<] switch to select the information screen to display.
- [>]: To display the next information screen.
- [<]: To display the previous information screen.

★ There are three types of information screen.

4) Information to be displayed (screen 1 – 3)

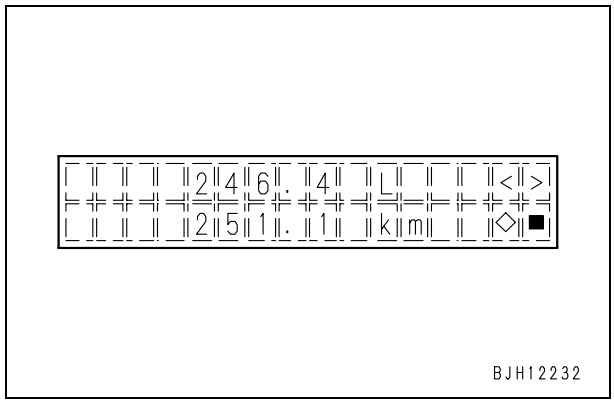
Above: Fuel consumption per km or mile from the last reset point (distance unit is km or mile and it depends on the setting of the integrated odometer in the operator mode).
Maximum display value:
99999.9 L/km (L/mile)

Below: Fuel consumption per time started from the last reset point
Maximum display value: 99999.9 L/h



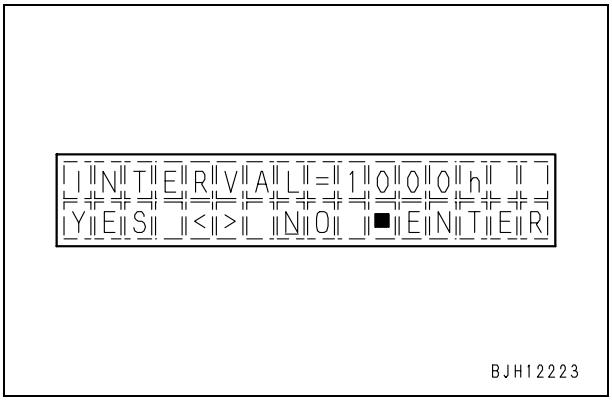
Above: Integrated fuel consumption started from the last reset point
Maximum display value: 9999999.9 L

Below: Accumulated travel distance from the last reset point (travel distance unit is km or mile and it depends on the setting of the integrated odometer in the operator mode).
Maximum display value:
9999999.9 km (mile)

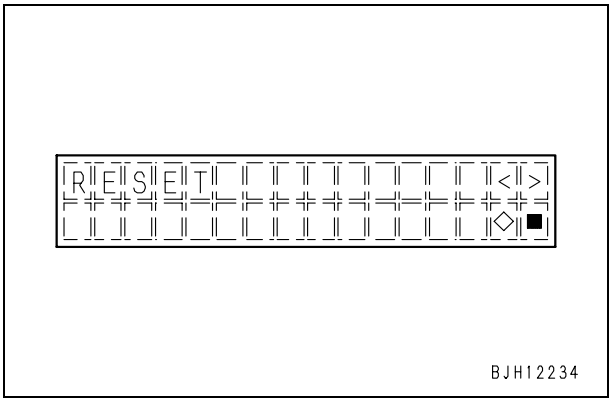


Above: Integrated fuel consumption started from the last reset point
Maximum display value: 9999999.9 L

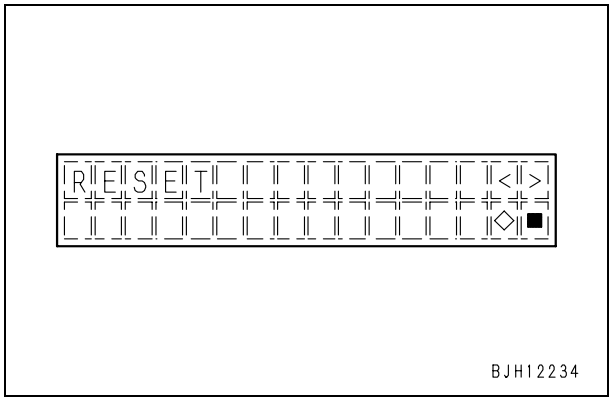
Below: Elapsed time from the last reset point
Maximum display value: 9999999.9 h



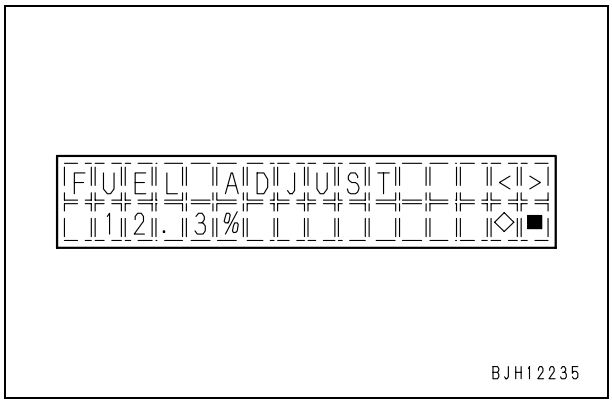
5) Resetting displayed information
   1] With any information screen displayed, press the [◇] switch to display the reset screen.
      - [◇]: Switch to the reset screen.
   2] After the reset screen is displayed, press the [◇] switch or the [■] switch and execute or cancel the reset.
      - [◇]: Implement resetting.
      - [■]: Cancel resetting
      ★ When the resetting is carried out, all the information goes to "0", and the monitoring starts newly from that point of time (Monitoring is only conducted while engine is running.)
      ★ If the [>] switch or the [<] switch is operated with this screen displayed, the screen is switched to the fuel consumption correction screen.



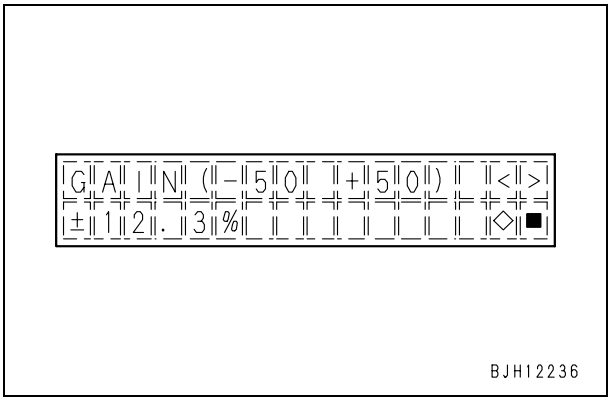
6) Correction of integrated fuel consumption
   ★ When there is the difference between the integrated fuel consumption (L) in display and the actually measured fuel consumption, correct it in the following way.
   1] With the reset screen displayed, press the [>] switch or the [<] switch to display the fuel consumption correction screen.
      - [>]: Switch the displayed screen
      - [<]: Change the displayed screen



   2] After the fuel consumption correction screen is displayed, press the [◇] switch or the [■] switch to switch to the correction value input screen.
      - [◇]: Switch to the correction value input screen
      - [■]: To return to the service menu screen



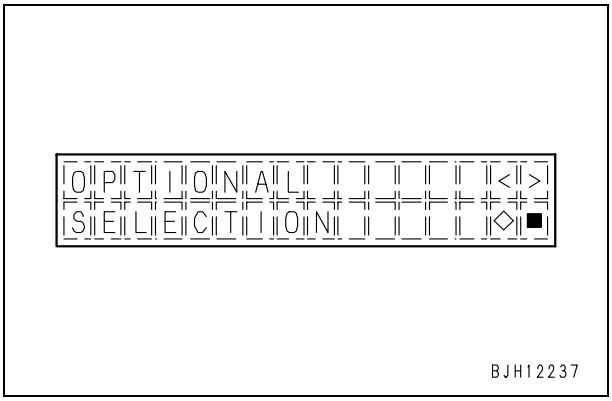
   3] After displaying the compensation value input screen, operate each of the switches [>], [<], [◇] and [■] to input the compensation value directly.
      - [>]: To switch the cursor symbol (+/-) / Number increases.
      - [<]: To switch the cursor symbol (+/-) / Number decreases.
      - [◇]: Sign/number at the cursor is determined.
      - [■]: Return to the fuel correction screen
      ★ The correction value at the plant before shipment is [+/-00.0%] (In case of inputting 00.0, +/- does not matter.)
      ★ The compensation value can be input within the range of [-50.0% – +50.0%].



16. Option selection function (OPTIONAL SELECTION)

Machine monitor can set and adjust various optional devices which have been installed or removed.

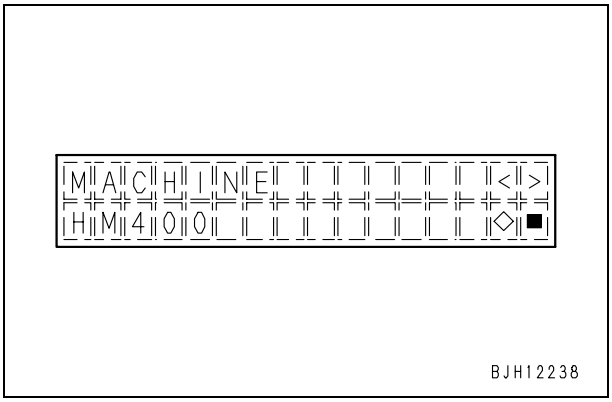
★ The operating method of this function refers to the item of "Setting and adjusting various equipment".



17. Model selection function (MACHINE)

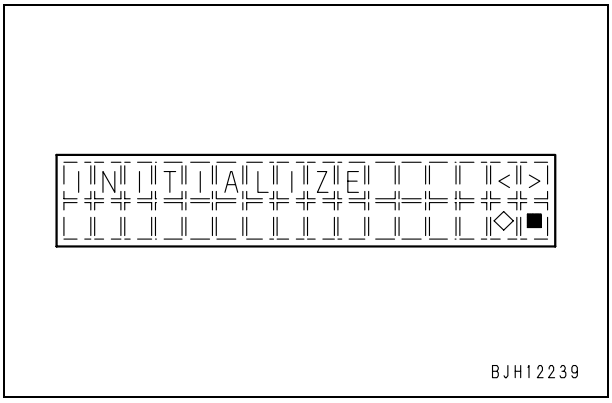
Machine monitor is common among many models, and if the machine monitor is replaced, select the same model as the one currently installed.

★ The operating method of this function refers to the item of "Setting and adjusting various equipment".



18. Initializing function (INITIALIZE)

★ This function is exclusive for the plant, and is not used for service.



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).
- Domestic (Japan): The setting work has already completed.
- Other than Japan: Execute "3. Request of opening station of ORBCOMM terminal".

In the case where KOMTRAX terminal is retrofitted on machine after shipment:

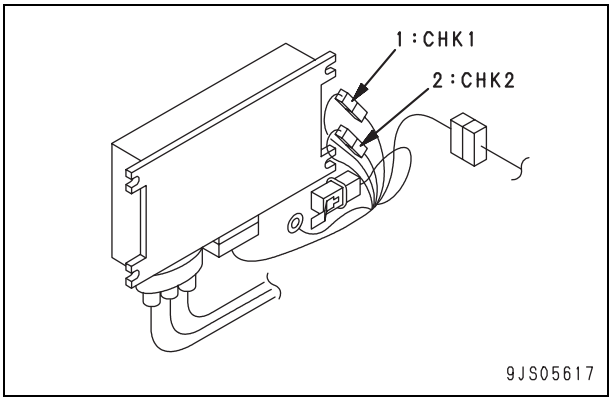
★ Implement the following procedure in the case where the KOMTRAX terminal is retrofitted after shipment of the machine (retrofitted machine).
- Domestic (Japan): Execute "1. Opening station inspection of machine side" and "2. Application of start of use".
- Other than domestic (Japan): Execute "1. Opening station inspection of machine side" and "2. Application of start of use" and "3. Opening station request of ORBCOMM terminal".

How to start operation

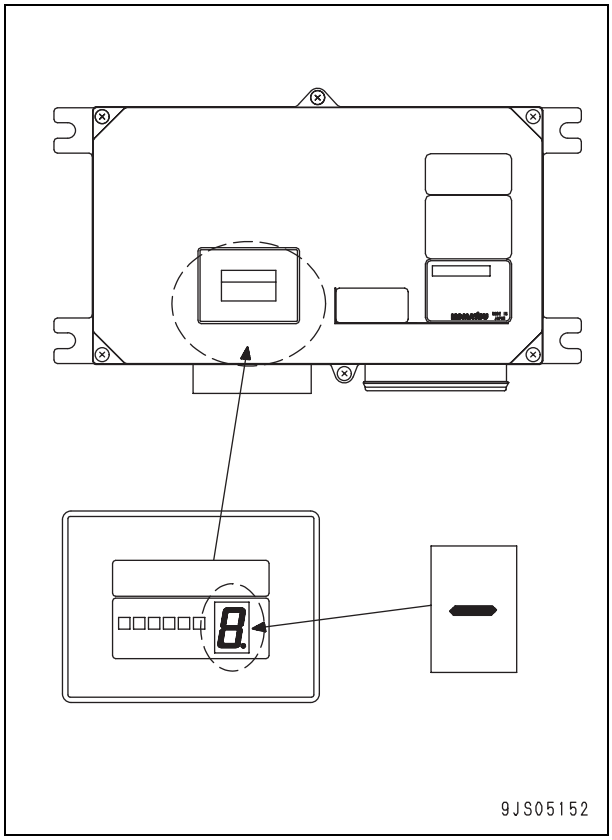
1. Station opening check in machine side

★ Complete steps 3) to 5) within 60 seconds. If 60 seconds or above elapsed, begin with step 1) again.

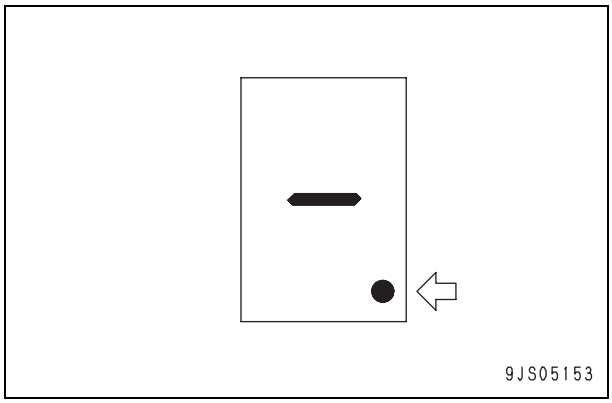
1) Turn OFF the starting switch and then, after making sure 5 seconds have elapsed, proceed to the next step.
2) Visually check that check connectors 1 and 2 are connected.
   - Check connector 1: CHK1
   - Check connector 2: CHK2



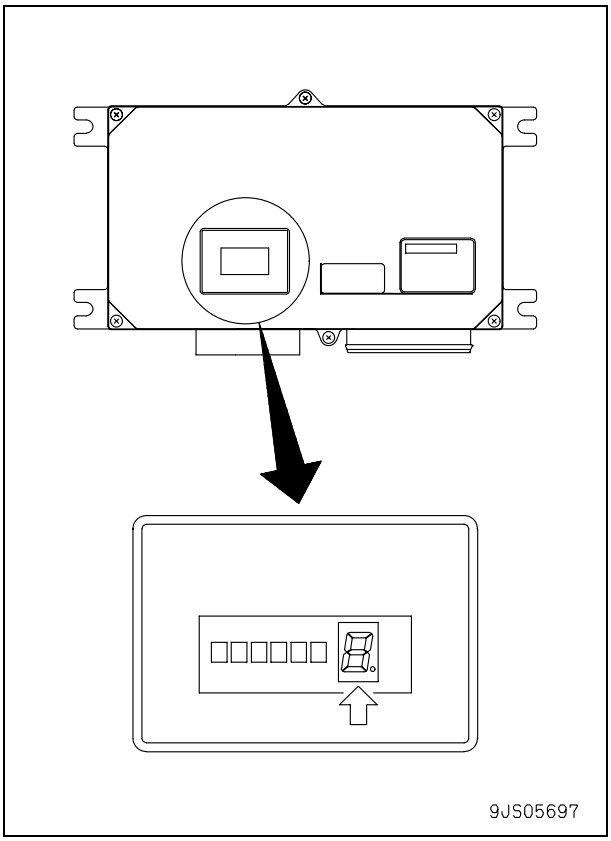
3) When about 3 to 5 seconds elapsed after the starting switch was set to ACC, make sure that the 7-segment indicator lamp changes to hyphen "–" on the KOMTRAX terminal.



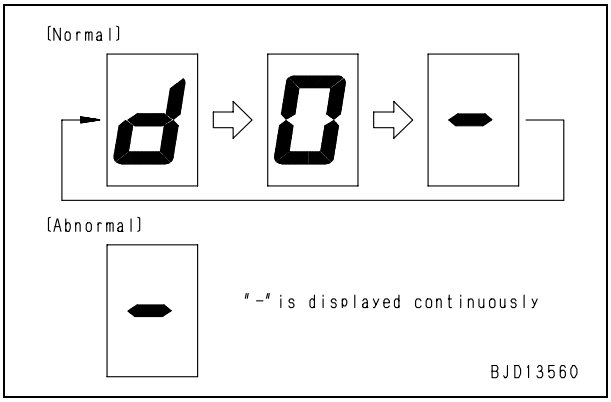
4) Disconnect inspection connector 1, and wait for about 3 to 5 seconds as it is.
   ★ Ensure that the connector is disconnected.
5) Reconnect inspection connector 1, and wait for about 3 to 5 seconds as it is.
   ★ If the KOMTRAX terminal detects that the connector was disconnected and connected, the 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 “0” even within 30 seconds.

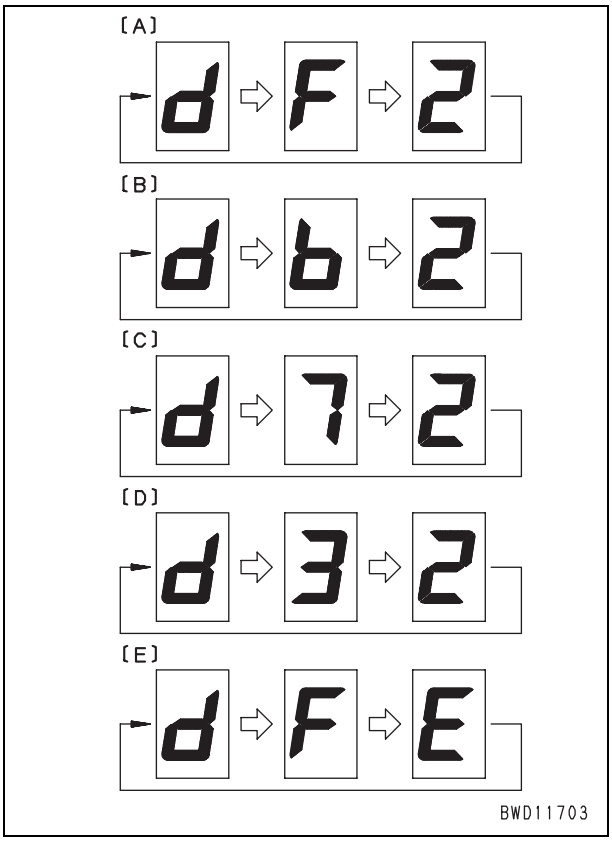


   ★ As [Normal] is indicated, proceed to the next step.
   ★ If “–” remains displayed, execute steps 1) to 5) again.

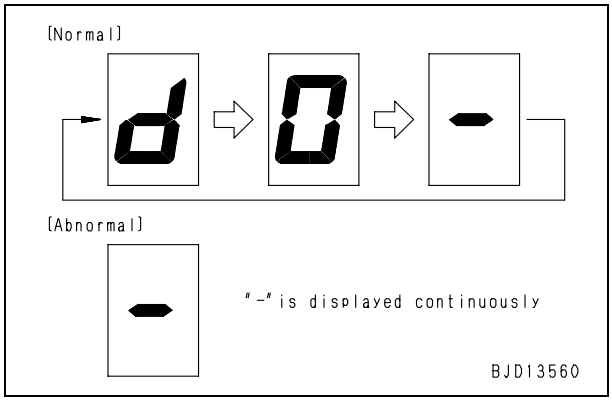


7) Turn the starting switch to START position for about 3 to 5 seconds, and make sure that the engine does not start.
   ★ If the engine starts, re-execute the procedure above from step 1).
   ★ Do not return the starting switch to OFF position.
8) Turn the starting switch from ACC position to START 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.

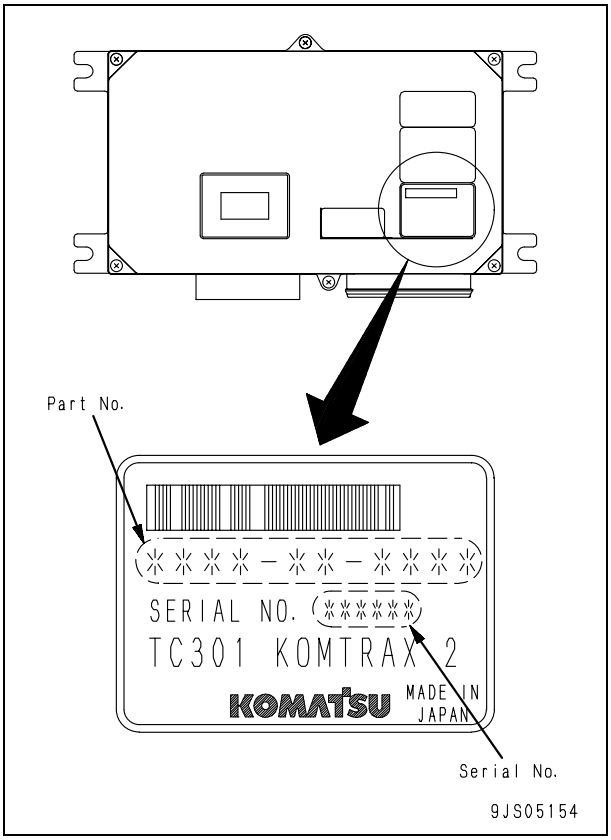


12) When station opening check ended normally, a communication with the KOMTRAX server starts automatically, and settings are stored in KOMTRAX. (This requires about 25 minutes to 4 hours.)
★ During this time, you may turn the starting switch off and start the engine.
★ During the communication and check 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;

In Japan: "KOMTRAX instruction manual for responsible person for operation"

Out of Japan: "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

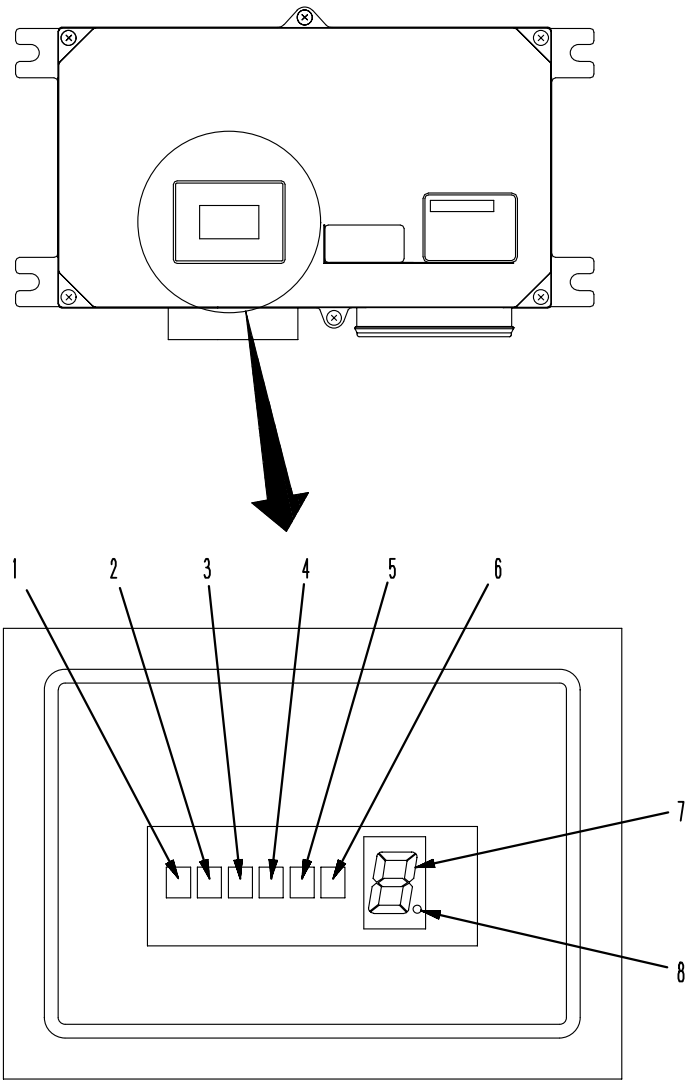
オーブコム衛星通信端末使用開始にあたり、ご面倒ですが下記項目をご記入の上、本用紙を上記の弊社ＫＯＭＴＲＡＸサービスホットライン宛てにファックスまたは郵送お願い致します。
Please fill in the form below and fax or send by mail to Customer Support Gr., Kltd. to activate Orbcomm terminal.

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.

Pm Clinic check sheet

HM300-2	Machine Serial No.
	Engine Serial No.

☐☐☐☐☐ Hour inspection

Work No.	Date	Service meter	Name of inspector
	Year Month Day	hrs	

Questions to operator and inspection around the machine

Was there any abnormality before start of inspection ?	Ambient Temperature Max. °C(°F) Min. °C(°F) Altitude m

Is maximum coolant temperature level normal ? (During operation)	Is maximum torque converter oil temperature level normal ? (During operation)	Is maximum retarder oil temperature level normal ? (During operation)

★ After starting engine !

Measurement item		Measurement condition		Unit	STD.	PMS.	Result	Satis-faction	Unsatis-faction
Engine	Engine speed	Economy mode, low idle		rpm	700 – 750	700 – 750			
		Power mode, low idle			945 – 995	945 – 995			
		Power mode, high idle			2,150 – 2,250	2,150 – 2,250			
		Economy mode, high idle			2,050 – 2,150	2,050 – 2,150			
		Power mode, torque converter stall			1,840 – 2,040	1,840 – 2,040			
		Economy mode, torque converter stall			1,680 – 1,880	1,680 – 1,880			
		Torque converter lockup operates			1,000 – 1,100	1,000 – 1,100			
		Torque converter lockup is reset (Brake is turned ON)			900 – 1,000	900 – 1,000			
		Torque converter lockup is reset (Brake is turned OFF)			800 – 900	800 – 900			
	Blow-by pressure	Torque converter stall		kPa {mmH2O}	Max. 0.98 {Max. 100}	1.96 {200}			
	Engine lubricating oil pressure	SAE0W30E0S SAE5W40E0S SAE10W30DH SAE15W40DH SAE30DH	Torque converter stall	MPa {kg/cm2}	0.29 – 0.69 {3.0 – 7.0}	0.18 {1.8}			
			Low idle		Min. 0.05 {Min. 0.5}	0.03 {0.3}			
	Boost pressure	Torque converter stall		kPa {mmHg}	Min. 107 {Min. 800}	87 {650}			
	Exhaust temperature	Ambient temperature: 20°C (at air cleaner suction port)	Whole speed range	°C	Max. 700	700			

T/C	—	T/C oil temperature : 75 – 85 °C		—	—	—			
	T/C inlet oil pressure	Engine at high idle		MPa {kg/cm2}	0.91±0.10 {9.3±1.0}	0.91±0.10 {9.3±1.0}			
	T/C outlet oil pressure				0.54±0.10 {5.5±1.0}	0.54±0.10 {5.5±1.0}			
	T/C look up oil pressure				2.16±0.15 {22.0±1.5}	2.16±0.15 {22.0±1.5}			
T/M	Main relief oil pressure	Gear shift lever at N position	Engine at low idle		2.55±0.2 {26.0±2.0}	2.55±0.2 {26.0±2.0}			
			Engine at high idle		2.55±0.2 {26.0±2.0}	2.55±0.2 {26.0±2.0}			
	T/M lubicating oil pressure	Engine at high idle			0.1±0.029 {1.0±0.3}	0.1±0.029 {1.0±0.3}			

★ Change oil, clean of transmission case and strainer at every 1000 hours service !

	Measurement item	Measurement condition	Unit	STD.	PMS.	Result	Satis-faction	Unsatis-faction
T/M	Visual check of transmission strainer		—	Must be no excessive metallic particles or rayflex (black powder)				
Steering	Steering time lock to lock	Steering wheel speed: 10 rpm, Eigine at low idle	sec.	Max. 6	Max. 6			
	Steering relief oil pressure	Engine at high idle Hydraulic oil temperature : 45 – 55 °C	MPa {kg/cm²}	20.59 – 21.57 {210 – 220}	20.59 – 21.57 {210 – 220}			
Brake	Brake oil pressure	Charge accumulator and operate brake 1 time and measure operating pressure at this time — Wheel brake	MPa {kg/cm²}	4.9±0.49 {50±5}	4.9±0.49 {50±5}			
	Charging valve set pressure	Engine at high idle — Cut-in		11.77 – 12.06 {120 – 123}	11.77 – 12.06 {120 – 123}			
		Engine at high idle — Cut-out		20.09 – 21.57 {205 – 220}	20.09 – 21.57 {205 – 220}			
	Service brake	When the brake is applied and the engine speed is increased gradually until the torque converter stalls with the gear speed in D, the machine must not move.	rpm	Must not move at 1,440 rpm.				
	Retarder brake			Must not move at 1,470 rpm.				
	Parking brake			Must not move at 1,540 rpm.				
	Emergency brake	Braking distance on slope of 9 ± 1% with load of 24 t at speed of 50 ± 3 km/h	m	Max. 102	Max. 102			
Hydraulic equipment	—	Hydraulic oil temperature : 45 – 55 °C	—	—	—			
	Dump raise relief pressure	At high idle	MPa {kg/cm²}	20.59 – 21.57 {210 – 220}	20.59 – 21.57 {210 – 220}			
	Dump lower relief pressure	At high idle		3.4 ± 0.49 {35 ± 5}	3.4 ± 0.49 {35 ± 5}			
	Dump pilot relief pressure	At high idle		2.6 ± 0.49 {27 ± 5}	2.6 ± 0.49 {27 ± 5}			
	Dump body raise time	Engine at high idle	sec.	12.0 ± 1.5	12.0 ± 1.5			
	Dump body lowering time	When in "Float" position with engine at low idle		Max. 12.5	Max. 12.5			

★ Set dump body and stop engine !

HYDRAULIC DRIFT	—	Hydraulic oil temperature : 45 – 55 °C	—	—	—			
	Hydraulic drift of dump cylinder	At start of measurement: Position of 70% of cylinder length	mm/5 min.	Max.85	Max.170			

★ Replace drain plug with spare plug !

Axle	Visual check of differential case drain plug	Stop engine	—	There must be no excessive metal powder				
	Visual check of final drive case drain plug	Left Right	—	There must be no excessive metal powder				

★ At every 1,000 hours service !

Brakes	Wheel brake (disk wear measurement gauge)	Left		Must be in wear gauge range				
		Right		Must be in wear gauge range				

★ At every 1,000 hours service !

Measurement item		Measurement condition	Unit	STD.	PMS.	Result	Satis-faction	Unsatis-faction
Suspension	Left front suspension	Suspension cylinder length	mm	153 – 173	153 – 173			
		Oil, gas leakage	—	There must be no leakage				
	Right front suspension	Suspension cylinder length	mm	153 – 173	153 – 173			
		Oil, gas leakage	—	There must be no leakage				
	Left rear suspension	Suspension cylinder length	mm	96 – 106	96 – 106			
		Oil, gas leakage	—	There must be no leakage				
	Right rear suspension	Suspension cylinder length	mm	96 – 106	96 – 106			
		Oil, gas leakage	—	There must be no leakage				
	Contact of rear suspension stopper	Left	—	There must be no contact				
		Right	—	There must be no contact				

Failure code record

	h ▶ h	Time		h ▶ h	Time
Contents:			Contents:		
	h ▶ h	Time		h ▶ h	Time
Contents:			Contents:		
	h ▶ h	Time		h ▶ h	Time
Contents:			Contents:		

MEMO : Write any data or phenomena that you noticed during today's check.

HM300-2 Articulated dump truck

Form No. SEN00669-03

ARTICULATED DUMP TRUCK

HM300-2

Machine model	Serial number
HM300-2	2001 and up

40 Troubleshooting

Failure code table and fuse locations

Failure codes table

Failure codes	Failure contents	Applicable equipments	Action code	History classification	Reference manual
1500L0	Detecting dual engagement	TM	E03	Mechanical system	Troubleshooting by failure code, Part 1 SEN00671-03
15B0NX	Transmission oil filter clogging	TM	E01	Mechanical system	
15F0KM	R → F gear shift abuse 1	TM	–	Mechanical system	
15F0MB	R → F gear shift abuse 2	TM	–	Mechanical system	
15F7KM	Transmission forward clutch abuse	TM	–	Mechanical system	
15G0MW	R clutch system failure (Slip is detected)	TM	E03	Electrical system	
15G7KM	Transmission reverse clutch abuse	TM	–	Mechanical system	
15H0MW	Hi clutch system failure (Slip is detected.)	TM	E03	Electrical system	
15J0MW	Lo clutch system failure (Slip is detected.)	TM	E03	Electrical system	
15K0MW	1st clutch system failure (Slip is detected.)	TM	E03	Electrical system	
15L0MW	2nd clutch system failure (Slip is detected.)	TM	E03	Electrical system	
15M0MW	3rd clutch system failure (Slip is detected.)	TM	E03	Electrical system	
15SBL1	R clutch pressure control valve failure Ⅰ	TM	E03	Electrical system	
15SBMA	R clutch pressure control valve failure Ⅱ	TM	E03	Electrical system	
15SCL1	Hi clutch pressure control valve failure Ⅰ	TM	E03	Electrical system	
15SCMA	Hi clutch pressure control valve failure Ⅱ	TM	E03	Electrical system	
15SDL1	Lo clutch pressure control valve failure Ⅰ	TM	E03	Electrical system	
15SDMA	Lo clutch pressure control valve failure Ⅱ	TM	E03	Electrical system	
15SEL1	1st clutch pressure control valve failure Ⅰ	TM	E03	Electrical system	
15SEMA	1st clutch pressure control valve failure Ⅱ	TM	E03	Electrical system	
15SFL1	2nd clutch pressure control valve failure Ⅰ	TM	E03	Electrical system	
15SFMA	2nd clutch pressure control valve failure Ⅱ	TM	E03	Electrical system	
15SGL1	3rd clutch pressure control valve failure Ⅰ	TM	E03	Electrical system	
15SGMA	3rd clutch pressure control valve failure Ⅱ	TM	E03	Electrical system	
15SJMA	Lockup clutch pressure control valve failure Ⅱ	TM	E03	Electrical system	
15SKMA	Inter axle differential lock-up clutch pressure control valve failure Ⅱ	TM	E01	Electrical system	
2F00KM	Dragging of parking brake	TM	–	Mechanical system	
2G42ZG	Decrease of accumulator oil pressure (Front)	BK	E03	Mechanical system	
2G43ZG	Decrease of accumulator oil pressure (Rear)	BK	E03	Mechanical system	
(989A00)	Engine over run prevention activated	MON	E02	–	

Failure codes	Failure contents	Applicable equipments	Action code	History classification	Reference manual
989D00	Rear section tipping over alarm (Rising operation on slope)	MON	–	–	Troubleshooting by failure code, Part 1 SEN00671-03
AA10NX	Clogged air cleaner	MON	E01	Mechanical system	
AB00MA	Failure of battery charge circuit	TM	E03	Electrical system	
B@BAZG	Engine oil pressure is too low.	ENG	E03	Mechanical system	
B@BAZK	Engine oil level is too low.	TM	E01	Mechanical system	
B@BCNS	Engine overheat	ENG	E02	Mechanical system	
B@BCZK	Coolant level is too low.	MON	E01	Mechanical system	
B@BFZK	Lowering of fuel level	MON	–	–	
B@C6NS	Overheat of brake cooling oil temperature (Front)	MON	E02	Mechanical system	
B@C8NS	Overheat of brake cooling oil temperature (Center)	MON	E02	Mechanical system	
B@CENS	Overheat of torque converter fluid temperature	MON	E02	Mechanical system	
B@HAZK	(Hydraulic tank oil: Level too low)	MON	E01	Mechanical system	
B@JANS	Overheat of steering oil temperature	TM	E02	Mechanical system	
CA111	Abnormality in engine controller	ENG	E03	Electrical system	Troubleshooting by failure code, Part 2 SEN00672-03
CA115	Abnormal engine Ne and Bkup speed sensors	ENG	E03	Electrical system	
CA122	Charge pressure sensor too high	ENG	E03	Electrical system	
CA123	Charge pressure sensor too low	ENG	E03	Electrical system	
CA131	Throttle sensor tool high	ENG	E03	Electrical system	
CA132	Throttle sensor too low	ENG	E03	Electrical system	
CA135	Engine oil pressure sensor too high	ENG	E01	Electrical system	
CA141	Engine oil pressure sensor too low	ENG	E01	Electrical system	
CA144	Coolant temperature sensor too high	ENG	E01	Electrical system	
CA145	Coolant temperature sensor too low	ENG	E01	Electrical system	
CA153	Charge temperature sensor too high	ENG	E01	Electrical system	
CA154	Charge temperature sensor too low	ENG	E01	Electrical system	
CA187	Sensor power source 2 too low	ENG	E03	Electrical system	
CA221	Atmospheric pressure sensor too high	ENG	E01	Electrical system	
CA222	Atmospheric pressure sensor too low	ENG	E01	Electrical system	
CA227	Sensor power source 2 too high	ENG	E03	Electrical system	
CA234	Engine overspeed	ENG	E02	Mechanical system	
CA238	Abnormal power source for Ne speed sensor	ENG	E03	Electrical system	
CA263	Fuel temperature sensor too high	ENG	E01	Electrical system	

Failure codes	Failure contents	Applicable equipments	Action code	History classification	Reference manual
CA265	Fuel temperature sensor too low	ENG	E01	Electrical system	Troubleshooting by failure code, Part 2 SEN00672-03
CA271	PCV1 short circuit	ENG	E03	Electrical system	
CA272	PCV1 disconnection	ENG	E03	Electrical system	
CA273	PCV2 short circuit	ENG	E03	Electrical system	
CA274	PCV2 disconnection	ENG	E03	Electrical system	
CA322	Disconnection or short circuit in injector No.1(L No.1)	ENG	E03	Electrical system	
CA323	Disconnection or short circuit in injector No.5 (L No.5)	ENG	E03	Electrical system	
CA324	Disconnection or short circuit in injector No.3 (L No.3)	ENG	E03	Electrical system	
CA325	Disconnection or short circuit in injector No.6 (L No.6)	ENG	E03	Electrical system	
CA331	Disconnection or short circuit in injector No.2 (L No.2)	ENG	E03	Electrical system	
CA332	Disconnection or short circuit in injector No.4 (L No.4)	ENG	E03	Electrical system	
CA342	Abnormal engine controller data consistency	ENG	E03	Electrical system	
CA351	Abnormal injector drive circuit	ENG	E03	Electrical system	
CA352	Sensor power source 1 too low	ENG	E03	Electrical system	
CA386	Sensor power source 1 too high	ENG	E03	Electrical system	
CA431	Abnormal idle validation switch	ENG	E01	Electrical system	
CA432	Abnormal process with idle validation	ENG	E03	Electrical system	
CA441	Power source voltage too low	ENG	E03	Electrical system	
CA442	Power source voltage too high	ENG	E03	Electrical system	
CA449	Common rail pressure too high 2	ENG	E03	Electrical system	
CA451	Common rail pressure sensor too high	ENG	E03	Electrical system	
CA452	Common rail pressure sensor too low	ENG	E03	Electrical system	
CA553	Common rail pressure too high 1	ENG	E03	Electrical system	
CA554	Common rail pressure sensor: in range error	ENG	E03	Electrical system	
CA559	Loss of pressure feed from supply pump 1	ENG	E03	Electrical system	
CA689	Abnormal engine Ne speed sensor	ENG	E03	Electrical system	
CA731	Abnormal engine Bkup speed sensor phase	ENG	E03	Electrical system	
CA757	Loss of all engine controller data	ENG	E03	Electrical system	
CA778	Abnormal engine Bkup speed sensor	ENG	E03	Electrical system	
CA1117	Loss of partial data in engine controller	ENG	E03	Electrical system	
CA1228	Abnormal EGR valve servo 1	ENG	E03	Electrical system	

Failure codes	Failure contents	Applicable equipments	Action code	History classification	Reference manual
CA1625	Abnormal EGR valve servo 2	ENG	E03	Electrical system	Troubleshooting by failure code, Part 2 SEN00672-03
CA1626	Short circuit of bypass valve solenoid drive	ENG	E03	Electrical system	
CA1627	Disconnection in bypass valve solenoid drive	ENG	E03	Electrical system	
CA1628	Abnormal bypass valve servo 1	ENG	E03	Electrical system	
CA1629	Abnormal bypass valve servo 2	ENG	E03	Electrical system	
CA1631	Bypass valve lift sensor too high	ENG	E03	Electrical system	Troubleshooting by failure code, Part 3 SEN00673-03
CA1632	Bypass valve lift sensor too low	ENG	E03	Electrical system	
CA1633	Abnormal KOMNET	ENG	E03	Electrical system	
CA1642	EGR inlet pressure sensor too low	ENG	E01	Electrical system	
CA1653	EGR inlet pressure sensor too high	ENG	E01	Electrical system	
CA2185	Throttle sensor power source too high	ENG	E03	Electrical system	
CA2186	Throttle sensor power source too low	ENG	E03	Electrical system	
CA2249	Loss of pressure feed from supply pump 2	ENG	E03	Electrical system	
CA2271	EGR valve lift sensor too high	ENG	E03	Electrical system	
CA2272	EGR valve lift sensor too low	ENG	E03	Electrical system	
CA2351	EGR valve solenoid drive short circuit	ENG	E03	Electrical system	
CA2352	EGR valve solenoid drive disconnection	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	
DAF9KM	Wrong connection of connector	MON	E03	Electrical system	
DAFRKR	Abnormal CAN communication (machine monitor)	TM	E03	Electrical system	
DAQ0KK	Power source voltage too low	TM	E03	Electrical system	
DAQ0KT	Abnormal non volatile memory	TM	E01	Electrical system	
DAQ2KK	Solenoid power supply system failure	TM	E03	Electrical system	
DAQRKR	Abnormal CAN communication (Transmission controller)	MON	E03	Electrical system	
(DAQRMA)	Inconsistent option setting (Transmission controller)	MON	E03	–	
DB10KT	Abnormal non volatile memory	BK	E03	Electrical system	
DB12KK	Solenoid power supply system failure	BK	E03	Electrical system	
DB13KK	Battery direct power supply too low	BK	E03	Electrical system	
(DB19KQ)	Inconsistent model selection (Transmission controller)	MON	E03	–	
(DB1QMA)	Inconsistent option setting (Transmission controller)	MON	E03	–	

Failure codes	Failure contents	Applicable equipments	Action code	History classification	Reference manual
DB1RKR	Abnormal CAN communication (Transmission controller)	TM	E03	Electrical system	Troubleshooting by failure code, Part 3 SEN00673-03
DB2RKR	Abnormal CAN communication (engine controller)	TM	E03	Electrical system	
DD1ML4	Inconsistent signal of axle connected retarder switch	TM	E01	Electrical system	
DDTHKA	Failure of flow detection valve for Hi clutch	TM	E03	Electrical system	
DDTJKA	Failure of flow detection valve for Lo clutch	TM	E03	Electrical system	
DDTKKA	Failure of flow detection valve for 1st clutch	TM	E03	Electrical system	
DDTLKA	Failure of flow detection valve for 2nd clutch	TM	E03	Electrical system	
DDTMKA	Failure of flow detection valve for 3rd clutch	TM	E03	Electrical system	
DDTNKA	Failure of flow detection valve for R clutch	TM	E03	Electrical system	
DF10KA	No lever signal input	TM	E03	Electrical system	
DF10KB	Multiple lever signal input	TM	E03	Electrical system	
DGF1KX	Transmission oil temperature out of range	TM	E03	Electrical system	
DGR3KZ	Ground fault of brake oil temperature sensor (center) system	MON	E01	Electrical system	
DGR3L8	Disconnection of brake oil temperature sensor (center) system	MON	E01	Electrical system	
DGR4KZ	Ground fault of brake oil temperature sensor (front) system	MON	E01	Electrical system	
DGR4L8	Disconnection of brake oil temperature sensor (front) system	MON	E01	Electrical system	
DGR6KX	Steering oil temperature signal out of range	TM	E01	Electrical system	
DGT1KX	Short circuit of torque converter oil temperature sensor system	TM	E01	Electrical system	
DHT5KX	Disconnection, ground fault, and short circuit of torque converter fluid pressure sensor system	TM	E01	Electrical system	
DHT5L6	torque converter fluid pressure sensor failure	TM	E01	Electrical system	
DHU2KX	Accumulator fluid pressure sensor (front) system failure	BK	E01	Electrical system	
DHU3KX	Accumulator fluid pressure sensor (rear) system failure	BK	E01	Electrical system	
DJF1KA	Disconnection of fuel level sensor system	MON	E01	Electrical system	
DK51L5	Manual retarder potentiometer and RVS failure	BK	E03	Electrical system	
DK52KX	Dump lever potentiometer failure 1	TM	E03	Electrical system	
DK53L8	Dump lever potentiometer failure 2	TM	E03	Electrical system	
DK54KX	Body positioner sensor failure	TM	E03	Electrical system	
DKH0KX	Pitch angle sensor signal out of range	TM	E01	Electrical system	Troubleshooting by failure code, Part 4 SEN00674-02
DLF1KA	Disconnection of transmission input shaft speed sensor system	TM	E03	Electrical system	
DLF1LC	Transmission input shaft speed sensor failure	TM	E03	Electrical system	
DLF2KA	Disconnection of transmission intermediate shaft speed sensor system	TM	E03	Electrical system	

Failure codes	Failure contents	Applicable equipments	Action code	History classification	Reference manual
DLF2LC	Transmission intermediate shaft speed sensor failure	TM	E03	Electrical system	Troubleshooting by failure code, Part 4 SEN00674-02
DLF4KA	Disconnection of transmission differential speed sensor system	TM	E01	Electrical system	
DLT3KA	Disconnection of transmission output shaft speed sensor system	TM	E03	Electrical system	
DV00KB	Short circuit of buzzer output	MON	E01	Electrical system	
DW72KZ	Kick out solenoid output system failure (disconnection or ground fault)	TM	E01	Electrical system	
DW73KZ	Dump selector valve output system failure	TM	E03	Electrical system	
DW78KZ	Rear wheel BCV command output system failure	BK	E01	Electrical system	
DW79KZ	Front wheel BCV command output system failure	BK	E01	Electrical system	
DX11K4	Rear wheels electromagnetic proportional pressure reducing valve failure 1	BK	E03	Electrical system	
DX11KA	Disconnection of rear wheels electromagnetic proportional pressure reducing valve output system	BK	E03	Electrical system	
DX11KB	Ground fault of rear wheels electromagnetic proportional pressure reducing valve output circuit	BK	E03	Electrical system	
DX11KY	Hot short of rear wheels electromagnetic proportional pressure reducing valve output circuit	BK	E03	Electrical system	
DX11MA	Rear wheels electromagnetic proportional pressure reducing valve failure 2	BK	E03	Electrical system	
DX12K4	Front wheels electromagnetic proportional pressure reducing valve failure 1	BK	E03	Electrical system	
DX12KA	Disconnection of rear wheels electromagnetic proportional pressure reducing valve output circuit	BK	E03	Electrical system	
DX12KB	Ground fault of front wheels electromagnetic proportional pressure reducing valve output circuit	BK	E03	Electrical system	
DX12KY	Hot short circuit of front wheels electromagnetic proportional pressure reducing valve output circuit	BK	E03	Electrical system	
DX12MA	Front wheels electromagnetic proportional pressure reducing valve failure 2	BK	E03	Electrical system	
DX13KA	Disconnection of Dump EPC valve output circuit	TM	E03	Electrical system	
DX13KB	Ground fault of Dump EPC valve output circuit	TM	E03	Electrical system	
DX13KY	Hot short circuit of Dump EPC valve output circuit	TM	E03	Electrical system	
DXH0KA	Disconnection of inter axle differential lock-up clutch solenoid output circuit	TM	E01	Electrical system	
DXH0KB	Ground fault of inter axle differential lock-up clutch solenoid output circuit	TM	E01	Electrical system	
DXH0KY	Hot short circuit of inter axle differential lock-up clutch solenoid output circuit	TM	E03	Electrical system	
DXH1KA	Disconnection of lockup clutch solenoid output circuit	TM	E03	Electrical system	
DXH1KB	Ground fault of lock-up clutch solenoid output circuit	TM	E03	Electrical system	
DXH1KY	Hot short circuit of lock-up clutch solenoid output circuit	TM	E03	Electrical system	
DXH2KA	Disconnection of Hi clutch solenoid output circuit	TM	E03	Electrical system	
DXH2KB	Ground fault of Hi clutch solenoid output circuit	TM	E03	Electrical system	

Failure codes	Failure contents	Applicable equipments	Action code	History classification	Reference manual
DXH2KY	Hot short circuit of Hi clutch solenoid output circuit	TM	E03	Electrical system	Troubleshooting by failure code, Part 4 SEN00674-02
DXH3KA	Disconnection of Lo clutch solenoid output circuit	TM	E03	Electrical system	
DXH3KB	Ground fault of Lo clutch solenoid output circuit	TM	E03	Electrical system	
DXH3KY	Hot short circuit of Lo clutch solenoid output circuit	TM	E03	Electrical system	
DXH4KA	Disconnection of 1st clutch solenoid output circuit	TM	E03	Electrical system	
DXH4KB	Ground fault of 1st clutch solenoid output circuit	TM	E03	Electrical system	
DXH4KY	Hot short circuit of 1st clutch solenoid output circuit	TM	E03	Electrical system	
DXH5KA	Disconnection of 2nd clutch solenoid output circuit	TM	E03	Electrical system	
DXH5KB	Ground fault of 2nd clutch solenoid output circuit	TM	E03	Electrical system	
DXH5KY	Hot short circuit of 2nd clutch solenoid output circuit	TM	E03	Electrical system	
DXH6KA	Disconnection of 3rd clutch solenoid output circuit	TM	E03	Electrical system	
DXH6KB	Ground fault of 3rd clutch solenoid output circuit	TM	E03	Electrical system	
DXH6KY	Hot short circuit of 3rd clutch solenoid output circuit	TM	E03	Electrical system	
DXH7KA	Disconnection of R clutch solenoid output circuit	TM	E03	Electrical system	
DXH7KB	Ground fault of R clutch solenoid output circuit	TM	E03	Electrical system	
DXH7KY	Hot short circuit of R clutch solenoid output circuit	TM	E03	Electrical system	

★ Failure codes:
The failure code table is written in alphabetical order and also starting from small number.
The failure code in parentheses is not recorded in the failure history for both electrical system and mechanical system.

★ Applicable equipment:
Applicable equipment indicates in which controller system the failure has occurred.
MON : Machine monitor system
ENG : Engine controller system
TM : Transmission controller system
BK : Retarder controller system

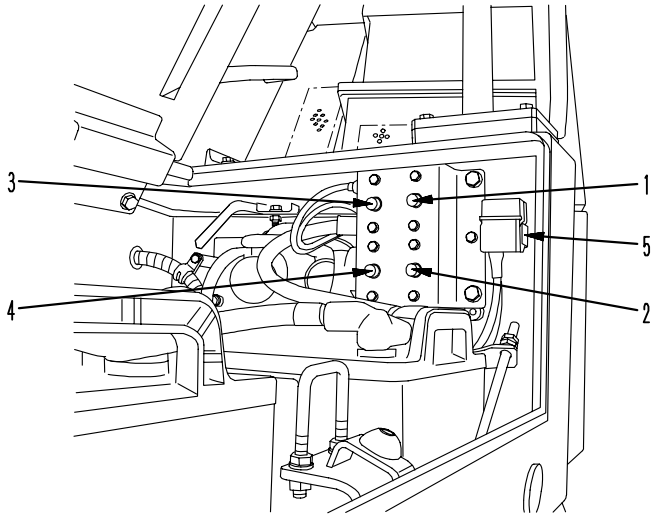
★ Action codes:
Action codes indicate what is displayed in the operator mode when a failure is detected.

★ History classification:
History classification indicates in which system, either electrical system or mechanical system in the failure history display function, a failure has been recorded.

Fuse locations

★ When carrying out troubleshooting related to the electrical system, you should check the circuit breakers and fuses to see if the power is supplied normally.

Circuit breaker (30A/80A) and fuse locations in battery box and connection table



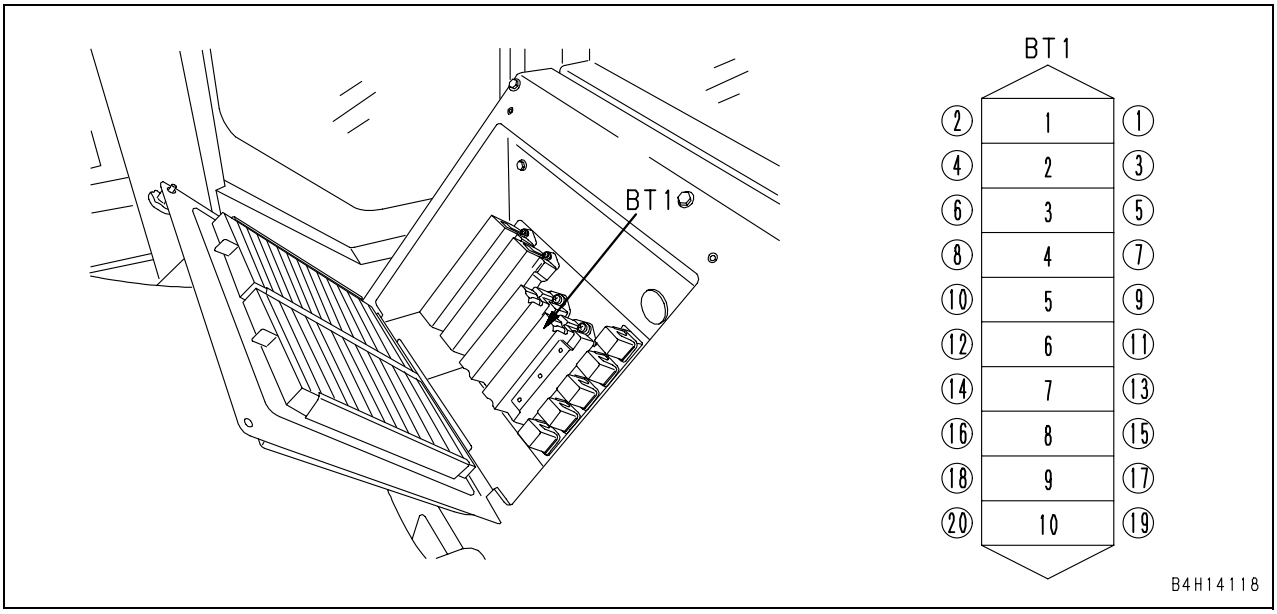
★ This connection table shows the devices to which each power supply of the circuit breakers and fuse box supplies power (An accessory power supply is a device which supplies power while the starting switch is in the ON position and an unswitched power supply is a device which supplies power while the starting switch is in the OFF and ON positions).

Type of power supply	Circuit breaker No. (Connector No.)	Circuit breaker capacity	Destination of power
Unswitched power supply (Battery output)	1 (82, 84)	30A	Fuse box (BT2) *1
			Fuse box (BT4) *1
	2 (81, 83)	30A	Fuse box (BT3) *1
Accessory power supply (Battery relay output)	3 (62, 63)	80A	Fuse box (BT1) *1
			Fuse box (BT2) *1
			Fuse box (BT3) *1
			Fuse box (BT4) *1
	4 (64,65)	80A	Fuse box (BT3) *1

Type of power supply	Fuse No. (Connector No.)	Fuse capacity	Destination of power
Accessory power supply (Battery relay output)	5 (SBF)	120A	Electrical intake air heater (engine) connected through heater relay (HR)

*1: For fuse boxes (BT1) – (BT4), see the following pages.

Fuse box (BT1) location and connection table



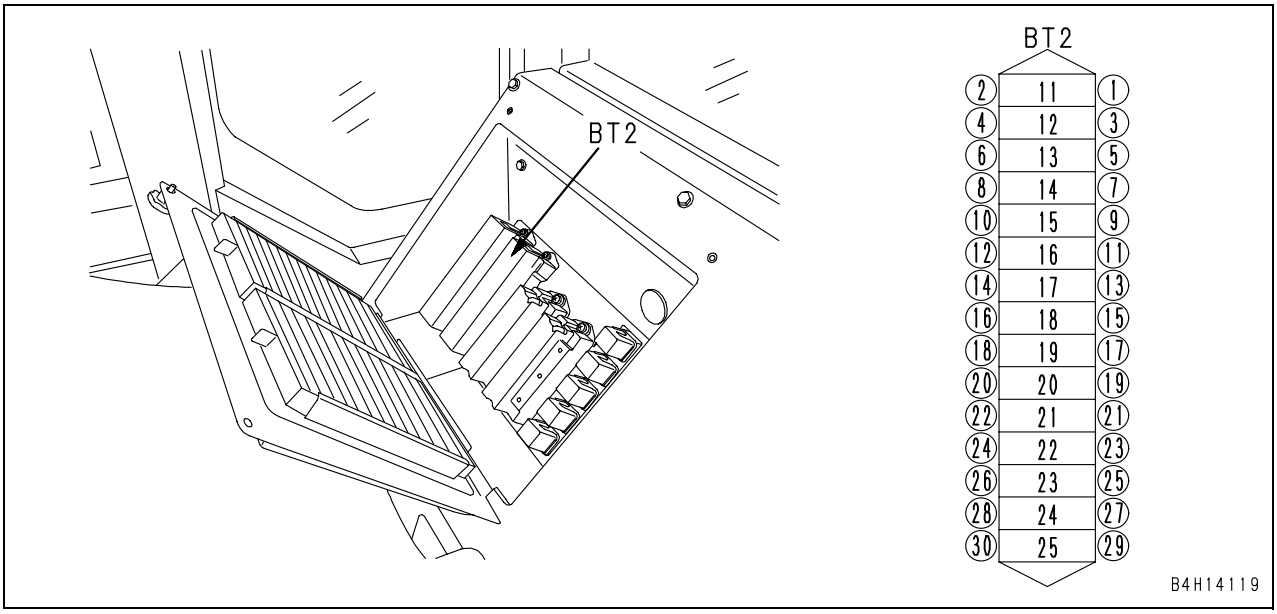
★ The circled numbers are the terminal numbers shown in the circuit diagram of each failure code.

- Fuse box BT1

Type of power supply	Circuit breaker No.	Fuse No.	Fuse capacity	Destination of power
Accessory power supply (Battery relay output)	3 (80A)	(1)	20A	Main lamp
		(2)	10A	Turn signal lamp
Accessory power supply	3 (80A)	(3)	20A	Headlamp (Right) *1
		(4)	20A	Headlamp (Left) *1
		(5)	10A	Small lamp (Right) *1
		(6)	10A	Small lamp (Left) *1
Accessory power supply (Battery relay output)	3 (80A)	(7)	10A	Brake lamp
		(8)	20A	Backup lamp, Backup buzzer
		(9)	20A	Working lamp (Front)
		(10)	20A	Spare

*1: These are connected to the corresponding fuses (1) and lighting switch and then connected to the fuses again. See troubleshooting of electrical system (E mode), "E-12".

Fuse box (BT2) location and connection table

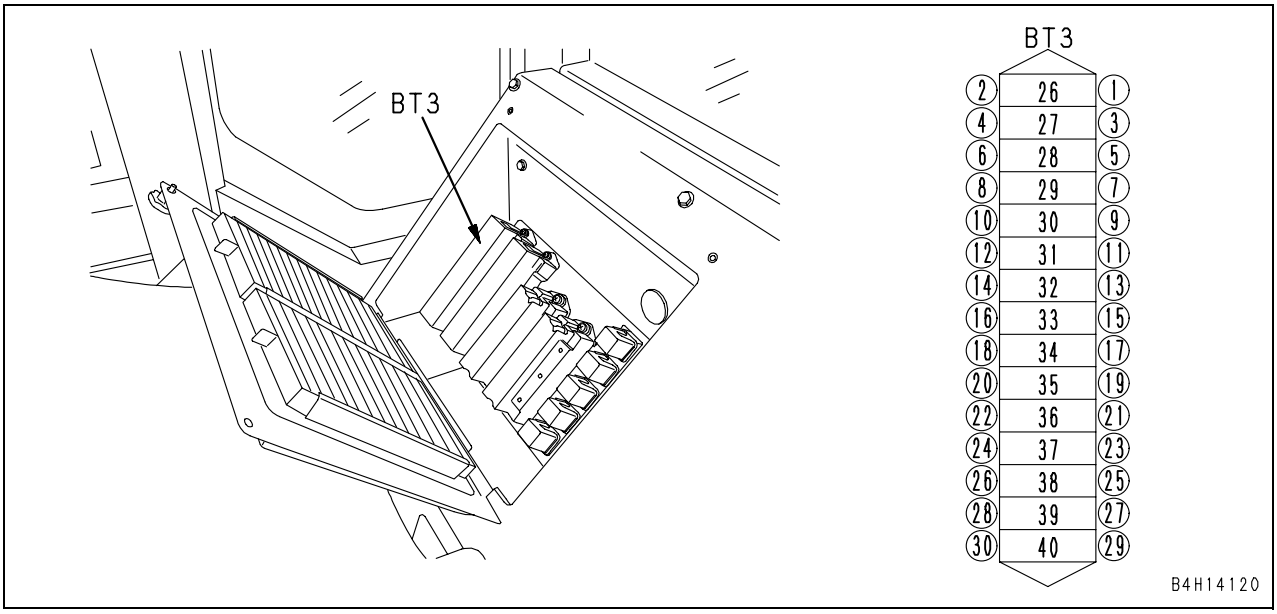


★ The circled numbers are the terminal numbers shown in the circuit diagram of each failure code.

- Fuse box BT2

Type of power supply	Circuit breaker No.	Fuse No.	Fuse capacity	Destination of power
Key switch (ACC)		(11)	5A	Engine controller
		(12)	10A	KOMTRAX
		(13)	10A	Machine monitor
Key switch (BR)		(14)	10A	Parking brake
		(15)	10A	Rear view range monitor
Accessory power supply (Battery relay output)	3 (80A)	(16)	20A	Front windshield wiper
		(17)	20A	Rear windshield wiper
Unswitched power supply	1 (30A)	(18)	10A	Machine monitor, KOMTRAX
		(19)	10A	Retarder controller
		(20)	20A	Terminal B
		(21)	10A	Transmission controller
		(22)	20A	Hazard lamp
		(23)	10A	Emergency steering
		(24)	10A	Room lamp, Radio
		(25)	20A	Spare

Fuse box (BT3) location and connection table

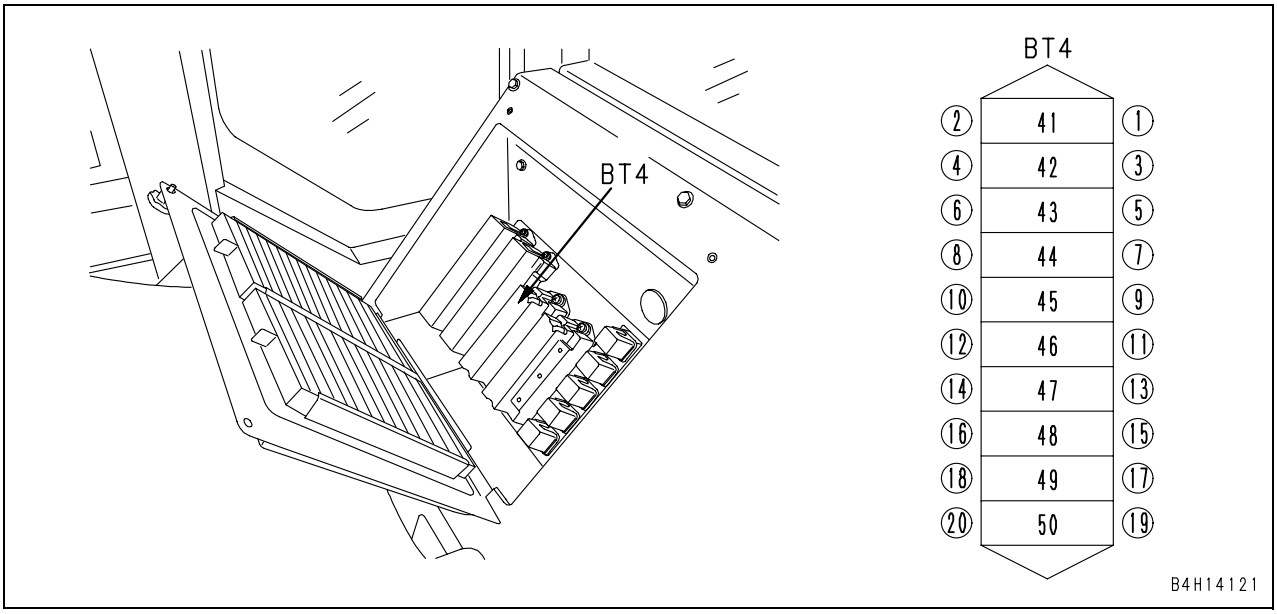


★ The circled numbers are the terminal numbers shown in the circuit diagram of each failure code.

- Fuse box BT3

Type of power supply	Circuit breaker No.	Fuse No.	Fuse capacity	Destination of power
Accessory power supply (Battery relay output)	3 (80A)	(26)	20A	Fog lamp (if equipped)
Accessory power supply (Battery relay output)	4 (80A)	(27)	20A	Air conditioner controller (if equipped)
		(28)	10A	Heater
		(29)	10A	Heater
		(30)	10A	Machine monitor
		(31)	10A	Retarder controller
		(32)	10A	Transmission controller
		(33)	10A	Emergency steering, parking brake relay
		(34)	20A	Power window (Right)
		(35)	20A	Power window (Left)
		(36)		
		(37)		
		(38)		
		(39)	20A	Rear heater
Unswitched power supply	2 (30A)	(40)	30A	Engine controller

Fuse box (BT4) location and connection table



★ The circled numbers are the terminal numbers shown in the circuit diagram of each failure code.

- Fuse box BT4

Type of power supply	Circuit breaker No.	Fuse No.	Fuse capacity	Destination of power
Accessory power supply (Battery relay out put)	3 (80A)	(41)	10A	Room lamp 2, Spot lamp (if equipped)
		(42)	10A	Radio
		(43)	10A	Yellow rotary lamp (if equipped), Step lamp (if equipped)
		(44)	20A	Side lamp (if equipped)
		(45)	10A	Auto-preheater
Unswitched power supply	1 (30A)	(46)	10A	Horn
Accessory power supply (Battery relay out put)	3 (80A)	(47)	10A	Tachograph (if equipped)
		(48)	10A	Cigarette lighter
		(49)	10A	Air suspension seat
		(50)	10A	Air conditioner

HM300-2 Articulated dump truck

Form No. SEN03299-01

ARTICULATED DUMP TRUCK

HM300-2

Machine model	Serial number
HM300-2	2001 and up

40 Troubleshooting
General Information on troubleshooting

Points to remember when troubleshooting

⚠ **Stop the machine in a level ground, and check that the lock pin, blocks, and parking brake are securely fitted.**
⚠ **When carrying out the operation with two 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?

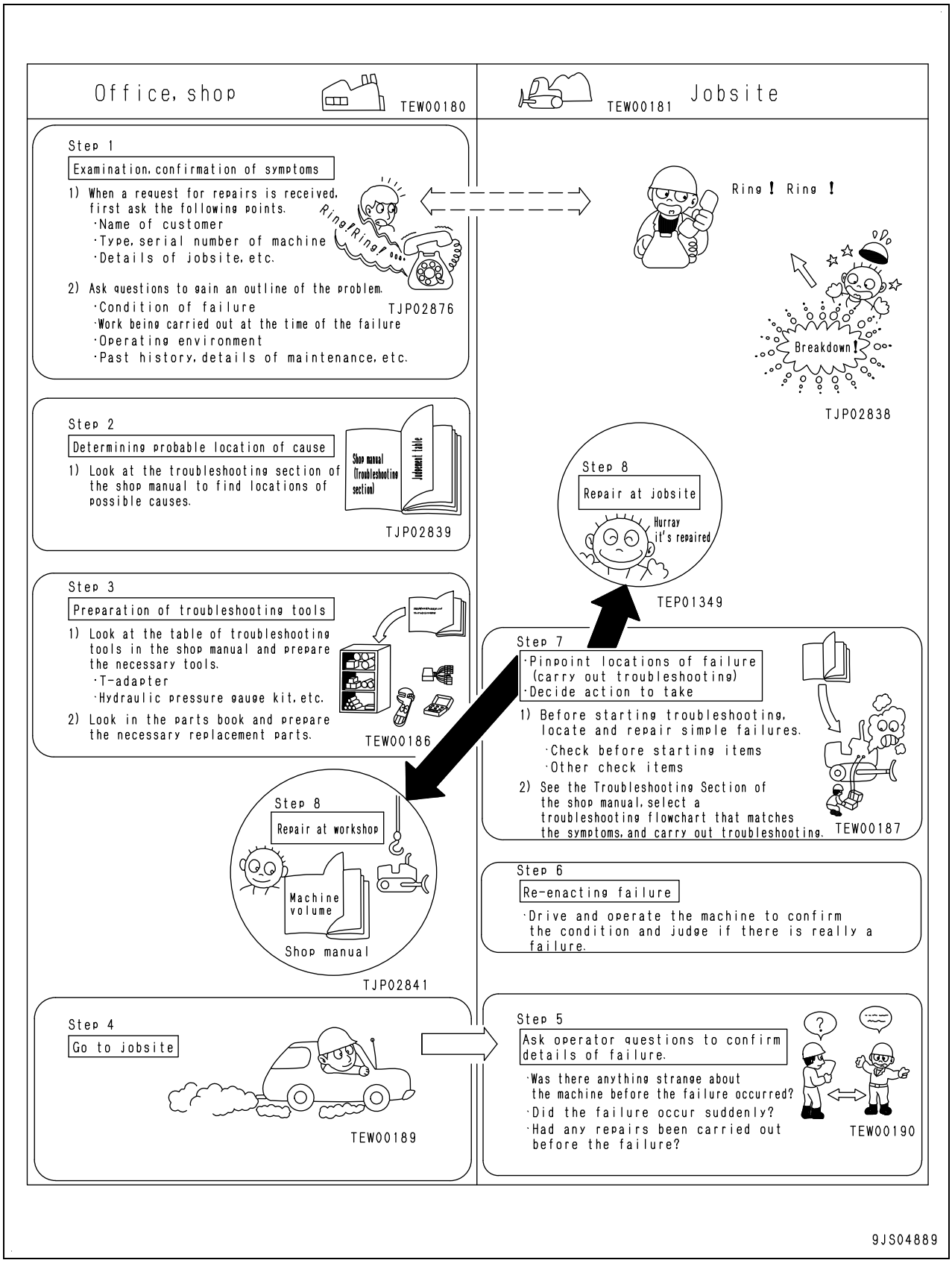
3. Check before troubleshooting
   1) Check the oil level
   2) Check for any external leakage of oil from the piping or hydraulic equipment.
   3) Check the travel of the control levers.
   4) Check the stroke of the control valve spool.
   5) Other maintenance items can be checked externally, so check any item that is considered to be necessary.

4. Confirming failure
   - Confirm the extent of the failure yourself, and judge whether to handle it as a real failure or as a problem with the method of operation, etc.
     ★ When operating the machine to reenact the troubleshooting symptoms, do not carry out any investigation or measurement that may make the problem worse.

5. Troubleshooting
   - Use the results of the investigation and inspection in Items 2 - 4 to narrow down the causes of failure, then use the troubleshooting flowchart to locate the position of the failure exactly.
     ★ The basic procedure for troubleshooting is as follows.
       1] Start from the simple points.
       2] Start from the most likely points.
       3] Investigate other related parts or information.

6. Measures to remove root cause of failure
   - Even if the failure is repaired, if the root cause of the failure is not repaired, the same failure will occur again.
     To prevent this, always investigate why the problem occurred. Then, remove the root cause.

Sequence of events in troubleshooting



Checks before troubleshooting

	Check item	Judgement value	Remedy
Lubricating oil, coolant	1.Check fuel level and type	—	Add fuel
	2.Check for impurities in fuel	—	Clean, drain
	3.Check hydraulic oil level	—	Add oil
	4.Check hydraulic oil strainer	—	Clean, drain
	5.Check power train oil level	—	Add oil
	6.Check engine oil level (engine oil pan level) and type	—	Add oil
	7.Check coolant level	—	Add coolant
	8.Check dust indicator for clogging	—	Clean or replace
	9.Check power train oil filter	—	Replace
	10.Check hydraulic oil filter	—	Replace
	11.Check final drive oil level	—	Add oil
Electrical equipment	1.Check for looseness and corrosion of battery cable terminals	—	Retighten or replace
	2.Check for looseness and corrosion of alternator harness terminals	—	Retighten or replace
	3.Check for looseness and corrosion of starting motor harness terminals	—	Retighten or replace
	4.Check operation of instruments	—	Repair or replace
Hydraulic and mechanical equipment	1.Check for abnormal noise and smell	—	Repair
	2.Check for oil leakage	—	Repair
	3.Carry out air bleeding	—	Bleed air
Electrical equipment	1.Check battery voltage (engine stopped)	20 – 26 V	Replace
	2.Check battery electrolyte level	—	Refill or replace
	3.Check for discoloration, burnout of wiring, and peeling of harness coating	—	Replace
	4.Check for missing wiring clamps and a slack of wire	—	Repair
	5. Check for water leaking on wiring (pay particularly careful attention to water leaking on connectors or terminals)	—	Disconnect connector and dry
	6.Check for blown or corroded fuse	—	Replace
	7.Check alternator voltage (engine running at half throttle or above)	After running for several minutes: 27.5 – 29.5 V	Replace
	8.Check operating noise of battery relay (when turning the starting switch ON or OFF)	–	Replace

Classification and procedures for troubleshooting

Classification for troubleshooting

Type	Contents
Display of code	Troubleshooting by failure code
E mode	Troubleshooting for electrical system
H mode	Troubleshooting for hydraulic and mechanical system
S mode	Troubleshooting for 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 and failure code are displayed on machine monitor:**
   If a action code and a failure code are displayed on the machine monitor, carry out the troubleshooting for the corresponding "**Display of code**" according to the displayed failure code.

2. **When electrical system failure code or mechanical system failure code is recorded in fault history:**
   If a action code and a failure code are not displayed on the machine monitor, check for a mechanical system failure code and an electrical system failure code with the fault history function of the machine monitor.
   If a failure code is recorded, carry out troubleshooting for the corresponding "**Display of code**" according to that code.
   ★ If an electrical system failure code is recorded, delete all the codes and reproduce them, and then see if the trouble is still detected.
   ★ A failure code of the mechanical system cannot be deleted.
   ★ If a trouble is displayed in the air conditioner fault history or heater fault history by the fault history function, carry out the corresponding troubleshooting in "**E mode**".

3. **When action code or failure code is not displayed and no failure code is recorded in fault history:**
   If a action code or a failure code is not displayed on the machine monitor and no failure code is recorded in the fault history, 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 corresponding to that phenomenon in the "**E mode**", "**H mode**", or "**S mode**".

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.

Action code	Failure code	Trouble	**Trouble name displayed in fault history of machine monitor**
Display on machine monitor	**Display on machine monitor**		
Contents of trouble	**Contents of trouble detected by machine monitor or controller**		
Action of machine monitor or controller	**Action taken by machine monitor or controller to protect system or devices when they detect 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 (Given numbers are reference numbers, which do not indicate priority)	**<Contents of description>** ● **Standard value in normal state to judge possible causes** ● **Remarks on judgment** **<Troubles in wiring harness>** ● **Disconnection** **Connector is connected defectively or wiring harness is broken.** ● **Ground fault** **Wiring harness which is not connected to chassis ground circuit is in contact with chassis ground circuit.** ● **Hot short** **Wiring harness which is not connected to power source (24 V) circuit is in contact with power source (24 V) circuit.** ● **Short circuit** **Independent wiring harnesses are in contact with each other abnormally.** **<Precautions for troubleshooting>** **(1) Method of indicating connector No. and handling of T-adapter** **Insert or connect T-adapter as explained below for troubleshooting, unless otherwise specified.** ● **If connector No. has no marks of "male" and "female", disconnect connector and insert T-adapters in both male side and female side.** ● **If connector No. has marks of "male" and "female", disconnect connector and connect T-adapter to only male side or female side.** **(2) Entry order of pin Nos. and handling of tester leads** **Connect positive (+) lead and negative (-) lead of tester as explained below for troubleshooting, unless otherwise specified.** ● **Connect positive (+) lead to pin No. or wiring harness entered on front side.** ● **Connect negative (-) lead to pin No. or harness entered on rear side.**
	2		
	3		
	4		

Related circuit diagram

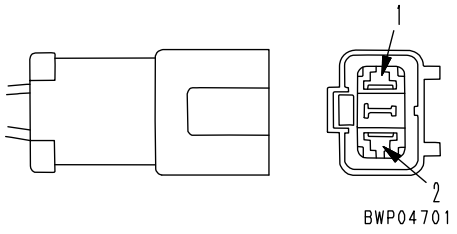
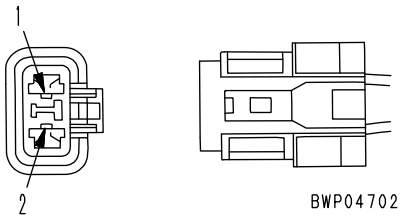
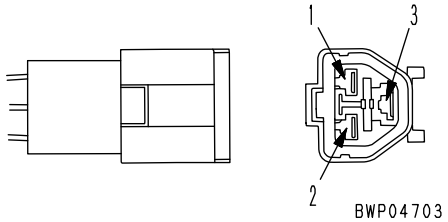
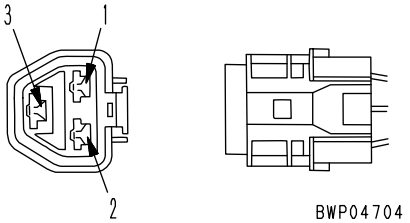
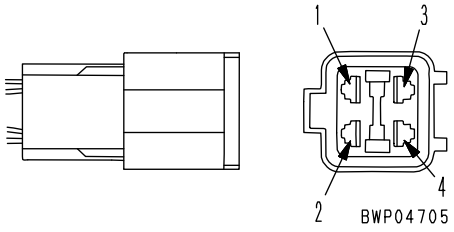
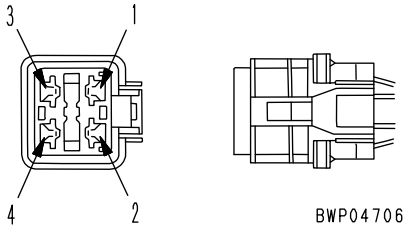
This drawing is a part of the electric circuit diagram related to troubleshooting.

- Connector No.: Indicates (Model - Number of pins) and (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.

Connection table for connector pin numbers

(Rev. 2009. 04)

★ The terms of male and female refer to the pins, while the terms of 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)	Testing connection use special tool Part No.
1	Part No. : 08055-00181	Part No. : 08055-00191	99-601-7010 (T-adapter)
2	 BWP04701	 BWP04702	799-601-7020 (T-adapter)
	Part No. : 08055-00282	Part No. : 08055-00292	
3	 BWP04703	 BWP04704	799-601-7030 (T-adapter)
	Part No. : 08055-00381	Part No. : 08055-00391	
4	 BWP04705	 BWP04706	799-601-7040 (T-adapter)
	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	—

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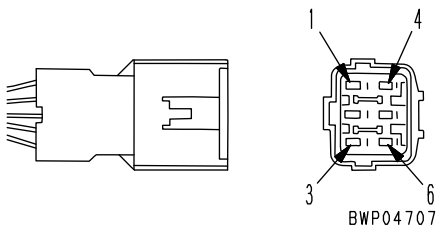
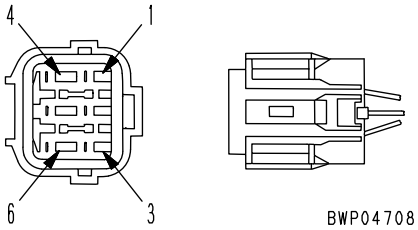
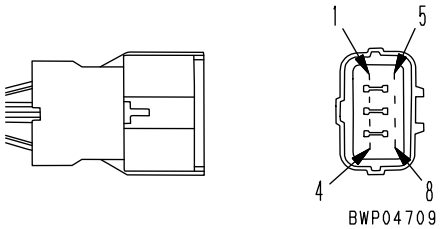
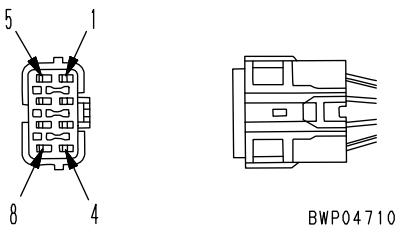
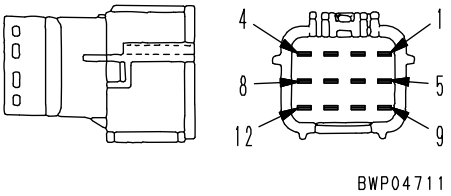
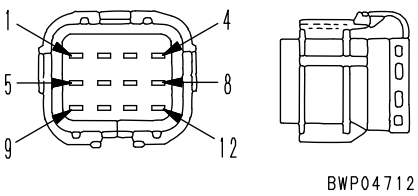
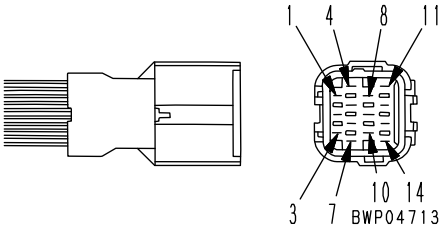
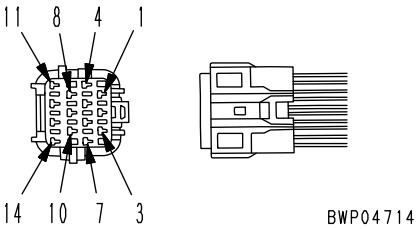
No. of pins	SWP type connector		
	Male (female housing)	Female (male housing)	Testing connection use special tool Part No.
6			799-601-7050 (T-adapter)
	Part No. : 08055-10681	Part No. : 08055-10691	
8			799-601-7060 (T-adapter)
	Part No. : 08055-10881	Part No. : 08055-10891	
12			799-601-7310 (T-adapter)
	Part No. : 08055-11281	Part No. : 08055-11291	
14			799-601-7070 (T-adapter)
	Part No. : 08055-11481	Part No. : 08055-11491	

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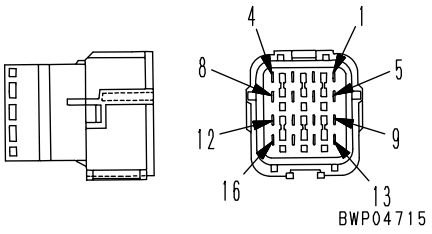
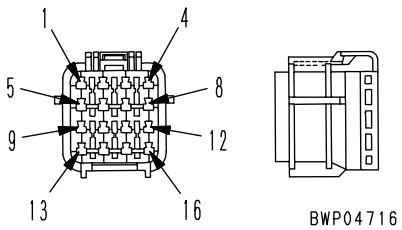
No. of pins	SWP type connector		
	Male (female housing)	Female (male housing)	Testing connection use special tool Part No.
16	 BWP04715	 BWP04716	799-601-7320 (T-adapter)
	Part No. : 08055-11681	Part No. : 08055-11691	
—	Terminal part No. : ·Electric wire size: 0.85 ·Grommet: Black ·Q'ty: 20	Terminal 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	—

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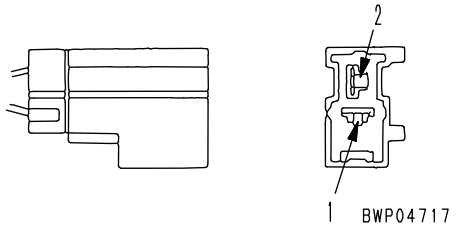
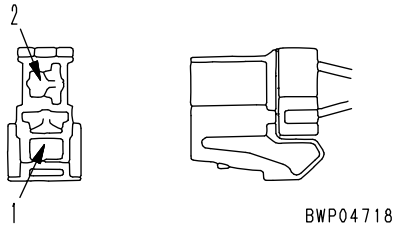
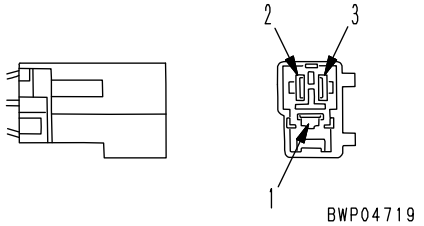
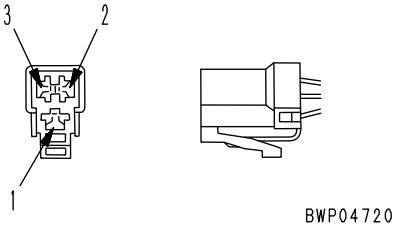
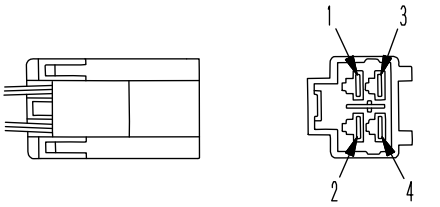
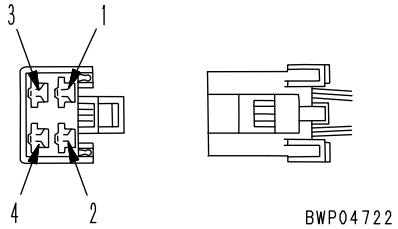
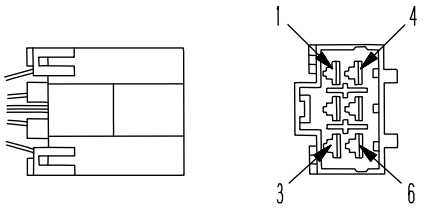
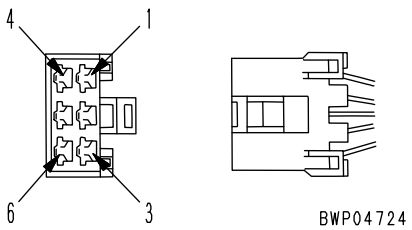
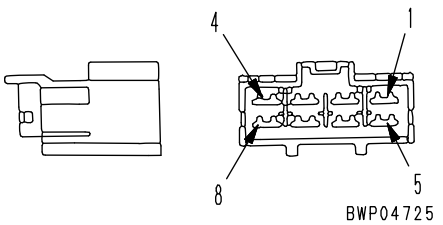
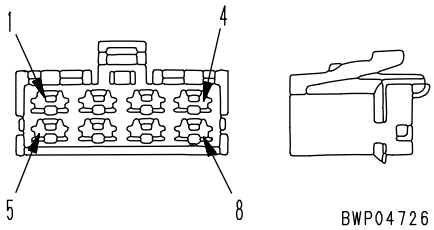
No. of pins	M type connector		
	Male (female housing)	Female (male housing)	Testing connection use special tool Part No.
1	Part No. : 08056-00171	Part No. : 08056-00181	799-601-7080 (T-adapter)
2	 BWP04717	 BWP04718	799-601-7090 (T-adapter)
	Part No. : 08056-00271	Part No. : 08056-00281	
3	 BWP04719	 BWP04720	799-601-7110 (T-adapter)
	Part No. : 08056-00371	Part No. : 08056-00381	
4	 BWP04721	 BWP04722	799-601-7120 (T-adapter)
	Part No. : 08056-00471	Part No. : 08056-00481	
6	 BWP04723	 BWP04724	799-601-7130 (T-adapter)
	Part No. : 08056-00671	Part No. : 08056-00681	
8	 BWP04725	 BWP04726	799-601-7340 (T-adapter)
	Part No. : 08056-00871	Part No. : 08056-00881	

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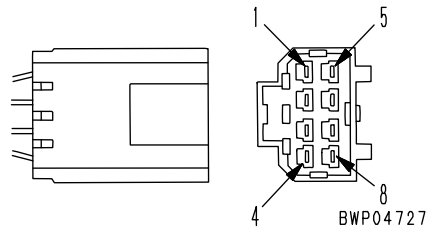
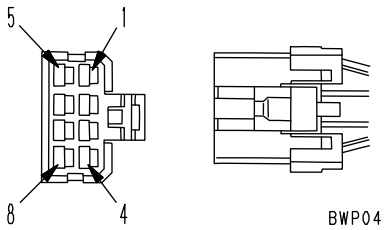
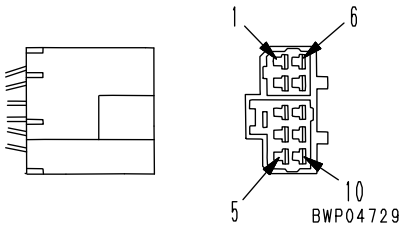
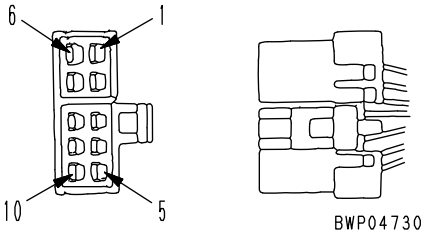
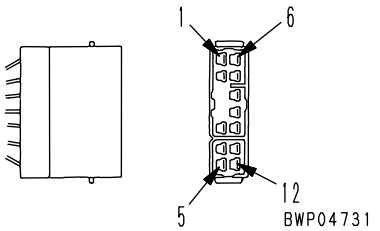
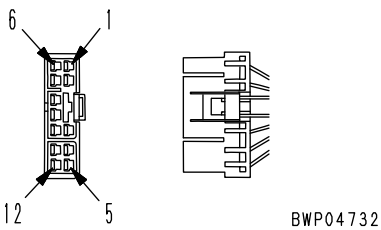
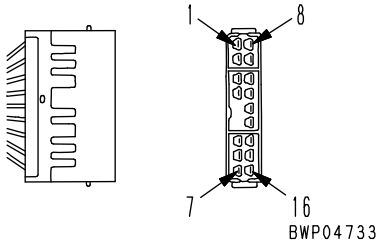
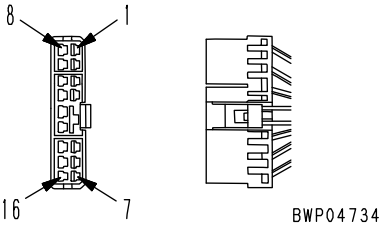
No. of pins	S type connector		
	Male (female housing)	Female (male housing)	Testing connection use special tool Part No.
8			799-601-7140 (T-adapter)
	Part No. : 08056-10871	Part No. : 08056-10881	
10 (White)			799-601-7150 (T-adapter)
	Part No. : 08056-11071	Part No. : 08056-11081	
12 (White)			799-601-7350 (T-adapter)
	Part No. : 08056-11271	Part No. : 08056-11281	
16 (White)			799-601-7330 (T-adapter)
	Part No. : 08056-11671	Part No. : 08056-11681	

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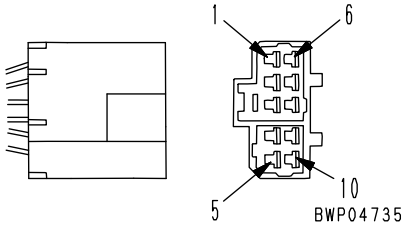
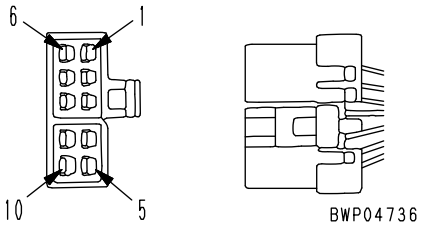
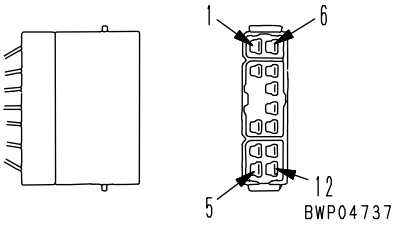
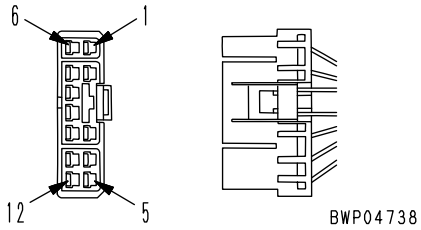
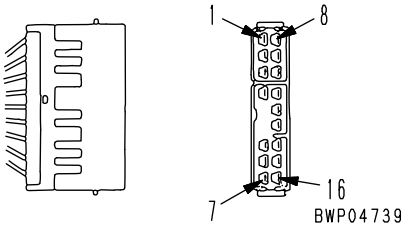
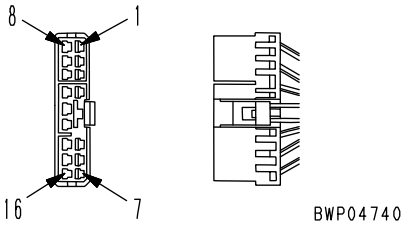
No. of pins	S type connector		
	Male (female housing)	Female (male housing)	Testing connection use special tool Part No.
10 (Blue)			—
	—	—	
12 (Blue)			799-601-7160 (T-adapter)
	Part No. : 08056-11272	Part No. : 08056-11282	
16 (Blue)			799-601-7170 (T-adapter)
	Part No. : 08056-11672	Part No. : 08056-11682	

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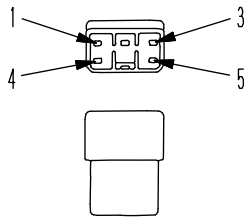
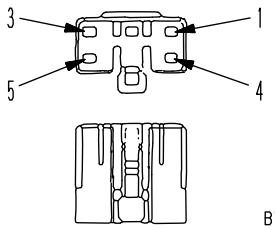
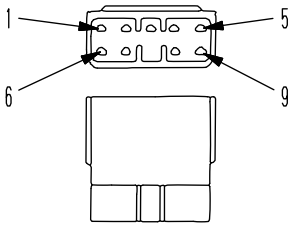
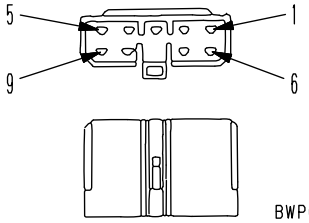
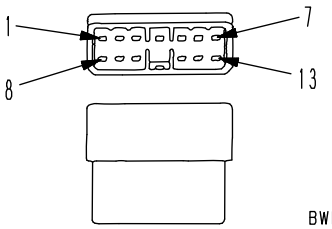
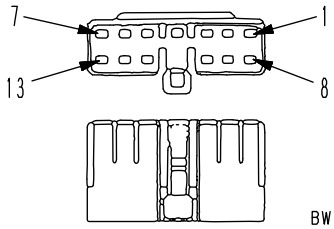
No. of pins	MIC type connector		
	Male (female housing)	Female (male housing)	Testing connection use special tool Part No.
7	Body part No. : 79A-222-2640 (Q'ty:5)	Body part No. : 79A-222-2630 (Q'ty:5)	—
11	Body part No. : 79A-222-2680 (Q'ty:5)	Body part No. : 79A-222-2670 (Q'ty:5)	—
5	 BWP04741	 BWP04742	799-601-2710 (T-adapter)
	Body part No. : 79A-222-2620 (Q'ty:5)	Body part No. : 79A-222-2610 (Q'ty:5)	
9	 BWP04743	 BWP04744	799-601-2950 (T-adapter)
	Body part No. : 79A-222-2660 (Q'ty:5)	Body part No. : 79A-222-2650 (Q'ty:5)	
13	 BWP04745	 BWP04746	799-601-2720 (T-adapter)
	Body part No. : 79A-222-2710 (Q'ty:2)	Body part No. : 79A-222-2690 (Q'ty:2)	

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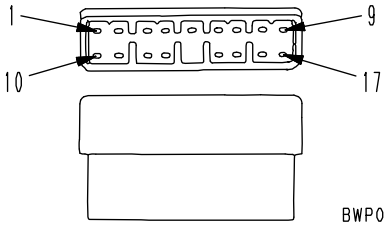
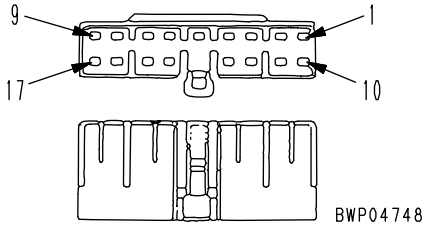
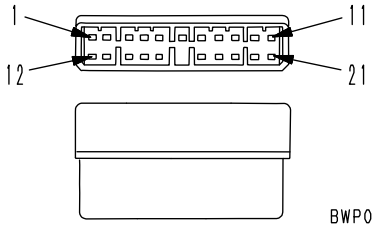
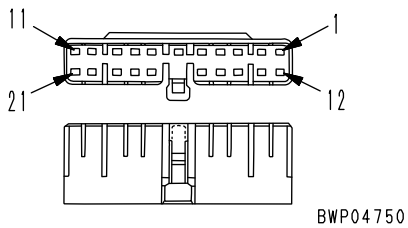
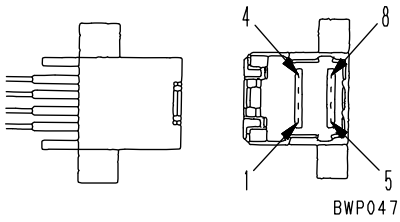
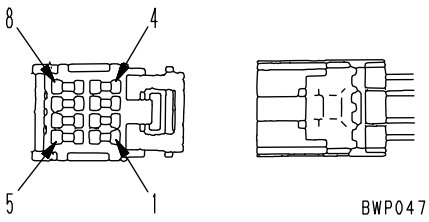
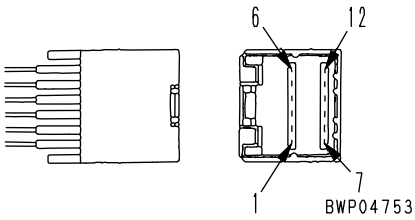
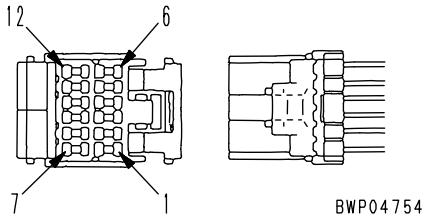
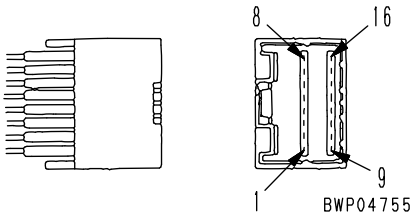
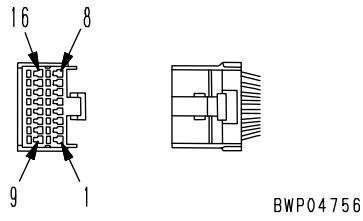
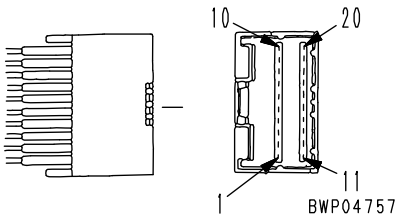
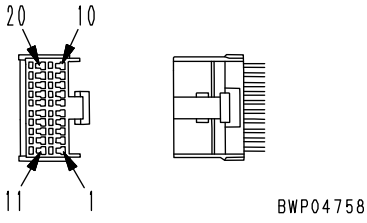
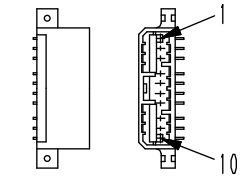
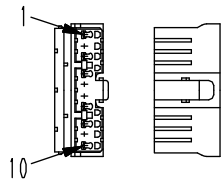
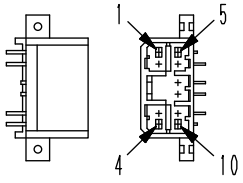
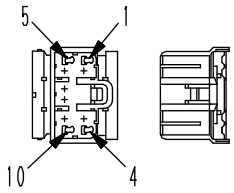
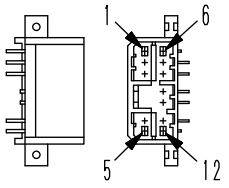
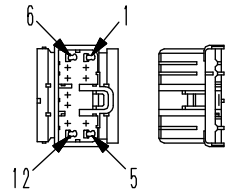
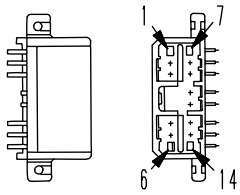
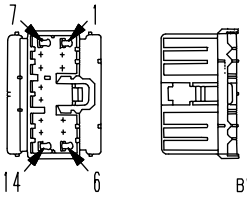
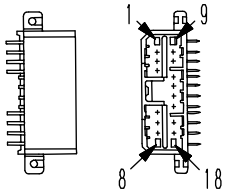
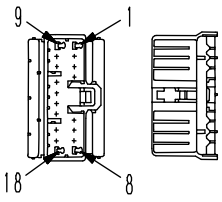
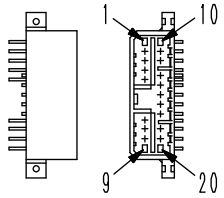
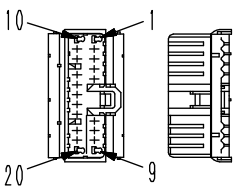
No. of pins	MIC type connector		
	Male (female housing)	Female (male housing)	Testing connection use special tool Part No.
17	 BWP04747	 BWP04748	799-601-2730 (T-adapter)
	Body part No. : 79A-222-2730 (Q'ty:2)	Body part No. : 79A-222-2720 (Q'ty:2)	
21	 BWP04749	 BWP04750	799-601-2740 (T-adapter)
	Body 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)	

B4D18197

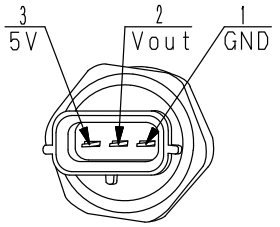
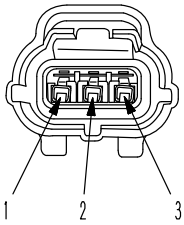
No. of pins	AMP040 type connector		
	Male (female housing)	Female (male housing)	Testing connection use special tool Part No.
8			799-601-7180 (T-adapter)
	—	Housing part No. : 79A-222-3430 (Q'ty:5)	
12			799-601-7190 (T-adapter)
	—	Housing part No. : 79A-222-3440 (Q'ty:5)	
16			799-601-7210 (T-adapter)
	—	Housing part No. : 79A-222-3450 (Q'ty:5)	
20			799-601-7220 (T-adapter)
	—	Housing part No. : 79A-222-3460 (Q'ty:5)	

B4D18198

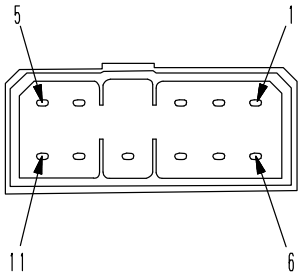
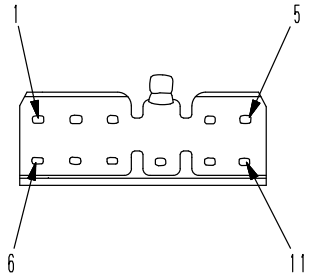
No. of pins	AMP070 type connector		
	Male (female housing)	Female (male housing)	Testing connection use special tool Part No.
10	 BWP04759	 BWP04760	—
	—	—	
10	 9JS02245	 9JS02246	799-601-7510 (T-adapter)
	—	Part No. :7821-92-7330	
12	 BWP04761	 BWP04762	799-601-7520 (T-adapter)
	—	Part No. :7821-92-7340	
14	 BWP04763	 BWP04764	799-601-7530 (T-adapter)
	—	Part No. :7821-92-7350	
18	 BWP04765	 BWP04766	799-601-7540 (T-adapter)
	—	Part No. :7821-92-7360	
20	 BWP04767	 BWP04768	799-601-7550 (T-adapter)
	—	Part No. :7821-92-7370	

B4D18199

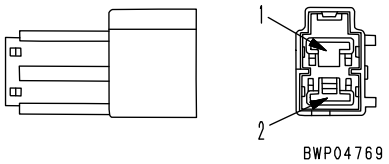
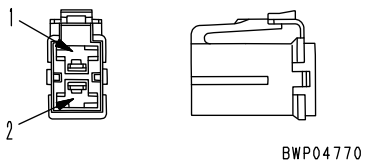
AMP connetor

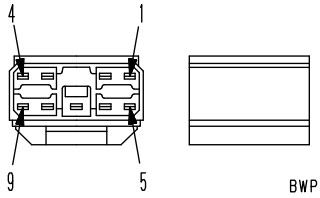
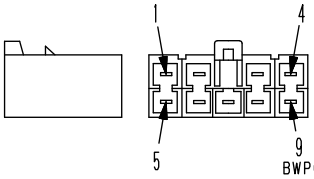
No. of pins	Oil pressure sensor		
	Sensor side (plue)	Harness side (receptacle)	Testing connection use special tool Part No.
3			799-601-9420 (T-adapter) (kit:799-601 -4101) (kit:799-601 -4201)
	—	—	

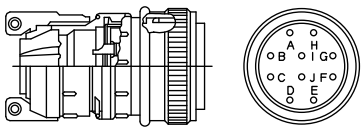
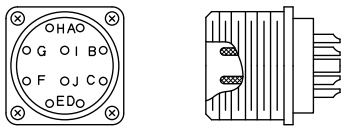
YAZAKI connector

No. of pins	WIPER INTERMITTENT UNIT		
	Male pin (female housing)	Female pin (male housing)	
11			—
	—	—	

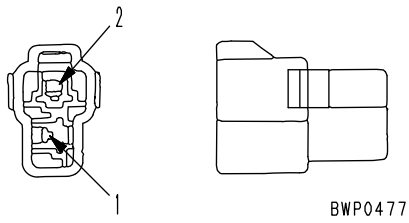
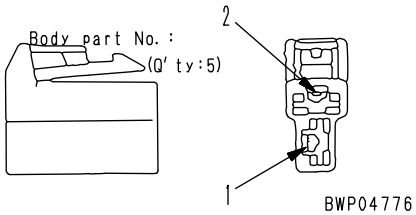
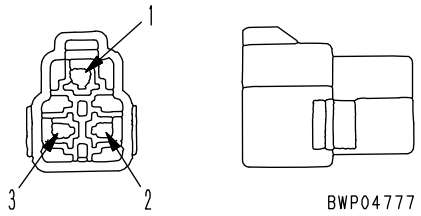
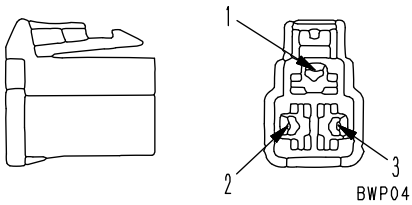
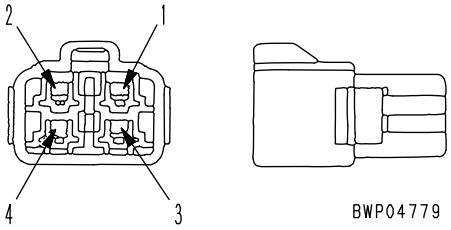
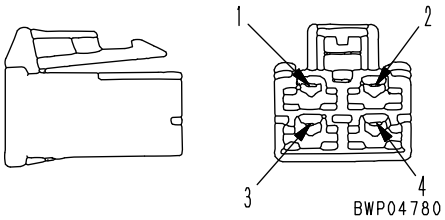
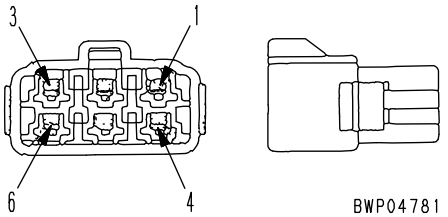
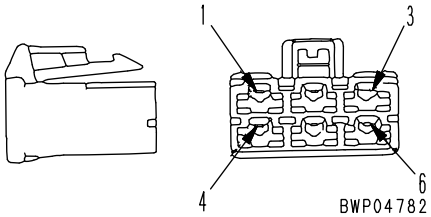
B4D18200

No. of pins	L type connector		
	Male (female housing)	Female (male housing)	Testing connection use special tool Part No.
2	 BWP04769	 BWP04770	—
	—	—	

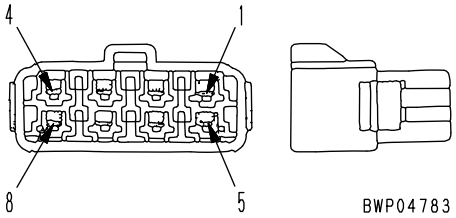
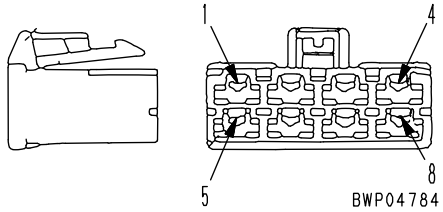
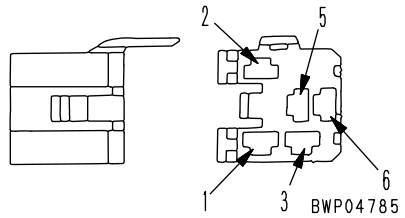
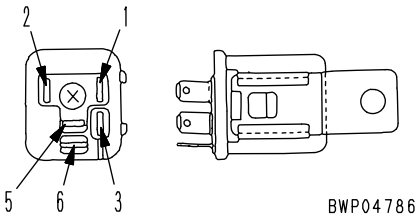
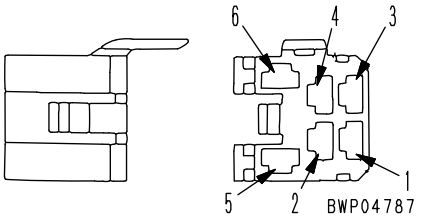
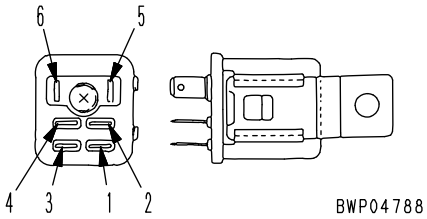
No. of pins	Connector for PA		
	Male (female housing)	Female (male housing)	
9	 BWP04771	 BWP04772	—
	—	—	

No. of pins	Bendix MS connector		
	Male (female housing)	Female (male housing)	
10	 BWP04773	 BWP04774	799-601-3460 (T-adapter)
	—	—	

B4D18401

No. of pins	KES 1 (Automobile) connector		
	Male (female housing)	Female (male housing)	Testing connection use special tool 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)	

B4D18402

No. of pins	KES1 (Automobile) connector		
	Male (female housing)	Female (male housing)	Testing connection use special tool 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)	
5			799-601-7360 (T-adapter)
	—	—	
6			799-601-7370 (T-adapter)
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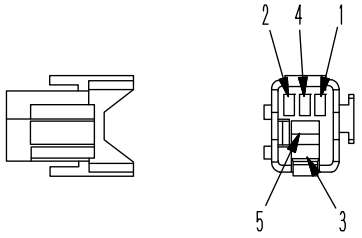
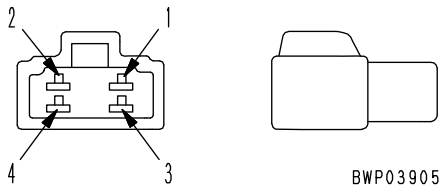
B4D18403

No. of pins	Connector for relay (Socket type)		
	Female (female housing)	Relay (male housing)	Testing connection use special tool Part No.
5			—
	Part No. :7861-74-5300	Part No. :7861-74-5100	

No. of pins	F type connector		
	Male (female housing)	Female (male housing)	
4			—
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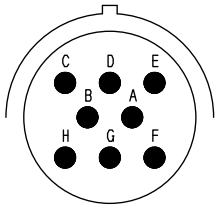
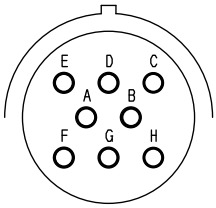
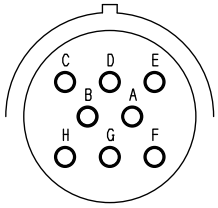
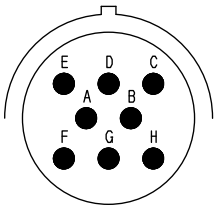
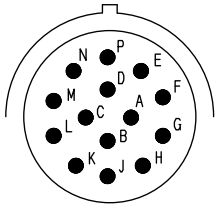
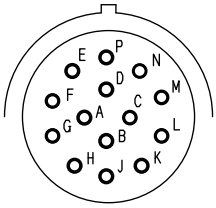
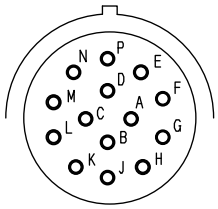
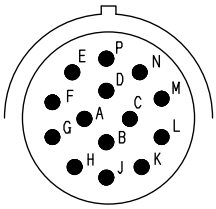
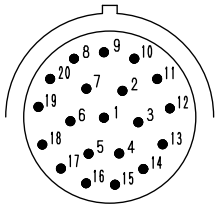
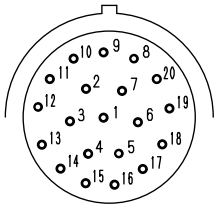
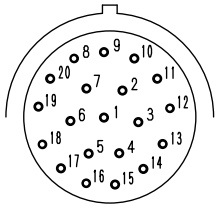
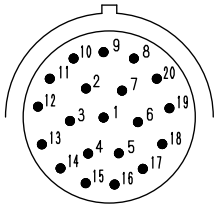
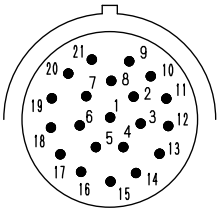
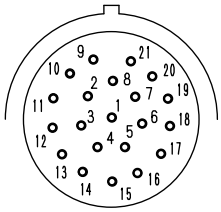
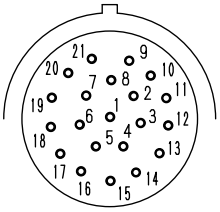
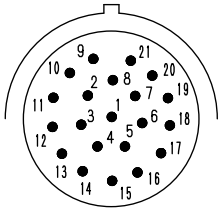
B4D18404

[The pin No. is also marked on the connector (electric wire insertion end)]

Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	Testing connection use special tool Part No.
18-8 (1)	Pin (male terminal)	Socket (female terminal)	799-601-9210 (T-adapter)
	 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 (T-adapter)
	 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 (T-adapter)
	 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 (T-adapter)
	 BWP05007	 BWP05008	
	Part No. :08191-22201, 08191-22202, 08191-22205, 08191-22206	Part No. :08191-23101, 08191-23102, 08191-23105, 08191-23106	

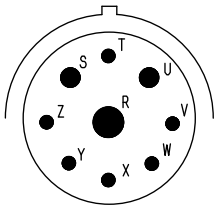
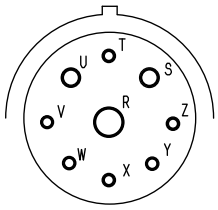
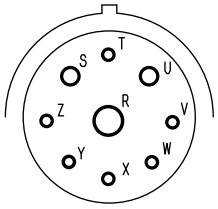
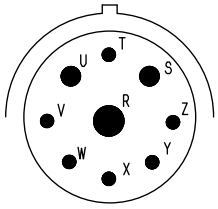
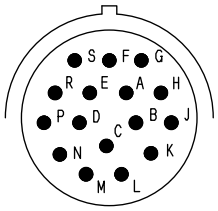
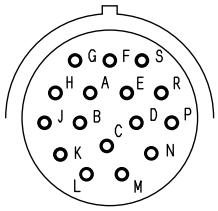
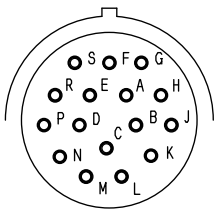
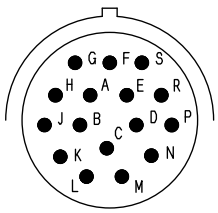
B4D18405

[The pin No. is also marked on the connector (electric wire insertion end)]

Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	Testing connection use special tool Part No.
18-20 (3)	Pin (male terminal)	Socket (female terminal)	799-601-9230 (T-adapter)
	 BWP05009	 BWP05010	
	Part No. :08191-31201, 08191-31202	Part No. :08191-34101, 08191-34102	
	Socket (female terminal)	Pin (male termial)	799-601-9230 (T-adapter)
	 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 (T-adapter)
	 BWP05013	 BWP05014	
	Part No. :08191-41201, 08191-42202	Part No. :08191-44101, 08191-44102	
	Socket (female terminal)	Pin (male termial)	799-601-9240 (T-adapter)
	 BWP05015	 BWP05016	
	Part No. :08191-42201, 08191-42202	Part No. :08191-43101, 08191-43102	

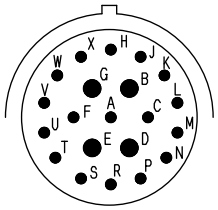
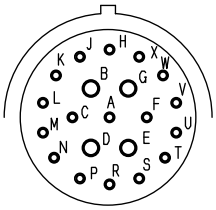
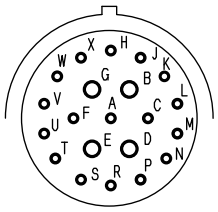
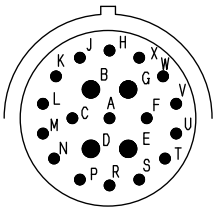
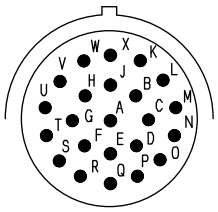
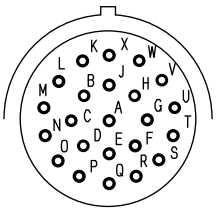
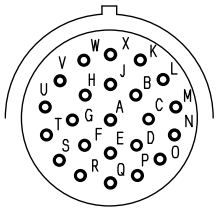
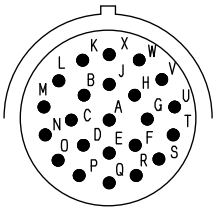
B4D18406

[The pin No. is also marked on the connector (electric wire insertion end)]

Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	Testing connection use special tool Part No.
24-9 (5)	Pin (male terminal)	Socket (female terminal)	799-601-9250 (T-adapter)
	 BWP05017	 BWP05018	
	Part No. :08191-51201, 08191-51202	Part No. :08191-54101, 08191-54102	
	Socket (female terminal)	Pin (male termial)	799-601-9250 (T-adapter)
	 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 (T-adapter)
	 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 (T-adapter)
	 BWP05023	 BWP05024	
	Part No. :08191-62201, 08191-62202, 08191-62205, 08191-62206	Part No. :08191-63101, 08191-63102, 08191-63105, 08191-63106	

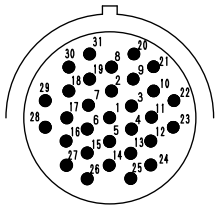
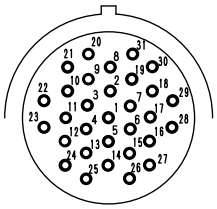
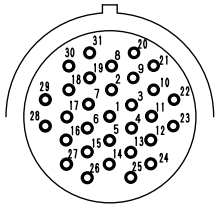
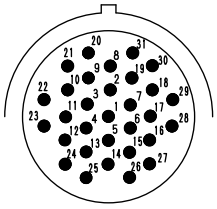
B4D18407

[The pin No. is also marked on the connector (electric wire insertion end)]

Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	Testing connection use special tool Part No.
24-21 (7)	Pin (male terminal)	Socket (female terminal)	799-601-9270 (T-adapter)
	 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 (T-adapter)
	 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 (T-adapter)
	 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 (T-adapter)
	 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	

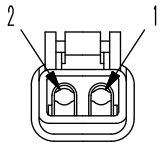
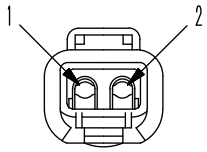
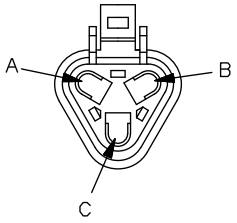
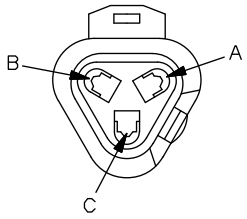
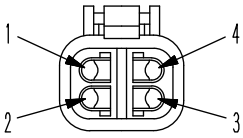
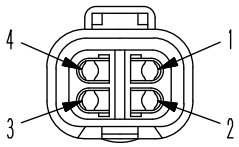
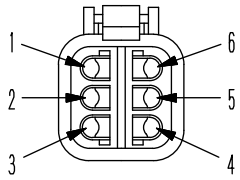
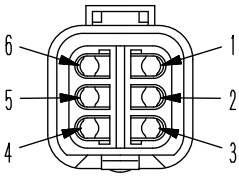
B4D18408

[The pin No. is also marked on the connector (electric wire insertion end)]

Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	Testing connection use special tool Part No.
24-31 (9)	Pin (male terminal)	Socket (female terminal)	799-601-9290 (T-adapter)
	 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 (T-adapter)
	 BWP05035	 BWP05036	
	Part No. :08191-92203, 08191-92204, 08191-92205, 08191-92206	Part No. :08191-93103, 08191-93104, 08191-93105, 08191-93106	

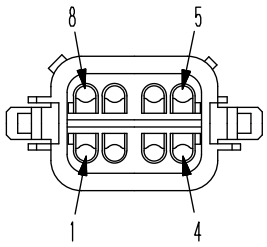
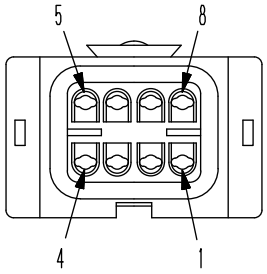
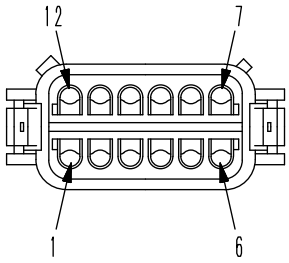
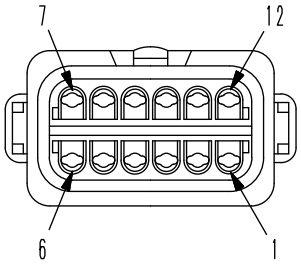
B4D18409

[The pin No. is also marked on the connector (electric wire insertion end)]

No. of pins	DT Series connector		
	Body (plug)	Body (receptacle)	Testing connection use special tool Part No.
2	 BWP05037	 BWP05038	799-601-9020 (T-adapter) 799-601-9890 (T-adapter)
	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 (T-adapter) 799-601-9890 (T-adapter)
	Part No. :08192-1A200 (normal type) 08192-2A200 (fine wire type)	Part No. :08192-13100 (normal type) 08192-23100 (fine wire type)	
4	 BWP05041	 BWP05042	799-601-9040 (T-adapter) 799-601-9890 (T-adapter)
	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 (T-adapter)
	Part No. :08192-16200 (normal type) 08192-26200 (fine wire type)	Part No. :08192-16100 (normal type) 08192-26100 (fine wire type)	

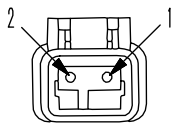
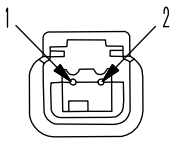
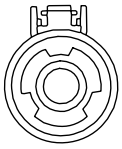
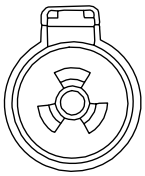
B4D18410

[The pin No. is also marked on the connector (electric wire insertion end)]

No. of pins	DT Series connector		
	Body (plug)	Body (receptacle)	Testing connection use special tool Part No.
8	 BWP05045	 BWP05046	8GR:799-601-9060 (T-adapter) 8B: 799-601-9070 (T-adapter) 8G: 799-601-9080 (T-adapter) 8BR:799-601-9090 (T-adapter)
	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 (T-adapter) 12B: 799-601-9120 (T-adapter) 12G: 799-601-9130 (T-adapter) 12BR:799-601-9140 (T-adapter)
	Part No. :08192-1920□ (normal type) 08192-2920□ (fine wire type)	Part No. :08192-1910□ (normal type) 08192-2910□ (fine wire type)	

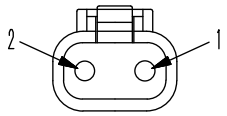
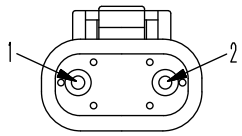
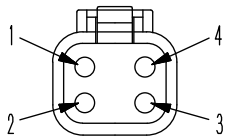
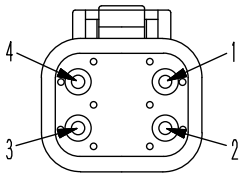
B4D18411

[The pin No. is also marked on the connector (electric wire insertion end)]

No. of pins	DTM Series connector		
	Body (plug)	Body (receptacle)	Testing connection use special tool Part No.
2	 BWP05049	 BWP05050	799-601-9010 (T-adapter) 799-601-9890 (T-adapter)
	Part No. :08192-02200	Part No. :08192-02100	
No. of pins	DTHD Series connector		—
	Body (plug)	Body (receptacle)	
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)	

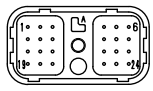
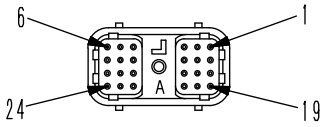
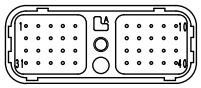
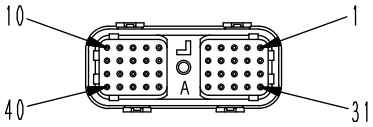
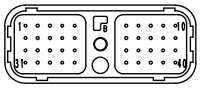
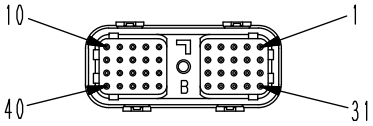
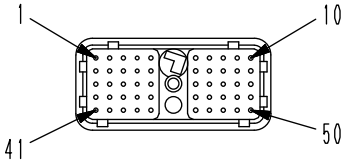
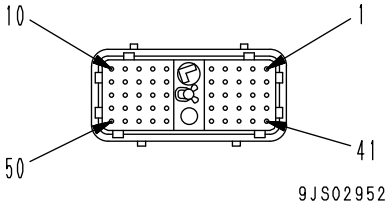
B4D18412

[The pin No. is also marked on the connector(electric wire insertion end)]

No. of pins	DTP Series connector		
	Body (plug)	Body (receptacle)	Testing connection use special tool Part No.
2	Pin(female terminal)	Socket(male terminal)	
			–
	–	–	
4			799-601-4260 (T-adapter)
	Part No. :6261-81-2810	–	

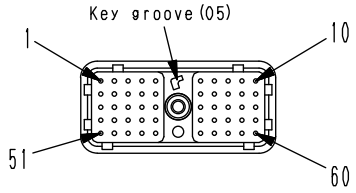
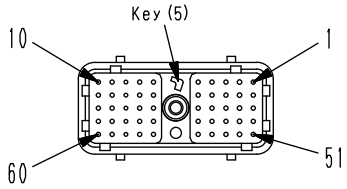
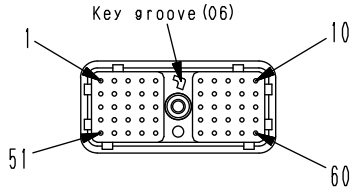
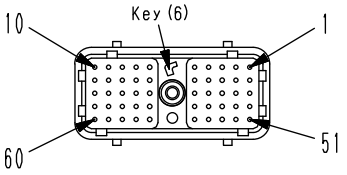
B4D18413

[The pin No. is also marked on the connector (electric wire insertion end)]

No. of pins	DRC26 Series connector		
	Male pin (female housing)	Female pin (male housing)	Testing connection use special tool Part No.
24	 BJD12722	 BJD12723	799-601-9360 (T-adapter) (Kit:799-601-9300)
	–	Part No. :08194-01101	
40 (A)	 BJD12724	 BJD12725	799-601-9350 (T-adapter) (Kit:799-601-9300)
	–	Part No. :08194-02101	
40 (B)	 BJD12726	 BJD12727	799-601-9350 (T-adapter) (Kit:799-601-9300)
	–	Part No. :08194-02102	
50	 9JS02951	 9JS02952	799-601-4211 (T-adapter) (Kit:799-601-4101)
	–	Part No. :08194-03103	

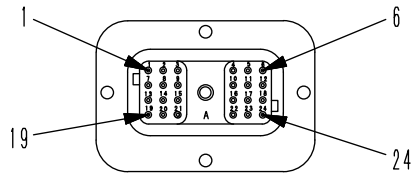
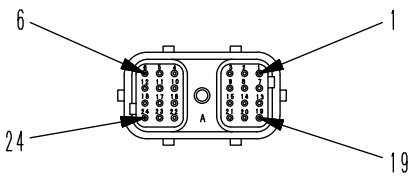
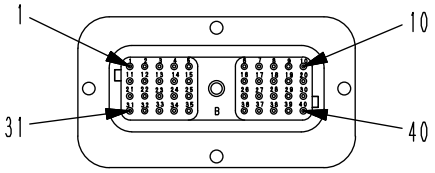
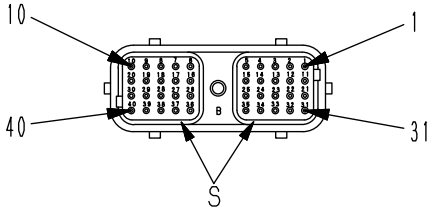
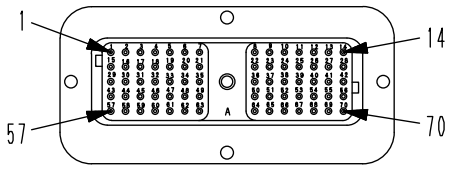
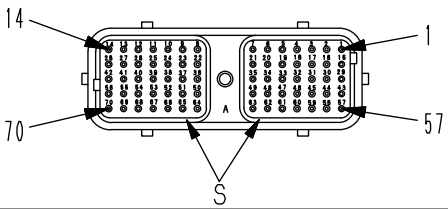
B4D18414

[The pin No. is also marked on the connector (electric wire insertion end)]

No. of pins	DRC26 Series connector		
	Male pin (female housing)	Female pin (male housing)	Testing connection use special tool Part No.
60 -05※	 BJD14063	 BJD14064	799-601-4220 (T-adapter) (Kit:799-601-4101)
	–	Part No. 08194-04104	
	※-05:Key position		
60 -06※			799-601-4390 (Socket)
	–	–	
	※-06:Key position		

B4D18415

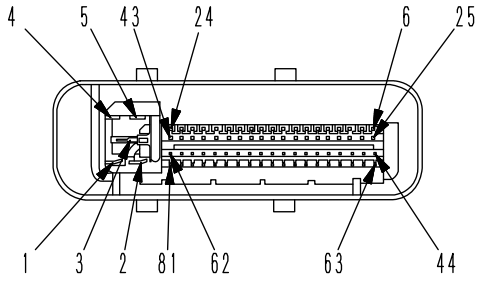
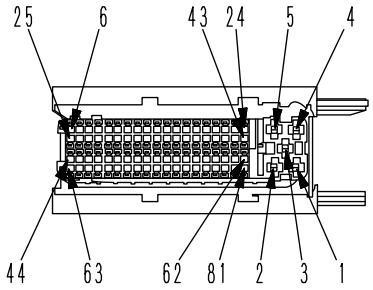
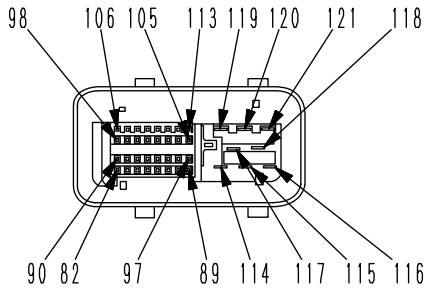
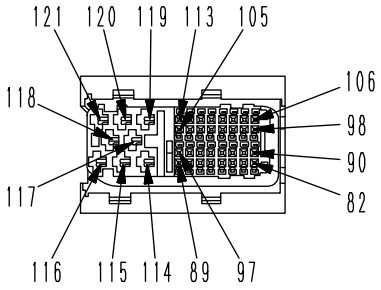
[The pin No. is also marked on the connector (electric wire insertion end)]

No. of pins	DRC12,16 Series connector		
	DRC12:Male pin (female housing)	DRC16:Female pin (male housing)	Testing connection use special tool Part No.
24 (A)※ (B) (C)			–
	–	–	
40 (A)※ (B) (C)			–
	–	Seal(S) Part No. : 17A-06-41830	
70 (A)※ (B) (C)			–
	–	Seal(S) Part No. : 17A-06-41840	

※ (A), (B), (C) : Key position

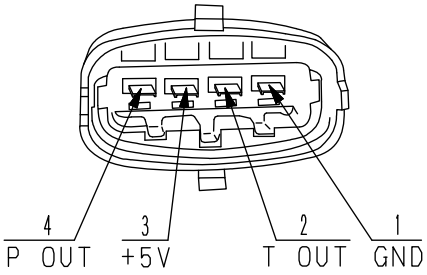
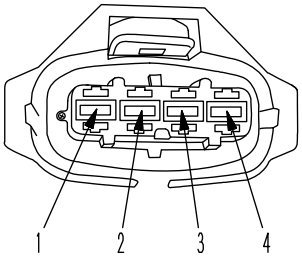
B4D18416

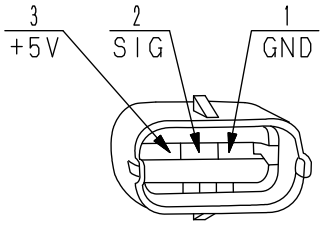
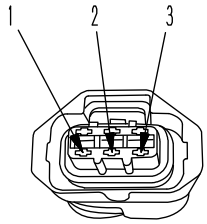
AMP connector for pump controller (CH700)

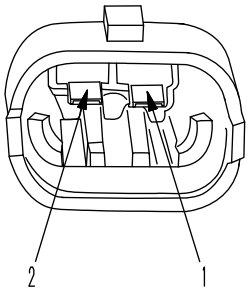
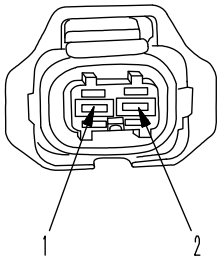
No. of pins	PC200/220-8, PC270-8, PC300-8, PC400-8, PC128/138US-8 and so on	Testing connection use special tool Part No.
	Controller side (plug)	
		
	—	
81	Harness side (receptacle)	
		
	Part No. : 7880-70-9040	799-601-4280 (Socket)
	Controller side (plug)	
		
	—	
40	Harness side (receptacle)	
		
	Part No. : 7880-70-9010	

B4D18417

BOSCH connector for engine

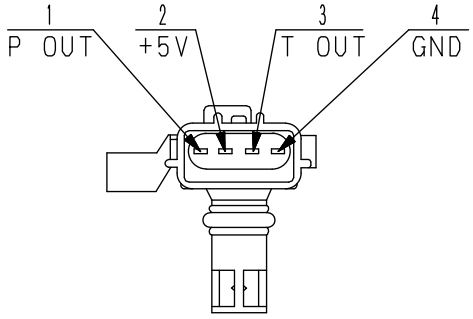
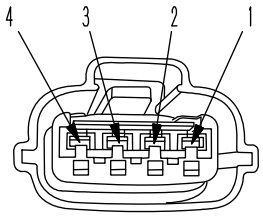
No. of pins	Boost (air intake) pressure and temperature sensor (95 engine)		
	Sensor side (plug)	Harness side (receptacle)	Testing connection use special tool Part No.
4			799-601-4380 (Socket)
	—	—	

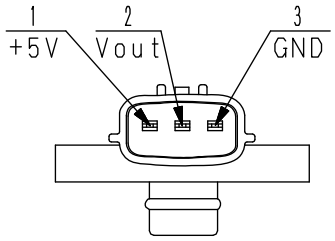
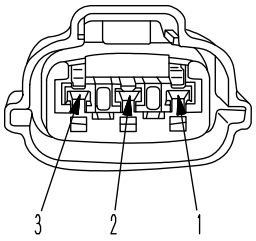
No. of pins	Common rail (fuel) pressure sensor (95, 107, 114 engine)		
	Sensor side (plug)	Harness side (receptacle)	
3			799-601-4190 (Socket) (Kit:799-601-4101) (Kit:799-601-4201)
	—	—	

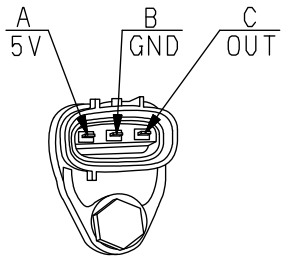
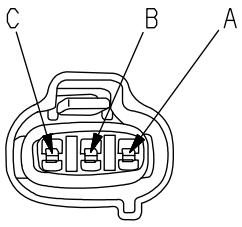
No. of pins	Fuel supply pump (95, 107 engine) and fuel injector (95 engine)		
	Valve side (plug)	Harness side (receptacle)	
2			799-601-4340 (Socket) (Kit:799-601-4101) (Kit:799-601-4201)
	—	—	

B4D18418

SUMITOMO connector for engine

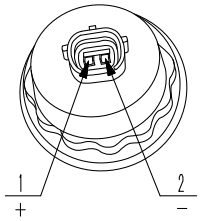
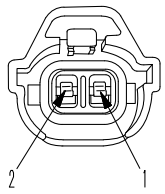
No. of pins	Boost (air intake) pressure and temeperature sensor (107, 114 engine)		
	Sensor side (plug)	Harness side (receptacle)	Testing connection use special tool Part No.
4			799-601-4230 (Socket) (Kit:799-601-4101) (Kit:799-601-4201)
	-	-	

No. of pins	Boost (air intake) pressure sensor (125, 170, 12V140 engine)		
	Sensor side (plug)	Harness side (receptacle)	
3			799-601-4250 (Socket) (Kit:799-601-4101) (Kit:799-601-4201)
	-	-	

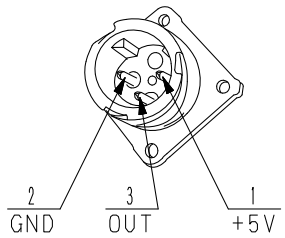
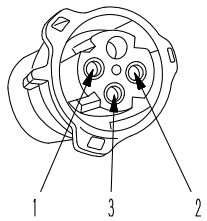
No. of pins	G sensor (fuel supply pump speed sensor) (125, 140, 170, 12V140 engine)		
	Sensor side (plug)	Harness side (receptacle)	
3			799-601-4330 (Socket) (Kit:799-601-4101) (Kit:799-601-4201)
	-	-	

B4D18419

SUMITOMO connector for engine

No. of pins	PCV (125, 140, 170, 12V140 engine)		
	Valve side (plug)	Harness side (receptacle)	Testing connection use special tool Part No.
2			799-601-9430 (Socket) (Kit: 799-601-4101) (Kit: 799-601-4201)
	−	−	

CANNON connector for engine

No. of pins	Boost (air intake) pressure sensor (140 engine)		
	Sensor side (plug)	Harness side (receptacle)	
4			799-601-4110 (T-adapter) (Kit: 799-601-4101) (Kit: 799-601-4201)
	☆ Without pin (4)	☆ Without pin (4)	

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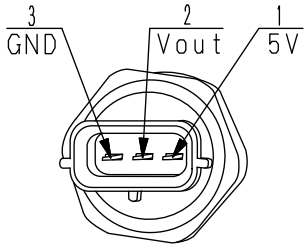
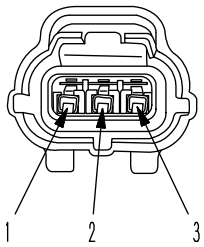
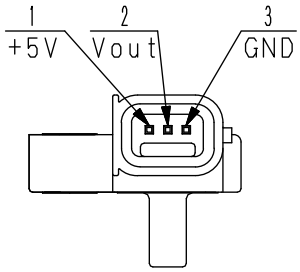
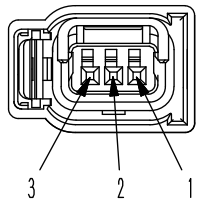
AMP connelor for engine

No. of pins	Common rail (fuel) pressure sensor (125. 140. 170. 12V140 engine)		
	Sensor side (plue)	Harness side (receptacle)	Testing connection use special tool Part No.
3			799-601-9420 (T-adapter) (kit:799-601 -4101) (kit:799-601 -4201)
	—	—	

No. of pins	Ambient pressure sensor (95. 125. 140. 170. 12V140 engine)		
	Sensor side (plue)	Harness side (receptacle)	
3			799-601-4240 (Socket) (kit:799-601 -4101) (kit:799-601 -4201)
	—	—	

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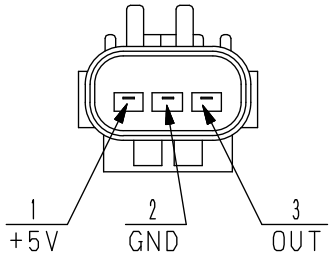
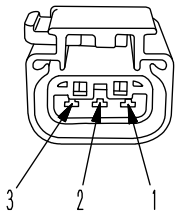
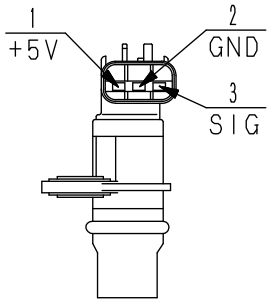
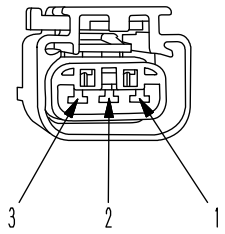
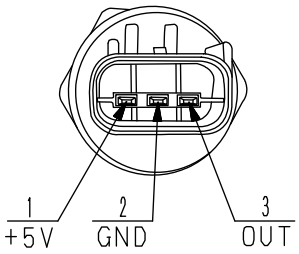
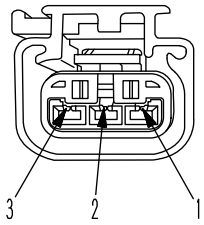
FRAMATOME connector for engine

No. of pins	Ambient pressure sensor (107, 114 engine)		
	Sensor side (plug)	Harness side (receptacle)	Testing connection use special tool Part No.
3			799-601-4140 (T-adapter) (Kit: 799-601-4101) (Kit: 799-601-4201)
	—	—	

No. of pins	NE speed sensor (95, 107, 114, 125, 140, 170, 12V140 engine) and CAM sensor (95, 107, 114 engine)		
	Sensor side (plug)	Harness side (receptacle)	
3			799-601-4130 (T-adapter) (Kit: 799-601-4101) (Kit: 799-601-4201)
	—	—	

No. of pins	EGR gas pressure sensor (125, 140 engine)		
	Sensor side (plug)	Harness side (receptacle)	
3			799-601-4180 (T-adapter) (Kit: 799-601-4101) (Kit: 799-601-4201)
	—	—	

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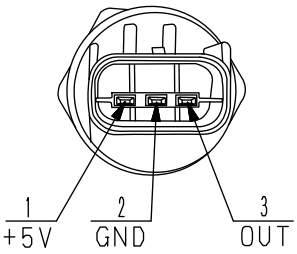
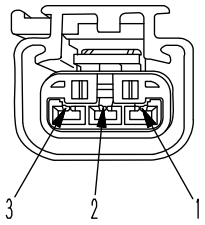
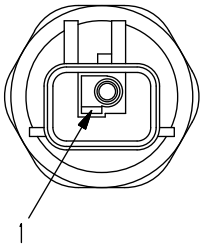
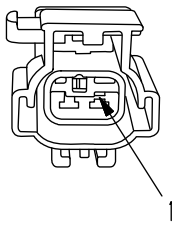
FRAMATOME connector for engine

No. of pins	Lubricating oil pressure sensor (125, 140, 170, 12V140 engine)		
	Sensor side (plug)	Harness side (receptacle)	Testing connection use special tool Part No.
3			799-601-4150 (T-adapter) (Kit : 799-601-4101) (Kit : 799-601-4201)
	-	-	

No. of pins	Hydraulic switch (95, 107, 114 engine)		
	Switch side (plug)	Harness side (receptacle)	
2			799-601-4160 (T-adapter) (Kit : 799-601-4101) (Kit : 799-601-4201)
	☆ Without pin (2)	☆ Without pin (2)	

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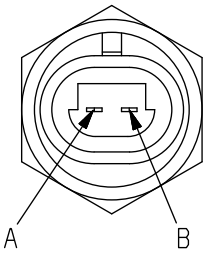
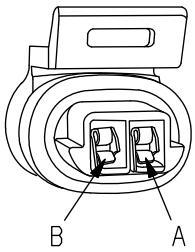
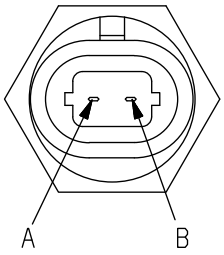
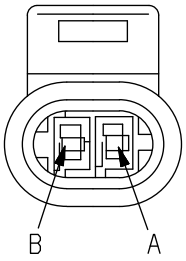
PACKARD conncetor for engine

No. of pins	Temperature sensor of coolant, fuel and lubricating oil (95, 107, 114, 125, 140, 170, 12V140 engine)		
	Sensor side (plug)	Harness side (receptacle)	Testing connection use special tool Part No.
2			795-799-5530 (Socket) (Kit : 799-601-4101) (Kit : 799-601-4201)
	☆ Non-polarity	—	

No. of pins	Boost (air intake) temperature sensor (125, 140, 170, 12V140 engine)		
	Sensor side (plug)	Harness side (receptacle)	
2			795-799-5540 (Socket) (Kit : 799-601-4101) (Kit : 799-601-4201)
	☆ Non-polarity	—	

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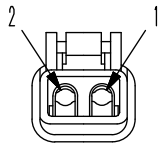
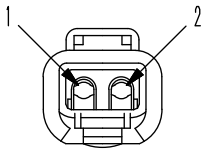
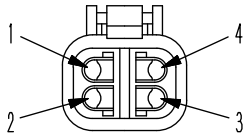
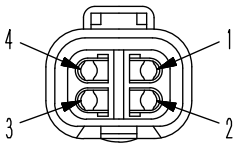
DT series connector for engine

No. of pins	WIF (water in fuel) sensor (107, 114 engine)		
	Body (plug)	Body (receptacle)	Testing connection use special tool Part No.
2	 BWP05037	 BWP05038	799-601-9020 (T-adapter) (kit:799-601-4101) (kit:799-601-4201)
	Part No. :08192-12200 (normal type) 08192-22200 (fine wire type)	Part No. :08192-12100 (normal type) 08192-22100 (fine wire type)	

No. of pins	EGR (by pass) valve stroke sensor (125, 140, 170 engine)		
	Body (plug)	Body (receptacle)	
4	 BWP05041	 BWP05042	799-601-9040 (T-adapter) (kit:799-601-4101) (kit:799-601-4201)
	Part No. :08192-14200 (normal type) 08192-24200 (fine wire type)	Part No. :08192-14100 (normal type) 08192-24100 (fine wire type)	

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T-branch box and T-branch adapter table

(Rev. 2009. 03)

★ The vertical column indicates a part number of T-branch box or T-branch adapter while the horizontal column indicates a part number of harness checker assembly.

Part No.	Part name	Number of pins	Identification symbol	T-adapter kit														Out of kit
				799-601-2500	799-601-2700	799-601-2800	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	799-601-4101	799-601-4201	
799-601-2600	T-box (for ECONO)	21		●		●		●	●		●							
799-601-3100	T-box (for MS)	37																●
799-601-3200	T-box (for MS)	37																●
799-601-3380	Plate for MS (14-pin)																	●
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-5P															●
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	Extension cable (ECONO type)	12	ECONO12P	●	●				●									
799-601-2850	Case			●														
799-601-4350	T-box (for DRC 60, ECONO)	60														●		
799-601-4360	Case															●		
799-601-7010	Adapter for X (T-adapter)	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															●
799-601-7070	Adapter for SWP	14	SW14P						●		●							
799-601-7320	Adapter for SWP	16	SW16P															●
799-601-7080	Adapter for M (T-adapter)	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				●	●	●		●							

Part No.	Part name	Number of pins	Identification symbol	T-adapter kit														Out of kit
				799-601-2500	799-601-2700	799-601-2800	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	799-601-4101	799-601-4201	
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 (Brown)	12	DT12BR									●		●				
799-601-9210	Adapter for HD30-18	8	D18-8									●	●					
799-601-9220	Adapter for HD30-18	14	D18-14									●	●					
799-601-9230	Adapter for HD30-18	20	D18-20									●	●					
799-601-9240	Adapter for HD30-18	21	D18-21									●	●					
799-601-9250	Adapter for HD30-24	9	D24-9									●	●					
799-601-9260	Adapter for HD30-24	16	D24-16									●	●					
799-601-9270	Adapter for HD30-24	21	D24-21									●	●					
799-601-9280	Adapter for HD30-24	23	D24-23									●	●					
799-601-9290	Adapter for HD30-24	31	D24-31									●	●					
799-601-9310	Plate for HD30 (24-pin)											●	●		●			
799-601-9320	T-box (for ECONO)	24										●	●		●			
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*	Socket for engine (CRI-T2)	2	G															●
799-601-9420	Adapter for engine (CRI-T2) Adapter for engine (CRI-T3) PFUEL Oil pressure sensor	3	A3													●	●	
799-601-9430*	Socket for engine (CRI-T2) Socket for engine(CRI-T3) PCV	2	P													●	●	
799-601-9440*	Socket for engine (CRI-T2)	3	1,2,3															●
795-799-5520*	Socket for engine (HPI-T2)	2	S															●

Part No.	Part name	Number of pins	Identification symbol	T-adapter kit														Out of kit
				799-601-2500	799-601-2700	799-601-2800	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	799-601-4101	799-601-4201	
795-799-5530*	Socket for engine (HPI-T2) Socket for engine (CRI-T3) Temperature sensor	2	C													●	●	
795-799-5540*	Socket for engine (HPI-T2) Socket for engine(CRI-T3) TIM	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	—															●
799-601-4110	Adapter for engine (140-T3) PIM	4	ITT3N													●	●	
799-601-4130	Adapter for engine (CRI-T3) NE, CAM	3	FCIN													●	●	
799-601-4140	Adapter for engine (CRI-T3) Ambient Pressure	3	FCIG													●	●	
799-601-4150	Adapter for engine (CRI-T3) POIL	3	FCIB													●	●	
799-601-4160	Adapter for engine (CRI-T3) Oil pressure switch	2	4160													●	●	
799-601-4180	Adapter for engine (CRI-T3) PEVA	3	4180													●	●	
799-601-4190*	Socket for engine (CRI-T3) Common rail pressure	3	1,2,3L													●	●	
799-601-4230*	Socket for engine (CRI-T3) Air intake pressure/temperature	4	1,2,3,4C													●	●	
799-601-4240*	Socket for engine (CRI-T3) PAMB	3	1,2,3A													●	●	
799-601-4250*	Socket for engine (CRI-T3) PIM	3	1,2,3B													●	●	
799-601-4330*	Socket for engine (CRI-T3) G	3	1,2,3,G													●	●	
799-601-4340*	Socket for engine (CRI-T3) Pump actuator	2	2,PA													●	●	
799-601-4380*	Socket for engine (CRI-T3)(95) Air intake pressure/temperature	4	1,2,3,4T															●
799-601-4260	Adapter for controller (ENG)	4	DTP4													●	●	
799-601-4211	Adapter for controller (ENG)	50	DRC50													●		
799-601-4220	Adapter for controller (ENG)	60	DRC60													●		
799-601-4390*	Socket for controller (95 ENG)	60	—															●
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															●
799-601-9730	Adapter for controller (HST)	26	HST26A															●
799-601-9890	Multi-adapter for DT2 – 4 andDTM2	2, 3, 4	—															●

" * " Shows not T-adapter but socket.

HM300-2 Articulated dump truck

Form No. SEN00670-04

ARTICULATED DUMP TRUCK

HM300-2

Machine model	Serial number
HM300-2	2001 and up

40 Troubleshooting

Troubleshooting by failure code, Part 1

Failure code [1500L0] (Dual engagement)

Action code	Failure code	Trouble	Dual engagement: (Transmission controller system)
E03	**1500L0**		
Contents of trouble	• Fill switch signals have been inputted from 2 clutches that do not form a normal combination.		
Action of controller	• Suddenly shifts to Neutral while traveling, and cannot move off again. • Even after the repair, does not resume to normal unless starting switch is once turned OFF.		
Problem that appears on machine	• The gear speed is shifted to Neutral.		
Related information	• Other problem (clutch pressure control valve system failure code [15S*L1]) occurs at same time.		

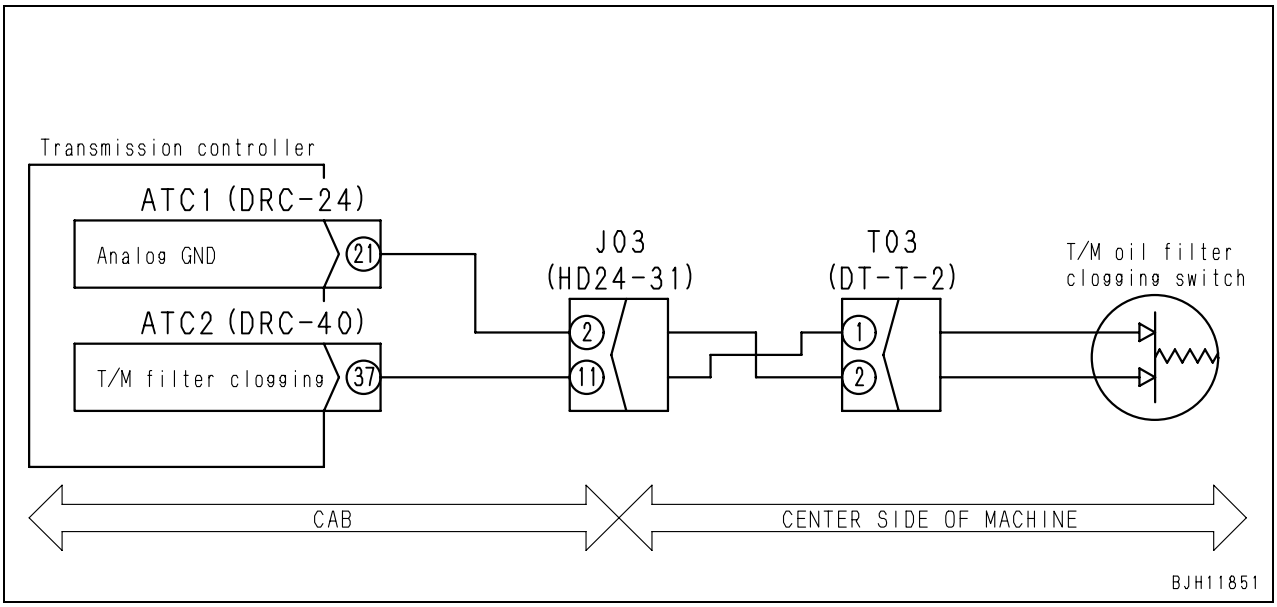
	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Clutch pressure control valve system failure code (15S*L1) has occurred	Troubleshooting by the active failure code.
	2	Defective transmission controller	Troubleshooting by the active failure code.

Failure code [15B0NX] (Transmission oil filter: Clogged)

Action code	Failure code	Trouble	Transmission oil filter: Clogged (Transmission controller system)
E01	**15B0NX**		
Contents of trouble	• When the torque converter oil temperature is above 50°C, the signal circuit of the transmission clogging sensor has become OPEN (disconnected from the ground).		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• If the machine is operated in as-is condition, a dirt may get into the transmission circuit.		
Related information	• Check that the condition has returned to normal after taking corrective measures, and then implement initial learning procedure for the transmission controller referring to “Setting and adjusting various equipments“ in “Testing and adjusting“.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Clogged transmission filter	Clean or replace			
	2	Defective transmission filter clogging sensor	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between T03 (male) (1) – (2)	Filter is normal	Resistance	Max. 1 Ω
				Clogging filter	Resistance	Min. 1 MΩ
	3	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ATC2 (female) (37) – T03 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between ATC1 (female) (21) – T03 (female) (2)		Resistance	Max. 1 Ω
	4	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between ATC2 (female) (37) – body ground	Filter is normal	Voltage	Max. 1V
				Clogging filter	Voltage	20 – 30 V

Circuit diagram related



Failure code [15F0KM] (R → F shifting abuse 1: Operational error or incorrect setting)

Action code	Failure code	Trouble	R → F shifting abuse 1: Operational error or incorrect setting (Transmission controller system)
—	**15F0KM**		
Contents of trouble	• When output shaft speed is 200 – 300 rpm (about 5 – 7 km/h), gear shifting from reverse to forward has been detected.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• If the machine is operated in as-is condition, the machine may be damaged. • Only recorded in failure history.		
Related information	• Output shaft speed can be checked by monitoring function (code: **31400**).		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Abuse	A forward-reverse shifting should be performed when the machine is stationary.

Failure code [15F0MB] (R → F shifting abuse 2: Functional deterioration)

Action code	Failure code	Trouble	R → F shifting abuse 2: Operational error or incorrect setting (Transmission controller system)
—	**15F0MB**		
Contents of trouble	• When output shaft speed is above 300 rpm (about 7 km/h), gear shifting from reverse to forward has been detected.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• If the machine is operated in as-is condition, the machine may be damaged. • Only recorded in failure history.		
Related information	• Output shaft speed can be checked by monitoring function (code: **31400**).		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Abuse	A forward-reverse shifting should be performed when the machine is stationary.

Failure code [15F7KM] (forward clutch disc abuse)

Action code	Failure code	Trouble	Transmission forward clutch disc abuse (Transmission controller system)
—	**15F7KM**		
Contents of trouble	• When the engine speed is above 1,800 rpm, gear shifting from neutral or reverse to forward has been detected.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• Repeated abnormal operations may cause machine damage. • Only recorded in failure history.		
Related information			

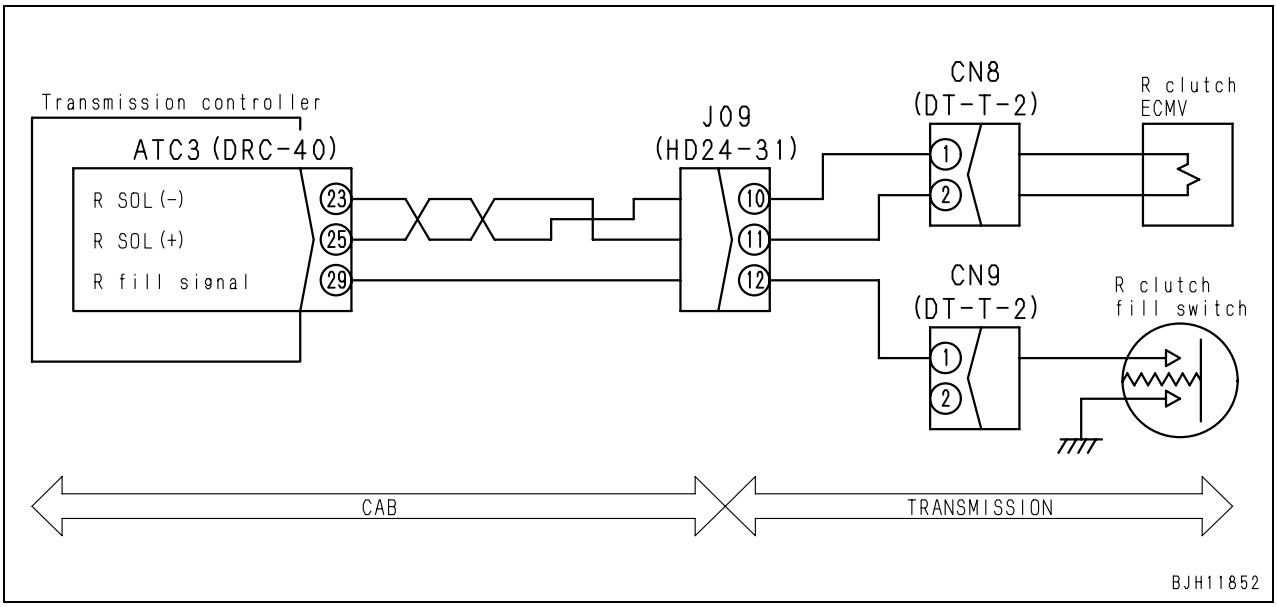
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Abuse	A forward-reverse shifting should be performed when the machine is stationary.

Failure code [15G0MW] (R clutch: Slipping)

Action code	Failure code	Trouble	R clutch: Slipping (R command holding pressure, R clutch fill switch ON, slipping detected) (Transmission controller system)
E03	**15G0MW**		
Contents of trouble	• During an output to R clutch ECMV, a slip of R clutch has been detected.		
Action of controller	• Shifts up and holds the gear speed depending on the gear speed before failure as mentioned in Table 1. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31606**) • If the electrical system is normal, check for a failure in the hydraulic or mechanical system for R clutch or pressure control valve.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective R clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN8 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN8 (male) (1), (2) – body ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (25) – CN8 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ATC3 (female) (23) – CN8 (female) (2)	Resistance	Max. 1 Ω
	3	Defective speed sensor detection	• Troubleshooting by failure code DL**KA, DL**LC		
	4	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (25) – (23)	Resistance	5 – 15 Ω

Circuit diagram related



Failure code [15G7KM] (reverse clutch disc abuse)

Action code	Failure code	Trouble	Transmission reverse clutch disc abuse (Transmission controller system)
—	**15G7KM**		
Contents of trouble	• When the engine speed is above 1,800 rpm, gear shifting from neutral or forward to reverse has been detected.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• Repeated abnormal operations may cause machine damage. • Only recorded in failure history.		
Related information			

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Abuse	A forward-reverse shifting should be performed when the machine is stationary.

Failure code [15H0MW] (Hi clutch: Slipping)

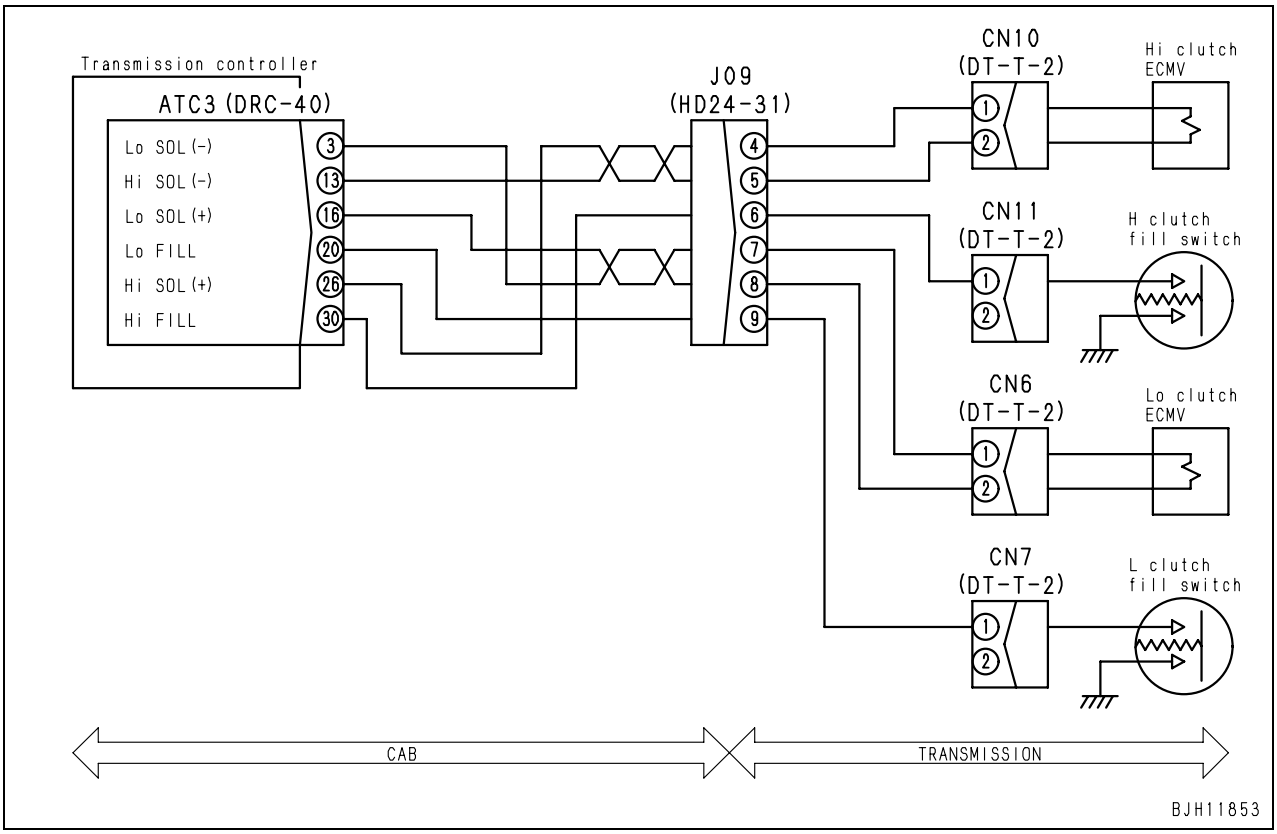
Action code	Failure code	Trouble	Hi clutch: Slipping (Hi command holding pressure, Hi clutch fill switch ON, slipping detected) (Transmission controller system)
E03	**15H0MW**		
Contents of trouble	• During an output to the Hi clutch ECMV, an abnormality exists in the value calculated from the signals of transmission input shaft speed sensor, transmission intermediate shaft speed sensor and transmission output shaft speed sensor.		
Action of controller	• Shifts up and holds the gear speed depending on the gear speed before failure as mentioned in **Table 1**. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31600**) • If the electrical system is normal, check for a failure in the hydraulic or mechanical system for Hi clutch or pressure control valve.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective Hi clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN10 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN10 (male) (1), (2) – body ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (26) – CN10 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ATC3 (female) (13) – CN10 (female) (2)	Resistance	Max. 1 Ω
	3	Defective speed sensor detection	• Troubleshooting by failure code DL**KA, DL**LC		
	4	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (26) – (13)	Resistance	5 – 15 Ω

Table 1

Previous range		Trouble clutch [Command ON] (Slip , short to GND or signal lost)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	3rd	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
F5	3rd Low	3rd	OFF	Neutral	OFF
		Low	3H	F6	OFF
F4	2nd High	2nd	3L	F5	OFF
		High	3L	F5	OFF
F3	2nd Low	2nd	3L	F5	OFF
		Low	2H	F4	OFF
F2	1st High	1st	2L	F3	OFF
		High	2L	F3	OFF
F1	1st Low	1st	2L	F3	OFF
		Low	1H	F2	OFF
R3	3rd Reverse	3rd	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
R2	2nd Reverse	2nd	3R	R3	OFF
		Reverse	OFF	Neutral	OFF
R1	1st Reverse	1st	2R	R2	OFF
		Reverse	OFF	Neutral	OFF

Circuit diagram related



Failure code [15J0MW] (Lo clutch: Slipping)

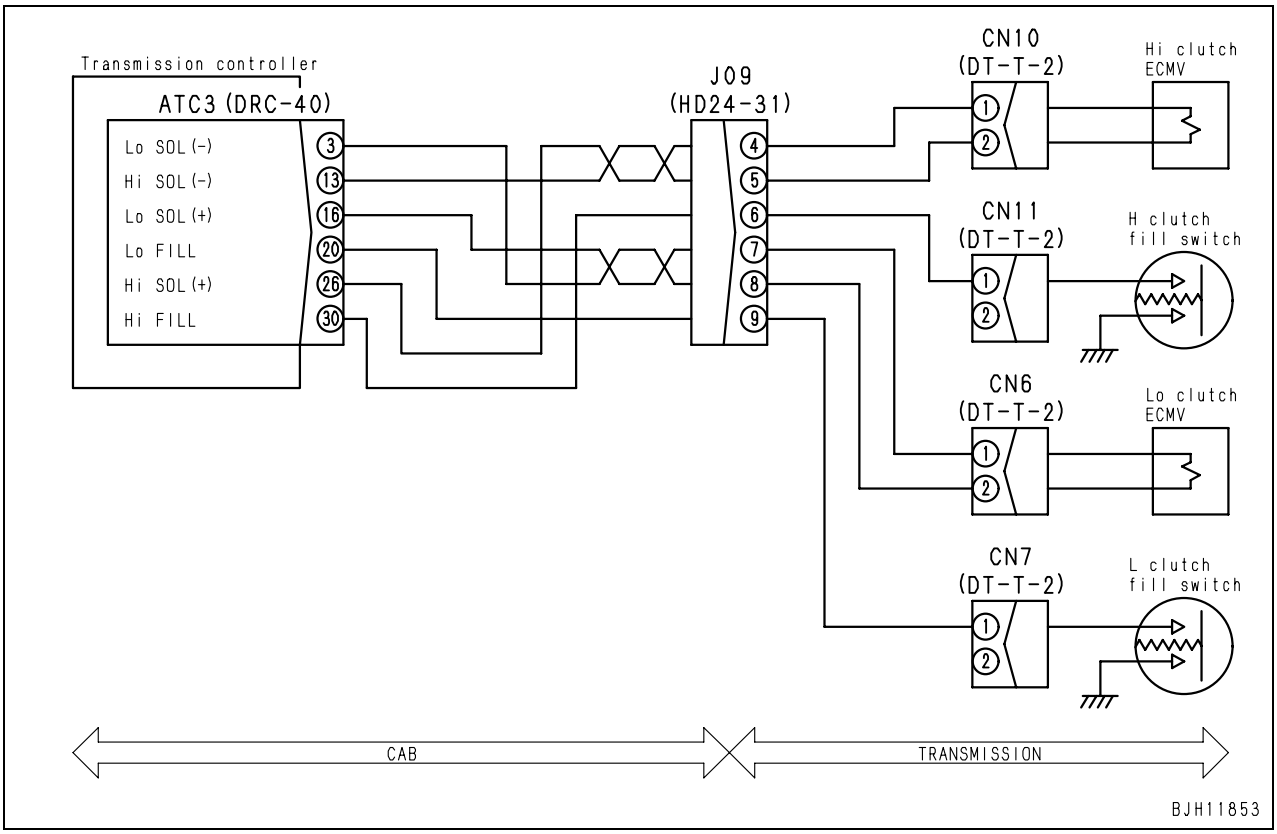
Action code	Failure code	Trouble	Lo clutch: Slipping (Lo command holding pressure, Lo clutch fill switch ON, slipping detected) (Transmission controller system)
E03	**15J0MW**		
Contents of trouble	• During an output to the Lo clutch ECMV, an abnormality exists in the value calculated from the signals of transmission input shaft speed sensor, transmission intermediate shaft speed sensor and transmission output shaft speed sensor.		
Action of controller	• Shifts up and holds the gear speed depending on the gear speed before failure as mentioned in **Table 1**. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31601**) • If the electrical system is normal, check for a failure in the hydraulic or mechanical system for Lo clutch or pressure control valve.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective Lo clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN6 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN6 (male) (1), (2) – body ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (16) – CN6 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ATC3 (female) (3) – CN6 (female) (2)	Resistance	Max. 1 Ω
	3	Defective speed sensor detection	• Troubleshooting by failure code DL**KA, DL**LC		
	4	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (16) – (3)	Resistance	5 – 15 Ω

Table 1

Previous range		Trouble clutch [Command ON] (Slip , short to GND or signal lost)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	3rd	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
F5	3rd Low	3rd	OFF	Neutral	OFF
		Low	3H	F6	OFF
F4	2nd High	2nd	3L	F5	OFF
		High	3L	F5	OFF
F3	2nd Low	2nd	3L	F5	OFF
		Low	2H	F4	OFF
F2	1st High	1st	2L	F3	OFF
		High	2L	F3	OFF
F1	1st Low	1st	2L	F3	OFF
		Low	1H	F2	OFF
R3	3rd Reverse	3rd	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
R2	2nd Reverse	2nd	3R	R3	OFF
		Reverse	OFF	Neutral	OFF
R1	1st Reverse	1st	2R	R2	OFF
		Reverse	OFF	Neutral	OFF

Circuit diagram related



Failure code [15K0MW] (1st clutch: Slipping)

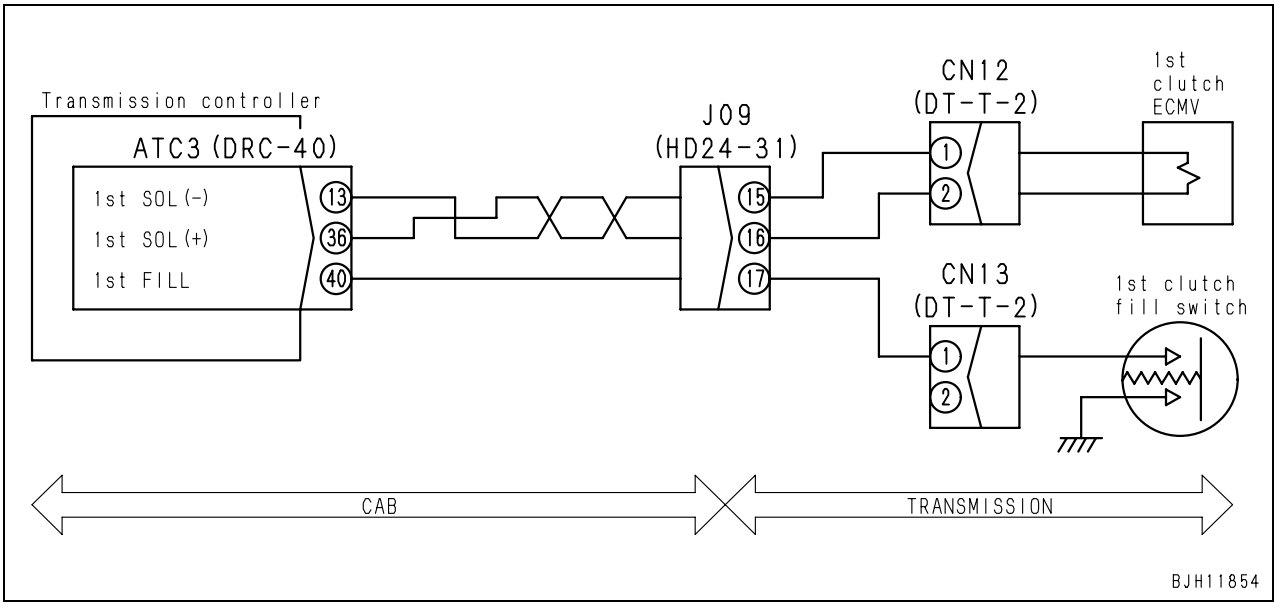
Action code	Failure code	Trouble	1st clutch: Slipping (1st command holding pressure, 1st clutch fill switch ON, slipping detected) (Transmission controller system)
E03	**15K0MW**		
Contents of trouble	• During an output to the 1st clutch ECMV, an abnormality exists in the value calculated from the signals of transmission input shaft speed sensor, transmission intermediate shaft speed sensor and transmission output shaft speed sensor.		
Action of controller	• Shifts up and holds the gear speed depending on the gear speed before failure as mentioned in **Table 1**. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31602**) • If the electrical system is normal, check for a failure in the hydraulic or mechanical system for 1st clutch or pressure control valve.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective 1st clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN12 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN12 (male) (1), (2) – body ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (36) – CN12 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ATC3 (female) (13) – CN12 (female) (2)	Resistance	Max. 1 Ω
	3	Defective speed sensor detection	• Troubleshooting by failure code DL**KA, DL**LC		
	4	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (36) – ATC3 (female) (13)	Resistance	5 – 15 Ω

Table 1

Previous range		Trouble clutch [Command ON] (Slip , short to GND or signal lost)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	3rd	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
F5	3rd Low	3rd	OFF	Neutral	OFF
		Low	3H	F6	OFF
F4	2nd High	2nd	3L	F5	OFF
		High	3L	F5	OFF
F3	2nd Low	2nd	3L	F5	OFF
		Low	2H	F4	OFF
F2	1st High	1st	2L	F3	OFF
		High	2L	F3	OFF
F1	1st Low	1st	2L	F3	OFF
		Low	1H	F2	OFF
R3	3rd Reverse	3rd	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
R2	2nd Reverse	2nd	3R	R3	OFF
		Reverse	OFF	Neutral	OFF
R1	1st Reverse	1st	2R	R2	OFF
		Reverse	OFF	Neutral	OFF

Circuit diagram related



Failure code [15L0MW] (2nd clutch: Slipping)

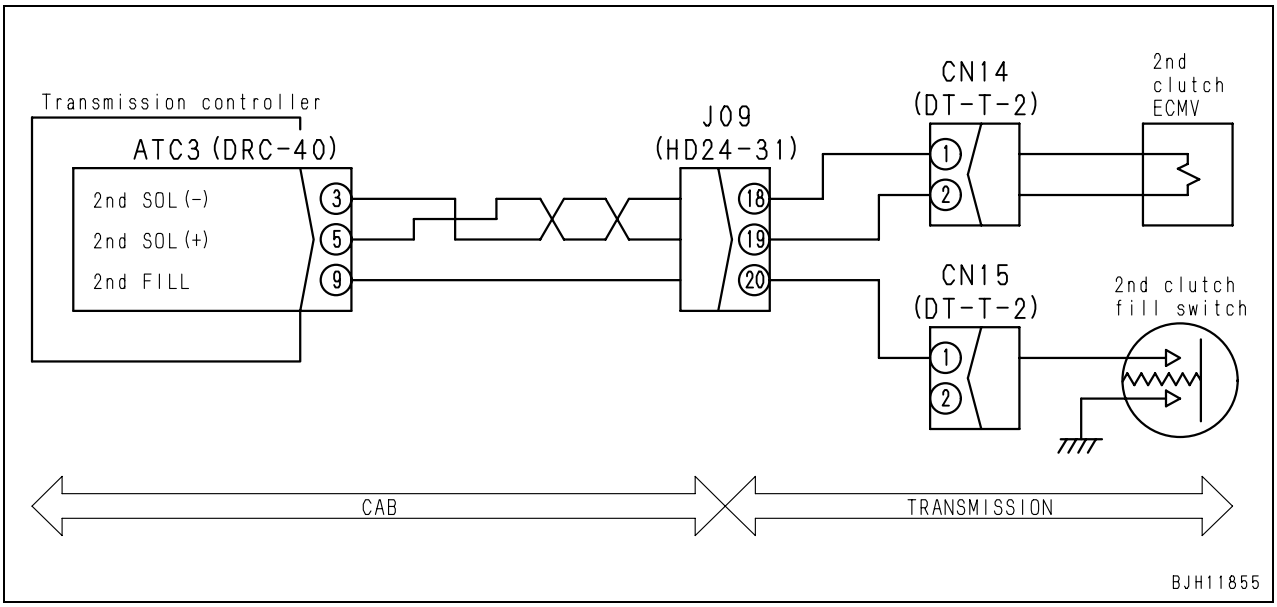
Action code	Failure code	Trouble	2nd clutch: Slipping (2nd command holding pressure, 2nd clutch fill switch ON, slipping detected) (Transmission controller system)
E03	**15L0MW**		
Contents of trouble	• During an output to the 2nd clutch ECMV, an abnormality exists in the value calculated from the signals of transmission input shaft speed sensor, transmission intermediate shaft speed sensor and transmission output shaft speed sensor.		
Action of controller	• Shifts up and holds the gear speed depending on the gear speed before failure as mentioned in **Table 1**. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31603**) • If the electrical system is normal, check for a failure in the hydraulic or mechanical system for 2nd clutch or pressure control valve.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective 2nd clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN14 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN14 (male) (1), (2) and body ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (5) – CN14 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ATC3 (female) (3) – CN14 (female) (2)	Resistance	Max. 1 Ω
	3	Defective speed sensor detection	• Troubleshooting by failure code DL**KA, DL**LC		
	4	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (5) – ATC3 (female) (3)	Resistance	5 – 15 Ω

Table 1

Previous range		Trouble clutch [Command ON] (Slip , short to GND or signal lost)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	3rd	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
F5	3rd Low	3rd	OFF	Neutral	OFF
		Low	3H	F6	OFF
F4	2nd High	2nd	3L	F5	OFF
		High	3L	F5	OFF
F3	2nd Low	2nd	3L	F5	OFF
		Low	2H	F4	OFF
F2	1st High	1st	2L	F3	OFF
		High	2L	F3	OFF
F1	1st Low	1st	2L	F3	OFF
		Low	1H	F2	OFF
R3	3rd Reverse	3rd	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
R2	2nd Reverse	2nd	3R	R3	OFF
		Reverse	OFF	Neutral	OFF
R1	1st Reverse	1st	2R	R2	OFF
		Reverse	OFF	Neutral	OFF

Circuit diagram related



Failure code [15M0MW] (3rd clutch: Slipping)

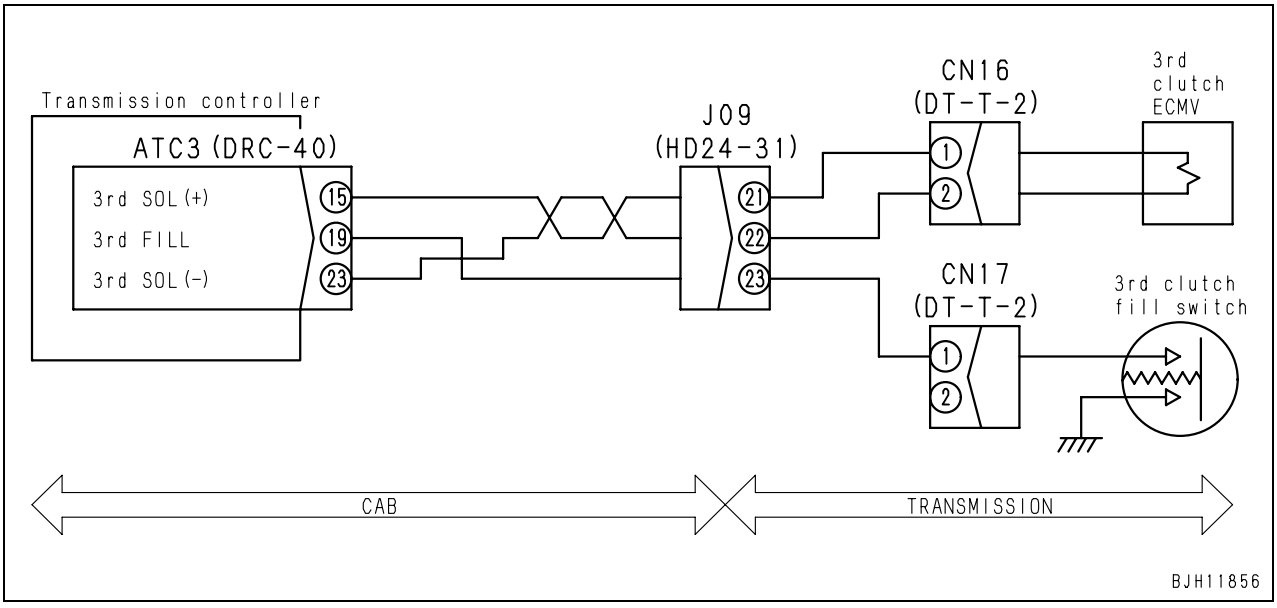
Action code	Failure code	Trouble	3rd clutch: Slipping (3rd command holding pressure, 3rd clutch fill switch ON, slipping detected) (Transmission controller system)
E03	**15M0MW**		
Contents of trouble	• During an output to the 3rd clutch ECMV, an abnormality exists in the value calculated from the signals of transmission input shaft speed sensor, transmission intermediate shaft speed sensor and transmission output shaft speed sensor.		
Action of controller	• Shifts up and holds the gear speed depending on the gear speed before failure as mentioned in **Table 1**.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31604**) • If the electrical system is normal, check for a failure in the hydraulic or mechanical system for 3rd clutch or pressure control valve.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective 3rd clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN16 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN16 (male) (1), (2) – body ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (15) – CN16 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ATC3 (female) (23) – CN16 (female) (2)	Resistance	Max. 1 Ω
	3	Defective speed sensor detection	• Troubleshooting by failure code DL**KA, DL**LC		
	4	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (15) – ATC3 (female) (23)	Resistance	5 – 15 Ω

Table 1

Previous range		Trouble clutch [Command ON] (Slip , short to GND or signal lost)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	3rd	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
F5	3rd Low	3rd	OFF	Neutral	OFF
		Low	3H	F6	OFF
F4	2nd High	2nd	3L	F5	OFF
		High	3L	F5	OFF
F3	2nd Low	2nd	3L	F5	OFF
		Low	2H	F4	OFF
F2	1st High	1st	2L	F3	OFF
		High	2L	F3	OFF
F1	1st Low	1st	2L	F3	OFF
		Low	1H	F2	OFF
R3	3rd Reverse	3rd	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
R2	2nd Reverse	2nd	3R	R3	OFF
		Reverse	OFF	Neutral	OFF
R1	1st Reverse	1st	2R	R2	OFF
		Reverse	OFF	Neutral	OFF

Circuit diagram related



Failure code [15SBL1] (R clutch solenoid: Fill signal is ON when command current is OFF.)

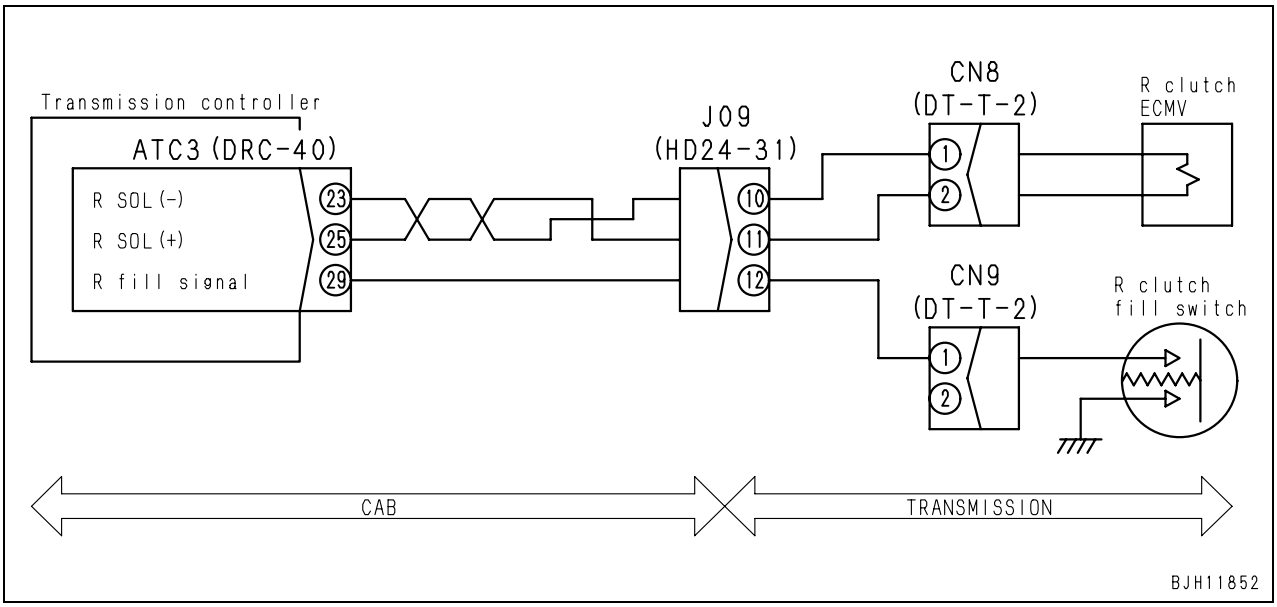
Action code	Failure code	Trouble	R clutch solenoid: Fill signal is ON when command current is OFF. (Transmission controller system)
E03	**15SBL1**		
Contents of trouble	• Even when output to the R clutch ECMV is turned OFF, the signal from the fill switch stays ON and the clutch is not released.		
Action of controller	• Shifts up and holds the gear speed depending on the gear speed before failure as mentioned in **Table 2**. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31606**)		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective for R clutch fill switch	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between CN9 (male) (1) – body ground	When released	Resistance	Min. 1 MΩ
				When engaged	Resistance	Max. 1 Ω
	2	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ATC3 (female) (29) – CN9 (female) (1)		Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ATC3 (female) (29) – body ground	When released	Resistance	Min. 1 MΩ
				When engaged	Resistance	Max. 1 Ω

Table 2

Previous range		Trouble clutch [Command ON] (Fill SW ON)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
F5	3rd Low	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		High	3H	F6	OFF
F4	2nd High	3rd	3L	F5	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		Low	3L	F5	OFF
F3	2nd Low	3rd	3L	F5	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		High	2H	F4	OFF
F2	1st High	3rd	3L	F5	OFF
		2nd	2L	F3	OFF
		Reverse	OFF	Neutral	OFF
		Low	2L	F3	OFF
F1	1st Low	3rd	3L	F5	OFF
		2nd	2L	F3	OFF
		Reverse	OFF	Neutral	OFF
		High	1H	F2	OFF
R3	3rd Reverse	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
R2	2nd Reverse	3rd	3R	R3	OFF
		1st	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
R1	1st Reverse	3rd	3R	R3	OFF
		2nd	2R	R2	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
N		Any	None	No reaction	—

Circuit diagram related



Failure code [15SBMA] (R clutch solenoid: Malfunction)

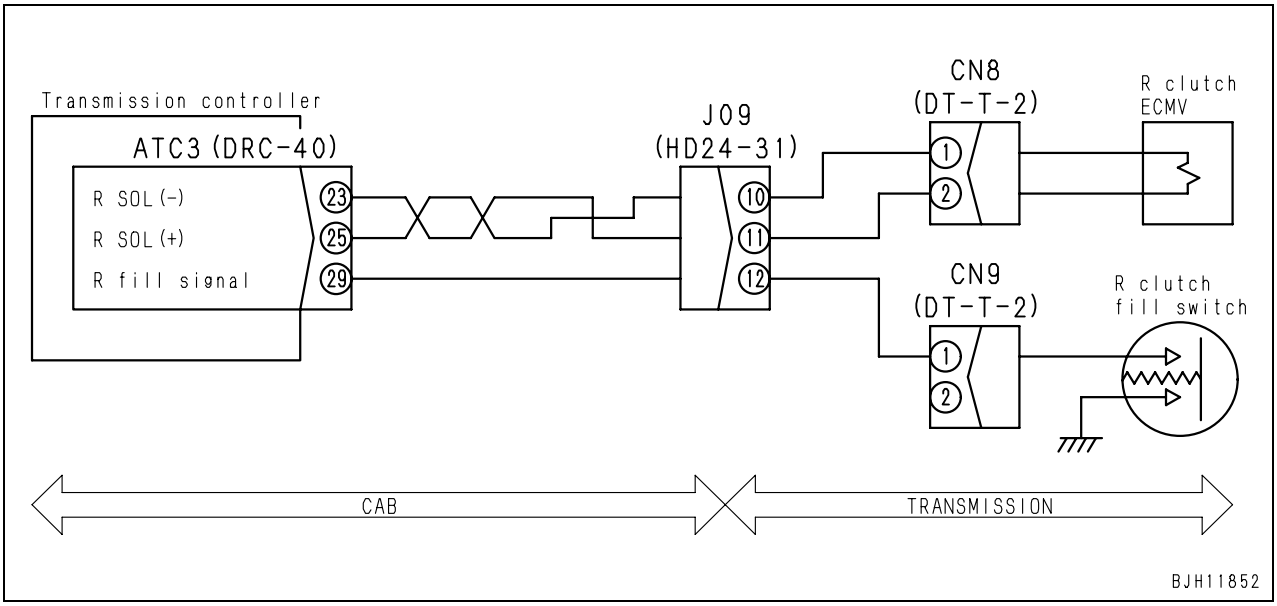
Action code	Failure code	Trouble	R clutch solenoid: Malfunction (R command holding pressure, R clutch fill switch OFF, slipping detected) (Transmission controller system)
E03	**15SBMA**		
Contents of trouble	• The signal from the fill switch stays OFF during an output to the R clutch ECMV and an abnormality exists in the value calculated from the signals of transmission input shaft speed sensor, transmission intermediate shaft speed sensor and transmission output shaft speed sensor.		
Action of controller	• Shifts up and holds the gear speed depending on the gear speed before failure as mentioned in **Table 1**. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31606**) • If the electrical system is normal, check for a failure in the hydraulic or mechanical system for R clutch or pressure control valve.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective R clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN8 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN8 (male) (1), (2) – body ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (25) – CN8 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ATC3 (female) (23) – CN8 (female) (2)	Resistance	Max. 1 Ω
	3	Defective speed sensor detection	• Troubleshooting by failure code DL**KA, DL**LC		
	4	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (25) – ATC3 (female) (23)	Resistance	5 – 15 Ω

Table 1

Previous range		Trouble clutch [Command ON] (Slip , short to GND or signal lost)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	3rd	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
F5	3rd Low	3rd	OFF	Neutral	OFF
		Low	3H	F6	OFF
F4	2nd High	2nd	3L	F5	OFF
		High	3L	F5	OFF
F3	2nd Low	2nd	3L	F5	OFF
		Low	2H	F4	OFF
F2	1st High	1st	2L	F3	OFF
		High	2L	F3	OFF
F1	1st Low	1st	2L	F3	OFF
		Low	1H	F2	OFF
R3	3rd Reverse	3rd	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
R2	2nd Reverse	2nd	3R	R3	OFF
		Reverse	OFF	Neutral	OFF
R1	1st Reverse	1st	2R	R2	OFF
		Reverse	OFF	Neutral	OFF

Circuit diagram related



Failure code [15SCL1] (Hi clutch solenoid: Fill signal is ON when command current is OFF.)

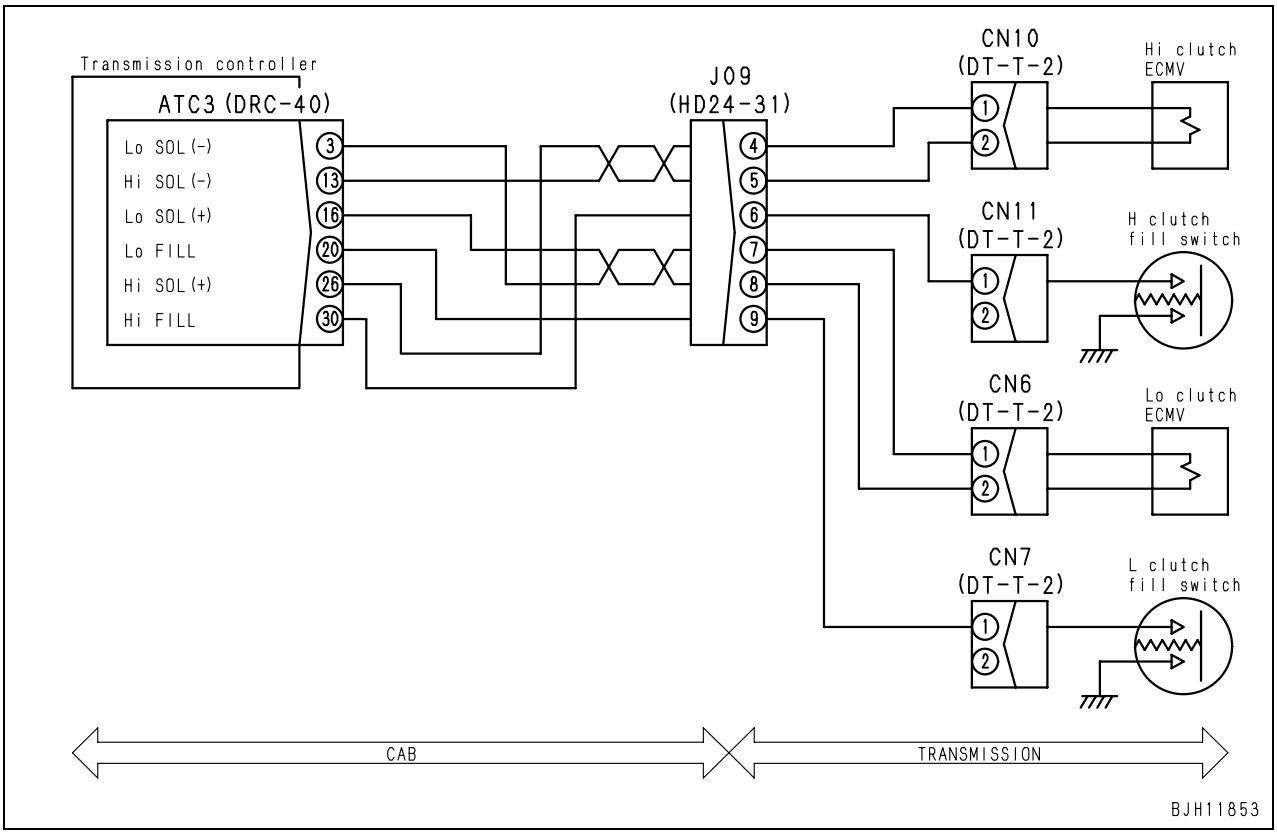
Action code	Failure code	Trouble	Hi clutch solenoid: Fill signal is ON when command signal is OFF. (Transmission controller system)
E03	**15SCL1**		
Contents of trouble	• Even when output to the Hi clutch ECMV is turned OFF, the signal from the fill switch stays ON and the clutch is not released.		
Action of controller	• Shifts up and holds the gear speed depending on the gear speed before failure as mentioned in **Table 2**. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31600**)		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective Hi clutch fill switch	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between CN11 (male) (1) – body ground	When released	Resistance	Min. 1 MΩ
				When engaged	Resistance	Max. 1 Ω
	2	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ATC3 (female) (30) – CN11 (female) (1)		Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ATC3 (female) (30) – body ground	When released	Resistance	Min. 1 MΩ
				When engaged	Resistance	Max. 1 Ω

Table 2

Previous range		Trouble clutch [Command ON] (Fill SW ON)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
F5	3rd Low	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		High	3H	F6	OFF
F4	2nd High	3rd	3L	F5	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		Low	3L	F5	OFF
F3	2nd Low	3rd	3L	F5	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		High	2H	F4	OFF
F2	1st High	3rd	3L	F5	OFF
		2nd	2L	F3	OFF
		Reverse	OFF	Neutral	OFF
		Low	2L	F3	OFF
F1	1st Low	3rd	3L	F5	OFF
		2nd	2L	F3	OFF
		Reverse	OFF	Neutral	OFF
		High	1H	F2	OFF
R3	3rd Reverse	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
R2	2nd Reverse	3rd	3R	R3	OFF
		1st	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
R1	1st Reverse	3rd	3R	R3	OFF
		2nd	2R	R2	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
N		Any	None	No reaction	—

Circuit diagram related



Failure code [15SCMA] (Hi clutch solenoid: Malfunction)

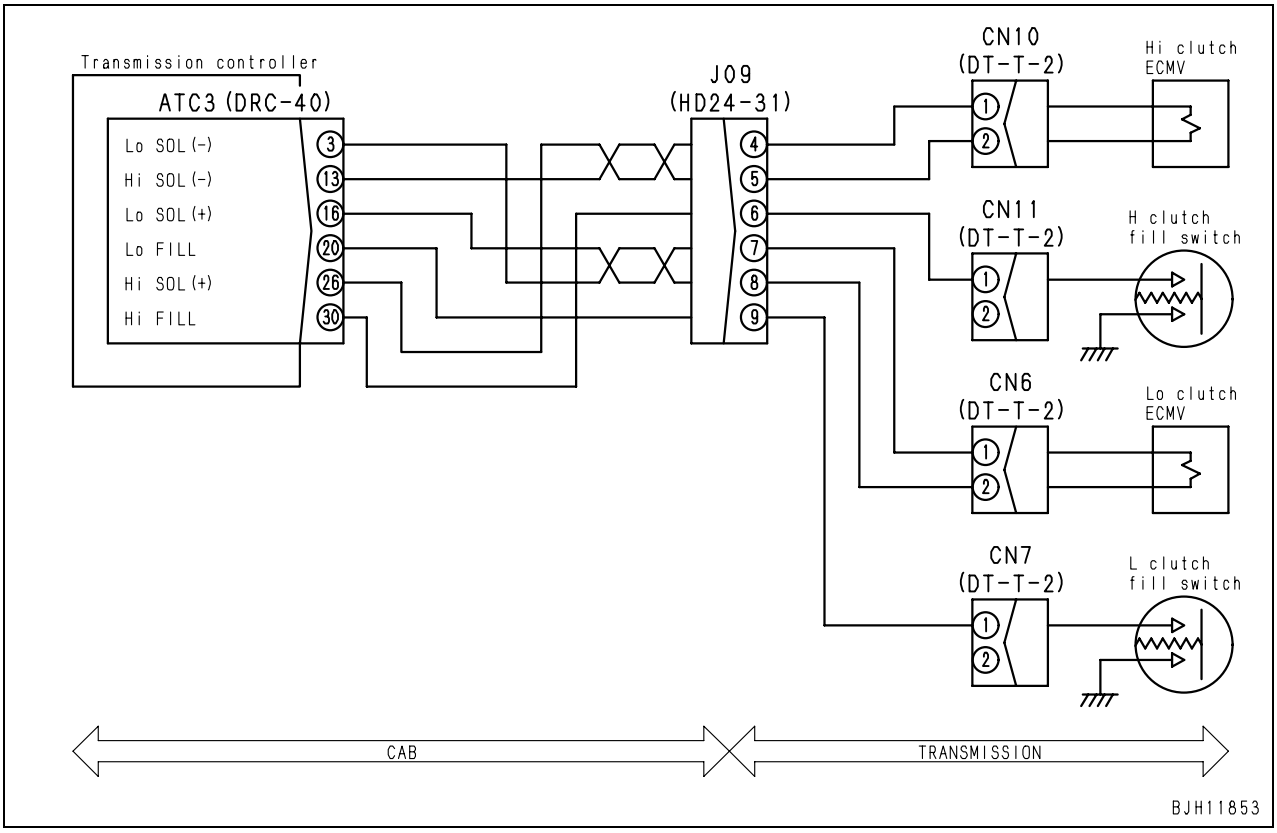
Action code	Failure code	Trouble	Hi clutch solenoid: Malfunction (Hi command holding pressure, Hi clutch fill switch OFF, slipping detected) (Transmission controller system)
E03	**15SCMA**		
Contents of trouble	• The signal from the fill switch stays OFF during an output to the Hi clutch ECMV and an abnormality exists in the value calculated from the signals of transmission input shaft speed sensor, transmission intermediate shaft speed sensor and transmission output shaft speed sensor.		
Action of controller	• Shifts up and holds the gear speed depending on the gear speed before failure as mentioned in **Table 1**. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31600**) • If the electrical system is normal, check for a failure in the hydraulic or mechanical system for Hi clutch or pressure control valve.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective Hi clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN10 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN10 (male) (1), (2) – body ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (26) – CN10 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ATC3 (female) (13) – CN10 (female) (2)	Resistance	Max. 1 Ω
	3	Defective speed sensor detection	• Troubleshooting by failure code DL**KA, DL**LC		
	4	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (26) – ATC3 (female) (13)	Resistance	5 – 15 Ω

Table 1

Previous range		Trouble clutch [Command ON] (Slip , short to GND or signal lost)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	3rd	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
F5	3rd Low	3rd	OFF	Neutral	OFF
		Low	3H	F6	OFF
F4	2nd High	2nd	3L	F5	OFF
		High	3L	F5	OFF
F3	2nd Low	2nd	3L	F5	OFF
		Low	2H	F4	OFF
F2	1st High	1st	2L	F3	OFF
		High	2L	F3	OFF
F1	1st Low	1st	2L	F3	OFF
		Low	1H	F2	OFF
R3	3rd Reverse	3rd	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
R2	2nd Reverse	2nd	3R	R3	OFF
		Reverse	OFF	Neutral	OFF
R1	1st Reverse	1st	2R	R2	OFF
		Reverse	OFF	Neutral	OFF

Circuit diagram related



Failure code [15SDL1] (Lo clutch solenoid: Fill signal is ON when command current is OFF.)

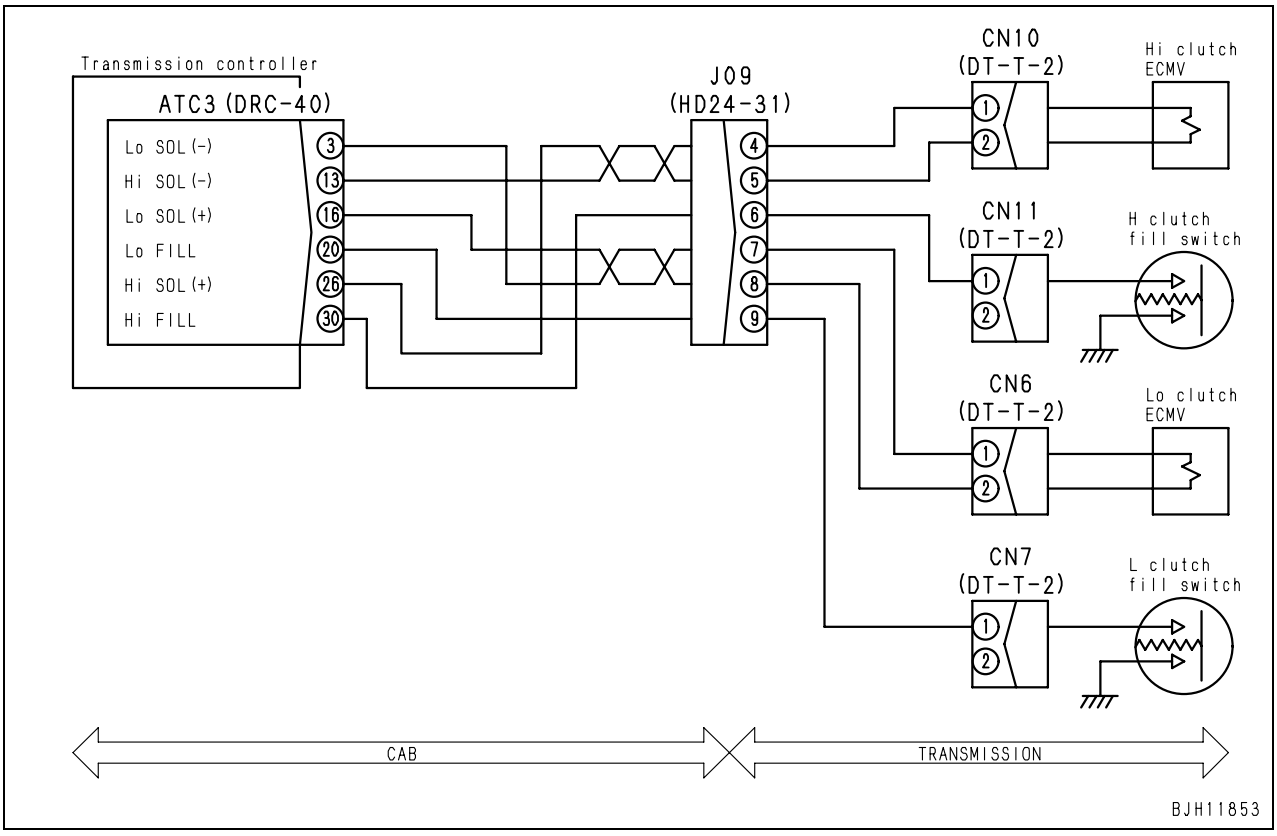
Action code	Failure code	Trouble	Lo clutch solenoid: Fill signal is ON when command current is OFF. (Transmission controller system)
E03	**15SDL1**		
Contents of trouble	• Even when output to the Lo clutch ECMV is turned “OFF“, the signal from the fill switch stays “ON“ and the clutch is not released.		
Action of controller	• Shifts up and holds the gear speed as shown in **Table 1** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31601**)		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective Lo clutch fill switch	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between CN7 (male) (1) – body ground	When released	Resistance	Min. 1 MΩ
				When engaged	Resistance	Max. 1 Ω
	2	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ATC3 (female) (20) – CN7 (female) (1)		Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ATC3 (female) (20) – body ground	When released	Resistance	Min. 1 MΩ
				When engaged	Resistance	Max. 1 Ω

Table 1

Previous range		Trouble clutch [Command ON] (Slip , short to GND or signal lost)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	3rd	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
F5	3rd Low	3rd	OFF	Neutral	OFF
		Low	3H	F6	OFF
F4	2nd High	2nd	3L	F5	OFF
		High	3L	F5	OFF
F3	2nd Low	2nd	3L	F5	OFF
		Low	2H	F4	OFF
F2	1st High	1st	2L	F3	OFF
		High	2L	F3	OFF
F1	1st Low	1st	2L	F3	OFF
		Low	1H	F2	OFF
R3	3rd Reverse	3rd	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
R2	2nd Reverse	2nd	3R	R3	OFF
		Reverse	OFF	Neutral	OFF
R1	1st Reverse	1st	2R	R2	OFF
		Reverse	OFF	Neutral	OFF

Circuit diagram related



Failure code [15SDMA] (Lo clutch solenoid: Malfunction)

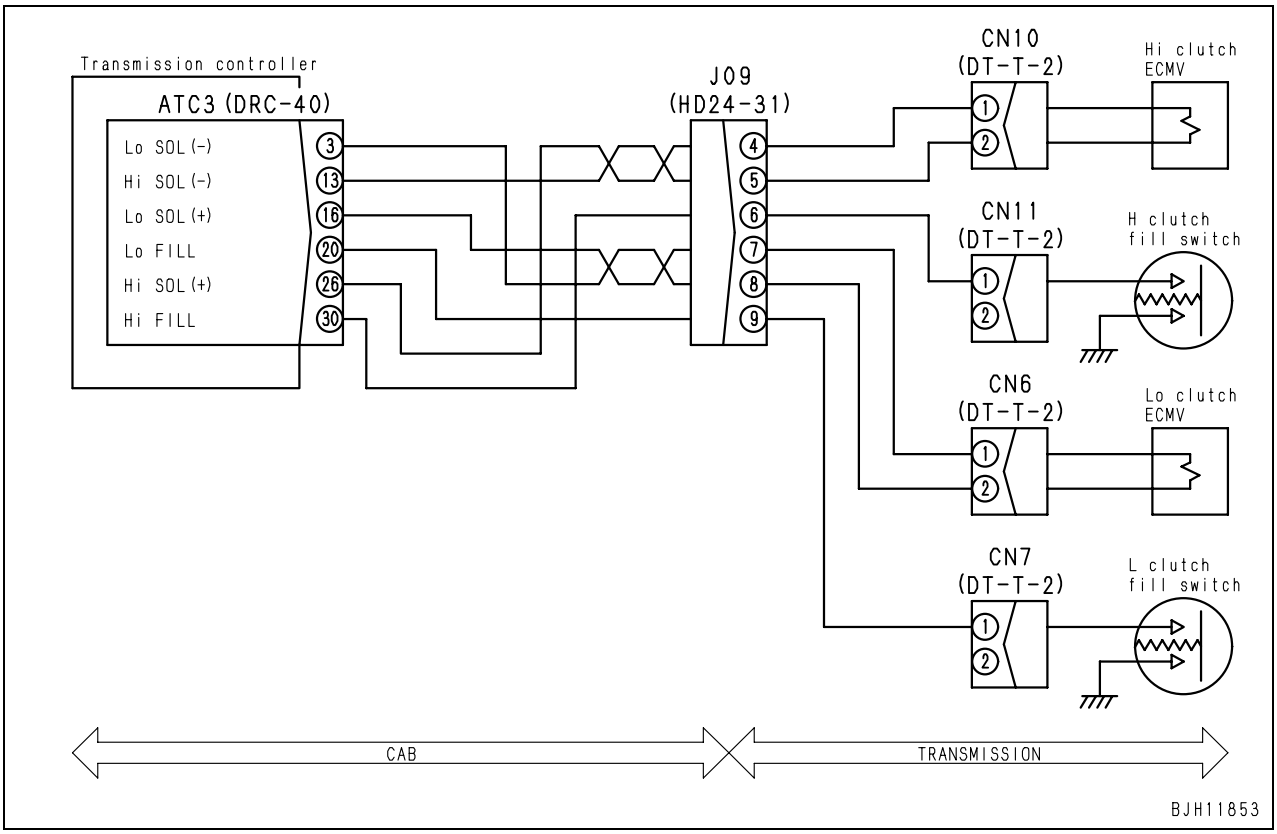
Action code	Failure code	Trouble	Lo clutch solenoid: Malfunction (Lo command holding pressure, Lo clutch fill switch OFF, slipping detected) (Transmission controller system)
E03	**15SDMA**		
Contents of trouble	• The signal from the fill switch stays OFF during an output to the Lo clutch ECMV and an abnormality exists in the value calculated from the signals of transmission input shaft speed sensor, transmission intermediate shaft speed sensor and transmission output shaft speed sensor.		
Action of controller	• Shifts up and holds the gear speed as shown in **Table 2** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31601**) • If the electrical system is normal, check for a failure in the hydraulic or mechanical system for Lo clutch or pressure control valve.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective Lo clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN6 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN6 (male) (1), (2) – body ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (16) – CN6 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ATC3 (female) (3) – CN6 (female) (2)	Resistance	Max. 1 Ω
	3	Defective speed sensor detection	• Troubleshooting by failure code DL**KA, DL**LC		
	4	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (16) – ATC3 (female) (3)	Resistance	5 – 15 Ω

Table 2

Previous range		Trouble clutch [Command ON] (Fill SW ON)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
F5	3rd Low	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		High	3H	F6	OFF
F4	2nd High	3rd	3L	F5	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		Low	3L	F5	OFF
F3	2nd Low	3rd	3L	F5	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		High	2H	F4	OFF
F2	1st High	3rd	3L	F5	OFF
		2nd	2L	F3	OFF
		Reverse	OFF	Neutral	OFF
		Low	2L	F3	OFF
F1	1st Low	3rd	3L	F5	OFF
		2nd	2L	F3	OFF
		Reverse	OFF	Neutral	OFF
		High	1H	F2	OFF
R3	3rd Reverse	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
R2	2nd Reverse	3rd	3R	R3	OFF
		1st	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
R1	1st Reverse	3rd	3R	R3	OFF
		2nd	2R	R2	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
N		Any	None	No reaction	—

Circuit diagram related



Failure code [15SEL1] (1st clutch solenoid: Fill signal is ON when command current is OFF)

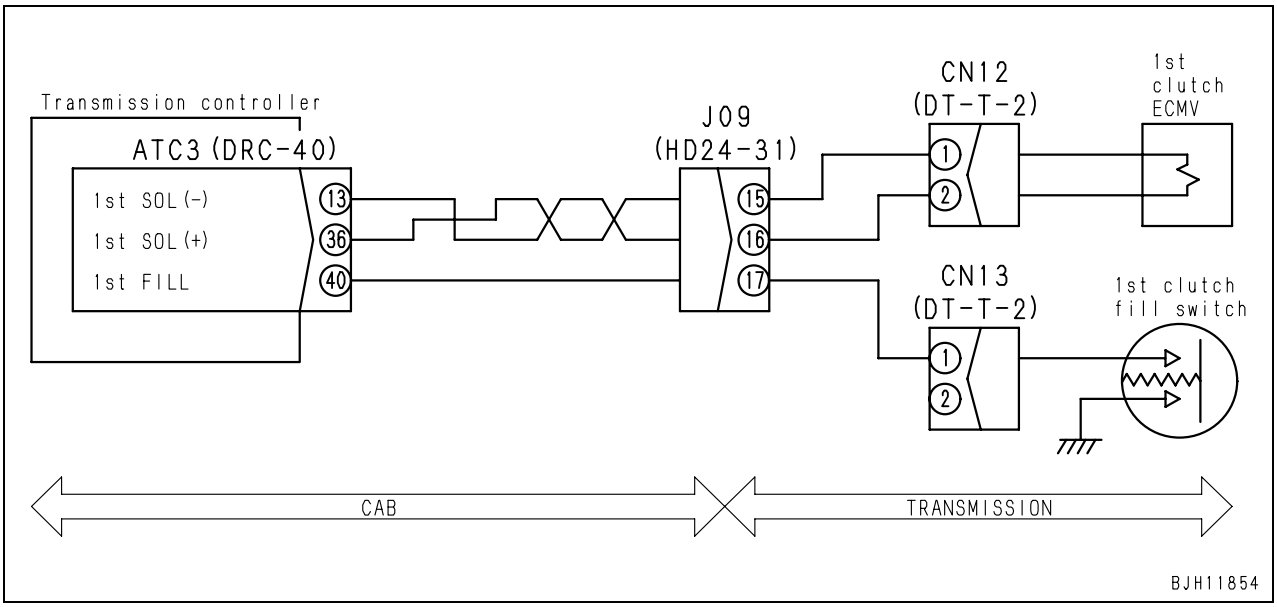
Action code	Failure code	Trouble	1st clutch solenoid: Fill signal is ON when command current is OFF (Transmission controller system)
E03	**15SEL1**		
Contents of trouble	• Even when output to the 1st clutch ECMV is turned “OFF“, the signal from the fill switch stays “ON“ and the clutch is not released.		
Action of controller	• Shifts up and holds the gear speed as shown in **Table 2** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31602**)		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective 1st clutch fill switch	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between CN13 (male) (1) – body ground	When released	Resistance	Min. 1 MΩ
				When engaged	Resistance	Max. 1 Ω
	2	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ATC3 (female) (40) – CN13 (female) (1)		Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ATC3 (female) (40) – body ground	When released	Resistance	Min. 1 MΩ
				When engaged	Resistance	Max. 1 Ω

Table 2

Previous range		Trouble clutch [Command ON] (Fill SW ON)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
F5	3rd Low	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		High	3H	F6	OFF
F4	2nd High	3rd	3L	F5	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		Low	3L	F5	OFF
F3	2nd Low	3rd	3L	F5	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		High	2H	F4	OFF
F2	1st High	3rd	3L	F5	OFF
		2nd	2L	F3	OFF
		Reverse	OFF	Neutral	OFF
		Low	2L	F3	OFF
F1	1st Low	3rd	3L	F5	OFF
		2nd	2L	F3	OFF
		Reverse	OFF	Neutral	OFF
		High	1H	F2	OFF
R3	3rd Reverse	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
R2	2nd Reverse	3rd	3R	R3	OFF
		1st	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
R1	1st Reverse	3rd	3R	R3	OFF
		2nd	2R	R2	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
N		Any	None	No reaction	—

Circuit diagram related



Failure code [15SEMA] (1st clutch solenoid: Malfunction)

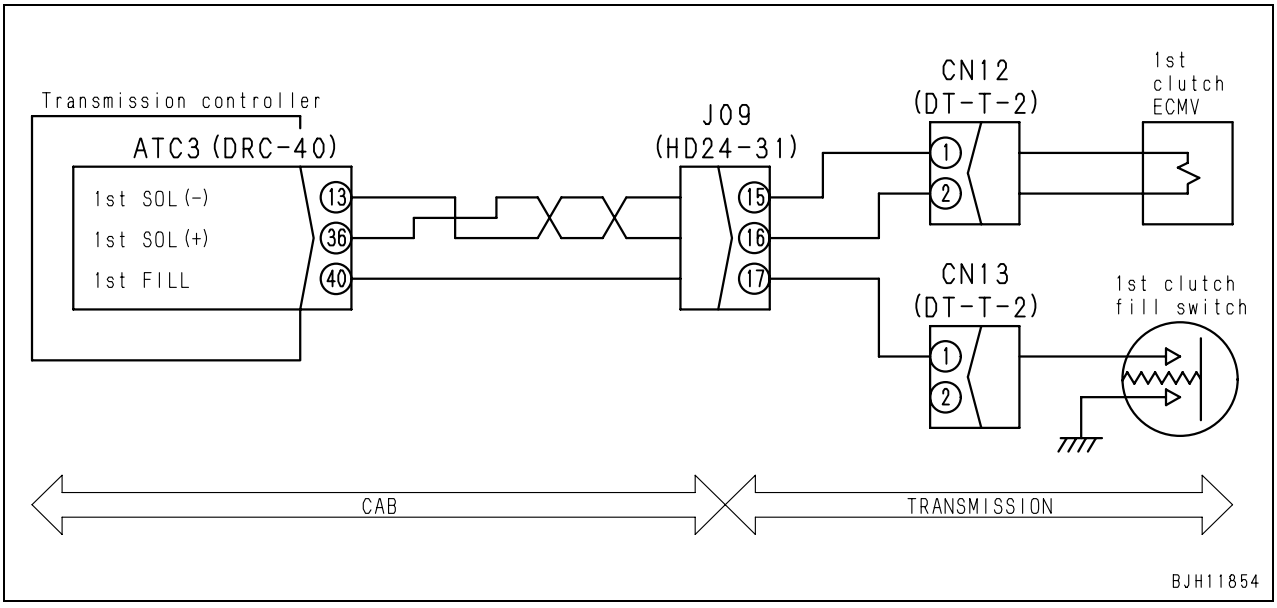
Action code	Failure code	Trouble	1st clutch solenoid: Malfunction (1st command holding pressure, 1st clutch fill switch OFF, slipping detected) (Transmission controller system)
E03	**15SEMA**		
Contents of trouble	• The signal from the fill switch stays OFF during an output to the 1st clutch ECMV and an abnormality exists in the value calculated from the signals of transmission input shaft speed sensor, transmission intermediate shaft speed sensor and transmission output shaft speed sensor.		
Action of controller	• Shifts up and holds the gear speed as shown in **Table 1** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31602**) • If the electrical system is normal, check for a failure in the hydraulic or mechanical system for 1st clutch or pressure control valve.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective 1st clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN12 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN12 (male) (1), (2) – body ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ACT3 (female) (36) – CN12 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ATC3 (female) (13) – CN12 (female) (2)	Resistance	Max. 1 Ω
	3	Defective speed sensor detection	• Troubleshooting by failure code DL**KA, DL**LC		
	4	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (36) – ATC3 (female) (13)	Resistance	5 – 15 Ω

Table 1

Previous range		Trouble clutch [Command ON] (Slip , short to GND or signal lost)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	3rd	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
F5	3rd Low	3rd	OFF	Neutral	OFF
		Low	3H	F6	OFF
F4	2nd High	2nd	3L	F5	OFF
		High	3L	F5	OFF
F3	2nd Low	2nd	3L	F5	OFF
		Low	2H	F4	OFF
F2	1st High	1st	2L	F3	OFF
		High	2L	F3	OFF
F1	1st Low	1st	2L	F3	OFF
		Low	1H	F2	OFF
R3	3rd Reverse	3rd	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
R2	2nd Reverse	2nd	3R	R3	OFF
		Reverse	OFF	Neutral	OFF
R1	1st Reverse	1st	2R	R2	OFF
		Reverse	OFF	Neutral	OFF

Circuit diagram related



Failure code [15SFL1] (2nd clutch solenoid: Fill signal is ON when command current is OFF.)

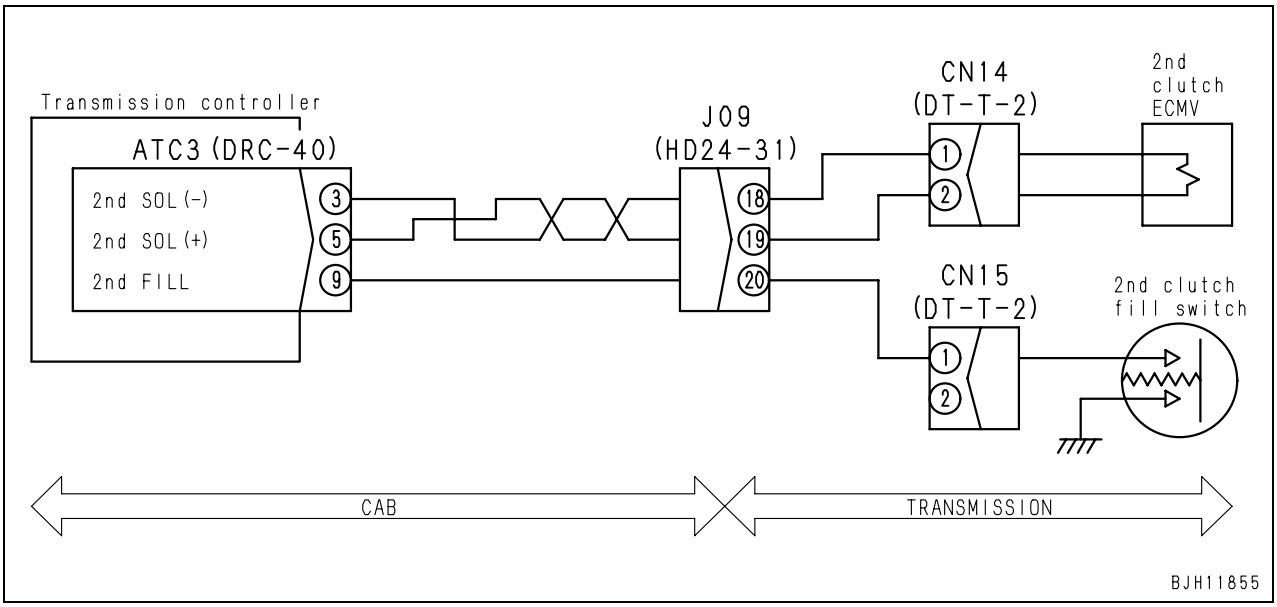
Action code	Failure code	Trouble	2nd clutch solenoid: Fill signal is ON when command current is OFF. (Transmission controller system)
E03	**15SFL1**		
Contents of trouble	• Even when output to the 2nd clutch ECMV is turned “OFF“, the signal from the fill switch stays “ON“ and the clutch is not released.		
Action of controller	• Shifts up and holds the gear speed as shown in **Table 2** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31603**)		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state			★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
	1	Defective fill switch for 2nd clutch	Between CN15 (male) (1) – body ground	When released	Resistance	Min. 1 MΩ
				When engaged	Resistance	Max. 1 Ω
	2	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ATC3 (female) (9) – CN15 (female) (1)		Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ATC3 (female) (9) – body ground	When released	Resistance	Min. 1 MΩ
				When engaged	Resistance	Max. 1 Ω

Table 2

Previous range		Trouble clutch [Command ON] (Fill SW ON)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
F5	3rd Low	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		High	3H	F6	OFF
F4	2nd High	3rd	3L	F5	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		Low	3L	F5	OFF
F3	2nd Low	3rd	3L	F5	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		High	2H	F4	OFF
F2	1st High	3rd	3L	F5	OFF
		2nd	2L	F3	OFF
		Reverse	OFF	Neutral	OFF
		Low	2L	F3	OFF
F1	1st Low	3rd	3L	F5	OFF
		2nd	2L	F3	OFF
		Reverse	OFF	Neutral	OFF
		High	1H	F2	OFF
R3	3rd Reverse	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
R2	2nd Reverse	3rd	3R	R3	OFF
		1st	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
R1	1st Reverse	3rd	3R	R3	OFF
		2nd	2R	R2	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
N		Any	None	No reaction	—

Circuit diagram related



Failure code [15SFMA] (2nd clutch solenoid: Malfunction)

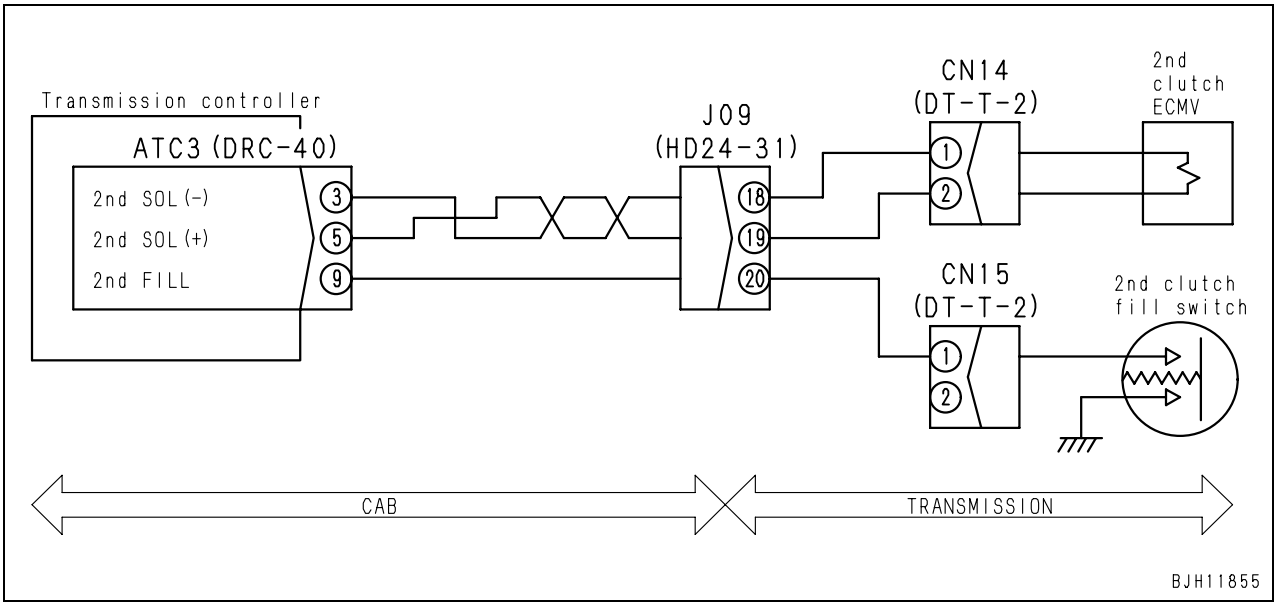
Action code	Failure code	Trouble	2nd clutch solenoid: Malfunction (2nd command holding pressure, 2nd clutch fill switch OFF, slipping detected) (Transmission controller system)
E03	**15SFMA**		
Contents of trouble	• The signal from the fill switch stays OFF during an output to the 2nd clutch ECMV and an abnormality exists in the value calculated from the signals of transmission input shaft speed sensor, transmission intermediate shaft speed sensor and transmission output shaft speed sensor.		
Action of controller	• Shifts up and holds the gear speed as shown in **Table 1** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31603**) • If the electrical system is normal, check for a failure in the hydraulic or mechanical system for 2nd clutch or pressure control valve.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective 2nd clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN14 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN14 (male) (1), (2) – body ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (5) – CN14 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ATC3 (female) (3) – CN14 (female) (2)	Resistance	Max. 1 Ω
	3	Defective speed sensor detection	• Troubleshooting by failure code DL**KA, DL**LC		
	4	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ACT3 (female) (5) – ACT3 (female) (3)	Resistance	5 – 15 Ω

Table 1

Previous range		Trouble clutch [Command ON] (Slip , short to GND or signal lost)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	3rd	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
F5	3rd Low	3rd	OFF	Neutral	OFF
		Low	3H	F6	OFF
F4	2nd High	2nd	3L	F5	OFF
		High	3L	F5	OFF
F3	2nd Low	2nd	3L	F5	OFF
		Low	2H	F4	OFF
F2	1st High	1st	2L	F3	OFF
		High	2L	F3	OFF
F1	1st Low	1st	2L	F3	OFF
		Low	1H	F2	OFF
R3	3rd Reverse	3rd	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
R2	2nd Reverse	2nd	3R	R3	OFF
		Reverse	OFF	Neutral	OFF
R1	1st Reverse	1st	2R	R2	OFF
		Reverse	OFF	Neutral	OFF

Circuit diagram related



Failure code [15SGL1] (3rd clutch solenoid: Fill signal is ON when command current is OFF.)

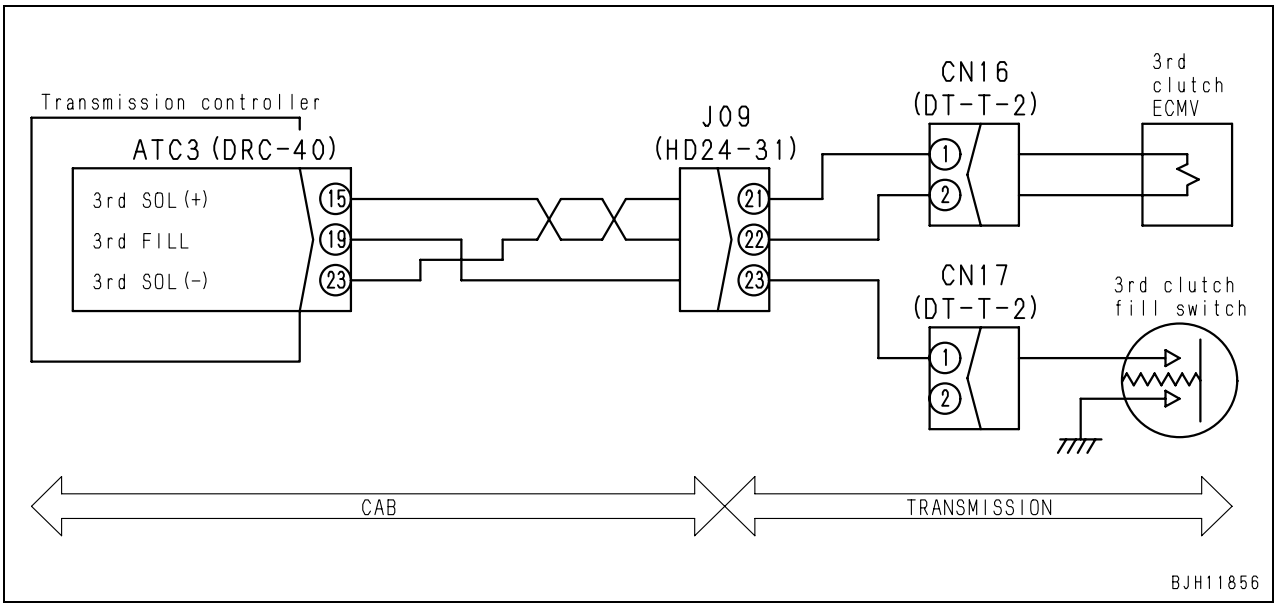
Action code	Failure code	Trouble	3rd clutch solenoid: Fill signal is ON when command current is OFF. (Transmission controller system)
E03	**15SGL1**		
Contents of trouble	• Even when output to the 3rd clutch ECMV is turned “OFF“, the signal from the fill switch stays “ON“ and the clutch is not released.		
Action of controller	• Shifts up and holds the gear speed as shown in **Table 2** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31604**)		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 3rd clutch fill switch	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between CN17 (male) (1) – body ground	When released	Resistance	Min. 1 MΩ
				When engaged	Resistance	Max. 1 Ω
	2	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ATC3 (female) (19) – CN17 (female) (1)		Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ATC3 (female) (19) – body ground	When released	Resistance	Min. 1 MΩ
				When engaged	Resistance	Max. 1 Ω

Table 2

Previous range		Trouble clutch [Command ON] (Fill SW ON)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
F5	3rd Low	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		High	3H	F6	OFF
F4	2nd High	3rd	3L	F5	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		Low	3L	F5	OFF
F3	2nd Low	3rd	3L	F5	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		High	2H	F4	OFF
F2	1st High	3rd	3L	F5	OFF
		2nd	2L	F3	OFF
		Reverse	OFF	Neutral	OFF
		Low	2L	F3	OFF
F1	1st Low	3rd	3L	F5	OFF
		2nd	2L	F3	OFF
		Reverse	OFF	Neutral	OFF
		High	1H	F2	OFF
R3	3rd Reverse	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
R2	2nd Reverse	3rd	3R	R3	OFF
		1st	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
R1	1st Reverse	3rd	3R	R3	OFF
		2nd	2R	R2	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
N		Any	None	No reaction	—

Circuit diagram related



Failure code [15SGMA] (3rd clutch solenoid: Malfunction)

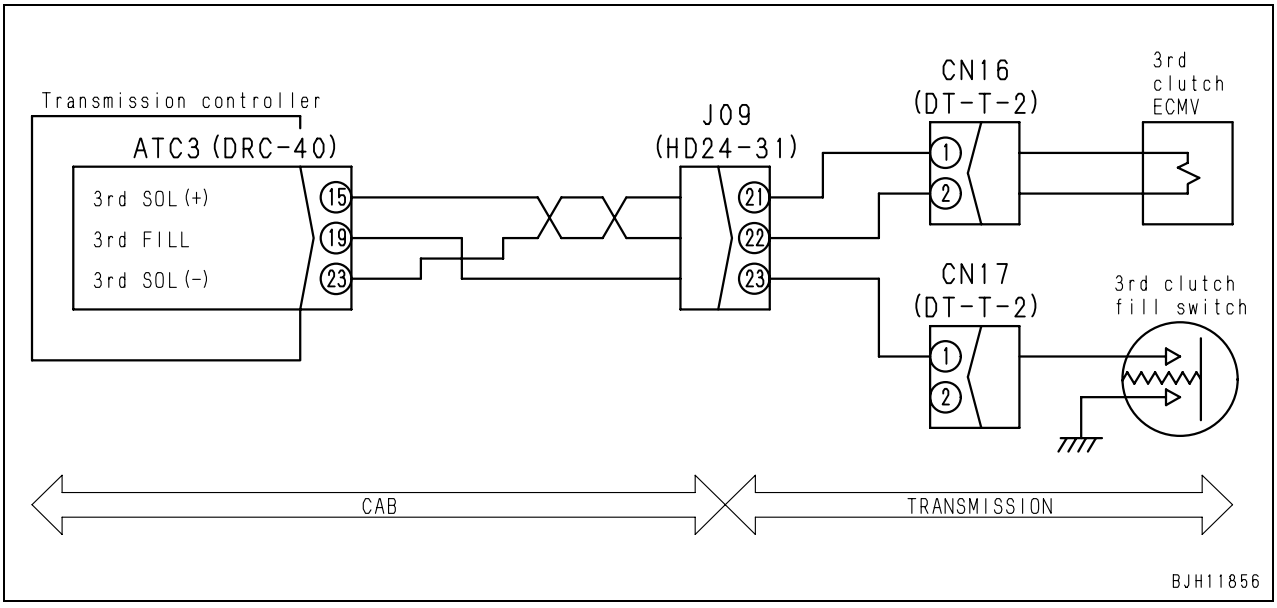
Action code	Failure code	Trouble	3rd clutch solenoid: Malfunction (3rd command holding pressure, 3rd clutch fill switch OFF, slipping detected) (Transmission controller system)
E03	**15SGMA**		
Contents of trouble	• The signal from the fill switch stays OFF during an output to the 3rd clutch ECMV and an abnormality exists in the value calculated from the signals of transmission input shaft speed sensor, transmission intermediate shaft speed sensor and transmission output shaft speed sensor.		
Action of controller	• Shifts up and holds the gear speed as shown in **Table 1** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31604**) • If the electrical system is normal, check for a failure in the hydraulic or mechanical system for 3rd clutch or pressure control valve.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective 3rd clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN16 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN16 (male) (1), (2) – body ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (15) – CN16 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ATC3 (female) (23) – CN16 (female) (2)	Resistance	Max. 1 Ω
	3	Defective speed sensor detection	• Troubleshooting by failure code DL**KA, DL**LC		
	4	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (15) – ATC3 (female) (23)	Resistance	5 – 15 Ω

Table 1

Previous range		Trouble clutch [Command ON] (Slip , short to GND or signal lost)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	3rd	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
F5	3rd Low	3rd	OFF	Neutral	OFF
		Low	3H	F6	OFF
F4	2nd High	2nd	3L	F5	OFF
		High	3L	F5	OFF
F3	2nd Low	2nd	3L	F5	OFF
		Low	2H	F4	OFF
F2	1st High	1st	2L	F3	OFF
		High	2L	F3	OFF
F1	1st Low	1st	2L	F3	OFF
		Low	1H	F2	OFF
R3	3rd Reverse	3rd	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
R2	2nd Reverse	2nd	3R	R3	OFF
		Reverse	OFF	Neutral	OFF
R1	1st Reverse	1st	2R	R2	OFF
		Reverse	OFF	Neutral	OFF

Circuit diagram related

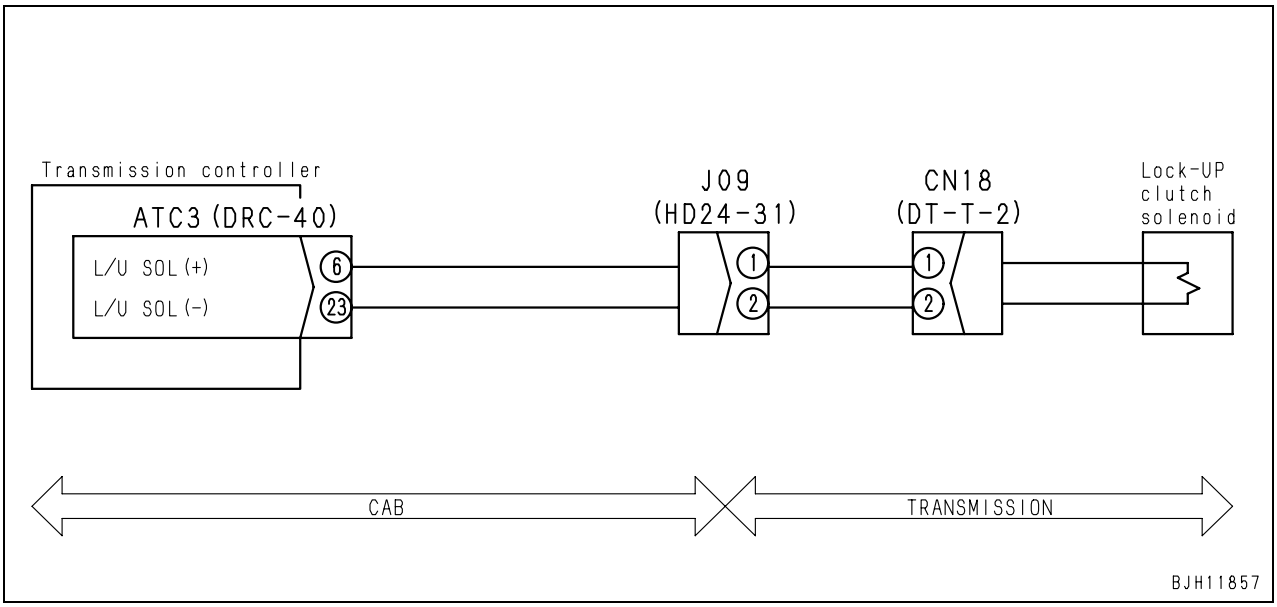


Failure code [15SJMA] (Lockup clutch solenoid: Malfunction)

Action code	Failure code	Trouble	Lockup clutch solenoid: Malfunction (Lockup command holding pressure, lockup clutch fill switch OFF, slipping detected) (Transmission controller system)
E03	**15SJMA**		
Contents of trouble	• During an output to the lockup clutch solenoid, an abnormality exists in the value calculated from the signals of engine speed sensor, transmission intermediated shaft speed sensor, and transmission output shaft speed sensor.		
Action of controller	• Holds gear speed during traveling and turns lockup to OFF. • Holds neutral when gear shift lever is set to “N“.		
Problem that appears on machine	• Lockup is released and gear shift is disabled. • If gear shift lever is shifted to “N“, machine does not start unless it is stopped.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31609**) • If the electrical system is normal, check for a failure in the hydraulic or mechanical system for lockup clutch or pressure control valve.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective lockup clutch solenoid	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN18 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN18 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (6) – CN18 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ATC3 (female) (18) – CN18 (female) (2)	Resistance	Max. 1 Ω
	3	Defective speed sensor detection	• Troubleshooting by failure code DL**KA, DL**LC		
	4	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (6) – ATC3 (female) (23)	Resistance	5 – 15 Ω

Circuit diagram related

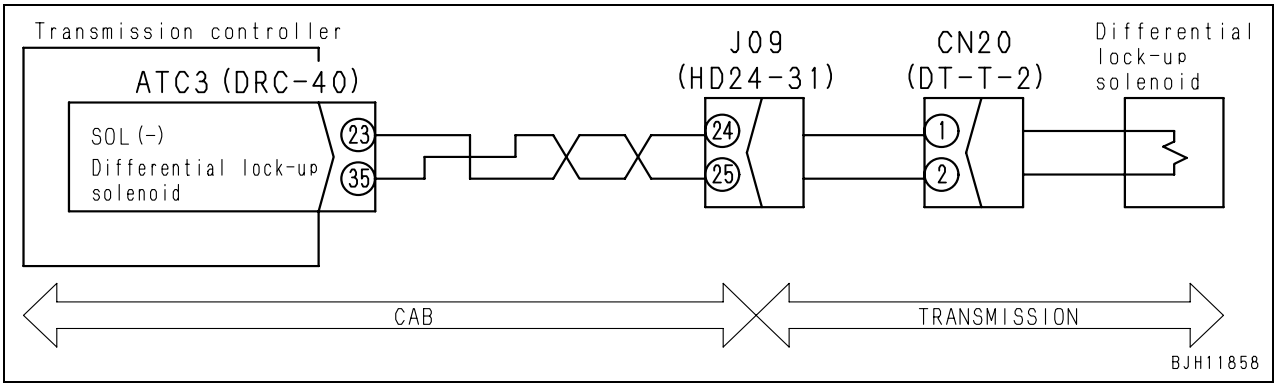


Failure code [15SKMA] (Inter-axle differential lockup pressure control valve: Malfunction)

Action code	Failure code	Trouble	Inter-axle differential lockup pressure control valve: Malfunction (Failure of pressure control valve) (Transmission controller system)
E01	**15SKMA**		
Contents of trouble	• Whereas there is output to differential lockup clutch pressure control valve, clutch does not engage or clutch slips.		
Action of controller	• Turns inter-axle differential lockup command OFF. • Even though the symptom of failure disappears, it does not return to normal unless once turning starting switch OFF.		
Problem that appears on machine	• Inter-axle differential lockup does not operate.		
Related information	• Output current to inter-axle differential lockup pressure control valve can be checked by monitoring function (code: **31607**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective differential lockup pressure control valve	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN20 (male) (1) – (2)	Resistance	7 – 14 Ω
			Between CN20 (male) (1), (2) – body ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ACT3 (female) (35) – CN20 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ACT3 (female) (23) – CN20 (female) (2)	Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ATC3 (female) (35) – (23)	Resistance	4 – 14 Ω

Circuit diagram related

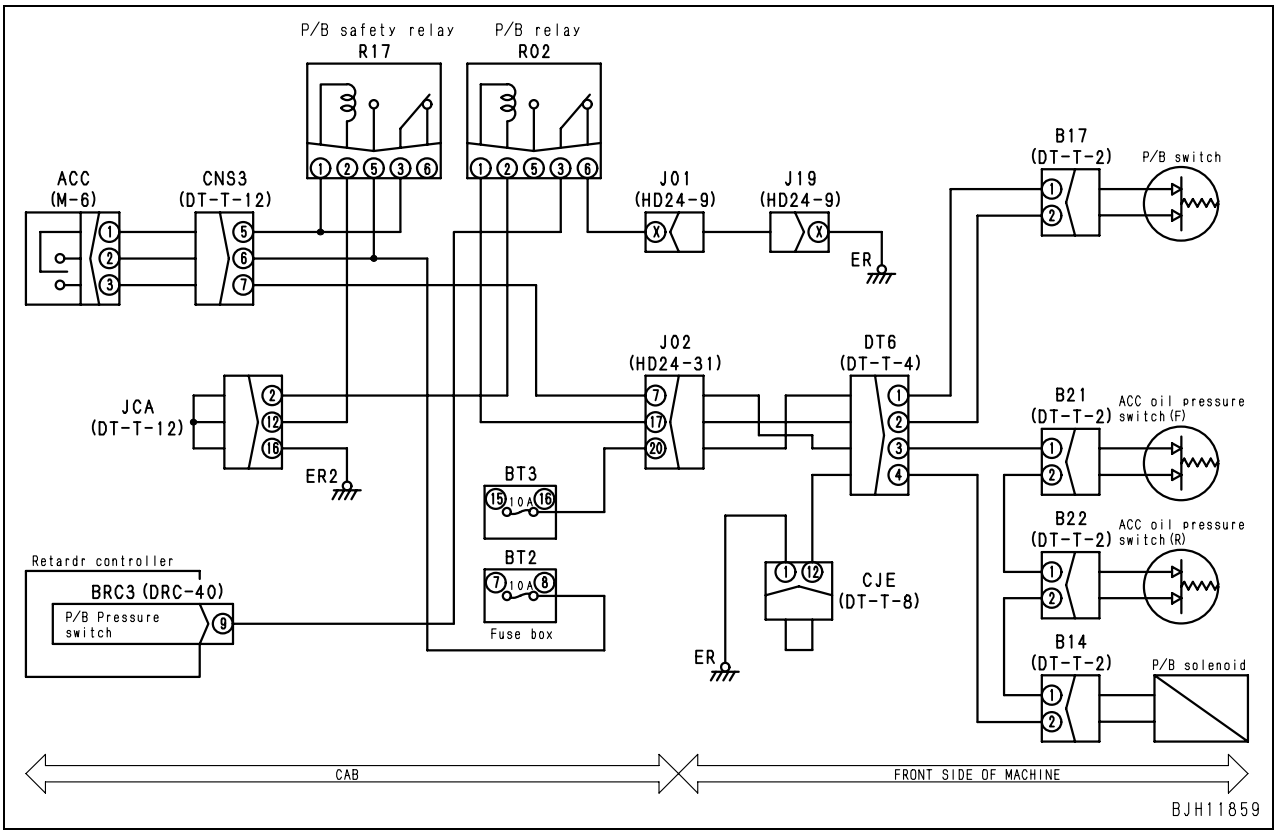


Failure code [2F00KM] (Parking brake: Error in operation or setting)

Action code	Failure code	Trouble	Parking brake: Error in operation or setting (Dragging of parking brake) (Retarder controller system)
E03	**2F00KM**		
Contents of trouble	• When output shaft speed is more than 200 rpm (approx. 5 km/h), parking brake or emergency brake has been activated.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• When oil pressure of accumulator is decreased (ACC switch is turned to OPEN), parking brake cannot be released. • If the machine is operated in as-is condition, the machine may be damaged.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Error in operation of parking brake switch	• Turn parking brake switch to “Release“ position and then travel. • Stop machine completely, turn emergency brake switch to “Release“ position and then travel.			
	2	Defective parking brake relay (R02)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Does the problem resolve by replacing parking brake relay (R02)?	The problem is resolved.	Relay (R02) is normal	
				The problem is not resolved.	Relay (R02) is defective	
			Between R02 (male) (1) – (2)		Resistance	200 – 400 Ω
			★ Prepare with starting switch OFF, disconnect connector R02, and troubleshooting with starting switch ON.			
			Between R02 (male) (3) – (6)	Applying 24V between (1) – (2)	Resistance	Min. 1 MΩ
				Voltage not applied between (1) – (2)	Resistance	Max. 1 Ω
	3	Defective parking brake oil pressure switch	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between B17 (male) (1) – (2)	Turn parking brake switch to “Release“	Resistance	Min. 1 MΩ
				Turn parking brake switch to “Park“	Resistance	Max. 1 Ω
	4	Error in operation of emergency brake (Operate emergency brake while traveling)	• Do not operate emergency brake unless it is necessary.			
	5	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between R02 (female) (2), (6) – machine body		Resistance	Max. 1 Ω
			Wiring harness between fuse BT3 (16) – B17 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between R02 (female) (1) – B17 (female) (2)		Resistance	Max. 1 Ω
	6	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between BRC3 (female) (9) – R02 (female) (3)		Resistance	Min. 1 MΩ
	7	Defective retarder controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between BRC3 (9) and ground	Turn parking brake switch to “Release“	Voltage	Max. 1V
				Turn parking brake switch to “Park“	Voltage	20 – 30 V

Circuit diagram related



Failure code [2G42ZG] (Front accumulator: Oil pressure too low)

Action code	Failure code	Trouble	Front accumulator: Oil pressure too low (Retarder controller system)
E03	**2G42ZG**		
Contents of trouble	• When engine is running (continuously for more than 30 seconds), signal from front accumulator oil pressure sensor became below 6.9 MPa {70 kg/cm²} (Voltage is below 1.56 V)		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• If machine is kept operated in such a condition, front brake may become ineffective.		
Related information	• Input signal of accumulator pressure can be checked in monitoring function (code: **35500 and 35506**).		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Front accumulator (brake) oil pressure too low	• Front accumulator (brake) oil pressure is normal. ★ If oil pressure is not normal, carry out troubleshooting for hydraulic and mechanical systems.
	2	Defective retarder controller	• If front accumulator (brake) oil pressure is normal, the retarder controller is defective.

Failure code [2G43ZG] (Rear accumulator: Oil pressure too low)

Action code	Failure code	Trouble	Rear accumulator: Oil pressure too low (Retarder controller system)
E03	**2G43ZG**		
Contents of trouble	• When engine is running (continuously for more than 30 seconds), signal from rear accumulator oil pressure sensor became below 6.9 MPa {70 kg/cm²} (Voltage is below 1.56 V)		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• If machine is kept operated in such a condition, rear brake may become ineffective.		
Related information	• Input signal of accumulator pressure can be checked in monitoring function (code: **35501 and 35507**).		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Rear accumulator (brake) oil pressure too low	• Rear accumulator (brake) oil pressure is normal. ★ If oil pressure is not normal, carry out troubleshooting for hydraulic and mechanical systems.
	2	Defective retarder controller	• If rear accumulator (brake) oil pressure is normal, there is a defect in retarder controller.

Failure code [989A00] (Engine over run prevention command signal: Operating)

Action code	Failure code	Trouble	Engine over run prevention signal: Operating (Transmission controller system)
E02	**989A00**		
Contents of trouble	• When gear speed is set at the position other than neutral, transmission input shaft speed signal exceeds the input shaft speed which is set for each gear speed to prevent over run.		
Action of controller	• Send out command signal to retarder controller and activate brake.		
Problem that appears on machine	• Brake becomes activated and travel speed lowers.		
Related information	• Input shaft speed can be checked in monitoring function (code: **31200**).		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Engine over run	★ If the machine is traveling with transmission input shaft speed signal at more than 2,600 rpm, engine is over running.
	2	Defective transmission controller	• If the machine is not traveling with transmission input shaft speed signal at more than 2,600 rpm, there is defect in transmission controller.

Failure code [989D00] (Rear section tipping over alarm: Alarm is activated.)

Action code	Failure code	Trouble	Rear section tipping over alarm: Alarm is activated. (Lift operation when machine is inclined) (Machine monitor system)
—	**989D00**		
Contents of trouble	• Body is lifted when machine is inclined.		
Action of controller	• Inclination caution lamp • Turns on centralized warning lamp and sounds alarm buzzer.		
Problem that appears on machine	• If body is lifted in such condition, machine body may tip over.		
Related information	• Input signal from pitch angle sensor can be checked with monitoring function (code: **32900, 32902**).		

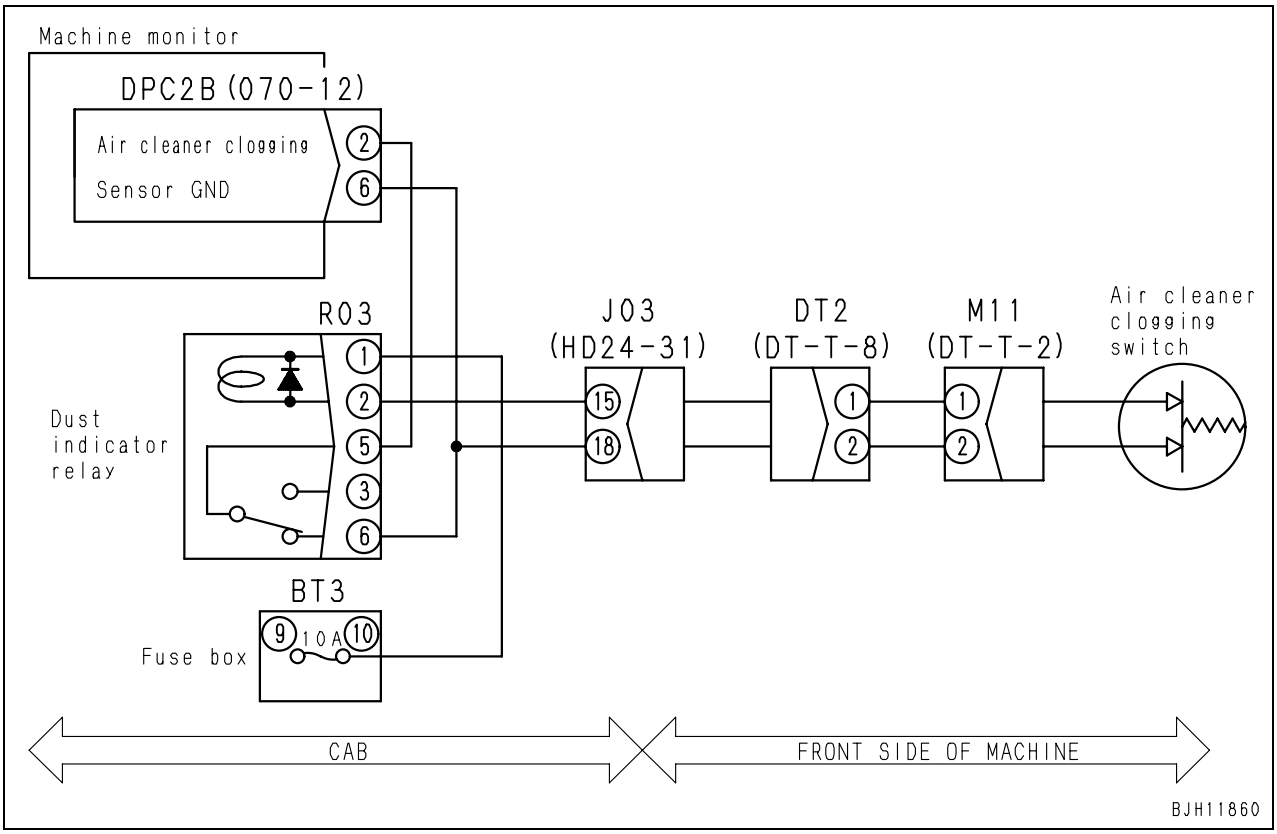
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Error in operation	Do not lift body when machine is inclined for more than 15°.

Failure code [AA10NX] (Air cleaner element: Clogged)

Action code	Failure code	Trouble	Air cleaner element: Clogged (Machine monitor system)
E01	**AA10NX**		
Contents of trouble	• Air cleaner element clogging signal circuit becomes “OPEN“ (disconnected with GND).		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• If machine is operated in such a condition, air intake performance may be deteriorated.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Clogged air cleaner	Dust indicator is not indicated in red.		Air cleaner is normal.	
			Dust indicator is indicated in red.		Clogged air cleaner	
	2	Defective dust indicator relay (R32)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Does the problem resolve by replacing dust indicator relay (R03)?		The problem is not resolved.	Relay (R03) is normal
					The problem is resolved.	Defective relay (R03)
			★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between R03 (male) (1) – (2)		Resistance	200 – 400 Ω
			★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between R03 (male) (5) – (6)	Applying 24V between (1) – (2)	Resistance	Min. 1 MΩ
				Voltage not applied between (1) – (2)	Resistance	Max. 1 Ω
	3	Defective air cleaner clogging sensor	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between M11 (male) (1) – (2)	Air cleaner is normal.	Resistance	Max. 1 Ω
				Clogged air cleaner	Resistance	Min. 1 MΩ
	4	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between DPC2B (female) (6) – R03 (female) (6)		Resistance	Max. 1 Ω
			Wiring harness between DPC2B (female) (2) – R03 (female) (5)		Resistance	Max. 1 Ω
	5	Defective harness grounding	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between R03 (female) (2) – M11 (female) (1)		Resistance	Min. 1 MΩ
	6	Defective machine monitor	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between DPC2B (2) – (6)	Air cleaner is normal.	Voltage	20 – 30 V
				Clogged air cleaner	Voltage	Max. 1V

Circuit diagram related

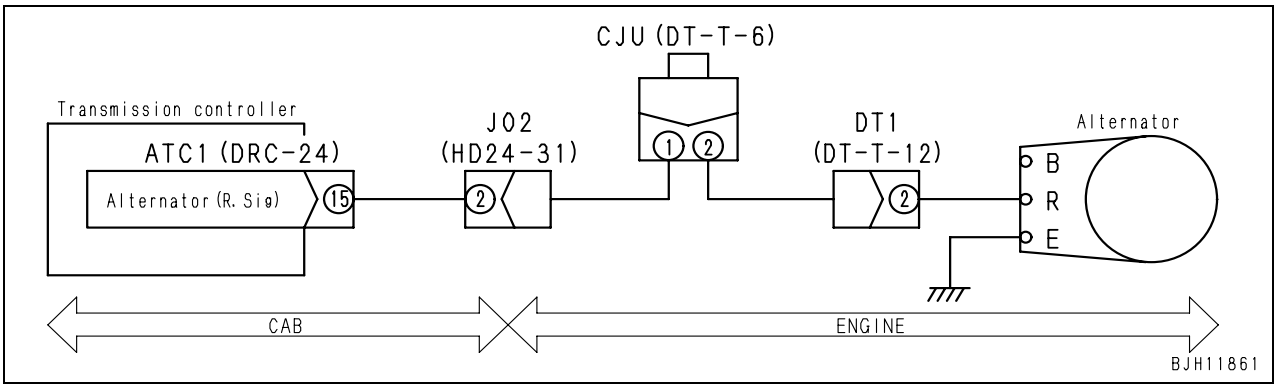


Failure code [AB00MA] (Alternator: Malfunction)

Action code	Failure code	Trouble	Alternator: Malfunction (Failure of battery charge circuit) (Transmission controller system)
E03	**AB00MA**		
Contents of trouble	• Electricity generation signal is not input from alternator while engine is running.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• If machine is operated in such a condition, power supply voltage may drop and machine may not be able to travel.		
Related information	• It can be checked with monitoring function (code: **04301**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective alternator	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between alternator R – E	Voltage	27.6 – 29.5 V
			★ If deteriorated battery is used or in a cold region, voltage may not rise for a while after engine is started.		
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ATC1 (15) – ground	Voltage	20 – 30 V
			★ If deteriorated battery is used or in a cold region, voltage may not rise for a while after engine is started.		
			If no problem is found in above 1 and no voltage is supplied between ATC1 (15) and ground, there is disconnection and defective contact of wiring harness between alternator terminal R and ATC1 (female) (5).		
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ACT1 (15) – ground	Voltage	20 – 30 V
			★ If deteriorated battery is used or in a cold region, voltage may not rise for a while after engine is started.		

Circuit diagram related



Failure code [B@BAZG] Lowering of engine oil pressure

Action code	Failure code	Trouble	Lowering of engine oil pressure (Engine controller system)
–	**B@BAZG**		
Contents of trouble	• While engine was running, engine oil pressure sensor signal circuit detected abnormal lowering of engine oil pressure.		
Action of controller	• Operates with normal control system. • Turns engine oil pressure caution lamp ON and sounds alarm buzzer.		
Problem that appears on machine	• If machine is used as it is, engine may be seized.		
Related information	• Engine oil pressure can be checked with monitoring function. (Monitoring code: ENGINE - ENGINE OIL PRESS - 37200) • Method of reproducing failure code: Start engine.		

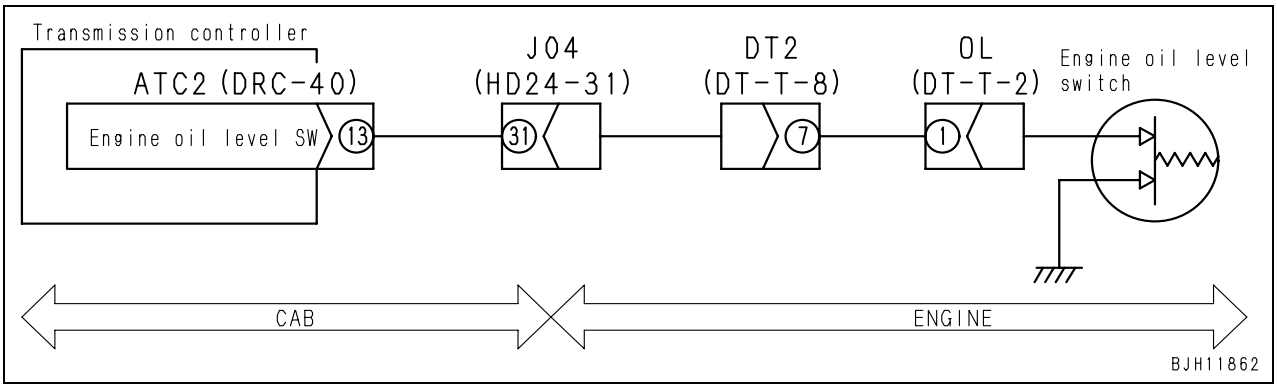
	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Lowering of engine oil pressure (When system is normal)	Engine oil pressure may be low. Check it and remove cause, if necessary.
	2	Defective engine oil pressure sensor system	If cause 1 is not detected, engine oil pressure sensor system may be defective. Carry out troubleshooting for failure codes [**CA135**] and [**CA141**].

Failure code [B@BAZK] (Engine oil : Level too low)

Action code	Failure code	Trouble	Engine oil: Level too low (Transmission controller system)
E01	**B@BAZK**		
Contents of trouble	• Engine oil level switch circuit has become “OPEN“ (disconnected with GND).		
Action of controller	• Turn on the maintenance caution lamp.		
Problem that appears on machine	• If machine is operated in such a condition, engine may be seized.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Engine oil level is too low.	• Engine oil level is normal.			
			★ If engine oil level is too low, check for an oil leakage around engine before refilling.			
	2	Defective engine oil level switch	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between OL (male) (1) and ground	Engine oil level is normal	Resistance	Max. 1 Ω
				Engine oil level is too low.	Resistance	Min. 1 MΩ
	3	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ATC2 (female) (13) – OL (female) (1)		Resistance	Max. 1 Ω
	4	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between ATC2 (13) – ground	Engine oil level is normal	Voltage	Max. 1V
				Engine oil level is too low.	Voltage	20 – 30 V

Circuit diagram related

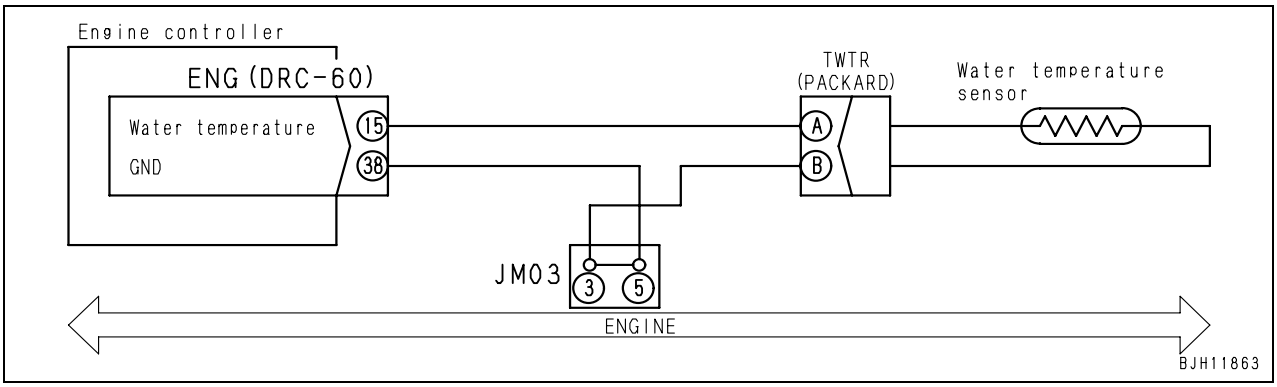


Failure code [B@BCNS] (Engine: Overheat)

Action code	Failure code	Trouble	Engine: Overheat (Engine controller system)
—	**B@BCNS**		
Contents of trouble	• Coolant temperature sensor signal circuit detected a coolant overheat (above 102°C) while engine is running.		
Action of controller	• Indicate the coolant temperature monitor of the machine monitor in red. • When coolant temperature drops below 102°C. it returns to normal.		
Problem that appears on machine	• If the machine is operated in such a condition, engine may be damaged.		
Related information	• Signal of coolant temperature sensor is inputted into the engine controller and that information is transmitted to the machine monitor through communication system. • Coolant temperature can be checked with monitoring function (code: **04104 and 04105**).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Coolant overheat (When system is normal)	★ Investigate the cause and irregular condition of engine, and carry out the repair.			
	2	Defective coolant tem perature sensor (internal short circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			TWTR (male)	Coolant temperature	Resistance	
			Between (A) – (B)	10 – 100°C	90 – 3.5 kΩ	
			Between (A) – ground		Min. 1 MΩ	
	3	Defective harness grounding	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between TWTR (female) (A) – ENG (female) (15)		Resistance	Min. 1 MΩ
	4	Defective engine controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			ENG (male)	Coolant temperature	Resistance	
			Between (15) – ground	10 – 100°C	90 – 3.5 kΩ	

Circuit diagram related

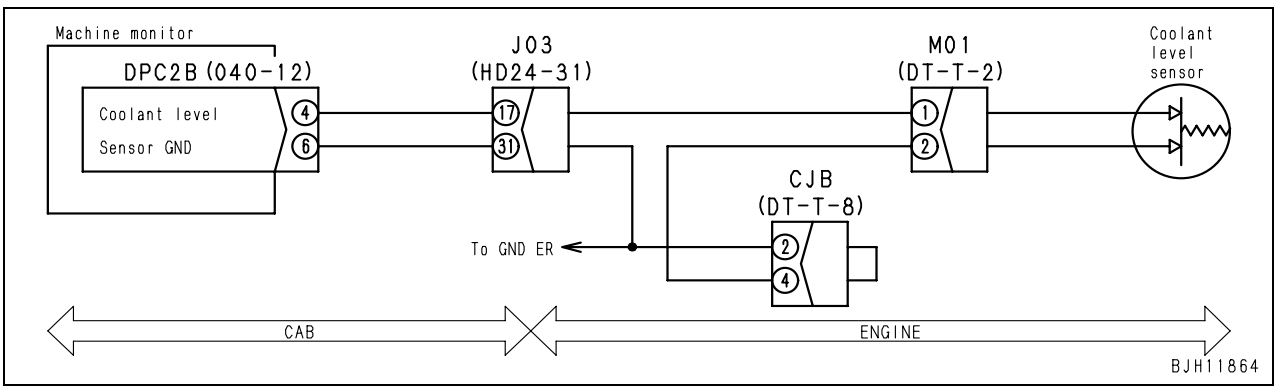


Failure code [B@BCZK] (Radiator coolant: Level too low)

Action code	Failure code	Trouble	Radiator coolant: Level too low (Machine monitor system)
E01	**B@BCZK**		
Contents of trouble	• Radiator level switch circuit has become “OPEN“ (disconnected with GND).		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• If machine is operated in such a condition, engine may overheat.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Radiator coolant level is too low.	• Radiator coolant level is normal.			
			★ If radiator coolant level is too low, check for a coolant leakage around engine and radiator before refilling.			
	2	Defective radiator coolant level switch	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between M01 (male) (1) – (2)	Radiator level is normal	Resistance	Max. 1 Ω
				Radiator level too low	Resistance	Min. 1 MΩ
	3	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between DPC2B (female) (4) – M01 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between DPC2B (female) (6) and ground		Resistance	Max. 1 Ω
	4	Defective machine monitor	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between DPC2B (4) – (6)	Radiator level is normal	Voltage	Max. 1V
				Radiator level too low	Voltage	20 – 30 V

Circuit diagram related

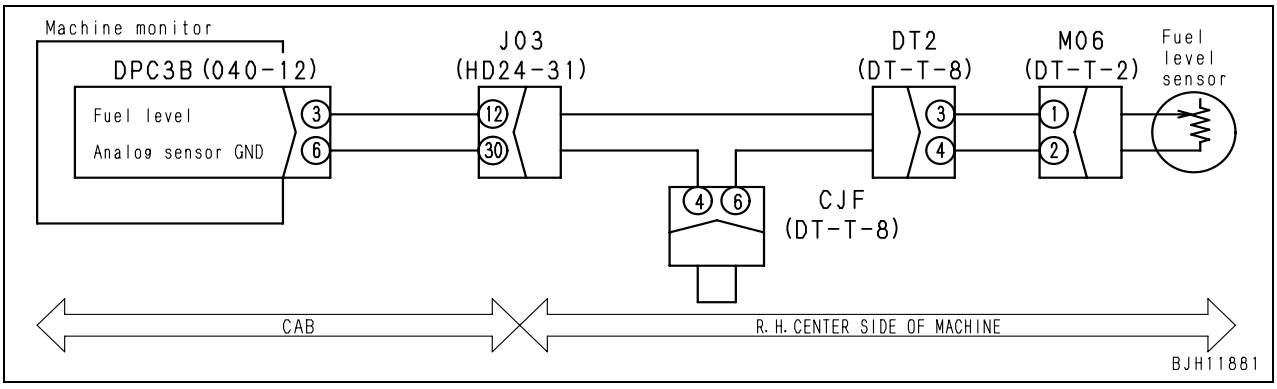


Failure code [B@BFZK] (Fuel level: Level too low)

Action code	Failure code	Trouble	Fuel level: Level too low (Machine monitor system)
—	**B@BFZK**		
Contents of trouble	• Fuel level sensor signal (resistance becomes above 70 Ω) is indicating the level is too low.		
Action of controller	• **Does not detect an excessively low fuel level when DJF1KA** is detected. • Turns on the fuel level caution lamp.		
Problem that appears on machine	• No particular influence		
Related information	• When fuel level is below the low level, fill the fuel. If indication goes off, it means “fuel shortage“. • Signal from fuel level sensor can be checked with monitoring function (code: **04200 and 04201**).		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective fuel level sensor	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between M06 (male) (1) – (2)	Fuel level: at Full	Resistance	Max. 12 Ω
				Fuel level: at Empty	Resistance	74 – 100 Ω
	2	Defective machine monitor	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between DPC3B (female) (3) – 6)	Fuel level: at Full	Resistance	Max. 12 Ω
				Fuel level: at Empty	Resistance	74 – 100 Ω

Circuit diagram related



Failure code [B@C6NS] (Front brake oil: Overheat)

Action code	Failure code	Trouble	Front brake oil: Overheat (Machine monitor system)
E02	**B@C6NS**		
Contents of trouble	• Overheat (120°C) was detected in front brake cooling oil.		
Action of controller	• Turns on brake oil temperature caution lamp. • Turns on centralized warning lamp and sounds alarm buzzer.		
Problem that appears on machine	• If the machine is operated in such a condition, the front brake may be damaged.		
Related information	• Brake oil temperature can be checked with monitoring function (code: **30201**).		

		Cause	Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Front brake oil is overheated. (When the system is operating normally)	Investigate the cause and irregular condition of brake, and carry out the repair.
	2	Defective front brake oil temperature sensor	If no problem is found in cause 1, the front brake oil temperature sensor system can be suspected to be defective. Carry out the troubleshooting of failure code [**DGR4KZ**]. • If brake cooling oil is not overheated, machine monitor is defective.

Failure code [B@C8NS] (Center brake oil: Overheat)

Action code	Failure code	Trouble	Center brake oil: Overheat (Brake cooling oil is overheated) (Transmission controller system)
E02	**B@C8NS**		
Contents of trouble	• Center brake cooling oil is overheated.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• If the machine is operated in such a condition, center brake may be damaged.		
Related information	• This failure code is indicated when the trouble is less likely due to a failure of electrical system. • Center brake oil temperature can be checked with monitoring function (code: **30203 and 30206**).		

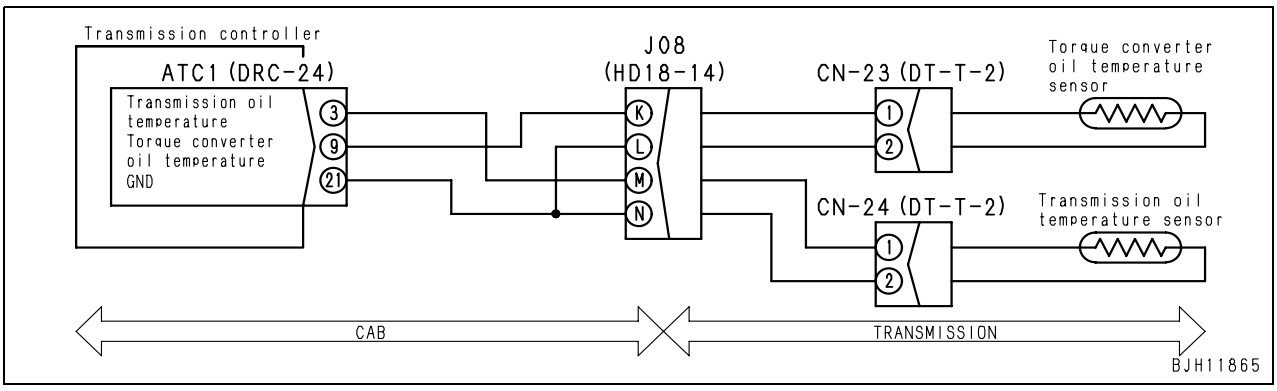
		Cause	Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Center brake oil is overheated.	Since the overheat of the center brake oil can be suspected, if there is an overheat, repair the cause of the failure.
	2	Defective center brake oil temperature sensor	If no problem is found in cause 1, it is suspected that center brake oil temperature sensor system is defective. Carry out troubleshooting of [Failure code **DGR3KZ**].

Failure code [B@CENS] (Torque converter: Overheat)

Action code	Failure code	Trouble	Torque converter: Overheat (Transmission controller system)
E02	**B@CENS**		
Contents of trouble	• Overheat (above 120°C) of torque converter has been detected.		
Action of controller	• Turns on the caution lamp of torque converter oil temperature. • Turns on centralized warning lamp and sounds alarm buzzer.		
Problem that appears on machine	• If machine is operated in such a condition, torque converter may be damaged.		
Related information	• Torque converter oil temperature can be checked with monitoring function (code: **30100**).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Torque converter is overheated (When system is normal)	★ Investigate the cause and irregular condition of torque converter, transmission, and machine, and repair the trouble.			
	2	Defective torque converter oil temperature sensor (Internal short circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			CN23 (male)	Torque converter oil temperature	Resistance	
			Between (1) – (2)	25 – 100°C	50 – 3.5 kΩ	
			Between (1) – ground		Min. 1 MΩ	
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between CN23 (female) (1) – ATC1 (female) (9)		Resistance	Min. 1 MΩ
	4	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			ATC1 (female)	Torque converter oil temperature	Resistance	
			Between (9) – (21)	25 – 100°C	50 – 3.5 kΩ	

Circuit diagram related

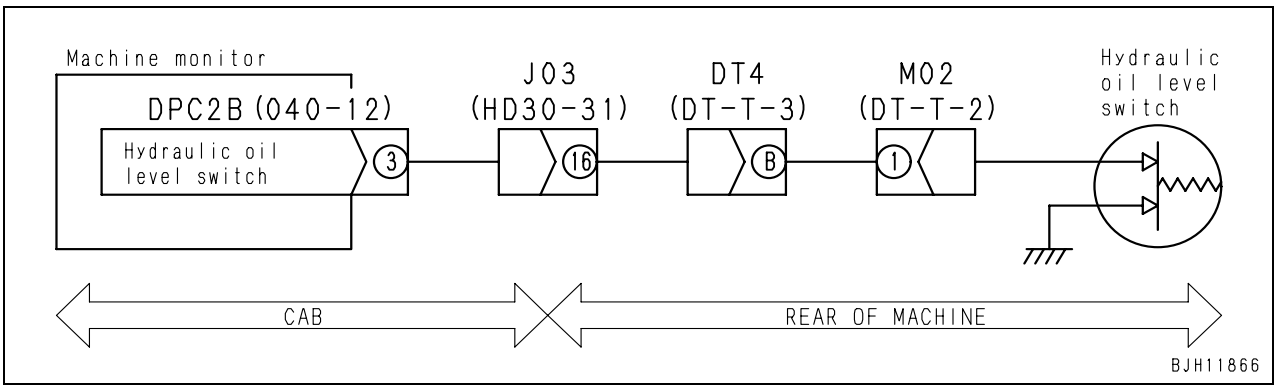


Failure code [B@HAZK] (Hydraulic tank oil: Level too low)

Action code	Failure code	Controller code	Trouble	Hydraulic tank oil: Level too low (Machine monitor system)
E01	**B@HAZK**	**MON**		
Contents of trouble	• The hydraulic oil level switch signal has become “OPEN“ (disconnected with GND).			
Action of machine monitor	• No particular action • Turn on the maintenance caution lamp. • Detect failure when engine is stopped and starting switch terminal C signal is OFF.			
Problem that appears on machine	• If machine is operated in such a condition, hydraulic oil may overheat.			
Related information				

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Hydraulic oil level too low	• Hydraulic oil level is normal.			
			★ If hydraulic oil level is too low, check for an oil leakage around hydraulic pump and hydraulic piping before refilling.			
	2	Defective hydraulic oil level switch	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between M02 (male) (1) and ground	Hydraulic oil level is normal	Resistance	Max. 1 Ω
				Hydraulic oil level too low	Resistance	Min. 1 MΩ
	3	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between DPC2B (female) (3) – M02 (female) (1)		Resistance	Max. 1 Ω
	4	Defective machine monitor	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between DPC2B (female) (3) and ground	Hydraulic oil level is normal	Voltage	Max. 1V
				Hydraulic oil level too low	Voltage	20 – 30 V

Circuit diagram related



Failure code [B@JANS] (Steering oil: Overheat)

Action code	Failure code	Trouble	Steering oil: Overheat (Transmission controller system)
E02	**B@JANS**		
Contents of trouble	• Voltage of steering temperature sensor circuit has become below 1.61 V (oil temperature is above 120°C).		
Action of controller	• No particular action • Turn on steering oil temperature caution lamp. • Turns on centralized warning lamp and sounds alarm buzzer.		
Problem that appears on machine	• If machine is operated in such a condition, it may cause an oil leakage.		
Related information	• Steering oil temperature can be checked with monitoring function (code: **32701 and 32702**).		

	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Steering oil temperature is overheated. (When the system is operating normally)	Since the overheat of the steering oil can be suspected, if there is an overheat, repair the cause of the failure.
	2	Defective steering oil temperature sensor	If no problem is found in cause 1, the steering oil temperature sensor system can be suspected to be defective. Carry out the troubleshooting of [Steering oil temperature does not indicate correctly] in E mode.

HM300-2 Articulated dump truck

Form No. SEN00671-03

ARTICULATED DUMP TRUCK

HM300-2

Machine model	Serial number
HM300-2	2001 and up

40 Troubleshooting

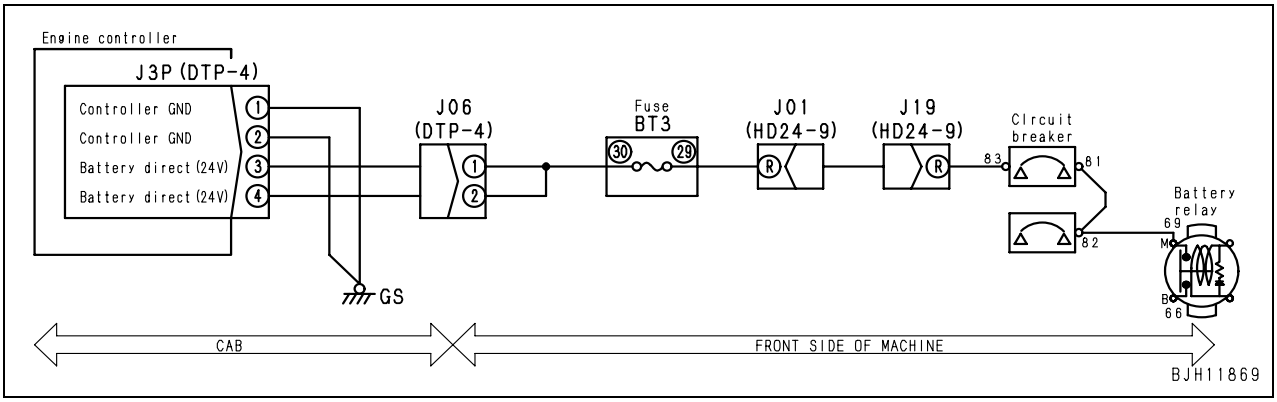
Troubleshooting by failure code, Part 2

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 has occurred in engine controller.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• Though the engine can operate normally, it may stall during the operation and may not start when the engine is stopped.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fuse	Since a fuse or circuit breaker of equipped machine side can be suspected to be defective, directly check them. (If fuse is blown, or circuit breaker is shut off, it is highly possible that a defective grounding, etc. has occurred in the circuit.)		
	2	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between J3P (female) (3), (4) – battery (+)	Resistance	Max. 1 Ω
			Wiring harness between J3P (female) (1), (2) – ground	Resistance	Max. 1 Ω
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between J3P (female) (3), (4) – battery (+)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between J3P (female) (1), (2) – ground	Resistance	Min. 1 MΩ
	4	Defective engine controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			J3P	Voltage	
			Between (3) – (1)	20 – 30 V	

Circuit diagram related



Failure code [CA115] (Abnormal engine Ne and Bkup sensors)

Action code	Failure code	Trouble	Abnormal engine Ne and Bkup speed sensors (Engine controller system)
E03	**CA115**		
Contents of trouble	• Abnormality has occurred at the same time in Ne speed sensor circuit and Bkup speed sensor circuit.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• Engine does not start (during engine stop). • Engine stops (during engine running).		
Related information			

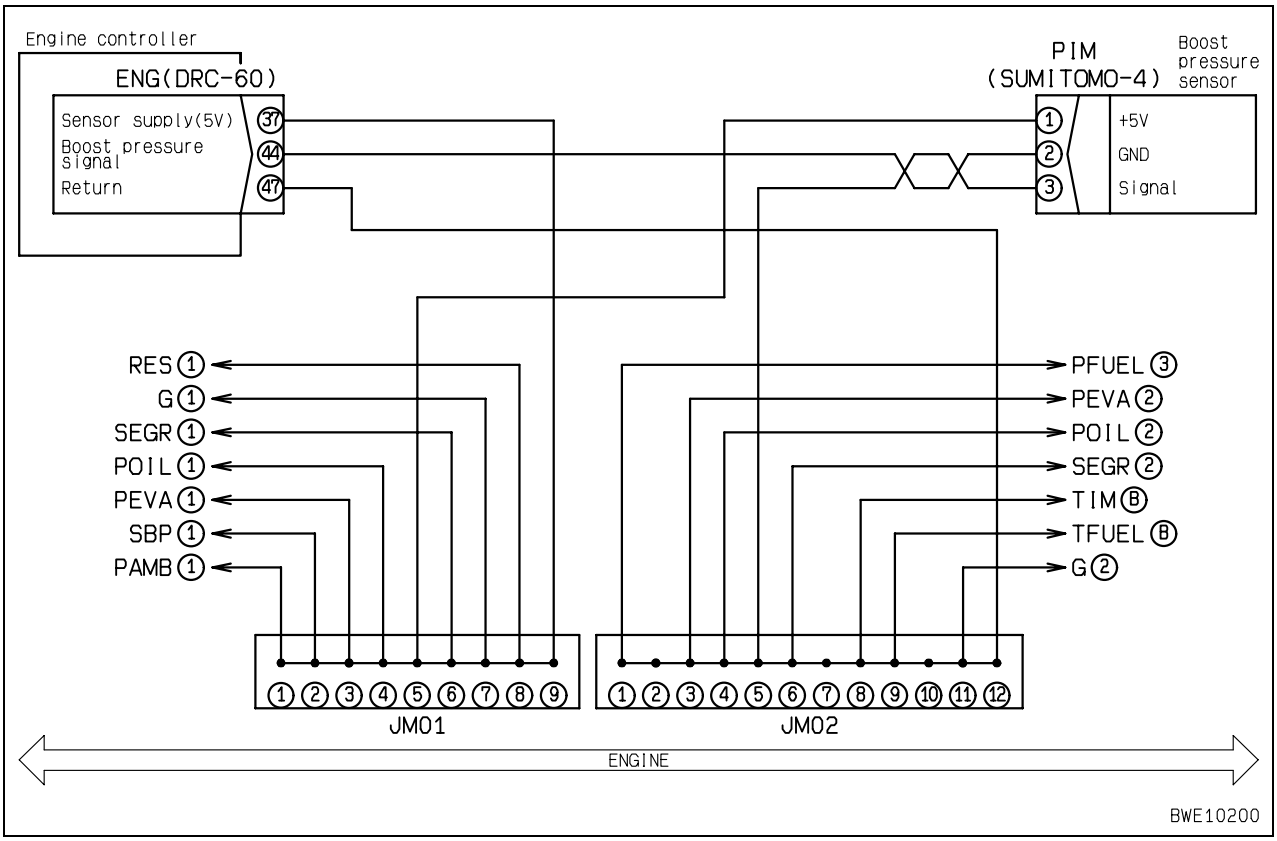
		Cause	Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Defective Ne speed sensor circuit	Carry out troubleshooting of the failure code [**CA689**].
	2	Defective Bkup speed sensor circuit	Carry out troubleshooting of failure code [**CA778**].
	3	Defective Ne speed sensor mounting section	Since a mounting section of Ne speed sensor can be suspected to be defective, directly check the mounting section. (Defective installation of sensor itself, internal defect of flywheel, etc.)
	4	Bkup speed sensor mounting section	Since a mounting section of Bkup speed sensor can be suspected to be defective, directly check the mounting section. (Defective installation of sensor itself, internal defect of supply pump, etc.)
	5	Defective connection of sensor (wrong connection)	The defective (wrong) connections of Ne speed sensor and Bkup speed sensor can be suspected. Directly check them.
	6	Defective engine controller	Engine controller can be suspected to be defective if no problem is found in causes 1 – 5 (since this is an internal defect, it cannot be diagnosed).

Failure code [CA122] (Charge pressure sensor too high)

Action code	Failure code	Trouble	Charge pressure sensor too high (Engine controller system)
E03	**CA122**		
Contents of trouble	• Excessively high voltage has occurred in charge pressure sensor circuit.		
Action of controller	• Operate with a fixed charge pressure (400 kPa {4.1 kg/cm²}).		
Problem that appears on machine	• Acceleration performance of engine deteriorates.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective sensor power source circuit	If failure code [**CA187**] or [**CA227**] is displayed, carry out troubleshooting for it first.			
	2	Defective charge pressure sensor (internal defect)	Prepare with starting switch OFF and troubleshooting with starting switch ON or with engine started.			
			PIM		Voltage	
			Between (1) – (3)	Power source	4.75 – 5.25 V	
			Since voltage of sensor is measured with the harness connected, troubleshooting the harness and the controller if the voltage is abnormal, and then make judgment after it is determined that there is no other cause of the abnormality.			
	3	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ENG (female) (37) – PIM (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (44) – PIM (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (47) – PIM (female) (3)		Resistance	Max. 1 Ω
	4	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ENG (female) (37) – PIM (female) (1)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between ENG (female) (44) – PIM (female) (2)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between ENG (female) (47) – PIM (female) (3)		Resistance	Min. 1 MΩ
	5	Harness short (Harness internal short)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between wiring harness from ENG (female) (37) – PIM (female) (1) and wiring harness from ENG (female) (44) – PIM (female) (2)		Resistance	Min. 1 MΩ
			Between wiring harness from ENG (female) (37) – PIM (female) (1) and wiring harness from ENG (female) (44) – PIM (female) (3)		Resistance	Min. 1 MΩ
			Between wiring harness from ENG (female) (44) – PIM (female) (2) and wiring harness from ENG (female) (44) – PIM (female) (3)		Resistance	Min. 1 MΩ
	6	Defective engine controller	★ Prepare with starting switch OFF, and troubleshooting with starting switch ON or with engine started.			
			ENG		Voltage	
			Between (37) – (47)	Power source	4.75 – 5.25 V	

Circuit diagram related



Failure code [CA123] (Charge pressure sensor too low)

Action code	Failure code	Trouble	Charge pressure sensor too low (Engine controller system)
E03	**CA123**		
Contents of trouble	• Excessively low voltage has occurred in charge pressure sensor circuit.		
Action of controller	• Operate with a fixed charge pressure (400 kPa {4.1 kg/cm²}).		
Problem that appears on machine	• Acceleration performance of engine deteriorates.		
Related information			

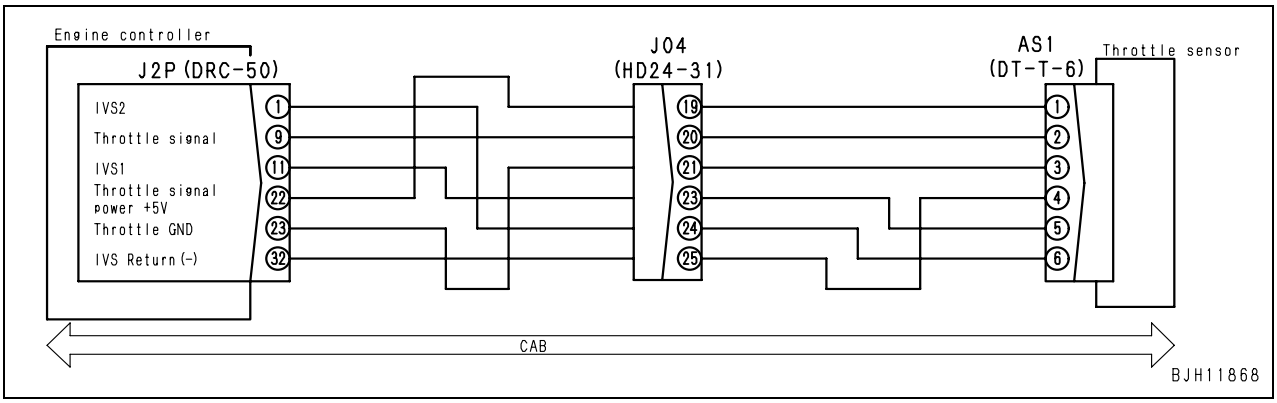
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of failure code [**CA122**].	

Failure code [CA131] (Throttle sensor tool high)

Action code	Failure code	Trouble	Throttle sensor tool high (Engine controller system)
E03	**CA131**		
Contents of trouble	• Signal voltage of throttle sensor has become above 4.5 V.		
Action of controller	• Sets the throttle to low idle position when pedal is released and sets to a medium speed position when pedal is depressed according to idle validation switch. • Turns on a warning lamp and sounds an alarm buzzer.		
Problem that appears on machine	• Even if the accelerator pedal is depressed, the engine speed does not increase above medium speed.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective sensor power source circuit	If failure code [**CA2185**] or [**CA2186**] is displayed, carry out troubleshooting for it first.			
	2	Defective accelerator pedal (internal defect)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			AS1	Accelerator pedal	Voltage	
			Between (1) – (3)	At any position (power source)	4.75 – 5.25 V	
			Between (2) – (3)	When released	(13 ± 2 % of power source)	
				When depressed	(77 ± 2 % of power source)	
			Since voltage of sensor is measured with the harness connected, troubleshooting the harness and the controller if the voltage is abnormal, and then make judgment after it is determined that there is no other cause of the abnormality.			
	3	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between J2P (female) (22) – AS1 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between J2P (female) (9) – AS1 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between J2P (female) (23) – AS1 (female) (3)		Resistance	Max. 1 Ω
	4	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between J2P (female) (22) – AS1 (female) (1)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between J2P (female) (9) – AS1 (female) (2)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between J2P (female) (23) – AS1 (female) (3)		Resistance	Min. 1 MΩ
	5	Defective engine controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			J2P	Accelerator pedal	Voltage	
			Between (22) – (23)	At any position (power source)	4.75 – 5.25 V	
			Between (9) – (23)	When released	(13 ± 2 % of power source)	
				When depressed	(77 ± 2 % of power source)	

Circuit diagram related



Failure code [CA132] (Throttle sensor tool low)

Action code	Failure code	Trouble	Throttle sensor too low (Engine controller system)
E03	**CA132**		
Contents of trouble	• Excessively low voltage has occurred in throttle sensor circuit.		
Action of controller	• Establishes the throttle opening and controls using signals other than throttle sensor signal.		
Problem that appears on machine			
Related information			

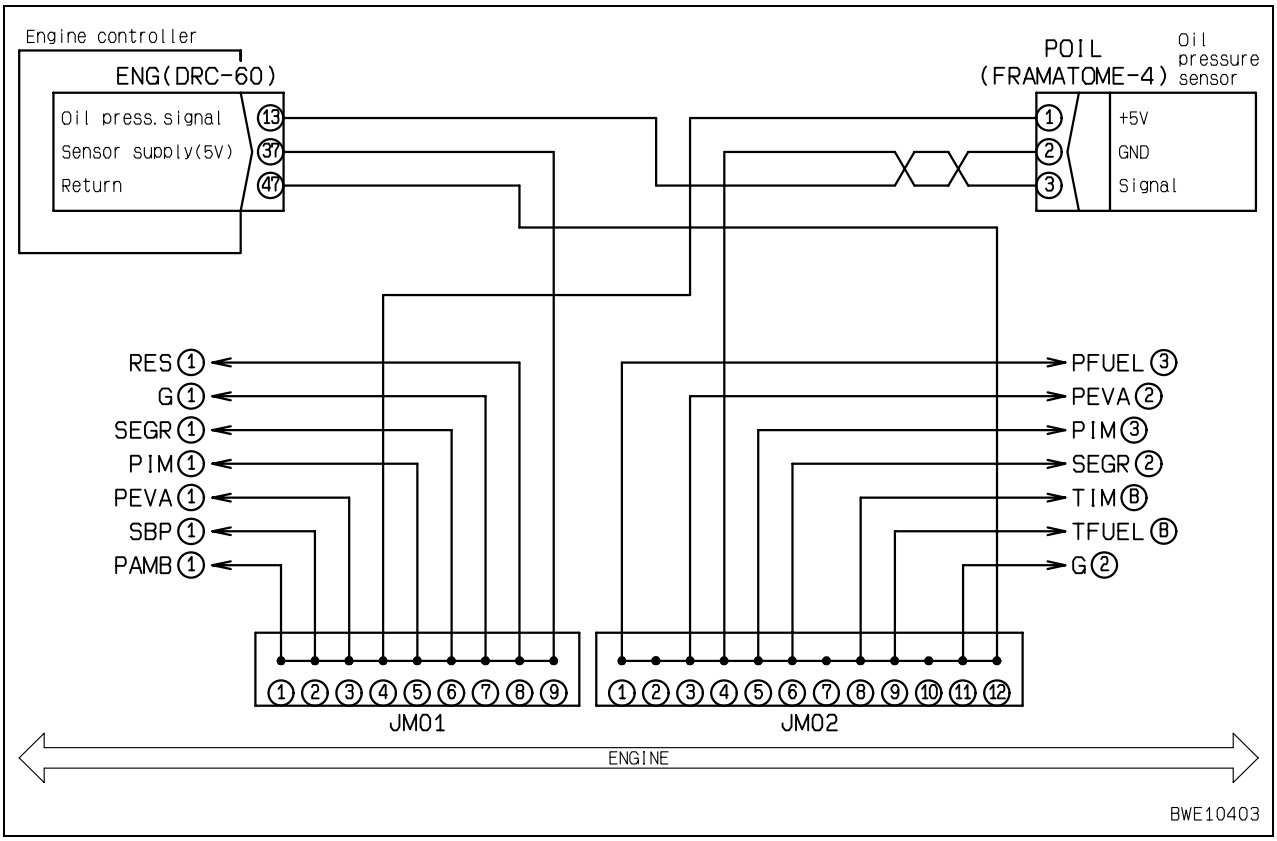
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of failure code [**CA131**].	

Failure code [CA135] (Oil pressure sensor too high)

Action code	Failure code	Trouble	Oil pressure sensor too high (Engine controller system)
E01	**CA135**		
Contents of trouble	• Excessively high voltage has occurred in oil pressure sensor circuit.		
Action of controller	• Operates with oil pressure at default value (250 kPa {2.5 kg/cm²})		
Problem that appears on machine			
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective sensor power source circuit	If failure code [**CA187**] or [**CA227**] is displayed, carry out troubleshooting for it first.			
	2	Defective oil pressure sensor (internal defect)	Prepare with starting switch OFF and troubleshooting with starting switch ON or with engine started.			
			POIL		Voltage	
			Between (1) – (2)	Power source	4.75 – 5.25 V	
			Since voltage of sensor is measured with the harness connected, troubleshooting the harness and the controller if the voltage is abnormal, and then make judgment after it is determined that there is no other cause of the abnormality.			
	3	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ENG (female) (37) – POIL (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (47) – POIL (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (13) – POIL (female) (3)		Resistance	Max. 1 Ω
	4	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ENG (female) (37) – POIL (female) (1)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between ENG (female) (47) – POIL (female) (2)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between ENG (female) (13) – POIL (female) (3)		Resistance	Min. 1 MΩ
	5	Harness short (Harness internal short)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between wiring harness from ENG (female) (37) – POIL (female) (1) and wiring harness from ENG (female) (47) – POIL (female) (2)		Resistance	Min. 1 MΩ
			Between wiring harness from ENG (female) (37) – POIL (female) (1) and wiring harness from ENG (female) (13) – POIL (female) (3)		Resistance	Min. 1 MΩ
			Between wiring harness from ENG (female) (47) – POIL (female) (2) and wiring harness from ENG (female) (13) – POIL (female) (3)		Resistance	Min. 1 MΩ
	6	Defective engine controller	★ Prepare with starting switch OFF, and troubleshooting with starting switch ON or with engine started.			
			ENG		Voltage	
			Between (37) – (47)	Power source	4.75 – 5.25 V	

Circuit diagram related



Failure code [CA141] (Oil pressure sensor too low)

Action code	Failure code	Trouble	Oil pressure sensor too low (Engine controller system)
E01	**CA141**		
Contents of trouble	• Excessively low voltage has occurred in oil pressure sensor circuit.		
Action of controller	• Operates with oil pressure at default value (250 kPa {2.5 kg/cm²})		
Problem that appears on machine			
Related information			

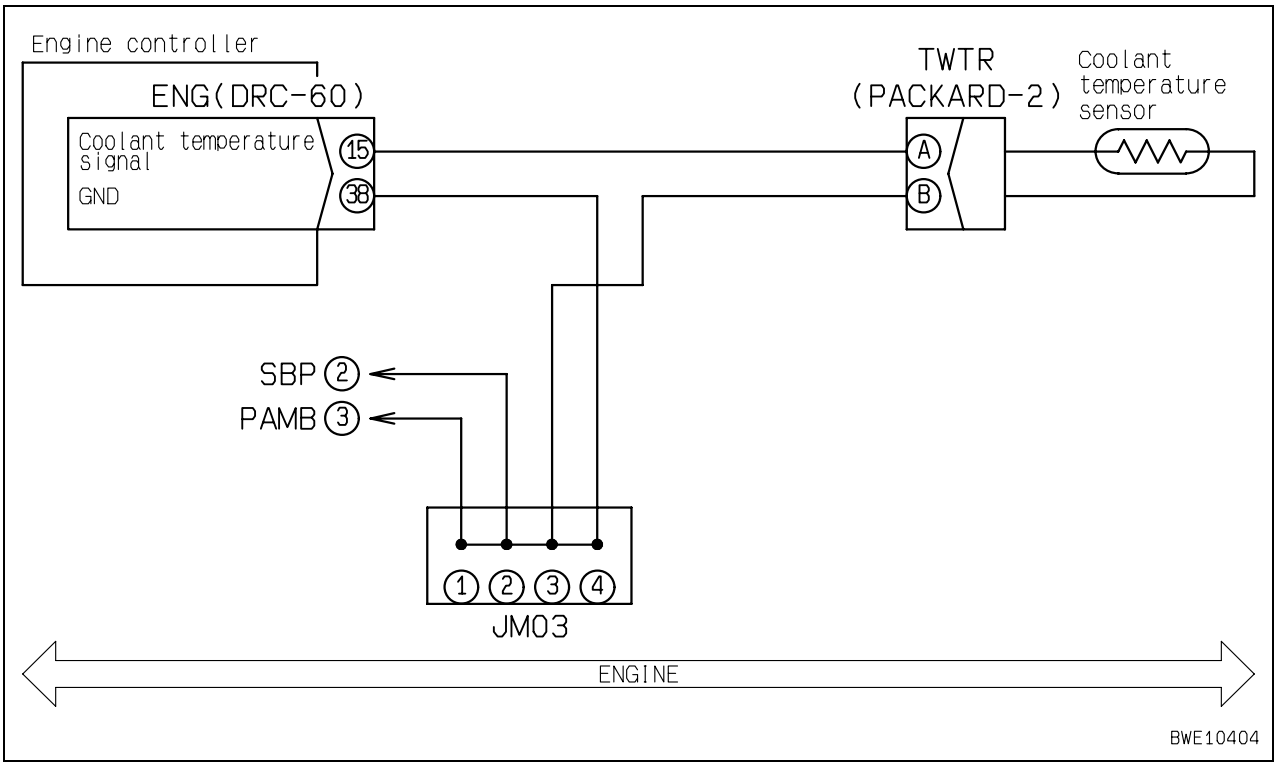
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of failure code [**CA135**].	

Failure code [CA144] (Coolant temperature sensor too high)

Action code	Failure code	Trouble	Coolant temperature sensor too high (Engine controller system)
E01	**CA144**		
Contents of trouble	• Excessively high voltage has occurred in coolant temperature sensor circuit.		
Action of controller	• Operates with a fixed coolant temperature (90°C).		
Problem that appears on machine			
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective coolant temperature sensor (internal defect)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			TWTR (male)	Coolant temperature	Resistance	
			Between (A) – (B)	10 – 100°C	0.6 – 20 kΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ENG (female) (15) – TWTR (female) (A)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (38) – TWTR (female) (B)		Resistance	Max. 1 Ω
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ENG (female) (15) – TWTR (female) (A)		Resistance	Min. 1 MΩ
	4	Defective engine controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			ENG (female)	Coolant temperature	Resistance	
			Between (15) – (38)	10 – 100°C	0.6 – 20 kΩ	

Circuit diagram related



Failure code [CA145] (Coolant temperature sensor too low)

Action code	Failure code	Trouble	Coolant temperature sensor too low (Engine controller system)
E01	**CA145**		
Contents of trouble	• Excessively low voltage has occurred in coolant temperature sensor circuit.		
Action of controller	• Operates with a fixed coolant temperature (90°C).		
Problem that appears on machine			
Related information			

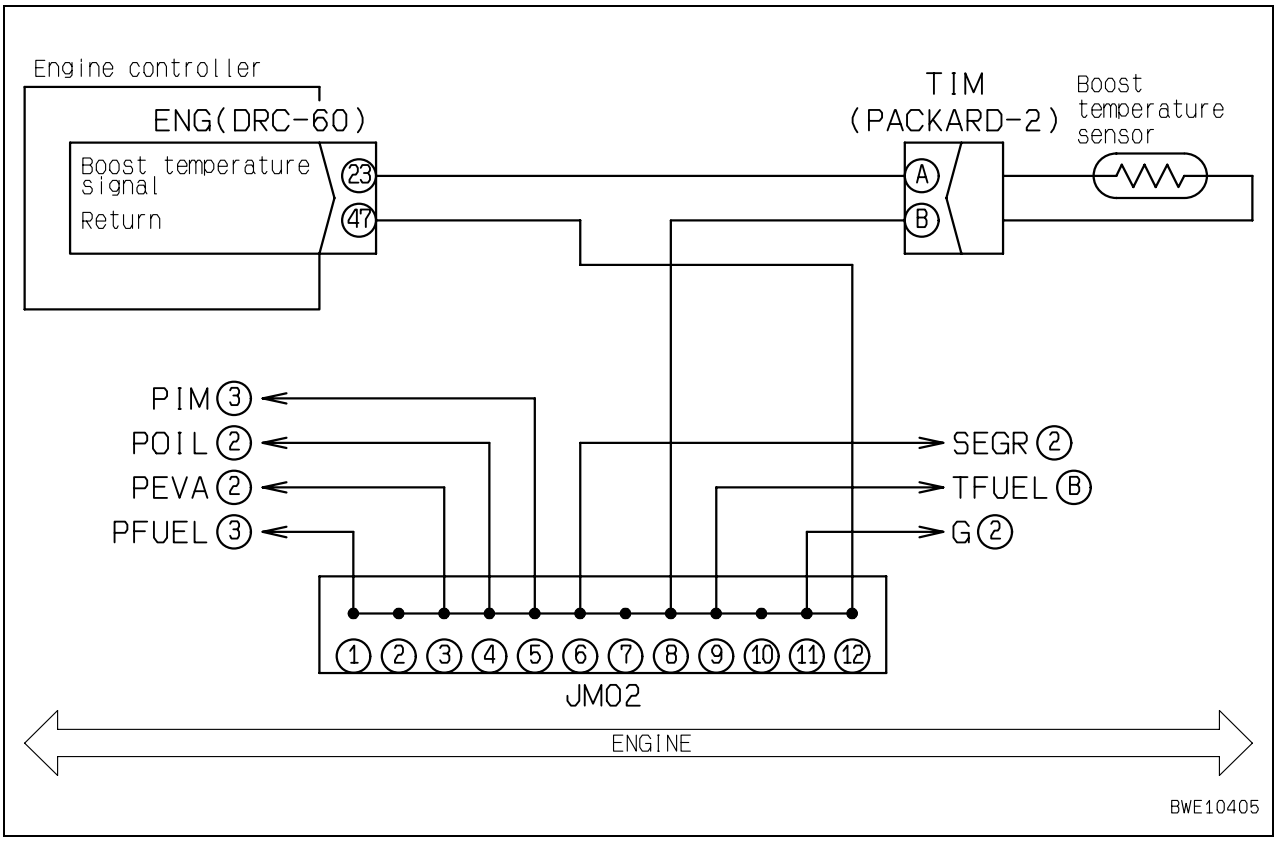
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of failure code [**CA144**].	

Failure code [CA153] (Charge temperature sensor too high)

Action code	Failure code	Trouble	Charge temperature sensor too high (Engine controller system)
E01	**CA153**		
Contents of trouble	• Excessively high voltage has occurred in charge temperature sensor circuit.		
Action of controller	• Operates with a fixed charge temperature (intake air temperature) (70°C).		
Problem that appears on machine			
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective charge temperature sensor (internal defect)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			TIM (male)	Intake air temperature	Resistance	
			Between (A) – (B)	10 – 100°C	0.5 – 20 kΩ	
			Between (A) – ground	Any condition	Min. 1 MΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ENG (female) (23) – TIM (female) (A)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (47) – TIM (female) (B)		Resistance	Max. 1 Ω
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ENG (female) (23) – TIM (female) (A)		Resistance	Min. 1 MΩ
	4	Defective engine controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			ENG (female)	Intake air temperature	Resistance	
			Between (23) – (47)	10 – 100°C	0.5 – 20 kΩ	

Circuit diagram related



Failure code [CA154] (Charge temperature sensor too low)

Action code	Failure code	Trouble	Charge temperature sensor too low (Engine controller system)
E01	**CA154**		
Contents of trouble	• Excessively low voltage has occurred in charge temperature sensor circuit.		
Action of controller	• Operates with a fixed charge temperature (intake air temperature) (70°C).		
Problem that appears on machine			
Related information			

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of failure code [**CA153**].	

Failure code [CA187] (Sensor power source 2 too low)

Action code	Failure code	Trouble	Sensor power source 2 too low (Engine controller system)
E01	**CA187**		
Contents of trouble	• Excessively low voltage has occurred in sensor power source 2 (5 V) circuit.		
Action of controller	• Operates using Ne speed sensor signal instead of Bkup speed sensor signal. • Operate oil pressure sensor with oil pressure at default value (250 kPa {25 kg/cm²}) • Operates with atmospheric pressure sensor value defaulted to (52.44 kPa {0.5 kg/cm²}) • Operates with charge pressure sensor at fixed value (400 kPa {4.1 kg/cm²}). • Operates with EGR inlet pressure sensor value defaulted to (102 kPa {1.0 kg/cm²}) and runs by limiting output. • Restricts the EGR valve lift sensor output and closes EGR valve and bypass valve. • Restricts the bypass valve lift sensor output and closes EGR valve and bypass valve.		
Problem that appears on machine	• Output decreases.		
Related information			

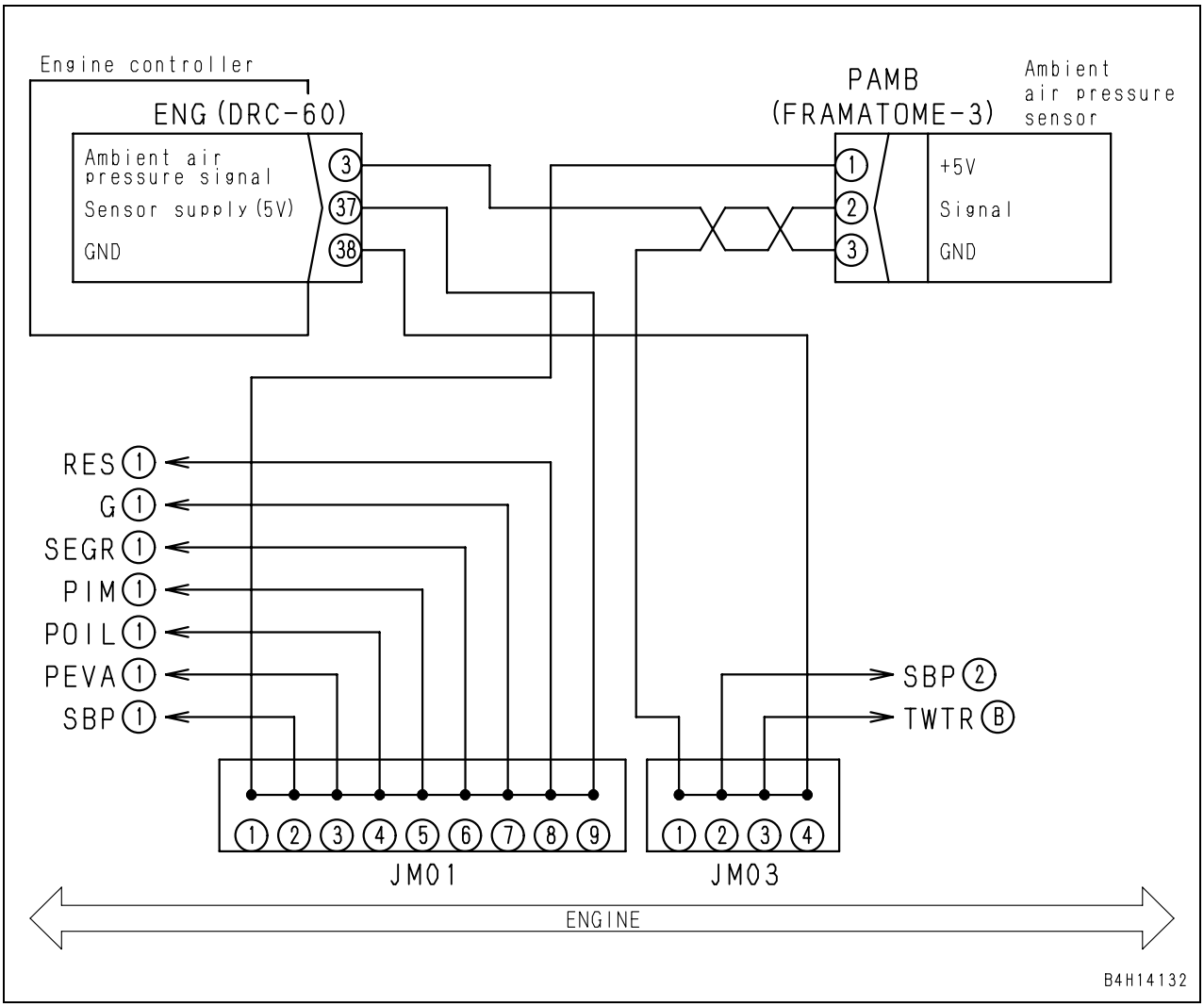
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of failure code [**CA227**].	

Failure code [CA221] (Atmospheric sensor too high)

Action code	Failure code	Trouble	Atmospheric pressure sensor too high (Engine controller system)
E01	**CA221**		
Contents of trouble	• Excessively high voltage has occurred in atmospheric pressure sensor circuit.		
Action of controller	• Operates with atmospheric pressure value defaulted to (52.44 kPa {0.51 kg/cm²}).		
Problem that appears on machine	• Output decreases.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective sensor power source circuit	If failure code [**CA187**] or [**CA227**] is displayed, carry out troubleshooting for it first.			
	2	Defective atmospheric pressure sensor (internal defect)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			PAMB		Voltage	
			Between (1) – (3)	Power source	4.75 – 5.25 V	
			Between (2) – (3)	Signal	0.3 – 4.7 V	
			Since voltage of sensor is measured with the harness connected, troubleshooting the harness and the controller if the voltage is abnormal, and then make judgment after it is determined that there is no other cause of the abnormality.			
	3	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ENG (female) (37) – PAMB (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (3) – PAMB (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (38) – PAMB (female) (3)		Resistance	Max. 1 Ω
	4	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ENG (female) (37) – PAMB (female) (1)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between ENG (female) (3) – PAMB (female) (2)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between ENG (female) (38) – PAMB (female) (3)		Resistance	Min. 1 MΩ
	5	Harness short (Harness internal short)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between wiring harness from ENG (female) (37) – PAMB (female) (1) and wiring harness from ENG (female) (3) – PAMB (female) (2)		Resistance	Min. 1 MΩ
			Between wiring harness from ENG (female) (37) – PAMB (female) (1) and wiring harness from ENG (female) (38) – PAMB (female) (3)		Resistance	Min. 1 MΩ
			Between wiring harness from ENG (female) (3) – PAMB (female) (2) and wiring harness from ENG (female) (38) – PAMB (female) (3)		Resistance	Min. 1 MΩ
	6	Defective engine controller	★ Prepare with starting switch OFF, and troubleshooting with starting switch ON or with engine started.			
			ENG		Voltage	
			Between (37) – (38)		4.75 – 5.25 V	
			Between (3) – (38)		0.3 – 4.7 V	

Circuit diagram related



Failure code [CA222] (Atmospheric sensor too low)

Action code	Failure code	Trouble	Atmospheric pressure sensor too low (Engine controller system)
E01	**CA222**		
Contents of trouble	• Excessively low voltage has occurred in atmospheric pressure sensor circuit.		
Action of controller	• Operates with atmospheric pressure value defaulted to (52.44 kPa {0.51 kg/cm²}).		
Problem that appears on machine	• Output decreases.		
Related information			

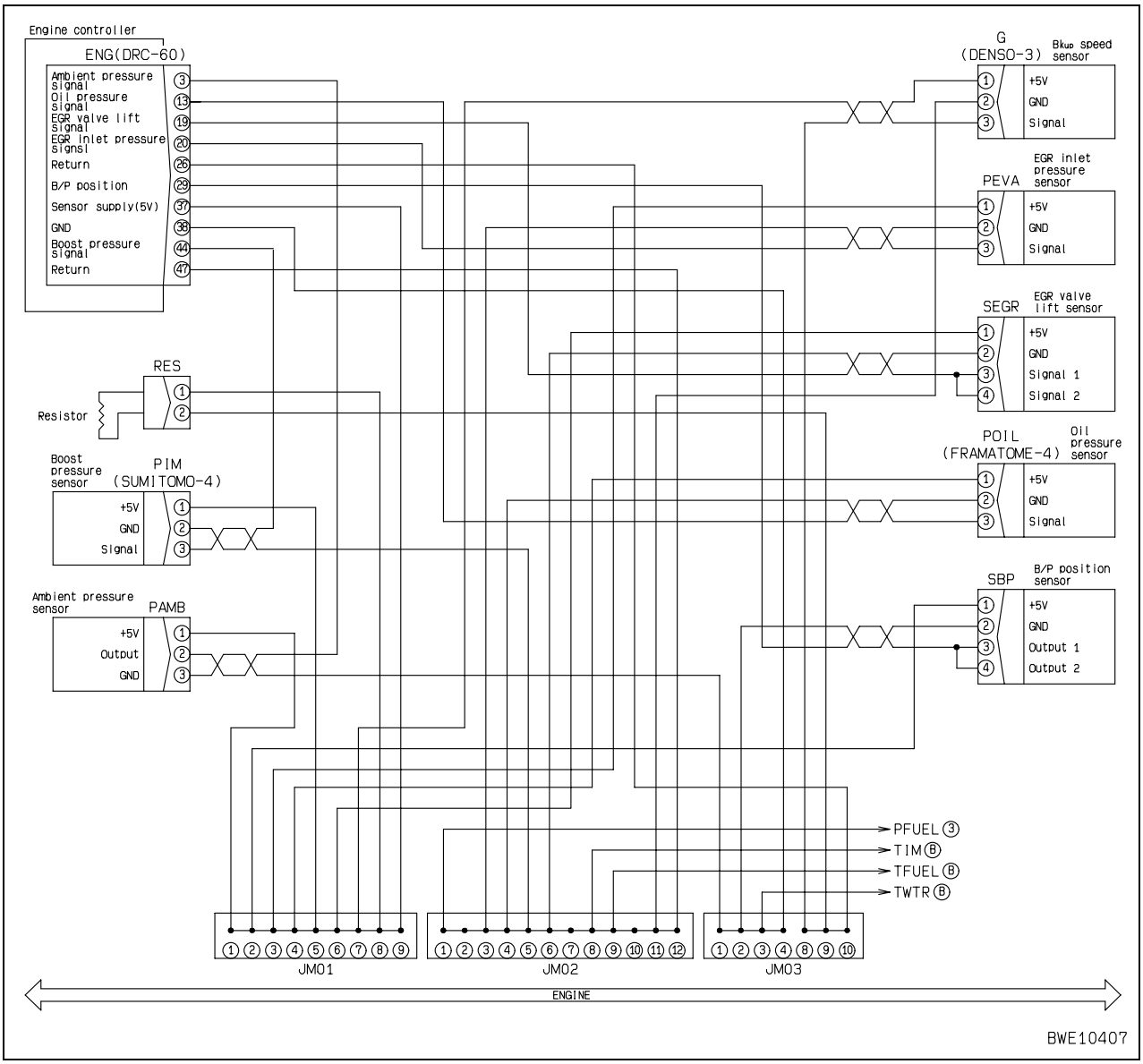
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of failure code [**CA221**].	

Failure code [CA227] (Sensor power source 2 too high)

Action code	Failure code	Trouble	Sensor power source 2 too high (Engine controller system)
E03	**CA227**		
Contents of trouble	• Excessively high voltage has occurred in sensor power source 2 (5 V) circuit.		
Action of controller	• Operates using Ne speed sensor signal instead of Bkup speed sensor signal. • Operate oil pressure sensor with oil pressure at default value (250 kPa {2.5 kg/cm²}) • Operates with atmospheric pressure sensor value defaulted to (52.44 kPa {0.51 kg/cm²}) • Operates with charge pressure sensor at fixed value (400 kPa {4.1 kg/cm²}). • Operates with EGR inlet pressure sensor value defaulted to (102 kPa {1.0 kg/cm²}) and runs by limiting output. • Restricts the EGR valve lift sensor output and closes EGR valve and bypass valve. • Restricts the bypass valve lift sensor output and closes EGR valve and bypass valve.		
Problem that appears on machine	• Output decreases.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective related circuits	Check the codes that are displayed at the same time. If any other codes are displayed, carry out troubleshooting for those codes.			
	2	Defective sensor (internal defect)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Disconnect the devices on the right one at a time. If the code disappears, that device is internally defective.	Bkup speed sensor	G connector	
				Oil pressure sensor	POIL connector	
				Atmospheric pressure sensor	PAMB connector	
				Charge pressure sensor	PIM connector	
				EGR inlet pressure sensor	PEVA connector	
				EGR valve lift sensor	SEGR connector	
				Bypass valve lift sensor	SBP connector	
	3	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ENG (female) (37) – each sensor (female)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (47) – each sensor (female)		Resistance	Max. 1 Ω
	4	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ENG (female) (37) – each sensor (female)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between ENG (female) (47) – each sensor (female)		Resistance	Min. 1 MΩ
	5	Harness short (Harness internal short)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between wiring harness from ENG (female) (37) – each sensor (female) and wiring harness from ENG (female) (47) – each sensor (female)		Resistance	Min. 1 MΩ
	6	Defective engine controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			ENG	Voltage		
			Between (37) – (47)	4.75 – 5.25 V		

Circuit diagram related



Failure code [CA234] (Engine over speed)

Action code	Failure code	Trouble	Engine overspeed (Engine controller system)
E02	**CA234**		
Contents of trouble	• Engine speed has exceeded the normal operating range.		
Action of controller	• Limits fuel injection rate until the speed drops within operating range.		
Problem that appears on machine	• Engine speed fluctuates.		
Related information			

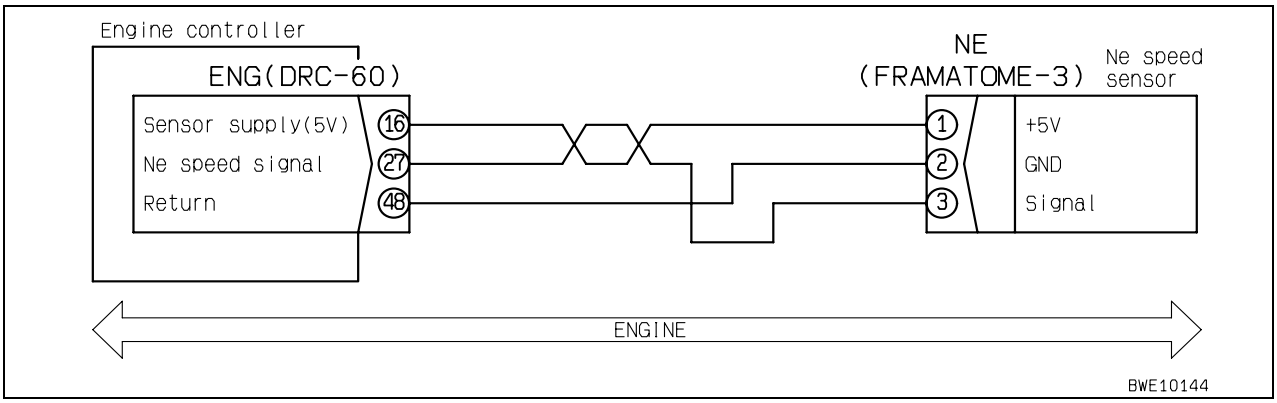
	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Defective related circuits	Check the failure codes that are displayed at the same time. If any other codes are displayed, carry out troubleshooting for those codes.
	2	Improper usage	The improper usage of equipped machine can be suspected. Instruct the proper usage.
	3	Defective engine controller	Engine controller can be suspected to be defective if no problem is found in causes 1 – 2 (since this is an internal defect, it cannot be diagnosed).

Failure code [CA238] (Abnormal power source for Ne speed sensor)

Action code	Failure code	Trouble	Abnormal power source for Ne speed sensor (Engine controller system)
E03	**CA238**		
Contents of trouble	• An abnormality has occurred in Ne speed sensor power supply (5 V) circuit.		
Action of controller	• Controls using Bkup speed sensor signal.		
Problem that appears on machine	• Engine stops during operation (when Bkup speed sensor is defective at the same time). • Engine cannot be started while stopping (when Bkup speed sensor is defective at the same time).		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective Ne speed sensor (internal defect)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Disconnect a device shown on the right. If the failure code disappears, that device is internally defective.	Ne speed sensor	NE connector	
	2	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ENG (female) (16) – NE (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (48) – NE (female) (2)		Resistance	Max. 1 Ω
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ENG (female) (16) – NE (female) (1)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between ENG (female) (48) – NE (female) (2)		Resistance	Min. 1 MΩ
	4	Harness short (Harness internal short)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between wiring harness from ENG (female) (16) – NE (female) (1) and wiring harness from ENG (female) (48) – NE (female) (2)		Resistance	Min. 1 MΩ
	5	Defective engine controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			ENG	Voltage		
			Between (16) – (48)	4.75 – 5.25 V		

Circuit diagram related

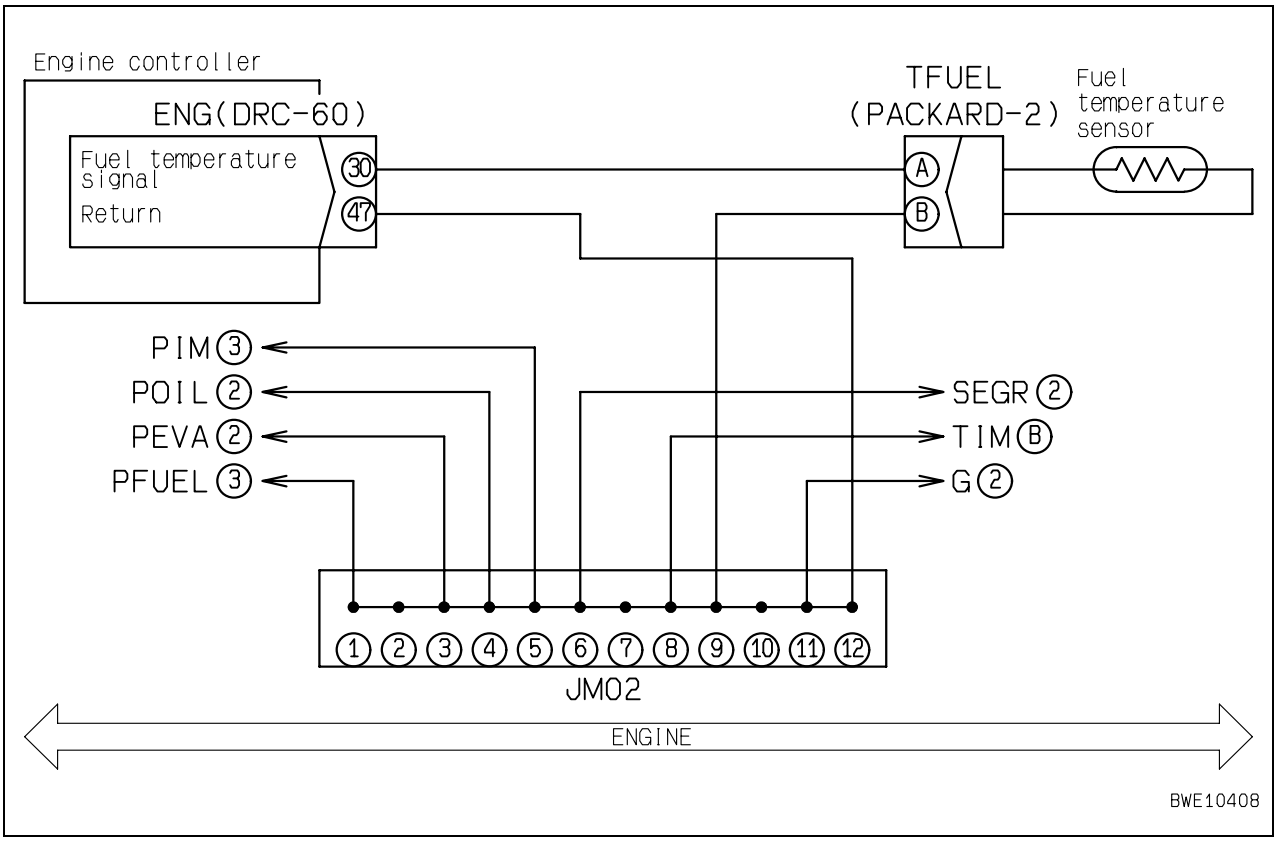


Failure code [CA263] (Fuel temperature sensor too high)

Action code	Failure code	Trouble	Fuel temperature sensor too high (Engine controller system)
E01	**CA263**		
Contents of trouble	• Excessively high voltage has occurred in fuel temperature sensor circuit.		
Action of controller	• Operates with a fixed fuel temperature (90°C).		
Problem that appears on machine			
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fuel temperature sensor (internal defect)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			TFUEL (male)	Fuel temperature	Resistance	
			Between (A) – (B)	10 – 100°C	0.6 – 20 kΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ENG (female) (30) – TFUEL (female) (A)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (47) – TFUEL (female) (B)		Resistance	Max. 1 Ω
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ENG (female) (30) – TFUEL (female) (A)		Resistance	Min. 1 MΩ
			★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
	4	Defective engine controller	ENG (female)	Fuel temperature	Resistance	
			Between (30) – (47)	10 – 100°C	0.6 – 20 kΩ	

Circuit diagram related



Failure code [CA265] (Fuel temperature sensor too low)

Action code	Failure code	Trouble	Fuel temperature sensor too low (Engine controller system)
E01	**CA265**		
Contents of trouble	• Excessively low voltage has occurred in fuel temperature sensor circuit.		
Action of controller	• Operates with a fixed fuel temperature (90°C).		
Problem that appears on machine			
Related information			

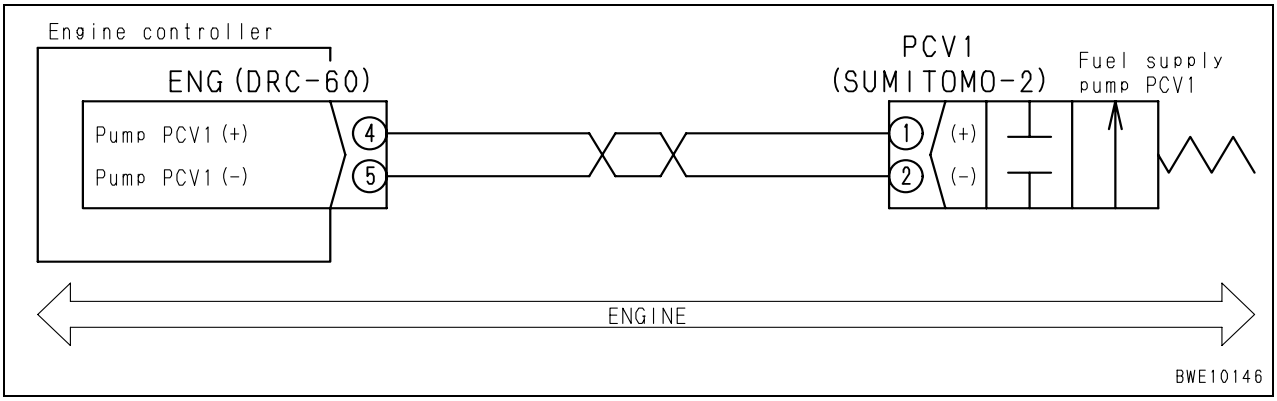
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of failure code [**CA263**].	

Failure code [CA271] (PCV1 short circuit)

Action code	Failure code	Trouble	PCV1 short circuit (Engine controller system)
E03	**CA271**		
Contents of trouble	• Short circuit has occurred in supply pump PCV1 circuit.		
Action of controller	• Takes no particular action.		
Problem that appears on machine			
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective supply pump PCV1 (internal short circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			PCV1 (male)	Resistance		
			Between (1) – (2)	2.3 – 5.3 Ω		
			Between (1), (2) – ground	Min. 1 MΩ		
	2	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ENG (female) (4) – PCV1 (female) (1)	Resistance	Min. 1 MΩ	
			Between ground and wiring harness between ENG (female) (5) – PCV1 (female) (2)	Resistance	Min. 1 MΩ	
	3	Hot short of wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between ground and wiring harness between ENG (female) (4) – PCV1 (female) (1)	Voltage	Max. 1 V	
			Between ground and wiring harness between ENG (female) (5) – PCV1 (female) (2)	Voltage	Max. 1 V	
	4	Defective engine controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			ENG (female)	Resistance		
			Between (4) – (5)	2.3 – 5.3 Ω		
			Between (4), (5) – ground	Min. 1 MΩ		

Circuit diagram related

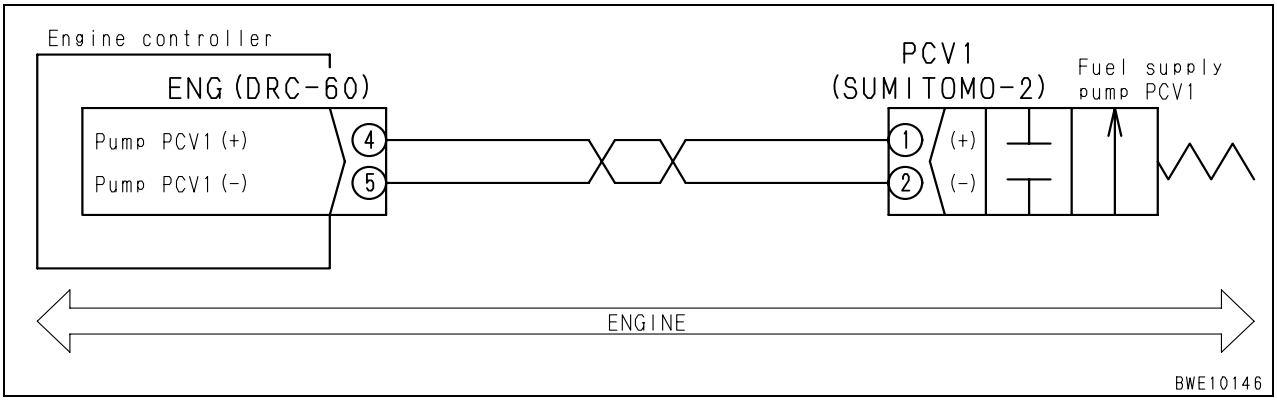


Failure code [CA272] (PCV1 disconnection)

Action code	Failure code	Trouble	PCV1 disconnection (Engine controller system)
E03	**CA272**		
Contents of trouble	• Disconnection has occurred in supply pump PCV1 circuit.		
Action of controller	• Takes no particular action.		
Problem that appears on machine			
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective supply pump PCV1 (internal disconnection)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			PCV1 (male)	Resistance	
			Between (1) – (2)	2.3 – 5.3 Ω	
			Between (1), (2) – ground	Min. 1 MΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ENG (female) (4) – PCV1 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (5) – PCV1 (female) (2)	Resistance	Max. 1 Ω
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between ENG (female) (4) – PCV1 (female) (1)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between ENG (female) (5) – PCV1 (female) (2)	Resistance	Min. 1 MΩ
	4	Defective engine controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			ENG (female)	Resistance	
			Between (4) – (5)	2.3 – 5.3 Ω	
			Between (4), (5) – ground	Min. 1 MΩ	

Circuit diagram related

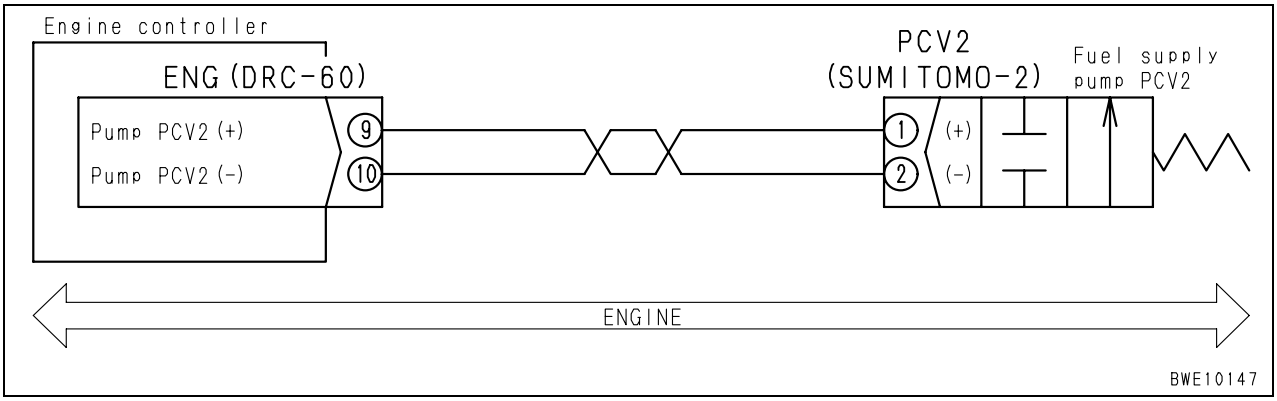


Failure code [CA273] (PCV2 short circuit)

Action code	Failure code	Trouble	PCV2 short circuit (Engine controller system)
E03	**CA273**		
Contents of trouble	• Short circuit has occurred in supply pump PCV2 circuit.		
Action of controller	• Takes no particular action.		
Problem that appears on machine			
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective supply pump PCV2 (internal short circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			PCV2 (male)	Resistance		
			Between (1) – (2)	2.3 – 5.3 Ω		
			Between (1), (2) – ground	Min. 1 MΩ		
	2	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ENG (female) (9) – PCV2 (female) (1)	Resistance	Min. 1 MΩ	
			Between ground and wiring harness between ENG (female) (10) – PCV2 (female) (2)	Resistance	Min. 1 MΩ	
	3	Hot short of wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between ground and wiring harness between ENG (female) (9) – PCV2 (female) (1)	Voltage	Max. 1 V	
			Between ground and wiring harness between ENG (female) (10) – PCV2 (female) (2)	Voltage	Max. 1 V	
	4	Defective engine controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			ENG (female)	Resistance		
			Between (9) – (10)	2.3 – 5.3 Ω		
			Between (9), (10) – ground	Min. 1 MΩ		

Circuit diagram related

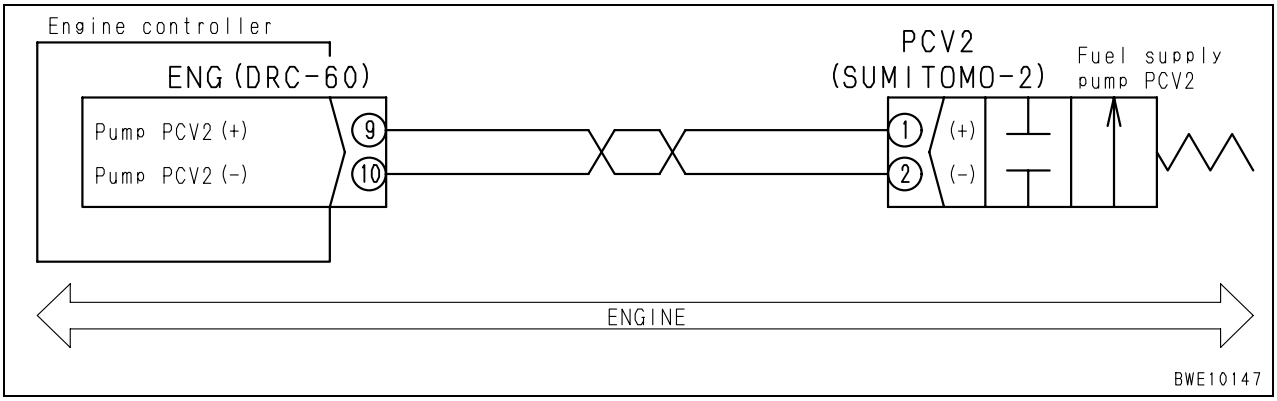


Failure code [CA274] (PCV2 disconnection)

Action code	Failure code	Trouble	PCV2 disconnection (Engine controller system)
E03	**CA274**		
Contents of trouble	• Disconnection has occurred in supply pump PCV2 circuit.		
Action of controller	• Takes no particular action.		
Problem that appears on machine			
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective supply pump PCV2 (internal disconnection)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			PCV2 (male)	Resistance		
			Between (1) – (2)	2.3 – 5.3 Ω		
	2	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ENG (female) (9) – PCV2 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between ENG (female) (10) – PCV2 (female) (2)	Resistance	Max. 1 Ω	
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ENG (female) (9) – PCV2 (female) (1)	Resistance	Min. 1 MΩ	
			Between ground and wiring harness between ENG (female) (10) – PCV2 (female) (2)	Resistance	Min. 1 MΩ	
	4	Defective engine controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			ENG (female)	Resistance		
			Between (9) – (10)	2.3 – 5.3 Ω		
			Between (9), (10) – ground	Min. 1 MΩ		

Circuit diagram related

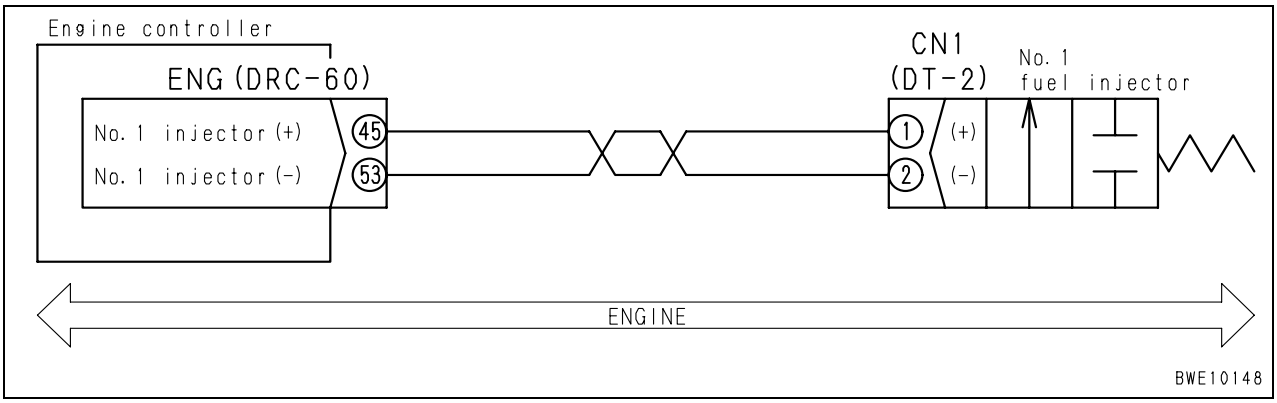


Failure code [CA322] Disconnection or short circuit in injector #1 (L#1)

Action code	Failure code	Trouble	Disconnection or short circuit in injector #1 (L#1) (Engine controller system)
E03	**CA322**		
Contents of trouble	• A disconnection or short has occurred in injector #1 circuit.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• Output decreases. • Speed is not stable.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective injector #1 (internal defect)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			CN1 (male)	Resistance		
			Between (1) – (2)	0.4 – 1.1 Ω		
			Between (1), (2) – ground	Min. 1 MΩ		
	2	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ENG (female) (45) – CN1(female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between ENG (female) (53) – CN1(female) (2)	Resistance	Max. 1 Ω	
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ENG (female) (45) – CN1 (female) (1)	Resistance	Min. 1 MΩ	
			Between ground and wiring harness between ENG (female) (53) – CN1 (female) (2)	Resistance	Min. 1 MΩ	
	4	Defective another cylinder injector or wiring harness	If multiple failure codes are displayed for infector malfunction, carry out troubleshooting for them, too.			
	5	Defective engine controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			ENG (female)	Resistance		
			Between (45) – (53)	0.4 – 1.1 Ω		
			Between (45), (53) – ground	Min. 1 MΩ		

Circuit diagram related

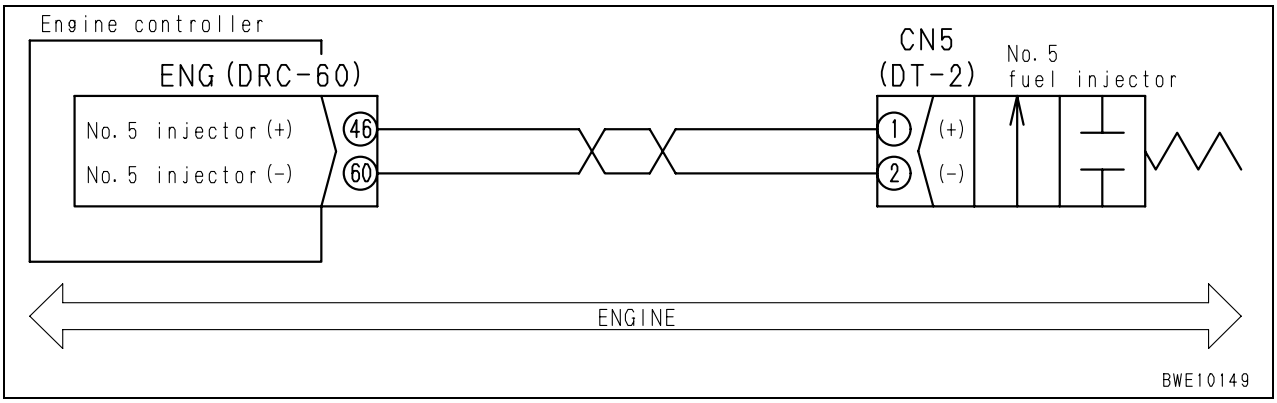


Failure code [CA323] Disconnection or short circuit in injector #5 (L#5)

Action code	Failure code	Trouble	Disconnection or short circuit in injector #5 (L#5) (Engine controller system)
E03	**CA323**		
Contents of trouble	• A disconnection or short has occurred in injector #5 circuit.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• Output decreases. • Speed is not stable.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective injector #5 (internal defect)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			CN5 (male)	Resistance		
			Between (1) – (2)	0.4 – 1.1 Ω		
			Between (1), (2) – ground	Min. 1 MΩ		
	2	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ENG (female) (46) – CN5 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between ENG (female) (60) – CN5 (female) (2)	Resistance	Max. 1 Ω	
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ENG (female) (46) – CN5 (female) (1)	Resistance	Min. 1 MΩ	
			Between ground and wiring harness between ENG (female) (60) – CN5 (female) (2)	Resistance	Min. 1 MΩ	
	4	Defective another cylinder injector or wiring harness	If multiple failure codes are displayed for infector malfunction, carry out troubleshooting for them, too.			
	5	Defective engine controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			ENG (female)	Resistance		
			Between (46) – (60)	0.4 – 1.1 Ω		
			Between (46), (60) – ground	Min. 1 MΩ		

Circuit diagram related

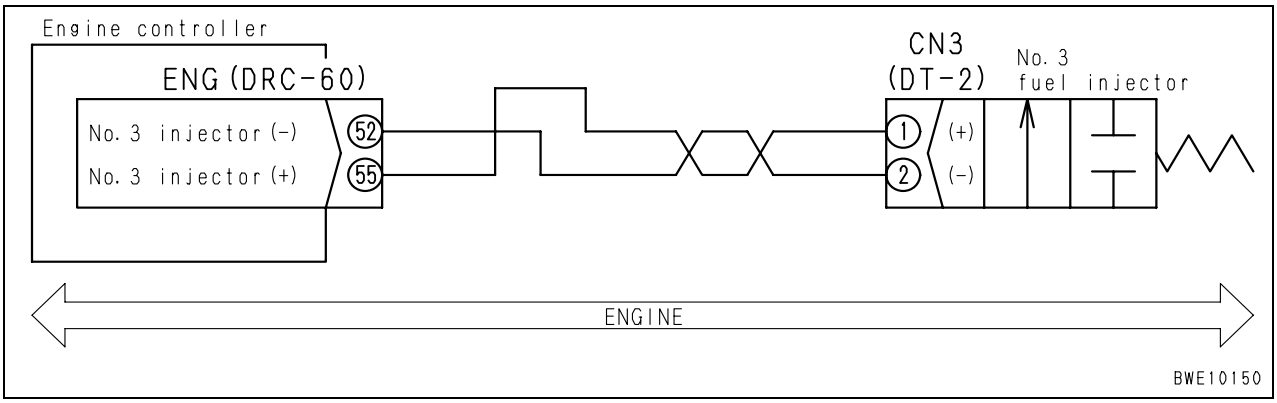


Failure code [CA324] Disconnection or short circuit in injector #3 (L#3)

Action code	Failure code	Trouble	Disconnection or short circuit in injector #3 (L#3) (Engine controller system)
E03	**CA324**		
Contents of trouble	• A disconnection or short has occurred in injector #3 circuit.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• Output decreases. • Speed is not stable.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective injector #3 (internal defect)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			CN3 (male)	Resistance		
			Between (1) – (2)	0.4 – 1.1 Ω		
			Between (1), (2) – ground	Min. 1 MΩ		
	2	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ENG (female) (55) – CN3 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between ENG (female) (52) – CN3 (female) (2)	Resistance	Max. 1 Ω	
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ENG (female) (55) – CN3 (female) (1)	Resistance	Min. 1 MΩ	
			Between ground and wiring harness between ENG (female) (52) – CN3 (female) (2)	Resistance	Min. 1 MΩ	
	4	Defective another cylinder injector or wiring harness	If multiple failure codes are displayed for infector malfunction, carry out troubleshooting for them, too.			
	5	Defective engine controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			ENG (female)	Resistance		
			Between (55) – (52)	0.4 – 1.1 Ω		
			Between (55), (52) – ground	Min. 1 MΩ		

Circuit diagram related

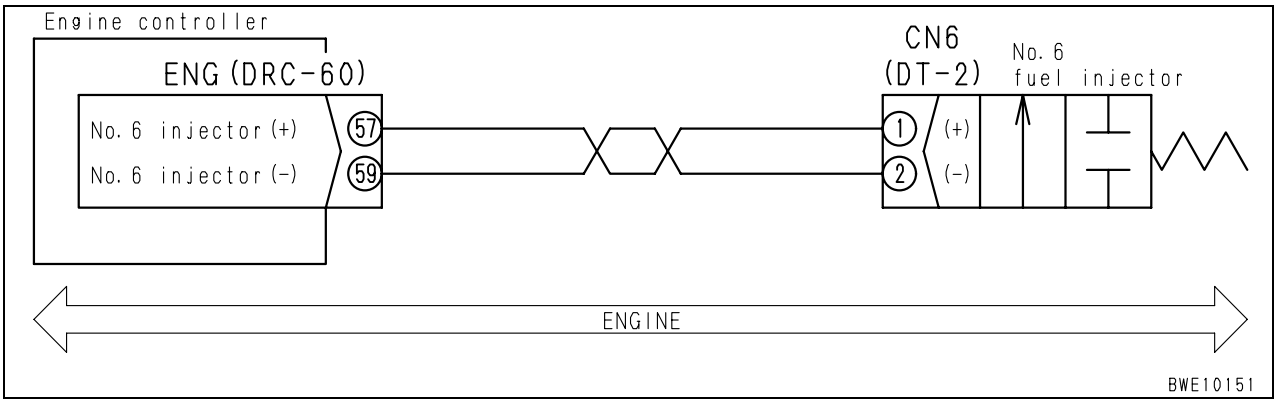


Failure code [CA325] Disconnection or short circuit in injector #6 (L#6)

Action code	Failure code	Trouble	Disconnection or short circuit in injector #6 (L#6) (Engine controller system)
E03	**CA325**		
Contents of trouble	• A disconnection or short has occurred in injector #6 circuit.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• Output decreases. • Speed is not stable.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective injector #6 (internal defect)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			CN6 (male)	Resistance		
			Between (1) – (2)	0.4 – 1.1 Ω		
			Between (1), (2) – ground	Min. 1 MΩ		
	2	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ENG (female) (57) – CN6 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between ENG (female) (59) – CN6 (female) (2)	Resistance	Max. 1 Ω	
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ENG (female) (57) – CN6 (female) (1)	Resistance	Min. 1 MΩ	
			Between ground and wiring harness between ENG (female) (59) – CN6 (female) (2)	Resistance	Min. 1 MΩ	
	4	Defective another cylinder injector or wiring harness	If multiple failure codes are displayed for infector malfunction, carry out troubleshooting for them, too.			
	5	Defective engine controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			ENG (female)	Resistance		
			Between (57) – (59)	0.4 – 1.1 Ω		
			Between (57), (59) – ground	Min. 1 MΩ		

Circuit diagram related

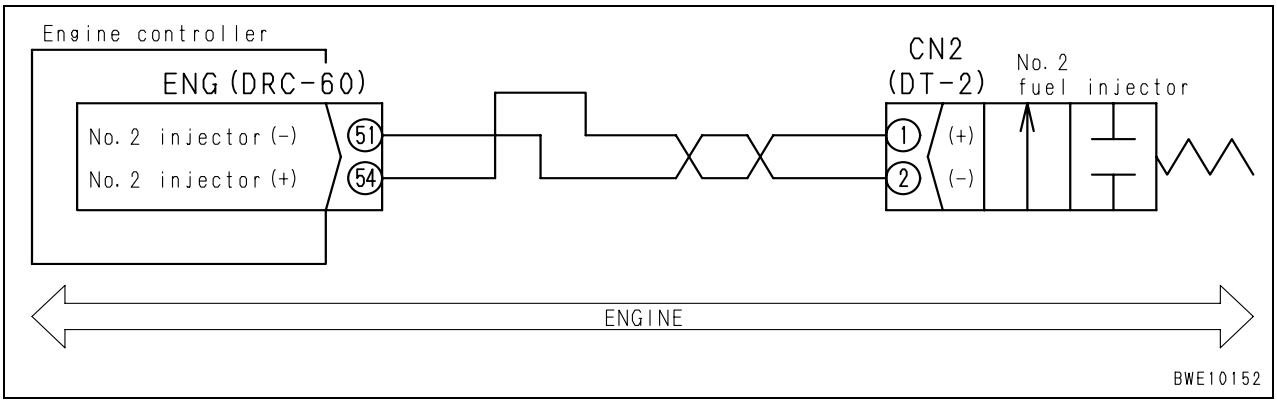


Failure code [CA331] Disconnection or short circuit in injector #2 (L#2)

Action code	Failure code	Trouble	Disconnection or short circuit in injector #2 (L#2) (Engine controller system)
E03	**CA331**		
Contents of trouble	• A disconnection or short has occurred in injector #2 circuit.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• Output decreases. • Speed is not stable.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective injector #2 (internal defect)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			CN2 (male)	Resistance		
			Between (1) – (2)	0.4 – 1.1 Ω		
			Between (1), (2) – ground	Min. 1 MΩ		
	2	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ENG (female) (54) – CN2 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between ENG (female) (51) – CN2 (female) (2)	Resistance	Max. 1 Ω	
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ENG (female) (54) – CN2 (female) (1)	Resistance	Min. 1 MΩ	
			Between ground and wiring harness between ENG (female) (51) – CN2 (female) (2)	Resistance	Min. 1 MΩ	
	4	Defective another cylinder injector or wiring harness	If multiple failure codes are displayed for infector malfunction, carry out troubleshooting for them, too.			
	5	Defective engine controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			ENG (female)	Resistance		
			Between (54) – (51)	0.4 – 1.1 Ω		
			Between (54), (51) – ground	Min. 1 MΩ		

Circuit diagram related

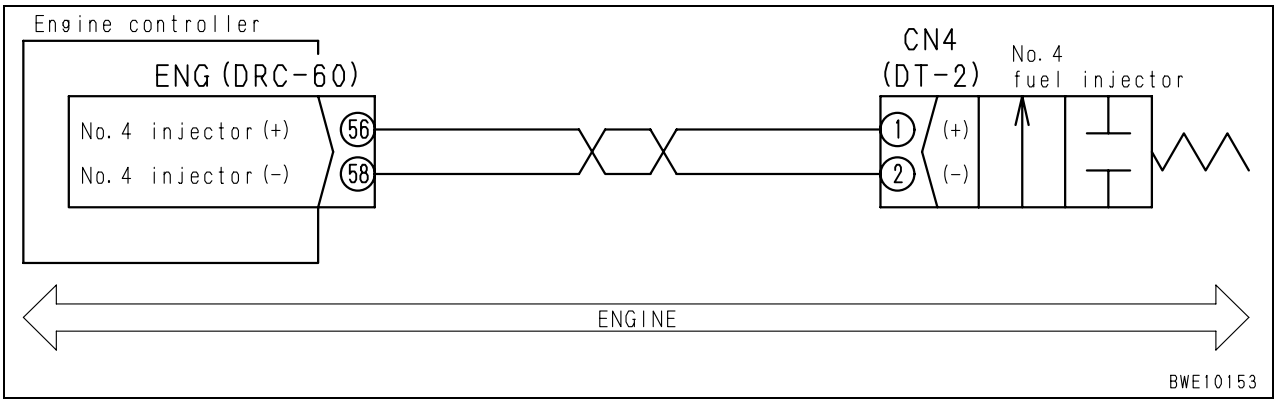


Failure code [CA332] Disconnection or short circuit in injector #4 (L#4)

Action code	Failure code	Trouble	Disconnection or short circuit in injector #4 (L#4) (Engine controller system)
E03	**CA332**		
Contents of trouble	• A disconnection or short has occurred in injector #4 circuit.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• Output decreases. • Speed is not stable.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective injector #4 (internal defect)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			CN4 (male)	Resistance		
			Between (1) – (2)	0.4 – 1.1 Ω		
			Between (1), (2) – ground	Min. 1 MΩ		
	2	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ENG (female) (56) – CN4 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between ENG (female) (58) – CN4 (female) (2)	Resistance	Max. 1 Ω	
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ENG (female) (56) – CN4 (female) (1)	Resistance	Min. 1 MΩ	
			Between ground and wiring harness between ENG (female) (58) – CN4 (female) (2)	Resistance	Min. 1 MΩ	
	4	Defective another cylinder injector or wiring harness	If multiple failure codes are displayed for infector malfunction, carry out troubleshooting for them, too.			
	5	Defective engine controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			ENG (female)	Resistance		
			Between (56) – (58)	0.4 – 1.1 Ω		
			Between (56), (58) – ground	Min. 1 MΩ		

Circuit diagram related



Failure code [CA342] (Abnormal engine controller data consistency)

Action code	Failure code	Trouble	Abnormal engine controller data consistency (Engine controller system)
E03	**CA342**		
Contents of trouble	• Abnormal data consistency has occurred in engine controller.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• Though the engine can operate normally, it may stall during the operation and may not start when the engine is stopped.		
Related information			

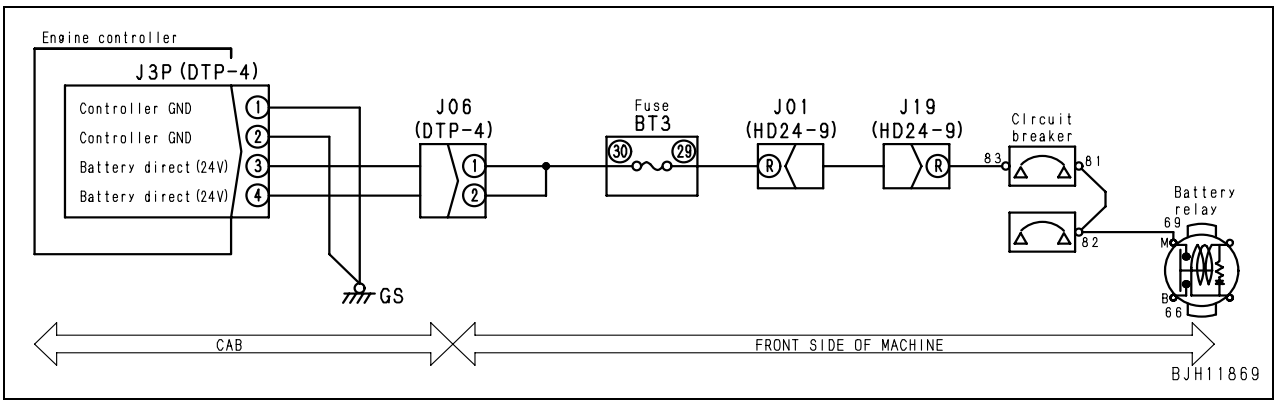
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of [**CA111**].	

Failure code [CA351] (Abnormal injector drive circuit)

Action code	Failure code	Trouble	Abnormal injector drive circuit (Engine controller system)
E03	**CA351**		
Contents of trouble	• Abnormality has occurred in injector drive circuit.		
Action of controller	• Operates with limited output.(Limits common rail pressure.)		
Problem that appears on machine	• Output decreases.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective related circuits	Check the failure codes (codes for injector system trouble) that are displayed at the same time. If any other codes are displayed, carry out troubleshooting for those codes.		
	2	Defective fuse BT3 (30 – 29) or defective circuit breaker	Since a defect of the fuse or circuit breaker can be suspected, directly check it. (If fuse is blown, or circuit breaker is shut off, it is highly possible that a defective grounding, etc. has occurred in the circuit.)		
	3	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between J3P (female) (3) – Battery (+)	Resistance	Max. 1 Ω
			Wiring harness between J3P (female) (1) – ground	Resistance	Max. 1 Ω
	4	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between J3P (female) (3) – Battery (+)	Resistance	Min. 1 MΩ
			Wiring harness between J3P (female) (1) – ground	Resistance	Min. 1 MΩ
	5	Defective engine controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			J3P	Voltage	
			Between (3) – (1)	20 – 30 V	

Circuit diagram related



Failure code [CA352] (Sensor power source 1 too low)

Action code	Failure code	Trouble	Sensor power source 1 too low (Engine controller system)
E03	**CA352**		
Contents of trouble	• Excessively low voltage has occurred in sensor power source 1 (5 V) circuit.		
Action of controller	• Common rail pressure sensor functions with limited output. (Limits common rail pressure.)		
Problem that appears on machine	• Output decreases.		
Related information			

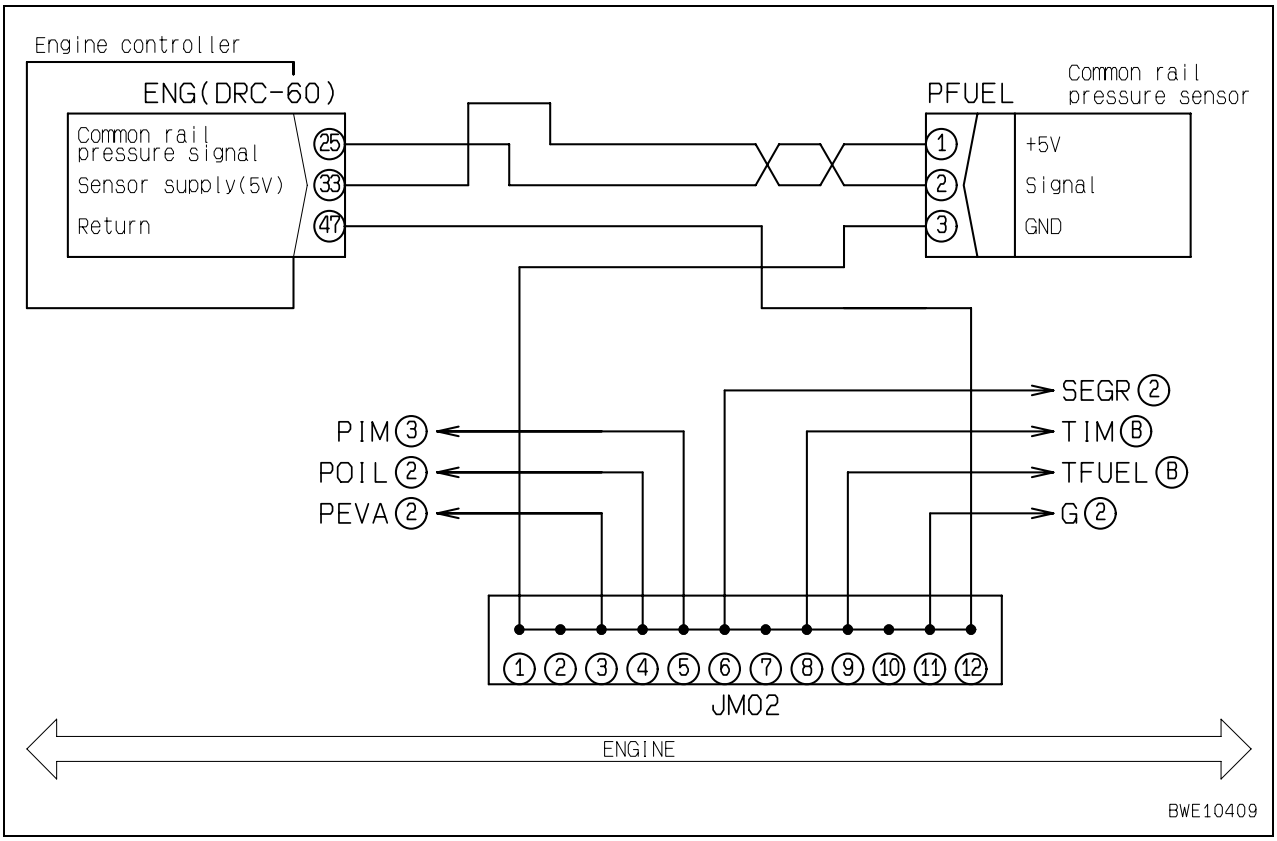
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of [**CA386**].	

Failure code [CA386] (Sensor power source 1 too high)

Action code	Failure code	Trouble	Sensor power source 1 too high (Engine controller system)
E03	**CA386**		
Contents of trouble	• Excessively high voltage has occurred in sensor power source 1 (5 V) circuit.		
Action of controller	• Common rail pressure sensor functions with limited output. (Limits common rail pressure.)		
Problem that appears on machine	• Output decreases.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective related circuits	Check the failure codes that are displayed at the same time. If any other codes are displayed, carry out troubleshooting for those codes.			
	2	Defective sensor (internal defect)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Disconnect a device shown on the right. If the failure code disappears, that device is internally defective.	Common rail pressure sensor	PFUEL connector	
	3	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ENG (female) (33) – PFUEL (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (47) – PFUEL (female) (3)		Resistance	Max. 1 Ω
	4	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ENG (female) (33) – PFUEL (female) (1)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between ENG (female) (47) – PFUEL (female) (3)		Resistance	Min. 1 MΩ
	5	Harness short (Harness internal short)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between wiring harness from ENG (female) (33) – PFUEL (female) (1) and wiring harness from ENG (female) (47) – PFUEL (female) (3)		Resistance	Min. 1 MΩ
	6	Defective engine controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			ENG	Voltage		
			Between (33) – (47)	4.75 – 5.25 V		

Circuit diagram related

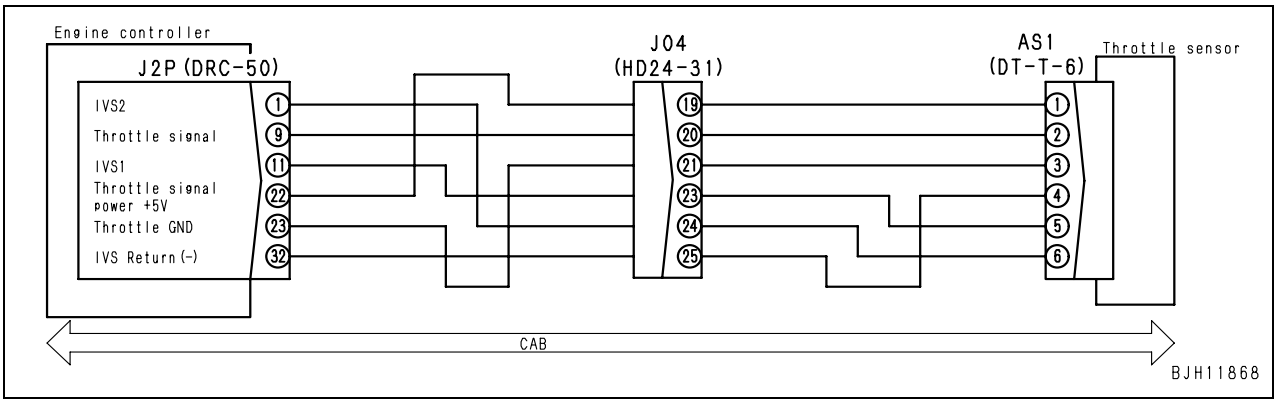


Failure code [CA431] (Abnormal idle validation switch)

Action code	Failure code	Trouble	Abnormal idle validation switch (Engine controller system)
E01	**CA431**		
Contents of trouble	• Open circuits of both idle validation switch signals 1 and 2 or abnormality in their ground circuit has occurred.		
Action of controller	• Operates normally in accordance with the throttle sensor (E01 Testing and maintenance).		
Problem that appears on machine	• No particular abnormality appears.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective accelerator pedal (internal defect)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			AS1	Signal name	Voltage	
			Between (5) – (4)	Signal 1	See figure 1.	
			Between (6) – (4)	Signal 2		
			Since voltage of sensor is measured with the harness connected, troubleshooting the harness and the controller if the voltage is abnormal, and then make judgment after it is determined that there is no other cause of the abnormality.			
	2	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between J2P (female) (32) – AS1 (female) (4)		Resistance	Max. 1 Ω
			Wiring harness between J2P (female) (11) – AS1 (female) (5)		Resistance	Max. 1 Ω
			Wiring harness between J2P (female) (1) – AS1 (female) (6)		Resistance	Max. 1 Ω
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between J2P (female) (32) – AS1 (female) (4)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between J2P (female) (11) – AS1 (female) (5)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between J2P (female) (1) – AS1 (female) (6)		Resistance	Min. 1 MΩ
	4	Hot short of wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between ground and wiring harness between J2P (female) (32) – AS1 (female) (4)		Voltage	Max. 1V
			Between ground and wiring harness between J2P (female) (11) – AS1 (female) (5)		Voltage	Max. 1V
			Between ground and wiring harness between J2P (female) (1) – AS1 (female) (6)		Voltage	Max. 1V
	5	Defective engine controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			J2P	Signal name	Voltage	
			Between (11) – (32)	Signal 1	See figure 1.	
			Between (1) – (32)	Signal 2		

Circuit diagram related



Failure code [CA432] (Abnormal process with idle validation switch)

Action code	Failure code	Trouble	Abnormal process with idle validation (Engine controller system)
E03	**CA432**		
Contents of trouble	• Throttle potentiometer signal of accelerator pedal is inconsistent with idle validation switch signal 1 and 2.		
Action of controller	• Turns on a warning lamp and sounds an alarm buzzer. • Fixes throttle at low idle or fixes engine speed at idle when the pedal is released and at a medium speed when the pedal is depressed.		
Problem that appears on machine	• Even if accelerator pedal is depressed, the engine speed stays at low idle or does not increase above medium speed.		
Related information			

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of [**CA431**].	

Failure code [CA441] (Power source voltage too low)

Action code	Failure code	Trouble	Power source voltage too low (Engine controller system)
E03	**CA441**		
Contents of trouble	• Excessively low voltage has occurred in power source voltage circuit.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• Though the engine can operate normally, it may stall during the operation and may not start when the engine is stopped.		
Related information			

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of [**CA111**].	

Failure code [CA442] (Power source voltage too high)

Action code	Failure code	Trouble	Power source voltage too high (Engine controller system)
E03	**CA442**		
Contents of trouble	• Excessively high voltage has occurred in power source voltage circuit.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• Though the engine can operate normally, it may stall during the operation and may not start when the engine is stopped.		
Related information			

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of [**CA111**].	

Failure code [CA449] (Common rail pressure too high 2)

Action code	Failure code	Trouble	Common rail pressure too high 2 (Engine controller system)
E03	**CA449**		
Contents of trouble	• Excessively high pressure (level 2) has been detected with common rail pressure sensor circuit.		
Action of controller	• Operates with limited output.(Limits common rail pressure.)		
Problem that appears on machine	• Output decreases.		
Related information			

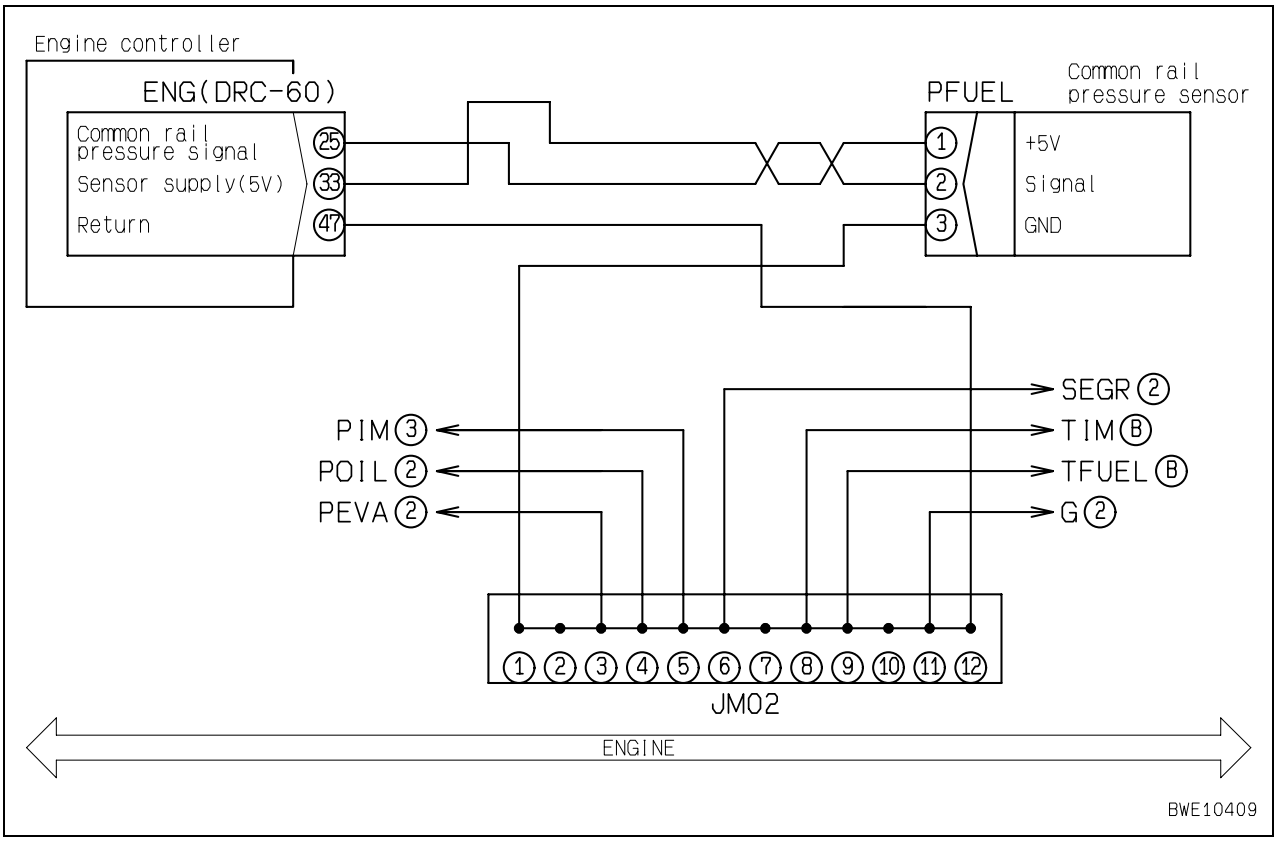
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of [**CA553**].	

Failure code [CA451] (Common rail pressure sensor too high)

Action code	Failure code	Trouble	Common rail pressure sensor too high (Engine controller system)
E03	**CA451**		
Contents of trouble	• Excessively high voltage has occurred in common rail pressure sensor circuit.		
Action of controller	• Operates with limited output.(Limits common rail pressure.)		
Problem that appears on machine	• Output decreases.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective sensor power source circuit	If failure code [**CA352**] or [**CA386**] is displayed, carry out troubleshooting for it first.			
	2	Defective common rail pressure sensor (internal defect)	★ Prepare with starting switch OFF, and troubleshooting with starting switch ON.			
			PFUEL		Voltage	
			Between (1) – (3)	Power source	4.75 – 5.25 V	
			Between (2) – (3)	Signal	0.25 – 4.6 V	
			Since voltage of sensor is measured with the harness connected, troubleshooting the harness and the controller if the voltage is abnormal, and then make judgment after it is determined that there is no other cause of the abnormality.			
	3	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ENG (female) (33) – PFUEL (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (25) – PFUEL (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (47) – PFUEL (female) (3)		Resistance	Max. 1 Ω
	4	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ENG (female) (33) – PFUEL (female) (1)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between ENG (female) (25) – PFUEL (female) (2)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between ENG (female) (47) – PFUEL (female) (3)		Resistance	Min. 1 MΩ
	5	Harness short (Harness internal short)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between wiring harness from ENG (female) (33) – PFUEL (female) (1) and wiring harness from ENG (female) (25) – PFUEL (female) (2)		Resistance	Min. 1 MΩ
			Between wiring harness from ENG (female) (33) – PFUEL (female) (1) and wiring harness from ENG (female) (47) – PFUEL (female) (3)		Resistance	Min. 1 MΩ
			Between wiring harness from ENG (female) (25) – PFUEL (female) (2) and wiring harness from ENG (female) (47) – PFUEL (female) (3)		Resistance	Min. 1 MΩ
	6	Defective engine controller	★ Prepare with starting switch OFF, and troubleshooting with starting switch ON.			
			ENG		Voltage	
			Between (33) – (47)		4.75 – 5.25 V	
			Between (25) – (47)		0.25 – 4.6 V	

Circuit diagram related



Failure code [CA452] (Common rail pressure sensor too low)

Action code	Failure code	Trouble	Common rail pressure sensor too low (Engine controller system)
E03	**CA452**		
Contents of trouble	• Excessively low voltage has occurred in common rail pressure sensor circuit.		
Action of controller	• Operates with limited output.(Limits common rail pressure.)		
Problem that appears on machine	• Output decreases.		
Related information			

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of [**CA451**].	

Failure code [CA553] (Common rail pressure too high 1)

Action code	Failure code	Trouble	Common rail pressure too high 1 (Engine controller system)
E03	**CA553**		
Contents of trouble	• Excessively high pressure (level 1) has been detected with common rail pressure sensor circuit.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• Output decreases.		
Related information			

Possible causes and standard value in normal state		Cause	Standard value in normal state/Remarks on troubleshooting
	1	Defective related circuits	Check the failure codes that are displayed at the same time. If any other codes are displayed, carry out troubleshooting for those codes.
	2	Improper fuel has been used.	Since the use of improper fuel can be suspected, check the fuel. (Viscosity is too high)
	3	Defective electrical system of common rail pressure sensor	Since an electrical defect of common rail pressure sensor is suspected, carry out troubleshooting for the following code. [**CA451**]
	4	Defective mechanical system of common rail pressure sensor	Since a mechanical defect of common rail pressure sensor is suspected, directly check the sensor.
	5	Defective overflow valve	Since a damage of spring, wear of seat or sticking of ball is suspected, directly check them.
	6	Clogged over flow piping	Since an over flow piping is suspected to be clogged, directly check it.
	7	Defective pressure limiter	Since a mechanical defect of pressure limiter is suspected, directly check the limiter.

Failure code [CA554] (In-range error of common rail pressure sensor)

Action code	Failure code	Trouble	In-range error in common rail pressure sensor (Engine controller system)
E03	**CA554**		
Contents of trouble	• In-range error has occurred in common rail pressure sensor circuit.		
Action of controller	• Operates with limited output.(Limits common rail pressure.)		
Problem that appears on machine	• Output decreases.		
Related information			

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of [**CA451**].	

Failure code [CA559] (Loss of pressure feed from supply pump 1)

Action code	Failure code	Trouble	Loss of pressure feed from supply pump 1 (Engine controller system)
E03	**CA559**		
Contents of trouble	• Loss of pressure feed (level 1) from supply pump has occurred.		
Action of controller	• Limits common rail pressure.		
Problem that appears on machine	• Output decreases.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Defective related circuits	Check the failure codes that are displayed at the same time. If any other codes are displayed, carry out troubleshooting for those codes.	
	2	Improper fuel has been used.	Since the use of improper fuel is suspected, directly check the fuel.	
	3	Defective low pressure circuit device	★ See “Note 1“ for the contents of diagnosis. See Testing and adjusting “Testing fuel pressure“ for the pressure inspection of the fuel low pressure circuit.	
			Fuel low pressure circuit pressure	Min. 0.15 MPa {Min. 1.5 kg/cm²}
	4	Clogged filter or strainer	★ See “Note 2“ for the contents of diagnosis.	
	5	Defective electrical system of supply pump PCV	Since an electrical defect of supply pump PCV is suspected, carry out troubleshooting for the following codes. [**CA271**], [**CA272**], [**CA273**], and [**CA274**]	
	6	Defective common rail pressure sensor	Since a defect of common rail pressure sensor is suspected, check for a damage in harnesses.	
	7	Defective pressure limiter	★ As for testing an amount of pressure limiter leak, see testing and adjusting “Testing fuel return and leak amount“.	
			Pressure limiter leak amount	Max. 10 cc/min (at 1,600 rpm)
	8	Defective injector	★ As for the test relating to return (spill) limit amount of injector, see testing and adjusting “Testing fuel return and leak amount“.	
			Speed under the conditions which is equivalent to rated operation	Injector return (spill) limit amount
			1,600 rpm	960 cc/min
			1,700 rpm	1,020 cc/min
			1,800 rpm	1,080 cc/min
			1,900 rpm	1,140 cc/min
			2,000 rpm	1,200 cc/min
	9	Defective supply pump	Supply pump can be suspected to be defective if no problem is found in causes 1 – 8.	

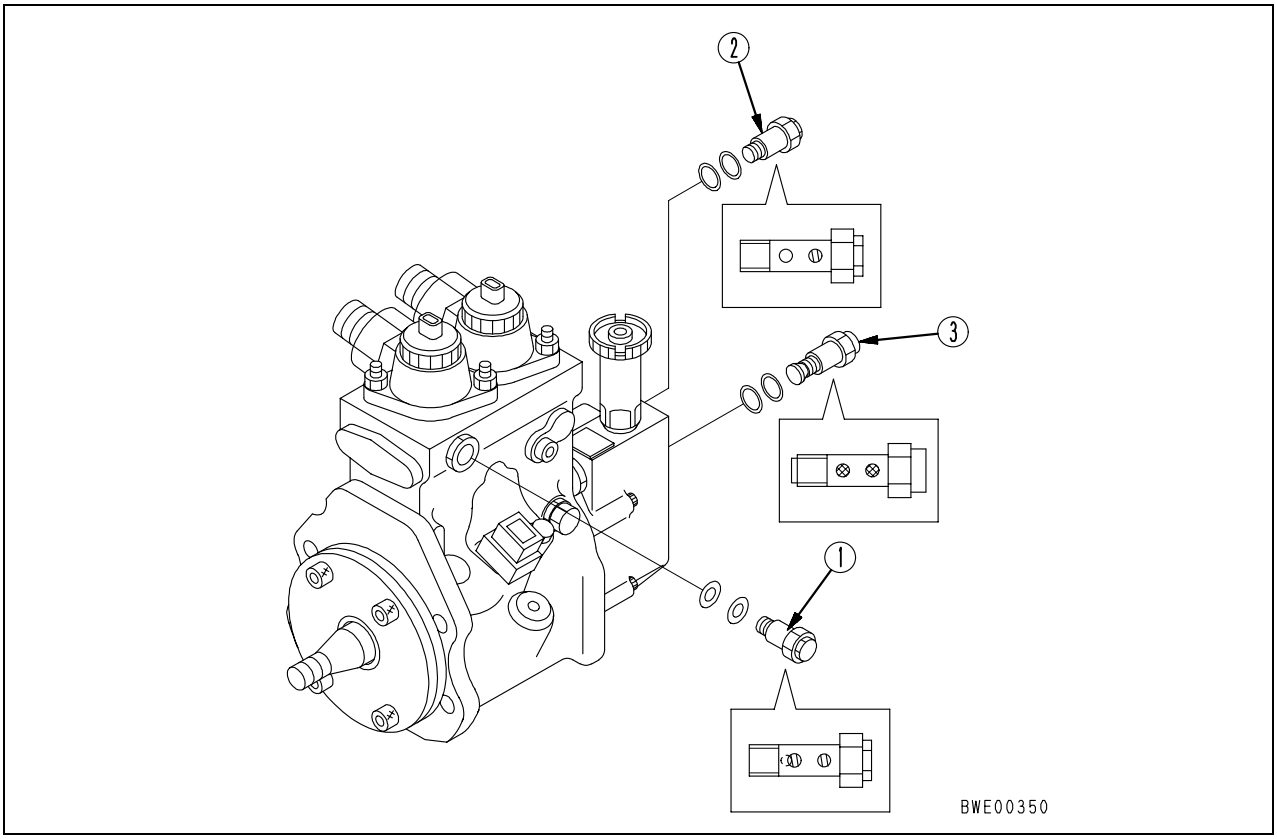
<How to use the check sheet>
Carry out the above diagnosis as well as record the results for the contents of diagnosis using the attached “Check sheet for loss of pressure feed“.

Note 1: When low-pressure circuit is defective, check the following:

1) Fuel level
2) Clogged hydraulic tank breather
3) Stuck or worn feed pump, clogged filter
4) Leaked or clogged low-pressure fuel pipe
5) Bypass valve malfunction, defective assembly of other parts (See Fig.1.)
6) Clogged fuel filter
7) Fuel in oil pan (fuel leakage in head cover)

Fig. 1: Locations of overflow valve (1), bypass valve (2), and fuel inlet joint (3)

- Overflow valve (1): Spring is seen through both holes.
- Bypass valve (2): Spring is seen through hole on nut side.
- Fuel inlet joint (3): Gauze filter is seen through both holes.



Note 2: Follow the procedure below to check, clean, and replace filter and strainer.

1) Gauze filter: Disassemble this filter for checking. If clogged, clean it.
2) Gauze filter upstream strainer: Clean upstream strainer if gauze filter is clogged.
3) Fuel filter: If failure is not remedied after steps 1) and 2) above were executed, replace fuel filter.

Check sheet for no-pressure feed

Machine model		Working No.	
Model serial No.		Checked on	/ /
Engine		Service meter	h
Engine serial No.		Worker name	

A. Visual check		Good	Bad
1	Fuel leakage to outside		
2	Clogged fuel tank breather		

B. Check with machine monitor (Abnormality record, monitoring, cylinder cut-out operation)

			Good	Bad
3	Checking failure code	/ / / /		

4 — Checking monitoring information

Code	Display item	Check conditions	Unit	Standard value (Reference value)	Measured value	Good	Bad
*1	Engine Speed	Low idle	rpm	1,930 ± 50			
		High idle	rpm	1,000 ± 25			
		Rating or equivalent	rpm	1,850			
*2	Throttle speed	Low idle	%	0			
		High idle	%	100			
*3	Injection rate command	Rating or equivalent	mm^3	—		—	—
*4	Common rail pressure command	Rating or equivalent	MPa				
*5	Common rail fuel pressure	Rating or equivalent	MPa				
*6	Injection timing command	Low idle	CA	—		—	—
		High idle	CA	—		—	—
		Rating or equivalent	CA	—		—	—
*7	Boost Pressure	Rating or equivalent	kPa	—		—	—
*8	Engine coolant temperature (High)	Low idle	°C	—		—	—
*9	Fuel temperature	Low idle	°C	—		—	—

5 — Checking cylinder cut-out operation (Engine speed)

Function	Cut-out cylinder	Check conditions	Unit	Standard value (Reference value)	Measured value	Good	Bad
*10	Cylinder 1	Low idle	rpm	—		—	—
	Cylinder 2	Low idle	rpm	—		—	—
	Cylinder 3	Low idle	rpm	—		—	—
	Cylinder 4	Low idle	rpm	—		—	—
	Cylinder 5	Low idle	rpm	—		—	—
	Cylinder 6	Low idle	rpm	—		—	—

C. Checking fuel circuit pressure		Check conditions	Unit	Standard value (Reference value)	Measured value	Good	Bad
6	Pressure in fuel low-pressure circuit	High idle	MPa {kg/cm²}	Min. 0.15 {Min. 1.5}			

D. Checking strainer, filter		Good	Bad
7	Visual check of strainer		
8	Visual check of gauze filter		
9	Visual check of fuel filter		
10	Visual check of bypass valve		

E. Checking leakage and fuel return rate		Check conditions	Unit	Standard value (Reference value)	Measured value	Good	Bad
11	Leakage through pressure limiter	No-load, 1600 rpm	cc/min	Max. 10			
12	Return rate from injector	Rating or equivalent 1600 rpm	cc/min	960	Speed: Return rate:		
		Rating or equivalent 1,700 rpm	cc/min	1,020			
		Rating or equivalent 1,800 rpm	cc/min	1,080			
		Rating or equivalent 1,900 rpm	cc/min	1,140			
		Rating or equivalent 2,000 rpm	cc/min	1,200			

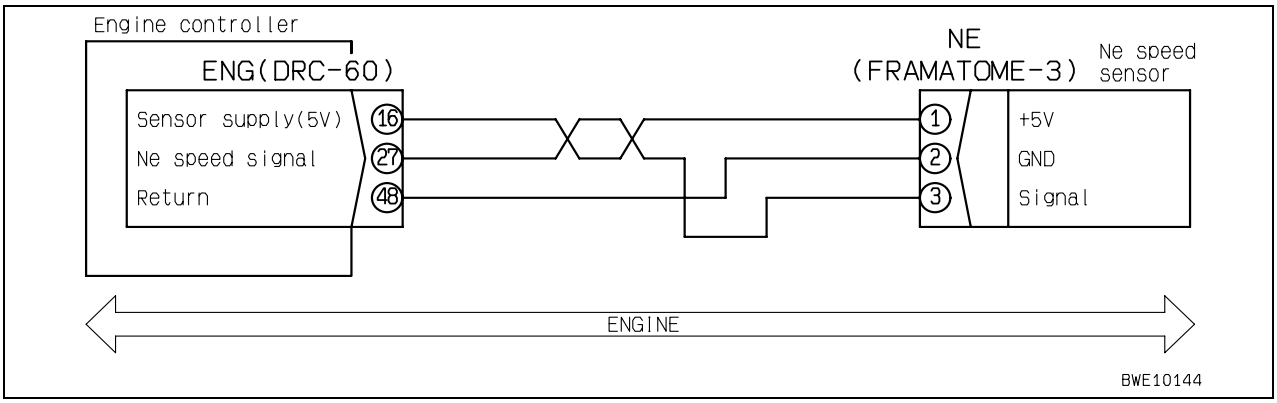
*1 to *10:
When using the monitoring function for checking, see Monitoring Code List.
Equivalent to rating:
1) Engine at full throttle, 2) Torque converter is relieved.

Failure code [CA689] (Abnormal engine Ne speed sensor)

Action code	Failure code	Trouble	Abnormal engine Ne speed sensor (Engine controller system)
E03	**CA689**		
Contents of trouble	• An abnormality has occurred in engine Ne speed sensor circuit.		
Action of controller	• Operates using Bkup speed sensor signal.		
Problem that appears on machine	• Engine stops during operation (when Bkup speed sensor is defective at the same time). • Engine cannot be started while stopping (when Bkup speed sensor is defective at the same time).		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective sensor power source circuit	If failure code [**CA238**] is displayed at the same time, carry out troubleshooting for it first.		
	2	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ENG (female) (16) – NE (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (48) – NE (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (27) – NE (female) (3)	Resistance	Max. 1 Ω
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between ENG (female) (16) – NE (female) (1)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between ENG (female) (48) – NE (female) (2)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between ENG (female) (27) – NE (female) (3)	Resistance	Min. 1 MΩ
	4	Harness short (Harness internal short)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between wiring harness from ENG (female) (16) – NE (female) (1) and wiring harness from ENG (female) (48) – NE (female) (2)	Resistance	Min. 1 MΩ
			Between wiring harness from ENG (female) (16) – NE (female) (1) and wiring harness from ENG (female) (27) – NE (female) (3)	Resistance	Min. 1 MΩ
			Between wiring harness from ENG (female) (48) – NE (female) (2) and wiring harness from ENG (female) (27) – NE (female) (3)	Resistance	Min. 1 MΩ
	5	Defective mounting of sensor or defective parts for speed detection	Since defective mounting of Ne speed sensor (improper gap) or defective parts for speed detection (flywheel) can be suspected, directly check it.		
	6	Defective engine Ne speed sensor	Engine Ne speed sensor can be suspected to be defective if no problem is found in causes 1 – 5 (since this is an internal defect, it cannot be diagnosed).		
	7	Defective engine controller	Engine controller can be suspected to be defective if no problem is found in causes 1 – 6 (since this is an internal defect, it cannot be diagnosed).		

Circuit diagram related



Failure code [CA697] (Engine controller inside temperature sensor too high)

Action code	Failure code	Trouble	Engine controller inside temperature sensor too high (Engine controller system)
E03	**CA697**		
Contents of trouble	• Excessively high voltage has occurred in engine controller inside temperature sensor circuit.		
Action of controller	• Takes no particular action.		
Problem that appears on machine			
Related information			

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective engine controller	Internal defect of controller can be suspected. (It cannot be diagnosed.)

Failure code [CA698] (Engine controller inside temperature sensor too low)

Action code	Failure code	Trouble	Engine controller inside temperature sensor too low (Engine controller system)
E03	**CA698**		
Contents of trouble	• Excessively low voltage has occurred in engine controller inside temperature sensor circuit.		
Action of controller	• Takes no particular action.		
Problem that appears on machine			
Related information			

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective engine controller	Internal defect of controller can be suspected. (It cannot be diagnosed.)

Failure code [CA731] (Abnormal engine Bkup speed sensor phase)

Action code	Failure code	Trouble	Abnormal engine Bkup speed sensor phase (Engine controller system)
E03	**CA731**		
Contents of trouble	• Abnormal phase has been detected in the engine Bkup sensor circuit.		
Action of controller	• Operates using engine Ne speed sensor signal.		
Problem that appears on machine	• Engine stops during operation (when Ne speed sensor is defective at the same time). • Engine cannot be started while stopping (when Ne speed sensor is defective at the same time).		
Related information			

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective engine Ne speed sensor circuit	Since a defect of engine Ne speed sensor can be suspected, carry out troubleshooting for the following code. [**CA689**]
	2	Defective engine Bkup speed sensor system	Since a defect of engine Bkup speed sensor can be suspected, carry out troubleshooting for the following code. [**CA778**]

Failure code [CA757] (Loss of all engine controller data)

Action code	Failure code	Trouble	Loss of all engine controller data (Engine controller system)
E03	**CA757**		
Contents of trouble	• Loss of all data in engine controller has been detected.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• Though the engine can operate normally, it may stall during the operation and may not start when the engine is stopped.		
Related information			

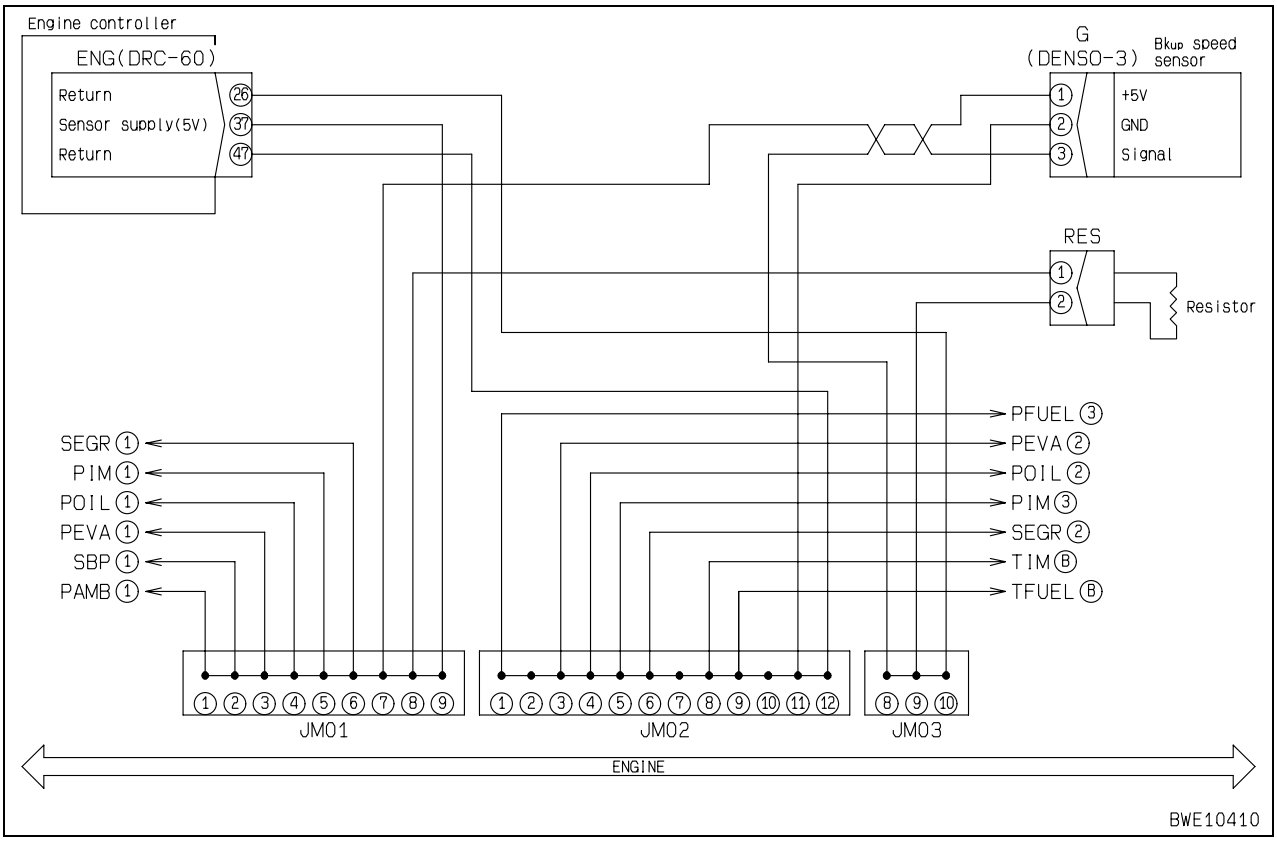
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of [**CA111**].	

Failure code [CA778] (Abnormal engine Bkup speed sensor)

Action code	Failure code	Trouble	Abnormal engine Bkup speed sensor (Engine controller system)
E03	**CA778**		
Contents of trouble	• An abnormality has occurred in engine Bkup speed sensor circuit.		
Action of controller	• Operates using Ne speed sensor signal.		
Problem that appears on machine	• Engine stops during operation (when Ne speed sensor is defective at the same time). • Engine cannot be started while stopping (when Ne speed sensor is defective at the same time).		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective sensor power source circuit	If failure code [**CA187**] or [**CA227**] is displayed, carry out troubleshooting for it first.		
	2	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ENG (female) (37) – G (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (47) – G (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (26) – G (female) (3)	Resistance	Max. 1 Ω
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between ENG (female) (37) – G (female) (1)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between ENG (female) (47) – G (female) (2)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between ENG (female) (26) – G (female) (3)	Resistance	Min. 1 MΩ
	4	Harness short (Harness internal short)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between wiring harness from ENG (female) (37) – G (female) (1) and wiring harness from ENG (female) (47) – G (female) (2)	Resistance	Min. 1 MΩ
			Between wiring harness from ENG (female) (37) – G (female) (1) and wiring harness from ENG (female) (26) – G (female) (3)	Resistance	Min. 1 MΩ
			Between wiring harness from ENG (female) (47) – G (female) (2) and wiring harness from ENG (female) (26) – G (female) (3)	Resistance	Min. 1 MΩ
	5	Defective mounting of sensor or defective parts for speed detection	Since defective mounting of Bkup speed sensor (improper gap) or defective parts for speed detection (in supply pump) can be suspected, directly check it.		
	6	Defective engine Bkup speed sensor	Engine Bkup speed sensor can be suspected to be defective if no problem is found in causes 1 – 5 (since this is an internal defect, it cannot be diagnosed).		
	7	Defective engine controller	Engine controller can be suspected to be defective if no problem is found in causes 1 – 6 (since this is an internal defect, it cannot be diagnosed).		

Circuit diagram related



Failure code [CA1117] (Loss of partial engine controller data)

Action code	Failure code	Trouble	Loss of partial engine controller data (Engine controller system)
E03	**CA1117**		
Contents of trouble	• Loss of partial engine controller data has occurred.		
Action of controller	• Takes no particular action.		
Problem that appears on machine			
Related information			

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of [**CA111**].	

Failure code [CA1228] (Abnormal EGR valve servo 1)

Action code	Failure code	Trouble	Abnormal EGR valve servo 1 (Engine controller system)
E03	**CA1228**		
Contents of trouble	• An abnormality has occurred in EGR valve servo (level 1).		
Action of controller	• Executes open loop control.		
Problem that appears on machine			
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Defective related circuits	Check the failure codes that are displayed at the same time. If any other codes are displayed, carry out troubleshooting for those codes.	
	2	Improper EGR valve drive pressure	★ For testing of EGR valve drive pressure, see Testing and adjusting, “Testing EGR valve, bypass valve drive pressure“.	
			Engine	Valve drive pressure
			Low idle	Min. 1.18 MPa {Min. 12 kg/cm²}
			High idle	Min. 1.43 MPa {Min. 14.6 kg/cm²}
			If valve drive pressure is abnormal, carry out troubleshooting for 4 and 5.	
	3	Defective engine hydraulic system (main circuit)	★ See Testing and adjusting “Measuring engine oil pressure“ for engine oil pressure inspection.	
			Engine	Engine oil pressure
			Low idle	0.05 MPa {0.5 kg/cm²}
			High idle	0.29 – 0.69 MPa {3.0 – 7.0 kg/cm²}
			If engine oil pressure is out of range, carry out troubleshooting for mechanical system (S-12 Oil pressure drops)	
	4	Defective oil pump for EGR valve	Since the oil pump relief valve for the EGR valve circuit can be suspected to be defective, directly check it.	
	5	Defective hydraulic feed piping for EGR valve	Since the hydraulic feed piping for EGR valve circuit can be suspected to be defective, directly check it.	
	6	Defective hydraulic return piping for EGR valve	Since hydraulic return piping for EGR valve circuit can be suspected to be defective, directly check it.	
	7	Defective EGR valve	Since a mechanical defect of EGR valve can be suspected, directly check it.	
	8	Defective engine controller	Engine controller can be suspected to be defective if no problem is found in causes 1 – 6 (since this is an internal defect, it cannot be diagnosed).	

Failure code [CA1625] (Abnormal EGR valve servo 2)

Action code	Failure code	Trouble	Abnormal EGR valve servo 2 (Engine controller system)
E03	**CA1625**		
Contents of trouble	• An abnormality has occurred in EGR valve servo (level 2).		
Action of controller	• Operates by limiting output. • Closes EGR valve and bypass valve.		
Problem that appears on machine	• Output decreases.		
Related information			

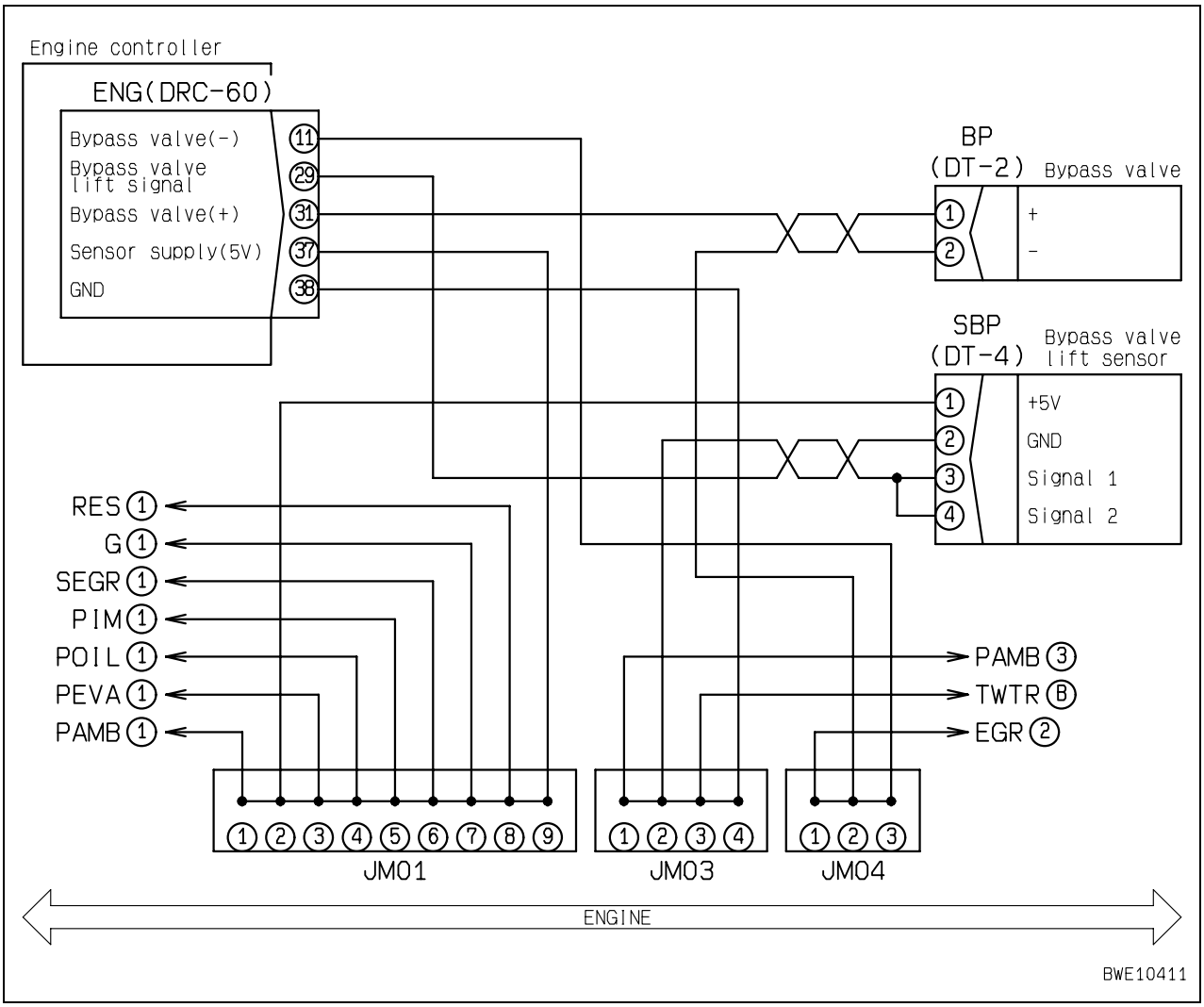
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of [**CA1228**].	

Failure code [CA1626] (Short circuit of bypass valve solenoid drive)

Action code	Failure code	Trouble	Short circuit of bypass valve solenoid drive (Engine controller system)
E03	**CA1626**		
Contents of trouble	• Short circuit has occurred in the bypass valve solenoid drive circuit.		
Action of controller	• Operates by limiting output. • Closes EGR valve and bypass valve.		
Problem that appears on machine	• Output decreases.		
Related information	• Connector No. may vary depending on the equipped model.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective bypass valve solenoid (Internal defect)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			BP (male)	Resistance	
			Between (1) – (2)	10 – 21 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ENG (female) (31) – BP (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (11) – BP (female) (2)	Resistance	Max. 1 Ω
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between ENG (female) (31) – BP (female) (1)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between ENG (female) (11) – BP (female) (2)	Resistance	Min. 1 MΩ
	4	Hot short of wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ground and wiring harness between ENG (female) (31) – BP (female) (1)	Voltage	Max. 1 V
			Between ground and wiring harness between ENG (female) (11) – BP (female) (2)	Voltage	Max. 1 V
	5	Defective engine controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			ENG (female)	Resistance	
			Between (31) – (11)	10 – 21 Ω	

Circuit diagram related



Failure code [CA1627] (Disconnection in bypass valve solenoid drive)

Action code	Failure code	Trouble	Disconnection in bypass valve solenoid drive (Engine controller system)
E03	**CA1627**		
Contents of trouble	• An disconnection has occurred in the bypass valve solenoid drive circuit.		
Action of controller	• Operates by limiting output. • Closes EGR valve and bypass valve.		
Problem that appears on machine	• Output decreases.		
Related information			

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of [**CA1626**].	

Failure code [CA1628] (Abnormal bypass valve servo 1)

Action code	Failure code	Trouble	Abnormal bypass valve servo 1 (Engine controller system)
E03	**CA1628**		
Contents of trouble	• An abnormality has occurred in the bypass valve servo (level 1).		
Action of controller	• Executes open loop control.		
Problem that appears on machine			
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Defective related circuits	Check the failure codes that are displayed at the same time. If any other codes are displayed, carry out troubleshooting for those codes.	
	2	Improper bypass valve drive pressure	★ For testing of bypass valve drive pressure, see Testing and adjusting, “Testing EGR valve, bypass valve drive pressure“.	
			Engine	Valve drive pressure
			Low idle	Min. 1.18 MPa {Min. 12 kg/cm²}
			High idle	Min. 1.43 MPa {Min. 14.6 kg/cm²}
			If valve drive pressure is abnormal, carry out troubleshooting for 4 and 5.	
	3	Defective engine hydraulic system (main circuit)	★ See Testing and adjusting “Measuring engine oil pressure“ for engine oil pressure inspection.	
			Engine	Engine oil pressure
			Low idle	0.05 MPa {0.5 kg/cm²}
			High idle	0.29 – 0.69 MPa {3.0 – 7.0 kg/cm²}
			If engine oil pressure is out of range, carry out troubleshooting for mechanical system (S-12 Oil pressure drops)	
	4	Defective oil pump for bypass valve	Since the oil pump relief valve for the bypass valve circuit can be suspected to be defective, directly check it.	
	5	Defective hydraulic feed piping for bypass valve	Since hydraulic feed piping for bypass valve circuit can be suspected to be defective, directly check it.	
	6	Defective hydraulic return piping for bypass valve	Since hydraulic return piping for bypass valve circuit can be suspected to be defective, directly check it.	
	7	Defective bypass valve	Since a mechanical defect of bypass valve can be suspected, directly check it.	
	8	Defective engine controller	Engine controller can be suspected to be defective if no problem is found in causes 1 – 6 (since this is an internal defect, it cannot be diagnosed).	

Failure code [CA1629] (Abnormal bypass valve servo 2)

Action code	Failure code	Trouble	Abnormal bypass valve servo 2 (Engine controller system)
E03	**CA1629**		
Contents of trouble	• An abnormality has occurred in the bypass valve servo (level 2).		
Action of controller	• Operates by limiting output. • Closes EGR valve and bypass valve.		
Problem that appears on machine	• Output decreases.		
Related information			

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of [**CA1628**].	

HM300-2 Articulated dump truck

Form No. SEN00672-03

ARTICULATED DUMP TRUCK

HM300-2

Machine model	Serial number
HM300-2	2001 and up

40 Troubleshooting

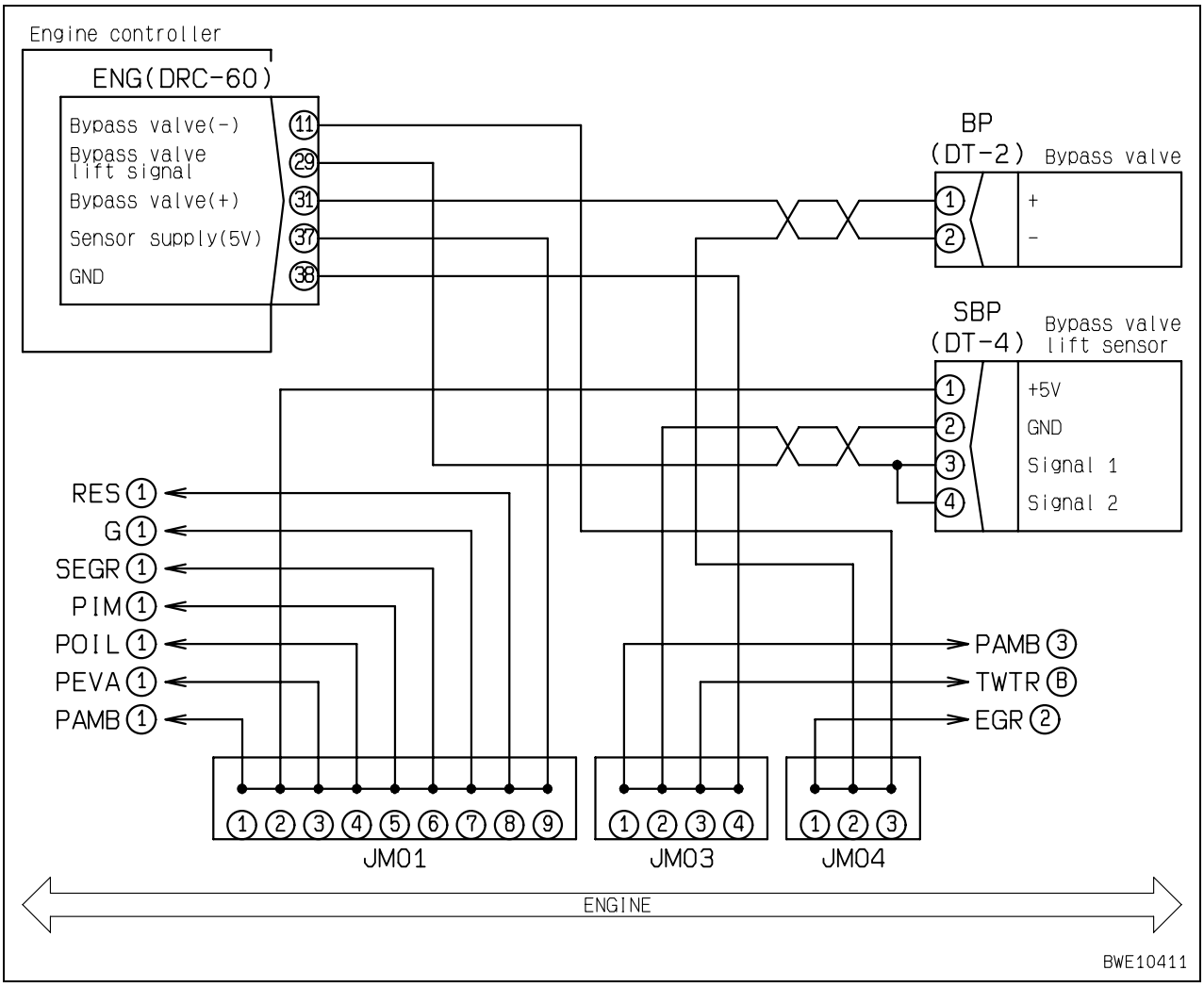
Troubleshooting by failure code, Part 3

Failure code [CA1631] (Bypass valve lift sensor too high)

Action code	Failure code	Trouble	Bypass valve lift sensor too high (Engine controller system)
E03	**CA1631**		
Contents of trouble	• Excessively high voltage has occurred in the bypass valve lift sensor circuit.		
Action of controller	• Operates by limiting output. • Closes EGR valve and bypass valve.		
Problem that appears on machine	• Output decreases.		
Related information	• Connector No. may vary depending on the equipped model.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective sensor power source circuit	If failure code [**CA187**] or [**CA227**] is displayed, carry out troubleshooting for it first.			
	2	Defective bypass valve lift sensor (internal defect)	★ Prepare with starting switch OFF, and troubleshooting with starting switch ON or with engine started.			
			SBP		Voltage	
			Between (1) – (2)	Power source	4.75 – 5.25 V	
			Since the sensor voltage is measured with the harness being connected, if the voltage is abnormal, first check the harness and the controller to make it sure if there is no other cause of the trouble, and then judge the sensor voltage.			
	3	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ENG (female) (37) – SBP (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (38) – SBP (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (29) – SBP (female) (3) (4)		Resistance	Max. 1 Ω
	4	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ENG (female) (37) – SBP (female) (1)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between ENG (female) (38) – SBP (female) (2)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between ENG (female) (29) – SBP (female) (3) (4)		Resistance	Min. 1 MΩ
	5	Harness short (Harness internal short)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between wiring harness from ENG (female) (37) – SBP (female) (1) and wiring harness from ENG (female) (38) – SBP (female) (2)		Resistance	Min. 1 MΩ
			Between wiring harness from ENG (female) (37) – SBP (female) (1) and wiring harness from ENG (female) (29) – SBP (female) (3) (4)		Resistance	Min. 1 MΩ
			Between wiring harness from ENG (female) (38) – SBP (female) (2) and wiring harness from ENG (female) (29) – SBP (female) (3) (4)		Resistance	Min. 1 MΩ
	6	Defective engine controller	★ Prepare with starting switch OFF, and troubleshooting with starting switch ON or with engine started.			
			ENG		Voltage	
			Between (37) – (38)		4.75 – 5.25 V	

Circuit diagram related



Failure code [CA1632] (Bypass valve lift sensor too low)

Action code	Failure code	Trouble	Bypass valve lift sensor too low (Engine controller system)
E03	**CA1632**		
Contents of trouble	• Excessively low voltage has occurred in the bypass valve lift sensor circuit.		
Action of controller	• Operates by limiting output. • Closes EGR valve and bypass valve.		
Problem that appears on machine	• Output decreases.		
Related information			

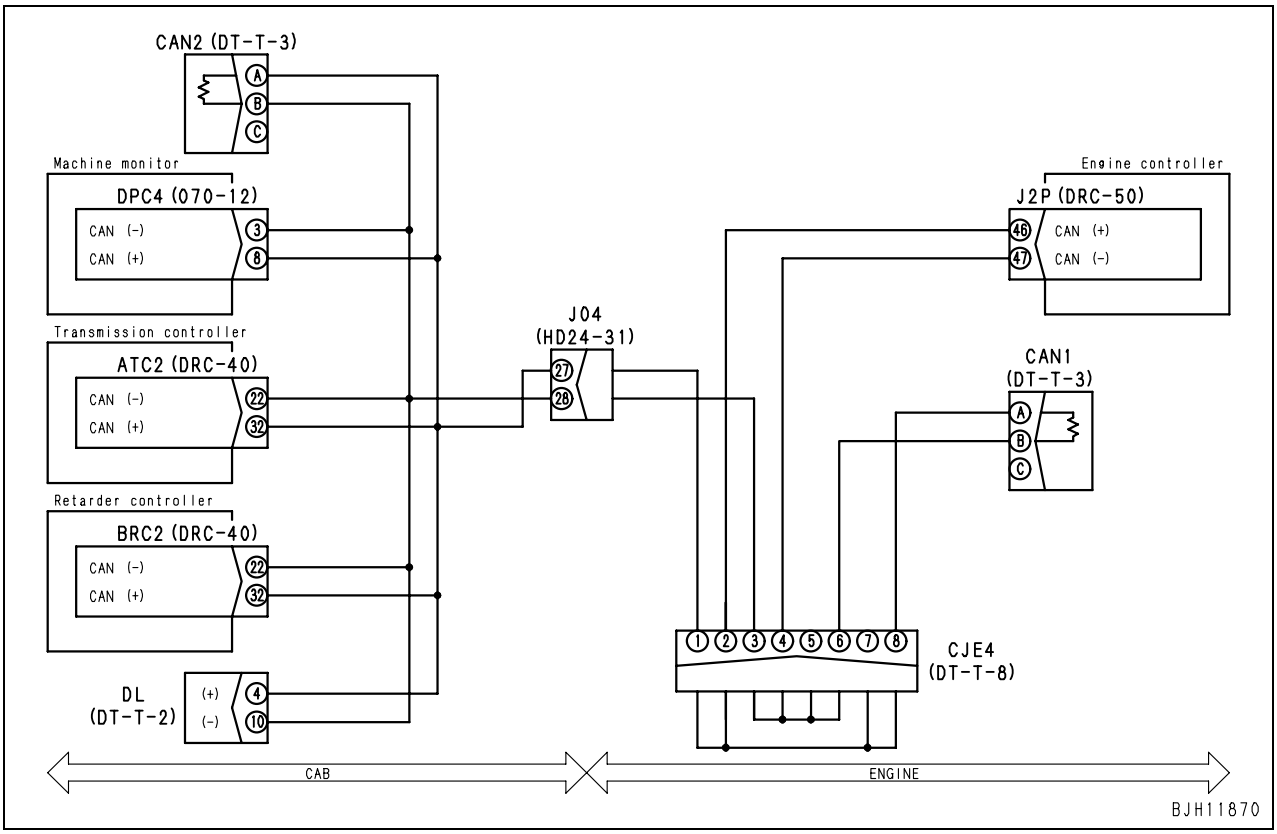
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of [**CA1631**].	

Failure code [CA1633] (Abnormal KOMNET)

Action code	Failure code	Trouble	Abnormal KOMNET (Engine controller system)
E03	**CA1633**		
Contents of trouble	• An abnormality has occurred in the KOMNET communication circuit to the machine monitor.		
Action of controller	• Operates in a default mode or keeps the conditions when the abnormality has occurred.		
Problem that appears on machine			
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harnesses among DPC4 (female) (3) – J2P (female) (47) – ATC2 (female) (22) – BRC2 (female) (22)	Resistance	Max. 1 Ω
			Wiring harnesses among DPC4 (female) (8) – J2P (female) (46) – ATC2 (female) (32) – BRC2 (female) (32)	Resistance	Max. 1 Ω
	2	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harnesses among DPC4 (female) (3) – J2P (female) (47) – ATC2 (female) (22) – BRC2 (female) (22) – other related circuits.	Resistance	Min. 1 MΩ
			Between ground and wiring harnesses among DPC4 (female) (8) – J2P (female) (46) – ATC2 (female) (32) – BRC2 (female) (32) – other related circuits.	Resistance	Min. 1 MΩ
	3	Hot short in wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ground and wiring harnesses among DPC4 (female) (3) – J2P (female) (47) – ATC2 (female) (22) – BRC2 (female) (22) – other related circuits.	Voltage	Max. 1 V
			Between ground and wiring harnesses among DPC4 (female) (8) – J2P (female) (46) – ATC2 (female) (32) – BRC2 (female) (32) – other related circuits.	Voltage	Max. 1 V
	4	Defective CAN terminal resistance	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CAN 1(male) (A) – (B)	Resistance	40 – 80 Ω
			Between CAN2 (male) (A) – (B)	Resistance	120 Ω
	5	Defective machine monitor, engine controller or pump controller	If no problem is found in causes 1 – 4, machine monitor, engine controller or pump controller can be suspected to be defective (since this is an internal defect, it cannot be diagnosed).		

Circuit diagram related



Failure code [CA1642] (EGR inlet pressure sensor too low)

Action code	Failure code	Trouble	EGR inlet pressure sensor too low (Engine controller system)
E01	**CA1642**		
Contents of trouble	• Excessively low pressure has occurred in the EGR inlet pressure sensor circuit.		
Action of controller	• Operates with the EGR inlet pressure value defaulted to (102 kPa {1.0 kg/cm²}) • Operates by limiting output.		
Problem that appears on machine	• Output decreases.		
Related information			

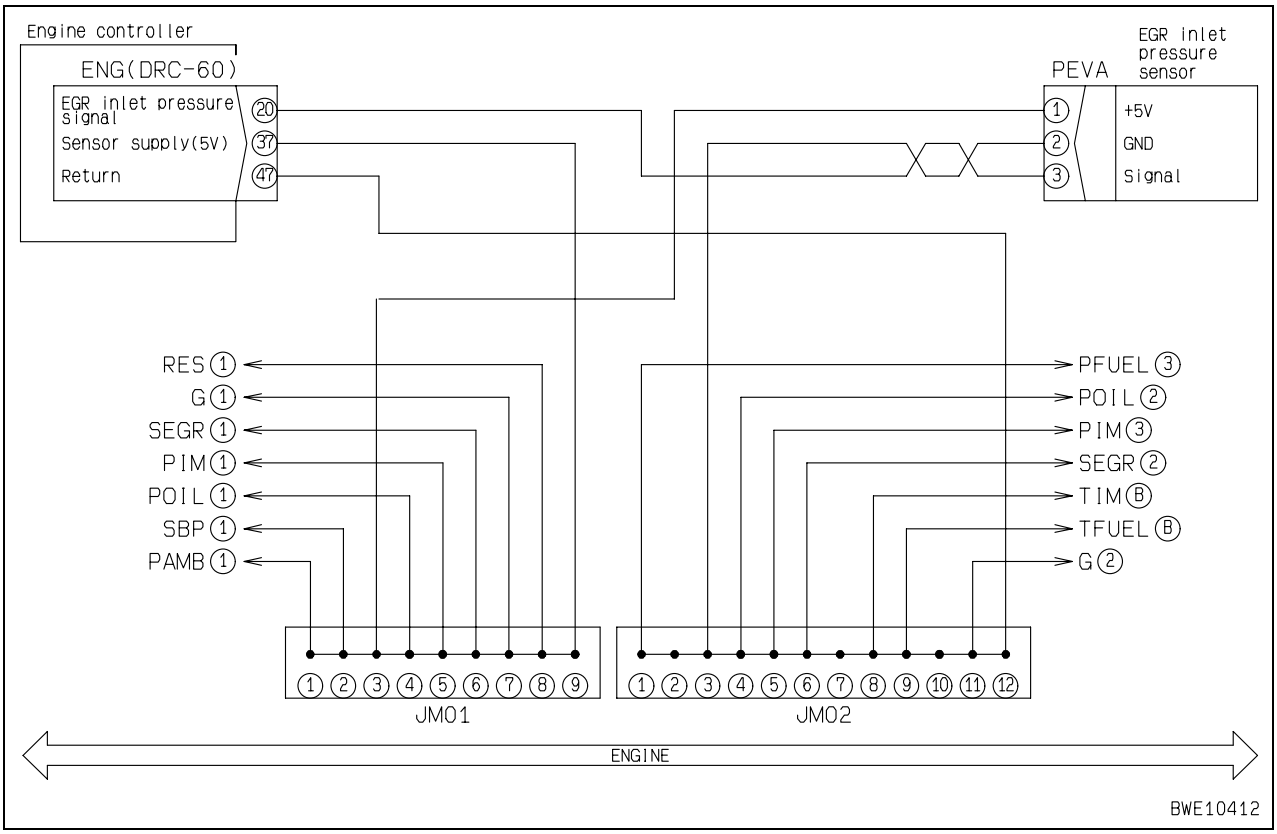
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of [**CA1653**].	

Failure code [CA1653] (EGR inlet pressure sensor too high)

Action code	Failure code	Trouble	EGR inlet pressure sensor too high (Engine controller system)
E01	**CA1653**		
Contents of trouble	• Excessively high pressure has occurred in the EGR inlet pressure sensor circuit.		
Action of controller	• Operates with the EGR inlet pressure value defaulted to (102 kPa {1.0 kg/cm²}) • Operates by limiting output.		
Problem that appears on machine	• Output decreases.		
Related information	• Connector No. may vary depending on the equipped model.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective sensor power source circuit	If failure code [**CA187**] or [**CA227**] is displayed, carry out troubleshooting for it first.			
	2	Defective EGR inlet pressure sensor (internal defect)	★ Prepare with starting switch OFF, and troubleshooting with starting switch ON or with engine started.			
			PEVA		Voltage	
			Between (1) – (2)	Power source	4.75 – 5.25 V	
			Since the sensor voltage is measured with the harness being connected, if the voltage is abnormal, first check the harness and the controller to make it sure if there is no other cause of the trouble, and then judge the sensor voltage.			
	3	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ENG (female) (37) – PEVA (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (47) – PEVA (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (20) – PEVA (female) (3)		Resistance	Max. 1 Ω
	4	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness ENG (female) (37) – PEVA (female) (1)		Resistance	Min. 1 MΩ
			Between ground and wiring harness ENG (female) (47) – PEVA (female) (2)		Resistance	Min. 1 MΩ
			Between ground and wiring harness ENG (female) (20) – PEVA (female) (3)		Resistance	Min. 1 MΩ
	5	Harness short (Harness internal short)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between wiring harness from ENG (female) (37) – PEVA (female) (1) and wiring harness from ENG (female) (47) – PEVA (female) (2)		Resistance	Min. 1 MΩ
			Between wiring harness from ENG (female) (37) – PEVA (female) (1) and wiring harness from ENG (female) (20) – PEVA (female) (3)		Resistance	Min. 1 MΩ
			Between wiring harness from ENG (female) (47) – PEVA (female) (2) and wiring harness from ENG (female) (20) – PEVA (female) (3)		Resistance	Min. 1 MΩ
	6	Defective engine controller	★ Prepare with starting switch OFF, and troubleshooting with starting switch ON or with engine started.			
			ENG		Voltage	
			Between (37) – (47)		4.75 – 5.25 V	

Circuit diagram related

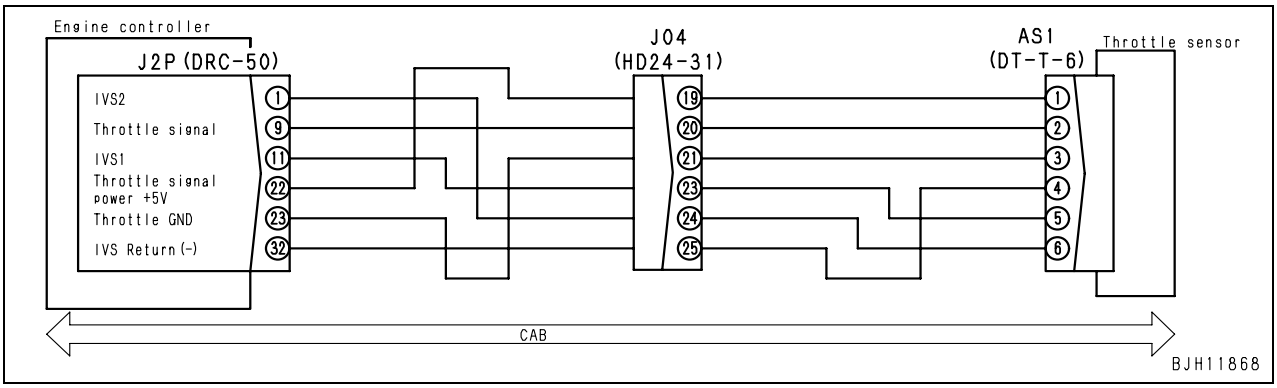


Failure code [CA2185] (Throttle sensor power source too high)

Action code	Failure code	Trouble	Throttle sensor power source too high (Engine controller system)
E03	**CA2185**		
Contents of trouble	• Excessively high voltage has occurred in the throttle sensor power source (5 V) circuit.		
Action of controller	• Establishes the throttle opening using signals other than throttle sensor signal in order to operate engine. (depends on an equipped machine)		
Problem that appears on machine	• Depends on an equipped machine.		
Related information	• Connector No. may vary depending on the equipped model.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective accelerator pedal (internal defect)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Disconnect a device shown on the right. If the failure code disappears, that device is internally defective.	Accelerator pedal	AS1 connector	
	2	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between J2P (female) (22) – AS1 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between J2P (female) (23) – AS1 (female) (3)		Resistance	Max. 1 Ω
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between J2P (female) (22) – AS1 (female) (1)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between J2P (female) (23) – AS1 (female) (3)		Resistance	Min. 1 MΩ
	4	Harness short (Harness internal short)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between wiring harness from J2P (female) (22) – AS1 (female) (1) and wiring harness from E02 (female) (23) – AS1 (female) (3)		Resistance	Min. 1 MΩ
	5	Defective engine controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			J2P	Voltage		
			Between (22) – (23)	4.75 – 5.25 V		

Circuit diagram related



Failure code [CA2186] (Throttle sensor power source too low)

Action code	Failure code	Trouble	Throttle sensor power source too low (Engine controller system)
E03	**CA2186**		
Contents of trouble	• Excessively low voltage has occurred in the throttle sensor power source (5 V) circuit.		
Action of controller	• Establishes the throttle opening using signals other than throttle sensor signal in order to operate engine.		
Problem that appears on machine			
Related information			

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of [**CA2185**].	

Failure code [CA2249] (Loss of pressure feed from supply pump 2)

Action code	Failure code	Trouble	Loss of pressure feed from supply pump 2 (Engine controller system)
E03	**CA2249**		
Contents of trouble	• Loss of pressure feed (level 2) from supply pump has occurred.		
Action of controller	• Limits common rail pressure.		
Problem that appears on machine	• Output decreases.		
Related information			

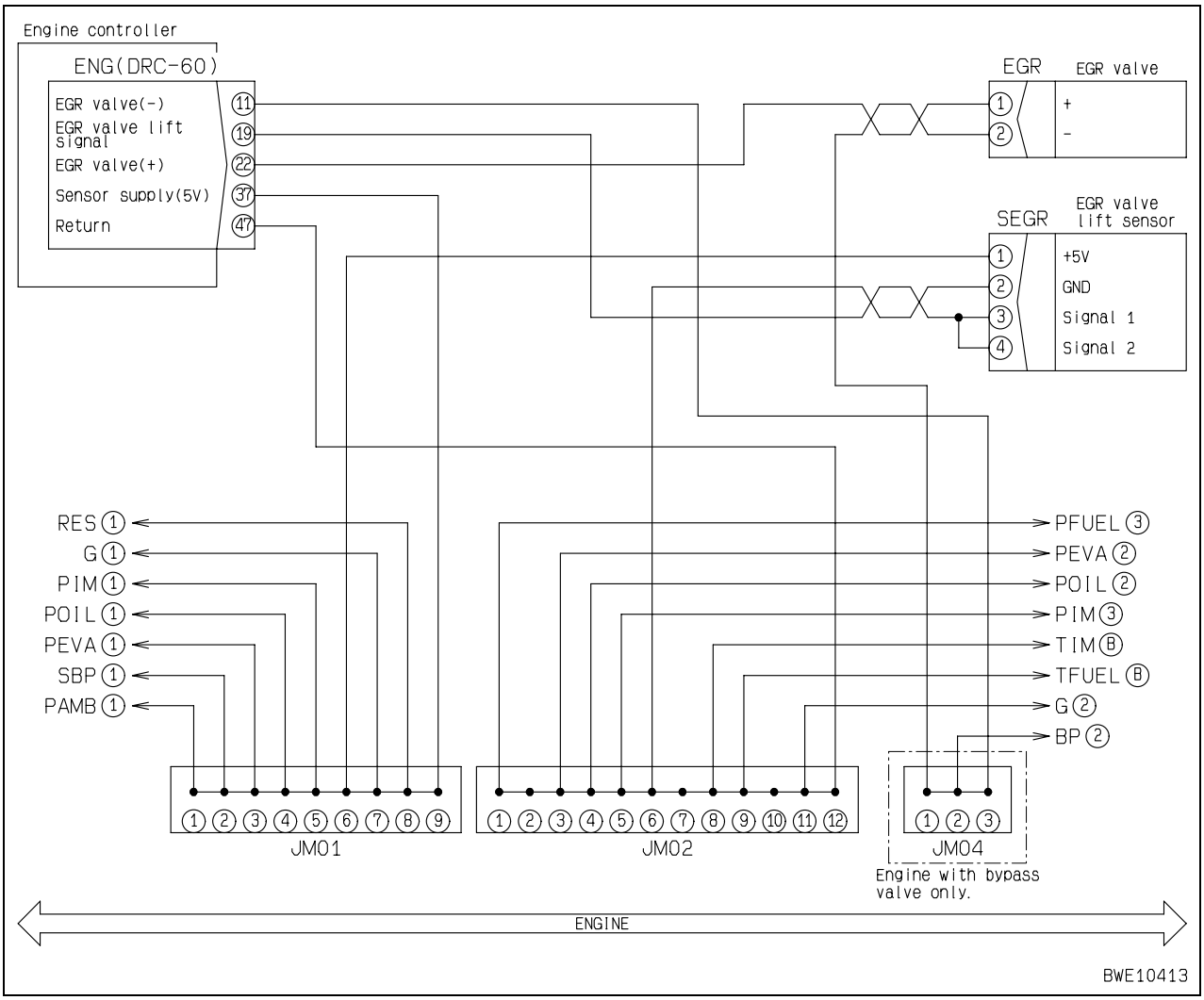
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of [**CA559**].	

Failure code [CA2271] (EGR valve lift sensor too high)

Action code	Failure code	Trouble	EGR valve lift sensor too high (Engine controller system)
E03	**CA2271**		
Contents of trouble	• Excessively high voltage has occurred in the EGR valve lift sensor circuit.		
Action of controller	• Operates by limiting output. • Closes EGR valve and bypass valve.		
Problem that appears on machine	• Output decreases.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective sensor power source circuit	If failure code [**CA187**] or [**CA227**] is displayed, carry out troubleshooting for it first.			
	2	Defective EGR valve lift sensor (internal defect)	★ Prepare with starting switch OFF, and troubleshooting with starting switch ON or with engine started.			
			SEGR		Voltage	
			Between (1) – (2)	Power source	4.75 – 5.25 V	
			Since the sensor voltage is measured with the harness being connected, if the voltage is abnormal, first check the harness and the controller to make it sure if there is no other cause of the trouble, and then judge the sensor voltage.			
	3	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ENG (female) (37) – SEGR (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (47) – SEGR (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (19) – SEGR (female) (3) (4)		Resistance	Max. 1 Ω
	4	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness ENG (female) (37) – SEGR (female) (1)		Resistance	Min. 1 MΩ
			Between ground and wiring harness ENG (female) (47) – SEGR (female) (2)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between ENG (female) (19) – SEGR (female) (3) (4)		Resistance	Min. 1 MΩ
	5	Harness short (Harness internal short)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between wiring harness from ENG (female) (37) – SEGR (female) (1) and wiring harness from ENG (female) (47) – SEGR (female) (2)		Resistance	Min. 1 MΩ
			Between wiring harness from ENG (female) (37) – SEGR (female) (1) and wiring harness from ENG (female) (19) – SEGR (female) (3) (4)		Resistance	Min. 1 MΩ
			Between wiring harness from ENG (female) (47) – SEGR (female) (2) and wiring harness from ENG (female) (19) – SEGR (female) (3) (4)		Resistance	Min. 1 MΩ
	6	Defective engine controller	★ Prepare with starting switch OFF, and troubleshooting with starting switch ON or with engine started.			
			ENG		Voltage	
			Between (37) – (47)		4.75 – 5.25 V	

Circuit diagram related



Failure code [CA2272] (EGR valve lift sensor too low)

Action code	Failure code	Trouble	EGR valve lift sensor too low (Engine controller system)
E03	**CA2272**		
Contents of trouble	• Excessively low voltage has occurred in the EGR valve lift sensor circuit.		
Action of controller	• Operates by limiting output. • Closes EGR valve and bypass valve.		
Problem that appears on machine	• Output decreases.		
Related information			

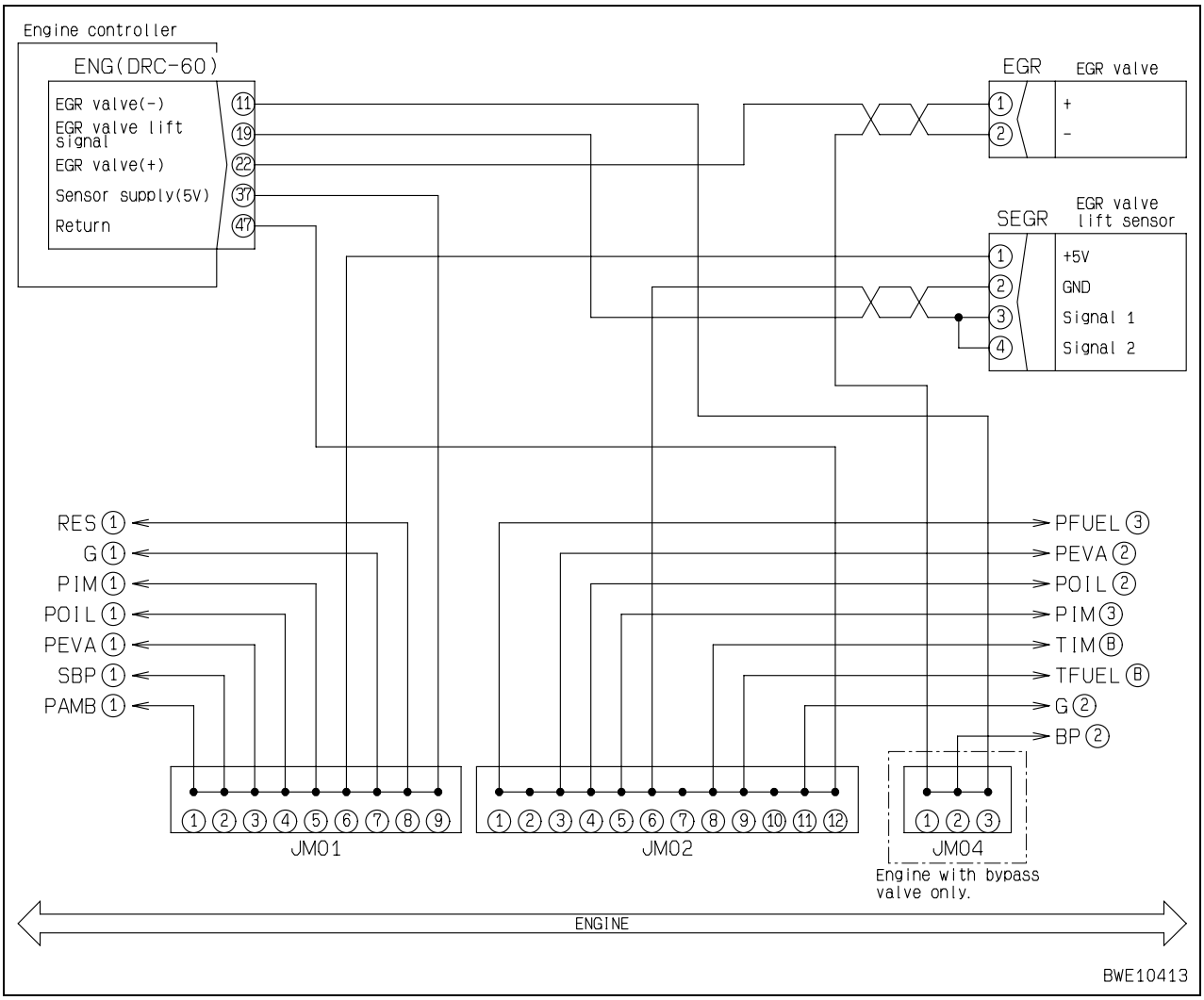
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of [**CA2271**].	

Failure code [CA2351] (EGR valve solenoid drive short circuit)

Action code	Failure code	Trouble	EGR valve solenoid drive short circuit (Engine controller system)
E03	**CA2351**		
Contents of trouble	• Short circuit has occurred in the drive circuit of EGR valve solenoid.		
Action of controller	• Operates by limiting output. • Closes EGR valve and bypass valve.		
Problem that appears on machine	• Output decreases.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective EGR valve solenoid (internal defect)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			EGR (male)	Resistance	
			Between (1) – (2)	10 – 21 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ENG (female) (22) – EGR (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ENG (female) (11) – EGR (female) (2)	Resistance	Max. 1 Ω
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness ENG (female) (22) – EGR (female) (1)	Resistance	Min. 1 MΩ
			Between ground and wiring harness ENG (female) (11) – EGR (female) (2)	Resistance	Min. 1 MΩ
	4	Hot short of wiring harness (a contact with 24V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ground and wiring harness ENG (female) (22) – EGR (female) (1)	Voltage	Max. 1 V
			Between ground and wiring harness ENG (female) (11) – EGR (female) (2)	Voltage	Max. 1 V
	5	Defective engine controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			ENG (female)	Resistance	
			Between (22) – (11)	10 – 21 Ω	

Circuit diagram related



Failure code [CA2352] (EGR valve solenoid drive disconnection)

Action code	Failure code	Trouble	EGR valve solenoid drive disconnection (Engine controller system)
E03	**CA2352**		
Contents of trouble	• Disconnection has occurred in the drive circuit of EGR valve solenoid.		
Action of controller	• Operates by limiting output. • Closes EGR valve and bypass valve.		
Problem that appears on machine	• Output decreases.		
Related information			

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of [**CA2351**].	

Failure code [CA2555] (Intake air heater relay disconnection)

Action code	Failure code	Trouble	Disconnection in intake air heater relay (Engine controller system)
E01	**CA2555**		
Contents of trouble	• Disconnection has occurred in intake air heater relay circuit.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• Startability of engine deteriorates in low temperature.		
Related information			

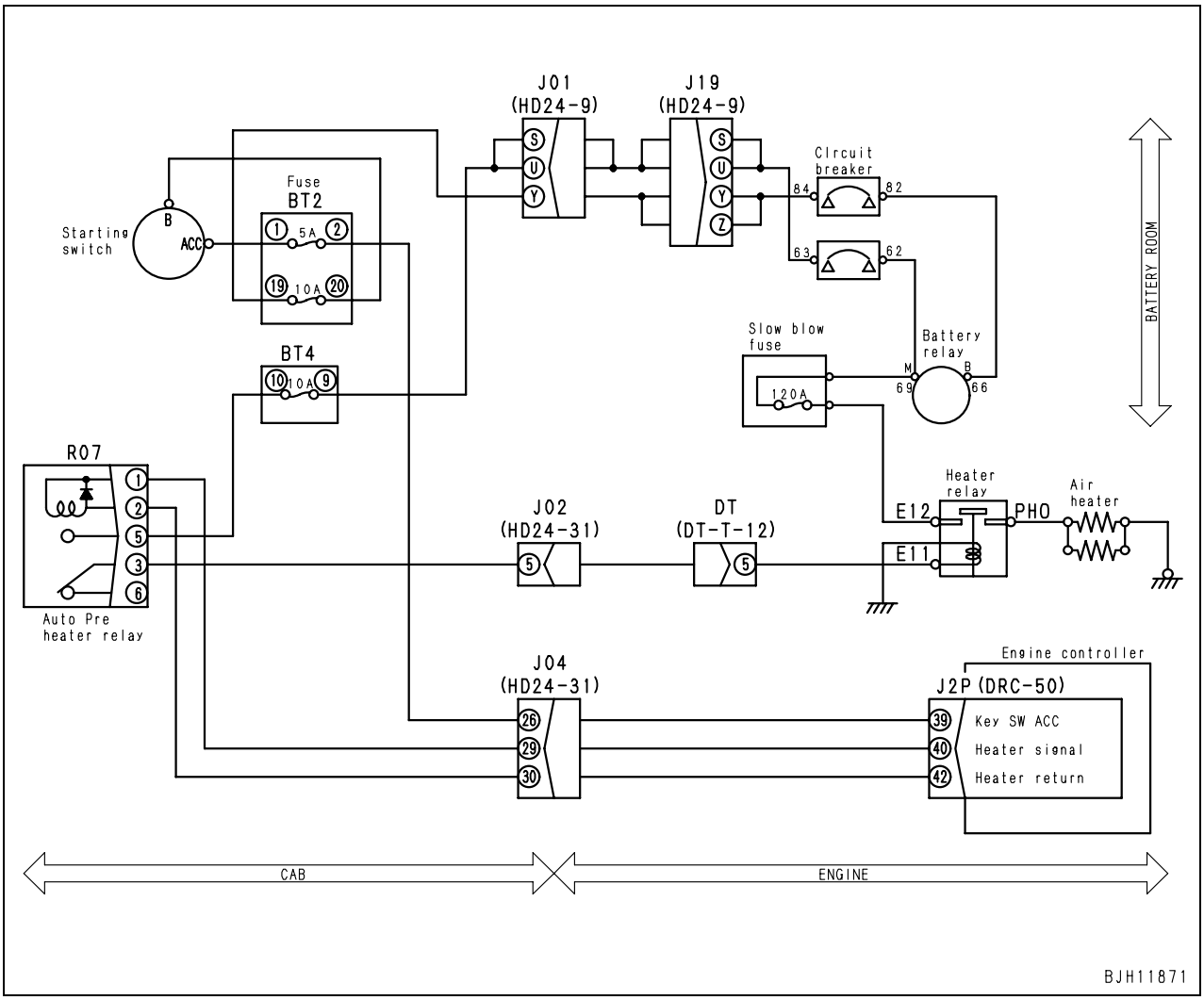
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting of [**CA2556**].	

Failure code [CA2556] (Intake air heater relay short circuit)

Action code	Failure code	Trouble	Short circuit in intake air heater relay (Engine controller system)
E01	**CA2556**		
Contents of trouble	• Short circuit has occurred in intake air heater relay circuit.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• Startability of engine deteriorates in low temperature.		
Related information	• The drive condition of heater relay varies depending on an equipped model.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective intake air heater relay (internal defect)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			R07 (male)	Resistance		
			Between (1) – (2)	200 – 400 Ω		
	2	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between J2P (female) (40) – R07 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between J2P (female) (42) – R07 (female) (2)	Resistance	Max. 1 Ω	
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between J2P (female) (40) – R07 (female) (1)	Resistance	Min. 1 MΩ	
			Between ground and wiring harness between J2P (female) (42) – R07 (female) (2)	Resistance	Min. 1 MΩ	
	4	Defective engine controlle	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			J2P	Heater relay	Voltage	
			Between (40) – (42)	At working condition	Max. 1 V	
				At stopping condition	20 – 30 V	

Circuit diagram related

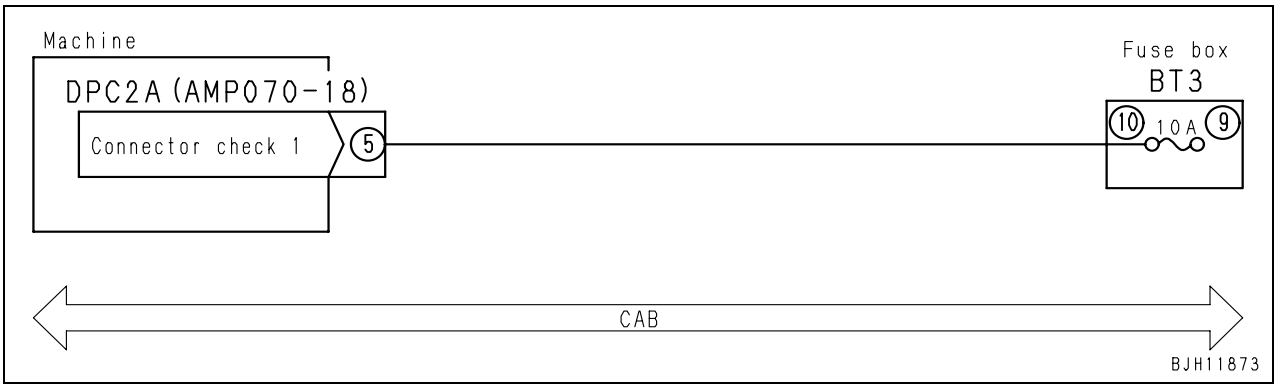


Failure code [DAF9KM] (Machine monitor connector: Error in operation or setting)

Action code	Failure code	Trouble	Machine monitor: Error in operation or setting (Wrong or defective connection of the connector) (Machine monitor system)
E03	**DAF9KM**		
Contents of trouble	• The connector check signal does not match with internal setting of machine monitor.		
Action of controller	• Only detects during a start. • Keeps the abnormal condition until starting switch is turned OFF. • Does not record as failure history information.		
Problem that appears on machine	• Machine monitor mode selector switch is not operable. • Optional function does not work. • Headlamp high beam pilot lamp, turn signal pilot lamp, output mode pilot lamp, etc. do not work.		
Related information	• Nothing particular.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Wrong connection of connector	The connector of connector check signal is connected normally. ★ Connector of connector check signal:**DPC2A (5)** (CLOSE)		
	2	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between fuse terminal BT3 (10) – DPC2A (female) (5)	Resistance	Max. 1 Ω
	3	Defective machine monitor	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between DPC2A (5) – body ground	Resistance	Min. 1 MΩ

Circuit diagram related

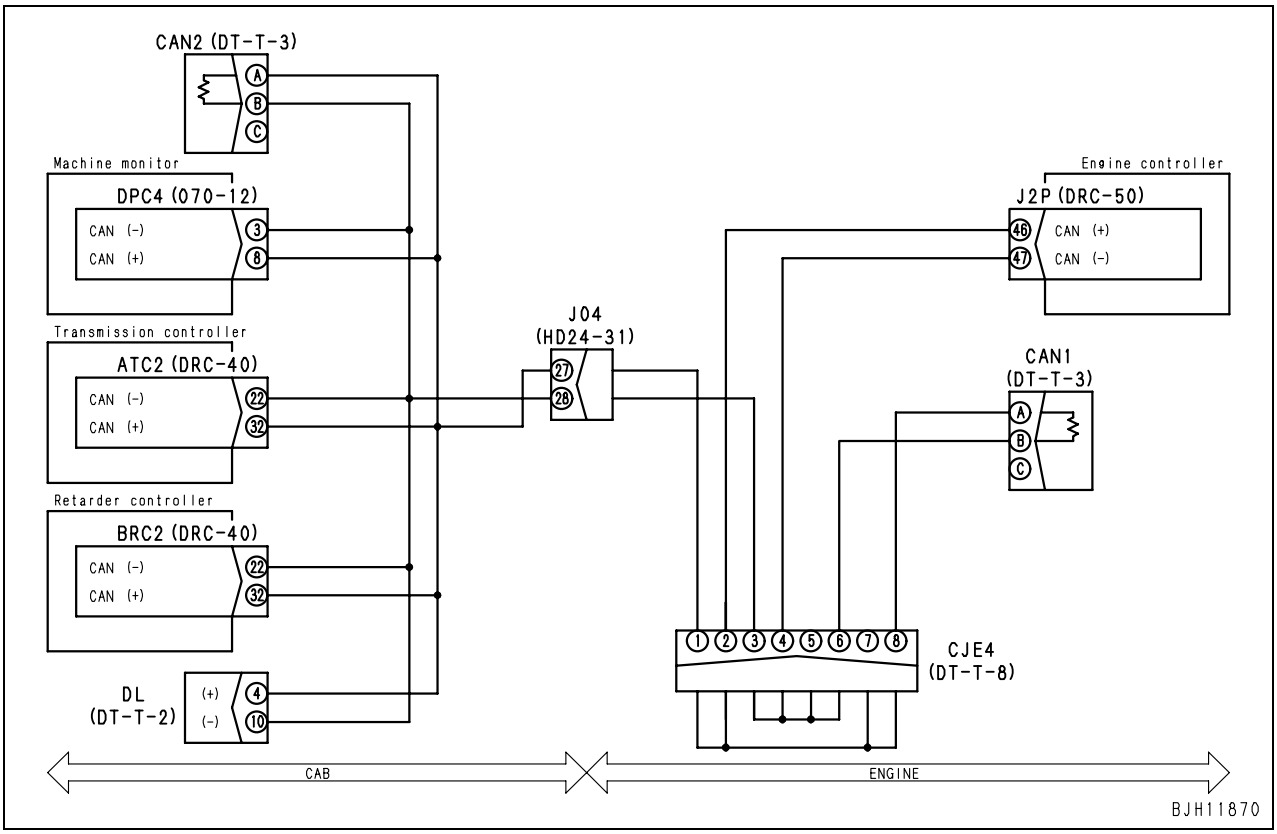


Failure code [DAFRKR] (Abnormal CAN communication (machine monitor): Abnormal communication)

Action code	Failure code	Trouble	Abnormal CAN communication (machine monitor): Abnormal communication (Machine monitor system)
E03	**DAFRKR**		
Contents of trouble	• Transmission controller stops updating the data received from the machine monitor.		
Action of controller	• Keeps the information at the time when abnormality occurred. • Turns on centralized warning lamp and sounds alarm buzzer.		
Problem that appears on machine	• When the network is abnormal, the machine monitor can not correctly display the data from each controller.		
Related information	• Check that the power source circuit of machine monitor is normal.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harnesses among J2P (female) (46) – CJE4 (female) (2), (8) – CAN1 (female) (A) – CJE4 (female) (7) – CAN2 (female) (A)	Resistance	Max. 1 Ω
			Wiring harnesses among J2P (female) (47) – CJE4 (female) (4), (6) – CAN1 (female) (B) – CJE (female) (5) – CAN2 (female) (B)	Resistance	Max. 1 Ω
			Wiring harnesses among CJE4 (female) (1) – DPC4 (female) (8) – ATC2 (female) (32) – BRC2 (female) (32) – DL (female) (4) – CAN2 (female) (A)	Resistance	Max. 1 Ω
			Wiring harnesses among CJE4 (female) (3) – DPC4 (female) (3) – ATC2 (female) (22) – BRC2 (female) (22) – DL (female) (10) – CAN (female) (B)	Resistance	Max. 1 Ω
	2	Short circuit of harness (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness among J2P (female) (46) – CJE4 (female) (2), (8) – CAN1	Resistance	Min. 1 MΩ
			Between ground and wiring harness among CJE4 (female) (1) – DPC4 (female) (8) – ATC (female) (32) – BRC2 (female) (32) – DL (female) (4) – CAN2 (female) (A)	Resistance	Min. 1 MΩ
	3	Defective CAN terminal resistance	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CAN1 (male) (A) – (B)	Resistance	40 – 80 Ω
			Between CAN2 (male) (A) – (B)	Resistance	120 Ω
	4	Defective machine monitor, engine controller, transmission controller or retarder controller	If no problem is found in causes 1 and 2, machine monitor, engine controller ,transmission controller or retarder controller can be suspected to be defective (since this is an internal defect, it cannot be diagnosed).		

Circuit diagram related

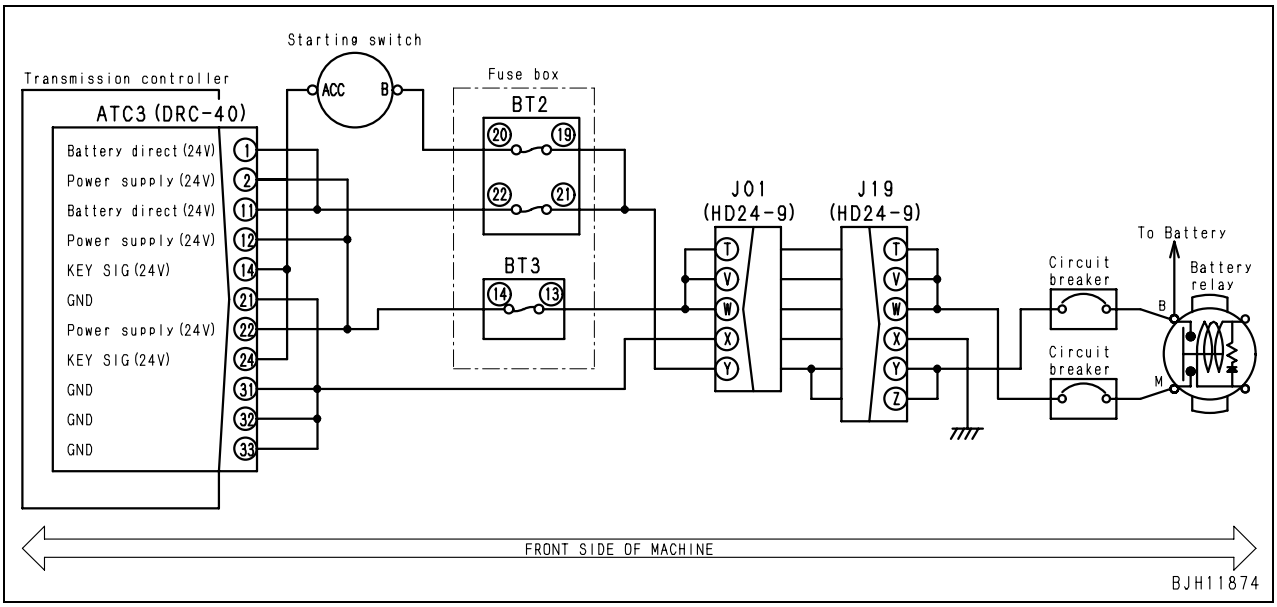


Failure code [DAQ0KK] (Transmission controller: Power source voltage too low)

Action code	Failure code	Trouble	Transmission controller: Power source voltage too low and input (KK) (Transmission controller system)
E03	**DAQ0KK**		
Contents of trouble	• While the engine is running, the voltage of both direct power source voltage circuits have become below 18V.		
Action of controller	• Holds the gear speed. • Keeps the neutral with gear shift lever N.		
Problem that appears on machine	• Suddenly shifts to neutral while traveling, and cannot move off again unless the voltage resumes to normal.		
Related information	• When the failure code [**AB00MA**] (defective alternator function) has occurred, carry out troubleshooting for it first. • If the fuse is blown, check for ground fault in the line between fuse-BRC3 (female) (1), (11), (14), and (24).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective battery	★ Check battery voltage and specific gravity.		
			Battery voltage	Voltage	Min. 24 V
			Battery specific gravity	Gravity	Min. 1.26
	2	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (21), (31), (32), (33) – body ground.	Resistance	Max. 1 Ω
			★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between battery relay B terminal – ground.	Voltage	20 – 30 V
			Between ATC3 (1), (11) – (21), (31), (32), (33)	Voltage	20 – 30 V
			Between ATC3 (14), (24) – (21), (31), (32), (33)	Voltage	20 – 30 V
			Between battery relay terminal M – ground	Voltage	20 – 30 V
			If there is voltage between battery relay terminal B – ground but there is no voltage between ATC3 (1), (11), (14), (24) – ground, the harness is disconnected.		
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ATC3 (1), (11) – (21), (31), (32), (33)	Voltage	20 – 30 V
			Between ATC3 (14), (24) – (21), (31), (32), (33)	Voltage	20 – 30 V

Circuit diagram related



Failure code [DAQ0KT] (Transmission nonvolatile memory: Abnormality in controller)

Action code	Failure code	Trouble	Transmission nonvolatile memory: Abnormality in controller (Transmission controller system)
E01	**DAQOKT**		
Contents of trouble	• An abnormality has occurred in the nonvolatile memory inside the controller.		
Action of controller	• Controls the model selection and option setting with default value. • Even if the cause of the failure has been eliminated automatically, the machine does not return to normal unless once resetting the starting switch OFF.		
Problem that appears on machine	• Machine control parameter may change and transmission gear shift shock and hoist seating shock may get worse.		
Related information	• Perform initial setting and initial adjustment as when transmission controller is replaced.		

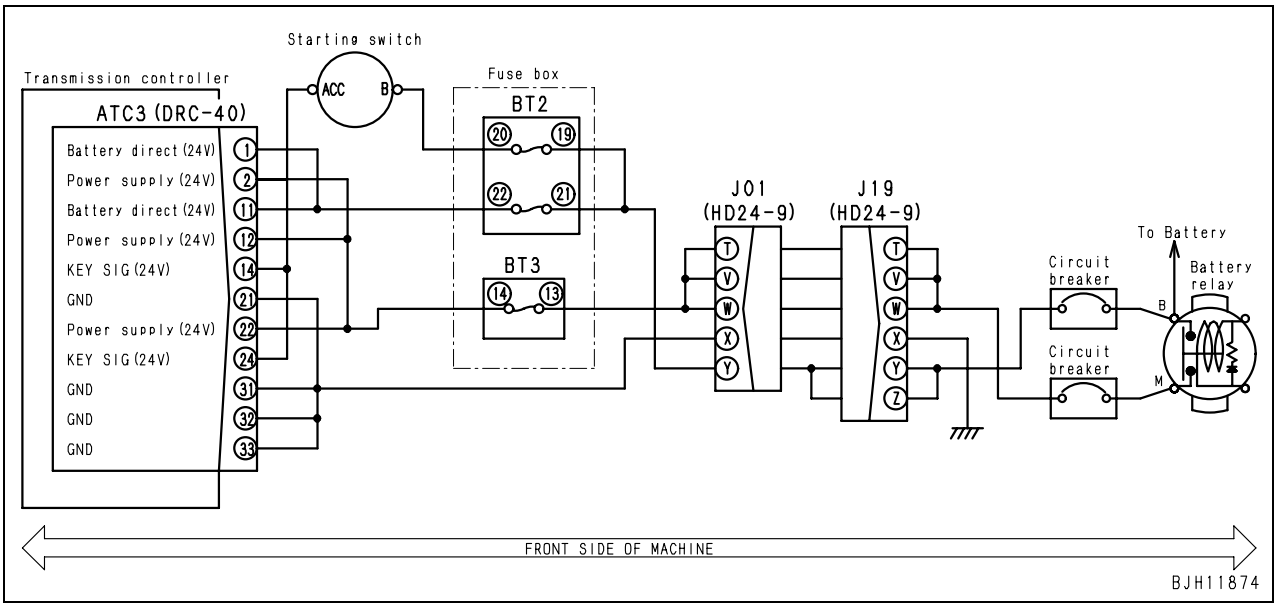
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective transmission controller	(Since this is an internal defect, it cannot be diagnosed.) (It is no problem to keep using controller unless any visible trouble symptom appears on machine.)

Failure code [DAQ2KK] (Transmission controller solenoid power source: Voltage too low)

Action code	Failure code	Trouble	Transmission controller solenoid power source: Power source too low and input (Transmission controller system)
E03	**DAQ2KK**		
Contents of trouble	• Battery direct power source voltage of transmission controller has dropped to below 20 V, and solenoid power source voltage has dropped to below 18 V.		
Action of controller	• Holds the gear speed. • Keeps neutral with shift lever neutral.		
Problem that appears on machine	• Suddenly shifts to neutral while traveling, and the machine cannot move off again.		
Related information	• When the fuse is blown, check for ground fault of line from fuse – ATC3 (female) (2), (12), (22).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between fuse BT3 (11) and ground.	Voltage	20 – 30 V
			Between ATC3 (2), (12), (22) – (21), (31), (32), (33) – R15 (female) (3)	Voltage	20 – 30 V
			If there is voltage between battery relay terminal M – ground but there is no voltage between ATC3 (2), (12), (22) – ground, a disconnection exists between them.		
	2	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ATC3 (2), (12), (22) – ground	Resistance	20 – 30 V

Circuit diagram related

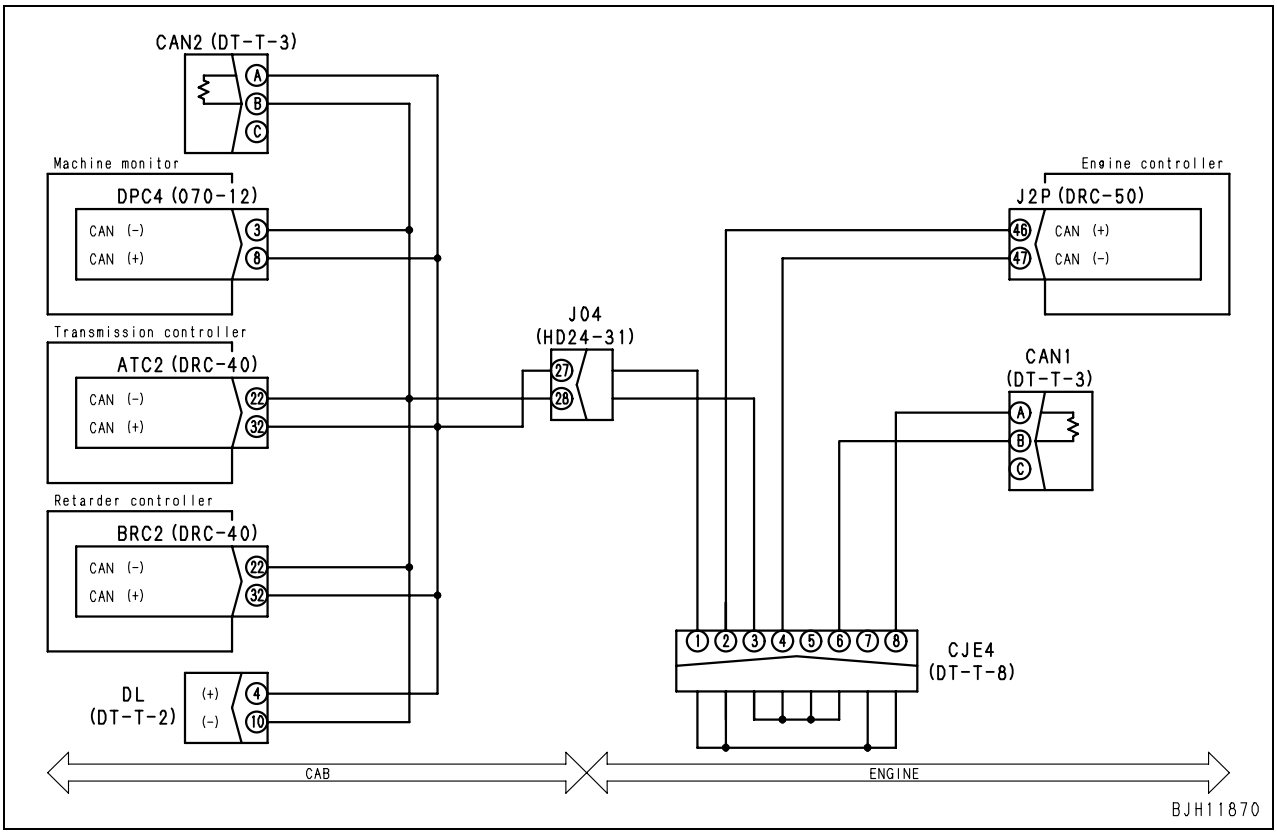


Failure code [DAQRKR] (COMMUNICATION LOST: Defective communication)

Action code	Failure code	Trouble	COMMUNICATION LOST: Defective communication (Transmission controller – machine monitor) (Machine monitor system)
E03	**DAQRKR**		
Contents of trouble	• Machine monitor cannot retrieve the information from transmission controller.		
Action of controller	• Keeps the information at the time when abnormality occurred. • Turns on centralized warning lamp and sounds alarm buzzer.		
Problem that appears on machine	• The information and special functions which are retrieved from transmission controller do not work or display.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective CAN terminal resistance	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CAN1 (male) (A) – (B)	Resistance	40 – 80 Ω
			Between CAN2 (male) (A) – (B)	Resistance	120 Ω
	2	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between DPC4 (female) (8), (3) – CAN2 (female) (A), (B)	Resistance	Max. 1 Ω
			Wiring harness between DPC4 (female) (8), (3) – ATC2 (female) (32), (22)	Resistance	Max. 1 Ω
			Wiring harness between DPC4 (female) (8), (3) – BRC2 (female) (32), (22)	Resistance	Max. 1 Ω
			Wiring harness between DPC4 (female) (8), (3) – J2P (female) (46), (47)	Resistance	Max. 1 Ω
			Wiring harness between DPC4 (female) (8), (3) – CAN1 (female) (A), (B)	Resistance	Max. 1 Ω
			Wiring harness between DPC4 (female) (8), (3) – DL (female) (4), (10)	Resistance	Max. 1 Ω
			Wiring harness between J2P (female) (46), (47) – CAN1 (female) (A), (B) – CAN2 (female) (A), (B)	Resistance	Max. 1 Ω
	3	Short circuit of harness (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness among DPC4 (female) (8) – CAN2 (female) (A)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between DPC4 (female) (8) – ATC2 (female) (32)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between DPC4 (female) (8) – J2P (female) (46)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between DPC4 (female) (8) – CAN1 (female) (A)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between DPC4 (female) (8) – DL (female) (4)	Resistance	Min. 1 MΩ
			Between ground and wiring harness among J2P (female) (46) – CAN1 (female) (A) – CAN2 (female) (A)	Resistance	Min. 1 MΩ
	4	Defective machine monitor, engine controller, transmission controller or brake controller	If no problem is found in causes 1 – 3, machine monitor, engine controller ,transmission controller and retarder controller can be suspected to be defective (since this is an internal defect, it cannot be diagnosed).		

Circuit diagram related



Failure code [DAQRMA] (Transmission controller option setting: Malfunction)

Action code	Failure code	Trouble	Transmission controller option setting: Malfunction (Machine monitor-transmission controller) (Machine monitor system)
E03	**DAQRMA**		
Contents of trouble	• Option setting signals inputted from machine monitor with the starting switch ON are different from the option settings that controller memorizes.		
Action of controller	• Holds the gear speed in neutral. • Controls with the option setting that the controller memorizes. • It does not return normal unless the starting switch is turned OFF.		
Problem that appears on machine	• The gear speed becomes neutral and the machine cannot move off again.		
Related information	• Perform initial setting and initial adjustment as when transmission controller is replaced.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective machine monitor	Defective option setting of machine monitor or internal defect of monitor

Failure code [DB10KT] (Retarder controller nonvolatile memory: Abnormality in controller)

Action code	Failure code	Trouble	Retarder controller nonvolatile memory: Abnormality in controller (Retarder controller system)
E01	**DB10KT**		
Contents of trouble	• An abnormality has occurred in the nonvolatile memory inside the controller.		
Action of controller	• Control the model selection and option setting with default value. • Even if the cause of the failure has been eliminated automatically, the machine does not return to normal unless once resetting the starting switch OFF.		
Problem that appears on machine	• Machine parameter may change and power may increase or decrease.		
Related information			

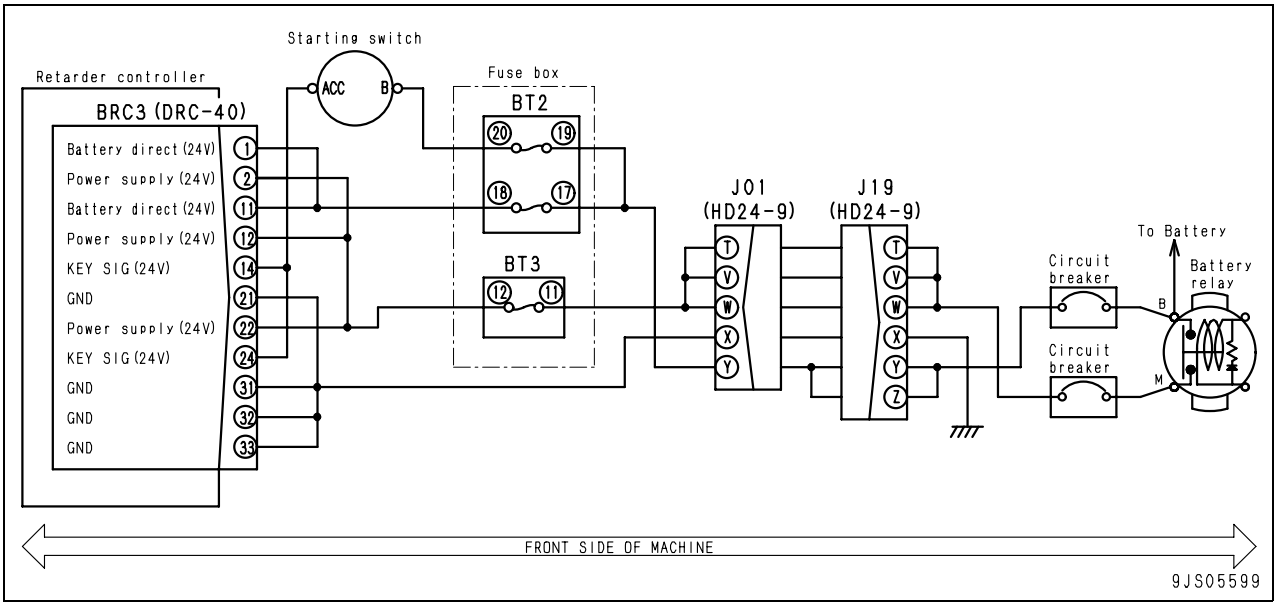
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective retarder controller	(Since this is an internal defect, it cannot be diagnosed.) (It is no problem to keep using controller unless any visible trouble symptom appears on machine.)

Failure code [DB12KK] (Retarder controller solenoid power source: Power source voltage too low)

Action code	Failure code	Trouble	Retarder controller solenoid power source: Power source voltage too low (Retarder controller system)
E03	**DB12KK**		
Contents of trouble	• While controller power source voltage is normal, solenoid power source voltage has become below 18 V.		
Action of controller	• Turns OFF all of output circuits. • Turns OFF sensor 24 V power source.		
Problem that appears on machine	• All systems of retarder controller do not operate. (retarder, dump, automatic suspension, ARSC and ASR) • Failure code (**DHU2KX** and **DHU3KX**) are displayed at the same time.		
Related information	• If the fuse is blown, check for ground fault of line from fuse – BRC3 (female) (2), (12), (22). • If failure code“**DAQ0KK**“ or “**DAQ2KK**“ (transmission controller power source) is displayed, carry out troubleshooting for it first.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between fuse BT3 (12) – ground.	Voltage	20 – 30 V
			Between BRC3 (2), (12), (22) – (21), (31), (32), (33)	Voltage	Max. 1 Ω
			When the voltage of fuse BT3 (12) is normal and the voltage of BRC3 (2), (12), (22) are defective, a disconnection exists in wiring harness between fuse (12) – BRC3 (female) (2), (12), (22).		
	2	Defective retarder controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between BRC3 (2), (12), (22) – ground	Voltage	20 – 30 V

Circuit diagram related

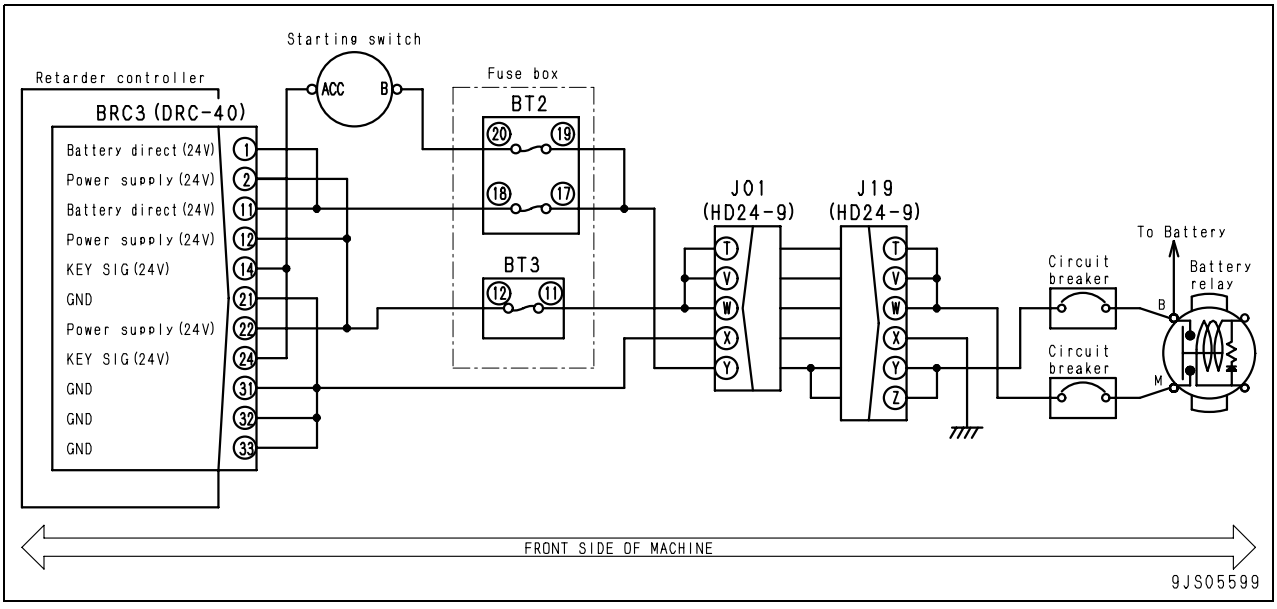


Failure code [DB13KK] (Retarder controller battery direct power source: Power source voltage too low)

Action code	Failure code	Trouble	Retarder controller battery direct power source: Power source voltage too low (Retarder controller system)
E03	**DB13KK**		
Contents of trouble	• Direct power source voltage circuit has become below 5V.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• There is no great influence on the machine.		
Related information	• When the fuse is blown, check the short circuit of line from fuse – BRC3 (female) (1), (11), (2), (12), (22). • If failure code“**DAQ0KK**“ or “**DAQ2KK**“ (transmission controller power source) is displayed, carry out troubleshooting for it first.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between fuse BT3 (18) – ground.	Voltage	20 – 30 V
			Wiring harness between BRC3 (female) (1), (11) – ground.	Voltage	20 – 30 V
			When the voltage of fuse BT3 (18) is normal and the voltage of BRC3 (1), (11) are defective, a disconnection exists in wiring harness between fuse (18) – BRC3 (female) (1), (11).		
	2	Defective retarder controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between BRC3 (1), (11) – (21), (31), (32), (33)	Voltage	20 – 30 V

Circuit diagram related



Failure code [DB19KQ] (Retarder controller model select signal: Inconsistent model selection signal)

Action code	Failure code	Trouble	Model selection signal: Inconsistent model selection signal (Retarder controller system)
—	**DB19KQ**		
Contents of trouble	• Model selection signals inputted from machine monitor with the starting switch ON are different from the model setting that controller memorizes.		
Action of controller	• Turns OFF all output. • Even if the cause of failure is repaired, the machine does not return to normal unless the starting switch is reset to OFF once. • Turns on centralized warning lamp and sounds alarm buzzer.		
Problem that appears on machine	• Even if the starting operation is carried out, the machine can not move off.		
Related information			

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective machine monitor	Improper setting of machine monitor or internal defect of monitor

Failure code [DB1QMA] (Retarder controller option setting: Malfunction)

Action code	Failure code	Trouble	Inconsistent retarder controller option setting (Retarder controller system)
—	**DB1QMA**		
Contents of trouble	• Option setting signals inputted from machine monitor with the starting switch ON are different from the option settings that retarder controller memorizes.		
Action of controller	• No particular action. • Controls with the option setting that the controller memorizes. • Even if the cause of failure is repaired, the machine does not return to normal unless the starting switch is reset to OFF once.		
Problem that appears on machine			
Related information			

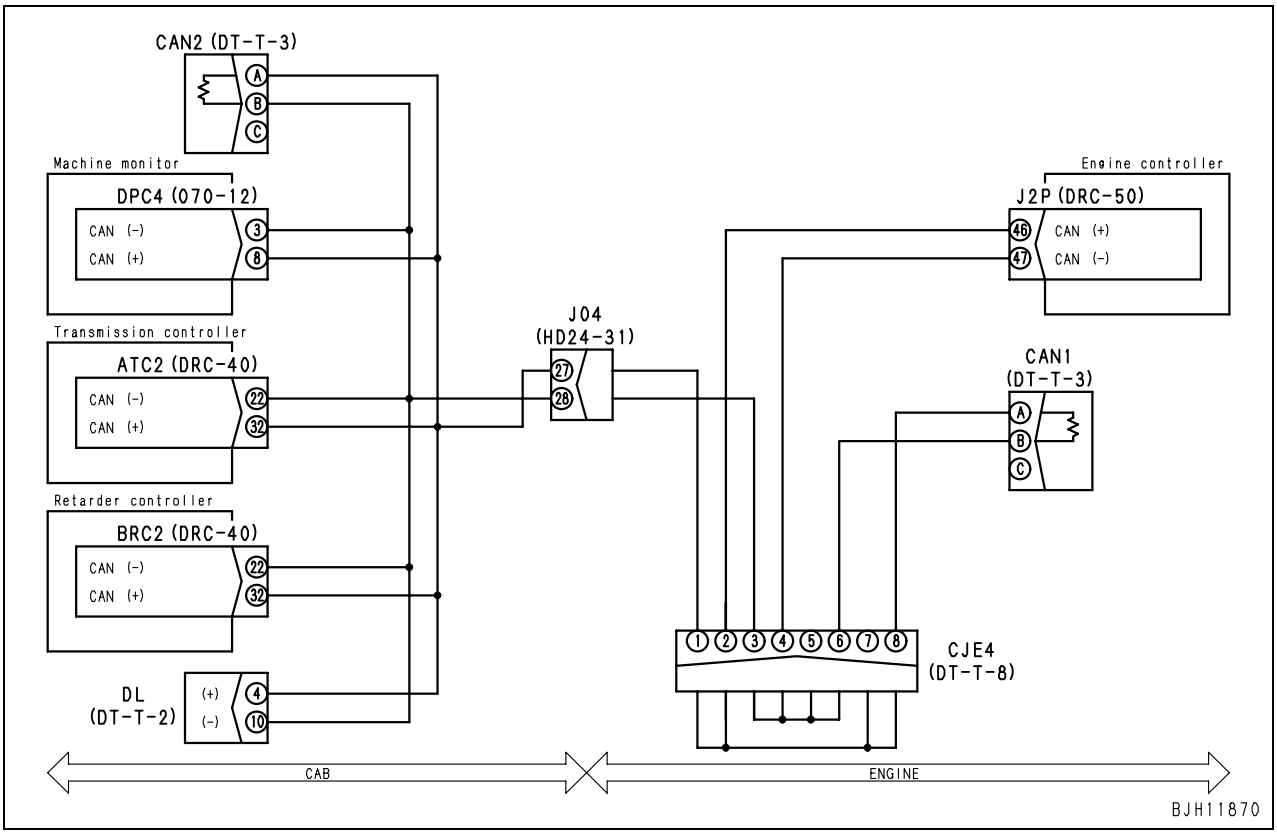
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective machine monitor	Improper setting of machine monitor or internal defect of monitor

Failure code [DB1RKR] (CAN communication (retarder controller): Communication disabled)

Action code	Failure code		Abnormal CAN communication (retarder controller): Communication disabled (Between retarder controller – transmission controller) (Retarder controller system)
E03	**DB1RKR**	Trouble	
Contents of trouble	• Updating of received data from retarder controller has stopped.		
Action of controller	• AISS is locked in LOW or Hi.(until starting switch is turned OFF.) • Keeps the information at the time when abnormality occurred. • Turns on centralized warning lamp and sounds alarm buzzer.		
Problem that appears on machine	• The information and special functions which are retrieved from retarder controller do not work or display.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective CAN terminal resistance	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CAN1 (male) (A) – (B)	Resistance	40 – 80 Ω
			Between CAN2 (male) (A) – (B)	Resistance	120 Ω
	2	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between DPC4 (female) (8), (3) – CAN2 (female) (A), (B)	Resistance	Max. 1 Ω
			Wiring harness between DPC4 (female) (8), (3) – BRC2 (female) (32), (22)	Resistance	Max. 1 Ω
			Wiring harness between DPC4 (female) (8), (3) – ATC2 (female) (32), (22)	Resistance	Max. 1 Ω
			Wiring harness between DPC4 (female) (8), (3) – J2P (female) (46), (47)	Resistance	Max. 1 Ω
			Wiring harness between DPC4 (female) (8), (3) – DL (female) (4), (10)	Resistance	Max. 1 Ω
			Wiring harness between DPC4 (female) (8), (3) – CAN1 (female) (A), (B)	Resistance	Max. 1 Ω
			Wiring harness between J2P (female) (46), (47) – CAN1 (female) (A), (B) – CAN2 (female) (A), (B)	Resistance	Max. 1 Ω
	3	Short circuit of harness (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness among DPC4 (female) (8) – CAN2 (female) (A)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between DPC4 (female) (8) – BRC2 (female) (32)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between DPC4 (female) (8) – ATC2 (female) (32)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between DPC4 (female) (8) – J2P (female) (46)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between DPC4 (female) (8) – CAN (female) (4)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between DPC4 (female) (8) – DL (female) (4)	Resistance	Min. 1 MΩ
			Between ground and wiring harness among J2P (female) (46) – CAN1 (female) (A) – CAN2 (female) (A)	Resistance	Min. 1 MΩ
	4	Defective machine monitor, engine controller, transmission controller or retarder controller	If no problem is found in causes 1 – 3, machine monitor, engine controller ,transmission controller and retarder controller can be suspected to be defective (since this is an internal defect, it cannot be diagnosed).		

Circuit diagram related



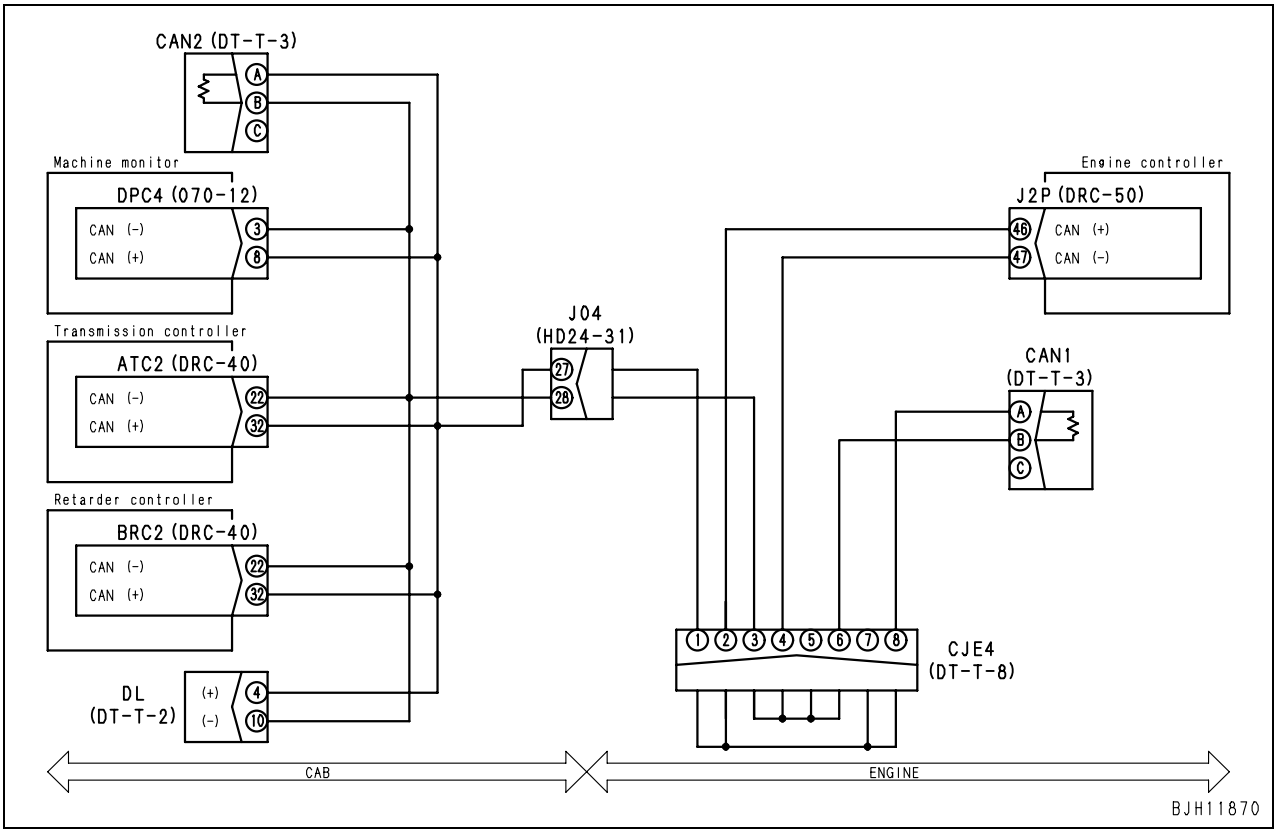
Failure code [DB2RKR] (CAN communication (engine controller): Communication disabled)

Action code	Failure code	Trouble	CAN communication (engine controller): Communication disabled (Between engine controller – transmission controller) (Engine controller system)
E03	**DB2RKR**		
Contents of trouble	• Updating of received data from engine controller has stopped.		
Action of controller	• Holds the gear speed. • Keeps the neutral with gear shift lever N. • Turns on centralized warning lamp and sounds alarm buzzer.		
Problem that appears on machine	• The information and special functions which are retrieved from engine controller do not work or display.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective CAN terminal resistance	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CAN1 (male) (A) – (B)	Resistance	40 – 80 Ω
			Between CAN2 (male) (A) – (B)	Resistance	120 Ω
	2	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between DPC4 (female) (8), (3) – CAN2 (female) (A), (B)	Resistance	Max. 1 Ω
			Wiring harness between DPC4 (female) (8), (3) – J2P (female) (46), (47)	Resistance	Max. 1 Ω
			Wiring harness between DPC4 (female) (8), (3) – ATC2 (female) (32), (22)	Resistance	Max. 1 Ω
			Wiring harness between DPC4 (female) (8), (3) – BRC2 (female) (32), (22)	Resistance	Max. 1 Ω
			Wiring harness between DPC4 (female) (8), (3) – CAN1 (female) (A), (B)	Resistance	Max. 1 Ω
			Wiring harness between DPC4 (female) (8), (3) – DL (female) (4), (10)	Resistance	Max. 1 Ω
			Wiring harness between J2P (female) (46), (47) – CAN1 (female) (A), (B) – CAN2 (female) (A), (B)	Resistance	Max. 1 Ω
	3	Short circuit of harness (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness among DPC4 (female) (8) – CAN2 (female) (A)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between DPC4 (female) (8) – J2P (female) (46)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between DPC4 (female) (8) – ATC2 (female) (32)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between DPC4 (female) (8) – BRC2 (female) (32)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between DPC4 (female) (8) – CAN1 (female) (A)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between DPC4 (female) (8) – DL (female) (4)	Resistance	Min. 1 MΩ
			Between ground and wiring harness among J2P (female) (46) – CAN1 (female) (A) – CAN2 (female) (A)	Resistance	Min. 1 MΩ
	4	Detective engine controller power supply	As the engine controller power supply can be detective, carry out troubleshooting for "Failure code CA111".		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	5	Defective machine monitor, engine controller, transmission controller or retarder controller	If no problem is found in causes 1 – 3, machine monitor, engine controller ,transmission controller and retarder controller can be suspected to be defective (since this is an internal defect, it cannot be diagnosed).

Circuit diagram related



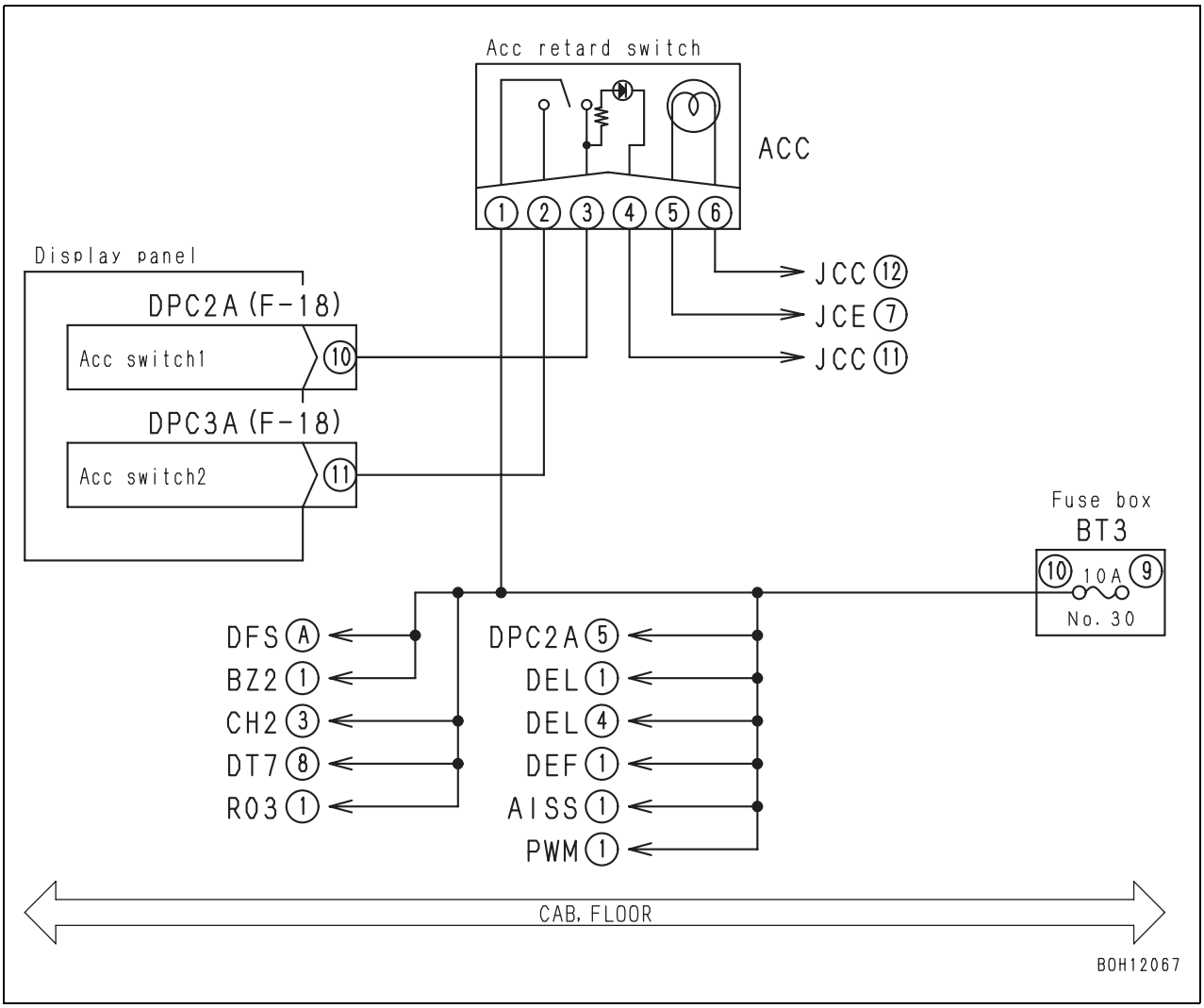
Failure code [DD1ML4] Disagreement of accelerator-linked retarder switch signal

Action code	Failure code	Trouble	Disagreement of accelerator-linked retarder switch signal (Transmission controller system)
E01	DD1ML4		
Contents of trouble	• Switch 1 signal and switch 2 signal of accelerator-linked retarder switch are turned ON simultaneously. • Switch 1 signal and switch 2 signal of accelerator-linked retarder switch are turned OFF simultaneously.		
Action of machine monitor	• Stops operation of accelerator-linked retarder.		
Problem that appears on machine	• Accelerator-linked retarder does not operate.		
Related information	• Signal of accelerator-linked retarder switch is input to machine monitor and then its information is transmitted to transmission controller through communication system. • Operation of accelerator-linked retarder switch can be checked with monitoring function. (Monitoring code: MONITOR PANEL - D-IN---0------7 - 40900) (Monitoring code: MONITOR PANEL - D-IN-24-----31 - 40903) • 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	Trip of circuit breaker (30 A)	If circuit breaker has tripped, circuit probably has ground fault. (See cause 5.)			
	2	Defective fuse (BT3-No. 30)	If fuse is broken, circuit probably has ground fault. (See cause 5.)			
	3	Defective accelerator-linked retarder switch (Internal defect)	ACC (female)	Accelerator-linked retarder switch	Resistance	
			Between (1) – (2)	Upper	Min. 1 MΩ	
				Lower	Max. 1 Ω	
			Between (1) – (3)	Upper	Max. 1 Ω	
				Lower	Min. 1 MΩ	
	4	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between DPC2A (female) (10) – ACC (female) (3)		Resistance	Max. 1 Ω
			Wiring harness between DPC3A (female) (11) – ACC (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between AAC (male) (1) – fuse BT3-No. 30 (10)		Resistance	Max. 1 Ω
	5	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 DPC2A (female) (10) – ACC (female) (3)		Resistance	Min. 1 MΩ
			Wiring harness between DPC3A (female) (11) – ACC (female) (2)		Resistance	Min. 1 MΩ
			Wiring harness between AAC (male) (1) – fuse BT3-No. 30 (10)		Resistance	Min. 1 MΩ
	6	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 DPC2A (female) (10) – ACC (female) (3)		Voltage	Max. 1 V
			Wiring harness between DPC3A (female) (11) – ACC (female) (2)		Voltage	Max. 1 V

<table>
<tr><td rowspan="8">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="7">7</td><td rowspan="7">Defective machine monitor</td><td colspan="3">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td>DPC2A, DPC3A</td><td>Accelerator-linked retarder switch</td><td>Voltage</td></tr>
<tr><td rowspan="2">Between DPC2A (10) – chassis ground</td><td>Upper</td><td>20 – 30 V</td></tr>
<tr><td>Lower</td><td>Max. 1 V</td></tr>
<tr><td rowspan="2">Between DPC3A (11) – chassis ground</td><td>Upper</td><td>Max. 1 V</td></tr>
<tr><td>Lower</td><td>20 – 30 V</td></tr>
<tr><td>8</td><td>Defective transmission controller</td><td colspan="3">If causes 1 – 7 are not detected, transmission controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)</td></tr>
</table>

Circuit diagram related to accelerator-linked retarder switch

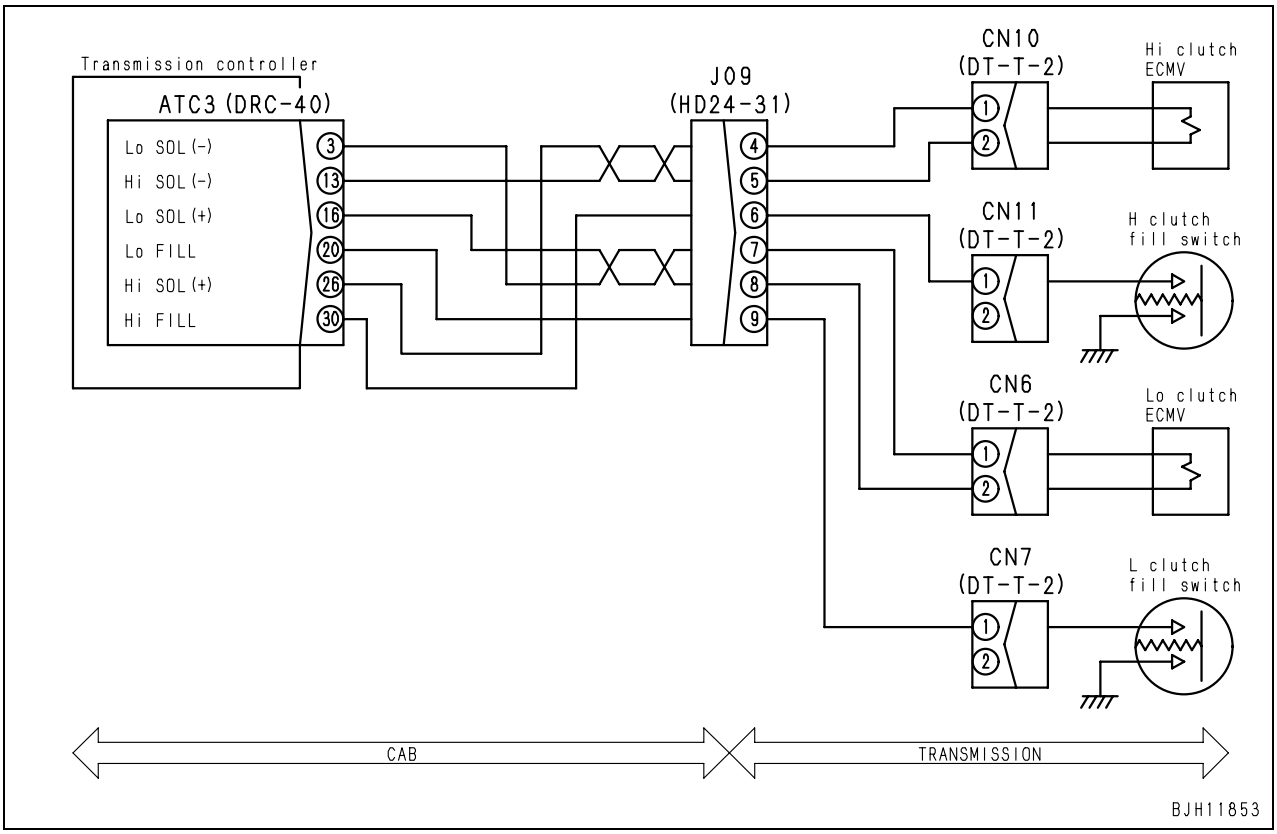


Failure code [DDTHKA] (Fill switch for Hi clutch: Disconnection)

Action code	Failure code	Trouble	Fill switch for Hi clutch: Disconnection (Specified holding pressure, fill switch OFF, no slip) (Transmission controller system)
E03	**DDTHKA**		
Contents of trouble	• When output to Hi clutch ECMV is turned “ON“, clutch engages, but the signal from fill switch does not come “ON“.		
Action of controller	• Holds gear speed during traveling. • Holds neutral when gear shift lever is set to “N“.		
Problem that appears on machine	• Cannot change gear speed. • Once gear shift lever is set to “N“, cannot restart until machine stops.		
Related information	• Since a fill signal is detected when it is output to ECMV, be sure to perform the duplication operation under the same conditions for the confirmation after repair. • Input state of fill signal can be checked with monitoring function (code: **41801**).		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective Hi clutch fill switch	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between CN11 (male) (30) – ground	When released	Resistance	Min. 1 MΩ
				When engaged	Resistance	Max. 1 Ω
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ATC3 (female) (30) – CN11 (female) (1)		Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ATC3 (female) (30) – ground	When released	Resistance	Min. 1 MΩ
				When engaged	Resistance	Max. 1 Ω

Circuit diagram related

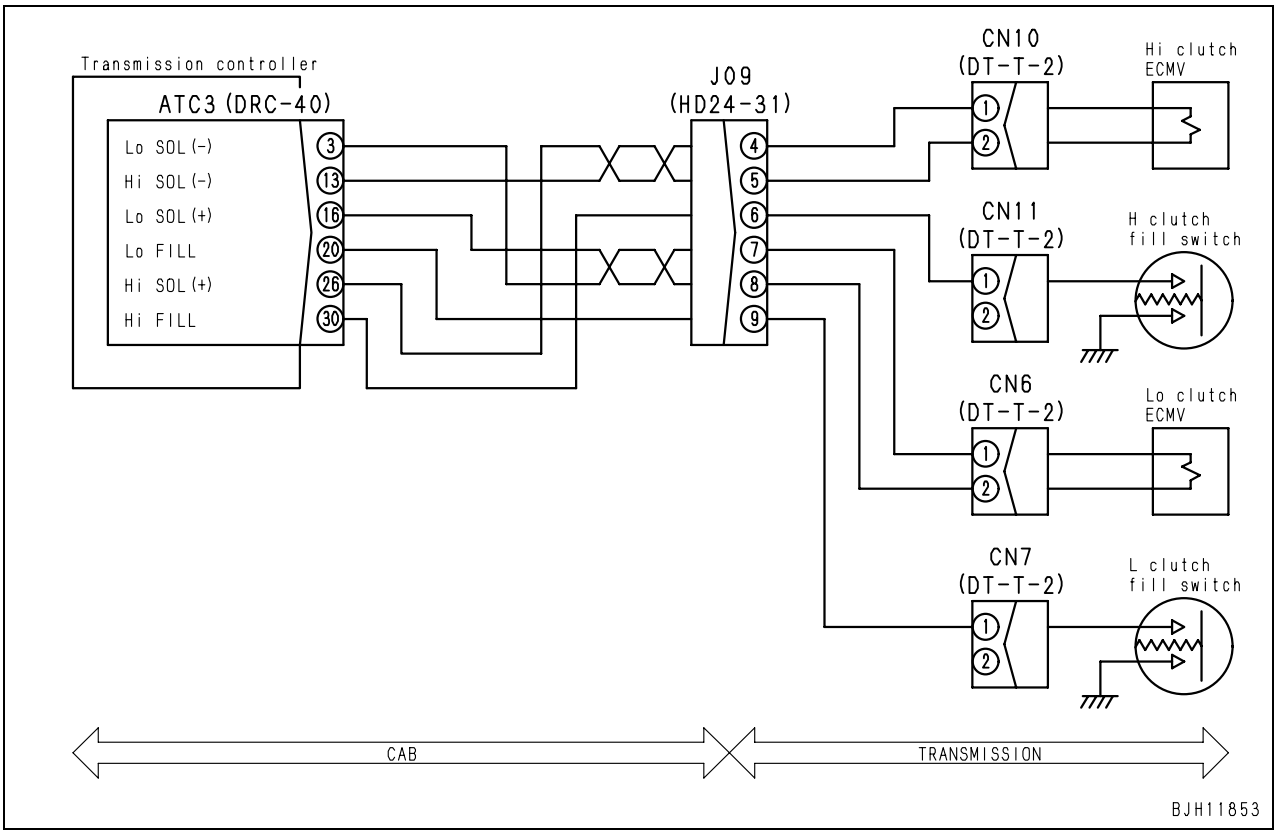


Failure code [DDTJKA] (Fill switch for Lo clutch: Disconnection)

Action code	Failure code	Trouble	Fill switch for Lo clutch : Disconnection (Specified holding pressure, fill switch OFF, no slip) (Transmission controller system)
E03	**DDTJKA**		
Contents of trouble	• When output to Lo clutch ECMV is turned “ON“, clutch engages, but signal from fill switch does not come “ON“.		
Action of controller	• Holds gear speed during traveling. • Holds neutral when gear shift lever is set to “N“.		
Problem that appears on machine	• Cannot change gear speed. • Once gear shift lever is set to “N“, cannot restart until machine stops.		
Related information	• Since a fill signal is detected when it is output to ECMV, be sure to perform the duplication operation under the same conditions for the confirmation after repair. • Input state of fill signal can be checked with monitoring function (code: **41800**).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective Lo clutch fill switch	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between CN7 (male) (1) – body ground	When released	Resistance	Min. 1 MΩ
				When engaged	Resistance	Max. 1 Ω
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ATC3 (female) (20) – CN7 (female) (1)		Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ATC3 (female) (20) – ground	When released	Resistance	Min. 1 MΩ
				When engaged	Resistance	Max. 1 Ω

Circuit diagram related

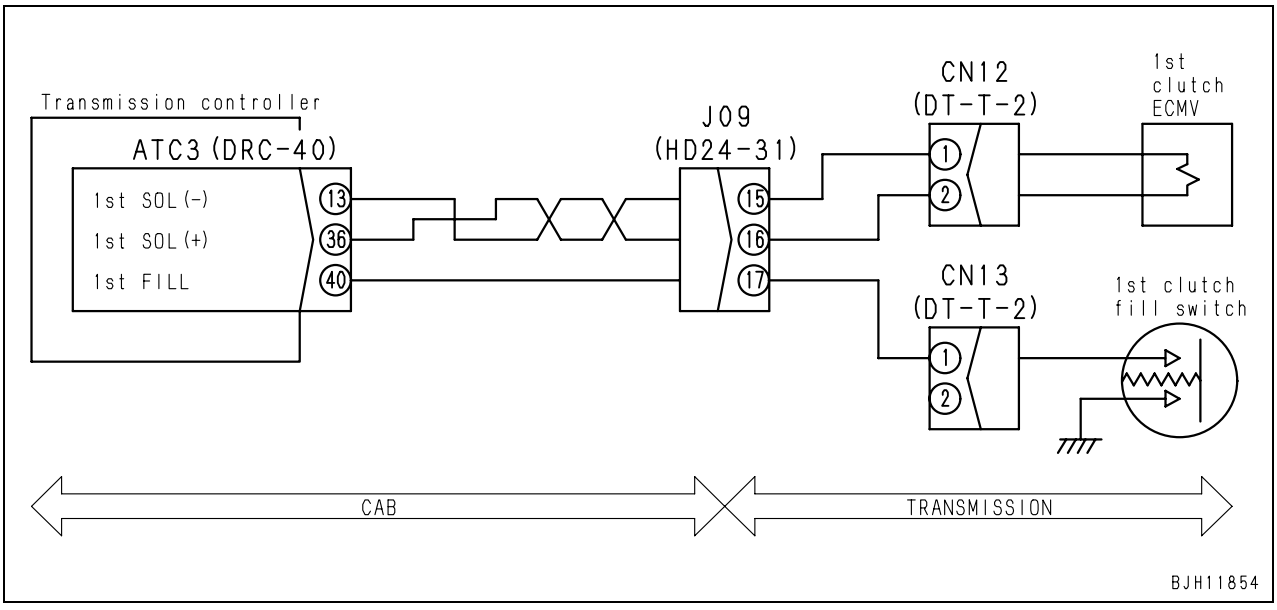


Failure code [DDTKKA] (Fill switch for 1st clutch: Disconnection)

Action code	Failure code	Trouble	Fill switch for 1st clutch: Disconnection (Specified holding pressure, fill switch OFF, no slip) (Transmission controller system)
E03	**DDTKKA**		
Contents of trouble	• When output to 1st clutch ECMV is turned “ON“, clutch engages, but signal from fill switch does not come “ON“.		
Action of controller	• Holds gear speed during traveling. • Holds neutral when gear shift lever is set to “N“.		
Problem that appears on machine	• Cannot change gear speed. • Once gear shift lever is set to “N“, cannot restart until machine stops.		
Related information	• Since a fill signal is detected when it is output to ECMV, be sure to perform the duplication operation under the same conditions for the confirmation after repair. • Input state of fill signal can be checked with monitoring function (code: **41802**).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 1st clutch fill switch	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between CN13 (male) (1) – ground	When released	Resistance	Min. 1 MΩ
				When engaged	Resistance	Max. 1 Ω
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ATC3 (female) (40) – CN13 (female) (1)		Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ATC3 (female) (40) – ground	When released	Resistance	Min. 1 MΩ
				When engaged	Resistance	Max. 1 Ω

Circuit diagram related

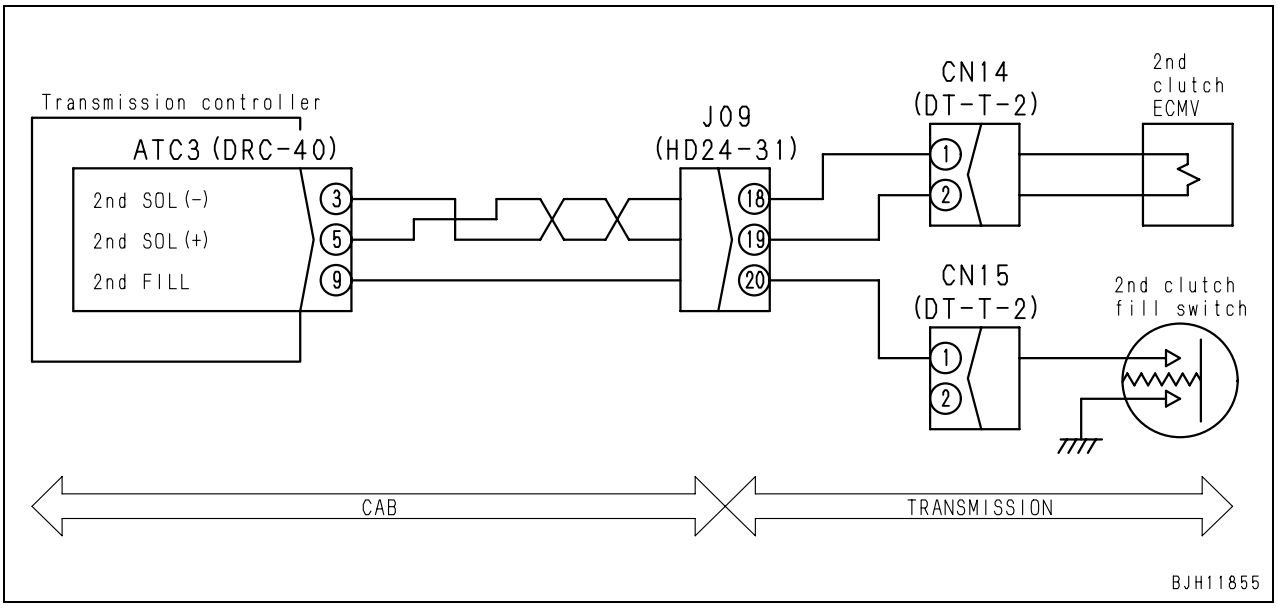


Failure code [DDTLKA] (Fill switch for 2nd clutch: Disconnection)

Action code	Failure code	Trouble	Fill switch for 2nd clutch: Disconnection (Specified holding pressure, fill switch OFF, no slip) (Transmission controller system)
E03	**DDTLKA**		
Contents of trouble	• When output to 2nd clutch ECMV is turned “ON“, clutch engages, but signal from fill switch does not come “ON“.		
Action of controller	• Holds gear speed during traveling. • Holds neutral when gear shift lever is set to “N“.		
Problem that appears on machine	• Cannot change gear speed. • Once gear shift lever is set to “N“, cannot restart until machine stops.		
Related information	• Since a fill signal is detected when it is output to ECMV, be sure to perform the duplication operation under the same conditions for the confirmation after repair. • Input state of fill signal can be checked with monitoring function (code: **41803**).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fill switch for 2nd clutch	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between CN15 (male) (1) – ground	When released	Resistance	Min. 1 MΩ
				When engaged	Resistance	Max. 1 Ω
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ATC3 (female) (9) – CN15 (female) (1)		Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ATC3 (female) (9) – ground	When released	Resistance	Min. 1 MΩ
				When engaged	Resistance	Max. 1 Ω

Circuit diagram related

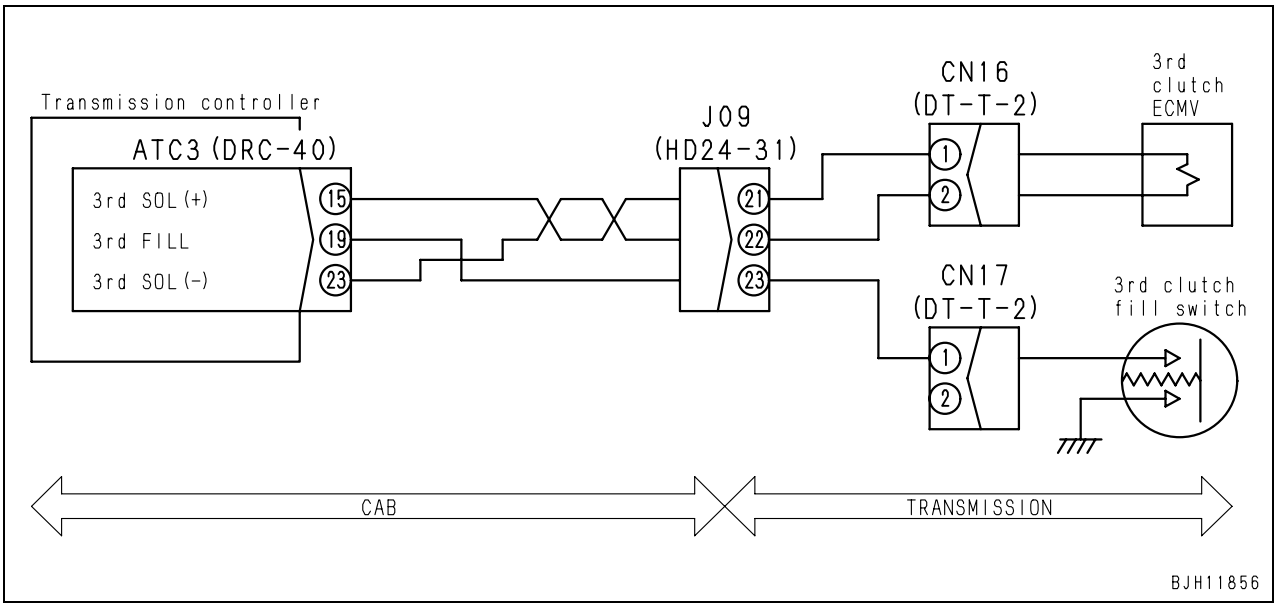


Failure code [DDTMKA] (Fill switch for 3rd clutch: Disconnection)

Action code	Failure code	Trouble	Fill switch for 3rd clutch: Disconnection (Specified holding pressure, fill switch OFF, no slip) (Transmission controller system)
E03	**DDTMKA**		
Contents of trouble	• When output to 3rd clutch ECMV is turned “ON“, clutch engages, but signal from fill switch does not come “ON“.		
Action of controller	• Holds gear speed during traveling. • Holds neutral when gear shift lever is set to “N“.		
Problem that appears on machine	• Cannot change gear speed. • Once gear shift lever is set to “N“, cannot restart until machine stops.		
Related information	• Since a fill signal is detected when it is output to ECMV, be sure to perform the duplication operation under the same conditions for the confirmation after repair. • Input state of fill signal can be checked with monitoring function (code: **41804**).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 3rd clutch fill switch	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between CN17 (male) (1) – ground	When released	Resistance	Min. 1 MΩ
				When engaged	Resistance	Max. 1 Ω
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ATC3 (female) (19) – CN17 (female) (1)		Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ATC3 (female) (19) – body ground	When released	Resistance	Min. 1 MΩ
				When engaged	Resistance	Max. 1 Ω

Circuit diagram related

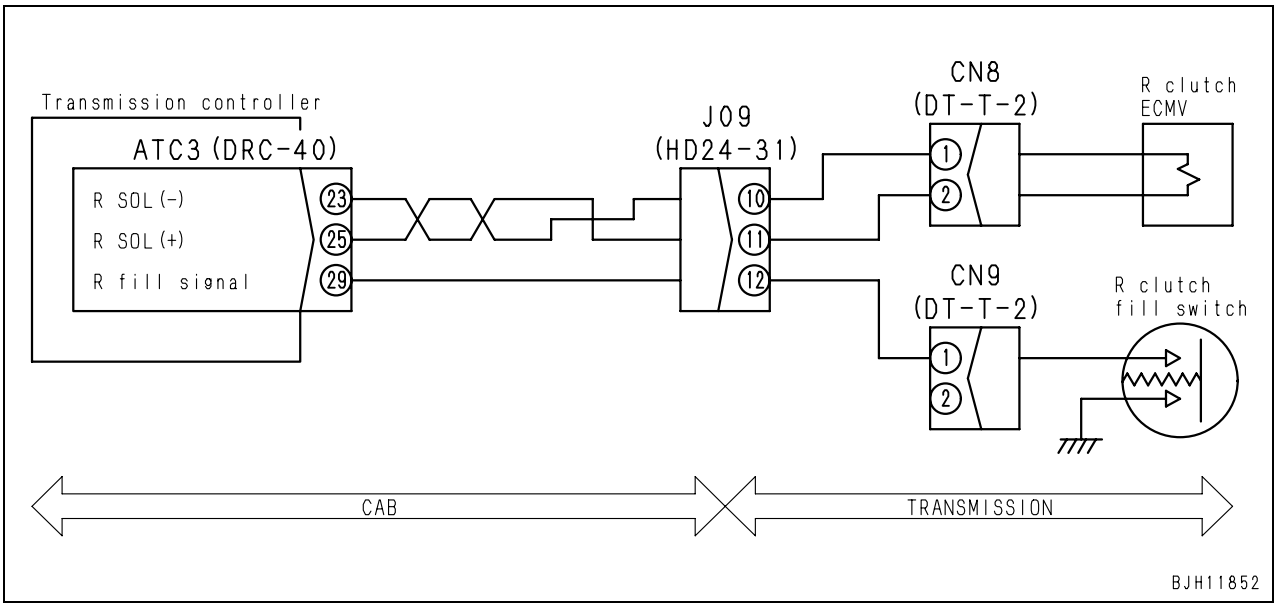


Failure code [DDTNKA] (Fill switch for R clutch: Disconnection)

Action code	Failure code	Trouble	Fill switch for R clutch: Disconnection (Specified holding pressure, fill switch OFF, no slip) (Transmission controller system)
E03	**DDTNKA**		
Contents of trouble	• When output to R clutch ECMV is turned “ON“, clutch engages, but signal from fill switch does not come “ON“.		
Action of controller	• Holds gear speed during traveling. • Holds neutral when gear shift lever is set to “N“.		
Problem that appears on machine	• Cannot change gear speed. • Once gear shift lever is set to “N“, cannot restart until machine stops.		
Related information	• Since a fill signal is detected when it is output to ECMV, be sure to perform the duplication operation under the same conditions for the confirmation after repair. • Input state of fill signal can be checked with monitoring function (code: **41806**).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective for R clutch fill switch	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between CN9 (male) (1) – ground	When released	Resistance	Min. 1 MΩ
				When engaged	Resistance	Max. 1 Ω
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ATC3 (female) (29) – CN9 (female) (1)		Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ATC3 (female) (29) – ground	When released	Resistance	Min. 1 MΩ
				When engaged	Resistance	Max. 1 Ω

Circuit diagram related



Failure code [DF10KA] (Gear shift lever: Disconnection)

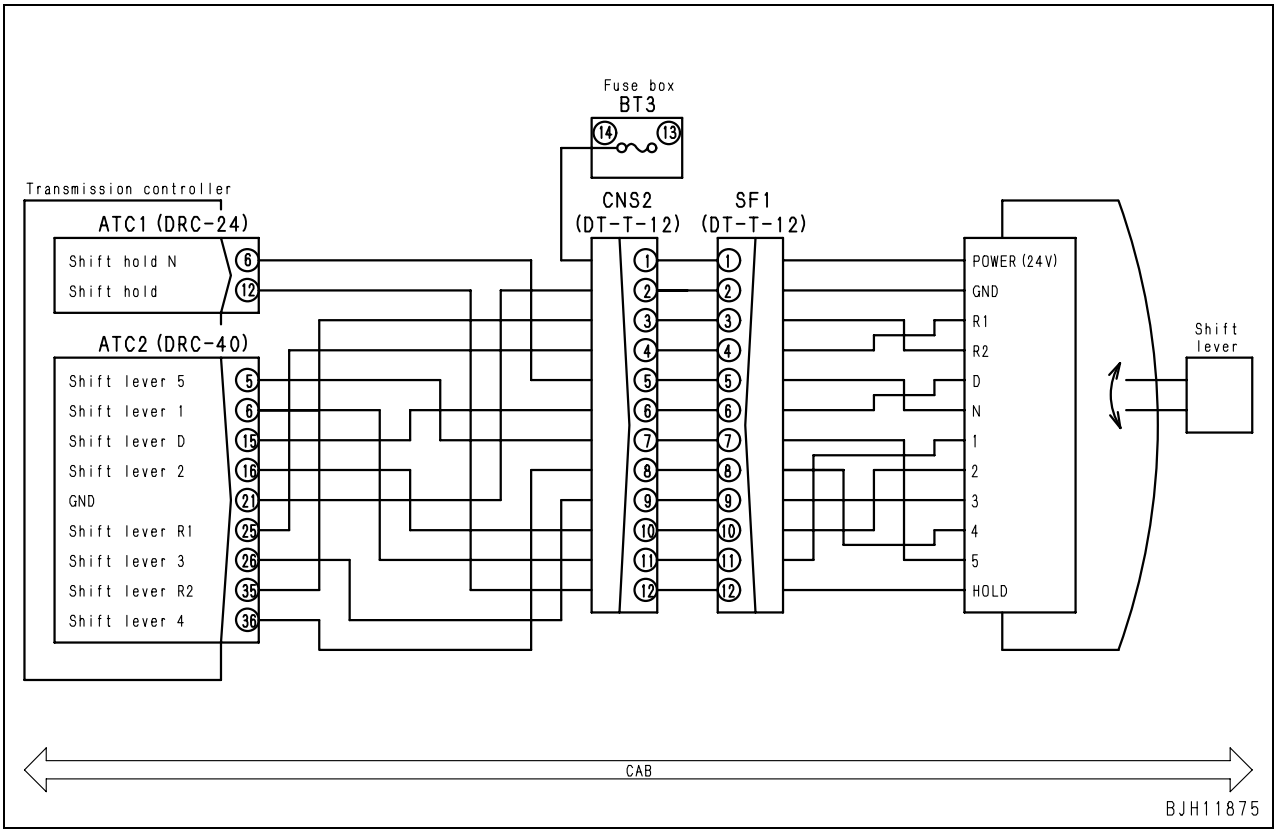
Action code	Failure code	Trouble	Gear shift lever: Disconnection (Transmission controller system)
E03	**DF10KA**		
Contents of trouble	• Gear shift lever signal is not input at all.		
Action of controller	• Controls according to previous gear shift lever information before abnormality occurs.		
Problem that appears on machine	• Gear speed is still in neutral and cannot start vehicle. • Cannot shift between forward and reverse positions. • All gear shift lever position lamps go out.		
Related information	• Nothing particular.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Operational error	• Gear shift lever is being pushed even though it is not operated.		
			• Gear shift lever has been stopped at the midway point between each of the gear positions.		
	2	Disconnection in wiring harness (Disconnection or defective contact of connectors)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Harness between BT3 (14) – SF1 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ATC2 (female) (35) – SF1 (female) (3)	Resistance	Max. 1 Ω
			Wiring harness between ATC2 (female) (25) – SF1 (female) (4)	Resistance	Max. 1 Ω
			Wiring harness between ATC1 (female) (6) – SF1 (female) (5)	Resistance	Max. 1 Ω
			Wiring harness between ATC2 (female) (15) – SF1 (female) (6)	Resistance	Max. 1 Ω
			Wiring harness between ATC2 (female) (5) – SF1 (female) (7)	Resistance	Max. 1 Ω
			Wiring harness between ATC2 (female) (36) – SF1 (female) (8)	Resistance	Max. 1 Ω
			Wiring harness between ATC2 (female) (26) – SF1 (female) (9)	Resistance	Max. 1 Ω
			Wiring harness between ATC2 (female) (16) – SF1 (female) (10)	Resistance	Max. 1 Ω
			Wiring harness between ATC2 (female) (6) – SF1 (female) (11)	Resistance	Max. 1 Ω
			Wiring harness between ATC1 (female) (12) – SF1 (female) (12)	Resistance	Max. 1 Ω
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between ATC2 (female) (35) – SF1 (female) (3)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between ATC2 (female) (25) – SF1 (female) (4)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between ATC1 (female) (6) – SF1 (female) (5)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between ATC2 (female) (15) – SF1 (female) (6)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between ATC2 (female) (5) – SF1 (female) (7)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between ATC2 (female) (36) – SF1 (female) (8)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between ATC2 (female) (26) – SF1 (female) (9)	Resistance	Min. 1 MΩ

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	3	Defective harness grounding (Contact with ground circuit)	Between ground and wiring harness between ATC2 (female) (16) – SF1 (female) (10)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between ATC2 (female) (6) – SF1 (female) (11)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between ATC1 (female) (12) – SF1 (female) (12)		Resistance	Min. 1 MΩ
	4	Defective gear shift lever	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between SF1 (3) – ground	In shift range “R2“	Voltage	20 – 30 V
				In shift range other than “R2“	Voltage	Max. 1 V
			Between SF1 (4) – ground	In shift range “R1“	Voltage	20 – 30 V
				In shift range other than “R1“	Voltage	Max. 1 V
			Between SF1 (5) – ground	In shift range “N“	Voltage	20 – 30 V
				In shift range other than “N“	Voltage	Max. 1 V
			Between SF1 (6) – ground	In shift range “D“	Voltage	20 – 30 V
				In shift range other than “D“	Voltage	Max. 1 V
			Between SF1 (7) – ground	In shift range “5“	Voltage	20 – 30 V
				In shift range other than “5“	Voltage	Max. 1 V
			Between SF1 (8) – ground	In shift range “4“	Voltage	20 – 30 V
				In shift range other than “4“	Voltage	Max. 1 V
			Between SF1 (9) – ground	In shift range “3“	Voltage	20 – 30 V
				In shift range other than “3“	Voltage	Max. 1 V
			Between SF1 (10) – ground	In shift range “2“	Voltage	20 – 30 V
				In shift range other than “2“	Voltage	Max. 1 V
			Between SF1 (11) – ground	In shift range “1“	Voltage	20 – 30 V
				In shift range other than “1“	Voltage	Max. 1 V
			Between SF1 (12) – ground	In shift range “HOLD“	Voltage	20 – 30 V
				In shift range other than “HOLD“	Voltage	Max. 1 V
	5	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between ATC2 (35) – ground	In shift range “R2“	Voltage	20 – 30 V
				In shift range other than “R2“	Voltage	Max. 1 V
			Between ATC2 (25) – ground	In shift range “R1“	Voltage	20 – 30 V
				In shift range other than “R1“	Voltage	Max. 1 V
			Between ATC1 (6) – ground	In shift range “N“	Voltage	20 – 30 V
				In shift range other than “N“	Voltage	Max. 1 V

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	5	Defective transmission controller	Between ATC2 (15) – ground	In shift range “D“	Voltage	20 – 30 V
				In shift range other than “D“	Voltage	Max. 1 V
			Between ATC2 (5) – ground	In shift range “5“	Voltage	20 – 30 V
				In shift range other than “5“	Voltage	Max. 1 V
			Between ATC2 (36) – ground	In shift range “4“	Voltage	20 – 30 V
				In shift range other than “4“	Voltage	Max. 1 V
			Between ATC2 (26) – ground	In shift range “3“	Voltage	20 – 30 V
				In shift range other than “3“	Voltage	Max. 1 V
			Between ATC2 (16) – ground	In shift range “2“	Voltage	20 – 30 V
				In shift range other than “2“	Voltage	Max. 1 V
			Between ATC2 (6) – ground	In shift range “1“	Voltage	20 – 30 V
				In shift range other than “1“	Voltage	Max. 1 V
			Between ATC1 (12) – ground	In shift range “HOLD“	Voltage	20 – 30 V
				In shift range other than “HOLD“	Voltage	Max. 1 V

Circuit diagram related



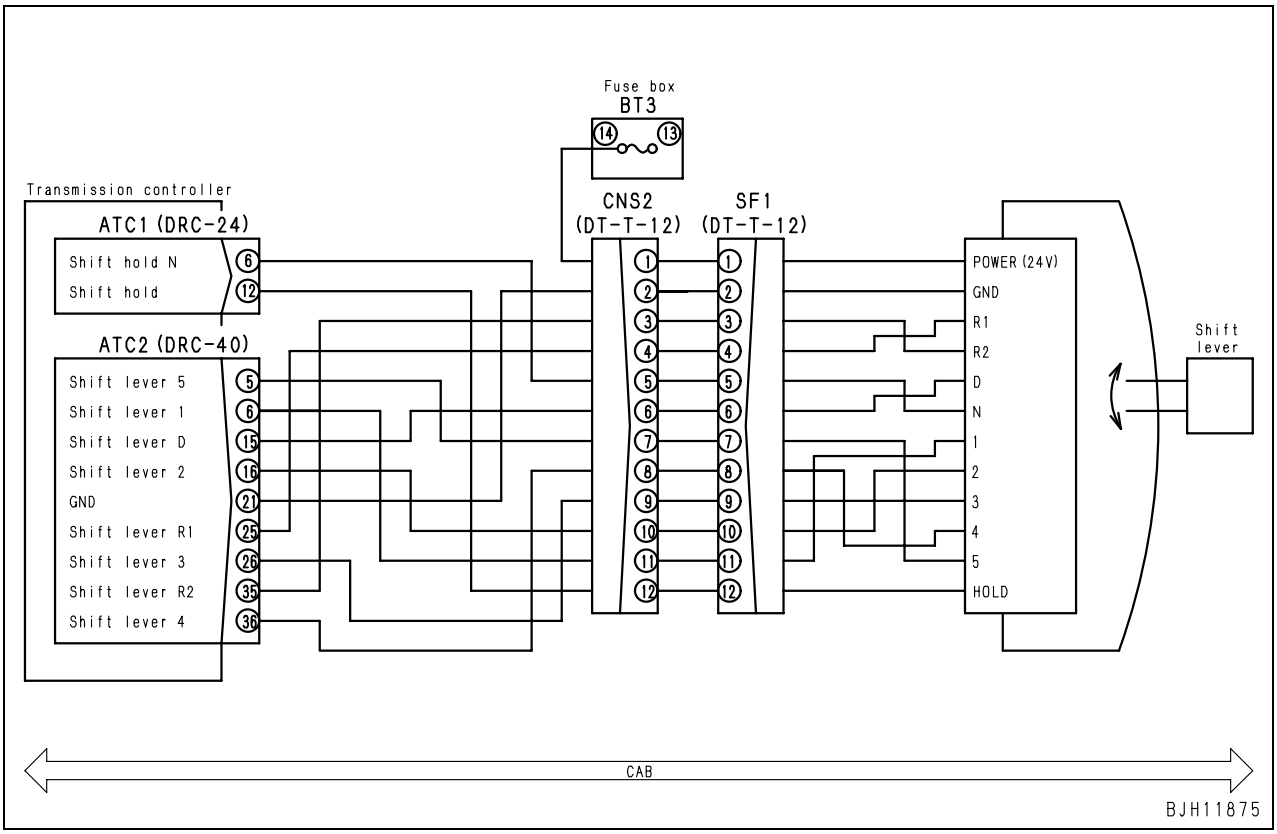
Failure code [DF10KB] (Gear shift lever: Short circuit)

Action code	Failure code	Trouble	Gear shift lever: Short circuit (Transmission controller system)
E03	**DF10KB**		
Contents of trouble	• Gear shift lever signals have been inputted at the same time from 2 or more systems.		
Action of controller	• Controls according to high priority signal. (1): N > D > 5 > 4 > 3 > 2 > 1 (2): N > R2 > R1 • Shifts gear speed to neutral when signals have been inputted from system (1) and system (2) at the same time.		
Problem that appears on machine	• There are cases where the gear speed is shifted to a higher gear speed than that which has been set by the gear shift lever. • Gear speed is still in neutral and cannot start vehicle. • Gear shift lever position lamp does not indicate actual gear shift lever position.		
Related information	• Nothing particular.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Hot short in wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between ground and wiring harness between ATC2 (female) (35) – SF1 (female) (3)		Voltage	Max. 1 V
			Between ground and wiring harness between ATC2 (female) (25) – SF1 (female) (4)		Voltage	Max. 1 V
			Between ground and wiring harness between ATC1 (female) (6) – SF1 (female) (5)		Voltage	Max. 1 V
			Between ground and wiring harness between ATC2 (female) (15) – SF1 (female) (6)		Voltage	Max. 1 V
			Between ground and wiring harness between ATC2 (female) (5) – SF1 (female) (7)		Voltage	Max. 1 V
			Between ground and wiring harness between ATC2 (female) (36) – SF1 (female) (8)		Voltage	Max. 1 V
			Between ground and wiring harness between ATC2 (female) (26) – SF1 (female) (9)		Voltage	Max. 1 V
			Between ground and wiring harness between ATC2 (female) (16) – SF1 (female) (10)		Voltage	Max. 1 V
			Between ground and wiring harness between ATC2 (female) (6) – SF1 (female) (11)		Voltage	Max. 1 V
			Wiring harness between ATC1 (female) (12) – SF1 (female)		Voltage	Max. 1 V
	2	Defective gear shift lever	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between SF1 (3) – ground	In shift range “R2“	Voltage	20 – 30 V
				In shift range other than “R2“	Voltage	Max. 1 V
			Between SF1 (4) – ground	In shift range “R1“	Voltage	20 – 30 V
				In shift range other than “R1“	Voltage	Max. 1 V
			Between SF1 (5) – ground	In shift range “N“	Voltage	20 – 30 V
				In shift range other than “N“	Voltage	Max. 1 V
			Between SF1 (6) – ground	In shift range “D“	Voltage	20 – 30 V
				In shift range other than “D“	Voltage	Max. 1 V
			Between SF1 (7) – ground	In shift range “5“	Voltage	20 – 30 V
				In shift range other than “5“	Voltage	Max. 1 V

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	2	Defective gear shift lever	Between SF1 (8) – ground	In shift range “4“	Voltage	20 – 30 V
				In shift range other than “4“	Voltage	Max. 1 V
			Between SF1 (9) – ground	In shift range “3“	Voltage	20 – 30 V
				In shift range other than “3“	Voltage	Max. 1 V
			Between SF1 (10) – ground	In shift range “2“	Voltage	20 – 30 V
				In shift range other than “2“	Voltage	Max. 1 V
			Between SF1 (11) – ground	In shift range “1“	Voltage	20 – 30 V
				In shift range other than “1“	Voltage	Max. 1 V
			Between SF1 (12) – ground	In shift range “HOLD“	Voltage	20 – 30 V
				In shift range other than “HOLD“	Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			If right FNR switch is installed (with right FNR switch “ON“)			
			Between ATC2 (35) – ground	In shift range “R2“	Voltage	20 – 30 V
				In shift range other than “R2“	Voltage	Max. 1 V
			Between ATC2 (25) – ground	In shift range “R1“	Voltage	20 – 30 V
				In shift range other than “R1“	Voltage	Max. 1 V
			Between ATC1 (6) – ground	In shift range “N“	Voltage	20 – 30 V
				In shift range other than “N“	Voltage	Max. 1 V
			Between ATC2 (15) – ground	In shift range “D“	Voltage	20 – 30 V
				In shift range other than “D“	Voltage	Max. 1 V
			Between ATC2 (5) – ground	In shift range “5“	Voltage	20 – 30 V
				In shift range other than “5“	Voltage	Max. 1 V
			Between ATC2 (36) – ground	In shift range “4“	Voltage	20 – 30 V
				In shift range other than “4“	Voltage	Max. 1 V
			Between ATC2 (26) – ground	In shift range “3“	Voltage	20 – 30 V
				In shift range other than “3“	Voltage	Max. 1 V
			Between ATC2 (16) – ground	In shift range “2“	Voltage	20 – 30 V
				In shift range other than “2“	Voltage	Max. 1 V
			Between ATC2 (6) – ground	In shift range “1“	Voltage	20 – 30 V
				In shift range other than “1“	Voltage	Max. 1 V
			Between ATC1 (12) – ground	In shift range “HOLD“	Voltage	20 – 30 V
				In shift range other than “HOLD“	Voltage	Max. 1 V

Circuit diagram related

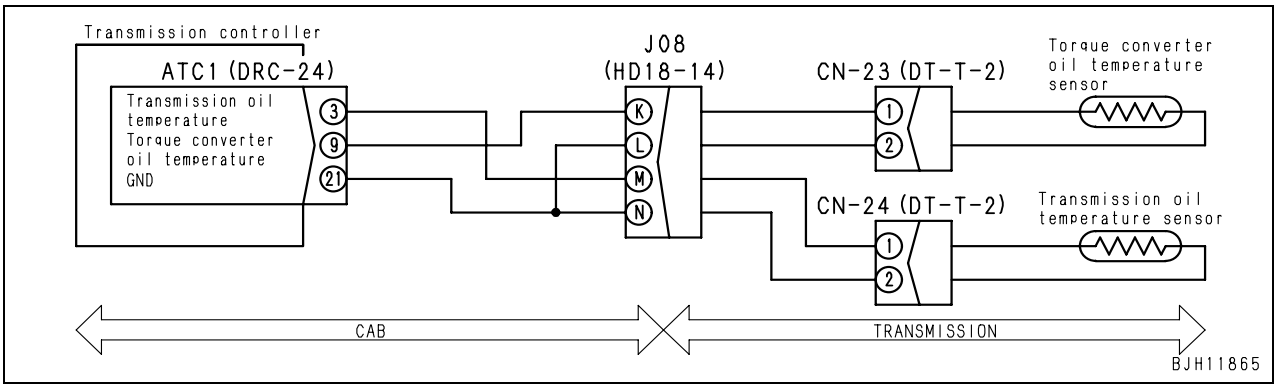


Failure code [DGF1KX] (Transmission oil temperature sensor: Input signal out of range)

Action code	Failure code	Trouble	Transmission oil temperature sensor : Input signal out of range (Transmission controller system)
E03	**DGF1KX**		
Contents of trouble	• Signal circuit voltage of transmission oil temperature sensor has become below 0.97 V (more than 150°C), or the sensor signal is greatly inconsistent with torque converter oil temperature signal.		
Action of controller	• Controls clutch oil pressure assuming the oil temperature is high and constant.		
Problem that appears on machine	• Gear shift shocks become large.		
Related information	• Input signal from oil temperature sensor can be checked with monitoring function (codes: **32500** and **32501**). • Check that sensor has returned to normal after taking corrective measures, and then implement initial learning procedure for the transmission controller referring to “Setting and adjusting various equipments“ in “Testing and adjusting“.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective transmission oil temperature sensor	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between CN24 (male) (1) – (2)	Oil temperature: 25°C	Resistance	37 – 50 kΩ
				Oil temperature: 100°C	Resistance	3.5 – 4.0 kΩ
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ATC1 (female) (3) – CN24 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between ATC1 (female) (21) – CN24 (female) (2)		Resistance	Max. 1 Ω
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ATC1 (female) (3) – CN24 (female) (1)		Resistance	Min. 1 MΩ
	4	Hot short in wiring harness (a contact with 24V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between ground and wiring harness between ATC1 (female) (3) – CN24 (female) (1)		Voltage	Max. 1 V
	5	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ATC1 (female) (3) – (21)	Oil temperature: 25°C	Resistance	37 – 50 kΩ
				Oil temperature: 100°C	Resistance	3.5 – 4.0 kΩ

Circuit diagram related

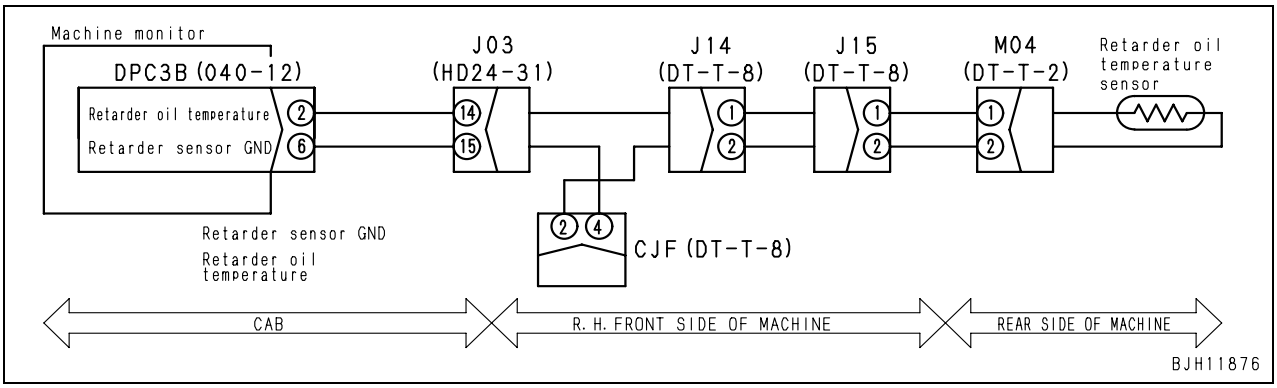


Failure code [DGR3KZ] (Center brake oil temperature sensor: Disconnection or short circuit)

Action code	Failure code	Trouble	Center brake oil temperature sensor: Disconnection or short circuit (Machine monitor system)
E01	**DGR3KZ**		
Contents of trouble	• Signal circuit voltage of retarder brake oil temperature sensor has become below 0.96 V.		
Action of controller			
Problem that appears on machine	• There is no great influence on the machine.		
Related information	• Input signal from oil temperature sensor can be checked with monitoring function (codes: **30203** and **30206**).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective center brake oil temperature sensor	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between M04 (male) (1) – (2)	Brake oil temperature: 25°C	Resistance	37 – 50 kΩ
				Brake oil temperature: 100°C	Resistance	3.5 – 4.0 kΩ
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between DPC3B (female) (2) – M04 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between DPC3B (female) (6) – M04 (female) (2)		Resistance	Max. 1 Ω
	3	Short circuit of harness (Contact with GND circuit or contact among harnesses)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between DPC3B (female) (2) – M04 (female) (1)		Resistance	Min. 1 MΩ
			Between wiring harnesses from DPC3B (female) (2) – M04 (female) (1) and from DPC3B (female) (6) – M04 (female) (2)		Resistance	Min. 1 MΩ
	4	Defective machine monitor	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between DPC3B (female) (2) – (6)	Brake oil temperature: 25°C	Resistance	37 – 50 kΩ
				Brake oil temperature: 100°C	Resistance	3.5 – 4.0 kΩ

Circuit diagram related

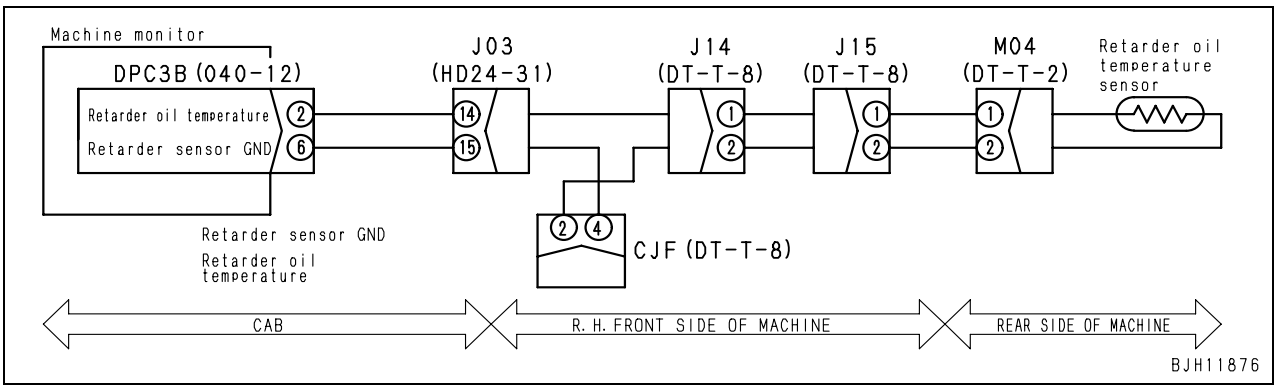


Failure code [DGR3L8] (Center brake oil temperature sensor: Inconsistent analog signals)

Action code	Failure code	Trouble	Center brake oil temperature sensor: Inconsistent analog signals (Machine monitor system)
E01	**DGR3L8**		
Contents of trouble	• Signal voltage of front brake oil temperature sensor has become above 4.72 V and signal voltage of center brake oil temperature sensor has become below 3.606 V.		
Action of controller			
Problem that appears on machine	• There is no great influence on the machine.		
Related information	• Input signal from oil temperature sensor can be checked with monitoring function (codes : **30203** and **30206**). • If ARSC is not installed or ARSC system switch is turned [OFF], code [**DGR2L8**] is displayed.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective center brake oil temperature sensor	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between M04 (male) (1) – (2)	Brake oil temperature: 25°C	Resistance	37 – 50 kΩ
				Brake oil temperature: 100°C	Resistance	3.5 – 4.0 kΩ
	2	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between DPC3B (female) (2) – M04 (female) (1)		Resistance	Min. 1 MΩ
	3	Defective machine monitor	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between DPC3B (female) (2) – (6)	Brake oil temperature: 25°C	Resistance	37 – 50 kΩ
				Brake oil temperature: 100°C	Resistance	3.5 – 4.0 kΩ

Circuit diagram related

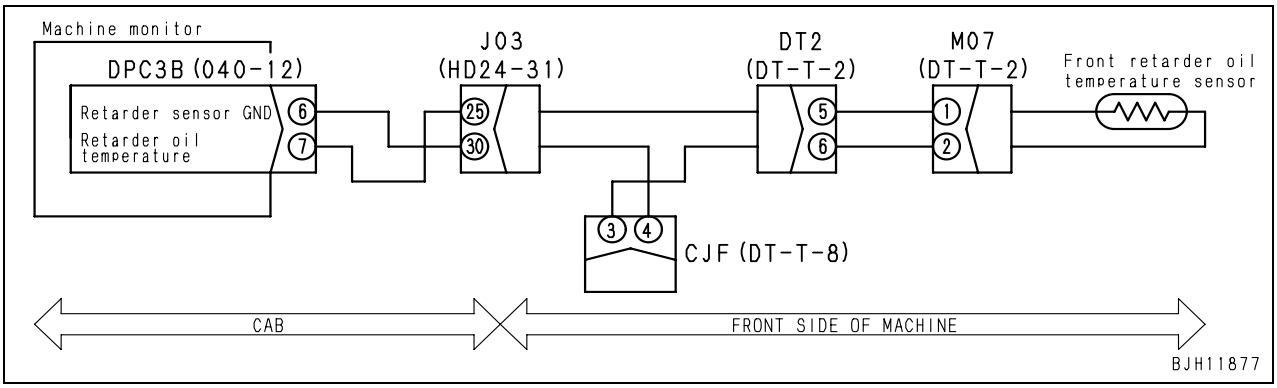


Failure code [DGR4KZ] (Front brake oil temperature sensor: Disconnection or short circuit)

Action code	Failure code	Trouble	Front brake oil temperature sensor: Disconnection or short circuit (Machine monitor system)
E01	**DGR4KZ**		
Contents of trouble	• Signal circuit voltage of retarder brake oil temperature sensor has become below 0.96 V.		
Action of controller			
Problem that appears on machine	• There is no great influence on the machine.		
Related information	• Input signal from oil temperature sensor can be checked with monitoring function (codes: **30201** and **30204**).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective front brake oil temperature sensor	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between M07 (male) (1) – (2)	Brake oil temperature: 25°C	Resistance	37 – 50 kΩ
				Brake oil temperature: 100°C	Resistance	3.5 – 4.0 kΩ
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between DPC3B (female) (7) – M07 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between DPC3B (female) (6) – M07 (female) (2)		Resistance	Max. 1 Ω
	3	Defective harness grounding (Contact with GND circuit or contact among harnesses)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between DPC3B (female) (7) – M07 (female) (1)		Resistance	Min. 1 MΩ
			Between wiring harnesses from DPC3B (female) (7) – M07 (female) (1) and from DPC3B (female) (6) – M07 (female) (2)		Resistance	Min. 1 MΩ
	4	Defective machine monitor	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between DPC3B (female) (7) – (6)	Brake oil temperature: 25°C	Resistance	37 – 50 kΩ
				Brake oil temperature: 100°C	Resistance	3.5 – 4.0 kΩ

Circuit diagram related

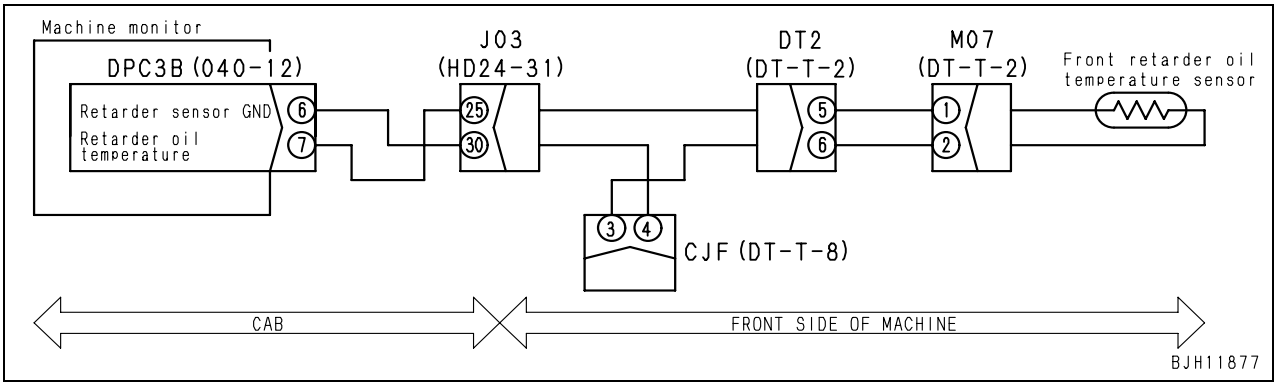


Failure code [DGR4L8] (Front brake oil temperature sensor: Inconsistent analog signals)

Action code	Failure code	Trouble	Front brake oil temperature sensor system: Inconsistent analog signals (Machine monitor system)
E01	**DGR4L8**		
Contents of trouble	• Signal voltage of front brake oil temperature sensor has become above 4.72 V and signal voltage of center brake oil temperature sensor has become below 3.606 V.		
Action of controller	• When both of the signals from front brake and center brake are out of standard values, failure code is displayed.		
Problem that appears on machine	• There is no great influence on the machine.		
Related information	• Input signal from oil temperature sensor can be checked with monitoring function (codes: **30201** and **30204**).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective front brake oil temperature sensor	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between M07 (male) (1) – (2)	Brake oil temperature: 25°C	Resistance	37 – 50 kΩ
				Brake oil temperature: 100°C	Resistance	3.5 – 4.0 kΩ
	2	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between DPC3B (female) (7) – M07 (female) (1)		Resistance	Min. 1 MΩ
	3	Defective machine monitor	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between DPC3B (female) (7) – (6)	Brake oil temperature: 25°C	Resistance	37 – 50 kΩ
				Brake oil temperature: 100°C	Resistance	3.5 – 4.0 kΩ

Circuit diagram related

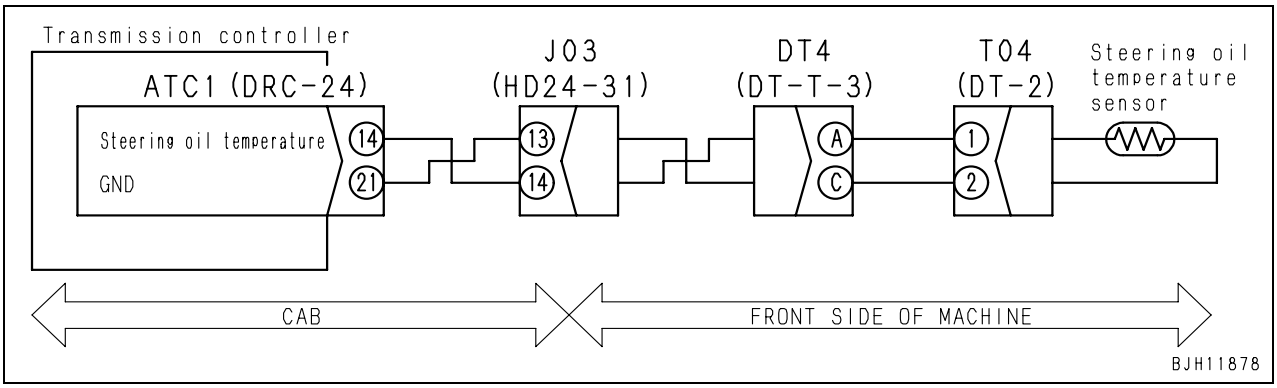


Failure code [DGR6KX] (Steering oil temperature sensor: Input signal out of range)

Action code	Failure code	Trouble	Steering oil temperature sensor: Input signal out of range (Transmission controller system)
E01	**DGR6KX**		
Contents of trouble	• Signal circuit voltage of steering oil temperature sensor has reached 0.97 V (more than 150°C) or only steering oil temperature is low (signal circuit voltage of steering oil temperature sensor is above 4.56 V (less than 15°C)). • Oil temperature sensor voltages of torque converter and brake are below 3.7 V (more than 55°C) and normal.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• Steering oil temperature gauge does not indicate properly.		
Related information	• Input signal from oil temperature sensor can be checked with monitoring function. 1) Steering oil temperature sensor (codes: **32701** and **32702**) 2) Torque converter oil temperature sensor (codes: **30100** and **30101**) 3) Brake oil temperature sensor (F) (codes: **30201** and **30204**) 4) Brake oil temperature sensor (M) (codes: **30203** and **30206**)		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective steering oil temperature sensor	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between T04 (male) (1) – (2)	Oil temperature: 25°C	Resistance	37 – 50 kΩ
				Oil temperature: 100°C	Resistance	3.5 – 4.0 kΩ
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ATC1 (female) (14) – T04 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between ATC1 (female) (21) – T04 (female) (2)		Resistance	Max. 1 Ω
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ATC1 (female) (14) – T04 (female) (1)		Resistance	Min. 1 MΩ
	4	Hot short in wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between ground and wiring harness between ATC1 (female) (14) – T04 (female) (1)		Voltage	Max. 1V
	5	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ATC1 (female) (14) – (21)	Oil temperature: 25°C	Resistance	37 – 50 kΩ
				Oil temperature: 100°C	Resistance	3.5 – 4.0 kΩ

Circuit diagram related

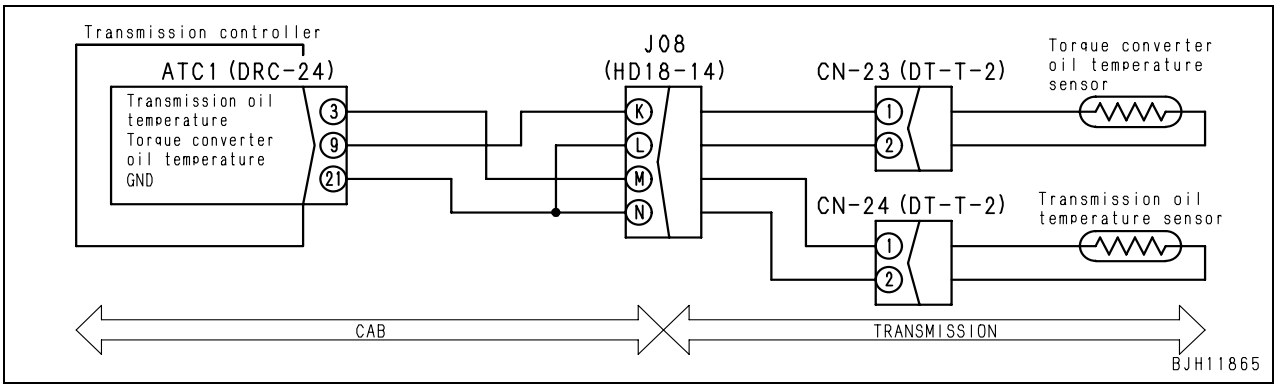


Failure code [DGT1KX] (Torque converter oil temperature sensor: Input signal out of range)

Action code	Failure code	Trouble	Torque converter oil temperature sensor: Input signal out of range (Transmission controller system)
E01	**DGT1KX**		
Contents of trouble	• Signal circuit voltage of torque converter oil temperature sensor has become below 0.97 V (more than 150°C), or the sensor signal is greatly inconsistent with transmission valve oil temperature signal.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• Torque converter oil temperature gauge does not indicate properly.		
Related information	• Input signal from oil temperature sensor can be checked with monitoring function (codes: **30100** and **30101**).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective torque converter oil temperature sensor	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between CN23 (male) (1) – (2)	Oil temperature: 25°C	Resistance	37 – 50 kΩ
				Oil temperature: 100°C	Resistance	3.5 – 4.0 kΩ
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ATC1 (female) (9) – CN23 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between ATC1 (female) (21) – CN23 (female) (2)		Resistance	Max. 1 Ω
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ATC1 (female) (9) – CN23 (female) (1)		Resistance	Min. 1 MΩ
	4	Hot short in wiring harness (a contact with 24V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between ground and wiring harness between ATC1 (female) (9) – CN23 (female) (1)		Resistance	Max. 1 V
	5	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between ATC1 (female) (9) – (21)	Oil temperature: 25°C	Resistance	37 – 50 kΩ
				Oil temperature: 100°C	Resistance	3.5 – 4.0 kΩ

Circuit diagram related

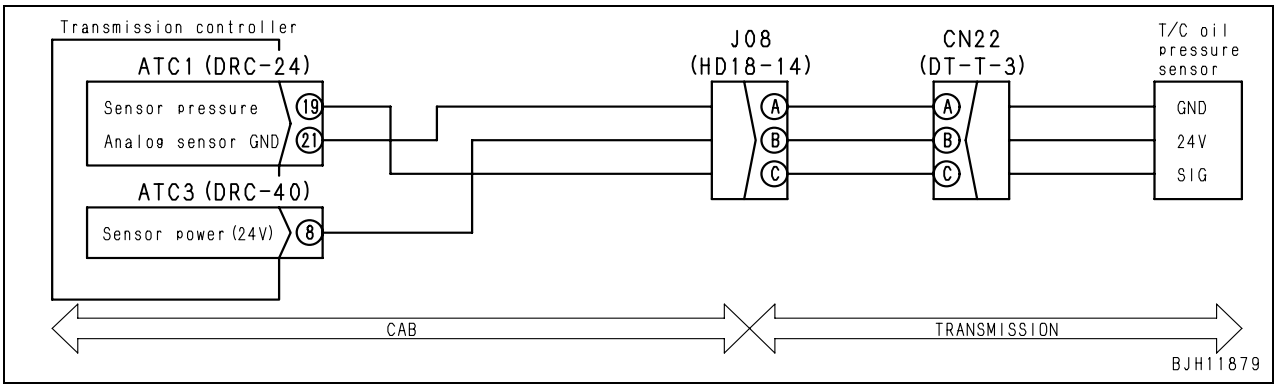


Failure code [DHT5KX] (Torque converter oil pressure sensor: Input signal out of range)

Action code	Failure code	Trouble	Torque converter oil pressure sensor: Input signal out of range (Transmission controller system)
E01	**DHT5KX**		
Contents of trouble	• Signal circuit voltage of torque converter oil pressure sensor has become below 0.5 V or above 4.5 V.		
Action of controller	• Controls torque converter oil pressure to be a predetermined constant value stored in the controller.		
Problem that appears on machine	• Large shock at lockup operation		
Related information	• Signal from oil pressure sensor can be checked with monitoring function (codes: **32600** and **32605**).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective torque converter oil pressure sensor	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between CN22 (B) – (A)	Voltage	20 – 30 V	
			Between CN22 (C) – (A)	Voltage	0.8 – 2.0 V	
	2	Disconnection in wiring harness (Disconnection and defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ATC1 (female) (19) – CN22 (female) (C)	Resistance	Max. 1 Ω	
			Wiring harness between ATC1 (female) (21) – CN22 (female) (A)	Resistance	Max. 1 Ω	
			Wiring harness between ATC3 (female) (8) – CN22 (female) (B)	Resistance	Max. 1 Ω	
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ATC1 (female) (19) – CN22 (female) (C)	Resistance	Min. 1 MΩ	
			Between ground and wiring harness between ATC3 (female) (8) – CN22 (female) (B)	Resistance	Min. 1 MΩ	
	4	Hot short in wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between ground and wiring harness between ATC1 (female) (19) – CN22 (female) (C)	Voltage	0.8 – 2.0 V	
	5	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between ATC3 (8) – ATC1 (21)	Voltage	20 – 30 V	
			Between ATC1 (19) – (21)	Voltage	0.8 – 2.0 V	

Circuit diagram related

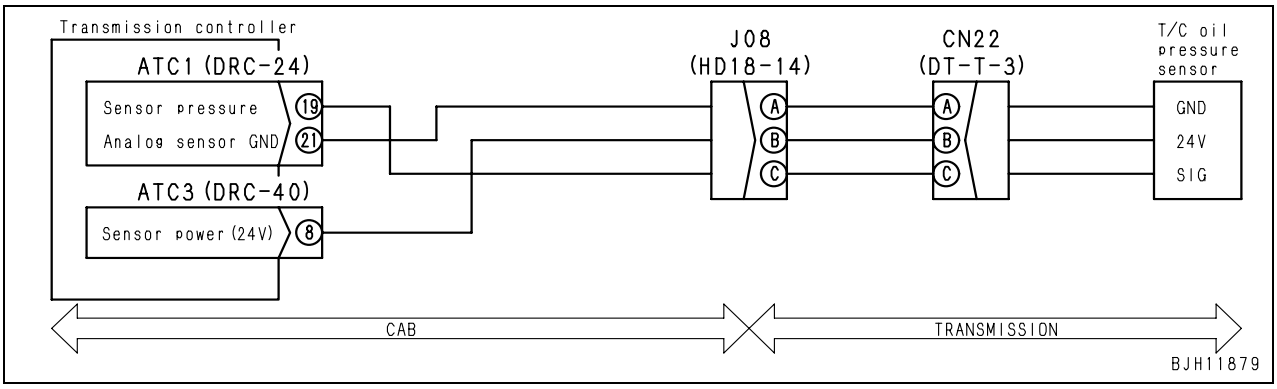


Failure code [DHT5L6] (Torque converter oil pressure sensor: Inconsistent signals during a travel and stop)

Action code	Failure code	Trouble	Torque converter oil pressure sensor: Inconsistent signal (Signals are inconsistent with the engine states of running and stop.) (Transmission controller system)
E01	**DHT5L6**		
Contents of trouble	• While engine stop, oil pressure signal is input to signal circuit of torque converter oil pressure sensor.		
Action of controller	• Controls torque converter oil pressure to be a predetermined constant value stored in the controller.		
Problem that appears on machine	• Large shock at lockup operation		
Related information	• Signal from oil pressure sensor can be checked with monitoring function (codes: **32600** and **32605**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective torque converter oil pressure sensor	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between CN22 (B) – (A)	Voltage	20 – 30 V
			Between CN22 (C) – (A)	Voltage	0.8 – 2.0 V
	2	Hot short in wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ground and wiring harness between ATC1 (female) (19) – CN22 (female) (C)	Voltage	Max. 1.2 V
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ATC3 (8) – ATC1 (21)	Voltage	20 – 30 V
			Between ATC1 (19) – (21)	Voltage	0.8 – 2.0 V

Circuit diagram related

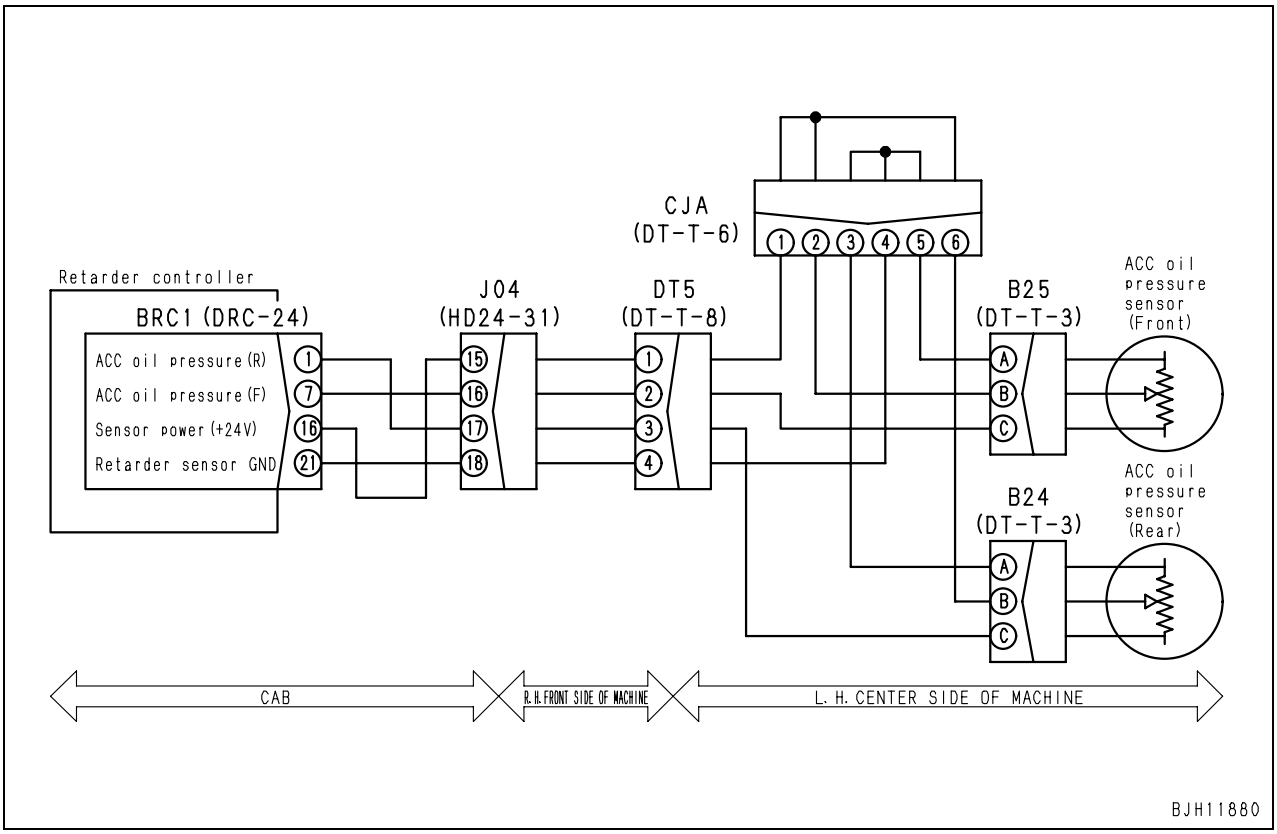


Failure code [DHU2KX] (Front accumulator oil pressure sensor: Input signal out of range)

Action code	Failure code	Trouble	Front accumulator oil pressure sensor : Input signal out of range (Retarder controller system)
E01	**DHU2KX**		
Contents of trouble	• Signal circuit voltage of front accumulator oil pressure sensor has become below 0.5 V or above 4.5 V.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• There is no great influence on the machine.		
Related information	• Signal from oil pressure sensor can be checked with monitoring function (codes: **35500** and **35506**).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Disconnection in wiring harness (Disconnection and defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between BRC1 (female) (7) – B25 (female) (C)		Resistance	Max. 1 Ω
			Wiring harness between BRC1 (female) (21) – B25 (female) (A)		Resistance	Max. 1 Ω
			Wiring harness between BRC1 (female) (16) – B25 (female) (B)		Resistance	Max. 1 Ω
	2	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between BRC1 (female) (7) – B25 (female) (C)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between BRC1 (female) (16) – B25 (female) (B)		Resistance	Min. 1 MΩ
	3	Hot short in wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between ground and wiring harness between BRC1 (female) (7) – B25 (female) (C)		Voltage	Max. 1 V
	4	Defective front accumulator oil pressure sensor	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			B25	Differential lockup oil pressure		Resistance
			Between (A) – (B)	Max. 4.9 MPa {Max. 50 kg/cm²}		Min. 1 MΩ
				Min. 4.9 MPa {Min. 50 kg/cm²}		Max. 1 Ω
			Between B25 (B) – (A)		Voltage	20 – 30 V
			Between B25 (C) – (A)		Voltage	1.8 – 3.5 V
	5	Defective retarder controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between BRC1 (16) – BRC1 (21)		Voltage	20 – 30 V
			Between BRC1 (7) – (21)		Voltage	0.5 – 4.5 V

Circuit diagram related

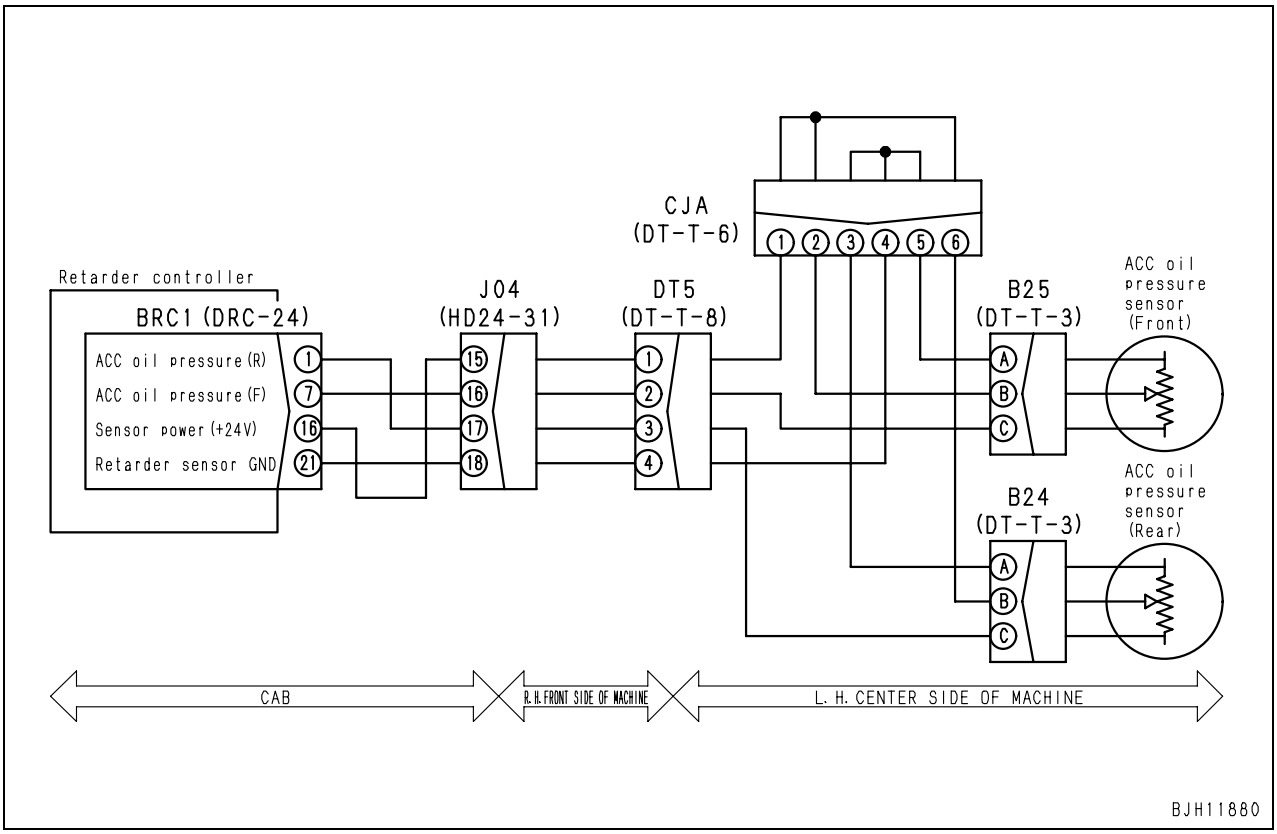


Failure code [DHU3KX] (Rear accumulator oil pressure sensor: Input signal out of range)

Action code	Failure code	Trouble	Rear accumulator oil pressure sensor: Input signal out of range (Retarder controller system)
E01	**DHU3KX**		
Contents of trouble	• Signal circuit voltage of front accumulator oil pressure sensor has become below 0.5 V or above 4.5 V.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• There is no great influence on the machine.		
Related information	• Signal from oil pressure sensor can be checked with monitoring function (codes: **35501** and **35507**).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Disconnection in wiring harness (Disconnection and defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between BRC1 (female) (1) – B24 (female) (C)		Resistance	Max. 1 Ω
			Wiring harness between BRC1 (female) (21) – B24 (female) (A)		Resistance	Max. 1 Ω
			Wiring harness between BRC1 (female) (16) – B24 (female) (B)		Resistance	Max. 1 Ω
	2	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between BRC1 (female) (1) – B24 (female) (C)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between BRC1 (female) (16) – B24 (female) (B)		Resistance	Min. 1 MΩ
	3	Hot short in wiring harness (a contact with 24V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between ground and wiring harness between BRC1 (female) (1) – B24 (female) (C)		Voltage	Max. 1 V
	4	Defective rear accumulator oil pressure sensor	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			B24 (male)	Differential lockup oil pressure		Resistance
			Between (A) – (B)	Max. 4.9 MPa {Max. 50 kg/cm²}		Min. 1 MΩ
				Min. 4.9 MPa {Min. 50 kg/cm²}		Max. 1 Ω
			Between B24 (B) – (A)		Voltage	20 – 30 V
			Between B24 (C) – (A)		Voltage	1.8 – 3.5 V
	5	Defective retarder controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between BRC1 (16) – (21)		Voltage	20 – 30 V
			Between BRC1 (1) – (21)		Voltage	0.5 – 4.5 V

Circuit diagram related

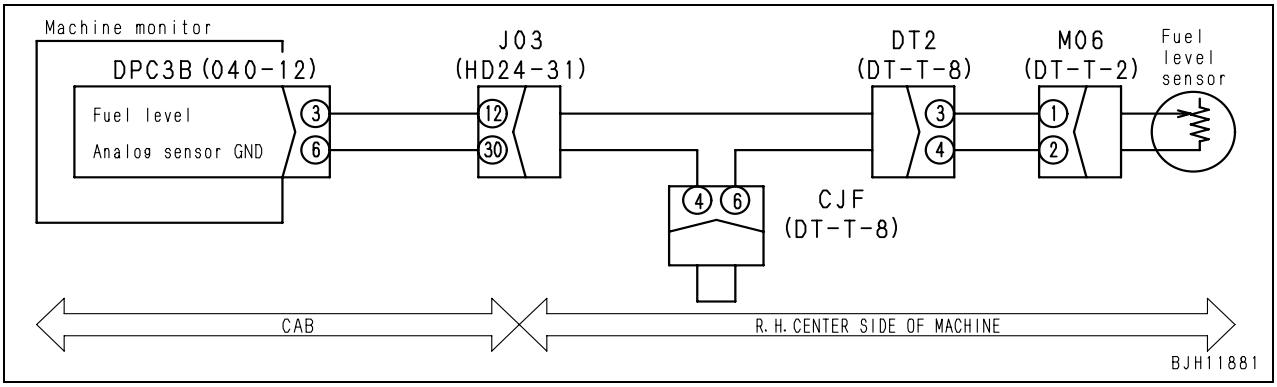


Failure code [DJF1KA] (Fuel level sensor: Disconnection)

Action code	Failure code	Trouble	Fuel level sensor: Disconnection (Machine monitor system)
E01	**DJF1KA**		
Contents of trouble	• Signal circuit voltage of fuel level sensor has become above 4.0 V.		
Action of controller	• Takes no particular action.		
Problem that appears on machine	• Fuel gauge does not indicate properly.		
Related information	• Signal from level sensor can be checked with monitoring function (codes: **04200** and **04201**).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fuel level sensor	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between M06 (male) (1) – (2)	Fuel level: At full (FULL)	Resistance	Max. 12 Ω
				Fuel level: At empty (EMPTY)	Resistance	74 – 100 Ω
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between DPC3B (female) (3) – M06 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between DPC3B (female) (6) – M06 (female) (2)		Resistance	Max. 1 Ω
	3	Hot short in wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between ground and wiring harness between DPC3B (female) (3) – M06 (female) (1)		Voltage	Max. 1 V
	4	Defective machine monitor	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between DPC3B (female) (3) – (6)	Fuel level: At full (FULL)	Resistance	Max. 12 Ω
				Fuel level: At empty (EMPTY)	Resistance	74 – 100 Ω

Circuit diagram related



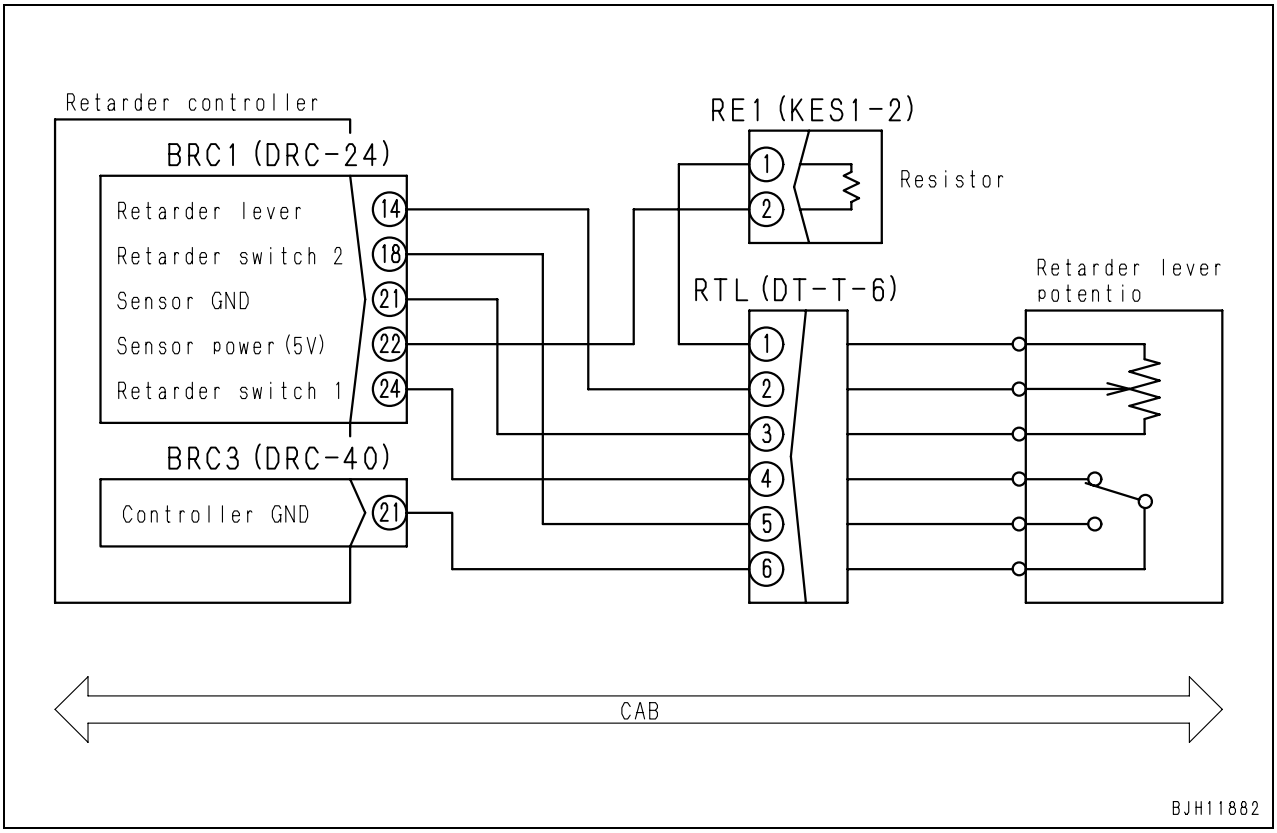
Failure code [DK51L5] (Retarder lever potentiometer : Potentiometer signal is inconsistent with switch signal)

Action code	Failure code	Trouble	Retarder lever potentiometer : Potentiometer signal is inconsistent with switch signal (Retarder controller system).
E03	**DK51L5**		
Contents of trouble	• Potentiometer signal voltage of retarder lever circuit has become below 0.3 V or above 4.7 V, or potentiometer signal is inconsistent with switch signal.		
Action of controller	Controls as follows depending on situation of failure occurrence. • Controls according to potentiometer signal. • Limits output to solenoid to 70 %. • Turns output to solenoid [OFF].		
Problem that appears on machine	As follows depending on action taken. • There is no great influence on the machine. • Cannot perform a fine control of retarder. • Retarder does not work (foot brake works).		
Related information	• Can be checked with monitoring function (code: **33900**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between BRC1 (female) (22) – RE1 (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between RE1 (female) (1) – RTL (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between BRC1 (female) (21) – RTL (female) (3)	Resistance	Max. 1 Ω
			Wiring harness between BRC1 (female) (14) – RTL (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between BRC1 (female) (24) – RTL (female) (4)	Resistance	Max. 1 Ω
			Wiring harness between BRC1 (female) (18) – RTL (female) (5)	Resistance	Max. 1 Ω
			Wiring harness between BRC3 (female) (21) – RTL (female) (6)	Resistance	Max. 1 Ω
	2	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between BRC1 (female) (22) – RE1 (female) (2)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between RE1 (female) (1) – RTL (female) (1)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between BRC1 (female) (14) – RTL (female) (2)	Resistance	Min. 1 MΩ
	3	Hot short in wiring harness (a contact with 24V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ground and wiring harness between BRC1 (female) (22) – RE1 (female) (1)	Voltage	Max. 1 V
			Between ground and wiring harness between RE1 (female) (1) – RTL (female) (1)	Voltage	Max. 1 V
			Between ground and wiring harness between BRC1 (female) (14) – RTL (female) (2)	Voltage	Max. 1 V
	4	Defective resistor (RE1)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between RE1 (male) (1) – (2)	Resistance	250 ± 5 Ω

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	5	Defective retarder lever potentiometer	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between RTL (1) – (3)	Voltage	4.1 – 4.8 V	
			Between RTL (2) – (3)	Voltage	0.3 – 4.7 V	
			★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between RTL (male) (4) – (6)	Released lever position	Resistance	Max. 1 Ω
				Operating lever position	Resistance	Min. 1 MΩ
			Between RTL (male) (5) – (6)	Released lever position	Resistance	Min. 1 MΩ
				Operating lever position	Resistance	Max. 1 Ω
	6	Defective retarder controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between BRC1 (22) – (21)	Voltage	4.1 – 4.8 V	
			Between BRC1 (14) – (21)	Voltage	0.3 – 4.7 V	
			★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between BRC1 (female) (24) – ground	Released lever position	Resistance	Max. 1 Ω
				Operating lever position	Resistance	Min. 1 MΩ
			Between BRC1 (female) (18) – ground	Released lever position	Resistance	Min. 1 MΩ
				Operating lever position	Resistance	Max. 1 Ω

Circuit diagram related

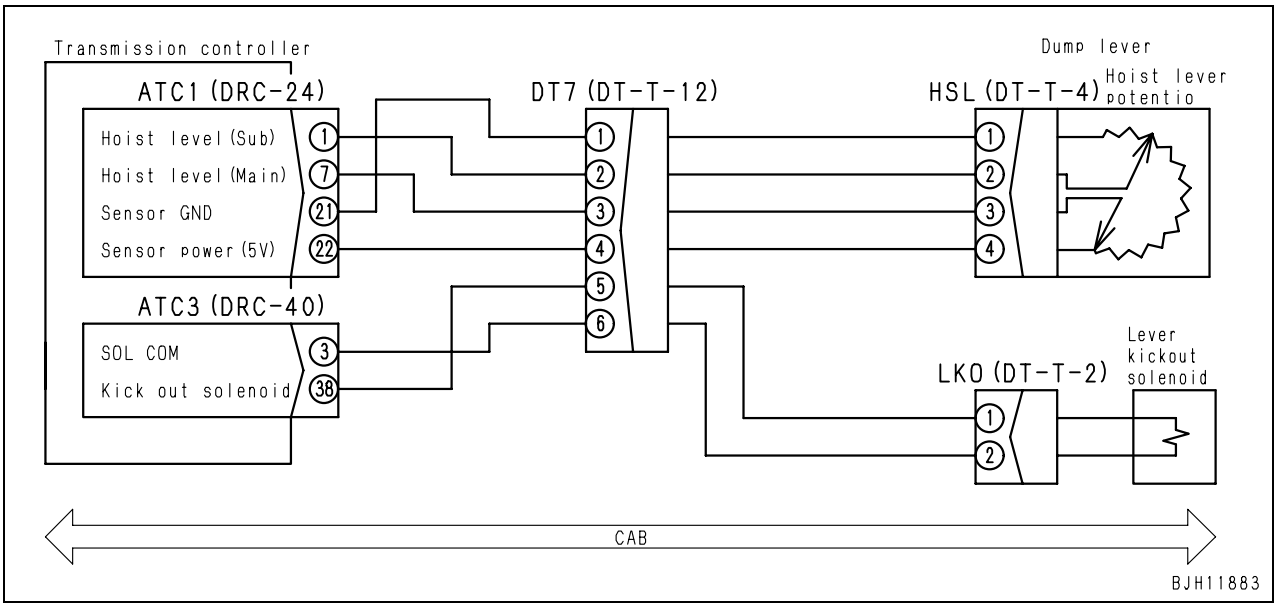


Failure code [DK52KX] (Dump lever potentiometer failure 1: Input signal out of range)

Action code	Failure code	Trouble	Dump lever potentiometer failure 1: Input signal out of range (Input signal of lever potentiometer 1 or 2 is out of range) (Transmission controller system)
E03	**DK52KX**		
Contents of trouble	• Signal voltage of dump lever potentiometer 1 or 2 signal circuit has become below 0.3 V or above 4.7 V.		
Action of controller	• Recognizes dump lever position as [HOLD] position.		
Problem that appears on machine	• Dump body does not operate.		
Related information	• Can be checked with monitoring function (codes: **34506** and **34507**).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between ATC1 (female) (22) – HSL (female) (4)		Resistance	Max. 1 Ω
			Wiring harness between ATC1 (female) (1) – HSL (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between ATC1 (female) (7) – HSL (female) (3)		Resistance	Max. 1 Ω
			Wiring harness between ATC1 (female) (21) – HSL (female) (1)		Resistance	Max. 1 Ω
	2	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between ATC1 (female) (22) – HSL (female) (4)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between ATC1 (female) (1) – HSL (female) (2)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between ATC1 (female) (7) – HSL (female) (3)		Resistance	Min. 1 MΩ
	3	Hot short in wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between ground and wiring harness between ATC1 (female) (22) – HSL (female) (4)		Voltage	Max. 1 V
			Between ground and wiring harness between ATC1 (female) (1) – HSL (female) (2)		Voltage	Max. 1 V
			Between ground and wiring harness between ATC1 (female) (7) – HSL (female) (3)		Voltage	Max. 1 V
	4	Defective hoist lever	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between HSL (4) – (1)	Voltage	4.6 – 5.4 V	
			Between HSL (2) – (1)	Voltage	0.3 – 4.7 V	
			Between HSL (3) – (1)	Voltage	0.3 – 4.7 V	
	5	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between ATC1 (22) – (21)	Voltage	4.6 – 4.8 V	
			Between ATC1 (1) – (21)	Voltage	0.3 – 4.7 V	
			Between ATC (7) – (21)	Voltage	0.3 – 4.7 V	

Circuit diagram related

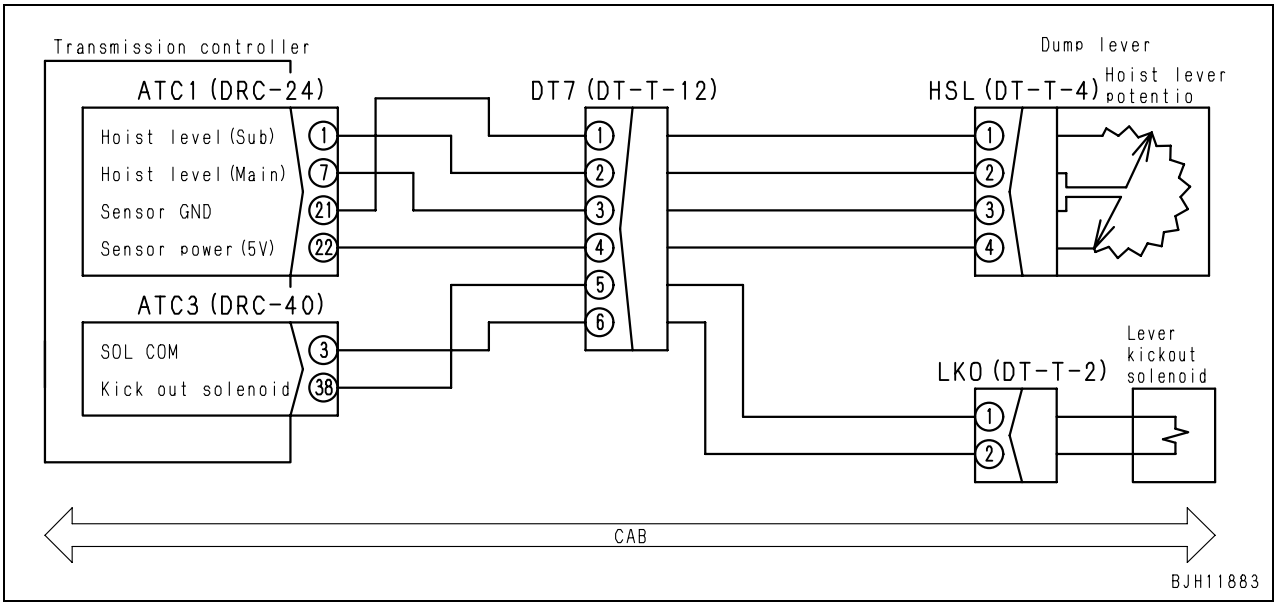


Failure code [DK53L8] (Dump lever potentiometer failure 2: Inconsistent analog signal)

Action code	Failure code		Dump lever potentiometer failure 2: Inconsistent analog signal (Total input signal voltage of lever potentiometer 1 and 2 is out of range.) (Transmission controller system)
E03	**DK53L8**	Trouble	
Contents of trouble	• Total voltage of dump lever potentiometer 1 and 2 signal circuit has become below 4.4 V or above 5.6 V.		
Action of controller	• Recognizes dump lever position as [NEUTRAL] position.		
Problem that appears on machine	• Dump body does not operate.		
Related information	• Can be checked with monitoring function (codes: **34506** and **34507**). • When failure code [**DK52KX**] is displayed, troubleshooting corresponding code.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective hoist lever	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between HSL (4) – (1)	Voltage	4.6 – 5.4 V
			Between HSL (2) – (1)	Voltage	0.3 – 4.7 V
			Between HSL (3) – (1)	Voltage	0.3 – 4.7 V
	2	Defective transmission controller	• If abnormality is not solved even after carrying out the diagnosis of item 1, retarder controller is defective.		

Circuit diagram related

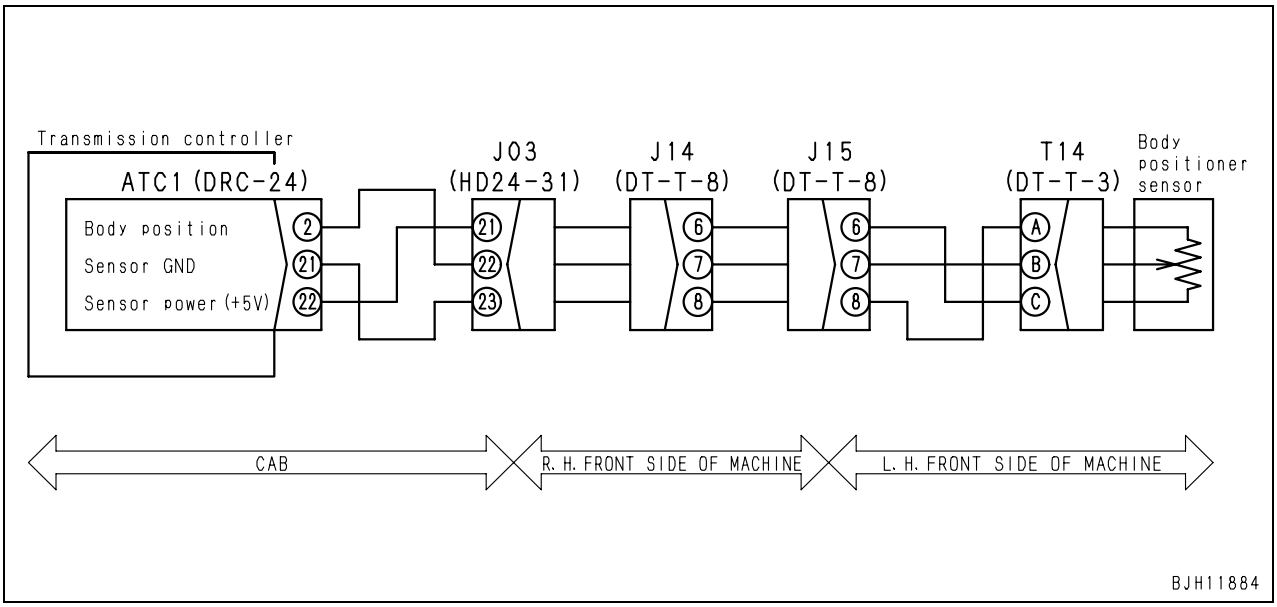


Failure code [DK54KX] (Body positioner sensor: Input signal out of range)

Action code	Failure code	Trouble	Body positioner sensor: Input signal out of range (Input signal of lever potentiometer 1 or 2 is out of range) (Transmission controller system)
E03	**DK54KX**		
Contents of trouble	• Signal circuit voltage of body positioner sensor has become below 0.3 V or above 4.7 V.		
Action of controller	• Conducts dump control according to the dump lever signal. • Controls dump with recognition that the body has not yet been seated.		
Problem that appears on machine	• Shock when body is seated becomes large. • Function of dump lever positioner does not work. • Highest gear speed is restricted. • Machine cannot move backward in the dump lever position other than [FLOAT].		
Related information	• Can be checked with monitoring function (code: **34603**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Disconnection in wiring harness (Disconnection and defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC1 (female) (22) – T14 (female) (C)	Resistance	Max. 1 Ω
			Wiring harness between ATC1 (female) (2) – T14 (female) (B)	Resistance	Max. 1 Ω
			Wiring harness between ATC1 (female) (21) – T14 (female) (A)	Resistance	Max. 1 Ω
	2	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between ATC1 (female) (22) – T14 (female) (C)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between ATC1 (female) (2) – T14 (female) (B)	Resistance	Min. 1 MΩ
	3	Hot short in wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ground and wiring harness between ATC1 (female) (22) – T14 (female) (C)	Voltage	Max. 1 V
			Between ground and wiring harness between ATC1 (female) (2) – T14 (female) (B)	Voltage	Max. 1 V
	4	Defective body positioner sensor	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between T14 (C) – (A)	Voltage	4.6 – 5.4 V
			Between T14 (B) – (A)	Voltage	0.3 – 4.7 V
	5	Defective retarder controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ATC1 (22) – (21)	Voltage	4.1 – 4.8 V
			Between ATC1 (2) – (21)	Voltage	0.3 – 4.7 V

Circuit diagram related



HM300-2 Articulated dump truck

Form No. SEN00673-03

ARTICULATED DUMP TRUCK

HM300-2

Machine model	Serial number
HM300-2	2001 and up

40 Troubleshooting

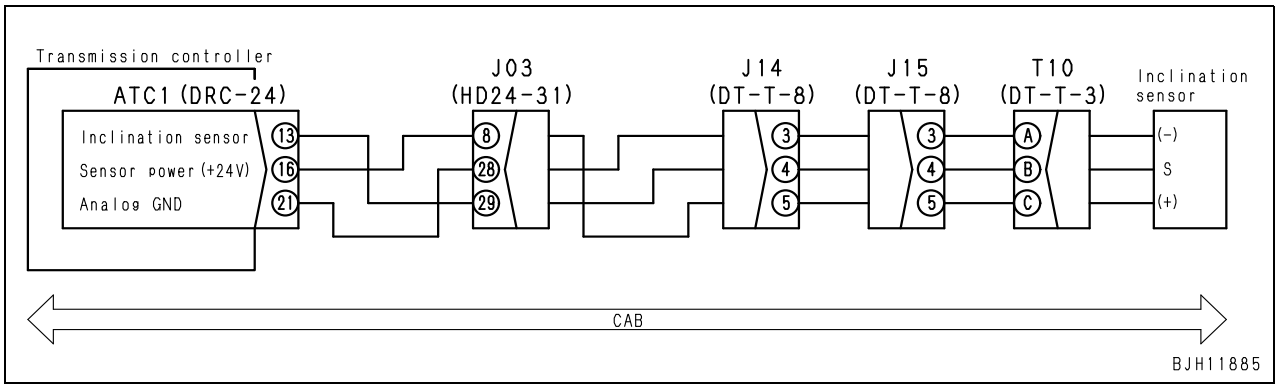
Troubleshooting by failure code, Part 4

Failure code [DKH0KX] (Inclination sensor: Inclination out of range)

Action code	Failure code	Trouble	Inclination sensor: Input signal out of range (Transmission controller system)
E01	**DKH0KX**		
Contents of trouble	• Voltage in signal circuit of Inclination sensor has become below 0.5 V or above 4.5 V.		
Action of controller	• No particular action.		
Problem that appears on machine			
Related information	• Signal from Inclination sensor can be checked with monitoring function (Code: **32900** and **32902**). • Cannot detect tipping over.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective inclination sensor	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between T10 (A) – (C)	Voltage	11 – 13 V
			Between T10 (A) – (B)	Voltage	1.4 – 4.6 V
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC1 (female) (13) – T10 (female) (B)	Resistance	Max. 1 Ω
			Wiring harness between ATC1 (female) (16) – T10 (female) (C)	Resistance	Max. 1 Ω
			Wiring harness between ATC1 (female) (21) – T10 (female) (A)	Resistance	Max. 1 Ω
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between ATC1 (female) (13) – T10 (female) (B)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between ATC1 (female) (16) – T10 (female) (C)	Resistance	Min. 1 MΩ
	4	Hot short in wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ground and wiring harness between ATC1 (female) (13) – T10 (female) (B)	Voltage	Max. 4.6 V
	5	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ATC1 (female) (16) – (21)	Voltage	20 – 30 V
			Between ATC1 (female) (13) – (21)	Voltage	1.0 – 4.6 V

Circuit diagram related

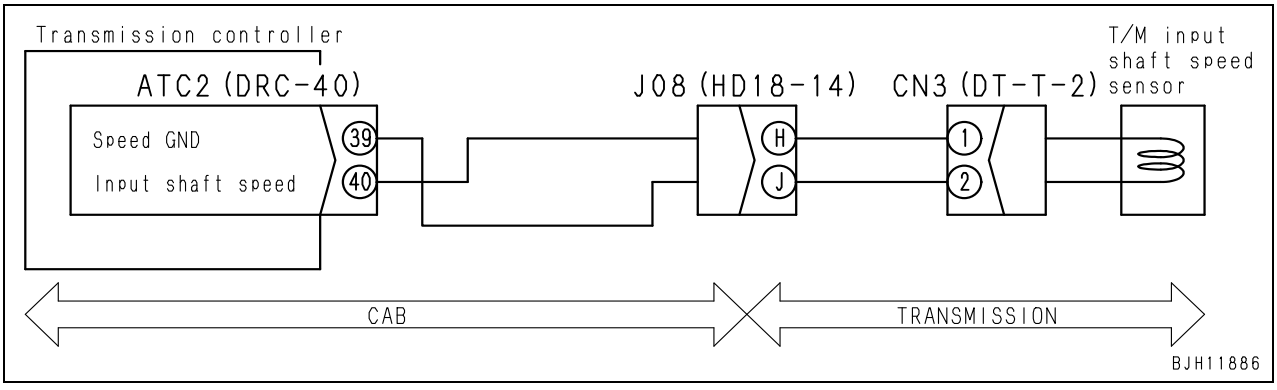


Failure code [DLF1KA] (Transmission input shaft speed sensor: Disconnection)

Action code	Failure code	TroubleTrouble	Transmission input shaft speed sensor: Disconnection (Transmission controller system)
E03	**DLF1KA**		
Contents of trouble	• There is a disconnection in signal circuit of transmission input shaft speed sensor and the signal is not inputted.		
Action of controller	• Holds gear speed for traveling and turns lockup to OFF. • Holds neutral when gear shift lever is set to “N“. • Even if failure is repaired, it does not return to normal unless the starting switch is once turned OFF.		
Problem that appears on machine	• During travel, lockup is released and gear can not be shifted. • Once gear shift lever is set to “N“, cannot restart until machine stops.		
Related information	• Signal from input shaft speed sensor can be checked with monitoring function (Code: **31200**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Improper adjustment of transmission input shaft speed sensor	Screw the sensor gently until it bottoms to the speed detection gear, then turn it back by 1/2 – 1 turn. ★ See Testing and adjusting “Adjusting transmission speed sensor“ for details.		
	2	Defective transmission input shaft speed sensor	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN3 (male) (1) – (2)	Resistance	500 – 1,000 Ω
			Between CN3 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	3	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC2 (female) (40) – CN3 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ATC2 (female) (39) – CN3 (female) (2)	Resistance	Max. 1 Ω
	4	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ATC2 (female) (40) – (39)	Resistance	500 – 1,000 Ω

Circuit diagram related

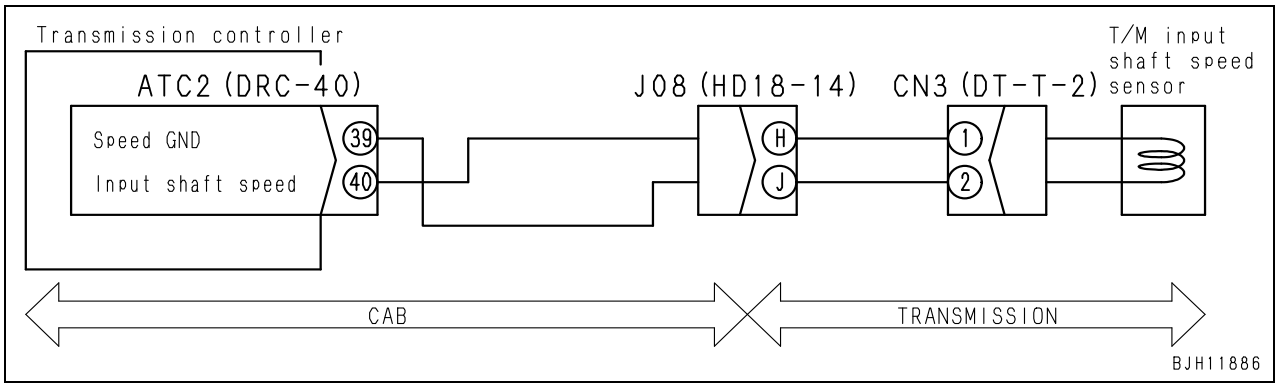


Failure code [DLF1LC] (Transmission input shaft speed sensor: Inconsistent rotation speed signal)

Action code	Failure code	Trouble	Transmission input shaft speed sensor: Inconsistent speed signal (Transmission controller system)
E03	**DLF1LC**		
Contents of trouble	• There is an abnormality in the speed calculated from engine speed sensor signal, transmission intermediate shaft speed sensor signal and transmission output shaft speed sensor signal, and the speed of transmission input shaft sensor signal.		
Action of controller	• Holds gear speed for traveling and turns lockup to OFF. • Holds neutral when gear shift lever is set to “N“.		
Problem that appears on machine	• Lockup is released and gear cannot be shifted. • Once gear shift lever is set to “N“, cannot restart until machine stops.		
Related information	• Signal from input shaft speed sensor can be checked with monitoring function (Code: **31200**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective transmission input shaft speed sensor	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN3 (male) (1) – (2)	Resistance	500 – 1,000 Ω
			Between CN3 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between ATC2 (female) (40) – CN3 (female) (1)	Resistance	Min. 1 MΩ
	3	Hot short in wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ground and wiring harness between ATC2 (female) (40) – CN3 (female) (1)	Voltage	Max. 1 V
	4	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ATC2 (female) (40) – (39)	Resistance	500 – 1,000 Ω

Circuit diagram related

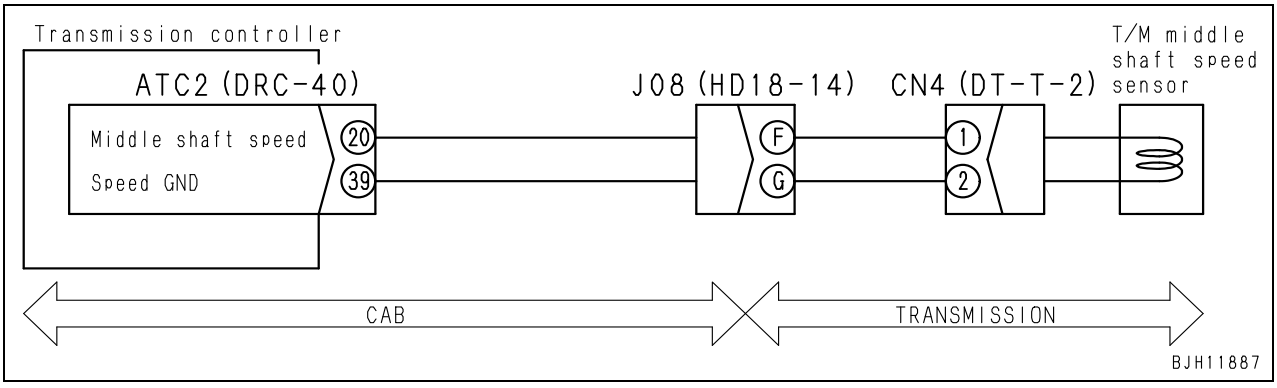


Failure code [DLF2KA] (Transmission intermediate shaft speed sensor: Disconnection)

Action code	Failure code	Trouble	Transmission intermediate shaft speed sensor: Disconnection (Transmission controller system)
E03	**DLF2KA**		
Contents of trouble	• There is a disconnection in signal circuit of transmission intermediate shaft speed sensor and no signal is inputted.		
Action of controller	• Holds gear speed during traveling. • Holds neutral when gear shift lever is set to “N“. • Even if failure is repaired, it does not return to normal unless starting switch is once turned OFF.		
Problem that appears on machine	• Lockup is released and gear cannot be shifted. • Once gear shift lever is set to “N“, cannot restart until machine stops.		
Related information	• Signal from intermediate shaft speed sensor can be checked with monitoring function (Code: **31300**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Improper adjustment of the transmission intermediate shaft speed sensor	• Screw the sensor gently until it bottoms to the speed detection gear, then turn it back by 1/2 – 1 turn. ★ See Testing and adjusting “Adjusting transmission speed sensor“ for details.		
	2	Defective transmission intermediate shaft speed sensor	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN4 (male) (1) – (2)	Resistance	500 – 1,000 Ω
			Between CN4 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	3	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC2 (female) (20) – CN4 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ATC2 (female) (39) – CN4 (female) (2)	Resistance	Max. 1 Ω
	4	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ATC2 (female) (20) – (39)	Resistance	500 – 1,000 Ω

Circuit diagram related

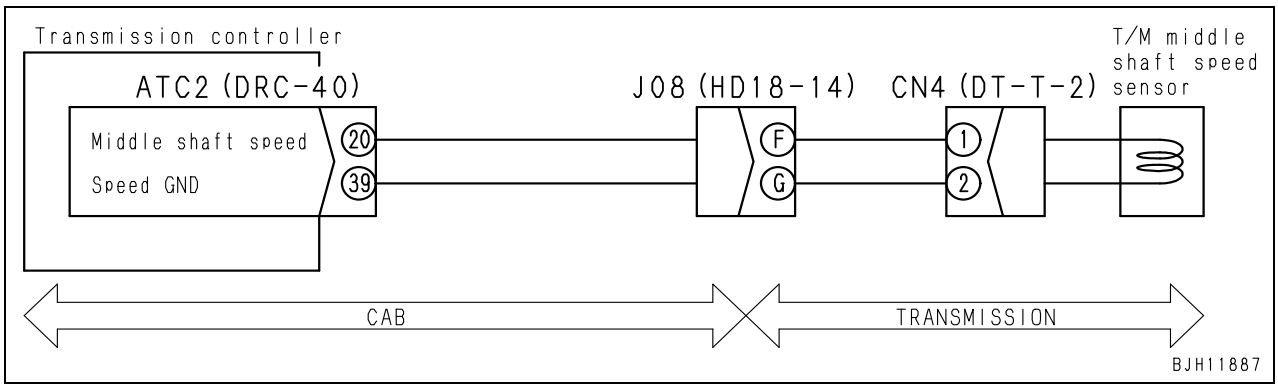


Failure code [DLF2LC] (Transmission intermediate shaft speed sensor: Inconsistent speed signal)

Action code	Failure code	Trouble	Transmission intermediate shaft speed sensor: Inconsistent speed signal (Transmission controller system)
E03	**DLF2LC**		
Contents of trouble	• There is an abnormality in the speed calculated from engine speed sensor signal, transmission input shaft speed sensor signal and transmission output shaft speed sensor signal, and the speed of transmission intermediate shaft sensor signal.		
Action of controller	• Holds gear speed during traveling. • Holds neutral when gear shift lever is set to “N“. • Even if failure is repaired, it does not return to normal unless starting switch is once turned OFF.		
Problem that appears on machine	• Cannot change gear speed. • Once gear shift lever is set to “N“, cannot restart until machine stops.		
Related information	• Signal from intermediate shaft speed sensor can be checked with monitoring function (Code: **31300**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective transmission intermediate shaft speed sensor	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN4 (male) (1) – (2)	Resistance	500 – 1,000 Ω
			Between CN4 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between ATC2 (female) (20) – CN4 (female) (1)	Resistance	Min. 1 MΩ
	3	Hot short in wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ground and wiring harness between ATC2 (female) (20) – CN4 (female) (1)	Voltage	Max. 1V
	4	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ATC2 (female) (20) – (39)	Resistance	500 – 1,000 Ω

Circuit diagram related

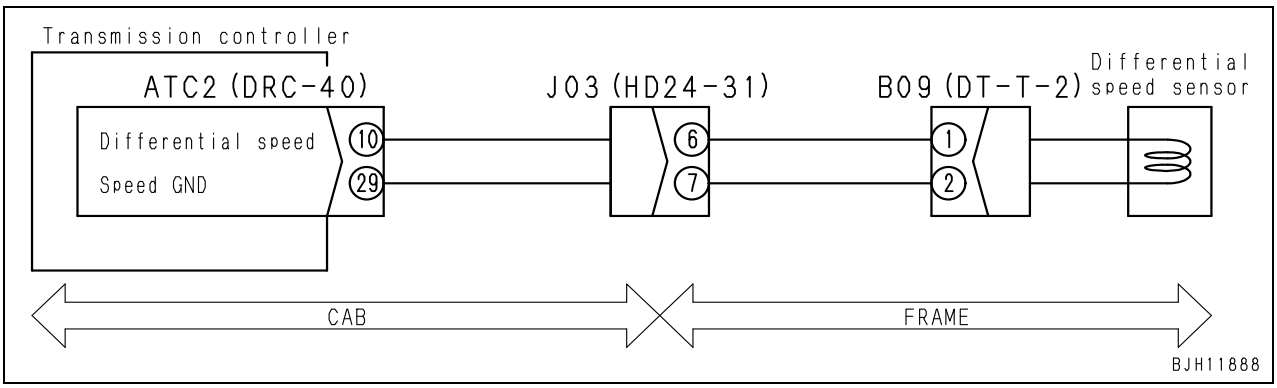


Failure code [DLF4KA] (Differential speed sensor: Disconnection)

Action code	Failure code	Trouble	Differential speed sensor: Disconnection (Transmission controller system)
E03	**DLF4KA**		
Contents of trouble	• There is a disconnection in signal circuit of differential speed sensor and no signal is inputted.		
Action of controller	• Turns inter-axle differential lockup command OFF and holds it.		
Problem that appears on machine	• Inter-axle differential lockup does not work.		
Related information	• Signal from differential speed sensor can be checked with monitoring function (Code: **31402**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Improper adjustment of differential speed sensor	Screw the sensor gently until it bottoms to the differential gear, turn it back by 1/2 – 3/4 turn. ★ See Testing and adjusting “Adjusting transmission speed sensor“ for details.		
	2	Defective differential speed sensor	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between B09 (male) (1) – (2)	Resistance	500 – 1,000 Ω
			Between B09 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	3	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC2 (female) (10) – B09 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ATC2 (female) (29) – B09 (female) (2)	Resistance	Max. 1 Ω
	4	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ATC2 (female) (10) – (29)	Resistance	500 – 1,000 Ω

Circuit diagram related

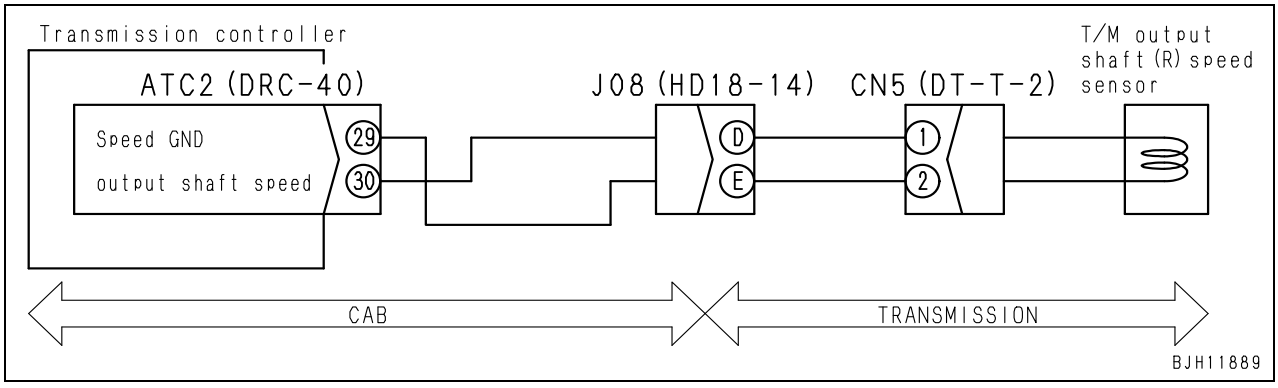


Failure code [DLT3KA] (Transmission output shaft speed sensor: Disconnection)

Action code	Failure code	Trouble	Transmission output shaft speed sensor: Disconnection (Transmission controller system)
E03	**DLT3KA**		
Contents of trouble	• There is a disconnection in signal circuit of transmission output shaft speed sensor and no signal is inputted.		
Action of controller	• Holds gear speed for traveling and turns lockup to OFF. • Holds neutral when gear shift lever is set to “N“. • Even if failure is repaired, it does not return to normal unless starting switch is once turned OFF.		
Problem that appears on machine	• Lockup is released and gear cannot be shifted. • When gear shift lever is shifted to N, transmission is set to neutral.		
Related information	• Signal from output shaft speed sensor can be checked with monitoring function (Code: **31400**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Improper adjustment of transmission output shaft speed sensor	• Screw the sensor gently until it bottoms to the speed detection gear, then turn it back by 1/2 – 1 turn. ★ See Testing and adjusting “Adjusting transmission speed sensor“ for details.		
	2	Defective transmission output shaft speed sensor	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN5 (male) (1) – (2)	Resistance	500 – 1,000 Ω
			Between CN5 (male) (1), (2) – machine ground	Resistance	Min. 1 MΩ
	3	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC2 (female) (30) – CN5 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ATC2 (female) (29) – CN5 (female) (2)	Resistance	Max. 1 Ω
	4	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ATC2 (female) (30) – (29)	Resistance	500 – 1,000 Ω

Circuit diagram related

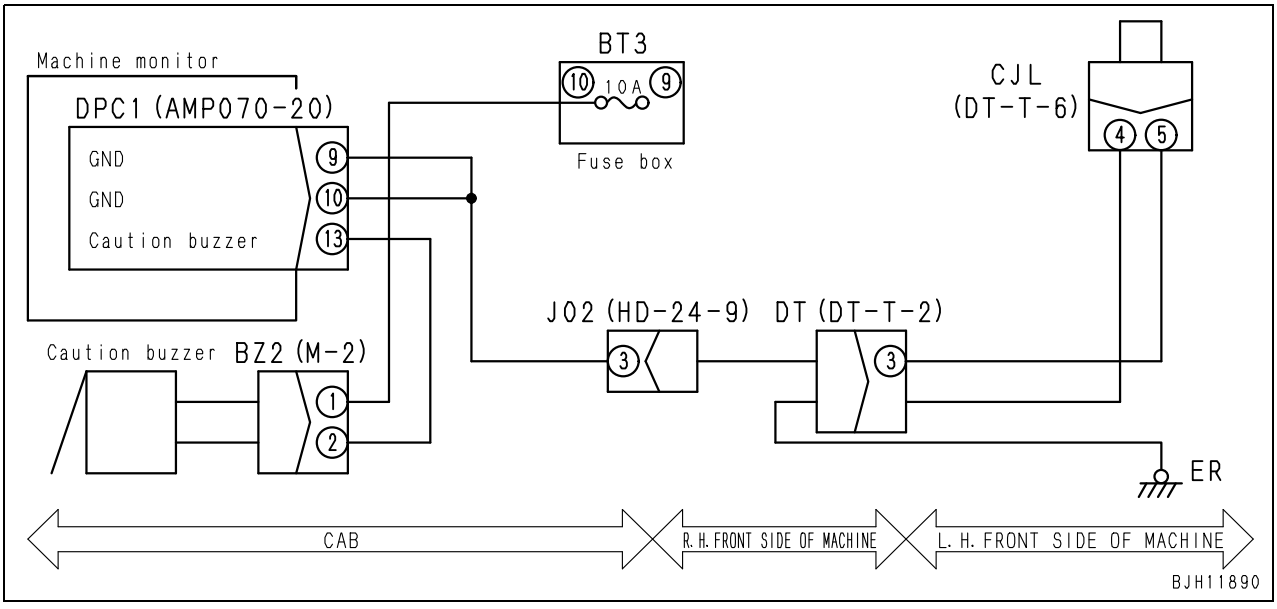


Failure code [DV00KB] (Alarm buzzer output: Short circuit)

Action code	Failure code	Trouble	Alarm buzzer output: Short circuit (Machine monitor system)
E01	**DV00KB**		
Contents of trouble	• An excess current has occurred while outputting to alarm buzzer circuit.		
Action of controller	• Keeps the abnormal condition until starting switch is turned OFF. • Turns alarm buzzer output OFF.		
Problem that appears on machine	• Alarm buzzer does not sound.		
Related information	• Nothing particular.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Short circuit of harness (Contact with ground circuit or contact among harnesses)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between wiring harness from DPC1 (female) (13) – BZ2 (female) (2) and wiring harness from BZ2 (female) (1) – BT3 (10).	Resistance	Min. 1 MΩ
			Between ground and wiring harness between DPC1 (female) (13) – BZ2 (female) (2)	Resistance	Min. 1 MΩ
	2	Defective alarm buzzer	★ Prepare with starting switch OFF and troubleshooting with starting switch ON. (Remove buzzer and connect +24 V to BZ2 (male) (1) and connect GND to BZ2 (male) (2)).		
			Alarm buzzer sounds.	Alarm buzzer is normal.	
			Alarm buzzer does not sound.	Defective alarm buzzer	
			★ Check alarm buzzer unit.		
	3	Defective machine monitor	• If no problem is found in above 1) and 2), machine monitor is defective.		

Circuit diagram related

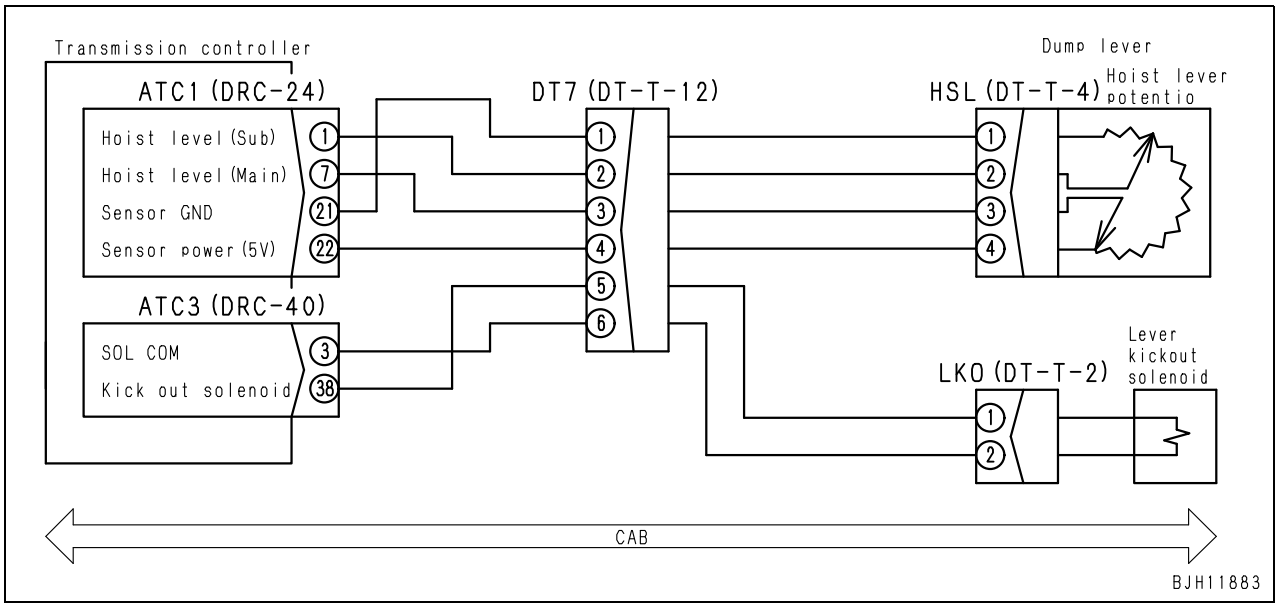


Failure code [DW72KZ] (Kick-out solenoid output system: Disconnection or short circuit)

Action code	Failure code	Trouble	Kick-out solenoid output system: Disconnection or short circuit (Transmission controller system)
E01	**DW72KZ**		
Contents of trouble	• Excessive current flows when output is ON to dump lever kick-out solenoid circuit, current does not flow when output is ON, or current flows when output is OFF.		
Action of controller	• Takes no particular action.		
Problem that appears on machine			
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective hoist lever kick-out solenoid	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between LK0 (male) (1) – (2)	Resistance	39 Ω ± 5 %
			Between LK0 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC (female) (3) – LK0 (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between ATC3 (female) (38) – LK0 (female) (1)	Resistance	Max. 1 Ω
	3	Short circuit of harness (Contact with ground circuit or contact among harnesses)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between ATC3 (female) (38) – LK0 (female) (1)	Resistance	Min. 1 MΩ
			Between wiring harness from ATC3 (female) (38) – LK0 (female) (1) and wiring harness from ATC3 (female) (3) – LK0 (female) (2)	Resistance	Min. 1 MΩ
	4	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ATC3 (female) (38) – ground	Resistance	39 Ω ± 5 %

Circuit diagram related

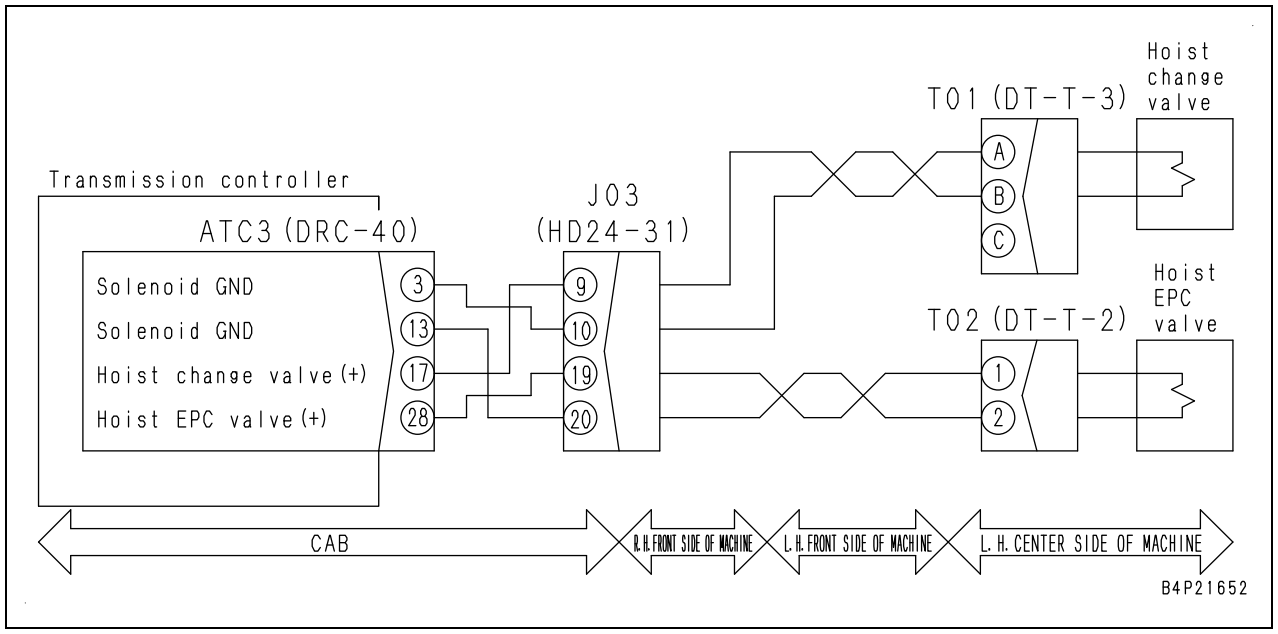


Failure code [DW73KZ] (Hoist selector valve output system: Disconnection or short circuit)

Action code	Failure code	Trouble	Hoist selector valve output system: Disconnection or short circuit (Transmission controller system)
E03	**DW73KZ**		
Contents of trouble	• Excessive current flows when output is ON to hoist selector valve solenoid circuit, or, current does not flow when output is ON, or, current flows when output is OFF.		
Action of controller	• Turn output to hoist selector valve solenoid OFF. • Turn output to hoist EPC valve solenoid OFF.		
Problem that appears on machine	• Dump body does not operate.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective hoist selector valve solenoid	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between T01 (male) (A) – (B)	Resistance	15 – 35 Ω
			Between T01 (male) (A), (B) – ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (3) – T01 (female) (B)	Resistance	Max. 1 Ω
			Wiring harness between ATC3 (female) (17) – T01 (female) (A)	Resistance	Max. 1 Ω
	3	Short circuit of harness (Contact with ground circuit or contact among harnesses)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between ATC3 (female) (17) – T01 (female) (A)	Resistance	Min. 1 MΩ
			Between wiring harness from ATC3 (female) (17) – T01 (female) (A) and wiring harness from ATC3 (female) (3) – T01 (female) (B)	Resistance	Min. 1 MΩ
	4	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ATC3 (female) (17) – (3)	Resistance	15 – 35 Ω

Circuit diagram related

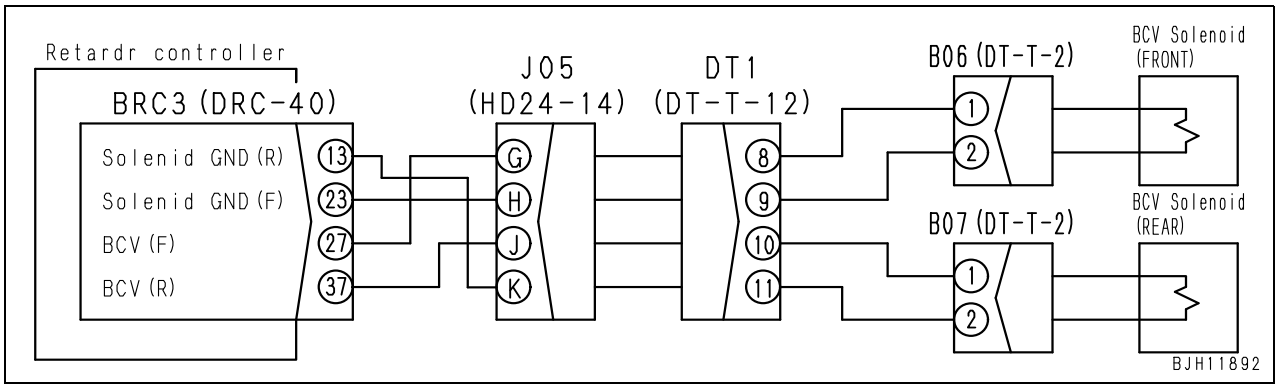


Failure code [DW78KZ] (Rear brake BCV command output system: Disconnection or short circuit)

Action code	Failure code	Trouble	Rear brake BCV command output: Disconnection or short circuit (Retarder controller system)
E01	**DW78KZ**		
Contents of trouble	• Current does not flow to rear brake BCV solenoid, or excessive current flows when output is ON.		
Action of controller	• Current does not flow to solenoid. • Continues to control.		
Problem that appears on machine			
Related information	• Output current to rear brake BCV can be checked with monitoring function (Code: **33806**).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective rear BCV solenoid	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between B07 (male) (1) – (2)		Resistance	Max. 1 Ω
			Between B07 (male) (1), (2) – ground		Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between BRC3 (female) (37) – B07 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between BRC3 (female) (13) – B07 (female) (2)		Resistance	Max. 1 Ω
	3	Short circuit of harness (Contact with ground circuit or contact among harnesses)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between BRC3 (female) (37) – B07 (female) (1)		Resistance	Min. 1 MΩ
			Between wiring harness from BRC3 (female) (37) – B07 (female) (1) and wiring harness from BRC3 (female) (13) – B07 (female) (2)		Resistance	Min. 1 MΩ
	4	Defective retarder controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between BRC3 (female) (37) – (13)	When solenoid output is ON	Voltage	20 – 30 V
				When solenoid output is OFF	Voltage	Max. 1 V

Circuit diagram related

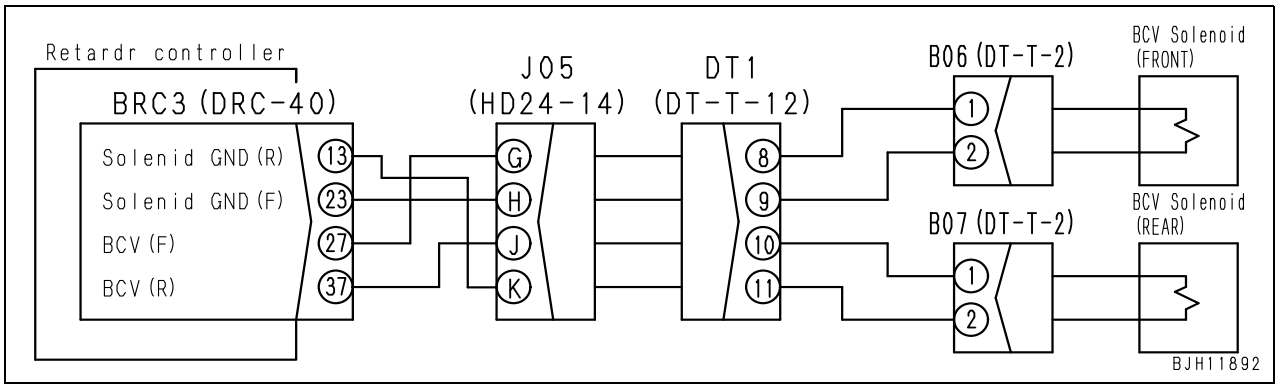


Failure code [DW79KZ] (Front brake BCV command output system: Disconnection or short circuit)

Action code	Failure code	Trouble	Front brake BCV command output: Disconnection or short circuit (Retarder controller system)
E01	**DW79KZ**		
Contents of trouble	• Current does not flow to front brake BCV solenoid, or excessive current flows when output is ON.		
Action of controller	• Current does not flow to solenoid. • Continues to control.		
Problem that appears on machine			
Related information	• Output current to front brake BCV can be checked with monitoring function (Code: **33807**).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective front BCV solenoid	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between B06 (male) (1) – (2)		Resistance	Max. 1 Ω
			Between B06 (male) (1), (2) – ground		Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between BRC3 (female) (27) – B06 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between BRC3 (female) (23) – B06 (female) (2)		Resistance	Max. 1 Ω
	3	Short circuit of harness (Contact with ground circuit or contact among harnesses)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between BRC3 (female) (27) – B06 (female) (1)		Resistance	Min. 1 MΩ
			Between wiring harness from BRC3 (female) (27) – B06 (female) (1) and wiring harness from BRC3 (female) (23) – B06 (female) (2)		Resistance	Min. 1 MΩ
	4	Defective retarder controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between BRC3 (female) (37) – (13)	When solenoid output is ON	Voltage	20 – 30 V
				When solenoid output is OFF	Voltage	Max. 1 V

Circuit diagram related

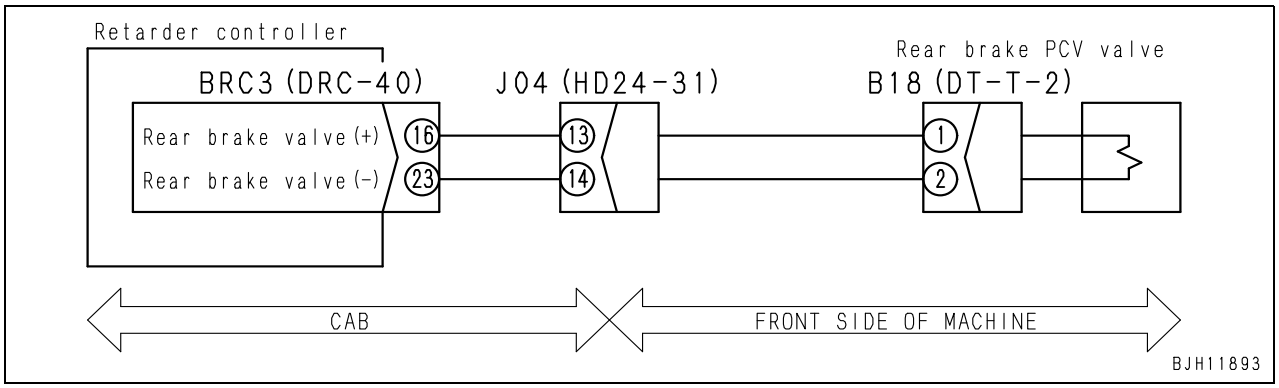


Failure code [DX11K4] (Rear brake proportional pressure reducing solenoid valve: Out of control)

Action code	Failure code	Trouble	Rear brake proportional pressure reducing solenoid valve: Out of control (Valve is stuck in operated condition) (Retarder controller system)
E03	**DX11K4**		
Contents of trouble	• Rear brake proportional pressure reducing solenoid valve is stuck in operated condition (does not move).		
Action of controller	• Releases retarder solenoid output.		
Problem that appears on machine	• Retarder (rear brake) and over run prevention do not operate.		
Related information	• Retarder oil pressure switch state can be checked with monitoring function (Code: **33806**).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective rear brake proportional pressure reducing solenoid valve	• Check rear brake proportional pressure reducing solenoid valve. If there is an abnormality (mechanical failure), repair or replace it.			
	2	Defective rear brake proportional pressure reducing solenoid valve	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between B18 (male) (1) – (2)	Oil pressure is ON.	Resistance	Max. 1 Ω
				Oil pressure is OFF.	Resistance	Min. 1 MΩ
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between BRC3 (female) (16) – B18 (female) (1)		Resistance	Max. 1 Ω
	4	Hot short in wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between ground and wiring harness between BRC3 (female) (16) – B18 (female) (1)		Voltage	Max. 1 V
	5	Defective retarder controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between BRC3 (16) – (23)	Oil pressure is ON.	Voltage	Max. 1 V
				Oil pressure is OFF.	Voltage	20 – 30 V

Circuit diagram related

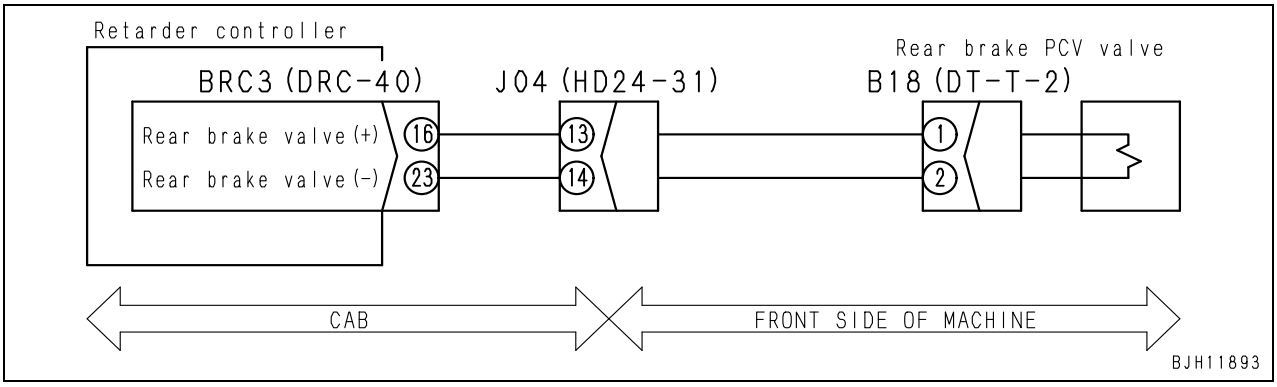


Failure code [DX11KA] (Rear brake proportional pressure reducing solenoid valve output circuit: Disconnection)

Action code	Failure code	Trouble	Rear brake proportional pressure reducing solenoid valve: Disconnection (Retarder controller system)
E03	**DX11KA**		
Contents of trouble	• When output to rear brake pressure reducing valve solenoid circuit is ON, current does not flow.		
Action of controller	• Turns output to rear brake pressure reducing valve solenoid OFF.		
Problem that appears on machine	• Retarder (rear brake) does not operate.		
Related information	• Can be checked with monitoring function (code: **33806**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective rear brake proportional pressure reducing solenoid valve	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between B18 (male) (1) – (2)	Resistance	10 – 30 Ω
			Between B18 (female) (1), (2) – machine ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between BRC3 (female) (16) – B18 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between BRC3 (female) (23) – B18 (female) (2)	Resistance	Max. 1 Ω
	3	Defective retarder controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between BRC3 (female) (16) – (23)	Resistance	10 – 30 Ω

Circuit diagram related

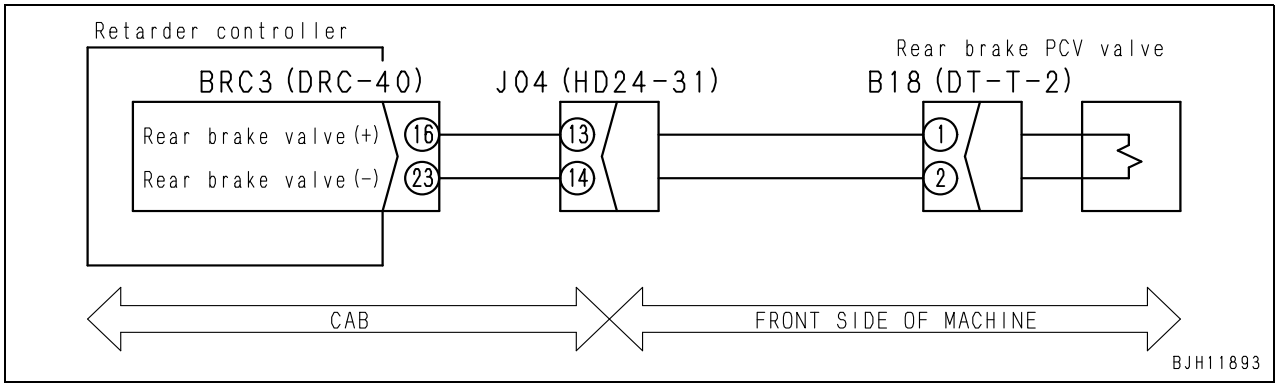


Failure code [DX11KB] (Rear brake proportional pressure reducing solenoid valve: Short circuit)

Action code	Failure code	Trouble	Rear brake proportional pressure reducing solenoid valve: Short circuit (Retarder controller system)
E03	**DX11KB**		
Contents of trouble	• When output is ON to rear brake pressure reducing valve solenoid circuit, excessive current flows.		
Action of controller	• Turns output to rear brake pressure reducing valve solenoid OFF.		
Problem that appears on machine	• Retarder (rear brake) does not operate.		
Related information	• Can be checked with monitoring function (code: **33806**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective rear brake proportional pressure reducing solenoid valve	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between B18 (male) (1) – (2)	Resistance	10 – 30 Ω
			Between B18 (male) (1), (2) – machine ground	Resistance	Min. 1 MΩ
	2	Short circuit of harness (Contact with GND circuit or contact among harnesses)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between BRC3 (female) (16) – B18 (female) (1)	Resistance	Min. 1 MΩ
			Between wiring harness from BRC3 (female) (16) – B18 (female) (1) and wiring harness from BRC3 (female) (23) – B18 (female) (2)	Resistance	Min. 1 MΩ
	3	Defective retarder controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between BRC3 (female) (16) – (23)	Resistance	10 – 30 Ω

Circuit diagram related

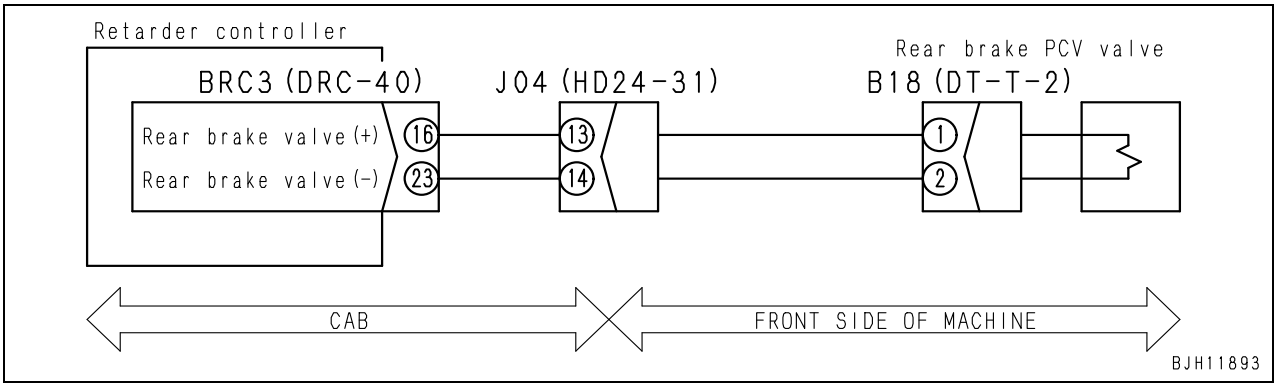


Failure code [DX11KY] (Rear brake proportional pressure reducing solenoid valve: Short circuit to power source line)

Action code	Failure code	Trouble	Rear brake proportional pressure reducing solenoid valve: Short circuit to power source line (Retarder controller system)
E03	**DX11KY**		
Contents of trouble	• When output to rear brake pressure reducing valve solenoid circuit is OFF, electric current flows.		
Action of controller	• Turns output to rear brake pressure reducing valve solenoid OFF.		
Problem that appears on machine	• Retarder (rear brake) does not operate.		
Related information	• Can be checked with monitoring function (code: **33806**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective rear brake proportional pressure reducing solenoid valve	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between B18 (male) (1) – (2)	Resistance	10 – 30 Ω
			Between B18 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Hot short in wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ground and wiring harness between BRC3 (female) (16) – B18 (female) (1)	Voltage	Max. 1 V
	3	Defective retarder controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between BRC3 (female) (16) – (23)	Resistance	10 – 30 Ω

Circuit diagram related

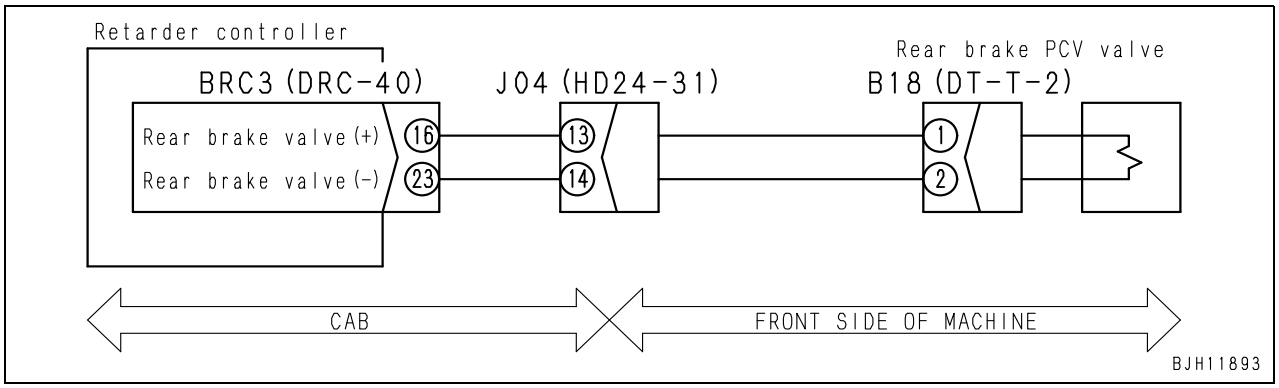


Failure code [DX11MA] (Rear brake proportional pressure reducing solenoid valve: Malfunction)

Action code	Failure code	Trouble	Rear brake proportional pressure reducing solenoid valve: Malfunction (Retarder controller system)
E03	**DX11MA**		
Contents of trouble	• Rear brake proportional pressure reducing solenoid valve does not operate (does not move).		
Action of controller	• Releases retarder solenoid output.		
Problem that appears on machine	• Retarder (rear brake), ARSC and over run prevention do not operate.		
Related information	• Retarder oil pressure switch state can be checked with monitoring function (Code: **33806**).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective rear brake proportional pressure reducing solenoid valve	• Check rear brake proportional pressure reducing solenoid valve. If there is an abnormality (mechanical failure), repair or replace it.			
	2	Defective rear brake proportional pressure reducing solenoid valve	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between B18 (male) (1) – (2)	Oil pressure is ON.	Resistance	Max. 1 Ω
				Oil pressure is OFF.	Resistance	Min. 1 MΩ
	3	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between BRC3 (female) (16) – B18 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between BRC3 (female) (23) – B18 (female) (2)		Resistance	Max. 1 Ω
	4	Defective retarder controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between BRC3 (16) – (23)	Oil pressure is ON.	Voltage	Max. 1 V
				Oil pressure is OFF.	Voltage	20 – 30 V

Circuit diagram related

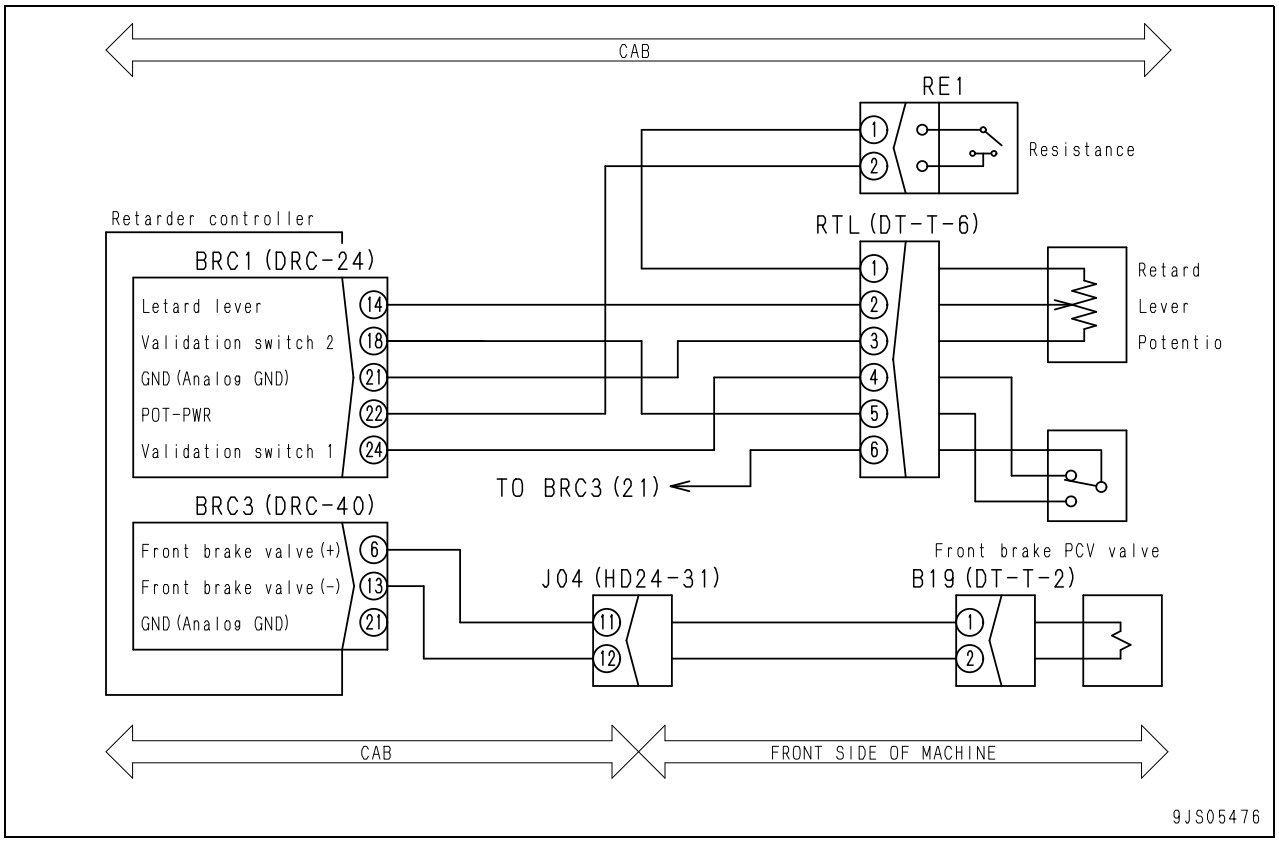


Failure code [DX12K4] (Front brake proportional pressure reducing solenoid valve: Out of control)

Action code	Failure code	Trouble	Front brake proportional pressure reducing solenoid valve: Out of control (Valve is stuck in operated condition) (Retarder controller system)
E03	**DX12K4**		
Contents of trouble	• Front brake proportional pressure reducing solenoid valve is stuck in the operated condition and do not close, or even if it is closed, condition cannot be identified because of defect of detection switch.		
Action of controller	• Continues to control.		
Problem that appears on machine	• If solenoid is defective, front brake is dragging. • When switch is defective or switch input circuit has a grounding failure, shift up becomes difficult and shift down becomes easy.		
Related information	• Can be checked with monitoring function (code: **33807**).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective retarder lever validation switch	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			RTL (male)	Retarder lever	Resistance	
			Between (5) – (6)	During operation	Max. 1 Ω	
			Between (4) – (6)		Min. 1 MΩ	
			Between (5) – (6)	When not operating	Min. 1 MΩ	
			Between (4) – (6)		Max. 1 Ω	
	2	Defective front brake proportional pressure reducing solenoid valve	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between B19 (male) (1) – (2)		Resistance	10 – 30 Ω
			Between B19 (male) (1) (2) – ground		Resistance	Min. 1 MΩ
	3	Defective harness grounding (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between BRC1 (female) (18) – RTL (female) (5)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between BRC1 (female) (24) – RTL (female) (4)		Resistance	Min. 1 MΩ
	4	Hot short in wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between ground and wiring harness between BRC3 (female) (6) – B19 (female) (1)		Voltage	Max. 1 V
	5	Defective retarder controller	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between BRC3 (6) – (13)	Retarder operation	Voltage	20 – 30 V
				Retarder neutral	Voltage	Max. 1 V
	6	Malfunction of front brake pressure reducing valve	If no problem is found in above 1 – 5, defective operation of pressure reducing valve unit is suspected.			

Circuit diagram related

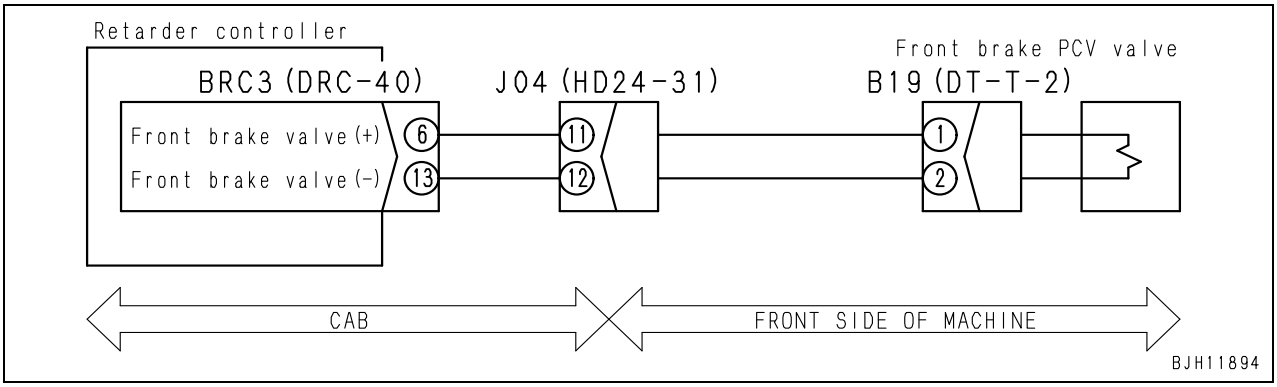


Failure code [DX12KA] (Front brake proportional pressure reducing solenoid valve output circuit: Disconnection)

Action code	Failure code	Trouble	Front brake proportional pressure reducing solenoid valve output circuit: Disconnection (Retarder controller system)
E03	**DX12KA**		
Contents of trouble	• When output to front brake pressure reducing valve solenoid circuit is ON, current does not flow.		
Action of controller	• Turns the output to front brake pressure reducing valve solenoid OFF.		
Problem that appears on machine	• Retarder (front brake) does not operate.		
Related information	• As solenoid detects disconnection while output is ON, be sure to turn output ON to check operation after repair. • Can be checked with monitoring function (Code: **33807**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective front brake proportional pressure reducing solenoid valve	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between B19 (female) (1) – (2)	Resistance	10 – 30 Ω
			Between B19 (female) (1), (2) – machine ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between BRC3 (female) (6) – B19 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between BRC3 (female) (13) – B19 (female) (2)	Resistance	Max. 1 Ω
	3	Defective retarder controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between BRC3 (female) (6) – (13)	Resistance	10 – 30 Ω

Circuit diagram related

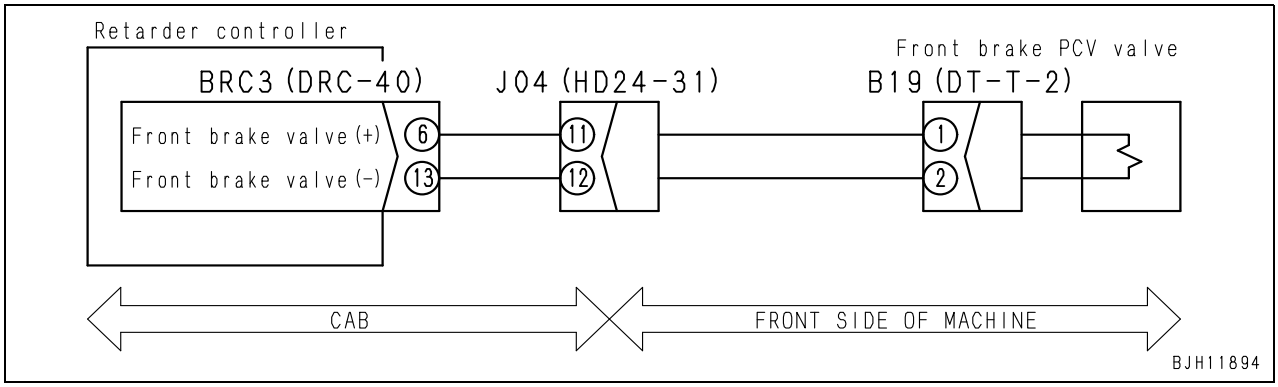


Failure code [DX12KB] (Front brake proportional pressure reducing solenoid valve: Short circuit)

Action code	Failure code	Trouble	Rear brake proportional pressure reducing solenoid valve: Short circuit (Retarder controller system)
E03	**DX12KB**		
Contents of trouble	• When output to front brake pressure reducing valve solenoid circuit is ON, excessive current flows.		
Action of controller	• Turns the output to front brake pressure reducing valve solenoid OFF.		
Problem that appears on machine	• Retarder (front brake) does not operate.		
Related information	• Can be checked with monitoring function (code: **33807**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective front brake proportional pressure reducing solenoid valve	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between B19 (female) (1) – (2)	Resistance	10 – 30 Ω
			Between B19 (female) (1), (2) – machine ground	Resistance	Min. 1 MΩ
	2	Short circuit of harness (Contact with ground circuit or contact among harnesses)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between BRC3 (female) (6) – B19 (female) (1)	Resistance	Min. 1 MΩ
			Between wiring harness from BRC3 (female) (6) – B19 (female) (1) and wiring harness from BRC3 (female) (13) – B19 (female) (2)	Resistance	Min. 1 MΩ
	3	Defective retarder controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between BRC3 (female) (6) – (13)	Resistance	10 – 30 Ω

Circuit diagram related

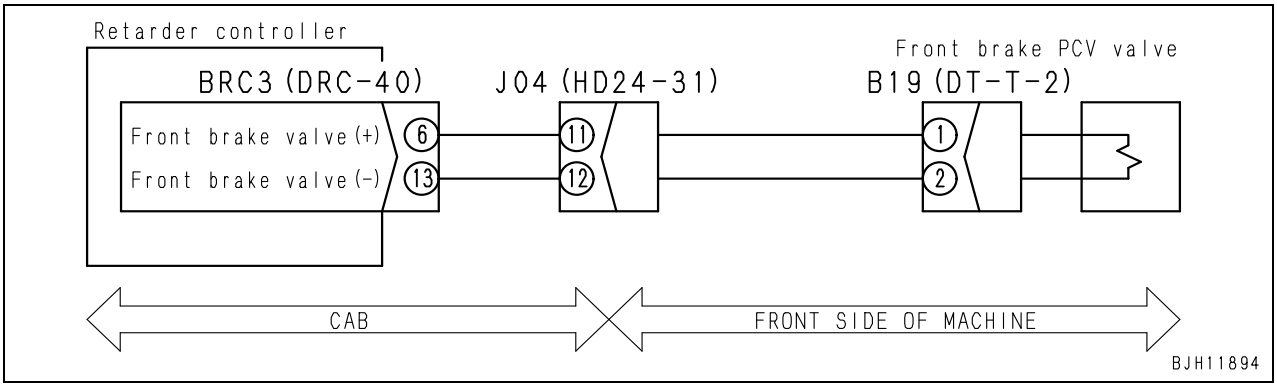


Failure code [DX12KY] (Front brake proportional pressure reducing solenoid valve: Short circuit to power source line)

Action code	Failure code	Trouble	Front brake proportional pressure reducing solenoid valve output circuit: Short circuit to power source line (Retarder controller system)
E03	**DX12KY**		
Contents of trouble	• When output to front brake pressure reducing valve solenoid circuit is OFF, current flows		
Action of controller	• Turns the output to front brake pressure reducing valve solenoid OFF.		
Problem that appears on machine	• Retarder (front brake) does not operate.		
Related information	• Can be checked with monitoring function (code: **33807**).		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective front brake proportional pressure reducing solenoid valve	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between B19 (female) (1) – (2)	Resistance	10 – 30 Ω
			Between B19 (female) (1) (2) – ground	Resistance	Min. 1 MΩ
	2	Hot short in wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ground and wiring harness between BRC3 (female) (6) – B19 (female) (1)	Voltage	Max. 1 V
	3	Defective retarder controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between BRC3 (female) (6) – (13)	Resistance	10 – 30 Ω

Circuit diagram related

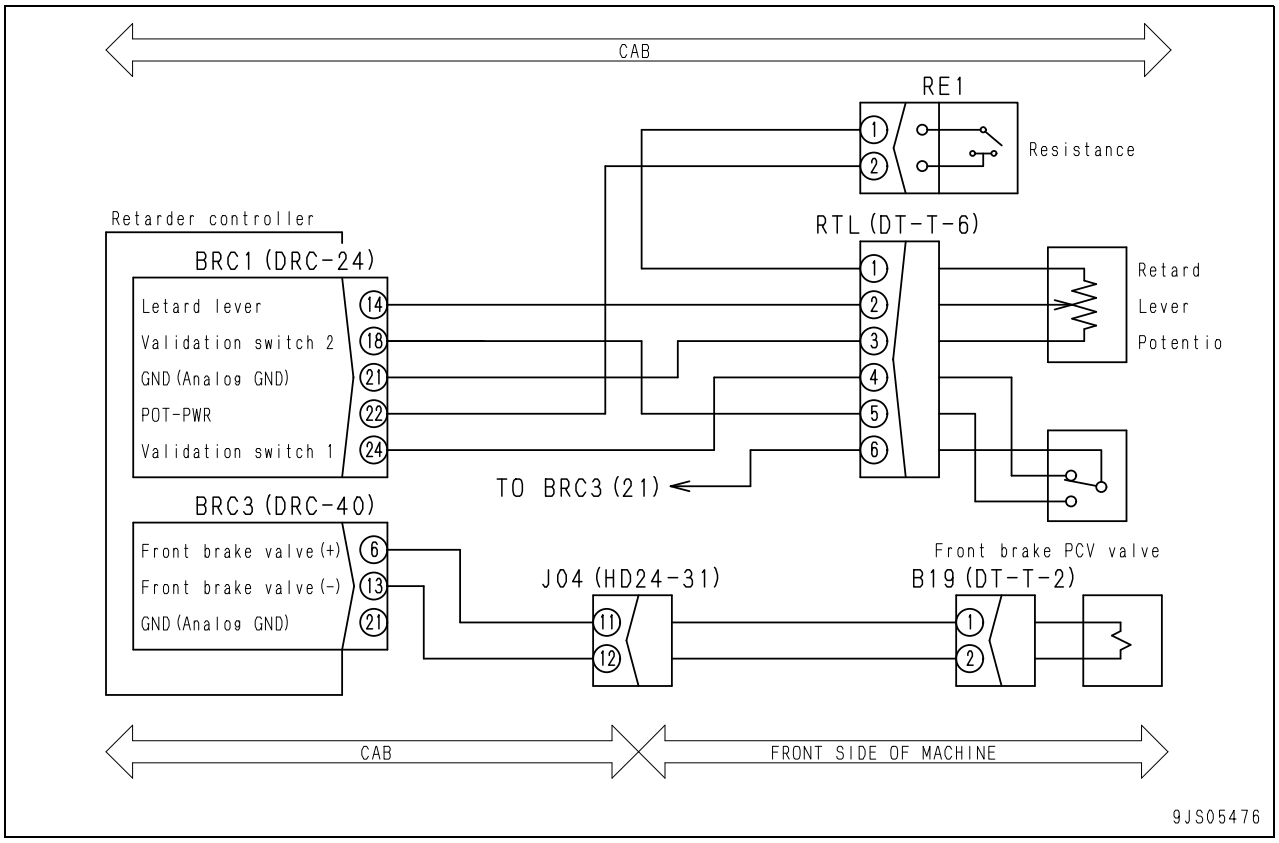


Failure code [DX12MA] (Front brake proportional pressure reducing solenoid valve: Malfunction)

Action code	Failure code	Trouble	Front brake pressure proportional reducing solenoid valve: Malfunction (Retarder controller system)
E03	**DX12MA**		
Contents of trouble	• Front brake proportional pressure reducing solenoid valve is stuck in the operated condition and do not close, or even if it is closed, condition cannot be identified because of defect of detection switch.		
Action of controller	• Continues to control.		
Problem that appears on machine	• If the solenoid is defective, front retarder cannot be used. • When switch is defective or there is a disconnection in switch input circuit, there is no change.		
Related information	• Can be checked with monitoring function (code: **33807**).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective retarder lever validation switch	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			RTL (male)	Retarder lever	Resistance	
			Between (5) – (6)	During operation	Max. 1 Ω	
			Between (4) – (6)		Min. 1 MΩ	
			Between (5) – (6)	When not operating	Min. 1 MΩ	
			Between (4) – (6)		Max. 1 Ω	
	2	Defective front brake proportional pressure reducing solenoid valve	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between B19 (female) (1) – (2)		Resistance	10 – 30 Ω
			Between B19 (female) (1), (2) – ground		Resistance	Min. 1 MΩ
	3	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between BRC3 (female) (6) – B19 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between BRC3 (female) (13) – B19 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between BRC1 (female) (18) – RLT (female) (5)		Resistance	Max. 1 Ω
			Wiring harness between BRC1 (female) (24) – RLT (female) (4)		Resistance	Max. 1 Ω
	4	Defective retarder controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between BRC3 (female) (6) – (13)		Resistance	10 – 30 Ω
			If no problem is found in above 1 – 3, pressure reducing valve is defective.			

Circuit diagram related

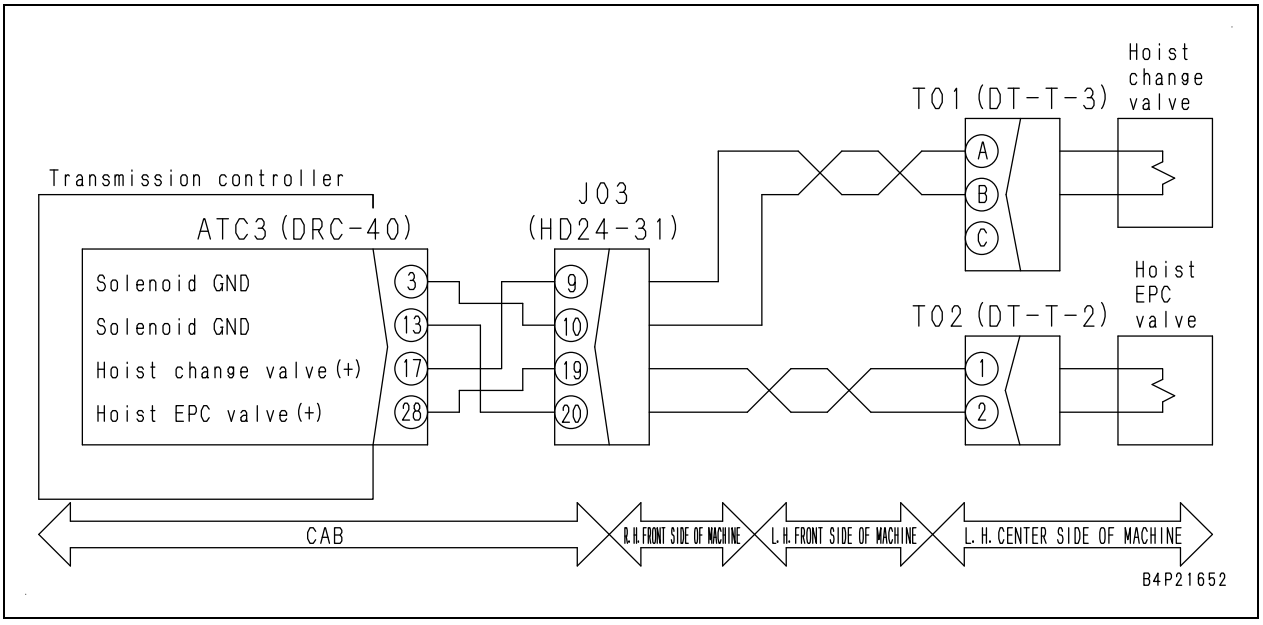


Failure code [DX13KA] (Hoist EPC valve output circuit: Disconnection)

Action code	Failure code	Trouble	Hoist EPC valve output circuit: Disconnection (Transmission controller system)
E03	**DX13KA**		
Contents of trouble	• When output to hoist EPC valve solenoid circuit is ON, current does not flow.		
Action of controller	• Turns output to hoist selector valve solenoid OFF. • Turns output to hoist EPC valve solenoid OFF.		
Problem that appears on machine	• Body does not operate.		
Related information	• As solenoid detects disconnection while output is ON, be sure to turn output ON to check operation after repair. • Output current to hoist EPC can be checked with monitoring function (Code: **45601**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective hoist EPC valve solenoid	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between T02 (female) (1) – (2)	Resistance	15 – 20 Ω
			Between T02 (female) (1), (2) – body ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (28) – T02 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ATC3 (female) (13) – T02 (female) (2)	Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ATC3 (female) (28) – (13)	Resistance	15 – 20 Ω

Circuit diagram related

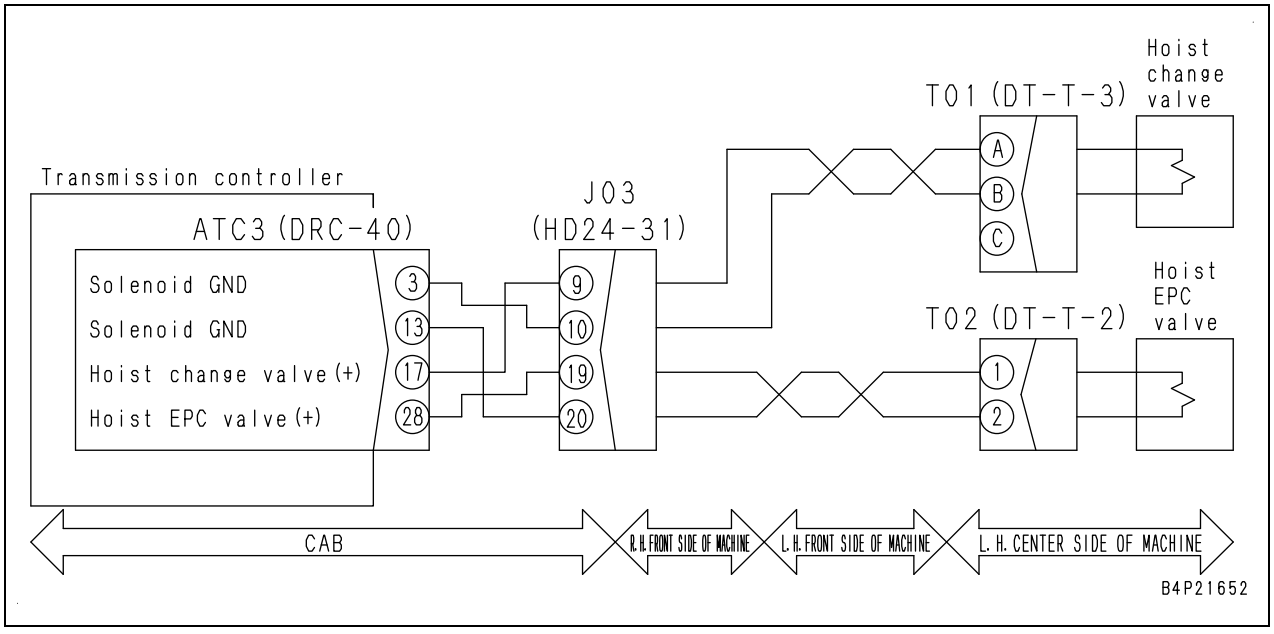


Failure code [DX13KB] (Hoist EPC valve output circuit: Short circuit)

Action code	Failure code	Trouble	Hoist EPC valve output circuit: Short circuit (Transmission controller system)
E03	**DX13KB**		
Contents of trouble	• When output is ON to hoist EPC valve solenoid circuit, excessive current flows.		
Action of controller	• Turns output to hoist selector valve solenoid OFF. • Turns output to hoist EPC valve solenoid OFF.		
Problem that appears on machine	• Body does not operate.		
Related information	• Can be checked with monitoring function (code: **45601**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state			★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
	1	Defective hoist EPC valve solenoid	Between T02 (female) (1) – (2)	Resistance	15 – 20 Ω
			Between T02 (female) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Short circuit of harness (Contact with ground circuit or contact among harnesses)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between ATC3 (female) (28) – T02 (female) (1)	Resistance	Min. 1 MΩ
			Between wiring harness from ATC3 (female) (28) – T02 (female) (1) and wiring harness from ATC3 (female) (13) – T02 (female) (2)	Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ATC3 (female) (28) – (13)	Resistance	15 – 20 Ω

Circuit diagram related

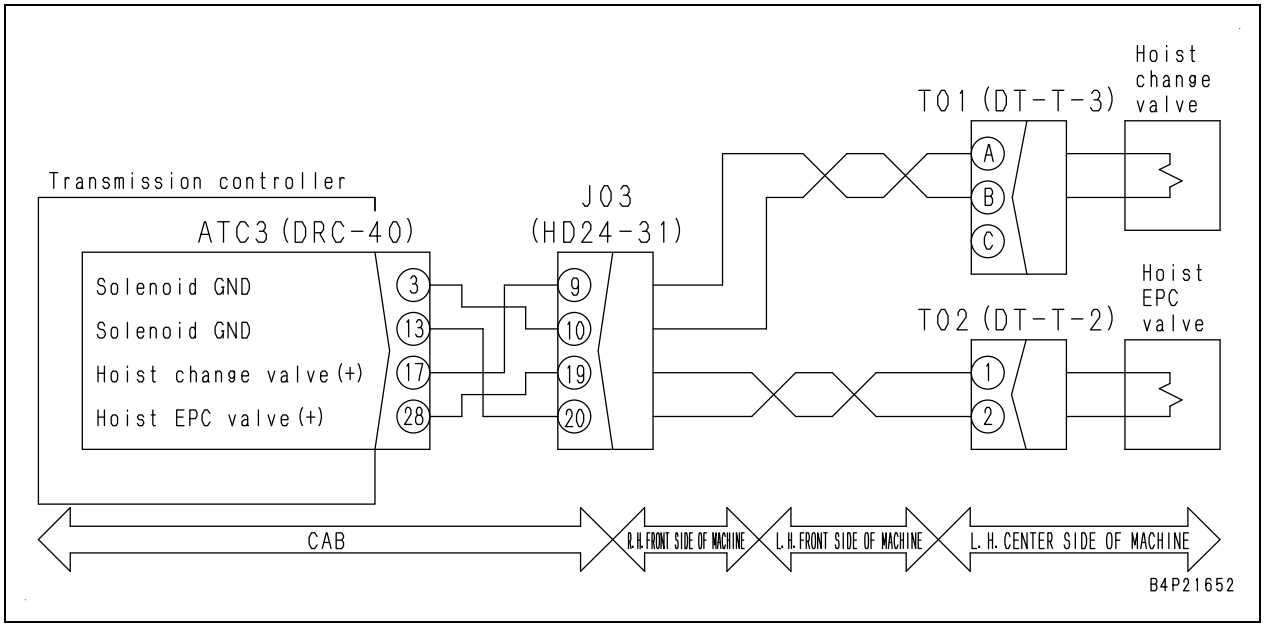


Failure code [DX13KY] (Hoist EPC valve output circuit: Short circuit in power source line)

Action code	Failure code	Trouble	Hoist EPC valve output circuit: Short circuit in power source line (Transmission controller system)
E03	**DX13KY**		
Contents of trouble	• When output to hoist EPC valve solenoid circuit is OFF, electric current flows.		
Action of controller	• Turns output to hoist selector valve solenoid OFF. • Turns output to hoist EPC valve solenoid OFF.		
Problem that appears on machine	• Body does not operate.		
Related information	• Can be checked with monitoring function (code: **45601**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective hoist EPC valve solenoid	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between T02 (female) (1) – (2)	Resistance	15 – 20 Ω
			Between T02 (female) (1), (2) – body ground	Resistance	Min. 1 MΩ
	2	Hot short in wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ground and wiring harness between ATC3 (female) (28) – T02 (female) (1)	Voltage	Max. 1 V
			Between ground and wiring harness between ATC3 (female) (13) – T02 (female) (2)	Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ATC3 (female) (28) – (13)	Resistance	15 – 20 Ω

Circuit diagram related

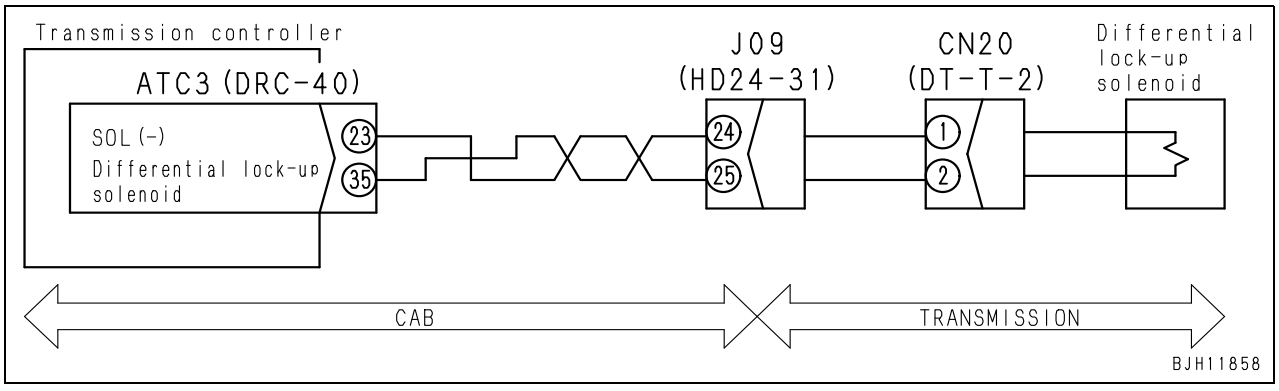


Failure code [DXH0KA] (Inter-axle differential lock pressure control valve: Disconnection)

Action code	Failure code	Trouble	Inter-axle differential lock pressure control valve: Disconnection (Transmission controller system)
E01	**DXH0KA**		
Contents of trouble	• Current does not flow when the output to differential lock clutch solenoid is ON.		
Action of controller	• Turns differential lock OFF and hold it.		
Problem that appears on machine	• Inter-axle differential lockup does not operate.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective differential lockup pressure control valve	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN20 (female) (1) – (2)	Resistance	4 – 14 Ω
			Between CN20 (female) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or improper contact of connector)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ACT3 (female) (35) – CN20 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ACT3 (female) (23) – CN20 (female) (2)	Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ATC3 (female) (35) – (23)	Resistance	4 – 14 Ω

Circuit diagram related

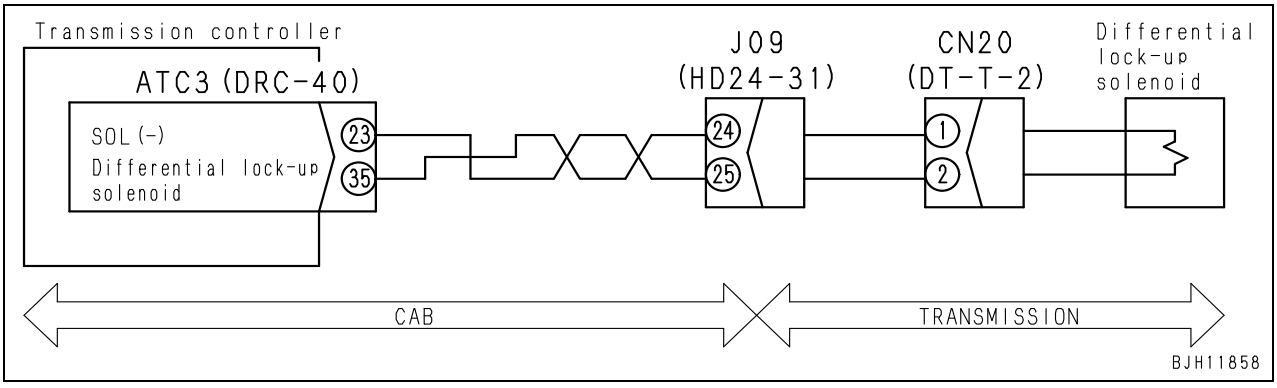


Failure code [DXH0KB] (Inter-axle differential lock pressure control valve: Short circuit)

Action code	Failure code	Trouble	Inter-axle differential lock pressure control valve: Short circuit (Transmission controller system)
E01	**DXH0KB**		
Contents of trouble	• Abnormally excessive current flows when output to differential lockup clutch solenoid is ON.		
Action of controller	• Turns output to inter-axle differential lockup solenoid OFF.		
Problem that appears on machine	• Inter-axle differential lockup does not operate.		
Related information			

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective differential lockup pressure control valve	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN20 (female) (1) – (2)	Resistance	5 – 15 Ω
			Between CN20 (female) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Short circuit of harness (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between ATC3 (female) (35) – CN20 (female) (1)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between ATC3 (female) (23) – CN20 (female) (2)	Resistance	Min. 1 MΩ
	3	Hot short in wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ground and wiring harness between ATC3 (female) (35) – CN20 (female) (1)	Voltage	Max. 1 V
	4	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ATC3 (female) (35) – (23)	Resistance	5 – 15 Ω

Circuit diagram related

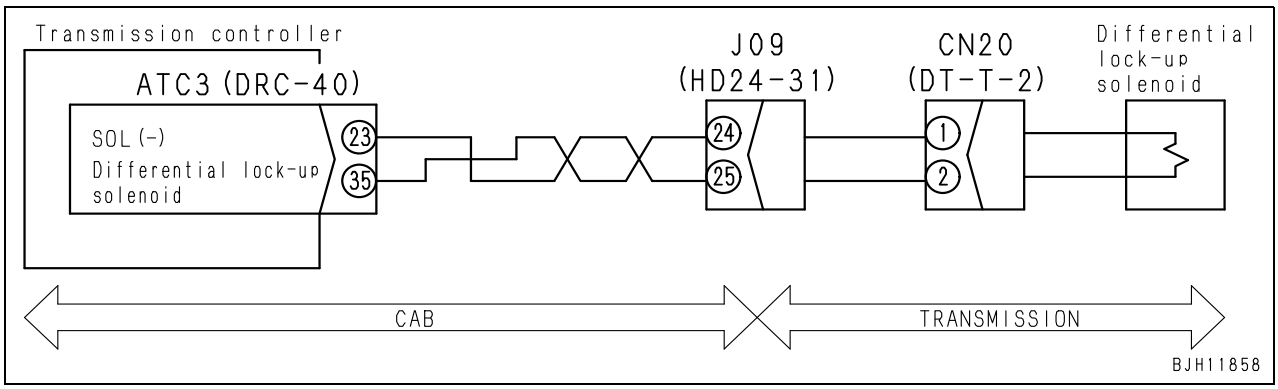


Failure code [DXH0KY] (Inter-axle differential lockup pressure control valve: Short circuit to power source line)

Action code	Failure code	Trouble	Inter-axle differential lockup pressure control valve: Short circuit to power source line (Transmission controller system)
E03	**DXH0KY**		
Contents of trouble	• Electric current flows when output to differential lockup pressure control valve is OFF.		
Action of controller	• Turns output to inter-axle differential lockup pressure control valve OFF.		
Problem that appears on machine	• Differential lockup keeps operating.		
Related information			

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective differential lockup pressure control valve	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN20 (female) (1) – (2)	Resistance	5 – 15 Ω
			Between CN20 (female) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Hot short in wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ground and wiring harness between ATC3 (female) (35) – CN20 (female) (1)	Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ATC3 (female) (35) – (23)		

Circuit diagram related

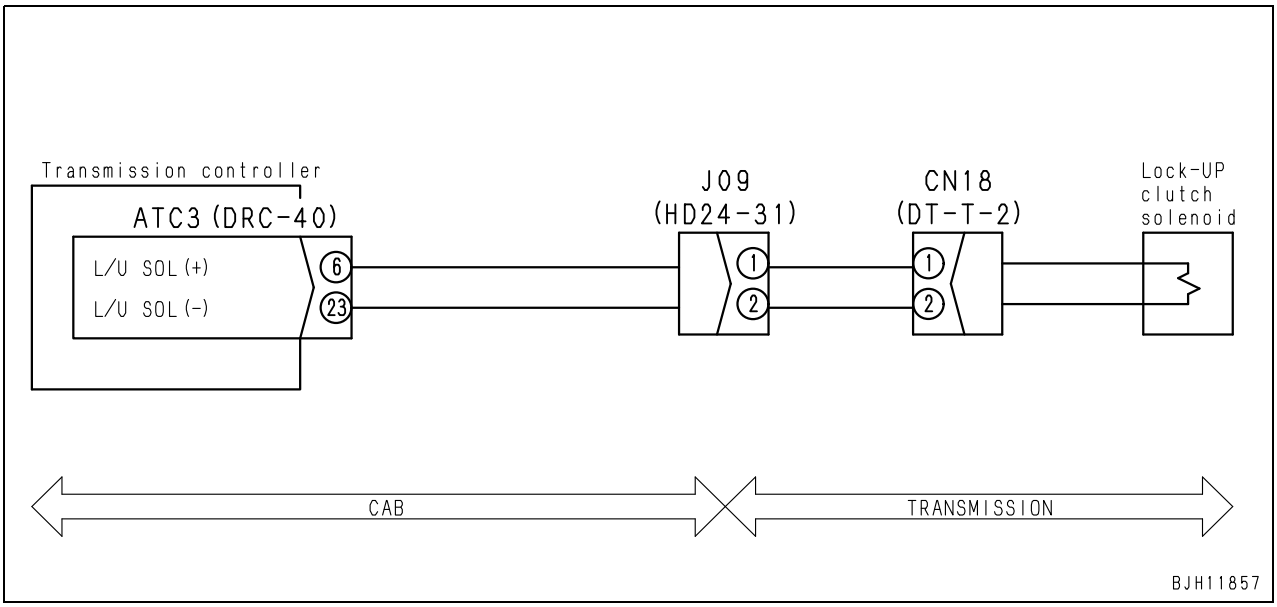


Failure code [DXH1KA] (Lockup clutch solenoid output circuit: Disconnection)

Action code	Failure code	Trouble	Lockup clutch solenoid: Disconnection (Transmission controller system)
E03	**DXH1KA**		
Contents of trouble	• Current does not flow when output to lockup clutch solenoid is ON.		
Action of controller	• Holds gear speed during travel. • Turns lockup actuation OFF.		
Problem that appears on machine	• Lockup does not operate. • When gearshift lever is set to neutral position, machine cannot move off again.		
Related information	• As solenoid detects disconnection while output is ON, be sure to turn output ON to check operation after repair. • Output current to lockup solenoid can be checked with monitoring function (Code: **31609**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective lockup clutch solenoid	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN18 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN18 (male) (1), (2) – body ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (6) – CN18 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ATC3 (female) (23) – CN18 (female) (2)	Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ATC3 (female) (6) – (23)	Resistance	5 – 15 Ω

Circuit diagram related

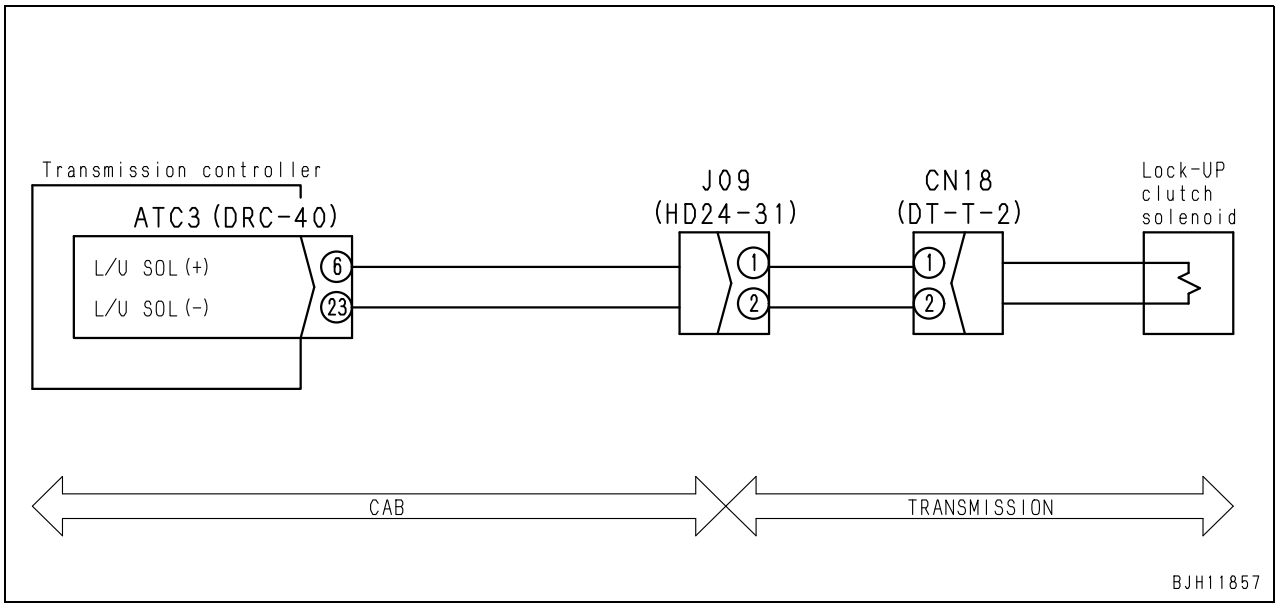


Failure code [DXH1KB] (Lockup clutch solenoid output circuit: Short circuit)

Action code	Failure code	Trouble	Lockup clutch solenoid: Short circuit (Transmission controller system)
E03	**DXH1KB**		
Contents of trouble	• Abnormally excessive current flows while output to lockup clutch solenoid is ON, or current flows while output is OFF.		
Action of controller	• Holds gear speed during traveling and turns lockup to OFF. • Holds neutral when gear shift lever is set to “N“.		
Problem that appears on machine	• Lockup is either released or operated all the time and gear cannot be shifted. • Once gearshift lever is set to “N“, the machine cannot move off again until it is stopped (Will not even move forward depending on the failure condition.)		
Related information	• Output current to lockup solenoid can be checked with monitoring function (Code: **31609**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective lockup clutch solenoid	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN18 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN18 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Short circuit of harness (Contact with ground circuit or contact among harnesses)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between ATC3 (female) (6) – CN18 (female) (1)	Resistance	Min. 1 MΩ
			Between wiring harness from ATC3 (female) (6) – CN18 (female) (1) and wiring harness from ATC3 (female) (23) – CN18 (female) (2)	Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (6) – (23)	Resistance	5 – 15 Ω

Circuit diagram related

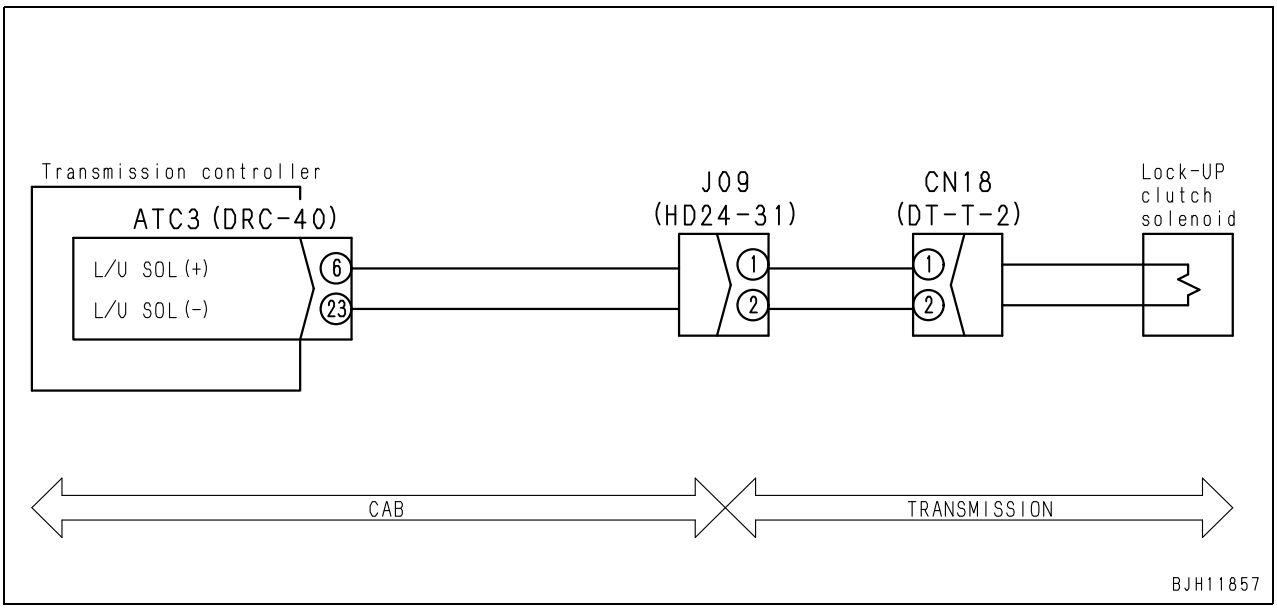


Failure code [DXH1KY] (Lockup clutch solenoid output circuit: Short circuit to power source line)

Action code	Failure code	Trouble	Lockup clutch solenoid output circuit: Short circuit to power source line (Transmission controller system)
E03	**DXH1KY**		
Contents of trouble	• While output to lockup clutch solenoid is OFF, electric current flows.		
Action of controller	• Holds gear speed during traveling and turns lockup to OFF. • Turns on centralized warning lamp and sounds alarm buzzer.		
Problem that appears on machine	• Cannot change gear speed. • Keeps lockup OFF • When gear shift lever is operated to N, machine cannot move off.		
Related information	• Output current to lockup solenoid can be checked with monitoring function (Code: **31609**)		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective lockup clutch solenoid	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN18 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN18 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Hot short in wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ground and wiring harness between ATC3 (female) (6) – CN18 (female) (1)	Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ATC3 (female) (6) – (23)	Resistance	5 – 15 Ω

Circuit diagram related



Failure code [DXH2KA] (Hi clutch solenoid output circuit: Disconnection)

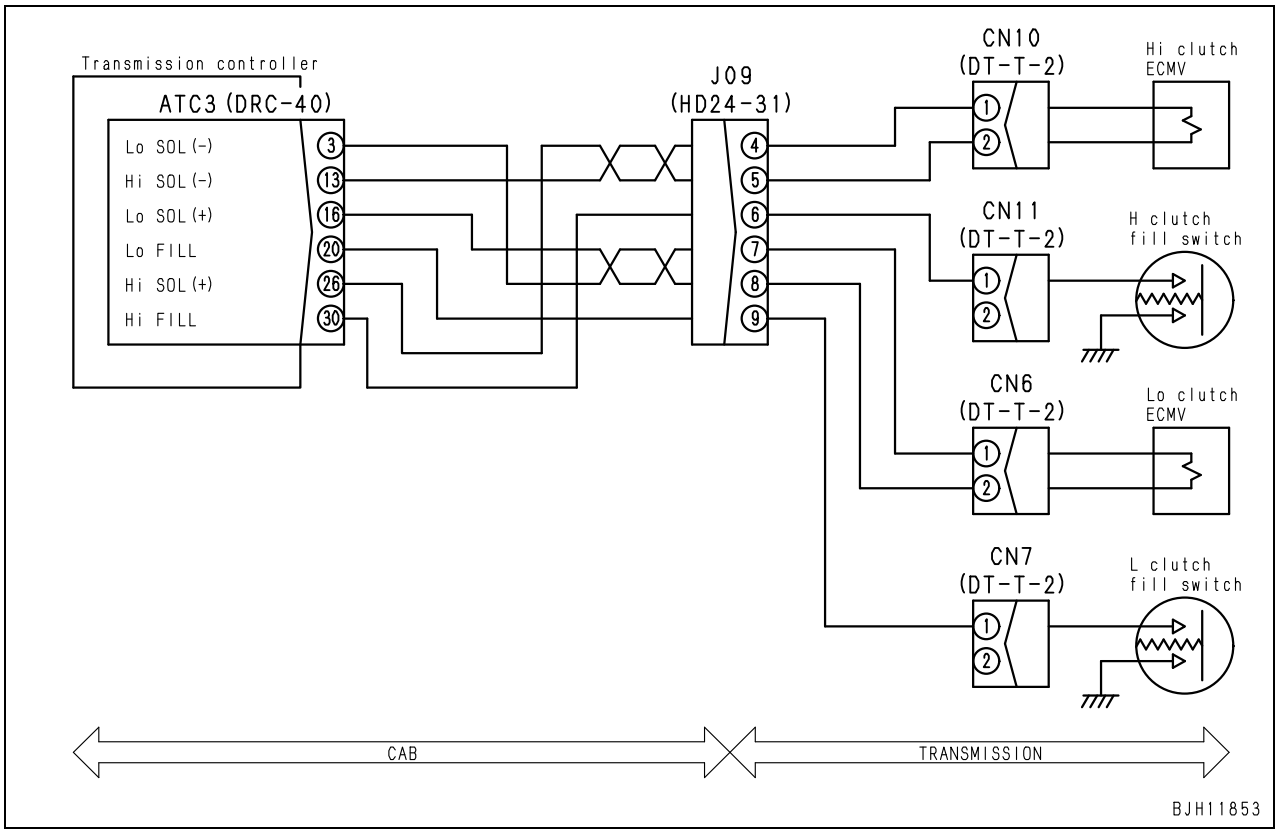
Action code	Failure code	Trouble	Hi clutch solenoid output circuit: Disconnection (Transmission controller system)
E03	**DXH2KA**		
Contents of trouble	• No electric current flows when the output to Hi clutch ECMV is ON.		
Action of controller	• The gear speed is shifted to Neutral. • Shifts up and holds the gear speed as shown in **Table 1** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds. • Shift to neutral when traveling. • Machine cannot move off again until it is stopped.		
Related information	• As solenoid detects disconnection while output is ON, be sure to turn output ON to check operation after repair. • Electric current of output to ECMV can be checked with monitoring function (code: **31600**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective Hi clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN10 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN10 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection and defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (26) – CN10 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ATC3 (female) (13) – CN10 (female) (2)	Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (26) – (13)	Resistance	5 – 15 Ω

Table 1

Previous range		Trouble clutch [Command ON] (Slip , short to GND or signal lost)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	3rd	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
F5	3rd Low	3rd	OFF	Neutral	OFF
		Low	3H	F6	OFF
F4	2nd High	2nd	3L	F5	OFF
		High	3L	F5	OFF
F3	2nd Low	2nd	3L	F5	OFF
		Low	2H	F4	OFF
F2	1st High	1st	2L	F3	OFF
		High	2L	F3	OFF
F1	1st Low	1st	2L	F3	OFF
		Low	1H	F2	OFF
R3	3rd Reverse	3rd	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
R2	2nd Reverse	2nd	3R	R3	OFF
		Reverse	OFF	Neutral	OFF
R1	1st Reverse	1st	2R	R2	OFF
		Reverse	OFF	Neutral	OFF

Circuit diagram related



Failure code [DXH2KB] (Hi clutch solenoid output circuit: Short circuit)

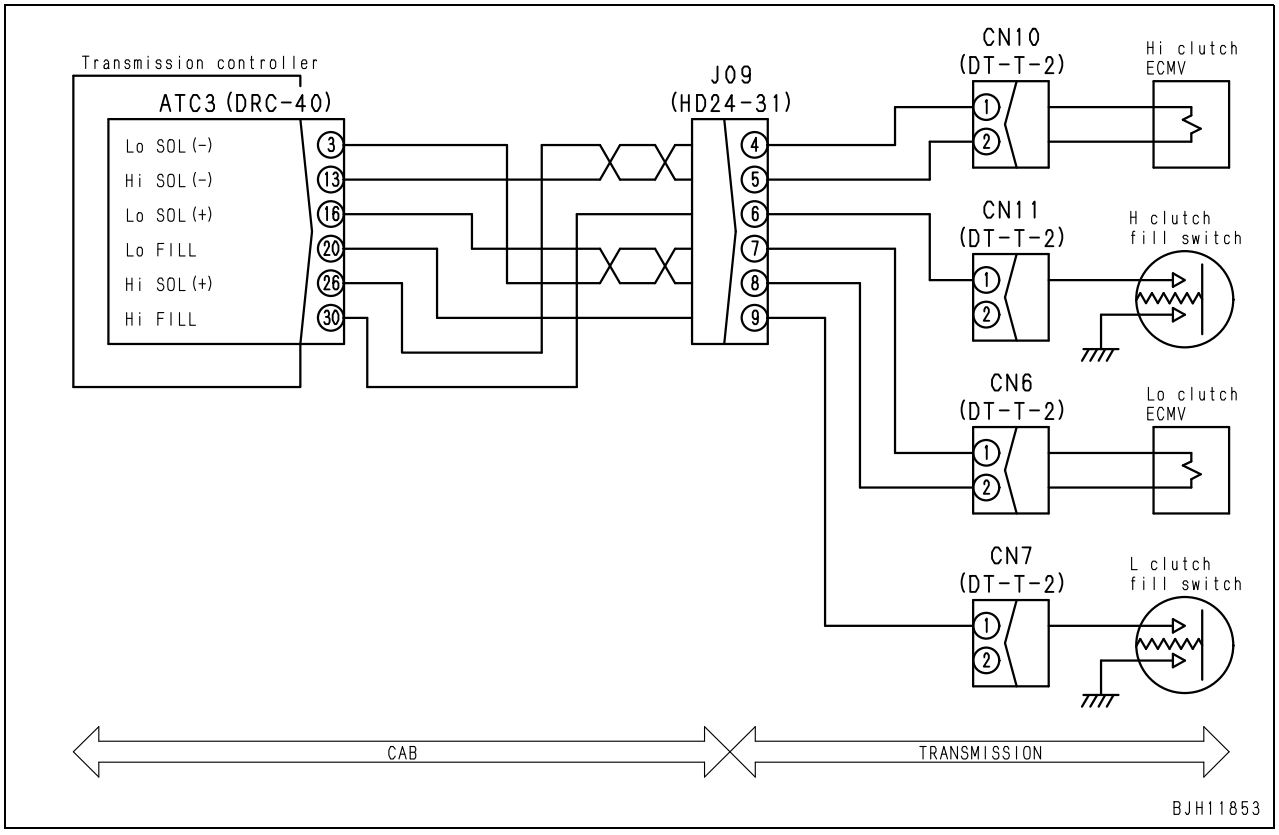
Action code	Failure code	Trouble	Hi clutch solenoid output circuit: Short circuit (Transmission controller system)
E03	**DXH2KB**		
Contents of trouble	• Abnormally excessive current flows while output to Hi clutch ECMV is ON, or current flows while output is OFF.		
Action of controller	• Shifts up and holds the gear speed as shown in **Table 1** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31600**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective Hi clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN10 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN10 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Short circuit of harness (Contact with GND circuit or contact among harnesses)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between ATC3 (female) (26) – CN10 (female) (1)	Resistance	Min. 1 MΩ
			Between wiring harness from ATC3 (female) (26) – CN10 (female) (1) and wiring harness from ATC3 (female) (13) – CN10 (female) (2)	Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ATC3 (female) (26) – (13)	Resistance	5 – 15 Ω

Table 1

Previous range		Trouble clutch [Command ON] (Slip , short to GND or signal lost)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	3rd	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
F5	3rd Low	3rd	OFF	Neutral	OFF
		Low	3H	F6	OFF
F4	2nd High	2nd	3L	F5	OFF
		High	3L	F5	OFF
F3	2nd Low	2nd	3L	F5	OFF
		Low	2H	F4	OFF
F2	1st High	1st	2L	F3	OFF
		High	2L	F3	OFF
F1	1st Low	1st	2L	F3	OFF
		Low	1H	F2	OFF
R3	3rd Reverse	3rd	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
R2	2nd Reverse	2nd	3R	R3	OFF
		Reverse	OFF	Neutral	OFF
R1	1st Reverse	1st	2R	R2	OFF
		Reverse	OFF	Neutral	OFF

Circuit diagram related



Failure code [DXH2KY] (Hi clutch solenoid output circuit: Short circuit to power source line)

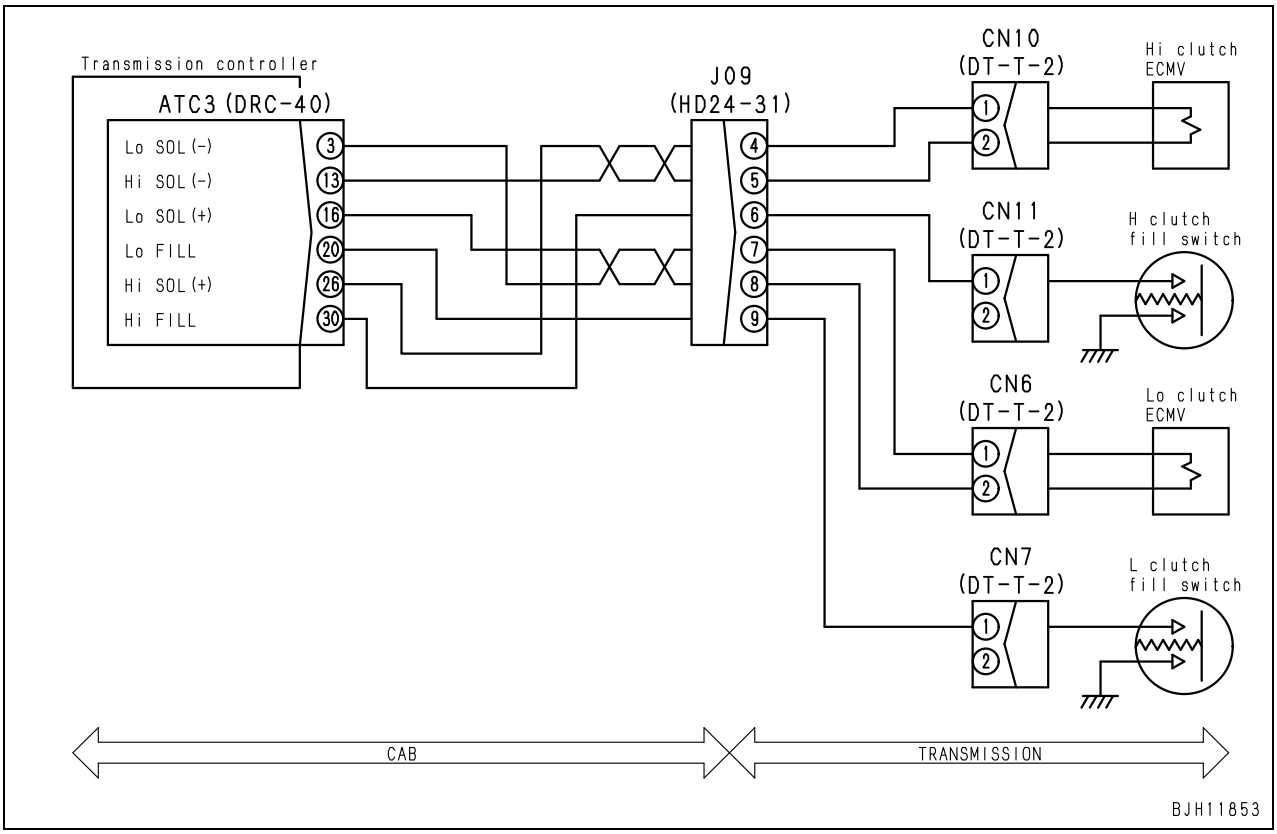
Action code	Failure code	Trouble	Hi clutch solenoid output circuit: Short circuit to power source line (Transmission controller system)
E03	**DXH2KY**		
Contents of trouble	• When output to Hi clutch ECMV is OFF, electric current flows.		
Action of controller	• The gear speed is shifted to Neutral. • Shifts up and holds the gear speed as shown in **Table 2** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **61600**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state			★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
	1	Defective Hi clutch ECMV	Between CN10 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN10 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Hot short in wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ground and wiring harness between ATC3 (female) (26) – CN10 (female) (1)	Voltage	Max. 1V
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ATC3 (female) (26) – (13)	Resistance	5 – 15 Ω

Table 2

Previous range		Trouble clutch [Command on] (Fill SW ON)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
F5	3rd Low	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		High	3H	F6	OFF
F4	2nd High	3rd	3L	F5	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		Low	3L	F5	OFF
F3	2nd Low	3rd	3L	F5	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		High	2H	F4	OFF
F2	1st High	3rd	3L	F5	OFF
		2nd	2L	F3	OFF
		Reverse	OFF	Neutral	OFF
		Low	2L	F3	OFF
F1	1st Low	3rd	3L	F5	OFF
		2nd	2L	F3	OFF
		Reverse	OFF	Neutral	OFF
		High	1H	F2	OFF
R3	3rd Reverse	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
R2	2nd Reverse	3rd	3R	R3	OFF
		1st	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
R1	1st Reverse	3rd	3R	R3	OFF
		2nd	2R	R2	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
N		Any	None	No reaction	—

Circuit diagram related



Failure code [DXH3KA] (Lo clutch solenoid output circuit: Disconnection)

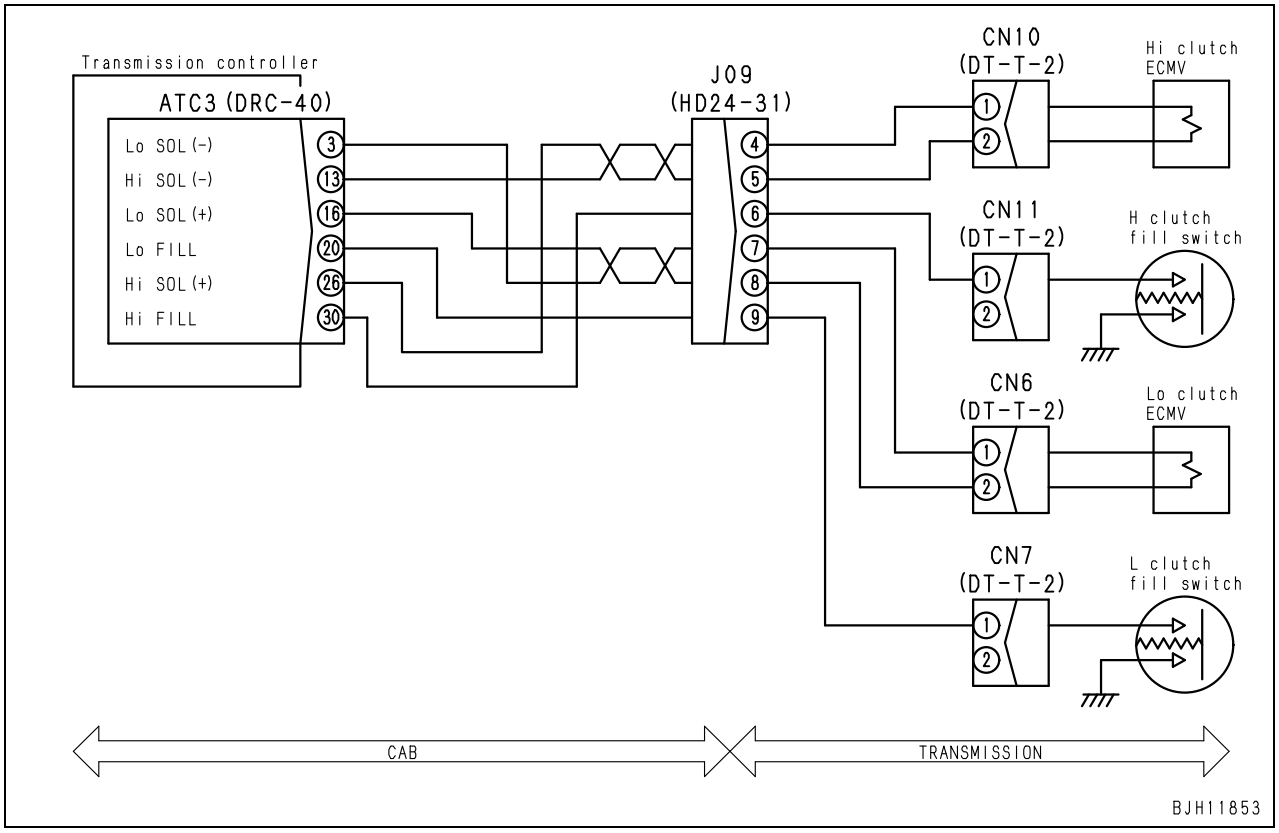
Action code	Failure code	Trouble	Lo clutch solenoid output circuit: Disconnection (Transmission controller system)
E03	**DXH3KA**		
Contents of trouble	• Current does not flow when output to Lo clutch ECMV is ON.		
Action of controller	• Shifts up and holds the gear speed as shown in **Table 1** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• As solenoid detects disconnection while output is ON, be sure to turn output ON to check operation after repair. • Electric current of output to ECMV can be checked with monitoring function (code: **31601**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective Lo clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN6 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN6 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (16) – CN6 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ATC3 (female) (3) – CN6 (female) (2)	Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (16) – (3)	Resistance	5 – 15 Ω

Table 1

Previous range		Trouble clutch [Command ON] (Slip , short to GND or signal lost)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	3rd	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
F5	3rd Low	3rd	OFF	Neutral	OFF
		Low	3H	F6	OFF
F4	2nd High	2nd	3L	F5	OFF
		High	3L	F5	OFF
F3	2nd Low	2nd	3L	F5	OFF
		Low	2H	F4	OFF
F2	1st High	1st	2L	F3	OFF
		High	2L	F3	OFF
F1	1st Low	1st	2L	F3	OFF
		Low	1H	F2	OFF
R3	3rd Reverse	3rd	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
R2	2nd Reverse	2nd	3R	R3	OFF
		Reverse	OFF	Neutral	OFF
R1	1st Reverse	1st	2R	R2	OFF
		Reverse	OFF	Neutral	OFF

Circuit diagram related



Failure code [DXH3KB] (Lo clutch solenoid output circuit: Short circuit)

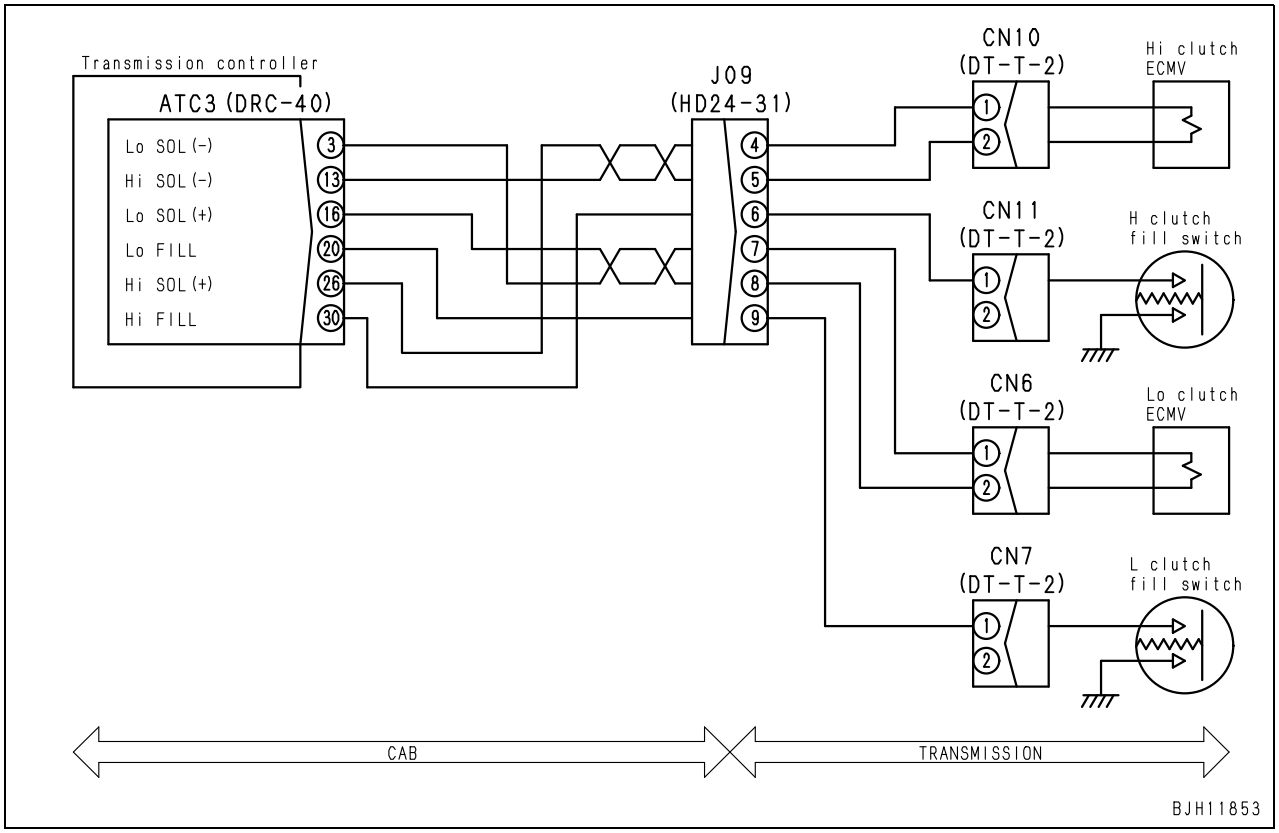
Action code	Failure code	Trouble	Lo clutch solenoid output circuit: Short circuit (KB) (Transmission controller system)
E03	**DXH3KB**		
Contents of trouble	• Excessive current flows while output to Lo clutch ECMV is ON, or current flows while output is OFF.		
Action of controller	• Shifts up and holds the gear speed as shown in **Table 1** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31601**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective Lo clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN6 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN6 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Short circuit of harness (Contact with ground circuit or contact among harnesses)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between ATC3 (female) (16) – CN6 (female) (1)	Resistance	Min. 1 MΩ
			Between wiring harness from ATC3 (female) (16) – CN6 (female) (1) and wiring harness from ATC3 (female) (3) – CN6 (female) (2)	Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (16) – (3)	Resistance	5 – 15 Ω

Table 1

Previous range		Trouble clutch [Command ON] (Slip , short to GND or signal lost)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	3rd	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
F5	3rd Low	3rd	OFF	Neutral	OFF
		Low	3H	F6	OFF
F4	2nd High	2nd	3L	F5	OFF
		High	3L	F5	OFF
F3	2nd Low	2nd	3L	F5	OFF
		Low	2H	F4	OFF
F2	1st High	1st	2L	F3	OFF
		High	2L	F3	OFF
F1	1st Low	1st	2L	F3	OFF
		Low	1H	F2	OFF
R3	3rd Reverse	3rd	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
R2	2nd Reverse	2nd	3R	R3	OFF
		Reverse	OFF	Neutral	OFF
R1	1st Reverse	1st	2R	R2	OFF
		Reverse	OFF	Neutral	OFF

Circuit diagram related



Failure code [DXH3KY] (Lo clutch solenoid output circuit: Short circuit in power source line)

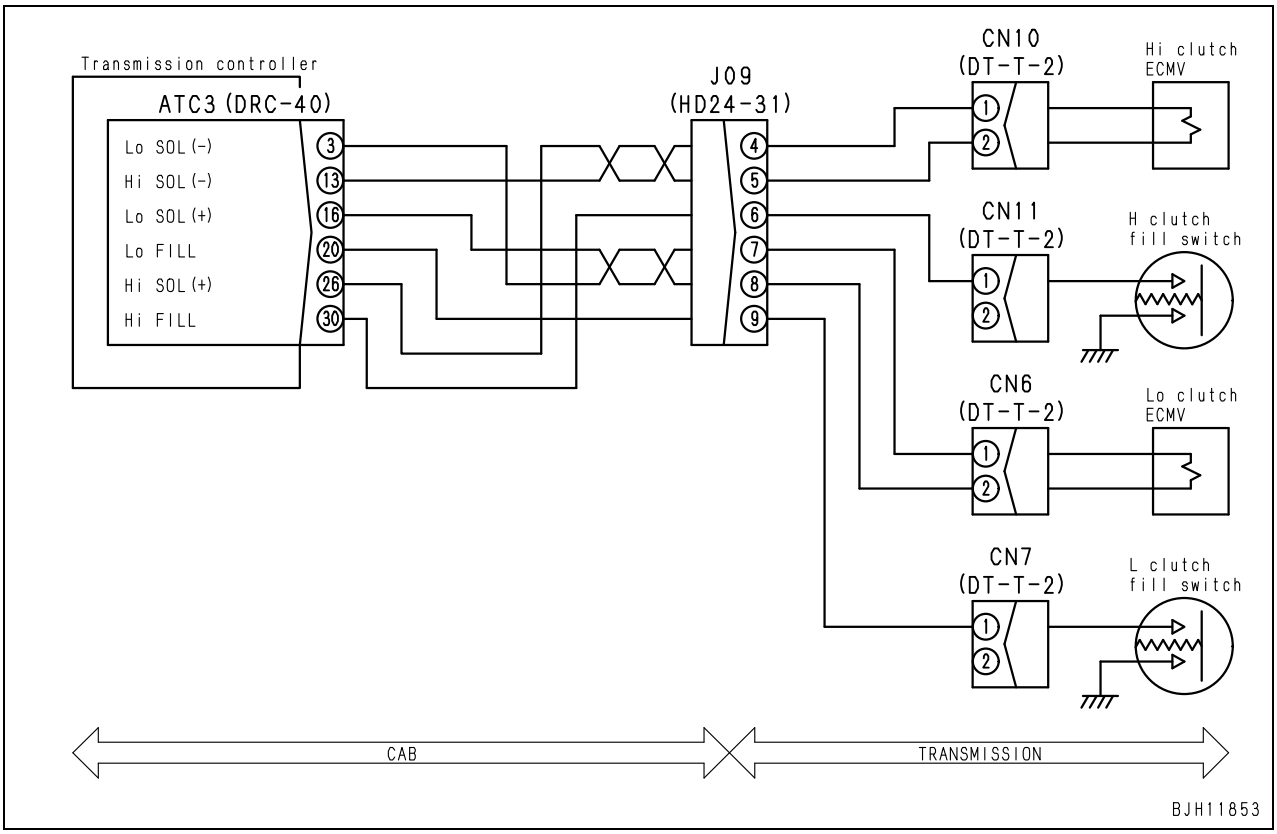
Action code	Failure code	Trouble	Lo clutch solenoid output circuit: Short circuit to power source line (Transmission controller system)
E03	**DXH3KY**		
Contents of trouble	• When output to Lo clutch ECMV is turned “OFF“, current flows to circuit.		
Action of controller	• Shifts up and holds the gear speed as shown in **Table 2** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31601**).		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective Lo clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN6 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN6 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Hot short in wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ground and wiring harness between ATC3 (female) (16) – CN6 (female) (1)	Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ATC3 (female) (16) – (3)	Resistance	5 – 15 Ω

Table 2

Previous range		Trouble clutch [Command ON] (Fill SW ON)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
F5	3rd Low	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		High	3H	F6	OFF
F4	2nd High	3rd	3L	F5	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		Low	3L	F5	OFF
F3	2nd Low	3rd	3L	F5	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		High	2H	F4	OFF
F2	1st High	3rd	3L	F5	OFF
		2nd	2L	F3	OFF
		Reverse	OFF	Neutral	OFF
		Low	2L	F3	OFF
F1	1st Low	3rd	3L	F5	OFF
		2nd	2L	F3	OFF
		Reverse	OFF	Neutral	OFF
		High	1H	F2	OFF
R3	3rd Reverse	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
R2	2nd Reverse	3rd	3R	R3	OFF
		1st	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
R1	1st Reverse	3rd	3R	R3	OFF
		2nd	2R	R2	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
N		Any	None	No reaction	—

Circuit diagram related



Failure code [DXH4KA] (1st clutch solenoid output circuit: Disconnection)

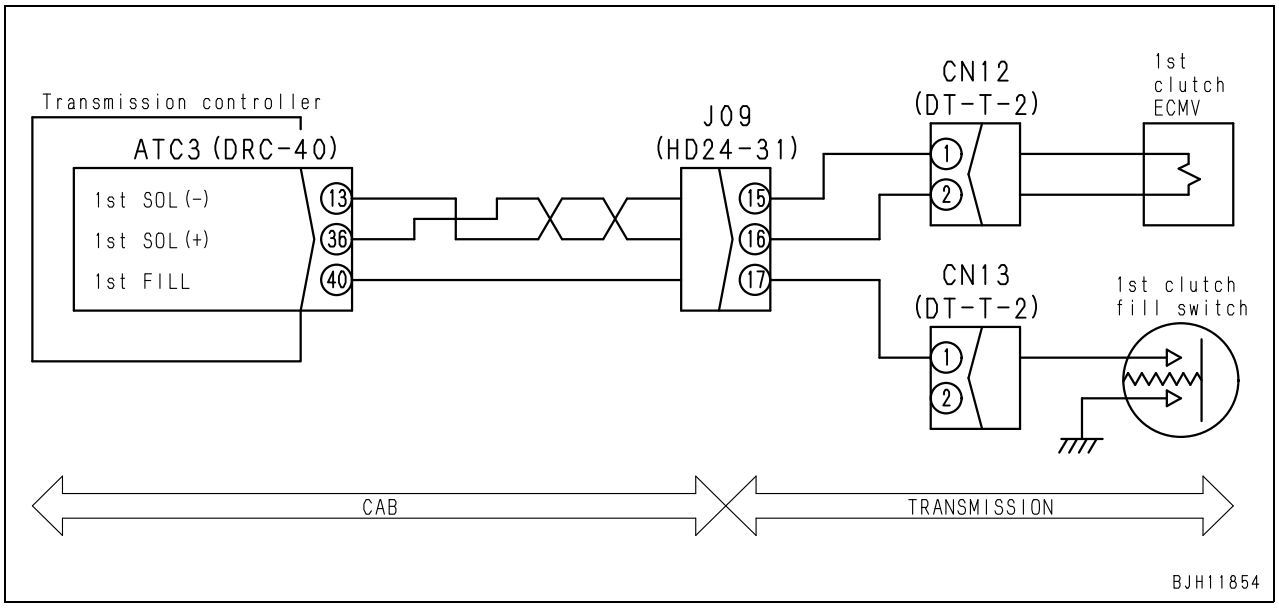
Action code	Failure code	Trouble	1st clutch solenoid output circuit: Disconnection (Transmission controller system)
E03	**DXH4KA**		
Contents of trouble	• Current does not flow when output to 1st clutch ECMV is ON.		
Action of controller	• Shifts up and holds the gear speed as shown in **Table 1** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• As solenoid detects disconnection while output is ON, be sure to turn output ON to check operation after repair. • Electric current of output to ECMV can be checked with monitoring function (code: **31602**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective 1st clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN12 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN12 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (36) – CN12 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ATC3 (female) (13) – CN12 (female) (2)	Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (36) – (13)	Resistance	5 – 15 Ω

Table 1

Previous range		Trouble clutch [Command ON] (Slip , short to GND or signal lost)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	3rd	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
F5	3rd Low	3rd	OFF	Neutral	OFF
		Low	3H	F6	OFF
F4	2nd High	2nd	3L	F5	OFF
		High	3L	F5	OFF
F3	2nd Low	2nd	3L	F5	OFF
		Low	2H	F4	OFF
F2	1st High	1st	2L	F3	OFF
		High	2L	F3	OFF
F1	1st Low	1st	2L	F3	OFF
		Low	1H	F2	OFF
R3	3rd Reverse	3rd	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
R2	2nd Reverse	2nd	3R	R3	OFF
		Reverse	OFF	Neutral	OFF
R1	1st Reverse	1st	2R	R2	OFF
		Reverse	OFF	Neutral	OFF

Circuit diagram related



Failure code [DXH4KB] (1st clutch solenoid output circuit: Short circuit)

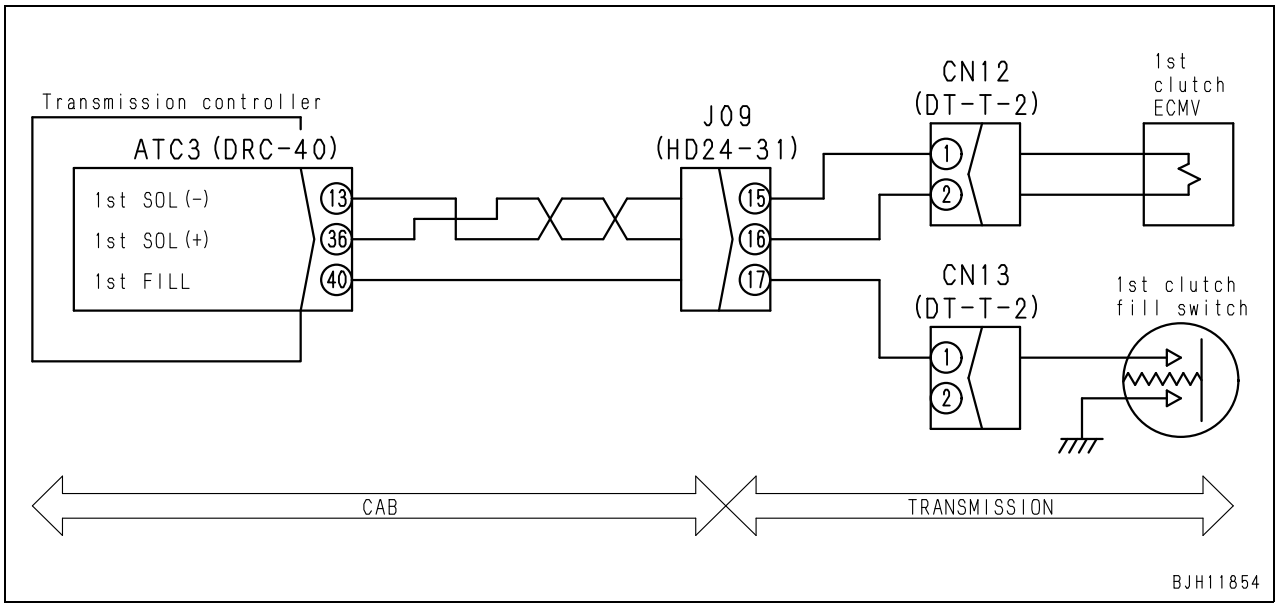
Action code	Failure code	Trouble	1st clutch solenoid output circuit: Short circuit (Transmission controller system)
E03	**DXH4KB**		
Contents of trouble	• Abnormally excessive current flows when output to 1st clutch ECMV is ON, or current flows while output is OFF.		
Action of controller	• Shifts up and holds the gear speed as shown in **Table 1** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31602**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective 1st clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN12 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN12 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Short circuit of harness (Contact with ground circuit or contact among harnesses)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between ATC3 (female) (36) – CN12 (female) (1)	Resistance	Min. 1 MΩ
			Between wiring harness from ATC3 (female) (36) – CN12 (female) (1) and wiring harness from ATC3 (female) (13) – CN12 (female) (2)	Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (36) – (13)	Resistance	5 – 15 Ω

Table 1

Previous range		Trouble clutch [Command ON] (Slip , short to GND or signal lost)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	3rd	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
F5	3rd Low	3rd	OFF	Neutral	OFF
		Low	3H	F6	OFF
F4	2nd High	2nd	3L	F5	OFF
		High	3L	F5	OFF
F3	2nd Low	2nd	3L	F5	OFF
		Low	2H	F4	OFF
F2	1st High	1st	2L	F3	OFF
		High	2L	F3	OFF
F1	1st Low	1st	2L	F3	OFF
		Low	1H	F2	OFF
R3	3rd Reverse	3rd	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
R2	2nd Reverse	2nd	3R	R3	OFF
		Reverse	OFF	Neutral	OFF
R1	1st Reverse	1st	2R	R2	OFF
		Reverse	OFF	Neutral	OFF

Circuit diagram related



Failure code [DXH4KY] (1st clutch solenoid output circuit: Short circuit to power source line)

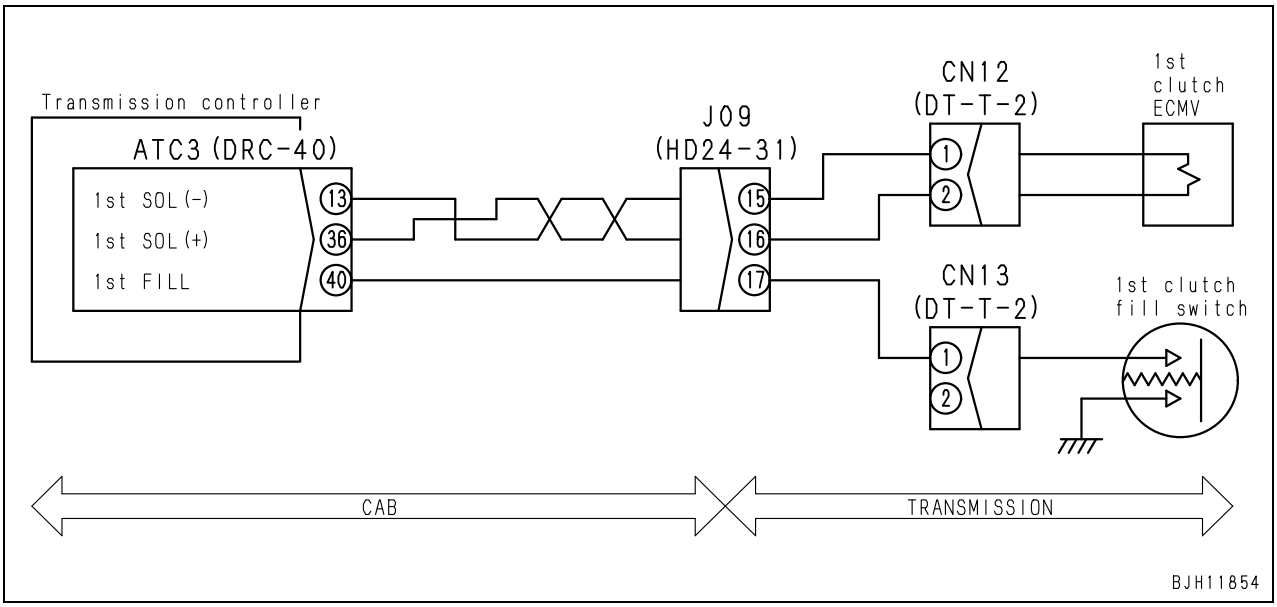
Action code	Failure code	Trouble	1st clutch solenoid output circuit: Short circuit in power source line (Transmission controller system)
E03	**DXH4KY**		
Contents of trouble	• When output to 1st clutch ECMV is “OFF“, current flows to circuit.		
Action of controller	• Shifts up and holds the gear speed as shown in **Table 2** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31602**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective 1st clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN12 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN12 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Hot short in wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ground and wiring harness between ATC3 (female) (36) – CN12 (female) (1)	Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ATC3 (female) (36) – (13)	Resistance	5 – 15 Ω

Table 2

Previous range		Trouble clutch [Command ON] (Fill SW ON)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
F5	3rd Low	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		High	3H	F6	OFF
F4	2nd High	3rd	3L	F5	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		Low	3L	F5	OFF
F3	2nd Low	3rd	3L	F5	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		High	2H	F4	OFF
F2	1st High	3rd	3L	F5	OFF
		2nd	2L	F3	OFF
		Reverse	OFF	Neutral	OFF
		Low	2L	F3	OFF
F1	1st Low	3rd	3L	F5	OFF
		2nd	2L	F3	OFF
		Reverse	OFF	Neutral	OFF
		High	1H	F2	OFF
R3	3rd Reverse	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
R2	2nd Reverse	3rd	3R	R3	OFF
		1st	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
R1	1st Reverse	3rd	3R	R3	OFF
		2nd	2R	R2	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
N		Any	None	No reaction	—

Circuit diagram related



Failure code [DXH5KA] (2nd clutch solenoid output circuit: Disconnection)

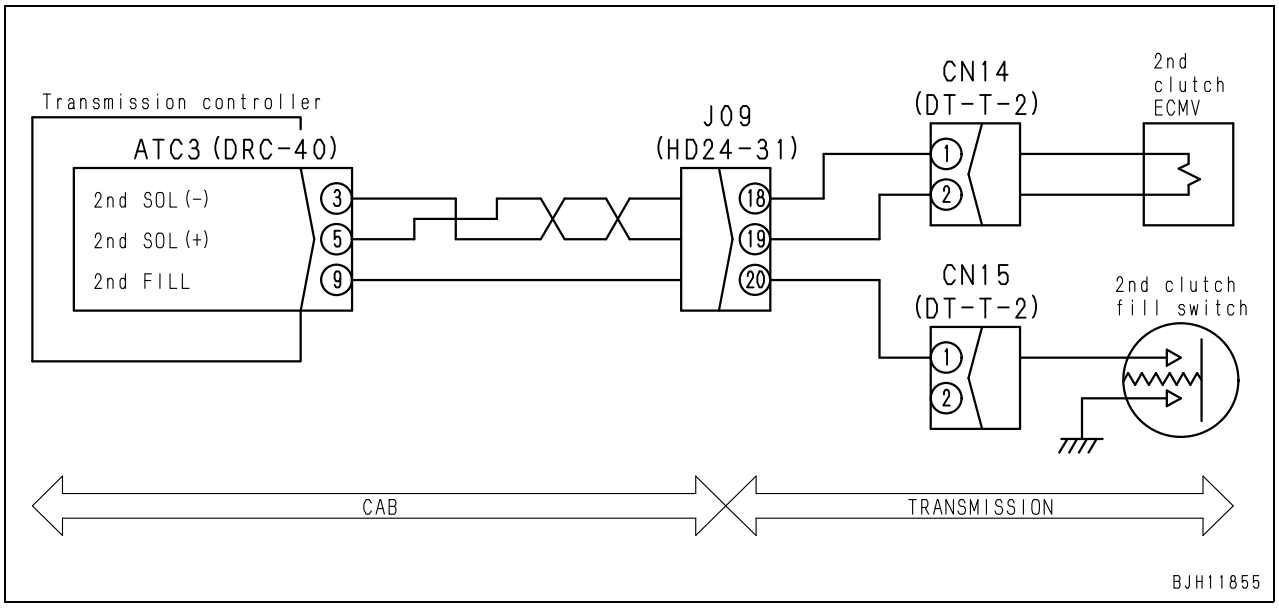
Action code	Failure code	Trouble	2nd clutch solenoid output circuit: Disconnection (Transmission controller system)
E03	**DXH5KA**		
Contents of trouble	• Current does not flow when output to 2nd clutch ECMV is ON.		
Action of controller	• Shifts up and holds the gear speed as shown in **Table 1** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds. • As solenoid detects disconnection while output is ON, be sure to turn output ON to check operation after repair.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31603**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective 2nd clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN14 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN14 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (5) – CN14 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ATC3 (female) (3) – CN14 (female) (2)	Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (5) – (3)	Resistance	5 – 15 Ω

Table 1

Previous range		Trouble clutch [Command ON] (Slip , short to GND or signal lost)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	3rd	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
F5	3rd Low	3rd	OFF	Neutral	OFF
		Low	3H	F6	OFF
F4	2nd High	2nd	3L	F5	OFF
		High	3L	F5	OFF
F3	2nd Low	2nd	3L	F5	OFF
		Low	2H	F4	OFF
F2	1st High	1st	2L	F3	OFF
		High	2L	F3	OFF
F1	1st Low	1st	2L	F3	OFF
		Low	1H	F2	OFF
R3	3rd Reverse	3rd	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
R2	2nd Reverse	2nd	3R	R3	OFF
		Reverse	OFF	Neutral	OFF
R1	1st Reverse	1st	2R	R2	OFF
		Reverse	OFF	Neutral	OFF

Circuit diagram related



Failure code [DXH5KB] (2nd clutch solenoid output circuit: Short circuit)

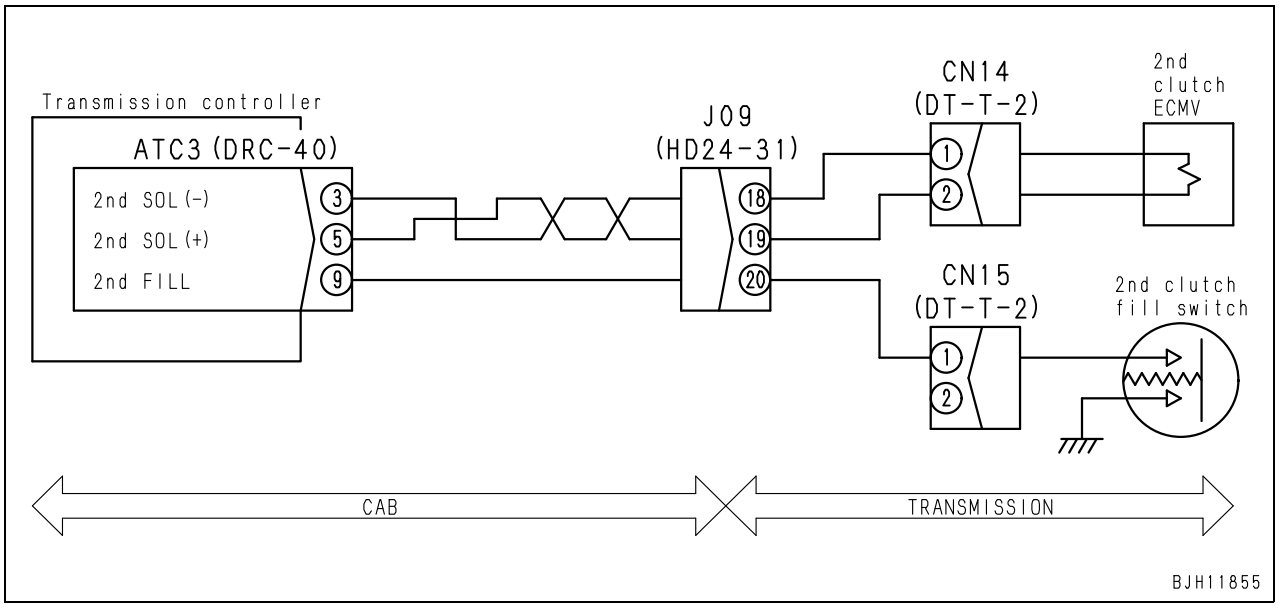
Action code	Failure code	Trouble	2nd clutch solenoid output circuit: Short circuit (Transmission controller system)
E03	**DXH5KB**		
Contents of trouble	• Abnormally excessive current flows while output to 2nd clutch ECMV is ON, or current flows while output is OFF.		
Action of controller	• Shifts up and holds the gear speed as shown in **Table 1** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31603**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective 2nd clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN14 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN14 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Short circuit of harness (Contact with GND circuit or contact among harnesses)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between ATC3 (female) (5) – CN14 (female) (1)	Resistance	Min. 1 MΩ
			Between wiring harness from ATC3 (female) (5) – CN14 (female) (1) and wiring harness from ATC3 (female) (3) – CN14 (female) (2)	Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (5) – (3)	Resistance	5 – 15 Ω

Table 1

Previous range		Trouble clutch [Command ON] (Slip , short to GND or signal lost)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	3rd	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
F5	3rd Low	3rd	OFF	Neutral	OFF
		Low	3H	F6	OFF
F4	2nd High	2nd	3L	F5	OFF
		High	3L	F5	OFF
F3	2nd Low	2nd	3L	F5	OFF
		Low	2H	F4	OFF
F2	1st High	1st	2L	F3	OFF
		High	2L	F3	OFF
F1	1st Low	1st	2L	F3	OFF
		Low	1H	F2	OFF
R3	3rd Reverse	3rd	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
R2	2nd Reverse	2nd	3R	R3	OFF
		Reverse	OFF	Neutral	OFF
R1	1st Reverse	1st	2R	R2	OFF
		Reverse	OFF	Neutral	OFF

Circuit diagram related



Failure code [DXH5KY] (2nd clutch solenoid output circuit: Short circuit in power source line)

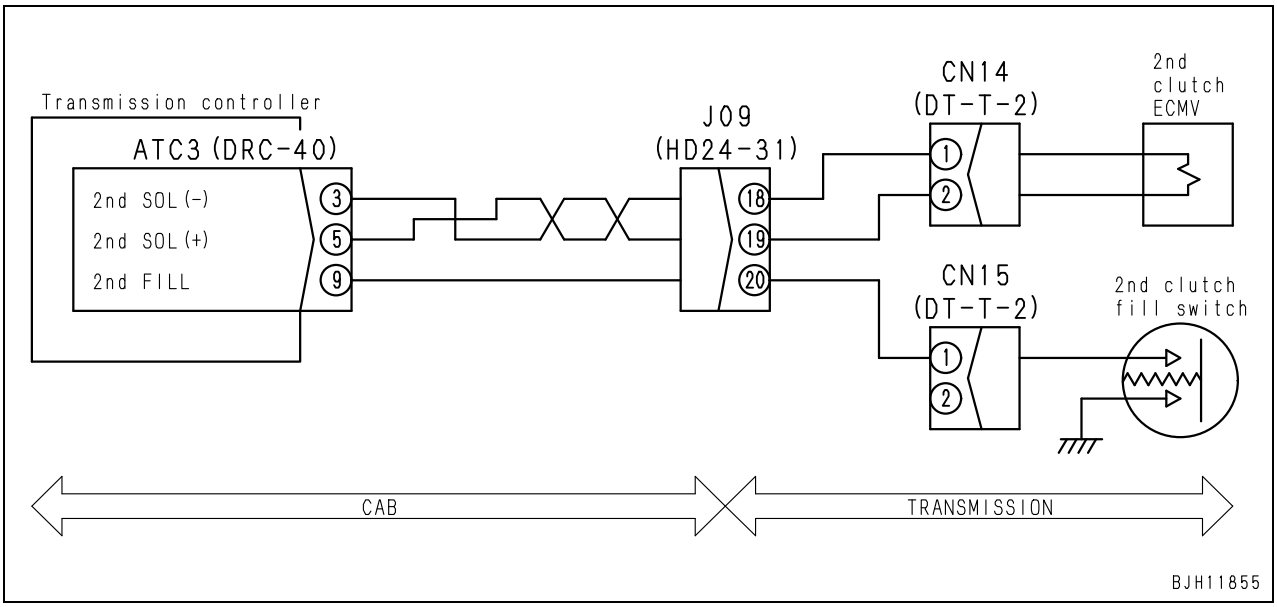
Action code	Failure code	Trouble	2nd clutch solenoid output circuit: Short circuit in power source line (Transmission controller system)
E03	**DXH5KY**		
Contents of trouble	• When output to 2nd clutch ECMV is “OFF“, current flows to circuit.		
Action of controller	• Shifts up and holds the gear speed as shown in **Table 2** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31603**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective 2nd clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN14 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN14 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Hot short in wiring harness (a contact with 24V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ground and wiring harness between ATC3 (female) (5) – CN14 (female) (1)	Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ATC3 (female) (5) – (3)	Resistance	5 – 15 Ω

Table 2

Previous range		Trouble clutch [Command ON] (Fill SW ON)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
F5	3rd Low	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		High	3H	F6	OFF
F4	2nd High	3rd	3L	F5	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		Low	3L	F5	OFF
F3	2nd Low	3rd	3L	F5	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		High	2H	F4	OFF
F2	1st High	3rd	3L	F5	OFF
		2nd	2L	F3	OFF
		Reverse	OFF	Neutral	OFF
		Low	2L	F3	OFF
F1	1st Low	3rd	3L	F5	OFF
		2nd	2L	F3	OFF
		Reverse	OFF	Neutral	OFF
		High	1H	F2	OFF
R3	3rd Reverse	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
R2	2nd Reverse	3rd	3R	R3	OFF
		1st	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
R1	1st Reverse	3rd	3R	R3	OFF
		2nd	2R	R2	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
N		Any	None	No reaction	—

Circuit diagram related



Failure code [DXH6KA] (3rd clutch solenoid output circuit: Disconnection)

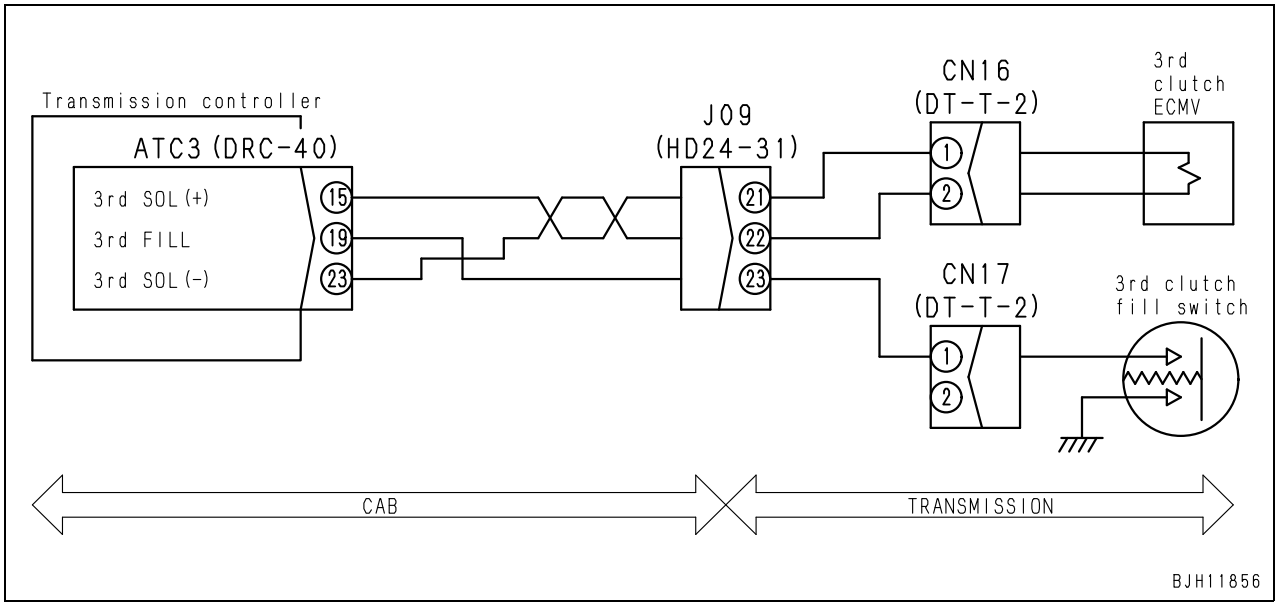
Action code	Failure code	Trouble	3rd clutch solenoid output circuit: Disconnection (Transmission controller system)
E03	**DXH6KA**		
Contents of trouble	• Current does not flow when output to 2nd clutch ECMV is ON.		
Action of controller	• Shifts up and holds the gear speed as shown in **Table 1** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• As solenoid detects disconnection while output is ON, be sure to turn output ON to check operation after repair. • Electric current of output to ECMV can be checked with monitoring function (code: **31604**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state			★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
	1	Defective 3rd clutch ECMV	Between CN16 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN16 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (15) – CN16 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ATC3 (female) (23) – CN16 (female) (2)	Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (15) – (23)	Resistance	5 – 15 Ω

Table 1

Previous range		Trouble clutch [Command ON] (Slip , short to GND or signal lost)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	3rd	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
F5	3rd Low	3rd	OFF	Neutral	OFF
		Low	3H	F6	OFF
F4	2nd High	2nd	3L	F5	OFF
		High	3L	F5	OFF
F3	2nd Low	2nd	3L	F5	OFF
		Low	2H	F4	OFF
F2	1st High	1st	2L	F3	OFF
		High	2L	F3	OFF
F1	1st Low	1st	2L	F3	OFF
		Low	1H	F2	OFF
R3	3rd Reverse	3rd	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
R2	2nd Reverse	2nd	3R	R3	OFF
		Reverse	OFF	Neutral	OFF
R1	1st Reverse	1st	2R	R2	OFF
		Reverse	OFF	Neutral	OFF

Circuit diagram related



Failure code [DXH6KB] (3rd clutch solenoid output circuit: Short circuit)

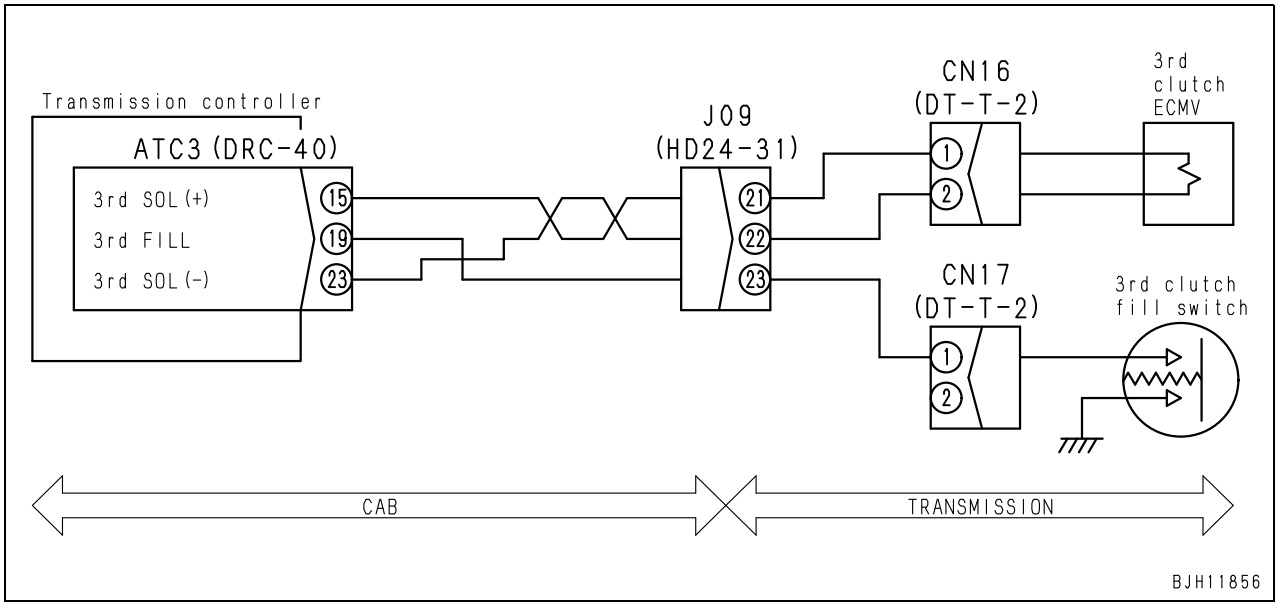
Action code	Failure code	Trouble	3rd clutch solenoid output circuit: Short circuit (Transmission controller system)
E03	**DXH6KB**		
Contents of trouble	• Abnormally excessive current flows while output to 3rd clutch ECMV is ON, or current flows while output is OFF.		
Action of controller	• Shifts up and holds the gear speed as shown in **Table 1** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31604**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective 3rd clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN16 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN16 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Short circuit of harness (Contact with ground circuit or contact among harnesses)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between ATC3 (female) (15) – CN16 (female) (1)	Resistance	Min. 1 MΩ
			Between wiring harness from ATC3 (female) (15) – CN16 (female) (1) and wiring harness from ATC3 (female) (23) – CN16 (female) (2)	Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (15) – (23)	Resistance	5 – 15 Ω

Table 1

Previous range		Trouble clutch [Command ON] (Slip , short to GND or signal lost)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	3rd	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
F5	3rd Low	3rd	OFF	Neutral	OFF
		Low	3H	F6	OFF
F4	2nd High	2nd	3L	F5	OFF
		High	3L	F5	OFF
F3	2nd Low	2nd	3L	F5	OFF
		Low	2H	F4	OFF
F2	1st High	1st	2L	F3	OFF
		High	2L	F3	OFF
F1	1st Low	1st	2L	F3	OFF
		Low	1H	F2	OFF
R3	3rd Reverse	3rd	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
R2	2nd Reverse	2nd	3R	R3	OFF
		Reverse	OFF	Neutral	OFF
R1	1st Reverse	1st	2R	R2	OFF
		Reverse	OFF	Neutral	OFF

Circuit diagram related



Failure code [DXH6KY] (3rd clutch solenoid output circuit: Short circuit to power source line)

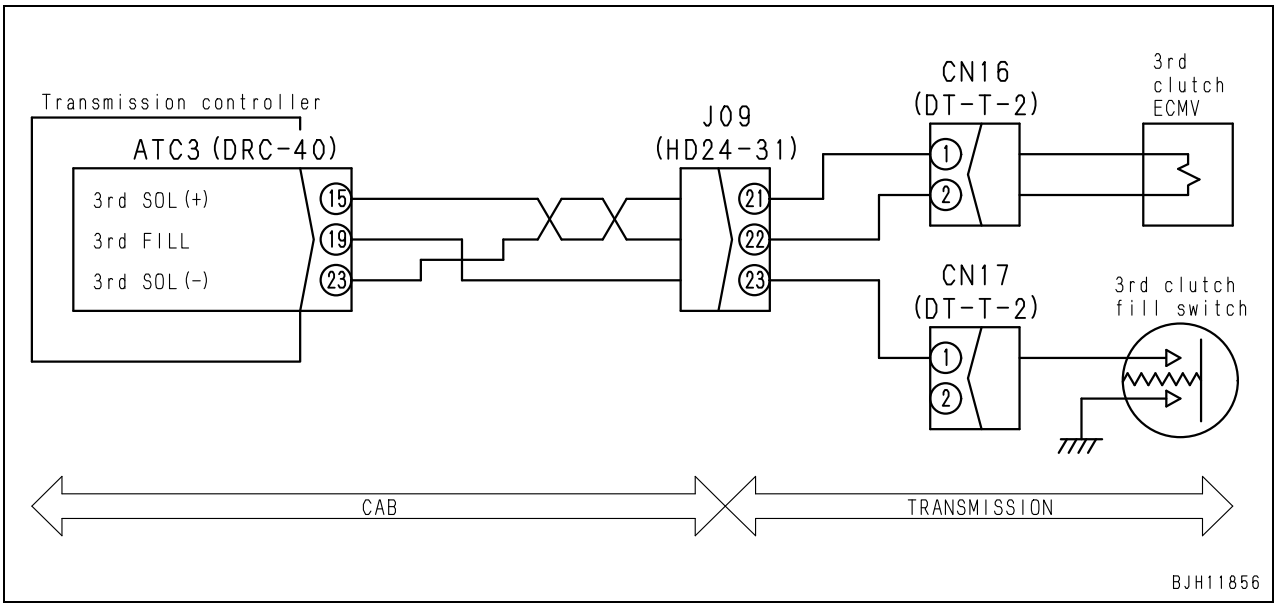
Action code	Failure code	Trouble	3rd clutch solenoid output circuit: Short circuit to power source line (Transmission controller system)
E03	**DXH6KY**		
Contents of trouble	• When output to 3rd clutch ECMV is OFF, current flows to circuit.		
Action of controller	• Shifts up and holds the gear speed as shown in **Table 2** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31604**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective 3rd clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN16 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN16 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Hot short in wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between ATC3 (female) (15) – CN16 (female) (1)	Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ATC3 (female) (15) – (23)	Resistance	5 – 15 Ω

Table 2

Previous range		Trouble clutch [Command ON] (Fill SW ON)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
F5	3rd Low	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		High	3H	F6	OFF
F4	2nd High	3rd	3L	F5	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		Low	3L	F5	OFF
F3	2nd Low	3rd	3L	F5	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		High	2H	F4	OFF
F2	1st High	3rd	3L	F5	OFF
		2nd	2L	F3	OFF
		Reverse	OFF	Neutral	OFF
		Low	2L	F3	OFF
F1	1st Low	3rd	3L	F5	OFF
		2nd	2L	F3	OFF
		Reverse	OFF	Neutral	OFF
		High	1H	F2	OFF
R3	3rd Reverse	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
R2	2nd Reverse	3rd	3R	R3	OFF
		1st	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
R1	1st Reverse	3rd	3R	R3	OFF
		2nd	2R	R2	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
N		Any	None	No reaction	—

Circuit diagram related



Failure code [DXH7KA] (R clutch solenoid output circuit: Disconnection)

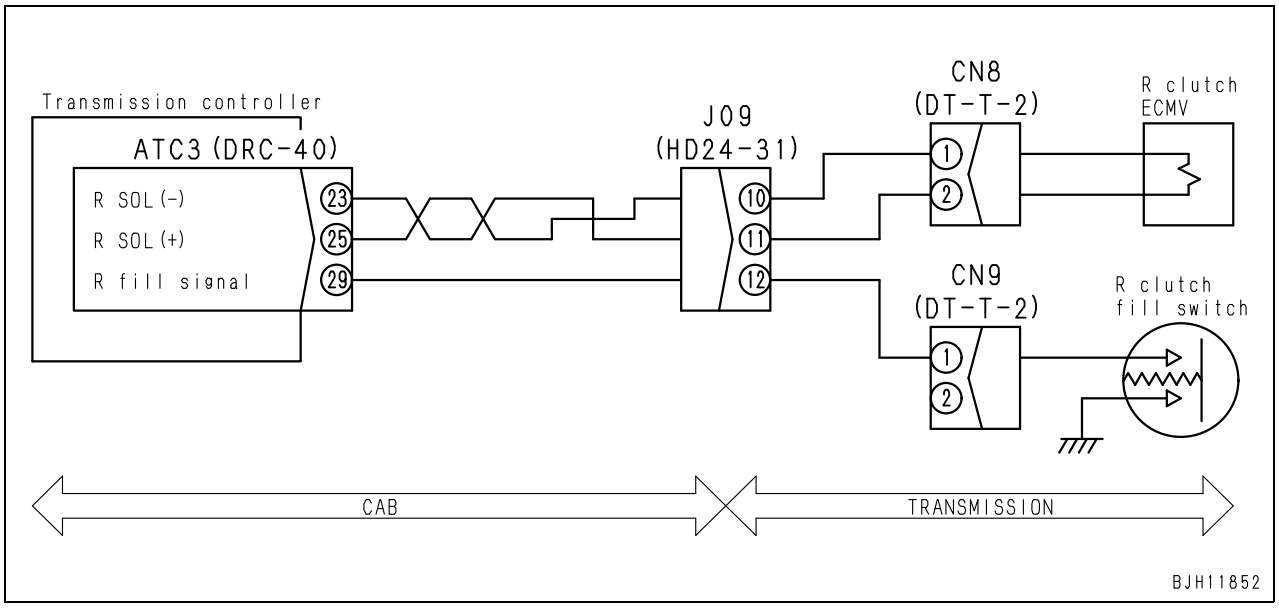
Action code	Failure code	Trouble	R clutch solenoid output circuit: Disconnection (Transmission controller system)
E03	**DXH7KA**		
Contents of trouble	• Current does not flow when output to R clutch ECMV is ON.		
Action of controller	• Shifts up and holds the gear speed as shown in **Table 1** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• As solenoid detects disconnection while output is ON, be sure to turn output ON to check operation after repair. • Electric current of output to ECMV can be checked with monitoring function (code: **31606**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state			★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
	1	Defective R clutch ECMV	Between CN8 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN8 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection or improper contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (25) – CN8 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ATC3 (female) (23) – CN8 (female) (2)	Resistance	Max. 1 Ω
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (25) – (23)	Resistance	5 – 15 Ω

Table 1

Previous range		Trouble clutch [Command ON] (Slip , short to GND or signal lost)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	3rd	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
F5	3rd Low	3rd	OFF	Neutral	OFF
		Low	3H	F6	OFF
F4	2nd High	2nd	3L	F5	OFF
		High	3L	F5	OFF
F3	2nd Low	2nd	3L	F5	OFF
		Low	2H	F4	OFF
F2	1st High	1st	2L	F3	OFF
		High	2L	F3	OFF
F1	1st Low	1st	2L	F3	OFF
		Low	1H	F2	OFF
R3	3rd Reverse	3rd	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
R2	2nd Reverse	2nd	3R	R3	OFF
		Reverse	OFF	Neutral	OFF
R1	1st Reverse	1st	2R	R2	OFF
		Reverse	OFF	Neutral	OFF

Circuit diagram related



Failure code [DXH7KB] (R clutch solenoid output circuit: Short circuit)

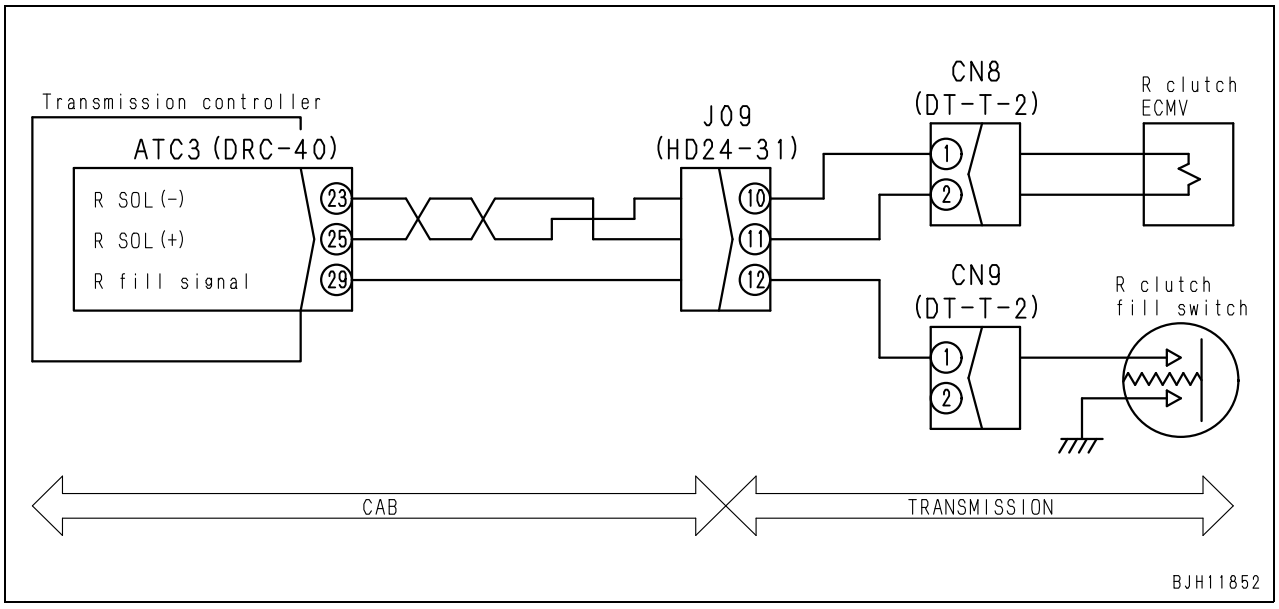
Action code	Failure code	Trouble	R clutch solenoid output circuit: Short circuit (Transmission controller system)
E03	**DXH7KB**		
Contents of trouble	• Abnormally excessive current flows while output to R clutch ECMV is ON, or current flows while output is OFF.		
Action of controller	• Shifts up and holds the gear speed as shown in **Table 1** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31606**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective R clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN8 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN8 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Short circuit of harness (Contact with ground circuit or contact among harnesses)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between ATC3 (female) (25) – CN8 (female) (1)	Resistance	Min. 1 MΩ
			Between wiring harness from ATC3 (female) (25) – CN8 (female) (1) and wiring harness from ATC3 (female) (23) – CN8 (female) (2)	Resistance	Min. 1 MΩ
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between ATC3 (female) (25) – (23)	Resistance	5 – 15 Ω

Table 1

Previous range		Trouble clutch [Command ON] (Slip , short to GND or signal lost)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	3rd	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
F5	3rd Low	3rd	OFF	Neutral	OFF
		Low	3H	F6	OFF
F4	2nd High	2nd	3L	F5	OFF
		High	3L	F5	OFF
F3	2nd Low	2nd	3L	F5	OFF
		Low	2H	F4	OFF
F2	1st High	1st	2L	F3	OFF
		High	2L	F3	OFF
F1	1st Low	1st	2L	F3	OFF
		Low	1H	F2	OFF
R3	3rd Reverse	3rd	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
R2	2nd Reverse	2nd	3R	R3	OFF
		Reverse	OFF	Neutral	OFF
R1	1st Reverse	1st	2R	R2	OFF
		Reverse	OFF	Neutral	OFF

Circuit diagram related



Failure code [DXH7KY] (R clutch solenoid output circuit: Short circuit to power source line)

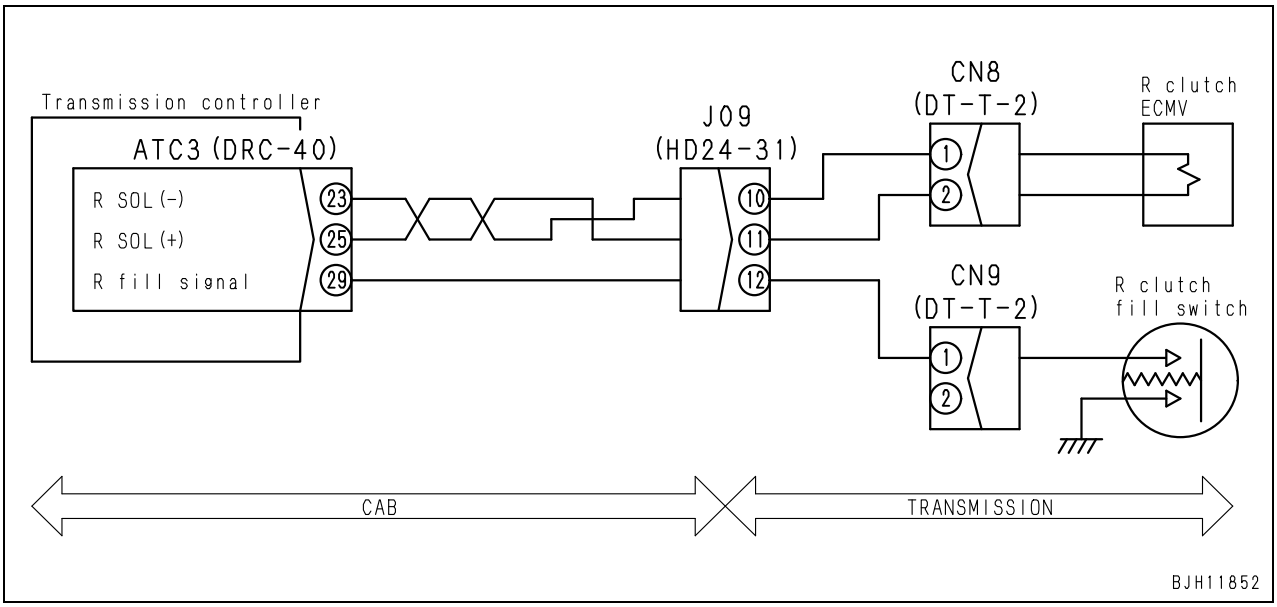
Action code	Failure code	Trouble	R clutch solenoid output circuit: Short circuit to power source line (Transmission controller system)
E03	**DXH7KY**		
Contents of trouble	• When output to R clutch ECMV is OFF, current flows to circuit.		
Action of controller	• Shifts up and holds the gear speed as shown in **Table 2** depending on the gear speed before failure. • Turns lockup to OFF.		
Problem that appears on machine	• Once the gear shift lever is set to neutral, the machine can not move off in any gear speeds.		
Related information	• Electric current of output to ECMV can be checked by monitoring function (code: **31606**).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective R clutch ECMV	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between CN8 (male) (1) – (2)	Resistance	5 – 15 Ω
			Between CN8 (male) (1), (2) – ground	Resistance	Min. 1 MΩ
	2	Hot short in wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ground and wiring harness between ATC3 (female) (25) – CN8 (female) (1)	Voltage	Max. 1 V
	3	Defective transmission controller	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ATC3 (female) (25) – (23)	Resistance	5 – 15 Ω

Table 2

Previous range		Trouble clutch [Command ON] (Fill SW ON)	Controller reaction (Alternative clutch)		ON or OFF state of lockup clutch
F6	3rd High	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
F5	3rd Low	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		High	3H	F6	OFF
F4	2nd High	3rd	3L	F5	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		Low	3L	F5	OFF
F3	2nd Low	3rd	3L	F5	OFF
		1st	OFF	Neutral	OFF
		Reverse	OFF	Neutral	OFF
		High	2H	F4	OFF
F2	1st High	3rd	3L	F5	OFF
		2nd	2L	F3	OFF
		Reverse	OFF	Neutral	OFF
		Low	2L	F3	OFF
F1	1st Low	3rd	3L	F5	OFF
		2nd	2L	F3	OFF
		Reverse	OFF	Neutral	OFF
		High	1H	F2	OFF
R3	3rd Reverse	2nd	OFF	Neutral	OFF
		1st	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
R2	2nd Reverse	3rd	3R	R3	OFF
		1st	OFF	Neutral	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
R1	1st Reverse	3rd	3R	R3	OFF
		2nd	2R	R2	OFF
		High	OFF	Neutral	OFF
		Low	OFF	Neutral	OFF
N		Any	None	No reaction	—

Circuit diagram related



HM300-2 Articulated dump truck

Form No. SEN00674-03

ARTICULATED DUMP TRUCK

HM300-2

Machine model	Serial number
HM300-2	2001 and up

40 Troubleshooting
Troubleshooting of electrical system (E-mode)

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	**Trouble which occurred in the 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	**Possible causes of trouble (Given numbers are reference numbers, which do not indicate priority)**	**<Contents of description>** ● **Standard value in normal state to judge possible causes** ● **Remarks on judgment** **<Troubles in wiring harness>** ● **Disconnection** **Connector is connected defectively or wiring harness is broken.** ● **Ground fault** **Wiring harness which is not connected to chassis ground circuit is in contact with chassis ground circuit.** ● **Hot short** **Wiring harness which is not connected to power source (24 V) circuit is in contact with power source (24 V) circuit.** ● **Short circuit** **Independent wiring harnesses are in contact with each other abnormally.** **<Precautions for troubleshooting>** **(1) Method of indicating connector No. and handling of T-adapter** **Insert or connect T-adapter as explained below for troubleshooting, unless otherwise specified.** ● **If connector No. has no marks of "male" and "female", disconnect connector and insert T-adapters in both male side and female side.** ● **If connector No. has marks of "male" and "female", disconnect connector and connect T-adapter to only male side or female side.** **(2) Entry order of pin Nos. and handling of tester leads** **Connect positive (+) lead and negative (–) lead of tester as explained below for troubleshooting, unless otherwise specified.** ● **Connect positive (+) lead to pin No. or wiring harness entered on front side.** ● **Connect negative (–) lead to pin No. or harness entered on rear side.**
	2		
	3		
	4		

Related circuit diagram

This drawing is a part of the electric circuit diagram related to troubleshooting.
- Connector No.: Indicates (Model – Number of pins) and (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.

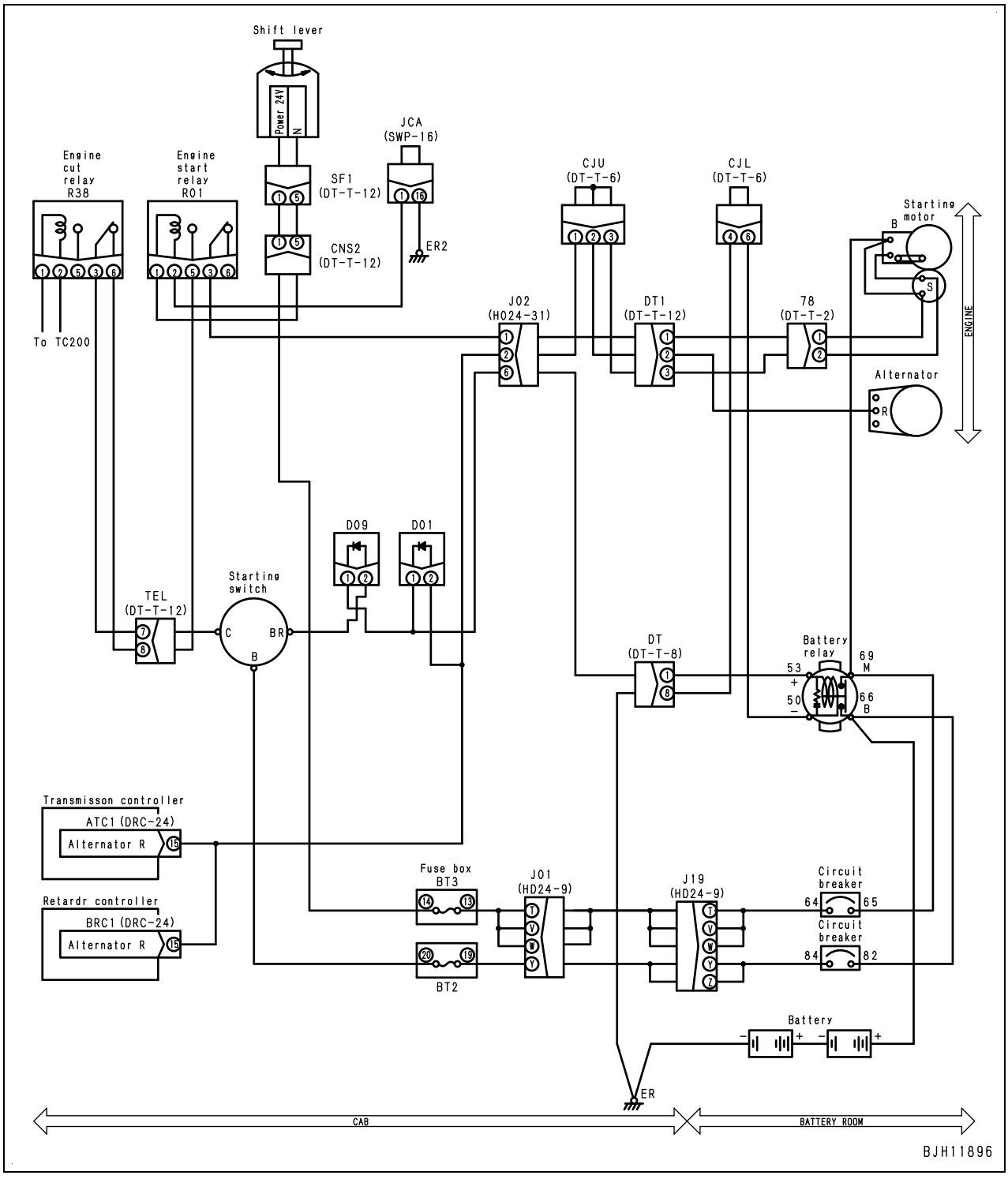
E-1 Engine does not start

Trouble	Engine does not start.
Related information	● When failure code related to engine controller or transmission is present, troubleshooting the corresponding failure code first.

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective battery	Gravity		Min. 1.26	
			Voltage		Min. 25 V	
	2	Defective circuit breaker (64 – 65) and (82 – 84) or defective fuse BT2 (19 – 20) and BT3 (13 – 14)	When circuit breaker (64 – 65), (82 – 84) is shut off, or fuse BT2 (19 – 20), BT3 (13 – 14) is blown, it is highly possible that a defective grounding has occurred in the circuit.			
	3	Defective engine starter relay (R01)	★ Prepare with the starting switch OFF, then start engine to troubleshooting.			
			Replace relay (R01) with other relay (5 terminals)	The problem is resolved.	Defective relay	
				The problem is not resolved.	Relay is normal	
	4	Defective diode (D01), (D09)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			D01, D09 (male)	Between (1) – (2)	Continuity	None
				Between (2) – (1)	Continuity	Yes
			● Troubleshooting in a diode range.			
	5	Defective alternator (regulator)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			Between 78 (2) – ground		Voltage	Max. 12V
	6	Disconnection in wiring harness (Disconnection or defective contact) (Power supply circuits)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between BT2 (19) – battery relay (66) terminal B		Resistance	Max. 1 Ω
			Wiring harness between BT3 (13) – battery relay (69) terminal M		Resistance	Max. 1 Ω
			Harness between battery (+) terminal-battery relay (66) terminal B		Resistance	Max. 1 Ω
			Harness between BT2 (20) – starting switch (terminal B)		Resistance	Max. 1 Ω
			Harness between BT3 (14) – SF1 (female) (1)		Resistance	Max. 1 Ω
			Harness between starting switch (terminal BR) – battery relay (53) terminal BR (Troubleshooting in the diode range from starting switch (terminal BR) side)		Continuity	Continue
			Harness between battery relay (50) terminal (-) – frame ground (ER)		Resistance	Max. 1 Ω
			Harness between battery relay (69) terminal M – starting motor (terminal B)		Resistance	Max. 1 Ω

	Cause		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) (Related circuit after starting switch terminal C)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Harness between starting switch (terminal C) – R38 (female) (3)	Resistance	Max. 1 Ω
			Harness between R38 (female) (6) – R01 (female) (5)	Resistance	Max. 1 Ω
			Harness between R01 (female) (3) – 78 (female) (1)	Resistance	Max. 1 Ω
			Harness between R01 (female) (1) – SF1 (female) (5)	Resistance	Max. 1 Ω
			Harness between R01 (female) (2) – ground (ER2)	Resistance	Max. 1 Ω
	7	Hot short of wiring harness (a contact with 24 V circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between ground and wiring harness between alternator (terminal R) – 78 (male) (2)	Voltage	Max. 1V
			Between ground and wiring harnesses between CJU (female) (1) – ATC1 (female) (15), BRC1 (female) (15), and D01 (female) (2)	Voltage	Max. 1V
	8	Defective starting switch (Between terminals B – C)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Starting switch unit (between B – C)	Resistance	Max. 1 Ω
	9	Defective starting motor	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between starting motor (B terminal) – ground	Voltage	20 – 30 V
			★ Prepare with the starting switch OFF, then start engine to troubleshooting.		
			Between 78 (1) – ground	Voltage	20 – 30 V
	10	Detective engine controller power supply	As the engine controller power supply can be detective, carry out troubleshooting for "Failure code CA111".		

Circuit diagram related



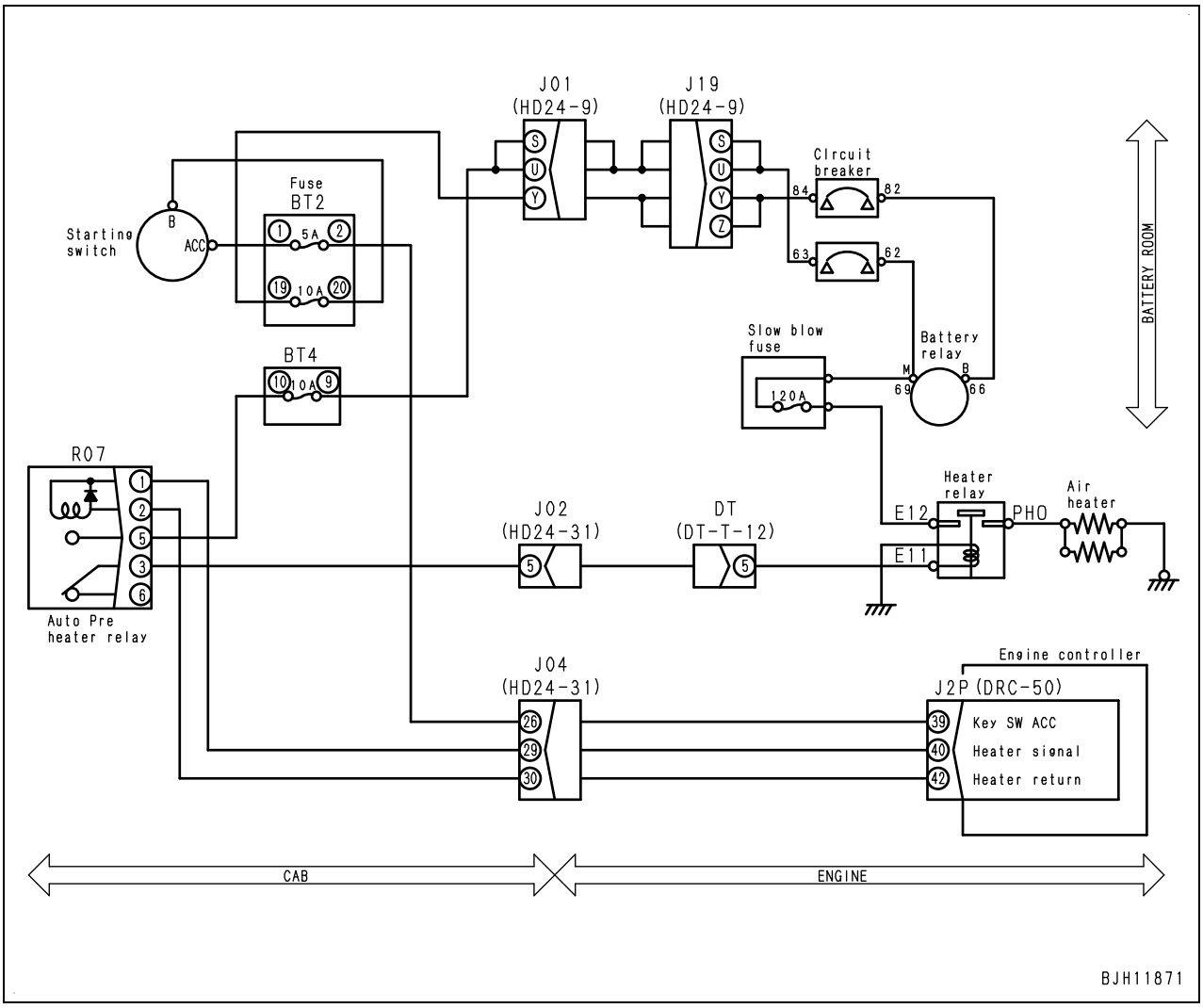
E-2 Automatic preheating does not operate

Trouble	Automatic preheating does not operate when coolant temperature is below 0°C and starting switch is ON.
Related information	● When failure code **CA2555** or **CA2556** is not displayed (if failure code is displayed, troubleshooting the code first.)

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective circuit breaker 30 A, 80 A or defective fuse BT2 (20), BT4 (10)	When the circuit breaker is shut off or the fuse is blown, it is highly possible that a defective grounding has occurred in the circuit (troubleshooting cause 8).		
	2	Defective high current fuse (fuse is blown)	Fuse is normal if continuity exists between inlet and outlet of high current fuse (disconnect the inlet and outlet terminals).		
	3	Defect intake air heater (inside disconnection)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between heater inlet terminal – ground	Voltage	15 – 28 V
			★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between heater (-) terminal – ground	Resistance	Max. 1 Ω
			● If no problem is found by above diagnoses, intake air heater is defective.		
	4	Defective heater relay (Internal disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between heater relay terminal (E12) – ground	Voltage	15 – 28 V
			Between heater relay terminal (PHO) – ground	Voltage	15 – 28 V
			Between heater relay terminal (E11) – ground	Voltage	15 – 28 V
			★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between heater relay coil side (-) terminal – ground	Resistance	Max. 1 Ω
			● If no problem is found by above diagnoses, heater relay is defective.		
	5	Defective auto preheater relay (R07)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between R07 (5) – ground	Voltage	15 – 28 V
			Between R07 (3) – ground	Voltage	15 – 28 V
			When a failure code is not displayed and no problem is found in above diagnoses, pre-auto heater relay is defective. * It can be also diagnosed by replacing relay with another one.		
	6	Defective starting switch (Defective contact between contact points B and ACC)	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between starting switch terminal B – ground	Voltage	15 – 28 V
			Between starting switch terminal ACC – ground	Voltage	15 – 28 V
			● If no problem is found by above diagnoses, starting switch is defective.		
	7	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with the starting switch OFF and troubleshooting with the starting switch still OFF (disconnect the terminals).		
			Wiring harness between heater relay terminal (PHO) – air heater inlet terminal	Resistance	Max. 1 Ω
			Wiring harness between heater relay terminal (E12) – high current fuse outlet terminal	Resistance	Max. 1 Ω

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	7	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with the starting switch OFF and troubleshooting with the starting switch still OFF (disconnect the terminals).		
			Wiring harness between high current fuse inlet – battery relay terminal M (69)	Resistance	Max. 1 Ω
			Wiring harness between battery relay terminal M (69) – circuit breaker 80 A terminal (62)	Resistance	Max. 1 Ω
			Wiring harness among circuit breaker 80A terminal (63) – fuse BT4 (9), (10) – R07 (female) (5)	Resistance	Max. 1 Ω
			Wiring harness between battery relay terminal M (69) – circuit breaker 30A terminal (82)	Resistance	Max. 1 Ω
			Wiring harness among circuit breaker 30A terminal (84) – fuse BT2 (19), (20) – starting switch terminal B	Resistance	Max. 1 Ω
			Wiring harness among starting switch terminal ACC-fuse BT2 (1), (2) – J2P (female) (39)	Resistance	Max. 1 Ω
	8	Short circuit of harness (Contact with ground circuit)	★ Prepare with the starting switch OFF and troubleshooting with the starting switch still OFF (disconnect the terminals).		
			Between ground and wiring harness between heater relay terminal (PHO) – air heater inlet terminal	Resistance	Min. 1 MΩ
			Between ground and wiring harness between heater relay terminal (E12) – high current fuse outlet terminal	Resistance	Min. 1 MΩ
			Between ground and wiring harness between high current fuse inlet – battery relay terminal M (69)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between battery relay terminal M (69) – circuit breaker 80 A terminal (62)	Resistance	Min. 1 MΩ
			Between ground and wiring harness among circuit breaker 80 A terminal (63) – fuse BT4 (9), (10) – R07 (female) (5)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between battery relay terminal B (69) – circuit breaker 30 A terminal (82)	Resistance	Min. 1 MΩ
			Between ground and wiring harness among circuit breaker 30 A terminal (84) – fuse BT2 (19), (20) – starting switch terminal B	Resistance	Min. 1 MΩ
			Between ground and wiring harness among starting switch terminal ACC-fuse BT2 (1), (2) – J2P (female) (39)	Resistance	Min. 1 MΩ

Circuit diagram related

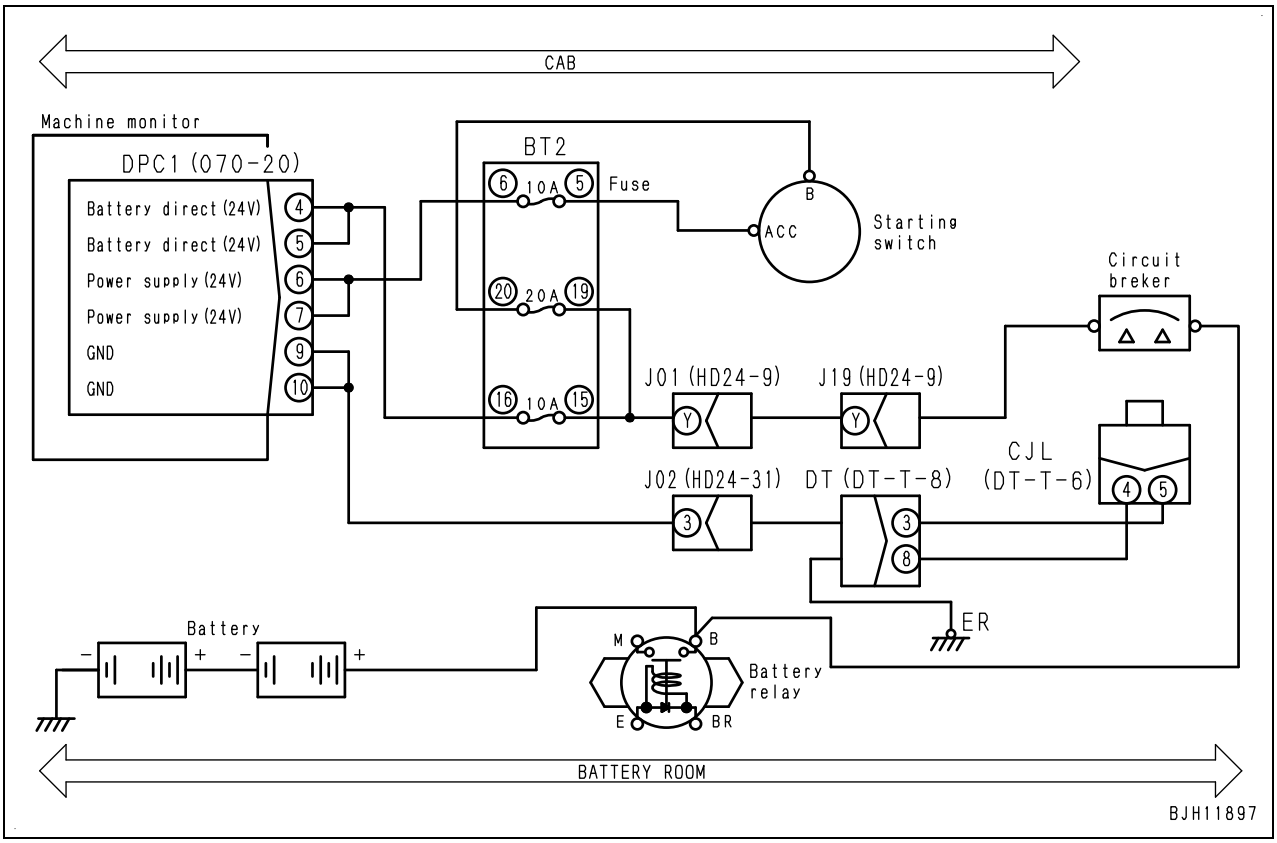


E-3 Machine monitor does not display all, when starting switch is turned ON

Trouble	Lamps and gauges of machine monitor do not display all, when starting switch is turned ON.
Related information	● When the machine related failure code is not displayed (if displayed, troubleshooting the code first.)

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fuse BT2 (6) or (20) or defective circuit breaker (30 A)	When the fuse BT2 (6) or (20) is blown or the circuit breaker (30 A) is shut off, it is highly possible that a defective grounding has occurred in the circuit (troubleshooting cause 3).		
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between DPC1 (female) (6), (7) – fuse BT2 (6)	Resistance	Max. 1 Ω
			Wiring harness between BT2 (5) – starting switch terminal ACC	Resistance	Max. 1 Ω
			Wiring harness between BT2 (20) – starting switch terminal B	Resistance	Max. 1 Ω
			Wiring harness between circuit breaker (30A) – fuse BT2 (19)	Resistance	Max. 1 Ω
			Wiring harness between DPC1 (female) (9), (10) – ground ER	Resistance	Max. 1 Ω
	3	Short circuit of harness (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between DPC1 (female) (6), (7) – fuse BT2 (6)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between BT2 (5) – starting switch terminal ACC	Resistance	Min. 1 MΩ
			Between ground and wiring harness between fuse BT2 (20) – starting switch terminal B	Resistance	Min. 1 MΩ
			Between ground and wiring harness between circuit breaker (30A) – fuse BT2 (19)	Resistance	Min. 1 MΩ
	4	Defective machine monitor	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between DPC1 (6), (7) – (9), (10)	Voltage	20 – 30 V

Circuit diagram related

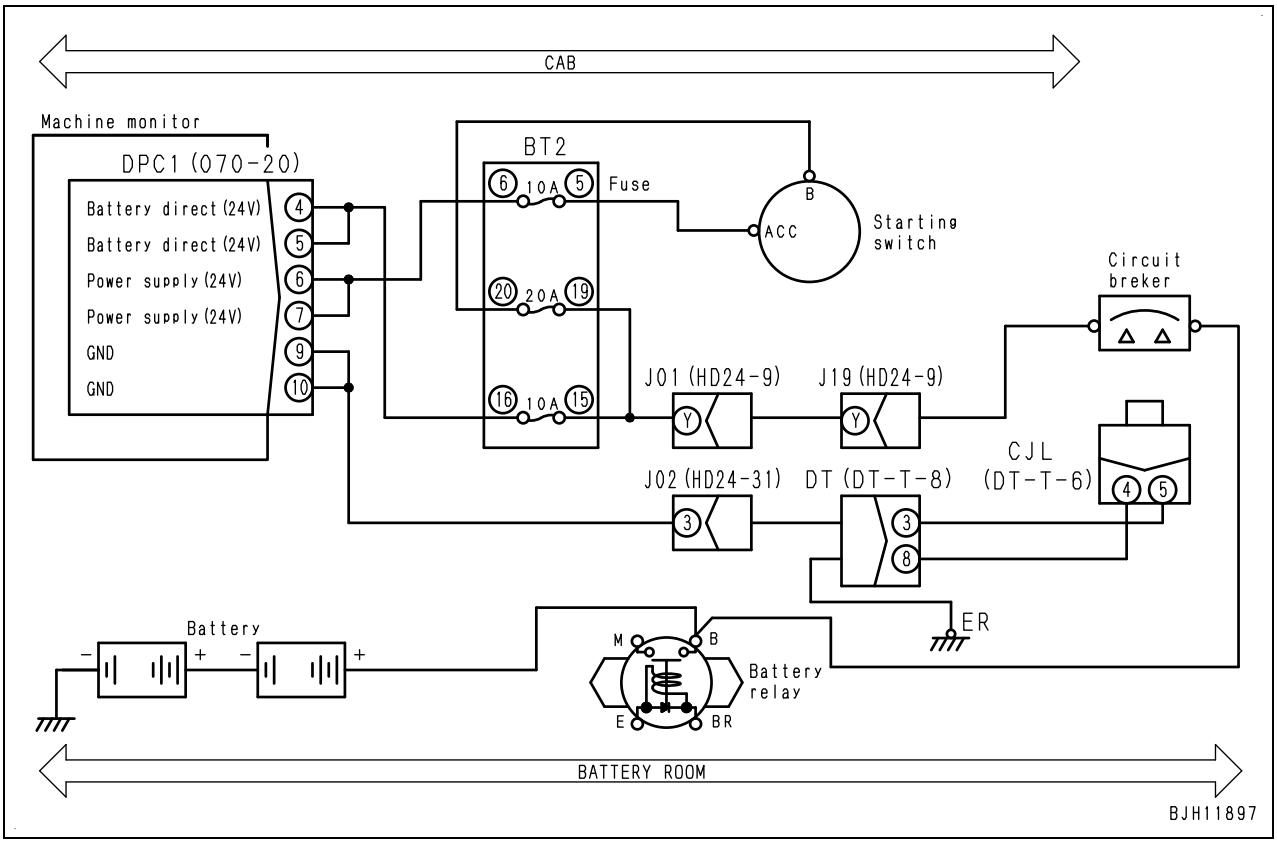


E-4 Machine monitor does not operate when starting switch is OFF

Trouble	Service meter and travel distance integrating meter, turn signal pilot lamp, and high beam pilot lamp do not flash, if the switches are operated with starting switch OFF.
Related information	● When the machine related failure code is not displayed (if displayed, troubleshooting the code first.)

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fuse BT2 (16) or defective circuit breaker (30A)	When the fuse BT2 (16) is blown or the circuit breaker (30 A) is shut off, it is highly possible that a defective grounding has occurred in the circuit (troubleshooting cause 3).		
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between DPC1 (female) (4), (5) – fuse BT2 (16)	Resistance	Max. 1 Ω
			Wiring harness between circuit breaker (30A) – fuse BT2 (15)	Resistance	Max. 1 Ω
			Wiring harness between DPC1 (female) (9), (10) – ground ER	Resistance	Max. 1 Ω
	3	Short circuit of harness (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between DPC1 (female) (4), (5) – fuse BT2 (16)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between circuit breaker (30A) – fuse BT2 (15)	Resistance	Min. 1 MΩ
	4	Defective machine monitor	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between DPC1 (4), (5) – (9), (10)	Voltage	20 – 30 V

Circuit diagram related



E-5 Alarm buzzer does not stop sounding

Trouble	● When starting switch is turned ON, central warning lamp lights up and alarm buzzer does not stop sounding.
Related information	● Causes 2 – 7 are alarms for avoiding dangers in operation, which stop when problem in operation is solved.

	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Failure detection	● When failure is detected, central warning lamp lights up and alarm buzzer sounds (Note: Lamp/Buzzer may not light up/sound, depending on each failure) ● In this case, perform troubleshooting for that code (Check fault history, too)
	2	Parking brake dragging warning	● When gear shift lever is set in position other than "N" with engine started and parking brake switch in "Park" position, central warning lamp lights up and alarm buzzer sounds ● If parking brake switch is set in "Travel" position or gear shift lever is set in "N" position, alarm is turned OFF
	3	Overrun warning	● If travel speed exceeds set speed or engine speed increases abnormally, central warning lamp lights up and alarm buzzer sounds ● If travel speed decreases below set speed or engine speed decreases to normal range, alarm is turned OFF
	4	Dump body up warning	● If gear shift lever is set in position other than "N" with parking brake switch in "Travel" position while engine is running and dump body is raised (dump body pilot lamp in machine monitor is lighting), central warning lamp lights up and alarm buzzer sounds ● If dump body is lowered or parking brake switch is set in "Park position" or gear shift lever is set in "N" position, alarm is turned OFF
	5	Neutral safety warning	● If starting switch is turned from OFF to ON, while gear shift lever is not in "N" position, central warning lamp lights up and alarm buzzer sounds ● If gear shift lever is set in "N" position, alarm is turned OFF
	6	Warning by dump body up caution (if equipped)	● If engine is started and dump body is raised (body pilot lamp in machine monitor is lighting) while this option is set, central warning lamp lights up and alarm buzzer sounds ● If dump body is lowered, alarm is turned OFF
	7	Warning for start with gear shift lever not in neutral	● If engine start signal (key switch terminal C) is detected while gear shift lever is not in "N" position, central warning lamp lights up and alarm buzzer sounds. ● If gear shift lever is set in "N" position or engine start signal is turned OFF, alarm is turned OFF
	8	Retarder oil pressure drop detection	● If accumulator oil pressure is still low after engine is started, retarder caution lamp (accumulator oil pressure drop detection) of machine monitor and central warning lamp light up and alarm buzzer sounds (Reference: Failure code [2G42ZG] or [2G43ZG] and [DHU2KX] or [DHU3KX] are turned ON after 30 seconds) ● Check retarder hydraulic circuit (accumulator oil pressure)
	9	Defective initialization	● If initialization is not performed normally after controller is replaced, central warning lamp lights up and alarm buzzer sounds ● Perform initialization correctly
	10	Defective machine monitor or controller	● If any of above causes is not detected, machine monitor or a controller may be defective ((Since trouble is in system, troubleshooting cannot be performed)

E-6 Gauges of machine monitor, caution lamps or character display section do not display properly

Trouble	Gauges, lamps or character display section are malfunctioning
Related information	● When the machine related failure code is not displayed (if displayed, troubleshooting the code first.)

		Cause	Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Defective sensors or switches	Troubleshooting corresponding sensors or switches by the failure code.
	2	Defective CAN communication circuit	Troubleshooting by the communication related failure code
	3	Defective machine monitor	If no problem is found in above 1 and 2, machine monitor is defective (since this is an internal defect, it cannot be diagnosed).

E-7 Selection of display in character display section cannot be changed

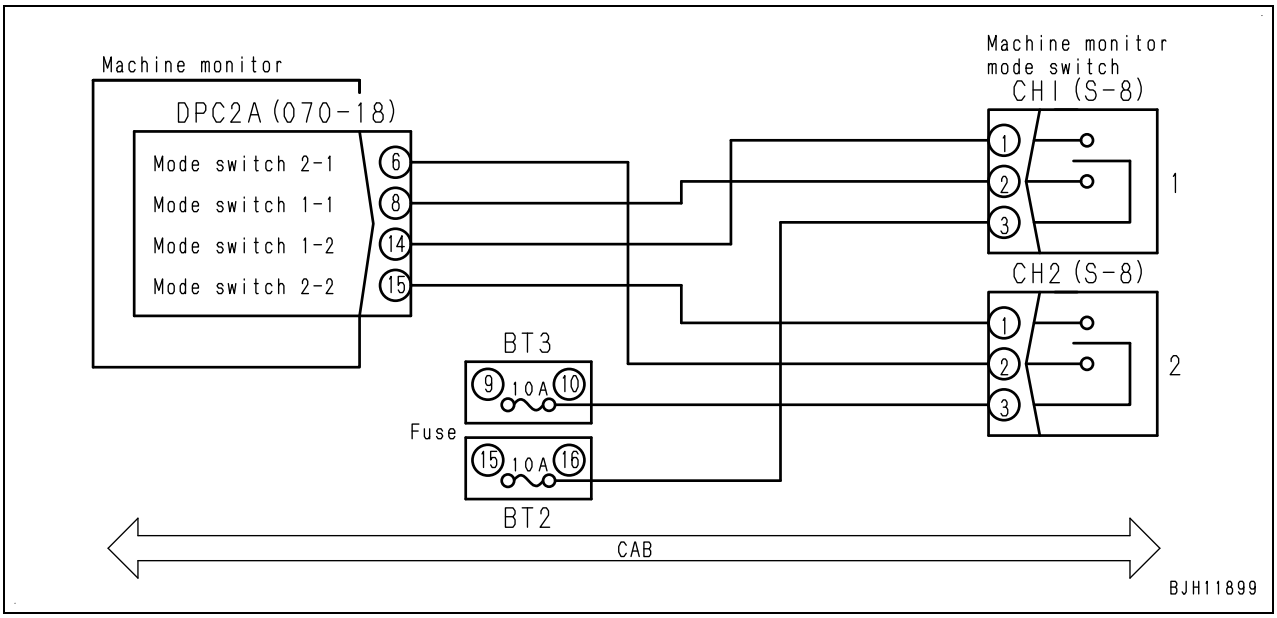
Trouble (1)	When the mode selector switch 1 circuit for machine monitor is defective
Related information	

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fuse BT2 (16)	When the fuse BT2 (16) is blown, it is highly possible that a defective grounding has occurred in the circuit (troubleshooting cause 4).			
	2	Defective monitor mode selector switch 1 (CH1)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			CH1 (male)	Operation of switch (switch unit)		Resistance
			Between (3) – (2)	Press the switch [◇].		Max. 1 Ω
				Switch is in the neutral.		Min. 1 MΩ
			Between (3) – (1)	Press the switch [■].		Max. 1 Ω
				Switch is in the neutral.		Min. 1 MΩ
	3	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between CH1 (female) (1) – DPC2A (female) (14)		Resistance	Max. 1 Ω
			Wiring harness between CH1 (female) (2) – DPC2A (female) (8)		Resistance	Max. 1 Ω
			Wiring harness between CH1 (female) (3) – fuse BT2 (16)		Resistance	Max. 1 Ω
	4	Short circuit of harness (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between CH1 (female) (1) – DPC2A (female) (14)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between CH1 (female) (2) – DPC2A (female) (8)		Resistance	Min. 1 MΩ
			Between ground and wiring harness between CH1 (female) (3) – fuse BT2 (16)		Resistance	Min. 1 MΩ
	5	Defective machine monitor	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			DPC2A	Operation of switch		Voltage
			Between (8) – ground	Press the switch [◇].		20 – 30 V
				Switch is in the neutral.		Max. 1 V
			Between (14) – ground	Press the switch [■].		20 – 30 V
				Switch is in the neutral.		Max. 1 V

Trouble (2)	When the mode selector switch 2 circuit for machine monitor is defective
Related information	

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fuse BT3 (10)	When the fuse BT3 (10) is blown, it is highly possible that a defective grounding has occurred in the circuit (troubleshooting cause 4).		
	2	Defective monitor mode selector switch 2 (CH2)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			CH2 (male)	Operation of switch (switch unit)	Resistance
			Between (3) – (2)	Press the switch [>].	Max. 1 Ω
				Switch is in the neutral.	Min. 1 MΩ
			Between (3) – (1)	Press the switch [<].	Max. 1 Ω
				Switch is in the neutral.	Min. 1 MΩ
	3	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between CH2 (female) (1) – DPC2A (female) (15)	Resistance	Max. 1 Ω
			Harness between CH2 (female) (2) – DPC2A (female) (6)	Resistance	Max. 1 Ω
			Wiring harness between CH2 (female) (3) – fuse BT3 (10)	Resistance	Max. 1 Ω
	4	Short circuit of harness (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between CH2 (female) (1) – DPC2A (female) (15)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between CH2 (female) (2) – DPC2A (female) (6)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between CH2 (female) (3) – fuse BT3 (10)	Resistance	Min. 1 MΩ
	5	Defective machine monitor	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			DPC2A	Operation of switch	Voltage
			Between (6) – ground	Press the switch [>].	20 – 30 V
				Switch is in the neutral.	Max. 1V
			Between (15) – ground	Press the switch [<].	20 – 30 V
				Switch is in the neutral.	Max. 1V

Circuit diagram related

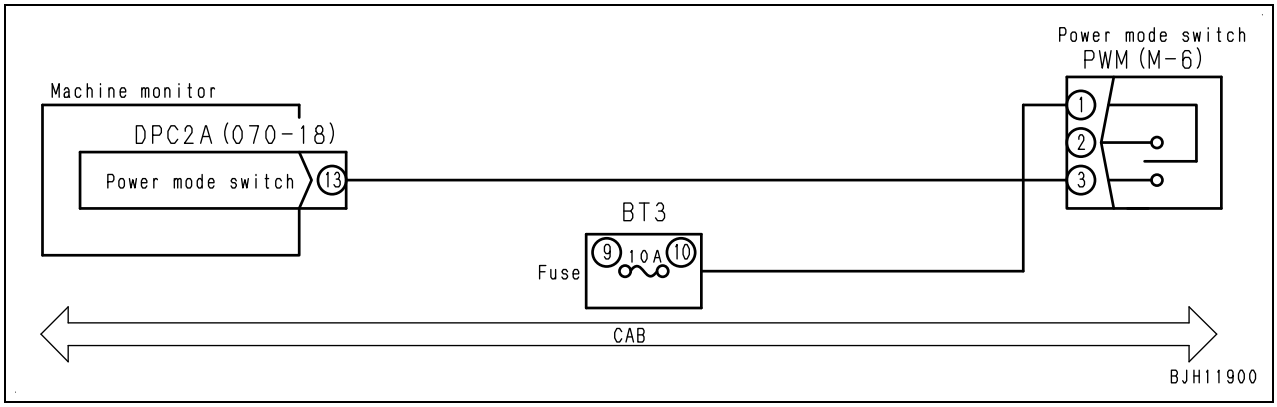


E-8 Power mode selecting function does not operate properly

Trouble	When power mode selector function does not operate properly, even if the power mode selector switch is operated.
Related information	● When the machine related failure code is not displayed (if displayed, troubleshooting the code first.)

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fuse BT3 (10)	When the fuse BT3 (10) is blown, it is highly possible that a defective grounding has occurred in the circuit (troubleshooting cause 4).		
	2	Defective power mode selector switch	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			PWM (male)	Operation of switch (switch unit)	Resistance
			Between (1) – (3)	Switch: down	Max. 1 Ω
				Switch: up	Min. 1 MΩ
	3	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between DPC2A (female) (13) – PWM (female) (3)	Resistance	Max. 1 Ω
			Wiring harness between PWM (female) (1) – fuse BT3 (10)	Resistance	Max. 1 Ω
	4	Short circuit of harness (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between DPC2A (female) (13) – PWM (female) (3)	Resistance	Min. 1 Ω
			Between ground and wiring harness between PWM (female) (1) – fuse BT3 (10)	Resistance	Min. 1 Ω
	5	Defective machine monitor	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			DPC2A	Operation of switch	Voltage
			Between (13) – ground	Switch: down	20 – 30 V
				Switch: up	Max. 1V

Circuit diagram related

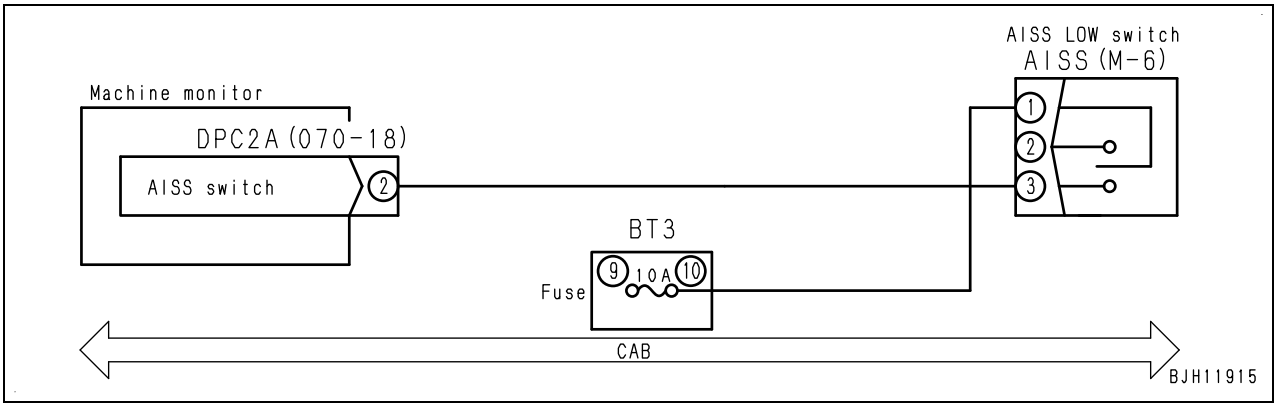


E-9 AISS function does not operate properly

Trouble	When AISS function does not operate properly, even if the AISS LOW switch is operated.
Related information	● When the machine related failure code is not displayed (if displayed, troubleshooting the code first.)

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fuse BT3 (10)	When the fuse BT3 (10) is blown, it is highly possible that a defective grounding has occurred in the circuit (troubleshooting cause 4).		
	2	Defective AISS switch	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			AISS (male)	Operation of switch (switch unit)	Resistance
			Between (1) – (3)	Switch: up	Min. 1 MΩ
				Switch: down	Max. 1 Ω
	3	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between DPC2A (female) (2) – AISS (female) (3)	Resistance	Max. 1 Ω
			Wiring harness between AISS (female) (1) – fuse BT3 (10)	Resistance	Max. 1 Ω
	4	Short circuit of harness (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between DPC2A (female) (2) – AISS (female) (3)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between AISS (female) (1) – fuse BT3 (10)	Resistance	Min. 1 MΩ
	5	Defective machine monitor	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			DPC2A	Operation of switch	Voltage
			Between (2) – ground	Switch: down	20 – 30 V
				Switch: up	Max. 1 V

Circuit diagram related

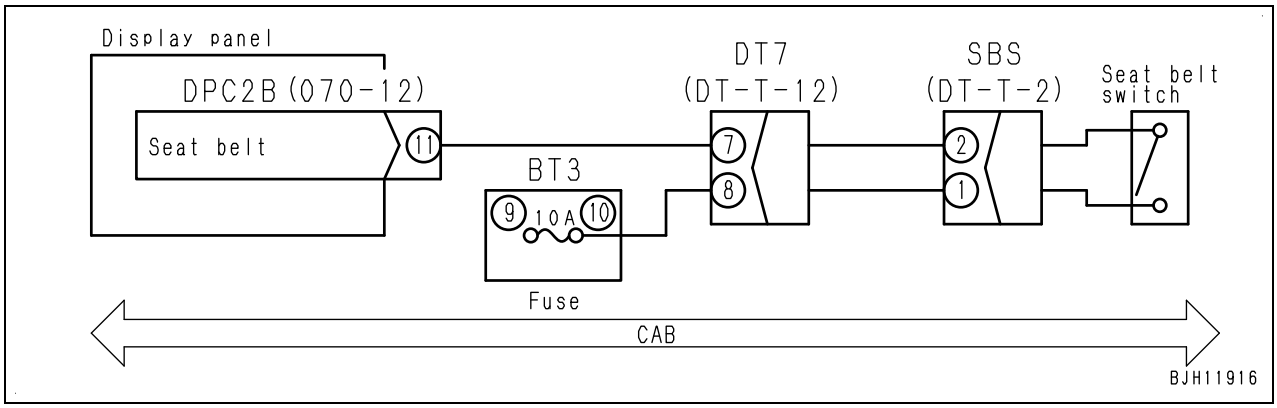


E-10 Seat belt caution lamp does not display properly

Trouble	The lamp lights up even if the seat belt is fastened, or the lamp does not light up even if the seat belt is not fastened.
Related information	● When the machine related failure code is not displayed (if displayed, troubleshooting the code first.)

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fuse BT3 (10)	When the fuse BT3 (10) is blown, it is highly possible that a defective grounding has occurred in the circuit (troubleshooting cause 4).		
	2	Defective seat belt switch	★ Prepare with the starting switch OFF and troubleshooting with starting switch still OFF (switch unit).		
			SBS	Seat belt	Resistance
			Between (1) – (2)	Fastened	Max. 1 Ω
				Unfastened	Min. 1 MΩ
	3	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between DPC2B (female) (11) – SBS (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between SBS (female) (2) – fuse BT3 (10)	Resistance	Max. 1 Ω
	4	Short circuit of harness (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between DPC2B (female) (11) – SBS (female) (1)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between SBS (female) (2) – fuse BT3 (10)	Resistance	Min. 1 MΩ
	5	Defective machine monitor	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			DPC2B	Seat belt	Voltage
			Between (11) – ground	Fastened	20 – 30 V
				Unfastened	Max. 1 V

Circuit diagram related



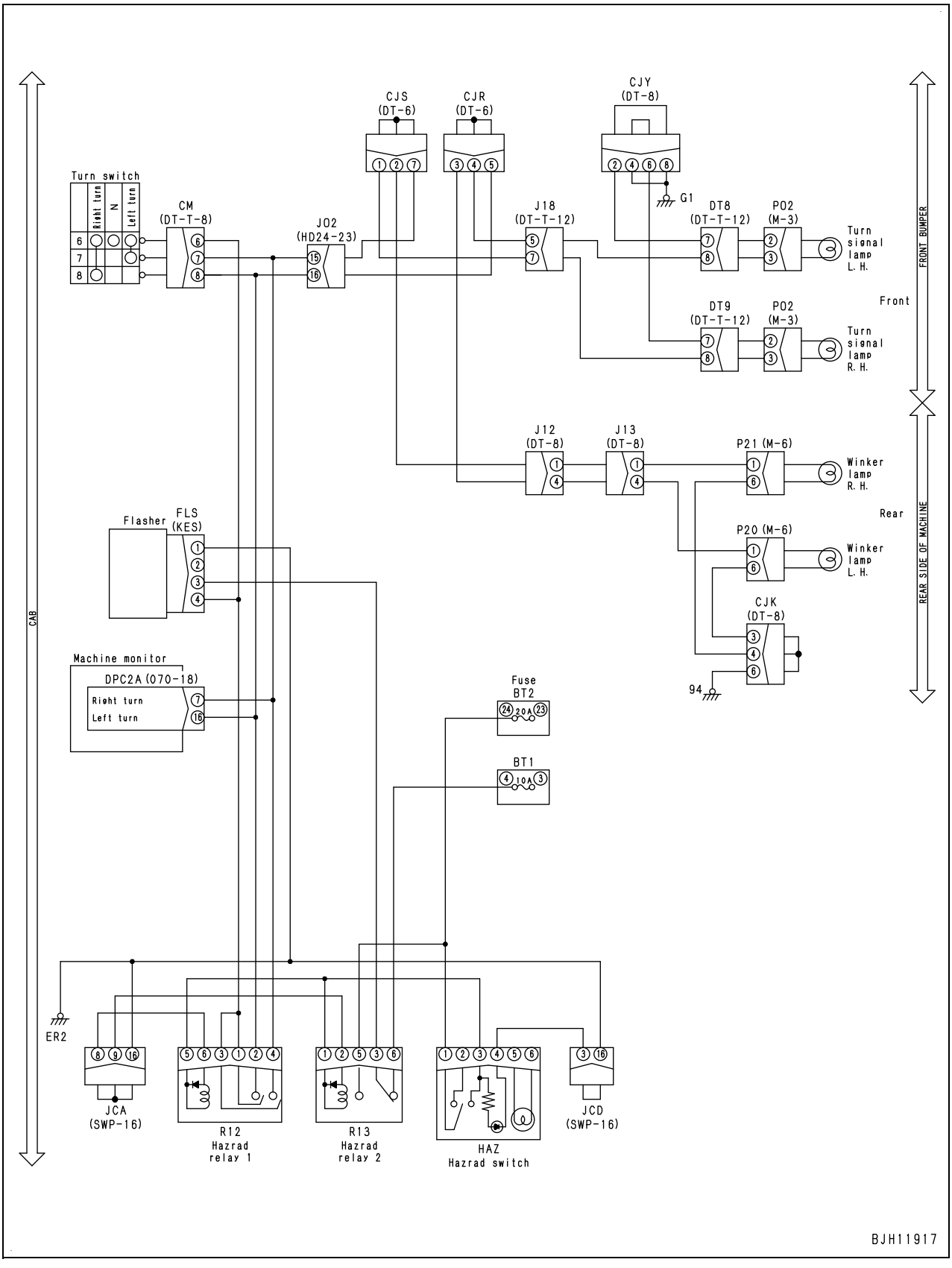
E-11 Turn signal lamp or turning lamp (hazard lamp) does not work properly

Trouble	Turn signal lamp or turning lamp (hazard lamp) does not flash.
Related information	

<table>
<tr><td rowspan="15">Possible causes and standard value in normal state</td><td>Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>1</td><td>Defective fuse BT1 (4) or BT2 (24)</td><td colspan="4">When the fuse BT1 (4) or BT2 (24) is blown, it is highly possible that a defective grounding has occurred in the circuit (troubleshooting cause 7).</td></tr>
<tr><td>2</td><td>Defective lamp</td><td colspan="4">Since the lamp can be suspected to be defective, visually check it or replace it with known good lamp to make a judgement.</td></tr>
<tr><td>3</td><td>Defective turn signal lamp</td><td colspan="4">★ Prepare with starting switch OFF and troubleshooting with starting switch ON.
FLS | Turn signal switch | Voltage
Between (3) – GND | At any positions | 20 – 30 V
Between (4) – GND | Turned to the left or right | 20 – 30 V – 0 V repeatedly</td></tr>
<tr><td>4</td><td>Defective turn signal switch</td><td colspan="4">★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.
CM (male) | Turn signal switch (lever) | Resistance
Between (6) – (7) | Turned to the left | Max. 1 Ω
Turned to the right | Min. 1 MΩ
Between (6) – (8) | Turned to the right | Max. 1 Ω
Turned to the left | Min. 1 MΩ</td></tr>
<tr><td>5</td><td>Defective relay</td><td colspan="4">When the relay can be suspected to be defective, replace it with another relay to make a judgement.
● As for the relay R12 (6 terminals): Replace with the relay R11, R16 or R09, etc.
● As for the relay R13 (5 terminals): Replace with the relay R14, R15 or R17, etc.</td></tr>
<tr><td rowspan="9">6</td><td rowspan="9">Disconnection in wiring harness
(Disconnection or defective contact)</td><td colspan="4">★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.</td></tr>
<tr><td>Wiring harness between BT1 (4) – R13 (female) (6)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness among BT2 (24) – R13 (female) (3) – HAZ (female) (5)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness among HAZ (female) (3) – R13 (female) (1) – R12 (female) (5)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between R13 (female) (3) – FLS (female) (3)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness among R12 (female) (4) – CM (female) (7) – DPC2A (female) (7)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness among R12 (female) (2) – CM (female) (8) – DPC2A (female) (16)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness among R12 (female) (1), (3) – FLS (female) (4) – DPC2A (female) (6)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between CM (female) (7) – CJS (female) (7)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td>Wiring harness between CJS (female) (1) – P02 (female) (3) (right front)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td></td><td></td><td>Wiring harness between CJS (female) (2) – P21 (female) (1) (right rear)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td></td><td></td><td>Wiring harness between CM (female) (8) – CJR (female) (5)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td></td><td></td><td>Wiring harness between CJR (female) (3) – P20 (female) (1) (left rear)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
</table>

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	6	Disconnection in wiring harness (Disconnection or defective contact)	Wiring harness between CJR (female) (4) – P02 (female) (3) (left front)	Resistance	Max. 1 Ω
			Wiring harness among P02 (female) (2) – CJY (2), (8) – ground (G1) (left front)	Resistance	Max. 1 Ω
			Wiring harness between P02 (female) (6) – CJY (6), (4) – ground (G1) (right front)	Resistance	Max. 1 Ω
			Wiring harness among P21 (female) (6) – CJK (4), (6) – ground (94) (right rear)	Resistance	Max. 1 Ω
			Wiring harness between P21 (female) (6) – CJK (3), (6) – ground (94) (left rear)	Resistance	Max. 1 Ω
			Wiring harness between HAZ (female) (4) – ground (EG2)	Resistance	Max. 1 Ω
			Wiring harness among R13 (female) (2) – JCA (9), (16) – ground (EG2)	Resistance	Max. 1 Ω
			Wiring harness among R12 (female) (6) – JCA (8), (16) – ground (EG2)	Resistance	Max. 1 Ω
			Wiring harness between FLS (female) (1) – ground (EG2)	Resistance	Max. 1 Ω
	7	Short circuit of harness (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between BT1 (4) – R13 (female) (6)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between BT2 (24) – R13 (female) (3) – HAZ (female) (5)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between HAZ (female) (3) – R13 (female) (1) – R12(female) (5)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between R13 (female) (3) – FLS (female) (3)	Resistance	Min. 1 MΩ
			Between ground and wiring harness among R12 (female) (4) – CM (female) (7) – DPC2A (female) (7)	Resistance	Min. 1 MΩ
			Between ground and wiring harness among R12 (female) (2) – CM (female) (8) – DPC2A (female) (16)	Resistance	Min. 1 MΩ
			Between ground and wiring harness among R12 (female) (1) – FLS (female) (4) – DPC2A (female) (6)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between CM (female) (7) – CJS (female) (7)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between CJS (female) (1) – P02 (female) (3) (right front)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between CJS (female) (2) – P21 (female) (1) (right rear)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between CM (female) (8) – CJR (female) (5)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between CJR (female) (3) – P20 (female) (1) (left rear)	Resistance	Min. 1 MΩ
			Between ground and wiring harness between CJR (female) (4) – P02 (female) (3) (left front)	Resistance	Min. 1 MΩ

Circuit diagram related



E-12 Night illumination (lighting) does not work properly

Trouble (1)	Small lamps (clearance lamp, tail lamp), night illumination and head lamp do not light up at all.
Related information	

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fuse BT1(2)	When the fuse BT1 (2) is blown, it is highly possible that a defective grounding has occurred in the circuit (troubleshooting cause 4).			
	2	Defective lamp switch	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			CM (male)	Lamp switch	Resistance	
			Between (1) – (2)	1st detent	Max. 1Ω	
			Between (1) – (3)		Min. 1MΩ	
			Between (1) – (2)	2nd detent	Max. 1Ω	
			Between (1) – (3)		Max. 1Ω	
	3	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between fuse BT1 (2) – CM (female) (1), (4)		Resistance	Max. 1Ω
	4	Short circuit of harness (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness among fuse BT1 (2) – CM (female) (1), (4) – R14 (female) (5) – R16 (female) (3), (1)		Resistance	Min. 1MΩ
			Between ground and wiring harness among fuse BT1 (5) – R15 (female) (5) – R16 (female) (2), (4) – DPC2A (female) (1)		Resistance	Min. 1MΩ
			Between ground and wiring harness between fuse BT1 (5) – R15 (female) (6)		Resistance	Min. 1MΩ
			Between ground and wiring harness among fuse BT1 (9), (7) – CM (female) (2) – LS (female) (1) – DPC2A (female) (5)			

Trouble (2)	Small lamps (clearance lamp and tail lamp) or night illumination do not light up at the first detent position of the lamp switch.
Related information	● When the head lamps light up.

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective lamp switch	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			CM (male)	Lamp switch	Resistance	
			Between (1) – (2)	1st detent	Max. 1Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between CM (female) (2) – fuse BT1 (9), (11) (branched point)		Resistance	Max. 1Ω

Trouble (3)	Left small lamps (clearance lamp and tail lamp) do not light up.
Related information	● When right side and head lamps light up.

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fuse BT1(12)	When the fuse BT1 (12) is blown, it is highly possible that a defective grounding has occurred in the circuit (troubleshooting cause 4).		
	2	Defective lamp (bulb)	When the lamp (bulb) can be suspected to be defective, judge by visual check or replacing the lamp bulb.		
	3	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between P20 (female) (4) – CJS (female) (3)	Resistance	Max. 1Ω
			Wiring harness between P02 (female) (1) – CJS (female) (4)	Resistance	Max. 1Ω
			Wiring harness between CJS (female) (5) – fuse BT1 (12)	Resistance	Max. 1Ω
			Wiring harness between BT1 (9), (11) – CM (female) (2) (to branched point)	Resistance	Max. 1Ω
			Wiring harness among P20 (female) (6) – CJK (3), (6) – ground (94)	Resistance	Max. 1Ω
			Wiring harness among P20 (female) (2) – CJY (2), (8) – ground (G1)	Resistance	Max. 1Ω
	4	Short circuit of harness (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between P20 (female) (4) – CJS (female) (3)	Resistance	Min. 1MΩ
			Between ground and wiring harness between P02 (female) (1) – CJS (female) (4)	Resistance	Min. 1MΩ
			Between ground and wiring harness between CJS (female) (5) – fuse BT1 (12)	Resistance	Min. 1MΩ
			Between ground and wiring harness between BT1 (9), (11) – CM (female) (2) (to branched point)	Resistance	Min. 1MΩ

Trouble (4)	Right small lamps (clearance lamp and tail lamp) do not light up.
Related information	● When left side and head lamps light up.

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fuse BT1(10)	When the fuse BT1 (10) is blown, it is highly possible that a defective grounding has occurred in the circuit (troubleshooting cause 4).		
	2	Defective lamp (bulb)	When the lamp (bulb) can be suspected to be defective, judge by visual check or replacing the lamp bulb.		
	3	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between P21 (female) (4) – CJT (female) (5)	Resistance	Max. 1Ω
			Wiring harness between P02 (female) (1) – CJT (female) (3)	Resistance	Max. 1Ω
			Wiring harness between CJT(female) (4) – fuse BT1 (10).	Resistance	Max. 1Ω
			Wiring harness between BT1 (9), (11) – CM (female) (2) (to branched point)	Resistance	Max. 1Ω
			Wiring harness among P21 (female) (6) – CJK (4), (6) – ground (94)	Resistance	Max. 1Ω
			Wiring harness among P20 (female) (2) – CJY (6), (4) – ground (G1)	Resistance	Max. 1Ω
	4	Short circuit of harness (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between P21 (female) (4) – CJT (female) (5)	Resistance	Min. 1MΩ
			Between ground and wiring harness between P02 (female) (1) – CJT (female) (3)	Resistance	Min. 1MΩ
			Between ground and wiring harness between CJT (female) (4) – fuse BT1 (10)	Resistance	Min. 1MΩ
			Between ground and wiring harness between BT1 (9), (11) – CM (female) (2) (to branched point)	Resistance	Min. 1MΩ

Trouble (5)	Head lamps ”Lo beam” do not light up.
Related information	● When the lamps light up in the Hi beam side.

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fuse BT1(8)	When the fuse BT1 (8) is blown, it is highly possible that a defective grounding has occurred in the circuit (troubleshooting cause 5).		
	2	Defective lamp (bulb)	When the lamp (bulb) can be suspected to be defective, judge by visual check or replacing the lamp bulb.		
	3	Defective lamp switch	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			CM (male)	Lamp switch	Resistance
			Between (1) – (3)	Turn to 2nd detent.	Max. 1Ω
	4	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between P01 (female) (1) – CJU (female) (3) (right side)	Resistance	Max. 1Ω
			Wiring harness between P01 (female) (1) – CJU (female) (5) (left side)	Resistance	Max. 1Ω
			Wiring harness between CJU (female) (4) – fuse BT1 (8).	Resistance	Max. 1Ω
			Wiring harness between fuse BT1 (7) – R15 (female) (6)	Resistance	Max. 1Ω
			Wiring harness between CM (female) (3) – R14 (female) (1)	Resistance	Max. 1Ω
			Wiring harness between R14 (female) (3) – R15 (female) (3)	Resistance	Max. 1Ω
			Wiring harness between P01 (female) (2) – CJY(5), (4) – ground (G1) (right side)	Resistance	Max. 1Ω
			Wiring harness between P01 (female) (2) – CJY(7), (8) – ground (G1) (left side)	Resistance	Max. 1Ω
	5	Short circuit of harness (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between P01 (female) (1) – CJU (female) (3) (right side)	Resistance	Min. 1MΩ
			Between ground and wiring harness between P01 (female) (1) – CJU (female) (5) (left side)	Resistance	Min. 1MΩ
			Between ground and wiring harness between CJU (female) (4) – fuse BT1 (8)	Resistance	Min. 1MΩ
			Between ground and wiring harness between fuse BT1 (7) – R15 (female) (6)	Resistance	Min. 1MΩ
			Between ground and wiring harness between CM (female) (3) – R14 (female) (1)	Resistance	Min. 1MΩ
			Between ground and wiring harness between R14 (female) (3) – R15 (female) (3)	Resistance	Min. 1MΩ

Trouble (6)	Head lamps "Hi beam" do not light up.
Related information	● When the lamps light up in the Lo beam side.

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fuse BT1(6)	When the fuse BT1 (6) is blown, it is highly possible that a defective grounding has occurred in the circuit (troubleshooting cause 4).		
	2	Defective lamp (bulb)	When the lamp (bulb) can be suspected to be defective, judge by visual check or replacing the lamp bulb.		
	3	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between P01 (female) (3) – CJT (female) (7) (right side)	Resistance	Max. 1Ω
			Wiring harness between P01 (female) (3) – CJT (female) (2) (left side)	Resistance	Max. 1Ω
			Wiring harness between CJT (female) (1) – fuse BT1 (6).	Resistance	Max. 1Ω
			Wiring harness between fuse BT1 (5) – R15 (female) (5)	Resistance	Max. 1Ω
			Between ground and wiring harness between R14 (female) (1) – R15 (female) (1)	Resistance	Max. 1Ω
			Wiring harness between DPC1 (female) (14) – R15 (female) (2)	Resistance	Max. 1Ω
			Wiring harness between DPC2A (female) (1) – R15 (female) (5) (to branched point)	Resistance	Max. 1Ω
	4	Short circuit of harness (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between P01 (female) (3) – CJT (female) (7) (right side)	Resistance	Min. 1MΩ
			Between ground and wiring harness between P01 (female) (3) – CJT (female) (2) (left side)	Resistance	Min. 1MΩ
			Between ground and wiring harness between CJT (female) (1) – fuse BT1 (6)	Resistance	Min. 1MΩ
			Between ground and wiring harness between fuse BT1 (5) – R15 (female) (5)	Resistance	Min. 1MΩ
			Wiring harness between R14 (female) (1) – R15 (female) (1)	Resistance	Min. 1MΩ
			Between ground and wiring harness between DPC1 (female) (14) – R15 (female) (2)	Resistance	Min. 1MΩ
			Between ground and wiring harness between DPC2A (female) (1) – R15 (female) (5) (to branched point)	Resistance	Min. 1MΩ

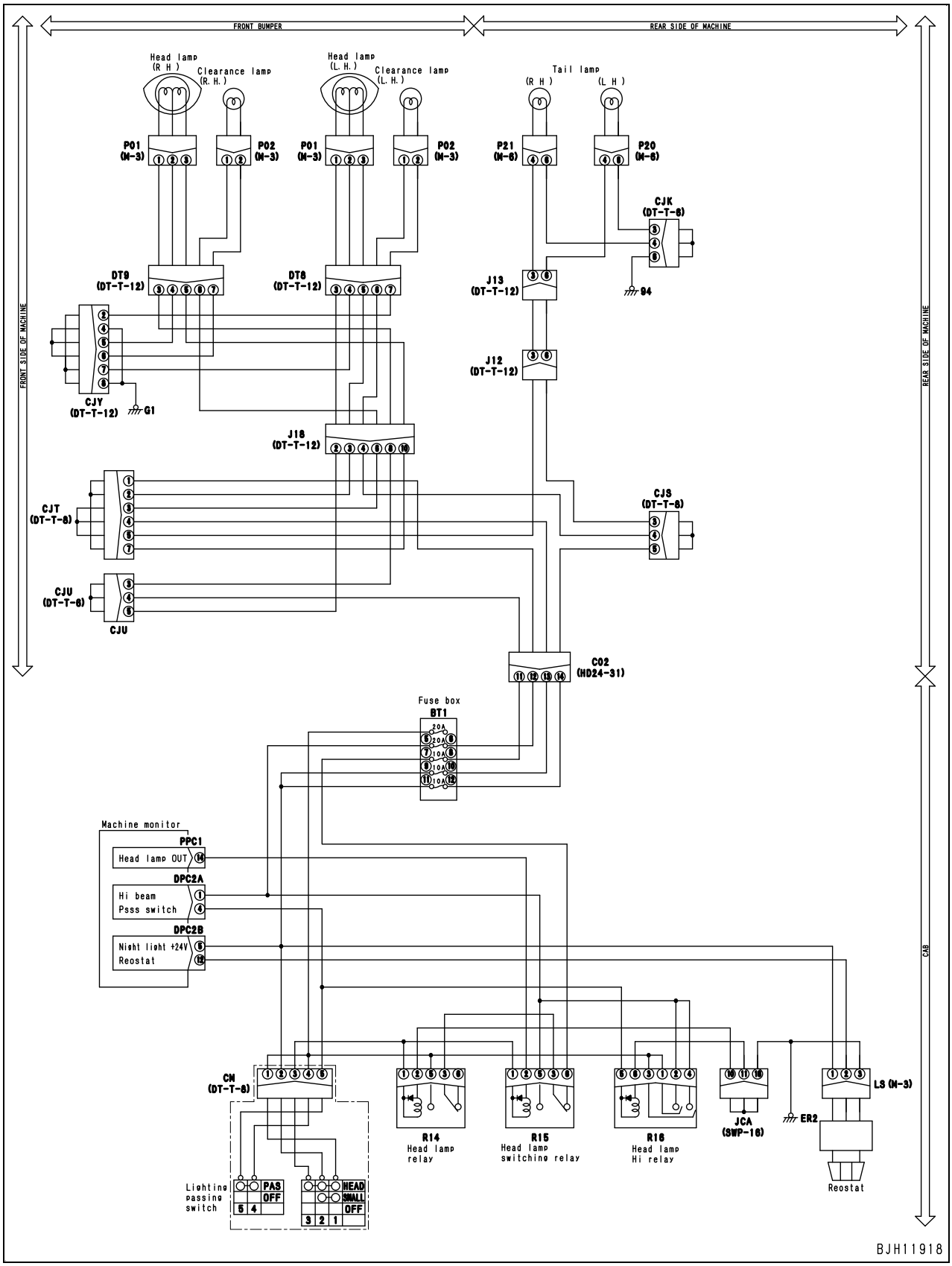
Trouble (7)	At passing position, “Hi“ beam lamps do not light up.
Related information	● When head lamps light up properly.

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective passing switch	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			CM (male)	Passing switch	Resistance	
			Between (4) – (5)	Operated	Max. 1Ω	
				Not operated	Min. 1MΩ	
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between CM (female) (5) – R16 (female) (5)		Resistance	Max. 1Ω
			Wiring harness between R16 (female) (2), (4) – R15 (female) (5) (to branched point)		Resistance	Max. 1Ω
			Wiring harness between DPC2A (female) (4) – CM (female) (5) (to branched point)		Resistance	Max. 1Ω

Trouble (8)	The brightness of the night illumination does not change, even if the rheostat is operated.
Related information	

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective rheostat	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.			
			LS	Rheostat	Voltage	
			Between (1) – ground	Neutral	20 – 30 V	
			Between (2) – ground	Left end	6 – 12 V	
				Right end	18 – 27 V	
	2	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Wiring harness between LS (female) (2) – DPC2B (female) (12)		Resistance	Max. 1Ω
			Wiring harness between LS (female) (3) – ground (EG2)		Resistance	Max. 1Ω
	3	Short circuit of harness (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.			
			Between ground and wiring harness between LS (female) (2) – DPC2B (female) (12)		Resistance	Min. 1MΩ
			Between ground and wiring harness between LS (female) (3) – ground (EG2)		Resistance	Min. 1MΩ

Circuit diagram related



E-13 Emergency steering does not operate

Trouble (1)	When the steering pomp stops operating, it does not operate with auto.
Related information	● Check that the parking brake is released.

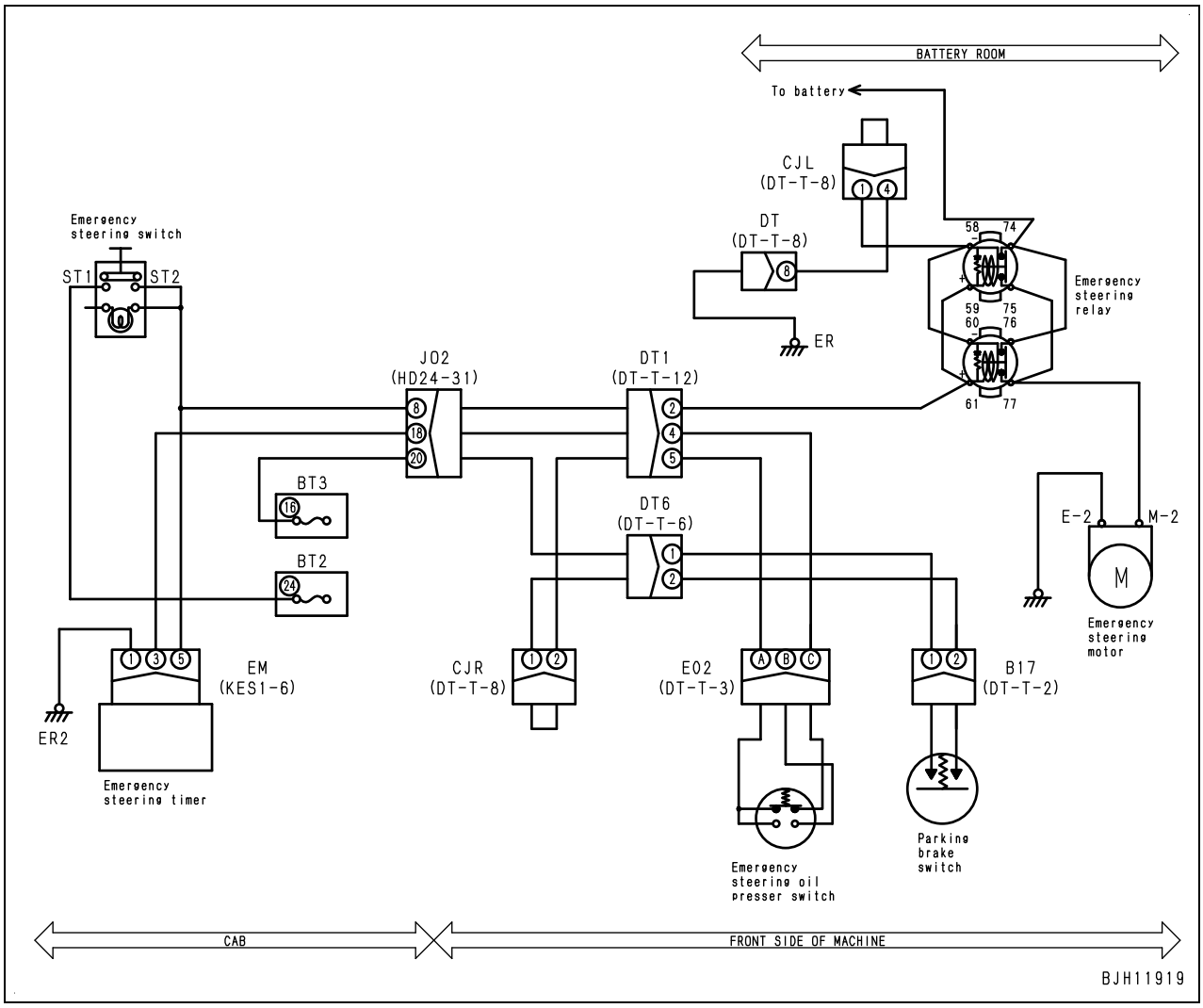
	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fuse BT3 (16)	When the fuse BT3 (16) is blown, it is highly possible that a defective grounding has occurred in the circuit (troubleshooting cause 8).		
	2	Defective parking brake switch (internal defective contact)	★ Prepare with starting switch OFF, then start the engine to troubleshooting. ● Connect T-adapter to B17 (male).		
			B17 (male)	Parking brake operations	Resistance
			Between (1) – (2)	Released (CLOSE)	Max. 1Ω
				Operated (OPEN)	Min. 1MΩ
	3	Defective emergency oil pressure switch (internal defective contact)	★ Prepare with starting switch OFF, then start the engine to troubleshooting. ● Connect T-adapter to E02 (male).		
			E02 (male)	Steering pump	Resistance
			Between (1) – (2)	Operated (OPEN)	Min. 1MΩ
				Stopped (CLOSE)	Max. 1Ω
	4	Defective emergency steering timer	★ Prepare with starting switch OFF and troubleshooting with starting switch ON. (parking brake ON)		
			1) Between EM (female) (3) – ground	Voltage	20 – 30 V
			2) Between EM (female) (5) – ground	Voltage	20 – 30 V
			★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			3) Between EM (female) (1) – ground	Resistance	Max. 1Ω
			● When the voltage of the above 1) is within the range and 2) is out of range, the timer is defective. ● If the voltage of the above 1) is defective, troubleshooting cause 7.		
	5	Defective emergency steering relay	★ Prepare with starting switch OFF and troubleshooting with starting switch ON. (parking brake ON)		
			1) Between relay terminal (74) – ground	Voltage	20 – 30 V
			2) Between relay terminal (77) – ground	Voltage	20 – 30 V
			3) Between relay terminal (61) – ground	Voltage	20 – 30 V
			★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			4) Between relay terminal (58) – ground	Resistance	Max. 1Ω
			● When the voltage of the above 1), 3) and 4) are within the ranges, and 2) is out of range, the relay is defective. ● If the voltage of the above 1) is defective, troubleshooting cause 7.		
	6	Defective emergency steering motor	★ Prepare with starting switch OFF and troubleshooting with starting switch ON.		
			Between motor terminal M-2 and ground	Voltage	20 – 30 V
			★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between motor terminal E-2 and ground	Resistance	Max. 1Ω
			● If no problem is found in above diagnoses, the steering motor is defective.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	7	Disconnection in wiring harness (Disconnection or defective contact)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Wiring harness between fuse BT-3 (16) – B17 (female) (1)	Resistance	Max. 1Ω
			Wiring harness between B17 (female) (2) – CJR (female) (1)	Resistance	Max. 1Ω
			Wiring harness between CJR (female) (2) – E02 (female) (A)	Resistance	Max. 1Ω
			Wiring harness between E02 (female) (C) – EM (female) (3)	Resistance	Max. 1Ω
			Wiring harness between EM (female) (5) – relay terminal (61)	Resistance	Max. 1Ω
			Wiring harness between relay terminal (77) – motor terminal M-2	Resistance	Max. 1Ω
			Wiring harness between EM (female) (1) – ground	Resistance	Max. 1Ω
			Wiring harness between motor terminal E-2 – ground	Resistance	Max. 1Ω
			Wiring harness between motor terminal (58) – ground	Resistance	Max. 1Ω
			Wiring harness between relay terminal (74) – battery (+)	Resistance	Max. 1Ω
	8	Short circuit (ground fault) of harness (Contact with ground circuit)	★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.		
			Between ground and wiring harness between fuse BT-3 (16) – B17 (female) (1)	Resistance	Min. 1MΩ
			Between ground and wiring harness between B17 (female) (2) – CJR (female) (1)	Resistance	Min. 1MΩ
			Between ground and wiring harness between CJR (female) (2) – E02 (female) (A)	Resistance	Min. 1MΩ
			Between ground and wiring harness between E02 (female) (C) – EM (female) (3)	Resistance	Min. 1MΩ
			Between ground and wiring harness between EM (female) (5) – relay terminal (61)	Resistance	Min. 1MΩ
			Between ground and wiring harness between relay terminal (77) – motor terminal M-2	Resistance	Min. 1MΩ

Trouble (2)	When the steering pump stops operating, it does not operate with manual.
Related information	● When it operates with auto (troubleshooting the symptom of failure (1) first, if it does not operate with auto), check that the parking brake is released.

<table>
<tr><td rowspan="11">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>1</td><td>Defective fuse BT2 (24)</td><td colspan="4">If fuse BT2 (24) is blown, it is highly possible that a defective harness grounding has occurred in the circuit.</td></tr>
<tr><td rowspan="3">2</td><td rowspan="3">Defective manual switch (internal defective contact)</td><td colspan="4">★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.</td></tr>
<tr><td>Manual switch terminal</td><td>Manual switch operation</td><td colspan="2">Resistance</td></tr>
<tr><td>Between ST1 – ST2 (Switch unit)</td><td>Switch (pressed)</td><td colspan="2">Max. 1Ω</td></tr>
<tr><td></td><td></td><td>Switch (not pressed)</td><td colspan="2">Min. 1MΩ</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 and troubleshooting with starting switch still OFF.</td></tr>
<tr><td colspan="3">Wiring harness between BT2 (24) – manual switch terminal ST1</td><td>Resistance</td><td>Max. 1Ω</td></tr>
<tr><td colspan="3">Wiring harness between manual switch terminal ST2 – J02 (female) (8) (to branched point)</td><td>Resistance</td><td>Max. 1Ω</td></tr>
<tr><td rowspan="3">4</td><td rowspan="3">Short circuit (ground fault) of harness (Contact with ground circuit)</td><td colspan="4">★ Prepare with starting switch OFF and troubleshooting with starting switch still OFF.</td></tr>
<tr><td colspan="3">Between ground and wiring harness between BT2 (24) – manual switch terminal ST1</td><td>Resistance</td><td>Min. 1MΩ</td></tr>
<tr><td colspan="3">Between ground and wiring harness between manual switch terminal ST2 – J02 (female) (8) (to branched point)</td><td>Resistance</td><td>Min. 1MΩ</td></tr>
</table>

Circuit diagram related



E-14 Air conditioner does not operate normally

Trouble	(1) When air conditioner switch is operated, air conditioner does not operate at all
Related information	

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fuse in unit	If fuse in unit is broken, circuit in unit probably has ground fault (See cause 5).		
	2	Defective wiring harness (ground cable)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning switch ON.		
			Between (4) (brown) on wiring harness side of connector [1] - ground	Resistance	Max. 1 Ω
			Between wiring harness side (black) of connector [13] - ground	Resistance	Max. 1 Ω
	3	Defective relay (Short circuit in relay coil)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning switch ON.		
			● Between blower relay (1) - (2)	Resistance	320 Ω
	4	Defective wiring harness or defective control amplifier	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Between (16) (WG) . (4) (brown) of connector [1]	Voltage	20 – 30 V
			Between (1) (red) . (4) (black) of connector [13]	Voltage	20 – 30 V
	5	Ground fault in wiring harness (Contact with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning switch ON.		
			Between connector (1) (white) - (9) (black) of [12] (machine side)	Resistance	Min. 1 MΩ
			Between connector (1) (white) of [12] (machine side) - ground	Resistance	Min. 1 MΩ
			Between (1) (WG) - (9) (black) of connector [11] (air conditioner side)	Resistance	Min. 1 MΩ
			Between (1) (WG) of connector [11] (air conditioner side) - ground	Resistance	Min. 1 MΩ
			Between (6) (red) - (3) (black) of connector [12] (machine side)	Resistance	Min. 1 MΩ
			Between (6) (red) of connector [12] (machine side) - ground	Resistance	Min. 1 MΩ
			Between (6) (red) - (3) (black) of connector [11] (air conditioner unit side)	Resistance	Min. 1 MΩ
			Between (6) (red) of connector [11] (air conditioner unit side) - ground	Resistance	Min. 1 MΩ
			Between connector [9] (wiring harness side) (red) - ground	Resistance	Min. 1 MΩ
			Between connector [9] (wiring harness side) (blue) - ground	Resistance	Min. 1 MΩ

Possible causes and standard value in normal state	6	Short circuit with another wire (Communication between control panel and control amplifier is defective)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning switch ON.		
			Between (2) - (1) of connector AC2 [13]	Resis-tance	Min. 1 MΩ
			Between (2) - (4) of connector AC2 [13]	Resis-tance	Min. 1 MΩ
			Between (3) - (1) of connector AC2 [13]	Resis-tance	Min. 1 MΩ
			Between (3) - (4) of connector AC2 [13]	Resis-tance	Min. 1 MΩ
	7	Defective control amplifier	If causes 1-6 are not detected, control amplifier may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		
	8	Defective control panel	If causes 1-6 are not detected, control amplifier may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

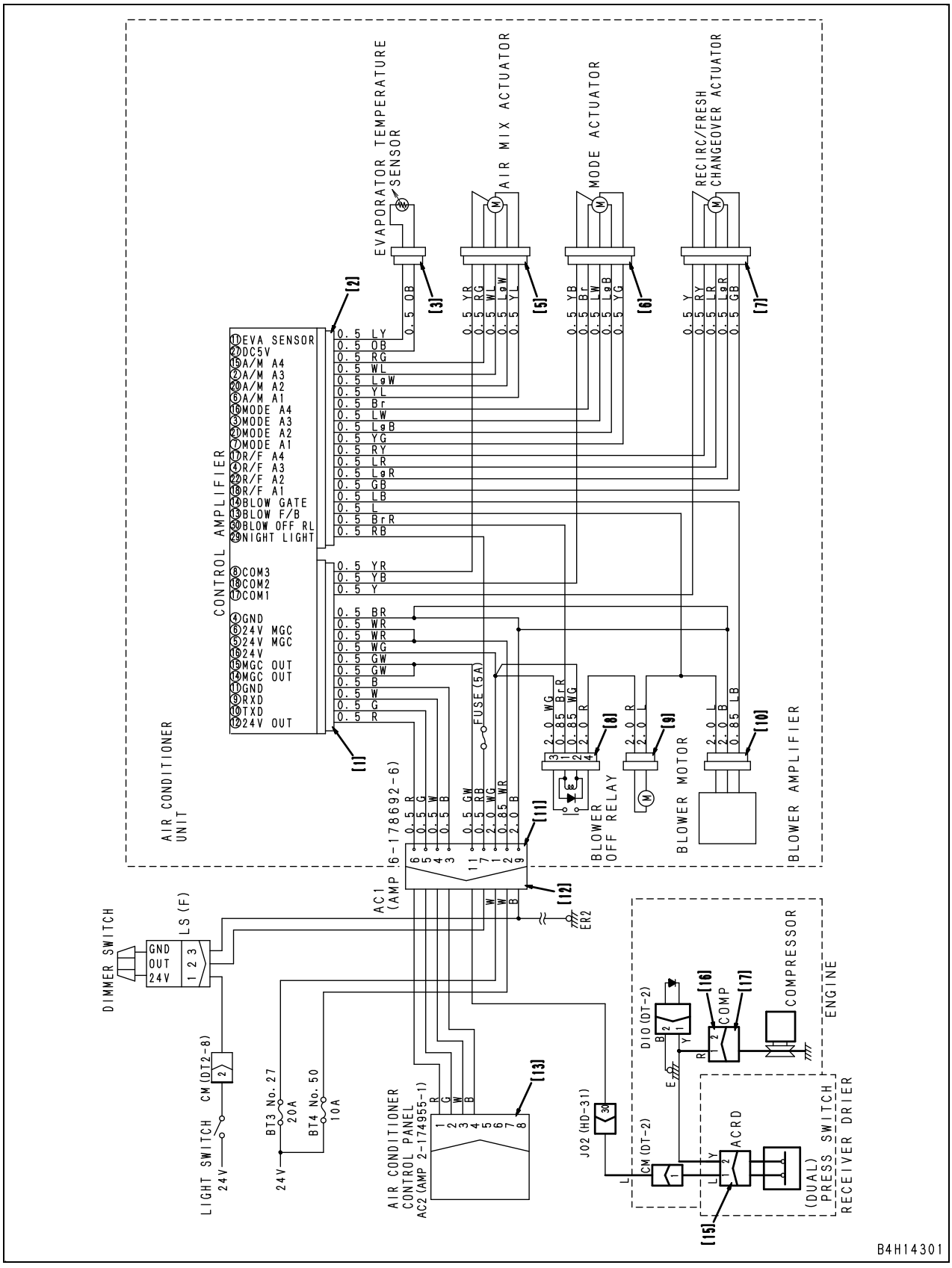
Trouble	(2) Air does not come out (Air flow is insufficient)
Related information	

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective blower (fan) motor, defective blower-OFF relay, defective blower amplifier or defective wiring harness	★ Prepare with starting switch OFF, then carry out troubleshooting without turning switch ON.		
			Between wiring harness terminals on blower motor side of connector [9]		There is continuity
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Between red and blue wiring harness terminals on control amplifier side of connector [9]	Voltage	20 – 30 V
	2	Defective blower (fan) motor	★ When test result for cause 1 is abnormal (When continuity is broken or when motor does not rotate while voltage is normal), blower (fan) motor is defective. blower (fan) motor is defective.		
	3	Defective blower-OFF relay (Does not turn ON)	● Referring to test of relay, check turn-on sound of blower-OFF relay		Click is heard.
			★ If test result for cause 3 is abnormal but relay is normal, go to cause 7.		
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Turn main power of control panel ON.		Air comes out.
			★ If air does not come out even when blower motor is turned ON forcibly without using relay, cause is part other than relay.		
	4	Defective wiring harness (ground fault)	★ If ground fault occurs, 20 A fuse (BT3, No. 27) is broken.		
	5	Defective blower amplifier	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Between terminal (blue) and ground of connector [9] (Output voltage of blower amplifier)	Voltage	Approx. 10 V
			Between terminal (blue/black) and (black) of connector [10] (intput voltage of blower amplifier)	Voltage	Change within 10 V
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning switch ON.		
			Between (blue/black) and (black) of connector [10]	Resistance	4.7 kΩ ± 5 %
			Between (blue) (+) and (black) (-) of connector [10]	There is no continuity * Diode range	
			Between (blue) (-) and (black) (+) of connector [10]	There is no continuity * Diode range	
	6	Defective control amplifier	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Between (30) on controller side of connector [2] - ground	Voltage	Max. 1 V
			Between (14) on controller side of connector [2] - ground	Voltage	Approx. 10 V

Trouble	(3) Air is not cooled (Cooling performance is insufficient)
Related information	

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective diode	★ Prepare with starting switch OFF, then carry out troubleshooting without turning switch ON.		
			Between (male) (2) (+) . (1) (.) of connector DIO	There is continuity	
			Between (male) (1) (+) . (2) (.) of connector DIO	There is no continuity	
	2	Defective air conditioner compressor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning switch ON.		
			Between [17] on air conditioner compressor side of connector COMP . ground (Air conditioner compressor coil resistance)	Resistance	Approx. 15 Ω
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Between connector COMP (female) ([16]) (1) - ground	Voltage	20 – 30 V
	3	Ground fault in wiring harness (Contact with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning switch ON.		
			Between (2) - (9) of [12] on machine wiring harness side of connector AC1	Resistance	Min. 1 MΩ
			Between (2) of [11] on air conditioner wiring harness of connector AC1 - (9) of [12] on machine wiring harness side	Resistance	Min. 1 MΩ
			Between (11) of [11] on air conditioner wiring harness of connector AC1 - (9) of [12] on machine wiring harness side	Resistance	Min. 1 MΩ
			Between (11) - (9) of [12] on machine wiring harness side of connector AC1	Resistance	Min. 1 MΩ
			Between (2) of [15] on wiring harness side of connector ACRD - ground	Resistance	Min. 1 MΩ
	4	Defective pressure switch	★ Prepare with starting switch OFF, then carry out troubleshooting without turning switch ON.		
			Between (1) . (2) on pressure switch side of connector ACRD	Resistance	Min. 1 Ω
	5	Disconnection in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Between (14) or (15) of connector [1] - ground (Air conditioner compressor coil resistance)	Resistance	Approx. 15 Ω
	6	Defective control amplifier	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Between connector CM (female) (1) - ground	Voltage	20 – 30 V

CIrcuit diagram related



HM300-2 Articulated dump truck

Form No. SEN00675-04

ARTICULATED DUMP TRUCK

HM300-2

Machine model	Serial number
HM300-2	2001 and up

40 Troubleshooting

Troubleshooting of hydraulic and mechanical system (H-mode)

Contents of troubleshooting table

★ Troubleshooting Table and Related Circuit Diagram collectively carry the following information. Carry out troubleshooting work after fully grasping their contents.

Trouble	**Phenomenon occurring on machine**
Related information	**Information on the failure occurred as well as the troubleshooting**

	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	**Cause for presumed failure (The attached No. is for filing and reference purpose only. It does not stand for any priority.)**	**<Contents>** • **The standard values in normalcy by which to judge "Good" or "No Good" about presumed causes.** • **References for making judgement of "good" or "No Good"**
	2		
	3		
	4		
	5		

H-1 Machine does not start

Trouble	Machine does not start at any gear speed.
Related information	• Check that the transmission oil level is correct. • If a failure code related to the input shaft speed sensor circuit or related to the machine is displayed, firstly troubleshooting the displayed code. • Check that there is no defect in the drive shaft, etc. • Check that the parking brake is completely released.

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective power train pump strainer	The power train pump strainer is suspected to be clogged, check it directly.		
	2	Air sucked in at the suction side of the power train pump	Since the air can be suspected to be sucked in from the suction piping of the power train pump, check it directly.		
	3	Defective power train pump main relief valve	★ Prepare with the engine stopped and troubleshooting with engine running at low idle and high idle.		
			Relief oil pressure	Low idle	2.55 ± 0.2 MPa {26.0 ± 2.0 kg/cm²}
				High idle	2.55 ± 0.2 MPa {26.0 ± 2.0 kg/cm²}
	4	Defective torque converter oil pressure (relief valve)	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.		
			Torque converter inlet pressure		0.91 ± 0.1 MPa {9.3 ± 1.0 kg/cm²}
			Torque converter outlet pressure		0.54 ± 0.1 MPa {5.0 ± 1.0 kg/cm²}
	5	Defective torque converter	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.		
			Stall speed (power mode)		1,940 ± 100 rpm
	6	Defective gear speed clutch ECMV	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.		
			Lo clutch ECMV output pressure		2.45 ± 0.15 MPa {25.0 ± 1.5 kg/cm²}
			Hi clutch ECMV output pressure		2.45 ± 0.15 MPa {25.0 ± 1.5 kg/cm²}
			1st clutch ECMV output pressure		2.45 ± 0.15 MPa {25.0 ± 1.5 kg/cm²}
			R clutch ECMV output pressure		2.45 ± 0.15 MPa {25.0 ± 1.5 kg/cm²}
			* A gear speed clutch operates using a combined operations of two clutches; check the combination referring to Table 1.		
	7	Defective gear speed clutch	• If the oil pressure is low in the item 6, leaks from the clutch seal ring can be suspected. • If the oil pressures are within the ranges in the item 6, a slip of the clutch can be suspected.		
	8	Defective power train pump	• If a defect is found in the item 3, disconnect the power train pump outlet hose, crank the engine, and check if the oil comes out. • Judge by checking for presence of foreign materials.		
	9	Internally defective transmission	Since the transmission can be suspected to be internally defective, inspect the transmission directly.		

Table 1

		Operated clutches					
		Hi	Lo	1st	2nd	3rd	R
Gear speed	R2				●		●
	R1			●			●
	N						
	F1		●	●			
	F2	●		●			
	F3		●		●		
	F4	●			●		
	F5		●			●	
	F6	●				●	

H-2 Machine does not travel smoothly (machine jerks)

Trouble	Machine does not travel smoothly (hunting).
Related information	• Check that the transmission oil level is correct. • If a failure code related to the machine is displayed, firstly troubleshooting the displayed code.

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective power train pump strainer	Since the power train pump strainer can be suspected to be clogged, check it directly.		
	2	Air sucked in at the suction side of the power train pump	Since the air is potentially sucked in from the suction piping of the power train pump; visually check it.		
	3	Defective power train pump main relief valve	★ Prepare with the engine stopped and troubleshooting with engine running at low idle and high idle.		
			Relief oil pressure	Low idle	2.55 ± 0.2 MPa {26.0 ± 2.0 kg/cm²}
				High idle	2.55 ± 0.2 MPa {26.0 ± 2.0 kg/cm²}
	4	Defective gear speed clutch	• If the oil pressure is low in the item 3, wear of the gear speed clutch piston seal ring or wear of the ring groove can be suspected. • If the oil pressures are within the ranges in the item 3, a slip of the clutch can be suspected.		

H-3 Lockup cannot be cancelled

Trouble	Torque converter lockup cannot be cancelled.
Related information	• Check that the transmission oil level is correct. • If a failure code related to the machine is displayed, firstly troubleshooting the displayed code.

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Defective lockup solenoid valve	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.	
			Lockup solenoid valve output pressure	Max. 0.1 MPa {10 kg/cm²}
	2	Defective lockup clutch	If the oil pressure is within the range in the item 1, a seizure of the lockup clutch can be suspected.	

H-4 Excessive shock when starting or shifting

Trouble	Shock when starting or shifting is excessive.
Related information	• If a failure code related to the machine is displayed, firstly troubleshooting the displayed code.

	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Defective gear speed clutch ECMV	* There is some shock, but it is difficult to judge if the shock is excessive or not, so judge that it is excessive in the following cases. • When it is apparent that the shock suddenly became severer than before. • The shock is severer compared with other machines of the same class.
			Since the operation of the gear speed clutch ECMV can be suspected to be defective, check it directly.

H-5 Transmission does not shift up

Trouble	Transmission does not shift up.
Related information	• If a failure code related to the machine is displayed, firstly troubleshooting the displayed code.

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective power train pump main relief valve	★ Prepare with the engine stopped and troubleshooting with engine running at low idle and high idle.		
			Relief oil pressure	Low idle	2.55 ± 0.2 MPa {26.0 ± 2.0 kg/cm²}
				High idle	2.55 ± 0.2 MPa {26.0 ± 2.0 kg/cm²}
	2	Defective lockup solenoid valve	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.		
			Lockup solenoid valve output pressure		2.16 ± 0.15 MPa {22.0 ± 1.5 kg/cm²}
	3	Defective lockup clutch	If the shit up operations take place when traveling down a slope, a slip of the lockup clutch can be suspected.		
	4	Defective gear speed clutch ECMV	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.		
			Hi clutch ECMV output pressure		2.45 ± 0.15 MPa {25.0 ± 1.5 kg/cm²}
			Lo clutch ECMV output pressure		2.45 ± 0.15 MPa {25.0 ± 1.5 kg/cm²}
			1st clutch ECMV output pressure		2.45 ± 0.15 MPa {25.0 ± 1.5 kg/cm²}
			2nd clutch ECMV output pressure		2.35 ± 0.15 MPa {24.0 ± 1.5 kg/cm²}
			3rd clutch ECMV output pressure		2.45 ± 0.15 MPa {25.0 ± 1.5 kg/cm²}
			R clutch ECMV output pressure		2.45 ± 0.15 MPa {25.0 ± 1.5 kg/cm²}
			* A gear speed clutch operates using a combined operations of two clutches; check the combination referring to Table 1.		
	5	Defective gear speed clutch piston	• If the oil pressure is low in the item 4, wear of the gear speed clutch piston seal ring or wear of the ring groove can be suspected. • If the oil pressure is within the range in the item 4, a slip of the gear speed clutch piston can be suspected.		

Table 1

		Operated clutches					
		Hi	Lo	1st	2nd	3rd	R
Gear speed	R2				●		●
	R1			●			●
	N						
	F1		●	●			
	F2	●		●			
	F3		●		●		
	F4	●			●		
	F5		●			●	
	F6	●				●	

H-6 Machine lacks power or speed when traveling

Trouble (1)	When abnormality is present at all gear speeds (when traveling in lockup range).
Related information	• Check that the transmission oil level is correct. • If a failure code related to the machine is displayed, firstly troubleshooting the displayed code. • Check that the parking brake is completely released and also check for dragging of the retarder brake. • Check that the tire inflation pressure is proper.

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective power train pump strainer	The power train pump strainer is suspected to be clogged, check it directly.		
	2	Air sucked in at the suction side of the power train pump	Since the air can be suspected to be sucked in from the suction piping of the power train pump, check it directly.		
	3	Defective power train pump main relief valve	★ Prepare with the engine stopped and troubleshooting with engine running at low idle and high idle.		
			Relief oil pressure	Low idle	2.55 ± 0.2 MPa {26.0 ± 2.0 kg/cm²}
				High idle	2.55 ± 0.2 MPa {26.0 ± 2.0 kg/cm²}
	4	Defective lockup solenoid valve	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.		
			Lockup solenoid valve output pressure		2.16 ± 0.15 MPa {22.0 ± 1.5 kg/cm²}
	5	Slip of lockup clutch	• If the oil pressure is low in the item 4, wear of the lockup clutch piston seal ring or wear of the ring groove can be suspected. • If the oil pressures are within the ranges in the item 4, a slip of the lockup clutch piston can be suspected.		
	6	Defective power train pump	If a defect is found in the item 3, the power train pump can be suspected to be defective. Check for aluminum worn powder etc. residing on the line filter.		
	7	Decrease of engine output	If no problem is found in item 1 through 6, measure the torque converter stall speed (in the power mode: 1,940 ± 100 rpm). If it is below the standard value, the deterioration of the engine unit performance can be suspected.		

Trouble (2)	When machine lacks power or speed while traveling in torque converter range.
Related information	• Check that the transmission oil level is correct. • If a failure code related to the machine is displayed, firstly troubleshooting the displayed code. • Check for oil leaking from the piping to the outside. • Check that the parking brake is completely released and also check for dragging of the retarder brake.

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective power train pump main relief valve	★ Prepare with the engine stopped and troubleshooting with engine running at low idle and high idle.		
			Relief oil pressure	Low idle	2.55 ± 0.2 MPa {26.0 ± 2.0 kg/cm²}
				High idle	2.55 ± 0.2 MPa {26.0 ± 2.0 kg/cm²}
	2	Defective torque converter oil pressure	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.		
			Torque converter inlet pressure		0.91 ± 0.1 MPa {9.3 ± 1.0 kg/cm²}
			Torque converter outlet pressure		0.54 ± 0.1 MPa {5.0 ± 1.0 kg/cm²}
	3	Defective torque converter	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.		
			Stall speed (power mode)		1,940 ± 100 rpm

Trouble (3)	Machine lacks speed or power when traveling in certain gear speeds.
Related information	• Check that the transmission oil level is correct. • If a failure code related to the machine is displayed, firstly troubleshooting the displayed code.

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Defective gear speed clutch ECMV	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.	
			Hi clutch ECMV output pressure	2.45 ± 0.15 MPa {25.0 ± 1.5 kg/cm²}
			Lo clutch ECMV output pressure	2.45 ± 0.15 MPa {25.0 ± 1.5 kg/cm²}
			1st clutch ECMV output pressure	2.45 ± 0.15 MPa {25.0 ± 1.5 kg/cm²}
			2nd clutch ECMV output pressure	2.35 ± 0.15 MPa {24.0 ± 1.5 kg/cm²}
			3rd clutch ECMV output pressure	2.45 ± 0.15 MPa {25.0 ± 1.5 kg/cm²}
			R clutch ECMV output pressure	2.45 ± 0.15 MPa {25.0 ± 1.5 kg/cm²}
			• It can be also diagnosed by replacing the ECMV.	
			* A gear speed clutch operates using a combined operations of two clutches; check the combination referring to Table 1.	
	2	Defective gear speed clutch	• If the oil pressure is low in the item 1, wear of the gear speed clutch piston seal ring or wear of the ring groove can be suspected. • If the oil pressure is within the range in the item 1, a slip of the gear speed clutch can be suspected.	

Table 1

		Operated clutches					
		Hi	Lo	1st	2nd	3rd	R
Gear speed	R2				●		●
	R1			●			●
	N						
	F1		●	●			
	F2	●		●			
	F3		●		●		
	F4	●			●		
	F5		●			●	
	F6	●				●	

H-7 Time lag is excessive when starting or shifting gear

Trouble	Time lag is excessive when starting or shifting gear.
Related information	• Check that the transmission oil level is correct. • If a failure code related to the machine is displayed, firstly troubleshooting the displayed code. • Check for oil leaking from the piping to the outside.

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective power train pump strainer	Since the power train pump strainer can be suspected to be clogged, check it directly.		
	2	Air sucked in at the suction side of the power train pump	Since the air is potentially sucked in from the suction piping of the power train pump; visually check it.		
	3	Defective power train pump main relief valve	★ Prepare with the engine stopped and troubleshooting with engine running at low idle and high idle.		
			Relief oil pressure	Low idle	2.55 ± 0.2 MPa {26.0 ± 2.0 kg/cm²}
				High idle	2.55 ± 0.2 MPa {26.0 ± 2.0 kg/cm²}
	4	Defective gear speed clutch ECMV	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.		
			Hi clutch ECMV output pressure		2.45 ± 0.15 MPa {25.0 ± 1.5 kg/cm²}
			Lo clutch ECMV output pressure		2.45 ± 0.15 MPa {25.0 ± 1.5 kg/cm²}
			1st clutch ECMV output pressure		2.45 ± 0.15 MPa {25.0 ± 1.5 kg/cm²}
			2nd clutch ECMV output pressure		2.35 ± 0.15 MPa {24.0 ± 1.5 kg/cm²}
			3rd clutch ECMV output pressure		2.45 ± 0.15 MPa {25.0 ± 1.5 kg/cm²}
			R clutch ECMV output pressure		2.45 ± 0.15 MPa {25.0 ± 1.5 kg/cm²}
			• It can be also diagnosed by replacing the ECMV.		
			* A gear speed clutch operates using a combined operations of two clutches; check the combination referring to Table 1.		
	5	Defective gear speed clutch	• If the oil pressure is low in the item 4, wear of the gear speed clutch piston seal ring or wear of the ring groove can be suspected. • If the oil pressure is within the range in the item 4, a slip of the gear speed clutch can be suspected.		
	6	Defective power train pump	• If a defect is found in the item 3, the power train pump can be suspected to be defective. Check for aluminum worn powder etc. residing on the line filter.		

Table 1

		Operated clutches					
		Hi	Lo	1st	2nd	3rd	R
Gear speed	R2				●		●
	R1			●			●
	N						
	F1		●	●			
	F2	●		●			
	F3		●		●		
	F4	●			●		
	F5		●			●	
	F6	●				●	

H-8 Torque converter oil temperature is high

Trouble	Torque converter oil temperature is high.
Related information	• Check that the transmission oil level is correct. • If a failure code related to the machine is displayed, firstly troubleshooting the displayed code. • If the oil temperature goes up when the torque converter is stalled and goes down when the transmission is returned to the neutral position, the machine is normal and overload operation is a cause of the problem.

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective power train pump strainer	The power train pump strainer is suspected to be clogged, check it directly.		
	2	Air sucked in at the suction side of the power train pump	Since the air can be suspected to be sucked in from the suction piping of the power train pump, check it directly.		
	3	Defective power train pump line filter	The filter can be suspected to be clogged; visually check it.		
	4	Defective power train pump main relief valve	★ Prepare with the engine stopped and troubleshooting with engine running at low idle and high idle.		
			Relief oil pressure	Low idle	2.55 ± 0.2 MPa {26.0 ± 2.0 kg/cm²}
				High idle	2.55 ± 0.2 MPa {26.0 ± 2.0 kg/cm²}
	5	Defective power train pump	• If a defect is found in the item 4, the power train pump can be suspected to be defective. Check for aluminum worn powder etc. residing on the line filter.		
	6	Defective torque converter relief valve	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.		
			Torque converter inlet pressure		0.91 ± 0.1 MPa {9.3 ± 1.0 kg/cm²}
	7	Defective torque converter	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.		
			Torque converter inlet pressure		0.91 ± 0.1 MPa {9.3 ± 1.0 kg/cm²}
			Torque converter outlet pressure		0.54 ± 0.1 MPa {5.0 ± 1.0 kg/cm²}

H-9 Torque converter oil pressure is low

Trouble	Torque converter oil pressure is low.
Related information	• Check that the transmission oil level is correct. • If a failure code related to the machine is displayed, firstly troubleshooting the displayed code. • Check for oil leaking from the piping to the outside.

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective power train pump strainer	The power train pump strainer is suspected to be clogged, check it directly.		
	2	Air sucked in at the suction side of the power train pump	Since the air can be suspected to be sucked in from the suction piping of the power train pump, check it directly.		
	3	Defective power train pump main relief valve	★ Prepare with the engine stopped and troubleshooting with engine running at low idle and high idle.		
			Relief oil pressure	Low idle	2.55 ± 0.2 MPa {26.0 ± 2.0 kg/cm²}
				High idle	2.55 ± 0.2 MPa {26.0 ± 2.0 kg/cm²}
	4	Defective power train pump	• If a defect is found in the item 3, the power train pump can be suspected to be defective. Check for aluminum worn powder etc. residing on the line filter.		
	5	Defective torque converter relief valve	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.		
			Torque converter inlet pressure		0.91 ± 0.1 MPa {9.3 ± 1.0 kg/cm²}
	6	Defective torque converter	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.		
			Torque converter inlet pressure		0.91 ± 0.1 MPa {9.3 ± 1.0 kg/cm²}
			Torque converter outlet pressure		0.54 ± 0.1 MPa {5.0 ± 1.0 kg/cm²}

H-10 Front brake is ineffective

Trouble	Front brake is ineffective.
Related information	• Check that the transmission oil level is correct. • If a failure code related to the machine is displayed, firstly troubleshooting the displayed code. • Check that the tire inflation pressure is proper.

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Air sucked in at the suction side of the brake control pump	Since the air can be suspected to be sucked in from the suction piping of the brake control pump, check it directly.		
	2	Defective accumulator charge valve	★ Prepare with the engine stopped and measure with the engine running at high idle.		
			Charge valve cut-in pressure		11.77 (+0.29/0) MPa {120 (+3.0/0) kg/cm²}
			Charge valve cut-out pressure		20.59 (+0.98/–0.5) MPa {210 (+10/–5) kg/cm²}
	3	Defective accumulator for front brake	• If the brake becomes ineffective as soon as the engine is stopped, the gas charged in the accumulator is insufficient. * [Reference] Charged gas pressure: 4.4 ± 0.15 MPa {45 ± 1.5 kg/cm²}		
	4	Defective front brake valve	★ Prepare with the engine stopped and measure with the engine running at high idle.		
			Brake actuating pressure	Brake pedal operated	4.9 ± 0.49 MPa {50 ± 5.0 kg/cm²}
	5	Defective front brake retarder pressure reducing valve	★ Prepare with the engine stopped and measure with the engine running at high idle.		
			Brake actuating pressure	Retarder lever operated	4.9 ± 0.49 MPa {50 ± 5.0 kg/cm²}
	6	Defective front brake slack adjuster	When the initial response time of brake system is excessively long or excess pedal effort is required to obtain the specific braking force, the slack adjuster can be suspected to be defective.		
	7	Defective front wheel brake	• If the oil pressure is low in the item 4 or 5, a seal ring or ring groove can be suspected to be defective. • If the oil pressures are within the range in the item 4 and 5, a slip of the brake disc is suspected.		

H-11 Center brake is ineffective

Trouble	Center brake is ineffective.
Related information	• Check that the transmission oil level is correct. • If a failure code related to the machine is displayed, firstly troubleshooting the displayed code. • Check that the tire inflation pressure is proper.

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Air sucked in at the suction side of the brake control pump	Since the air can be suspected to be sucked in from the suction piping of the brake control pump, check it directly.		
	2	Defective accumulator charge valve	★ Prepare with the engine stopped and measure with the engine running at high idle.		
			Charge valve cut-in pressure		11.77 (+0.29/0) MPa {120 (+3.0/0) kg/cm²}
			Charge valve cut-out pressure		20.59 (+0.98/–0.5) MPa {210 (+10/–5) kg/cm²}
	3	Defective accumulator for center brake	• If the brake becomes ineffective as soon as the engine is stopped, the gas charged in the accumulator is insufficient. * [Reference] Charged gas pressure: 4.4 ± 0.15 MPa {45 ± 1.5 kg/cm²}		
	4	Defective center brake valve	★ Prepare with the engine stopped and measure with the engine running at high idle.		
			Brake actuating pressure	Brake pedal operated	4.9 ± 0.49 MPa {50 ± 5 .0 kg/cm²}
	5	Defective center brake retarder pressure reducing valve	★ Prepare with the engine stopped and measure with the engine running at high idle.		
			Brake actuating pressure	Retarder lever operated	4.9 ± 0.49 MPa {50 ± 5.0 kg/cm²}
	6	Defective center brake slack adjuster	When the initial response time of brake system is excessively long or excess pedal effort is required to obtain the specific braking force, the slack adjuster can be suspected to be defective.		
	7	Defective center wheel brake	• If the oil pressure is low in the item 4 or 5, a seal ring or ring groove can be suspected to be defective. • If the oil pressures are within the range in the item 4 and 5, a slip of the brake disc is suspected.		

H-12 Steering wheel is heavy

Trouble	Steering wheel is heavy.
Related information	• Check that the oil level in the hydraulic tank is correct. • If a failure code related to the machine is displayed, firstly troubleshooting the displayed code. • Check that the steering wheel play is correct (less than 150 mm). • Check tha the hinge pin, etc. are greased sufficiently. • Adjust the tire inflation pressure to the proper value before troubleshooting. [Standard tire] 750-65 R25 (30-65 R25) × 2 (Front: 0.343 MPa {3.50 kg/cm²}) (Rear: 0.402 MPa {4.1 kg/cm²})

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Air sucked in at the suction side of the steering and work equipment pump	Since the air can be suspected to be sucked in from the suction side of the steering and work equipment pump, check it directly.	
	2	Defective steering and work equipment pump strainer	Since the steering and work equipment pump strainer is potentially clogged, visually check it.	
	3	Defective relief valve of flow amplifier valve	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.	
			Relief oil pressure (cylinder stroke end)	20.59 (+0.98/0) MPa {210 (+10/0) kg/cm²}
	4	Defective steering valve	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.	
			Relief oil pressure (cylinder stroke end)	20.59 (+0.98/0) MPa {210 (+10/0) kg/cm²}
	5	Defective operation of flow amplifier valve spool	If the oil pressure is within the range, the operation of the flow amplifier valve spool can be suspected to be defective: check it directly.	
	6	Defective steering cylinder	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.	
			Relief oil pressure (cylinder stroke end)	20.59 (+0.98/0) MPa {210 (+10/0) kg/cm²}
			When the oil pressure is low, disconnect the hydraulic hose in the steering cylinder head side and relieve the pressure at the stroke end. If the oil comes out from the cylinder side, the cylinder piston ring is defective.	
	7	Defective steering and work equipment pump	If the oil pressure is low in the item 3 or 4, the steering and work equipment pump can be suspected to be defective. Check for aluminum worn powder etc. residing on the line filter.	

H-13 Steering wheel does not work

Trouble	Steering wheel does not work.
Related information	• Check that the oil level in the hydraulic tank is correct. • If a failure code related to the machine is displayed, firstly troubleshooting the displayed code. • Check that the steering wheel play is correct (less than 150 mm). • Check that the hinge pin, etc. are greased sufficiently.

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Defective PTO	If the dump body also does not work, the PTO can be suspected to be defective.	
	2	Air sucked in at the suction side of the steering and work equipment pump	Since the air can be suspected to be sucked in from the suction side of the steering and work equipment pump, check it directly.	
	3	Defective steering and work equipment pump strainer	Since the steering and work equipment pump strainer is potentially clogged, visually check it.	
	4	Defective relief valve of flow amplifier valve	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.	
			Relief oil pressure (cylinder stroke end)	20.59 (+0.98/0) MPa {210 (+10/0) kg/cm²}
	5	Defective steering valve	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.	
			Relief oil pressure (cylinder stroke end)	20.59 (+0.98/0) MPa {210 (+10/0) kg/cm²}
	6	Defective operation of flow amplifier valve spool	If the oil pressure is within the range, the operation of the flow amplifier valve spool can be suspected to be defective: check it directly.	
	7	Defective steering cylinder	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.	
			Relief oil pressure (cylinder stroke end)	20.59 (+0.98/0) MPa {210 (+10/0) kg/cm²}
			When the oil pressure is low, disconnect the hydraulic hose in the steering cylinder head side and relieve the pressure at the stroke end. If the oil comes out from the cylinder side, the cylinder piston ring is defective.	
	8	Defective steering and work equipment pump	If the oil pressure is low in the item 4 or 5, the steering and work equipment pump can be suspected to be defective. Check for aluminum worn powder etc. residing on the line filter.	

H-14 Steering wheel vibrates

Trouble	Steering wheel vibrates.
Related information	• Check that the oil level in the hydraulic tank is correct. • If a failure code related to the machine is displayed, firstly troubleshooting the displayed code.

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Defective oil	Check for deterioration of oil.	
	2	Defective steering cylinder	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.	
			Relief oil pressure (cylinder stroke end)	20.59 (+0.98/0) MPa {210 (+10/0) kg/cm²}
			When the oil pressure is low, disconnect the hydraulic hose in the steering cylinder head side and relieve the pressure at the stroke end. If the oil comes out from the cylinder side, the cylinder piston ring is defective.	

H-15 Dump body lifting speed is slow

Trouble	When lifting dump body, the speed is slow and the power is insufficient.
Related information	• Check that the oil level in the hydraulic tank is correct. • If a failure code related to the machine is displayed, firstly troubleshooting the displayed code. • Check that the dump lever moves smoothly.

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Air sucked in at the suction side of the work equipment and steering pump	Since the air can be suspected to be sucked in from the suction side of the steering and work equipment pump, check it directly.	
	2	Defective work equipment and steering pump strainer	The work equipment and steering pump strainer is potentially clogged, visually check it.	
	3	Defective relief valve of flow amplifier valve	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.	
			Relief oil pressure (steering cylinder stroke end)	20.59 (+0.98/0) MPa {210 (+10/0) kg/cm²}
	4	Defective dump EPC valve relief valve (dump pilot pressure)	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.	
			Operate dump lever to “raise“ or “lower“ position.	3.4 ± 0.49 MPa {35 ± 5 kg/cm²}
				(Reference: low idle) 2.6 ± 0.49 MPa {27 ± 5 kg/cm²}
	5	Defective operation of dump EPC valve	If the oil pressure is low in the item 4, the operation of the dump EPC valve can be suspected to be defective; visually check the valve.	
	6	Defective pilot pump for dump EPC valve	If the oil pressure is low in the item 4, the pilot pump for the dump EPC valve circuit can be suspected to be defective; check it directly.	
	7	Defective hoist valve relief valve	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.	
			Relief oil pressure (dump cylinder raise stroke end)	20.59 (+0.98/0) MPa {210 (+10/0) kg/cm²}
	8	Defective operation of the hoist valve main spool	If the oil pressure does not reach the standard value in the item 7, the operation of the hoist valve main spool can be suspected to be defective. (Visually check the spool.)	
	9	Defective dump cylinder	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.	
			Relief oil pressure (cylinder stroke end)	20.59 (+0.98/0) MPa {210 (+10/0) kg/cm²}
			When the oil pressure is low, disconnect the hydraulic hose in the dump cylinder head side and relieve the pressure at the raise stroke end. If the oil comes out from the cylinder side, the cylinder piston ring is defective.	

H-16 Dump body does not work

Trouble	Dump body does not work.
Related information	• Check that the oil level in the hydraulic tank is correct. • If a failure code related to the machine is displayed, firstly troubleshooting the displayed code. • Check that the dump lever moves smoothly.

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Defective PTO	If the steering also does not work, the PTO can be suspected to be defective.	
	2	Air sucked in at the suction side of the work equipment and steering pump	Since the air can be suspected to be sucked in from the suction side of the steering and work equipment pump, check it directly.	
	3	Defective work equipment and steering pump strainer	The work equipment and steering pump strainer is potentially clogged, visually check it.	
	4	Defective relief valve of flow amplifier valve	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.	
			Relief oil pressure (steering cylinder stroke end)	20.59 (+0.98/0) MPa {210 (+10/0) kg/cm²}
	5	Defective dump EPC valve relief valve (dump pilot pressure)	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.	
			Operate dump lever to “raise“ or “lower“ position.	3.4 ± 0.49 MPa {35 ± 5 kg/cm²}
				(Reference: low idle) 2.6 ± 0.49 MPa {27 ± 5 kg/cm²}
	6	Defective operation of dump EPC valve	If the oil pressure is low in the item 5, the operation of the dump EPC valve can be suspected to be defective; visually check the valve.	
	7	Defective pilot pump for dump EPC valve	If the oil pressure is low in the item 5, the pilot pump for the dump EPC valve circuit can be suspected to be defective; check it directly.	
	8	Defective hoist valve relief valve	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.	
			Relief oil pressure (dump cylinder raise stroke end)	20.59 (+0.98/0) MPa {210 (+10/0) kg/cm²}
	9	Defective operation of the hoist valve main spool	If the oil pressure does not reach the standard value in the item 8, the operation of the hoist valve main spool can be suspected to be defective. (Visually check the spool.)	
	10	Defective dump cylinder	★ Prepare with the engine stopped and troubleshooting with the engine running at high idle.	
			Relief oil pressure (cylinder stroke end)	20.59 (+0.98/0) MPa {210 (+10/0) kg/cm²}
			When the oil pressure is low, disconnect the hydraulic hose in the dump cylinder head side. If the oil comes out from the cylinder side at the raise stroke end, the cylinder piston ring is defective.	

H-17 Excessive hydraulic drift of dump body

Trouble	Hydraulic drift of dump body is excessive.
Related information	• If a failure code related to the machine is displayed, firstly troubleshooting the displayed code.

	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state			★ Raise the dump body and troubleshooting with the engine stopped.
	1	Defective oil tightness of hoist valve main spool	Raise the dump body and disconnect the hydraulic hose in the dump cylinder head side. If the oil flows out from the cylinder side, the oil tightness of the spool is defective.
	2	Defective dump cylinder	Raise the dump body and disconnect the hydraulic hose in the dump cylinder head side. If the oil does not flow out from the cylinder side, the cylinder piston ring is defective.

HM300-2 Articulated dump truck

Form No. SEN00676-02

ARTICULATED DUMP TRUCK

HM300-2

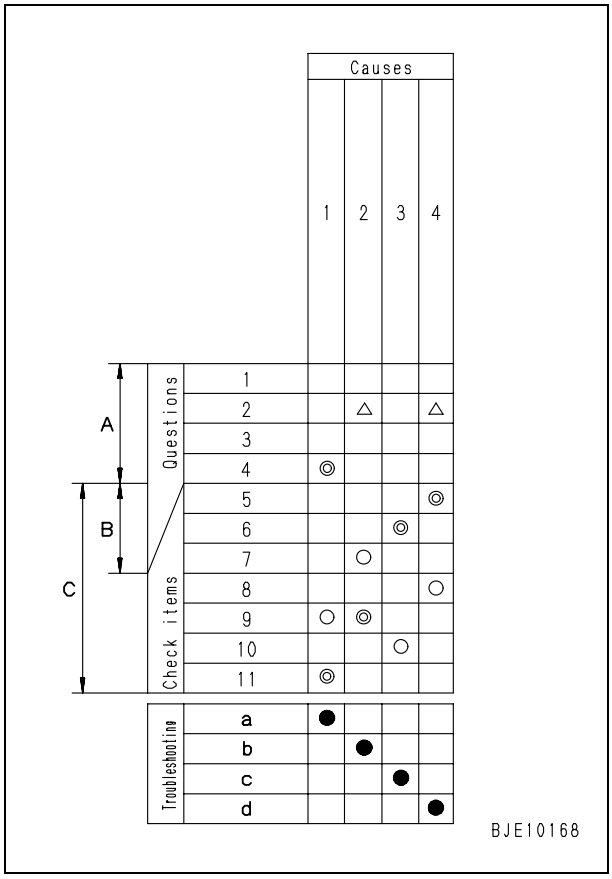
Machine model	Serial number
HM300-2	2001 and up

40 Troubleshooting

Troubleshooting of engine (S-mode)

How to use a 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.

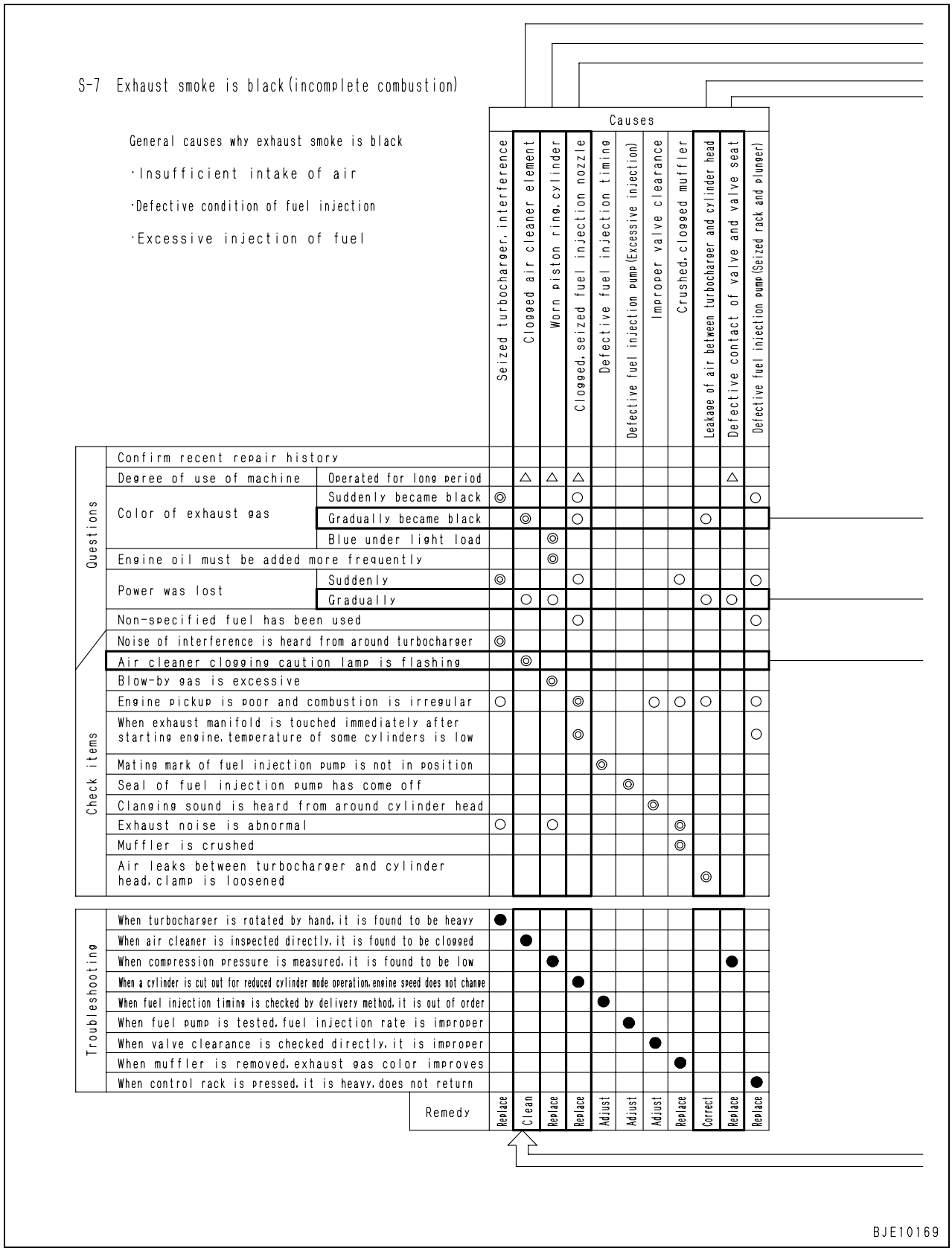
This troubleshooting chart marks the content of the questions and check items with △, ○ or ◎ according to their closer relationship with the causes.

△: A cause that can be referred to in relation to the question or check item.
○ : A cause that is related the question or check item.
◎ : A cause particularly probable among those marked with ○ above.

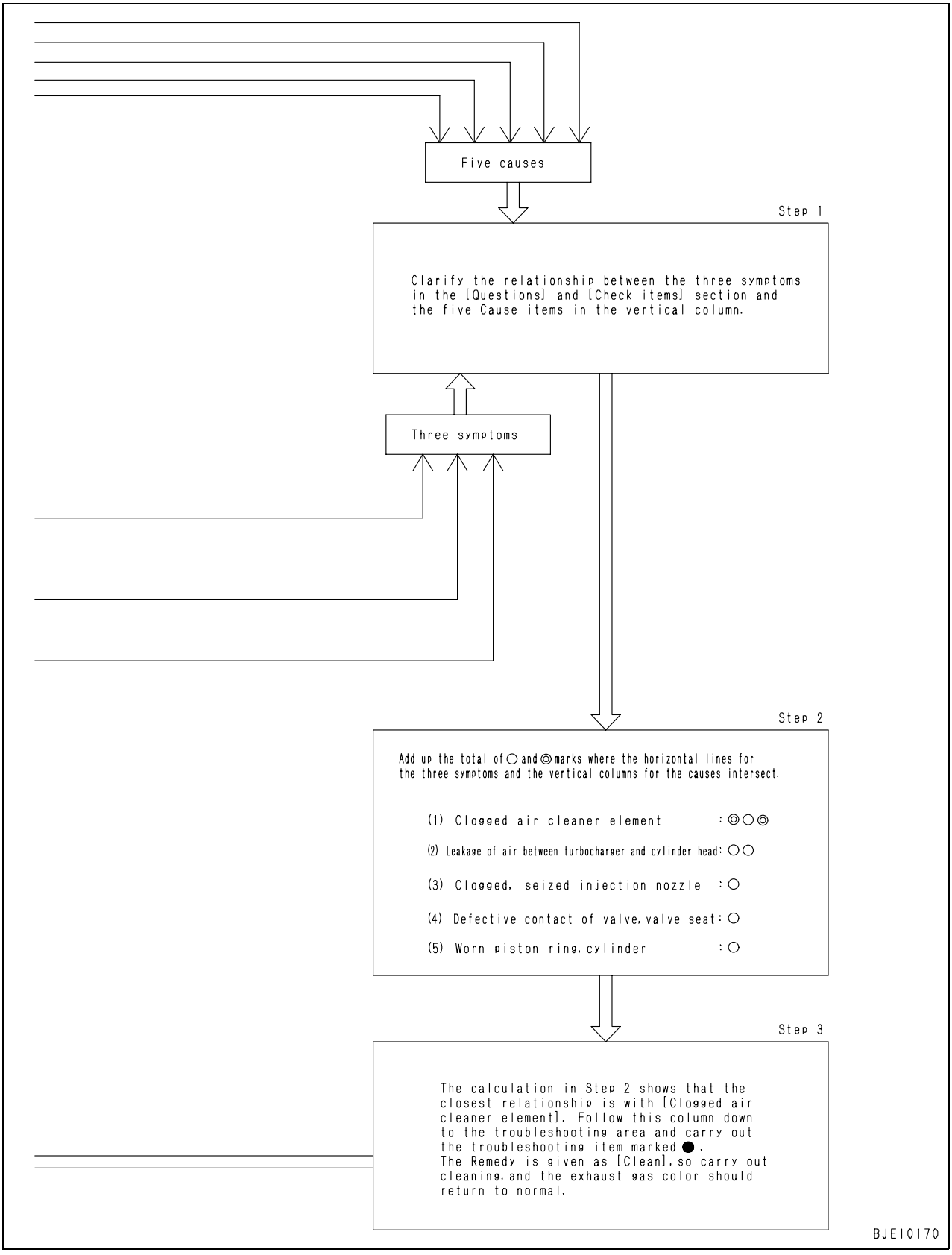
★ Count the priority level of each marking as ◎ > ○ when determining the cause.
Don't count △ when determining the cause. The item with this marking may be counted, however, if no difference is present than this and the cause cannot be determined.

<Example of troubleshooting> Exhaust gas color is black (incomplete combustion)

Let us now assume that a defect, “Color of exhaust gas 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 [Air cleaner clogging caution lamp is flashing].



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].



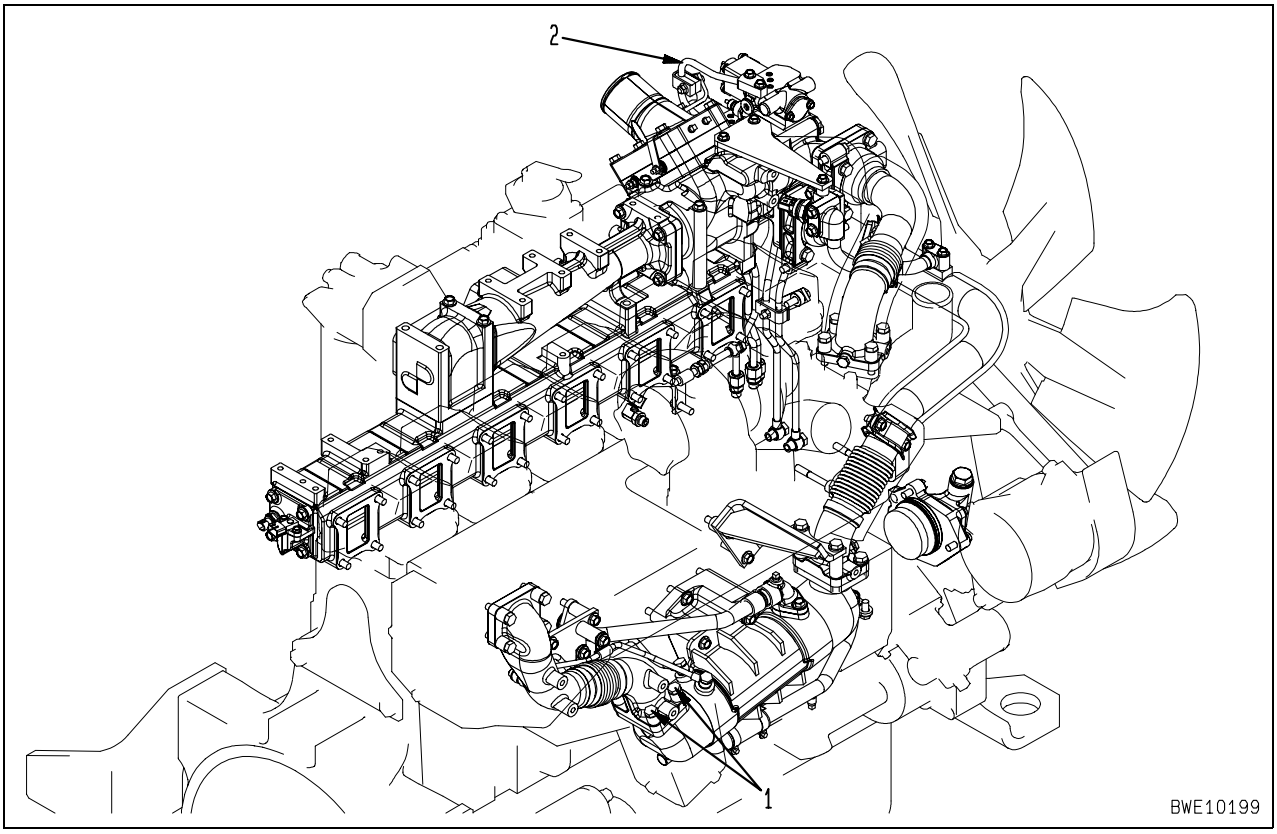
S-1 Engine is hard to start

General causes why engine is hard to start:

- Defective electrical system
- Insufficient supply of fuel
- Insufficient intake of air
- Improper selection of fuel
- Coolant in exhaust pipe
- ★ 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 symptom does not indicate a trouble, however.

			Causes														
			Clogged air cleaner element	Cracked EGR cooler (Coolant in exhaust gas)	Defective contact of valve and valve seat	Worn piston ring or cylinder	Clogged air breather hole in fuel tank cap	Leaking or clogged fuel piping, entry of air	Clogged fuel filter element	Clogged feed pump gauze filter	Stuck or seized supply pump plunger	Defective injector	Defective intake air heater system	Defective alternator (regulator section)	Defective alternator (generator section)	Defective or deteriorated battery
Questions	Confirm recent repair history															
	Degree of use of machine	Operated for long period	△	△					△	△						△
	Startability	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		◎						◎	◎	○	○				
	More engine oil is required for refill than before					◎										
	When engine is preheated or when temperature is low, preheating monitor does not indicate properly. (if monitor is installed)												◎			
	During operation, charge level monitor indicates abnormal charge (if monitor is installed)													◎	◎	
Check items	Dust indicator is red (if indicator is installed)		◎													
	Air breather hole in 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,	If air bleeding plug of fuel filter is removed, fuel does not flow out							◎	◎						
		When 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				○	○						◎				
	Engine hunts (rotation is irregular)						○	◎	○	○						
	Blow-by gas is excessive					◎										
Troubleshooting	Inspect air cleaner directly		●													
	When EGR cooler outlet gas piping is removed, coolant containing antifreeze flows out (*1)			●												
	When compression pressure is measured, it is found to be low				●	●										
	When air is bled from fuel system, air comes out							●								
	Inspect fuel filter and strainer directly								●							
	Inspect feed pump gauze filter directly									●						
	Carry out troubleshooting by failure code "Loss of pressure feed from supply pump (*2)"										●					
	When a specific cylinder is cut out for reduced cylinder mode operation, engine speed does not change											●				
	Intake air heater mount does not become warm during operation of preheating												●			
	Is voltage 20 – 30 V between alternator terminal B and terminal E with engine at low idle ?	Yes												●		
		No													●	
	When electrolyte specific gravity and voltage of battery are measured, they are too low															●
		Remedy	Clean	Replace	Correct	Replace	Clean	Correct	Clean	Clean	Replace	Replace	Replace	Replace	Replace	Replace

*1: EGR cooler outlet gas piping
Loosen 4 mounting bolts (1) of the EGR cooler outlet gas piping and check that the coolant flows out.
A little condensate produced from cooled exhaust gas may flow out. If it is colorless and transparent, however, it is not a problem.



*2: Failure code [**CA559**] and failure code [**CA2249]**

S-2 Engine does not start

a) Engine does not crank

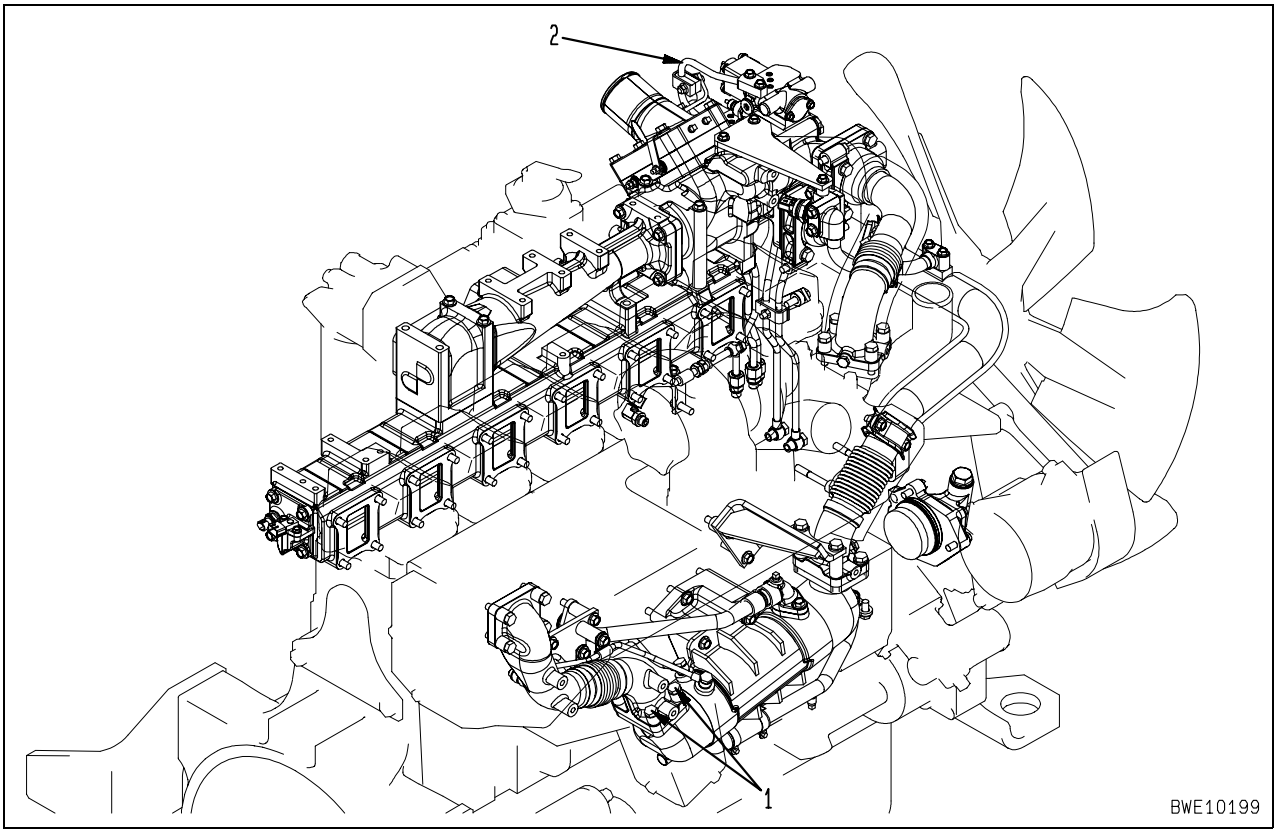
General causes why engine does not crank:

- Internal parts of engine seized
  → See "S-4 Engine stops during operations"
- Water hammer caused by coolant which entered cylinder
- Defective electrical system
- Defective PTO or hydraulic pump

			Causes										
			Cracked EGR cooler (Coolant in exhaust pipe)	Broken flywheel ring gear	Defective or deteriorated battery	Defective connection of battery terminal	Defective battery relay	Defective starting switch	Defective starting motor (safety relay section)	Defective starting motor (motor section)	Defective starting circuit wiring	Defective PTO or hydraulic pump
Questions	Confirm recent repair history											
	Degree of use of machine	Operated for long period	△	△	△							
	Condition of horn with starting switch ON	Horn does not sound				○		○			◎	
		Horn volume is too low			◎							
Check items	Battery electrolyte level is too low				◎							
	Battery terminal is loose					◎						
	When starting switch is turned ON, there is no operating noise 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, however	Speed of rotation is too low	○		◎							
		Makes grating noise		◎					◎			
		Soon disengages again							◎			
		Makes rattling noise and does not turn	◎		○				○	◎		

Troubleshooting	When EGR cooler outlet gas piping is removed, coolant containing antifreeze flows out (*1)		●								Carry out troubleshooting in E mode.	Carry out troubleshooting in H mode
	Inspect flywheel ring gear directly			●								
	When electrolyte specific gravity and voltage of battery are measured, they are too low				●							
	Turn starting switch OFF to connect cord, then turn ON to diagnose	The voltage (20 – 30 V) is not supplied 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								●		
		Remedy	Replace	Replace	Replace	Correct	Replace	Replace	Replace	Replace	—	—

*1: EGR cooler outlet gas piping
Loosen 4 mounting bolts (1) of the EGR cooler outlet gas piping and check that the coolant flows out.
A little condensate produced from cooled exhaust gas may flow out. If it is colorless and transparent, however, it is not a problem.



b) Engine cranks but no exhaust smoke comes out

General causes why engine cranks but no exhaust smoke comes out:

- Fuel is not being supplied
- Supply of fuel is extremely small
- Improper selection of fuel (particularly in winter)

			Causes														
			Use of improper fuel	Insufficient fuel in tank	Clogged air breather hole in fuel tank cap	Leaking or clogged fuel piping, entry of air	Clogged fuel filter element	Clogged feed pump gauze filter	Seized or abnormally worn feed pump	Broken supply pump shaft or key	Stuck or seized supply pump plunger	Defective supply pump PCV	Wrong connection of supply pump PCV	Defective operation of overflow valve (does not close)	Defective operation of flow damper	Defective fuel injector
Questions	Confirm recent repair history															
	Degree of use of machine	Operated for long period				△	△	△								
	Exhaust smoke suddenly stopped coming out (when restarting)								◎	○	◎	◎	◎		△	△
	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 in fuel tank cap is clogged			○	◎											
	Rust or water are observed when fuel tank is drained						○	○	○		○	○				
	When fuel filter is removed, there is no fuel in filter		◎			◎										
	Fuel is leaking from fuel piping					◎										
	When priming pump is operated, it makes no reaction or it is heavy					◎	○	○								
	While engine is cranked with starting motor,	If air bleeding plug of fuel filter is removed, fuel does not flow out		○		○			◎	○						
		When spill hose from injector is disconnected, little fuel spills				○				◎	◎	◎	◎			○
Troubleshooting	When air is bled from fuel system, air comes out					●										
	Inspect fuel filter directly						●									
	Inspect feed pump gauze filter directly							●								
	Check feed pump directly								●							
	Carry out troubleshooting by failure code "Loss of pressure feed from supply pump (*1)"									●	●		●			●
	Carry out troubleshooting by failure code "Abnormal PCV1 (*2) or Abnormal PCV2 (*3)"											●				
	Inspect overflow valve directly													●		
	Engine can be started in reduced cylinder mode														●	●
		Remedy	Replace	Refill	Correct	Correct	Replace	Clean	Replace	Replace	Replace	Replace	Correct	Replace	Replace	Replace

*1: Failure code [**CA559**] and failure code [**CA2249**]

*2: Failure code [**CA271**] and failure code [**CA272**]

*3: Failure code [**CA273**] and failure code [**CA274**]

c) Exhaust smoke comes out but engine does not start (fuel is being injected)

General causes why exhaust smoke comes out but engine does not start:

- Lack of rotating force due to defective electrical system
- Insufficient supply of fuel
- Insufficient intake of air
- Improper selection of fuel

			Causes													
			Clogged air cleaner element	Worn valve system (valve, rocker lever, etc.)	Worn piston ring or cylinder liner	Use of improper fuel	Clogged air breather hole in fuel tank cap	Leaking or clogged fuel system, entry of air	Clogged fuel filter or strainer	Clogged feed pump gauze filter	Stuck or seized supply pump plunger	Clogged injector, defective spray	Defective or deteriorated battery	Defective coolant temperature sensor or wiring harness	Defective intake air heater system
Questions	Confirm recent repair history														
	Degree of use of 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		◎						◎	◎					
	More engine oil is required for refill than before				◎										
	When engine is preheated or when temperature is low, preheating monitor does not indicate properly (if monitor is installed)														◎
Check items	Dust indicator is red (if indicator is installed)		◎												
	Air breather hole in fuel tank cap is clogged						○								
	Rust or water are observed when fuel tank is drained								◎	◎					
	When fuel filter is removed, there is no fuel in 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 noise comes out around cylinder head			◎											
	While engine is cranked with starting motor,	If air bleeding plug of fuel filter is removed, fuel does not flow out				○			◎	◎					
		When spill hose from injector is disconnected, little fuel spills									◎				
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low											◎			
Troubleshooting	Inspect air cleaner directly		●												
	Inspect valve system directly			●											
	When compression pressure is measured, it is found to be low				●										
	When air is bled from fuel system, air comes out							●							
	Inspect fuel filter and strainer directly								●						
	Inspect feed pump gauze filter directly									●					
	Carry out troubleshooting by failure code "Loss of pressure feed from supply pump (*1)"										●				
	When injector unit is tested, spray condition is bad											●			
	When electrolyte specific gravity and voltage of battery are measured, they are too low												●		
	Coolant temperature gauge does not indicate properly (if coolant temperature gauge is installed)													●	
	Intake air heater mount does not become warm during operation of preheating														●
		Remedy	Clean	Replace	Replace	Replace	Clean	Correct	Clean	Clean	Replace	Clean	Replace	Replace	Replace

*1: Failure code [**CA559**] and failure code [**CA2249**]

S-3 Engine does not pick up smoothly

General causes why engine does not pick up smoothly:

- Insufficient intake of air
- Insufficient supply of fuel
- Defective condition of fuel injection
- Improper selection of fuel
- Controller is controlling in derate mode (limiting injection rate (output) because of an error in electrical system)
- EGR valve is stuck open (There is much EGR gas and intake of air is insufficient)

			Causes													
			Clogged air cleaner element	Stuck EGR valve	Defective contact of valve and valve seat	Improper valve clearance	Seized turbocharger or interference of turbocharger	Worn piston ring or cylinder liner	Clogged air breather hole in fuel tank cap	Leaking or clogged fuel piping, entry of air	Clogged fuel filter or strainer	Clogged feed pump gauze filter	Stuck or seized supply pump plunger	Defective operation of flow damper (Excessive leakage from injector)	Clogged injector, defective spray
Questions	Confirm recent repair history														
	Degree of use of machine	Operated for long period	△	△	△			△			△	△			
	Engine pick-up suddenly becomes worse			○			◎		○	○					○
	Non-specified fuel is being used										◎	◎	◎		◎
	Replacement of filters has not been carried out according to Operation and Maintenance Manual		◎								◎	◎			
	More engine oil is required for refill than before							◎							
Check items	Dust indicator is red (if indicator is installed)		◎												
	Air breather hole in fuel tank cap is clogged								◎						
	Rust and water are observed 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 gas is	Blue under light load						◎							
		Black	◎		○		◎								◎
	When engine is cranked, abnormal noise comes out around cylinder head					◎									
	When engine is running, interference noise comes out around turbocharger						◎								
	High idle speed under no load is normal, but speed suddenly drops when load is applied								○		◎	◎			
	Engine hunts (rotation is irregular)								○		○	◎			○
	Blow-by gas is excessive							◎							

Troubleshooting	Inspect air cleaner directly		●												
	Carry out troubleshooting by failure code "Abnormal EGR valve servo (*1)"			●											
	When compression pressure is measured, it is found to be 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 and strainer directly										●				
	Inspect feed pump gauze filter directly											●			
	Carry out troubleshooting by failure code "Loss of pressure feed from supply pump (*2)"												●		
	When a specific cylinder is cut out for reduced cylinder mode operation, engine speed does not change													●	●
		Remedy	Clean	Replace	Replace	Adjust	Replace	Replace	Clean	Correct	Clean	Clean	Replace	Replace	Correct

*1: Failure code [**CA1228**] and failure code [**CA1625**]
*2: Failure code [**CA559**] and failure code [**CA2249**]

S-4 Engine stops during operations

General causes why engine stops during operations:

- Seized parts inside engine
- Insufficient supply of fuel
- Engine is overheating
- Defective PTO or hydraulic pump

			Causes													
			Broken valve system (valve, rocker lever, etc.)	Broken or seized piston or connecting rod	Broken or seized crankshaft bearing	Broken or seized gear train	Insufficient fuel in tank	Clogged air breather hole in fuel tank cap	Leaking or clogged fuel piping	Clogged fuel filter or strainer	Clogged feed pump gauze filter	Broken or seized feed pump	Broken supply pump shaft or key	Stuck or seized supply pump plunger	Defective PTO or hydraulic pump
Questions	Confirm recent repair history															
	Degree of use of machine	Operated for long period								△	△					
	Condition when engine stopped	Abnormal noise was heard and engine stopped suddenly	◎	◎	◎	◎						○	◎	○	◎
		Engine overheated and stopped		◎	○										
		Engine stopped slowly					◎			○	○				
		There was hunting and engine stopped					◎	○		○	○	○			
	Non-specified fuel is being used									○	○	○		○	
	Replacement of filters has not been carried out according to Operation and Maintenance Manual									◎	◎				
	Fuel level monitor indicates low level (if monitor is installed)						◎								
Check items	When fuel tank is inspected, it is found to be empty						◎								
	Air breather hole in 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 or water are observed when fuel tank is drained									◎	◎				
	Metal particles are observed when oil in 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 valve system directly		●												
	Inspect piston and connecting rod directly			●											
	Inspect crankshaft bearing directly				●										
	Inspect gear train directly					●									
	Inspect fuel filter and strainer directly									●					
	Inspect feed pump gauze filter directly										●				
	Check feed pump directly											●			
	Carry out troubleshooting by failure code "Loss of pressure feed from supply pump (*1)"												●	●	Carry out troubleshooting in H mode
		Remedy	Replace	Replace	Replace	Replace	Refill	Clean	Correct	Clean	Clean	Replace	Replace	Replace	—

*1: Failure code [**CA559**] and failure code [**CA2249**]

S-5 Engine does not rotate smoothly

General causes why engine does not rotate smoothly:

- Air in fuel system
- Defective speed sensor (Error at degree that it is not indicated)
- Defective EGR valve
- Defective bypass valve

			Causes												
			Low idle speed is set too low	Defective operation of EGR valve	Defective operation of bypass valve	Insufficient fuel in tank	Clogged air breather hole in fuel tank cap	Leaking or clogged fuel piping, entry of air	Clogged feed pump gauze filter	Clogged fuel filter or strainer	Defective operation of flow damper (Excessive leakage from injector)	Clogged injector, defective spray (dirt in injector)	Defective Ne speed sensor or wiring harness	Defective Bkup speed sensor or wiring harness
Questions	Confirm recent repair history													
	Degree of use of machine	Operated for long period		△	△				△	△				
	Condition of hunting	Occurs at a certain speed range	○	○	○								○	○
		Occurs at low idle	◎					○	○	○	○	○	○	○
		Occurs even when speed is raised		○	○		○						○	○
		Occurs on 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 in fuel tank cap is clogged						◎							
	Rust or water are observed 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	Carry out troubleshooting by failure code "Abnormal EGR valve servo (*1)"			●										
	Carry out troubleshooting by failure code "Abnormal bypass valve servo (*2)"				●									
	When air is bled from fuel system, air comes out							●						
	Inspect feed pump gauze filter directly								●					
	Inspect fuel filter and strainer directly									●				
	When a specific cylinder is cut out for reduced cylinder mode operation, engine speed does not change										●	●		
	Carry out troubleshooting by failure code "Abnormal engine Ne speed sensor (*3)"												●	
	Carry out troubleshooting by failure code "Abnormal engine Bkup speed sensor (*4)"													●
		Remedy	Correct	Replace	Replace	Refill	Clean	Correct	Replace	Replace	Replace	Correct	Correct	Correct

*1: Failure code [**CA1228**] and failure code [**CA1625**]
*2: Failure code [**CA1628**] and failure code [**CA1629**]
*3: Failure code [**CA689**]
*4: Failure code [**CA778**]

S-6 Engine lacks output (or lacks power)

General causes why engine lacks output:

- Insufficient intake of air
- Insufficient supply of fuel
- Defective condition of fuel injection
- Improper selection of fuel
- Engine is overheating
  → See "S-14 Coolant temperature becomes too high (overheating)"
- Controller is controlling in derate mode (limiting injection rate (output) because of an error in electrical system)

			Causes																
			Clogged air cleaner element	Air leakage from air intake piping	Seized turbocharger or interference of turbocharger	Defective contact of valve and valve seat	Improper valve clearance	Worn piston ring or cylinder liner	Clogged air breather hole in fuel tank cap	Leaking or clogged fuel piping	Clogged fuel filter or strainer	Clogged feed pump gauze filter	Stuck or seized supply pump plunger	Clogged injector, defective spray (dirt in injector)	Defective drive of injector (signal, solenoid)	Defective installation of charge pressure sensor (air leakage)	Defective charge pressure sensor or wiring harness	Defective fuel temperature sensor or wiring harness
Questions	Confirm recent repair history																		
	Degree of use of machine	Operated for long period	△			△		△			△	△							
	Power was lost	Suddenly		○											○	○	○		
		Gradually	○			○		○			○	○		○		○			
	Non-specified fuel is being used										○	○							
	Replacement of filters has not been carried out according to Operation and Maintenance Manual		◎																
	More engine oil is required for refill than before					○	○	○											
Check items	Dust indicator is red (if indicator is installed)		◎																
	Air breather hole in fuel tank cap is clogged								◎										
	Fuel is leaking from fuel piping									◎									
	Output becomes insufficient after short stop of operation																		◎
	Color of exhaust gas is	Black	◎	◎															
		Blue under light load			◎														
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low													◎					
	When engine is cranked, interference noise comes out around turbocharger			◎															
	When engine is cranked, abnormal noise comes out around cylinder head						◎												
	High idle speed is too low														○				
	High idle speed under no load is normal, but speed suddenly drops when load is applied										◎	◎	○						
	Engine does not pick up smoothly and combustion is irregular			◎					○	○				◎					
	Engine hunts (rotation is irregular)								○	○	○	○							
	Blow-by gas is excessive				◎														
Troubleshooting	Inspect air cleaner directly		●																
	Inspect air intake piping directly			●															
	When boost pressure is measured, it is found to be low		●	●	●														
	When compression pressure is measured, it is found to be low					●		●											
	Inspect valve clearance directly						●												
	Inspect fuel filter and strainer directly										●								
	Inspect feed pump gauze filter directly											●							
	Carry out troubleshooting by failure code "Loss of pressure feed from supply pump (*1)"												●						
	When a specific cylinder is cut out for reduced cylinder mode operation, engine speed does not change													●	●				
	Inspect boost pressure sensor mounting section directly															●			
	Carry out troubleshooting by failure code "Abnormal charge pressure sensor (*2)"																●		
	Carry out troubleshooting by failure code "Abnormal fuel temperature sensor (*3)"																		●
		Remedy	Clean	Correct	Replace	Replace	Adjust	Replace	Clean	Correct	Replace	Clean	Replace	Replace	Replace	Correct	Replace	Replace

*1: Failure code [**CA559**] and failure code [**CA2249**]
*2: Failure code [**CA122**] and failure code [**CA123**]
*3: Failure code [**CA263**] and failure code [**CA265**]

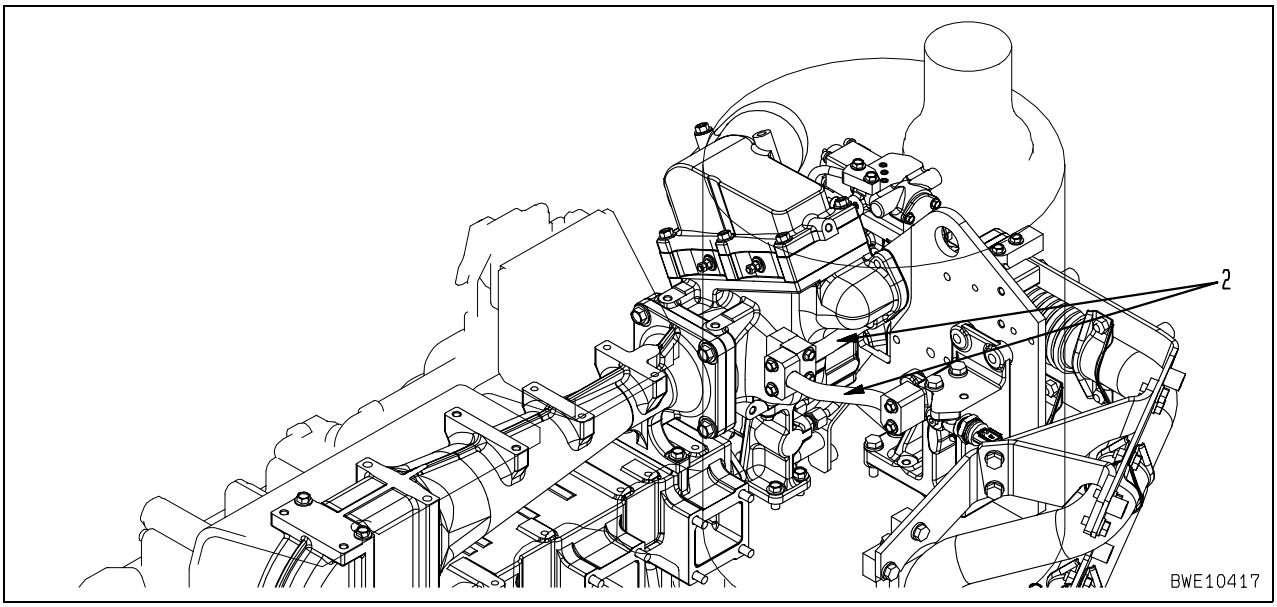
S-7 Exhaust gas color is black (incomplete combustion)

General causes why exhaust gas color is black:

- Insufficient intake of air
- Excessive fuel is supplied
- Defective condition of fuel injection
- Improper selection of fuel
- Engine is overheating
  → See "S-14 Coolant temperature becomes too high (overheating)"
- Controller is controlling in derate mode
  (limiting injection rate (output) because of an error in electrical system)
- EGR valve is stuck open
  (There is much EGR gas and intake of air is insufficient)
- EGR gas piping is clogged
  (Exhaust gas is mixed into intake air during acceleration or deceleration)

			Causes																
			Clogged air cleaner element	Seized turbocharger or interference of turbocharger	Stuck EGR valve	EGR gas piping is clogged	Defective contact of valve and valve seat	Improper valve clearance	Leakage of air between turbocharger and cylinder head	Crushed or clogged muffler	Worn piston ring or cylinder liner	Stuck or seized supply pump plunger	Clogged or seized injector	Abnormally worn injector	Clogged fuel spill piping (on cylinder head side)	Improper fuel injection timing	Improper fuel injection pressure	Defective coolant temperature sensor or wiring harness
Questions	Confirm recent repair history																	
	Degree of use of machine	Operated for long period	△		△		△				△		△					
	Color of exhaust gas is	Suddenly became black		◎	○	○						○	○					
		Gradually became black	◎			◎			○				○	○				
		Blue under light load									◎							
	Non-specified fuel is being used											○	○					
	More oil is required for refill than before										◎							
	Power was lost	Suddenly		◎						○		○	○					
		Gradually	○				○		○		○							
Check items	Dust indicator is red (if indicator is installed)		◎															
	Muffler is crushed									◎								
	Leakage of air between turbocharger and cylinder head or loose clamp								◎									
	Engine is running 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 running, interference noise comes out around turbocharger		◎															
	When engine is running, abnormal noise comes out around cylinder head							◎										
	Torque converter stall speed or pump relief speed is too high (Excessive fuel is injected)												○	○				
	Exhaust noise is abnormal		○						◎			○						
	Engine does not pick up smoothly and combustion is irregular		○	○			○	○	○		○	◎						
	Blow-by gas is excessive										◎							
	When 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			●														
	Carry out troubleshooting by failure code "Abnormal EGR valve servo (*1)"				●													
	Inspect EGR gas piping visually (*2)					●												
	When compression pressure is measured, it is found to be low						●				●							
	Inspect valve clearance directly							●										
	When muffler is removed, exhaust gas color improves									●								
	Carry out troubleshooting by failure code "Loss of pressure feed from supply pump (*3)"											●		●				
	When a specific cylinder is cut out for reduced cylinder mode operation, engine speed does not change												●					
	Inspect fuel spill piping (on cylinder head side) visually														●			
	Carry out troubleshooting by failure code "Abnormal coolant temperature sensor (*4)"																	●
		Remedy	Clean	Replace	Replace	Replace	Replace	Adjust	Correct	Replace	Replace	Replace	Replace	Replace	Correct	Adjust	Adjust	Replace

*1: Failure code [**CA1228**] and failure code [**CA1625**]
*2: EGR gas piping
Remove two EGR gas pipings (2) and check for internal clogging.



*3: Failure code [**CA559**] and failure code [**CA2249**]
*4: Failure code [**CA144**] and [**CA145**]

S-8 Oil consumption is excessive (or exhaust gas color is blue)

General causes why oil consumption is excessive:

- Abnormal combustion of oil
- Long-time operation of engine at low idle or high idle
  (Do not run engine at idle for more than 20 minutes continuously)
- External leakage of oil
- Wear of parts in lubrication system

			Causes																
					Turbocharger														
			Dust sucked in from air intake system	Worn or damaged valve (stem, guide or seal)	Worn seal at turbine end	Worn seal at blower end	Oil leakage from EGR valve stem	Clogged breather or breather hose	Broken piston ring	Worn piston ring or cylinder liner	Worn or 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	Confirm recent repair history																		
	Degree of use of machine	Operated for long period		△	△	△	△			△									
	Oil consumption suddenly increased								◎			○							
	More oil is required for refill than before						○			◎		○							
	Oil gets contaminated prematurely							○	○	◎									
Check items	Smear of oil is observed on the outside of engine												◎	◎	◎	◎	◎		
	There are loose piping clamps in air intake system		◎																
	Inside of turbocharger intake air outlet pipe has been smeared with oil					◎													
	Inside of turbocharger exhaust gas outlet pipe has been smeared with oil			○	◎														
	Oil has been mixed into the coolant											◎							
	Oil level in damper chamber has risen										◎								
	Exhaust gas color is blue under light load						○		◎	◎									
	Amount of blow-by gas	Excessive		○		○			◎	◎									
		None						◎											
Troubleshooting	When intake manifold is removed, dust is observed inside		●																
	When intake manifold is removed, excessive dirt is observed on the inside			●															
	Excessive play of turbocharger shaft				●	●													
	When EGR valve is removed, exhaust port is found to be smeared with oil						●												
	Inspect breather and breather hose visually							●											
	When compression pressure is measured, it is found to be low								●	●									
	Inspect rear oil seal visually										●								
	A leakage has been detected during a pressure tightness test of the oil cooler											●	●						
	Oil is leaking to the outside of the engine													●	●	●	●		
		Remedy	Correct	Correct	Replace	Replace	Replace	Clean	Replace	Replace	Correct	Replace	Replace	Correct	Correct	Correct	Correct		

S-9 Oil gets contaminated prematurely

General causes why oil gets contaminated prematurely:

- Entry of exhaust gas into oil due to internal wear
- Clogging of lubrication passage
- Use of improper fuel
- Use of improper oil
- Operation under excessive load

			Causes										
			Defective seal at turbocharger turbine end	Worn EGR valve guide	Worn valve or valve guide	Worn piston ring or cylinder liner	Clogged breather or breather hose	Clogged oil cooler	Clogged oil filter	Defective oil filter safety valve	Clogged turbocharger lubrication drain tube	Exhaust gas color is bad
Questions	Confirm recent repair history											
	Degree of use of machine	Operated for long period	△	△	△	△						
	Non-specified fuel is being used								○			
	More engine oil is required for refill than before			○		◎						
	Even when engine oil temperature rises, oil filter clogging monitor displays clogging (if monitor is installed)								◎	○		
Check items	Metal particles are observed when oil in oil filter is drained				○	○			◎			
	Inside of exhaust pipe has been smeared with oil				◎							
	Engine oil temperature rises quickly							◎				
	Color of exhaust gas is	Blue under light load				◎						
		Black										◎
	Amount of blow-by gas	Excessive	○		○	◎					○	
		No					◎					
Troubleshooting	Excessive play of turbocharger shaft		●									See S-7
	When EGR valve is removed, exhaust port is found to be smeared with oil			●								
	When compression pressure is measured, it is found to be low				●	●						
	Inspect breather and breather hose visually						●					
	Inspect oil cooler visually							●				
	Inspect oil filter visually								●			
	Spring of oil filter safety valve is hitched or broken									●		
	Inspect turbocharger lubrication drain tube visually										●	
	Remedy		Replace	Replace	Replace	Replace	Clean	Clean	Replace	Replace	Clean	—

S-10 Fuel consumption is excessive

General causes why fuel consumption is excessive:
- Leakage of fuel
- Defective condition of fuel injection (fuel pressure, injection timing)
- 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 fuel pressure	Defective spray by injector	Defective operation of injector	Improper fuel injection timing	Defective coolant temperature sensor or wiring harness
Questions	Confirm recent repair history										
	Degree of use of machine	Operated for long period			△	△		△			
	Fuel consumption	Is excessive when compared with others of same model					○		○	○	○
		Gradually increased				○		○			
		Suddenly increased	○	○							
Check items	Fuel is leaking to the outside of the engine			◎							
	Combustion is irregular							◎			
	Oil level rises and oil smells of diesel fuel		◎		◎						
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders are low							◎			
	Low idle speed is too high								○		
	Torque converter stall speed or pump relief speed is too high								○		
	Color of exhaust gas is	Black					○	○		○	○
		White	○								

Troubleshooting	Remove head cover and inspect visually		●								
	Inspect feed pump oil seal visually				●						
	Carry out troubleshooting by failure code "Loss of pressure feed from supply pump (*1)"					●					
	When a specific cylinder is cut out for reduced cylinder mode operation, engine speed does not change							●			
	When spill hose from injector is disconnected, the spill measures too much								●		
	Carry out troubleshooting by failure code "Abnormal coolant temperature sensor (*2)"										●
	Confirm with monitoring function of machine monitor						●			●	
		Remedy	Correct	Correct	Replace	Replace	Correct	Replace	Replace	Correct	Correct

*1: Failure code [**CA559**] and failure code [**CA2249**]
*2: Failure code [**CA144**] and [**CA145**]

S-11 Oil is in coolant (or coolant spurts back or coolant level goes down)

General causes why oil is in coolant:
- Internal leakage in lubrication system
- Internal leakage in cooling system

			Causes					
			Broken cylinder head or head gasket	Cracks inside of cylinder block	Damaged cylinder liner O-ring or holes caused by pitting	Insufficient protrusion of cylinder liner	Broken oil cooler core or O-ring	Broken hydraulic oil cooler or power train oil cooler
Questions	Confirm recent repair history							
	Degree of use of machine	Operated for long period			△		△	
	Oil level rose	Suddenly	○				○	○
		Gradually		○	○			
	Hard water is being used as coolant				○		○	
Check items	Oil level has risen and oil is milky			○	○		◎	
	Excessive air bubbles are trapped in the radiator and coolant spurts back		◎			◎		
	Hydraulic oil or power train oil is milky							◎
	When hydraulic oil or power train oil is drained, water comes out with the oil							◎
Troubleshooting	A leakage has been detected during a pressure tightness test of the cylinder head		●					Carry out troubleshooting in H mode.
	Inspect cylinder block and liner visually			●	●			
	Inspect cylinder liner visually					●		
	A leakage has been detected during a pressure tightness test of the oil cooler						●	
		Remedy	Replace	Replace	Replace	Replace	Replace	—

S-12 Oil pressure drops

General causes why oil pressure drops:

- Leakage, clogging or worn part in lubrication system
- Defective oil pressure control
- Selection of oil by the temperature etc. specified in the Operation and Maintenance Manual is not observed
- Deterioration of oil due to overheat

			Causes													
			Worn bearing journal	Lack of oil in oil pan	Coolant or fuel in oil	Clogged strainer in oil pan	Clogged or broken pipe in oil pan	Defective oil pump	Defective oil pump relief valve	Clogged oil filter	Leaking, crushed, clogged hydraulic piping	Defective EGR oil pump	Leaking EGR hydraulic piping	Defective oil pressure sensor or wiring harness	Defective oil level sensor or wiring harness
Questions	Confirm recent repair history														
	Degree of use of machine	Operated for long period	△					△		△		△			
	Oil pressure monitor indicates oil pressure is too low (if monitor is installed)								○	◎					
	Non-specified oil is used		○							○					
	Replacement of filters has not been carried out according to Operation and Maintenance Manual									◎					
Check items	Oil pressure monitor (if monitor is installed)	Indicates pressure drop at low idle	◎						○			○			
		Indicates pressure drop at low and high idle		○		◎	◎	◎	○			○	○		
		Indicates pressure drop on slopes		◎											
		Sometimes indicates pressure drop							◎					○	○
	Oil level monitor indicates oil level drop (if monitor is installed)			◎											◎
	Oil level in oil pan is low			◎											
	External hydraulic piping is leaking or crushed										◎		◎		
	Oil is milky or smells of diesel oil				◎										
	Metal particles are observed when oil pan is drained		◎												
	Metal particles are observed when oil filter is drained		◎					○				○			
Troubleshooting	Metal particles are observed in oil filter		●		See S-13										
	Inspect oil pan strainer and pipe visually					●	●								
	Oil pump rotation is heavy, or there is excessive play in oil pump							●							
	Valve or spring of oil pump relief valve is fatigued or damaged								●						
	Inspect oil filter visually									●					
	Relief valve of EGR oil pump is damaged or oil leaks from it											●			
	Inspect EGR hydraulic piping visually												●		
	Carry out troubleshooting by failure code "Abnormal oil pressure sensor (*1)"													●	
	If oil level sensor is replaced, oil pressure monitor indicates properly														●
		Remedy	Replace	Refill	—	Clean	Clean	Replace	Adjust	Replace	Correct	Replace	Replace	Replace	Replace

*1: Failure code [**CA135**] and [**CA141**]

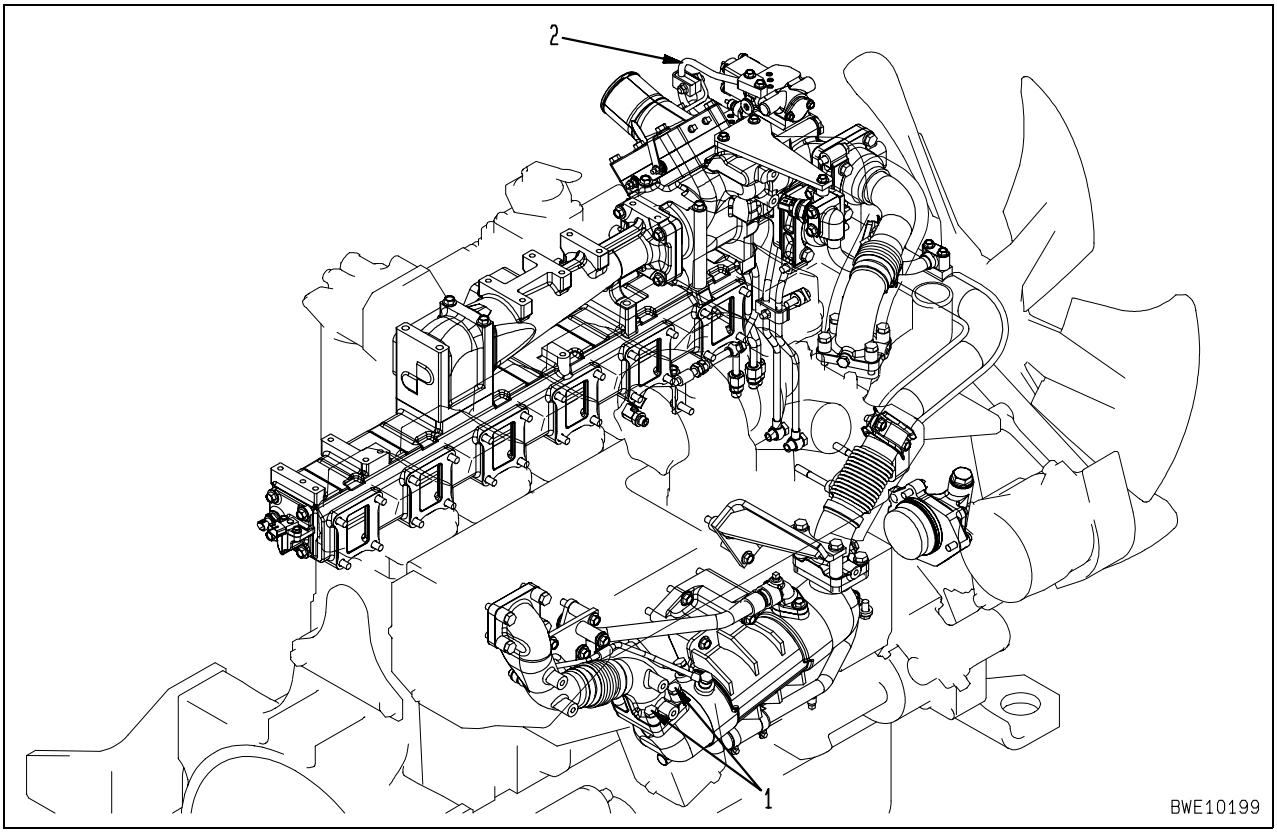
S-13 Oil level rises (coolant or fuel mixes)

General causes why oil level rises:
- Coolant in oil (milky)
- Fuel in oil (smells of diluted diesel fuel)

★ If oil is in coolant, carry out troubleshooting for "S-11 Oil is in coolant".

		Causes									
		Cracked EGR cooler (entry of coolant)	Broken cylinder head or head gasket	Fuel leakage inside head cover	Cracks inside of cylinder block	Damaged cylinder liner O-ring or holes caused by pitting	Worn or damaged rear oil seal	Broken oil cooler core or O-ring	Clogged water pump drain hole (breather hole) or defective seal	Defective thermostat seat	Internally defective supply pump
Questions	Confirm recent repair history										
Questions	Degree of use of machine: Operated for long period					△	△		△		
Questions	Fuel consumption has increased			◎							◎
Questions	More coolant is required for refill than before	○	○							◎	
Check items	Oil has been mixed into the coolant		○		○	○		◎			
Check items	Oil smells of diesel fuel			◎							◎
Check items	Oil is milky	○	○							◎	
Check items	After engine is started, drops of water come from muffler	○	○								
Check items	When engine is running at low idle with the radiator cap removed, excessive bubbles come out or coolant spurts back		◎			○					
Check items	Exhaust gas color is white			○						○	
Check items	Water pump drain hole (breather hole) is clogged								◎		
Check items	When water pump drain hole (breather hole) is cleaned, coolant comes out								◎		
Check items	Oil level in clutch or damper chamber of machine has lowered						◎				
Check items	Oil level in hydraulic tank of machine has lowered										
Troubleshooting	When EGR cooler outlet gas piping is removed, coolant containing antifreeze flows out (*1)	●									
Troubleshooting	When compression pressure is measured, it is found to be low		●								
Troubleshooting	Remove head cover and inspect visually			●							
Troubleshooting	Inspect cylinder block and liner visually				●	●					
Troubleshooting	Inspect rear oil seal visually						●				
Troubleshooting	A leakage has been detected during a pressure tightness test of the oil cooler							●			
Troubleshooting	Remove water pump and inspect visually								●		
Troubleshooting	Remove thermostat cover and inspect visually									●	
Troubleshooting	Remove supply pump and inspect visually										●
	Remedy	Replace	Replace	Correct	Replace	Replace	Correct	Replace	Replace	Correct	Replace

*1: EGR cooler outlet gas piping
Loosen 4 mounting bolts (1) of the EGR cooler outlet gas piping and check that the coolant flows out.
A little condensate produced from cooled exhaust gas may flow out. If it is colorless and transparent, however, it is not a problem.



S-14 Coolant temperature rises too high (overheat)

General causes why coolant temperature rises too high:
- Lack of cooling air (deformation or damage of fan)
- Drop in heat radiation efficiency
- Problem in coolant circulation system
- Rise in oil temperature in power train

			Causes													
			Coolant is leaking to the outside from EGR cooler	Broken cylinder head or head gasket	Damaged cylinder liner O-ring or holes caused by pitting	Clogged or 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 or worn fan pulley	Defective coolant temperature gauge	Rise in power train oil temperature
Questions	Confirm recent repair history														
	Degree of use of machine	Operated for long period	△	△	△					△	△				
	Overheating	Suddenly occurred	○				○	◎					○		
		Always tends to overheat							○	◎	◎		○		
	Coolant temperature gauge (if coolant temperature gauge is installed)	Rises quickly					○		◎						
		Does not go down from red range												◎	
Check items	Radiator coolant level monitor indicates drop of coolant level (if monitor is installed)		○				◎								
	Engine oil level has risen and oil is milky				◎	○									
	Fan belt tension is too low												◎		
	Fan pulley has excessive play when it is turned							◎							
	Milky oil is floating on the coolant					◎									
	Excessive air bubbles are trapped in the radiator and coolant spurts back			◎											
	When light bulb is held behind radiator core, no light passes through									◎					
	Radiator shroud and inside of 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												◎		
	Power train oil temperature enters red range faster than engine coolant temperature (if oil temperature gauge and coolant temperature gauge are installed)														◎
Troubleshooting	Check for coolant leakage of EGR cooler visually		●												Carry out troubleshooting in H mode
	When compression pressure is measured, it is found to be low			●											
	Inspect cylinder liner visually				●										
	Inspect oil cooler visually					●									
	Temperature difference between upper and lower tanks of radiator is too large							●							
	When operation test of thermostat is carried out, it does not open at valve cracking temperature								●						
	Temperature difference between upper and lower tanks of radiator is too small									●					
	Inspect radiator core visually										●				
	When operation test for radiator cap is carried out, valve cracking pressure is too low											●			
	Inspect fan belt and pulley visually												●		
	When coolant temperature is measured, it is found to be normal													●	
		Remedy	Replace	Replace	Replace	Replace	Refill	Replace	Replace	Correct	Correct	Replace	Correct	Replace	—

S-15 Abnormal noise comes out

General causes why abnormal noise comes out:

- Abnormality due to defective parts
- Abnormal combustion
- Air sucked in from air intake system

★ Judge if the noise is an internal noise or an external noise, before starting 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 5 seconds. This does not indicate abnormality, however.

			Causes													
			Leakage of air between turbocharger and cylinder head	Interference of turbocharger or seized turbocharger	Cracked or leaking EGR gas piping	Broken valve system (valve, rocker lever)	Internally defective muffler (partition plate out of position)	Improper valve clearance	Excessive wear of piston ring or cylinder liner	Improper gear train backlash	Removed or seized gear train bushing	Deformed fan, loose fan belt or interference of fan belt	Clogged or seized injector	Dirt caught in injector	Improper fuel injection timing (abnormal coolant temperature sensor)
Questions	Confirm recent repair history														
	Degree of use of machine	Operated for long period							△						
	Abnormal noise appeared	Gradually							○			○			
		Suddenly		○	○	○					○				
	Non-specified fuel is being used												○		
	More oil is required for refill than before								◎						
Check items	Metal particles are observed when oil in oil filter is drained								◎		◎				
	Air leaks between turbocharger and cylinder head		◎												
	When engine is running, interference noise comes out around turbocharger			◎											
	When engine is running, abnormal noise comes out around EGR gas piping				◎										
	When engine is running, abnormal noise comes out around cylinder head					◎		◎							
	When engine is running, beating noise comes out around muffler						◎								
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low												◎	○	
	Color of exhaust gas is	Blue under light load							◎						
		Black	○	◎				○							
	Engine does not pick up smoothly and combustion is irregular												◎		
	Abnormal noise is loud during acceleration							○		○		○	○		
	Blow-by gas is excessive								◎						
Troubleshooting	When turbocharger is rotated by hand, it is found to be heavy			●											
	Inspect EGR gas piping visually				●										
	Inspect valve system directly					●									
	When muffler is removed, abnormal noise disappears						●								
	Inspect valve clearance directly							●							
	When compression pressure is measured, it is found to be low								●						
	Inspect gear train directly									●	●				
	Inspect fan and fan belt visually											●			
	When a specific cylinder is cut out for reduced cylinder mode operation, engine speed does not change												●	●	
	Abnormal noise comes out only when engine is started													●	
	Confirm with monitoring function of machine monitor														●
		Remedy	Replace	Replace	Replace	Correct	Replace	Adjust	Replace	Replace	Replace	Correct	Replace	Correct	Correct

S-16 Vibration is excessive

General causes why vibration is excessive:
- Defective parts (abnormal wear, breakage, etc.)
- Misalignment with chassis side
- Abnormal combustion

★ If abnormal noise comes out and vibration is excessive, also carry out troubleshooting for "S-15 Abnormal noise comes out".

			Causes								
			Stuck valve system (valve, rocker lever, etc.)	Worn main bearings or connecting rod bearings	Improper gear train backlash	Worn camshaft bushing	Improper fuel injection timing	Loose engine mounting bolts, broken cushions	Misalignment between engine and devices on machine side	Broken output shaft or parts in damper
Questions	Confirm recent repair history									
	Degree of use of machine	Operated for long period		△		△		△		
	Condition of vibration	Suddenly increased	○							○
		Gradually increased		○		○		○		
	Non-specified fuel is being used			○		○				
Check items	Metal particles are observed when oil in oil filter is drained			◎		◎				
	Metal particles are observed when oil pan is drained			◎		◎				
	Oil pressure is low when running at low idle			○		○				
	Vibration occurs when running at a medium speed							○		○
	Vibration follows engine speed				○			○	○	○
	Exhaust gas color is black		◎							
Troubleshooting	Inspect valve system directly		●							
	Inspect main bearings and connecting rod bearings visually			●						
	Inspect gear train directly				●					
	Inspect camshaft bushing visually					●				
	Confirm with monitoring function of machine monitor						●			
	Inspect engine mounting bolts and cushions visually							●		
	When alignment is checked, radial runout or facial runout is detected								●	
	Inspect output shaft or inside of damper visually									●
		Remedy	Replace	Replace	Replace	Replace	Adjust	Replace	Adjust	Replace

HM300-2 Articulated dump truck

Form No. SEN00677-02

ARTICULATED DUMP TRUCK

HM300-2

Machine model	Serial number
HM300-2	2001 and up

50 Disassembly and assembly
General information on disassembly and assembly

How to read this manual

(Rev. 2009.01)

1. Removal and installation of assemblies

Special tools

- Special tools which are necessary for removal or installation of parts are described as **A1**, ... **X1** etc. and their part numbers, part names and quantities are described in the special tool list.
- Also the following information is described in the special tool list.
  1) Necessity
     - ■ : Special tools that cannot be substituted and should always be used.
     - ● : Special tools that will be useful if available and are substitutable with tools available on the market.
  2) Distinction of new and existing special tools
     N : Tools newly developed for this model. They have a new part number respectively.
     R : Tools made available by redesigning the existing tools which were developed for other models. Each of them has a new part number assigned by setting forward the part number of the existing tool.
     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 are not available from Komatsu Ltd. (i.e. tools to be made locally).

Removal

- In “Removal” section, the work procedures, precautions and know-how to do the work and the amount of oil and coolant to be drained are discribed.
- Common tools that are necessary for removal are described as [1], [2]•••etc. and their part numbers, part names and quantities are not described.
- Various symbols used in the “Removal” section are explained and listed below.

⚠ : Precautions related to work safety.

★ : Guidance or precautions for the work

[*1]: This mark shows that instructions or precautions for parts installation work are given in “Installation” section.

: This mark shows the amount of oil or coolant to be drained.

: Weight of part or component

Installation

- Unless otherwise instructed, installation of parts is to be done in the reverse order to removal.
- Instructions and precautions for parts installion is shown with the mark ([*1], [*2]...which corresponds to the mark in “Removal” section).
- Common tools that are necessary for installation are described as [1], [2]•••etc. and their part numbers, part names and quantities are not described.
- Marks shown in the “Installation” section stand for the following.

⚠ : Precautions related to work safety.

★ : Guidance or precautions for the work

: Type of coating material

: Tightening torque

: Amount of oil or coolant to be replenished.

Sketch of special tool

- Various special tools are illustrated for the local manufacture.

2. Disassembly and assembly of assemblies

Special tools

- Special tools which are necessary for disassembly and assembly of parts are described as **A1**, **••• X1** etc. and their part numbers, part names and quantities are described in the special tool list.
- Also the following information is described in the special tool list.
  1) Necessity
     - ■ : Special tools that cannot be substituted and should always be used.
     - ● : Special tools that will be useful if available and are substitutable with tools available on the market.
  2) Distinction of new existing special tools
     N : Tools newly developed for this model. They have a new part number respectively.
     R : Tools made available by redesigning the existing tools which were developed for other models. Each of them has a new part number assigned by setting forward the part number of the existing tool.
     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 are not available from Komatsu Ltd. (i.e. tools to be made locally).

Disassembly

- In “Disassembly” section, the work procedures, precautions and know-how to do the work, and amount of the oil and coolant drained are described.
- Common tools that are necessary for the disassembly work are indicated as [1], [2]•••etc. and their part numbers, part names, and quantities are not described.
- The meanings of the symbols used in “Disassembly” section are as follows.

⚠ : Precautions related to work safety
★ : Guidance or precautions for the work
: Amount of oil or coolant drained.

Assembly

- In “Assembly” section, the work procedures, precautions and know-how to do the work, and amount of the oil and coolant to be replenished are described.
- Common tools that are necessary for the disassembly work are indicated as [1], [2]•••etc. and their part numbers, part names, and quantities are not described.
- The meanings of the symbols used in “Assembly” section are as follows.

⚠ : Precautions related to work safety
★ : Guidance or precautions for the work
: Type of coating material
: Tightening torque
: Amount of oil or coolant to be replenished

Sketch of special tool

- Various special tools are illustrated for the local manufacture.

Coating materials list

(Rev. 2009. 08)

★ The recommended coating materials such as adhesives, liquid gaskets, and greases used for disassembly and assembly are listed below.
★ For coating materials not listed below, use the equivalent of products shown in this manual.

Category	Komatsu code	Part No.	Capacity	Container	Main features and applications
Adhesive	LT-1A	790-129-9030	150 g	Tube	● Use to prevent rubber gaskets, rubber cushions, and cork plugs from coming out.
	LT-1B	790-129-9050	20 g (2 pcs.)	Polyethylene container	● Use for plastic (except polyethylene, polypropylene, tetrafluoroethylene and vinyl chloride), rubber, metal, and non-metal parts which require immediate and strong adhesion.
	LT-2	790-129-9040	50 g	Polyethylene container	● Features: Resistance to heat and chemicals. ● Use to fix and seal bolts and plugs.
	LT-3	790-129-9060 (Set of adhesive and hardener)	Adhesive: 1 kg Hardener: 500 g	Can	● Use to bond and seal metal, glass and plastics.
	LT-4	790-129-9040	250 g	Polyethylene container	● Use to seal plugs for blank holes
	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	● Instanetaneous adhesive. ● Curing time: From 5 sec. to 3 min. ● Use mainly to bond metals, rubbers, plastics, and woods.
	Aron-alpha 201	790-129-9130	2 g	Polyethylene container	● Instanetaneous adhesive. ● Quick-curing type (max. strength is obtained after 30 minutes) ● Use mainly to bond rubbers, plastics, and metals.
	Loctite 648-50	79A-129-9110	50 cc	Polyethylene container	● Features: Resistance to heat and chemicals. ● Use for fitted portions subjected to high temperature.
Liquid gasket	LG-5	790-129-9080	1 kg	Polyethylene container	● Use to seal various threaded portions, pipejoints, and flanges. ● Use to seal taper plugs, elbows, and nipples for hydraulic piping.
	LG-6	790-129-9160	200 g	Tube	● Features: Silicon-based heat and cold-resistant sealant. ● Use to seal flange surfaces and threaded portions. ● Use to seal oil pan, final drive case, etc.
	LG-7	790-129-9170	1 kg	Tube	● Features: Silicon-based quick-curing sealant. ● Use to seal flywheel housing, intake manifold, thermostat old, oil pan, thermostat housing, etc.
	LG-8 ThreeBond 1207B	419-15-18131	100 g	Tube	● Features: Silicon-based, heat and cold-resistant, vibration-resistant, impact-resistant sealant. ● Use to seal transfer case, etc.
	LG-9 ThreeBond 1206D	790-129-9310	200 g	Tube	● Use for rough surfaces such as the circle gear top seal which is not clamped by bolts, gaps in the weld which must be caulked, etc. ● Can be coated with paint.

Category	Komatsu code	Part No.	Capacity	Container	Main features and applications
Liquid gasket	LG-10 ThreeBond 1206E	790-129-9320	200 g	Tube	● Use as lubricant/sealant when installing the radiator hoses to the water tubes. ● Can be coated with paint.
	LG-11 ThreeBond 1121	790-129-9330	200 g	Tube	● Feature: Can be used together with solid gaskets. ● Use for covers of the transmission case and steering case etc.
	ThreeBond 1211	790-129-9090	100 g	Tube	● Liquid gasket used to repair engine.
Molybdenum disulfide lubricant	LM-P	09940-00040	200 g	Tube	● Use to prevent galling and seizure of press-fitted portions, shrinkage-fitted portions, and threaded portions. ● Use to lubricate linkages, bearings, etc.
	—	09995-00250	190 g	Can	● Spray type ● Thin molybdenum disulphide films are made on metal surfaces to prevent the metals from galling. ● Use for the drive shaft splines, needle bearings, various link pins, bolts, etc.
Seizure prevention compound	LC-G NEVER-SEEZ	—	—	Can	● Feature: Seizure and galling prevention compound with metallic super-fine-grain, etc. ● Use for the mounting bolt in the high temperature area of the exhaust manifold and the turbocharger, etc.
Grease	G2-LI G0-LI (*) *: For cold district	SYG2-400LI SYG2-350LI SYG2-400LI-A SYG2-160LI SYGA-160CNLI SYG0-400LI-A (*) SYG0-160CNLI (*)	Various	Various	● Feature: Lithium grease with extreme pressure lubrication performance, general purpose type.
	Molybdenum disulfide grease LM-G (G2-M)	SYG2-400M SYG2-400M-A SYGA-16CNM	400 g × 10 400 g × 20 16 kg	Bellows-type container Can	● Use for parts under heavy load. Caution: ● Do not use this grease for rolling bearings like swing circle bearings, etc. and spline. ● Use this grease for work equipment pins only when installing them, but do not use it afterward.
	Hyper White G2-T, G0-T (*) *: For cold district	SYG2-400T-A SYG0-400T-A (*) SYG2-16CNT SYG0-16CNT (*)	400 g 16 kg	Bellows-type container Can	● Seizure resistance, heat resistance and water resistance higher than molybdenum disulfide grease. ● Not conspicuous on machine since color is white.
	Biogrease G2-B G2-BT (*) *: For use at high temperature and under high load	SYG2-400B SYG2-400BT (*) SYGA-16CNB SYGA-16CNBT (*)	400 g 16 kg	Bellows-type container Can	● Since this grease is biodegradable in short period, it has less impact on microorganisms, animals, and plants.
	G2-S ThreeBond 1855	—	200 g	Tube	● Feature: Silicone grease with wide usable temperature range, high resistance to thermal-oxidative degradation and performance to prevent deterioration of rubber and plastic parts. ● Use for oil seals of the transmission, etc.

Category	Komatsu code	Part No.	Capacity	Container	Main features and applications	
Grease	G2-U-S ENS grease	427-12-11871	2 kg	Can	● Feature: Urea (organic system) grease with heat resistance and long life, can be packed into the confined space and left intact until next overhaul. ● Use for rubber, bearing and oil seal in damper. Caution: Do not mix with lithium grease.	
Primer	SUNSTAR PAINT PRIMER580 SUPER	417-926-3910	20 mℓ	Glass container	For adhered window glass	● Use as primer for painted cab sheet metal surface. (Effective period: four months after date of manufacture)
	SUNSTAR GLASS PRIMER 580 SUPER		20 mℓ	Glass container		● Use as primer for glass. (Effective period: four months after date of manufacture)
	SUNSTAR PAINT PRIMER 435-95	22M-54-27230	20 mℓ	Glass container		● Use as primer for painted cab sheet metal surface. (Effective period: four months after date of manufacture)
	SUNSTAR GLASS PRIMER 435-41	22M-54-27240	150 mℓ	Can		● Use as primer for black ceramic-coated glass surface and for hard polycarbonate-coated surface. (Effective period: four months after date of manufacture)
	SUNSTAR SASH PRIMER GP-402	22M-54-27250	20 mℓ	Glass container		● Use as primer for sash (anodized aluminum surface). (Effective period: four months after date of manufacture)
Adhesive	SUNSTAR PENGUINE SEAL580 SUPER " S" or " W"	417-926-3910	320 mℓ	Polyethylene container	For adhered window glass	● Use "S" in high-temperature season and "W" in low-temperature season as adhesive for glass. (Effective period: four months after date of manufacture)
	Sika Japan, Sikaflex 256HV	20Y-54-39850	310 mℓ	Polyethylene container		● Use as adhesive for glass. (Effective period: six months after date of manufacture)
	SUNSTAR PENGUINE SUPER 560	22M-54-27210	320 mℓ	Ecocart (Special container)		● Use as adhesive for glass. (Effective period: six months after date of manufacture)
Caulking material	SUNSTAR PENGUINE SEAL No. 2505	417-926-3920	320 mℓ	Polyethylene container		● Use to seal glass-to-glass joints. (Effective period: four months after date of manufacture)
	SEKISUI SILICONE SEALANT	20Y-54-55130	333 mℓ	Polyethylene container		● Use to seal front window. (Effective period: six months after date of manufacture)
	GE TOSHIBA SILICONES TOSSEAL381	22M-54-27220	333 mℓ	Cartridge		● Use to seal glass-to-glass joint. Translucent white seal. (Effective period: 12 months after date of manufacture)

Special tool list

(Rev. 2009.1)

★ Tools with part number 79*T-***-**** means that they are not available from Komatsu Ltd. (i.e. tools to be made locally).
★ Necessity
■. . . . . Special tools that cannot be substituted and should always be used
●. . . . . Special tools that will be useful if available and are substitutable with tools available on the market
★ New/Remodel
N. . . . . Tools newly developed for this model. They have a new part number respectively.
R. . . . . Tools made available by redesigning the existing tools which were developed for other models. Each of them has a new part number assigned by setting forward the part number of the existing tool.
Blank . . Tools already available for other models. They can be used without any modification.
★ Tools marked with ○ in the sketch column are presented in the sketches of the special tools (See "Sketches of special tools")

Work item	Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch	Nature of work and remarks
Engine assembly	A	1	795-630-5500	Standard puller	■	1			Removal and installation of fuel supply pump
			01010-81090	Bolt	■	2			
			01643-31032	Washer	■	2			
		2	790-331-1110	Wrench (Angle)	●	1			Tightening of cylinder head bolt
		3	795-931-1100	Seal puller assembly	■	1			Removal of engine seal
		4	795-931-1210	Push tool	■	1			Press fitting of engine rear seal
			01050-31625	Bolt	■	3			
			01050-31645	Bolt	■	3			
		5	795-931-1220	Push tool	■	1			
			01050-31645	Bolt	■	3			
		6	795T-521-1140	Push tool	■	1		○	Press fitting of engine front seal
			790-101-5221	Grip	■	1			
			01010-81225	Bolt	■	1			
			01050-31640	Bolt	■	3			
		7	792T-220-1310	Centering tool	■	2	N	○	Centering of engine assembly and transmission assembly
			01050-61225	Bolt	■	8			
Torque converter assembly	C	1	790-501-5000	Unit repair stand	●	1			Disassembly and assembly of torque converter assembly
			790-901-2110	Bracket	●	1			
			792T-213-1210	Plate	●	1		○	
		2	792-213-1110	Wrench	■	1			Removal and installation of pump bearing nut
Transmission assembly	D	1	790-102-1871	Nut wrench	■	1			Removal and installation of PTO bearing nut
		2	796-465-1120	Push tool	■	1			Press fitting of lower shaft bearing (3rd side)
		3	792T-423-1110	Push tool	■	1		○	Press fitting of lower shaft bearing (2nd side)

Work item	Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch	Nature of work and remarks
Transmission assembly	D	4	792T-213-1220	Push tool	■	1		○	Press fitting of input coupling dust seal
			790-101-5421	Grip	■	1			
			01010-81240	Bolt	■	1			
		5	792T-213-1230	Push tool	■	1		○	Press fitting of input coupling oil seal
			790-101-5421	Grip	■	1			
			01010-81240	Bolt	■	1			
		6	790-201-2730	Spacer	■	1			Press fitting of PTO bearing
		7	792T-413-1120	Push tool	■	1		○	Press fitting of idler gear bearing
		8	792T-215-1120	Push tool	■	1		○	Press fitting of output coupling cover
		9	799-301-1500	Oil leak tester kit	■	1			
Front differential assembly	H	1	792T-227-1110	Push tool	■	1		○	Press fitting of output shaft bearing
		2	792T-423-1130	Push tool	■	1		○	Press fitting of side carrier oil seal
			790-101-5421	Grip	■	1			
			01010-51240	Bolt	■	1			
		3	790-201-2840	Spacer	■	1			Press fitting of bevel pinion bearing
Center differential assembly		2	792T-423-1130	Push tool	■	1		○	Press fitting of transfer input shaft cage oil seal
			790-101-5421	Grip	■	1			
			01010-51240	Bolt	■	1			
		4	790-101-5401	Push tool kit	■	1			Press fitting of bearing cage oil seal
			790-101-5441	● Plate		1			
			790-101-5421	● Grip		1			
			01010-51240	● Bolt		1			
		5	790-201-2770	Spacer	■	1			Press fitting of bearing cage side seal
		6	790-501-5000	Unit repair stand (AC 100 V)	■	1			Disassembly and assembly of center differential assembly
			790-501-5200	Unit repair stand (AC 100 V, AC 220 V)	■	1			
			790-901-2110	Bracket	■	1			
			792T-222-1210	Plate	■	1		○	
		7	792-103-0901	Wrench	■	1			Adjustment of pre-load on side bearing
		8	792T-223-1120	Push tool	■	1		○	Press fitting of transfer input shaft bearing
		9	792T-423-1140	Push tool	■	1		○	Press fitting of transfer input shaft cage oil seal
			790-101-542	Grip	■	1			
			01010-51240	Bolt	■	1			
		10	792T-223-1110	Push tool	■	1		○	Press fitting of bevel pinion bearing
Rear differential assembly		6	790-501-5000	Unit repair stand (AC 100 V)	■	1			Disassembly and assembly of rear differential assembly
			790-501-5200	Unit repair stand (AC 100 V, AC 220 V)	■	1			
			790-901-2110	Bracket	■	1			
			792T-222-1210	Plate	■	1		○	
		7	792-103-0901	Wrench	■	1			Adjustment of pre-load on side bearing
		10	792T-223-1110	Push tool	■	1		○	Press fitting of bevel pinion bearing

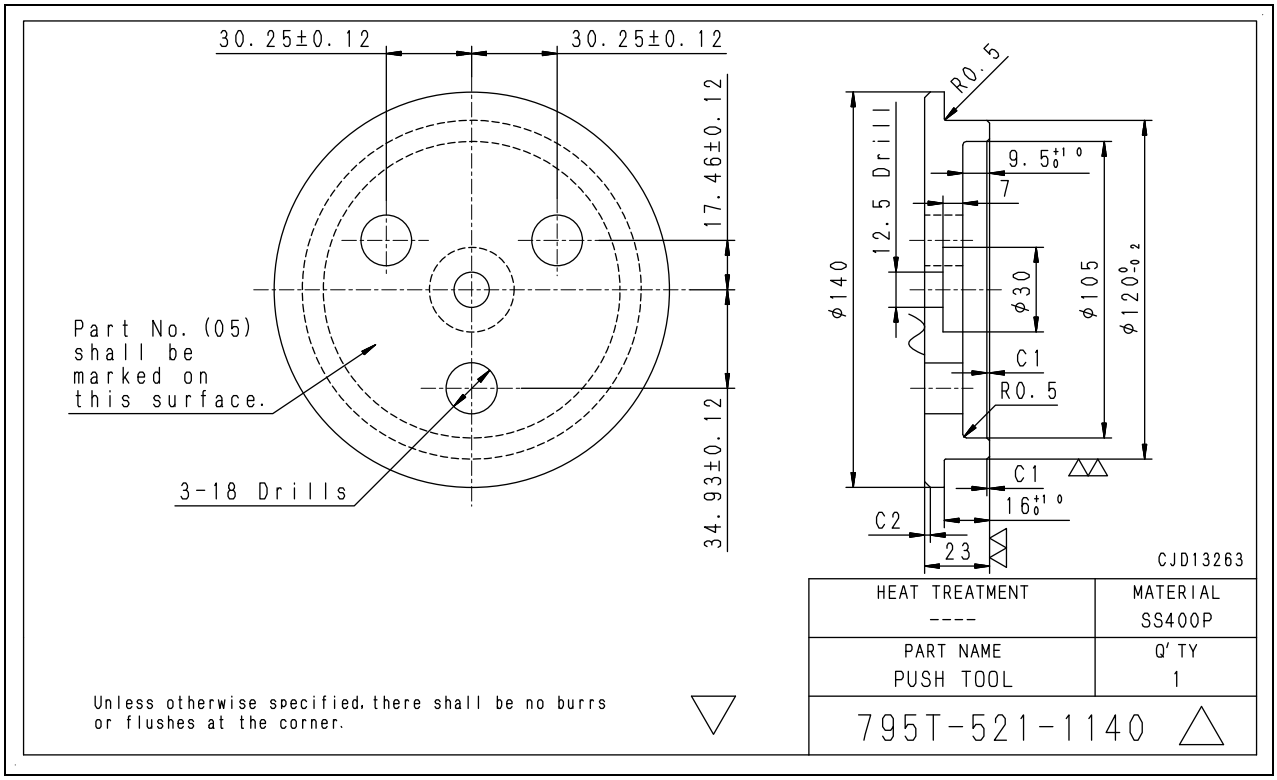
Work item	Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch	Nature of work and remarks
Front final drive and brake assembly	J	1	792T-227-1120	Fixture	■	3		○	Removal and installation of brake assembly
			792T-223-1140	Plate	■	3		○	
			01010-61240	Bolt	■	3			
			01643-31232	Washer	■	3			
			01580-01210	Nut	■	3			
			01010-61245	Bolt	■	3			
			01010-62440	Bolt	■	3			
		2	792T-222-1220	Push tool	■	1		○	Press fitting of shaft bearing
		3	792T-227-1130	Push tool	■	1		○	Press fitting of shaft oil seal
			790-101-5221	Grip	■	1			
			01010-81225	Bolt	■	1			
		4	791-580-1520	Installer	■	1			
		5	791-580-1510	Installer	■	1			
		6	793T-622-1110	Push tool	■	1		○	Press fitting of outer gear oil seal
			790-101-5421	Grip	■	1			
			01010-81240	Bolt	■	1			
		7	797T-622-1240	Push tool	■	1		○	Press fitting of inner hub bearing
Center final drive and brake assembly		2	792T-222-1220	Push tool	■	1		○	Press fitting of shaft bearing
		4	791-580-1520	Installer	■	1			Installation of floating seal
		5	791-580-1510	Installer	■	1		○	
		6	793T-622-1110	Push tool	■	1			Press fitting of outer gear oil seal
			790-101-5421	Grip	■	1			
			01010-81240	Bolt	■	1			
		7	797T-622-1240	Push tool	■	1		○	Press fitting of inner hub bearing
		8	792T-227-1130	Fixture	■	3		○	Removal and installation of brake assembly
			792T-223-1140	Plate	■	3		○	
			01010-61240	Bolt	■	3			
			01643-31232	Washer	■	3			
			01580-01210	Nut	■	3			
			01010-61245	Bolt	■	3			
			01010-62440	Bolt	■	3			
Rear final drive assembly		2	792T-222-1220	Push tool	■	1		○	Press fitting of wheel hub bearing
		7	797T-622-1240	Push tool	■	1		○	Press fitting of inner hub bearing
Hitch frame assembly	K	1	792T-246-1130	Plate	■	1		○	Press fitting of dust seal
		2	792T-246-1140	Plate	■	1		○	
		3	792T-246-1110	Push tool	■	1		○	Press fitting of bearing
		4	790-101-5201	Push tool kit	■	1			Press fitting of dust seal (For center shaft) (For upper hinge pin)
			790-101-5341	● Plate		1			
			790-101-5331	● Plate		1			
			790-101-5221	● Grip		1			
			01010-51225	● Bolt		1			
		5	790-201-1500	Push tool kit	■	1			Press fitting of dust seal for lower hinge pin
			790-201-1640	● Plate		1			
			790-101-5021	● Grip		1			
			01010-50816	● Bolt		1			
		6	792T-446-1120	Push tool	■	1		○	
			790-101-2310	Block	■	2			
			790-101-2390	Leg	■	2			
			790-101-2420	Adapter (16 mm)	■	2			
			790-101-2360	Plate	■	2			
			02215-11622	Nut	■	2			
			790-101-2102	Puller 300 kN {30 ton}	■	1			
			790-101-1102	Pump	■	1			

Work item	Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch	Nature of work and remarks
Suspension cylinder and equalizer bar	Q		792-610-1000	Suspension tool assembly	■	1			Filling suspension cylinder with oil and nitrogen gas
Steering cylinder assembly	U	1	790-502-1003	Cylinder repair stand	■	1			Disassembly and assembly of cylinder assembly
			790-101-1102	Hydraulic pump	■	1			
		2	790-102-3802	Wrench assembly	■	1			Removal and installation of cylinder head
		3	790-102-1480	Socket (Width across flats: 80 mm)	■	1			Removal and installation of nut
		4	790-720-1000	Expander	■	1			Installation of piston ring
			796-720-1660	Ring	■	1			
			07281-01159	Clamp	■	1			
		5	790-201-1702	Push tool kit	■	1			Press fitting of bushing
			790-101-5021	● Grip		1			
			01010-50816	● Bolt		1			
			790-202-1811	● Push tool		1			
		6	790-201-1500	Push tool kit	■	1			Press fitting of dust seal
			790-101-5021	● Grip		1			
			01010-50816	● Bolt		1			
			790-201-1620	● Plate		1			
Hoist cylinder assembly		1	790-502-1003	Cylinder repair stand	■	1			Disassembly and assembly of cylinder assembly
			790-101-1102	Hydraulic pump	■	1			
		2	790-102-3802	Wrench assembly	■	1			Removal and installation of cylinder head
		4	790-720-1000	Expander	■	1			Installation of piston ring
			796-720-1660	Ring	■	1			
			07281-01159	Clamp	■	1			
		5	790-201-1702	Push tool kit	■	1			Press fitting of bushing
			790-101-5021	● Grip		1			
			01010-50816	● Bolt		1			
			790-201-1831	● Push tool		1			
			790-201-1871	● Push tool		1			
		6	790-201-1500	Push tool kit	■	1			Press fitting of dust seal
			790-101-5021	● Grip		1			
			01010-50816	● Bolt		1			
			790-201-1640	● Plate		1			
			790-201-1680	● Plate		1			
		7	790-102-4300	Wrench assembly	■	1			Tightening of piston assembly
			790-102-4310	Pin	■	1			
Operator's cab	X	1	792-454-1100	Pump assembly	●	1	N		Tilting up by tilt cylinder
Operator's cab glass		2	793-498-1210	Lifter (Suction cup)	■	2			Installation of operator's cab glass
		3	20Y-54-13180	Stopper rubber	■	2			

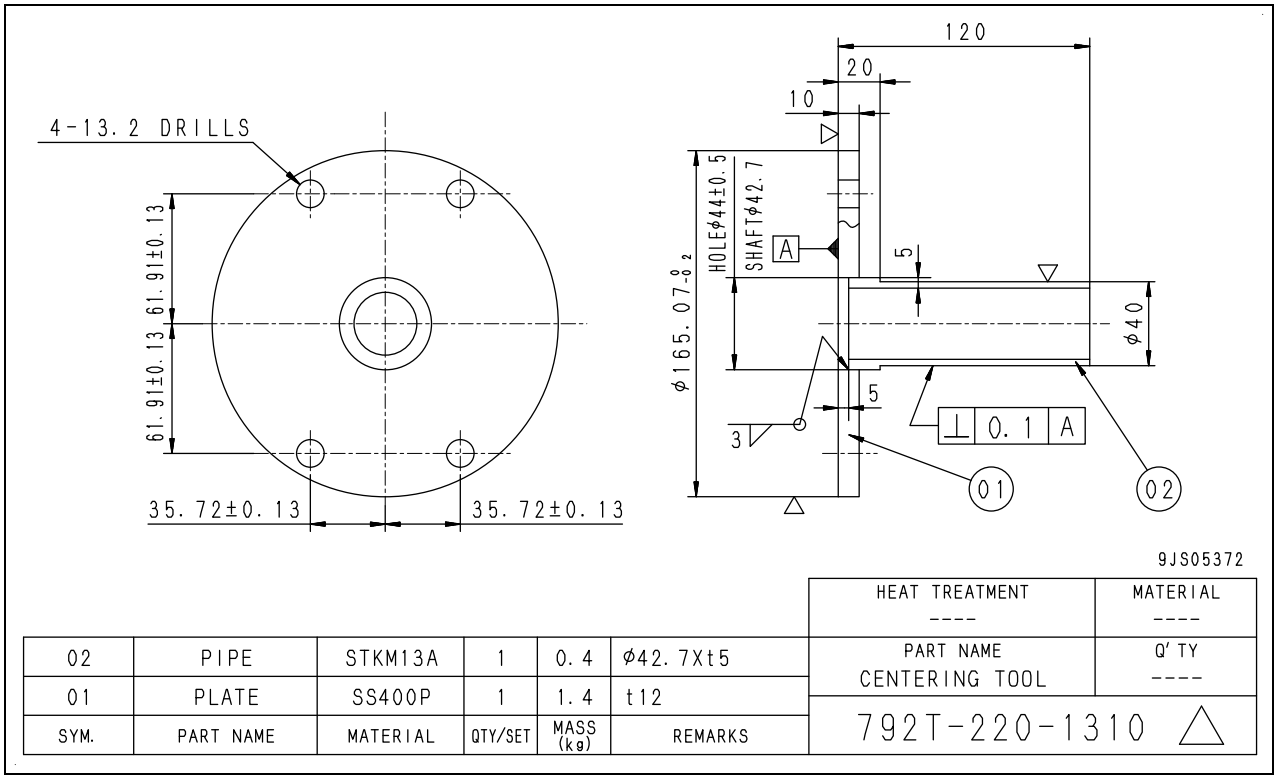
Sketches of special tools

Note: Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.

A6 Push tool



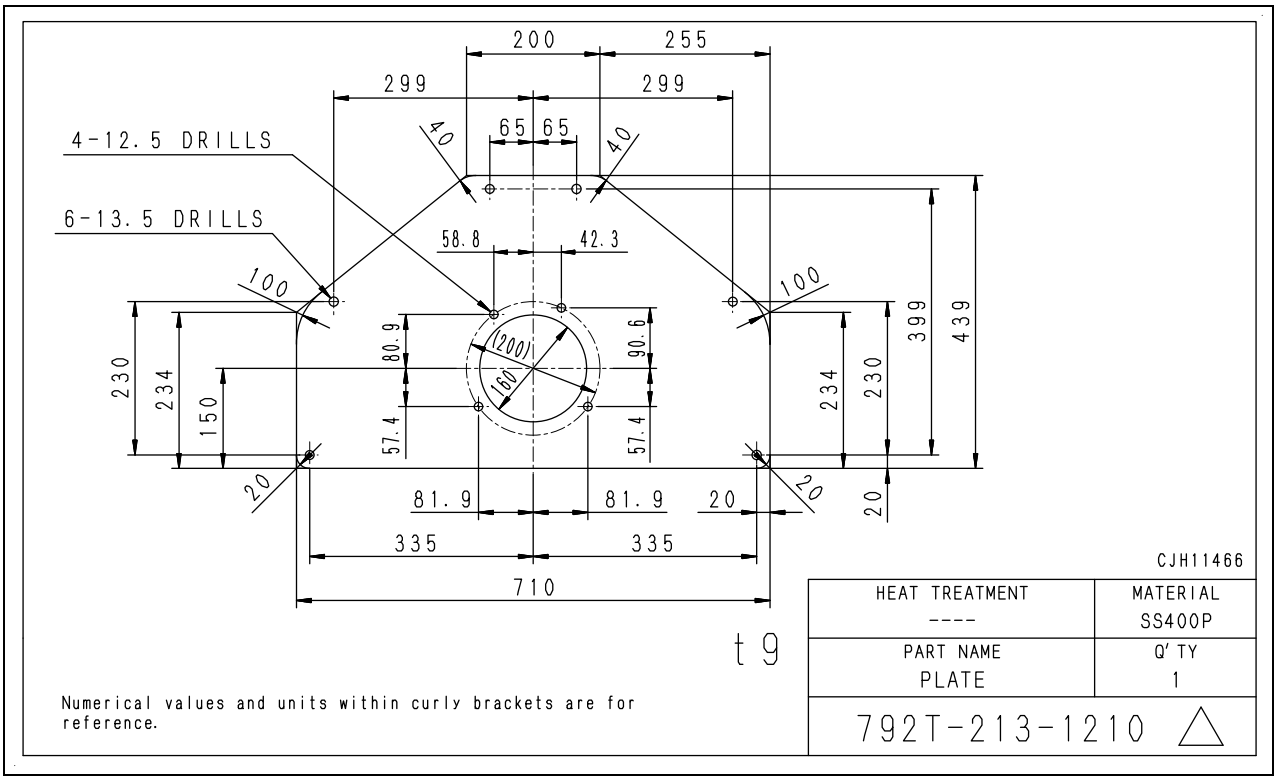
A7 Centering tool



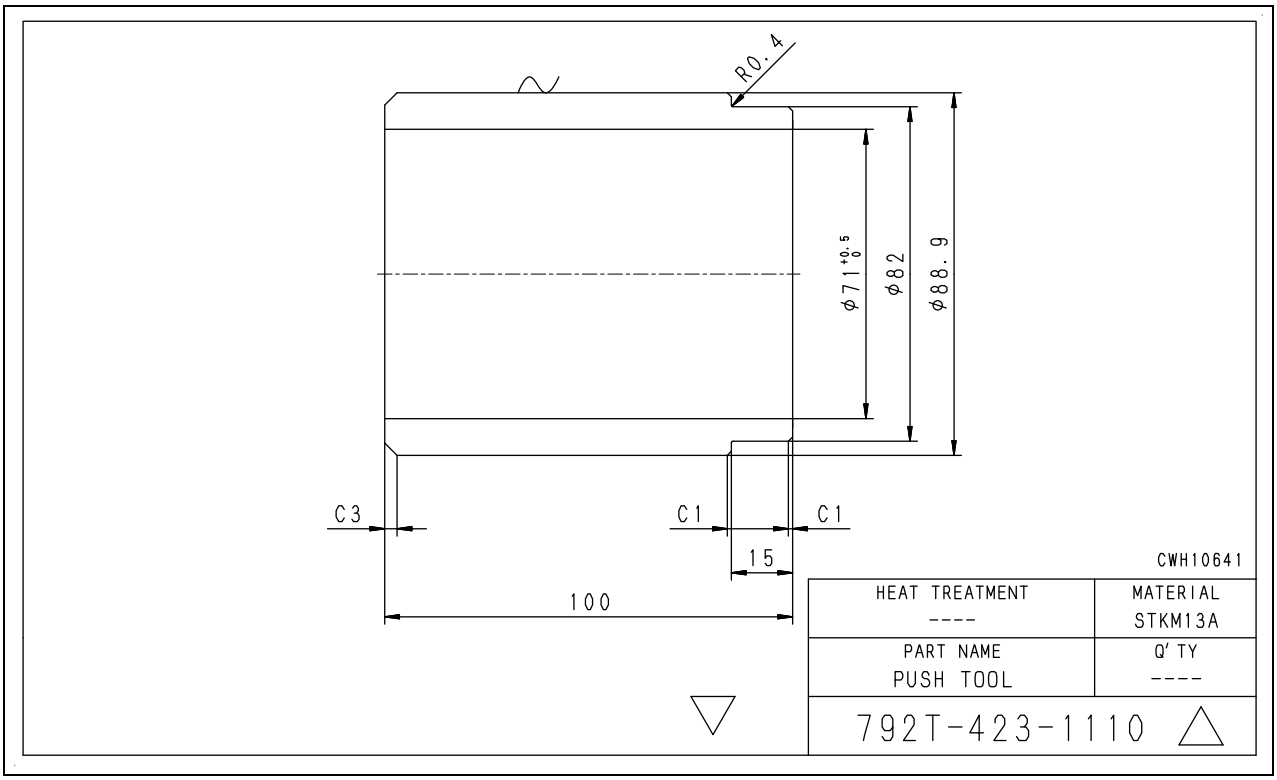
SYM.	PART NAME	MATERIAL	QTY/SET	MASS (kg)	REMARKS
02	PIPE	STKM13A	1	0.4	φ42.7Xt5
01	PLATE	SS400P	1	1.4	t12

Note: Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.

C1 Plate

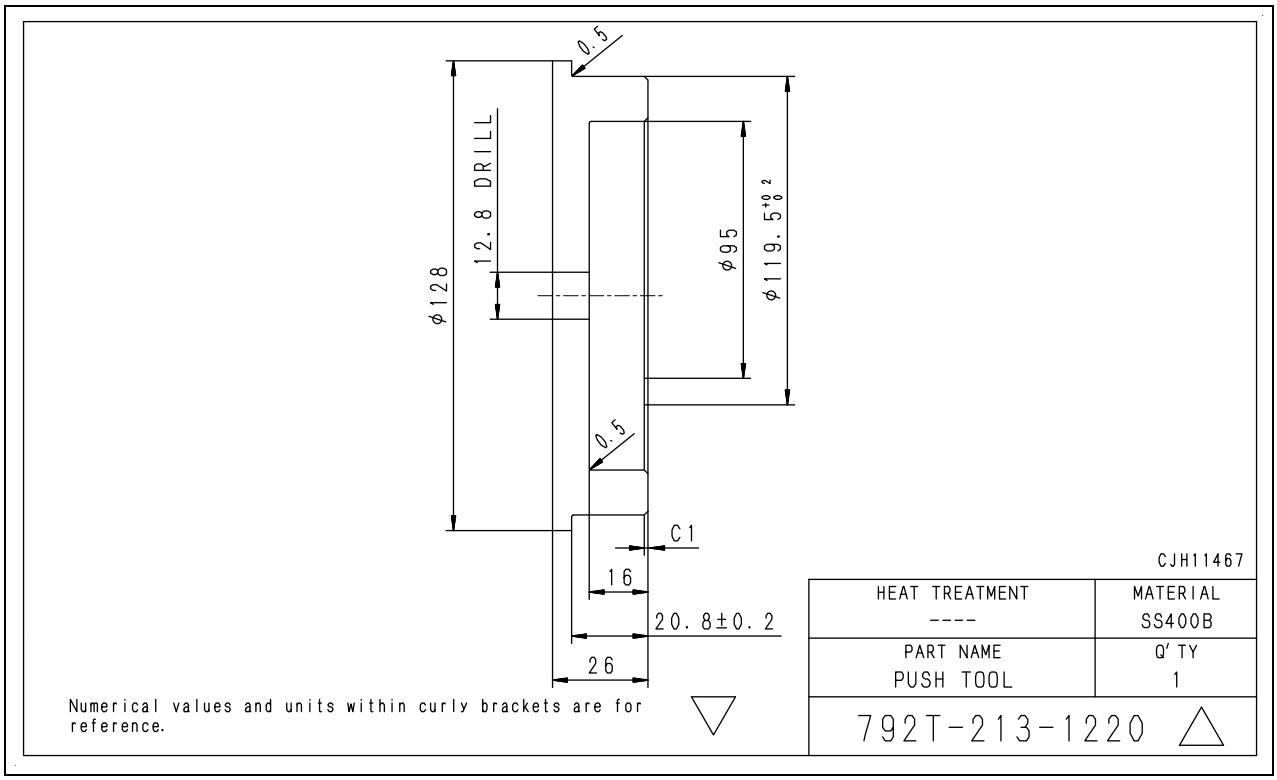


D3 Push tool

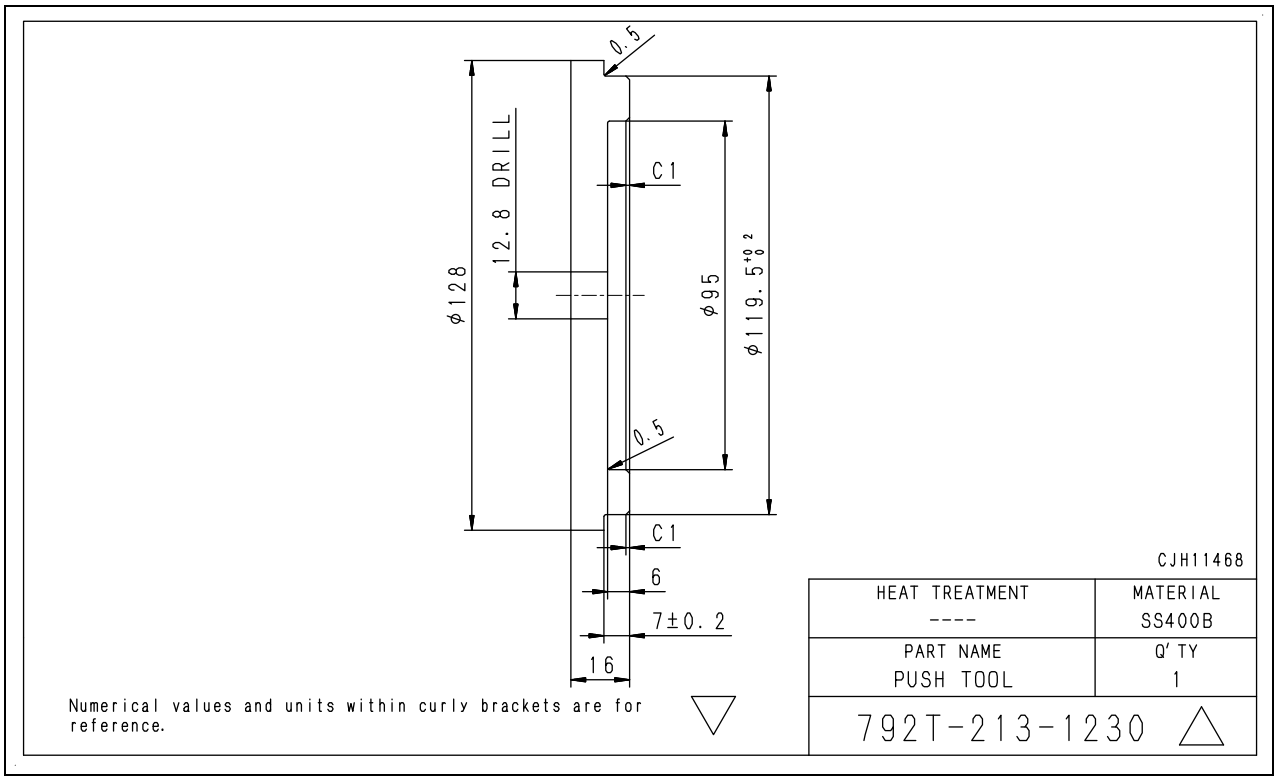


Note: Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.

D4 Push tool

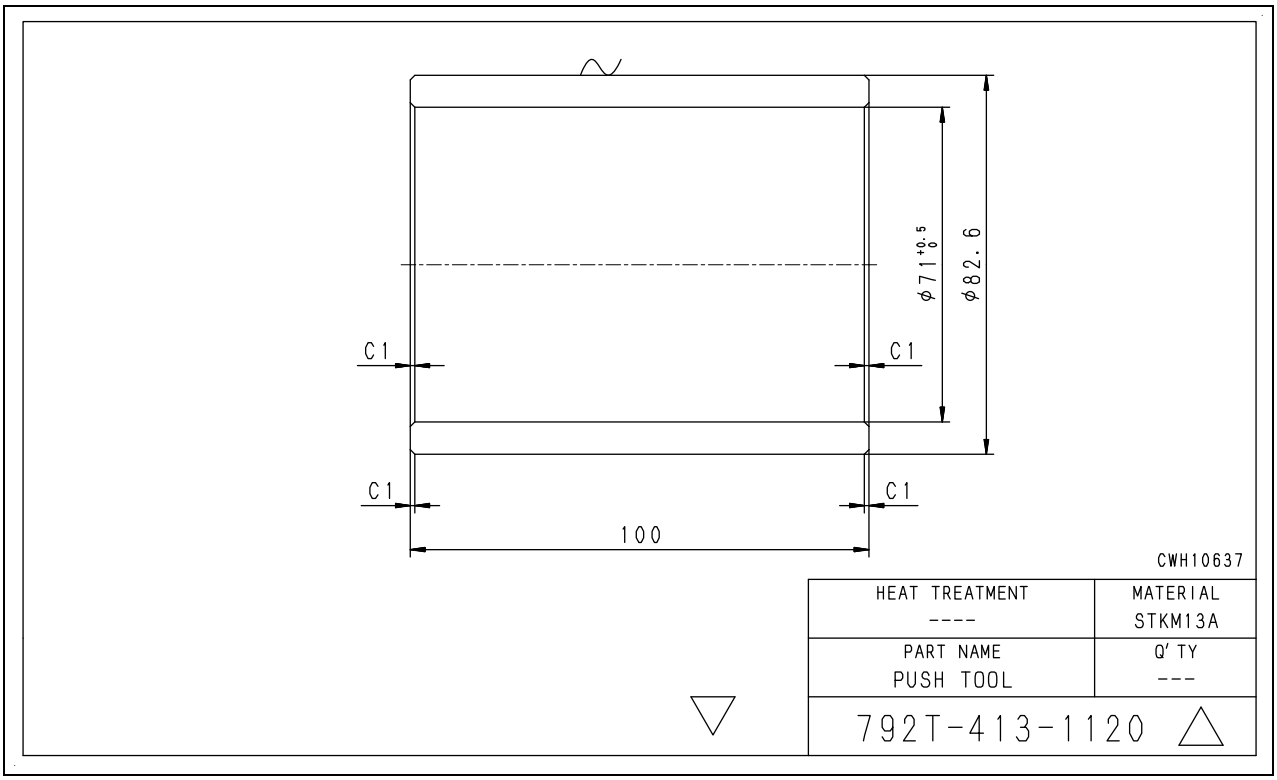


D5 Push tool

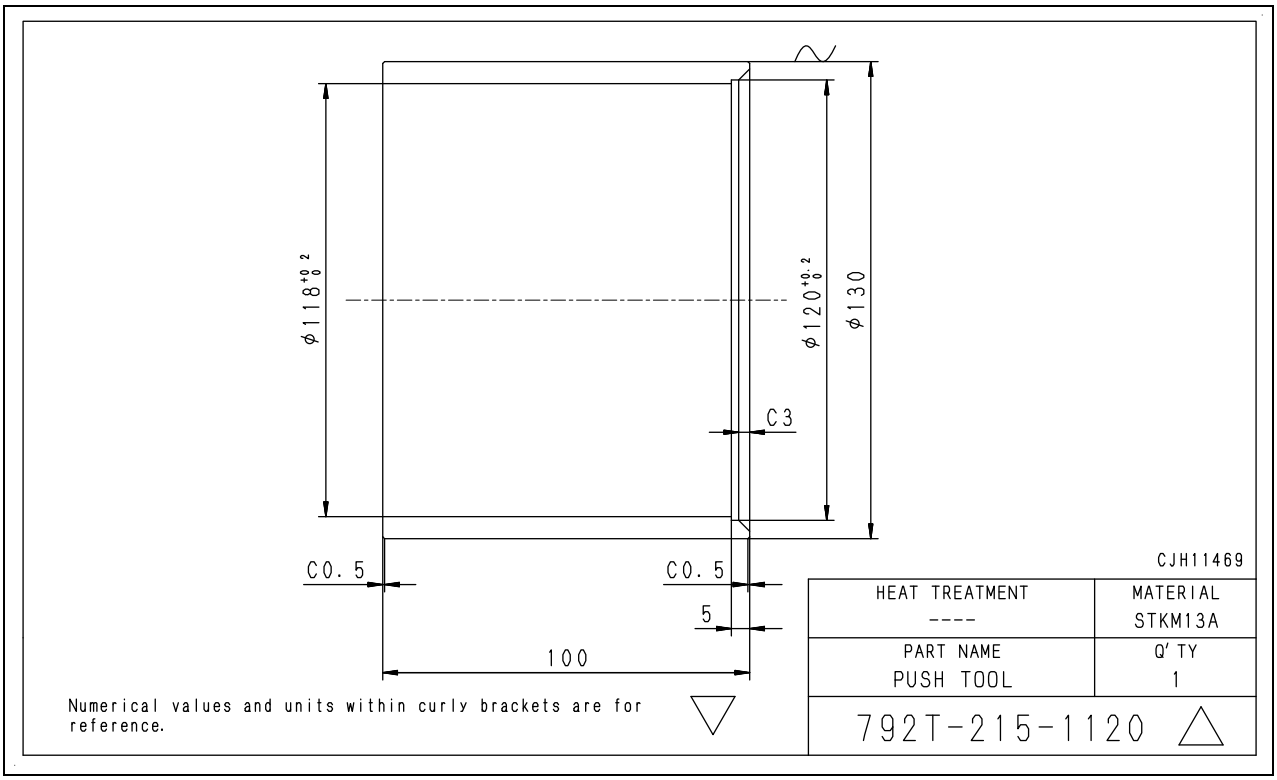


Note: Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.

D7 Push tool

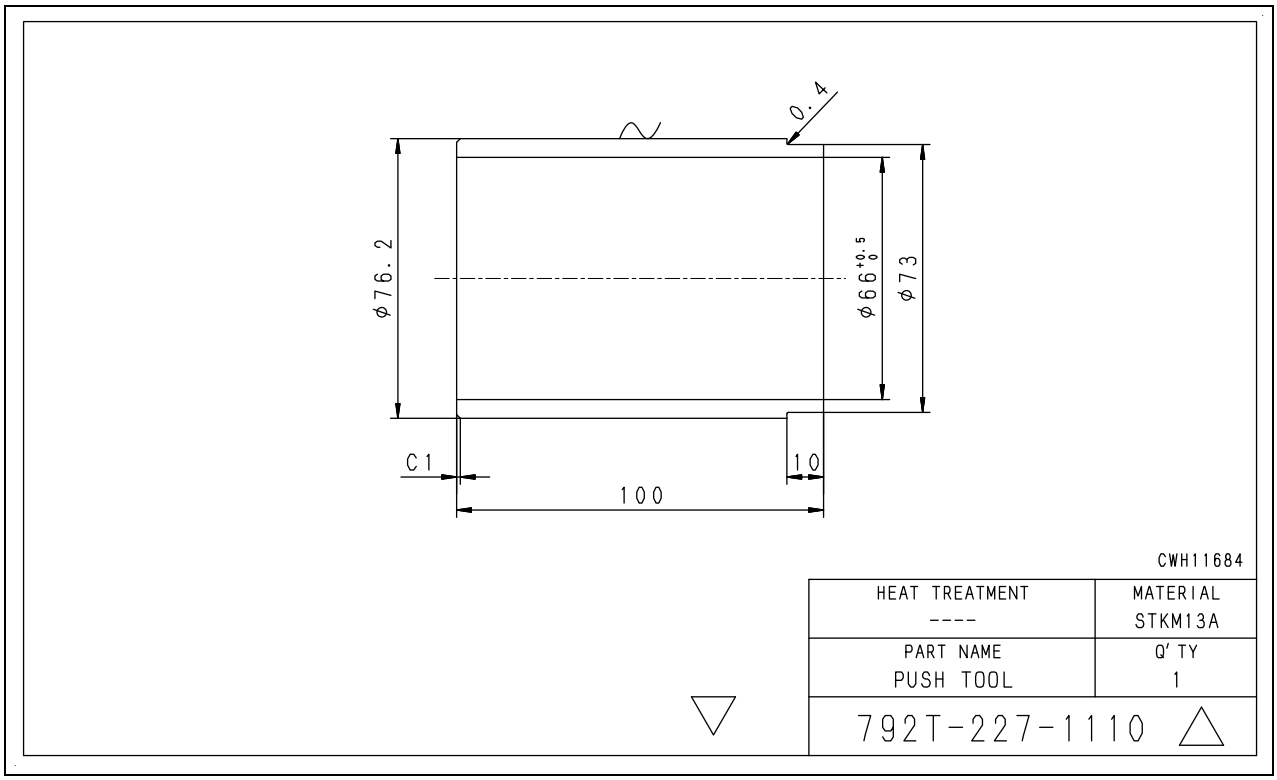


D8 Push tool

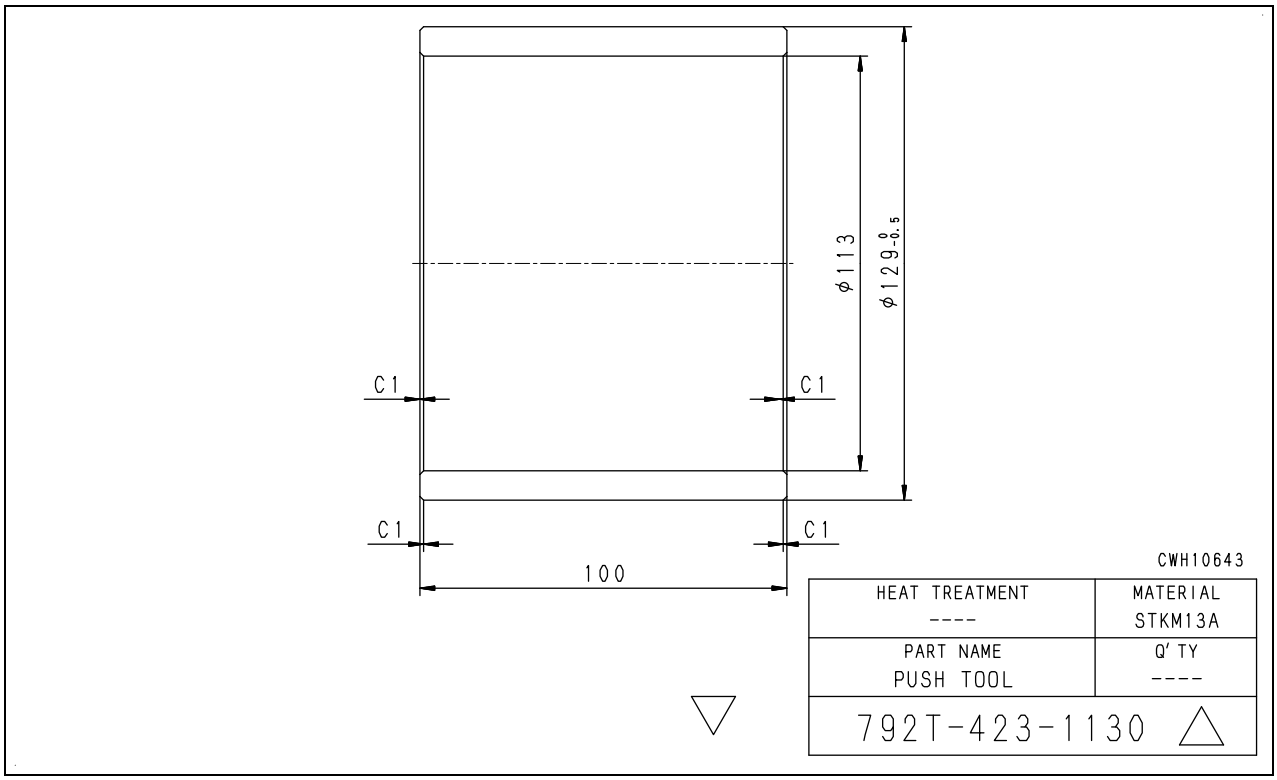


Note: Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.

H1 Push tool

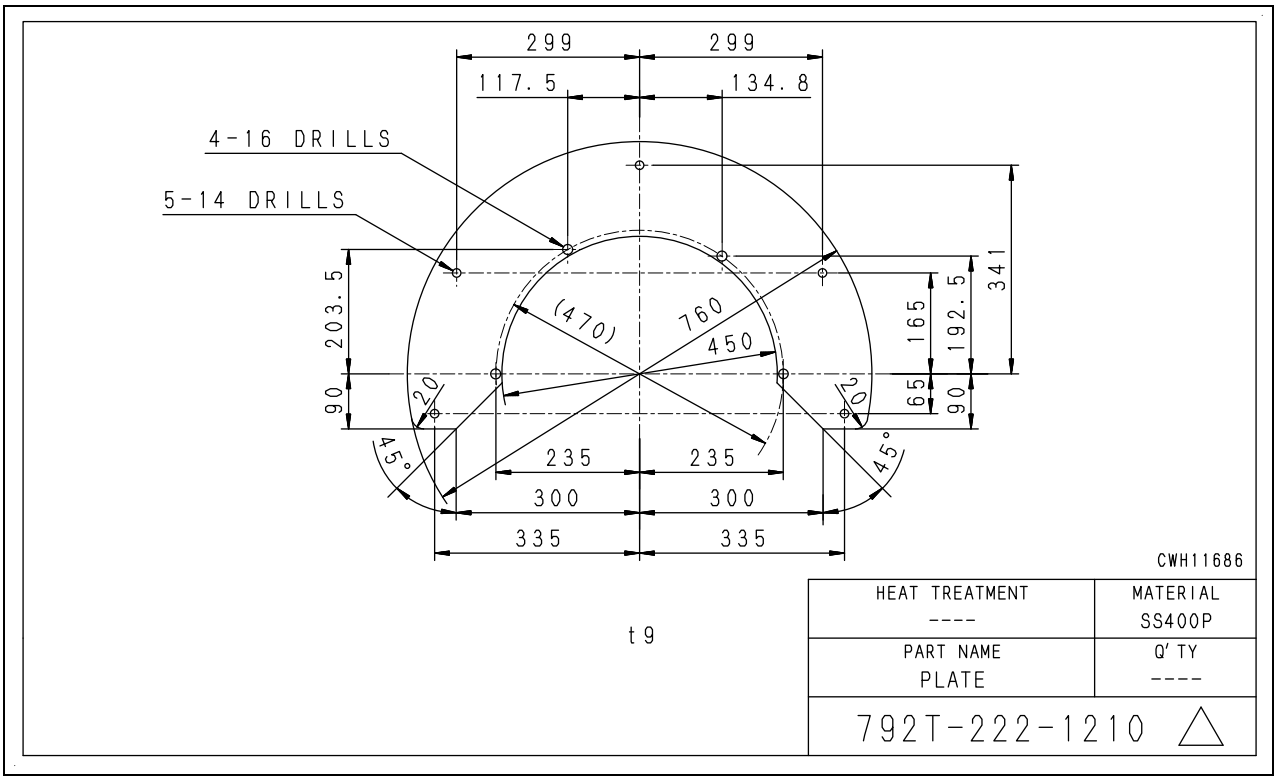


H2 Push tool

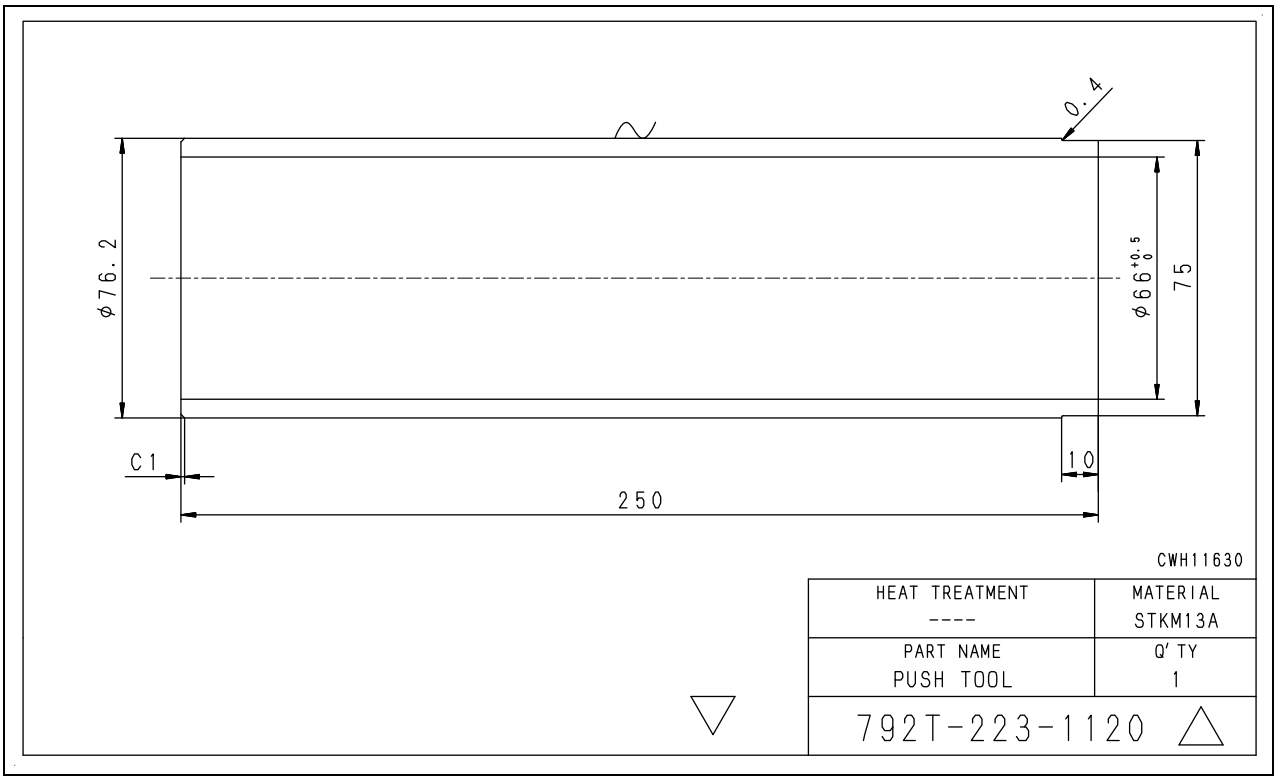


Note: Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.

H6 Plate

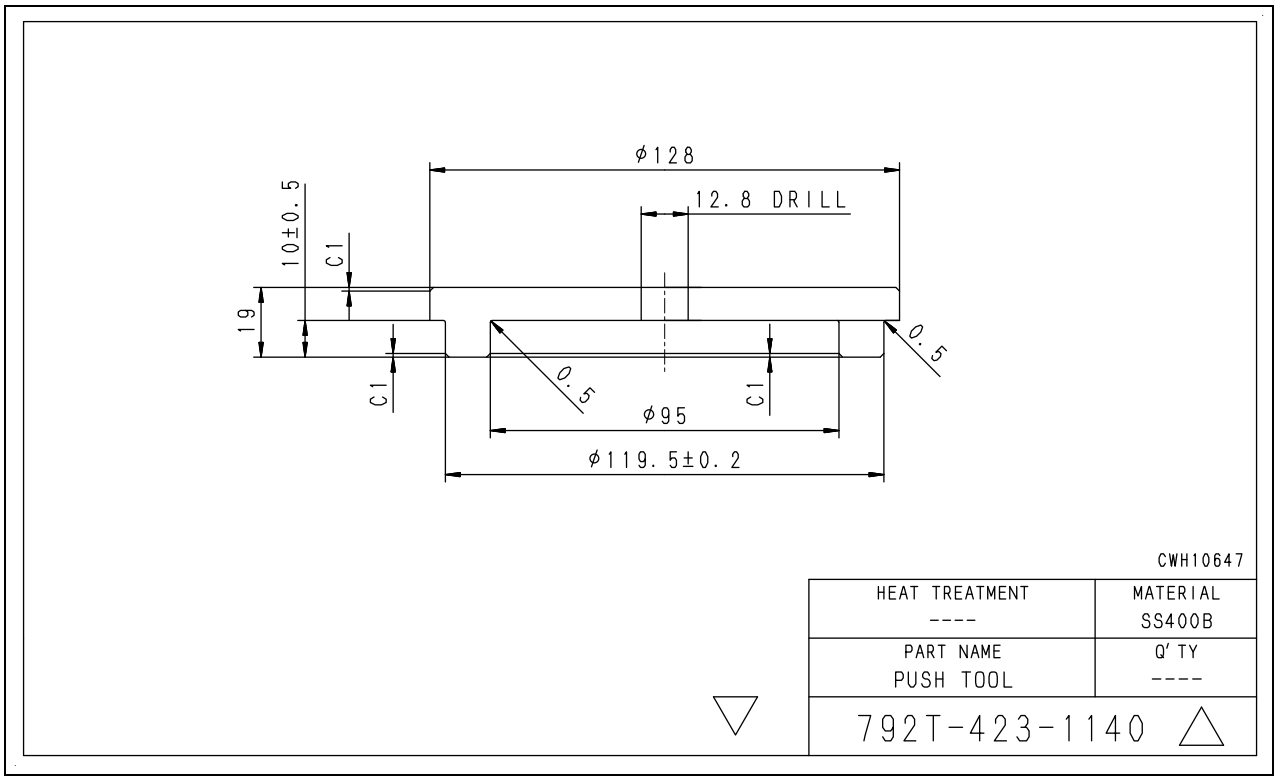


H8 Push tool

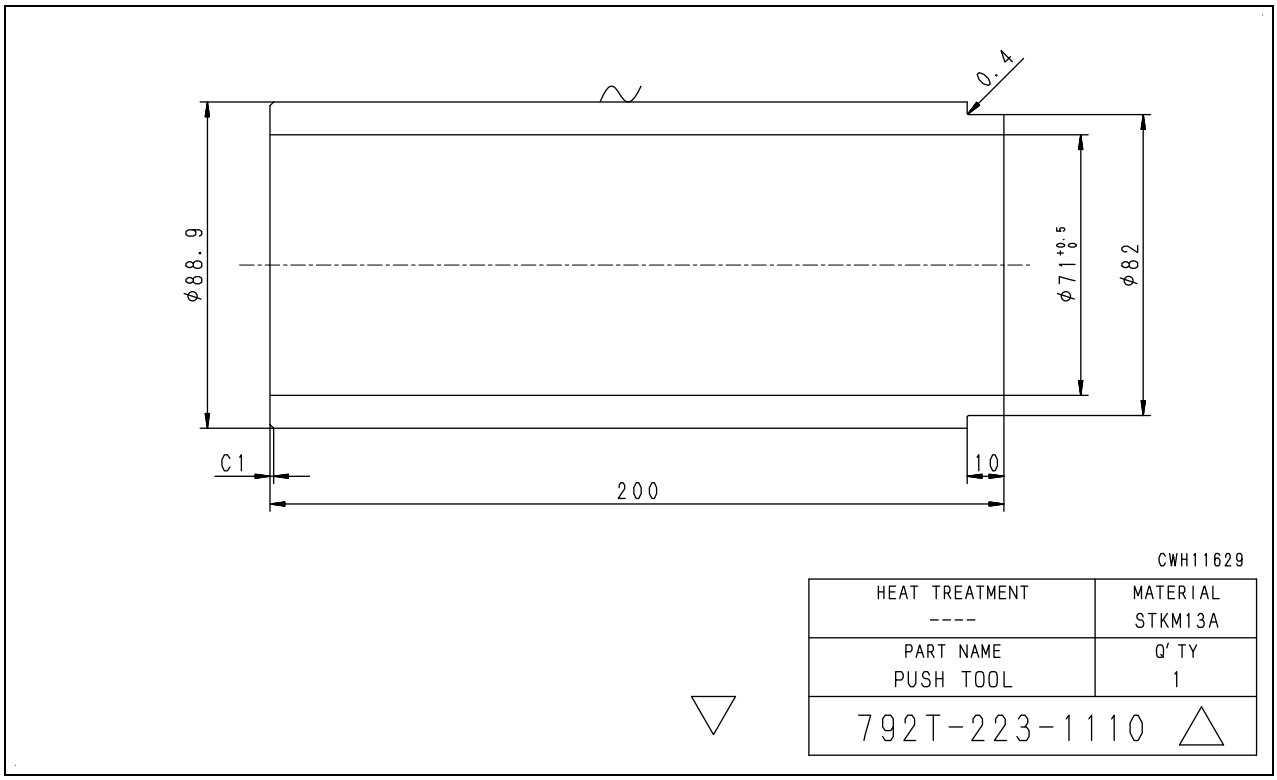


Note: Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.

H9 Push tool

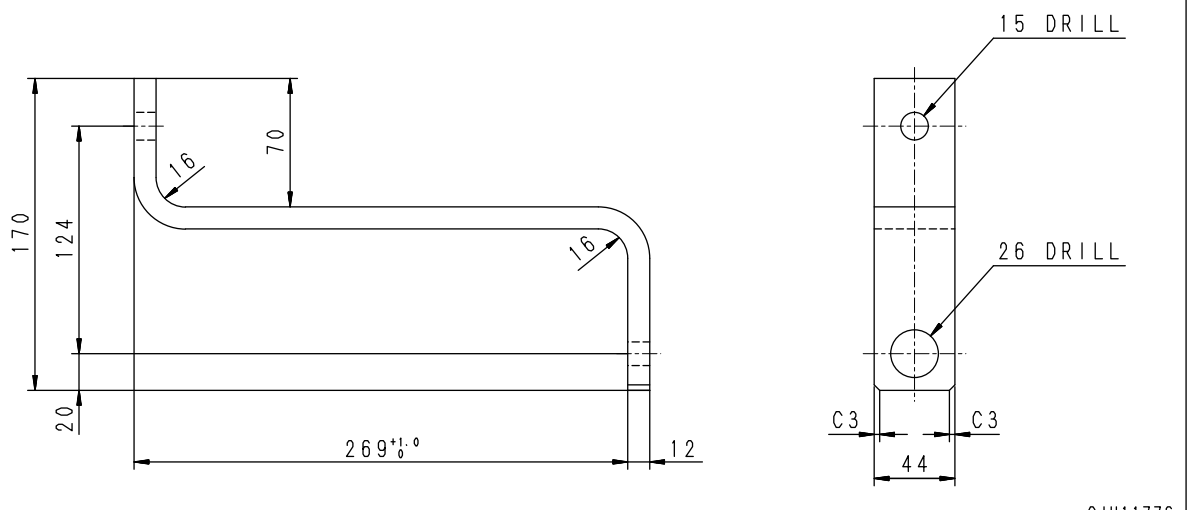


H10 Push tool



Note: Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.

J1 Fixture

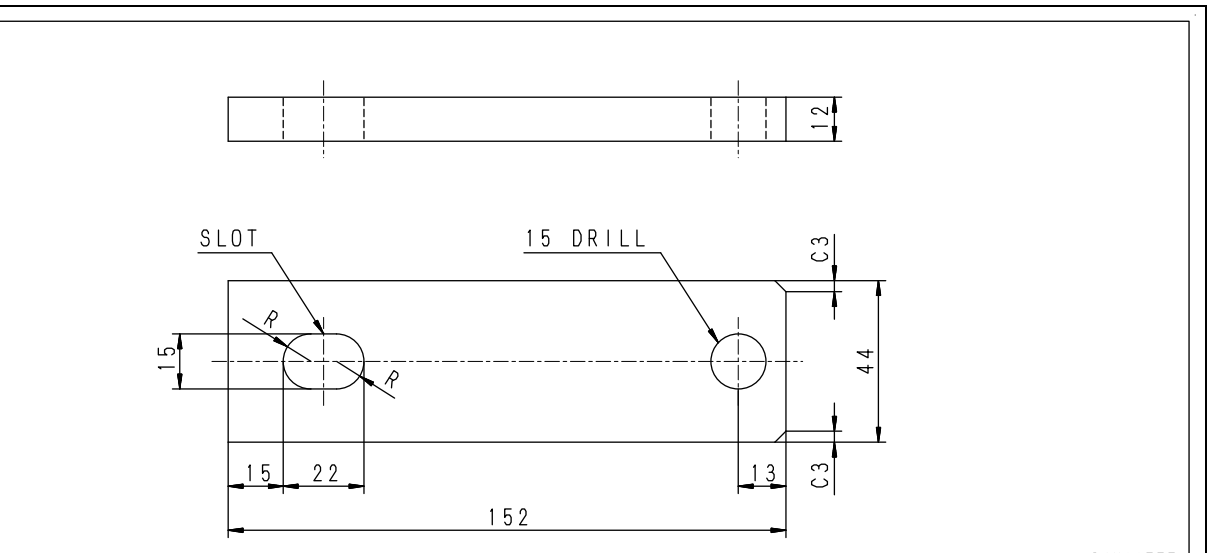


CJH11776

HEAT TREATMENT	MATERIAL
----	SS400F
PART NAME	Q'TY
FIXTURE	3
792T-227-1120 △	

Numerical values and units within curly brackets are for reference.

J1 Plate



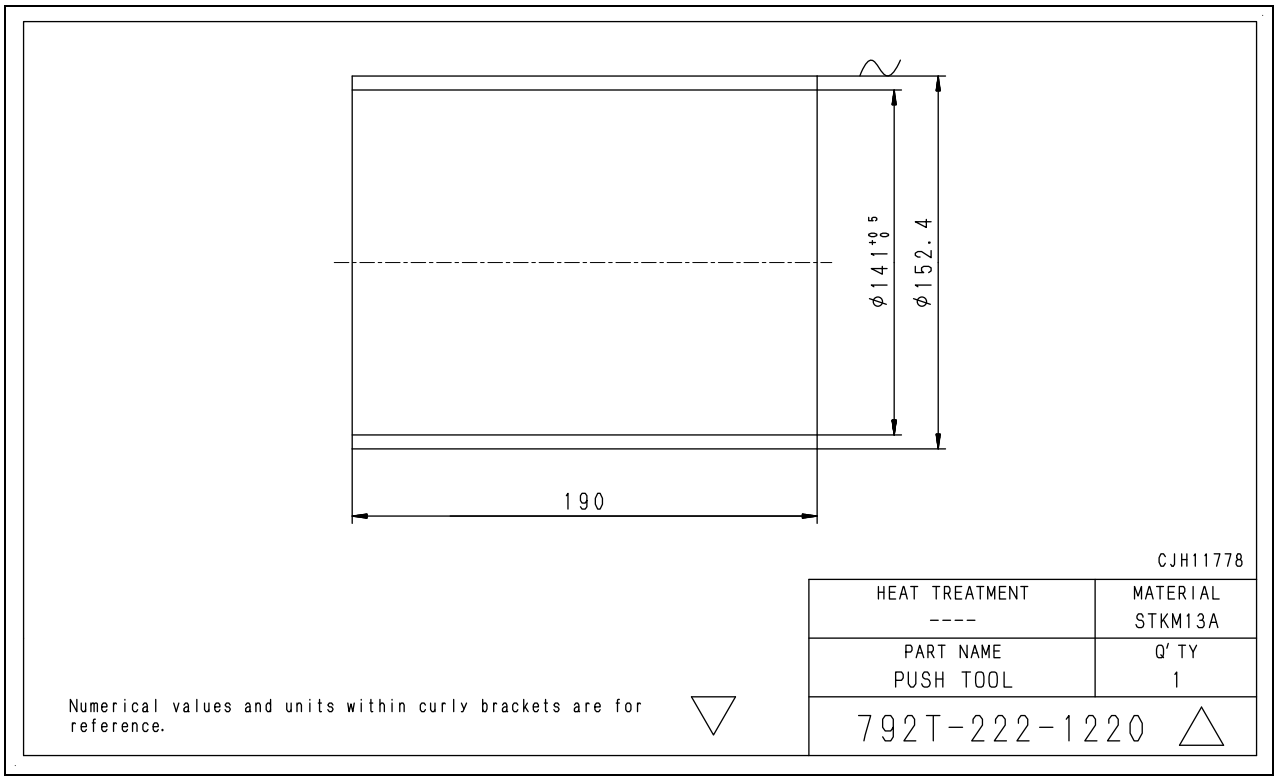
CJH11777

HEAT TREATMENT	MATERIAL
----	SS400F
PART NAME	Q'TY
PLATE	3
792T-223-1140 △	

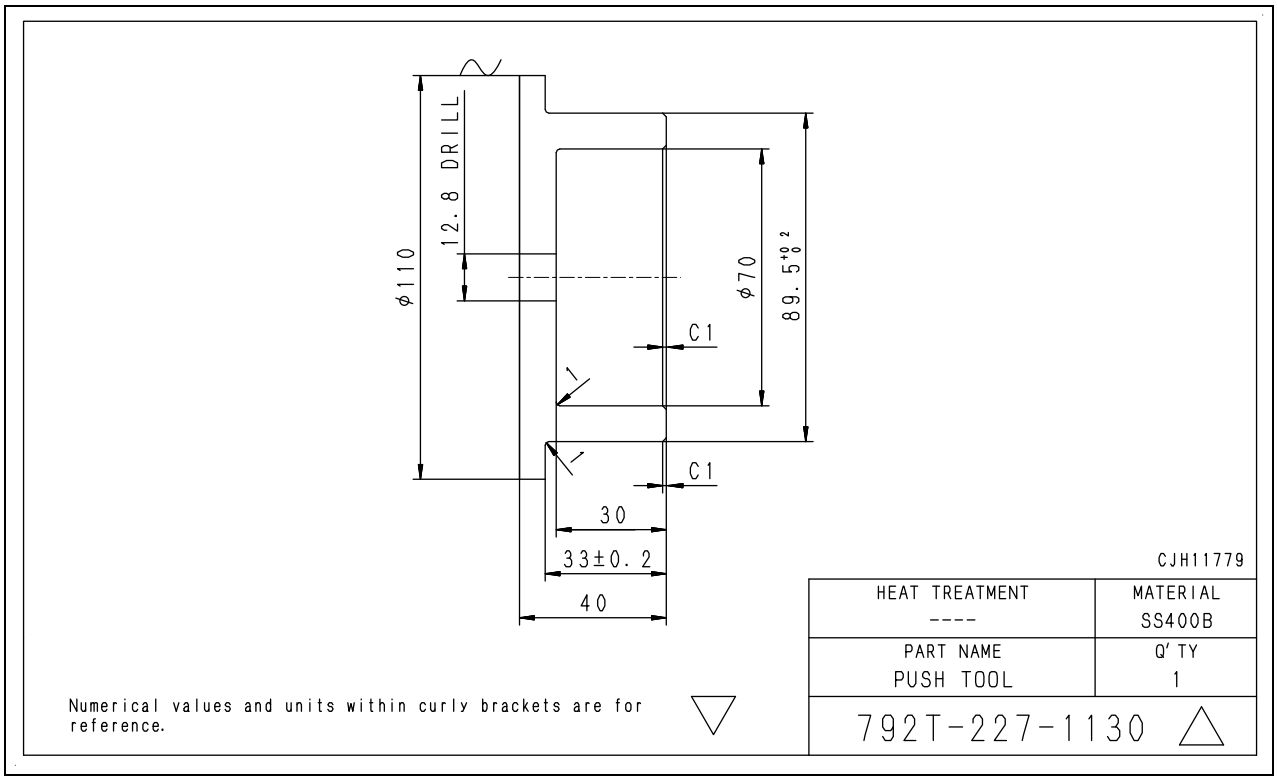
Numerical values and units within curly brackets are for reference.

Note: Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.

J2 Push tool

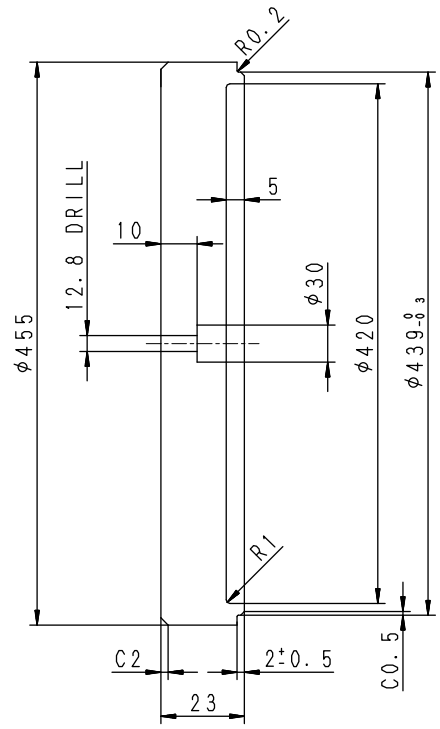


J3 Push tool



Note: Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.

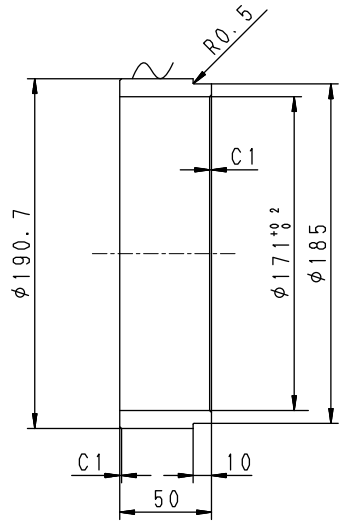
J6 Push tool



CDW01114

HEAT TREATMENT	MATERIAL
----	SS400P
PART NAME	Q'TY
PLATE	1
793T-622-1110 △	

J7 Push tool

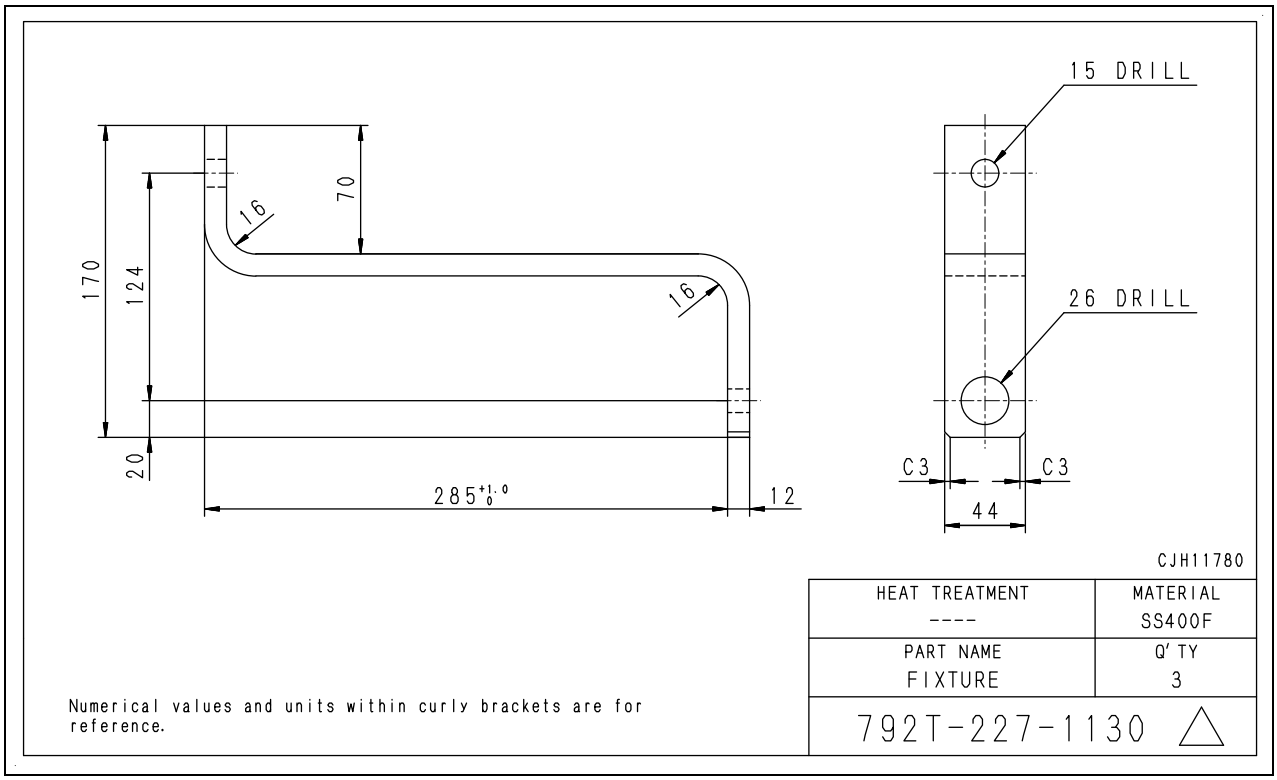


CWL03366

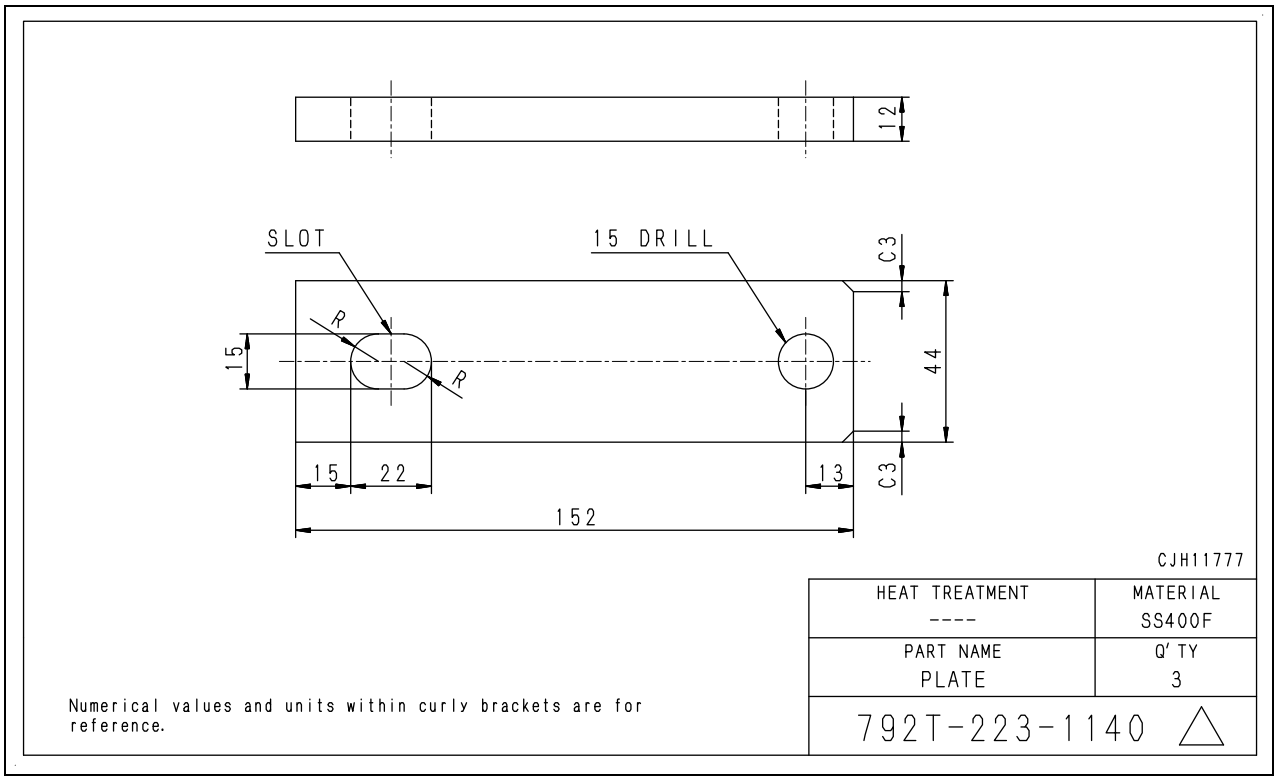
HEAT TREATMENT	MATERIAL
----	STKM13A
PART NAME	Q'TY
PUSH TOOL	----
797T-622-1240 △	

Note: Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.

J8 Fixture

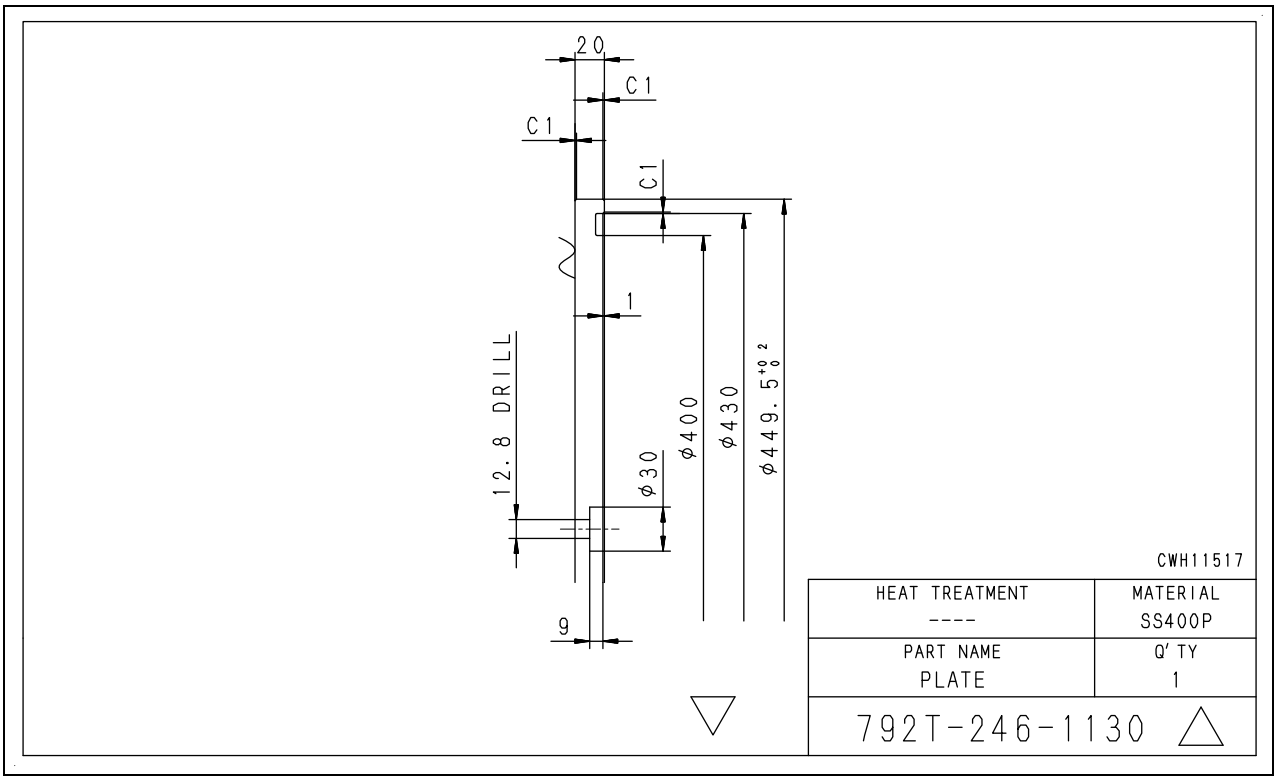


J8 Plate

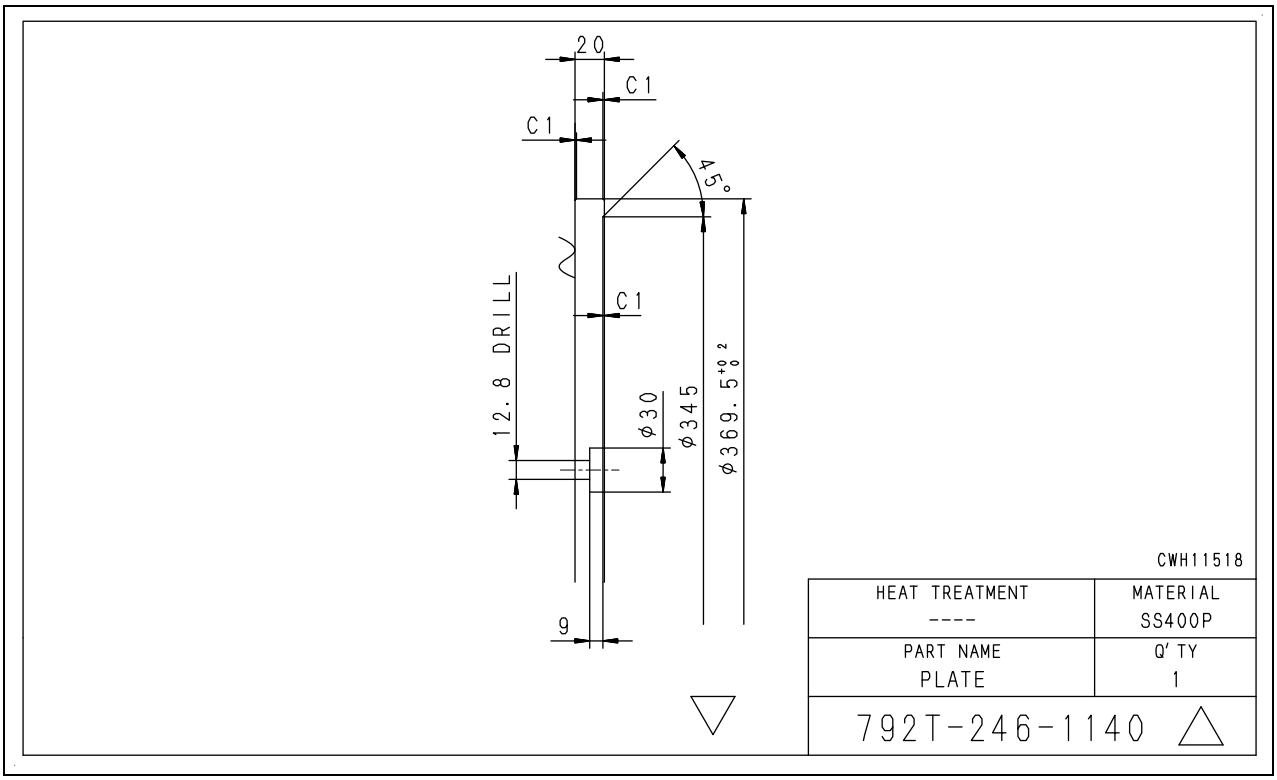


Note: Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.

K1 Plate

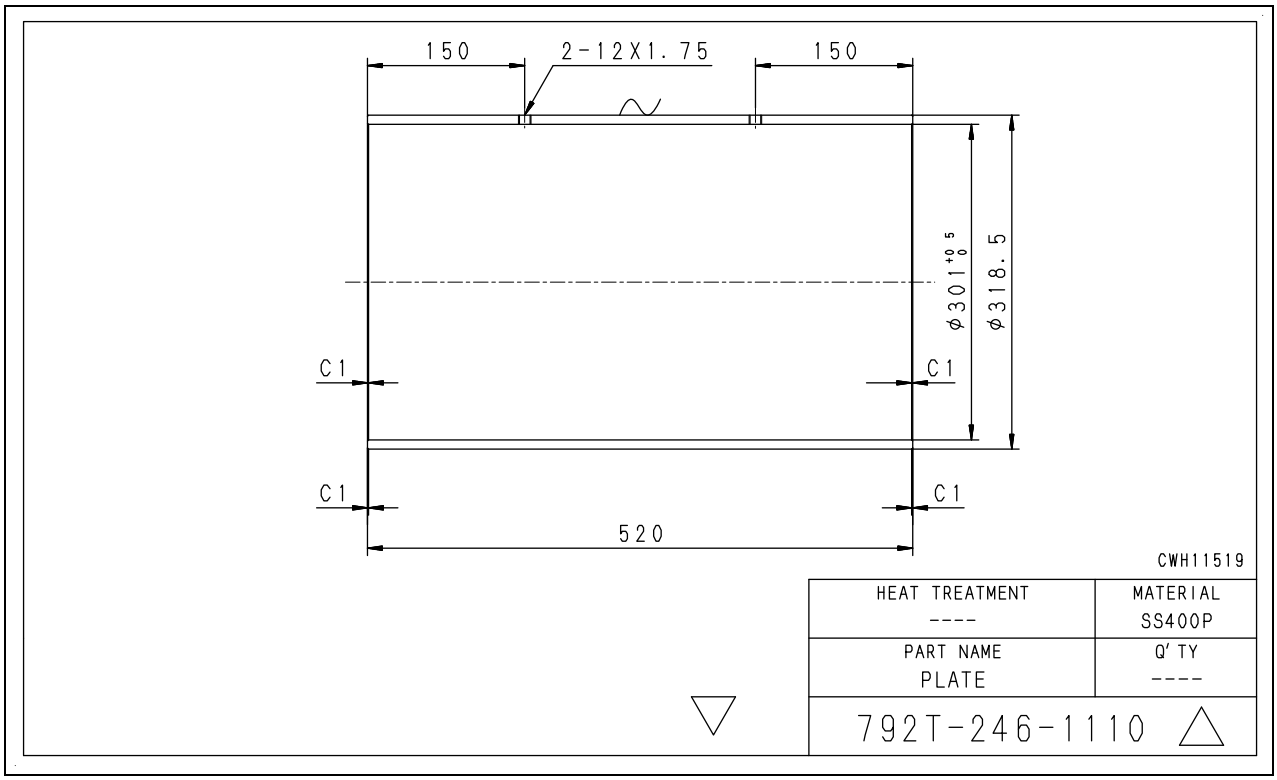


K2 Plate

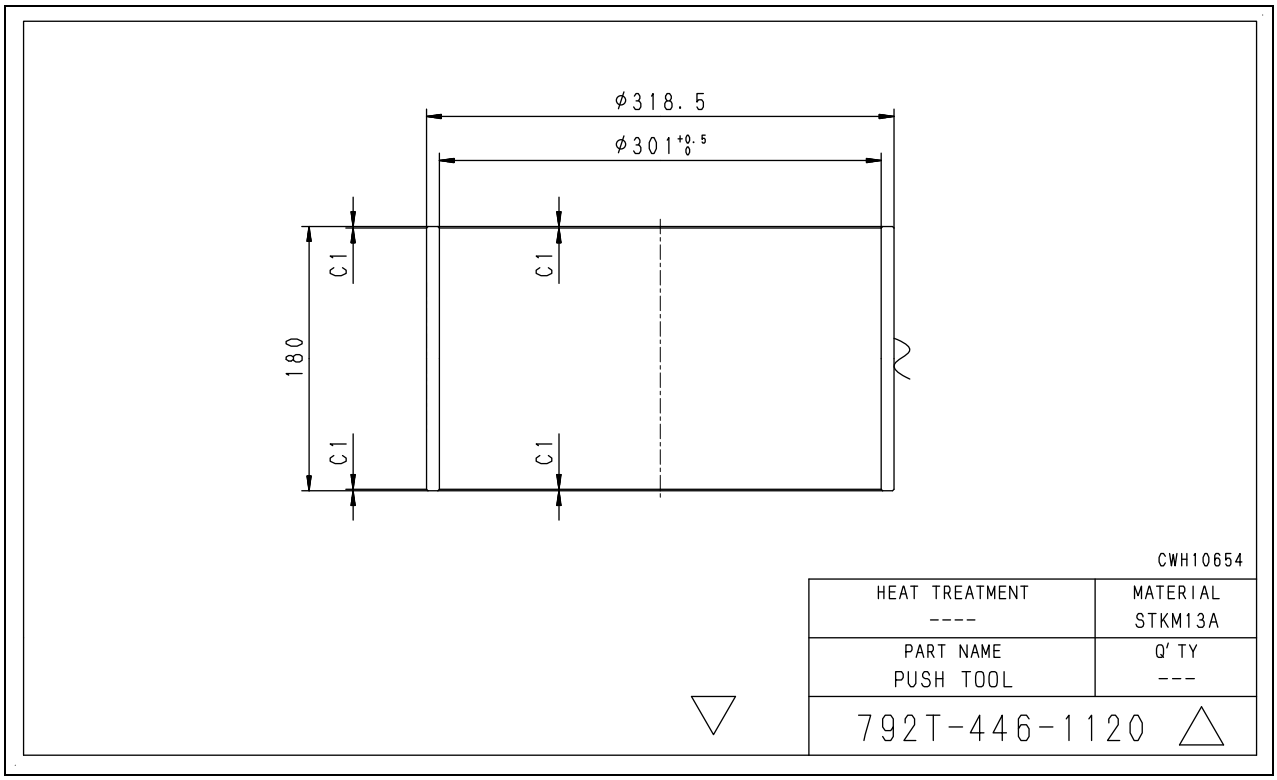


Note: Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.

K3 Push tool



K6 Push tool (For bearing of rear side hitch frame)



HM300-2 Articulated dump truck

Form No. SEN00683-04

ARTICULATED DUMP TRUCK

HM300-2

Machine model	Serial number
HM300-2	2001 and up

50 Disassembly and assembly
Engine and cooling system, Part 1

Removal and installation of fuel supply pump assembly

Special tools

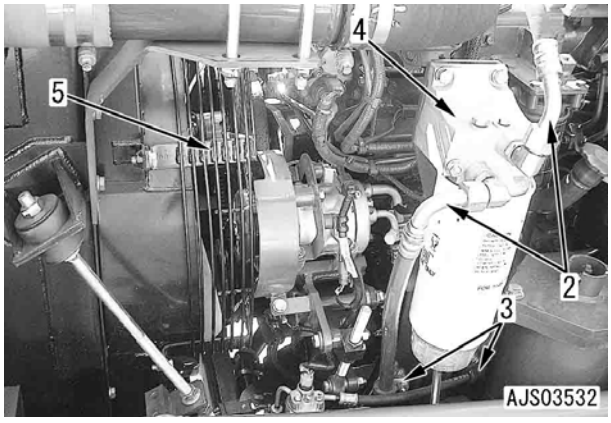
Sym-bol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
A	1	795-630-5500	Standard puller	■	1		
		01010-81090	Bolt	■	2		
		01643-31032	Washer	■	2		

Removal

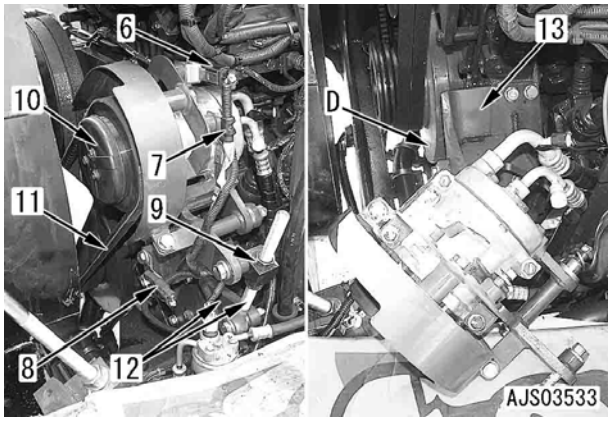
- ⚠ **Stop the machine on level ground, and turn the parking brake switch ON and stop the engine.**
- ⚠ **Chock the wheels.**
- ⚠ **Set the lock bar to the frame.**
- ⚠ **Disconnect the cable from the negative (–) terminal of the battery.**

1. Open engine undercover (1)

2. Open the engine hood.
3. Disconnect fuel hose (2).
4. Disconnect hose clamp (3).
5. Remove prefilter (4).
   ★ Remove the prefilter and bracket together.
6. Remove fan guard (5).

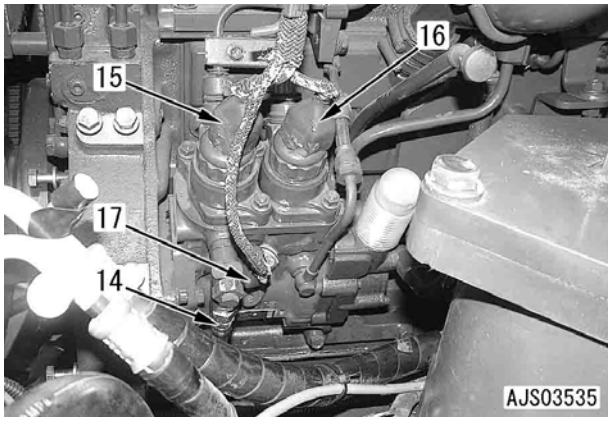


7. Disconnect connector COMP (6).
8. Disconnect wiring harness clamp (7).
9. Disconnect connector CM (8).
10. Loosen adjustment nut (9) of the air conditioner compressor.
11. Loosen the mounting bolts of air conditioner compressor (10).
12. Remove air conditioner compressor belt (11). [*1]
13. Remove rod and plate assembly (12).
14. Remove air conditioner compressor (10) from the bracket.
    ★ Do not disconnect air conditioner compressor hoses but place them on this side.
15. Remove air conditioner compressor bracket (13).
    ★ D: Damper



16. Disconnect fuel return hose (14).

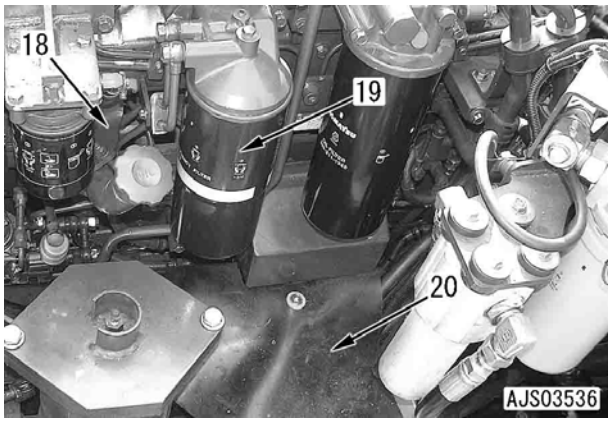
17. Disconnect connectors PCV1 (15), PCV2 (16), and G (17).



18. Disconnect bracket (18). [*2]

19. Remove fuel filter (19).
    ★ Use a filter wrench, etc. to remove the filter.

20. Remove rubber cover (20).

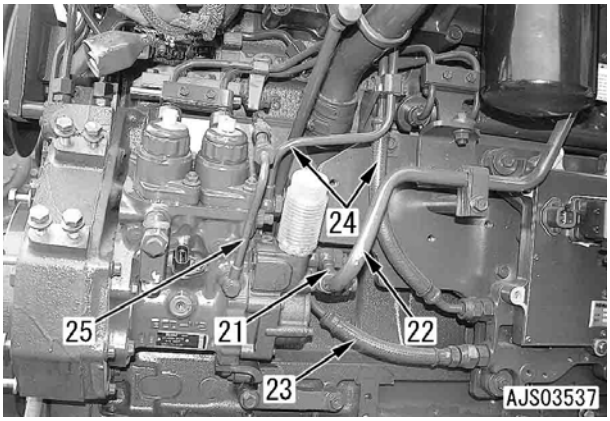


21. Remove fuel tubes (21) and (22). [*3]

22. Disconnect fuel hose (23).

23. Remove fuel tube, hose, and clamp assembly (24). [*4]

24. Remove lubrication tube (25).

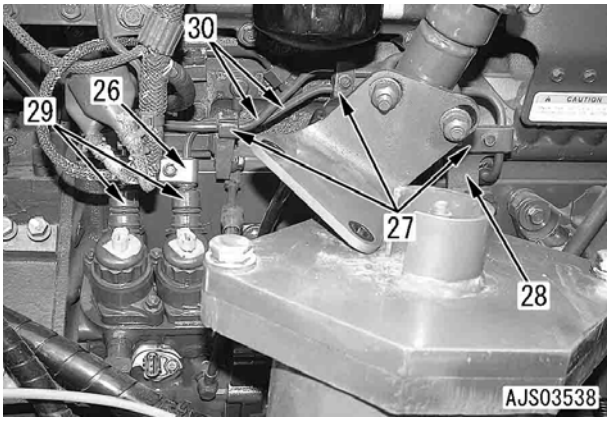


25. Disconnect clamps (26) and (27).

26. Disconnect bracket (28).

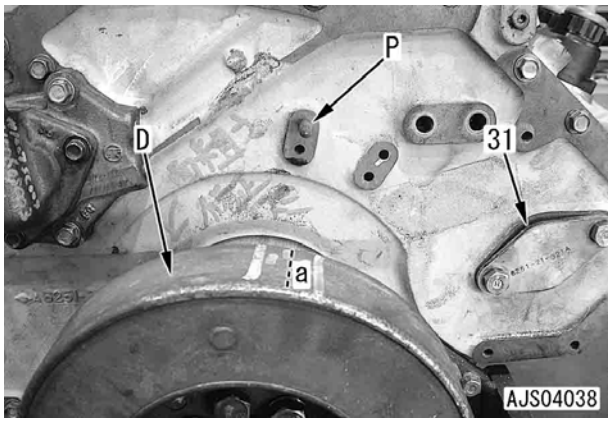
27. Remove right and left bellows (29).

28. Remove high-pressure pipe assembly (30).

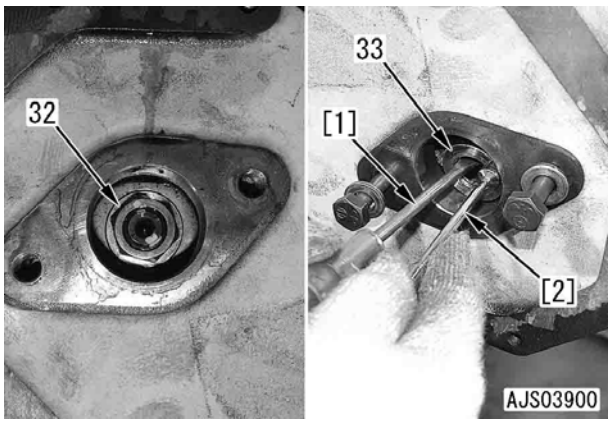


29. Remove cover (31).

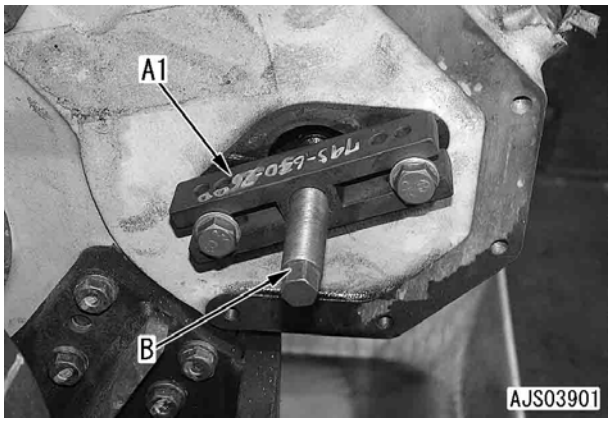
30. Rotate the crankshaft forward and set intermediate point (a) between the stamps of 2•5 TOP and 3•4 TOP on damper (D) to pointer (P) (The stamp of 1•6 TOP is set near the bottom at this time).
    ★ At this time, check that the forcing tap of the drive gear is aligned with the bolt hole of cover (31). (If not, rotate the crankshaft 1 more turn.)
    ★ At this point, the key of the pump shaft is turned clockwise by 15° from the top



31. Remove nut (32) and washer (33). [*5]
    ★ Using driver [1] and magnet [2], prevent washer (33) from falling in the case

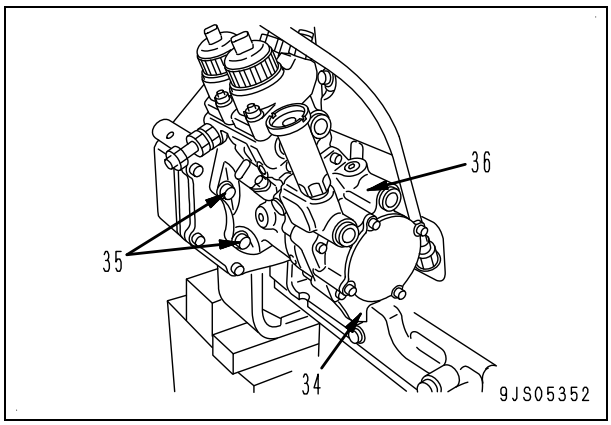


32. Install tool **A1** and tighten bolt (B) to pull the fuel supply pump shaft out of the drive gear.
    ★ Keep tool **A1** installed until the gear is installed again



33. Remove bracket (34).

34. Remove 4 bolts (35) and fuel supply pump assembly (36).

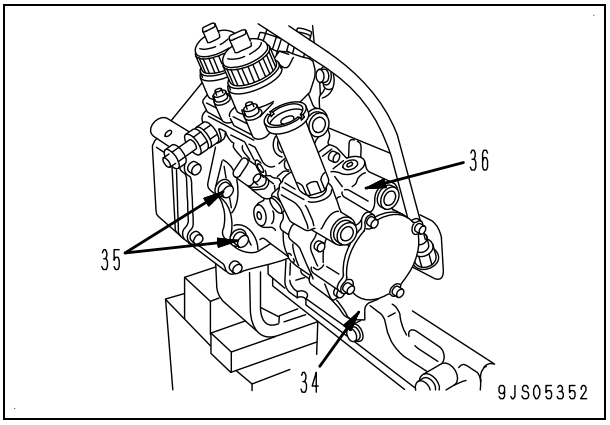


Installation

- **Fuel supply pump and high-pressure pipe assembly**

1. Install fuel supply pump assembly (36) with 4 bolts (35) and finger tighten them.
   Mounting bolts: **Liquid adhesive (LT-2)**

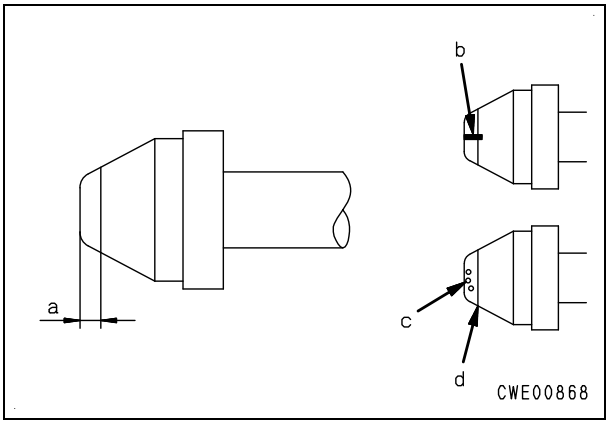
2. Finger tighten bracket (34).



⚠ Don't correct high-pressure tube by bending it for re-use.
⚠ Always use genuine clamp for fixing high-pressure pipe. Strictly observe the tightening torque requirements.

★ Check the following matters before installing high-pressure pipe. If there is any abnormality, replace the high-pressure tube to prevent possible fuel leakage.

- Check the taper seal portion (between the tip of section (a) and 2 mm from the end) of the joint section for any vertical slit (b) and/or dent (c) visually recognizable.
- Check part (d) (from the tip of the taper seal portion to 2 mm from the end) for any stepped wear (fatigue) your finger nail may catch



3. Finger tighten high-pressure pipe assembly (30).

4. Permanently tighten the sleeve nuts of high-pressure pipe assembly (30).
   Common rail side:
   39.2 – 58.8 Nm{4 – 6 kgm}
   Pump side:**39.2 – 49 Nm{4 – 5 kgm}**

5. Permanently tighten mounting bolts (35) of fuel supply pump assembly (36).

6. Permanently tighten the cylinder block side of bracket (34) and then permanently tighten the fuel supply pump side.
   Fuel supply pump side:
   19.6 – 29.4 Nm{2.0 – 3.0 kgm}

7. Install bellows (29) to each high-pressure pipe.
   ★ When installing, take care of the direction of the slit.
   - Pump side: To be directed to the block.
   - Common rail side: To be directed down.

8. Finger tighten lubrication tube (25).

9. Finger tighten clamp (27-2) and then permanently tighten it.

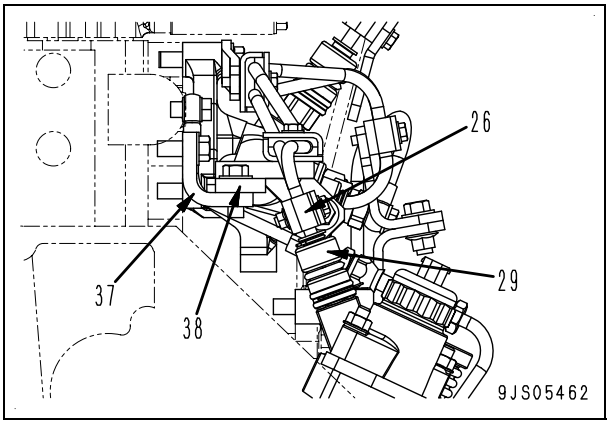
10. Finger tighten bracket (37) and clamp (38) and then permanently tighten them.

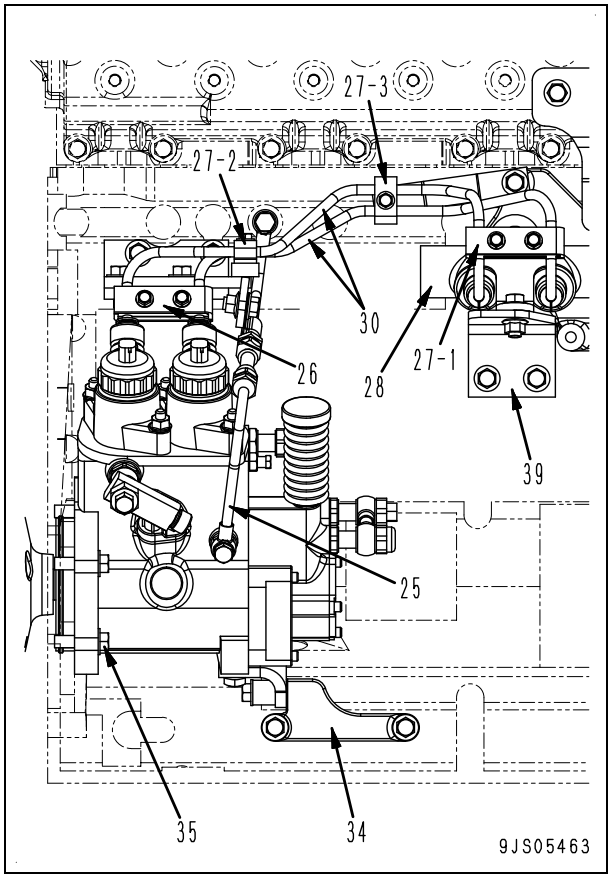
11. Finger tighten brackets (39) and (28) and clamp (27-1) and then permanently tighten them.

12. Finger tighten clamp (27-3) and then permanently tighten it.

13. Permanently tighten lubrication tube (25).
    Lubrication tube (25) joint bolt:
    9.8 – 12.7 Nm{1.0 – 1.3 kgm}

14. Finger tighten clamp (26) and then permanently tighten it.
    Clamp mounting bolt:
    11.8 – 14.7 Nm{1.2 – 1.5 kgm}





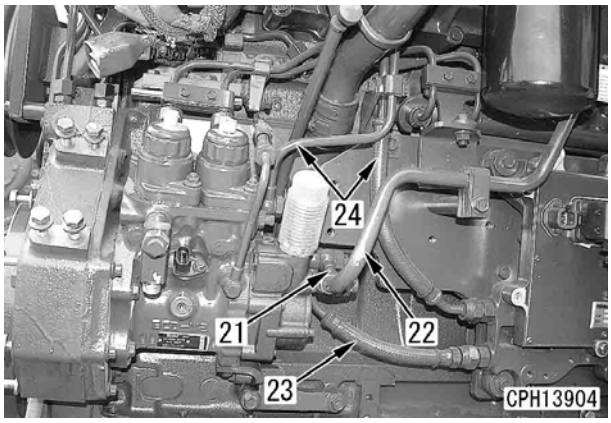
- Carry out the rest of installation in the reverse order to removal.

[*1]
Adjust the air conditioner compressor belt tension. For details, see Testing and adjusting, "Testing and adjusting air conditioner compressor belt tension".

[*2]
Return hose joint bolt:
14.8 – 19.6 Nm {1.5 – 2.0 kgm}

[*3]
Fuel filler clamp:
10.8 – 26.5 Nm {1.1 – 2.7 kgm}

[*4]
Joint bolt on fuel supply pump side of tubes (21) – (24):
14.8 – 19.6 Nm {1.5 – 2.0 kgm}
Sleeve nut on pump (upper) side of tube (22):
84 – 132 Nm {8.5 – 13.5 kgm}
Clamp of tube (22):
27 – 34 Nm {2.8 – 3.5 kgm}
Joint bolt on filter (upper) side of tube-hose-clamp assembly (24):
24.5 – 34.3 Nm {2.5 – 3.5 kgm}
Sleeve nut on engine controller (lower) side of tube-hose-clamp assembly (24):
84 – 132 Nm {8.5 – 13.5 kgm}
Clamp of tube-hose-clamp assembly (24):
27 – 34 Nm {2.8 – 3.5 kgm}



[*5]
Gear mounting nut:
127 – 147 Nm {13 – 15 kgm}

⚠ Check that each high-pressure pipe and wiring harness are at least 10 mm apart from each other.

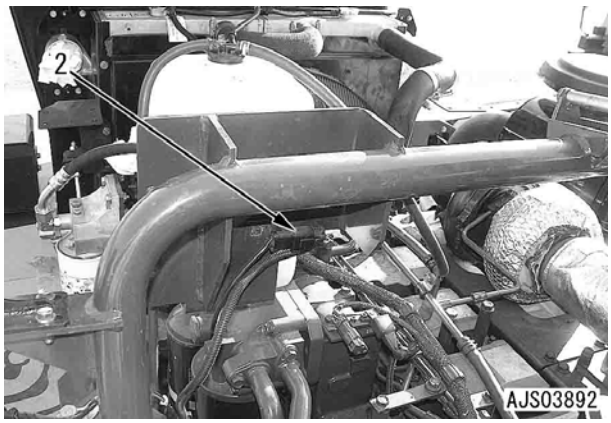
Removal and installation of fuel injector assembly

Removal

- ⚠ **Stop the machine on level ground.**
- ⚠ **Turn the parking brake switch ON and stop the engine.**
- ⚠ **Chock the wheels.**
- ⚠ **Set the lock bar to the frame.**
- ⚠ **Disconnect the cable from the negative (–) terminal of the battery.**

1. Open engine hood (1).

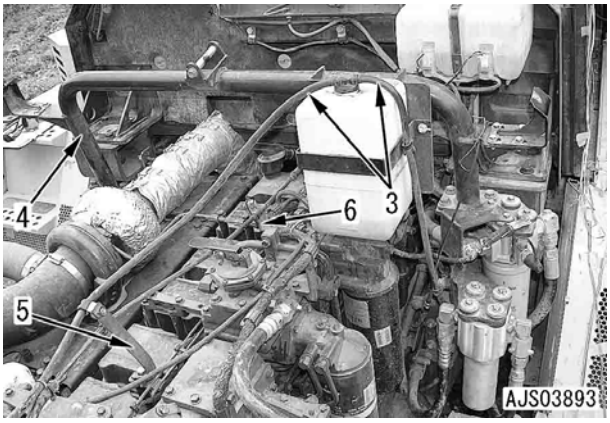
2. Disconnect connector M01 (2) from the rear of the reservoir tank.



3. Disconnect reservoir tank hoses (3).

4. Remove bar (4).

5. Disconnect hose and bracket assemblies (5) and (6).



6. Disconnect fuel hose (7).

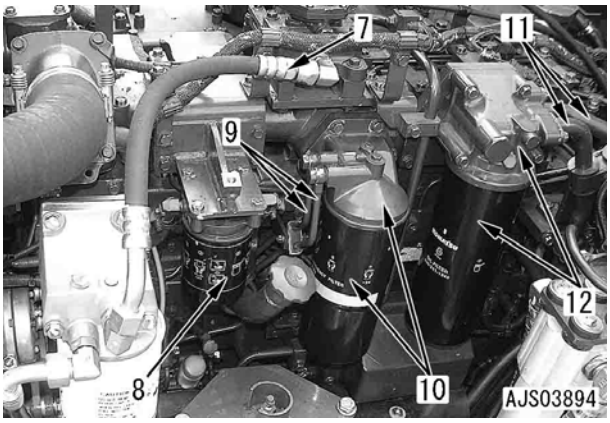
7. Disconnect corrosion resistor (8). [*1]

8. Remove tube and clamp assembly (9). [*2]

9. Remove filter and bracket assembly (10).

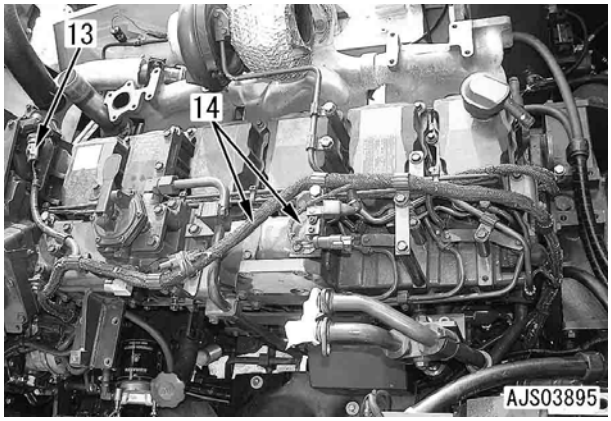
10. Disconnect 2 tubes (11). [*3]

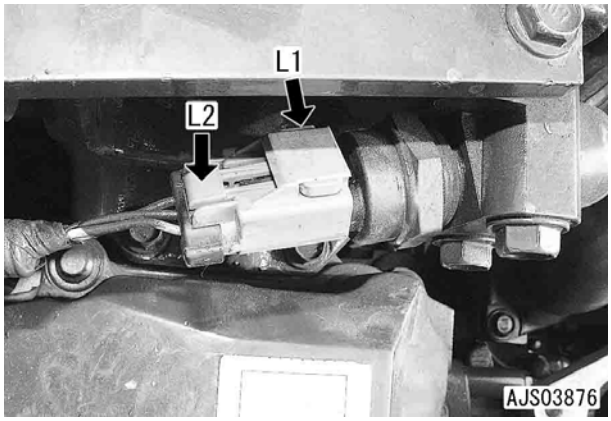
11. Remove filter and bracket assembly (12). [*3]



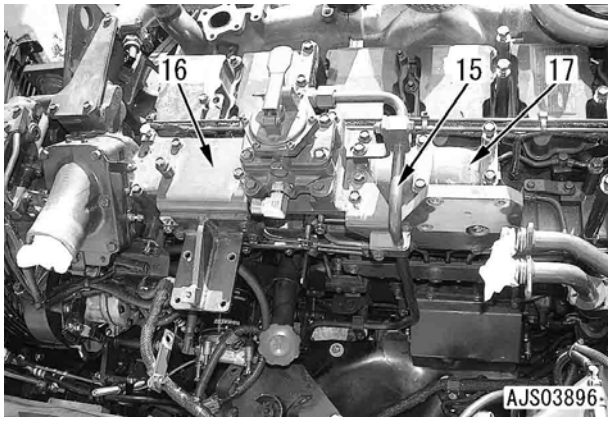
12. Disconnect connector PEVA (13) as explained below.
    ★ After serial number 561328, connector PEVA is abolished.
    1) Slide lock (L1).
    2) While pressing lock (L2), pull out the connector.

13. Disconnect wiring harness and plate assembly (14).

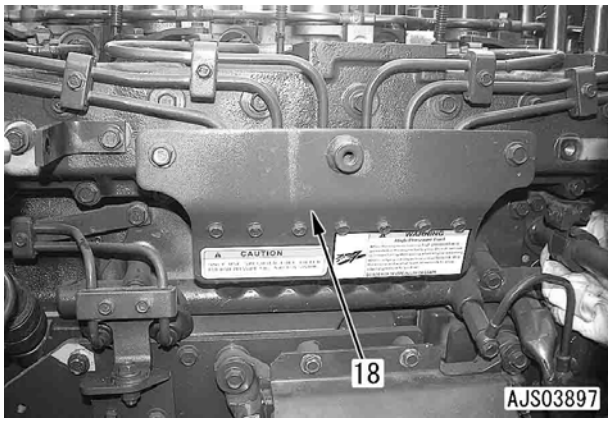




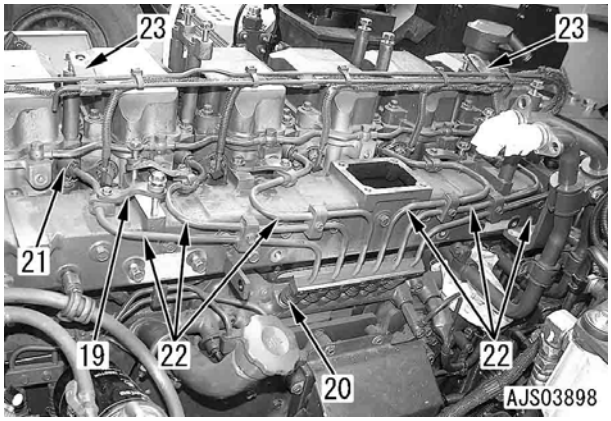
14. Remove fuel tube (15). [*4]
15. Remove bracket (16).
    ★ The lengths of the bolts are different from each other. Take care.
16. Remove diffuser and pump assembly (17).
    Diffuser and pump assembly:**25kg**



17. Remove cover (18). [*5]

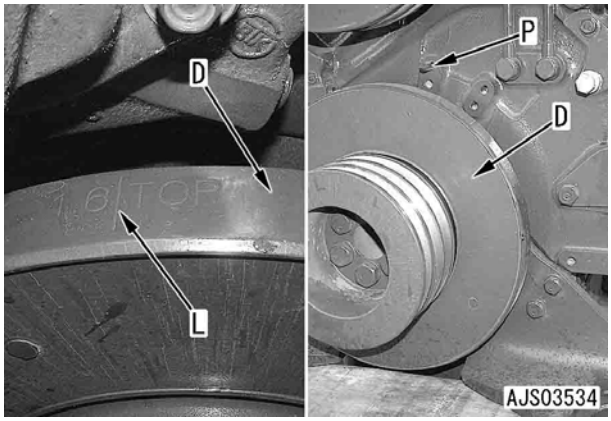


18. Remove 6 clamps (19). [*5]
19. Remove 6 bellows (20) and 6 bellows (21). [*5]
20. Remove high-pressure pipe assembly (22). [*5]
21. Remove 2 clamps (23)



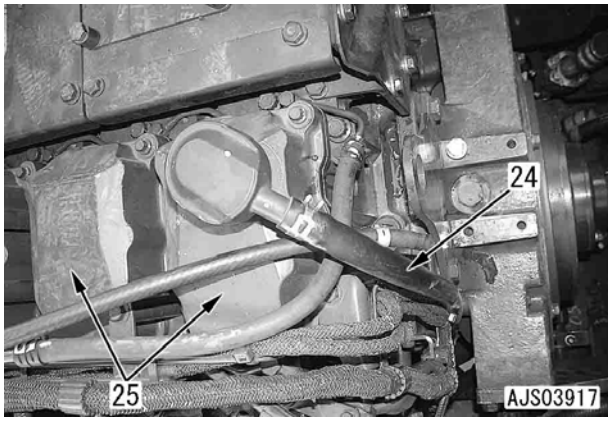
22. Remove the air conditioner compressor. For details, see "Removal of fuel supply pump assembly". (Do not disconnect the air conditioner hoses.)

23. Using the side hole of the fan pulley, set stamped line **L** of 1•6 TOP of damper (D) to pointer **P**.
    ★ Rotate the crankshaft. For details, see Testing and adjusting, Testing and adjusting valve clearance.



24. Remove blow-by hose (24).

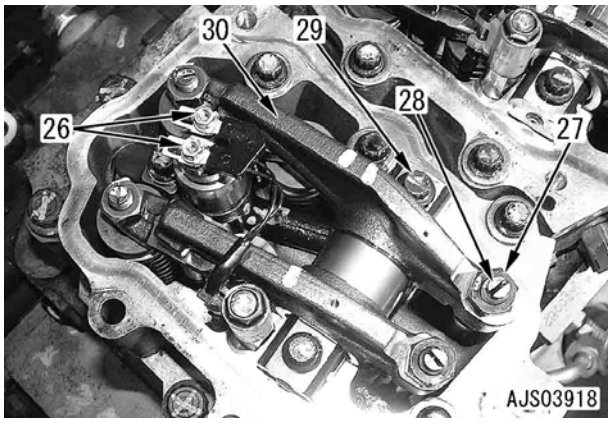
25. Remove cylinder head cover (25).



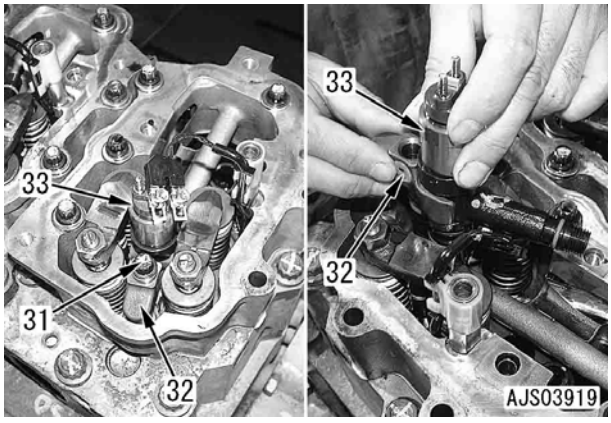
26. Disconnect 2 capture nuts (26).
    ★ The capture nuts are so installed that they will not fall.

27. Loosen locknut (27) and adjustment screw (28).

28. Remove mounting bolts (29) and rocker arm and shaft assembly (30).



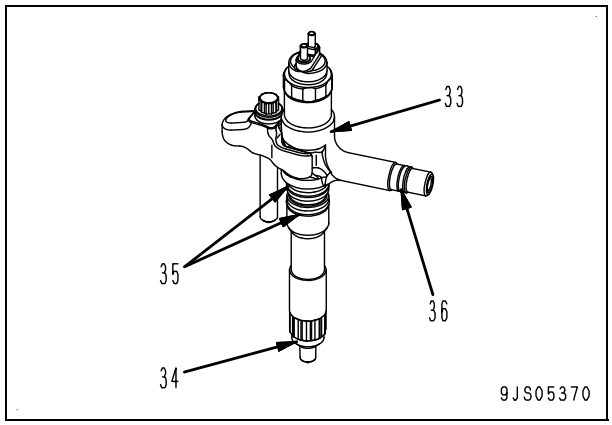
29. Remove holder mounting bolts (31) and then remove holder (32) and fuel injector assembly (33) together.
    ★ Never hold the solenoid valve unit at the top of the injector with pliers, etc



Installation

- **Fuel injector assembly**

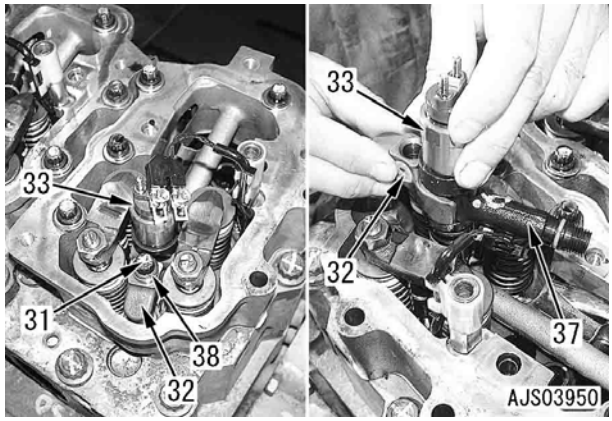
1. Install gasket (34) and O-rings (35) and (36) to fuel injector assembly (33).
   O-ring:**Engine oil (EO30-DH)**



2. Insert holder (32) in fuel injector assembly (33) and insert inlet connector (37) in the rocker housing, directing it to the hole to insert the high-pressure pipe.

3. Install spherical washer (38) to bolt (31) and temporarily tighten holder (32).
   ★ Check that the holder is inserted firmly to the end.
   Spherical part of washer:
   Engine oil (EO30-DH)

4. Permanently tighten bolt (31) of holder (32).
   Holder mounting bolt:
   58.8 – 73.5 Nm{6.0 – 7.5kgm}

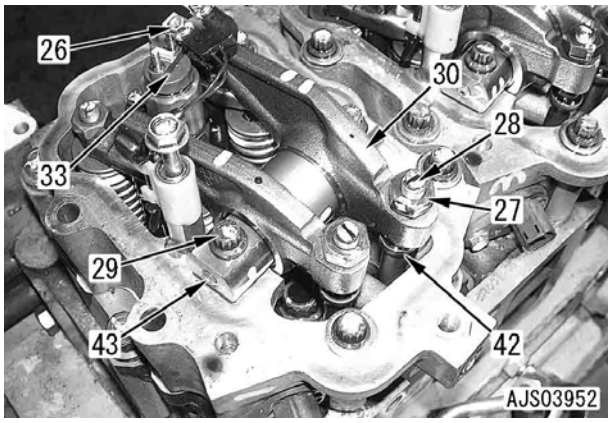


- **Rocker arm and shaft assembly**

1. Set rocker arm and shaft assembly (30).
   ★ When installing the rocker arm shaft, direct its larger mounting hole end down and its ball plug (43) end forward.
2. Check that the ball of adjustment screw (28) is fitted in push rod socket (42) and tighten mounting bolts (29).
   ★ Before installing, clean the oil holes.
   Mounting bolt:
   58.8 – 73.5 Nm {6.0 – 7.5 kgm}
3. Adjust the valve clearance. For details, see Testing and adjusting, "Testing and adjusting valve clearance".
   Locknut (27):
   58.8 – 73.5 Nm {6 – 7.5 kgm}

- **Fuel injector wiring harness**

1. Tighten 2 capture nuts (26) of the wiring harness into injector assembly (33).
   Capture nut:
   2.0 – 2.4 Nm {0.2 – 0.24 kgm}

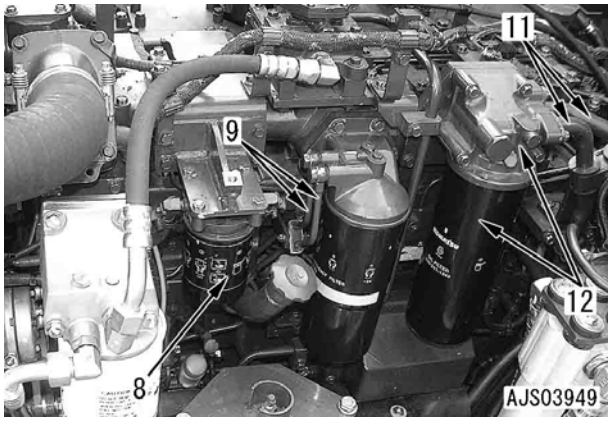


- Carry out the rest of installation in the reverse order to removal.

[*1]
Corrosion resistor mounting bolt:
44.1 – 58.8 Nm {4.5 – 6.0 kgm}

[*2]
oint bolt on filter (upper) side of tube and clamp assembly (9):
24.5 – 34.3 Nm {2.5 – 3.5 kgm}
oint bolt on fuel supply pump (lower) side of tube and clamp assembly (9):
14.8 – 19.6 Nm {1.5 – 2.0 kgm}
Sleeve nut on engine controller (lower) side of tube and clamp assembly (9):
84 – 132 Nm {8.5 – 13.5 kgm}
Clamp of tube and clamp assembly (9):
27 – 34 Nm {2.8 – 3.5 kgm}

[*3]
Filter and bracket assembly (12) and tube (11)
1. Finger tighten filter and bracket assembly (12).
2. Finger tighten tube (11).
3. Permanently tighten tube (11).
4. Permanently tighten filter and bracket assembly (12).



[*4]
Sleeve nut on pump (upper) side of tube (15):
84 – 132 Nm {8.5 – 13.5 kgm}
Clamp of tube (15):
27 – 34 Nm {2.8 – 3.5 kgm}
Joint bolt on fuel supply pump (lower) side of tube (15):
14.8 – 19.6 Nm {1.5 – 2.0 kgm}

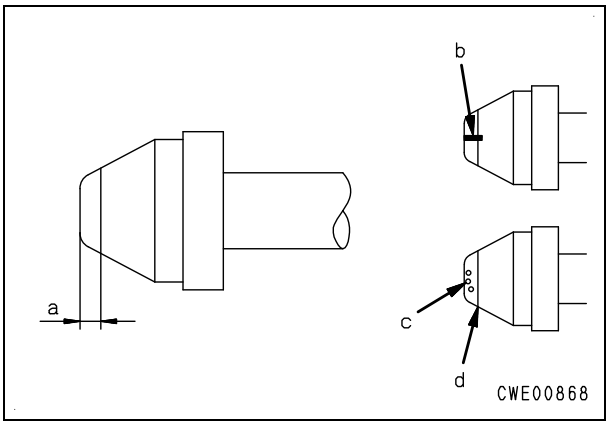
[*5]

⚠ **Don't correct high-pressure tube by bending it for re-use.**

⚠ **Always use genuine clamp for fixing high-pressure pipe. Strictly observe the tightening torque requirements.**

★ Check the following matters before installing high-pressure pipe. If there is any abnormality, replace the high-pressure tube to prevent possible fuel leakage.

- Check the taper seal portion (between the tip of section (a) and 2 mm from the end) of the joint section for any vertical slit (b) and/or dent (c) visually recognizable.
- Check part (d) (from the tip of the taper seal portion to 2 mm from the end) for any stepped wear (fatigue) your finger nail may catch.



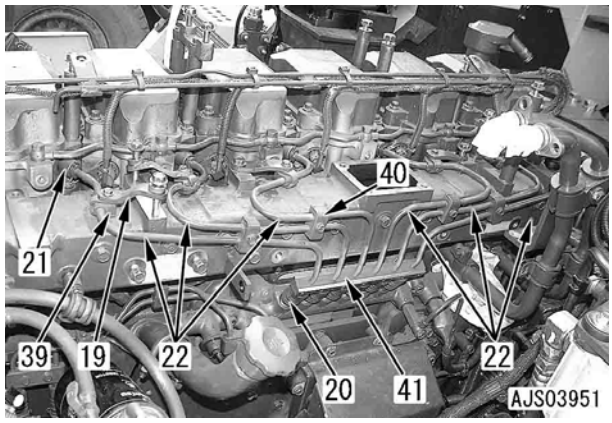
1. Finger tighten high-pressure pipe assembly (22).
   ★ Loosen all of the high-pressure pipe clamps.

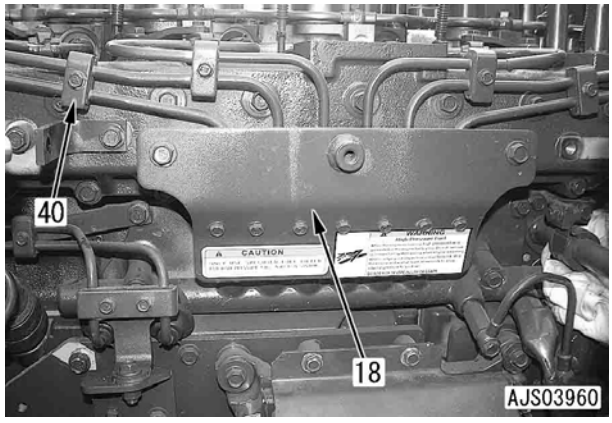
2. Permanently tighten high-pressure pipe assembly (22).
   Sleeve nut of high-pressure pipe assembly (22) (on both sides):
   39.2 – 49 Nm {4 – 5 kgm}

3. Install 6 bellows (20) and 6 bellows (21) each to each high-pressure pipe.
   ★ When each bellows, take care of the direction of the slit.
   - Fuel injector side: To be directed down.
   - Common rail side: To be directed to cylinder block (upper) side.

   ★ 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.

4. Installation procedure for clamps and brackets
   Mounting bolt of clamp and bracket (Permanently tightening):
   11.8 – 14.7 Nm {1.2 – 1.5 kgm}
   1) Finger tighten 6 clamps (39) and 6 brackets (19).
   2) Permanently tighten clamps (39) and brackets (19) in order.
   3) Finger tighten 4 hollow clamps (40).
   4) Finger tighten clamp (41) to bracket (18) and then permanently tighten it.
   5) Permanently tighten bracket (18).
   6) Permanently tighten 4 hollow clamps (40).





[*6]

- **Cylinder head cover**
  ★ Check that the O-ring is installed without being twisted.

  Mounting bolt:
  9.8 ± 1 Nm {1.0 ± 0.1 kgm}

⚠ **Check that each high-pressure pipe and wiring harness are at least 10 mm apart from each other.**

Removal and installation of cylinder head assembly

Special tool

Sym-bol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
A2	790-331-1110	Wrench (Angle)	●	1		
X1	792-454-1100	Pump assembly	●	1	N	

Removal

⚠ **When tilting the cab, observe the following precautions to prevent a serious injury or fatal accident caused by fall of the cab.**

⚠ **To prevent interference between the cab and the dump body, set the steering in a straight ahead position and stop the machine on the level ground.**

⚠ **Lock the dump lever with the dump lever lock knob.**

⚠ **Turn the parking brake switch ON and chock the wheels.**

⚠ **Set the lock bar to the frame and lock front and rear frame.**

- **Precautions in tilting cab**

⚠ **When tilting the cab, check that the lock lever is fixed securely.**

⚠ **Do not start the engine while the cab is tilted.**

⚠ **When it is obliged to start the engine for testing etc., check that there is nobody under the cab.**

⚠ **Do not operate the gear shift lever or dump lever.**

⚠ **Do not give a large shock to the machine.**

⚠ **Do not tilt the cab while it is loaded.**

⚠ **Disconnect the cable from the negative (–) terminal of the battery.**

⚠ **If the coolant temperature in the radiator is high, you may be scalded. In this case, wait until the coolant temperature lowers and then drain the coolant.**

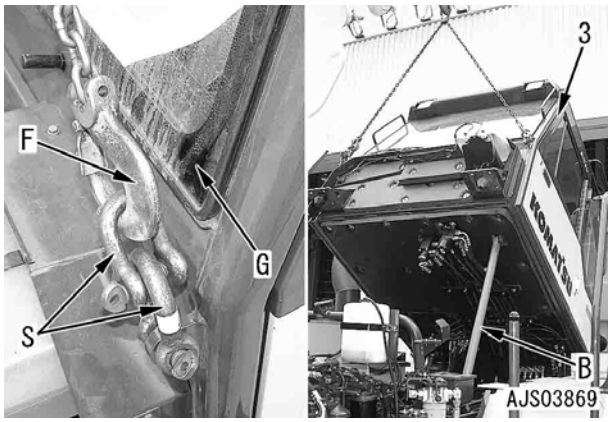
1. Open engine undercover (1).

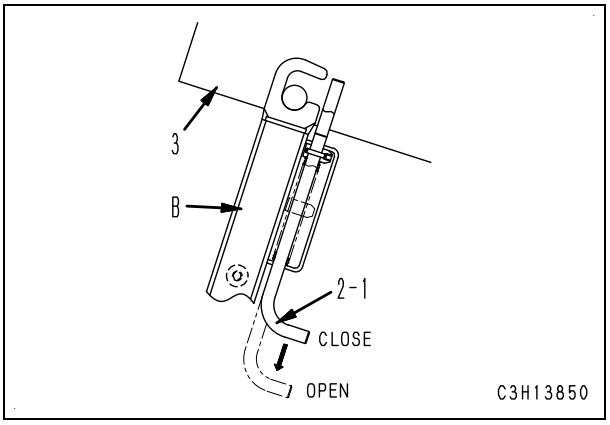
2. Open engine hood (2).

3. Drain the coolant.
   Coolant: **59 ℓ**

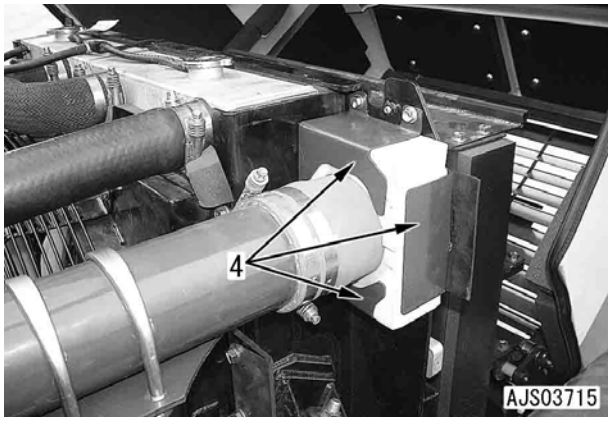
4. Sling operator's cab assembly (3) and tilt it up.
   ★ Use 2 shackles (S) so that hook (F) of the sling will not hit glass (G) of the cab assembly.

5. Pull lock lever (2-1) and set lock bar (B) with the care the direction of the lock bar (B).
   ⚠ **Check that the lock lever (2-1) closes and the operator cab assembly (3) is held securely in position by the lock bar (B).**
   For details, see Testing and adjusting, Method of tilting up cab.
   ★ Pump assembly **X1** is necessary for tilting up by tilt cylinder.





6. Remove cover (4).



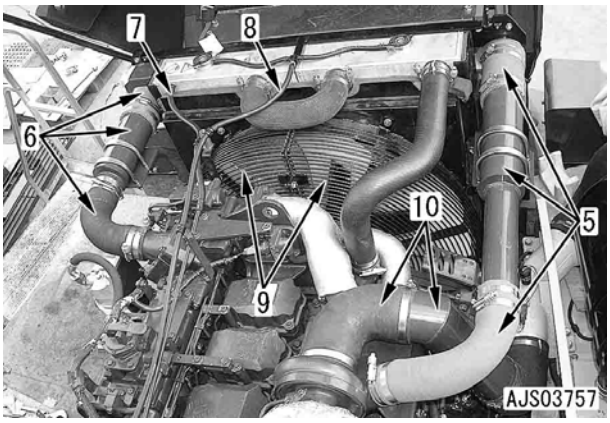
7. Remove air tube-hose-bracket assemblies (5) and (6). [*1]

8. Disconnect air vent hose (7).

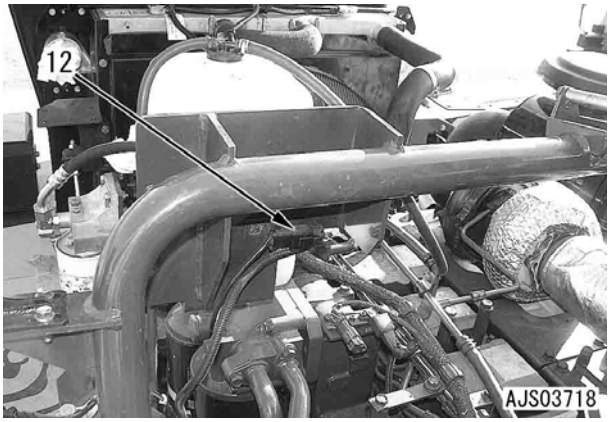
9. Disconnect reservoir tank hose (8).

10. Remove fan guard (9).

11. Remove air tube and hose assembly (10). [*2]

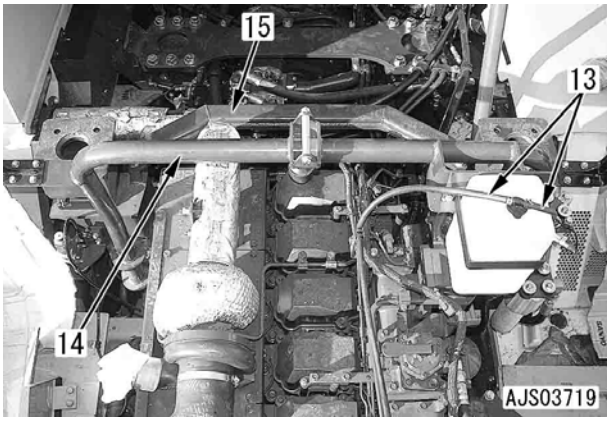


12. Disconnect connector M01 (12) from the rear of the reservoir tank.



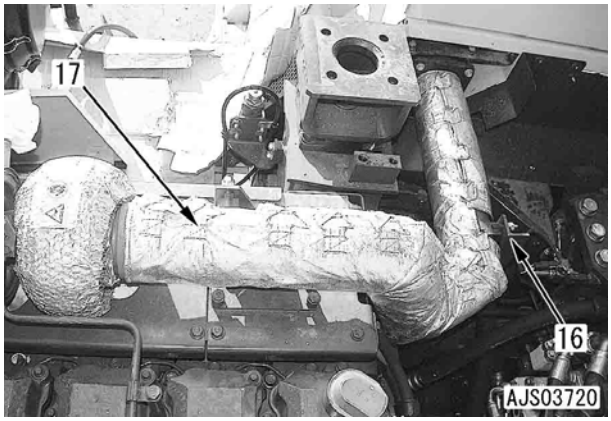
13. Disconnect reservoir tank hose (13).

14. Remove bars (14) and (15).



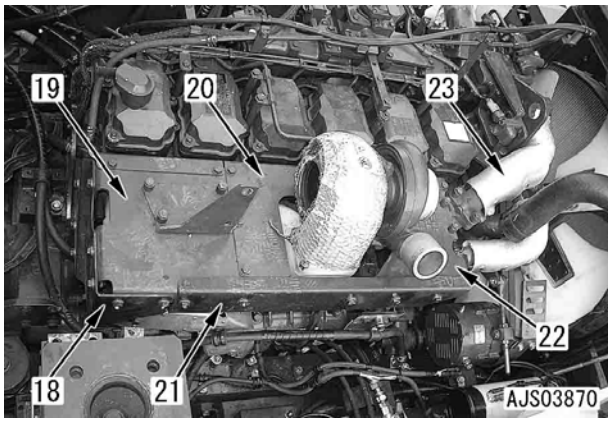
15. Loosen the mounting bolts of bracket (16).

16. Remove exhaust tube (17).



17. Remove covers (18) – (22).

18. Remove bypass tube (23). [*3]



19. Remove bracket (24).

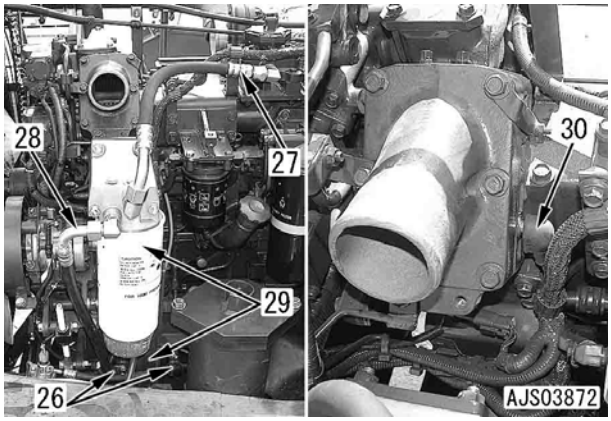
20. Remove heat insulation cover (25).

21. Disconnect hose clamp (26).

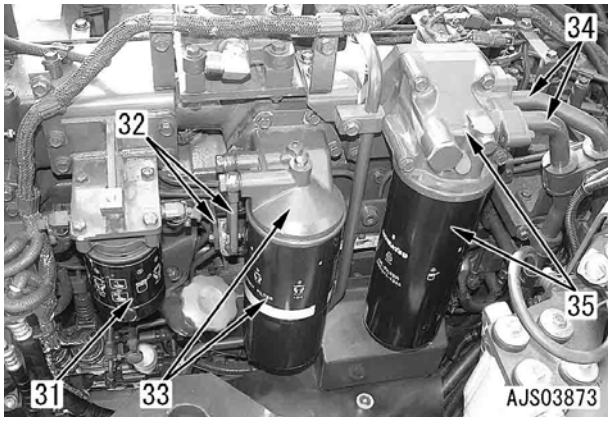
22. Disconnect fuel hoses (27) and (28).

23. Remove filter and bracket assembly (29).

24. Disconnect heater terminal (30). [*4]



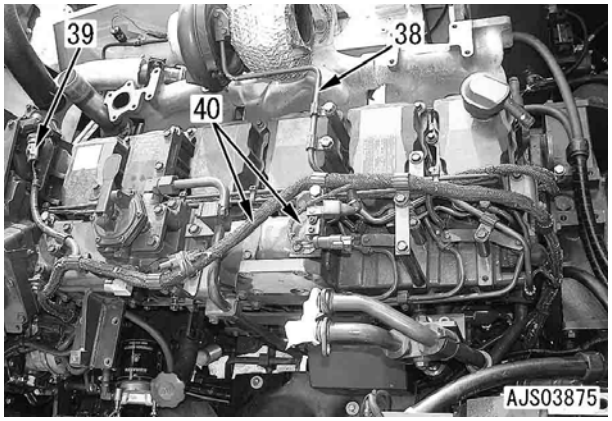
25. Disconnect corrosion resistor (31). [*5]
26. Remove tube and clamp assembly (32). [*6]
27. Remove filter and bracket assembly (33).
28. Disconnect 2 tubes (34). [*7]
29. Remove filter and bracket assembly (35). [*7]

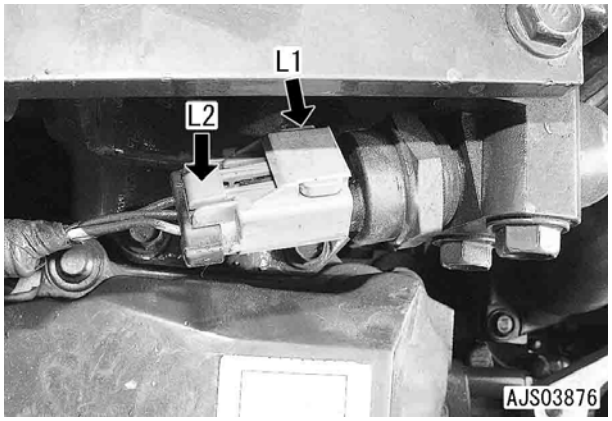


30. Disconnect blow-by hose (36).
31. Remove hose and bracket assembly (37).

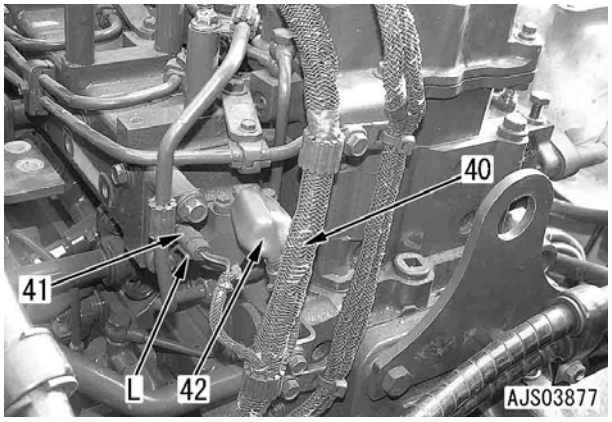
32. Remove turbocharger lubrication tube (38). [*8]
33. Disconnect connector PEVA (39) according to the following procedure.
    ★ After serial number 561328, connector PEVA is abolished.
    1) Slide lock (L1).
    2) While pressing lock (L2), pull out the connector.

34. Disconnect wiring harness and plate assembly (40).



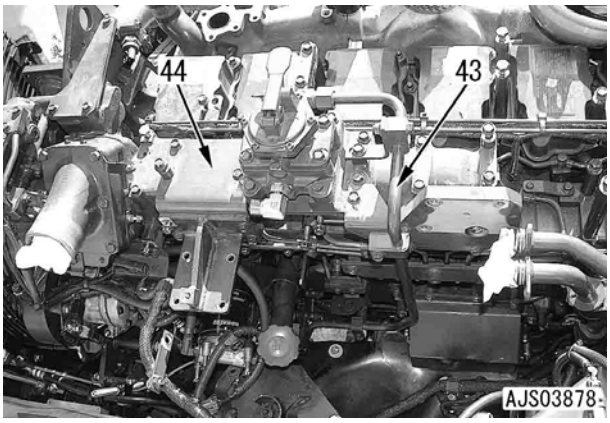


35. Disconnect connectors TIM (41) and PIM (42).
    ★ While lowering lock (L), pull out connector (41).
36. Disconnect wiring harness and plate assembly (40).



37. Remove fuel tube (43). [*9]

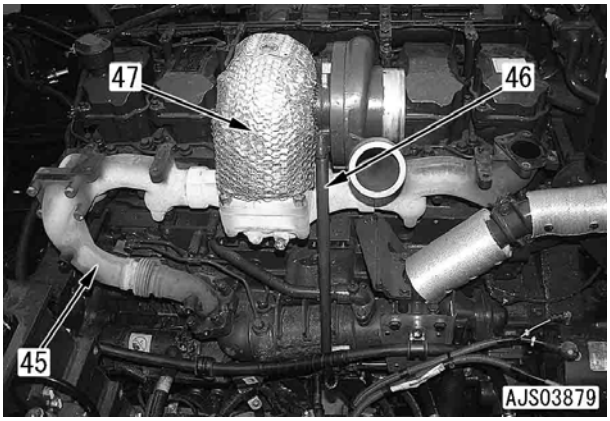
38. Remove bracket (44).
    ★ The lengths of the bolts are different from each other. Check them.



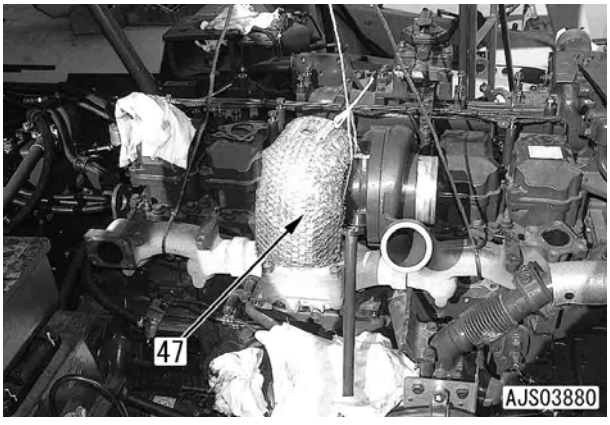
39. Remove exhaust tube (45). [*10]

40. Disconnect turbocharger drain tube (46).

41. Temporarily sling turbocharger and exhaust manifold assembly (47).



42. Lift off turbocharger and exhaust manifold assembly (47). [*11]
    Turbocharger and exhaust manifold assembly: **40 kg**



43. Disconnect cable ties (48) and (49).

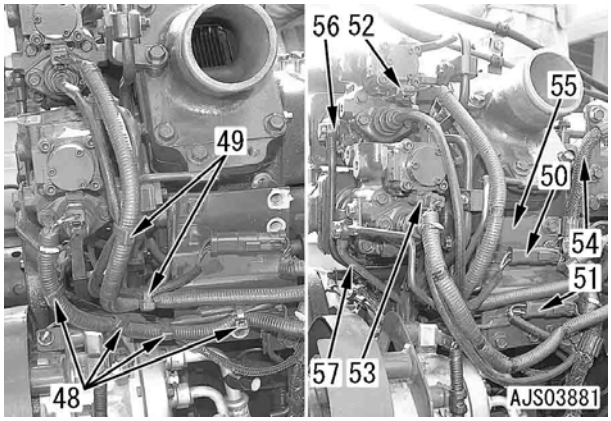
44. Disconnect connector SBP (50) and SEGR (51).

45. Disconnect connectors BP (52) and EGR (53).

46. Disconnect wiring harness (54).

47. Remove bracket (55).

48. Disconnect lubrication tubes (56) and (57). [*12]

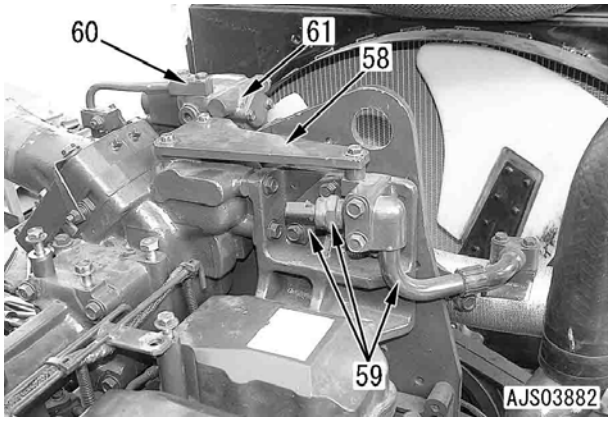


49. Remove plate (58).

50. Remove sensor-tube-plate assembly (59).
    ★ After serial number 561328, plate (58) and sensor-tube-plate assembly (59) are abolished.

51. Disconnect lubrication tube (60).

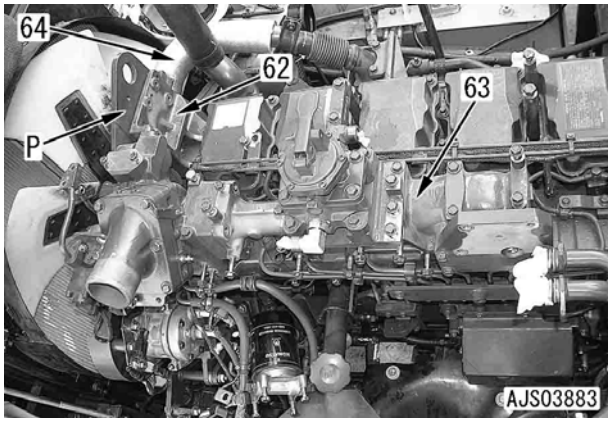
52. Remove bypass valve (61). [*13]



53. Remove bracket (62).

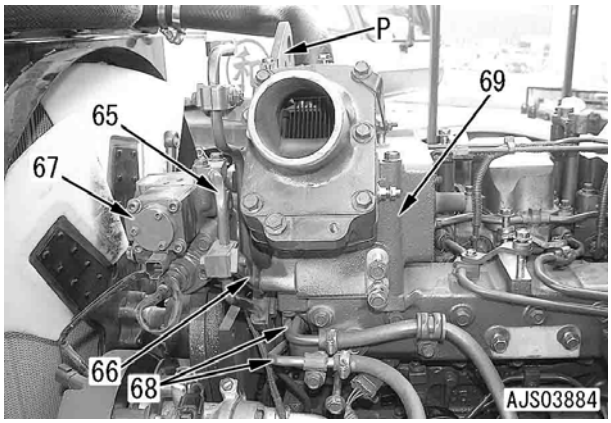
54. Remove diffuser and pump assembly (63).
    Diffuser and pump assembly: **25 kg**

55. Disconnect EGR tube (64) from plate (P).

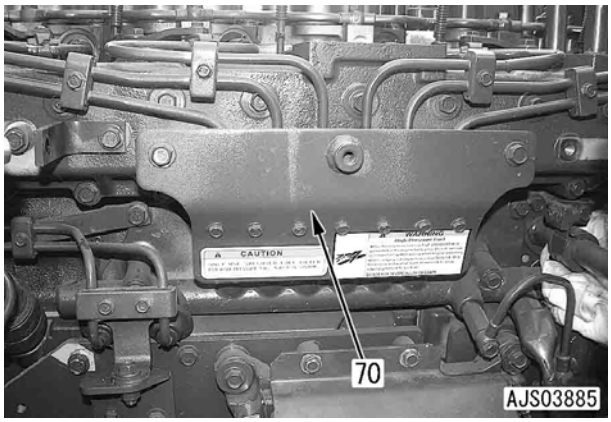


56. Disconnect lubrication tube (65).
57. Disconnect plate (66) from air housing (69).
58. Disconnect EGR valve (67) from plate (P).
59. Disconnect the clamp of tubes (68) and loosen the joint bolt. [*14]

60. Remove air housing (69).

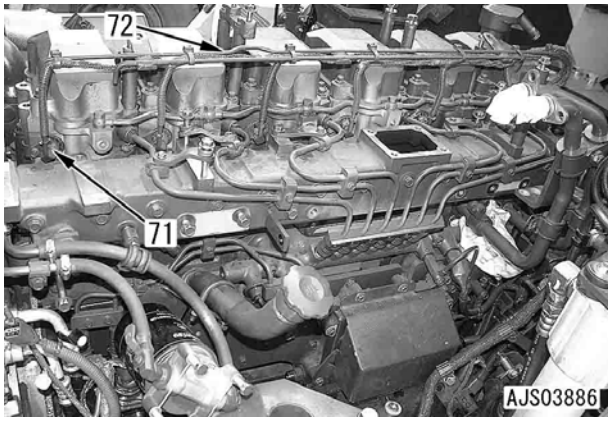


61. Remove bracket (70).



62. Disconnect 6 injector connectors (71).

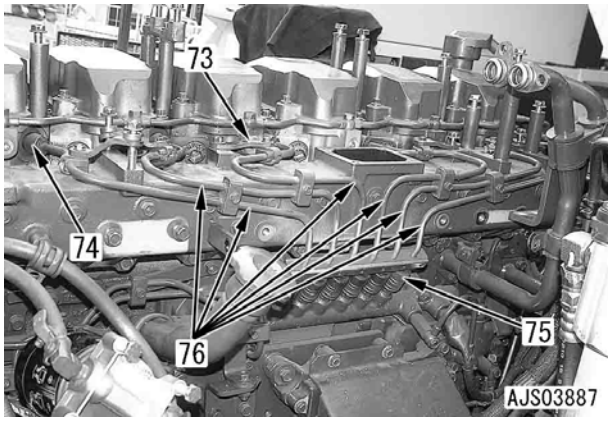
63. Disconnect wiring harness and bracket assembly (72).



64. Disconnect 6 clamps (73). [*15]

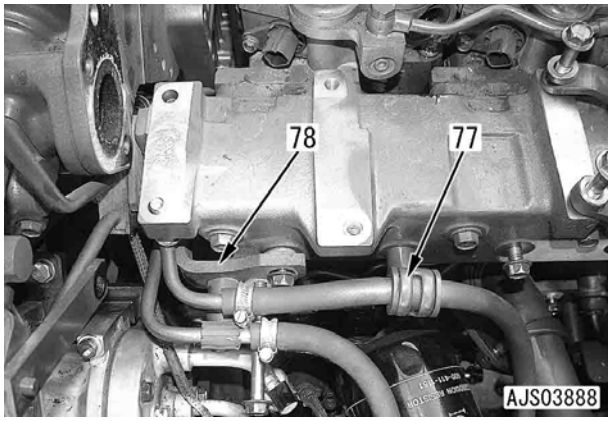
65. Remove 6 bellows (74) and 6 bellows (75). [*15]

66. Remove high-pressure pipe assembly (76).[*15]



67. Disconnect clamp (77).

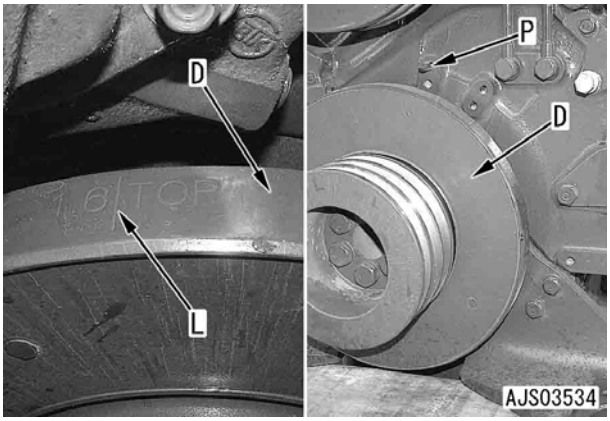
68. Disconnect bracket (78).



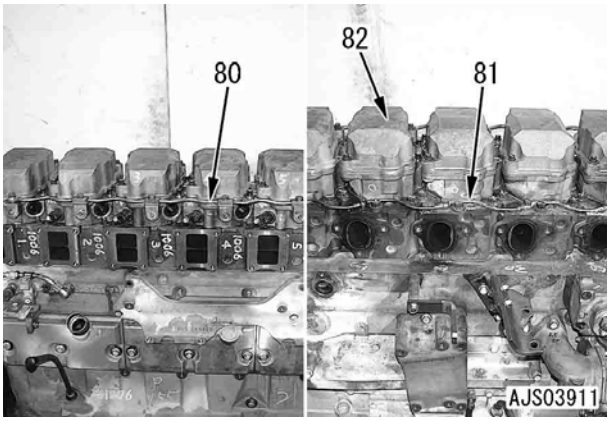
69. Lift off air intake manifold (79).
Air intake manifold: **25 kg**

70. Remove the air conditioner compressor. For details, see Removal and installation of fuel supply pump assembly. (Do not disconnect the air conditioner hoses.)

71. Using the side hole of the fan pulley, set stamped line **L** of 1•6 TOP of damper (D) to pointer **P**.
★ Rotate the crankshaft. For details, see Testing and adjusting, Testing and adjusting valve clearance.



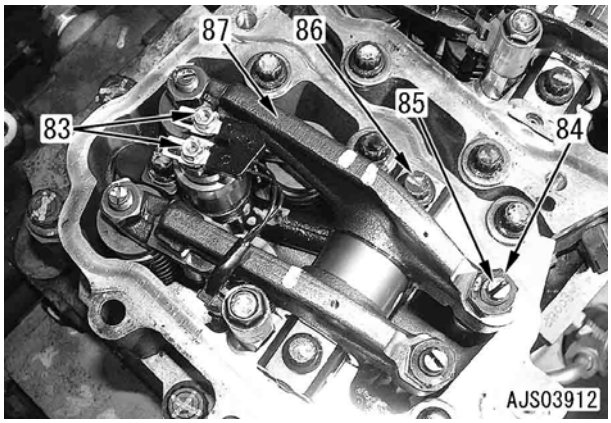
72. Remove spill tube (80).
73. Remove air vent tube (81).
74. Remove cylinder head cover (82).



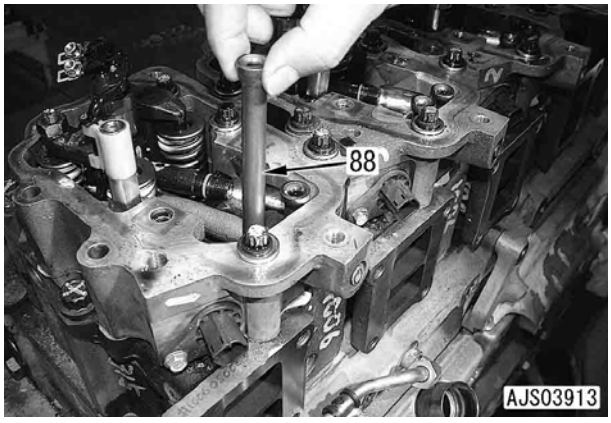
75. Disconnect 2 capture nuts (83).
    ★ The capture nuts are so installed that they will not fall.

76. Loosen locknut (84) and adjustment screw (85).

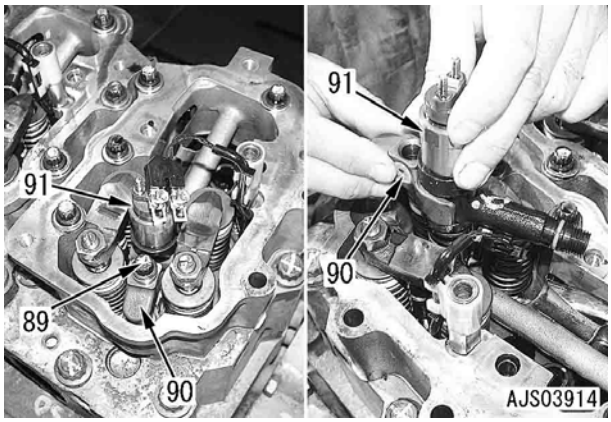
77. Remove mounting bolts (86) and rocker arm and shaft assembly (87).



78. Remove 12 push rods (88).



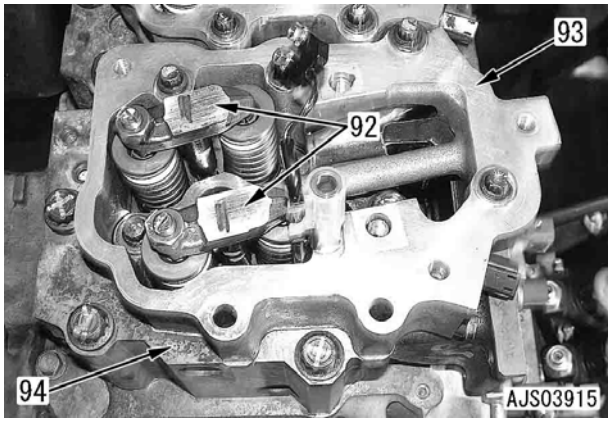
79. Remove holder mounting bolts (89) and then remove holder (90) and fuel injector assembly (91) together.
    ★ Never hold the solenoid valve unit at the top of the injector with pliers, etc.



80. Remove 12 crossheads (92).

81. Remove rocker arm housing (93).

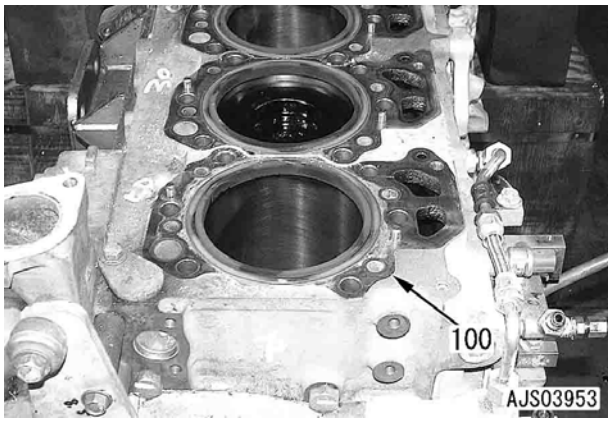
82. Remove cylinder head assembly (94).



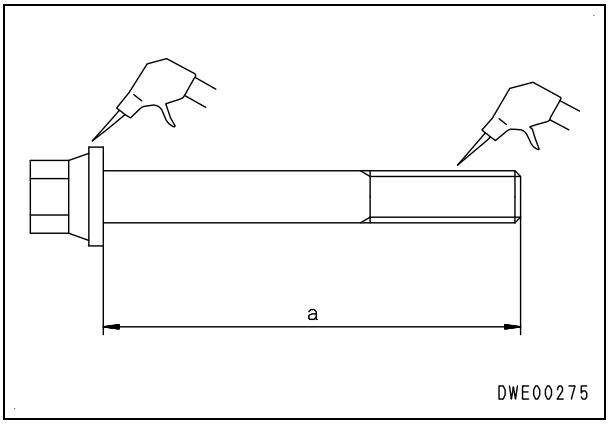
Installation

- **Cylinder head assembly**

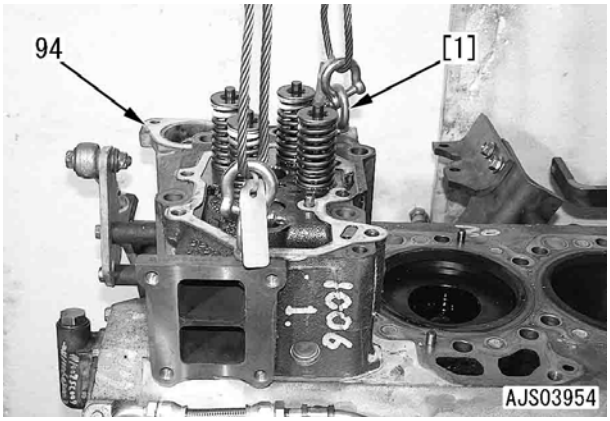
1. Check that the cylinder head mounting surface and the inside of the cylinder are free from dirt and foreign matter and then set cylinder head gasket (100).
   ★ When installing the gasket, check that the grommet is fitted normally.



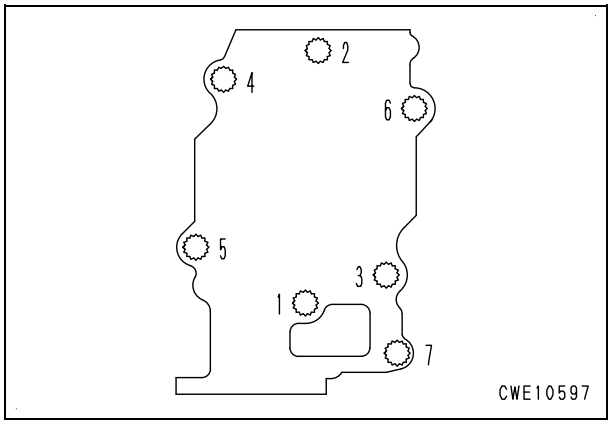
2. Check the following items of the cylinder head mounting bolts. If any bolt is out of the standard, do not use it but replace it.
   1) The number of tightening times of the bolt (indicated by the number of punch marks) must be 5 or less.
   2) Using limit of stem length (a) of bolt: Below 171.4 mm.

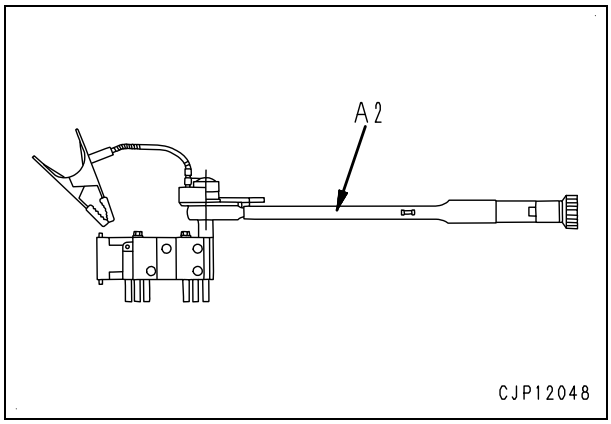


3. Using slings [1], lift up cylinder head assembly (94) and set it on the cylinder block.
   Cylinder head assembly: **20 kg**

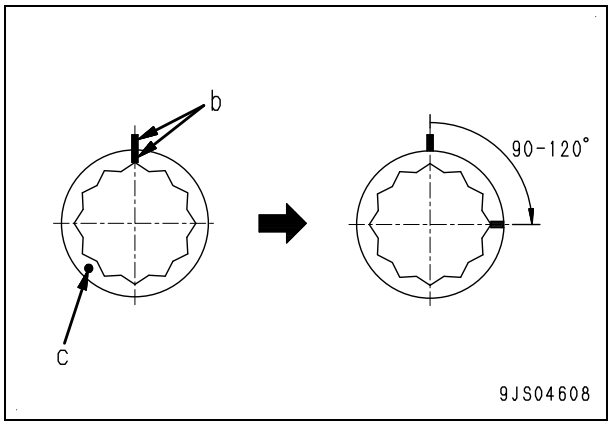


4. Tighten the cylinder head mounting bolts in the order of 1 – 6 and then tighten auxiliary bolt 7.
   - Mounting bolt (1 – 6 in following figure): **Molybdenum disulfide grease (LM-P) or engine oil (EO30-DH).**
   - Mounting bolt (1 – 6 in following figure)
     1st time: **98.1 ± 9.8 Nm {10 ± 1 kgm}**
     2nd time:
     166.6 – 176.4 Nm {17 – 18 kgm}
     (Target: 176.4 Nm {18 kgm})
     3rd time: Using tool **A2**, tighten by **90 – 120°** (Target: **120°**).
   - Auxiliary bolt (7 in following figure):
     66.2 ± 7.4 Nm {6.75 ± 0.75 kgm}



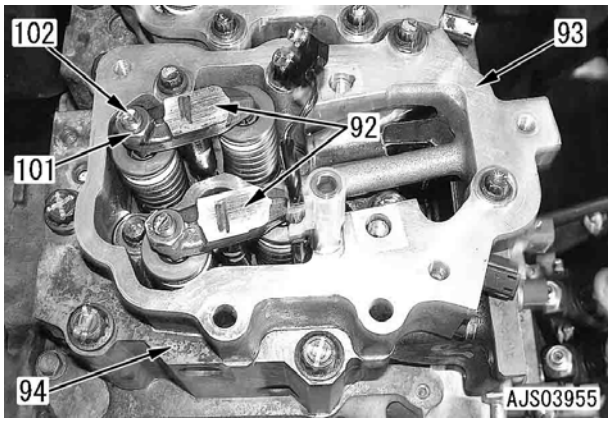


★ When not using tool **A2**, make marks (b) on the cylinder head and bolt with paint and then tighten the bolt by 90 – 120° (Target: 120°).
   1] Make a punch mark (c) on the mounting bolt head to indicate the number of tightening times.
      ★ When a new bolt is used, do not make a punch mark on its head.



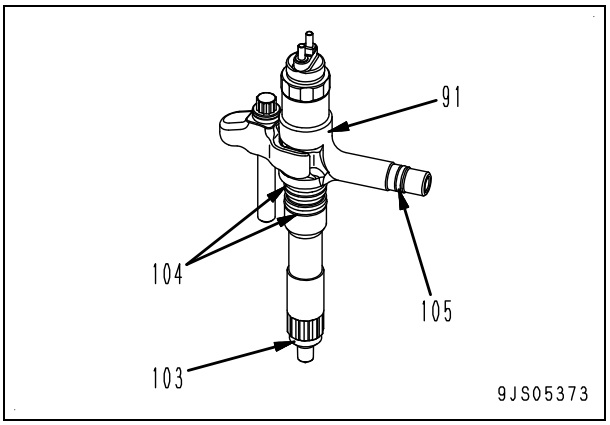
5. Fit the gasket to cylinder head assembly (94) and install rocker arm housing (93).
   - Mounting bolt:
     58.8 – 73.5 Nm {6 – 7.5 kgm}

- **Crosshead**
  1) Set crosshead (92), loosen locknut (101), and return adjustment screw (102).
  2) Hold the rocker arm contacting surface of crossheads (92) lightly with the finger to keep crosshead (92) in contact with the valve stem on the push rod side.
  3) Tighten adjustment screw (102) until crossheads (92) touches the other valve stem.
  4) After adjustment screw (102) touches the valve stem, tighten it further by 20° and tighten locknut (101) under this condition.
     - Crosshead guide and top of crosshead:
       Engine oil (EO30-DH)
     - Locknut: **58.7 ± 5.9 Nm {6.0 ± 0.6 kgm}**



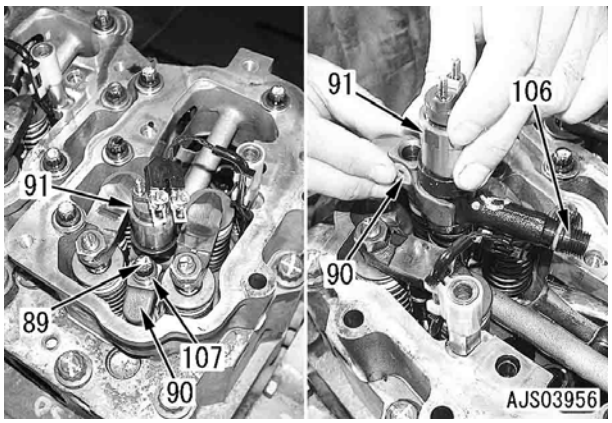
- **Fuel injector assembly**

1. Install gasket (103) and O-rings (104) and (105) to fuel injector assembly (91).
   O-ring: **Engine oil (EO30-DH)**



2. Insert holder (90) in fuel injector assembly (91) and insert inlet connector (106) in the rocker housing, directing it to the hole to insert the high-pressure pipe.

3. Install spherical washer (107) to bolt (89) and temporarily tighten holder (90).
   ★ Check that the holder is inserted firmly to the end.
   Spherical part of washer:
   Engine oil (EO30-DH)
4. Permanently tighten bolt (89) of holder (90).
   Holder mounting bolt:
   58.8 – 73.5 Nm {6.0 – 7.5 kgm}



5. Install the 12 push rods.

- **Rocker arm and shaft assembly**

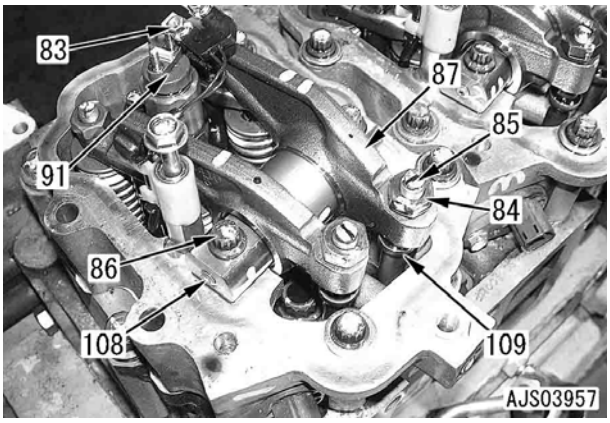
1. Set rocker arm and shaft assembly (87).
   ★ When installing the rocker arm shaft, direct its larger mounting hole end down and its ball plug (108) end forward.

2. Check that the ball of adjustment screw (85) is fitted in push rod socket (109) and tighten mounting bolts (86).
   ★ Before installing, clean the oil holes.
   Mounting bolt:
   58.8 – 73.5 Nm {6.0 – 7.5 kgm}

3. Adjust the valve clearance. For details, see Testing and adjusting, Testing and adjusting valve clearance.
   Locknut (84):
   58.8 – 73.5 Nm {6 – 7.5 kgm}

- **Fuel injector wiring harness**

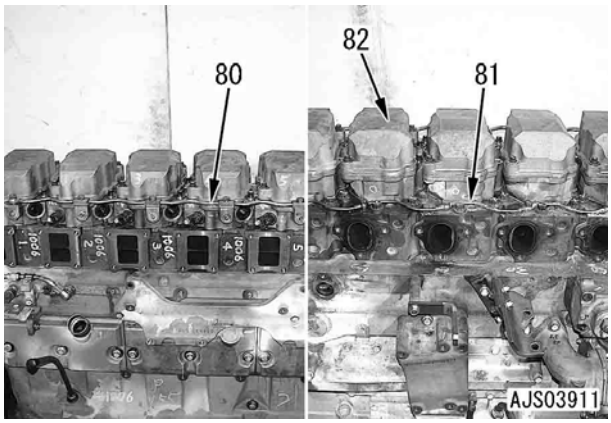
1. Tighten 2 capture nuts (83) of the wiring harness into injector assembly (91).
   Capture nut:
   2.0 – 2.4 Nm {0.2 – 0.24 kgm}



2. Fit the O-ring and install cylinder head cover (82).
   ★ When installing the O-ring, do not twist it.
   Mounting bolt:
   9.8 ± 1 Nm {1.0 ± 0.1 kgm}

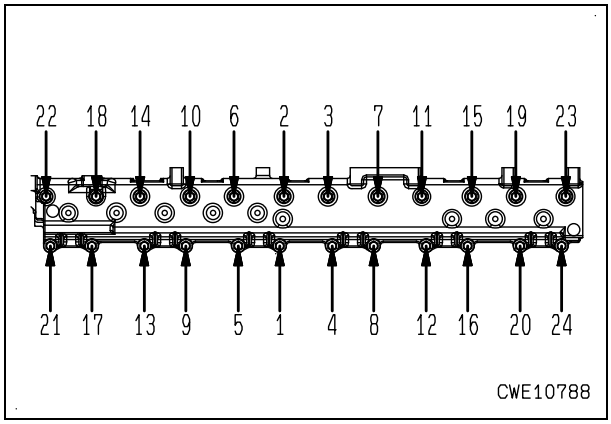
3. Fit the gaskets to both sides, install air vent tube (81).
   Joint bolt:
   9.8 – 12.7 Nm {1.0 – 1.3 kgm}

4. Fit the gaskets to both sides, install spill tube (80).
   Joint bolt:
   9.8 – 12.7 Nm {1.0 – 1.3 kgm}



- **Intake manifold**

1. Tighten the mounting bolts in the numeric order shown below.
   Mounting bolt:
   59 – 74 Nm {6 – 7.5 kgm}



- Carry out the rest of installation in the reverse order to removal.

★ For the photos corresponding to the Nos., see Removal.

[*1]
★ Set the tightening portions of the 2 clamps on the exactly opposite side to each other so that they can be tightened from the same direction.
Clamp on aftercooler side:
8.8 ± 0.5 Nm {0.90 ± 0.05 kgm}
Clamp on engine side:
9.8 ± 0.5 Nm {1.0 ± 0.05 kgm}

[*2]
★ Set the tightening portions of the 2 clamps on the exactly opposite side to each other so that they can be tightened from the same direction.
Clamp: 8.8 ± 0.5 Nm {0.90 ± 0.05 kgm}

[*3]
★ Before tightening the mounting bolts of bypass valve (61), temporarily install bypass tube (23).

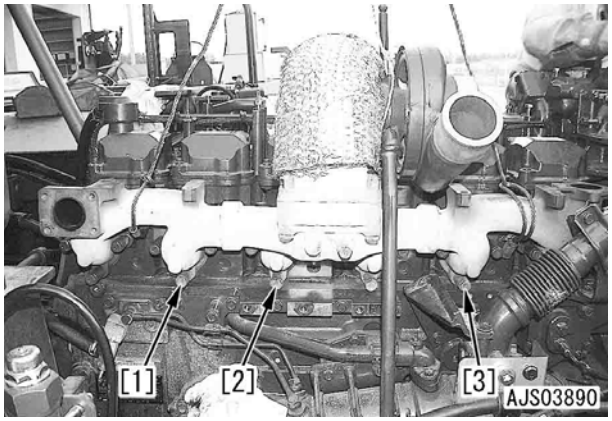
[*4]
Heater terminal:
5.88 – 7.48 Nm {0.6 – 0.8 kgm}

[*5]
Corrosion resistor mounting bolt:
44.1 – 58.8 Nm {4.5 – 6.0 kgm}

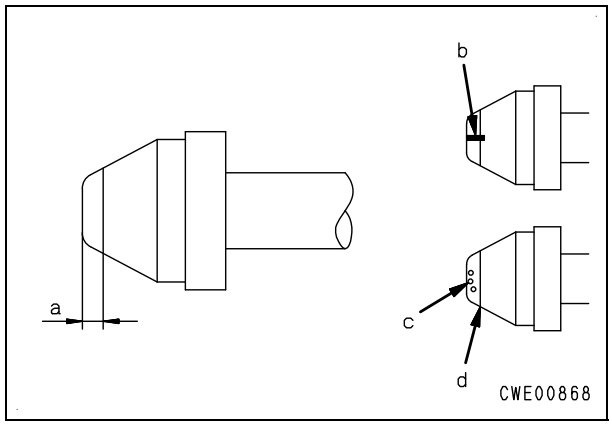
[*6]
Joint bolt on filter (upper) side of tube and clamp assembly (32):
24.5 – 34.3 Nm {2.5 – 3.5 kgm}
Joint bolt on fuel supply pump (lower) side of tube and clamp assembly (32):
14.8 – 19.6 Nm {1.5 – 2.0 kgm}
Sleeve nut on engine controller (lower) side of tube and clamp assembly (32):
84 – 132 Nm {8.5 – 13.5 kgm}
Clamp of tube and clamp assembly (32):
27 – 34 Nm {2.8 – 3.5 kgm}

[*7]
Filter and bracket assembly (35) and tube (34)
1. Finger tighten filter and bracket assembly (35).
2. Finger tighten tube (34).
3. Permanently tighten tube (34).
4. Permanently tighten filter and bracket assembly (35).

[*8]
Sleeve nut: **40 – 44 Nm {4.1 – 4.5 kgm}**
[*9]
Sleeve nut on pump (upper) side of tube (43):
84 – 132 Nm {8.5 – 13.5 kgm}
Clamp of tube (43):
27 – 34 Nm {2.8 – 3.5 kgm}
Joint bolt on fuel supply pump (lower) side of tube (43):
14.8 – 19.6 Nm {1.5 – 2.0 kgm}
[*10]
Mounting bolt:
58.8 – 73.5 Nm {6 – 7.5 kgm}
[*11]
- **Exhaust manifold**
  Tighten bolts [1], [2], and [3] first and then tighten the other bolts.
  Mounting bolt:
  58.8 – 73.5 Nm {6 – 7.5 kgm}



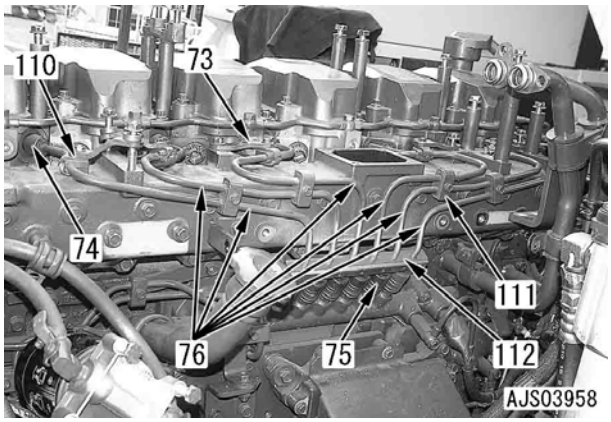
[*12]
Joint bolt:
24.5 – 34.3 Nm {2.5 – 3.5 kgm}
[*13]
★ Temporarily install bypass tube (23) and then tighten the mounting bolts of bypass valve (61).
Bypass valve mounting bolt:
58.8 – 73.5 Nm {6 – 7.5 kgm}
[*14]
Joint bolt:
24.5 – 34.3 Nm {2.5 – 3.5 kgm}
[*15]
⚠ **Don't correct high-pressure tube by bending it for re-use.**
⚠ **Always use genuine clamp for fixing high-pressure pipe. Strictly observe the tightening torque requirements.**
★ Check the following matters before installing high-pressure pipe. If there is any abnormality, replace the high-pressure tube to prevent possible fuel leakage.
★ Check the taper seal portion (between the tip of section (a) and 2 mm from the end) of the joint section for any vertical slit (b) and/or dent (c) visually recognizable.
★ Check part (d) (from the tip of the taper seal portion to 2 mm from the end) for any stepped wear (fatigue) your finger nail may catch.

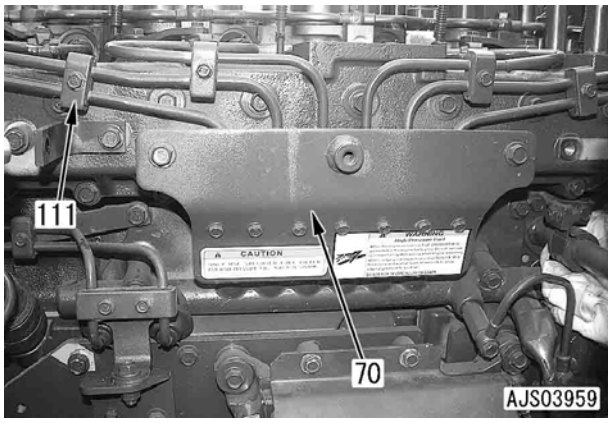


1. Finger tighten high-pressure pipe assembly (76).
   ★ Loosen all of the high-pressure pipe clamps.
2. Permanently tighten high-pressure pipe assembly (76).
   Sleeve nut (on both sides):
   39.2 – 49 Nm {4 – 5 kgm}
3. Install 6 bellows (74) and 6 bellows (75) each to each high-pressure pipe.
   ★ When each bellows, take care of the direction of the slit.
   - Fuel injector side: To be directed down.
   - Common rail side:
     To be directed to cylinder block (upper) side.

   ★ 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.

4. **Installation procedure for clamps and brackets**
   - Mounting bolt of clamp and bracket (Permanently tightening):
     11.8 – 14.7 Nm {1.2 – 1.5 kgm}
   1) Finger tighten 6 clamps (110) and 6 brackets (73).
   2) Permanently tighten clamps (110) and brackets (73) in order.
   3) Finger tighten 4 hollow clamps (111).
   4) Finger tighten clamp (112) to bracket (70) and then permanently tighten it.
   5) Permanently tighten bracket (70).
   6) Permanently tighten 4 hollow clamps (111).





⚠ **Check that each high-pressure pipe and wiring harness are at least 10 mm apart from each other.**

- **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: 59 ℓ

Removal and installation of engine front seal

Special tools

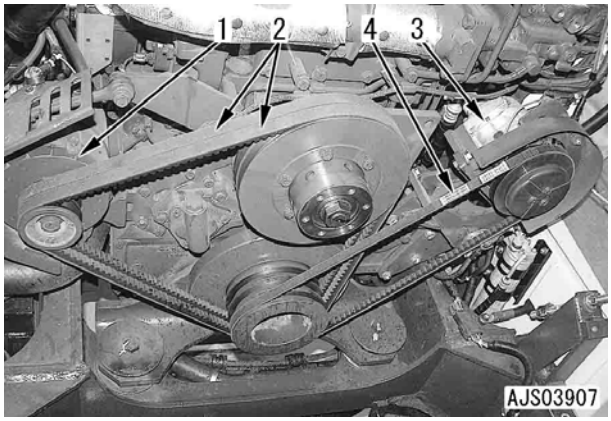
Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
A	3	795-931-1100	Seal puller assembly	■	1		
	6	795T-521-1140	Push tool	■	1		○
		790-101-5221	Grip	■	1		
		01010-81225	Bolt	■	1		
		01050-31640	Bolt	■	3		

Removal

1. Remove the cooling assembly. For details, see "Removal of cooling assembly".

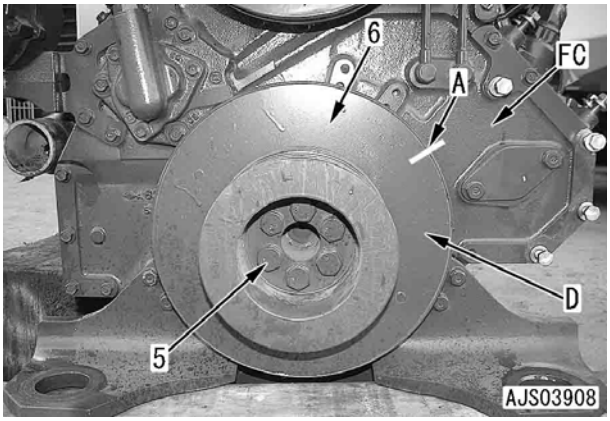
2. Loosen alternator (1) and remove alternator belt (2). [*1]

3. Loosen air conditioner compressor (3) and remove air conditioner compressor belt (4). [*2]

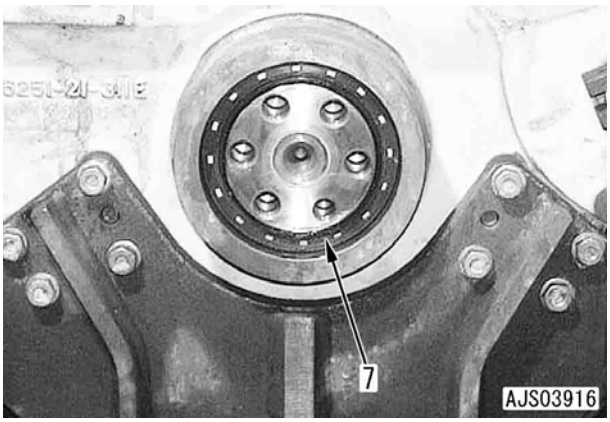


4. There is a stamped line of 1•6TOP on damper (D). Make a matchmark (A) on damper (D) and front cover (FC).

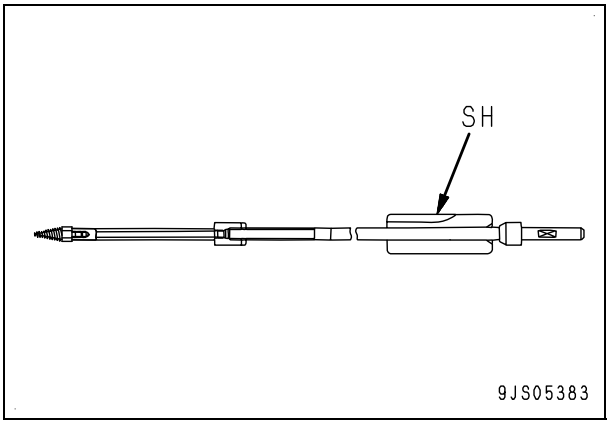
5. Remove 6 mounting bolts (5) and pulley and damper assembly (6). [*3]
   Pulley and damper assembly:**30 kg**



6. Remove front seal (7) according to the following procedure.
   1) Make several holes about 3 mm in diameter with a drill on front seal (7).
   2) Set tool **A3** to the drilled holes. (Tip: Drill type)
   3) Remove the front seal with impacts of slide hammer (SH).
      ★ Remove all the chips.



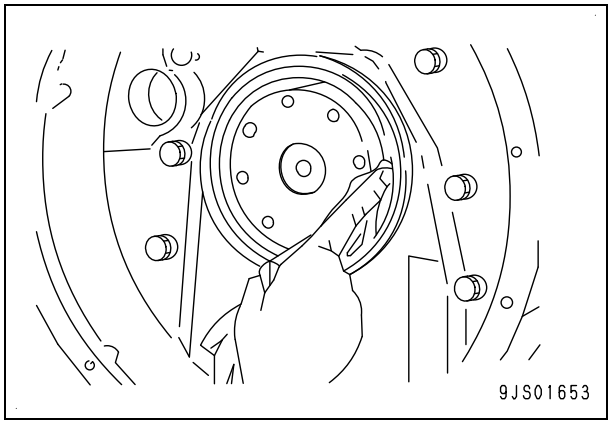
- Tool **A3**



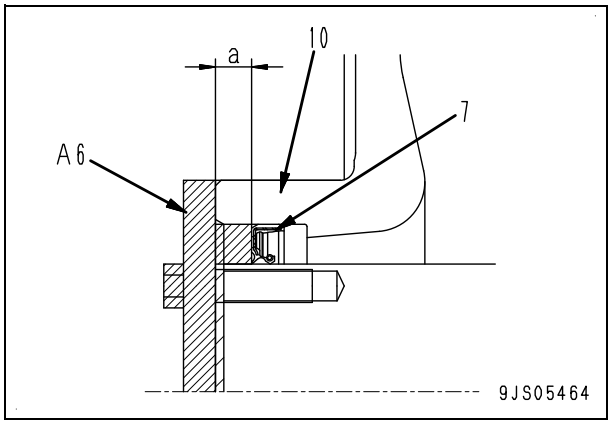
Installation

1. Clean, degrease, and dry the contacting surface against the front cover.

2. Remove the matter sticking to the crankshaft flange with clean cloth.
   ★ Clean, degrease, and dry the seal lip surface (peripheral surface of the crankshaft).
   ★ Check that the end corner and lip sliding surface of the crankshaft are free from flaw, burr, sharp fin, rust, etc.



3. Evenly tighten the bolts to press fit front seal (7) until the end of tool **A6** touches the end of cover (10).
   ★ Take care not to mistake the installing direction.
   Front seal lip (50 – 80% full of hollow part of lip): **Grease (G2-LI)**
   ★ When press fitting the front seal, take care extremely not to damage the lip on this side with the tool set.
   ★ Installed dimension of front oil seal (7) from end of cover (10).
   a: 16 – 17 (mm)



- Carry out the rest of installation in the reverse order to removal.

[*1]
Adjust the alternator belt tension. For details, see Testing and adjusting, Testing and adjusting alternator belt tension.

[*2]
Adjust the air conditioner compressor belt tension. For details, see Testing and adjusting, Testing and adjusting air conditioner compressor belt tension.

[*3]
★ There are 2 kinds in the pulley and damp assembly mounting bolts. Take care.
M14 (1 piece):
157 – 196 Nm {16 – 20 kgm}
M16 (5 pieces):
245 – 309 Nm {25 – 31.5 kgm}

Removal and installation of engine rear seal

Special tools

Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
A	3	795-931-1100	Seal puller assembly	■	1		
	4	795-931-1210	Push tool	■	1		
		01050-31625	Bolt	■	3		
		01050-31645	Bolt	■	3		
	5	795-931-1220	Push tool	■	1		
		01050-31645	Bolt	■	3		

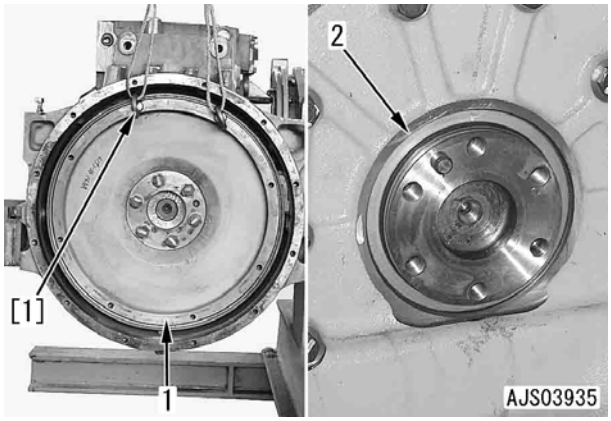
Removal

1. Remove the output shaft assembly. For details, see "Removal and installation of output shaft assembly".

2. Install sling [1] to flywheel (1) and lift up the flywheel temporarily.

3. Remove the 6 mounting bolts and remove flywheel (1) from the dowel pin and lift it off. [*1]
   Flywheel: **25 kg**

4. Remove rear seal (2).
   ★ Take care not to damage the seal mounting section of the flywheel housing and the seal contacting surface of the crankshaft.



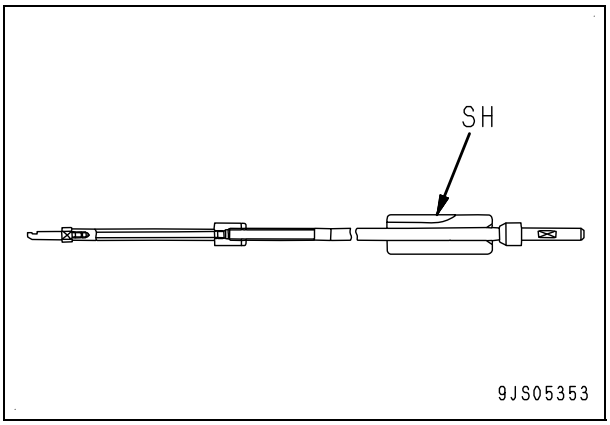
   ★ If real seal (2) cannot be removed from the crankshaft easily, remove it according to the following procedure.
   1) Change the tip of tool **A3** to the hook type.
   2) Hitch the hook to the metal ring of seal (2).
   3) Remove the rear seal with impacts of slide hammer (SH).

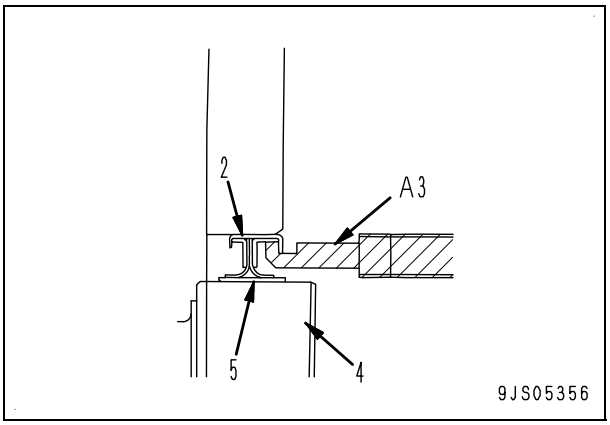
★ Before pulling out the seal, drive in it a little to separate.

★ If the seal is sleeved, cut and remove sleeve (5) with a chisel and a hammer.

★ Take care not to damage crankshaft (4).

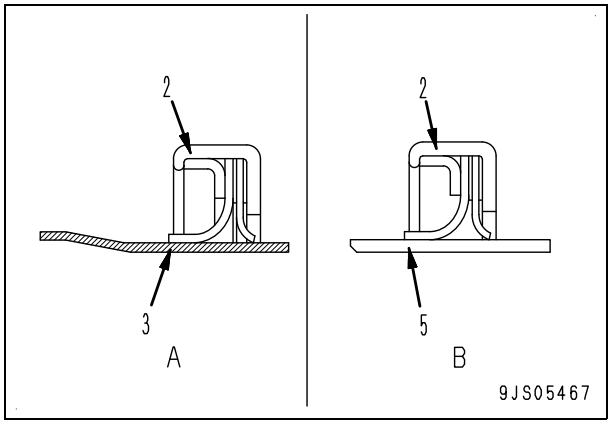
- Tool **A3**



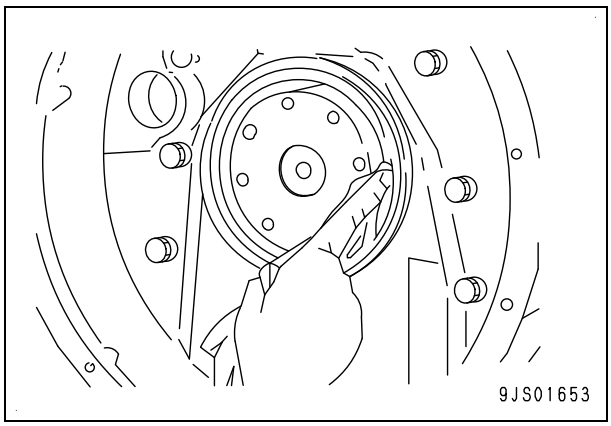


Installation

★ Check the Teflon seal (Laydown lip seal) by checking the wear of the shaft and replace it with the "standard seal" or "sleeved seal".
★ If the shaft is worn to the degree of luster (If wear which you feel with your finger is less than 10 µm) and does not have any flaw, install the standard seal **A**. In other cases, install the sleeved seal **B**.
★ (3): Plastic inside cylinder which is also used as installation guide
★ (5): Sleeve
★ Do not remove installation guide (3) from rear seal (2) before installing it.
★ Handle rear seal (2) and sleeve (5) as an assembly and never separate them from each other.

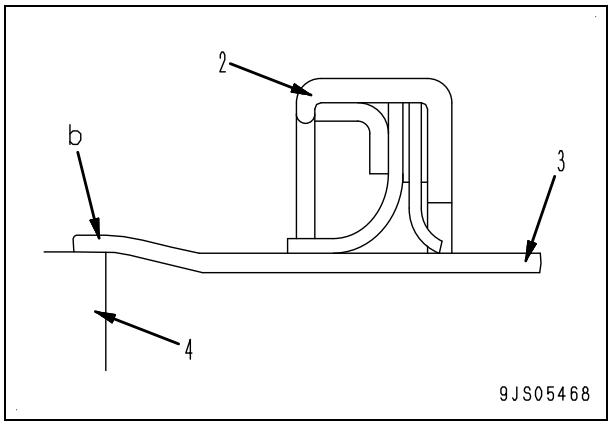


★ Clean, degrease, and dry the contacting surface against the flywheel housing.
★ Clean, degrease, and dry the seal lip surface (peripheral surface of the crankshaft).
★ Check that the end corner and lip sliding surface of the crankshaft are free from flaw, burr, sharp fin, rust, etc.

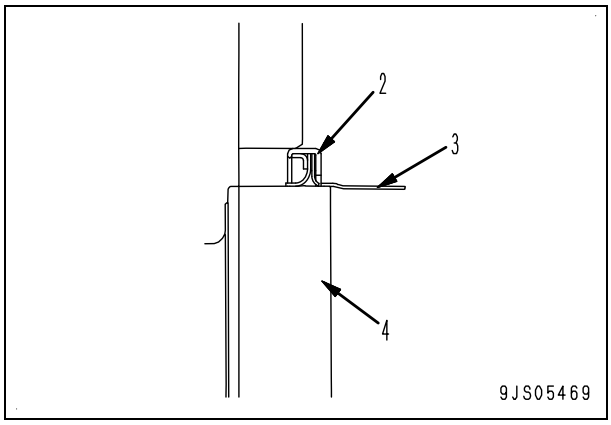


- **Procedure for installing standard seal**

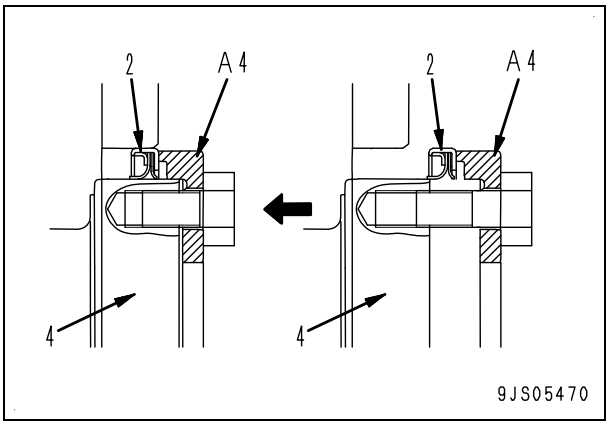
★ Do not apply grease, oil, etc. to the seal lip surface.
1) Set the large inside diameter side (b) of plastic inside cylinder (3) of rear seal (2) to the end of crankshaft (4).
★ Take care not to mistake the direction of the plastic inside cylinder.



2) Hold the metal ring of rear seal (2) with both hands and push it in firmly.
3) After pushing in the rear seal, remove plastic inside cylinder (3).
★ When removing the inside cylinder, take care not to damage the seal lip.



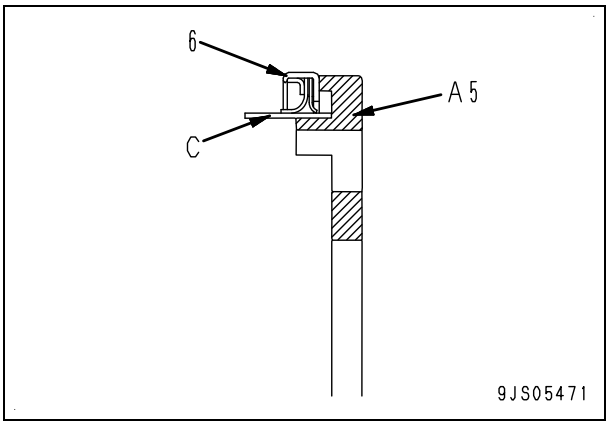
4) Tighten the bolts evenly to press fit rear seal (2) until the end of tool **A4** reaches the end of crankshaft (4).
   ★ Driving depth of rear seal:
   10 ± 0.2 (mm) from end of crankshaft
   ★ First, tighten tool **A4** until the bolt (Stem length: 45 mm) stops, then tighten the bolt (Stem length: 25 mm).
   ★ When press fitting the seal, take care not to damage the lip on this side with the tool set, etc.
   ★ After press fitting the seal, remove the red sealant layer from its periphery



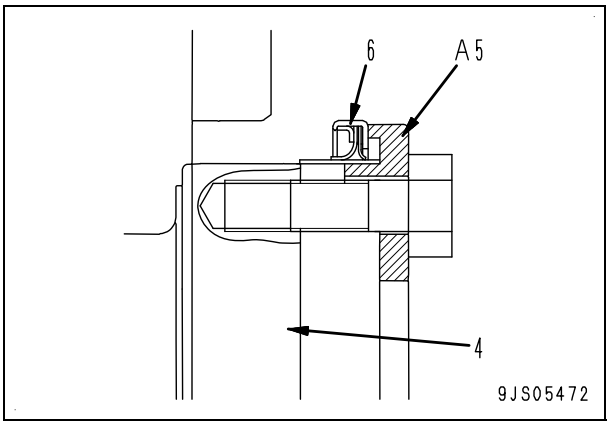
- **Procedure for installing sleeved seal**

★ Do not apply grease, oil, etc. to the seal lip surface.

1) Set sleeve and rear seal assembly (6) to tool **A5**.
   Inside surface (C) of sleeve:
   Gasket sealant (LG-7)

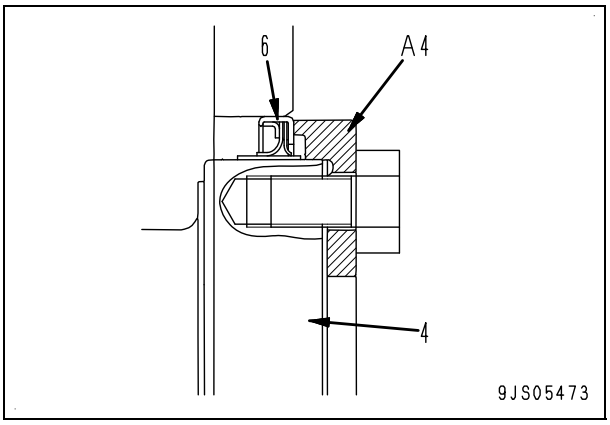


2) Set the sleeve of the rear seal to the end of the crankshaft, and then tighten the bolts evenly to press fit sleeve and rear seal assembly (6) until the end of tool **A5**reaches the end of crankshaft (4).



3) Remove tool **A5** and install tool **A4**.
4) Tighten the bolts evenly to press fit sleeve and rear seal assembly (6) until the end of tool **A4** reaches the end of crankshaft (4).
   ★ After press fitting the rear seal, remove the red sealant layer from its periphery.

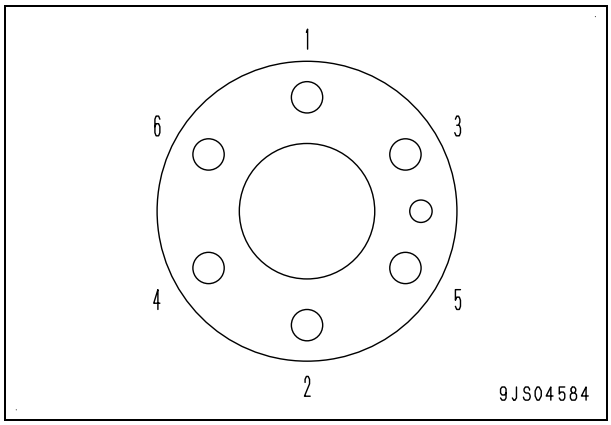
★ Driving depth of rear seal:
10 ± 0.2 (mm) from end of crankshaft



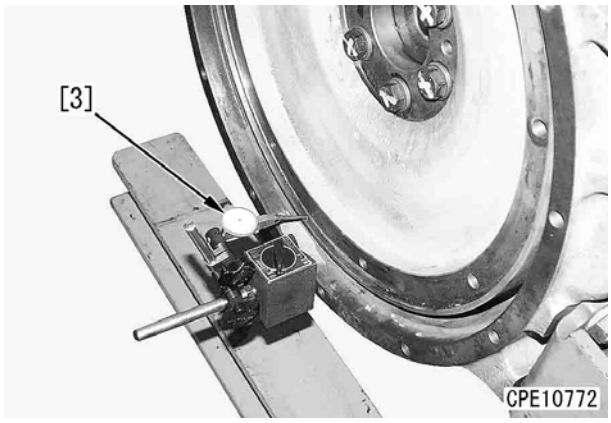
- Carry out the rest of installation in the reverse order to removal.

[*1]
Flywheel

1. Tighten the mounting bolts twice in the numeric order shown below.
   - Mounting bolt: **Engine oil (EO30-DH)**
   - Mounting bolt
     1st time: **147 ± 19.6 Nm {15 ± 2.0 kgm}**
     2nd time: **289.1 ± 19.6 Nm {29.5 ± 2.0 kgm}**



2. Using dial gauge [3], measure the facial runout and radial runout.
   - ★ Facial runout: **Max. 0.20 mm**
   - ★ Radial runout: **Max. 0.15 mm**



HM300-2 Articulated dump truck

Form No. SEN00684-04

ARTICULATED DUMP TRUCK

HM300-2

Machine model	Serial number
HM300-2	2001 and up

50 Disassembly and assembly
Engine and cooling system, Part 2

Removal and installation of engine assembly

Special tool

Sym-bol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
A	7	792T-220-1310	Centering tool	■	2	N	○
		01050-61225	Bolt	■	8		
X	1	792-454-1100	Pump assembly	●	1	N	

Removal

⚠ **When tilting the cab, observe the following precautions to prevent a serious injury or fatal accident caused by fall of the cab.**

⚠ **To prevent interference between the cab and the dump body, set the steering in a straight ahead position and stop the machine on the level ground.**

⚠ **Lock the dump lever with the dump lever lock knob.**

⚠ **Turn the parking brake switch ON and chock the wheels.**

⚠ **Set the lock bar to the frame and lock front and rear frame.**

- **Precautions in tilting cab**

⚠ **When tilting the cab, check that the lock lever is fixed securely.**

⚠ **Do not start the engine while the cab is tilted.**

⚠ **When it is obliged to start the engine for testing etc., check that there is nobody under the cab.**

⚠ **Do not operate the gear shift lever or dump lever.**

⚠ **Do not give a large shock to the machine.**

⚠ **Do not tilt the cab while it is loaded.**

⚠ **Disconnect the cable from the negative (–) terminal of the battery.**

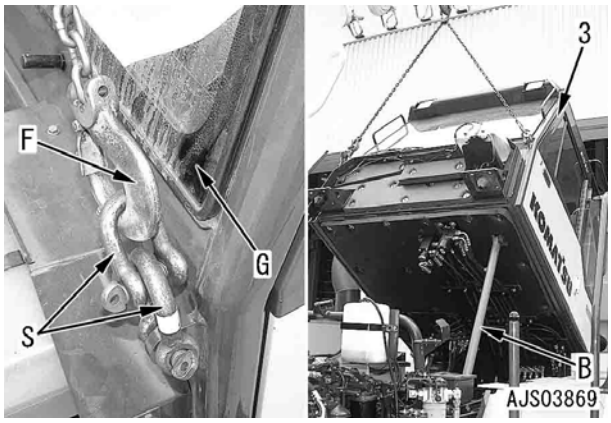
⚠ **If the coolant temperature in the radiator is high, you may be scalded. In this case, wait until the coolant temperature lowers and then drain the coolant.**

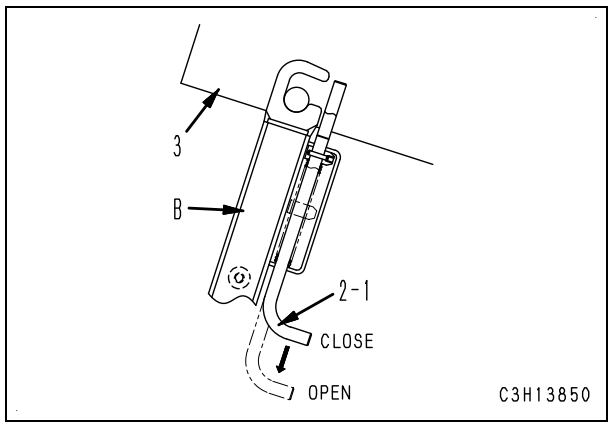
1. Open engine undercover(1).

2. Open engine hood (2).

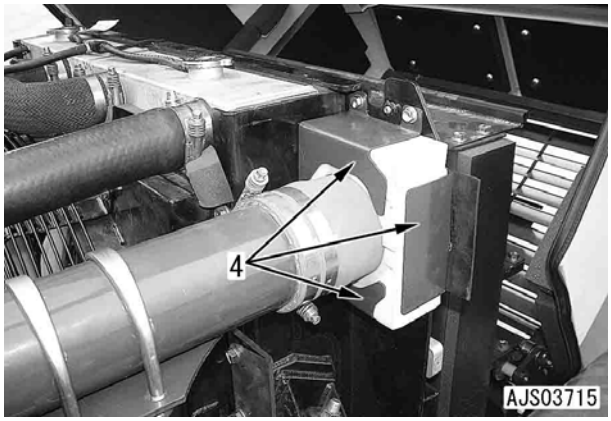
3. Remove radiator cap and then drain the coolant.
   - ★ Location of drain valves
     - Lower tank – 2 places
     - Oil cooler – 1 place
   - Coolant: **59 ℓ**

4. Sling operator's cab assembly (3) and tilt it up.
   ★ Use 2 shackles (S) so that hook (F) of the sling will not hit glass (G) of the cab assembly.
5. Pull lock lever (2-1) and set lock bar (B) with the care the direction of the lock bar (B).
   ⚠ **Check that the lock lever (2-1) closes and the operator cab assembly (3) is held securely in position by the lock bar (B).**
   For details, see Testing and adjusting, Method of tilting up cab.
   ★ Pump assembly **X1** is necessary for tilting up by tilt cylinder.

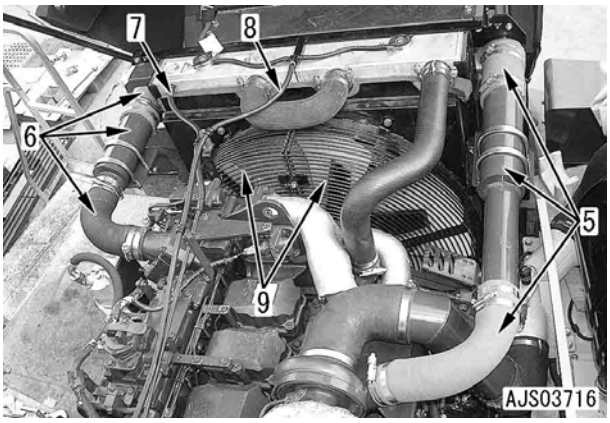




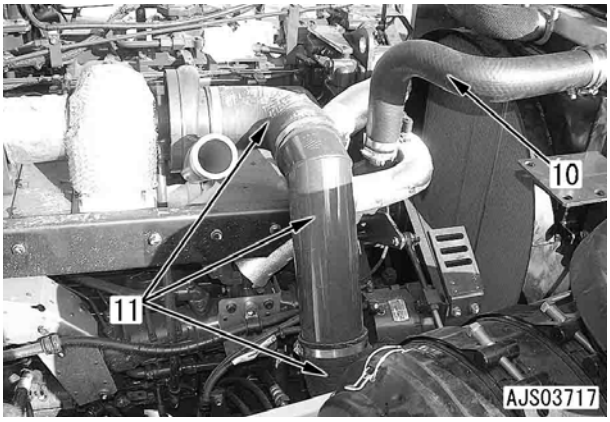
6. Remove cover (4).



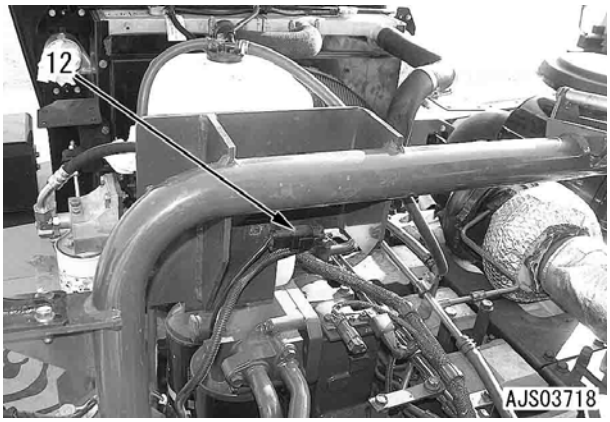
7. Remove air tube-hose-bracket assemblies (5) and (6). [*1]
8. Disconnect air vent hose (7).
9. Disconnect reservoir tank hose (8).
10. Remove fan guard (9).



11. Disconnect radiator inlet hose (10). [*2]
12. Remove air tube and hose assembly (11).

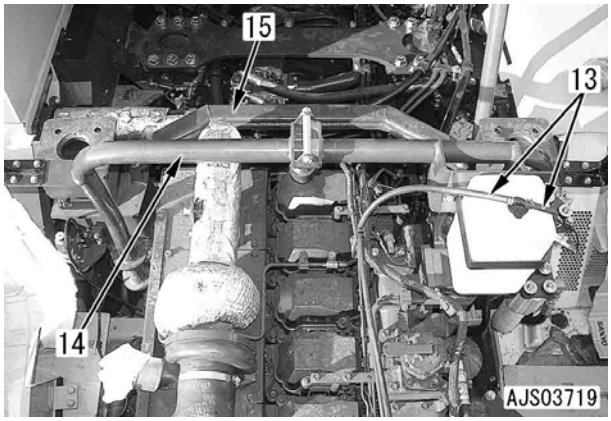


13. Disconnect connector M01 (12) from the rear of the reservoir tank.



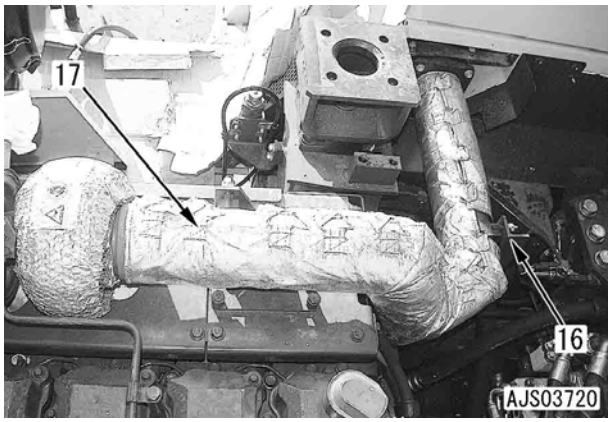
14. Disconnect reservoir tank hose (13).

15. Remove bars (14) and (15).



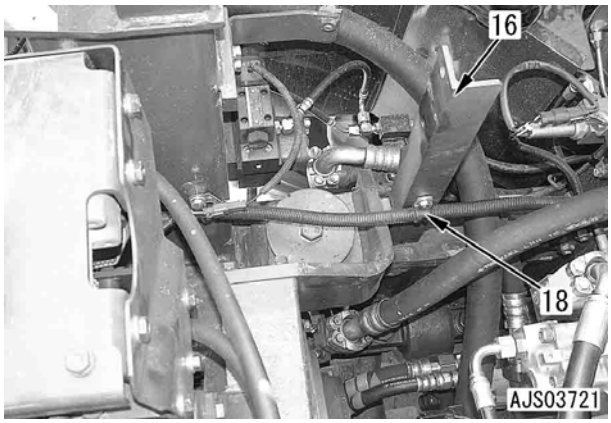
16. Loosen the mounting bolts of bracket (16).

17. Remove exhaust tube (17).

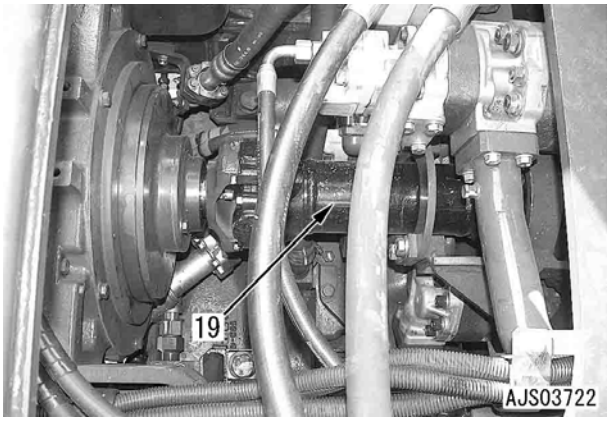


18. Disconnect clamp (18).

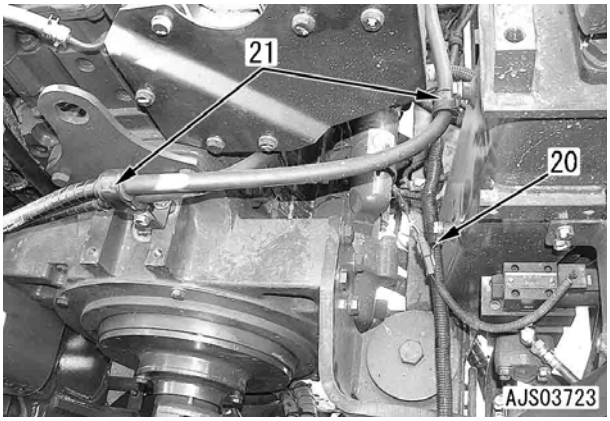
19. Remove bracket (16).



20. Disconnect drive shaft (19). [*4]
    ★ Socket size: 3/4 in.



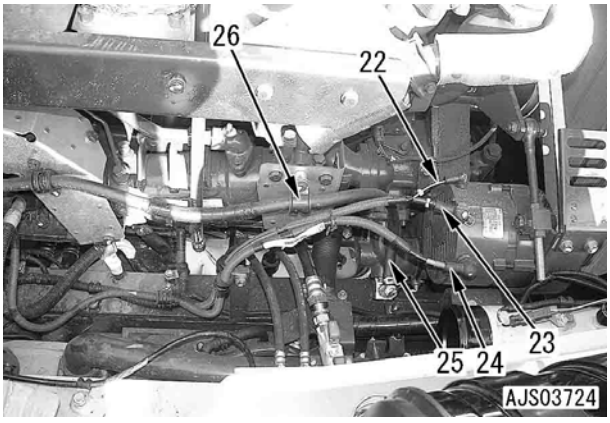
21. Disconnect clamps (20) and (21).



22. Disconnect terminals 80 (22), E1 black (23), and E1 red (24) from the alternator. [*5]

23. Disconnect heater hose (25).

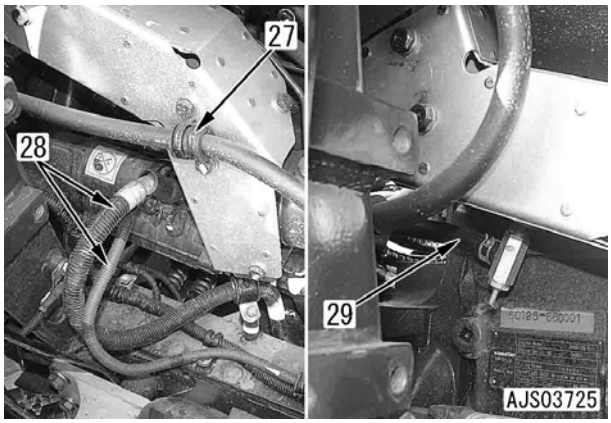
24. Disconnect clamp (26).



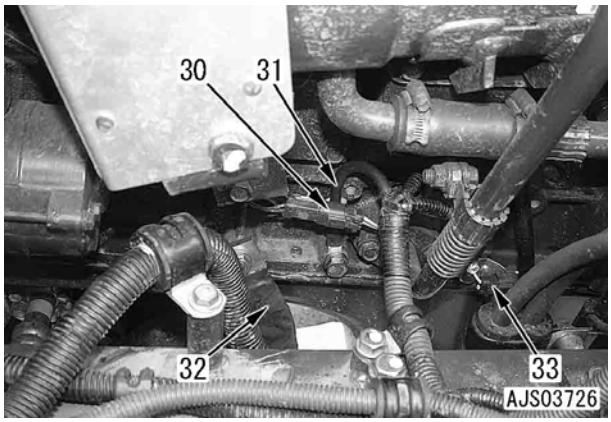
25. Disconnect clamp (27).

26. Disconnect 2 terminals (28) from the starting motor. [*6]

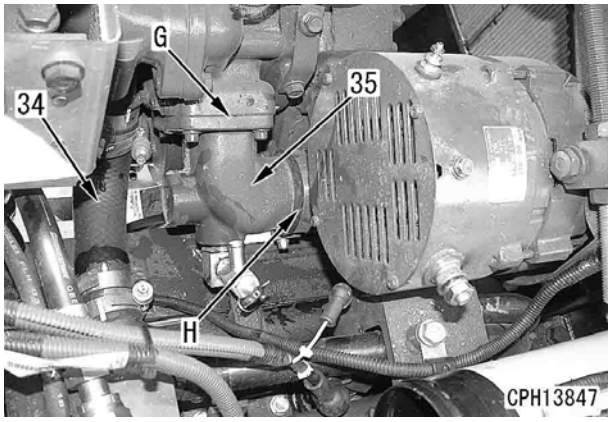
27. Disconnect heater hose (29) from the top of the starting motor.



28. Disconnect connector 78 (30), ground terminals (31) and (32), and connector OL (33) from the right of the starting motor.

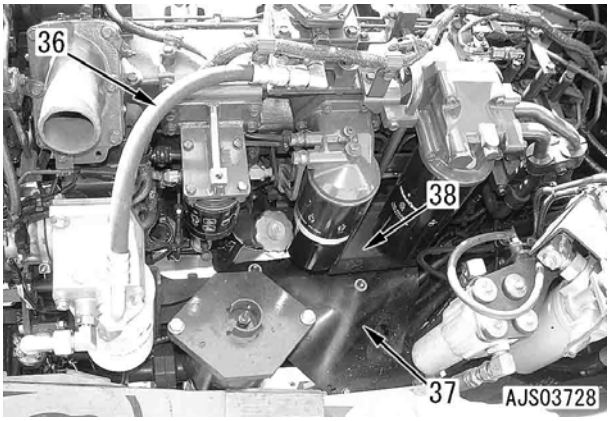


29. Disconnect hose (34).
30. Disconnect water tube (35).
    - ★ Replace the gasket (G).
    - ★ If hose (H) is disconnected, the work will take more than 1 hour.

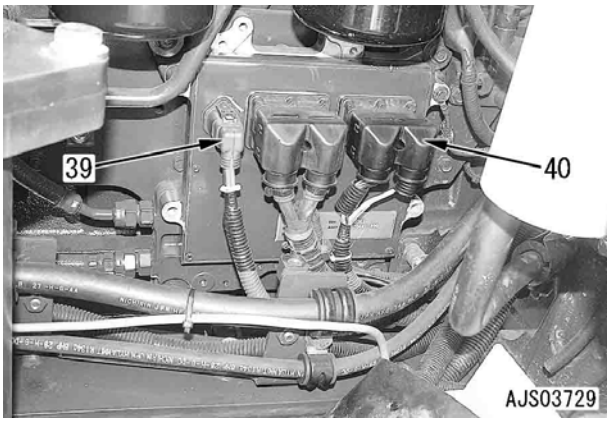


31. Disconnect fuel hose (36).

32. Remove cover (37) and engine controller cover (38).



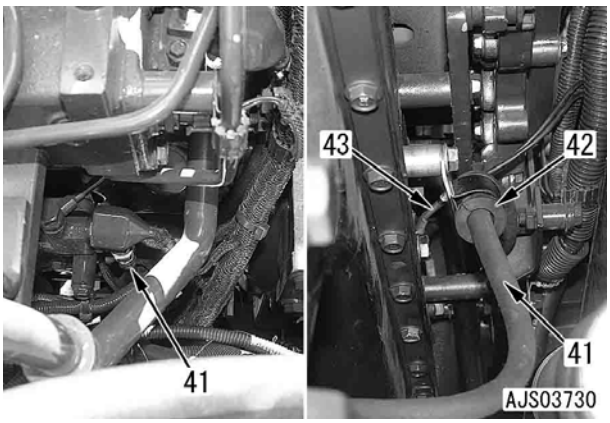
33. Disconnect connectors J3P (39) and J2P (40) from the engine controller.
    - ★ Disconnect clamps, too.



34. Disconnect fuel return hose (41) from the common rail (at the left rear of the engine unit).

35. Disconnect clamp (42) of fuel return hose (41).

36. Disconnect ground terminal GS (43).



37. Disconnect connector COMP (44).

38. Disconnect wiring harness clamp (45).

39. Disconnect connector CM (46)

40. Loosen adjustment nut (47) of the air conditioner compressor.

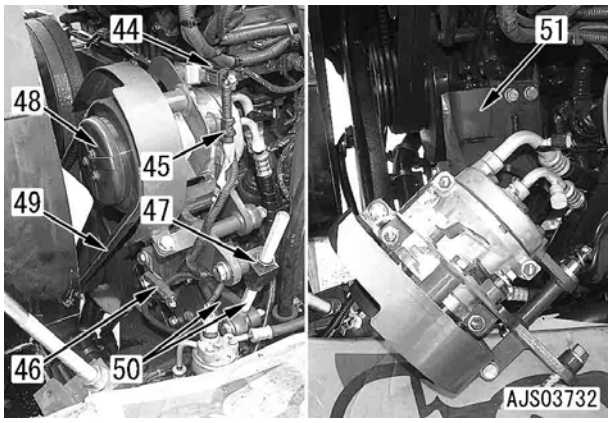
41. Loosen the mounting bolts of air conditioner compressor (48).

42. Remove air conditioner compressor belt (49). [*7]

43. Remove rod and plate assembly (50).

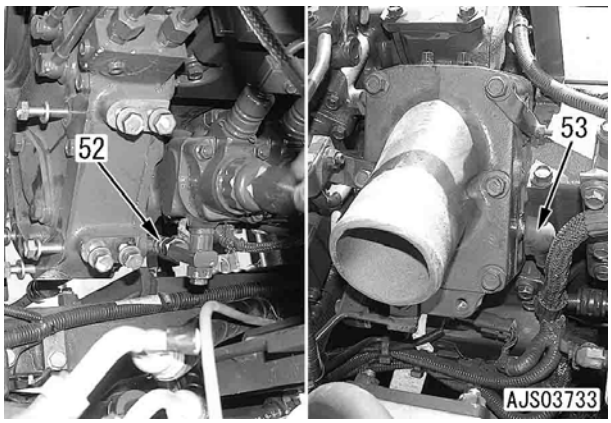
44. Remove air conditioner compressor (48) from bracket (51).
    ★ Do not disconnect air conditioner compressor hoses but place the air conditioner compressor on this side.

45. Remove air conditioner compressor bracket (51).

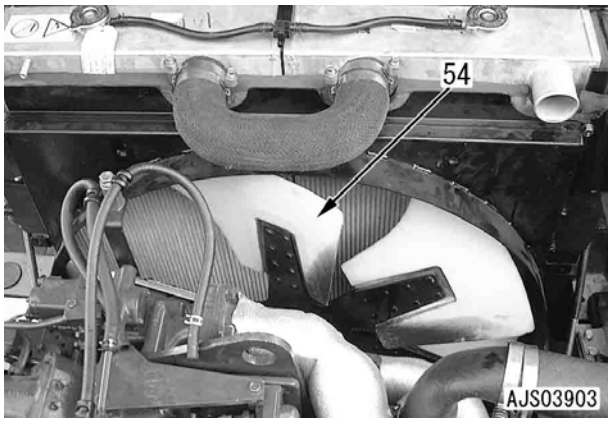


46. Disconnect fuel return hose (52).

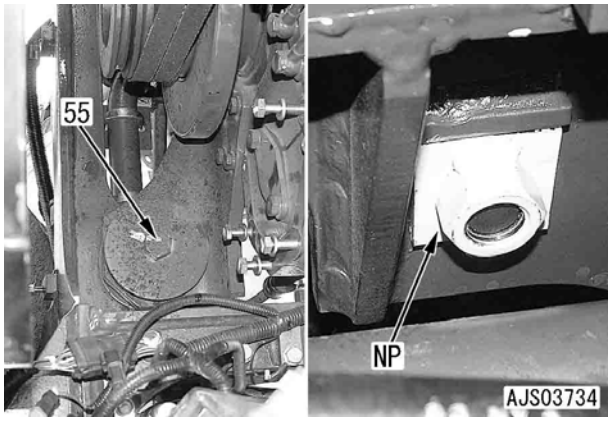
47. Disconnect heater terminal (53). [*8]



48. Remove fan assembly (54).

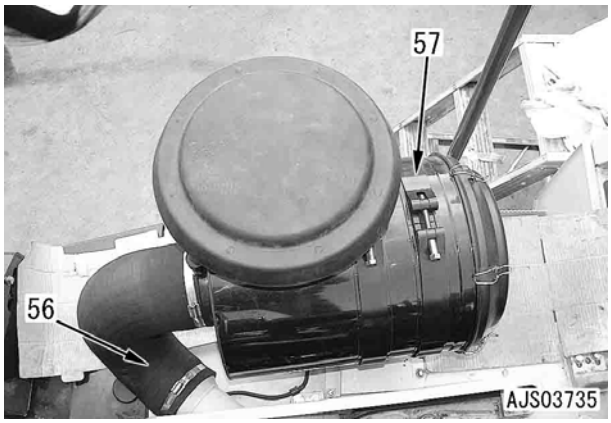


49. Remove engine mounting bolts (55). [*9]
    ★ The nut plate (NP) comes off the reverse side.



50. Disconnect air hose (56). [*10]

51. Remove air cleaner (57).

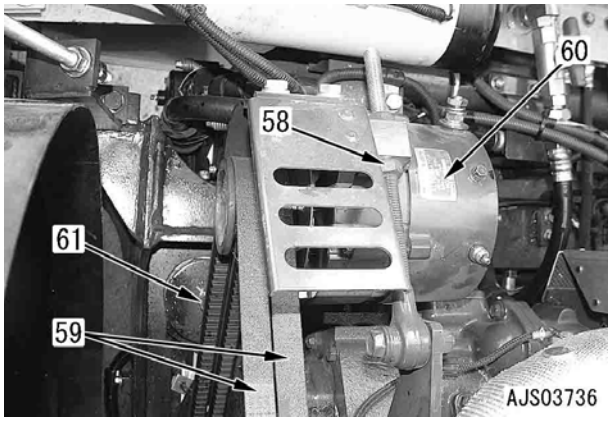


52. Loosen alternator locknut (58).

53. Remove alternator belt (59).

54. Remove alternator (60). [*11]

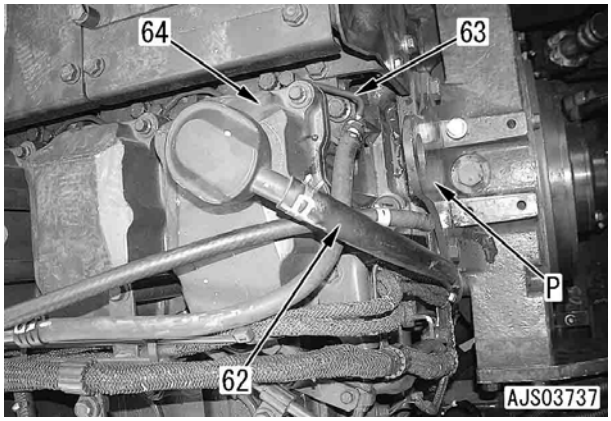
55. Remove engine mounting bolts (61). [*12]



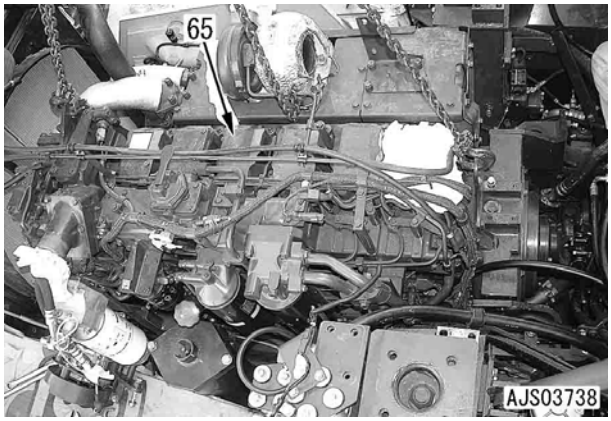
56. Disconnect blow-by hose (62).

57. Disconnect aeration tube (63).

58. Remove cylinder head cover (64). [*13]
★ PPlate to hitch sling

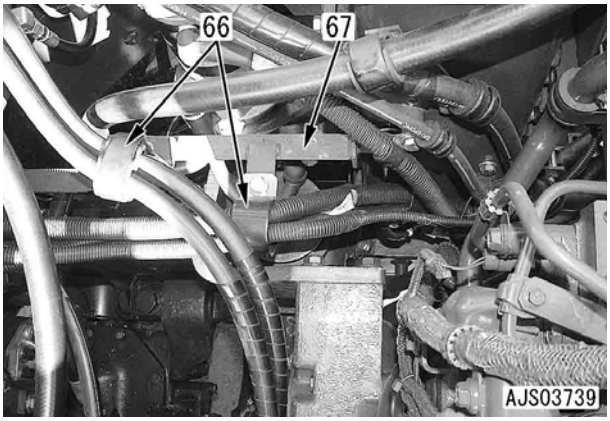


59. Temporarily sling engine assembly (65).



60. Disconnect clamps (66).

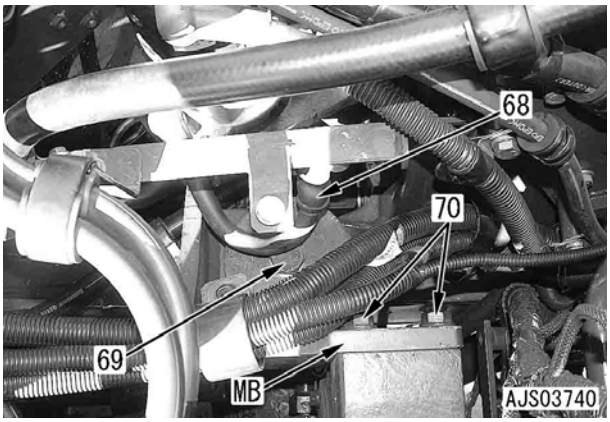
61. Disconnect bracket (67).



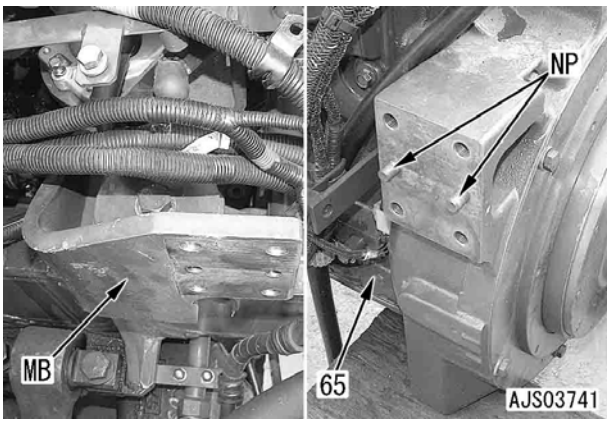
62. Disconnect emergency steering motor ground terminal (68).

63. Loosen engine mounting bolts (69). [*14]

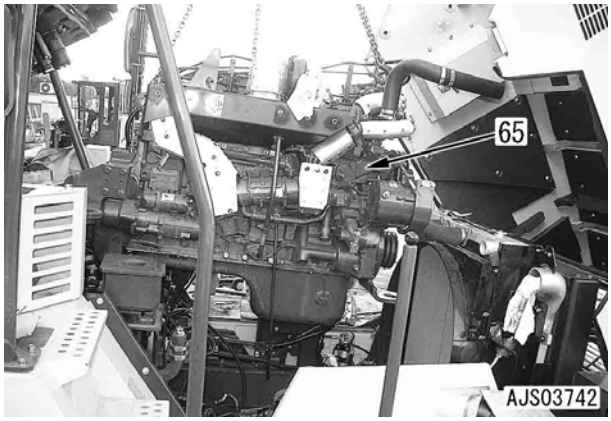
64. Remove mounting bolts (70) of the engine mounting bracket (MB).



65. Disconnect engine assembly (65) from the engine mounting bracket (MB) .
★ NP: Dowel pin



66. Lift off engine assembly (65).
Engine assembly: **1,400 kg**



Installation

- Carry out installation in the reverse order to removal.

[*1]

★ Set the tightening portions of the 2 clamps on the exactly opposite side to each other so that they can be tightened from the same direction.

Clamp: **10.5 ± 0.5 Nm{1.07 ± 0.05 kgm}**

[*2]

Radiator hose clamp:
10.5 ± 0.5 Nm{1.07 ± 0.05 kgm}

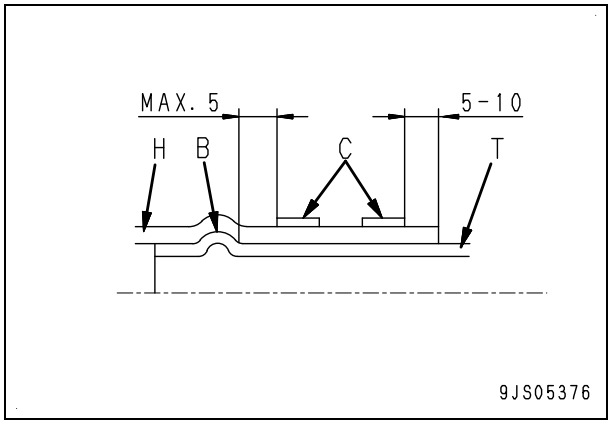
★ Set the tightening portions of the 2 clamps on the exactly opposite side to each other so that they can be tightened from the same direction.

Positions of hose clamps

- B: Bulge
- C: Clamp
- H: Hose
- T: Tube

★ Between bulge and inside clamp:
Max. 5 mm

★ Between hose end and outside clamp:
5 – 10 mm



[*3]

★ Set the tightening portions of the 2 clamps on the exactly opposite side to each other so that they can be tightened from the same direction.

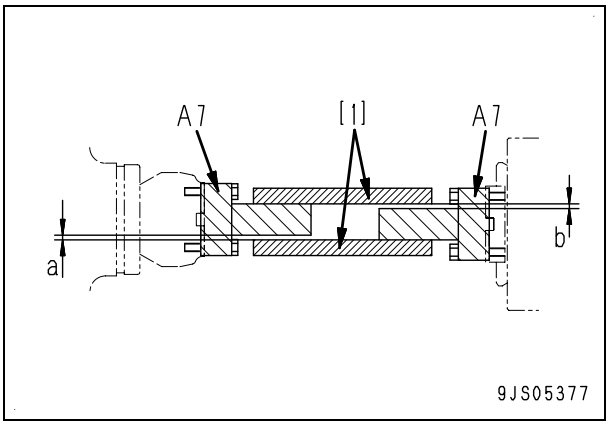
Clamp: **8.8 ± 0.5 Nm{0.90 ± 0.05 kgm}**

[*4]

★ If the engine assembly, transmission and torque converter assembly, drive shaft was removed, align them in the lateral direction with tools A7 according to the following procedure.

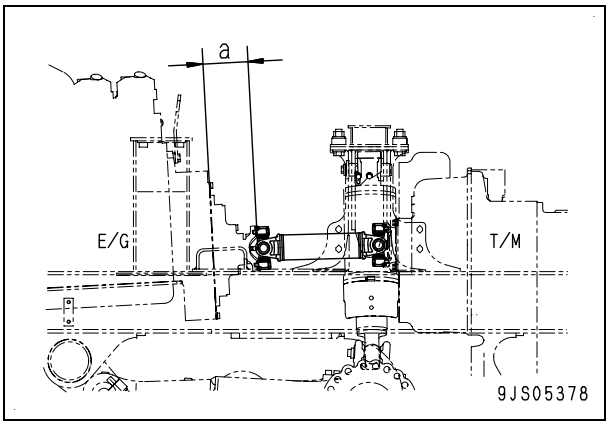
1) Install tools A7 to the coupling on the engine side and the coupling on the torque converter side.

2) Apply rules [1] to both sides of tools **A7**.
3) Measure respective clearances "a" and "b" between rules [1] and tools **A7** on both sides.
   ★ Check that the clearances at the widest position are 3 mm or less on both sides. (If the clearances are not even, check that the widest clearance is 3 mm or less.)
   ★ If the level difference is larger than 3mm mm, reduce them by moving the engine assembly.



★ When installing the drive shaft, check that the convex section on the spider cap is fitted in the groove of the mating yoke, and then tighten the mounting bolts.
Mounting bolt: **Liquid adhesive (LT-2)**
Mounting bolt:
98 – 123 Nm {10.0 – 12.5 kgm}
Target: **113 Nm{11.5 kgm}**

★ After the drive shaft between the engine and transmission is installed, measure distance (a) between the flywheel housing and coupling end. If distance (a) is out of the following range, adjust it into the standard range by moving the engine assembly.
- Distance between flywheel housing and coupling end
  (a)**: 153.2 - 156.2mm**



[*5]
★ Alternator terminal
Size M5:
1.9 – 2.5 Nm {0.19 – 0.25 kgm}
Size M6:
3.2 – 4.4 Nm {0.33 – 0.4 5 kgm}

[*6]
Starting motor terminal (M10):
19.6 – 25.5 Nm {2 – 2.6 kgm}

[*7]
Adjust the air conditioner compressor belt tension. For details, see Testing and adjusting, "Testing and adjusting air conditioner compressor belt tension".

[*8]
Heater terminal:
5.88 – 7.48 Nm {0.6 – 0.8 kgm}

[*9], [*12], [*14]
Engine mounting bolt (4 places):
662 – 829 Nm {67.5 – 84.5kgm}

[*10]
Clamp: **8.8 ± 0.5 Nm {0.90 ± 0.05 kgm}**

[*11]
Adjust the alternator belt tension. For details, see Testing and adjusting, "Testing and adjusting alternator belt tension".

[*13]
- **Cylinder head cover**

★ Check that the O-ring is installed without being twisted.
Mounting bolt:
9.8 ± 1 Nm {1.0 ± 0.1 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: **59 ℓ**

- **Bleeding air**
  See Testing and adjusting, "Bleeding air from each part".

Removal and installation of radiator assembly

Removal

- ⚠ **Stop the machine on level ground.**
- ⚠ **Turn the parking brake switch ON and stop the engine.**
- ⚠ **Chock the wheels.**
- ⚠ **Set the lock bar to the frame.**
- ⚠ **Disconnect the cable from the negative (–) terminal of the battery.**
- ⚠ **If the coolant temperature in the radiator is high, you may be scalded. In this case, wait until the coolant temperature lowers and then drain the coolant.**

1. Open engine undercover (1).

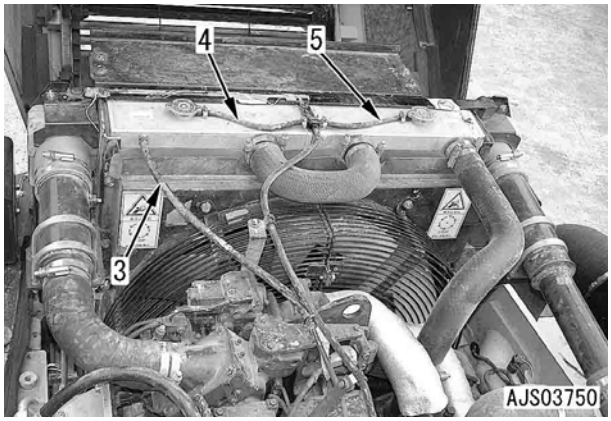
2. Open engine hood (2).

3. Remove radiator cap and then drain the coolant.
   - ★ Location of drain valves
     - Lower tank – 2 places
     - Oil cooler – 1 place

   Coolant:**59 ℓ**

4. Disconnect aeration hose (3).

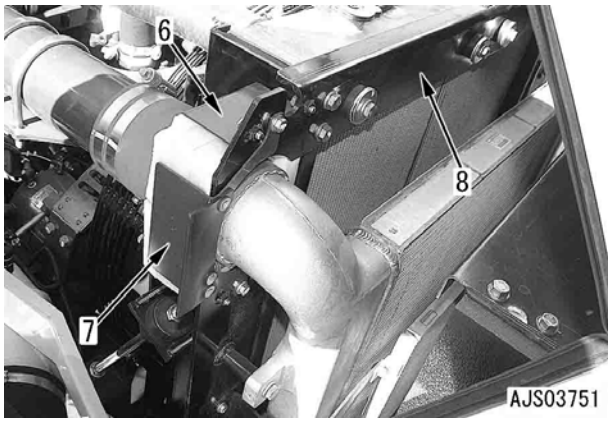
5. Disconnect reservoir tank hoses (4) and (5).



6. Remove cover (6).

7. Disconnect cover (7).

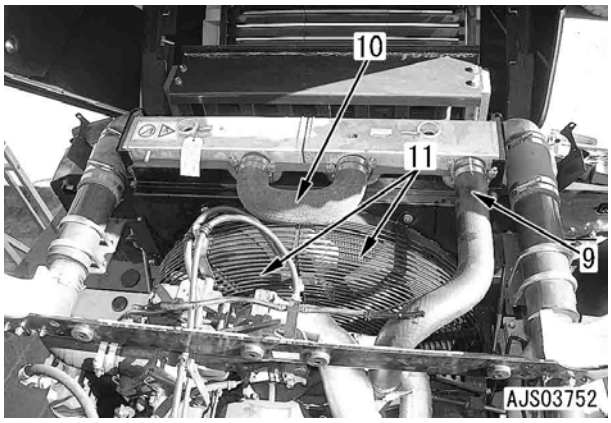
8. Remove plate (8).



9. Disconnect radiator inlet hose (9). [*1]

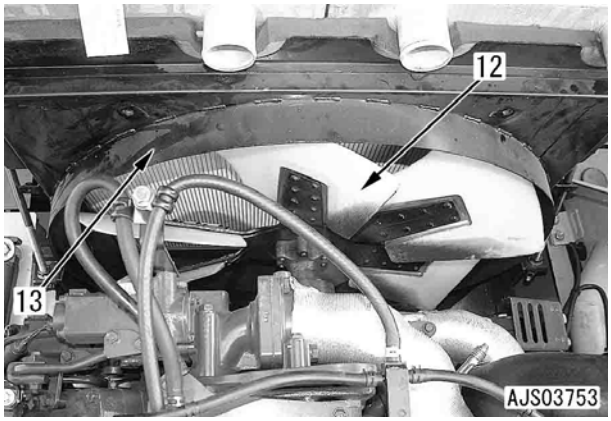
10. Remove radiator hose (10). [*2]

11. Remove fan guard (11).



12. Remove fan assembly (12).

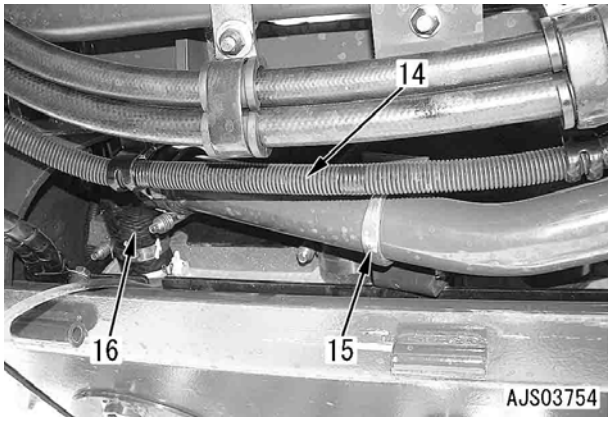
13. Disconnect shroud (13).



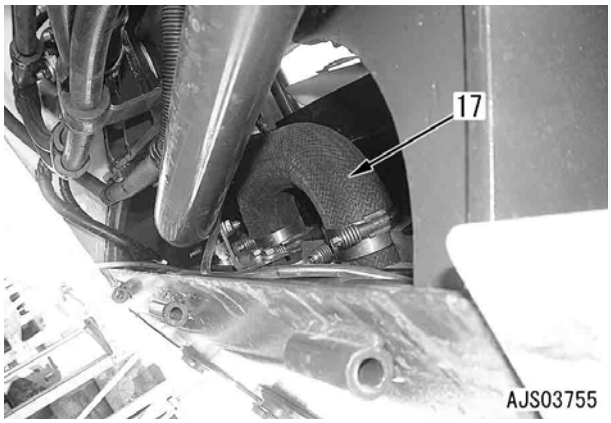
14. Disconnect the clamp of wiring harness (14) from underside.

15. Remove radiator tube clamp (15).

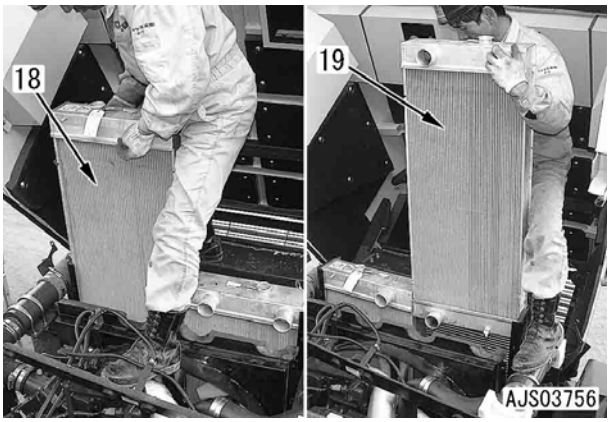
16. Disconnect radiator hose (16). [*3]



17. Remove radiator hose (17). [*4]



18. Remove radiator assemblies (18) and (19). [*5]



Installation

- Carry out installation in the reverse order to removal.

[*1] – [*4]

Radiator hose clamp:
10.5 ± 0.5 Nm {1.07 ± 0.05 kgm}

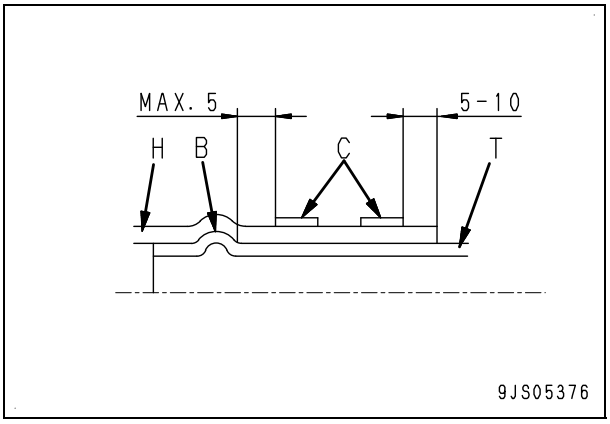
★ If there are 2 clamps, set their tightening portions on the exactly opposite side to each other so that they can be tightened from the same direction.

Positions of hose clamps

- B: Bulge
- C: Clamp
- H: Hose
- T: Tube

★ Between bulge and inside clamp:
Max. 5 mm

★ Between hose end and outside clamp:
5 – 10 mm



[*5]

If the seal (sponge) is damaged, replace it.

- **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: **59 ℓ**

Removal and installation of cooling assembly

Removal

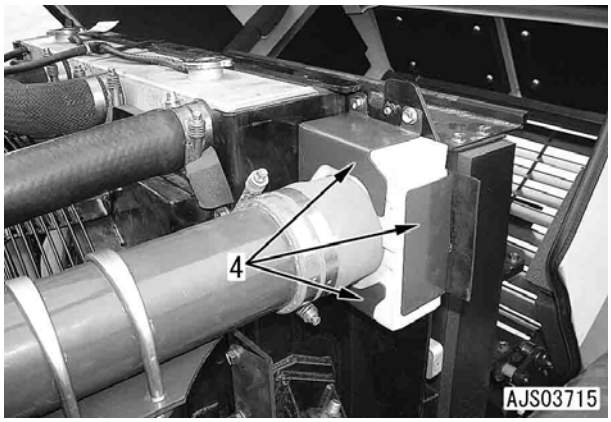
- ⚠ **Stop the machine on level ground.**
- ⚠ **Turn the parking brake switch ON and stop the engine.**
- ⚠ **Chock the wheels.**
- ⚠ **Set the lock bar to the frame.**
- ⚠ **Disconnect the cable from the negative (–) terminal of the battery.**
- ⚠ **If the coolant temperature in the radiator is high, you may be scalded. In this case, wait until the coolant temperature lowers and then drain the coolant.**

1. Open engine undercover (1).

2. Open engine hood (2).

3. Remove radiator cap and then drain the coolant.
   - ★ Location of drain valves
     - Lower tank – 2 places
     - Oil cooler – 1 place
   - Coolant: **59 ℓ**

4. Remove cover (4).



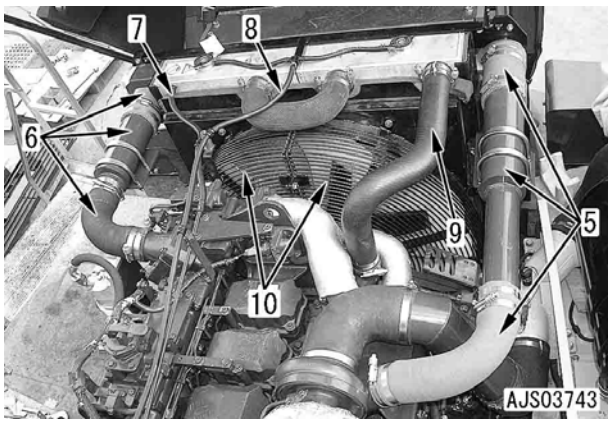
5. Remove air tube-hose-bracket assemblies (5) and (6). [*1]

6. Disconnect aeration hose (7).

7. Disconnect reservoir tank hose (8).

8. Disconnect radiator inlet hose (9). [*2]

9. Remove fan guard (10).

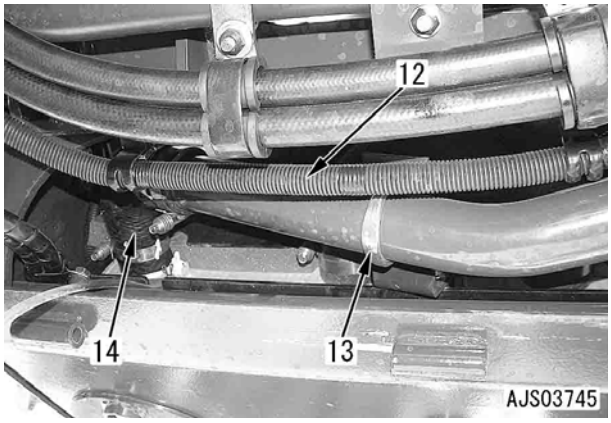


10. Remove fan assembly (11).

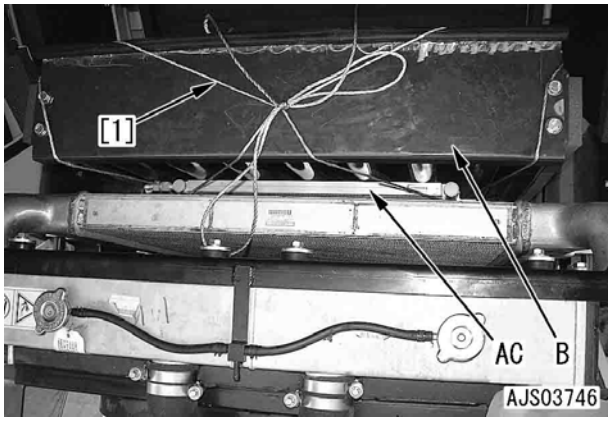
11. Disconnect the clamp of wiring harness (12) from underside.

12. Remove radiator tube clamp (13).

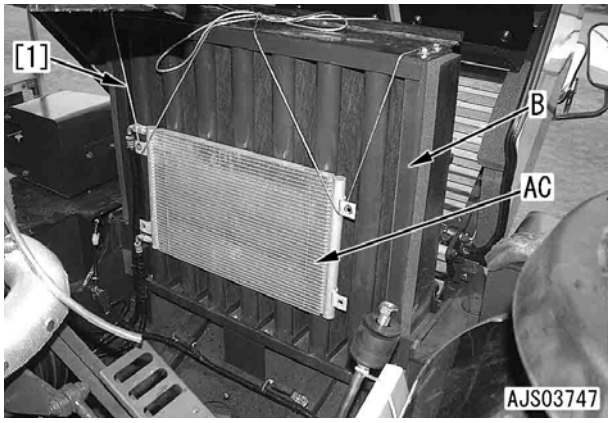
13. Disconnect radiator hose (14). [*3]



14. Secure air conditioner condenser (AC) with line [1] and disconnect air conditioner condenser (AC).
    ★ For the EU specification model, fix line [1] to sound absorbing blade (B).



★ View after cooling assembly is removed



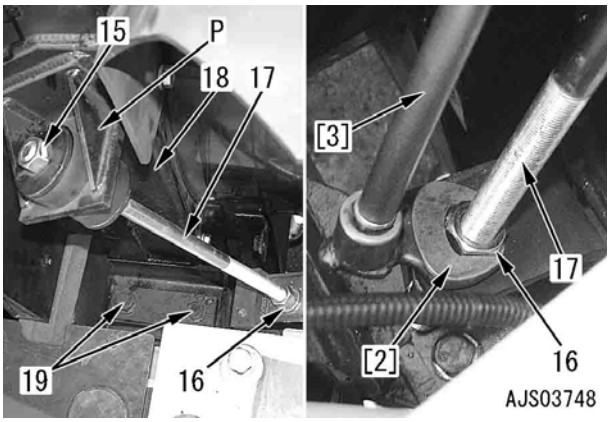
★ For models other than EU specification model, fix line [1] to the grille, etc.

15. Remove nut (15).

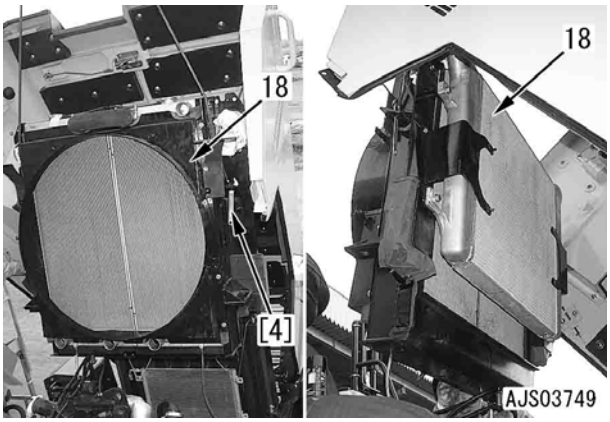
16. Loosen nut (16) and disconnect rod (17).
    ★ Since there is not sufficient space on the right side, make tool [2] by cutting a spanner of 24 mm and install an extension [3] to it for the ease of work

17. Temporarily sling cooling assembly (18).
    ★ Use mounting bracket (P) as a fulcrum.

18. Remove mounting bolts (19).



19. Lift off cooling assembly (18).
    ★ Tool [4] is used to lock the sling.
    Cooling assembly: **160 kg**



Installation

- Carry out installation in the reverse order to removal.

[*1]

★ Set the tightening portions of the 2 clamps on the exactly opposite side to each other so that they can be tightened from the same direction.

Clamp : **10.5 ± 0.5 Nm {1.07 ± 0.05 kgm}**

[*2], [*3]

Radiator hose clamp:

10.5 ± 0.5 Nm {1.07 ± 0.05 kgm}

★ If there are 2 clamps, set their tightening portions on the exactly opposite side to each other so that they can be tightened from the same direction.

Positions of hose clamps

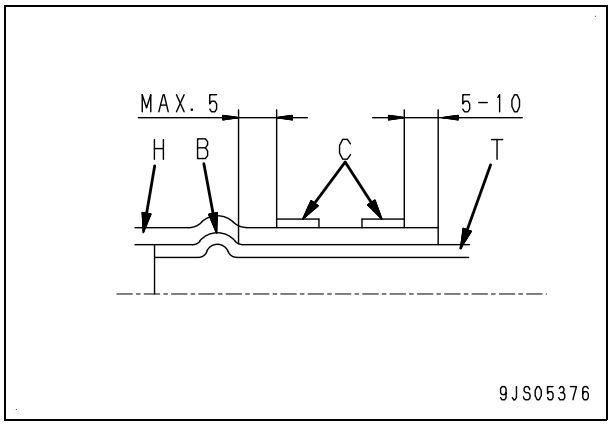
- B: Bulge
- C: Clamp
- H: Hose
- T: Tube

★ Between bulge and inside clamp:

Max. 5 mm

★ Between hose end and outside clamp:

5 – 10mm



- **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: **59 ℓ**

Removal and installation of output shaft assembly

Special tool

Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
A	7	792T-220-1310	Centering tool	■	2	N	○
		01050-61225	Bolt	■	8		
X	1	792-454-1100	Pump assembly	●	1	N	

Removal

⚠ When tilting the cab, observe the following precautions to prevent a serious injury or fatal accident caused by fall of the cab.
⚠ To prevent interference between the cab and the dump body, set the steering in a straight ahead position and stop the machine on the level ground.
⚠ Lock the dump lever with the dump lever lock knob.
⚠ Turn the parking brake switch ON and chock the wheels.
⚠ Set the lock bar to the frame and lock front and rear frame.

● Precautions in tilting cab
⚠ When tilting the cab, check that the lock lever is fixed securely.
⚠ Do not start the engine while the cab is tilted.
⚠ When it is obliged to start the engine for testing etc., check that there is nobody under the cab.
⚠ Do not operate the gear shift lever or dump lever.
⚠ Do not give a large shock to the machine.
⚠ Do not tilt the cab while it is loaded.

⚠ Disconnect the cable from the negative (–) terminal of the battery.
⚠ Loosen the hydraulic oil filler cap to release the internal pressure of the hydraulic tank.

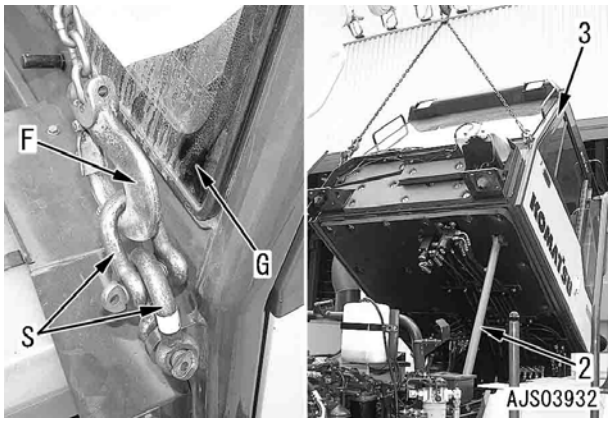
1. Drain the oil from the hydraulic tank.
   Hydraulic tank: **120 ℓ**

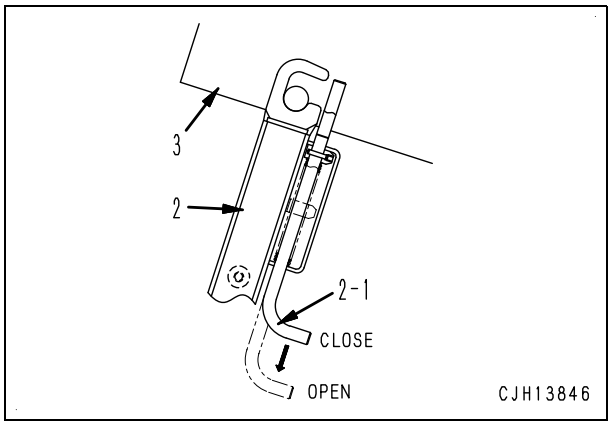
2. Open engine hood (1).

3. Remove 4 each mounting bolts from the right and left mounts at the front of the cab.
   ★ Check the thickness, quantity, and positions of the inserted shims.

4. Sling opsserator's cab (3) and tilt it up.
   ★ Use 2 shackles (S) so that hook (F) of the sling will not hit glass (G) of the cab assembly.

5. Pull lock lever (2-1) and set lock bar (2) with the care the direction of the lock bar (2).
   ⚠ **Check that the lock lever (2-1) closes and the operator cab assembly (3) is held securely in position by the lock bar (2).**
   For details about cab tilt, see "Method of tilting cab up" in chapter Testing and adjusting.
   ★ Pump assembly **X1** is necessary for tilting up by tilt cylinder.

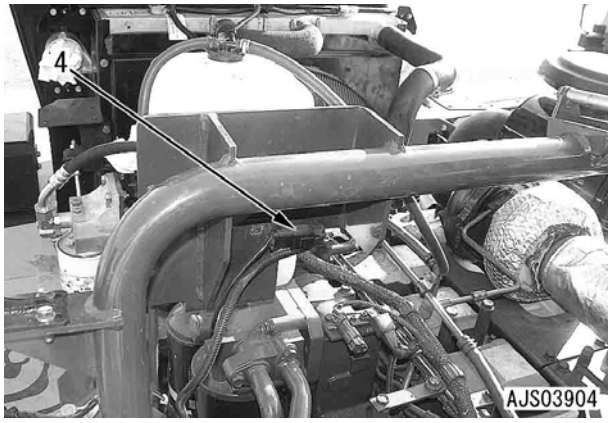


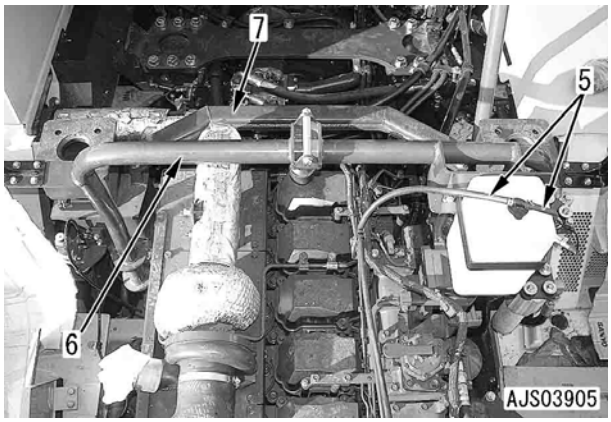


6. Disconnect connector M01 (4) from the rear of the reservoir tank.

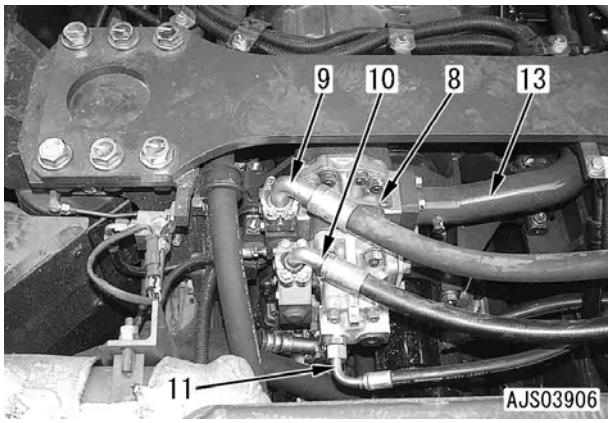
7. Disconnect reservoir tank hose (5).

8. Remove bars (6) and (7).

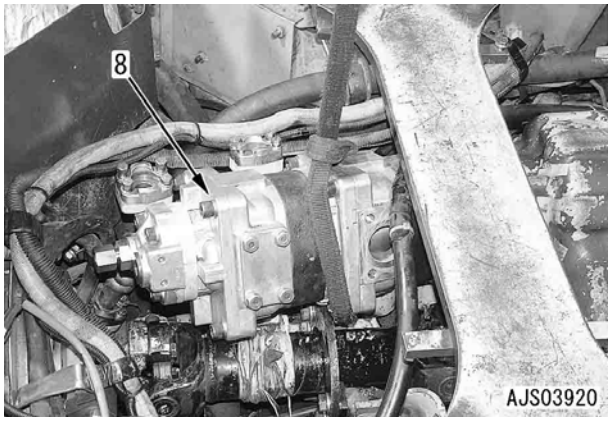




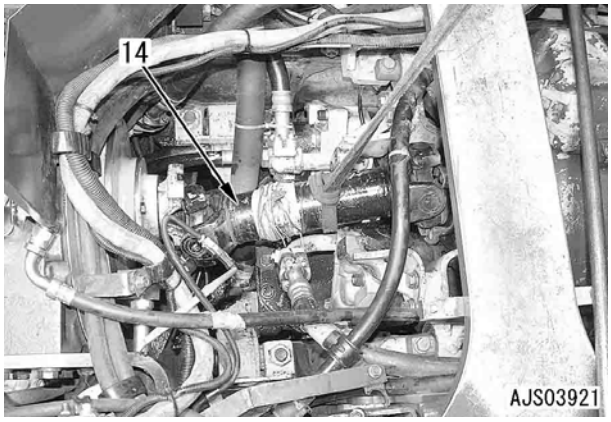
9. Disconnect the following piping from steering and hoist pump (8).
   - (9) – (11): Discharge hoses
   - (13): Suction tube



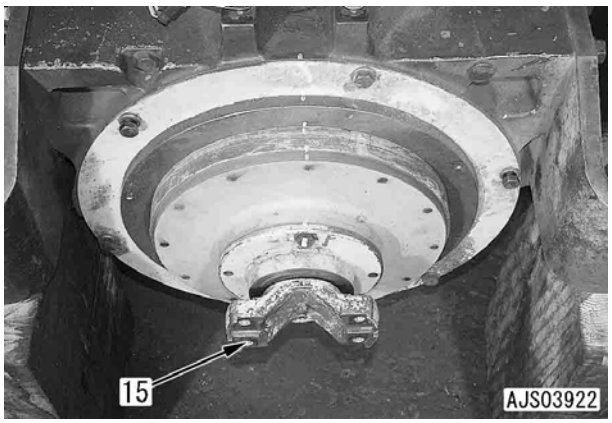
10. Lift off steering and hoist pump assembly (8).
    Steering and hoist pump assembly: **40 kg**



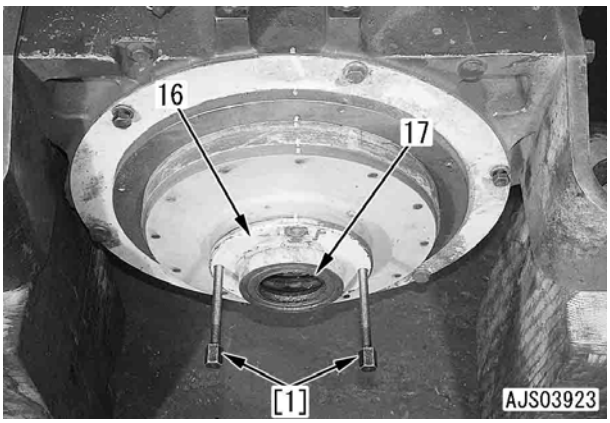
11. Lift off drive shaft (14) between the engine and transmission.



12. Remove coupling (15). [*2]

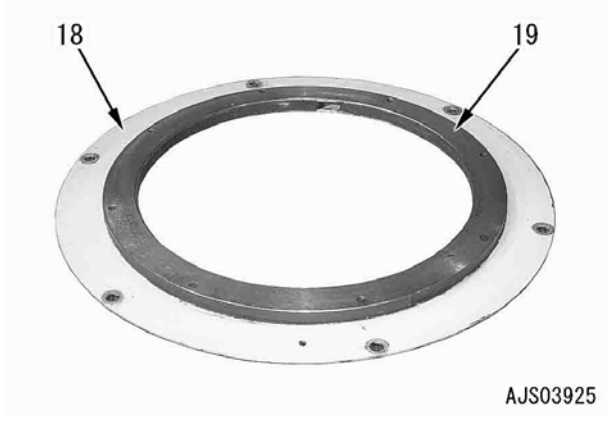


★ When replacing oil seal (17), remove oil seal cage (16) with forcing screws [1] and remove oil seal (17) from the oil seal cage. [*3]

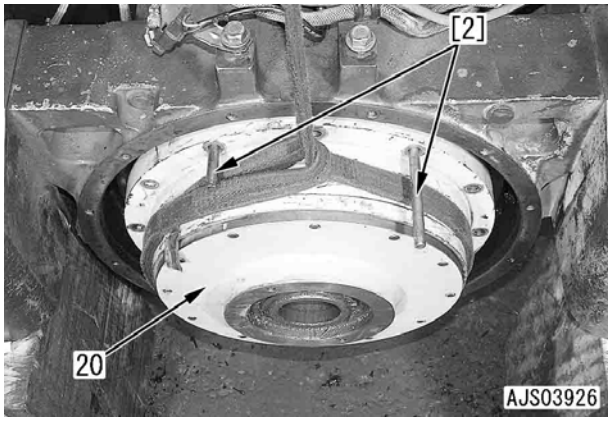


13. Remove cover (18). [*4]

14. Remove plate (19) from cover (18). [*5]
    ★ There is a seal between cover (18) and plate (19).



15. Using guide bolts [2], lift off output shaft assembly (20). [*6].
    Output shaft assembly: **50 kg**



Installation

- Carry out installation in the reverse order to removal.

[*1]

★ For details, see Removal and installation of engine assembly, Installation, [*4].

Mounting bolt: **Liquid adhesive (LT-2)**

Mounting bolt:

98 – 123 Nm {10.0 – 12.5 kgm}

Target: 113 Nm {11.5 kgm}

[*2]

★ Before installing the coupling, supply 20 cc of lithium molybdenum disulfide extreme pressure grease to part S.

Lithium molybdenum disulfide extreme pressure grease:

- **Molylex No. 2 manufactured by KHODO YUSHI or equivalent**
- **Retinax AM manufactured by SHOWA SHELL SEKIYU or equivalent**
- **Molytex No. 2 manufactured by NIPPON OIL CORPORATION or equivalent**

★ Before installing the coupling, apply molybdenum disulfide dry lubricant to its spline (R) and dry in air for 2 – 3 minutes.

Molybdenum disulfide dry lubricant:

Rocol Dry Spray manufactured by SUMICO LUBRICANT or equivalent

[*3]

★ When installing the oil seal, fill space **G**between the main lip and dust lip with **G2-LI** or lithium molybdenum disulfide extreme pressure grease.

★ When installing the oil seal cage, supply **100 cc** of lithium molybdenum disulfide extreme pressure grease to part **T**.

Lithium molybdenum disulfide extreme pressure grease:

- **Molylex No. 2 manufactured by KHODO YUSHI or equivalent**
- **Retinax AM manufactured by SHOWA SHELL SEKIYU or equivalent**
- **Molytex No. 2 manufactured by NIPPON OIL CORPORATION or equivalent**

Oil seal cage mounting bolt:

58.8 – 73.5 Nm {6 – 7.5 kgm}

[*4]

Between cover and flywheel housing (U):

Gasket sealant:

ThreeBond 1207B or equivalent

Cover and plate assembly mounting bolt:

58.8 – 73.5 Nm {6 – 7.5 kgm}

[*5]

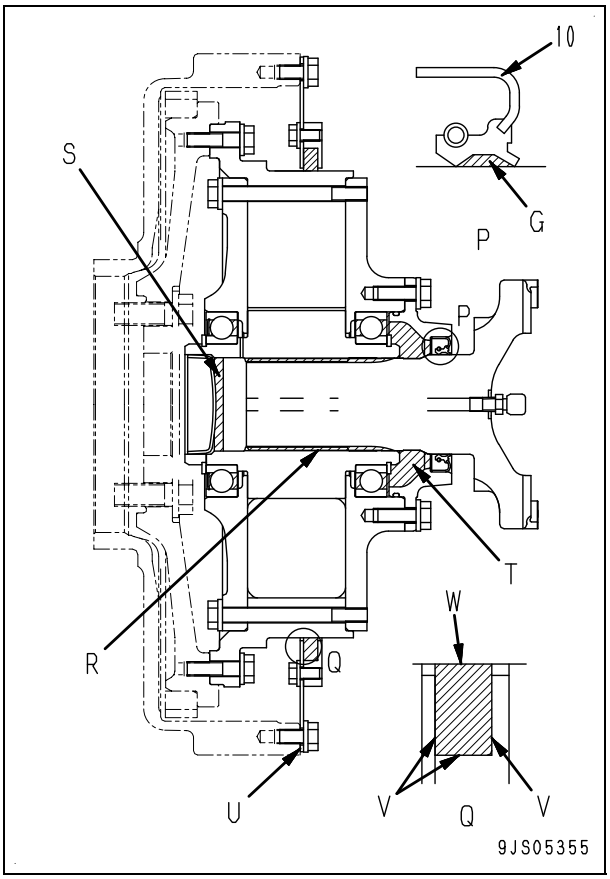
Contacting surfaces of seal cover and plate (V): **Adhesive (ThreeBond No. 1521 or equivalent)**

Inside contacting surface of seal (W):

Grease (G2-LI)

Plate mounting bolt:

27.44 – 34.3 Nm {2.8 – 3.5 kgm}



[*6]

Mounting bolt: **Liquid adhesive (LT-2)**

Output shaft assembly mounting bolt:

58.8 – 73.5 Nm {6 – 7.5 kgm}

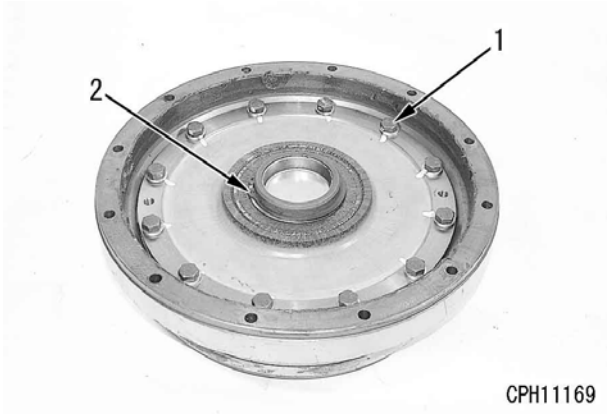
Disassembly and assembly of output shaft assembly

Disassembly

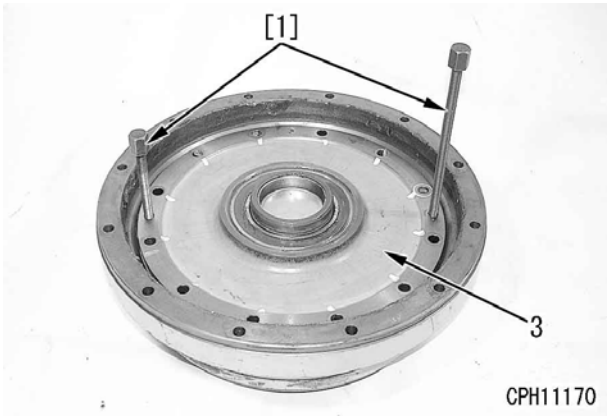
★ Prepare for ENS grease (G2-U-S):
427-12-11871 (grease).

★ In order not to lose the original balance of the output shaft assembly due to disassembly, mark a setting position on the flange and outer body before disassembling.

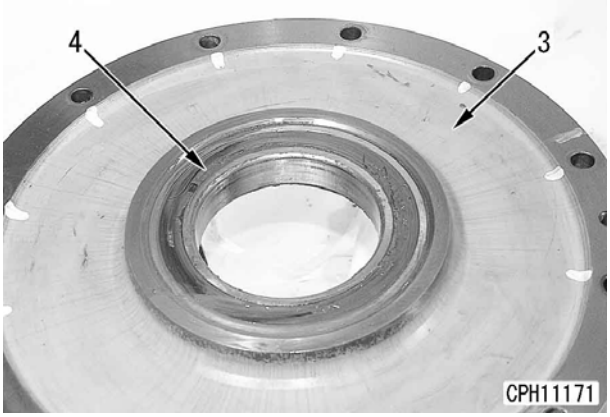
1. **Inner flange**
   1) Remove 12 flange mounting bolts (1).
   2) Remove snap ring (2).



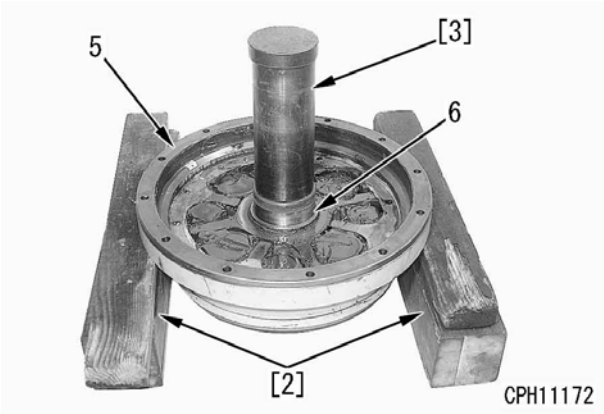
   3) Remove inside flange (3), using forcing screws [1].



   4) Remove bearing (4) from inside flange (3).

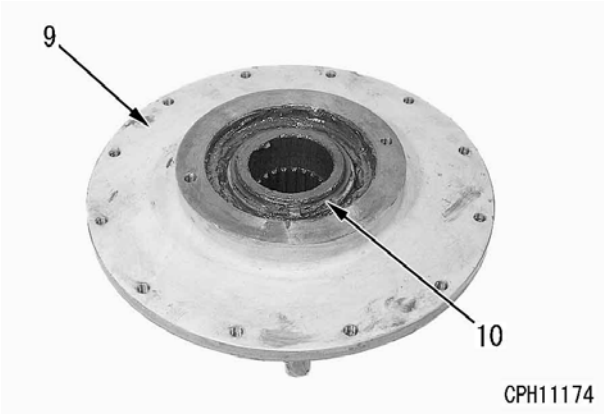


2. **Outer body**
   1) Set outer body (5) on wooden blocks [2], keeping it off the ground.
   2) Separate outer body (5) from inner body (6), hitting the inner body with push tool [3].

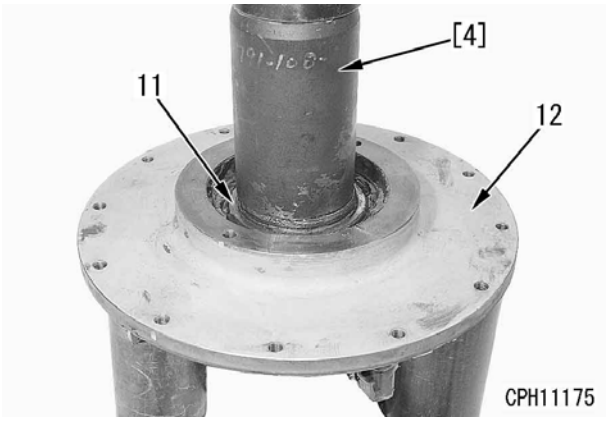


3. **Rubber**
   Remove 4 large pieces of rubber (7) and 4 small pieces of rubber (8).

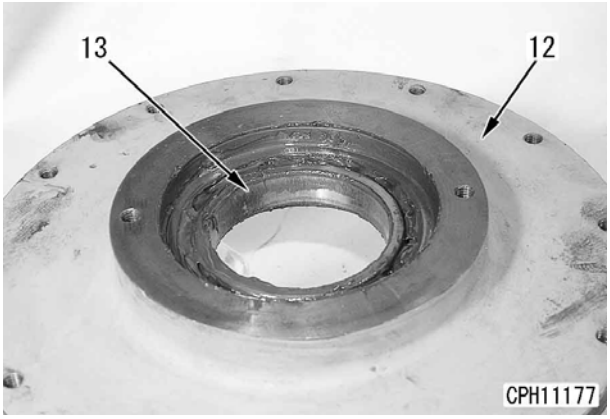
4. **Outside flange and inner body**
   1) Reverse outside flange and inner body assembly (9).
   2) Remove snap ring (10).



3) Push inner body (11) out of outer flange (12) with a press, using push tool [4].



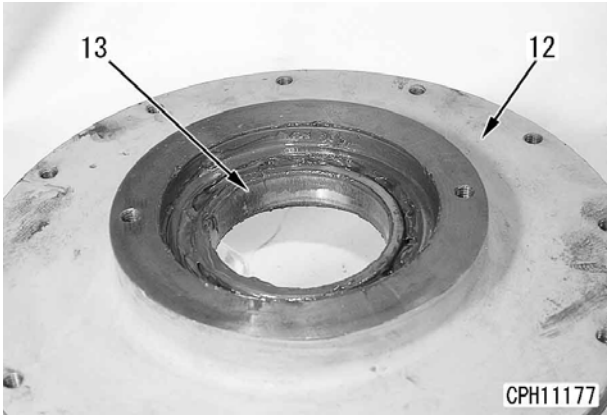
4) Remove bearing (13) from outside flange (12).



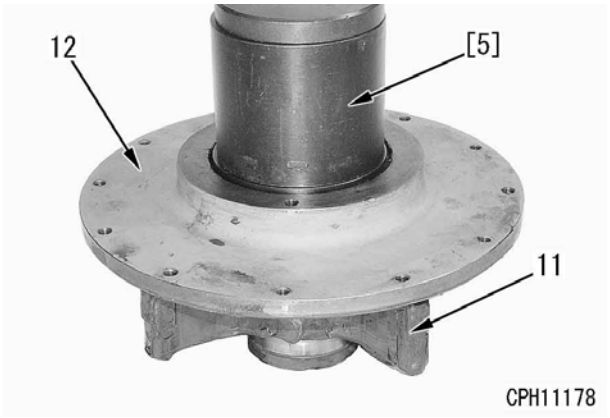
Assembly

1. **Outside flange and inner body**

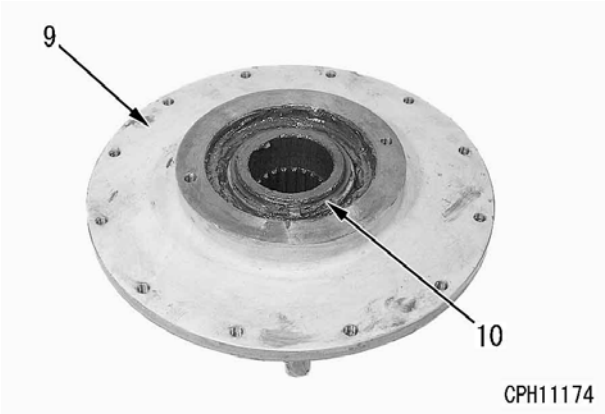
1) Press-fit bearing (13) into outside flange (12).
   - ★ Fill the inside and outside of bearing balls completely with lithium type extreme-pressure grease containing molybdenum disulfide.
   - Lithium type extreme-pressure grease containing molybdenum sulfide:
     - **Molylex No. 2 of Kyodo Yushi or equivalent**
     - **Retinax AM of Showa Shell Sekiyu or equivalent**
     - **Molynoc No.2 of Nippon Mitsubishi Oil or equivalent**
   - Bearing outside contact face on outside flange and outside cylindrical surface of bearing: **Loctite 601 or equivalent**



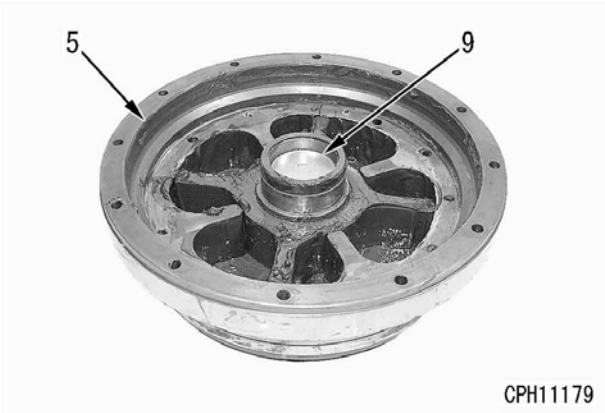
2) Set outside flange (12) on inner body (11), and then press-fit, using push tool [5].
   - Bearing contact face on inner body and intside cylindrical surface of bearing: **Loctite 601 or equivalent**



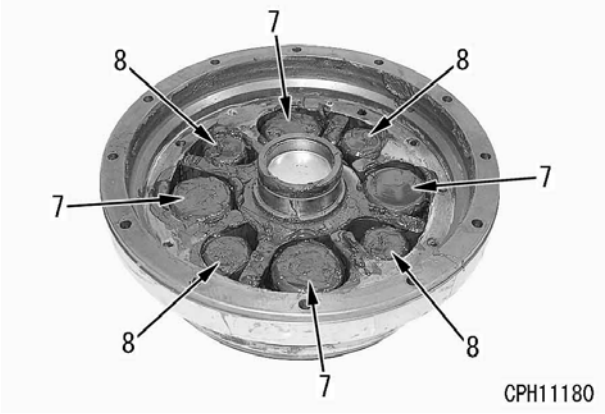
3) Install snap ring (10).

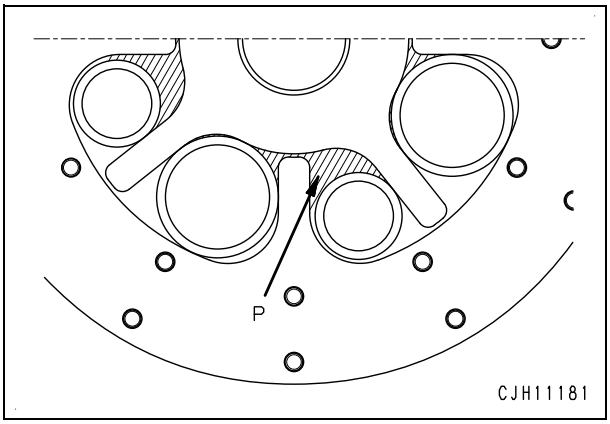


2. **Outer body**
   1) Reverse outside flange and inner body assembly (9).
   2) Press-fit outer body (5) into outside flange and inner body assembly (9).
      Mating face: **Gasket sealant (LG-11)**



3. **Rubber**
   Install 4 large pieces of rubber (7) and 4 small pieces of rubber (8).
   ★ Set the rubber pieces as shown in the photo below.
   When installing the rubber pieces, coat all over the rubber, inner body periphery and outer body periphery with ENS grease (G2-U-S).
   After installing the rubber pieces, fill each (P) portion (4 points) between the rubber and inner body evenly with **190 mℓ** of ENS grease (G2-U-S).
   ★ ENS grease (G2-U-S):
   427-12-11871





HM300-2 Articulated dump truck

Form No. SEN00685-04

ARTICULATED DUMP TRUCK

HM300-2

Machine model	Serial number
HM300-2	2001 and up

50 Disassembly and assembly

Power train, Part 1

Removal and installation of transmission and front differential assembly

Special tool

Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
A	7	792T-220-1310	Centering tool	■	2	N	○
		01050-61225	Bolt	■	8		

Removal

⚠ **Stop the machine on level ground.**

⚠ **Turn the parking brake switch ON and stop the engine.**

⚠ **Chock the wheels.**

⚠ **Set the lock bar to the frame.**

⚠ **Disconnect the cable from the negative (–) terminal of the battery.**

⚠ **Loosen the hydraulic oil filler cap to release the internal pressure of the hydraulic tank.**

1. Drain hydraulic oil.

Hydraulic tank: **120ℓ**

2. Drain oil from the transmission and brake oil tank.

Transmission case and brake oil tank: **77.5ℓ**

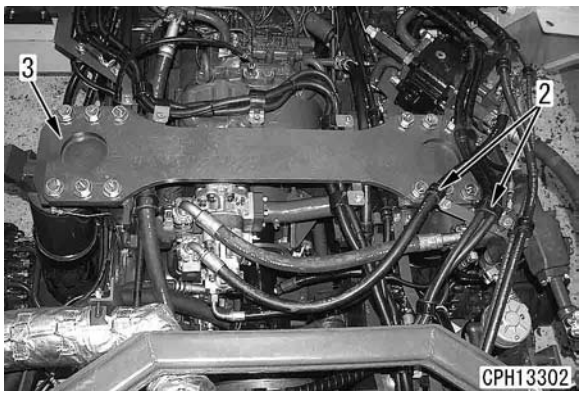
3. Refer to the section of "removing and installing the operator's cab assembly", sling operator's cab assembly (1) to remove.

Operator's cab assembly: **1,200 kg**

4. Disconnect clamp (2).

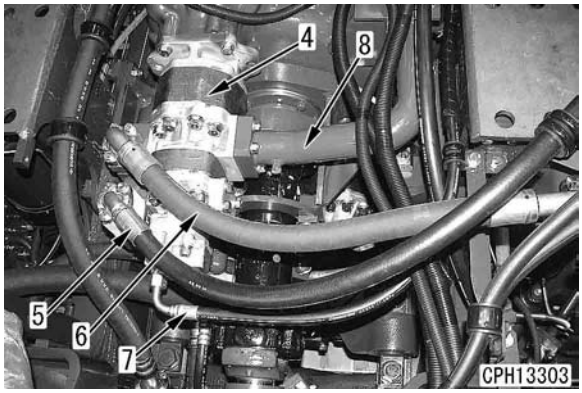
5. Sling vertical member (3) to remove.

Vertical member: **35 kg**



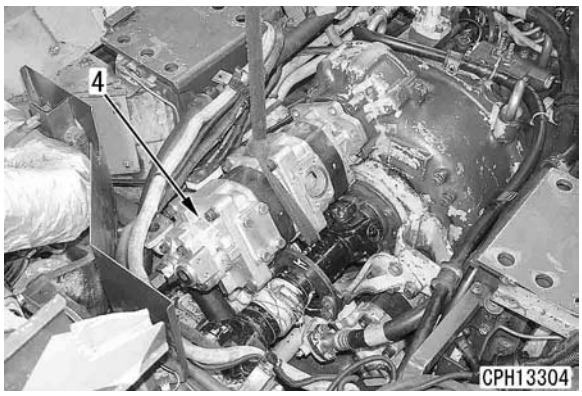
6. Separate the following parts from the transmission upper front side.

1) Disconnect 3 discharging hoses (5) to (7) from steering and hoist pump assembly (4).
2) Remove suction tube (8).

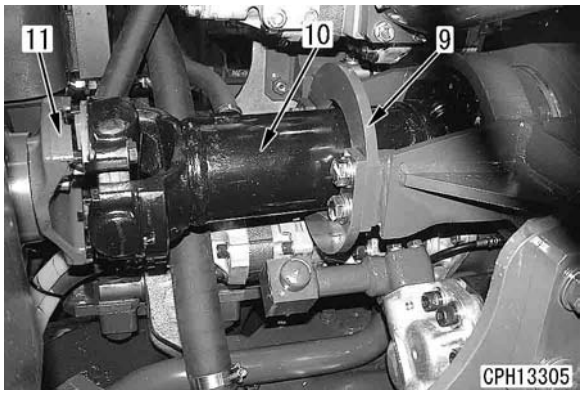


3) Sling steering and hoist pump assembly (4) to remove.

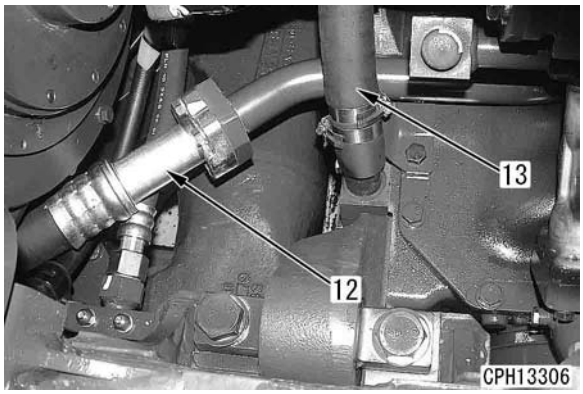
Steering and hoist pump assembly : **50 kg**

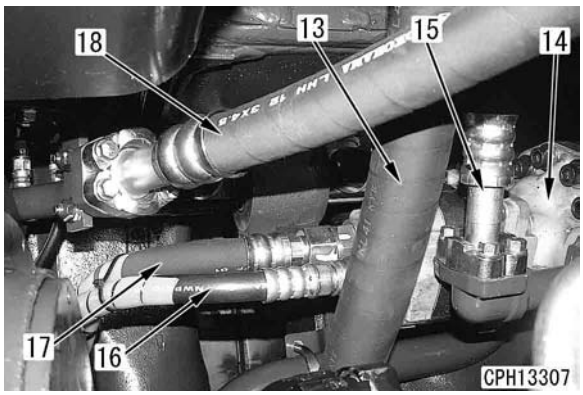


4) Remove upper and lower drive shaft guards (9), and then remove drive shaft (10) between the engine and transmission. [*1]
   Drive shaft: **25 kg**
5) Remove coupling (11) on the output shaft side. [*2]

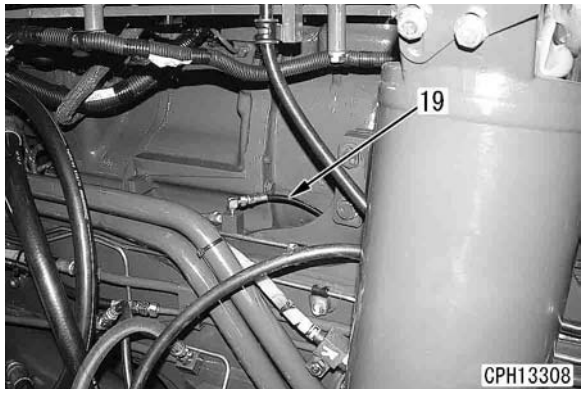


6) Disconnect transmission lubrication circuit inlet hoses (12).
7) Disconnect front differential breather hose (13).
8) Disconnect 3 discharging hoses (15), (16) and (17) from the rear brake cooling and brake actuating pump assembly (14).
9) Disconnect hose (18).

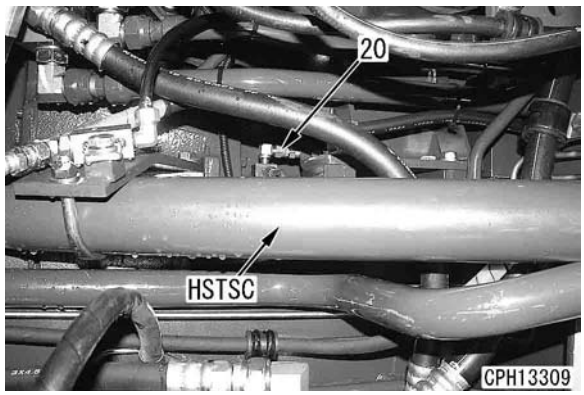




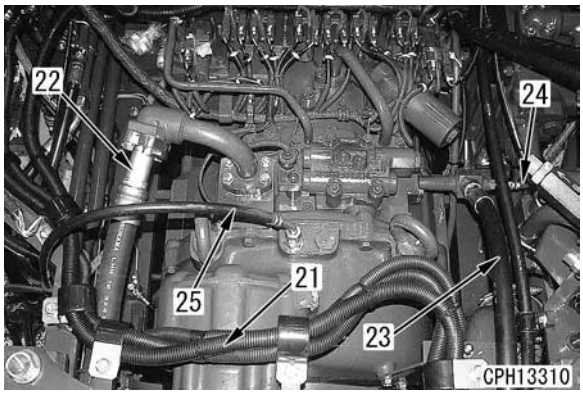
7. Disconnect grease hose (19) from the frame right side.

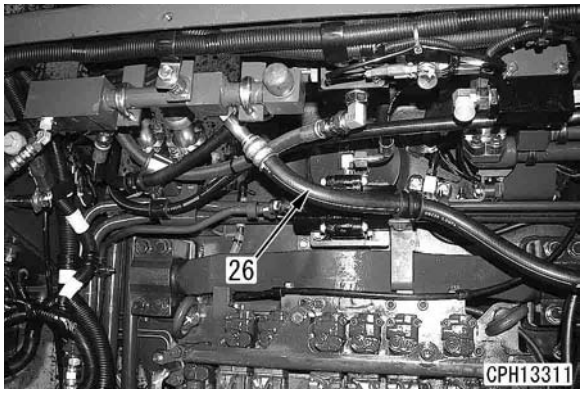


8. Disconnect grease hose (20) from frame left side.
★ HSTSC: Hydraulic tank suction tube

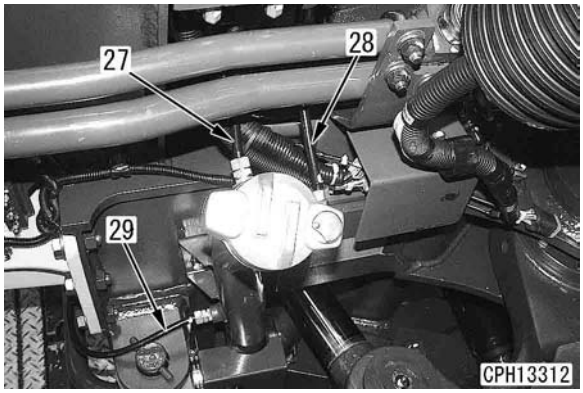


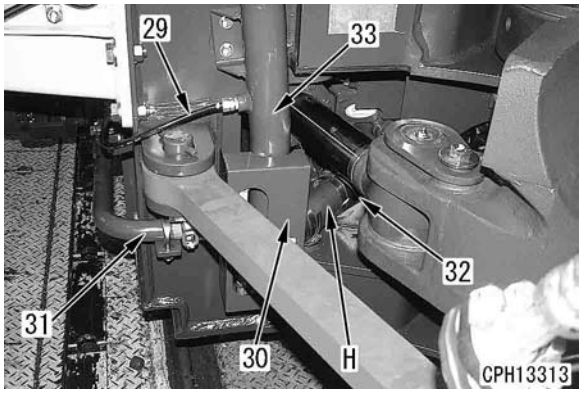
9. Separate the following parts from the transmission upper rear side.
1) Disconnect clamp of the hose (21).
2) Disconnect torque converter outlet hoses (22), (23) and (24) and return hose (25).
3) Disconnect hose (26).



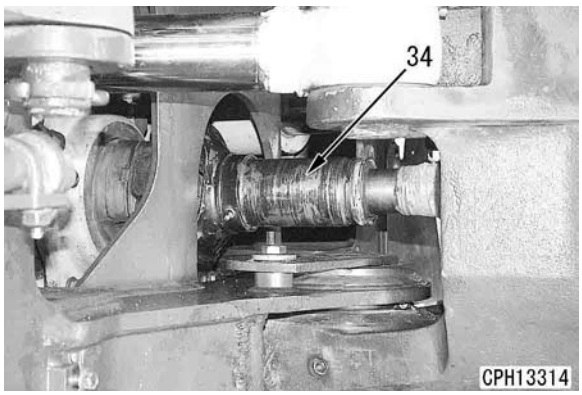


10. Separate the following parts from the rear left of the transmission.
1) Disconnect return hoses (29) to brake sub-tank as well as breather hose (27) and (28) from the oil supply piping.
2) Remove cover (30).
3) Remove tube (31) between the sub-tank and oil supply piping.
4) Remove the mounting bolts of oil supply hose (H) connector (32).
5) Disconnect oil supply piping (33).

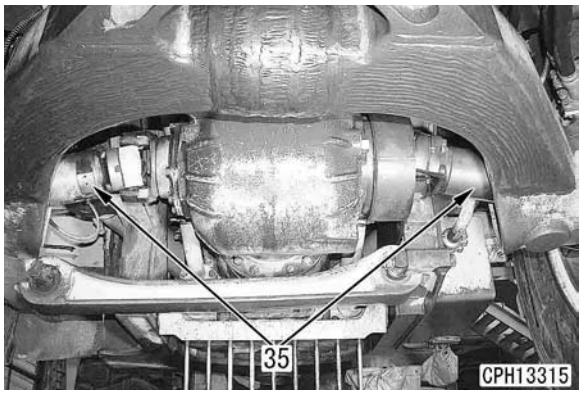




6) Remove drive shaft (34) between the transmission and hitch frame. [*3]
Drive shaft between transmission and hitch frame: **30 kg**



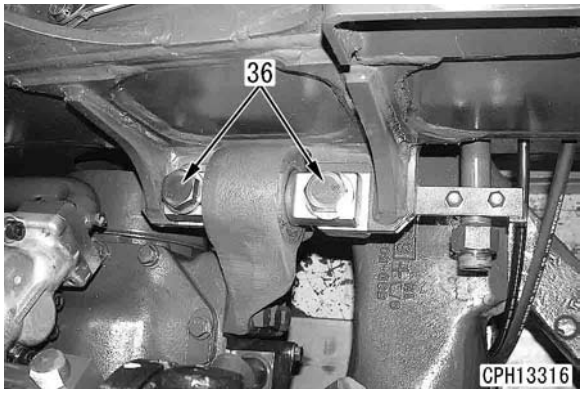
11. Disconnect left and right drive shafts (35) from the underside of the transmission. [*4]
★ Disconnect them at the front differential side.

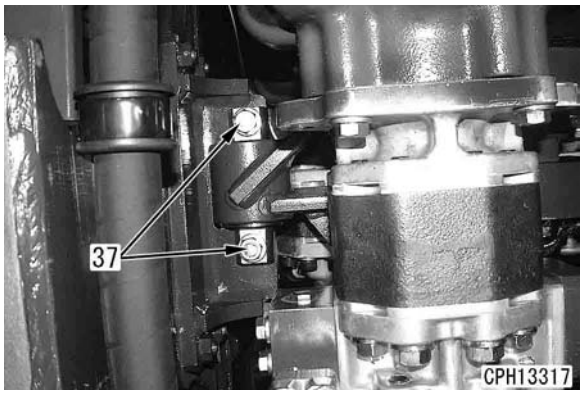


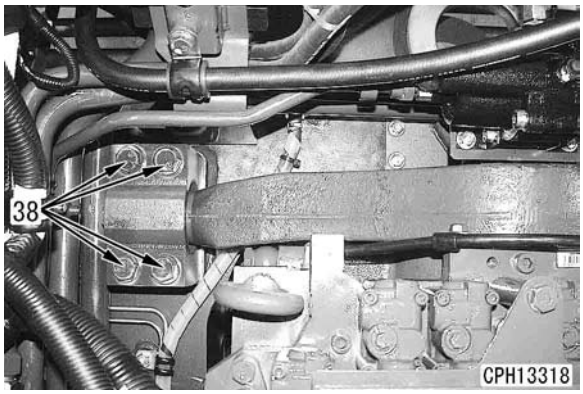
12. Remove the each mounting bolt. [*5]
- Front differential mount (36).
- Transmission mounts front side (37) and rear side (38).

★ Remove the mounting bolt of the front differential mount (36) from under the machine.

★ Shims are installed, so check their thickness, number in use and installed location beforehand.



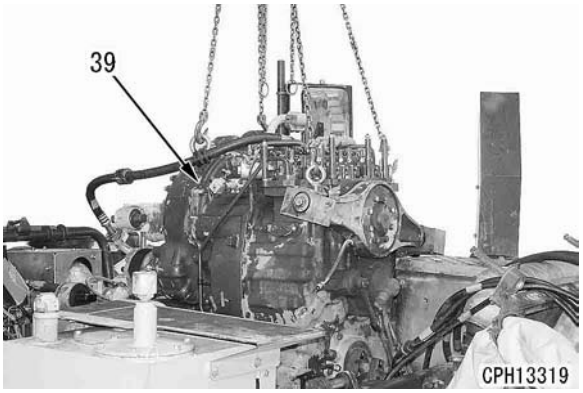




13. Sling the transmission and front differential assembly (39) slowly and remove it.

★ Make sure that no hose or wiring is left still connected.
In particular, take good care to avoid interference between the transmission lubrication inlet tube (return tube) on the front side and the output shaft oil seal as well as interference between the rear left mount and the hoist valve.

Transmission and front differential assembly: **1,450 kg**



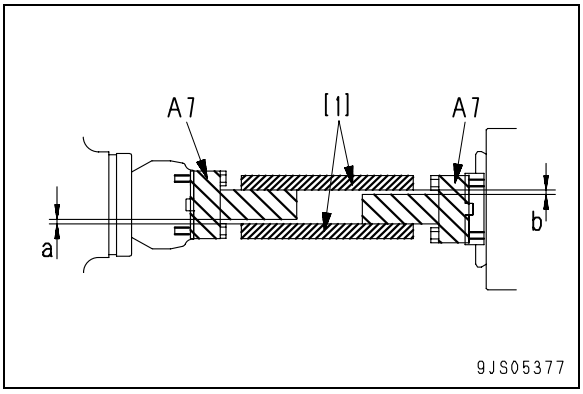
Installation

- Installation is carried out in the reverse order to removal.

[*1]

★ When removing the engine assembly, transmission and torque converter assembly or drive shafts, carry out centering the engine and transmission in the left and right direction in the following manner, using tool **A7**.

1) Install tool **A7** to the coupling on the engine side and the coupling on the torque converter side.
2) Put scale [1] to the left and right sides of tool **A7**.
3) Measure the clearance between scale [1] and tool **A7** on the left side (a) and on the right side (b).
   ★ Check that the max. clearance remains below 3 mm both on the left and right sides. (If both clearances are not in parallel, check that the clearance remains less than 3 mm even at the widest point)
   ★ If the clearance exceeds 3 mm, make adjustment by shifting the position of torque transmission front differential assembly mount.



★ When installing the drive shaft, check that the convex section on the spider cap fully engage with groove of the corresponding yoke, and then tighten the mounting bolt.

Mounting bolt: **Liquid adhesive (LT-2)**

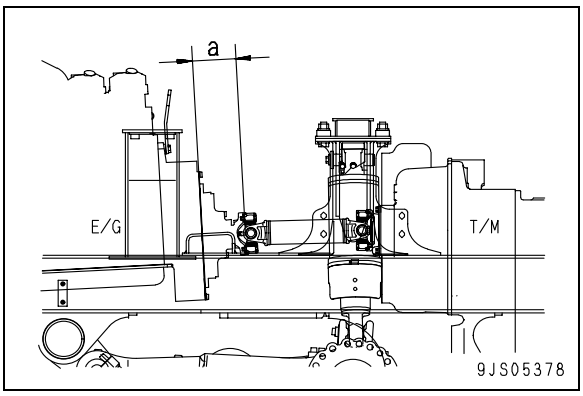
Mounting bolt for drive shaft between engine and transmission:

98 – 123 Nm {10 – 12.5 kgm}

[Target value: 113 Nm {11.5 kgm}]

★ When measuring dimension "**a**" between the flywheel housing and the coupling tip, while drive shaft between the engine and transmission is in place, and if this dimension "**a**" falls out of the value shown below, make adjustment by shifting the position of transmission and front differential assembly mount so that the dimension falls within the specified value.

- Dimension "**a**" between flywheel housing and coupling tip: **156.2** $^{0}_{-3}$ **mm**

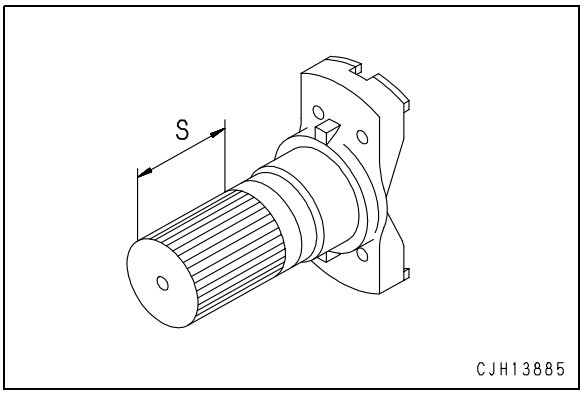


[*2]

★ Coat the coupling spline area (S) with dry type lubricant of molybdenum disulfide, and install after it dries up in a few minutes.

Dry type lubricant of molybdenum disulfide:

Rocol Dry Spray of Sumico Lubricant or equivalent



[*3] [*4]

★ When installing the drive shaft between the transmission and hitch frame, turn it to face in the same direction as the yoke of the drive shaft between the hitch frame and center differential.

★ When installing drive shafts, check that the convex section on spider cap fully engages with the groove of the counter yoke, and then tighten the mounting bolts.

★ Install the drive shaft between the transmission and hitch frame only after confirming that it faces in the same direction as the yoke of the drive shaft between the hitch frame and center differential does.

Mounting bolt
: Liquid adhesive (LT-2)

Mounting bolt for drive shaft between transmission and hitch frame and mounting bolt for left and right drive shaft
: 98 – 123 Nm {10 – 12.5 kgm}
[Target value: 113 Nm {11.5 kgm}]

[*5]

★ Install shims both for the front differential mount and for the transmission rear mount. Do not make a mistake about their right location for installation.
- Standard shim thickness: **2 mm**
- Kind of shim thickness:
  0.5 mm (for front differential mount)
  1.0 mm (for transmission rear mount)

Mounting bolt for front differential mount
: 1,150 – 1,440 Nm {118 – 147 kgm}

Mounting bolt for front transmission mount: **157 – 196 Nm {16 – 20 kgm}**

Mounting bolt for rear transmission mount
: 235 – 285 Nm {23.5 – 29.5 kgm}

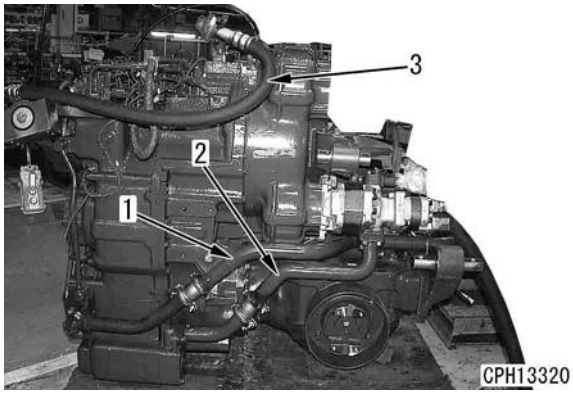
- **Oil supply (hydraulic tank)**
  Refill with oil through the oil filler port up to the specified level, then start the engine to let oil circulate in the piping and check the oil level again.
  Hydraulic tank: **120ℓ (TO10)**
- **Oil supply (transmission case and brake oil tank)**
  Refill with oil through the oil filler port up to the specified level, then start the engine and run at low idle, and check the oil level again.
  Transmission and brake oil tank
  : 77.5ℓ (TO10)

Air bleeding (brake)
After finishing the installation, bleed air from the brake circuit, referring to the section of "Bleeding air from brake circuit" in Testing and adjusting.

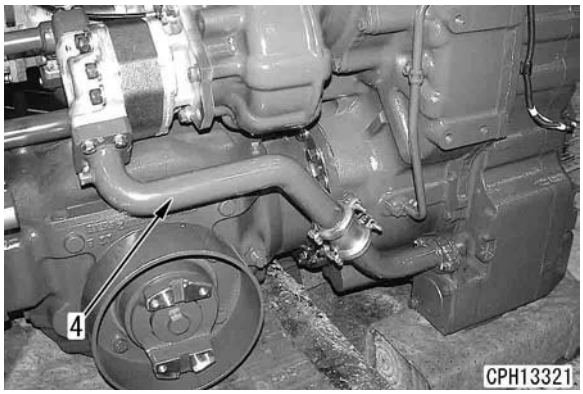
Disconnection and connection of front differential assembly and transmission assembly

Disconnection

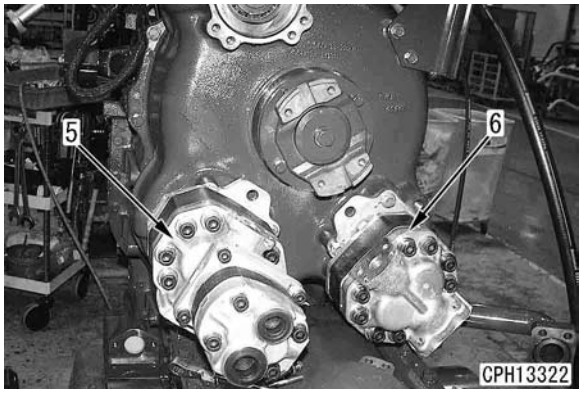
1. Remove pipes (1), (2).
2. Disconnect hose (3).



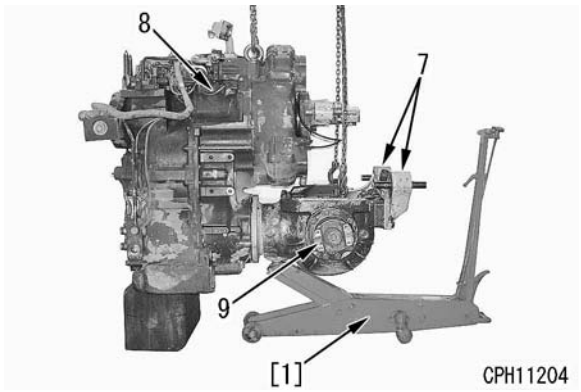
3. Remove pipe (4).

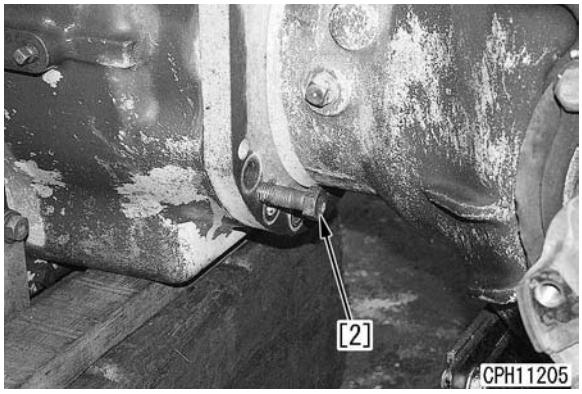


4. Remove the rear brake cooling and brake actuating pump (5).
   Rear brake cooling and brake actuating pump: **25 kg**
5. Remove the torque converter, transmission and front brake cooling pump (6).
   Torque converter, transmission and front brake cooling pump: **25 kg**



6. Remove mount bracket (7). [*1]
7. Sling transmission assembly (8) and front differential assembly (9) temporalily, and support front differential assembly (9) with hydraulic jack [1].
8. Remove the front differential assembly mounting bolts, tighten left and right forcing screws [2] evenly and separate the front differential assembly.
9. Pull out front differential assembly (9) with hoist and a hydraulic jack [1] and remove. [*2]
   Front differential assembly: **340 kg**





Connection

- Carry out connection in the reverse order to disconnection.

[*1]

Mount bracket mounting bolt
: Liquid adhesive (LT-2)

Mount bracket mounting bolt
: 455 – 565 Nm {46.5 – 58 kgm}

[*2]

Front differential mounting bolt
: Liquid adhesive (LT-2)

Front differential mounting bolt
: 245 – 309 Nm {25 – 31.5 kgm}

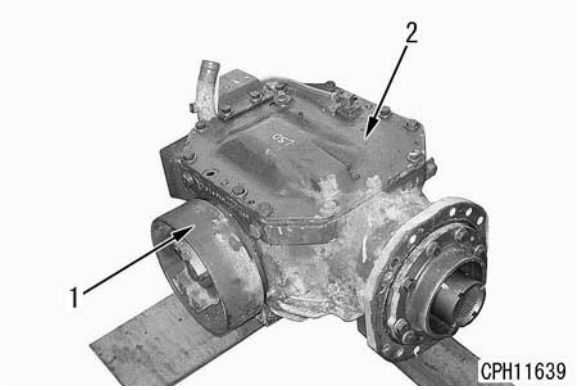
Disassembly and assembly of front differential assembly

Special tools

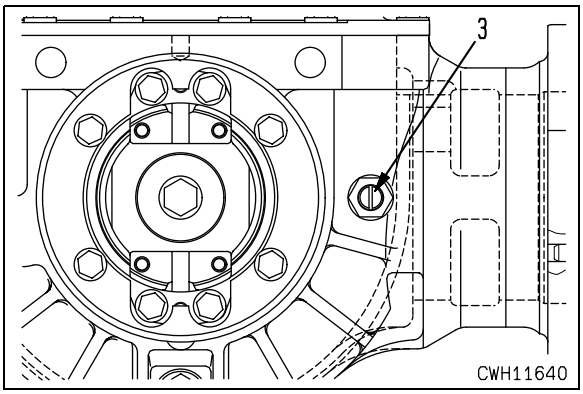
Sym-bol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
H	1	792T-227-1110	Push tool	■	1		○
	2	792T-423-1130	Push tool	■	1		○
		790-101-5421	Grip	■	1		
		01010-51240	Bolt	■	1		
	3	790-201-2840	Spacer	■	1		

Disassembly

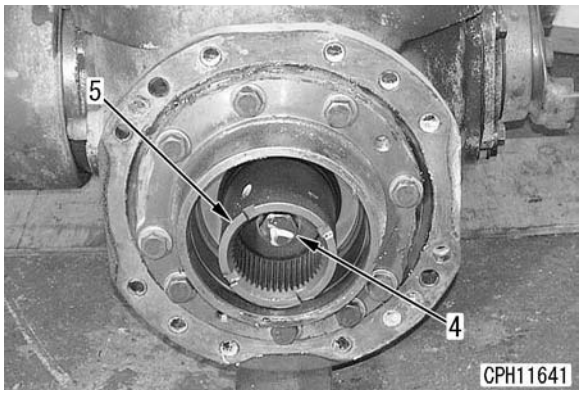
1. **Drive shaft cover**
   Remove drive shaft covers (1) at left and right.
2. **Upper cover**
   Remove upper cover (2).



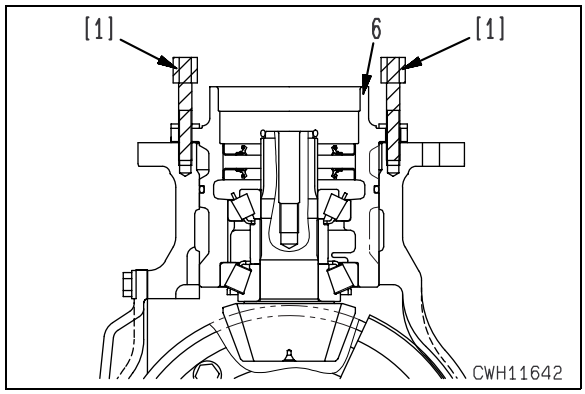
3. **Bevel gear fall-proof bolt**
   Remove bevel gear fall-proof bolt (3).



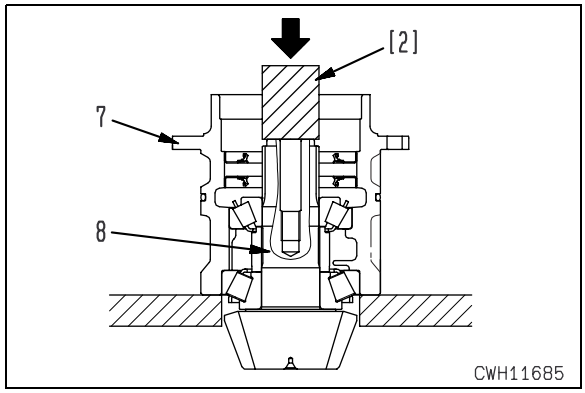
4. **Coupling**
   Remove holder (4) and coupling (5).



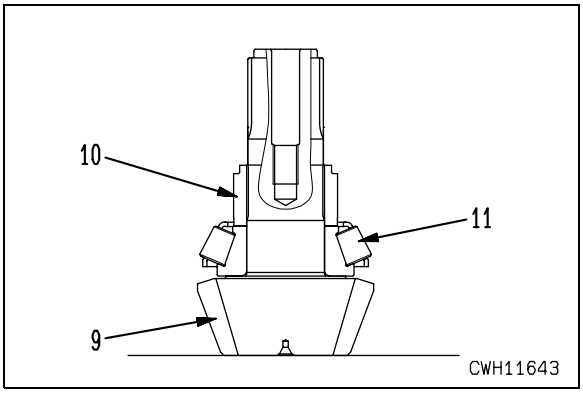
5. **Removal of bevel pinion and cage assembly**
   Remove bevel opinion and cage assembly (6), using forcing screws [1].
   ★ Shims are provided, so check their thickness, number in use and installed locations beforehand.



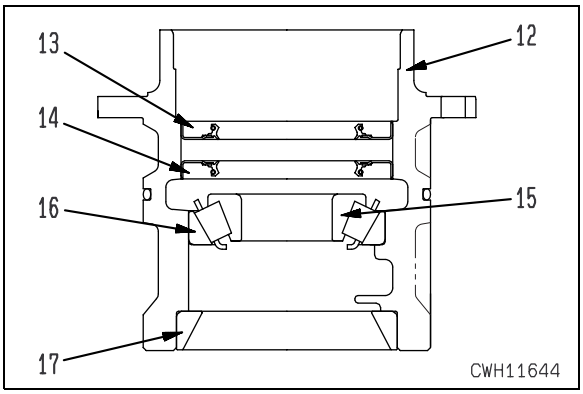
6. **Further disassembly of bevel pinion and cage assembly**
   1) Remove bevel pinion assembly (8) from cage assembly (7), using push tool [2].



2) Remove spacer (10) and bearing (11) from bevel pinion (9).



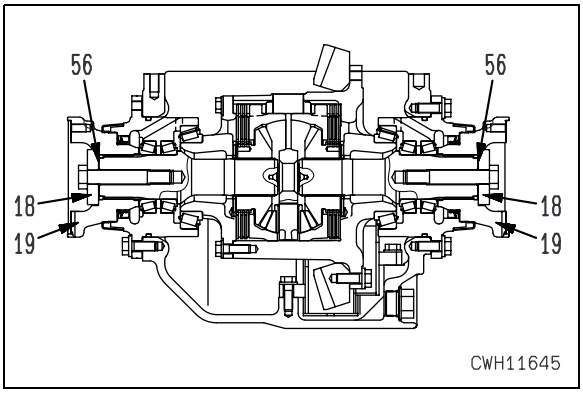
3) Remove oil seals (13) and (14) from cage (12).
4) Remove bearing (15) and outer races (16) and (17).



7. Left and right output shaft couplings

Remove holders (18) and then remove output shaft couplings (19).

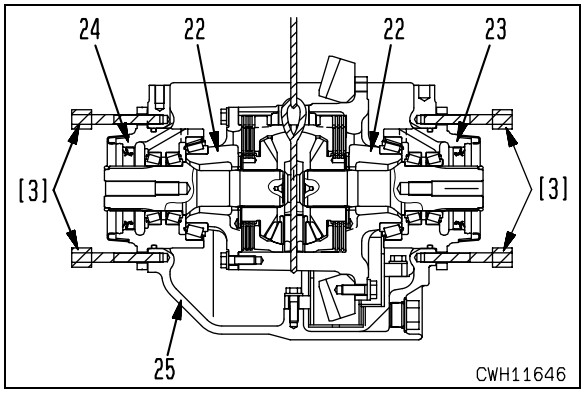
★ Shims (56) are provided, so check their thickness, number in use and installed locations beforehand.



8. Side carrier and shaft assembly and differential gear assembly

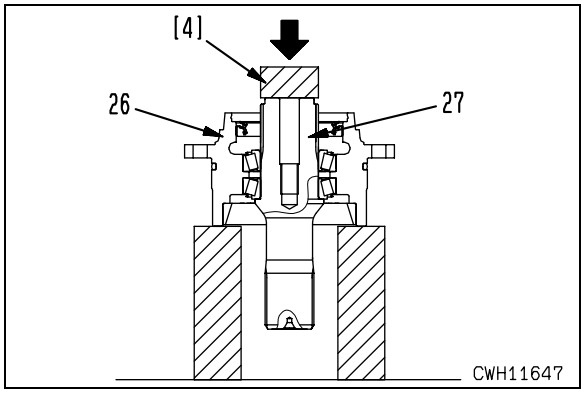
1) Sling differential gear assembly (22), and remove side carrier assemblies (23) and (24), using forcing screws [3].
   ★ Shims are provided, so check their thickness, number in use and installed locations beforehand.
2) Remove differential gear assembly (22) from differential housing (25).

Differential gear assembly: **80 kg**

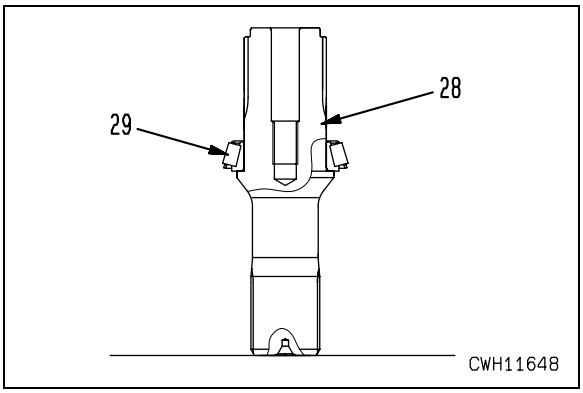


9. Further disassembly of side carrier and shaft assembly

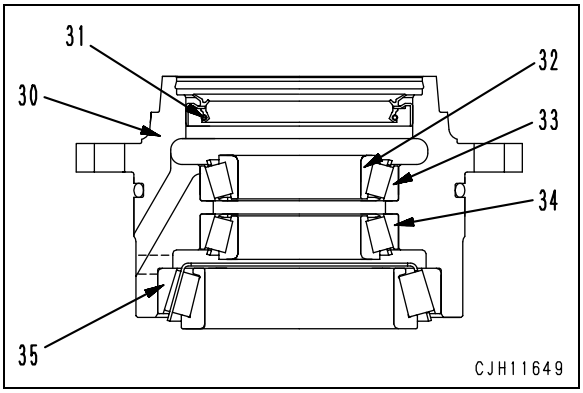
1) Remove shaft and bearing assembly (27) from side carrier assembly (26), using push tool [4].



2) Remove bearing (29) from shaft (28).

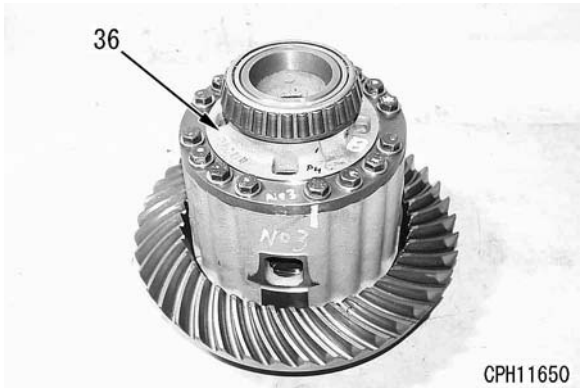


3) Remove oil seal (31) from carrier (30).
4) Remove bearing (32) and outer races (33), (34) and (35).

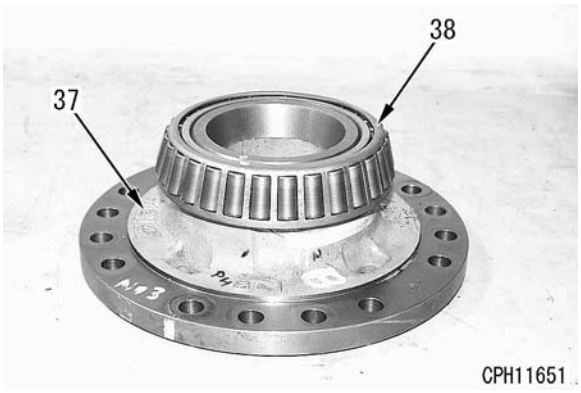


10. Further disassembly of differential gear assembly

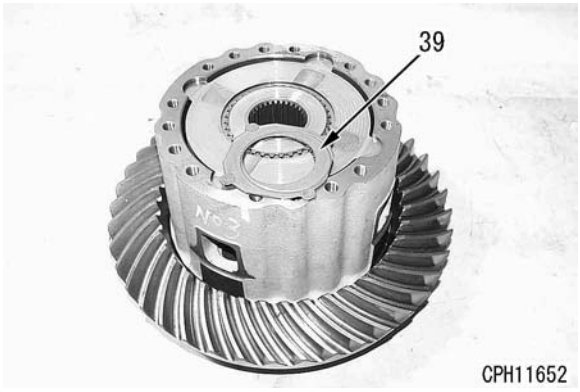
1) Remove case and bearing assembly (36).



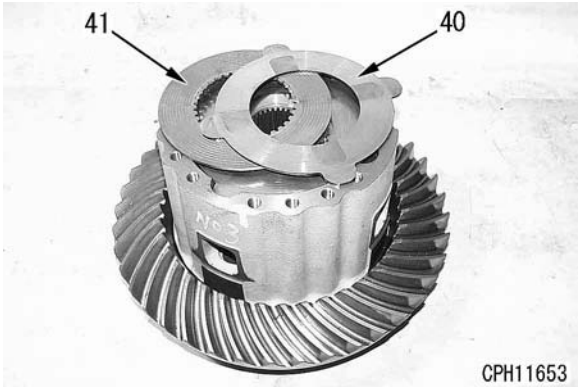
2) Remove bearing (38) from case (37).



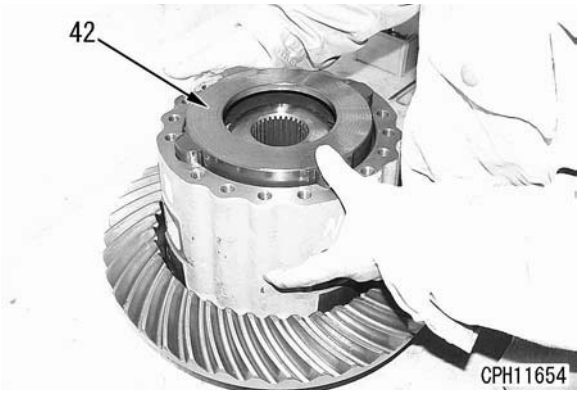
3) Remove washer (39).



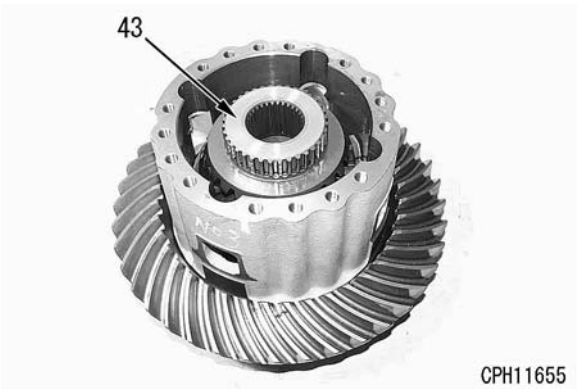
4) Remove 3 plates (40) and 2 discs (41).



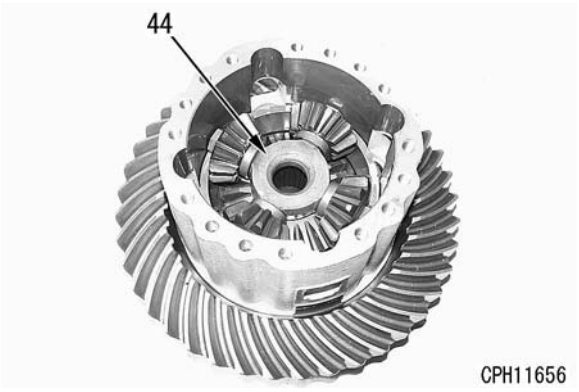
5) Remove pressure ring (42).
★ Put fingers into a hole on the case side and lift.



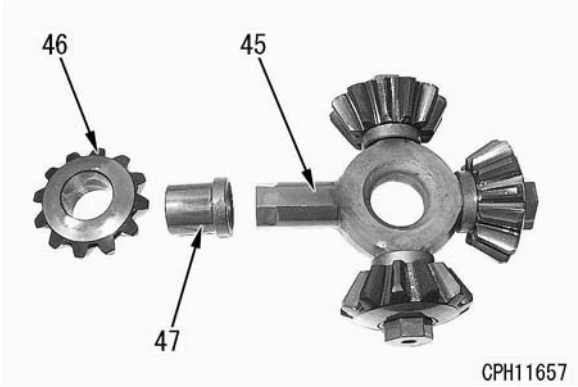
6) Remove differential side gear (43).



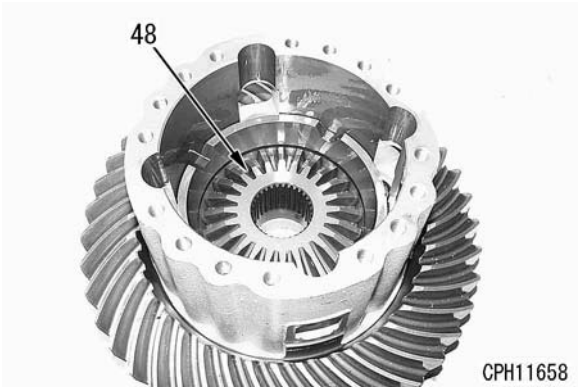
7) Remove pinion gear assembly (44) in one piece.



8) Remove 4 pinion gears (46) and 4 bushings (47) from shaft (45).

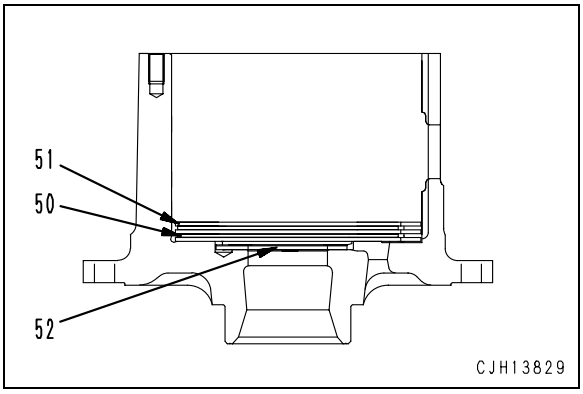


9) Remove differential side gear (48).

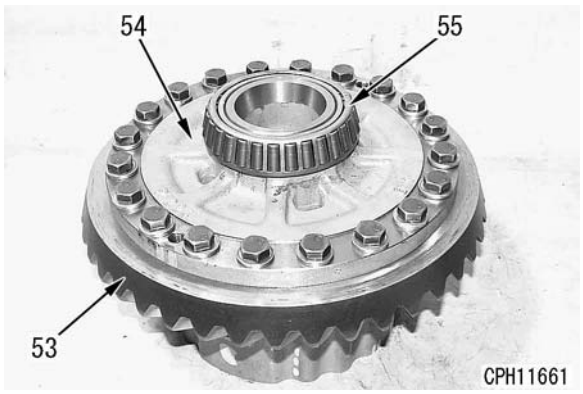


10) Remove pressure ring (49).

11) Remove 3 plates (51) and 2 discs (50).
12) Remove washer (52).



13) Reverse the case and bevel gear assembly.
14) Remove bevel gear (53) from case (54).
★ Leave a counter mark both on the bevel gear and on the case before removing.
15) Remove bearing (55).

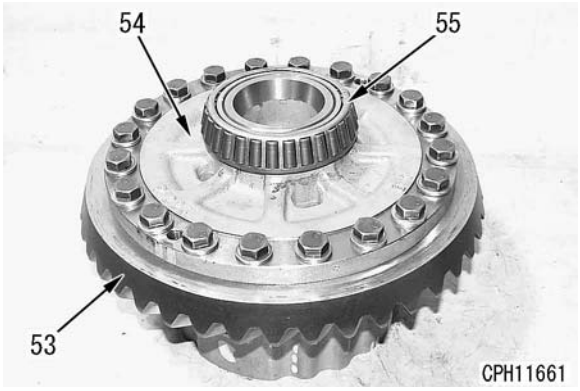


Assembly

★ Clean each of the parts thoroughly and check that it is free of dust or damage. Coat the sliding surface with **axle oil (AXO80)** and then assemble.

1. Subassembly of differential gear assembly

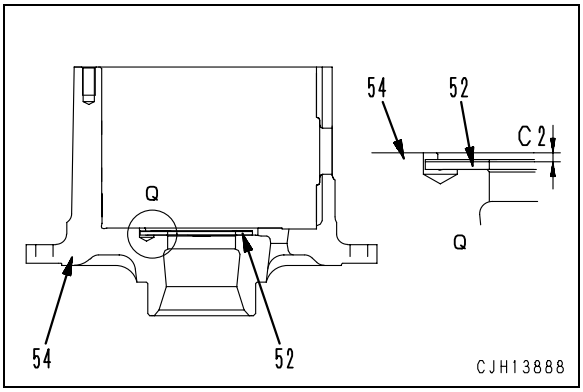
1) Shrink-fit bearing (55) to case (54).
• Shrink-fit temperature: For 30 minutes at approx. 120°C.
★ Drip **axle oil (AXO80)** on the bearing after installing.
2) Install bevel gear (53) to case (54).
★ Install according to the counter marks which were left at the time of removing.
Mounting bolt
: Liquid adhesive (LT-2)
Mounting bolt
: 157 – 196 Nm {16 – 20kgm}



3) Reverse the bevel gear and case assembly.
4) Put washers (52) in the case (54).
★ Direct the lined face toward the gear.
5) Using the depth gauge, measure level difference **C2** between case (54) and washer (52) at 4 places equally spaced on the periphery.
• Value **C2** on drawing = **6.05 – 6.15 mm**

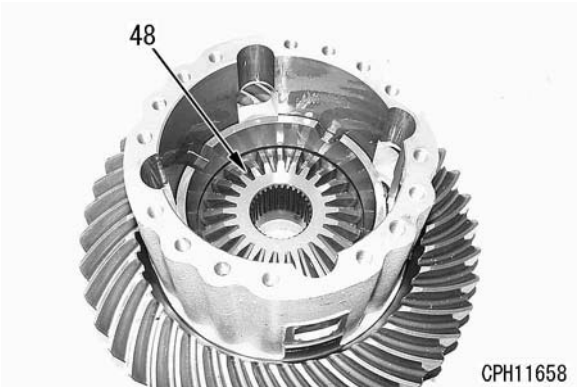
Record the values measured at the 4 places in the check sheet and obtain an average.
Average of level difference **C2** = Total of values measured at 4 places / 4

6) Assemble 3 plates (51) and 2 discs (50).
★ Immerse the discs and plates in the following oil before assembling.
Disc and plate: **Axle oil (AXO80)**
★ Align the 4 toothless position of the discs.

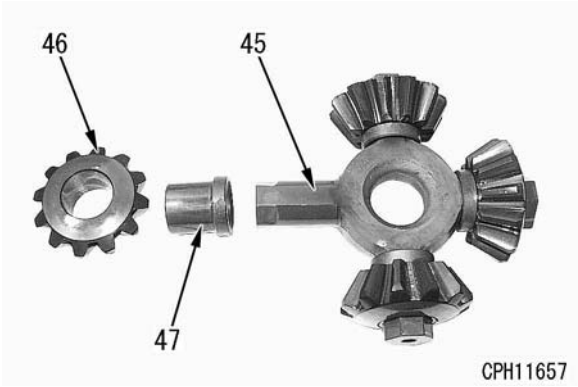


7) Install pressure ring (49) to the case.

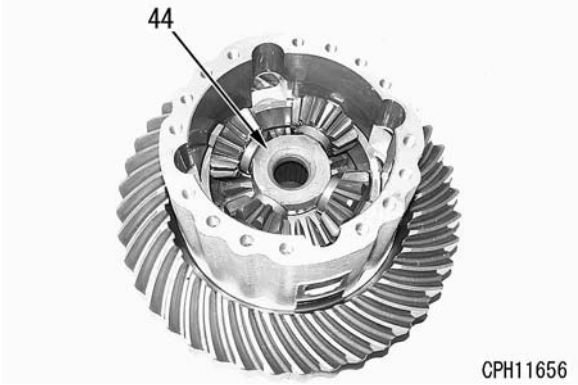
8) Install differential side gear (48).



9) Install bushings (47) and pinion gears (46) 4 pieces for each to shaft (45).

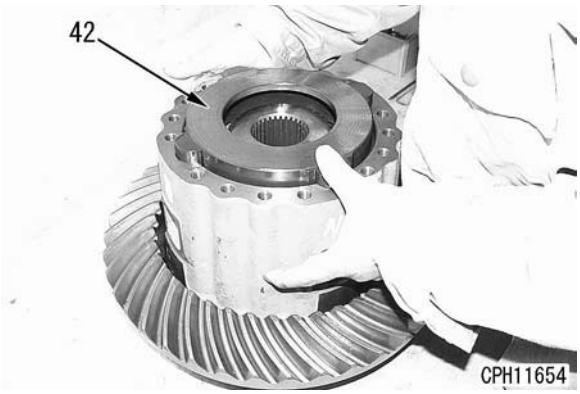


10) Install pinion gear assembly (44) in one piece.

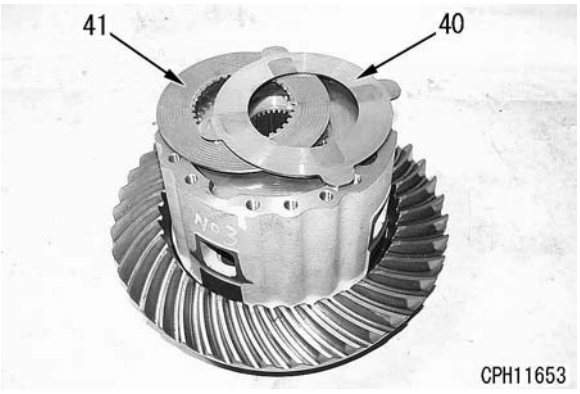


11) Install differential side gear (43).

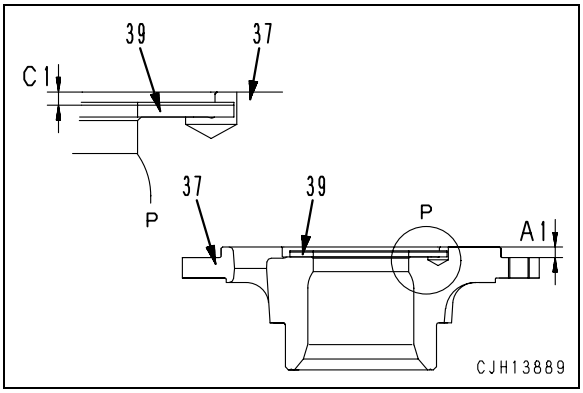
12) Install pressure ring (42).



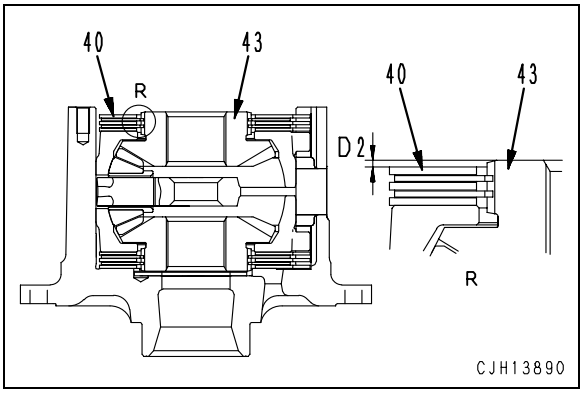
13) Assemble 3 plates (40) and 2 discs (41).
★ Immerse the discs and plates in the following oil before assembling.
Disc and plate: **Axle oil (AXO80)**



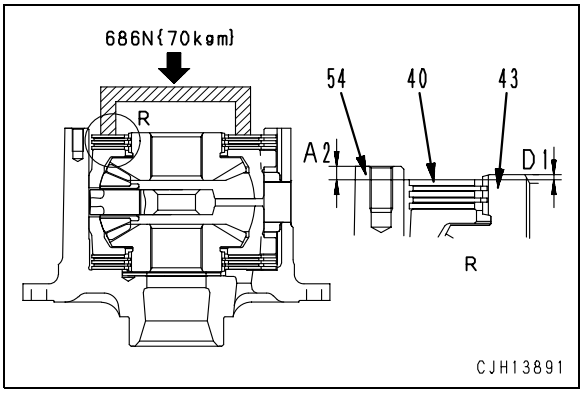
14) Adjustment of clearance.
i) Using the depth gauge, measure level difference **A1** of case (37) at 4 places equally spaced on the periphery. Record the values measured at the 4 places in the check sheet and obtain an average.
Average of level difference **A1** = Total of values measured at 4 places / 4
ii) Set washer (39) on case (37).
★ Direct the lined face toward the gear.
iii) Using the depth gauge, measure level difference **C1** between case (37) and washer (39) at 4 places equally spaced on the periphery.
Record the values measured at the 4 places in the check sheet and obtain an average.
Average of level difference **C1** = Total of values measured at 4 places / 4



iv) Using the depth gauge, measure level difference **D2** between gear (43) and plate (40) at 4 places equally spaced on the periphery.
Record the values measured at the 4 places in the check sheet and obtain an average.
Average of level difference **D2** = Total of values measured at 4 places / 4



v) While pressing the disc and plate with a force of **686 N {70 kg}**, perform steps vi) and vii).
vi) Using the depth gauge, measure level difference **A2** between case (54) and plate (40) at 4 places equally spaced on the periphery. Record the values measured at the 4 places in the check sheet and obtain an average.
Average of level difference **A2** = Total of values measured at 4 places / 4
vii) Using the depth gauge, measure level difference **D1** between gear (43) and plate (40) at 4 places equally spaced on the periphery. Record the values measured at the 4 places in the check sheet and obtain an average.
Average of level difference **D1** = Total of values measured at 4 places / 4



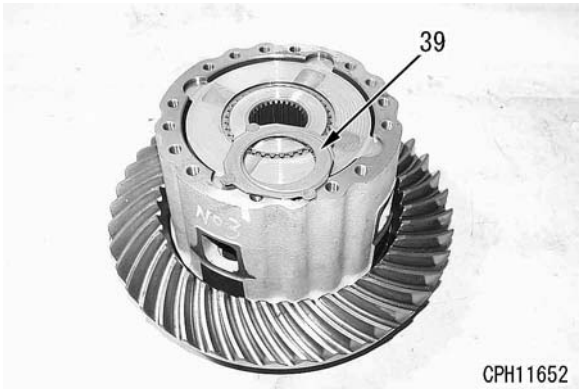
viii) Calculation method for clearance **A** between disc and plate.
Clearance **A** = Clearance **A2** – Clearance **A1**
★ Check that clearance **A** is **0.2 – 0.75 mm**.

ix) If clearance **A** is out of the above range, replace plate (40) and measure dimension **A2** again until a proper clearance is obtained.
★ The total thicknesses of the 3 plates on the right and left sides must be the same.
• Thicknesses of plates (40):
3.1 mm, 3.2 mm

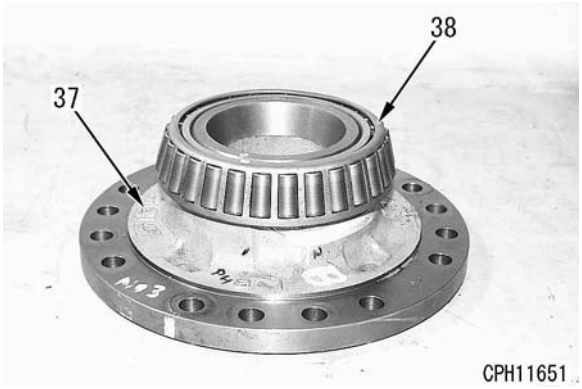
x) Calculation method for side gear clearances **B1** and **B2** in axial direction
Clearance **B1** = Clearance **C1** – Clearance **D1** + (Clearance **A** / 2)
Clearance **B2** = Clearance **C2** – Clearance **D2** + (Clearance **A** / 2)
★ Use the clearance obtained in viii) as clearance **A**.
★ Check that both clearances **B1** and **B2** are **0.15 – 0.35 mm**.

xi) If either or both of clearances **B1** and **B2** are out of the above range, replace washers (39) and (52) and measure dimensions **C1** and **C2** again until proper clearances are obtained.
• Thicknesses of washers:
4.0 mm, 4.1 mm

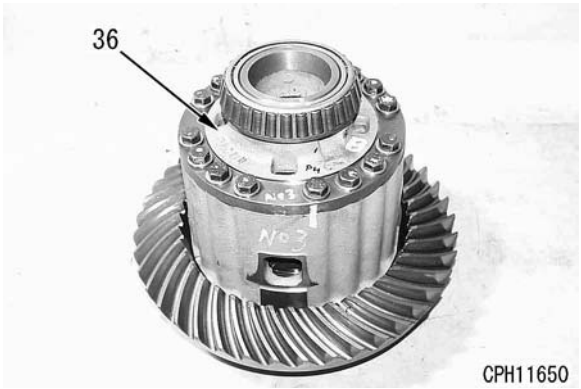
15) Install washer (39).
★ Direct the lined face toward the gear.



16) Shrink-fit bearing (38) to case (37).
• Bearing shrink fit temperature
: For 30 minutes at 120°C
★ Drip **axle oil (AXO80)** on the bearing after installing.

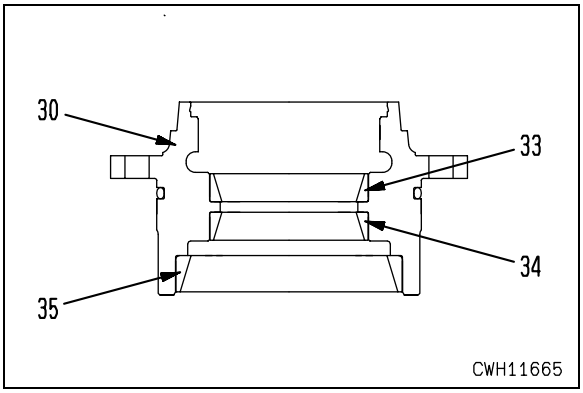


17) Install case and bearing assembly (36).
Mounting bolt
: 98 – 123 Nm {10.0 – 12.5 kgm}

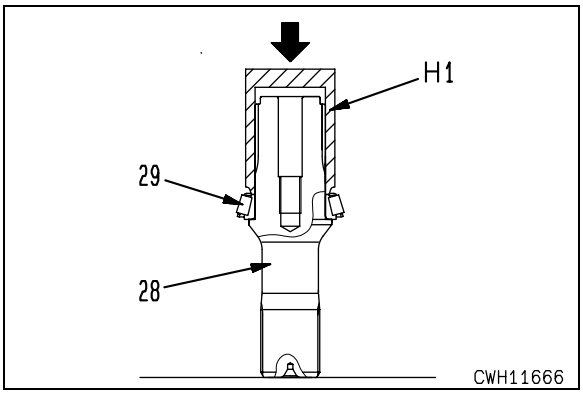


2. Subassembly of side carrier and shaft assembly

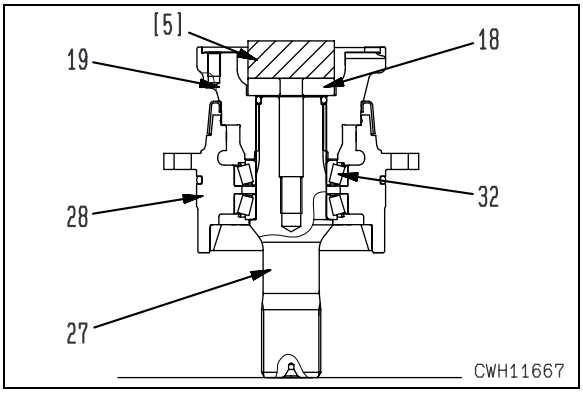
1) Install outer races (35), (34) and (33) to carrier (30).



2) Press-fit bearing (29) into shaft (28), using tool **H1**.

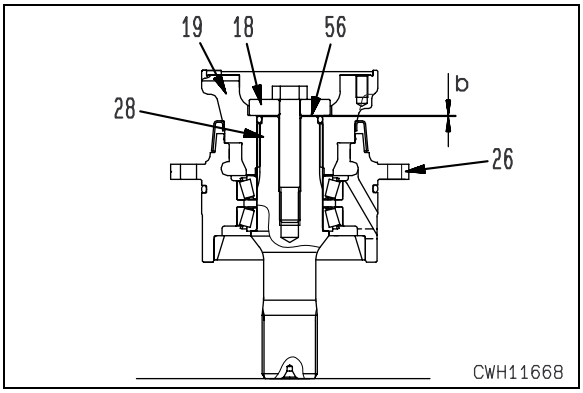


3) Put side carrier assembly (28) on shaft and bearing assembly (27).
4) Assemble bearing (32) in.
5) Install output shaft coupling (19) and holder (18), and then press-fit bearing (32), using push tool [5].

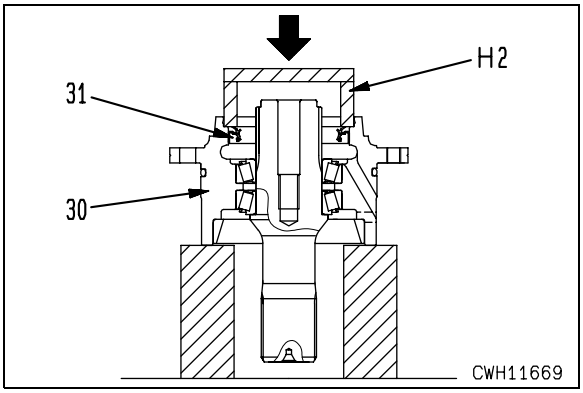


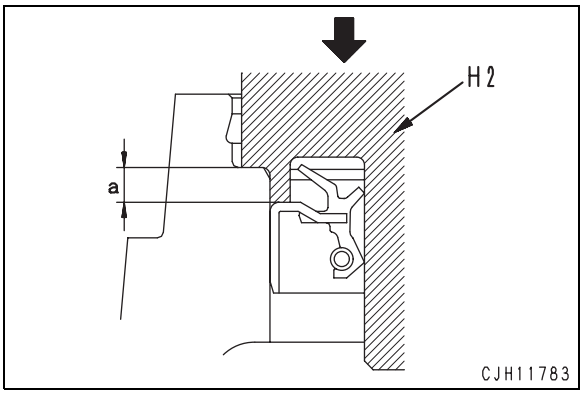
3. Adjustment of pre-load on shaft bearing

1) Drip **axle oil (AXO80)** on the bearing and rotate it.
2) Measure dimension "**b**" between the end surface of shaft (28) and the end surface of output shaft coupling.
3) Select shims which attain the dimension of **b** + (0 to 0.05 mm).
4) Assemble the selected shims (56) in and then install output shaft coupling (19) and holder (18).
   Mounting bolt
   : 490 – 608 Nm {50 – 62 kgm}
5) Hook a push-pull scale on to the bolt hole (208 mm in dia.) on side carrier assembly (28), and measure start torque.
   • Standard value for start torque
   : Min. 14.7 N {1.5 kg}
   ★ If the start torque exceeds the above standard value, increase or decrease the number of shims for adjustment and measure again.
6) Remove holder (18) and output shaft coupling (19).



7) Press-fit oil seal (31) into carrier (30), using tool **H2**.
   ★ Keep press-fitting until distance "**a**" between the oil seal periphery surface and carrier end surface becomes 4.6 ± 0.2 mm.
   Oil seal periphery surface
   : Seal End 242 or equivalent
   Oil seal lip face and oil seal inside (100% full): **Grease (G2-LI)**





4. Differential gear assembly and side carrier and shaft assembly

1) Sling differential gear assembly (22) and keep the gear on the mounting position of differential case (25).

Differential gear assembly: **80 kg**

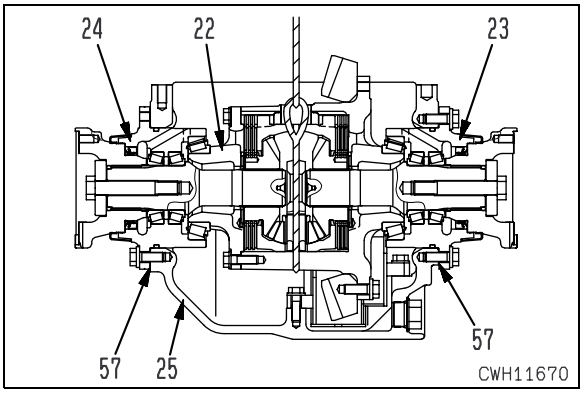
2) Assemble shims (57) whose thickness, number in use and location were confirmed at the time of disassembling, and then install side carrier and shaft assemblies (23) and (24).

- Kind of shim thickness

: 0.05 mm, 0.2 mm, 0.3 mm and 0.8 mm

Mounting bolt

: 157 – 196 Nm {16 – 20 kgm}



5. Adjustment of pre-load on side bearing

★ Drip **axle oil (AXO80)** on the bearing thoroughly.

1) Measure start torque of bevel gear (53) at the addendums (in the tangential direction), using push scale [5].

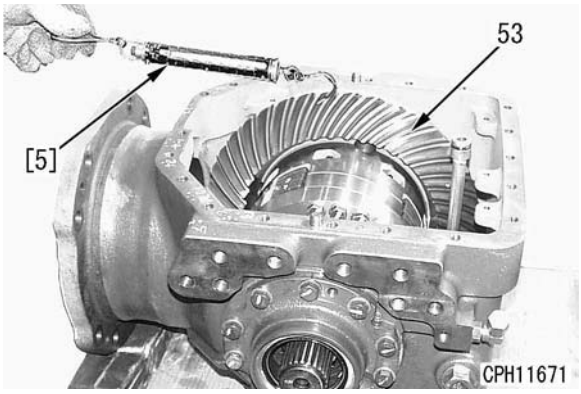
- Standard value for start torque

: 7.2 – 32.4 N {0.74 – 3.3 kg}

2) If the start torque exceeds the standard value, decrease thickness of the shims and measure again.

★ Do not change the total thickness of left and right shims, even if swapping them between the left and right for adjusting tooth contact or backlash.

★ After adjusting the pre-load, be sure to tighten the mounting bolts to the torque specified in the step 2).



6. Left and right output shaft couplings

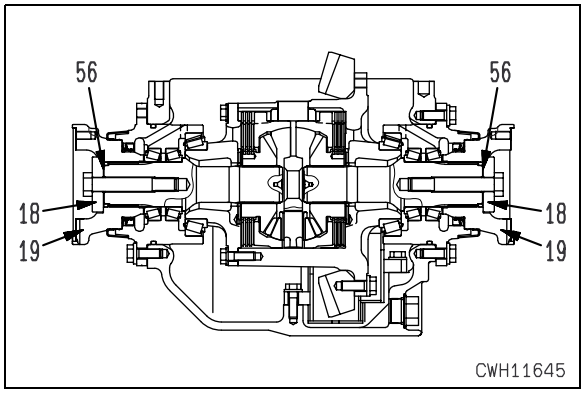
1) Assemble shims (56) selected in the step 3, and install output shaft coupling (19) and holder (18).

Mounting bolt

: Liquid adhesive (LT-2)

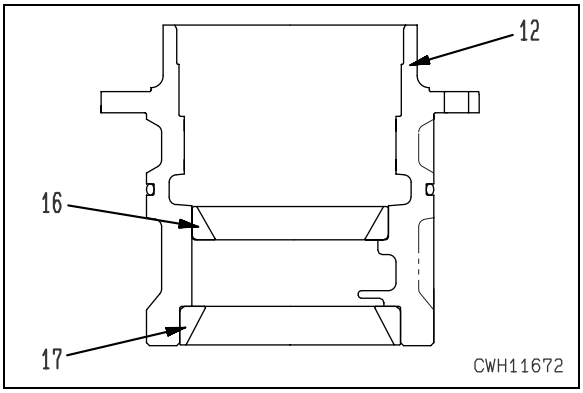
Mounting bolt

: 490 – 608 Nm {50 – 62 kgm}

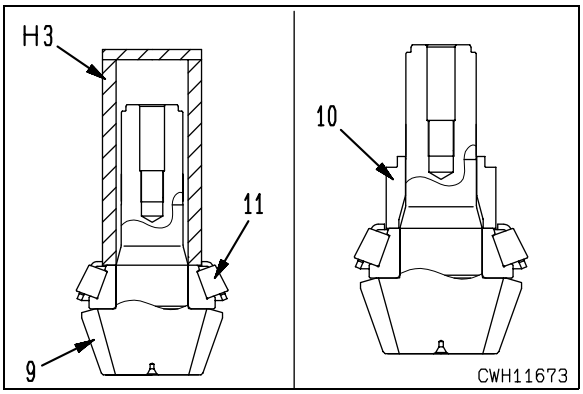


7. Subassembly of bevel pinion and cage assembly

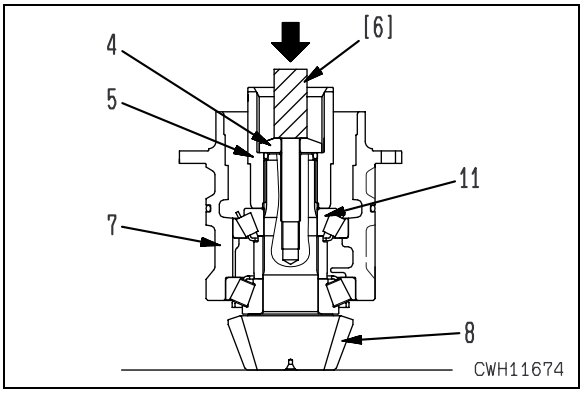
1) Install outer races (17) and (16) to cage (12).



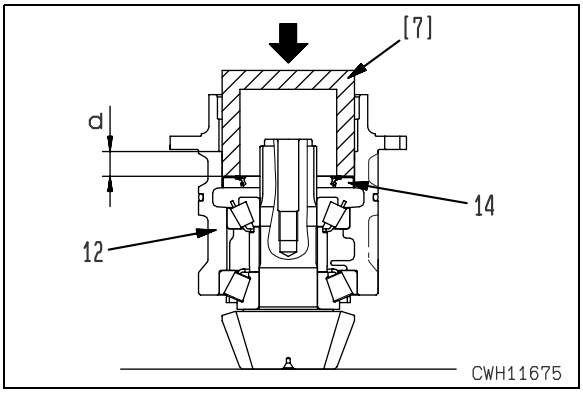
2) Press-fit bearing (11) into bevel pinion (9), using tool **H3**.
   ★ Drip **axle oil (AXO80)** on the bearing after assembling.
3) Install spacer (10).



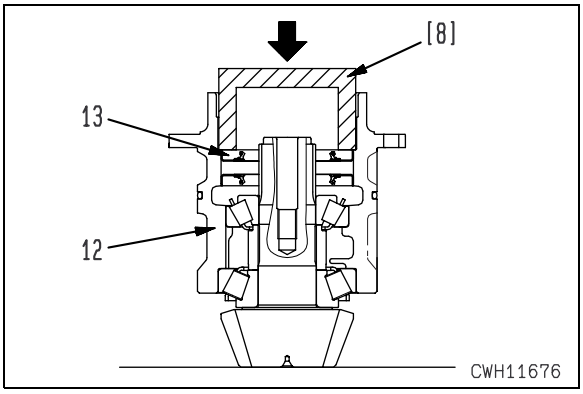
4) Put cage assembly (7) and bearing (11) on bevel pinion assembly (8), and press-fit bearing (11) into the cage assembly, while turning the cage assembly, using coupling (5), holder (4) and push tool [6].
   ★ Drip **axle oil (AXO80)** on the bearing (11).
   ★ Remove holder (4) and coupling (5) after press-fitting.



5) Press-fit oil seal (14), using tool [7].
   ★ Keep press-fitting until distance "**d**" between periphery surface of the oil seal and end surface of cage (12) is 26 ± 0.5 mm.
   Oil seal periphery surface
   : Seal end 242 or equivalent
   Oil seal lip face and between lips
   : Grease (G2-LI)

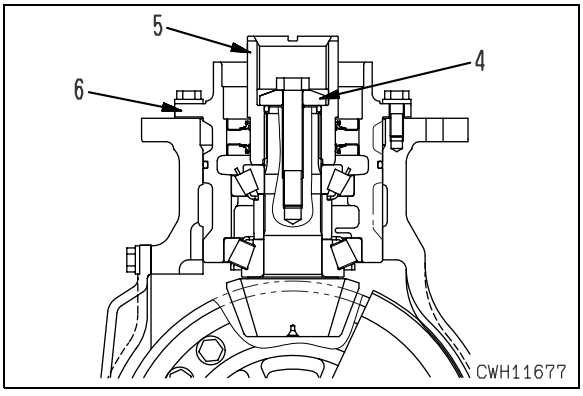


6) Press-fit oil seal (13), using tool [8].
★ Keep press-fitting until the oil seal periphery surface is flush with the cage (12) end surface.
Oil seal periphery surface
: Seal end 242 or equivalent
Oil seal lip face and between lips
: Grease (G2-LI)

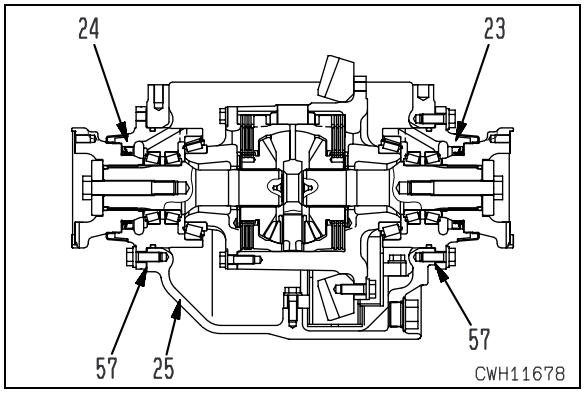


8. Installation of bevel pinion and cage assembly
Assemble the shims whose thickness, number in use and location were confirmed at the time disassembling, and then install bevel pinion cage assembly (6).
★ Tighten with 3 mounting bolts.
★ Tighten all the mounting bolts after adjusting tooth contact.
Mounting bolt
: 157 – 196 Nm {16 – 20 kgm}

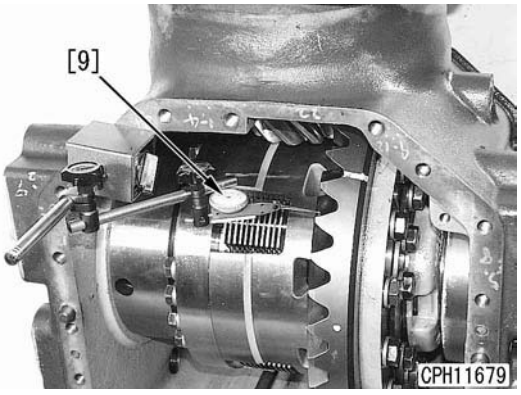
9. Input shaft coupling and holder
1) Install coupling (5) and holder (4).
Mounting bolt
: Liquid adhesive (LT-2)
Mounting bolt
: 490 – 608 Nm {50 – 62 kgm}



10. Adjustment of tooth contact and backlash
• Adjust backlash and adjust tooth contact at the same time.
1) Adjustment of backlash
i) To shift the bevel gear for the adjustment, change shims (57) between differential case (25) and side carrier assembly (23) or (24). In that case, do not change the total thickness of left and right shims (57) in order not to change the pre-load given to the bearing.

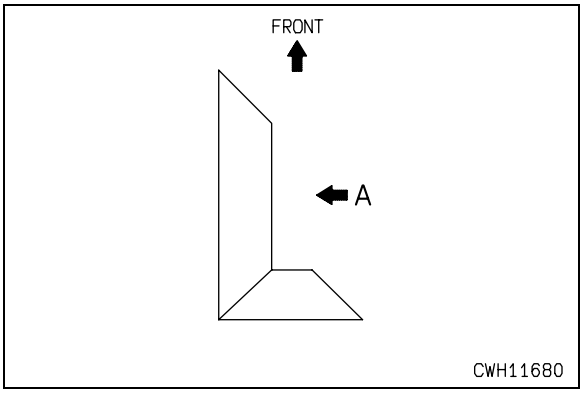


ii) Apply the probe of dial gauge [9] perpendicularly to the tip of bevel gear.
iii) Read out the dial when moving the bevel gear back and forth (in the direction of rotation), while fixing the bevel pinion.
• Standard value for backlash
In the circumferential direction of the gear**: 0.36 – 0.55 mm**
In the perpendicular direction to the gear
: 0.25 – 0.38 mm
★ Make this adjustment at 3 points and keep the fluctuation of backlash less than 0.1 mm.
(The bevel gear in the photo below slightly differs from the one for HM300-2)

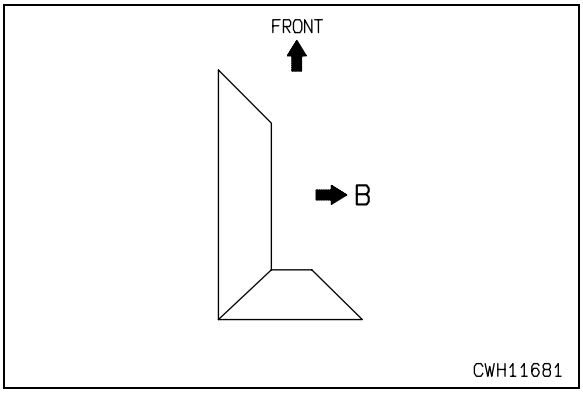


iv) If the backlash is found to fall out of the standard value as a result of the measurement, make adjustment in the following manner.

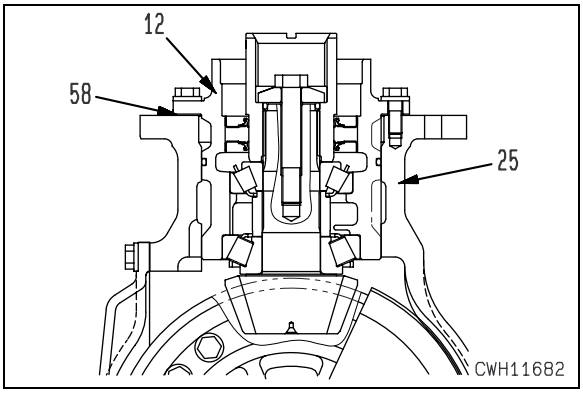
- When there is a small backlash:
  Decrease the shims on the right side of chassis and add as many shims to the left side (i.e. shifting the bevel gear in direction **A**).



- When there is a big backlash:
  Decrease the shims on the left side of chassis and add as many shims to the right side (i.e. shifting the bevel gear in direction **B**).



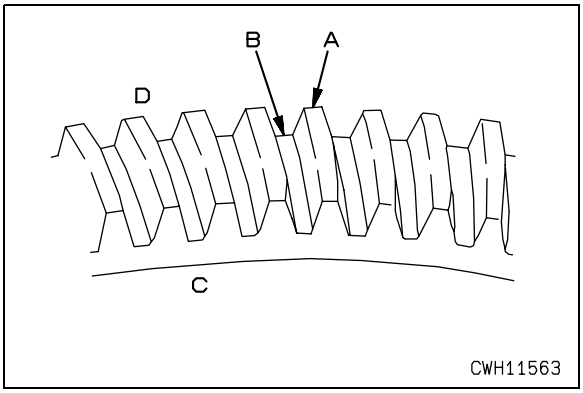
2) Adjustment of tooth contact
   To shift the bevel pinion for the adjustment, increase or decrease shims (58) between differential case (25) and cage (12).
   - Kind of shim thickness
     : 0.15 mm, 0.2 mm, 0.3 mm and 1.0 mm

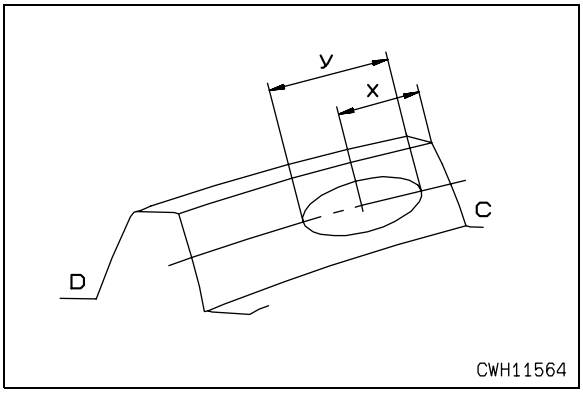


Inspection

i) Coat the bevel gear tooth surface thinly with minium or red lead, then rotate the bevel gear back and forth to check the tooth contact pattern on the bevel gear.

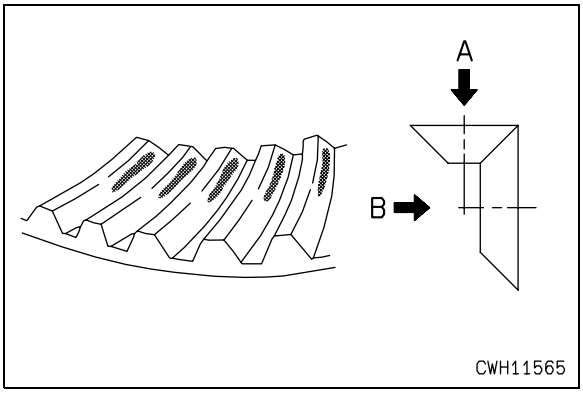
ii) The center of tooth contact must come in the middle of tooth height. Moreover, it must be approx. 33% away from the small end along the tooth length (**x**), and the contact width must cover 45% to 55% of the tooth length (**y**). Meanwhile, make sure that there is no excessively strong tooth contact at any point of addendum **A**, dedendum **B**, small end **C** and big end **D**.
   ★ If the adjustment is made this way, right tooth contact is ensured, when load is applied.



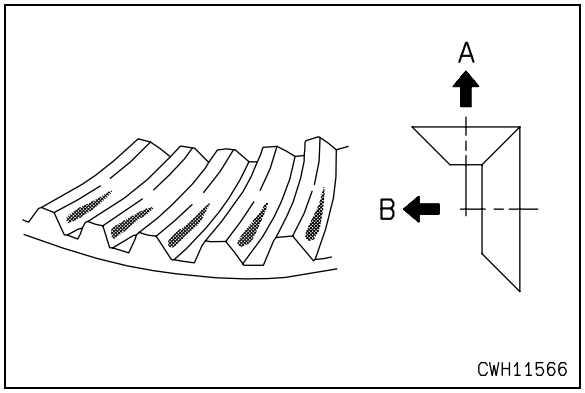


Adjusting

- If no right pattern of tooth contact is obtained as a result of inspection, make readjustment in the following manner.
  - ★ When adjusting shims for the side carrier assemblies, do not change the total thickness of left and right shims in order not to change the pre-load given to the bearing.
  - i) When the bevel pinion is too far away from the bevel gear centerline, a tooth contact pattern shows the contact of the small end tooth face of the bevel gear tooth face curved outward with the big end tooth face of the bevel gear tooth face curved inward.
  - • Make adjustment in the following manner.
    Shift the bevel pinion in direction **A** by adjusting the shims on the bevel pinion side.
    In addition, shift the bevel gear in direction **B** and check the tooth contact pattern and backlash again.



  - ii) When the bevel pinion is too close to the bevel gear centerline, a tooth contact pattern shows the contact of the big end tooth face of the bevel gear tooth face curved outward with the small end tooth face of the bevel gear tooth face curved inward.
  - • Make adjustment in the following manner.
    Shift the bevel pinion in direction **A** by adjusting the shims on the bevel pinion side.
    In addition, shift the bevel gear in direction **B** and check the tooth contact pattern and backlash again.



3) After adjusting tooth contact, tighten the mounting bolts for the bevel pinion cage and side carriers to the specified torque.
   - Bevel pinion cage mounting bolt
     : 157 – 196 Nm {16 – 20 kgm}
   - Side carrier mounting bolt
     : 157 – 196 Nm {16 – 20 kgm}

11. Bevel gear fall-proof bolt

Install bevel gear fall-proof bolt (3).

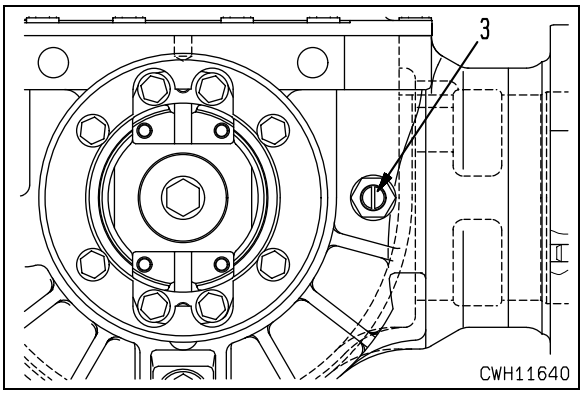
★ Screw the bolt in until it contacts the bevel gear backside, then loosen the screw by a 3/4 turn and fasten with a lock nut.

Mounting bolt

: Gasket sealant (LG-5)

Lock nut

: 196 – 245 Nm {20 – 25 kgm}



12. Upper cover

Install upper cover (2).

★ Pick out bolt **A** out of the 15 mounting bolts and coat it with gasket sealant and install.

Cover mating surface

: Gasket sealant (Loctite LT-515 or equivalent)

Bolt **A**

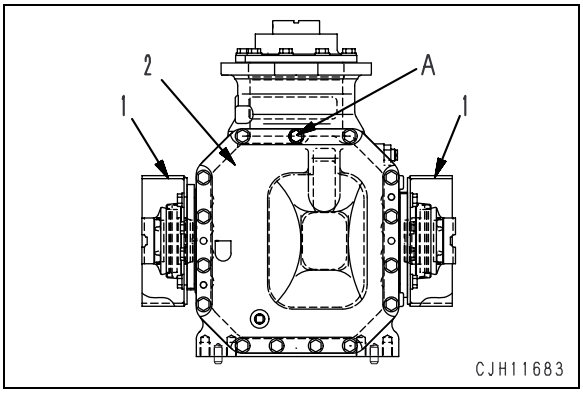
: Gasket sealant (LG-5 or equivalent)

Mounting bolt

: 157 – 196 Nm {16 – 20 kgm}

13. Drive shaft cover

Install left and right drive shaft covers (1).



Disassembly and assembly of torque converter assembly

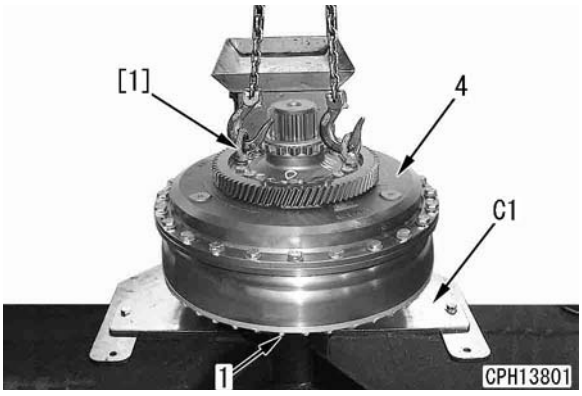
Special tools

Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
C		790-501-5000	Unit repair stand	●	1		
	1	790-901-2110	Bracket	●	1		
		792T-213-1210	Plate	●	1		○
	2	792-213-1110	Wrench	■	1		

Disassembly

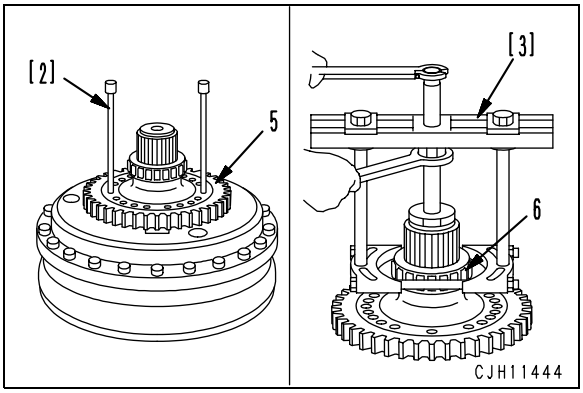
1. Turbine and clutch disassembly

1) Set the torque converter assembly on tool **C1**.
2) Remove mounting bolt (1) at the pump side.
3) Remove turbine and clutch assembly (4), using eyebolts [1].

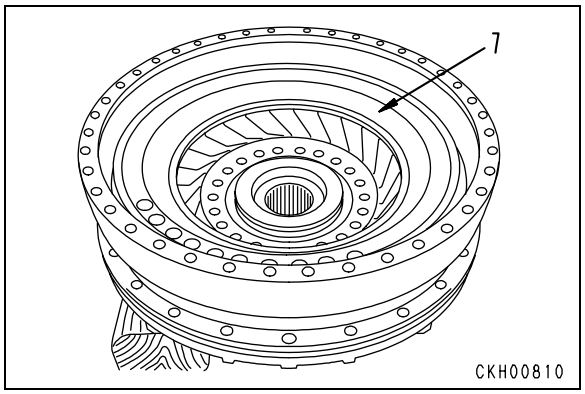


2. Further disassembly of turbine and clutch assembly

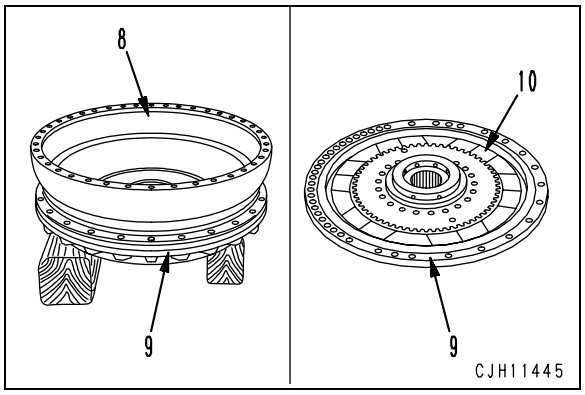
1) Input shaft
   i) Remove input shaft (5), using forcing screws [2].
   ii) Remove bearing (6), using puller [3].



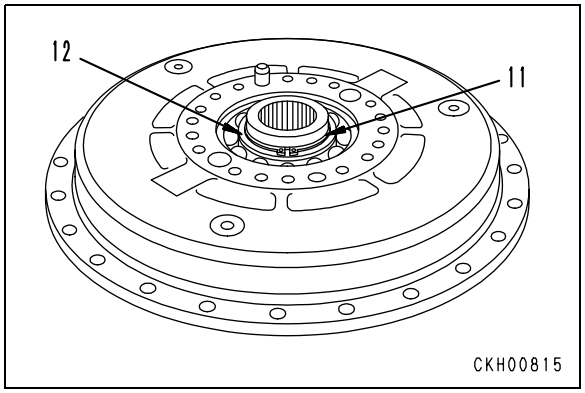
2) Turbine
   Reverse the drive case, then remove the mounting bolts, and remove turbine (7).



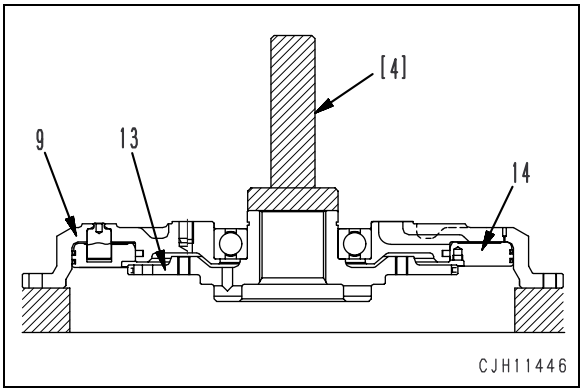
3) Drive case
   Remove the mounting bolts and then drive case (8) from clutch housing assembly (9).
4) Disc
   Remove disc (10) from clutch housing assembly (9).



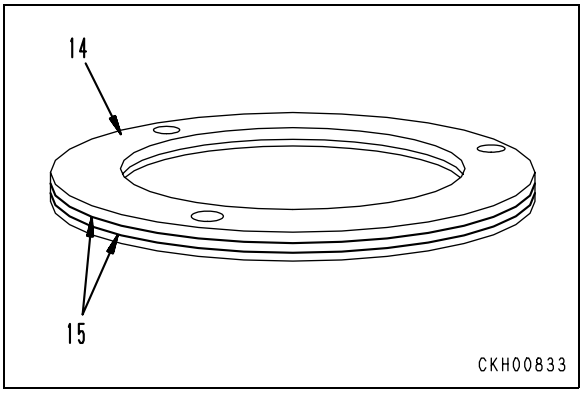
5) Plate and snap ring
   Reverse the clutch housing, then remove snap ring (11), and remove plate (12).



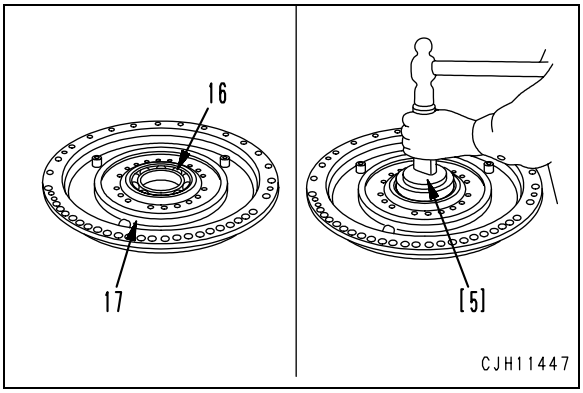
6) Shaft and piston
Remove shaft (13) from clutch housing assembly (9), using push tool [4], and then remove piston (14).



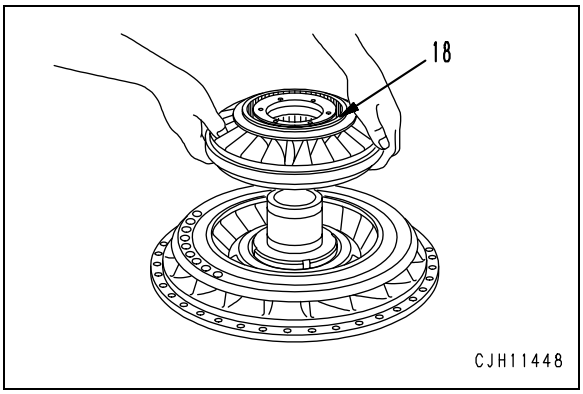
7) Seal ring
Remove seal rings (15) from piston (14).



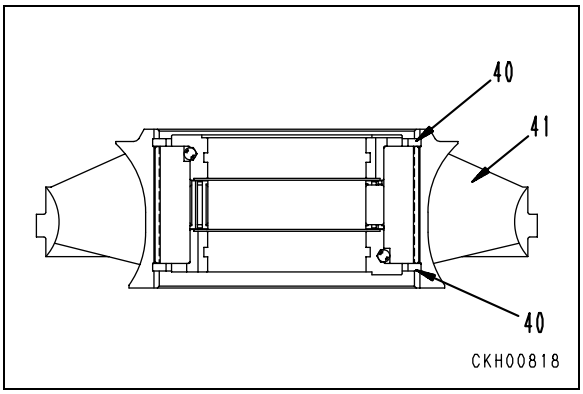
8) Bearing, seal ring and pin
i) Remove bearing (16) from the clutch housing, using push tool [5].
ii) Remove seal ring (17).



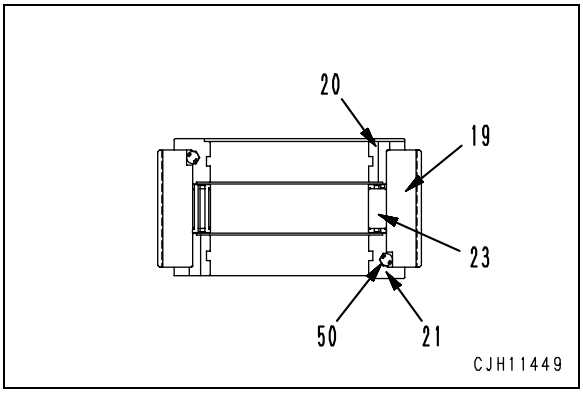
3. Stator assembly
Pull up stator assembly (18) to remove.



4. Further disassembly of stator assembly
1) Stator
Remove snap ring (40) and then remove stator (41).

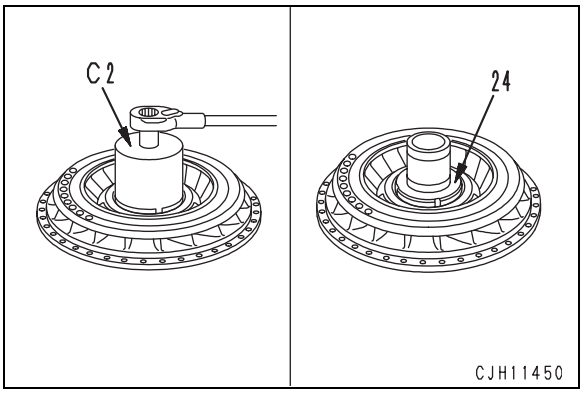


2) Bushing
Remove bushings (20) and (21) from race (19).
★ Be careful not to lose ball (50).
3) Race and one-way clutch
Remove one-way clutch (23) from race (19).

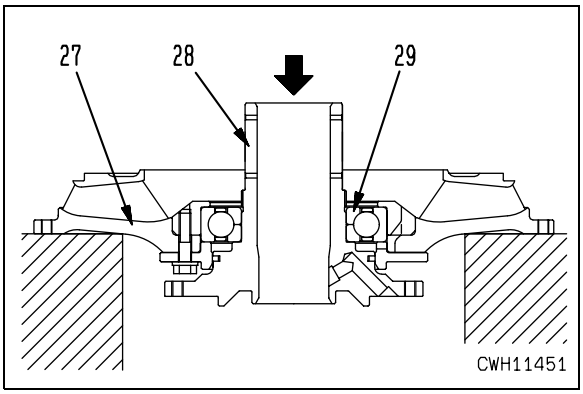


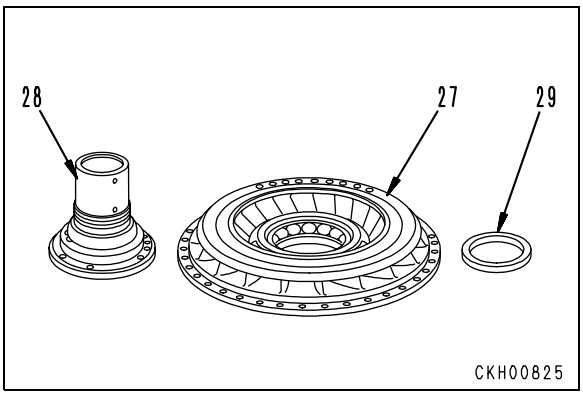
5. Further disassembly of pump and stator shaft assembly

1) Nut
Remove nut (24), using tool **C2**.

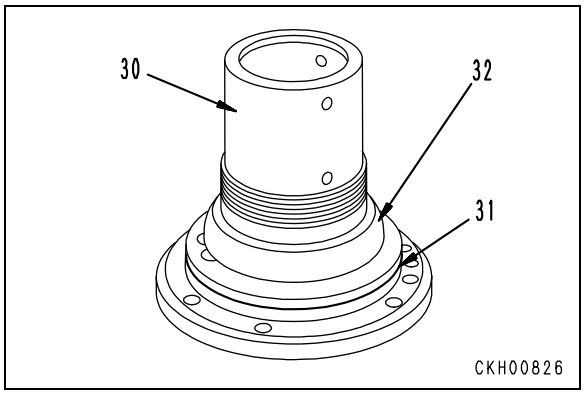


2) Remove the pump and stator shaft assembly from tool **C1**.
3) Stator shaft assembly and bearing inner race
Remove stator shaft assembly (28) and bearing inner race (29) from pump assembly (27) by pushing stator shaft assembly (28).

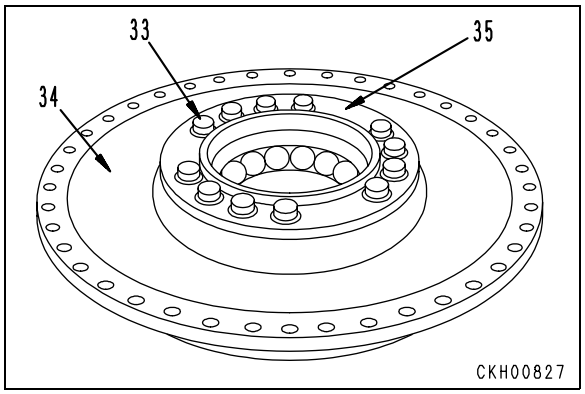




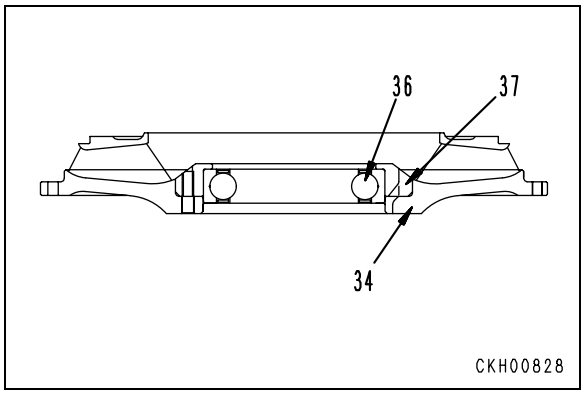
4) Seal ring and bearing inner race
Remove seal ring (31) and bearing inner race (32) from stator shaft (30).



5) Retainer
Remove mounting bolts (33) and then remove retainer (35) from pump (34).



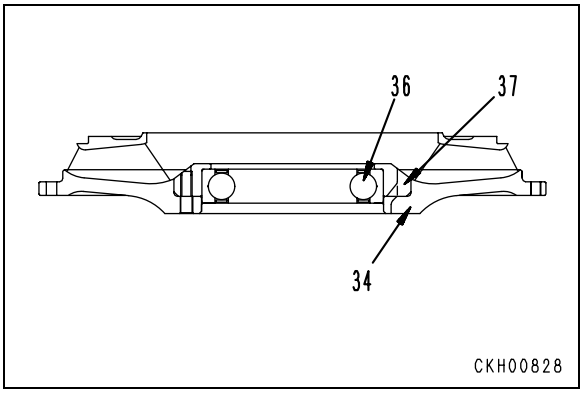
6) Bearing and guide
i) Remove guide (37) from pump (34).
ii) Remove bearing (36) from guide (37).



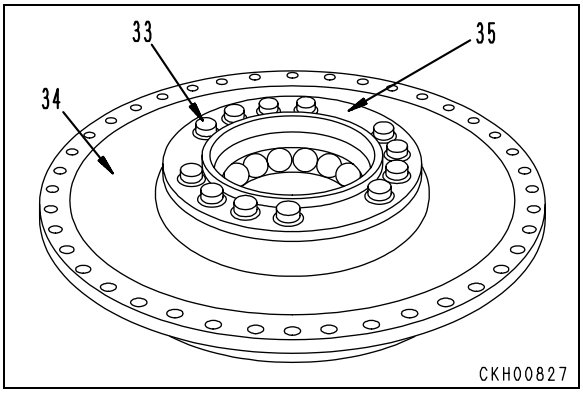
Assembly

1. Subassembly of pump and stator shaft assembly

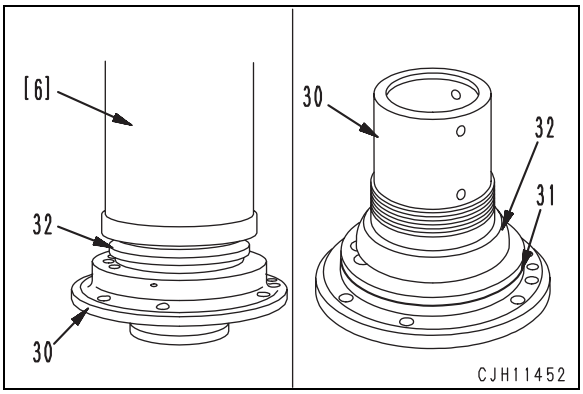
1) Bearing and guide
Install bearing (36) to guide (37), and then install the combination to pump (34).
★ Bearing (36) is a set part, so install it after checking that its manufacturing No. and counter mark (**A**) on the edge are the same as those of a counter bearing.



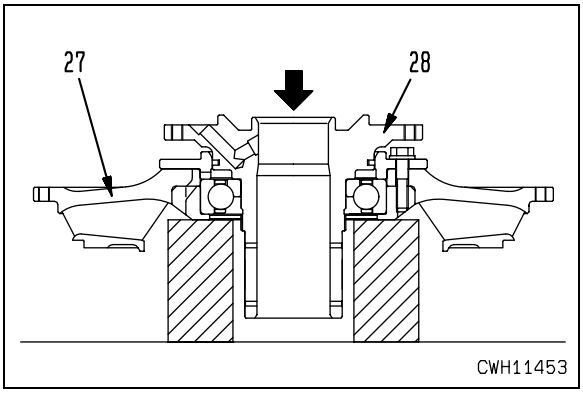
2) Retainer
Install retainer (35) on pump (34) and fasten with mounting bolts (33).
Retainer mounting bolt
: Liquid adhesive (LT-2)
Retainer mounting bolt
: 58.8 – 73.5 Nm {6 – 7.5 kgm}



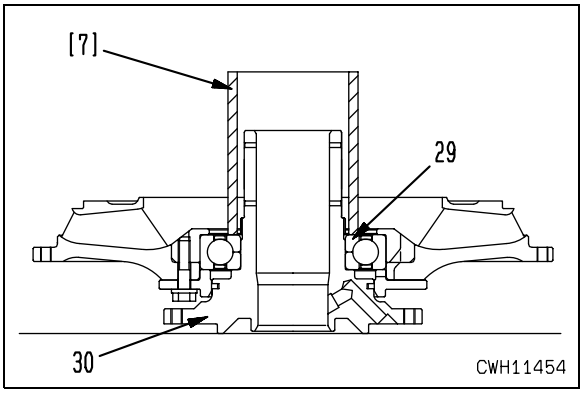
3) Bearing inner race and seal ring
Press-fit bearing inner race (32) into stator shaft (30), using push tool [6], and install seal ring (31).
★ Bearing inner race (32) is a set part, so install it after checking that its manufacturing No. and counter mark (**A**) on the edge are the same as those of a counter bearing.
Seal ring periphery: **Grease (G2-LI)**



4) Stator shaft assembly and bearing inner race
i) Press-fit stator shaft assembly (28) into pump assembly (27).



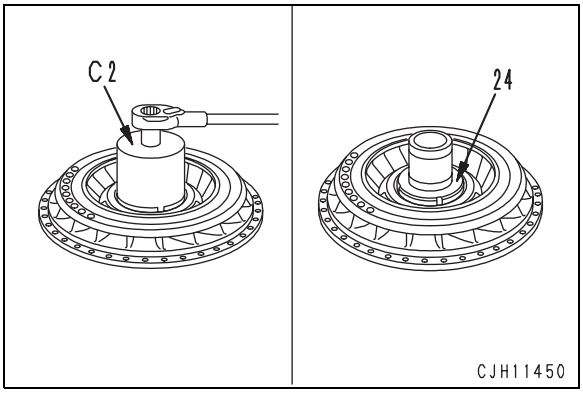
ii) Press-fit bearing inner race (29) into stator shaft (30), using push tool [7].
★ Bearing inner race (29) is a set part, so install it after checking that its manufacturing No. and counter mark (**A**) on the edge are the same as those of a counter bearing.



iii) Drip approx. 6 cc of **powertrain oil (TO10 or TO30)** on the bearing and rotate it by 10 turns.

5) Set pump and stator shaft assembly on tool **C1**.

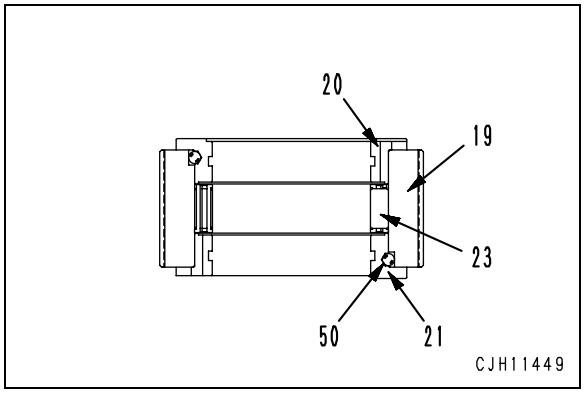
6) Nut
Install nut (24), using tool **C2**.
Nut thread portion
: Liquid adhesive (LT-2)
Nut
: 441.3 – 490.3 Nm {45 – 50 kgm}



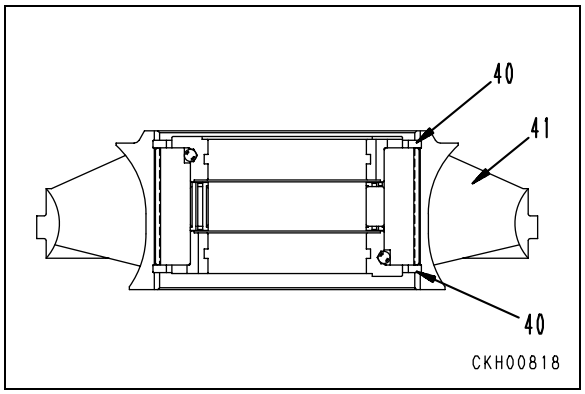
2. Subassembly of stator assembly

1) One-way clutch and race
Install one-way clutch (23) to race (19).
★ Install the one-way clutch so that an arrow shown on the cage edge faces the input side, and check the stator rotation direction as viewed from the input side.
Clockwise: **No load**
Counter-clockwise: **Lock**
Sliding surface
: Powertrain oil (TO10 or TO30)

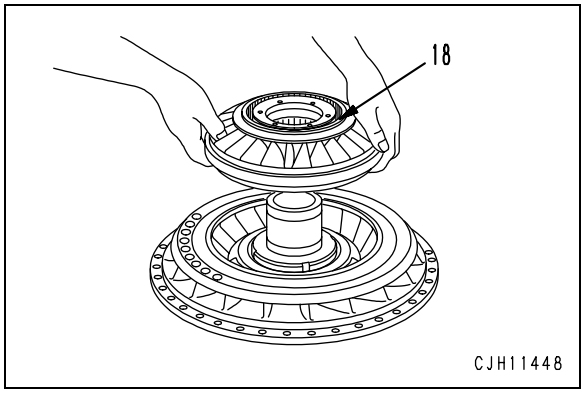
2) Bushing
Expansion-fit bushings (20) and (21) with ball (50) into race (19).
Sliding surface
: Powertrain oil (TO10 or TO30)



3) Stator
Install stator (41) with snap rings (40).

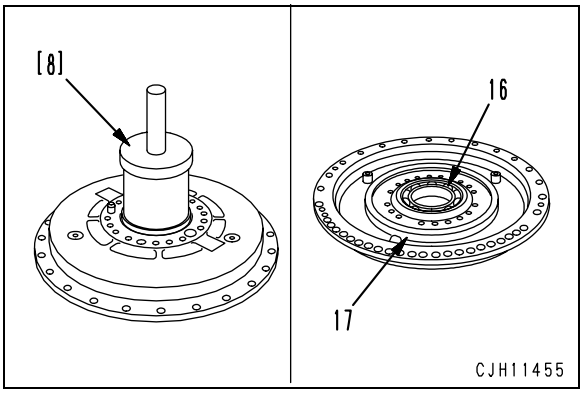


3. Stator assembly
Install stator assembly (18).

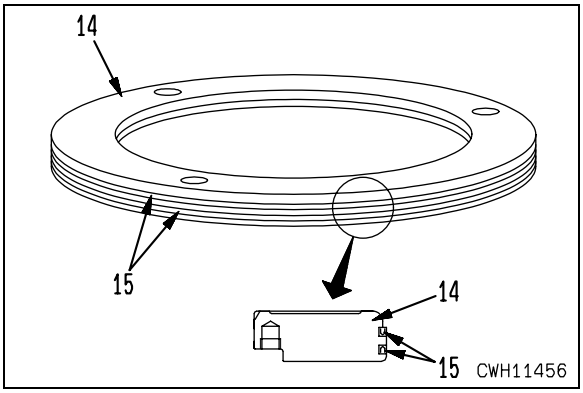


4. Subassembly of turbine and clutch assembly

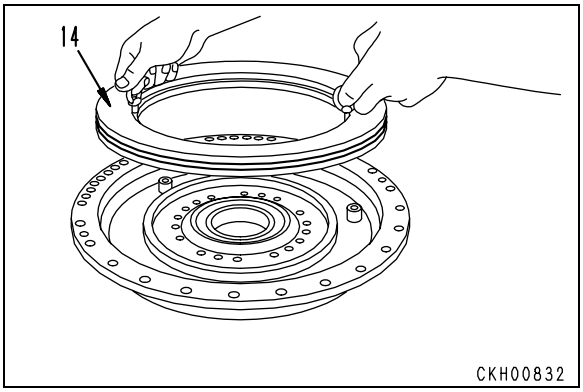
1) Bearing, seal ring and pin
   i) Install bearing (16), using push tool [8]
   ii) Install seal ring (17).
   Seal ring periphery: **Grease (G2-LI)**
   ★ Drip approx. 6 cc of **powertrain oil (TO10 or TO30)** on the bearing (16) and rotate it by 10 turns.



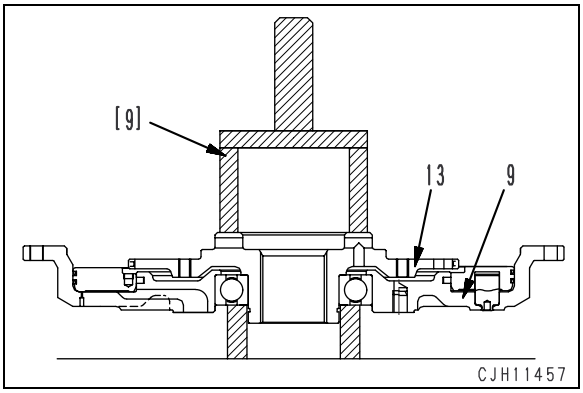
2) Seal ring, piston and shaft
   i) Install seal rings (15) to piston (14).
   ★ Do not make a mistake about the direction of installation, referring to the figure below.



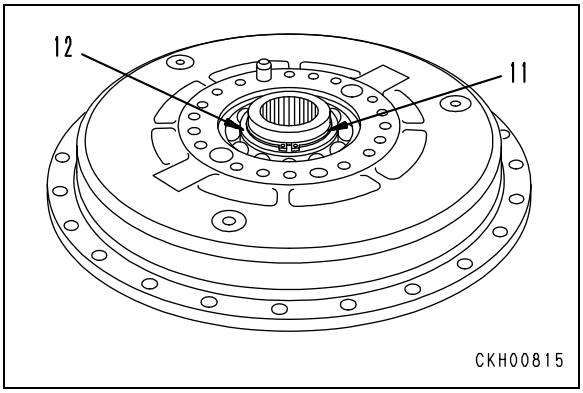
   ii) Install piston (14) to the clutch housing assembly.
   Seal ring periphery: **Grease (G2-LI)**



   iii) Press-fit shaft (13) into clutch housing assembly (9), using push tool [9].

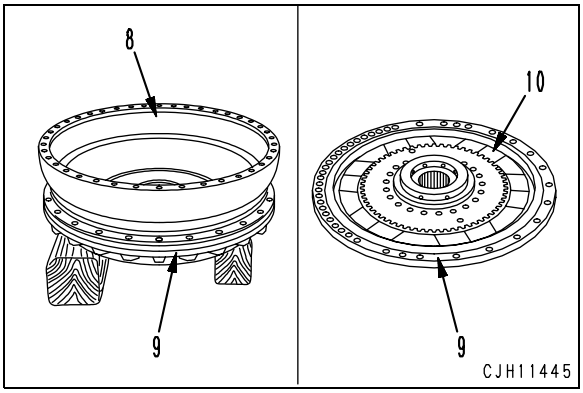


3) Plate, snap ring
   Install plate (12) to the shaft and then install snap ring (11).

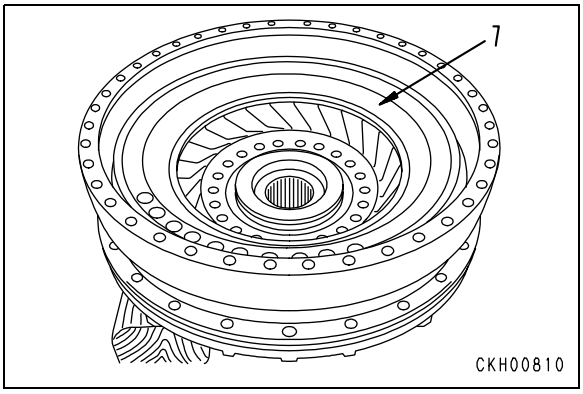


4) Disc
Install disc (10) to clutch housing assembly (9).
Sliding surface
: Powertrain oil (TO10 or TO30)

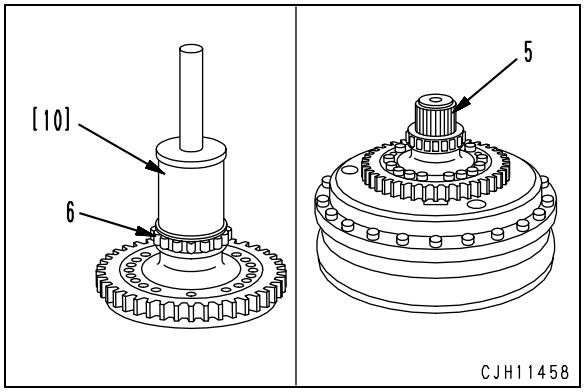
5) Drive case
Install drive case (8) to clutch housing assembly (9).
Mounting bolt
: Liquid adhesive (LT-2)
Mounting bolt
: 58.8 – 73.5 Nm {6.0 – 7.5 kgm}



6) Turbine
Install turbine (7).
Mounting bolt
: Liquid adhesive (LT-2)
Mounting bolt
: 58.8 – 73.5 Nm {6.0 – 7.5 kgm}



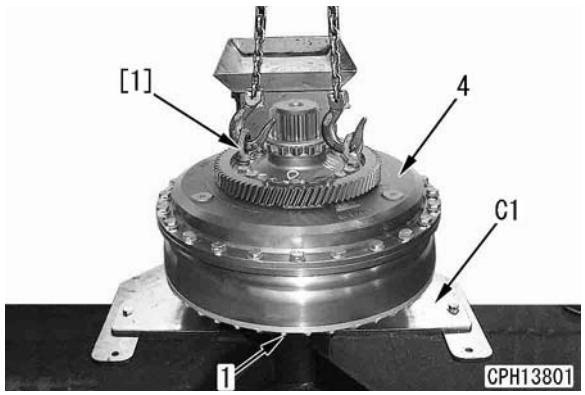
7) Input shaft
i) Install bearing (6), using push tool [10].
★ Drip approx. 6 cc of powertrain oil (TO10 or TO30) on the bearing (6) and rotate it by 10 turns.
ii) Install input shaft assembly (5) to the clutch housing.
Mounting bolt
: Liquid adhesive (LT-2)
Mounting bolt
: 58.8 – 73.5 Nm {6.0 – 7.5 kgm}



5. Turbine and clutch assembly

1) Install turbine and clutch assembly (4), using eyebolts [1].

2) Tighten 40 mounting bolts (1).
Mounting bolt
: Liquid adhesive (LT-2)
Mounting bolt
: 27 – 34 Nm {2.8 – 3.5 kgm}



HM300-2 Articulated dump truck

Form No. SEN00686-03

ARTICULATED DUMP TRUCK

HM300-2

Machine model	Serial number
HM300-2	2001 and up

50 Disassembly and assembly

Power train, Part 2

Disassembly and assembly of transmission assembly

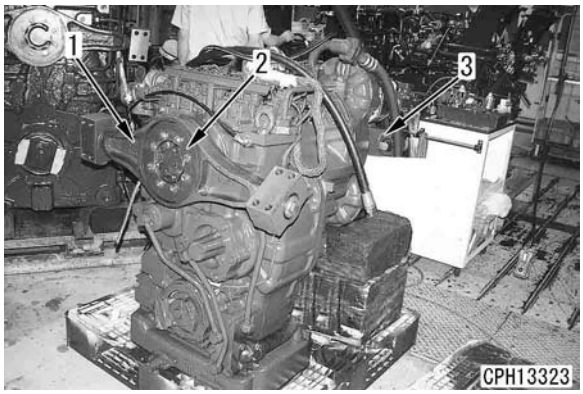
Special tools

Sym-bol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
D	1	790-102-1871	Nut wrench	■	1		
	2	796-465-1120	Push tool	■	1		
	3	792T-423-1110	Push tool	■	1		○
	4	792T-213-1220	Push tool	■	1		○
		790-101-5421	Grip	■	1		
		01010-81240	Bolt	■	1		
	5	792T-213-1230	Push tool	■	1		○
		790-101-5421	Grip	■	1		
		01010-81240	Bolt	■	1		
	6	790-201-2730	Spacer	■	1		
	7	792T-413-1120	Push tool	■	1		○
	8	792T-215-1120	Push tool	■	1		○
	9	799-301-1500	Oil leak tester kit	■	1		

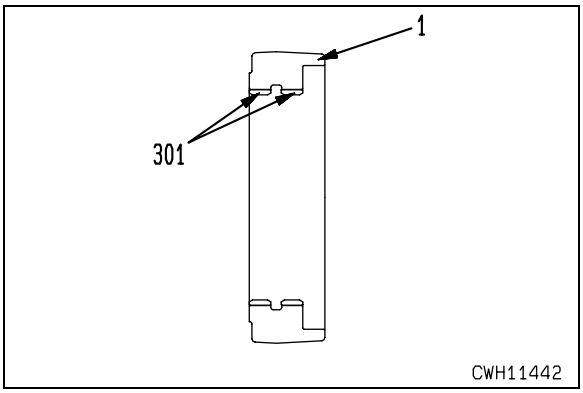
Disassembly

1. Trunnion

1) Remove plate (2) and then remove trunnions (1) and (3).

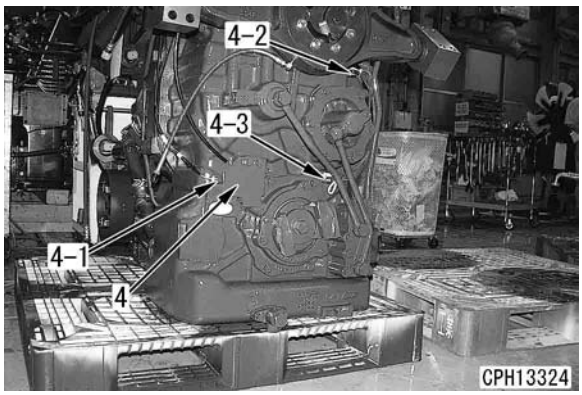


2) Remove bushing (301) from trunnion (1).

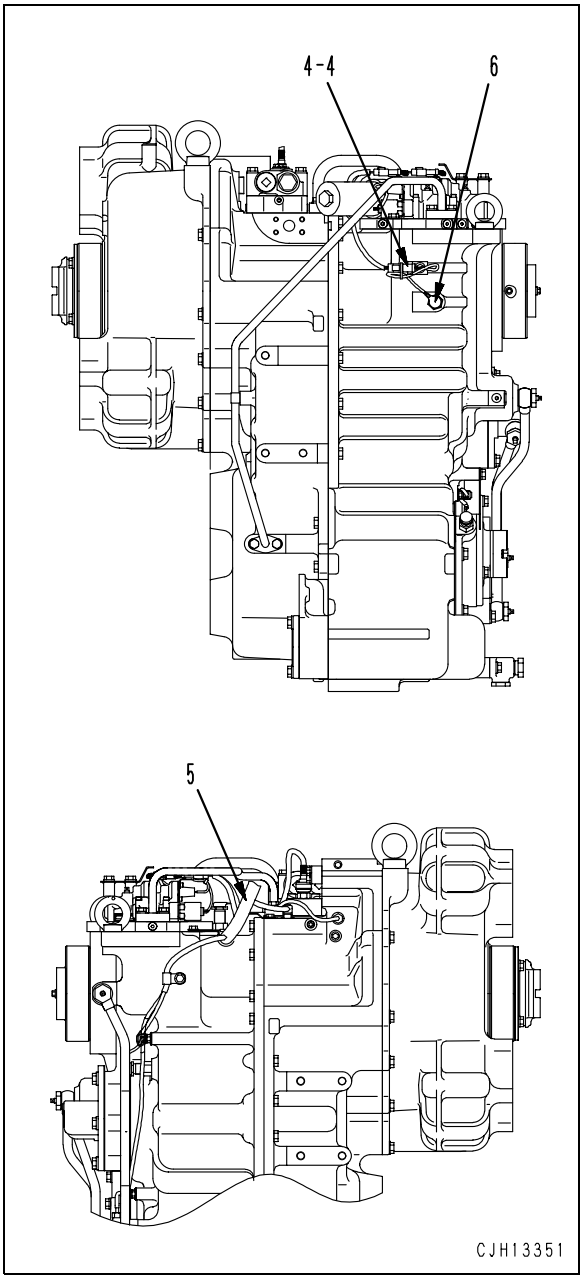


2. Wiring harness, sensor and piping

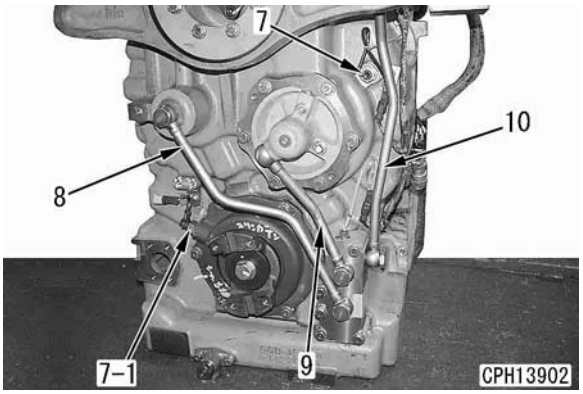
1) Remove cover (4).
2) Disconnect connector B09 (4-1), (4-2) and (4-3).



3) Disconnect connector (4-4).
4) Disconnect wiring harness assembly (5).
5) Remove intermediate shaft rotation sensor (6).

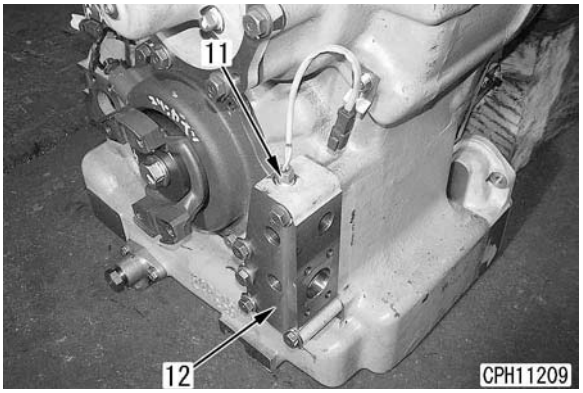


6) Output shaft R rotation sensor (7-1), output shaft rotation sensor (differential input) (7).
7) Tubes (8), (9) and (10).

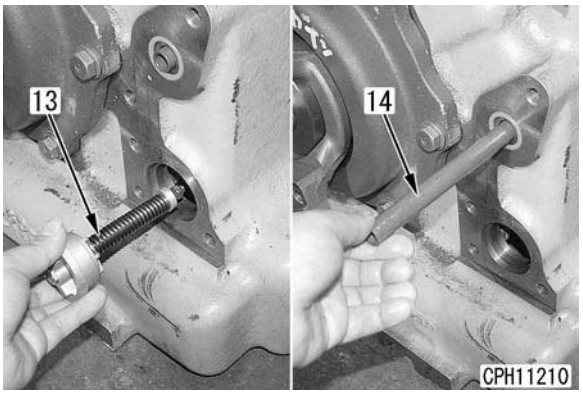


3. Relief valve assembly

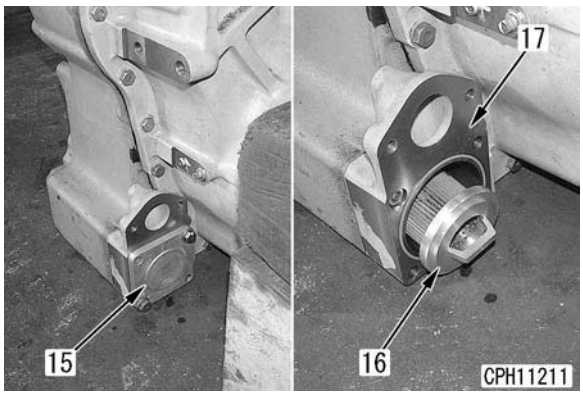
1) Remove lubrication oil temperature sensor (LUB) (11) and then remove block (12).



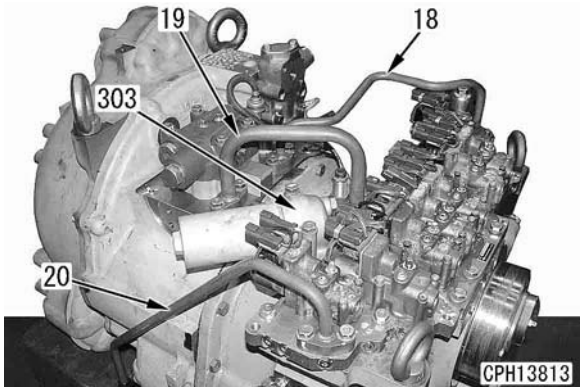
2) Remove relief valve assembly (13) and disconnect piping (14).

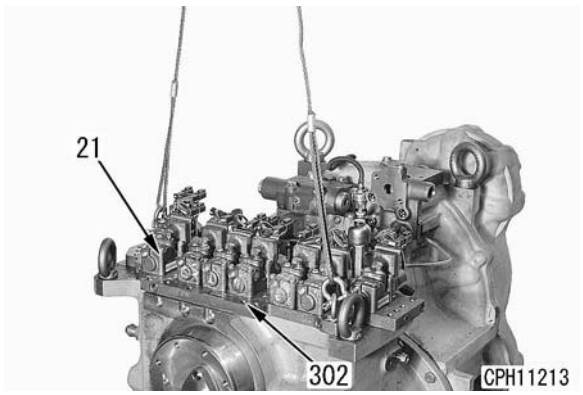


4. Strainer (left and right)
Remove cover (15) and then remove strainer (16) and block (17).

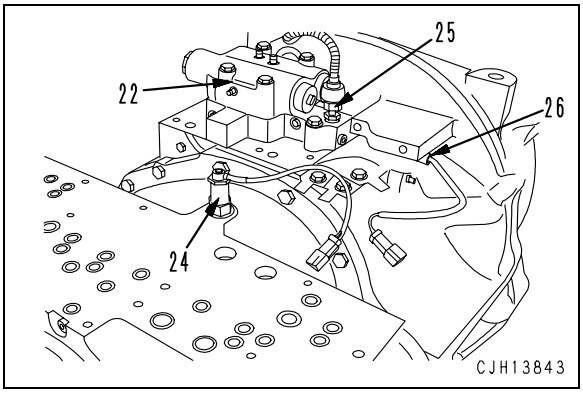


5. Transmission control valve assembly
★ Seal the oil holes on the installing face with tape or the like so that no foreign objects enter them.
1) Disconnect tubes (18), (19) and (20).
2) Remove transmission control valve assembly (21) and valve seat (302) together.
3) Remove each transmission control valve (21) and filter assembly (303) from the valve seat (302).

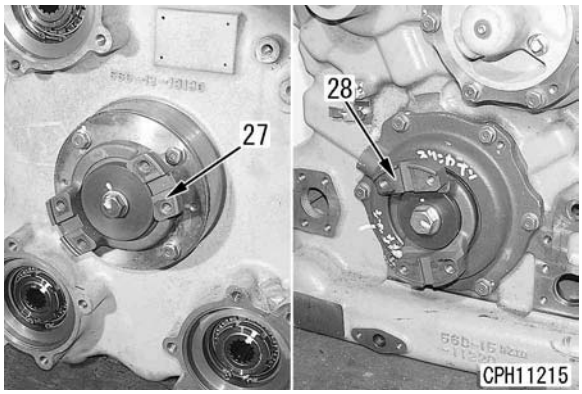




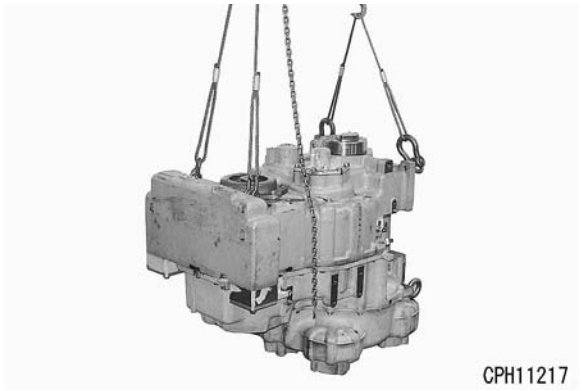
6. Main relief valve assembly, valve flow assembly and sensor
Remove main relief valve assembly (22), input shaft rotation sensor (24), torque converter intermediate pressure oil pressure sensor (25) and torque converter outlet oil temperature sensor (26).
★ Seal the oil holes on the installing face with tape or the like so that no foreign objects enter them.



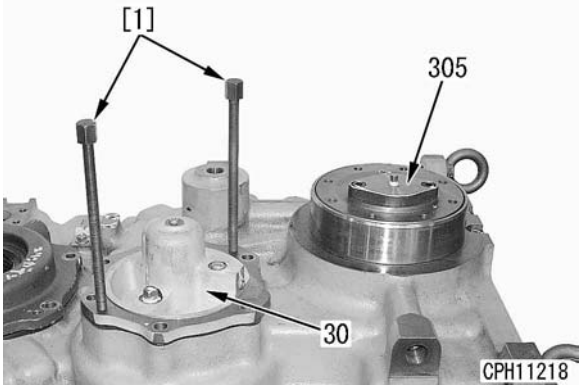
7. Coupling
1) Remove input coupling (27) and output coupling (28).



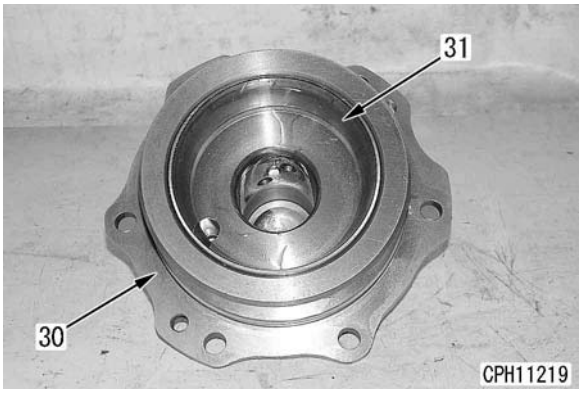
8. Cover and cage (R clutch and 2nd clutch side)
1) Sling the transmission assembly and set it on the block so that the transmission case faces up.



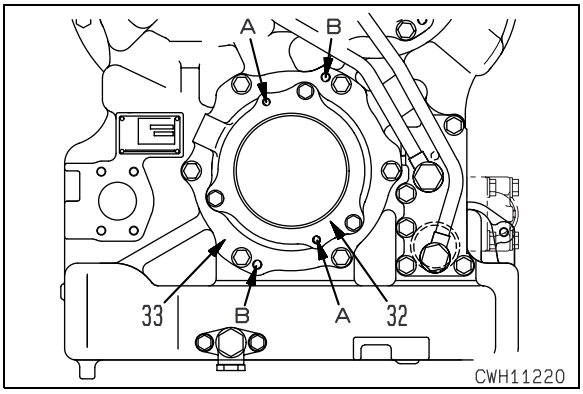
2) Remove cover (305).
3) Remove cage (30), using forcing screws [1].
★ Check the thickness of shims and their number in use beforehand.



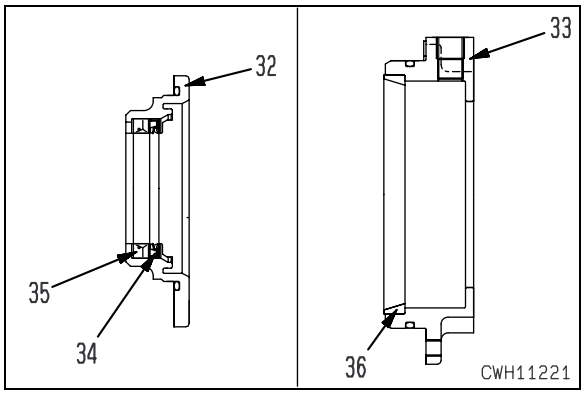
4) Remove outer race (31) from cage (30).



9. Retainer and cage (differential lock clutch rear output side)
1) Screw forcing screws in holes **A** and remove retainer (32).
2) Screw forcing screws in holes **B** and remove cage (33).



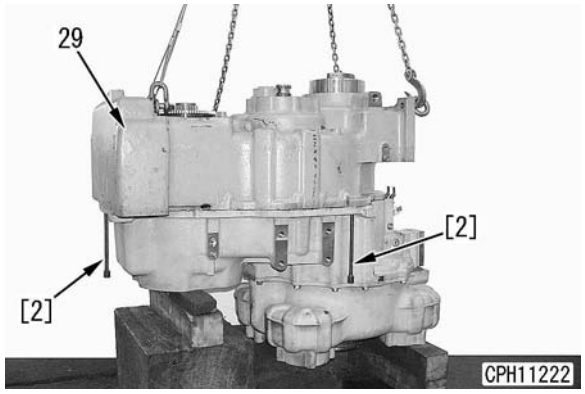
3) Remove dust seal (34) and oil seal (35) from retainer (32).
4) Remove outer race (36) from cage (33).



10. Rear transmission case assembly
Separate rear transmission case assembly (29) from the front side, using forcing screws [2] at 3 points.

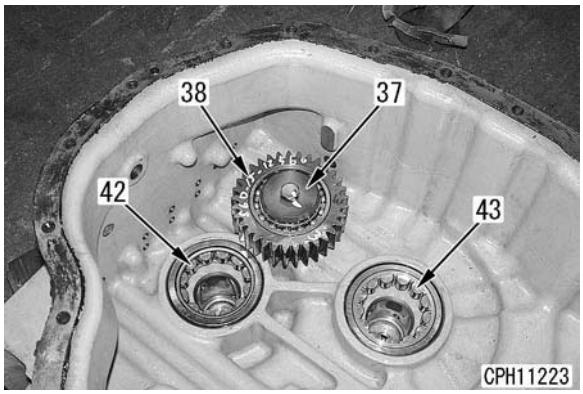
⚠ **If the transmission is not placed with the torque converter side down, it cannot be disassembled. Be sure to set it with the torque converter side down.**

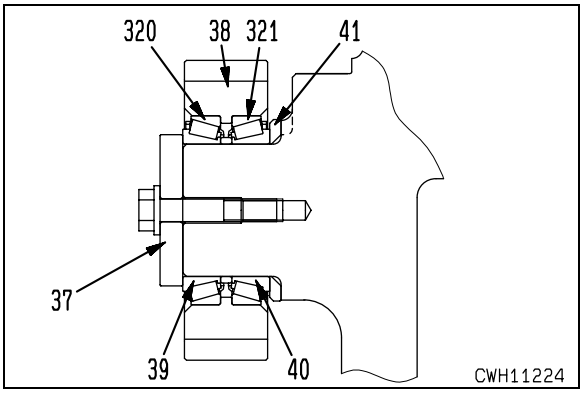
★ If the transmission is disassembled with the torque converter side up, its inside will be broken. Accordingly, be sure to disassemble the transmission with the torque converter side down.



11. Further disassembly of rear transmission case assembly

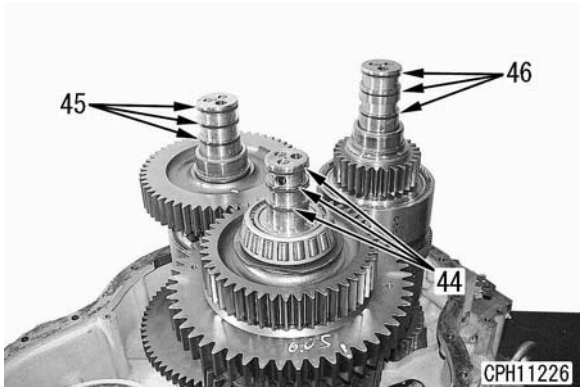
1) Remove holder (37) to remove bearing (39), then remove gear (38), bearing (40) and collar (41).
2) Remove outer races (320) and (321) from gear (38).
3) Remove bearings (42) and (43).





12. Seal ring

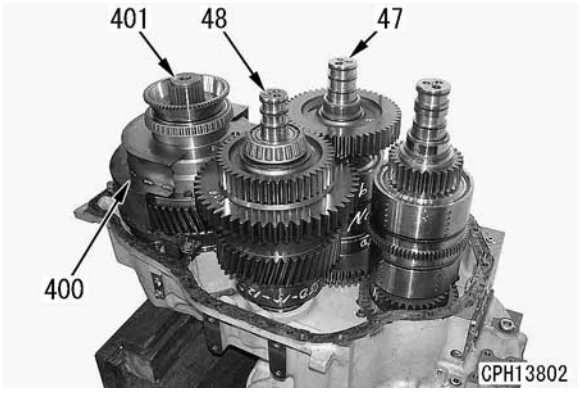
Remove seal rings (44), (45) and (46).



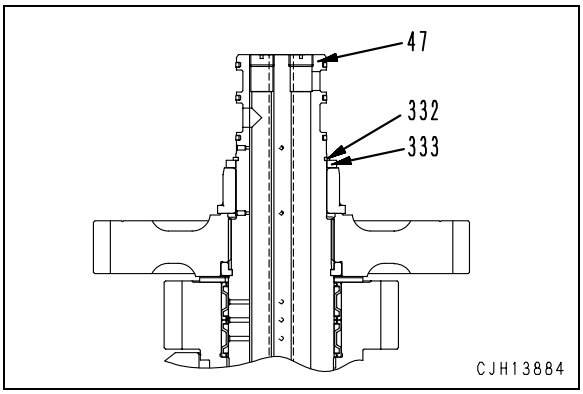
13. Clutch assembly

Whole figure

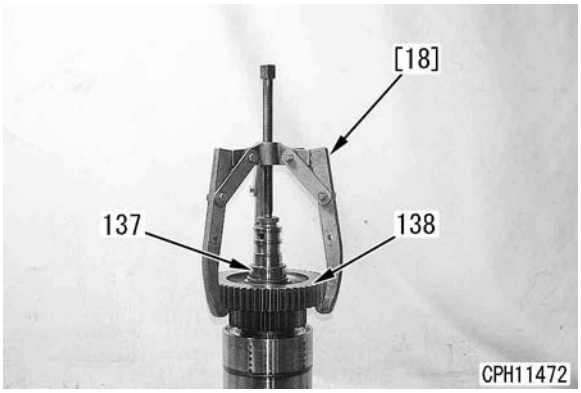
- (47): The FH and 1st clutch assembly
- (48): The 2nd and 3rd clutch assembly
- (400): Shroud
- (401): Differential clutch assembly



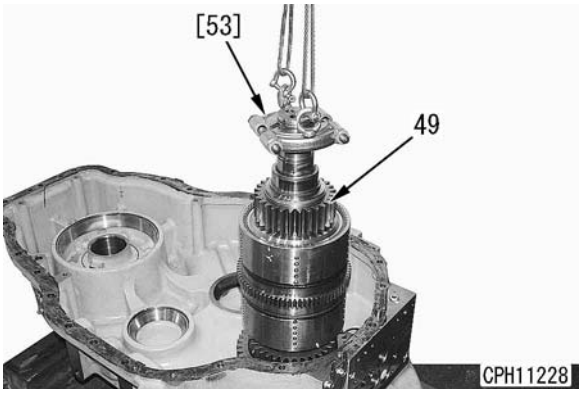
1) Remove snap ring (332) and spacer (333) form the FH and 1st clutch assembly (47).



2) Take out idler gear (138) of FH and 1st clutch assembly together with inner race (137), using puller [18].

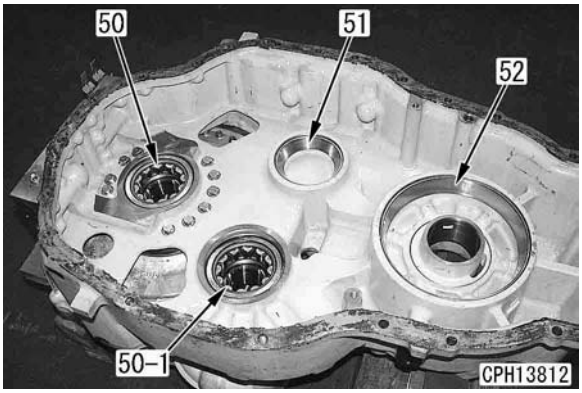


3) Sling 2nd and 3rd clutch assembly (48) to remove. (Refer to whole figure)
   ★ For details on the further disassembly of the 2nd and 3rd clutch assembly, refer to the sections of 19 and 20.
   ★ Sling tool [53] is shown just as an example. (Refer to 6))
4) Sling differential clutch assembly (401) together with shroud (400) to remove. (Refer to whole figure)
   ★ Shroud (400) cannot be removed independently, when the differential lock clutch assembly is still installed.
   ★ For details on the further disassembly of differential lock clutch assembly, refer to the section of 18.
5) Sling FH and 1st clutch assembly (47) to remove. (Refer to whole figure)
   ★ For details on the further disassembly of the FH and 1st clutch assembly, refer to the sections of 21 and 22.
6) Sling FL and R clutch assembly (49) to remove.
   ★ For details on the further disassembly of the FL and R clutch assembly, refer to the sections of 23 and 24.

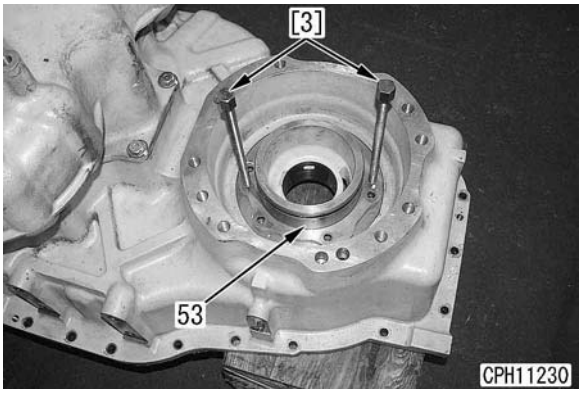


14. Further disassembly of front transmission case assembly

1) Remove bearing (50) and (50-1) and outer races (51) and (52).

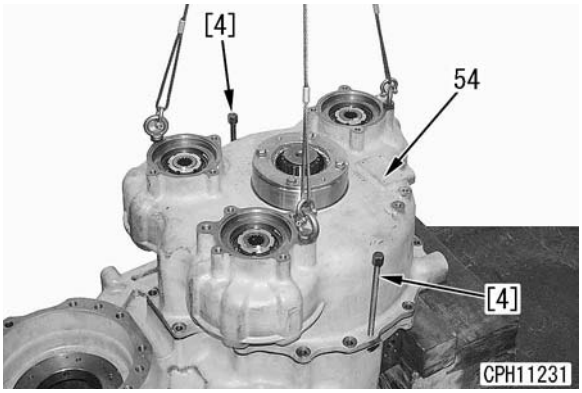


2) Reverse the case and remove cage (53), using forcing screws [3].



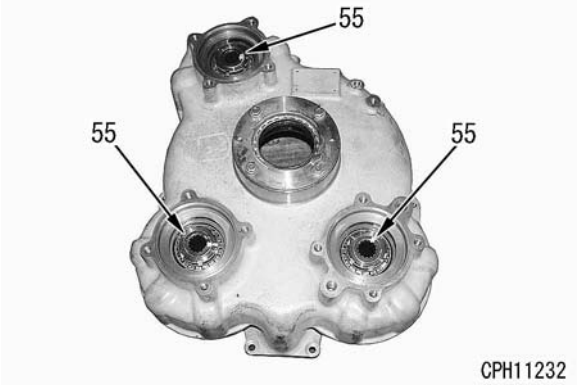
15. PTO case assembly

Separate PTO case assembly (54) from the front transmission case to remove, using forcing screws [4].
   ★ Before removing, loosen nut (55) beforehand, using tool **D1**. (Refer to the section of 16.)
   ★ Use the input coupling as a rotation lock.

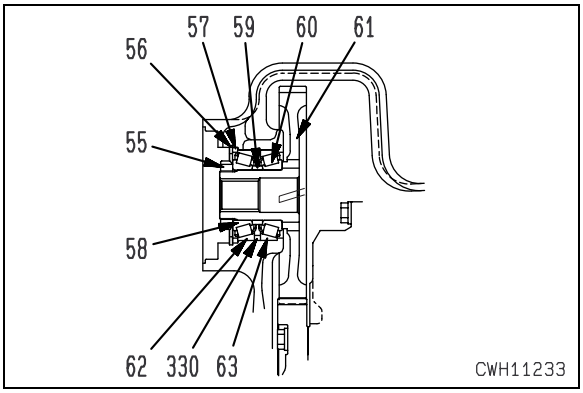


16. Further disassembly of PTO case assembly

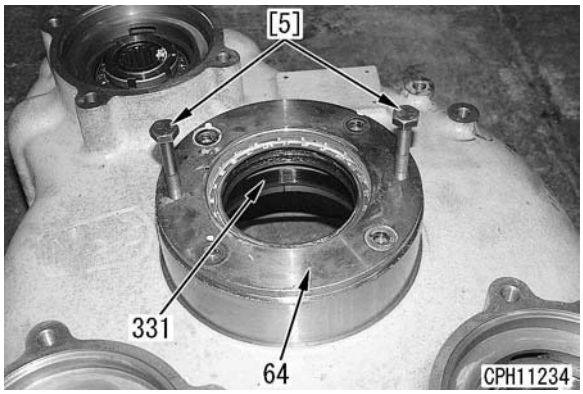
1) Disassemble PTO gears at 3 locations further in the following steps.
   i) Remove nuts (55), using tool **D1**.



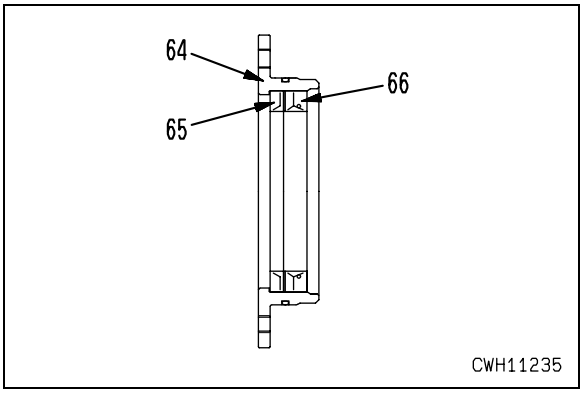
   ii) Remove snap ring (56) and spacer (57).
   iii) Remove PTO gear (61) together with spacer (59) and bearing (60) by pushing the shaft portion.
      ★ When the PTO gear is disengaged, the bearing (58) goes off, too.
   iv) Remove spacer (59) and bearing (60) from PTO gear (61).
   v) Remove outer races (62) and (63) as well as spacer (330) from the PTO case.



2) Remove retainer (64), using forcing screws [5].
3) Remove outer race (331) from the PTO case.



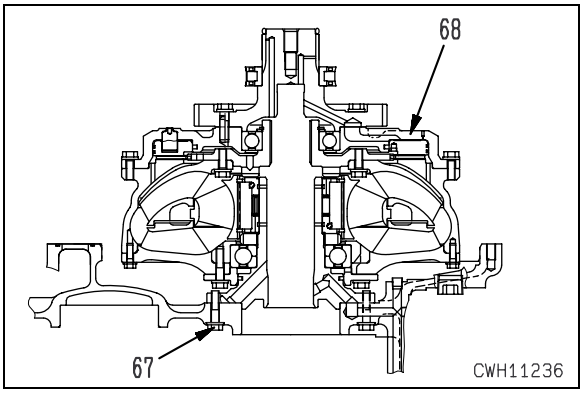
4) Remove dust seal (65) and oil seal (66) from retainer (64).

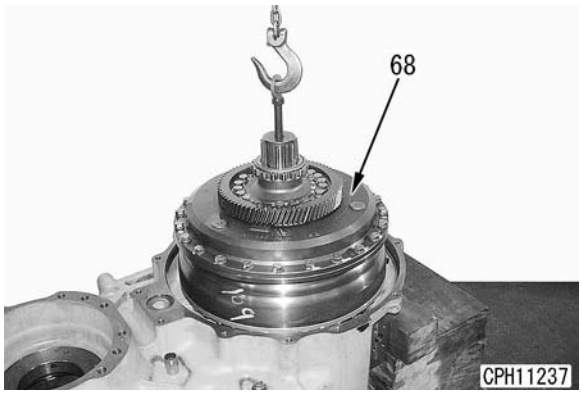


17. Torque converter assembly

Remove mounting bolts (67) connecting the torque converter assembly with front transmission case, and then remove torque converter assembly (68).

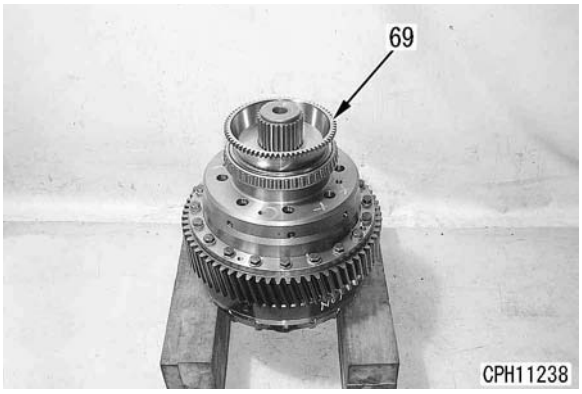
★ For disassembly of the torque converter assembly, refer to the section of "Disassembly and assembly of torque converter".



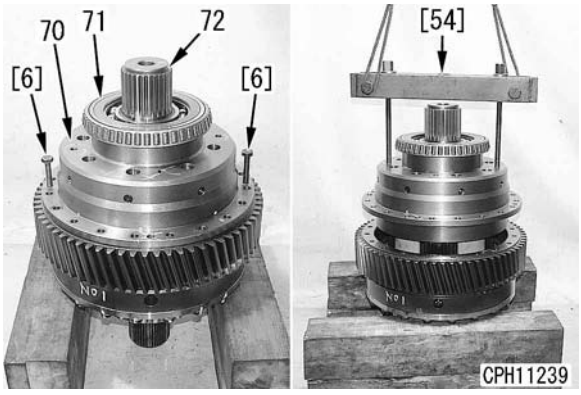


18. Further disassembly of differential lock clutch assembly

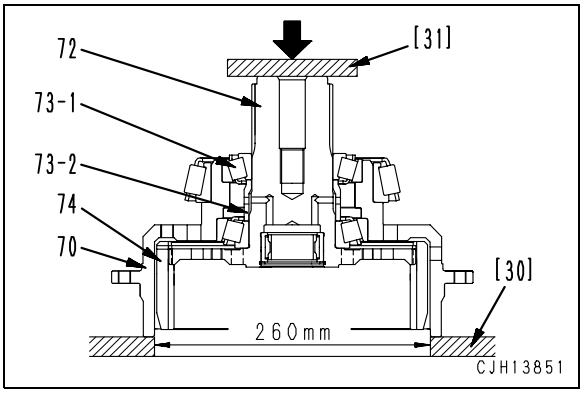
1) Remove gear (69).



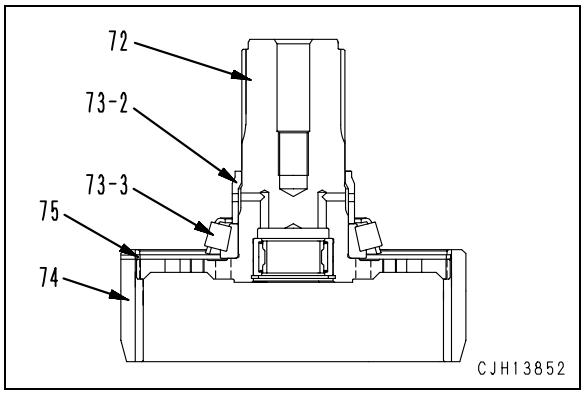
2) Separate rear housing (70) from the output gear, using forcing screws [6].
3) Sling rear housing (70) together with bearing (71) and rear output shaft (72), using tool [54] and remove.



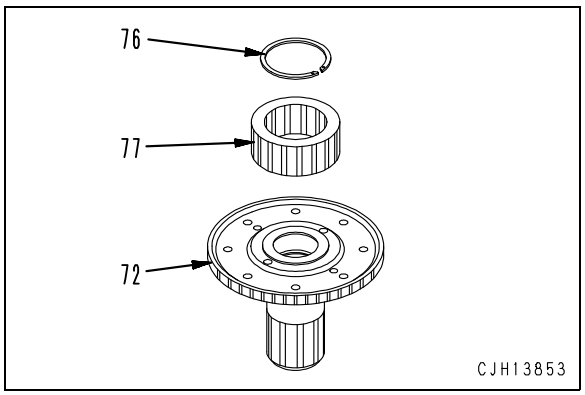
4) Disassemble the rear output shaft (72), rear housing (70) and ring gear (74) further in the following steps.
   i) Using push tool [30] and [31], remove the rear output shaft (72) together with ring gear (74) assembly from rear housing (70) and bearing (73-1) assembly.



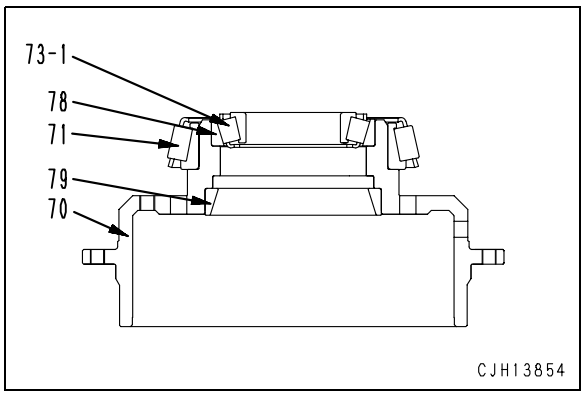
   ii) Remove spacer (73-2) from the rear output shaft (72).
   iii) Remove ring gear (74).
   iv) Remove snap ring (75) from ring gear (74).
   v) Remove bearing (73-3).



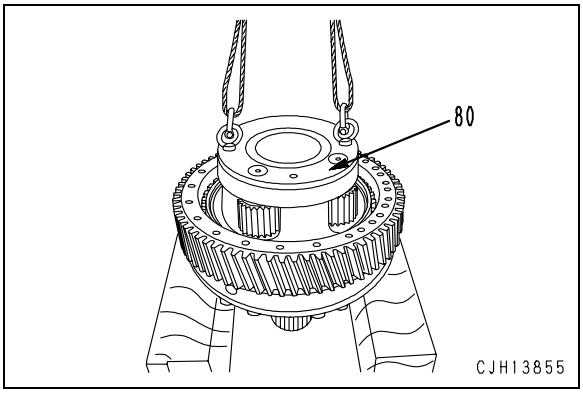
   vi) Remove snap ring (76) and bearing (77) from the rear output shaft (72).



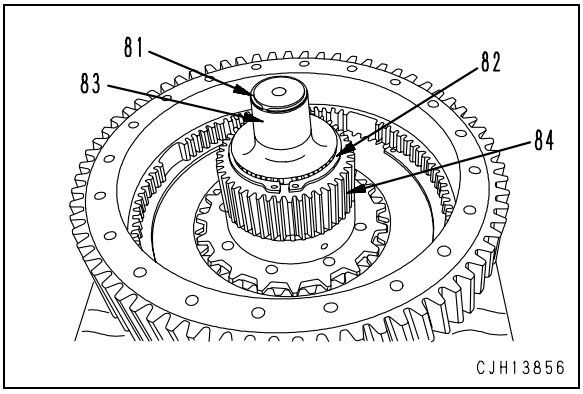
   vii) Remove bearing (73-1) from rear housing (70).
   viii) Remove outer race (78) and (79).
   ix) Remove bearing (71).



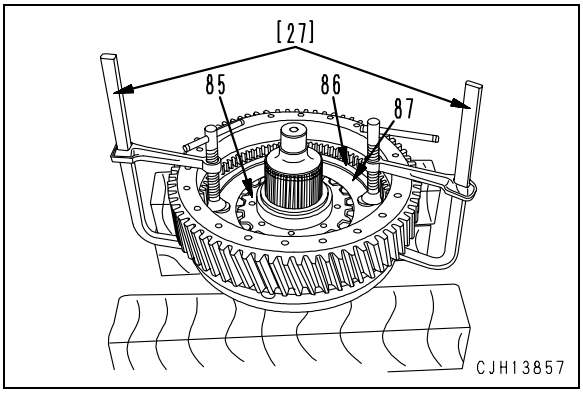
5) Remove carrier assembly (80).
★ For further disassembly of the carrier assembly, refer to the section 15).



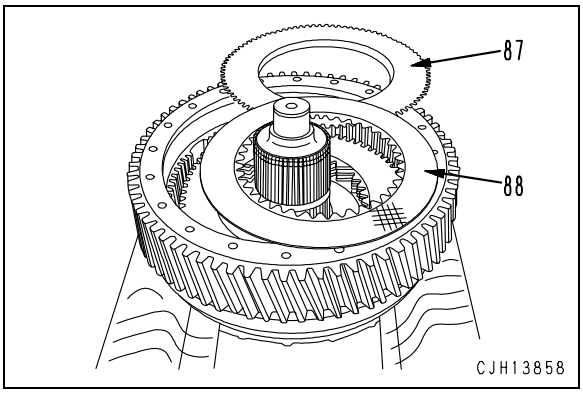
6) Remove snap ring (81) and remove inner race (83).
7) Remove snap ring (82).
8) Remove sun gear (84).



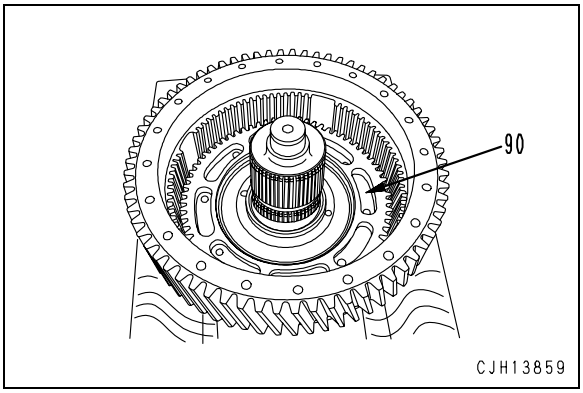
9) Remove clutch hub (85).
10) Compress the spring by pushing plate (87), using tools [27], and remove snap ring (86).



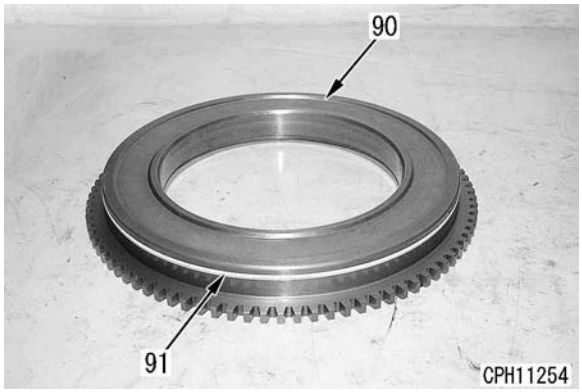
11) Remove 6 plates (87) and 5 discs (88).



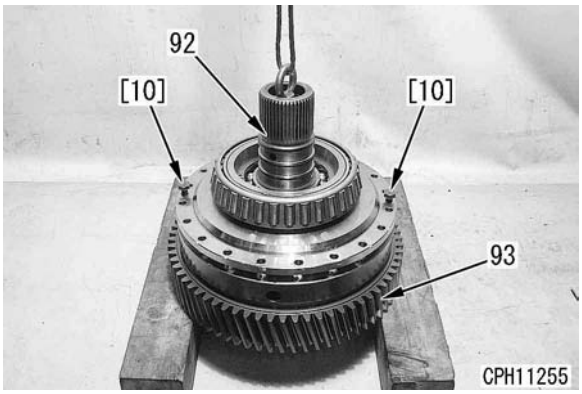
12) Remove piston (90).
★ Use the tapped holes for slinging.



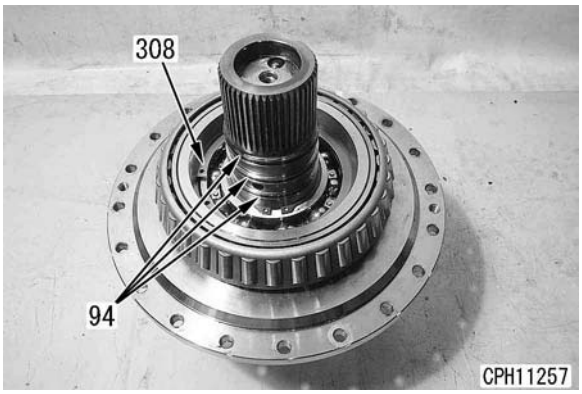
13) Remove seal ring (91) from piston (90).



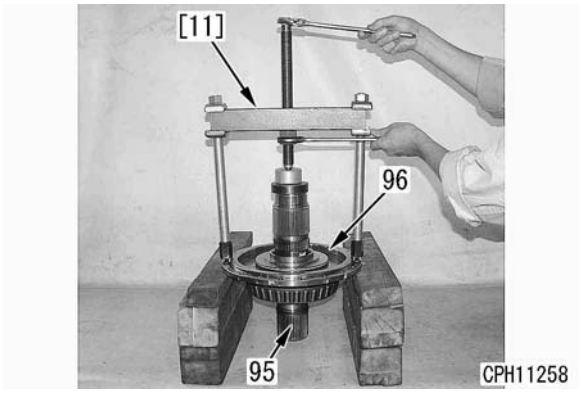
14) Disassemble the front output shaft, front housing and output gear further in the following steps.
   i) Separate front output shaft and housing assembly (92) from output gear (93), using forcing screws [10], and sling to remove.



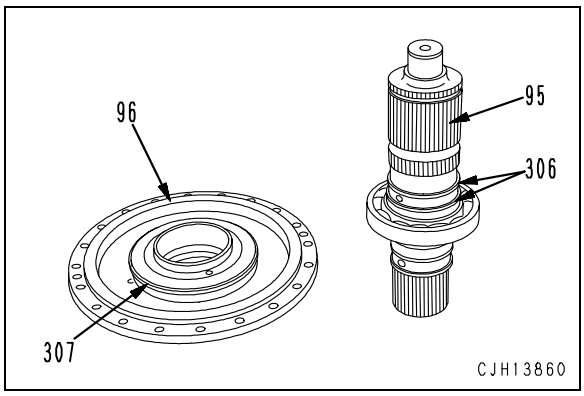
   ii) Remove seal rings (94).
   iii) Remove snap ring (308).



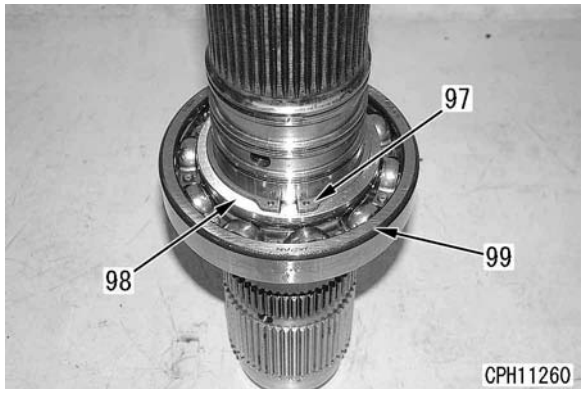
   iv) Reverse the front output shaft and housing assembly, and separate front output shaft (95) from front housing (96), using puller [11].



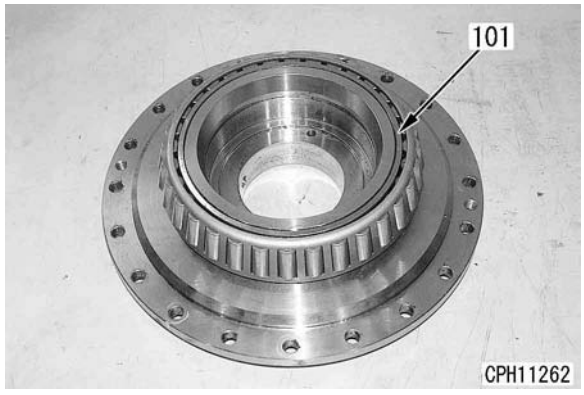
   v) Remove seal rings (306) from front output shaft (95) and seal ring (307) from front housing (96).



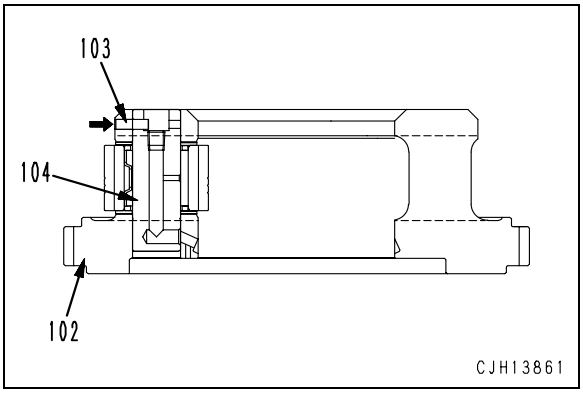
   vi) Remove snap ring (97) and spacer (98), and then remove bearing (99) from the front output shaft.



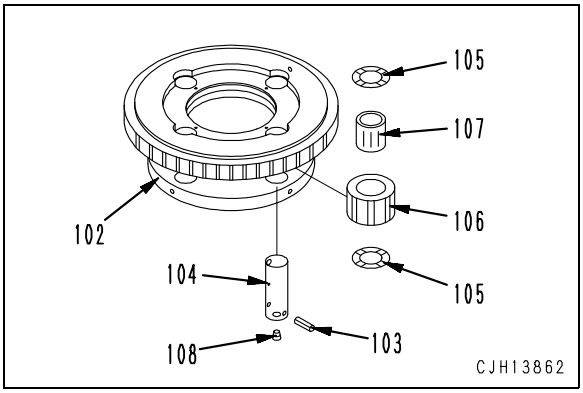
   vii) Remove bearing (101) from the front housing.



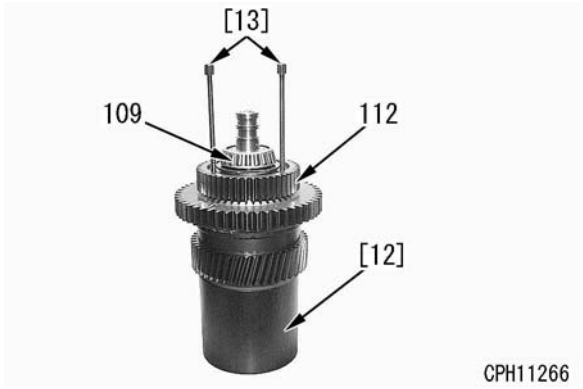
15) Disassemble the carrier (102) assembly further in the following steps.
   i) Hammer pin (103) into shaft (104).

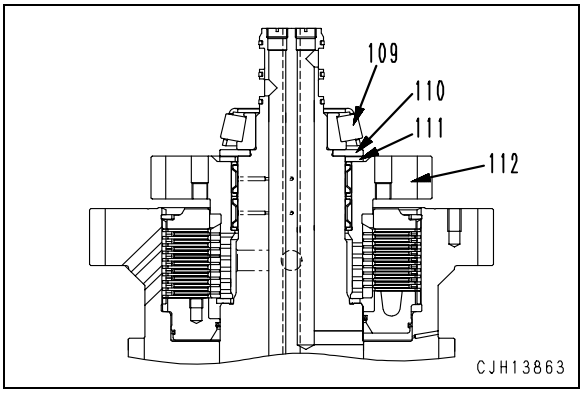


   ii) Hammer out shaft (104) and remove shaft (104), thrust washer (105), planetary gear (106) and bearing (107).
   iii) Remove pin (103) and plug (108) from the shaft (104).

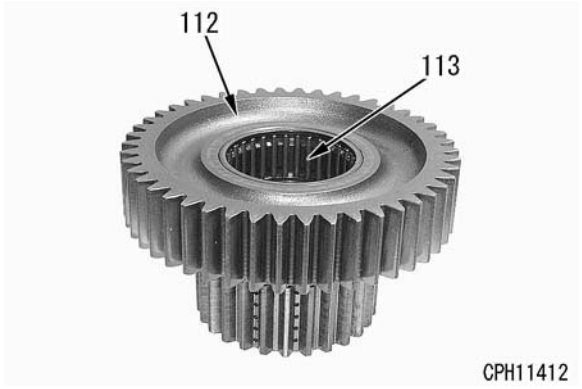


19. Further disassembly of 2nd and 3rd clutch assembly (2nd clutch side)
1) Set the clutch assembly to tool [12].
2) Remove 2nd gear (112) together with bearing (109), plate (110) and thrust washer (111), using forcing screws [13].

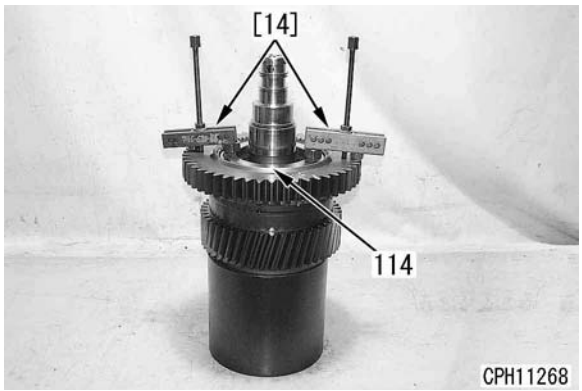


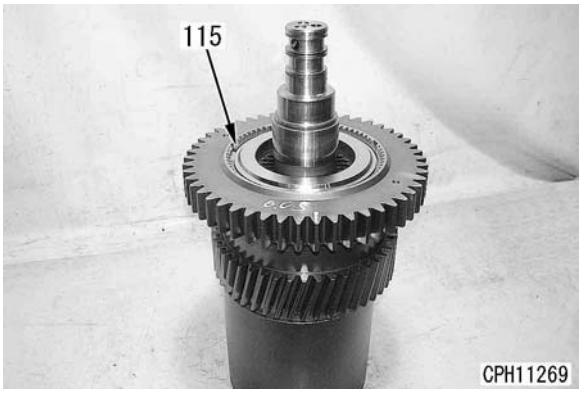


3) Remove bearing (113) from 2nd gear (112).

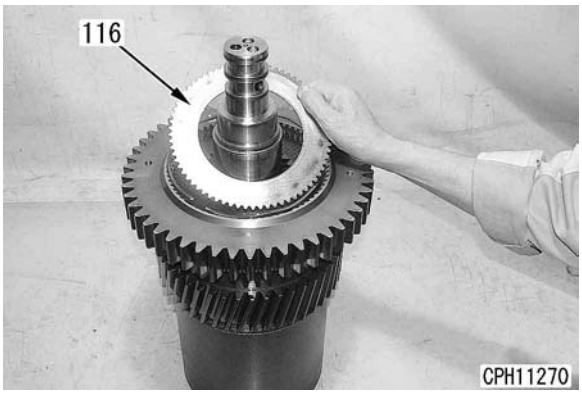


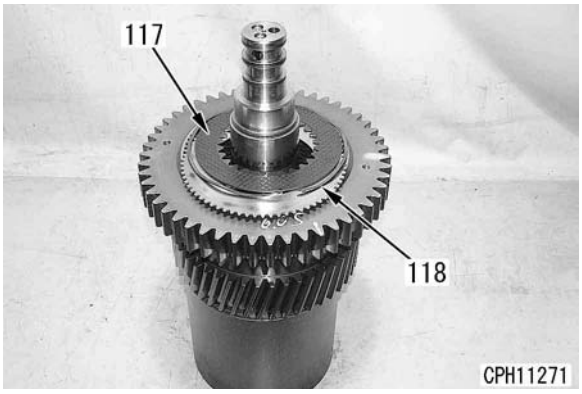
4) Compress the spring by pushing end plate (114), using tool [14], and remove snap ring (115).
   ★ Fit the tool to the gear, using tapped holes for slinging provided on the gear, then insert a spacer of appropriate thickness in between the tool and end plate (114), and compress the spring.
5) Remove end plate (114).



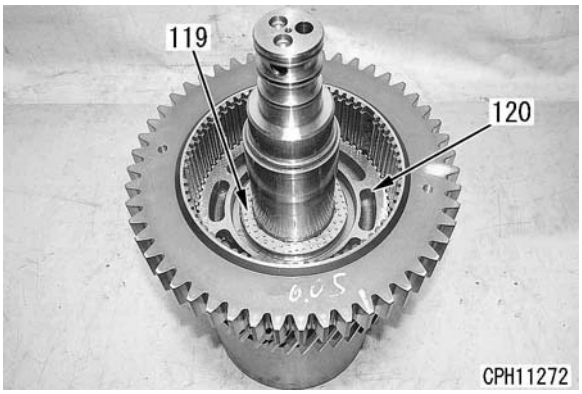


6) Remove 10 plates (116), 9 discs (117) and 9 springs (118).

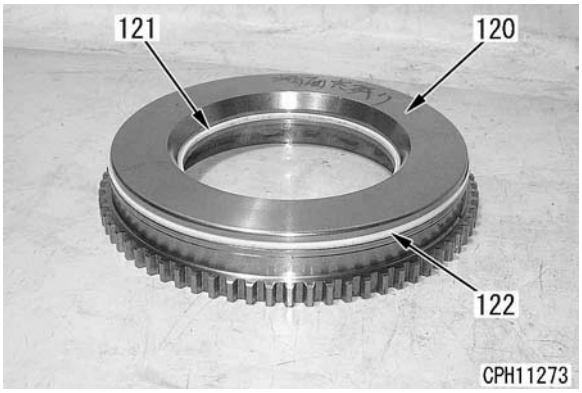




7) Remove thrust washer (119) and piston (120).
   ★ For removing the piston, use provided tapped holes.

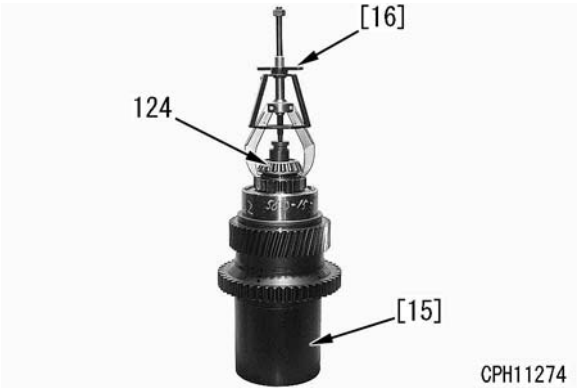


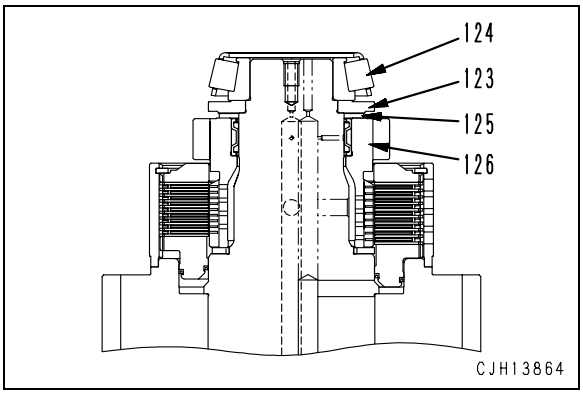
8) Remove seal rings (121) and (122) from piston (120).



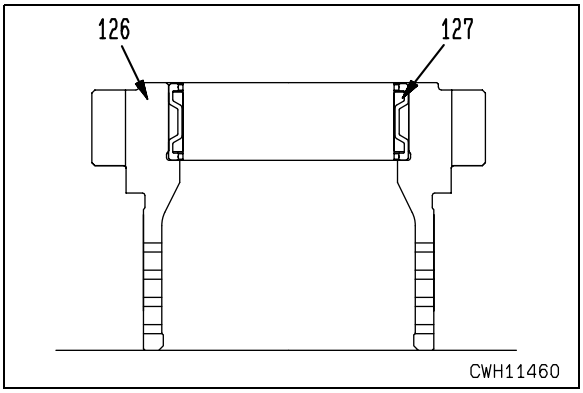
20. Further disassembly of 2nd and 3rd clutch assembly (3rd clutch side)

1) Set the clutch assembly to tool [15].
2) Hook the claw of puller [16] to the underside of plate (123), and remove bearing (124) together with plate (123).
3) Remove thrust washer (125).
4) Remove 3rd gear (126).

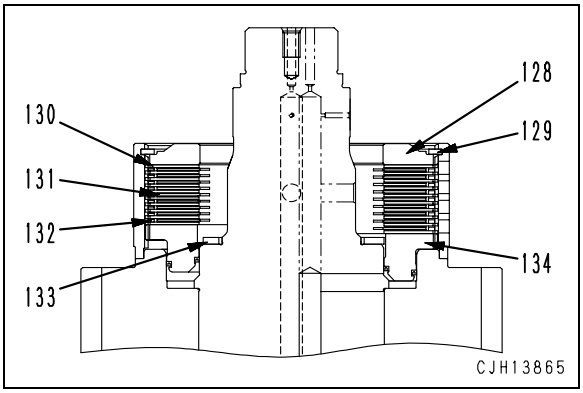




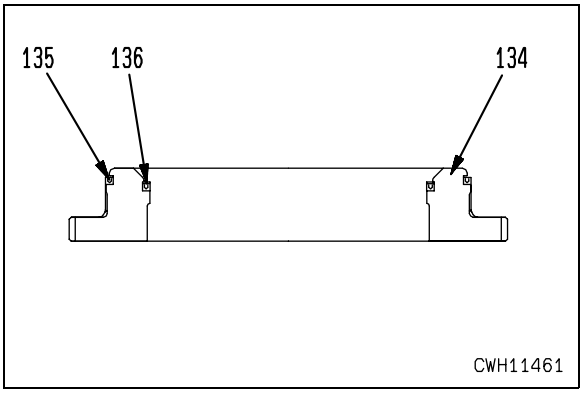
5) Remove bearing (127) from 3rd gear (126).



6) Compress the spring by pushing end plate (128) with C clamp, and remove snap ring (129).
7) Remove end plate (128), 10 plates (130), 9 discs (131) and 9 springs (132).
8) Remove thrust washer (133) and piston (134).

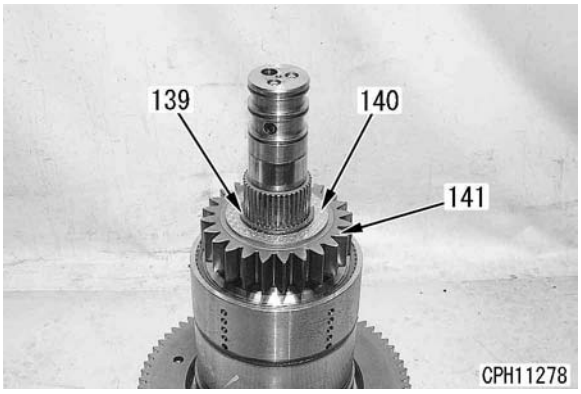


9) Remove seal rings (135) and (136) from piston (134).

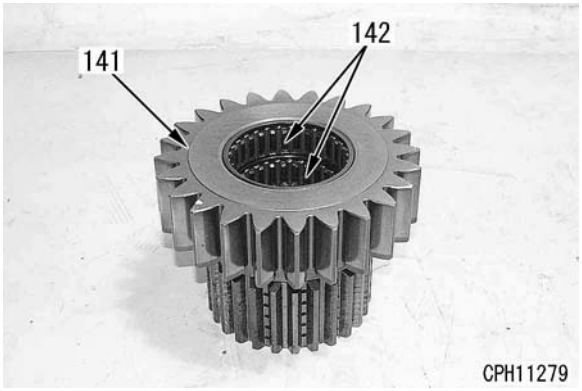


21. Further disassembly of FH and 1st clutch assembly (1st clutch side)

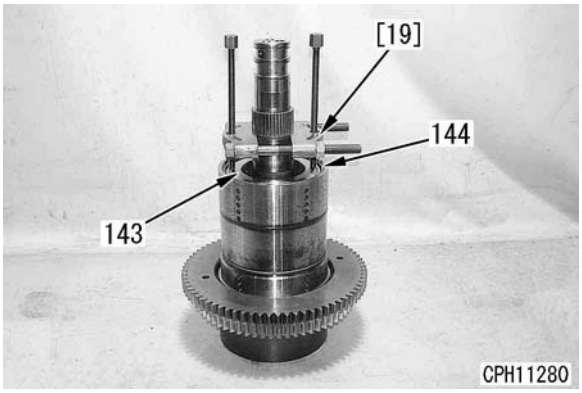
1) Set the clutch assembly to a cylinder-like tool.
2) Remove 2 spacers (139) and thrust washer (140).
3) Remove 1st gear (141).



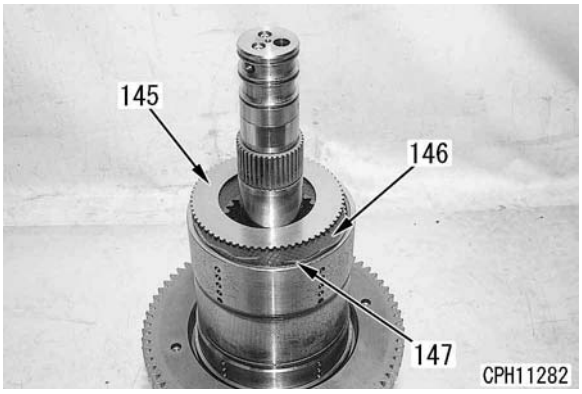
4) Remove 2 bearings (142) from 1st gear (141).



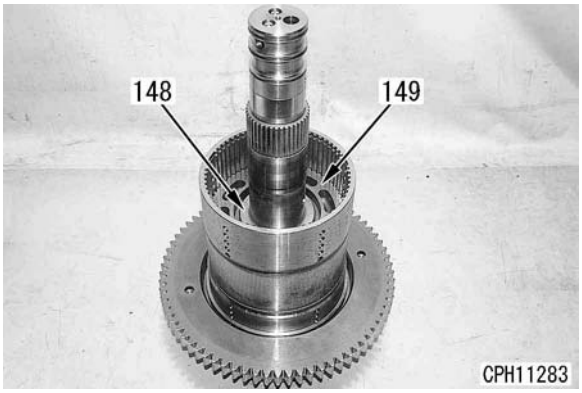
5) Compress the spring by pushing end plate (143), using tool [19], and remove snap ring (144).
6) Remove end plate (143).



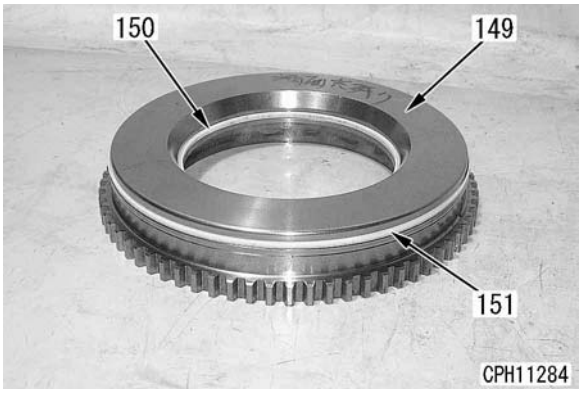
7) Remove 13 plates (145), 12 discs (146) and 12 springs (147).



8) Remove thrust washer (148) and piston (149).

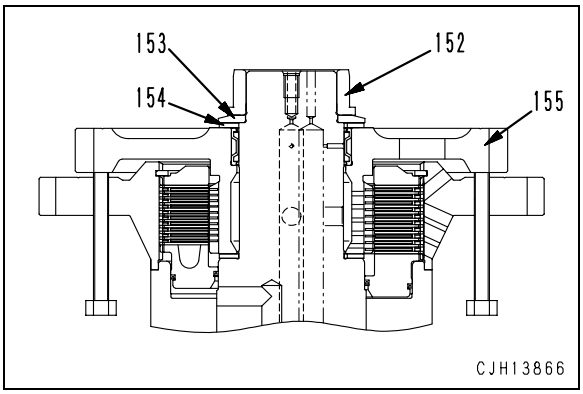


9) Remove seal rings (150) and (151) from piston (149).

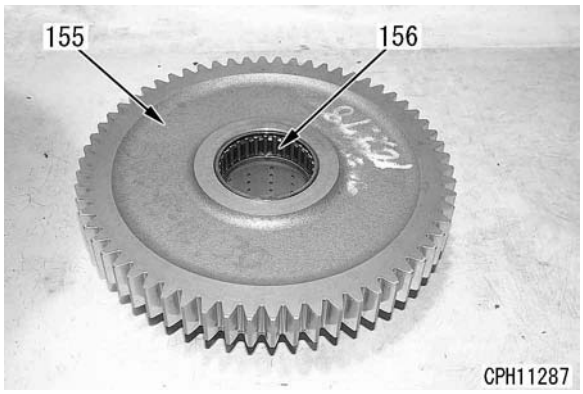


22. Further disassembly of FH and 1st clutch assembly (FH clutch side)

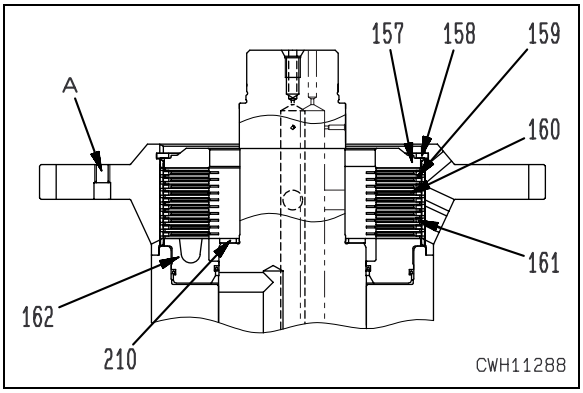
1) Set the clutch assembly to cylinder-like tool.
2) Remove FH gear (155) together with inner race (152), plate (153) and thrust washer (154), using forcing screws.



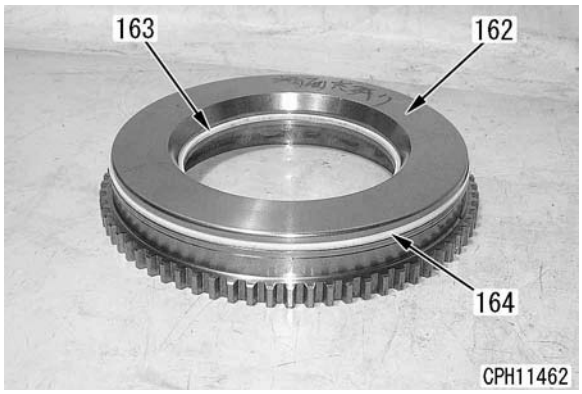
3) Remove bearing (156) from FH gear (155).



4) Compress the spring by pushing end plate (157), using C clamp, and remove snap ring (158).
   ★ The spring can also be compressed by fitting the tool to tapped holes **A** on the FH and 1st cylinder and idler gear, and then inserting a spacer of appropriate thickness in between the tool and end plate.
5) Remove end plate (157), 11 plates (159), 10 discs (160) and 10 springs (161).
6) Remove thrust washer (210) and piston (162).

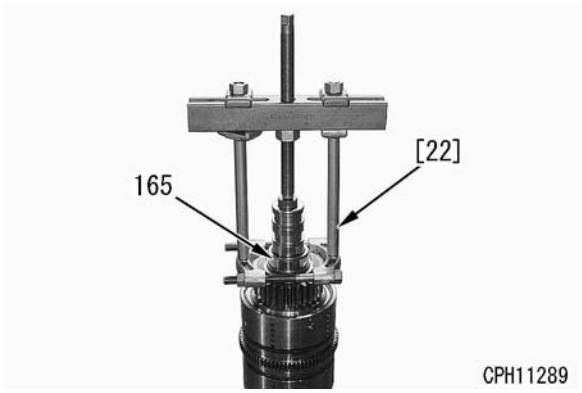


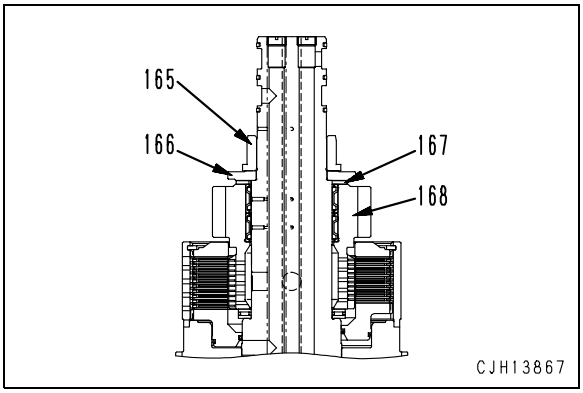
7) Remove seal rings (163) and (164) from piston (162).



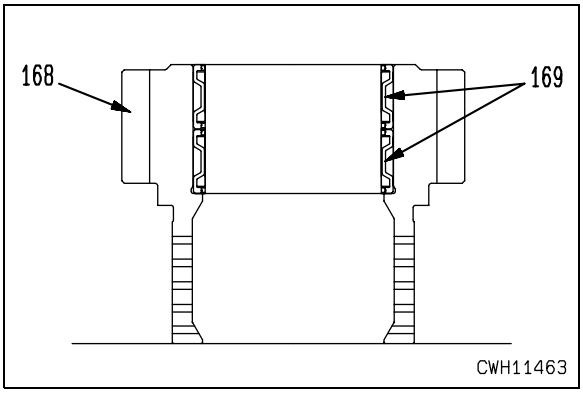
23. Further disassembly of FL and R clutch assembly (R clutch side)

1) Set the clutch assembly to a cylinder-like tool.
2) Hook the claw of puller [22] to the underside of plate (166), and remove inner race (165) and plate (166).
3) Remove thrust washer (167) and then R gear (168).

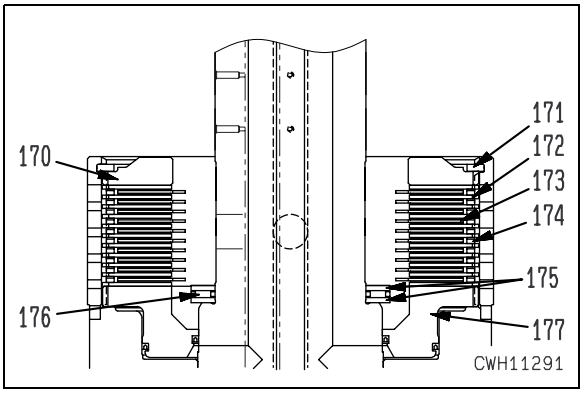




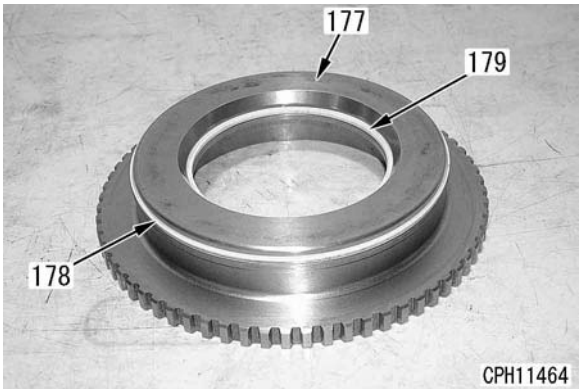
4) Remove bearing (169) from R gear (168).



5) Compress the spring by pushing end plate (170) with C clamp, and remove snap ring (171).
6) Remove end plate (170), 11 plates (172), 10 discs (173) and 10 springs (174).
7) Remove thrust washer (175) and thrust bearing (176).
8) Remove piston (177).

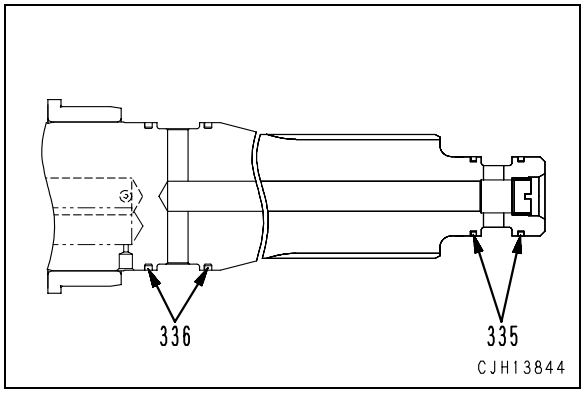


9) Remove seal rings (178) and (179) from piston (177).

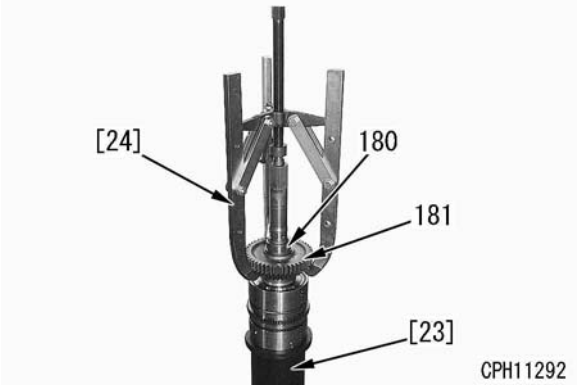


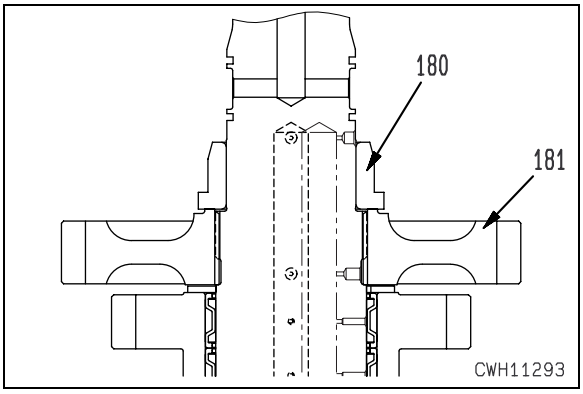
24. Further disassembly of FL and R clutch assembly (FL clutch side)

1) Remove seal ring (335) and (336).

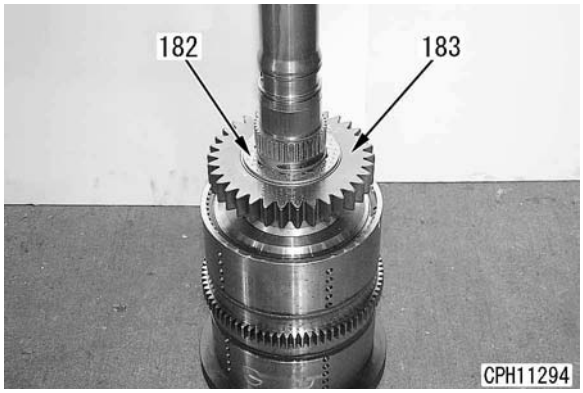


2) Set the clutch assembly to tool [23].
3) Remove idler gear (181) together with inner race (180), using puller [24].

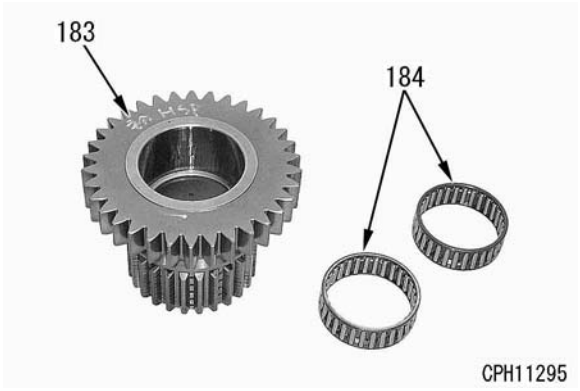




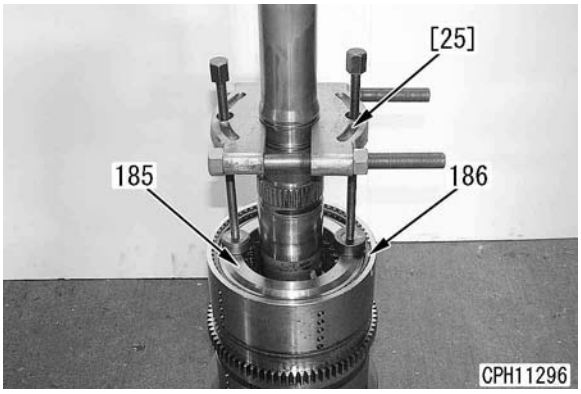
4) Remove thrust washer (182) and then FL gear (183).



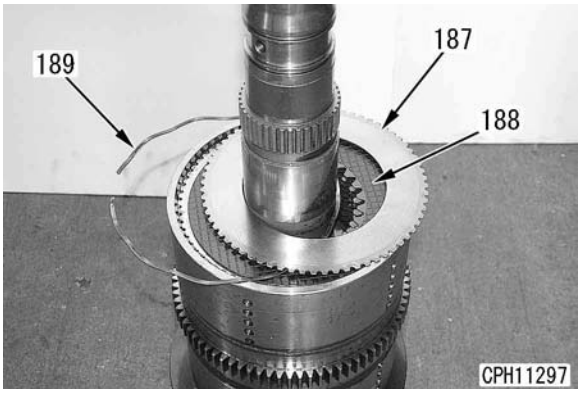
5) Remove bearings (184) from FL gear (183).



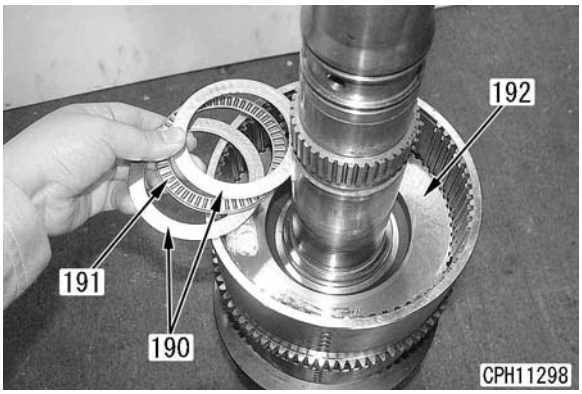
6) Compress the spring by pushing end plate (185), using tool [25], and remove snap ring (186).
7) Remove end plate (185).



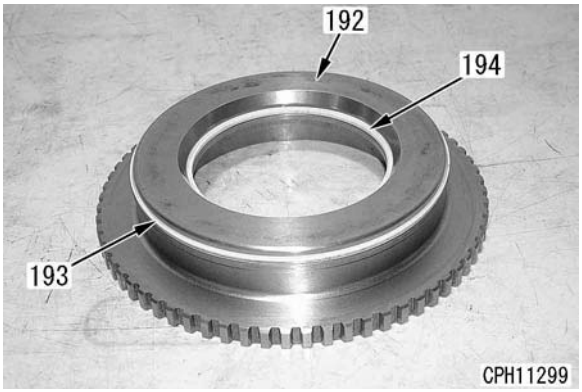
8) Remove 11 plates (187), 10 discs (188) and 10 springs (189).



9) Remove thrust washers (190) and thrust bearing (191).
10) Remove piston (192).

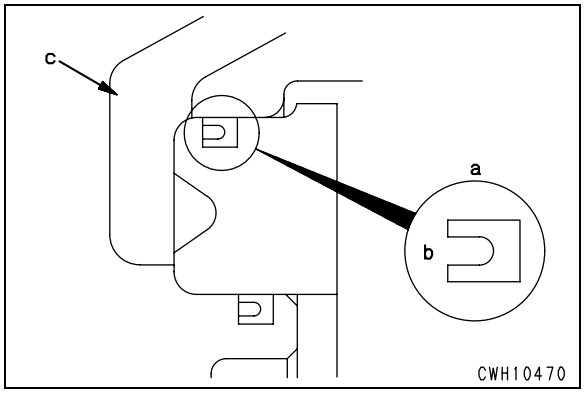


11) Remove seal rings (193) and (194) from piston (192).



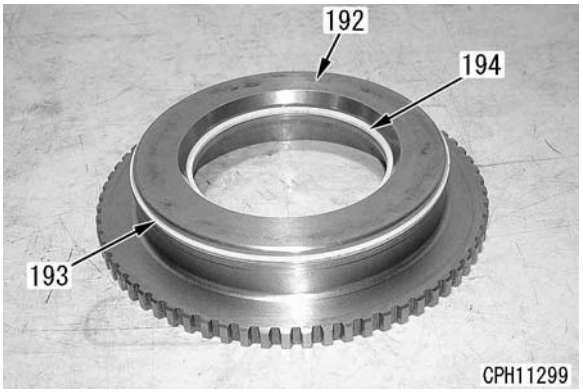
Assembly

★ Clean each of the parts thoroughly and check that it is free of dust, damage, etc. before assembling.
★ Coat the sliding surface of each of the parts with engine oil before assembling.
★ Immerse discs in clean powertrain oil (TO10) for more than 2 minutes before assembling.
★ Assemble each seal ring (**a**) for pistons of the clutch assembly with its pressure-receiving side (**b** side) facing housing (**c**) as shown in the figure below.

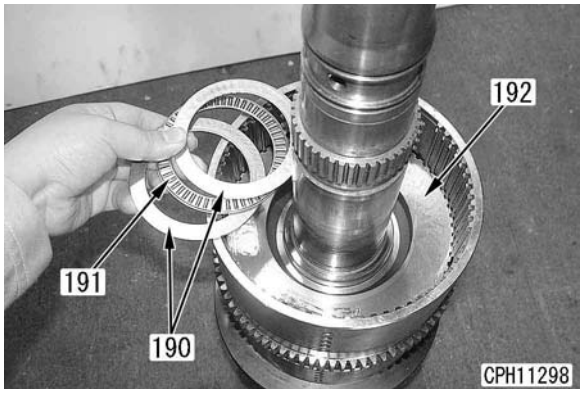


1. Subassembly of FL and R clutch assembly (FL clutch side)

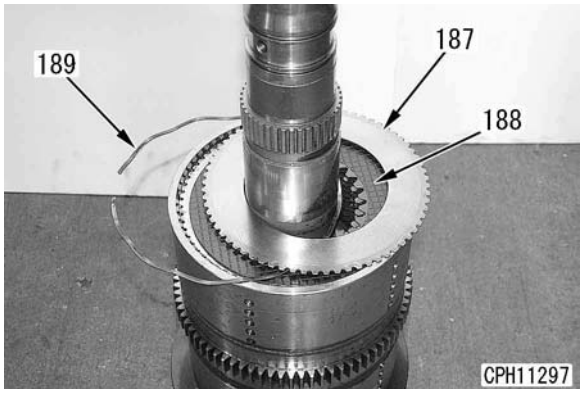
1) Install seal rings (193) and (194) to piston (192).
★ Install the seal ring with its pressure-receiving side facing the housing side.



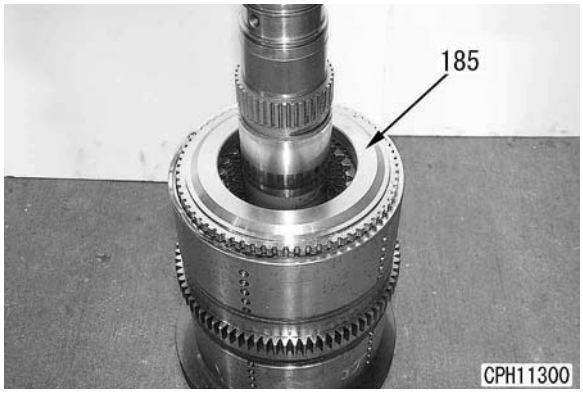
2) Install piston (192).
   Seal ring periphery and sliding surface: **Powertrain oil (TO10)**
3) Install thrust washers (190) and thrust bearing (191).



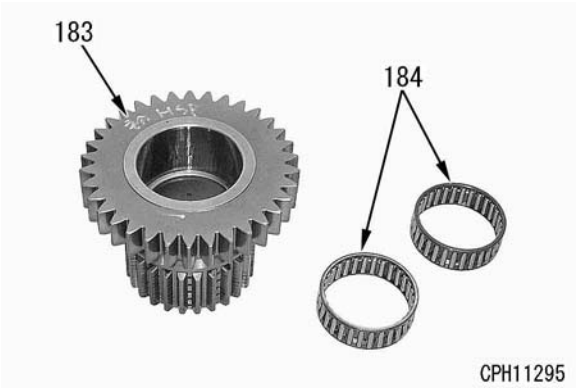
4) Install each of 11 plates (187), 10 discs (188) and 10 springs (189) alternately from the bottom to the top.
   ★ Immerse the discs in clean powertrain oil (TO10) for more than 2 minutes before assembling.



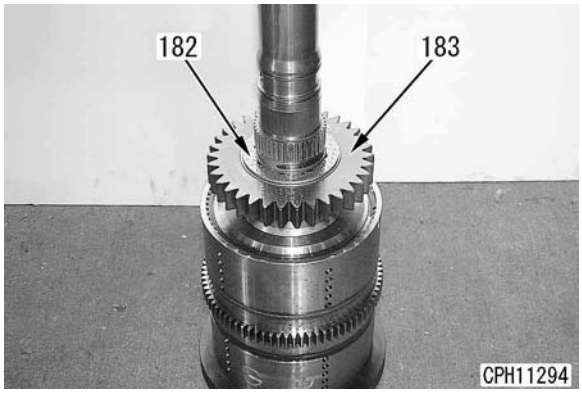
5) Install end plate (185).

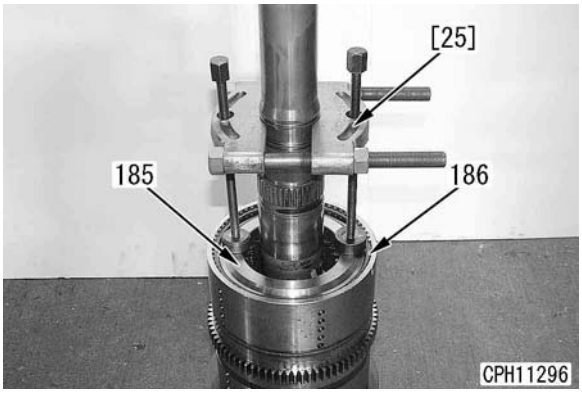


6) Install bearings (184) to FL gear (183).

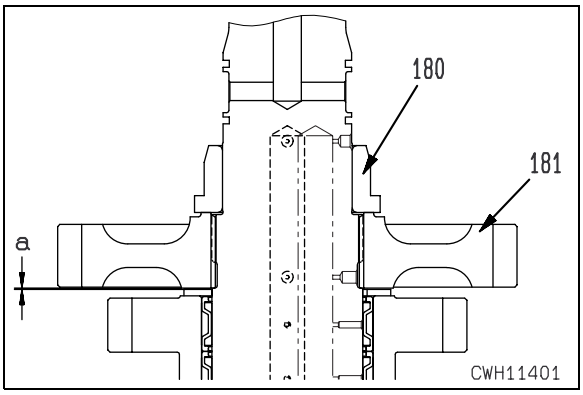


7) Install FL gear (183) to the clutch assembly temporarily, and match grooves of the discs.
   ★ Turn the gear to the left and right, while pressing it down, and push the gear in gradually, avoiding interfering with the disc mountains.
8) Remove FL gear (183) once.
9) Compress the spring by pushing end plate (185), using tool [25], and install snap ring (186).
   ★ Take care so that the plate will not get caught in the snap ring groove.
   ★ Make sure that the snap ring settles in the groove completely.
10) Install FL gear (183) and thrust washer (182).
   ★ If it is found difficult to assemble the FL gear in, start the work all again from the step 7) above.



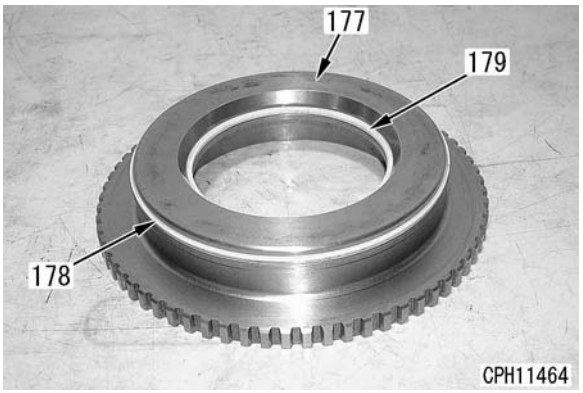


11) Install idler gear (181) and shrink-fit inner race (180).
    - Shrink-fit temperature
      : For 30 minutes at approx. 120°C
12) Apply a dial gauge to the edge surface of idler gear (181), move the idler gear in the thrust direction and check that clearance "**a**" remains within the range of 0.28 and 1.10 mm.

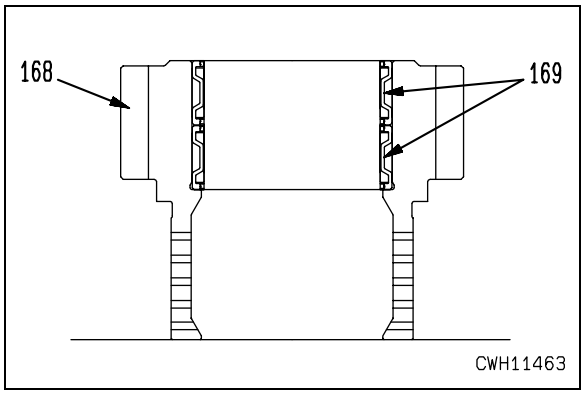


2. Subassembly of FL and R clutch assembly (R clutch side)

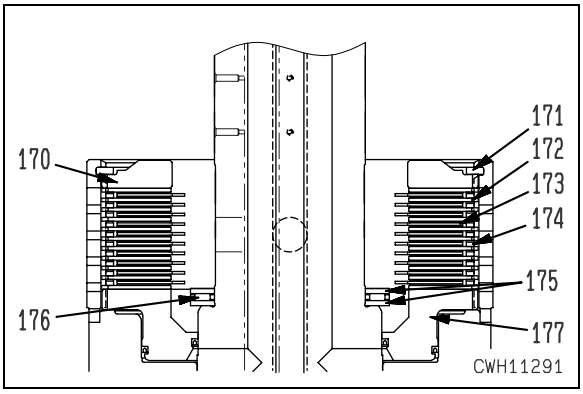
1) Install seal rings (178) and (179) to piston (177).
   ★ Install the seal ring with its pressure-receiving side facing the housing.



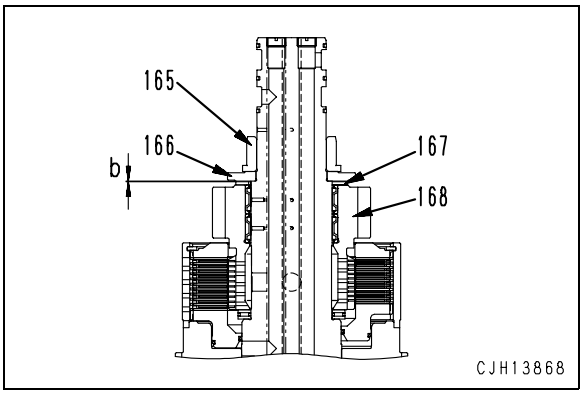
2) Install bearing (169) to R gear (168).



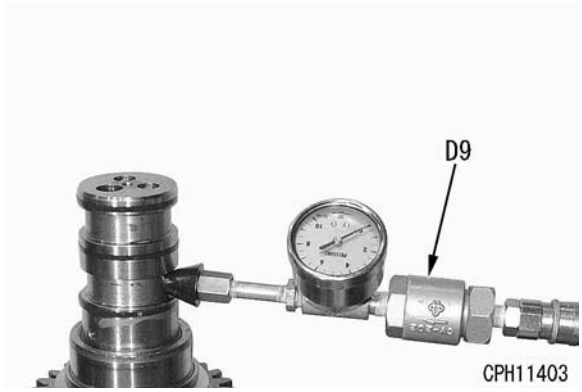
3) Install piston (177).
   Seal ring periphery and sliding surface: **Powertrain oil (TO10)**
4) Install thrust washers (175) and thrust bearing (176).
5) Install each of 11 plates (172), 10 discs (173) and 10 springs (174) alternately from the bottom to the top.
   ★ Immerse the discs in clean powertrain oil (TO10) for more than 2 minutes before assembling.
6) Install end plate (170).
7) Install R gear (168) (above-mention) to the clutch assembly temporarily, and match disc tooth.
   ★ Turn the gear to the left and right, while pressing it down, and push the gear in gradually, avoiding interference with the disc tooth.
8) Remove R gear (168) once.
9) Compress the spring by pushing end plate (170) with C clamp, and then install snap ring (171).
   ★ Take care so that the plate will not get caught in the snap ring groove.
   ★ Make sure that the snap ring settles in the groove completely.



10) Install R gear (168) and thrust washer (167).
   ★ If it is found difficult to assemble the R gear in, start the work all again from the step 7) above.
11) Install plate (166) and shrink-fit inner race (165).
   • Shrink-fit temperature
   : For 30 minutes at approx. 120°C
12) Apply a dial gauge to the edge surface of R gear (168), move the R gear in the thrust direction and check that clearance "**b**" remains within the range of 0.08 and 0.90 mm.

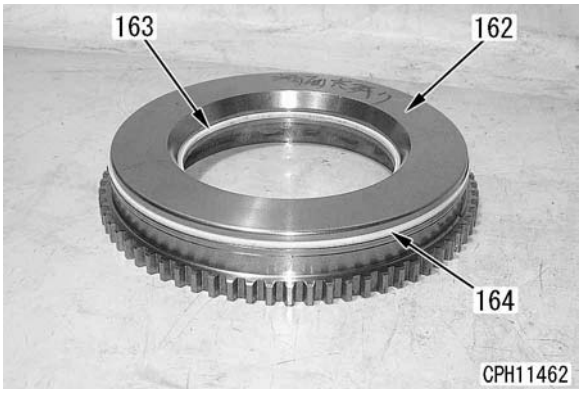


3. Actuation test of FL and R clutch assembly
Blow air into the shaft oil hole, using tool **D9**, and check that each clutch is actuated.
   ★ If the gear on the air-blown side is fixed, the clutch is in normal operation.

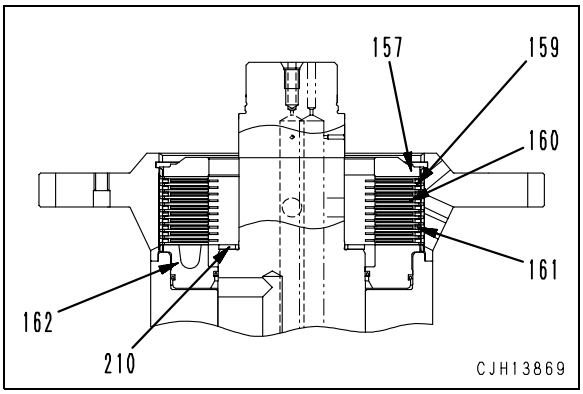


4. Subassembly of FH and 1st clutch assembly (FH clutch side)

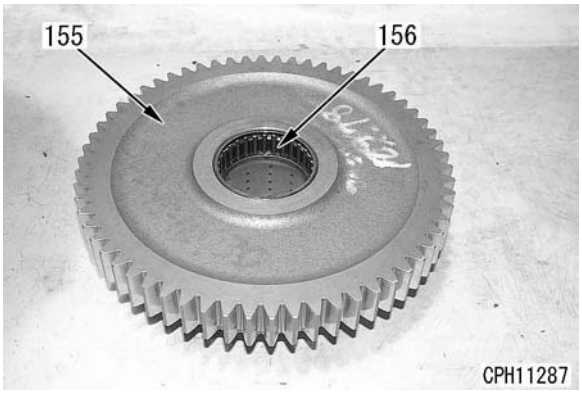
1) Install seal rings (163) and (164) to piston (162).
   ★ Install the seal rings with their pressure-receiving side facing the housing.



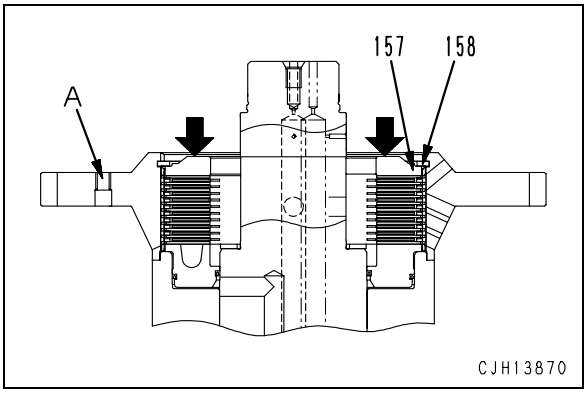
2) Install piston (162).
   Seal ring periphery and sliding surface: **Powertrain oil (TO10)**
3) Install thrust washer (210).
4) Install each of 11 plates (159), 10 discs (160) and 10 springs (161) alternately from the bottom to the top.
   ★ Immerse the discs in clean powertrain oil (TO10) for more than 2 minutes before assembling.
5) Install end plate (157).



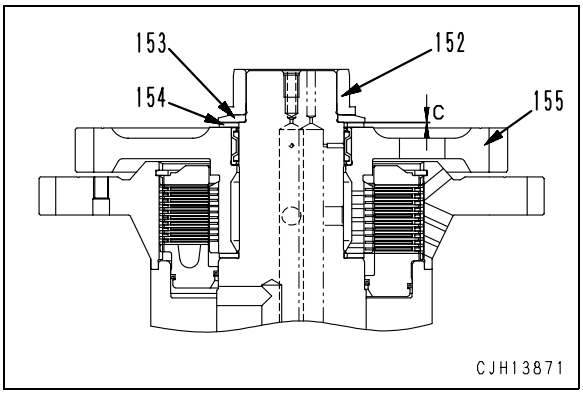
6) Install bearing (156) to FH gear (155).



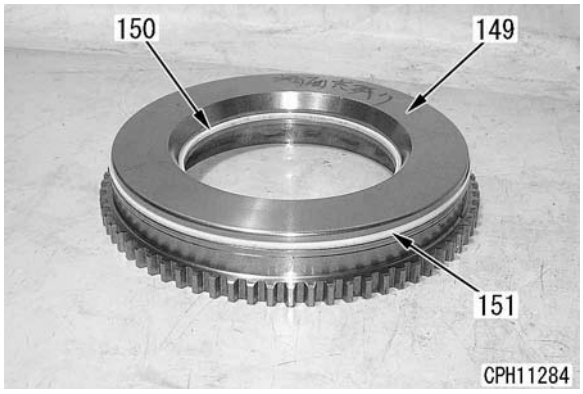
7) Install FH gear (155) to the clutch assembly temporarily, and match disc tooth.
   ★ Turn the gear to the left and right, while pressing it down, and push the gear in gradually, avoiding interference with the disc tooth.
8) Remove FH gear (155) once.
9) Compress the spring by pushing end plate (157) with C clamp, and install snap ring (158).
   ★ Take care so that the plate will not get caught in the snap ring groove.
   ★ Make sure that the snap ring settles in the groove completely.



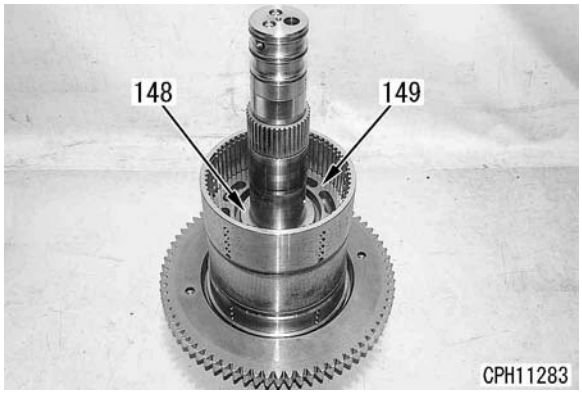
10) Install FH gear (155).
★ If it is found difficult to assemble the FH gear in, start the work all again from the step 7) above.
11) Install thrust washer (154) and plate (153).
12) Shrink-fit inner race (152).
• Shrink-fit temperature
: For 30 minutes at approx. 120°C
13) Apply a dial gauge to the edge surface of FH gear (155), move the FH gear in the thrust direction and check that clearance "**c**" remains within the range of 0.07 to 0.93 mm.



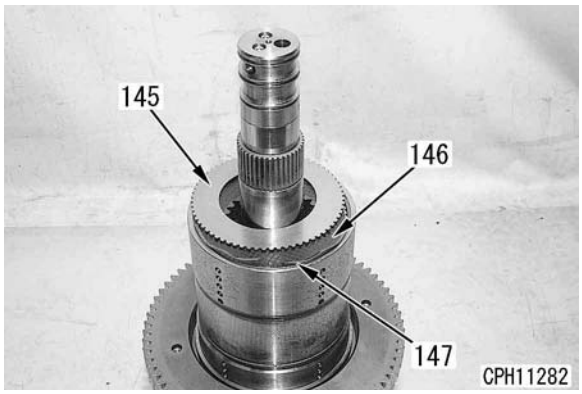
5. Subassembly of FH and 1st clutch assembly (1st clutch side)
1) Install seal rings (150) and (151) to piston (149).
★ Install seal rings with their pressure-receiving side facing the housing.



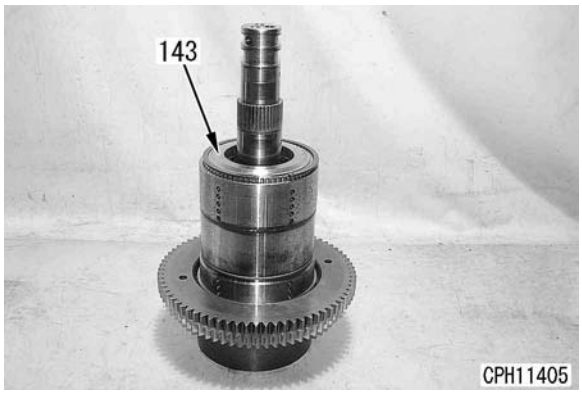
2) Install piston (149).
Seal ring periphery and sliding surface: **Powertrain oil (TO10)**
3) Install thrust washer (148).



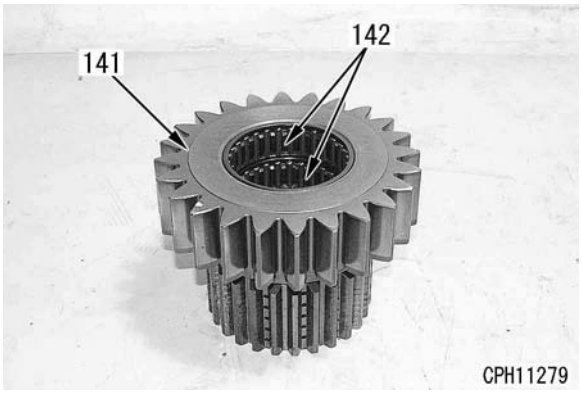
4) Install each of 13 plates (145), 12 discs (146) and 12 springs (147) alternately from the bottom to the top.
★ Immerse the discs in clean powertrain oil (TO10) for more than 2 minutes before assembling.



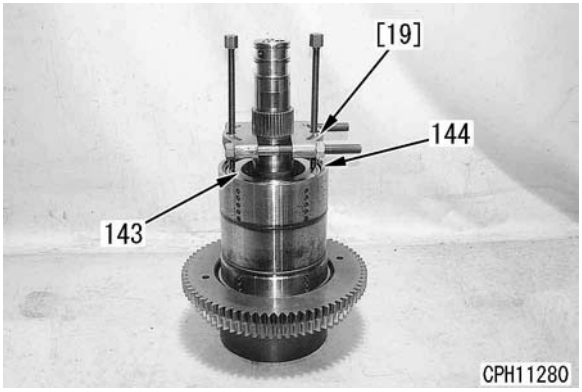
5) Install end plate (143).



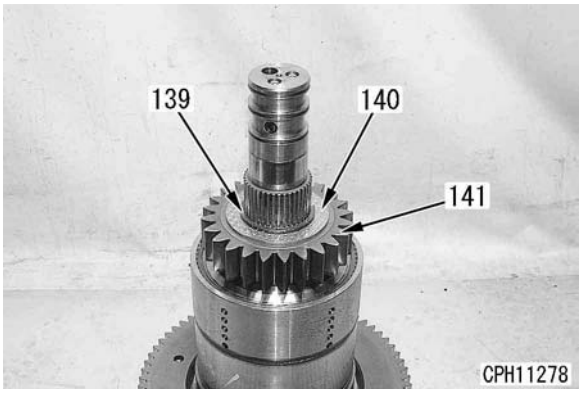
6) Install bearings (142) to 1st gear (141).



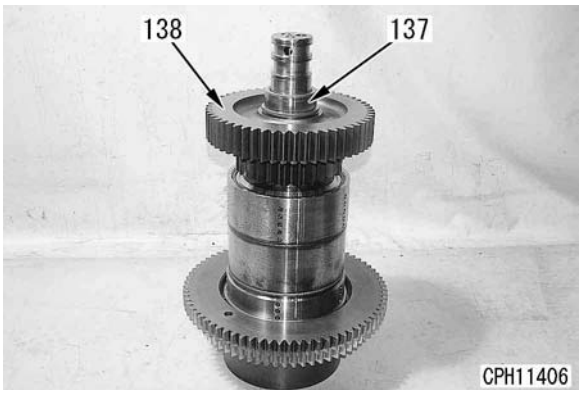
7) Install 1st gear (141) to the clutch assembly temporarily, and match tooth of the discs.
   ★ Turn the gear to the left and right, while pressing it down, and push the gear in gradually, avoiding interference with the disc tooth.
8) Remove 1st gear (141) once.
9) Compress the spring by pushing end plate (143), using tool [19], and install snap ring (144).
   ★ Take care so that the plate will not get caught in the snap ring groove.
   ★ Make sure that the snap ring settles in the groove completely.



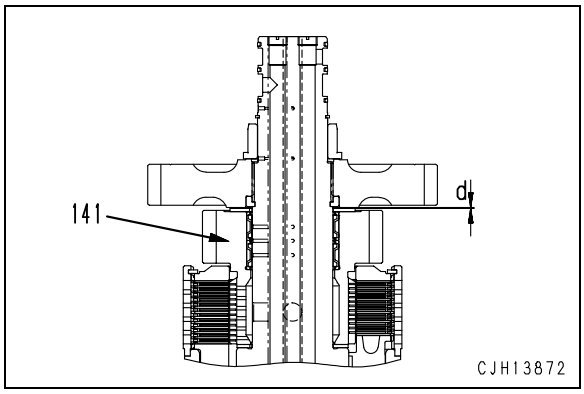
10) Install 1st gear (141).
   ★ If it is found difficult to assemble in the 1st gear, start the work all again from the step 7) above.
11) Install thrust washer (140) and 2 spacers (139).



12) Install idler gear (138) and shrink-fit inner race (137).
   • Shrink fit temperature
   : For 30 minutes at approx. 120°C

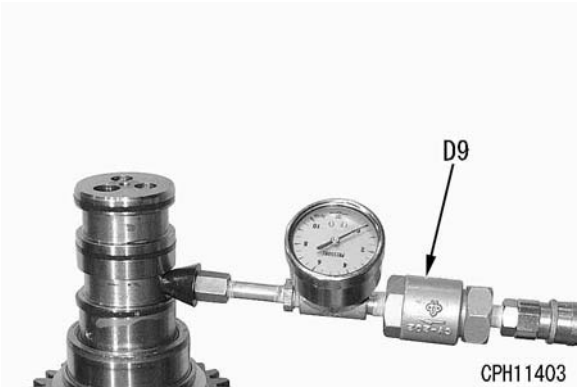


13) Apply a dial gauge to the edge surface of 1st gear (141), move the 1st gear in the thrust direction and check that clearance "d" remains within the range of 0.23 to 1.37 mm.



6. Actuation test of FH and 1st clutch assembly

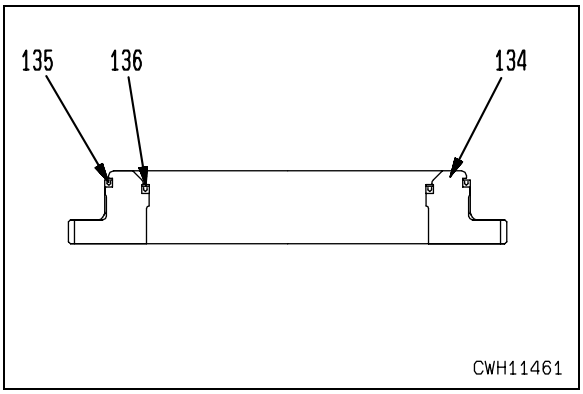
1) Blow air into the shaft oil hole, using tool **D9**, and check that each clutch is actuated.
   ★ If the gear on the air-blown side is fixed, the clutch is in normal operation.



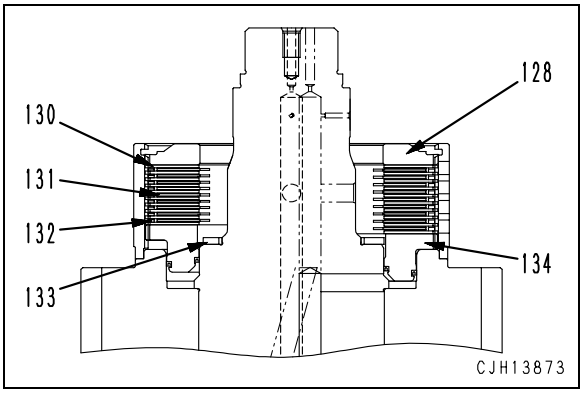
2) Remove idler gear (138) and inner race (137) once, referring to the step 13 section 2) of the "DISASSEMBLY".
   ★ Installation is to be made in the step 15.

7. Subassembly of 2nd and 3rd clutch assembly (3rd clutch side)

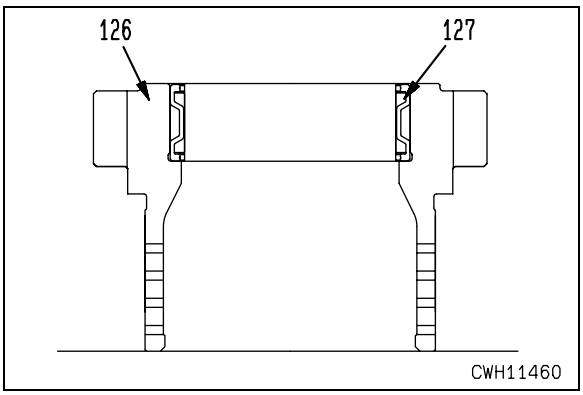
1) Install seal rings (135) and (136) to piston (134).
   ★ Install the seal rings with their pressure-receiving side facing the housing.



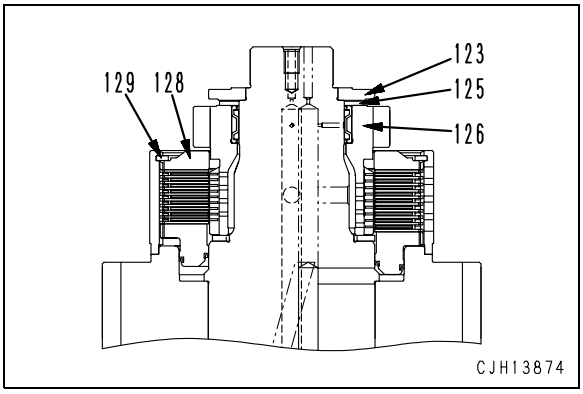
2) Install piston (134).
   Seal ring periphery and sliding surface: **Powertrain oil (TO10)**
3) Install thrust washer (133).
4) Install each of 10 plates (130), 9 discs (131) and 9 springs (132) alternately from the bottom to the top.
   ★ Immerse the discs in clean powertrain oil (TO10) for more than 2 minutes before assembling.
5) Install end plate (128).



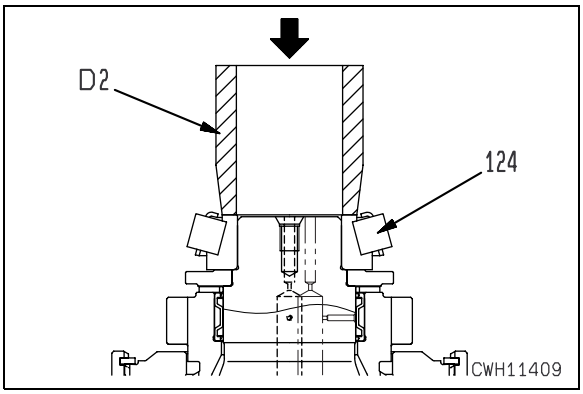
6) Install bearing (127) to 3rd gear (126).
7) Install 3rd gear (126) to the clutch assembly temporarily, and match tooth of the discs.
   ★ Turn the gear to the left and right, while pressing it down, and push the gear in gradually, avoiding interference with the disc tooth.
8) Remove 3rd gear (126) once.



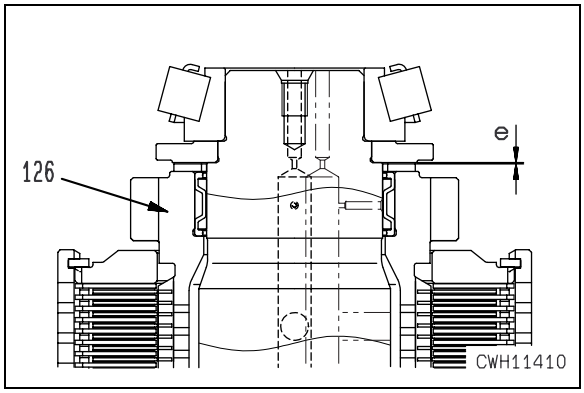
9) Compress the spring by pushing end plate (128) with C clamp, and then install snap ring (129).
   ★ Take care so that the plate will not get caught in the snap ring groove.
   ★ Make sure that the snap ring settles in the groove completely.
10) Install 3rd gear (126).
   ★ If it is found difficult to assemble in the 3rd gear, start the work all again from the step 7) above.
11) Install thrust washer (125) and plate (123).



12) Press-fit bearing (124), using tool **D2**. (Or shrink-fit the bearing)
   • Shrink-fit temperature
   : For 30 minutes at approx. 120°C

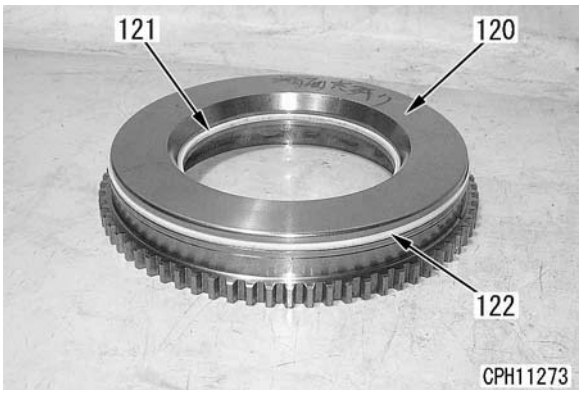


13) Apply a dial gauge to the edge surface of 3rd gear (126), move the 3rd gear in the thrust direction and check that clearance "e" remains within the range of 0.07 to 0.93 mm.

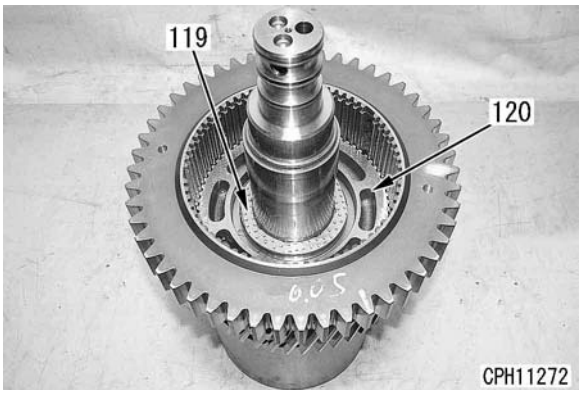


8. Subassembly of 2nd and 3rd clutch assembly (2nd clutch side)

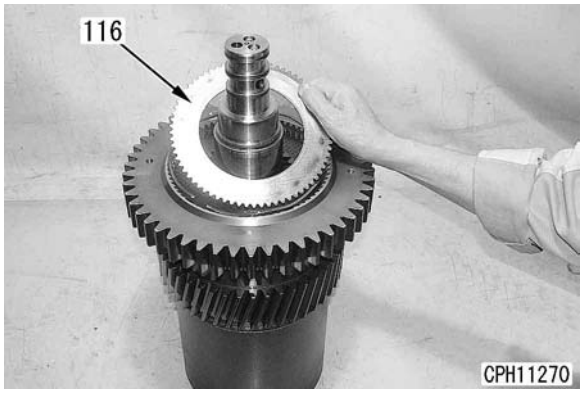
1) Install seal rings (121) and (122) to piston (120).
   ★ Install the seal rings with their pressure-receiving side facing the housing.

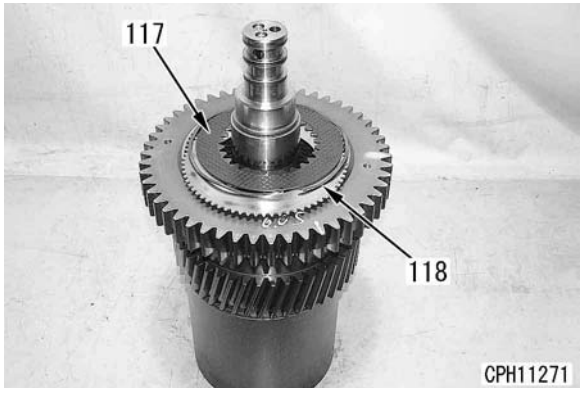


2) Install piston (120).
   Seal ring periphery and sliding surface: **Powertrain oil (TO10)**
3) Install thrust washer (119).



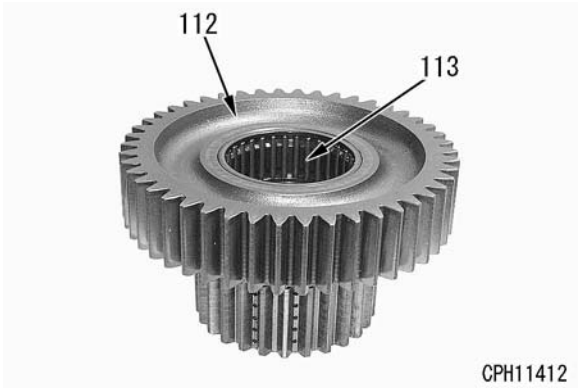
4) Install each of 10 plates (116), 9 discs (117) and 9 springs (118) alternately from the bottom to the top.
   ★ Immerse the discs in clean powertrain oil (TO10) for more than 2 minutes before assembling.



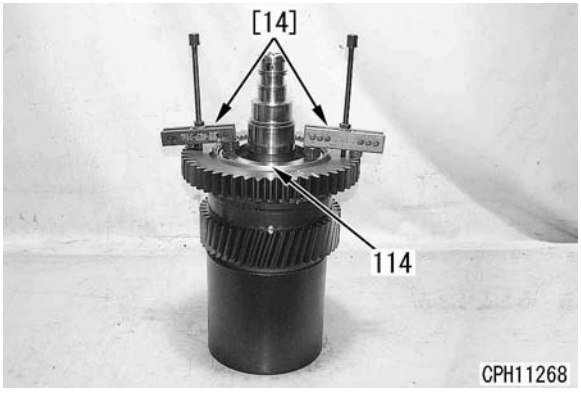


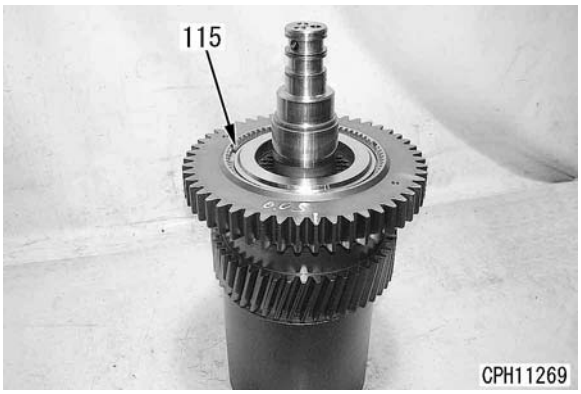
5) Install end plate (114).

6) Install bearing (113) to 2nd gear (112).

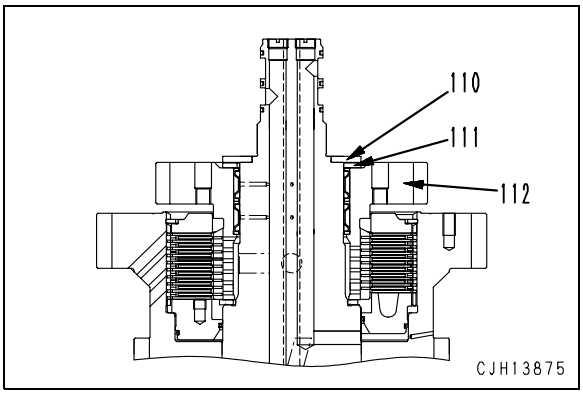


7) Install 2nd gear (112) to the clutch assembly temporarily, and match tooth of the discs.
   ★ Turn the gear to the left and right, while pressing it down, and push the gear in gradually, avoiding interference with the disc tooth.
8) Remove 2nd gear (112) once.
9) Compress the spring by pushing end plate (114), using tool [14], and then install snap ring (115).
   ★ Take care so that the plate will not get caught in the snap ring groove.
   ★ Make sure that the snap ring settles in the groove completely.

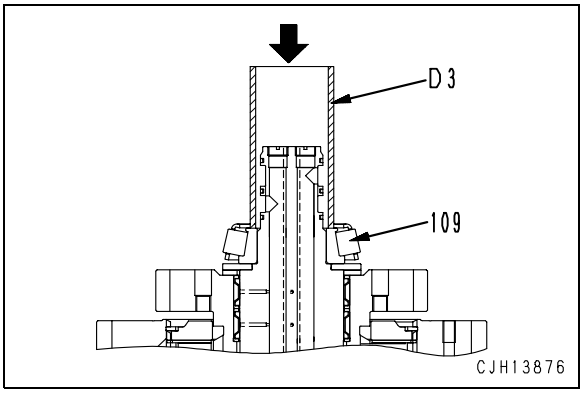




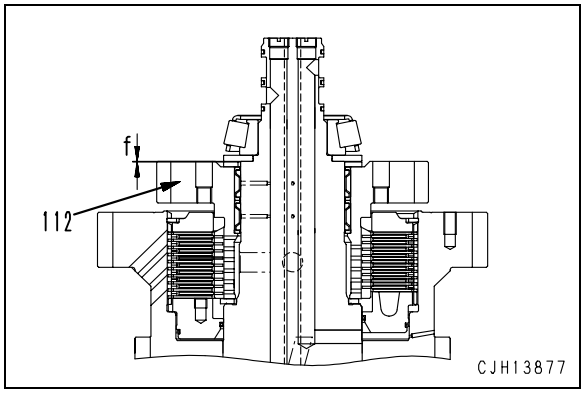
10) Install 2nd gear (112).
★ If it is found difficult to assemble the 2nd gear in, start the work all again from the step 7) above.
11) Install thrust washer (111) and plate (110).



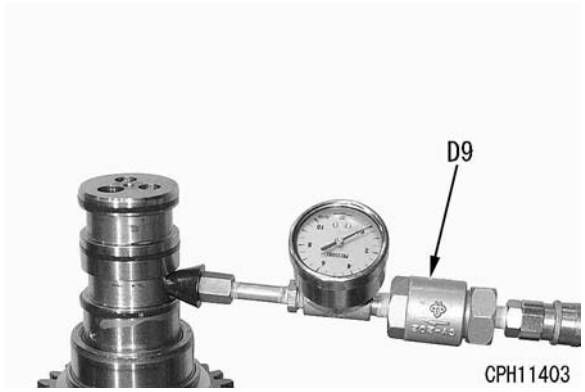
12) Press-fit bearing (109), using tool **D3**. (Or shrink-fit the bearing.)
• Shrink-fit temperature
: For 30 minutes at approx. 120°C



13) Apply a dial gauge to the edge surface of 2nd gear (112), move the 2nd gear in the thrust direction and check that clearance "**f**" remains within the range of 0.07 to 0.93 mm.

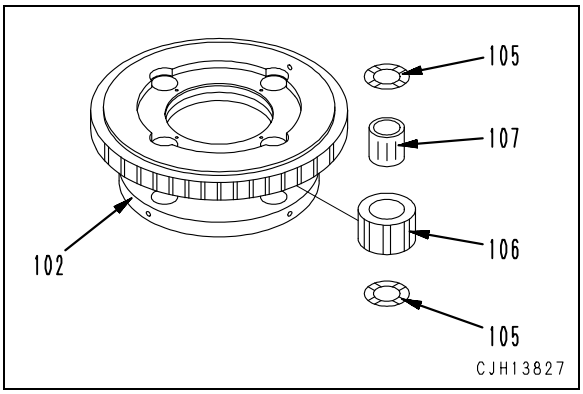


9. Actuation test of 2nd and 3rd clutch assembly
Blow air into the shaft oil hole, using tool **D9**, and check that each clutch is actuated.
★ If the gear on the air-blown side is fixed, the clutch is in normal operation.

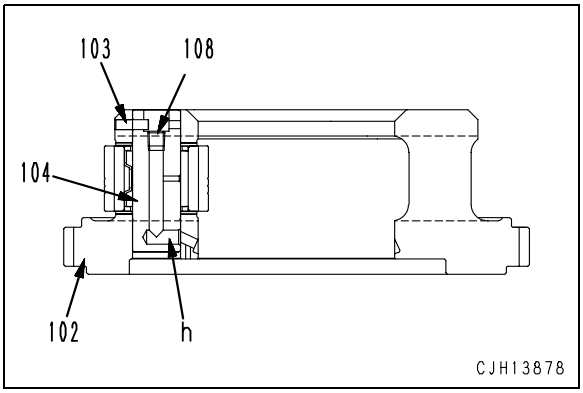


10. Subassembly of differential lock clutch assembly

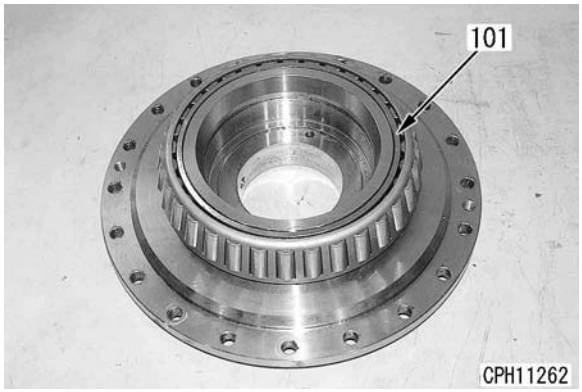
1) Carry out subassembly of the carrier assembly in the following steps.
   i) Assemble bearings (107) in planetary gear (106).
   ii) Set planetary gear (106) to the carrier with thrust washers (105) installed to the top and bottom.



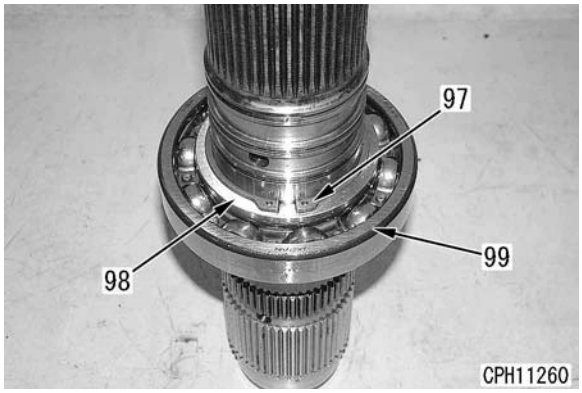
   iii) Hammer shaft (104) to the halfway, then check the hole, and hammer the shaft in until it is flush with the carrier edge surface.
      ★ Make the hole (h) of the shaft inside and aligne the shaft pin hole and the hole on the carrier side. Then hammer the shaft.
   iv) Install plug (108) and hammer the pin (103).



2) Carry out subassembly of the front output shaft, front housing and output gear in the following steps.
   i) Shrink-fit bearing (101) to the front housing.
      • Shrink-fit temperature
        : For 30 minutes at approx. 120°C



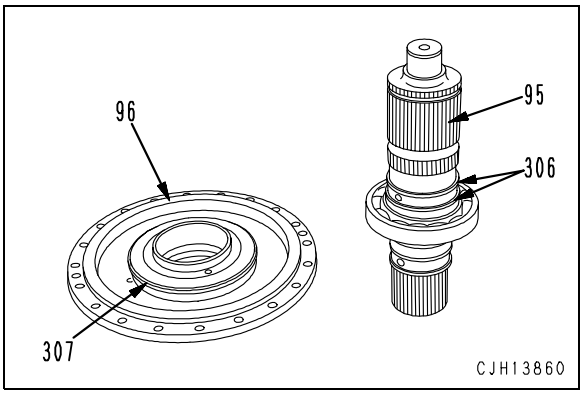
   ii) Shrink-fit bearing (99) to the front output shaft.
      • Shrink-fit temperature
        : For 30 minutes at approx. 120°C
   iii) Install spacer (98) and snap ring (97).

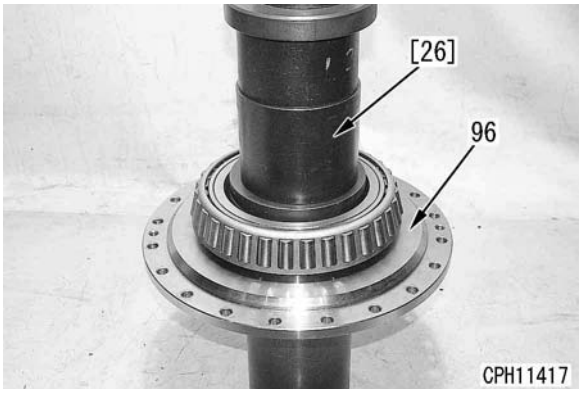


   iv) Install seal rings (306) to front output shaft (95) and seal ring (307) to front housing (96).
      ★ Install seal ring (307) with its pressure-receiving side facing the bearing in the housing.

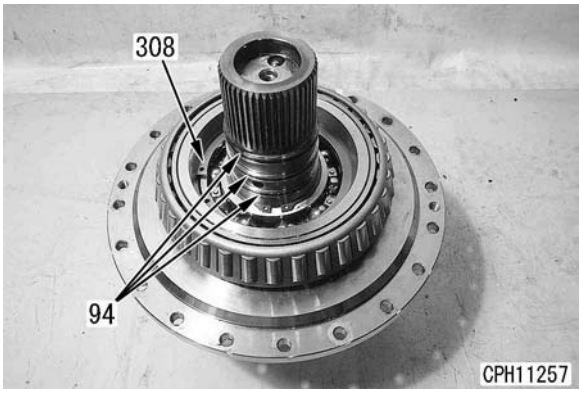
Seal ring periphery: **Grease (G2-LI)**

v) Install front output shaft (95) to front housing (96) with the shaft front facing up (the side of shorter shaft from the bearing), using tool [26].
★ Be careful not to damage the seal ring.

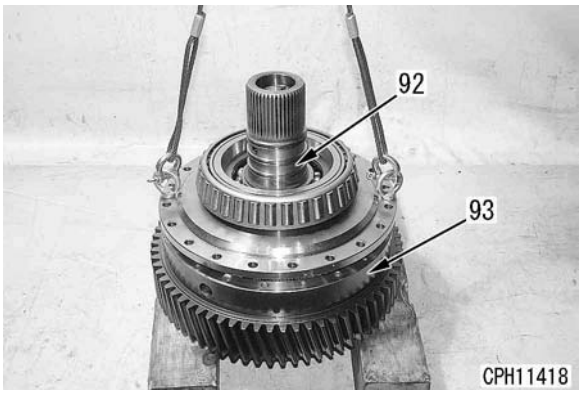




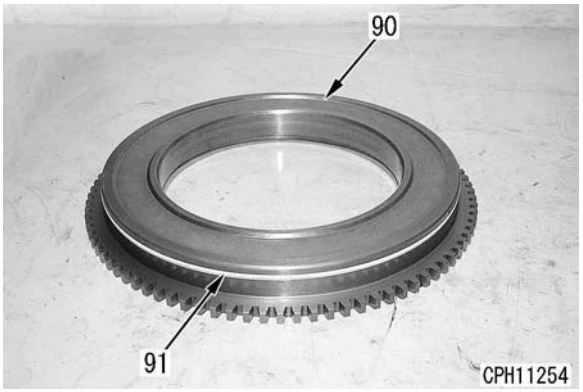
vi) Install snap ring (308), and then install seal rings (94) to the front output shaft.



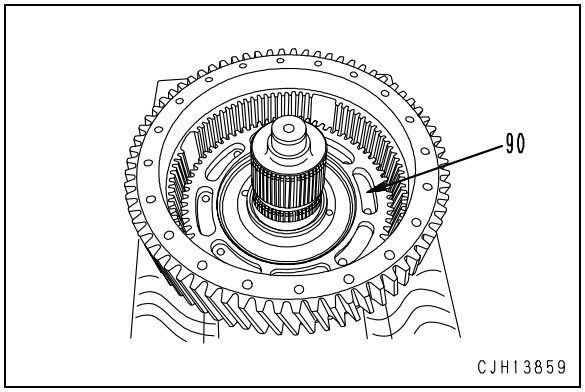
vii) Sling front output shaft and housing assembly (92) and install output gear (93).
Housing mounting bolt
: Liquid adhesive (LT-2)
Housing mounting bolt
: 59 – 74 Nm {6 – 7.5 kgm}



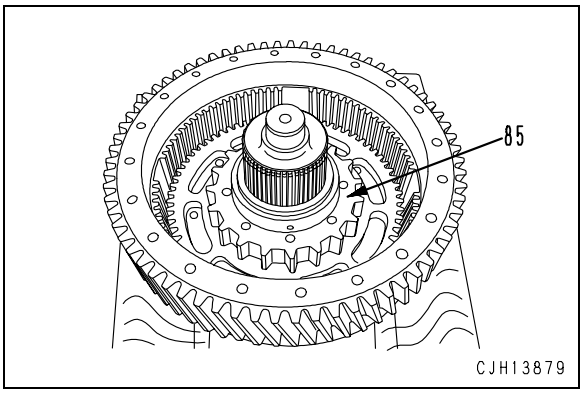
3) Set the front output shaft-housing-output gear assembly with the rear output shaft connecting side facing up.
4) Install seal ring (91) to piston (90).
★ Install the seal ring with its pressure-receiving side facing the housing.
Seal ring periphery**: Grease (G2-LI)**



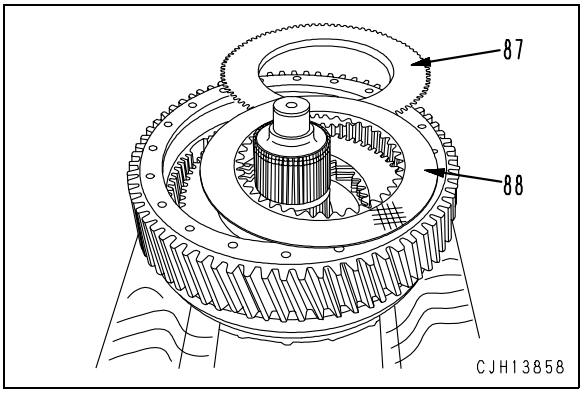
5) Install piston (90).



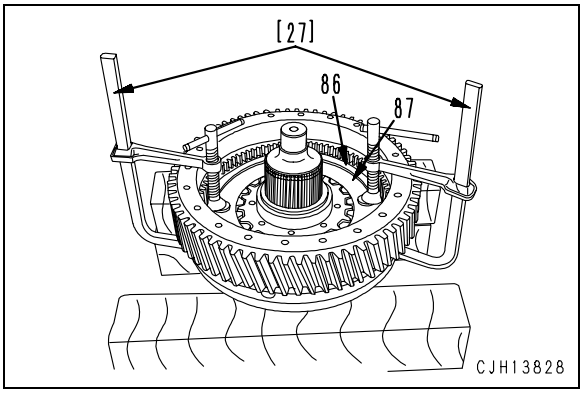
6) Install clutch hub (85).



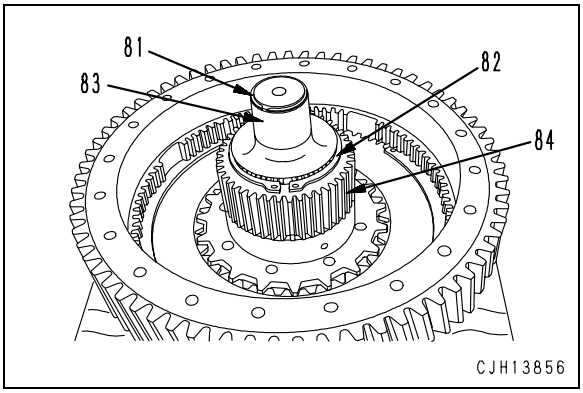
7) Install each of 6 plates (87) and 5 discs (88) alternately from the bottom to the top.
   ★ Immerse the discs in clean powertrain oil (TO10 or TO30) for more than 2 minutes before assembling.



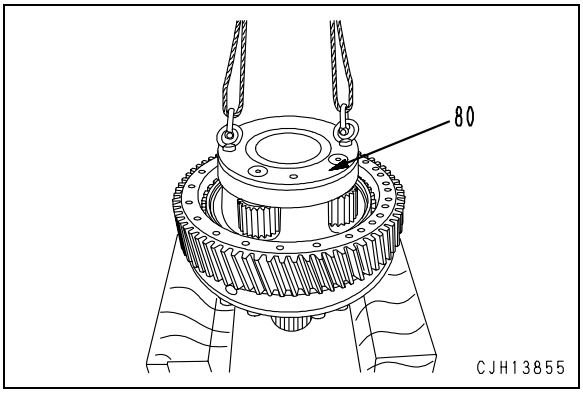
8) Compress the spring by pushing plate (87), using tool [27], and install snap ring (86).



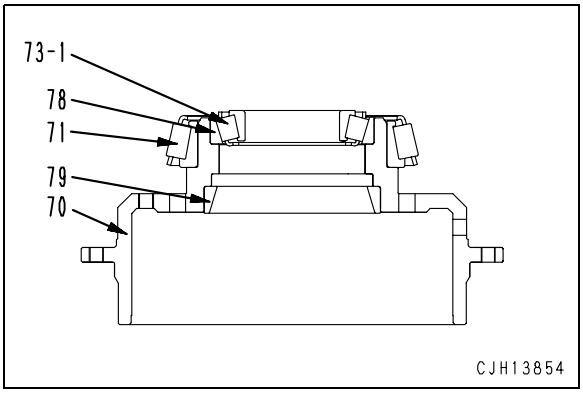
9) Install sun gear (84), snap ring (82), inner race (83) and snap ring (81).



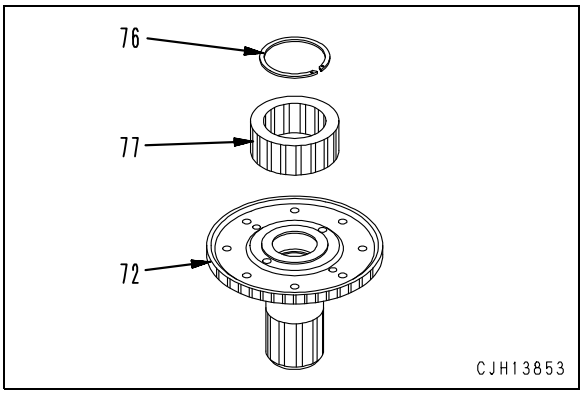
10) Install carrier assembly (80) to the front output shaft-housing-output gear assembly.



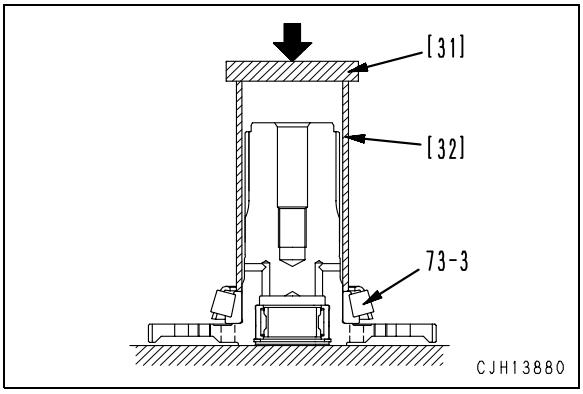
11) Carry out subassembly of the rear output shaft (72), rear housing (70) and ring gear (74) in the following steps.
   i) Shrink-fit bearing (71) to rear housing (70).
      • Shrink-fit temperature
        : For 30 minutes at approx. 120°C
   ii) Install outer race (78) and (79).



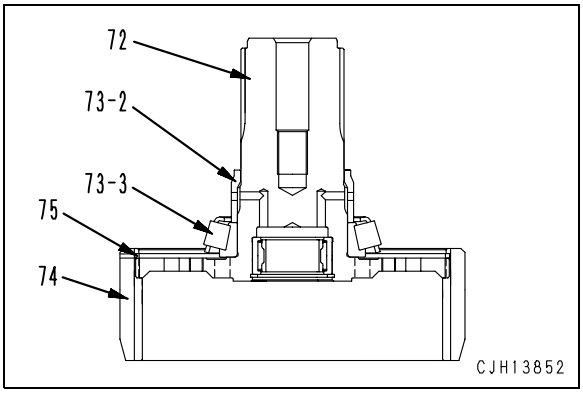
iii) Install bearing (77) and snap ring (76) to the rear output shaft (72).



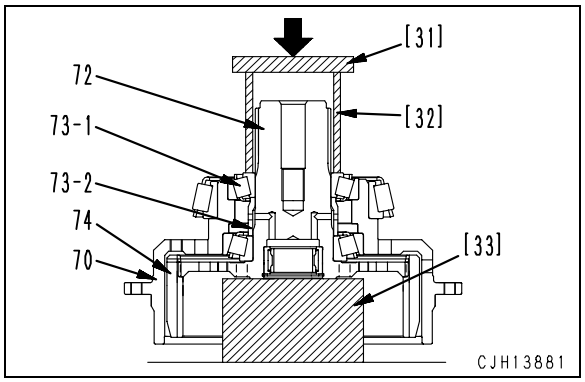
iv) Press-fit bearing (73-3) to rear output shaft (72), using tools [31] and [32].
★ Bearing (73-3) and (73-1) and spacer (73-2) are set parts.



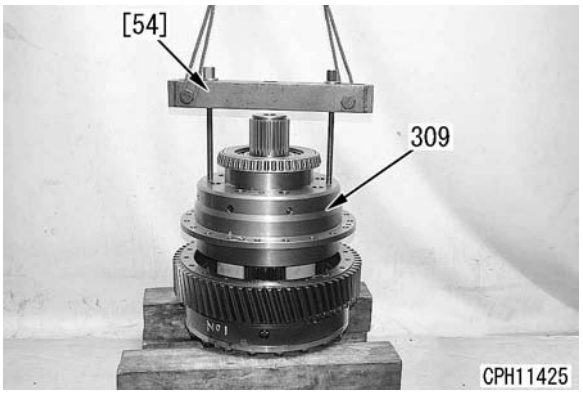
v) Install ring gear (74) to rear output shaft (72) and bearing (73-3) assembly.
vi) Install snap ring (75).
vii) Install spacer (73-2).



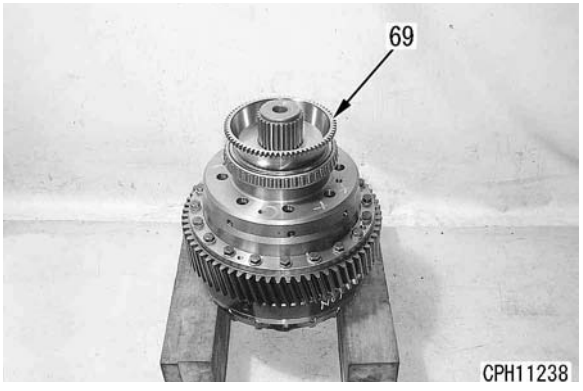
viii) Set shaft (72) and ring gear (74) assembly on the block [33].
ix) Install rear housing (70).
x) Press fit bearing (73-1), using push tool [31] and [32].
★ Check that spacer (73-2) is installed.



12) Set the front output shaft and housing assembly on a pair of blocks with the output gear facing up.
13) Install rear output shaft-housing-ring gear assembly (309), using tool [54].
Rear housing mounting bolt
: Liquid adhesive (LT-2)
Rear housing mounting bolt
: 59 – 74 Nm {6 – 7.5 kgm}



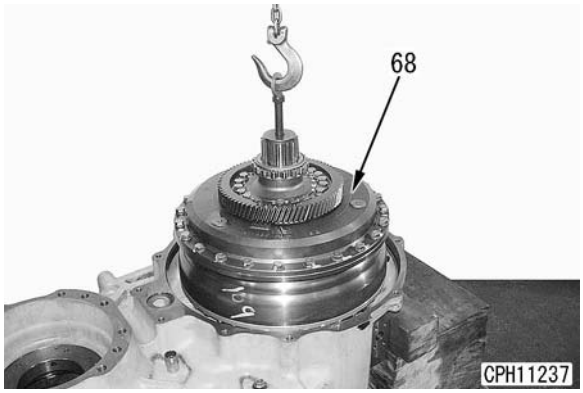
14) Install coupling (69).

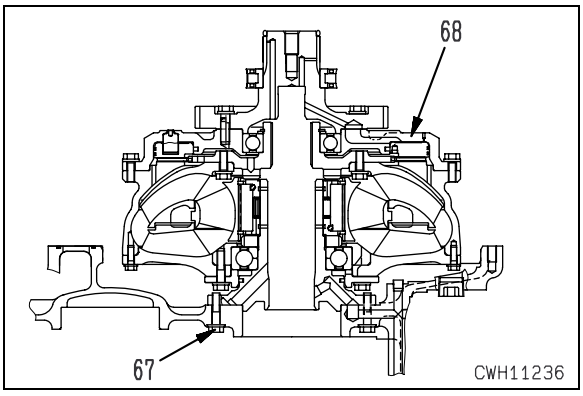


11. Torque converter assembly

Install torque converter assembly (68) in the front transmission case and tighten bolt (67).

★ For assembling the torque converter, refer to the section of "Disassembly and assemly of torque converter".





12. Subassembly of PTO case assembly

1) Install dust seal (65) and oil seal (66) to retainer (64), using tools **D4** and **D5**.

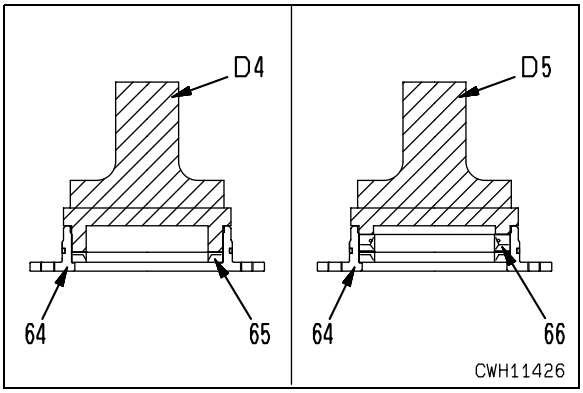
Seal lip face and clearance between dust seal and oil seal

: Silicone grease (G2-S (Three Bond 1855))

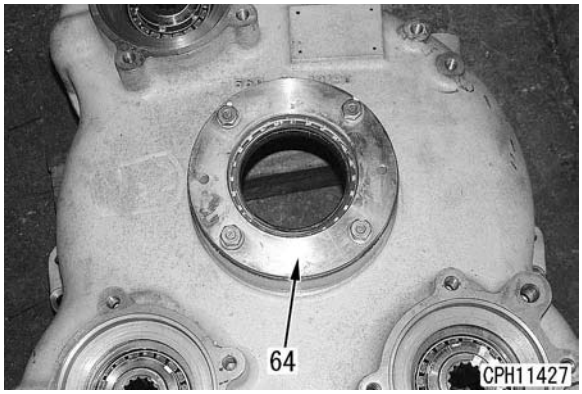
Periphery of press-fitted face on retainer side

: Gasket sealant (LG-5 (Three Bond 1110B))

★ After press-fitting, wipe out oozed gasket sealant completely.

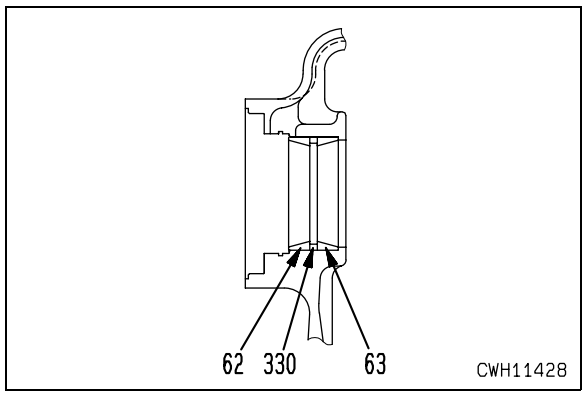


2) Install retainer (64) to the PTO case.



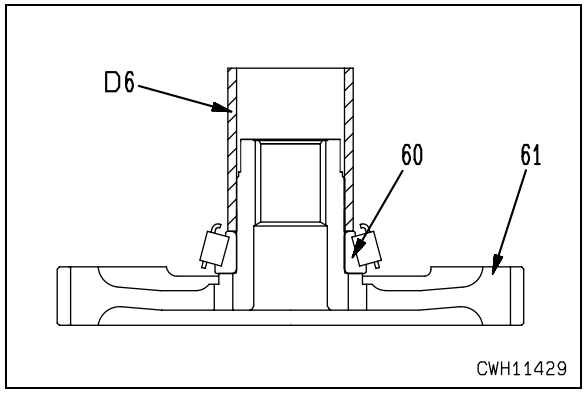
3) Carry out subassembly of PTO gears at 3 locations in the following steps.

i) Install to the PTO case in the order of outer race (63), spacer (330) and outer race (62).

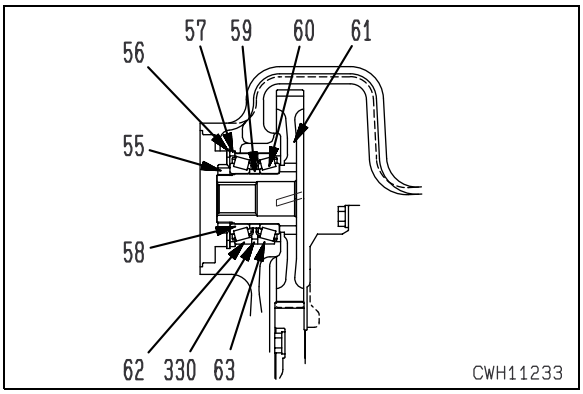


ii) Press-fit bearing (60) into PTO gear (61), using tool **D6**.

★ Check that a manufacturing No. and a counter mark on inner ring (58) and outer ring (60) match, i.e. match **A** and **A**, as well as **B** and **B**.
(This means that they are to be used as a set part.)

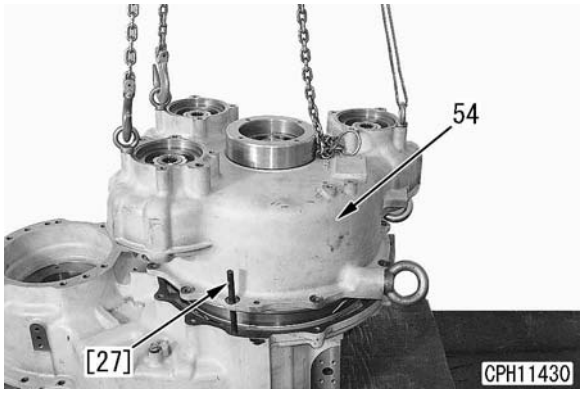


iii) Install spacer (59) to the shaft of PTO gear (61), and assemble in the PTO case.
iv) Press-fit bearing (58) and install spacer (57) and snap ring (56).

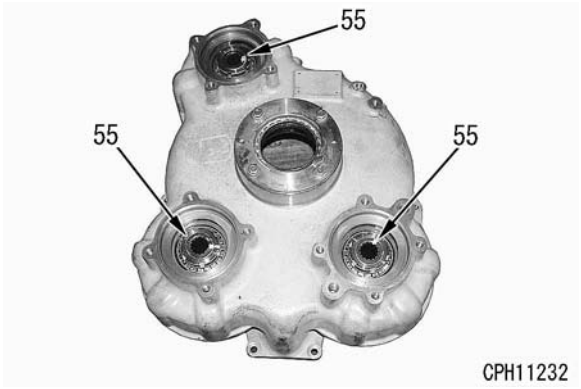


13. PTO case assembly

1) Install guide bolt [27] to the front transmission case, and install PTO case assembly (54) to the front transmission case.

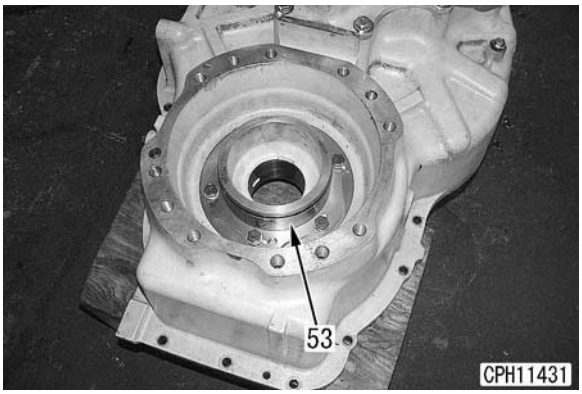


2) Tighten nut (55) of the PTO gear, using tool **D1**.
   ★ Install the nut with its chamfered side facing inward.
   ★ Install the input coupling and use it as a lock.
   Nut: **Liquid adhesive (LT-2)**
   Nut: **392 – 441 Nm {40 – 45 kgm}**
3) Coat the bearing with 6cc of powertrain oil (TO10 or TO30), rotate the bearing by 10 turns and check the nut tightening torque again.

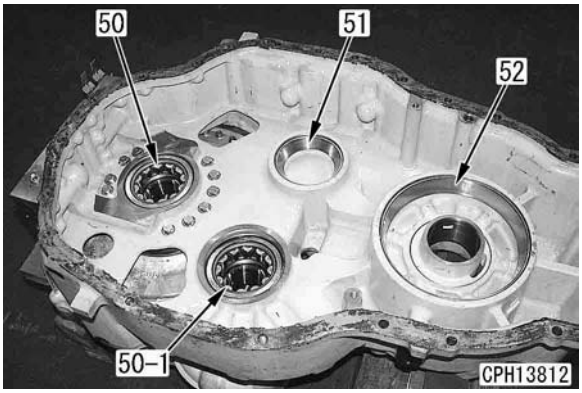


14. Subassembly of front transmission case assembly

1) Install cage (53).

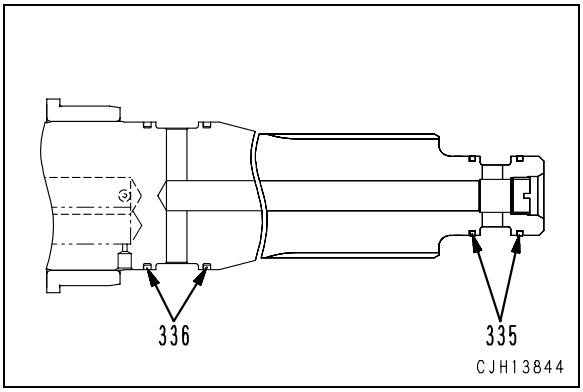


2) Reverse the case and install bearing (50), (50-1) and outer races (51) and (52).

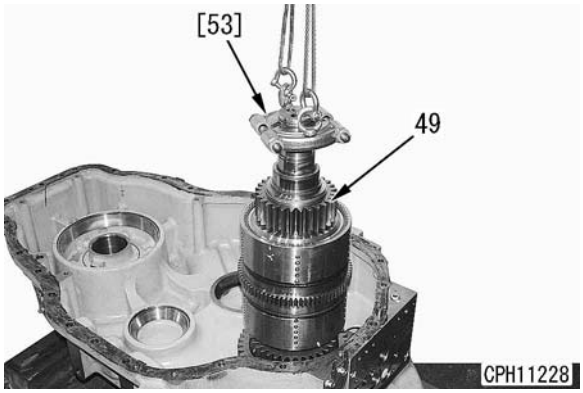


15. Clutch assembly

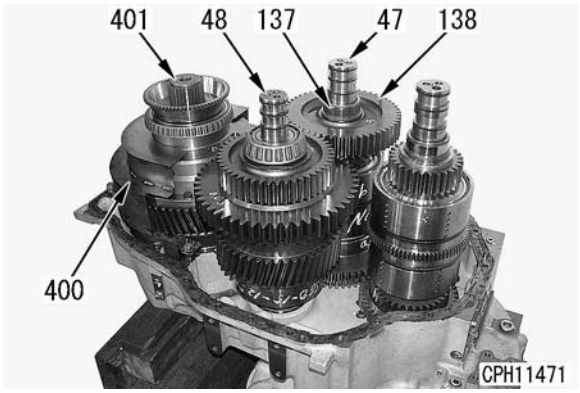
1) Install seal rings (335) and (336) on the FL clutch side.
   ★ Check that the seal ring on the FL clutch side has not enlarged at the abutment.
   Seal ring: **Grease (G2-LI)**



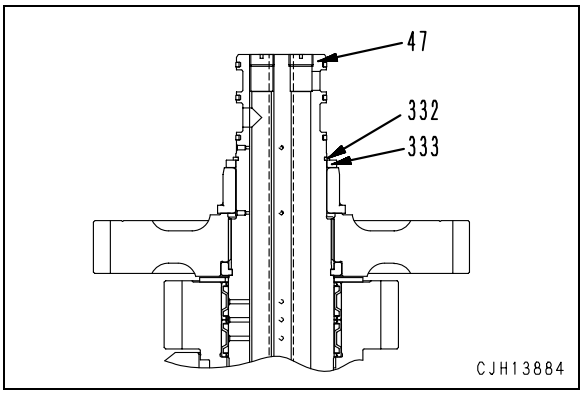
2) Install FL and R clutch assembly (49).
   ★ Tool [53] is shown just as an example.



3) Install FH and 1st clutch assembly (47).
   ★ Install this assembly without idler gear (138) and inner race (137).
4) Sling differential lock clutch assembly (401), and set shroud (400) to its setting position.
   ★ The shroud cannot be installed after the differential lock clutch assembly is installed.
5) Install differential lock clutch assembly (401) after it is lowered.
6) Put shroud (400) to the differential clutch assembly and tighten the mounting bolts in a position 1 mm away from the assembly.
7) Install 2nd and 3rd clutch assembly (48).
8) Install idler gear (138) to FH and 1st clutch assembly (47), and shrink-fit inner race (137).
   • Shrink-fit temperature
     : For 30 minutes at approx. 120°C

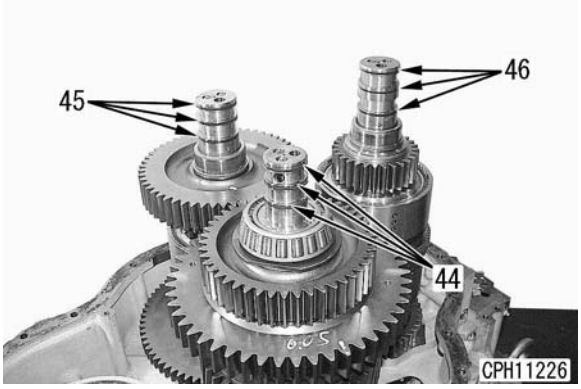


9) Install spacer (333) and snap ring (332) to FH and 1st clutch assembly (47).



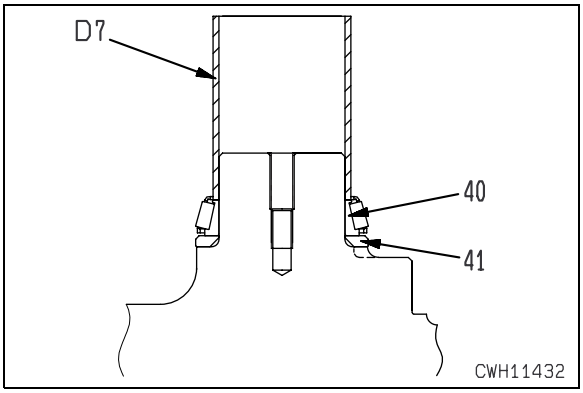
16. Seal ring

Install seal rings (44), (45) and (46).
Seal ring: **Grease (G2-LI)**

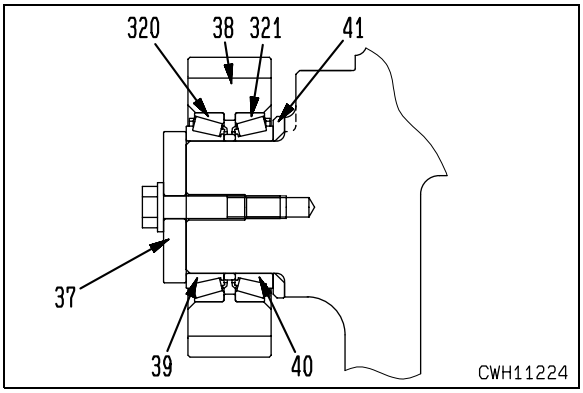


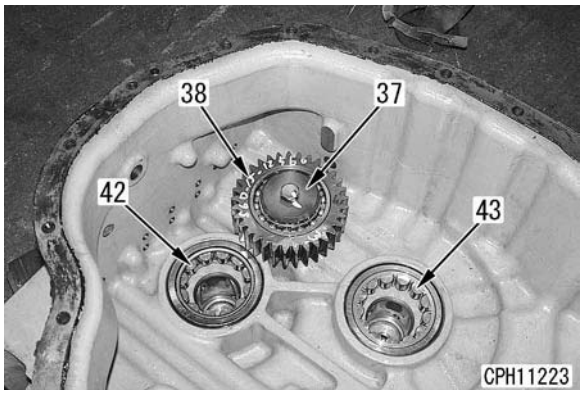
17. Subassembly of rear transmission case assembly

1) Install collar (41).
   ★ Be careful of the installing direction. (Refer to the following figure.)
2) Press-fit bearing (40), using tool **D7**.



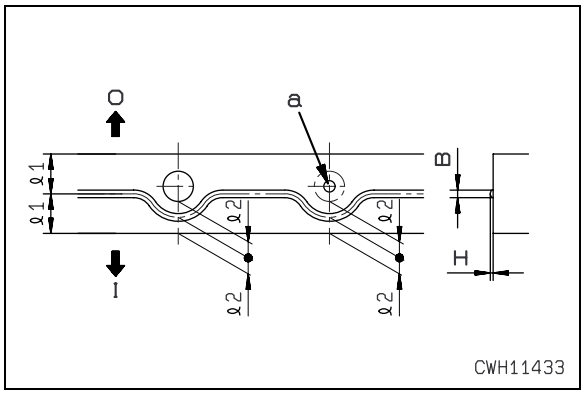
3) Expanshion-fit outer races (320) and (321) to gear (38).
4) Install gear (38) and press-fit bearing (39).
   ★ Before installing, make sure that a manufacturing No. and counter mark on inner ring (39) and outer ring (40) match with each other. (This means that they are to be used as a set parts.)
5) Install holder (37) and tighten the mounting bolt.
   Holder mounting bolt
   : Liquid adhesive (LT-2)
   Holder mounting bolt
   : 98 – 122.5 Nm {10 – 12.5 kgm}
6) Install bearings (42) and (43).



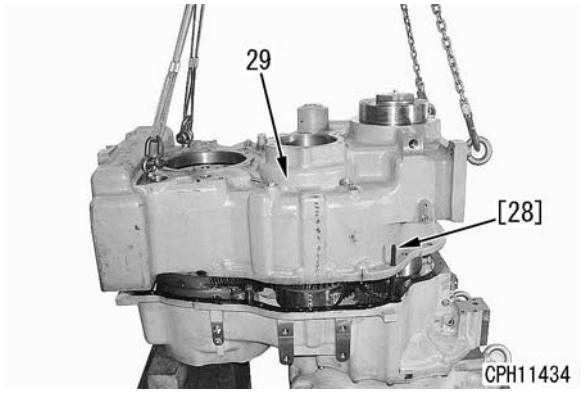


18. Rear transmission case assembly

1) Coat the case mating faces (both on the front side and on the rear side) with gasket sealant, referring to the drawing below.
   ★ "**a**" mark stands for a tapped hole.
   ★ "**I**" mark indicates the inside while "**O**" mark indicates the outside.
   ★ Coat so that area of the cross section of the coated gasket sealant (B x H) is 2 to 5 mm^2.
   Case mating face
   : Gasket sealant (LG-8 (Three Bond 1207B))

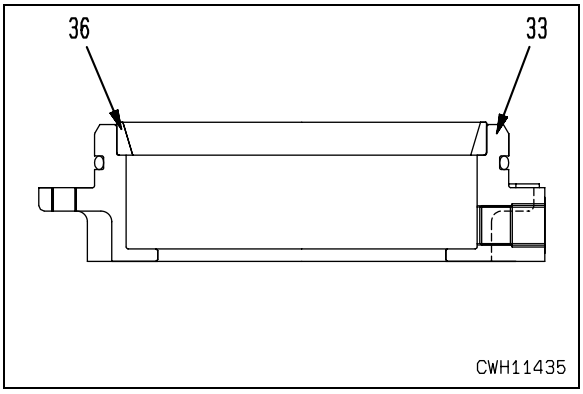


2) Install guide bolt [28] to rear transmission case assembly (29) and install the assembly.
   ★ When installing, be careful of interference with the clutch assembly as well as displacement of the seal ring.
   Rear transmission case assembly mounting bolt
   : 98 – 122.5 Nm {10 – 12.5 kgm}



19. Subassembly of retainer and cage (differential lock clutch rear output side)

1) Expanshion-fit outer race (36) to cage (33).

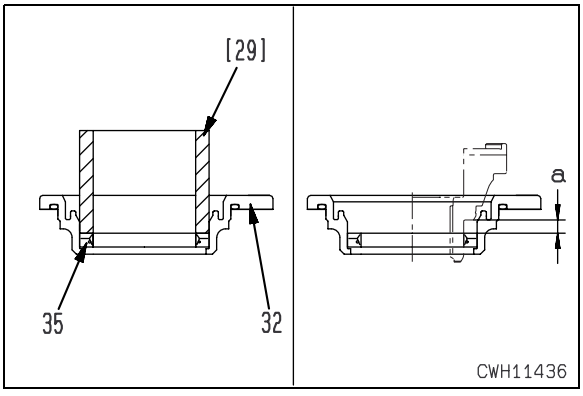


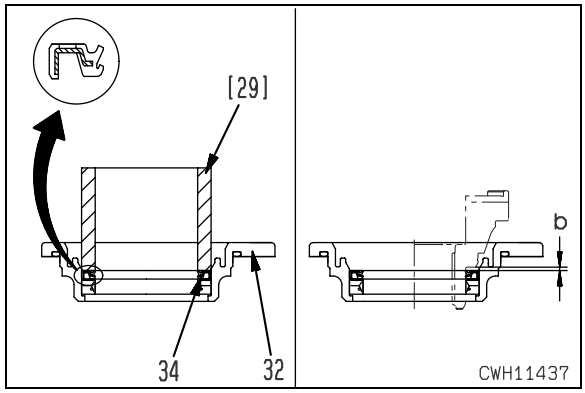
2) Press-fit oil seal (35) and dust seal (34) to retainer (32), using push tool [29].
   - ★ Oil seal press-fit dimension "**a**"
     : 11.5 ± 0.2 mm
   - ★ Press-fit dust seal (34) in the direction shown in the figure.
   - ★ Dust seal press-fit dimension "**b**"
     : 2.5 ± 0.2 mm
   - ★ Wipe out oozed gasket sealant completely after press-fitting.
   - Seal lip face and clearance between dust seal and oil seal

: Silicone grease (G2-S (Three Bond 1855))

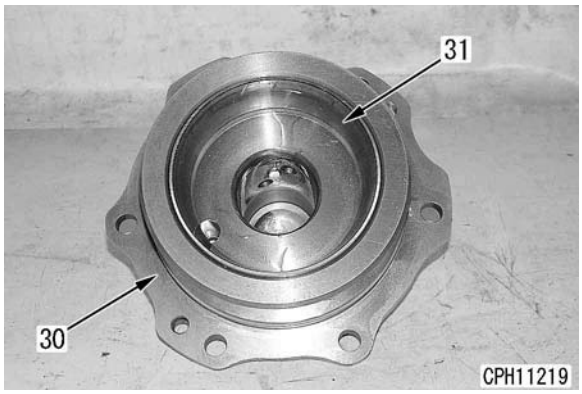
- Press-fitted surface of periphery on cover side

: Gasket sealant (LG-5 (Three Bond 1110B))



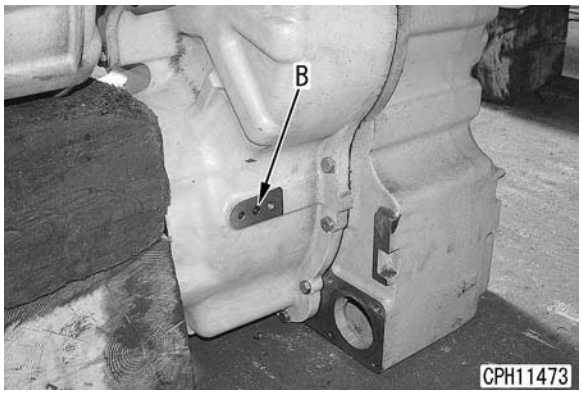


20. Expanshion-fit outer race (31) to cage (30) on the 2nd clutch side.



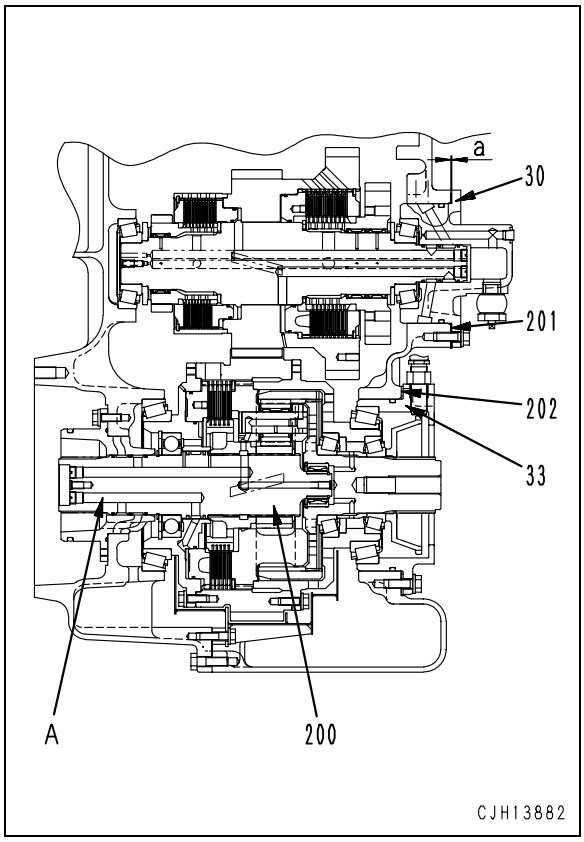
21. Shim adjustment of taper roller bearing (2nd clutch side and differential lock clutch side)

1) Install cages (30) and (33) without shims to the rear transmission case.
   - Mounting bolts of cages (30) and (33)
     : 8.8 – 10.8 Nm {0.9 – 1.1 kgm}
2) Blow air into oil passage **A** through oil hole **B** for the differential lock clutch to operate this clutch, using tool **D9**, and rotate output shaft (200) by 20 turns.

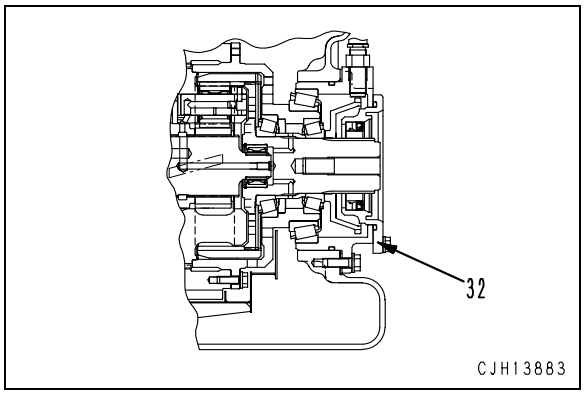


3) Check that there is no change in the tightening torque of cages (30) and (33) mounting bolts. If any, repeat the steps 1) and 2).
4) Loosen cages (30) and (33) mounting bolts.
5) Measure rotation torque of output shaft (200).
   ★ Rotation torque
   : 11.8 – 17.6 Nm {1.2 – 1.8 kgm}
6) Measure clearance "**a**" between cage (30) and the rear transmission case at three points of periphery (120° apart) and calculate the average value.
   ★ If fluctuation of the values measured at three points does not fall within 0.15 mm, check whether the bearing is correctly installed, or there is any other cause. Take a corrective action as the case may be, and measure again.
7) Assemble shims (201) having thickness of average value of "**a**" obtained in the step 6 above minus the following dimensions.
   ★ Thickness decrement: **0.15 – 0.20 mm**
   ★ Shim thickness tolerance (for reference): **0.55 – 2.20 mm**
8) Tighten cage (30) mounting bolts.
   Mounting bolt
   : 98 – 122 Nm {10 – 12.5 kgm}
9) Activate the differential lock clutch to measure rotation torque of output shaft (200), and check that increment from the value of rotation torque obtained in the step 5 remains within the following range of values.
   ★ Rotation torque increment
   : 4.9 – 12.8 Nm {0.5 – 1.3 kgm}
10) Measure clearance "**b**" between cage (33) and the rear transmission case at three points of periphery (120° apart) and calculate the average value.
   ★ If fluctuation of the values measured at three points does not fall within 0.15 mm, check whether the bearing is correctly installed, or there is any other cause. Take a corrective action as the case may be, and measure again.
11) Assemble shims (202) having thickness of average value of "**b**" obtained in the step 10 above minus the following dimensions.
   ★ Thickness decrement: **0.20 – 0.25 mm**
   ★ Shim thickness tolerance (for reference): **0.55 – 3.40 mm**
12) Tighten cage (33) mounting bolts.
   Mounting bolt
   : 98 – 122 Nm {10 – 12.5 kgm}
13) Measure rotation torque of output shaft (200), and check that increment from the value of rotation torque obtained in the step 9) remains within the following range of values. (See a note below.)
   ★ Rotation torque increment
   : 1.9 – 9.8 Nm {0.2 – 1.0 kgm}

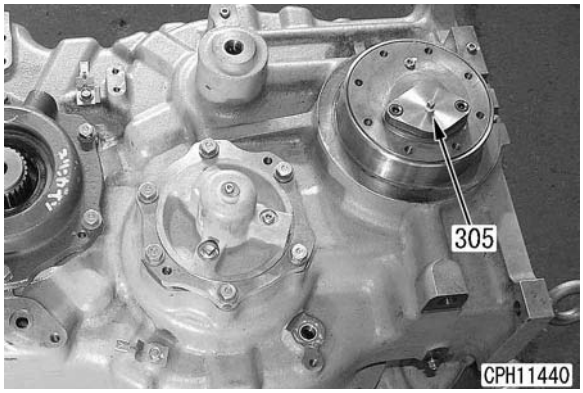
Note: Only with the 2nd clutch, this measurement is to be taken at the time of shim adjustment.



22. Install retainer (32).

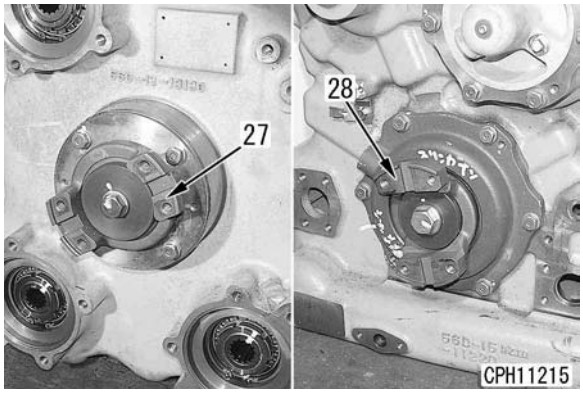


23. Install cover (305).
Mounting bolt
: 59 – 74 Nm {6 – 7.5 kgm}

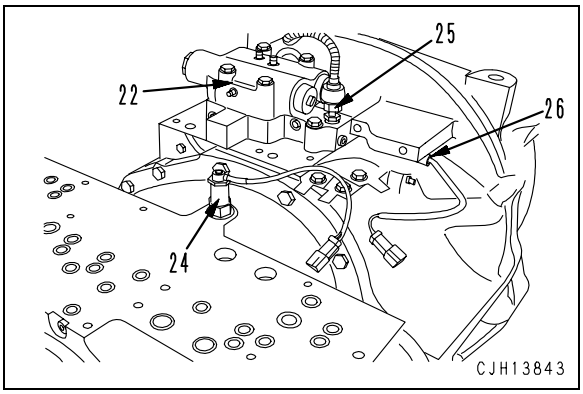


24. Sling the transmission assembly and put it on blocks as horizontally as if mounted on a truck.

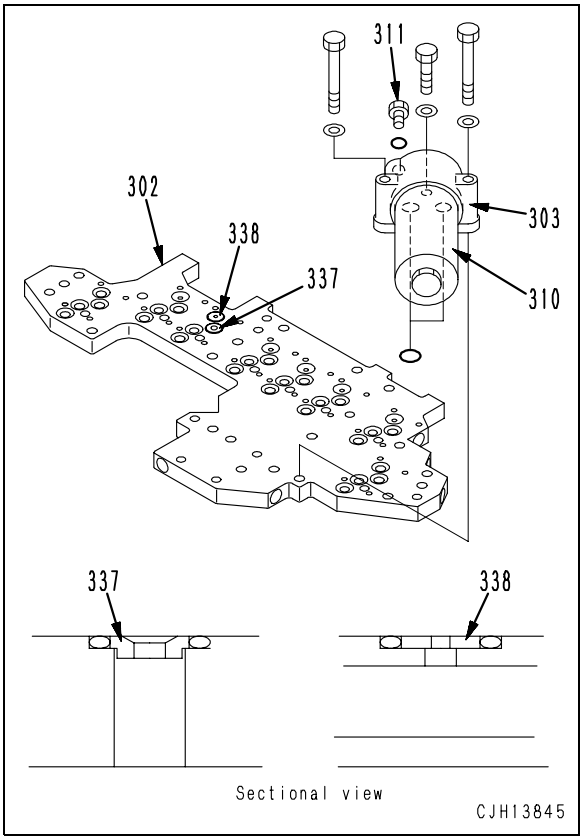
25. Install output coupling (28) and input coupling (27) together with the holder.
Output coupling mounting bolt
: Liquid adhesive (LT-2)
Output coupling mounting bolt
: 662 – 730 Nm {67.5 – 74.5 kgm}
Input coupling mounting bolt
: Liquid adhesive (LT-2)
Input coupling mounting bolt
: 245 – 309 Nm {25 – 31.5 kgm}



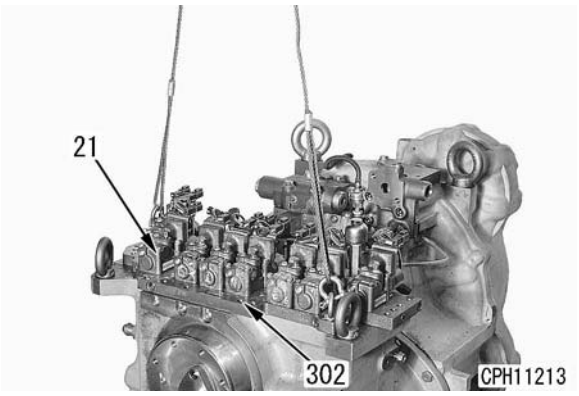
26. Main relief valve assembly, valve flow assembly and each sensor
Install main relief valve assembly (22), input shaft rotation sensor (24), torque converter intermediate pressure oil pressure sensor (25) and torque converter outlet oil temperature sensor (26).
★ Degrease the grounding wire mounting part on the main relief valve assembly thoroughly.
★ When installing the input shaft rotation sensor, refer to the section of "Adjusting transmission speed sensor" in Testing and adjusting
Main relief valve assembly mounting bolt
: 44.1 – 53.9 Nm {4.5 – 5.5 kgm}
Torque converter intermediate pressure oil pressure sensor thread
: Gasket sealant (LG-5)
Torque converter intermediate pressure oil pressure sensor
: 9.8 – 19.6 Nm {1.0 – 2.0 kgm}
Torque converter output oil temperature sensor thread
: Gasket sealant (LG-5)
Torque converter output oil temperature sensor
: 29.4 – 49 Nm {3 – 5 kgm}

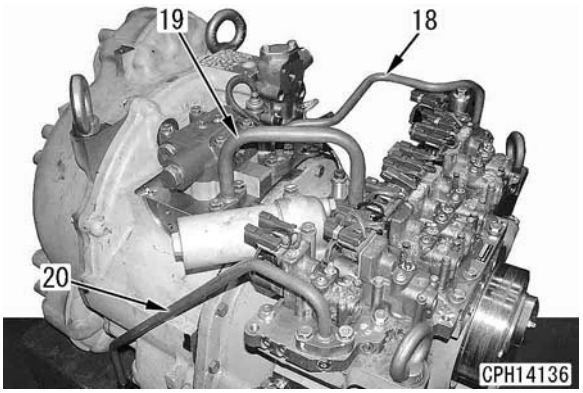


27. Transmission control valve assembly
1) Install filter assembly (303) to valve seat (302).
★ When case (310) and plug (311) have been removed from the filter assembly, tighten each of them to the following torque.
Case
: 34.3 – 44.1 Nm {3.5 – 4.5 kgm}
Plug
: 15.7 – 19.2 Nm {1.6 – 2.0 kgm}
2) Install orifice (337) and (338).
★ Take care not to install them to opposite position because orifice (337) and (338) are different parts.
★ Take care for orifice (337) not to turn upside down.

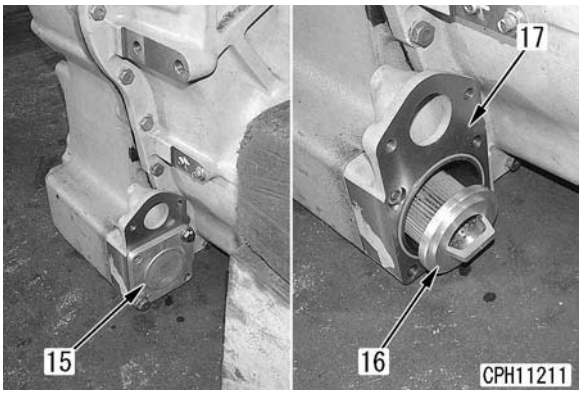


3) Install each transmission control valve (21) on the valve seat (302).
   Mounting bolt
   : 8 – 10 Nm {0.8 – 1.0 kgm}
4) Install transmission control valve assembly (21) together with the valve seat (302) after installing O-rings to the rear transmission case.
5) Install tubes (18), (19) and (20).

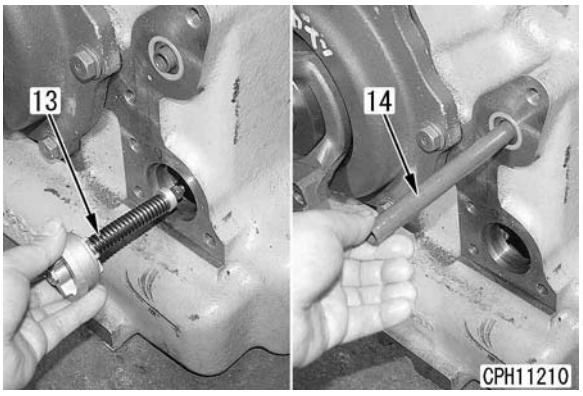




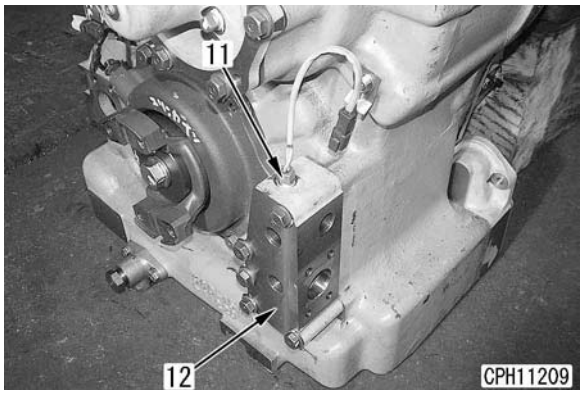
28. Strainer (left and right)
Install block (17) and then strainer (16) and cover (15).



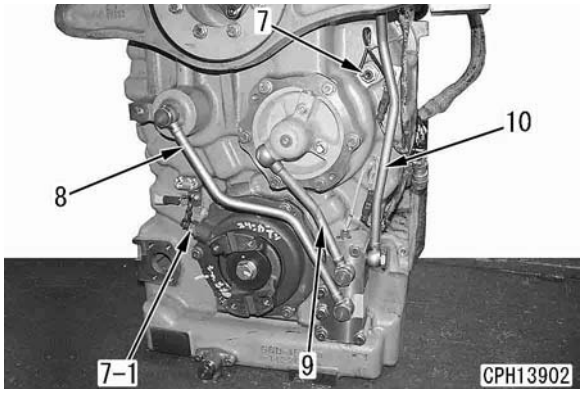
29. Relief valve assembly
1) Install in the order of piping (14) and relief valve assembly (13).



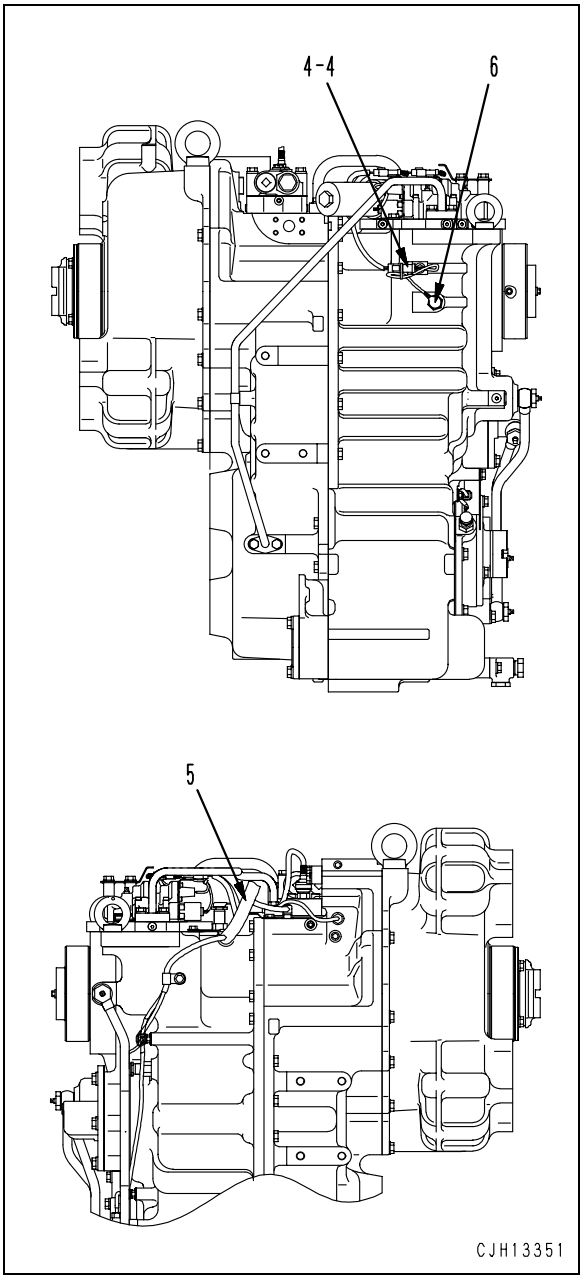
2) Install block (12).
   ★ Tighten the mounting bolt temporarily. (Refer to the step 30 when tightening for the last time.)
3) Install lubrication oil temperature sensor (LUB) (11).
   Sensor thread
   : Gasket sealant (LG-5)
   Lubrication oil temperature sensor (LUB)**: 29.4 – 49 Nm {3 – 5 kgm}**



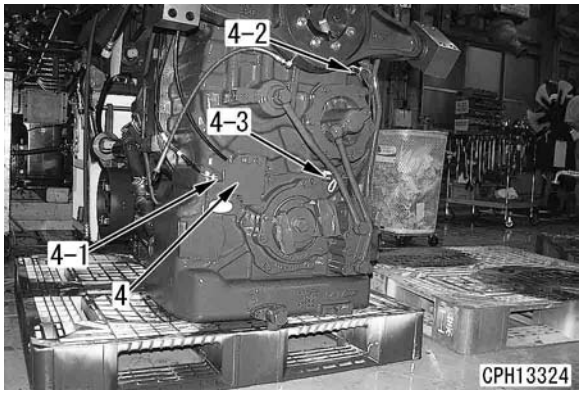
30. Wiring harness, each sensor and piping
1) Install tubes (8), (9) and (10).
2) Tighten the mounting bolts of block (12) which were temporarily tightened in the step 29 2).
3) Install output shaft rotation sensor (differential input) (7), output shaft R rotation sensor (7-1).



4) Install inter-mediate shaft rotation sensor (6).
   ★ When installing them, refer to the section of "Adjusting transmission speed sensor" in Testing and adjusting.
5) Install wiring harness assembly (5).
6) Install connector (4-4).



7) Install connector B09 (4-1), (4-2) and (4-3).
8) Install cover (4).

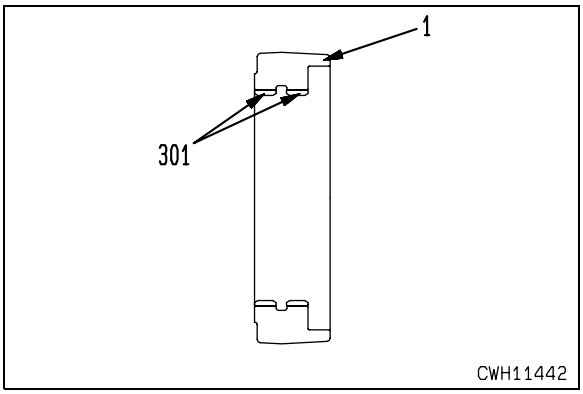


31. Trunnion

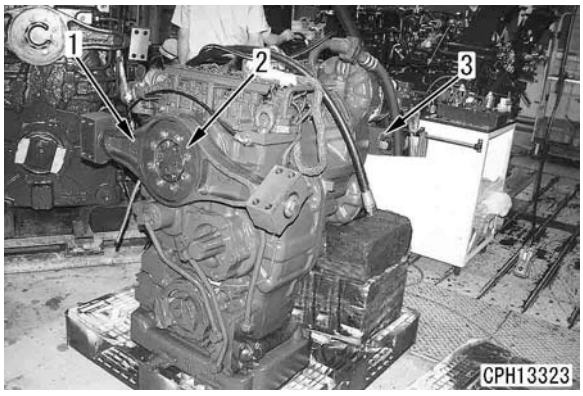
1) Install bushing (301) to trunnion (1) in the following steps.
   i) Remove smudges and oil inside the trunnion with detergent.
   ii) Ingrain primer for hardening promotion of Loctite 712 in cloth and clean the mating surface on the bushing side.

   Adhesive surface on bushing side
   : Primer for hardening promotion (Loctite 712 or equivalent)
   iii) Coat the trunnion mating surfaces with instant adhesive of Loctite Prism 411 (or equivalent). Approx. 3g a bushing is a benchmark for the adhesive to coat.

   Adhesive surface on trunnion side
   : Instant adhesive (Loctite Prism 411 or equivalent)
   iv) Press-fit the bushing into the trunnion.
   ★ Press-fit within 5 minutes after coating the hard-to-stick application adhesive compound of Loctite Prism.
   ★ Do not mix the primer with the adhesive.



2) Install trunnions (1) and (3).
3) Install plate (2).



HM300-2 Articulated dump truck

Form No. SEN00688-03

ARTICULATED DUMP TRUCK

HM300-2

Machine model	Serial number
HM300-2	2001 and up

50 Disassembly and assembly

Power train, Part 3

Removal and installation of center differential assembly

Special tools

Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
H	4	790-101-5401	Push tool kit	■	1		
		790-101-5441	• Plate		1		
		790-101-5421	• Grip		1		
		01010-51240	• Bolt		1		
	5	790-201-2770	Spacer	■	1		

Removal

⚠ **Turn the parking brake switch on and put wooden blocks behind the wheels.**

⚠ **Raise the body assembly fully and insert a lock pin.**

⚠ **Loosen the hydraulic oil filler cap to release the internal pressure of the hydraulic tank.**

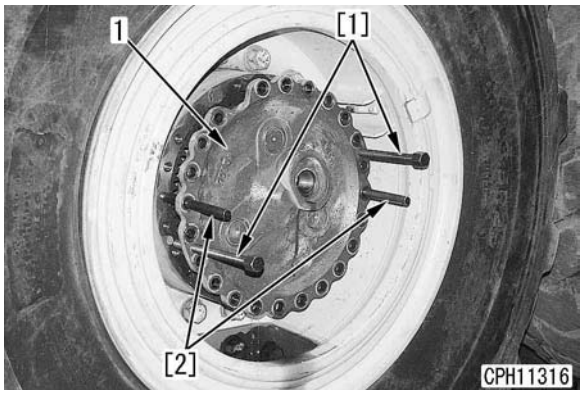
1. Drain oil from the center differential case and center final drive case.

Center differential case: **25 ℓ**

Center final drive case: **4 ℓ (one side)**

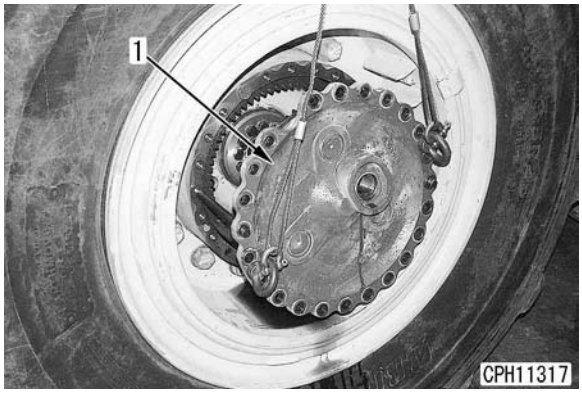
2. Remove the left and right drive shafts in the following steps.

1) Remove the mounting bolts of carrier assembly (1), and pull out of the final drive assembly, using forcing screws [1] and guide bolts [2]. [*1]



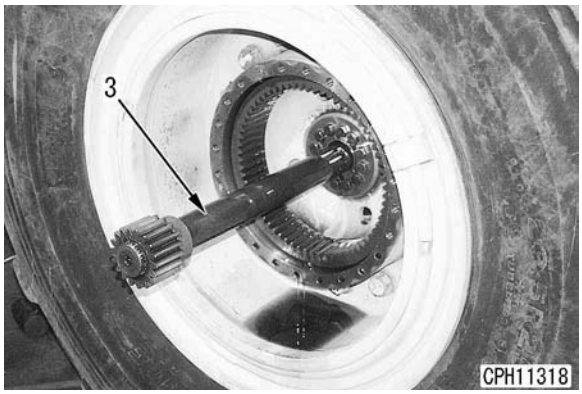
2) Sling carrier assembly (1) to remove. [*2]

Carrier assembly: **40 kg (one side)**



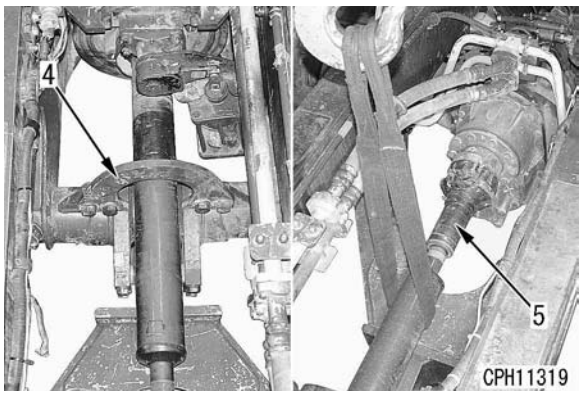
3) Sling sun gear and drive shaft assembly (3) to remove. [*3]

Sun gear and drive shaft assembly **: 25 kg (one side)**

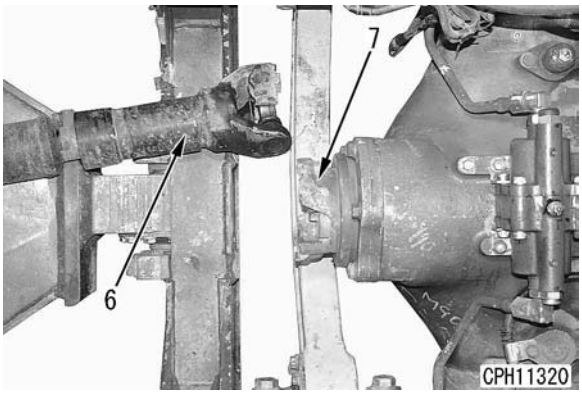


3. Remove drive shaft guard (4).

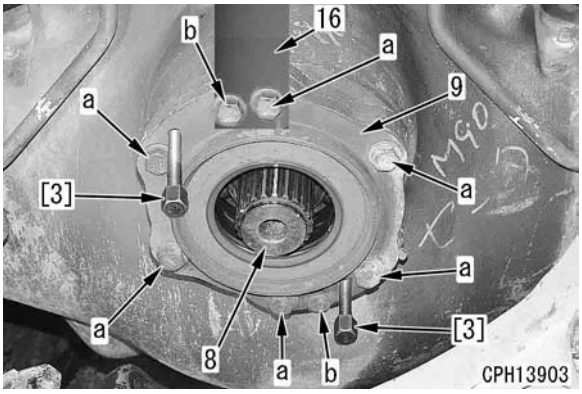
4. Sling drive shaft (5) between the hitch frame and center differential temporarily, and disconnect it at the center differential side. [*4]



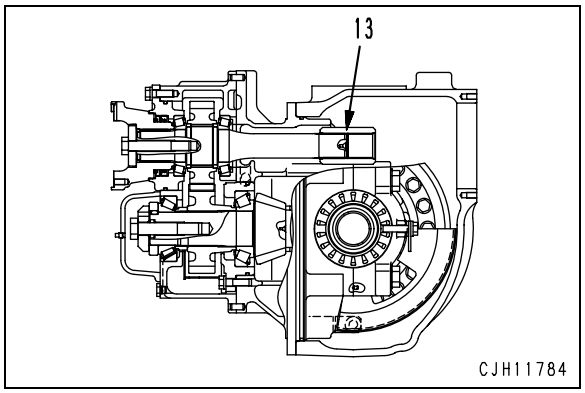
5. Sling drive shaft (6) between the center differential and rear differential and disconnect it at the center differential side. [*5]
6. Remove the mounting bolts of coupling (7) on the transfer output side and remove the coupling. [*6]



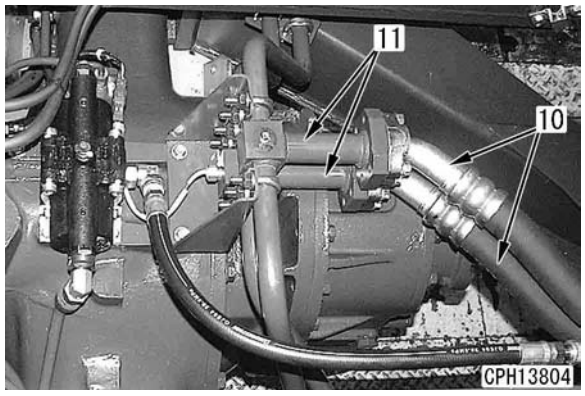
7. Remove bracket (16) for remote breather.
8. Remove the mounting bolts of bearing cage assembly (9) and remove the bearing cage assembly (9) together with transfer output shaft (8), using forcing screw [3]. [*7]
   ★ Do not remove a under side mounting bolt (b), but remove only 6 mounting bolts (a) and a upper side mounting bolt (b).



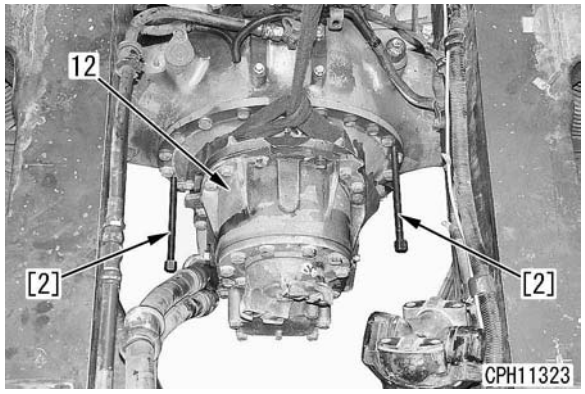
9. Remove coupling (13).



10. Disconnect 2 brake cooling hoses (10).
11. Disconnect 2 brake cooling tubes (11).
    ★ Remove the U clamp and tube mounting bolts from the left and right brakes.



12. Sling center differential assembly (12) and remove the mounting bolts; separate the center differential assembly from the axle case, using forcing screws [2], and remove. [*8]
    Center differential assembly: **300 kg**



Installation

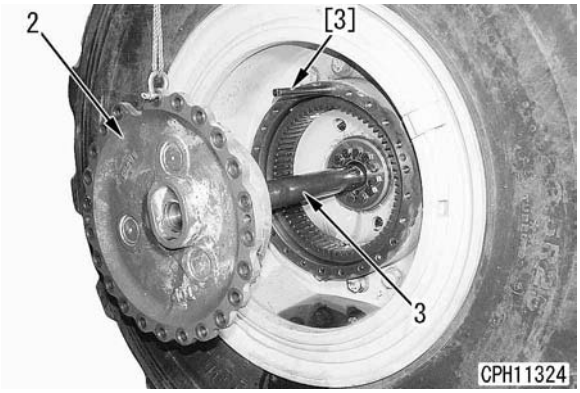
- Installation is carried out in the reverse order to removal.

[*1] [*2] [*3]

★ Install the carrier assembly in the following steps.

1) Insert the carrier assembly into the center axle assembly up to the intermediate point of sun gear and drive shaft assembly (3).
2) Assemble the sun gear portion of sun gear and drive shaft assembly (3) in lifted carrier assembly (2).
3) In that condition, match the carrier assembly with guide bolt [3], then match the ring gear of the final drive assembly with the planetary gear of the carrier assembly, and push them in.

Carrier assembly mounting bolt
: 157 – 196 Nm {16 – 20 kgm}
[Target value: 177 Nm {18 kgm}]



[*4] [*5]

★ When installing the drive shaft between hitch frame and center differential, let it face in the same direction as that of the yoke of drive shaft between the transmission and hitch frame.
★ When installing, the yoke of drive shaft between the hitch frame and center differential and the yoke of drive shaft between center differential and rear differential must be shifted from each other by 45° ± 6°.
★ When installing the drive shafts, check that the convex section on spider cap completely engages with groove of counter yoke, and then tighten the mounting bolts.

Mounting bolt
: Liquid adhesive (LT-2)

Mounting bolts for drive shaft between transmission and hitch frame and drive shaft between center differential and rear differential
: 98 – 123 Nm {10 – 12.5 kgm}
[Target value: 113 Nm {11.5 kgm}]

[*6]

★ Install as shifted from the coupling on the input side of center differential by 45° ± 6°.

Mating faces between coupling and bearing
: Lubricant containing molybdenum disulfide (LM-P)

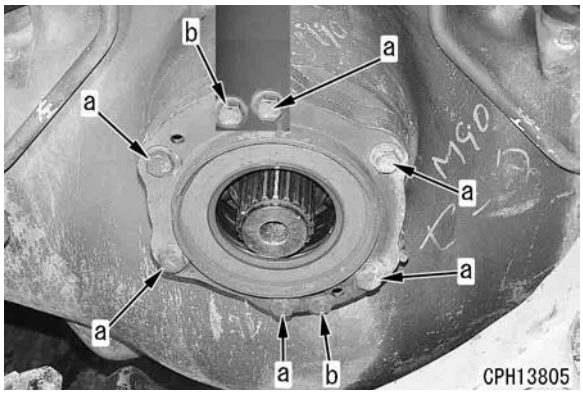
Coupling mounting bolt
: Liquid adhesive (LT-2)

Coupling mounting bolt
: 490 – 608 Nm {50 – 62 kgm}

[*7]

Transfer output shaft spline portion
: Extreme-pressure grease containing molybdenum disulfide

Bearing cage assembly mounting bolt
a: 98 – 123 Nm {10 – 12.5 kgm}
b: 54 – 64 Nm {5.5 – 6.5 kgm}



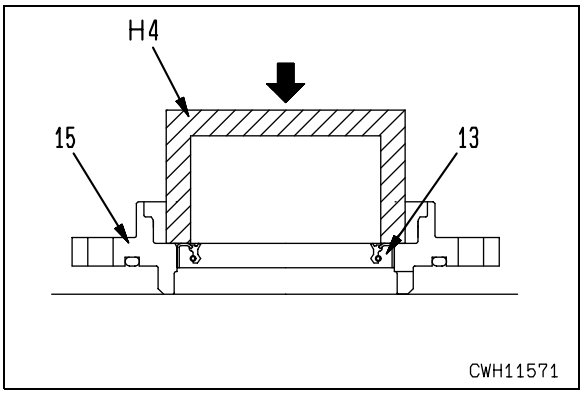
★ When disassembling the bearing cage assembly, press-fit oil seal (13) and side seal (14) into cage (15) in the following manner.

i) Press-fit oil seal (13) into cage (15), using tool **H4**.

★ Keep press-fitting until the oil seal periphery surface is flush with the cage end surface.

Oil seal periphery
: Seal end 242 or equivalent

Oil seal lip face**: Grease (G2-LI)**

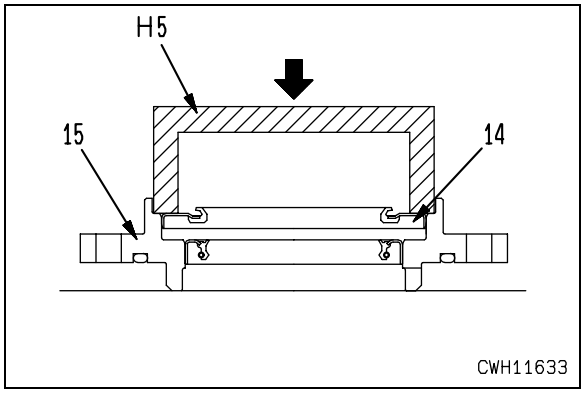


ii) Press-fit side seal (14) into cage (15), using tool **H5**.

★ Keep press-fitting until the side seal periphery surface is flush with the cage end face.

Side seal periphery**: Seal end 242**

Side seal lip face**: Grease (G2-LI)**



[*8]

Center differential mounting bolt
: 157 – 196 Nm {16 – 20 kgm}
[Target value: 177 Nm {18 kgm}]

• Refilling with oil (center differential case and center final drive case)
Refill with oil through the oil filler ports of the center differential case and left and right final drive cases up to the specified level.

Center differential case
: 25ℓ Axle oil (AXO80)

Center final drive case
: 4ℓ (one side) Axle oil (AXO80)

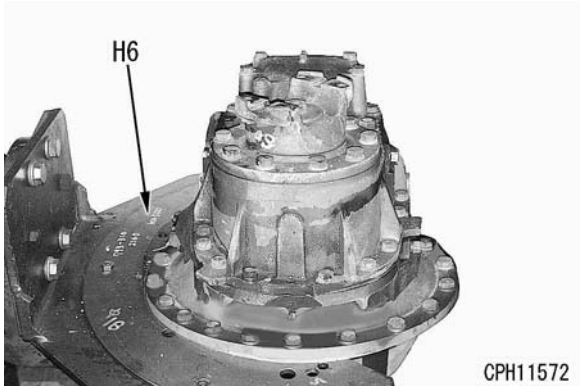
Disassembly and assembly of center differential assembly

Special tools

Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
H		792T-423-1130	Push tool	■	1		○
	2	790-101-5421	Grip	■	1		
		01010-51240	Bolt	■	1		
	6	790-501-5000	Unit repair stand (AC100V)	■	1		
		790-501-5200	Unit repair stand (AC110V, AC220V)	■	1		
		790-901-2110	Bracket	■	1		
		792T-222-1210	Plate	■	1		○
	7	792-103-0901	Wrench	■	1		
	8	792T-223-1120	Push tool	■	1		○
	9	792T-423-1140	Push tool	■	1		○
		790-101-5421	Grip	■	1		
		01010-51240	Bolt	■	1		
	10	792T-223-1110	Push tool	■	1		○

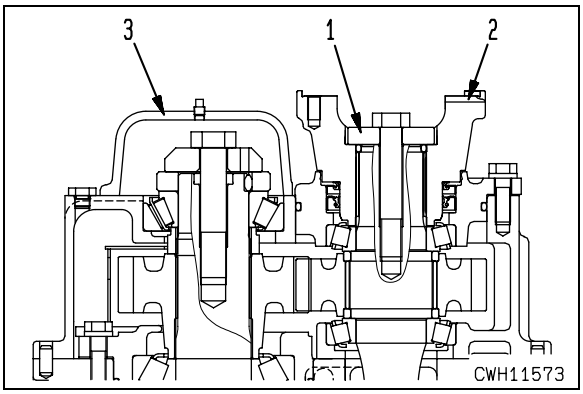
Disassembly

1. **Setting center differential assembly to tool**
   Set the center differential assembly to tool **H6**.

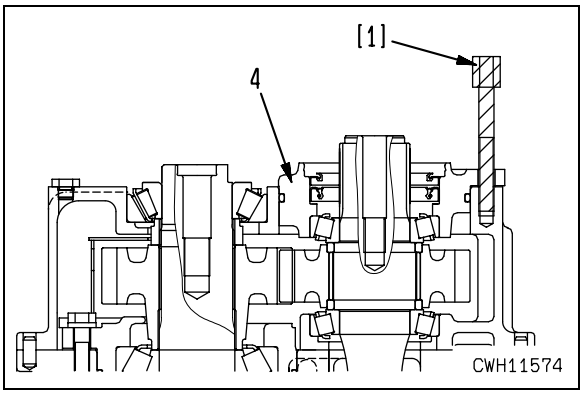


2. **Transfer input coupling and holder**
   Remove holder (1) and then remove coupling (2).

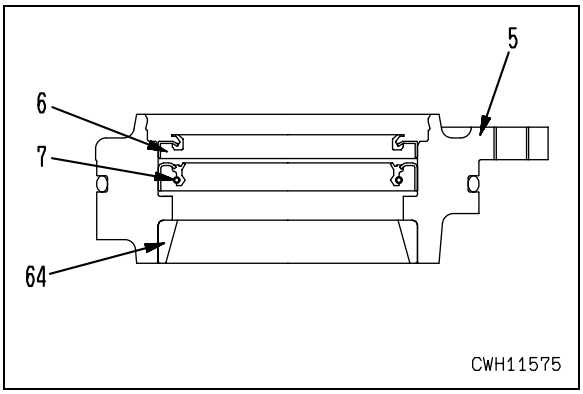
3. **Cover**
   Remove cover (3).



4. **Input shaft cage**
   1) Remove input shaft cage assembly (4), using forcing screws [1].
      ★ Shims are provided, so check their thickness, number in use and installed locations beforehand.

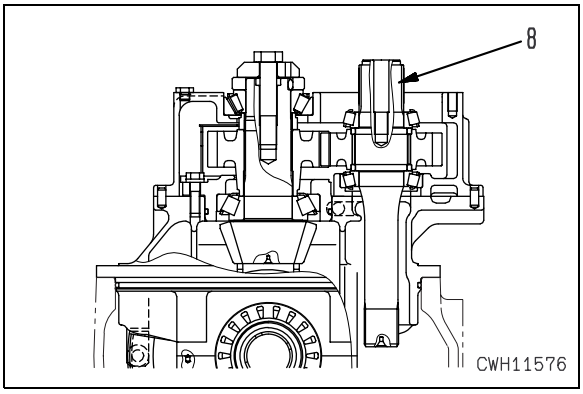


   2) Remove side seal (6) and oil seal (7) from cage (5).
   3) Remove outer race (64).

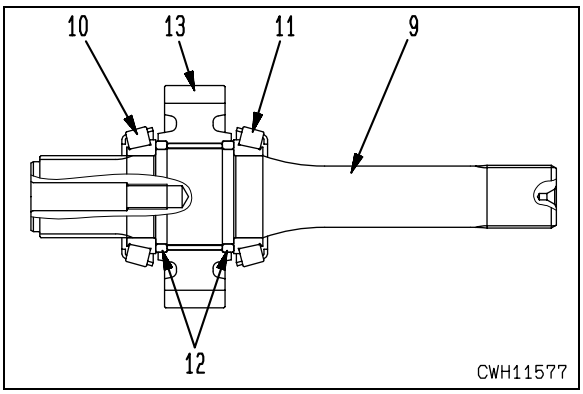


5. Transfer input shaft and gear assembly

1) Remove transfer input shaft and gear assembly (8).



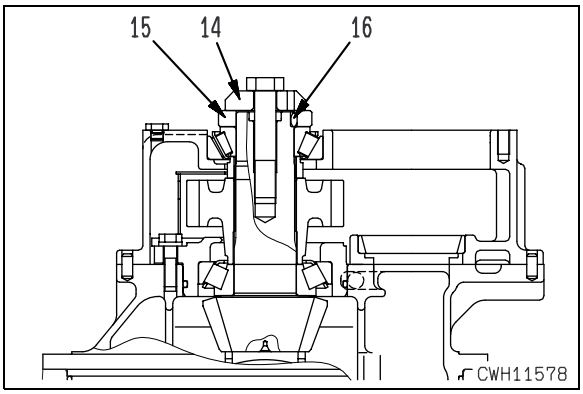
2) Remove bearings (10) and (11), 2 spacers (12) and gear (13) from transfer input shaft (9).



6. Input shaft holder

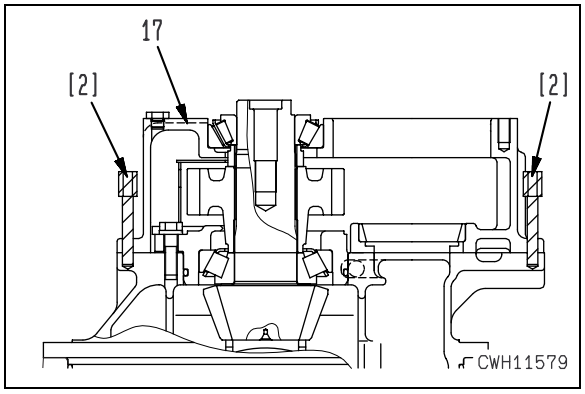
★ Before removing the holder, put wooden blocks or the like under the bevel pinion so as not to let it fall.

1) Remove holder (14).
   ★ Shims are provided, so check their thickness, number in use and installed locations beforehand.
2) Remove holder (15) and key (16).

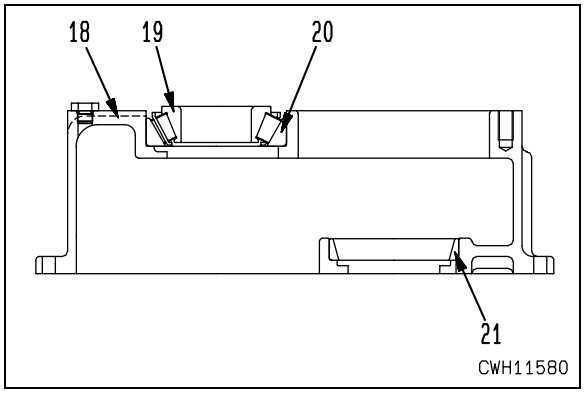


7. Transfer case

1) Sling transfer case assembly (17) to remove, using forcing screws [2].

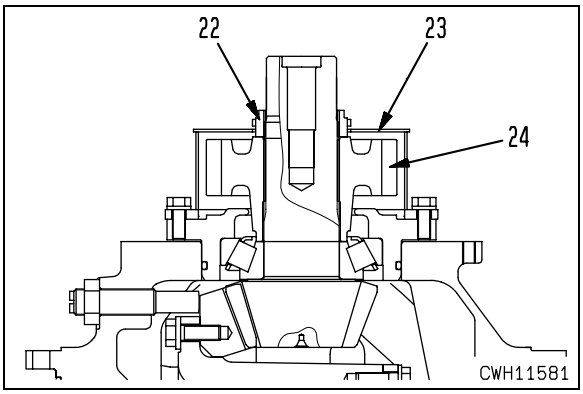


2) Remove bearing (19) and outer races (20) and (21) from transfer case (18).



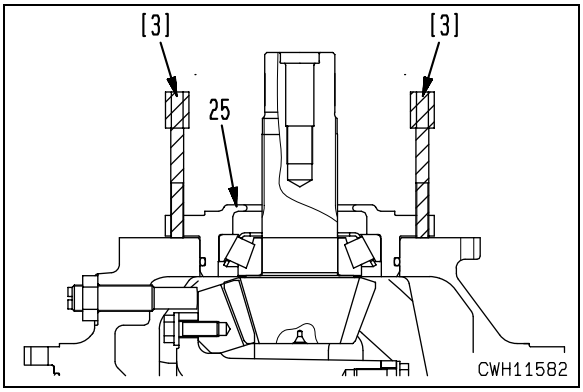
8. Spacer and input gear

1) Remove spacer (22).
2) Remover spacer cover (23) and then remove input gear (24).

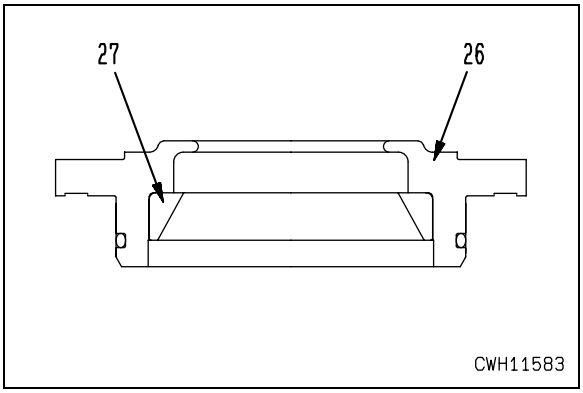


9. Cage assembly

1) Remove cage assembly (25), using forcing screws [3].

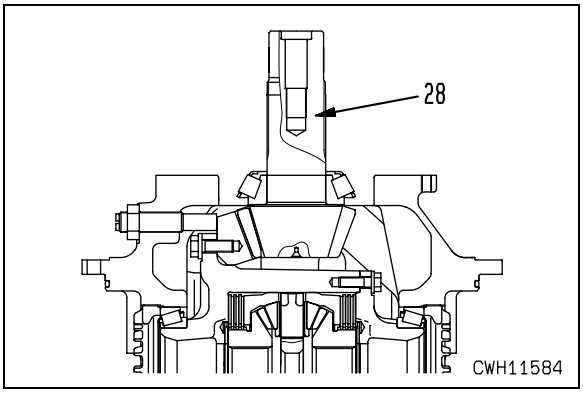


2) Remove outer race (27) from cage (26).

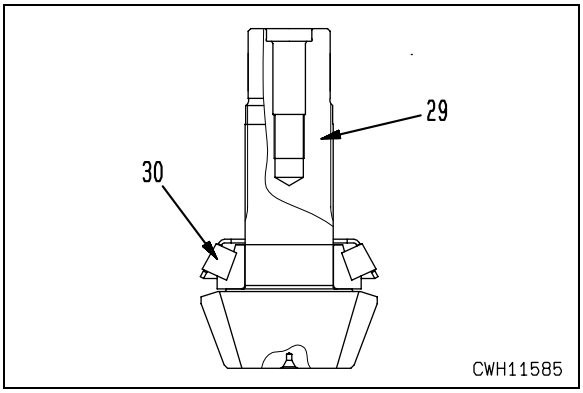


10. Bevel pinion and bearing assembly

1) Remove bevel pinion and bearing assembly (28).



2) Remove bearing (30) from bevel pinion (29).

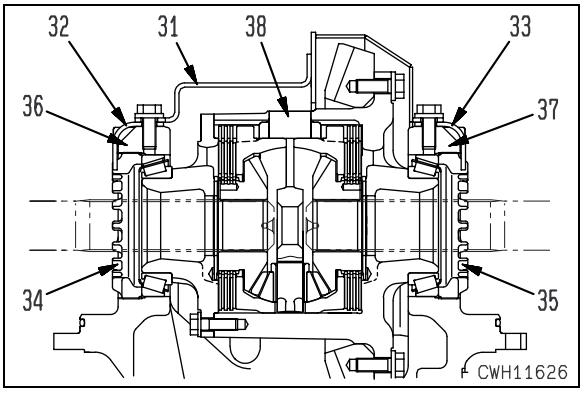


11. Removal of differential gear assembly

1) Reverse tool **H6**.
2) Remove locks (32) and (33) together with cover (31).
3) Loosen adjusting nuts (34) and (35) using tool **H7** until they can be loosened manually.
4) Sling the differential gear assembly and remove bearing caps (36) and (37) as well as adjusting nuts (34) and (35).
5) Sling differential gear assembly (38) to remove.

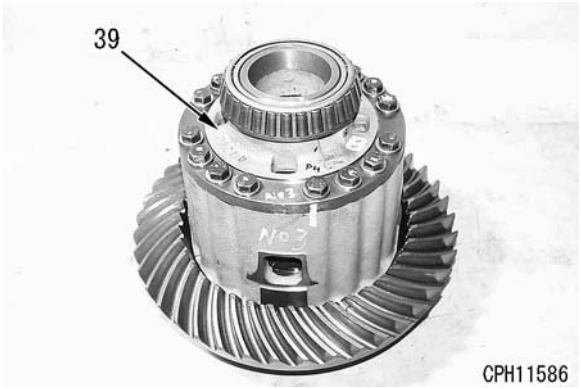
Differential gear assembly: **80 kg**

★ Be careful then not to let fall the bearing outer race.

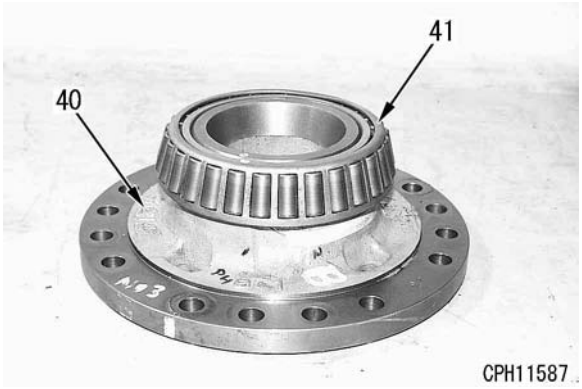


12. Further disassembly of differential gear assembly

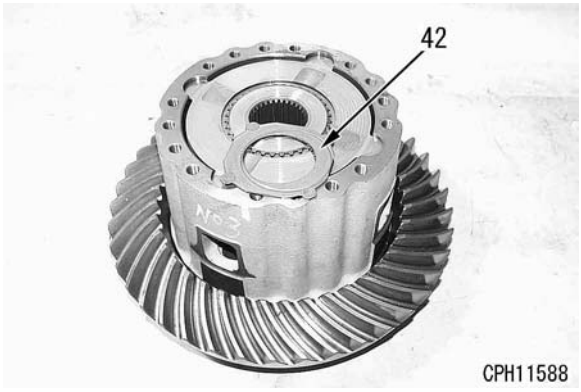
1) Remove case and bearing assembly (39).



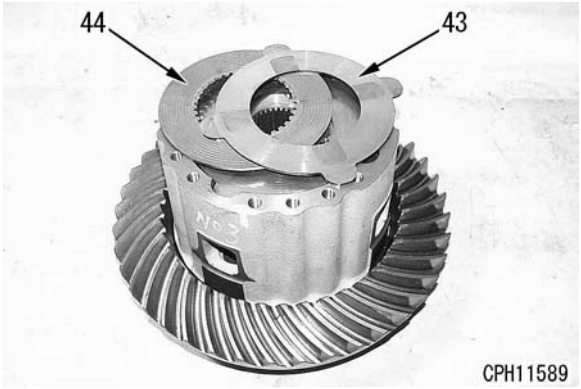
2) Remove bearing (41) from case (40).



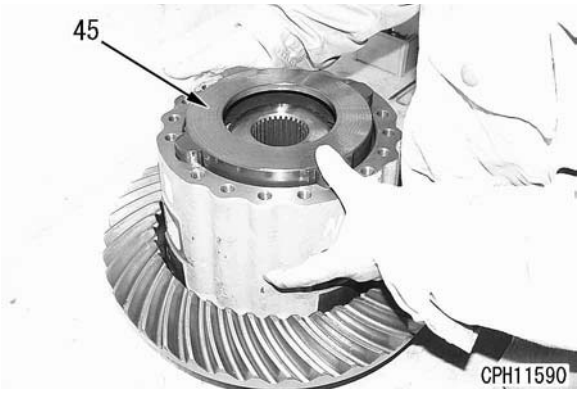
3) Remove washer (42).



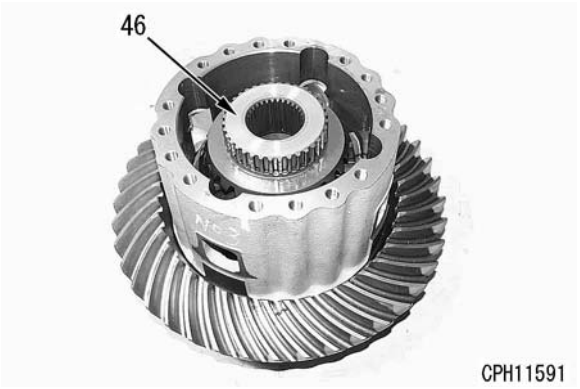
4) Remove 3 plates (43) and 2 discs (44).



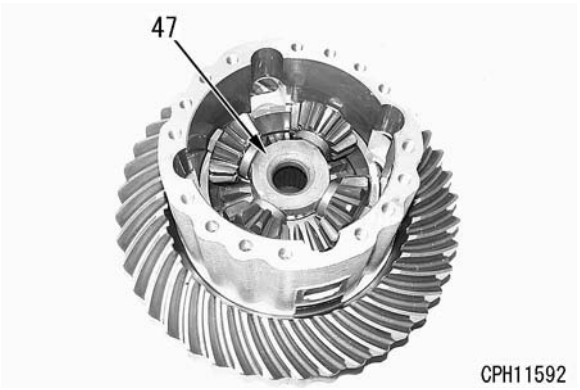
5) Remove pressure ring (45).
   ★ Lift the ring with a finger inserted into the case side hole.



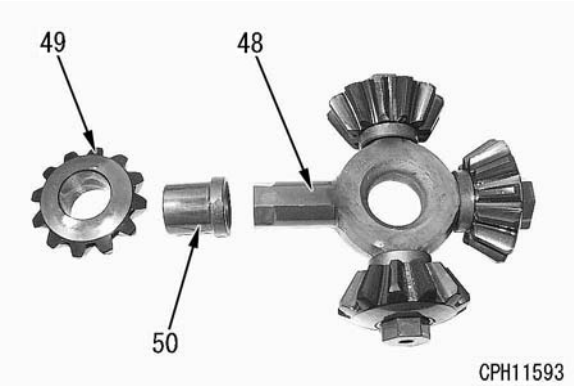
6) Remove differential side gear (46).



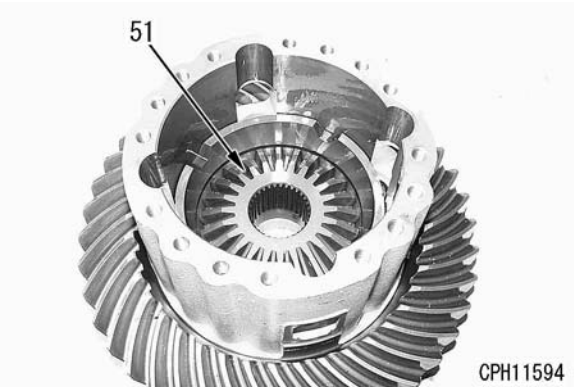
7) Remove pinion gear assembly (47) in one piece.



8) Remove pinion gears (49) and bushings (50) 4 for each from shaft (48).

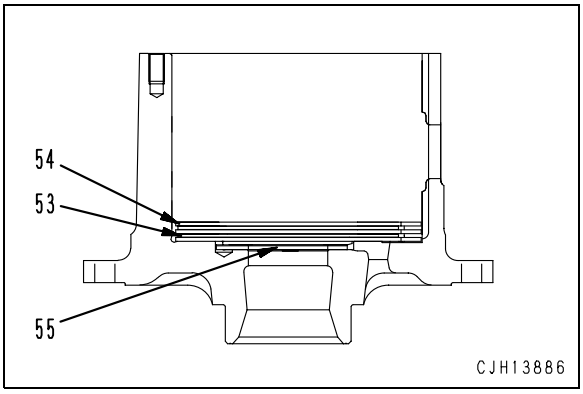


9) Remove differential side gear (51).

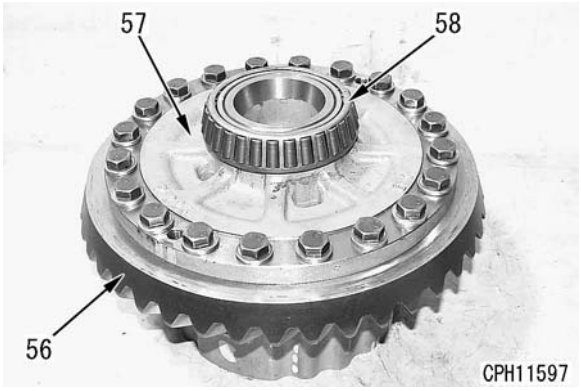


10) Remove pressure ring (52).

11) Remove 3 plates (54) and 2 discs (53).
12) Remove washer (55).



13) Reverse the bevel gear assembly.
14) Remove bevel gear (56) from case (57).
★ Before removing, put a counter mark both on the bevel gear and on the case.
15) Remove bearing (58).

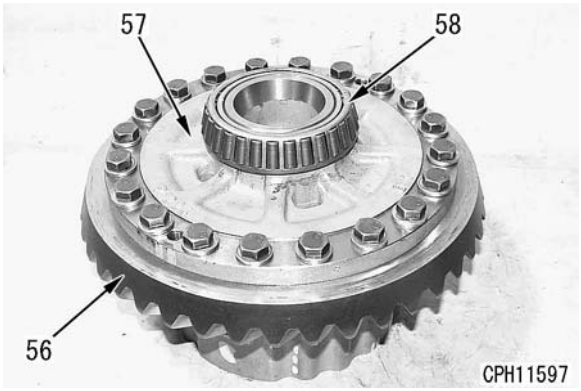


Assembly

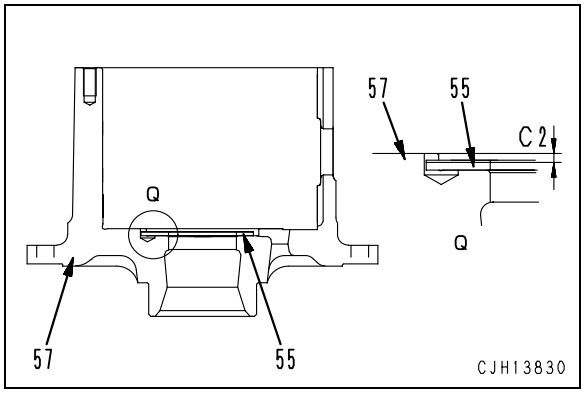
★ Clean each of the parts and check that it is free of dust or damage, then coat the sliding surface with **axle oil (AXO80)** and assemble.

1. Subassembly of differential gear assembly

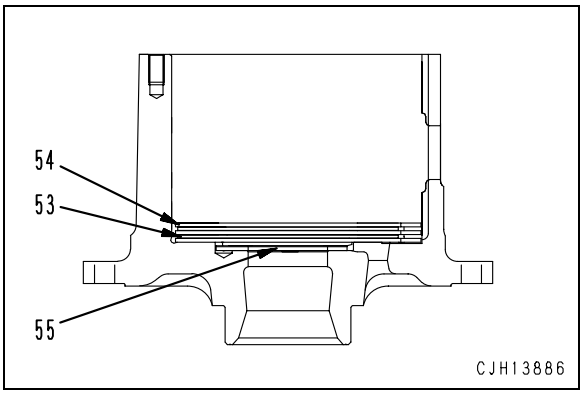
1) Shrink-fit bearing (58) to case (57).
• Shrink-fit temperature
: For 30 minutes at 120°C
★ After shrink fitting, drip **axle oil (AXO80)** on the bearing.
2) Install bevel gear (56) to case (57).
★ Install the gear, matching the counter marks which were put when removing.
Mounting bolt
: Liquid adhesive (LT-2)
Mounting bolt
: 157 – 196 Nm {16 – 20 kgm}



3) Reverse the case and bevel gear assembly.
4) Put washer (55) in the case (54).
★ Direct the lined face toward the gear.
5) Using the depth gauge, measure level difference **C2** between case (57) and washer (55) at 4 places equally spaced on the periphery.
• Value **C2** on drawing = **6.05 – 6.15 mm**
Record the values measured at the 4 places in the check sheet and obtain an average.
Average of level difference **C2** = Total of values measured at 4 places / 4

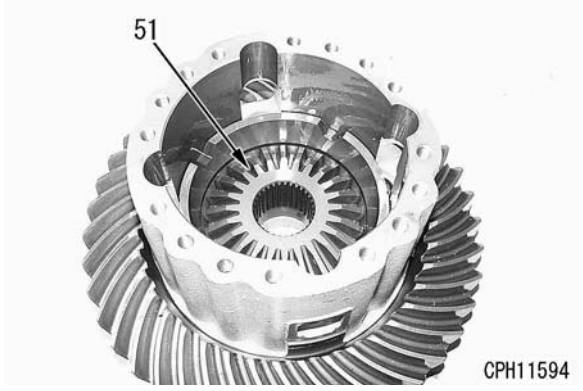


6) Assemble 3 plates (54) and 2 discs (53) for each.
   ★ Immerse the discs and plates in the following oil before installing.
   Disc and plate: **Axle oil (AXO80)**
   ★ Align the 4 toothless position of the discs.

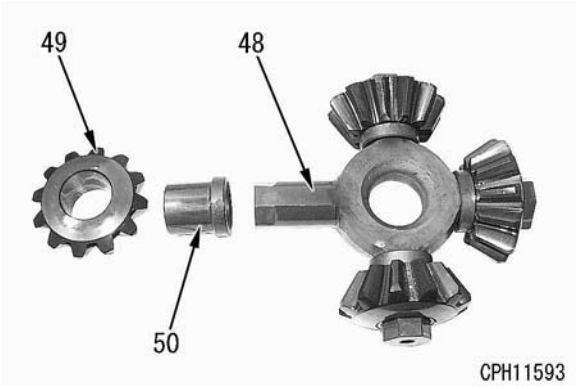


7) Install pressure ring (52) to the case.

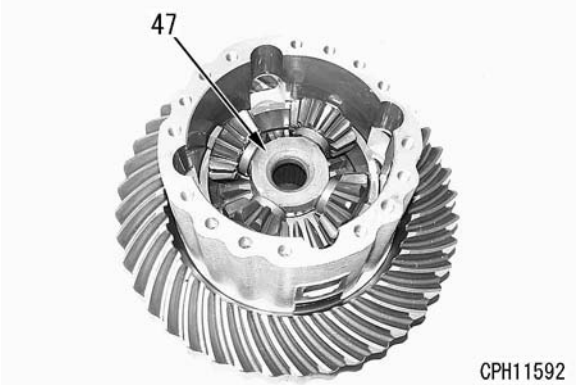
8) Install differential side gear (51).



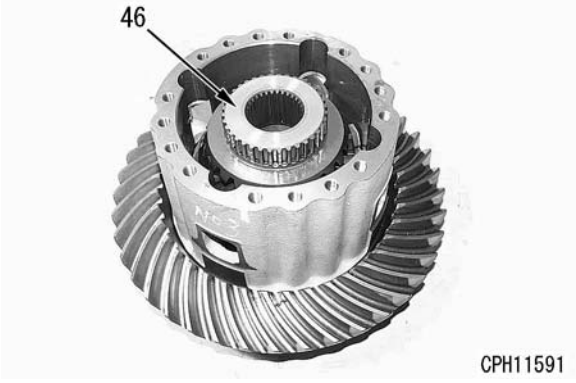
9) Install bushings (50) and pinion gears (49) 4 for each to shaft (48).



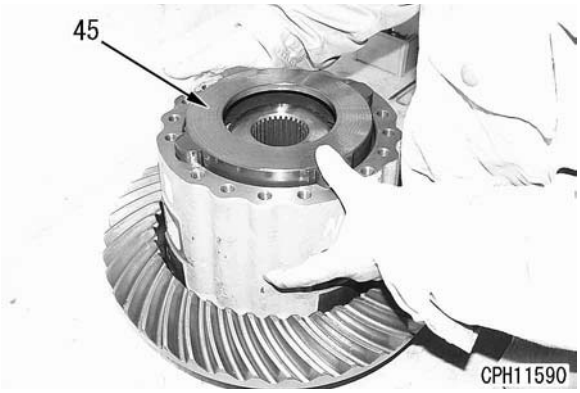
10) Install pinion gear assembly (47) in one piece.



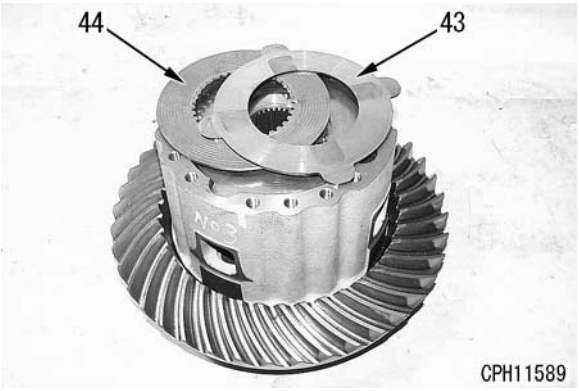
11) Install differential side gear (46).



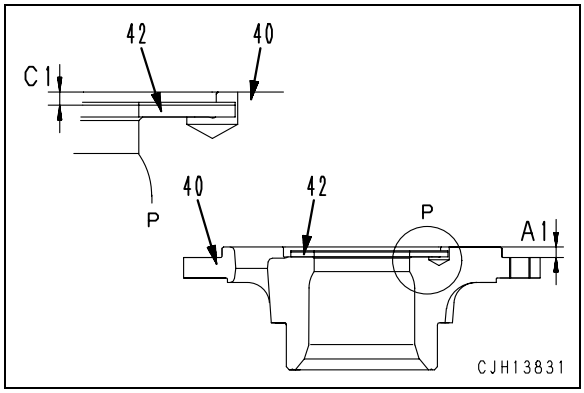
12) Install pressure ring (45).



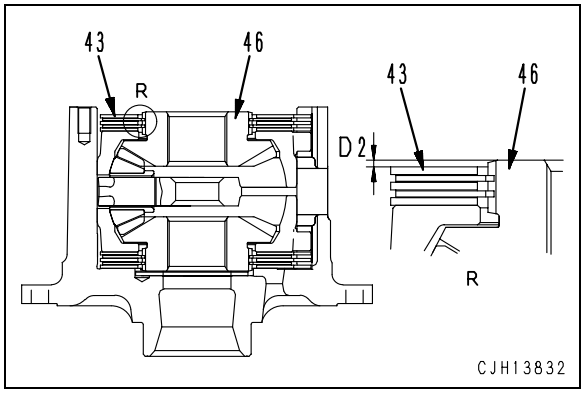
13) Assemble 3 plates (43) and 2 discs (44).
★ Immerse the discs and plates in the following oil before installing.
Disc and plate: **Axle oil (AXO80)**



14) Adjustment of clearance.
i) Using the depth gauge, measure level difference **A1** of case (40) at 4 places equally spaced on the periphery. Record the values measured at the 4 places in the check sheet and obtain an average.
Average of level difference **A1** = Total of values measured at 4 places / 4
ii) Set washer (42) on case (40).
★ Direct the lined face toward the gear.
iii) Using the depth gauge, measure level difference **C1** between case (40) and washer (42) at 4 places equally spaced on the periphery.
Record the values measured at the 4 places in the check sheet and obtain an average.
Average of level difference **C1** = Total of values measured at 4 places / 4



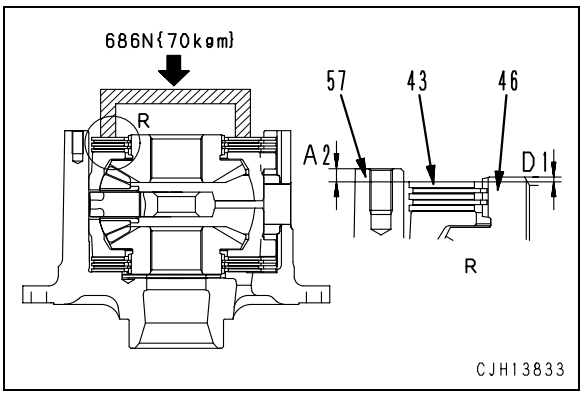
iv) Using the depth gauge, measure level difference **D2** between gear (46) and plate (43) at 4 places equally spaced on the periphery.
Record the values measured at the 4 places in the check sheet and obtain an average.
Average of level difference **D2** = Total of values measured at 4 places / 4



v) While pressing the disc and plate with a force of **686 N {70 kg}**, perform steps vi) and vii).

vi) Using the depth gauge, measure level difference **A2** between case (57) and plate (43) at 4 places equally spaced on the periphery. Record the values measured at the 4 places in the check sheet and obtain an average.
Average of level difference **A2** = Total of values measured at 4 places / 4

vii) Using the depth gauge, measure level difference **D1** between gear (46) and plate (43) at 4 places equally spaced on the periphery. Record the values measured at the 4 places in the check sheet and obtain an average.
Average of level difference **D1** = Total of values measured at 4 places / 4



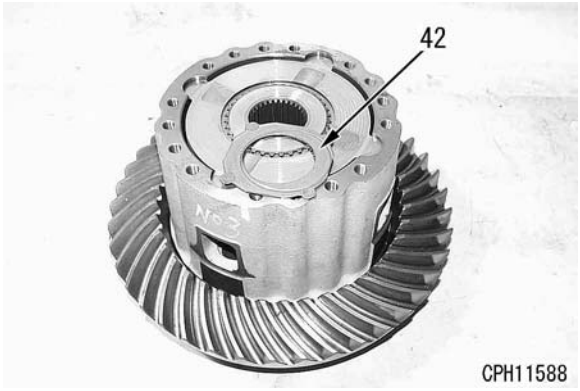
viii) Calculation method for clearance **A** between disc and plate.
Clearance **A** = Clearance **A2** – Clearance **A1**
★ Check that clearance **A** is **0.2 – 0.75 mm**.

ix) If clearance **A** is out of the above range, replace plate (43) and measure dimension **A2** again until a proper clearance is obtained.
★ The total thicknesses of the 3 plates on the right and left sides must be the same.
• Thicknesses of plates (43):
3.1 mm, 3.2 mm

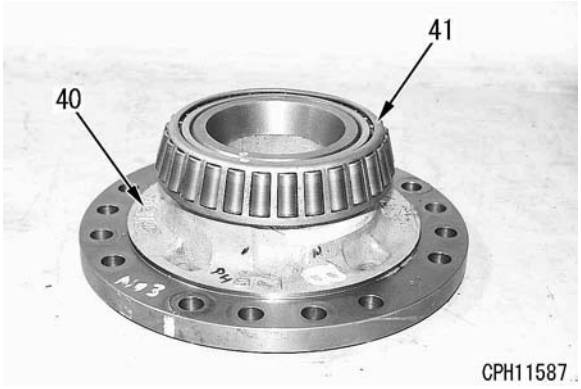
x) Calculation method for side gear clearances **B1** and **B2** in axial direction
Clearance **B1** = Clearance **C1** – Clearance **D1** + (Clearance **A** / 2)
Clearance **B2** = Clearance **C2** – Clearance **D2** + (Clearance **A** / 2)
★ Use the clearance obtained in viii) as clearance **A**.
★ Check that both clearances **B1** and **B2** are **0.15 – 0.35 mm**.

xi) If either or both of clearances **B1** and **B2** are out of the above range, replace washers (42) and (55) and measure dimensions **C1** and **C2** again until proper clearances are obtained.
• Thicknesses of washers:
4.0 mm, 4.1 mm

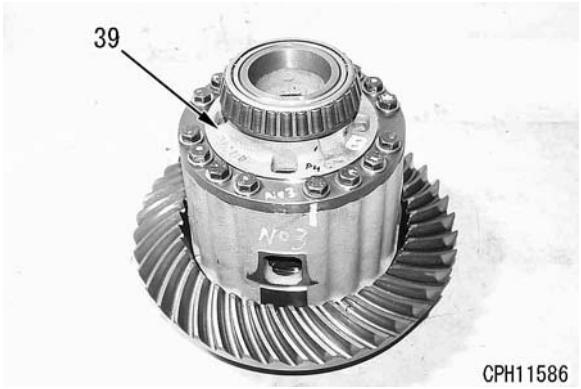
15) Install washer (42).
★ Direct the lined face toward the gear.



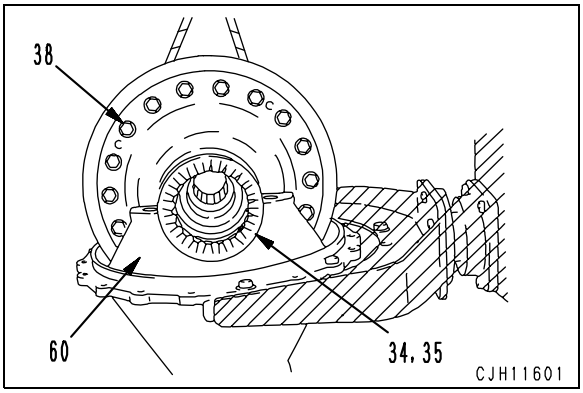
16) Shrink-fit bearing (41) to case (40).
• Bearing shrink-fit temperature
: For 30 minutes at 120°C
★ Drip **axle oil (AXO80)** on the bearing after installing.



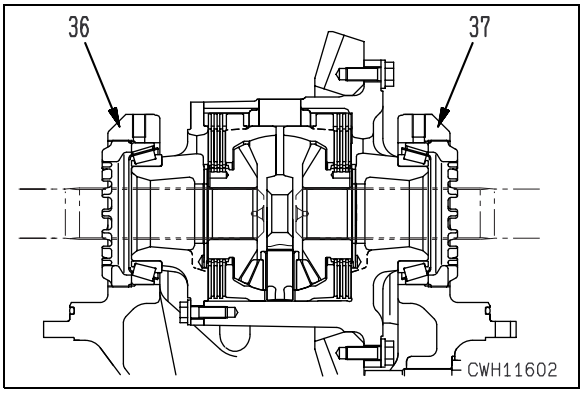
17) Install case and bearing assembly (39).
Mounting bolt
: 98 – 123 Nm {10.0 – 12.5 kgm}



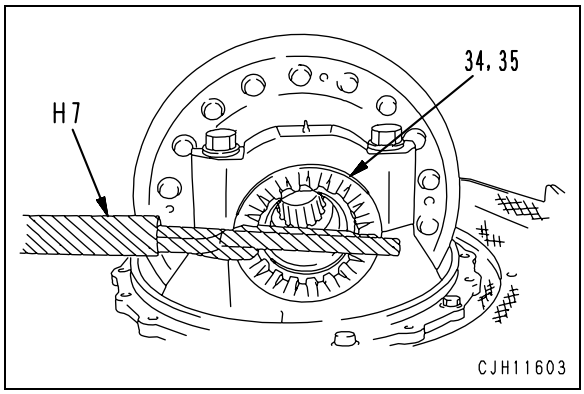
2. Installation of differential gear assembly
1) Sling differential gear assembly (38) and keep it above the installing position of differential case (60).
★ Keep the differential gear assembly in loose contact with the differential case.
2) Install an outer race to the bearing, and tighten adjusting nuts (34) and (35) to the differential case temporarily.



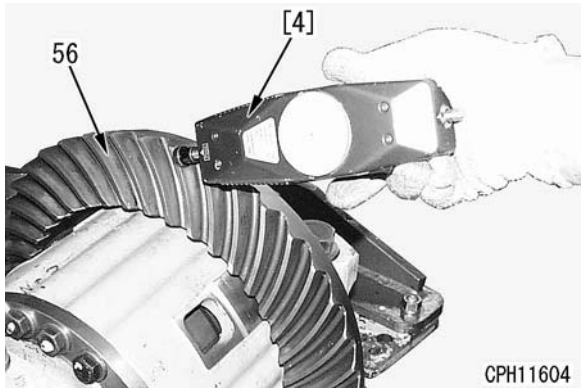
3) Install bearing caps (37) and (36) and tighten the mounting bolts.
Mounting bolt
: Liquid adhesive (LT-2)
Mounting bolt
: 824 – 1,030 Nm {84 – 105 kgm}



3. Adjustment of bearing pre-load
1) Tighten adjusting nuts (34) and (35), using tool **H7**.
★ Drip **axle oil (AXO80)** on the bearing thoroughly.
★ Rap the bevel gear with a copper hammer, while rotating the bearing, so that the bearing sits well with other parts in contact.

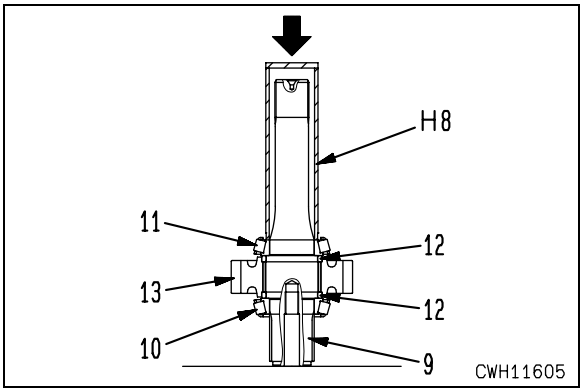


2) Measure start torque in the tangential direction at the peripheral addendums of bevel gear (56), using push-pull scale [4].
• Standard value for start torque
: 7.1 – 19.6 N (0.73 – 2.0 kg)
★ If the start torque is lower than the standard value, tighten the adjusting nuts, and if it is higher, loosen the nuts.
★ When the adjusting nut is loosened on one side, tighten the nut on the opposite side as much.



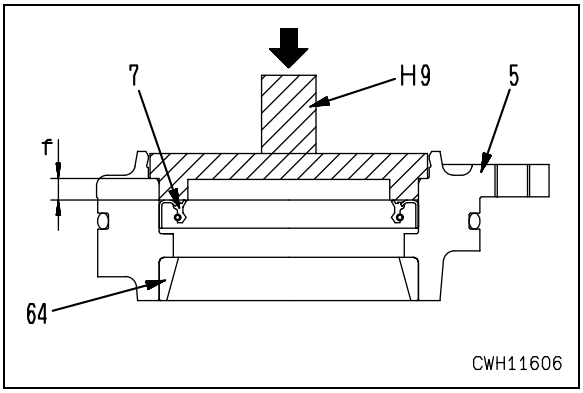
4. Subassembly of transfer input shaft

1) Install gear (13) and 2 spacers (12) to transfer input shaft (9).
   - Spline portion of inserted gear
     : Extreme-pressure grease containing molybdenum disulfide
2) Press-fit bearing (11), using tool **H8**.
   - ★ Press-fit bearing (10) in the same manner, too.

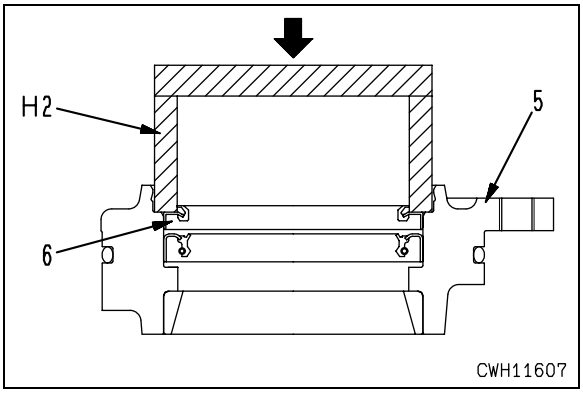


5. Subassembly of transfer input shaft cage

1) Install outer race (64) to cage (5).
2) Press-fit oil seal (7), using tool **H9**.
   - ★ Keep press-fitting until distance "**f**" between the oil seal periphery surface and end surface of cage (12) is 10 ± 0.5 mm.
   - Oil seal periphery surface
     : Seal end 242 or equivalent
   - Oil seal lip face and inside of oil seal (100% full): **Grease (G2-LI)**

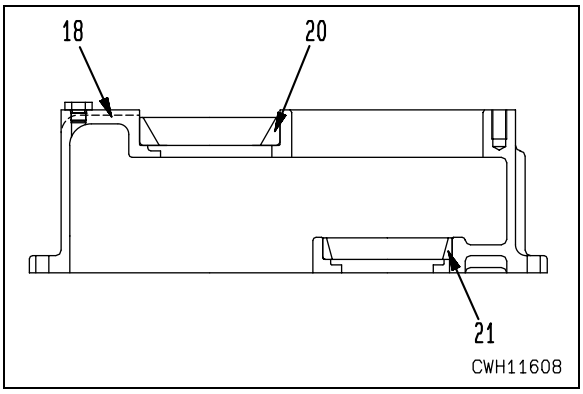


3) Press-fit side seal (6), using tool **H2**.
   - ★ Keep press-fitting until the side seal periphery surface is flush with cage (12) end surface.
   - Side seal periphery surface
     : Seal end 242 or equivalent
   - Side seal lip face and inside of side seal (100% full): **Grease (G2-LI)**



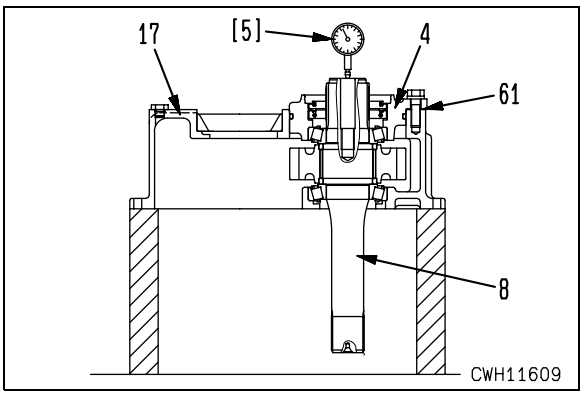
6. Transfer case

Install outer races (20) and (21) to transfer case (18).



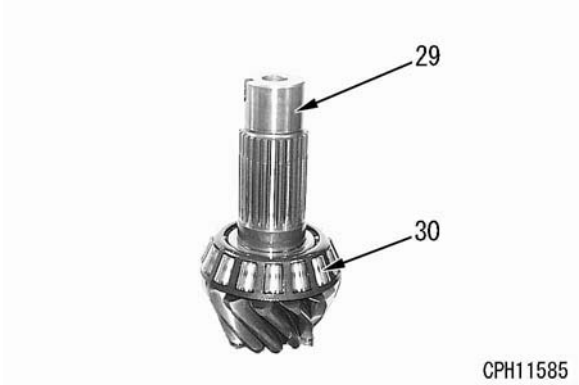
7. Adjustment of pre-load on transfer input shaft

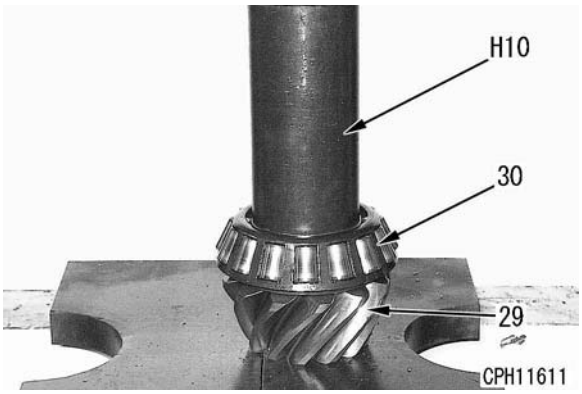
1) Support transfer case assembly (17) with wooden blocks, then assemble transfer input shaft and gear assembly (8), and install input shaft cage assembly (4).
   ★ Assemble the standard shims (having thickness checked at the time of disassembling) and install the input shaft cage assembly.
   ★ Keep tightening the mounting bolts, while rotating the bearing, until the bearing is steadied.
   Mounting bolt
   : 157 – 196 Nm {16 – 20 kgm}
2) Measure the endplay with dial gauge [5] while lifting and lowering input shaft and gear assembly (8) with a crane.
3) Adjust thickness of shims (61) so that the endplay may reach the standard value.
   • Standard value for endplay
   : 0 – 0.05 mm
   • Shim adjustment allowance
   : 0.8 – 1.7 mm
   • Kind of shim thickness
   : 0.15 mm, 0.18 mm, 0.2 mm, 0.3 mm and 0.8 mm
4) After adjusting the shim thickness, once remove transfer input shaft and gear assembly (8) and input shaft cage assembly (4).



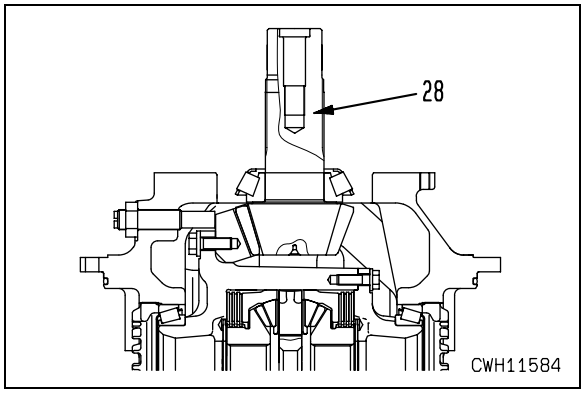
8. Bevel pinion and bearing assembly

1) Install bearing (30) to bevel pinion (29).
   ★ Shrink-fit bearing (30), or press-fit, using push tool **H10**.



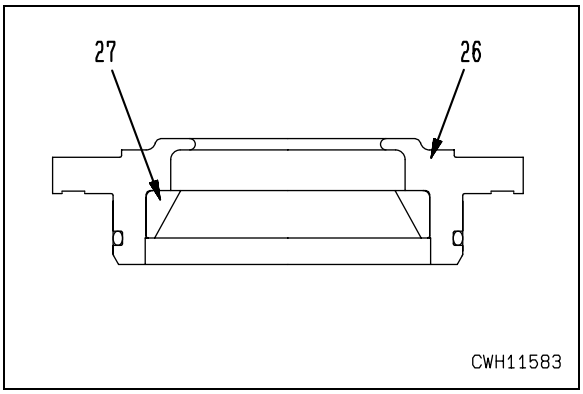


2) Install bevel pinion and bearing assembly (28).



9. Cage assembly

1) Install outer race (27) to cage (26).

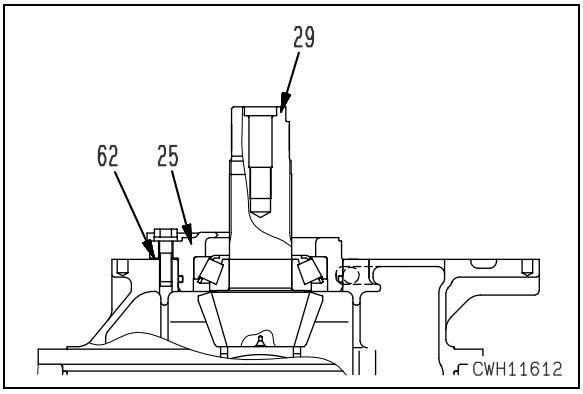


2) Install cage assembly (25).
   - ★ Assemble shims (62), whose thickness, number in use and installed location were confirmed at the time of disassembling, in cage assembly (25), and install the cage assembly.
   - ★ Determine thickness and number in use of shims after carrying out "Tooth contact and backlash adjustment" in the subsequent section of 12.

   Mounting bolt
   : 157 – 196 mm {16 – 20 kgm}

Table 1

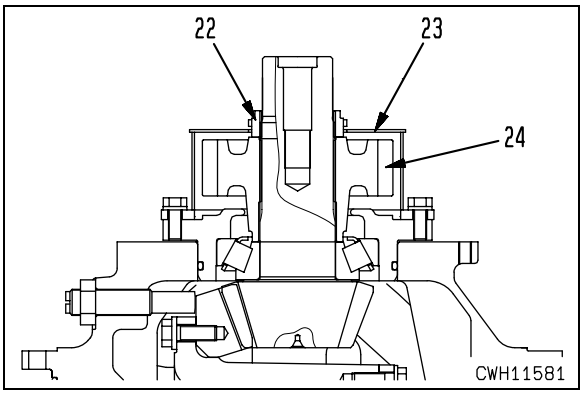
MD shim thickness range (mm)	Spacer part No.	Letter notched on spacer	Dimension of spacer width (mm)
1.07 – 1.16	56D-23-16900	A	24.765 ± 0.025
1.17 – 1.26	56D-23-16910	B	24.665 ± 0.025
1.27 – 1.36	56D-23-16920	C	24.565 ± 0.025
1.37 – 1.46	56D-23-16930	D	24.465 ± 0.025
1.47 – 1.56	56D-23-16940	E	24.365 ± 0.025
1.57 – 1.66	56D-23-16950	F	24.265 ± 0.025
1.67 – 1.76	56D-23-16960	G	24.165 ± 0.025
1.77 – 1.86	56D-23-16970	H	24.065 ± 0.025
1.87 – 1.96	56D-23-16980	I	23.965 ± 0.025
1.97 – 2.06	56D-23-16990	J	23.865 ± 0.025



10. Spacer and input gear

1) Assemble in input gear (24).
2) Install cover (23).

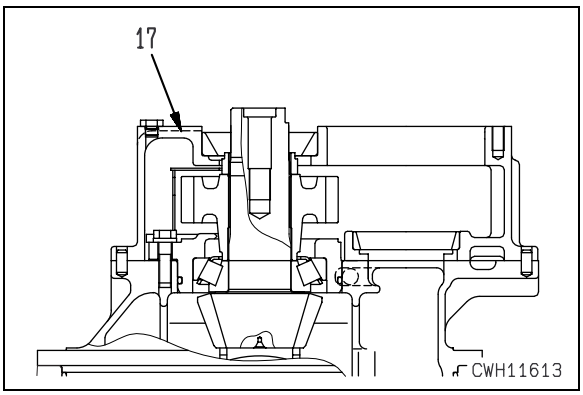
   Mounting bolt
   : 98 –123 Nm {10 – 12.5 kgm}
3) Assemble spacer (22) in.
   - ★ When changing thickness of the shims as a result of carrying out "Tooth contact and backlash adjustment" in the subsequent section of 12, change the spacers, too, in reference to Table 1 above.



4) Sling transfer case assembly (17) to install.

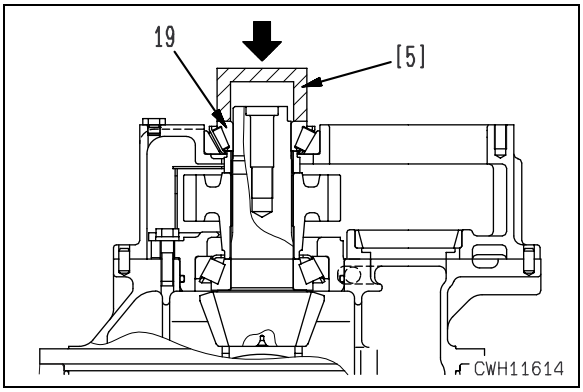
   Case mating face
   : Gasket sealant (LT-515 or equivalent)

   Mounting bolt
   : 98 – 123 Nm {10 – 12.5 kgm}

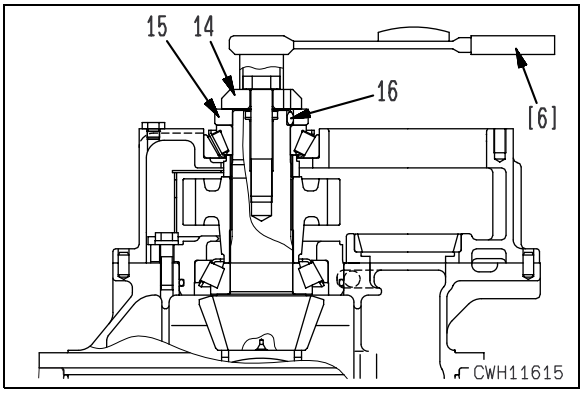


11. Bearing

1) Assemble bearing (19) in.
2) Press-fit bearing (19) using push tool [5].



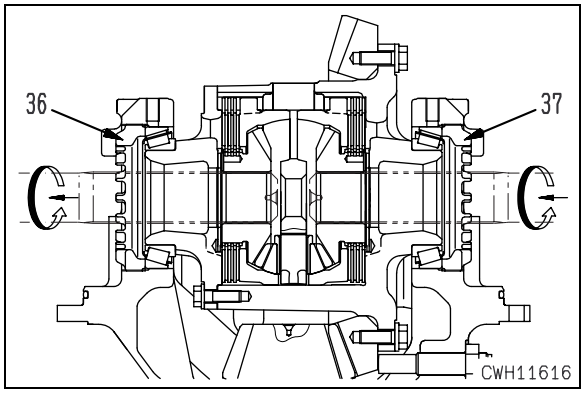
3) Install holder (14) after being fitted with holder (15) and key (16).
   ★ Assemble the shims whose thickness, number in use and installed location were confirmed at the time of disassembling.
   • Kind of shim thickness
   : 0.15 mm, 0.18 mm, 0.2 mm and 0.5 mm
   • Shim adjustment allowance
   : 0.36 – 1.74 mm
   Mounting bolt
   : Liquid adhesive (LT-2)
   Mounting bolt
   : 824 – 1,030 Nm {84 – 105 kgm}
4) Measure start torque of the input shaft at the holder mounting bolt, using torque wrench [6].
   • Start torque
   : 4.1 – 9.0 N {0.42 – 0.92 kg}
   ★ If the measured start torque falls out of the standard value, either increase or decrease the shim thickness and measure again.



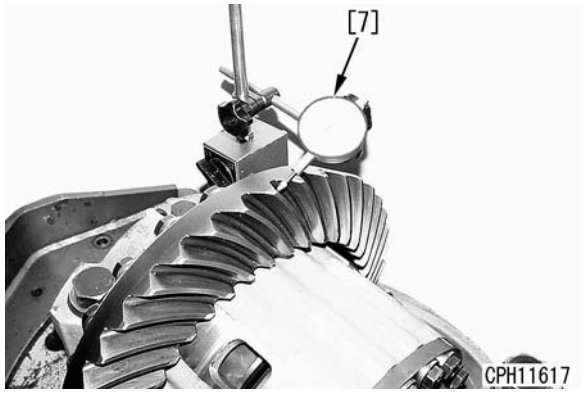
12. Tooth contact and backlash adjustment

• Adjust backlash and at the same time, adjust tooth contact.

1) Adjustment of backlash
   i) To shift the bevel gear, use adjusting nuts (36) and (37). In that case, if loosening the adjusting nut on one side, tighten the adjusting nut on the opposite side as much, in order not to change the pre-load given to the bearing.

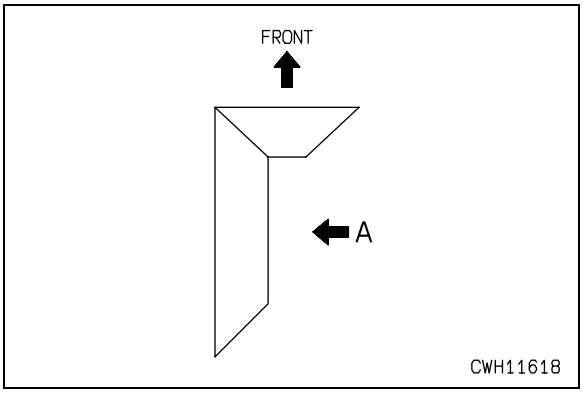


   ii) Apply the probe of dial gauge [7] perpendicularly to the addendums of bevel gear.
   iii) Fix the bevel pinion and shift the bevel gear back and forth (in the direction of rotation), then read out the dial.
   • Standard value for backlash:
   In the circumferential direction of the gear: **0.36 – 0.55 mm**
   In the perpendicular direction to the gear: **0.25 – 0.38 mm**
   ★ Make this adjustment at 3 points. Keep fluctuation of the backlash below 0.1 mm.

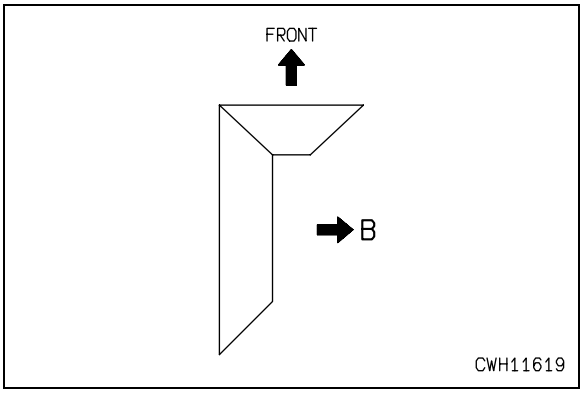


iv) If the measured value of backlash falls out of the standard value as a result of the measurement, make adjustment in the following manner.

• When there is small backlash:
Loosen the adjusting nut on the left side of chassis and tighten the adjusting nut on the right side as much (shift the bevel gear in direction **A**).

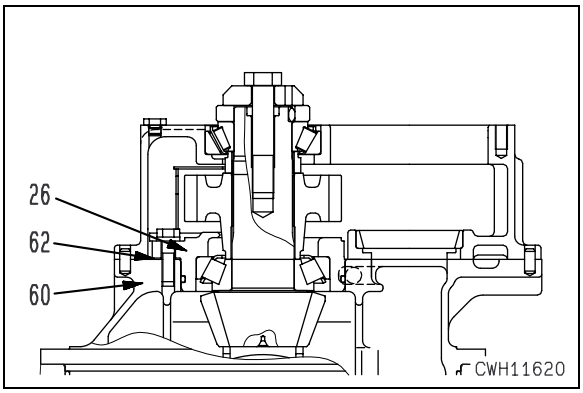


• When there is big backlash:
Loosen the adjusting nut on the right side of chassis and tighten the adjusting nut on the left side as much (shift the bevel gear in direction **B**).



2) Adjustment of tooth contact

• To shift the bevel pinion, increase or decrease the number of shims (62) between differential case (60) and cage (26).

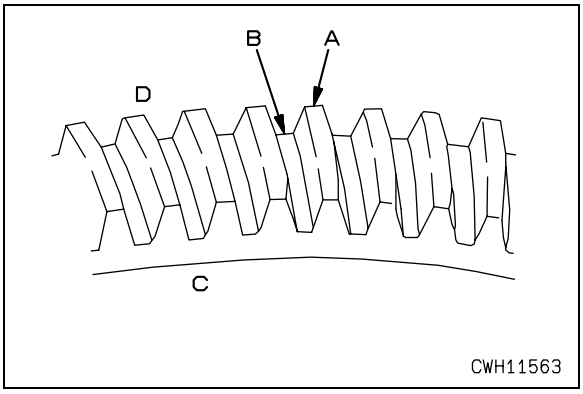


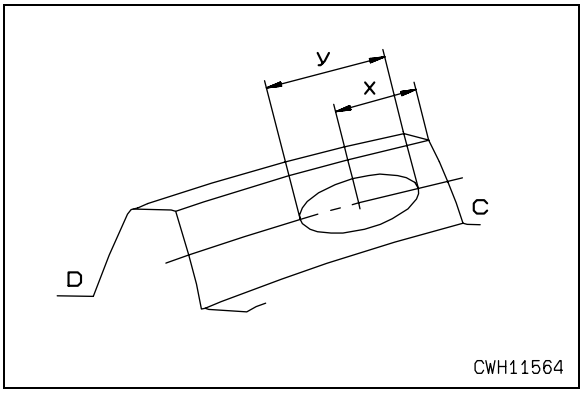
Inspection

i) Coat the tooth surface of bevel gear with minimum or red lead thinly, and check a tooth contact pattern on the bevel gear after moving the bevel gear back and forth.

ii) The center of tooth contact must come in the middle of tooth height. Moreover, it must be approx. 33% away from the small end along the tooth length (**x**), and the contact width must cover 45% to 55% of the tooth length (**y**). Meanwhile, make sure that there is no excessively strong tooth contact at any point of addendum **A**, dedendum **B**, small end **C** and big end **D**.

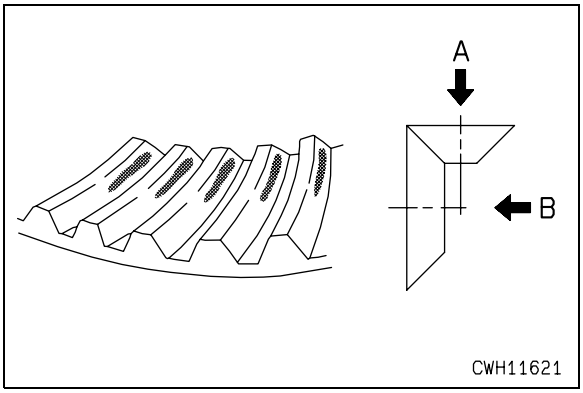
★ If the adjustment is made this way, right tooth contact is ensured, when load is applied.



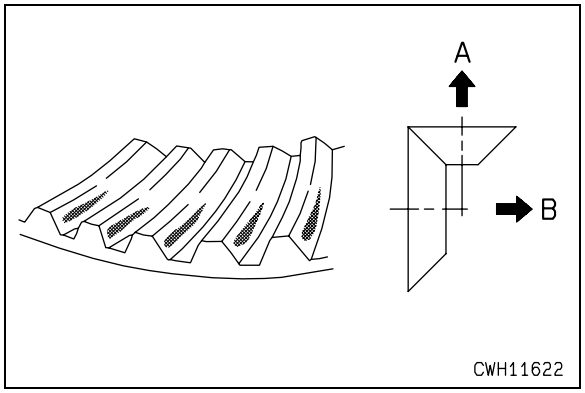


Adjustment

- If no right pattern of tooth contact is obtained as a result of inspection, make readjustment in the following manner.
  - ★ To shift the bevel gear, use the left and right adjusting nuts. In that case, if loosening the adjusting nut on one side, tighten the adjusting nut on the other as much, in order not to change the preload given to the bearing.
  - i) When the bevel pinion is too far away from the bevel gear centerline, a tooth contact pattern shows the contact of the small end tooth face of the bevel gear tooth face curved outward with the big end tooth face of the bevel gear tooth face curved inward.
  - Make adjustment in the following manner.
    Shift the bevel pinion in direction **A** by adjusting the shims on the bevel pinion side.
    In addition, shift the bevel gear in direction **B** and check the tooth contact pattern and backlash again.



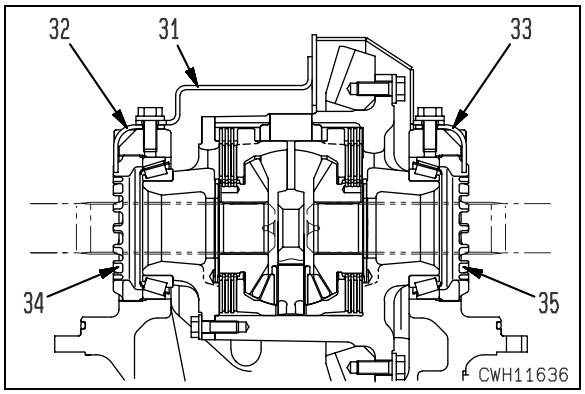
  - ii) When the bevel pinion is too close to the bevel gear centerline, a tooth contact pattern shows the contact of the big end tooth face of the bevel gear tooth face curved outward with the small end tooth face of the bevel gear tooth face curved inward.
  - Make adjustment in the following manner.
    Shift the bevel pinion in direction **A** by adjusting the shims on the bevel pinion side.
    In addition, shift the bevel gear in direction **B** and check the tooth contact pattern and backlash again.



3) After adjusting the tooth contact, tighten the bevel pinion cage mounting bolts.
   Mounting bolt
   : 157 – 196 Nm {16 – 20kgm}

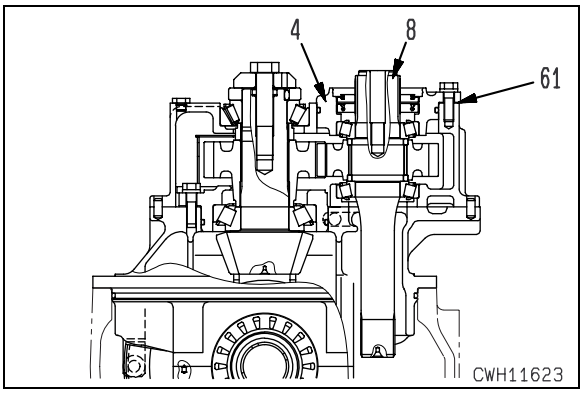
13. Lock and cover

Install locks (32) and (33) for the left and right adjusting nuts and cover (31).
Mounting bolt
: 157 – 196 Nm {16 – 20 kgm}



14. Transfer input shaft

1) Assemble transfer input shaft and gear assembly (8).
   - Input shaft spline (both sides)
     : Extreme-pressure grease containing molybdenum disulfide
2) Assemble shims (61) selected in the foregoing step 7, then install an O-ring and install input shaft cage assembly (4).
   - Mounting bolt
     : 157 – 196 Nm {16 – 20 kgm}

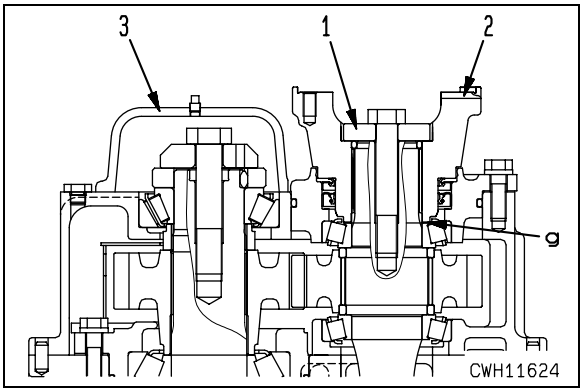


15. Cover

Install cover (3).
- Cover mating part
  : Gasket sealant (LT-515)
- Mounting bolt
  : 98 – 123 Nm {10 – 12.5 kgm}

16. Transfer input coupling and holder

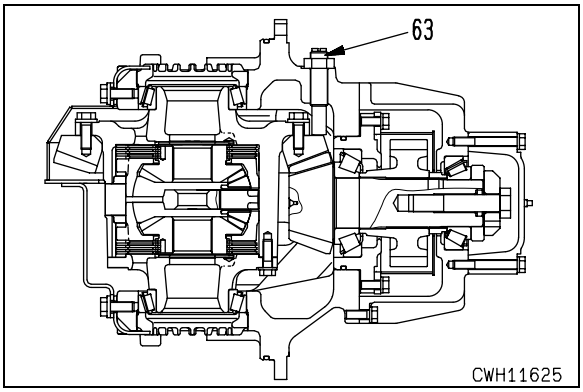
Install an O-ring and coupling (2), then install holder (1).
- Mating part g of bearing and coupling
  : Lubricant containing molybdenum disulfide (LM-P)
- Mounting bolt: **Liquid adhesive (LT-2)**
- Mounting bolt
  : 490 – 608 Nm {50 – 62 kgm}



17. Bevel gear fall-proof bolt

Install bevel gear fall-proof bolt (63).

★ Tighten the bolt until it touches the backside of bevel gear, then loosen by a 3/4 turn and fix with a lock nut.
- Mounting bolt: **Gasket sealant (LG-5)**
- Lock nut: **196 – 245 Nm {20 – 25 kgm}**



Removal and installation of rear differential assembly

Removal

⚠ **Turn the parking brake switch on and put wooden blocks behind the wheels.**

1. Remove the body assembly, referring to the section of "Removal and installation of body assembly".

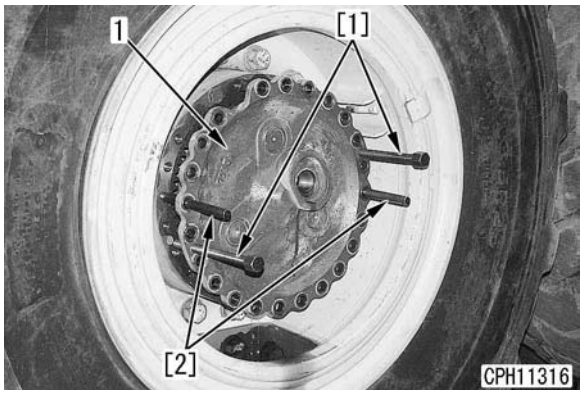
2. Drain oil from the rear differential case and rear final drive case.

Rear differential case: **25ℓ**

Rear final drive case: **5ℓ (one side)**

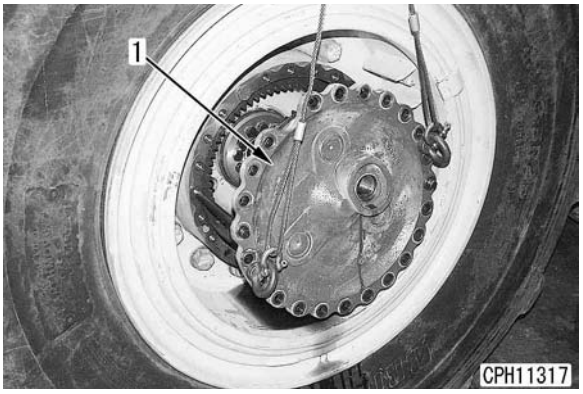
3. Remove the left and right drive shafts in the following manner.

1) Remove the mounting bolts of carrier assembly (1), and pull it out of the final drive assembly, using forcing screws [1] and guide bolts [2]. [*1]



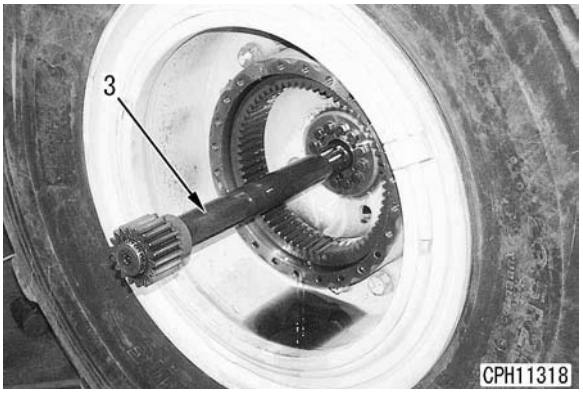
2) Sling carrier assembly (1) to remove. [*2]

Carrier assembly: **40 kg (one side)**

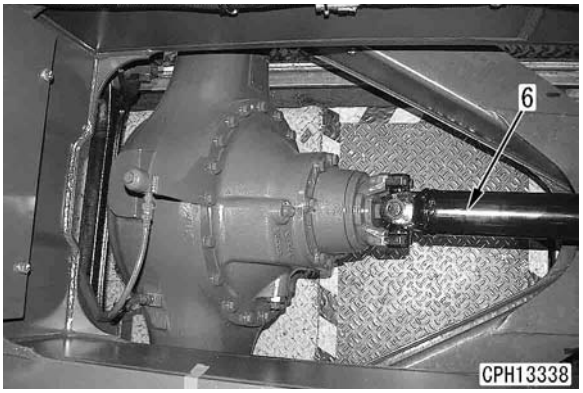


3) Sling sun gear and drive shaft assembly (3) to remove. [*3]

Sun gear and drive shaft assembly **: 25 kg (one side)**



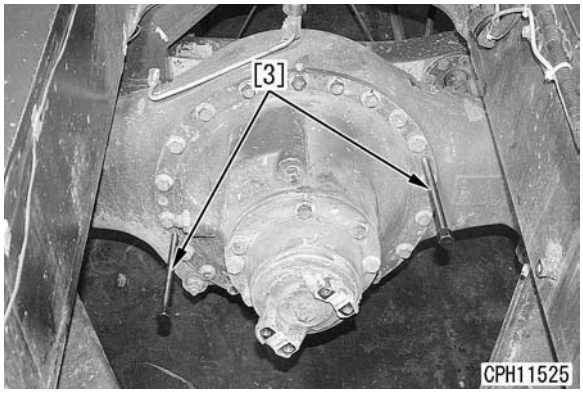
4. Sling drive shaft (6) between the center differential and rear differential temporarily and disconnect at the rear differential side. [*4]



5. Remove the rear differential assembly.

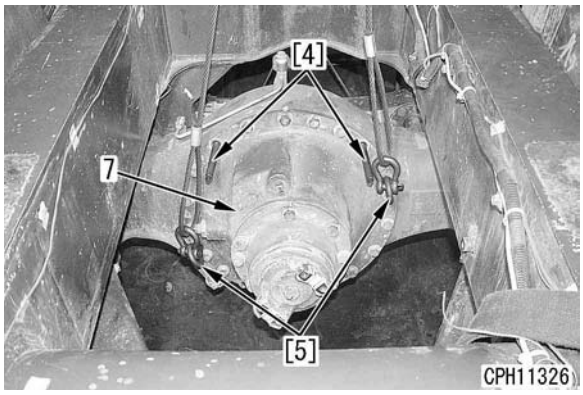
1) Remove the mounting bolts of rear differential assembly (7) and separate it from the axle case, using forcing screw bolts [3].

[*5]



2) Sling rear differential assembly (7) to remove, using eyebolts [5] and guide bolts [4].

Rear differential assembly: **200 kg**



Installation

- Installation is carried out in the reverse order to removal.

[*1] [*2] [*3]

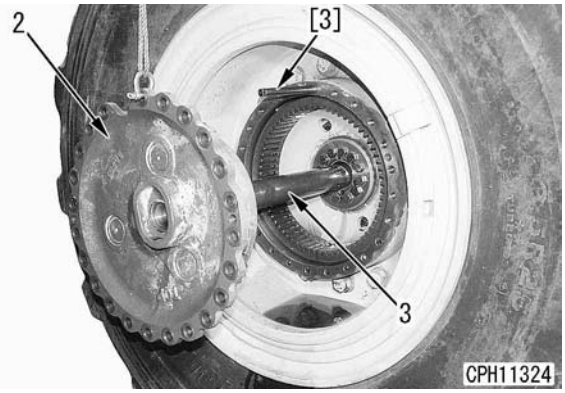
★ Install the carrier assembly in the following steps.

1) Insert the carrier assembly into the center axle assembly up to the middle point of sun gear and drive shaft assembly (3).
2) Assemble the sun gear portion of sun gear and drive shaft assembly (3) in lifted carrier assembly (2).
3) Push the carrier assembly in along guide bolts [3], matching the ring gear of the final drive assembly with the planetary gear of the carrier assembly.

Carrier assembly mounting bolt

: 157 – 196 Nm {16 – 20 kgm}

[Target value: 177 Nm {18 kgm}]



[*4]

★ Install after confirming that the yoke of drive shaft between the hitch frame and center differential is shifted from the yoke of drive shaft between center differential and rear differential by 45° ± 6°.

★ When installing the drive shafts, tighten the mounting bolts only after confirming that convex section on the spider cap completely engages with groove of the counter yoke.

Mounting bolt

: Liquid adhesive compound (LT-2)

Mounting bolt for drive shaft between center differential and rear differential

: 98 – 123 Nm {10 – 12.5 kgm}

[Target value: 113 Nm {11.5 kgm}]

[*5]

Rear differential mounting bolt
: 157 – 196 Nm {16 – 20 kgm}
[Target value: 177 Nm {18 kgm}]

- **Refilling with oil (rear differential case and rear final drive case)**
  Refill with oil through the oil filler port of rear differential case and through oil filler ports of the left and right rear final drives up to the specified level.
  Center differential case
  : 25ℓ Axle oil (AXO80)
  Center final drive case
  : 5ℓ (one side) Axle oil (AXO80)

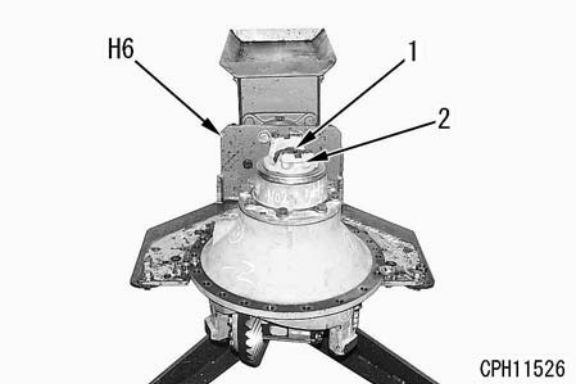
Disassembly and assembly of rear differential assembly

Special tools

Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
H	6	790-501-5000	Unit repair stand (AC100V)	■	1		
		790-501-5200	Unit repair stand (AC110V and AC220V)	■	1		
		790-901-2110	Bracket	■	1		
		792T-222-1210	Plate	■	1		○
	7	792-103-0901	Wrench	■	1		
	10	792T-223-1110	Push tool	■	1		○

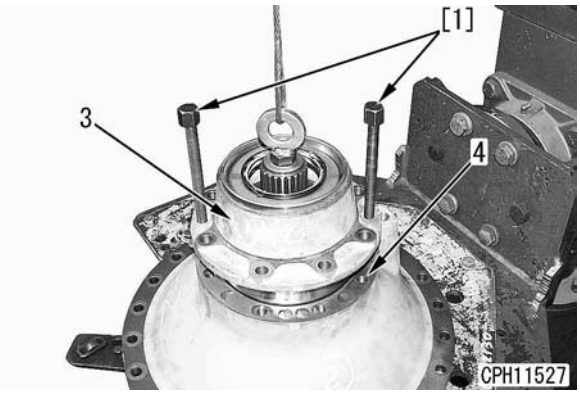
Disassembly

1. **Setting rear differential assembly to tool H6**
   Set the rear differential assembly to tool **H6**.
2. **Input coupling and holder**
   Remove holder (1) and then remove coupling (2).

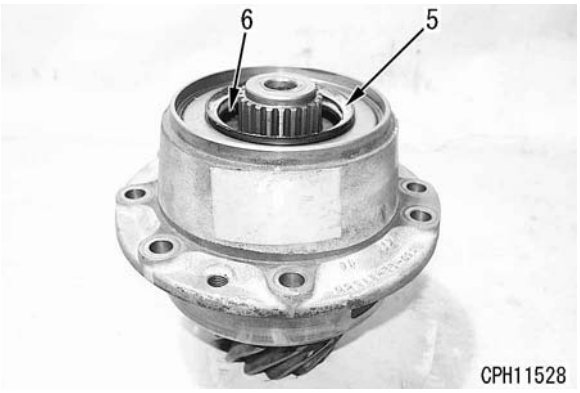


3. Pinion and cage assembly

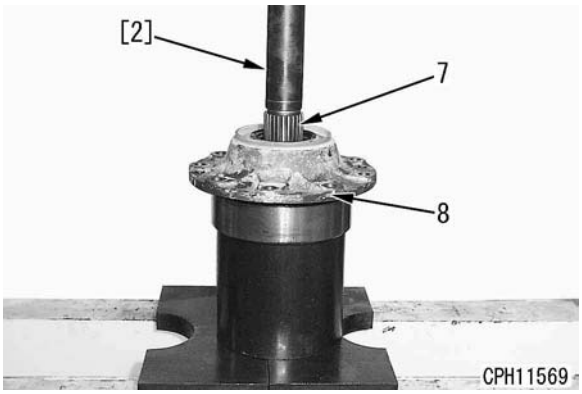
1) Remove pinion and cage assembly (3), using forcing screws [1].
   ★ Shims (4) are provided, so check their thickness, number in use and installed location beforehand.



2) Remove side seal (5) and oil seal (6) from the pinion and cage assembly.

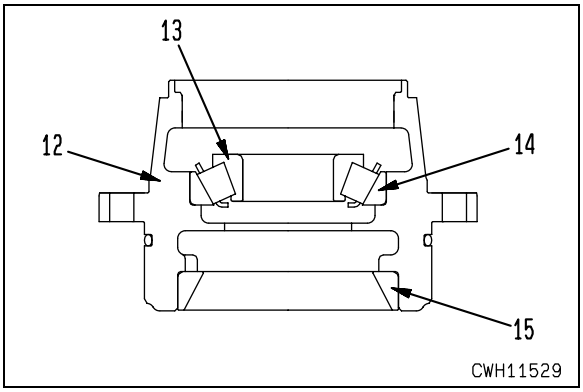


3) Remove pinion assembly (7) from cage assembly (8), using push tool [2].



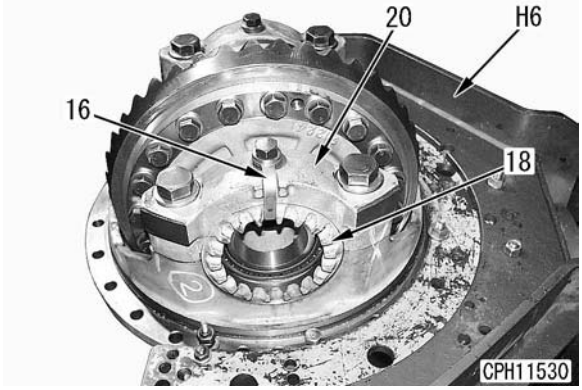
4) Further disassembly of pinion assembly
Remove spacer (10) and bearing (11) from pinion (9).

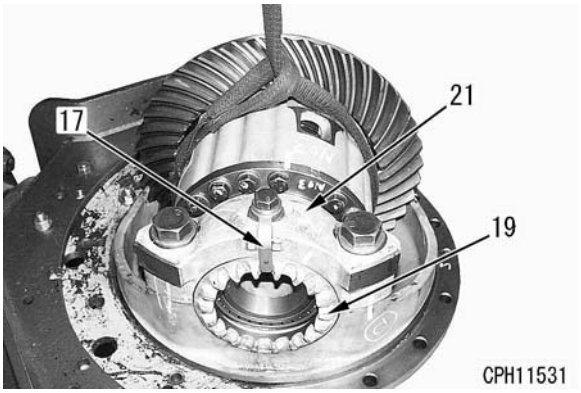
5) Further disassembly of cage assembly
Remove bearing (13) and bearing outer races (14) and (15) from cage (12).
   ★ Bearing (13) has already been removed in the step 3).



4. Removal of differential gear assembly

1) Reverse tool **H6**.
2) Remove locks (16) and (17) together with the cover.
3) Loosen adjusting nuts (18) and (19), using tool **H7**, until they can be turned manually.
4) Sling the differential gear assembly and remove bearing caps (20) and (21) as well as adjusting nuts (18) and (19).

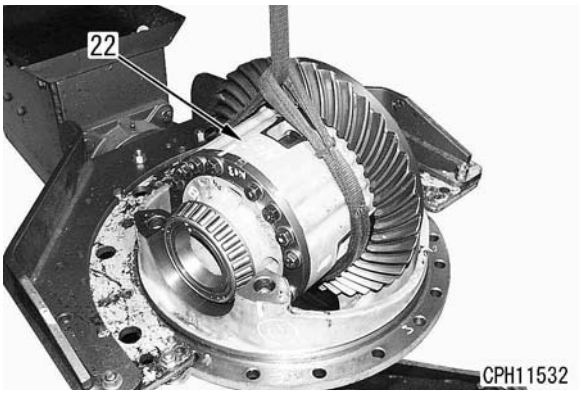




5) Sling differential gear assembly (22) to remove.

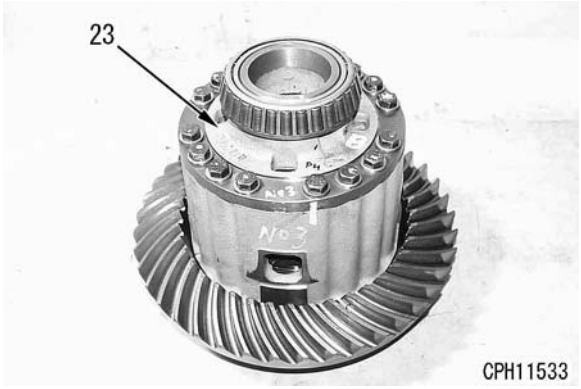
Differential gear assembly: **80 kg**

★ Be careful not to let fall the bearing outer race.

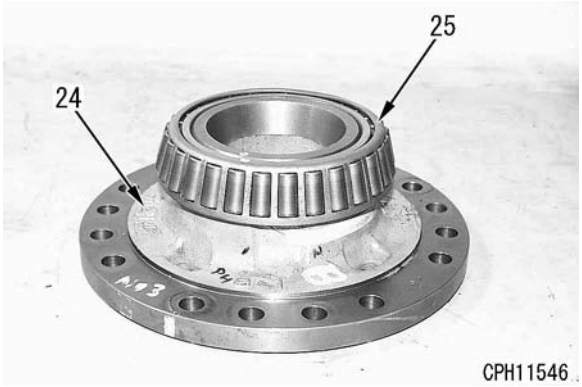


5. Further disassembly of differential gear assembly

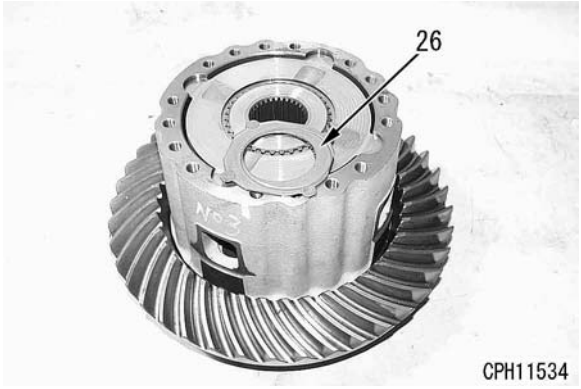
1) Remove case and bearing assembly (23).



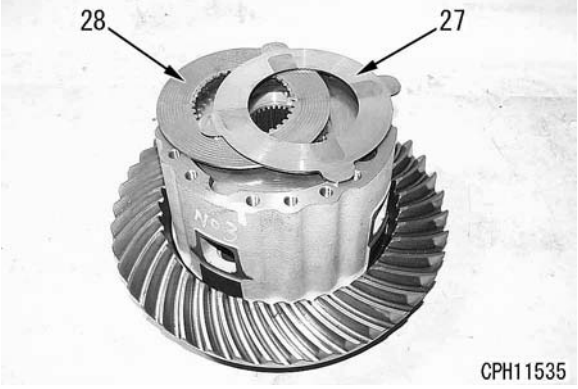
2) Remove bearing (25) from case (24).



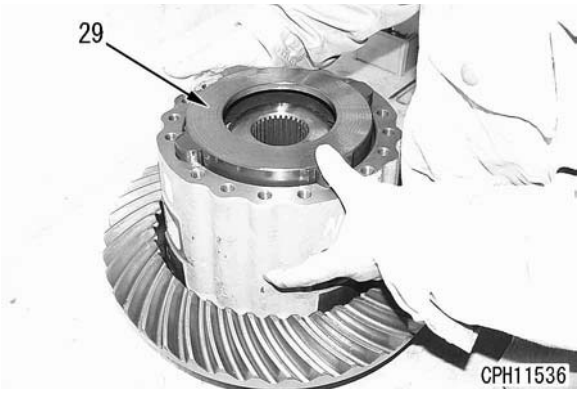
3) Remove washer (26).



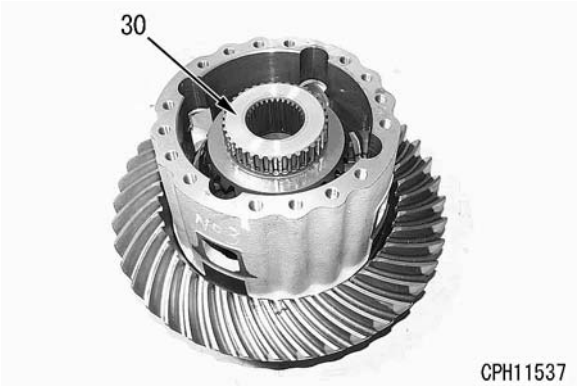
4) Remove 3 plates (27) and 2 discs (28).



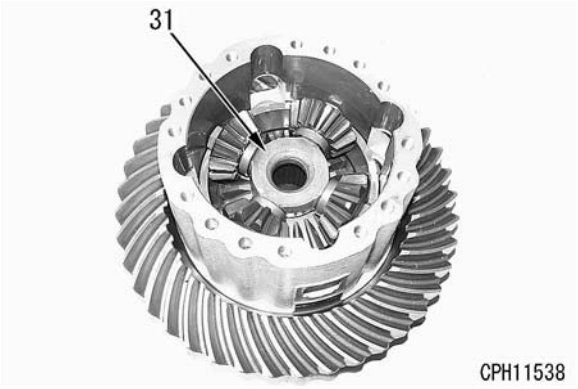
5) Remove pressure ring (29).
   ★ Put your fingers in the side hole and raise the ring.



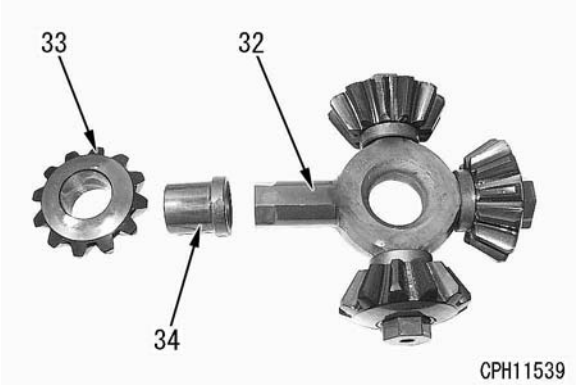
6) Remove differential side gear (30).



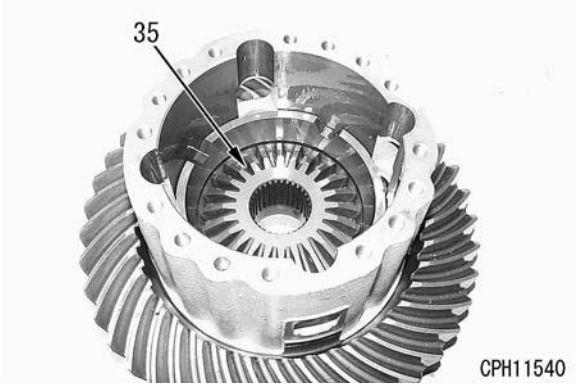
7) Remove pinion gear assembly (31) in one piece.



8) Remove pinion gears (33) and bushings (34) 4 for each from shaft (32).

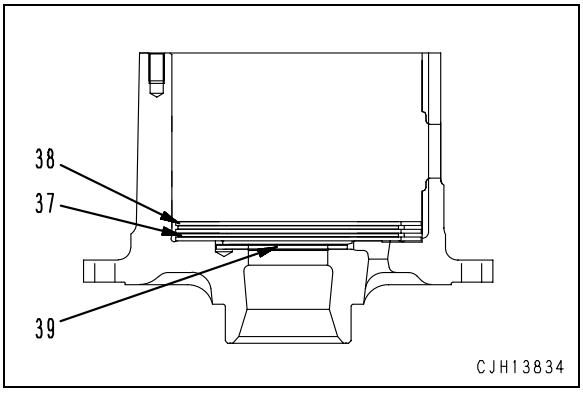


9) Remove differential side gear (35).

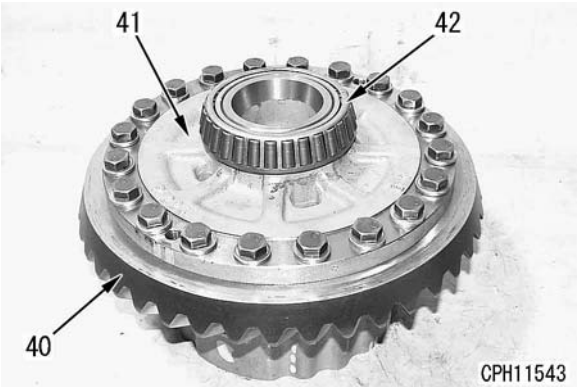


10) Remove pressure ring (36).

11) Remove 3 plates (38) and 2 discs (37).
12) Remove washer (39).



13) Reverse the case and bevel gear assembly.
14) Remove bevel gear (40) from case (41).
★ Before removing, put a counter mark both on the bevel gear and on the case.
15) Remove bearing (42).



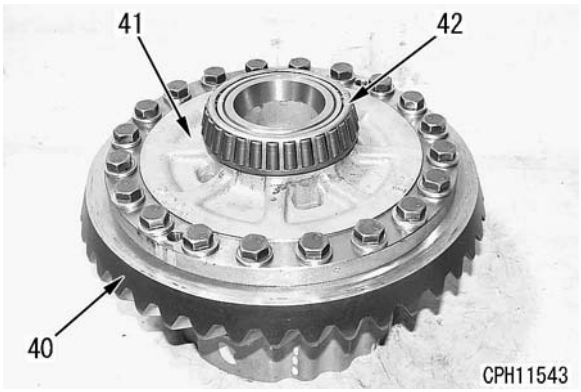
Assembly

★ Clean each of the parts and check that it is free of any dust and damage. Coat the sliding surfaces with **axle oil (AXO80)** before assembling.

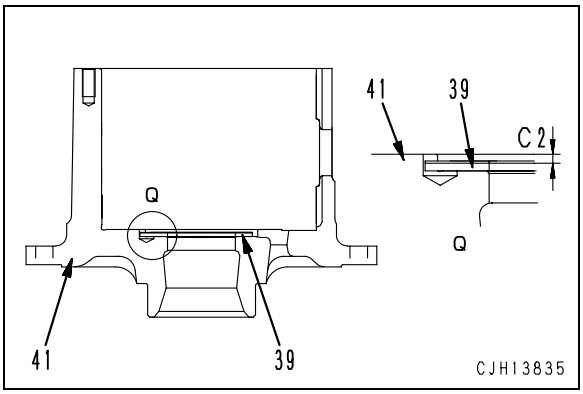
1. Subassembly of differential gear assembly

1) Shrink-fit bearing (42) to case (41).
• Bearing shrink-fit temperature
: For 30 minutes at 120°C
★ After installing, drip **axle oil (AXO80)** on the bearing.

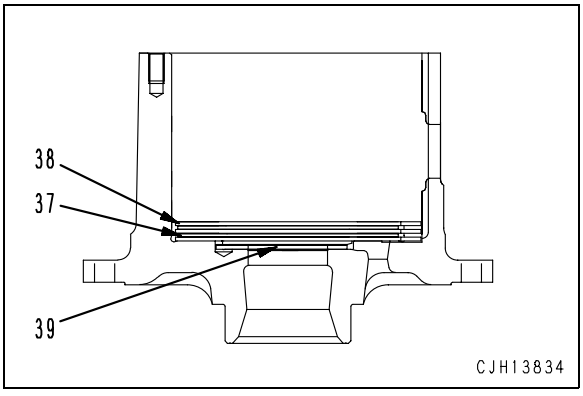
2) Install bevel gear (40) to case (41).
★ Install matching the counter marks which were put at the time of disassembling.
Mounting bolt
: Liquid adhesive (LT-2)
Mounting bolt
: 157 – 196 Nm {16 – 20 kgm}



3) Reverse the case and bevel gear case assembly.
4) Put washer (39) in the case (41).
   ★ Direct the lined face toward the gear.
5) Using the depth gauge, measure level difference **C2** between case (41) and washer (39) at 4 places equally spaced on the periphery.
   • Value **C2** on drawing = **6.05 – 6.15 mm**
   Record the values measured at the 4 places in the check sheet and obtain an average.
   Average of level difference **C2** = Total of values measured at 4 places / 4

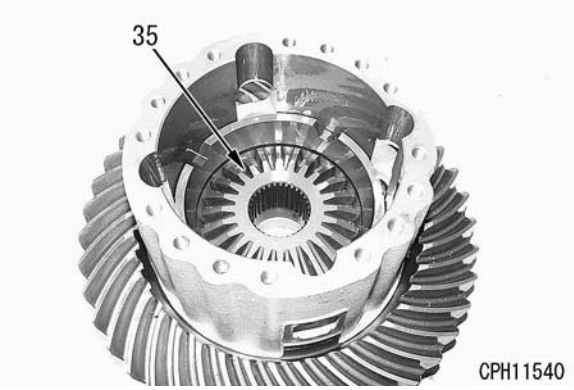


6) Assemble 3 plates (38) and 2 discs (37).
   ★ Immerse the discs and plates in the following oil before installing.
   Disc and plate: **Axle oil (AXO80)**
   ★ Align the 4 toothless position of the discs.

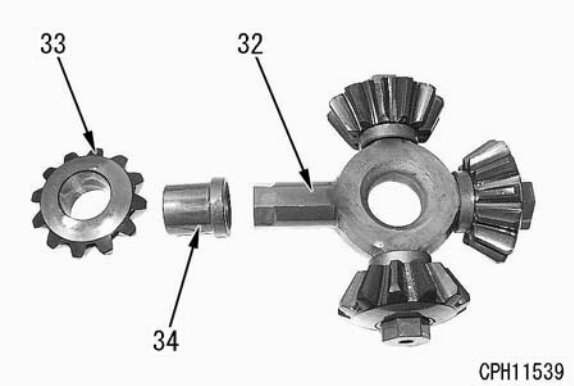


7) Install pressure ring (36) to the case.

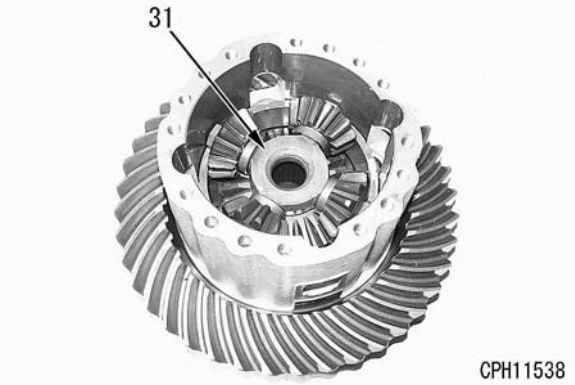
8) Install differential side gear (35).



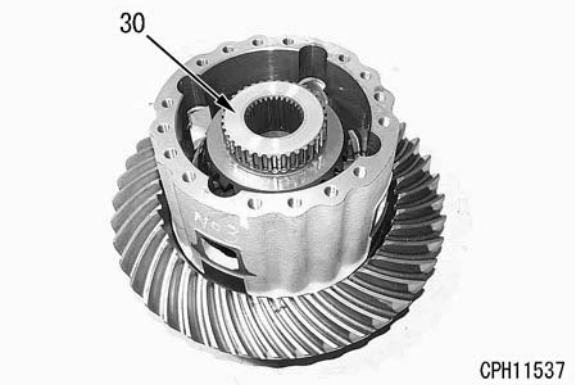
9) Install bushings (34) and pinion gears (33) 4 for each to shaft (32).



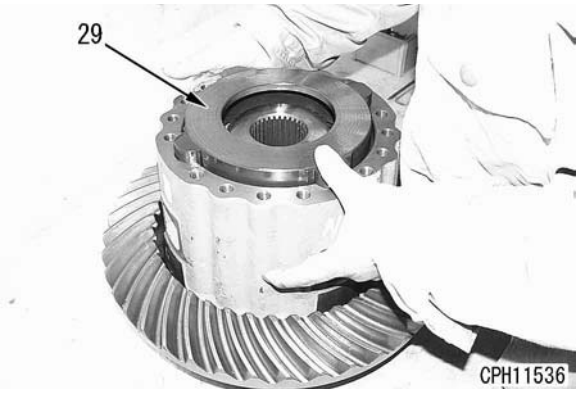
10) Install pinion gear assembly (31) in one piece.



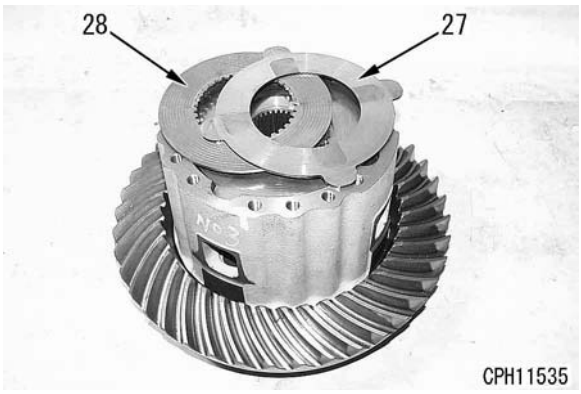
11) Install differential gear (30).



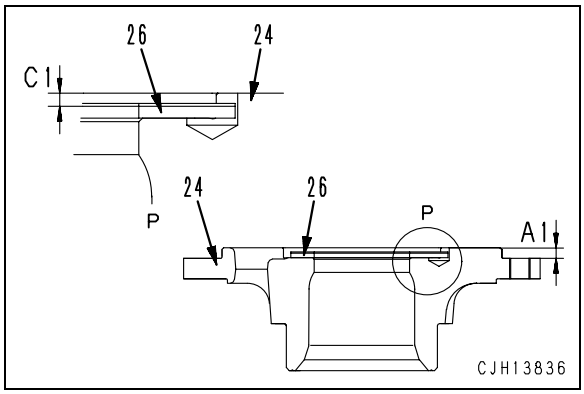
12) Install pressure ring (29).



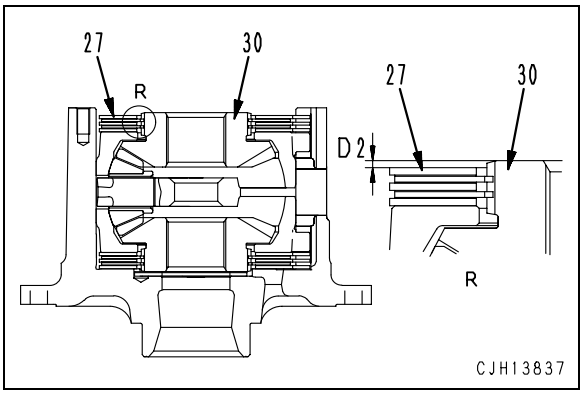
13) Assemble 3 plates (27) and 2 discs (28).
★ Immerse the discs and plates in the following oil before installing.
Disc and plate: **Axle oil (AXO80)**



14) Adjustment of clearance.
i) Using the depth gauge, measure level difference **A1** of case (24) at 4 places equally spaced on the periphery. Record the values measured at the 4 places in the check sheet and obtain an average.
Average of level difference **A1** = Total of values measured at 4 places / 4
ii) Set washer (26) on case (24).
★ Direct the lined face toward the gear.
iii) Using the depth gauge, measure level difference **C1** between case (24) and washer (26) at 4 places equally spaced on the periphery.
Record the values measured at the 4 places in the check sheet and obtain an average.
Average of level difference **C1** = Total of values measured at 4 places / 4



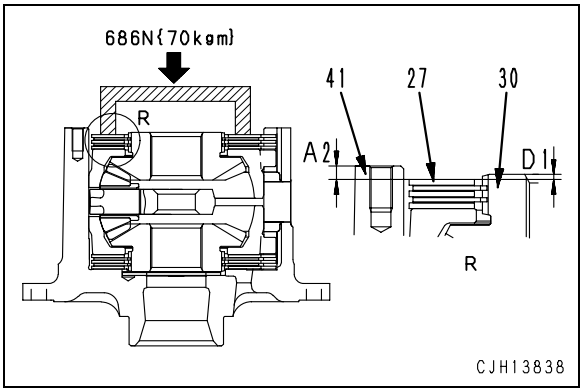
iv) Using the depth gauge, measure level difference **D2** between gear (30) and plate (27) at 4 places equally spaced on the periphery.
Record the values measured at the 4 places in the check sheet and obtain an average.
Average of level difference **D2** = Total of values measured at 4 places / 4



v) While pressing the disc and plate with a force of **686 N {70 kg}**, perform steps vi) and vii).

vi) Using the depth gauge, measure level difference **A2** between case (41) and plate (27) at 4 places equally spaced on the periphery. Record the values measured at the 4 places in the check sheet and obtain an average.
Average of level difference **A2** = Total of values measured at 4 places / 4

vii) Using the depth gauge, measure level difference **D1** between gear (30) and plate (27) at 4 places equally spaced on the periphery. Record the values measured at the 4 places in the check sheet and obtain an average.
Average of level difference **D1** = Total of values measured at 4 places / 4



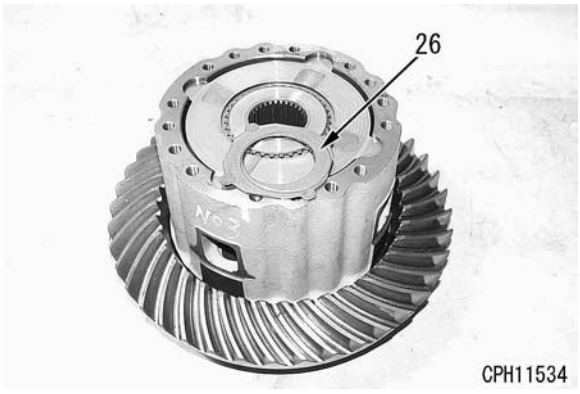
viii) Calculation method for clearance **A** between disc and plate.
Clearance **A** = Clearance **A2** – Clearance **A1**
★ Check that clearance **A** is **0.2 – 0.75 mm**.

ix) If clearance **A** is out of the above range, replace plate (27) and measure dimension **A2** again until a proper clearance is obtained.
★ The total thicknesses of the 3 plates on the right and left sides must be the same.
• Thicknesses of plates (27):
3.1 mm, 3.2 mm

x) Calculation method for side gear clearances **B1** and **B2** in axial direction
Clearance **B1** = Clearance **C1** – Clearance **D1** + (Clearance **A** / 2)
Clearance **B2** = Clearance **C2** – Clearance **D2** + (Clearance **A** / 2)
★ Use the clearance obtained in viii) as clearance **A**.
★ Check that both clearances **B1** and **B2** are **0.15 – 0.35 mm**.

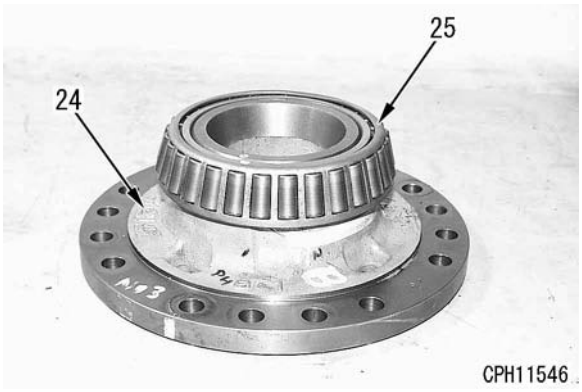
xi) If either or both of clearances **B1** and **B2** are out of the above range, replace washers (26) and (39) and measure dimensions **C1** and **C2** again until proper clearances are obtained.
• Thicknesses of washers:
4.0 mm, 4.1 mm

15) Install washer (26).
★ Direct the lined face toward the gear.

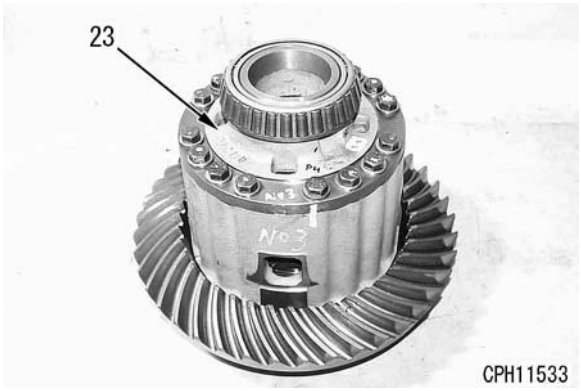


16) Shrink-fit bearing (25) to case (24).
- Bearing shrink-fit temperature
  : For 30 minutes at 120°C

★ Drip **axle oil (AXO80)** on the bearing after installing.



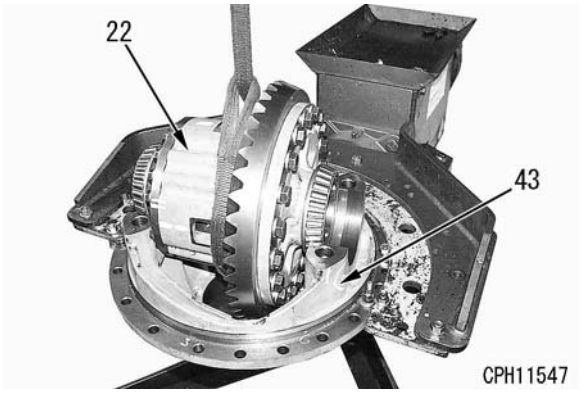
17) Install case and bearing assembly (23).
Mounting bolt
: 98 – 123 Nm {10.0 – 12.5 kgm}



2. Installation of differential gear assembly

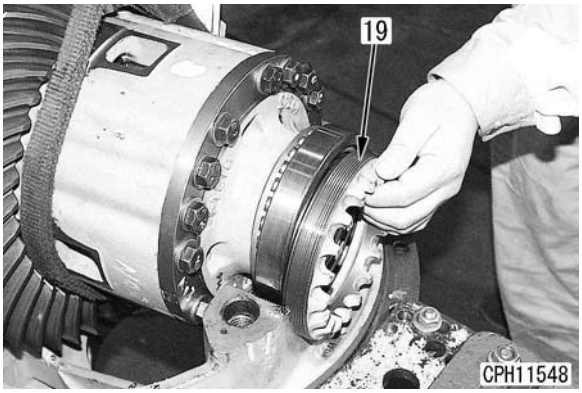
1) Sling differential gear assembly (22) on the installing position of differential case (43).

★ Do not fix it to the differential case yet.



2) Install an outer race to the bearing and tighten adjusting nut (19) to the differential case temporarily.

★ Install an outer race and tighten the adjusting nut in the same manner on the other side, too.

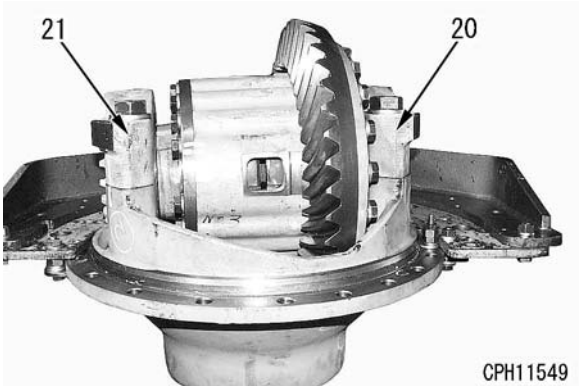


3) Install bearing caps (21) and (20), and tighten the mounting bolts.

★ Install the caps in the same manner on the other side, too.

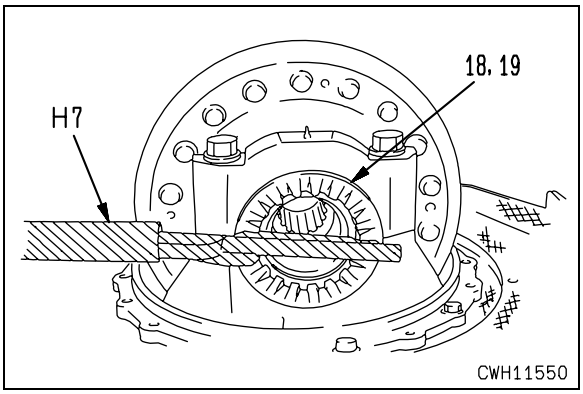
Mounting bolt
: Liquid adhesive (LT-2)

Mounting bolt
: 824 – 1,030 Nm {84 – 105 kgm}

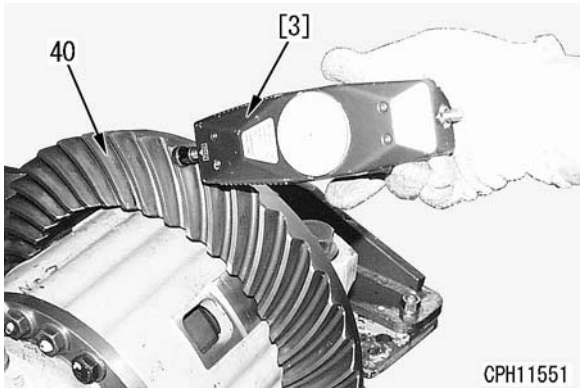


3. Adjustment of bearing pre-load

1) Tighten adjusting nuts (19) and (18), using tool **H7**.
   - ★ Drip an ample amount of **axle oil (AXO80)** on the bearing.
   - ★ Rap the bevel gear with a copper hammer, while rotating the bearing, so that the bearing can have a good contact with other parts.

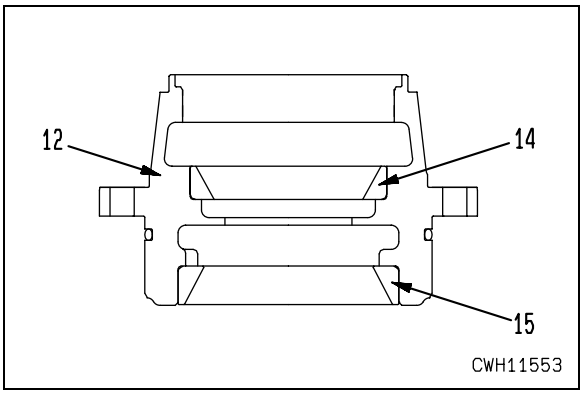


2) Measure start torque in the tangential direction at the peripheral addendums of bevel gear (40), using push-pull scale [3].
   - Standard value for start torque
     : 7.2 – 19.6 N {0.73 – 2.0 kg}
   - ★ If the measured start torque is lower than the standard value, tighten the adjusting nut. If it is higher than the standard value, loosen the adjusting nut.
   - ★ When tightening the adjusting nut on one side, loosen the adjusting nut on the opposite side as much.

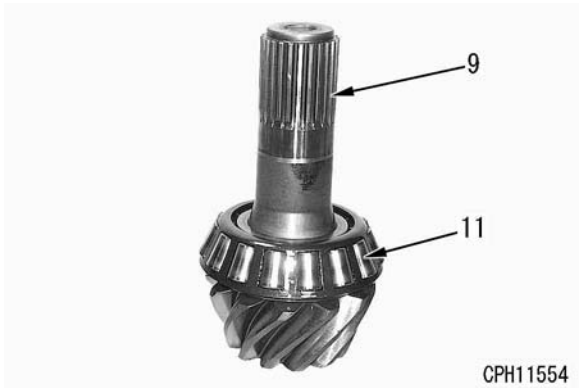


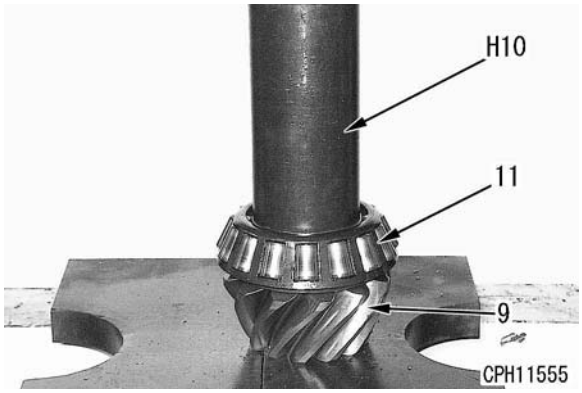
4. Subassembly of bevel pinion and cage assembly

1) Subassembly of cage assembly
   Install outer races (15) and (14) to cage (12).



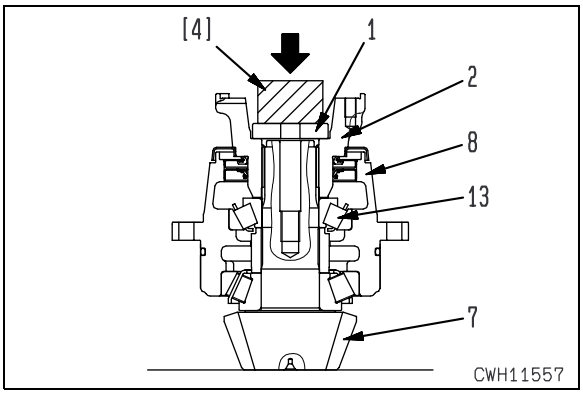
2) Subassembly of bevel pinion assembly
   Install bearing (11) to bevel pinion (9).
   - ★ When installing the bearing, either shrink-fit or press-fit it using push tool **H10**.



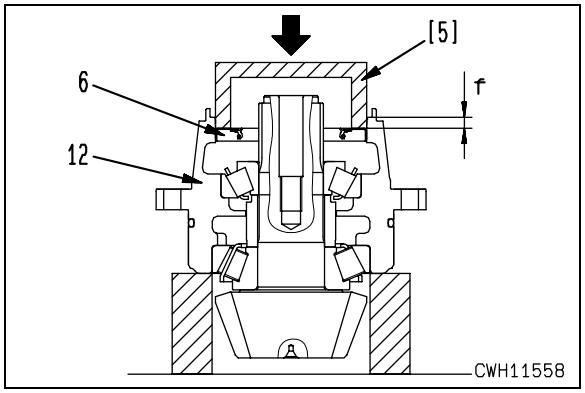


3) Install spacer (10) to bevel pinion (9).

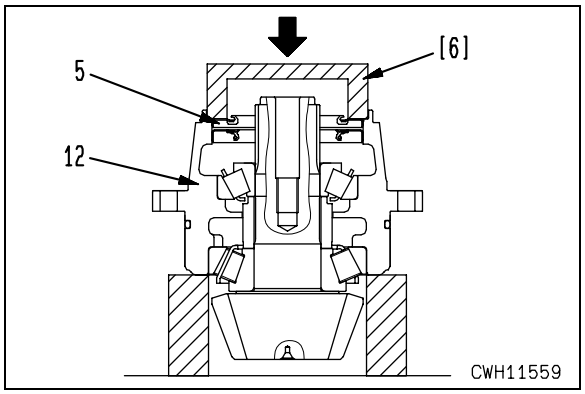
4) Mount cage assembly (8) on bevel pinion assembly (7).
5) Assemble bearing (13) in.
6) Press-fit bearing (13), while turning case assembly (8), using coupling (2), holder (1) and push tool [4].
   ★ Drip **axle oil (AXO80)** on bearing (13).
   ★ Remove holder (1) and coupling (2) after press-fitting.



7) Press-fit oil seal (6), using tool [5].
   ★ Keep press-fitting until distance "**f**" between the peripheral surface of oil seal and the end surface of cage (12) is 10 ± 0.5 mm.
   Oil seal peripheral surface
   : Seal end 242 or equivalent
   Oil seal lip face and inside of oil seal (100% full): **Grease (G2-LI)**



8) Press-fit side seal (5), using tool [6].
   ★ Press-fit so that the peripheral surface of the side seal is flush with the end surface of cage (12).
   Side seal peripheral surface
   : Seal end 242 or equivalent
   Side seal lip face and inside of side seal (100% full)**: Grease (G2-LI)**



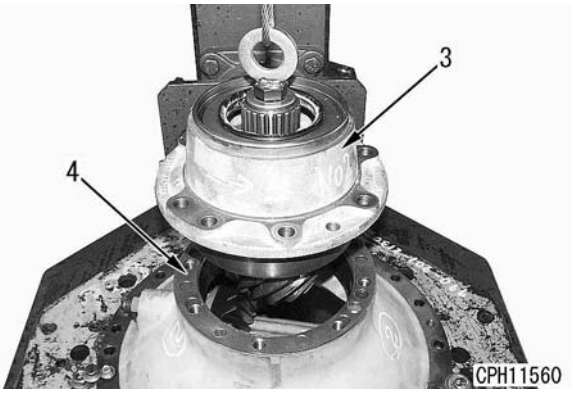
5. Installation of bevel pinion and cage assembly

Assemble shims (4) whose thickness, number in use and installed location were confirmed at the time of disassembling, then sling bevel pinion and cage assembly (3) to install.

- Kind of shim thickness
  : 0.15 mm, 0.2 mm, 0.3 mm and 0.8 mm

Mounting bolt
: 157 – 196 Nm {16 – 20 kgm}

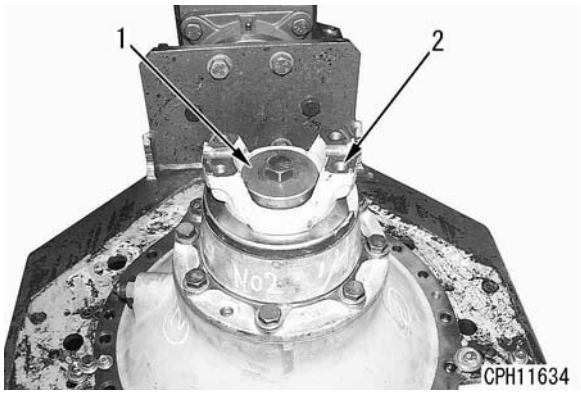
★ Determine the thickness and number of shims to be used after carrying out the following "Adjustment of tooth contact and backlash".



6. Input coupling and holder

Remove coupling (2) and holder (1) with the O-ring.

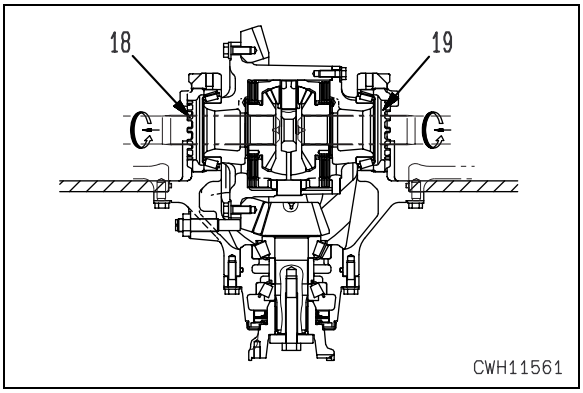
Mounting bolt: **Liquid adhesive (LT-2)**
Mounting bolt
: 490 – 608 Nm {50 – 62 kgm}



7. Adjustment of tooth contact and backlash

- Adjust the backlash and also the tooth contact at the same time.

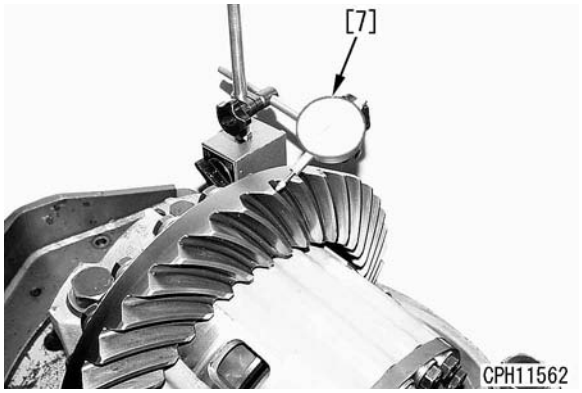
1) Adjustment of backlash
   i) When shifting the bevel gear, do so with adjusting nuts (18) and (19). In that case, if tightening the adjusting-nut on one side, loosen the adjusting-nut on the opposite side as much in order not to change the preload given on the bearing.



   ii) Apply the probe of dial gauge [7] perpendicularly to the addendums of bevel gear.
   iii) Read out the dial when moving the bevel gear back and forth (in the direction of rotation), while fixing the bevel pinion.

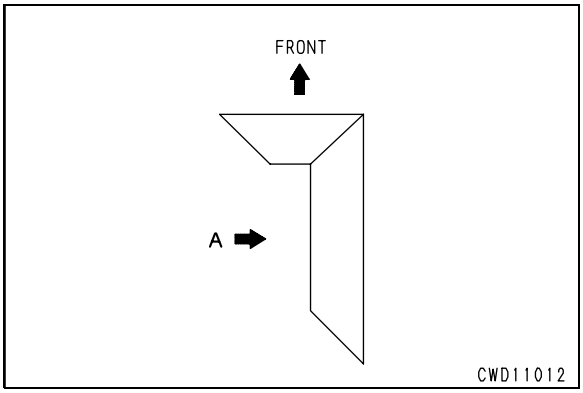
- Standard value for backlash:
  In the circumferential direction of the gear**: 0.36 – 0.55 mm**
  In the perpendicular direction of the gear**: 0.25 – 0.38 mm**

★ Make this adjustment at 3 points and keep fluctuation of the measured backlash values less than 0.1 mm.

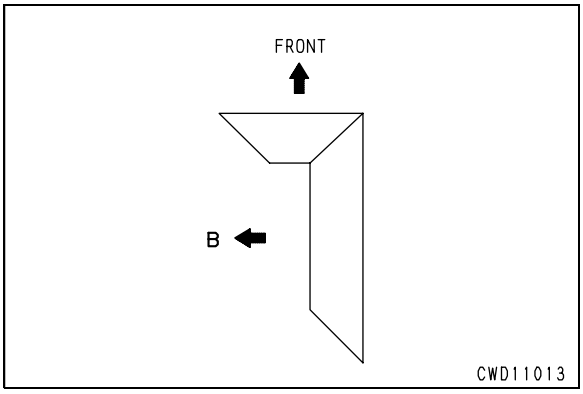


iv) If the measured backlash is found to fall out of the standard value as a result of the measurement, make adjustment in the following manner.

- When there is small backlash:
  Loosen the adjusting nut on the right side of chassis and tighten the adjusting nut on the left side as much shift (i.e. shifting the bevel gear in direction **A**).

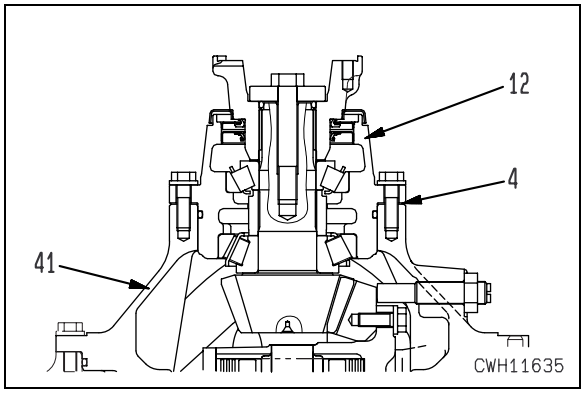


- When there are big backlash:
  Loosen the adjusting nut on the left side of chassis and tighten the adjusting nut on the right side as much (i.e. shifting the bevel gear in direction **B**).



2) Adjustment of tooth contact

- Adjust the tooth contact of bevel pinion by either increasing or decreasing the number of shims (4) between differential case (41) and cage (12).

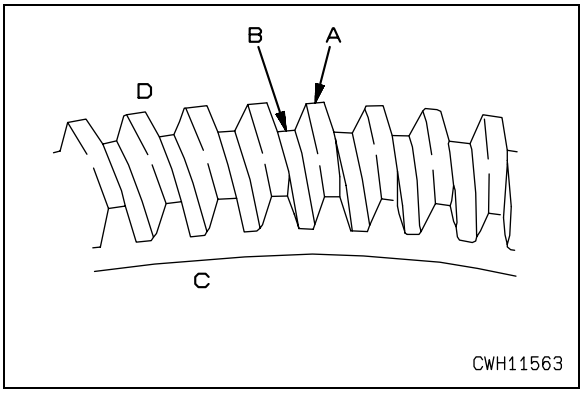


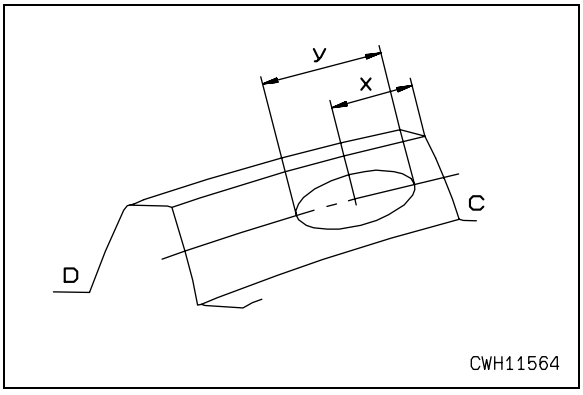
Inspection

i) Coat the tooth surface of bevel gear with minimum or red lead thinly, and check a tooth contact pattern on the bevel gear after moving the bevel gear back and forth.

ii) The center of tooth contact must come in the middle of tooth height. Moreover, it must be approx. 33% away from the small end along the tooth length (**x**), and the contact width must cover 45% to 55% of the tooth length (**y**). Meanwhile, make sure that there is no excessively strong tooth contact at any point of addendum **A**, dedendum **B**, small end **C** and big end **D**.

★ If the adjustment is made this way, right tooth contact is ensured, when load is applied.



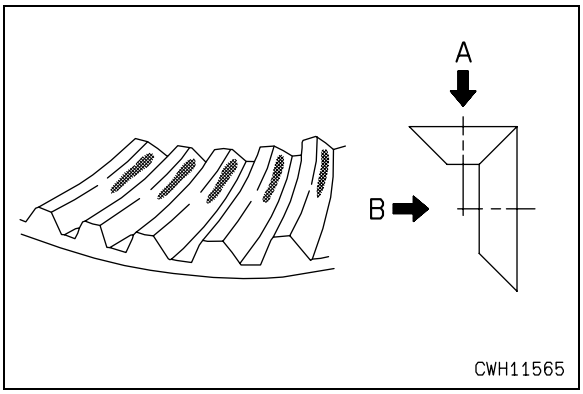


Adjustment

• If no right pattern of tooth contact is obtained as a result of the inspection, make readjustment in the following manner.

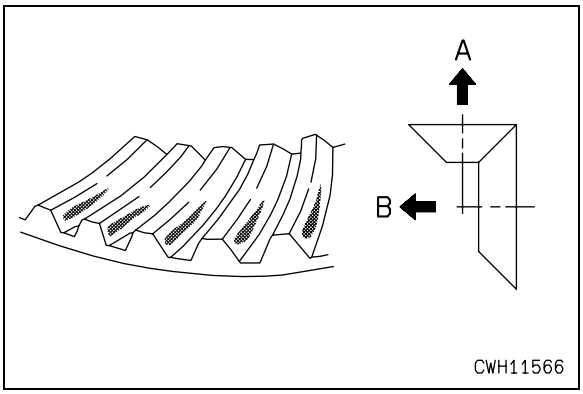
i) When the bevel pinion is too far away from the bevel gear centerline, a tooth contact pattern shows the contact of the small end tooth face of the bevel gear tooth face curved outward with the big end tooth face of the bevel gear tooth face curved inward.

• Make adjustment in the following manner.
Shift the bevel pinion in direction **A** by adjusting the shims on the bevel pinion side.
In addition, shift the bevel gear in direction **B** and check the tooth contact pattern and backlash again.



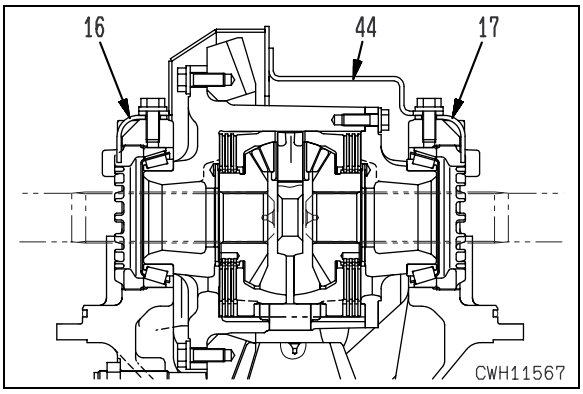
ii) When the bevel pinion is too close to the bevel gear centerline, a tooth contact pattern shows the contact of the big end tooth face of the bevel gear tooth face curved outward with the small end tooth face of the bevel gear tooth face curved inward.

• Make adjustment in the following manner.
Shift the bevel pinion in direction **A** by adjusting the shims on the bevel pinion side.
In addition, shift the bevel gear in direction **B** and check the tooth contact pattern and backlash again.

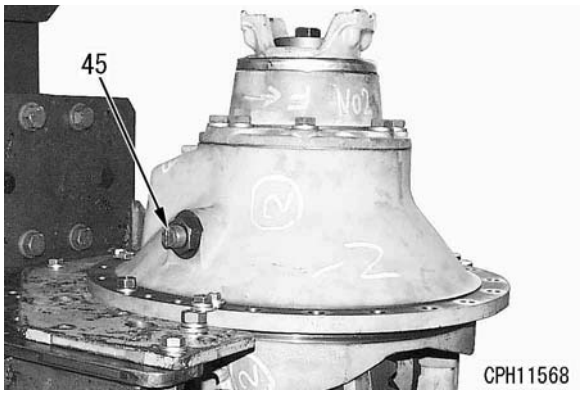


3) After adjusting the tooth contact, tighten the bevel pinion cage mounting bolts.
   Bevel pinion cage mounting bolts
   : 157 – 196 Nm {16 – 20kgm}

8. Lock and cover
Install adjusting nut locks (17) and (16) as well as cover (44).
Mounting bolt
: 157 – 196 Nm {16 – 20 kgm}



9. Bevel gear fall-proof bolt
Install bevel gear fall-proof bolt (45).
★ Tighten the bolt until it touches the backside of bevel gear, then loosen by a 3/4 turn and fasten with the lock nut.
Mounting bolt: **Gasket sealant (LG-5)**
Lock nut: **196 – 245 Nm {20 – 25 kgm}**



HM300-2 Articulated dump truck

Form No. SEN00689-02

ARTICULATED DUMP TRUCK

HM300-2

Machine model	Serial number
HM300-2	2001 and up

50 Disassembly and assembly

Power train, Part 4

Removal and installation of front final drive and brake assembly

Removal

⚠ **Turn the parking brake switch on and put wooden blocks behind the wheels.**

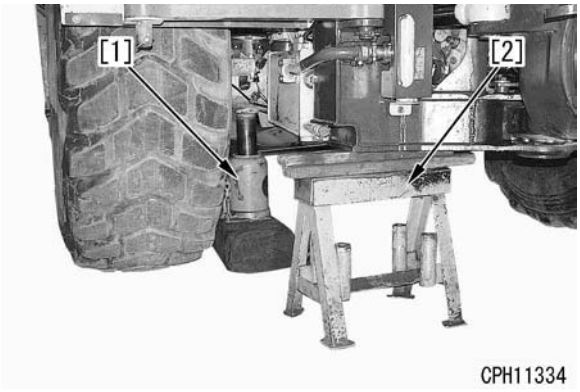
⚠ **Loosen the hydraulic oil filler cap to release the internal pressure of the hydraulic tank.**

1. Drain oil from the front final drive case.

Front final drive case: **4.5ℓ (one side)**

2. Remove the front wheels.

1) Push up the underside of front axle on the side of wheel to be removed, using hydraulic jacks [1].
2) Support the front axle underside with a pedestal (frame) [2].

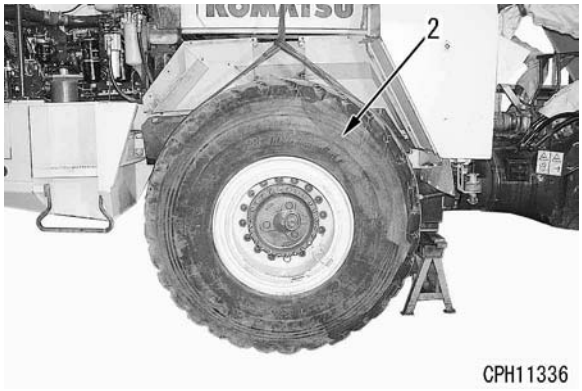


3) Sling left fender (1) to remove.

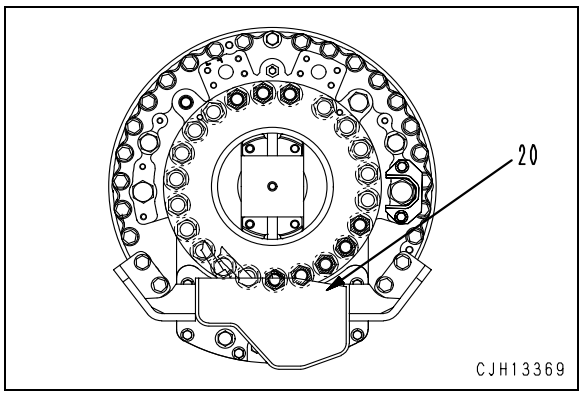
Left fender: **80 kg**

4) Sling front wheel (2) and remove the mounting bolts. [*1]

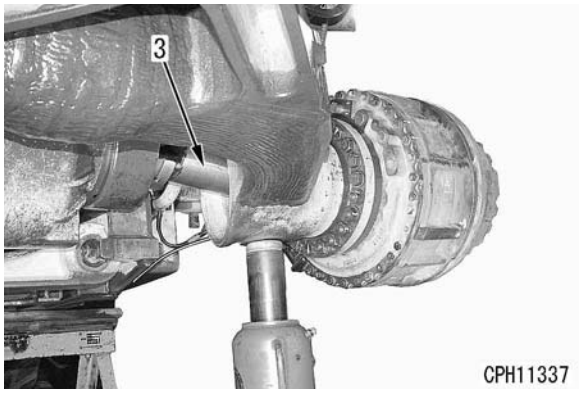
Front wheel: **550 kg (one side)**



3. Remove cover (20).



4. Disconnect drive shaft (3) at the front differential side. [*2]

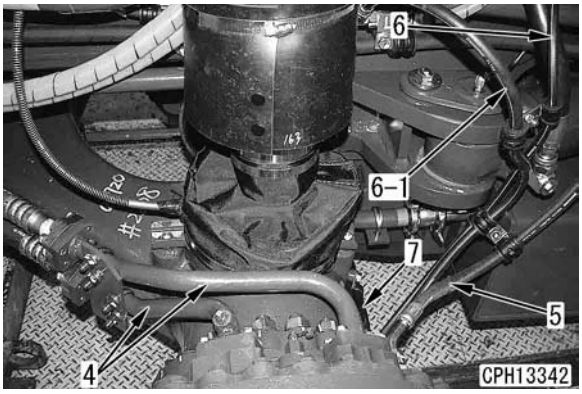


5. Remove brake cooling tube (4).

6. Disconnect breather hose (5).

7. Disconnect brake actuating hose (6) and drain hose (6-1).

8. Disconnect catch tank drain hose (7).



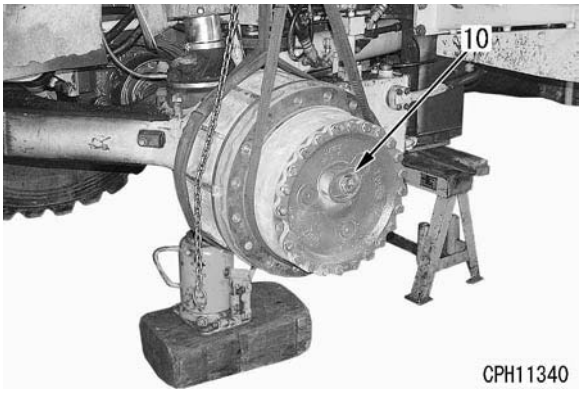
9. Disconnect wiring connectors (If equipped) (8).
- Right final drive: **B28**
- Left final drive: **B01**

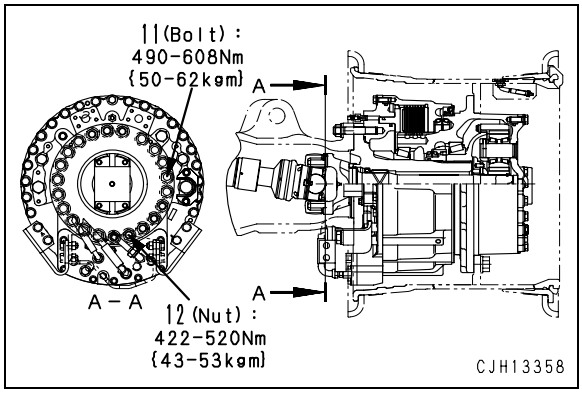
10. Remove brake wear sensor (If equipped) (9).

11. Sling final drive and brake assembly (10) temporarily, and remove the 14 mounting bolts (11) and 8 mounting nuts (12). [*3]

Front final drive and brake assembly (including drive shaft)

: 420 kg (one side)





Installation

- Installation is carried out in the reverse order to removal.

[*1]

Front wheel mounting bolt
: 824 – 1,030 Nm {84 – 105 kgm}
[Target value: 927 Nm {94.5 kgm}]

[*2]

★ When installing the drive shaft, check that the convex section on spider cap completely engages with groove of the counter yoke, and then tighten the mounting bolts.

Drive shaft mounting bolt
: Liquid adhesive (LT-2)

Drive shaft mounting bolt
: 98 – 123 Nm {10 – 12.5 kgm}
[Target value: 113 Nm {11.5 kgm}]

[*3]

Front final drive and brake assembly mounting bolt: **Liquid adhesive (LT-2)**

Front final drive and brake assembly mounting bolt
: 490 – 608 Nm {50 – 62 kgm}
[Target value: 549 Nm {56 kgm}]

Front final drive and brake assembly mounting nut
: 422 – 520 Nm {43 – 53 kgm}

- **Refilling with oil (front final drive case)**
  Refill with oil through the oil filler port of front final drive up to the specified level.

  Front final drive case
  : 4.5ℓ (one side) Axle oil (AXO80)

- **Air bleeding (brake)**
  After installing, bleed air from the brake circuit, referring to the section of "Bleeding air from brake circuit". in Testing and adjusting.

Disassembly and assembly of front final drive and brake assembly

Special tools

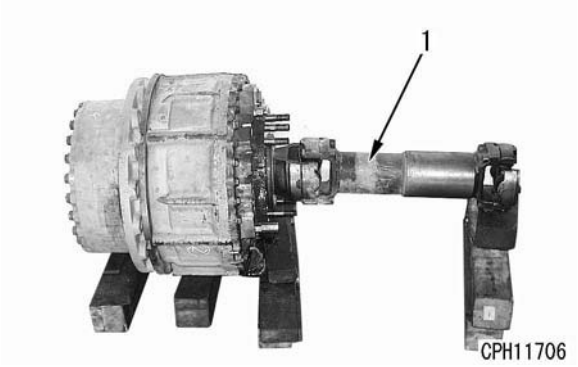
Sym-bol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
J	1	792T-227-1120	Fixture	■	3		○
		792T-223-1140	Plate	■	3		○
		01010-61240	Bolt	■	3		
		01643-31232	Washer	■	3		
		01580-01210	Nut	■	3		
		01010-61245	Bolt	■	3		
		01010-62440	Bolt	■	3		
	2	792T-222-1220	Push tool	■	1		○
	3	792T-227-1130	Push tool	■	1		○
		790-101-5221	Grip	■	1		
		01010-81225	Bolt	■	1		
	4	791-580-1520	Installer	■	1		
	5	791-580-1510	Installer	■	1		
	6	793T-622-1110	Push tool	■	1		○
		790-101-5421	Grip	■	1		
		01010-81240	Bolt	■	1		
	7	797T-622-1240	Push tool	■	1		○

Disassembly

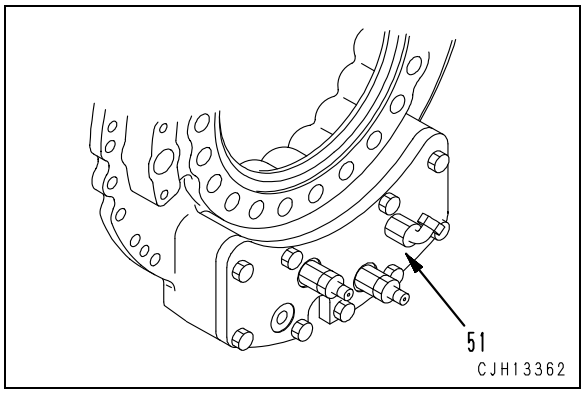
1. Drive shaft

Remove drive shaft (1).

★ Take care so that the drive shaft cap (yoke) will not slip off.

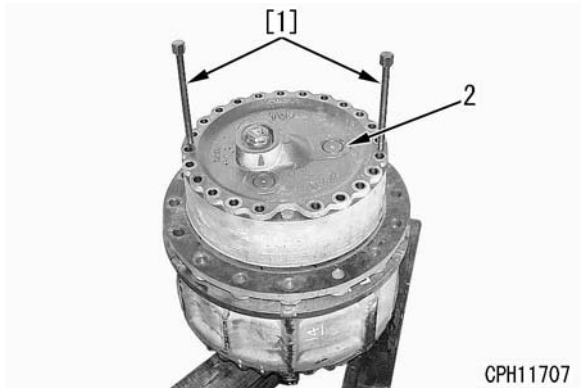


2. Remove cover (51).

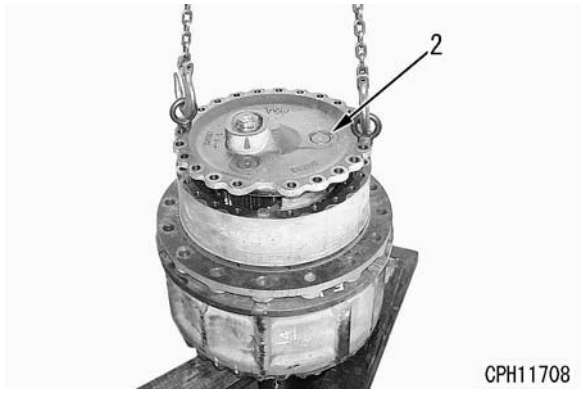


3. Removal of carrier assembly

1) Separate carrier assembly (2), using forcing screws [1].

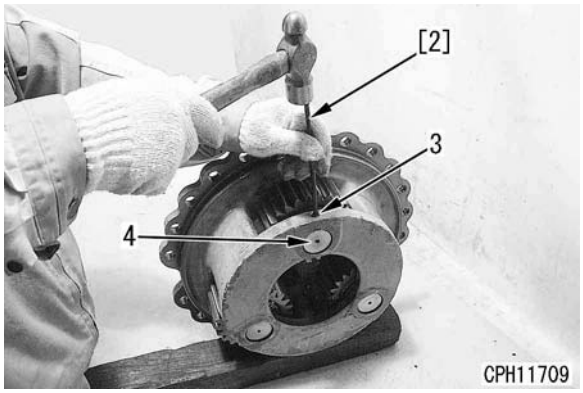


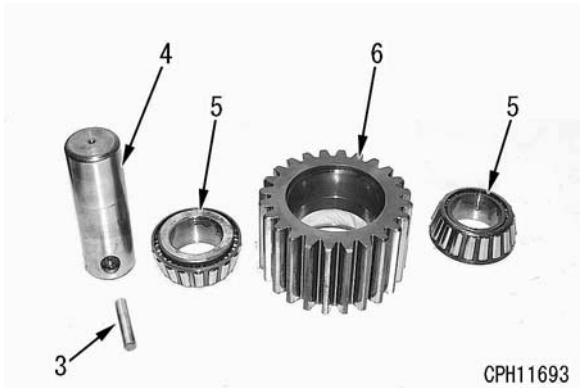
2) Sling carrier assembly (2) to remove.



4. Further disassembly of carrier assembly

1) Drive spring pin (3) into shaft (4), using round bar [2].
2) Drive out shaft (4) and remove bearing (5) and gear (6).
3) Pull spring pin (3) out of shaft (4).

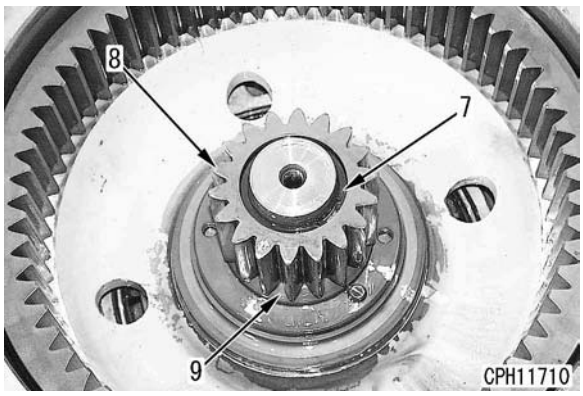




5. Sun gear and shaft

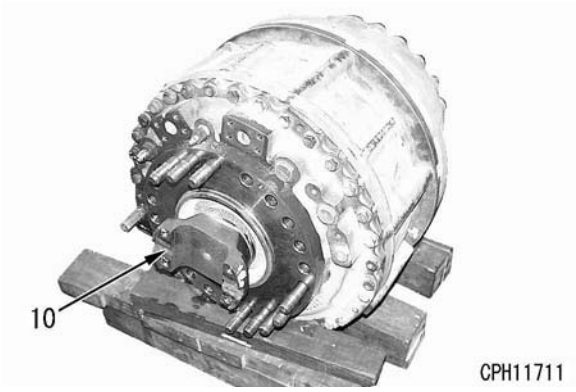
1) Remove snap ring (7).
2) Remove sun gear (8) and collar (9).

★ When removing the snap ring, be careful not to expand it too widely. Moreover, if the snap ring inner diameter is found to exceed 46.5 mm, or if there is a height difference of more than 0.3 mm when it is put on a flat surface, do not use it but replace with new one.



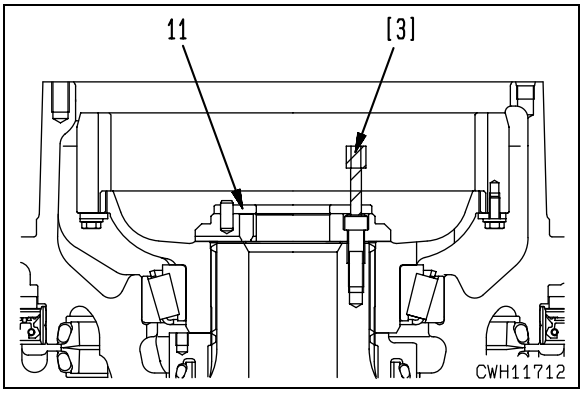
3) Remove shaft (10).

★ Drain oil remaining in the case.



6. Plate

1) Remove plate (11), using forcing screws [3].



7. Retainer and shim

1) Fix tools **J1** at three points between the outer gear and wheel hub (inner gear).

★ Be sure to fix tools **J1** before removing retainer (12) in order not to give damage to the floating seal.

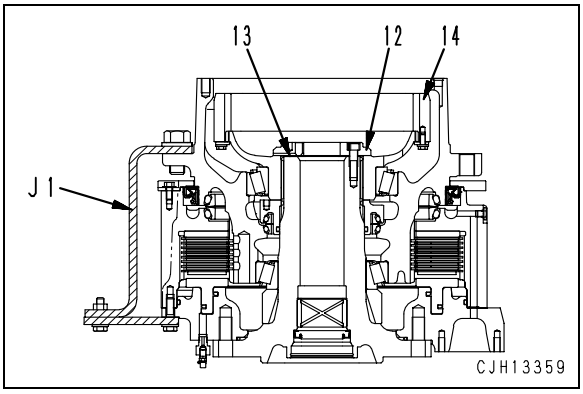
★ Fix tools **J1** at an equal interval.

2) Remove retainer (12) and shims (13).

★ Check their thickness, number in use and installed location beforehand.

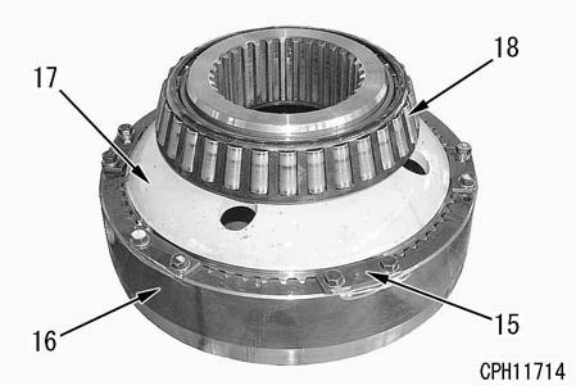
8. Removal of ring gear

Remove ring gear (14).



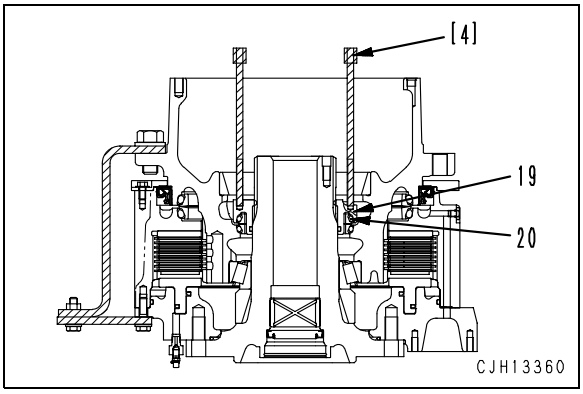
9. Further disassembly of ring gear

1) Remove 6 plates (15).
2) Remove inner hub (17) from ring gear (16).
3) Remove bearing (18) from inner hub (17).



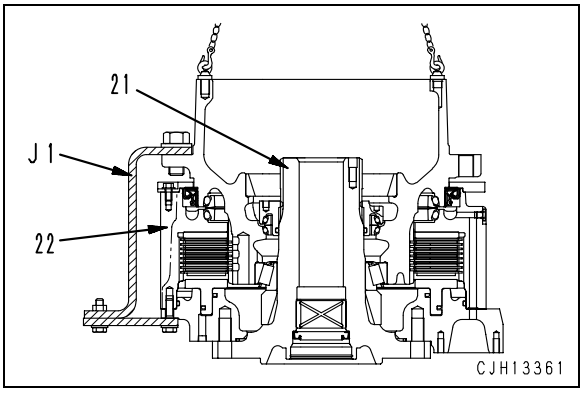
10. Floating seal retainer and floating seal

1) Remove the assembly of floating seal retainer (19) and floating seal (20), using forcing screws [4].



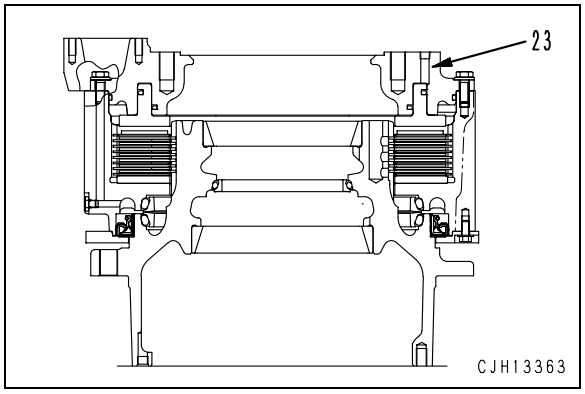
11. Removal of brake assembly

1) Remove brake assembly (22) from shaft (tube) (21).
   ★ Before removing, put a counter mark on the assembly and shaft.
2) Remove tools **J1** from the brake assembly.

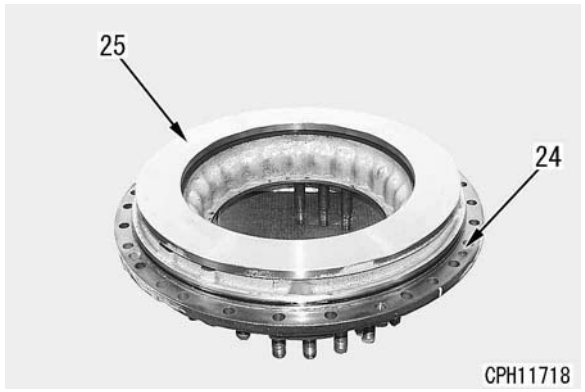


12. Separation of outer gear assembly and inner gear assembly

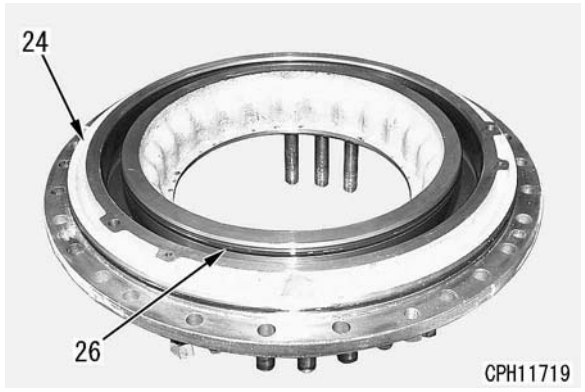
1) Remove cylinder and piston assembly (23).

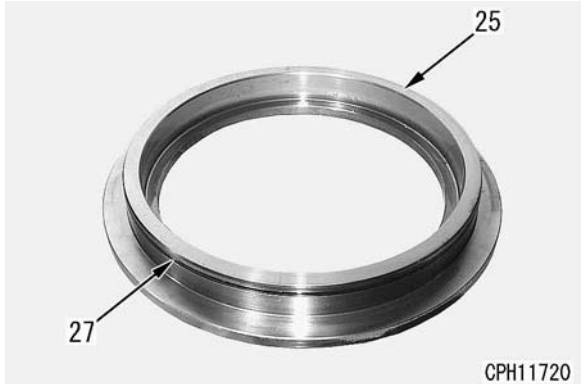


2) Remove piston (25) from cylinder (24).

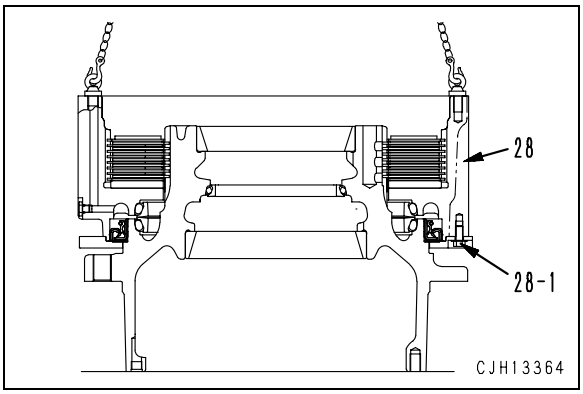


3) Remove seal rings (26) and (27) from cylinder (24) and piston (25).



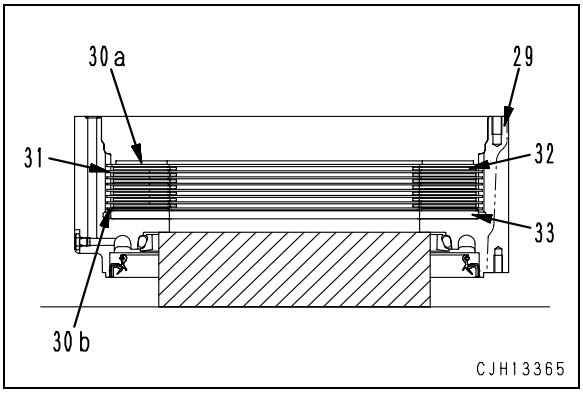


4) Remove the mounting bolts (28-1) and sling outer gear and disc plate assembly (28) to remove.

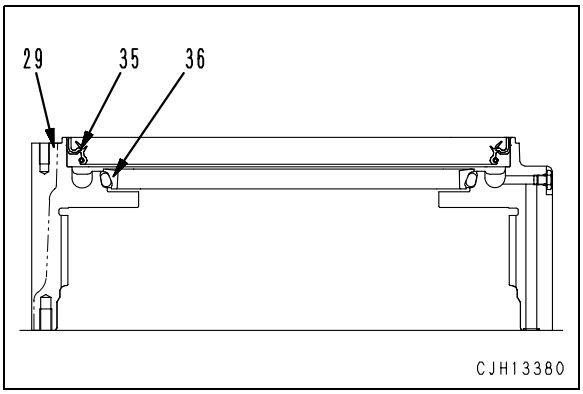


13. Further disassembly of outer gear assembly

1) Remove dampers (30a) and (30b), 6 plates (31), 7 discs (32) and plate (33) from outer gear (29).

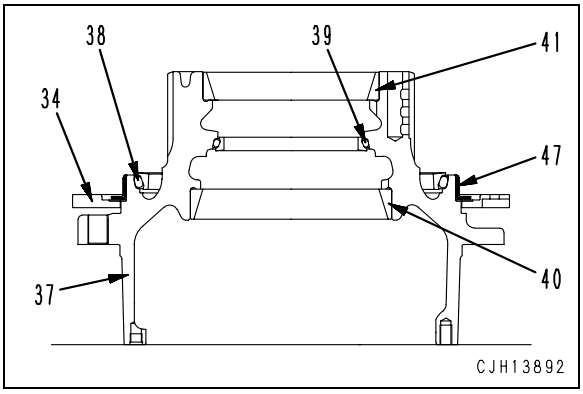


2) Remove oil seal (35) from outer gear (29).
3) Remove floating seal (36).



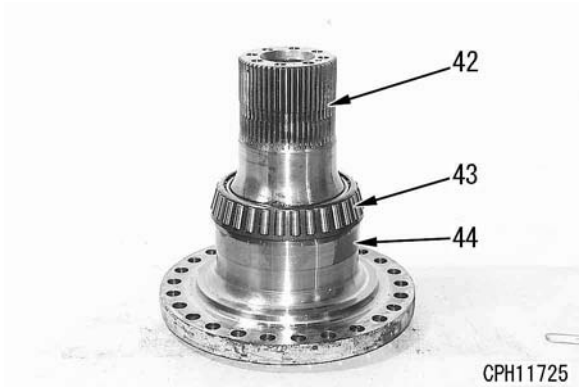
14. Further disassembly of inner gear assembly

1) Remove sleeve (47) and plate (34) from hub (inner gear) (37).
2) Remove floating seals (38) and (39).
3) Remove outer races (40) and (41).

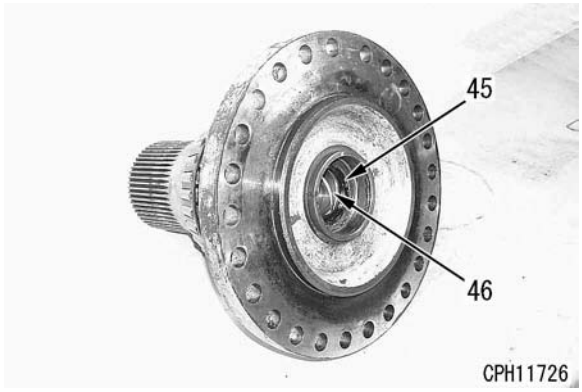


15. Further disassembly of shaft assembly

1) Remove bearing (43) and retainer (44) from shaft (tube) (42).



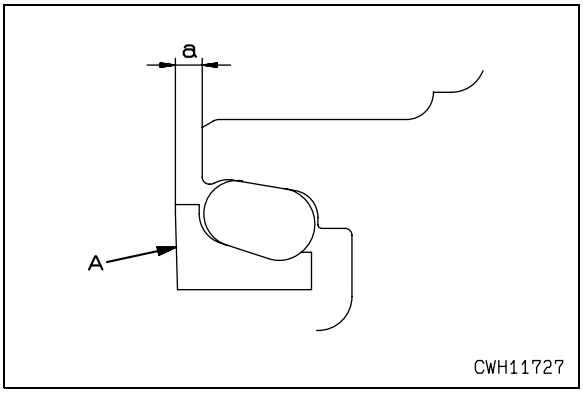
2) Remove oil seal (45) and bushing (46).



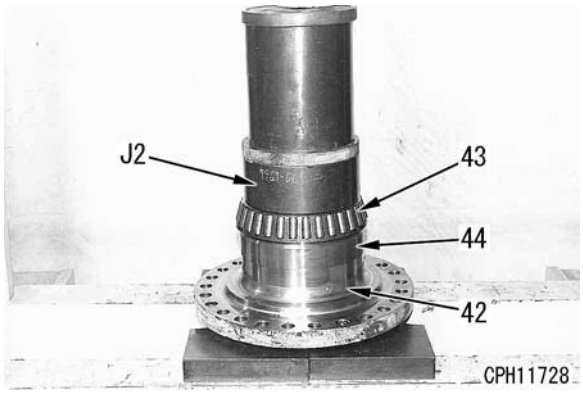
Assembly

★ Before installing, clean each of the parts thoroughly; also check that it is free of dust and damage and coat the sliding surface with **axle oil (AXO80)**.

★ Precautions when installing floating seal
- When installing a brand-new oil seal, completely wipe out white dust on the O-ring surface with alcohol.
- Degrease the mating face of O-ring before installing.
- Install the O-ring with a push-in type special tool.
- Coat sealing face **A** with engine oil. Also check that the face is free of dust.
- Measure dimension "**a**" (at 4 points on the circumference) that is the seal height against the gear and hub as well as retainer and confirm that the difference of the measured dimension "**a**" is less than 1 (mm).



1. Subassembly of shaft assembly
1) Install retainer (44) to shaft (tube) (42).
2) Press-fit bearing (43), using tool **J2**.



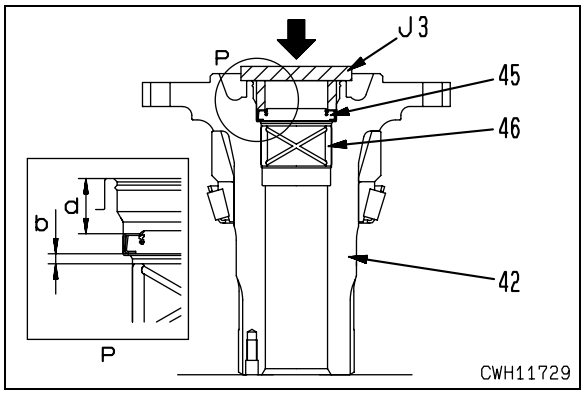
3) Install bushing (46) to shaft (42).
- Install so that dimension "**b**" between the shaft end surface and bushing end surface is 5 ± 0.2 mm.

4) Install oil seal (45), using tool **J3**.

★ Install so that dimension "**d**" between the shaft end surface and bushing end surface is 33 ± 0.2 mm.

Oil seal peripheral surface
: Seal end 242 or equivalent

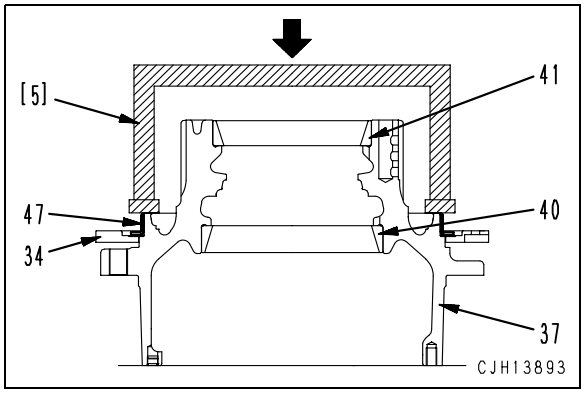
Oil seal lip face and inside of oil seal (100% full): **Grease (G2-LI)**



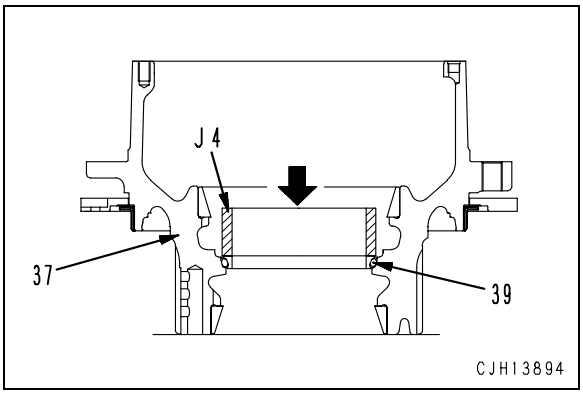
2. Subassembly of inner gear assembly
1) Install outer races (41) and (40) to hub (inner gear) (37).
2) Put plate (34).
3) Press-fit sleeve (47) for the oil seal, using tool [5].

Insertion face: **Axle oil or LM-P**

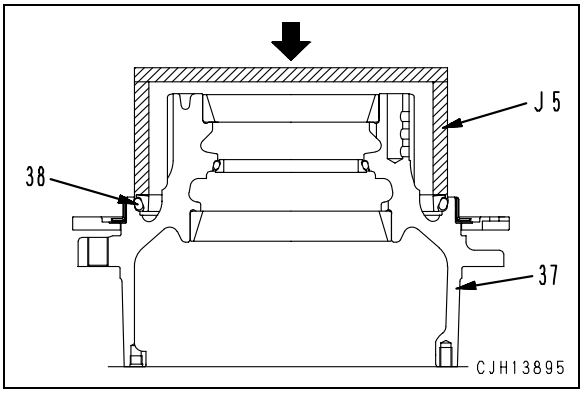
★ Keep press-fitting until the top end of the sleeve (47) is flush with the hub end face.



4) Install floating seal (39) to hub (inner gear) (37), using tool **J4**.
   ★ Refer to the section of "Precautions when installing floating seal".

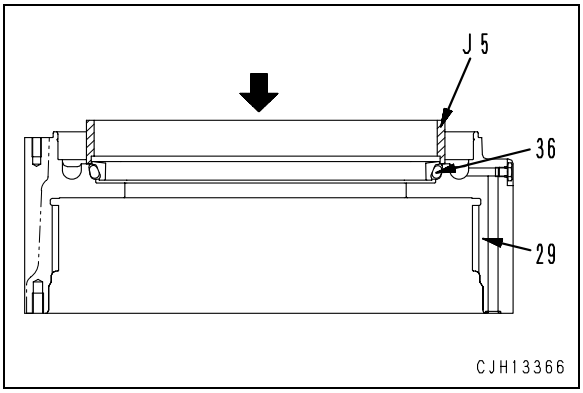


5) Install floating seal (38) to hub (inner gear) (37), using tool **J5**.
   ★ Refer to the section of "Precautions when installing floating seal".

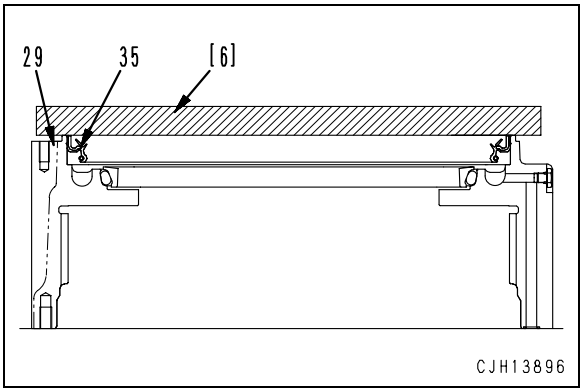


3. Subassembly of outer gear assembly

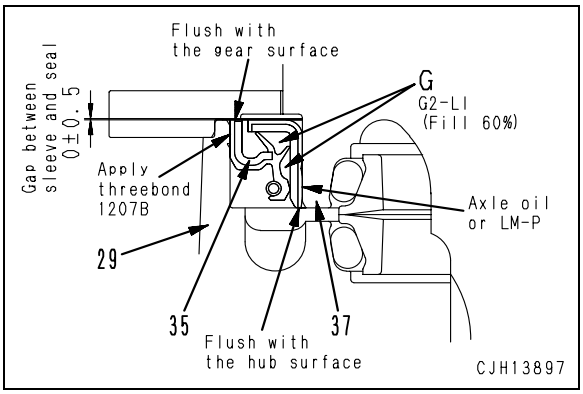
1) Install floating seal (36) to outer gear (29), using tool **J5**.
   ★ Refer to the section of "Precautions when installing floating seal".



2) Install floating seal (35) to outer gear (29), using tool [6].
   Oil seal peripheral surface
   : Gasket sealant LG-8 (Three Bond 1207B)
   ★ The end face of outer gear is flush with that oil seal.
   Oil seal lip face and inside **G** of oil seal (60% full): **Grease (G2-LI)**

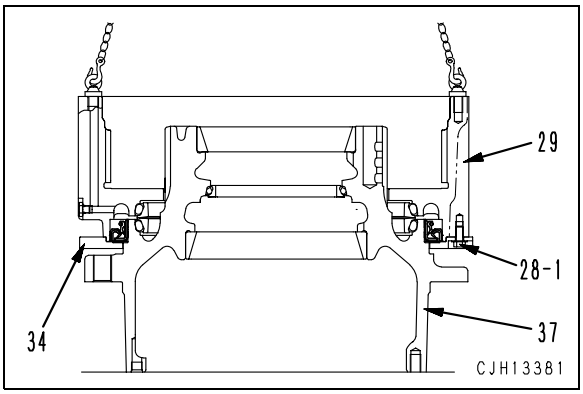


• Summary of oil seal

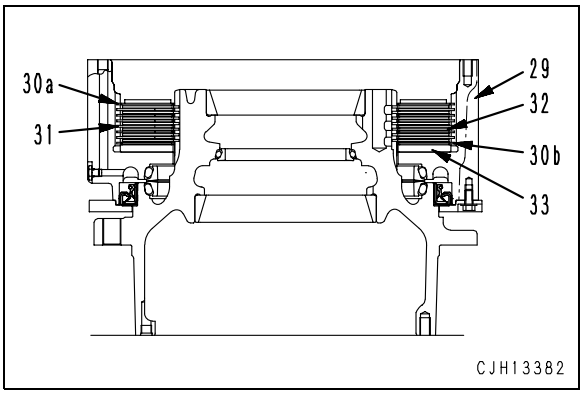


4. Brake assembly

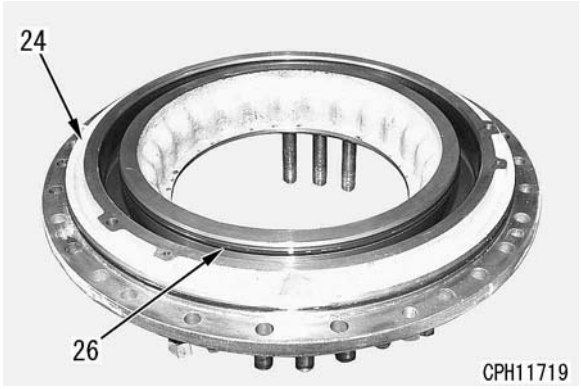
1) Install outer gear (29) to hub (inner gear) (37).
   ★ When installing, take care so that the floating seal will not be damaged or turned up.
2) Install plate (34) with mounting bolts (28-1).
   Mounting bolt
   : 59 – 74 Nm {6 – 7.5 kgm}

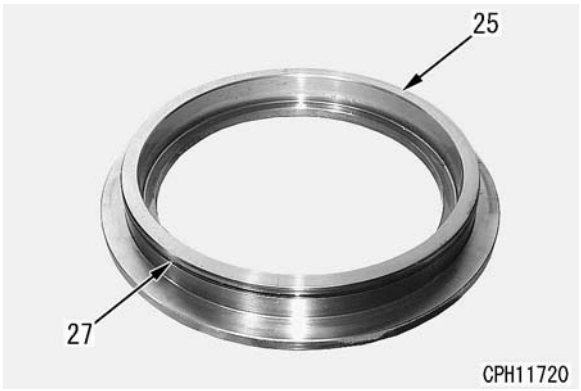


3) Install plate (33), 7 discs (32), 6 plates (31) and dampers (30a) and (30b) to outer gear (29).
   ★ When installing, take care so that the surfaces of discs and plates are not damaged.

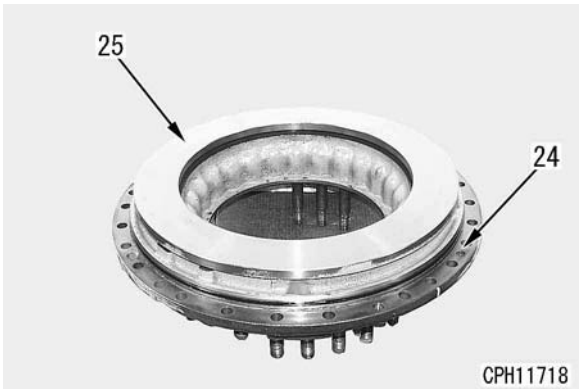


4) Install seal rings (26) and (27) to cylinder (24) and piston (25) respectively.

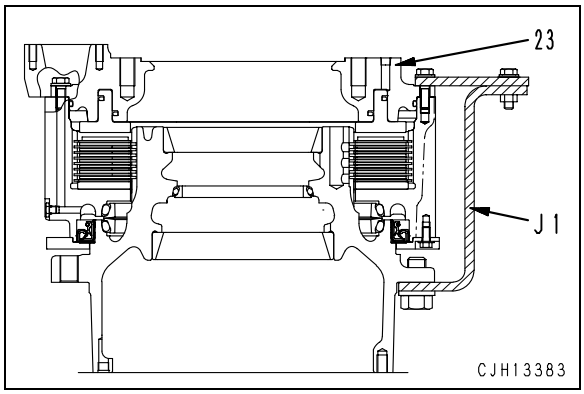




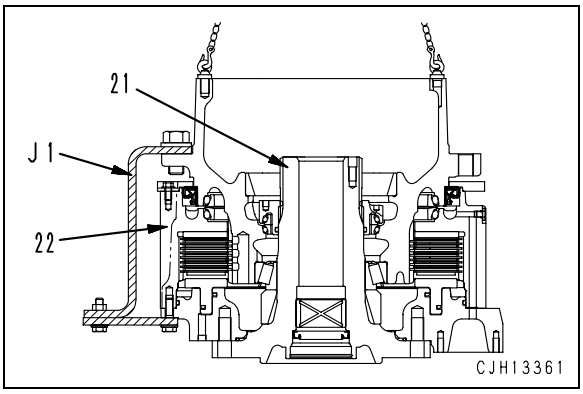
5) Install piston (25) to cylinder (24).



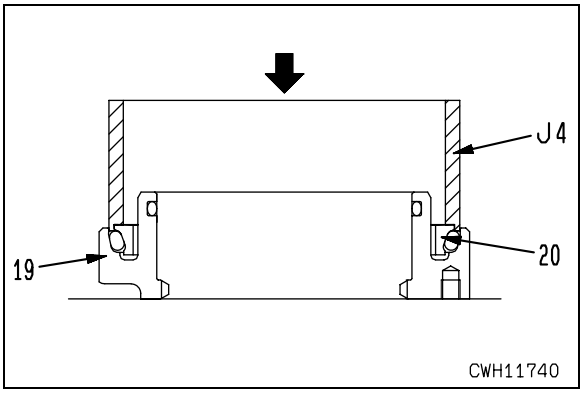
6) Install cylinder and piston assembly (23).
7) Fix tool **J1**.



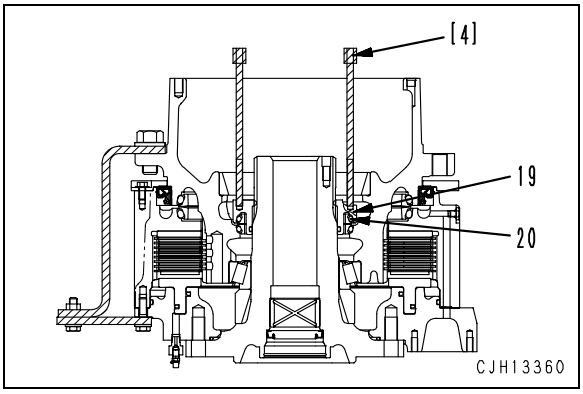
8) Install brake assembly (22) to shaft (21).
★ When installing, match both counter marks which were put at the time of disassembling.



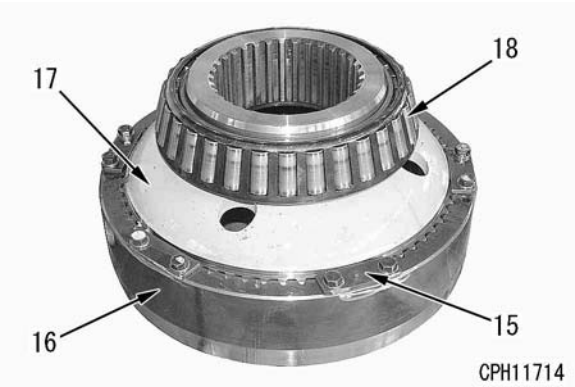
5. Floating seal retainer and floating seal
1) Install floating seal assembly (20) to floating seal retainer (19), using tool **J4**.
★ Refer to the section of "Precautions when installing floating seal".

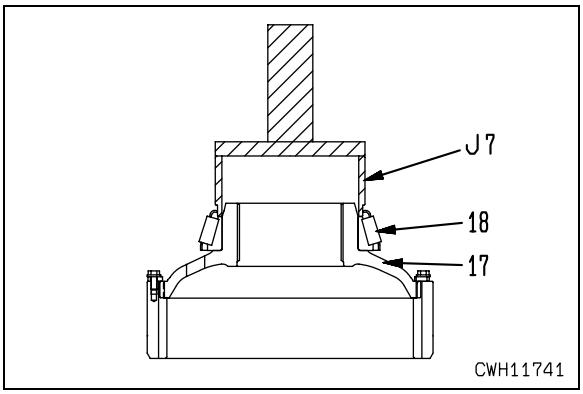


2) Install the assembly of floating seal retainer (19) and floating seal assembly (20), holding forcing screw [4].



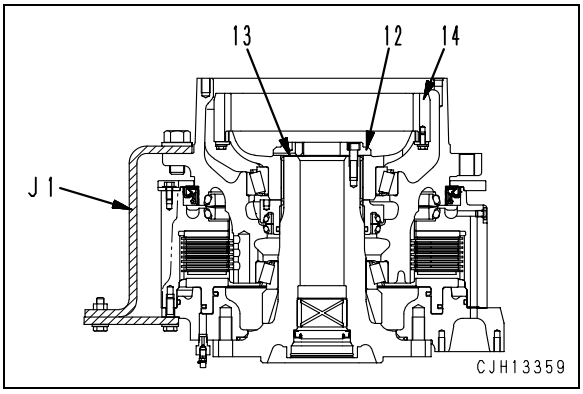
6. Subassembly of ring gear assembly
1) Install ring gear (16) to inner hub (17).
2) Install 6 plates (15).
Mounting bolt
: Liquid adhesive (LT-2)
Mounting bolt
: 27.5 – 34.5 Nm {2.8 – 3.5 kgm}
[Target value: 31 Nm {3.2 kgm}]
3) Press-fit bearing (18) into inner hub (17), using tool **J7**.



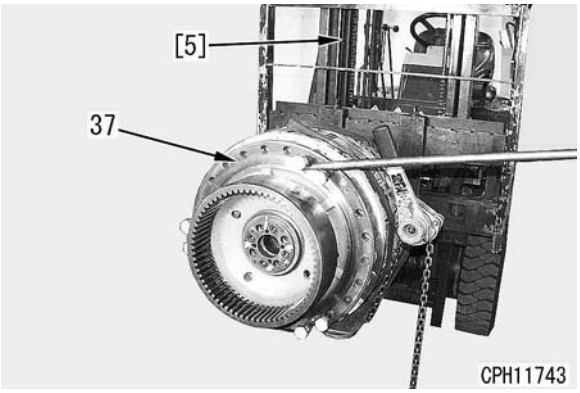


7. Installation of ring gear assembly
Install ring gear assembly (14).

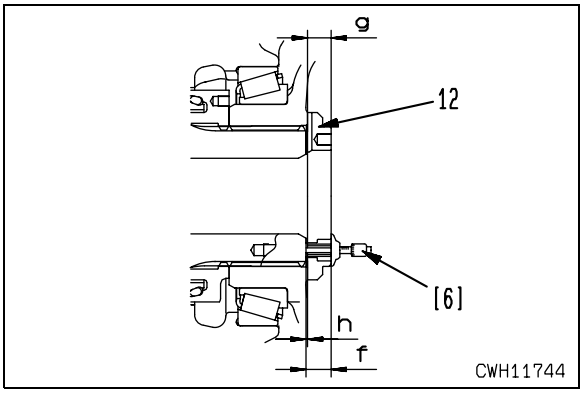
8. Adjustment of bearing pre-load
1) Install retainer (12) temporarily without shims being assembled in.
2) Remove tools **J1** (at 3 points).



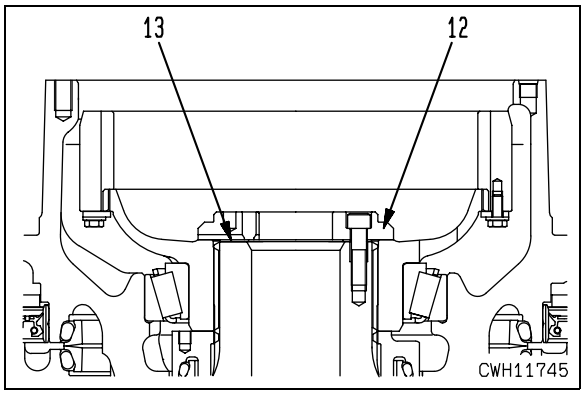
3) Fasten the ring gear assembly to the forks of lift truck [5], and tighten hub bolt in every 2 (4 bolts in total) to the specified torque of 49 ± 4.9 Nm {5 ± 0.5 kgm}., while rotating the hub (inner gear) (37) by 20 to 30 turns.
   ★ If the bolts are tightened without hub (inner gear) (37) being rotated, the bearing will not fit in well, thus giving no appropriate pre-load.
   (The photo below differs a bit from the actual ring gear in its outer gear configuration.)



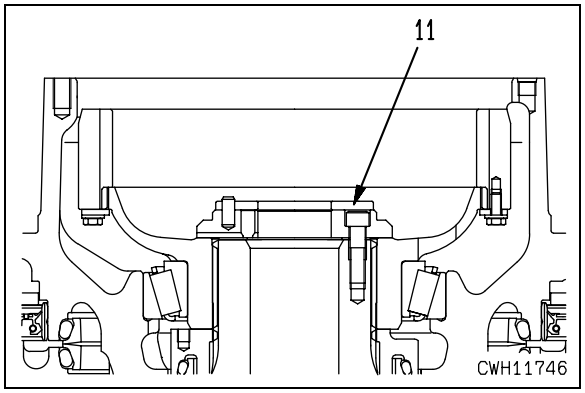
4) Measure dimension "**f**" between the end surface of shaft and the end surface of retainer (12), using depth micrometer [6].
   ★ Take measurement at 2 points and obtain the average value.
5) Remove retainer (12) and measure retainer thickness "**g**", then calculate difference "**h**" **(=f – g)** and add 0.27 mm to it. That value is the thickness of shim.
   • Kind of shim thickness
   : 0.05 mm, 0.2 mm, 0.3 mm and 1.0 mm



6) Assemble retainer (12) and shims (13) whose thickness was determined in the foregoing step, and install the retainer.
   ★ Tighten the mounting bolts evenly, rotating hub (inner gear) (37), until an even tightening torque is obtained for all the bolts.
   Mounting bolt
   : Liquid adhesive (LT-2)
   Mounting bolt
   : 98 – 123 Nm {10 – 12.5 kgm}
   [Target value: 113 Nm {11.5 kgm}]
   ★ After finishing tightening, check that there is nothing wrong with its rotation, while actually rotating hub (inner gear) (37).

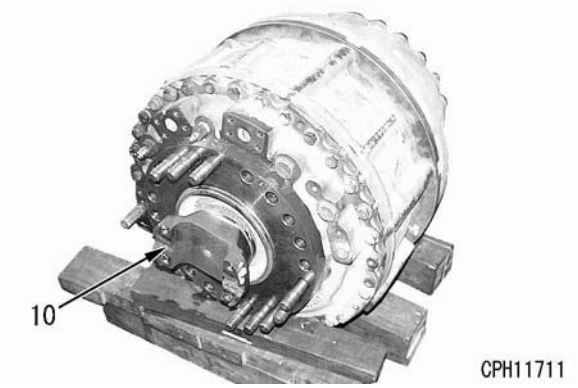


9. Plate
Install plate (11).



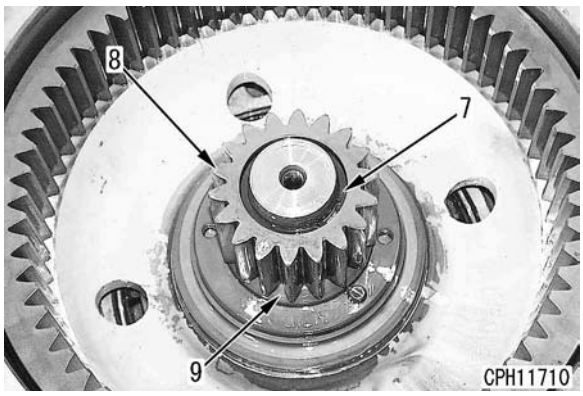
10. Shaft

Install shaft (10).



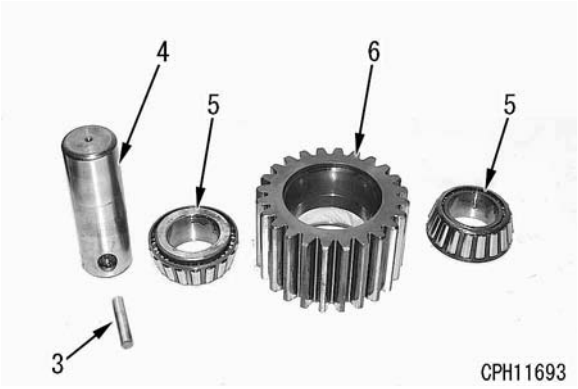
11. Collar and sun gear

1) Install collar (9) and sun gear (8).
2) Install snap ring (7).



12. Subassembly of carrier assembly

1) Set bearings (5) to gear (6) and install them to the carrier.
2) Install shaft (4).
   ★ When installing, pay attention to the spring pinholes.
3) Install spring pin (3).



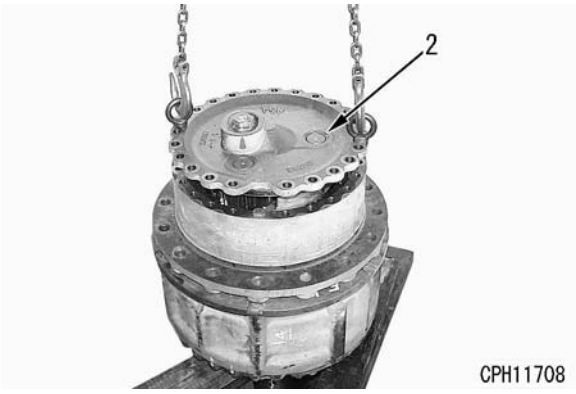
13. Installation of carrier assembly

Sling carrier assembly (2) to install.

Mounting bolt

: 157 – 196 Nm {16 – 20 kgm}

[Target value: 177 Nm {18 kgm}]



14. Drive shaft

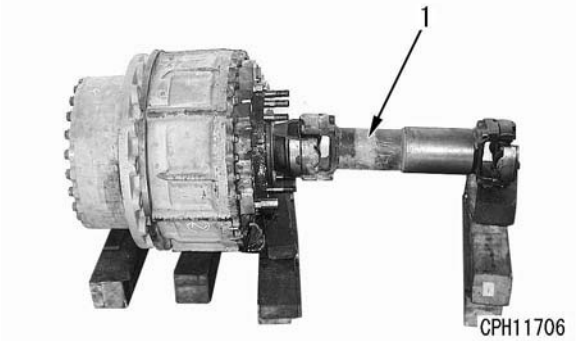
Install drive shaft (1).

Mounting bolt: **Liquid adhesive (LT-2)**

Mounting bolt

: 98 – 123 Nm {10 – 12.5 kgm}

[Target value: 113 Nm {11.5 kgm}]



15. Install cover (51).

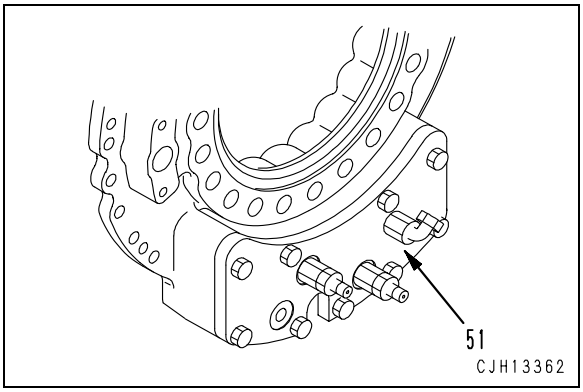
Mating face

: Gasket sealant

(Loctite LT-515 or equivalent)

Mounting bolt

: 59 – 74 Nm {6 – 7.5 kgm}



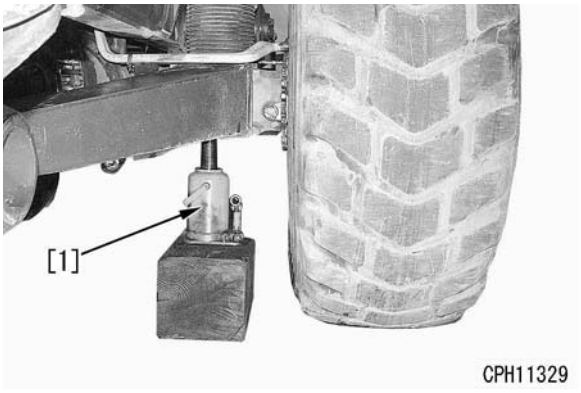
Removal and installation of center final drive and brake assembly

Removal

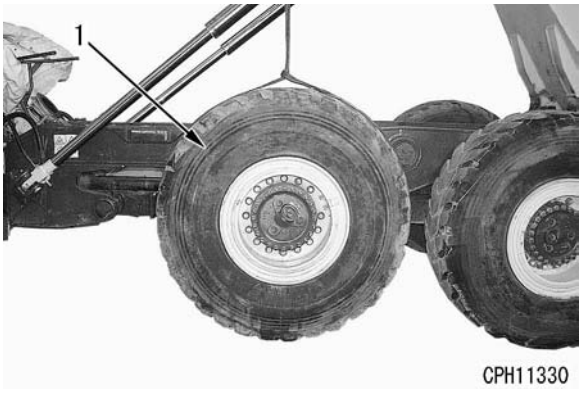
- **Turn the parking brake switch on and put wooden blocks behind the wheels.**
- **Raise the body assembly to the maximum and insert a lock pin.**
- **Disconnect the cable from the negative (–) terminal of battery beforehand.**
- **Loosen the hydraulic oil filler cap to release the internal pressure of the hydraulic tank.**

1. Drain oil from the center differential case and the center final drive case.
- Center differential case: **25ℓ**
- Center final drive case: **4ℓ (one side)**

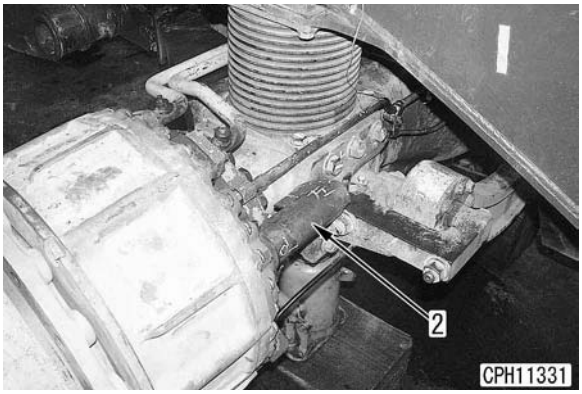
2. Disconnect the center wheel.
1) Raise the underside of center axle on the side of wheel to be removed, using hydraulic jack [1].



2) Sling the center wheel (1) and remove the mounting bolts. [*1]
- Center wheel: **550 kg (one side)**



3. Remove cover (2).

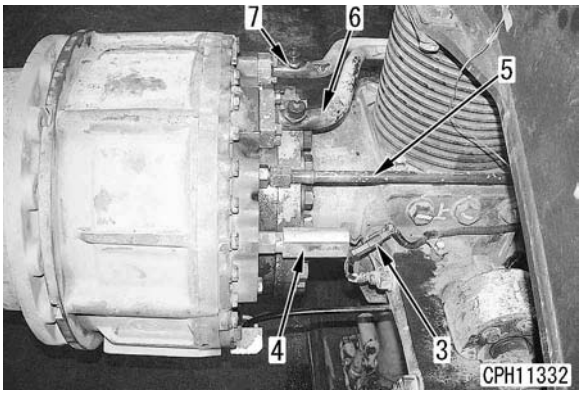


4. Disconnect brake wearing switch connector (3) (If equipped).

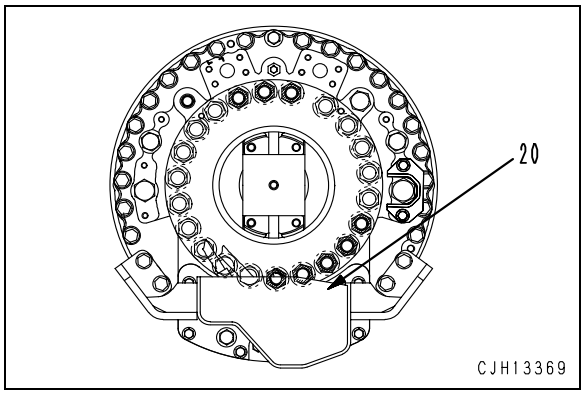
5. Disconnect wiring connectors (4) (If equipped).
- Final drive, right: **B26**
- Final drive, left: **B02**

6. Disconnect left and right brake actuating tubes (5).

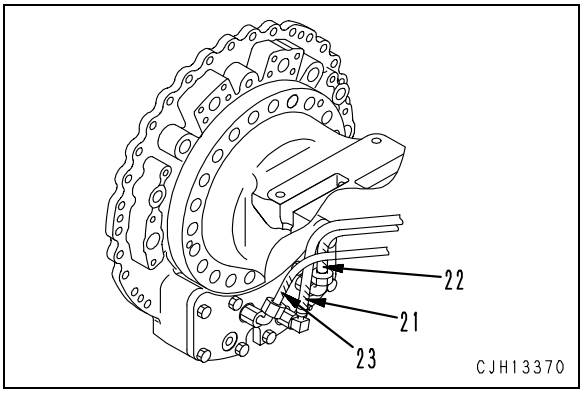
7. Disconnect brake cooling tubes (6) and (7).



8. Remove cover (20).



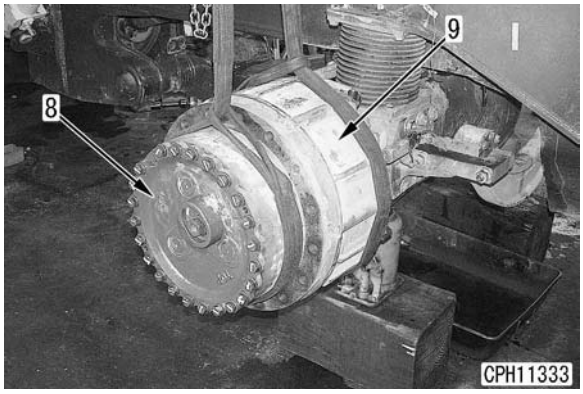
9. Disconnect drain hose (21), catch tank drain hose (22) and breather hose (23).



10. Remove carrier assembly (8) and the sun gear and drive shaft assembly from the final drive assembly, referring to the section of "Removal and installation of center differential assembly". [*2]

11. Sling final drive and brake assembly (9) temporarily and remove the 22 mounting bolts. [*3]

Center final drive and brake assembly
: **350 kg (one side)**



Installation

- Installation is carried out in the reverse order to removal.

[*1]

Center wheel mounting bolt
: 824 – 1,030 Nm {84 – 105 kgm}
[Target value: 927 Nm {94.5 kgm}]

[*2]

★ Install the sun gear and drive shaft assembly and the carrier assembly, referring to the section of "Removal and installation of center differential assembly".

[*3]

Center final drive and brake assembly mounting bolt: **Liquid adhesive (LT-2)**
Center final drive and brake assembly mounting bolt
: 490 – 608 Nm {50 – 62 kgm}
[Target value: 549 Nm {56 kgm}]

- **Refilling with oil (center differential case and center final drive case)**
  Refill with oil through the oil filler ports of center differential case and left and right center final drive up to the specified level.
  Center differential case
  : 25ℓ Axle oil (AXO80)
  Center final drive case
  : 4ℓ (one side) Axle oil (AXO80)

- **Air bleeding**
  Bleed air from the brake circuit after finishing installation, referring to the section of "Bleeding air from brake circuit" in Testing and adjusting.

Disassembly and assembly of center final drive and brake assembly

Special tools

Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
J	2	792T-222-1220	Push tool	■	1		○
	4	791-580-1520	Installer	■	1		
	5	791-580-1510	Installer	■	1		
	6	793T-622-1110	Push tool	■	1		○
		790-101-5421	Grip	■	1		
		01010-81240	Bolt	■	1		
	7	797T-622-1240	Push tool	■	1		○
	8	792T-223-1130	Fixture	■	3		○
		792T-223-1140	Plate	■	3		○
		01010-61240	Bolt	■	3		
		01643-31232	Washer	■	3		
		01580-01210	Nut	■	3		
		01010-61245	Bolt	■	3		
		01010-62440	Bolt	■	3		

★ For further disassembly and assembly of carrier assembly, refer to the section of "Disassembly and assembly of rear final drive assembly".

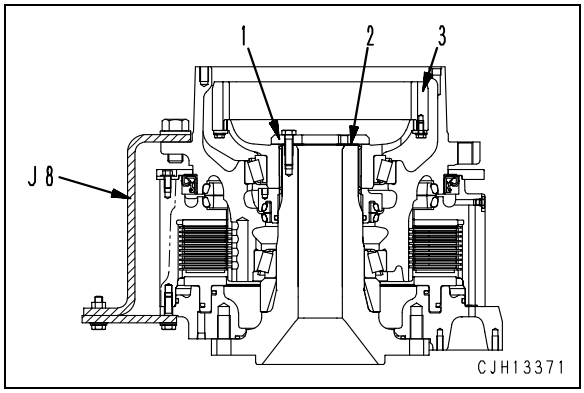
Disassembly

1. Retainer and shim

1) Fix tools **J8** at 3 points between the outer gear and wheel hub (inner gear).
   ★ Be sure to fix tools **J8** before removing retainer (1) in order to protect the floating seal from damage.
   ★ Fix tools **J8** at an equal interval.
2) Remove retainer (1) and shim (2).
   ★ Check the thickness, number in use and installed location of the shims beforehand.

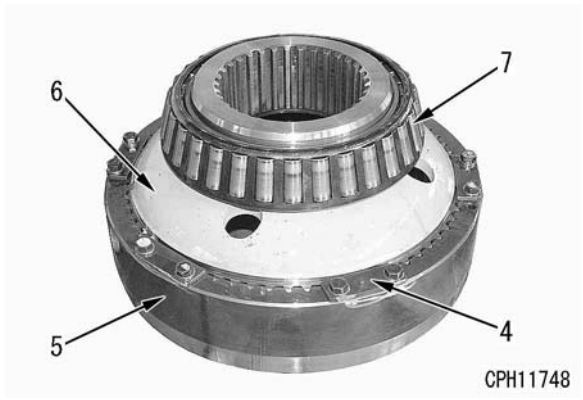
2. Removal of ring gear assembly

1) Remove ring gear assembly (3).



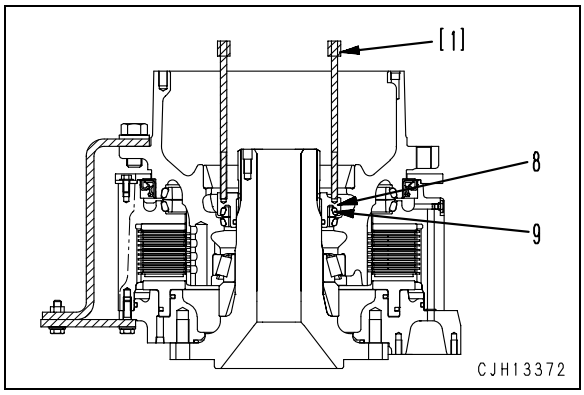
3. Further disassembly of ring gear assembly

1) Remove 6 plates (4).
2) Remove inner hub (6) from ring gear (5).
3) Remove bearing (7) from inner hub (6).



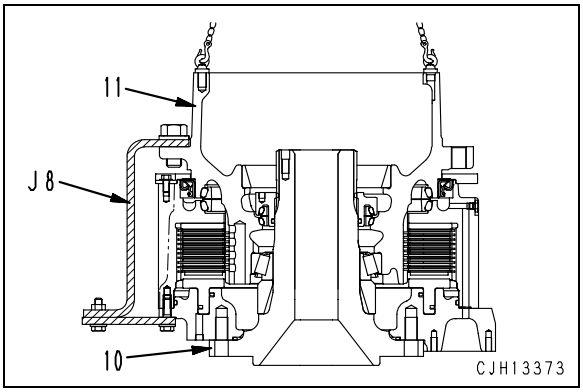
4. Floating seal retainer and floating seal

1) Remove the assembly of floating seal retainer (8) and floating seal assembly (9) by fitting forcing screws [1].



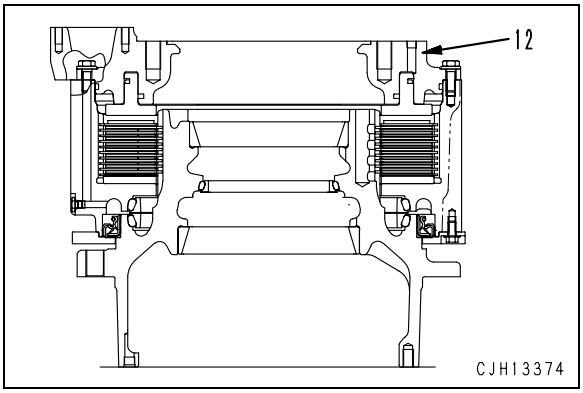
5. Removal of brake assembly

1) Remove brake assembly (11) from shaft (tube) (10).
   ★ Before removing, put a counter mark on both of them.
2) Remove tools **J8** from the brake assembly.

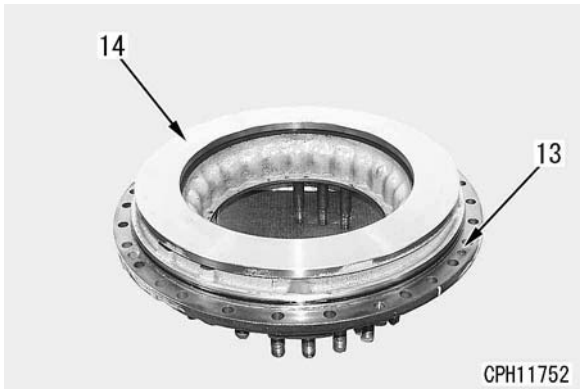


6. Separation of outer gear assembly and inner gear assembly

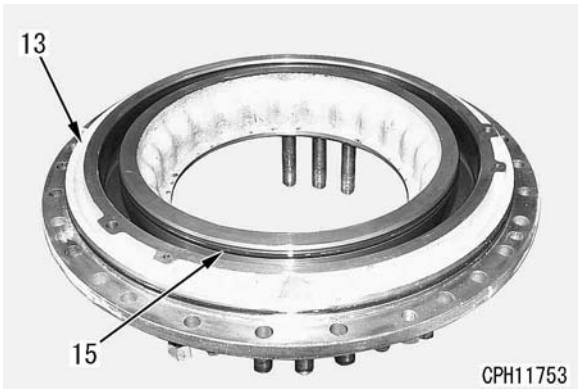
1) Remove cylinder and piston assembly (12).



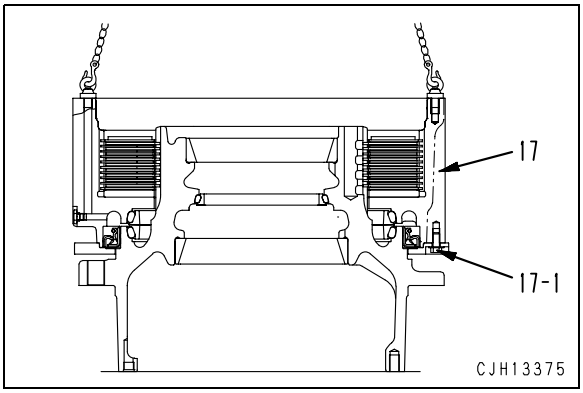
2) Remove piston (14) from cylinder (13).



3) Remover seal rings (15) and (16) from cylinder (13) and piston (14) respectively.

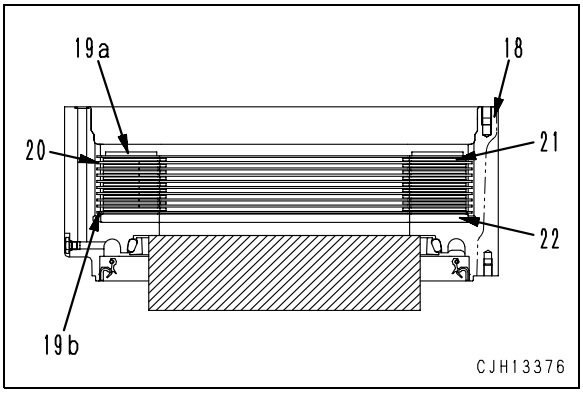


4) Remove mounting bolts (17-1), and sling outer gear and disc plate assembly (17) to remove.

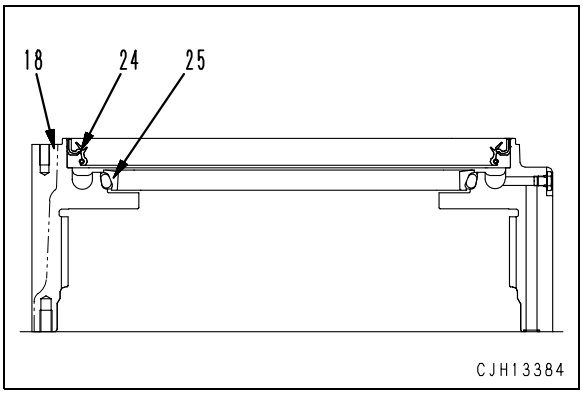


7. Further disassembly of outer gear assembly

1) Remove dampers (19a) and (19b), 8 plates (20), 9 discs (21) and plate (22) from outer gear (18).

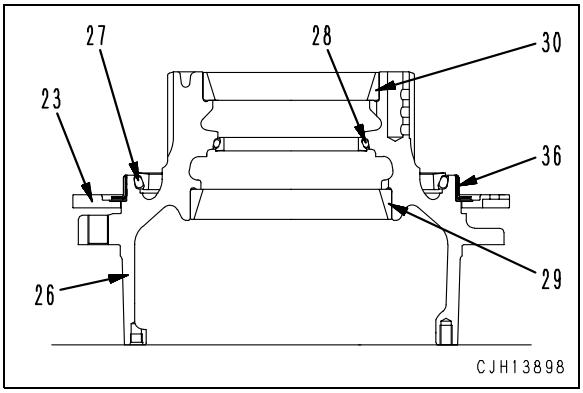


2) Remove oil seal (24) from outer gear (18).
3) Remove floating seal (25).



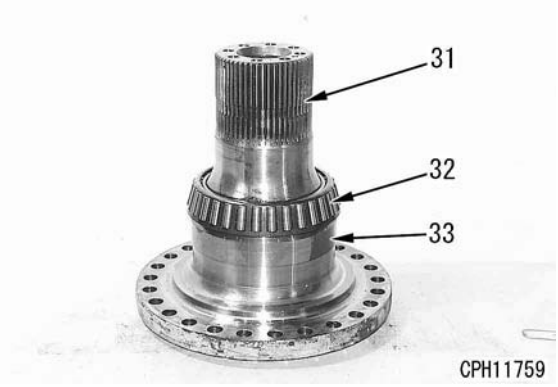
8. Further disassembly of inner gear assembly

1) Remove floating seals (27) and (28) from hub (inner gear) (26).
2) Remove sleeve (36).
3) Remove plate (23).
4) Remove outer races (29) and (30).



9. Further disassembly of shaft assembly

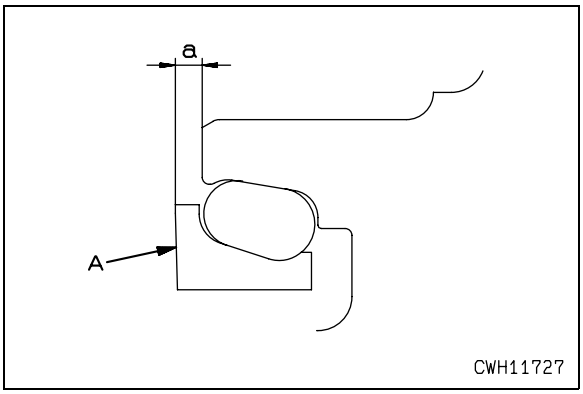
Remove bearing (32) and retainer (33) from shaft (31).



Assembly

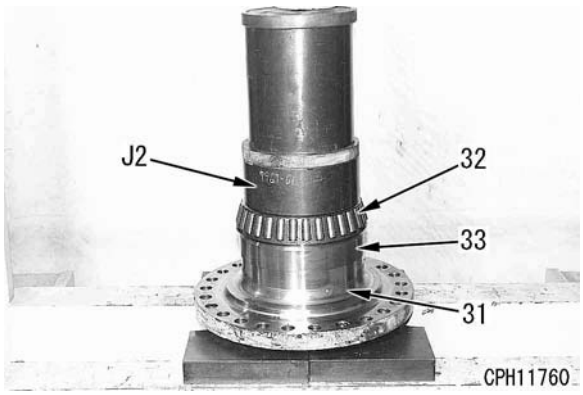
★ Before assembling, clean each of the parts thoroughly; check that it is free of dust and damage, and coat the sliding surface with **axle oil (AXO80)**.

★ Precautions when installing floating seal
- When installing a brand-new O-ring, completely wipe out white dust on the O-ring surface with alcohol.
- Degrease the mating surface of O-ring before installing.
- Install an O-ring with a push-in type special tool.
- Coat seal face **A** with engine oil, and check that the seal is free of dust and damage.
- Measure dimension "**a**" (at 4 points on the circumference) that is the seal height as against the carrier and hub as well as retainer and confirm that the difference of the measured dimension "**a**" is less than 1 (mm).



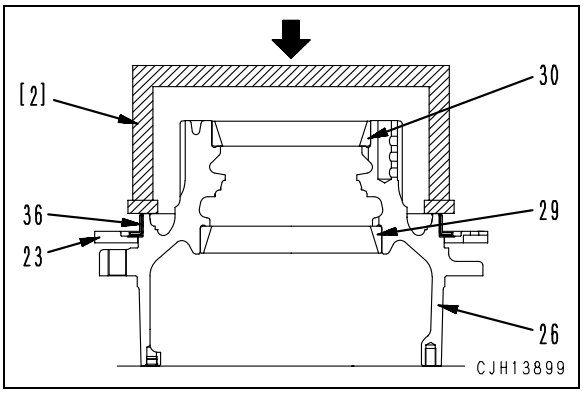
1. Subassembly of shaft assembly

1) Install retainer (33) to shaft (31).
2) Press-fit bearing (32), using tool **J2**.

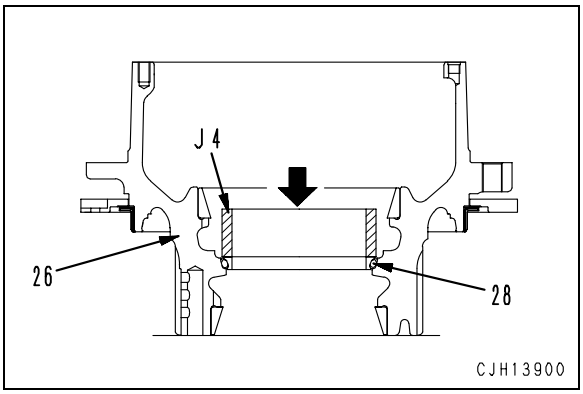


2. Subassembly of inner gear assembly

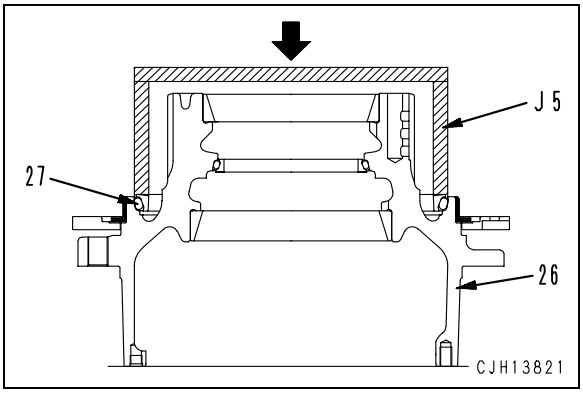
1) Install outer races (30), (29) to hub (inner gear) (26).
2) Put plate (23).
3) Press-fit sleeve (36) for the oil seal, using tool [2].
   Insertion face: **Axle oil or LM-P**
   ★ Keep press-fitting until the top end of the sleeve (36) is flush with the hub end face.



4) Install floating seal (28) to hub (inner gear) (26), using tool **J4**.
   ★ Refer to the section of "Precautions when installing floating seal".

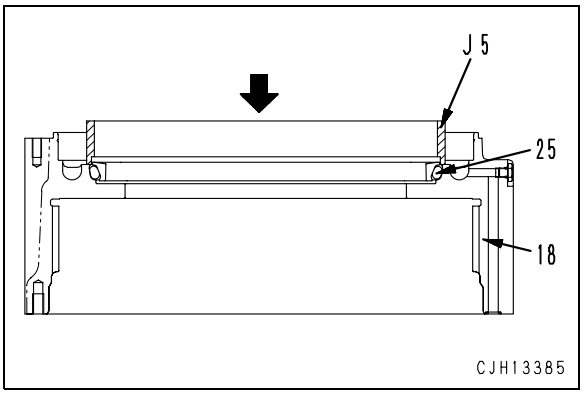


5) Install floating seal (27) to hub (inner gear) (26), using tool **J5**.
   ★ Refer to the section of "Precautions when installing floating seal".

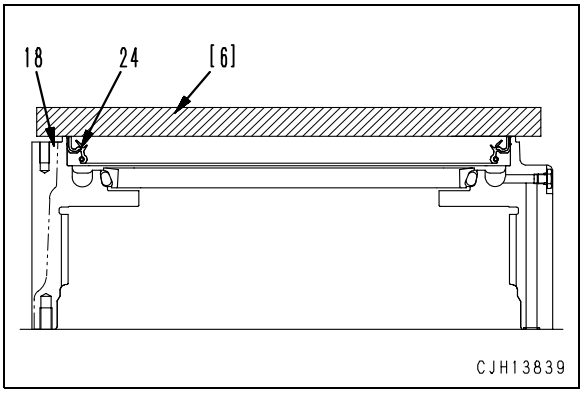


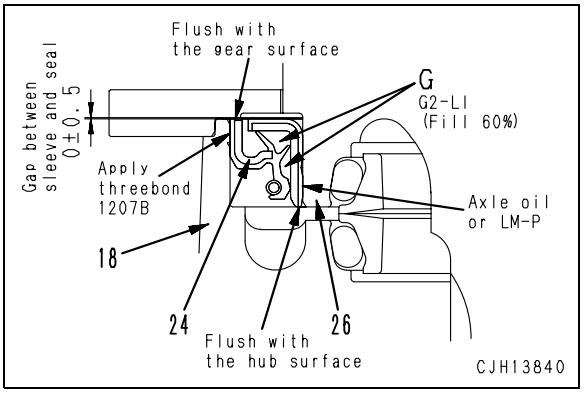
3. Subassembly of outer gear assembly

1) Install floating seal (25) to outer gear (18), using tool **J5**.
   ★ Refer to the section of "Precautions when installing floating seal".



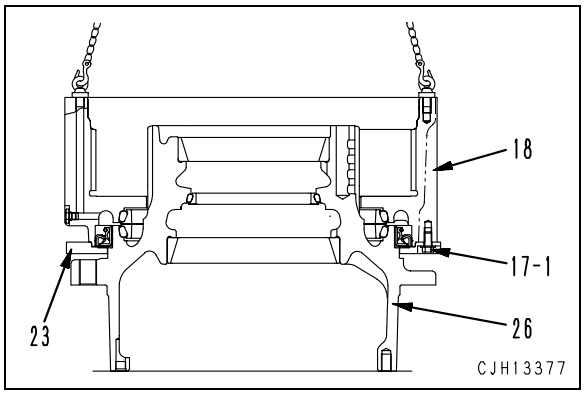
2) Install oil seal (24) to outer gear (18), using tool [6].
   Oil seal peripheral surface
   : Gasket sealant LG-8 (Three Bond 1207B)
   ★ The end face of outer gear is flush with that oil seal.
   Oil seal lip face and inside (G) of oil seal (60% full): **Grease (G2-LI)**



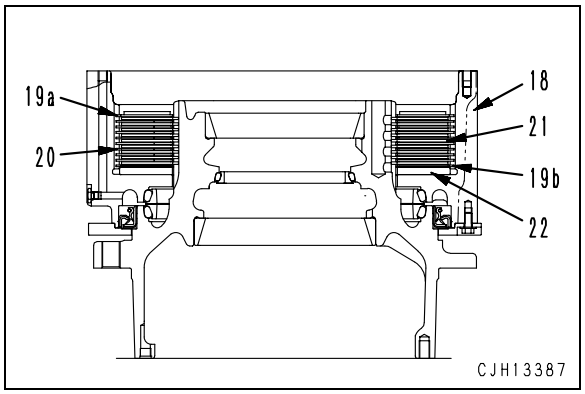


4. Brake assembly

1) Install outer gear (18) to hub (inner gear) (26).
   ★ When installing, take care so that the floating seal will not be damaged or turned up.
2) Install plate (23) with mounting bolt (17-1).
   Mounting bolt
   : 59 – 74 Nm {6 – 7.5 kgm}

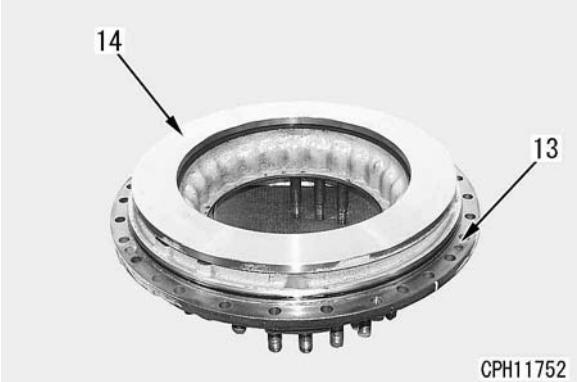


3) Install plate (22), 9 discs (21), 8 plates (20) and dampers (19a) and (19b) to outer gear (18).
   ★ When installing, take care so that the surfaces of discs and plates are not damaged.

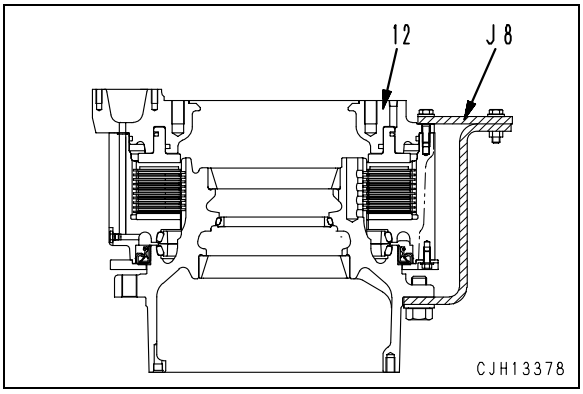


4) Install seal rings (15) and (16) to cylinder (13) and piston (14) respectively.

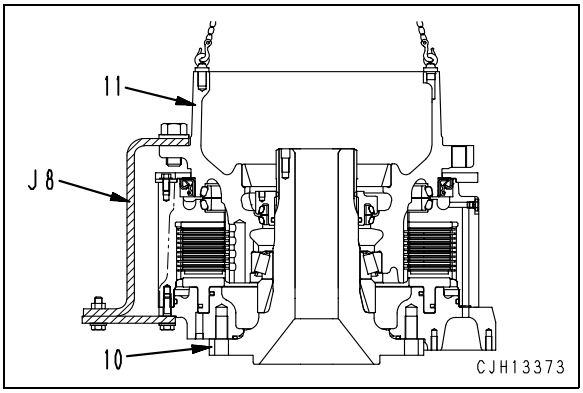
5) Install piston (14) to cylinder (13).



6) Install cylinder and piston assembly (12).
7) Fix tool **J8**.

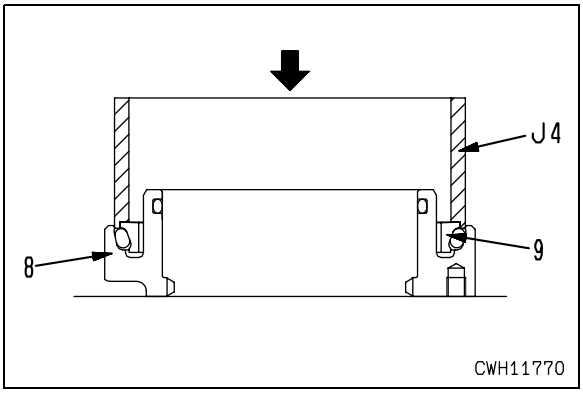


8) Install brake assembly (11) to shaft (tube) (10).
   ★ When installing, pay attention to the counter marks which were put at the time of disassembly.

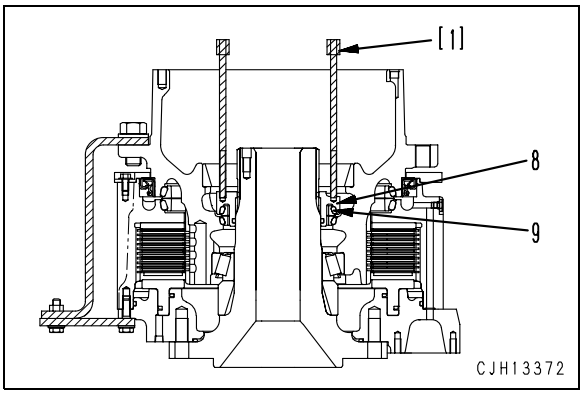


5. Floating seal retainer and floating seal

1) Install floating seal (9) to floating seal retainer (8), using tool **J4**.
   ★ Refer to the section of "Precautions when installing floating seal".

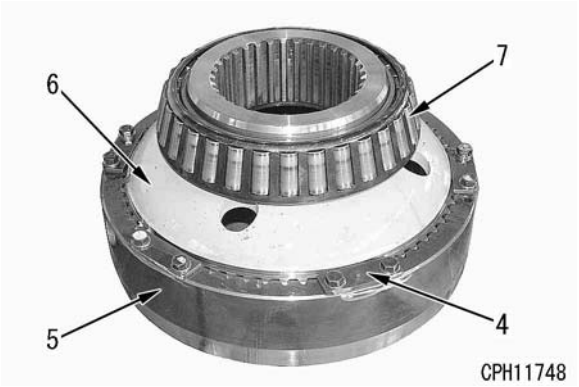


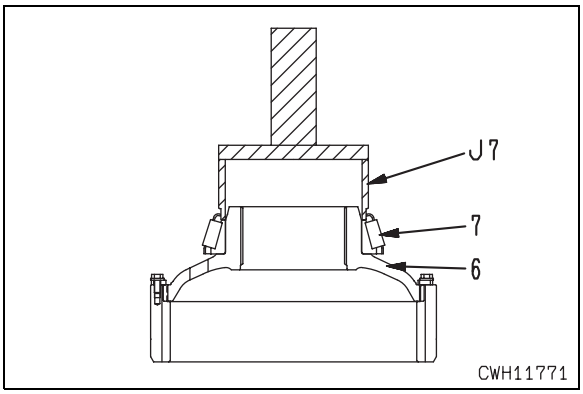
2) Install the assembly of floating seal cage (8) and floating seal assembly (9), holding forcing screw [1].



6. Subassembly of ring gear assembly

1) Install ring gear (5) to inner hub (6).
2) Install 6 plates (4).
   Mounting bolt
   : Liquid adhesive (LT-2)
   Mounting bolt
   : 27.5 – 34.5 Nm {2.8 – 3.5 kgm}
   [Target value: 31 Nm {3.2 kgm}]
3) Press-fit bearing (7) to inner hub (6), using tool **J7**.



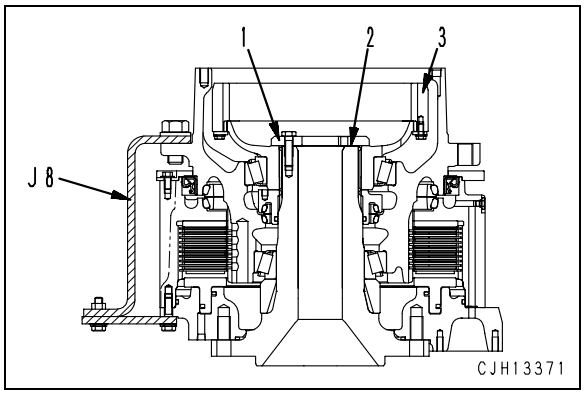


7. Installation of ring gear assembly

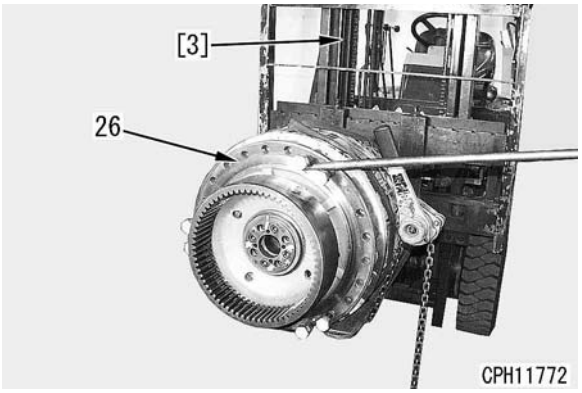
Install ring gear assembly (3).

8. Adjustment of bearing pre-load

1) Install retainer (1) temporarily without shim (2) being assembled in.
2) Remove tools **J8** (at 3 points).

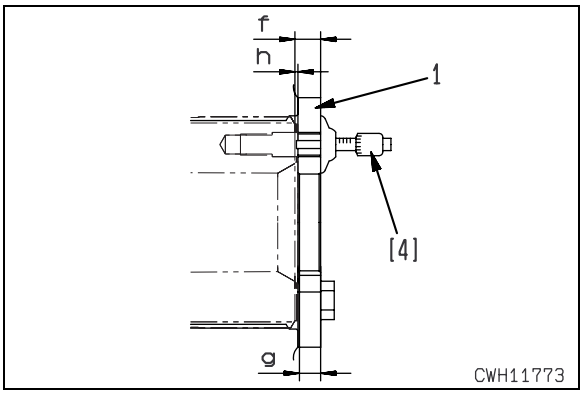


3) Fasten the ring gear assembly to the forks of lift truck [3], and tighten hub bolt in every 2 (4 bolts in total) to the specified torque of 49 ± 4.9 Nm {5 ± 0.5 kgm}, while rotating hub (inner gear) (26) by 20 to 30 turns.
   ★ If the bolts are tightened without hub (inner gear) (26) being rotated, the bearing will not fit in well, thus giving no appropriate pre-load.
   (The photo below differs a bit from the actual ring gear in its outer gear configuration.)

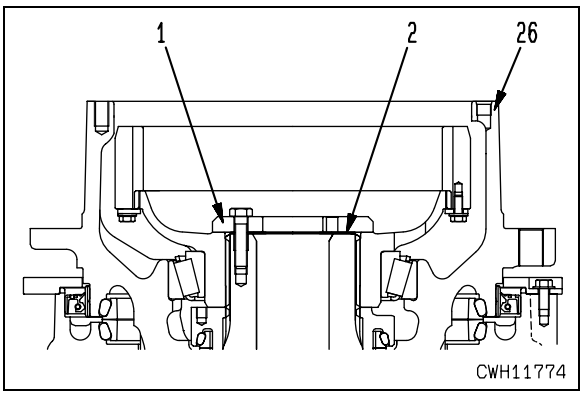


4) Measure dimension "**f**" between the end surface of shaft and the end surface of retainer (1), using depth micrometer [4].
   ★ Take measurement at 2 points and obtain the average value.
5) Remove retainer (1) and measure retainer thickness "**g**", then calculate difference "**h**" **(= f – g)** and add 0.27 mm to it. That value is the thickness of shim.

• Kind of shim thickness
  : 0.05 mm, 0.2 mm, 0.3 mm and 1.0 mm



6) Assemble in retainer (1) and shims (2) which were selected in the foregoing step.
   ★ Tighten the mounting bolts evenly, while rotating hub (inner gear) (26), until all the mounting bolts are tightened to even torque.
   Mounting bolt
   : Liquid adhesive (LT-2)
   Mounting bolt
   : 98 – 123 Nm {10 – 12.5 kgm}
   [Target value: 113 Nm {11.5 kgm}]
   ★ After finishing installing, check that there is nothing wrong with rotation, while turning hub (inner gear) (26).



HM300-2 Articulated dump truck

Form No. SEN00690-03

ARTICULATED DUMP TRUCK

HM300-2

Machine model	Serial number
HM300-2	2001 and up

50 Disassembly and assembly

Power train, Part 5

Disassembly and assembly of rear final drive assembly

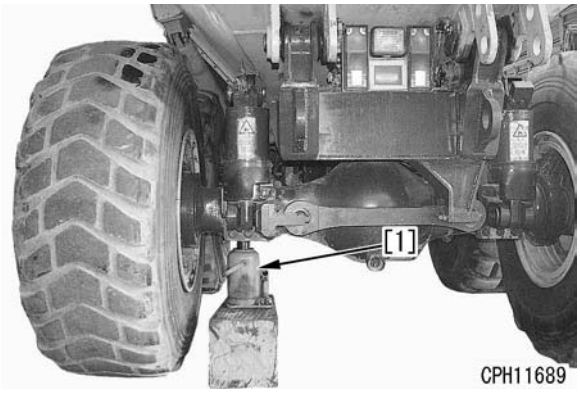
Special tools

Sym-bol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
J	2	792T-222-1220	Push tool	■	1		○
	7	797T-622-1240	Push tool	■	1		○

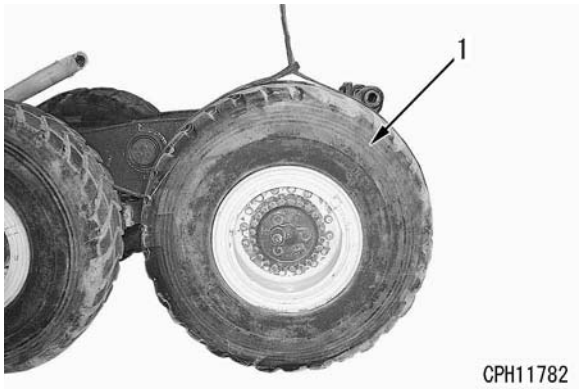
Disassembly

Turn the parking brake switch on and put wooden blocks behind the wheels.

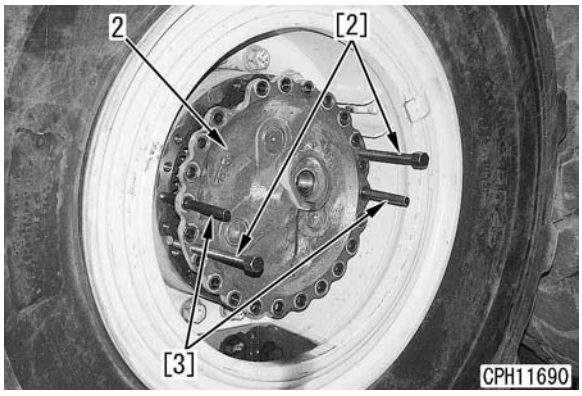
1. **Body assembly**
   Remove the body assembly, referring to the section of "Removal and installation of body assembly".
2. **Draining oil**
   Drain oil from the rear differential case and the rear final drive case.
   Rear differential case: **25ℓ**
   Rear final drive case: **5ℓ (one side)**
3. **Rear wheel**
   1) Raise the underside of rear axle with hydraulic jack [1].



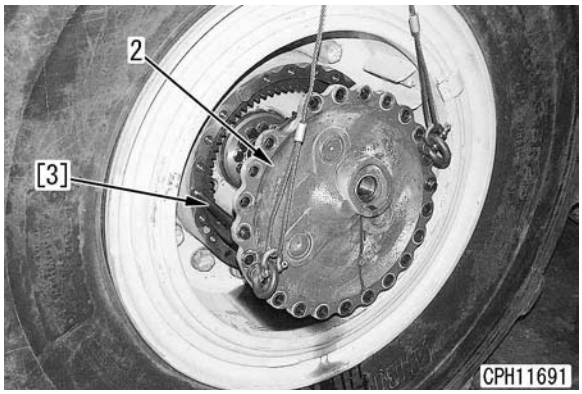
   2) Sling rear wheel (1), then remove the mounting bolts and remove the rear wheel.
   Rear wheel: **550 kg**



4. **Removal of carrier assembly**
   1) Remove the mounting bolts, and pull carrier assembly (2) out of the final drive assembly, using forcing screws [2] and guide bolts [3]. [*1]
   (Remove the carrier assembly without a wheel unlike the photo below)

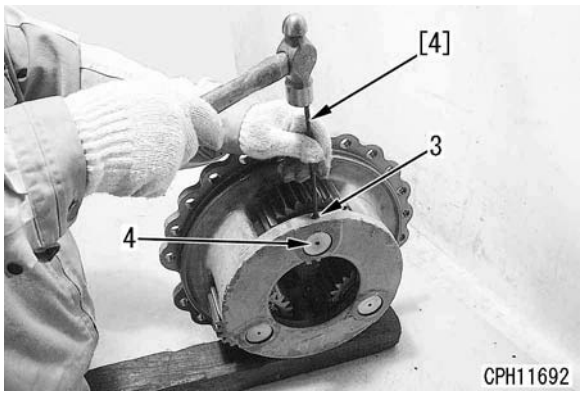


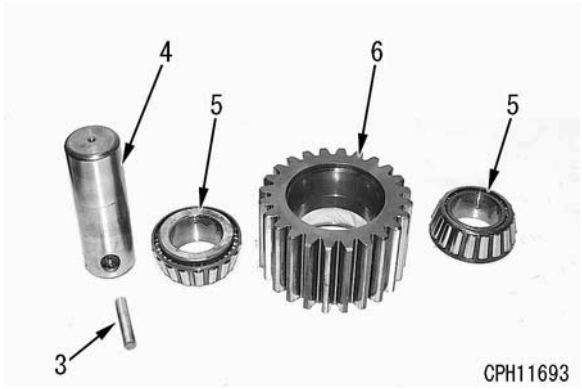
   2) Sling carrier assembly (2) to remove. [*2]
   Carrier assembly: **40 kg (one side)**
   (Remove the carrier assembly without wheel unlike the photo below)



5. Further disassembly of carrier assembly

1) Drive spring pin (3) into shaft (4), using round bar [4].
2) Pull out shaft (4) and then take out bearing (5) and gear (6).
3) Pull spring pin (3) out of shaft (4) beforehand.



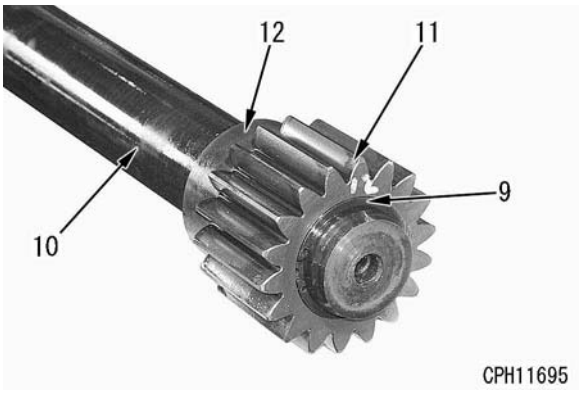


6. Sun gear and drive shaft

1) Remove sun gear and drive shaft assembly (8).

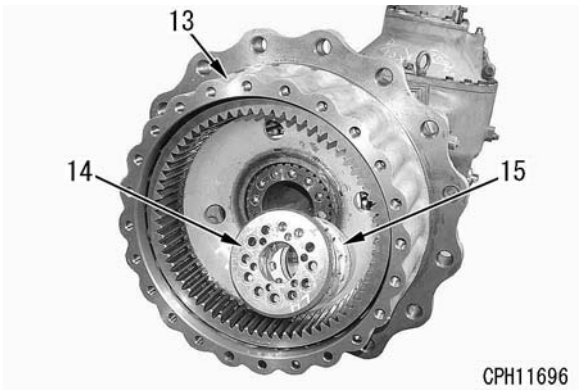
Sun gear and drive shaft assembly **: 25 kg**

2) Remove snap ring (9).
3) Remove sun gear (11) and spacer (12) from drive shaft (10).

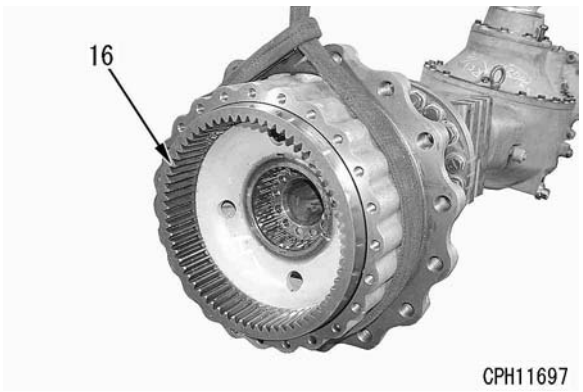


7. Removal of ring gear assembly

1) Sling flywheel hub assembly (13).
2) Remove retainer (14).
   ★ Shims (15) are provided, so check their thickness, number in use and installed locations beforehand.

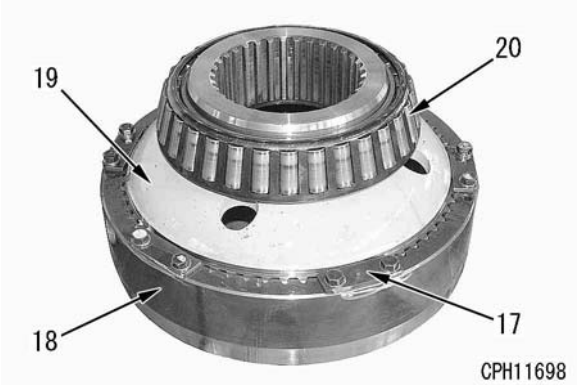


3) Remove ring gear (16).



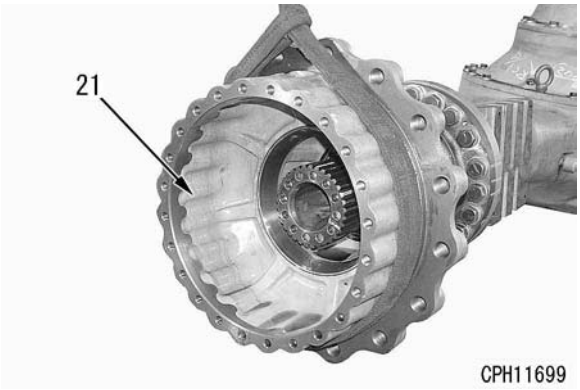
8. Further disassembly of ring gear assembly

1) Remove 6 plates (17).
2) Remove inner hub (19) from ring gear (18).
3) Remove bearing (20) from inner hub (19).

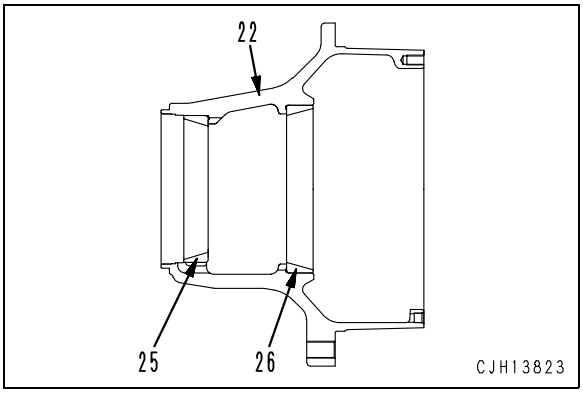


9. Wheel hub assembly

1) Sling flywheel hub assembly (21) to remove.
   Flywheel hub assembly: **60 kg**

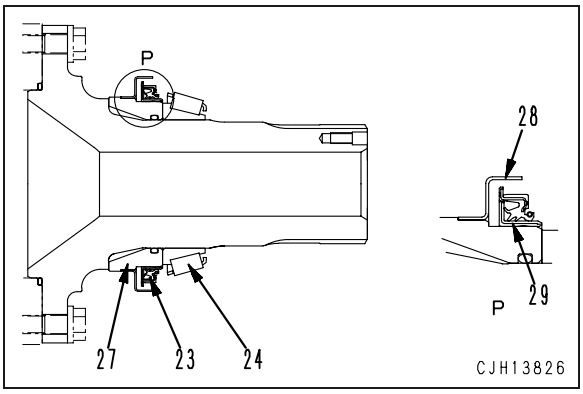


2) Remove outer races (25) and (26) from wheel hub (22).



10. Retainer assembly

1) Remove bearing (24).
2) Remove oil seal (23).
3) Remove retainer (27).
4) Remove protector (28) from retainer (27).
5) Remove sleeve (29).

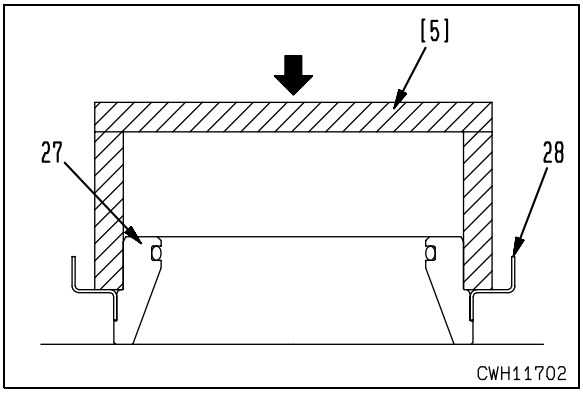


Assembly

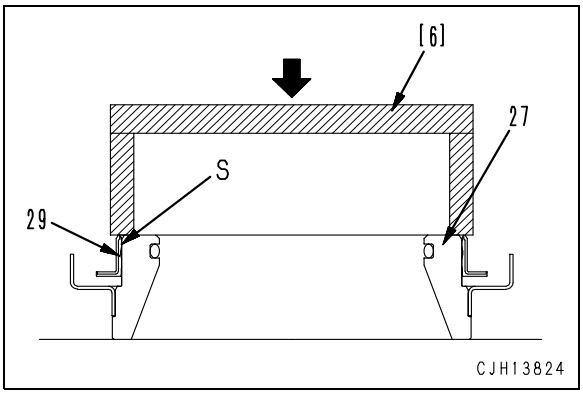
★ Before assembling, clean each of the parts thoroughly, then check that it is free of dust and damage and coat the sliding surface with **axle oil (AXO80)**.

1. Retainer assembly

1) Install protector (28) to retainer (27), using push tool [5].
   ★ Keep press-fitting until the protector is flush with the retainer.

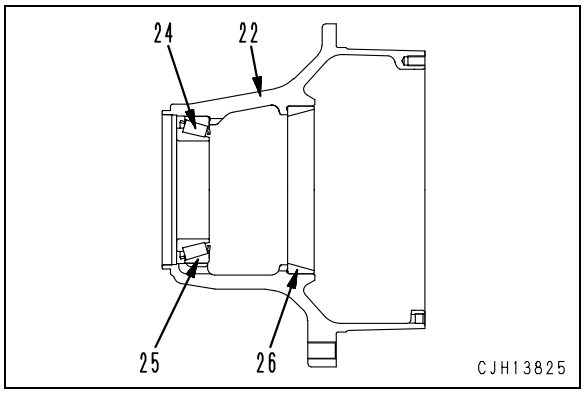


2) Press-fit sleeve (29) to retainer (27), using tool [6].
   Insertion face (S) of sleeve (29)
   : Axle oil (AXO80) or LM-P
   ★ Keep press-fitting until the top end of the sleeve is flush with the retainer.
3) Install retainer (27) with an O-ring to the axle housing.

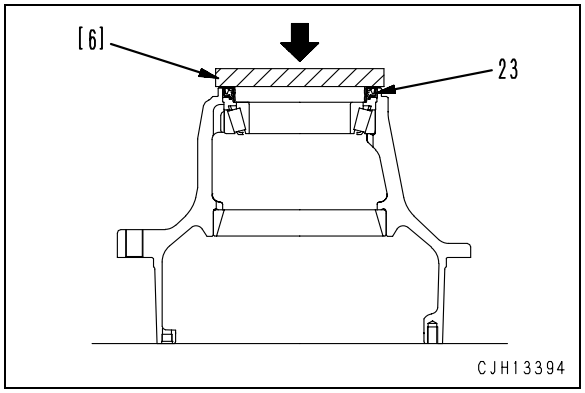


2. Wheel hub assembly

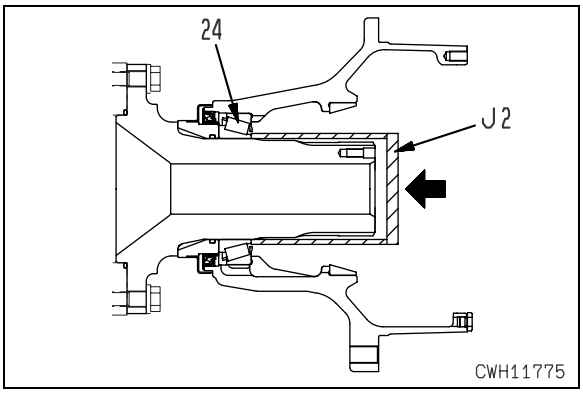
1) Install outer races (25) and (26) to wheel hub (22).
2) Assemble bearing (24) in.
   ★ Drip **axle oil (AXO80)** on the bearing.

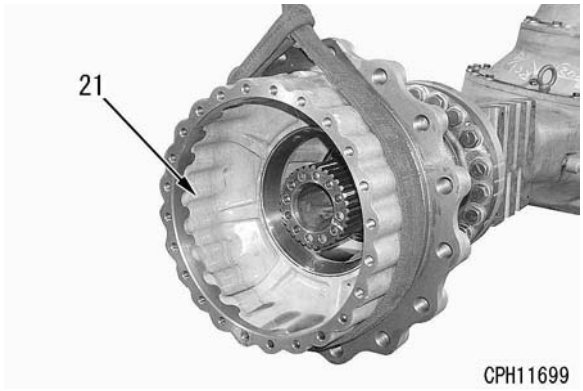


3) Press-fit oil seal (23), using push tool [6].
   ★ Keep press-fitting until the oil seal comes into close contact with the wheel hub. (Clearance is less than **0.2 mm**)
   Oil seal lip face and inside of oil seal (100% full): **Grease (G2-LI)**



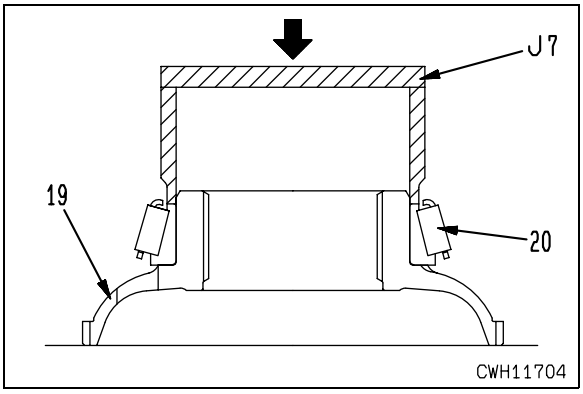
4) Sling wheel hub assembly (21) and install it to the axle housing.
   Wheel hub assembly: **60 kg**
5) Press-fit bearing (24), using tool **J2**.



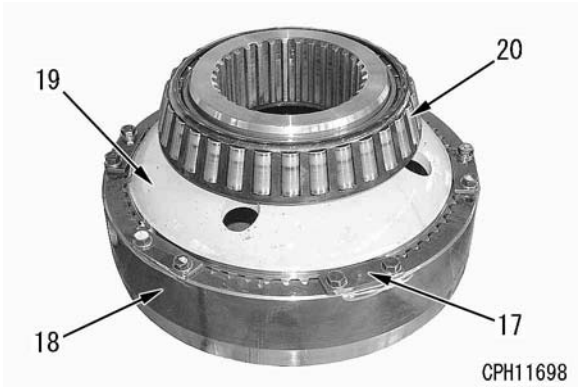


3. Subassembly of ring gear assembly

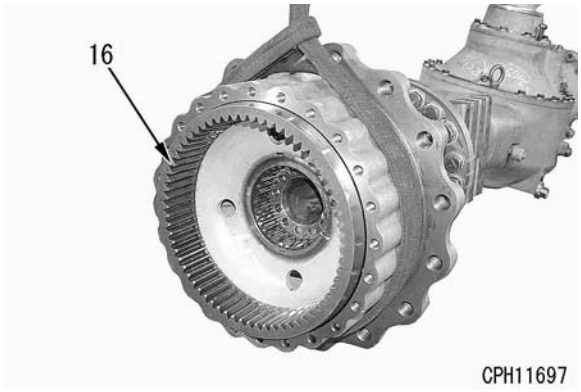
1) Press-fit bearing (20) into inner hub (19), using push tool **J7**.
   ★ Drip **axle oil (AXO80)** on the bearing after assembly.



2) Assemble inner hub (19) in ring gear (18) and install plate (17).
   Mounting bolt
   : Liquid adhesive (LT-2)
   Mounting bolt
   : 27.5 – 34.5 Nm {2.8 – 3.5 kgm}
   [Target value: 31 Nm {3.2 kgm}]

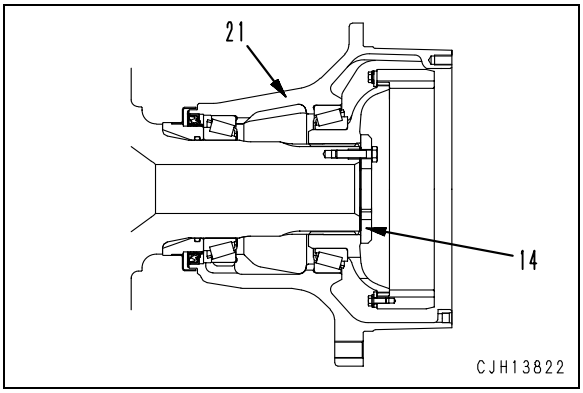


3) Install ring gear assembly (16).

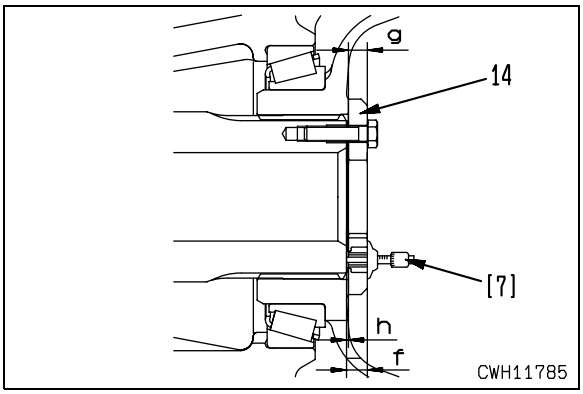


4. Adjustment of pre-load on bearing

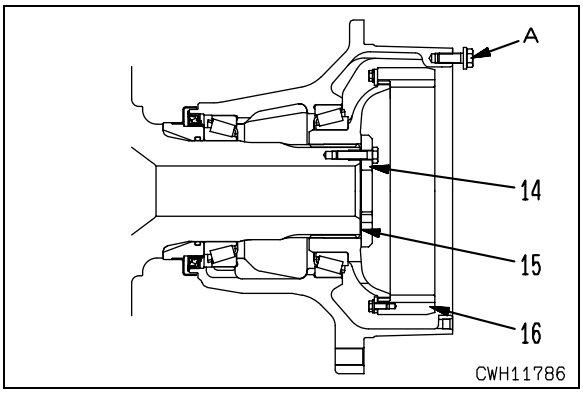
1) Install retainer (14) temporarily without shims being assembled in.
2) Tighten mounting bolt in every 2 (4 bolts in total) evenly to the specified torque of 49 ± 4.9 Nm {5 ± 0.5 kgm}, while wheel hub assembly (21) by 20 to 30 turns.
   ★ If the mounting bolts are tightened without rotating the wheel hub assembly (21), the bearing will not sit in well and no right preload is given to the bearing.



3) Measure dimension "**f**" between the end surface of the shaft and the end surface of retainer (14), using depth micrometer [7].
   ★ Take measurement at 2 points and calculate the average value.
4) Remove retainer (14) and measure thickness "**g**" of the retainer. Add 0.27mm to difference "**h**" of the measured values **h (= f – g)**, and the shim thickness is obtained.
   • Kind of shim thickness
   : 0.05 mm, 0.2 mm, 0.3 mm and 1.0 mm

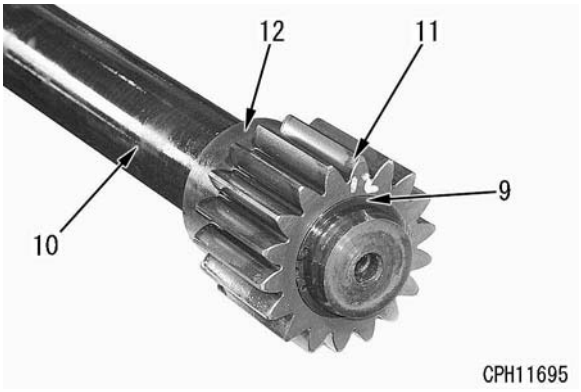


5) Assemble shims (15) having thickness selected in the step 4) above in retainer (14) and install the retainer.
   ★ Tighten the mounting bolts evenly, while rotating ring gear assembly (16), until the tightening torque is equal for all the bolts.
   Mounting bolt
   : Liquid adhesive (LT-2)
   Mounting bolt
   : 98 – 123 Nm {10 – 12.5 kgm}
   [Target value: 11.3 Nm {11.5 kgm}]
   ★ After finishing tightening, check that there is nothing wrong with rotation when turning ring gear assembly (16).



5. Sun gear and drive shaft

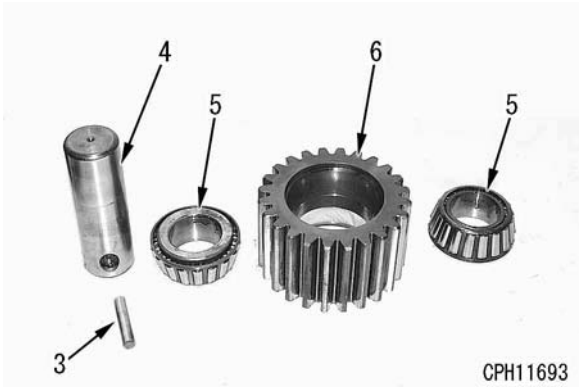
1) Assemble spacer (12) and sun gear (11) in drive shaft (10) and install snap ring (9).



2) Install sun gear and drive shaft assembly (8).
   Sun gear and drive shaft assembly
   : 25 kg

6. Subassembly of carrier assembly

1) Set bearings (5) to gear (6) and assemble the gear in the carrier.
2) Install shaft (4).
   ★ When installing the shaft, pay attention to its pinhole for spring pin.
3) Install spring pin (3).



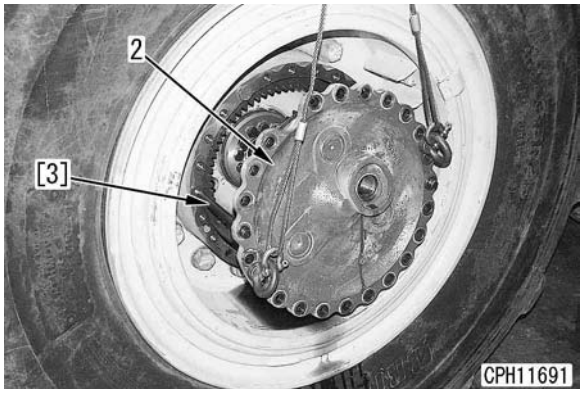
7. Installation of carrier assembly

1) Sling carrier assembly (2) after installing an O-ring and install along guide bolt [3].

Mounting bolt

: 157 – 196 Nm {16 – 20 kgm}

[Target value: 177 Nm {18 kgm}]



8. Rear wheel assembly

Sling rear wheel (1) to install.

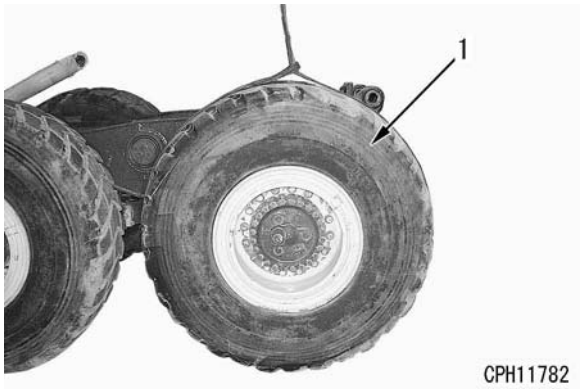
Rear wheel assembly (one side)

: 550 kg

Mounting bolt

: 824 – 1,030 Nm {84 – 105 kgm}

[Target value: 927 Nm {94.5 kgm}]



- **Refilling with oil (rear differential case and rear final drive case)**

  Refill with oil through oil filler ports of rear differential case and left and right rear final drives up to the specified level.

  Rear differential case

  : 25ℓ Axle oil (AXO80)

  Rear final drive case

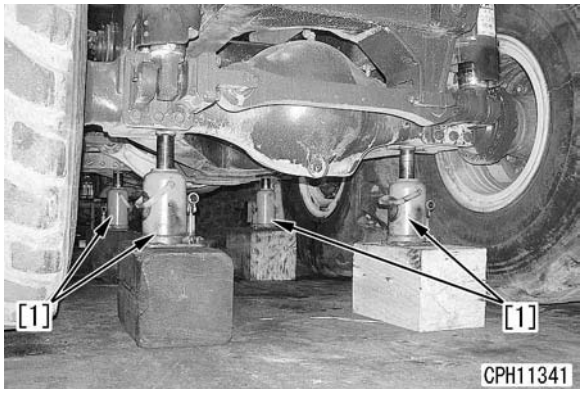
  : 5ℓ (one side) Axle oil (AXO80)

Removal and installation of center axle assembly

Removal

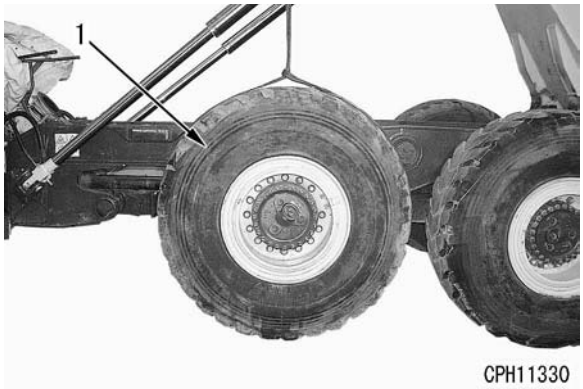
- ⚠ **Turn the parking brake switch on and put wooden blocks behind the wheels.**
- ⚠ **Raise the body assembly to the maximum and insert a lock pin.**
- ⚠ **Disconnect the cable from the negative (–) terminal of battery.**
- ⚠ **Release nitrogen gas from the rear suspension cylinder, referring to the section of "Testing and adjusting suspension cylinder" in the chapter of Testing and adjusting.**
- ⚠ **Loosen the hydraulic oil filler cap to release the internal pressure of the hydraulic tank.**

1. Raise the underside of center axle and rear axle at the left and right sides, using hydraulic jacks [1].



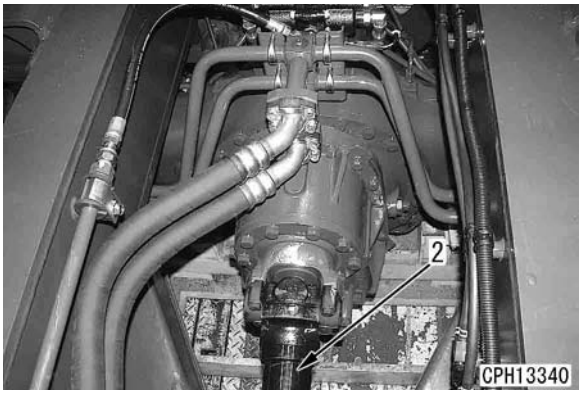
2. Sling center wheel (1) to remove the mounting bolts, and remove the left and right center wheels. [*1]

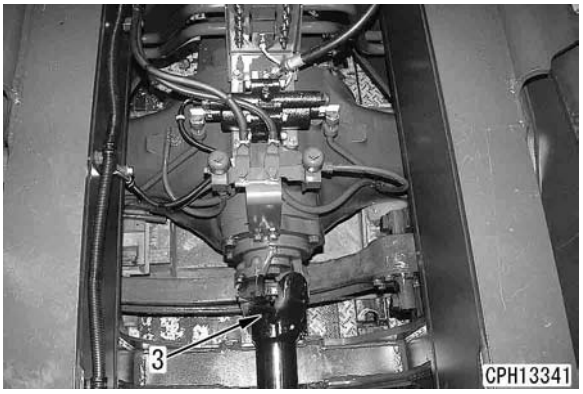
Center wheel: **550 kg (one side)**



3. Separate drive shaft (2) between the hitch frame and center differential and drive shaft (3) between the center differential and rear differential at the center differential side. [*2]

★ After slinging, separate by removing the drive shaft mounting bolts.

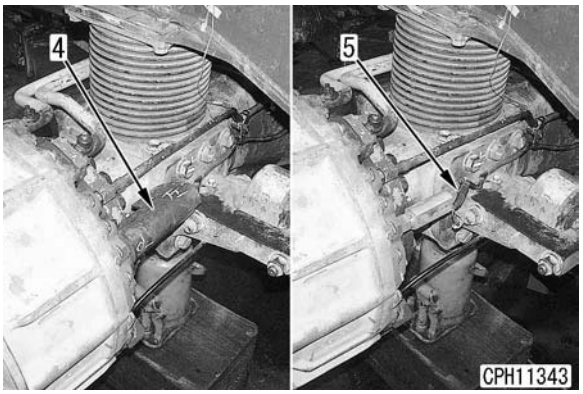




4. Remove cover (4). (If equipped)

5. Disconnect left and right wiring connectors (5). (If equipped)

- Final drive, right: **B26**
- Final drive, left: **B02**

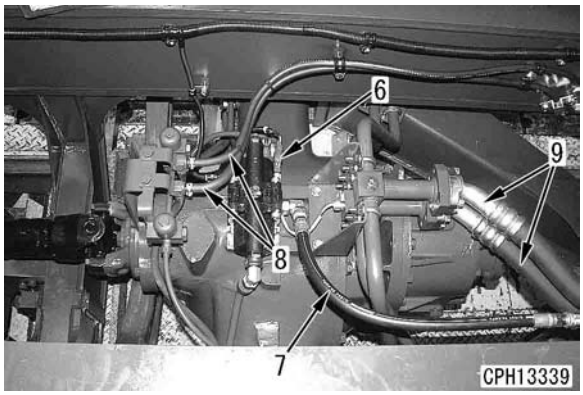


6. Disconnect wiring connector (T14) (6).

7. Disconnect brake actuator hose (7).

8. Disconnect pump suction hoses (8).

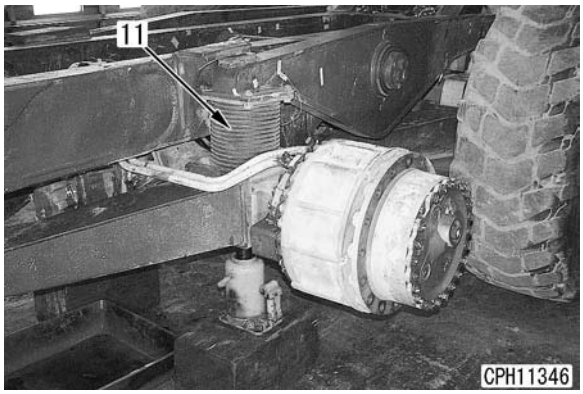
9. Disconnect 2 brake cooling hoses (9).



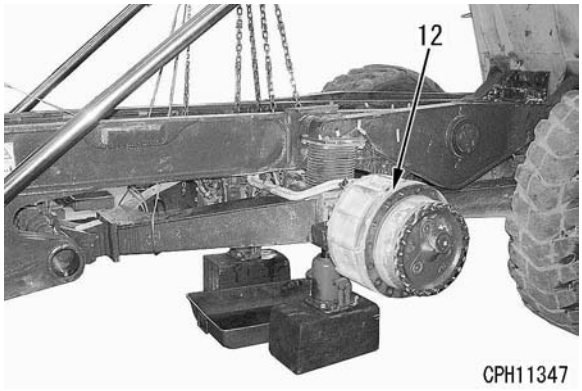
10. Remove the mounting bolts for center lateral rod (10) and sling the rod to remove. [*3]

Center lateral rod: **40 kg**

11. Remove the mounting bolts for equalizer bar spring (11) and separate the spring.



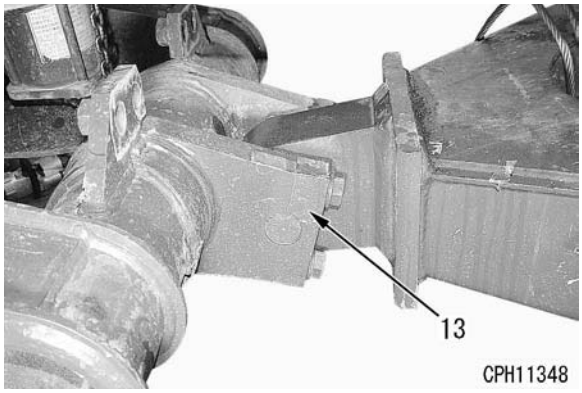
12. Sling center axle and arm assembly (12).



13. Remove left and right caps (13) at a pin of the arm mounting base, and take down center axle and arm assembly (12) to remove. [*4]

Center axle and arm assembly

: 1,600 kg



Installation

- Installation is carried out in the reverse order to removal.

[*1]

Center wheel mounting bolt
: 824 – 1,030 Nm {84 – 105 kgm}
[Target value: 927 Nm {94.5 kgm}]

[*2]

★ Install the center axle assembly after confirming that the yoke of drive shaft between the hitch frame and center differential and the yoke of drive shaft between center differential and rear differential are shifted from each other at 45° ± 6°.

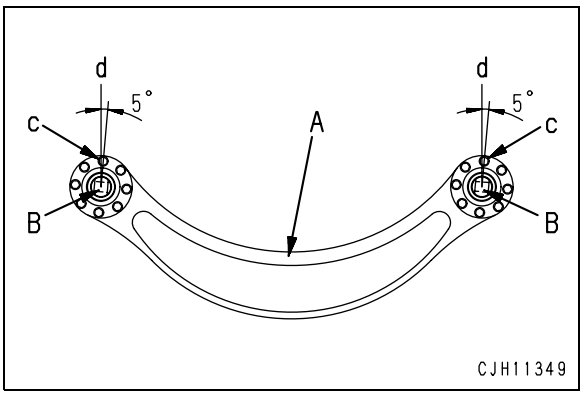
★ When installing the drive shafts, check that convex section on the spider cap engages completely with groove of the counter yoke, and then tighten the mounting bolts.

Drive shaft mounting bolt
: Liquid adhesive (LT-2)

Drive shaft mounting bolt
: 98 – 123 Nm {10 – 12.5 kgm}
[Target value: 113 Nm {11.5 kgm}]

[*3]

★ When installing bearing (**B**) to center lateral rod (**A**), align tapped hole "**c**" with centerline "**d**" of bearing (**B**).



[*4]

Cap mounting bolt
: 455 – 565 Nm {46.5 – 58 kgm}

★ Adjust the suspension cylinder stroke, referring to the section of "Testing and adjusting suspension cylinder" in the chapter of Inspection and adjustment.

- **Refilling with oil (transmission case and brake oil tank)**
  Refill with oil through the oil filler port up to the specified level, then start the engine and run at low idle, and check the oil level again.

- **Air Bleeding (brake)**
  After finishing the installation, bleed air from the brake circuit , referring to the section of "Bleeding air from brake circuit" in Inspection and adjustment.

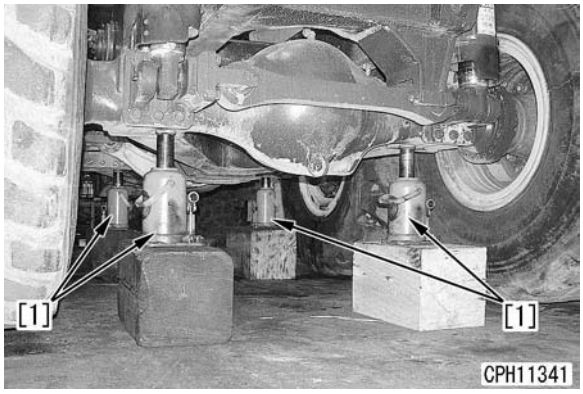
Removal and installation of rear axle assembly

Removal

⚠ **Turn the parking brake switch on and put wooden blocks behind wheels.**

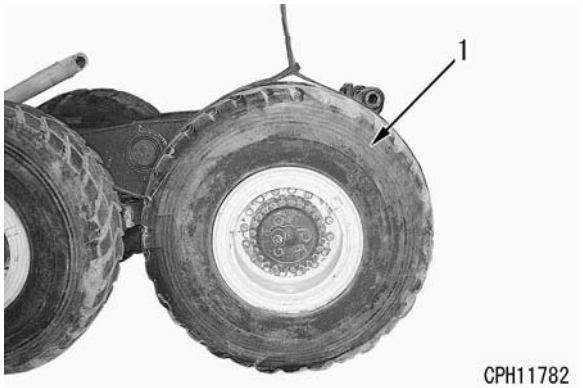
⚠ **Release nitrogen gas from the rear suspension cylinder, referring to the section of "Testing and adjusting suspension cylinder" in the chapter of Testing and adjusting.**

1. Remove the body assembly, referring to the section of "Removal and installation of body assembly".
2. Raise the underside of center axle and rear axle at the left and right sides, with hydraulic jacks [1].



3. Sling rear wheel (1) to remove the mounting bolts and then remove the left and right rear wheels. [*1]

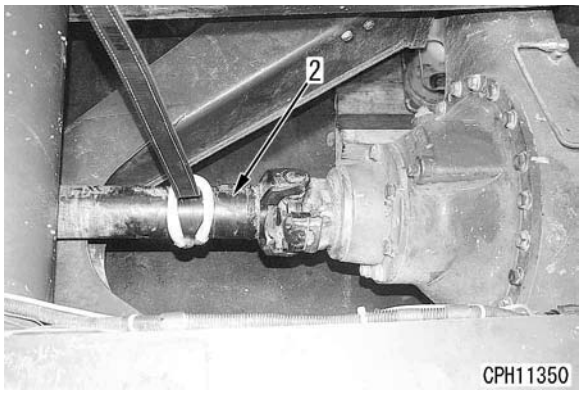
   Rear wheel: **550 kg (one side)**



4. Separate drive shaft (2) between the center differential and rear differential at the rear differential side. [*2]

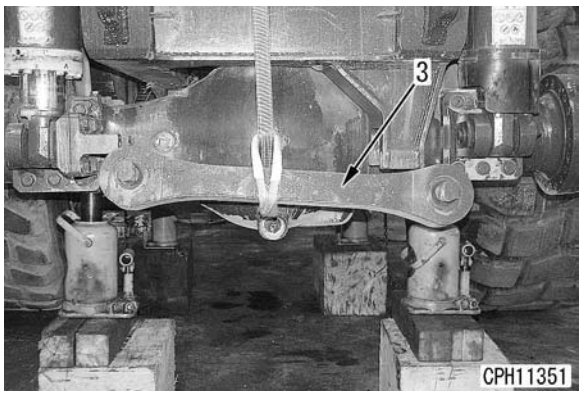
   ★ After slinging temporarily, remove the drive shaft mounting bolts and separate the shaft.

   Drive shaft: **30 kg**



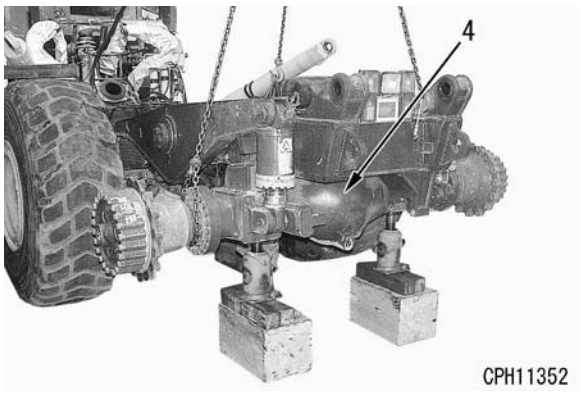
5. Remove the mounting bolts of rear lateral rod (3) and sling the rod to remove. [*3]

   Rear lateral rod: **50 kg**



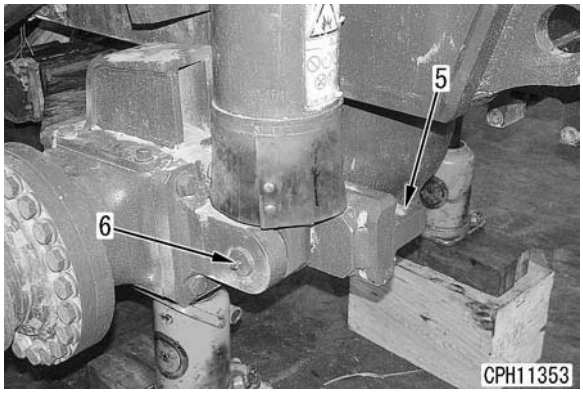
6. Sling rear axle and arm assembly (4).

   Rear axle and arm assembly: **1,100 kg**



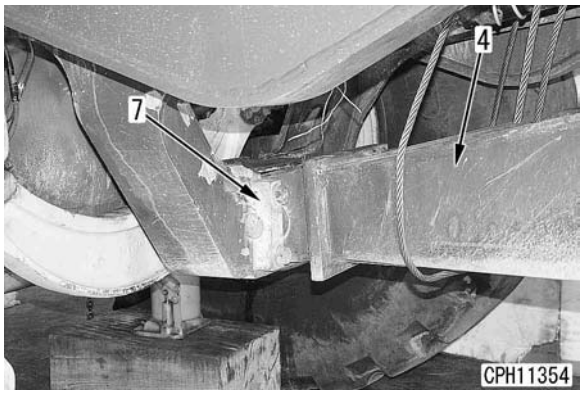
7. Remove left bracket (5). [*4]

8. Remove rear suspension pins (6) of both left and right sides at their head side.



9. Remove left and right caps (7) at a pin of the arm mounting base, and take down rear axle arm (4) to remove. [*5]

Rear axle and arm assembly: **1,100 kg**



Installation

- Installation is carried out in the reverse order to removal.

[*1]

Rear wheel mounting bolt

: 824 – 1,030 Nm {84 – 105 kgm}

[Target value: 927 Nm {94.5 kgm}]

[*2]

★ When installing the drive shafts, check that convex section on the spider cap engages completely with groove of the counter yoke, and then tighten the mounting bolts.

Drive shaft mounting bolt

: Liquid adhesive (LT-2)

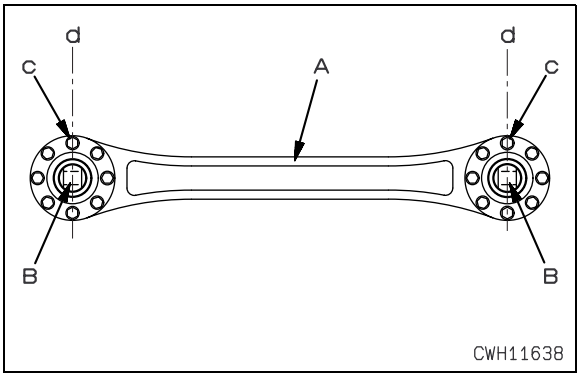
Drive shaft mounting bolt

: 98 – 123 Nm {10 – 12.5 kgm}

[Target value: 113 Nm {11.5 kgm}]

[*3]

★ When installing bearing (**B**) to rear lateral rod (**A**), align tapped hole "**c**" with centerline "**d**" of bearing (**B**).



[*4]

Bracket mounting bolt

: 455 – 565 Nm {46.5 – 58 kgm}

[*5]

Cap mounting bolt

: 455 – 565 Nm {46.5 – 58 kgm}

★ Adjust the suspender cylinder stroke, referring to the section of "Testing and adjusting suspenion cylinder" in the chapter of Testing and adjusting.

HM300-2 Articulated dump truck

Form No. SEN00691-02

ARTICULATED DUMP TRUCK

HM300-2

Machine model	Serial number
HM300-2	2001 and up

50 Disassembly and assembly

Undercarriage and frame

Removal and installation of front suspension cylinder assembly

Special tools

Sym-bol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
Q	792-610-1000	Suspension tool assembly	■	1		

Removal

⚠ **Turn the parking brake switch on and put wooden blocks behind the wheels.**

⚠ **Release nitrogen gas from the front suspension cylinder, referring to the section of "Testing and adjusting suspension cylinder" in the chapter of Testing and adjusting.**

★ Show left side.

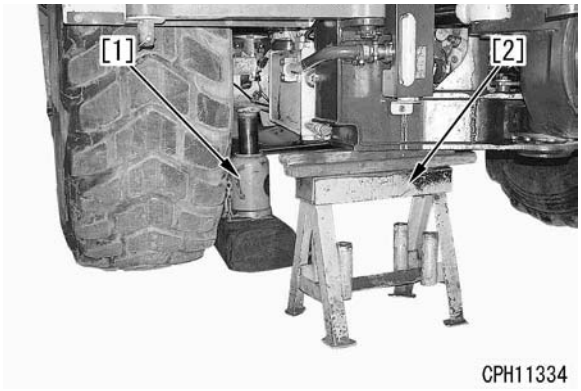
1. Remove the front wheel.

1) Sling left fender (1) to remove.

Left fender: **80 kg**

2) Raise the underside of front axle on the side of wheel to be removed with hydraulic jack [1].

3) Support the front frame underside with pedestal (frame) [2].

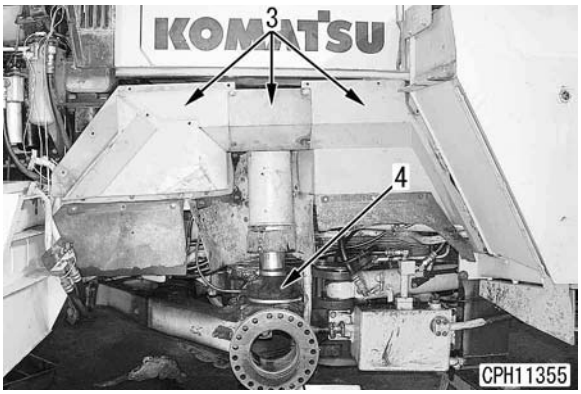


4) Sling front wheel (2) temporarily, and remove the mounting bolts to remove the wheel. [*1]

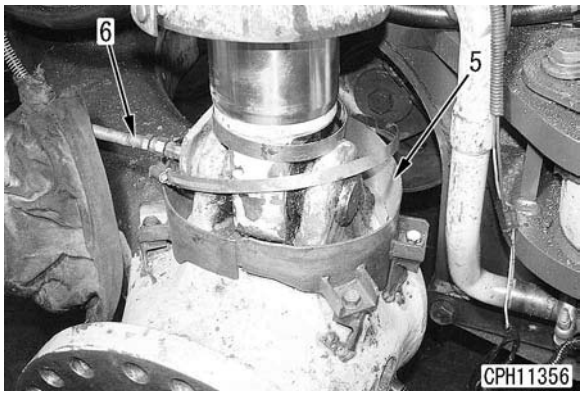
Front wheel: **550 kg (one side)**

2. Remove 3 covers (3).

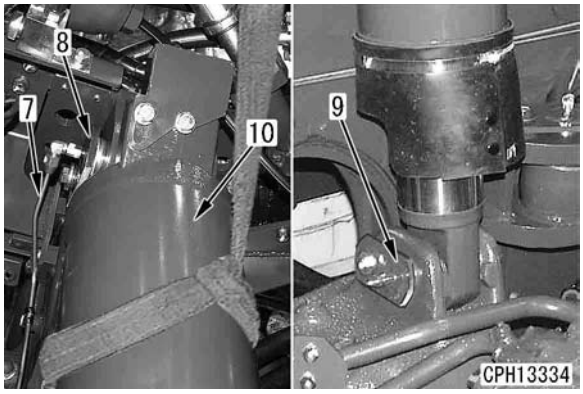
3. Remove cover (4). [*2]



4. Remove bracket (5). [*3]
5. Disconnect grease hose (6) from the head pin.



6. Disconnect grease tube (7).
7. Sling the front suspension cylinder assembly (10) temporarily.
8. Remove head pin (8) and bottom pin (9), and sling front suspension cylinder (10) off. [*4]
   Front cylinder suspension assembly
   : 75 kg



Installation

- Installation is carried out in the reverse order to removal.

[*1]
Center wheel mounting bolt
: 824 – 1,030 Nm {84 – 105 kgm}
[Target value: 927 Nm {94.5 kgm}]

[*2]
Cover clamp
: 6.28 – 7.25 Nm {0.64 – 0.74 kgm}
[Target value: 6.8 Nm {69 kgm}]

[*3]
Bracket mounting bolt
: 69 – 74 Nm {6 – 7.5 kgm}
[Target value: 66.5 Nm {6.75 kgm}]

[*4]
Pin mounting bolt
: 98 – 123 Nm {10 – 12.5 kgm}
[Target value: 110.5 Nm {11.3 kgm}]

- **Refilling with nitrogen gas and adjusting cylinder stroke**
  Refill with nitrogen gas and adjust the cylinder stroke, referring to the section of "Testing and adjusting suspension cylinder" in the chapter of Testing and adjusting.
  ★ Use tool **Q** for filling nitrogen gas to the cylinder.

Removal and installation of rear suspension cylinder assembly

Special tools

Sym-bol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
Q	792-610-1000	Suspension tool assembly	■	1		

Removal

⚠ **Turn the parking brake switch on and put wooden blocks behind the wheels.**

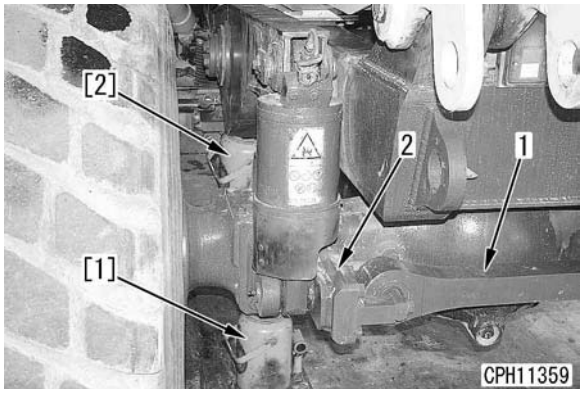
⚠ **Release nitrogen gas from the rear suspension cylinder, referring to the section of "Testing and adjusting suspension cylinder" in the chapter of Testing and adjusting.**

1. Raise the underside of rear axle and equalizer bar (underside of rear frame) with hydraulic jacks [1] and [2].

2. Support rear lateral rod (1) with a hydraulic jack and remove. [*1]

Rear lateral rod: **50 kg**

3. Remove left bracket (2). [*2]



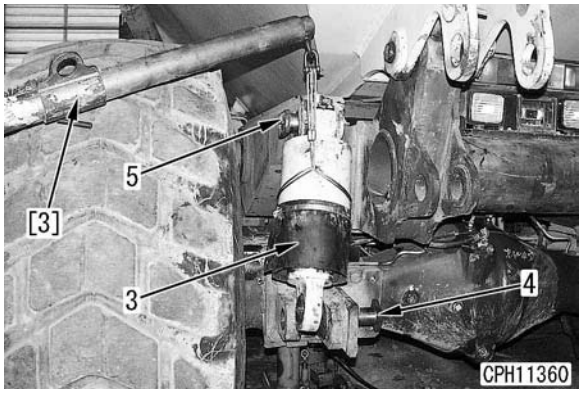
4. Sling rear suspension cylinder assembly (3) with balance bar [3] temporarily.

★ Hold a pole tool [3] with a crane.

5. Remove pin (4) on the head side and pin (5) on the bottom side, and sling rear suspension cylinder assembly (4) to remove.

★ You hold a pole tool [3] at the opposite side with rear suspension cylinder assembly. Keeping the balance, move the crane slowly and take rear suspension cylinder assembly (3) down.

Rear suspension cylinder assembly: **55 kg**

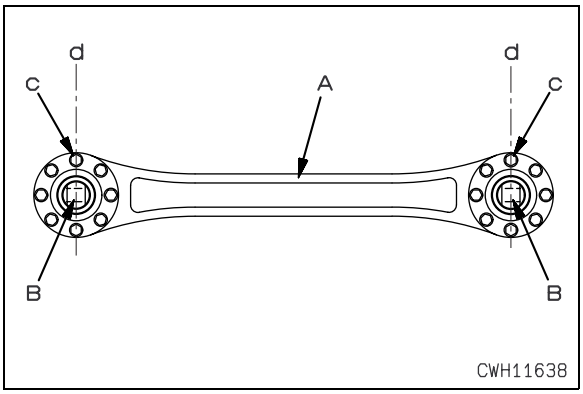


Installation

- Installation is carried out in the reverse order to removal.

[*1]

★ Install bearing (**B**) to rear lateral rod (**A**) and align tapped hole "**c**" with centerline "**d**" of bearing (**B**).



[*2]

Bracket mounting bolt

: 455 – 565 Nm {46.5 – 58 kgm}

- **Refilling with nitrogen gas and adjusting cylinder stroke**

  Refill with nitrogen gas and adjust the cylinder stroke, referring to the section of "Testing and adjusting suspension cylinder" in the chapter of Testing and adjusting.

  ★ Use tool **Q** for filling nitrogen gas to the cylinder.

Removal and installation of equalizer bar

Special tools

Sym-bol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
Q	792-610-1000	Suspension tool assembly	■	1		

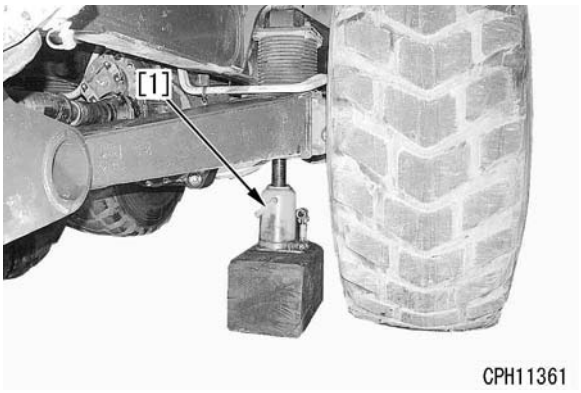
Removal

⚠ **Turn the parking brake switch on and put wooden blocks behind the wheels.**

⚠ **Raise the body assembly to the maximum and insert a lock pin.**

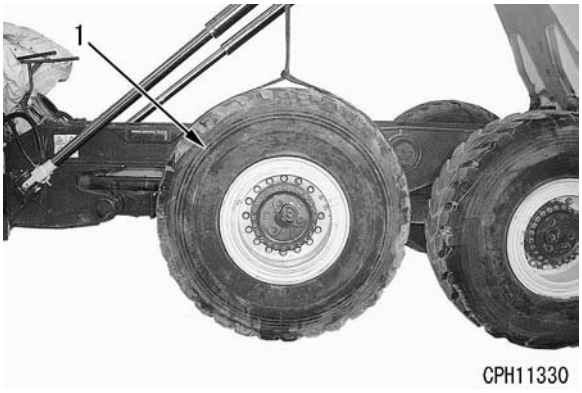
⚠ **Release nitrogen gas in the rear suspension cylinder, referring to the section of "Testing and adjusting suspension cylinder" in the chapter of Testing and adjusting.**

1. Raise the center axle, rear axle and rear frame on the side of equalizer bar to be removed, using 3 hydraulic jacks [1].



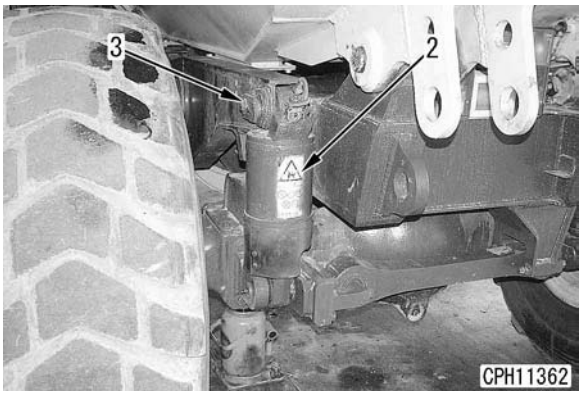
2. Sling center wheel (1), and remove its mounting bolts to remove. [*1]

Center wheel: **550 kg (one side)**

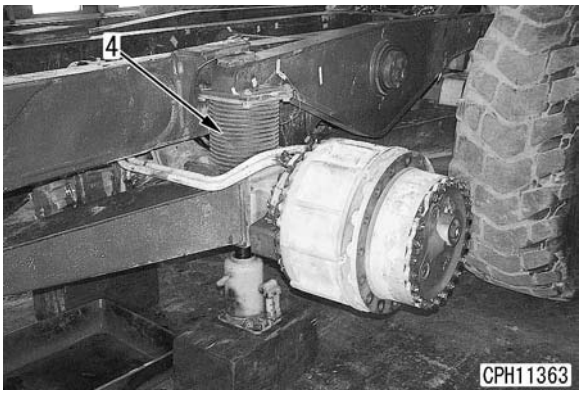


3. Remove bottom pin (3) of rear suspension cylinder assembly (2).

★ Tilt back the rear suspension cylinder toward the rear and secure it.

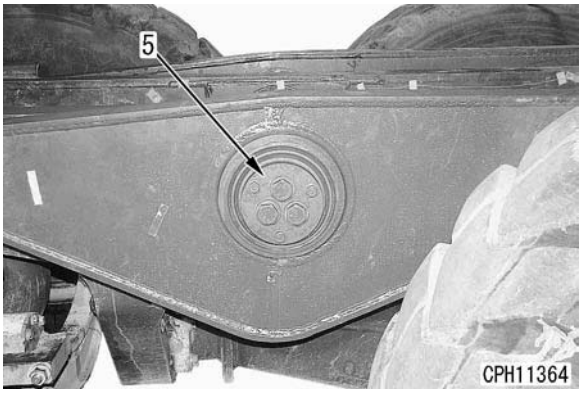


4. Separate equalizer spring (4) after removing its mounting bolts.

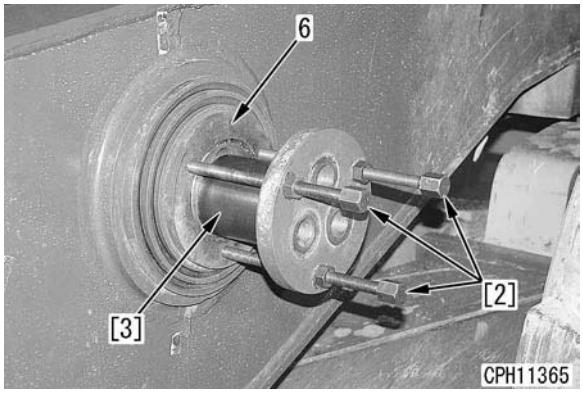


5. Sling the equalizer bar.

6. Remove plate (5) in the center of equalizer bar. [*2]



7. Remove bushing (6), using 3 forcing screws [2] and tool [3].



8. Sling equalizer bar (7) to remove.

Equalizer bar: **200 kg**

Installation

- Installation is carried out in the reverse order to removal.

[*1]

Center wheel mounting bolt
: 824 – 1,030 Nm {84 – 105 kgm}
[Target value: 927 Nm {94.5 kgm}]

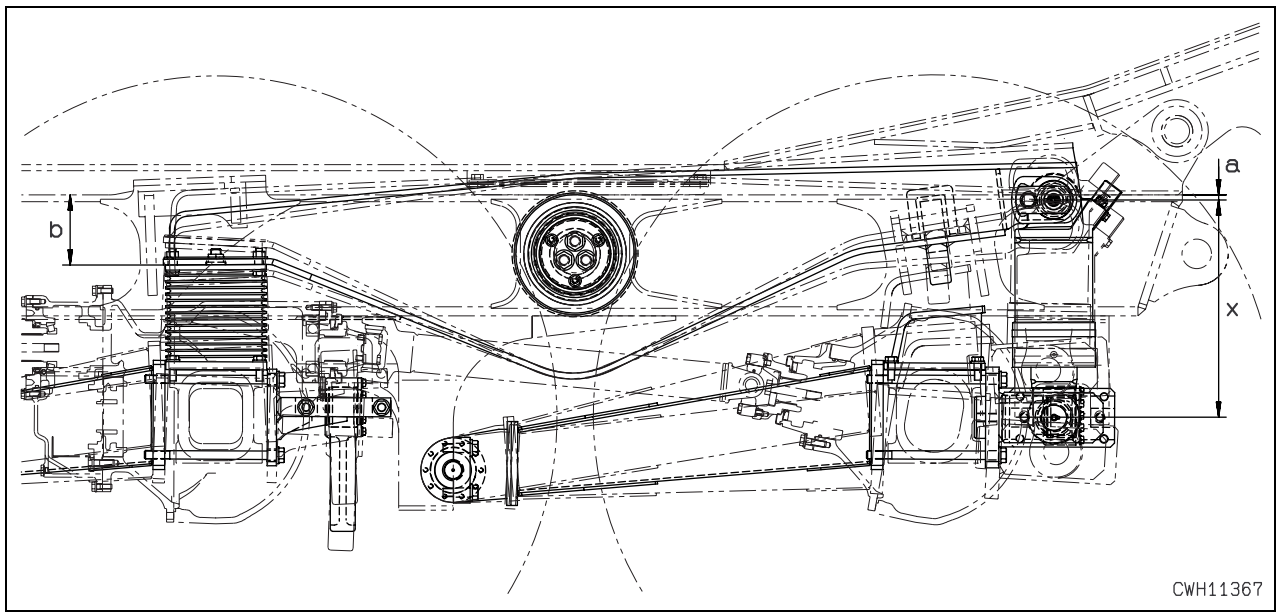
[*2]

★ Tighten 3 cover bolts (M24) after confirming the following installing dimensions.
- Check that when dimension "**x**" between upper and lower pins of rear suspension cylinder is 518 mm (**x** = 518 mm), dimension "**a**" between the bottom pin center of rear suspension cylinder and the rear frame upper face is 17 mm and dimension "**b**" between the equalizer upper face and the rear frame upper face is 162 mm.

Cover mounting bolt (M14)
: 157 – 196 Nm {16 – 20 kgm}
[Target value: 177 Nm {18 kgm}]

Cover mounting bolt (M24)
: 824 – 1,030 Nm {84 – 105 kgm}
[Target value: 927 Nm {94.5 kgm}]

- **Refilling with nitrogen gas and adjusting cylinder stroke**
  Refill with nitrogen gas and adjust the cylinder stroke, referring to the section of "Testing and adjusting suspension cylinder" in the chapter of Testing and adjusting.
  ★ Use tool **Q** for filling nitrogen gas to the cylinder.



Removal and installation of hitch frame assembly

Special tools

Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
K	1	792T-246-1130	Plate	■	1		○
	2	792T-246-1140	Plate	■	1		○
	6	792T-446-1120	Push tool	■	1		○
		790-101-2310	Block	■	2		
		790-101-2390	Leg	■	2		
		790-101-2420	Adapter (16 mm)	■	2		
		790-101-2360	Plate	■	2		
		02215-11622	Nut	■	2		
		790-101-2102	Puller 300 kN {30 ton}	■	1		
		790-101-1102	Pump	■	1		

Removal

⚠ **Turn the parking brake switch on and put wooden blocks behind the wheels.**

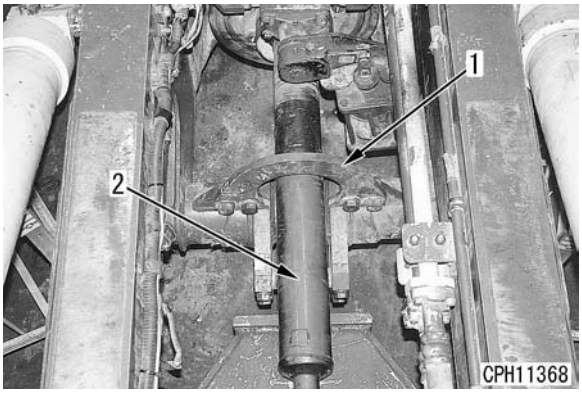
⚠ **Raise the body assembly to the maximum and insert a lock pin.**

⚠ **Key switch ON and set the dump lever "down" to release residual pressure from hoist hydraulic circuit.**
Do not start the engine during this procedure.

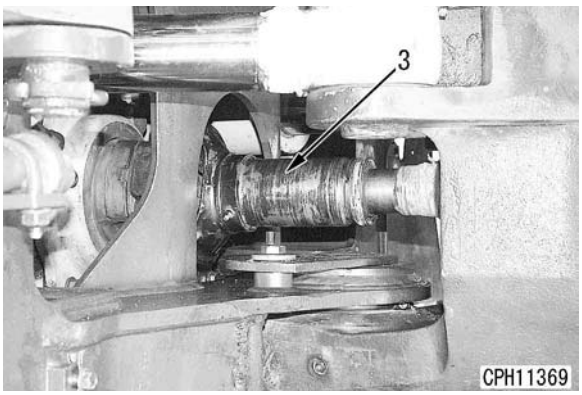
⚠ **Disconnect the cable from the negative (–) terminal of the battery beforehand.**

⚠ **Loosen the hydraulic oil filler cap to release the internal pressure of the hydraulic tank.**

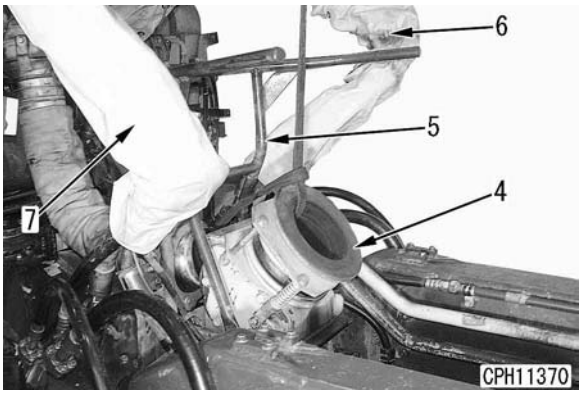
1. Unscrew the cap on the hydraulic tank.
2. Remove drive shaft guard (1).
3. Sling drive shaft (2) between the hitch frame and center differential to remove. [*1]
   Drive shaft between hitch frame and center differential: **45 kg**



4. Remove drive shaft (3) between the transmission and hitch frame. [*2]
   Drive shaft between transmission and hitch frame: **30 kg**



5. Sling exhaust box (4) to remove.
   Exhaust box: **35 kg**
6. Remove guard (5).
7. Remove hose covers (6) and (7).



8. Gradually loosen hoist cylinder hoses (8) and (9) between the front frame and rear frame as well as brake cooling hoses (10) and (11) and evacuate oil.

Hydraulic oil [hoses (8) and (9)]: **50**ℓ

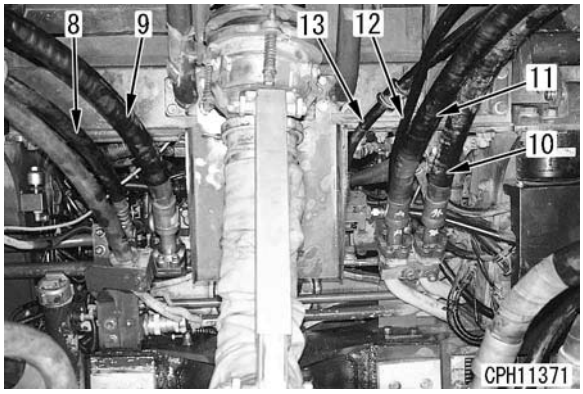
Transmission and brake cooling oil [hoses (10) and (11)]**: 15**ℓ

9. Disconnect the following hoses between the front frame and rear frame.

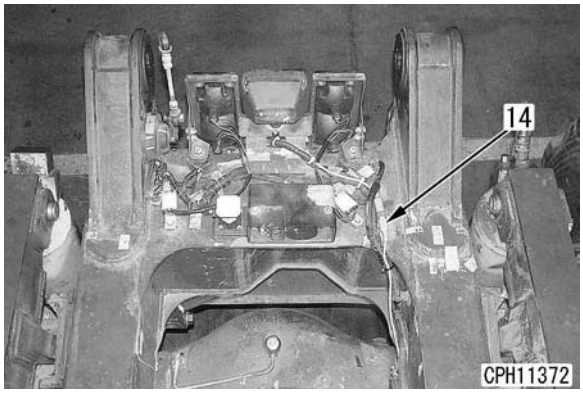
★ Either put an identification tag or put a counter mark on the piping in order to make no mistake about the installing position later.

★ Disconnect the parking brake hose at the rear frame side.

- Hoist cylinder hoses (8) and (9)
- Brake cooling hoses (10) and (11)
- Parking brake hose (12)
- Brake hose (13)

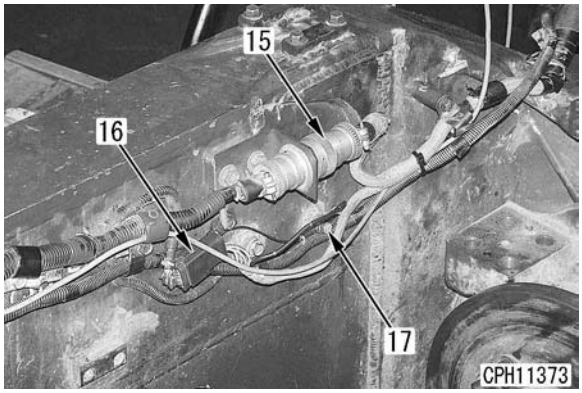


10. Disconnect connector (14) (If equipped) for a rearview camera at the machine rear.



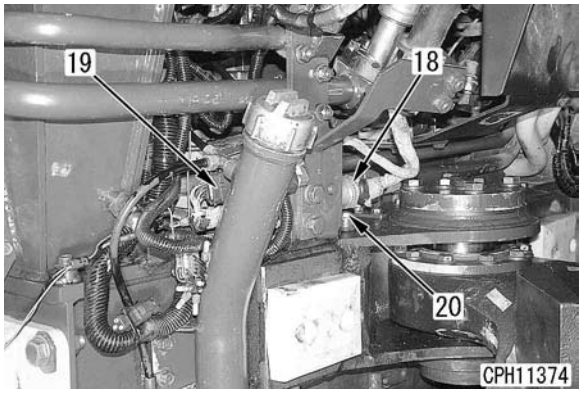
11. Disconnect the following wiring connectors and terminal from the rear frame front side.

- (15): J15
- (16): J13
- (17): Grounding terminal (ER)



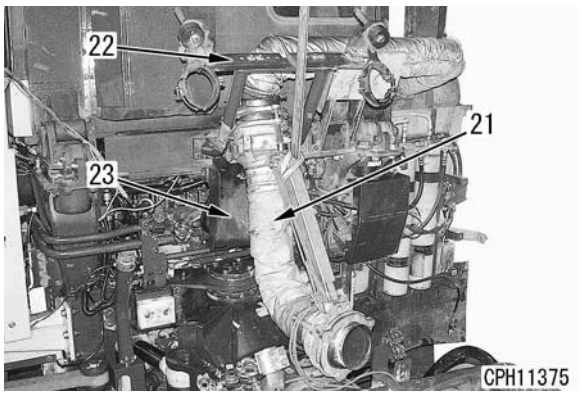
12. Disconnect the following wiring connectors and terminal from the front frame rear side.

- (18): J14
- (19): J12
- (20): Grounding terminal (ER)

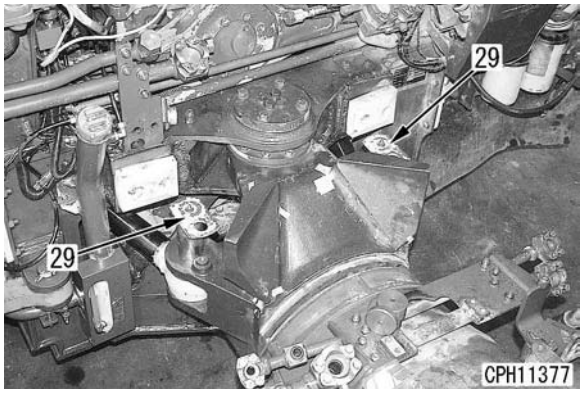


13. Sling exhaust duct assembly (21) to remove.
Exhaust duct assembly: **40 kg**

14. Remove brackets (22) and (23).



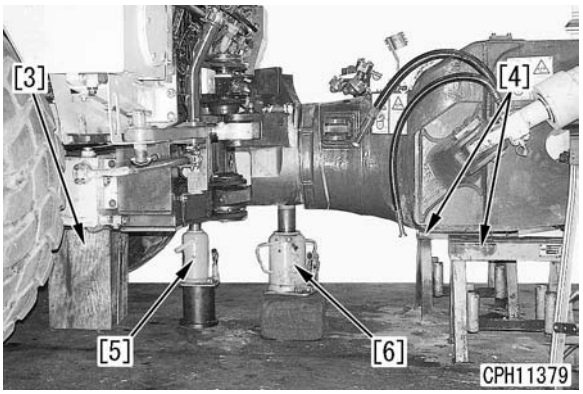
15. Remove left and right steering cylinder head pins (29). [*3]



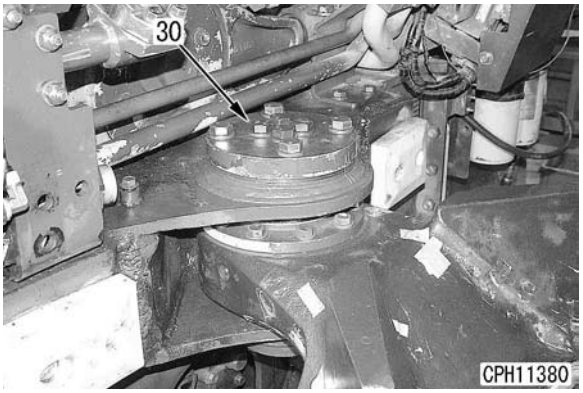
16. Support the chassis front and rear in the following manner.
1) Lift the chassis front part with sling [1], using a crane.

2) Support the body underside at the machine rear with block [2].

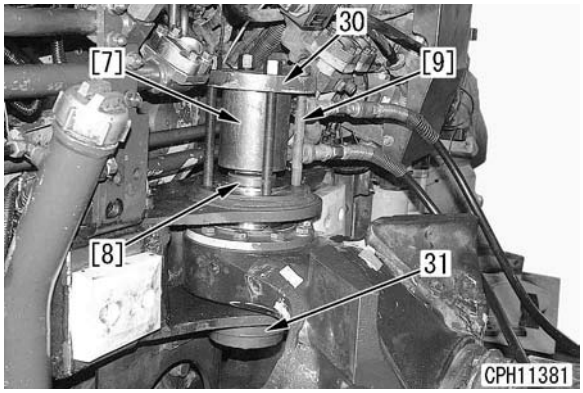
3) Support the front frame underside at the rear and the rear frame underside at the front with block [3] and pedestal [4] to ensure safety in the work.
4) Align the hinge pinhole centers by raising and lowering the front frame and rear frame with hydraulic jacks [5] and [6].



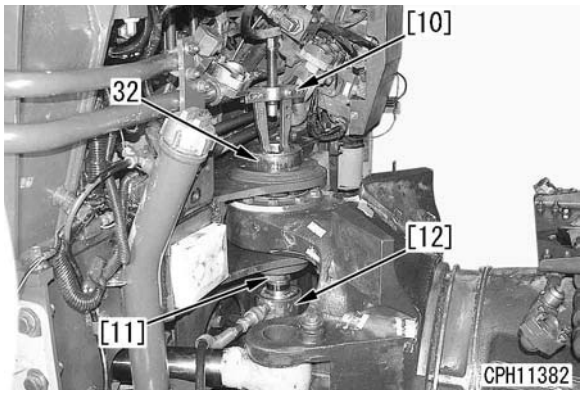
17. Remove the upper hinge pin and bushing in the following manner. [*4]
1) Remove retainer (30).
★ Shims are provided, so check their thickness, number in use and installed locations beforehand.



2) If it is difficult to remove upper hinge pin (31), set puller [7], plate [8] and 4 bolts [9] between retainer (30) and upper hinge pin (31) and push down upper hinge pin (31) to remove.

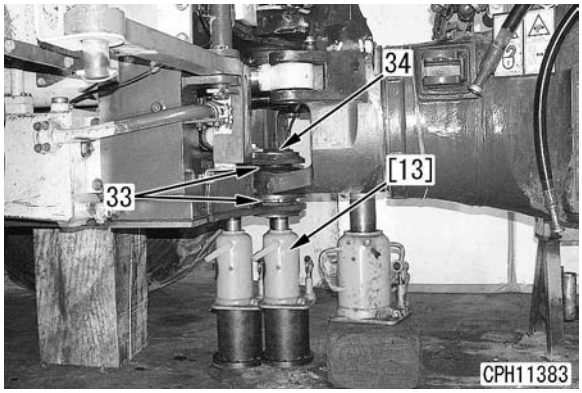


3) Hook puller [10] to a step inside the bushing, and take out bushing (32) upward by pushing up the claw of puller [10], using push tool [11] and puller [12].



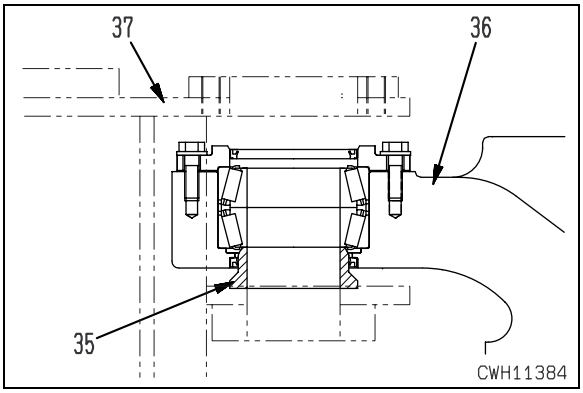
18. Remove the lower hinge pin in the following manner. [*5]

1) Remove the mounting bolts for the lower hinge pin.
2) Remove the mounting bolts and nuts, and then remove 2 O-rings (33).
3) Put hydraulic jack [13] to lower hinge pin (34) and take the pin out by pushing upward.
   ★ If the truck body is lifted with the lower hinge pin and the pin cannot be pulled out, hit the frame around the pin from above in that lifted condition and strike the pin out downward.



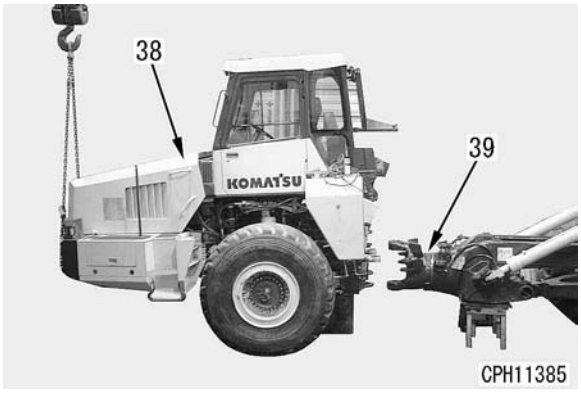
19. Check that there is clearance between the front frame and hitch frame.

20. Push up lower bushing (35) on the upper pin side toward the hitch frame (36) side by approx. 1 mm in order to avoid a step of the front frame (37). (Lower bushing (35) is not pressed.)



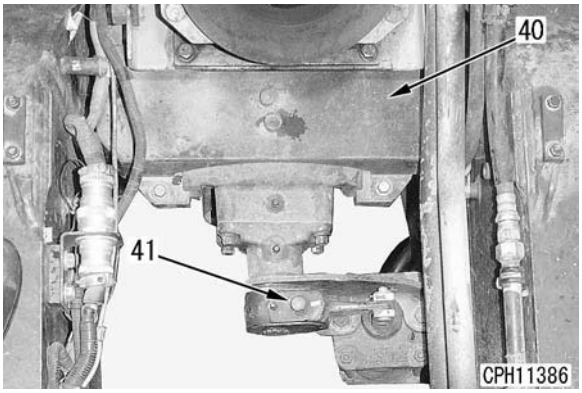
21. While keeping the front portion of frame assembly lifted with a crane, move the assembly a bit forward, using a lift truck, and separate front frame assembly (38) from hitch frame assembly (39).

⚠ **Before separating, carefully check levelness of the front frame and hitch frame and also check that there is clearance between the two frames.**



22. Remove cover (40).

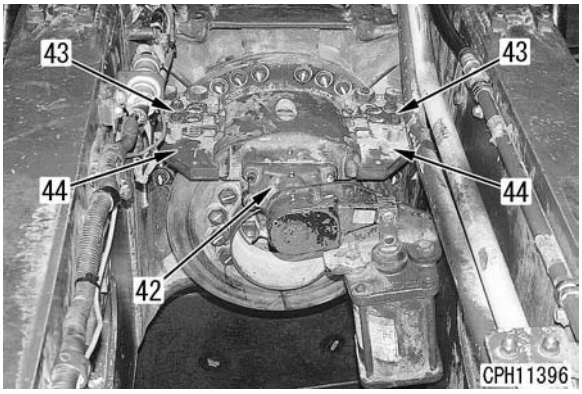
23. Turn parking brake releasing bolt (41) counterclockwise to release the parking brake. [*6]



24. Sling parking brake caliper assembly (42) and remove brackets (43) for expanding the pads and bracket (44). [*7]

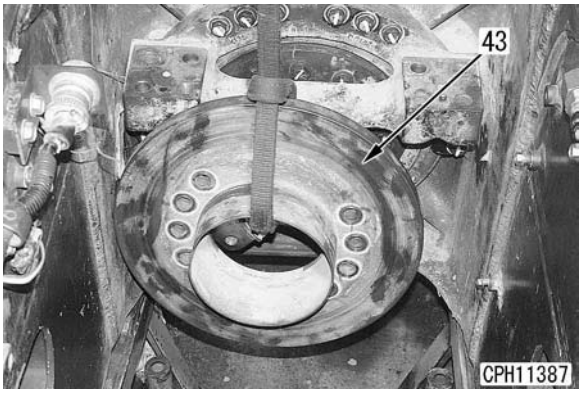
25. Sling parking brake caliper assembly (42) to remove.

Parking brake caliper assembly: **45 kg**



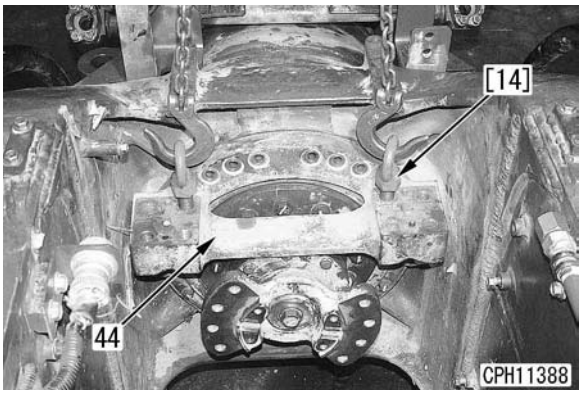
26. Sling parking brake disc (43) to remove. [*8]

Parking brake disc: **30 kg**

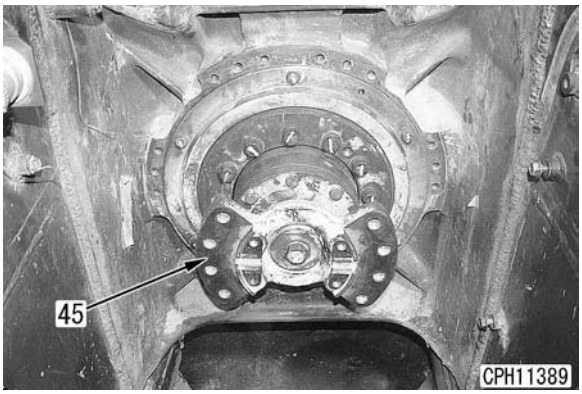


27. Sling bracket (44) to remove, using eyebolts [14]. [*9]

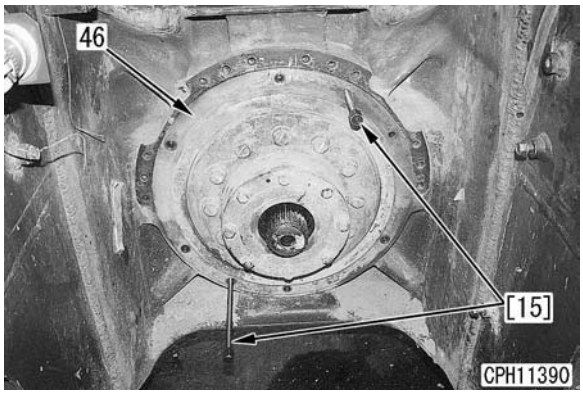
Bracket: **30 kg**



28. Remove coupling (45). [*10]

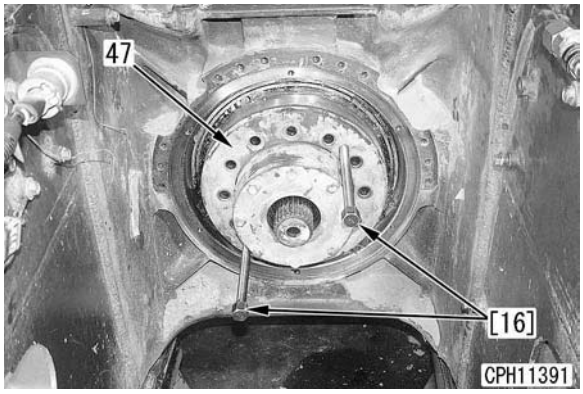


29. Remove retainer (46), using forcing screws [15]. [*11]



30. Remove retainer (47), using forcing screws [16]. [*12]

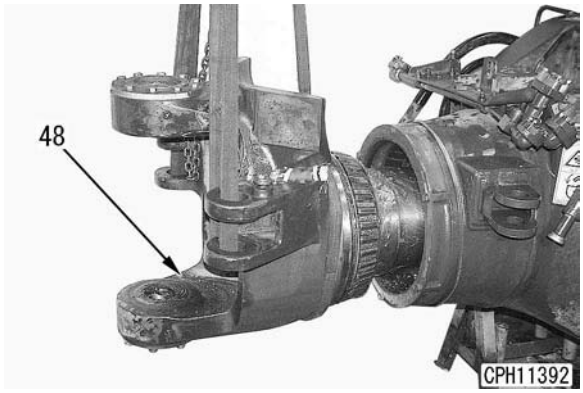
★ Shims are provided, so check their thickness, number in use and installed locations beforehand.

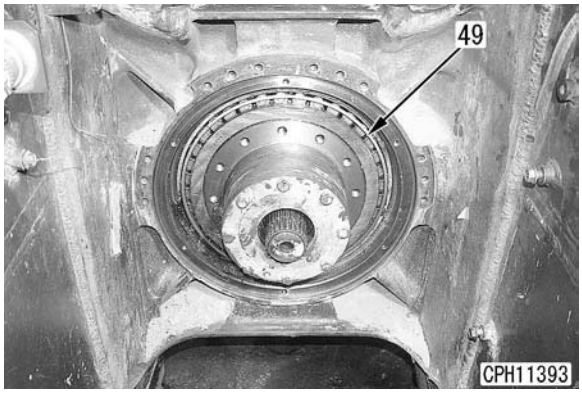


31. Sling hitch frame assembly (48) to remove. [*13]

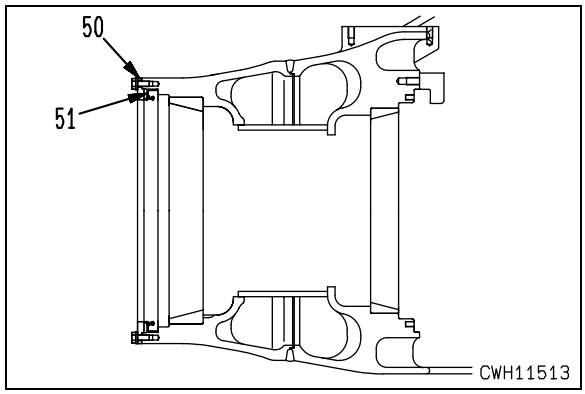
Hitch frame assembly: **600 kg**

★ Bearing (49) may fall off from the rear frame, so secure it to prevent fall-off.





32. Remove retainer (50) and dust seal (51) from the rear frame. [*14]



Installation

- Installation is carried out in the reverse order to removal.

[*1]

★ Before installing, check that the yoke of drive shaft between the hitch frame and center differential and the yoke of drive shaft between center differential and rear differential are shifted from each other by 45° ± 6°.

[*1] [*2]

★ When installing the drive shafts, check that convex section on the spider cap completely engages with groove of the counter yoke, and then tighten the mounting bolts.

Drive shaft mounting bolt
: Liquid adhesive (LT-2)

Drive shaft mounting bolt
: 98 – 123 Nm {10 – 12.5 kgm}
[Target value: 113 Nm {11.5 kgm}]

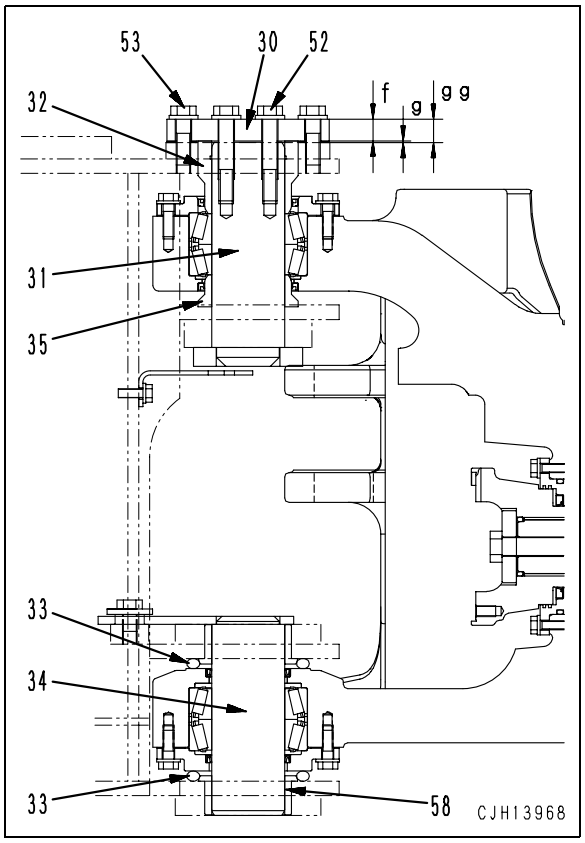
[*3]

⚠ When aligning the pinholes, never put a finger into the hole.

[*4] [*5]

★ Install the hinge pin in the following steps.

1) Set bushing (58) to the front frame.
2) Set bushing (35) to the hitch frame and match the articulation center (position of center pin) by moving the front frame assembly to the rear.
   Dust seal lip face: **Grease (G2-LI)**
3) Insert lower hinge pin (34) from above.
   Dust seal lip face: **Grease (G2-LI)**
   Bearing inside perimeter
   : Lubricant containing molybdenum disulfide (LM-P)
4) Install 2 O-rings (33).
   O-ring: **Grease (G2-LI)**
5) Measure thickness "**f**" of retainer (30).
6) Insert upper hinge pin (31) from below.
   Dust seal lip: **Grease (G2-LI)**
   Upper hinge pin outside perimeter
   : Lubricant containing molybdenum disulfide (LM-P)
7) Assemble bushing (32) from above.
8) Assemble retainer (30) by tightening the mounting bolt (52).
   Retainer mounting bolt
   : 245 – 309 Nm {25.0 – 31.5 kgm}
   ★ After confirming thorough running-in of each contact surface, tighten mounting bolt (52) again to the specified torque.
9) Measure dimension "**gg**" with clearance between top of retainer (30) and the front frame at 3 points.
10) Select appropriate shims and assemble them in so that the total shim thickness is "**g**", i.e. the difference between "**gg**" and "**f**" dimensions (**g = gg – f**) minus 0.08 to 0.18 mm.
    0.08 < g = gg – f < 0.18 (mm)
    - Kind of shim thickness
      : 0.1 mm and 0.5 mm
    - Standard shim thickness: **2 mm**
11) Install a combination of the selected shims to retainer (30) and tighten retainer mounting bolts (52) and (53).
    Retainer mounting bolt
    : Liquid adhesive (LT-2)
    Retainer mounting bolt
    : 245 – 309 Nm {25.0 – 31.5 kgm}



[*6] [*7]

★ Check the parking brake pad wear amount and adjust the pad clearance, referring to the section of "Testing wear of parking brake pad" in Testing and adjusting.

Pad expanding bracket mounting bolt (43)**: 98 – 123 Nm {10 – 12.5 kgm}**

Bracket mounting bolt (44)
: Liquid adhesive (LT-2)

Bracket mounting bolt (44)
: 824 – 1,030 Nm {84 – 105 kgm}

[*8]

Parking brake disc mounting bolt
: Liquid adhesive (LT-2)

Parking brake disc mounting bolt
: 490 – 608 Nm {50.0 – 62.0 kgm}

[*9]

Bracket mounting bolt
: Liquid adhesive (LT-2)

Bracket mounting bolt
: 157 – 196 Nm {16.0 – 20.0 kgm}

[*10]

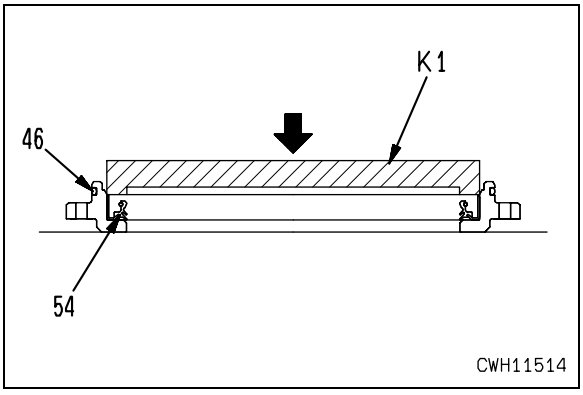
Coupling spline portion
: Grease containing molybdenum disulfide (LM-G)

Coupling mounting bolt
: Liquid adhesive (LT-2)

Coupling mounting bolt
: 455 – 565 Nm {46.5 – 58.0 kgm}

[*11]

★ When removing dust seal (54) from retainer (46), press-fit dust seal (54), using tool **K1**.



[*12] [*13]

★ Before installing the hitch frame assembly and retainer (47), fill the space H – Q listed below completely with **hub grease**.

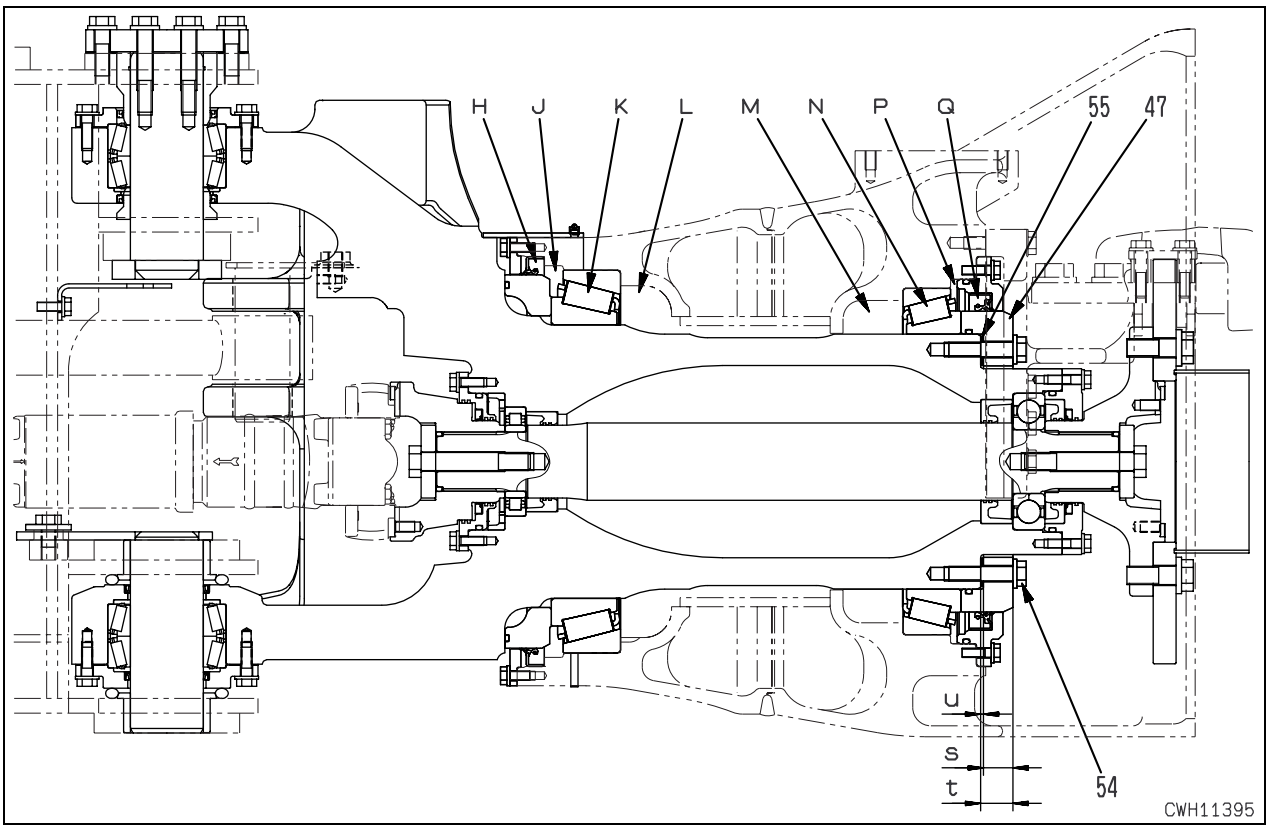
- H space: **350 g (inside of dust seal and dust seal lip)**
- J space: **620 g**
- K space: **1,030 g (inside of bearing)**
- L space: **2,400 g**
- M space: **2,085 g**
- N space: **680 g (inside of bearing)**
- P space: **530 g**
- Q space: **295 g (inside of dust seal and dust seal lip)**

★ Select **hub grease** to be filled from among those listed below.

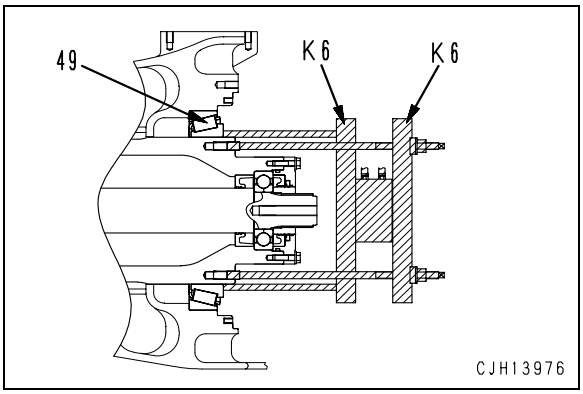
No.	Manufacturer	Hub Grease Brand
1	Nihon Ryuyu	Hilex HD-2
2	SHELL OIL	Super Duty Grease2
3	ESSO OIL	RONEX MP
4	BP	Energrease LS-EP2

★ Method for adjusting bearing at oscillating portion

1) Measure thickness "**s**" of retainer (47) at 2 points. (Calculate the average value of the 2 points.)
2) Tighten retainer (47) without shims with 3 mounting bolts (54).
   - Mounting bolt: **49 Nm {5 kgm}**
3) In that condition, measure dimension "**t**" with a micrometer.
4) Rotate the hitch by 5 to 6 turns and repeat the steps 2) and 3) above.
   - ★ Repeat the steps 2) to 4) until dimension "**t**" is constant.
5) Select appropriate shims so that the total shim thickness is "**u**", i.e. the difference between dimensions "**t**" and "**s**" (**u = t – s**) minus 0 to 0.15 mm.
   - Standard thickness of shim: **3.0 mm**
   - Kind of shim thickness
     : 0.2 mm, 0.3 mm and 1.0 mm
6) Install a combination of selected shims (55) to retainer (47) and install the retainer with 12 mounting bolts (54).
   - Mounting bolt
     : Liquid adhesive (LT-2)
   - Mounting bolt
     : 245 – 309 Nm {25.0 – 31.5 kgm}

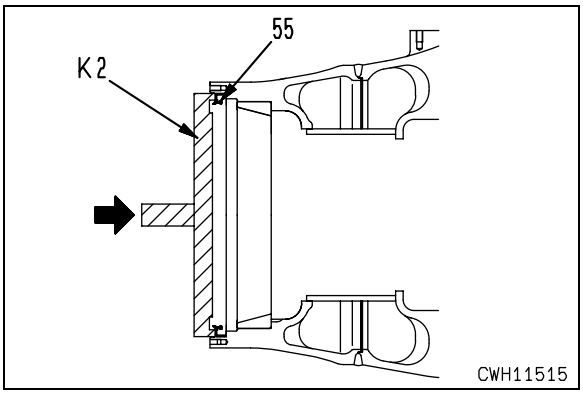


- Using push tool **K6**, press fit inner race of bearing (49) after installing hitch frame assembly.



[*14]

★ Press-fit dust seal (55), using tool **K2**.



Disassembly and assembly of hitch frame assembly

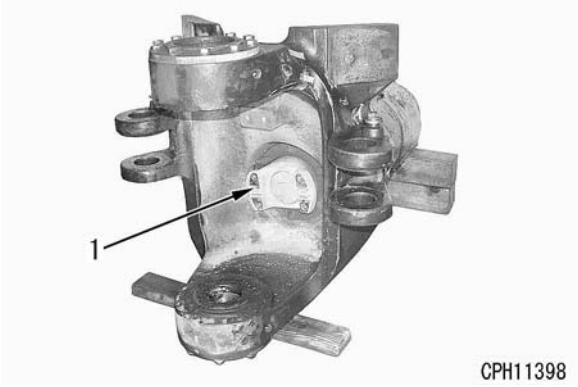
Special tools

Sym-bol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
K	3	792T-246-1110	Push tool	■	1		○
	4	790-101-5201	Push tool kit	■	1		
		790-101-5341	• Plate		1		
		790-101-5331	• Plate		1		
		790-101-5221	• Grip		1		
		01010-51225	• Bolt		1		
	5	790-201-1500	Push tool kit	■	1		
		790-201-1640	• Plate		1		
		790-101-5021	• Grip		1		
		01010-50816	• Bolt		1		

Disassembly

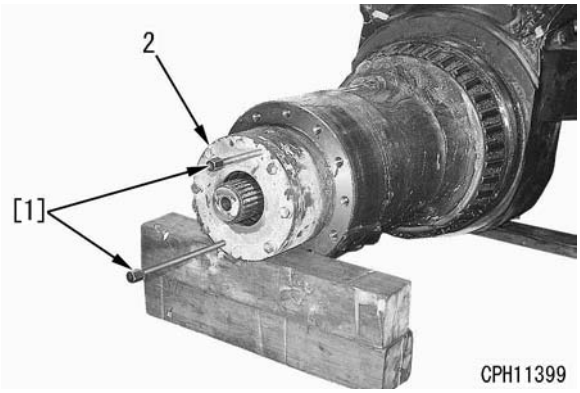
1. Coupling

Remove the mounting bolts and remove coupling (1).

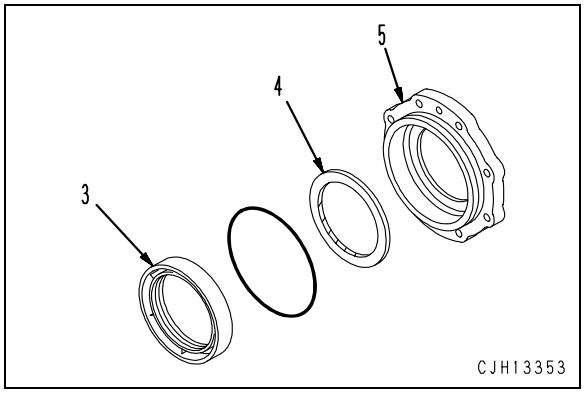


2. Rear retainer

1) Remove rear retainer assembly (2), using forcing screws [1].

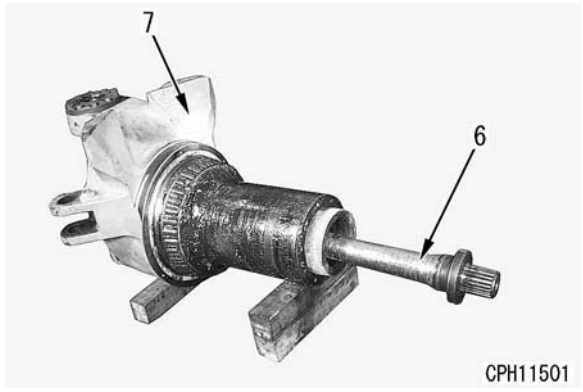


2) Remove ring (3), and dust seal (4), from rear retainer (5).

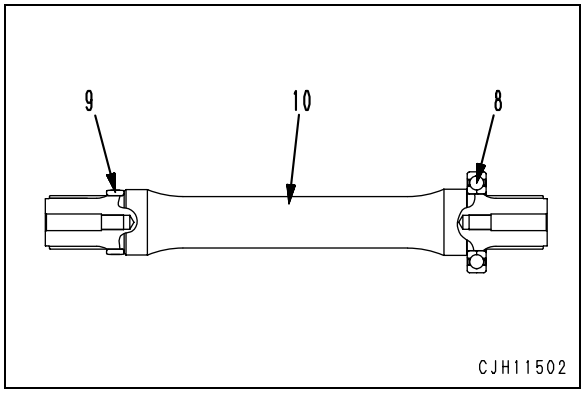


3. Center shaft

1) Remove center shaft and bearing assembly (6) from hitch frame assembly (7).

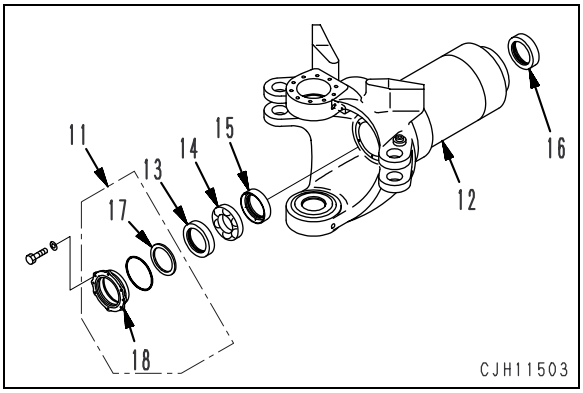


2) Remove bearing (8) and bearing inner race (9) from center shaft (10).

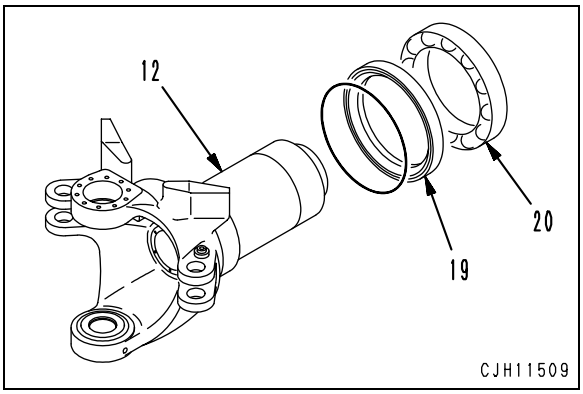


4. Further disassembly of hitch frame

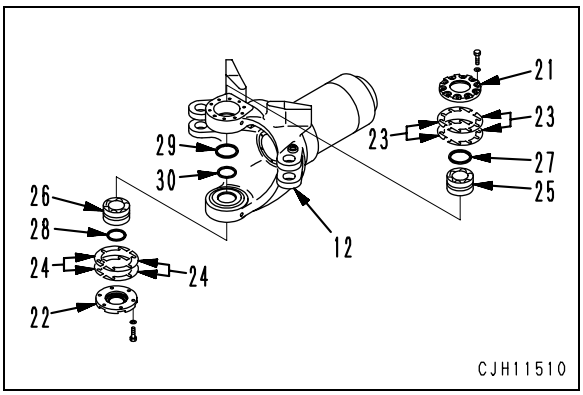
1) Remove front cage assembly (11) from hitch frame (12).
2) Remove ring (13), bearing (14) and rings (15) and (16).
3) Remove dust seal (17) from front cage (18).



4) Remove bearing (19) and spacer (20) from hitch frame (12).



5) Remove retainers (21) and (22) and shims (23) and (24) from the hinge portion, and then remove bearings (25) and (26).
6) Remove dust seals (27), (28), (29) and (30) from retainers (21) and (22) and hitch frame (12) respectively.



Assembly

★ Clean each of the parts thoroughly and check that it is free of dust and damage.
★ When installing the seals, use a push tool of the size which corresponds with the seal diameter.
★ Select **hub grease** to be filled from among those listed below.

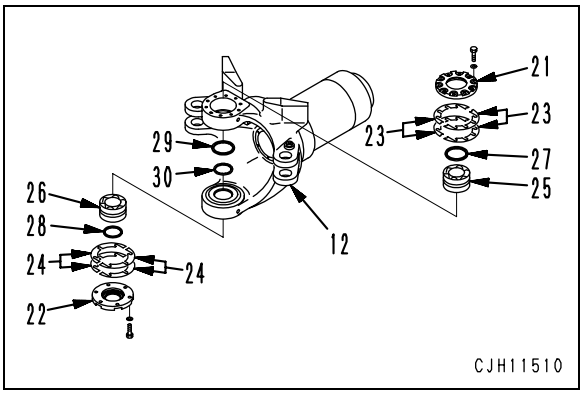
No.	Manufacturer	Hub Grease Brand
1	Nihon Ryuyu	Hilex HD-2
2	SHELL OIL	Super Duty Grease2
3	ESSO OIL	RONEX MP
4	BP	Energrease LS-EP2

1. Subassembly of upper and lower hinge pin portions of hitch frame

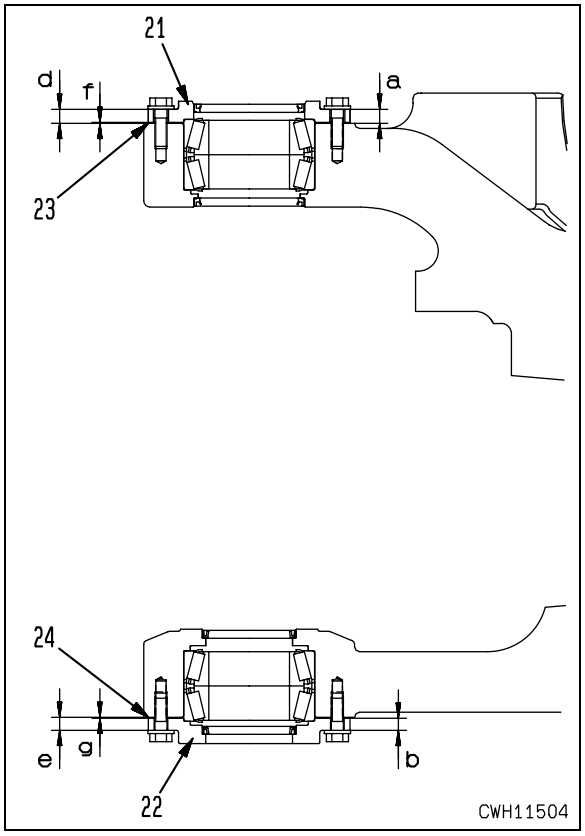
★ Adjust shims in the following manner.

1) Using tool **K4** and **K5**, install dust seals (30) and (29) to hitch frame (12), using tool **K4** for dust seal (29) and **K5** for dust seal (30).
   ★ Tool **K4**: for dust seal (29)
   ★ Tool **K5**: for dust seal (30)
2) Using tool **K4** and **K5**, install dust seals (28) and (27) to retainers (22) and (21), using tool **K4** for dust seal (27) and **K5** for dust seal (28).
   ★ Tool **K4**: for dust seal (27)
   ★ Tool **K5**: for dust seal (28)
   Dust seal lip: **Grease (G2-LI)**
3) Install bearings (25) and (26) to the hitch frame.

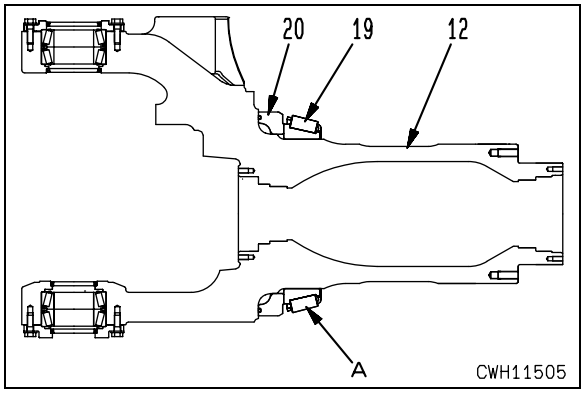
★ Bearings (25) and (26) are a set part, so do not change the combination of bearing and spacer.

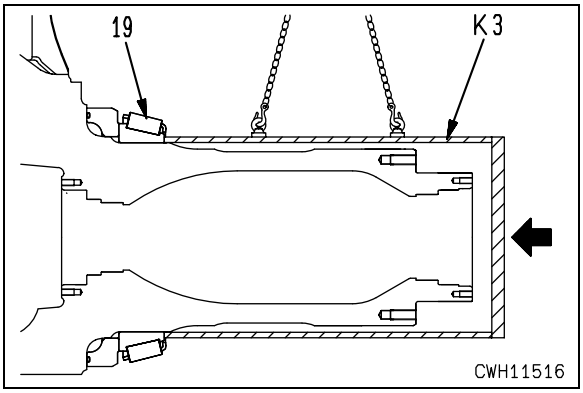


4) Install retainers (21) and (22) after adjusting the shims.
   i) Measure respective thickness "**a**" and "**b**" of retainers (21) and (22) of the hitch frame.
   ii) Install retainer (21) to the hitch frame upper side with 5 mounting bolts.
   Retainer mounting bolt
   : 58.8 Nm {6 kgm} ± 10%
   iii) Install retainer (22) to the hitch frame underside with 4 mounting bolts.
   Retainer mounting bolt
   : 39.2 Nm {4 kgm} ± 10%
   iv) Measure respective dimensions "**d**" and "**e**" of clearance between retainer (21) and the hinge plate, and retainer (22) and the hinge plate.
   v) Select and make a combination of the shims so that the total shim thickness is "**f**", i.e. the difference between "**d**" and "**a**" dimensions (**f = d – a**) minus 0.02 to 0.12mm, and likewise "**g**", i.e. the difference between "**e**" and "**b**" dimensions (**g = e – d**) minus 0.02 to 0.12 mm.
   ★ Kind of shim thickness
   : 0.1 mm and 0.5 mm
   ★ Retainer (21) portion
   : Standard shim thickness: 2 mm
   ★ Retainer (22) portion
   : Standard shim thickness: 1 mm
   vi) Install a combination of the shims to retainers (21) and (22), and tighten all the mounting bolts.
   Retainer mounting bolt
   : Liquid adhesive (LT-2)
   Retainer mounting bolt
   : 98 – 123 Nm {10.0 – 12.5 kgm}

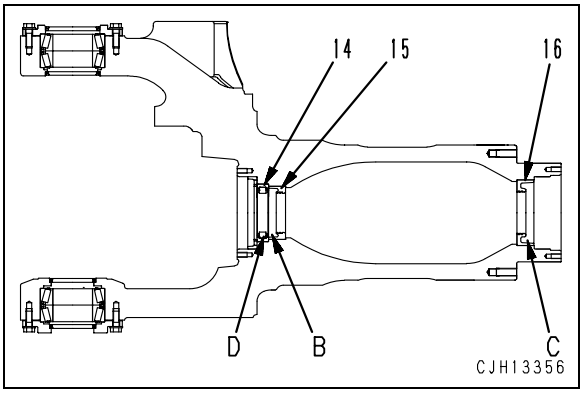


2. Subassembly of hitch frame
1) Install spacer (20) to hitch frame (12).
2) Press-fit bearing (19), using tool **K3**.
★ Fill space **A** inside the bearing with **hub grease** completely.
Space **A**: **Hub grease 1,030 g**



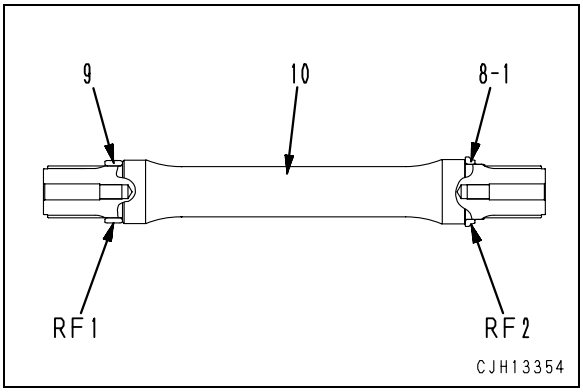


3) Install rings (16) and (15) to hitch frame (12).
   ★ Fill spaces **B** and **C** with grease to 100%.
   Space **B**: **Grease (G2-LI) 48 g**
   Space **C**: **Grease (G2-LI) 33 g**
4) Install bearing (14).
   ★ Fill space **D** inside the bearing with grease to 100%.
   Space **D**: **Grease (G2-LI) 35 g**
   ★ Be careful not to make a mistake about the grease amount. Such a mistake will likely cause the bearing to overheat.

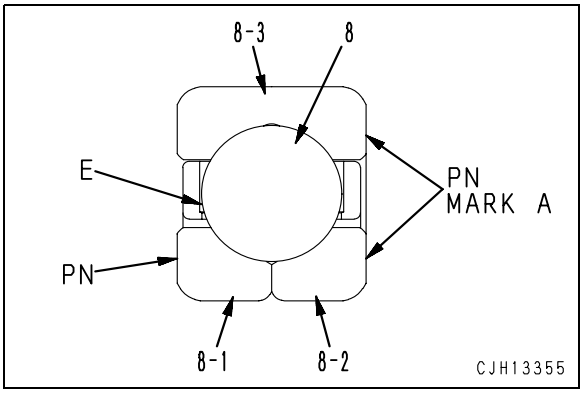


3. Center shaft

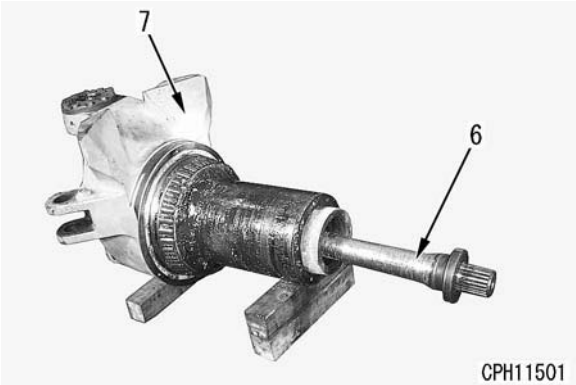
1) Press-fit roller bearing inner race (9) and ball bearing inner race (8-1) to center shaft (10), using a push tool.
   Bearing roller surface (RF1) and (RF2):
   Grease (G2-LI) (Coat it thinly after press-fitting of inner race)



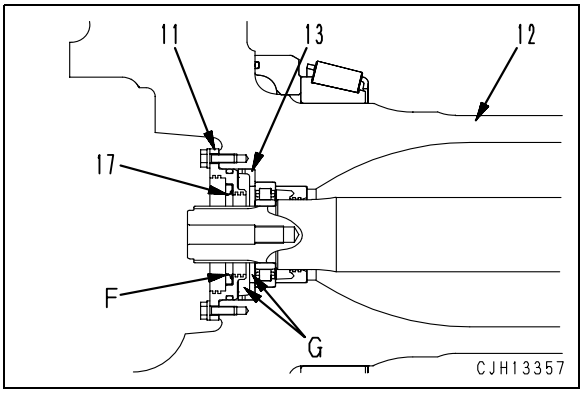
2) There are product number (PN) and mark on inner race (8-1) and (8-2) and outer race (8-3) of ball bearing (8). Align the mark surface (MARK A) with inner race and outer race.
   ★ Fill space **E** inside the bearing (8) with grease to 100%.
   Space **E**: **Grease (G2-LI) 65 g**
   ★ Be careful not to make a mistake about the grease amount. Such a mistake will likely cause the bearing to overheat.



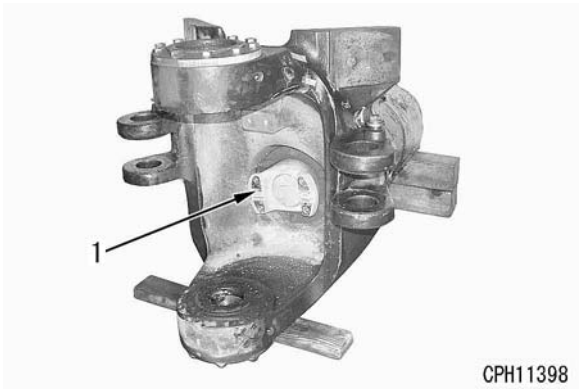
3) Insert center shaft and bearing assembly (6) into hitch frame assembly (7).
   ★ Press-fit the portion of bearing outer race of the center shaft and bearing assembly.



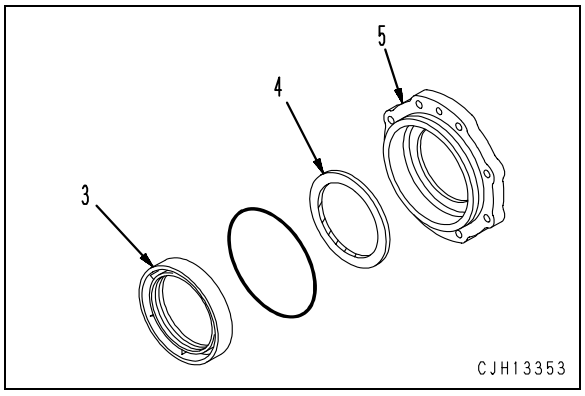
4. Front cage assembly
1) Install ring (13) to the hitch frame front side.
2) Using tool **K4**, install dust seal (17) to the front cage (11).
   ★ Coat the dust seal lip **F** with grease and also fill the inside space with grease to 100%.
   Space **F**: **Grease (G2-LI) 25 g**
   ★ Be careful not to make a mistake about the grease amount. Such a mistake will likely cause the bearing to overheat.
3) Fill space **G** with grease to 100%.
   Space **G**: **Grease (G2-LI) 100 g**
   ★ Be careful not to make a mistake about the grease amount. Such a mistake will likely cause the bearing to overheat.
4) Install front cage assembly (11) to hitch frame (12).

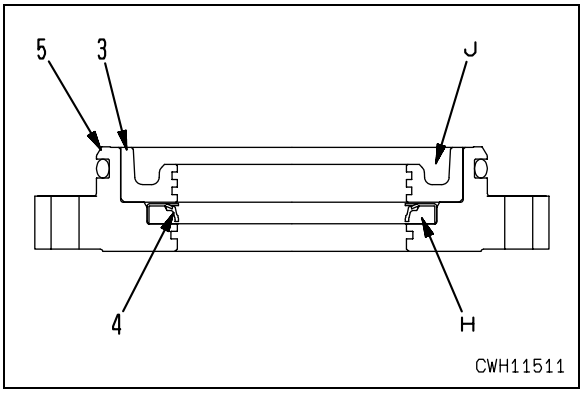


5. Coupling
Install coupling (1).
Coupling spline portion
: Grease with molybdenum disulfide (LM-G)
Mounting bolt: **Liquid adhesive (LT-2)**
Mounting bolt
: 455 – 565 Nm {46.5 – 58 kgm}

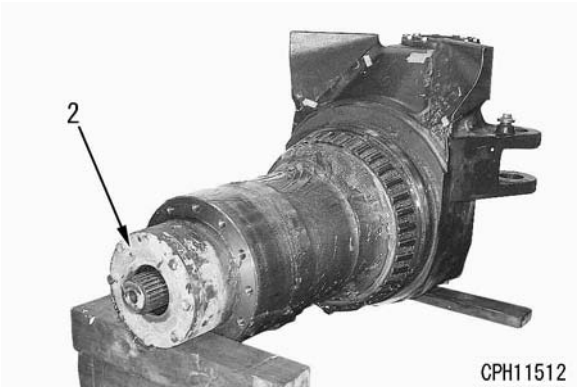


6. Rear retainer
1) Using tool **K4**, press fit dust seal (4) to rear retainer (5).
   ★ Supply grease of 25 g to the dust seal lip and the inner space **H**.
   Dust seal lip and the inner space **H**:
   Grease (G2-LI) 25 g
   ★ If the quantity of the grease is improper, the bearing will overheat. Accordingly, take care extremely.
2) Install ring (3) to rear retainer (5).
   ★ Fill space **J** of the ring with grease of 65 g to 100%.
   Space **J** of ring: **Grease (G2-LI) 65 g**
   ★ If the quantity of the grease is improper, the bearing will overheat. Accordingly, take care extremely.





3) Install rear retainer assembly (2).
   - Mounting bolt
     : Liquid adhesive compound (LT-2)
   - Mounting bolt
     : 59 – 74 Nm {6.0 – 7.5 kgm}
   - ★ Supply grease to the retainer through the grease fitting to 100%.
   - Inside of retainer
     : **Grease (G2-LI) 62 g**



HM300-2 Articulated dump truck

Form No. SEN00692-03

ARTICULATED DUMP TRUCK

HM300-2

Machine model	Serial number
HM300-2	2001 and up

50 Disassembly and assembly

Hydraulic system

Removal and installation of flow amp valve

Special tools

Sym-bol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
X1	792-454-1100	Pump assembly	●	1	N	

Removal

⚠ **When tilting the cab, observe the following precautions to prevent a serious injury or fatal accident caused by fall of the cab.**
⚠ **To prevent interference between the cab and the dump body, set the steering in a straight ahead position and stop the machine on the level ground.**
⚠ **Lock the dump lever with the dump lever lock knob.**
⚠ **Turn the parking brake switch ON and chock the wheels.**
⚠ **Set the lock bar to the frame and lock front and rear frame.**

- **Precautions in tilting cab**

⚠ **When tilting the cab, check that the lock lever is fixed securely.**
⚠ **Do not start the engine while the cab is tilted.**
⚠ **When it is obliged to start the engine for testing etc., check that there is nobody under the cab.**
⚠ **Do not operate the gear shift lever or dump lever.**
⚠ **Do not give a large shock to the machine.**
⚠ **Do not tilt the cab while it is loaded.**

⚠ **Disconnect the cable from the negative (–) terminal of the battery.**
⚠ **Loosen the hydraulic oil filler cap to release the internal pressure of the hydraulic tank.**

1. Drain hydraulic oil.
Hydraulic tank: **120ℓ**

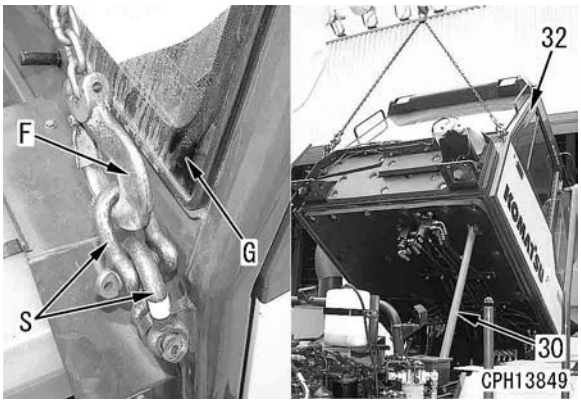
2. Remove left fender • inner cover assembly (1).
Left fender • inner cover assembly: **85 kg**

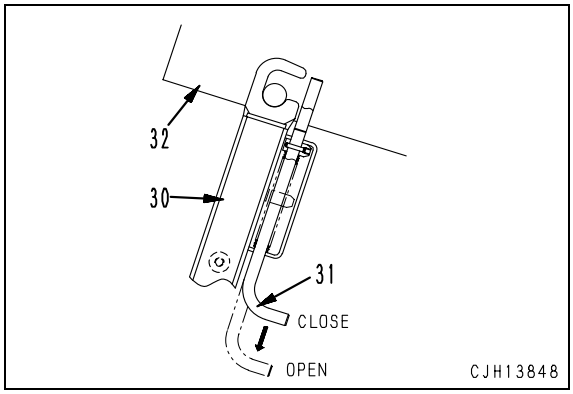
3. Open up the engine hood.

4. Remove 4 each mounting bolts from the right and left mounts at the front of the cab.
★ Check the thickness, quantity, and positions of the inserted shims.

5. Sling operator's cab (32) and tilt it up.
★ Use 2 shackles (S) so that hook (F) of the sling will not hit glass (G) of the cab assembly.

6. Pull lock lever (31) and set lock bar (30) with the care the direction of the lock bar (30).
⚠ **Check that the lock lever (31) closes and the operator cab assembly (32) is held securely in position by the lock bar (30).**
For details about cab tilt, see "Method of tilting cab up" in chapter Testing and adjusting.
★ Pump assembly **X1** is necessary for tilting up by tilt cylinder.



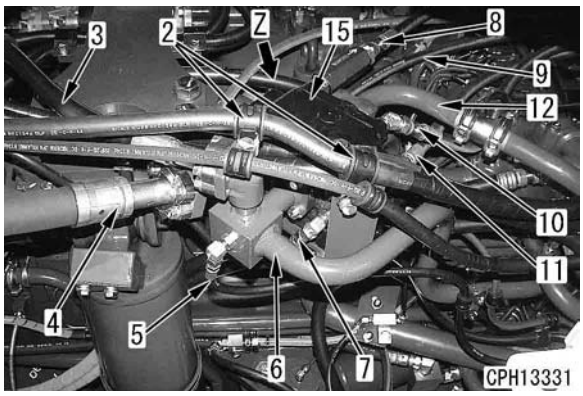


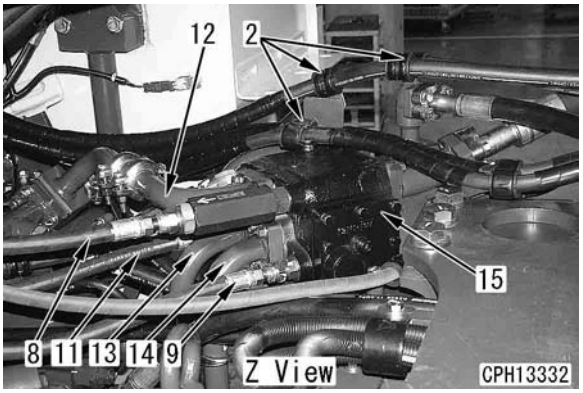
7. Disconnect clamp (2).

8. Disconnect the following hoses.
- (3): Sending out hose from hoist pump
- (4): The flow amp valve HP port hose
- (5): Hose for centralized pressure check

9. Disconnect tube (6) between the flow amp valve (15) and hoist valve.

10. Disconnect hoses and tubes, (7) to (14) from the flow amp valve assembly (15).
- (7): LS port hose
- (8): P port hose
- (9): CL port hose
- (10): T port hose
- (11): L port hose
- (12): HT port tube
- (13): CL port tube
- (14): CR port tube





11. Remove the mounting bolts for flow amp valve assembly (15) and then remove the assembly.

Flow amp valve assembly: **35 kg**

Installation

- Installation is carried out in the reverse order to removal.

- **Refilling with oil (hydraulic tank)**
  Refill with oil through the oil filler port up to the specified level, then start the engine to let the oil circulate in the piping and check the oil level again.

  Hydraulic tank: **120 ℓ (TO10)**

Removal and installation of hoist valve assembly

Special tools

Sym-bol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
X1	792-454-1100	Pump assembly	●	1	N	

Removal

⚠ **When tilting the cab, observe the following precautions to prevent a serious injury or fatal accident caused by fall of the cab.**
⚠ **To prevent interference between the cab and the dump body, set the steering in a straight ahead position and stop the machine on the level ground.**
⚠ **Lock the dump lever with the dump lever lock knob.**
⚠ **Turn the parking brake switch ON and chock the wheels.**
⚠ **Set the lock bar to the frame and lock front and rear frame.**

- **Precautions in tilting cab**

⚠ **When tilting the cab, check that the lock lever is fixed securely.**
⚠ **Do not start the engine while the cab is tilted.**
⚠ **When it is obliged to start the engine for testing etc., check that there is nobody under the cab.**
⚠ **Do not operate the gear shift lever or dump lever.**
⚠ **Do not give a large shock to the machine.**
⚠ **Do not tilt the cab while it is loaded.**

⚠ **Disconnect the cable from the negative (–) terminal of the battery.**
⚠ **Check that the body is lowered completely.**
⚠ **Loosen the hydraulic oil filler cap to release the internal pressure of the hydraulic tank.**

1. Drain hydraulic oil.
Hydraulic tank: **120ℓ**

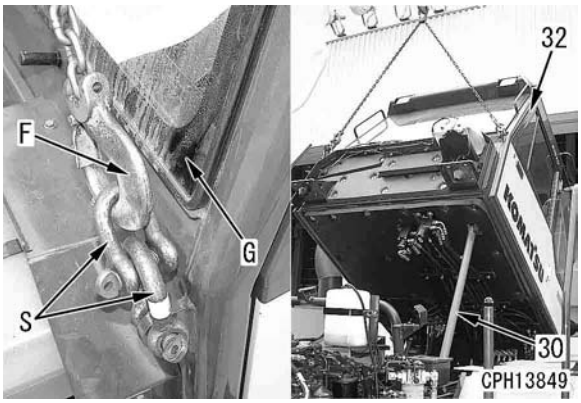
2. Remove left fender • inner cover assembly (1).
Left fender • inner cover assembly:
85 kg

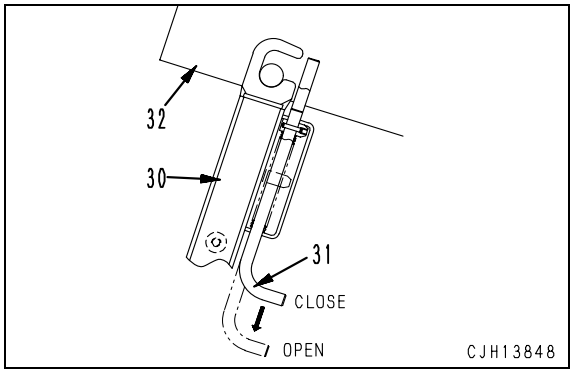
3. Open up the engine hood.

4. Remove 4 each mounting bolts from the right and left mounts at the front of the cab.
★ Check the thickness, quantity, and positions of the inserted shims.

5. Sling operator's cab (32) and tilt it up.
★ Use 2 shackles (S) so that hook (F) of the sling will not hit glass (G) of the cab assembly.

6. Pull lock lever (31) and set lock bar (30) with the care the direction of the lock bar (30).
⚠ **Check that the lock lever (31) closes and the operator cab assembly (32) is held securely in position by the lock bar (30).**
For details about cab tilt, see "Method of tilting cab up" in chapter Testing and adjusting.
★ Pump assembly **X1** is necessary for tilting up by tilt cylinder.



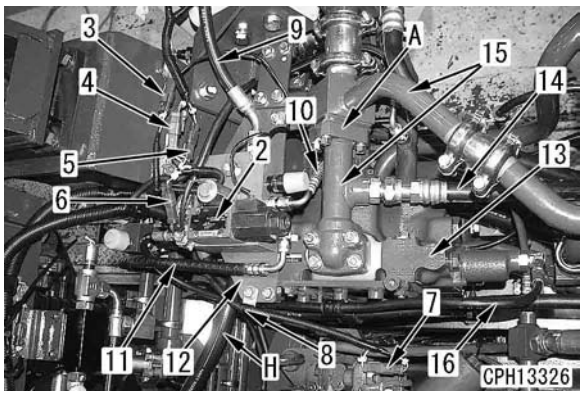


7. Remove the following to slide the bracket (12) of EPC valve (2).
- Connector T01 (3), DT4 (4), P05 (5), T02 (6), BOS (7)
- Clamp (8)
- Oil hose (9), (10), (11)

8. Remove bracket (12).
★ Disconnect clamp of the hose (H) on the back of the bracket.

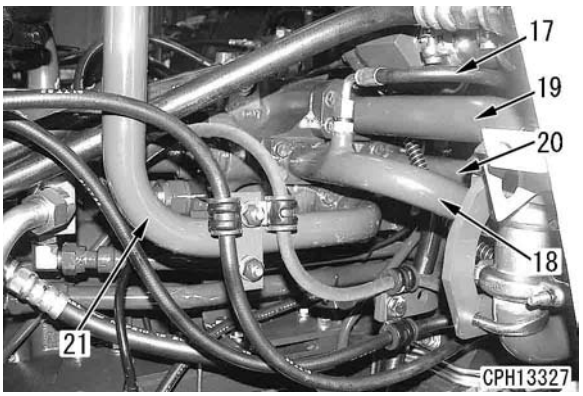
9. Disconnect the following piping from the hoist valve (13).
- (14): T port hose
- (15): T port tube

★ Disconnect the tube coupling.
★ Do not separate the tube assembly (15) because of the orifice in A portion.
- (16): PA port hose



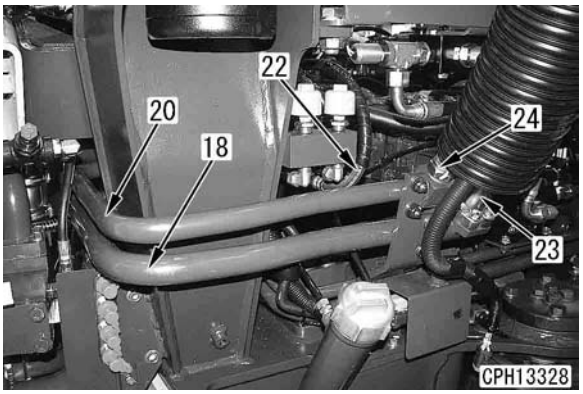
- (17): A1 port hose
- (18): A1 port tube
- (19): T2 port tube
- (20): B1 port tube
- (21): P port tube

★ Remove a U clamp and coupling from each tube.

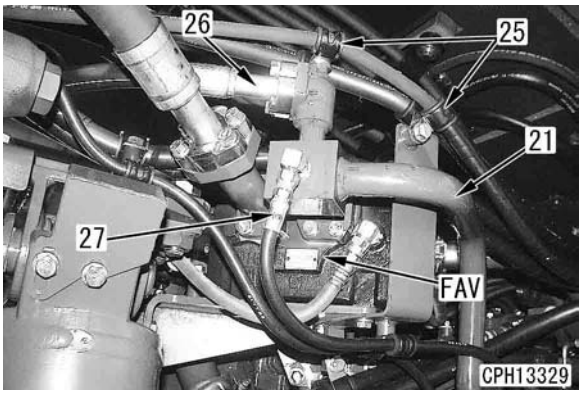


- (22): PB port hose
- (23): A1 port hose
- (24): B1 port hose

★ Start the work from the hitch frame side.
★ Disconnect U clamps from A1 port tube (18) and B1 port tube (20).

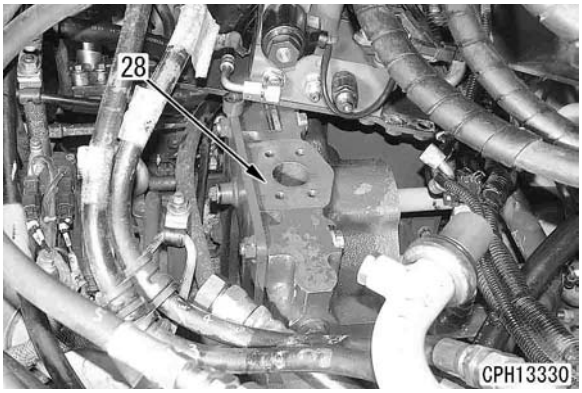


10. Disconnect following from flow amp valve (FAV).
- (25): Clamp
- (26): Discharging hose from hoist pump
- (27): Hose for centralized pressure check
- (21): Tube between flow amp valve (FAV) and hoist valve



11. Remove the mounting bolts for hoist valve assembly (28) and then remove the assembly.

Hoist valve assembly: **35 kg**



Installation

- Installation is carried out in the reverse order to removal.

- **Refilling with oil (hydraulic tank)**
  Refill with oil through the oil filler port up to the specified level, then start the engine to have the oil circulate in the piping, and check the oil level again.

  Hydraulic tank: **120ℓ (TO10)**

Disassembly and assembly of steering cylinder assembly

Special tools

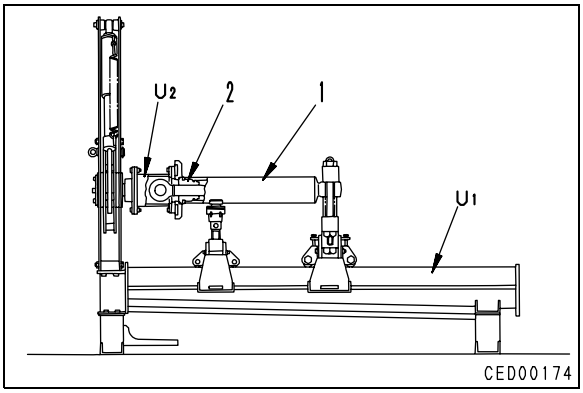
Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
U	1	790-502-1003	Cylinder repair stand	■	1		
		790-101-1102	Hydraulic pump	■	1		
	2	790-102-3802	Wrench assembly	■	1		
	3	790-102-1480	Socket (width across flats: 80 mm)	■	1		
	4	790-720-1000	Expander	■	1		
		796-720-1660	Ring	■	1		
		07281-01159	Clamp	■	1		
	5	790-201-1702	Push tool kit	■	1		
		790-101-5021	• Grip		1		
		01010-50816	• Bolt		1		
		790-202-1811	• Push tool		1		
	6	790-201-1500	Push tool kit	■	1		
		790-101-5021	• Grip		1		
		01010-50816	• Bolt		1		
		790-201-1620	• Plate		1		

Disassembly

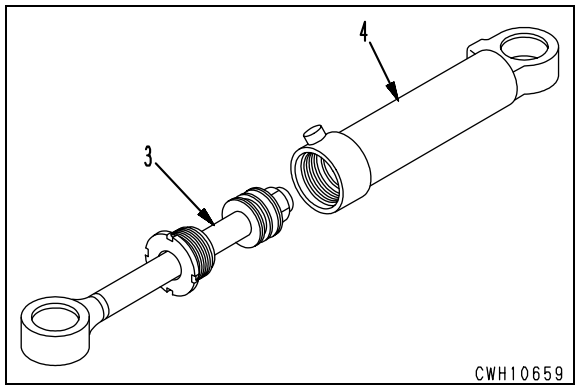
★ Be careful not to give damage to the rod packing, dust seal, piston ring, wear ring, etc. during the work.

1. Piston rod assembly

1) Set cylinder assembly (1) in tool **U1**.
   Cylinder assembly: **60 kg**
2) Raise lock of cylinder head nut, and using tool **U2**, remove cylinder head assembly (2).

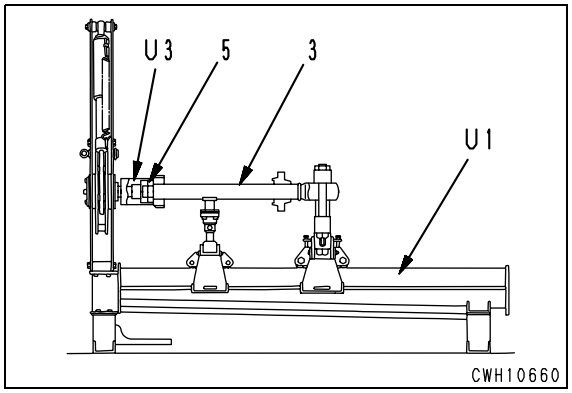


3) Pull out cylinder head and piston rod assembly (3) from cylinder (4) and remove.
   ★ When the piston rod assembly is pulled out from the cylinder, oil will come out, so catch it in a container.
   Cylinder head and piston rod assembly: **35 kg**
4) Remove cylinder (4) from tool **U1**.

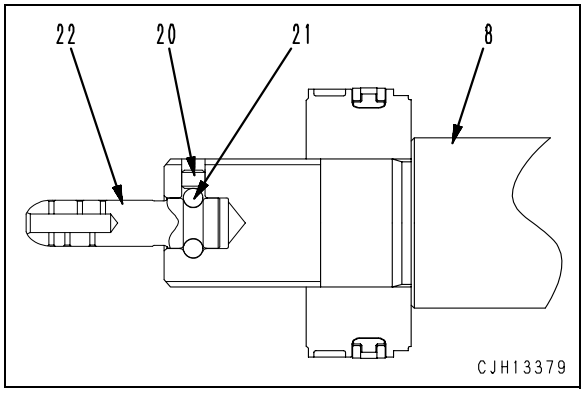


2. Disassembly of piston rod assembly

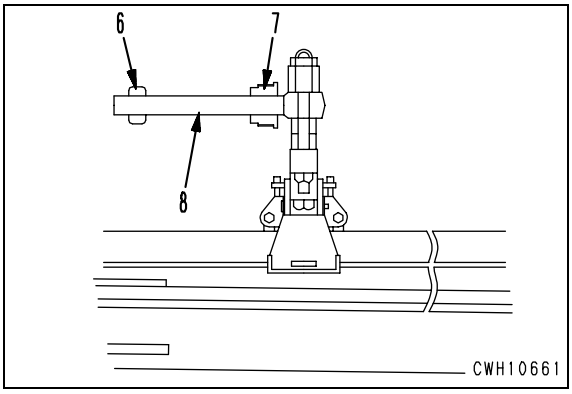
1) Set piston rod assembly (3) in tool **U1**.
2) Using tool **U3**, remove nut (5).



3) Remove cap (20) from the rod (8).
4) Remove 9 balls (21) and plunger (22).

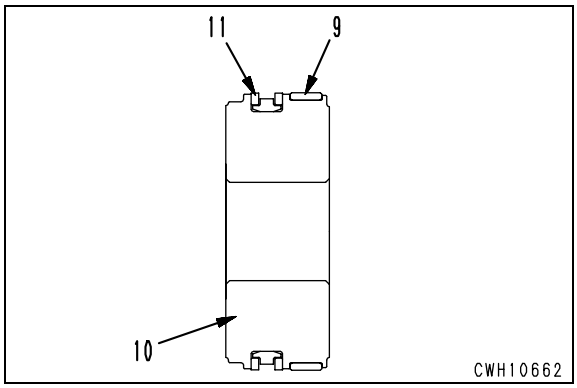


5) Remove piston assembly (6) and cylinder head assembly (7) from the rod (8).



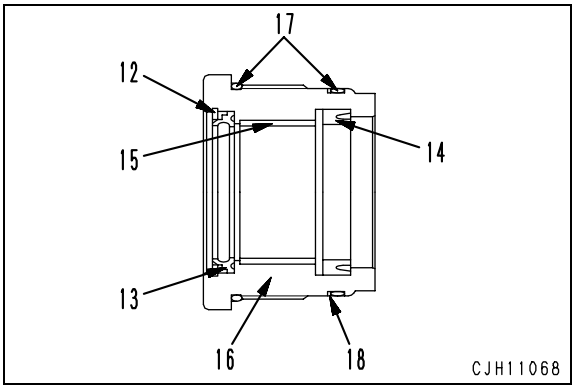
3. Disassembly of piston assembly

1) Remove wear ring (9) from piston (10).
2) Remove wear ring (11) from piston (10).



4. Disassembly of cylinder head assembly

1) Remove snap ring (12), then remove dust seal (13).
2) Remove rod packing (14).
3) Remove bushing (15) from cylinder head (16).
4) Remove O-ring (17) and backup ring (18).

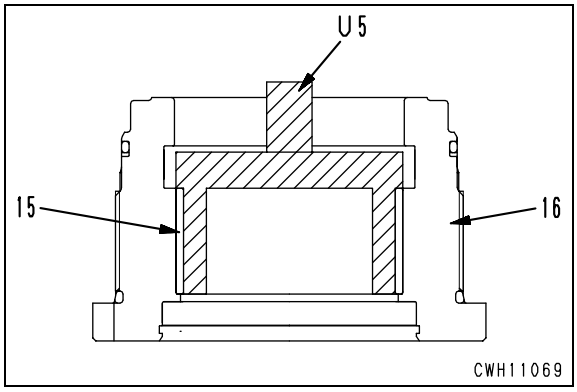


Assembly

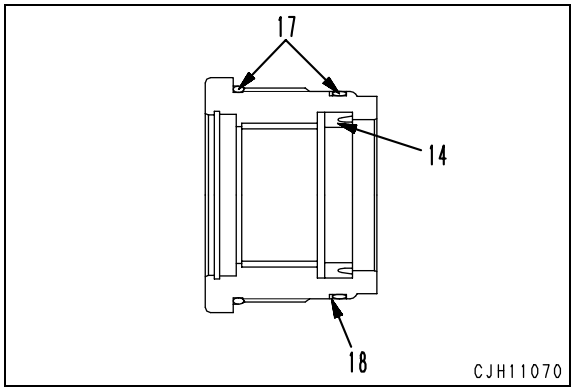
★ Clean all parts, and check for dirt or damage. Coat the sliding surfaces of all parts with engine oil before installing.

1. Assembly of cylinder head assembly

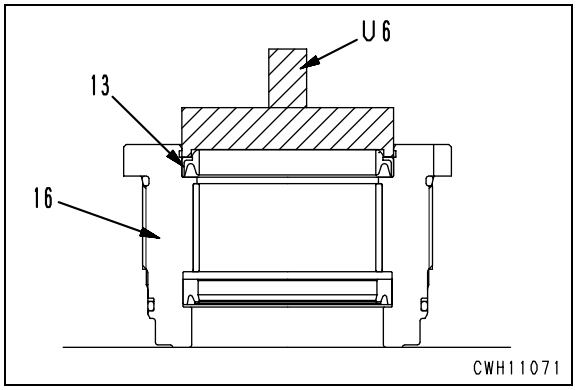
1) Using tool **U5**, press fit bushing (15) to cylinder head (16).
   ★ Take care not to deform bushing (15) when press fitting it.



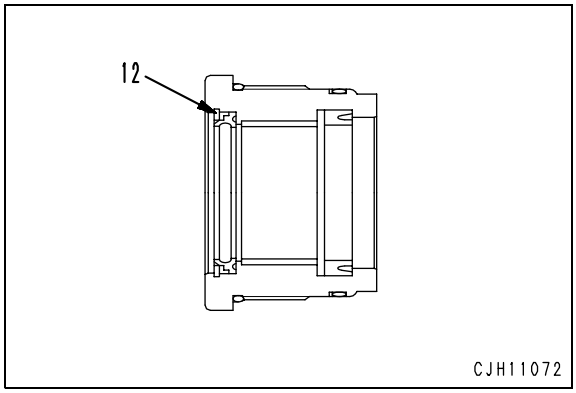
2) Install rod packing (14).
   ★ Take care of installing direction.
3) Install backup ring (18) and O-ring (17) in order.
   ★ Do not insert the backup ring forcibly, but heat it in water at about 50 – 60°C, then insert it.



4) Using tool **U6**, install dust seal (13) to cylinder head (16).

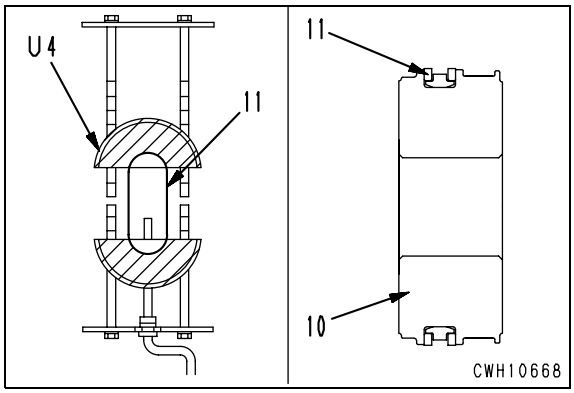


5) Install snap ring (12).

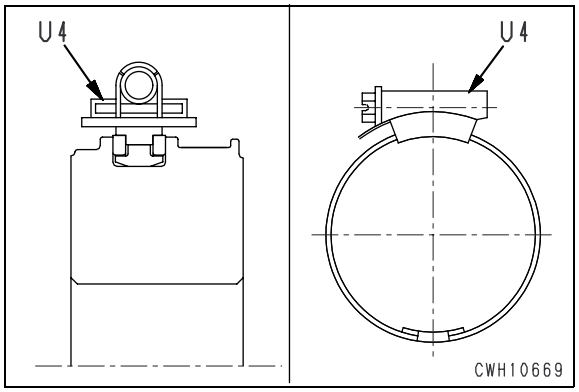


2. Assembly of piston assembly

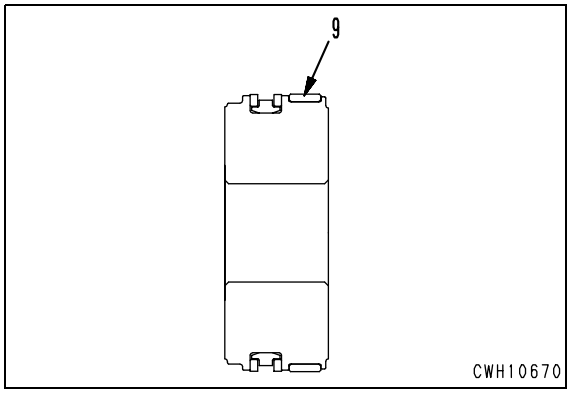
1) Using tool **U4**, expand piston ring (11).
   ★ Set piston ring (11) to the tool and rotate the handle by 8 – 10 turns to expand the ring.
2) Remove piston rod (11) from tool **U4** and install it to piston (10).



3) Using tool **U4**, shrink the piston ring.

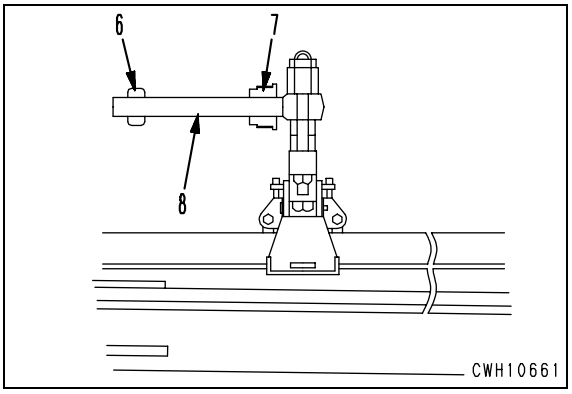


4) Install wear ring (9).

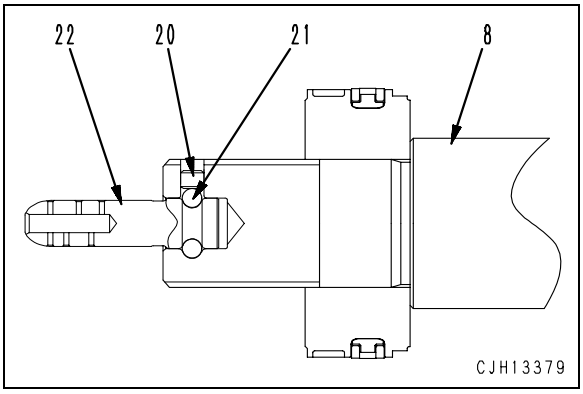


3. Assembly of piston rod assembly

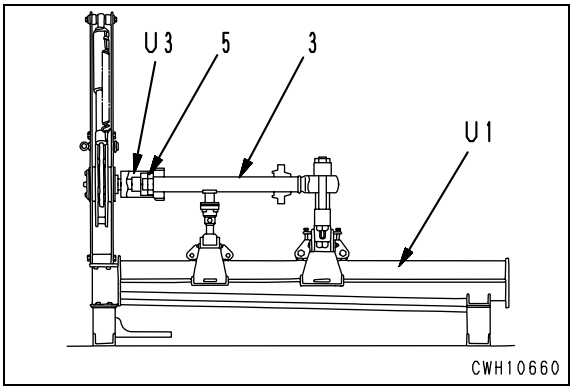
1) Assemble cylinder head assembly (7) and piston assembly (6) to piston rod (8).



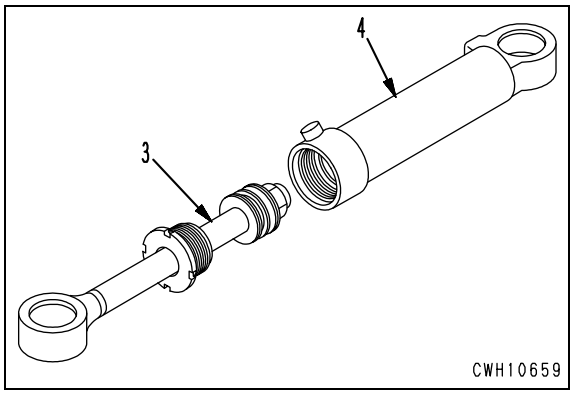
2) Install plunger (22) with 9 balls (21).
3) Install cap (20) in the rod (8).



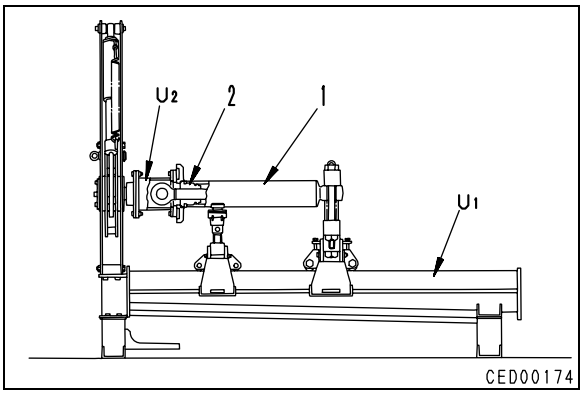
4) Set cylinder head and piston rod assembly (3) to tool **U1**.
5) Using tool **U3**, tighten nuts (5).
   Nut**: Liquid adhesive (LT-2)**
   Nut
   : 3.97 ± 0.4 kNm {405 ± 40.5 kgm}



4. Piston rod assembly
1) Set cylinder (4) in tool **U1**.
2) Assemble cylinder head and piston rod assembly (3) into the cylinder (4).
   Cylinder head and piston rod assembly: **35 kg**



3) Using tool **U2**, tighten cylinder head assembly (2).
   Cylinder head nut
   : 931 ± 93.1Nm {95 ± 9.5kgm}



Disassembly and assembly of hoist cylinder assembly

Special tools

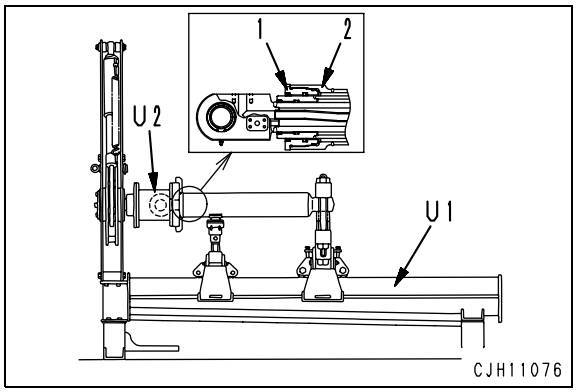
Sym-bol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
U	1	790-502-1003	Cylinder repair stand	■	1		
		790-101-1102	Hydraulic pump	■	1		
	2	790-102-3802	Wrench assembly	■	1		
	4	790-720-1000	Expander	■	1		
		796-720-1660	Ring	■	1		
		07281-01159	Clamp	■	1		
	5	790-201-1702	Push tool kit	■	1		
		790-101-5021	• Grip		1		
		01010-50816	• Bolt		1		
		790-201-1831	• Push tool		1		
		790-201-1871	• Push tool		1		
	6	790-201-1500	Push tool kit	■	1		
		790-101-5021	• Grip		1		
		01010-50816	• Bolt		1		
		790-201-1640	• Plate		1		
		790-201-1680	• Plate		1		
	7	790-102-4300	Wrench assembly	■	1		
		790-102-4310	Pin	■	1		

Disassembly

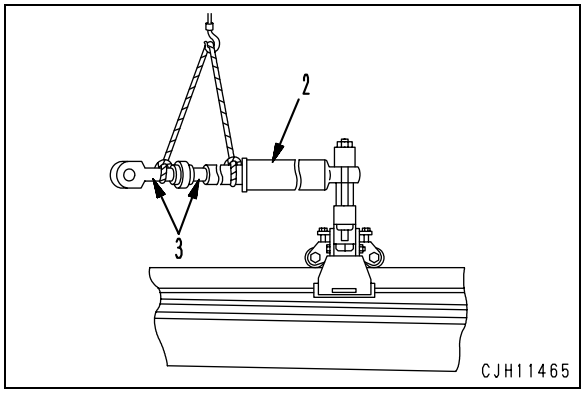
★ Be careful not to damage the rod packing, dust seal, piston ring, and wear ring.

1. Rod assembly

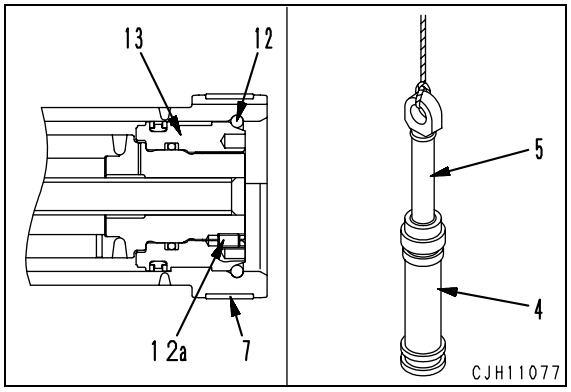
1) Set cylinder assembly to tool **U1**.
   Cylinder assembly: **185 kg**
2) Using tool **U2**, remove cylinder head assembly (1) from cylinder Ⅰ (2).



3) Remove cylinder Ⅱ and rod assembly (3) from cylinder Ⅰ (2).
   Cylinder Ⅱ and rod assembly: **140 kg**

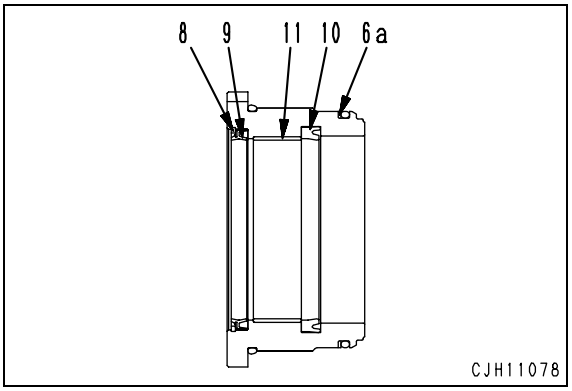


4) Remove snap ring (12) and screw (12a).
5) Remove piston assembly (13), using tool **U7**, and then sling rod (5) to detach from cylinder Ⅱ (4).
6) Remove wear ring (7) from cylinder Ⅱ (4).

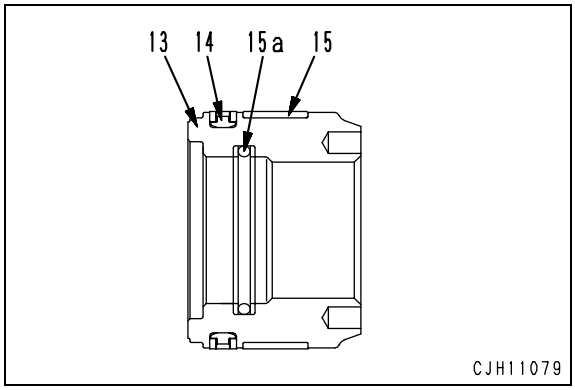


2. Further disassembling cylinder assembly

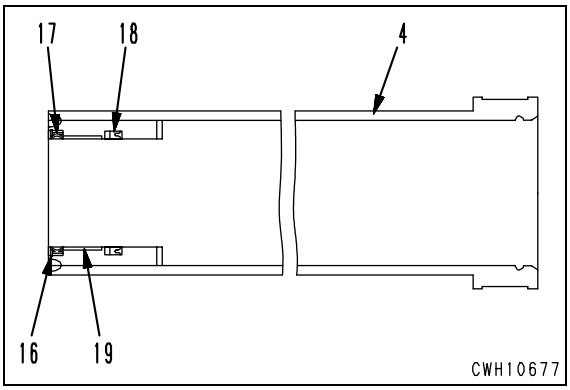
1) Remove snap ring (8), then remove dust seal (9) and rod packing (10).
2) Remove bushing (11).
3) Remove the O-ring and backup ring (6a).



3. Further disassembling piston assembly
Remove piston ring (14), wear ring (15), O-ring and backup ring (15a) from piston assembly (13).



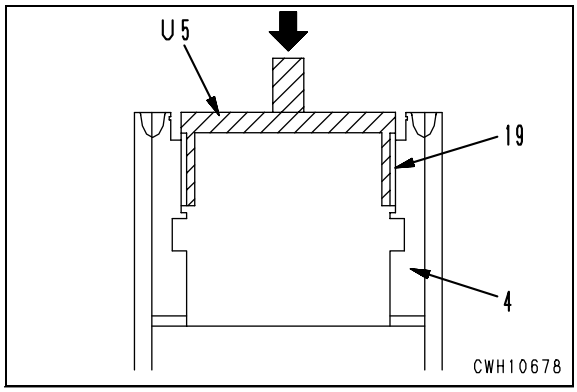
4. Cylinder Ⅱ
Remove snap ring (16) from cylinder Ⅱ (4), then remove dust seal (17), rod packing (18) and bushing (19).



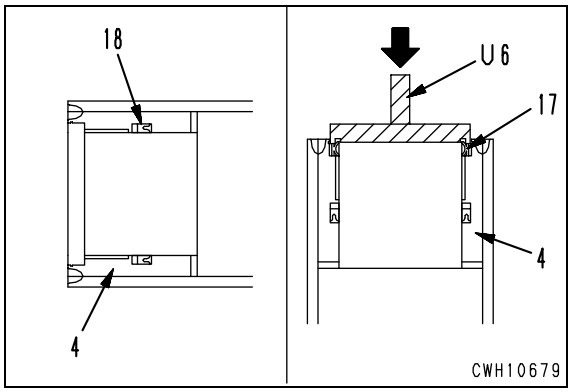
Assembly

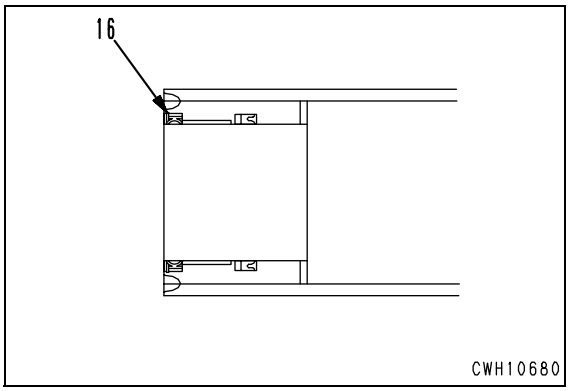
★ Clean all parts, and check for dirt or damage. Coat the sliding surfaces of all parts with engine oil before installing.

1. Cylinder Ⅱ
1) Using tool **U5**, press fit bushing (19) to cylinder Ⅱ (4).



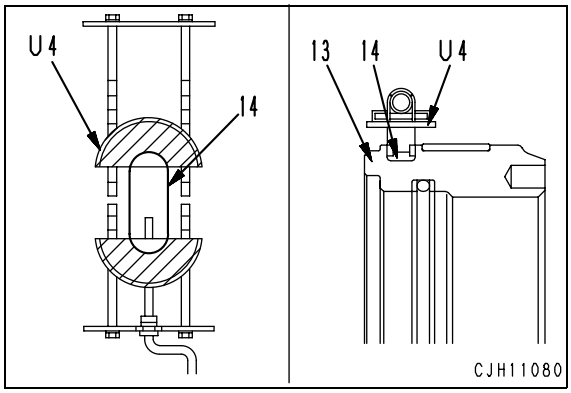
2) Install rod packing (18).
★ Check the direction of assembly for the rod packing when installing.
3) Using tool **U6**, fit dust seal (17) and install snap ring (16).

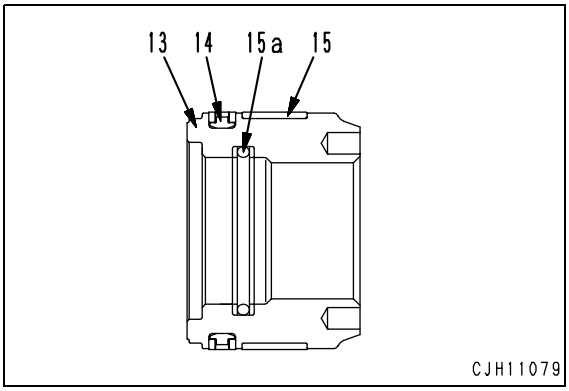




2. Assembly of piston assembly

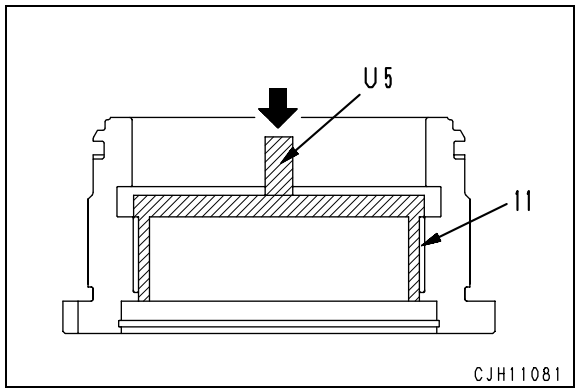
1) Using tool **U4**, expand piston ring (14), and assemble to piston (13).
   ★ Set the piston ring on tool, and turn the handle 8 – 10 times to expand the ring.
2) Set tool **U4** in position, and compress piston ring (14).
3) Install wear ring (15).
4) Fit the O-ring and backup ring (15a).



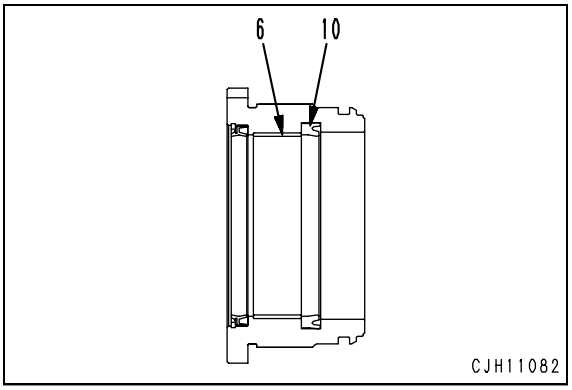


3. Assembly of cylinder head assembly

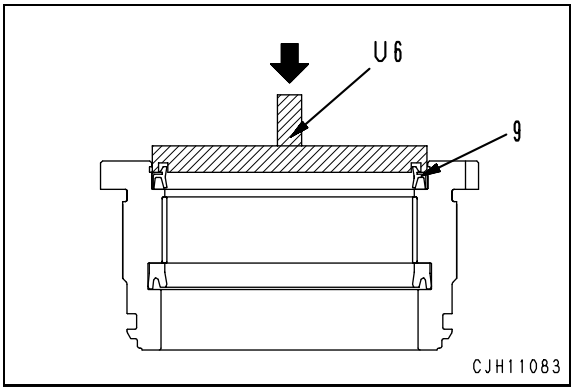
1) Using tool **U5**, press fit bushing (11).



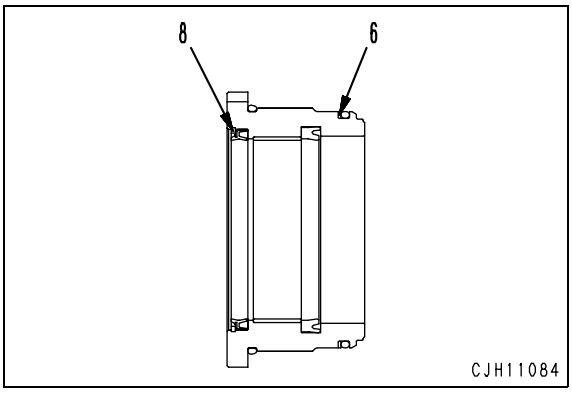
2) Assemble rod packing (10) to cylinder head (6).
   ★ Check the direction of assembly for the rod packing when installing.



3) Using tool **U6**, install dust seal (9).

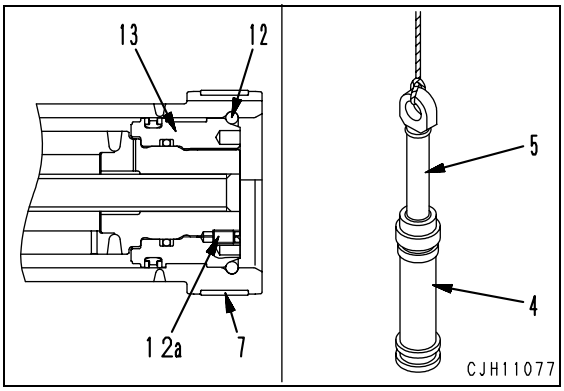


4) Fit snap ring (8), O-ring and backup ring (6).

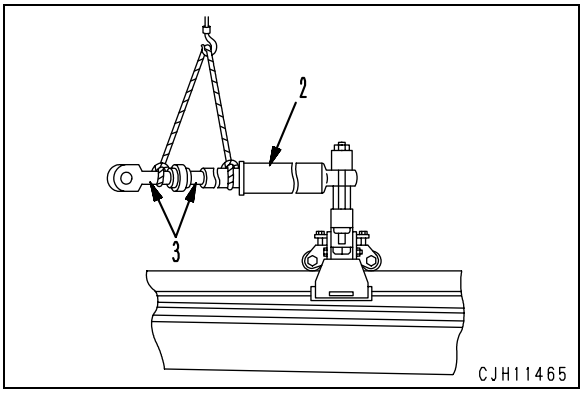


4. Rod assembly

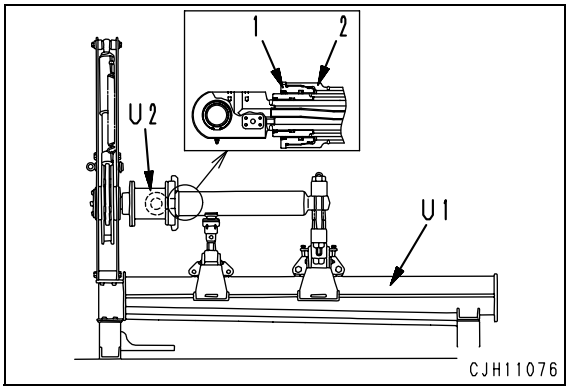
1) Fit wear ring (7) to cylinder Ⅱ (4).
2) Tighten piston assembly (13), using tool **U7**.
   Piston assembly
   : 294 ± 29.4Nm {30 ± 3.0kgm}
3) Sling rod (5) and assemble it into the cylinder Ⅱ (4).
4) Tighten screw (12a).
   ★ When using a new part for either or both of piston assembly (13), or rod (5), make a drill hole for screw.
   Hole depth: **27 mm**
   Tap depth: **20 mm**
   Tap used: **10 x 1.5**
   ★ Degrease the threads of the screw sufficiently.
   Screw
   : Liquid adhesive (Loctite #262)
   Screw
   : 27.5 – 34.3Nm {2.8 – 3.5kgm}
5) Fit snap ring (12).



6) Assemble the cylinder Ⅱ • rod assembly into the cylinder Ⅰ (2).
   Cylinder Ⅱ • rod assembly: **140 kg**



7) Install cylinder head assembly (1) to cylinder Ⅰ (2), using tool **U2**.
   Cylinder head assembly
   : 1.23 ± 0.12kNm {125 ± 12.5kgm}



HM300-2 Articulated dump truck

Form No. SEN00693-02

ARTICULATED DUMP TRUCK

HM300-2

Machine model	Serial number
HM300-2	2001 and up

50 Disassembly and assembly

Body

Body

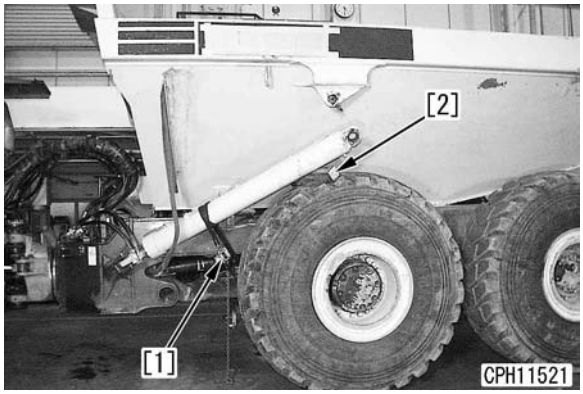
Removal and installation of body assembly

Removal

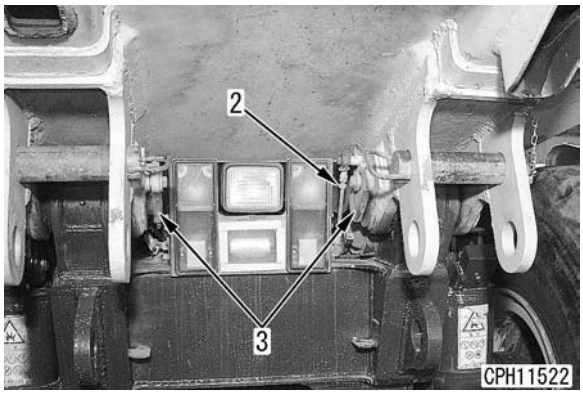
⚠ **Turn the parking brake switch on and put wooden blocks behind the wheels.**

1. Sling the bottom side of hoist cylinder.
2. Remove bottom pins (1) of the left and right hoist cylinders. [*1]
   ⚠ **When the bottom pin is removed, the hoist cylinder will swing outward, so fasten the hoist cylinder with lever lock [1] inwardly.**

3. Loosen lever block [1] by lowering the crane and put the hoist cylinder on the wheel.
   ★ Put block [2] between the hoist cylinder and wheel.



4. Separate body potentio linkage (2) at the body side. [*2]
5. Sling the body assembly at 4 points.
6. Remove 2 body hinge pins (3) on the left and right sides. [*3]
   ★ Shims are provided, so check their thickness, number in use and installed locations beforehand.



7. Sling body assembly (4) to remove. [*4]
   Body assembly: **3,500 kg**

Installation

- Installation is carried out in the reverse order to removal.

[*1]

⚠ **When matching the pinholes, never put a finger into the hole.**

Cylinder bottom pin mounting bolt

: 157 – 196 Nm {16 – 20 kgm}

[*2]

★ Adjust the body positioner sensor, referring to the section of "Adjusting body positioner sensor" in Testing and adjusting.

[*3]

⚠ **When matching the pinholes, never put a finger into the pinhole.**

Hinge pin mounting bolt

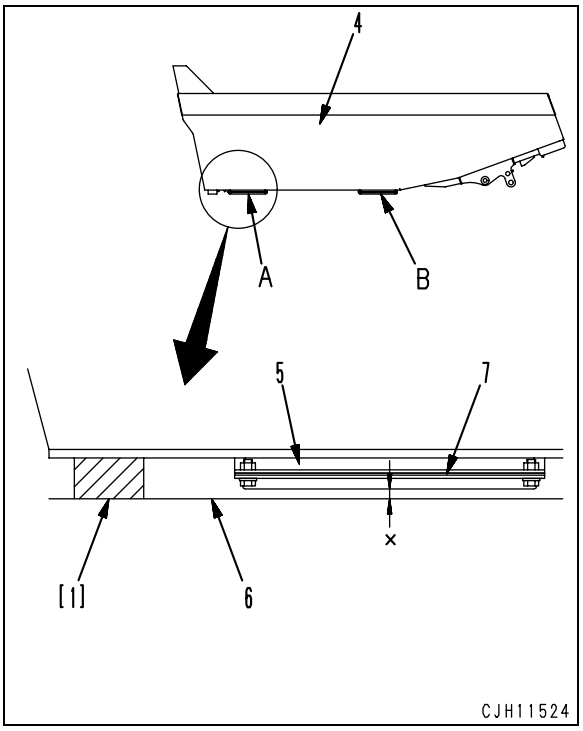
: 157 – 196 Nm {16 – 20 kgm}

[*4]

★ Adjust the shims in the body mount in the following steps.

1) Insert spacer [1] of 58 mm in thickness in the front end of body (4). (1 each for left and right)
2) Measure clearance "**x**" between the center of bottom mount (5) and the upper surface of rear frame (6).
   ★ Measure clearance at 4 points of **A** and **B** on the left and right sides.
3) Calculate the shim thickness at **A** and **B** points both on the left and right sides.
   - Shim thickness = (**x** – 26) mm
4) Assemble shim (7) having thickness calculated in the step 3) above in bottom mount (5).
   - Standard shim thickness**: 4 mm**
   - Kind of shim thickness

   : 1 mm and 3.2 mm
5) Remove spacer [1] and check that the bottom mount is in contact with the upper surface of the rear frame at all 4 points of **A** and **B**.



HM300-2 Articulated dump truck

Form No. SEN00694-01

ARTICULATED DUMP TRUCK

HM300-2

Machine model	Serial number
HM300-2	2001 and up

50 Disassembly and assembly

Cab and its attachments

Removal and installation of operator's cab

Special tools

Symbol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
X1	792-454-1100	Pump assembly	●	1	N	

Removal

⚠ **When tilting the cab, observe the following precautions to prevent a serious injury or fatal accident caused by fall of the cab.**
⚠ **To prevent interference between the cab and the dump body, set the steering in a straight ahead position and stop the machine on the level ground.**
⚠ **Lock the dump lever with the dump lever lock knob.**
⚠ **Turn the parking brake switch ON and chock the wheels.**
⚠ **Set the lock bar to the frame and lock front and rear frame.**

- **Precautions in tilting cab**

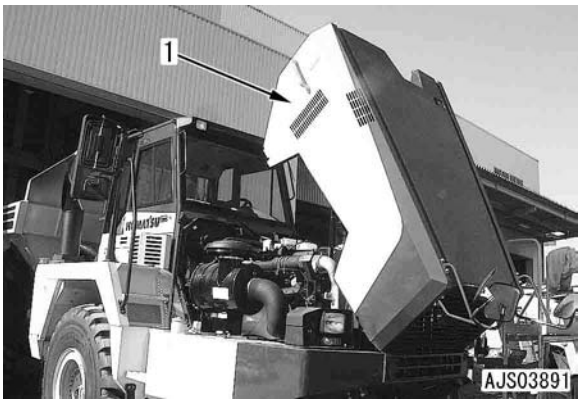
⚠ **When tilting the cab, check that the lock lever is fixed securely.**
⚠ **Do not start the engine while the cab is tilted.**
⚠ **When it is obliged to start the engine for testing etc., check that there is nobody under the cab.**
⚠ **Do not operate the gear shift lever or dump lever.**
⚠ **Do not give a large shock to the machine.**
⚠ **Do not tilt the cab while it is loaded.**

⚠ **Disconnect the cable from the negative (–) terminal of the battery.**
⚠ **Collect the air conditioner refrigerant (R134a) from air conditioner circuit in advance.**
★ Ask professional traders for collecting and filling operation of refrigerant (R134a).
★ Never release the refrigerant (R134a) to the atmosphere.

⚠ **If refrigerant gas (R134a) gets in your eyes, you may lose your sight. Accordingly, put on protective goggles while you are collecting the refrigerant (R134a) or filling the air conditioner circuit with the refrigerant (R134a). Collecting and filling work must be conducted by a qualified person.**

⚠ **In the case that you do not drain the coolant, if you disconnect the heater hose when the coolant temperature in the radiator is high, you may be scalded. In this case, wait until the coolant temperature lowers and then disconnect the heater hose.**

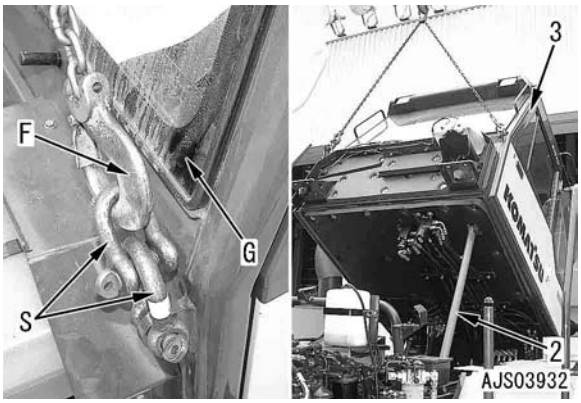
1. Open engine hood (1).

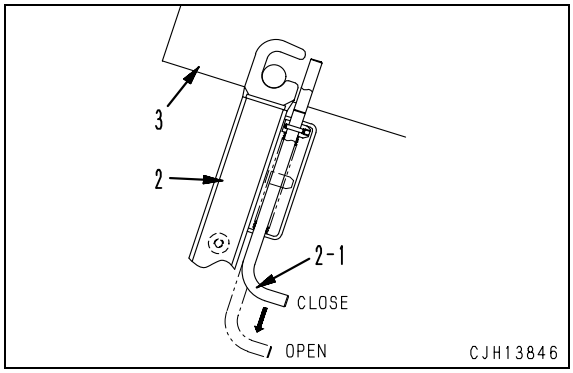


2. Remove 4 each mounting bolts from the right and left mounts at the front of the cab.
★ Check the thickness, quantity, and positions of the inserted shims.

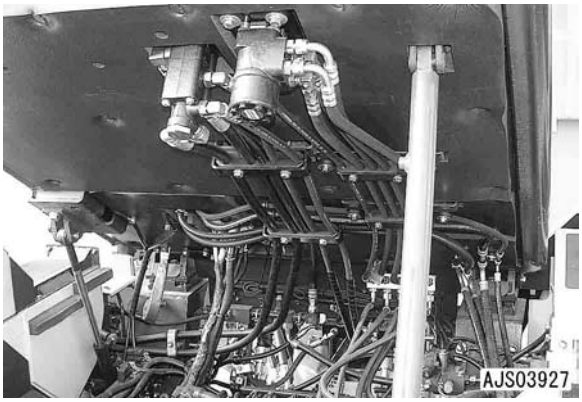
3. Sling operator's cab (3) and tilt it up.
★ Use 2 shackles (S) so that hook (F) of the sling will not hit glass (G) of the cab assembly.

4. Pull lock lever (2-1) and set lock bar (2) with the care the direction of the lock bar (2).
⚠ **Check that the lock lever (2-1) closes and the operator cab assembly (3) is held securely in position by the lock bar (2).**
For details about cab tilt, see "Method of tilting cab up" in chapter Testing and adjusting.
★ Pump assembly **X1** is necessary for tilting up by tilt cylinder.



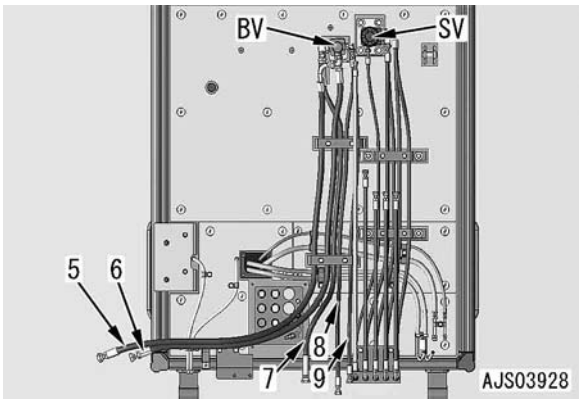


★ Underview of operator's cab.



5. Disconnect hoses (5) – (9) from brake valve (BV).
- (5), (6): Port PA and PB
- (7): Port T
- (8): Port B
- (9): Port A
- (SV): Steering valve

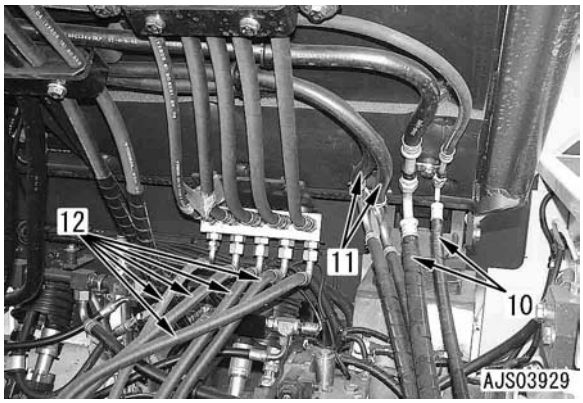
★ Check the destination of each hose.
★ Prepare an oil container.
★ Put plugs to the hoses.
★ When disconnecting the hose from brake valve (BV), make a matchmark at the position of the hose clamp and take care that noise will not be increased by the sag of the hose.



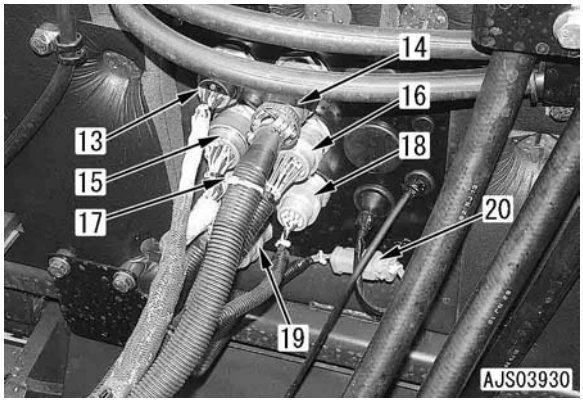
6. Disconnect air conditioner hoses (10). [*1]
★ Stop the openings with tapes, etc. to prevent air from entering them

7. Disconnect heater hoses (11).
★ Prepare an oil container.

8. Disconnect hoses (12) from steering valve (SV).

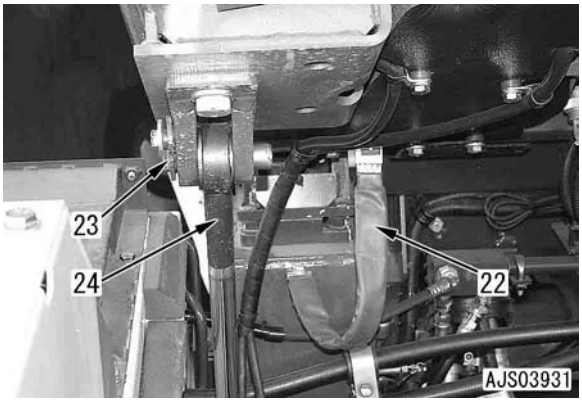


9. Disconnect connectors (13) – (20).
- (13): J08, (14): J01
- (15): J09, (16): J02
- (17): J03, (18): J05
- (19): J04, (20): J06



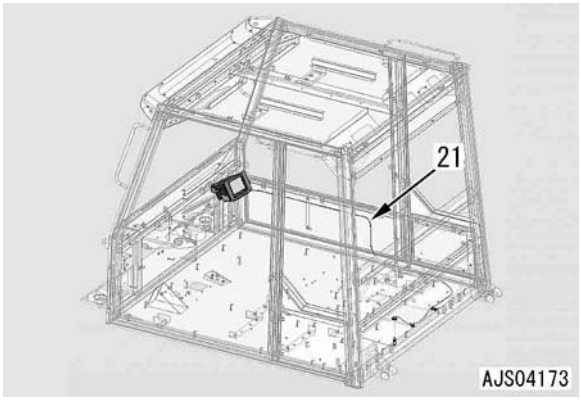
10. Disconnect ground terminal (22).

11. Fix cylinder (24) temporarily to prevent it from falling down and remove pin (23).
★ Retract cylinder (24).
★ Check the thickness, quantity, and positions of the inserted shims.

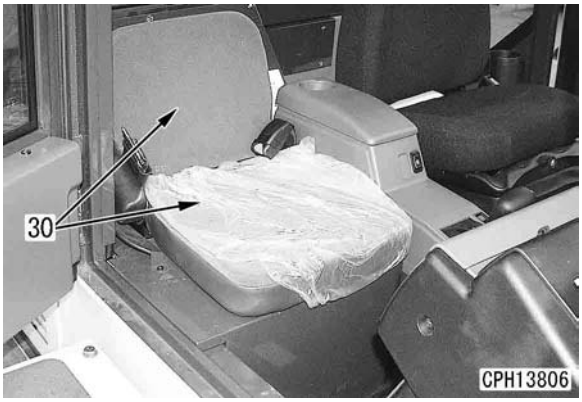


12. Return the operator's cab assembly (3) to the horizontal position.

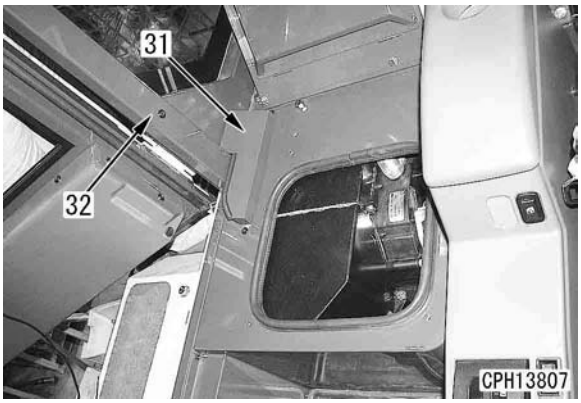
13. Disconnect rearview monitor cable (21) in the following steps.



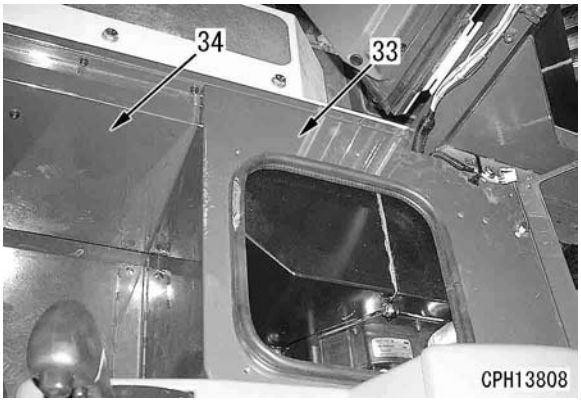
1) Remove seat (30).



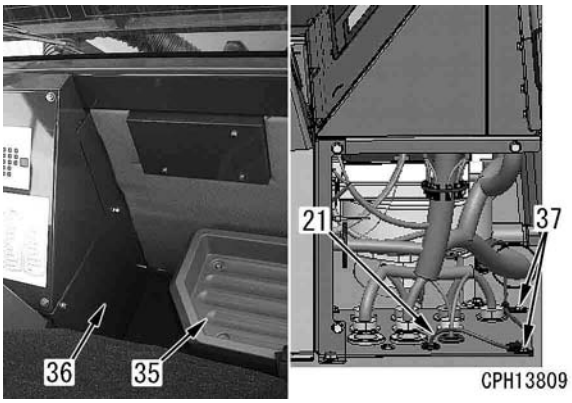
2) Remove cover (31)
★ Disconnect connector PWR from inside of the cover.
3) Remove cover (32).



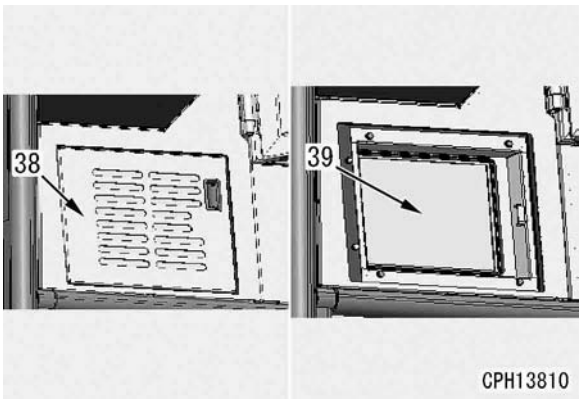
4) Remove covers (33) and (34).



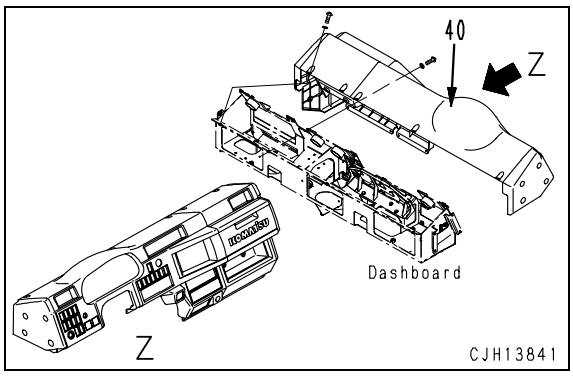
5) Remove storage box (35).
6) Remove cover (36).
7) Remove clamp (37) from rear view monitor cable (21).



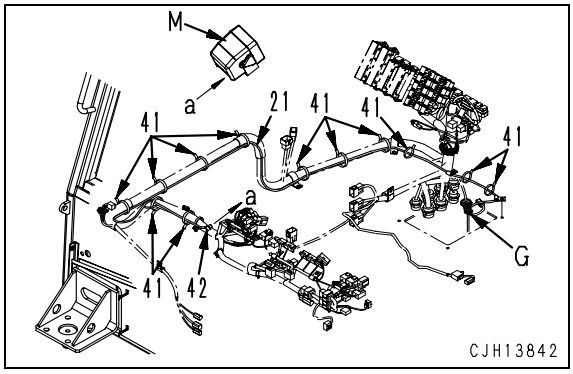
8) Remove the external air filter cover (38) from outside of the operator's cab and remove the external air filter.
9) Remove external air filter box (39).



10) Remove the rear mounting bolts and remove cover (40) from the dashboard.

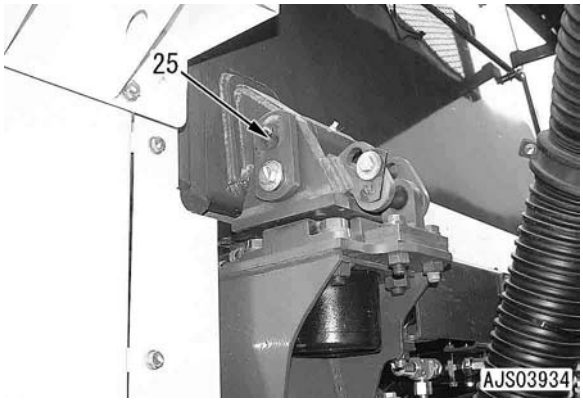


11) Disconnect band (41).
12) Disconnect connector (42) from monitor (M).
13) Remove the molding material of grommet (G). [*2]
14) Drop monitor cable (21) below the operator's cab.



14. Sling the operator's cab assembly temporarily by using plate (P).

15. Remove pin (25). [*3]
★ Check the thickness, quantity, and positions of the inserted shims.



16. Lift off operator's cab assembly (3).
Operator's cab assembly: **1,200 kg**

Installation

- Carry out installation in the reverse order to removal.

[*1]

★ When installing the air conditioner circuit hoses, take care that dirt and water will not enter them.
★ When installing each air conditioner hose, check that the O-ring is fitted to the joint.
★ Check each O-ring for a flaw and deterioration.
★ When connecting the refrigerant piping, coat the O-rings with compressor oil for new refrigerant R134a (**DENSO: ND-OIL 8, ZEXEL: ZXL 100 PG (equivalent to PAG 46**).

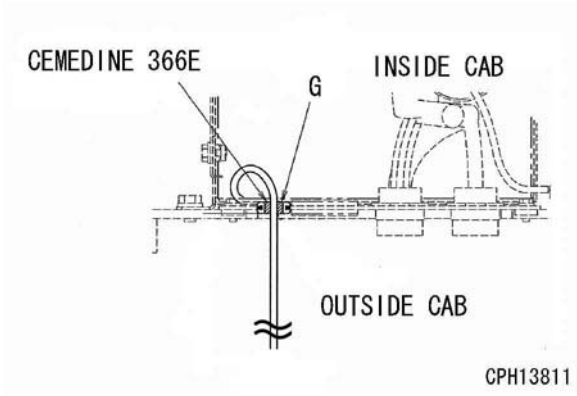
Tightening torque for air conditioner piping

Thread size	Tightening torque
16 x 1.5	11.8 – 14.7 Nm {1.2 – 1.5 kgm}
22 x 1.5	19.6 – 24.5 Nm {2.0 – 2.5 kgm}
24 x 1.5	29.4 – 34.3 Nm {3.0 – 3.5 kgm}

[*2]

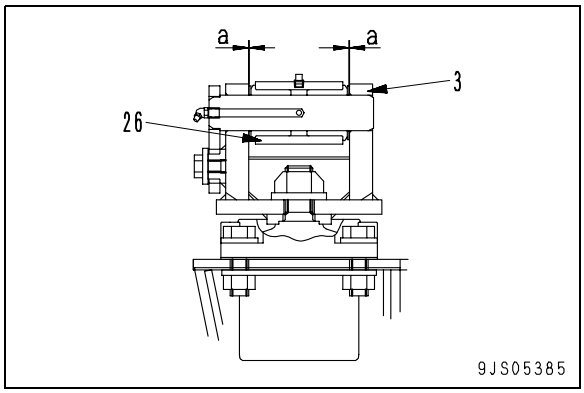
Make seal the grommet (G) area of the monitor cable.

Oblique line area in the grommet (G) (100% full):
CEMEDINE 366E or equivalent



[*3]

★ Adjust the shims so that the clearance between operator's cab (3) and mount (26) will be "a" on each side.
- Standard clearance "**a**": 0.2 mm (Each side)
- Kinds of shim thickness:
  0.5 mm, 1.0 mm, 2.3 mm

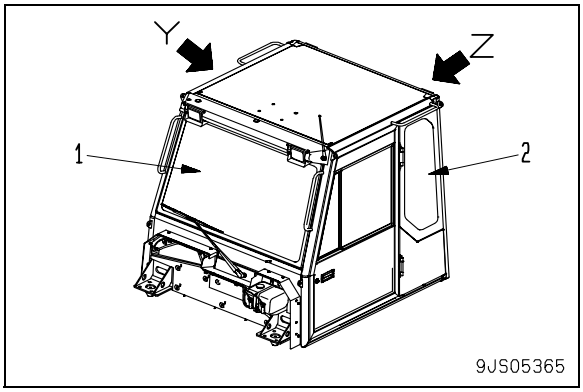


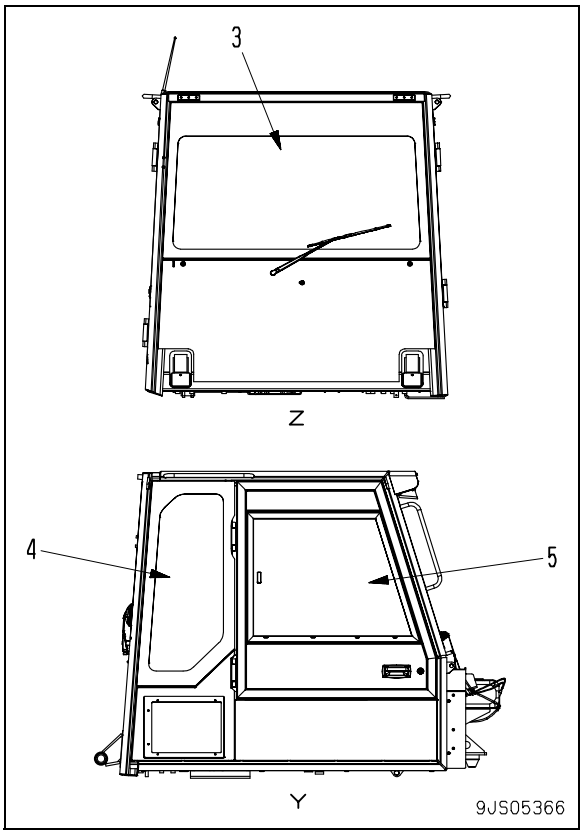
- **Filling air conditioner circuit with refrigerant (R134a)**
  Fill the air conditioner circuit with refrigerant (R134a).
  ★ Quantity of refrigerant: **1,200 ± 50 g**

- **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.

Removal and installation of operator's cab glass (Stuck glass)

★ Among the panes of window glass on the 4 sides of the operator's cab, 5 panes (1) – (5) shown in the figure are stuck.
★ In this section, the procedure for replacing the stuck glass is explained.
(1) Front window glass
(2) Left rear window glass
(3) Rear window glass
(4) Right rear window glass
(5) Right door sash assembly (Sash is stuck)





Procedure

Preparation (Cleaning)

↓

Applying primer
- Cab side: **SUNSTAR 435-95**
- Glass side: **SUNSTAR 435-40**

↓ Dry for at least 5 minutes and stick within 24 hours.

Sticking both-sided adhesive tape (cab side)

↓

Positioning window glass

↓

Applying adhesive **(SUNSTAR Industrial sealant, Petaseal 551**) (cab side)

↓ Within 5 minutes

Sticking window glass
* Keep pressing the glass for at least 10 hours.

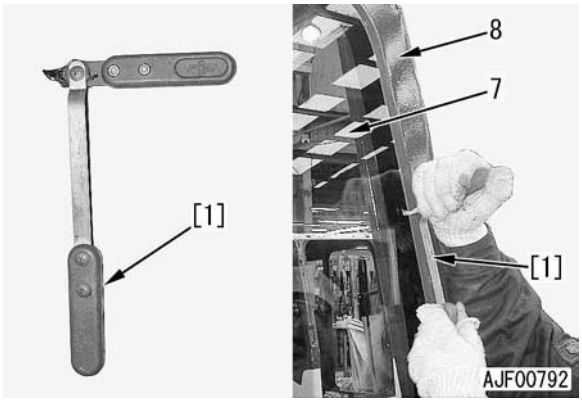
Special tools

Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
X	2	793-498-1210	Lifter (Suction cup)	■	2		
	3	20Y-54-13180	Stopper rubber	■	2		

Removal

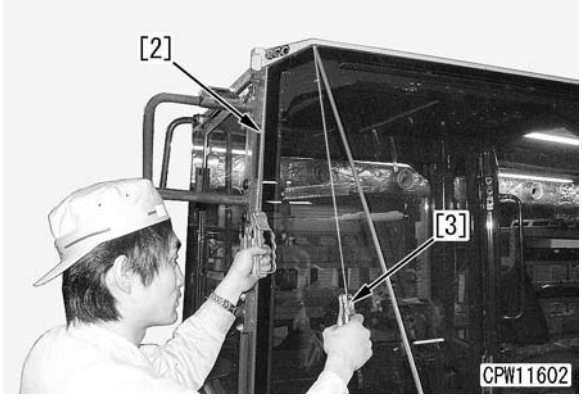
★ Remove the window glass to be replaced according to the following procedure.

1. Using seal cutter [1], cut the adhesive between broken window glass (7) and operator's cab (metal sheet) (8).



★ If a seal cutter is not available, make holes on the adhesive and both-sided adhesive tape with a drill and pass a fine wire (piano wire, etc.) [2] through the holes. Grip the both ends of the wire with pliers [3], etc. (or hold them by winding them onto something) and move the wire to the right and left to cut the adhesive and both-sided adhesive tape. Since the wire may be broken by the frictional heat, apply lubricant to it.

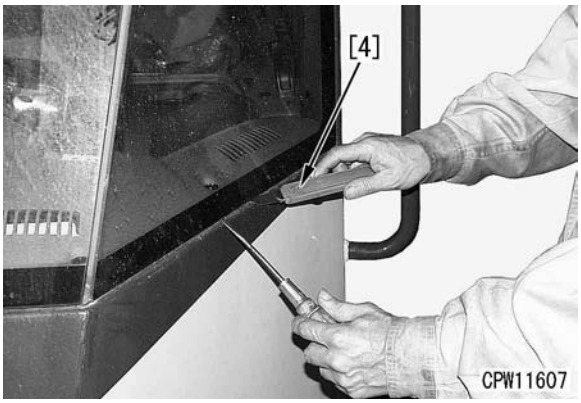
(The following figure shows the operator's cab of a wheel loader.)



★ If the window glass is broken finely, it may be removed with knife [4] and a screwdriver.

★ Widening the cut with a flat-head screwdriver, cut the adhesive and both-sided adhesive tape with knife [4].

(The following figure shows the operator's cab of a wheel loader.)



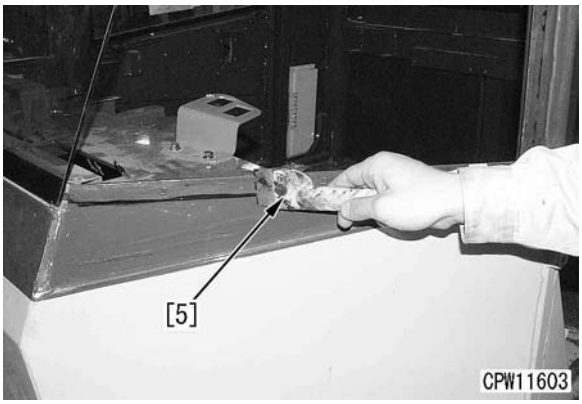
2. Remove the window glass.

Installation

Preparation

1. Using a knife and scraper [5], remove the remaining adhesive and both-sided adhesive tape from the metal sheets (glass sticking surfaces) of the operator's cab.
- ★ Remove the adhesive and both-sided adhesive tape to a degree that they will not affect adhesion of the new adhesive. Take care not to scratch the painted surfaces. (If the painted surfaces are scratched, adhesion will be lowered.)

(The following figure shows the operator's cab of a wheel loader.)



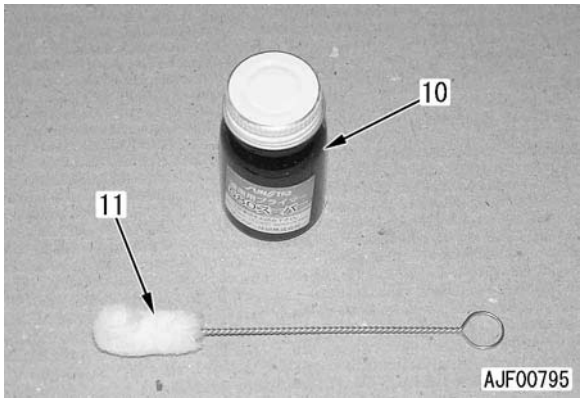
2. Remove oil, dust, dirt, etc. from the sticking surfaces of cab (8) and window glass (9) with white gasoline.
- ★ If the sticking surfaces are not cleaned well, the glass may not be stuck perfectly.
- ★ Clean the all black part on the back side of the window glass.
- ★ After cleaning the sticking surfaces, leave them in air for at least 5 minutes to dry.

(The following figure shows the operator's cab of a wheel loader.)

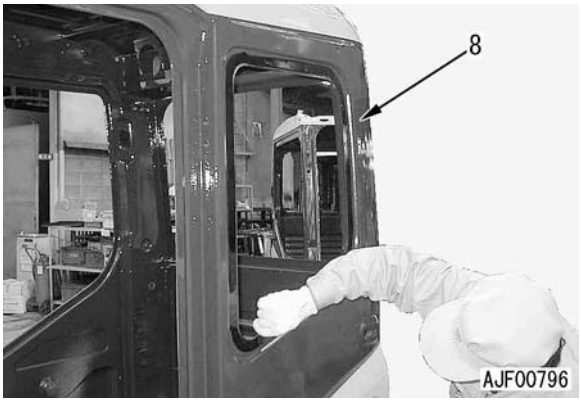
Applying primer

3. Apply primer (10).
- ★ The using limit of the primer is 4 months after the date of manufacture. Do not use the primer after this limit.
- ★ Use the primer within 2 hours after unpacking it.
- ★ Even if the primer is packed again just after it is unpacked, use it within 24 hours after it is unpacked for the first time. (Discard the primer 24 hours after it is unpacked.)

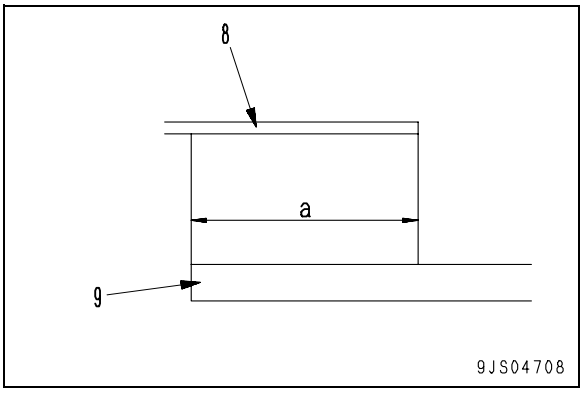
1) Stir both of the paint primers and glass primer sufficiently before using them.
   - ★ If the primer has been stored in a refrigerator, leave it at the room temperature for at least half a day before stirring it. (If the primer is unpacked just after taken out of the refrigerator, water will be condensed. Accordingly, leave the primer at the room temperature for a sufficient time.)
2) When reusing primer brush (11), wash it in white gasoline.
   - ★ After washing the brush, check it again for dirt and foreign matter.
   - ★ Prepare respective brushes for the paint primer and glass primer.



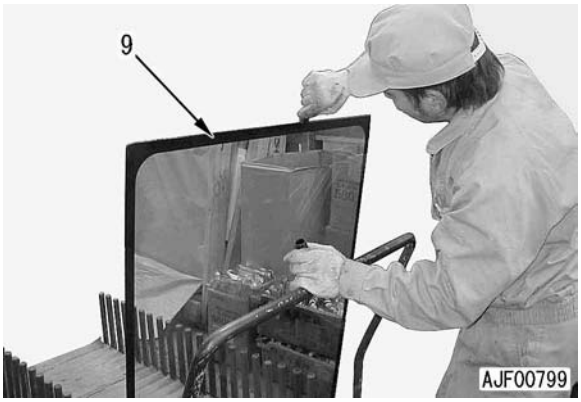
3) Evenly apply paint primer to the surfaces to stick both-sided adhesive tapes.
a: Min. 30 mm
Primer for cab (painted surface): **SUNSTAR 435-95**
★ Do not apply the primer more than 2 times. (If it is applied more than 2 times, its performance will be lowered.)
★ Never apply wrong primer. If you have applied the glass primer, etc. by mistake, wipe it off with white gasoline.
★ After applying the primer, leave it for at least 5 minutes in air to dry and stick the both-sided adhesive tape within 24 hours.
(The figure shows the operator's cab of a hydraulic excavator.)



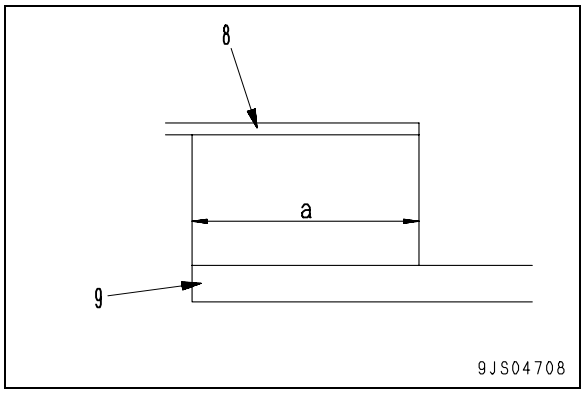
★ (9): Glass



4) Evenly apply glass primer all around inside of the black coated surface of window glass (9).
a: Min. 30 mm
Glass primer: **SUNSTAR 435-40**
★ The black coating is for prevention of deterioration by light.
★ Do not apply the primer more than 2 times. (If it is applied more than 2 times, its performance will be lowered.)



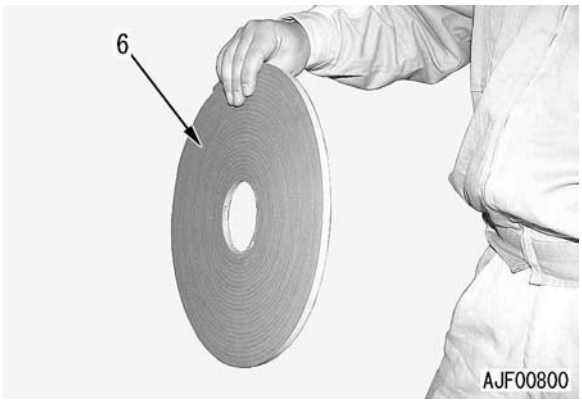
★ (8): Cab



★ Never apply wrong primer. If you have applied the paint primer, etc. by mistake, wipe it off with white gasoline.

Sticking both-sided adhesive tape

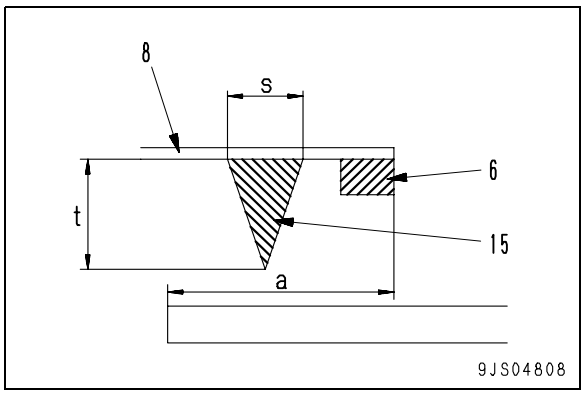
4. Stick both-sided adhesive tape (6) along the edge of cab (8).
- ★ Do not remove the release tape of the both-sided adhesive tape on the glass sticking side before sticking the glass.
- ★ When sticking the both-sided adhesive tape, do not touch the cleaned surface as long as possible.
- ★ Take that the both-sided adhesive tape will not float at each corner of the window frame.



- ★ When sticking both-sided adhesive tape (6) around a frame, do not lap its finishing end over the starting end but make clearance "**e**" of about 5 mm between them.

1) Stick both-sided adhesive tape (6) for right window glass (1) as shown in the figure.
   - ★ (The figure shows the operator's cab of a hydraulic excavator.)

- ★ (8): Cab
- ★ (a): Range to apply primer (Described above)
- ★ (15): Adhesive (Described below)



Positioning window glass

5. Position the new window glass.

1) Check the clearance between the window glass and the operator's cab on the right, left, upper, and lower sides, and then adjust it evenly.
2) Stick tapes [6] between window glass (9) and operator's cab (8) and draw positioning line (n).
   - ★ Stick tapes [6] to the right, left, and lower parts of the glass for accurate positioning.
3) Cut the tape between window glass (9) and operator's cab (8) with a knife, and then remove the window glass.
   - ★ Do not remove the release tape of the both-sided adhesive tape on the glass sticking side before sticking the glass.

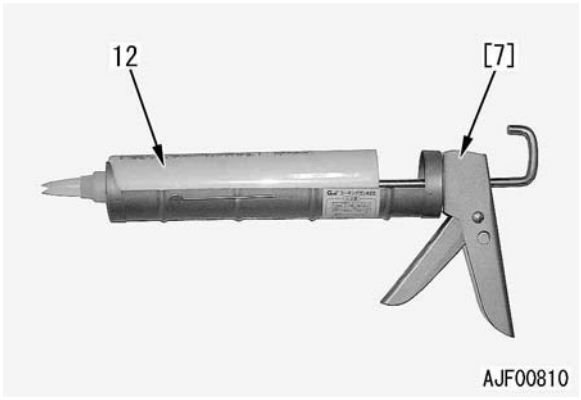
   (The figure shows the operator's cab of a hydraulic excavator.)

Applying adhesive

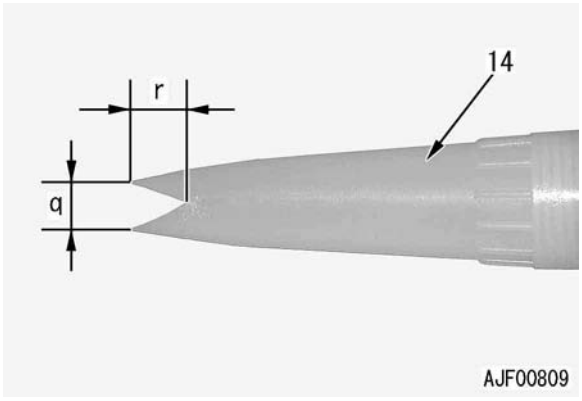
6. Prepare for applying the adhesive.
- Adhesive:
  SUNSTAR Industrial sealant, Petaseal 551

★ The using limit of the adhesive is 4 months after the date of manufacture. Do not use the adhesive after this limit.
★ Keep the adhesive in a dark place where the temperature is below 25°C.
★ Never heat the adhesive higher than 30°C.
★ When reusing the adhesive, remove the all hardened part from the nozzle tip.

1) Set adhesive cartridge (12) to caulking gun [7].
   ★ An electric caulking gun is more efficient.



2) Cut the tip of the adhesive nozzle (14) so that dimensions (q) and (r) will be as follows.
   - Dimension (q): 10 mm
   - Dimension (r): 15 mm

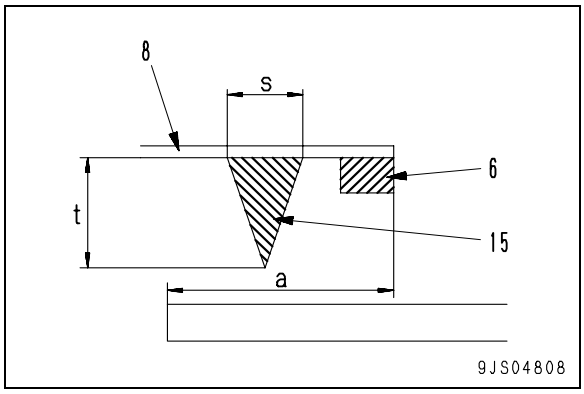


3) Remove the release tape of the both-sided adhesive tape on the glass side.

7. Apply the adhesive.
★ Apply adhesive (15) to dimensions (s) and (t) of both-sided adhesive tape (6) of operator's cab (8).
- Dimension (s): 10 mm
- Dimension (t): 15 mm

Adhesive: **SUNSTAR Industrial sealant, Petaseal 551**

★ Apply adhesive (15) higher than both-sided adhesive tape (6).
★ Apply the adhesive evenly.
★ (a): Range to apply primer (Described above)
★ Stick the glass within 5 minutes after applying the adhesive.



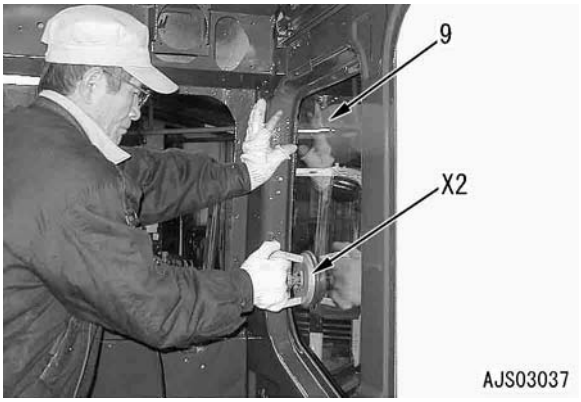
Installing window glass

8. Install the window glass.

1) Install window glass (9), matching it to the lines of the positioning tapes drawn in step 5.
   ★ Since the window glass cannot be removed and stuck again, stick it very carefully.
2) After sticking window glass (9), press all around it until it is stuck to the both-sided adhesive tape.
   ★ Press the corners of the window glass firmly.

   (The figure shows the operator's cab of a hydraulic excavator.)

★ You can perform this work efficiently by pulling window glass (9) from inside of the operator's cab with suction cup **X2**.

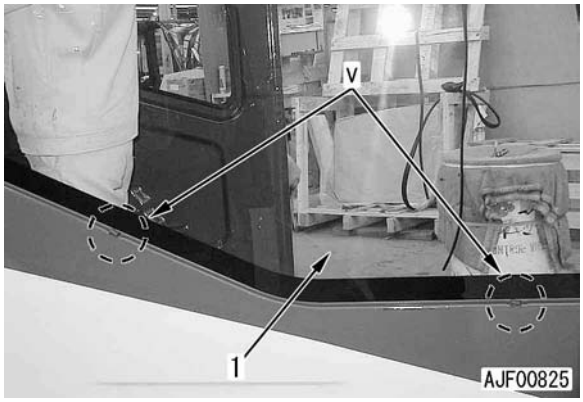


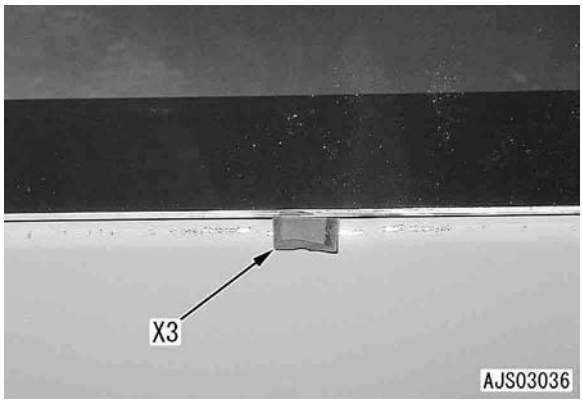
★ Wipe off the projected adhesive.

9. Fix the window glass.

1) After installing right window glass (1) to the operator's cab, insert stopper rubbers **X3** in 2 places (v) at the bottom of the glass to fix the glass.

   (The figure shows the operator's cab of a hydraulic excavator.)





2) Using styrene foam blocks [9] and rubber bands [10], fix the window glass and both-sided adhesive tape for at least 10 hours to fit them completely.

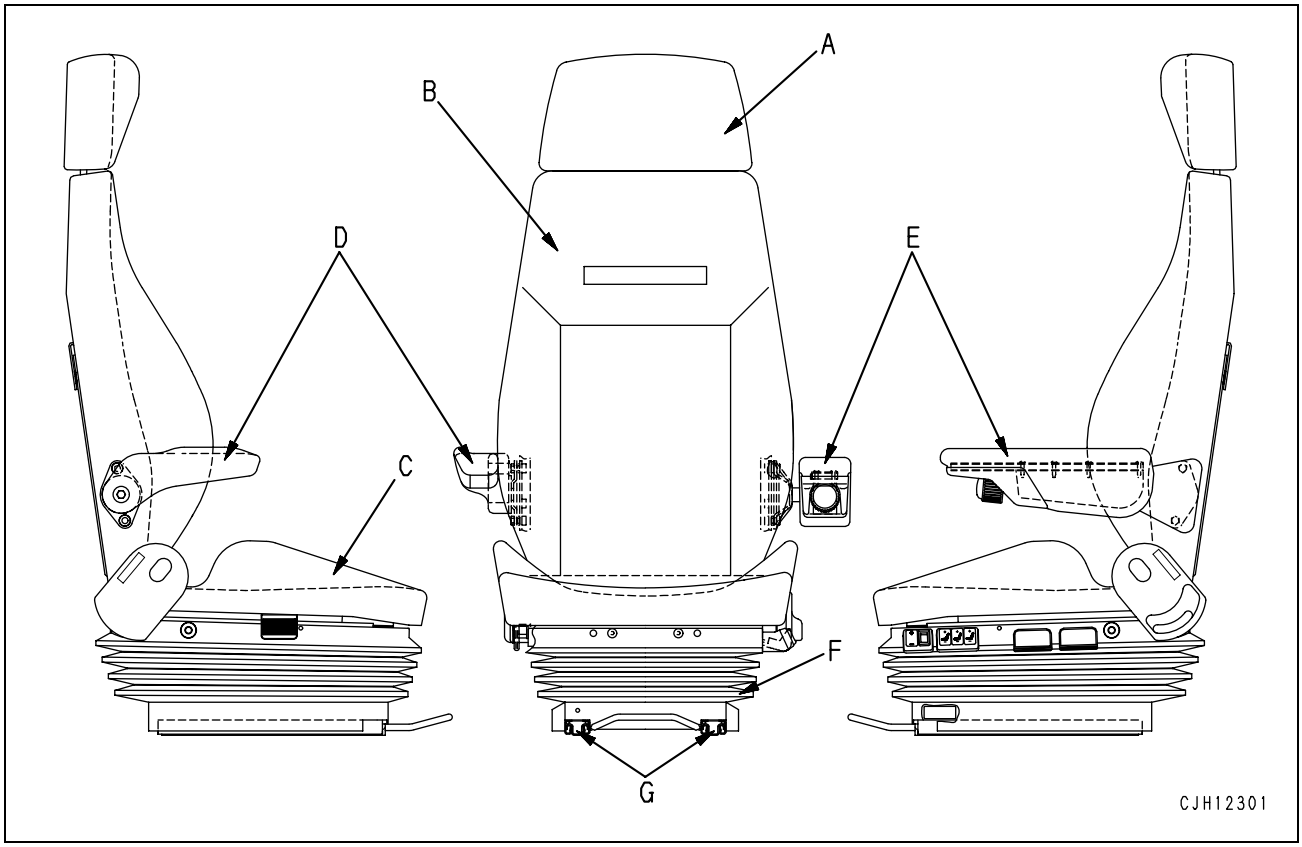
   (The figure shows the operator's cab of a hydraulic excavator.)

10. After installing the window glass, remove the primer and adhesive from the operator's cab and window glass.

★ Using white gasoline, wipe off the adhesive before it is dried up.
★ When cleaning the glass, do not give an impact to it.

Disassembly and assembly of operator's seat assembly (If equipped)

★ The procedure for disassembling and assembling the operator's seat assembly {Air suspension (product made from ISRING HAUSEN)} is shown below.

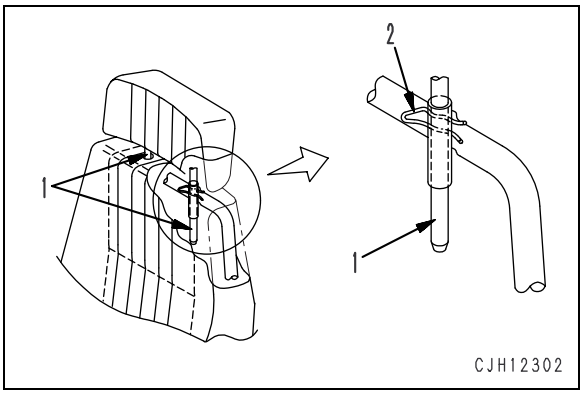


A : Headrest
B : Seatback
C : Seat cushion
D : Right-hand armrest
E : Left-hand armrest
F : Suspension cover
G : Sliderails

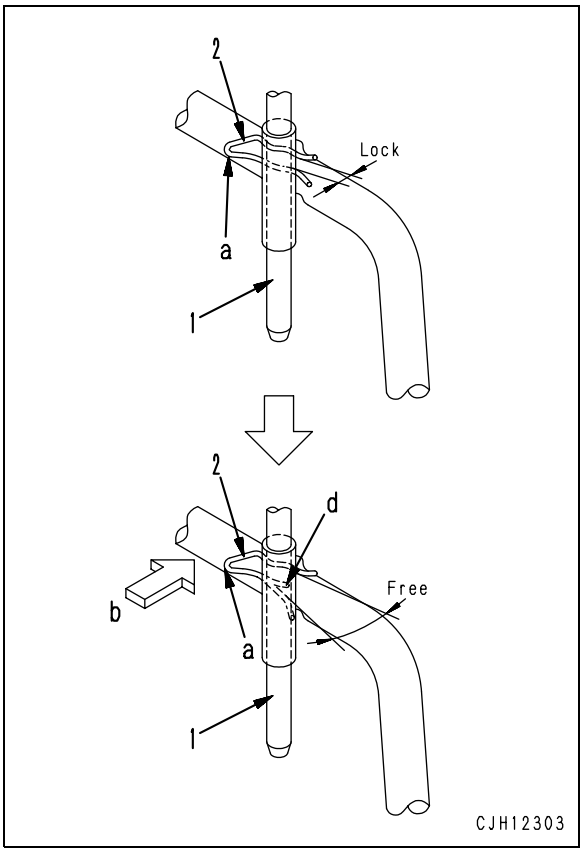
Disassembly

1. Headrest

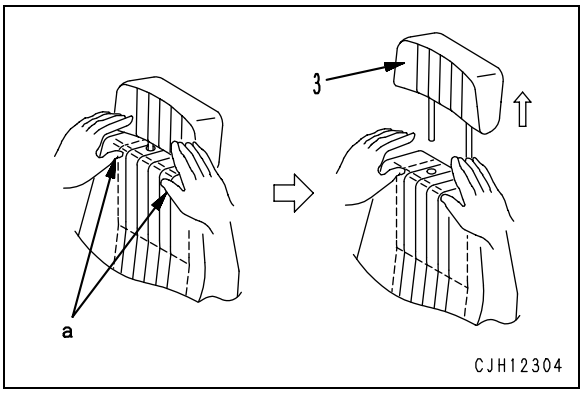
1) Referring to the figure, check the positions of the 2 clips (2) of headrest stay (1) on both sides.



2) Apply force **b** to part **a** of each clip (2) in the direction of the arrow to turn the clip. Release headrest stay (1) from part **d** of the clip and pull out up headrest (3).



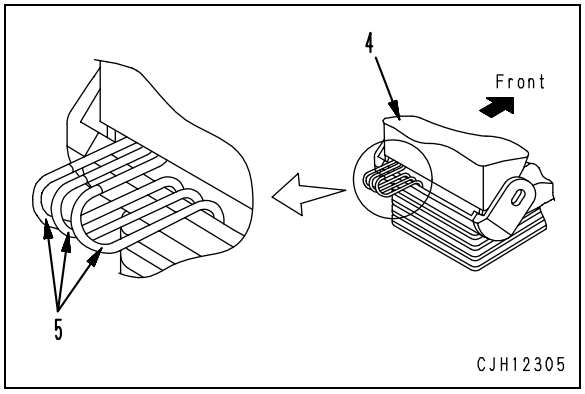
★ Pushing in both clips (2) simultaneously, remove headrest (3).



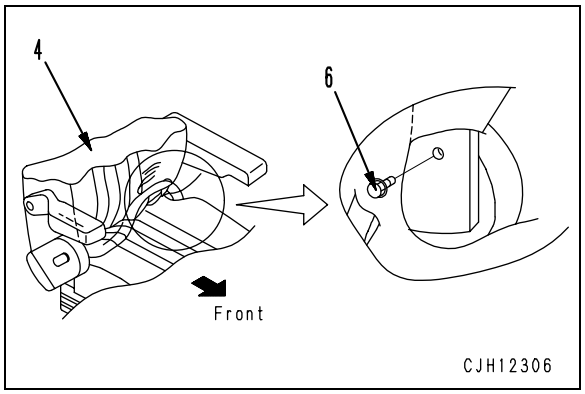
2. Seatback

1) Disconnect 3 air hoses (5) from the rear left of seatback (4).

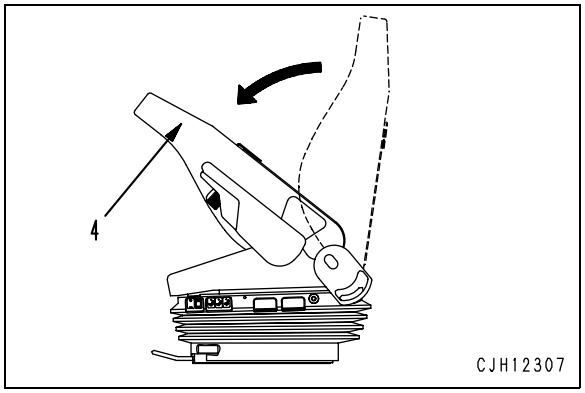
★ Before disconnecting the air hoses, check their types.



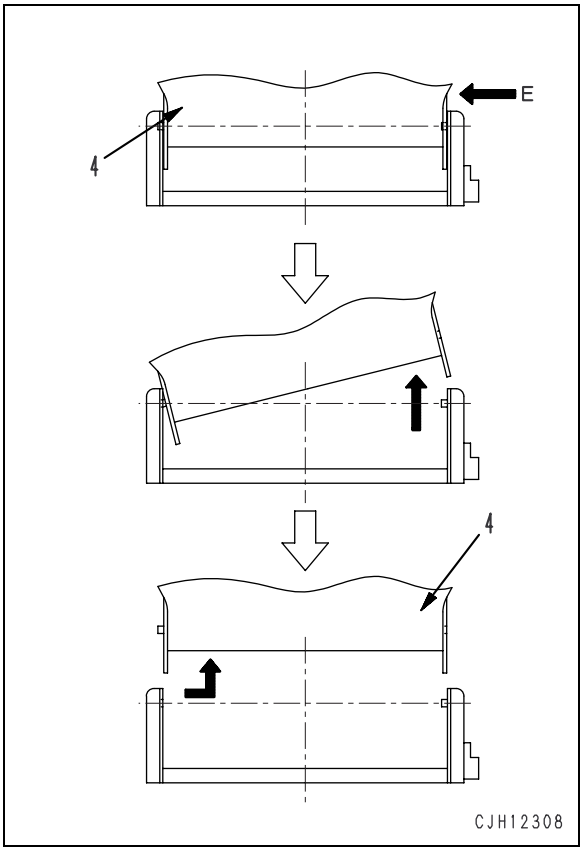
2) Remove seatback hinge mounting bolt (6) (M8 bolt).



3) Bring seatback (4) down forward.

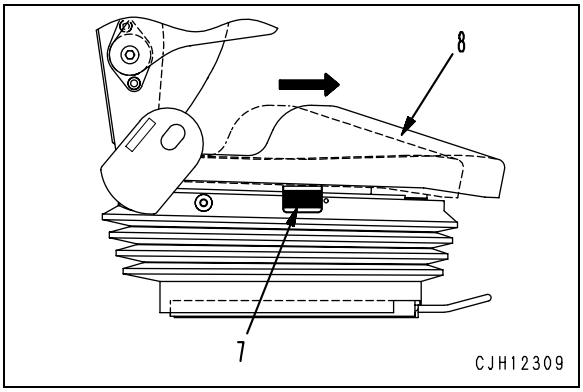


4) Apply force **E** to the right side of seatback (4) in the direction of the arrow.
5) Applying the force to seatback (4), pull its right side up.
6) Slide seatback (4) sideway and remove it.

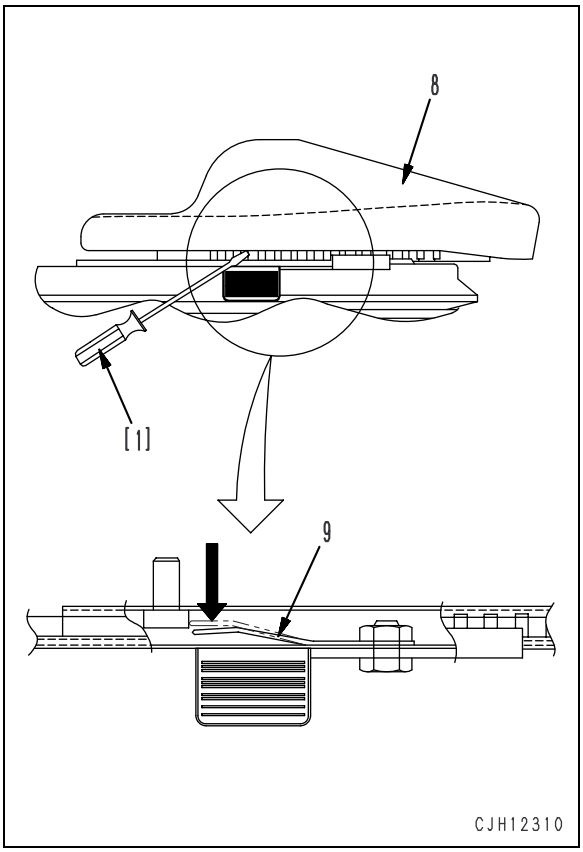


3. Seat cushion

1) Push cushion adjuster lever (7) inward and slide seat cushion (8) to the front end.

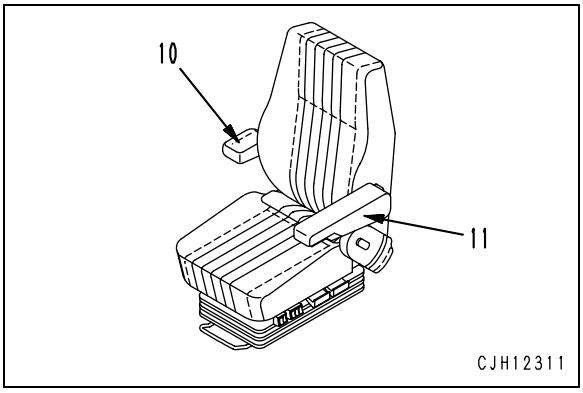


2) Push cushion stopper wire (9) down with screwdriver [1], etc.
3) Pull out seat cushion (8) forward and remove it.

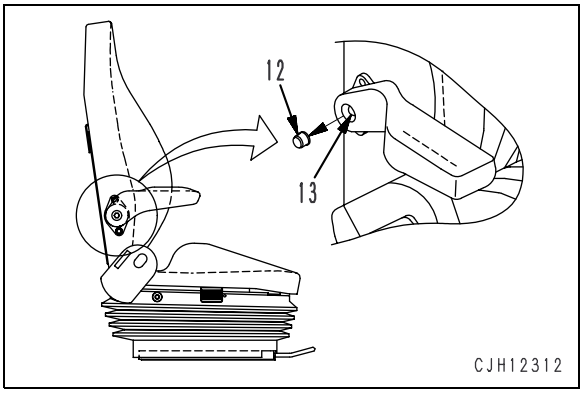


4. Armrest

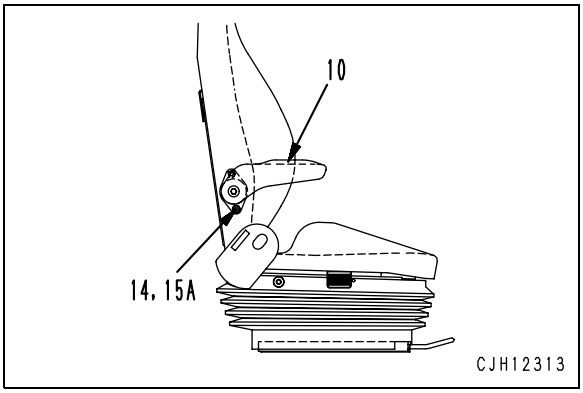
- The procedure for disassembling right-hand armrest (10) is shown below.
  (Disassemble left-hand armrest (11) similarly.)



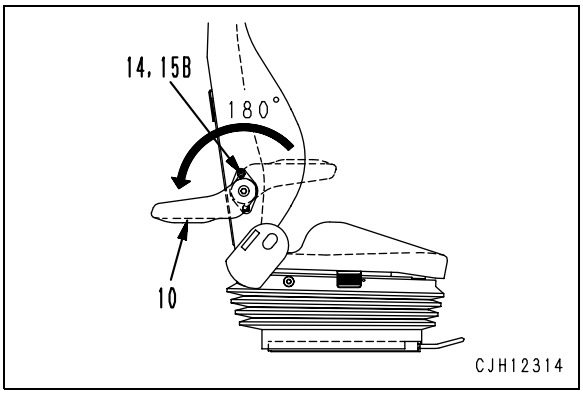
1) Remove plastic cap (12) from the armrest hinge.
   ★ Use a flat-head screwdriver, etc. to remove the cap.
2) Loosen armrest hinge mounting bolt (13).



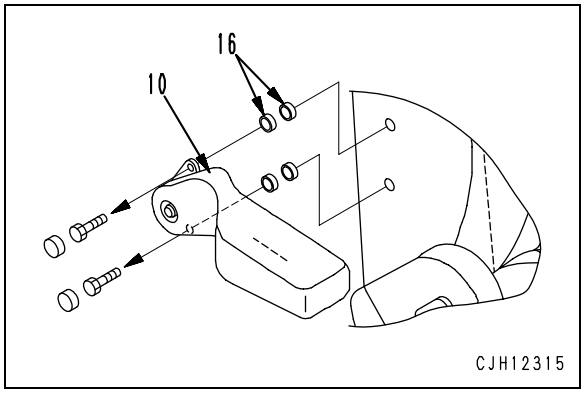
3) Remove plastic cap (14), and then remove lower mounting bolt (15A) (M8 bolt) of right-hand armrest (10).



4) Turn right-hand armrest (10) up by 180°.
   ★ If the armrest is not turned, you cannot apply the tool to upper mounting bolt (15B).
5) Remove plastic cap (14) and upper mounting bolt (15B).

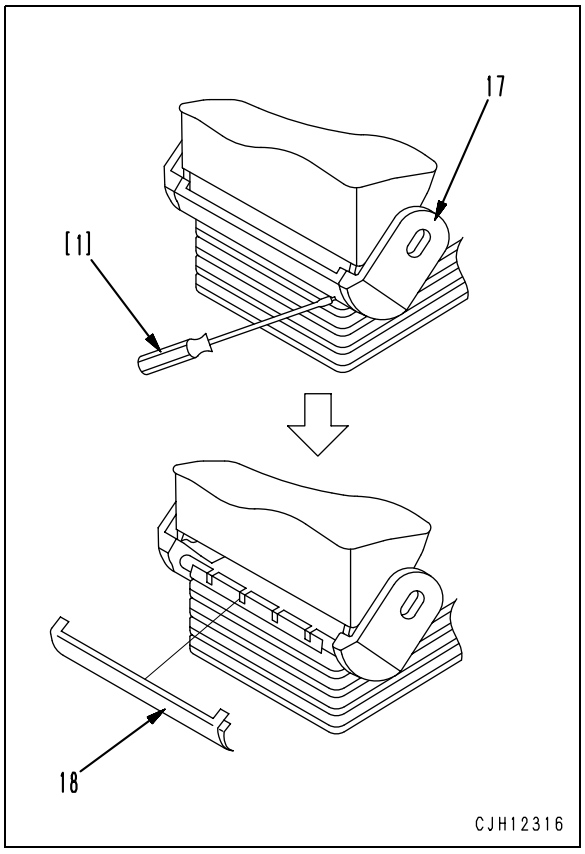


6) Remove right-hand armrest (10).
   ★ There are 2 position adjustment washers (16) installed to each bolt between the armrest and seatback. Take care not lose them.

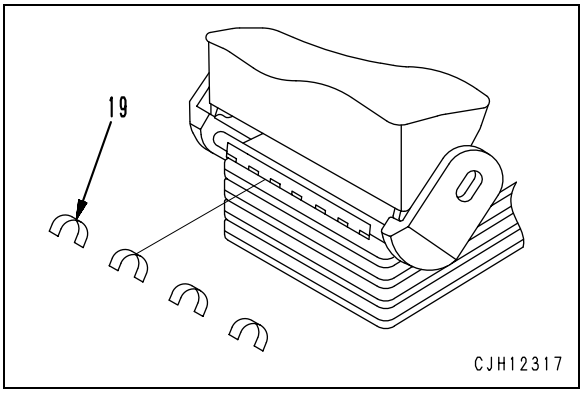


5. Suspension cover

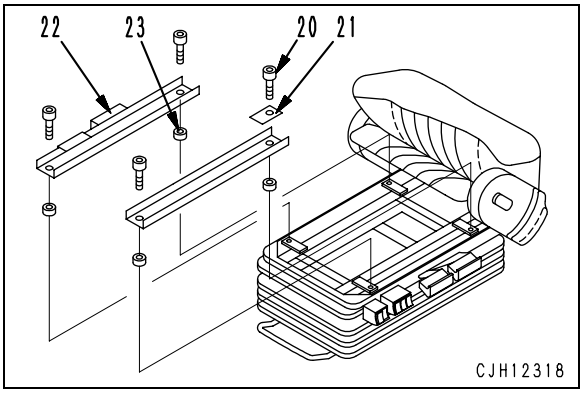
1) Remove right-hand hinge cover (17).
2) Remove plastic plate (18) from the rear with screwdriver [1], etc.
   ★ Take care not to damage the plastic plate by prying it off forcibly with a screwdriver, etc.



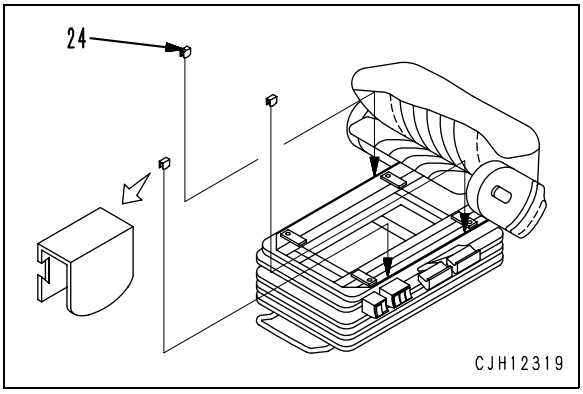
3) Remove 4 suspension cover fixing rings (19).



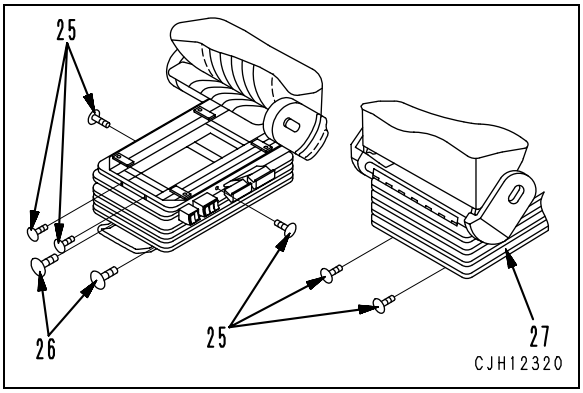
4) Remove 4 mounting bolts (20), cushion rear fixing plate (21), 2 cushion rails (22), and 4 bushings (23).



5) Remove 3 metallic suspension cover clips (24).

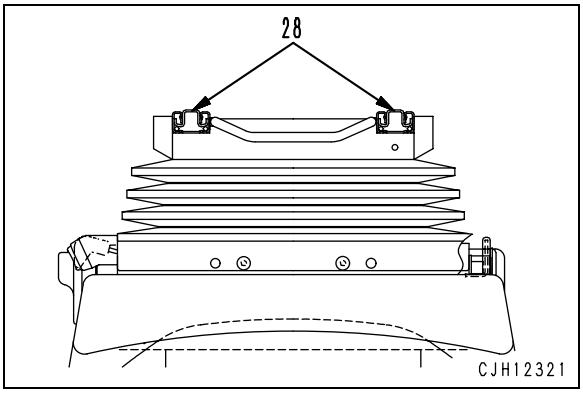


6) Remove 6 plastic suspension cover clips (small) (25) and 2 plastic suspension cover clips (large) (26).
   ★ Clips (small) (25):
   Front upper part; 2 places
   Each side; 1 place
   Rear lower part; 2 places
   Clips (large) (26):
   Front lower part; 2 places
7) Remove suspension cover (27).
   ★ If you remove the suspension cover without performing the work in steps 5) and 6), the suspension cover may be broken.

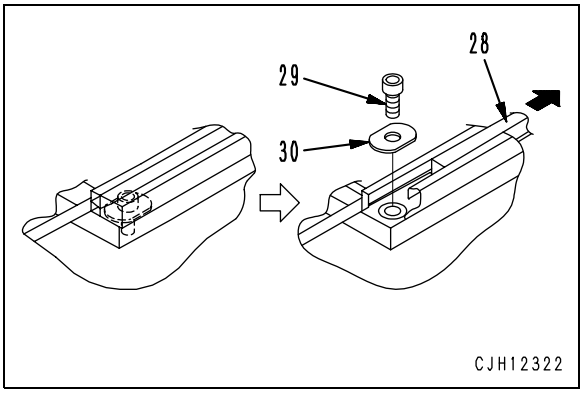


6. Rails

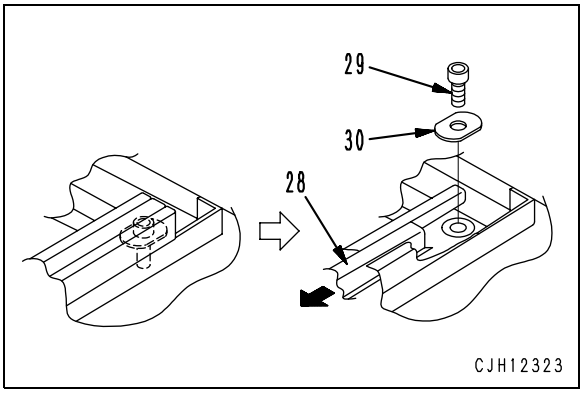
1) Turn over the seat assembly to set rails (28) on the upside.



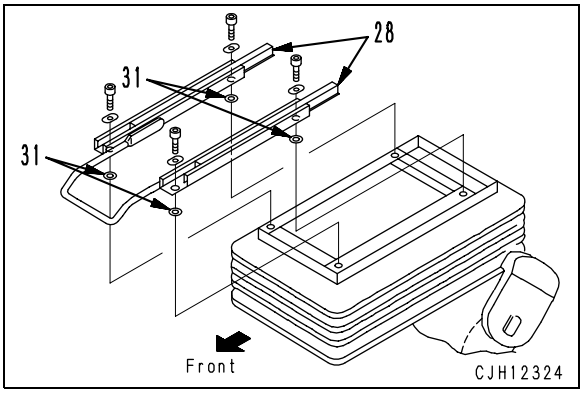
2) Slide rails (28) to the rear end.
3) Remove 1 hexagon socket head bolt (29) and 1 lock washer (30) from the front part of each rail. [*6]



4) Slide rails (28) to the front end.
5) Remove 1 hexagon socket head bolt (29) and 1 lock washer (30) from the rear part of each rail, and then remove rails (28). [*7]



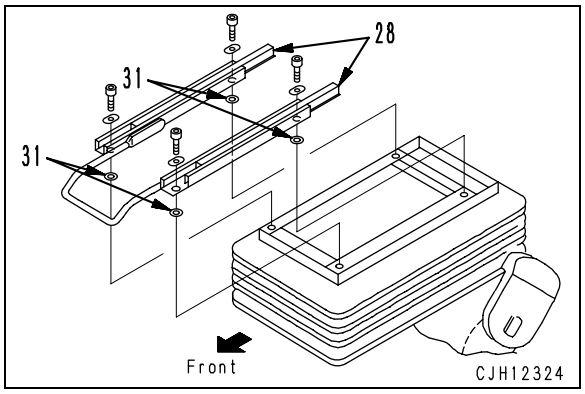
★ Take care not to lose height adjustment washers (31) between the rails and suspension.



Assembly

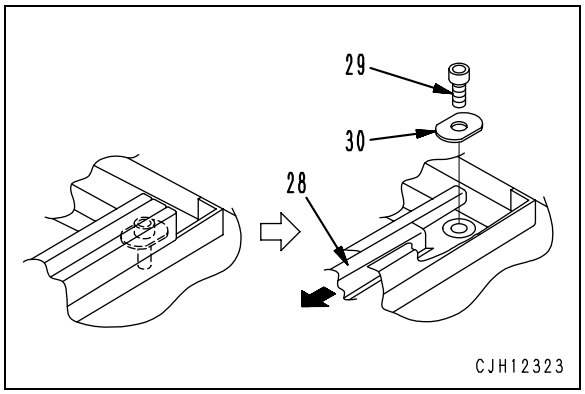
1. Rails

1) Put height adjustment washers (31) between rails (28) and suspension, and then set rails (28) in position.

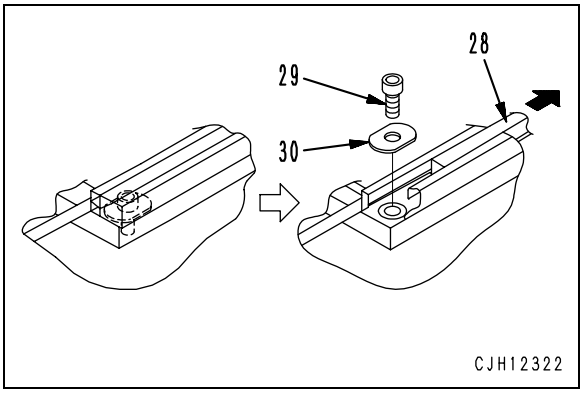


2) Set rails (28) to the front end and install 1 lock washer (30) and 1 hexagon socket head bolt (29) to each rail.

Hexagon socket head bolt:
21.4 – 27.6 Nm {2.18 – 2.82 kgm}

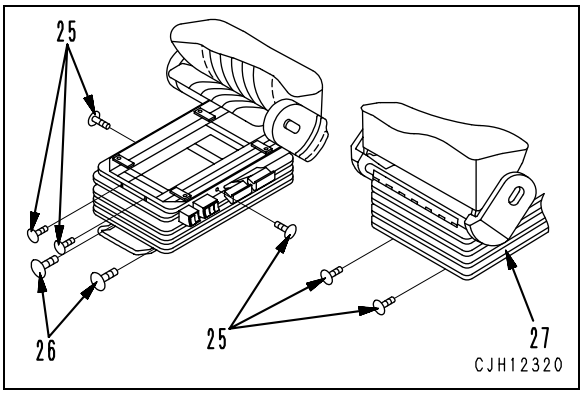


3) Set rails (28) to the rear end and install 1 lock washer (30) and 1 hexagon socket head bolt (29) to each rail.
   Hexagon socket head bolt:
   21.4 – 27.6 Nm {2.18 – 2.82 kgm}

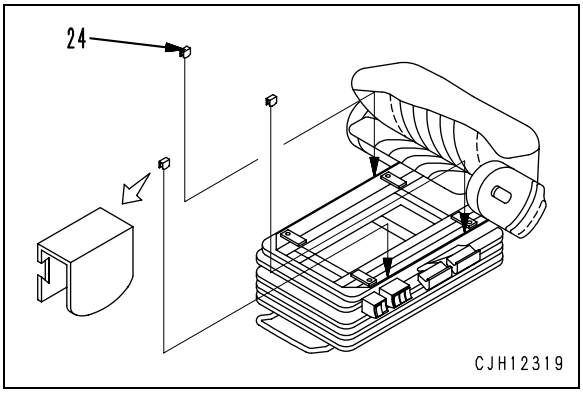


2. Suspension cover

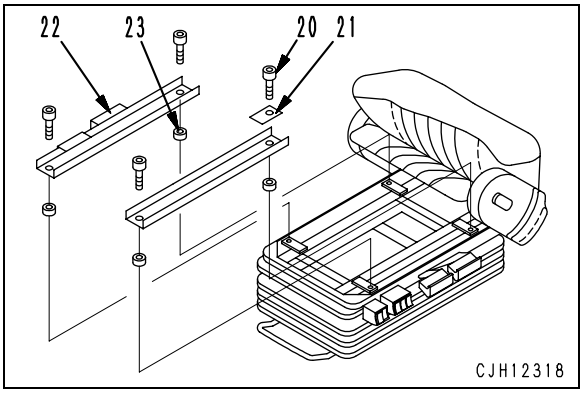
1) Set suspension cover (27) in position and install 6 plastic suspension cover clips (small) (25) and 2 plastic suspension cover clips (large) (26).
   ★ Clips (small) (25):
   Front upper part; 2 places
   Each side; 1 place
   Rear lower part; 2 places
   Clips (large) (26):
   Front lower part; 2 places



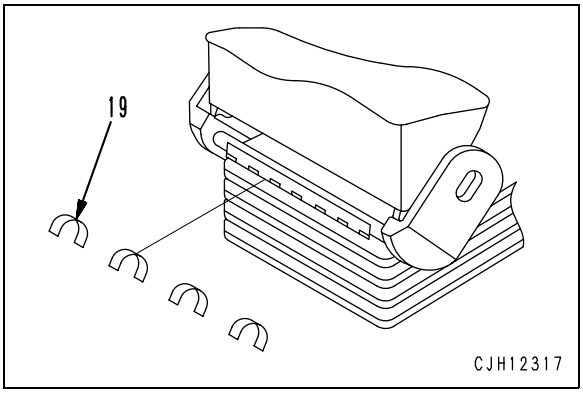
2) Install 3 metallic suspension cover clips (24).



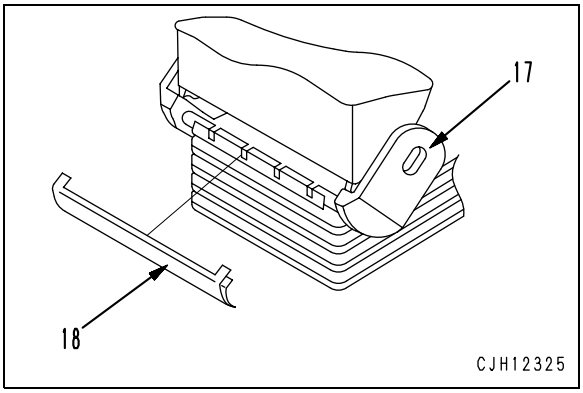
3) Set 4 bushings (23) and 2 cushion rails (22), and then install cushion rear fixing plate (21), and 4 mounting bolts (20).
   Cushion rail mounting bolt:
   21.4 – 27.6 Nm {2.18 – 2.82 kgm}



4) Install 4 suspension cover fixing rings (19).

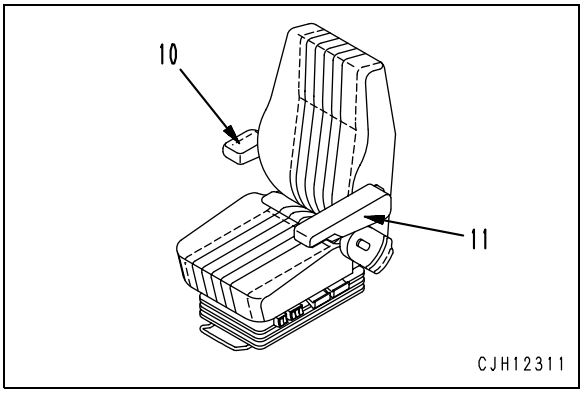


5) Install plastic plate (18) to the rear.
6) Install right-hand hinge cover (17).

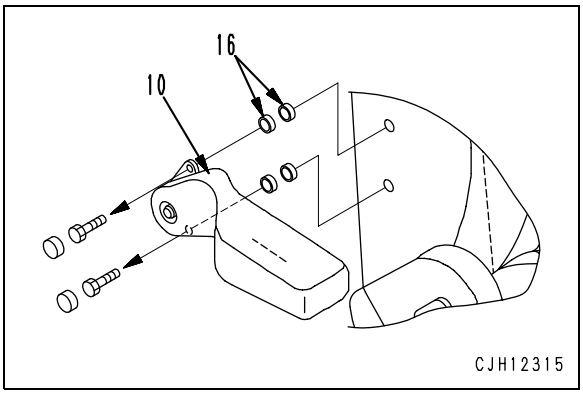


3. Armrest

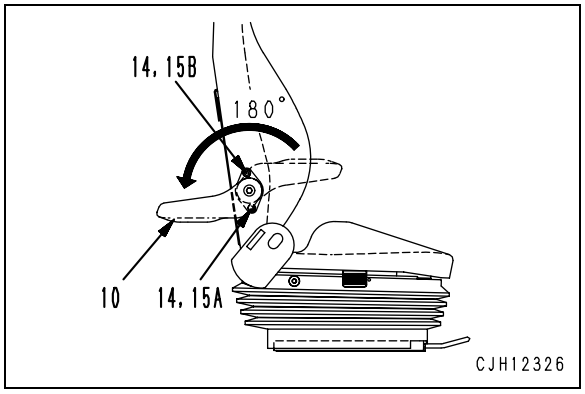
- The procedure for assembling right-hand armrest (10) is shown below.
  (Assemble left-hand armrest (11) similarly.)



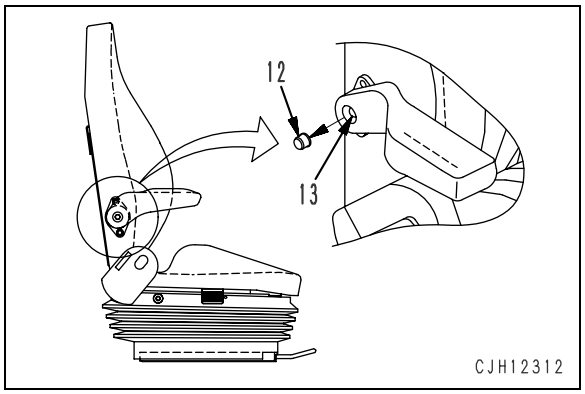
1) Install 2 position adjustment washers (16) for each bolt and set right-hand armrest (10) in position.



2) Tighten lower mounting bolt (15A) lightly and turn armrest (10) by 180 degrees.
3) Tighten upper mounting bolt (15B) lightly.
4) Tighten lower mounting bolt (15A) and upper mounting bolt (15A) permanently.
   Upper and lower armrest mounting bolt:
   21.4 – 27.6 Nm {2.18 – 2.82 kgm}
5) Install 2 plastic caps (14).

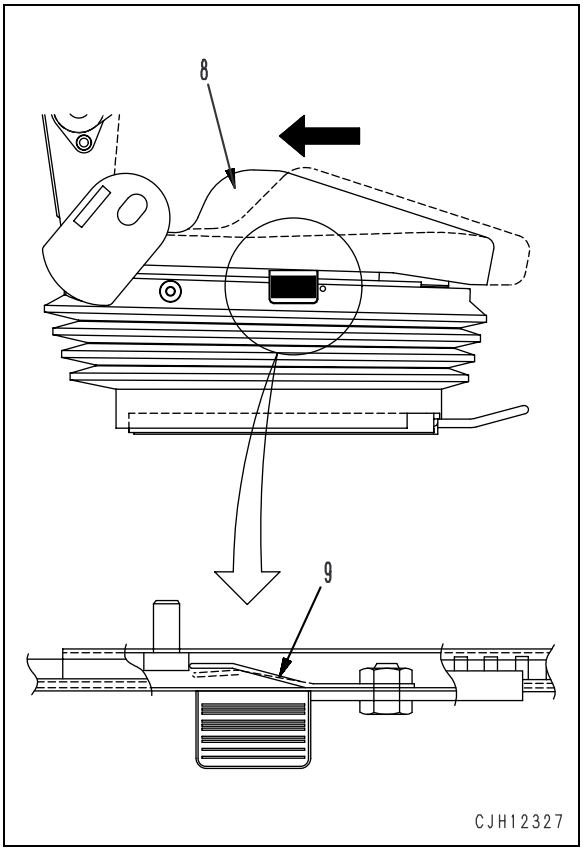


6) Tighten armrest hinge mounting bolt (13).
   ★ Tighten the bolt so that the arm will move smoothly.
   - Operating effort at armrest end:
     49 – 78.4 N {5 – 8 kg}
7) Install plastic cap (12).



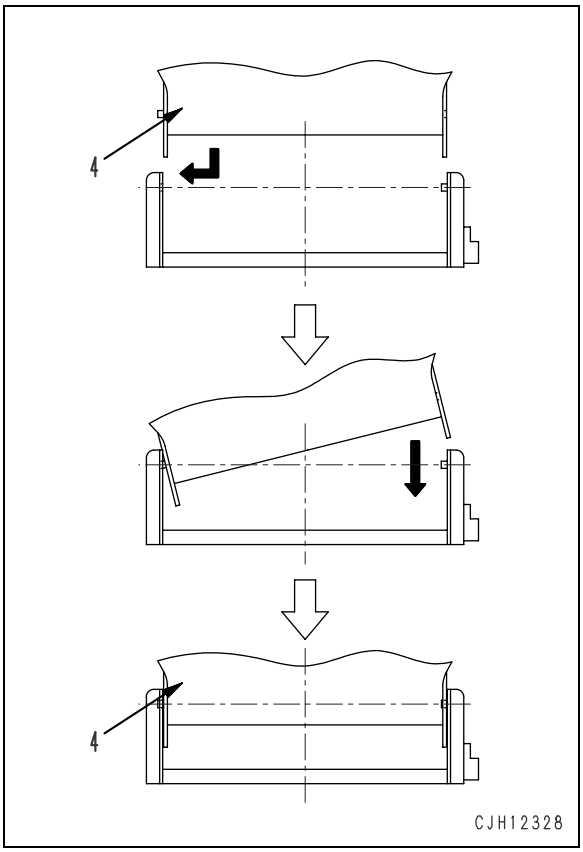
4. Seat cushion

1) Slide in the seat cushion from the front of the fitting position.
   ★ If seat cushion (8) is slid to the rear, it is locked by cushion stopper wire (9).

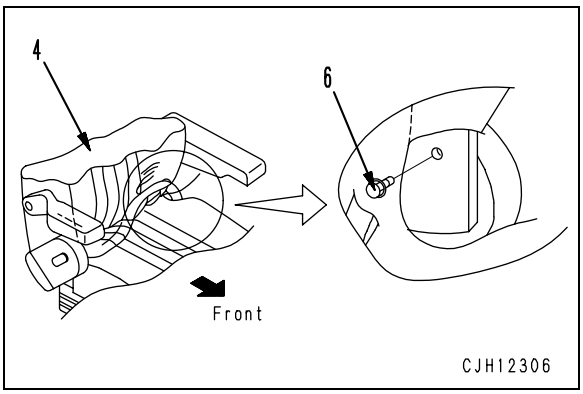


5. Seatback

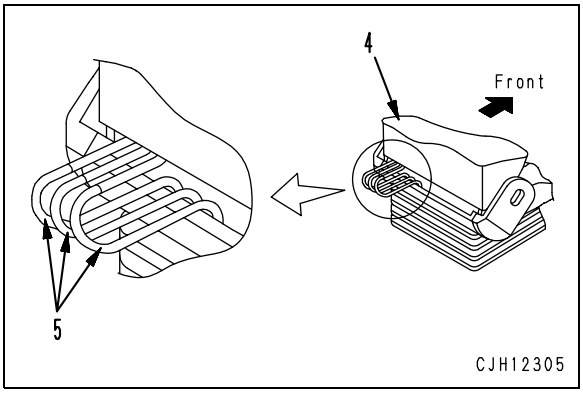
1) Insert the left side of seatback (4), and then lower and set the right side.



2) Install seatback hinge mounting bolt (6) (M8 bolt).
   Seatback hinge mounting bolt:
   21.4 – 27.6 Nm {2.18 – 2.82 kgm}

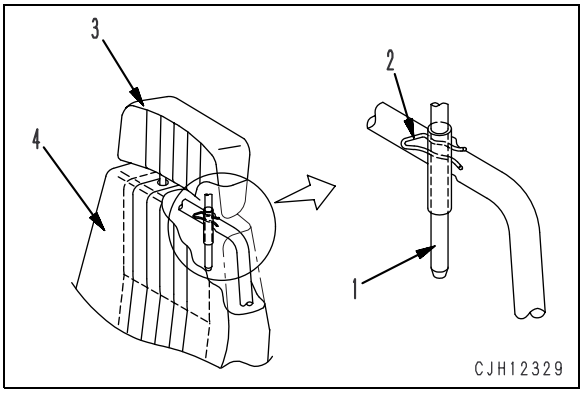


3) Connect 3 air hoses (5) to the rear left of the seatback (4).



6. Headrest

1) Insert headrest (3) in seatback (4).
   ★ Check that 2 clips (2) on both sides are locked securely.



HM300-2 Articulated dump truck

Form No. SEN00695-02

ARTICULATED DUMP TRUCK

HM300-2

Machine model	Serial number
HM300-2	2001 and up

50 Disassembly and assembly

Electrical system

Removal and installation of air conditioner unit assembly

Special tools

Symbol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
X1	792-454-1100	Pump assembly	●	1	N	

Removal

⚠ When tilting the cab, observe the following precautions to prevent a serious injury or fatal accident caused by fall of the cab.
⚠ To prevent interference between the cab and the dump body, set the steering in a straight ahead position and stop the machine on the level ground.
⚠ Lock the dump lever with the dump lever lock knob.
⚠ Turn the parking brake switch ON and chock the wheels.
⚠ Set the lock bar to the frame and lock front and rear frame.

- **Precautions in tilting cab**

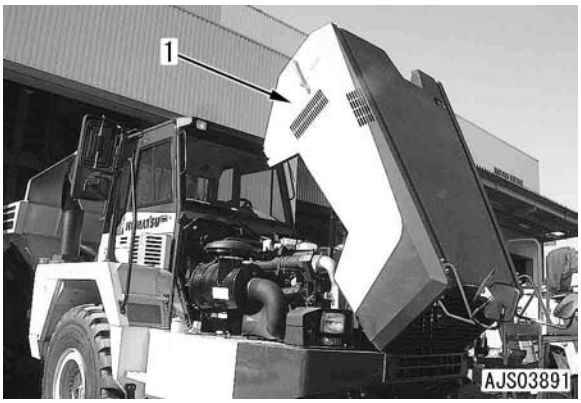
⚠ When tilting the cab, check that the lock lever is fixed securely.
⚠ Do not start the engine while the cab is tilted.
⚠ When it is obliged to start the engine for testing etc., check that there is nobody under the cab.
⚠ Do not operate the gear shift lever or dump lever.
⚠ Do not give a large shock to the machine.
⚠ Do not tilt the cab while it is loaded.

⚠ Disconnect the cable from the negative (–) terminal of the battery.
⚠ Collect the air conditioner refrigerant (R134a) from air conditioner circuit in advance.
★ Ask professional traders for collecting and filling operation of refrigerant (R134a).
★ Never release the refrigerant (R134a) to the atmosphere.

⚠ If refrigerant gas (R134a) gets in your eyes, you may lose your sight. Accordingly, put on protective goggles while you are collecting the refrigerant (R134a) or filling the air conditioner circuit with the refrigerant (R134a). Collecting and filling work must be conducted by a qualified person.

⚠ In the case that you do not drain the coolant, if you disconnect the heater hose when the coolant temperature in the radiator is high, you may be scalded. In this case, wait until the coolant temperature lowers and then disconnect the heater hose.

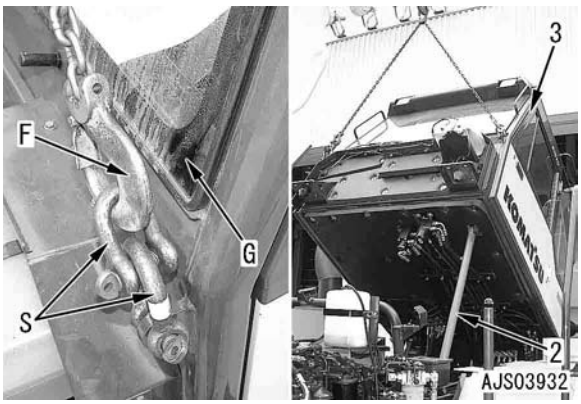
1. Open engine hood (1).

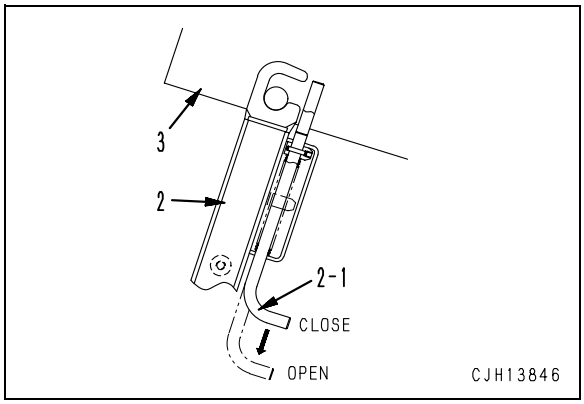


2. Remove 4 each mounting bolts from the right and left mounts at the front of the cab.
★ Check the thickness, quantity, and positions of the inserted shims.

3. Sling operator's cab (3) and tilt it up.
★ Use 2 shackles (S) so that hook (F) of the sling will not hit glass (G) of the cab assembly.

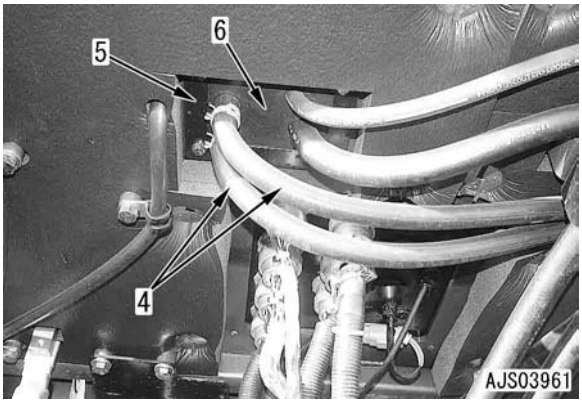
4. Pull lock lever (2-1) and set lock bar (2) with the care the direction of the lock bar (2).
⚠ Check that the lock lever (2-1) closes and the operator cab assembly (3) is held securely in position by the lock bar (2).
For details about cab tilt, see "Method of tilting cab up" in chapter Testing and adjusting.
★ Pump assembly **X1** is necessary for tilting up by tilt cylinder.



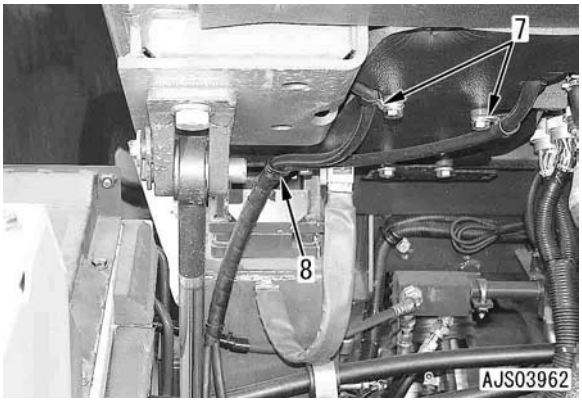


5. Disconnect heater hoses (4).
- ★ Check the destination of each hose.
- ★ Prepare an oil container.

6. Remove covers (5) and (6).



7. Disconnect drain hose clamps (7) and (8).

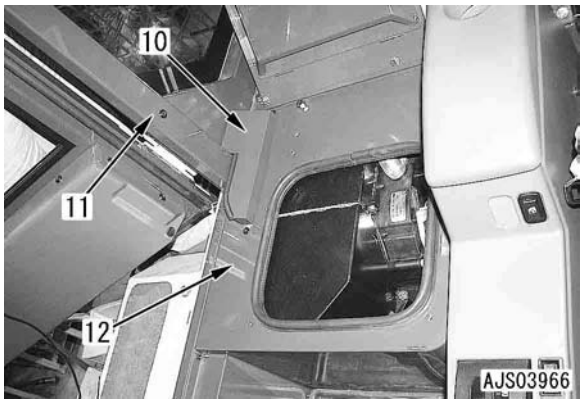


8. Return the operator's cab assembly (3) to the horizontal position.

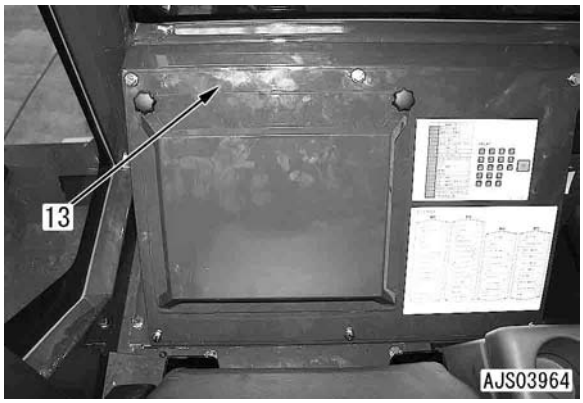
9. Remove seat (9).

10. Remove cover (10).
- ★ Disconnect connector PWR from inside of the cover.

11. Remove covers (11) and (12).



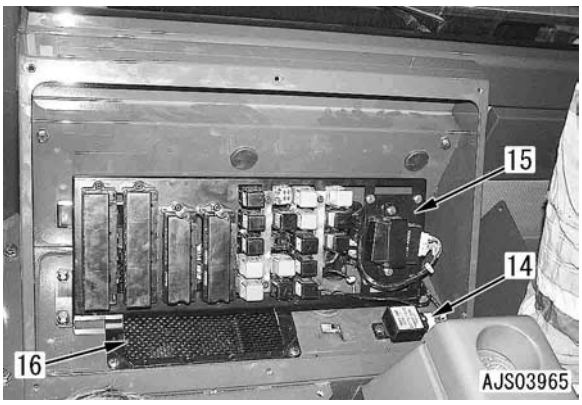
12. Remove cover (13).



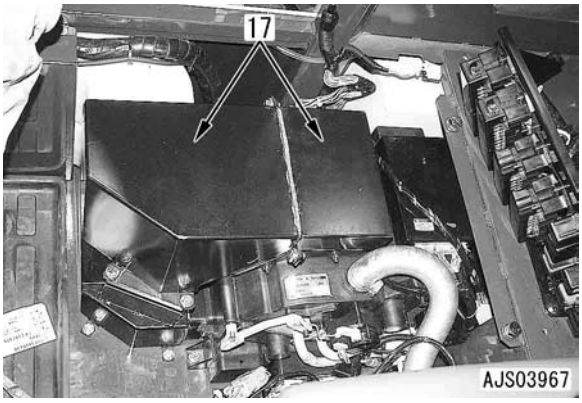
13. Disconnect connector EM (14).

14. Disconnect relay plate assembly (15).

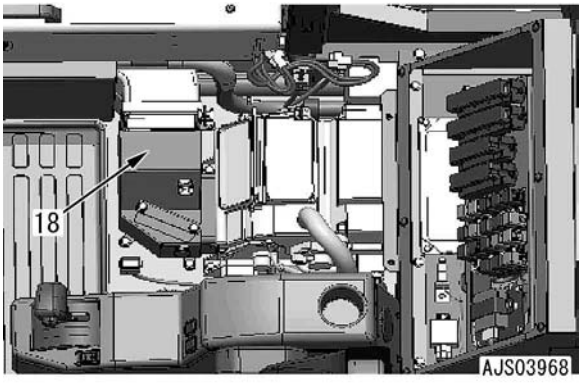
15. Remove internal air filter box (16).
★ Move relay plate assembly (15) in advance.



16. Remove duct (17).



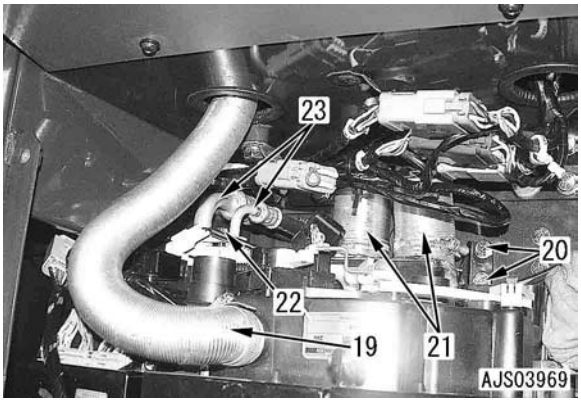
17. Remove duct (18).



18. Disconnect hose (19).

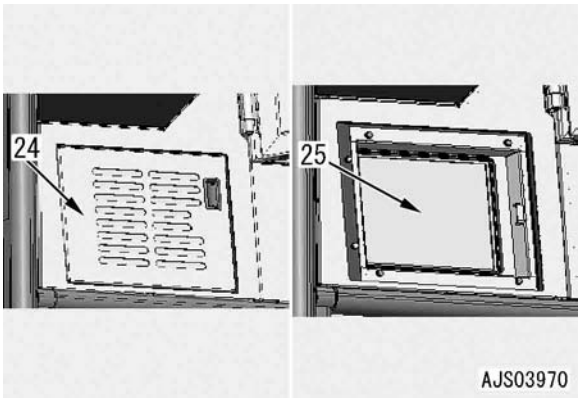
19. Remove mounting bolt (20) and disconnect hose assembly (21).

20. Remove mounting bolt (22) and disconnect air conditioner hose assembly (23). [*1]
★ Stop the openings with tapes, etc. to prevent air from entering them
★ Take care not drop the inside O-ring.

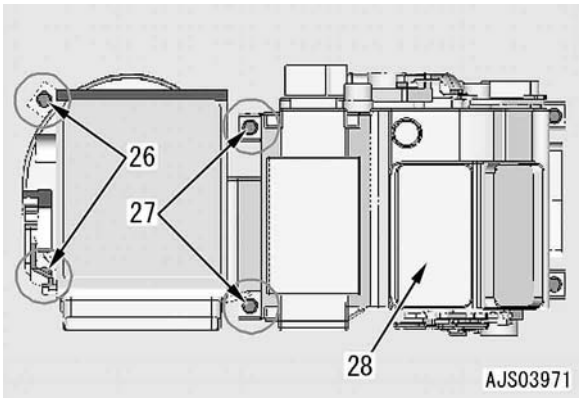


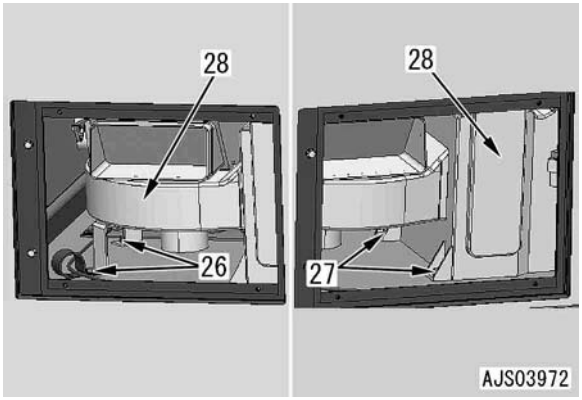
21. Remove external air filter cover (24) from outside of the operator's cab.
★ Remove the 4 rear mounting bolts of the air conditioner unit assembly from this place.

22. Remove external air filter box (25).



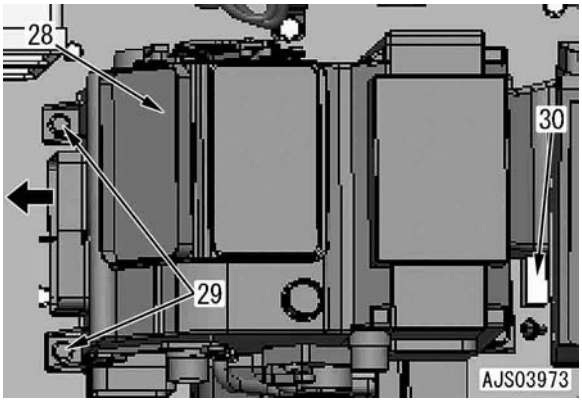
23. Remove rear mounting bolts (26) and (27) of air conditioner unit assembly (28).

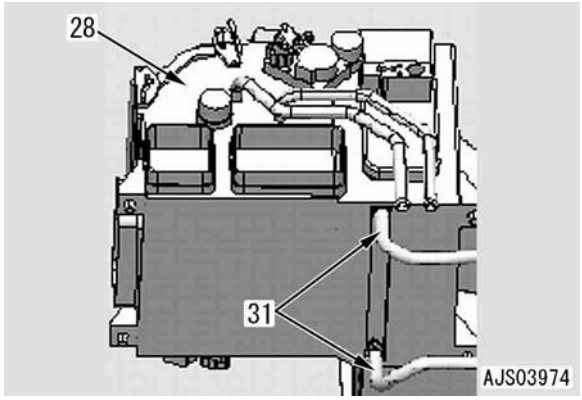




24. Remove the front mounting bolts (29) and lift and pull out air conditioner unit assembly (28).

25. While pulling out air conditioner unit assembly (28), disconnect the following.
- Connector AC1 (30).
- ★ Disconnect the wiring harness clamp, too.
- Drain hose (31) from bottom.





Installation

- Carry out installation in the reverse order to removal.

[*1]

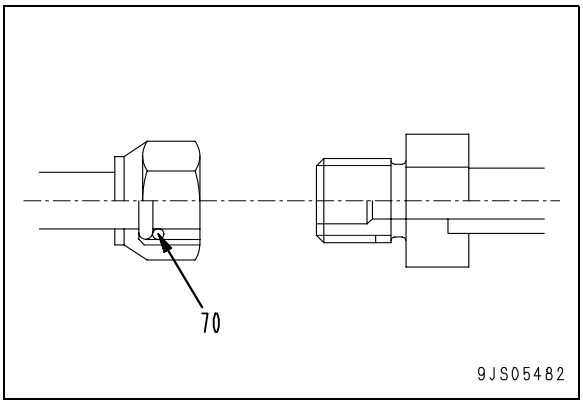
★ When installing the air conditioner circuit hoses, take care that dirt and water will not enter them.

★ When installing each air conditioner hose, check that the O-ring (70) is fitted to the joint.

★ Check each O-ring for a flaw and deterioration.

★ When connecting the refrigerant piping, coat the O-rings with compressor oil for new refrigerant R134a (DENSO: ND-OIL 8, ZEXEL: ZXL 100 PG (equivalent to PAG 46)).

Air conditioner hose assembly mounting bolt: **8 – 12 Nm {0.8 – 1.2 kgm}**



- **Filling air conditioner circuit with refrigerant (R134a)**
  Fill the air conditioner circuit with refrigerant (R134a).
  ★ Quantity of refrigerant: **1,200 ± 50 g**

- **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.

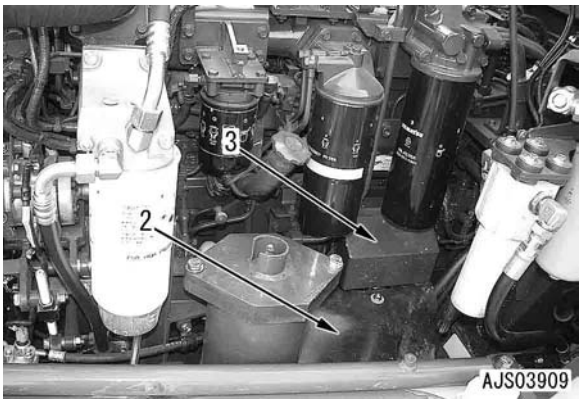
Removal and installation of engine controller

Removal

- ⚠ **Stop the machine on level ground.**
- ⚠ **Turn the parking brake switch ON and stop the engine.**
- ⚠ **Chock the wheels.**
- ⚠ **Set the lock bar to the frame.**
- ⚠ **Disconnect the cable from the negative (–) terminal of the battery.**

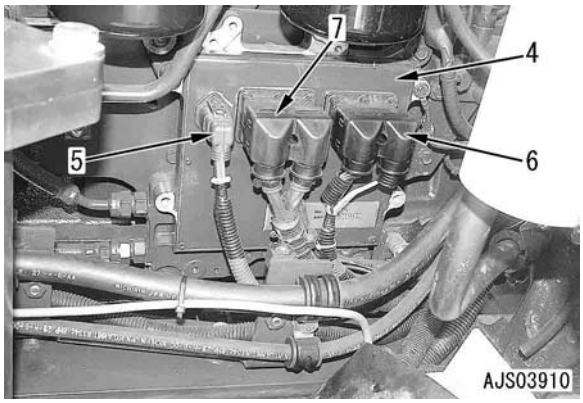
1. Open engine hood (1).

2. Remove covers (2) and (3).



3. Disconnect connectors J3P (5) and J2P (6) and (7) from engine controller (4). [*1]
★ Disconnect the clamp, too.

4. Remove engine controller (4).



Installation

- Carry out installation in the reverse order to removal.

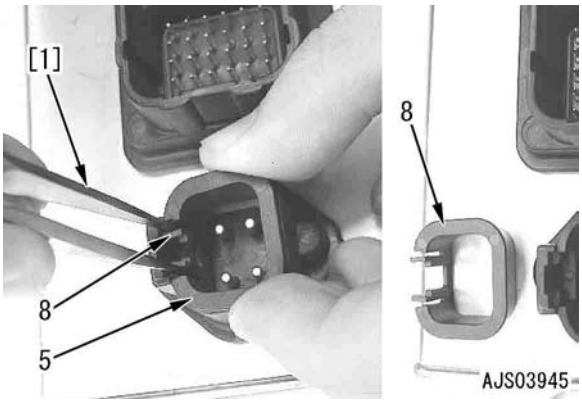
[*1]

- Check that there is no sand, dust, water, etc. in the controller connector (especially on the lower side). If there is any, remove completely by blowing air. (Sand, dust, water, etc. can cause defective contact and entry of water.)

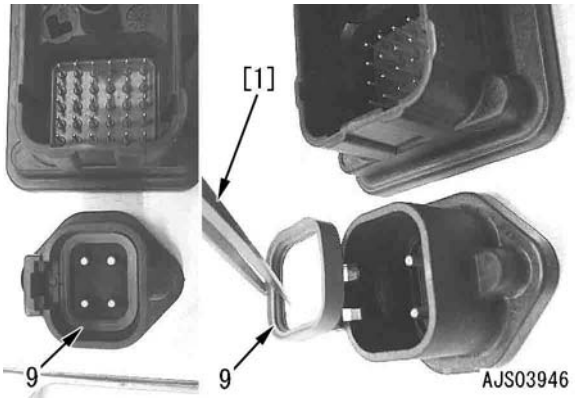
★ **Reference**

- Method of replacing O-ring seal of power connector J3P (5)
  O-ring seal:
  1010-074-0406 (NIHON-DEUTSCH LIMITED)

1) Using tweezers [1], pinch the claw and remove cover (8).



2) Using tweezers [1], remove O-ring (9).

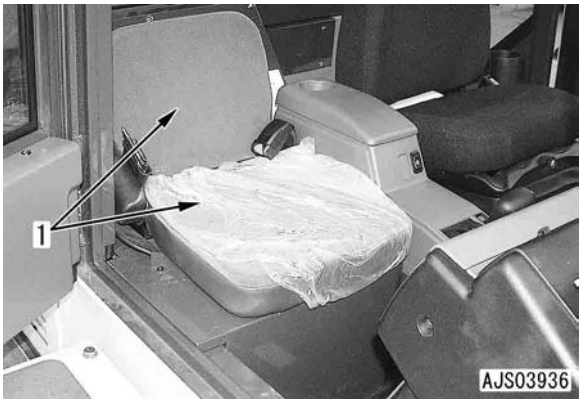


Removal and installation of retarder controller

Removal

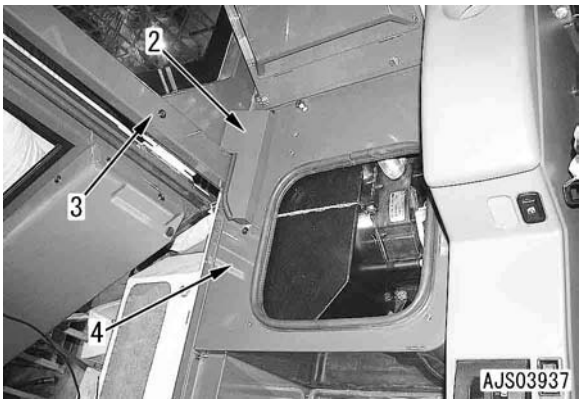
- ⚠ **Stop the machine on level ground.**
- ⚠ **Turn the parking brake switch ON and stop the engine.**
- ⚠ **Chock the wheels.**
- ⚠ **Set the lock bar to the frame.**
- ⚠ **Disconnect the cable from the negative (–) terminal of the battery.**

1. Remove seat (1).

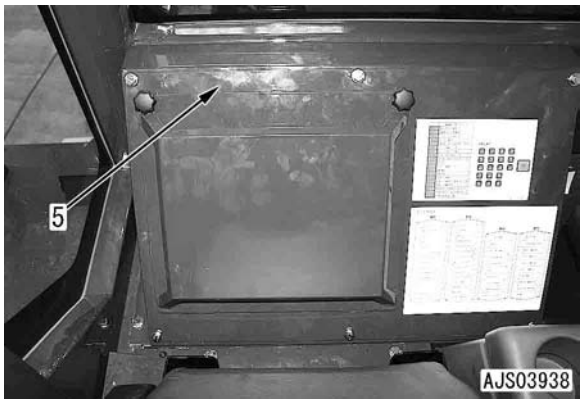


2. Remove cover (2).
★ Disconnect connector PWR from inside of the cover.

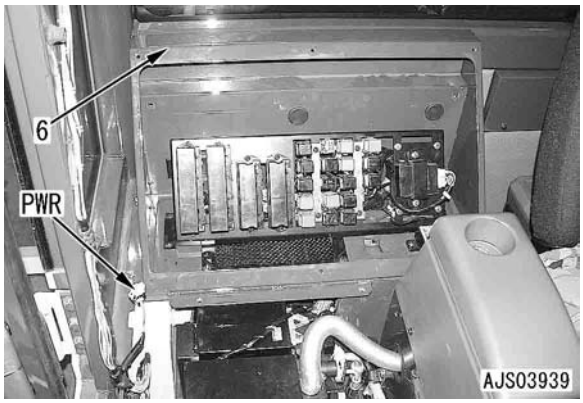
3. Remove covers (3) and (4).



4. Remove cover (5).



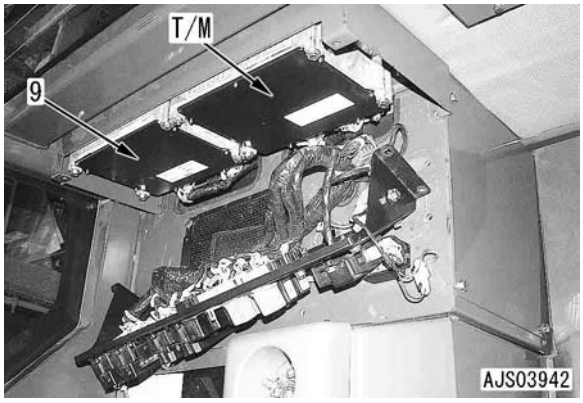
5. Remove bracket (6).
★ PWR: Connector removed in step 2



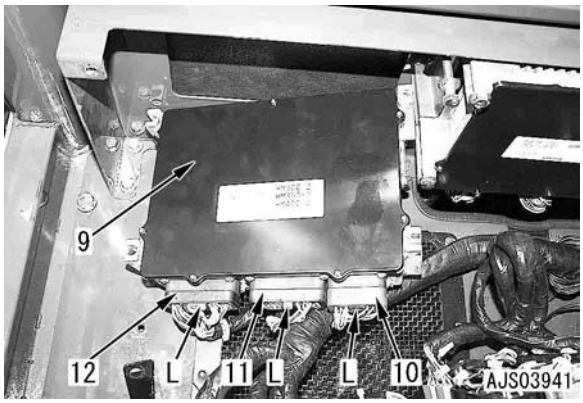
6. Disconnect connector EM (7).

7. Disconnect relay plate assembly (8).

8. Remove retarder controller (9).
★ T/M: Transmission controller



9. Disconnect connectors BRC1 (10), BRC2 (11), and BRC3 (12) from retarder controller (9). [*1]
★ Loosen lock (L) with 4-mm hexagonal wrench in advance.



Installation

- Carry out installation in the reverse order to removal.

[*1]
Mounting screw: **2.82 Nm {0.288 kgm}**

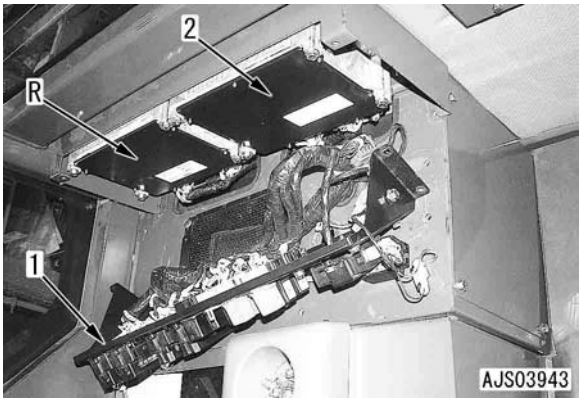
Removal and installation of transmission controller assembly

Removal

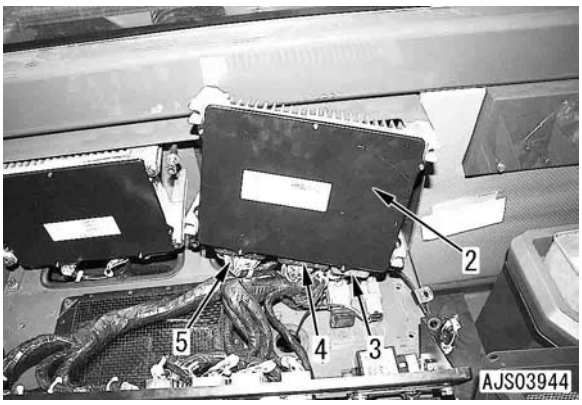
- ⚠ **Stop the machine on level ground.**
- ⚠ **Turn the parking brake switch ON and stop the engine.**
- ⚠ **Chock the wheels.**
- ⚠ **Set the lock bar to the frame.**
- ⚠ **Disconnect the cable from the negative (–) terminal of the battery.**

1. Disconnect relay plate assembly (1). For details, see "Removal and installation of retarder controller assembly".
★ R: Retarder controller

2. Remove transmission controller (2).



3. Disconnect connectors ATC1 (3), ATC2 (4), and ATC3 (5) from transmission controller (2). [*1]
★ Loosen the lock of each connector with 4-mm hexagonal wrench in advance.
★ See Removal and installation of retarder controller assembly.



Installation

- Carry out installation in the reverse order to removal.

[*1]
Mounting screw: **2.82 Nm {0.28 kgm}**

HM300-2 Articulated dump truck

Form No. SEN00696-02

ARTICULATED DUMP TRUCK

HM300-2

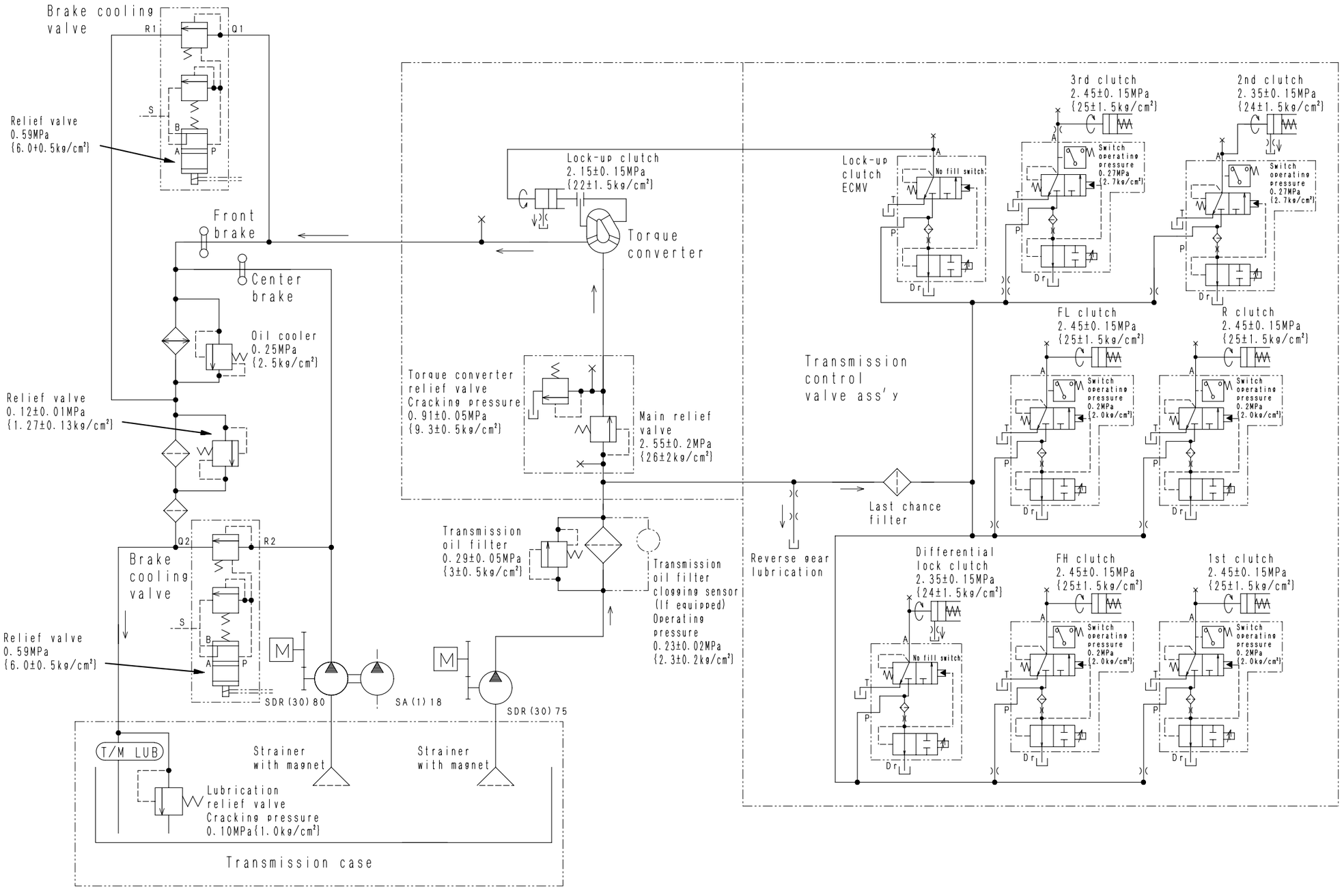
Machine model	Serial number
HM300-2	2001 and up

90 Diagrams and drawings

Hydraulic diagrams and drawings

Power train hydraulic circuit diagram

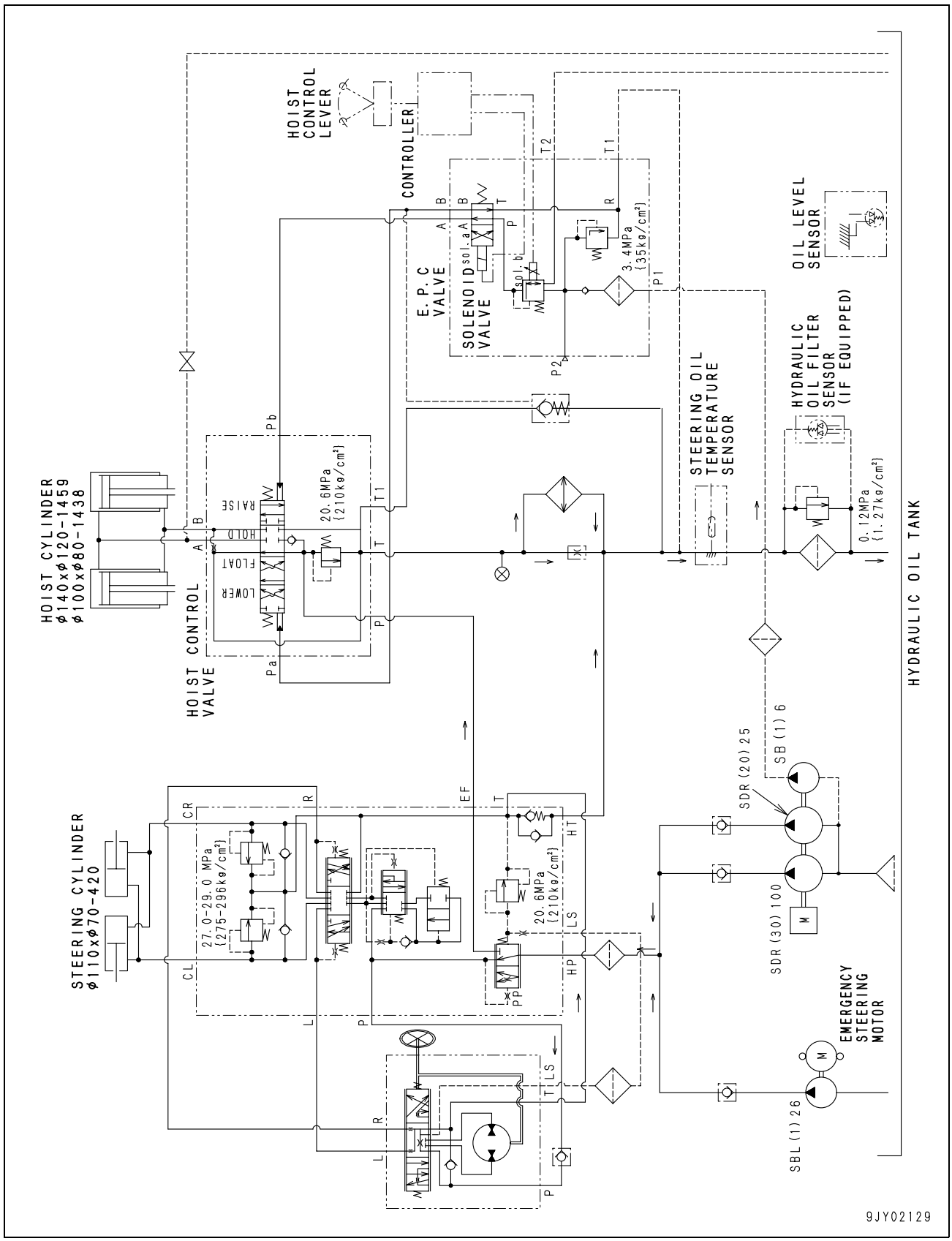
Power train hydraulic circuit diagram HM300-2



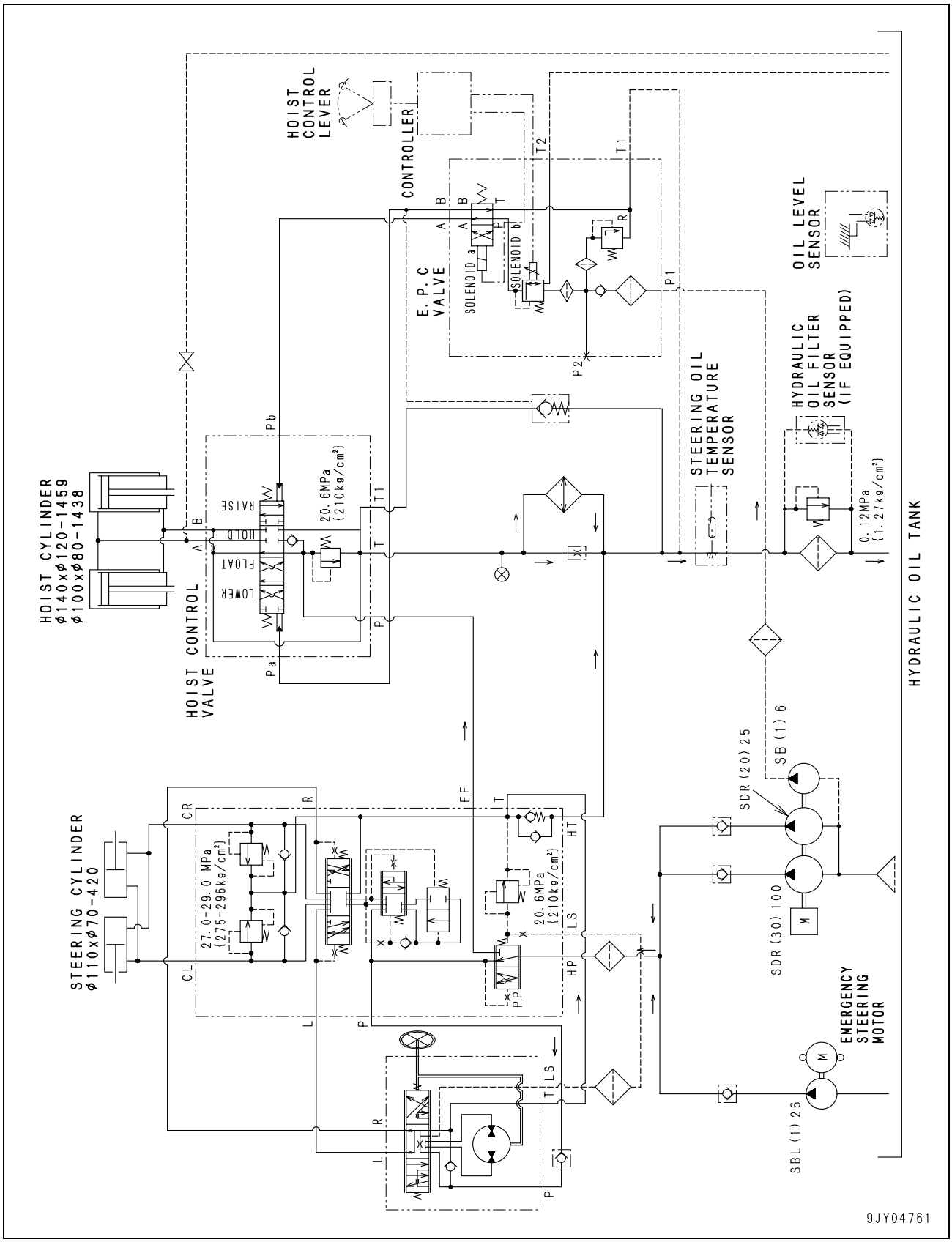
9JB02988

Steering and hoist hydraulic circuit diagram

Serial No.: 2001 – 2714

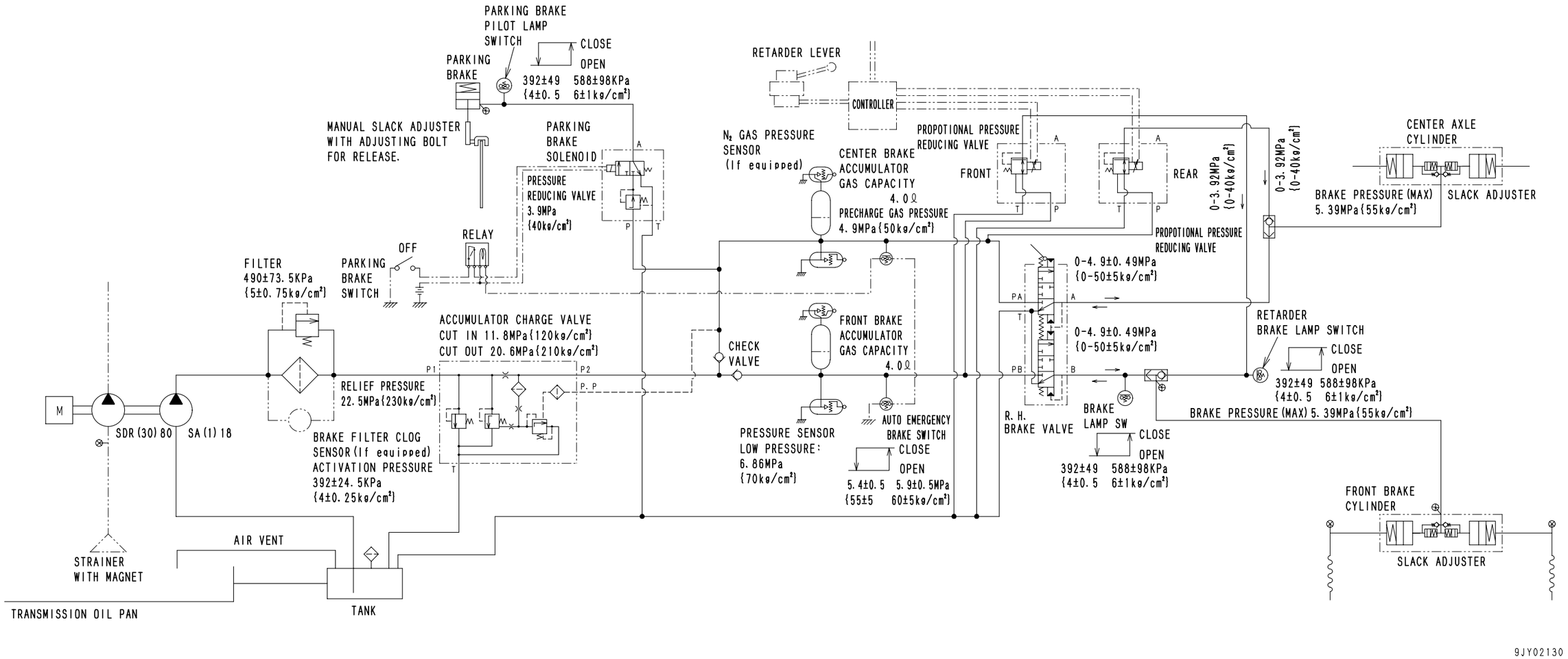


Serial No.: 2715 and up

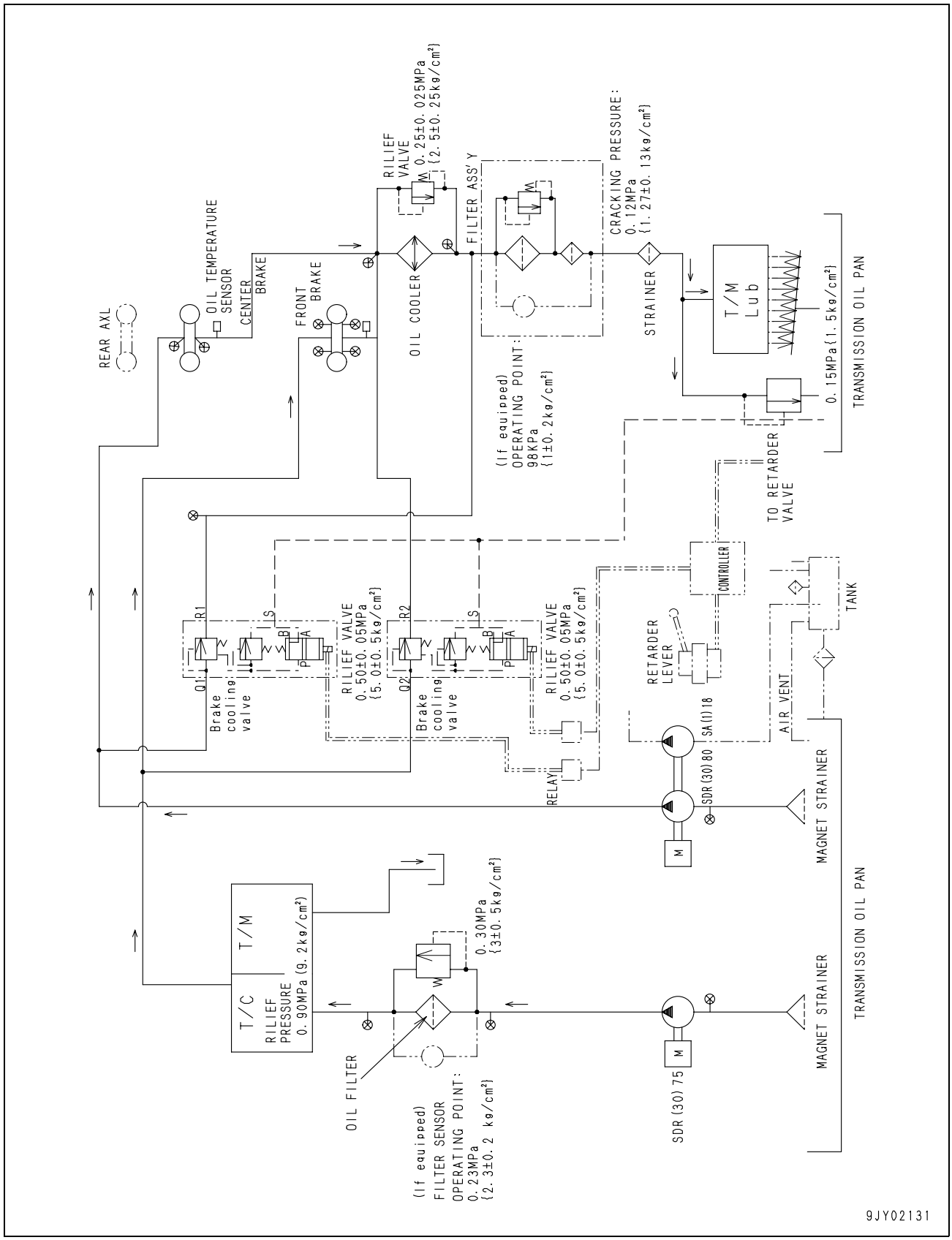


Brake hydraulic circuit diagram

Brake hydraulic circuit diagram
HM300-2



Brake cooling hydraulic circuit diagram



HM300-2 Articulated dump truck

Form No. SEN00338-02

ARTICULATED DUMP TRUCK

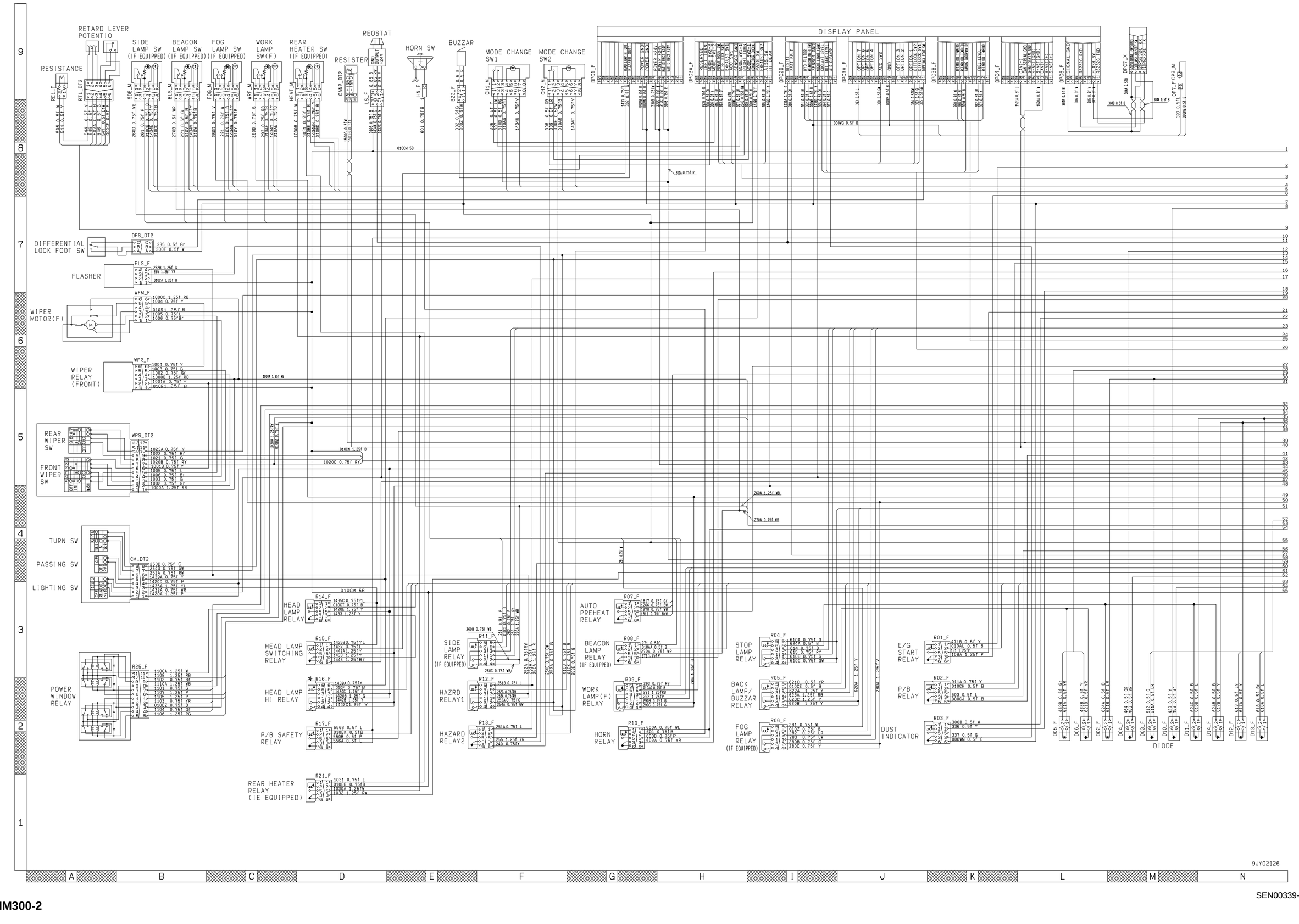
HM300-2

Machine model	Serial number
HM300-2	2001 and up

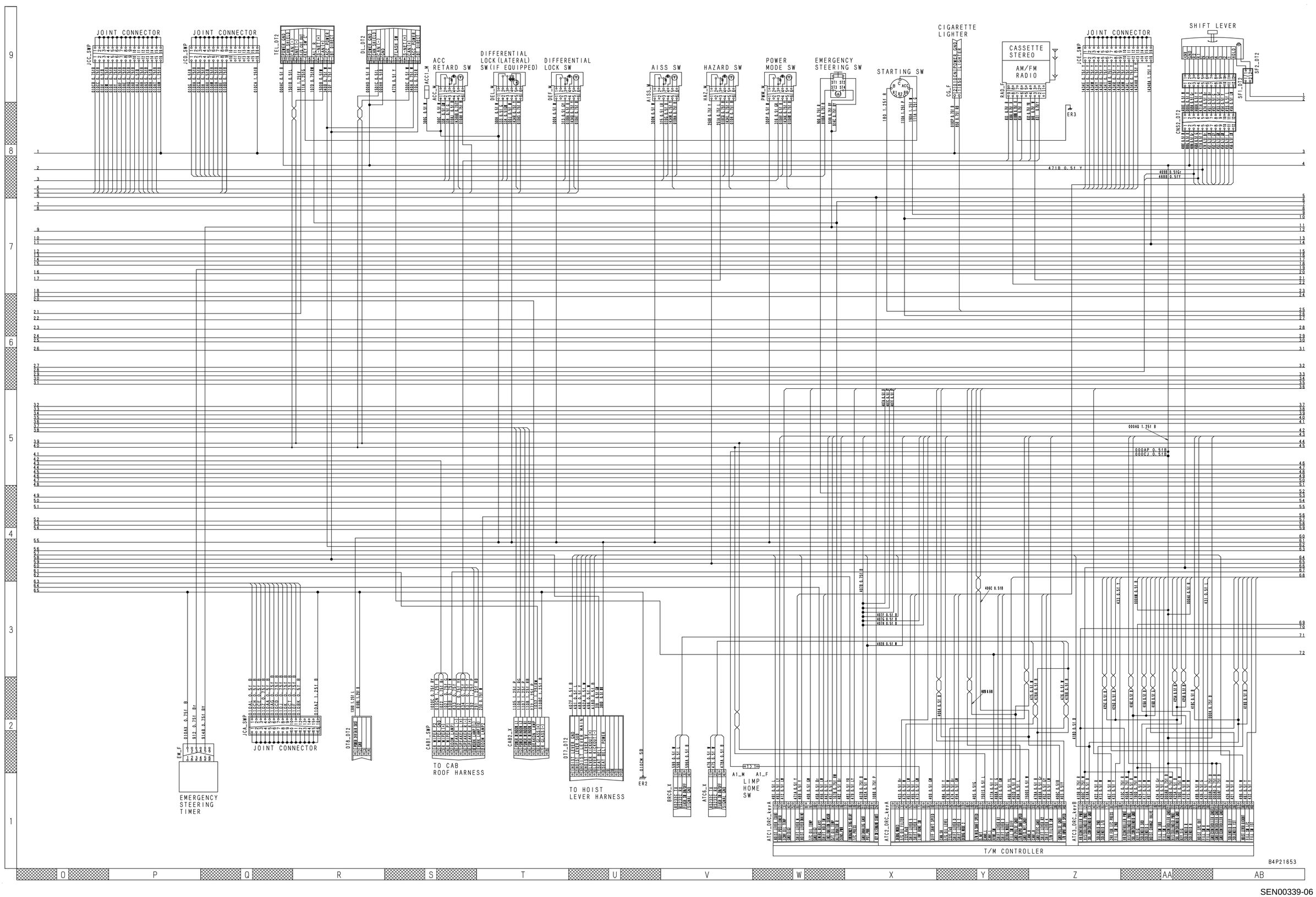
90 Diagrams and drawings

Electrical diagrams and drawings

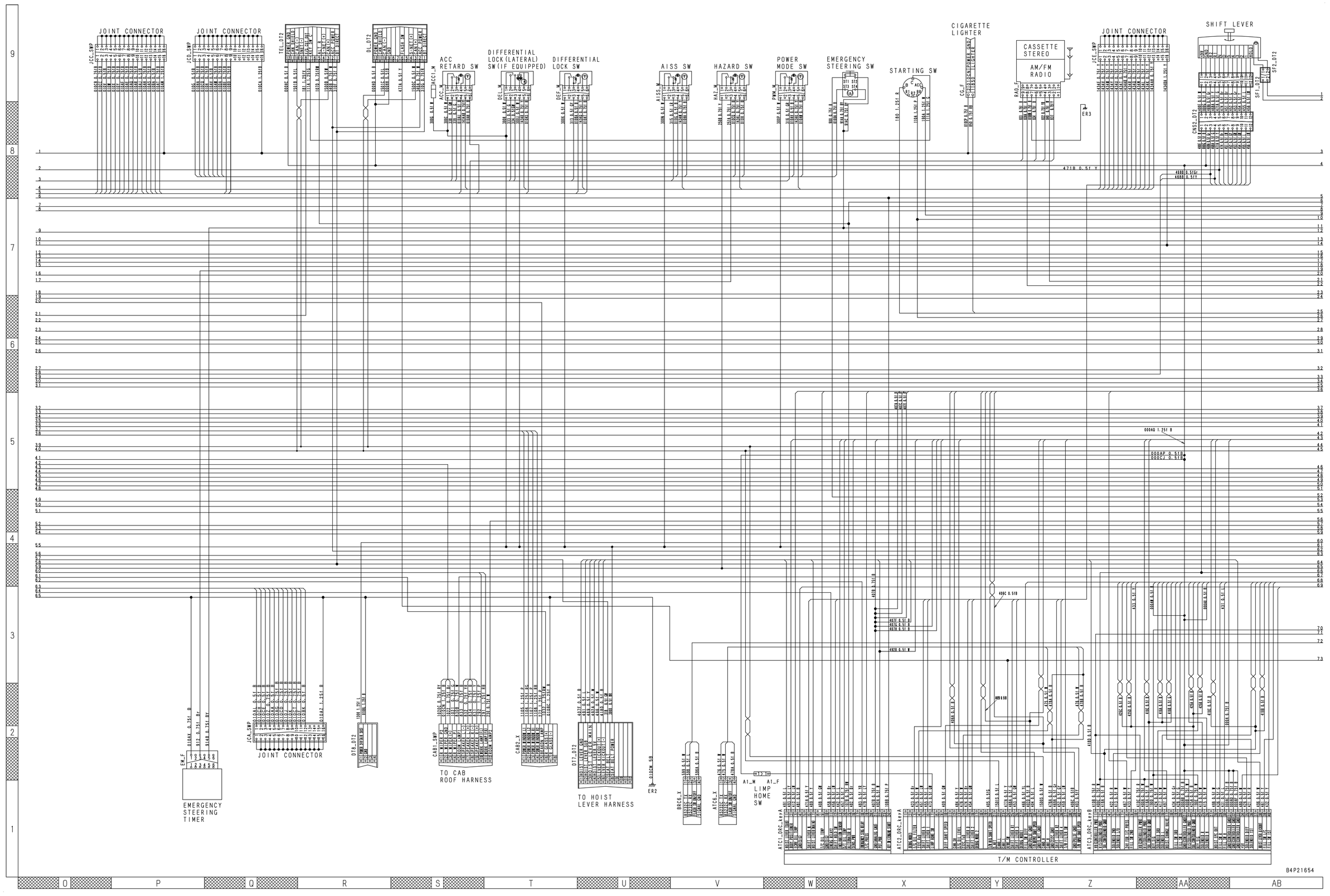
Electrical circuit diagram for inside cab (1/4)
HM300-2



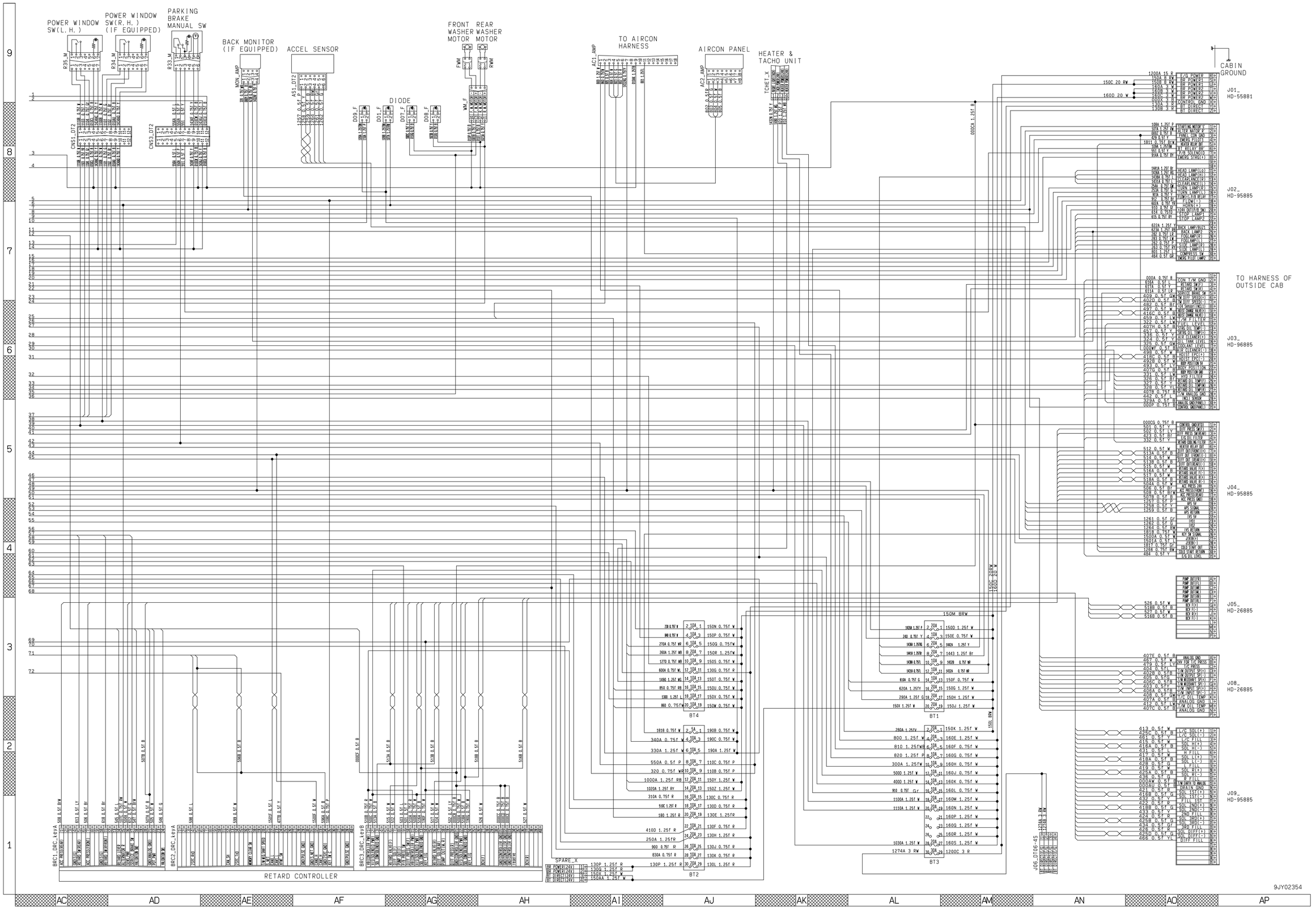
Electrical circuit diagram for inside cab (2/4) (Serial No.: 2001 – 2241)
HM300-2



Electrical circuit diagram for inside cab (2/4) (Serial No.: 2242 and up)
HM300-2

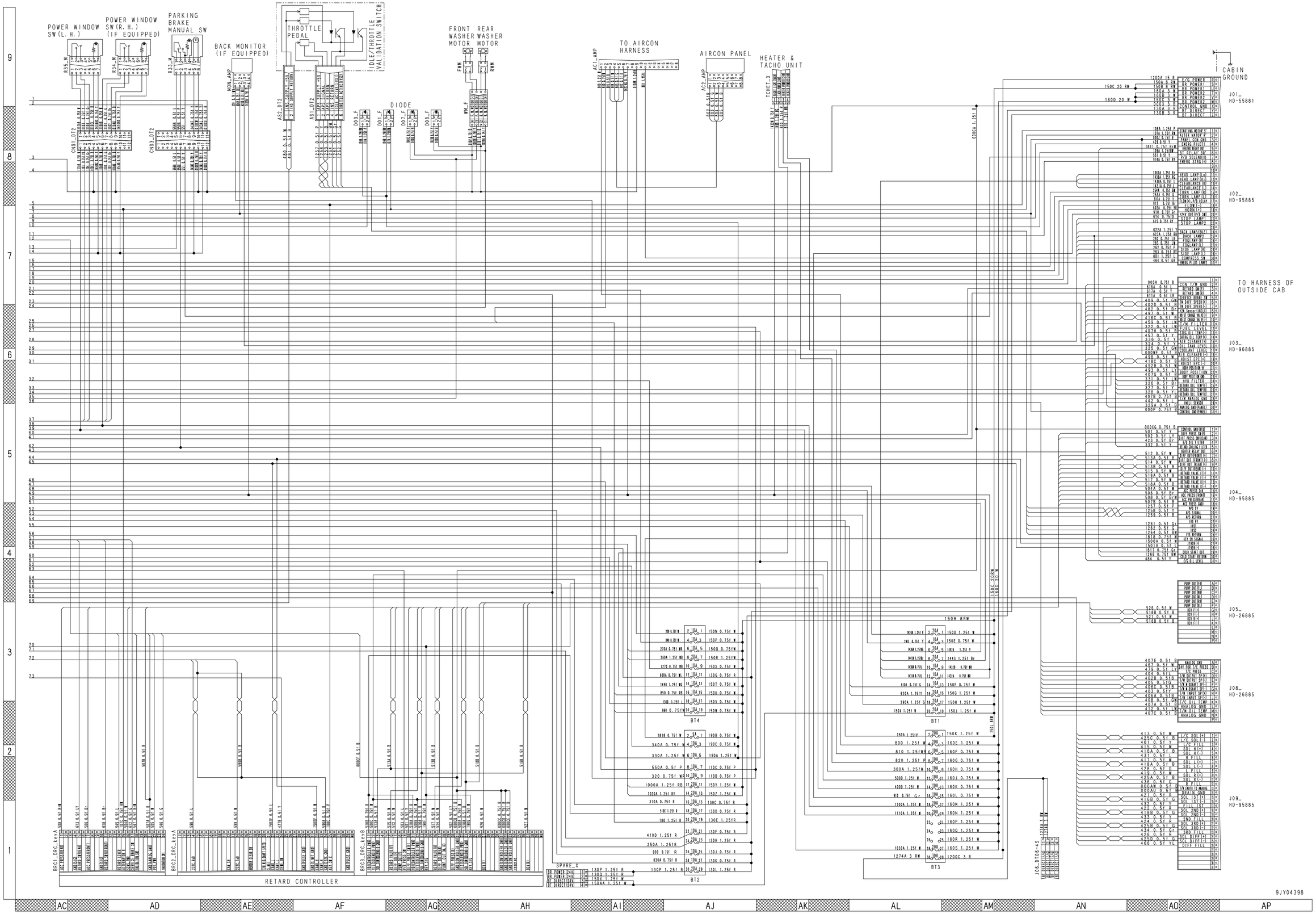


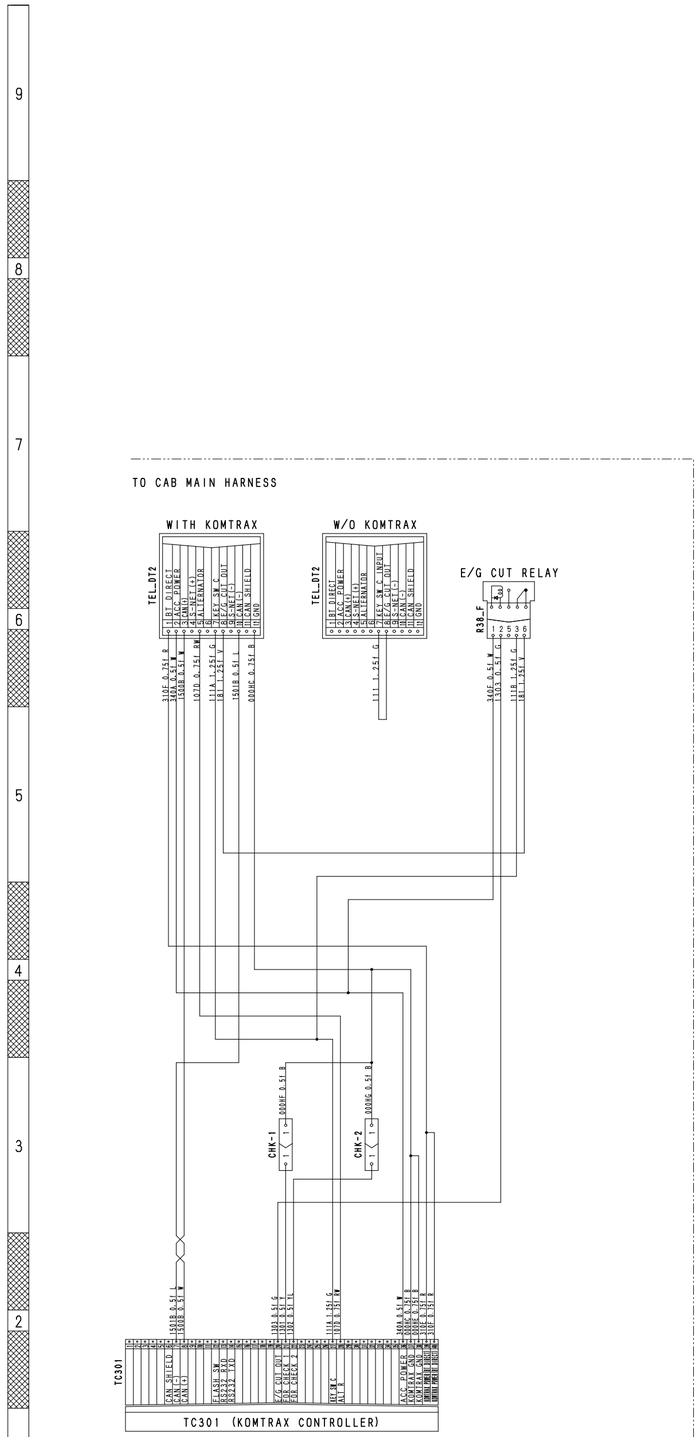
Electrical circuit diagram for inside cab (3/4) (Serial No.: 2001 – 2241)
HM300-2

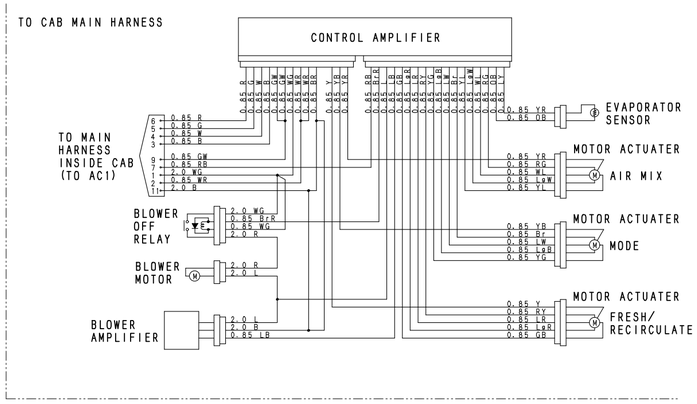


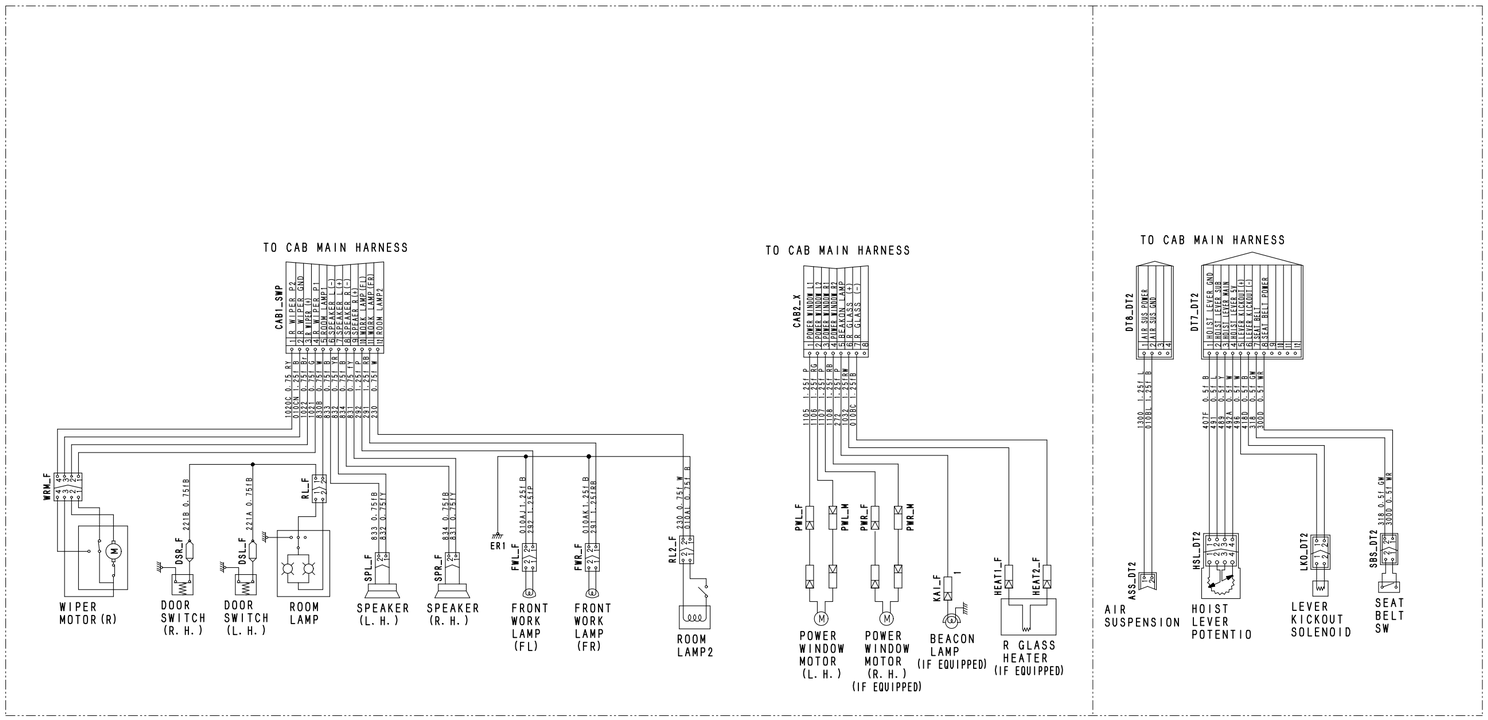
Electrical circuit diagram for inside cab (3/4) (Serial No.: 2242 and up)

Electrical circuit diagram for inside cab (3/4) (Serial No.: 2242 and up)
HM300-2

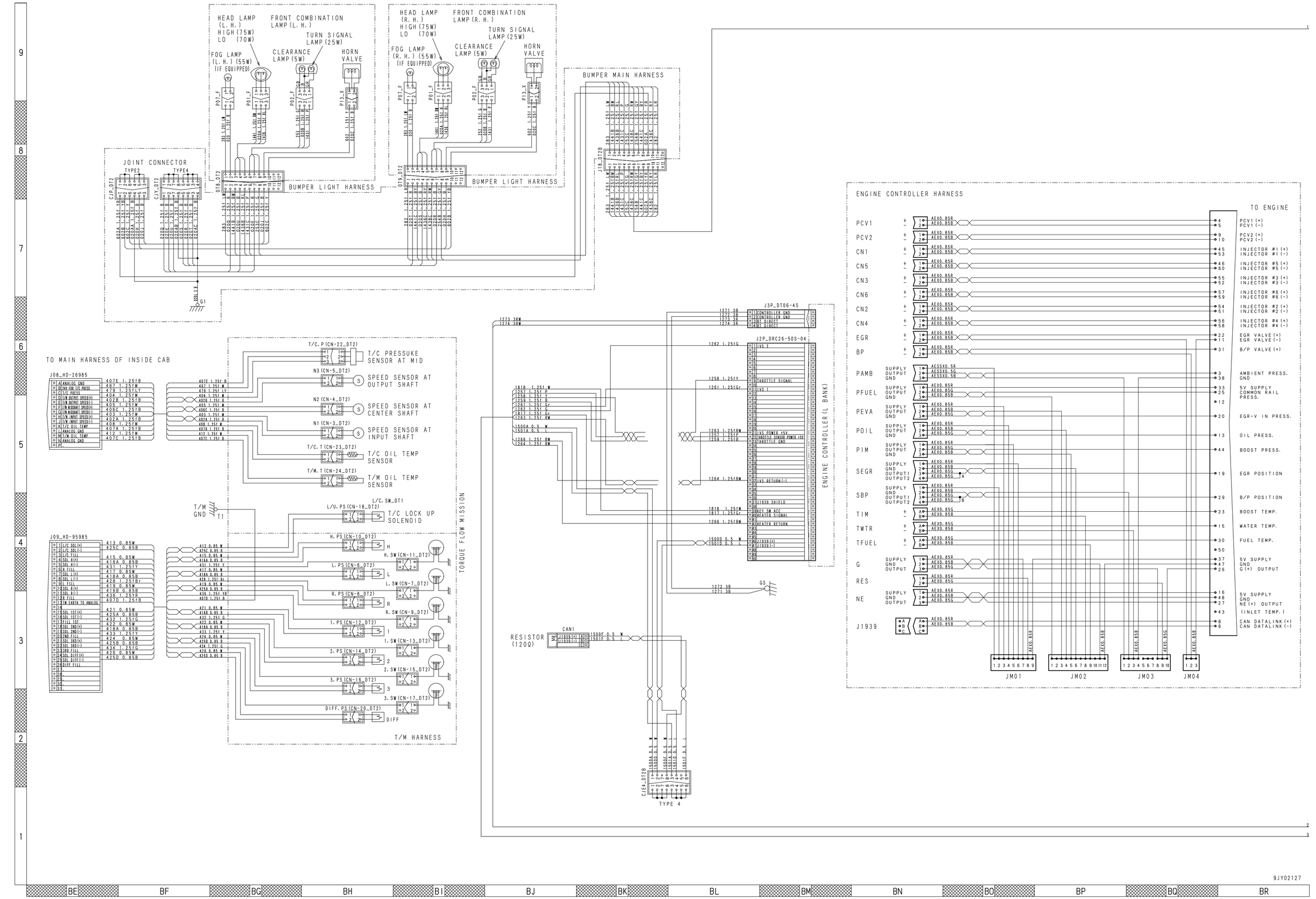



TO CAB MAIN HARNESS
WITH KOMTRAX
W/O KOMTRAX
E/G CUT RELAY
TEL_DT12
R838_F
CHK-1
CHK-2
TC301
TC301 (KOMTRAX CONTROLLER)

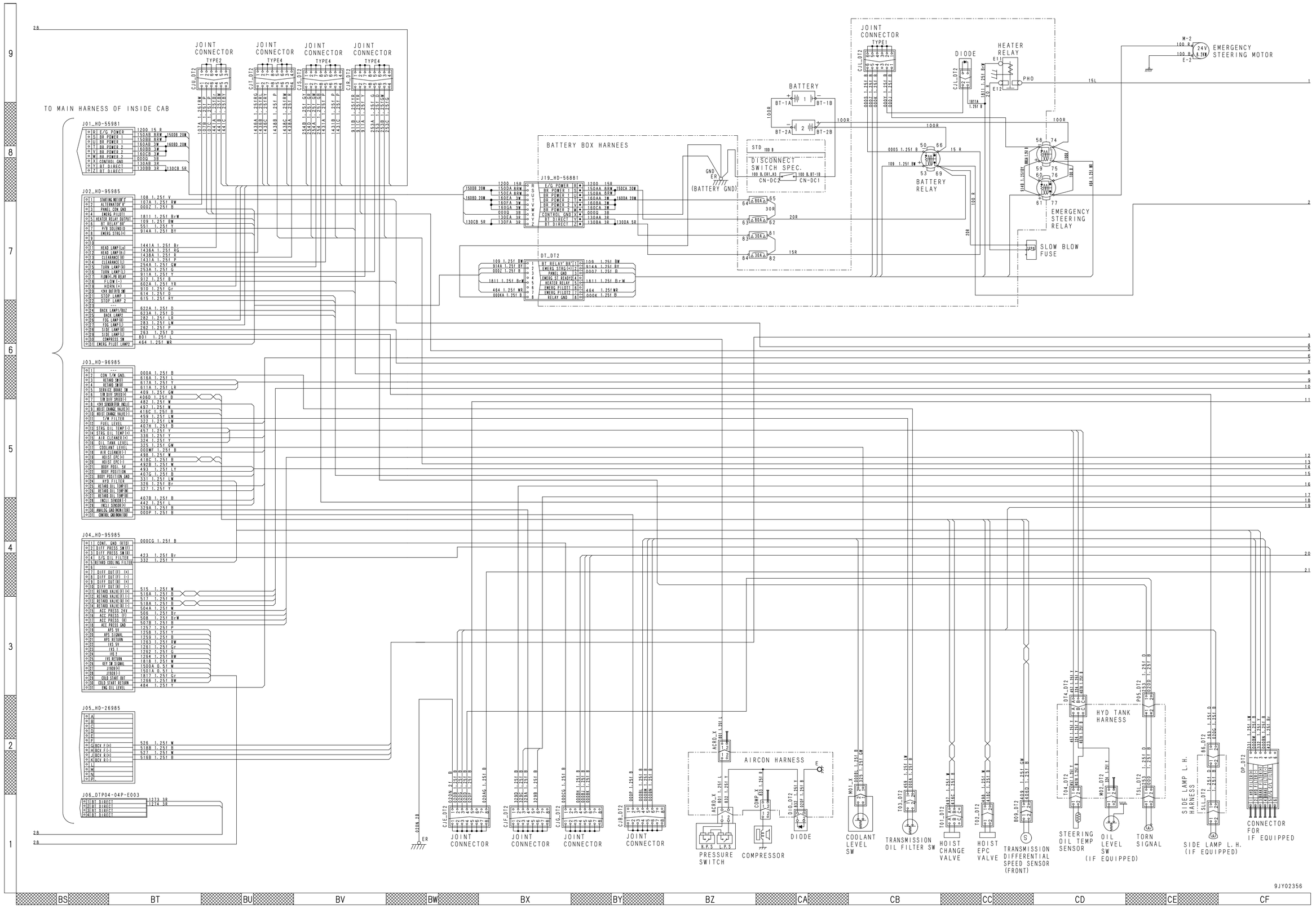

TO CAB MAIN HARNESS
CONTROL AMPLIFIER
TO MAIN HARNESS INSIDE CAB (TO AC1)
EVAPORATOR SENSOR
MOTOR ACTUATER
AIR MIX
MODE
FRESH/ RECIRCULATE
BLOWER OFF RELAY
BLOWER MOTOR
BLOWER AMPLIFIER

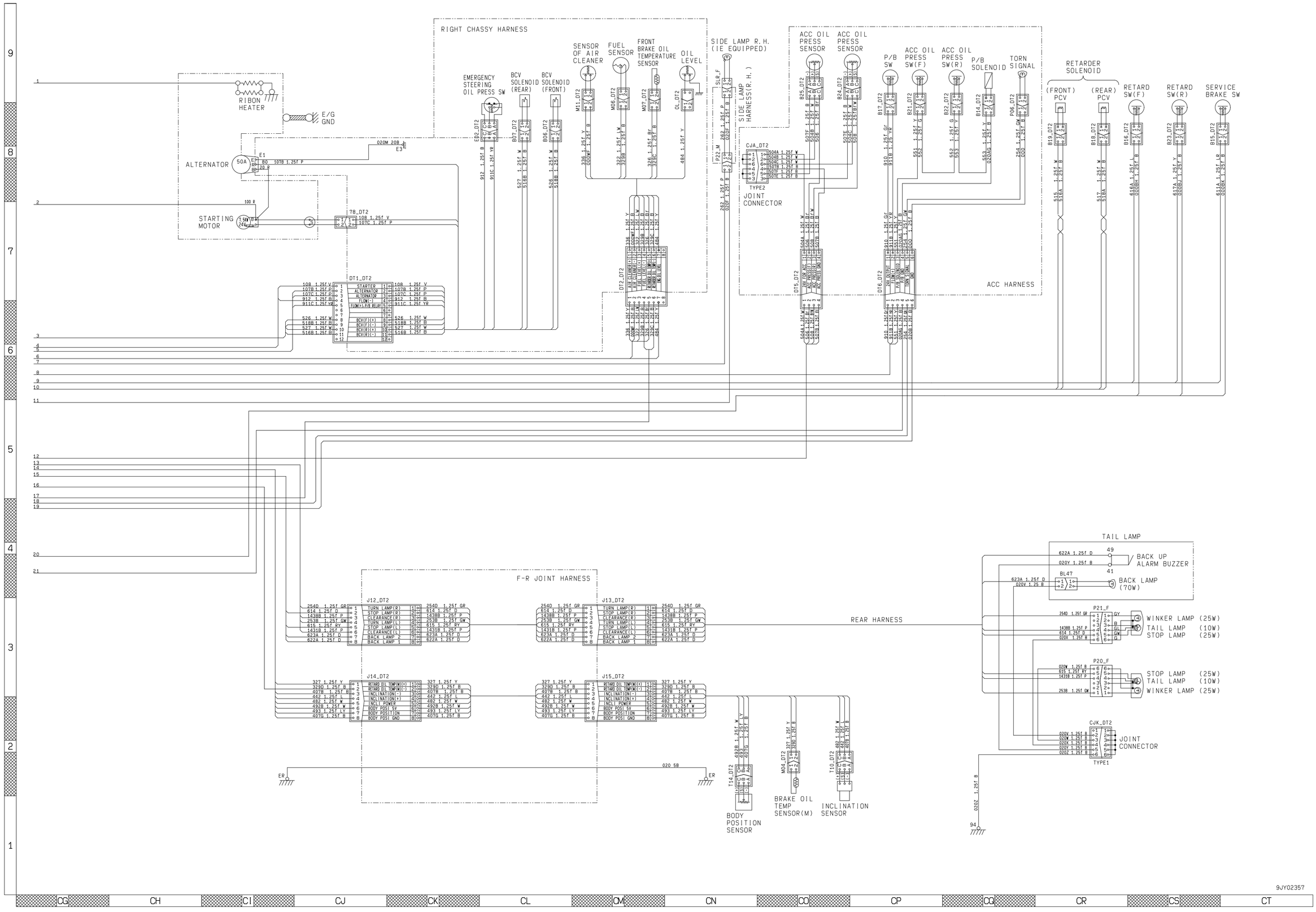

TO CAB MAIN HARNESS
CAB1_SWP
WIPER MOTOR(R)
DOOR SWITCH (R. H.)
DOOR SWITCH (L. H.)
ROOM LAMP
SPEAKER (L. H.)
SPEAKER (R. H.)
FRONT WORK LAMP (FL)
FRONT WORK LAMP (FR)
ROOM LAMP2
TO CAB MAIN HARNESS
CAB2_X
POWER WINDOW MOTOR (L. H.)
POWER WINDOW MOTOR (R. H.) (IF EQUIPPED)
BEACON LAMP (IF EQUIPPED)
R GLASS HEATER (IF EQUIPPED)
TO CAB MAIN HARNESS
DT8_DT2
DT7_DT2
AIR SUSPENSION
HOIST LEVER POTENTIO
LEVER KICKOUT SOLENOID
SEAT BELT SW

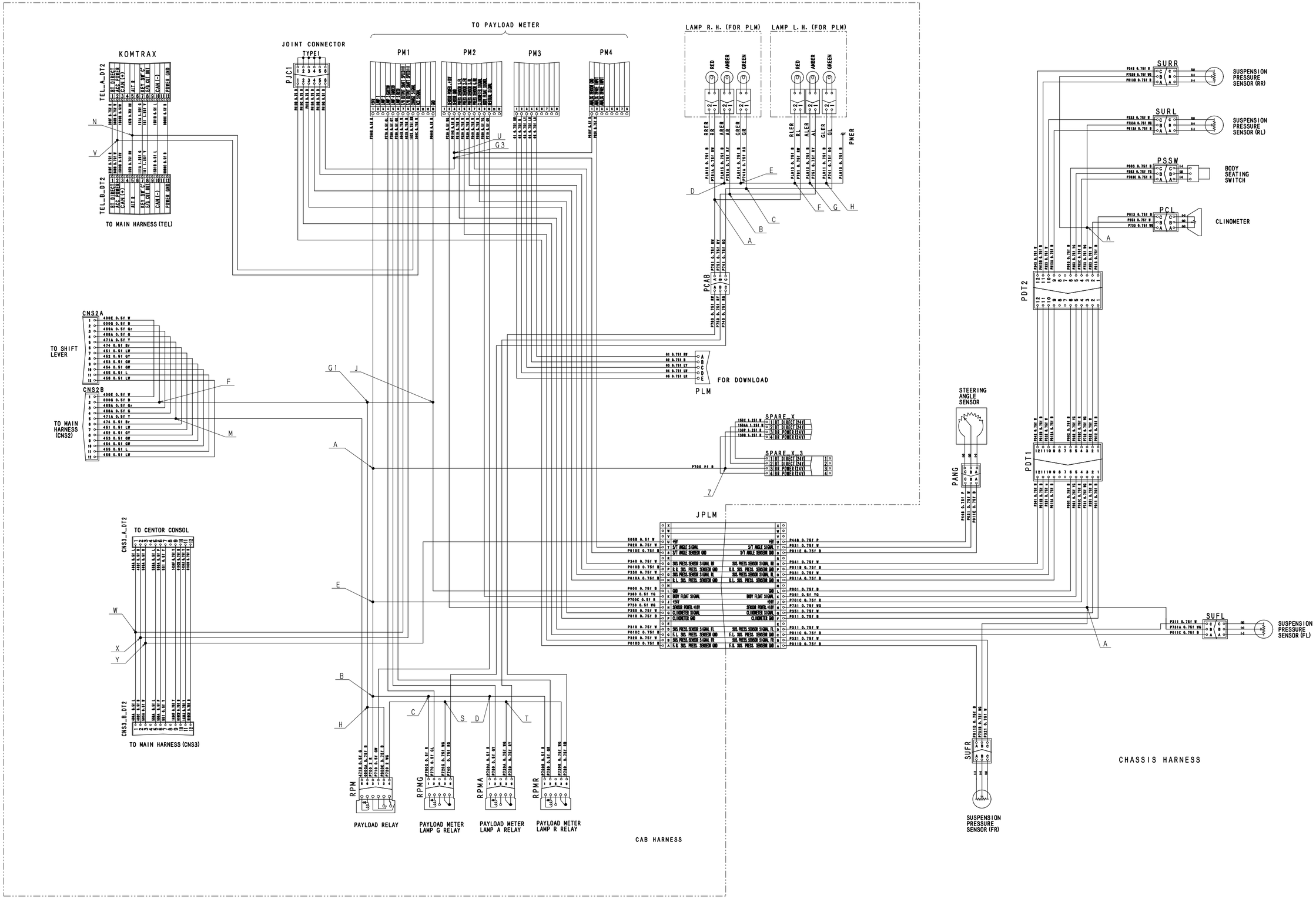
Electrical circuit diagram for outside cab (1/3)
HM300-2



Electrical circuit diagram for outside cab (2/3)
HM300-2




RIGHT CHASSY HARNESS
RIBON HEATER
E/G GND
ALTERNATOR
50A
STARTING MOTOR
EMERGENCY STEERING OIL PRESS SW
BCV SOLENOID (REAR)
BCV SOLENOID (FRONT)
SENSOR OF AIR CLEANER
FUEL SENSOR
FRONT BRAKE OIL TEMPERATURE SENSOR
OIL LEVEL
SIDE LAMP R.H. (IE EQUIPPED)
SIDE LAMP HARNESS(R.H.)
ACC OIL PRESS SENSOR
ACC OIL PRESS SENSOR
P/B SW
ACC OIL PRESS SW(F)
ACC OIL PRESS SW(R)
P/B SOLENOID
TORN SIGNAL
RETARDER SOLENOID
(FRONT) PCV
(REAR) PCV
RETARD SW(F)
RETARD SW(R)
SERVICE BRAKE SW
JOINT CONNECTOR
TYPE2
ACC HARNESS
F-R JOINT HARNESS
REAR HARNESS
BODY POSITION SENSOR
BRAKE OIL TEMP SENSOR(M)
INCLINATION SENSOR
TAIL LAMP
BACK UP ALARM BUZZER
BACK LAMP (70W)
WINKER LAMP (25W)
TAIL LAMP (10W)
STOP LAMP (25W)
STOP LAMP (25W)
TAIL LAMP (10W)
WINKER LAMP (25W)
JOINT CONNECTOR
TYPE1
9JY02357


TO PAYLOAD METER
JOINT CONNECTOR
TYPE1
PJC1
PM1
PM2
PM3
PM4
KOMTRAX
TEL_A_DT2
TEL_B_DT2
TO MAIN HARNESS (TEL)
LAMP R. H. (FOR PLM)
LAMP L. H. (FOR PLM)
RED
AMBER
GREEN
PMER
PCAB
PLM
FOR DOWNLOAD
CNS2A
CNS2B
TO SHIFT LEVER
TO MAIN HARNESS (CNS2)
SPARE X
SPARE X 3
JPLM
TO CENTOR CONSOL
CNS3_A_DT2
CNS3_B_DT2
TO MAIN HARNESS (CNS3)
RPM
RPMG
RPMA
RPMR
PAYLOAD RELAY
PAYLOAD METER LAMP G RELAY
PAYLOAD METER LAMP A RELAY
PAYLOAD METER LAMP R RELAY
CAB HARNESS
STEERING ANGLE SENSOR
PANG
SURR
SUSPENSION PRESSURE SENSOR (RR)
SURL
SUSPENSION PRESSURE SENSOR (RL)
PSSW
BODY SEATING SWITCH
PCL
CLINOMETER
PDT2
PDT1
SUFL
SUSPENSION PRESSURE SENSOR (FL)
SUFR
SUSPENSION PRESSURE SENSOR (FR)
CHASSIS HARNESS

9JY04663

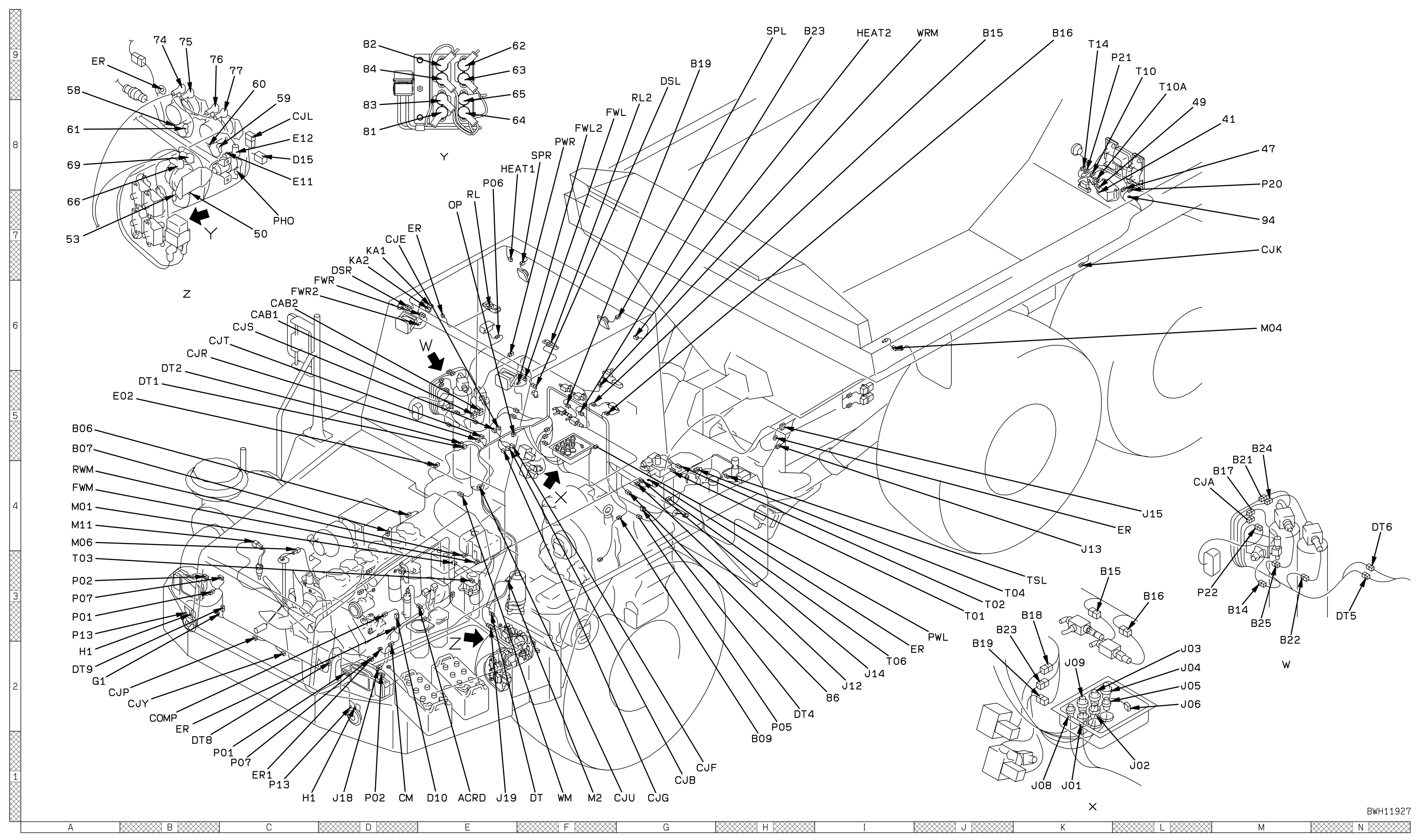
Connectors table and arrangement drawing HM300-2

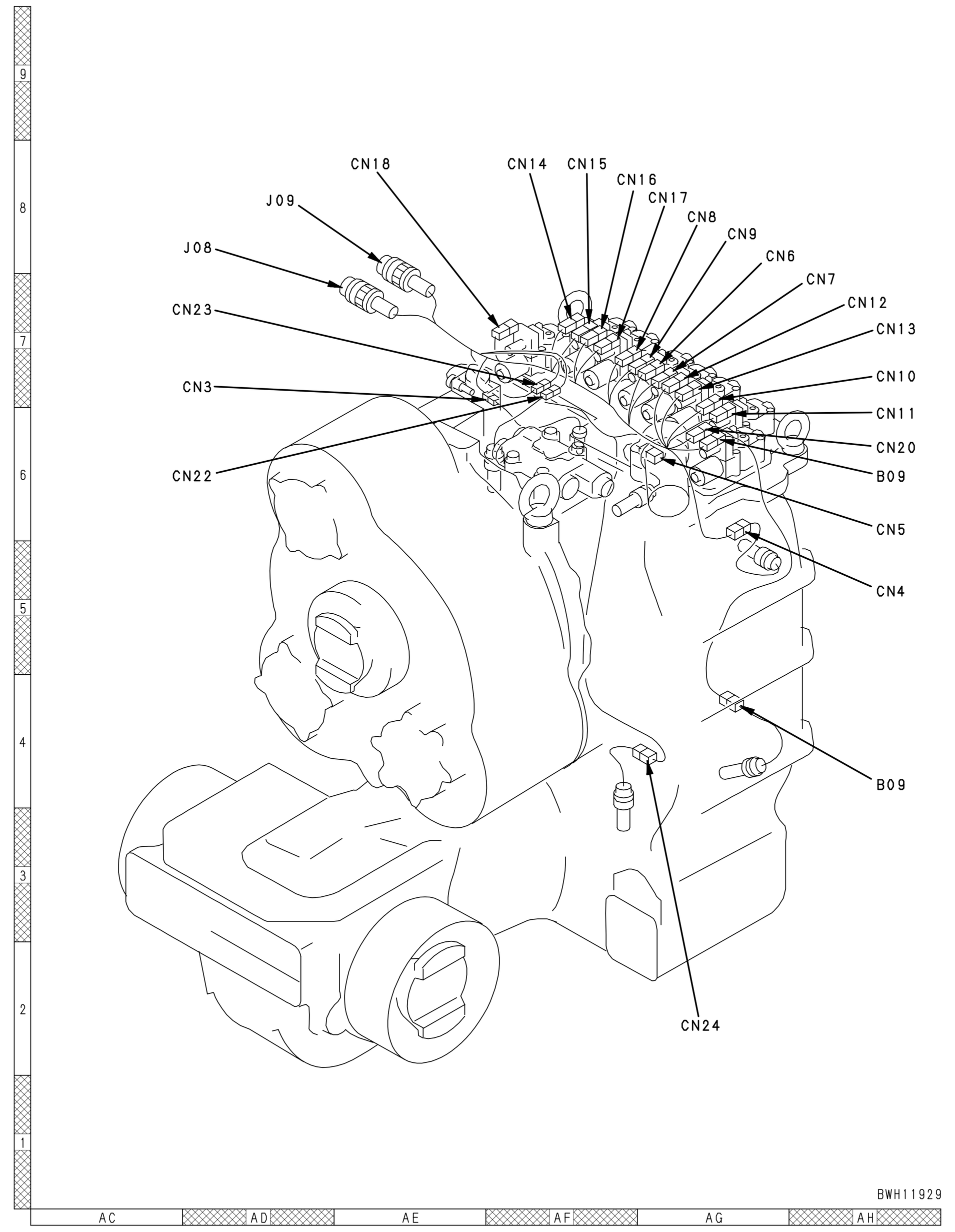
Connector No.	Type of connector	Number of pins	Location	Address
41	Terminal	1	Backup alarm buzzer	M-8
47	M	2	Backup lamp	M-8
49	Terminal	1	Backup alarm buzzer	L-8
50	Terminal	1	Battery relay (-) terminal	C-7
53	Terminal	1	Battery relay (+) terminal	A-7
58	Terminal	1	Emergency steering relay (-) terminal	A-9
59	Terminal	1	Emergency steering relay (+) terminal	C-9
60	Terminal	1	Emergency steering relay (-) terminal	C-9
61	Terminal	1	Emergency steering relay (+) terminal	A-8
62	Terminal	1	Circuit breaker (80A)	E-9
63	Terminal	1	Circuit breaker (80A)	E-9
64	Terminal	1	Circuit breaker (80A)	E-8
65	Terminal	1	Circuit breaker (80A)	E-9
66	Terminal	1	Battery relay (B) terminal	A-7
69	Terminal	1	Battery relay (M) terminal	A-8
74	Terminal	1	Emergency steering relay (B) terminal	B-9
75	Terminal	1	Emergency steering relay (M) terminal	B-9
76	Terminal	1	Emergency steering relay (B) terminal	B-9
77	Terminal	1	Emergency steering relay (M) terminal	C-9
78	DT	2	Starting motor terminals R and S	AJ-1
80	Terminal	1	Alternator terminal R	AK-1
81	Terminal	1	Circuit breaker (30A)	D-8
82	Terminal	1	Circuit breaker (30A)	D-9
83	Terminal	1	Circuit breaker (30A)	D-8
84	Terminal	1	Circuit breaker (30A)	D-9
86	Terminal	1	Side lamp (left) (if equipped)	I-2
94	Terminal	1	Ground	M-7
AC1	AMP	18	Intermediate connector (air conditioner wiring harness)	W-9
AC2	AMP	8	Air conditioner panel	P-5
ACC	M	6	Accelerator-linked switch	Q-3
ACC	Terminal	1	Starting switch	O-7
ACRD	SUMITOMODENSO	2	Pressure switch	E-1
A1-F	M	1	Emergency escape switch (female connector)	Y-8
A1-M	M	1	Emergency escape switch (male connector)	Y-8
AISS	M	6	AISS switch	Q-6
AS1	DT2	6	Accelerator sensor	R-2
AS2	DT2	2	Accelerator sensor Serial No.2442 and up	R-2
ASS	DT2	2	Air suspension seat	Z-5
ATC1	DT2	24	Transmission controller	AB-7
ATC2	DRC	40	Transmission controller	AB-7
ATC3	DRC	40	Transmission controller	AA-8
ATC6	X	4	Intermediate connector (brake controller)	Y-9
B	Terminal	1	Starting switch	P-7
B	Terminal	1	Starting motor terminal B	AI-2
B	Terminal	1	Alternator terminal B	AK-1
B06	DT2	2	BCV solenoid (front)	A-5, AI-2
B07	DT2	2	BCV solenoid (rear)	A-5, AI-2
B09	DT2	2	Transmission differential speed sensor	H-1, AH-4, AH-6
B14	DT2	2	Parking brake solenoid	M-3
B15	DT2	2	Service brake switch	K-3
B16	DT2	2	Retarder brake switch (F)	L-3
B17	DT2	2	Parking brake operation switch	M-4
B18	DT2	2	Solenoid proportional pressure regulator valve (rear)	K-3
B19	DT2	2	Solenoid proportional pressure regulator valve (front)	J-2
B21	DT2	2	ACC oil pressure switch (F)	M-4
B22	DT2	2	ACC oil pressure switch (R)	M-3
B23	DT2	2	Retarder brake switch (R)	J-3
B24	DT2	3	ACC oil pressure sensor (R)	M-5
B25	DT2	3	ACC oil pressure sensor (F)	M-3
BLS	M	6	Rotary lamp switch (if equipped)	P-1
BP	DT	2	Bypass valve	AJ-9
BR	Terminal	1	Starting switch terminal BR	O-6
BRC1	DRC	24	Brake controller	AA-8
BRC2	DRC	40	Brake controller	AA-8
BRC3	DRC	40	Brake controller	Z-8
BRC6	X	4	Intermediate connector	Y-9
BT1	—	10	Fuse box	AA-4
BT2	—	15	Fuse box	AA-4
BT3	—	15	Fuse box	AA-4
BT4	—	10	Fuse box	AA-4
BZR	M	2	Buzzer	V-1
C	Terminal	1	Starting switch	O-7
C	Terminal	1	Starting motor terminal C	AJ-2
CAB1	SWP	12	Cab wiring harness	C-6, T-8
CAB2	SWP	8	Cab wiring harness	C-6, U-8
CAN1	DT2	3	Terminal resistor (120Ω)	AM-5
CAN2	DT2	3	Resistor	S-1
CG	—	2	Cigarette lighter	P-3
CH1	S	8	Electronic panel display selector switch 1	O-2
CH2	S	8	Electronic panel display selector switch 2	O-2
CHK1	X	1	Setting connector (male connector)	R-7
CHK2	X	1	Setting connector (female connector)	Q-7
CJA	DT2	6	Joint connector	L-4
CJB	DT2	8	Joint connector	G-1
CJE	DT2	8	Join connector	D-7
CJE 4	DT2	8	Joint connector	AL-5
CJF	DT2	8	Joint connector	G-1
CJG	DT2	8	Joint connector	G-1
CJK	DT2	6	Joint connector	M-7
CJL	DT2	6	Joint connector	C-8
CJP	DT2	6	Joint connector	B-2
CJR	DT2	8	Joint connector	B-6
CJS	DT2	8	Joint connector	C-6
CJT	DT2	8	Joint connector	C-6
CJU	DT2	6	Joint connector	G-1
CJY	DT2	8	Joint connector	B-2
CM	DT2	8	Lighting switch, passing switch, turn switch	S-1
CM	DT2	2	Intermediate connector (air conditioner pressure switch)	D-1
CN1	DT	2	Injector #1	AJ-8

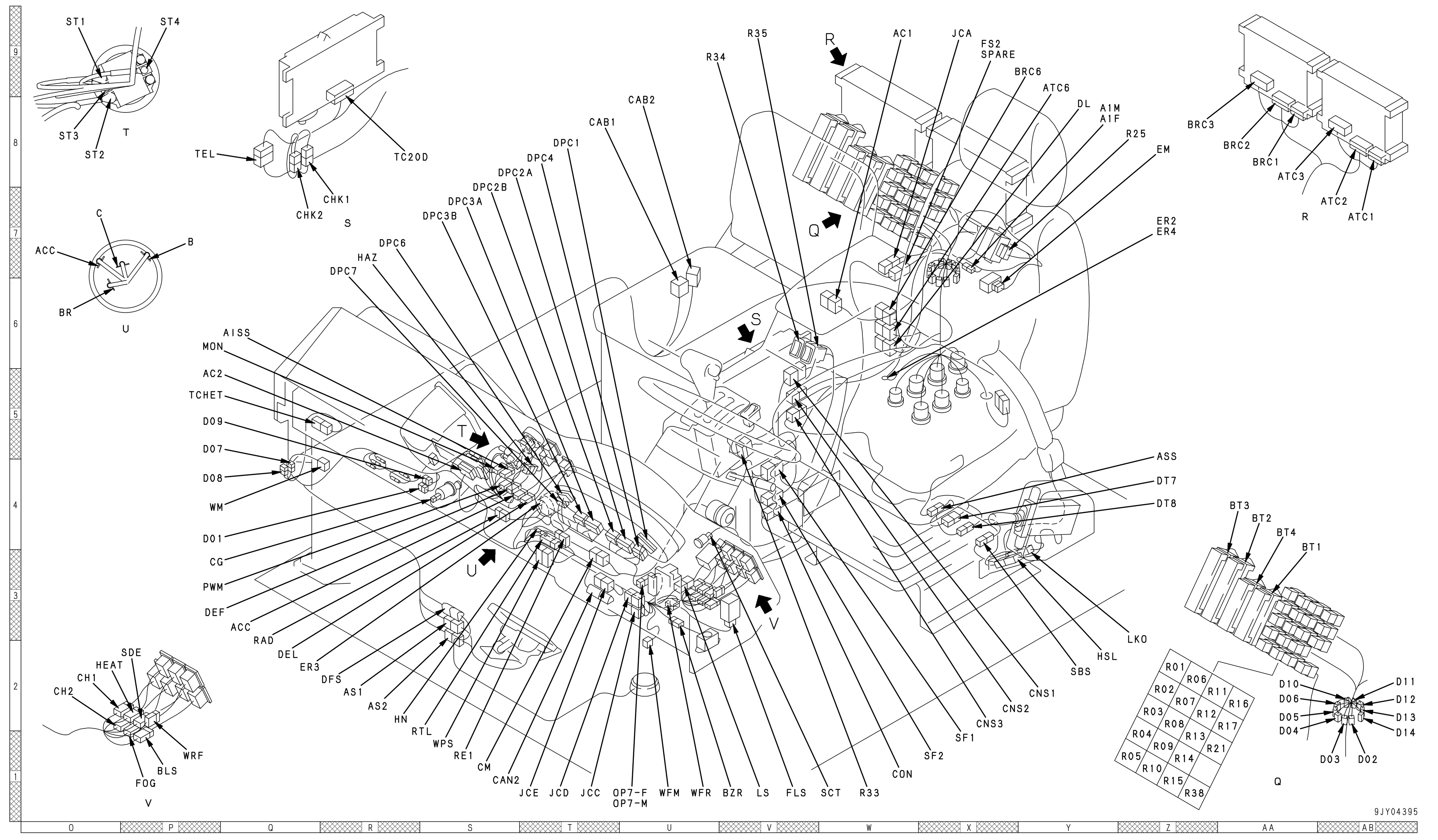
Connector No.	Type of connector	Number of pins	Location	Address
CN2	DT	2	Injector #2	AL-9
CN3	DT	2	Injector #3	AL-9
CN3	DT2	2	Input shaft speed sensor	AD-7
CN4	DT	2	Injector #4	AN-7
CN4	DT2	2	Intermediate shaft speed sensor	AH-5
CN5	DT	2	Injector #5	AN-6
CN5	DT2	2	Output shaft speed sensor	AH-6
CN6	DT	2	Injector #6	AN-6
CN6	DT2	2	Low clutch ECMV	AG-8
CN7	DT2	2	Low fill switch	AH-7
CN8	DT2	2	R clutch ECMV	AG-8
CN9	DT2	2	R fill switch	AG-8
CN10	DT2	2	High solenoid	AH-7
CN11	DT2	2	High fill switch	AH-6
CN12	DT2	2	1st clutch ECMV	AH-7
CN13	DT2	2	1st fill switch	AH-7
CN14	DT2	2	2nd clutch ECMV	AF-8
CN15	DT2	2	2nd fill switch	AF-8
CN16	DT2	2	3rd clutch ECMV	AF-8
CN17	DT2	2	3rd fill switch	AG-8
CN18	DT2	2	Torque converter lockup solenoid	AE-8
CN20	DT2	2	DIFF solenoid	AH-6
CN22	DT2	2	Torque converter oil pressure sensor	AD-6
CN23	DT2	2	Torque converter oil temperature sensor	AD-7
CN24	DT2	2	Transmission oil temperature sensor	AG-2
CNS1	DT2	12	Console wiring harness	Y-2
CNS2	DT2	12	Console wiring harness (gear shif tlever)	X-2
CNS3	DT2	12	Console wiring harness	X-2
COMP	X	2	Compressor	B-2
CON			DC/DC converter	W-1
D01	YAZAKI	2	Diode	P-4
D02	YAZAKI	2	Diode	AB-1
D03	YAZAKI	2	Diode	AB-1
D04	YAZAKI	2	Diode	AA-2
D05	YAZAKI	2	Diode	AA-2
D06	YAZAKI	2	Diode	AA-2
D07	YAZAKI	2	Diode	P-5
D08	YAZAKI	2	Diode	P-4
D09	YAZAKI	2	Diode	P-5
D10	DT2	2	Diode	E-1
D10	YAZAKI	2	Diode	AA-2
D11	YAZAKI	2	Diode	AB-2
D12	YAZAKI	2	Diode	AB-2
D13	YAZAKI	2	Diode	AB-2
D14	YAZAKI	2	Diode	AB-2
D15	YAZAKI	2	Diode	C-8
DEF	M	6	Differential lock switch	P-3
DEL	M	6	Right and left differential lock switch (if equipped)	Q-2
DFS	DT2	3	Differential lock foot switch	R-2
DL	DT2	12	Intermediate connector	Y-8
DPC1	070	20	Electronic display panel	T-8
DPC2A	070	18	Electronic display panel	S-8
DPC2B	070	12	Electronic display panel	S-7
DPC3A	070	18	Electronic display panel	S-7
DPC3B	070	12	Electronic display panel	S-7
DPC4	070	12	Electronic display panel	T-8
DPC6	040	8	Electronic display panel	R-7
DPC7	X	4	Electronic display panel	R-7
DSL	M	1	Door switch (left) (room lamp)	G-9
DSR	M	1	Door switch (right) (room lamp)	D-7
DT	DT2	8	Intermediate connector	F-1
DT1	DT2	12	Intermediate connector	B-5
DT2	DT2	8	Intermediate connector	B-6
DT4	DT2	3	Intermediate connector	H-2
DT5	DT2	4	Intermediate connector	N-3
DT6	DT2	6	Intermediate connector	N-4
DT7	DT2	12	Intermediate connector (hoist lever)	Z-4
DT8	DT2	12	Intermediate connector (front lighting) (left)	Z-4
DT8	DT2	4	Intermediate connector (air suspension seat)	B-1
DT9	DT2	12	Intermediate connector (front lighting) (right)	A-2
E1	Terminal	1	Ground (alternator side)	AK-1
E02	DT2	3	Emergency steering oil pressure switch	B-5
E3	Terminal	1	Ground (Engine side)	AJ-1
E11	Terminal	1	Air heater relay (+) terminal	C-8
E12	Terminal	1	Air heater relay (-) terminal	C-8
EGR	DT	2	EGR valve	AJ-8
EM	KES1	6	Emergency steering timer	Z-8
ENG	DRC	60	Engine controller	AK-6
ER	Terminal	1	Ground	A-9
ER	Terminal	1	Ground	B-2
ER	Terminal	1	Ground	E-7
ER	Terminal	1	Ground	H-2
ER	Terminal	1	Ground	I-2
ER	Terminal	1	Ground	L-4
ER1	Terminal	1	Ground	C-1
ER2	Terminal	1	Ground	Z-7
ER3	Terminal	1	Ground	Q-2
ER4	Terminal	1	Ground	Z-7
FLS	KES1	4	Flasher	V-1
FOG	M	6	Fog lamp switch (if equipped)	P-1
FS2	X	4	Intermediate connector	X-9
FWL	Plugconnector	1	Working lamp (left front)	F-8
FWL2	Plugconnector	1	Working lamp (left front)	F-8
FWM	KES1	2	Washer motor (front)	A-4
FWR	Plugconnector	1	Working lamp (right front)	D-6
FWR2	Plugconnector	1	Working lamp (right front)	C-6
G	SUMITOMO	3	G sensor	AJ-6
G1	Terminal	1	Ground	A-2
GS	Terminal	1	Engine ground	AK-5
HAZ	M	6	Hazard switch	R-7

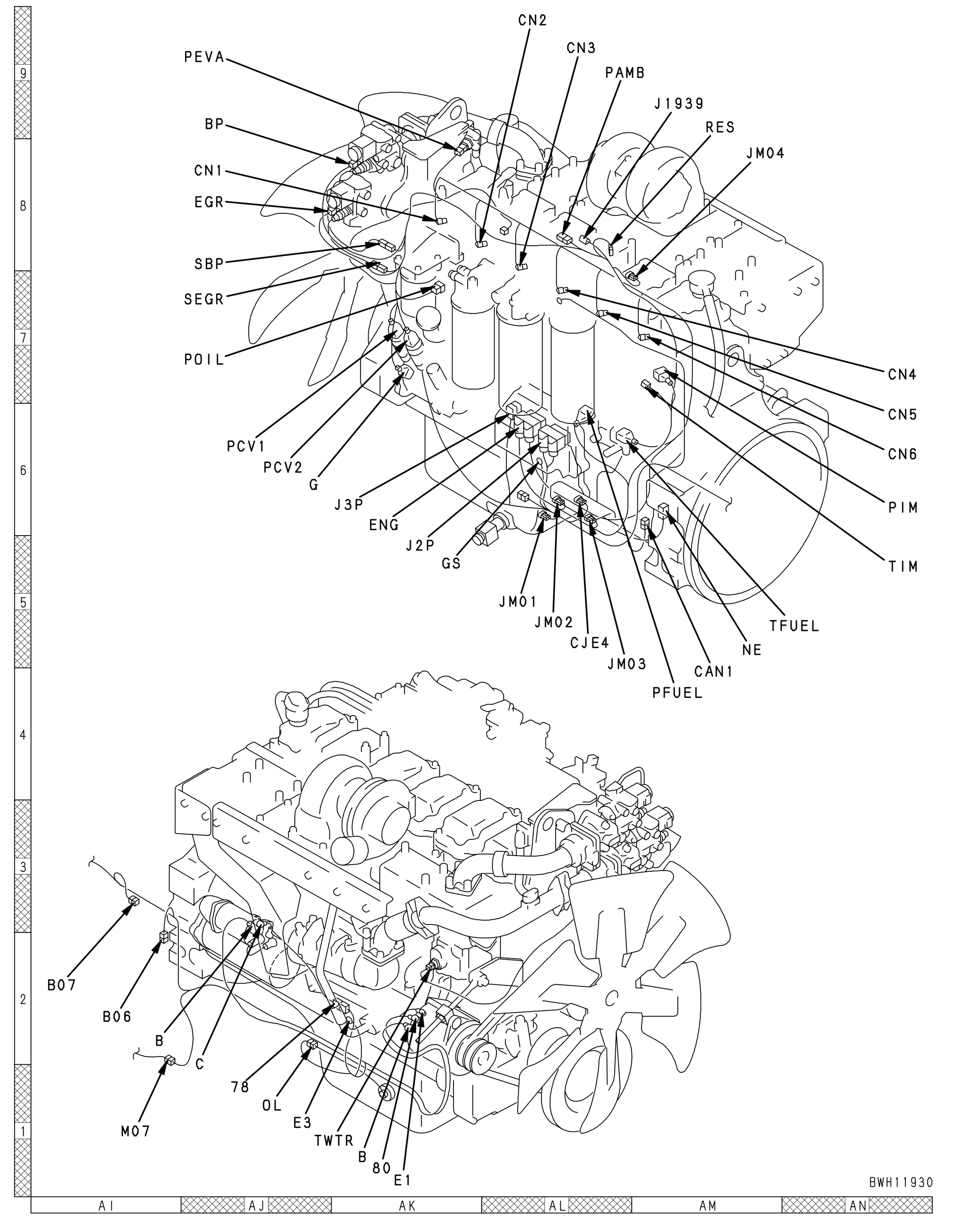
Connector No.	Type of connector	Number of pins	Location	Address
HEAT	M	6	Rear heater switch (if equipped)	O-2
HEAT1	KES1	1	Rear glass heater (if equipped) (right)	E-8
HEAT2	KES1	1	Rear glass heater (if equipped) (left)	I-9
HN	KES1	1	Horn switch	R-2
HSL	DT2	4	Hoist lever potentiometer	Y-2
J01	HD-24	9	Intermediate connector	K-1
J02	HD-24	31	Intermediate connector	L-1
J03	HD-24	31	Intermediate connector	L-2
J04	HD-24	31	Intermediate connector	L-2
J05	HD-18	14	Intermediate connector	L-2
J06	DTP04	4	Intermediate connector (engine)	L-2
J08	HD-18	14	Intermediate connector (transmission)	K-1, AD-8
J09	HD-24	31	Intermediate connector (transmission)	K-2, AD-8
J12	DT2	8	Intermediate connector	I-2
J13	DT2	8	Intermediate connector	K-4
J14	DT2	8	Intermediate connector	I-2
J15	DT2	8	Intermediate connector	L-4
J18	DT2	12	Intermediate connector	D-1
J19	HD-24	9	Intermediate connector	E-1
J1939	DT	3	CAN	AM-9
J2P	DRC	50	Engine controller	AK-5
J3P	DT06	4	Engine controller	AK-6
JCA	SWP	16	Joint connector	X-9
JCC	SWP	16	Joint connector	T-1
JCD	SWP	16	Joint connector	T-1
JCE	SWP	16	Joint connector	T-1
JM01	Terminalarray			AL-5
JM02	Terminalarray			AL-5
JM03	Terminalarray			AL-5
JM04	Terminalarray			AM-8
KA1	Plugconnector	1	Rotary lamp (if equipped)	D-7
KA2	Plugconnector	1	Rotary lamp (if equipped)	D-7
LKO	DT2	2	Lever kick-out solenoid	Z-3
LS	M	3	Rheostat	V-1
M01	X	2	Radiator coolant level switch	A-4
M04	DT2	2	Brake oil temperature sensor (M)	M-5
M06	DT2	2	Fuel gauge sensor	A-4
M07	DT2	2	Front brake oil temperature sensor	AI-1
M11	DT2	2	Air cleaner clogging sensor	A-4
M-2	Terminal	1	Emergency steering motor (+) terminal	F-1
MON	M	4	Rear view monitor (if equipped)	P-6
NE	FRAMATOME	3	NE sensor	AM-5
OL	DT	2	Oil level	AJ-1
OP	DT2	4	Optional connector	E-7
OP7-F	M	1	Option setting connector (female)	U-1
OP7-M	M	1	Option setting connector (male)	U-1
P01	M	3	Head lamp (left)	C-1
P01	M	3	Head lamp (right)	A-3
P02	DT2	3	Combination lamp (left)	D-1
P02	DT2	3	Combination lamp (right)	A-3
P05	DT2	2	Intermediate connector (turn signal, left)	H-2
P06	DT2	2	Turn signal (right)	E-8
P07	X	2	Fog lamp (left) (if equipped)	C-1
P07	X	2	Fog lamp (right) (if equipped)	A-3
P13	YAZAKI	1	Horn valve (left)	C-1
P13	YAZAKI	1	Horn valve (right)	A-3
P20	M	6	Winker tail stop lamp (left)	M-8
P21	M	6	Winker tail stop lamp (right)	L-9
P22	DT2	2	Side lamp (right) (if equipped)	M-3
PAMB	AMP	3	Ambient pressure sensor	AL-9
PCV1	SUMITOMO	2	Supply pump control valve	AJ-6
PCV2	SUMITOMO	2	Supply pump control valve	AJ-6
PEVA	FRAMATOME	3	EGR valve inlet pressure sensor	AJ-9
PFUEL	AMP	3	Common rail pressure sensor	AM-4
PHO	Terminal	1	Heater relay	C-7
PIM	SUMITOMO	3	Boost pressure sensor	AN-6
POIL	FRAMATOME	3	Engine oil pressure sensor	AJ-7
PWL	M	1	Power window motor (left)	J-3
PWM	M	6	Power mode switch	P-3
PWR	Plugconnector	1	Power window motor (right) (if equipped)	F-8
R01	SHINAGAWA	5	Engine start relay	Z-2
R02	SHINAGAWA	5	Parking brake relay	Z-2
R03	SHINAGAWA	5	Dust indicator	Z-2
R04	SHINAGAWA	6	Brake lamp relay	Z-1
R05	SHINAGAWA	6	Backup lamp/buzzer relay	Z-1
R06	SHINAGAWA	6	Fog lamp relay (if equipped)	Z-2
R07	SHINAGAWA	5	Auto preheater relay	Z-2
R08	SHINAGAWA	5	Rotary lamp relay (if equipped)	Z-2
R09	SHINAGAWA	6	Working lamp (front) relay	Z-1
R10	SHINAGAWA	5	Horn relay	Z-1
R11	SHINAGAWA	6	Side lamp relay	Z-2
R12	SHINAGAWA	6	Hazard relay 1	Z-2
R13	SHINAGAWA	5	Hazard relay 2	Z-1
R14	SHINAGAWA	5	Headlamp relay	Z-1
R15	SHINAGAWA	5	Headlamp selector relay	Z-1
R16	SHINAGAWA	6	Headlamp high relay	AA-2
R17	SHINAGAWA	5	Parking brake safety relay	AA-2
R21	SHINAGAWA	5	Rear heater relay (if equipped)	Z-1
R25	YAZAKI	11	Power window relay	Z-8
R33	M	6	Parking brake manual switch	W-1
R34	M	7	Power window switch (right) (if equipped)	V-9
R35	M	7	Power window switch (left)	V-9
R38	SHINAGAWA	5	Engine cut relay	Z-1
RAD	YAZAKI	9	Cassette stereo AM/FM radio	Q-3
RE1	KES1	2	Resistor	S-1
RES	DT	2	Resistor	AM-9
RL	KES1	2	Room lamp	E-7
RL2	KES1	4	Room lamp 2	G-9
RTL	DT2	6	Retarder lever potentiometer	S-2
RWM	KES1	2	Washer motor (rear)	A-4

Connector No.	Type of connector	Number of pins	Location	Address
SBP	DT	4	Bypass valve position sensor	AJ-8
SBS	DT2	2	Seat belt switch	Y-2
SCT	—	—	Socket	W-1
SDE	M	6	Side lamp switch (i fequipped)	P-2
SEGR	DT	4	EGR valve position sensor	AJ-7
SF1	DT2	12	Gear shift lever	X-1
SF2	DT2	2	Gea rshift lever	X-1
SPARE	X	4	Spare connector	X-9
SPL	KES1	2	Speake r(left)	H-9
SPR	KES1	2	Speaker (right)	F-8
ST1	Terminal	1	Emergency steering switch	O-9
ST2	Terminal	1	Emergency steering switch	O-8
ST3	Terminal	1	Emergency steering switch	O-8
ST4	Terminal	1	Emergency steering switch	P-9
T01	DT2	3	Hoist selector valve	J-3
T02	DT2	2	Hoist EPC valve	J-3
T03	DT2	2	Transmission oil filter switch	A-3
T04	DT2	2	Steering oil temperature sensor	K-3
T06	DT2	2	Hydraulic oil level switch (if equipped)	I-2
T10	DT2	3	Pitch angle sensor	L-9
T10A				L-9
T14	DT2	3	Body position sensor	K-9
TC20D	DRC	40	KOMTRAX Terminal	R-8
TCHET	X	4	Heater & touch unit	P-5
TEL	DT2	12	Tele-management	P-8
TFUEL	PACKARD	2	Fuel temperature sensor	AN-5
TIM	PACKARD	2	Boost temperature sensor	AN-5
TSL	DT2	2	turn signal (left)	K-3
TWTR	PACKARD	2	Engine coolant temperature sensor	AK-1
WFM	M	6	Wiper motor (fo rfront)	U-1
WFR	KES0	6	Wiper relay (for front)	U-1
WM	M	4	Intermediate connecto r(washer motor)	F-1,P-4
WPS	DT2	12	Wiper switch	S-1
WRF	M	6	Working lampswitch (if equipped)	P-1
WRM	KES	4	Wiper motor (for rear)	J-9









HM300-2 Articulated dump truck

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