UEN00084-01

Shop Manual

KOMATSU

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

SERIAL NUMBERS

PC210- K50001
PC210LC- K50001
PC210NLC- K50001
PC230NHD- K50001
PC240LC- K50001
PC240NLC- K50001

and up

KOMATSU

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

00 Index and foreword

Index

Organization list of the 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.

Section Title	Form Number
Shop Manual, contents binder, binder label and tabs	UEN00084-01 ●
00 Index and foreword	
Index	UEN00093-01 ●
Foreword and general information	UEN00094-00
01 Specification	
Specification and technical data	UEN00095-00
10 Structure, function and maintenance standard	
Engine and cooling system	UEN00096-00
Power train	UEN00097-00
Undercarriage and frame	UEN00098-00
Hydraulic system, Part 1	UEN00099-00
Hydraulic system, Part 2	UEN00100-00
Hydraulic system, Part 3	UEN00160-00
Work equipment	UEN00101-00
Cab and its attachments	UEN00102-00
Electrical system	UEN00103-00
20 Standard value table	
Standard service value table	UEN00227-00
30 Testing and adjusting	
Testing and adjusting, Part 1	UEN00228-00
Testing and adjusting, Part 2	UEN00229-00
Testing and adjusting, Part 3	UEN00230-00

Table of contents

PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00093-01

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

00 Index and foreword

Foreword and general information

Foreword and general information

(Rev. 2005/09)

Safety notice

Important safety notice

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

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

1. General precautions

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

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

Safety points

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

2. Preparations for work

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

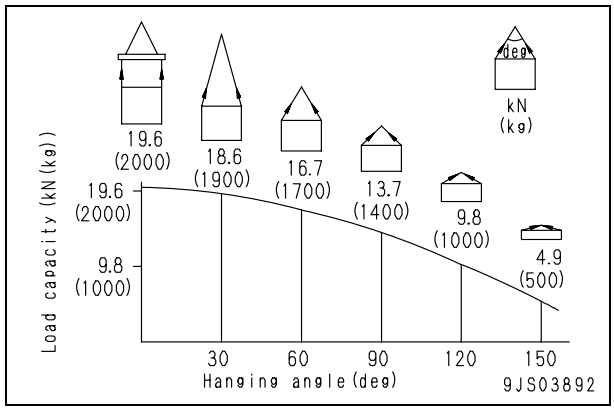
3) When disassembling or assembling, support the machine with blocks, jacks, or stands before starting work.
4) Remove all mud and oil from the steps or other places used to get on and off the machine. Always use the handrails, ladders or steps when getting on or off the machine. Never jump on or off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

3. Precautions during work

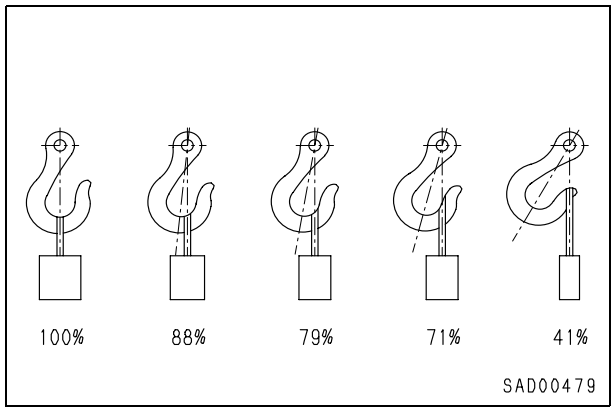
1) Before disconnecting or removing components of the oil, water, or air circuits, first release the pressure completely from the circuit. When removing the oil filler cap, a drain plug, or an oil pressure pickup plug, loosen it slowly to prevent the oil from spurting out.
2) The coolant and oil in the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

4. Precautions for sling work and making signs

1) Only one appointed worker must make signs and co-workers must communicate with each other frequently. The appointed sign maker must make specified signs clearly at a place where he is seen well from the operator's seat and where he can see the working condition easily. The sign maker must always stand in front of the load and guide the operator safely.
   - Do not stand under the load.
   - Do not step on the load.
2) Check the slings before starting sling work.
3) Keep putting on gloves during sling work. (Put on leather gloves, if available.)
4) Measure the weight of the load by the eye and check its center of gravity.
5) Use proper sling according to the weight of the load and method of slinging. If too thick wire ropes are used to sling a light load, the load may slip and fall.
6) Do not sling a load with 1 wire rope alone. If it is slung so, it may rotate and may slip out of the rope. Install 2 or more wire ropes symmetrically.
   ⚠ Slinging with one 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).

How to read the shop manual

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

1. Composition of shop manual

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

00. Index and foreword

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

01. Specification

This section explains the specifications of the machine.

10. Structure, function and maintenance standard

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

20. Standard value table

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

30. Testing and adjusting

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

40. Troubleshooting

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

50. Disassembly and assembly

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

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

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

2. Revision and distribution

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

3. Filing method

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

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

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

4. Symbols

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

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

5. Units

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

Explanation of terms for maintenance standard

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

1. Standard size and tolerance

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

Example:

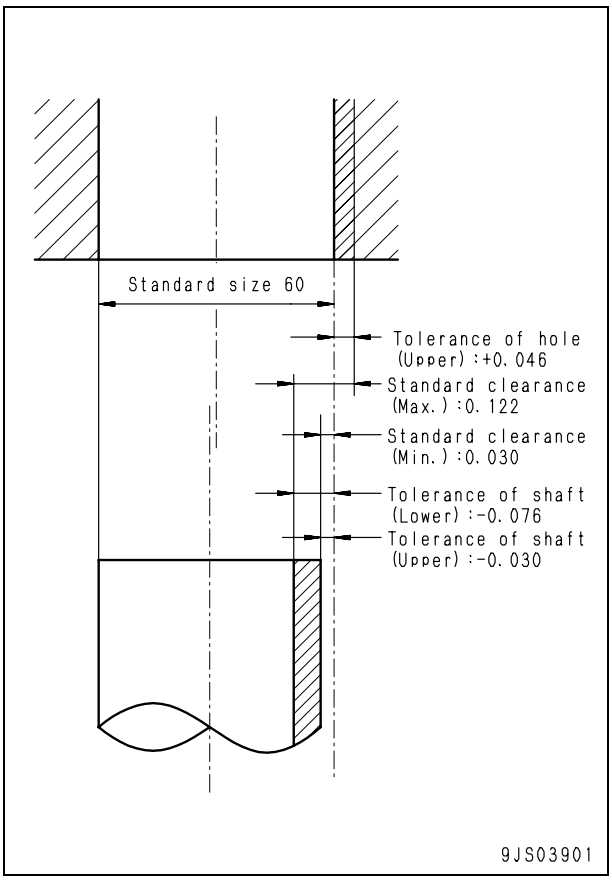
Standard size	Tolerance
120	–0.022 –0.126

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

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

Example:

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



2. Standard clearance and standard value

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

3. Standard interference

- When the size of a hole is smaller than the size of a shaft because of the standard size and tolerance, the difference between these sizes 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 shaft to the difference (B) between the maximum size of the shaft and the minimum size of the hole is the “standard interference”.
- After repairing or replacing some parts, measure the size of their hole and shaft and check that the interference is in the standard range.

4. Repair limit and allowable value

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

5. Clearance limit

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

6. Interference limit

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

Handling electric equipment and hydraulic component

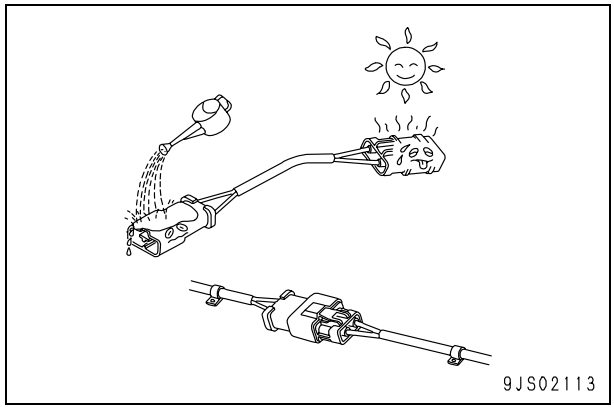
To maintain the performance of the machine over a long period, and to prevent failures or other troubles before they occur, correct “operation“, “maintenance and inspection“, “troubleshooting“, and “repairs” must be carried out. This section deals particularly with correct repair procedures for mechatronics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

Points to remember when handling electric equipment

1. Handling wiring harnesses and connectors

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

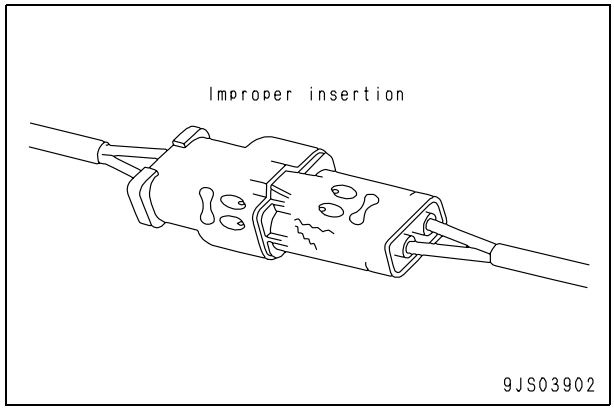
Compared with other electrical components fitted in boxes or cases, wiring harnesses are more likely to be affected by the direct effects of rain, water, heat, or vibration. Furthermore, during inspection and repair operations, they are frequently removed and installed again, so they are likely to suffer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



2. Main failures occurring in wiring harness

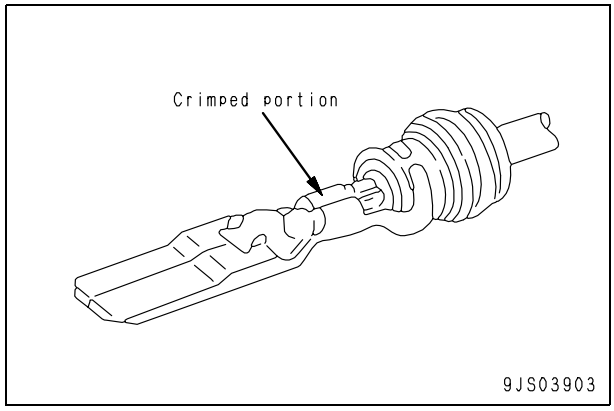
1) Defective contact of connectors (defective contact between male and female)

Problems with defective contact are likely to occur because the male connector is not properly inserted into the female connector, or because one or both of the connectors is deformed or the position is not correctly aligned, or because there is corrosion or oxidization of the contact surfaces.

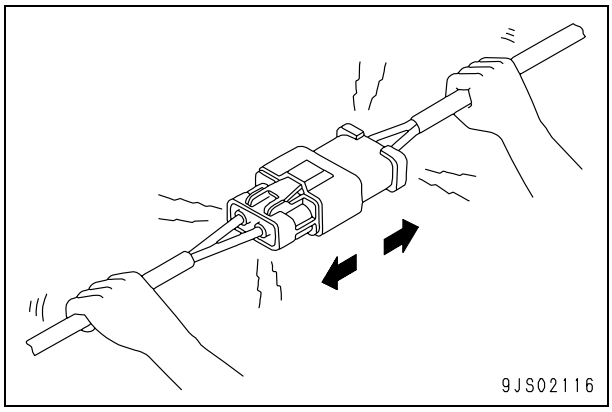


2) Defective crimping or soldering of connectors

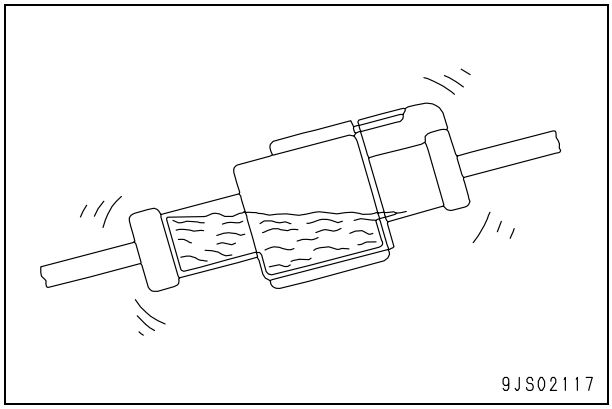
The pins of the male and female connectors are in contact at the crimped terminal or soldered portion, but if there is excessive force brought to bear on the wiring, the plating at the joint will peel and cause improper connection or breakage.



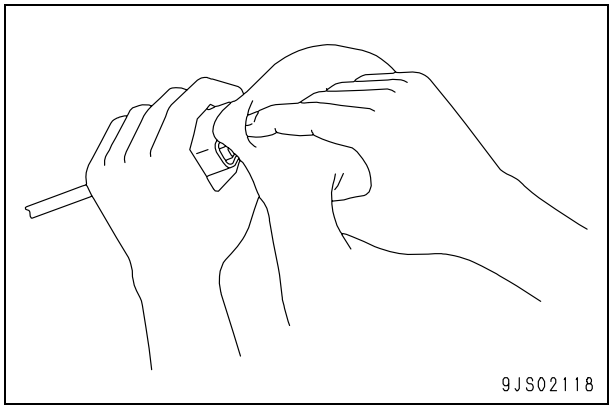
3) Disconnections in wiring
If the wiring is held and the connectors are pulled apart, or components are lifted with a crane with the wiring still connected, or a heavy object hits the wiring, the crimping of the connector may separate, or the soldering may be damaged, or the wiring may be broken.



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 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.



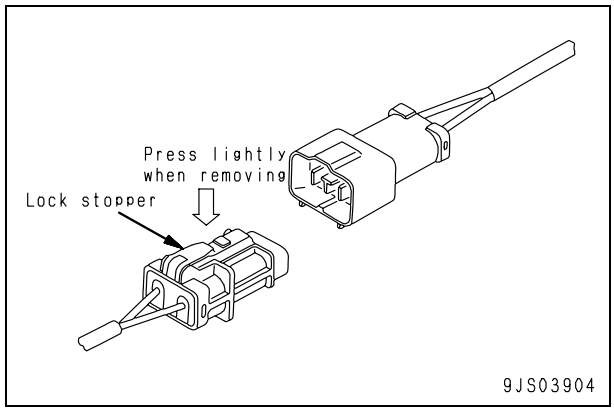
5) Oil or dirt stuck to connector
If oil or grease are stuck to the connector and an oil film is formed on the mating surface between the male and female pins, the oil will not let the electricity pass, so there will be defective contact. If there is oil or grease stuck to the connector, wipe it off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

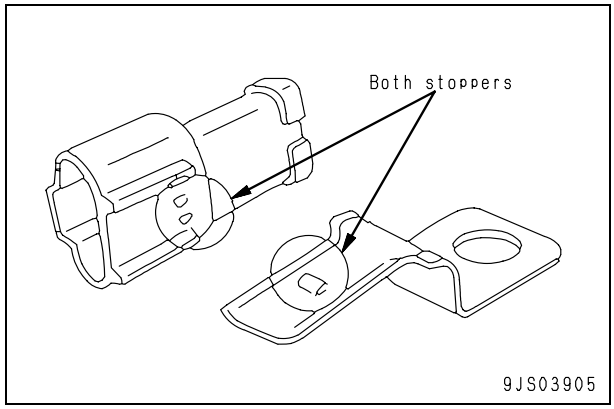
1) Disconnecting connectors

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.

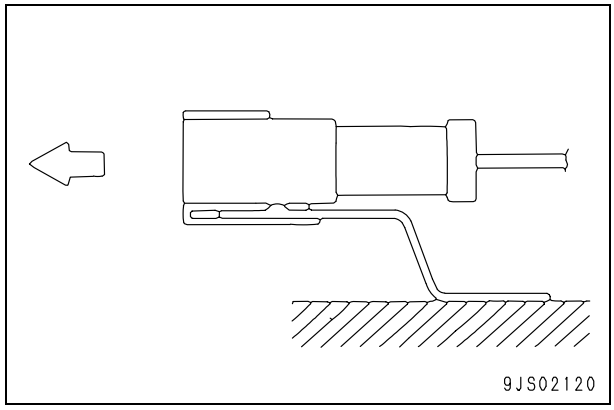


2] When removing from clips

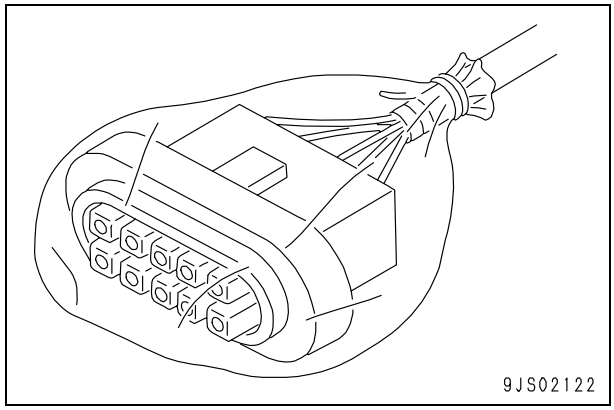
- Both of the connector and clip have stoppers, which are engaged with each other when the connector is installed.



- 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.



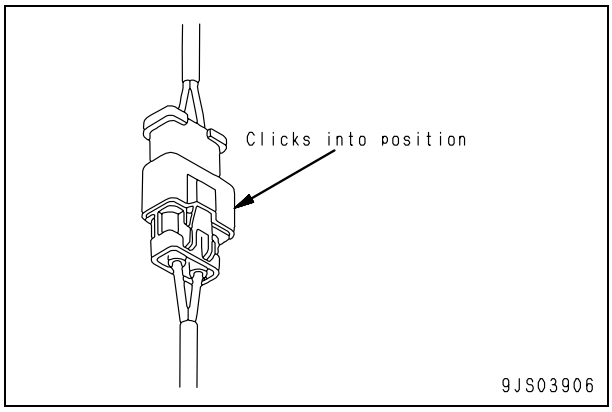
3] Action to take after removing connectors
After removing any connector, cover it with a vinyl bag to prevent any dust, dirt, oil, or water from getting in the connector portion.
★ If the machine is left disassembled for a long time, it is particularly easy for improper contact to occur, so always cover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

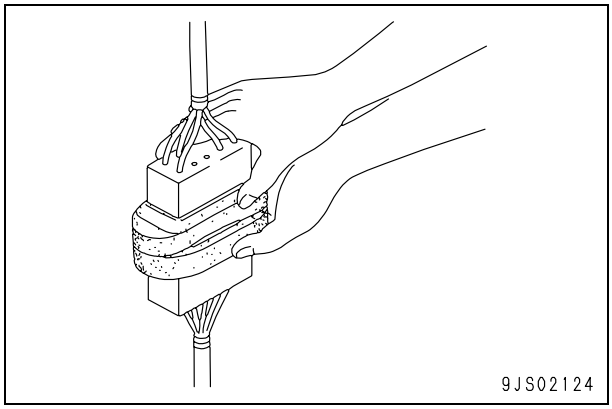


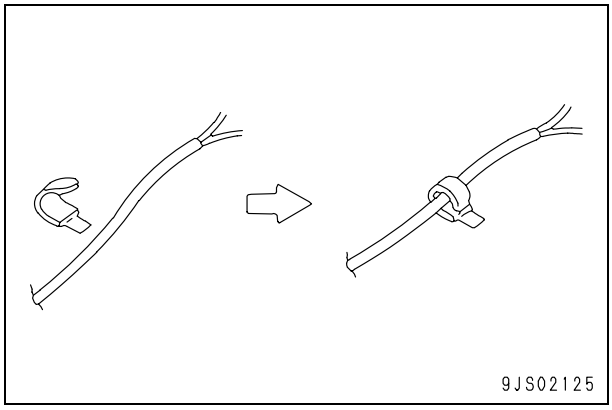
2) Connecting connectors
   1] Check the connector visually.
   Check that there is no oil, dirt, or water stuck to the connector pins (mating portion).
   Check that there is no deformation, defective contact, corrosion, or damage to the connector pins.
   Check that there is no damage or breakage to 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 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.

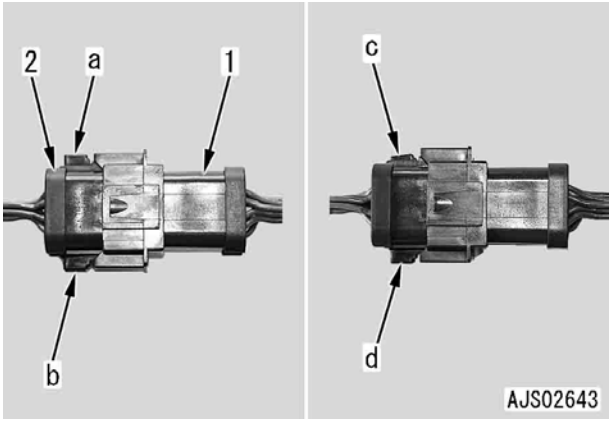
3) Connecting DT connectors
   Since the DT 8-pin and 12-pin heavy duty wire connectors have 2 latches respectively, push them in until they click 2 times.

   1. Male connector
   2. Female connector
   ● Normal locking state (Horizontal): a, b, d
   ● Incomplete locking state (Diagonal): c

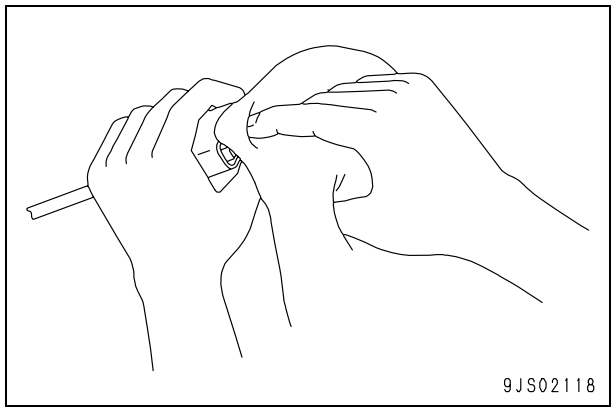


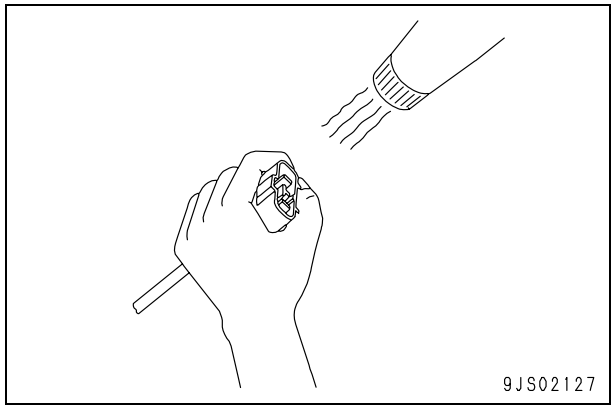


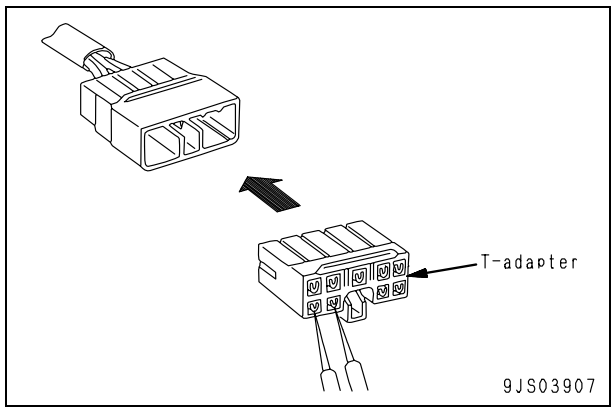




4) Drying wiring harness
If there is any oil or dirt on the wiring harness, wipe it off with a dry cloth. Avoid washing it in water or using steam. If the connector must be washed in water, do not use high-pressure water or steam directly on the wiring harness. If water gets directly on the connector, 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.

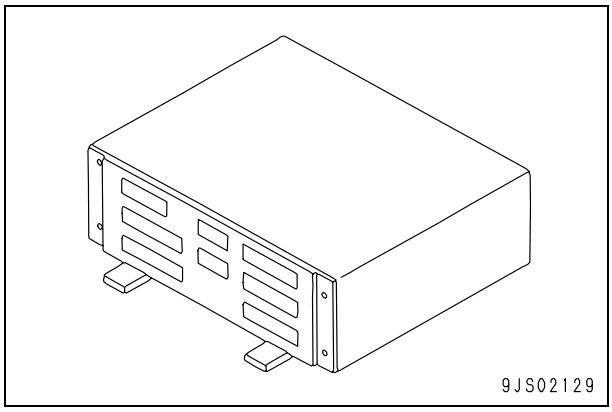


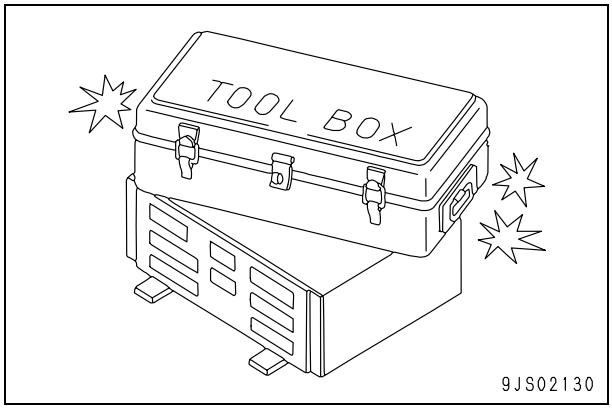




4. Handling controller

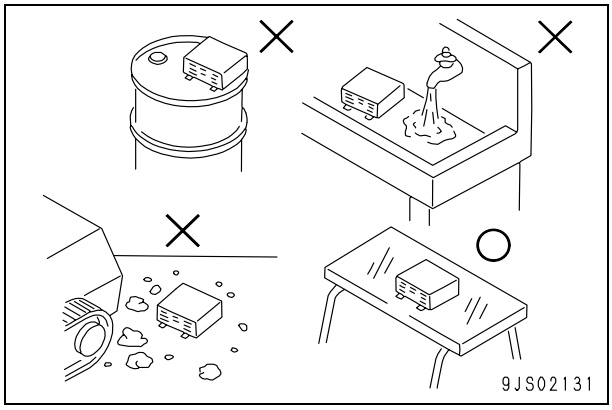
1) The controller contains a microcomputer and electronic control circuits. These control all of the electronic circuits on the machine, so be extremely careful when handling the controller.
2) Do not place objects on top of the controller.
3) Cover the control connectors with tape or a vinyl bag. Never 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

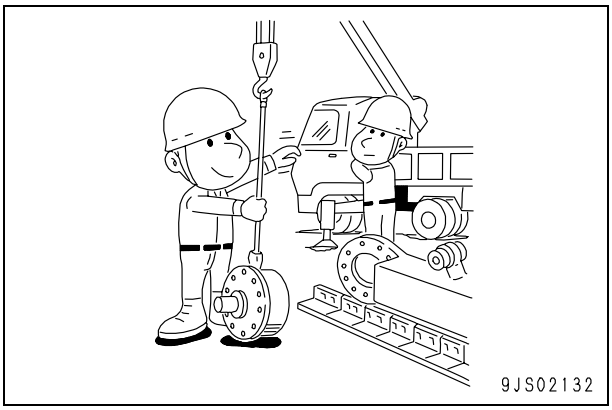
With the increase in pressure and precision of hydraulic equipment, the most common cause of failure is dirt (foreign material) in the hydraulic circuit. When adding hydraulic oil, or when disassembling or assembling hydraulic equipment, it is necessary to be particularly careful.

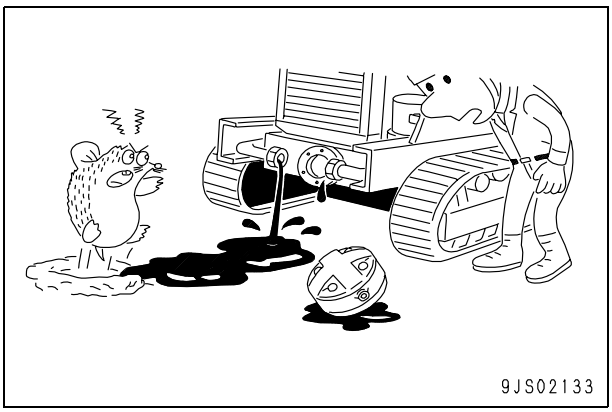
1. **Be careful of the operating environment.**
   Avoid adding hydraulic oil, replacing filters, or repairing the machine in rain or high winds, or places where there is a lot of dust.

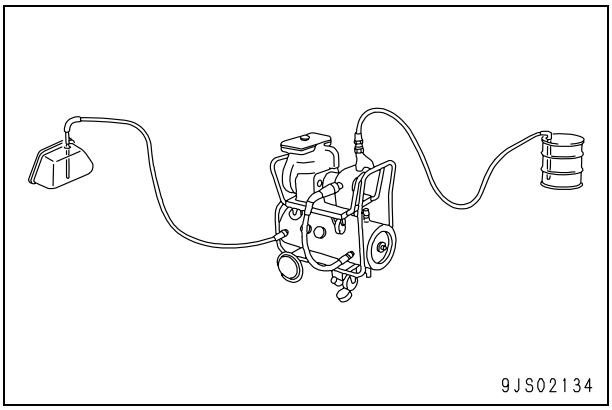
2. **Disassembly and maintenance work in the field**
   If disassembly or maintenance work is carried out on hydraulic equipment in the field, there is danger of dust entering the equipment. It is also difficult to check the performance after repairs, so it is desirable to use unit exchange. Disassembly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





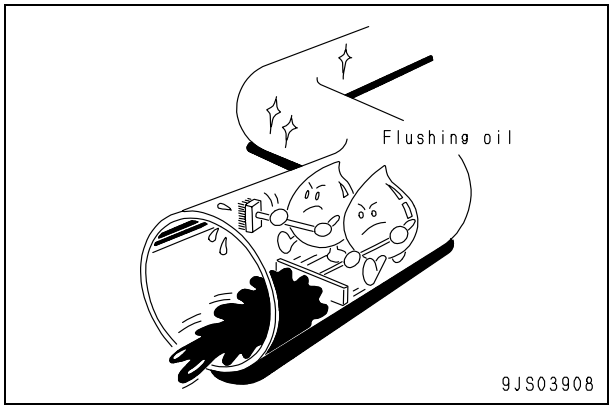


5. Change hydraulic oil when the temperature is high

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.

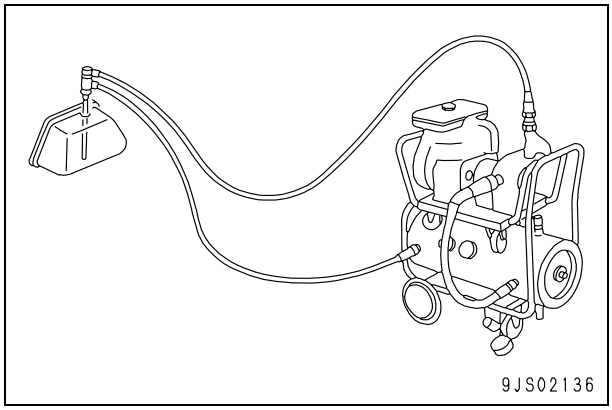
6. Flushing operations

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

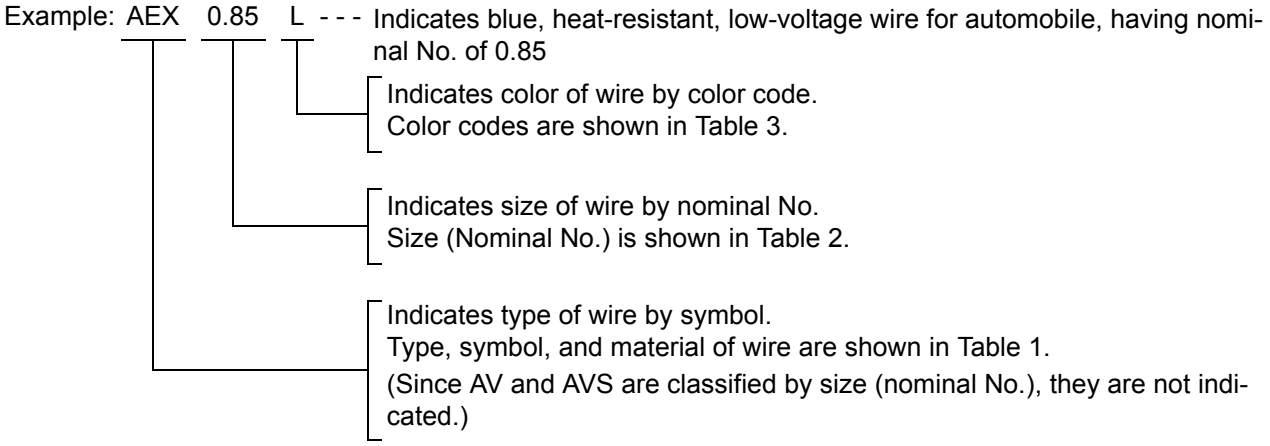
After repairing the hydraulic equipment (pump, control valve, etc.) or when running the machine, carry out oil cleaning to remove the sludge or contaminants in the hydraulic oil circuit. The oil cleaning equipment is used to remove the ultra fine (about 3 μ) particles that the filter built in the hydraulic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



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		

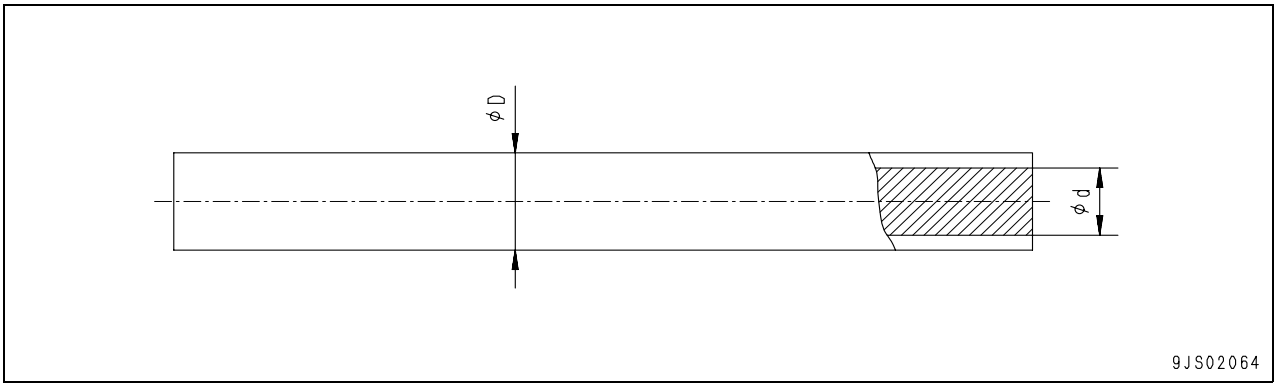
2. Dimensions

(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	–	–	–	–	–	–	–

Method of disassembling and connecting push-pull type coupler

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

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

Type 1

1. Disconnection

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

Fig. 1

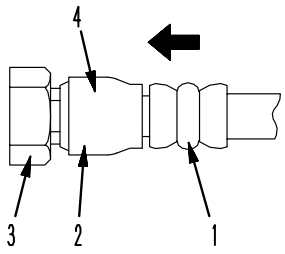


Fig. 2

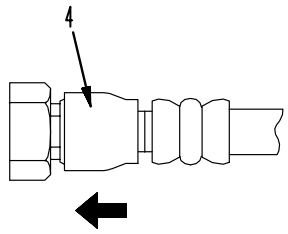
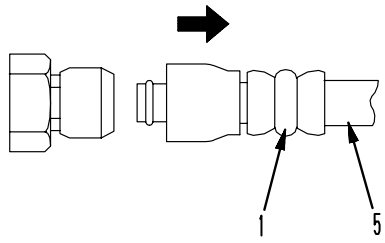


Fig. 3



9JS02109

2. Connection

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

Fig. 4

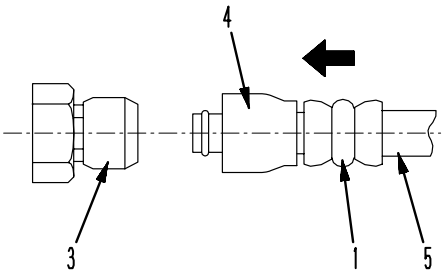
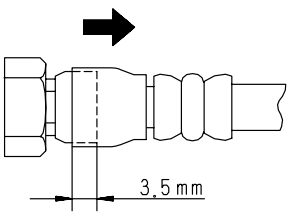


Fig. 5

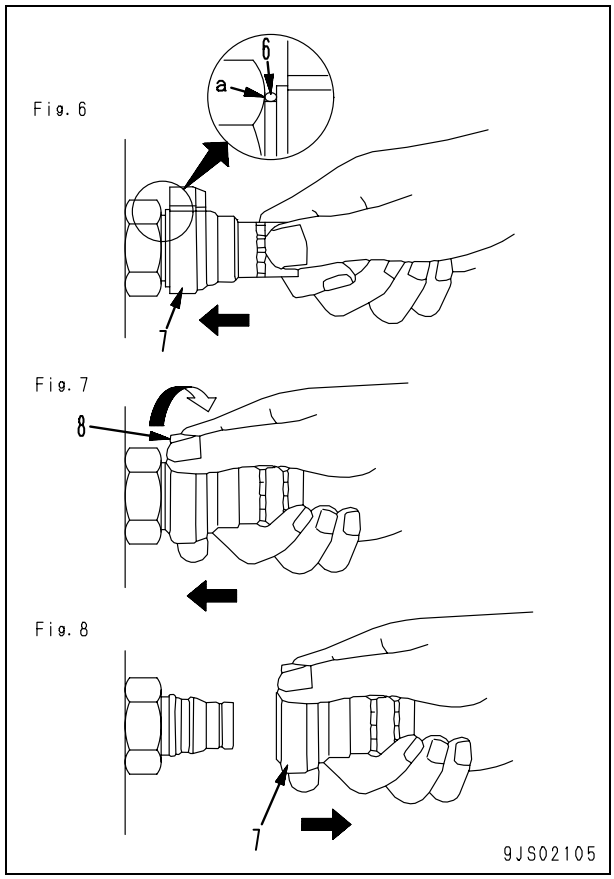


9JS02110

Type 2

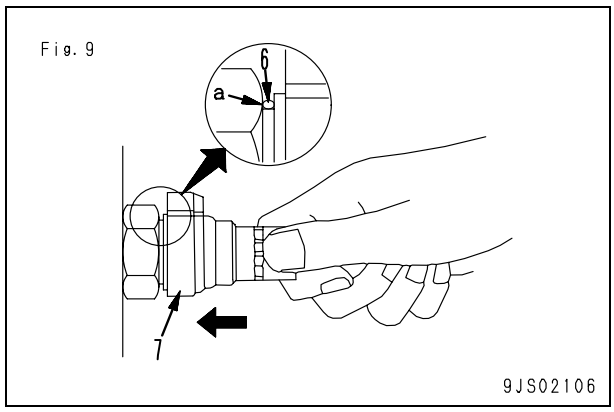
1. Disconnection

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



2. Connection

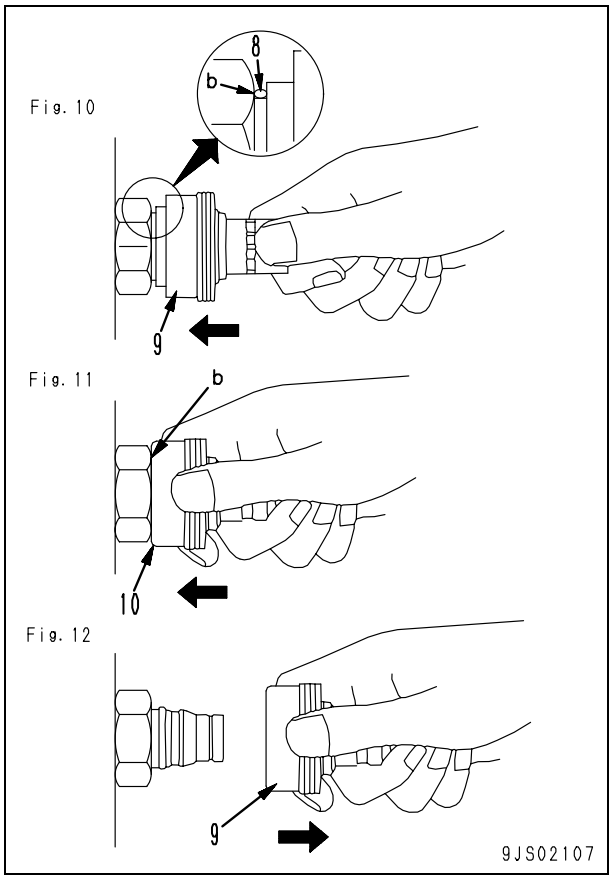
- Hold the tightening portion and push body (7) straight until sliding prevention ring (6) contacts contact surface (a) of the hexagonal portion at the male end. (Fig. 9)



Type 3

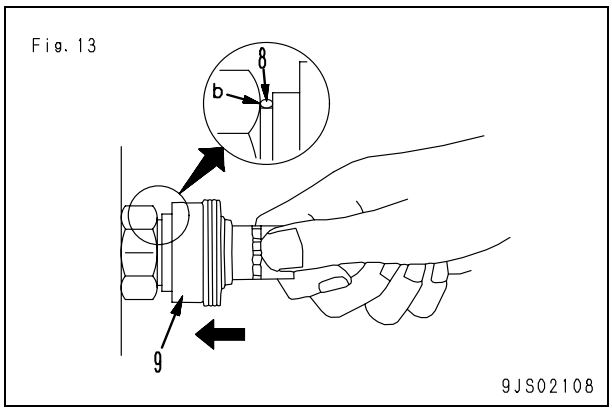
1. Disconnection

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



2. Connection

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



Standard tightening torque table

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

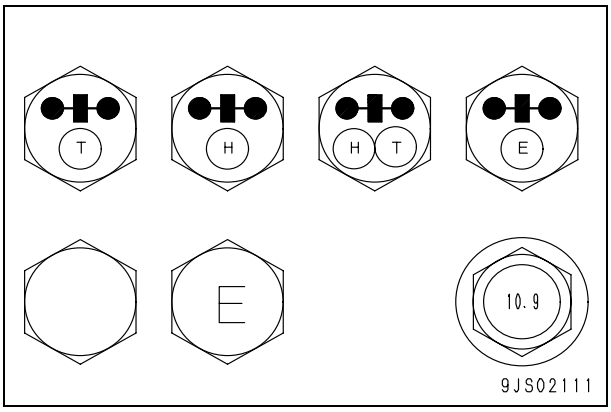
   ★ The following table corresponds to the bolts in Fig. A.

Thread diameter of bolt	Width across flats	Tightening torque	
mm	mm	Nm	kgm
6	10	11.8 – 14.7	1.2 – 1.5
8	13	27 – 34	2.8 – 3.5
10	17	59 – 74	6.0 – 7.5
12	19	98 – 123	10.0 – 12.5
14	22	153 – 190	15.5 – 19.5
16	24	235 – 285	23.5 – 29.5
18	27	320 – 400	33.0 – 41.0
20	30	455 – 565	46.5 – 58.0
22	32	610 – 765	62.5 – 78.0
24	36	785 – 980	80 – 100
27	41	1,150 – 1,440	118 – 147
30	46	1,520 – 1,910	155 – 195
33	50	1,960 – 2,450	200 – 250
36	55	2,450 – 3,040	250 – 310
39	60	2,890 – 3,630	295 – 370

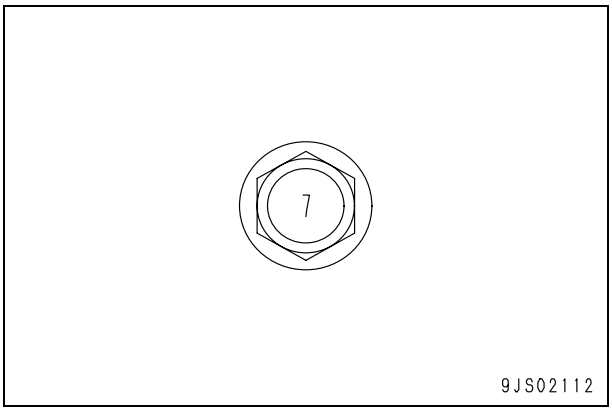
   ★ The following table corresponds to the bolts in Fig. B.

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

★ Fig. A



★ Fig. B



2. Table of tightening torques for split flange bolts

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Thread size	Tightening torque			
	Bolt		BANJO bolt	
mm	Nm	kgm	Nm	kgm
6	10 ± 2	1.02 ± 0.20	8 ± 2	0.81 ± 0.20
8	24 ± 4	2.45 ± 0.41	10 ± 2	1.02 ± 0.20
10	43 ± 6	4.38 ± 0.61	12 ± 2	1.22 ± 0.20
12	77 ± 12	7.85 ± 1.22	24 ± 4	2.45 ± 0.41
14	–	–	36 ± 5	3.67 ± 0.51

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

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

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

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

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

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

Conversion table

Method of using the conversion table

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

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

1. Convert 55 mm into inches.

1) Locate the number 50 in the vertical column at the left side, take this as (A), and then draw a horizontal line from (A).
2) Locate the number 5 in the row across the top, take this as (B), then draw a perpendicular line down from (B).
3) Take the point where the two 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/cm² to lb/in²

1 kg/cm² = 14.2233 lb/in²

	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.
If it is desired to 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.
If it is desired to 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

PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00094-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

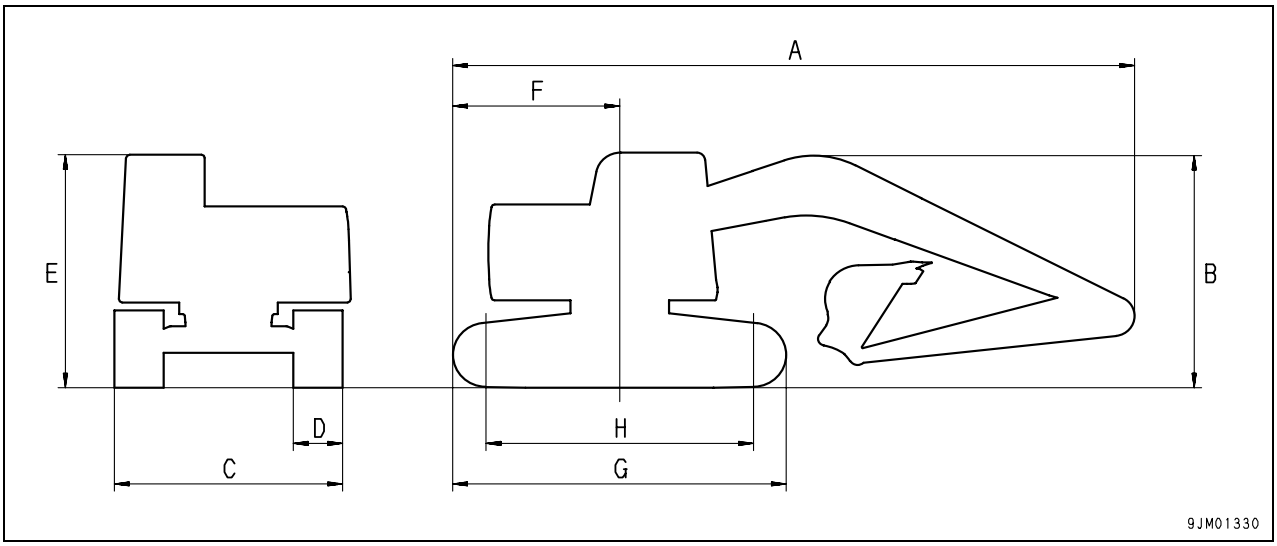
Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

01 Specification

Specification and technical data

Specification and technical data

Specification dimension drawings



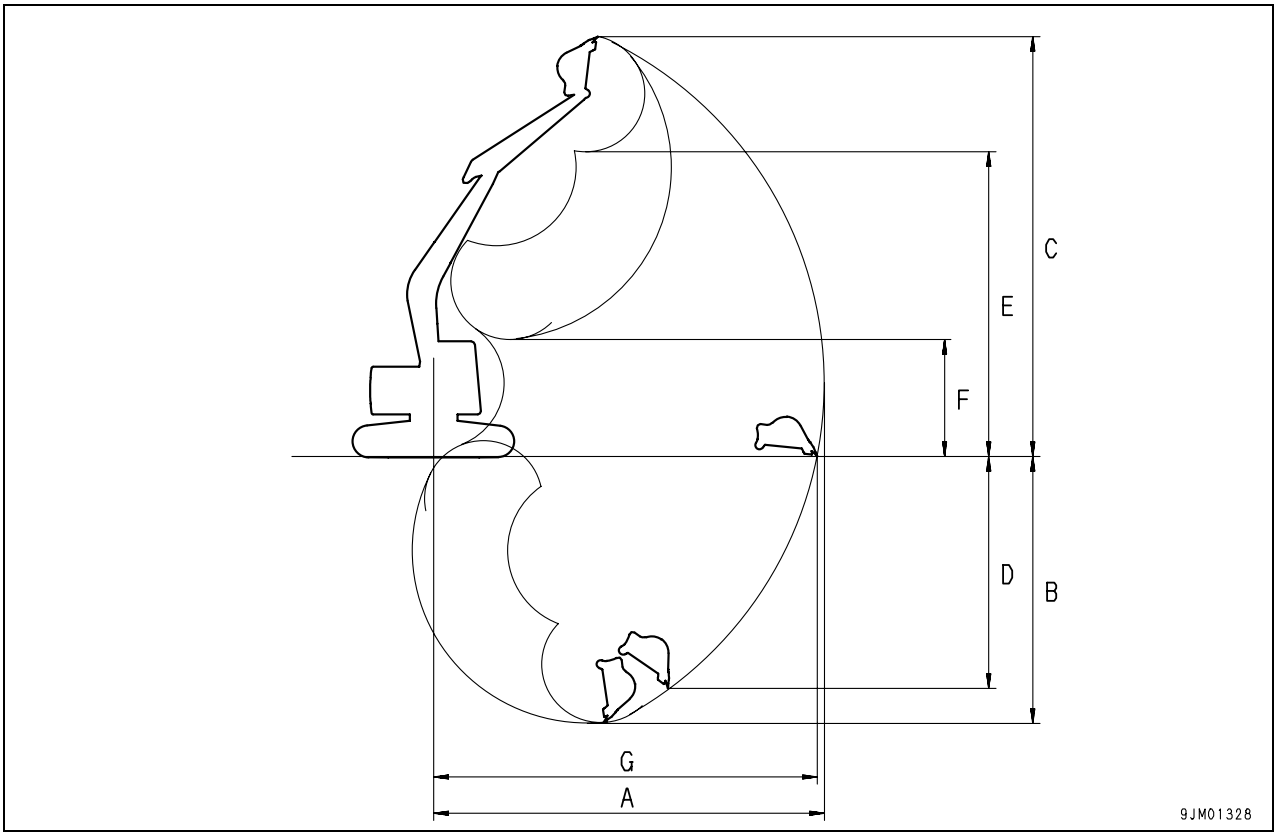
PC210, PC210LC, PC210NLC, PC230NHD-8

	Check item	Unit	PC210-8	PC210LC-8	PC210NLC-8	PC230NHD-8
A	Overall length	mm	9,475			
B	Overall height	mm	3,000			3,025
C	Overall width	mm	2,800	3,080	2,540	
D	Shoe width	mm	600	700	500	550
E	Cab height	mm	3,035			3,060
F	Tail swing radius	mm	2,800			
G	Overall track length	mm	4,080	4,450		4,305
H	Tumbler centre distance	mm	3,270	3,655		3,460
	Min. ground length	mm	440			465

PC240LC, PC240NLC-8

	Check item	Unit	PC240LC-8	PC240NLC-8
A	Overall length	mm	9,885	
B	Overall height	mm	3,160	
C	Overall width	mm	2,980	
D	Shoe width	mm	700	600
E	Cab height	mm	3,055	
F	Tail swing radius	mm	2,940	
G	Overall track length	mm	4,640	4,450
H	Tumbler centre distance	mm	3,845	3,655
	Min. ground length	mm	440	

Working range diagram



PC210, PC210LC, PC210NLC,PC210NLC-8

	Check item	Unit	PC210-8	PC210LC-8	PC210NLC-8	PC230NHD-8
A	Max. digging reach	mm	9,875			
B	Max. digging depth	mm	6,620			
C	Max. digging height	mm	10,000			
D	Max. vertical wall digging depth	mm	5,980			
E	Max. dumping height	mm	7,110			
F	Min. dumping height	mm	2,645			
G	Max. reach at ground level	mm	9,700			

PC240LC, PC240NLC-8

	Check item	Unit	PC240LC-8	PC240NLC-8
A	Max. digging reach	mm	10,180	
B	Max. digging depth	mm	6,920	
C	Max. digging height	mm	10,000	
D	Max. vertical wall digging depth	mm	6,010	
E	Max. dumping height	mm	7,035	
F	Min. dumping height	mm	2,530	
G	Max. reach at ground level	mm	10,020	

Specifications

PC210, PC210LC, PC210NLC, PC230NHD-8

Machine model				PC210-8	PC210LC-8	PC210NLC-8	PC230NHD-8
Serial number				K50001 and up			
Bucket mass			kg	900			
Operating weight			kg	21,390	22,260	21,830	22,820
Performance	Working range	Max. digging depth	mm	6,620			
		Max. vertical wall digging depth	mm	5,980			
		Max. digging radius	mm	9,875			
		Max. reach at ground level	mm	9,700			
		Max. digging height	mm	10,000			
		Max. dumping height	mm	7,110			
	Max. digging force (when power max. function is turned on)		kN {kg}	138.3 {14,100} (149.1 {15,200})			
	Swing speed		rpm	12.4			
	Swing operation max. slope angle		degree	25			
	Travel speed		km/h	Lo: 3.0 Mi: 4.1 Hi: 5.5			Lo: 2.6 Mi: 3.6 Hi: 5.4
	Gradability		degree	35			
	Ground pressure (Standard shoe)		kPa {kg/cm^2}	49 (0.50)	39.2 (0.40)	53.9 (0.55)	54.9 (0.56)
Dimensions	Overall length		mm	9,425			
	Overall width		mm	2,500			
	Overall crawler width		mm	2,800	3,080	2,540	
	Overall height (During transportation) (*)		mm	2,970			3,190
	Machine body overall height (*)		mm	3,035			3,060
	Ground clearance of upper structure bottom		mm	1,100			1,125
	Min. ground clearance		mm	440			
	Tail swing radius		mm	2,800			
	Work equipment min. swing radius		mm	3,040			
	Top height at min. swing radius of work equipment		mm	8,005			
	Length of track on ground		mm	3,270	3,655		3,460
	Track gauge		mm	2,200	2,380	2,040	1,990
	Cab height		mm	2,390			
	Width of standard shoe		mm	600	700	500	550

*: Grouser height (26 mm) included.

Note - Operating weights and overall heights in table above are calculated with 2.9M arm fitted to PC210 and 2.4M arm fitted to PC230.

Machine model				PC210-8	PC210LC-8	PC210NLC-8	PC230NHD-8
Serial number				K50001 and up			
Engine	Model			SAA6D107E-1			
	Type			4-cycle, water-cooled in-line, direct injection with turbocharger and air-cooled aftercooler			
	Number of cylinders – bore x stroke		mm	6 – 107 x 124			
	Piston displacement		ℓ {cc}	6.69 {6,690}			
	Performance	Rated pressure	kW/rpm {HP/rpm}	110/2,000 {148/2,000}			
		Max. torque	Nm/rpm {kgm/rpm}	609/1,500 {62.1/1,500}			
		High idle under no load	rpm	2,060			
		Low idle under no load	rpm	1,050			
		Min. fuel consumption ratio	g/kWh{g/HPh}	215 {155}			
	Starting motor			24 V,5.5 kW			
	Alternator			24 V, 60 A			
	Battery			12 V, 143 Ah x 2			
	Radiator type			Aluminum wave 4 rows			
Undercarriage	Carrier roller			2 on one side			
	Track roller			7 on one side	9 on one side		8 on one side
	Track shoe			Assembly-type triple grouser 45 on one side	Assembly-type triple grouser 49 on one side		Assembly-type triple grouser 47 on one side
Hydraulic system	Hydraulic pump	Type and numbers		HPV112+112, Variable displacement piston type: 2			
		Delivery	ℓ/min	Piston: 219.5 x 2			
		Set pressure	MPa {kg/cm^2}	Piston: 37.2 {380}			
	Control valve	Type and number		7-spool type: 1			
		Operating method		Hydraulic			
	Hydraulic motor	Travel motor		HMV110ADT-2, piston type: 2 (with brake valve and parking brake)			
		Swing motor		KMF125ABE-6, piston type: 1 (with safety valve and parking brake)			
	Hydraulic cylinder			Boom (*1)	Arm (*1) (*2)	Bucket (std)	Bucket (large)
		Type		Double acting piston			
		Cylinder inner diameter	mm	120	135	115	125
		Piston rod diameter	mm	85	95	80	85
		Stroke	mm	1,334.5	1,490	1,120	1,110
		Max. pin-to-pin distance	mm	3,204.5	3,565	2,800	2,801
		Min. pin-to-pin distance	mm	1,870	2,075	1,680	1,691
	Hydraulic tank			Closed type			
	Hydraulic oil filter			Tank return side			
	Hydraulic oil cooler			CF40-1 (Air-cooling type)			

*1: Cushion is provided on the head side
*2: Cushion is provided on the bottom side

PC240LC, PC240NLC-8

Machine model				PC240LC-8	PC240NLC-8
Serial number				K50001 and up	
Bucket capacity			kg	1070	
Operating weight			kg	26,290	25,290
Performance	Working range	Max. digging depth	mm	6,920	
		Max. vertical wall digging depth	mm	6,010	
		Max. digging radius	mm	10,180	
		Max. reach at ground level	mm	10,020	
		Max. digging height	mm	10,000	
		Max. dumping height	mm	7,035	
	Max. digging force (when power max. function is turned on)		kN {kg}	158.9 {16,200} (171.6 {17,500})	
	Swing speed		rpm	11.7	
	Swing operation max. slope angle		degree	25	
	Travel speed		km/h	Lo: 3.0 Mi: 4.1 Hi: 5.5	
	Gradability		degree	35	
	Ground pressure (Standard shoe)		kPa {kg/cm^2}	44.1 {0.45}	52.0 {0.53}
Dimensions	Overall length		mm	9,885	
	Overall width (upper structure)		mm	2,710	
	Overall crawler width		mm	3,280	2,980
	Overall height (during transportation)(*)		mm	3,160	
	Machine body overall height (*)		mm	3,055	
	Ground clearance of upper structure bottom		mm	1,100	
	Min. ground clearance		mm	440	
	Tail swing radius		mm	2,940	
	Work equipment min. swing radius		mm	3,450	
	Top height at min. swing radius of work equipment		mm	8,110	
	Length of track on ground		mm	3,845	3,655
	Track gauge		mm	2,580	2,380
	Cab height		mm	2,405	
	Width of standard shoe		mm	700	600

*: Grouser height (26 mm) included.

Note - Operating weights and overall heights in table above are calculated with 3.0M arm fitted to PC240.

Machine model				PC240LC-8		PC240NLC-8	
Serial number				K50001 and up			
Engine	Model			SAA6D107E-1			
	Type			4-cycle, water-cooled in-line, direct injection with turbocharger and air cooled aftercooler			
	Number of cylinders – bore x stroke		mm	6 – 107 x 124			
	Piston displacement		ℓ {cc}	6.69 {6,690}			
	Performance	Rated pressure	kW/rpm {HP/rpm}	125/2,000 {168/2,000}			
		Max. torque	Nm/rpm {kgm/rpm}	686/1,500 {70/1,500}			
		High idle under no load	rpm	2,160			
		Low idle under no load	rpm	1,060			
		Min. fuel consumption ratio	g/kWh{g/HPh}	215 {153}			
	Starting motor			24 V, 5.5 kW			
	Alternator			24 V, 60 A			
	Battery			12 V, 143 Ah x 2			
	Radiator type			Aluminium wave 4 rows			
Undercarriage	Carrier roller			2 on one side			
	Track roller			10 on one side		9 on one side	
	Track shoe			Assembly-type triple grosser 51 on one side		Assembly-type triple grosser 49 on one side	
Hydraulic system	Hydraulic pump	Type and number		HPV95+95, Variable displacement piston type: 2			
		Delivery	ℓ/min	Piston: 219.5 x 2			
		Set pressure	MPa {kg/cm^2}	Piston: 37.2 {380}			
	Control valve	Type and number		7-spool type: 1			
		Operating method		Hydraulic			
	Hydraulic motor	Travel motor		HMV110ADT-3, piston type: 2 (with brake valve and parking brake)			
		Swing motor		KMF125ABE-6, piston type: 1 (with safety valve and parking brake)			
	Hydraulic cylinder	Type		Boom (*1)	Arm (*1), (*2)	Bucket (std)	Bucket (large)
				Double acting piston	Double acting piston	Double acting piston	Double acting piston
		Cylinder inner diameter	mm	130	140	130	140
		Piston rod diameter	mm	90	100	90	100
		Stroke	mm	1,335	1,635	1,020	1,009
		Max. pin-to-pin distance	mm	3,205	2,235	2,625	2,626
		Min. pin-to-pin distance	mm	1,870	3,870	1,605	1,617
	Hydraulic tank			Box-shaped, closed type			
	Hydraulic oil filter			Tank return side			
	Hydraulic oil cooler			CF40-1 (Air-cooling type)			

*1: Cushion is provided on the head side
*2: Cushion is provided on the bottom side

Weight table

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

PC210, PC210LC, PC210NLC, PC230NHD-8

Unit: kg

Machine model	PC210-8	PC210LC-8	PC210NLC-8	PC230NHD-8
Serial number	K50001 and up			
Engine assembly	743			
• Engine	575			
• Damper	6			
• Hydraulic pump	162			
Radiator and oil cooler assembly	115			
Hydraulic tank and filter assembly (Not including hyd oil)	123			
Fuel tank assembly (Not including fuel)	122			
Revolving frame	1,886			
Cab	480			
Operator's seat	35			
Counterweight	4,000		4,300	
Swing machinery	174			
Control valve	235			
Swing motor	51.5			
Travel motor	93 x 2			
Center swivel joint	36			
Track frame assembly (Not including piping)	4,217	4,729	4,628	5,139
• Track frame	2,280	2,648	2,547	2,734
• Swing circle	273			
• Idler and cushion assembly	230 x 2			280 x 2
• Carrier roller	14 x 4			
• Track roller	36 x 14	36 x 18		49.5 x 16
• Final drive (including travel motor)	322 x 2			362 x 2
Track shoe assembly				
• Standard triple shoe (600 mm)	1,305 x 2	1,420 x 2	1,420 x 2	–
• Standard triple shoe (700 mm)	1,430 x 2	1,535 x 2	1,555 x 2	–
• Wide triple shoe (800 mm)	1,576 x 2	1,716 x 2	–	–
• Standard triple shoe (500 mm)	–	–	1,240 x 2	–
• Standard triple shoe (900 mm)	–	1,856 x 2	–	–
• Standard triple shoe (550 mm)	–	–	–	1,507 x 2

Unit: kg

Machine model	PC210-8	PC210LC-8	PC210NLC-8	PC230NHD-8
Serial number	K50001 and up			
Boom assembly	1,393			
Arm assembly (2.9M)	791			
Bucket assembly	900			
Boom cylinder assembly	173 x 2			
Arm cylinder assembly	223			
Bucket cylinder assembly (std)	133			
Bucket cylinder assembly (large)	159			
Link (large) assembly	83			
Link (small) assembly	22 x 2			
Boom pin	42 + 8 x 2 + 28 + 10 + 26			
Arm pin	12 +8			
Bucket pin	20 x 2			
Link pin	13 x 2			

PC240LC, PC240NLC-8

Unit: kg

Machine model	PC240LC-8	PC240NLC-8
Serial number	K50001 and up	
Engine assembly	733	
• Engine	575	
• Damper	6	
• Hydraulic pump	152	
Radiator and oil cooler assembly	115	
Hydraulic tank and filter assembly (Not including hydraulic oil)	123	
Fuel tank assembly (Not including fuel)	134	
Revolving frame	2,023	
Cab	480	
Operator's seat	35	
Counterweight	5,250	
Swing machinery	218	
Control valve	235	
Swing motor	51.5	
Travel motor	93 x 2	
Center swivel joint	36	
Track frame assembly (Not including piping)	5,302	4,829
• Track frame	3,049	2,648
• Swing circle	293	
• Idler	101 x 2	
• Idler cushion	129 x 2	
• Carrier roller	14 x 4	
• Track roller	36 x 20	36 x 18
• Final drive (including travel motor)	362 x 2	
Track shoe assembly	–	–
• Standard triple shoe (600 mm)	1,475 x 2	1,420
• Standard triple shoe (700 mm)	1,620 x 2	1,555 x 2
• Wide triple shoe (800 mm)	1,786 x 2	1,716
• Stadard triple shoe (900 mm)	1,931 x 2	–

Unit: kg

Machine model	PC240LC-8	PC240NLC-8
Serial number	K50001 and up	
Boom assembly	1,273	
Arm assembly (3.0M)	947	
Bucket assembly	1,070	
Boom cylinder assembly	200 x 2	
Arm cylinder assembly	265	
Bucket cylinder assembly (std)	160	
Bucket cylinder assembly (large)	190	
Link (large) assembly	83	
Link (small) assembly	22 x 2	
Boom pin	51 + 10 x 2 + 31 + 10 + 26	
Arm pin	12 + 10	
Bucket pin	20 x 2	
Link pin	17 x 2	

Table of fuel, coolant and lubricants

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

Reservoir	Fluid type	AMBIENT TEMPERATURE		Recommended komatsu Fluids
		Min	Max	
Engine oil pan	Engine oil	-30°C	30°C	Komatsu EOS0W30
		-25°C	40°C	Komatsu EOS5W40
		-20°C	40°C	Komatsu EO10W30DH
		-15°C	50°C	Komatsu EO15W40DH
		0°C	40°C	Komatsu EO30DH
Swing machinery case Final drive case Damper case	Power train oil (Note. 2)	-30°C	50°C	TO30
Hydraulic system	Power train oil	-20° C	50° C	TO10
	Hydraulic oil	-20° C	50° C	HO46-HM
Grease fitting	Hyper grease (Note. 3)	-20° C	50° C	G2-TE
	Lithium EP grease	-20° C	50° C	G2-LI
Cooling system	Supercoolant AF-NAC	-30°C	50°C	AF-NAC (Note. 4)
Fuel tank	Diesel fuel	0° C	50° C	ASTM No. 2-D (Grade low sulphur)
		-30° C	20° C	ASTM No. 1-D (Grade low sulphur)

		Engine oil pan	Swing machinery case	Final drive case (each)	Damper case	Hydraulic system	Fuel tank	Cooling system
Specified capacity	litre	25.4	7.1 (PC210/230) 8.2 (PC240)	3.5 (PC210) 5.4 (PC230/240)	0.65	234 (PC210/230) 239 (PC240)	325 400	21.0 (PC210/230) 20.4 (PC240)
Refill capacity	litre	23.1	7.1 (PC210/230) 8.2 (PC240)	3.3 (PC210) 5.2 (PC230/240)	-	135	-	-

PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00095-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

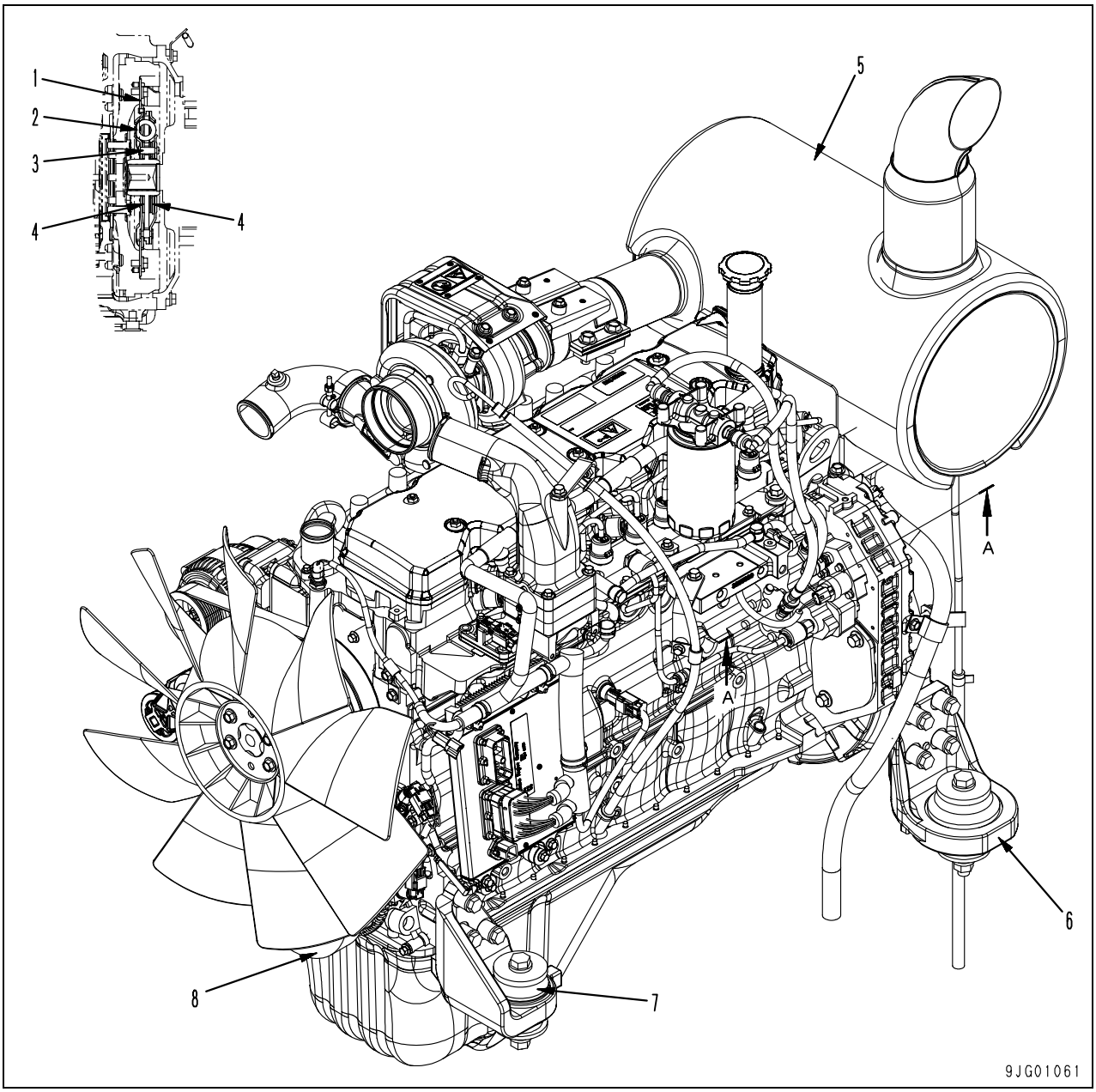
Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

10 Structure, function and maintenance standard

Engine and cooling system

Engine and cooling system

Engine related parts

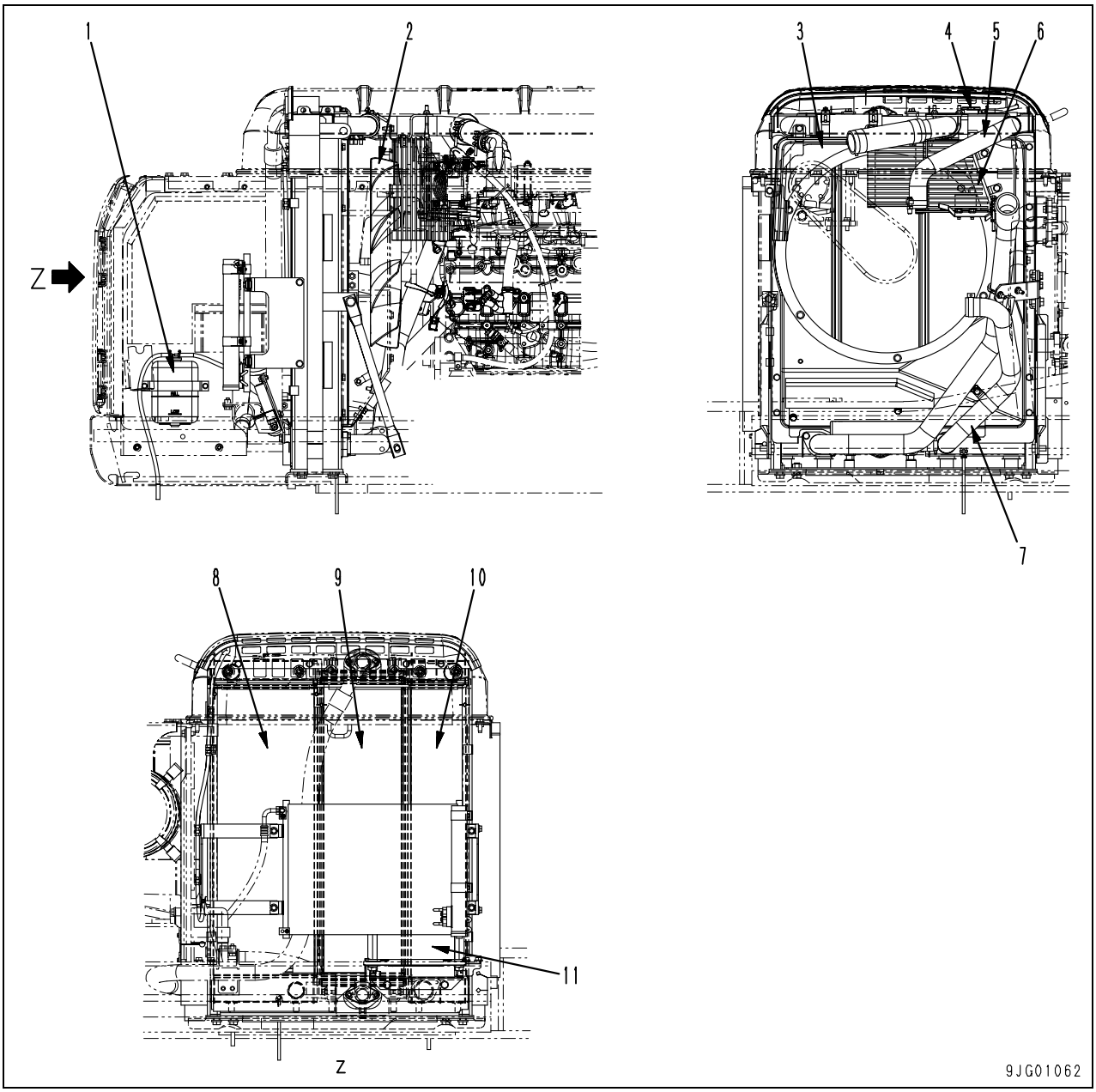


1. Drive plate
2. Torsion spring
3. Stopper pin
4. Friction plate
5. Muffler
6. Rear engine mount
7. Front engine mount
8. Damper assembly

Outline

A damper assembly is wet type.
Oil capacity: 0.65 ℓ

Radiator, oil cooler, aftercooler and fuel cooler



1. Reservoir tank
2. Fan
3. Shroud
4. Radiator cap
5. Radiator inlet hose
6. Net
7. Radiator outlet hose
8. Radiator
9. Oil cooler
10. Aftercooler
11. Fuel cooler

Specifications

Radiator : Aluminum wave type, 4th row
Oil cooler : CF40-1
Aftercooler : Aluminum wave type
Fuel cooler : Drawn cup type

PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00096-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

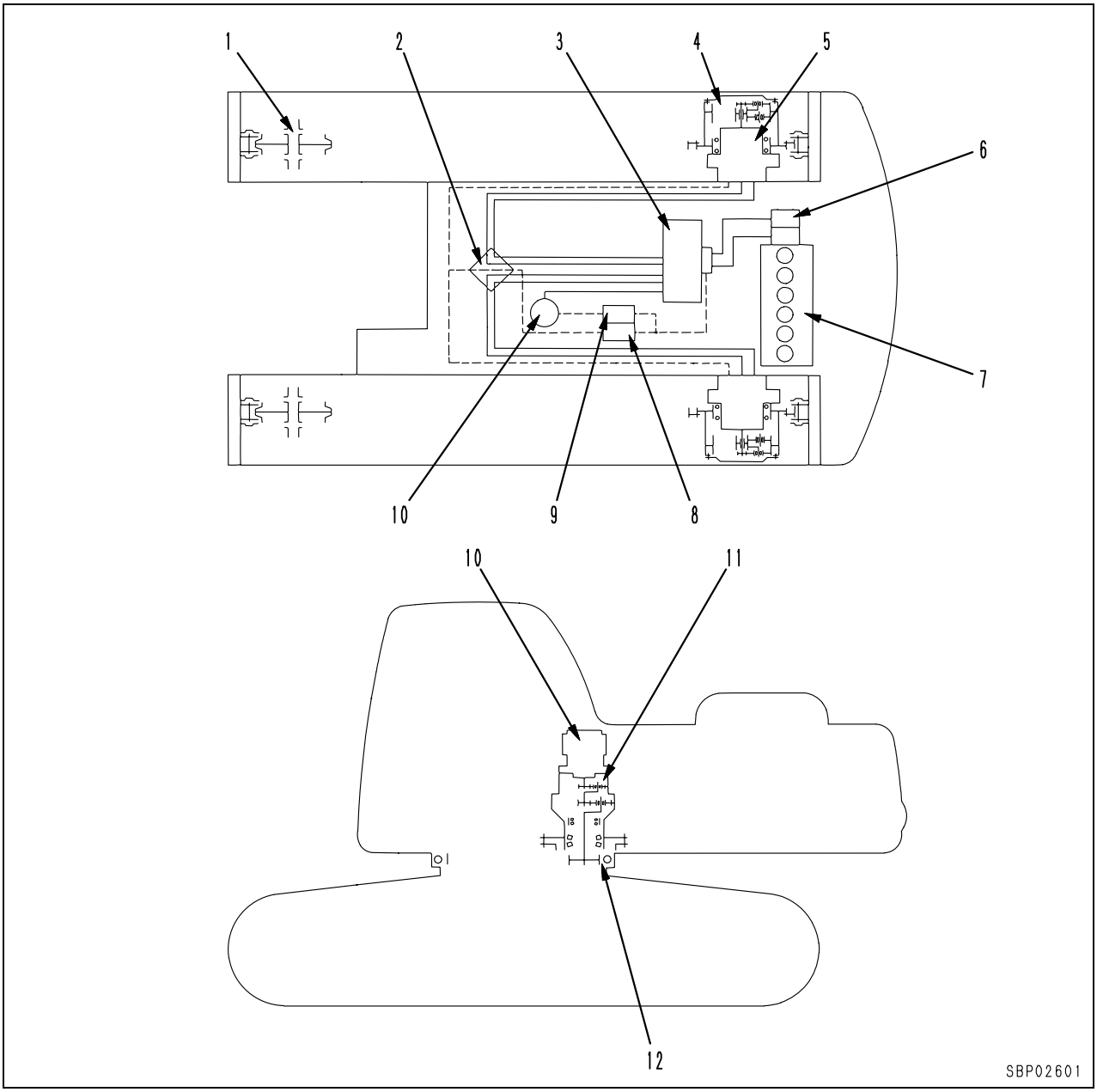
Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

10 Structure, function and maintenance standard

Power train

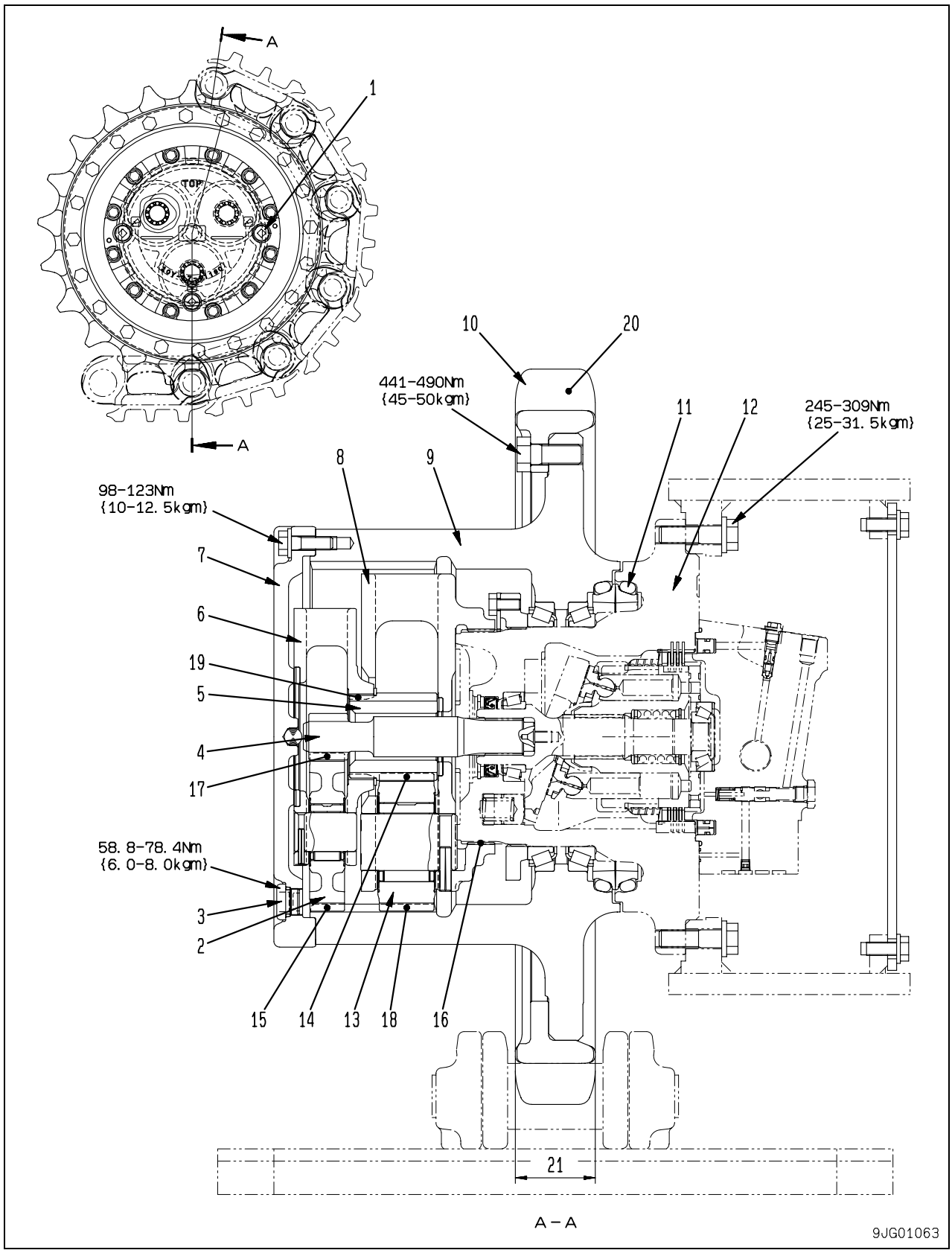
Power train

Power train



1. Idler
2. Center swivel joint
3. Control valve
4. Final drive
5. Travel motor (HMV110ADT-2)
6. Hydraulic pump
   PC210 / 230 (HPV112 + 112) - PC240 (HPV95 + 95)
7. Engine (SAA6D107E-1)
8. Travel speed solenoid valve
9. Swing brake solenoid valve
10. Swing motor (KMF125ABE-6)
11. Swing machinery
12. Swing circle

Final drive


A
1
TOP
A
10
20
441-490Nm
{45-50kgm}
11
12
245-309Nm
{25-31.5kgm}
8
9
98-123Nm
{10-12.5kgm}
7
6
19
5
4
17
58.8-78.4Nm
{6.0-8.0kgm}
3
2
15
14
13
18
16
21
A-A
9JG01063

1. Level plug
2. No. 1 planetary gear (No. of teeth: 42)
3. Drain plug
4. No. 1 sun gear (No. of teeth: 10)
5. No. 2 sun gear (No. of teeth: 21)
6. No. 1 planetary carrier
7. Cover
8. No. 2 planetary carrier
9. Gear hub (No. of teeth: 95)
10. Sprocket
11. Floating seal
12. Travel motor
13. No. 2 planetary gear (No. of teeth: 36)

Specifications

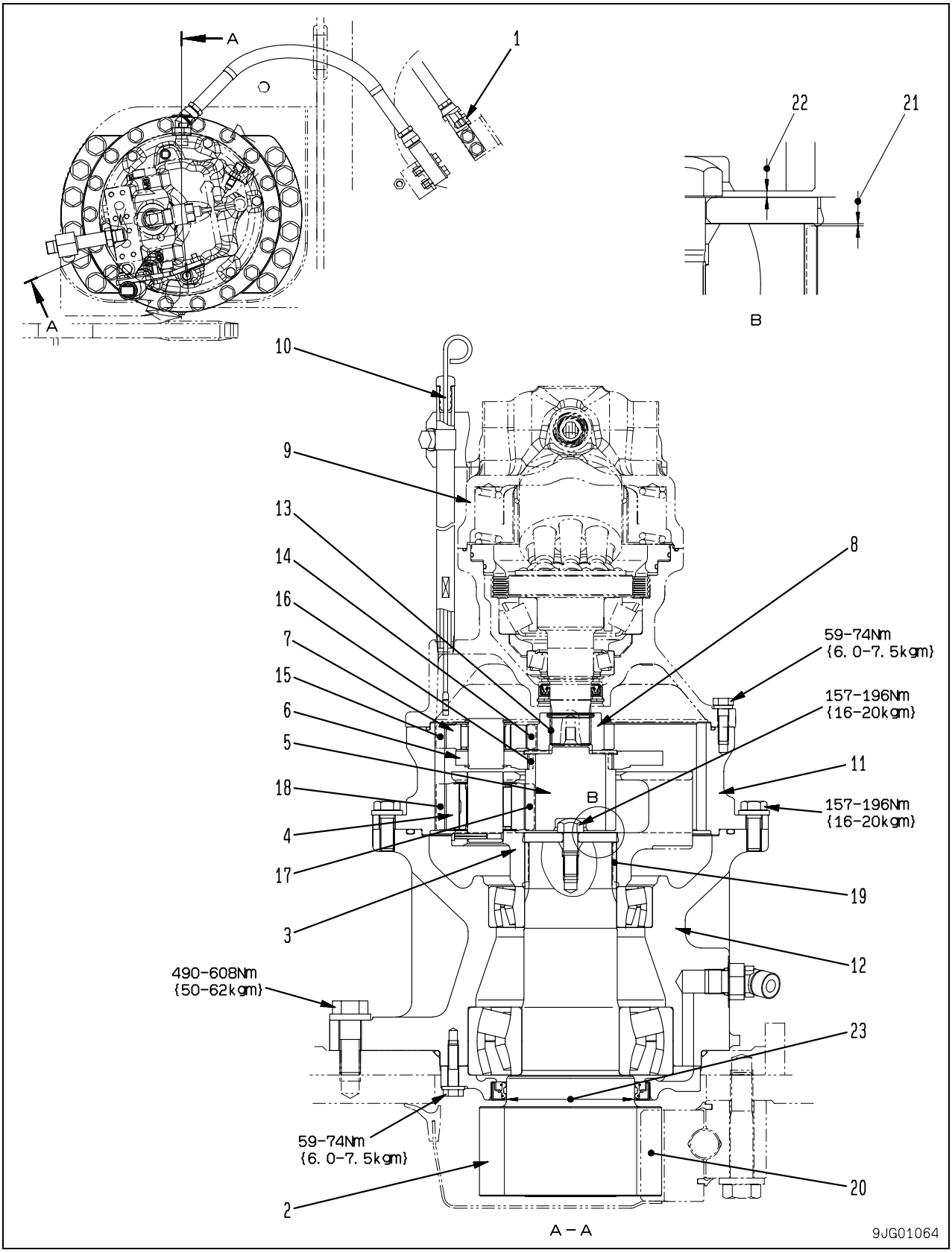
Reduction ratio: – ((10 + 95)/10) x ((21 + 95)/21) + 1 = –57.000

Unit: mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="2">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">14</td><td rowspan="2">Backlash between No. 2 sun gear and No.2 planetary gear</td><td>Standard clearance</td><td>Clearance limit</td><td rowspan="7">Replace</td></tr>
<tr><td>0.13 – 0.47</td><td>1.00</td></tr>
<tr><td>15</td><td>Backlash between No. 1 planetary gear and gear hub</td><td>0.17 – 0.57</td><td>1.10</td></tr>
<tr><td>16</td><td>Backlash between No. 2 planetary carrier and motor</td><td>0.06 – 0.25</td><td>—</td></tr>
<tr><td>17</td><td>Backlash between No. 1 sun gear and No.1 planetary gear</td><td>0.14 – 0.46</td><td>1.00</td></tr>
<tr><td>18</td><td>Backlash between No. 2 planetary gear and gear hub</td><td>0.16 – 0.56</td><td>1.10</td></tr>
<tr><td>19</td><td>Backlash between No. 1 planetary carrier and No. 2 sun gear</td><td>0.38 – 0.66</td><td>1.00</td></tr>
<tr><td>20</td><td>Amount of wear on sprocket tooth</td><td colspan="2">Repair limit: 6</td><td rowspan="3">Build-up welding or replace</td></tr>
<tr><td rowspan="2">21</td><td rowspan="2">Width of sprocket tooth</td><td>Standard size</td><td>Repair limit</td></tr>
<tr><td>71</td><td>68</td></tr>
</table>

Swing machinery

PC210-8, PC210LC, 210NLC, PC230NHD-8



1. Drain plug
2. Swing pinion (No. of teeth: 13)
3. No. 2 planetary carrier
4. No. 2 planetary gear
5. No. 2 sun gear
6. No. 1 planetary carrier
7. No. 1 planetary gear
8. No. 1 sun gear
9. Swing motor
10. Oil level gauge
11. Ring gear
12. Case

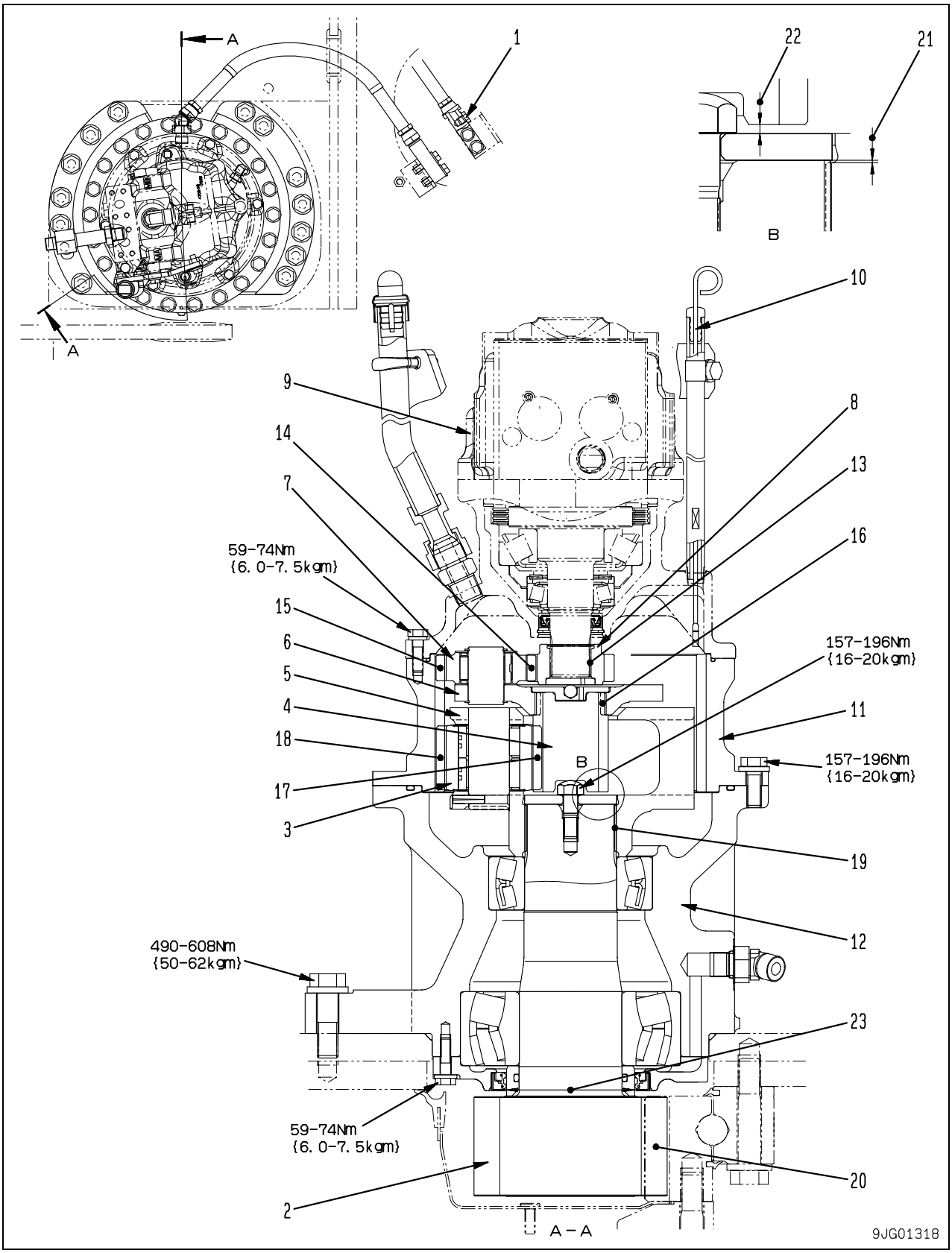
Specifications

Reduction ratio: ((17 + 58)/17) x ((18 + 58)/18) = 18.627

Unit: mm

No.	Check item	Criteria		Remedy
13	Backlash between swing motor shaft and No. 1 sun gear	Standard clearance	Clearance limit	Replace
		0.18 – 0.28	—	
14	Backlash between No. 1 sun gear and No.1 planetary gear	0.16 – 0.50	1.00	
15	Backlash between No. 1 planetary gear and ring gear	0.18 – 0.59	1.10	
16	Backlash between No. 1 planetary carrier and No. 2 sun gear	0.39 – 0.71	1.20	
17	Backlash between No. 2 sun gear and No.2 planetary gear	0.16 – 0.50	0.90	
18	Backlash between No. 2 planetary gear and ring gear	0.18 – 0.59	1.00	
19	Backlash between No. 2 planetary carrier and swing pinion	0.07 – 0.23	—	
20	Backlash between swing pinion and swing circle	0.22 – 1.32	2.00	
21	Clearance between plate and No. 2 planetary carrier	0.66 – 1.14	—	
22	Clearance between No. 2 sun gear and plate	1.66 – 2.94	—	
23	Wear of swing pinion surface contacting with oil seal	Standard size	Repair limit	Apply hard chrome plating or replace
		ø125 (0/ – 0.100)	—	

PC240LC, PC240NLC-8



1. Drain plug
2. Swing pinion (No. of teeth: 13)
3. No. 2 planetary gear
4. No. 2 sun gear
5. No. 2 planetary carrier
6. No. 1 planetary carrier
7. No. 1 planetary gear
8. No. 1 sun gear
9. Swing motor
10. Oil level gauge
11. Ring gear
12. Case

Specifications

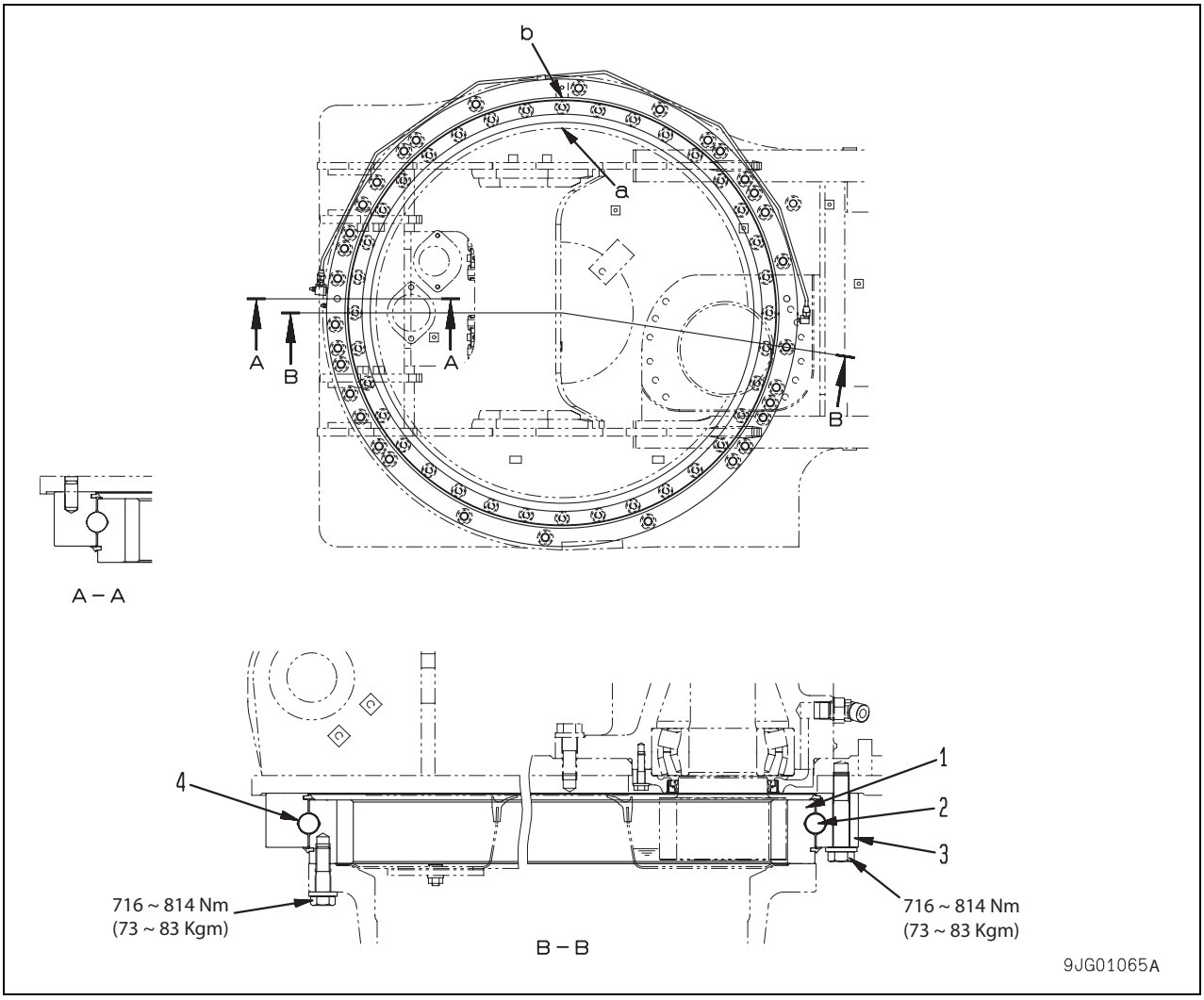
Reduction ratio: ((17 + 58)/17) x ((14 + 58)/14) = 22.689

Unit: mm

No.	Check item	Criteria		Remedy
13	Backlash between swing motor shaft and No. 1 sun gear	Standard clearance	Clearance limit	Replace
		0.18 – 0.28	—	
14	Backlash between No. 1 sun gear and No.1 planetary gear	0.16 – 0.50	1.00	
15	Backlash between No. 1 planetary gear and ring gear	0.18 – 0.59	1.10	
16	Backlash between No. 1 planetary carrier and No. 2 sun gear	0.35 – 0.64	1.20	
17	Backlash between No. 2 sun gear and No.2 planetary gear	0.12 – 0.44	0.90	
18	Backlash between No. 2 planetary gear and ring gear	0.16 – 0.56	1.00	
19	Backlash between No. 2 planetary carrier and swing pinion	0.08 – 0.23	—	
20	Backlash between swing pinion and swing circle	0.23 – 1.37	2.00	
21	Clearance between plate and No. 2 planetary carrier	0.58 – 1.62	—	
22	Clearance between No. 2 sun gear and plate	2.56 – 3.84	—	
23	Wear of swing pinion surface contacting with oil seal	Standard size	Repair limit	Apply hard chrome plating or replace
		125(0/ – 0.100)	—	

Swing circle

PC210, PC210LC, 210NLC, PC230NHD-8



1. Swing circle inner race (No. of teeth: 96)
2. Ball
3. Swing circle outer race

a. Inner race soft zone “S“ position
b. Outer race soft zone “S“ position

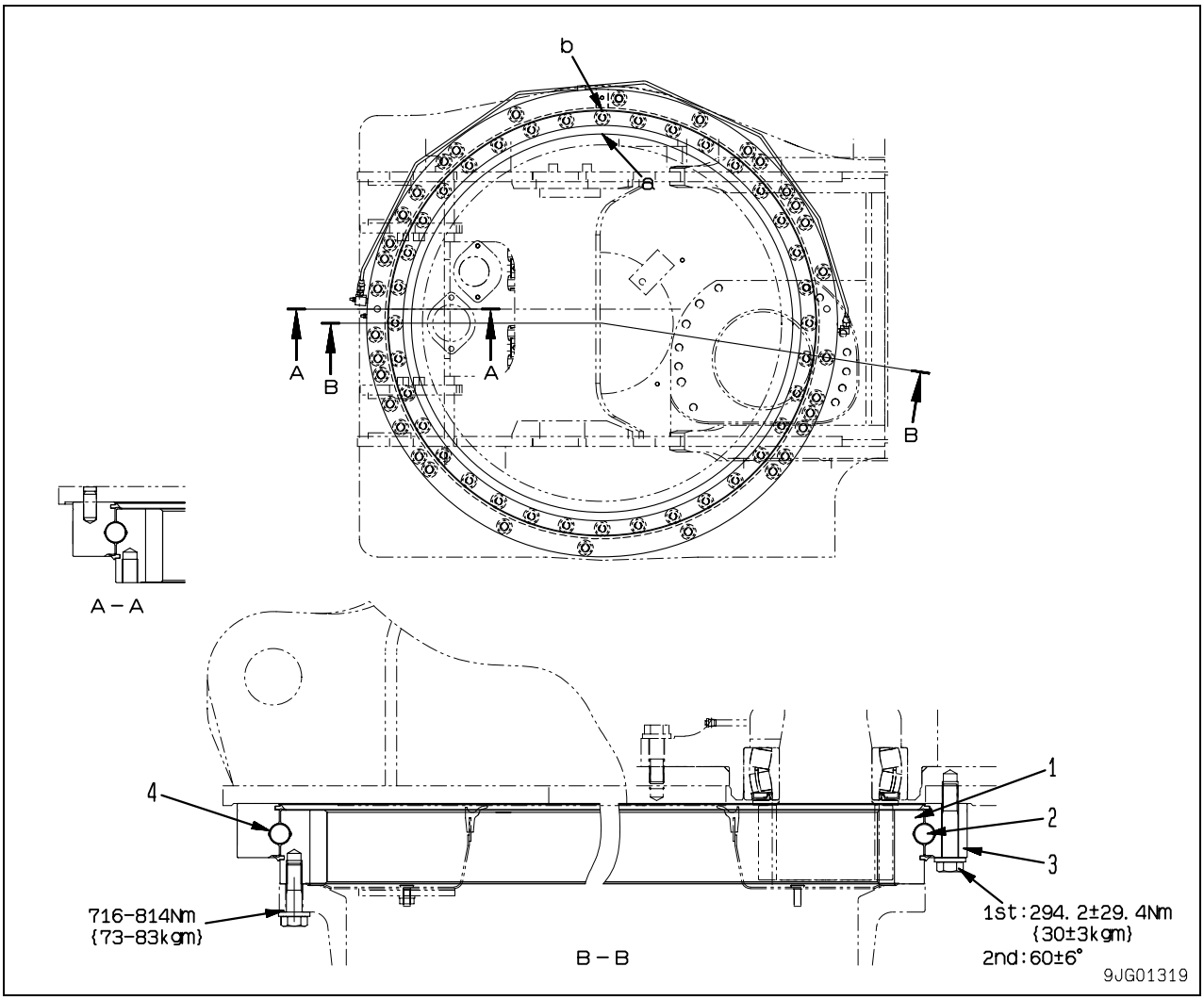
Specifications

Reduction ratio: –96/13 = –7.385
Amount of filled grease: 14.6 ℓ (G2-LI)

Unit: mm

No.	Check item	Criteria		Remedy
4	Axial clearance of bearing (when mounted on chassis)	Standard clearance	Clearance limit	Replace
		0.5 – 1.6	3.2	

PC240LC-8, PC240NLC-8



1. Swing circle inner race (No. of teeth: 92)
2. Ball
3. Swing circle outer race

a. Inner race soft zone “S“ position
b. Outer race soft zone “S“ position

Specifications

Reduction ratio: –92/13 = –7.077
Amount of filled grease: 15.8 ℓ (G2-LI)

Unit: mm

No.	Check Item	Criteria		Remedy
4	Axial clearance of bearing (when mounted on chassis)	Standard clearance	Clearance limit	Replace
		0.5 – 1.6	3.2	

PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00097-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

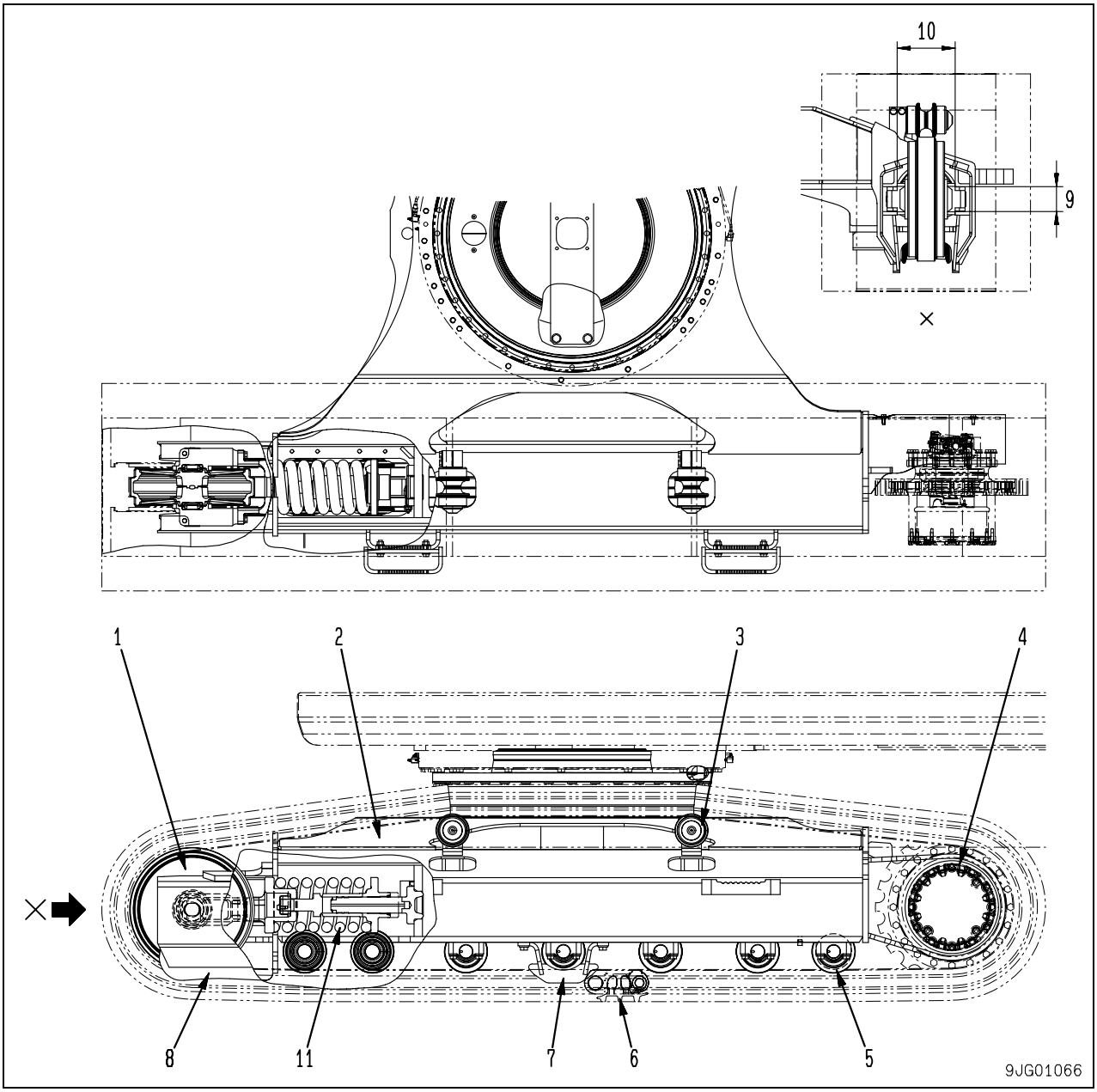
10 Structure, function and maintenance standard

Undercarriage and frame

Undercarriage and frame

Track frame and recoil spring

PC210/240-8



1. Idler
2. Track frame
3. Carrier roller
4. Final drive
5. Track roller
6. Track shoe
7. Center guard
8. Front guard

- The dimensions and the number of track rollers depend on the model, but the basic structure is not different.
- Number of track rollers

Model	Q'ty (One side)
PC210-8	7
PC210LC/NLC-8	9
PC240LC-8	10
PC240NLC-8	9

Standard shoe

Item \ Models	PC210-8	PC210LC-8	PC210NLC-8	PC240LC-8	PC240NLC-8
Shoe width (mm)	600	700	500	700	600
Link pitch (mm)	190	190	190	190	190
Q'ty (One side)	45	49	49	51	49

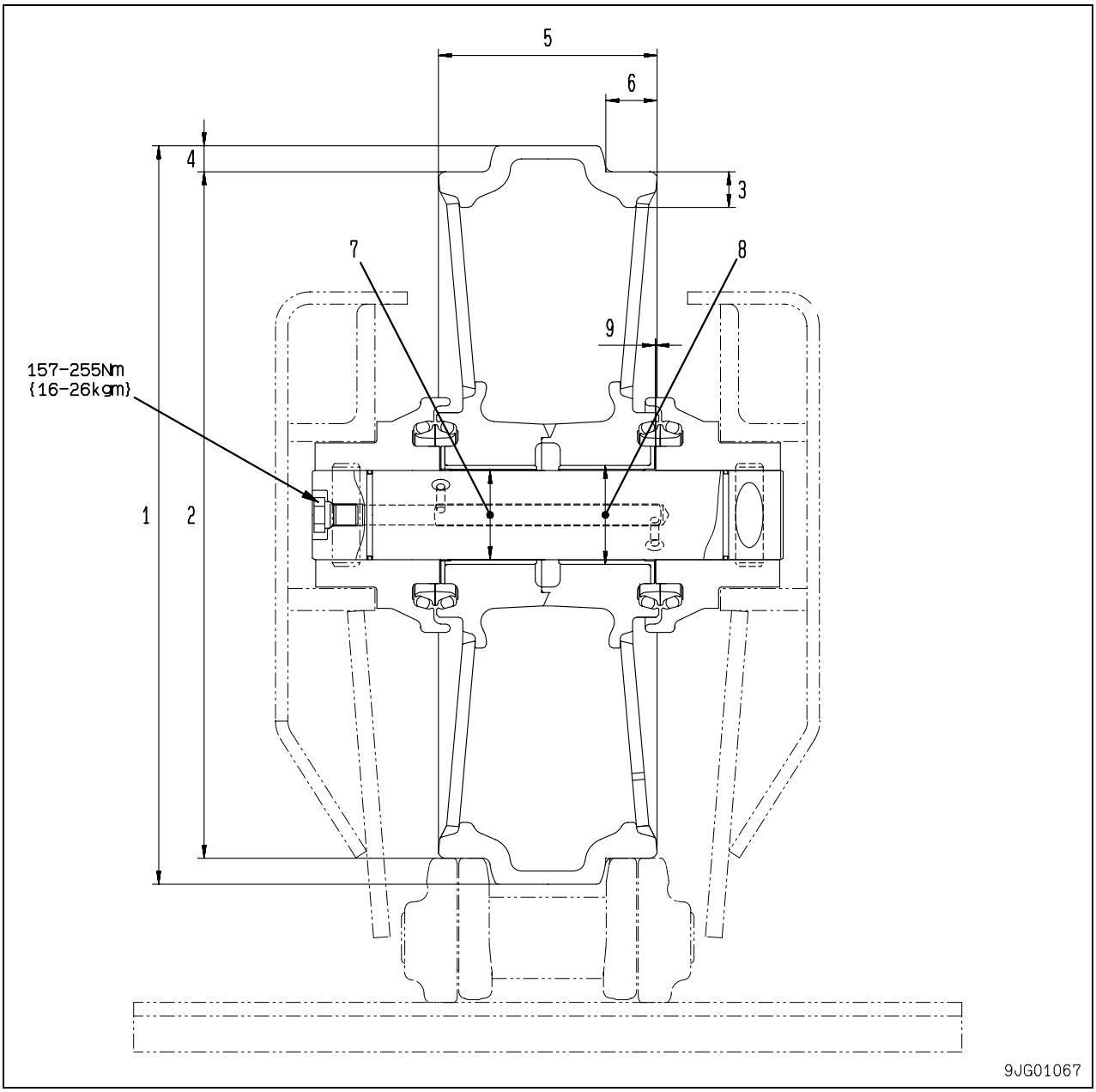
PC210/240-8

Unit: mm

No.	Check item		Criteria					Remedy
9	Vertical width of idler guide		Standard size	Tolerance	Repair limit			Build-up welding or replace
		Track frame	107	—	—			
		Idler support	105	—	—			
10	Horizontal width of idler guide	Track frame	250	—	—			
		Idler support	247.4	—	—			
11	Recoil spring		Standard size			Repair limit		Replace
			Free length x Outside diameter	Installation length	Installation load	Free length	Installation load	
			556 x 241	433	137.4 kN {14,010 kg}	528	109.9 kN {11,210 kg}	

Idler

PC210/240-8

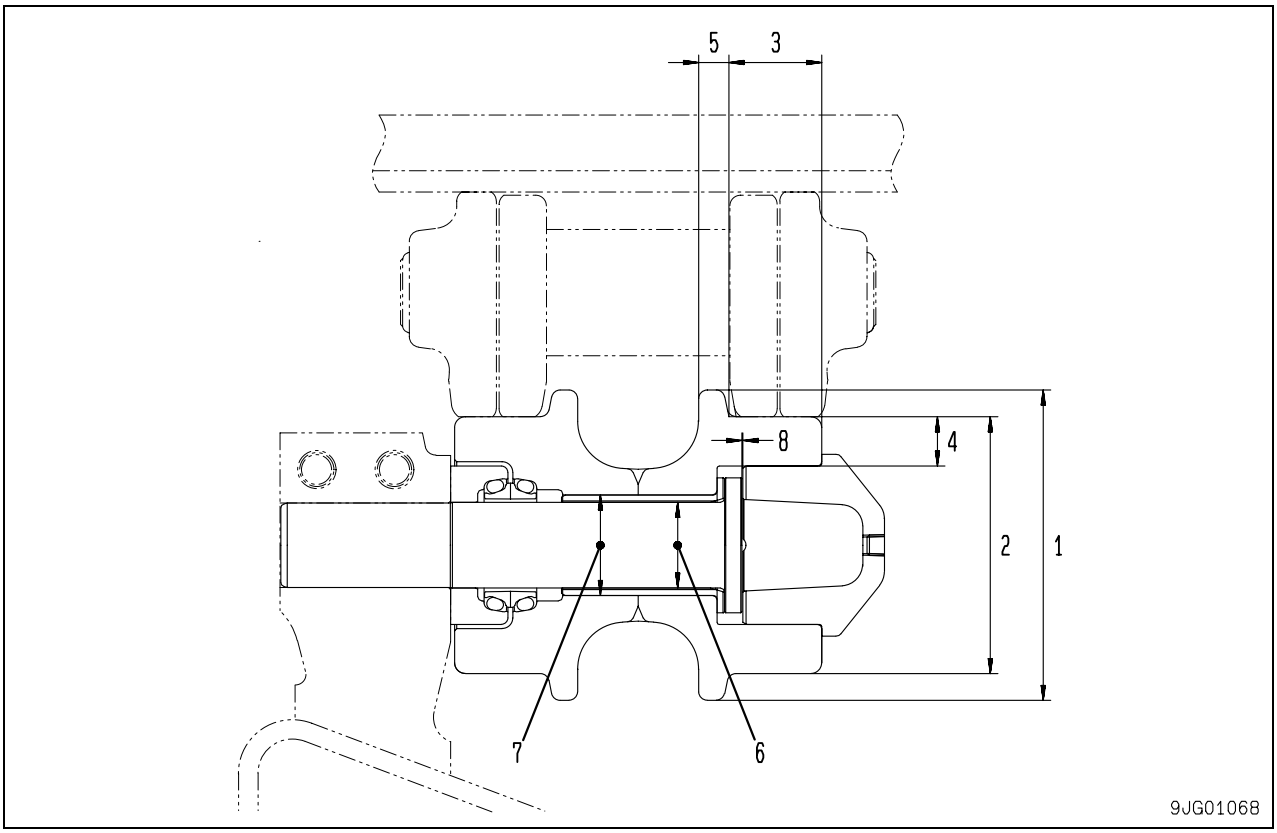


Unit: mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="6">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Outside diameter of protrusion</td><td colspan="3">Standard size</td><td colspan="2">Repair limit</td><td rowspan="6">Build-up welding or replace</td></tr>
<tr><td colspan="3">538</td><td colspan="2">—</td></tr>
<tr><td>2</td><td>Outside diameter of tread</td><td colspan="3">500</td><td colspan="2">488</td></tr>
<tr><td>3</td><td>Thickness of tread</td><td colspan="3">26</td><td colspan="2">20</td></tr>
<tr><td>4</td><td>Difference of tread</td><td colspan="3">19</td><td colspan="2">25</td></tr>
<tr><td>5</td><td>Total width</td><td colspan="3">159</td><td colspan="2">—</td></tr>
<tr><td>6</td><td>Width of tread</td><td colspan="3">37.5</td><td colspan="2">—</td></tr>
<tr><td rowspan="2">7</td><td rowspan="2">Clearance between shaft 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="5">Replace bushing</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>65</td><td>–0.250
–0.350</td><td>+0.164
–0.074</td><td>0.176 – 0.514</td><td>—</td></tr>
<tr><td rowspan="2">8</td><td rowspan="2">Interference between idler and bushing</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard interfer-ence</td><td rowspan="2">Interfer-ence limit</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>72</td><td>+0.108
+0.008</td><td>–0.032
–0.062</td><td>0.040 – 0.170</td><td>—</td></tr>
<tr><td rowspan="2">9</td><td rowspan="2">Clearance between bushing and support (Sum of clearance at both sides)</td><td colspan="3">Standard clearance</td><td colspan="2">Clearance limit</td></tr>
<tr><td colspan="3">0.5 – 1.0</td><td colspan="2">—</td></tr>
</table>

Carrier roller

PC210/240-8

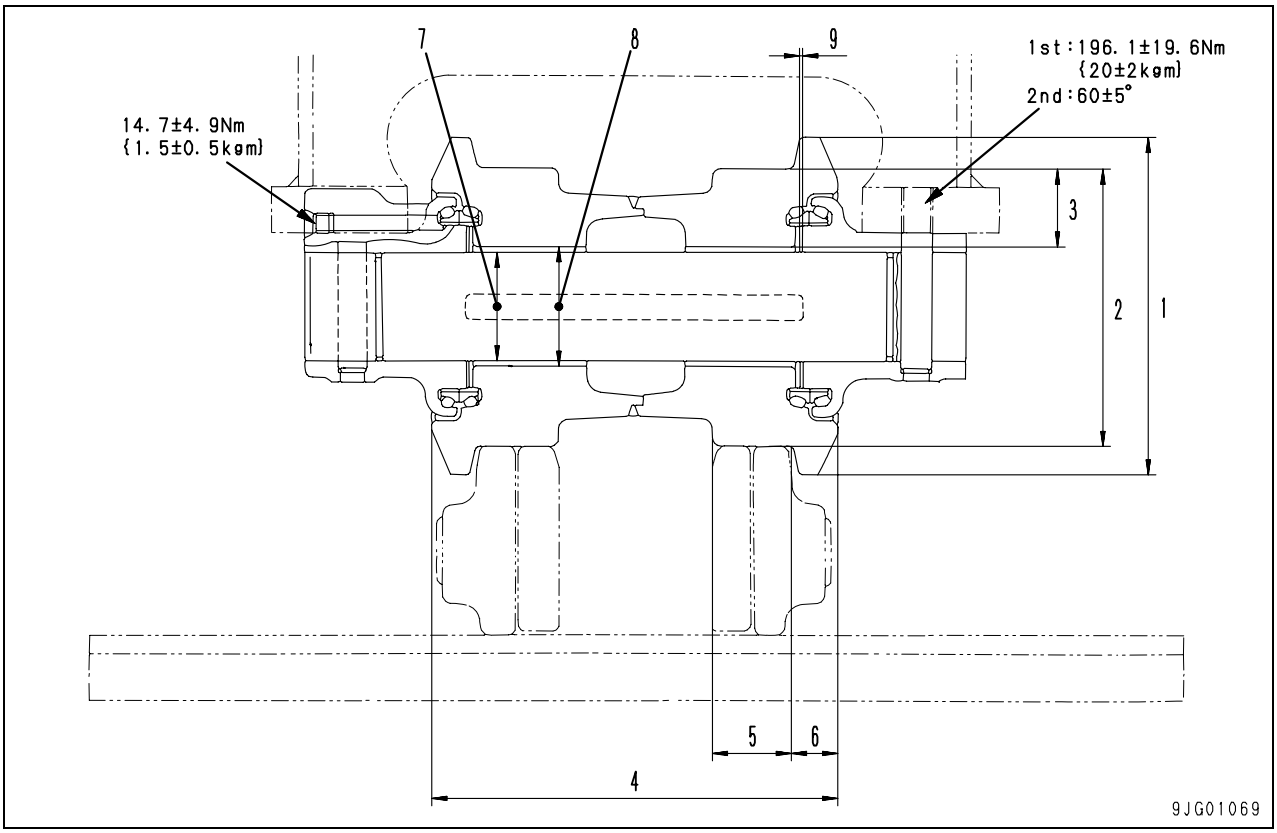


Unit: mm

No.	Check item	Criteria					Remedy
1	Outside diameter of flange	Standard size			Repair limit		Replace
		145			—		
2	Outside diameter of tread	120			106		
3	Width of tread	43			—		
4	Thickness of tread	23			16		
5	Width of flange	14			—		
6	Clearance between shaft and bushing	Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
		40	–0.170 –0.190	+0.301 +0.168	0.338 – 0.491	—	
7	Interference between roller and bushing	Standard size	Tolerance		Standard interfer-ence	Interfer-ence limit	
			Shaft	Hole			
		47	+0.061 +0.016	0 –0.040	0.016 – 0.101	—	
8	Axial clearance of roller	Standard clearance			Clearance limit		
		0.44 – 0.76			—		

Track roller

PC210/240-8

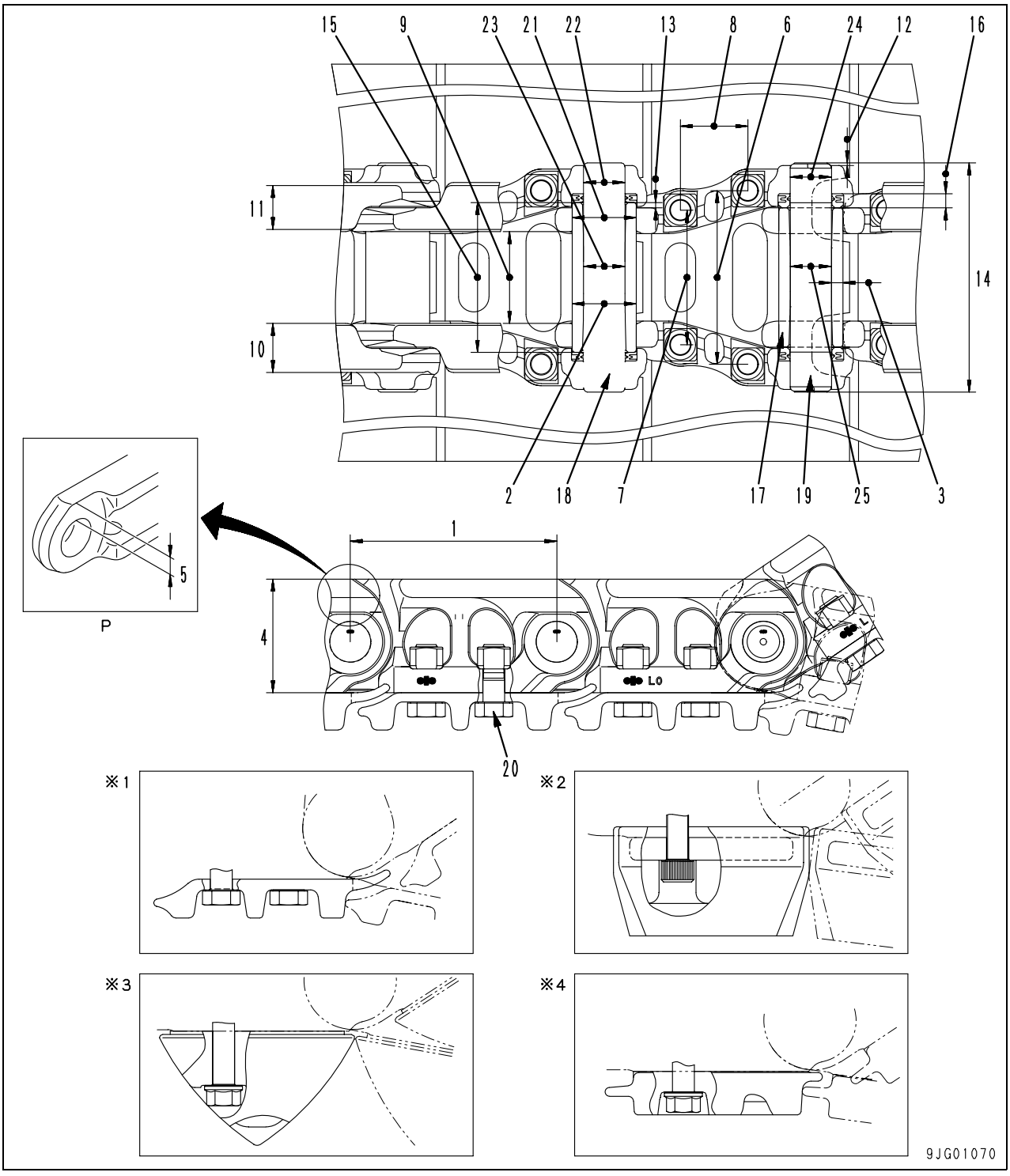


Unit: mm

No.	Check item	Criteria					Remedy
1	Outside diameter of flange	Standard size			Repair limit		Build-up welding or replace
		188			—		
2	Outside diameter of tread	156			144		
3	Thickness of tread	44.5			38.5		
4	Total width	225			—		
5	Width of tread	44.5			—		
6	Width of flange	25.5			—		
7	Clearance between shaft and bushing	Standard size	Tolerance		Standard clearance	Clearance limit	Replace bushing
			Shaft	Hole			
		60	–0.215 –0.315	+0.195 0	0.215 – 0.510	—	
8	Interference between roller and bushing	Standard size	Tolerance		Standard interfer-ence	Interfer-ence limit	
			Shaft	Hole			
		67	+0.153 +0.053	+0.030 0	0.023 – 0.153	—	
9	Clearance between bushing and collar (Sum of clearance at both sides)	Standard clearance			Clearance limit		Replace
		0.5 – 1.0			—		

Track shoe

PC210/240-8



★ P portion shows the link of bushing press fitting end.

※1. Triple grouser shoe
※2. Road liner
※3. Swamp shoe
※4. Flat shoe

Unit: mm

No.	Check item		Criteria		Remedy
1	Link pitch		Standard size	Repair limit	Reverse or replace
			190.3	193.3	
2	Outside diameter of bushing		Standard size	Reverse	
			59.3	54.3	
3	Thickness of bushing metal		10.4	5.4	
4	Link height		Standard size	Repair limit	Repair or replace
			105	97	
5	Thickness of link metal (bushing press-fitting portion)		28.5	20.5	
6	Shoe bolt pitch		160.4		Adjust or replace
7			124.4		
8			62		
9	Link	Inside width	84.8		
10		Overall width	45.4		
11		Tread width	39.6		
12	Protrusion of pin	Regular	2.5		
		Master	2.5		
13	Protrusion of bushing	Regular	4.85		
		Master	0.0		
14	Overall length of pin	Regular	212		
		Master	212		
15	Overall length of bushing	Regular	138.5		
		Master	128.7		
16	Thickness of spacer		—		
17	Press-fitting force	Bushing	88.2 – 245 kN{9 – 25 ton}		—
18		Regular pin	127.4 – 274.4 kN{13 – 28 ton}		
19 (*)		Master pin	78.4 – 147 kN{8 – 15 ton}		

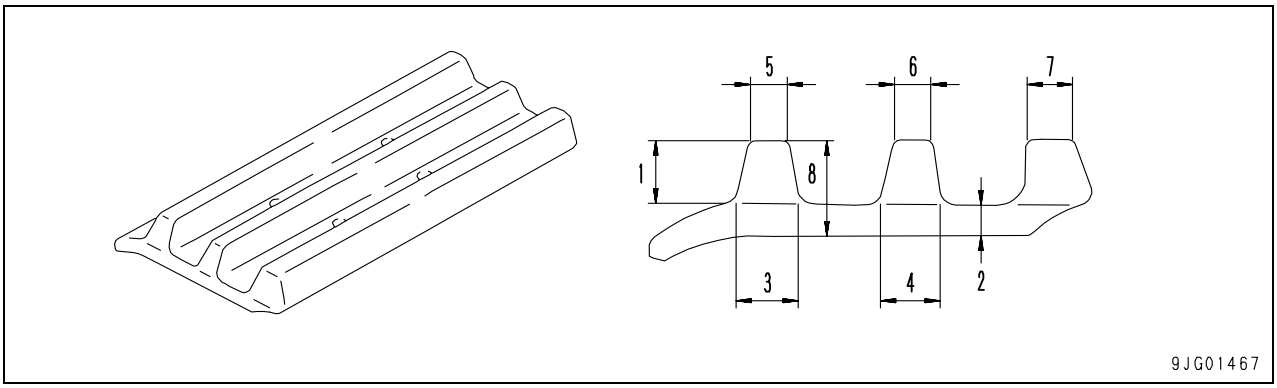
* Dry type track link

Unit: mm

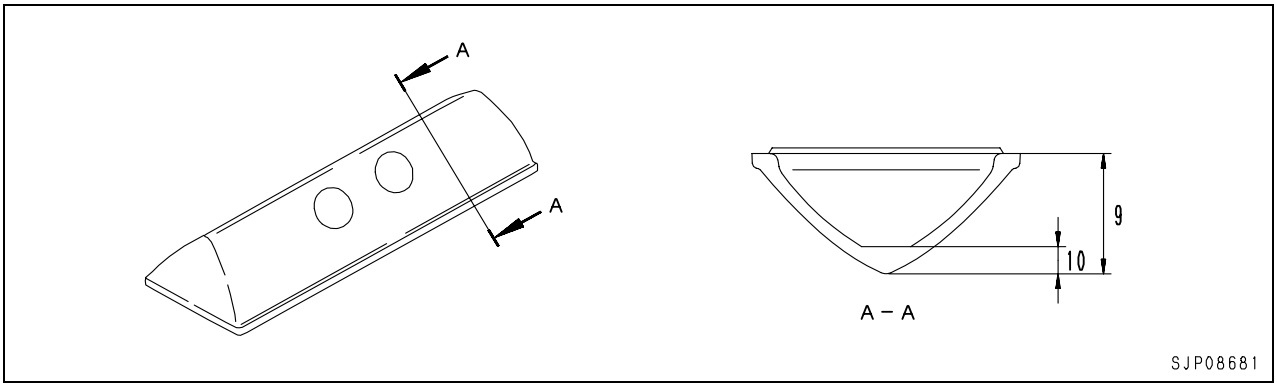
<table>
<tr><th>No.</th><th colspan="2">Check item</th><th colspan="5">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="5">20</td><td rowspan="5">Shoe bolt</td><td rowspan="3">a. Regular link</td><td colspan="2">Tightening torque (Nm {kgm})</td><td colspan="3">Retightening angle (deg.)</td><td rowspan="5">Retighten</td></tr>
<tr><td>Triple grouser shoe</td><td>490 ± 49
{50 ± 5}</td><td colspan="3">120 ± 10</td></tr>
<tr><td>Road liner (Rubber pad type)</td><td>549 ± 59
{56 ± 6}</td><td colspan="3">—</td></tr>
<tr><td rowspan="2">b. Master link</td><td>Tightening torque (Nm {kgm})</td><td colspan="2">Retightening angle (deg.)</td><td>Lower limit torque (Nm {kgm})</td></tr>
<tr><td>—</td><td colspan="2">—</td><td>—</td></tr>
<tr><td colspan="2">No. of shoes (each side)</td><td colspan="5">PC210: 45 PC210LC: 49 PC210NLC: 49
PC240LC: 49 PC240NLC: 51</td><td>—</td></tr>
<tr><td rowspan="2">21</td><td colspan="2" rowspan="2">Interference between bushing and link</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard interference</td><td rowspan="10">Adjust or replace</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>59</td><td>+0.434
+0.394</td><td>+0.074
0</td><td>0.320 – 0.434</td></tr>
<tr><td>22</td><td colspan="2">Interference between regular pin and link</td><td>38</td><td>+0.222
+0.162</td><td>–0.138
–0.200</td><td>0.300 – 0.422</td></tr>
<tr><td rowspan="2">23</td><td colspan="2" rowspan="2">Clearance between regular pin and bushing</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard clearance</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>38</td><td>+0.222
+0.162</td><td>+0.902
+0.402</td><td>0.180 – 0.740</td></tr>
<tr><td rowspan="2">24
(*)</td><td colspan="2" rowspan="2">Interference between master pin and link</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard interference</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>37.8</td><td>+0.280
+0.250</td><td>+0.062
0</td><td>0.188 – 0.280</td></tr>
<tr><td rowspan="2">25
(*)</td><td colspan="2" rowspan="2">Clearance between master pin and bushing</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard clearance</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>38</td><td>–0.150
–0.350</td><td>+0.902
+0.402</td><td>0.552 – 1.252</td></tr>
</table>

* Dry type track link

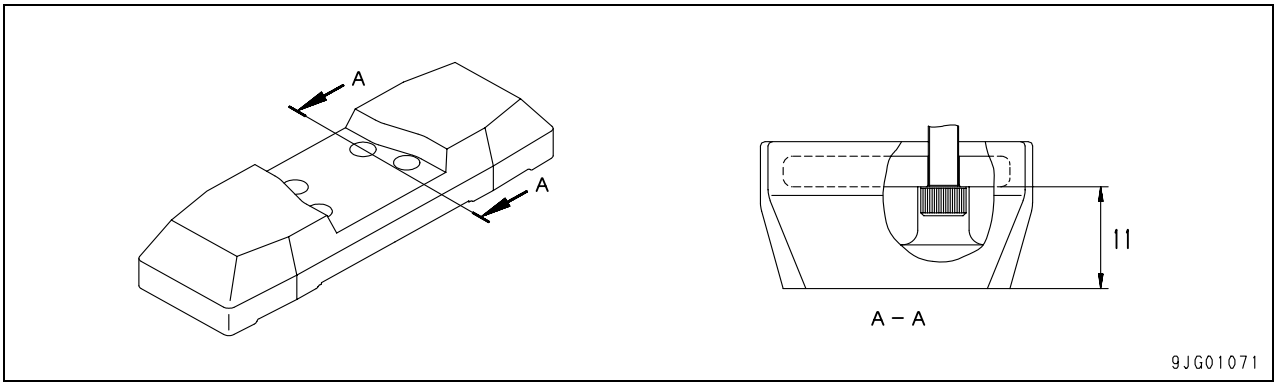
Triple grouser shoe



Swamp shoe



Road liner



Unit: mm

No.	Check item	Criteria		Remedy
1	Height	Standard size	Repair limit	Build-up welding or replace
		26	16	
2	Thickness	10		
3	Length of base	26		
4	Length of base	19		
5	Length at tip	20		
6	Length at tip	14		
7	Length at tip	19		
8	Thickness	Standard size	Repair limit	
		36	26	
9	Height	102.5	90.5	
10	Thickness	17	5	
11	Height	70		Replace

PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00098-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

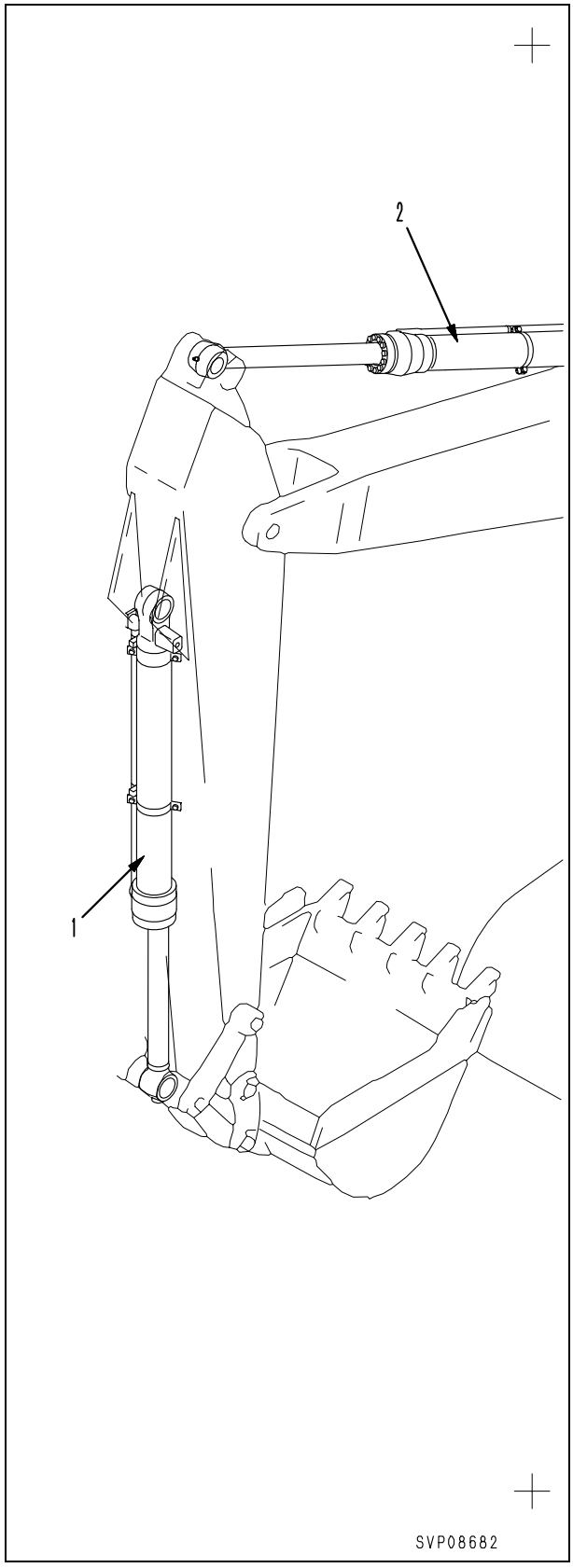
10 Structure, function and maintenance standard

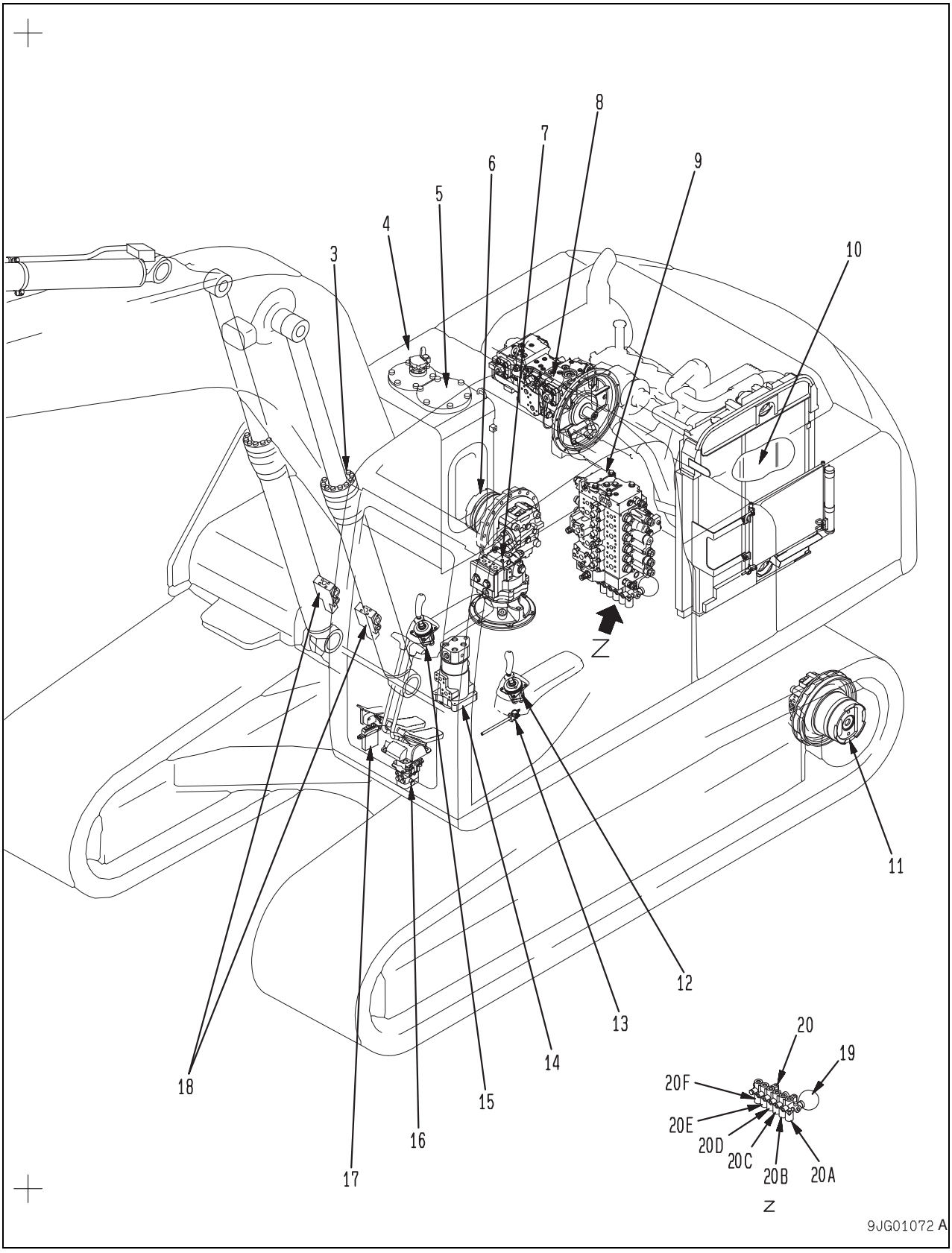
Hydraulic system, Part 1

Hydraulic system, Part 1

Hydraulic equipment layout drawing

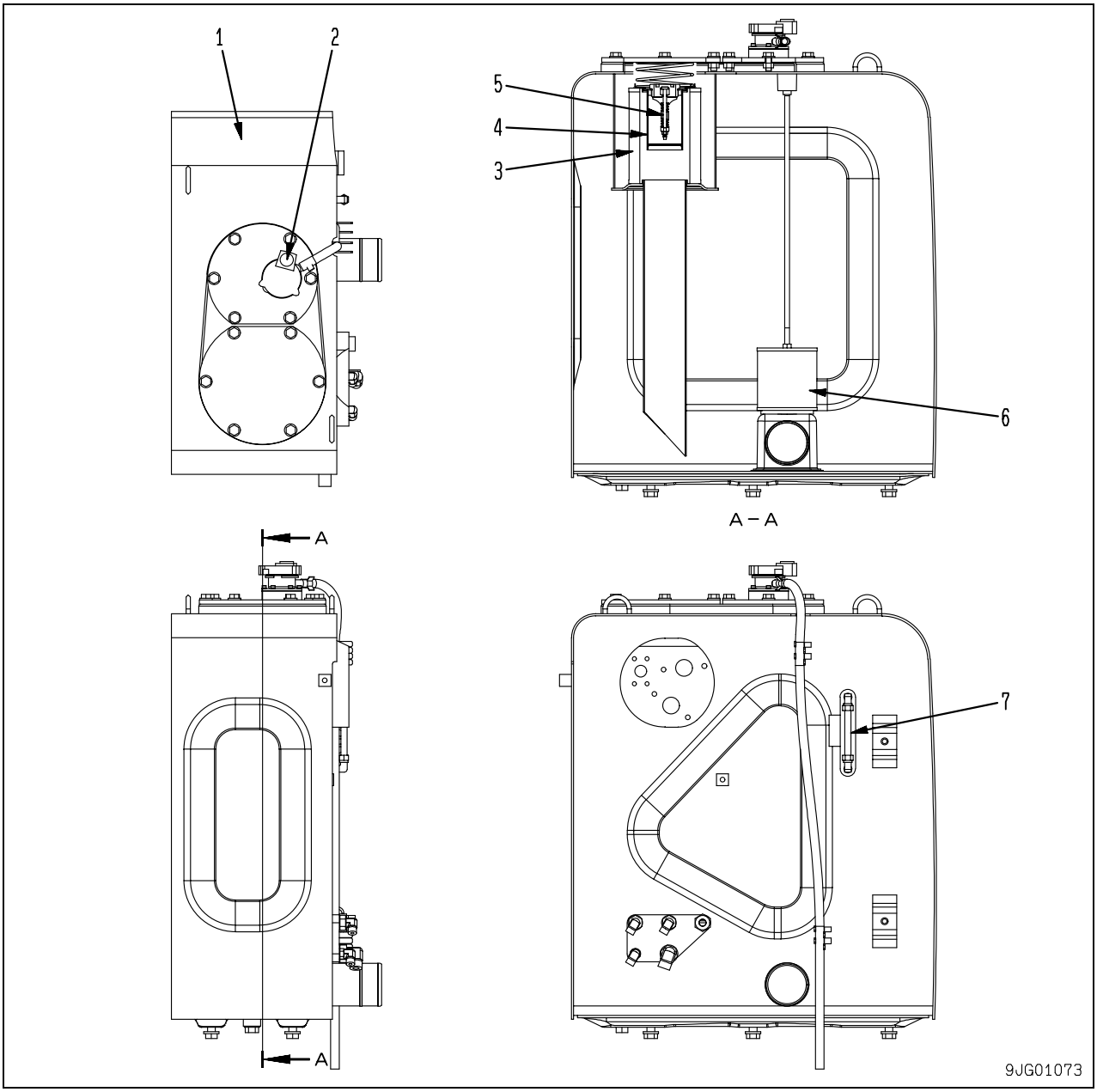
1. Bucket cylinder
2. Arm cylinder
3. Boom cylinder
4. Hydraulic tank
5. Hydraulic oil filter
6. R.H. travel motor
7. Swing motor
8. Hydraulic pump
9. Control valve
10. Oil cooler
11. L.H. travel motor
12. Left PPC valve
13. Lock lever
14. Center swivel joint
15. Right PPC valve
16. Travel PPC valve
17. Attachment PPC valve
18. Hydraulic drift prevention valve
19. Accumulator
20. Solenoid valve assembly
    - 20A. PPC lock solenoid valve
    - 20B. 2-stage relief solenoid valve
    - 20C. Swing brake solenoid valve
    - 20D. Travel speed solenoid valve
    - 20E. Travel junction solenoid valve
    - 20F. ATT selector solenoid valve




8
7
6
9
5
4
3
10
Z
11
12
13
14
15
16
17
18
20
19
20F
20E
20D
20C
20B
20A
Z
9JG01072 A

Hydraulic tank and filter

(**PC240 shown**)



1. Hydraulic tank
2. Oil filler port cap
3. Filter element
4. Strainer
5. Bypass valve
6. Suction strainer
7. Sight gauge

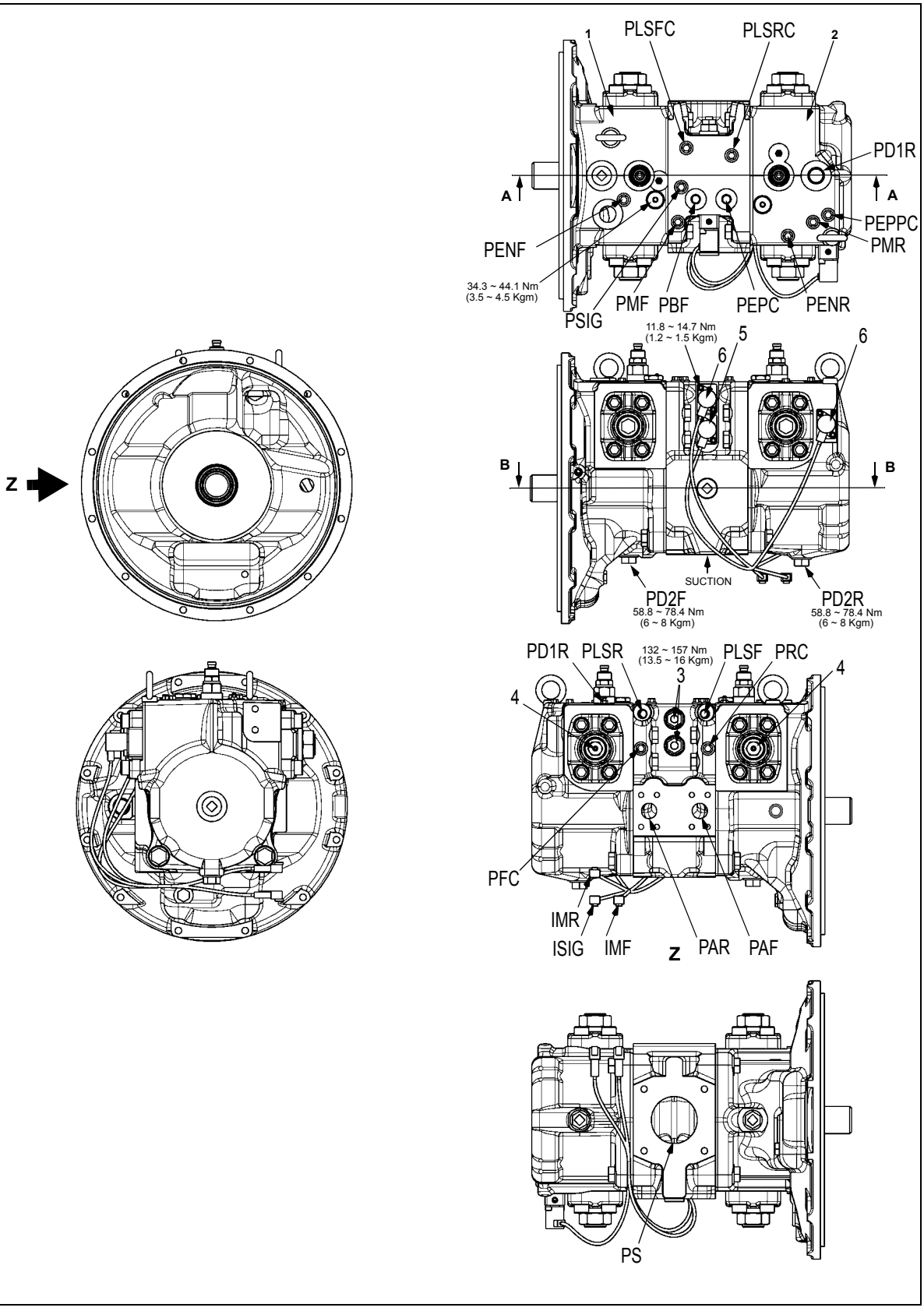
Specifications	PC240	PC210 / 230
Tank capacity	190 L	192 L
Amount of oil inside tank	135 L	137 L

Safety valve

Relief cracking pressure:
16.7 ± 6.9 kPa {0.17 ± 0.07 kg/cm^2}
Suction cracking pressure:
0 – 0.49 kPa {0 – 0.005 kg/cm^2}
Bypass valve set pressure:
150 ± 30 kPa {1.5 ± 0.3 kg/cm^2}

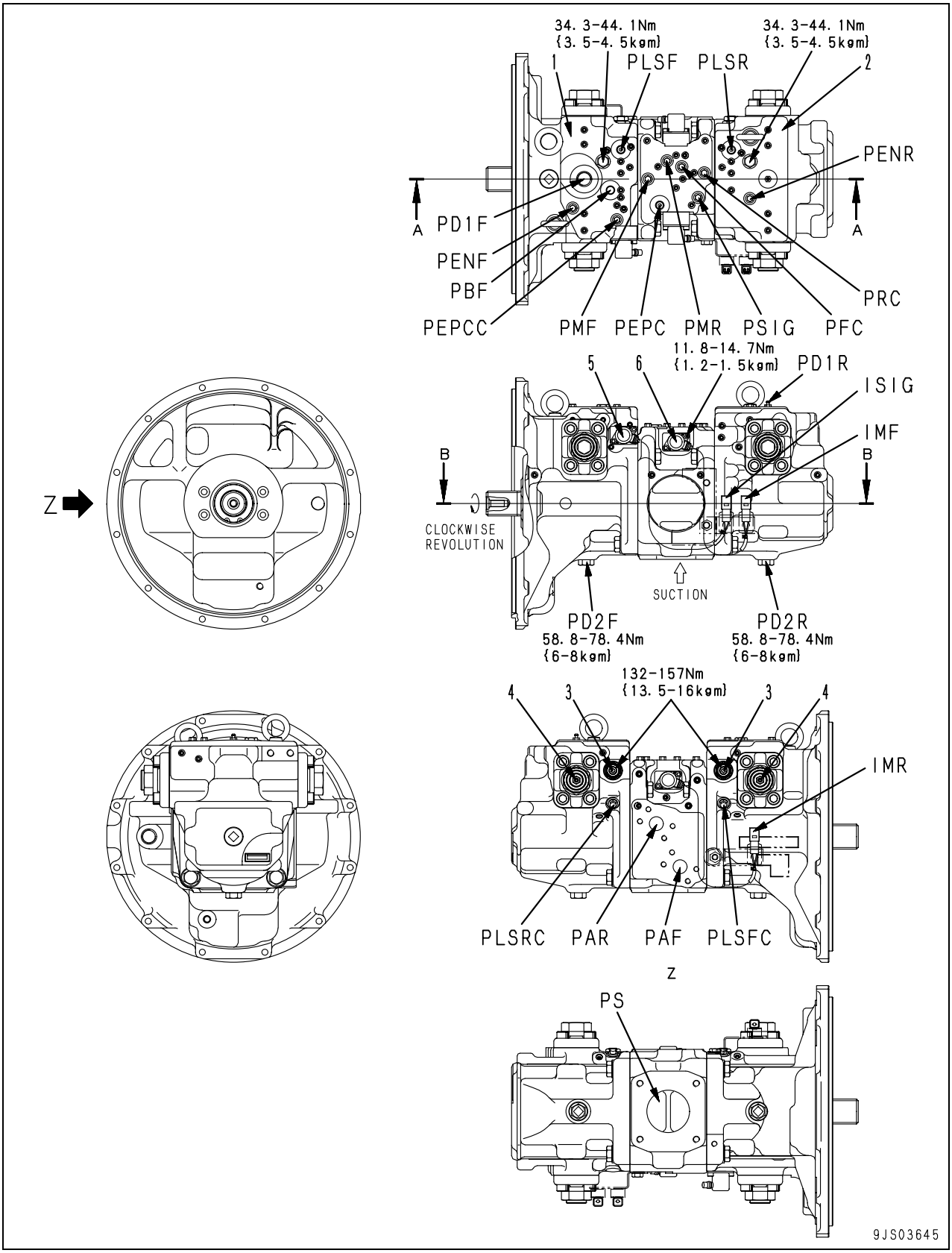
Hydraulic pump

PC210 / 230 - Type: HPV112+112



Hydraulic pump

PC240 - Type: HPV95+95



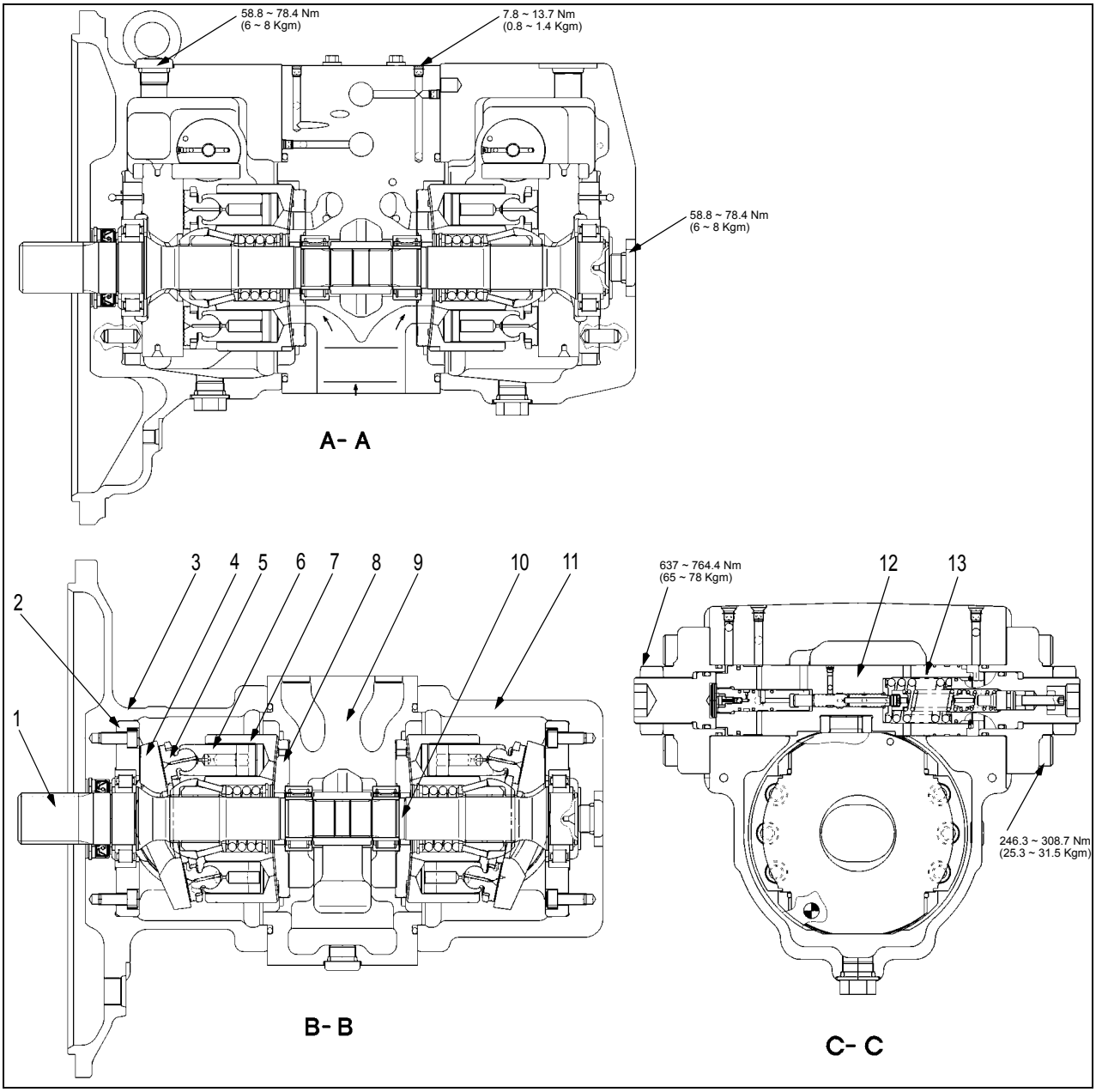
Outline

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

IMF : Front PC mode selector current
IMR : Rear PC mode selector current
ISIG : LS set pressure selector current
PAF : Front pump delivery port
PAR : Rear pump delivery port
PBF : Pump pressure input port
PD1F : Case drain port (PC240)
PD1R (PC210 / 230)
PD1R : Air bleeder
PD2F : Drain plug
PD2R : Drain plug
PENF : Front control pressure detection port
PENR : Rear control pressure detection port
PEPC : EPC basic pressure port
PEPCC : EPC basic pressure detection port
PFC : Front pump delivery pressure detection port
PLSF : Front load pressure input port
PLSFC : Front load pressure detection port
PLSR : Rear load pressure input port
PLSRC : Rear load pressure detection port
PMF : Front PC mode selector pressure detection port
PMR : Rear PC mode selector pressure detection port
PRC : Rear pump discharge pressure detection port
PS : Pump suction port
PSIG : LS set selector pressure detection port

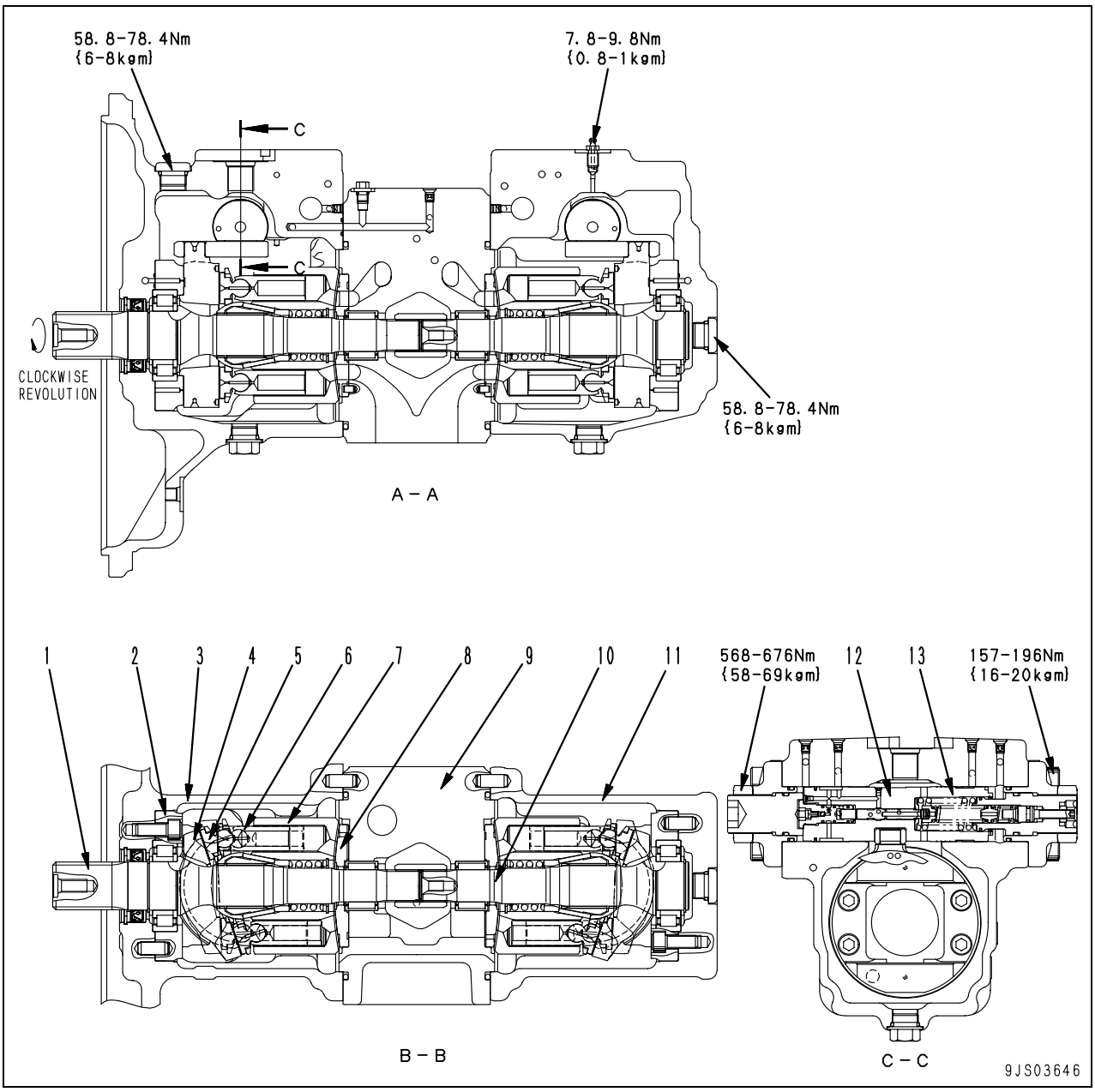
1. Front pump
2. Rear pump
3. LS valve
4. PC valve
5. LS-EPC valve
6. PC-EPC valve

PC210 / 230



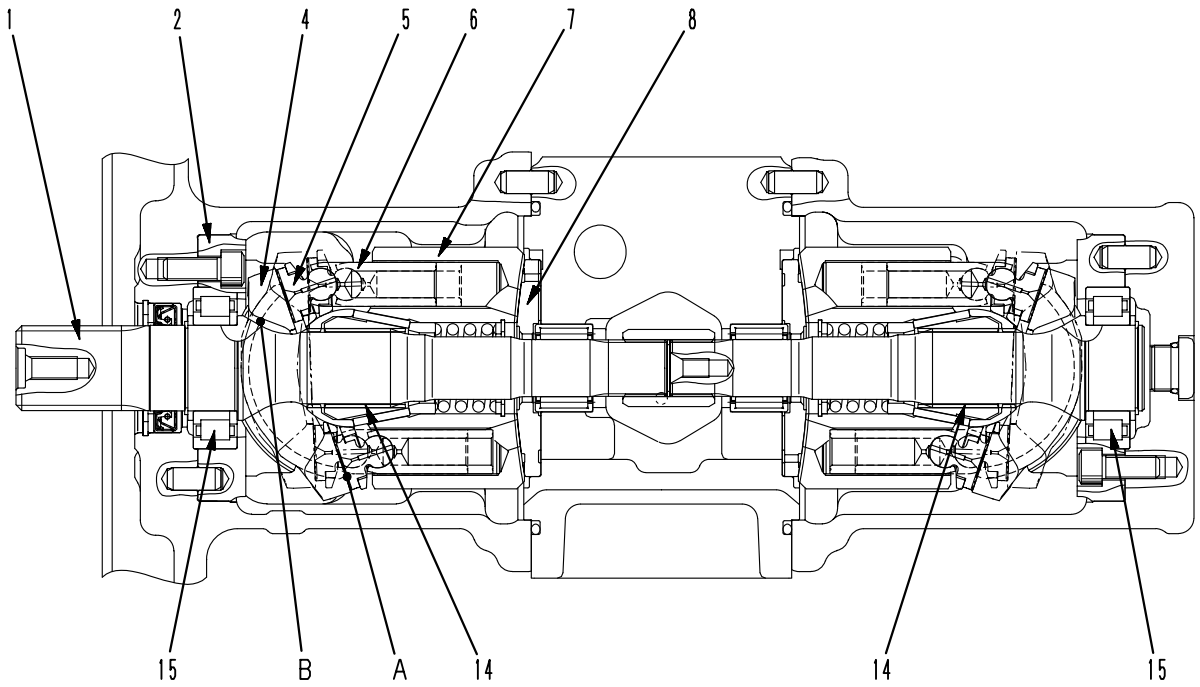
1. Front shaft
2. Cradle
3. Front case
4. Rocker cam
5. Shoe
6. Piston
7. Cylinder block
8. Valve plate
9. End cap
10. Rear shaft
11. Rear case
12. Servo piston
13. PC valve

PC240



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

PC240



Function

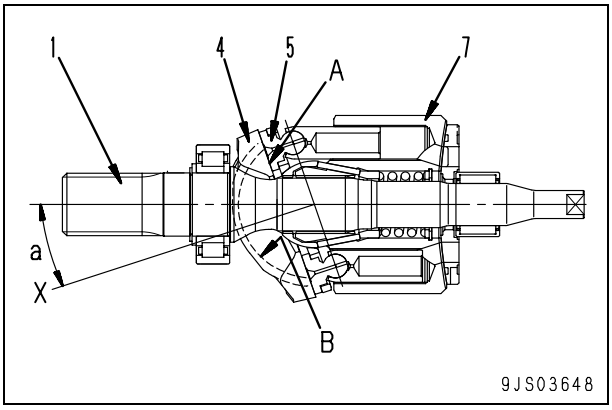
- The pump converts the engine rotation transmitted to is shaft to oil pressure and delivers pressurized oil corresponding to the load.
- It is possible to change the discharge amount by changing the swash plate angle.

Structure

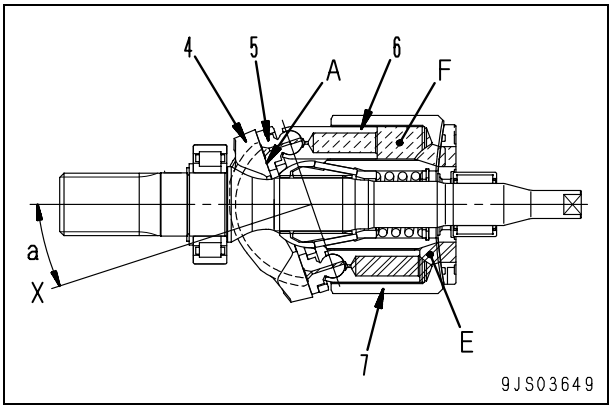
- Cylinder block (7) is supported to shaft (1) by spline (14).
- Shaft (1) is supported by front and rear bearings (15).
- Tip of piston (6) is shaped as a concave ball and shoe (5) is caulked to it to form one unit.
- Piston (6) and shoe (5) constitute the spherical bearing.
- Rocker cam (4) has flat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

Operation of pump

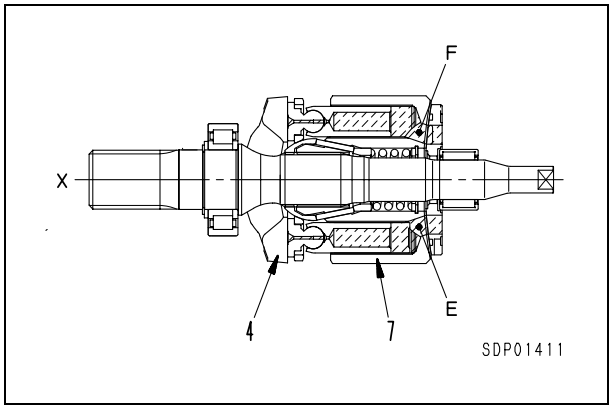
- Cylinder block (7) rotates together with shaft (1), and shoe (5) slides on flat surface (A).
- When this happens, rocker cam (4) moves along cylindrical surface (B), so angle (a) between center line (X) of rocker cam (4) and the axial direction of cylinder block (7) changes.
- (a) is named the swash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



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

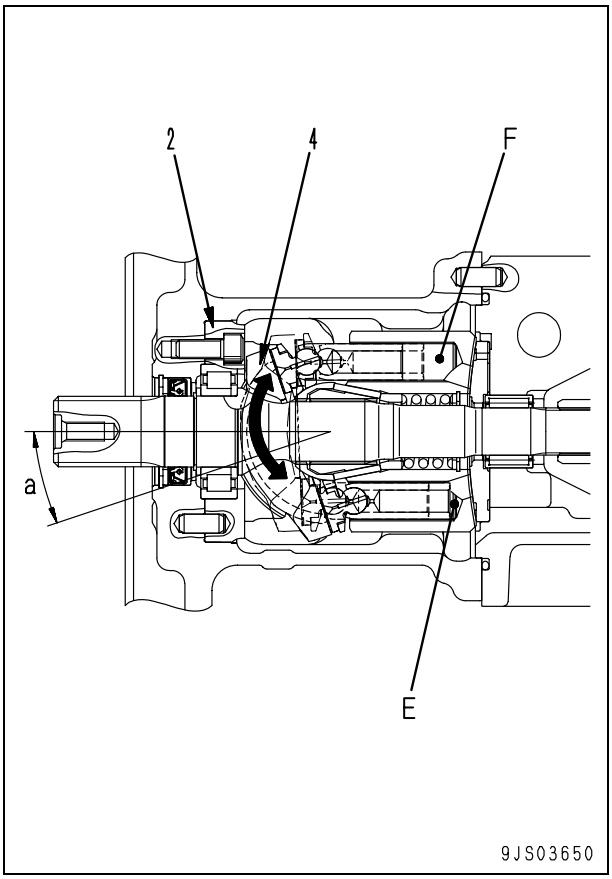


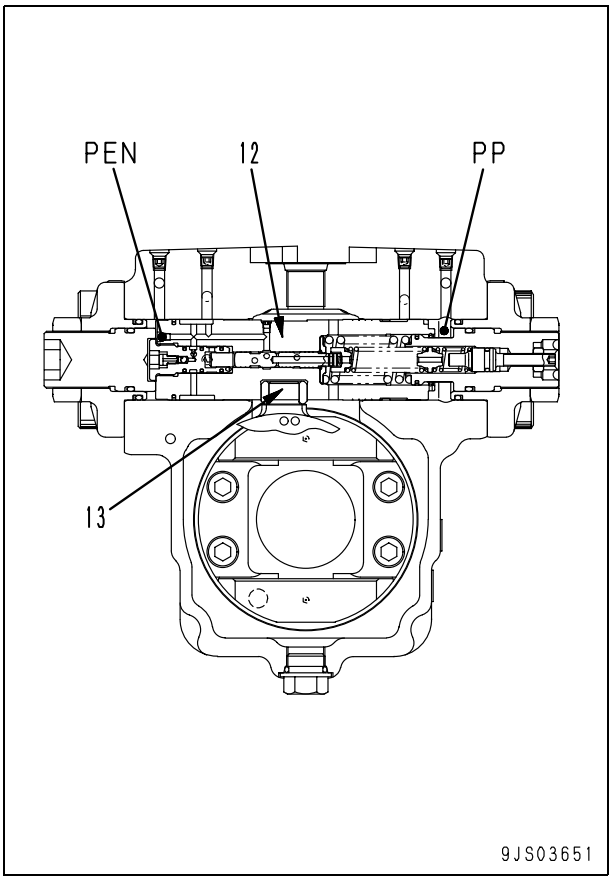
- As center line (X) of rocker cam (4) matches the axial direction of cylinder block (7) (swash plate angle (a) = 0), the difference between volumes (E) and (F) inside cylinder block (7) becomes 0.
- Suction and discharge of pressurized oil is not carried out in this state. Namely pumping action is not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



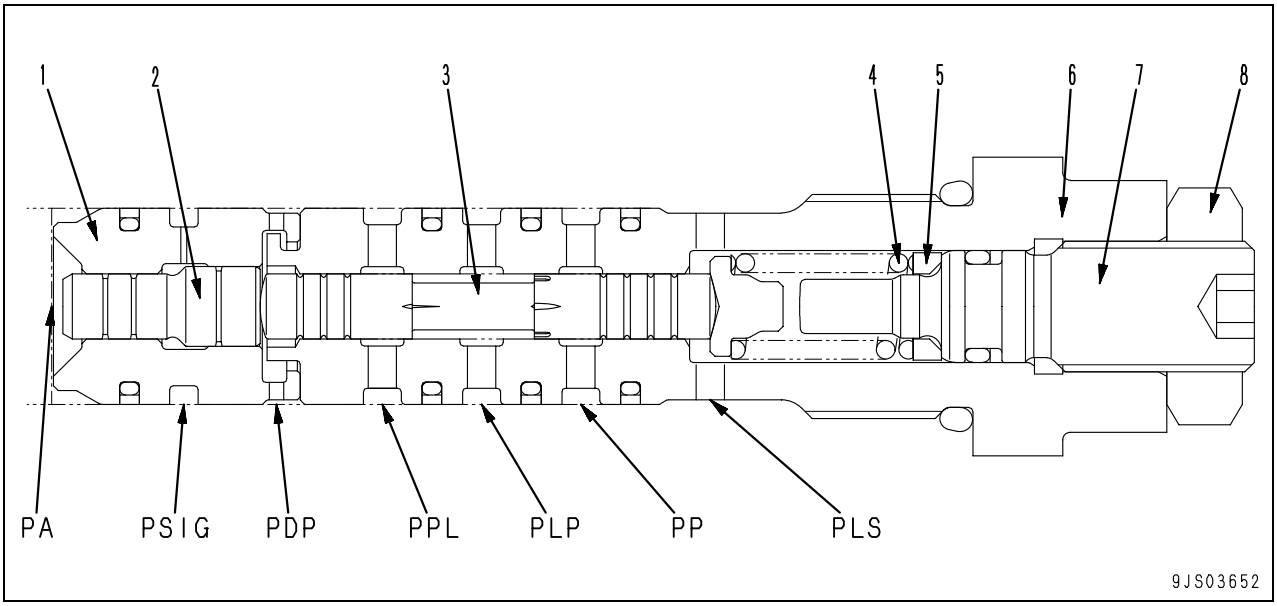
Control of delivery

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





1. LS valve

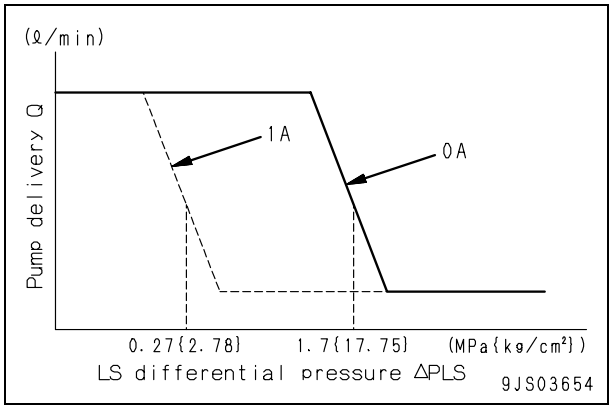


PA : Pump port
PDP : Drain port
PLP : LS control pressure output port
PLS : LS pressure input port
PP : Pump port
PPL : Control pressure input port
PSIG : LS mode selector pilot port

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

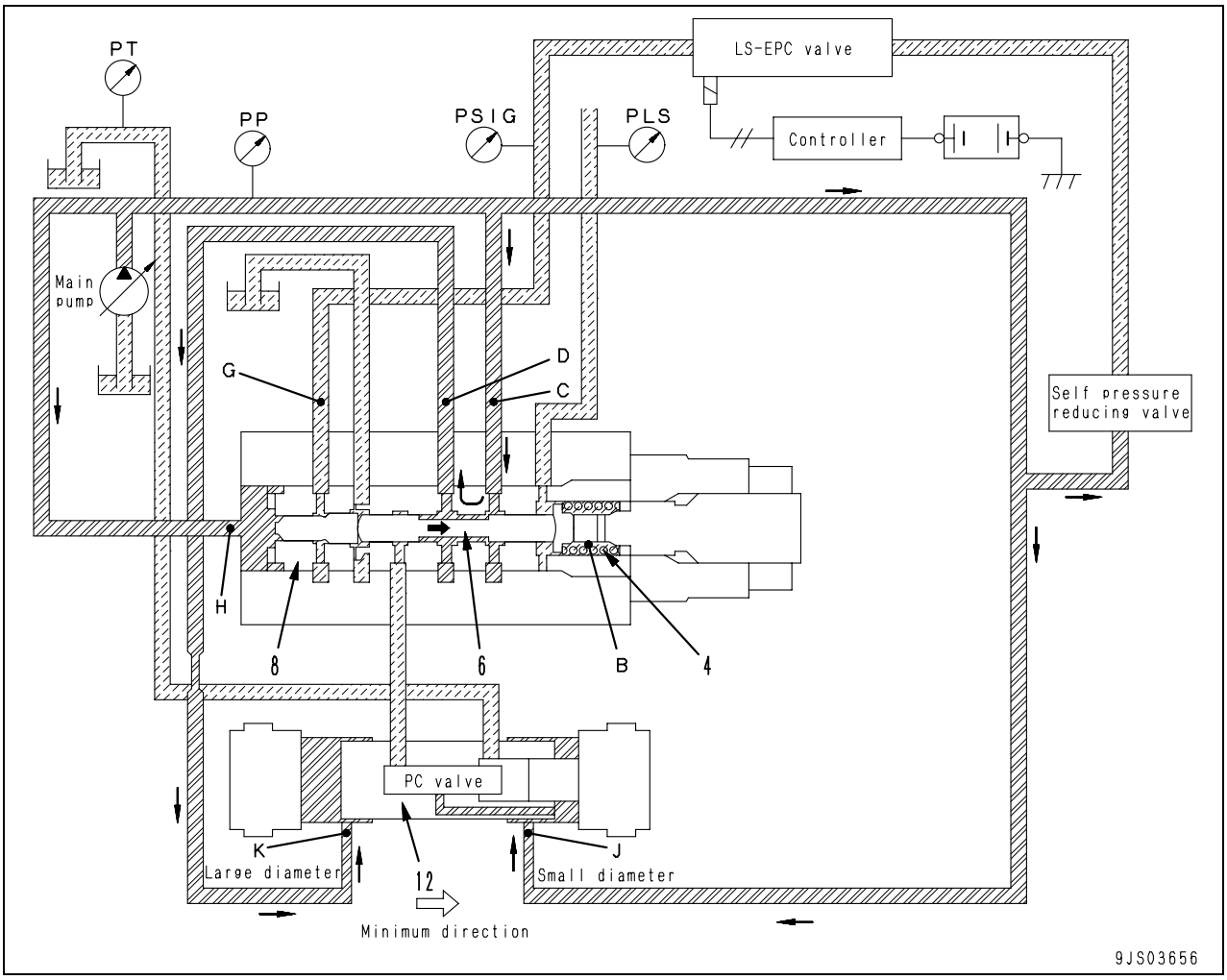
Function

- The LS (load sensing) valve detects the load and controls the discharge amount.
- This valve controls main pump delivery (Q) according to differential pressure (✕PLS)[= PP — PLS], called the LS differential pressure (the difference between main pump pressure PP and control valve outlet port pressure PLS).
- Main pump pressure (PP), pressure (PLS) (called the LS pressure) coming from the control valve output, and pressure (PSIG) (called the LS selector pressure) from the proportional solenoid valve enter this valve.
- The relationship between the LS differential pressure between the main pump pressure (PP) and LS pressure (PLS) (✕PLS) [= (PP) — (PLS)] and the pump delivery (Q) changes as shown in the diagram according to LS selector current (ISIG) of the LS-EPC valve.
- If (ISIG) changes from 0 to 1A, setting force the spring changes, too. As the result, the specified median of the pump delivery volume switching point changes as shown in the diagram. It will change in the range of 0.27 to 1.7 MPa {in the range of 2.78 to 17.75 kg/cm^2}.

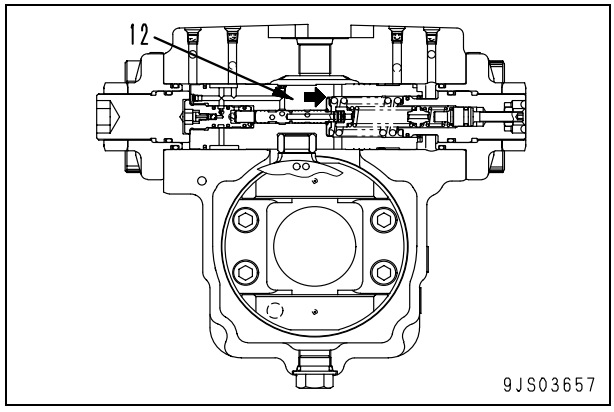


Operation

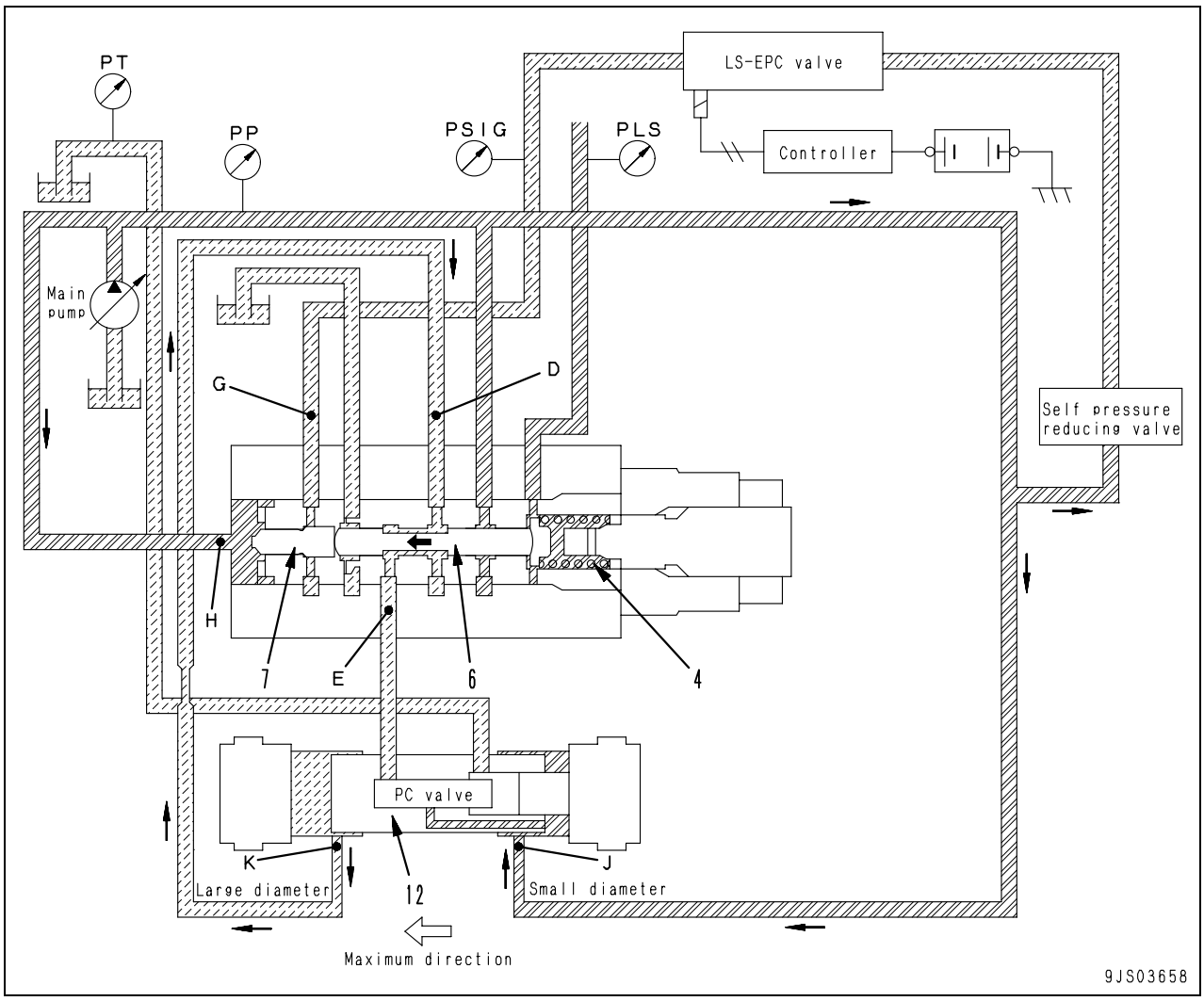
1) When the control valve is situated at neutral



- The LS valve is a 3-way selector valve, with pressure (PLS) (LS pressure) from the outlet port of the control valve brought to spring chamber (B), and main pump discharge pressure (PP) brought to port (H) of sleeve (8).
- Magnitude of the force resulting from this LS pressure (PLS), force of spring (4) and the pump delivery pressure (self pressure) (PP) determine the position of spool (6).
- However, magnitude of the output pressure (PSIG) (called the LS selector pressure) of the EPC valve for the LS valve entering port (G) also changes the position of spool (6). (Setting force of the spring is changed)
- Before the engine is started, servo piston (12) is pushed to the right. (See the figure)
- If the control lever is at the neutral position when the engine is started, LS pressure (PLS) will be set to 0 MPa {0 kg/cm^2}. (It is interconnected to the drain circuit via the control valve spool)
- Spool (6) is pushed to the right, and port (C) and port (D) will be connected.
- Pump pressure (PP) is conducted to the larger diameter end from the port (K).
- The same pump pressure (PP) is conducted to the smaller diameter end from the port (J).
- According to the difference in the areas on servo piston (12), the pressure moves in such that the swash plate angle may be minimized.

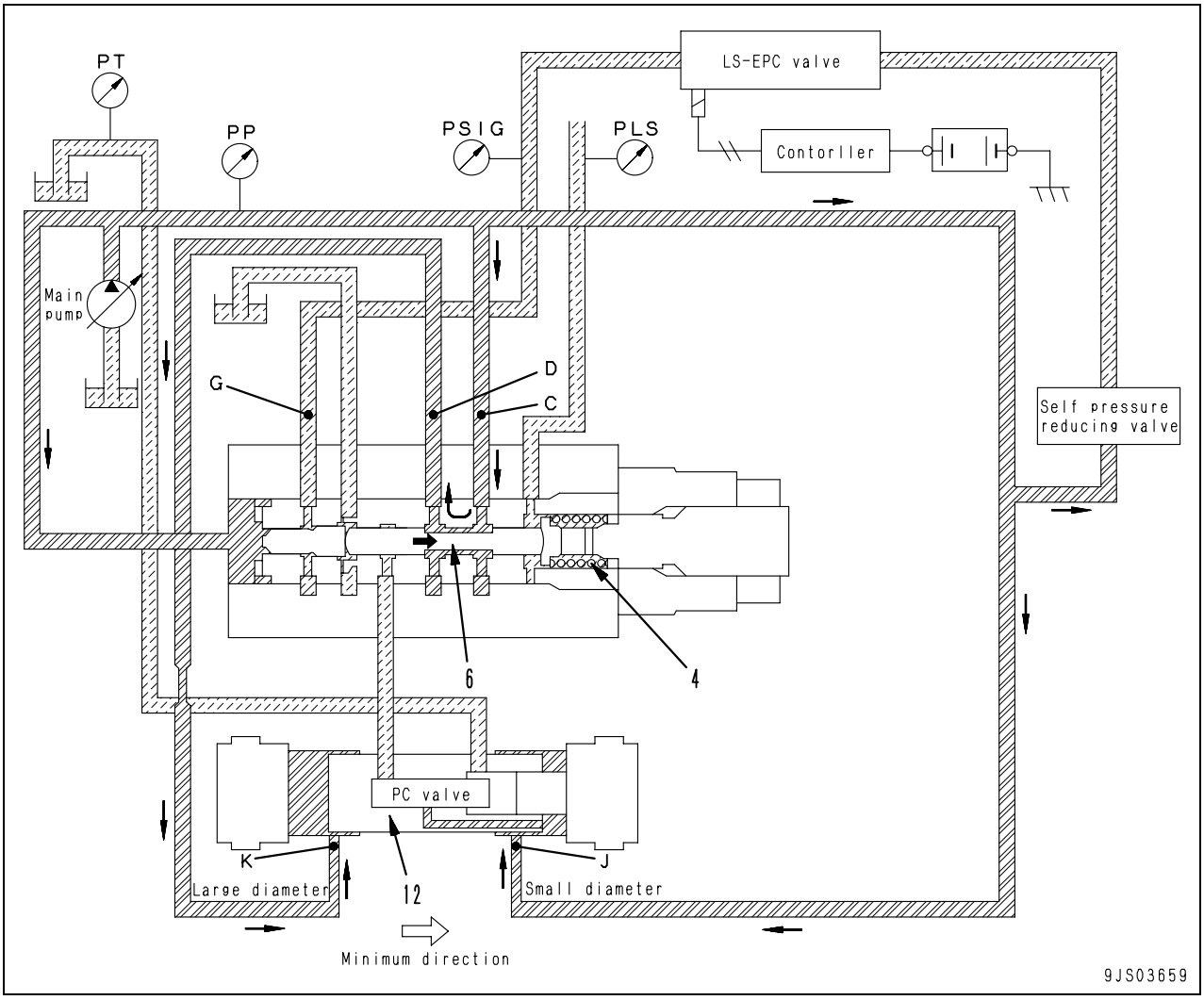


2) Action for the direction of maximizing the pump delivery



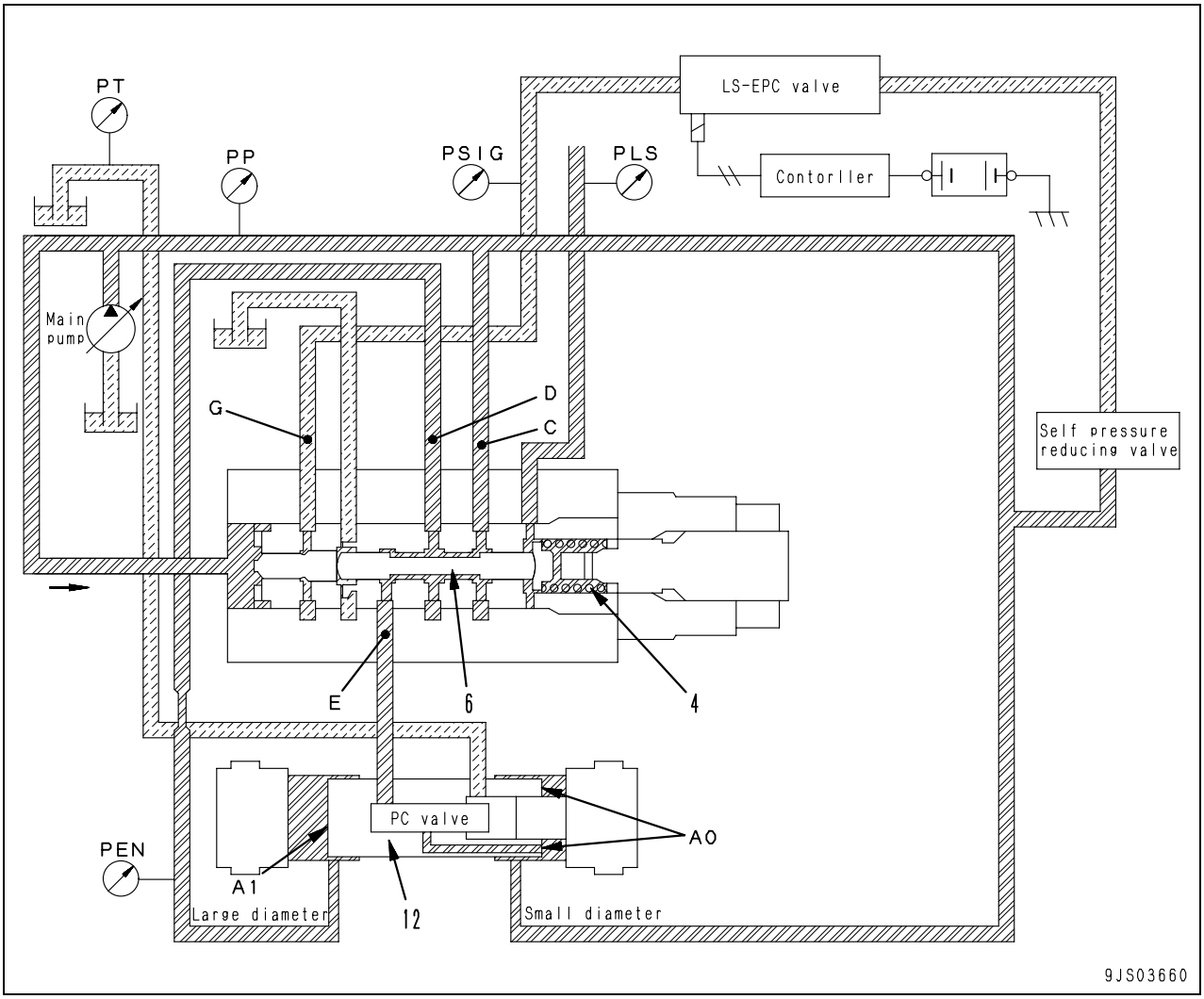
- When the difference between the main pump pressure (PP) and LS pressure (PLS), in other words, LS differential pressure (✕PLS) becomes smaller (for example, when the area of opening of the control valve becomes larger and pump pressure PP drops), spool (6) is pushed to the left by the combined force of LS pressure (PLS) and the force of spring (4).
- When spool (6) moves, port (D) and port (E) are interconnected and connected to the PC valve.
- The PC valve is connected to the drain port, so the pressure across circuits (D) and (K) becomes drain pressure (PT). (The operation of the PC valve is explained later.)
- The pressure at the large diameter end of servo piston (12) becomes drain pressure (PT), and pump pressure (PP) enters port (J) at the small diameter end, so servo piston (12) is pushed to the left side. Therefore, the swash plate is moved in the direction to make the discharge amount larger.
- If the output pressure of the EPC valve for the LS valve enters port (G), rightward force is generated on piston (7).
- If piston (7) is pushed to the right, setting force of spring (4) is weakened, changing the LS differential pressure (✕PLS) [Difference between oil pressures (PLS) and (PP)] when ports (D) and (E) of spool (6) are connected.

3) Action for the direction of minimizing the pump delivery



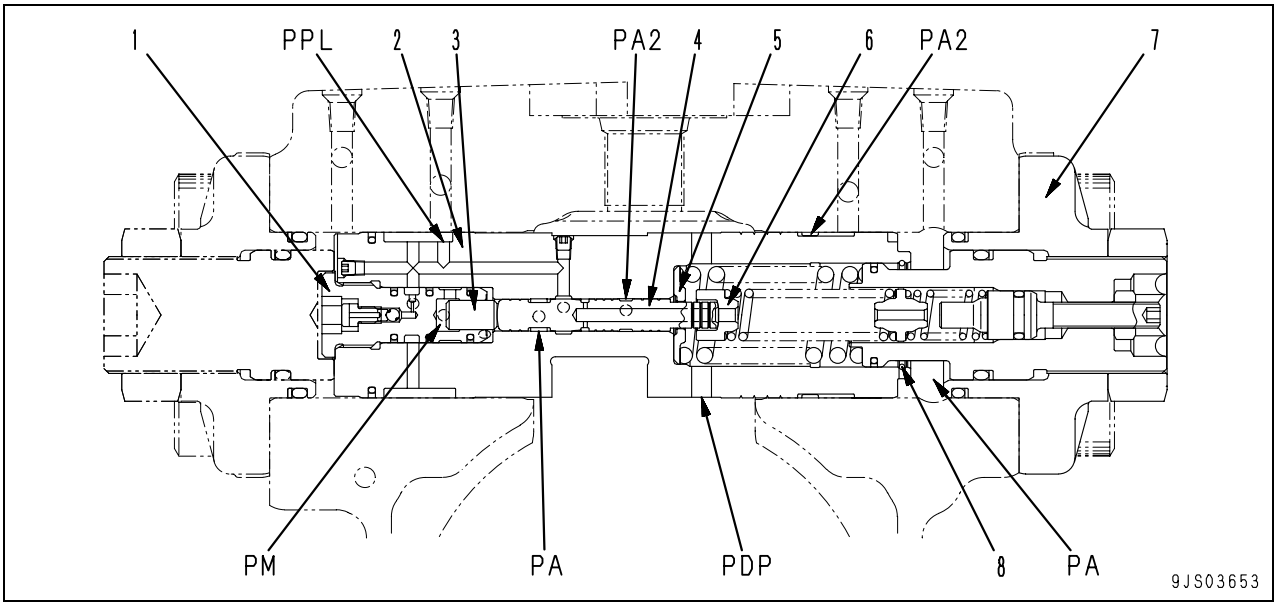
- When LS differential pressure (✕PLS) becomes larger (for example, when the area of opening of the control valve becomes smaller and pump pressure (PP) rises) because of the rightward move (it reduces discharge amount) of servo piston (12), pump pressure (PP) pushes spool (6) to the right.
- When spool (6) moves, main pump pressure (PP) flows from port (C) to port (D) and from port (K), it enters the large diameter end of the piston.
- Main pump pressure (PP) also enters port (J) of the small diameter end of the piston, but because of the difference in area between the large diameter end and the small diameter end on servo piston (12), it is pushed to the right. As the result, the servo piston (12) moves into the direction of reducing the swash plate angle.
- As LS selector pressure (PSIG) is input to port (G), setting force of spring (4) is reduced.

4) When servo piston is balanced



- Let us take the area receiving the pressure at the large diameter end of the piston as (A1), the area receiving the pressure at the small diameter end as (A0), and the pressure flowing into the large diameter end of the piston as (PEN).
- If the main pump pressure (PP) of the LS valve and the combined force of spring (4) and LS pressure (PLS) are balanced, and the relationship is (A0) x (PP) = (A1) x (PEN), servo piston (12) will stop in that position.
- The swash plate of the pump will be held at the intermediate position. [Spool (6) will be stopped at a position where the distance of the opening from port (D) to port (E) and the distance from port (C) to port (D) is almost the same.]
- At this point, the relationship between the pressure receiving areas across servo piston (12) is (A0) : (A1) = 3 : 5, so the pressure applied across the piston when it is balanced becomes (PP) : (PEN) ≒ 5 : 3.
- Force of spring (4) is adjusted in such that the position of the balanced stop of this spool (6) may be determined when (PP) — (PLS) = 1.7 MPa{17.75 kg/cm^2} at the median of the specified value.
- If (PSIG) [Output pressure of LS-EPC valve, 0 to 2.9 MPa {0 to 30 kg/cm^2}] is input to port (G), the position of the balanced stop is changed in the range of (PP) — (PLS) = 1.7 to 0.27 MPa {17.75 to 2.78 kg/cm^2} in proportion to (PSIG) pressure.

2. PC valve

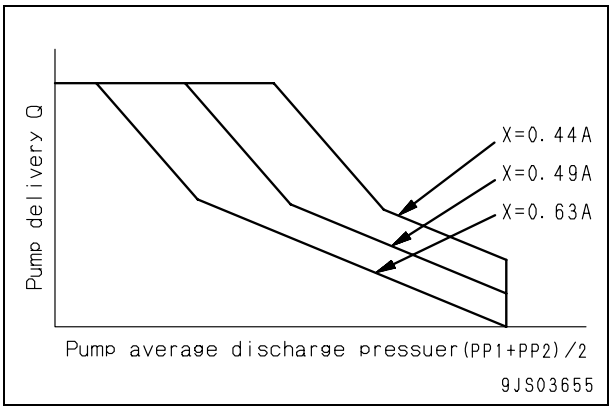


PA : Pump port
PA2 : Pump pressure pilot port
PDP : Drain port
PM : Mode selector pressure pilot port
PPL : Control pressure output port (to LS valve)

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

Function

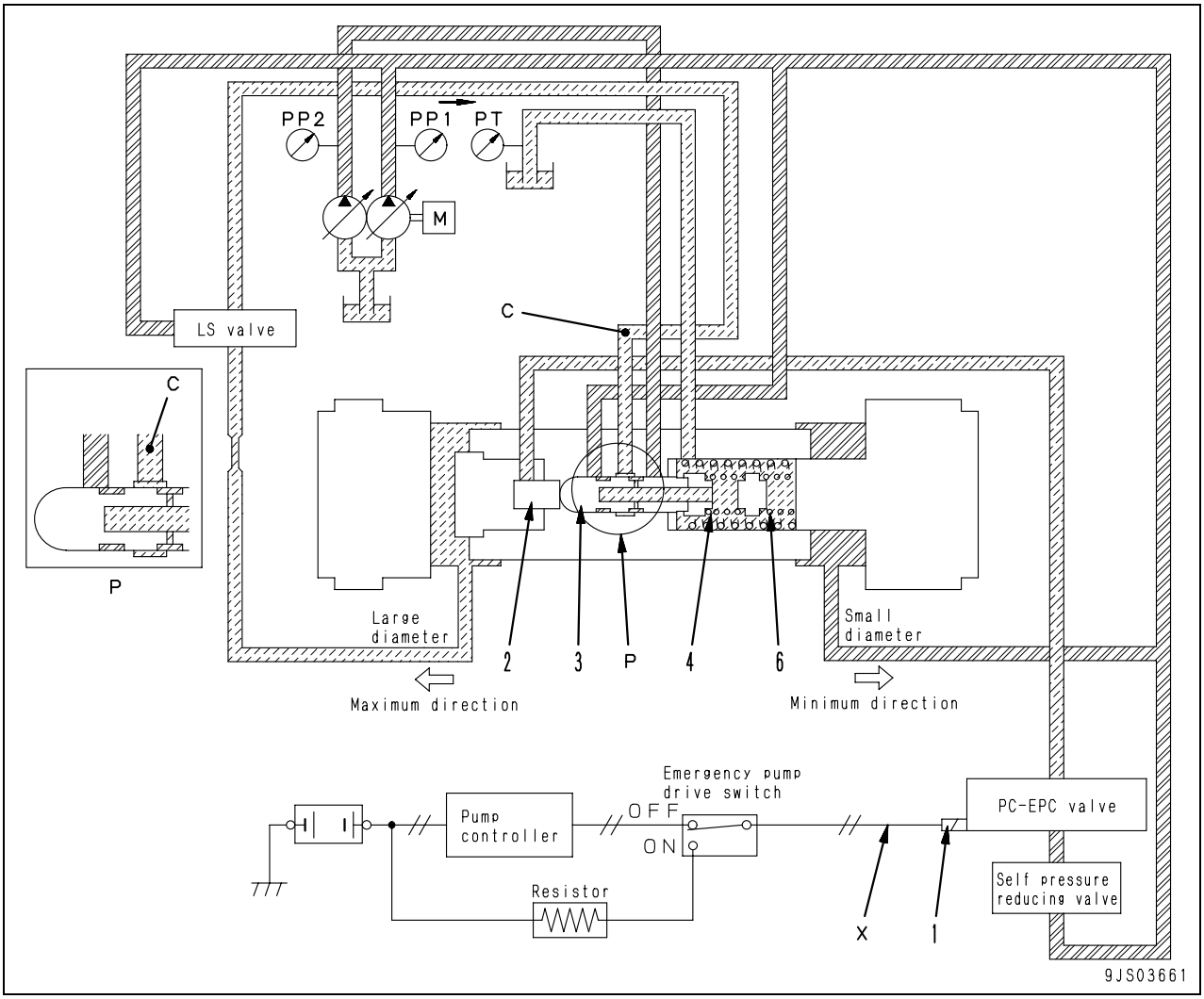
- When the pump discharge pressure (PP1) (self-pressure) and (PP2) (other pump pressure) are high, the PC valve controls the pump so that the volume of oil beyond the discharge pressure-based specific flowrate may not be conducted however you may increase the control valve stroke. Namely it is intended at controlling the horse power for the pumps so that it may not exceed the engine hose power.
- If the pump discharge pressure increases due to increased load during operation, this valve decreases the pump delivery.
- And if the pump delivery pressure goes low, it increases the pump delivery.
- In this case, relation between the mean discharge pressure of the front and rear pumps [(PP1) + (PP2)]/2 and the pump delivery (Q) will becomes as shown in the diagram if the relation is represented as the parameter the current value (X) to be given to PC-EPC valve solenoid.
- The controller continues counting the actual engine speed.
- If the engine speed is slowed down due to increased load, the controller reduces the pump delivery to recover the speed.
- If the engine speed goes below the specified value because of increased load, the controller sends a command current to PC-EPC valve solenoid in order to reduce the slope angle in proportion to reduction in the engine speed.



Operation

1) When pump controller is normal

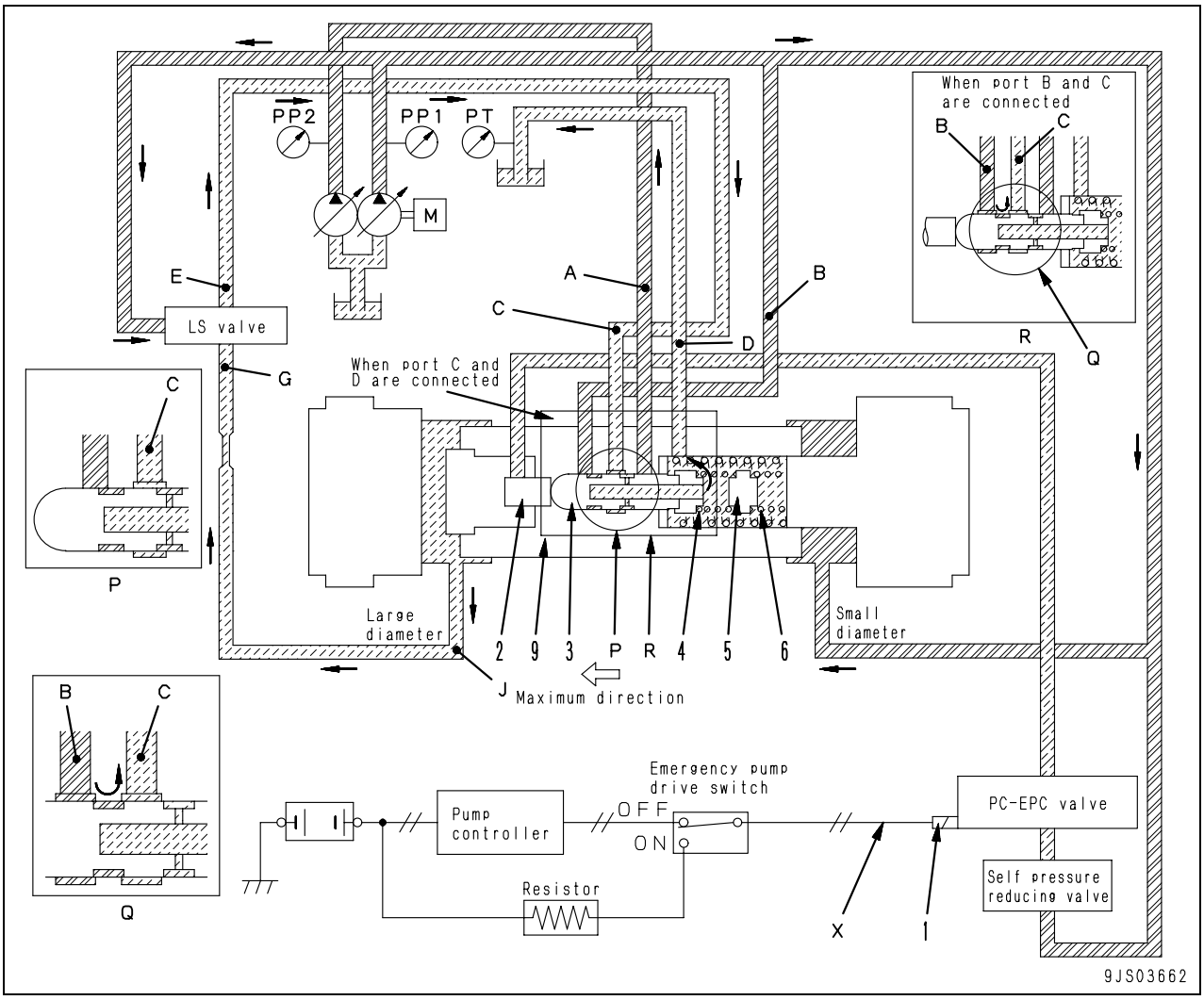
(1) When the load on the actuator is small and pump discharge pressures (PP1) and (PP2) are low



Action of PC-EPC valve solenoid (1)

- Command current (X) is being sent to PC-EPC valve solenoid (1) from the pump controller.
- This command current acts on PC-EPC valve to output the signal pressure in order to modify the force pushing piston (2).
- Spool (3) stops at a position where the combined spool-pushing force is balanced by the setting force of springs (4) and (6) as well as the pump pressures (PP1) (self-pressure) and (PP2) (another pump's pressure).
- The pressure [port (C) pressure] output from PC valve is changed depending on the above position.
- The size of command current (X) is determined by the nature of the operation (lever operation), the selected working mode, and the set value and actual value of the engine speed.

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

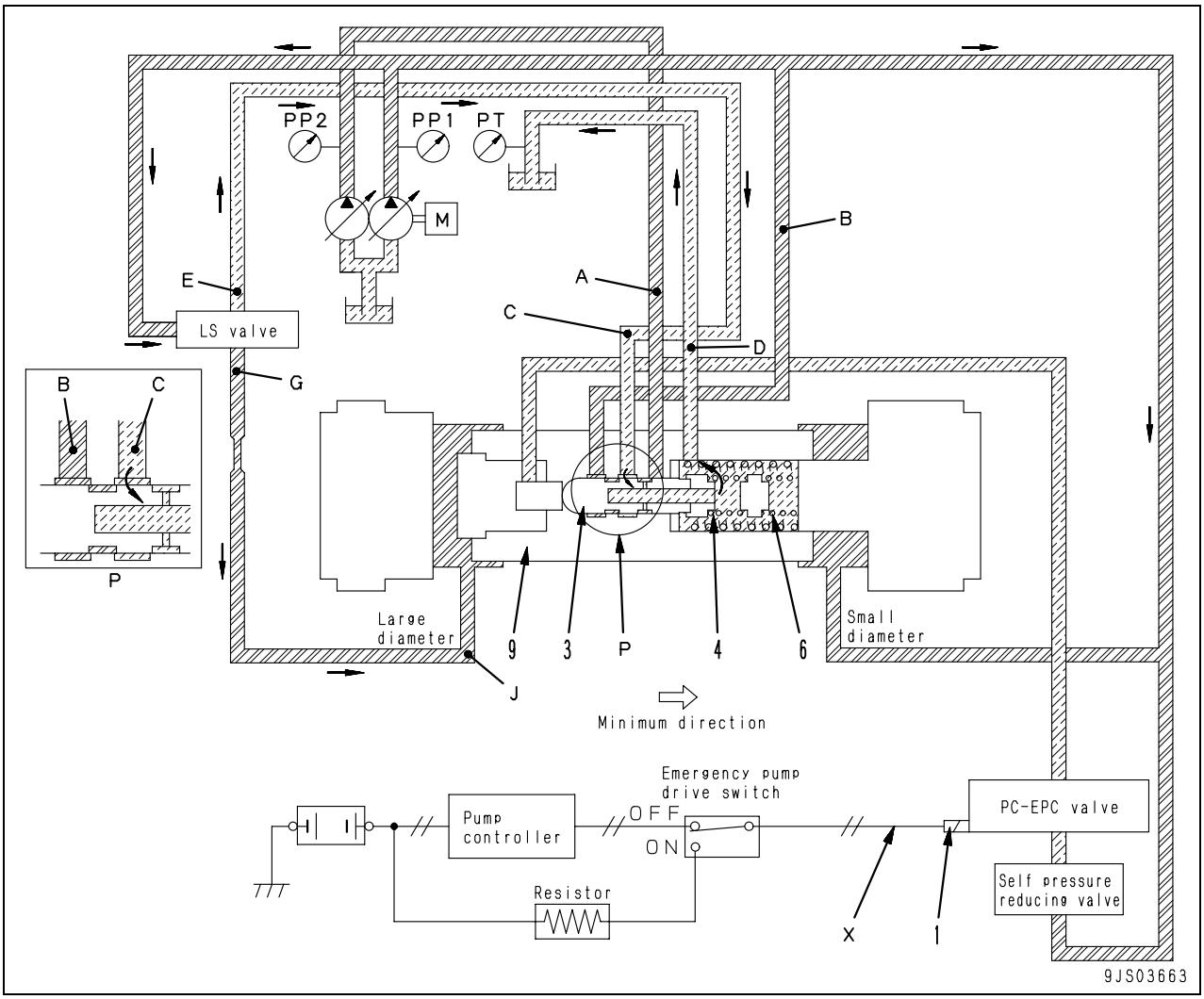


Action of spring

- Load of springs (4) and (6) on the PC valve is determined by the swash plate position.
- As servo piston (9) moves to right, spring (6) is retracted.
- If the servo piston moves further, it will be contacted again seat (5) and spring (6) will be fixed.
- After that, spring (4) alone will operate.
- The spring load is changed by servo piston (9) as it extends or compresses springs (4) and (6).
  The spring load changes as the servo piston (9) extends and contracts the springs (4) and (6).
- If the command current (X) to PC-EPC valve solenoid (1) changes, so does the force pushing piston (2).
- Spring load of springs (4) and (6) is also affected by the command current (X) to PC-EPC valve solenoid.
- Port (C) of the PC valve is connected to port (E) of the LS valve.
- Self pressure (PP1) enters port (B) and the small diameter end of servo piston (9), and other pump pressure (PP2) enters port (A).
- When pump pressures (PP1) and (PP2) are small, spool (3) will be positioned in the left side.
- Port (C) and (D) are connected, and the pressure entering the LS valve becomes drain pressure (PT).
- If port (E) and port (G) of the LS valve are connected, the pressure entering the large diameter end of the piston from port (J) becomes drain pressure (PT), and servo piston (9) moves to the left side.
- The pump delivery will be set to the increasing trend.
- Accompanied with move of servo piston (9), springs (4) and (6) will be expanded and the spring force becomes weaker.

- As the spring force is weakened, spool (3) moves to the right, the connecting between port (C) and port (D) is shut off and the pump discharge pressure ports (B) and (C) are connected.
- As a result, the pressure on port (C) rises and the pressure on the large diameter end of the piston also rises. Thus, the leftward move of servo piston (9) is stopped.
- Servo piston (9) stop position (= Pump delivery) is decided by the position where the pushing force generated from the pressures (PP1) and (PP2) applied to spool (3), the pushing force of the solenoid in PC-EPC valve generates and the pushing force of springs (4) and (6) are balanced.

(2) When load on actuator is large and pump discharge pressure is high



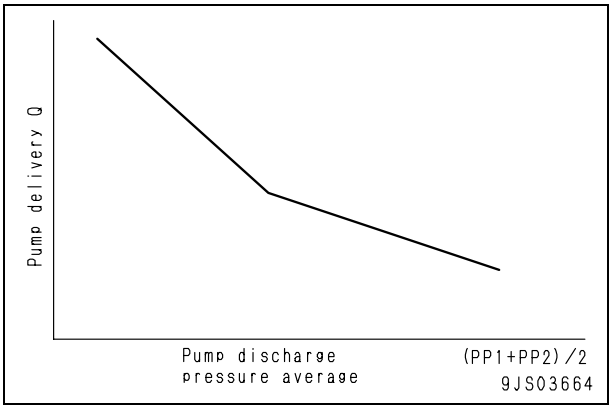
Outline

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

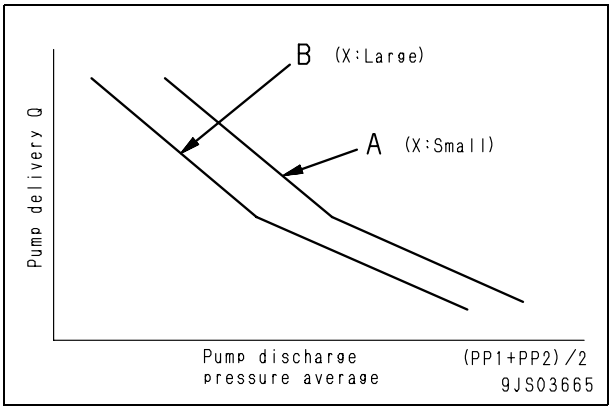
Operation

- When port (E) and port (G) of the LS valve are connected, this pressure from port (J) enters the large diameter end of servo piston (9), stopping servo piston (9).
- If main pump pressure (PP2) increases further and spool (3) moves further to the right, main pump pressure (PP1) flows to port (C) and acts to make the pump delivery the minimum.
- When servo piston (9) moves to the right, springs (4) and (6) are compressed and push back spool (3).
- When spool (3) moves to the left, the opening of port (C) and port (D) becomes larger.
- As a result, the pressure on port (C) (= J) is decreased and the rightward move servo piston (9) is stopped.
- The position in which servo piston (9) stops at this time is further to the right than the position when pump pressures (PP1) and (PP2) are low.
- The relationship between the average pump pressure (PP1 + PP2)/2 and servo piston (9) in terms of their positions can be represented by the broken line in the figure springs (4) and (6) form the double springs.

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

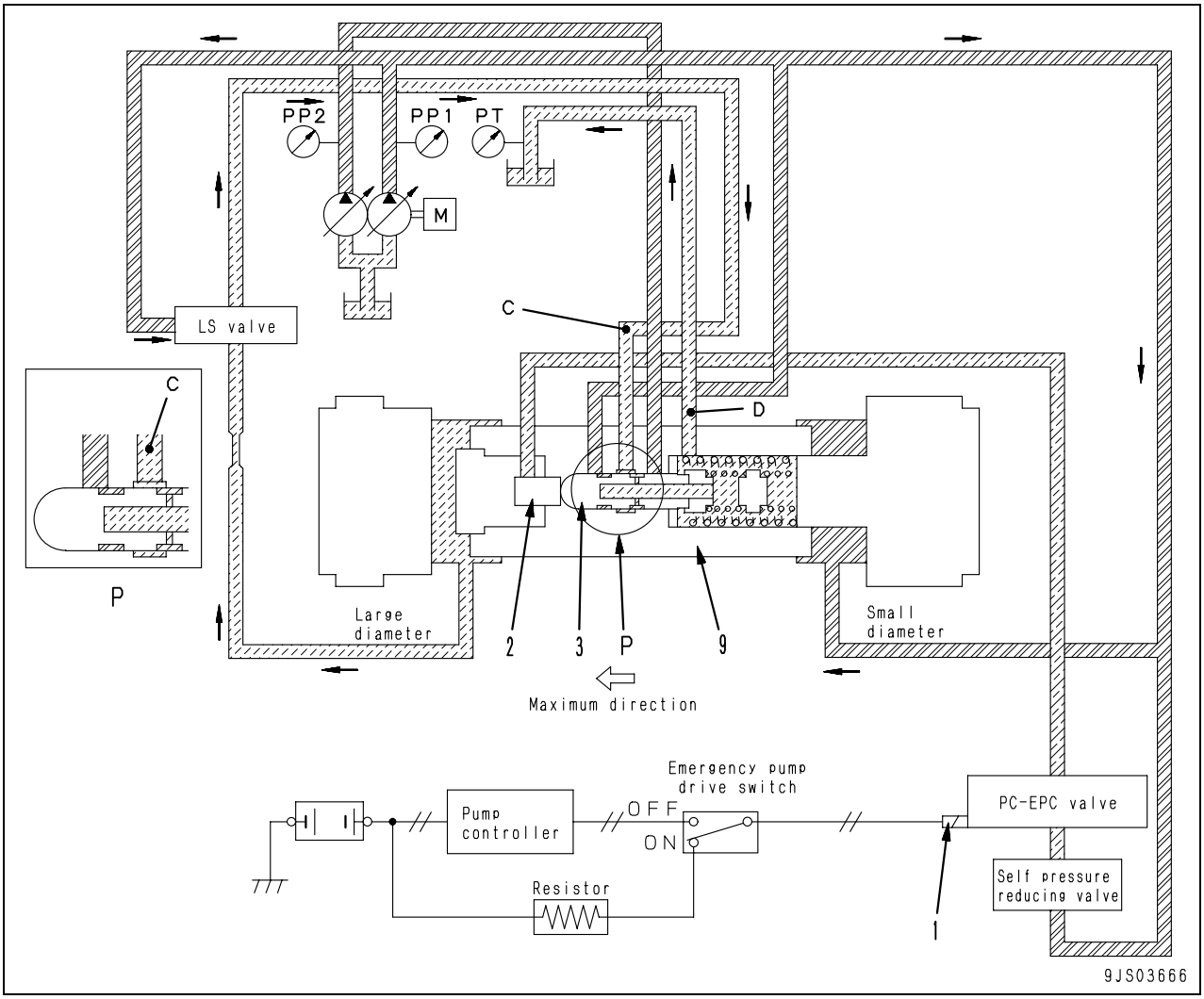


- If command voltage (X) sent to PC-EPC valve solenoid (1) increases further, the relationship between average pump pressure (PP1 + PP2)/2, and pump delivery (Q) is proportional to the force of the PC-EPC valve solenoid and moves in parallel.
- Namely, the force of PC-EPC valve solenoid (1) is added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



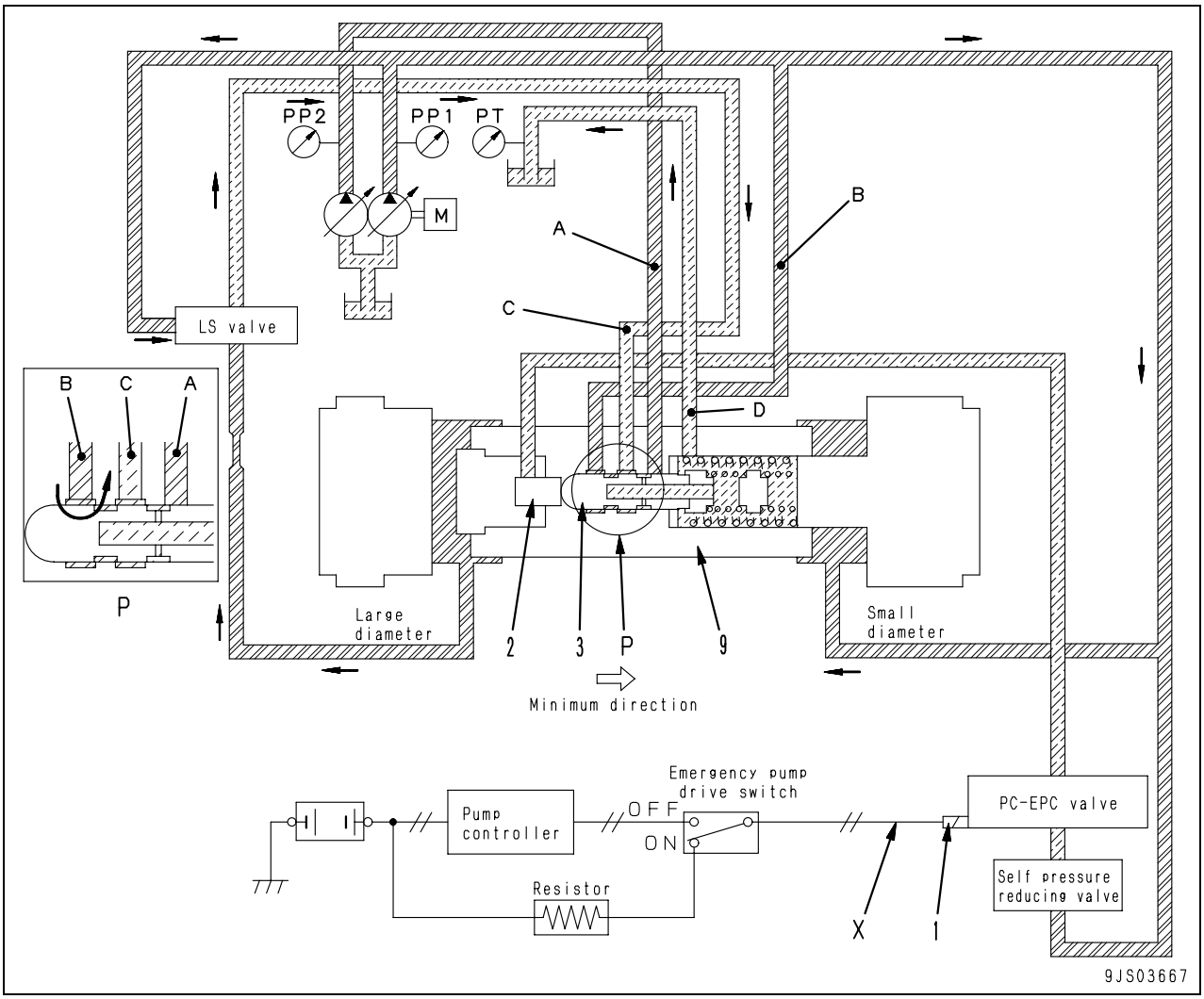
2) As the emergency pump drive switch is turned on due to failure on the pump controller

(1) When the main pump is under light load

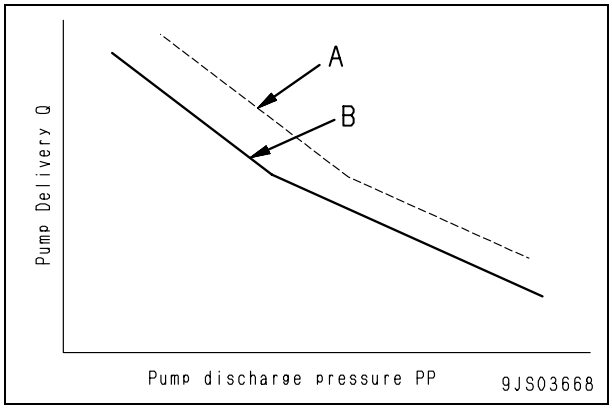


- If there is a failure in the pump controller, the emergency pump drive switch is turned on to hand the control to the resistor side.
- In this case, the power is directly supplied from the battery. The current, however, is too large as is, so the resistor is set in between to control the current flowing to PC-EPC valve solenoid (1).
- The current becomes constant, so the force pushing piston (2) is also constant.
- If the main pump pressures (PP1) and (PP2) are low, the combined force of the pump pressure and the PC-EPC valve solenoid (1) is weaker than the spring set force, so spool (3) is balanced at a position to the left.
- The port (C) is connected to the drain pressure of the port (D), and the large diameter end of the servo piston (9) also becomes the drain pressure (PT) through the LS valve.
- Since the pressure on the small diameter end of the piston large, servo piston (9) moves in the direction to make the discharge amount larger.

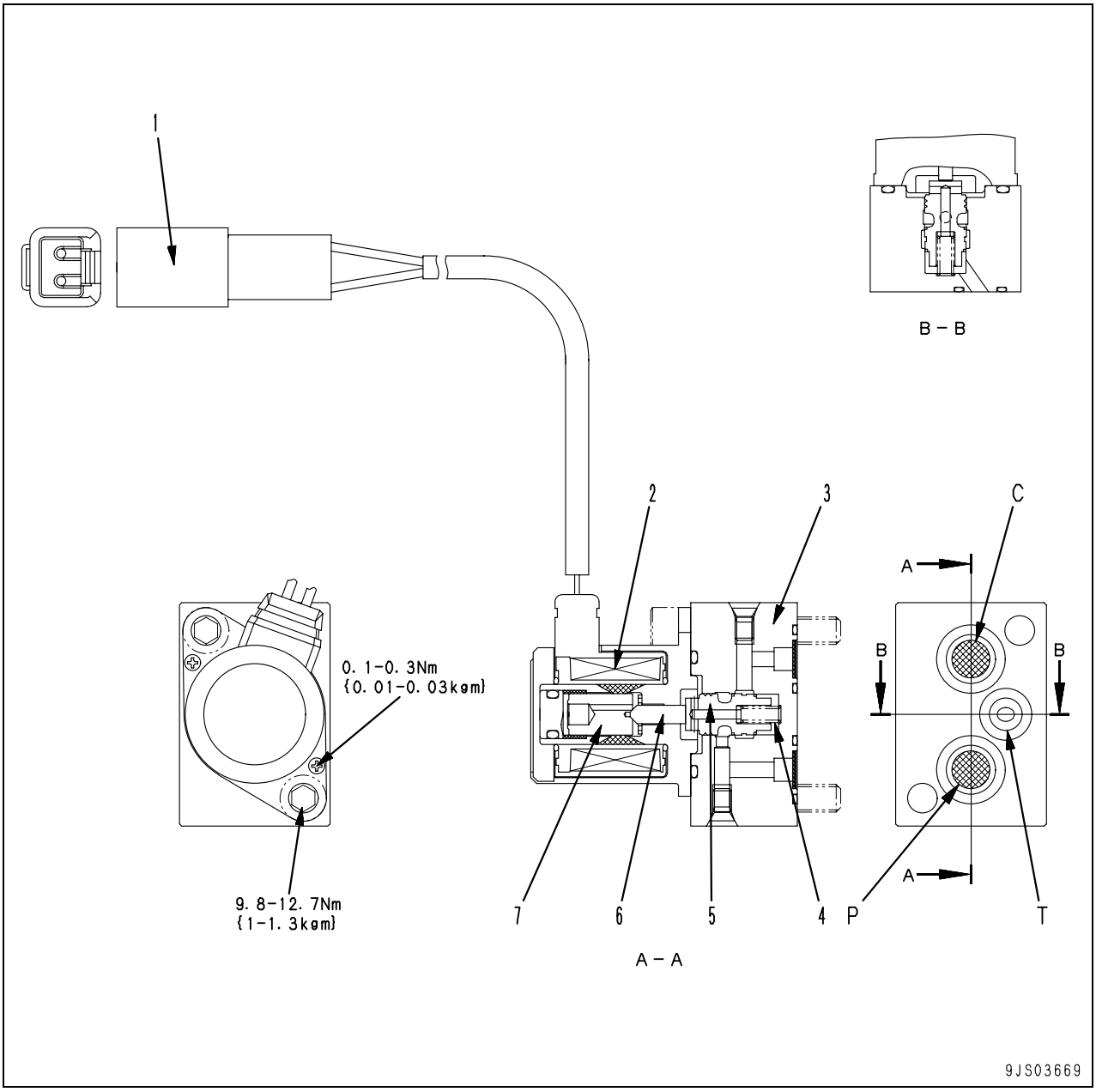
(2) When the main pump is under heavy load



- If the emergency pump drive switch is turned on in the same way as in above, the command current (X) sent to PC-EPC valve solenoid (1) becomes constant.
- For this reason, the force of piston (2) pushing spool (3) is constant.
- If main pump pressures (PP1) and (PP2) increase, spool (3) moves further to the right than when the main pump load is light, and is balanced at the position in the figure above.
- In this case, the pressure from port (B) flows to port (C), so servo piston (9) moves to the right (smaller pump delivery) and stops at a position to the further to the right then when the load on the pump is light.
- When the emergency pump drive switch is turned on, too, the pump pressure (PP) and pump delivery (Q) have a relationship as shown with the curve in the figure corresponding to the current sent to the PC-EPC valve solenoid through the resistor.
- The curve resulting when the emergency pump drive switch is ON is situated further to the left (B) than when the pump controller is normal (A).



3. LS (PC)-EPC valve

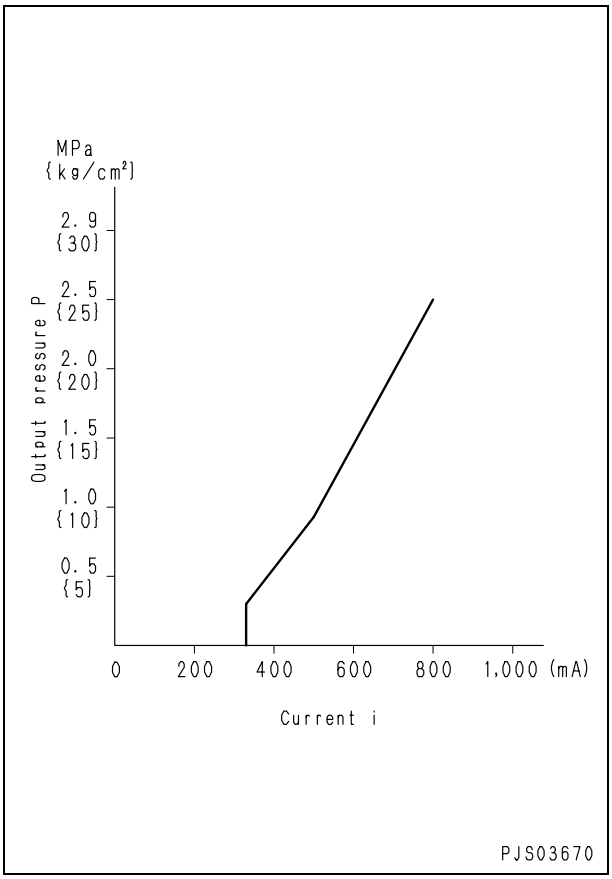


C : To LS (PC) valve
P : From self pressure reducing valve
T : To tank

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

Function

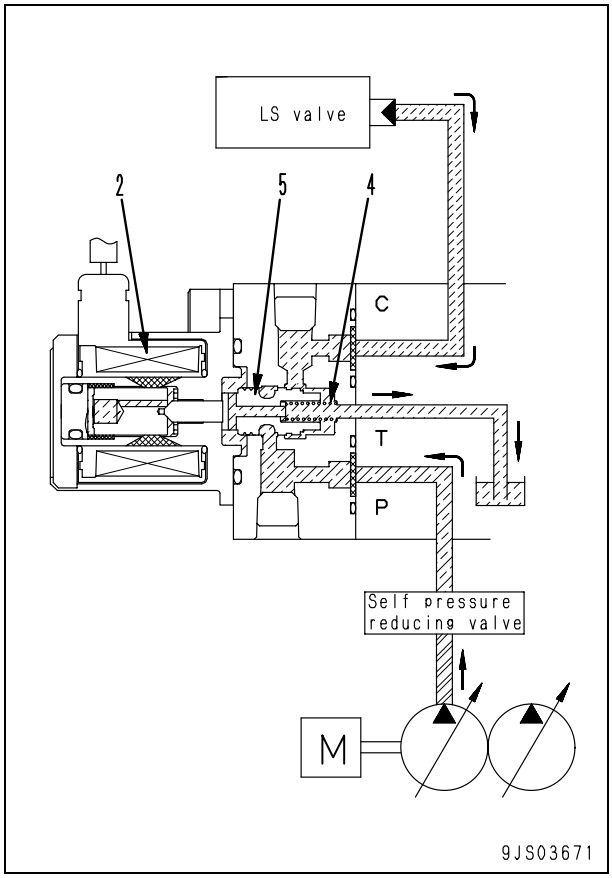
- The EPC valve consists of the proportional solenoid portion and the hydraulic valve portion.
- When it receives signal current (i) from the controller, it generates the EPC output pressure in proportion to the size of the signal, and outputs it to the LS (PC) valve.



Operation

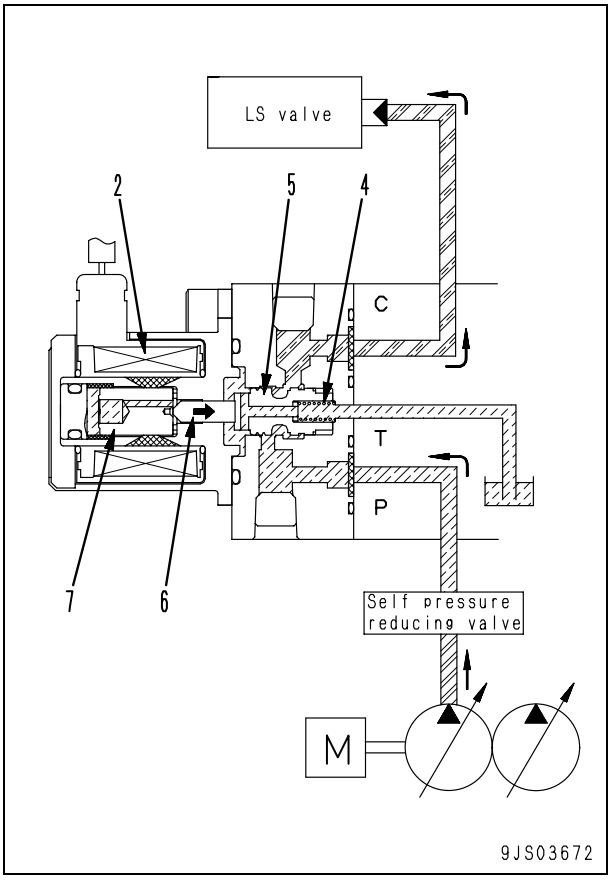
1) When signal current is 0 (coil is deenergized)

- When there is no signal current flowing from the controller to coil (2), coil (2) is deenergized.
- Spool (5) is pushed to the left by spring (4).
- Port (P) closes and the pressurized oil from the self pressure reducing valve does not flow to the LS (PC) valve.
- The pressurized oil from the LS (PC) valve is drained to the tank via port (C) and port (T).



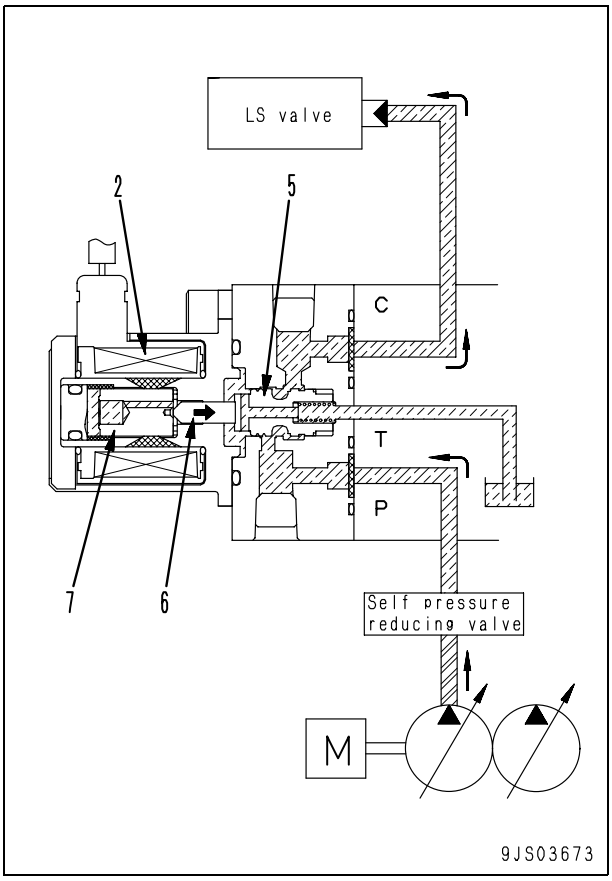
2) When signal current is very small (coil is energized)

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



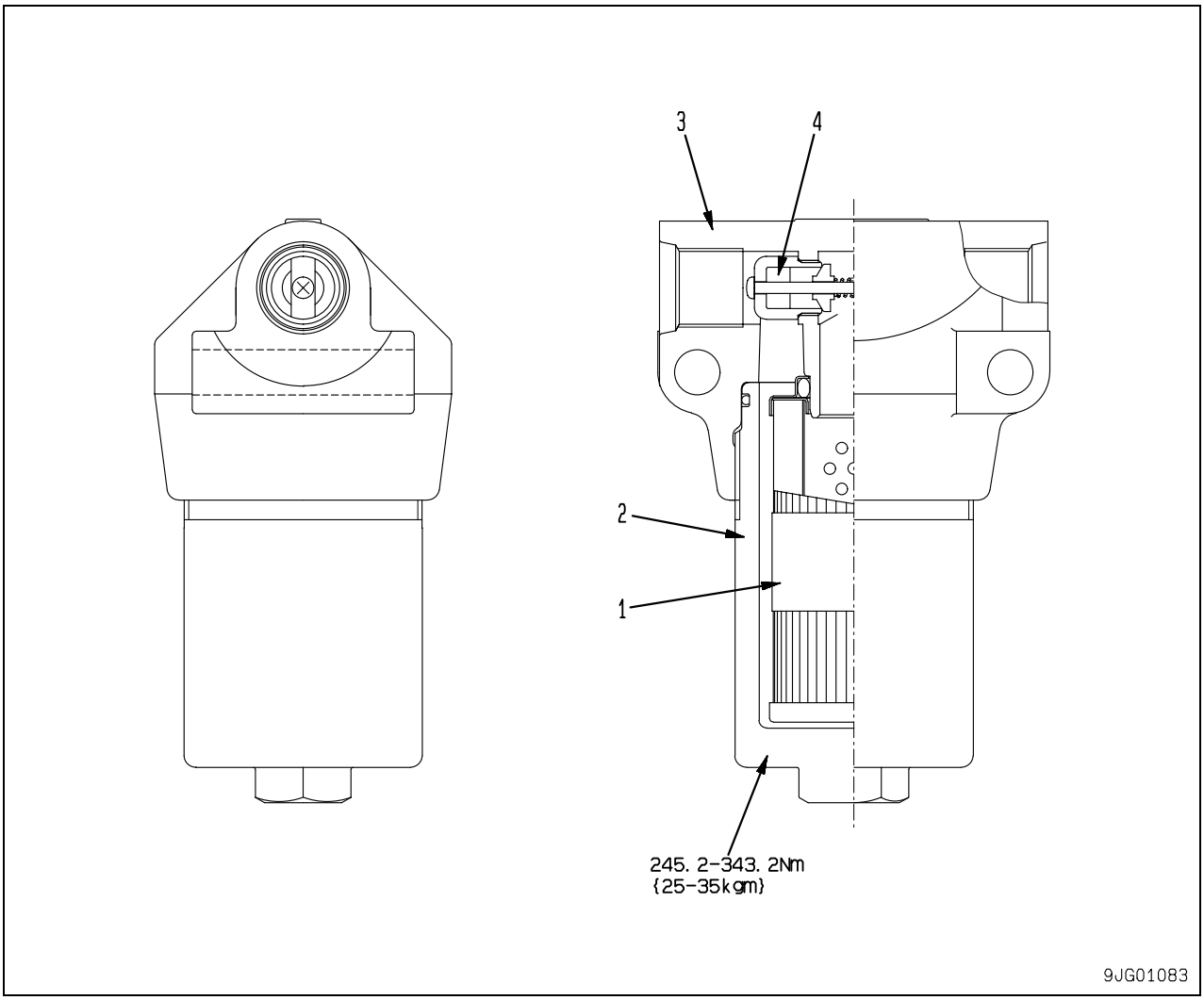
3) When signal current is maximum (coil is energized)

- As the signal current flows to coil (2), coil (2) is energized.
- When this happens, the signal current is at its maximum, so the propulsion force of plunger (7) is also at its maximum.
- Spool (5) is pushed toward right side by rod (6).
- The maximum volume of pressurized oil is conducted from port (P) to port (C), increasing the circuit pressure across EPC valve and LS (PC) valve to the maximum level.
- Since port (T) is closed, pressurized oil does not flow to the tank.



Pilot oil filter

For breaker



1. Filter
2. Case
3. Head cover
4. Relief valve

Specifications

Rated pressure : 6.57 MPa {67 kg/cm^2}
Flow rate : 16 ℓ/min.
Relief valve cracking pressure
: 0.15 MPa {1.5 kg/cm^2}
Filter mesh size : 6 ✕m
Filtering area : 450 cm^2

PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00099-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

10 Structure, function and maintenance standard

Hydraulic system, Part 2

Hydraulic system, Part 2

Control valve

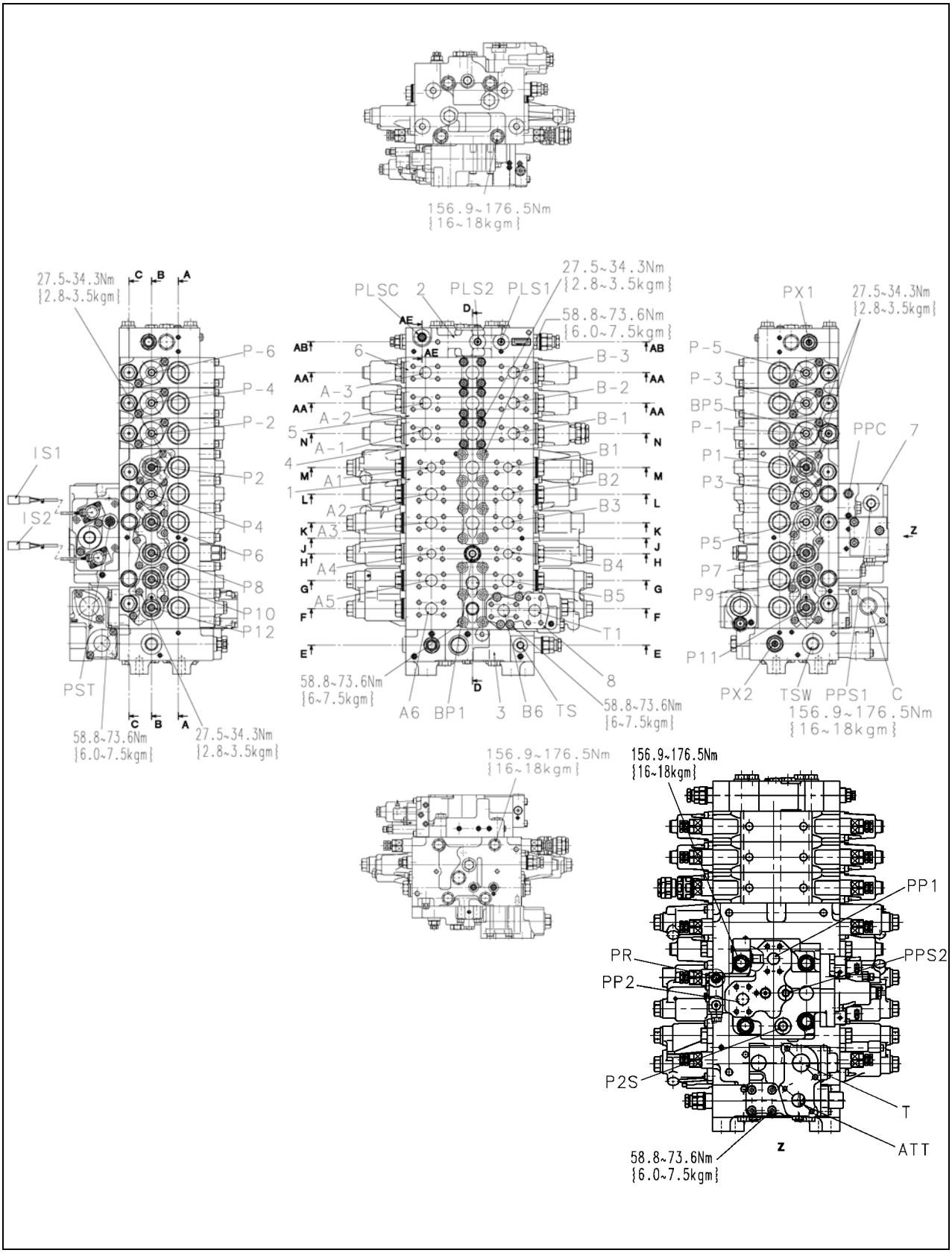
Outline

- This control valve consists of a 6-spool valve (one body composition) and a set of service valve. A merge-divider valve, a back pressure valve and a boom hydraulic drift prevention valve are installed to it.
- Since all the valves are assembled together with connecting bolts and their passes are connected to each other inside the assembly, the assembly is compact and easy to maintain.
- With one spool provided for one work equipment, this control valve is simple in construction.

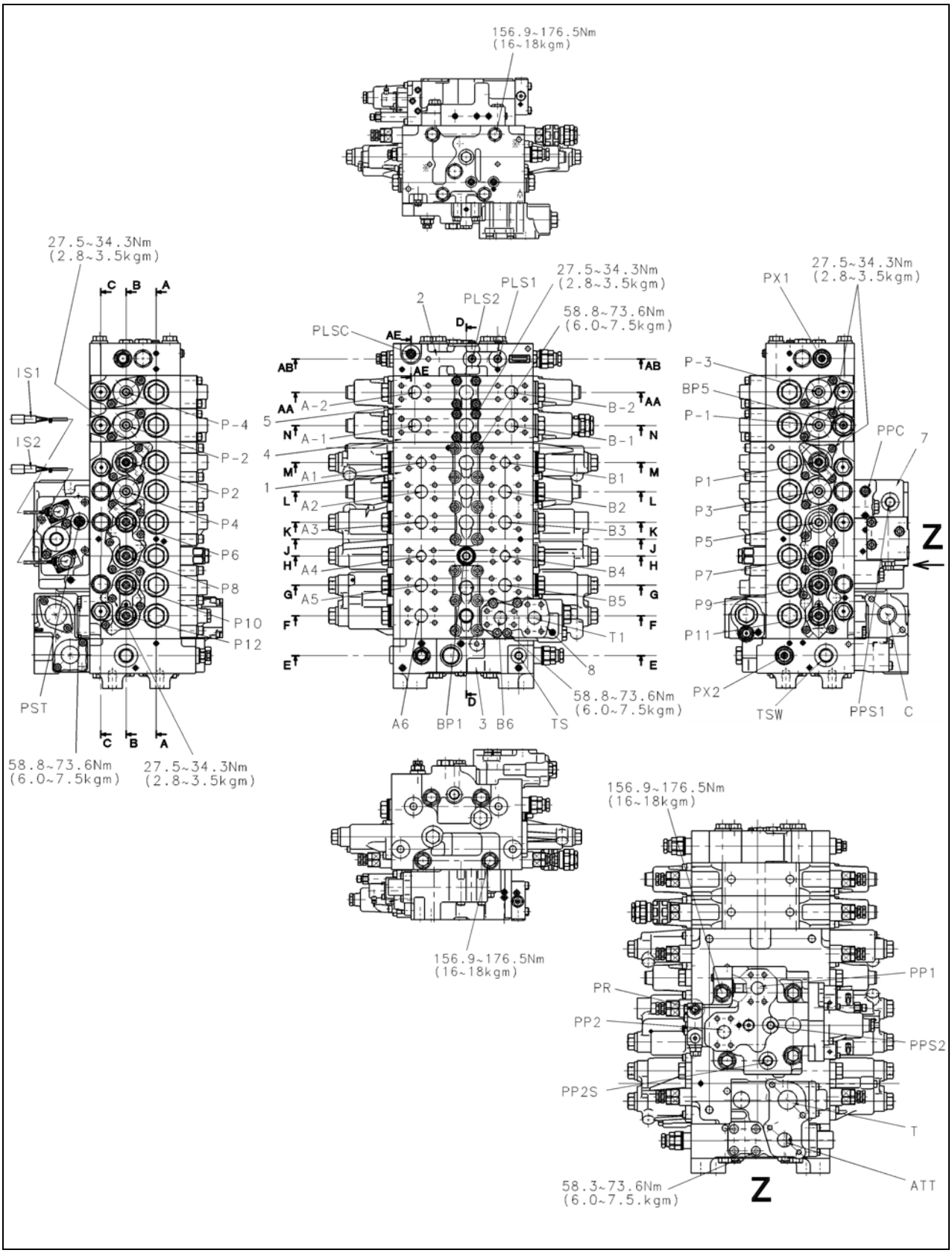
A1: To bucket cylinder head
A2: To L.H. travel motor
A3: To boom cylinder bottom
A4: To swing motor
A5: To R.H. travel motor
A6: To arm cylinder head
A-1: To attachment 1
A-2: To attachment 2
A-3: To attachment 3
ATT: From attachment
B1: To bucket cylinder bottom
B2: To L.H. travel motor
B3: To boom cylinder head
B4: To swing motor
B5: To R.H. travel motor
B6: To arm cylinder bottom
B-1: To attachment 1
B-2: To attachment 2
B-3: To attachment 3
BP1: From LS select solenoid valve
BP5: From attachment selector solenoid valve
C: To tank
IS1: From controller
IS2: From controller
P1: From bucket PPC and EPC valves
P2: From bucket PPC and EPC valves
P3: From L.H. Travel PPC valve
P4: From L.H. Travel PPC valve
P5: From boom PPC and EPC valves
P6: From boom PPC and EPC valves
P7: From swing PPC and EPC valves
P8: From swing PPC and EPC valves
P9: From R.H. Travel PPC valve
P10: From R.H. Travel PPC valve
P11: From arm PPC and EPC valves
P12: From arm PPC and EPC valves
P-1: From service 1 and PPC valves
P-2: From service 1 and PPC valves
P-3: From service 2 and PPC valves
P-4: From service 2 and PPC valves
P-5: From service 3 and PPC valves
P-6: From service 3 and PPC valves
PLS1: To rear pump control
PLS2: To front pump control
PLSC: LS pressure detection port
PP1: From front pump
PP2: From rear pump
PP2S: Pressure sensor mounting port
PPC: Pilot basic pressure detection port
PPS1: Pressure sensor mounting port
PPS2: To front pump control
PR: To solenoid valve, PPC valve, and EPC valve
PST: From travel junction valve solenoid valve
PX1: From 2-stage relief solenoid valve
PX2: From 2-stage relief solenoid valve
T: To tank
T1: To tank
TS: To tank
TSW: To swing motor S-port (suction side)

1. 6 spool valve
2. Cover A
3. Cover B
4. Service valve 1
5. Service valve 2
6. Service valve 3
7. Merge-divider valve
8. Arm quick return valve

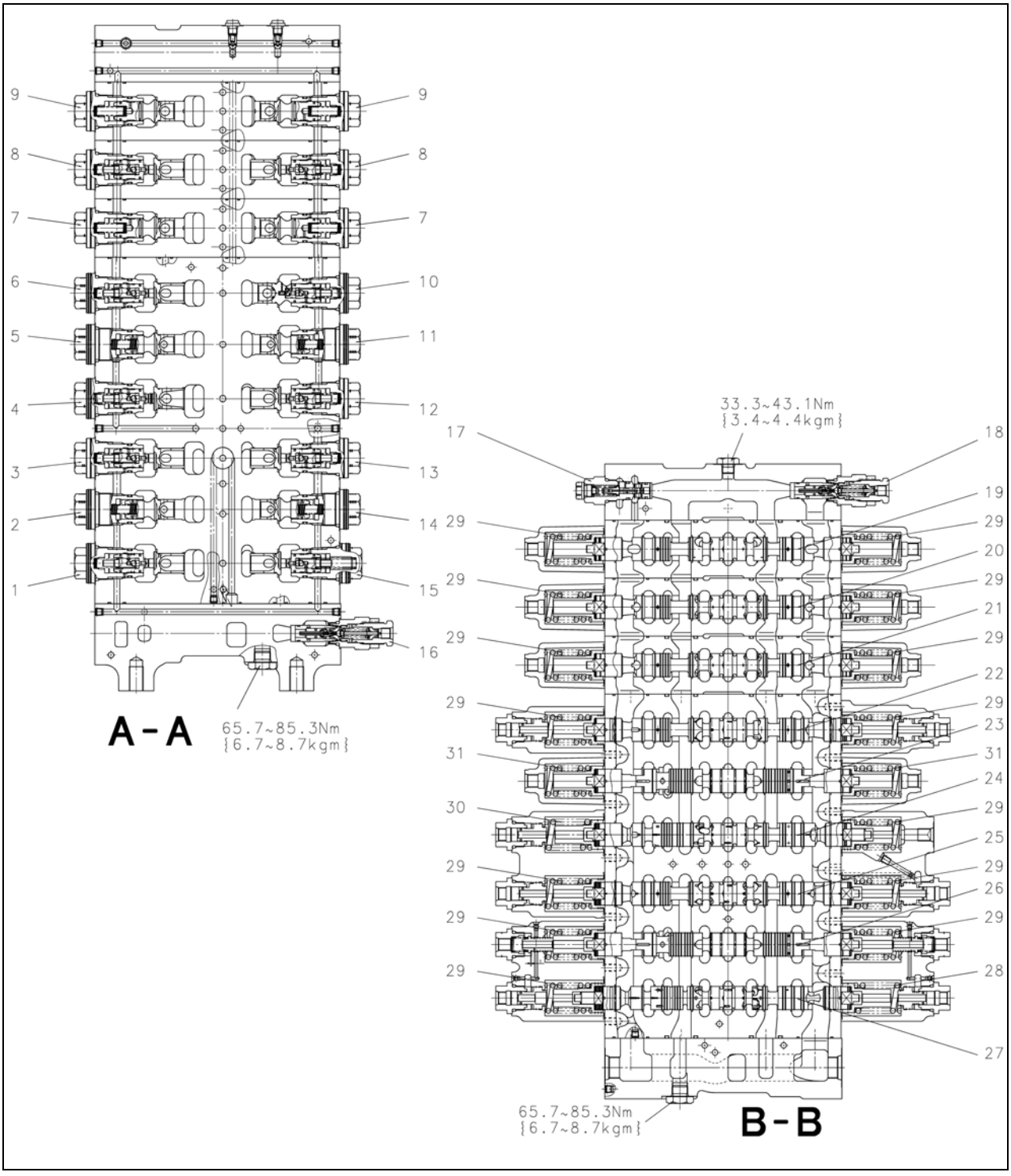
General view
PC210/230-8



PC240-8


156.9~176.5Nm
(16~18kgm)
27.5~34.3Nm
(2.8~3.5kgm)
IS1
IS2
P-4
P-2
P2
P4
P6
P8
P10
P12
PST
58.8~73.6Nm
(6.0~7.5kgm)
27.5~34.3Nm
(2.8~3.5kgm)
PLSC
PLS1
PLS2
58.8~73.6Nm
(6.0~7.5kgm)
A-2
A-1
A1
A2
A3
A4
A5
B-2
B-1
B1
B2
B3
B4
B5
T1
A6
BP1
3
B6
TS
58.8~73.6Nm
(6.0~7.5kgm)
PX1
27.5~34.3Nm
(2.8~3.5kgm)
P-3
BP5
P-1
PPC
7
P1
P3
P5
P7
P9
P11
Z
PX2
TSW
PPS1
C
156.9~176.5Nm
(16~18kgm)
156.9~176.5Nm
(16~18kgm)
PP1
PR
PP2
PPS2
PP2S
T
ATT
58.3~73.6Nm
(6.0~7.5.kgm)
Z

Sectional view
(1/5)

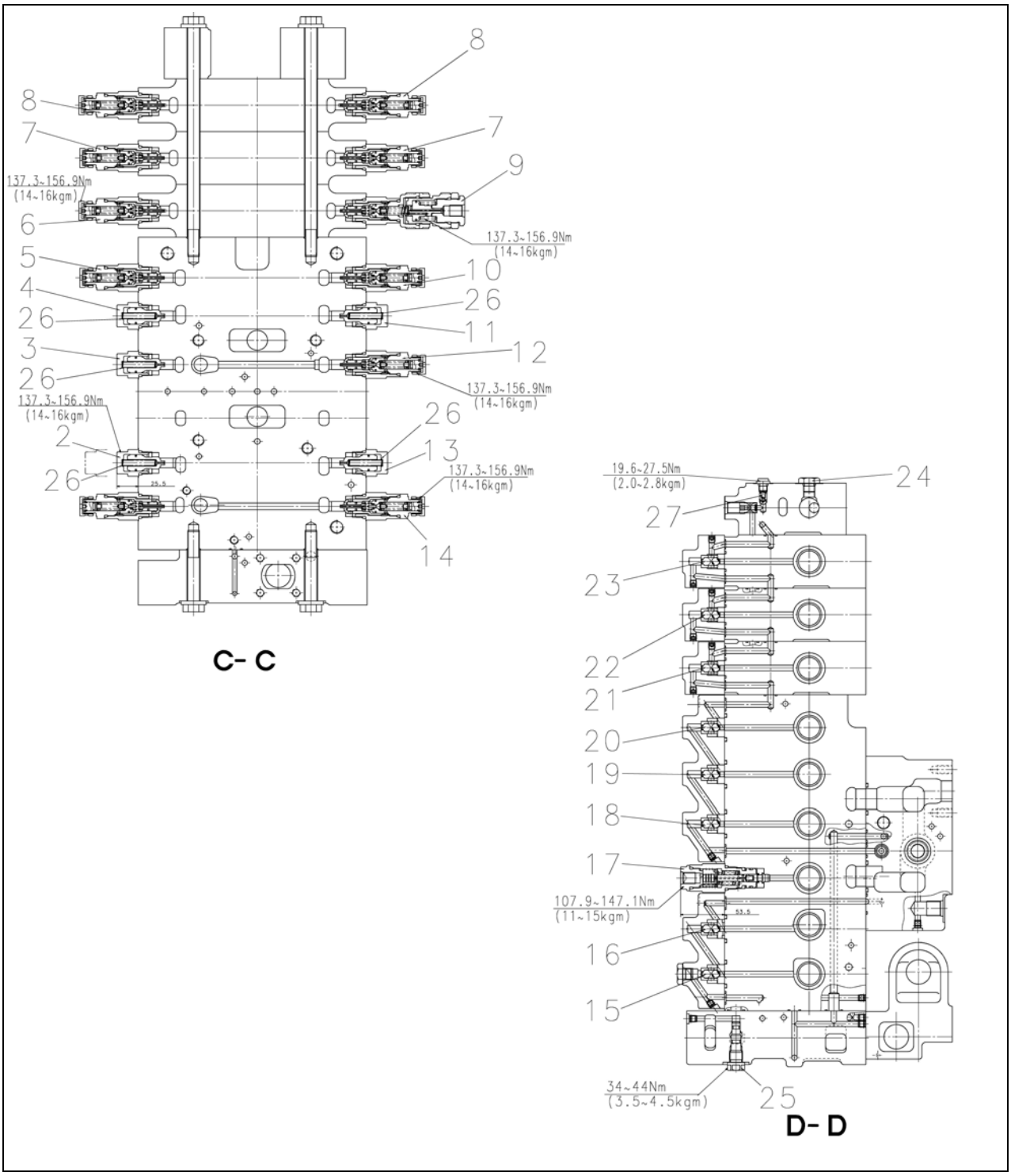


1. Pressure compensation valve (Arm out)
2. Pressure compensation valve (R.H. travel reverse)
3. Pressure compensation valve (Right swing)
4. Pressure compensation valve (Boom raise)
5. Pressure compensation valve (L.H. travel reverse)
6. Pressure compensation valve (Bucket dump)
7. Pressure compensation valve (Service 1)
8. Pressure compensation valve (Service 2)
9. Pressure compensation valve (Service 3)
10. Pressure compensation valve (Bucket curl)
11. Pressure compensation valve (L.H. travel forward)
12. Pressure compensation valve (Boom lower)
13. Pressure compensation valve (Left swing)
14. Pressure compensation valve (R.H. travel forward)
15. Pressure compensation valve (Arm in)
16. Main relief valve
17. Unload valve
18. Main relief valve
19. Spool (Service 3)
20. Spool (Service 2)
21. Spool (Service 1)
22. Spool (Bucket)
23. Spool (L.H. travel)
24. Spool (Boom)
25. Spool (Swing)
26. Spool (R.H. travel)
27. Spool (Arm)

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
28	Spool return spring	Free length x Outside diameter	Installed length	Installation load	Free length	Installation load	If damaged or deformed, replace spring.
		55.2 x 34.4	51.2	407 N {41.5 kg}	—	326 N {33.2 kg}	
29	Spool return spring	54.5 x 34.8	51.2	393 N {40.1 kg}	—	315 N {32.1 kg}	
30	Spool return spring	54.4 x 34.8	51.2	375 N {38.2 kg}	—	300 N {30.6 kg}	
31	Spool return spring	54.6 x 34.8	51.2	421 N {42.9 kg}	—	336 N {34.3 kg}	

(2/5)

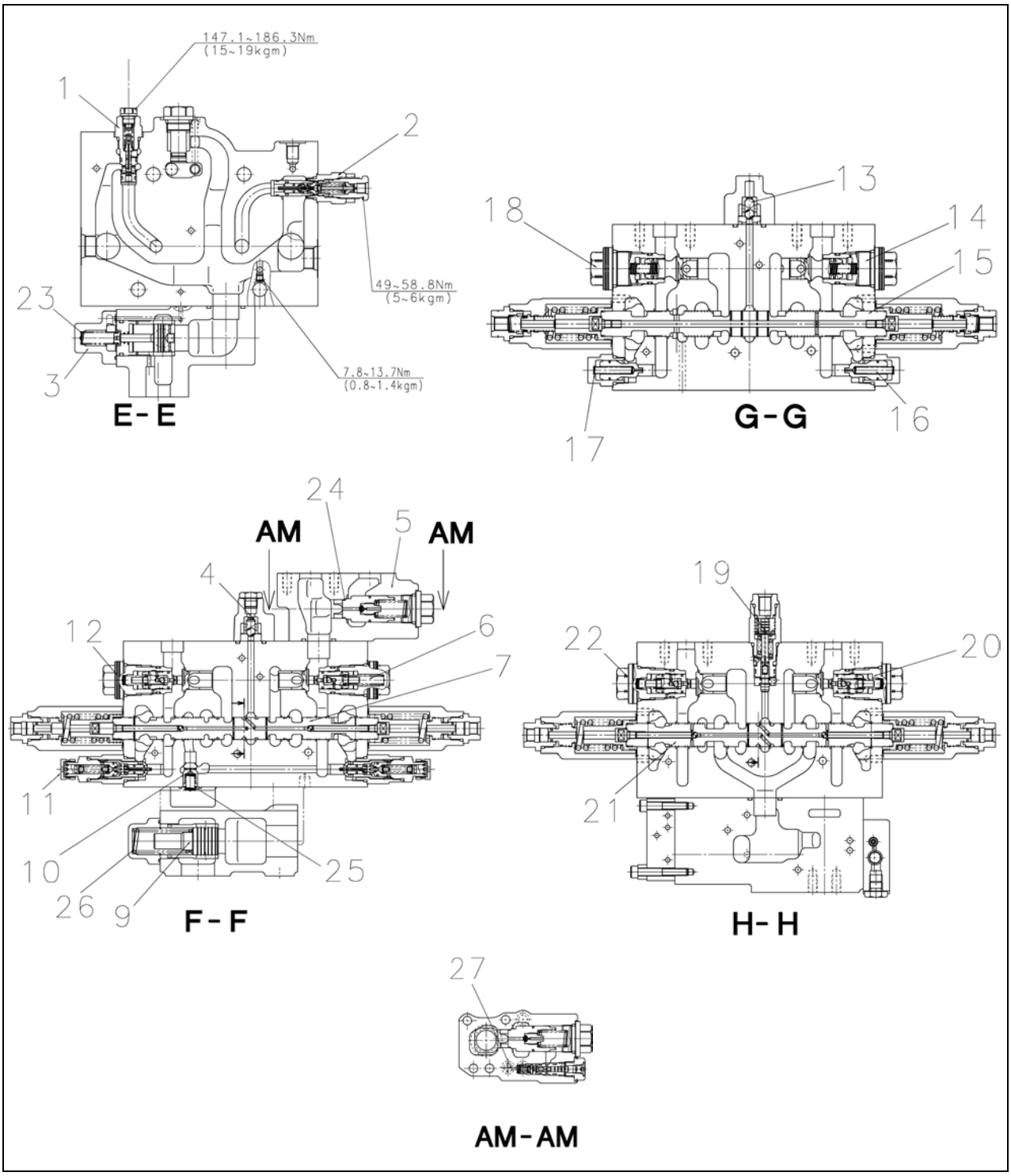

8
8
7
7
9
137.3~156.9Nm
(14~16kgm)
6
137.3~156.9Nm
(14~16kgm)
5
10
4
26
26
11
3
12
26
137.3~156.9Nm
(14~16kgm)
137.3~156.9Nm
(14~16kgm)
26
2
13
26
137.3~156.9Nm
(14~16kgm)
14
C- C
19.6~27.5Nm
(2.0~2.8kgm)
24
27
23
22
21
20
19
18
17
107.9~147.1Nm
(11~15kgm)
16
15
34~44Nm
(3.5~4.5kgm)
25
D- D

1. Suction valve (Arm out)
2. Suction valve (R.H. travel reverse)
3. Suction valve (Boom raise)
4. Suction valve (L.H. travel reverse)
5. Safety-suction valve (Bucket dump)
6. Safety-suction valve (Service 1)
7. Safety-suction valve (Service 2)
8. Safety-suction valve (Service 3)
9. 2-stage safety-suction valve (Service)
10. Safety-suction valve (Bucket curl)
11. Suction valve (L.H. travel forward)
12. Safety-suction valve (Boom lower)
13. Suction valve (R.H. travel forward)
14. Safety-suction valve (Arm in)
15. LS shuttle valve (Arm)
16. LS shuttle valve (R.H. travel)
17. LS select valve
18. LS shuttle valve (Boom)
19. LS shuttle valve (L.H. travel)
20. LS shuttle valve (Bucket)
21. LS shuttle valve (Service 1)
22. LS shuttle valve (Service 2)
23. LS shuttle valve (Service 3)
24. LS check valve
25. Pressure relief plug

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
26	Suction valve spring	Free length x Outside diameter	Installed length	Installation load	Free length	Installation load	If damaged or deformed, replace spring.
		46.8 x 7.5	40.6	5.5 N {0.56 kg}	—	4.4 N {0.45 kg}	
27	Check valve spring	11.5 x 4.6	8.5	1.5 N {0.15 kg}	—	1.2 N {0.12 kg}	

(3/5)


147.1~186.3Nm
(15~19kgm)
1
2
49~58.8Nm
(5~6kgm)
23
3
7.8~13.7Nm
(0.8~1.4kgm)
E-E
13
18
14
15
17
16
G-G
24
AM
5
AM
4
12
6
7
11
10
26
9
25
F-F
19
22
20
21
H-H
27
AM-AM

1. Unload valve
2. Main relief valve
3. Lift check valve

Arm valve

4. LS shuttle valve
5. Quick return valve
6. Pressure compensation valve (IN)
7. Spool
8. Safety-suction valve (IN)
9. Back pressure valve
10. Regeneration circuit check valve
11. Suction valve (OUT)
12. Pressure compensation valve (OUT)

R.H. travel valve

13. LS shuttle valve
14. Pressure compensation valve (Forward)
15. Spool
16. Suction valve (Forward)
17. Suction valve (Reverse)
18. Pressure compensation valve (Reverse)

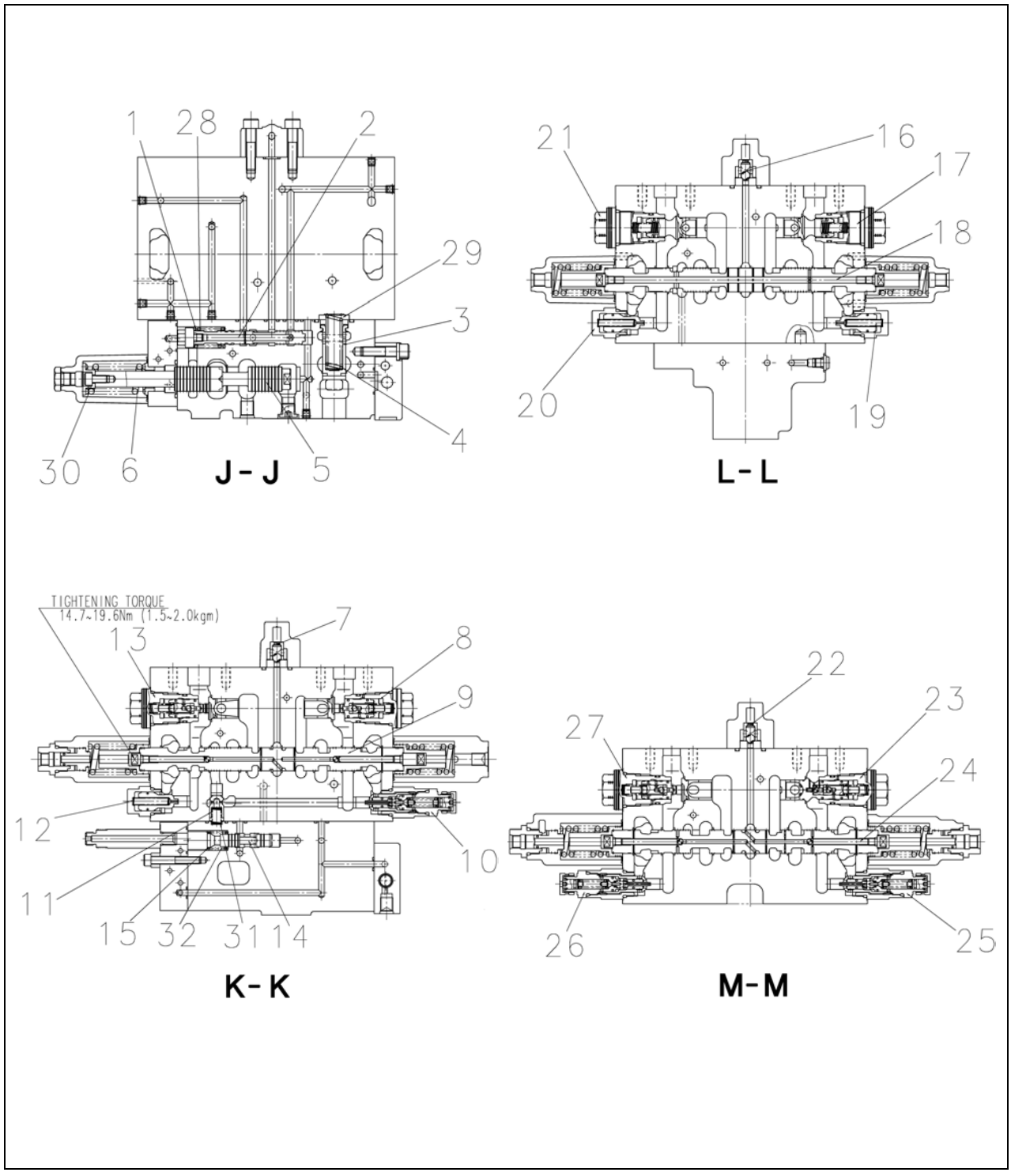
Swing valve

19. LS select valve
20. Pressure compensation valve (L.H.)
21. Spool
22. Pressure compensation valve (R.H.)

Unit: mm

No.	Check item	Criteria					Remedy
23	Check valve spring	Standard size			Repair limit		If damaged or deformed, replace spring.
		Free length x Outside diameter	Installed length	Installation load	Free length	Installation load	
		59.3 x 14.4	43	14.7 N {1.5 kg}	—	11.8 N {1.2 kg}	
24	Piston return spring	60.2 x 20	36	170 N {17.3 kg}	—	135 N {13.8 kg}	
25	Check valve spring	31.5 x 10.3	19.5	5.9 N {0.6 kg}	—	4.71 N {0.48 kg}	
26	Piston return spring	88.2 x 28.4	65	157 N {16 kg}	—	126 N {12.8 kg}	
27	Piston return spring	18.0 x 9.3	13.4	36.1 N {3.68 kg}	—	28.8 N {2.94 kg}	

(4/5)


1
28
2
29
3
4
30
6
5
J-J
21
16
17
18
20
19
L-L
TIGHTENING TORQUE
14.7~19.6Nm (1.5~2.0kgm)
13
7
8
9
12
10
11
15
32
31
14
K-K
22
23
27
24
26
25
M-M

1. Return spring
2. Merge-divider valve (for LS)
3. Valve (Sequence valve)
4. Spring (Sequence valve)
5. Merge-divider valve (Main)
6. Return spring

Boom valve

7. LS shuttle valve
8. Pressure compensation valve (Lower)
9. Spool
10. Safety-suction valve (Lower)
11. Regeneration circuit check valve
12. Suction valve (Raise)
13. Pressure compensation valve (Raise)

L.H. travel valve

14. Merge-divider valve (travel junction valve)
15. Return spring
16. LS shuttle valve
17. Pressure compensation valve (Forward)
18. Spool
19. Suction valve (Forward)
20. Suction valve (Reverse)
21. Pressure compensation valve (Reverse)

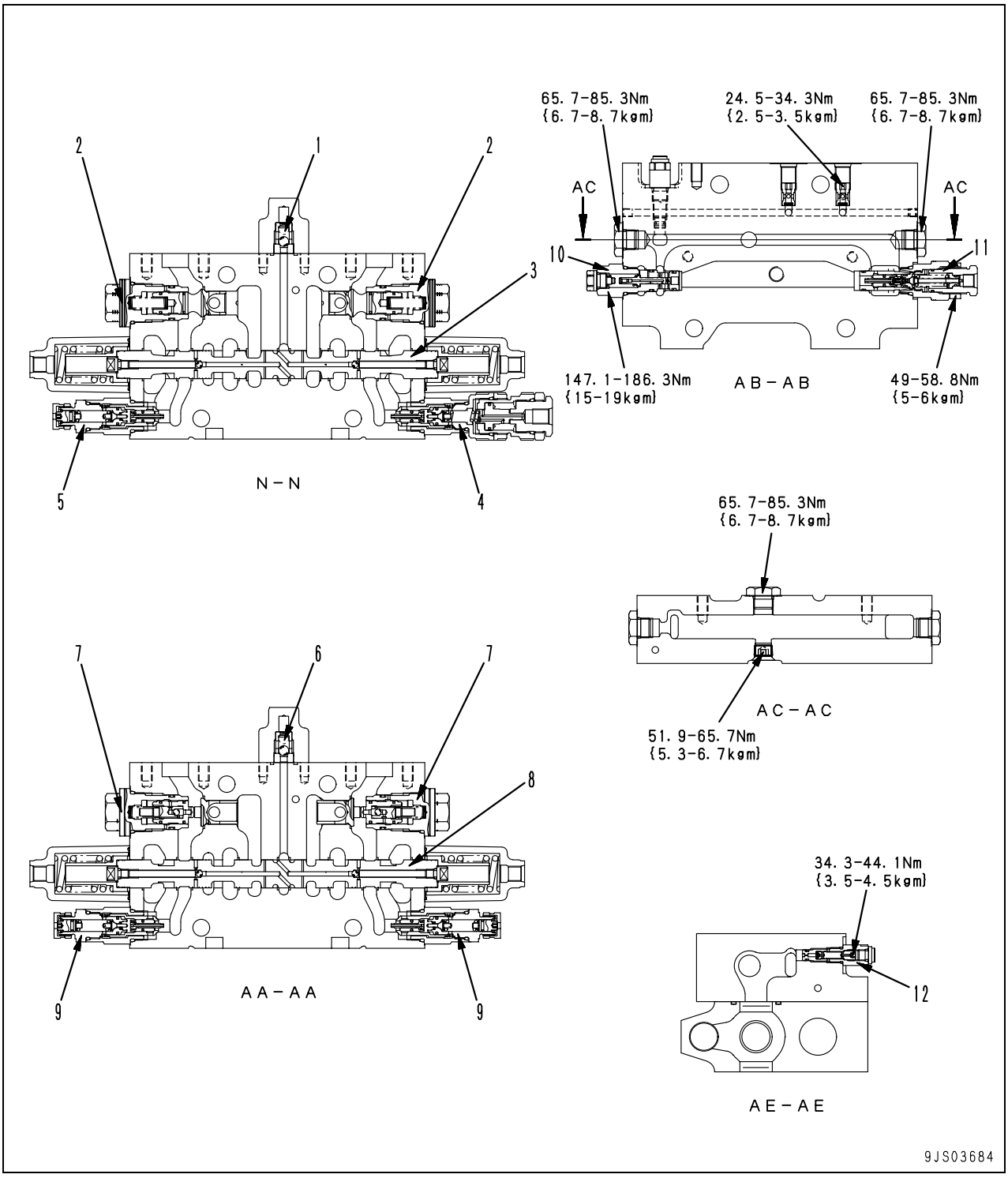
Bucket valve

22. LS shuttle valve
23. Pressure compensation valve (Curl)
24. Spool
25. Safety-suction valve (Curl)
26. Safety-suction valve (Dump)
27. Pressure compensation valve (Dump)

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
28	Spool return spring	Free length x Outside diameter	Installed length	Installation load	Free length	Installation load	If damaged or deformed, replace spring.
		36.4 x 21.8	33.0	121 N {12.3 kg}	—	96.5 N {9.84 kg}	
29	Check valve spring	70.9 x 18.0	56.0	250 N {25.5 kg}	—	200 N {20.4 kg}	
30	Spool return spring	64.5 x 32.3	63.0	178 N {18.1 kg}	—	142 N {14.5 kg}	
31	Piston return spring	31.5 x 10.3	19.5	5.9 N {0.6 kg}	—	4.71 N {0.48 kg}	
32	Piston return spring	30.7 x 20.5	23	50.0 N {5.1 kg}	—	40.0 N {4.08 kg}	

(5/5)



Service valve 1

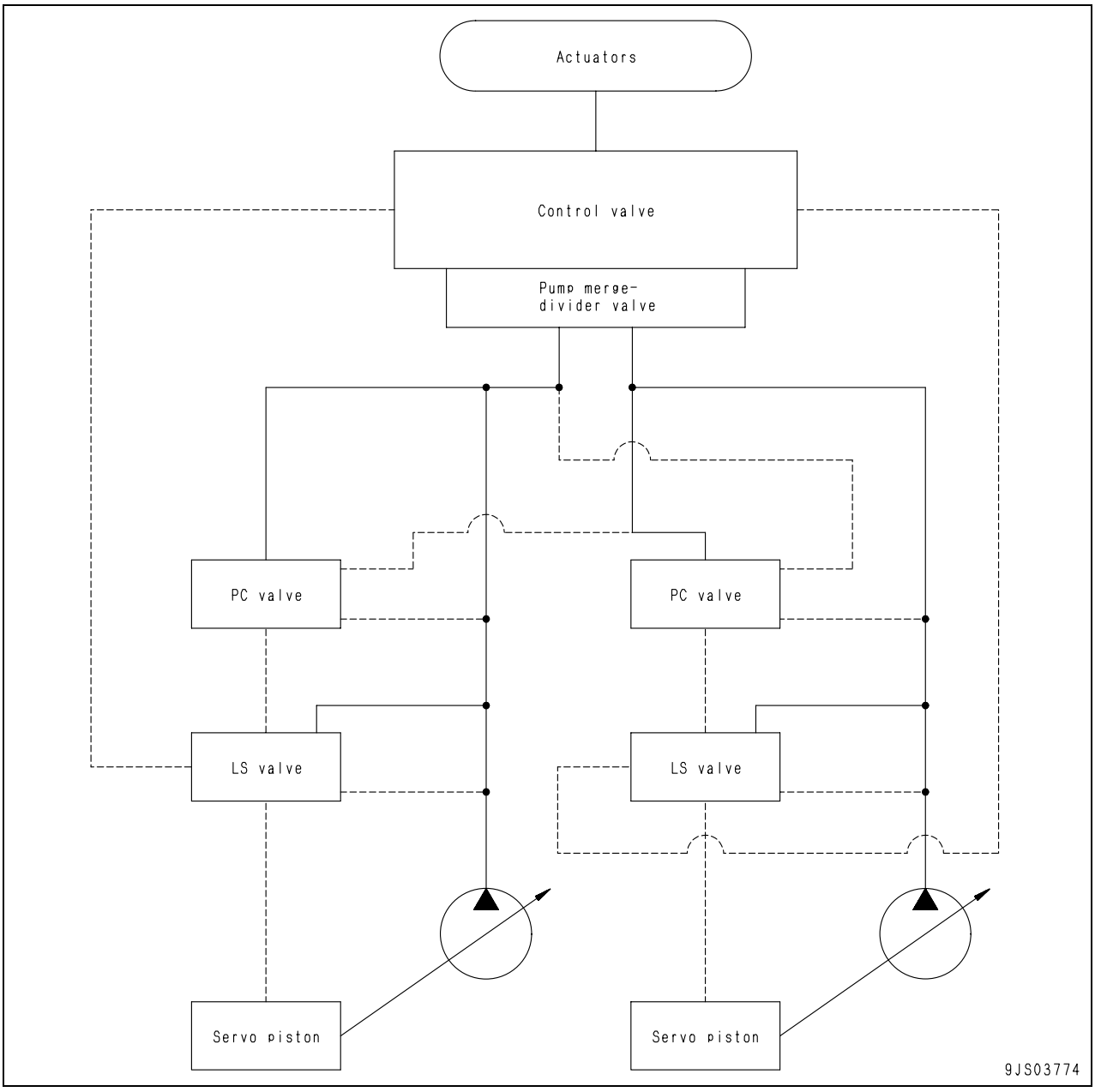
1. LS shuttle valve
2. Pressure compensation valve
3. Spool
4. 2-stage safety-suction valve
5. Safety-suction valve

Service valves 2 and 3

6. LS shuttle valve
7. Pressure compensation valve
8. Spool
9. Safety-suction valve
10. Unload valve
11. Main relief valve
12. LS bypass plug

CLSS

Outline of CLSS



Features

CLSS stands for Closed center Load Sensing System, which has the following characteristics:

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

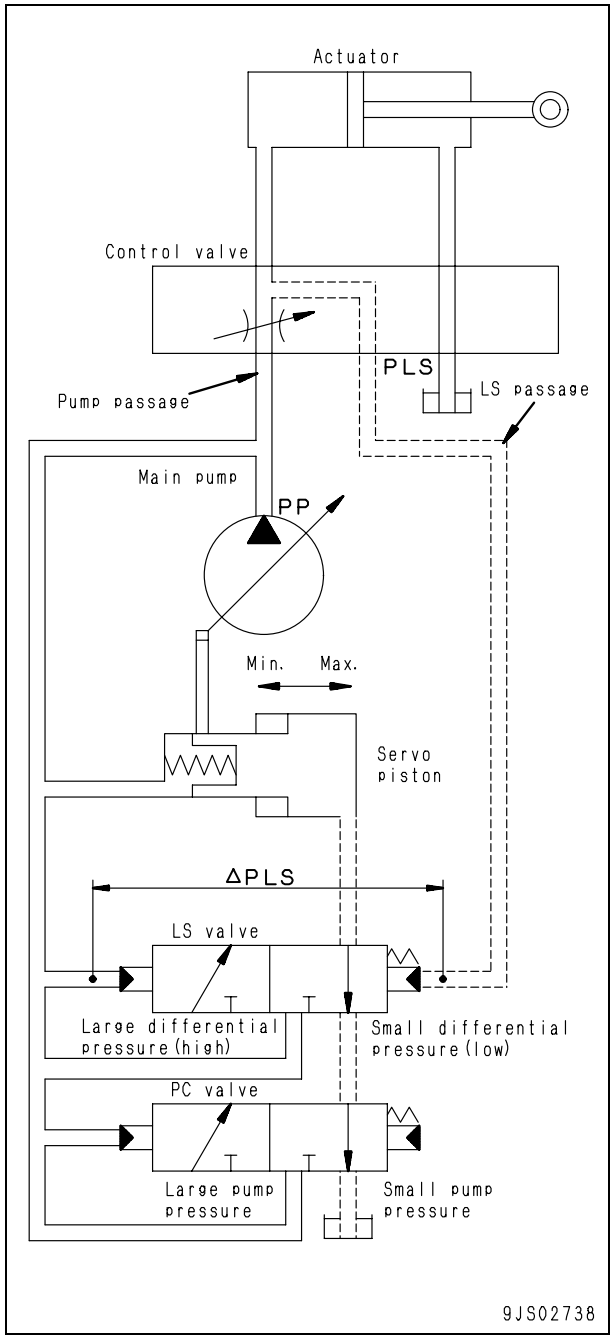
Configuration

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

Basic principle

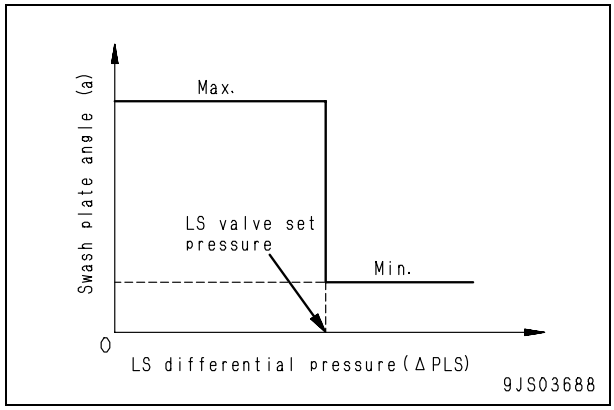
1. Pump swash plate angle control

- The pump swash plate angle (pump delivery) is controlled so that LS differential pressure (✕PLS) (the difference between pump pressure PP and control valve outlet port LS pressure PLS) (load pressure of actuator) is constant.
- [LS differential pressure (✕PLS) = Pump discharge pressure (PP) — LS pressure (PLS)]



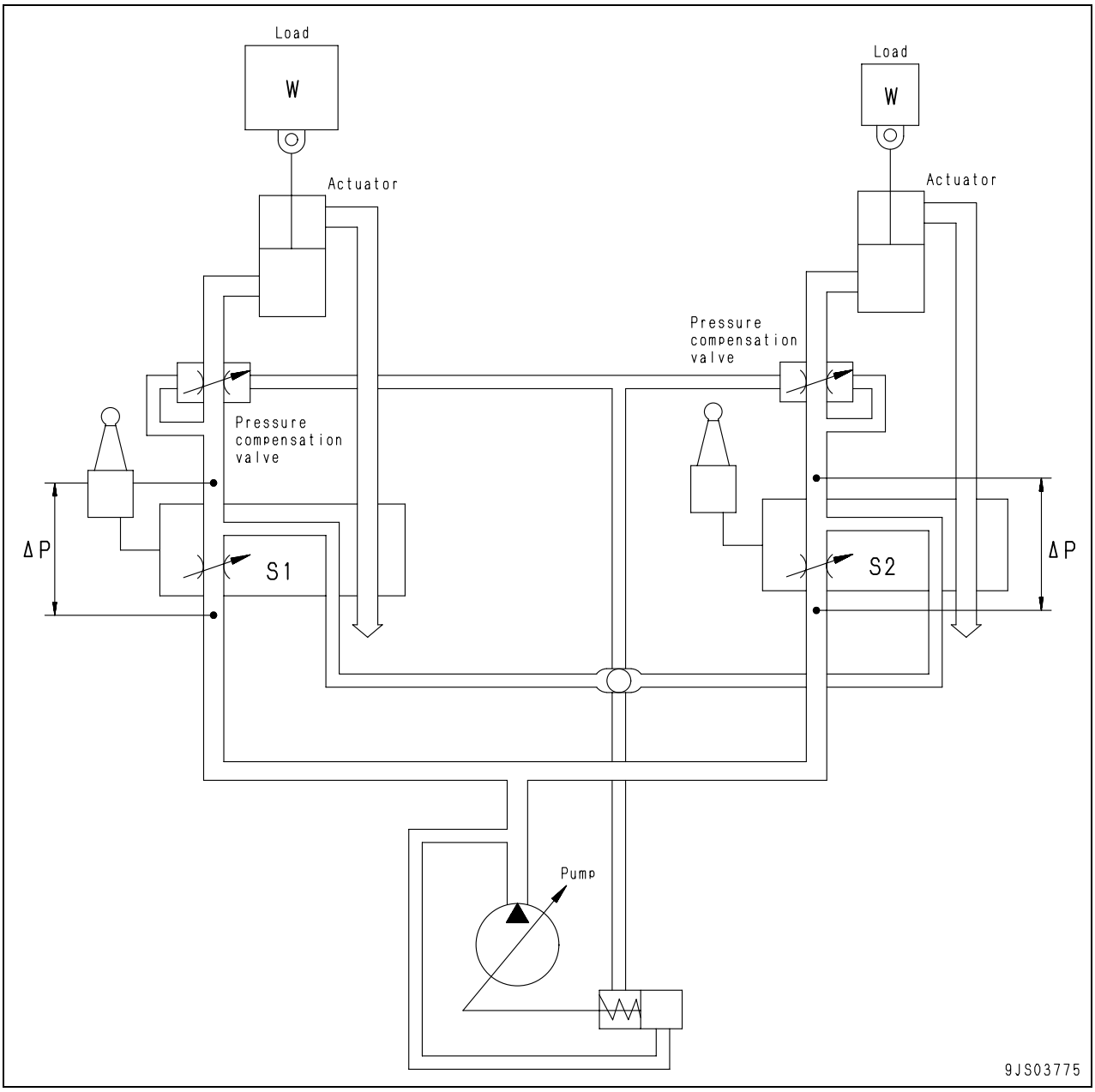
- The pump swash plate angle shifts toward the maximum position if LS differential pressure (✕PLS) is lower than the set pressure of the LS valve (when the actuator load pressure is high).
- If it becomes higher than the set pressure (when the actuator load pressure is low), the pump swash plate angle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

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



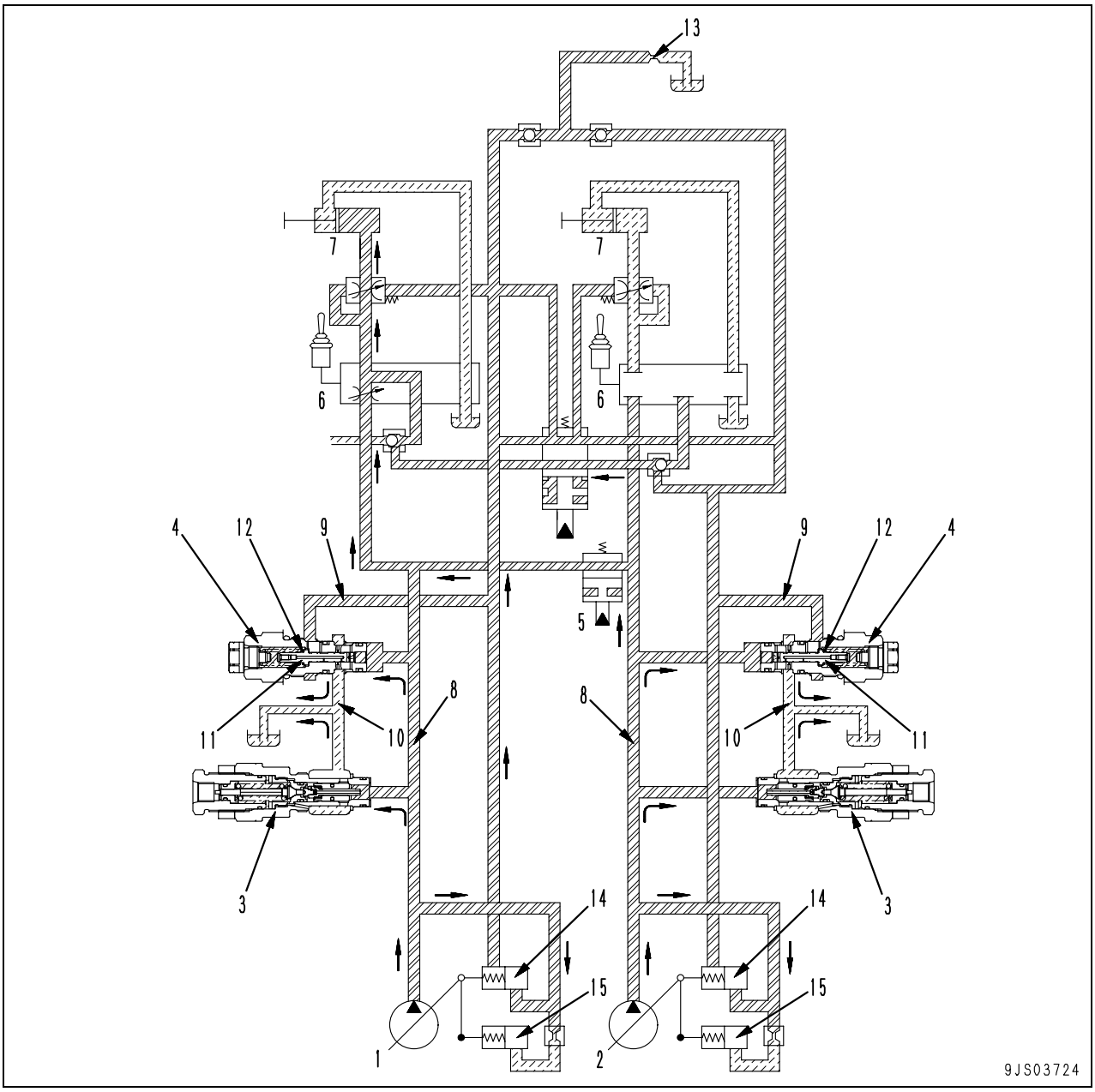
★ For details of functions, see the “Hydraulic pump“ paragraph.

2. Pressure compensation control



- A pressure compensation valve is installed to the outlet port side of the control valve to balance the load.
- When actuators are operated together, the pressure difference (✕P) between the upstream (inlet port) and downstream (outlet port) of the spool of each valve becomes the same regardless the size of the load (pressure).
- The flow of oil from the pump is divided (compensated) in proportion to the area of opening (S1) and (S2) of each valve.

3. System diagram

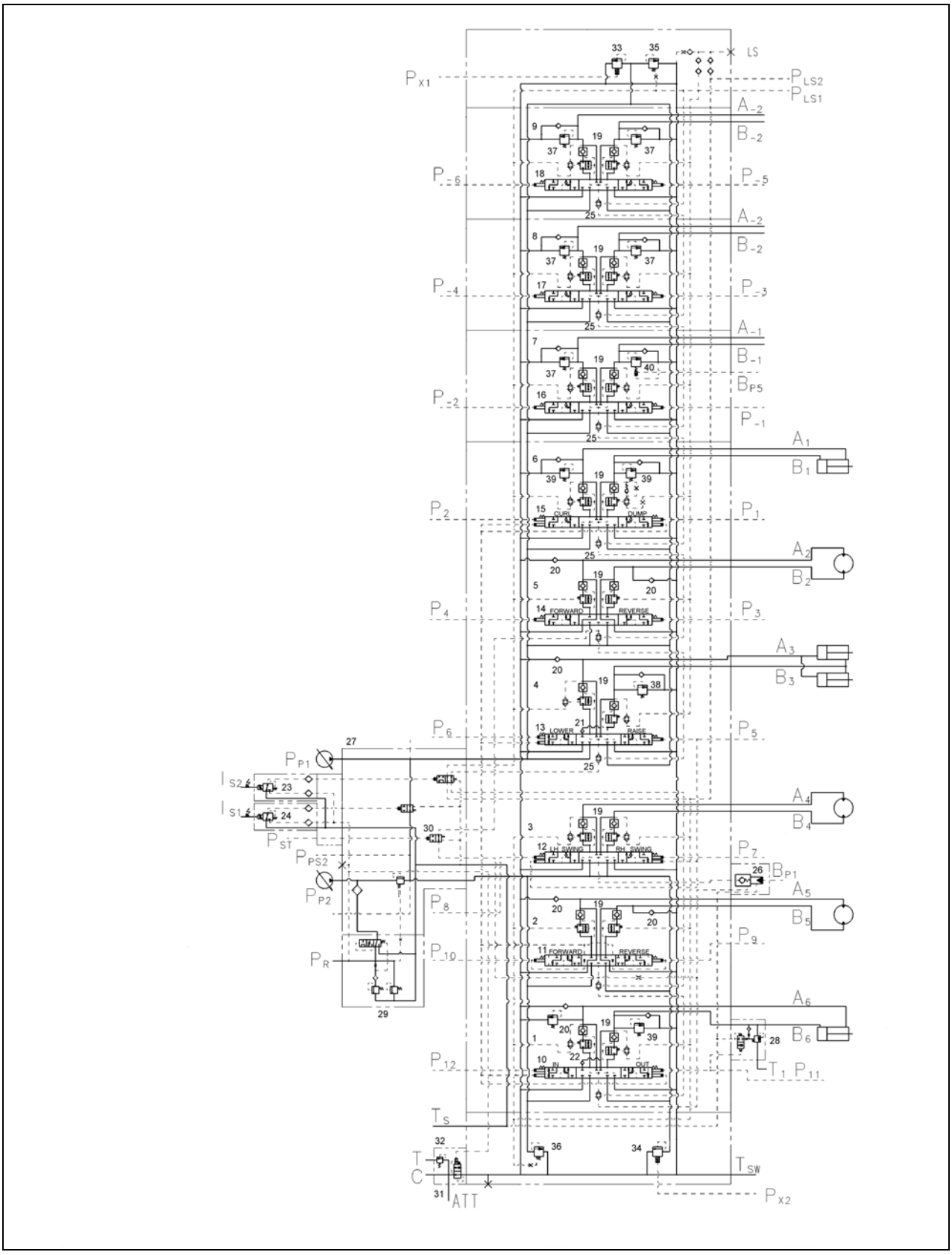


★ The illustration shows the actuator (6) in the merge mode with stroke end at the time of relief.

1. Front pump
2. Rear pump
3. Main relief valve
4. Unload valve
5. Merge-divider valve
6. Control valve
7. Actuator
8. Pump circuit
9. LS circuit
10. Tank circuit
11. Valve
12. Spring
13. LS bypass valve
14. LS valve
15. PC valve

Functions and operation by valve

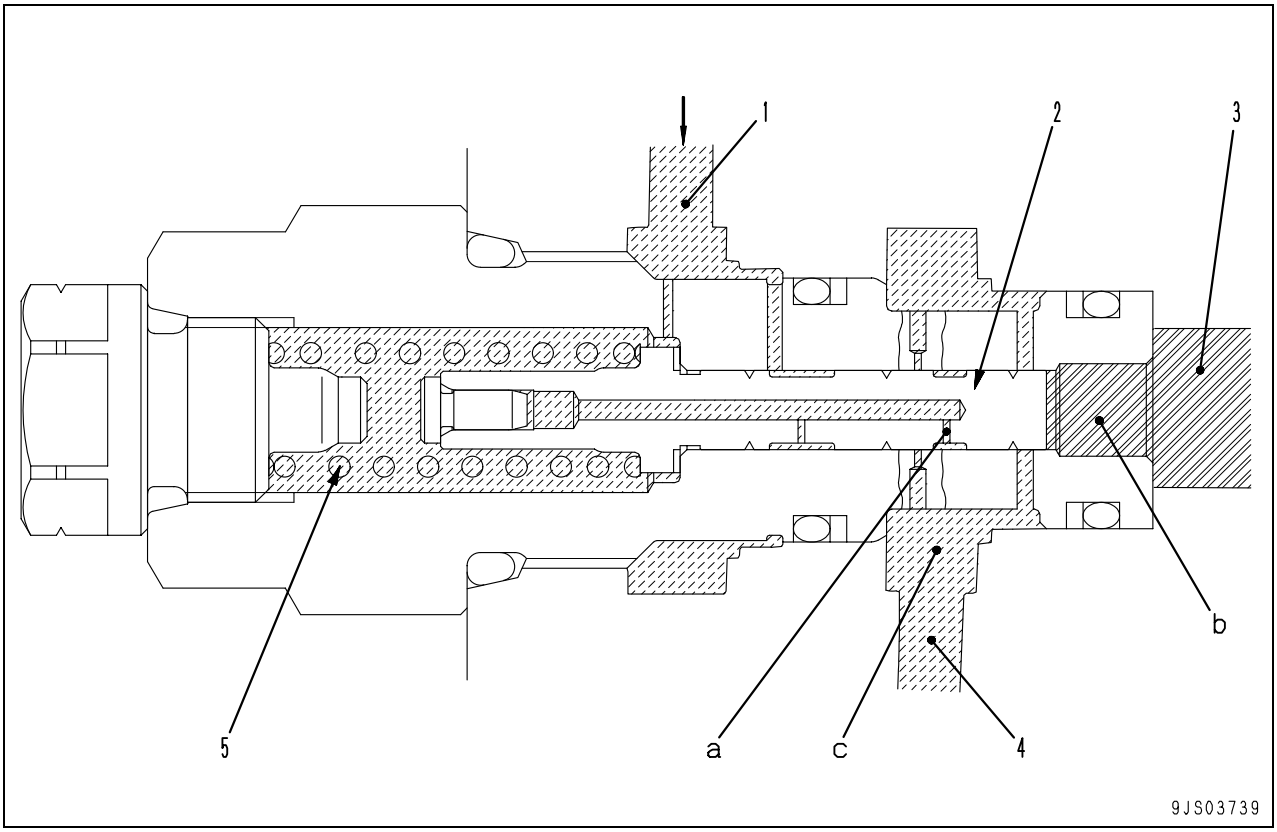
Hydraulic circuit diagram and the name of valves



1. Arm valve
2. R.H. travel valve
3. Swing valve
4. Boom valve
5. L.H. travel valve
6. Bucket valve
7. Service valve 1
8. Service valve 2
9. Service valve 3
10. Arm spool
11. R.H. travel spool
12. Swing spool
13. Boom spool
14. L.H. travel spool
15. Bucket spool
16. Service spool 1
17. Service spool 2
18. Service spool 3
19. Pressure compensation valve
20. Suction valve
21. Check valve (for boom regeneration circuit)
22. Check valve (for arm regeneration circuit)
23. EPC valve (for switching main spool of merge-divider valve)
24. EPC valve (for switching LS spool of merge-divider valve)
25. LS shuttle valve
26. LS select valve
27. Merge-divider valve
28. Arm quick return valve
29. Self pressure reducing valve
30. Travel junction valve
31. Back pressure valve
32. Cooler check valve
33. Main relief valve (bucket side)
    Set pressure: 34.9 ± 0.5 MPa{355.5 ± 5kg/cm^2}
    When digging force increased:
    37.5 ± 0.5 MPa{382 ± 5kg/cm^2}
34. Main relief valve (arm side)
    Set pressure: 34.9 ± 0.5 MPa{355.5 ± 5kg/cm^2}
    When digging force increased:
    37.5 ± 0.5 MPa{382 ± 5kg/cm^2}
35. Unload valve (bucket side)
    Cracking pressure:
    2.5 ± 0.5 MPa{26 ± 5kg/cm^2}
36. Unload valve (arm side)
    Cracking pressure:
    2.5 ± 0.5 MPa{26 ± 5kg/cm^2}
37. Safety-suction valve
    Set pressure: 24.5 ± 0.5 MPa{250 ± 5kg/cm^2}
38. Safety-suction valve
    Set pressure: 31.4 ± 0.5 MPa{320 ± 5 kg/cm^2}
39. Safety-suction valve
    Set pressure: 38.2 ± 0.5 MPa{390 ± 5 kg/cm^2}
40. 2-stage safety-suction valve
    Set pressure:
    1 stage: 24.5 ± 0.5 MPa{250 ± 5 kg/cm^2}
    2 stage: 20.6 ± 0.5 MPa{210 ± 5 kg/cm^2}

Unload valve

1. When the unload valve is actuating



1. LS circuit
2. Valve
3. Pump circuit
4. Tank circuit
5. Spring

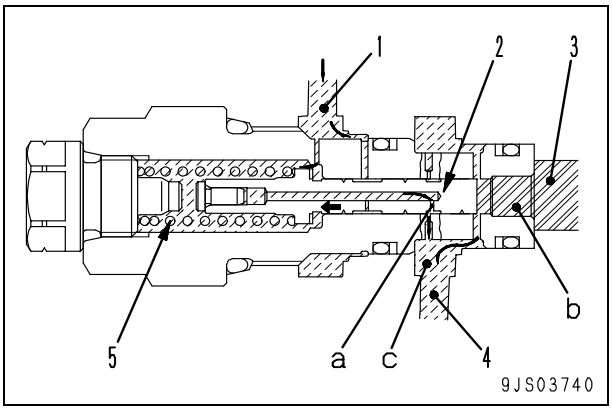
Function

- Drains an oil discharge for the portion of the minimum pump swash plate angle while all control valves are in the holding.
- The pump pressure will correspond to a set load of spring (5) inside the valve (this pressure will be P1).
- Since LS pressure is drained from the LS bypass valve, LS pressure ≒ tank pressure ≒ 0 MPa{0 kg/cm^2}.

Operation

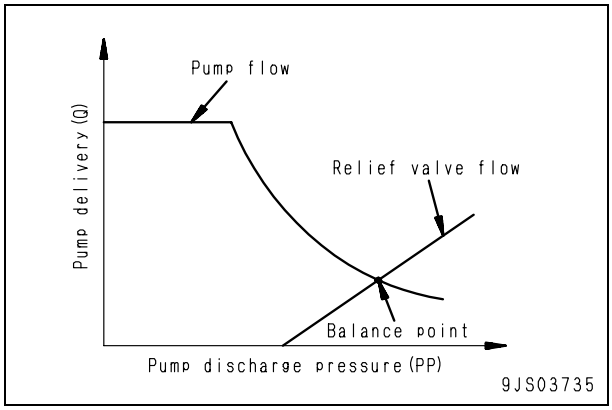
- Pressure of pump circuit (3) is received by the end of valve (2).
- Since the control valve is in neutral position, pressure of LS circuit (1) is 0 MPa{0 kg/cm^2}.
- Pressurized oil of pump circuit (3) stops at valve (2), and the pressure rises as no relief is available.
- When this pressure becomes larger than the force of spring (5), valve (2) moves to the left.
- Ports (b) and (c) are interconnected and the pump pressure flows to tank circuit (4).
- The pressurized oil of LS circuit (1) passes from orifice (a) via port (c) and is drained to the tank circuit (4).
- When actuated, LS pressure ≒ tank pressure.
- Since the pump discharge pressure - LS circuit pressure during unloading is larger than the pump LS control pressure, the signal is output to minimize the pump swash plate angle.

- During operation (a work within a scope of discharge by a minimum swash plate angle), the discharge pressure for the portion of minimum pump swash plate angle is set to LS pressure + P1 pressure.
- LS control differential pressure (✕PLS) of discharge for the portion of minimum swash plate angle will be equal to P1 pressure.

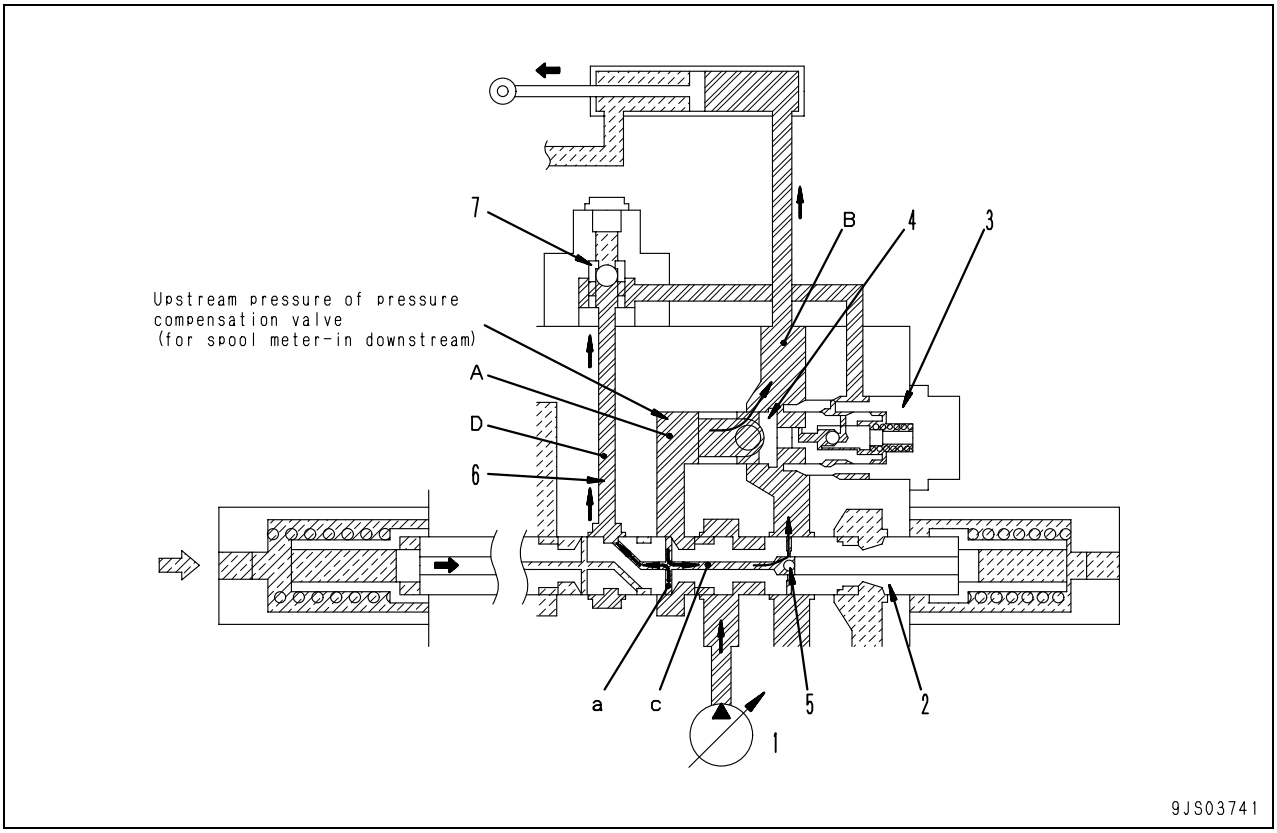


2. Operation of relief valve

- When the cylinder reaches the stroke end, the main relief valve opens.
- The pump delivery (Q) is relieved to the tank. (See the system diagram)
- The pump discharge pressure (PP) and LS pressure (PLS) become approximately the same as each has not flow at the upstream and downstream of the spool, and LS differential pressure (✕PLS) becomes 0 kg/cm^2.
- As LS differential pressure (✕PLS) is lower than the LS set pressure of LS valve, LS valve is actuated to maximize the pump swash plate angle.
- Mechanically, operation of PC valve have the prevalence to that of LS valve.
- The pump is held at a minimum swash plate angle by the cut-off function of PC valve.



Introduction of LS pressure



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

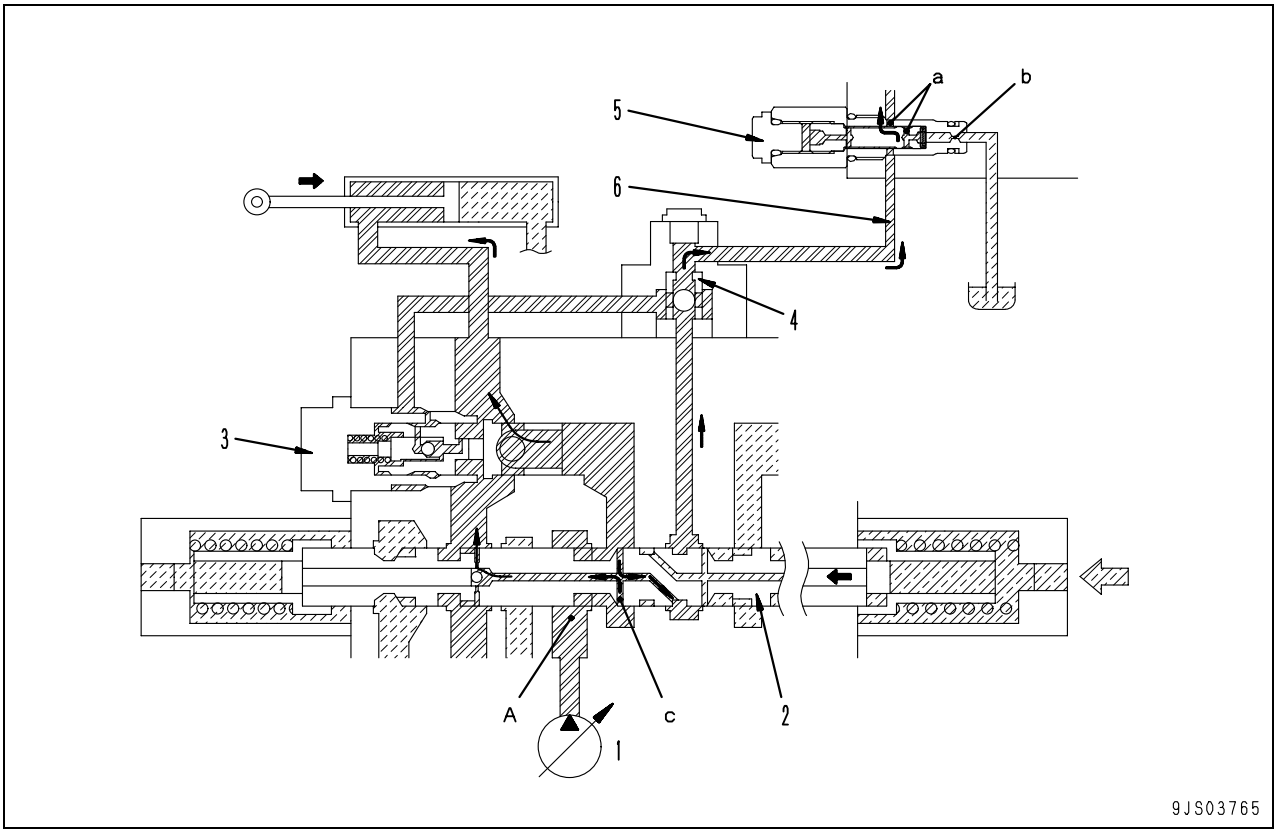
Function

- Introduces the upstream pressure (downstream pressure of the spool meter-in) of pressure compensation valve (3) and leads to LS shuttle valve (7) as the LS pressure.
- Connected to actuator port (B) via valve (4), and makes LS pressure ≒ actuator load pressure.
- Inlet pore (a) inside main spool (2) has a small diameter concurrently serving as a throttle.

Operation

- When main spool (2) is operated, the pump pressure enters port (c) via inlet pore (a) and is led to the LS circuit.
- When the pump pressures rises to reach the load pressure of port (B), check valve (5) opens.

LS bypass valve



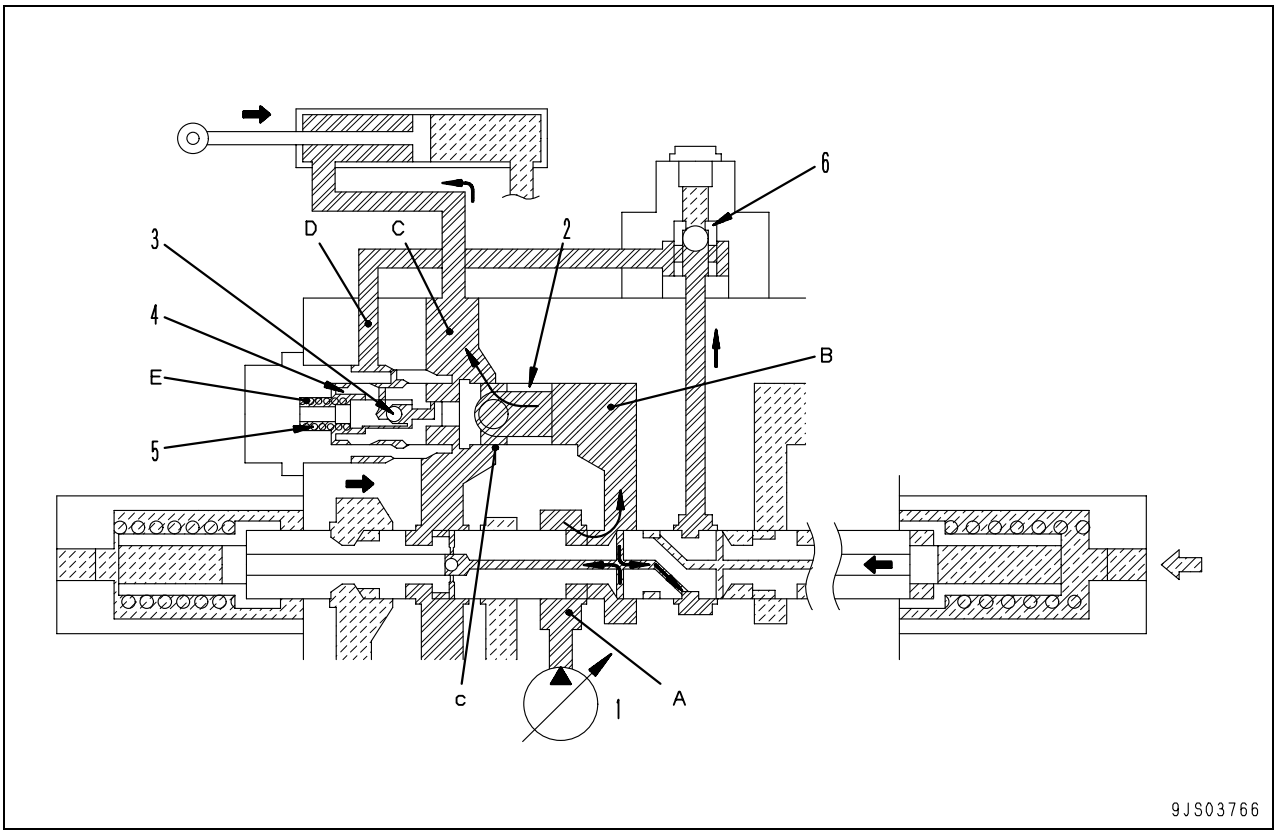
1. Hydraulic pump
2. Main spool
3. Pressure compensation valve
4. LS shuttle valve
5. LS bypass valve
6. LS circuit

Function

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

Pressure compensation valve

1. During independent operation and under maximum load pressure (If the load pressure is higher than other work equipment during a combined operation)



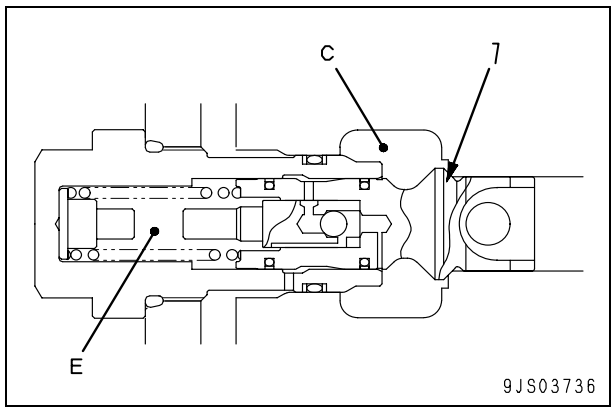
1. Hydraulic pump
2. Valve
3. Shuttle valve
4. Piston
5. Spring
6. LS shuttle valve

Function

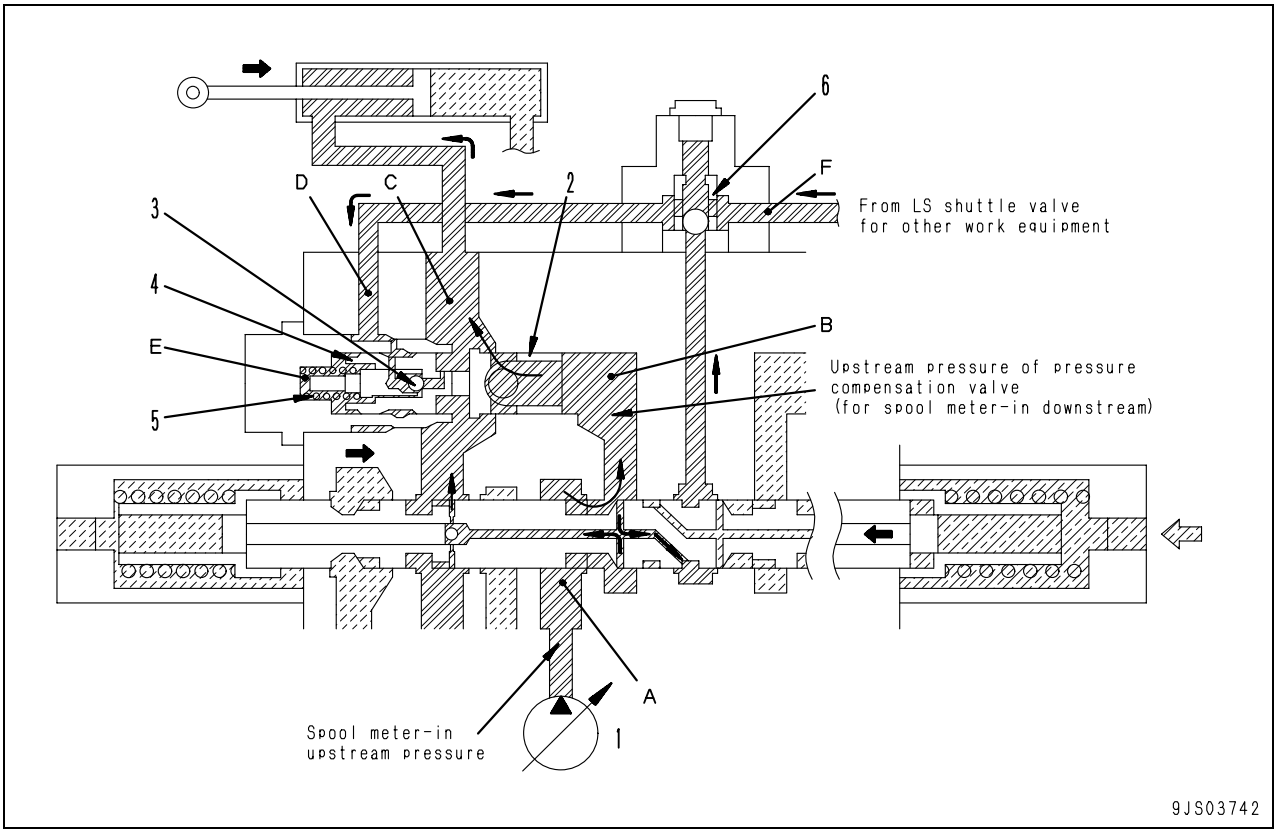
- Pressure compensation valve works as the load check valve.
- If the pump pressure (LS pressure) is lower than the load at port (c), shuttle valve (3) in pressure compensation valve piston (4) interconnects spring chamber (E) and port (C).
- The force of spring (5) operates piston (4) and valve (2) to the closing direction.

Integrated pressure compensation valve

- High stress may occur when valve (2) collides with valve chamber seat portion (C) if a high peak pressure is generated in the actuator circuit or repetitive peak pressure occurs continuously (example: when using the breaker).
- To prevent this, a pressure compensation valve with integrated valve (2) and piston (4) is used.
- With the present machine, this device is adopted for the bucket valve (cylinder bottom) and the service valve.
- As principle, port (C) and spring chamber (E) are not interconnected in an integrated pressure compensation valve.
- If high peak pressure is generated at port (C), valve (7) does not collide with the valve chamber.
- With a bucket valve, etc., port (C) and spring chamber (E) are designed to interconnect before valve (7) is seated.



2. When compensated (If the load pressure is lower than other work equipment during a combined operation)



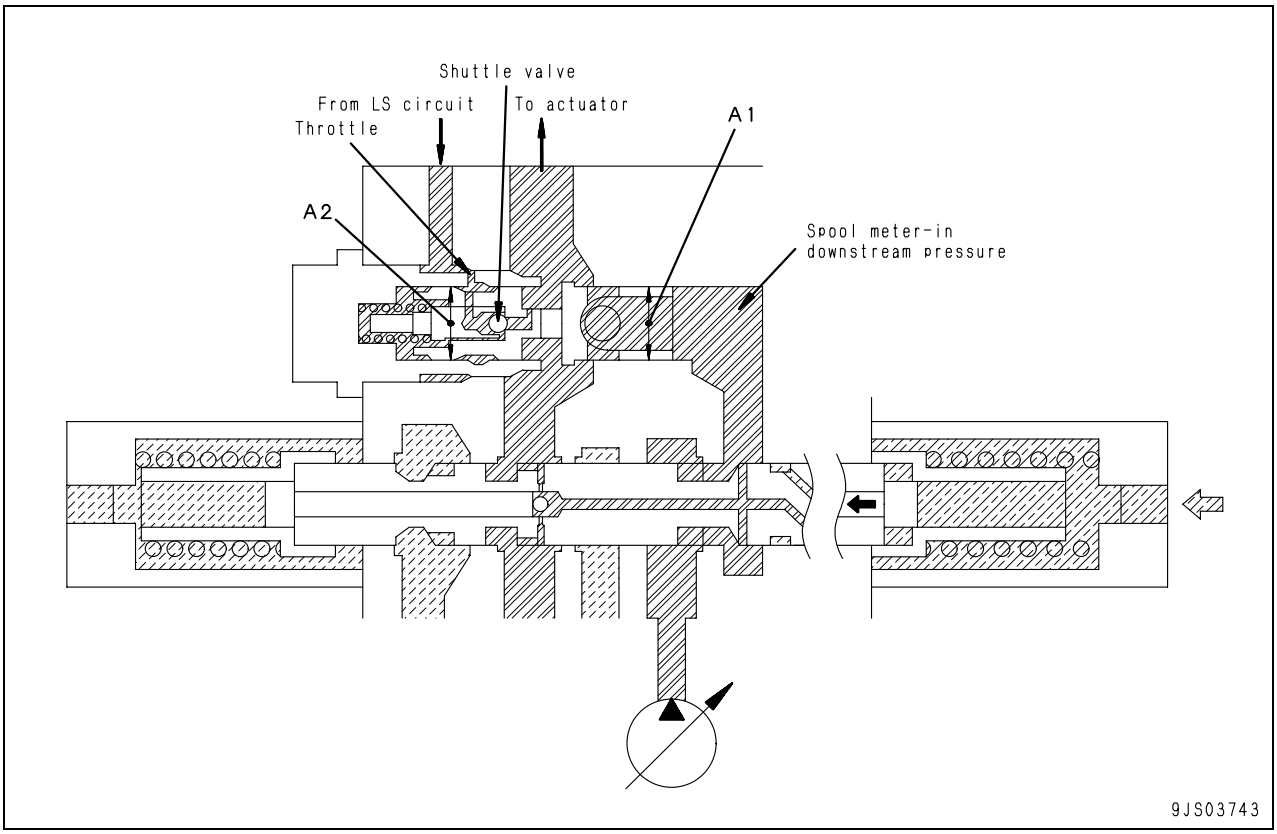
Function

- The pressure compensation valve closes under LS pressure of port (D), and the spool meter-in downstream pressure of port (B) becomes equivalent to the maximum pressure of other work equipment.
- Since the spool meter-in upstream pressure of port (A) is the pump pressure, the spool meter-in differential pressure [upstream pressure port (A) pressure]–downstream pressure [port (B) pressure] becomes equivalent to all the spools in operation.
- Pump flow is divided according to the ratio of the meter-in opening area.

Operation

- Spring chamber (E) is interconnected to port (D).
- Piston (4) and valve (2) operate in the closing direction (to the right) under the LS circuit pressure from other work equipment of port (F).
- Valve upstream pressure (= spool meter-in downstream pressure) of port (B) is controlled with LS pressure.

3. Pressure compensation valve area ratio

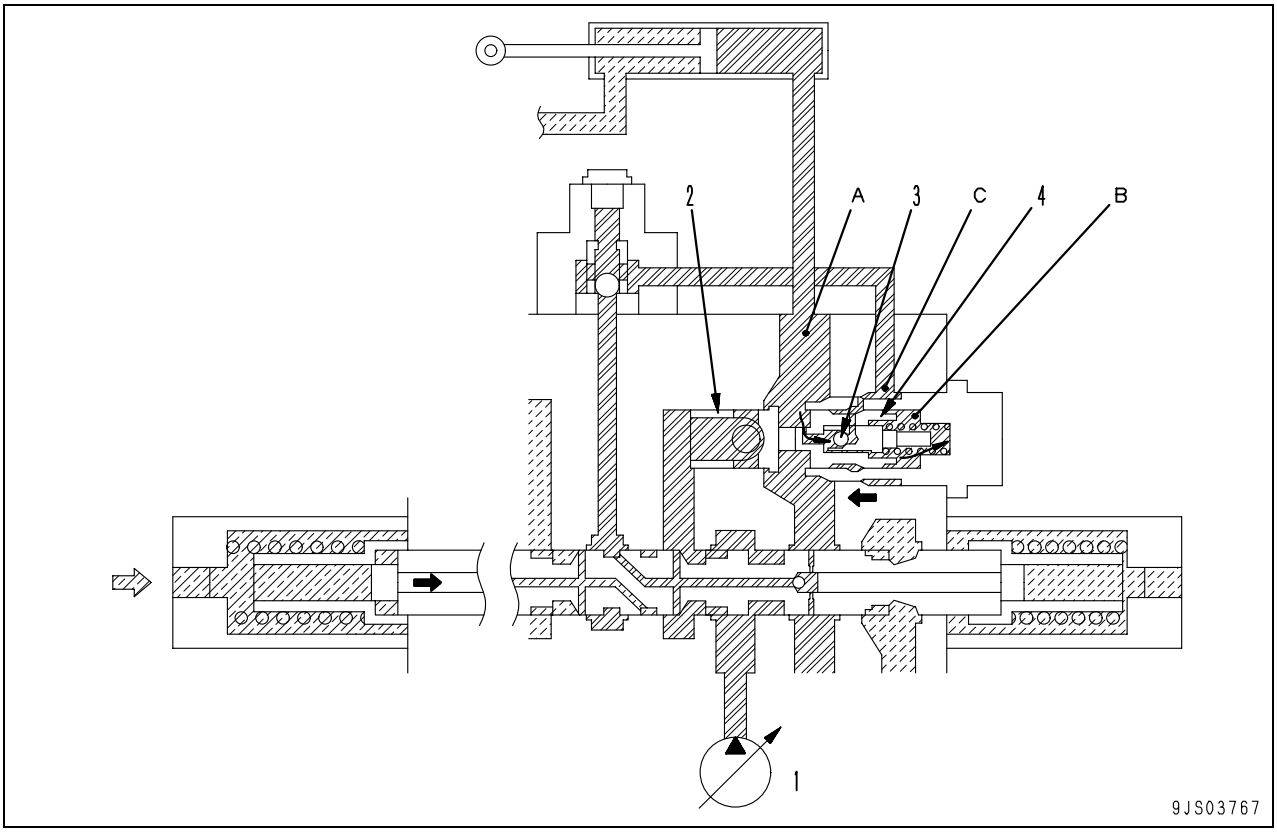


Function

- The state of division changes according to the area ratio of pressure compensation portion (A1) and (A2). Area ratio = (A2)/(A1)
- If area ratio = 1 : The spool meter-in downstream pressure will be equal to the maximum load pressure, and the pressure will be divided according to the opening area ratio.
- If area ratio = 1 or over : The spool meter-in downstream pressure will be greater than the maximum load pressure, and the pressure will be divided smaller than the opening area ratio.
- If area ratio = 1 or under : The spool meter-in downstream pressure will be smaller than the maximum load pressure, and the pressure will be divided greater than the opening area ratio.

Pressure compensation valve inner shuttle valve

1. If holding pressure at port (A) is larger than LS pressure in the springing chamber (B)

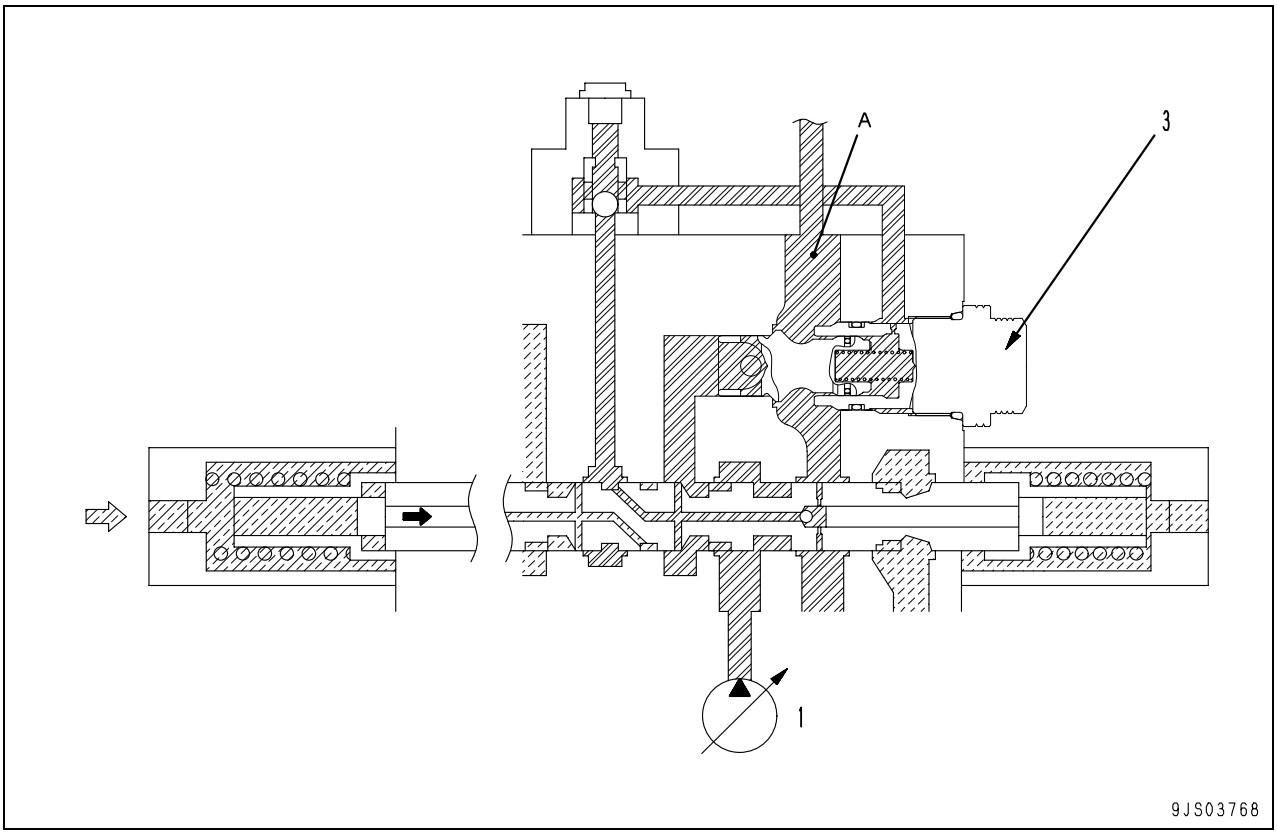


1. Hydraulic pump
2. Valve
3. Pressure compensation valve inner shuttle valve
4. Piston

Function

- Shuttle valve (3) is pushed to the right by port (A) pressure and cuts off interconnection between ports (A) and (C).
- Holding pressure at port (A) is led to the spring chamber (B) to push piston (4) to the left so that piston (4) and valve (2) will not be separated.

2. In the case of travel

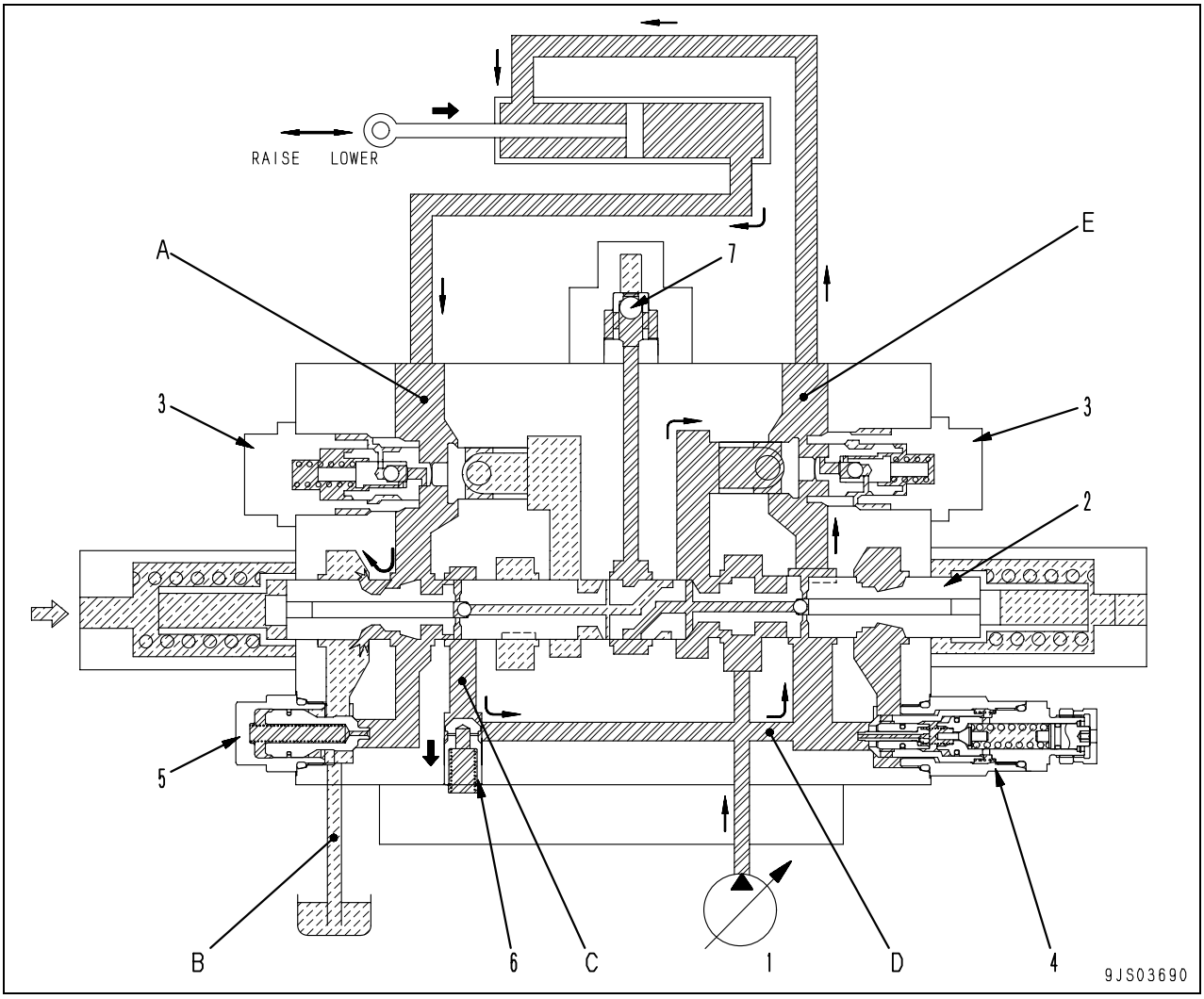


Outline

- Since no holding pressure is generated at port (A) of the travel circuit, a pressure compensation valve without shuttle valve (3) is adopted.

Boom regeneration circuit

1. If the cylinder head pressure is lower than the bottom pressure (free fall, etc.)



1. Hydraulic pump
2. Boom spool
3. Pressure compensation valve
4. Safety-suction valve
5. Suction valve
6. Check valve
7. LS shuttle valve

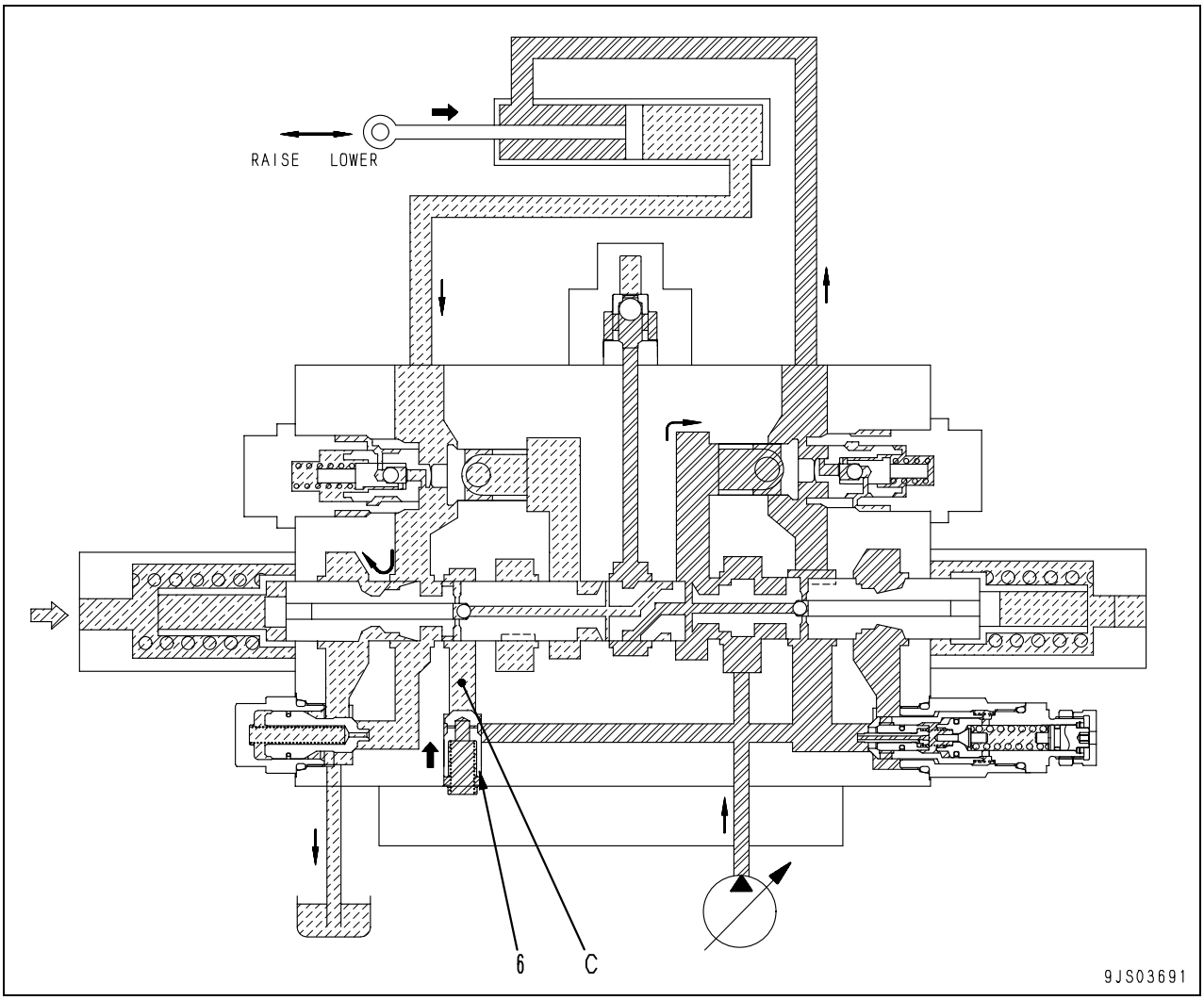
Function

- Provides the regeneration circuit from the cylinder bottom to the cylinder head when the boom is lowered and increases flow to the cylinder bottom.

Operation

- If the cylinder head pressure is lower than the bottom pressure, pressurized oil (A) from the cylinder bottom flows to drain circuit (B) from the notch of boom spool (2).
- On the other hand, remaining oil flows to regeneration circuit (C), opens check valve (6) and flows to the cylinder head via circuit (D).
- Flow from regeneration circuit (C) and pump (1) merges in circuit (E).

2. If the cylinder head pressure is higher than the bottom pressure (digging work, etc.)

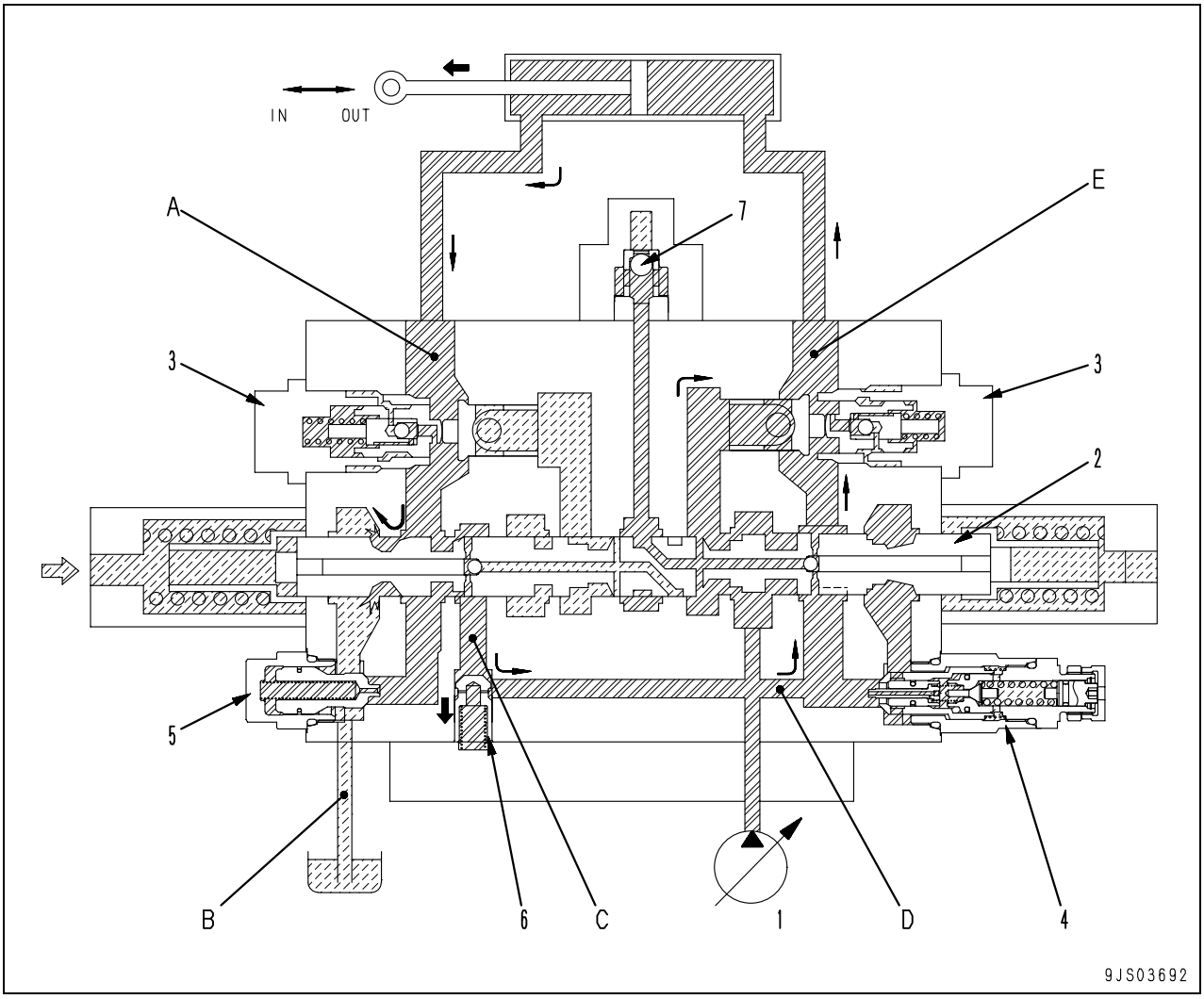


Function

- Check valve (6) provided to regeneration circuit (C) closes to shut off the flow from the cylinder bottom to the head.

Arm regeneration circuit

1. If the cylinder head pressure is higher than the bottom pressure



1. Hydraulic pump
2. Arm spool
3. Pressure compensation valve
4. Safety-suction valve
5. Suction valve
6. Check valve
7. LS shuttle valve

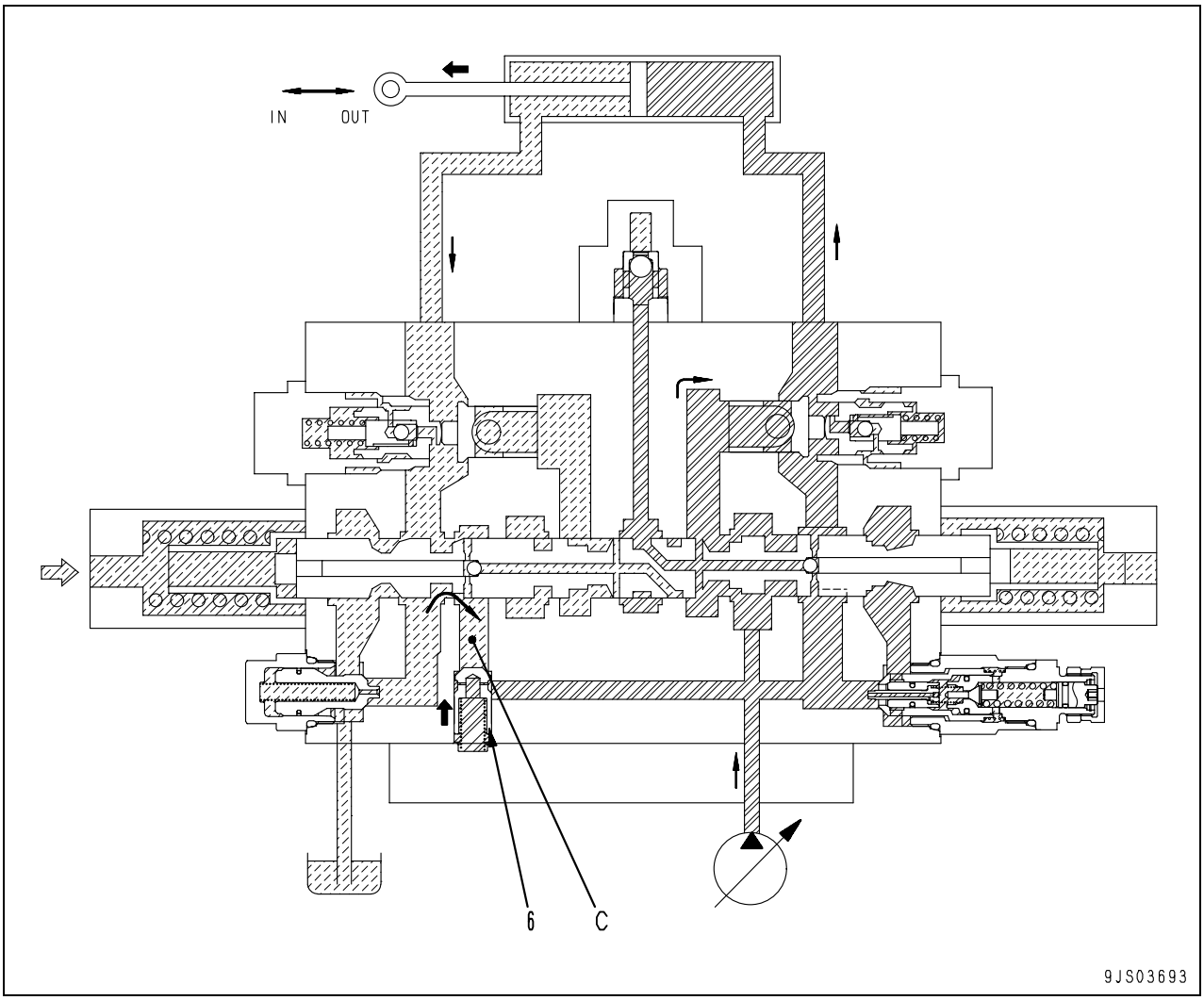
Function

- During arm digging, regeneration circuit provided from the cylinder head to the bottom increases the cylinder speed as the cylinder flow involves the pump delivery plus regenerated flow.

Operation

- If the cylinder head pressure is lower than the bottom pressure, pressurized oil (A) from the cylinder bottom flows to drain circuit (B) from the notch of arm spool (2).
- On the other hand, remaining oil flows to regeneration circuit (C), opens check valve (6) and flows to the cylinder head via circuit (D).
- Flow from regeneration circuit (C) and pump (1) merges in circuit (E).

2. If the cylinder head pressure is lower than the bottom pressure

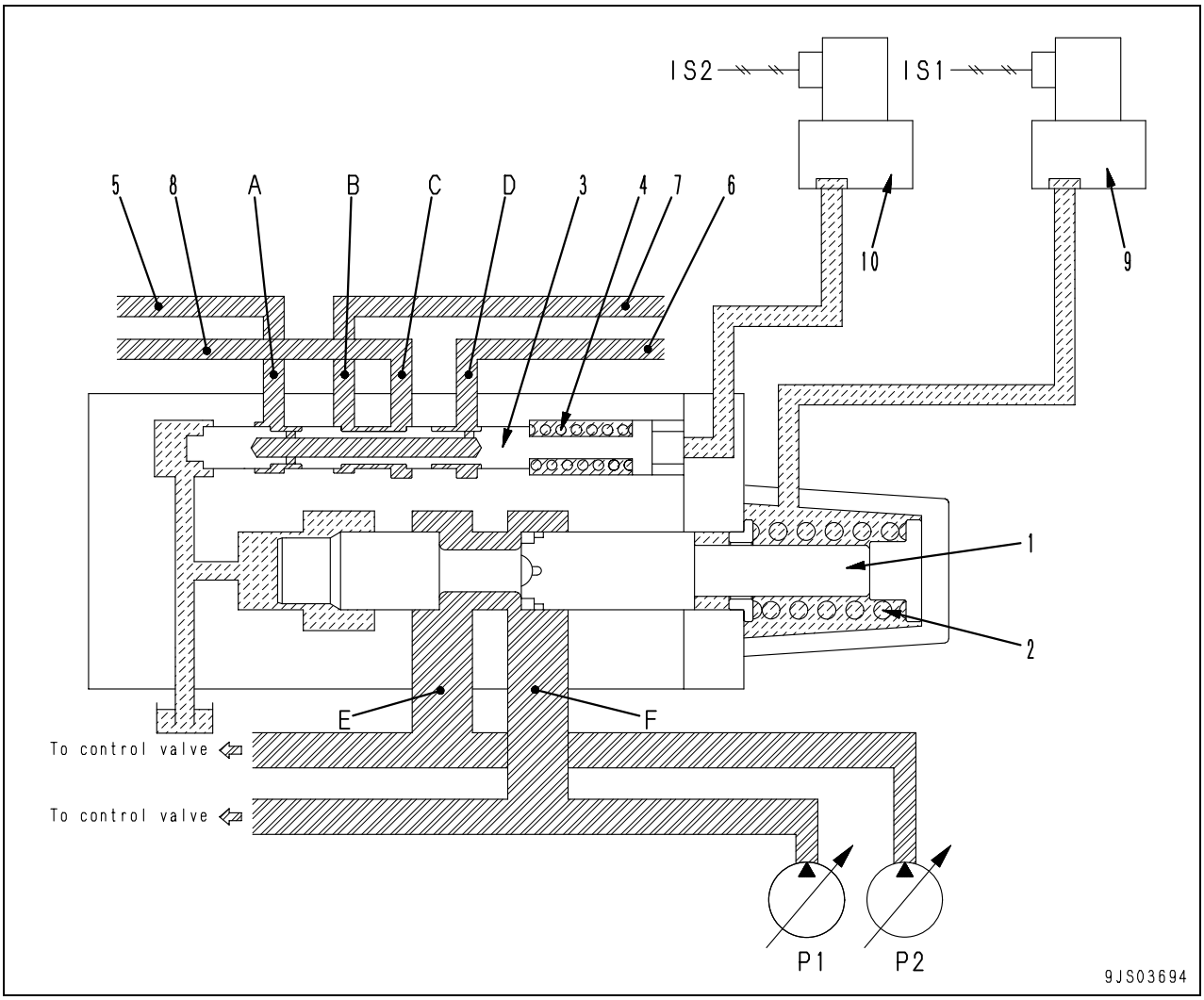


Function

- Check valve (6) provided to regeneration circuit (C) closes to shut off the flow from the cylinder bottom to the head.

Merge-divider valve

1. When flows from the pumps merge [if merge-divider selector signals (IS1) and (IS2) are OFF]



1. Main spool
2. Spring
3. LS spool
4. Spring
5. LS circuit (bucket side)
6. LS circuit (bucket side)
7. LS circuit (arm side)
8. LS circuit (arm side)
9. EPC valve (for main spool)
10. EPC valve (for LS spool)

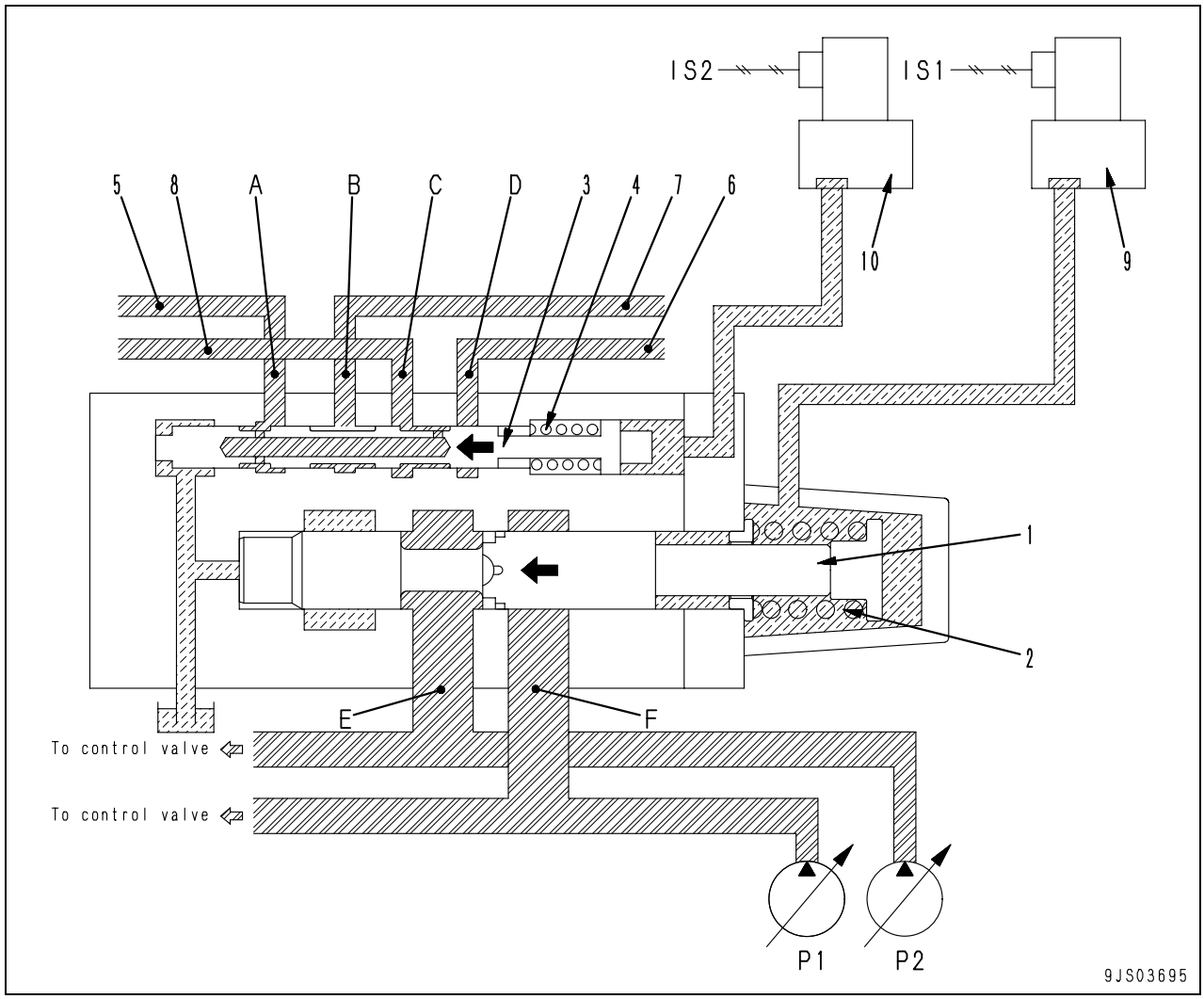
Function

- Merges pressurized oil (P1) and (P2) discharged from the two pumps or divides (to respective control valve group).
- Merges and divides LS circuit pressure.

Operation

- Since selector signal (IS1) is OFF, output pressure from EPC valve is 0 kg/cm^2.
- Main spool (1) is pressed to the right by spring (2) and ports (E) and (F) are interconnected.
- Merges pressurized oil (P1) and (P2) discharged from the two pumps at ports (E) and (F) and sends to necessary control valve.
- Since selector signal (IS2) is OFF for LS spool (3), it is pressed to the right by spring (4), and ports (A) – (D) and ports (B) – (C) are interconnected.
- Forwards LS pressure led from respective control valve spools to LS circuits (5), (6), (7) and (8) to all the pressure compensation valves.

2. When flows from the pumps merge [if merge-divider selector signals (IS1) and (IS2) are ON]



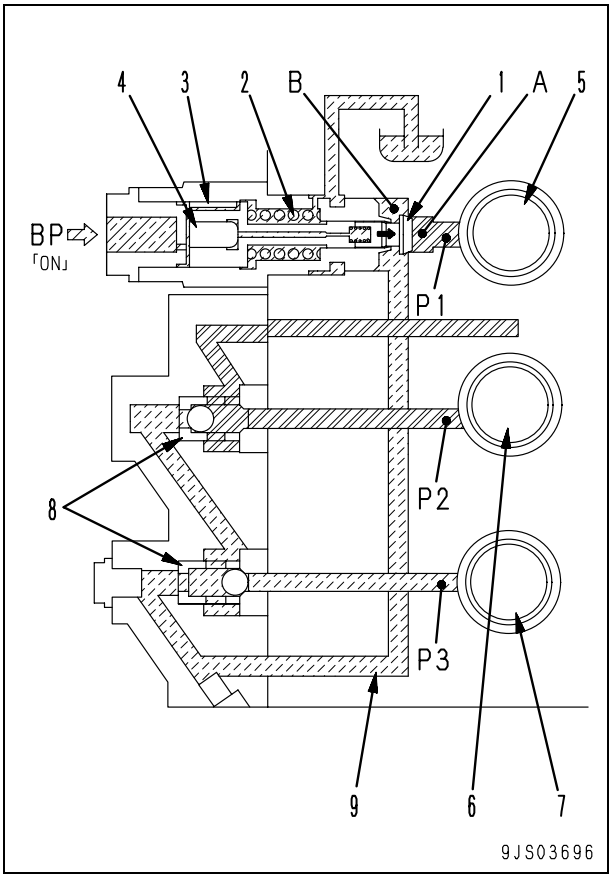
Operation

- Selector signal (IS1) turns ON, and output pressure from the EPC valve shifts main spool (1) to the left, and ports (E) and (F) are divided.
- Pressurized oil discharged from the two pumps are sent to respective control valves.
  P1 pressure: To bucket, L.H. travel, and boom
  P2 pressure: To swing, R.H. travel, and arm
- When selector signal (IS2) is turned ON, LS spool (3) too shifts to the left under the output pressure from the EPC valve, interconnects ports (A) and (C) and divides other ports.
- Forwards LS pressure led from each control valve spool to LS circuits (5), (6), (7) and (8) to respective control valves.

LS select valve

Function

- Prevents high LS pressure from the swinging from entering the LS circuit of work valves while the swinging and work equipment are in combined operation.
- Prevents high pressure generated during swing drive and improves operability of work equipment.



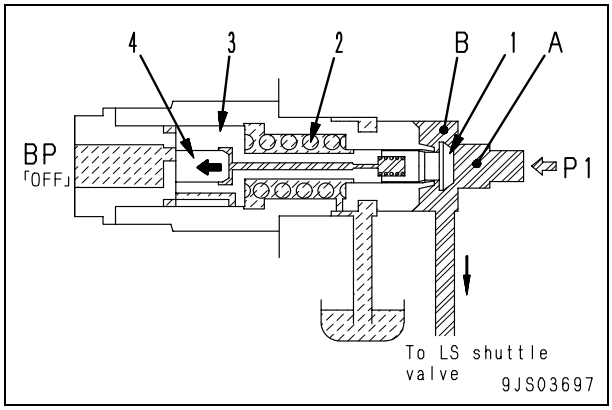
★ The illustration shows the state of simultaneous operation of swinging and R.H. travel. [(BP) pressure ON]

1. Valve
2. Spring
3. Piston
4. Piston
5. Swing spool
6. L.H. travel spool
7. Arm spool
8. LS shuttle valve
9. LS circuit

Operation

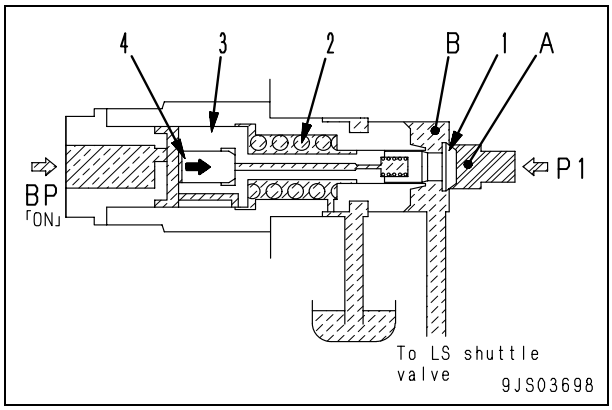
1. If pilot pressure (BP) is OFF

- Since pilot pressure (BP) is OFF, piston (3) is pressed to the left by spring (2).
- When swing-operated, swing LS pressure (P1) enters port (A) after passing swing spool (5).
- Valve (1) is pressed to the left and ports (A) and (B) are interconnected.
- Swing LS pressure (P1) flows to LS shuttle valve (8).



2. If pilot pressure (BP) is ON

- If pilot pressure (BP) is ON, BP pressure contracts spring (2), and piston (3) shifts to the right.
- Valve (1) is pressed to the right and interconnection between ports (A) and (B) is closed.
- Swing LS pressure (P1) stops flowing to LS shuttle valve (8).
- If swing LS pressure (P1) rises, other LS circuits are not affected.



Self pressure reducing valve

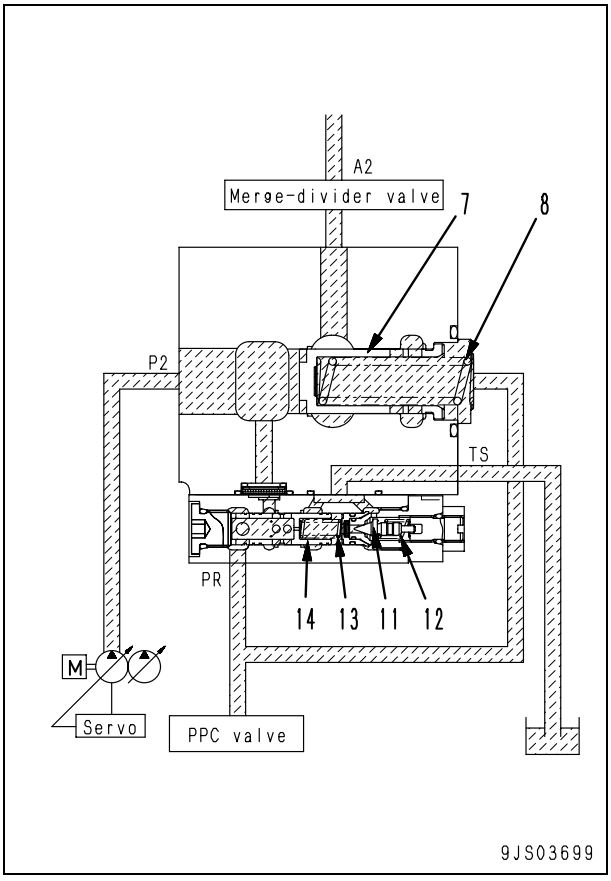
Function

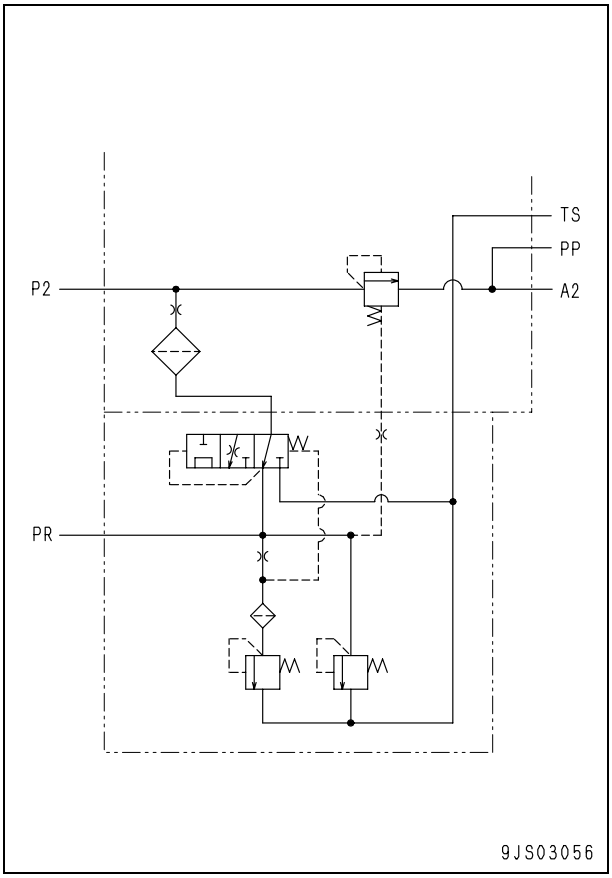
- Reduces the discharge pressure of the main pump and supplies it as control pressure for the solenoid valves, EPC valves, etc.

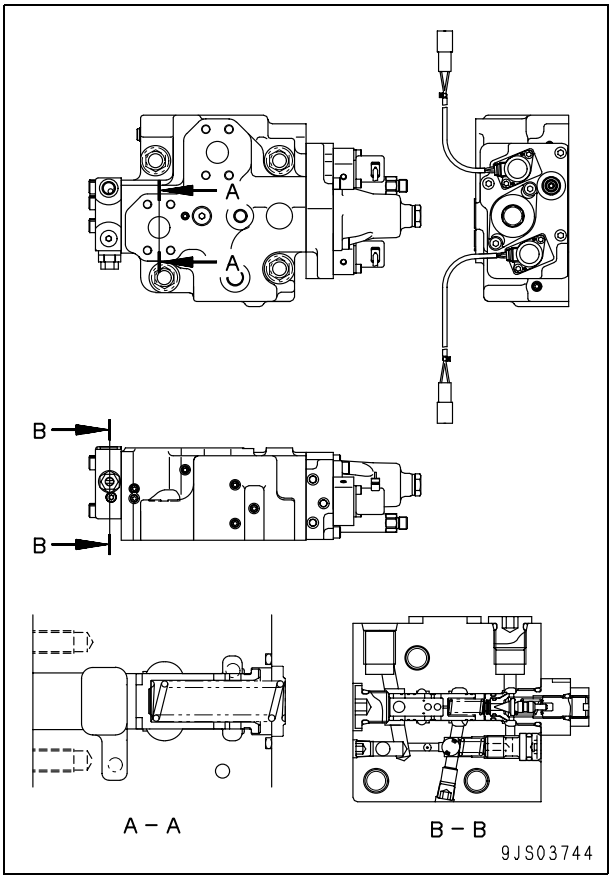
Operation

1. While engine is stopped

- Poppet (11) is pressed by spring (12) against the seat and port (PR) is not connected to (TS).
- Valve (14) is pressed by spring (13) against the left side and port (P2) is connected to (TS).
- Valve (7) is pressed by spring (8) against the left side and port (P2) is closed to (A2).



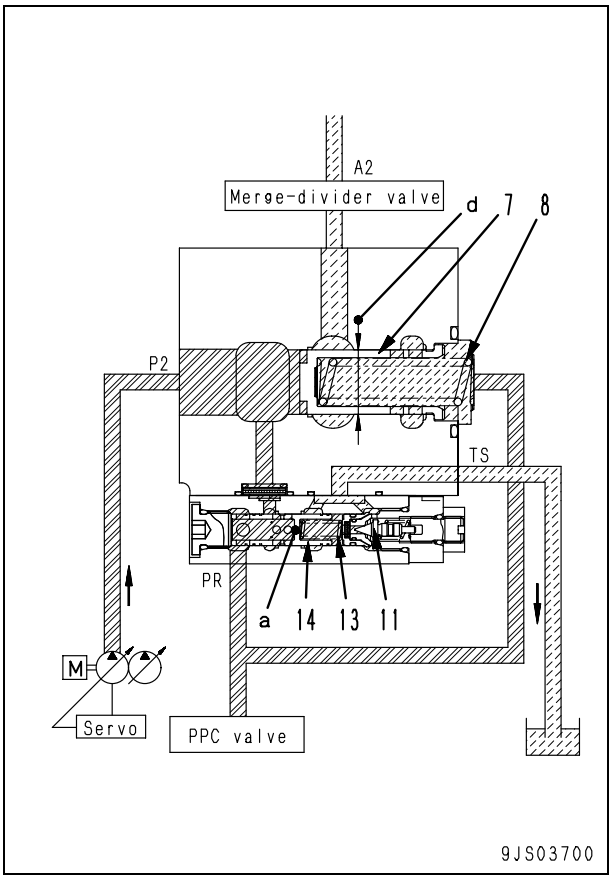




2. During neutral and when load pressure (P2) is low

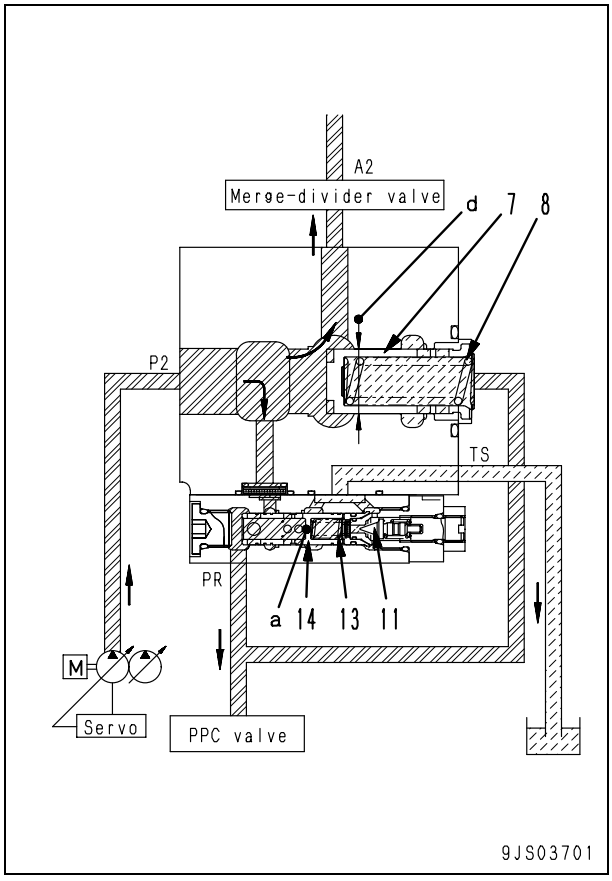
★ When load pressure (A2) is lower than self pressure reducing valve output pressure (PR)

- Valve (7) is pressed to the closing direction of circuit between ports (P2) and (A2) by spring (8) and under pressure (PR) (which is 0 MPa{0 kg/cm^2}).
- When pressurized oil flows in from port (P2), a balance is reached due to [(ϕd area x P2 pressure) = force of spring (8) + (ϕd area x PR pressure)].
- Adjusts valve (7) opening to keep pressure (P2) at a constant level over pressure (PR).
- When pressure (PR) rises above the set pressure, poppet (11) opens.
- Pressurized oil flows from port (PR) to orifice (a) in spool (14), then flows to seal drain port (TS) from poppet (11) opening.
- Differential pressure is generated before and after orifice (a) in spool (14) and then spool (14) moves to close the pass between ports (P2) and (PR).
- Pressure (P2) is reduced by the opening at this time and adjusted to a constant pressure (the set pressure) and supplied as pressure (PR).



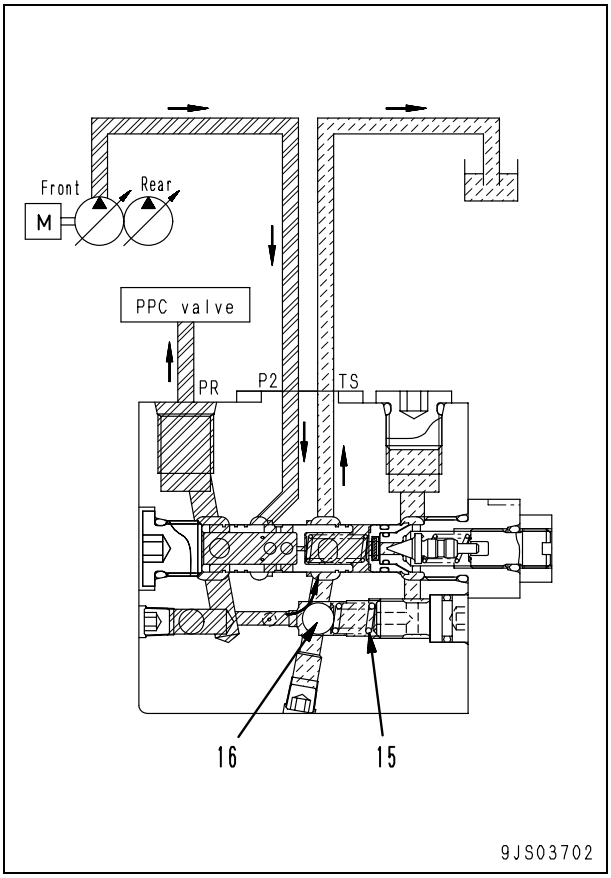
3. When load pressure (P2) is high

- Load pressure (A2) increases with the operation of digging, etc., and the pump discharge increases accordingly.
- Pressure (P2) increases to [(ϕd area x P2 pressure) > force of spring (8) + (ϕd area x PR pressure)]., and valve (7) moves to the right to the stroke end.
- As a result, opening between ports (P2) and (A2) increases, and the pass resistance reduces, reducing the engine horsepower loss.
- When pressure (PR) rises above the set pressure, poppet (11) opens.
- Pressurized oil flows from port (PR) to orifice (a) in spool (14), then flows to seal drain port (TS) from poppet (11) opening.
- Differential pressure is generated before and after orifice (a) in spool (14) and then spool (14) moves to close the pass between ports (P2) and (PR).
- Pressure (P2) is reduced by the opening at this time and adjusted to a constant pressure (the set pressure) and supplied as pressure (PR).



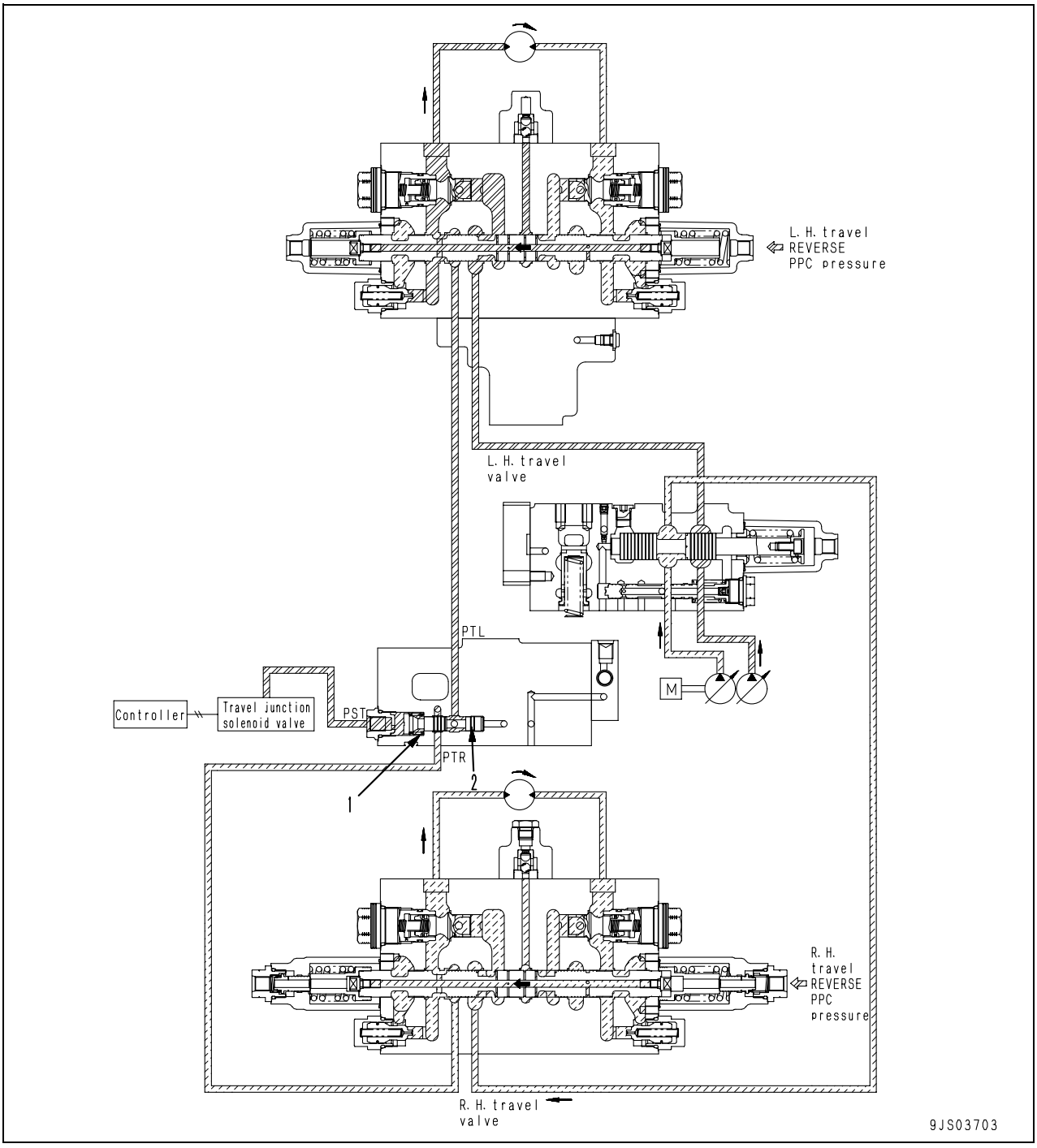
4. When abnormally high pressure is generated

- If pressure (PR) of self pressure reducing valve becomes abnormally high, ball (16) contracts spring (15) and becomes separated from the seat.
- Allows the pressurized oil to (TS) from port (PR) and lowers pressure (PR).
- Protects PPC valve, solenoid valve and other devices from abnormal pressure.



Travel junction valve

1. When pilot pressure is turned ON



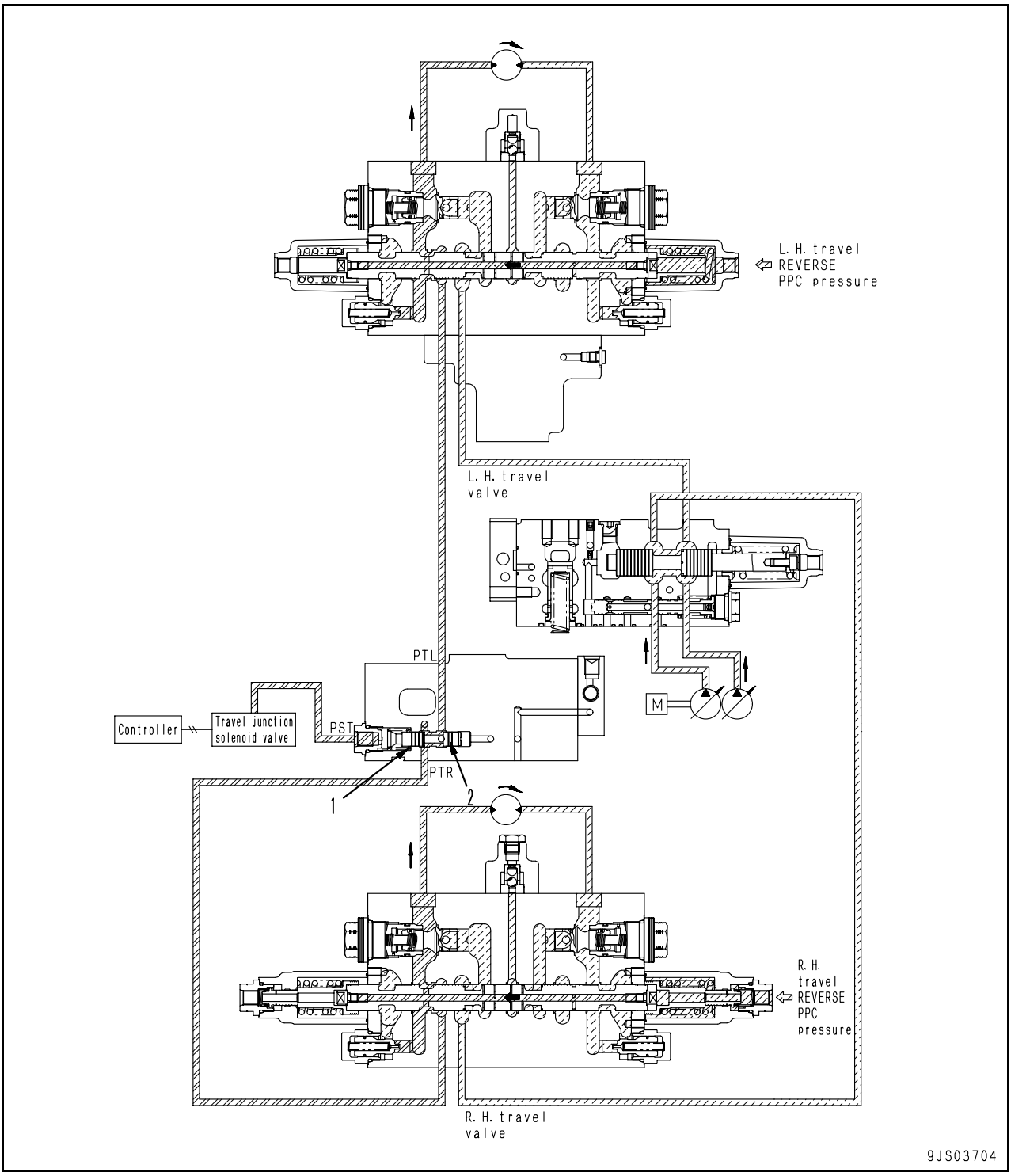
Function

- This valve connects the L.H. and R.H. travel circuits via travel junction valve so that the hydraulic oil will be supplied evenly to both travel motors to improve machine's straight travel performance.
- When the machine is steered, outside pilot pressure (PST) closes the travel junction valve to improve steering performance.

Operation

- Pilot pressure from the travel junction solenoid valve contracts spring (1), and travel junction spool (2) moves to the left to the stroke end.
- Junction circuit between port (PTL) (L.H. travel circuit) and port (PTR) (R.H. travel circuit) is closed.

2. When pilot pressure is turned OFF

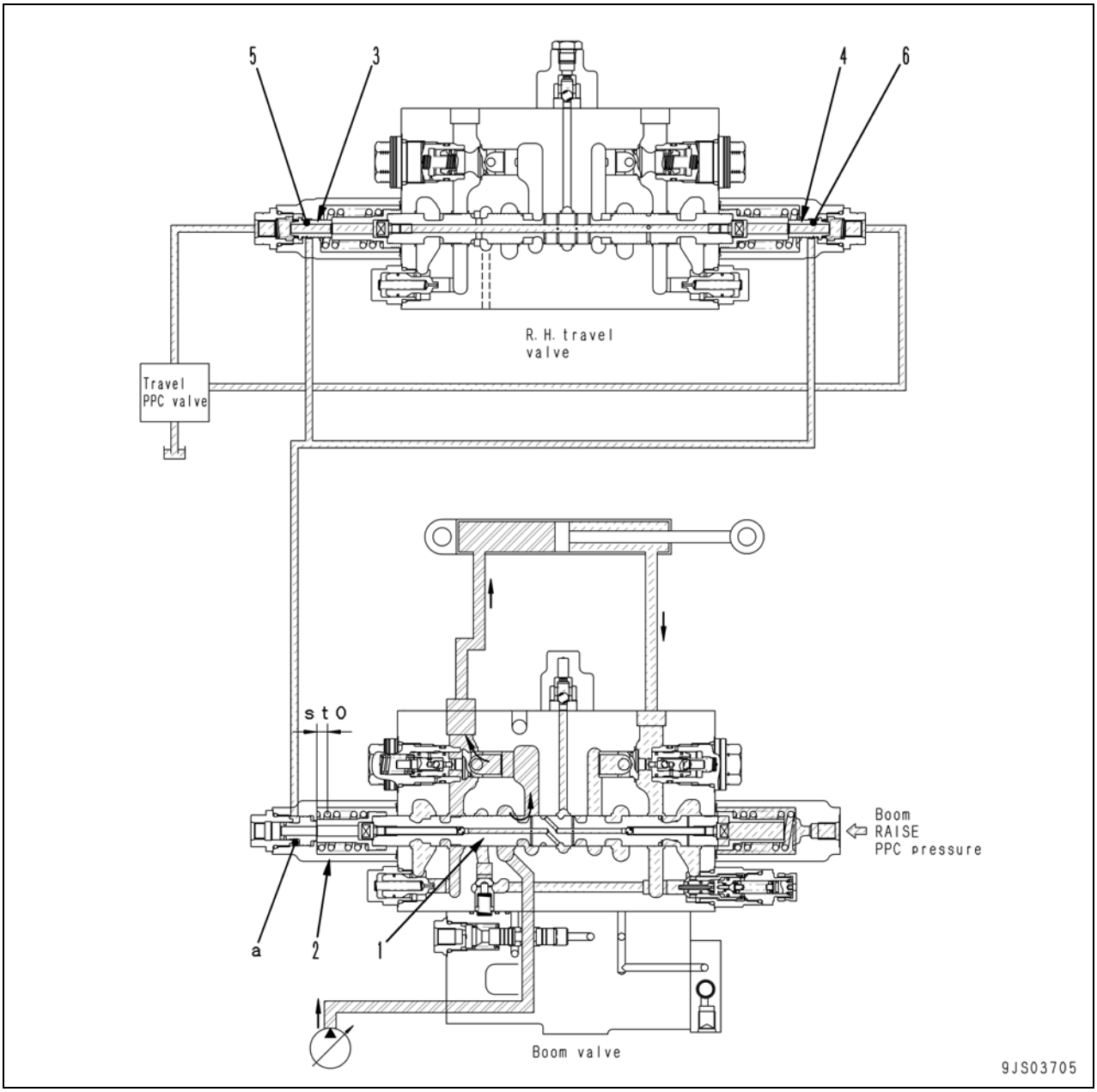


Operation

- If pilot pressure (PST) from the solenoid valve is 0, travel junction spool (2) is pressed by the force of spring (1) against the right side and the pass between ports (PTL) and (PTR) is open.
- If the oil flow rates to the L.H. and R.H. travel motors become different from each other, the oil flows through the route between port (PTL), travel junction spool (2), and port (PTR) so that the oil flow rates to both motors will be equalized again.

Travel PPC shuttle valve

1. When travel lever is in neutral



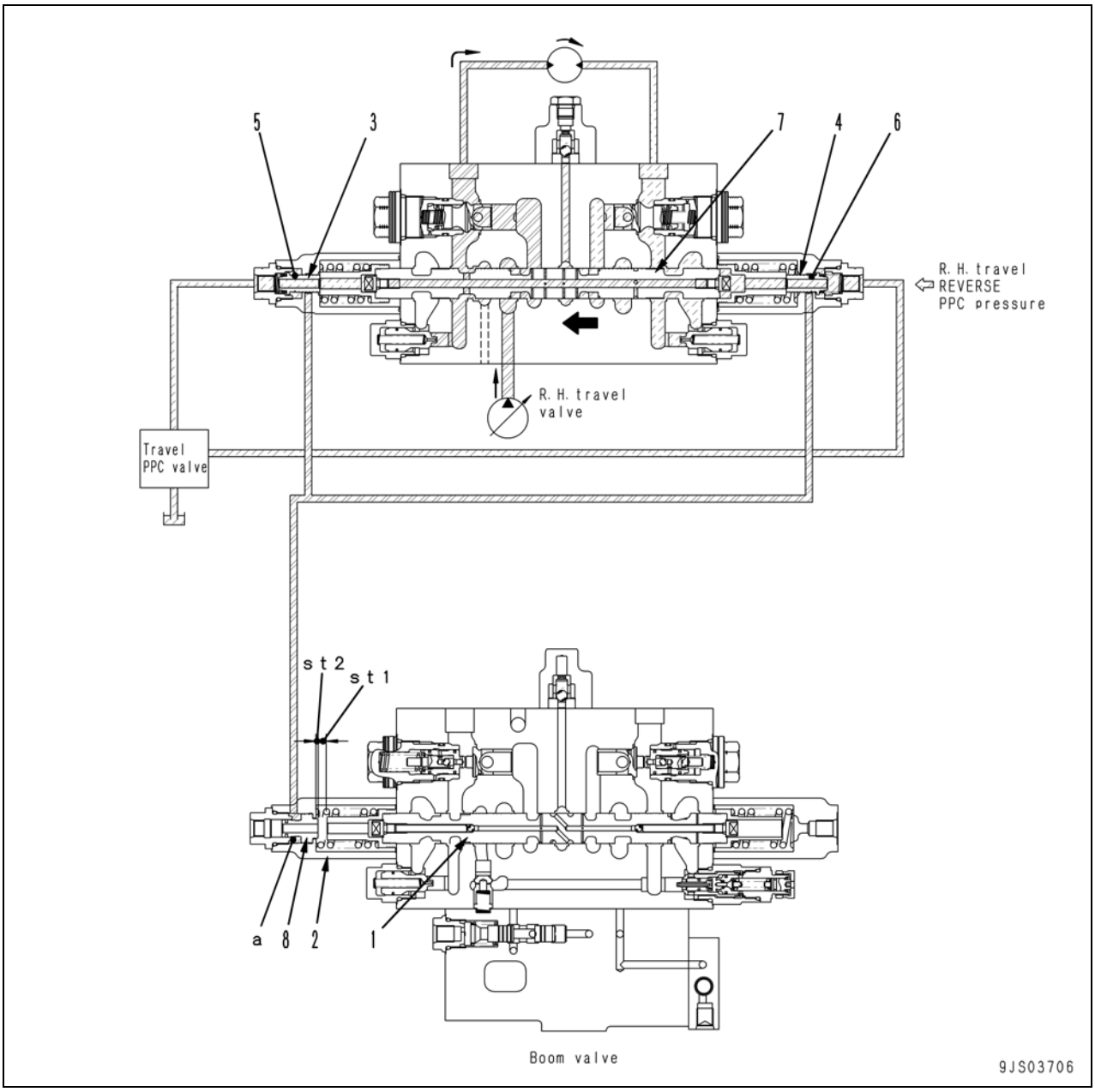
Function

- Regulates flow to each cylinder by controlling the stroke of each spool of the boom, arm, and bucket using the pilot pressure of travel PPC valve while climbing a steep grade, raising the boom, digging with arm, dumping, bucket-digging or operating dump.
- When controlling the stroke of the boom, arm and/or bucket, pilot pressure of travel PPC valve passes through the circuit inside the control valves to actuate the system.

Operation

- The oil in stroke regulation signal chamber (a) is drained through orifices (5) and (6) of pistons (3) and (4) in the travel spring case and the travel PPC valve.
- When operated for boom raising (or arm digging, dumping, bucket digging, dumping), spool (1) moves to the left until it makes contact with the end face of spring casing (2) (st0).

2. When travelling

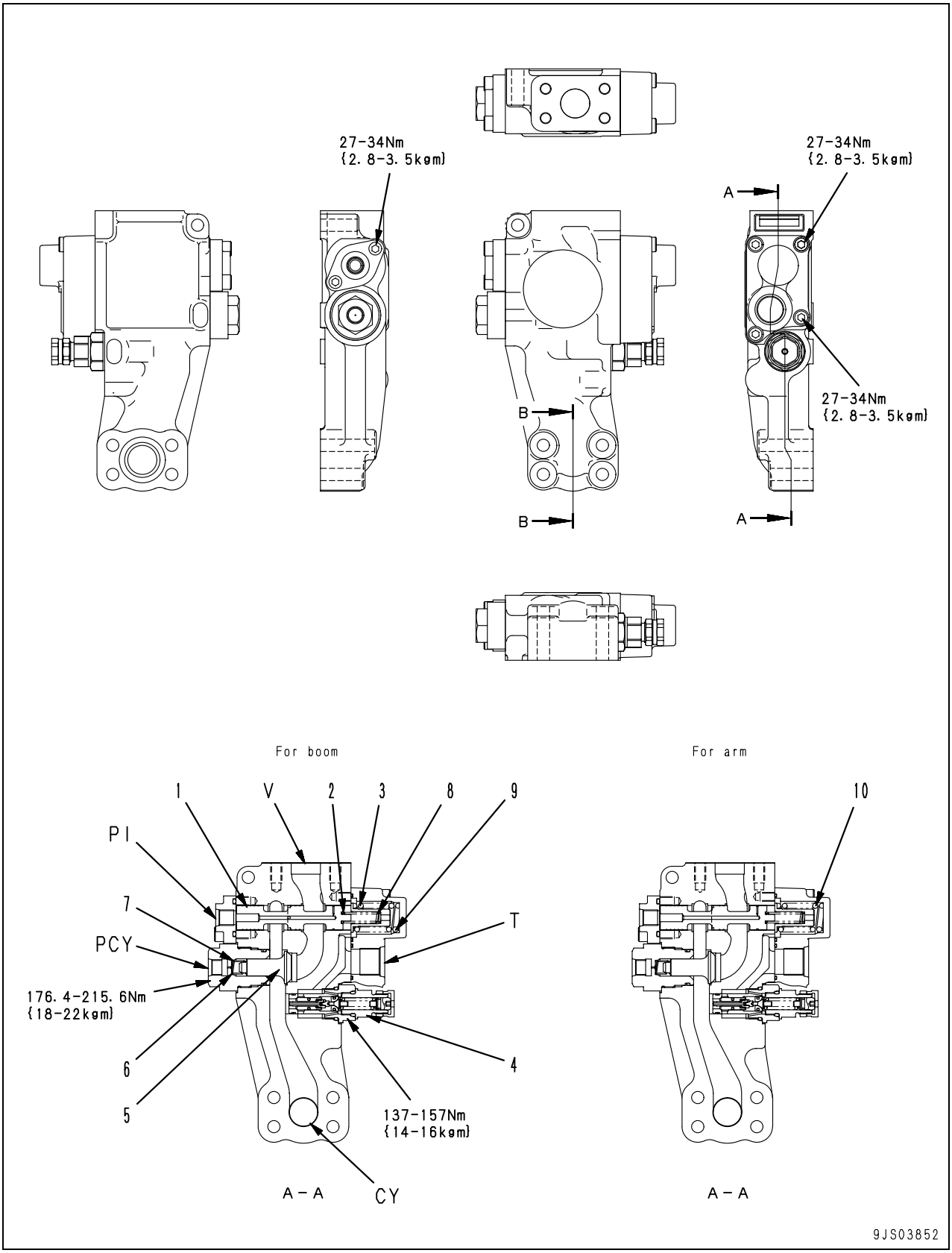


Operation

- If the right travel lever is set in the reverse (or forward) direction, pilot pressure from the PPC valve presses spool (7) to the left (or right).
- Spool (7) pushes piston (3) to close orifice (5) and shut off stroke regulation signal chamber (a) and the drain circuit of the travel PPC valve.
- At this time, the right travel reverse (or forward) lever is set, PPC pressure is applied through orifice (6) of piston (4) to the left end of piston (8) to push piston (8) to the right.
- When operated for boom raising (or arm IN, OUT, bucket curl, dump), spool (1) moves to the left.
- Maximum stroke of the spool is limited to (st1) for the amount of movement (st2) of piston (8) to the right.

Hydraulic drift prevention valve

(For the boom and arm)



CY: To work equipment cylinder
PCY: For pressure pickup port and equalizer circuit
PI: From PPC valve
T: To tank
V: From control valve

1. Pilot spool
2. Spool (1st stage spool)
3. Spring (2nd stage spool)
4. Safety valve
5. Check valve
6. Spring

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
7	Check valve spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring.
		20.8 x 12.2	13.5	12.7 N {1.3 kg}	—	10.2 N {1.04 kg}	
8	Spool return spring	41.1 x 9.6	35.0	58.8 N {6.0 kg}	—	47.1 N {4.8 kg}	
9	Spool return spring	41.9 x 25.8	41.0	78.5 N {8.0 kg}	—	62.8 N {6.4 kg}	
10	Spool return spring	44.6 x 25.6	41.0	181 N {18.5 kg}	—	145 N {14.8 kg}	

Function

- Prevents the pressurized oil from reversing from the work equipment cylinder and the latter from a sudden drop if the piping bursts between the control valve and the work equipment cylinder.

Operation

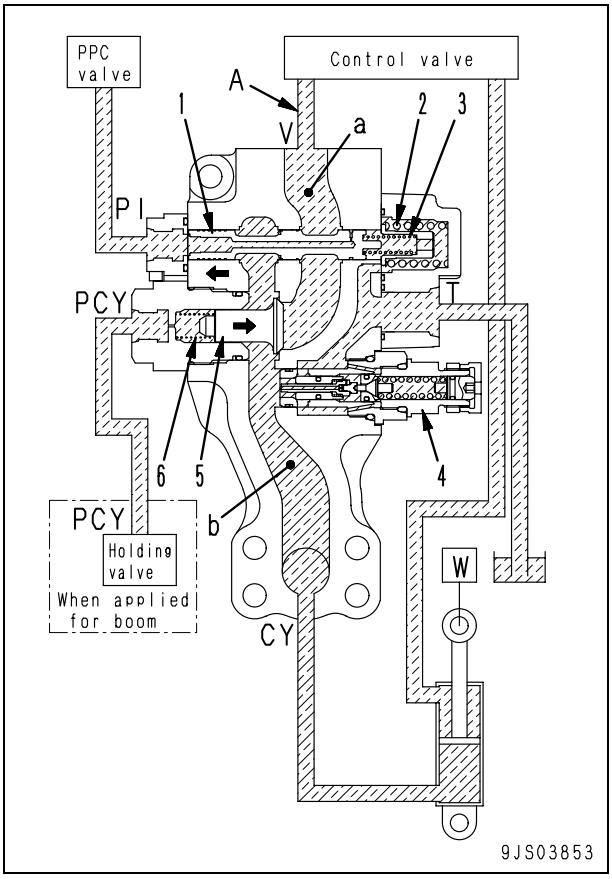
1. When the work equipment lever is in neutral

When the piping is free of burst

- Check valve (5) is closed under the holding pressure of the cylinder led from port (CY) to chamber (b).
- Pilot pressure led to port (PI) from the PPC valve when in neutral is 0 kg/cm^2.
- Spool (1) is pressed to the left by the force of springs (2) and (3)
- Chambers (a) and (b) are shut off.
- No pressurized oil flows between the control valve and the work equipment cylinder.
- Accordingly, the work equipment is held in position.
- If the work equipment cylinder has abnormally high pressure, safety valve (4) is actuated by the holding pressure of the work equipment cylinder.
- Chambers (b) of L.H. and R.H. hydraulic drift prevention valve for the boom are interconnected by port (PCY).
- Chambers (b) will have the same pressure if the L.H. and R.H. hydraulic drift prevention valves have a difference in leakage.

If the piping is bursted

- If piping (A) bursts between the control valve and the work equipment cylinder, chambers (a) and (b) are shut off same as when the piping has no burst.
- Pressure for the work equipment cylinder is held to prevent a sudden drop of the work equipment.



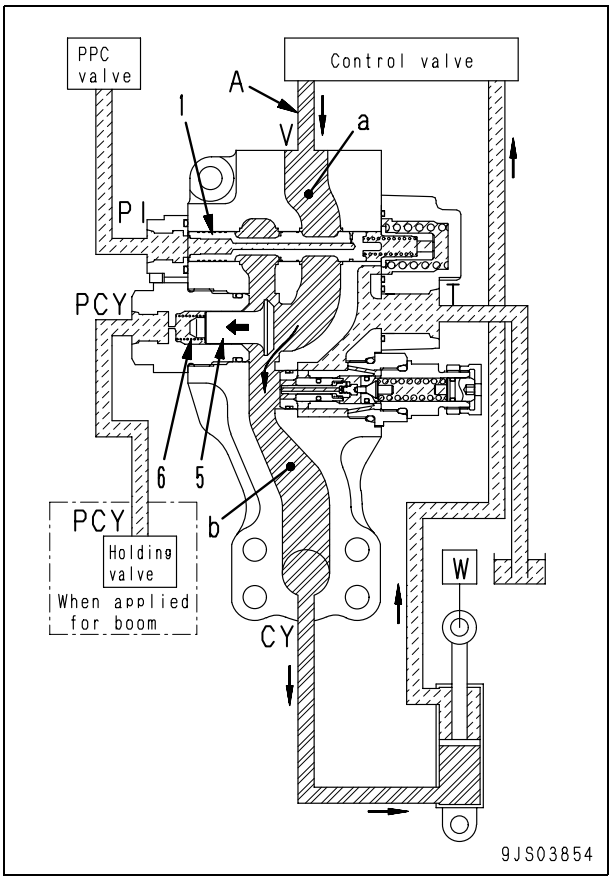
2. When pressurized oil flows from the main valve to the cylinder

When the piping is free of burst

- Pressurized oil led to chamber (a) from the control valve becomes higher than the combined force of pressure from work equipment cylinder circuit chamber (b) and spring (6).
- Check valve (5) opens and chambers (a) and (b) are interconnected.
- Pressurized oil flows from the control valve to the work equipment cylinder.

If the piping is bursted

- If piping (A) bursts between the control valve and the work equipment cylinder, pressurized oil in chamber (a) flows outside from the bursted portion.
- Pressure force in chamber (a) drops.
- Pressure force in chamber (a) drops lower than the combined pressure force of chamber (b) and spring (6).
- Check valve (5) closes and chambers (a) and (b) are cut off.
- Pressure for the work equipment cylinder is held to prevent a sudden drop of the work equipment.



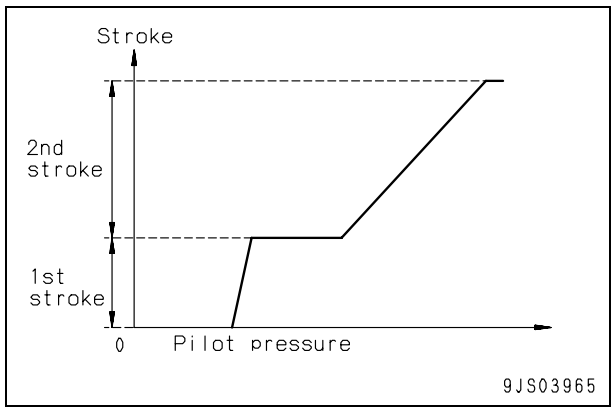
3. When returning pressurized oil to the main valve from the work equipment cylinder

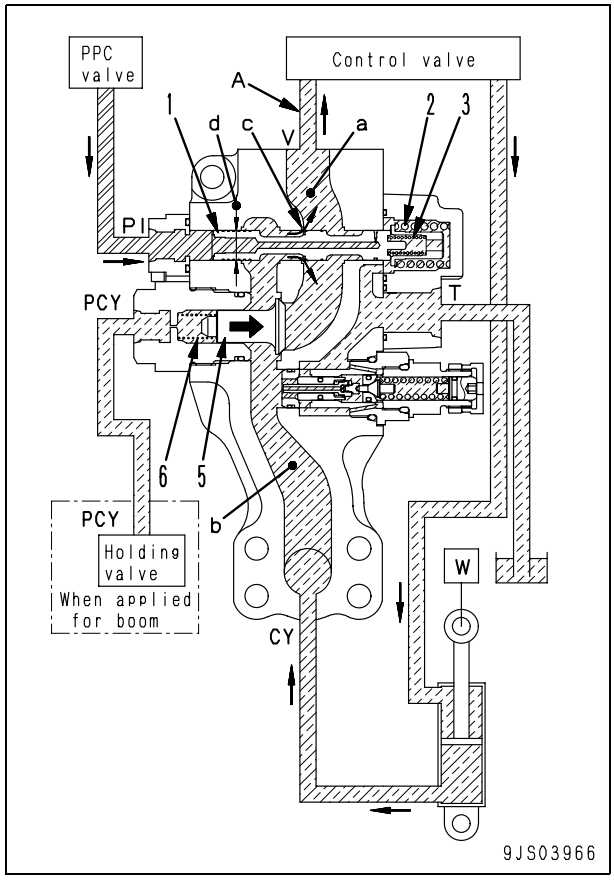
When the piping is free of burst

- Holding pressure of the work equipment cylinder is led to chamber (b) and check valve (5) closes.
- Pilot pressure from the PPC valve is led to port (PI) and reaches [Pilot Pressure > Force of Spring (3)] (area of d).
- Spool (1) moves to the right to the standby position. (1st stage stroke)
- At this point, chambers (a) and (b) are not interconnected.
- Pilot pressure further rises, and reaches [Pilot pressure > Force of spring (2)] (area of d).
- Spool (1) moves further to the right, and chambers (a) and (b) are interconnected. (2nd stage stroke)
- Pressurized oil returns to the control valve from the work equipment cylinder.

If the piping is bursted

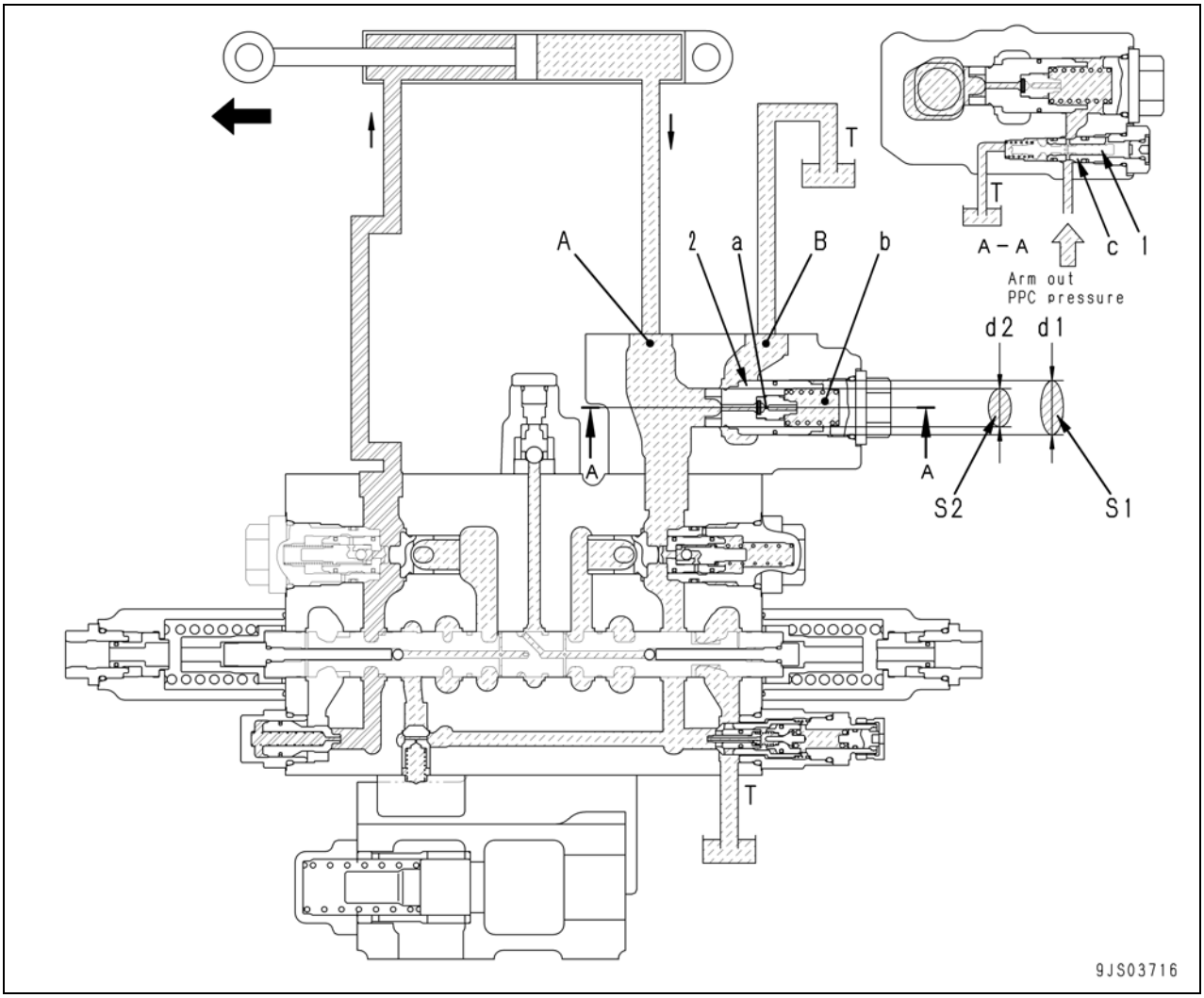
- If piping (A) bursts between the control valve and the work equipment cylinder.
- Pressurized oil in chamber (a) flows out to the bursted portion but resupplied from chamber (b).
- Since pressurized oil flows via opening (c) of spool (1), a sudden drop of the cylinder is prevented.





Quick return valve

1. When arm OUT



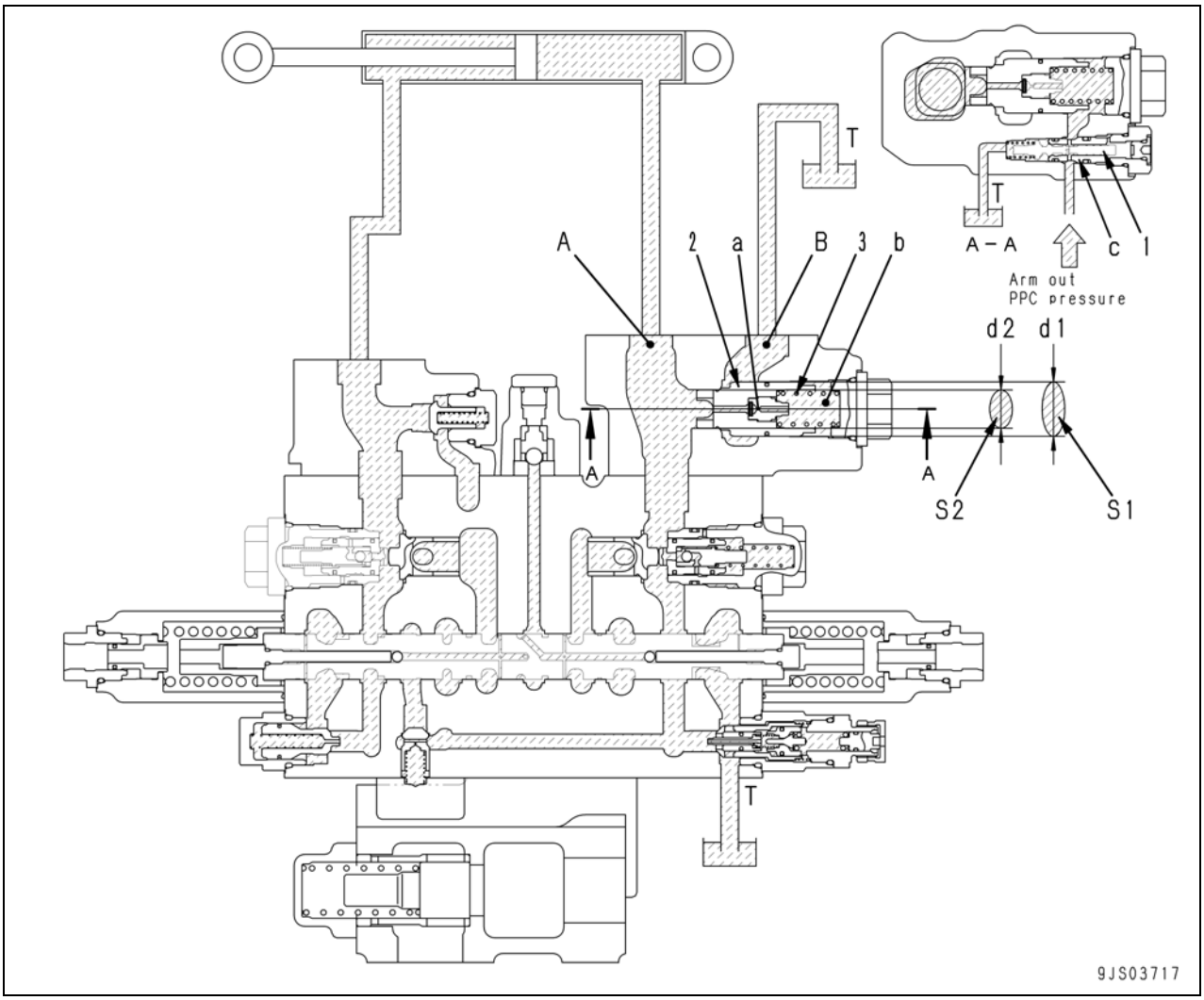
Function

- When arm OUT, large volume of oil returns from the cylinder bottom.
- Reduces this pressure loss.

Operation

- When the arm IN is operated, pilot spool (1) is pushed under the pilot pressure from the PPC valve.
- Pressurized oil in chamber (b) inside the valve is drained via orifice (c).
- Pressurized oil of the arm bottom side flows to orifice (a) → chamber (b) → orifice (c) → drain (T), and the pressure in chamber (b) lowers.
- If the pressure of chamber (b) drops lower than that of port (A), pressure receiving force of the pressure receiving portion [ϕd2 area (S2) (seat diameter area)] on the side of port (A) increases by the sum of the pressure receiving force of pressure receiving portion[ϕd1 area (S1)] on the chamber (b) side of valve (2) and the spring force.
- Or (ϕd2 pressure receiving force > ϕd1 pressure receiving force + spring force)
- Valve (2) is pressed to the right and pressurized oil is led from port (A) to (B).
- From port (B), pressurized oil is drained directly to the tank.

2. When the arm is in neutral



Operation

- Returning the lever to neutral reduces the pilot pressure from the PPC valve to 0 kg/cm^2.
- The pressurized oil that has flowed and been drained through orifice (a) in valve (2) is closed by pilot piston (1).
- The holding pressure on the arm bottom side works on the difference between areas (S2) and (S1) of valve (2) to the left.
- Valve (2) is closed by the total of this force and the force of spring (3), so ports (A) and (B) are shut off.

Lift check valve

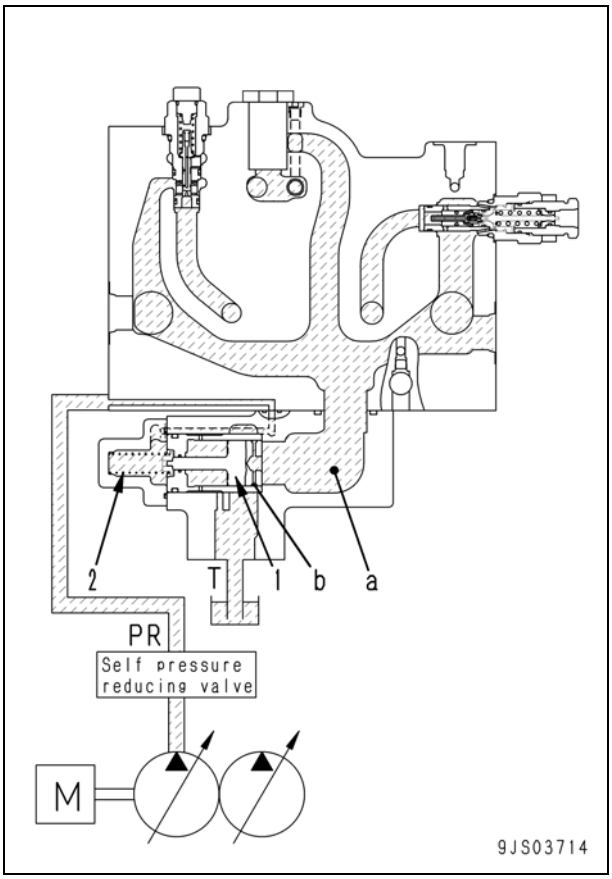
Function

- This valve applies back pressure to the drain circuit to prevent generation of negative pressure on each actuator (motors, cylinders, etc.).

Operation

1. While engine is stopped

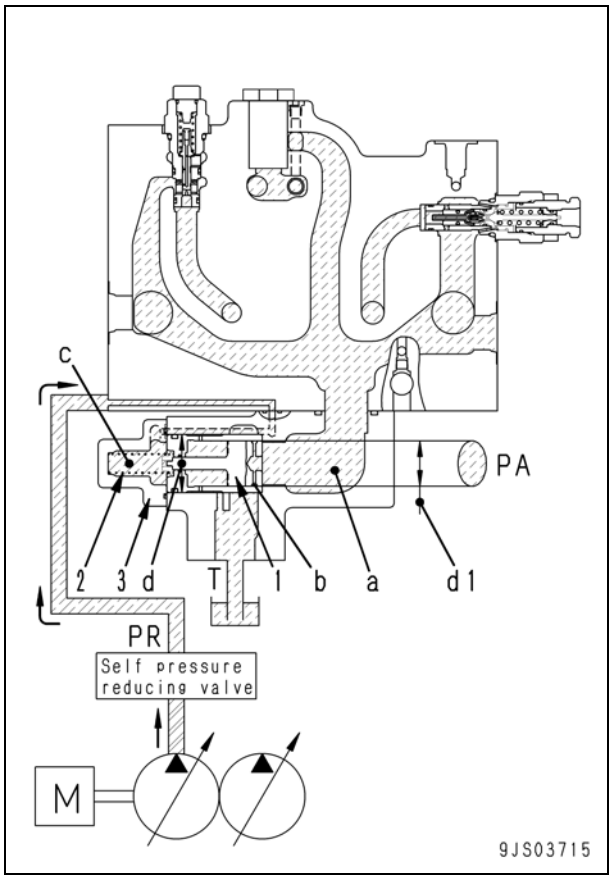
- Pressurized oil is not fed to the self pressure reducing valve from the pump, and valve (1) is pressed to the right by the force of spring (2).
- Drain circuit (a) of the control valve is connected with port (T) through orifice (b) of valve (1).



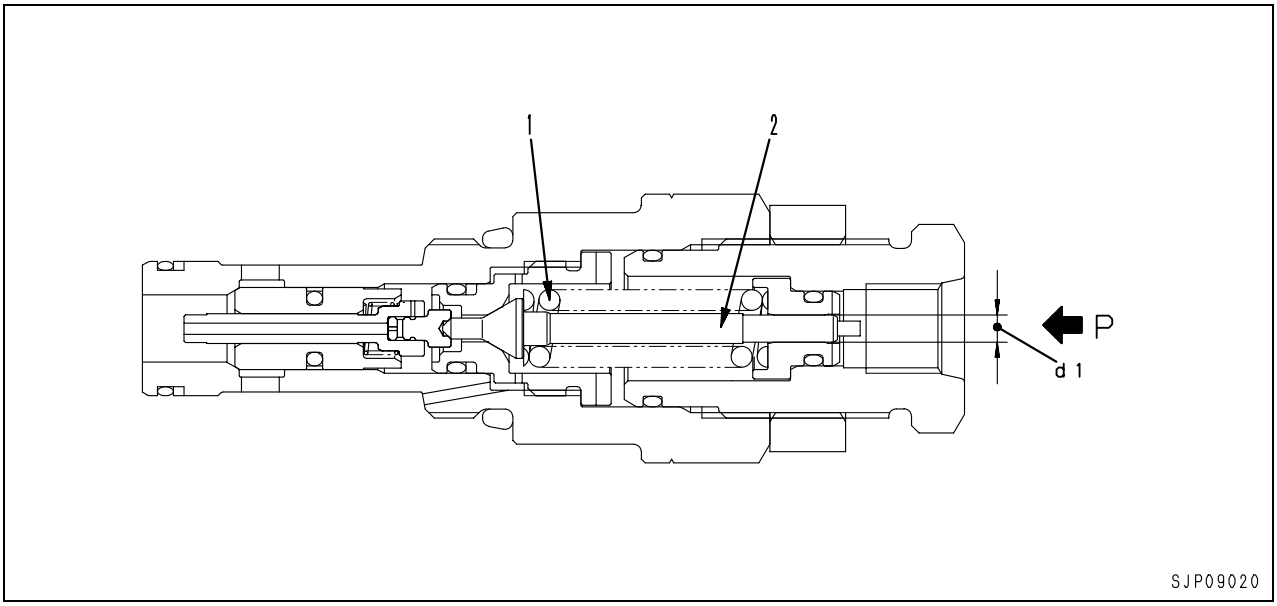
2. While engine is running

- Output pressure (PR) of the self pressure reducing valve is applied via the control valve to spring chamber (c) of back pressure valve (3).
- Output pressure (PR) applied to spring chamber (c) is applied to the left end of valve (1) (area of ϕd) to push valve (1) to the right.
- At this time, pressure (PA) of drain circuit (a) of the control valve is applied to the right end of valve (1) (area of ϕd1) to push valve (1) to the left.
- Valve (1) strikes balance to make the back pressure equal to (PA) in the equation below.

$$PA = \frac{(\text{Area of fd}) \times PR + \text{force of spring (2)}}{\text{Area of } \phi d1}$$



Main relief valve



1. Spring
2. Poppet

Function

- Set pressure of the relief valve is in two stages.
- When power is needed, pilot pressure (P) is turned ON and the set pressure becomes higher.

Operation

- The set pressure of relief valve is determined by spring (1) installed load. (1st stage)
- Respective setting is not required for both the 1st and 2nd stages. Setting the 1st stage completes the setting of the 2nd stage.

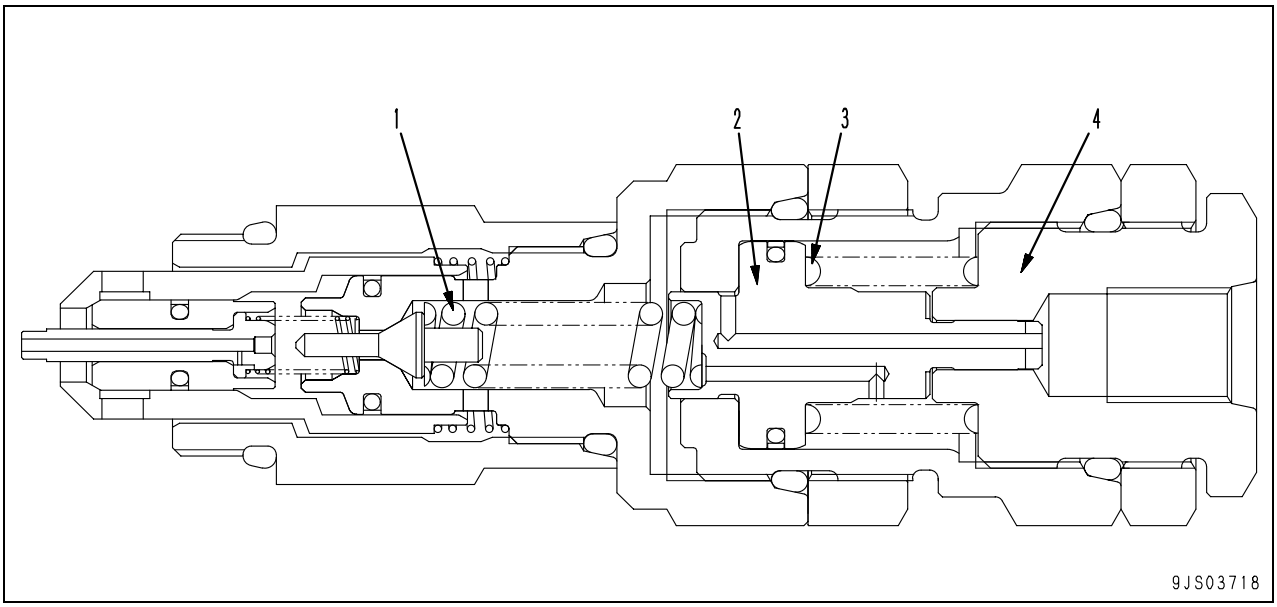
1. If pilot pressure (P) is OFF: Low-pressure setting

Set pressure is determined by spring (1) installed load.

2. If pilot pressure (P) is ON: High-pressure setting

Spring (1) installed load is added with pilot pressure (P) applied to the area of poppet diameter (d1), raising the set pressure to higher level.

2-stage safety-suction valve [Installed to port (B) of the service valve]



1. Spring
2. Piston
3. Spring
4. Holder

Function

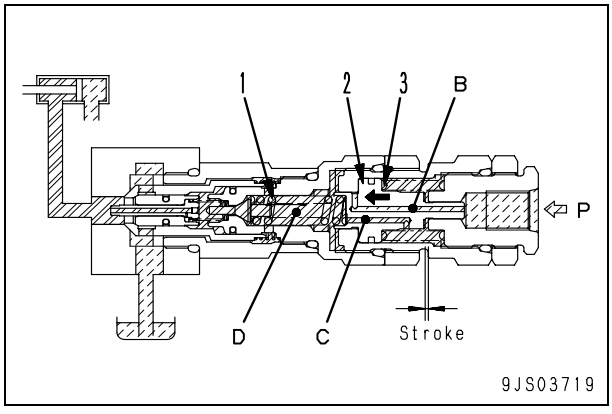
- Enables to provide the safety valve set pressure in two stages, and make the low-pressure setting smaller.
- Enables to relieve a load without lever operation if high load is applied to the cylinder.
- Improves work efficiency and reduces machine body vibration.

Operation

- The safety set pressure is determined by spring (1) installed load.

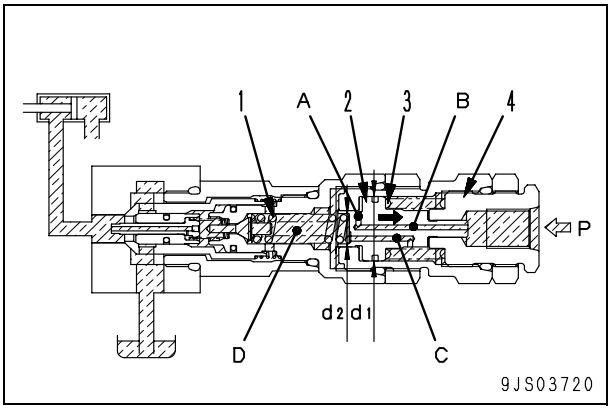
1. If pilot pressure is OFF (high-pressure setting)

- Since pilot pressure (P) is OFF, piston (2) is pressed to the left by spring (3). [Spring (1) installed load < spring (3) installed load]
- Spring (1) installed load becomes maximum and the set pressure rises.
- Passage (B) is interconnected to the drain circuit via passage (C) and chamber (D).



2. If pilot pressure is ON (low-pressure setting)

- If the pilot pressure (P) is ON, the pilot pressure is led to section (A) via passage (B).
- Piston (2) works on the pressure-receiving bore portion [(d2) — (d1)] of section (A).
- This pilot pressure contracts spring (3), and piston (2) moves to the right until making contact with holder (4).
- Spring (1) stretches, installed load is reduced, and the set pressure lowers.
- Pressurized oil proportionate to the piston stroke is drained via passage (C) and chamber (D).



PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00100-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

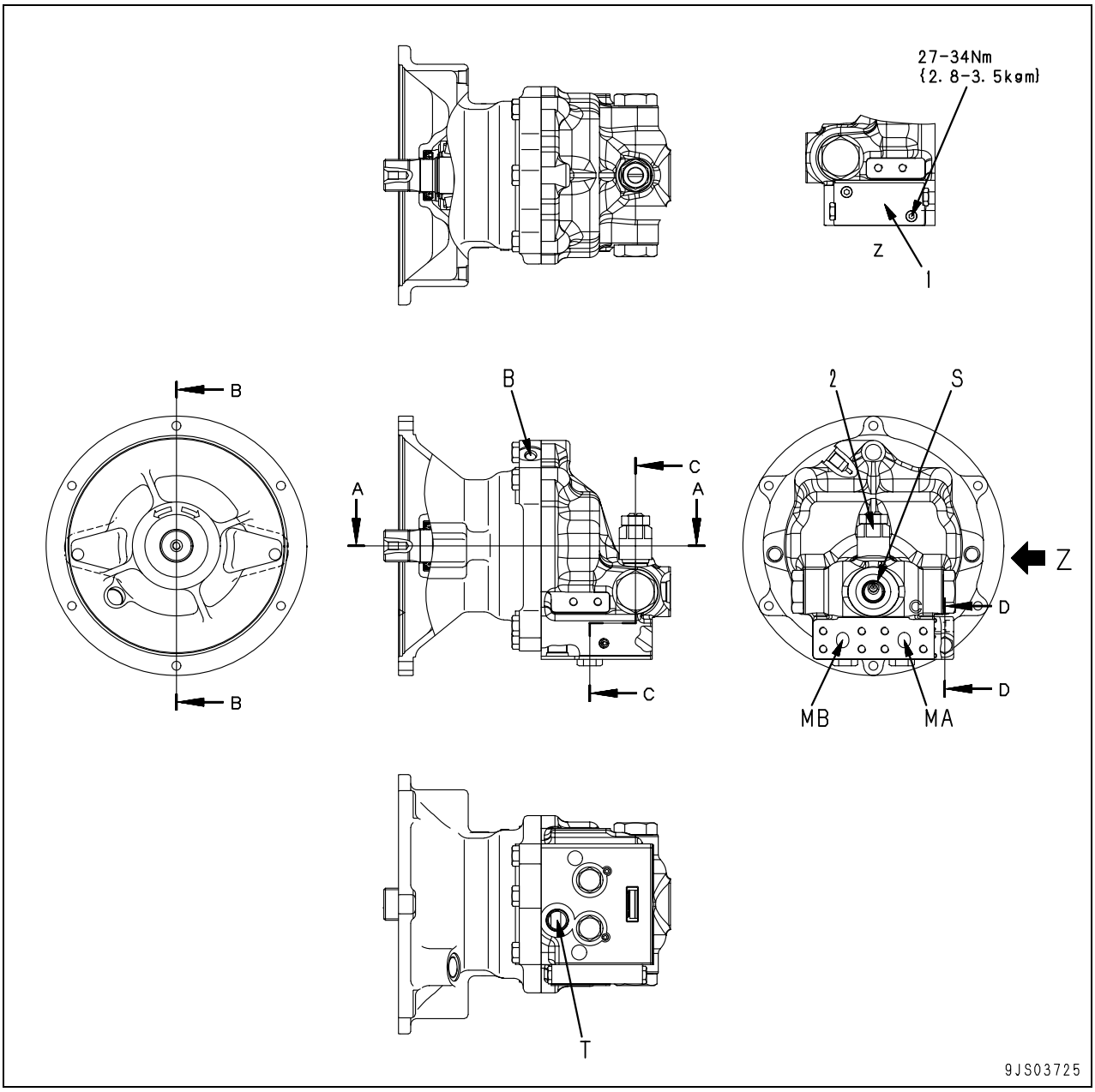
10 Structure, function and maintenance standard

Hydraulic system, Part 3

Hydraulic system, Part 3

Swing motor

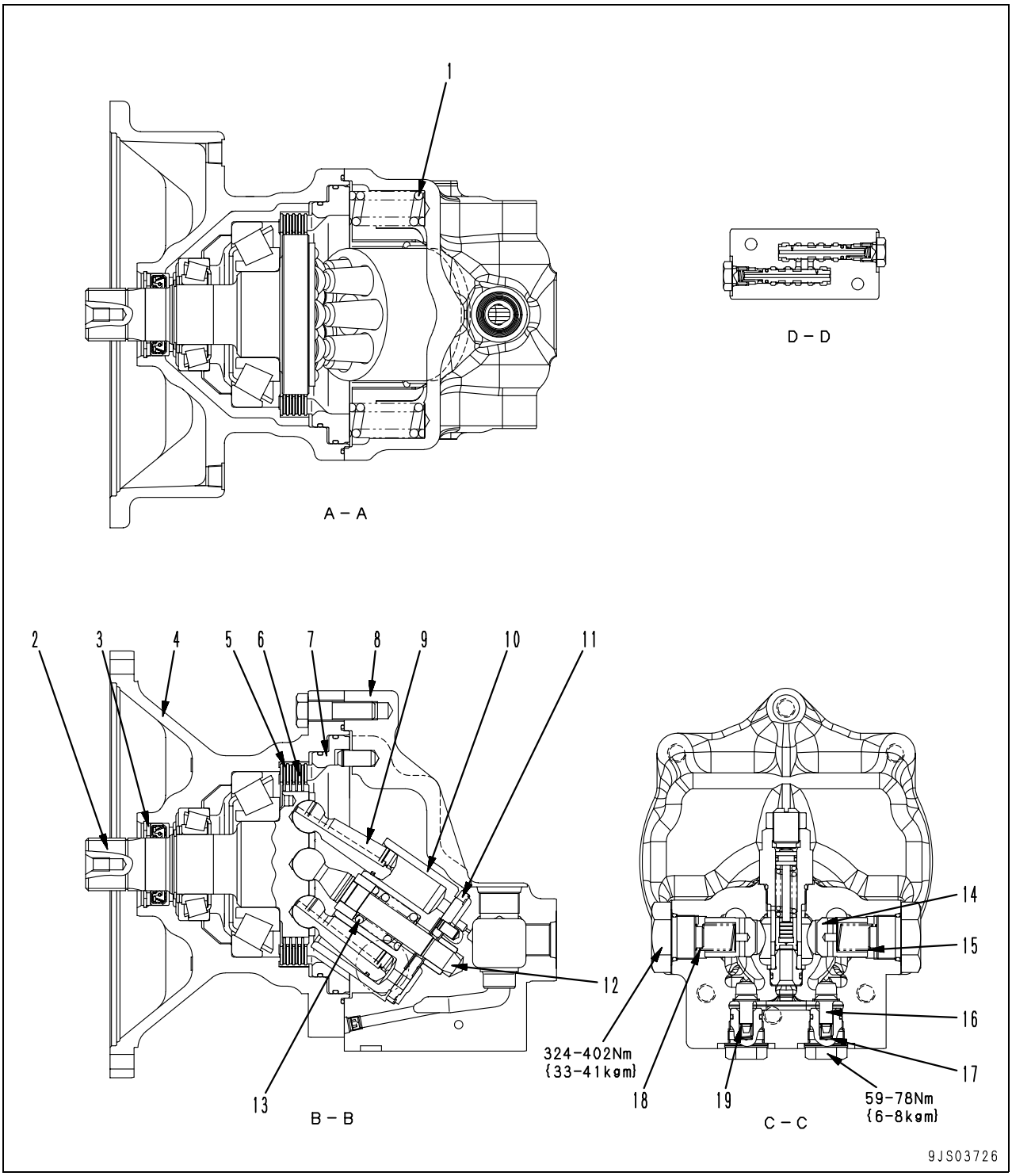
Type: KMF125ABE-6



B: From swing brake solenoid valve
MA: From control valve
MB: From control valve
S: From control valve
T: To tank
1. Reverse prevention valve
2. Safety valve

Specifications

Item \ Models	PC210 / 230-8K	PC240-8K
Type	KMF125ABE-6	
Theoretical displacement	125 cm^3/rev	
Safety valve set pressure	28.4 MPa {290 kg/cm^2}	
Rated engine speed:	1,694 rpm	1,879 rpm
Brake release pressure	1.4 MPa {14 kg/cm^2}	


1
A – A
D – D
2
3
4
5
6
7
8
9
10
11
12
13
B – B
14
15
16
17
18
19
324-402Nm
{33-41kgm}
59-78Nm
{6-8kgm}
C – C
9JS03726

1. Brake spring
2. Drive shaft
3. Spacer
4. Case
5. Disc
6. Plate
7. Brake piston
8. Housing
9. Piston
10. Cylinder block
11. Valve plate
12. Center shaft
13. Center spring
14. Check valve
15. Check valve spring
16. Shuttle valve
17. Shuttle valve spring

Unit: mm

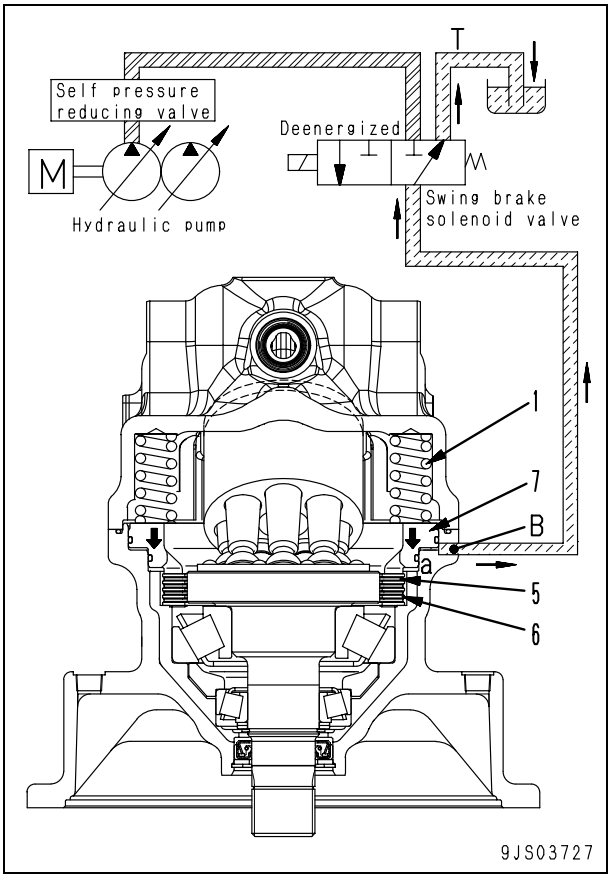
No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free length x Outside diameter	Installation length	Installation load	Free length	Installation load	
18	Check valve spring	57.2 x 20.0	30.0	3.53 N {0.36 kg}	—	2.84 N {0.29 kg}	If damaged or deformed, replace spring.
19	Shuttle valve spring	16.4 x 8.9	11.5	13.7 N {1.4 kg}	—	11.0 N {1.12 kg}	

Swing holding brake

1. When solenoid valve is deenergized

Operation

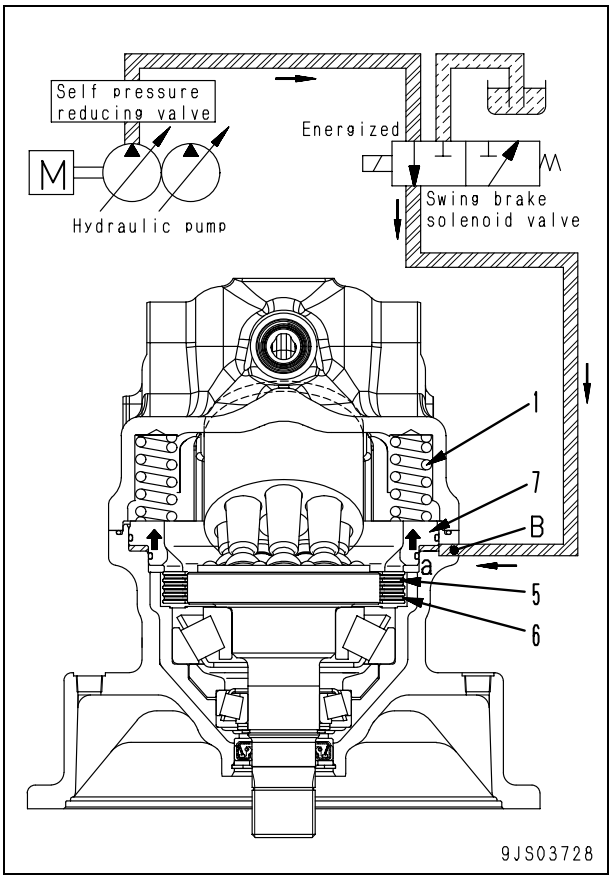
- As the swing holding brake is deenergized, the pressurized oil from the self pressure reducing valve is shut off.
- Port (B) is connected to tank circuit (T).
- Brake piston (7) is pushed down by brake spring (1).
- Disc (5) and plate (6) are pushed together, and the brake is applied.



2. When solenoid valve is energized

Operation

- As the swing brake solenoid valve is energized, the valve is switched.
- The pressurized oil from the self pressure reducing valve is conducted brake chamber (a) via port (B).
- After entering chamber (a), the pressurized oil compresses brake spring (1) and pushes brake piston (7) up.
- Disc (5) is separated from plate (6), releasing the brake.



Relief valve portion

Outline

- The relief valve portion consists of check valves (2) and (3), shuttle valves (4) and (5), and relief valve (1).

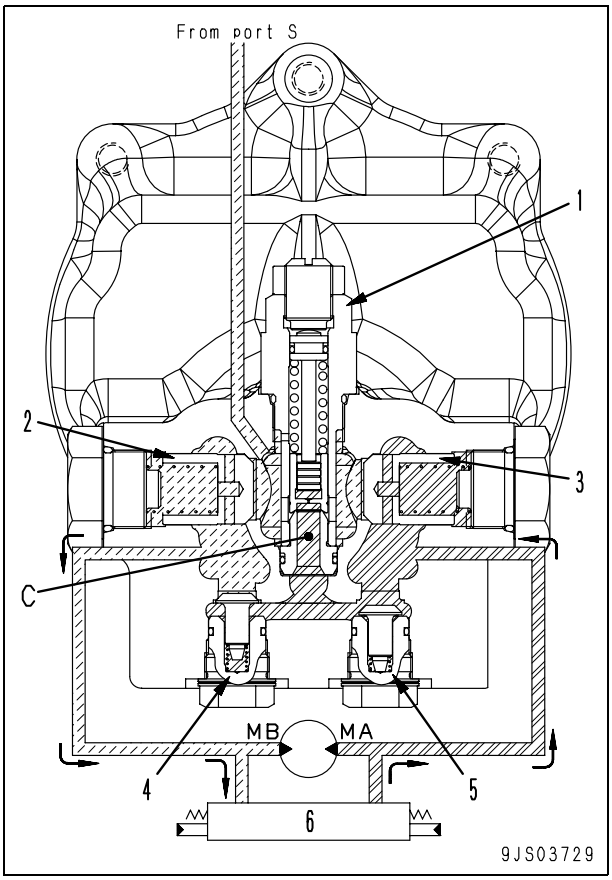
Function

- When the machine is in the swing holding mode, control valve (6) closes the motor outlet circuit, but the motor rotation is continued by inertial force.
- The motor output, therefore, is abnormally increased, resulting in damaging the motor.
- In order to prevent the motor damages, the relief valve relieves the abnormally high pressure to port (S) from the motor outlet side (high-pressure side) of the motor.

Operation

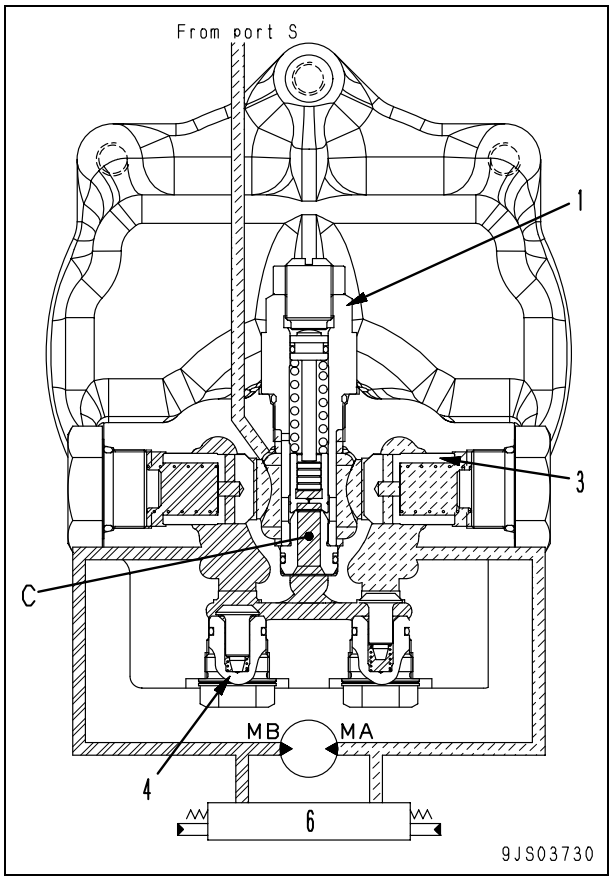
1 When starting swing

- When the swing control lever is operated to the right- swing, the pressurized oil from the pump is supplied to port (MA) via control valve (6).
- The pressure on port (MA) rises, the starting torque is generated in the motor, and the motor starts to rotate.
- The pressurized oil from the outlet port of the motor passes from port (MB) through the control valve (6) and returns to the tank.

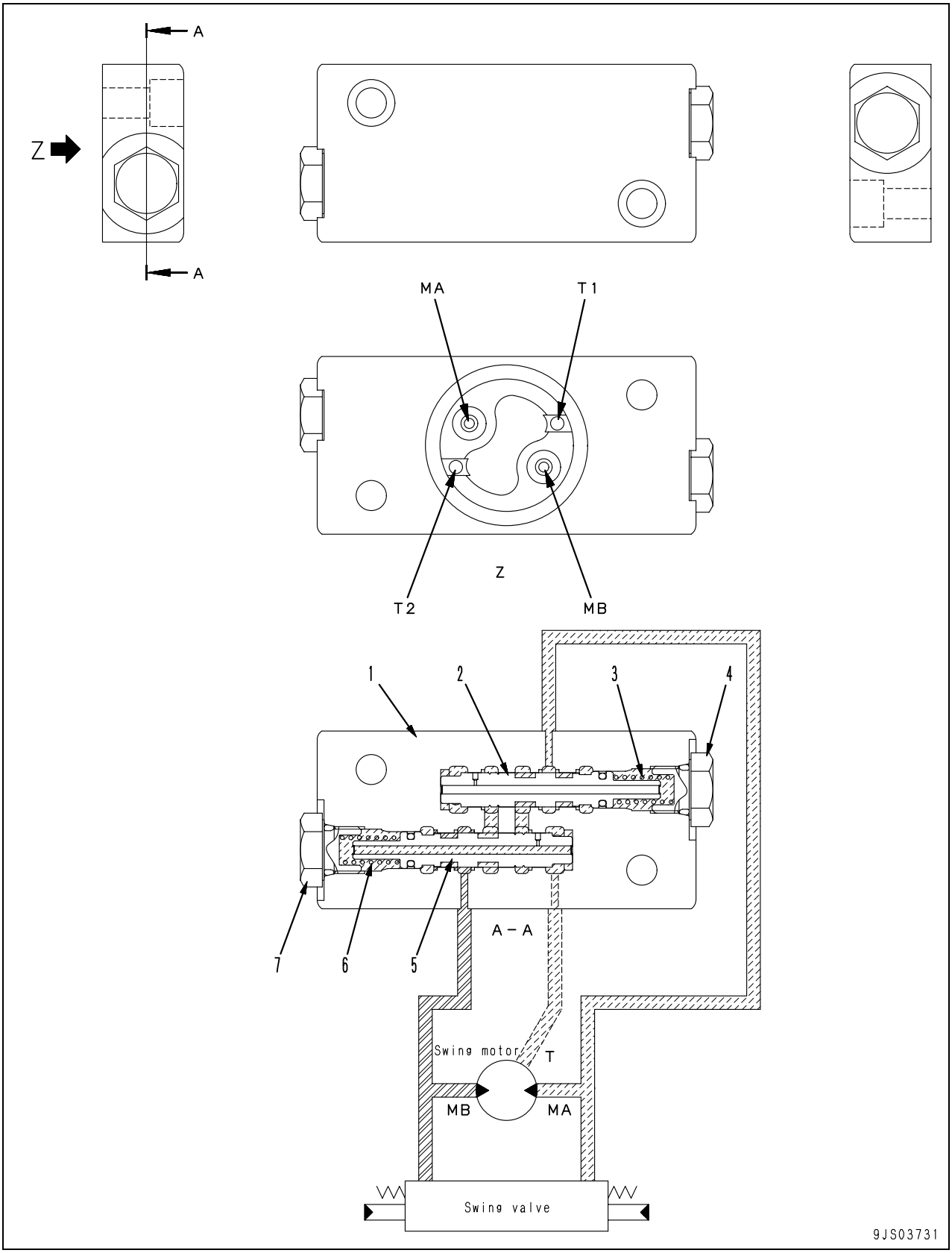


2 When swing is stopped

- When the swing control lever is returned to neutral, the supply of pressurized oil from the pump to port (MA) is stopped.
- The pressurized oil from the motor outlet can't return to the tank since the returning circuit to the tank is closed from control valve (6). Thus, pressure on port (MB) increases.
- Rotation resistance is generated on the motor and hence the brake tarts working.
- Shuttle valve (4) is pressed as pressure on port (MB) goes above port (MA).
- The pressure on chamber (C) is increased to the set pressure of relief valve (1) and becomes the same as that of port (MB).
- A high braking torque works on the motor, thereby stopping the motor.
- When relief valve (1) is being actuated, the relieved pressurized oil and the pressurized oil from port (S) are fed to port (MA) via check valve (3).
- Above prevents cavitation on port (MA).



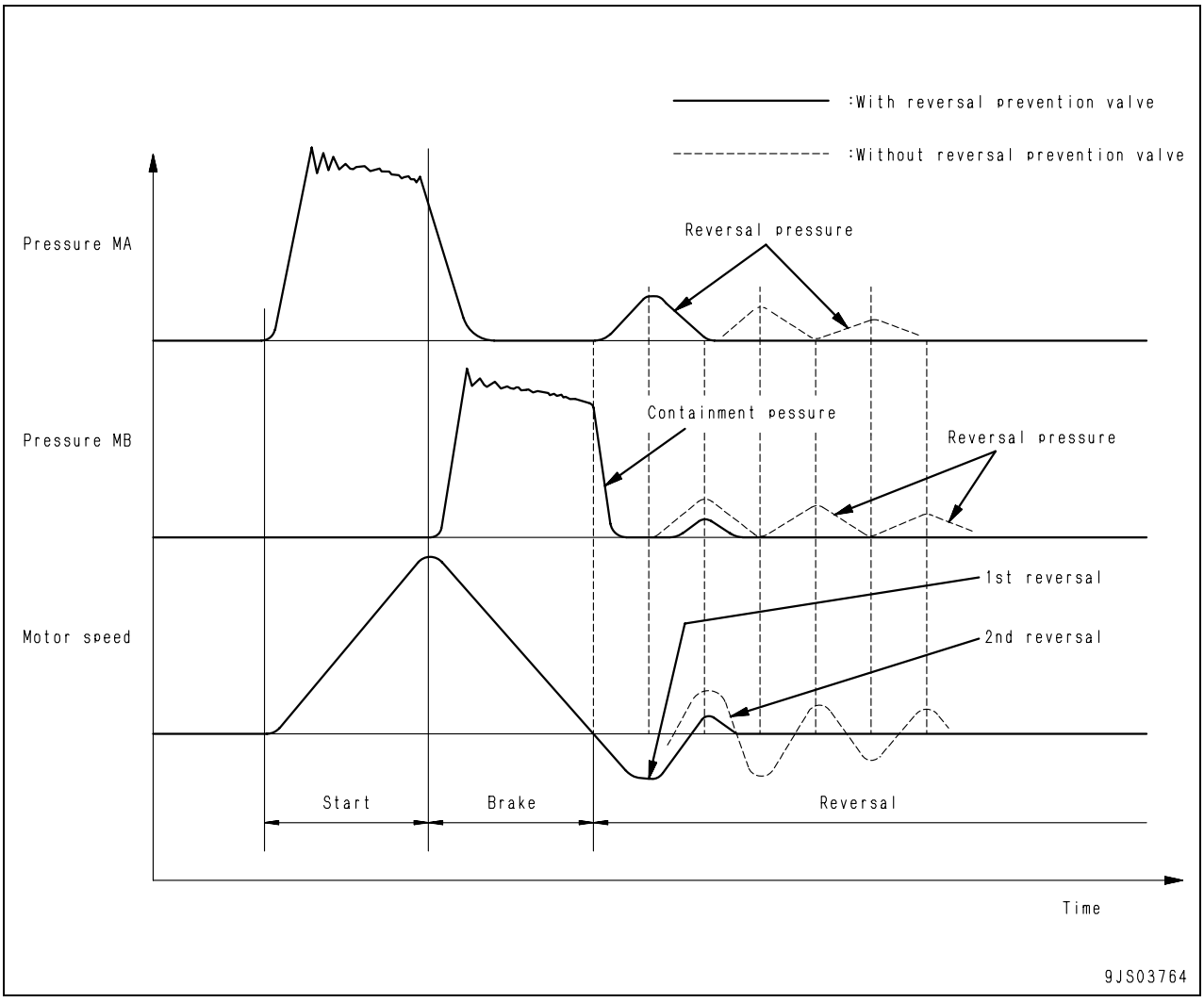
Reverse prevention valve



MA: From control valve
MB: From control valve
T1: To tank
T2: To tank

1. Valve body
2. Spool (MA side)
3. Spring (MA side)
4. Plug (MA side)
5. Spool (MB side)
6. Spring (MB side)
7. Plug (MB side)

Explanatory drawing of effects



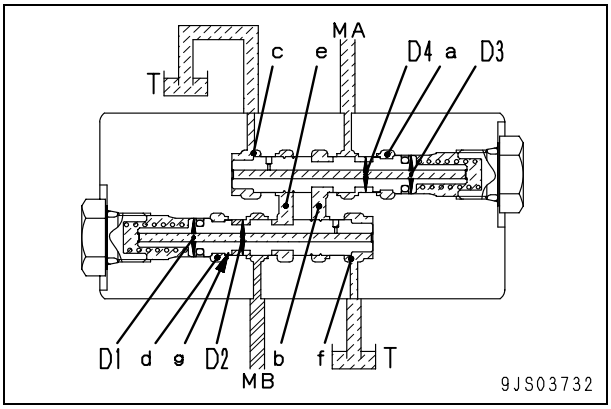
Function

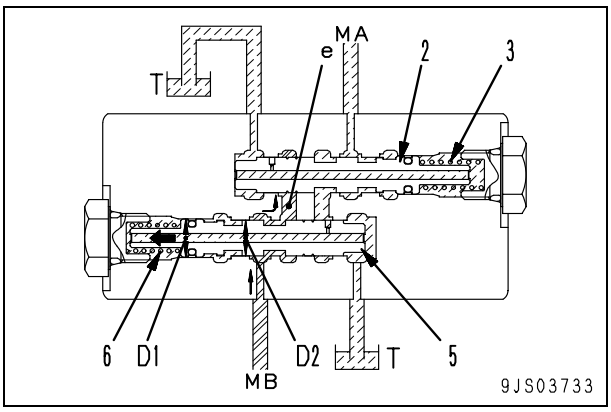
- This valve reduces the swing back generation in the swing body by the inertia of the swing body, the backlash and rigidity of the machinery system, and the compression of the hydraulic oil when the swing is stopped.
- The valve contributes in preventing collapsing of load when the swing is stopped and also contributes in reducing cycle time (enhances the positioning performance, enabling you to proceed to the next work quicker than ever).

Operation

1. When port (MB) brake pressure is generated

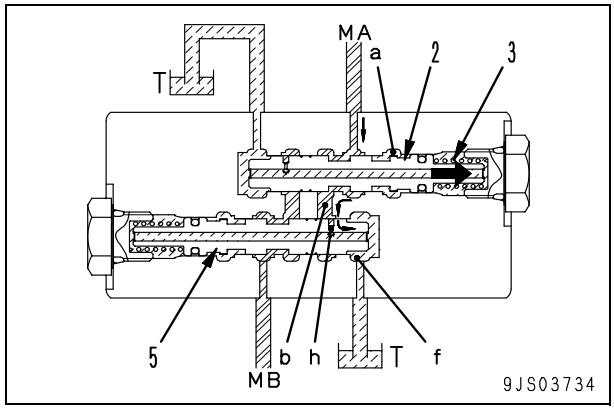
- Pressure (MB) is conducted to chamber (d) via notch (g).
- The pressure compresses spring (6) by use of the difference in areas of circles (ϕD1 > ϕD2) of spool (5) and moves spool (5) to the left side.
- Port (MB) → chamber (e) will be interconnected.
- Since pressure (MA) is lower than the set pressure of spring (3), spool (2) does not move and the pressurized oil is kept in. Thus the braking force is ensured.



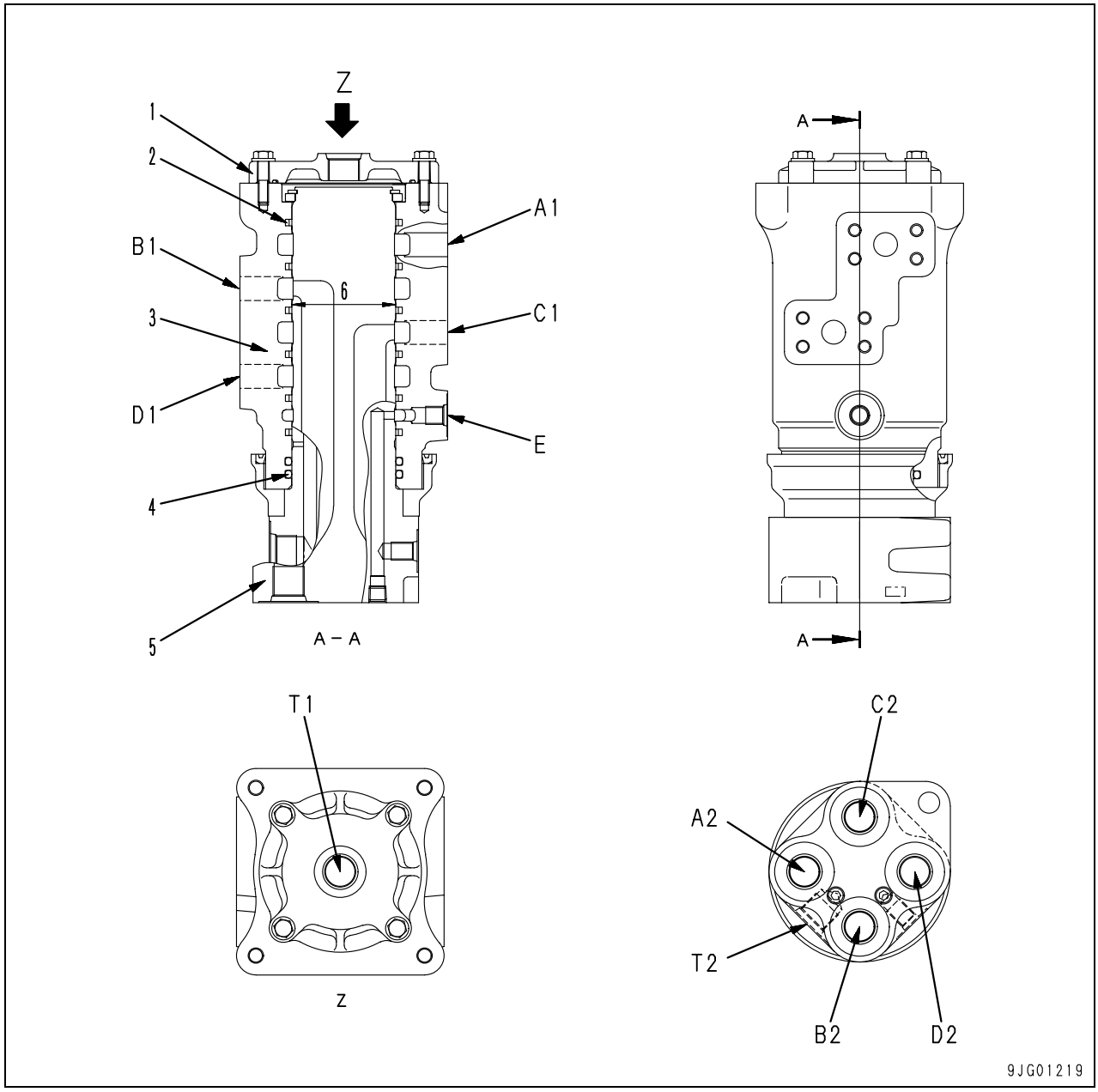


2. When motor is stopped temporarily

- The motor rotation is reversed by the closing pressure generated at port (MB). (1st time: reverse rotation)
- Reversing pressure is generated on port (MA). Pressure (MA) is conducted to chamber (a).
- The pressure compresses spring (3) by use of the difference in areas of circles (ϕD3 > ϕD4) of spool (2) and moves spool (2) to the right side.
- Port (MA) → chamber (b) will be interconnected.
- Ports (b) and (f) will be interconnected through the drilled hole (h) on spool (5). This interconnection bypasses the reversing pressure on port (MA) to port (T), thereby preventing the reverse rotation of the 2nd time.



Center swivel joint



1. Cover
2. Slipper seal
3. Body
4. O-ring
5. Shaft

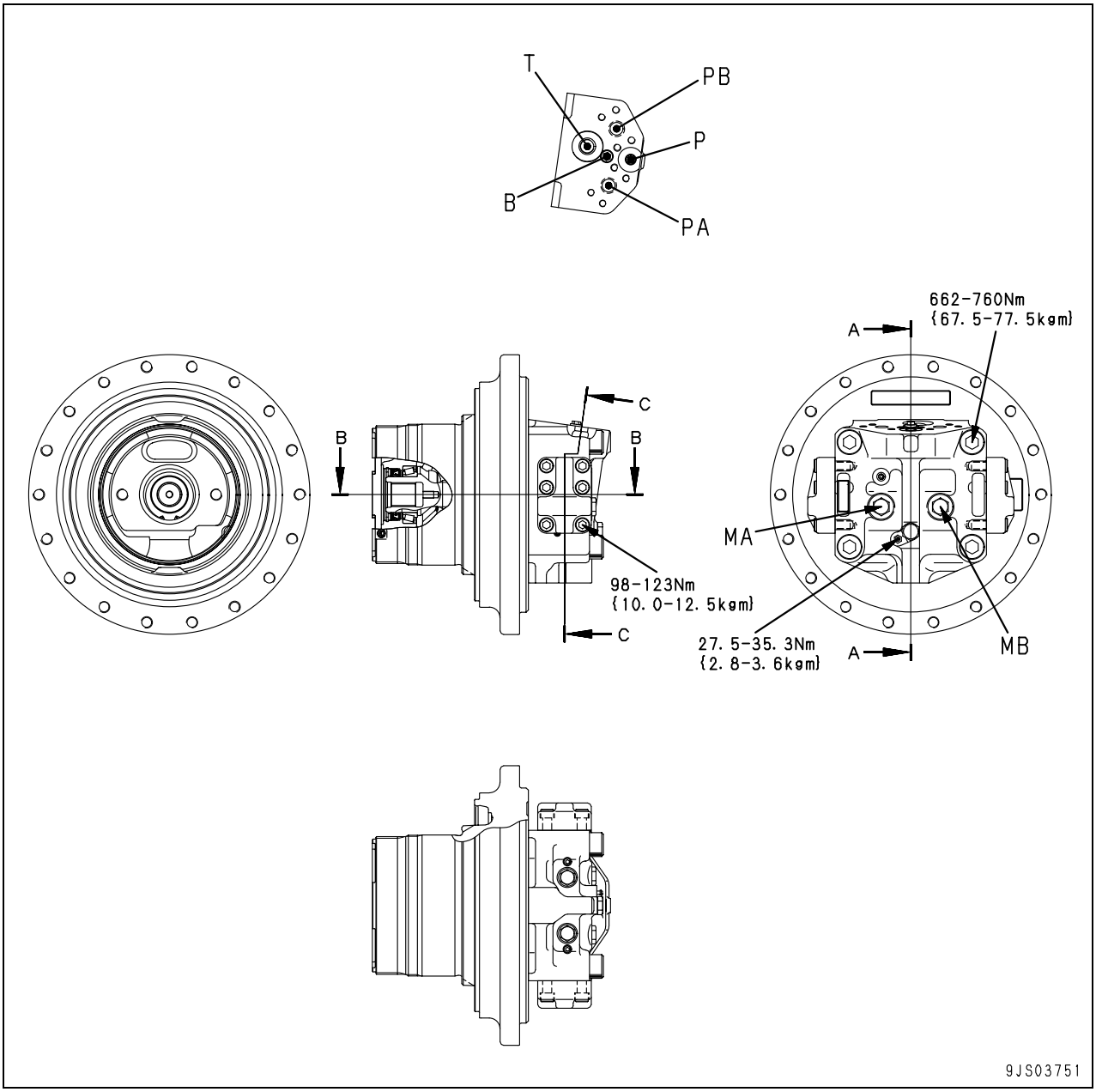
A1 : To L.H. travel motor port (PB)
A2 : From control valve port (A5)
B1 : To L.H. travel motor port (PA)
B2 : From control valve port (B5)
C1 : To R.H. travel motor port (PA)
C2 : From control valve port (A2)
D1 : To R.H. travel motor port (PB)
D2 : From control valve port (B2)
E : To L.H. and R.H. travel motors port (P)
T1 : From L.H. and R.H. travel motors port (T)
T2 : To tank

Unit: mm

No.	Check item	Criteria			Remedy
6	Clearance between rotor and shaft	Standard size	Standard clearance	Clearance limit	Replace
		80	—	—	

Travel motor

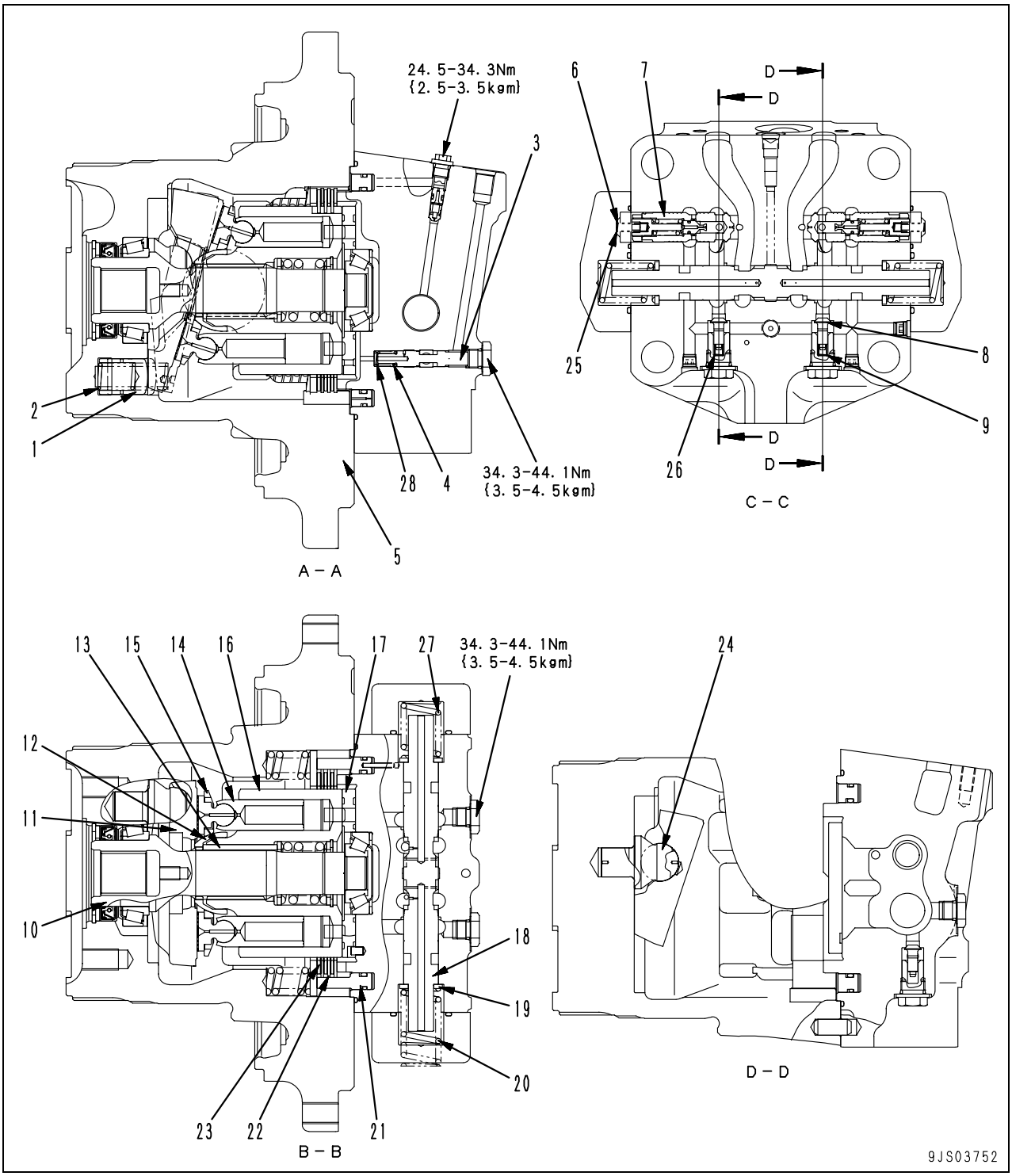
Type: HMV110ADT-3



B : Brake release pressure port
MA : MA pressure detection port
MB : MB pressure detection port
P : From travel speed solenoid valve
PA : From control valve
PB : From control valve
T : To tank

Specifications

Item \ Models		PC210-8K	PC230 / 240-8K
Type		HMV110ADT-3	
Theoretical displacement	Min.	78.6 cm^3/rev	74 cm^3/rev
	Max.	106.2 cm^3/rev	110.7 cm^3/rev
Rated pressure		37.3 MPa {380 kg/cm^2}	
Rated speed	Capacity min.	2,805 rpm	3,046 rpm
	Capacity max.	1,842 rpm	1,588 rpm
Brake release pressure		1.18 MPa {12 kg/cm^2}	
Travel speed selector pressure	Differential pressure	0.78 MPa {8 kg/cm^2}	


24. 5-34. 3Nm
{2. 5-3. 5kgm}
3
2
1
28
4
34. 3-44. 1Nm
{3. 5-4. 5kgm}
5
A – A
6
7
D
D
25
8
9
26
D
D
C – C
13
15
14
16
17
27
34. 3-44. 1Nm
{3. 5-4. 5kgm}
12
11
10
18
19
20
23
22
21
B – B
24
D – D
9JS03752

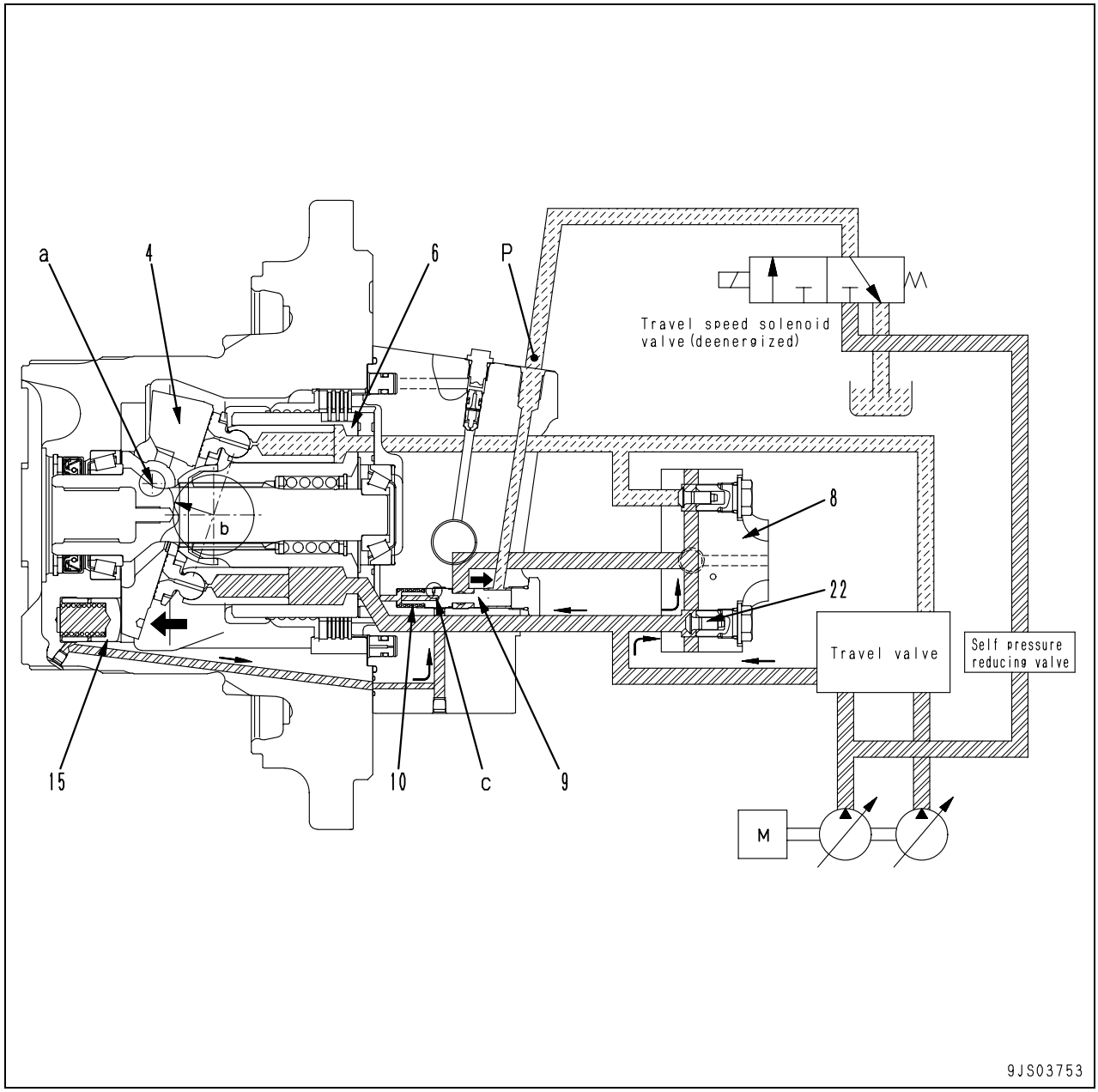
1. Regulator piston
2. Spring
3. Regulator valve
4. Spring
5. Motor case
6. Suction safety valve spring
7. Suction safety valve
8. Check valve
9. Check valve spring
10. Output shaft
11. Rocker cam
12. Retainer guide
13. Pin
14. Piston
15. Retainer
16. Cylinder block
17. Valve plate
18. Counterbalance valve
19. Ring
20. Spool return spring
21. Brake piston
22. Plate
23. Disc
24. Ball

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free length x Outside diameter	Installation length	Installation load	Free length	Installation load	
25	Check valve spring	32.5 x 6.5	24.2	7.16 N {0.73 kg}	—	5.69 N {0.58 kg}	If damaged or deformed, replace spring.
26	Check valve spring	13.0 x 6.5	9.5	1.96 N {0.2 kg}	—	1.57 N {0.16 kg}	
27	Spool return spring	58.4 x 30	42	427 N {43.5 kg}	—	341 N {34.8 kg}	
28	Regulator valve spring	21.5 x 11.1	17.1	54.9 N {5.6 kg}	—	43.9 N {4.48 kg}	

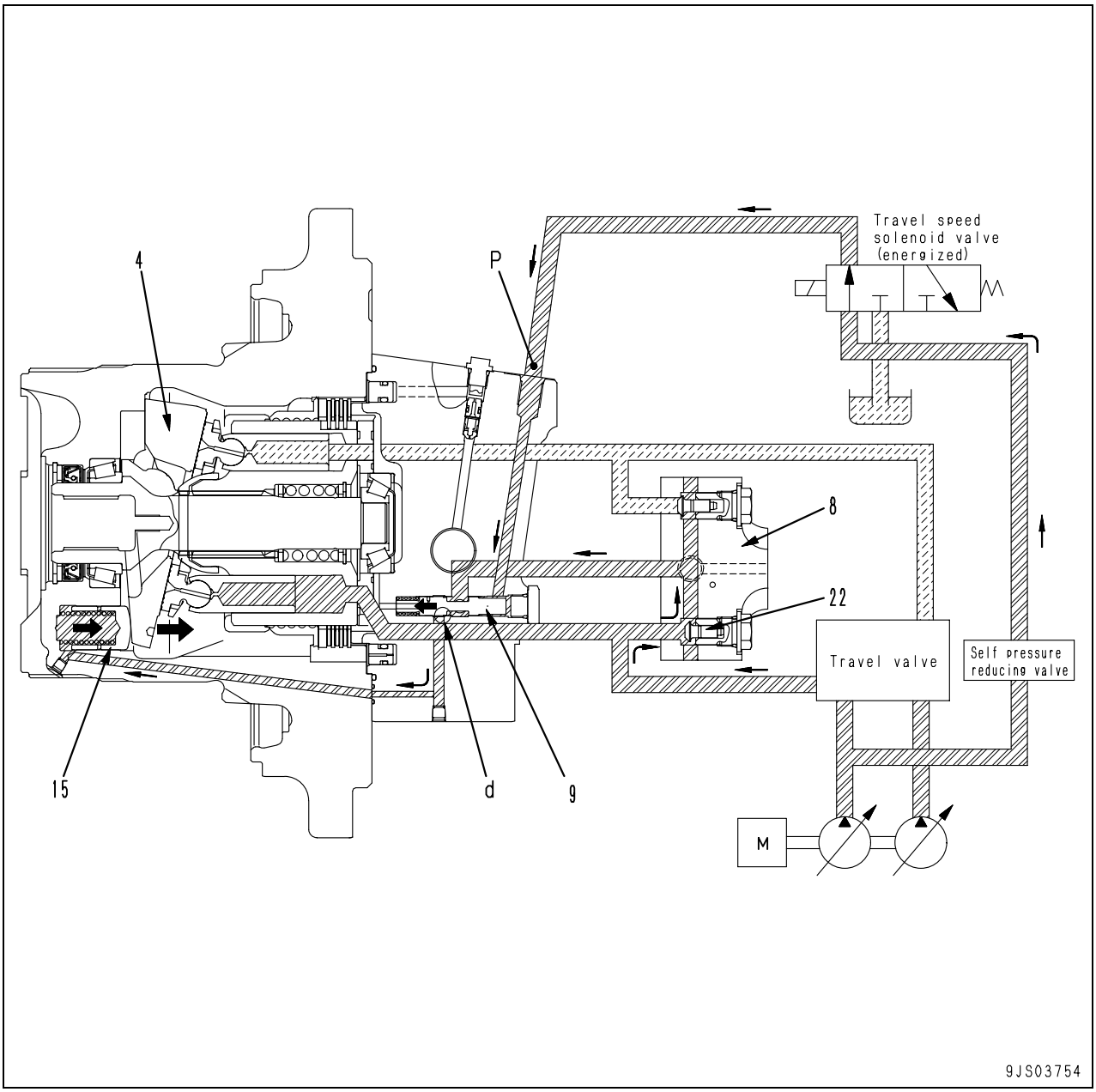
Operation of motor

1) At slow speed (motor swash plate angle at maximum)



- As the solenoid valve is deenergized, the pilot pressurized oil from the self pressure reducing valve does not flow to port (P).
- Regulator valve (9) is pushed to the right by spring (10).
- Pressurized oil being conducted from the control valve to end cover (8) by pressing check valve (22) is shut off by regulator valve (9).
- Fulcrum (a) of rocker cam (4) is eccentric to the working point (b) of the combined force of the propulsion force of cylinder (6).
- The combined force of the piston propulsion forces works as the moment of inclining rocker cam (4) toward the maximum swash plate angle.
- The pressurized oil at regulator piston (15) passes through orifice (c) of regulator valve (9) and is drained to the motor case.
- Rocker cam (4) is inclined in the maximum swash plate angle direction. The motor capacity becomes maximum, turning on the low speed travel.

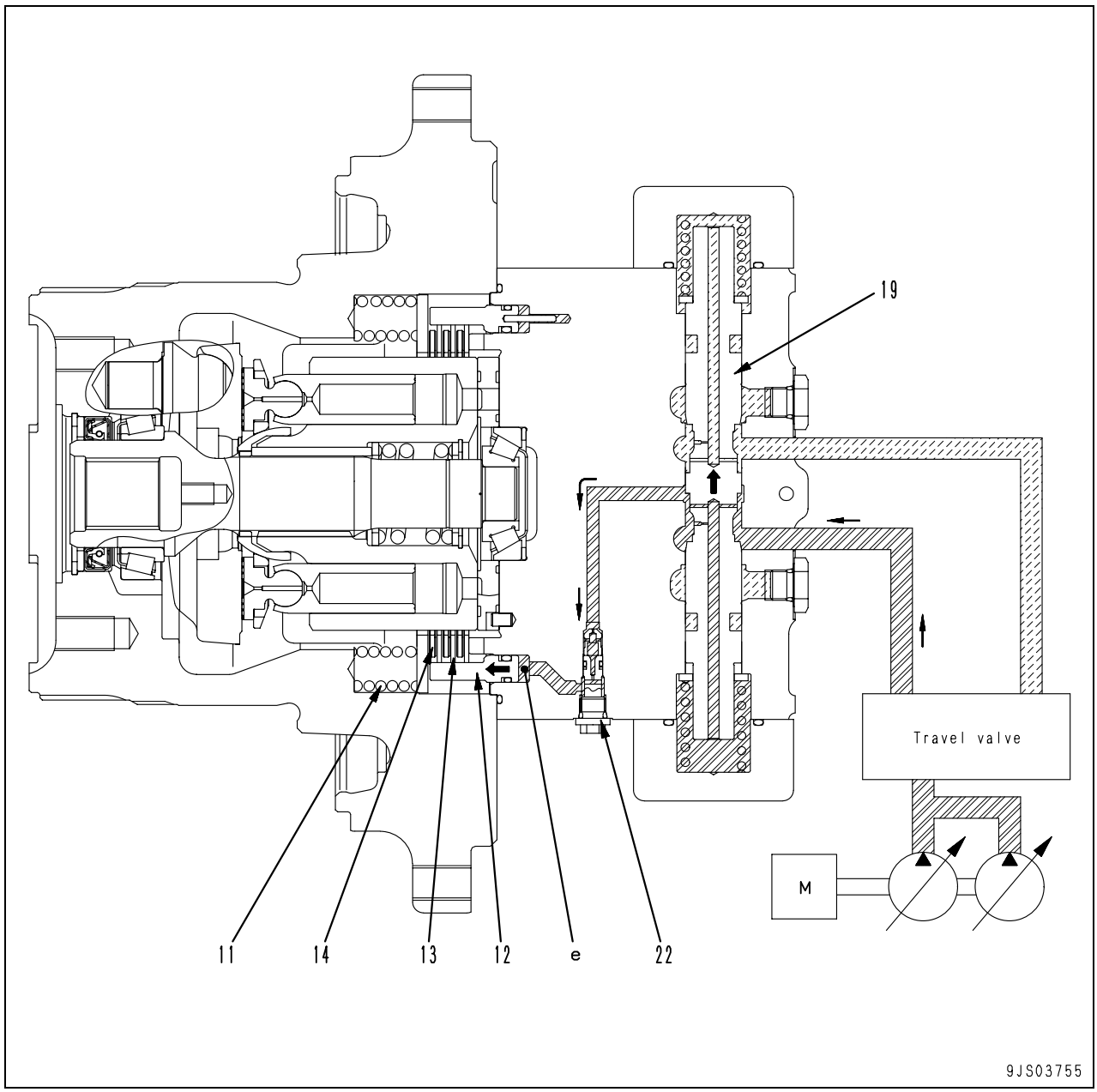
2) At high peed (motor swash plate angle at minimum)



- As the solenoid valve is energized, the pilot pressurized oil from the self pressure reducing valve flows to port (P).
- Regulator valve (9) is pushed to the left.
- The pressurized oil from the control valve passes through passage (d) in regulator valve (9) and enters regulator piston (15).
- Regulator piston (15) is pushed to the right.
- Rocker cam (4) is inclined in the minimum swash plate angle direction. The motor capacity becomes minimum, turning on the high speed travel.

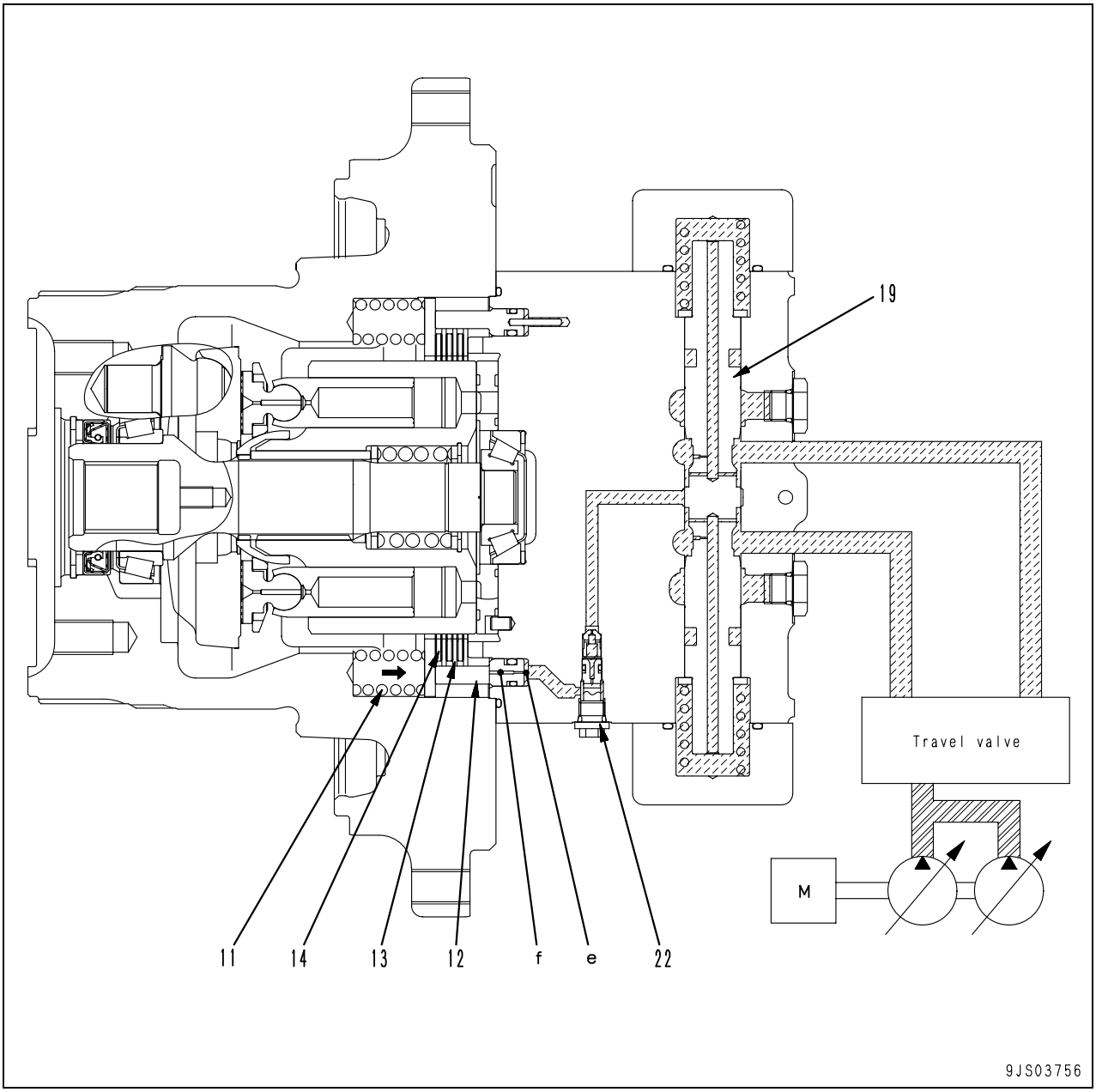
Operation of parking brake

1) When starting travel



- As the travel lever is operated, pressurized oil from the pump activates counterbalance valve spool (19), opening the parking brake circuit.
- The pressurized oil is conducted to chamber (e) of brake piston (12) and compresses spring (11), pushing piston (12) toward left.
- Since the pushing force to plate (13) and disc (14) disappears, plate (13) is separated from disc (14) and the brake is released.

2) When travel is stopped



- As the travel lever is placed in neutral, counterbalance valve spool (19) returns to the neutral position and closing the parking brake circuit.
- The pressurized oil in chamber (e) of brake piston (12) passes through orifice (f) of brake piston (12) and is drained to the motor case.
- Brake piston (12) is pushed to the right by spring (11).
- Plate (13) and disc (14) are pushed together, and the brake is applied.
- As brake piston (12) returns, flow of pressurized oil is reduced with slow return valve (22).
- The time delay will be set to activate the brake only after the machine has stopped.

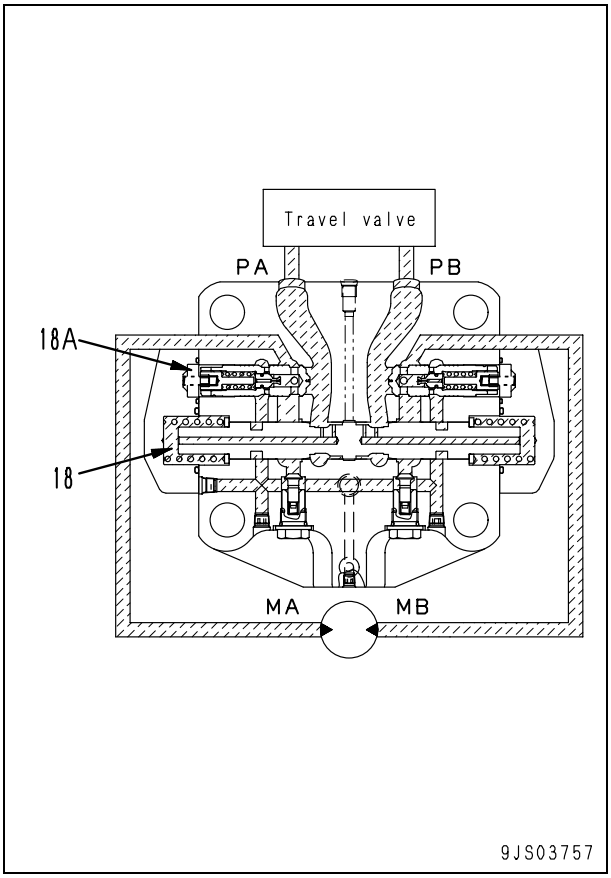
Brake valve

- The brake valve consists of suction safety valve (18A) and counterbalance valve (18).
- Functions and operations of respective components shall conform to the following.

1) Counterbalance valve and check valve

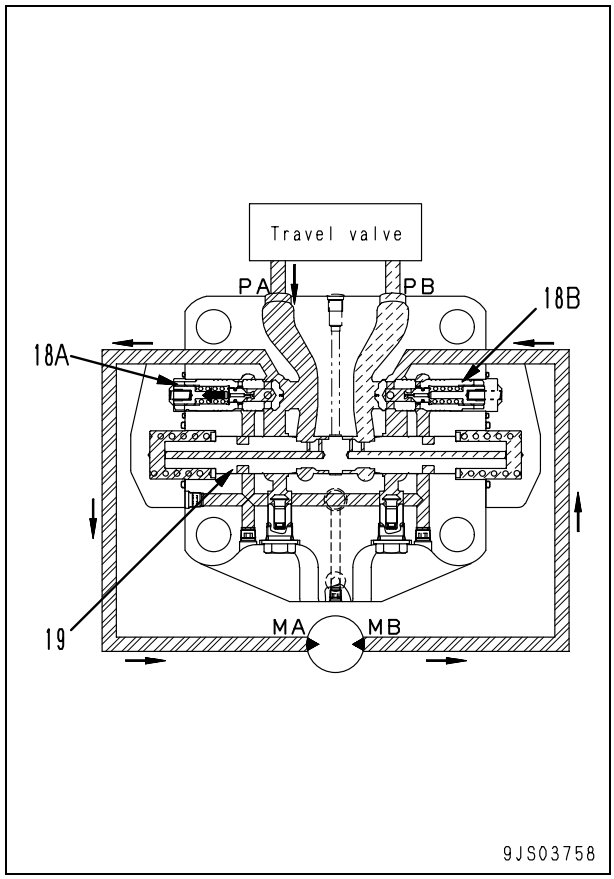
Function

- When traveling downhill, the machine travel speed tends to get faster than the motor (engine) speed because of the downward force generated from its own weight.
- If the machine travels with the engine at low speed, the motor may rotate without load, resulting in run away and inviting a very dangerous situation.
- These valves are used to prevent above by controlling the machine to travel according to the engine speed (pump delivery).



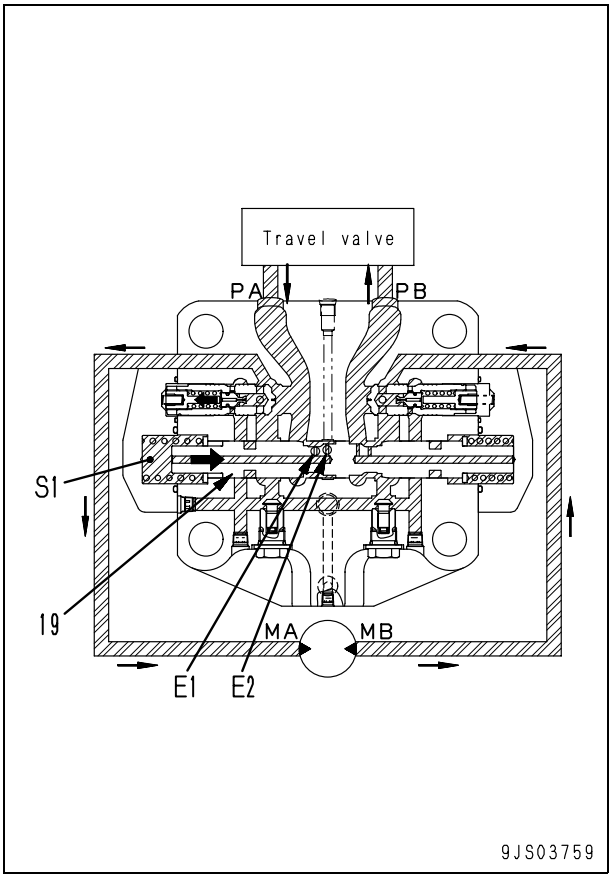
Operation when pressurized oil is supplied

- Operating the travel lever conducts the pressurized oil from the control valve to port (PA).
- The pressurized oil push-opens suction safety valve (18A) and then flows to motor outlet port (MB) via motor inlet port (MA).
- The motor outlet side is closed by suction safety valve (18B) and spool (19), so the pressure at the supply side rises.



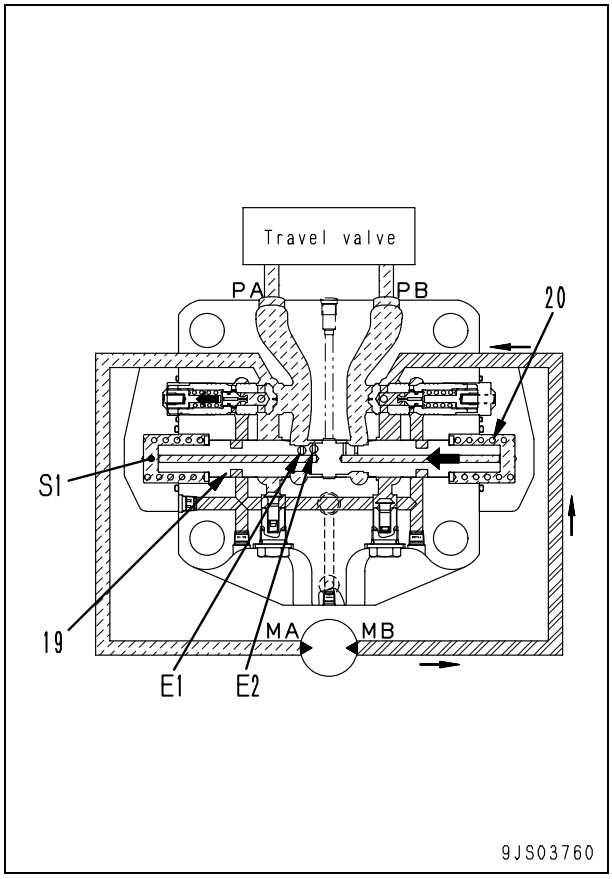
- The pressurized oil on the supply side flows to chamber (S1) via orifice (E1) and orifice (E2) of the spool (19).
- As the pressure in chamber (S1) goes above the spool selector pressure, spool (19) is pushed toward right.

- Port (MB) and port (PB) are connected, opening the motor outlet port side and starting the motor rotating.



Operation of brake during travelling downhill

- If indication of the machine runaway is sensed while travelling downhill, the motor will be caused to rotate without load to decrease the inlet side oil pressure.
- Pressure in chamber (S1) is released via orifices (E1) and (E2).
- As the pressure in chamber (S1) goes below the spool selector pressure, spool (19) is returned to the left by spring (20) and outlet port (MB) is throttled.
- The pressure at the outlet port side rises, generating rotation resistance on the motor to prevent the machine from running away.
- The spool moves to a position where the pressure on outlet port (MB) can be balanced against the machine's own weight and the inlet port pressure.
- Oil flow from the outlet circuit is reduced to ensure the travel speed corresponded to the pump delivery.



2) Safety valve

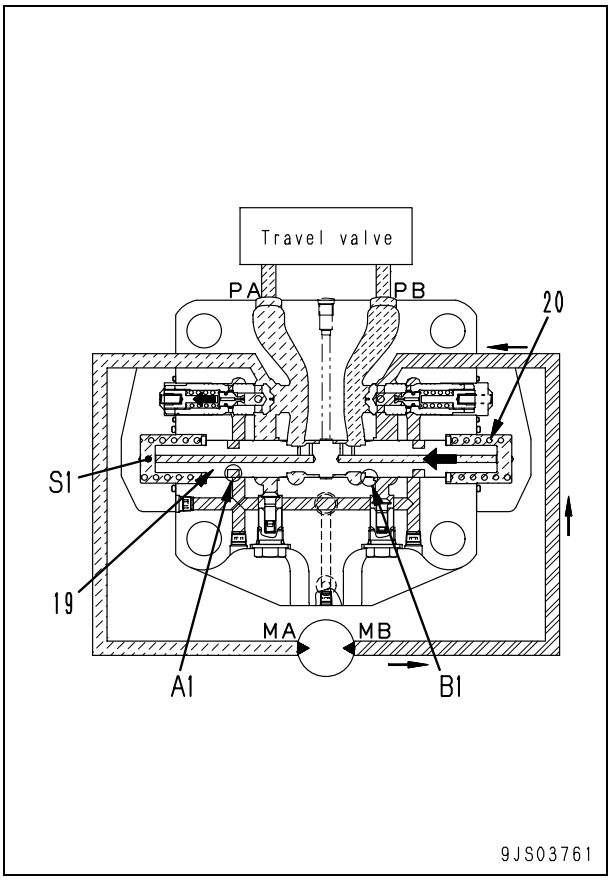
Function

- As long as the machine travel is stopped (or it is travelling downhill), the counterbalance valve closes the inlet and outlet circuits of the motor.
- Since the motor is rotated by inertial force, pressure in the motor outlet port side is abnormally increased, potentially resulting in damages on the motor and piping.
- The safety valve releases this abnormal pressure to the inlet port side of the motor in order to prevent damages to the equipment.

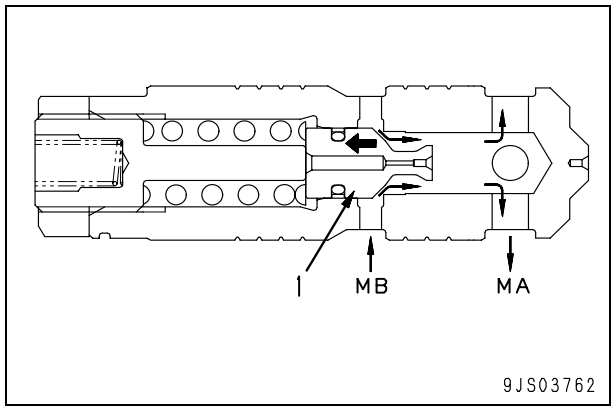
Operation

(1) When travel is stopped
(or when travelling downhill) (Right swing)

- Reduction of the pressure at motor inlet (PA) decreases the pressure in chamber (S1).
- When it drops beyond the spool switching pressure, spool (19) is returned to the left by spring (20), reducing the pressure at outlet passage (B1).
- The motor tries to continue rotation resorting to inertial force, thus pressure on the outlet port (MB) is increased.

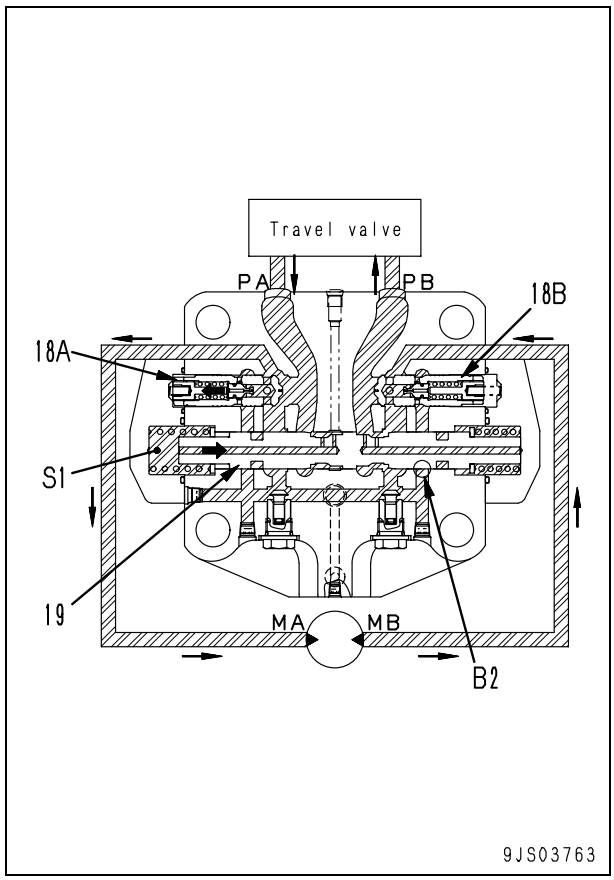


- When the pressure rises above the set pressure of the suction safety valve, poppet (1) opens.
- The pressurized oil passes through notch (A1) of spool (19) into chamber (MA) of the circuit at the opposite side.
- At the time of counterclockwise rotation, it makes reverse operation of clockwise rotation.



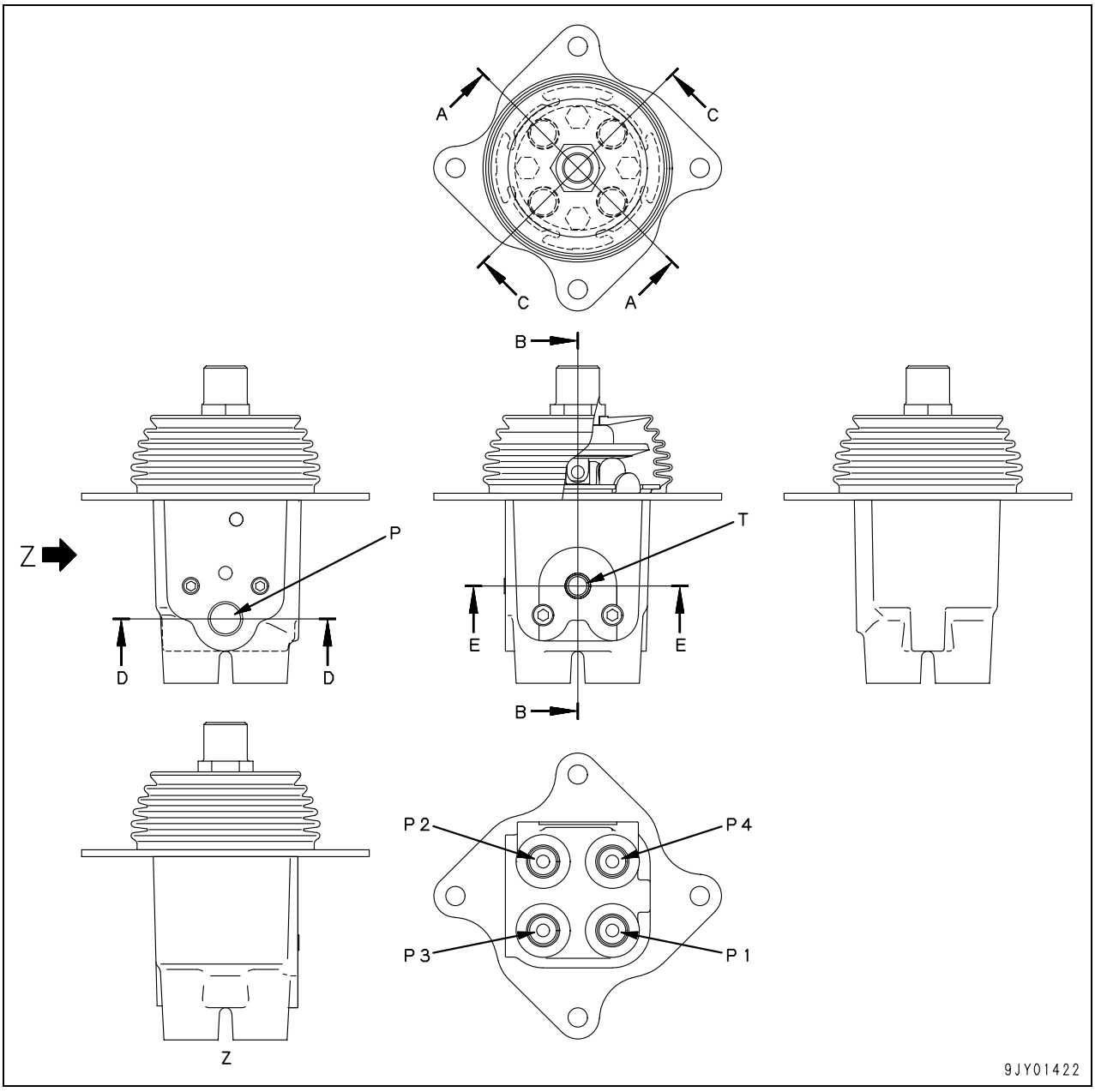
3) When starting travel (or when traveling at a constant speed)

- As the travel lever is operated, the pressurized oil from the pump moves spool (19) toward right.
- The passage to the suction safety valve functions as a circuit which passes through notch (B2) of spool (19), producing large differential pressure.
- The pump pressure rises, providing a large tractional force to the valve.

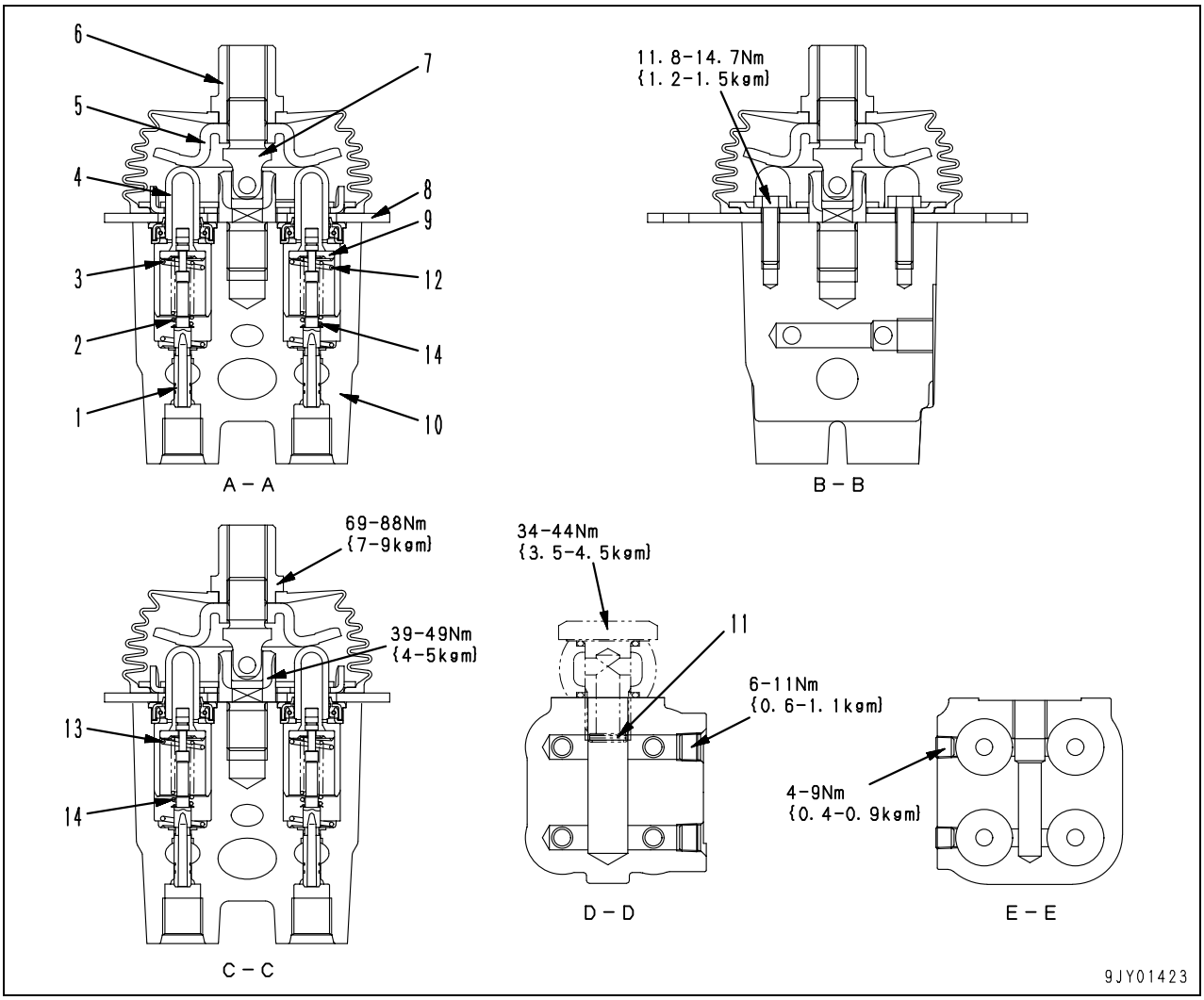


PPC valve

Work equipment and swing PPC valve



P : From self pressure reducing valve
P1 : L.H. PPC: Arm out/R.H. PPC: Boom lower
P2 : L.H. PPC: Arm in/R.H. PPC: Boom raise
P3 : L.H. PPC: Swing left/R.H PPC: Bucket curl
P4 : L.H. PPC: Swing right/R.H. PPC: Bucket dump
T : To tank



1. Spool
2. Metering spring
3. Centering spring
4. Piston
5. Disc
6. Nut (for lever connection)
7. Joint
8. Plate
9. Retainer
10. Body
11. Filter

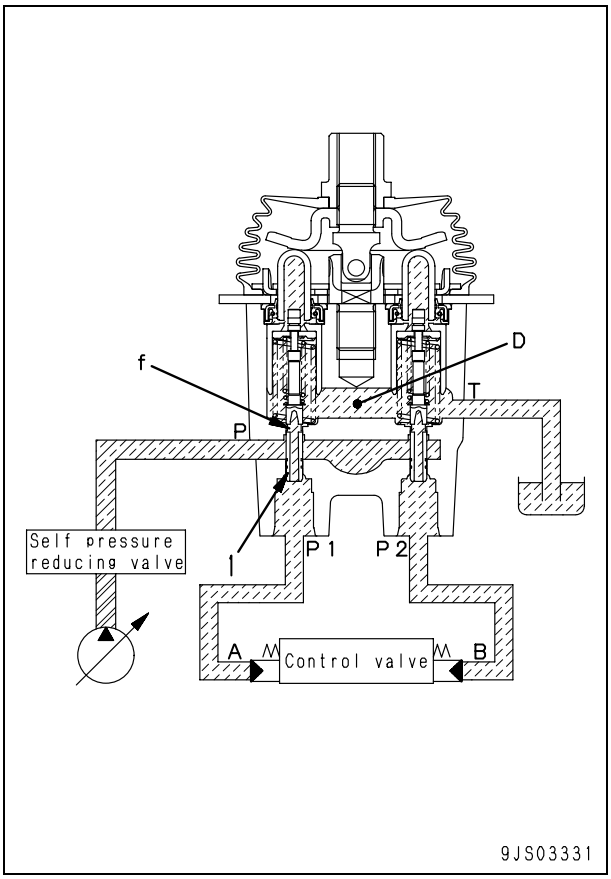
Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
12	Centering spring (for ports P3 and P4)	Free length x Outside diameter	Installation length	Installation load	Free length	Installation load	If damaged or deformed, replace spring.
		42.5 x 15.5	34.0	17.7 N {1.80 kg}	—	13.7 N {1.40 kg}	
13	Centering spring (for ports P1 and P2)	44.5 x 15.5	34.0	29.4 N {3.0 kg}	—	23.5 N {2.40 kg}	
14	Metering spring	26.5 x 8.15	24.9	16.7 N {1.70 kg}	—	13.7 N {1.40 kg}	

Operation

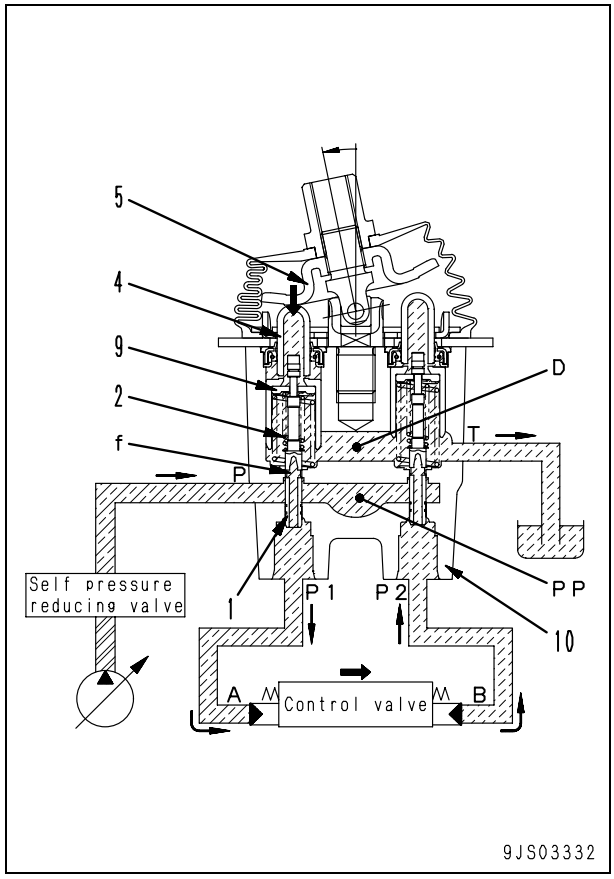
1. When in neutral

- Ports (A) and (B) of the control valve and ports (P1) and (P2) of the PPC valve are connected to drain chamber (D) via fine control hole (f) in spool (1).



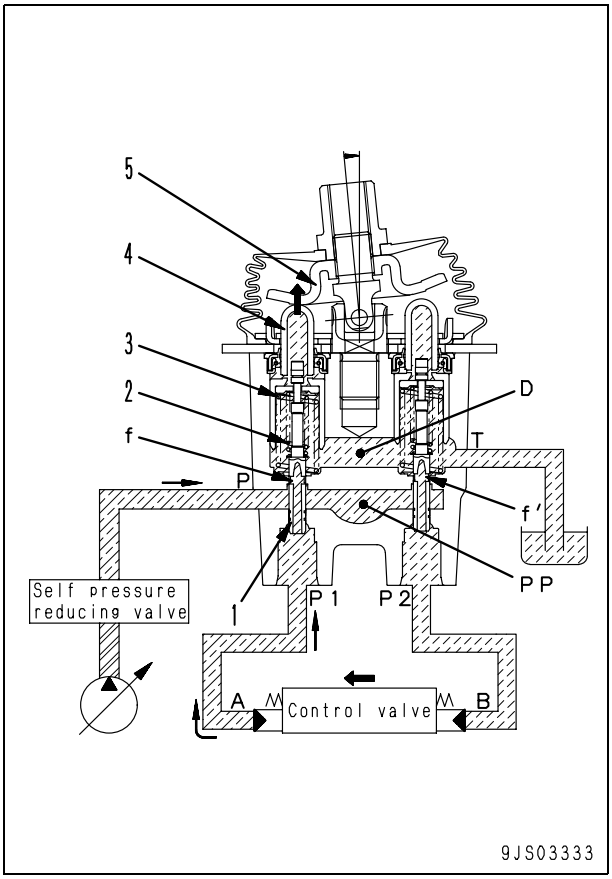
2. During fine control (Neutral o fine control)

- When piston (4) is pushed by disc (5), retainer (9) is pushed, spool (1) is also pushed by metering spring (2), and moves down.
- When fine control hole (f) is shut off from drain chamber (D), it is almost simultaneously interconnected to pump pressure chamber (PP).
- Pilot pressurized oil of the control pump is led to port (A) from port (P1) via fine control hole (f).
- When the pressure at port (P1) becomes higher, spool (1) is pushed back and fine control hole (f) is shut off from pump pressure chamber (PP). At almost the same time, it is connected to drain chamber (D) to release the pressure at port (P1).
- As a result, spool (1) moves up and down until the force of metering spring (2) is balanced with the pressure at port (P1).
- The relationship of the position of spool (1) and body (10) [fine control hole (f) is in the middle between drain chamber (D) and pump pressure chamber (PP)] does not change until retainer (9) contacts spool (1).
- Metering spring (2) contracts in proportion to the stroke of the control lever.
- Pressure at port (P1) also rises in proportion to the stroke of the control lever.
- In this way, the control valve spool moves to a position where the pressure of chamber (A) (same as pressure at port (P1)) and the force of the return spring of the control valve spool are balanced.



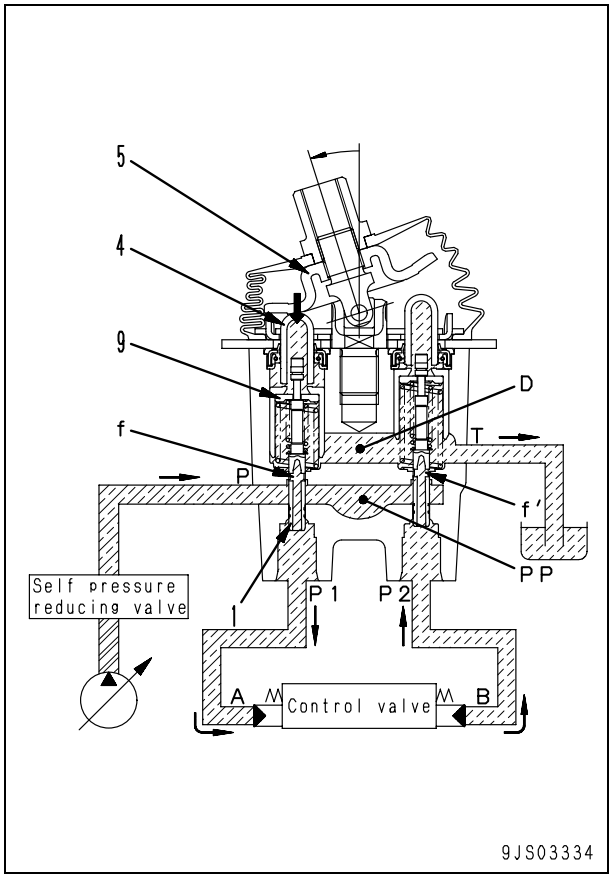
3. During fine control (When control lever is returned)

- When disc (5) starts to be returned, spool (1) is pushed up by the force of centering spring (3) and the pressure at port (P1).
- Because of this, fine control hole (f) is connected to drain chamber (D), and the pressurized oil at port (P1) is released.
- If the pressure of port (P1) is lowered excessively, spool (1) is pushed down by metering spring (2).
- Fine control hole (f) is shut off from drain chamber (D), and it is almost simultaneously interconnected to pump pressure chamber (PP).
- Pump pressure is supplied until the pressure at port (P1) recovers to the level equivalent to the lever position.
- When the spool of the control valve returns, the oil in drain chamber (D) flows in from fine control hole (f') in the valve on the side that is not working. The oil passes through port (P2) and enters chamber (B) to replenish the chamber with pressurized oil.

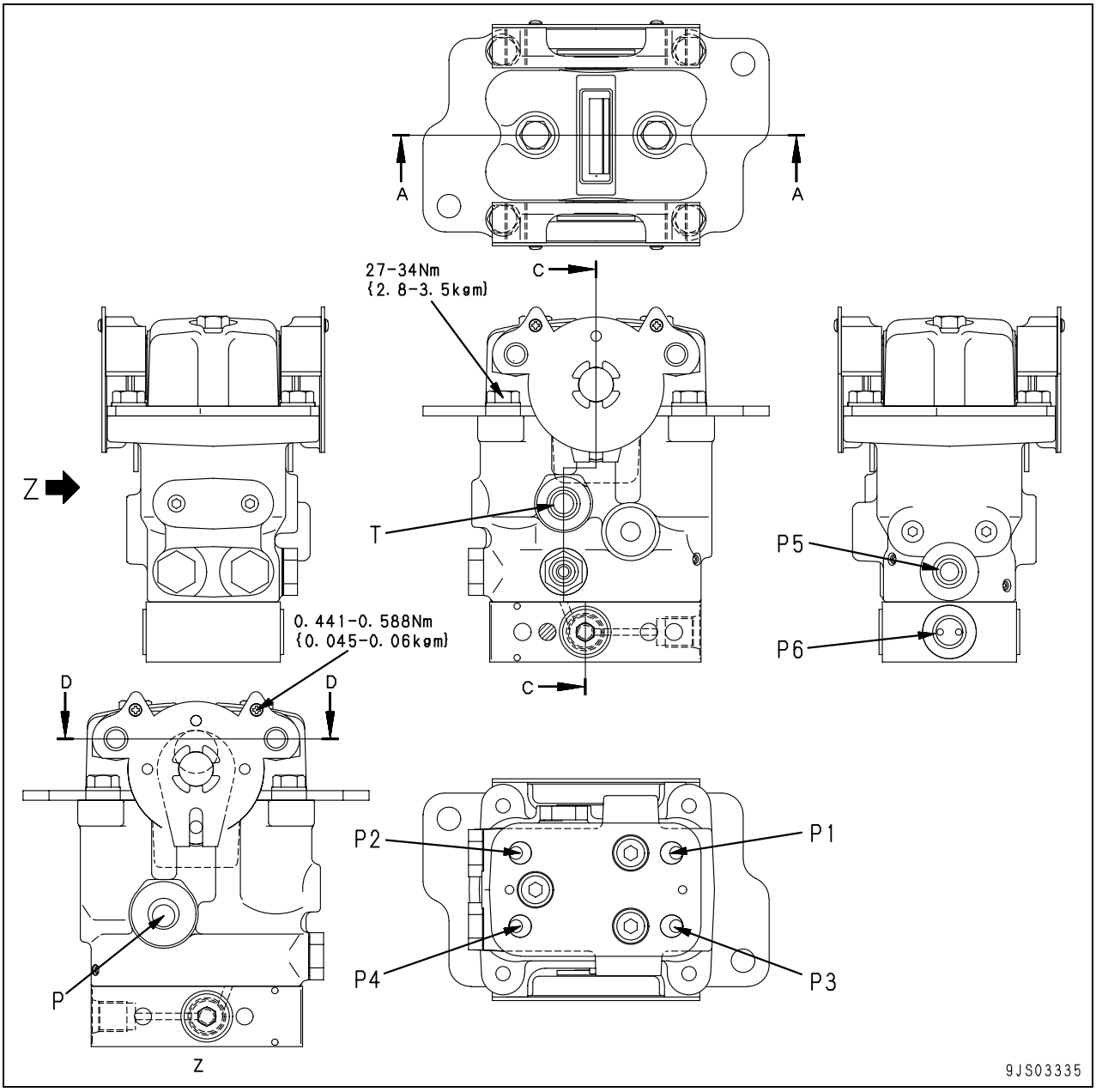


4. At full stroke

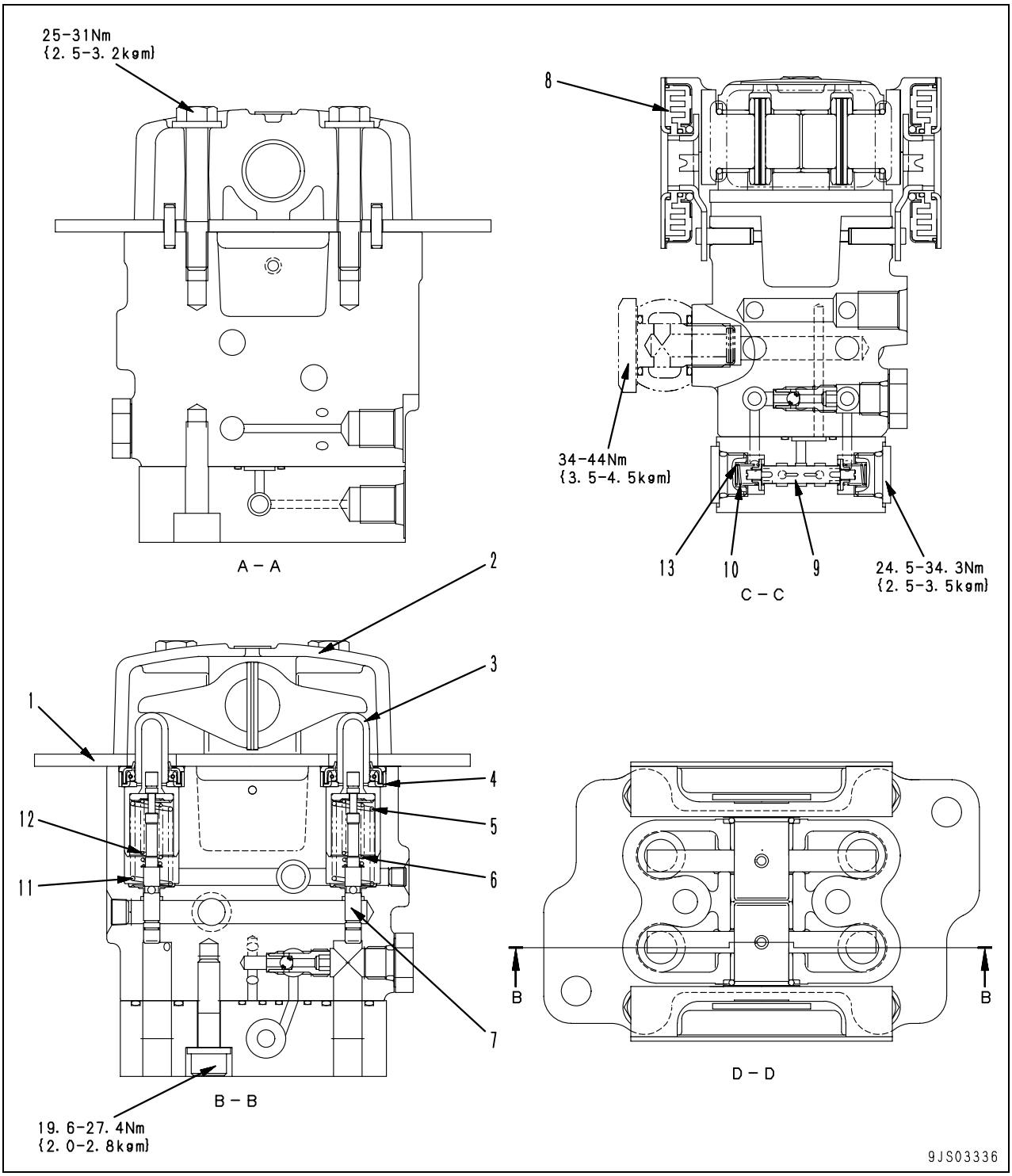
- Disc (5) pushes down piston (4), and retainer (9) pushes down spool (1).
- Fine control hole (f) is shut off from drain chamber (D), and is interconnected to pump pressure chamber (PP).
- Therefore, the pilot pressure oil from the self pressure reducing valve passes through fine control hole (f) and flows to chamber (A) from port (P1) to push the control valve spool.
- The oil returning from chamber (B) passes from port (P2) through fine control hole (f') and flows to drain chamber (D).



Travel PPC valve



P: From self pressure reducing valve
P1: L.H. reverse
P2: L.H. forward
P3: R.H. reverse
P4: R.H. forward
P5: Travel signal
P6: Steering signal
T: To tank


25-31Nm
{2. 5-3. 2kgm}
A - A
8
34-44Nm
{3. 5-4. 5kgm}
13
10
9
24. 5-34. 3Nm
{2. 5-3. 5kgm}
C - C
2
3
1
4
12
5
11
6
7
B - B
19. 6-27. 4Nm
{2. 0-2. 8kgm}
B
B
D - D
9JS03336

1. Plate
2. Body
3. Piston
4. Collar
5. Centering spring
6. Metering spring
7. Valve
8. Damper
9. Steering signal spool
10. Steering signal spool spring

Unit: mm

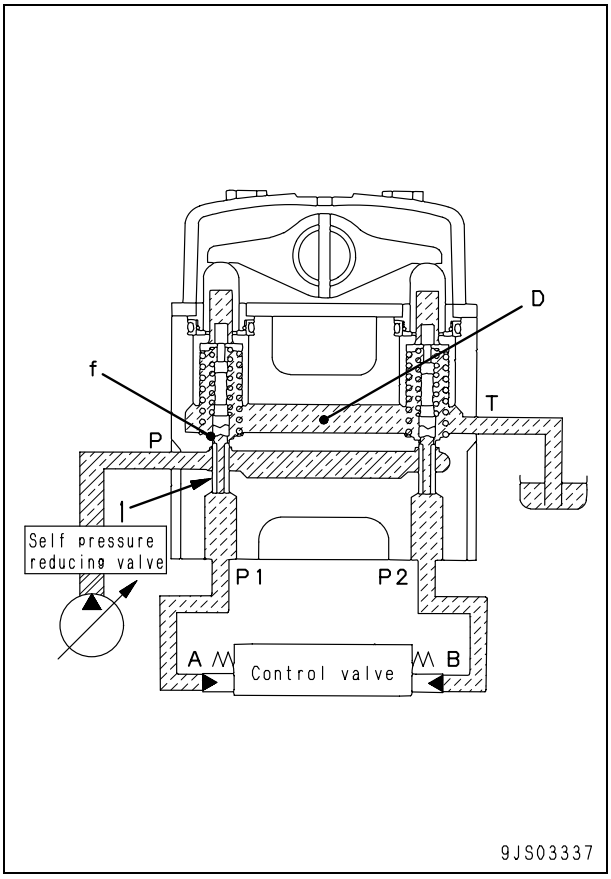
No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
11	Centering spring	Free length x Outside diameter	Installation length	Installation load	Free length	Installation load	If damaged or deformed, replace spring.
		47.6 x 15.5	32.5	108 N {11.0 kg}	—	86.3 N {8.8 kg}	
12	Metering spring	26.5 x 8.15	24.9	16.7 N {1.7 kg}	—	13.7 N {1.4 kg}	
13	Steering signal spring	12.8 x 7.3	8.5	8.8 N {0.9 kg}	—	7.1 N {0.72 kg}	

1. Pressure reducing valve function

Operation

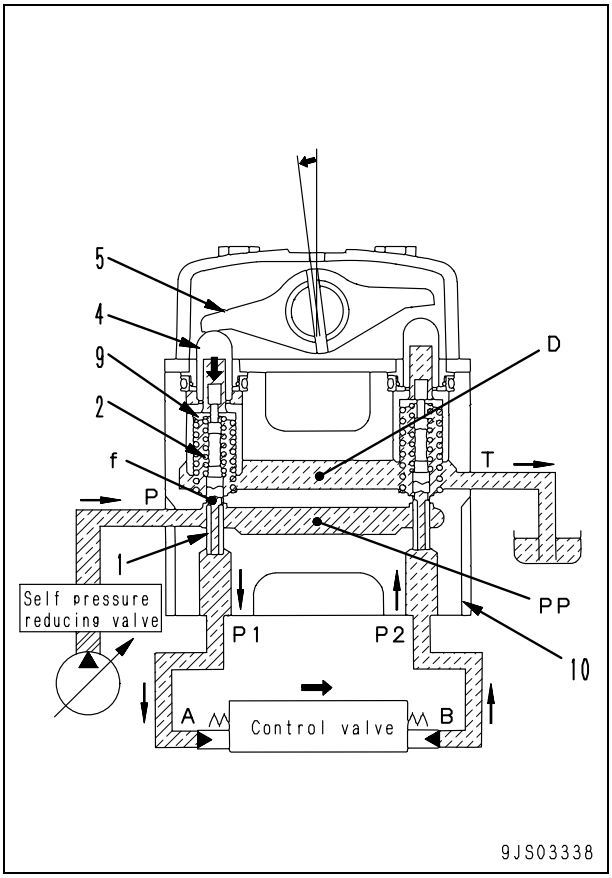
1) When in neutral

- Ports (A) and (B) of the control valve and ports (P1) and (P2) of the PPC valve are connected to drain chamber (D) via fine control hole (f) in spool (1).



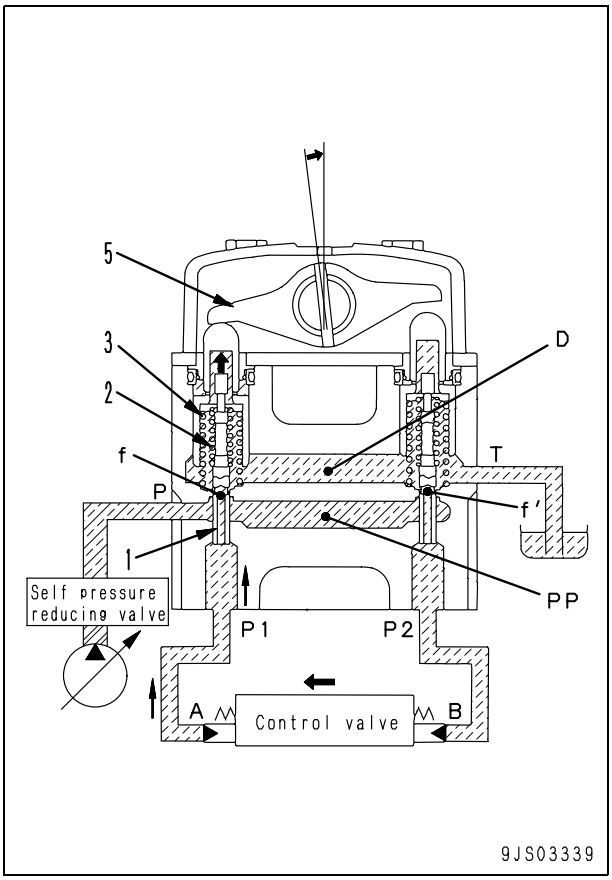
2) During fine control
(Neutral → fine control)

- When piston (4) is pushed by lever (5), retainer (9) is pushed, spool (1) is also pushed by metering spring (2), and moves down.
- When fine control hole (f) is shut off from drain chamber (D), it is almost simultaneously interconnected to pump pressure chamber (PP).
- Pilot pressurized oil of the control pump is led to port (A) from port (P1) via fine control hole (f).
- When the pressure at port (P1) becomes higher, spool (1) is pushed back and fine control hole (f) is shut off from pump pressure chamber (PP). At almost the same time, it is connected to drain chamber (D) to release the pressure at port (P1).
- As a result, spool (1) moves up and down until the force of metering spool (2) is balanced with the pressure at port (P1).
- The relationship of the position of spool (1) and body (10) [fine control hole (f) is in the middle between drain chamber (D) and pump pressure chamber (PP)] does not change until retainer (9) contacts spool (1).
- Metering spring (2) contracts in proportion to the stroke of the control lever.
- Pressure at port (P1) also rises in proportion to the stroke of the control lever.
- In this way, the control valve spool moves to a position where the pressure of chamber (A) (same as pressure at port (P1)) and the force of the return spring of the control valve spool are balanced.



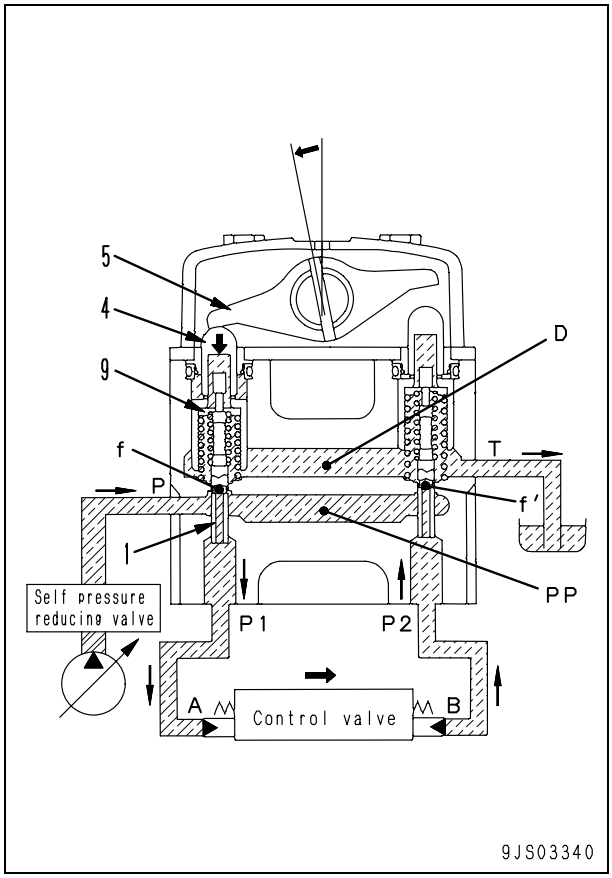
3) During fine control
(When control lever is returned)

- When lever (5) starts to be returned, spool (1) is pushed up by the force of centering spring (3) and pressure at port (P1).
- Because of this, fine control hole (f) is connected to drain chamber (D), and the pressurized oil at port (P1) is released.
- If the pressure of port (P1) is lowered excessively, spool (1) is pushed down by metering spring (2).
- Fine control hole (f) is shut off from drain chamber (D), and it is almost simultaneously interconnected to pump pressure chamber (PP).
- Pump pressure is supplied until the pressure at port (P1) recovers to the level equivalent to the lever position.
- When the spool of the control valve returns, the oil in drain chamber (D) flows in from fine control hole (f') in the valve on the side that is not working. The oil passes through port (P2) and enters chamber (B) to replenish the chamber with pressurized oil.



4) At full stroke

- Lever (5) pushes down piston (4), and retainer (9) pushes down spool (1).
- Fine control hole (f) is shut off from drain chamber (D), and is interconnected to pump pressure chamber (PP).
- Therefore, the pilot pressure oil from the self pressure reducing valve passes through fine control hole (f) and flows to chamber (A) from port (P1) to push the control valve spool.
- The oil returning from chamber (B) passes from port (P2) through fine control hole (f') and flows to drain chamber (D).



2. Travel signal/Steering function

Travel signal

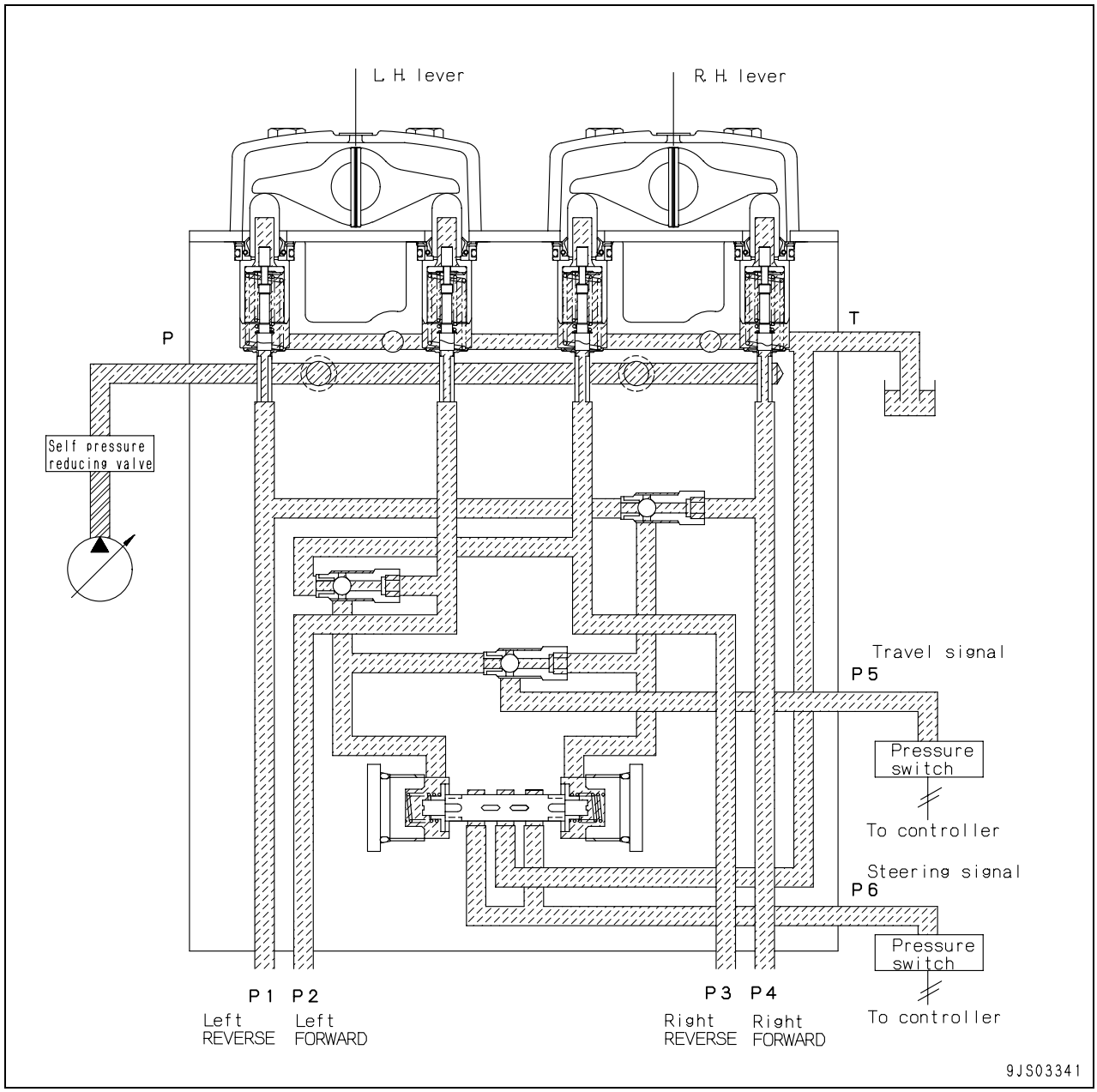
- If either of the L.H. or R.H. travel levers is operated, the higher PPC output pressure of both sides is output as the travel signal.
- Accordingly, whether the machine is travelling is judged by the signal of port (P5).

Steering signal

- If the operation quantities of both levers are different from each other as in the steering operation, the higher one of the PPC output pressures of both sides is output as the steering signal.
- Any signal is not output from port (P6) while the machine is travelling straight (forward or reverse) or in neutral.
- Accordingly, whether the machine is being steered is judged by the signal of port (P6).

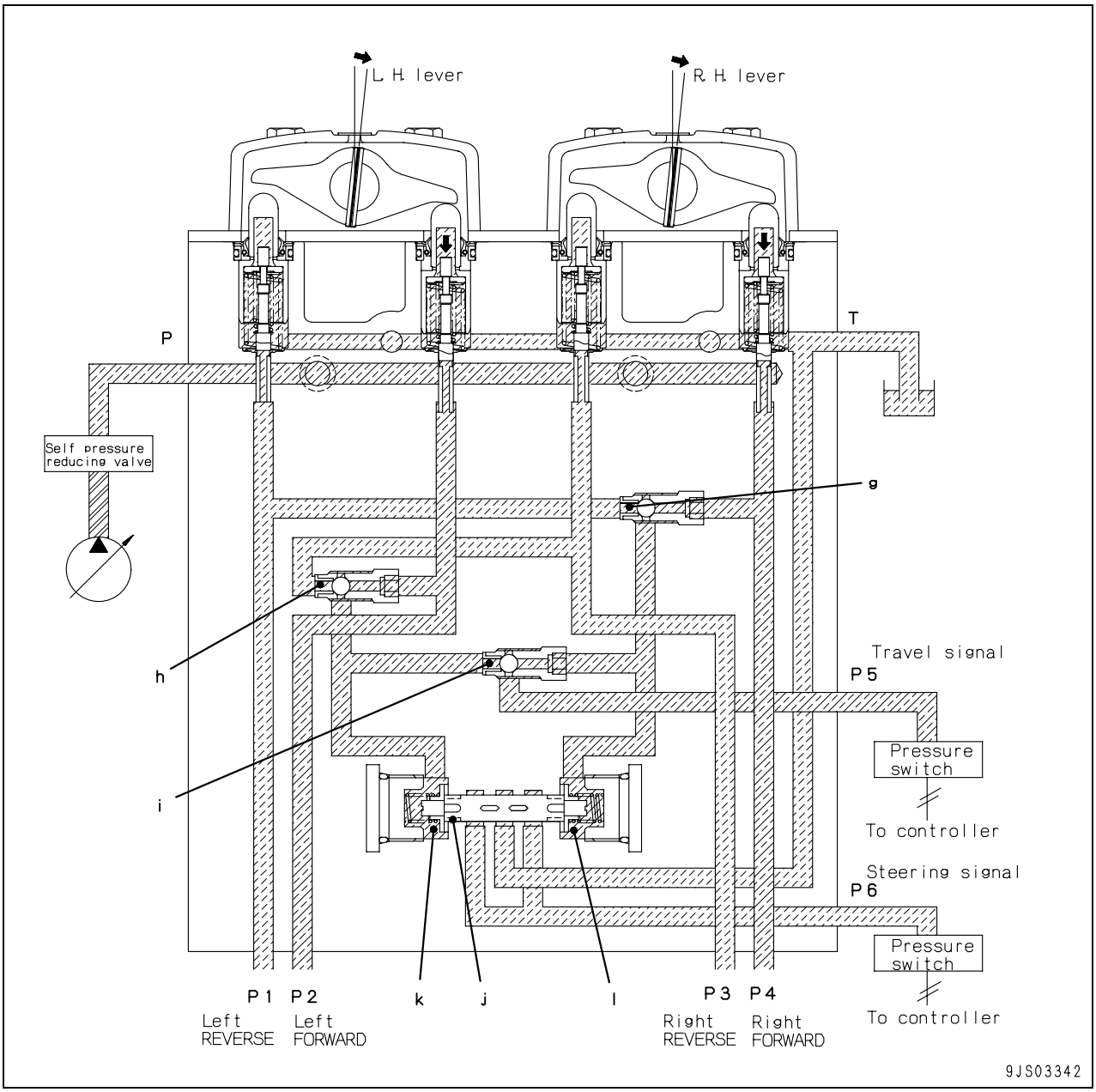
Operation

1) When in neutral



- No output is made from respective output ports [from port (P1) to (P4)], travel signal [port (P5)] and steering signal [port (P6)].

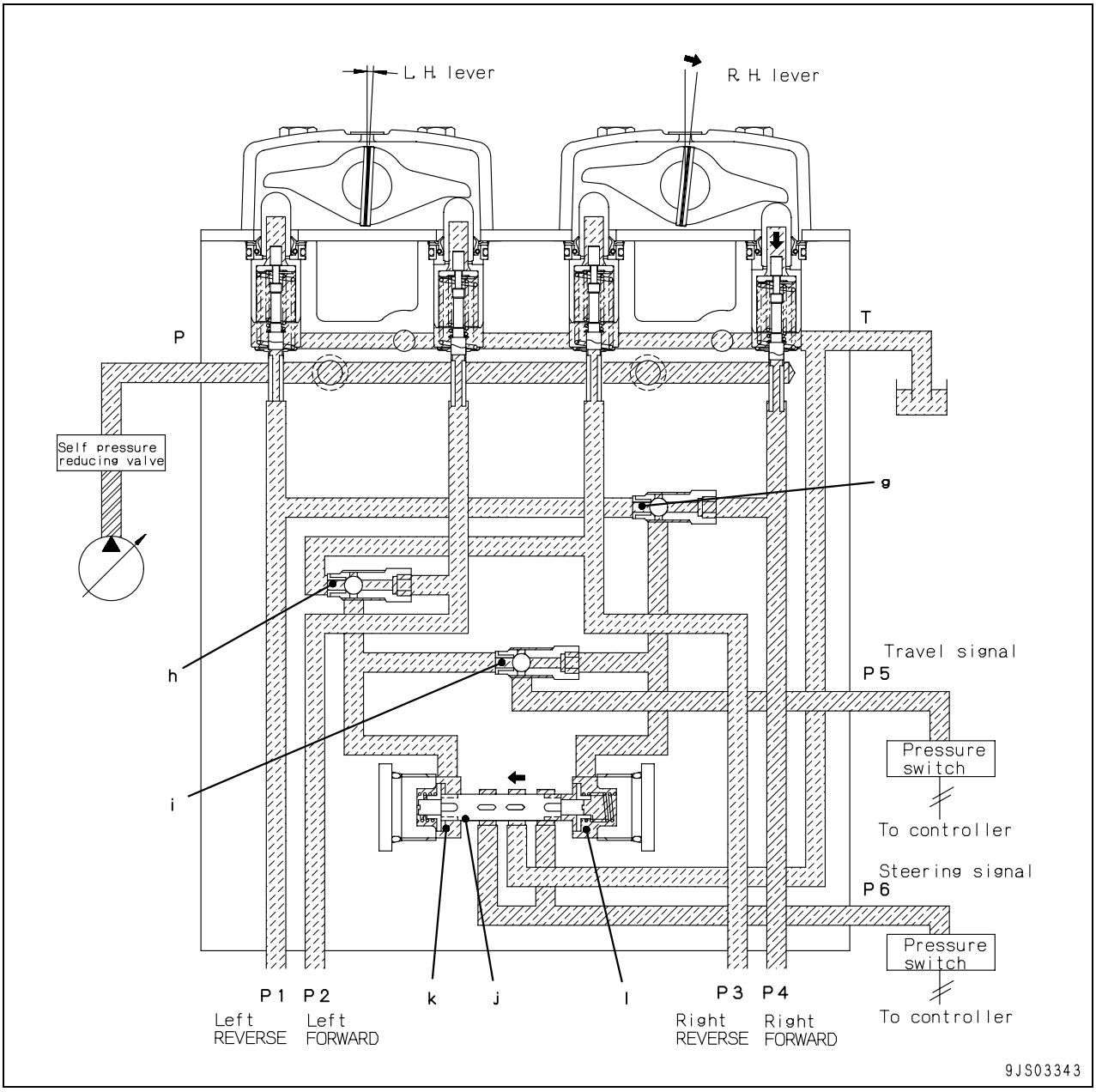
2) During straight travel



★ The Illustration shows the circuit for travelling straight forward.

- When operating L.H. motor forward [port (P2) output] and R.H. motor forward [port (P4) output], pressure of both L.H. spring chamber (k) and R.H. spring chamber (l) rises high.
- Steering signal spool (j) remains at neutral position and does not output a steering signal to port (P6).

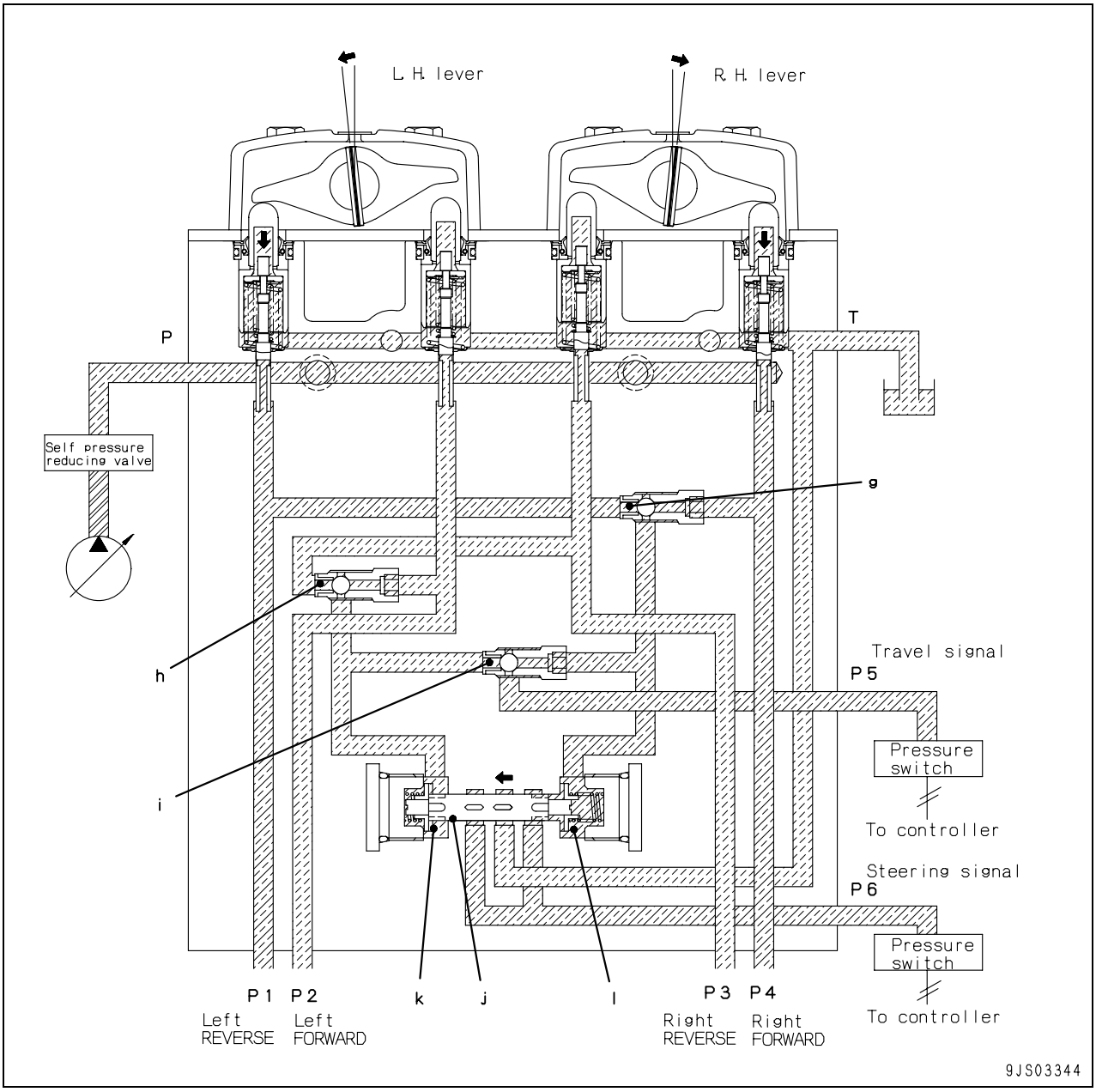
3) When steered or pivot-turned



★ The Illustration shows the circuit for travelling left forward (slow) and right forward (fast) operation.

- If the operation quantities of both levers are different from each other as in the steering operation (if the difference of the pilot pressure between both sides is higher than a certain level), the pilot pressure is output as the steering signal.
- The pressure in left spring chamber (k) of steering signal spool (j) is (P2).
- The pressure in right spring chamber (l) is (P4).
- When the pressure state reaches [(P4 – P2) x (Spool section) > Spring set load], the spool is switched to the direction of the arrow.
- Port (P4) pressure of the L.H. or R.H. PPC valves, whichever having a higher output pressure, is output to port (P6) as the steering signal.

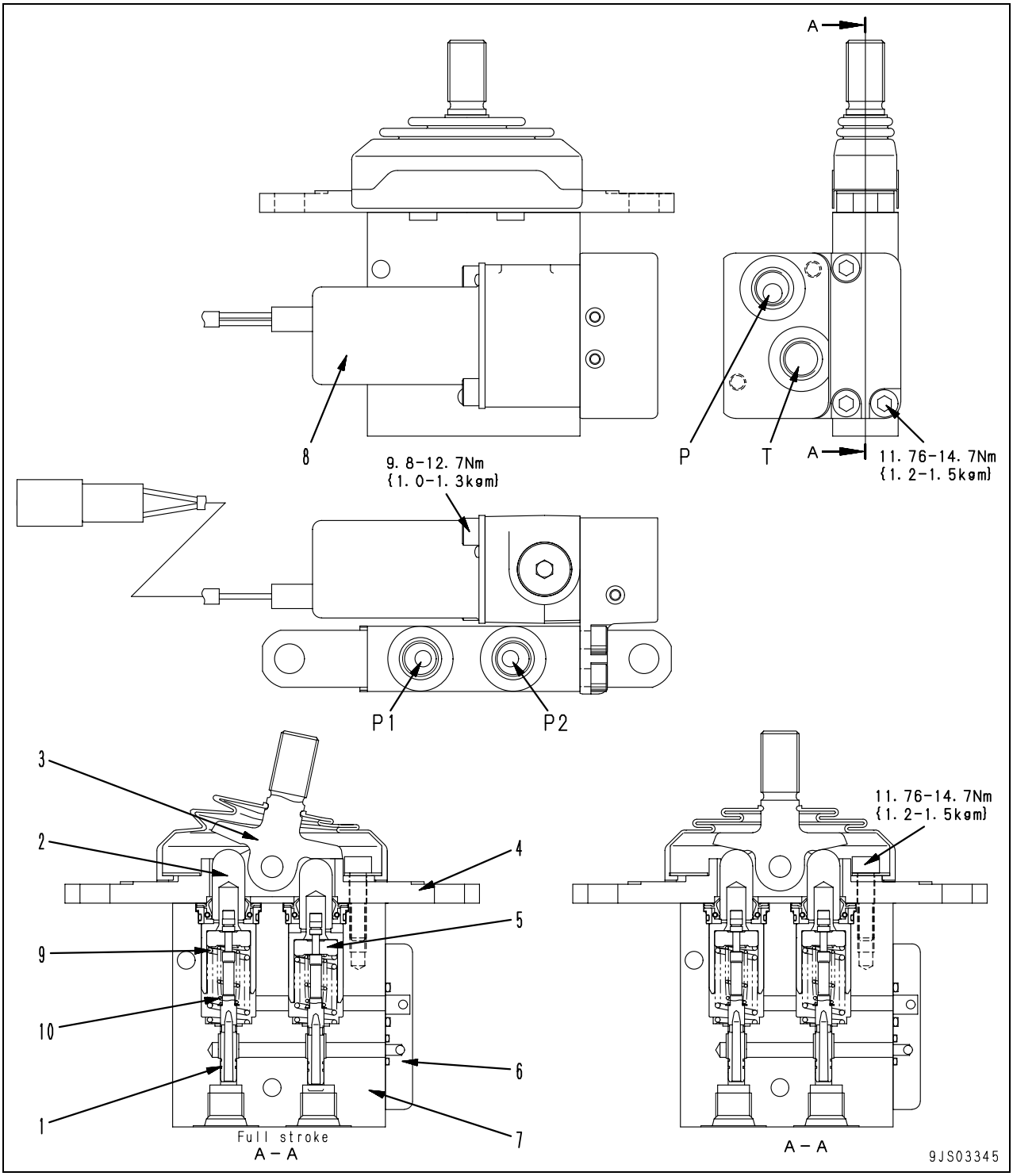
4) When counter-rotated



★ The illustration shows the circuit for travelling left reverse and right forward.

- When operating L.H. motor reverse [port (P1) output] and R.H. motor forward [port (P4) output], pressure of the R.H. spring chamber (l) only rises high.
- Steering signal spool (j) strokes to the left to output the steering signal to port (P6).

Service PPC valve (with EPC valve)



★ For the details of operation, see the paragraph of “Work equipment swing PPC valve.”

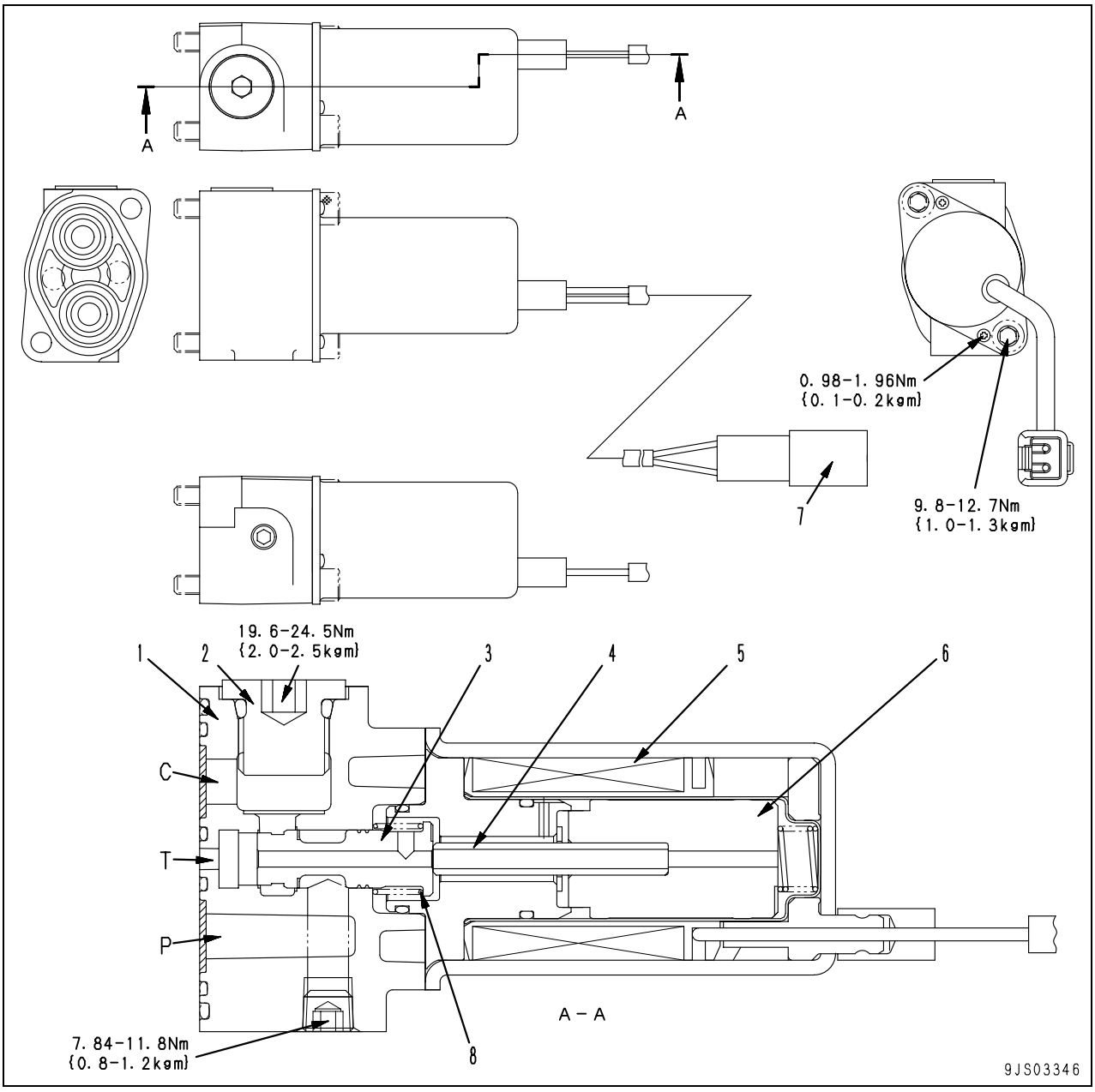
P: From self pressure reducing valve
P1: To service valve
P2: To service valve
T: To tank

1. Spool
2. Piston
3. Lever
4. Plate
5. Retainer
6. Block
7. Body
8. EPC valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
9	Centering spring	Free length x Outside diameter	Installation length	Installation load	Free length	Installation load	If damaged or deformed, replace spring.
		33.9 x 15.3	28.4	125 N {12.7 kg}	—	100 N {10.2 kg}	
10	Metering spring	22.7 x 8.10	22.0	16.7 N {1.70 kg}	—	13.3 N {1.36 kg}	

1. EPC valve



C: To control valve
P: From self pressure reducing valve
T: To hydraulic tank

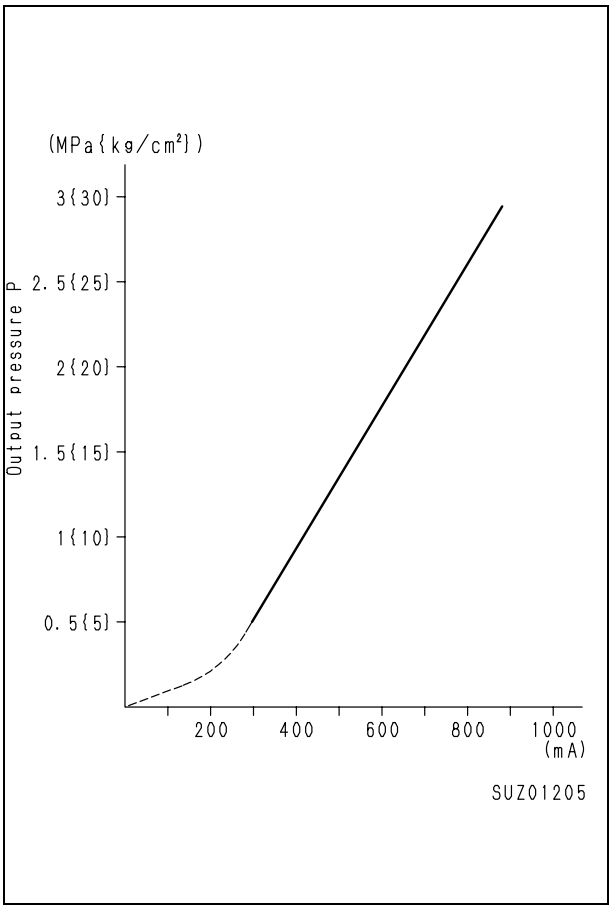
1. Body
2. Plug
3. Spool
4. Push pin
5. Coil
6. Plunger
7. Connector

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
8	Return spring	Free length	Installation length	Installation load	Free length	Installation load	If damaged or deformed, replace EPC valve assembly.
		9.0	8.4	3.1 N {0.32 kg}	—	—	

Function

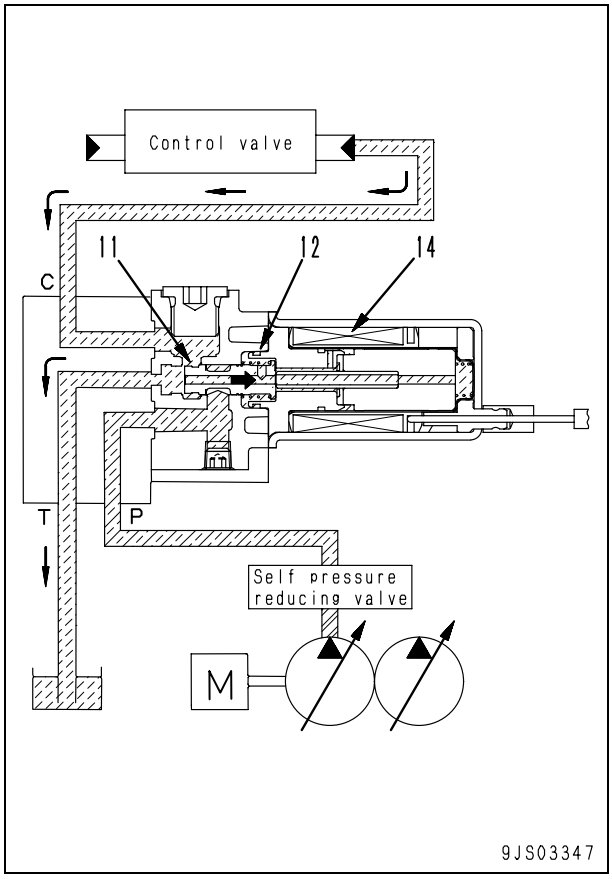
- The EPC valve consists of the proportional solenoid portion and the hydraulic valve portion.
- When it receives signal current (i) from the pump controller, it generates the EPC output pressure in proportion to the size of the signal, and outputs it to the control valve.



Operation

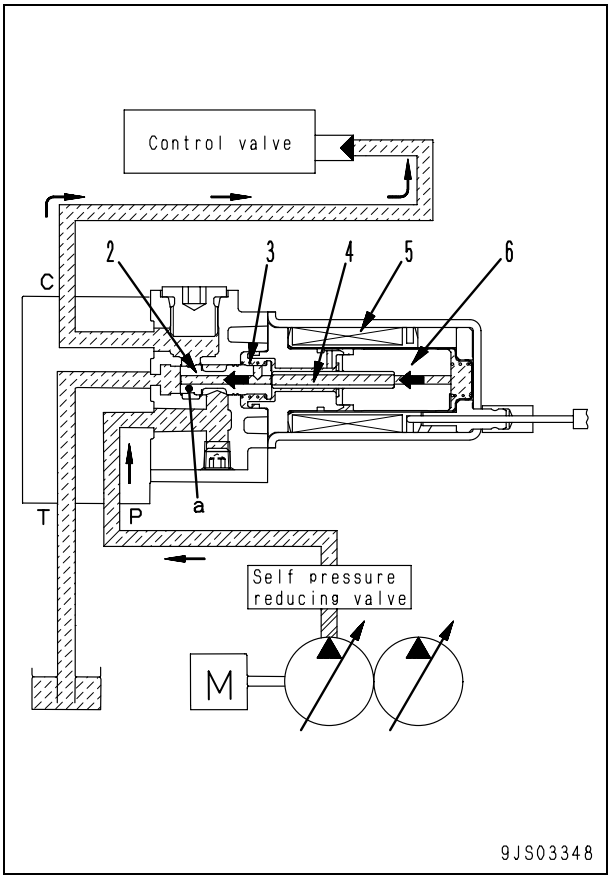
1) When signal current is 0 (coil is deenergized)

- When there is no signal current flowing from the controller to coil (14), coil (14) is deenergized.
- Spool (11) is pushed to the right by spring (12).
- Port (P) closes and the pressurized oil from the front pump does not flow to the control valve.
- The pressurized oil from the control valve is drained to the tank via port (C) and port (T).



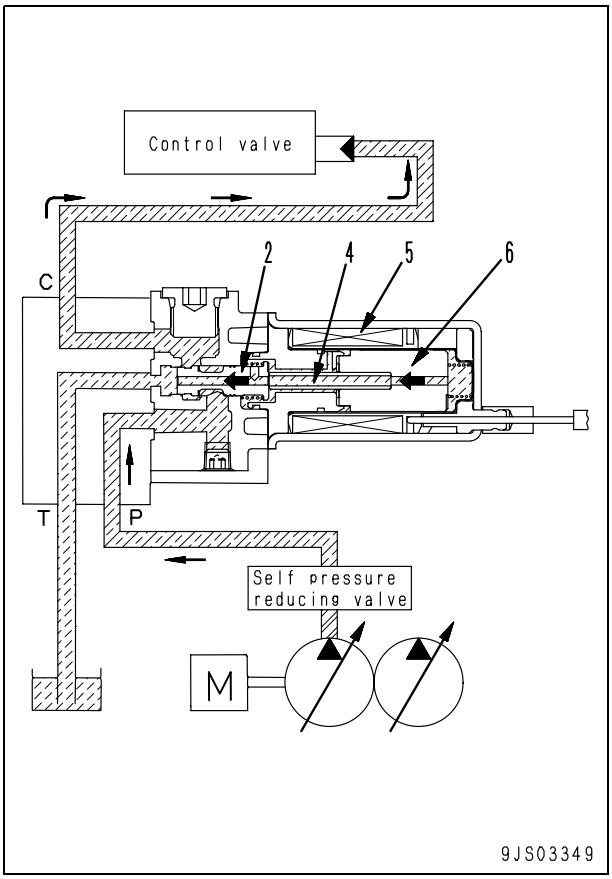
2) When signal current is very small (coil is energized)

- When a very small signal current flows to coil (5), coil (5) is energized, and a propulsion force is generated on the left side of plunger (6).
- Push pin (4) pushes spool (2) to the left, and pressurized oil flows from port (P) to port (C).
- Pressures on port (C) increases and the force to act on surface (a) of spool (2) and the spring load on spring (3) become larger than the propulsion force of plunger (6).
- Spool (2) is pushed to the right, port (P) is shut off from port (C) and ports (C) and (T) are connected.
- Spool (2) moves up and down so that the propulsion force of plunger (6) may be balance with pressure of port (C) + spring load of spring (3).
- The circuit pressure between the EPC valve and the control valve is controlled in proportion to the size of the signal current.

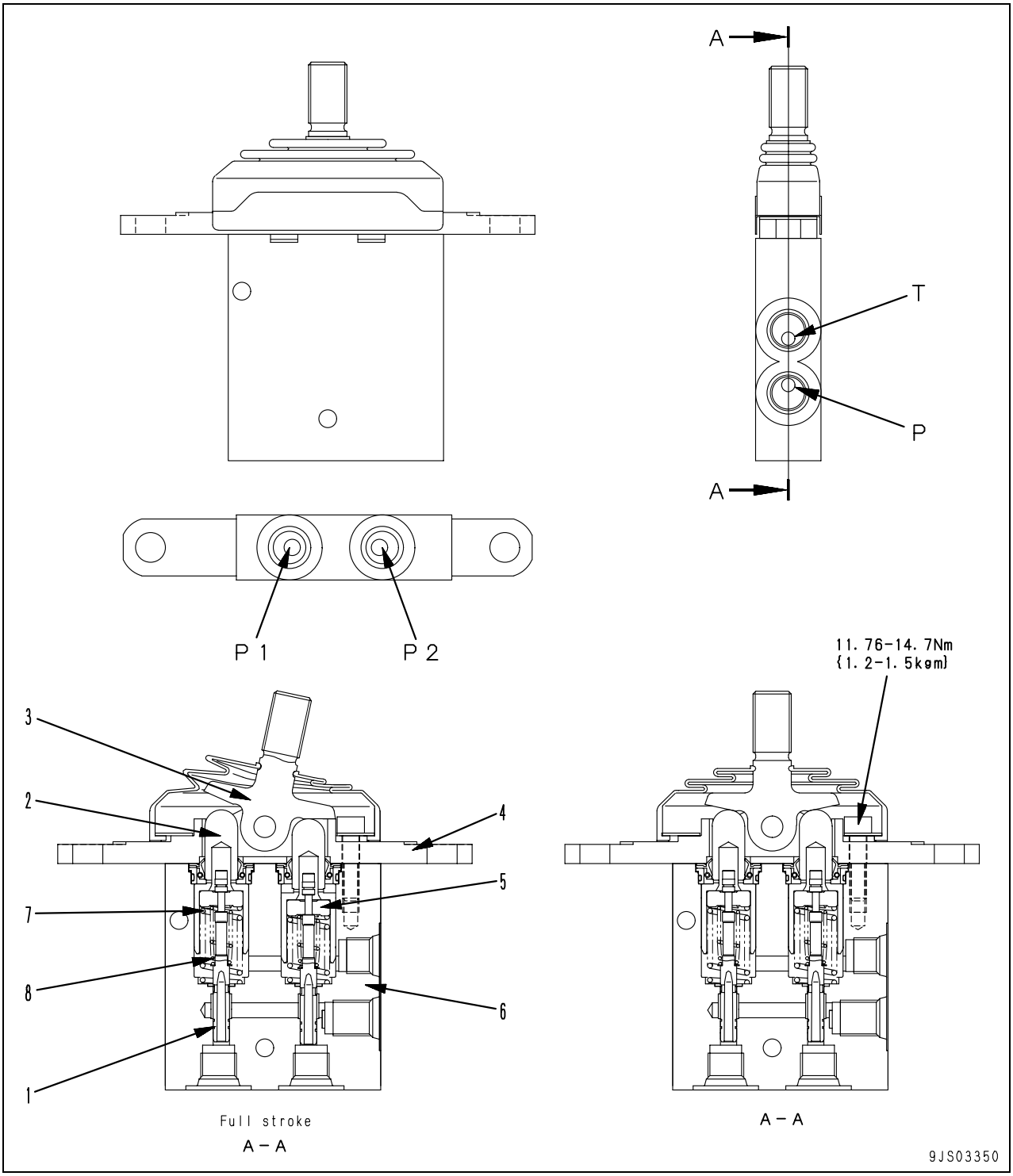


3) When signal current is maximum (coil is energized)

- As the signal current flows to coil (5), coil (5) is energized.
- When this happens, the signal current is at its maximum, so the propulsion force of plunger (6) is also at its maximum.
- Spool (2) is pushed to the left by push pin (4).
- The maximum volume of pressurized oil is conducted from port (P) to port (C), increasing the circuit pressure across EPC valve and the control valve to the maximum level.
- Since port (T) is closed, pressurized oil does not flow to the hydraulic tank.



Service PPC valve



★ For the details of operation, see the paragraph of “Work equipment swing PPC valve.“

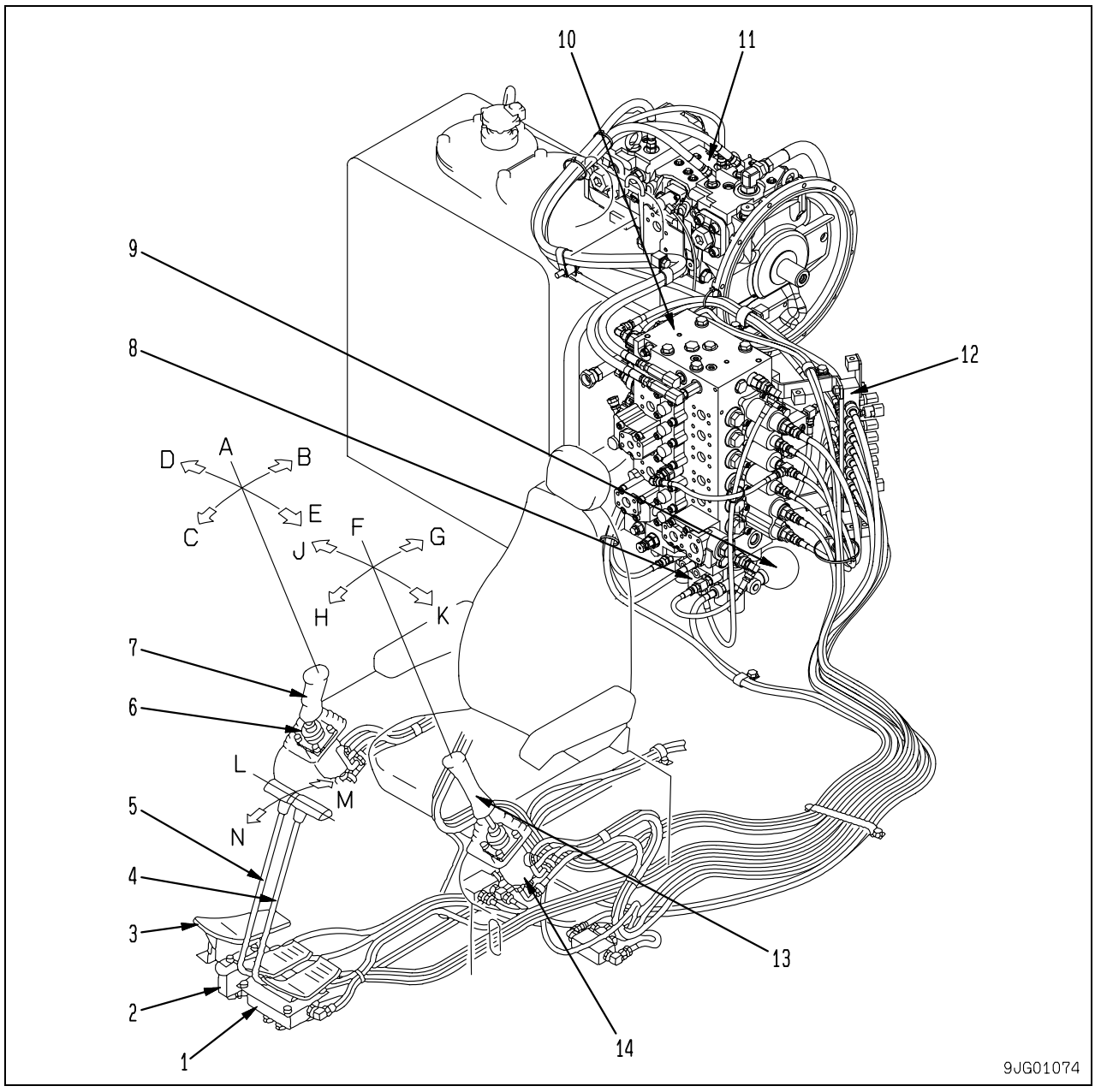
P: From self pressure reducing valve
P1: To service valve
P2: To service valve
T: To tank

1. Spool
2. Piston
3. Lever
4. Plate
5. Retainer
6. Body

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
7	Centering spring	Free length x Outside diameter	Installation length	Installation load	Free length	Installation load	If damaged or deformed, replace spring.
		33.9 x 15.3	28.4	125 N {12.7 kg}	—	100 N {10.2 kg}	
8	Metering spring	22.7 x 8.10	22.0	16.7 N {1.70 kg}	—	13.3 N {1.36 kg}	

Valve control



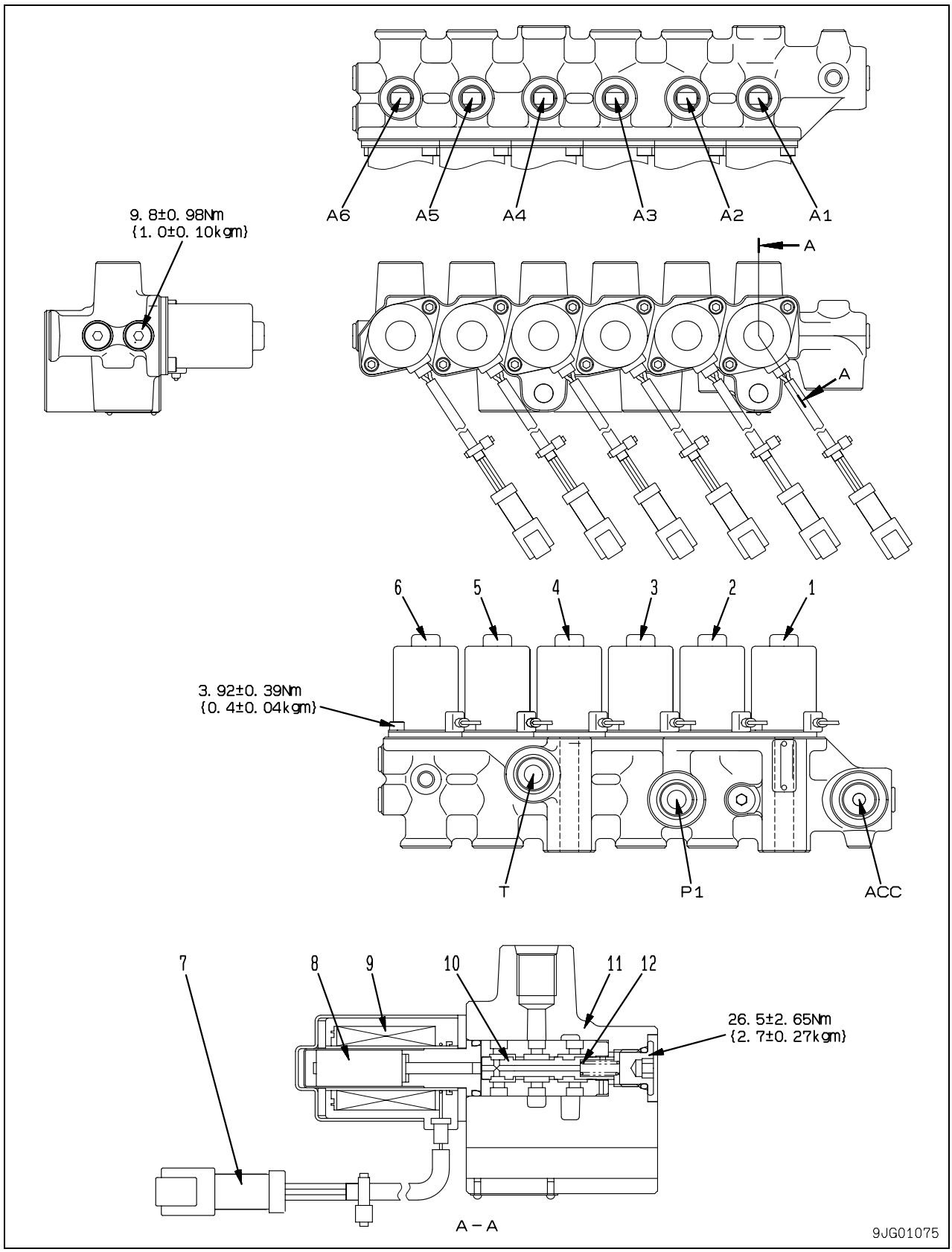
1. Travel PPC valve
2. Service PPC valve
3. Service pedal
4. L.H. travel lever
5. R.H. travel lever
6. R.H. PPC valve
7. R.H. work equipment control lever
8. Solenoid block
9. Accumulator
10. Control valve
11. Hydraulic pump
12. Junction box
13. L.H. work equipment control lever
14. L.H. PPC valve

Lever positions

A. Neutral
B. Boom “RAISE”
C. Boom “LOWER”
D. Bucket “DUMP”
E. Bucket “CURL”
F. Neutral
G. Arm “IN”
H. Arm “OUT”
J. Swing “RIGHT”
K. Swing “LEFT”
L. Neutral
M. Travel “REVERSE”
N. Travel “FORWARD”

Solenoid valve

PPC lock, travel junction, ATT selector, travel speed, swing brake, and 2-stage relief solenoid valves



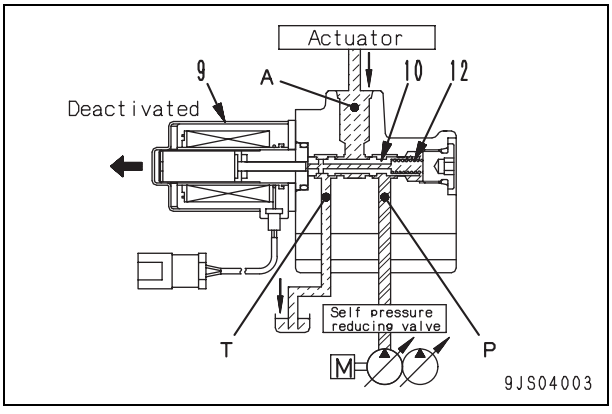
1. PPC lock solenoid valve
2. 2-stage relief solenoid valve
3. Swing brake solenoid valve
4. Travel speed solenoid valve
5. Travel junction solenoid valve
6. ATT selector solenoid valve
7. Connector
8. Moving core
9. Coil
10. Spool
11. Block
12. Spring

T: To tank
A1: To PPC valve
A2: To main valve (2-stage relief valve)
A3: To swing motor
A4: To L.H. and R.H. travel motors
A5: To main valve (Travel junction valve)
A6: To ATT selector valve
P1: From main pump
ACC: To accumulator

Operation

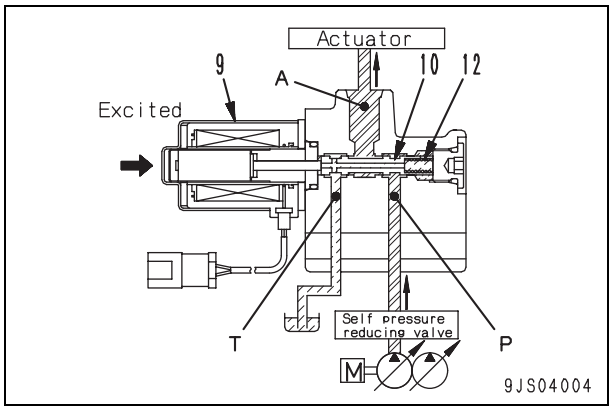
When solenoid is turned off

- Since the signal current does not flow from the controller, solenoid (9) is deenergized.
  For this reason, spool (10) is pushed to the left by spring (11).
  Since port (P) is closed to port (A), pressurized oil from the main pump does not flow to the actuator.
  At this time, the oil from the actuator is drained through ports (A) and (T) into the tank.

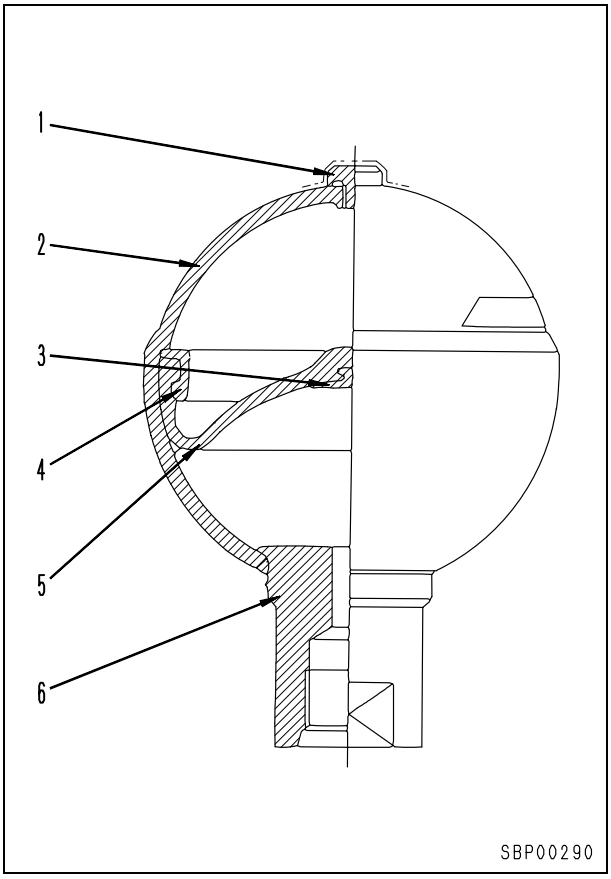


When solenoid is turned on

- As the signal current flows from the controller to solenoid (9), solenoid (9) is energized.
  Accordingly, spool (10) is pushed to the right.
  This operation flows the pressurized oil from the main pump, through port (P), via inside spool (10), to port (A), and eventually to the actuator.
  At the same time, port (T) closes, the oil does not flow to the tank.



PPC Accumulator



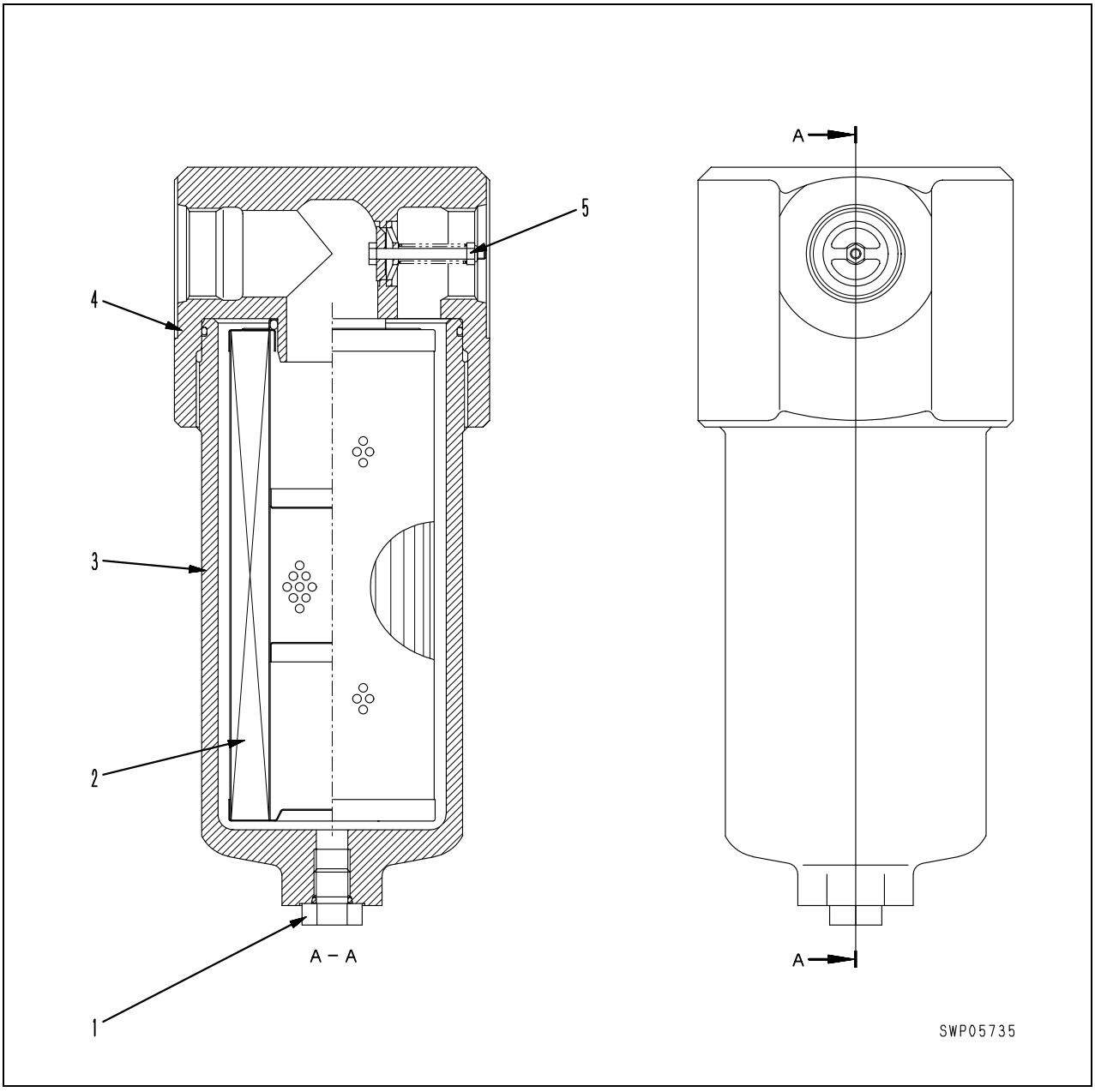
1. Gas plug
2. Shell
3. Poppet
4. Holder
5. Bladder
6. Oil port

Specifications

Gas capacity: 300 cc (for PPC)

Return oil filter

For breaker

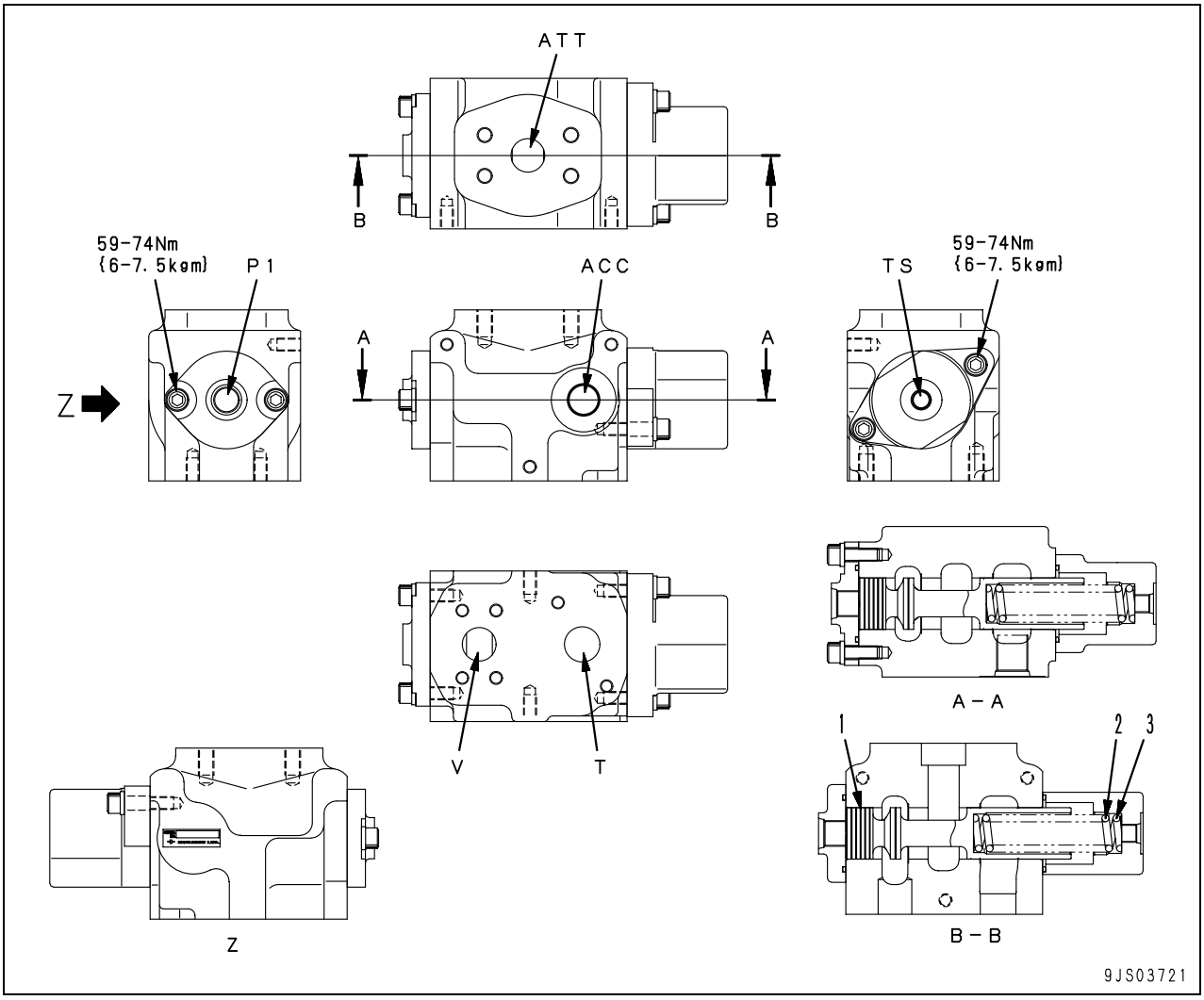


1. Drain plug
2. Filter
3. Case
4. Head cover
5. Relief valve

Specifications

Rated pressure: 6.9 MPa {70 kg/cm^2}
Flow rate: 200 ℓ/min
Relief valve cracking pressure:
0.34 ± 0.05 MPa {3.5 ± 0.5 kg/cm^2}
Filter mesh size: 6 μm
Filtering area: 4,570 cm^2

Attachment circuit selector valve



ACC: To accumulator
ATT: To attachment
P1: From attachment selector solenoid valve
T: To hydraulic tank
TS: To hydraulic tank
V: To control valve

1. Spool
2. Spring

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
3	Spool return spring	Free length x Outside diameter	Installation length	Installation load	Free length	Installation load	If damaged or deformed, replace spring.
		132 x 29	114.5	834 N {85.0 kg}	—	667 N {68.0 kg}	

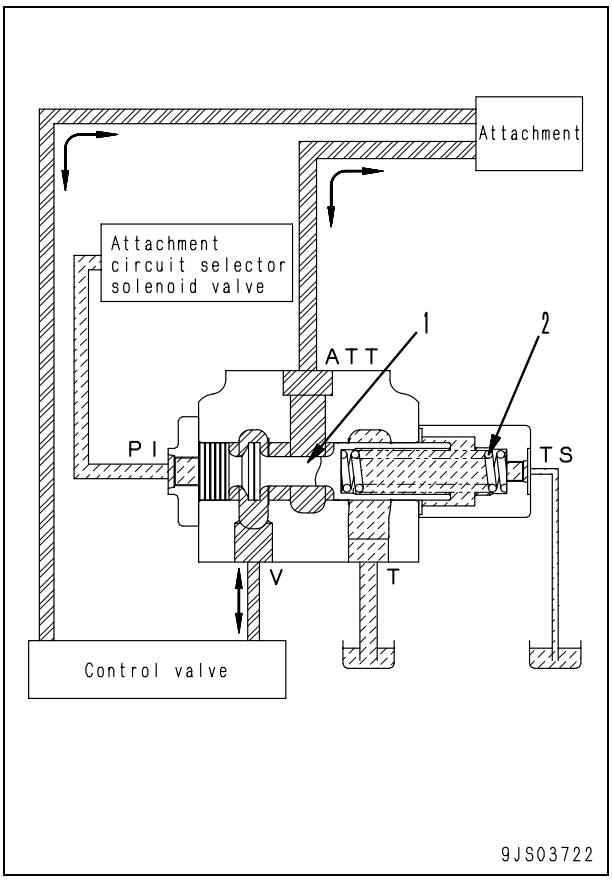
Function

- When a breaker is installed, the return oil from the breaker does not pass through the main valve, but returns directly to the hydraulic tank.
- When other attachments (crusher, etc.) are installed, the attachment and the main valve are interconnected.

Operation

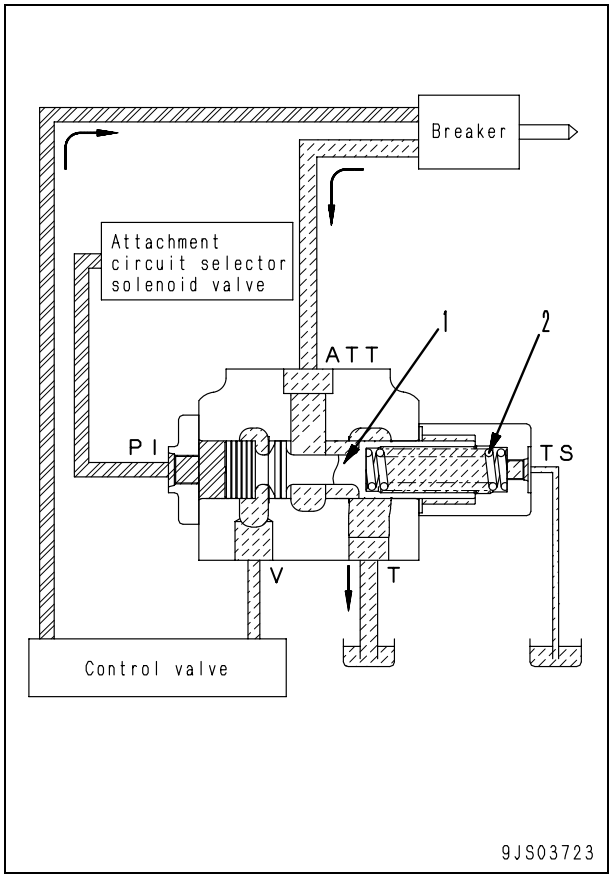
1. When attachment other than breaker is installed

- Spool (1) is pressed to the left by the force of spring (2).
- Ports (ATT) and (V) are interconnected and ports (ATT) and (T) are shut off. Attachment is thus interconnected to the control valve.



2. When breaker is installed

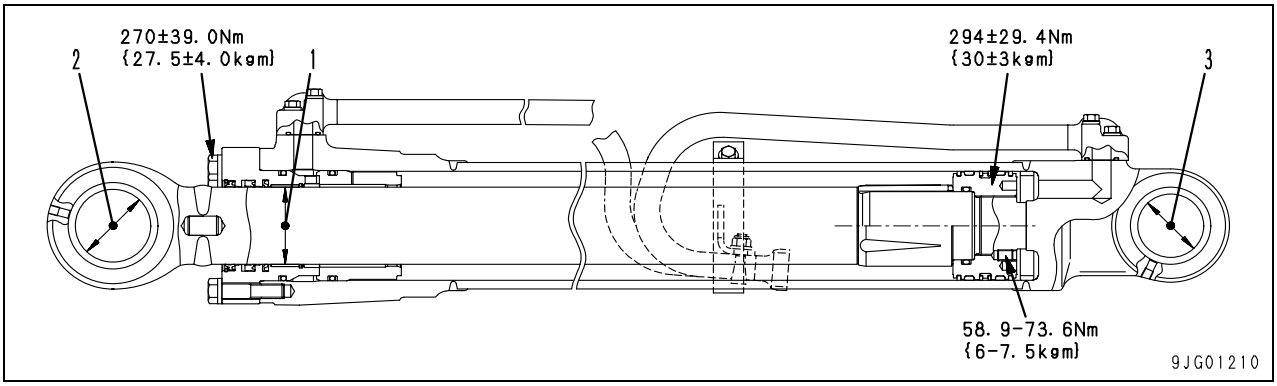
- Pilot pressure from the attachment circuit selector solenoid valve contracts spring (2), and spool (1) moves to the right to the stroke end.
- Ports (ATT) and (V) are shut off and ports (ATT) and (T) are interconnected.
- Pressurized oil returning from the breaker returns directly to the hydraulic tank via port (T) without passing through the control valve.



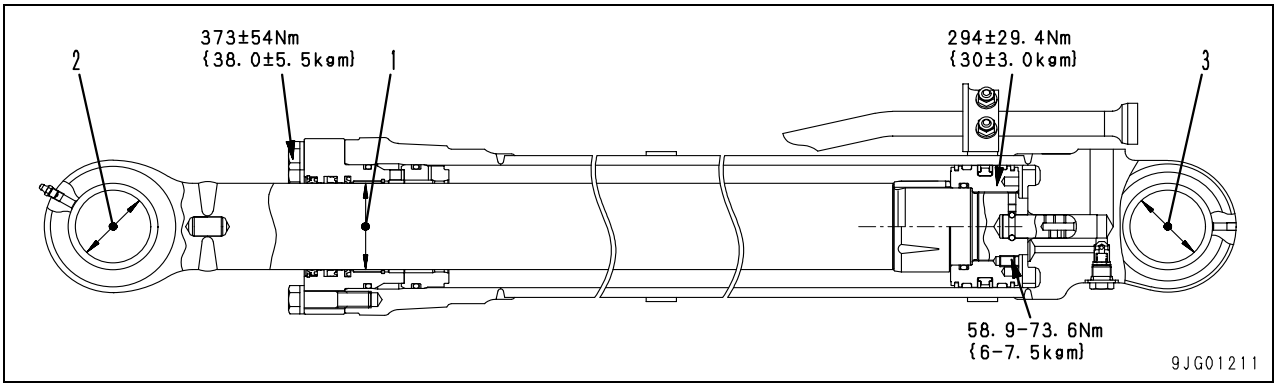
Hydraulic cylinder

PC210-8K, PC210LC, PC210NLC,PC230NHD-8K

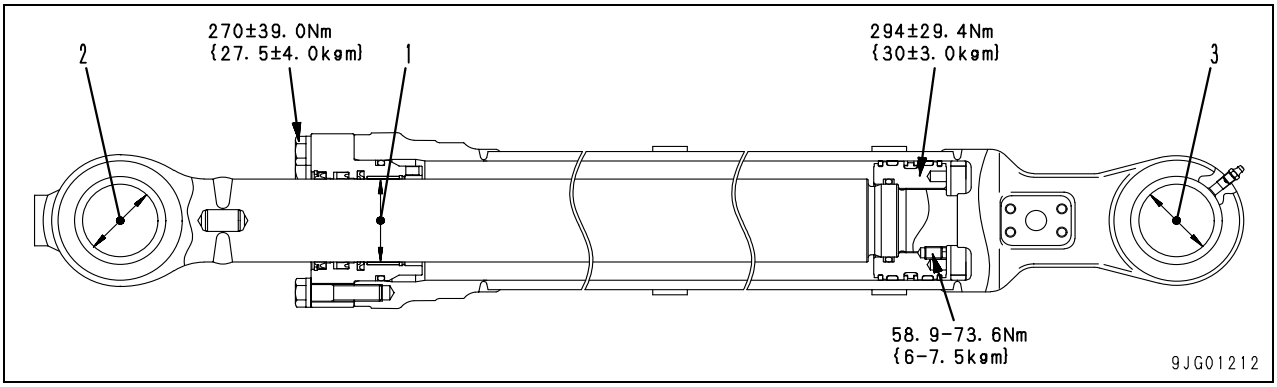
Boom cylinder



Arm cylinder



Bucket cylinder

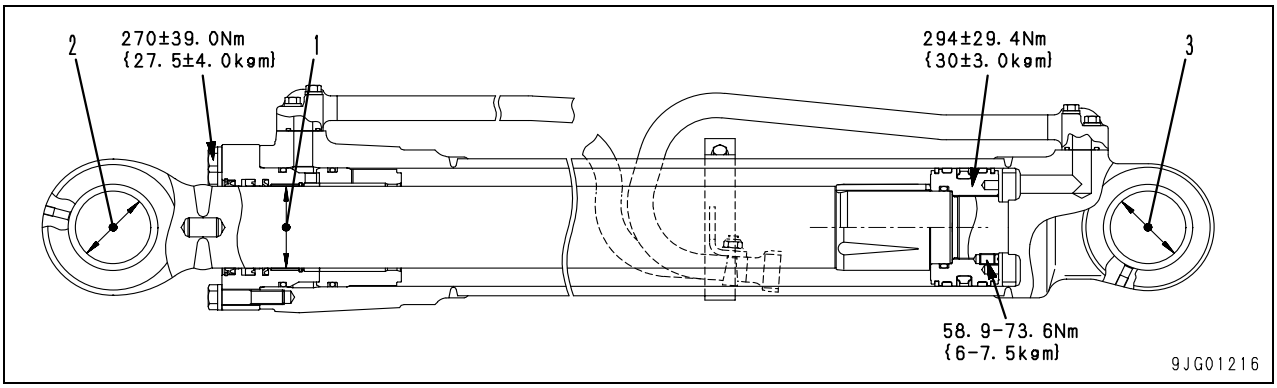


Unit: mm

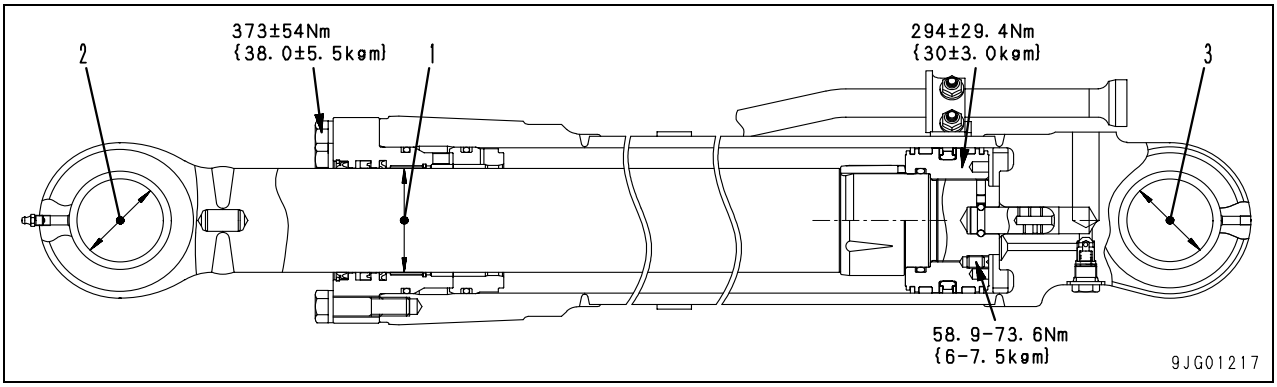
No.	Check item		Criteria					Remedy
		Cylinder	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
1	Clearance between piston rod and bushing	Boom	85	–0.036 –0.090	+0.222 +0.047	0.083 – 0.312	0.412	Replace bushing
		Arm	95	–0.036 –0.090	+0.222 +0.047	0.083 – 0.312	0.412	
		Bucket 1.8 / 2.4M Arm	85	–0.036 –0.091	+0.222 +0.047	0.083 – 0.313	1.0	
		Bucket (2.9M Arm)	80	–0.025 –0.076	+0.222 +0.047	0.072 – 0.298	0.398	
2	Clearance between piston rod support shaft and bushing	Boom	80	–0.030 –0.060	+0.190 +0.070	0.100 – 0.250	1.0	Replace pin or bushing
		Arm	80	–0.030 –0.076	+0.190 +0.070	0.100 – 0.266	1.0	
		Bucket 1.8 / 2.4M Arm	70	–0.030 –0.076	+0.424 +0.350	0.500 – 0.380	1.0	
		Bucket (2.9M Arm)	70	–0.030 –0.076	+0.424 +0.350	0.500 – 0.380	1.0	
3	Clearance between cylinder bottom support shaft and bushing	Boom	70	–0.030 –0.060	+0.165 +0.045	0.075 – 0.225	1.0	
		Arm	80	–0.030 –0.076	+0.190 +0.070	0.100 – 0.266	1.0	
		Bucket 1.8 / 2.4M Arm	70	–0.030 –0.060	+0.190 +0.070	0.100 – 0.250	1.0	
		Bucket (2.9M Arm)	70	–0.030 –0.060	+0.165 +0.045	0.075 – 0.225	1.0	

PC240LC-8K and PC240NLC-8K

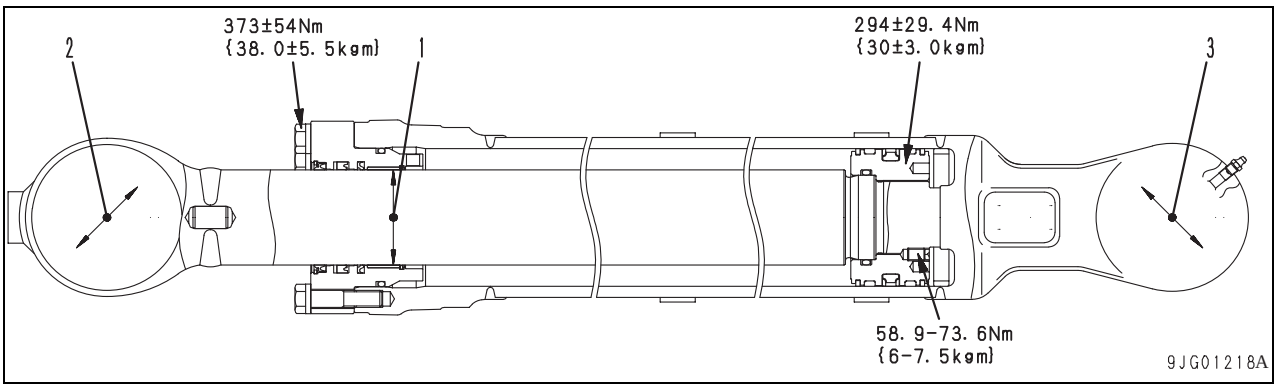
Boom cylinder



Arm cylinder



Bucket cylinder



Unit: mm

No.	Check item		Criteria					Remedy
		Cylinder	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
1	Clearance between piston rod and bushing	Boom	95	–0.036 –0.090	+0.222 +0.047	0.083 – 0.312	0.437	Replace bushing
		Arm	100	–0.036 –0.090	+0.257 +0.047	0.083 – 0.347	0.447	
		Bucket (2.0/2.5M Arm)	100	–0.036 –0.090	+0.257 +0.048	0.084 – 0.347	0.447	
		Bucket (3.0/3.5M Arm)	90	–0.036 –0.090	+0.257 +0.048	0.084 – 0.347	0.447	
2	Clearance between piston rod support shaft and bushing	Boom	80	–0.030 –0.060	+0.190 +0.070	0.100 – 0.250	1.0	Replace pin or bushing
		Arm	80	–0.030 –0.076	+0.190 +0.070	0.100 – 0.266	1.0	
		Bucket (2.0/2.5M Arm)	80	–0.030 –0.076	+0.457 +0.370	0.400 – 0.533	1.0	
		Bucket (3.0/3.5M Arm)	80	–0.030 –0.076	+0.457 +0.370	0.400 – 0.533	1.0	
3	Clearance between cylinder bottom support shaft and bushing	Boom	80	–0.030 –0.060	+0.190 +0.070	0.075 – 0.225	1.0	
		Arm	80	–0.030 –0.076	+0.190 +0.070	0.100 – 0.266	1.0	
		Bucket (2.0/2.5M Arm)	80	–0.030 –0.076	+0.190 +0.070	0.075 – 0.225	1.0	
		Bucket (3.0/3.5M Arm)	80	–0.030 –0.076	+0.190 +0.070	0.075 – 0.225	1.0	

PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00160-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

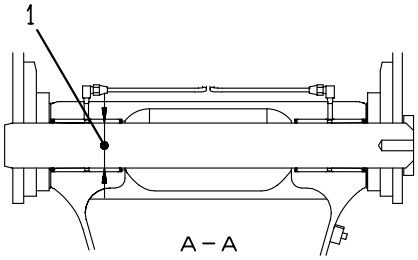
Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

10 Structure, function and maintenance standard

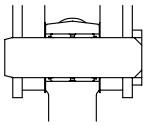
Work equipment

Work equipment

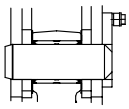
Dimensions of components



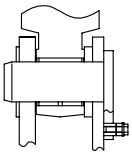
A – A



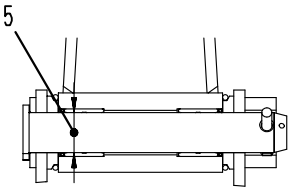
F – F



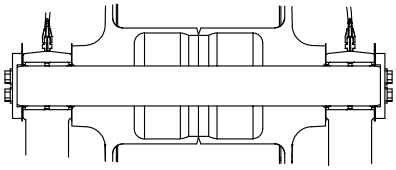
G – G



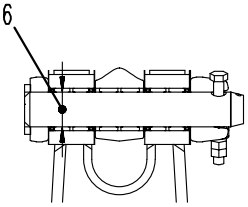
B – B



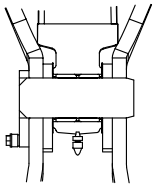
H – H



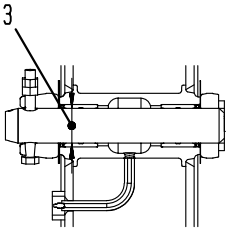
C – C



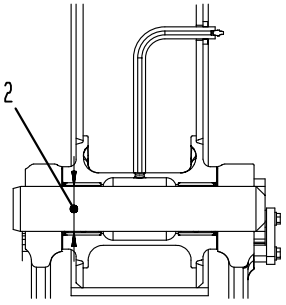
I – I



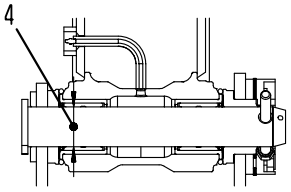
D – D



J – J

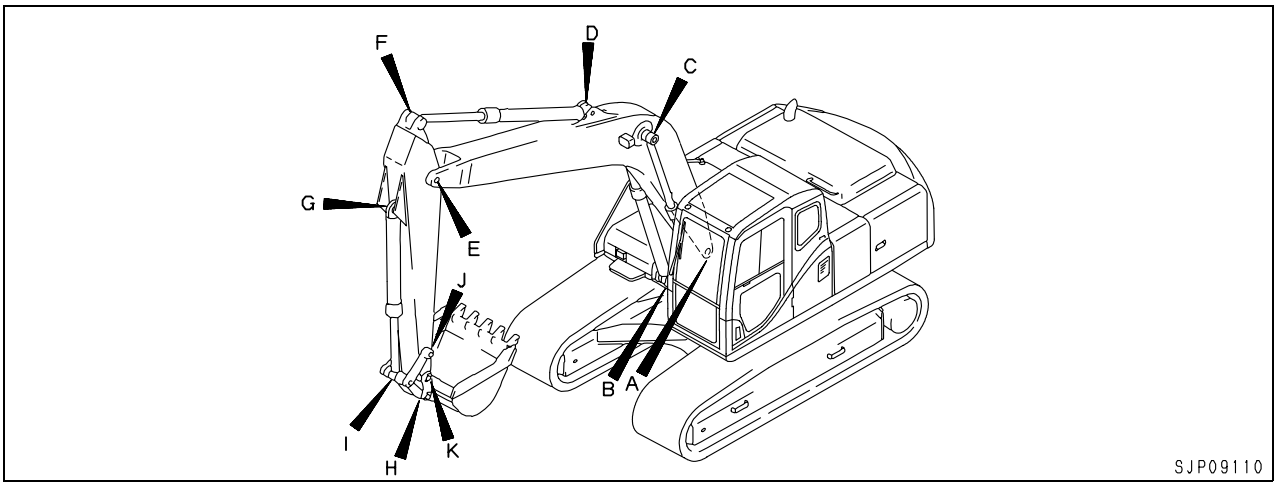


E – E



K – K

9JG01078



PC210, PC210LC, 210NLC, 230NHD-8

Unit: mm

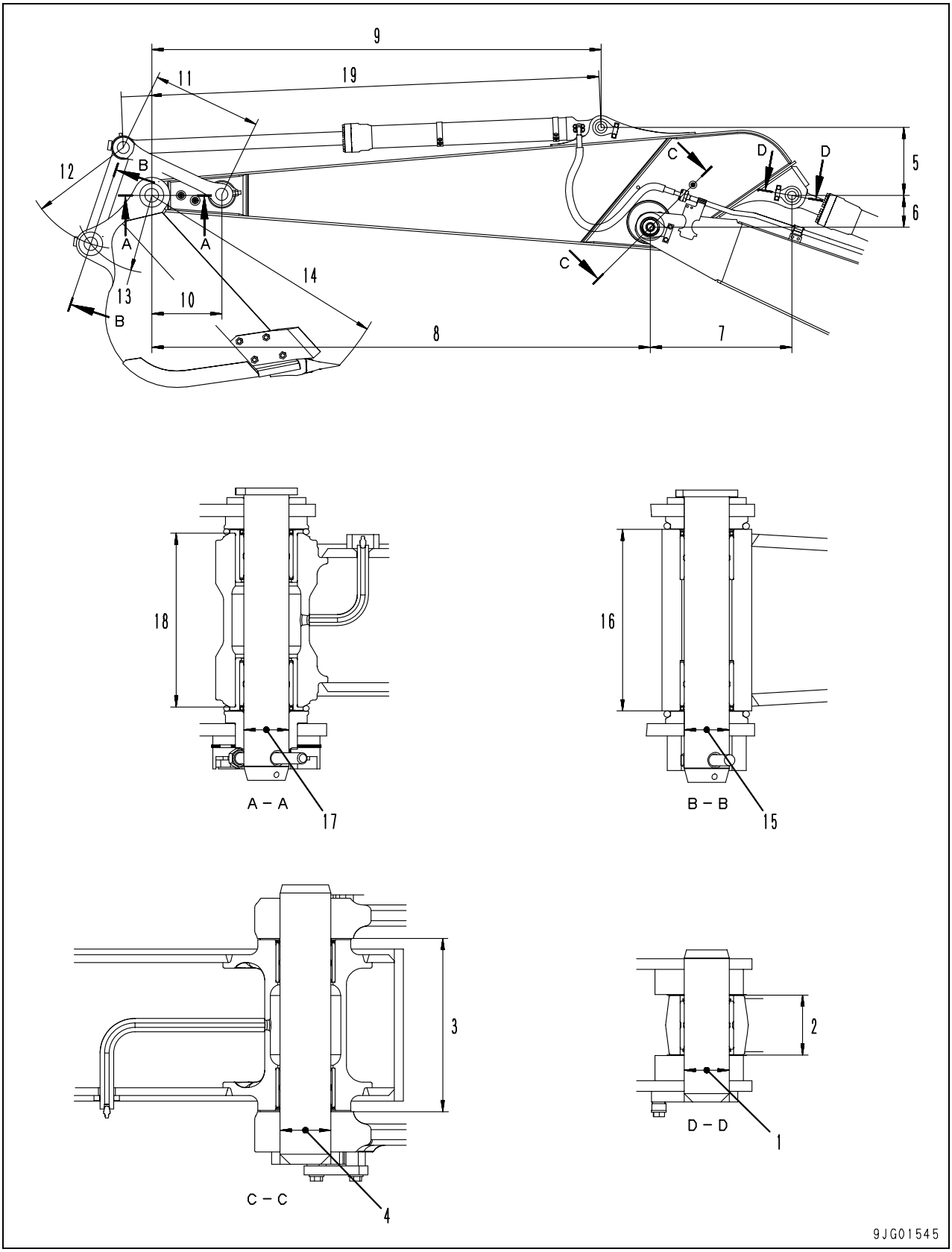
No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between pin connecting boom and revolving frame and bushing	90	–0.036 –0.071	+0.135 +0.074	0.110 – 0.206	1.0	Replace
2	Clearance between pin connecting boom and arm and bushing	90	–0.036 –0.071	+0.137 +0.077	0.113 – 0.208	1.0	
3	Clearance between pin connecting arm and link and bushing	70	–0.030 –0.076	+0.335 +0.275	0.305 – 0.411	1.0	
4	Clearance between pin connecting arm and bucket and bushing	80	–0.030 –0.076	+0.324 +0.270	0.300 – 0.400	1.0	
5	Clearance between pin connecting link and bucket and bushing	80	–0.030 –0.076	+0.337 +0.273	0.303 – 0.413	1.0	
6	Clearance between pin connecting links and bushing	70	–0.030 –0.076	+0.335 +0.275	0.305– 0.411	1.0	

PC240LC, PC240NLC-8

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between pin connecting boom and revolving frame and bushing	100	–0.036 –0.071	+0.138 +0.078	0.114 – 0.209	1.0	Replace
2	Clearance between pin connecting boom and arm and bushing	90	–0.036 –0.071	+0.137 +0.077	0.113 – 0.208	1.0	
3	Clearance between pin connecting arm and link and bushing	80	–0.030 –0.076	+0.337 +0.273	0.303 – 0.413	1.0	
4	Clearance between pin connecting arm and bucket and bushing	80	–0.030 –0.076	+0.324 +0.270	0.300– 0.400	1.0	
5	Clearance between pin connecting link and bucket and bushing	80	–0.030 –0.076	+0.337 +0.273	0.303 – 0.413	1.0	
6	Clearance between pin connecting links and bushing	80	–0.030 –0.076	+0.337 +0.273	0.303 – 0.413	1.0	

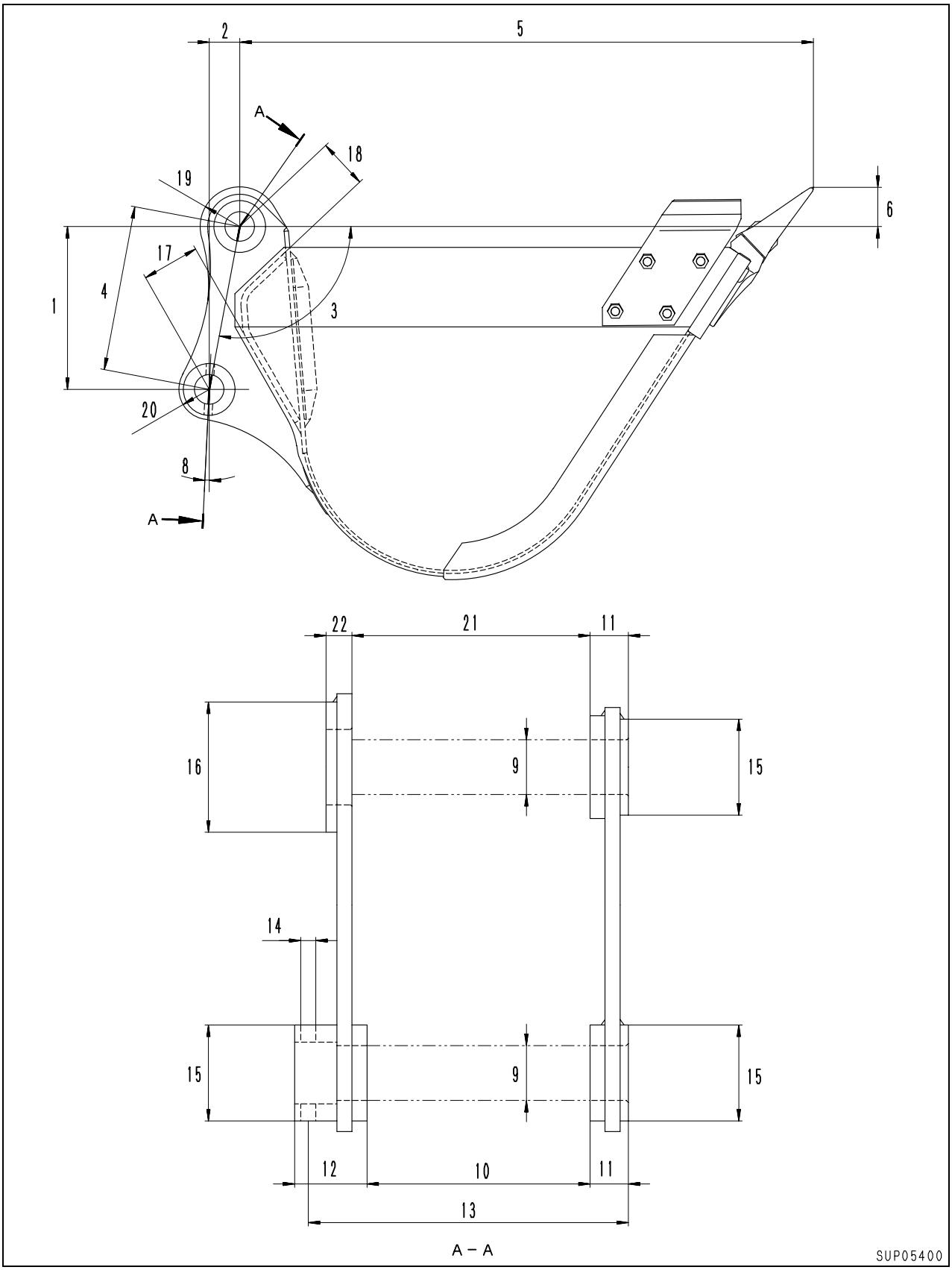
1. Dimension of arm



Unit: mm

No.		PC210, 210LC, 210NLC, 230NHD-8		PC240LC, 240NLC-8	
		Standard size	Tolerance	Standard size	Tolerance
		2.9M Arm		3.0M Arm	
1		ϕ80	+0.1 0	ϕ80	+0.1 0
2		109.3	+1.5 0	109.3	+1.5 0
3		305.5	0 –0.5	305.5	0 –0.5
4		ϕ90	+0.054 0	ϕ90	+0.054 0
5		407.1	±1	423.9	±1
6		187.2	±0.5	206.1	±0.5
7		829.1	±1	918.6	±1
8		2,919	—	3,037.6	—
9		2,630.5	±1	2,562.8	±1
10		410	±1	465	±1
11		640	±0.2	585	±0.2
12		600	±0.5	600	±0.5
13		458.1	—	446.3	—
14		1,486	—	1,551.7	—
15		ϕ80	+0.1 0	ϕ80	+0.1 0
16		325	±0.5	325	±0.5
17		ϕ80	+0.1 0	ϕ80	+0.1 0
18	Arm itself	311	0 –0.5	311	0 –0.5
	When press fitting bushing	325	—	325	—
19	Min.	1,680	±2.5	1,605	±2.5
	Max.	2,800	—	2,625	—

2. Dimension of bucket



Unit: mm

No.	PC210, 210LC, 210NLC, 230NHD-8		PC240LC, 240NLC-8	
	Standard size	Tolerance	Standard size	Tolerance
1	457.6	±0.5	442.4	±0.5
2	22	±0.5	59.2	±0.5
3	92° 45’	—	97° 37’	—
4	458.1	—	446.3	—
5	1,477.3	—	1,540.5	—
6	158.6	—	185.6	—
7	—	—	—	—
8	15° 54’	—	7° 48’	—
9	ϕ80	+0.1 0	ϕ80	+0.1 0
10	326.5	±1	326.5	±1
11	56	—	59	—
12	106	—	104	—
13	470	—	470	—
14	ϕ23.5	—	ϕ23.5	—
15	ϕ140	—	ϕ140	—
16	ϕ190	—	ϕ190	—
17	133.2	—	156.3	—
18	131.6	—	133.1	—
19	107	—	107	—
20	85	—	82	—
21	348.5	+2 0	348.5	+2 0
22	38	—	37	—

PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00101-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

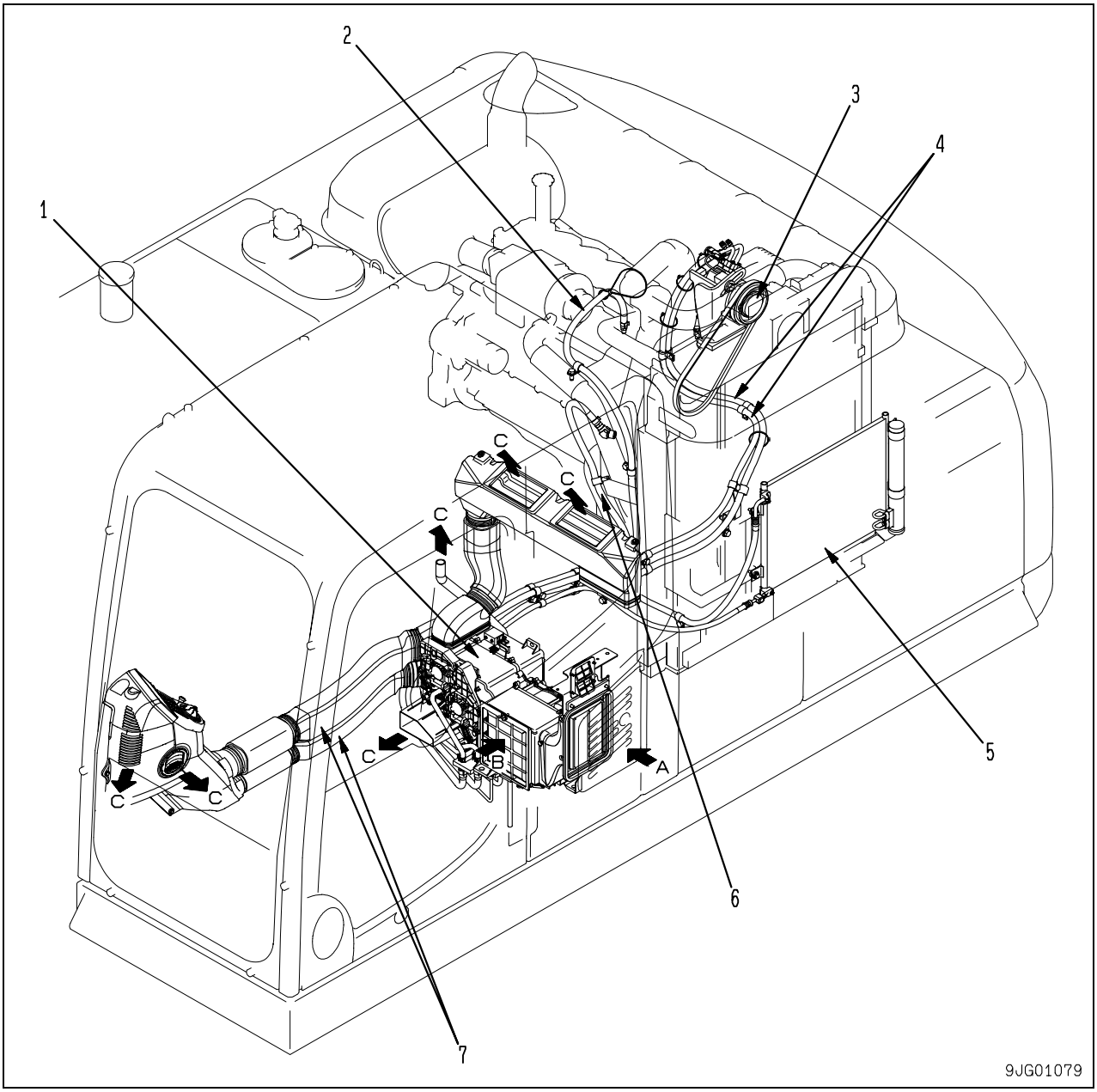
Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

10 Structure, function and maintenance standard

Cab and its attachments

Cab and its attachments

Air conditioner piping



1. Air conditioner unit
2. Hot water pickup piping
3. Air conditioner compressor
4. Refrigerant piping
5. Condenser
6. Hot water return piping
7. Duct

A: Fresh air
B: Recirculated air
C: Hot air/cold air

PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00102-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

10 Structure, function and maintenance standard

Electrical system

Electrical system

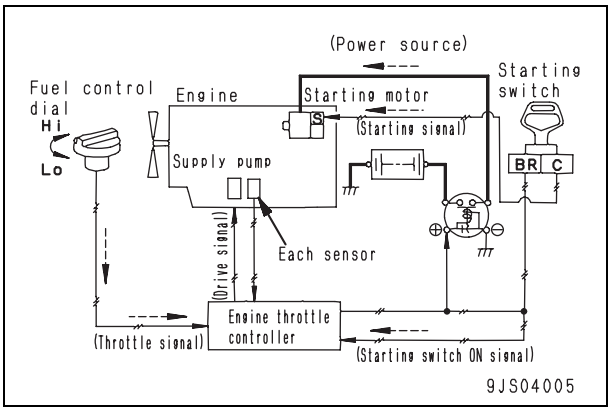
Engine control

Operation of system

Starting engine

- When the starting switch is turned to the START position, the starting signal flows to the starting motor. Then, the starting motor turns to start the engine.

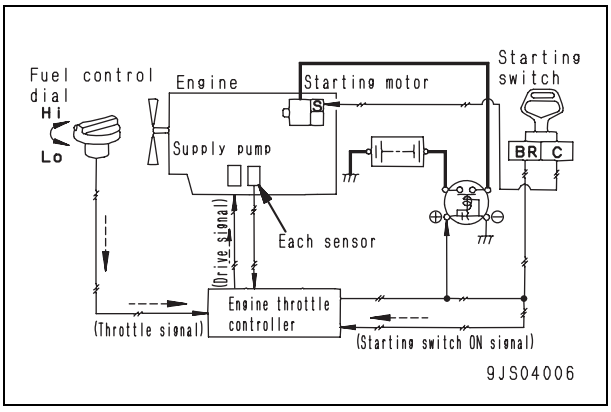
  When it happens, the engine controller checks the signal voltage from the fuel control dial and sets the engine speed to the speed set by the fuel control dial.



Engine speed control

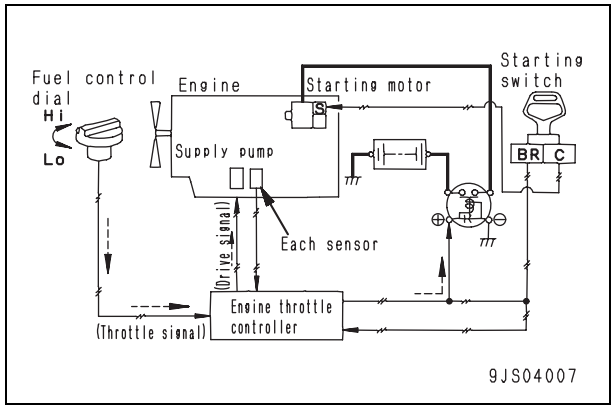
- The fuel control dial sends a signal voltage corresponding to the rotation angle to the engine controller.

  The engine controller sends a driving signal to the supply pump depending on the signal voltage to control the fuel injection pump, and eventually controls the engine speed.



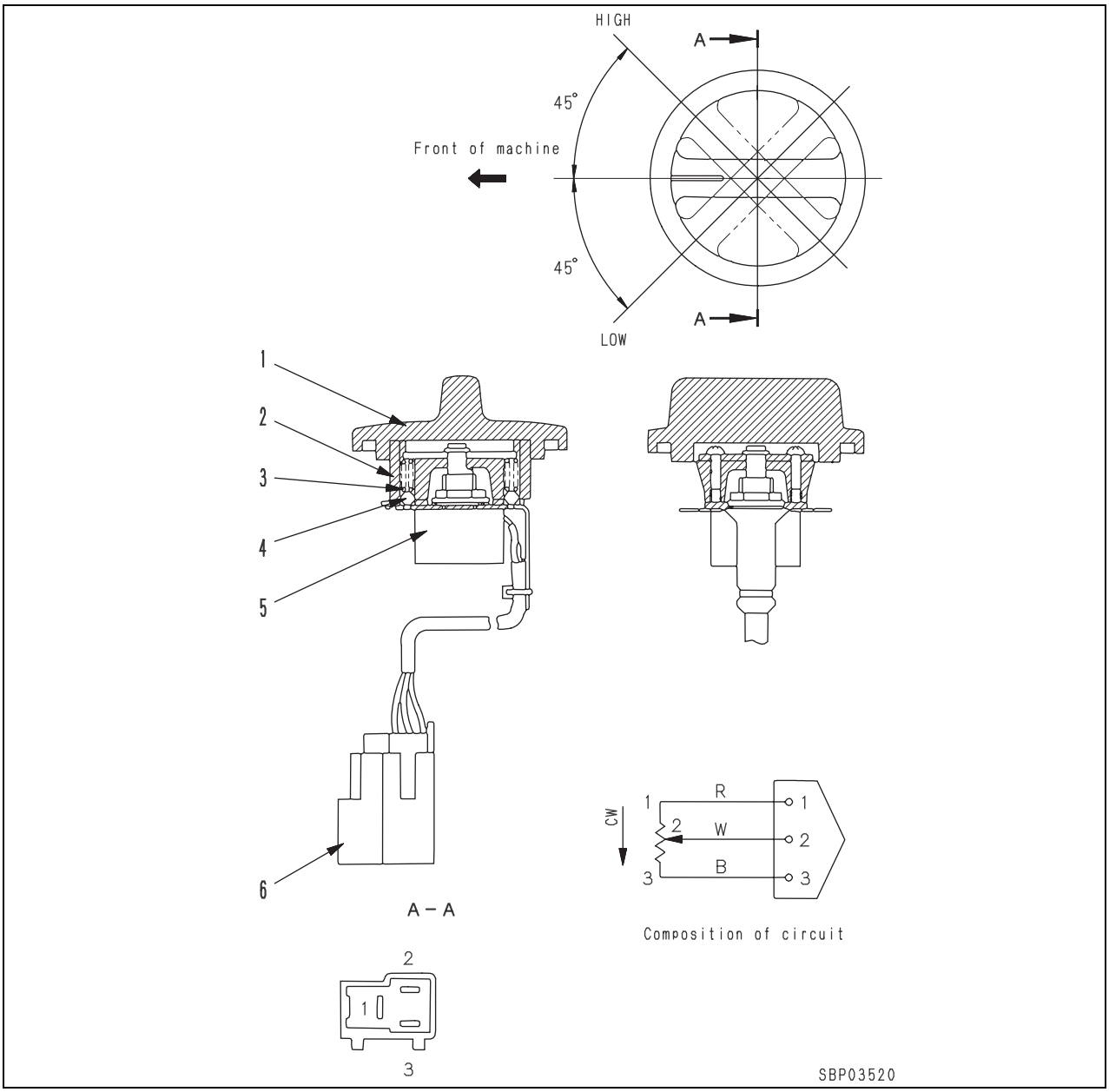
Stopping engine

- When detecting that the starting switch is set to the “STOP” position, the engine controller cuts the signal of the supply pump drive solenoid to stop the engine.



Component

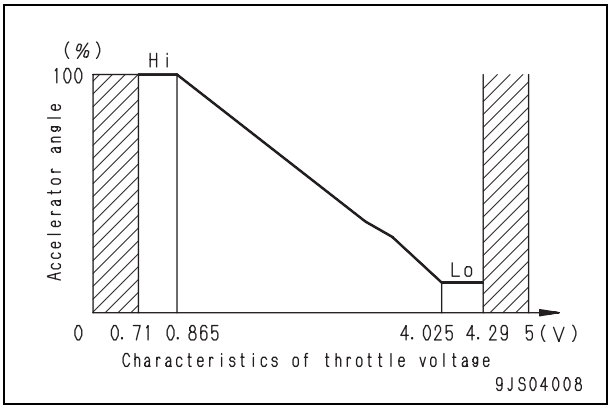
Fuel control dial



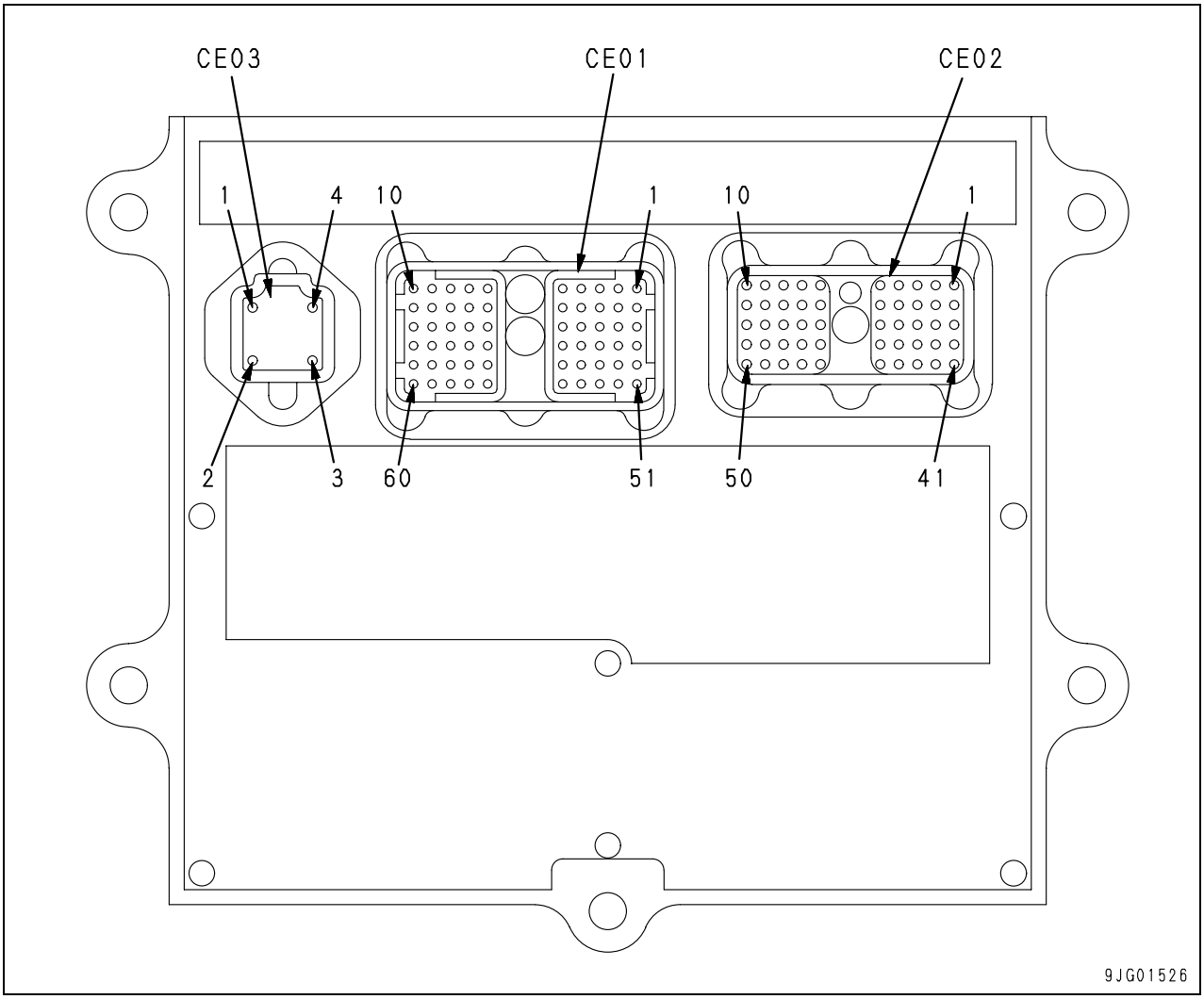
1. Knob
2. Dial
3. Spring
4. Ball
5. Potentiometer
6. Connector

Function

- The fuel control dial is installed under the machine monitor.
- Turning knob (1) rotates the shaft of potentiometer (5).
- The rotation of the shaft changes the resistance of the variable resistor in potentiometer (5), sending any throttle signal to the engine controller.
- The hatched area in the right graph is the abnormality detection area. When the throttle voltage is within this area, the engine is running at low idle.



Engine controller



CN-CE01

Pin No.	Signal name	Input/ output
1	Electric power supply for lift pump	
2	Electric power supply for IMA	
3	Atmosphere sensor	
4	NC(*)	
5	NC(*)	
6	CAN(–)	
7	NC(*)	
8	CAN(+)	
9	NC(*)	
10	NC(*)	
11	Lift pump return	
12	NC(*)	
13	NC(*)	
14	NC(*)	
15	Coolant temperature sensor	
16	5V electric power supply for sensor	
17	Oil pressure switch	

*: Never connect to NC or malfunctions or failures will occur.

CN-CE01

Pin No.	Signal name	Title panel
18	NC(*)	
19	NC(*)	
20	NC(*)	
21	NC(*)	
22	Engine brake drive	D
23	Boost temperature sensor	B
24	NC(*)	
25	Common rail pressure sensor	B
26	G sensor (+)	B
27	NE sensor (+)	B
28	Engine brake return	
29	NC(*)	
30	NC(*)	
31	NC(*)	D
32	IMA return	C
33	5V electric power supply for sensor	
34	NC(*)	

*: Never connect to NC or malfunctions or failures will occur.

CN-CE01

Pin No.	Signal name	Title panel
35	NC(*)	A
36	NC(*)	
37	5V electric power supply for sensor	A
38	GND	C
39	NC(*)	
40	NC(*)	
41	NC(*)	
42	NC(*)	C
43	NC(*)	
44	Boost pressure sensor	B
45	Injector #1 (+)	D
46	Injector #5 (+)	D
47	G sensor (–)	C
48	Ne sensor (–)	C
49	NC(*)	
50	NC(*)	
51	Injector #2 (–)	C
52	Injector #3 (–)	C
53	Injector #1 (–)	C
54	Injector #2 (+)	D
55	Injector #3 (+)	D
56	Injector #4 (+)	D
57	Injector #6 (+)	D
58	Injector #4 (–)	C
59	Injector #6 (–)	C
60	Injector #5 (–)	C

*: Never connect to NC or malfunctions or failures will occur.

CN-CE02

Pin No.	Signal name	Input/ output
1	NC(*)	
2	NC(*)	
3	NC(*)	
4	NC(*)	
5	NC(*)	
6	NC(*)	
7	NC(*)	
8	NC(*)	
9	Fuel control dial (+)	
10	NC(*)	
11	NC(*)	
12	NC(*)	
13	NC(*)	
14	NC(*)	
15	NC(*)	
16	NC(*)	
17	NC(*)	
18	NC(*)	
19	NC(*)	

*: Never connect to NC or malfunctions or failures will occur.

CN-CE02

Pin No.	Signal name	Input/ output
20	NC(*)	
21	NC(*)	
22	Fuel control dial (+5V)	
23	Fuel control dial (–)	
24	NC(*)	
25	NC(*)	
26	NC(*)	
27	NC(*)	
28	NC(*)	
29	NC(*)	
30	NC(*)	
31	NC(*)	
32	NC(*)	
33	GND	
34	NC(*)	
35	NC(*)	
36	NC(*)	
37	NC(*)	
38	NC(*)	
39	Key switch (ACC)	
40	Electrical intake air heater relay drive	
41	NC(*)	
42	Electrical intake air heater relay return	
43	NC(*)	
44	NC(*)	
45	NC(*)	
46	CAN(+)	
47	CAN(–)	
48	NC(*)	
49	PWM OUTPUT	
50	NC(*)	

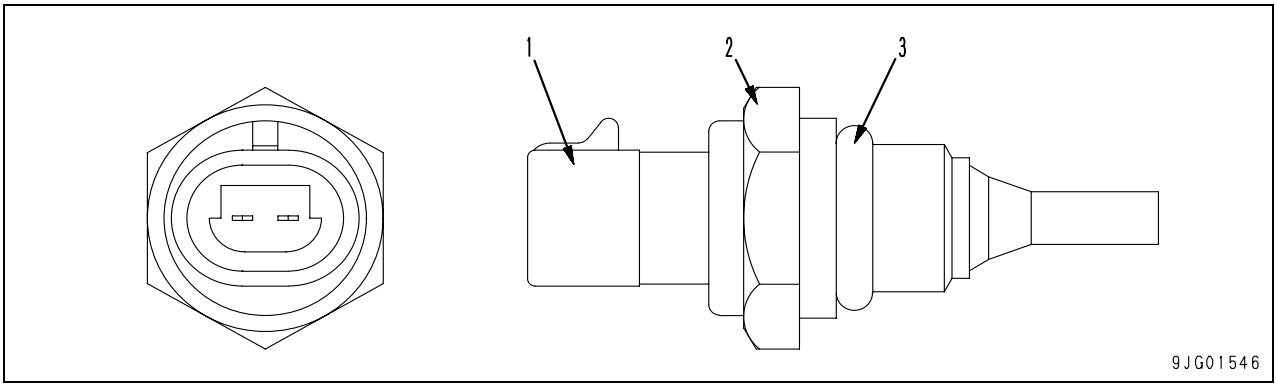
*: Never connect to NC or malfunctions or failures will occur.

CN-CE03

Pin No.	Signal name	Input/ output
1	GND	
2	NC(*)	
3	Electric power supply (+24V constantly)	
4	NC(*)	

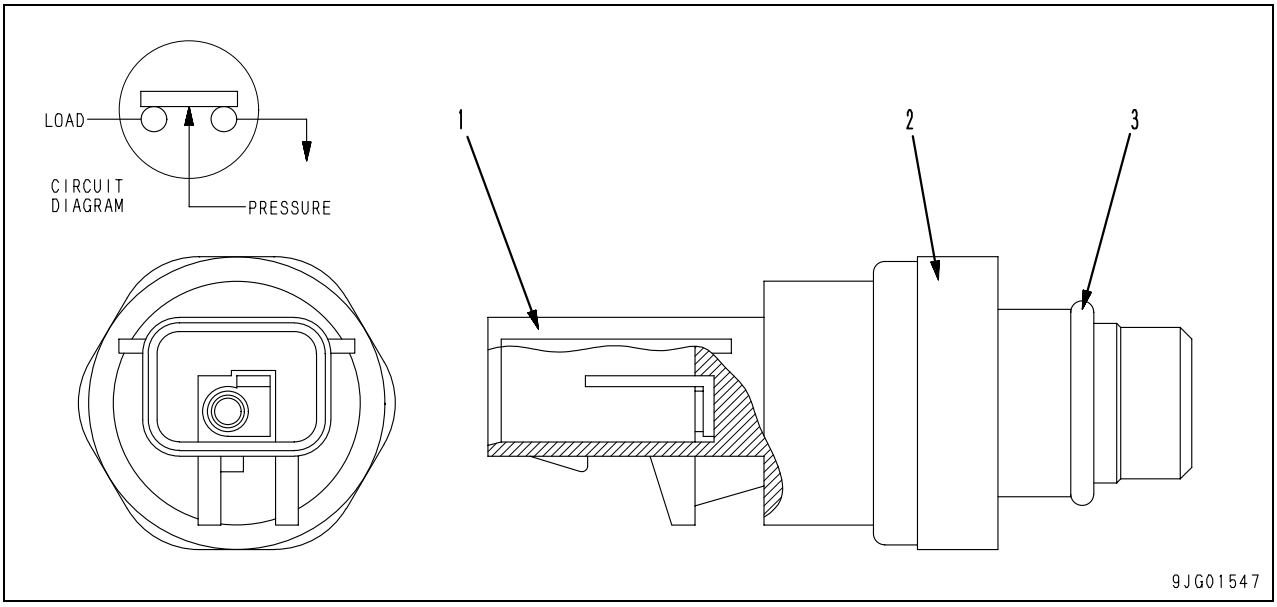
*: Never connect to NC or malfunctions or failures will occur.

Coolant temperature sensor



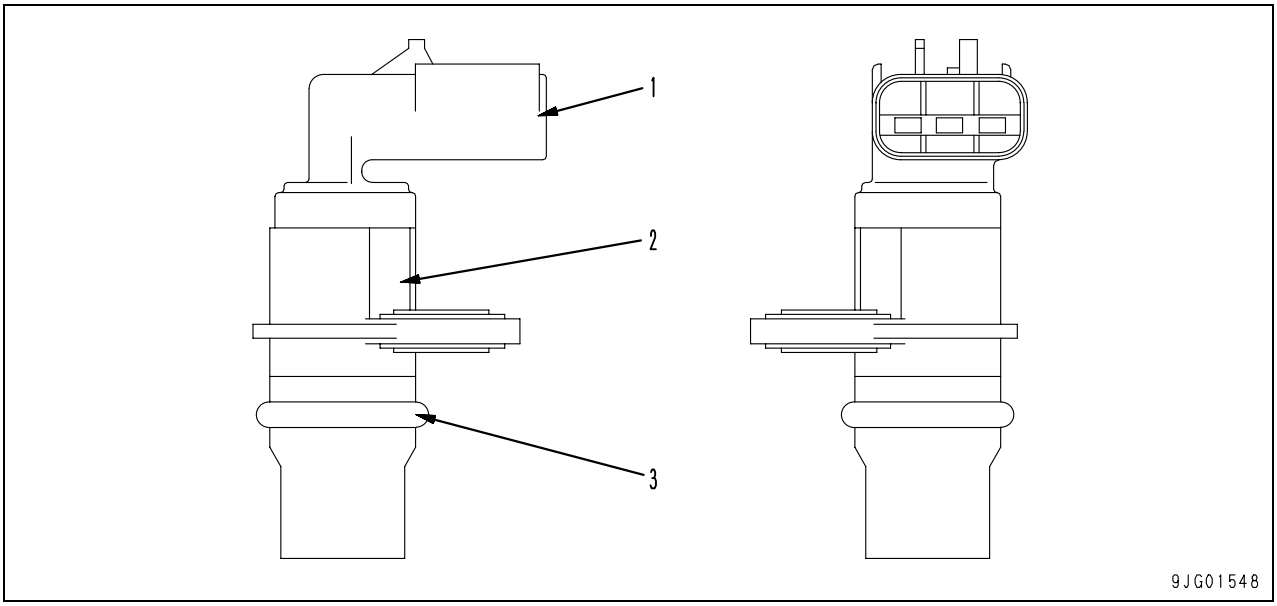
1. Sensor
2. O-ring
3. Connector

Oil pressure switch



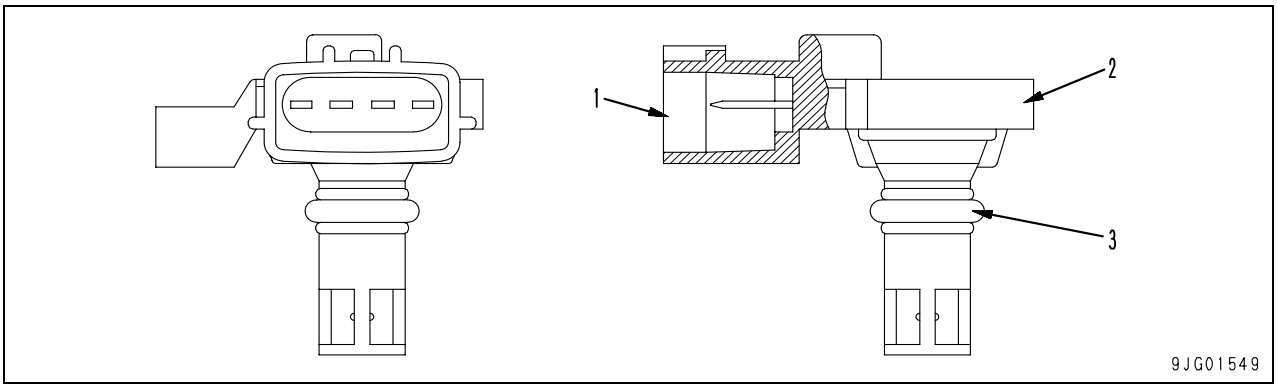
1. Connector
2. Sensor
3. O-ring

Rotation sensor



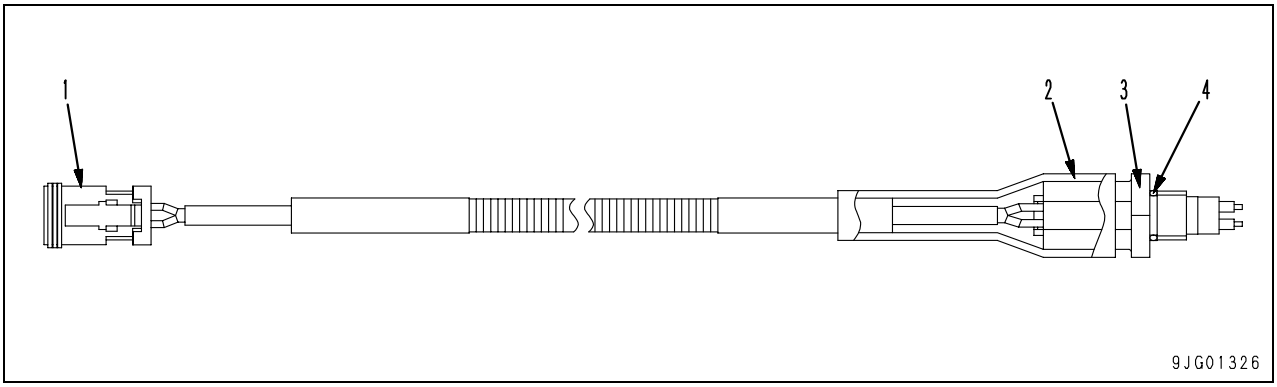
1. Connector
2. Sensor
3. O-ring

Boost pressure and temperature sensor



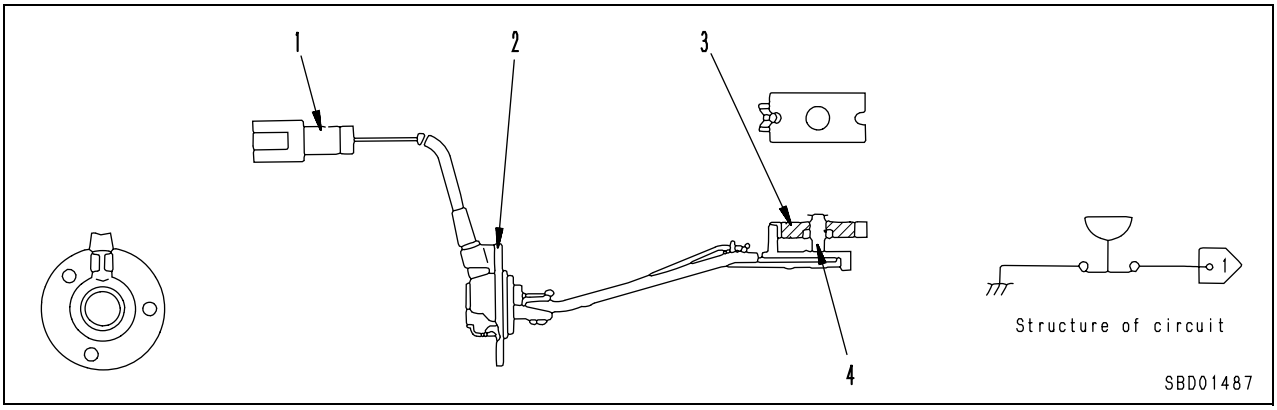
1. Connector
2. Sensor
3. O-ring

WIF (water-in-fuel detection) sensor



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

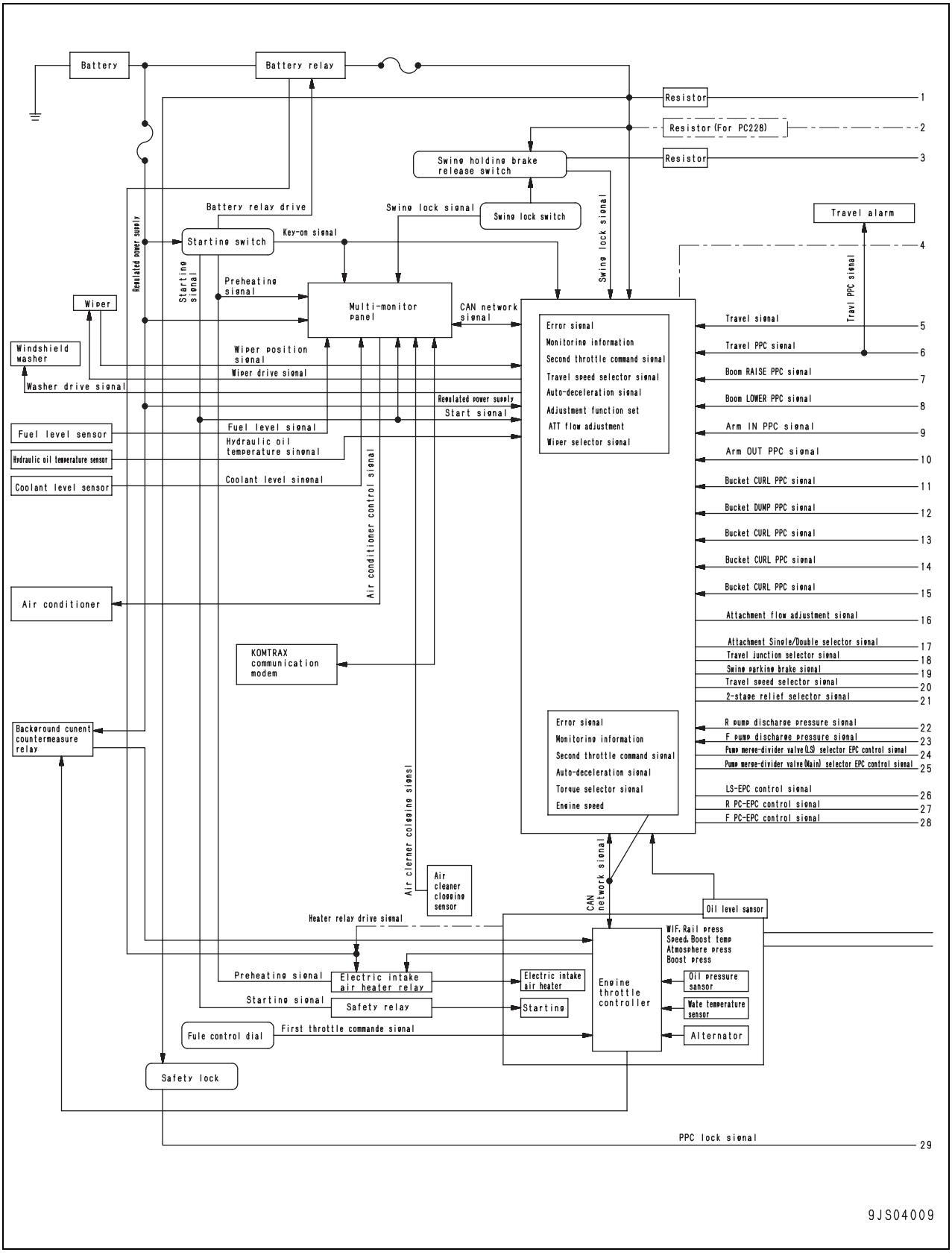
Engine oil level sensor

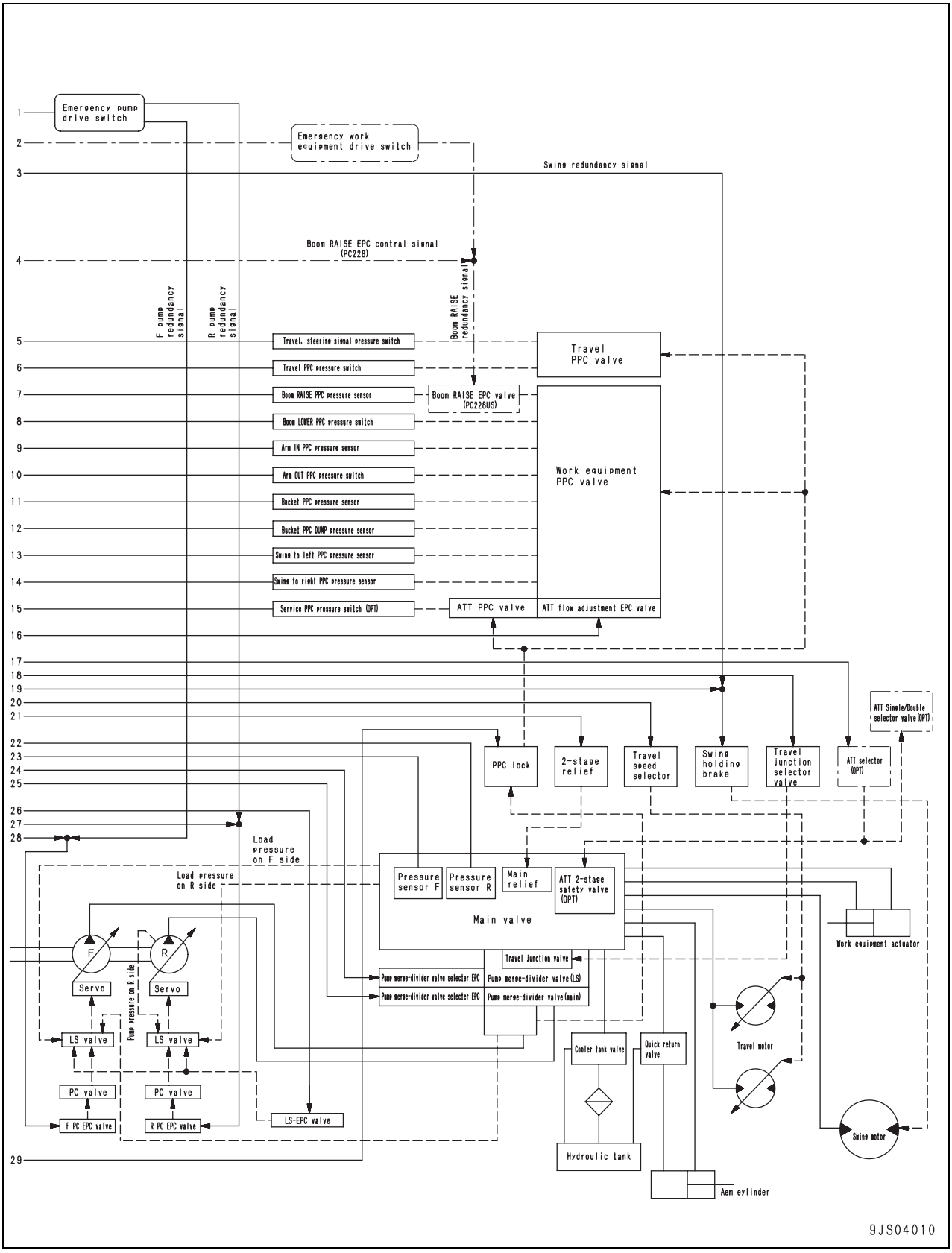


1. Connector
2. Bracket
3. Float
4. Switch

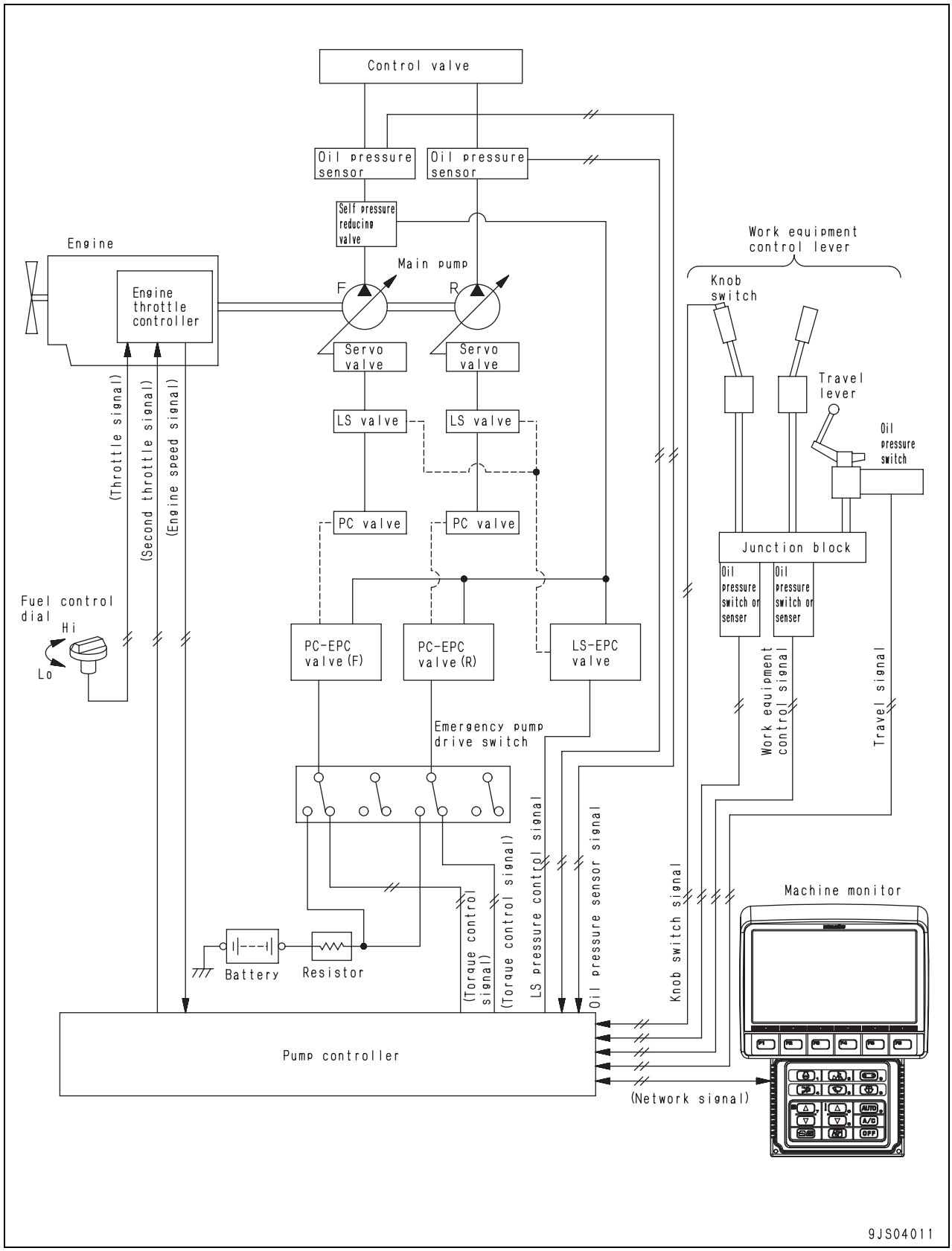
Electrical control system

Machine control system diagram



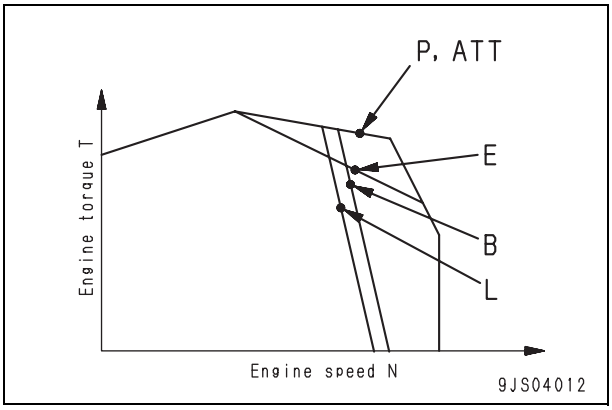

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
Emergency pump drive switch
Emergency work equipment drive switch
Swing redundancy signal
Boom RAISE EPC contral signal (PC228)
F pump redundancy signal
R pump redundancy signal
Boom RAISE redundancy signal
Travel, steering signal pressure switch
Travel PPC pressure switch
Boom RAISE PPC pressure sensor
Boom LOWER PPC pressure switch
Arm IN PPC pressure sensor
Arm OUT PPC pressure switch
Bucket PPC pressure sensor
Bucket PPC DUMP pressure sensor
Swing to left PPC pressure sensor
Swing to right PPC pressure sensor
Service PPC pressure switch (OPT)
Travel PPC valve
Boom RAISE EPC valve (PC228US)
Work equipment PPC valve
ATT PPC valve
ATT flow adjustment EPC valve
ATT Single/Double selector valve (OPT)
PPC lock
2-stage relief
Travel speed selector
Swing holding brake
Travel junction selector valve
ATT selector (OPT)
Load pressure on F side
Load pressure on R side
Pressure sensor F
Pressure sensor R
Main relief
ATT 2-stage safety valve (OPT)
Main valve
Work equipment actuator
Travel junction valve
Pump merge-divider valve selector EPC
Pump merge-divider valve (LS)
Pump merge-divider valve selector EPC
Pump merge-divider valve (main)
F
R
Servo
Servo
Pump pressure on R side
LS valve
LS valve
PC valve
PC valve
F PC EPC valve
R PC EPC valve
LS-EPC valve
Cooler tank valve
Quick return valve
Travel motor
Swing motor
Hydroulic tank
Aem cylinder
9JS04010

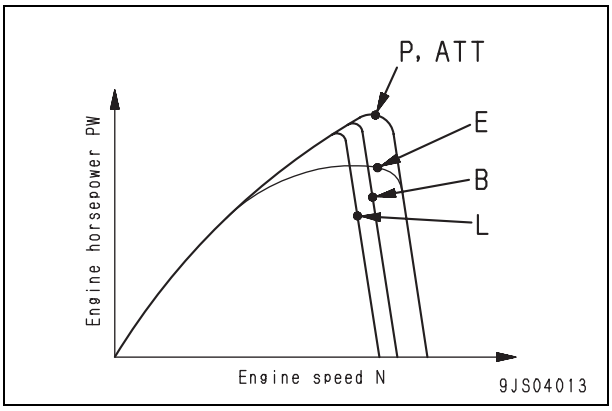
1. Engine and pump composite control function

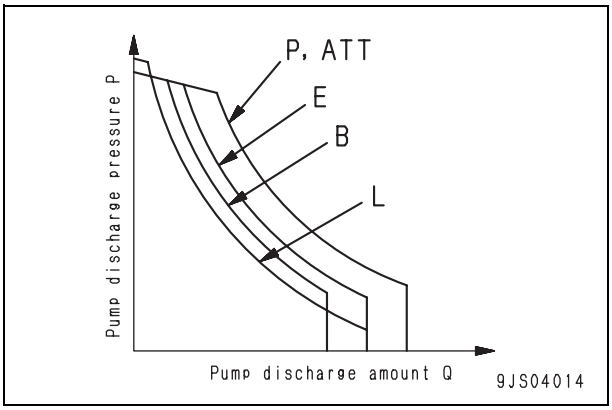


Function

- This function allows the operator to select engine torque (T) and pump absorption torque depending on the work contents of the machine.
  Five modes of P, E, L, ATT, and B (three modes of P, E, and L for machines with "No ATT" specified) are specified as working modes.
  To select a working mode, use the working mode selector switch of the machine monitor.
- The pump controller controls the pump so that it can absorb all the torque at the output points of the engine depending on the pump absorption torque specified for each mode, rotation set by the fuel control dial, and actual engine speed.







1) Control method in each mode

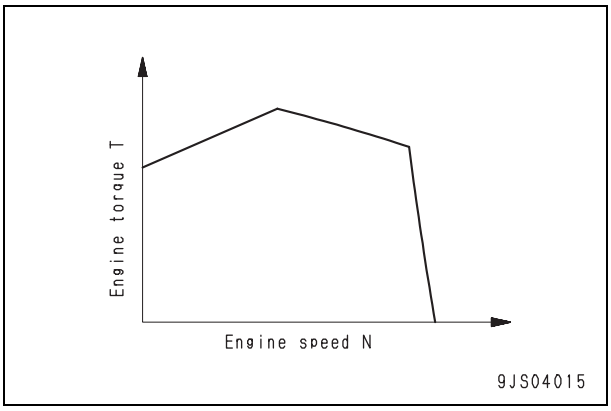
P mode, E mode, and ATT mode

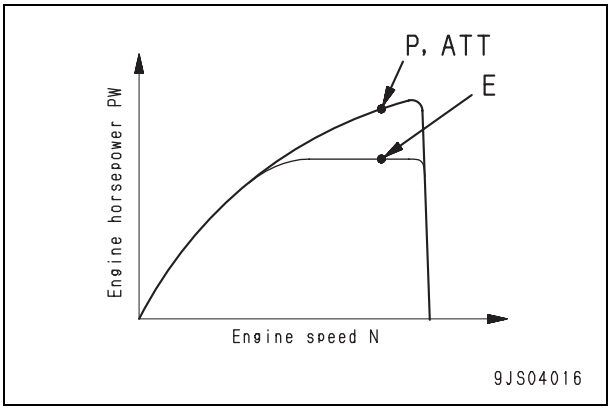
- Matching point:

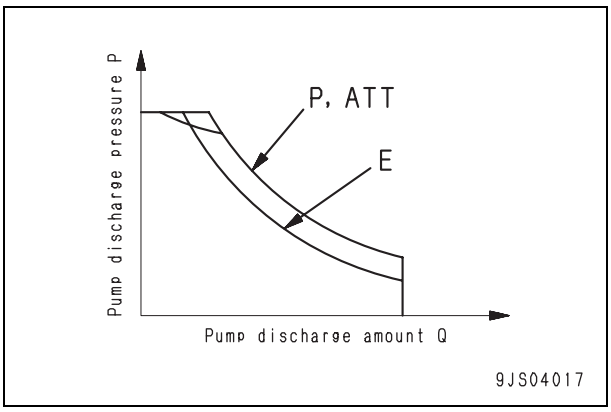
Mode \ Models	PC210/230-8
P and ATT (Work)	107.0 kW/1,800 rpm {143 HP/1,800 rpm}
E	91.9 kW/1,800 rpm {123 HP/1,800 rpm}

Mode \ Models	PC240-8
P and ATT (Work)	120.0 kW/1,850 rpm {161 HP/1,850 rpm}
E	109.8 kW/1,850 rpm {147.3 HP/1,850 rpm}

- In P, E, or ATT mode, engine speed is always controlled so that it is kept around the matching point specified for each mode.
- If the pump load increases and the pressure rises, engine speed (N) lowers. If it happens, the engine speed is increased to around the matching point, allowing the pump controller to decrease pump delivery (Q). On the contrary, the pump load decreases and the pressure lowers, the pump controller continues to increase pump delivery until the engine speed reaches around the matching point.







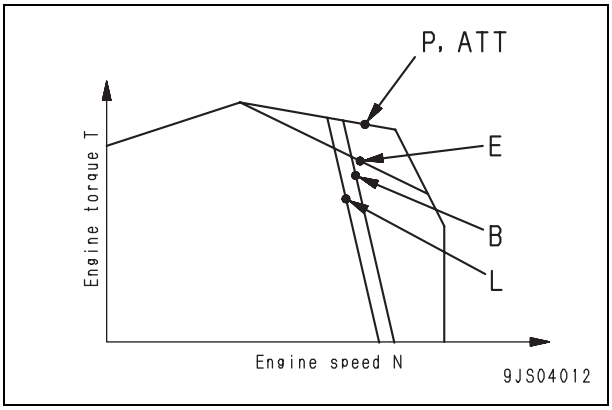
B mode and L mode

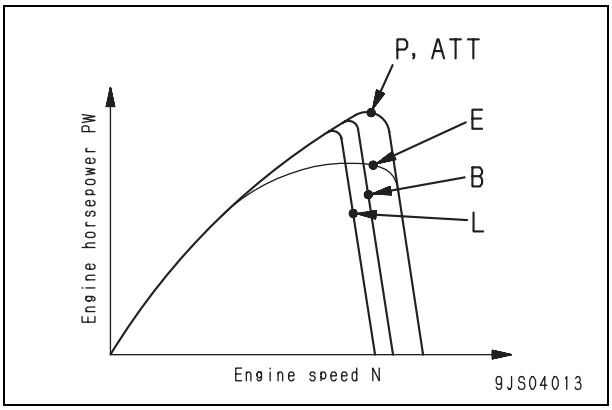
Mode	B	L
Partial output point	75%	70%

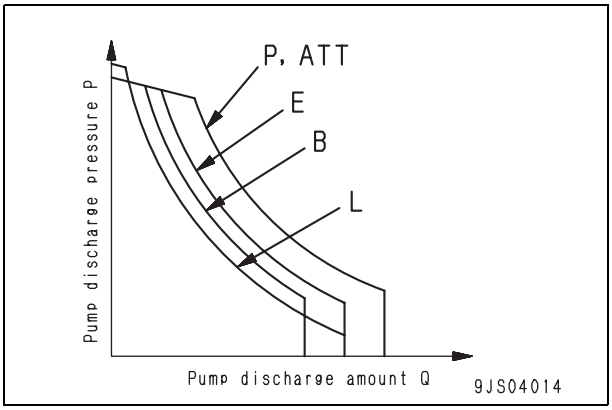
Mode \ Models	PC210/230-8
B	80.9 kW/1,780 rpm {108 HP/1,780 rpm}
L	73.6 kW/1,800 rpm {99 HP/1,800 rpm}

Mode \ Models	PC240-8
B	103 kW/1,750 rpm {138 HP/1,750 rpm}
L	80.9 kW/1,870 rpm {108 HP/1,870 rpm}

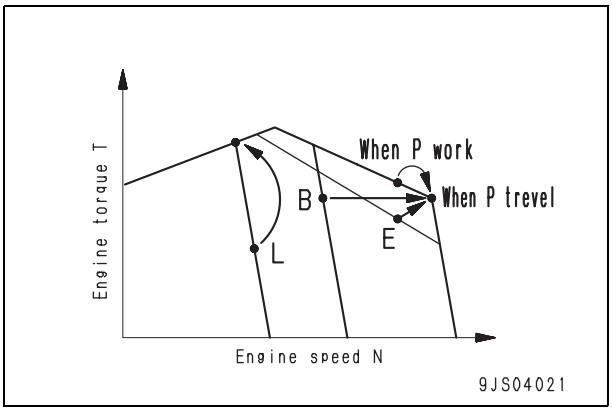
-
- In B or L mode, engine output is controlled to a constant level.
- The controller controls the pump absorption torque to decrease the engine speed while keeping the engine torque at a constant level along the equal engine horsepower curve.
- The controller controls pump delivery (Q) so that the engine torque can be kept at a constant level along the equal engine horsepower curve.

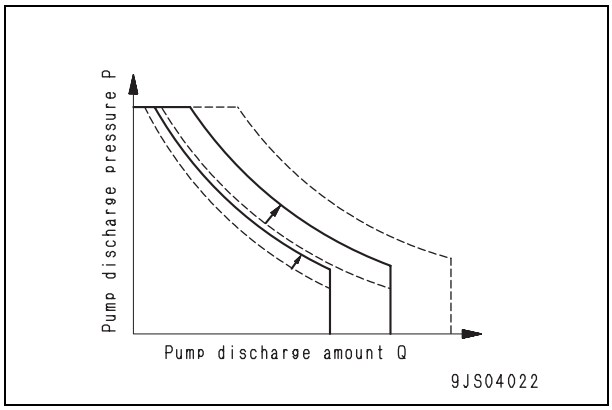




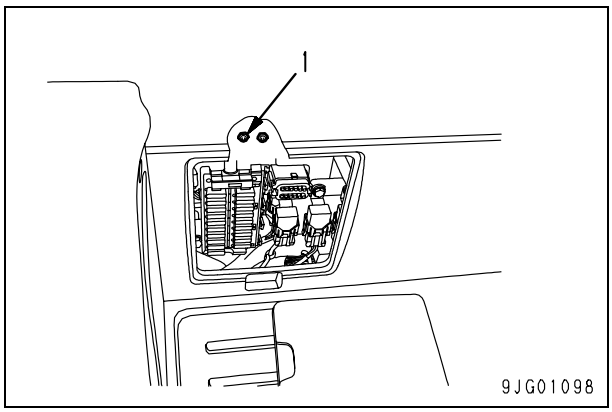


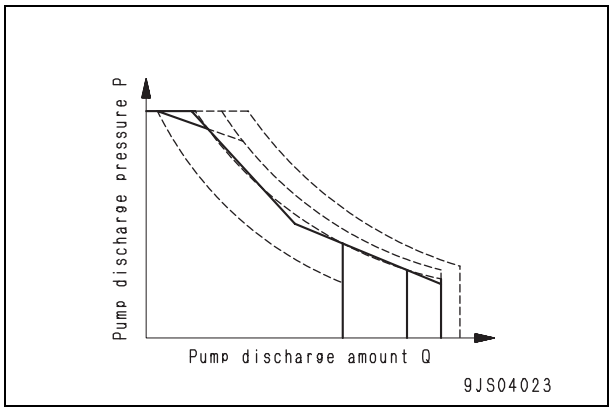
2) Function to control pump during travel
- Traveling the machine in P or ATT mode increases engine speed (N).
- Traveling the machine in E or B mode leaves the working mode unchanged, but raises the pump absorption torque and engine speed (N) to values same as those in P mode.
- If the machine travels in L mode, the working mode and engine speed (N) do not change, but the pump absorption torque is increased.



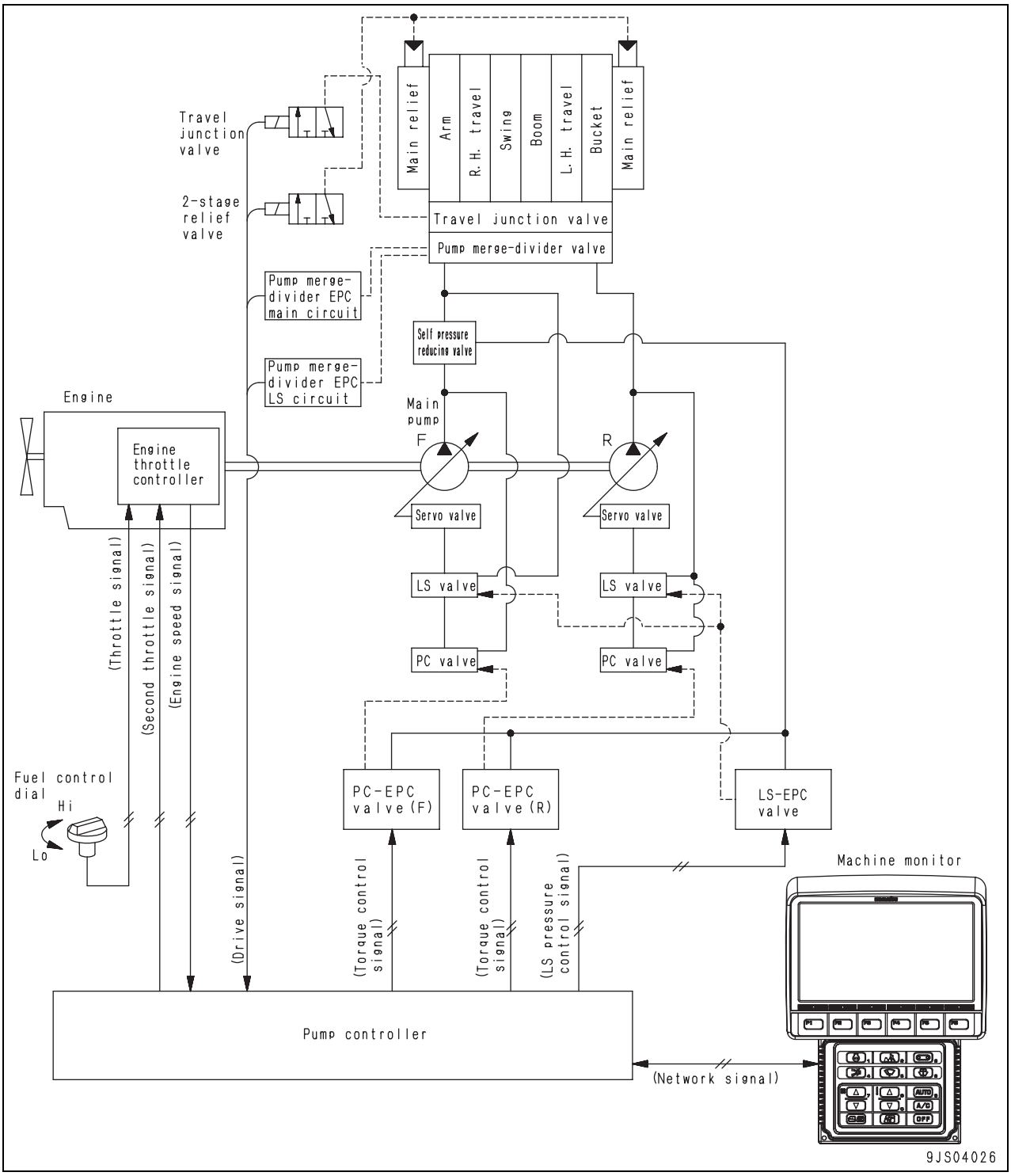


3) Function to control when emergency pump drive switch is turned on
- Even if any abnormality occurs in the controller or sensor, setting emergency pump drive switch (1) to the “ON” position activates the machine with an absorption torque approximately equivalent to that in E mode.
  In this case, a constant current flows from the battery to the EPC valve for PC and therefore, the oil pressure is sensed by only the EPC valve for PC.





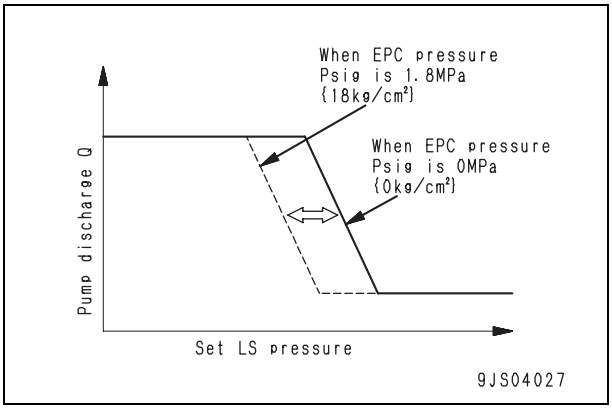
2. Pump and valve control function



Function

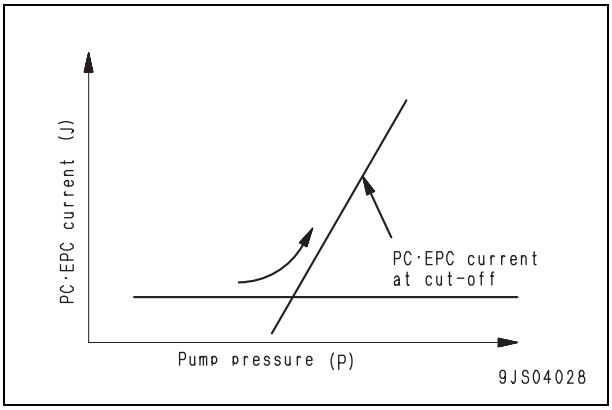
- The machine is matched to various types of work properly with the 2-stage relief function to increase the digging force, etc.

1) LS control function
- Depending on the operation condition of the actuator, this function changes the pressure output from the LS-EPC valve to LS valve to change the change point (LS set differential pressure (DLS)) of the pump discharge in the LS valve.
- By this operation, the start-up time of the pump discharge is optimized and the composite operation and fine control performance is improved.



2) Cut-off function
- This function increases PC-EPC current (J) to reduce the flow rate in the relief state, improving fuel consumption.

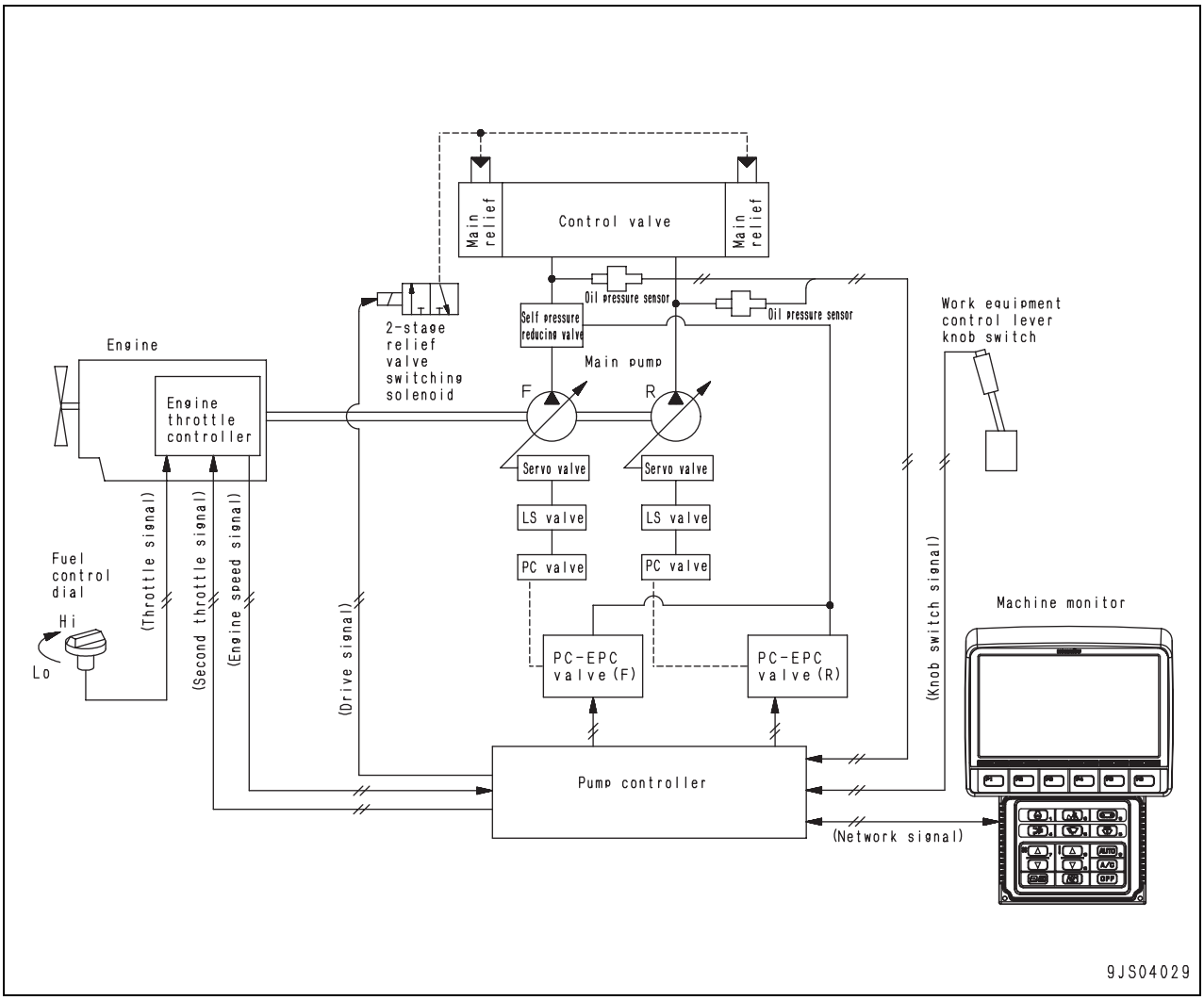
Operating condition for turning on cut-off function
When the average value of the front and rear pressure sensors is above 27.9 MPa {285 kg/cm^2} with the power maximizing function off. The cut-off function does not work, however, while the machine is travelling in A mode, swing lock switch is in the “ON” position.



3) 2-stage relief function
- The relief pressure in the normal work is 34.8 MPa {355 kg/cm^2}. If the 2-stage relief function is turned on, however, the relief pressure rises to about 37.2 MPa {380 kg/cm^2}. By this operation, the hydraulic force is increased further.

Operating condition for turning on 2-stage relief function	Relief pressure
• During travel • When swing lock switch is turned to the ON position • When boom is lowered • When power maximizing function is turned on • When L mode is operated	34.8 MPa {355 kg/cm^2} ↓ 37.2 MPa {380 kg/cm^2}

3. Power maximizing function



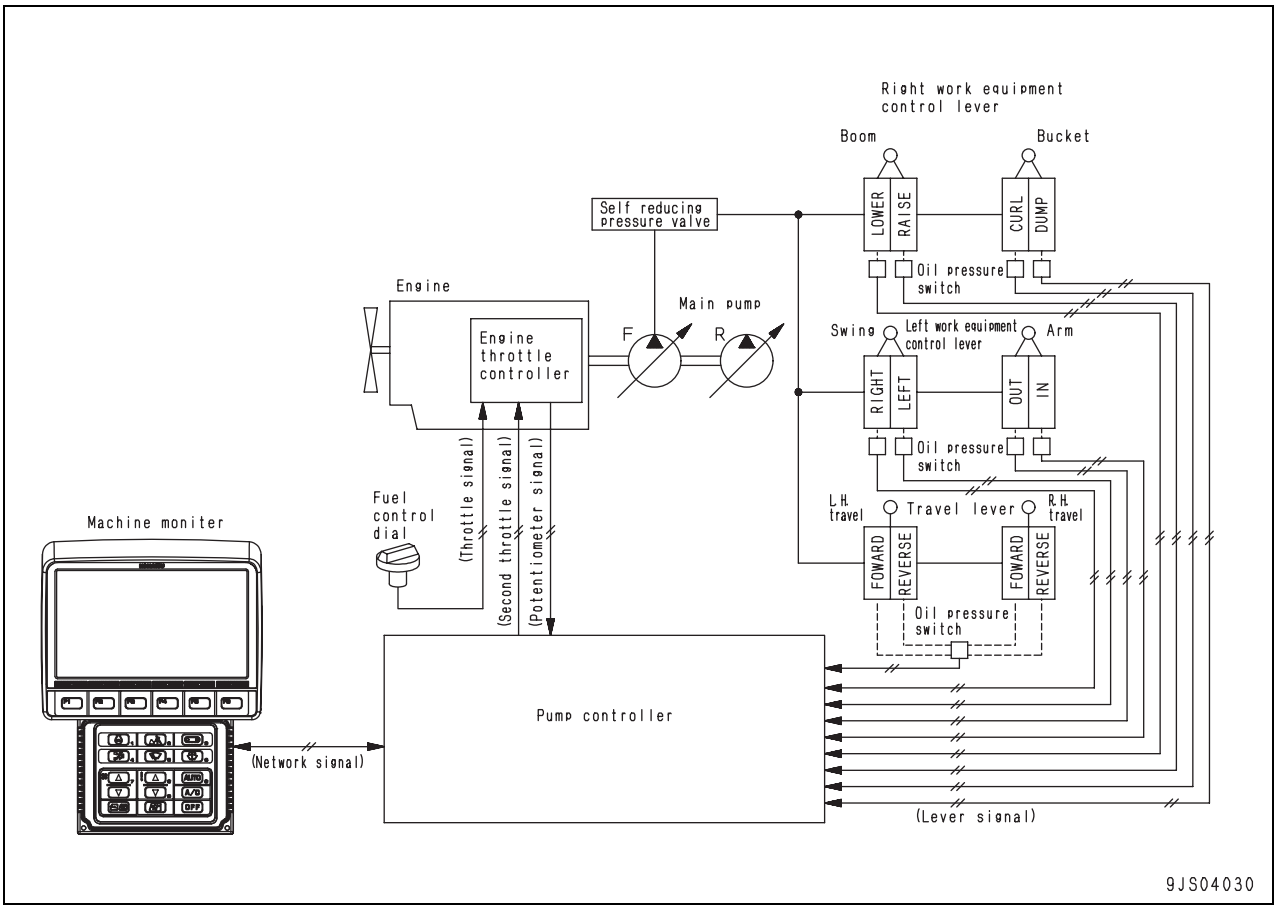
Function

- The power maximizing function allows the operator to increases power for a certain time by operating the left knob switch.
- This function is used to increase digging force for a certain period of time (e.g., when digging up a large rock).
- Pressing the L.H. knob switch in P, E, or ATT mode increases a hydraulic force by approximately 7% and horsepower by approximately 3%, increasing a digging force.
  At this time, each function is automatically set as shown below.

Function	Setting
Engine and pump control	Matching at rated output point
2-stage relief function	34.8 MPa {355 kg/cm^2} ↓ 37.2 MPa {380 kg/cm^2}
Software cut-off function	Cancel

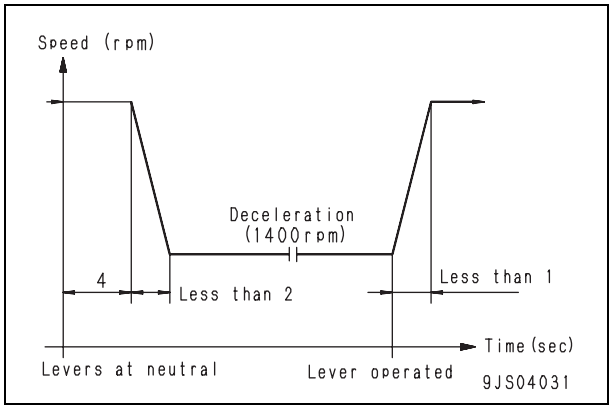
- These settings are automatically reset after 8.5 seconds when the switch is pressed.

4. Auto-deceleration function



Function

- The auto-deceleration function automatically reduces the engine speed to its medium speed range when the all control levers are set in NEUTRAL while waiting for a dump truck or work to reduce the fuel consumption and noise.
- If any lever is operated, the engine speed instantly returns to the speed set with the fuel control dial.



Operation

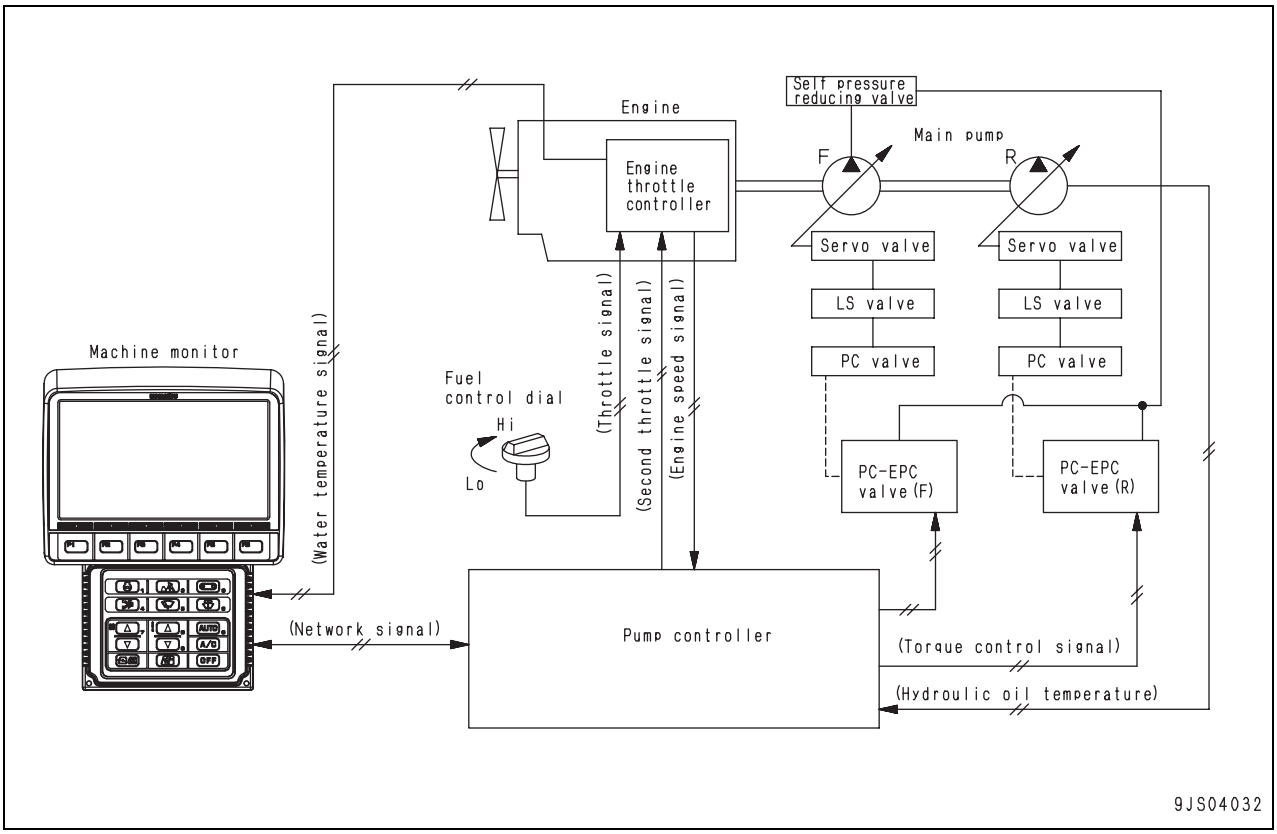
When control levers are set in neutral

- If all the control levers are kept to NEUTRAL for 4 sec. during operation at a engine speed above a decelerator operation level (approximately 1,400 rpm), this function lowers the engine speed to the deceleration operation level (approximately 1,400 rpm) and keeps it until you operate any lever.

When any control lever is operated

- If you operate any control lever while the engine speed is kept at the deceleration operation level, the engine speed instantly rises to the level set with the fuel control dial.

5. Auto-warm-up and overheat prevention function



Function

- The engine automatic warm-up function increases the engine speed to warm up the engine if coolant temperature is too low after the engine starts.

  The overheat prevention function reduces the pump load when coolant or hydraulic oil temperature is too high during operation to protect the engine from overheating.

1) Auto-warm-up function

- After the engine is started, if the engine coolant temperature is low, the engine speed is raised automatically to warm up the engine.

Operating condition (All of following conditions)		→	Operated
Coolant temperature: Below 30°C Engine speed: Max. 1,200 rpm			Engine speed: 1,200 rpm

↓

Resetting condition (Any one of following conditions)		→	Reset
Auto	Coolant temperature: Min. 30°C Auto-warm-up operation time: Min. 10 minutes		Engine speed: Any level
Manual	Fuel control dial: Kept at 70% of full level or above for 3 sec. or longer		

2) Overheat prevention function

- This function reduces the pump load and engine speed when coolant or hydraulic oil temperature is too high to protect the engine and hydraulic components from overheating.
- This function starts when coolant temperature reaches 100°C or hydraulic oil temperature reaches 95°C.

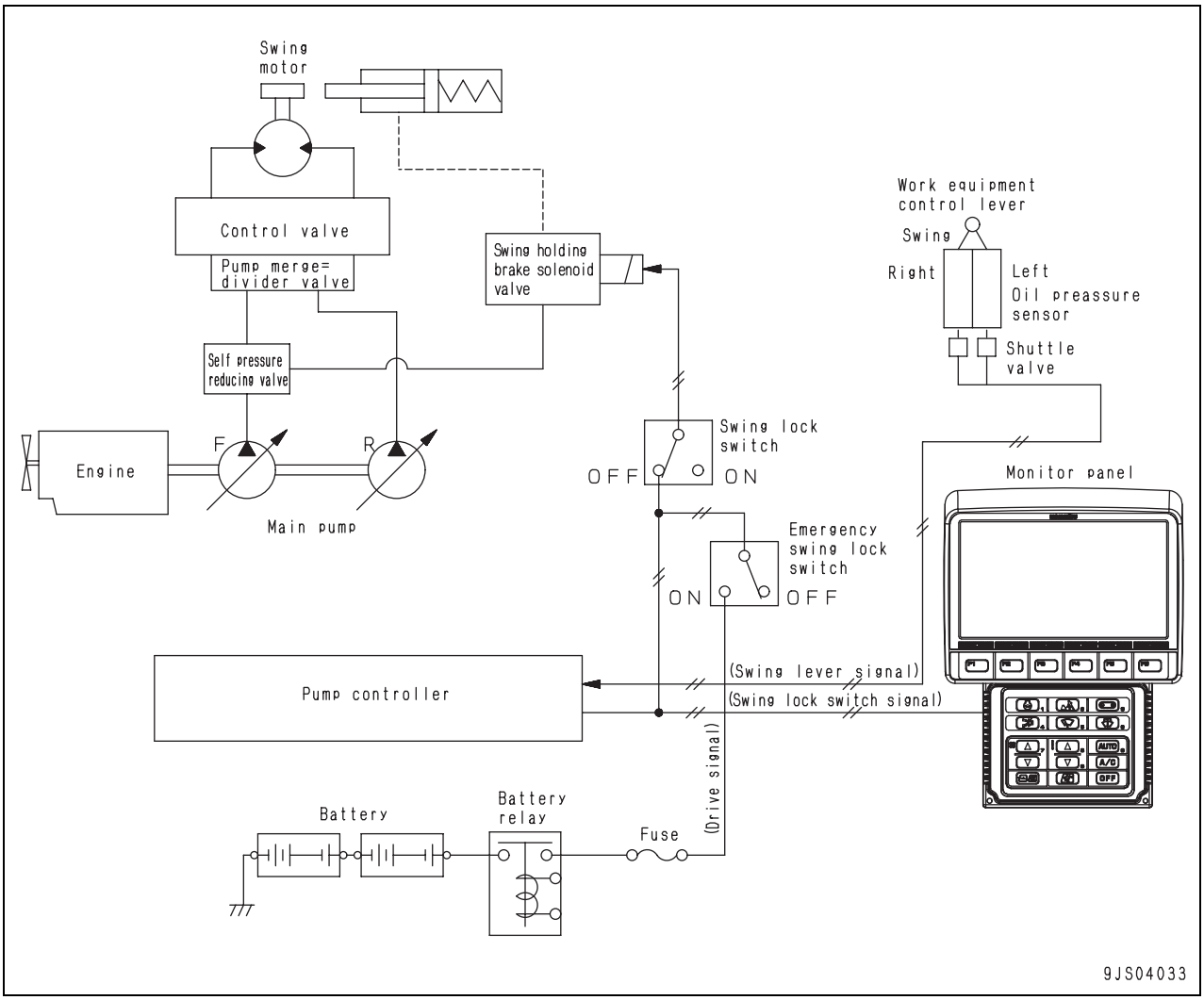
Operating condition	→	Operation/Remedy	→	Resetting condition
Coolant temperature: Min. 105°C or Hydraulic oil temperature: Min. 105°C		Working mode: Any mode Engine speed: Low idle Monitor alarm lamp: Lights up Alarm buzzer: Sounds		Coolant temperature, hydraulic oil temperature: Below 105°C Fuel control dial: Return to low idle position once. Under above condition, controller is set to condition before operation of function. (Manual reset)

Operating condition	→	Operation/Remedy	→	Resetting condition
Coolant temperature: Min. 102°C or Hydraulic oil temperature: Min. 102°		Working mode: P, E, B, or L mode Engine speed: Kept as is. Monitor alarm lamp: Lights up Reduce pump delivery.		Coolant temperature, hydraulic oil temperature: Below 102°C Under above condition, controller is set to condition before operation of function. (Automatic reset)

Operating condition	→	Operation/Remedy	→	Resetting condition
Coolant temperature: Min. 100°C or Hydraulic oil temperature: Min. 100°C		Working mode: P or E mode Engine speed: Kept as is. Reduce pump delivery.		Coolant temperature, hydraulic oil temperature: Below 100°C Under above condition, controller is set to condition before operation of function. (Automatic reset)

Operating condition	→	Operation/Remedy	→	Resetting condition
Hydraulic oil temperature: Min. 95°C		Working mode: Travel Engine speed: Kept as is. Lower travel speed.		Hydraulic oil temperature: Below 95°C Under above condition, controller is set to condition before operation of function. (Automatic reset)

6. Swing control function



Function

The swing lock and swing holding brake function are provided as a swing control function.

1) Swing lock and swing holding brake function

- The swing lock function (manual) is used to lock machine from swinging at any position. The swing holding brake function (automatic) is used to prevent hydraulic drift after the machine stops swinging.
- Operation of swing lock switch and swing lock/ holding brake

Lock switch	Lock lamp	Function	Operation
OFF	OFF	Swing holding brake	If swing lever is set in neutral, swing brake operates in about 5 sec. If swing lever is operated, brake is released and machine can swing freely.
ON	ON	Swing lock	Swing lock operates and machine is locked from swinging. Even if swing lever is operated, swing lock is not reset and machine does not swing.

Swing holding brake cancel switch

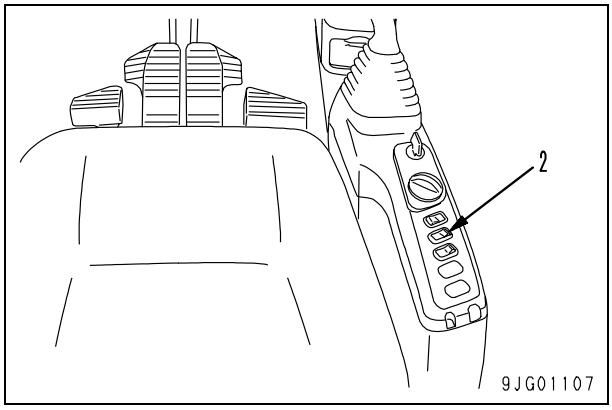
- If the controller, etc. has a problem, the swing holding brake does not work normally, and the machine cannot swing, the swing lock can be reset with the swing holding brake cancel switch.

Swing holding brake cancel switch	ON (when controller has trouble)		OFF (when controller is normaly)	
Swing lock switch	ON	OFF	ON	OFF
Swing brake	Swing lock is turned on.	Swing lock is canceled.	Swing lock is turned on.	Swing holding brake is turned on.

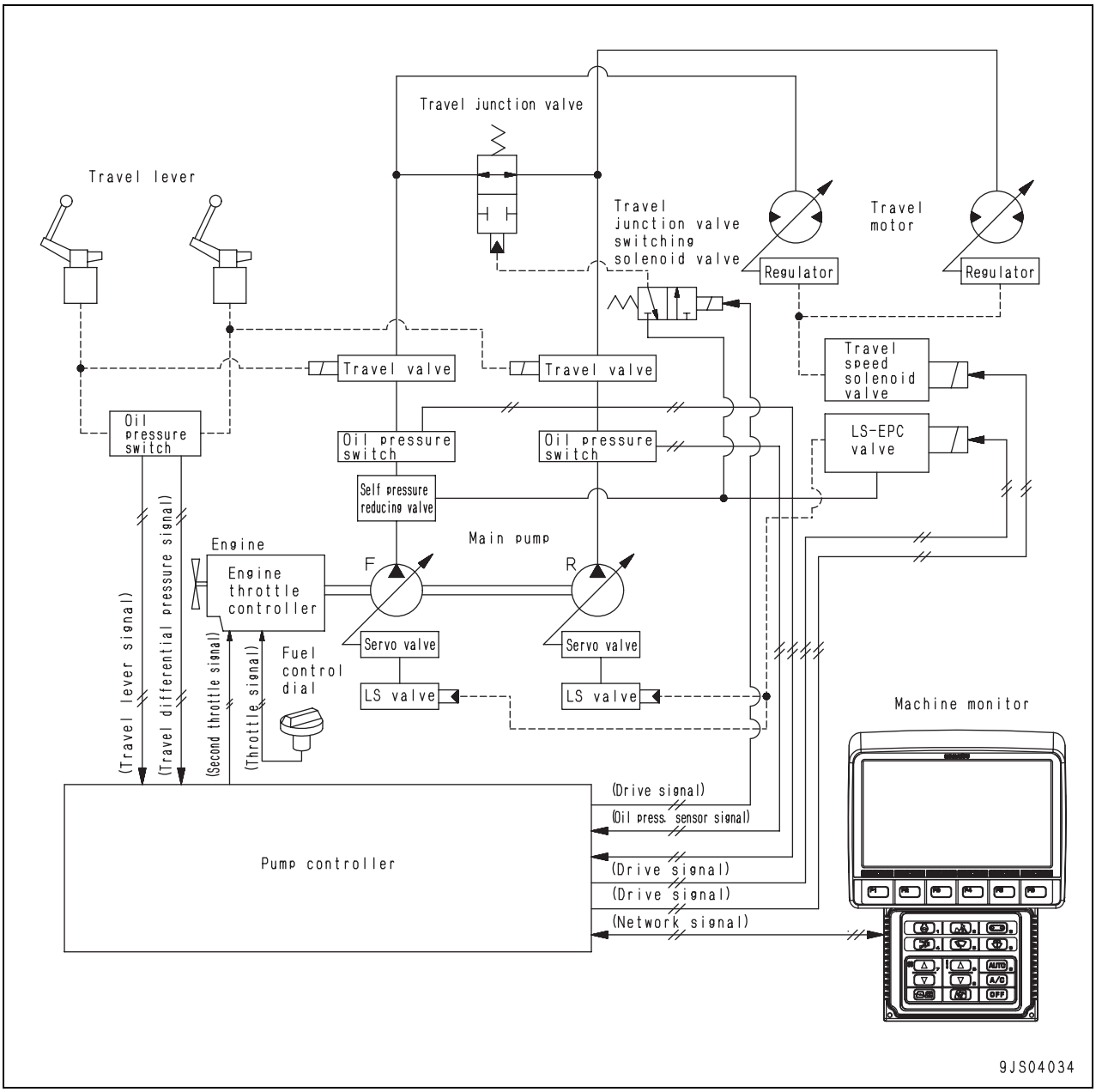
- Even if the swing holding brake cancel switch is turned on, if the swing lock switch is turned on, the swing brake is not released.
- If the swing lock is reset, only the hydraulic brake is applied by the safety valve. Note that if swinging is stopped on a slope, the upper structure may swing by its gravity.

2) Quick hydraulic oil warm-up function when swing lock switch is turned on

- If swing lock switch (2) is turned on, the pump cut-off function is cancelled and the relief pressure rises from 34.8 MPa {355 kg/cm^2} to 37.2 MPa {380 kg/cm^2}.
  If the work equipment is relieved under this condition, the hydraulic oil temperature rises quickly and the warm-up time can be shortened.



7. Travel control function



Function

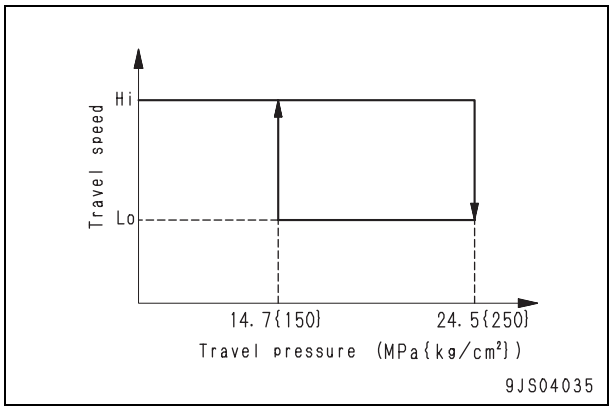
- The machine is provided with a function that ensures travel performance best fit to the type of work and jobsite by controlling pumps during travel or allowing operator to change travel speed automatically or manually.

1) Function to control pump during travel

- For details, see Engine and pump composite control function.

2) Travel speed change function

1] Manual change with travel speed selector switch
Switching the travel speed selector switch from Lo to Mi and Hi causes the pump controller to control the pump capacity and motor capacity at each gear speed as shown below, switching the travel speed.

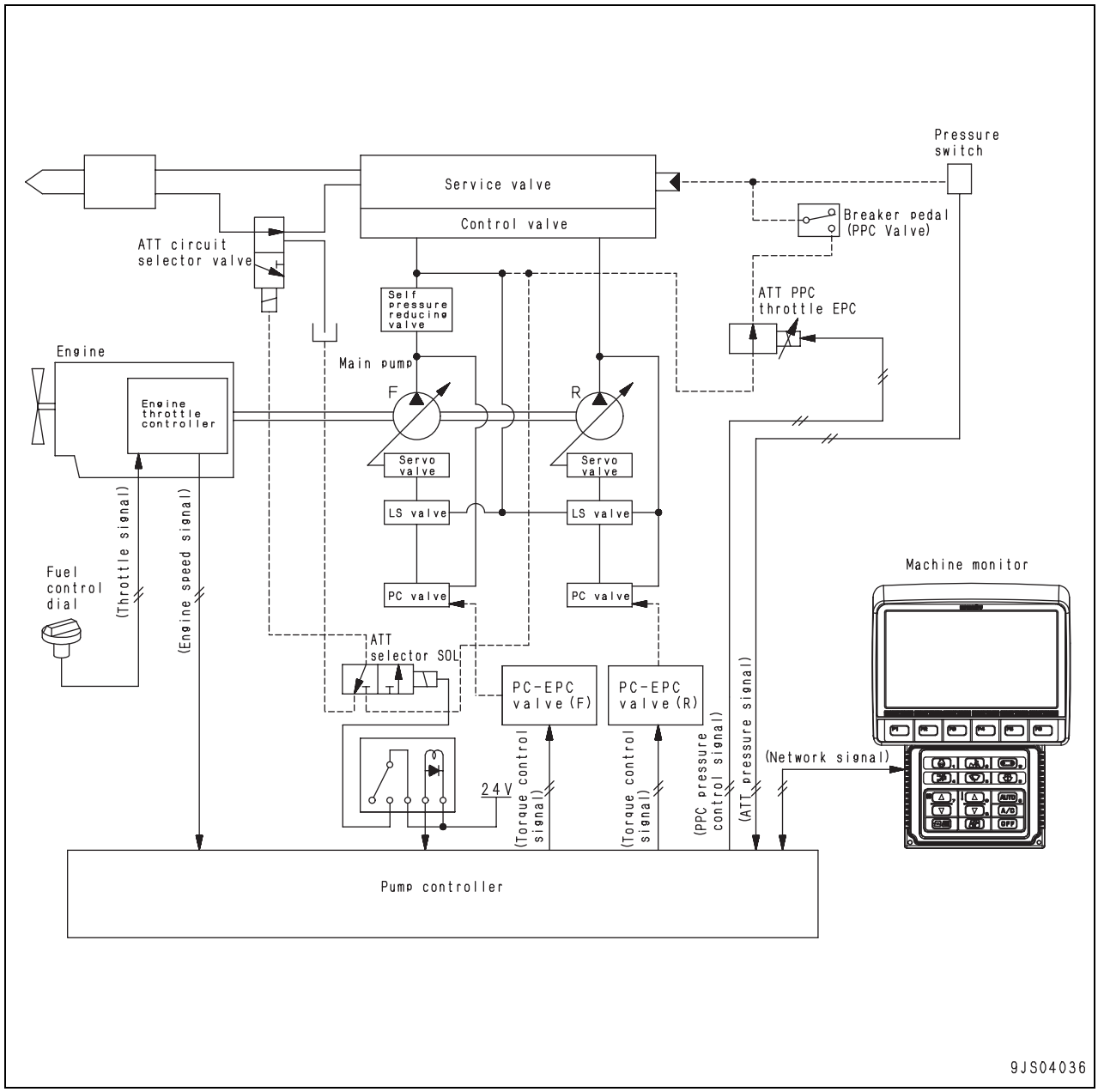


Travel speed switch	Lo (Low speed)	Mi (Medium speed)	Hi (High speed)
Pump capacity (%)	80	90	100
Motor capacity	Max.	Max.	Min.
Travel speed (km/h)	3.0	4.1	5.5

2] Automatic change by engine speed
If you adjust the engine speed to 1,500 rpm or less with the fuel control dial,
- The travel speed does not switch to Hi when the machine is traveling in Mi.
- The travel speed automatically changes to Mi when the machine is travelling in Hi.

3] Automatic change by pump discharge pressure
If the travel pressure is kept to 24.5 MPa {250 kg/cm^2} at least 0.5 sec. due to increased load during traveling in Hi on an uphill, the travel motor capacity automatically switches to the medium speed (Mi) (the travel speed switch stays at Hi).
If the machine starts traveling on level ground or downhill during operation of the above mentioned function and the travel pressure goes below 14.7 MPa {150 kg/cm^2} and continues such the condition at least 0.5 sec., the travel motor capacity will automatically change, switching the travel speed switch to Hi again.

8. Attachment flow control circuit selector function (if equipped)



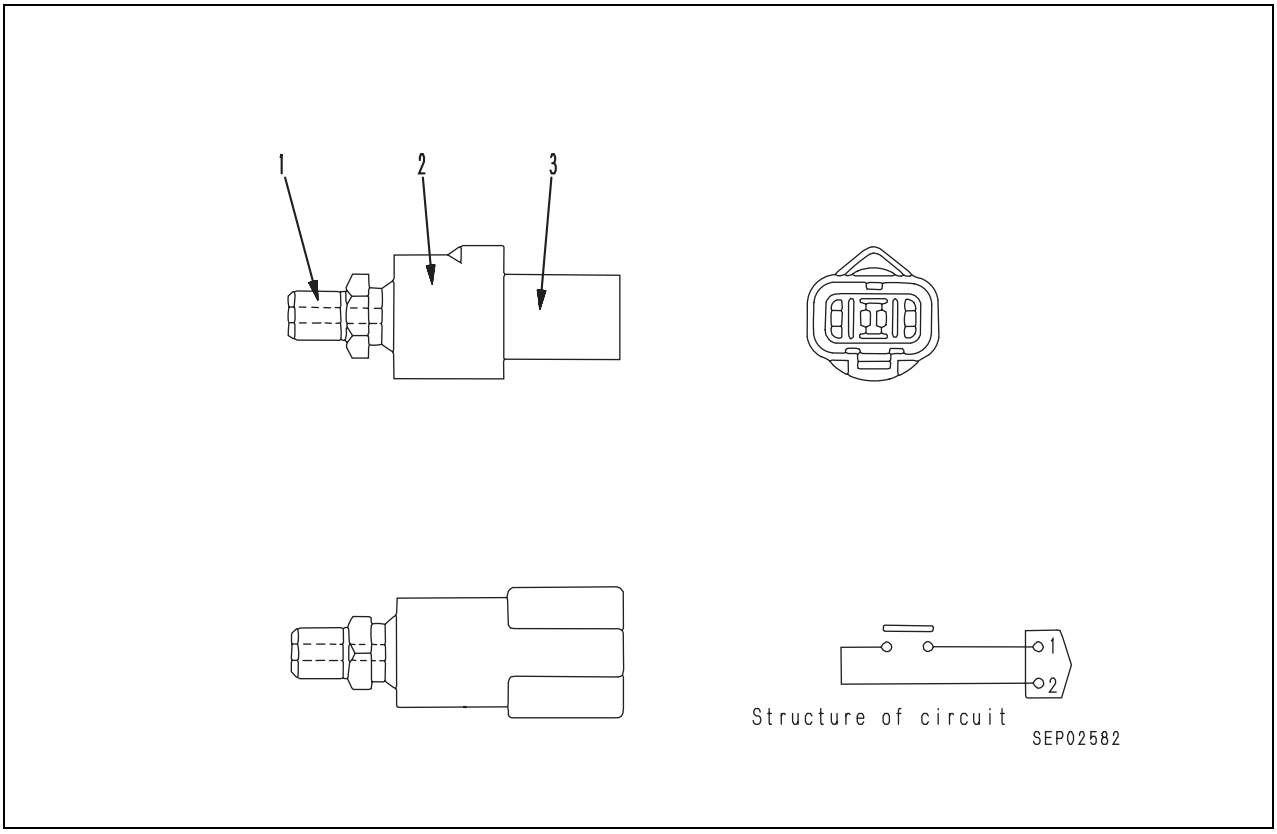
Function

- This function is available only with the attachment specification.
- The function acts as follows according to the flow command and working mode from the monitor.
  1) It throttles the attachment PPC pressure and controls the flow when the pedal is depressed fully.
  2) Attachment operation switches depending on the working mode as shown below.

Working mode	Attachment operation
ATT	Double-acting
B	Single-acting

9. System component parts

1) PPC oil pressure switch



1. Plug
2. Switch
3. Connector

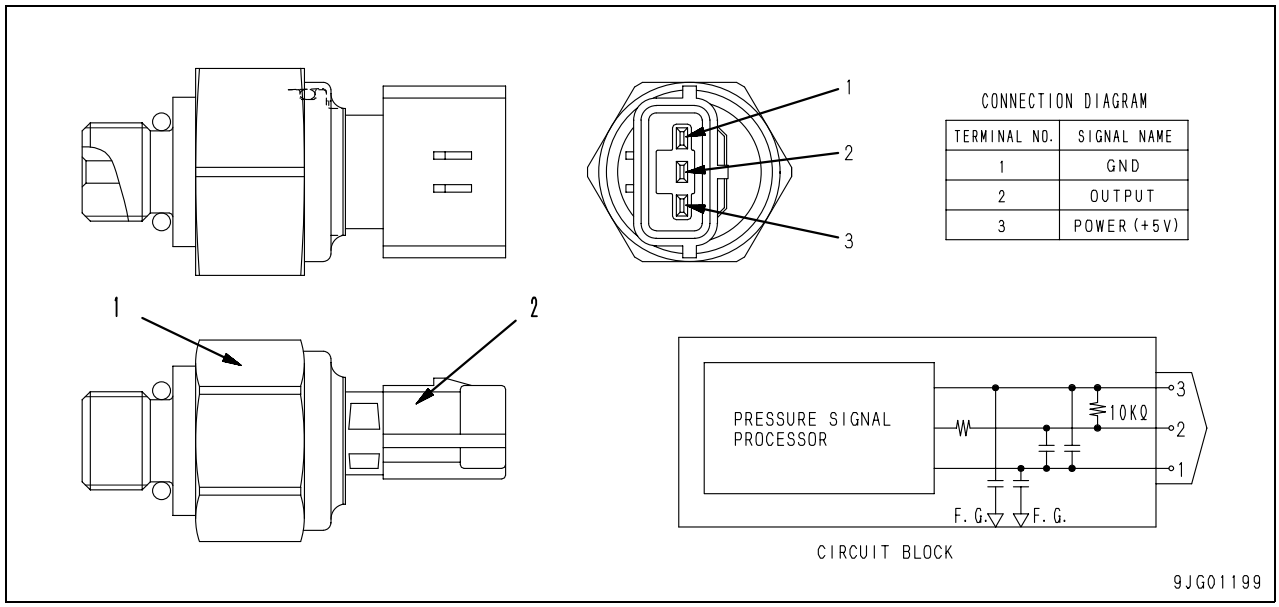
Specifications

Type of contacts: Normally open contacts
Operating (ON) pressure:
0.5 ± 0.1 MPa {5.0 ± 1.0 kg/cm^2}
Resetting (OFF) pressure:
0.3 ± 0.05 MPa {3.0 ± 0.5 kg/cm^2}

Function

- The junction block has 2 PPC oil pressure switches.
- This sensor detects the operating condition of each actuator by the PPC pressure and transmit it to the pump controller.

2) Oil pressure sensor



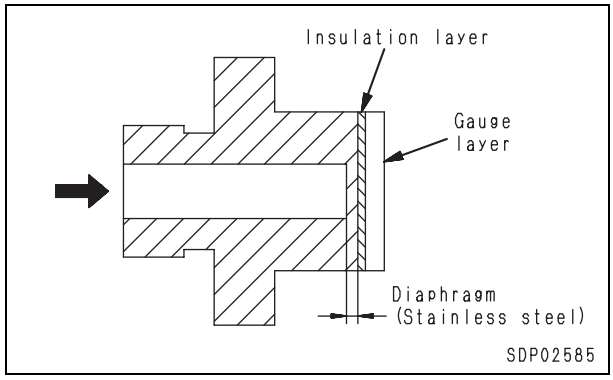
1. Sensor
2. Connector

Function

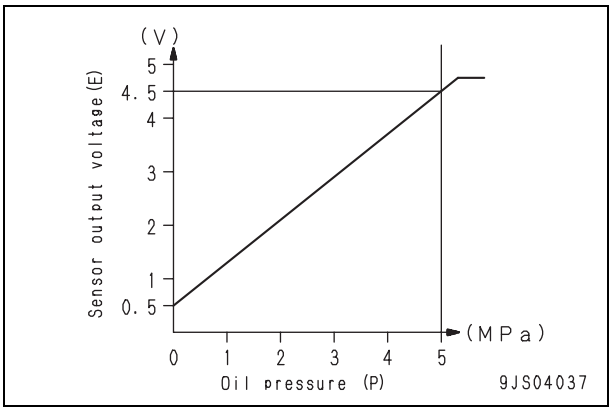
- The junction block has 6 PPC oil pressure sensor.
- This sensor detects the operating condition of each actuator by the PPC pressure and transmit it to the pump controller.

Operation

- The oil pressure is applied to the diaphragm of the oil pressure sensor from the pressure intake part, the diaphragm is deformed.
- The deformation in the diaphragm causes the resistance of the gauge to change. This causes a change in the output voltage, which is transmitted to the amplifier (voltage amplifier).

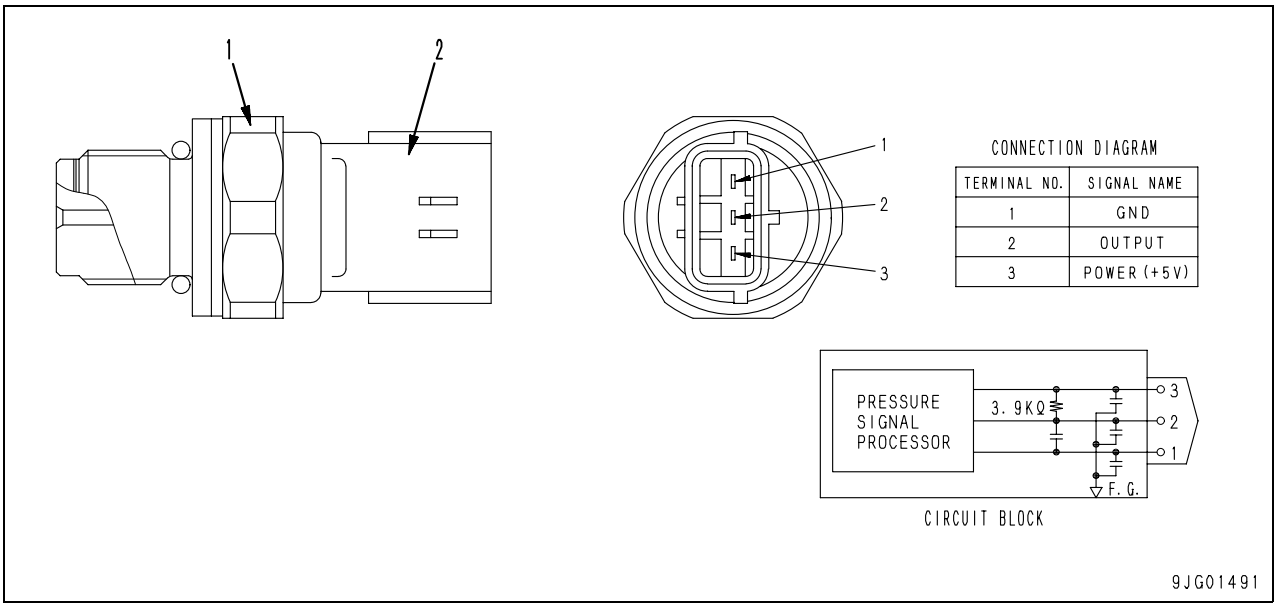


- The relationship between the pressure applied to sensors (P) and output voltage (E) is shown in the figure below.



- The amplifier magnifies output voltage (E) and transmits it to the pump controller.

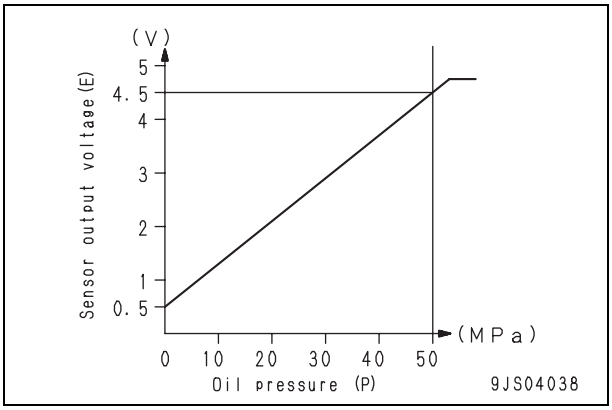
3) Pump pressure sensor



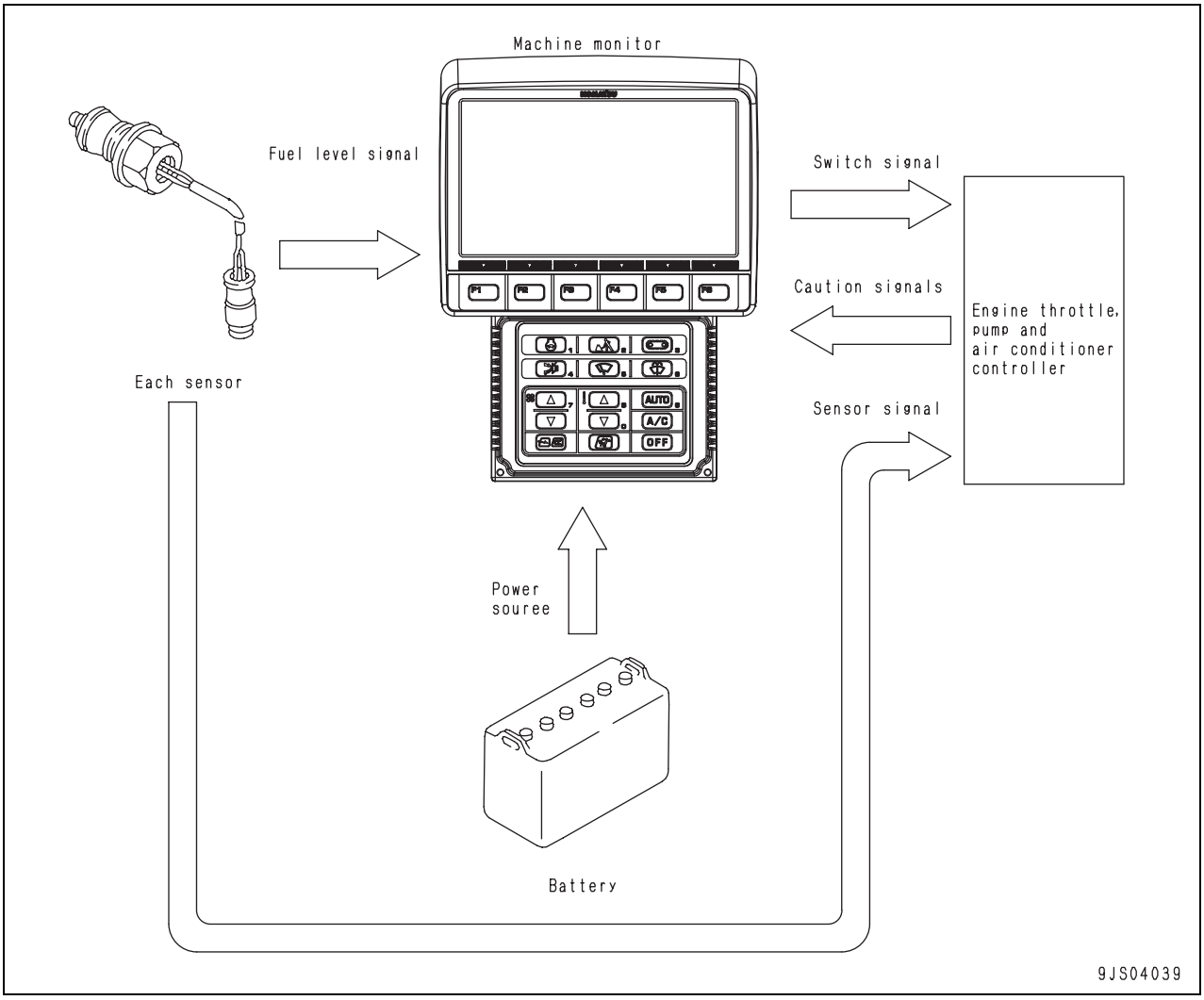
1. Sensor
2. Connector

Operation

- The relationship between the pressure applied to sensors (P) and output voltage (E) is shown in the figure below.

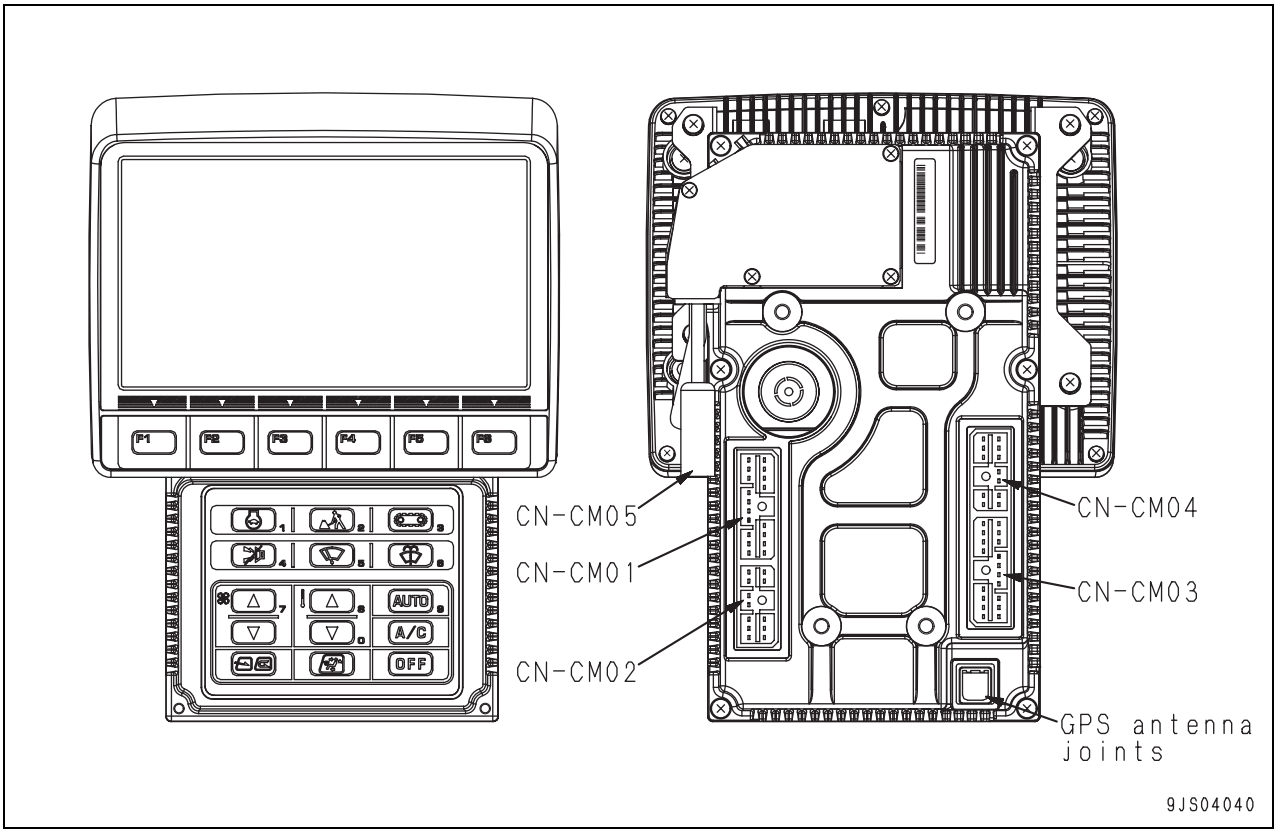


Monitor system



- The monitor system notifies the operator of machine status. It monitors the condition of the machine with the sensors mounted on various parts of the machine, processes and immediately displays the obtained information on the panel.
  Contents displayed on the panel are largely divided into the following.
  1. Alarm when an abnormality occurs on the machine
  2. Machine condition (Temperature of coolant and hydraulic oil, fuel level, etc.)
- The monitor panel also has various mode selector switches and functions to operate the machine control system.
  Also, the machine monitor is provided with various mode selector switches that function as the operation unit of the machine control system.

Machine monitor



Outline

- The machine monitor has the functions to display various items and the functions to select modes and electric parts.
- The machine monitor has a CPU (Central Processing Unit) in it to process, display, and output the information.
- The monitor display employs an LCD (Liquid Crystal Display). The switches are flat sheet switches.

Input and output signals

CN-CM01

Pin No.	Signal name	Input/ output
1	Battery power (+24V constantly)	Input
2	Battery power (+24V constantly)	Input
3	Battery power GND	—
4	Battery power GND	—
5	Wake-up	Input/ Output
6	Relay output	Output
7	Chassis signal GND	—
8	NC(*)	—
9	Fuel level	Input
10	NC(*)	—
11	Charge amount	Input
12	Chassis analog signal GND	—
13	Light switch	Input
14	Key switch (ACC)	Input
15	Key switch (C)	Input
16	Preheating	Input
17	NC(*)	—
18	NC(*)	—

*: Never connect to NC or malfunctions or failures will occur.

CN-CM02

Pin No.	Signal name	Input/ output
1	NC(*)	—
2	Engine oil level sensor	Input
3	Coolant level sensor	Input
4	Air cleaner clogging sensor	Input
5	Swing lock	Input
6	NC(*)	Input
7	Chassis signal GND	—
8	CAN terminating resistance	—
9	CAN_H	Input/ Output
10	CAN_L	Input/ Output
11	NC(*)	Input/ Output
12	NC(*)	Input/ Output

*: Never connect to NC or malfunctions or failures will occur.

CN-CM03

Pin No.	Signal name	Input/ output
1	RS232C CD for communication terminal	Input
2	RS232C RXD for communication terminal	Input
3	RS232C SG for communication terminal	—
4	Signal GND for communication terminal control	—
5	Communication terminal selection signal	Input
6	RS232C RTS for communication terminal	Output
7	RS232C TXD for communication terminal	Output
8	RS232C DTR for communication terminal	Output
9	RS232C DTR for communication terminal	Input
10	RS232C CTS for communication terminal	Input
11	RS232C RI for communication terminal	Input
12	Power GND for communication terminal	—
13	Input CH1 for communication terminal status	Input
14	Output for communication terminal power control	Output
15	Output CH1 for communication terminal control	Output
16	Output CH2 for communication terminal control	Output
17	Input CH2 for communication terminal status	Input
18	Electric power supply for communication terminal	Output

CN-CM04

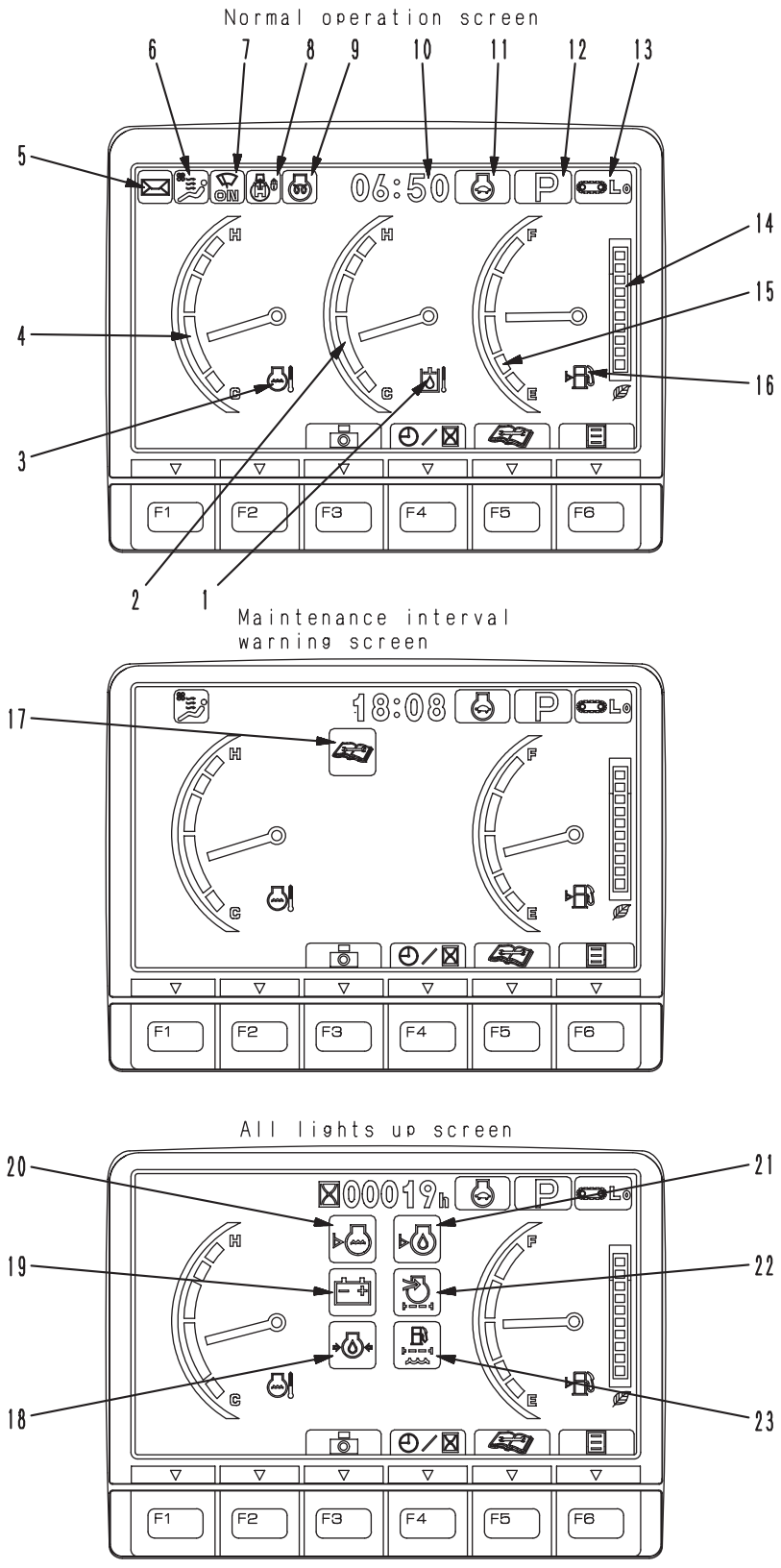
Pin No.	Signal name	Input/ output
1	NC(*)	—
2	NC(*)	—
3	NC(*)	—
4	NC(*)	—
5	NC(*)	—
6	NC(*)	—
7	NC(*)	—
8	NC(*)	—
9	NC(*)	—
10	NC(*)	—
11	NC(*)	—
12	NC(*)	—

*: Never connect to NC or malfunctions or failures will occur.

CN-CM05

Pin No.	Signal name	Input/ output
1	Electric power supply for camera	Output
2	Camera NTSC signal input 1	Input
3	Camera NTSC signal input 2	Input
4	Camera NTSC signal input 3	Input
5	Electric power supply GND for camera	—
6	Camera signal GND1	—
7	Camera signal GND2	—
8	Camera signal GND3	—

Monitor control, display portion

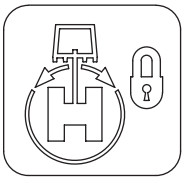
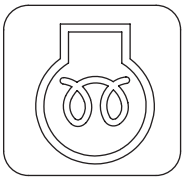
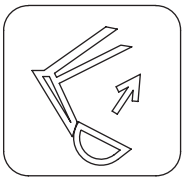


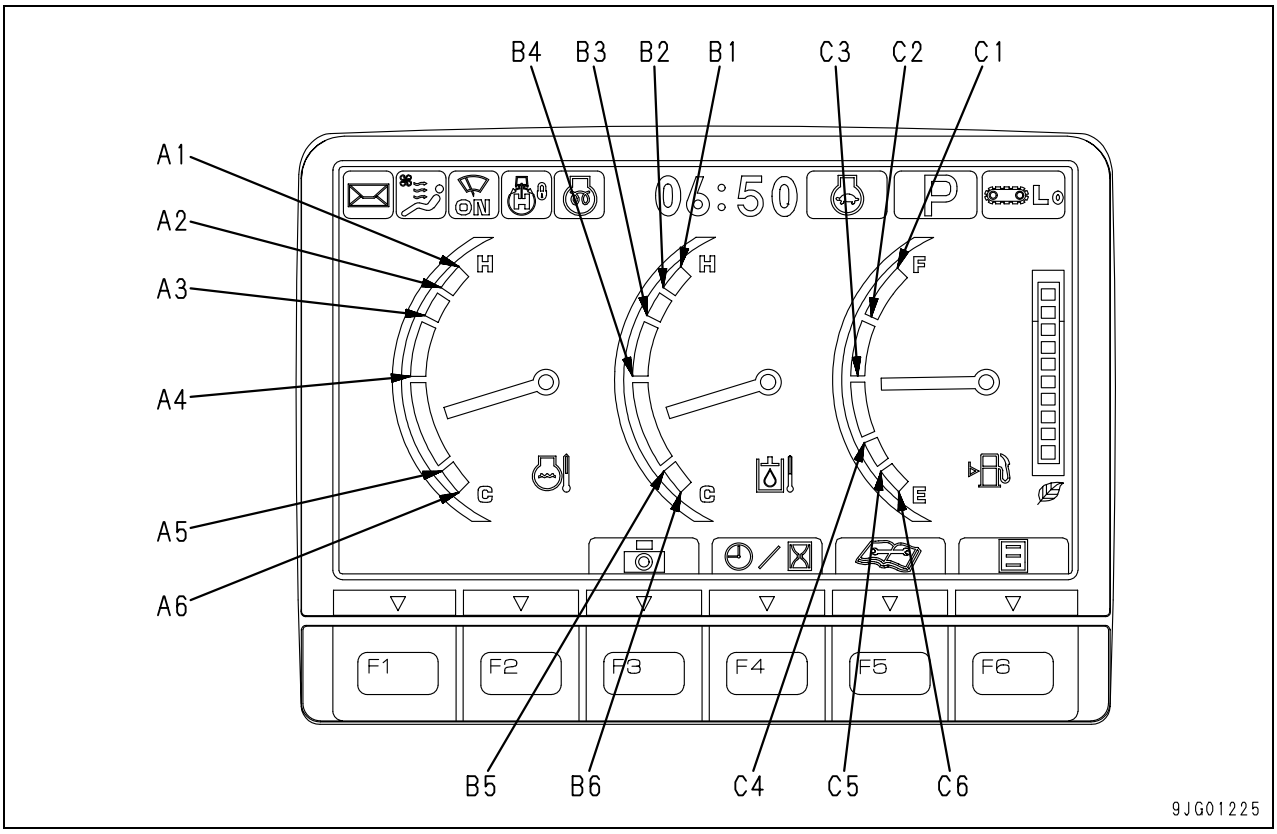
1. Hydraulic oil temperature monitor
2. Hydraulic oil temperature gauge
3. Engine coolant temperature monitor
4. Engine coolant temperature gauge
5. KOMTRAX message monitor
6. Air conditioner monitor
7. Wiper monitor
8. Swing lock monitor
9. Engine pre-heating monitor/power maximizing monitor
10. Time/service meter
11. Auto-deceleration monitor
12. Working mode monitor
13. Travel speed monitor
14. ECO indicator
15. Fuel gauge
16. Fuel level monitor
17. Maintenance interval monitor
18. Engine oil pressure monitor
19. Charge level monitor
20. Radiator coolant level monitor
21. Engine oil level monitor
22. Air cleaner clogging monitor
23. Water separator monitor

Precautions on the machine monitor display

- The liquid crystal display panel may have black spots (which do not light up) or bright spots (which stay on).
  Products having 10 or less black or bright spots conform the product specification; such the condition is quite normal.
- Battery voltage may suddenly drop at engine-start due to ambient temperature or the condition of the battery. The machine monitor display may temporarily disappear if it happens; it is quite normal.
- Continuous operation of the machine monitor may display blue bright spots on the screen having a black background; it is quite normal.
  The screen normally displayed on the monitor has a blue or white background. For this reason, blue spots will not cause any problem (since the liquid crystal lights up red, blue, and green spots when displaying white).

Monitor items and display

<table>
<tr><th>Symbol</th><th>Display item</th><th>Display method</th></tr>
<tr><td> 
9JG01222</td><td>Swing lock</td><td>
<table>
<tr><th>Swing lock switch</th><th>Swing holding brake release switch</th><th>Display of symbol</th></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>ON</td><td>OFF</td><td>ON</td></tr>
<tr><td>OFF</td><td>ON</td><td>Flashes</td></tr>
<tr><td>ON</td><td>ON</td><td>Flashes</td></tr>
</table>
</td></tr>
<tr><td> 
9JG01223</td><td>Preheating</td><td>
<table>
<tr><td>Automatic preheating</td><td colspan="2">Preheater operates at low temperature and symbol keeps lighting up for up to about 30 seconds and then goes off after engine starts.</td></tr>
<tr><td rowspan="2">Manual preheating</td><td>Time after setting</td><td>Display of symbol</td></tr>
<tr><td>0 – 30 sec
30 – 40 sec
After 40 sec</td><td>ON
Flashes
OFF</td></tr>
</table>
</td></tr>
<tr><td> 
9JG01224</td><td>Power Max.</td><td>
<table>
<tr><th>Power Max. switch</th><th>Display of symbol</th></tr>
<tr><td>While pressed</td><td>Keeps lighting up.
Goes off after about 9 sec. if switch is kept pressed.</td></tr>
<tr><td>While released</td><td>Kept turned OFF.</td></tr>
</table>
</td></tr>
<tr><td></td><td>Engine coolant temperature</td><td rowspan="3">See gauge display on next page.</td></tr>
<tr><td></td><td>Hydraulic oil temperature</td></tr>
<tr><td></td><td>Fuel level</td></tr>
</table>

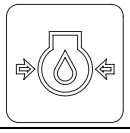
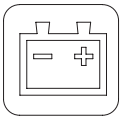
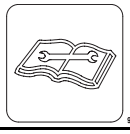


The gauge pointer disappears when information on coolant temperature or hydraulic oil temperature cannot be obtained due to disconnection of CAN.

Gauge	Range	Temperature or volume	Indicator	Buzzer sound
Engine coolant temperature (°C)	A1	105	Red	○
	A2	102	Red	
	A3	100	Off	
	A4	85	Off	
	A5	60	Off	
	A6	30	White	
Hydraulic oil temperature (°C)	B1	105	Red	
	B2	102	Red	
	B3	100	Off	
	B4	85	Off	
	B5	40	Off	
	B6	20	White	
Fuel level (ℓ)	C1	289	Off	
	C2	244.5	Off	
	C3	200	Off	
	C4	100	Off	
	C5	60	Off	
	C6	41	Red	

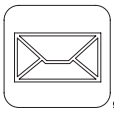
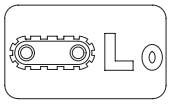
Checks before starting (all symbols light up), when maintenance interval is exceeded.

If the checks before starting or maintenance interval is exceeded items light up, the display of the hydraulic oil temperature gauge and the hydraulic oil temperature monitor disappear and the following symbols are displayed.

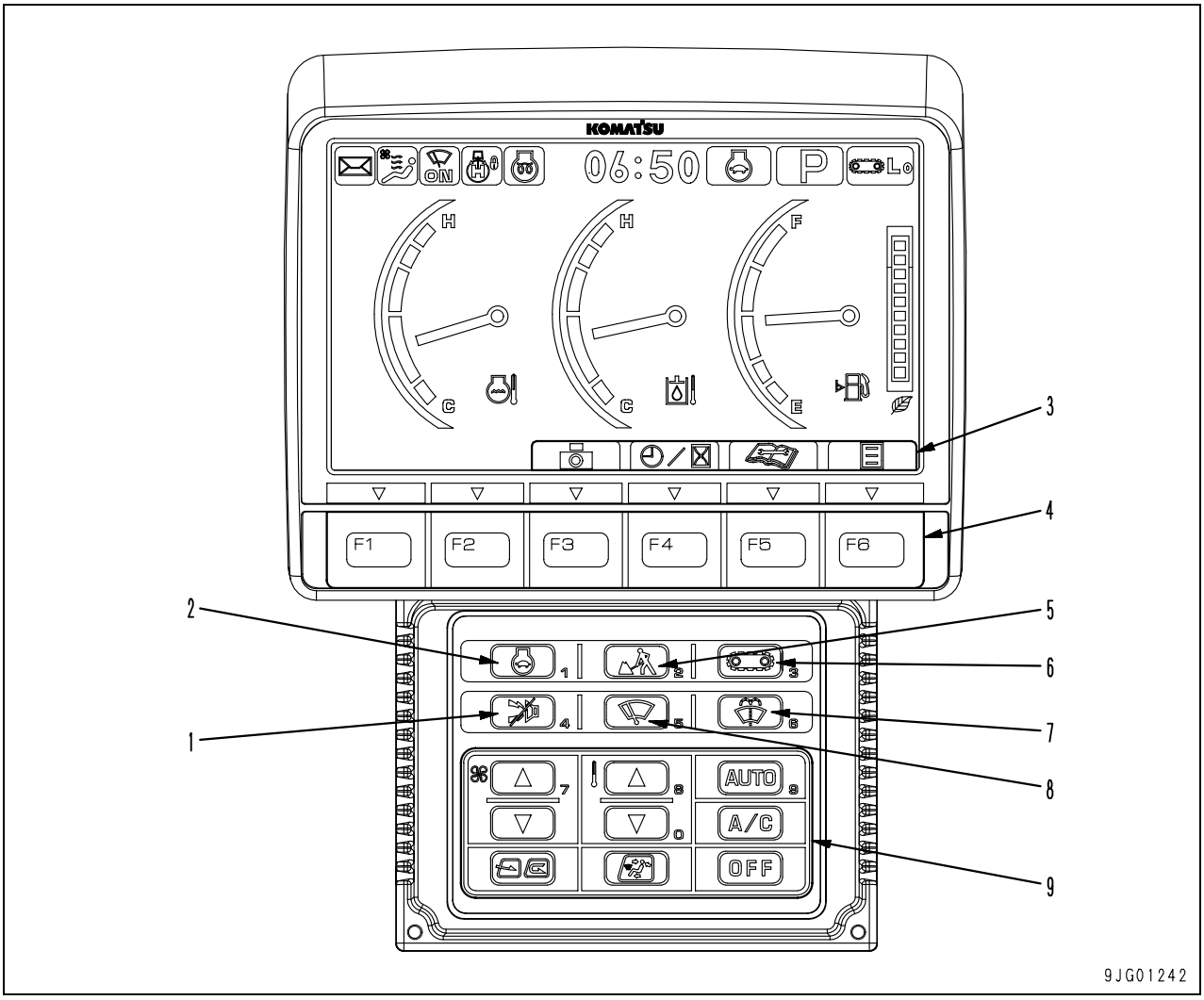
Symbol	Display item	Check before starting item	While engine is stopped	While engine is running
 9JG01376	Engine oil pressure	●	—	Lights up and buzzer sounds when abnormal.
 9JG01377	Battery charge	●	—	Lights up when abnormal.
 9JG01378	Radiator coolant level	●	Lights up and buzzer sounds when abnormal.	Lights up and buzzer sounds when abnormal.
 9JG01379	Engine oil level	●	Lights up when abnormal.	—
 9JG01380	Air cleaner clogging	●	—	Lights up when abnormal.
 9JG01232	Water separator	●	Lights up when abnormal.	Lights up when abnormal.
 9JG01381	Maintenance		Notice lamp (yellow)/Warning lamp (red). Lights up for only 30 seconds after starting switch is turned ON.	

Symbols appear in the order in which they occur from the upper left. When symbols are displayed, if the hydraulic oil temperature is high or low, only its symbol is displayed.

Condition of hydraulic oil	Color of symbol
Low temperature (below B6 or equivalent)	Black on white background
Normal (B6 – B2)	No display
High temperature (above B2)	White on red background

Display category	Symbol	Display item	Display range	Display method
Monitor	 9JG01240	KOMTRAX message	Green: There is unread message. Blue: There is unreturned message.	Displays state of message (for only machine equipped with KOMTRAX).
	 9JG01233	Air conditioner/ Heater	ON ⟷ OFF	Displays operating condition.
	 9JG01234	Wiper	→ INT → ON → OFF	Displays set condition.
	 9JG01235	Working mode	P, E, L, B, ATT	Displays set mode.
	 9JG01236	Travel speed	→ Lo → Mi → Hi	Displays set speed.
	 9JG01237	Auto-deceleration	ON ⟷ OFF	Displays operating condition.
ECO indicator	 9JG01241	ECO indicator	Green: Work load is light – medium. Orange: Work load is heavy.	Displays average work load in 1 minute on 10 levels. (Does not display if ECO display is set OFF in service menu.)
Service meter	 9JG01238	Service meter indicator	While service meter is working	Displays operating time. (Changes to clock if F4 is depressed.)
Clock	 9JG01239	Clock	12-hour display ⟷ 24-hour display	Displays time. (Changes to service meter if F4 is depressed.)

Switches



1. Buzzer cancel switch
2. Auto-deceleration switch
3. Guidance icon
4. Function switch
5. Working mode selector switch
6. Travel speed selector switch
7. Window washer switch
8. Wiper switch
9. Air conditioner control switch

Buzzer cancel switch

Pressing this switch when the alarm buzzer is making sound stops the alarm buzzer.
If a new abnormality is detected, the alarm buzzer sounds.
Depending on the alarm buzzer type, it does not stop even if you press the buzzer cancel switch.

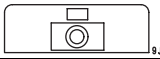
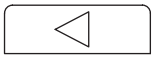
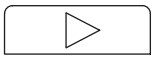
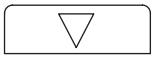
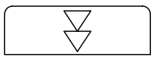
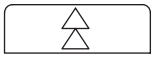
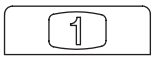
Auto-deceleration switch

The auto-deceleration switch toggles the auto-deceleration function on and off. When the working mode is switched, it is automatically set to ON. When it is set to ON, the auto-deceleration monitor appears.

★ The auto-deceleration function does not work in L mode.

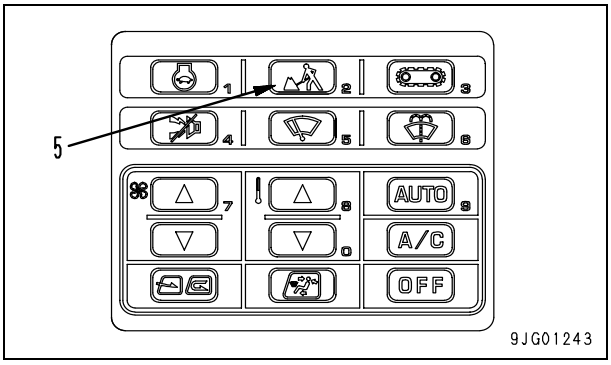
Guidance icon and function switch

The function switches differ depending on the screen display. Each guidance icon shows the function of the switch below it.
Switches with no guidance icon are disabled.
The functions shown by the guidance icons are as shown in the table below.

Symbol	Switch	Item	Function
 9JG01246	F6	Enter	Enters selected/set item.
 9JG01247	F5	Return	Returns to previous screen.
 9JG01248	F3	Select camera screen	Selects camera screen.
 9JG01249	F4	Select service meter/clock	Selects service meter and clock alternately.
 9JG01250	F5	Select maintenance screen	Selects maintenance screen.
 9JG01251	F6	Select user mode screen	Selects user mode screen.
 9JG01252	F3	Select item	Selects item on left side (Selects right end item after left end item).
 9JG01253	F4	Select item	Selects item on right side (Selects left end item after right end item).
 9JG01254	F3	Select item	Selects item on lower side (Selects top item after bottom item)/Resets holding of monitoring.
 9JG01255	F4	Select item	Selects item on upper side (Selects bottom item after top item)/Holds monitoring.
 9JG01256	F1	Select item	Selects page on lower side (Selects top page after bottom page).
 9JG01257	F2	Select item	Selects page on upper side (Selects bottom page after top page).
 9JG01258	F1	Display No. 1 camera screen	Selects No. 1 camera screen.
 9JG01259	F2	Display No. 2 camera screen	Selects No. 2 camera screen.
 9JG01260	F3	Display No. 3 camera screen	Selects No. 3 camera screen.
 9JG01261	F4	Display No. 1 and No. 2 camera screens	Displays No. 1 and No. 2 camera screens simultaneously.
 9JG01263	F2	Return to default setting	Returns selected item to default setting. (Used for adjustment of screen.)
 9JG01264	F1	Start	Starts operation. (Used to start measurement of split fuel consumption on fuel consumption display screen.)
 9JG01382	F1	Stop	Stops operation. (Used to stop measurement of split fuel consumption on fuel consumption display screen.)
 9JG01265	F1/F2	Clear	Clears selected/displayed item
 9JG01266	F1	Set	Executes setting.

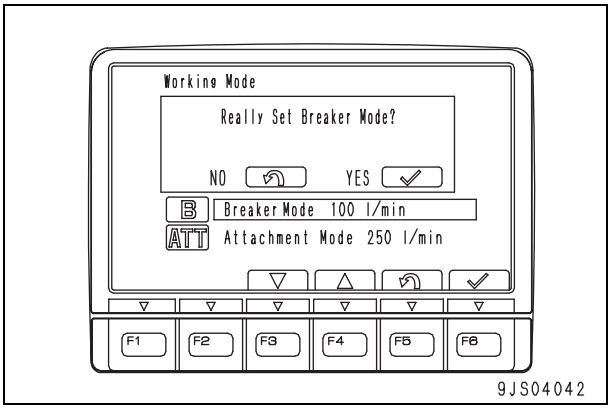
Working mode selector switch

Pressing working mode selector switch (5) switches among working modes.
Check the working mode on the working mode monitor.



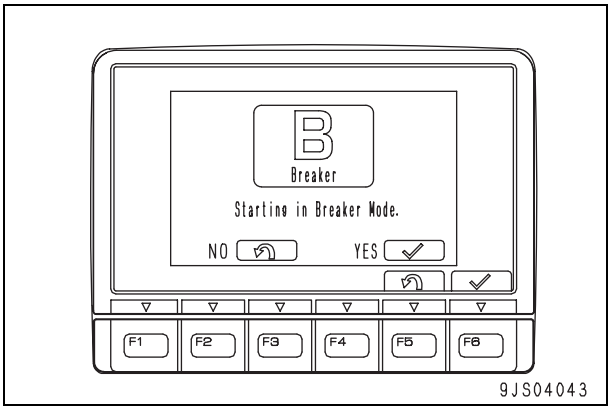
About B mode

- When you try specifying B mode as a working mode, the buzzer sounds for safety's sake and the following confirmation message appears.



F5 : Returns to the working mode selector screen.
F6 : Specifies the breaker mode.

- If B mode is specified as a working mode when you start the monitor, the buzzer sounds and the following message appears.



F5 : Starts up in E mode.
F6 : Starts up in B mode.

Travel speed selector switch

Each time you press the travel speed selector switch, the travel speed setting switches as shown below.
Lo → Mi → Hi → Lo ….
The travel speed setting is confirmable on the travel speed monitor.
The relationship between the speed setting and the monitor display is shown in the table below.

Display	Setting
Crawler symbol + Lo	Low speed (default)
Crawler symbol + Mi	Medium speed
Crawler symbol + Hi	High speed

Window washer switch

While the switch is being pressed, window washer liquid is sprayed out. There is a time delay before the wiper starts.

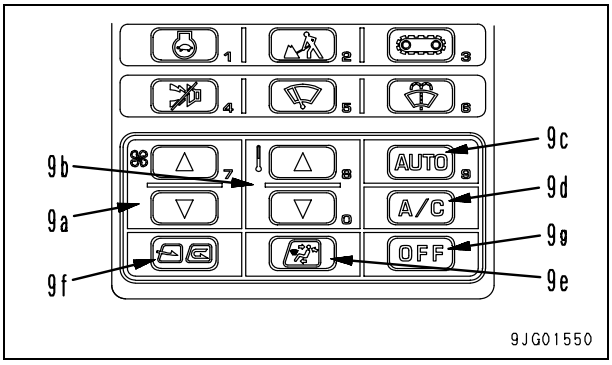
Wiper switch

Each time you press the wiper switch, the wiper settings switch as follows.
OFF → INT → ON → OFF → ….
The wiper operation setting is confirmable on the wiper monitor.
The relationship between the wiper setting and the monitor display is shown in the table below.

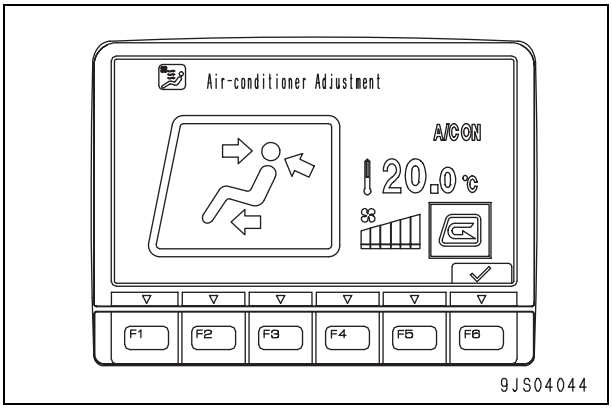
Display	Setting	Wiper actuation status
None	OFF	Stowing stopped or now stowing
Wiper symbol + INT	INT	Intermittent actuation
Wiper symbol + ON	ON	Continuous actuation

Air conditioner control switch

To operate the air conditioner, use the air conditioner control switches.

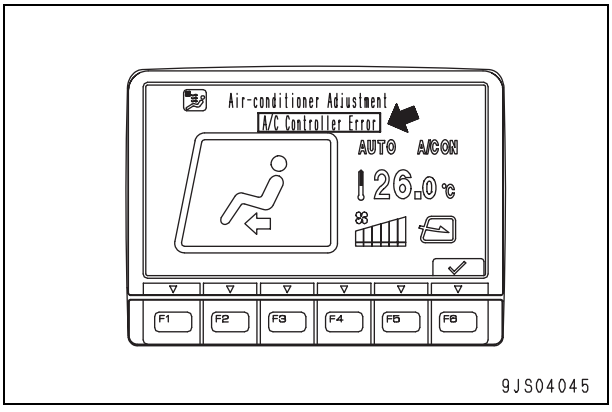


9a : Specifies airflow
9b : Specifies temperature
9c : AUTO
9d : A/C
9e : Switches among air blowing modes
9f : Switches between inside air and outside air
9g : OFF
9a to 9c : Enables entered information simultaneously with switching to the air conditioner control screen below.
9d to 9f : Switches to the air conditioner control screen below. Another pressing switches among modes.
9g : Turns OFF the air conditioner function without switching to the air conditioner screen.



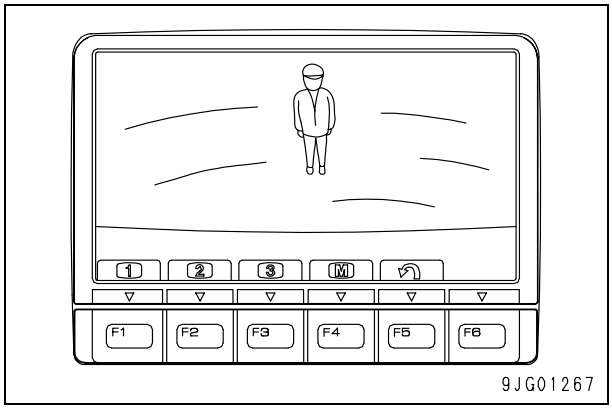
If you do no operation at least 5 sec. with the air conditioner control screen displayed, the window returns to the normal window.

★ When communication with the air conditioner is disconnected, or “spurting-out damper”, “A/M damper”, or “refrigerant” has a problem, the following screen appears.



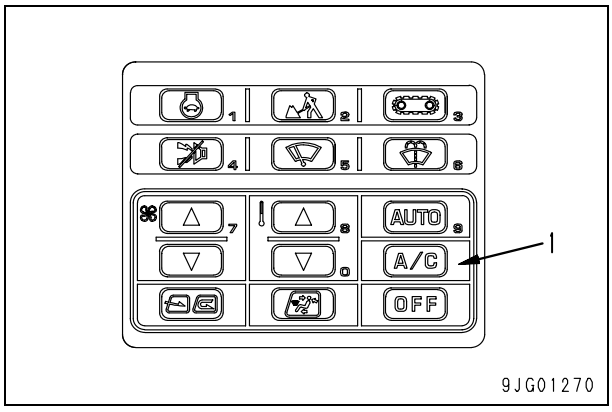
Camera screen display function

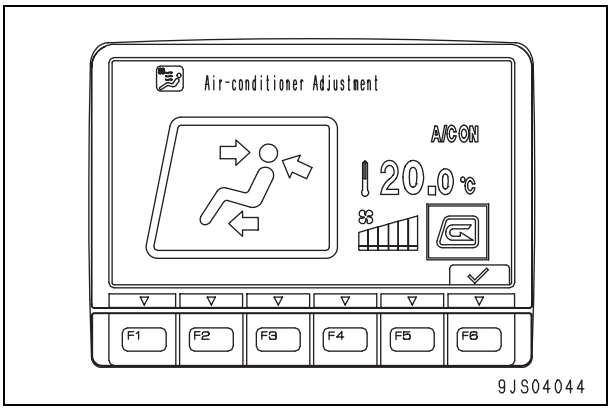
- For an optional-camera-equipped machine, pressing the F3 on the normal screen switches to the camera image.
- For a machine with no camera equipped, the guidance icon for switching to the camera screen does not appear; even if you press the switch, the screen does not switch to the camera image.
- Up to three cameras are mountable.



F1 : Displays the image of No. 1 camera full-screen.
F2 : Displays the image of No. 2 camera full-screen.
F3 : Displays the image of No. 3 camera full-screen.
F4 : Displays the images of No. 1 and No. 2 cameras at the same time.
F5 : Returns to the normal screen.

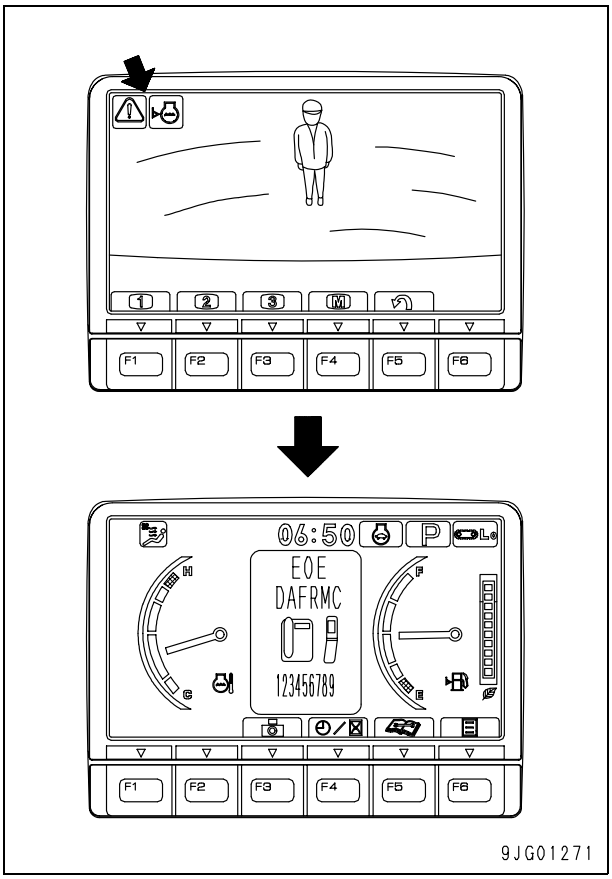
- Making operation of air conditioner button (1) with the camera screen displayed may switch to the air conditioner operation screen.





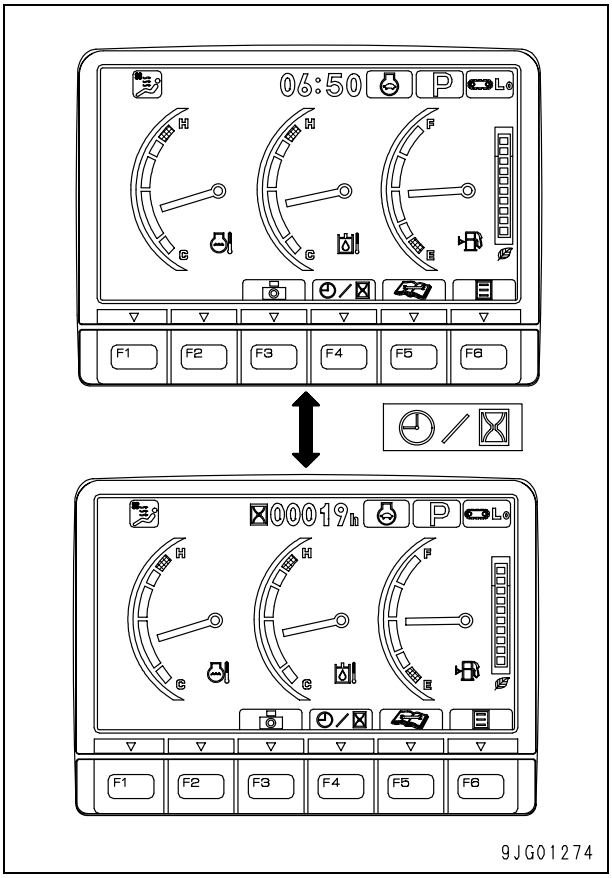
F6, or no operation for 5 sec.: Returns to the camera screen.

- Even when the camera screen is displayed, the working mode selector switch, travel speed selector switch, auto-deceleration switch, buzzer cancel switch, wiper switch, and window washer switch are enabled.
- Changing the working mode or travel speed returns to the normal screen.
- If an abnormality corresponding to an alarm item with the camera screen displayed, the alarm monitor appears on the upper left of the screen. If it appears, return to the normal screen with F5 to check the alarm display.
- If an abnormality corresponding to an error item with the camera screen displayed, the error monitor appears on the upper left of the screen. If it appears, you must move the machine to safe posture immediately and make inspections.
- If you do not operate the lever at least 10 sec. after the error monitor starts to blink, the screen switches to the normal screen.



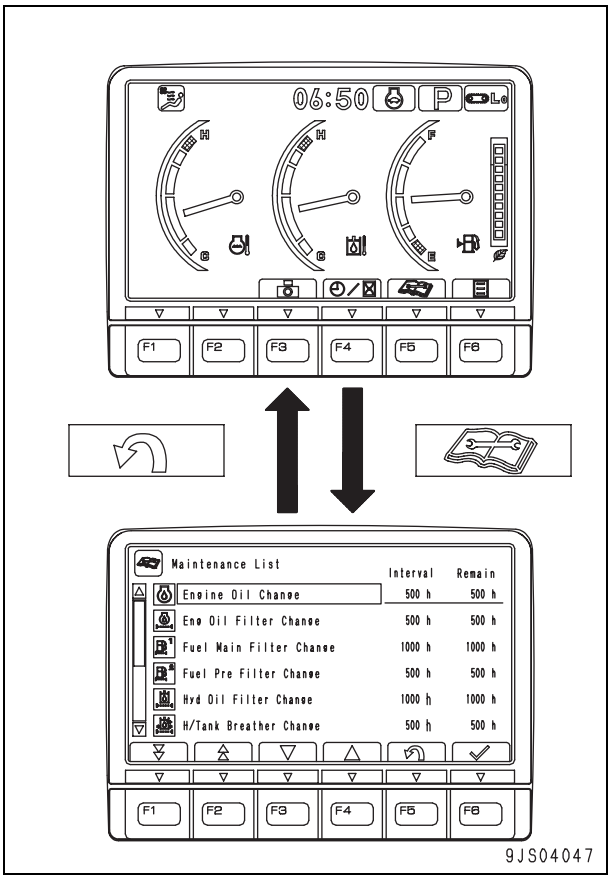
Service meter/time selector function

- Pressing F4 on the normal screen when the service meter is displayed in the top center of the screen switches the display to the time, and doing so when the time is displayed switches the display to the service meter.



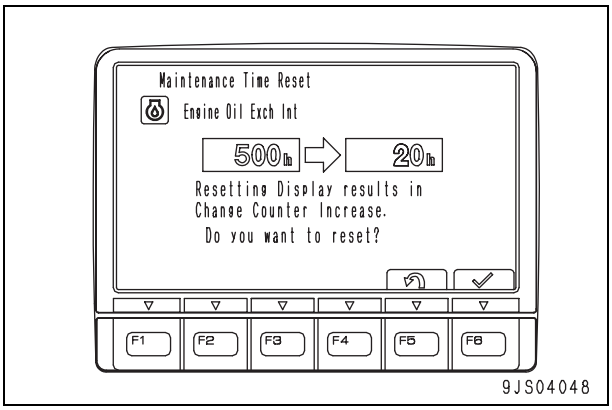
Maintenance function

- Pressing F5 on the normal screen switches to the maintenance screen.



F1 : Displays the next page.
Displays the top page when the last page is displayed.
F2 : Displays the previous page.
Displays the last page when the top page is displayed.
F3 : Selects (highlights) an item one down.
F4 : Selects (highlights) an item one up.
F5 : Returns to the normal screen.
F6 : Switches to the maintenance time reset screen.
No operation at least 30 sec. : Returns to the normal screen.

- If the remaining time on the maintenance table screen is less than 30 hours, the relevant items are highlighted in yellow, and if 0 hours, they are done in red.
- On the maintenance time reset screen, reset the remaining time for the selected item to return to the default.



F5 : Cancels the reset to return to the maintenance table screen.
F6 : Resets the remaining time to return to the normal screen.
No operation at least 30 sec. : Returns to the normal screen.

- The table below shows the maintenance items and replacement intervals. The time remaining to maintenance is reduced as the machine is operated.

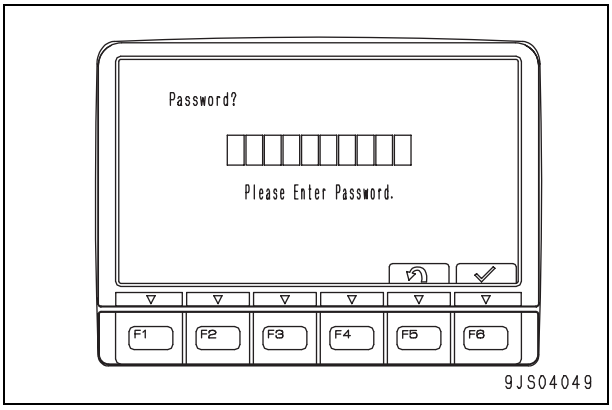
No.	Item	Replacement interval (Hours)
01	Engine oil	500
02	Engine oil filter	500
03	Fuel main filter	1000
41	Fuel prefilter	500
04	Hydraulic filter	1000
05	Hydraulic tank breather	500
06	Corrosion resistor	1000(*)
07	Damper case oil	1000
08	Final case oil	2000
09	Machinery case oil	1000
10	Hydraulic oil	5000

*: If equipped (To be determined)

- The content of the caution display differs according to the remaining time. The relationship is as shown in the table below.

Display	Condition
None	Remaining time for maintenance for all items is more than 30 hours.
Notice display (black symbol displayed on yellow background)	There is one or more items with less than 30-hour remaining time for maintenance.
Warning display (white symbol displayed on red background)	There is one or more items with less than 0-hour remaining time for maintenance.

- You can lock the maintenance time by a password to prevent it from carelessly being reset.

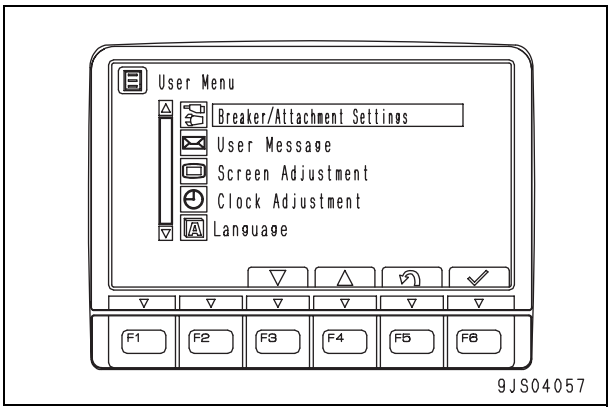


- The default password is “000000”.
- Enabling the password lock on an attachment-equipped machine locks the breaker/attachment setting screen at the same time.

★ For information on changing the attachment/maintenance password, see “Attachment/maintenance password change function” in the Testing and adjusting section.

User mode

- Pressing F6 on the normal screen enters the user mode, switching to the user menu screen.
- In user mode, you can specify items relating to the machine monitor and machine shown below.
  - Breaker/attachment setting
  - Message display
  - Screen adjustment
  - Time adjustment
  - Language setting
  - Economy mode adjustment

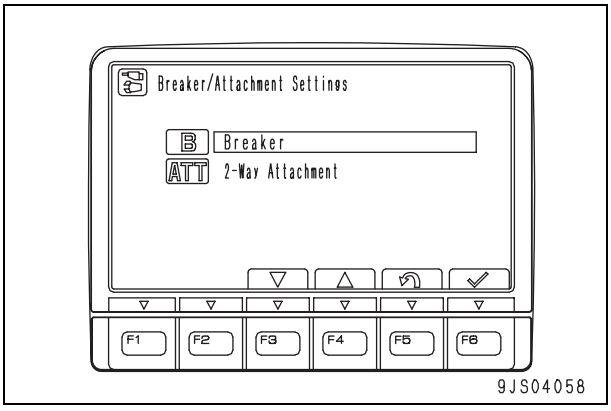


F3 : Selects (highlights) an item one down.
F4 : Selects (highlights) an item one up.
F5 : Returns to the normal screen.
F6 : Switches to the setting screen for the selected item.

No operation at least 30 sec. : Returns to the normal screen.
(In user mode, no switch operation at least 30 sec. returns to the previous screen.)

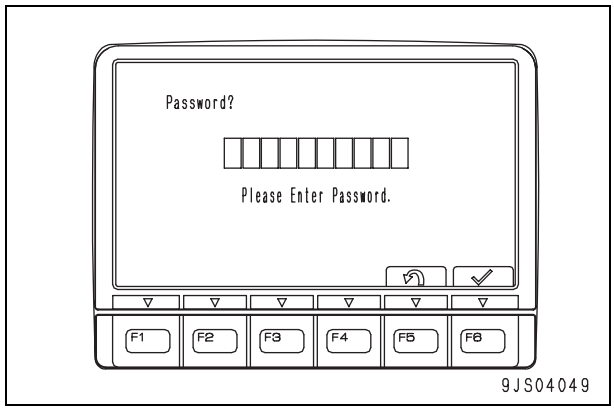
Breaker/attachment setting

- For an attachment-equipped machine, this menu allows you to adjust a flow rate in B mode and ATT mode.
- For a machine with no attachment, this menu does not appear.



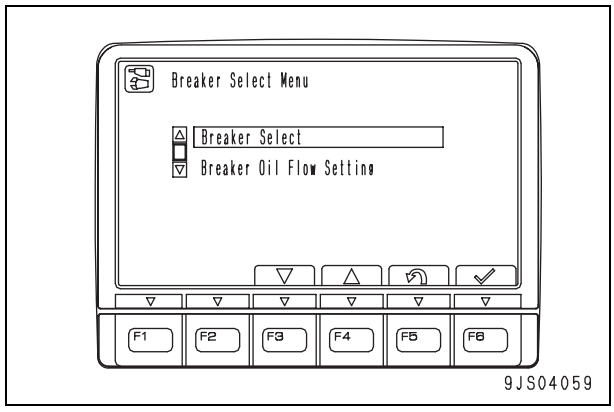
F3 : Selects (highlights) an item one down.
F4 : Selects (highlights) an item one up.
F5 : Cancels changes you made before confirming them with F6 to return to the menu screen.
F6 : Moves to the setup items of the selected (highlighted) item.

- Selecting B switches to the breaker setting menu, and selecting ATT switches to the attachment setting menu.
- You can lock this menu with a password. Enabling the password lock locks the maintenance reset screen at the same time.



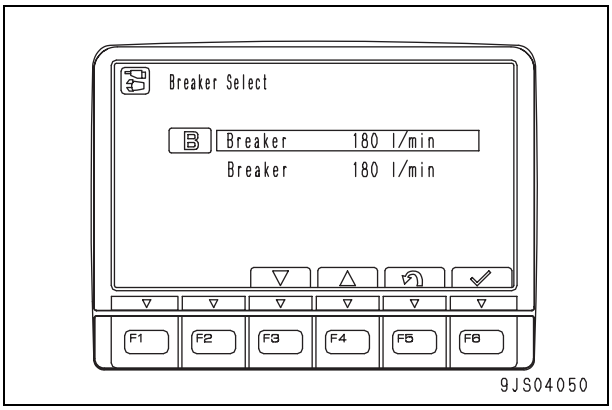
Changing breaker mode setting

- Selecting B on the breaker/attachment setting screen switches to the breaker setting screen. On this screen, select the breaker setting selection screen or breaker flow rate setting screen.



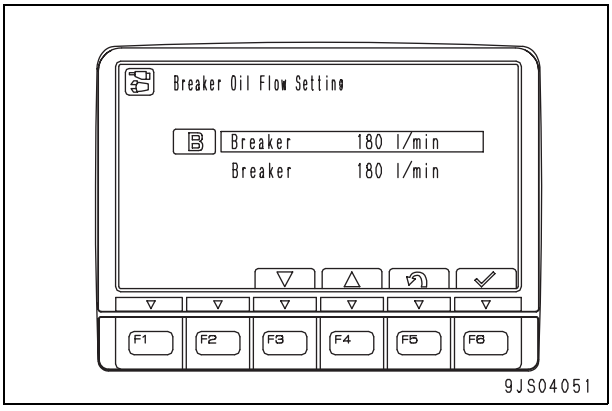
F3 : Selects (highlights) an item one down.
F4 : Selects (highlights) an item one up.
F5 : Returns to the breaker/attachment setting screen.
F6 : Switches to the setting screen for the selected (highlighted) item.

1. Breaker setting selection screen.
   - On this screen, you can allocate one of two set flow rates as a flow rate in breaker mode.
   - The B symbol is displayed before items specified to breaker mode.
   - ★ The defaults of both flow rates are 180 ℓ/min.



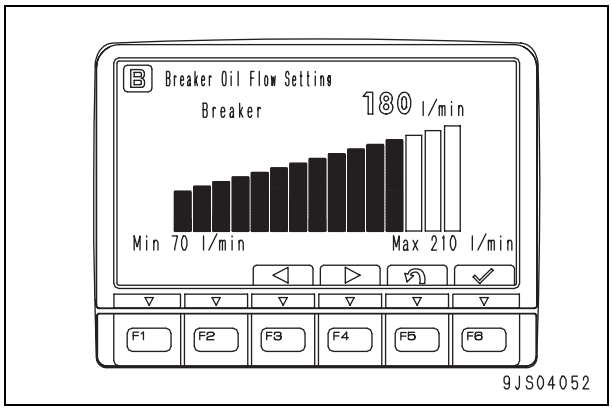
F3 : Selects (highlights) an item one down.
F4 : Selects (highlights) an item one up.
F5 : Returns to the breaker setting menu screen.
F6 : Specifies the selected (highlighted) item as a flow rate in breaker mode.

2. Breaker flow rate setting screen
   - On this screen, you can specify a flow rate.
   - The B symbol is displayed before items specified to breaker mode.



F3 : Selects (highlights) an item one down.
F4 : Selects (highlights) an item one up.
F5 : Returns to the breaker setting menu screen.
F6 : Switches to the flow rate level setting screen for the selected (highlighted) item.

   - On the flow rate level setting screen, change the set flow rate.

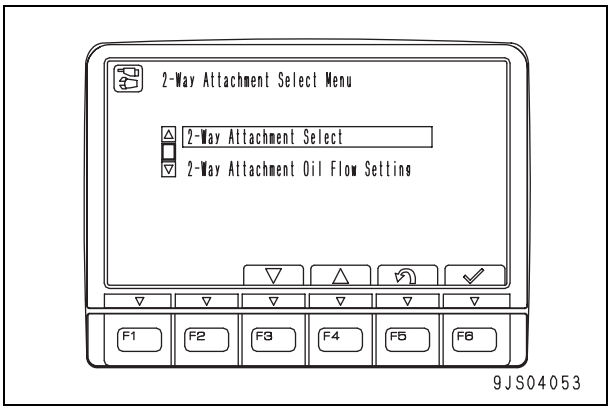


F3 : Decreases the flow rate.
F4 : Increases the flow rate.
F5 : Returns to the flow rate setting screen without changing the flow rate.
F6 : Returns to the flow rate setting screen after specifying the flow rate.

Flow level	Flow rate (ℓ/min)	Remarks
15	210	
14	200	
13	190	
12	180	Default
11	170	
10	160	
9	150	
8	140	
7	130	
6	120	
5	110	
4	100	
3	90	
2	80	
1	70	

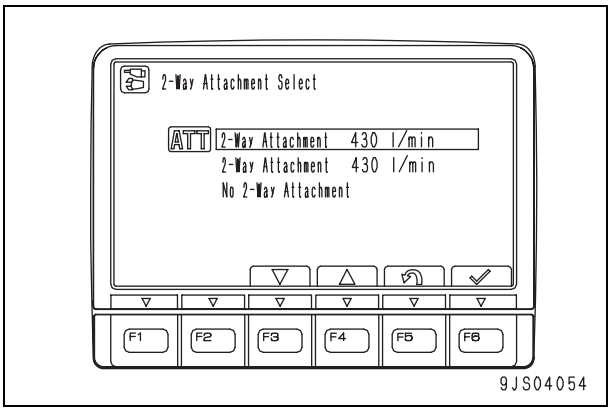
Changing attachment mode setting

- Selecting ATT on the breaker/attachment setting screen switches to the 2-way attachment setting menu. On this screen, select the attachment setting screen or breaker flow rate setting screen.



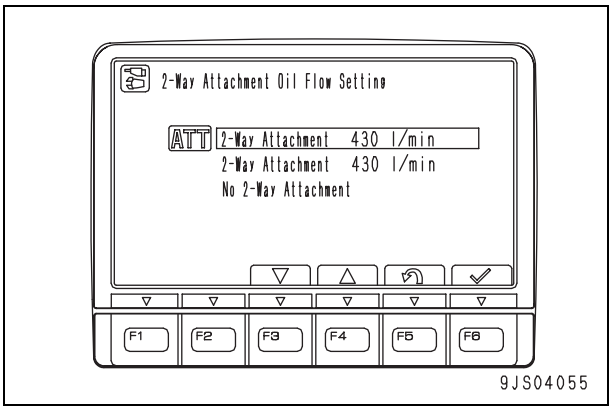
F3 : Selects (highlights) an item one down.
F4 : Selects (highlights) an item one up.
F5 : Returns to the breaker/attachment setting screen.
F6 : Switches to the setting screen for the selected (highlighted) item.

1. Attachment setting selection screen
   - On this screen, you can allocate one of two set flow rates as a flow rate in attachment mode.
   - The ATT symbol is displayed before items specified to attachment mode.
   - ★ The defaults of both flow rates are 430 ℓ/min.



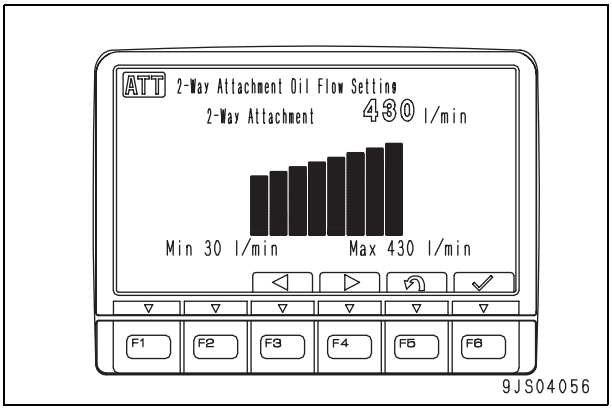
F3 : Selects (highlights) an item one down.
F4 : Selects (highlights) an item one up.
F5 : Returns to the attachment setting menu.
F6 : Specifies the selected (highlighted) item as a flow rate in attachment mode.
- Selecting “No attachment” disables selection of attachment mode on the working mode selection screen.

2. Attachment flow rate setting screen
   - On this screen, you can specify a flow rate.
   - The ATT symbol is displayed before items specified to attachment mode.



F3 : Selects (highlights) an item one down.
F4 : Selects (highlights) an item one up.
F5 : Returns to the breaker setting menu screen.
F6 : Switches to the flow rate level setting screen for the selected (highlighted) item.

- On the flow rate level setting screen, change the set flow rate.

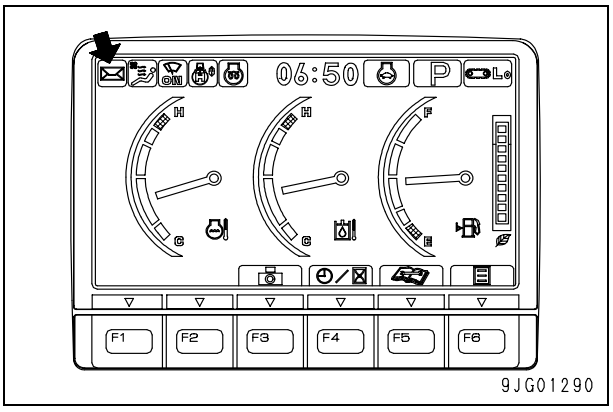


F3 : Decreases the flow rate.
F4 : Increases the flow rate.
F5 : Returns to the flow rate setting screen without changing the flow rate.
F6 : Returns to the flow rate setting screen after specifying the flow rate.

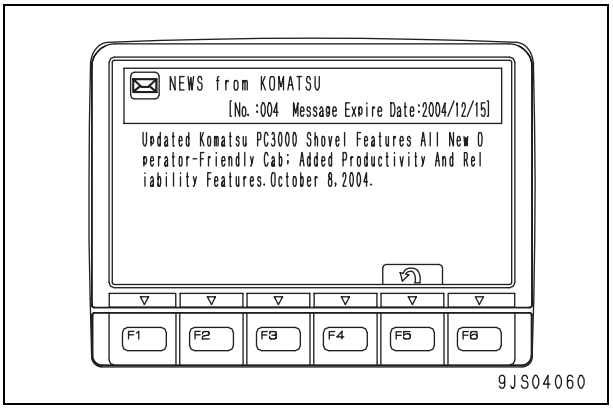
Flow level	Flow (ℓ/min)	Remarks
8	430	Default
7	350	
6	250	
5	170	
4	140	
3	115	
2	90	
1	30	

Message display

- For a KOMTRAX-equipped machine, you can view notification from the sales representative. When there is a message, the message monitor appears on the upper left of the normal screen.
- The lighting green monitor indicates that there are messages to be read.
- The lighting blue monitor appears when you have not sent replies yet after opening messages which accept replies.

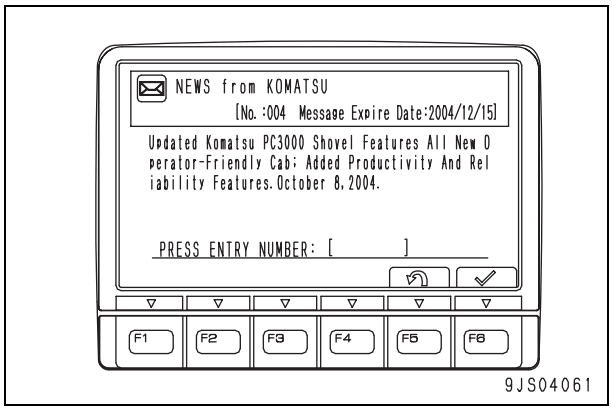


- Press F6 to enter user mode and select “Message display” and you can view (open) the messages.



F6 : Returns to the user mode screen.

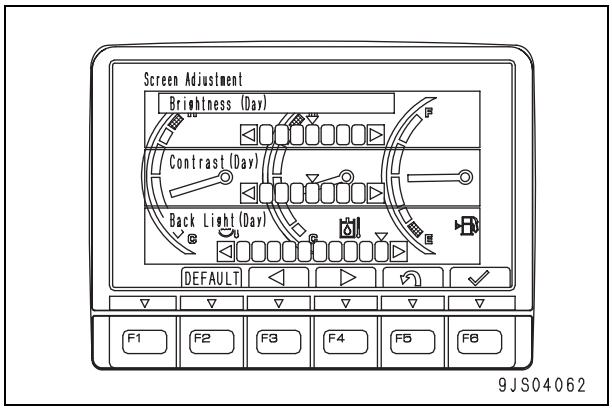
- Under messages that accept replies, “Value to be entered with 10-key: [ ]” appears.If it appears, enter the selected item number provided in the message using the switches of the machine monitor, and press F6.
- “Do you want to transmit the entered value?” appears under the message. Press F6 and the entered value will be sent.



- Messages will be deleted when their validity expire or a new message is received.
- When no message has not been received, “No message” appears at the blue part of the top of the screen.
- Separately from the message display for users above, the service menu is provided with message display for service.

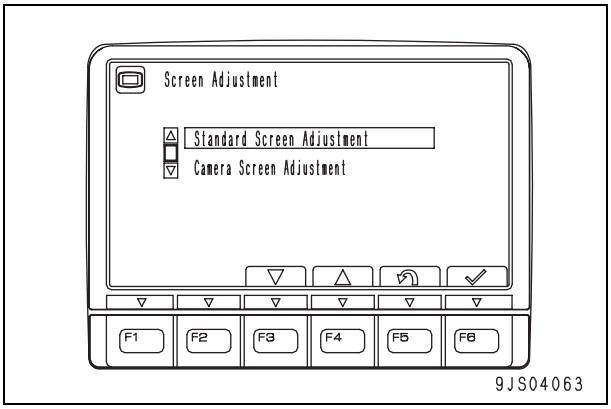
Screen adjustment

- Selecting the Screen adjustment from the user menu and pressing F6 switches to the screen adjustment screen.
- From this menu, you can adjust the brightness, contrast, and luminance of the machine monitor screen.
- When the light switch is in Night mode ON, the night mode screen is adjustable.
- When the light switch is in Daytime mode ON or OFF, the daytime mode screen is adjustable.



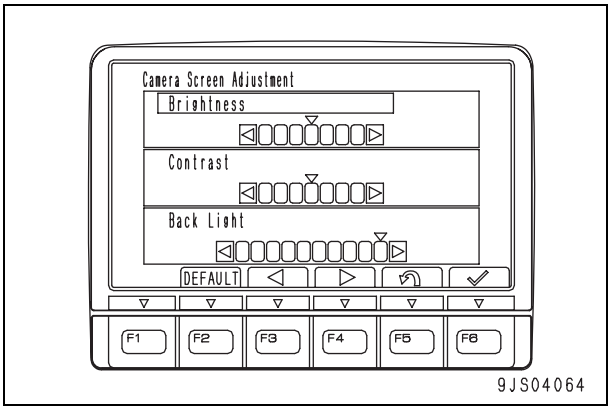
F2 : Returns all adjusted values to the defaults.
F3 : Decreases the value indicated by the indicator one graduation left.
F4 : Increases the value indicated by the indicator one graduation right.
F5 : Cancels changes you made before confirming them with F6 to return to the menu screen.
F6 : Confirms the changes and moves to the next item.

- For a camera-equipped machine, the brightness, contrast, and illuminance of the camera screen are also adjustable.
- For a camera-equipped machine, selecting Screen adjustment from the user menu switches to the screen for selecting a screen you want to adjust.



F3 : Selects (highlights) an item one down.
F4 : Selects (highlights) an item one up.
F5 : Cancels changes you made before confirming them with F6 to return to the menu screen.
F6 : Moves to the setup items of the selected (highlighted) item.

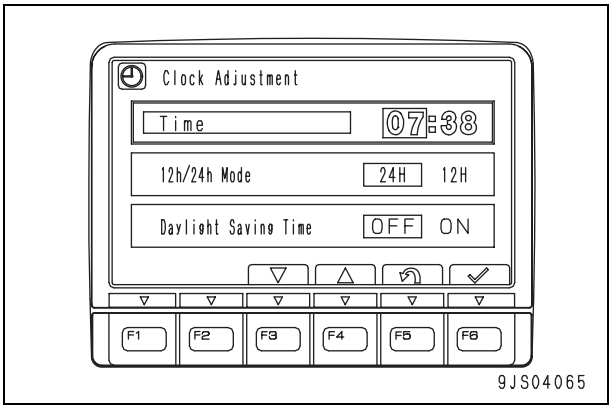
- The adjustment methods for the camera screen and normal screen are the same.
- The background when adjusting the camera screen is the No. 1 camera image.



F3 : Selects (highlights) an item one down.
F4 : Selects (highlights) an item one up.
F5 : Cancels changes you made before confirming them with F6 to return to the menu screen.
F6 : Moves to the setup items of the selected (highlighted) item.

Clock adjustment

- Selecting the Clock adjustment from the user menu and pressing F6 switches to the clock adjustment screen.
- On this screen, you can change the setting of the time displayed on the normal screen.



1) Time setting
Set the clock time. If the time setting item is not highlighted, press F6 to highlight it.

The time display part is highlighted.
F3 : Advances the clock one hour.
F4 : Sets the clock back one hour.
F5 : Cancels changes you made before confirming them with F6 to return to the user menu.
F6 : Confirms the changes and moves to minute setting.

The minute display part is highlighted.
F3 : Advances the clock one min.
F4 : Set the clock back one min.
F5 : Cancels changes you made before confirming them with F6 to return to the use menu.
F6 : Confirms the changes and moves to the 12/24 display mode.

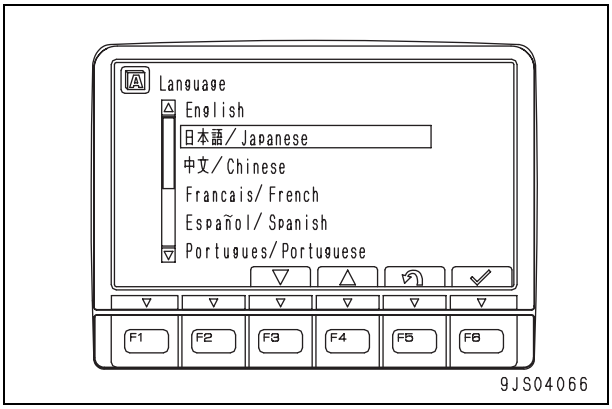
2) 12/24 display mode
Specify time display to 12-hour display (AM/PM) or 24-hour display. If the item of 12/24 display mode is not highlighted, press F6 to highlight it.
F3 : Moves to the item one right.
F4 : Moves to the item one left.
F5 : Cancels the changes to return to the user menu.
F6 : Confirms the changes and moves to summer time.

3) Summer time
Selecting ON for this sets the time forward one hour. Setting OFF returns to the ordinary time.
F3 : Moves to the item one right.
F4 : Moves to the item one left.
F5 : Cancels changes you made before confirming them with F6 to return to the user menu screen.
F6 : Confirms the changes and moves to the time setting.

★ Summer time (daylight saving time) is a system to lead a life according to the one-hour advanced time in order to make efficient use of daylight time.

Language setting

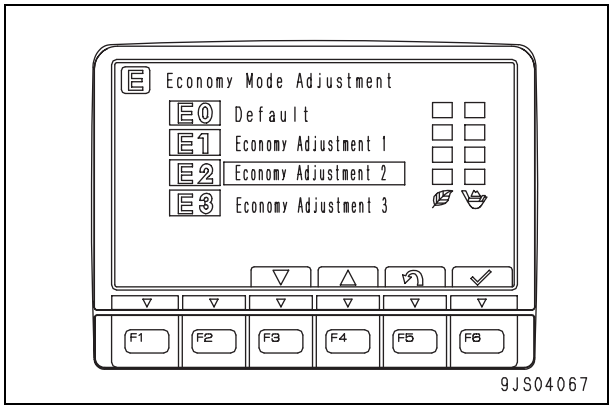
- Selecting the Language from the user menu screen and pressing F6 switches to the language setting screen.
- From this menu, you can change the language to be displayed on the monitor. Available languages are as follows.
  English, Japanese, Chinese, French, Spanish, Portuguese, Italian, German, Russian, and Turkish



F3 : Selects (highlights) an item one down.
F4 : Selects (highlights) an item one up.
F5 : Cancels the changes to return to the user menu.
F6 : Cancels the changes to return to the user menu.

Economy mode adjustment

- Selecting the Economy mode adjustment from the user menu and pressing F6 switches to the Economy mode setting screen.
- From this menu, you can adjust engine output to improve fuel consumption in E mode.
- The fuel consumption level is specified to one of four levels from E0 to E3. The larger the value, the better the fuel consumption, but the smaller the work rate.

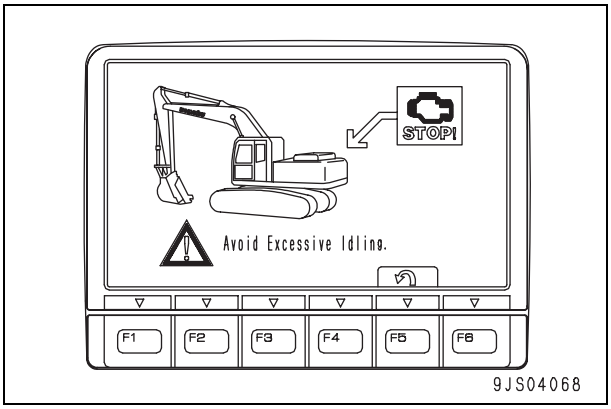


F3 : Selects (highlights) an item one down.
F4 : Selects (highlights) an item one up.
F5 : Cancels the changes to return to the user menu.
F6 : Cancels the changes to return to the user menu.

Idle stop guidance function

This function displays guidance to control unnecessary fuel consumption. It is displayed only when all the following conditions are met.

- Energy saving guidance display of the service menu is specified to ON.
- No operation is made at least 5 min. and the engine is running at idle.
- No error or caution (excluding low hydraulic oil temperature) is occurring.



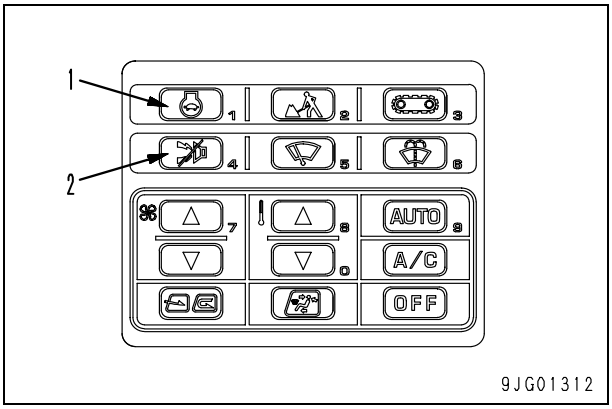
This screen switches to the normal screen if one of the following conditions occurs.

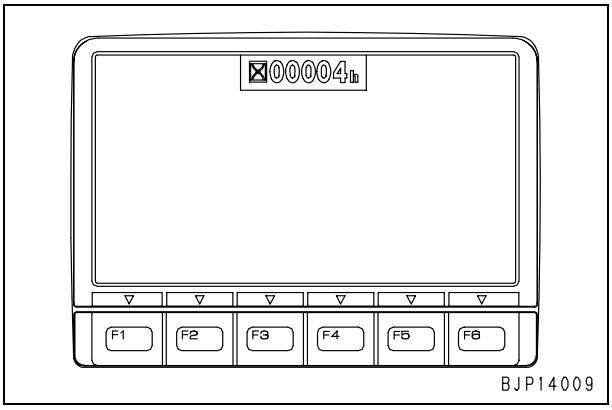
- When the lever is operated
- When F5 is pressed
- When an error or caution occurs

When you switch to the normal screen by pressing F5, this screen does not appear even if the engine continues to run at idle. If the engine continues to run at least five min. after operating the lever, this screen appears again.

Service meter check function

- If you continuously pressing auto-deceleration switch (1) and buzzer cancel switch (2) at the same time when setting the starting switch to the OFF position, the service meter will appear on the screen in 3 to 5 sec.



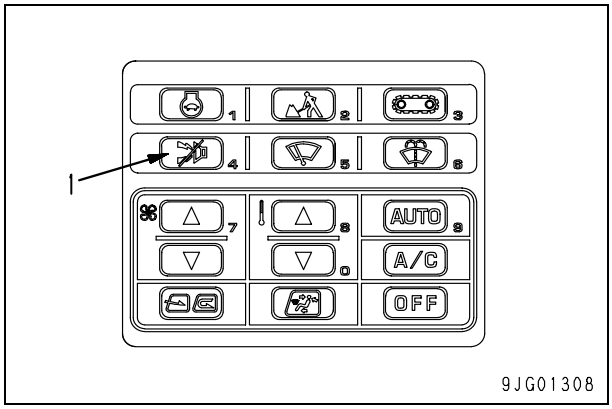


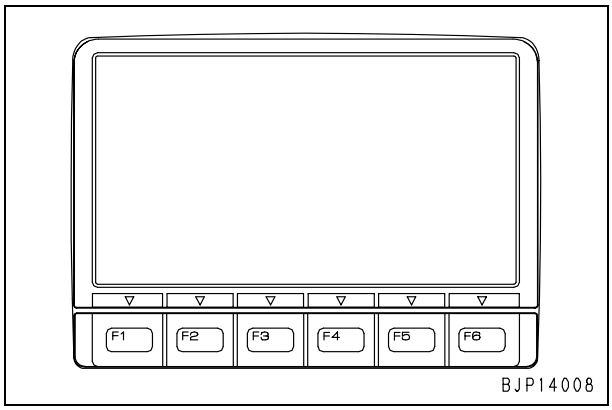
- When these switches are released, the LCD goes out.

★ Continuous operation of the machine monitor may display blue bright spots on this screen; it is quite normal.

Display LCD check function

- Continuously pressing the buzzer cancel switch (1) and F2 at the same time on the password input screen or normal screen causes the entire LCD to light in white. Release F2 and buzzer cancel switch in order. If any part of the display is black, the LCD is broken.

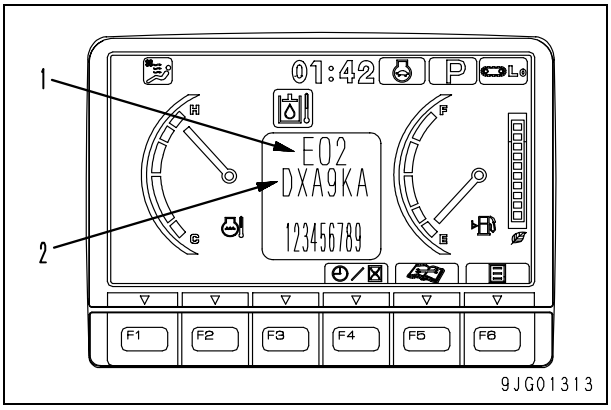




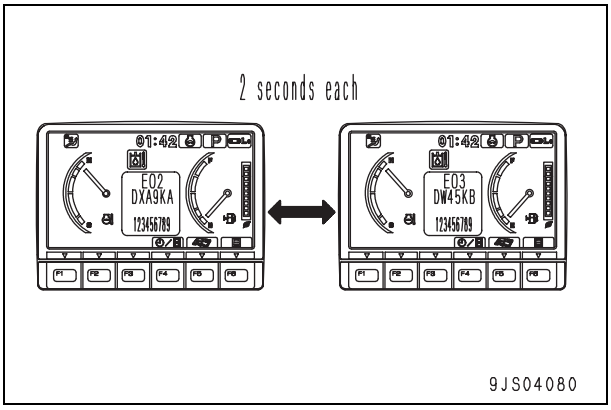
- Pressing any function switch returns to the previous screen.

User code/failure code display function

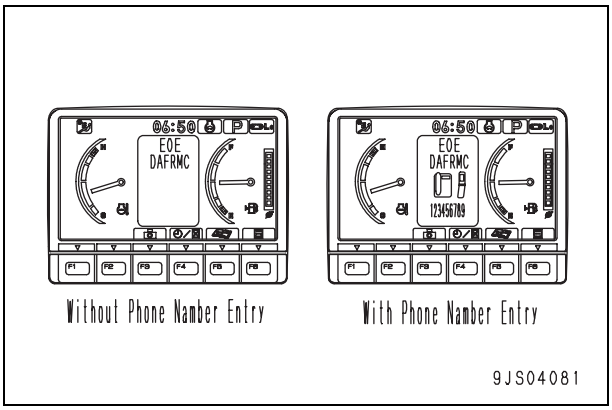
- If there is any problem in machine operation, the user code and failure code are displayed on the monitor to advise the operator of the steps to take.
- These codes appear on the normal screen.
- On the normal screen, user code (1) and failure code (2) are displayed on the portion for the hydraulic oil temperature gauge.



- If multiple user codes or failure codes are issued, they are displayed alternately every 2 sec. The drawing below shows the case two types of user codes and failure codes are displayed.



- If the telephone number has been set in the service menu, the screen shows the telephone symbol and telephone number simultaneously with the user code/failure code. (For information on how to input and set the telephone number, see “Special functions of monitor panel” in the Testing and adjusting section.)

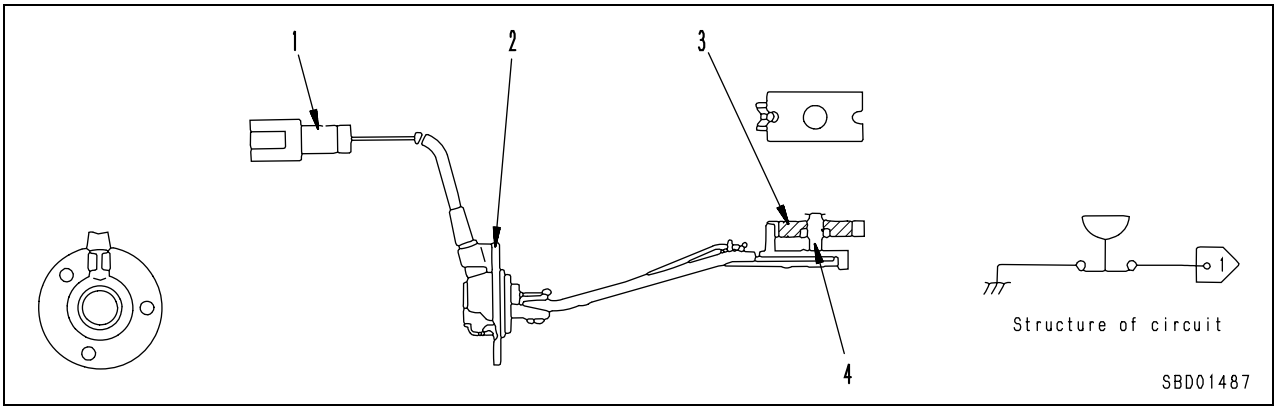


Sensor

- The signals from the sensors are input to the monitor panel directly.
- Either side of a sensor of contact type is always connected to the chassis ground.

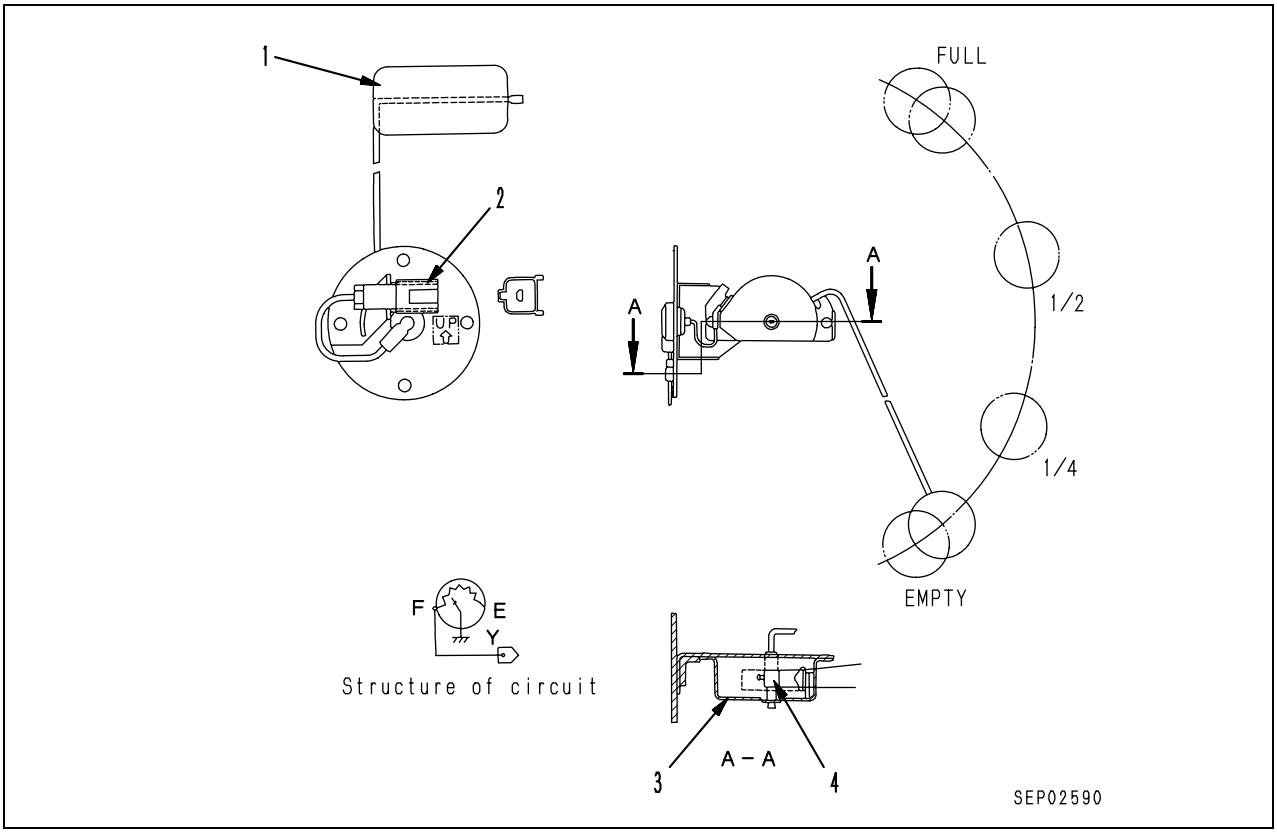
Sensor name	Type of sensor	When normal	When abnormal
Hydraulic oil level	Contact	ON (Closed)	OFF (Open)
Fuel level	Resis-tance	—	—
Air cleaner clogging	Contact	OFF (Closed)	ON (Open)
Coolant level	Contact	ON (Closed)	OFF (Open)

Hydraulic oil level sensor



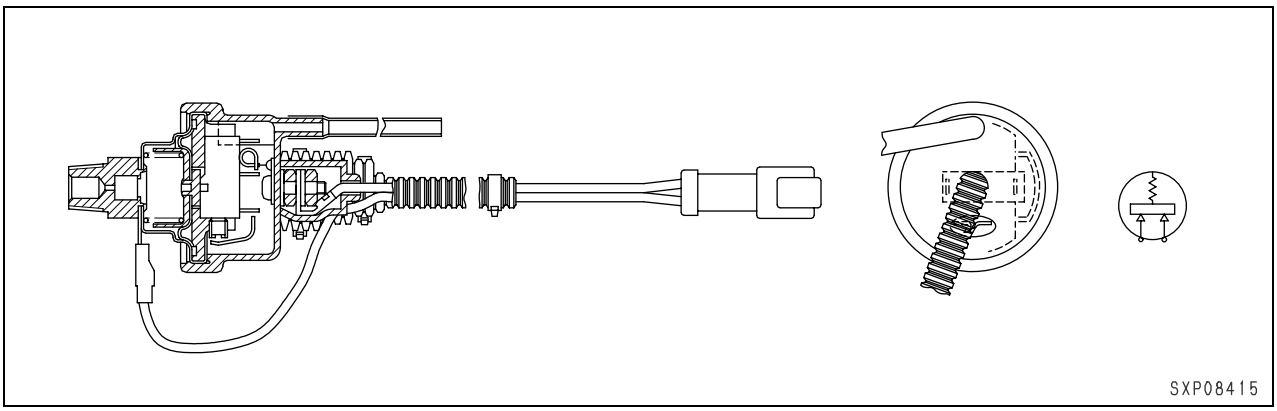
1. Connector
2. Bracket
3. Float
4. Switch

Fuel level sensor

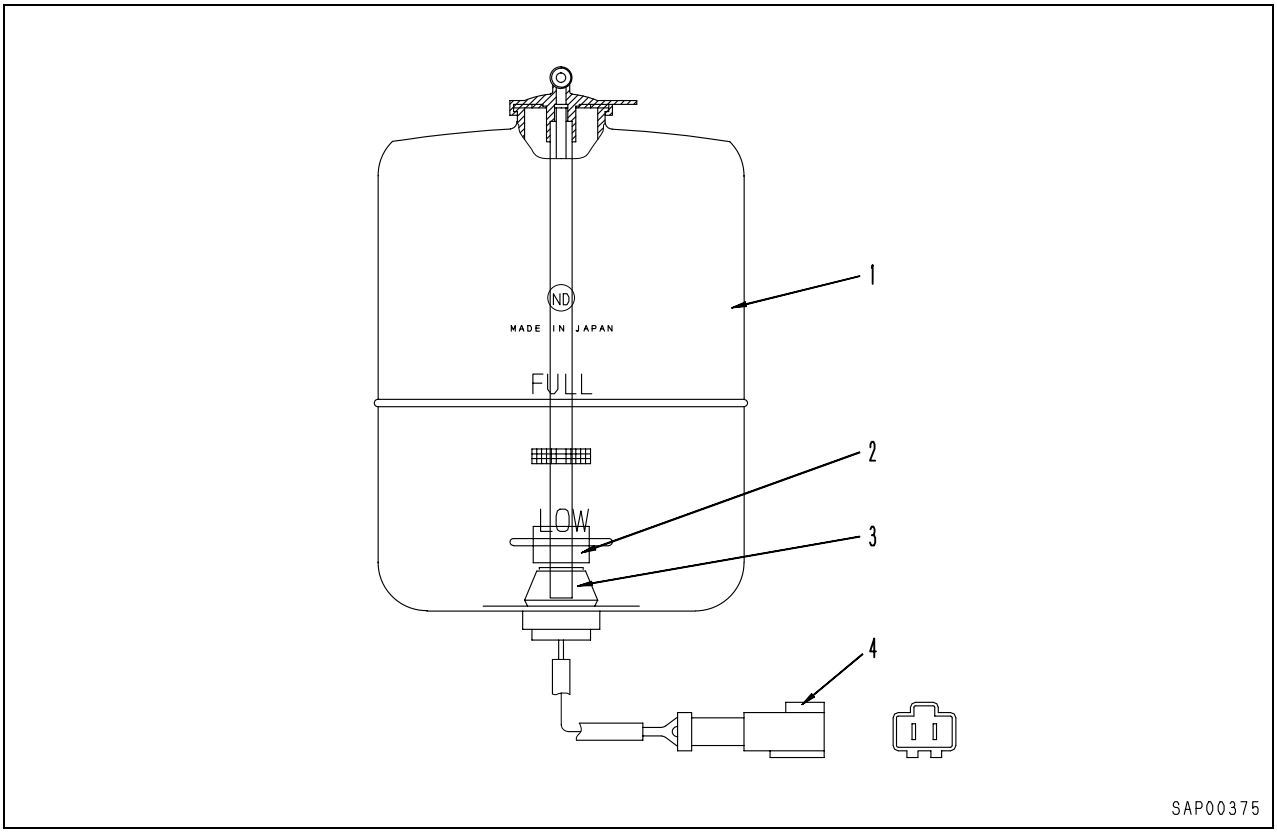


1. Float
2. Connector
3. Cover
4. Variable resistor

Air cleaner clogging sensor

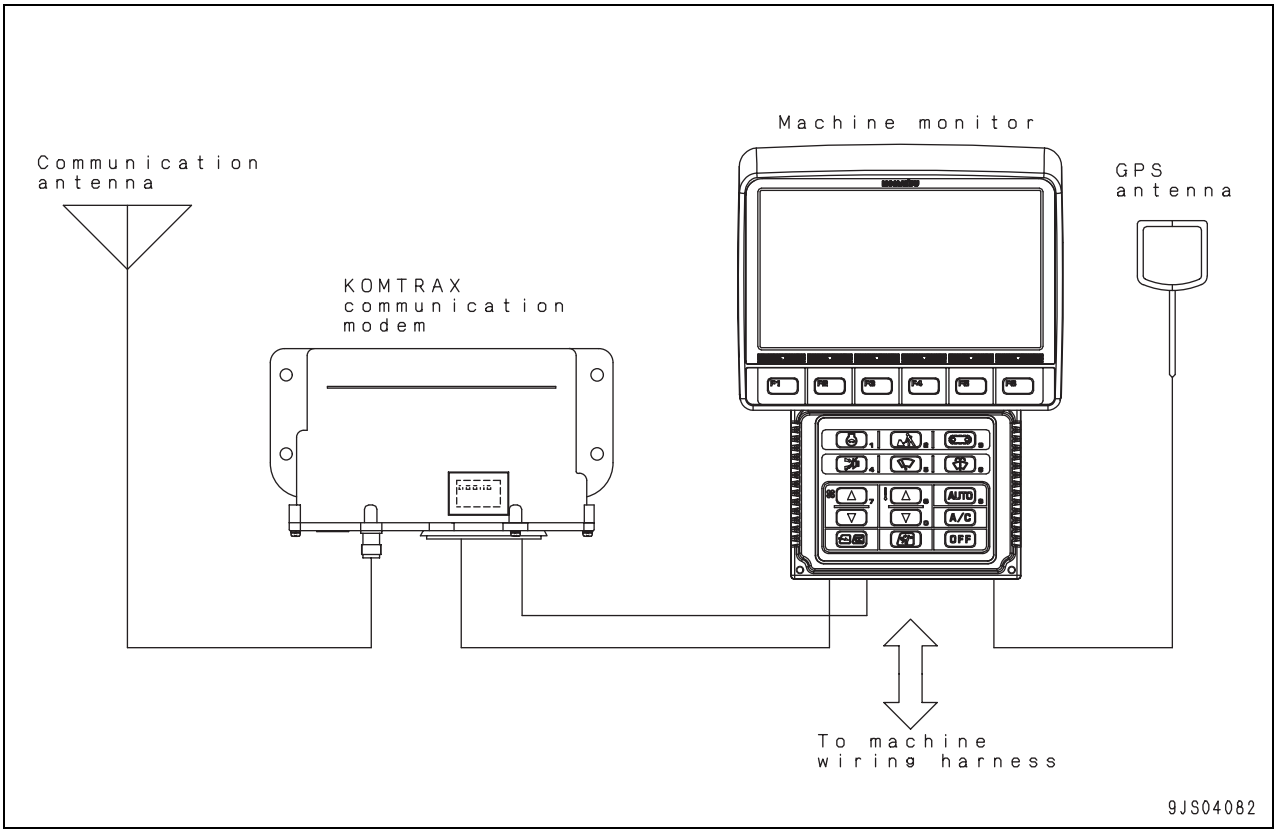


Coolant level sensor



1. Reserve tank
2. Float
3. Sensor
4. Connector

KOMTRAX terminal system

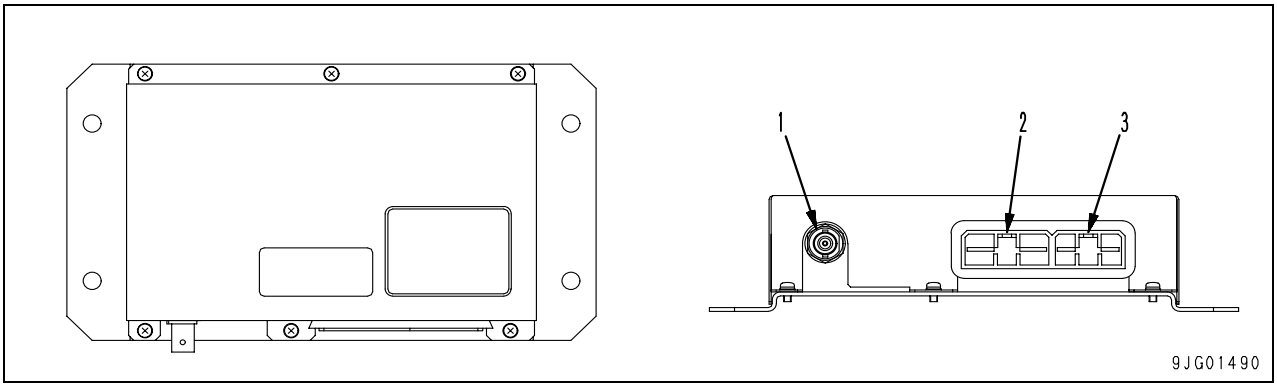


- The KOMTRAX terminal system consists of a KOMTRAX communication modem, communication antenna, machine monitor, and GPS antenna.
- This system transmits various kinds of machine information wirelessly. Persons to operate the KOMTRAX can refer to the information at office to provide various kinds of services for customers.
- Information transmittable from the KOMTRAX terminal system includes the following.
  1. Operation map
  2. Service meter
  3. Position information
  4. Error history

  and others.

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

KOMTRAX communication modem
TH300



1. Communication antenna connection
2. Connector A (14 poles)
3. Connector B (10 poles)

Outline

- The KOMTRAX communication modem is a wireless communication device to transmit various kinds of machine information or GPS position information the monitor obtains from network signals or input signals in the machine. The communication modem can transmit information via the communication antenna.
- The modem is provided with a LED lamp as a display unit. The LED is used for maintenance.

Input and output signals

Connector A

Pin No.	Signal name	Input/ output
A-1	Electric power supply	Input
A-2	NC(*1)	—
A-3	NC(*1)	—
A-4	Electric power supply switching	Output
A-5	NC(*1)	—
A-6	NC(*1)	—
A-7	GND	Input
A-8	GND	Input
A-9	Modem power control 1 (*2)	Input
A-10	Modem power control 2 (*2)	Input
A-11	Modem serial control (*2)	Input
A-12	Electric field intensity 1 (*2)	Output
A-13	Electric field intensity 2 (*2)	Output
A-14	NC(*1)	—

*1: Never connect to NC or malfunctions or failures will occur.
*2: Signal used by TH200

Connector B

Pin No.	Signal name	Input/ output
B-1	Serial signal DCD	Output
B-2	Serial signal RXD	Output
B-3	Serial signal TXD	Input
B-4	Serial signal DTR	Input
B-5	Serial signal SGND	Input
B-6	Serial signal DSR	Output
B-7	Serial signal RTS (*2)	Input
B-8	Serial signal CTS (*2)	Output
B-9	Serial signal RI (*2)	Output
B-10	NC(*1)	—

*1: Never connect to NC or malfunctions or failures will occur.
*2: Signal used by TH200

PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00103-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

20 Standard value table

Standard service value table

Standard service value table

Standard value table for engine related parts

PC210, 210LC, 210NLC, 230NHD-8

Applicable model					PC210, 210LC, 210NLC, 230NHD-8	
Engine					SAA6D107E-1	
Category	Item	Measurement condition		Unit	Standard value for new machine	Judgement criteria
Engine	Engine speed	• Coolant temperature: operating range	High idle	rpm	2,060 ± 70	2,060 ± 70
			Low idle	rpm	1,050 ± 50	1,050 ± 50
			Rated speed	rpm	2,000	2,000
	Intake pressure (boost pressure)	• Coolant temperature: operating range • Arm IN relief + Power Max.		kPa {mmHg}	Min. 133 {Min. 1,000}	103 {775}
	Exhaust gas color	• Coolant temperature: operating range	At sudden acceleration	%	Max. 25	35
			At high idle	%		
	Valve clearance	• Normal temperature	Intake valve	mm	0.25	0.152 – 0.381
			Exhaust valve	mm	0.51	0.381 – 0.762
	Compression pressure	• Oil temperature: 40 – 60°C	Compression pressure	MPa {kg/cm^2}	Min. 2.41 {Min. 24.6}	1.69 {17.2}
			Engine speed	rpm	250 – 280	250 – 280
	Blow-by pressure	• Coolant temperature: operating range • Arm IN relief + power max.		kPa {mmH$_2$O}	Max. 0.98 {Max. 100}	1.96 {200}
	Oil pressure	• SAE0W30E0S, SAE5W40E0S, SAE10W30DH, SAE15W40DH, SAE30DH engine oil • Coolant temperature: operating range	High idle	kPa {kg/cm^2}	Min. 0.29 {Min. 3.0}	0.25 {2.5}
			Low idle	kPa {kg/cm^2}	Min. 0.10 {Min. 1.0}	0.07 {0.7}
	Oil temperature	• Whole speed range (inside oil pan)		°C	80 – 110	120
	Fan belt tension	• Between fan pulley and alternator pulley • Deflection when pressed with finger force of approx. 98 N{10 kg}		mm	8	6 – 10
	Air conditioner compressor belt tension	• Between fan pulley and compressor pulley • Deflection when pressed with finger force of approx. 98 N{10 kg}		mm	5 – 8	5 – 8

PC240LC, 240NLC-8

Applicable model					PC240LC, 240NLC-8	
Engine					SAA6D107E-1	
Cate-gory	Item	Measurement condition		Unit	Standard value for new machine	Judgement criteria
Engine	Engine speed	• Coolant temperature: operating range	High idle	rpm	2,160 ± 70	2,160 ± 70
			Low idle	rpm	1,050 ± 50	1,050 ± 50
			Rated speed	rpm	2,000	2,000
	Intake pressure (boost pressure)	• Coolant temperature: operating range • Arm IN relief + Power Max.		kPa {mmHg}	Min. 133 {Min. 1,000}	103 {775}
	Exhaust gas color	• Coolant temperature: operating range	At sudden acceleration	%	Max. 25	35
			At high idle	%		
	Valve clearance	• Normal temperature	Intake valve	mm	0.25	0.152 – 0.381
			Exhaust valve	mm	0.51	0.381 – 0.762
	Compression pressure	• Oil temperature: 40 – 60°C	Compression pressure	MPa {kg/cm^2}	Min. 2.41 {Min. 24.6}	1.69 {17.2}
			Engine speed	rpm	250 – 280	250 – 280
	Blow-by pressure	• Coolant temperature: operating range • Arm IN relief + power max.		kPa {mmH_2O}	Max. 0.98 {Max. 100}	1.96 {200}
	Oil pressure	• SAE0W30E0S, SAE5W40E0S, SAE10W30DH, SAE15W40DH, SAE30DH engine oil • Coolant temperature: operating range	High idle	kPa {kg/cm^2}	Min. 0.29 {Min. 3.0}	0.25 {2.5}
			Low idle	kPa {kg/cm^2}	Min. 0.10 {Min. 1.0}	0.07 {0.7}
	Oil temperature	• Whole speed range (inside oil pan)		°C	80 – 110	120
	Fan belt tension	• Between fan pulley and alternator pulley • Deflection when pressed with finger force of approx. 98 N{10 kg}		mm	8	6 – 10
	Air conditioner compressor belt tension	• Between fan pulley and compressor pulley • Deflection when pressed with finger force of approx. 98 N{10 kg}		mm	5 – 8	5 – 8

Standard value table for chassis related parts

PC210, 210LC, 210NLC, 230NHD-8

Applicable model					PC210, 210LC, 210NLC, 230NHD-8	
Cate-gory	Item	Measurement condition		Unit	Standard value for new machine	Judgement criteria
Engine speed	2 pumps at relief	• Engine coolant temperature: Within operating range • Hydraulic oil temperature: Within operating range • Engine at high idle • Power mode (P) • Arm IN relief condition		rpm	1,920 ± 100	1,920 ± 100
	At 2-pump relief + power max.	• Engine coolant temperature: Within operating range • Hydraulic oil temperature: Within operating range • Engine at high idle • Working mode: P mode • Arm IN relief + Left knob switch ON		rpm	1,950 ± 100	1,950 ± 100
	Speed when auto-deceleration is operated	• Engine at high idle • Auto-deceleration switch in ON condition • All control levers in NEUTRAL condition		rpm	1,400 ± 100	1,400 ± 100
Spool stroke	Boom control valve	• Engine stopped • For measuring point, see **Control valve**.	Raise	mm	11.5 ± 0.5	11.5 ± 0.5
			Lower	mm	9.5 ± 0.5	9.5 ± 0.5
	Arm control valve		IN	mm	11.5 ± 0.5	11.5 ± 0.5
			OUT	mm	9.5 ± 0.5	9.5 ± 0.5
	Bucket control valve		CURL, DUMP	mm	9.5 ± 0.5	9.5 ± 0.5
	Swing control valve		LH, RH travel	mm	9.5 ± 0.5	9.5 ± 0.5
	Travel control valve		Forward, Reverse	mm	9.5 ± 0.5	9.5 ± 0.5
Travel of control levers	Boom control lever	• Engine stopped • Control lever grip at center • Max. reading up to stroke end (except lever play in NEUTRAL position)		mm	85 ± 10	85 ± 10
	Arm control lever			mm	85 ± 10	85 ± 10
	Bucket control lever			mm	85 ± 10	85 ± 10
	Swing control lever			mm	85 ± 10	85 ± 10
	Travel control lever			mm	115 ± 12	115 ± 12
	Play of control lever		Work equipment	mm	Max. 15	Max. 20
			Travel	mm	Max. 20	Max. 25

Applicable model					PC210, 210LC, 210NLC, 230NHD-8	
Category	Item	Measurement condition		Unit	Standard value for new machine	Judgement criteria
Operating force of control levers and pedal	Boom control lever	• Hydraulic oil temperature: Within operating range • Engine at high idle • Control lever grip at center • Pedal at tip • Max. reading up to stroke end		N {kg}	15.7 ± 3.9 {1.6 ± 0.4}	Max. 24.5 {Max. 2.5}
	Arm control lever			N {kg}	15.7 ± 3.9 {1.6 ± 0.4}	Max. 24.5 {Max. 2.5}
	Bucket control lever			N {kg}	12.7 ± 2.9 {1.3 ± 0.3}	Max. 21.6 {Max. 2.2}
	Swing control lever			N {kg}	12.7 ± 2.9 {1.3 ± 0.3}	Max. 21.6 {Max. 2.2}
	Travel control lever			N {kg}	24.5 ± 5.9 {2.5 ± 0.6}	Max. 39.2 {Max. 4.0}
	Travel control pedal			N {kg}	74.5 ± 18.6 {7.6 ± 1.9}	Max. 107.6 {Max. 11}
Hydraulic pressure	Unload pressure	• Hydraulic oil temperature: Within operating range • Engine at high idle • Working mode: P mode • Hydraulic pump output pressure with all control levers in NEUTRAL position		MPa {kg/cm^2}	3.5 ± 1.0 {36 ± 10}	3.5 ± 1.0 {36 ± 10}
	Boom relief	• Hydraulic oil temperature: Within operating range • Engine at high idle • Working mode: P mode • Hydraulic pump output pressure with all measurement circuits relieved	Normal relief	MPa {kg/cm^2}	34.8 ± 1.0 {355 ± 10}	33.3 – 36.8 {340 – 375}
			Power max.	MPa {kg/cm^2}	37.3 ± 1.0 {380 ± 10}	36.3 – 39.2 {370 – 400}
	Arm relief		Normal relief	MPa {kg/cm^2}	34.8 ± 1.0 {355 ± 10}	33.3 – 36.8 {340 – 375}
			Power max.	MPa {kg/cm^2}	37.3 ± 1.0 {380 ± 10}	36.3 – 39.2 {370 – 400}
	Bucket relief		Normal relief	MPa {kg/cm^2}	34.8 ± 1.0 {355 ± 10}	33.3 – 36.8 {340 – 375}
			Power max.	MPa {kg/cm^2}	37.3 ± 1.0 {380 ± 10}	36.3 – 39.2 {370 – 400}
	Swing relief	• Hydraulic oil temperature: Within operating range • Engine at high idle • Working mode: P mode • Hydraulic pump output pressure with all measurement circuits relieved		MPa {kg/cm^2}	30.3 ± 1.5 {310 ± 15}	28.4 – 32.3 {290 – 330}
	Travel relief			MPa {kg/cm^2}	38.7(+1.0/–2.0) {395(+10/–20)}	36.8 – 40.2 {375 – 410}
	Control circuit source pressure	• Hydraulic oil temperature: Within operating range • Engine running at high idle • Self pressure reducing valve output pressure with all control levers in NEUTRAL position		MPa {kg/cm^2}	3.23(+0.2/–0.3) {33(+2/–3)}	2.75 – 3.43 {28 – 35}
	LS differential pressure	• Hydraulic oil temperature: Within operating range • Engine at high idle • Working mode: P mode • Traveling speed: Hi • Run either track with no load • Hydraulic oil pump pressure – LS pressure	When all control levers in NEUTRAL position	MPa {kg/cm^2}	3.5 ± 1.0 {36 ± 10}	3.5 ± 1.0 {36 ± 10}
			When traveling at half stroke	MPa {kg/cm^2}	1.8 ± 0.1 {18 ± 1}	1.8 ± 0.1 {18 ± 1}

Applicable model					PC210, 210LC, 210NLC, 230NHD-8	
Category	Item	Measurement condition		Unit	Standard value for new machine	Judgement criteria
Swing	Swing brake angle	• Hydraulic oil temperature: Within operating range • Engine running at high idle • Working mode: P mode • Swing circle misalignment amount when stopping after one turn • For measuring posture, see **Swing 1**		deg. (mm)	Max. 100 (—)	Max. 130 (—)
	Time taken to start swing	• Hydraulic oil temperature: Within operating range • Engine running at high idle • Working mode: P mode • Time required for passing points 90° and 180° from starting point • For measuring posture, see **Swing 1**	90°	sec.	3.1 ± 0.3	Max. 3.7
			180°	sec.	4.4 ± 0.4	Max. 5.5
	Time taken to swing	• Hydraulic oil temperature: Within operating range • Engine running at high idle • Working mode: P mode • Time required for 5 more turns after making initial one turn • For measuring posture, see **Swing 1**		sec.	24.2 ± 2.5	Max. 30
	Hydraulic drift of swing	• Hydraulic oil temperature: Within operating range • Engine stopped • Keeping upper structure transverse on slope of 15° • Notching a mating mark on inner and outer races of swing circle • Mating mark misalignment amount during 5 minutes • For measuring posture, see **Swing 2**		mm	0	0
	Leakage from swing motor	• Hydraulic oil temperature: Within operating range • Engine running at high idle • Swing lock switch: ON • Leakage amount for one minute during swing relief		ℓ/min	Max. 5	Max. 10
Travel	Travel speed (without load)	• Hydraulic oil temperature: Within operating range • Engine running at high idle • Working mode: P mode • Time required for track shoes to make 5 turns after making one initial idle turn • For measuring posture, see **Travel 1**	Lo	sec.	[PC210] 51.3 ± 5.1	[PC210] 46.2 – 60.4
					[PC210LC/NLC] 55.9 ± 5.6	[PC210LC/NLC] 50.3 – 65.5
					[PC230NHD] 61.9 ± 6.2	[PC230NHD] 55.7 – 72.5
			Mi	sec.	[PC210] 37.5 ± 3.8	[PC210] 33.7 – 45.3
					[PC210LC/NLC] 40.8 ± 4.1	[PC210LC/NLC] 36.7 – 48.9
					[PC230NHD] 44.6 ± 4.5	[PC230NHD] 40.1 – 53.6
			Hi	sec.	[PC210] 26.5 ± 1.3	[PC210] 25.2 – 29.8
					[PC210LC/NLC] 28.8 ± 1.5	[PC210LC/NLC] 27.3 – 32.3
					[PC230NHD] 28.2 ± 1.5	[PC230NHD] 26.7 – 31.6

Applicable model					PC210, 210LC, 210NLC, 230NHD-8	
Category	Item	Measurement condition		Unit	Standard value for new machine	Judgement criteria
Travel	Travel speed (actual run)	• Hydraulic oil temperature: Within operating range • Engine running at high idle • Working mode: P mode • Flat ground • Time required for traveling 20 m after 10 m trial run • For measuring posture, see **Travel 2**	Lo	sec.	[PC210/LC/NLC] 24 ± 2.5	[PC210/LC/NLC] 21.5 – 27.5
					[PC230NHD] 28 ±2.5	[PC230NHD] 25.5 – 31.5
			Mi	sec.	[PC210/LC/NLC] 17 ± 2.5	[PC210/LC/NLC] 14.5 – 20.5
					[PC230NHD] 20 ±2.5	[PC230NHD] 17.5 – 23.5
			Hi	sec.	[PC210/LC/NLC] 13 ±1.0	[PC210/LC/NLC] 12.0 – 15.0
					[PC230NHD] 13 ±1.0	[PC230NHD] 12.0 – 15.0
	Travel deviation	• Hydraulic oil temperature: Within operating range • Engine at high idle • Working mode: P mode • Travel speed: Lo • Solid and flat ground • Swerving amount while traveling 20 m (X) after initial 10 m trial run • For measuring posture, see **Travel 2 and 3**		mm	Max. 150	Max. 250
	Hydraulic drift of travel	• Hydraulic oil temperature: Within operating range • Engine stopped • Parking machine on slope of 12° with sprocket facing upslope • Sliding distance for 5 minutes • For measuring posture, see **Travel 4**		mm	0	0
	Leakage of travel motor	• Hydraulic oil temperature: Within operating range • Engine at high idle • Traveling with sprocket locked • Oil leakage amount for one minute with traveling in relief condition		ℓ/min	13.6	27.2
Work equipment	Hydraulic drift of work equipment: Whole work equipment	• Hydraulic oil temperature: Within operating range • Flat and level ground • Fill bucket with dirt or rated load ($0.8m^3$: 1,440kg) • Boom horizontal, arm fully retracted, bucket cylinder fully extended • Engine stopped • Work equipment control lever in NEUTRAL position • Fall amount for 15 minutes as measured every 5 minutes starting immediately after initial setting • Whole work equipment: Lowering distance of tooth tip • Boom cylinder: Retraction distance of cylinder • Arm cylinder: Extraction distance of cylinder • Bucket cylinder: Retraction distance of cylinder • For measuring posture, see **Work equipment 1**		mm	Max. 600	Max. 900
	Hydraulic drift of work equipment: Boom cylinder			mm	Max. 18	Max. 27
	Hydraulic drift of work equipment: Arm cylinder			mm	Max. 160	Max. 240
	Hydraulic drift of work equipment: Bucket cylinder			mm	Max. 40	Max. 58

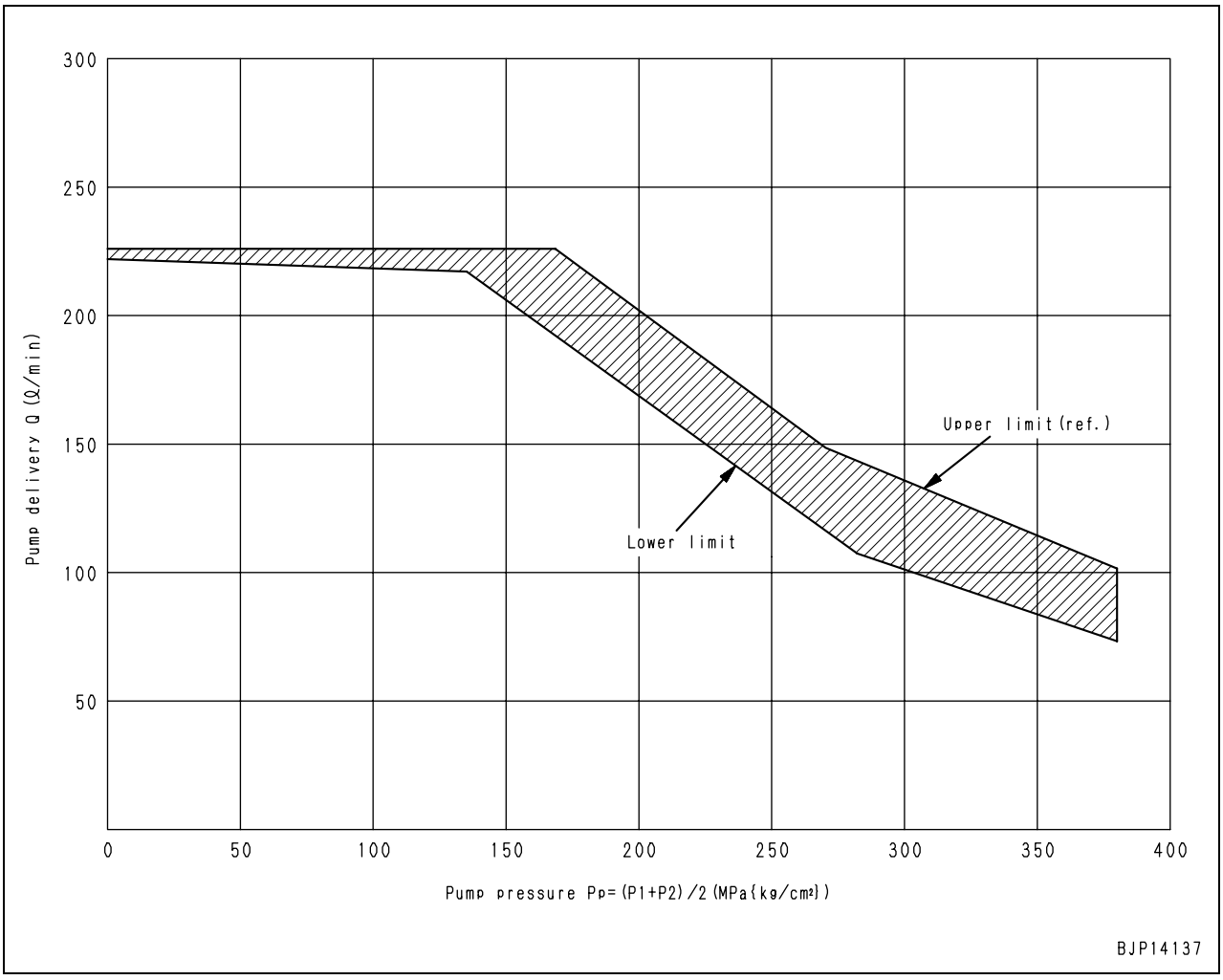
Applicable model						PC210, 210LC, 210NLC, 230NHD-8	
Cate-gory	Item		Measurement condition		Unit	Standard value for new machine	Judgement criteria
Work equipment	Work equipment speed	Boom	• Hydraulic oil temperature: Within operating range • Engine running at high idle • Working mode: P mode • Time required from raise stroke end till bucket touches ground • For measuring posture, see **Work equipment 2**	RAISE	sec.	3.3 ± 0.4	Max. 4.7
				LOWER	sec.	2.4 ± 0.3	Max. 3.7
		Arm	• Hydraulic oil temperature: Within operating range • Engine running at high idle • Working mode: P mode • Time required from dumping stroke end to digging stroke end • For measuring posture, see **Work equipment 3**	IN	sec.	3.5 ± 0.4	Max. 4.5
				OUT	sec.	2.7 ± 0.3	Max. 3.5
		Bucket	• Hydraulic oil temperature: Within operating range • Engine running at high idle • Working mode: P mode • Time required from dumping stroke end to digging stroke end • For measuring posture, see **Work equipment 4**	CURL	sec.	2.6 ± 0.3	Max. 3.3
				DUMP	sec.	1.9 ± 0.2	Max. 2.7

Applicable model					PC210, 210LC, 210NLC, 230NHD-8	
Category	Item		Measurement condition	Unit	Standard value for new machine	Judgement criteria
Work equipment	Time lag	Boom	• Hydraulic oil temperature: Within operating range • Engine running at low idle • Working mode: P mode • Time required from raise stroke end till bucket touches ground and pushes up machine front • For measuring posture, see **Work equipment 5**	sec.	Max. 1.0	Max. 1.2
		Arm	• Hydraulic oil temperature: Within operating range • Engine running at low idle • Working mode: P mode • Time required from dumping stroke end till bucket stops momentarily after control lever is tilted to digging and starts to move again • For measuring posture, see **Work equipment 6**	sec.	Max. 2.0	Max. 2.8
		Bucket	• Hydraulic oil temperature: Within operating range • Engine running at low idle • Working mode: P mode • Time required from dumping stroke end till bucket stops momentarily after control lever is tilted to digging and starts to move again • For measuring posture, see **Work equipment 7**	sec.	Max. 1.0	Max. 3.6
	Internal leackage	Cylinders	• Hydraulic oil temperature: Within operating range • Engine running at high idle • Leakage amount for one minute with cylinder or travel to be measured in relief condition	cc/min	4.5	20
		Center swivel joint		cc/min	10	50
Performance in compound operation	Swerving amount in simultaneous operation of work equipment and travel		• Hydraulic oil temperature: Within operating range • Engine at high idle • Working mode: P mode • Traveling speed: Lo • On hard and flat ground, make approach run of 10 m and then measure deviation in the travel of 20 m • For measuring posture, see **Travel 2 and 3**	mm	Max.200	Max.220
Characteristics of PC flow control valve	Time required for turning from 0 to 90° with boom raised		• Hydraulic oil temperature: Within operating range • Engine at high idle • Working mode: P mode • Rated load applied to bucket ($0.8m^3$: 1,440kg) • On hard and flat ground, set arm vertically and lower back of bucket to ground • Time required till passing spot of 90° starting from illustrated posture and with boom raised • For measuring posture, see **Work equipment 8**	sec.	4.2 ± 0.4 (Reference value)	
—	Discharge amount of hydraulic pump		See performance of hydraulic pump (next page)			

Applicable model				PC210, 210LC, 210NLC, 230NHD-8	
Category	Item	Measurement condition	Unit	Standard value	Standard lower limit of delivery
Hydraulic pump	Performance of hydraulic pump	• Pump speed (rpm): 2,000rpm • PC-EPC current value (mA): 440mA • Discharge pressure of test pump (MPa {kg/cm^2}): P1 • Discharge pressure of another pump (MPa {kg/cm^2}): P2 • Average discharge pressure (MPa {kg/cm^2}): Pp=(P1+P2)÷2	ℓ/min	Q (See graph)	Q (See graph)

★ As far as possible, bring pump discharge pressure P1 and P2 as close as possible to the average pressure when measuring.

★ When measuring with the pump mounted on the machine, if it is impossible to set the engine speed to the specified speed with the fuel control dial, take the pump discharge amount and the engine speed at the point of measurement, and use them as a base for calculating the pump discharge amount at the specified speed.



PC240LC, 240NLC-8

Applicable model					PC240LC, 240NLC-8	
Cate-gory	Item	Measurement condition		Unit	Standard value for new machine	Judgement criteria
Engine speed	2 pumps at relief	• Engine coolant temperature: Within operating range • Hydraulic oil temperature: Within operating range • Engine at high idle • Power mode (P) • Arm IN relief condition		rpm	1,940 ± 100	1,940 ± 100
	At 2-pump relief + power max.	• Engine coolant temperature: Within operating range • Hydraulic oil temperature: Within operating range • Engine at high idle • Working mode: P mode • Arm IN relief + Left knob switch ON		rpm	1,950 ± 100	1,950 ± 100
	Speed when auto-deceleration is operated	• Engine at high idle • Auto-deceleration switch in ON condition • All control levers in NEUTRAL condition		rpm	1,400 ± 100	1,400 ± 100
Spool stroke	Boom control valve	• Engine stopped • For measuring point, see **Control valve**.	Raise	mm	11.5 ± 0.5	11.5 ± 0.5
			Lower	mm	9.5 ± 0.5	9.5 ± 0.5
	Arm control valve		IN	mm	11.5 ± 0.5	11.5 ± 0.5
			OUT	mm	9.5 ± 0.5	9.5 ± 0.5
	Bucket control valve		CURL, DUMP	mm	9.5 ± 0.5	9.5 ± 0.5
	Swing control valve		LH, RH travel	mm	9.5 ± 0.5	9.5 ± 0.5
	Travel control valve		Forward, Reverse	mm	9.5 ± 0.5	9.5 ± 0.5
Travel of control levers	Boom control lever	• Engine stopped • Control lever grip at center • Max. reading up to stroke end (except lever play in NEUTRAL position)		mm	85 ± 10	85 ± 10
	Arm control lever			mm	85 ± 10	85 ± 10
	Bucket control lever			mm	85 ± 10	85 ± 10
	Swing control lever			mm	85 ± 10	85 ± 10
	Travel control lever			mm	115 ± 12	115 ± 12
	Play of control lever		Work equipment	mm	Max. 15	Max. 20
			Travel	mm	Max. 20	Max. 25

Applicable model					PC240LC, 240NLC-8	
Category	Item	Measurement condition		Unit	Standard value for new machine	Judgement criteria
Operating force of control levers and pedal	Boom control lever	• Hydraulic oil temperature: Within operating range • Engine at high idle • Control lever grip at center • Pedal at tip • Max. reading up to stroke end		N {kg}	15.7 ± 3.9 {1.6 ± 0.4}	Max. 24.5 {Max. 2.5}
	Arm control lever			N {kg}	15.7 ± 3.9 {1.6 ± 0.4}	Max. 24.5 {Max. 2.5}
	Bucket control lever			N {kg}	12.7 ± 2.9 {1.3 ± 0.3}	Max. 21.6 {Max. 2.2}
	Swing control lever			N {kg}	12.7 ± 2.9 {1.3 ± 0.3}	Max. 21.6 {Max. 2.2}
	Travel control lever			N {kg}	24.5 ± 5.9 {2.5 ± 0.6}	Max. 39.2 {Max. 4.0}
	Travel control pedal			N {kg}	74.5 ± 18.6 {7.6 ± 1.9}	Max. 107.6 {Max. 11}
Hydraulic pressure	Unload pressure	• Hydraulic oil temperature: Within operating range • Engine at high idle • Working mode: P mode • Hydraulic pump output pressure with all control levers in NEUTRAL position		MPa {kg/cm^2}	3.5 ± 1.0 {36 ± 10}	3.5 ± 1.0 {36 ± 10}
	Boom relief	• Hydraulic oil temperature: Within operating range • Engine at high idle • Working mode: P mode • Hydraulic pump output pressure with all measurement circuits relieved	Normal relief	MPa {kg/cm^2}	34.8 ± 1.0 {355 ± 10}	33.3 – 36.8 {340 – 375}
			Power max.	MPa {kg/cm^2}	37.3 ± 1.0 {380 ± 10}	36.3 – 39.2 {370 – 400}
	Arm relief		Normal relief	MPa {kg/cm^2}	34.8 ± 1.0 {355 ± 10}	33.3 – 36.8 {340 – 375}
			Power max.	MPa {kg/cm^2}	37.3 ± 1.0 {380 ± 10}	36.3 – 39.2 {370 – 400}
	Bucket relief		Normal relief	MPa {kg/cm^2}	34.8 ± 1.0 {355 ± 10}	33.3 – 36.8 {340 – 375}
			Power max.	MPa {kg/cm^2}	37.3 ± 1.0 {380 ± 10}	36.3 – 39.2 {370 – 400}
	Swing relief	• Hydraulic oil temperature: Within operating range • Engine at high idle • Working mode: P mode • Hydraulic pump output pressure with all measurement circuits relieved		MPa {kg/cm^2}	30.3 ± 1.5 {310 ± 15}	28.4 – 32.3 {290 – 330}
	Travel relief			MPa {kg/cm^2}	38.7(+1.0/–2.0) {395(+10/–20)}	36.8 – 40.2 {375 – 410}
	Control circuit source pressure	• Hydraulic oil temperature: Within operating range • Engine running at high idle • Self pressure reducing valve output pressure with all control levers in NEUTRAL position		MPa {kg/cm^2}	3.23(+0.2/–0.3) {33(+2/–3)}	2.75 – 3.43 {28 – 35}
	LS differential pressure	• Hydraulic oil temperature: Within operating range • Engine at high idle • Working mode: P mode • Traveling speed: Hi • Run either track with no load • Hydraulic oil pump pressure – LS pressure	When all control levers in NEUTRAL position	MPa {kg/cm^2}	3.5 ± 1.0 {36 ± 10}	3.5 ± 1.0 {36 ± 10}
			When traveling at half stroke	MPa {kg/cm^2}	1.8 ± 0.1 {18 ± 1}	1.8 ± 0.1 {18 ± 1}

Applicable model					PC240LC, 240NLC-8	
Category	Item	Measurement condition		Unit	Standard value for new machine	Judgement criteria
Swing	Swing brake angle	• Hydraulic oil temperature: Within operating range • Engine running at high idle • Working mode: P mode • Swing circle misalignment amount when stopping after one turn • For measuring posture, see **Swing 1**		deg. (mm)	Max. 165 (—)	Max. 200 (—)
	Time taken to start swing	• Hydraulic oil temperature: Within operating range • Engine running at high idle • Working mode: P mode • Time required for passing points 90° and 180° from starting point • For measuring posture, see **Swing 1**	90°	sec.	3.0 ± 0.3	Max. 3.5
			180°	sec.	4.5 ± 0.4	Max. 5.4
	Time taken to swing	• Hydraulic oil temperature: Within operating range • Engine running at high idle • Working mode: P mode • Time required for 5 more turns after making initial one turn • For measuring posture, see **Swing 1**		sec.	25.7 ± 2.8	Max. 31
	Hydraulic drift of swing	• Hydraulic oil temperature: Within operating range • Engine stopped • Keeping upper structure transverse on slope of 15° • Notching a mating mark on inner and outer races of swing circle • Mating mark misalignment amount during 5 minutes • For measuring posture, see **Swing 2**		mm	0	0
	Leakage from swing motor	• Hydraulic oil temperature: Within operating range • Engine running at high idle • Swing lock switch: ON • Leakage amount for one minute during swing relief		ℓ/min	Max. 5	Max. 10
Travel	Travel speed (without load)	• Hydraulic oil temperature: Within operating range • Engine running at high idle • Working mode: P mode • Time required for track shoes to make 5 turns after making one initial idle turn • For measuring posture, see **Travel 1**	Lo	sec.	58.1(+6.5/–5.3)	52.8 – 68.6
			Mi	sec.	42.5(+4.7/–3.9)	38.6 – 51.2
			Hi	sec.	30.3(+1.6/–1.4)	28.9 – 33.9

Applicable model					PC240LC, 240NLC-8	
Category	Item		Measurement condition	Unit	Standard value for new machine	Judgement criteria
Travel	Travel speed (actual run)		• Hydraulic oil temperature: Within operating range • Engine running at high idle • Working mode: P mode • Flat ground • Time required for traveling 20 m after 10 m trial run • For measuring posture, see **Travel 2** — Lo	sec.	24 ± 2.5	21.5 – 27.5
			Mi	sec.	17 ± 2.0	15.0 – 20.0
			Hi	sec.	13 ± 1.0	12.0 – 15.0
	Travel deviation		• Hydraulic oil temperature: Within operating range • Engine at high idle • Working mode: P mode • Travel speed: Lo • Solid and flat ground • Swerving amount while traveling 20 m (X) after initial 10 m trial run • For measuring posture, see **Travel 2 and 3**	mm	Max. 150	Max. 250
	Hydraulic drift of travel		• Hydraulic oil temperature: Within operating range • Engine stopped • Parking machine on slope of 12° with sprocket facing upslope • Sliding distance for 5 minutes • For measuring posture, see **Travel 4**	mm	0	0
	Leakage of travel motor		• Hydraulic oil temperature: Within operating range • Engine at high idle • Traveling with sprocket locked • Oil leakage amount for one minute with traveling in relief condition	ℓ/min	13.6	27.2
Work equipment	Hydraulic drift of work equipment	Whole work equipment	• Hydraulic oil temperature: Within operating range • Flat and level ground • Fill bucket with dirt or rated load (0.8m^3: 1,440kg) • Boom horizontal, arm fully retracted, bucket cylinder fully extended • Engine stopped • Work equipment control lever in NEUTRAL position • Fall amount for 15 minutes as measured every 5 minutes starting immediately after initial setting • Whole work equipment: Lowering distance of tooth tip • Boom cylinder: Retraction distance of cylinder • Arm cylinder: Extraction distance of cylinder • Bucket cylinder: Retraction distance of cylinder • For measuring posture, see **Work equipment 1**	mm	Max. 600	Max. 900
		Boom cylinder		mm	Max. 18	Max. 27
		Arm cylinder		mm	Max. 160	Max. 240
		Bucket cylinder		mm	Max. 40	Max. 58

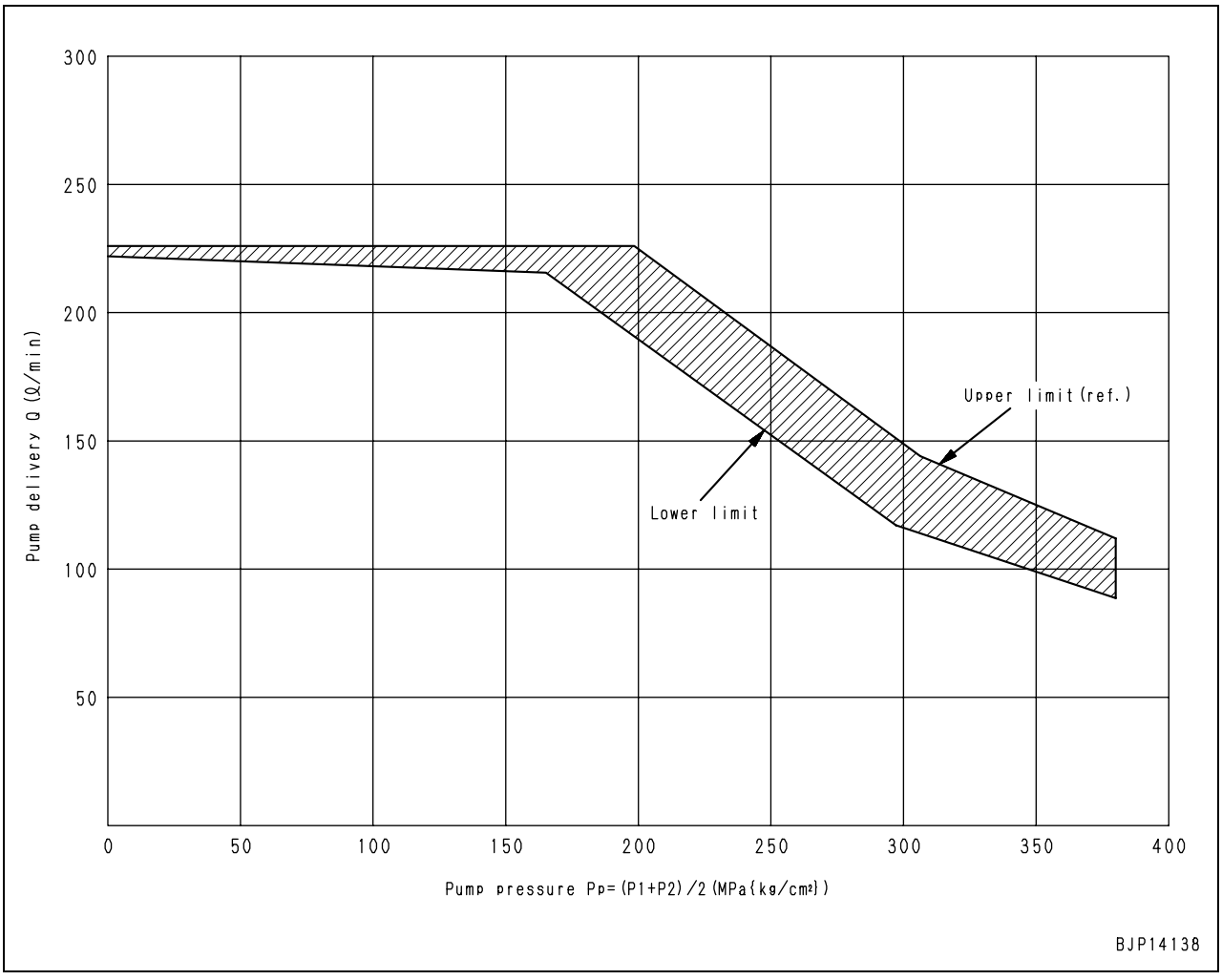
Applicable model						PC240LC, 240NLC-8	
Cate-gory	Item		Measurement condition		Unit	Standard value for new machine	Judgement criteria
Work equipment	Work equipment speed	Boom	• Hydraulic oil temperature: Within operating range • Engine running at high idle • Working mode: P mode • Time required from raise stroke end till bucket touches ground • For measuring posture, see **Work equipment 2**	RAISE	sec.	3.4(+0.5/–0.3)	Max. 4.9
				LOWER	sec.	2.7 ± 0.3	Max. 4.4
		Arm	• Hydraulic oil temperature: Within operating range • Engine running at high idle • Working mode: P mode • Time required from dumping stroke end to digging stroke end • For measuring posture, see **Work equipment 3**	IN	sec.	4.0 ± 0.4	Max. 4.7
				OUT	sec.	2.9(+0.4/–0.2)	Max. 3.5
		Bucket	• Hydraulic oil temperature: Within operating range • Engine running at high idle • Working mode: P mode • Time required from dumping stroke end to digging stroke end • For measuring posture, see **Work equipment 4**	CURL	sec.	2.7 ± 0.3	Max. 3.3
				DUMP	sec.	2.1 ± 0.3	Max. 2.7

Applicable model					PC240LC, 240NLC-8	
Category	Item		Measurement condition	Unit	Standard value for new machine	Judgement criteria
Work equipment	Time lag	Boom	• Hydraulic oil temperature: Within operating range • Engine running at low idle • Working mode: P mode • Time required from raise stroke end till bucket touches ground and pushes up machine front • For measuring posture, see **Work equipment 5**	sec.	Max. 1.0	Max. 1.2
		Arm	• Hydraulic oil temperature: Within operating range • Engine running at low idle • Working mode: P mode • Time required from dumping stroke end till bucket stops momentarily after control lever is tilted to digging and starts to move again • For measuring posture, see **Work equipment 6**	sec.	Max. 2.0	Max. 2.8
		Bucket	• Hydraulic oil temperature: Within operating range • Engine running at low idle • Working mode: P mode • Time required from dumping stroke end till bucket stops momentarily after control lever is tilted to digging and starts to move again • For measuring posture, see **Work equipment 7**	sec.	Max. 1.0	Max. 3.6
	Internal leackage	Cylinders	• Hydraulic oil temperature: Within operating range • Engine running at high idle • Leakage amount for one minute with cylinder or travel to be measured in relief condition	cc/min	4.5	20
		Center swivel joint		cc/min	10	50
Performance in compound operation	Swerving amount in simultaneous operation of work equipment and travel		• Hydraulic oil temperature: Within operating range • Engine at high idle • Working mode: P mode • Traveling speed: Lo • On hard and flat ground, make approach run of 10 m and then measure deviation in the travel of 20 m • For measuring posture, see **Travel 2 and 3**	mm	Max.200	Max.220
Characteristics of PC flow control valve	Time required for turning from 0 to 90° with boom raised		• Hydraulic oil temperature: Within operating range • Engine at high idle • Working mode: P mode • Rated load applied to bucket ($0.8m^3$: 1,440kg) • On hard and flat ground, set arm vertically and lower back of bucket to ground • Time required till passing spot of 90° starting from illustrated posture and with boom raised • For measuring posture, see **Work equipment 8**	sec.	4.3 ± 0.4 (Reference value)	
—	Discharge amount of hydraulic pump		See performance of hydraulic pump (next page)			

Applicable model				PC240LC, 240NLC-8	
Category	Item	Measurement condition	Unit	Standard value	Standard lower limit of delivery
Hydraulic pump	Performance of hydraulic pump	• Pump speed (rpm): 2,000rpm • PC-EPC current value (mA): 440mA • Discharge pressure of test pump (MPa {kg/cm^2}): P1 • Discharge pressure of another pump (MPa {kg/cm^2}): P2 • Average discharge pressure (MPa {kg/cm^2}): Pp=(P1+P2)÷2	ℓ/min	Q (See graph)	Q (See graph)

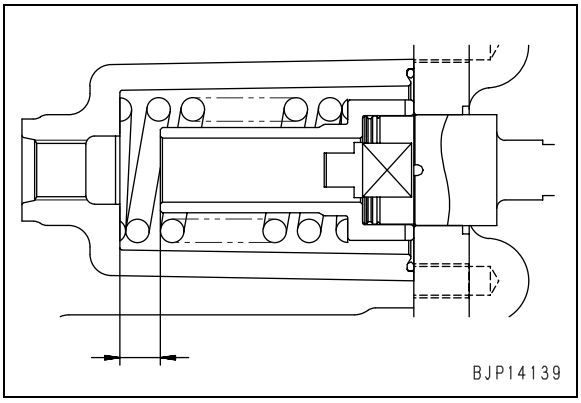
★ As far as possible, bring pump discharge pressure P1 and P2 as close as possible to the average pressure when measuring.

★ When measuring with the pump mounted on the machine, if it is impossible to set the engine speed to the specified speed with the fuel control dial, take the pump discharge amount and the engine speed at the point of measurement, and use them as a base for calculating the pump discharge amount at the specified speed.

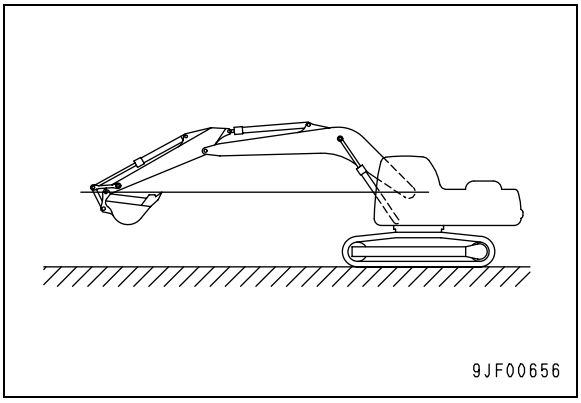


For all models (Posture of machine for measuring performance and measurement procedure)

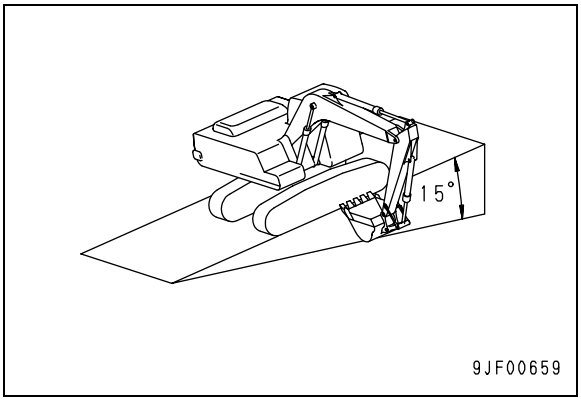
Control valve: spool stroke



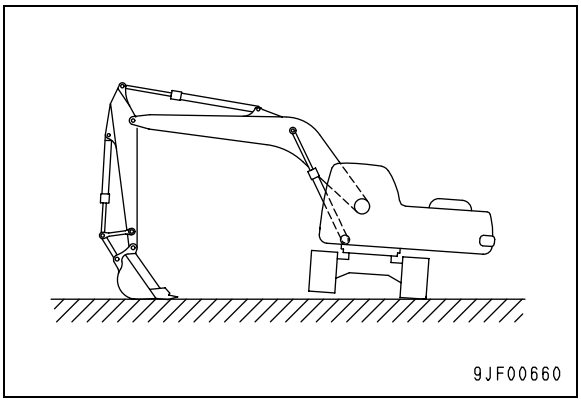
Swing 1: Swing brake angle, time taken to start swing, time taken to swing



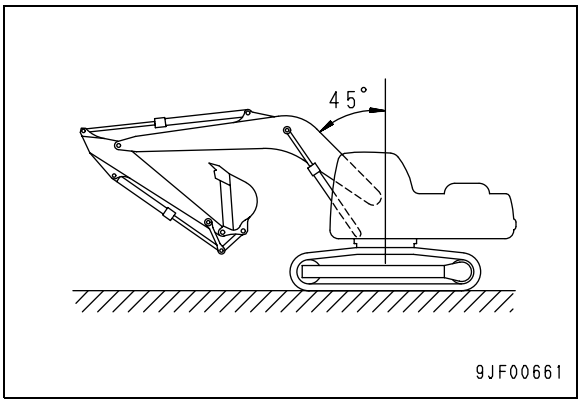
Swing 2: Hydraulic drift of swing



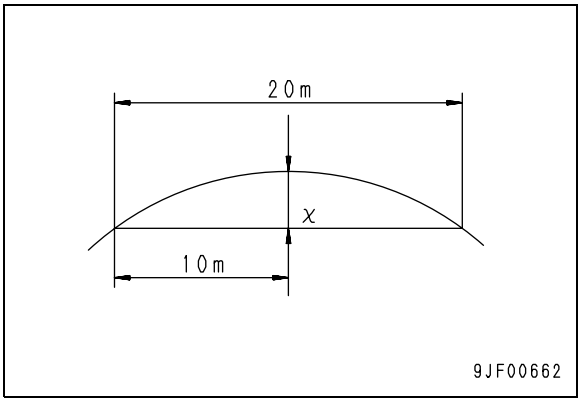
Travel 1: Travel speed (without load)



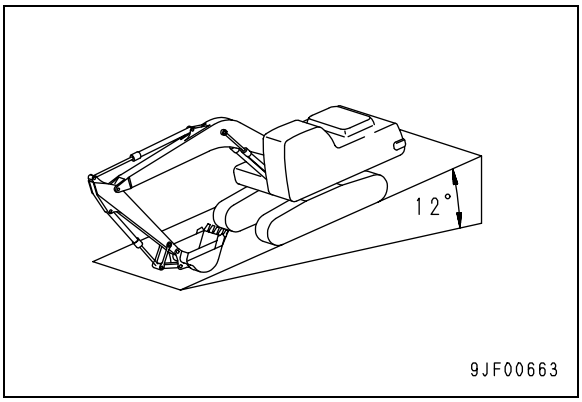
Travel 2: Travel speed (actual run), travel deviation



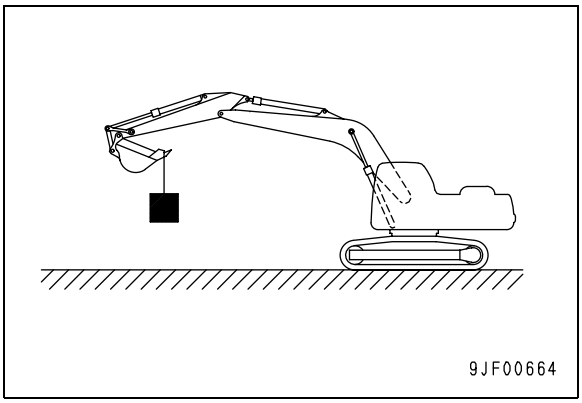
Travel 3: Travel deviation



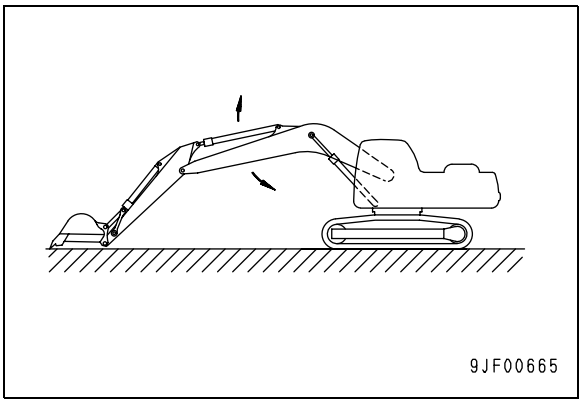
Travel 4: Hydraulic drift of travel



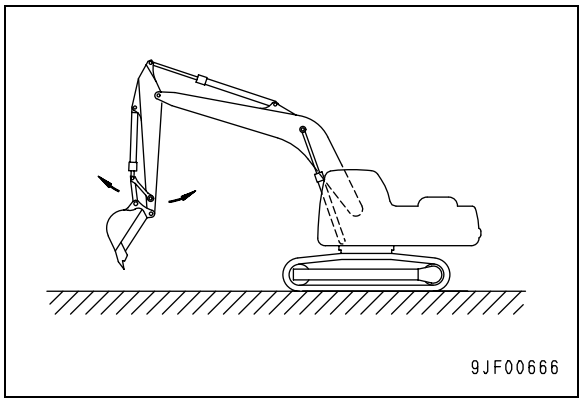
Work equipment 1: Hydraulic drift of work equipment



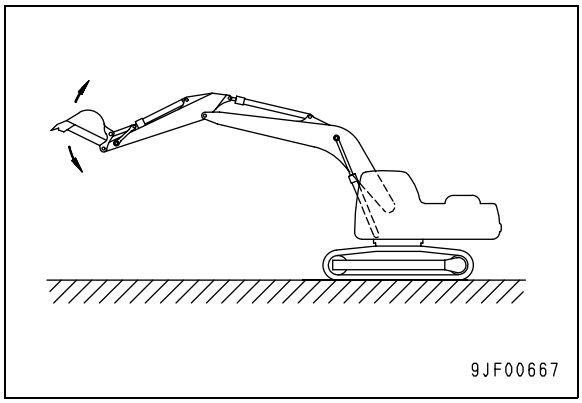
Work equipment 2: Boom speed



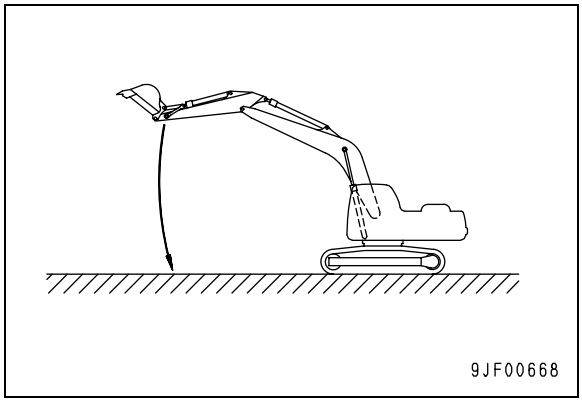
Work equipment 3: Arm speed



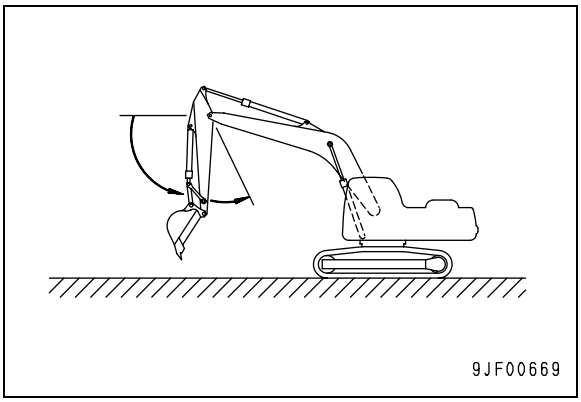
Work equipment 4: Bucket speed



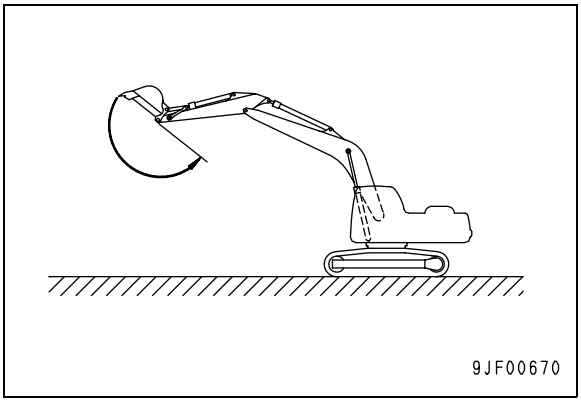
Work equipment 5: Boom time lag



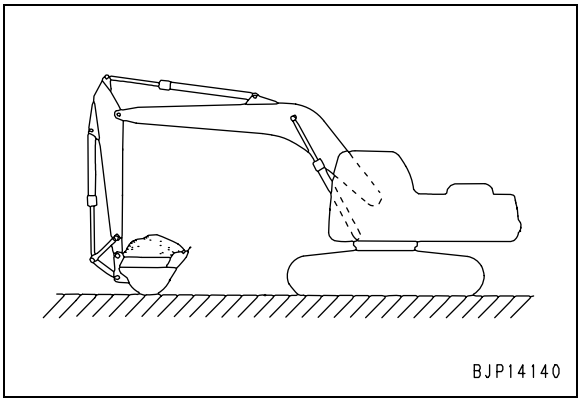
Work equipment 6: Arm time lag



Work equipment 7: Bucket time lag



Work equipment 8: Characteristics of PC flow control valve



PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00227-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

30 Testing and adjusting

Testing and adjusting, Part 1

Testing and adjusting, Part 1

Tools for testing, adjusting, and troubleshooting

Testing/Adjusting item	Symbol		Part No.	Part name	Q'ty	Remarks
Measuring intake air pressure (boost pressure)	R		799-201-2202	Boost gauge kit	1	– 101 – 200 kPa {– 760 – 1,500 mmHg}
Checking exhaust gas color	A	1	799-201-9001	Handy smoke checker	1	Bosch index: 0 – 9
		2	Commercially available	Smoke meter	1	
Adjusting valve clearance	B	1	795-799-1131	Gear	1	
		2	Commercially available	Thickness gauge	1	Intake: 0.25 mm, Exhaust: 0.51 mm
Measuring compression pressure	C	1	795-502-1590	Compression gauge	1	0 – 6.9 MPa {0 – 70 kg/cm^2}
		2	795-799-6700	Puller	1	For 107E-1 engine
		3	795-790-4410	Adapter	1	For 107E-1 engine
			6754-11-3130	Gasket	1	For 107E-1 engine
Measuring blow-by pressure	D	1	799-201-1504	Blow-by checker	1	0 – 5 kPa {0 – 500 mmH_2O}
		2	795-790-3300	Blow-by tool	1	For 107E-1 engine
Measuring engine oil pressure	E	1	799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm^2}
			790-261-1204	Digital hydraulic tester	1	Pressure gauge: 58.8 MPa {600 kg/cm^2}
		2	799-401-2320	Hydraulic tester	1	Pressure gauge: 0.98 MPa {10 kg/cm^2}
Measuring fuel pressure	F	1	799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm^2}
			790-261-1204	Digital hydraulic tester	1	Pressure gauge: 58.8 MPa {600 kg/cm^2}
		2	6732-81-3170	Adapter	1	10 × 1.0 mm → R1/8
			6215-81-9710	O-ring	1	
		3	799-401-2320	Hydraulic tester	1	Pressure gauge: 0.98 MPa {10 kg/cm^2}
Measuring fuel return rate and leakage	G	1	(Not set yet)	Supply pump testing tool	1	
		2	(Not set yet)	Pressure limiter testing tool	1	
		3	(Not set yet)	Injector testing tool	1	
		4	Commercially available	Measuring cylinder	1	
Measuring swing circle bearing clearance	H		Commercially available	Dial gauge	1	
Measuring and adjusting oil pressure in work equipment, swing, and travel circuits	J	1	799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm^2}
			790-261-1204	Digital hydraulic tester	1	Pressure gauge: 58.8 MPa {600 kg/cm^2}
		2	799-101-5220	Nipple	2	Size: 10 × 1.25 mm
			07002-11023	O-ring	2	

Testing/Adjusting item	Symbol		Part No.	Part name	Q'ty	Remarks
Measuring basic pressure of control circuit	K	1	799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm^2}
			790-261-1204	Digital hydraulic tester	1	Pressure gauge: 58.8 MPa {600 kg/cm^2}
		2	799-101-5220	Nipple	1	Size: 10 × 1.25 mm
			07002-11023	O-ring	1	
Measuring and adjusting oil pressure in pump PC control circuit	L	1	799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm^2}
			790-261-1204	Digital hydraulic tester	1	Pressure gauge: 58.8 MPa {600 kg/cm^2}
		2	799-101-5220	Nipple	4	Size: 10 × 1.25 mm
			07002-11023	O-ring	4	
Measuring and adjusting oil pressure in pump LS control circuit	M	1	799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm^2}
			790-261-1204	Digital hydraulic tester	1	Pressure gauge: 58.8 MPa {600 kg/cm^2}
		2	799-401-2701	Differential pressure gauge	1	49 MPa {500 kg/cm^2}
		3	799-101-5220	Nipple	4	Size: 10 × 1.25 mm
			07002-11023	O-ring	4	
Measuring solenoid valve output pressure	N	1	799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm^2}
			790-261-1204	Digital hydraulic tester	1	Pressure gauge: 58.8 MPa {600 kg/cm^2}
		2	799-401-3100	Adapter	1	Size: 02
Measuring PPC valve output pressure	P	1	799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm^2}
			790-261-1204	Digital hydraulic tester	1	Pressure gauge: 58.8 MPa {600 kg/cm^2}
		2	799-401-3100	Adapter	1	Size: 02
		3	799-401-3200	Adapter	1	Size: 03
Measuring oil leakage	Q		Commercially available	Measuring cylinder	1	
Measuring coolant temperature and oil temperature	—		799-101-1502	Digital thermometer	1	– 99.9 – 1,299°C
Measuring operating effort and depressing force	—		79A-264-0021	Push-pull scale	1	0 – 294 N {0 – 30 kg}
			79A-264-0091	Push-pull scale	1	0 – 490 N {0 – 50 kg}
Measuring stroke and hydraulic drift	—		Commercially available	Ruler	1	
Measuring work equipment speed	—		Commercially available	Stopwatch	1	
Measuring voltage and resistance	—		Commercially available	Circuit tester	1	
Removal and installation of boost pressure and temperature sensors	—		(Not set yet)	Screwdriver	1	3.35 mm torque wrench
Removal and installation of engine oil pressure sensor	—		(Not set yet)	Socket	1	27 mm deep socket

Testing/Adjusting item	Symbol	Part No.	Part name	Q'ty	Remarks
Removal and installation of engine coolant temperature sensor	—	(Not set yet)	Socket	1	21 mm deep socket

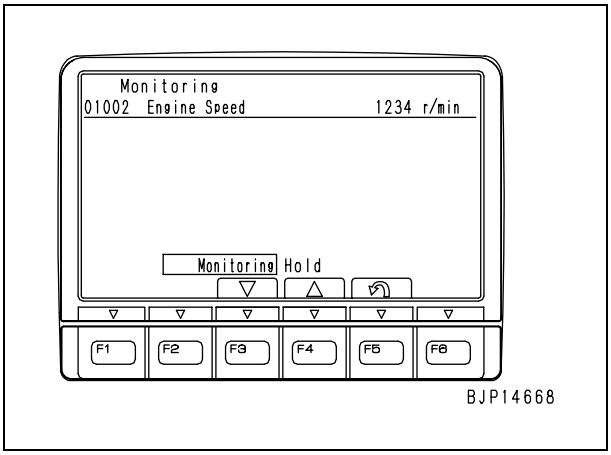
★ For the model names and part Nos. of the T-boxes and T-adapters used for troubleshooting for the machine monitor, controllers, sensors, actuators, electrical equipment, and wiring harnesses, see “Troubleshooting (General information on troubleshooting), List of T-boxes and T-adapters”.

Measuring engine speed

★ Measure the engine speed with the monitoring function of the machine monitor.
★ Measure the engine speed under the following condition.
- Engine coolant temperature: Within operating range
- Hydraulic oil temperature: Within operating range

1. Preparation work

Operate the machine monitor so that the engine speed can be monitored.
★ For the operating method of the machine monitor, see Special functions of machine monitor.
★ Monitoring code: 01002 Engine speed



2. Measuring low idle speed

1) Start the engine and set the fuel control dial in the low idle (MIN) position.
2) Set all the levers and pedals for work equipment control, swing control, and travel in neutral and measure the engine speed.

3. Measuring high idle speed

1) Start the engine and set the fuel control dial in the high idle (MAX) position.
2) Set the working mode in the power mode (P) and turn the auto-decelerator OFF.
3) Set all the levers and pedals for work equipment control, swing control, and travel in neutral and measure the engine speed.

4. Measuring 2-pump relief speed

1) Start the engine and operate the arm cylinder to the IN stroke end.
2) Set the fuel control dial in the high idle (MAX) position and set the working mode in the power mode (P).
3) Operate the left work equipment control lever to relieve the arm circuit at the IN stroke end and measure the engine speed.

5. Measuring 2-pump relief and power maximizing speed (near rated speed)

1) Start the engine and operate the arm cylinder to the IN stroke end.
2) Set the fuel control dial in the high idle (MAX) position and set the working mode in the power mode (P).
3) While operating the left work equipment control lever to relieve the arm circuit at the IN stroke end and depressing the power maximizing switch, measure the engine speed.

★ The power maximizing function is reset automatically in about 8.5 seconds even if the switch is kept depressed. Accordingly, measure the engine speed in that period.

6. Measuring auto-deceleration speed

1) Start the engine, set the fuel control dial in the high idle position (MAX), and turn the auto-decelerator ON.
2) Set all the levers and pedals for work equipment control, swing control, and travel in neutral and measure the engine speed when the auto-decelerator operates.

★ The engine speed lowers to a certain level about 5 seconds after all the levers and pedals are set in neutral. This level is the auto-deceleration speed.

Measuring intake air pressure (boost pressure)

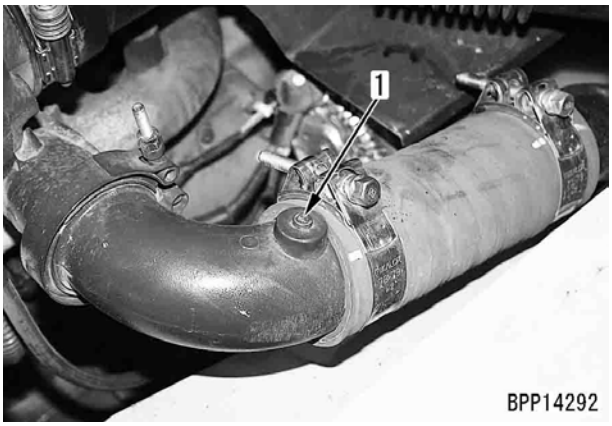
★ Measuring tools for intake air pressure (boost pressure)

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

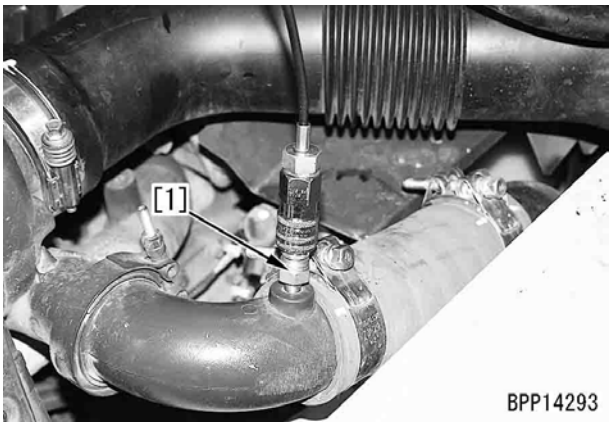
⚠ **Stop the machine on a level ground and lower the work equipment to the ground.**

★ Measure the intake air pressure under the following condition.
- Engine coolant temperature: Within operating range
- Hydraulic oil temperature: Within operating range

1. Open the engine hood and remove intake air pressure pickup plug (1) from the intake air connector.



2. Install nipple [1] of boost gauge kit **R** and connect it to gauge [2].



3. Run the engine at middle or higher speed and bleed oil from the hose.
   ★ Insert the connecting parts of the gauge and hose about a half and open the self-seal on the hose side repeatedly, and the oil will be drained.
   ★ If Pm kit (A) is available, you use the air-bleeding coupling (790-261-1130) in that kit.
   ★ If oil is left in the hose, the gauge does not work. Accordingly, be sure to drain the oil.

4. Set the working mode in the power mode (P) and turn the swing lock switch ON.
   ★ If the swing lock switch is turned ON, the main relief valve is set for high-pressure relief.

5. While running the engine at high idle, relieve the arm circuit and measure the intake air pressure.

6. After finishing measurement, remove the measuring tools and return the removed parts.

Checking exhaust gas color

★ Checking tools for exhaust gas color

Symbol		Part No.	Part name
A	1	799-210-9001	Handy smoke checker
	2	Commercially available	Smoke meter

⚠ **Stop the machine on a level ground and lower the work equipment to the ground.**

⚠ **Be careful not to touch any hot part when removing or installing the checking tools.**

★ Check the exhaust gas color under the following condition.
- Engine coolant temperature: Within operating range

★ If an air source and an electric power source are not available in the field, use handy smoke checker **A1**. When recording official data, use smoke meter **A2**.

1. Measuring with handy smoke checker A1

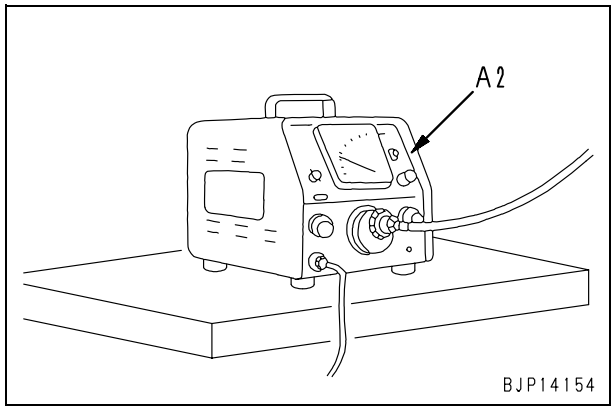
1) Stick a sheet of filter paper to smoke checker **A1**.
2) Insert the exhaust gas intake pipe in exhaust pipe (1).
3) Start the engine and accelerate it suddenly or run it at high idle and operate the handle of smoke checker **A1** so that the filter paper will absorb the exhaust gas.
   ★ Absorbing time: 1.4 ± 0.2 sec

4) Remove the filter paper and compare it with the attached scale.
5) After finishing checking, remove the measuring tools and return the removed parts.

2. Checking with smoke meter A2

1) Insert probe [1] of smoke meter **A2** in the outlet of the exhaust pipe and fix it to the exhaust pipe with a clip.

2) Connect the probe hose, receptacle of the accelerator switch, and air hose to smoke meter **A2**.
   ★ Limit the supplied air pressure to 1.5 MPa {15 kg/cm^2}.
3) Connect the power cable to an AC receptacle.
   ★ Before connecting the cable, check that the power switch of the smoke meter is turned OFF.
4) Loosen the cap nut of the suction pump and fit the filter paper.
   ★ Fit the filter paper securely so that the exhaust gas will not leak.
5) Turn on the power switch of smoke meter **A2**.



6) Start the engine and accelerate it suddenly or run it at high idle and depress the accelerator pedal of smoke meter **A2** and collect the exhaust gas into the filter paper.
7) Place the contaminated filter paper on the clean filter paper (at least 10 sheets) in the filter paper holder and read the indicated value.
8) After finishing checking, remove the checking tools and return the removed parts.

Adjusting valve clearance

★ Measuring tools for valve clearance

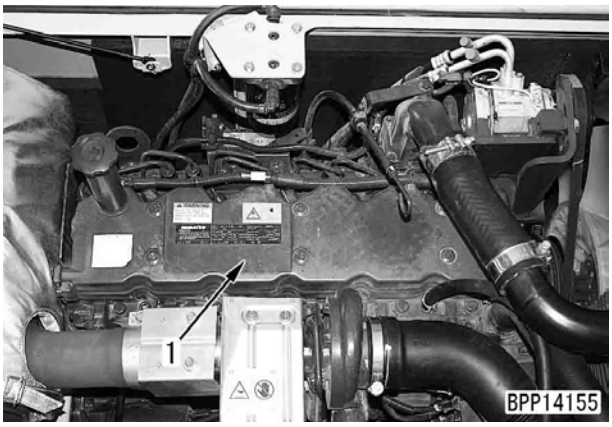
Symbol		Part No.	Part name
B	1	795-799-1131	Gear
	2	Commercially available	Thickness gauge

⚠ **Stop the machine on a level ground and lower the work equipment to the ground.**

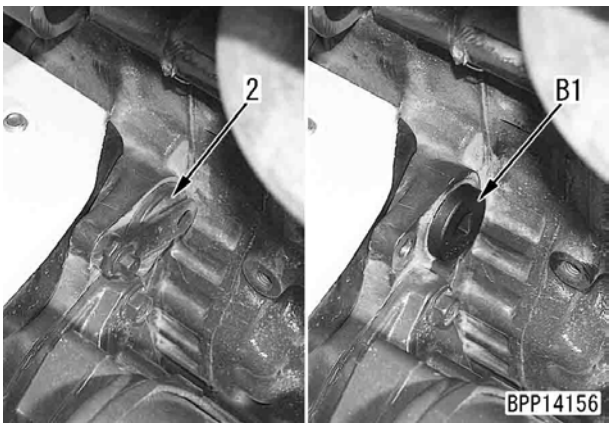
★ Measure the valve clearance under the following condition.
- Engine coolant temperature: Normal temperature

1. Open the engine hood and remove the belt guard from the top of the air conditioner compressor.

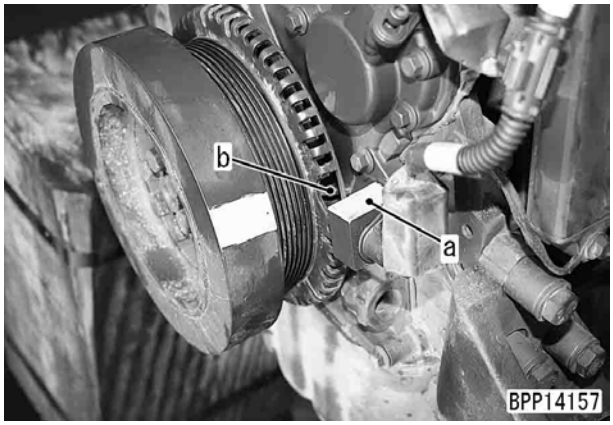
2. Remove cylinder head cover (1).
   ★ Since the breather connector on the rear side of the cylinder head cover is connected to the flywheel housing through the O-ring, pull it together with the cylinder head cover.



3. Remove plug (2) from the top of the starting motor and insert gear **B1**.

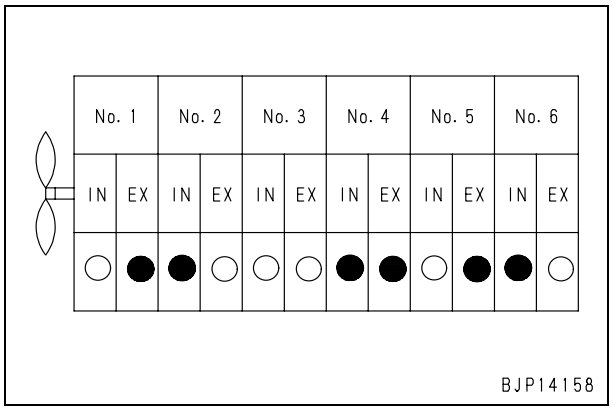


4. Rotate the crankshaft forward with gear **B1** and set wide slit (b) of the rotation sensor ring to projection top (a) of front cover.
   ★ Projection top (a) must be within the range of wide slit (b) when it is seen from the air conditioner compressor side.
   ★ If you can see the yellow marks of projection top (a) and wide slit (b), you may set them to each other.
   ⚠ **When the crankshaft is set as above, the piston in the No. 1 or No. 6 cylinder is not set to the compression top dead center (TDC). Take care.**

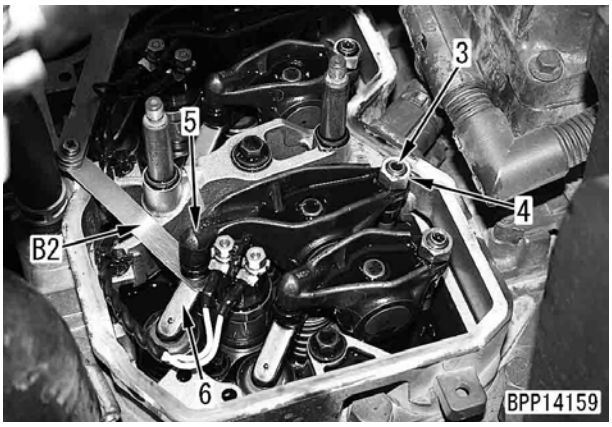


5. Check the movement of the rocker arm of the No. 1 cylinder to judge the valve to be adjusted.

   ★ If you can move the rocker arms of air intake valves (IN) with the hand by the valve clearance, adjust the valves marked with ○ in the valve arrangement drawing.
   ★ If you can move the rocker arms of exhaust valves (EX) with the hand by the valve clearance, adjust the valves marked with ● in the valve arrangement drawing.
   ★ Valve arrangement drawing



6. Adjust the valve clearance according to the following procedure.
   1) While fixing adjustment screw (3), loosen locknut (4).
   2) Insert thickness gauge **B2** in the clearance between rocker arm (5) and crosshead (6) and adjust the valve clearance with adjustment screw (3).
      ★ With the thickness gauge inserted, turn the adjustment screw to a degree that you can move the thickness gauge lightly.
   3) While fixing adjustment screw (3), tighten locknut (4).
      ⇨ Locknut:
      24 ± 4 Nm {2.45 ± 0.41 kgm}
      ★ After tightening the locknut, check the valve clearance again.



7. Rotate the crankshaft forward by 1 turn and set wide slit (b) to projection top (a) according to step 4.

8. Adjust the other valve clearances according to steps (5) and (6).
   ★ If the valves marked with ● in the valve arrangement drawing were adjusted in steps (5) and (6), adjust the valves marked with ○.
   ★ If the valves marked with ○ in the valve arrangement drawing were adjusted in steps (5) and (6), adjust the valves marked with ●.

9. After finishing adjustment, remove the adjusting tools and return the removed parts.
   ⚠ **Remove gear B1 without fail.**
   ⇨ Cylinder head cover mounting nut:
   24 ± 4 Nm {2.45 ± 0.41 kgm}

Measuring compression pressure

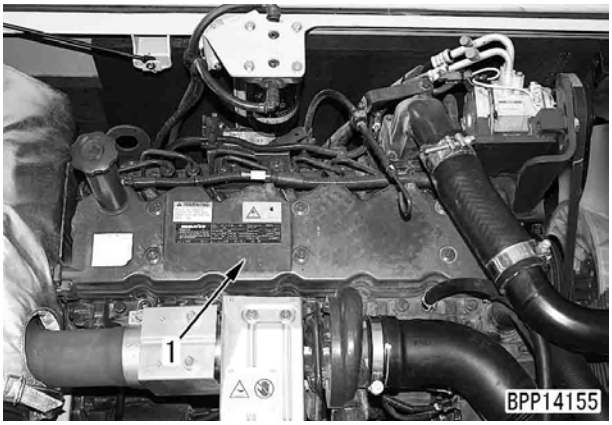
★ Measuring tools for compression pressure

Symbol		Part No.	Part name
C	1	795-502-1590	Compression gauge
	2	795-799-6700	Puller
	3	795-790-4410	Adapter
		6754-11-3130	Gasket

⚠ **Stop the machine on a level ground and lower the work equipment to the ground.**

★ Measure the compression pressure under the following condition.
- Engine oil temperature: 40 – 60°C

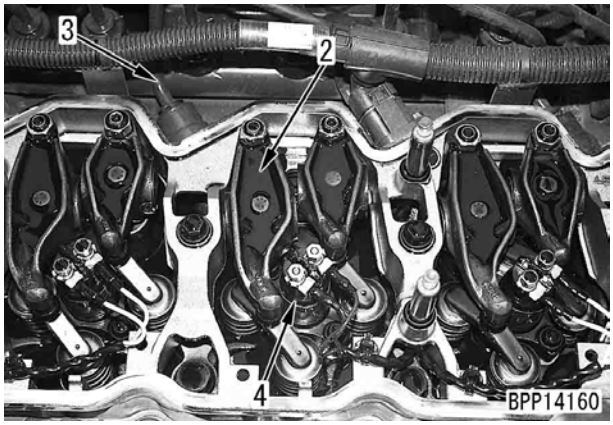
1. Open the engine hood and remove cylinder head cover (1).
   ★ Since the breather connector on the rear side of the cylinder head cover is connected to the flywheel housing through the O-ring, pull it together with the cylinder head cover.



2. Remove the mounting bolts of rocker arm assembly (2) on the exhaust side, and then remove rocker arm assembly (2).
   ★ When removing the injector, you do not need to remove the rocker arm assembly on the intake side.

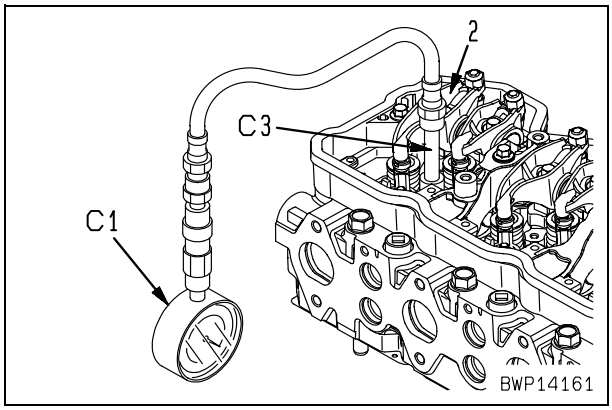
3. Remove fuel tube (3), and then remove inlet connector (7) in the cylinder head.
   ★ The inlet connector is connecting the fuel tube to the injector.

4. Disconnect injector wiring harness. Using tool **C2**, remove injector (4).

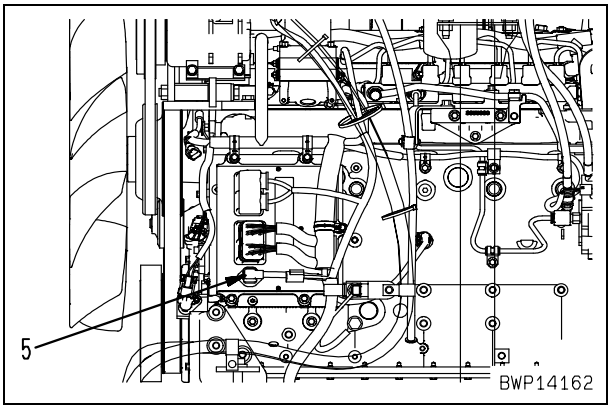


5. Install adapter **C3** to the injector mounting part with the injector clamp and connect compression gauge **C1**.
   ★ Install the gasket to the adapter end without fail.
   Injector clamp mounting bolt:
   1st time : 3.5 ± 0.35 Nm
   {0.36 ± 0.04 kgm}
   2nd time: 75 ± 5 ° (Angle tightening)
   ★ If a little quantity of engine oil is applied the joint of the adapter and gauge, air does not leak easily.

6. Install rocker arm assembly (2) on the exhaust side and adjust the valve clearance.
   ★ See “Adjusting valve clearance”.

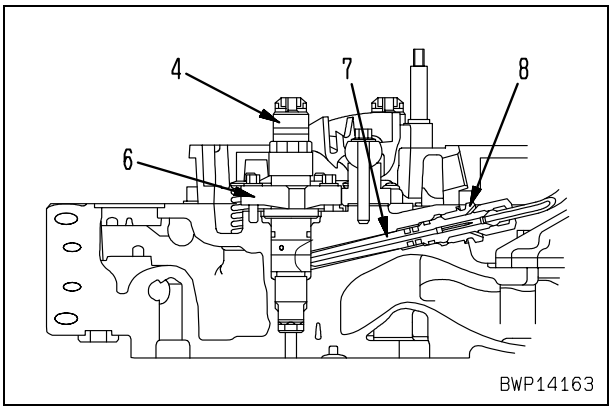


7. Disconnect **CE03** connector (5) of the engine controller.
   - ⚠ **If the connector is not disconnected, the engine will start during measurement and it will be dangerous.**
   - ⚠ **Since the CE03 connector is a part of the power supply circuit of the engine controller, cover the connector on the machine side with a vinyl sheet, etc. to prevent electric leakage and ground fault.**



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

9. After finishing measurement, remove the measuring tools and return the removed parts.
   - ★ Install the injector and inlet connector according to the following procedure.
   1) Apply new engine oil (SAE15W-40) to the O-ring of injector (4) and cylinder head.
   2) Install injector (4) with the fuel inlet hole directed to the air intake manifold.
   3) Install injector clamp (6) and tighten the mounting bolt by 3 – 4 threads.
   4) Install inlet connector (7) and tighten inlet connector retainer temporarily.
   5) Tighten the mounting bolt of injector clamp (6) securely.
      Injector clamp mounting bolt:
      1st time : 3.5 ± 0.35 Nm {0.36 ± 0.04 kgm}
      2nd time: 75 ± 5 ° (Angle tightening)
   6) Tighten inlet connector retainer (8) securely.
      Inlet connector retainer:
      50 ± 5 Nm {5.1 ± 0.5 kgm}



   - ★ Tighten the bolts and nuts other than the injector and inlet connector to the following torque.
   Injector wiring harness nut:
   1.5 ± 0.25 Nm {0.15 ± 0.026 kgm}
   Fuel tube sleeve nut:
   35 ± 3.5 Nm {3.6 ± 0.4 kgm}
   Rocker arm assembly mounting bolt:
   36 ± 6 Nm {3.7 ± 0.6 kgm}
   - ★ Adjust the valve clearance. For details, see “Adjusting valve clearance”.
   Cylinder head cover mounting nut:
   24 ± 4 Nm {2.45 ± 0.41 kgm}

Measuring blow-by pressure

★ Measuring tools for blow-by pressure

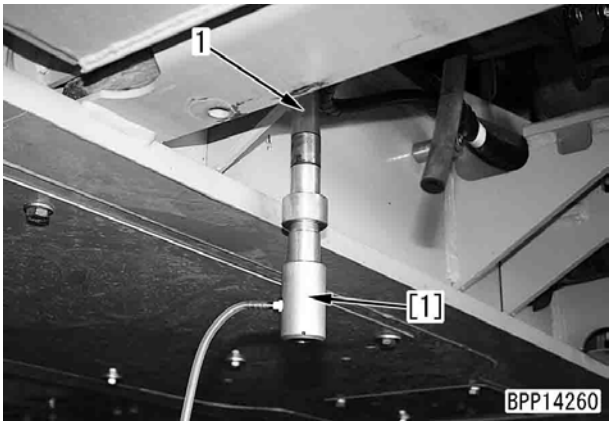
Symbol		Part No.	Part name
D	1	799-201-1504	Blow-by checker
	2	799-790-3300	Blow-by tool

⚠ **Stop the machine on a level ground and lower the work equipment to the ground.**

★ Measure the blow-by pressure under the following condition.
- Engine coolant temperature: Within operating range
- Hydraulic oil temperature: Within operating range

1. Remove the undercover of the hydraulic pump.

2. Install tool and adapter [1] of blow-by checker **D1** or blow-by tool **D2** to breather hose (1) and connect gauge [2].



3. Start the engine, set the working mode in the power mode (P), and turn the swing lock switch ON.
   ★ If the swing lock switch is turned ON, the main relief valve is set for high-pressure relief.

4. While running the engine at high idle, relieve the arm circuit and measure the blow-by pressure.
   ★ Read the gauge when the pointer is stabilized.

5. After finishing measurement, remove the measuring tools and return the removed parts.

Measuring engine oil pressure

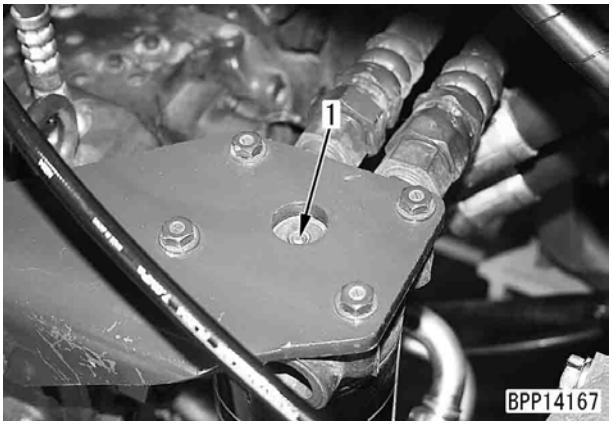
★ Measuring tools for engine oil pressure

Symbol		Part No.	Part name
E	1	799-101-5002	Hydraulic tester
		790-261-1204	Digital hydraulic tester
	2	799-401-2320	Hydraulic tester

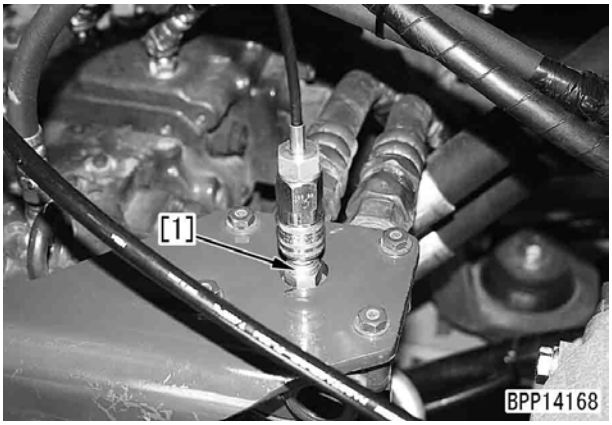
⚠ **Stop the machine on a level ground and lower the work equipment to the ground.**

★ Measure the engine oil pressure under the following condition.
- Engine coolant temperature: Within operating range

1. Open the side cover of the pump room and remove oil pressure pickup plug (1) from the engine oil filter.



2. Install nipple [1] of hydraulic tester **E1** and connect hydraulic tester **E2**.



3. Start the engine and turn the auto-decelerator OFF.

4. Run the engine and measure the engine oil pressure at high idle and low idle.

5. After finishing measurement, remove the measuring tools and return the removed parts.

Handling fuel system parts

★ 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:
Feed pump – Fuel main filter – Supply pump
High-pressure circuit:
Supply pump – Common rail – Injector

★ The pressure in both low-pressure circuit and high-pressure circuit lowers to a safety level automatically 30 seconds after the engine is stopped.

★ Before the fuel circuit is checked and its parts are removed, the residual pressure in the fuel circuit must be released completely. Accordingly, observe the following.

⚠ **Before checking the fuel system or removing its parts, wait at least 30 seconds after stopping the engine until the residual pressure in the fuel circuit is released. (Do not start the work just after stopping the engine since there is residual pressure.)**

Measuring fuel pressure

★ Measuring tools for fuel pressure

Symbol		Part No.	Part name
F	1	799-101-5002	Hydraulic tester
		790-261-1204	Digital hydraulic tester
	2	6732-81-3170	Adapter (10 × 1.0 mm → R1/8)
		6215-81-9710	O-ring
	3	799-401-2320	Hydraulic tester

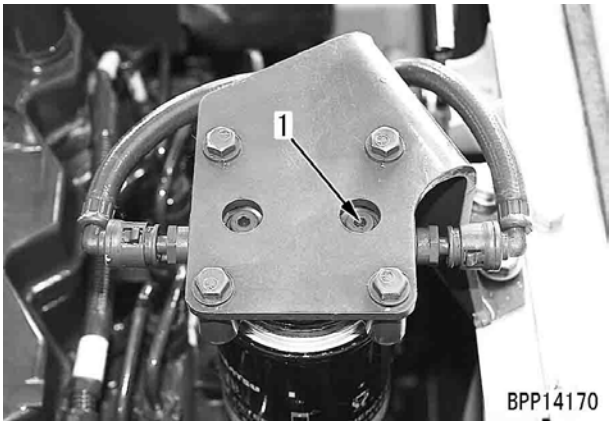
⚠ **Stop the machine on a level ground and lower the work equipment to the ground.**

★ Measure only the fuel pressure in the low-pressure circuit from the feed pump through the fuel main filter to the supply pump and the return circuit from the supply pump/common rail/injector to fuel tank.

⚠ **Since the pressure in the high-pressure circuit from the supply pump through the common rail to the injector is very high, it cannot be measured.**

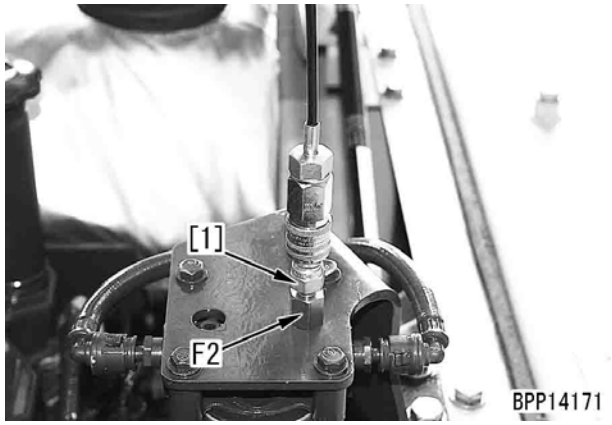
1. Measuring pressure in fuel low-pressure circuit

1) Open the engine hood and remove fuel pressure pickup plug (1) from the fuel main filter.



2) Install adapter **F2** and nipple [1] of hydraulic tester **F1** and connect them to oil pressure gauge [2]

★ Use the oil pressure gauge of 2.5 MPa {25 kg/cm^2}.



3) Run the engine at low idle and measure the pressure in the fuel low-pressure circuit.

★ If the pressure in the fuel low-pressure circuit is in the following range, it is normal.

At low idle	0.5 – 1.3 MPa {5.1 – 13.3 kg/cm^2}
During cranking	0.3 – 1.1 MPa {3.1 – 11.3 kg/cm^2}

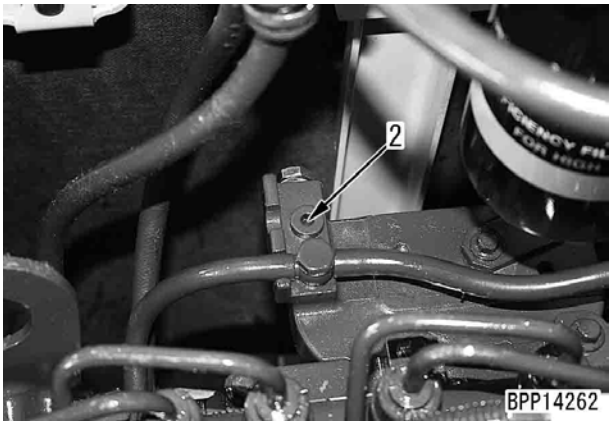
⚠ **If the engine cannot be started, you may measure the fuel pressure while rotating the engine with the starting motor. Do not rotate for more than 20 seconds continuously, however, for protection of the starting motor.**

4) After finishing measurement, remove the measuring tools and return the removed parts.

Fuel pressure pickup plug:
10 ± 2 Nm {1 ± 0.2 kgm}

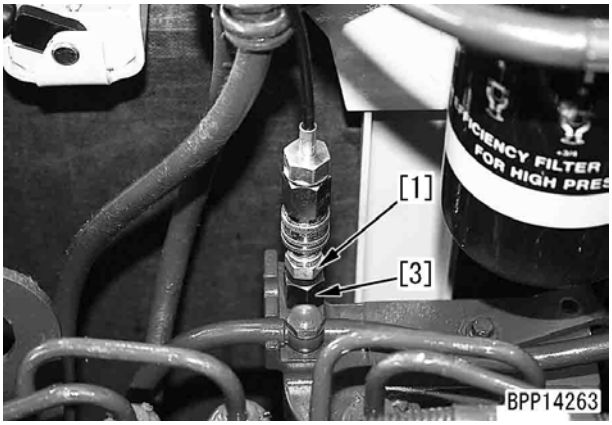
2. Measuring pressure in fuel return circuit

1) Open the engine hood and remove fuel pressure pickup plug (2) from the fuel return block.



2) Install nipple [3] of hydraulic tester **F1** and nipple [1] and connect them to hydraulic tester **F3**.

★ Nipple [3]:
790-301-1181, 07002-11223



3) Run the engine at low idle and measure the pressure in the fuel return circuit.

★ If the pressure in the fuel return circuit is in the following range, it is normal.

At low idle	Max. 0.02 MPa {Max. 0.19 kg/cm^2}
During cranking	

⚠ **If the engine cannot be started, you may measure the fuel pressure while rotating the engine with the starting motor. Do not rotate for more than 20 seconds continuously, however, for protection of the starting motor.**

4) After finishing measurement, remove the measuring tools and return the removed parts.

Fuel pressure pickup plug:
24 ± 4 Nm {2.4 ± 0.4 kgm}

Measuring fuel return rate and leakage

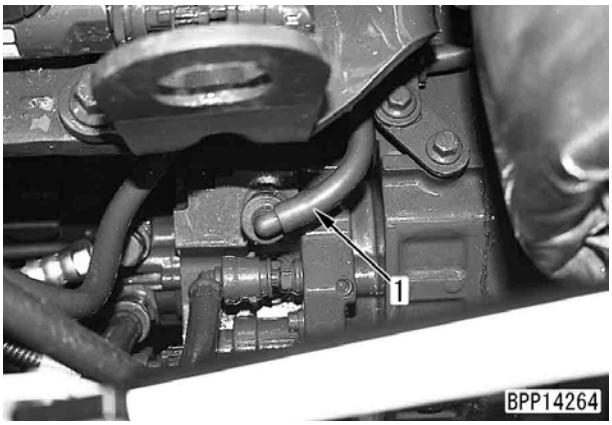
★ Measuring tools for fuel return rate and leakage

Symbol		Part No.	Part name
G	1	(Not set yet)	Supply pump testing tool
	2	(Not set yet)	Pressure limiter testing tool
	3	(Not set yet)	Injector testing tool
	4	Commercially available	Measuring cylinder

⚠ Stop the machine on a level ground and lower the work equipment to the ground.

1. Measuring return rate from supply pump

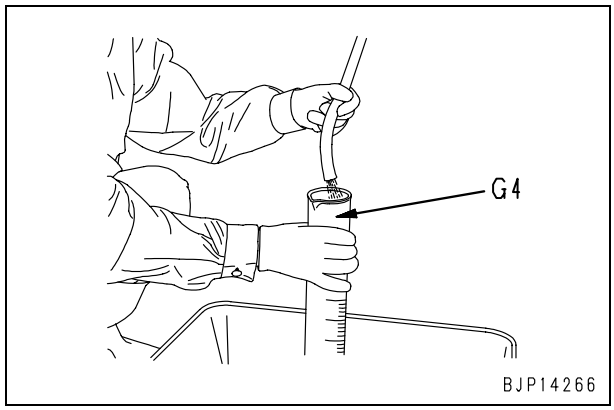
1) Open the engine hood and disconnect return hose (1) of the supply pump.



2) Connect testing tool **G1** to the supply pump side and insert its end in measuring cylinder **G4**.
3) Connect blocking tool **G1** to the return hose side to prevent the fuel from leaking.
4) Run the engine at low idle and measure the return rate from the supply pump.
   ★ If the return rate from the supply pump is in the following range, it is normal.

At low idle	Max. 1,000 cc/min
During cranking	Max. 140 cc/min

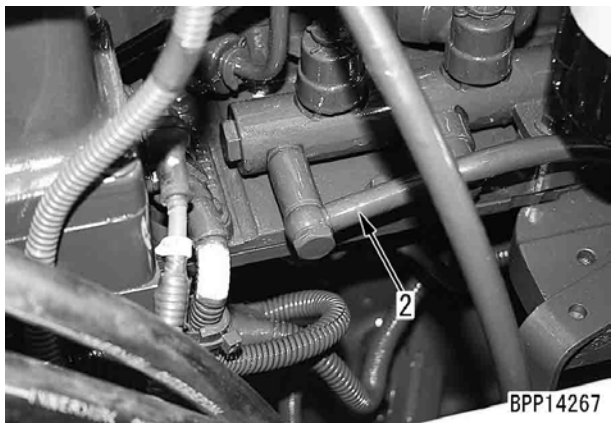
⚠ If the engine cannot be started, you may measure the fuel return rate while rotating the engine with the starting motor. Do not rotate for more than 20 seconds continuously, however, for protection of the starting motor.



5) After finishing measurement, remove the measuring tools and return the removed parts.

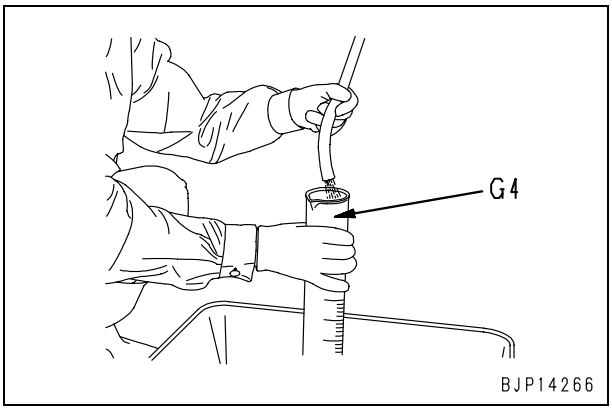
2. Measuring leakage from pressure limiter

1) Open the engine hood and disconnect return hose (2) of the pressure limiter.



2) Connect testing tool **G2** to the pressure limiter side and insert its end in measuring cylinder **G4**.
3) Connect blocking tool **G2** to the return hose side to prevent the fuel from leaking.
4) Run the engine at low idle and measure the leakage from the pressure limiter.
   ★ If the leakage from the pressure limiter is in the following range, it is normal.

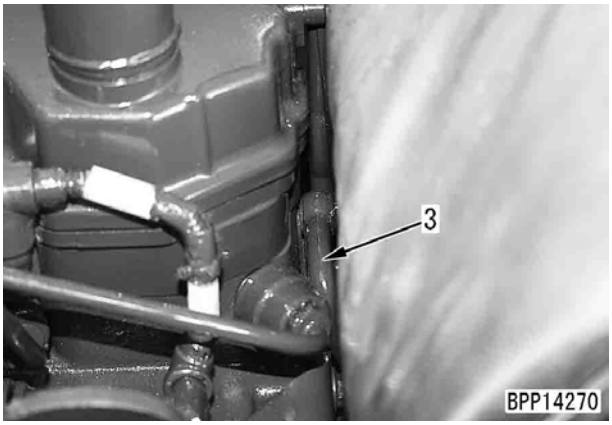
At low idle	0 cc (No leakage)



5) After finishing measurement, remove the measuring tools and return the removed parts.
   Joint bolt:
   24 ± 4 Nm {2.4 ± 0.4 kgm}

3. Measuring return rate from injector

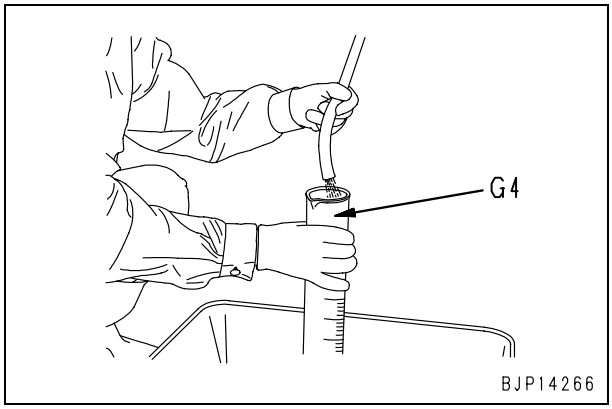
1) Open the engine hood and disconnect return hose (3) of the cylinder head.



2) Connect testing tool **G3** to the cylinder head side and insert its end in measuring cylinder **G4**.
3) Connect blocking tool **G3** to the return hose side to prevent the fuel from leaking.
4) Run the engine at low idle and measure the return rate from the injector.
   ★ If the return rate from the injector is in the following range, it is normal.

At low idle	Max. 180 cc/min
During cranking	Max. 90 cc/min

⚠ **If the engine cannot be started, you may measure the fuel return rate while rotating the engine with the starting motor. Do not rotate for more than 20 seconds continuously, however, for protection of the starting motor.**



5) After finishing measurement, remove the measuring tools and return the removed parts.
   Joint bolt:
   24 ± 4 Nm {2.4 ± 0.4 kgm}

Bleeding air from fuel circuit

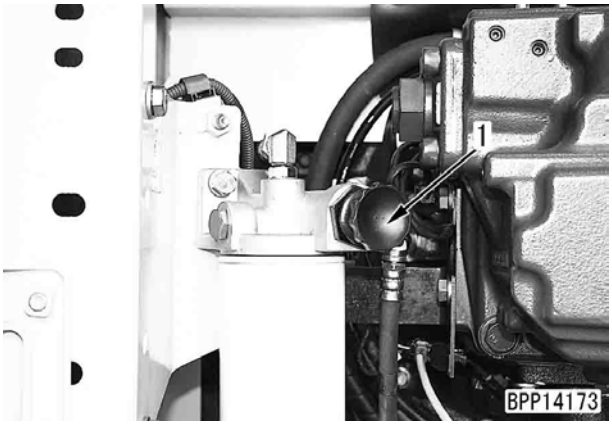
★ If fuel is used up or if a fuel circuit part is removed and installed, bleed air from the fuel circuit according to the following procedure.

⚠ **Stop the machine on a level ground and lower the work equipment to the ground.**

1. Fill the fuel tank with fuel.
   ★ Add fuel until the float of the sight gauge reaches the maximum position.

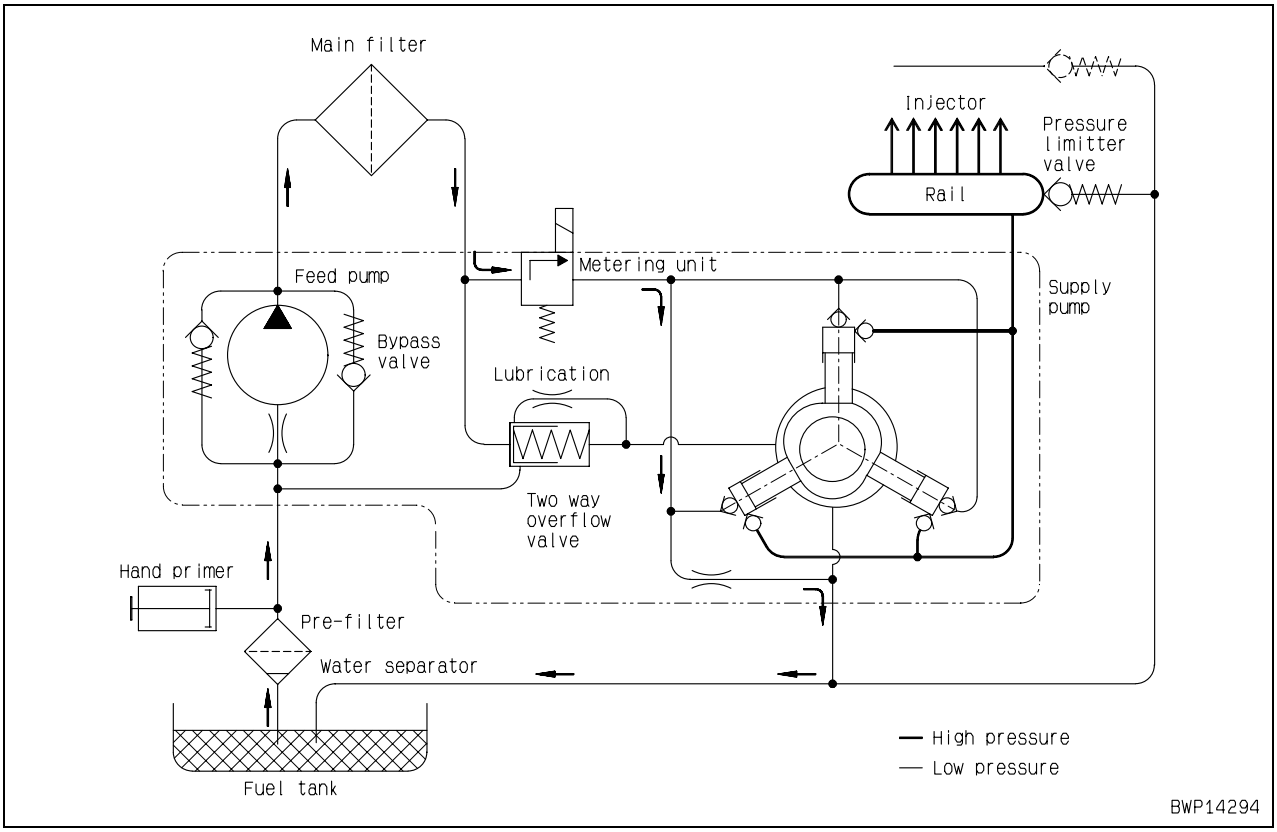
2. Open the side cover of the pump room.

3. Loosen knob (1) of the feed pump and pull it out, and then operate it forward and backward.
   ★ Move the knob until it becomes heavy.
   ★ The plug at the top of the fuel main filter does not need to be removed.



4. After bleeding air, push in and tighten knob (1).

★ Air bleeding route of fuel circuit
Fuel tank → Pre-filter → Feed pump → Main filter → Metering unit → Fuel tank



Checking 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 checking the fuel system or removing its parts, check it for fuel leakage according to the following procedure.

⚠ **Stop the machine on a level ground and lower the work equipment to the ground.**

★ Clean and degrease the engine and the parts around it in advance so that you can check it easily for fuel leakage.

1. Spray color checker (developer) over the fuel supply pump, common rail, fuel injector, and joints of the high-pressure piping.

2. Run the engine at speed below 1,000 rpm and stop it after its speed is stabilized.

3. Check 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 check again from step 2.

4. Run the engine at low idle.

5. Check 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 check again from step 2.

6. Run the engine at high idle.

7. Check the fuel piping and devices for fuel leakage.
   ★ Check around the high-pressure circuit parts coated with the color checker for fuel leakage.
   ★ If any fuel leakage is detected, repair it and check again from step 2.

8. Run the engine at high idle and load it.
   ★ Relieve the arm circuit at the IN stroke end.

9. Check 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 check again from step 2.
   ★ If no fuel leakage is detected, check is completed.

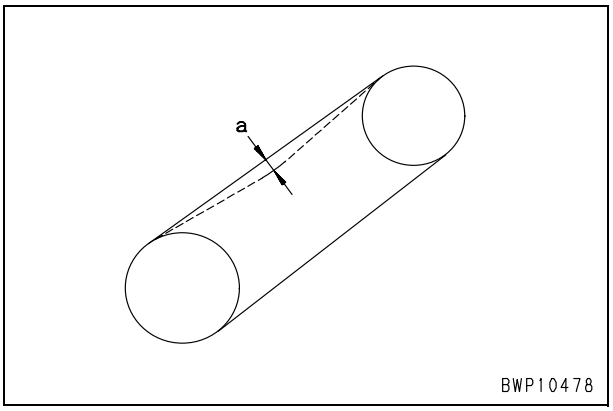
Checking and adjusting air conditioner compressor belt tension

⚠ Stop the machine on a level ground and lower the work equipment to the ground.

Checking

1. Open the engine hood and remove the belt guard from the top of the air conditioner compressor.

2. Press the intermediate point of the belt between fan pulley and compressor pulley with a finger and measure deflection (a) of the belt.
   - Belt pressing force: 98 N {10 kg}



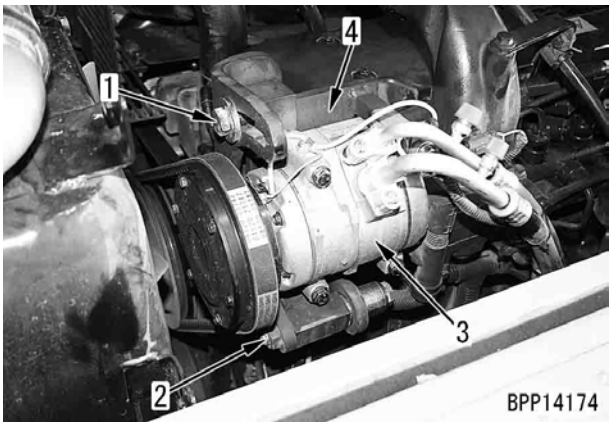
Adjusting

★ If the belt deflection is abnormal, adjust it according to the following procedure.

1. Loosen bolts (1) and (2).

2. Move compressor (3) and bracket (4) together to adjust the belt tension.

3. After positioning compressor (3), tighten bolts (1) and (2).
   ★ Check each pulley for breakage, wear of the V-groove, and contact of the V-belt and V-groove.
   ★ If the V-belt is so lengthened that the adjustment allowance is eliminated or it has a cut or a crack, replace it.
   ★ If the belt is replaced, adjust their tension again after operating the machine for 1 hour.
   ★ After tightening the bolts, check the belt tension again according the above procedure.



4. After finishing measurement, return the removed parts.

Measuring swing circle bearing clearance

★ Measuring tools for swing circle bearing clearance

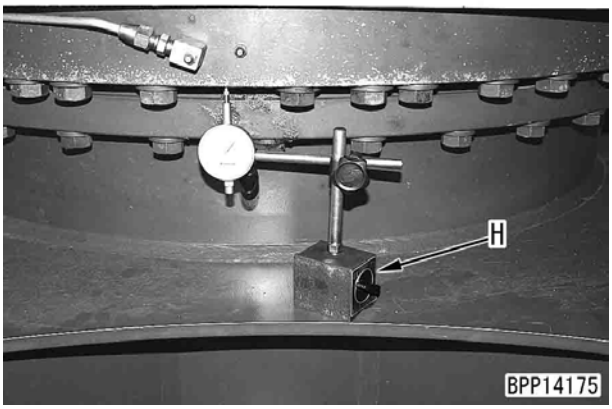
Symbol	Part No.	Part name
H	Commercially available	Dial gauge

★ When measuring the swing circle bearing clearance installed to the machine, perform the following procedure.

⚠ **Stop the machine on a level ground and lower the work equipment to the ground.**

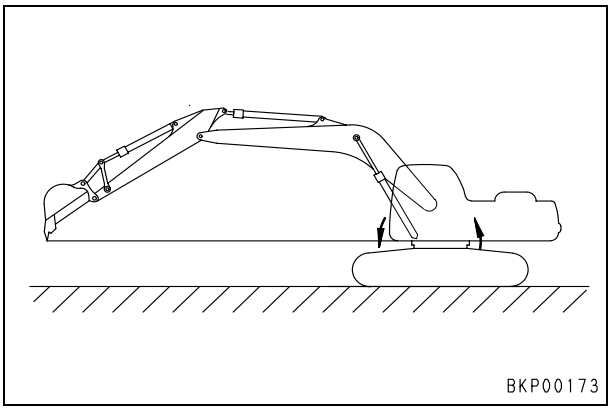
⚠ **Do not put your hands or feet under the undercarriage during measurement.**

1. Fix dial gauge **H** to the track frame and apply the probe to the lower end of the outer race.



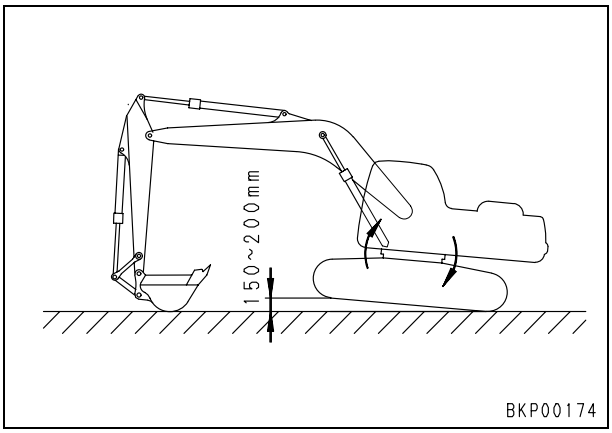
2. Set the work equipment to the maximum reach position and set the bucket tip to the height of the under side of the revolving frame.
   ★ At this time the front of the upper structure lowers and the rear rises.

3. Set dial gauge **H** to the 0 point.



4. Set the arm almost perpendicular to the ground and lower the boom until the front track shoe floats.
   ★ At this time the front of the upper structure rises and the rear lowers.

5. Under this condition, read dial gauge **H**.
   ★ The value indicated by dial gauge **H** is the clearance of the bearing.
   ★ For the standard value, see Structure, function and maintenance standard, “Swing circle”.



6. Return the machine to the condition of step 2 and check that dial gauge **H** indicates 0.
   ★ If the dial gauge does not indicate 0, repeat steps 2 through 5.

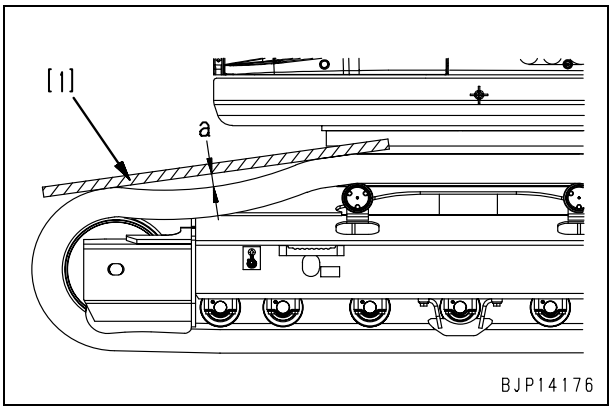
Checking and adjusting track shoe tension

Checking

1. Run the engine at low idle and drive the machine forward by the length of track on ground, and then stop slowly.

2. Place steel bar [1] on the track shoe between the idler and the 1st carrier roller.
   ★ As the steel bar, use an angle steel, etc. which will be deflected less.

3. Measure maximum clearance (a) between steel bar [1] and track shoe.
   - Standard maximum clearance (a):
     10 – 30 mm

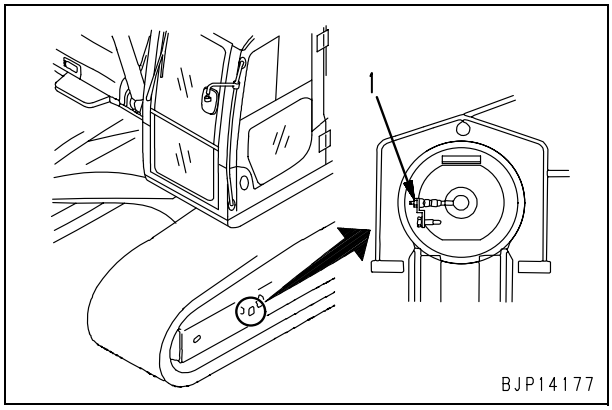


Adjusting

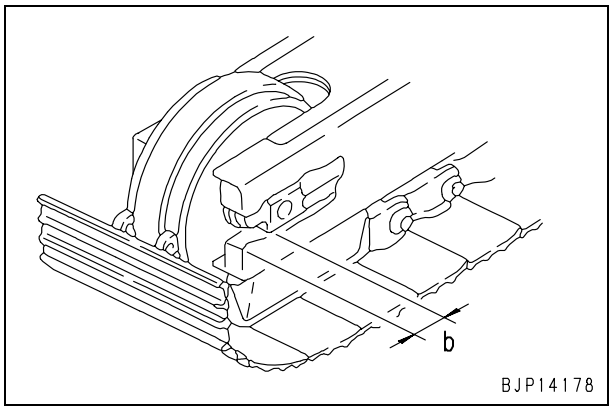
★ If the track shoe tension is abnormal, adjust it according to the following procedure.

1. Increasing tension

1) Add grease through grease fitting (1) with a grease gun.
2) To check that the tension is normal, run the engine at low idle and move the machine forward by the length of track on ground, then stop slowly.
3) After adjusting, check the track shoe tension again according to the above procedure.

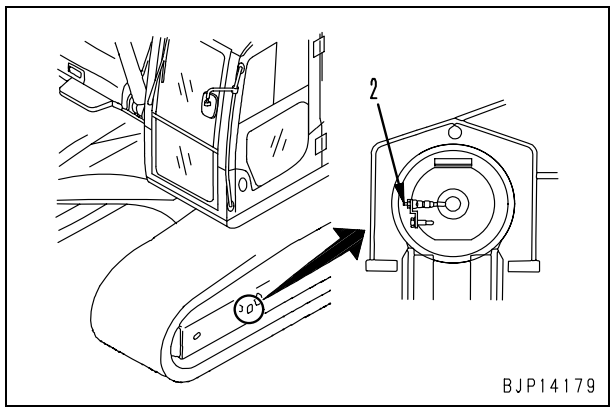


★ You may add grease until dimension (b) between the idler guide and track frame end becomes 0 mm. If the tension is still low, the pins and bushings are worn much. In this case, reverse or replace the pins and bushings.



2. Decreasing tension

1) Loosen valve (2) to discharge grease, and then tighten it.
   ⚠ **Do not loosen the valve more than 1 turn. If it is loosened more, it may jump out because of the high-pressure grease in it.**
2) To check that the tension is normal, run the engine at low idle and move the machine forward by the length of track on ground, then stop slowly.
3) After adjusting, check the track shoe tension again according to the above procedure.



Measuring and adjusting oil pressure in work equipment, swing, and travel circuits

★ Measuring and adjusting tools for oil pressure in work equipment, swing, and travel circuits

Symbol		Part No.	Part name
J	1	799-101-5002	Hydraulic tester
		790-261-1204	Digital hydraulic tester
	2	799-101-5220	Nipple (10 × 1.25 mm)
		07002-11023	O-ring

⚠ **Stop the machine on a level ground and lower the work equipment to the ground. Then, release the residual pressure from the hydraulic circuit. For details, see "Releasing residual pressure from hydraulic circuit".**

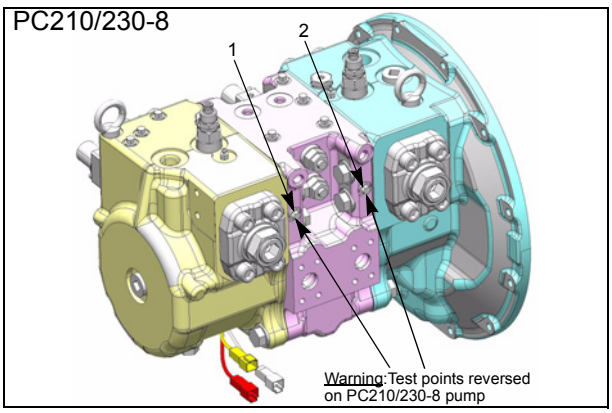
Measuring

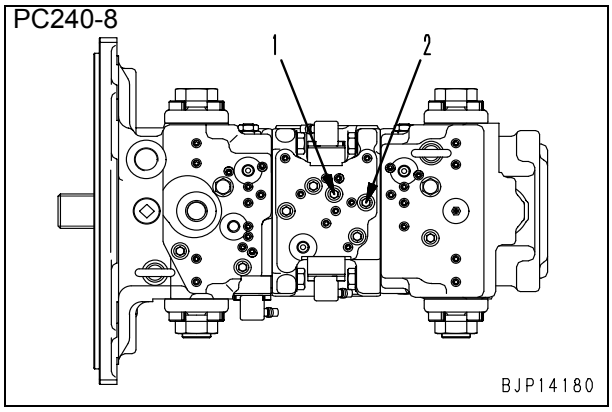
★ The oil pressure in the work equipment, swing, and travel circuits (pump discharge pressure) can be checked with monitoring function of the machine monitor, too (For details, see “Special functions of machine monitor”).
- Monitoring code: 01100 F pump pressure
- Monitoring code: 01101 R pump pressure

★ Measure the oil pressure in the work equipment, swing, and travel circuits under the following condition.
- Hydraulic oil temperature: Within operating range

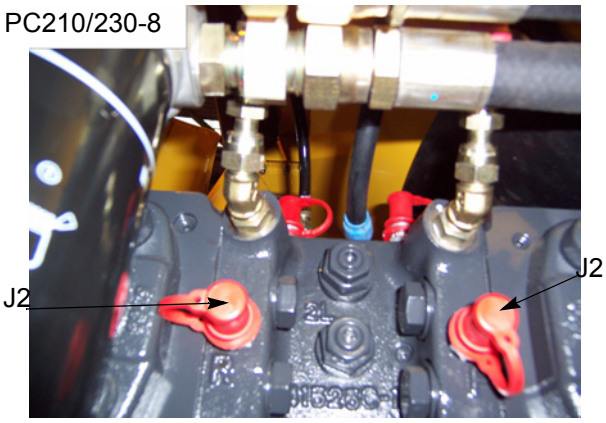
1. Preparation work

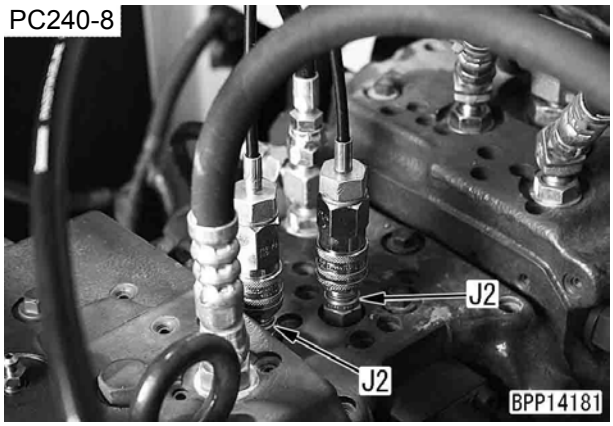
1) Open the side cover of the pump room and remove oil pressure pickup plugs (1) and (2).
- (1): Front pump discharge pressure pickup plug
- (2): Rear pump discharge pressure pickup plug





2) Install nipples **J2** and connect oil pressure gauges [1] of hydraulic tester **J1**.
★ Use the oil pressure gauges of 58.8 MPa {600 kg/cm^2}.





2. Combination of pump, actuator, and valve

★ When the oil from the pumps is divided, the front pump and rear pump act independently on each actuator. Note that different actuators relieve different valves.

★ When the work equipment circuit or swing circuit is relieved singly, the oils of the pumps are merged. When the travel circuit is relieved singly, the oils of the pumps are divided.

★ The actuators in the table are arranged in the order when the control valve is seen from the front of the machine (and an attachment is installed to the service valve).

	Actuator	Valve relieved
Rear pump	(R unload valve) (R main relief valve)	
	Service	Safety-suction valve
	Bucket	R main relief valve
	Left travel	R main relief valve
	Boom	Raise: R main relief valve
		Lower: Safety-suction valve
(Pump merge-divider valve) (Travel junction valve)		
Front pump	(Self pressure reducing valve)	
	Swing	Swing motor safety valve
	Right travel	F main relief valve
	Arm	F main relief valve
	(F unload valve) (F main relief valve)	
(Centralized safety valve) (Back pressure valve)		

3. **Measuring unload pressure**
   1) Start the engine, set the working mode in the power mode (P), and turn the auto-decelerator OFF.
   2) Run the engine at high idle, set all the levers and pedals for work equipment control, swing control, and travel in neutral, and measure the oil pressure.
      ★ The pressure measured when the unload valve is unloaded is indicated.

4. Measuring work equipment relief pressure
   1) Start the engine and move the cylinder to be measured to the stroke end.
   2) Set the working mode in the power mode (P).
   3) Run the engine at high idle, operate the right and left work equipment control levers to relieve the cylinder, and measure the oil pressure.
      ★ The pressure measured when the main relief valve is relieved is indicated (If the boom is lowered singly,

the safety-suction valve of the control valve for lowering the boom is relieved).

★ If the power maximizing switch is released, the main relief valve is relieved at low pressure. If the former is pressed, the latter is relieved at high pressure.

★ If the swing lock switch is set in turned ON, the 2-stage relief solenoid valve is kept turned ON and the relief valve is relieved at high pressure. Accordingly, keep the swing lock switch turned OFF.

5. Measuring swing relief pressure

1) Start the engine, set the working mode in the power mode (P), and turn the swing lock switch ON.

6. Run the engine at high idle, operate the left work equipment control lever to relieve the swing motor, and measure the oil pressure.

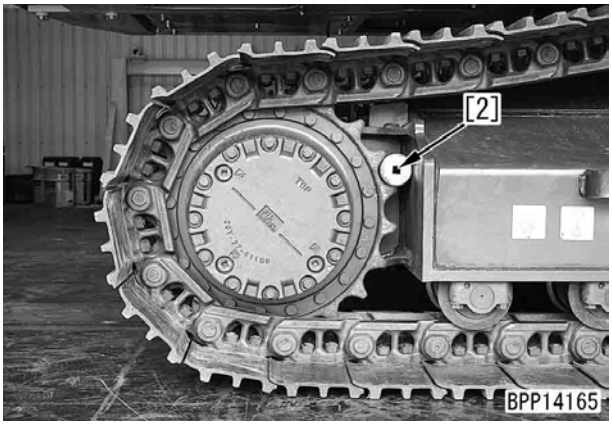
★ The pressure measured when the swing motor relief valve is relieved is indicated.

★ The swing relief pressure is lower than the main relief pressure.

7. Travel relief pressure

1) Run the engine and lock the travel mechanism.

⚠ **Put pin [2] between the sprocket and track frame to lock the travel mechanism securely.**



2) Set the working mode in the power mode (P).

3) Run the engine at high idle, operate the travel lever and pedal to relieve the travel motor, and measure the oil pressure.

⚠ **Before operating the travel lever and pedal, check the position and locking direction of the locked sprocket again.**

★ The pressure measured when the main relief valve of the control valve is relieved is indicated. The travel circuit is always relieved at high pressure.

8. Work after finishing measurement

After finishing measurement, remove the measuring tools and return the removed parts.

Oil pressure pickup plug:
20 – 27 Nm {2.0 – 2.8 kgm}

Adjusting

★ The unload valve and safety-suction valve for lowering the boom cannot be adjusted.

1. **Adjusting work equipment and travel relief pressure**

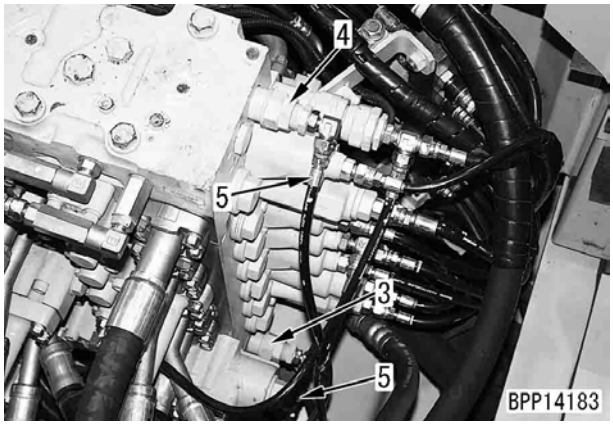
★ If the relief pressure of the work equipment circuit and travel circuit is abnormal, adjust main relief valves (3) and (4) according to the following procedure.

- (3): Front (F) main relief valve
- (4): Rear (R) main relief valve

★ When adjusting the main relief valves, remove the top cover of the control valve.

★ Adjust only the low relief pressure of the main relief valve. If the low repair procedure is adjusted, the high repair procedure is set automatically.

★ The low relief pressure is the pressure applied when the 2-stage relief solenoid valve is turned OFF and the pilot pressure is not applied to the selector port.



1) Disconnect pilot hose (5).
2) While fixing holder (6), loosen locknut (7).
3) Turn holder (6) to adjust the set pressure.

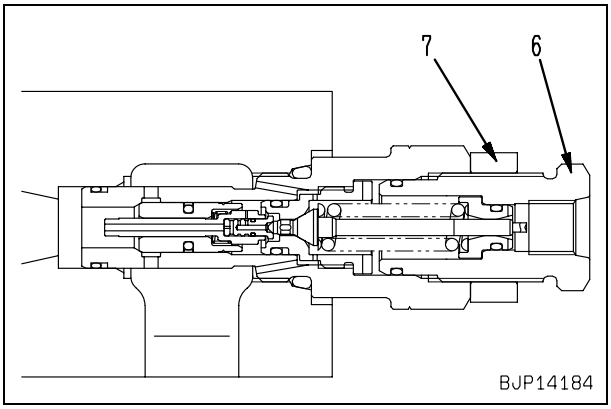
★ If the holder is

- Turned to the right, the set pressure is increased.
- Turned to the left, the set pressure is decreased.

★ Quantity of adjustment per turn of holder:

Approx. 20.5 MPa {Approx. 209 kg/cm^2}

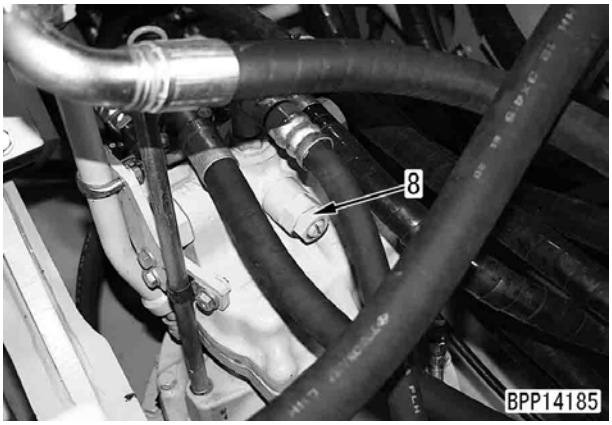
4) While fixing holder (6), tighten locknut (7).
   Locknut: **49 – 58.8 Nm {5 – 6 kgm}**



5) Connect pilot hose (5).
6) After finishing adjustment, check again that the oil pressure is normal according to the above described measurement procedure.

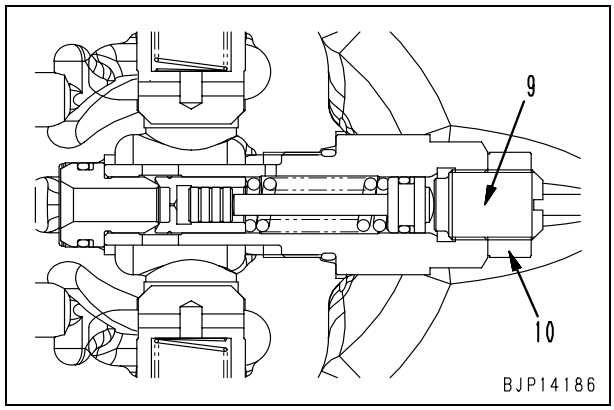
2. Adjusting swing relief pressure

★ If the swing relief pressure is abnormal, adjust safety valve (8) of the swing motor according to the following procedure.



1) While fixing adjustment screw (9), loosen locknut (10).
2) Turn adjustment screw (9) to adjust the pressure.
   ★ If the adjustment screw is
   - Turned to the right, the set pressure is increased.
   - Turned to the left, the set pressure is decreased.

   ★ Quantity of adjustment per turn of adjustment screw:
   Approx. 6.7 MPa {Approx. 68.4 kg/cm^2}
3) While fixing adjustment screw (9), tighten locknut (10).
   Locknut:
   78 – 103 Nm {8 – 10.5 kgm}



4) After finishing adjustment, check again that the oil pressure is normal according to the above described measurement procedure.

Measuring control circuit basic pressure

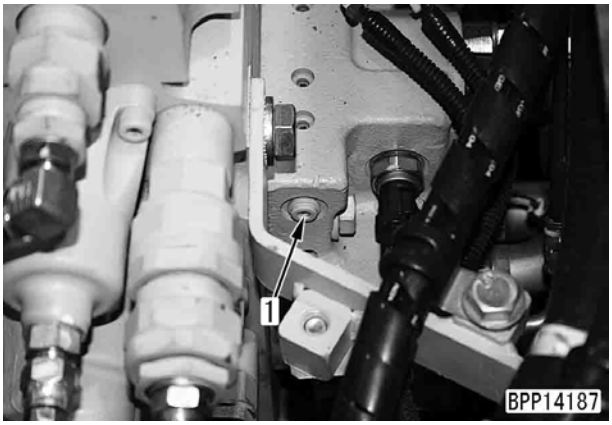
★ Measuring tools for control circuit basic pressure

Symbol		Part No.	Part name
K	1	799-101-5002	Hydraulic tester
		790-261-1204	Digital hydraulic tester
	2	799-101-5220	Nipple (10 × 1.25 mm)
		07002-11023	O-ring

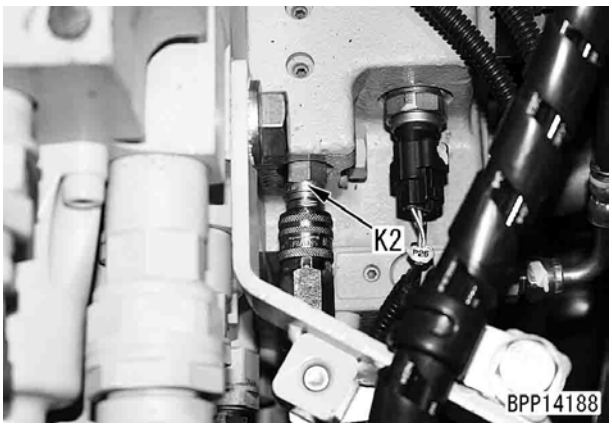
⚠ **Stop the machine on a level ground and lower the work equipment to the ground. Then, release the residual pressure from the hydraulic circuit. For details, see "Releasing residual pressure from hydraulic circuit".**

★ Measure the control circuit basic pressure under the following condition.
- Hydraulic oil temperature: Within operating range

1. Remove the control valve top cover and oil pressure pickup plug (1).



2. Install nipple **K2** and connect oil pressure gauge [1] of hydraulic tester **K1**.
   ★ Use the oil pressure gauge of 5.9 MPa {60 kg/cm^2}.



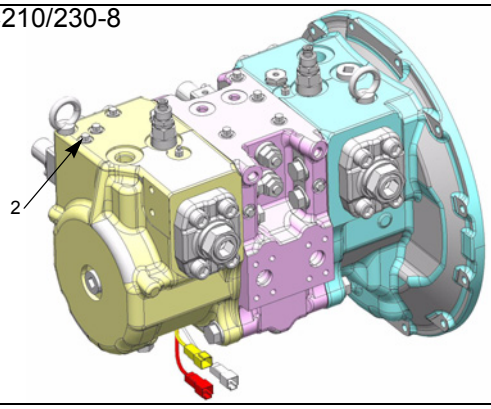
3. Start the engine, set the working mode in the power mode (P), and turn the auto-decelerator OFF.

4. Run the engine at high idle, set all the levers and pedals for work equipment control, swing control, and travel in neutral, and measure the oil pressure.

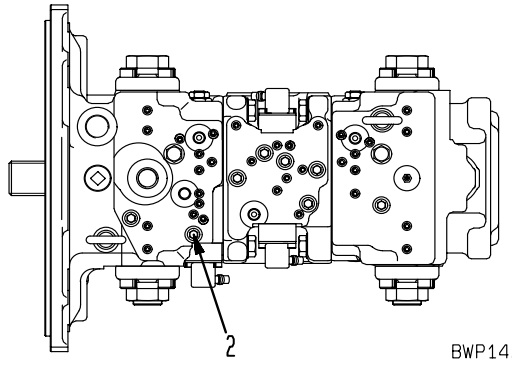
5. After finishing measurement, remove the measuring tools and return the removed parts.

★ The control circuit basic pressure may be measured with oil pressure pickup plug (2) on the hydraulic pump side.

PC210/230-8



PC240-8



★ Do not adjust the relief valve for control circuit basic pressure.

Measuring and adjusting oil pressure in pump PC control circuit

★ Measuring and adjusting tools for oil pressure in pump PC control circuit

Symbol		Part No.	Part name
L	1	799-101-5002	Hydraulic tester
		790-261-1204	Digital hydraulic tester
	2	799-101-5220	Nipple (10 × 1.25 mm)
		07002-11023	O-ring

⚠ **Stop the machine on a level ground and lower the work equipment to the ground. Then, release the residual pressure from the hydraulic circuit. For details, see "Releasing residual pressure from hydraulic circuit".**

Measuring

★ Before measuring the oil pressure in the PC control circuit, check that the oil pressure in the work equipment, swing, and travel circuits and the basic pressure of the control circuit are normal.

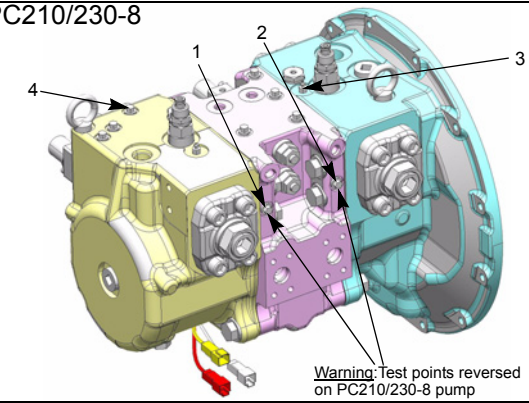
★ Measure the oil pressure in the pump PC control circuit under the following condition.
- Hydraulic oil temperature: Within operating range

1. Measuring PC valve output pressure (servo piston inlet pressure)

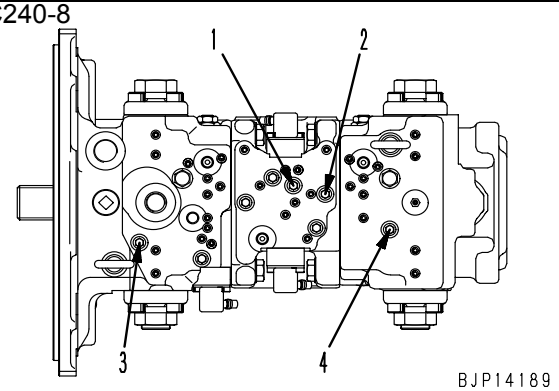
★ Measure the PC valve output pressure (servo piston inlet pressure) and pump discharge pressure simultaneously and compare them.

1) Open the side cover of the pump room and remove oil pressure pickup plugs (1), (2), (3), and (4).
- (1): Front pump discharge pressure pickup plug
- (2): Rear pump discharge pressure pickup plug
- (3): Front PC valve output pressure pickup plug
- (4): Rear PC valve output pressure pickup plug

PC210/230-8

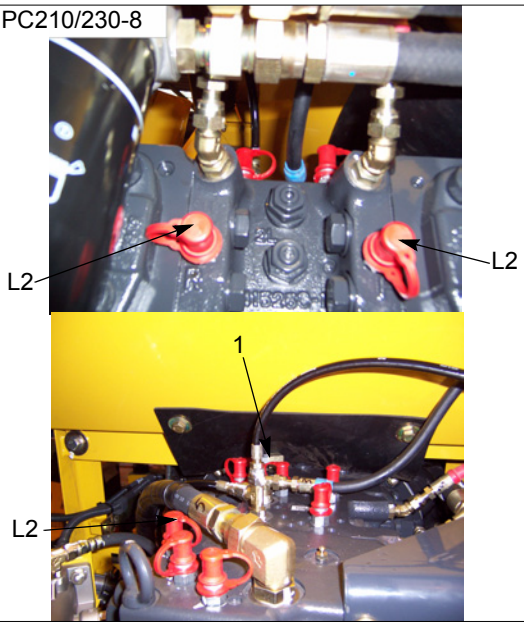


PC240-8

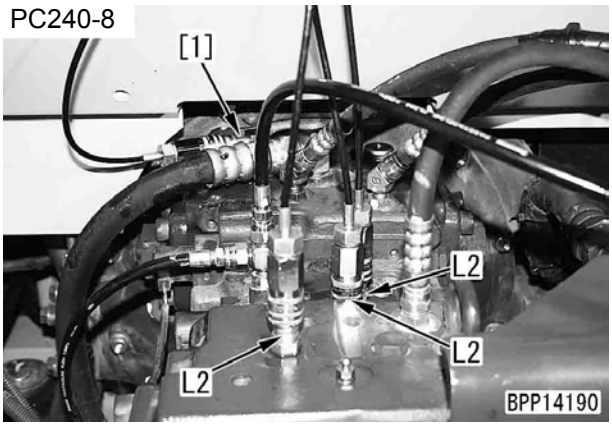


2) Install nipples **L2** and nipples [1] of hydraulic tester **L1** and connect them to oil pressure gauges [2].
- ★ Connect the measuring part of plug (3) by using joint (790-301-1271) and elbow (790-301-1530) of hydraulic tester **L1** and nipple [1] so that it will not interfere with the drain piping.
- ★ Use the oil pressure gauges of 58.8 MPa {600 kg/cm^2}.

PC210/230-8



PC240-8



3) Start the engine and move the arm cylinder to the IN stroke end.
4) Set the working mode in the power mode (P) and turn the swing lock switch ON.
   ★ If the swing lock switch is turned ON, the main relief valve is set for high-pressure relief.
5) Run the engine at high idle, operate the left work equipment control lever to relieve the arm circuit at the IN stroke end, and measure the oil pressure.

★ Measuring condition and method of judgment: If the pressures are in the following ratio, the PC valve is normal.

Measured oil pressure	Operation of lever	Ratio of oil pressures
Pump discharge pressure	Arm IN relief	1
PC valve output pressure		Approx. 0.6 (Approx. 3/5)

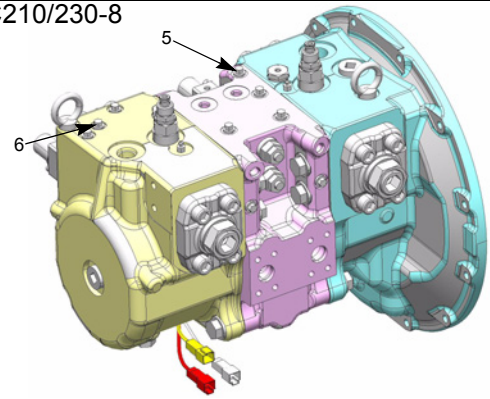
★ If the PC valve or the servo piston is abnormal, the PC valve output pressure (servo piston inlet pressure) is "the same as the pump discharge pressure" or "almost 0".

6) After finishing measurement, remove the measuring tools and return the removed parts.

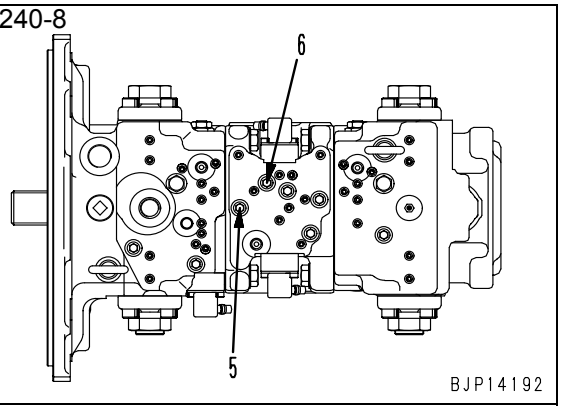
2. Measuring PC-EPC valve output pressure

1) Open the side cover of the pump room and remove oil pressure pickup plugs (5) and (6).
   (5): Front PC-EPC valve output pressure pickup plug
   (6): Rear PC-EPC valve output pressure pickup plug

PC210/230-8



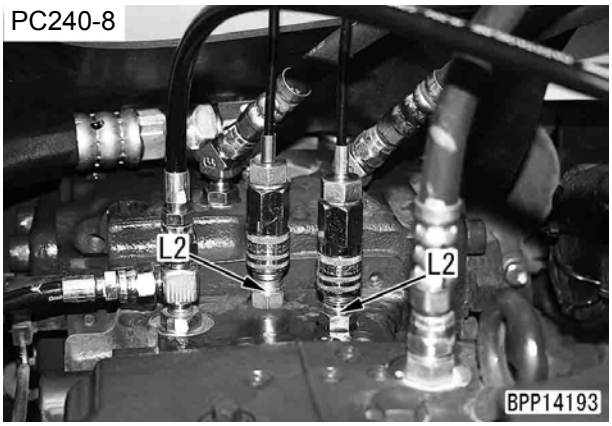
PC240-8



2) Install nipples **L2** and connect them to oil pressure gauges [2].
   ★ Use the oil pressure gauges of 5.9 MPa {60 kg/cm^2}.

PC210/230-8

PC240-8



3) Start the engine and set the working mode in the power mode (P).
4) Run the engine at high idle and low idle, set all the levers and pedals for work equipment control, swing control, and travel in neutral, and measure the oil pressure at each speed.

★ Measuring condition and method of judgment: If the output pressures are in the following ratio, the PC-EPC valve is normal.

Engine	Operation of lever	Output pressure
Low idle	All control levers and pedals in neutral	Approx. 2.9 MPa {Approx. 30 kg/cm^2}
High idle		0 MPa {0 kg/cm^2}

5) After finishing measurement, remove the measuring tools and return the removed parts.

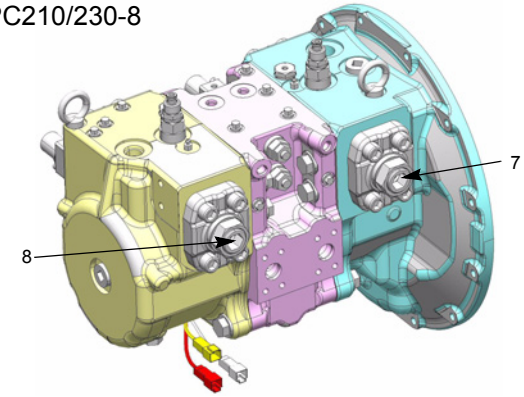
Adjusting

Adjusting pump PC valve

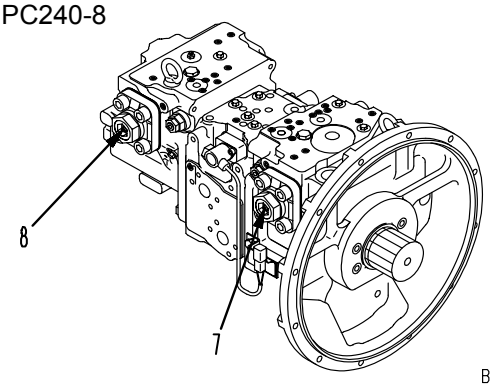
★ If either of the following phenomena occurs and the PC valve seems to be defective, adjust PC valves (7) and (8) according to the procedure shown below.
- As the working load increases, the engine speed lowers remarkably.
- The engine speed is normal but the work equipment speed is low.
- (7): Front pump PC valve
- (8): Rear pump PC valve

★ The width across flats of the PC valve locknut is 13 mm and that of the adjustment screw (inside width) is 4 mm.
Do not turn any other locknuts or adjustment screws since they affects the hydraulic pump performance.

PC210/230-8



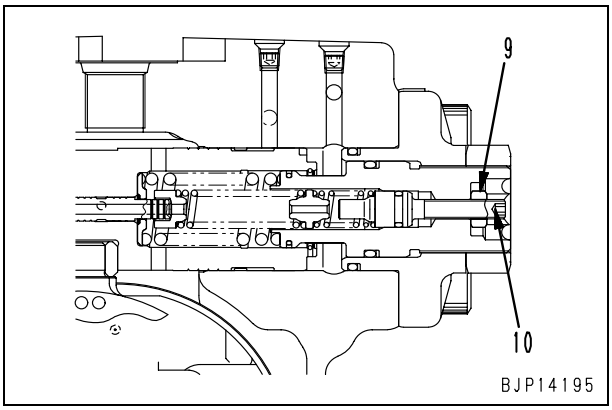
PC240-8



1. Loosen locknut (9).
   ★ Before loosening the locknut, make counter mark at the adjustment screw end so that you can see the position of the locknut before the adjustment (and you can return the locknut to its original position after turning it in reverse).

2. Turn adjustment screw (10) clockwise or counterclockwise to adjust.
   ★ Turn the adjustment screw
   - Clockwise when the work equipment speed is low (to increase pump absorption torque) and
   - Counterclockwise when the engine speed lowers (to decrease pump absorption torque).

3. Tighten locknut (9).
   Locknut: **27 – 34 Nm {2.8 – 3.5 kgm}**



4. After finishing adjustment, check again that the PC valve output pressure (servo piston inlet pressure) is normal according to the above described measurement procedure.

Measuring and adjusting oil pressure in pump LS control circuit

★ Measuring and adjusting tools for oil pressure in pump LS control circuit

Symbol		Part No.	Part name
M	1	799-101-5002	Hydraulic tester
		790-261-1204	Digital hydraulic tester
	2	799-401-2701	Differential pressure gauge
	3	799-101-5220	Nipple (10 × 1.25 mm)
		07002-11023	O-ring

⚠ **Stop the machine on a level ground and lower the work equipment to the ground. Then, release the residual pressure from the hydraulic circuit. For details, see "Releasing residual pressure from hydraulic circuit".**

Measuring

★ Before measuring the oil pressure in the PC control circuit, check that the oil pressure in the work equipment, swing, and travel circuits and the basic pressure of the control circuit are normal.

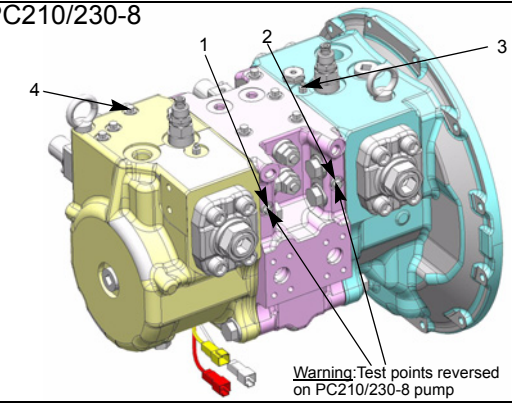
★ Measure the oil pressure in the pump LS control circuit under the following condition.
- Hydraulic oil temperature: Within operating range

1. Measuring LS valve output pressure (servo piston inlet pressure)

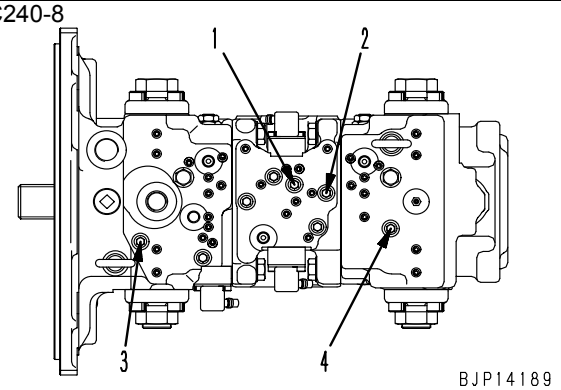
★ Measure the LS valve output pressure (servo piston inlet pressure) and pump discharge pressure simultaneously and compare them.

1) Open the side cover of the pump room and remove oil pressure pickup plugs (1), (2), (3), and (4).
- (1): Front pump discharge pressure pickup plug
- (2): Rear pump discharge pressure pickup plug
- (3): Front LS valve output pressure pickup plug
- (4): Rear LS valve output pressure pickup plug

PC210/230-8



PC240-8

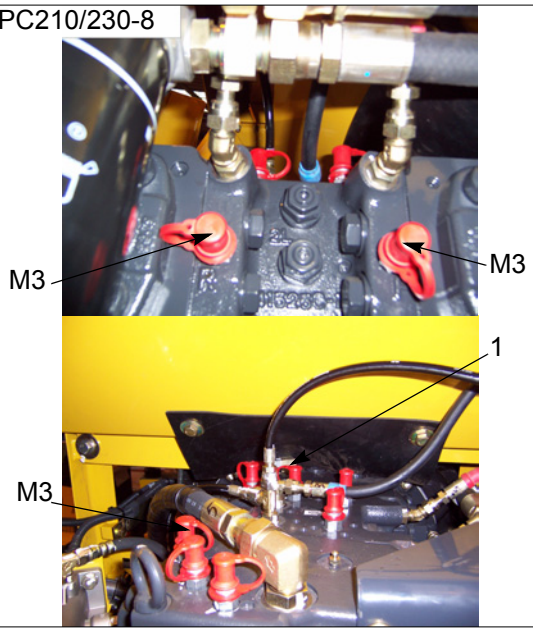


2) Install nipples **M3** and nipples [1] of hydraulic tester **M1** and connect them to oil pressure gauges [2].

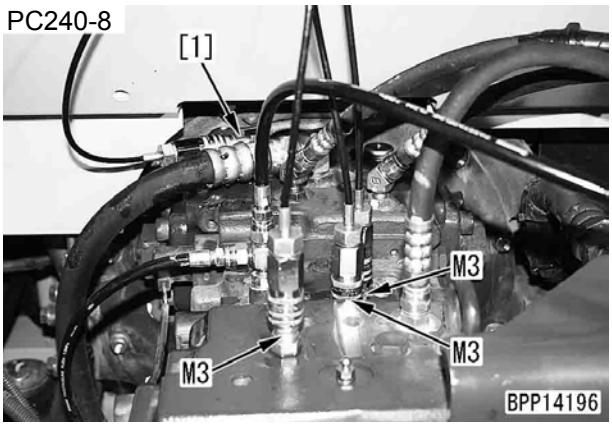
★ Connect the measuring part of plug (3) by using joint (790-301-1271) and elbow (790-301-1530) of hydraulic tester **M1** and nipple [1] so that it will not interfere with the drain piping.

★ Use the oil pressure gauges of 58.8 MPa {600 kg/cm^2}.

PC210/230-8



PC240-8



3) Start the engine and push up the track shoe on the side to be measured with the work equipment and prepare for running the track shoe idle.
   - When measuring front circuit: Right track shoe
   - When measuring rear circuit: Left track shoe

   ⚠ **Since the raised track shoe will be run idle during measurement, secure a sufficient working area.**
4) Set the working mode in the power mode (P) and set the travel speed in the High position.
5) Run the engine at high idle, set all the levers and pedals for work equipment control, swing control, and travel in neutral, and measure the oil pressure at each speed. Then, operate the travel lever to run the track shoe idle and measure the oil pressure.

   ⚠ **While checking the safety around the machine extremely, run the track shoe pushed up idle.**

   ★ Do not operate the travel lever to the stroke end (but stop it halfway).

★ Measuring condition and method of judgment: If the pressures are in the following ratio, the LS valve is normal.

Measured oil pressure	Operation of lever and ratio of oil pressures	
	All control levers and pedals in neutral	Travel lever moved halfway (Track shoe run idle)
Pump discharge pressure	Almost same	1
LS valve output pressure		Approx. 0.6 (Approx. 3/5)

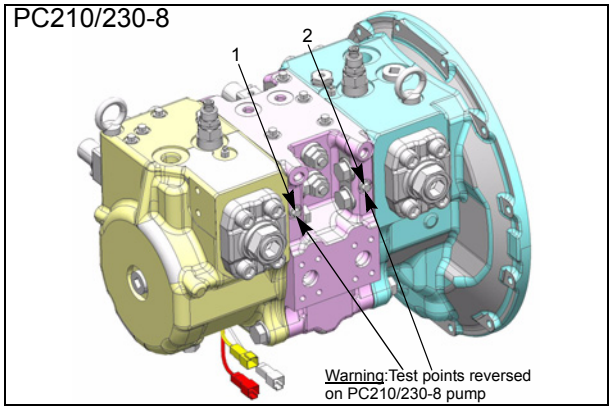
6) After finishing measurement, remove the measuring tools and return the removed parts.

2. Measuring LS differential pressure

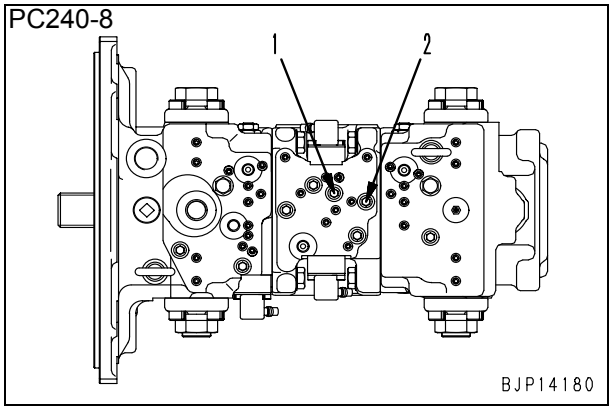
★ Measure the pump discharge pressure and LS pressure (actuator load pressure) simultaneously and calculate the difference between them.

1) Open the side cover of the pump room and remove oil pressure pickup plugs (1), (2), (5), and (6).
   - (1): Front pump discharge pressure pickup plug
   - (2): Rear pump discharge pressure pickup plug

PC210/230-8

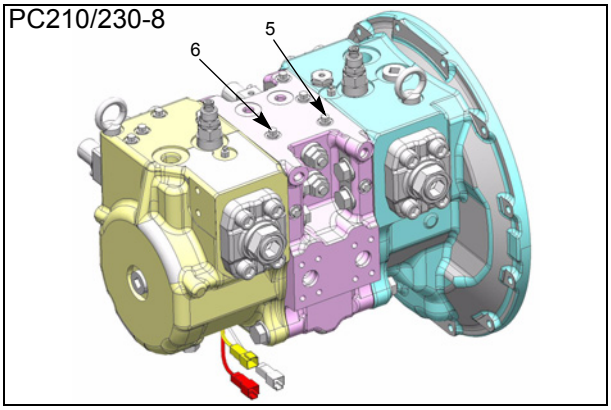


PC240-8

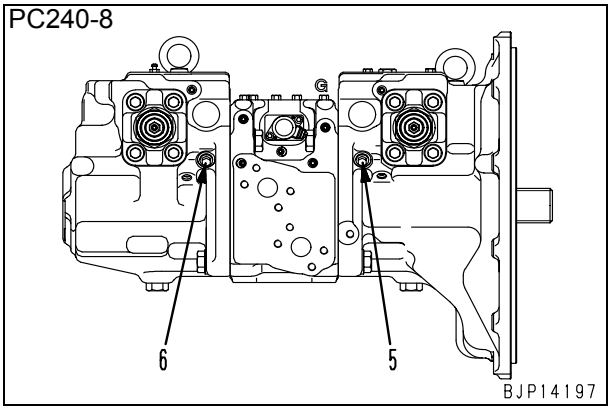


- (5): Front LS pressure pickup plug
- (6): Rear LS pressure pickup plug

PC210/230-8

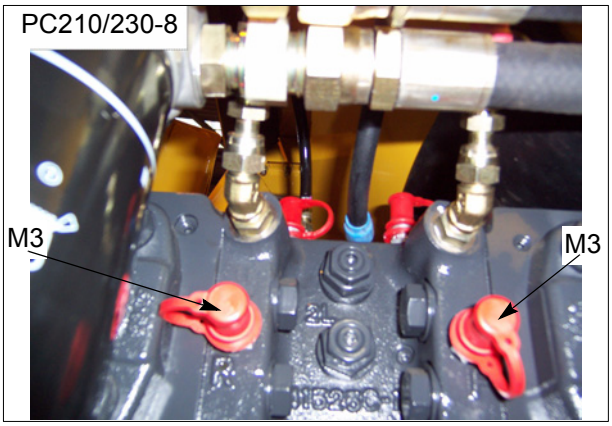


PC240-8

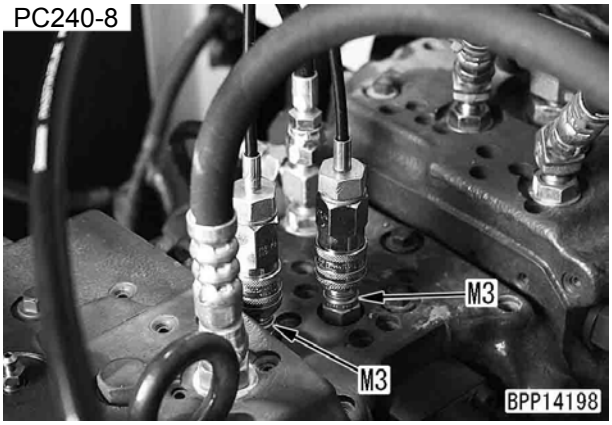


2) Install nipples **M3** and connect it to differential pressure gauge **M2** or the oil pressure gauge of hydraulic tester **M1**.
   - ★ When using differential pressure gauge **M2**:
     Connect the pump discharge pressure to the high pressure side (back side) and connect the LS pressure to the low pressure side (lower side). Since the differential pressure gauge needs a 12V power source, connect it to a battery.
   - ★ When using oil pressure gauge (in **M1**):
     Use the oil pressure gauge of 58.8 MPa {600 kg/cm^2} having the unit of 0.98 MPa {10 kg/cm^2}. Since the differential pressure is about 3.9 MPa {40 kg/cm^2} at maximum, measure it by installing the same gauge to the pickup plugs alternately.
   - The figure shows the pump discharge pressure side.

PC210/230-8

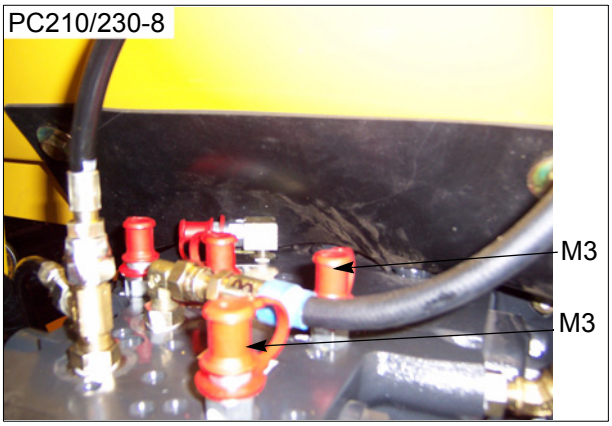


PC240-8

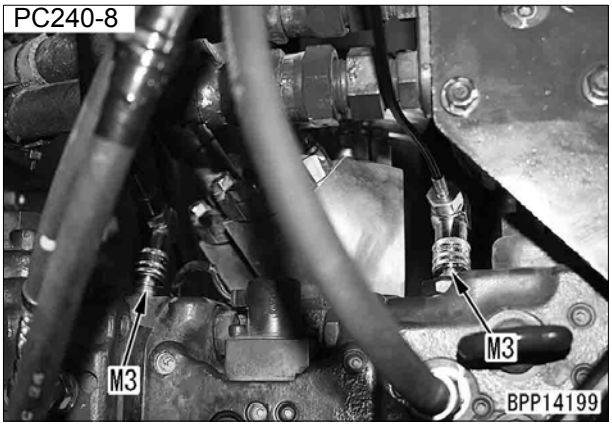


- The figure shows the LS pressure side.

PC210/230-8



PC240-8



3) Run the engine, push up the track shoe on the side to be measured with the work equipment, and prepare for running track shoe idle.
   - When measuring front circuit: Right track shoe
   - When measuring rear circuit: Left track shoe

   ⚠ **Since the raised track shoe will be run idle during measurement, secure a sufficient working area.**
4) Set the working mode in the power mode (P) and set the travel speed in the High position.
5) Run the engine at high idle, set all the levers and pedals for work equipment control, swing control, and travel in neutral, and measure the oil pressure at each speed. Then, operate the travel lever to run the track shoe idle and measure the oil pressure.

   ⚠ **While checking the safety around the machine extremely, run the track shoe pushed up idle.**

   ★ Do not operate the travel lever to the stroke end (but stop it halfway).

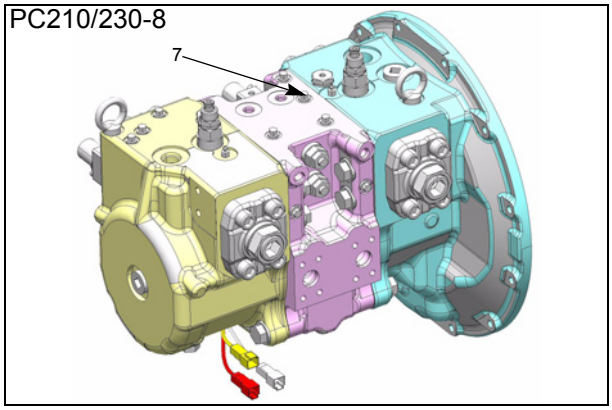
   ★ Measuring condition and method of judgment: If the pressures are in the following ratio, the LS valve is normal.

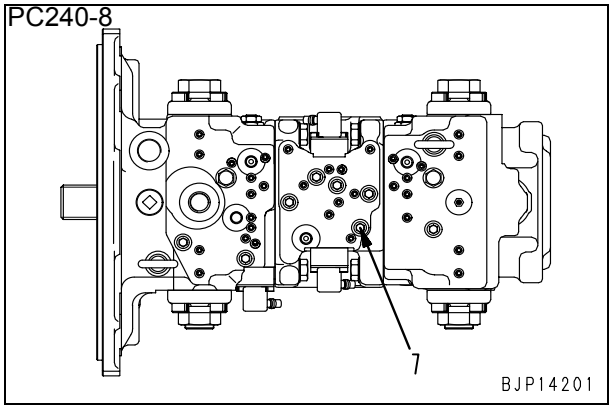
Operation of levers	LS differential pressure
All control levers and pedals in neutral	Specified LS differential pressure (See standard values table)
Travel lever moved halfway (Track shoe run idle)	

6) After finishing measurement, remove the measuring tools and return the removed parts.

3. Measuring LS-EPC valve output pressure

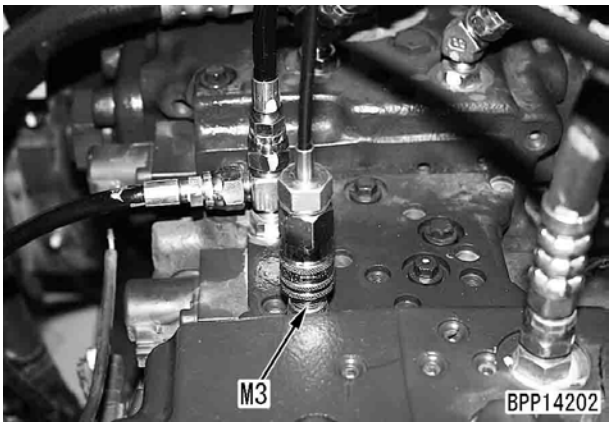
1) Open the side cover of the pump room and remove oil pressure pickup plug (7).





2) Install nipple **M3** and connect them to oil pressure gauge [2].

   ★ Use the oil pressure gauges of 5.9 MPa {60 kg/cm^2}.



3) Start the engine.
4) Run the engine at high idle, operate the travel speed switch and travel lever, and measure the output pressure in each case.
   ★ Measuring condition and method of judgment: If the output pressures are in the following ratio, the LS-EPC valve is normal.

Travel speed	Operation of lever	Output pressure
Lo	Travel lever in neutral	Approx. 2.9 MPa {Approx. 30 kg/cm^2}
Hi	Travel lever operated a little (Note)	0 MPa {0 kg/cm^2}

Note: Move the travel lever to a degree that the PPC oil pressure switch is turned ON (before the track starts moving).

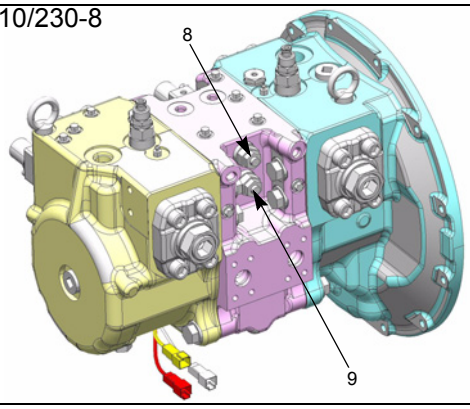
5) After finishing measurement, remove the measuring tools and return the removed parts.

Adjusting

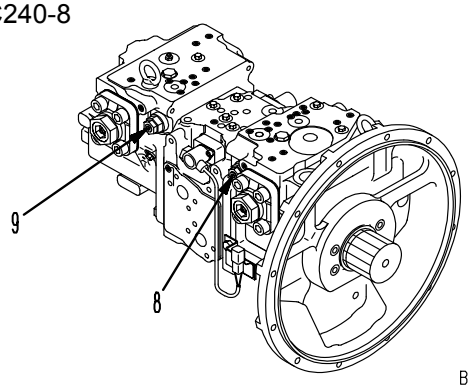
Adjusting LS valve

★ If the LS differential pressure is abnormal, adjust the LS valve according to the following procedure.
- (8): Front pump LS valve
- (9): Rear pump LS valve

PC210/230-8



PC240-8



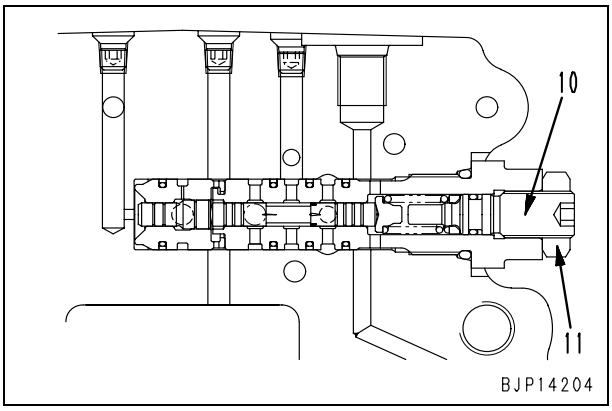
1. While fixing adjustment screw (10), loosen locknut (11).

2. Turn adjustment screw (10) to adjust the differential pressure.
   ★ If the adjustment screw is
   - Turned to the right, the differential pressure is increased.
   - Turned to the left, the differential pressure is decreased.

   ★ Quantity of adjustment (LS differential pressure) per turn of adjustment screw:
   Approx. 1.1 MPa {Approx. 10.8 kg/cm^2}

3. While fixing adjustment screw (10), tighten locknut (11).

Locknut: **49 – 68.6 Nm {5 – 7 kgm}**



4. After finishing adjustment, check again that the LS differential pressure is normal according to the above described measurement procedure.

Measuring solenoid valve output pressure

★ Measuring tools for solenoid valve output pressure

Symbol		Part No.	Part name
N	1	799-101-5002	Hydraulic tester
		790-261-1204	Digital hydraulic tester
	2	799-401-3100	Adapter (Size 02)

⚠ **Stop the machine on a level ground and lower the work equipment to the ground. Then, release the residual pressure from the hydraulic circuit. For details, see "Releasing residual pressure from hydraulic circuit".**

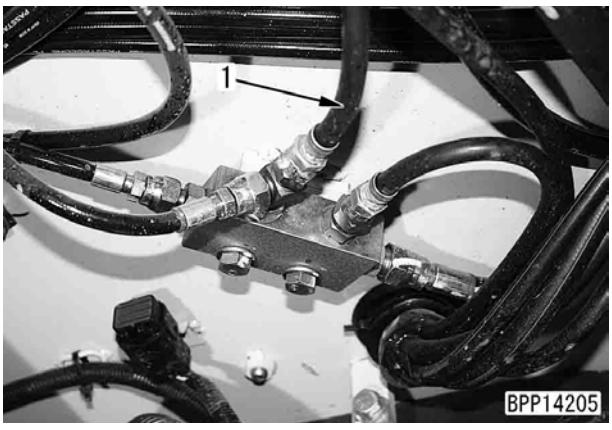
★ Before measuring the solenoid valve output pressure, check that the basic pressure of the control circuit is normal.

★ Measure the solenoid valve output pressure under the following condition.
- Hydraulic oil temperature: Within operating range

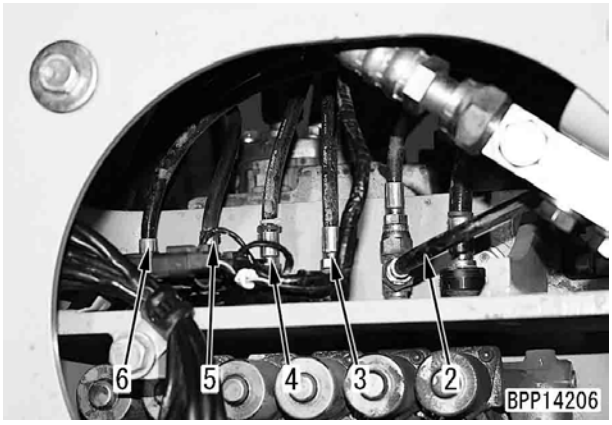
1. Disconnect outlet hoses (1) – (6) of the solenoid valves to be measured.

No.	Solenoid valve to be measured
1	PPC lock solenoid valve
2	2-stage relief solenoid valve
3	Swing holding brake solenoid valve
4	Travel speed shifting solenoid valve
5	Travel junction solenoid valve
6	ATT return selector solenoid valve (Attachment installation specification)

★ When measuring with hose (1), remove the undercover (rear side) of the operator's cab.

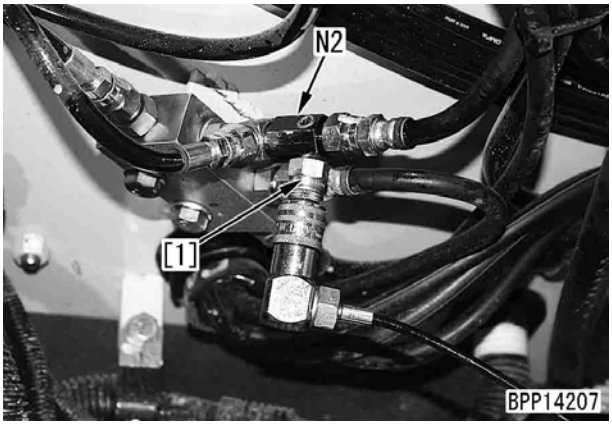


★ When measuring with hoses (2) – (6), remove the undercover of the control valve.



2. Install adapter **N2** and connect the disconnected hose again.

3. Install nipple [1] of hydraulic tester **N1** and connect it to oil pressure gauge [2].
★ Use the oil pressure gauge of 5.9 MPa {60 kg/cm^2}.
★ The figure shows the measuring tools connected to outlet hose (1) of the PPC lock solenoid valve.



4. Start the engine.

5. Run the engine at high idle, operate the control levers and switches to turn the solenoid valve ON or OFF, and measure the oil pressure.
★ For the conditions for turning the solenoid valve ON and OFF, see the operation table of each solenoid valve.
★ The operating condition of the solenoid valve can be checked with the monitoring function of the machine monitor (For details, see "Special functions of machine monitor").
- Monitoring code: 02300 Solenoid 1
- Monitoring code: 02301 Solenoid 2

★ If the output pressure is as follows, the solenoid valve is normal.

Solenoid valve	Output pressure
OFF (Demagnetization)	0 MPa {0 kg/cm^2}
ON (Excitation)	2.9 MPa {30 kg/cm^2}

6. After finishing measurement, remove the measuring tools and return the removed parts.

Operation table of PPC lock solenoid valve

Operating condition		Operation
Lock lever	Lock	OFF
	Free	ON

Operation table of 2-stage relief solenoid valve

Operating condition			Operation
Overheat 1st setting is ON			OFF
Overheat 2nd setting is ON			
All of work equipment, swing, and travel signals are OFF			
Swing lock switch is ON			ON
Travel signal is ON			
L mode is selected			
Boom LOWER signal is ON			
P/E mode is selected	Left knob switch is ON	Signals other than swing single signal are ON	
		Swing single signal is ON	OFF
Other than above condition			

Operation table of swing holding brake solenoid valve

Operating condition		Operation
Work equipment, swing, and travel signals	All are OFF	OFF
	Any one is ON	ON

Operation table of travel speed shifting solenoid valve

Operating condition			Operation
Overheat 2nd setting is ON			OFF
Fuel control dial is at 1,500 rpm or below			
Travel speed switch is at Lo/Mi (PC210/230-8) Travel speed switch is at Lo (PC240-8)			
Travel speed switch is at Hi (PC210/230-8) Travel speed switch is at Mi/Hi (PC240-8)	Travel signal is OFF		
	Travel signal is ON	F or R pump pressure is 24.5 MPa {250 kg/cm^2}	
		F or R pump pressure is 15.3 MPa {150 kg/cm^2}	ON
Other than above condition			

Operation table of travel junction solenoid valve

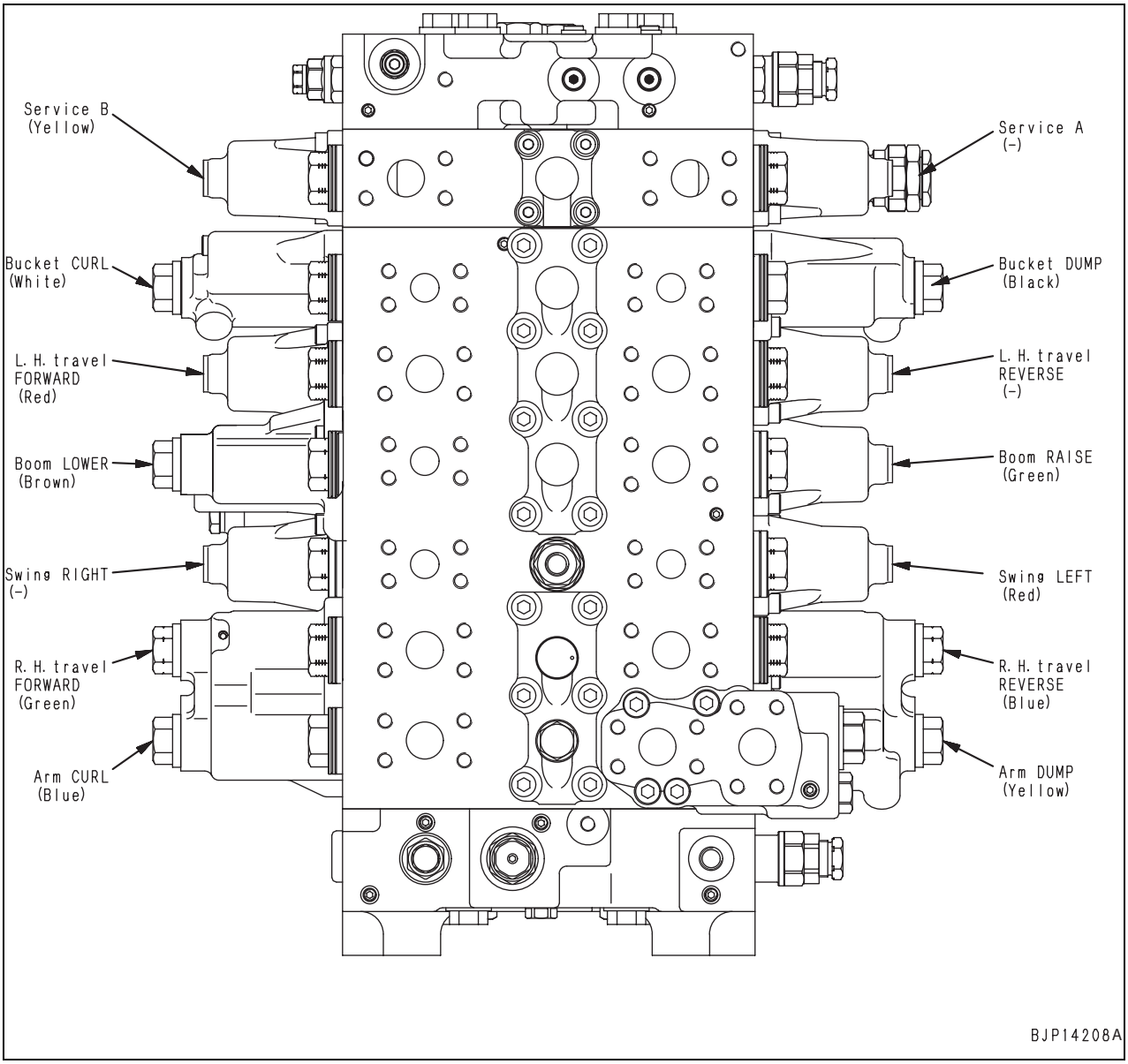
Operating condition			Operation
Travel steering signal is ON			ON
Travel steering signal is OFF	Travel lever is operated singly	F or R pump pressure is 24.5 MPa {250 kg/cm^2} or higher	
	Other than above condition		OFF

Operation table of ATT return selector solenoid valve (Attachment installation specification)

Operating condition	Operation
Working mode: Other than B	OFF
Working mode: B	ON

Measuring PPC valve output pressure

Connecting points of PPC piping



★ The above figure shows the connecting points of the PPC piping on the control valve of 1 attachment installation specification. The colors in ( ) are the colors of the bands installed for distinction of the pipes.

★ The figure at right shows the check points of the steering signal voltage of the travel PPC valve. When measuring the steering signal voltage, remove the undercover of the operator's cab (front side).

★ Measuring tools for PPC valve output pressure

Symbol		Part No.	Part name
P	1	799-101-5002	Hydraulic tester
		790-261-1204	Digital hydraulic tester
	2	799-401-3100	Adapter (Size 02)
	3	799-401-3200	Adapter (Size 03)

⚠ **Stop the machine on a level ground and lower the work equipment to the ground. Then, release the residual pressure from the hydraulic circuit. For details, see "Releasing residual pressure from hydraulic circuit".**

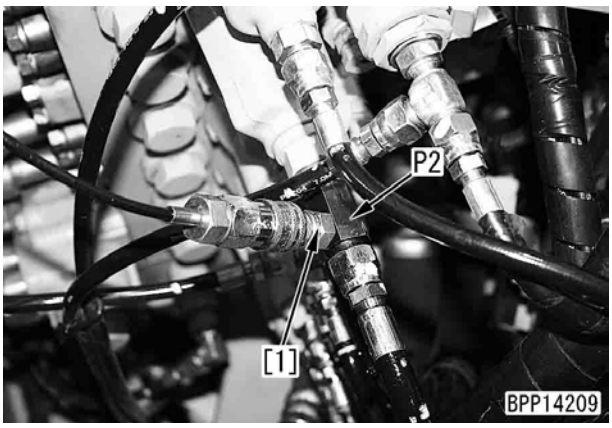
★ Before measuring the PPC valve output pressure, check that the basic pressure of the control circuit is normal.

★ Measure the solenoid valve output pressure under the following condition.
- Hydraulic oil temperature: Within operating range

1. Disconnect the hose of the PPC circuit to be measured.
   ★ For the hose to be disconnected, see "Connecting points of PPC piping".

2. Install adapter **P2** and connect the disconnected hose again.

3. Install nipple [1] of hydraulic tester **P1** and connect it to oil pressure gauge [2].
   ★ Use the oil pressure gauge of 5.9 MPa {60 kg/cm^2}.
   ★ The figure shows the measuring tools connected to the hose of the bucket dump PPC circuit.



4. Start the engine and set the working mode in the power mode (P).

5. Run the engine at high idle and measure the oil pressure with the control lever in neutral and moved to the stroke end.

★ If the output pressure is as follows, the PPC valve is normal.

Operation of lever	Output pressure
Neutral	0 MPa {0 kg/cm^2}
Stroke end	Almost same as control circuit basic pressure (See standard values table)

6. After finishing measurement, remove the measuring tools and return the removed parts.

Adjusting play of work equipment and swing PPC valves

★ If the right and left work equipment levers have large play, adjust them according to the following procedure.

1. Remove the work equipment and swing PPC valve assembly.

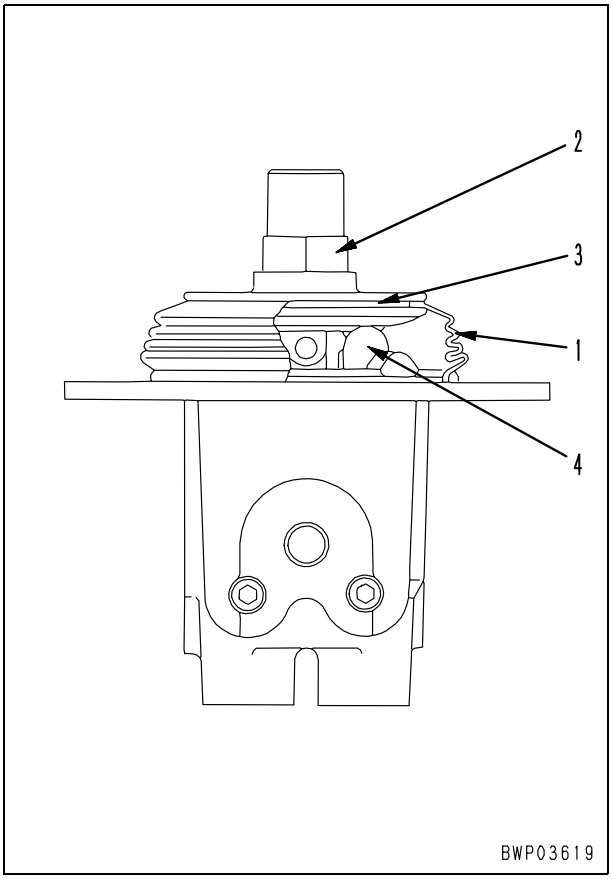
2. Remove bellows (1).

3. Loosen locknut (2) and tighten disc (3) until it touches the heads of 4 pistons (4).
   ★ Do not move the piston at this time.

4. Fix disc (3) and tighten locknut (2) to the specified torque.
   Locknut: **98 – 127 Nm {10 – 13 kgm}**

5. Install bellows (1).

6. Install the work equipment and swing PPC valve assembly.

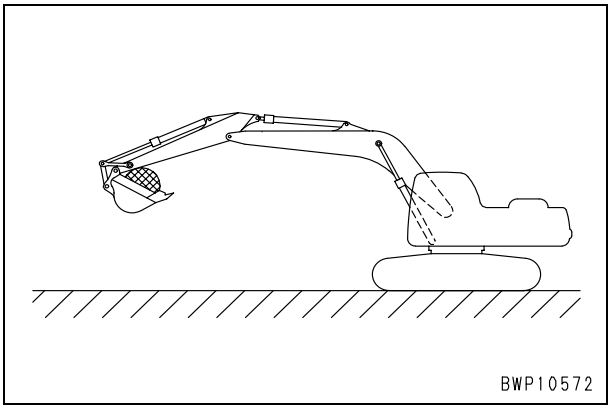


Checking parts which cause hydraulic drift of work equipment

★ If the work equipment (cylinder) drifts hydraulically, check to see if the cause is on the cylinder packing side or control valve side according to the following procedure.

1. Checking boom cylinder and bucket cylinder

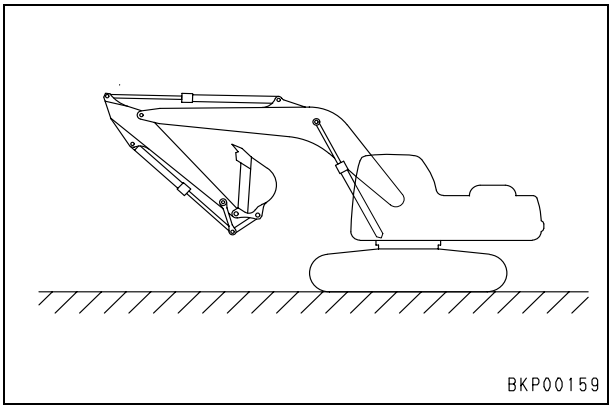
1) Set the machine in the position for measuring hydraulic drift and stop the engine.
   ★ Fill the bucket with a rated load or with dirt and sand.



2) When checking the boom cylinder, set the boom control lever in the RAISE position. When checking the bucket cylinder, set the bucket control lever in the CURL position.
   - If the lowering speed is increased at this time, the cylinder packing is defective.
   - If the lowering speed does not change at this time, the control valve is defective.
   ★ Operate the control lever while the starting switch is in the ON position.
   ★ If the pressure in the accumulator is lost, run the engine for about 5 seconds to heighten the pressure in the accumulator.

2. Checking arm cylinder

1) Stop the arm cylinder about 100 mm before the IN stroke end and stop the engine.



2) Operate the arm control lever in the IN position.
   - If the lowering speed is increased at this time, the cylinder packing is defective.
   - If the lowering speed does not change at this time, the control valve is defective.
   ★ Operate the control lever while the starting switch is in the ON position.
   ★ If the pressure in the accumulator is lost, run the engine for about 5 seconds to heighten the pressure in the accumulator.

[**Reference**]

Reason why the lowering speed is increased by the above operation when the cylinder packing is the cause of the hydraulic drift:

1) If the machine is set in the above position (where the holding pressure is applied to the bottom side), the oil leaks from the bottom side to the head side. Since the volume on the head side is less than that on the bottom side by the volume of the rod, the pressure in the head side is increased by the oil flowing in from the bottom side.
2) As the pressure in the head side is increased, it is balanced at a certain level (which depends on the leakage), and then the lowering speed is lowered.
3) If the circuit on the head side is opened to the drain circuit by the above operation of the lever (the bottom side is closed by the check valve at this time), the oil on the head side flows in the drain circuit. As a result, the pressure is unbalanced and the lowering speed is increased.

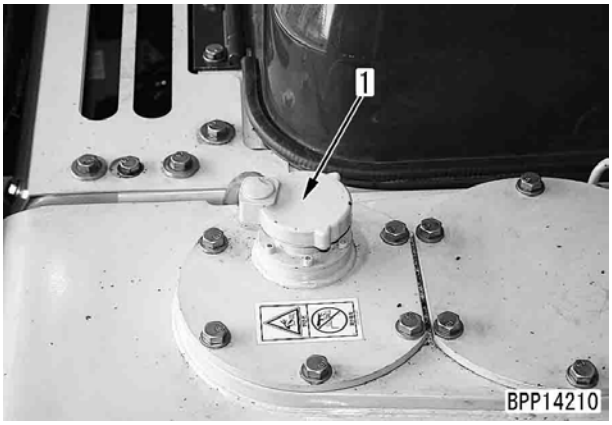
3. Checking PPC valve

While the pressure in the accumulator is high, set the lock lever in the LOCK/FREE position and measure the lowering distance.

- ★ Operate the control lever while the starting switch is in the ON position.
- ★ If the pressure in the accumulator is lost, run the engine for about 5 seconds to heighten the pressure in the accumulator.
- ★ If there is a difference in the lowering distance between the LOCK position and FREE position, the PPC valve is defective (it has an internal defect).

Releasing residual pressure from hydraulic circuit

1. **Releasing residual pressure from hydraulic tank**
   - ⚠ **Since the hydraulic tank is enclosed and pressurized, release the residual pressure from it when removing a hose or a plug connected to it.**
   1) Lower the work equipment to the ground in a stable position and stop the engine.
   2) Loosen oil filler cap (1) of the hydraulic tank gradually to release the air in the tank.



2. **Releasing residual pressure from hydraulic cylinder circuit**
   - ⚠ **When disconnecting a pipe between a hydraulic cylinder and the control valve, release the residual pressure from the piping according to the following procedure.**
   1) Lower the work equipment and release the residual pressure from the hydraulic tank. For details, see “Releasing residual pressure from hydraulic tank”.
      - ★ Keep the oil filler cap of the hydraulic tank removed.
   2) Turn the starting switch ON and set the lock lever in the FREE position, and then operate the right and left work equipment control levers forward, backward, to the right, and to the left.
      - ★ The control valve is operated by the pressure in the accumulator. The pressure in the accumulator is used up, however, after the control valve is operated 2 – 3 times.
   3) Run the engine at low idle for 5 seconds to heighten the pressure in the accumulator.
      - ★ The engine does not start until the lock lever is set in the LOCK position once.
   4) Repeat steps 2) and 3) above 2 – 3 times, and the residual pressure in the piping is released completely.

3. **Releasing residual pressure from swing motor circuit**
   The residual pressure in the swing motor circuit can be released by performing the operation for “Releasing residual pressure from hydraulic cylinder circuit” (Operate the lever in the swing direction only, however).

4. **Releasing residual pressure from travel motor circuit**
   Since the control valve spool of the travel motor circuit is open, the pressure in this circuit can be released by performing “Releasing residual pressure from hydraulic tank”.

Measuring oil leakage

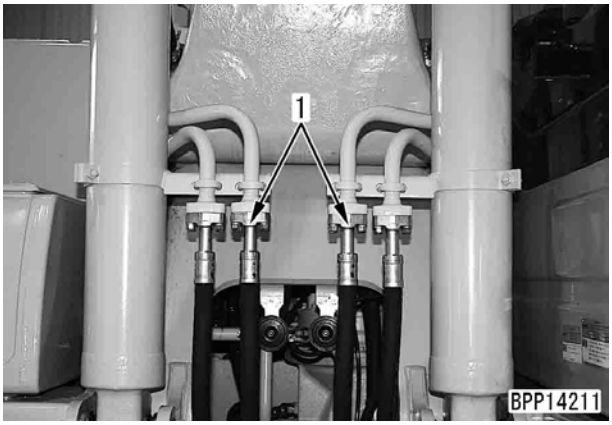
★ Measuring tools for oil leakage

Symbol	Part No.	Part name
Q	Commercially available	Measuring cylinder

★ Measure the oil leakage under the following condition.
- Hydraulic oil temperature: Within operating range

1. Measuring oil leakage from boom cylinder

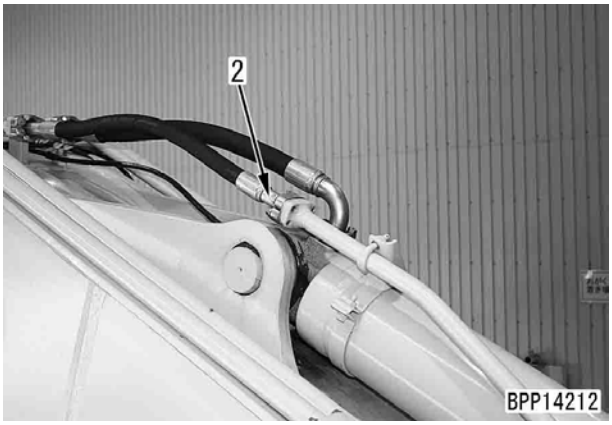
1) Move the boom cylinder to the RAISE stroke end and stop the engine.
   ⚠ **Release the residual pressure from the piping on the boom cylinder head side. For details, see "Releasing residual pressure from hydraulic circuit" (Operate the lever in the boom RAISE direction only, however).**
2) Disconnect hose (1) on the cylinder head side and block the hose side with a flange.
   ⚠ **Take care not to disconnect the hose on the cylinder bottom side.**
   ★ Use the following part to block the hose side.
   07379-00640 (Flange #06)



3) Run the engine at high idle and relieve the boom circuit by raising the boom.
   ⚠ **Take care not to "lower the boom".**
4) Start measuring the oil leakage 30 seconds after relieving is started and measure for 1 minute.
5) After finishing measurement, return the removed parts.

2. Measuring oil leakage from arm cylinder

1) Move the arm cylinder to the IN stroke end and stop the engine.
   ⚠ **Release the residual pressure from the piping on the arm cylinder head side. For details, see Releasing residual pressure from hydraulic circuit (Operate the lever in the arm IN direction only, however).**
2) Disconnect hose (2) on the cylinder head side and block the hose side with a flange.
   ⚠ **Take care not to disconnect the hose on the cylinder bottom side.**
   ★ Use the following part to block the hose side.
   07379-00640 (Flange #06)



3) Run the engine at high idle and relieve the arm circuit by moving the arm IN.
   ⚠ **Take care not to "move the arm OUT".**
4) Start measuring the oil leakage 30 seconds after relieving is started and measure for 1 minute.
5) After finishing measurement, return the removed parts.

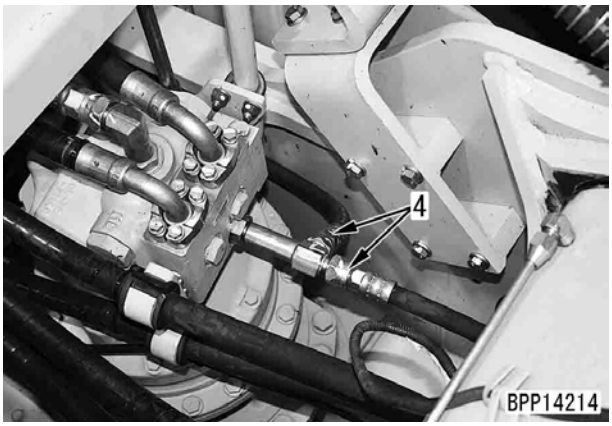
3. Measuring oil leakage from bucket cylinder

1) Move the bucket cylinder to the CURL stroke end and stop the engine.
   ⚠ **Release the residual pressure from the piping on the bucket cylinder head side. For details, see Releasing residual pressure from hydraulic circuit (Operate the lever in the bucket CURL direction only, however).**
2) Disconnect hose (3) on the cylinder head side and block the hose side with a flange.
   ⚠ **Take care not to disconnect the hose on the cylinder bottom side.**
   ★ Use the following part to block the hose side.
   07379-00640 (Flange #06)

3) Run the engine at high idle and relieve the bucket circuit by curling the bucket.
   ⚠ **Take care not to "dump the bucket".**
4) Start measuring the oil leakage 30 seconds after relieving is started and measure for 1 minute.
5) After finishing measurement, return the removed parts.

4. Measuring oil leakage from swing motor

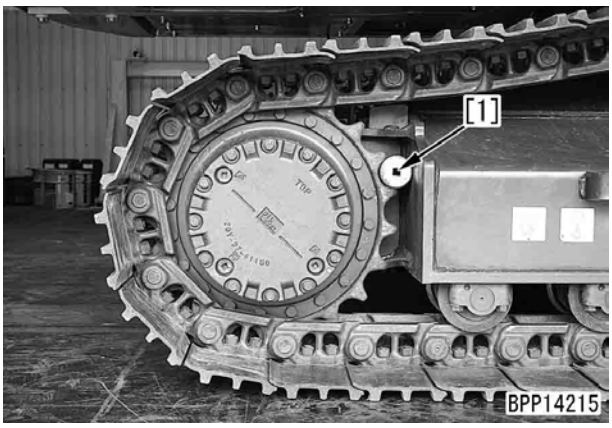
1) Disconnect 2 drain hoses (4) and block the hose side with plugs.
   ★ Use the following parts to block the hose side.
   07376-70522 (Plug #05)



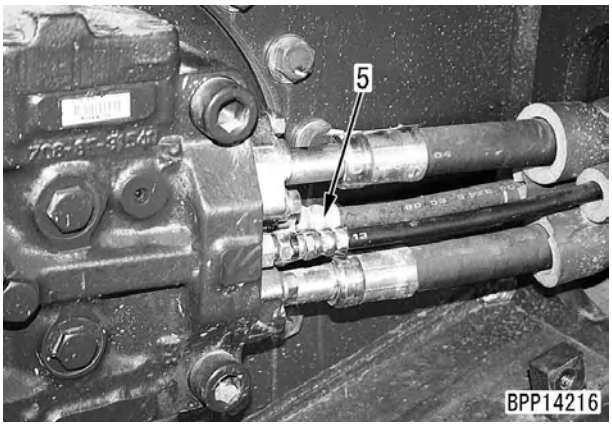
2) Turn the swing lock switch ON.
3) Run the engine at high idle and relieve the swing circuit by swinging.
   ★ Start measuring the oil leakage 30 seconds after relieving is started and measure for 1 minute.
   ★ After measuring 1 time, swing 180°, and then measure again.
4) After finishing measurement, return the removed parts.

5. Measuring oil leakage from travel motor

1) Remove the travel motor cover.
2) Run the engine, lock the travel mechanism, and stop the engine.
   ⚠ **Put pin [1] between the sprocket and track frame to lock the travel mechanism securely.**



3) Disconnect drain hose (5) of the travel motor and block the hose side with a plug.
   ★ Use the following part to block the hose side.
   07376-70422 (Plug #04)



4) Run the engine at high idle, relieve the travel circuit, and measure the oil leakage.
   ⚠ **Before operating the travel lever, check the position and locking direction of the locked sprocket again.**
   ⚠ **Wrong operation of the lever can cause an accident. Accordingly, make signs and checks securely.**
   ★ Start measuring the oil leakage 30 seconds after relieving is started and measure for 1 minute.
   ★ Measure several times, moving the motor a little (changing the position of the valve plate and cylinder and that of the cylinder and piston) each time.
5) After finishing measurement, return the removed parts.

Bleeding air from each part

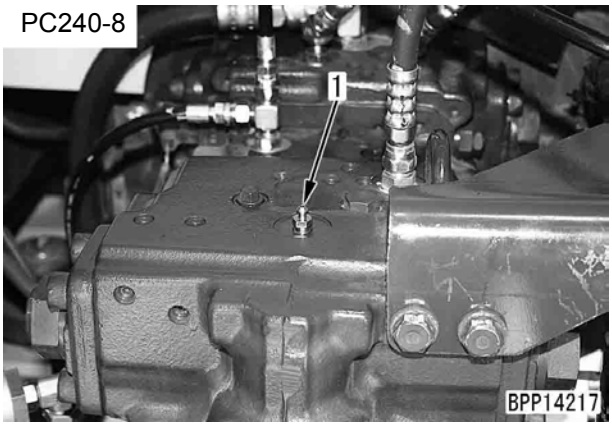
Air bleeding item / Contents of work	Air bleeding procedure					
	1	2	3	4	5	6
	Bleeding air from hydraulic pump	Starting engine	Bleeding air from cylinder	Bleeding air from swing motor	Bleeding air from travel motor	Checking oil level and starting operation
• Replacing hydraulic oil • Cleaning strainer	●	●	●	● (See note)	● (See note)	●
• Replacing return filter element		●	→	→	→	●
• Replacing and repairing hydraulic pump • Removing suction piping	●	●	●	→	→	●
• Replacing and repairing control valve • Removing control valve piping		●	●	→	→	●
• Replacing and repairing cylinder • Removing cylinder piping		●	●	→	→	●
• Replacing and repairing swing motor • Removing swing motor piping		●	→	●	→	●
• Replacing and repairing travel motor • Removing travel motor piping		●	→	→	●	●
• Replacing and repairing swivel joint • Removing swivel joint piping		●	→	→	→	●

Note: Bleed air from the swing motor and travel motor only when the oil in the motor cases is drained.

1. Bleeding air from hydraulic pump

1) Loosen air bleeder (1) and check that oil oozes out through the air bleeder.
2) After the oil oozes out, tighten air bleeder (1).
   Air bleeder:
   7.8 – 9.8 Nm {0.8 – 1.0 kgm}
   ★ Do not use an impact wrench to tighten the air bleeder.

PC240-8



PC210/230-8

2. Starting engine

When running the engine after performing step 1, keep its speed at low idle for 10 minutes.

★ If the engine coolant temperature is low and the automatic warm-up operation is started, stop the engine temporarily and reset the automatic warm-up operation with the fuel control dial (Set the starting switch in the ON position and hold the fuel control dial in the MAX position for 3 seconds, and the automatic warm-up operation is reset).

3. Bleeding air from cylinder

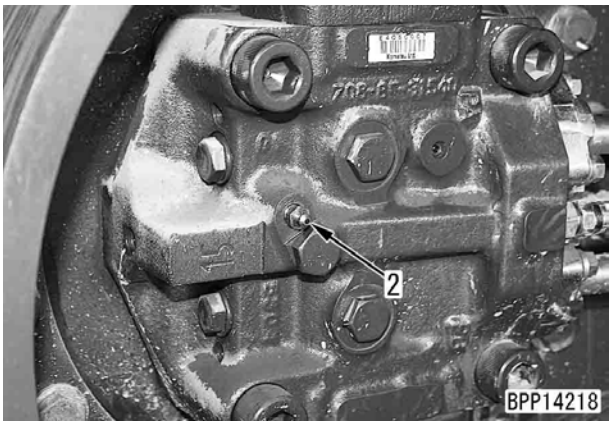
★ If a cylinder is replaced, bleed air from it before connecting the work equipment. In particular, the boom cylinder does not move to the lowering stroke end, if it is installed to the work equipment.

1) Run the engine at low idle for about 5 minutes.
2) While running the engine at low idle, raise and lower the boom 4 – 5 times.
   ★ Stop the piston rod about 100 mm before each stroke end. Do not relieve the oil.

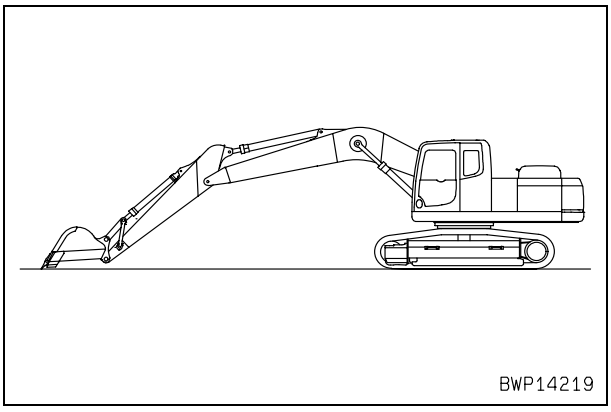
3) While running the engine at high idle, perform step 2).
4) While running the engine at low idle, move the piston rod to the stroke end and relieve the oil.
5) Bleed air from the arm cylinder and bucket cylinder according to steps 2) – 4).

4. Bleeding air from swing motor
1) Run the engine at low idle.
2) Swing slowly to bleed air.

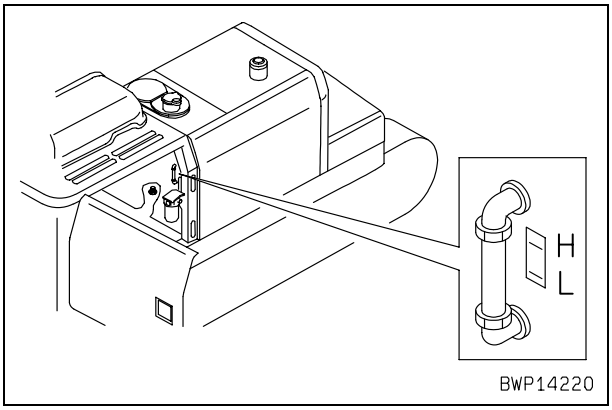
5. Bleeding air from travel motor
1) Run the engine at low idle.
2) Loosen air bleeder (2) and check that oil oozes out through the air bleeder.
3) After the oil oozes out, tighten air bleeder (2).
Air bleeder:
27.5 – 35.3 Nm {2.8 – 3.6 kgm}



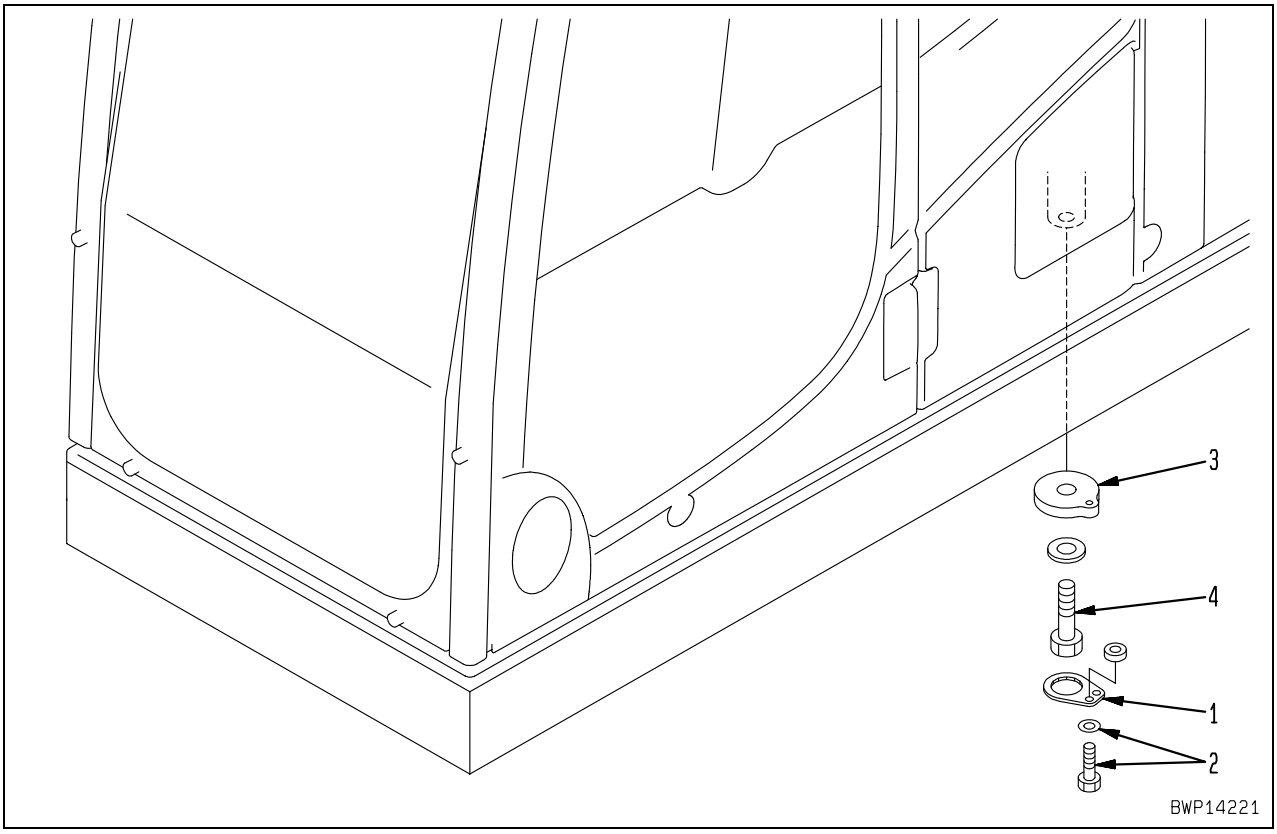
6. Checking oil level and starting work
1) Run the engine, retract the arm cylinder and bucket cylinder to the stroke ends, lower the work equipment to the ground, and stop the engine.



2) Check the oil level by sight gauge (3) on the rear side of the hydraulic tank.
★ If the oil level is below line L, it is insufficient. Add oil.
★ The oil level changes according to the oil temperature. Add oil when the oil level is out of the following standard ranges.
- When oil temperature is 10 – 30°C:
Between line H and line L
- When oil temperature is 50 – 80°C:
Near line H



Checking cab tipping stopper



★ Since the cab tipping stopper is a safety part, check it according to the following procedure.

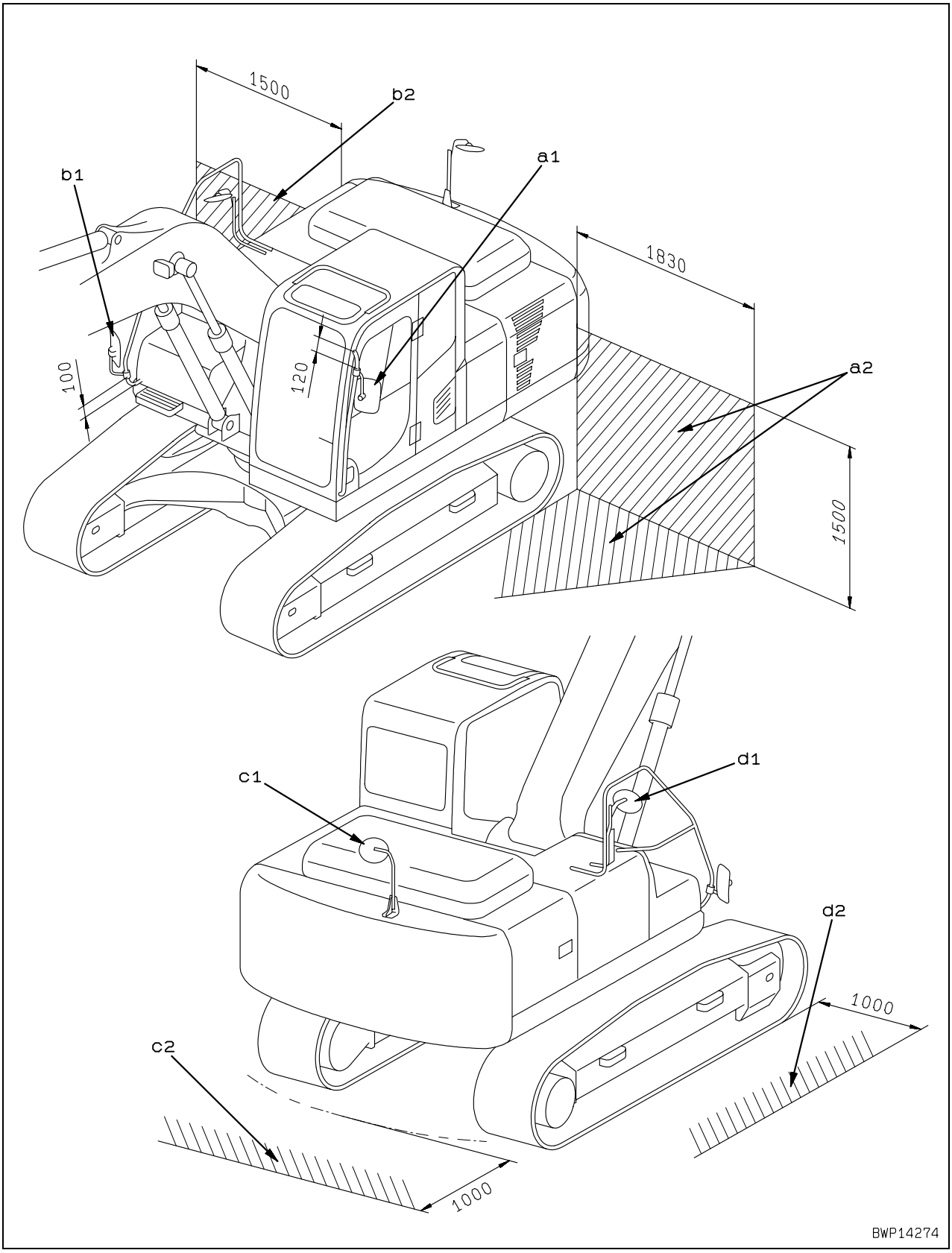
1. Remove the additional undercover from the rear of the operator's cab.
   ★ Perform this step only when the additional undercover is installed.

2. Check the tightening torque of the mounting bolt (2) of the lock plate (1).
   Bolt (2): **98 – 123 Nm {10 – 12.5 kgm}**

[**Reference**]
- The tightening torque of mounting bolt (4) of cab tipping stopper (3) is different from that of a common bolt 30 mm in diameter. Take care.

Bolt (4): **245 – 309 Nm {25 – 31.5 kgm}**

Adjusting mirrors



Installing positions of mirrors

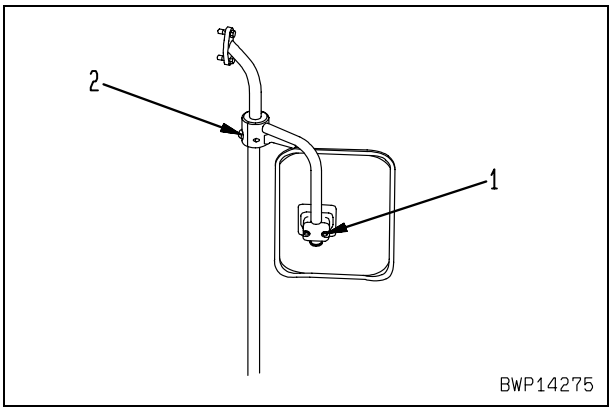
Install mirrors (a1) and (b1) as shown in the figure.

- Mirror (a1): 120 mm (from stay top)
- Mirror (b1): 100 mm (from stay bottom)

Adjusting mirrors (a1) and (b1)

Loosen bolts (1) and (2) of the mirrors and adjust the mirrors so that the operator can see the right and left rear views best which are blind corners from the operator's seat.

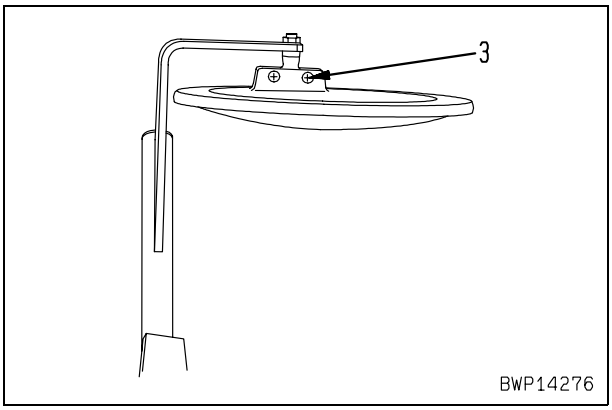
★ Adjust the mirrors so that the operator can see persons (or things 1 m high and about 30 cm in diameter) at the right and left rear of the machine.



Adjusting mirrors (c1) and (d1)

Adjust the mirrors so that the operator can see the ground at 1 m around the machine from the operator's seat.

★ If a mirror is hard to move, loosen screw (3).



Adjusting view

Adjust each mirror so that the operator can see the following ranges.

- Visibility (Left) :1,830 mm
- Visibility (Right):1,500 mm
- Mirror (a1): Hatched part (a2) must be seen
- Mirror (b1): Hatched part (b2) must be seen
- Mirror (c1): Hatched part (c2) must be seen
- Mirror (d1): Hatched part (d2) must be seen

PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00228-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

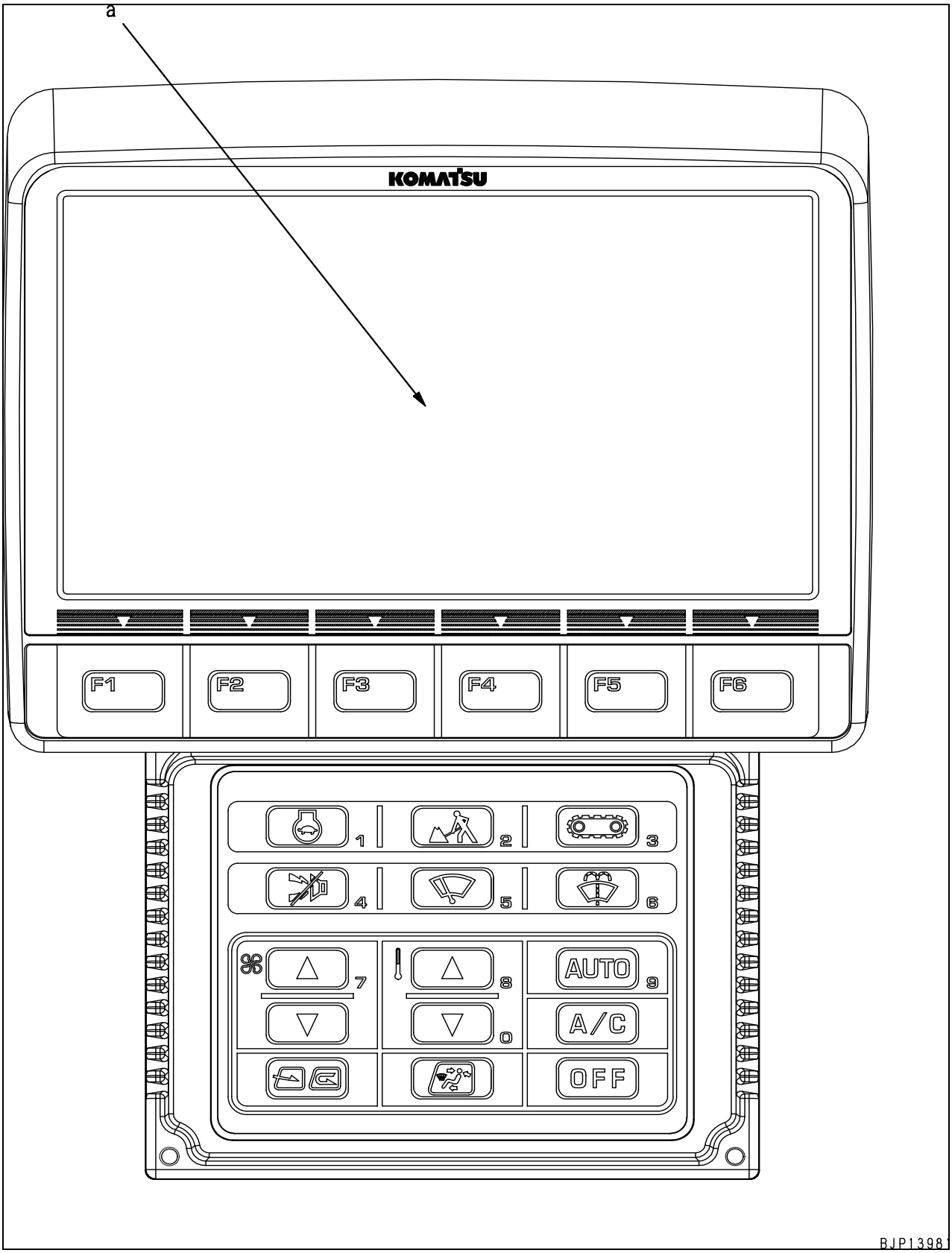
30 Testing and adjusting

Testing and adjusting, Part 2

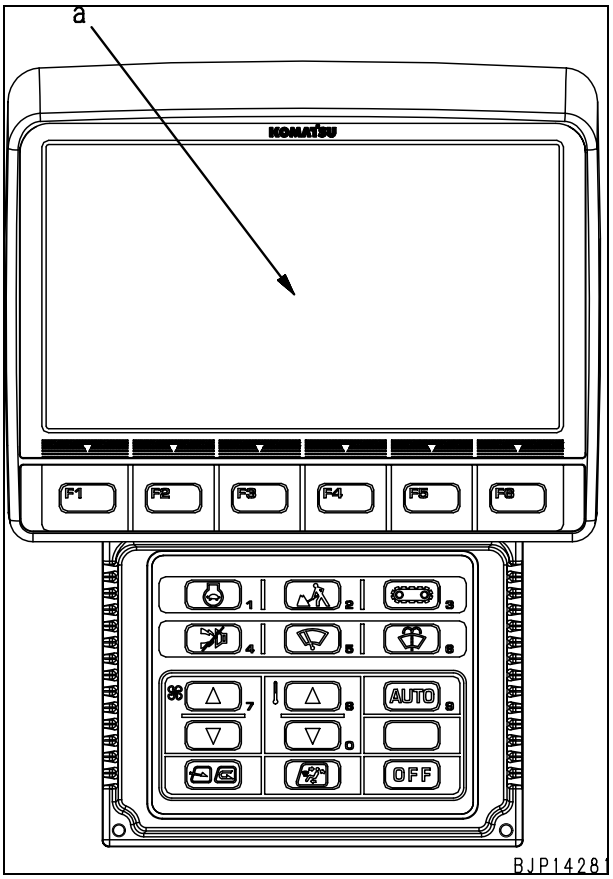
Testing and adjusting, Part 2

Special functions of machine monitor

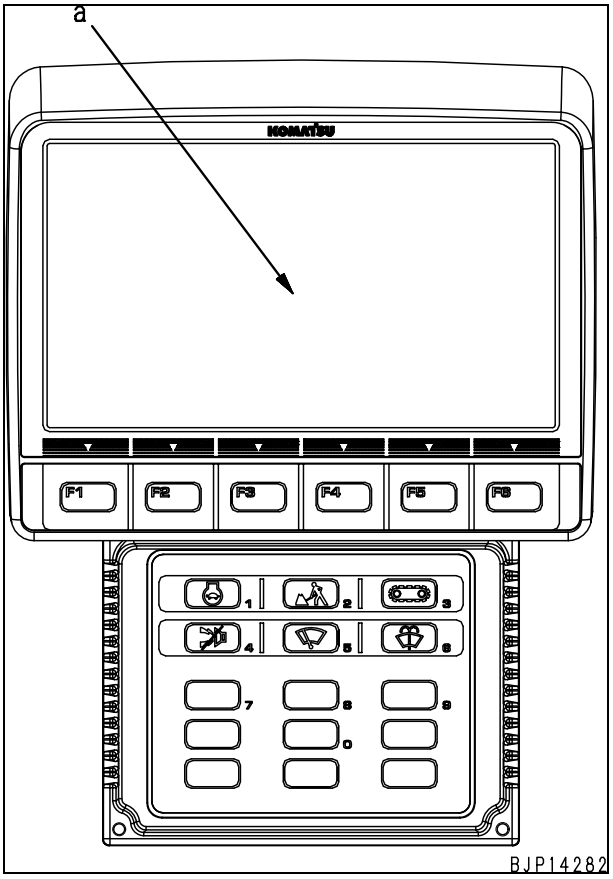
Air conditioner specification



Heater specification



Heaterless specification



Upper section of machine monitor (Display section)

(a): Multi-display

★ When the engine is started, the battery voltage may lower suddenly, depending on the ambient temperature and the condition of the battery. In this case, the machine monitor goes off for a moment. This phenomenon is not a failure, however.

Upper section of machine monitor (Switch section)

[F1]: F1 function switch
[F2]: F2 function switch
[F3]: F3 function switch
[F4]: F4 function switch
[F5]: F5 function switch
[F6]: F6 function switch

★ The function of each function switch is indicated by graphic mark in the multi-display (a) above that function switch.
★ If the graphic mark of a function switch is not displayed, that function switch is not working.

Lower section of machine monitor (Switch section)

[1]: Numeral 1 input switch/Auto-decelerator switch
[2]: Numeral 2 input switch/Working mode selector switch
[3]: Numeral 3 input switch/Travel speed shifting switch
[4]: Numeral 4 input switch/Alarm buzzer cancel switch
[5]: Numeral 5 input switch/Wiper switch
[6]: Numeral 6 input switch/Windshield washer switch
[7]: Numeral 7 input switch/Air conditioner or heater switch
[8]: Numeral 8 input switch/Air conditioner or heater switch
[9]: Numeral 9 input switch/Air conditioner or heater switch
[0]: Numeral 0 input switch/Air conditioner or heater switch

Switch having no numerals: Air conditioner or heater switch

★ Each switch has the function indicated by graphic mark and the function of inputting a numeral.
★ The machine monitor automatically judges which function of each switch is currently effective, according to the display condition of multi-display.
★ The difference between the air conditioner specification, heater specification, and heaterless specification is only the functions of the switches in this section.

■ Ordinary functions and special functions of machine monitor

The machine monitor has the ordinary function and special functions and displays information of various types on the multi-display.
Some items are displayed automatically according to the internal setting of the machine monitor and the others are displayed according to the operation of the switches.

1. Ordinary functions: Operator mode
   The items in this mode are displayed ordinarily. The operator can display and set them by operating the switches (Display and setting of some items need special operations of the switches).
2. Special functions: Service mode
   The items in this mode are not displayed ordinarily. Each serviceman can display them by operating the switches specially. This mode is used for special setting, testing, adjusting, or troubleshooting.

■ Operator mode (Outline)		Page
		6p
A	Display of KOMATSU logo	6p
A	Display of inputting password	7p
A	Display of check of breaker mode	7p
A	Display of check before starting	7p
A	Display of warning after check before starting	8p
A	Display of ending of maintenance interval	8p
A	Display of check of working mode and travel speed	8p
A	Display of ordinary screen	8p
A	Display of end screen	9p
B	Selection of auto-deceleration	9p
B	Selection of working mode	9p
B	Selection of travel speed	10p
B	Operation to stop alarm buzzer	10p
B	Operation of windshield wiper	11p
B	Operation of window washer	11p
B	Operation of air conditioner/heater	11p
B	Operation to display camera mode (if camera is installed)	12p
B	Operation to display clock and service meter	12p
B	Check of maintenance information	13p
B	Setting and display of user mode (Including KOMTRAX messages for user)	13p
C	Display of energy-saving guidance	14p
C	Display of caution monitor	14p
C	Display of automatic judgment of breaker	15p
C	Display of user code and failure code	15p
↓ (Special operation)		
D	Function of checking display of LCD (Liquid Crystal Display)	17p
D	Function of checking service meter	17p
D	Function of changing attachment/maintenance password	18p

↓ (Special operation)

Service mode		Page
		20p
Monitoring		21p
Abnormality record	Mechanical systems	26p
	Electrical systems	27p
	Air-conditioning system/Heater system	33p
Maintenance record		34p
Maintenance mode change		35p
Phone number entry		37p
Default	Working mode with key ON	38p
	Setting of unit	39p
	With/Without attachment	40p
	Setting of attachment/maintenance password	41p
	Setting of camera	42p
	Setting of ECO display	43p
	Setting of automatic judgment of breaker	44p
Adjustment	Pump absorption torque (F)	45p
	Pump absorption torque (R)	46p
	Setting of travel Lo speed	47p
	Adjustment of flow to attachment in compound operation	48p
Reduced cylinder mode operation		49p
No-injection cranking		50p
Display of fuel consumption		52p
Display of KOMTRAX	Setting condition of terminal	53p
	Condition of positioning and communication	54p
	MODEM S/N (Model TH300)	55p
	MODEM IP address (Model TH200)	56p
Display of KOMTRAX message		57p

★ Classification of operator mode
A: Display/Function from time when starting switch is turned ON to time when screen changes to ordinary screen and display after starting switch is turned OFF
B: Display/Function when switch of machine monitor is operated
C: Display/Function when certain condition is satisfied
D: Display/Function which needs special operation of switch

■ **Operator mode (Outline)**

★ Only outline of the operator mode is described in this section. For details of contents/operation of each function/display, see the Structure, function and maintenance standard, or Operation and Maintenance Manual.

★ The following are the displays or functions of the operator mode explained in this section (including some items which need special operations).

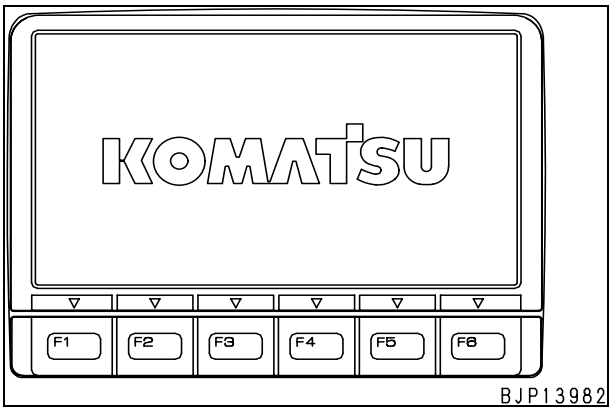
	Display pattern				
	A	B	C	D	E
Display of KOMATSU logo	1	1	1	1	1
Display of inputting password	2	—	—	—	—
Display of check of breaker mode	—	—	2	—	—
Display of check before starting	3	2	3	2	2
Display of warning after check before starting	—	—	—	3	—
Display of ending of maintenance interval	—	—	—	—	3
Display of check of working mode and travel speed	4	3	4	4	4
Display of ordinary screen	5	4	5	5	5
Display of end screen					
Selection of auto-deceleration					
Selection of working mode					
Selection of travel speed					
Operation to stop alarm buzzer					
Operation of windshield wiper					
Operation of windshield washer					
Operation of air conditioner/heater					
Operation to display camera mode (if camera is installed)					
Operation to display clock and service meter					
Check of maintenance information					
Setting and display of user mode (including KOMTRAX messages for user)					
Display of energy-saving guidance					
Display of caution monitor					
Display of automatic judgment of breaker					
Display of user code and failure code					
↓ (Special operation)					
Function of checking display of LCD (Liquid Crystal Display)					
Function of checking service meter					
Function of changing attachment/maintenance password					

★ Display pattern of operator mode
The contents of display from the time when starting switch is turned ON to time when screen changes to ordinary screen depends on the setting and condition of the machine.
A : When engine start lock is set effective
B : When engine start lock is set ineffective
C : When working mode at start is set to breaker mode (B)
D : When there is abnormal item in check-before-starting items
E : When there is maintenance item which is not maintained after specified interval

Display of KOMATSU logo

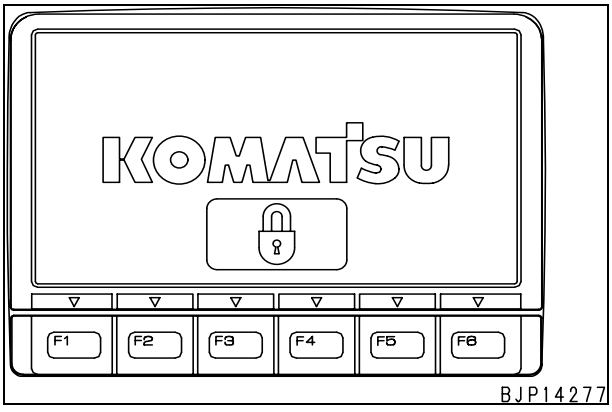
When the starting switch is turned ON, the KOMATSU logo is displayed for 2 seconds.

★ After the KOMATSU logo is displayed for 2 seconds, the screen changes to “Display of inputting password”, “Display of check of breaker mode (if B mode is set)”, or “Display of check before starting”.



★ The following screen may be displayed instead of the above Display of inputting password screen.

★ If this screen is displayed, call the person responsible to operation of KOMTRAX in your Komatsu distributor and ask for remedy.



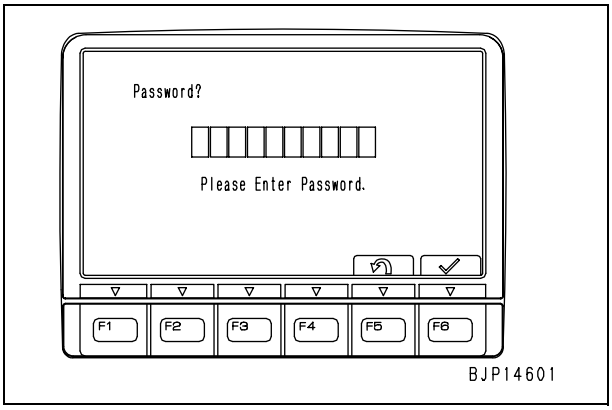
Display of inputting password

After the KOMATSU logo is displayed, the screen to input the engine start lock password is displayed.

★ This screen is displayed only when the engine start lock function is set effective.

★ If the password is input normally, the screen changes to “Display of check of breaker mode (if B mode is set)” or “Display of check before starting”.

★ The machine monitor has some password functions other than the engine start lock. Those functions are independent from one another.

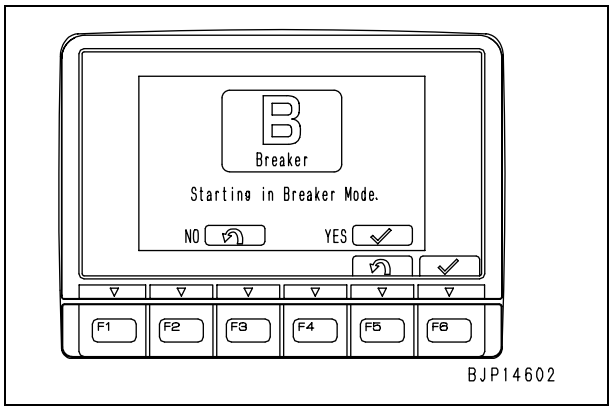


Display of check of breaker mode

When the starting switch is turned ON, if the working mode is set to the breaker mode [B], a message to inform the operator of starting in the breaker mode is displayed on the screen.

⚠ **If an attachment other than the breaker is used while the working mode is set to the breaker mode [B], the machine may move unexpectedly or may not operate normally or the hydraulic components may be damaged.**

★ After operation to check of the breaker mode is finished, the screen changes to “Display of check before starting”.
If No is selected: Working mode is set to economy mode [E]
If Yes is selected: Working mode is set to breaker mode [B]



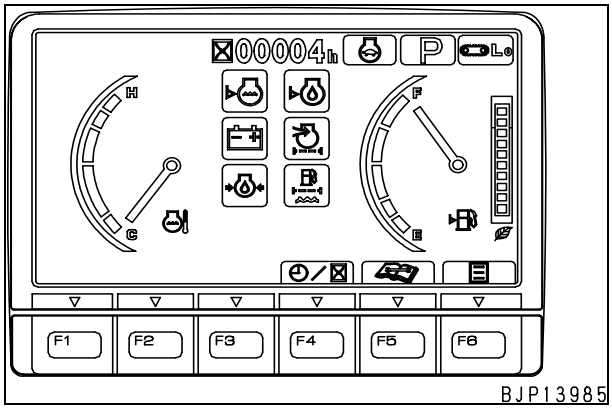
Display of check before starting

When the screen changes to the check-before-starting screen, the check before starting is carried out for 2 seconds.

★ If any abnormality is detected by the check before starting, the screen changes to “Display of warning after check before starting” or “Display of ending of maintenance interval”.

★ If no abnormality is detected by the check before starting, the screen changes to “Display of check of working mode and travel speed”.

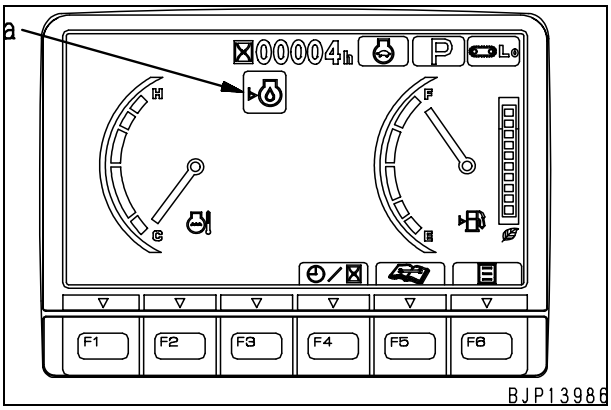
★ The monitors (6 pieces) displayed on the screen are the items under the check before starting.



Display of warning after check before starting

If any abnormality is detected by the check before starting, the warning monitor is displayed on the screen.

★ The following figure shows that the engine oil level monitor (a) is warning of low of engine oil level.



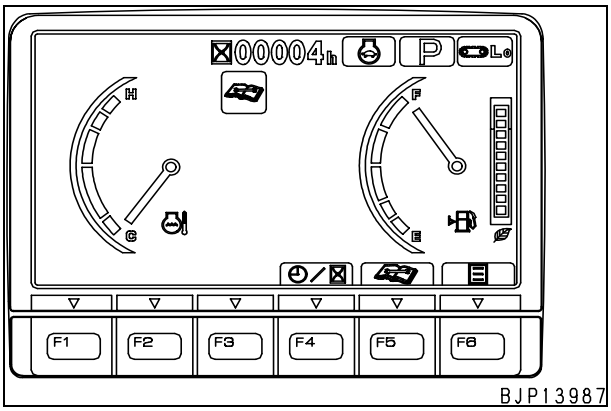
Display of ending of maintenance interval

When the check before starting is carried out, if a maintenance item is near or after the end of the set interval, the maintenance monitor is displayed for 30 seconds to urge the operator to maintenance.

★ This screen is displayed only when the maintenance function is effective. The color of the maintenance monitor (yellow or red) indicates the length of the time after the maintenance interval.

★ Set or change the maintenance function in the service mode.

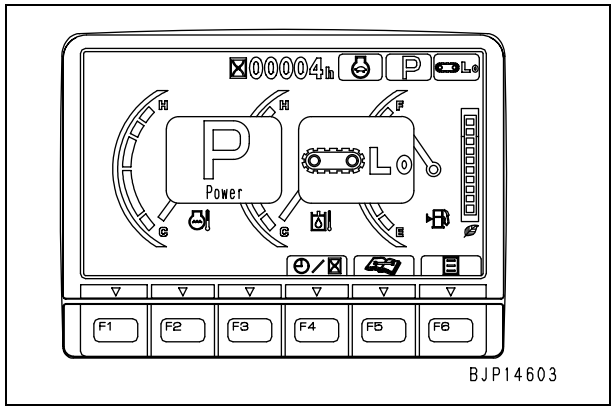
★ After display of this screen is finished, the screen changes to “Display of check of working mode and travel speed”.



Display of check of working mode and travel speed

If the check before starting is finished normally, the screen to check the working mode and travel speed is displayed for 2 seconds.

★ After display of check of the working mode and travel speed is finished, the screen changes to “Display of ordinary screen”.

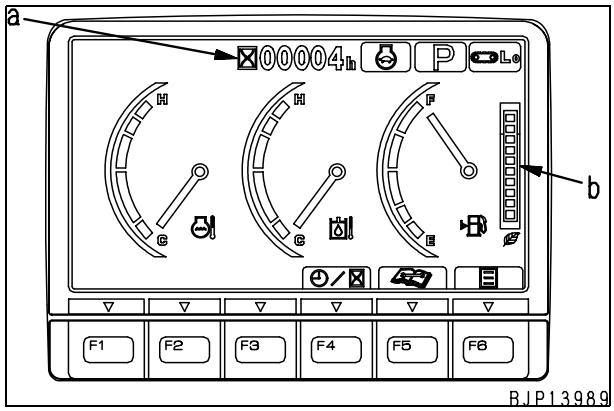


Display of ordinary screen

If the machine monitor starts normally, the ordinary screen is displayed.

★ Service meter (a) or a clock is displayed at the center upper section of the screen (The service meter or clock is selected with [F4]).

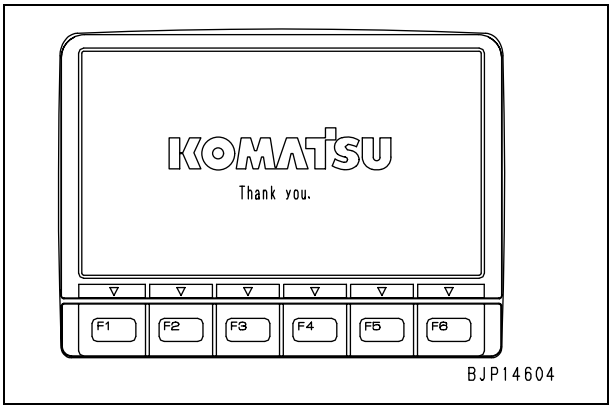
★ ECO gauge (b) is displayed at the right end of the screen (It is turned ON and OFF in the service mode).



Display of end screen

When the starting switch is turned OFF, the end screen is displayed for 5 seconds.

★ Another message may be displayed on the end screen, depending on the message display function of KOMTRAX.



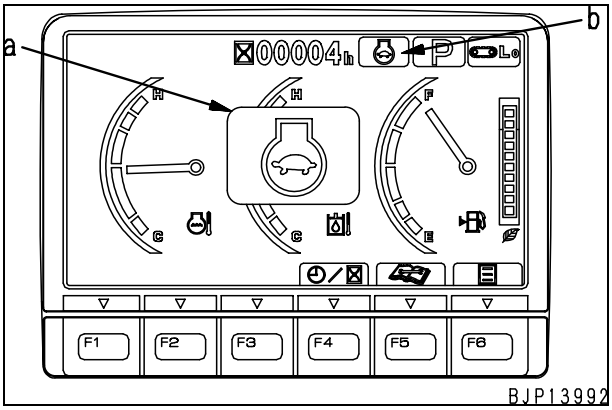
Selection of auto-deceleration

While the ordinary screen is displayed, if the auto-deceleration switch is pressed, large auto-deceleration monitor (a) is displayed for 2 seconds and the setting of the auto-deceleration is changed.

★ Each time the auto-deceleration switch is pressed, the auto-deceleration is turned ON and OFF alternately.

★ If the auto-deceleration is turned ON, large monitor (a) and auto-deceleration monitor (b) are displayed simultaneously.

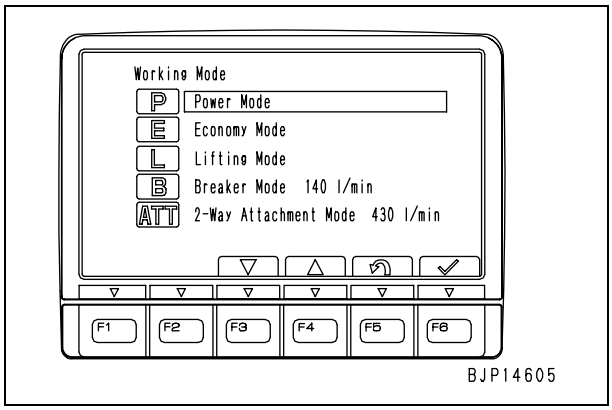
★ If the auto-deceleration is turned OFF, auto-deceleration monitor (b) goes off.



Selection of working mode

Select a working mode according to the following procedure.

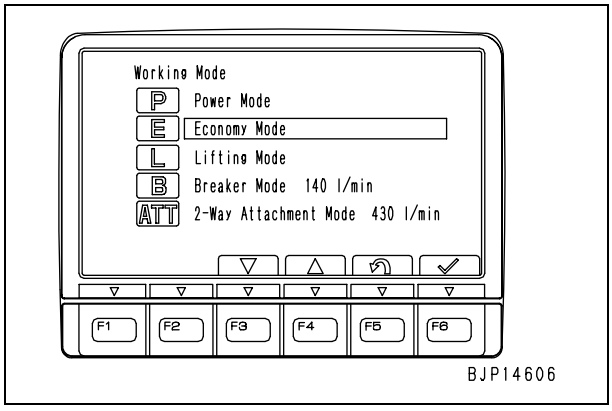
1. While the ordinary screen is displayed, press the working mode selector switch, and the working mode selection screen is displayed.
   ★ The following figure is the working mode selection screen displayed when "With attachment" is set (If "With attachment" is not set in the service mode, the attachment mode [ATT] is not displayed).



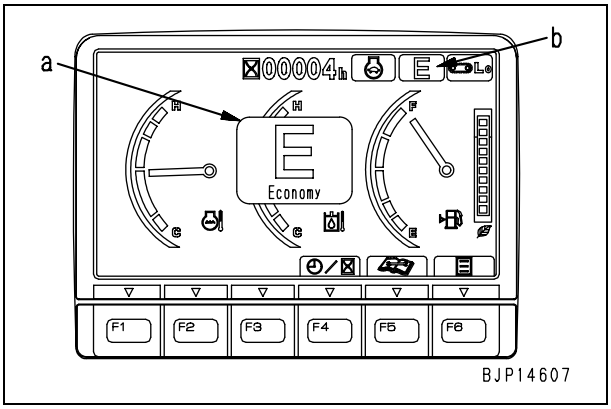
2. Operate the function switches or working mode selector switch to select and confirm the working mode which you will use.
   Function switches
   - [F3]: Move to lower working mode
   - [F4]: Move to upper working mode
   - [F5]: Cancel selection and return to ordinary screen
   - [F6]: Confirm selection and return to ordinary screen

   Working mode selector switch
   - Press: Move to lower working mode
   - Hold down: Confirm selection and return to ordinary screen

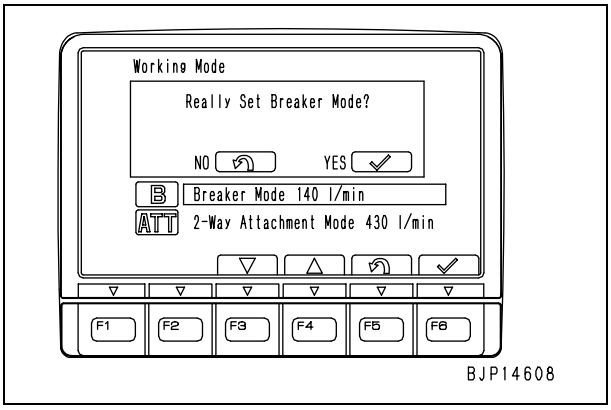
   ★ If you do not touch any of the function switches and working mode selector switch for 5 seconds, the selection is confirmed and the screen changes to the ordinary screen.



3. When the ordinary screen is displayed again, large working mode monitor (a) is displayed for 2 seconds, and then the setting of the working mode is changed.
   ★ When large monitor (a) is displayed, the display of working mode monitor (b) is changed, too.



<Precautions for selecting breaker mode [B]>
- If breaker mode [B] is selected, both of the control of the hydraulic pump and the setting of the hydraulic circuit are changed.
- If an attachment other than the breaker is used, the machine may move unexpectedly or may not operate normally or the hydraulic components may be damaged.
- After the breaker mode is selected, the screen to confirm the selection of the breaker mode is displayed (The buzzer sounds intermittently while this screen is displayed).
- If the setting is confirmed on this screen, the screen changes to the ordinary screen.
  If No is selected:
  Working mode is set to economy mode [E]
  If Yes is selected:
  Working mode is set to breaker mode [B]

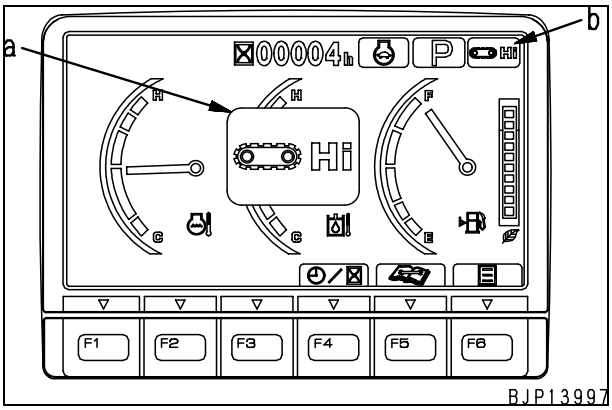


Selection of travel speed

While the ordinary screen is displayed, if the travel speed shifting switch is pressed, large travel speed monitor (a) is displayed for 2 seconds and the setting of the travel speed is changed.

★ Each time the travel speed shifting switch is pressed, the travel speed is changed to Lo, Mi, Hi, and Lo again in order.

★ When large monitor (a) is displayed, the display of travel speed monitor (b) is changed, too.



Operation to stop alarm buzzer

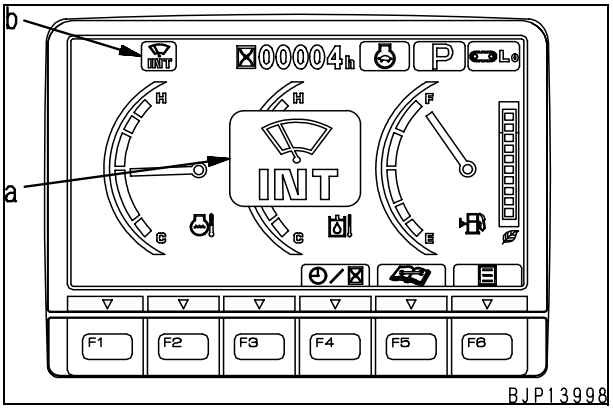
While the alarm buzzer is sounding, if the alarm buzzer cancel switch is pressed, the alarm buzzer stops.

★ Even if the alarm buzzer cancel switch is pressed, the screen does not change.

Operation of windshield wiper

While the ordinary screen is displayed, if the wiper switch is pressed, large wiper monitor (a) is displayed for 2 seconds and the windshield wiper starts or stops.

★ Each time the wiper switch is pressed, the windshield wiper setting is changed to INT, ON, OFF, and INT again in order.
★ When large monitor (a) is displayed, the display of wiper monitor (b) is changed or turned OFF, too.
★ If the windshield wiper is turned OFF, large monitor (a) is not displayed.



Operation of window washer

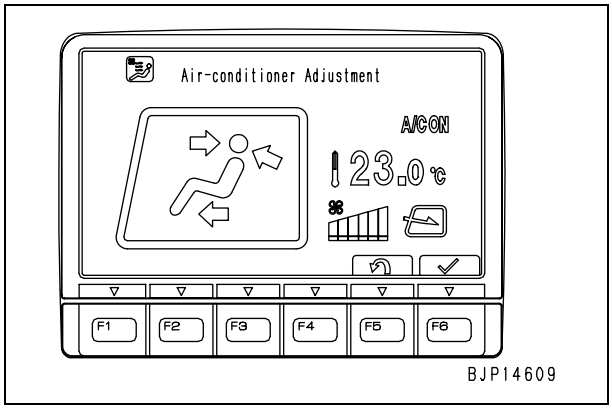
While the ordinary screen is displayed, if the window washer switch is pressed, the washing liquid is splashed only while the switch is held down.

★ Even if the window washer switch is pressed, the screen does not change.

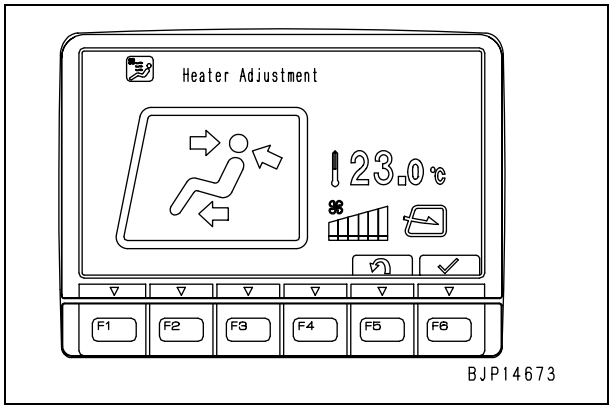
Operation of air conditioner/heater

While the ordinary screen is displayed, press the air conditioner switch or heater switch, and the air conditioner adjustment screen or heater adjustment screen is displayed.

★ While the air conditioner adjustment screen or heater adjustment screen is displayed, if you do not touch any switch for 5 seconds, the screen changes to the ordinary screen.
★ Air conditioner specification

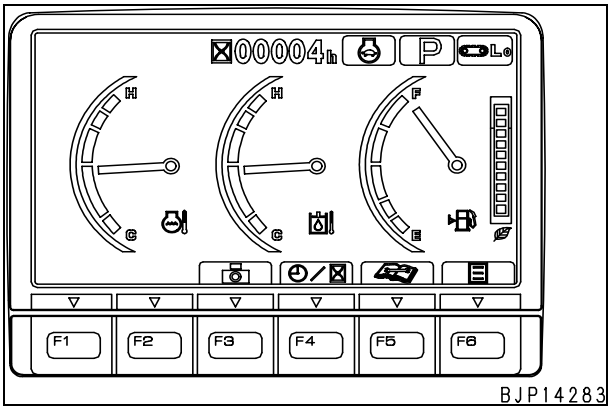


★ Heater specification

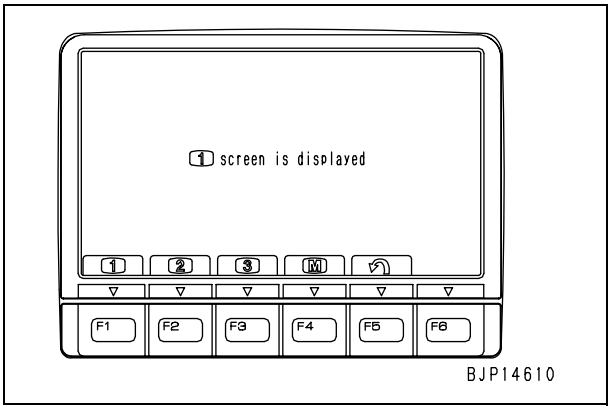


Operation to display camera mode (if camera is installed)

When a camera is installed, if [F3] is pressed, the multi-display changes to the camera image (Set the connection of the camera in the service mode).



★ Up to 3 cameras can be connected. If the camera mode is selected, however, only the image of camera 1 is always displayed.

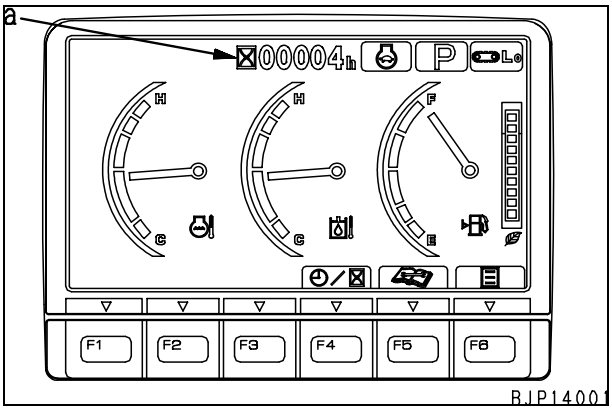


★ If a caution is generated in the camera mode, the caution monitor is displayed at the left upper of the screen (The low hydraulic oil temperature caution is not displayed there, however).
★ When an error that there is a user code occurs in the camera mode, if you do not touch any control lever for 10 seconds, the screen changes to the ordinary screen and displays the error information.
★ When two or more cameras are connected, the image of one of them or the images of two of them can be displayed.
  If 2-camera image display [F4] is selected, the image of camera 1 is displayed on the left side of the screen and the image of camera 2 is displayed on the right side. The image of camera 3 is displayed only singly.
★ If the images of 2 cameras are displayed simultaneously, images are displayed at intervals of 1 second on the right and left screen.

Operation to display clock and service meter

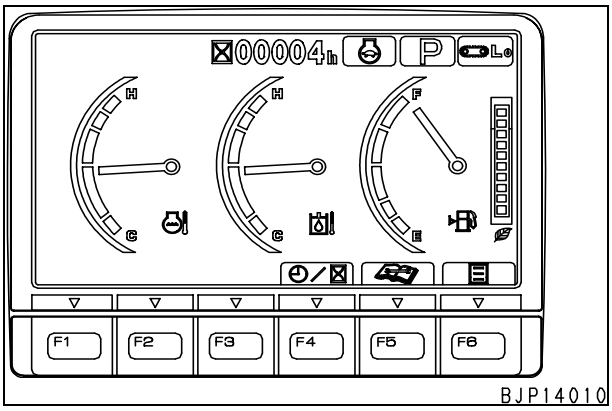
While the ordinary screen is displayed, press [F4], and section (a) changes to the service meter and clock alternately.

★ When the clock is selected, adjust the time, set 12-hour or 24-hour display, and set the summer time with the user mode function.

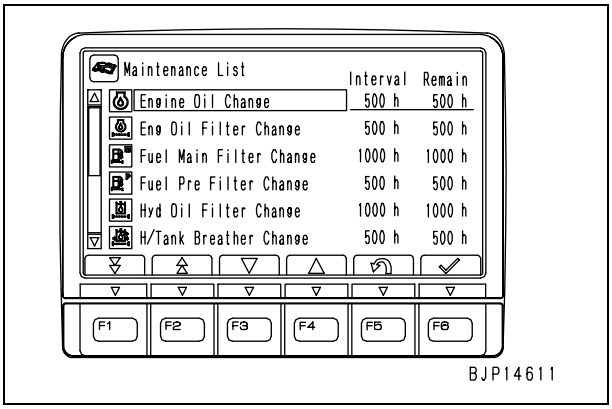


Check of maintenance information

While the maintenance monitor or ordinary screen is displayed, press [F5], and the maintenance table screen is displayed.

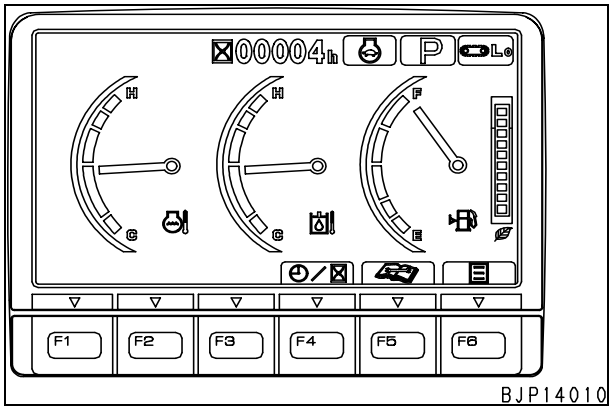


★ To reset the time left after finishing maintenance, more operations are necessary (See "Maintenance record" in the service mode).



Setting and display of user mode (Including KOMTRAX messages for user)

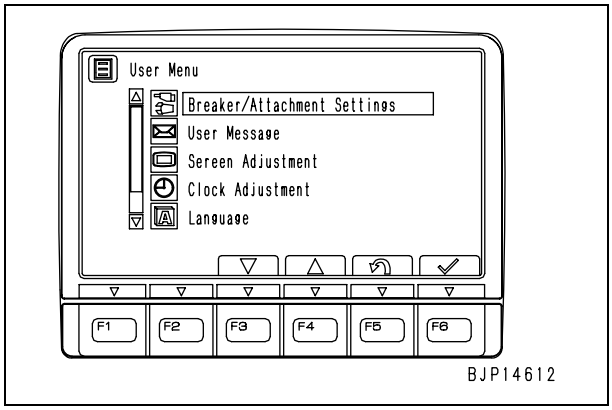
While the ordinary screen is displayed, press [F6], and the user menu screen is displayed.



★ There are following items in the user menu.

Breaker/Attachment setting
User message
Screen adjustment
Clock adjustment
Language
Economy mode adjustment

★ The breaker/attachment setting menu is displayed only when "With attachment" is set in the service mode.



[KOMTRAX message]

- There are 2 types of KOMTRAX message; 1 is for the user and the other is for the service.
- For user:
  A message transmitted from the KOMTRAX base station for the user. If it is received, the message monitor is displayed on the ordinary screen. To see the contents of the message, operate "Message display" in the above user menu.
- For service:
  A message transmitted from the KOMTRAX base station for the service. Even if it is received, nothing is displayed on the ordinary screen. To see the contents of the message, operate "KOMTRAX message" display in the service menu.

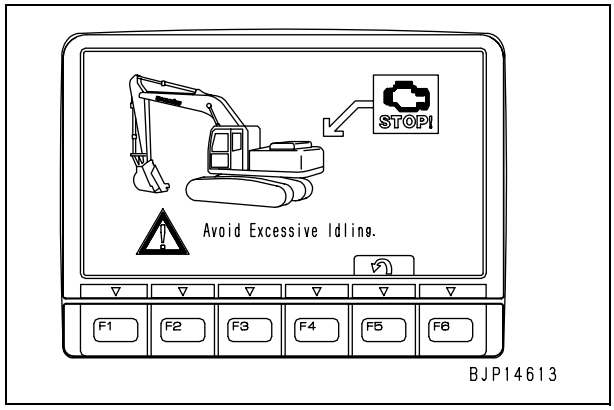
Display of energy-saving guidance

When the machine is set in a certain operating condition, the energy-saving guidance screen is displayed automatically to urge the operator to the energy-saving operation.

★ The energy-saving guidance is displayed when the following condition is satisfied while the display setting is set effective in the service mode.

★ Condition for display:
  Engine is running + All levers have been in neutral for 5 minutes + Caution (Note) or user code is not generated (Note)
  Note: Excluding hydraulic oil low temperature caution

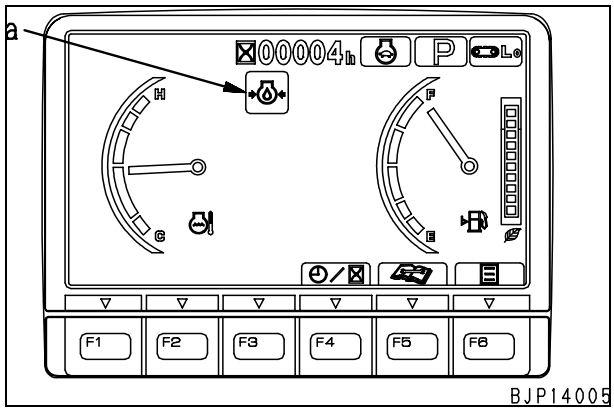
★ If any lever or pedal is operated, or [F5] is pressed, the screen returns to the ordinary screen.



Display of caution monitor

If an abnormality which displays a caution monitor occurs on the ordinary screen or camera mode screen, the caution monitor is displayed large for a moment and then displayed at (a) in the screen.

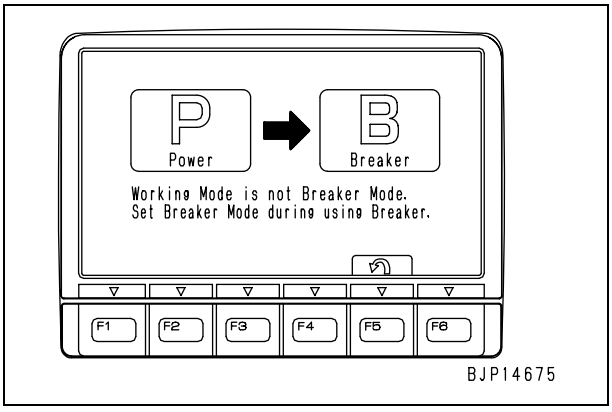
★ On the camera mode screen, the caution monitor flashes at the left upper of the screen when the caution is generated.



Display of automatic judgment of breaker

If the operator performs breaker work in an improper working mode, the breaker automatic judgment screen is displayed to urge the operator to select a proper working mode.

★ The breaker automatic judgment is displayed when the following condition is satisfied while the display setting is set effective in the service mode.
★ Condition for display:
When the pump controller measures the rear pump pressure for a certain time, the obtained value is similar to the pulsation wave form of breaker operation which is held in the controller in advance.
★ The breaker automatic judgment function is set to Not used (Not displayed) when delivered.
★ If this screen is displayed, check the setting of the working mode. If the breaker is being used, select the breaker mode [B].
★ To return to the ordinary screen, press [F5].

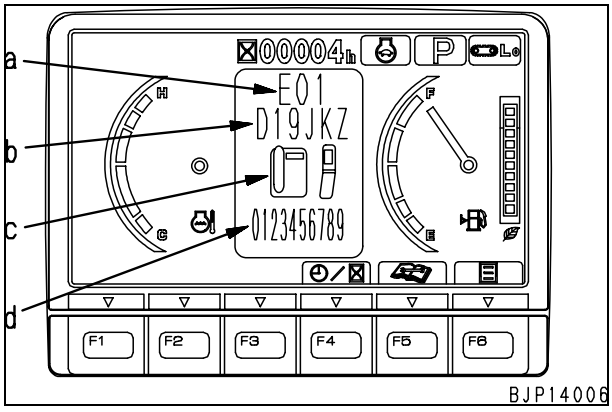


Display of user code and failure code

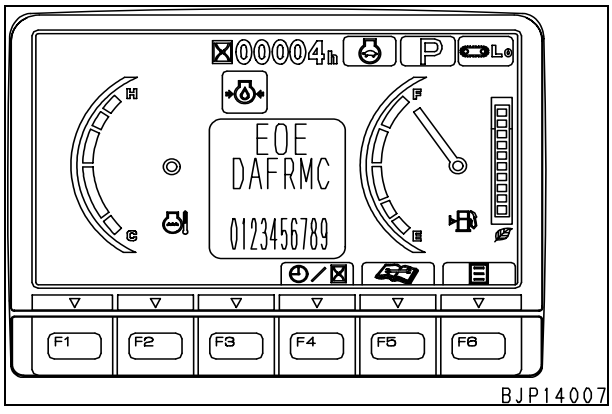
If an abnormality which displays a user code and a failure code occurs on the ordinary screen or camera mode screen, all the information of the abnormality is displayed.

(a): User code (3 digits)
(b): Failure code (5 or 6 digits)
(c): Telephone mark
(d): Telephone No.

★ This screen is displayed only when an abnormality (failure code) for which a user code is set occurs.
★ The telephone mark and telephone No. are displayed only when the telephone No. is registered in the service mode.
★ If multiple abnormalities occur simultaneously, all the codes are displayed repeatedly in order.
★ Since the information of the displayed failure code is recorded in the abnormality record in the service mode, check the details in the service mode.



★ When the caution monitor is also displayed, the telephone mark is not displayed.



★ Remedies given by displayed user codes to operator to take (The following table is an excerpt from the Operation and Maintenance Manual)

User code	Failure mode	Action
E02	Pump control system error	When emergency pump drive switch is at the up (emergency) position, normal operations become possible, but have inspection carried out immediately.
E03	Swing brake system error	Move the swing brake cancel switch up to release the brake. When applying the swing brake, operate the swing lock switch manually. Depending on the cause of the problem, it may not be possible to release it. In any case, have inspection carried out immediately.
E10	Engine controller power source error Engine controller drive system circuit error (engine stopped)	Have inspection carried out immediately.
E11	Engine controller system error Output reduced to protect engine	Operate machine to a safe posture and have inspection carried out immediately.
E14	Abnormality in throttle system	Operate machine to a safe posture and have inspection carried out immediately.
E15	Engine sensor (coolant temperature, fuel pressure, oil pressure) system error	Operations are possible, but have inspection carried out immediately.
E0E	Network error	Operate machine to a safe posture and have inspection carried out immediately.

Function of checking display of LCD (Liquid Crystal Display)

While the ordinary screen is displayed, if the following numeral input switch and function switch are operated as follows, all the LCD (Liquid Crystal Display) lights up in white.

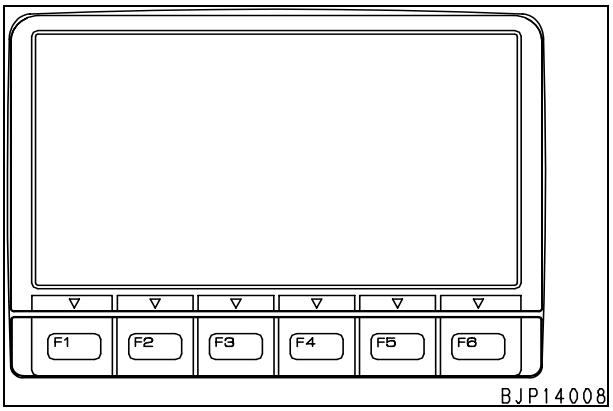
- Operation of switches (simultaneous): [4] + [F2]

★ When finishing the operation of the switches, release [F2] first.

★ If there is a display error in the LCD, only that part is indicated in black.

★ The LCD panel sometimes has black points (points which are not lighted) and bright points (points which do not go off) for the reason of its characteristics. If the number of the bright points and black points does not exceed 10, those points are not a failure or a defect.

★ To return to the former screen, press the function switch.



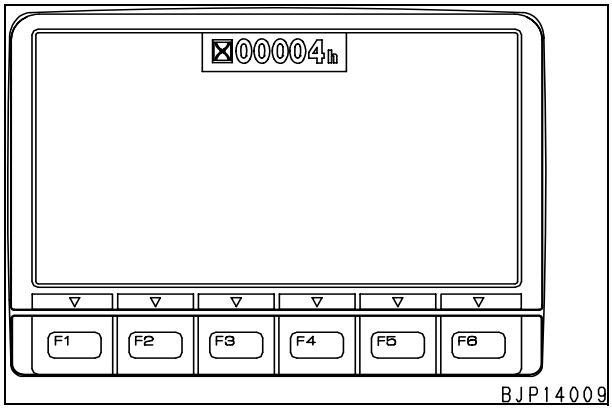
Function of checking service meter

To check the service meter while the starting switch is turned OFF, operate the numeral input switches as follows. At this time, only the service meter section displays.

- Operation of switches (simultaneous): [4] + [1]

★ Since there is some time lag in start of the LCD, hold down the switches until the LCD displays normally.

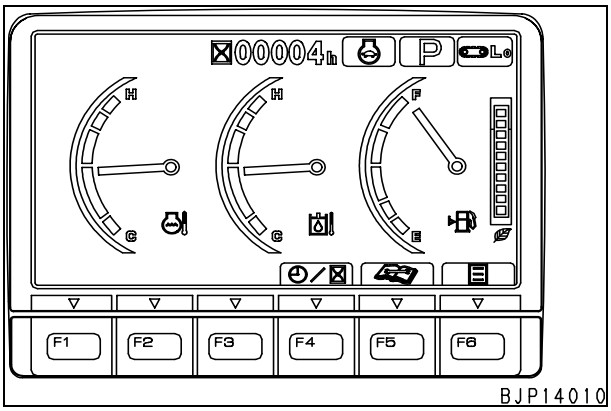
★ After the machine monitor is used continuously, blue points (points which do not go off) may be seen on this screen. This phenomenon does not indicate a failure or a defect.



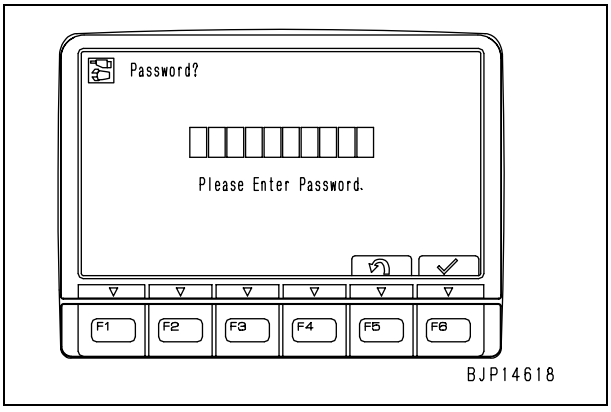
Function of changing attachment/maintenance password

When changing the attachment/maintenance password used for the attachment setting function and maintenance setting function, follow these procedures.

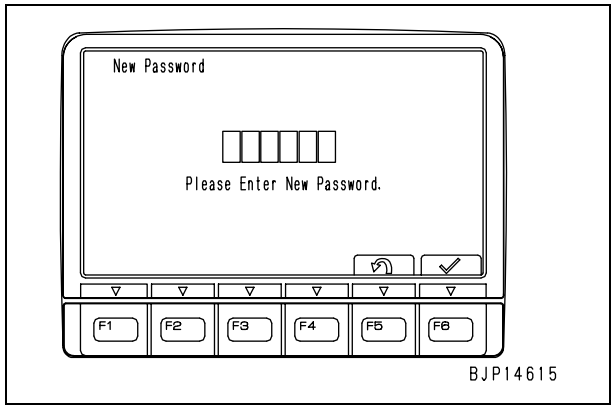
1. While the ordinary screen is displayed, perform the following operation with the numeral input switches.
   - Operation of switches (While pressing [4], perform the operation in order):
     [4] + [5] → [5] → [5]
   - ★ This operation of the switches is not accepted until 10 minutes pass after the starting switch is turned on.



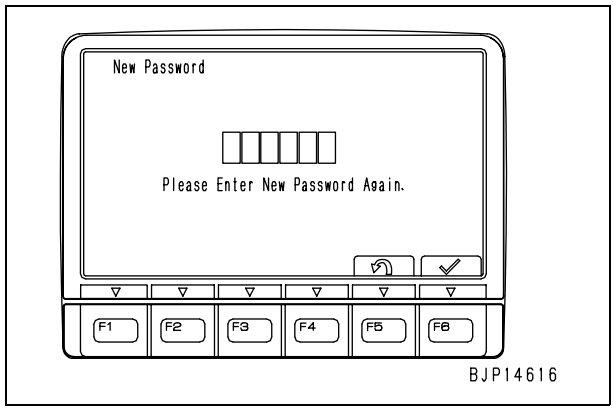
2. After the Attachment/Maintenance PASSWORD screen is displayed, input the current password with the numeral input switches and confirm it with the function switch.
   - [F5]: Reset input numeral/Return to ordinary screen
   - [F6]: Confirm input numeral
   - ★ Default password: [000000]
   - ★ If the input password is correct, the screen changes to the next screen.
   - ★ If the input password is incorrect, the message to input the password again is displayed.



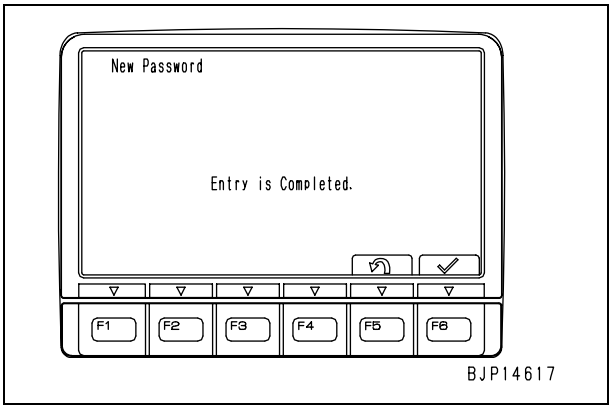
3. After the New password input screen is displayed, input a new password with the numeral input switches and confirm it with the function switch.
   - ★ Set a new password of 4 – 6 digits (If it has only 3 or less digits or has 7 or more digits, it is not accepted).
   - [F5]: Reset input numeral/Return to ordinary screen
   - [F6]: Confirm input numeral



4. After the New password input screen is displayed again, input a new password again with the numeral input switches and confirm it with the function switch.
   - [F5]: Reset input numeral/Return to ordinary screen
   - [F6]: Confirm input numeral
   - ★ If a password different from the password input before is input, the message to input again is displayed.



5. If the screen to notify completion of setting is displayed and then the ordinary screen is displayed, the password is changed successfully.

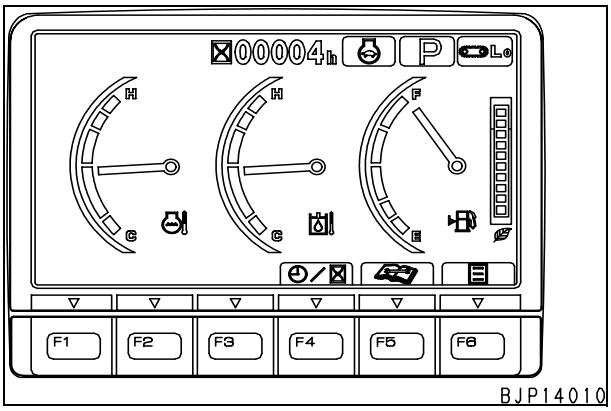


■ **Service mode**

To change the operator mode to the service mode, perform the following operation.
This operation is always required when you use the service mode.

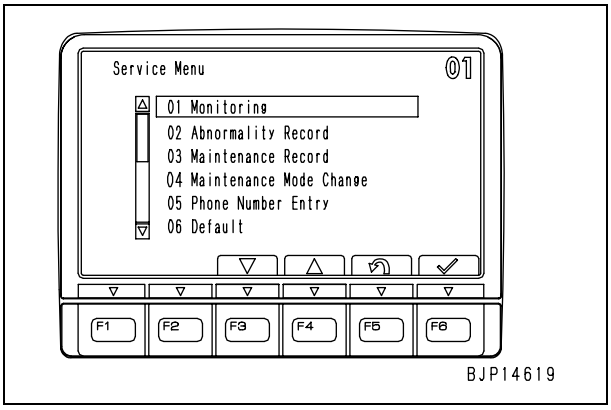
1. Check of display of screen and operation of switches
   While the ordinary screen is displayed, perform the following operation with the numeral input switches.
   - Operation of switches (While pressing [4], perform the operation in order):
     [4] + [1] → [2] → [3]

   ★ This operation of the switches is accepted only while the ordinary screen is displayed.



2. Selection of service menu
   When the Service menu screen is displayed, the service mode is selected. Select a service menu you use with the function switches or numeral input switches.
   - [F3]: Move to lower menu
   - [F4]: Move to upper menu
   - [F5]: Return to ordinary screen (operator mode)
   - [F6]: Confirm selection

   ★ You may enter a 2-digit code with the numeral input switches to select the menu of that code and confirm it with [F6].



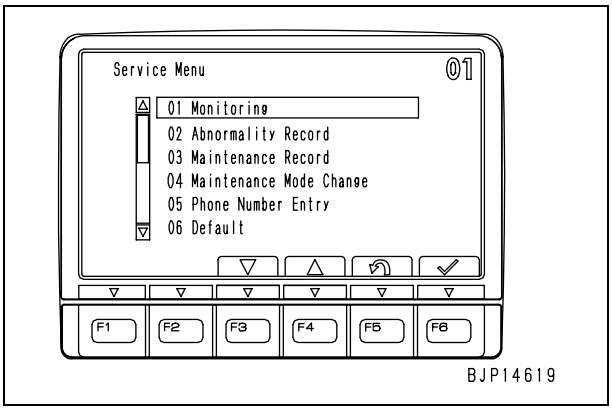
★ The items which can be selected in the service menu are as follows (including some items which need special operations).

01 Monitoring	
02 Abnormality record	Mechanical systems
	Electrical systems
	Air-conditioning system/Heater system
03 Maintenance record	
04 Maintenance mode change	
05 Phone number entry	
06 Default	Working mode with key ON
	Setting of unit
	With/Without attachment
	Setting of attachment/ maintenance password
	Setting of camera
	Setting of ECO display
	Setting of automatic judgment of breaker
07 Adjustment	Pump absorption torque (F)
	Pump absorption torque (R)
	Setting of travel Lo speed
	Adjustment of flow to attachment in compound operation
08 Reduced cylinder mode operation	
09 No-injection cranking	
10 Display of fuel consumption	
11 Display of KOMTRAX	Setting condition of terminal
	Condition of positioning and communication
	MODEM S/N (Model TH300)
	MODEM IP address (Model TH200)

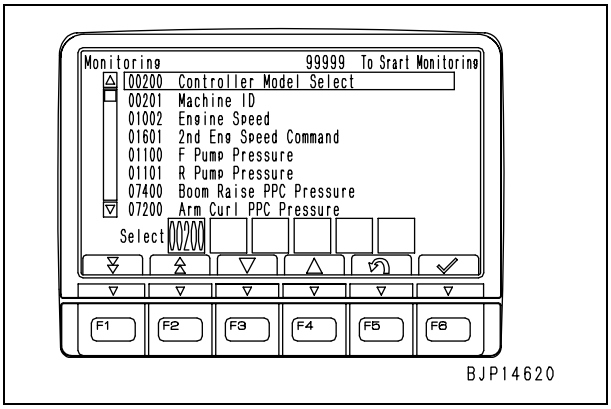
Monitoring

The machine monitor can monitor the condition of the machine in real time by receiving signals from various switches, sensors, and actuators installed to many parts of the machine and the information from the controllers which are controlling switches, etc.

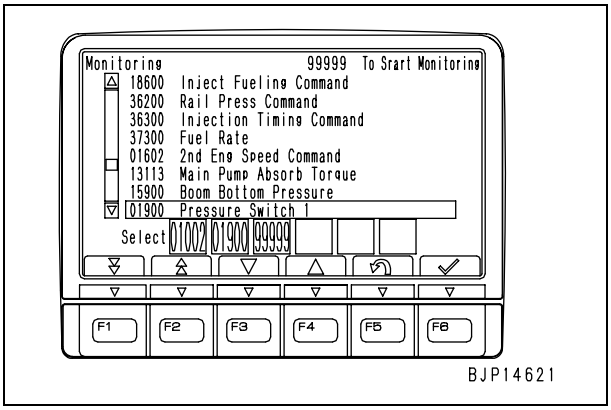
1. Selecting menu
   Select “Monitoring” on the service menu screen.



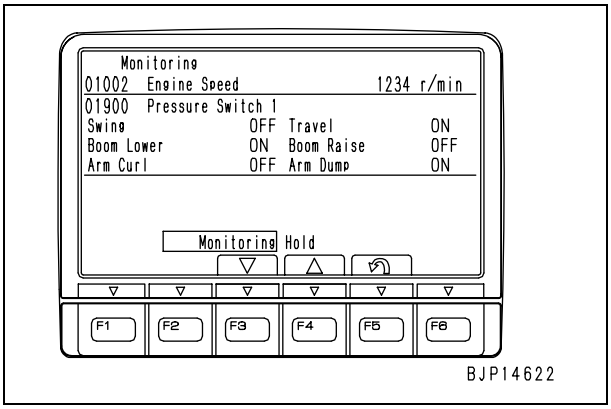
2. Selecting monitoring items
   After the “Monitoring selection menu screen” is displayed, select items to be monitored with the function switches or numeral input switches.
   - [F1]: Move to next page (screen)
   - [F2]: Move to previous page (screen)
   - [F3]: Move to lower item
   - [F4]: Move to upper item
   - [F5]: Reset input numeral/Return to service menu screen
   - [F6]: Confirm selection
   - ★ Selection with function switches: Select an item with [F3] or [F4] and confirm it with [F6].
   - ★ Selection with numeral input switches: Enter a 5-digit code, and the item of that code is selected directly. Confirm that item with [F6].
   - ★ If the color of the selected box changes from yellow to red, selection of the item of that box is confirmed.
   - ★ Up to 6 monitoring items can be selected at a time. You may not able to set up to 6 items, however, depending on the display form of those items.



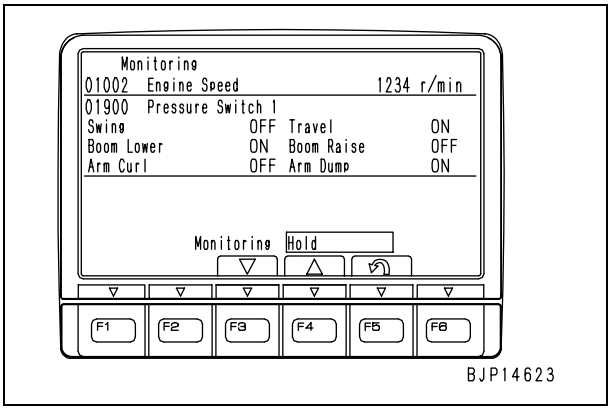
3. Deciding monitoring items
   After selecting monitoring items, execute monitoring with the function switch or numeral input switch.
   - ★ Execution with function switch: Double-click or hold down [F6] (about 2 seconds).
   - ★ Execution with numeral input switch: Input [99999] and press [F6].
   - ★ When monitoring only 2 items, for example, select them and confirm with [F6]. If [F6] is pressed once more at this time, monitoring is executed.
   - ★ If monitoring items are selected up to the limit number, monitoring is executed automatically.



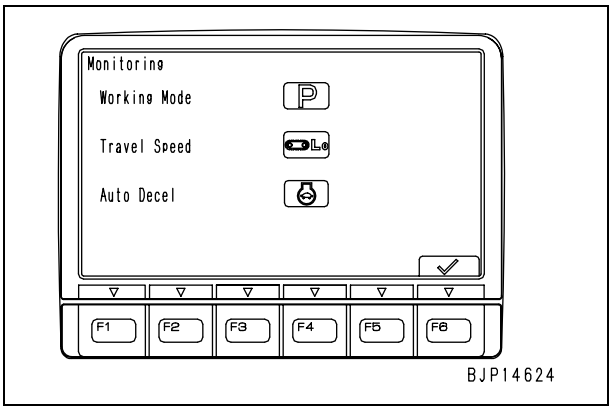
4. Executing monitoring
   After the “Executing monitoring screen” is displayed, perform the necessary operation of the machine and check the monitoring information.
   ★ Monitoring information is indicated by value, ON/OFF, or special display.
   ★ The unit of display can be set to SI unit, metric unit, or inch unit with the Initialization function in the service mode.



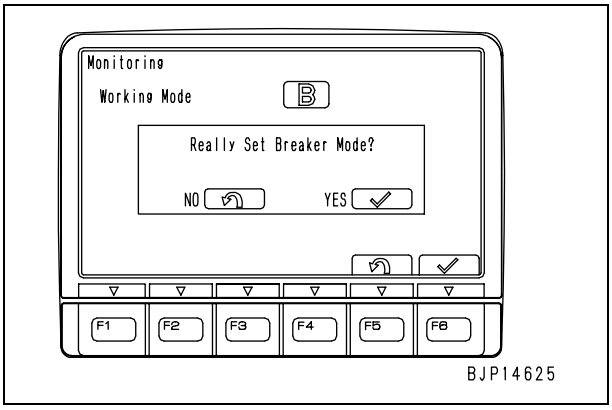
5. Holding monitoring information
   The monitoring information can be held and reset with the function switches.
   - [F3]: Reset holding
   - [F4]: Hold information (displayed data)
   - [F5]: Return to monitoring selection menu screen



6. Changing machine setting mode
   To change the setting of the working mode, travel speed, or auto-deceleration during monitoring, operate the corresponding switch under the current condition, and the mode setting screen is displayed.
   While this screen is displayed, if the corresponding switch is operated further, the corresponding mode is changed.
   ★ After finishing changing the setting, press [F6] to return to the monitoring information screen.
   ★ If the setting is changed during monitoring, the new setting is held even after the screen returns to the ordinary screen after monitoring is finished.



   ★ If the working mode is changed to breaker mode [B], the screen to confirm the change of the setting is displayed as in changing the working mode on the ordinary screen.



Monitoring items table

Code No.	Monitoring item (Display on screen)	Unit (Initial setting: ISO)			Component in charge	Remarks
		ISO	meter	inch		
00200	Controller Model Select	—			PUMP	
00201	Machine ID	—			ENG	
01002	Engine speed	r/min	rpm	rpm	ENG	
01601	2nd Eng. Speed Command	r/min	rpm	rpm	PUMP	
01100	F Pump Pressure	MPa	kg/cm^2	psi	PUMP	
01101	R Pump Pressure	MPa	kg/cm^2	psi	PUMP	
07400	Boom Raise PPC Pressure	MPa	kg/cm^2	psi	PUMP	
07200	Arm Curl PPC Pressure	MPa	kg/cm^2	psi	PUMP	
07300	Bucket Curl PPC Pressure	MPa	kg/cm^2	psi	PUMP	
07301	Bucket Dump PPC Pressure	MPa	kg/cm^2	psi	PUMP	
09001	Swing left PPC Pressure	MPa	kg/cm^2	psi	PUMP	
09002	Swing right PPC Pressure	MPa	kg/cm^2	psi	PUMP	
04107	Coolant Temperature	°C	°C	°F	ENG	
04401	Hydr. Oil Temperature	°C	°C	°F	PUMP	
01300	PC-EPC Sol. Curr.(F)	mA	mA	mA	PUMP	
01302	PC-EPC Sol. Curr.(R)	mA	mA	mA	PUMP	
01500	LS-EPC Sol. Curr.	mA	mA	mA	PUMP	
08000	Merge-divider Sol. Curr.(Main)	mA	mA	mA	PUMP	
08001	Merge-divider Sol. Curr.(LS)	mA	mA	mA	PUMP	
01700	Service Sol. Curr.	mA	mA	mA	PUMP	
03200	Battery Voltage	V	V	V	PUMP	
03203	Battery Power Supply	V	V	V	ENG	
04300	Battery Charge Vol.	V	V	V	MON	
36400	Rail Pressure	MPa	kg/cm^2	psi	ENG	
37400	Ambient Pressure	kPa	kg/cm^2	psi	ENG	
18500	Charge Temperature	°C	°C	°F	ENG	
36500	Boost Pressure	kPa	kg/cm^2	psi	ENG	Absolute value indication (including atmospheric pressure)
36700	Engine Torque Ratio	%	%	%	ENG	
18700	Engine Output Torque	Nm	kgm	lbft	ENG	
03000	Fuel Dial Pos Sens Volt	V	V	V	ENG	
04200	Fuel Level Sensor Vol.	V	V	V	MON	
04105	Eng. Water Temp. Vol. Lo	V	V	V	ENG	
04402	Hydr. Temp. Sonser Vol.	V	V	V	PUMP	
37401	Ambient Press Sens Volt	V	V	V	ENG	
18501	Charge Temp Sens Volt	V	V	V	ENG	
36501	Charge Press Sens Volt	V	V	V	ENG	
36401	Rail Pressure Sens Volt	V	V	V	ENG	
17500	Engine Power Mode	—			ENG	
31701	Throttle Position	%	%	%	ENG	
31706	Final Throttle Position	%	%	%	ENG	
18600	Inject Fueling Command	mg/st	mg/st	mg/st	ENG	
36200	Rail Press Command	MPa	kg/cm^2	psi	ENG	
36300	Injection Timing Command	CA	CA	CA	ENG	
37300	Fuel Rate	ℓ/h	ℓ/h	gal/h	ENG	
01602	2nd Eng. Speed Command	%	%	%	PUMP	
13113	Main Pump Absorb Torque	Nm	kgm	lbft	PUMP	
15900	Boom Bottom Pressure	MPa	kg/cm^2	psi	PUMP	

Code No.	Monitoring item (Display on screen)		Unit (Initial setting: ISO)			Component in charge	Remarks
			ISO	meter	inch		
01900	Pressure Switch 1	Swing	ON•OFF			PUMP	
		Travel	ON•OFF			PUMP	
		Boom Lower	ON•OFF			PUMP	
		Boom Raise	ON•OFF			PUMP	
		Arm Curl	ON•OFF			PUMP	
		Arm Dump	ON•OFF			PUMP	
01901	Pressure Switch 2	Bucket Curl	ON•OFF			PUMP	
		Bucket Dump	ON•OFF			PUMP	
		Service	ON•OFF			PUMP	
		Travel Steering	ON•OFF			PUMP	
02300	Solenoid Valve 1	Travel Junction	ON•OFF			PUMP	
		Swing Brake	ON•OFF			PUMP	
		Merge-divider	ON•OFF			PUMP	
		2-Stage Relief	ON•OFF			PUMP	
		Travel Speed	ON•OFF			PUMP	
02301	Solenoid Valve 2	Service Return	ON•OFF			PUMP	
02200	Switch Input 1	Lever Sw.	ON•OFF			PUMP	
		Swing Release Sw.	ON•OFF			PUMP	
		Swing Brake Sw.	ON•OFF			PUMP	
02201	Switch Input 2	Model Select 1	ON•OFF			PUMP	
		Model Select 2	ON•OFF			PUMP	
		Model Select 3	ON•OFF			PUMP	
		Model Select 4	ON•OFF			PUMP	
		Model Select 5	ON•OFF			PUMP	
		Overload Alarm	ON•OFF			PUMP	
02202	Switch Input 3	Key Switch (ACC)	ON•OFF			PUMP	
02204	Switch Input 5	Window Limit SW.	ON•OFF			PUMP	
		P Limit SW.	ON•OFF			PUMP	
		W Limit SW.	ON•OFF			PUMP	
04500	Monitor input 1	Key Switch	ON•OFF			MON	
		Start	ON•OFF			MON	
		Preheat	ON•OFF			MON	
		Light	ON•OFF			MON	
		Rad. Level	ON•OFF			MON	
04501	Monitor Input 2	Air cleaner	ON•OFF			MON	
		Eng. Oil Level	ON•OFF			MON	
		Battery Charge	ON•OFF			MON	
04502	Monitor Input 3	Swing Brake Sw.	ON•OFF			MON	
04503	Monitor Function Switchs	F1	ON•OFF			MON	
		F2	ON•OFF			MON	
		F3	ON•OFF			MON	
		F4	ON•OFF			MON	
		F5	ON•OFF			MON	
		F6	ON•OFF			MON	
04504	Monitor 1st & 2nd Row Switches	SW1	ON•OFF			MON	
		SW2	ON•OFF			MON	
		SW3	ON•OFF			MON	
		SW4	ON•OFF			MON	
		SW5	ON•OFF			MON	
		SW6	ON•OFF			MON	

Code No.	Monitoring item (Display on screen)		Unit (Initial setting: ISO)			Component in charge	Remarks
			ISO	meter	inch		
04505	Monitor 3rd & 4th Row Switches	SW7	ON•OFF			MON	
		SW8	ON•OFF			MON	
		SW9	ON•OFF			MON	
		SW10	ON•OFF			MON	
		SW11	ON•OFF			MON	
		SW12	ON•OFF			MON	
04506	Monitor 5th Row Switches	SW13	ON•OFF			MON	
		SW14	ON•OFF			MON	
		SW15	ON•OFF			MON	
18800	Water In Fuel		ON•OFF			ENG	WIF: Water In Fuel
20216	ECM Build Version		—			ENG	
20217	ECM CAL Data Ver		—			ENG	
18900	ECM Internal Temp		°C	°C	°F	ENG	
20400	ECM Serial No		—			ENG	
20227	Monitor Ass'y P/N		—			MON	
20402	Monitor Serial No		—			MON	
20228	Monitor Prog. P/N		—			MON	
20229	Pump Con. Ass'y P/N		—			PUMP	
20403	Pump Con. Serial No		—			PUMP	
20230	Pump Con. Prog. P/N		—			PUMP	

★ Entry order of items in table
The items are entered in the order of display on the monitoring selection menu screen.

★ Unit
The display unit can be set to ISO, meter, or inch freely (Set it with Unit setting in Initialization of the service menu).
"CA" in the display unit is an abbreviation for crankshaft angle.
"mg/st" in the display unit is an abbreviation for milligram/stroke.

★ Component in charge
MON: The machine monitor is in charge of detection of monitoring information.
ENG: The engine controller is in charge of detection of monitoring information.
PUMP: The pump controller is in charge of detection of monitoring information.

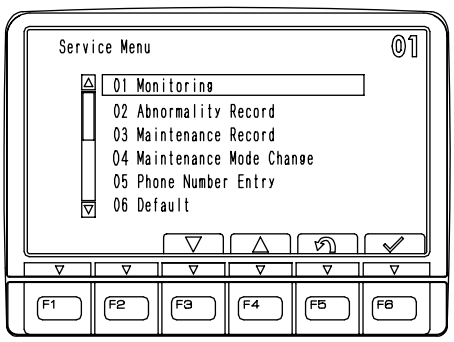
Abnormality record

(Mechanical system abnormality record)

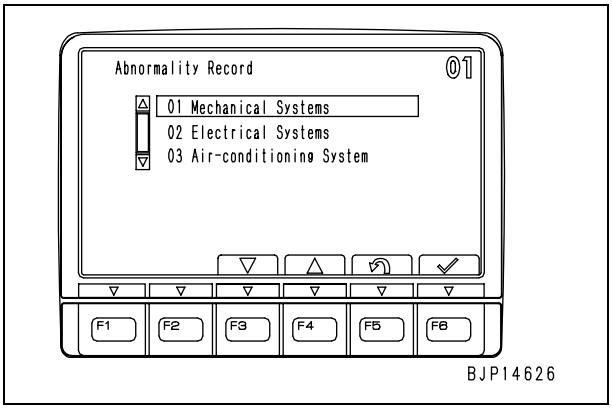
The machine monitor classifies and records the abnormalities which occurred in the past or which are occurring at present into the mechanical systems, electrical systems, and air-conditioning system or heater system.

To check the mechanical system abnormality record, perform the following procedures.

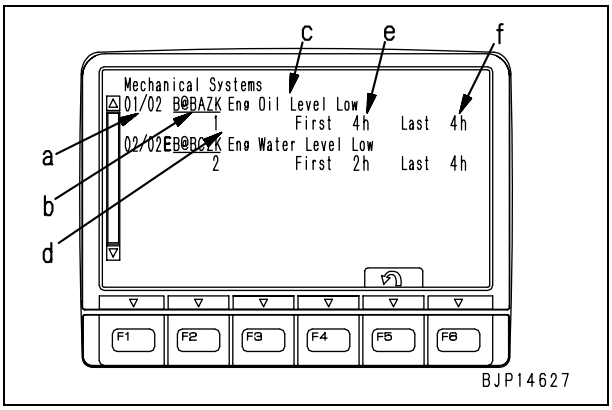
1. Selecting menu
   Select “Abnormality record” on the “service menu” screen.



2. Selecting sub menu
   After the “Abnormality record” screen is displayed, select “Mechanical systems with the function switches or numeral input switches.
   - [F3]: Move to lower item
   - [F4]: Move to upper item
   - [F5]: Return to service menu screen
   - [F6]: Confirm selection
   - ★ You may enter a 2-digit code with the numeral input switches to select the record of that code and confirm it with [F6].
   - ★ The following figure shows the display of the air conditioner specification. The heater specification and heaterless specification are different from each other in the display of "03 Air-conditioning system", which may not be displayed in the heaterless specification.



3. Information displayed on “abnormality record” screen
   On the “Mechanical systems” screen, the following information is displayed.
   (a) : Occurrence order of abnormalities from latest one/Total number of records
   (b) : Failure code
   (c) : Contents of trouble
   (d) : Number of occurrence time
   (e) : Service meter reading at first occurrence
   (f) : Service meter reach at last occurrence
   - [F1]: Move to next page (screen) (if displayed)
   - [F2]: Move to previous page (screen) (if displayed)
   - [F5]: Return to abnormality record screen
   - ★ If no abnormality record is recorded, "No abnormality record" is displayed.
   - ★ If the number of occurrence time is 1 (first occurrence), the service meter reading at the first occurrence and that at the last occurrence are the same.
   - ★ If [**E**] is displayed on the left of a failure code, the abnormality is still occurring or resetting of it has not been confirmed.
   - ★ For all the failure codes that the machine monitor can record, see the failure codes table in Abnormality record (Electrical systems).

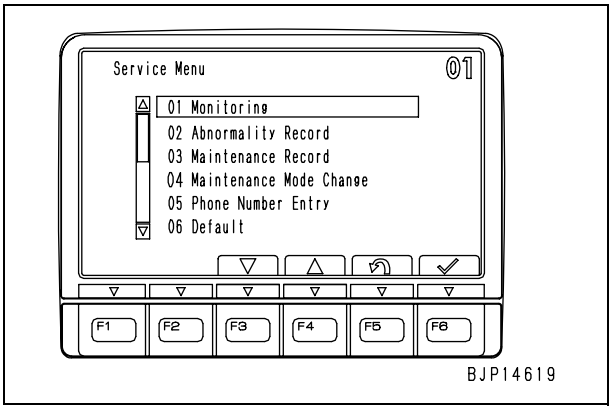


4. Resetting abnormality record
   The contents of the mechanical system abnormality record cannot be reset.

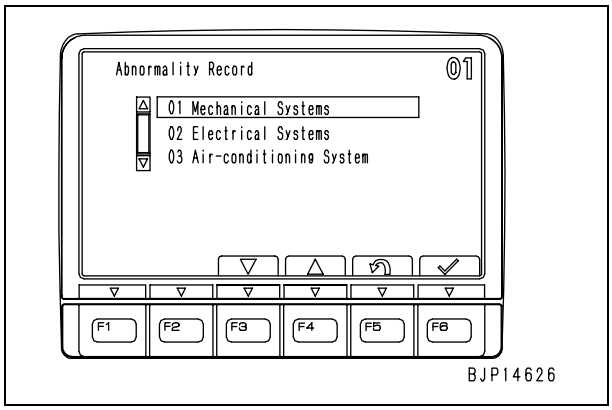
Abnormality record (Electrical systems)

The machine monitor classifies and records the abnormalities which occurred in the past or which are occurring at present into the mechanical systems, electrical systems, and air-conditioning system.
To check the electrical system abnormality record, perform the following procedures.

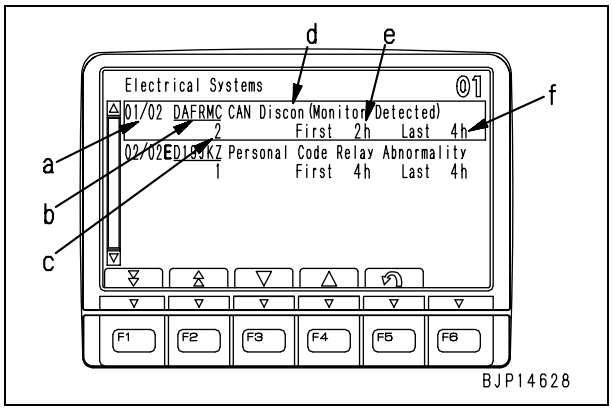
1. Selecting menu
   Select “Abnormality record” on the service menu screen.



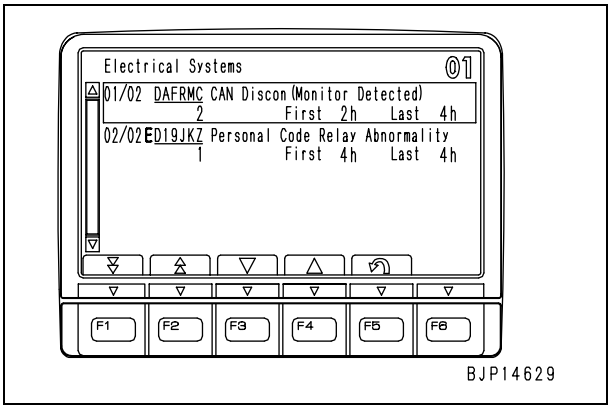
2. Selecting sub menu
   After the “Abnormality record” screen is displayed, select “Electrical systems” with the function switches or numeral input switches.
   - [F3]: Move to lower item
   - [F4]: Move to upper item
   - [F5]: Return to service menu screen
   - [F6]: Confirm selection
   - ★ You may enter a 2-digit code with the numeral input switches to select the record of that code and confirm it with [F6].
   - ★ The following figure shows the display of the air conditioner specification. The heater specification and heaterless specification are different from each other in the display of "03 Air-conditioning system", which may not be displayed in the heaterless specification.



3. Information displayed on “abnormality record” screen
   On the “Electrical systems” screen, the following information is displayed.
   (a) : Occurrence order of abnormalities from latest one/Total number of records
   (b) : Failure code
   (c) : Contents of trouble
   (d) : Number of occurrence time
   (e) : Service meter reading at first occurrence
   (f) : Service meter reach at last occurrence
   - [F1]: Move to next page (screen) (if displayed)
   - [F2]: Move to previous page (screen) (if displayed)
   - [F3]: Move to lower item
   - [F4]: Move to upper item
   - [F5]: Return to “abnormality record” screen
   - ★ If no abnormality record is recorded, "No abnormality record" is displayed.
   - ★ If the number of occurrence time is 1 (first occurrence), the service meter reading at the first occurrence and that at the last occurrence are the same.
   - ★ If [**E**] is displayed on the left of a failure code, the abnormality is still occurring or resetting of it has not been confirmed.
   - ★ For all the failure codes that the machine monitor can record, see the failure codes table.

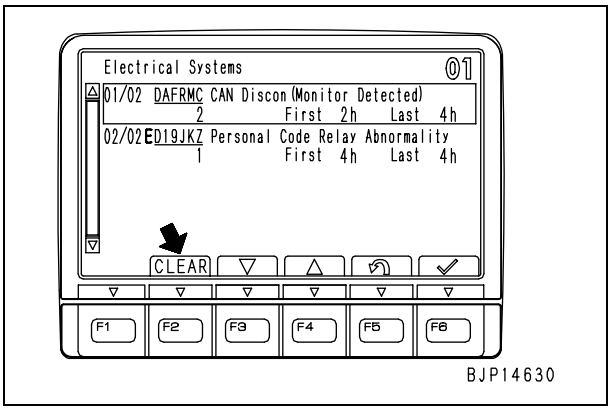


4. Resetting abnormality record
   1) While the “Electrical systems” screen is displayed, perform the following operation with the numeral input switches.
      - Operation of switches (While pressing [4], perform the operation in order):
        [4] + [1] → [2] → [3]



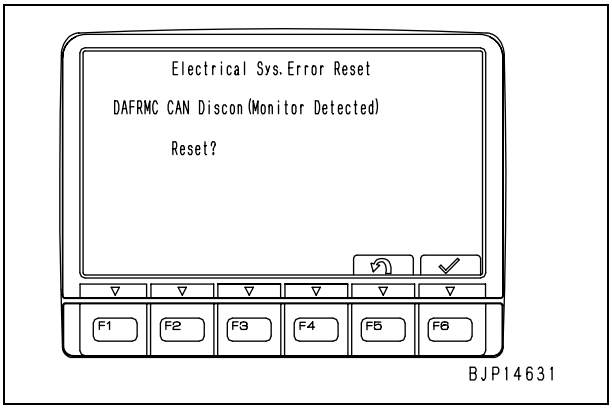
   2) Check that the screen is set in the reset mode, and then reset the items one by one or together with the function switches.
      ★ If the screen is set in the reset mode, [CLEAR] graphic mark is indicated at [F2].
      - [F2]: Reset all items
      - [F3]: Move to lower item
      - [F4]: Move to upper item
      - [F5]: Return to abnormality record screen
      - [F6]: Reset selected item

      ★ To reset items one by one: Select the item to be reset with [F3] or [F4] and press [F6].
      ★ To reset all items together: Press [F2], and all the items are reset, regardless of selection of the items.
      ★ If [**E**] is displayed on the left of a failure code, the resetting operation is accepted but the information is not reset.

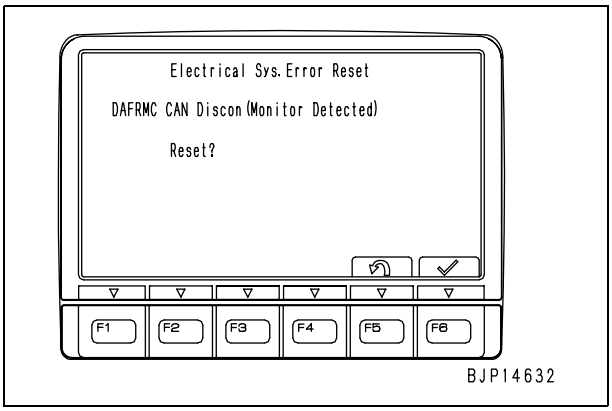


   3) After the “Electrical sys. error reset” screen is displayed, operate the function switches.
      - [F5]: Return to “Electrical systems” screen (Reset mode)
      - [F6]: Execute reset

      ★ The following figure shows the screen displayed when the items are reset one by one (which is a little different from the screen displayed when all the items are reset together).



   4) If the screen to notify completion of reset is displayed and then the “Electrical systems” (reset mode) screen is displayed, the reset of the abnormality record is completed.
      ★ After a while, the screen returns to the “Electrical systems” screen.



Failure codes table

User code	Failure code	Trouble (Displayed on screen)	Alarm buzzer	Component in charge	Category of record
	989L00	Engine Controller Lock Caution 1		MON	Electrical system
	989M00	Engine Controller Lock Caution 2		MON	Electrical system
	989N00	Engine Controller Lock Caution 3		MON	Electrical system
	AA10NX	Air Cleaner Clogging		MON	Mechanical system
	AB00KE	Charge Voltage Low		MON	Mechanical system
	B@BAZG	Eng Oil Press. Low	▲	ENG	Mechanical system
	B@BAZK	Eng Oil Level Low		MON	Mechanical system
	B@BCNS	Eng Water Overheat	▲	ENG	Mechanical system
	B@BCZK	Eng Water Level Low	▲	MON	Mechanical system
	B@HANS	Hydr Oil Overheat	▲	PUMP	Mechanical system
E10	**CA111**	EMC Critical Internal Failure	●	ENG	Electrical system
E10	**CA115**	Eng Ne and Bkup Speed Sens Error	●	ENG	Electrical system
E11	**CA122**	Chg Air Press Sensor High Error	●	ENG	Electrical system
E11	**CA123**	Chg Air Press Sensor Low Error	●	ENG	Electrical system
E14	**CA131**	Throttle Sensor High Error	●	ENG	Electrical system
E14	**CA132**	Throttle Sensor Low Error	●	ENG	Electrical system
E15	**CA144**	Coolant Temp Sens High Error	●	ENG	Electrical system
E15	**CA145**	Coolant Temp Sens Low Error	●	ENG	Electrical system
E15	**CA153**	Chg Air Temp Sensor High Error	●	ENG	Electrical system
E15	**CA154**	Chg Air Temp Sensor Low Error	●	ENG	Electrical system
E11	**CA155**	Chg Air Temp High Speed Derate	●	ENG	Electrical system
E15	**CA187**	Sens Supply 2 Volt Low Error	●	ENG	Electrical system
E11	**CA221**	Ambient Press Sens High Error	●	ENG	Electrical system
E11	**CA222**	Ambient Press Sens Low Error	●	ENG	Electrical system
E15	**CA227**	Sens Supply 2 Volt High Error	●	ENG	Electrical system
	CA234	Eng Overspeed		ENG	Mechanical system
E15	**CA238**	Ne Speed Sens Supply Volt Error	●	ENG	Electrical system
E10	**CA271**	IMV/PCV1 Short Error	●	ENG	Electrical system
E10	**CA272**	IMV/PCV1 Open Error	●	ENG	Electrical system
E11	**CA322**	Inj #1 (L#1) Open/Short Error	●	ENG	Electrical system

User code	Failure code	Trouble (Displayed on screen)	Alarm buzzer	Component in charge	Category of record
E11	**CA323**	Inj #5 (L#5) Open/Short Error	●	ENG	Electrical system
E11	**CA324**	Inj #3 (L#3) Open/Short Error	●	ENG	Electrical system
E11	**CA325**	Inj #6 (L#6) Open/Short Error	●	ENG	Electrical system
E11	**CA331**	Inj #2 (L#2) Open/Short Error	●	ENG	Electrical system
E11	**CA332**	Inj #4 (L#4) Open/Short Error	●	ENG	Electrical system
E10	**CA342**	Calibration Code Incompatibility	●	ENG	Electrical system
E10	**CA351**	Injectors Drive Circuit Error	●	ENG	Electrical system
E15	**CA352**	Sens Supply 1 Volt Low Error	●	ENG	Electrical system
E15	**CA386**	Sens Supply 1 Volt High Error	●	ENG	Electrical system
E15	**CA428**	Water in Fuel Sensor High Error	●	ENG	Electrical system
E15	**CA429**	Water in Fuel Sensor Low Error	●	ENG	Electrical system
E15	**CA435**	Eng Oil Press Sw Error	●	ENG	Electrical system
E10	**CA441**	Battery Voltage Low Error	●	ENG	Electrical system
E10	**CA442**	Battery Voltage High Error	●	ENG	Electrical system
E11	**CA449**	Rail Press Very High Error	●	ENG	Electrical system
E11	**CA451**	Rail Press Sensor High Error	●	ENG	Electrical system
E11	**CA452**	Rail Press Sensor Low Error	●	ENG	Electrical system
E11	**CA488**	Chg Air Temp High Torque Derate	●	ENG	Electrical system
E15	**CA553**	Rail Press High Error	●	ENG	Electrical system
E15	**CA559**	Rail Press Low Error	●	ENG	Electrical system
E15	**CA689**	Eng Ne Speed Sensor Error	●	ENG	Electrical system
E15	**CA731**	Eng Bkup Speed Sens Phase Error	●	ENG	Electrical system
E10	**CA757**	All Continuous Data Lost Error	●	ENG	Electrical system
E15	**CA778**	Eng Bkup Speed Sensor Error	●	ENG	Electrical system
E0E	**CA1633**	KOMNET Datalink Timeout Error	●	ENG	Electrical system
E14	**CA2185**	Throt Sens Sup Volt High Error	●	ENG	Electrical system
E14	**CA2186**	Throt Sens Sup Volt Low Error	●	ENG	Electrical system
E11	**CA2249**	Rail Press Very Low Error	●	ENG	Electrical system
E11	**CA2311**	IMV Solenoid Error	●	ENG	Electrical system
E15	**CA2555**	Grid Htr Relay Volt High Error	●	ENG	Electrical system

User code	Failure code	Trouble (Displayed on screen)	Alarm buzzer	Component in charge	Category of record
E15	**CA2556**	Grid Htr Relay Volt Low Error	●	ENG	Electrical system
E01	**D19JKZ**	Personal Code Relay Abnormality	●	MON2	Electrical system
	D862KA	GPS Antenna Discon		MON2	Electrical system
	DA25KP	5 V Sensor 1 Power Abnormality		PUMP	Electrical system
	DA29KQ	Model Selection Abnormality		PUMP	Electrical system
E0E	**DA2RMC**	CAN Discon (Pump Con Detected)	●	PUMP	Electrical system
	DAFGMC	GPS Module Error		MON2	Electrical system
E0E	**DAFRMC**	CAN Discon (Monitor Detected)	●	MON	Electrical system
	DGH2KB	Hydr Oil Sensor Short		PUMP	Electrical system
	DHPAMA	F Pump Press Sensor Abnormality		PUMP	Electrical system
	DHPBMA	R Pump Press Sensor Abnormality		PUMP	Electrical system
	DHS3MA	Arm Curl PPC Press Sensor Abnormality		PUMP	Electrical system
	DHS4MA	Bucket Curl PPC Press Sensor Abnormality		PUMP	Electrical system
	DHS8MA	Boom Raise PPC Press Sensor Abnormality		PUMP	Electrical system
	DHSAMA	Swing RH PPC Press Sensor Abnormality		PUMP	Electrical system
	DHSBMA	Swing LH PPC Press Sensor Abnormality		PUMP	Electrical system
	DHSDMA	Bucket Dump PPC Press Sensor Abnormality		PUMP	Electrical system
	DHX1MA	Overload Sensor Abnormality (Analog)		PUMP	Electrical system
	DW43KA	Travel Speed Sol Discon		PUMP	Electrical system
	DW43KB	Travel Speed Sol Short		PUMP	Electrical system
E03	**DW45KA**	Swing Brake Sol Discon	●	PUMP	Electrical system
E03	**DW45KB**	Swing Brake Sol Short	●	PUMP	Electrical system
	DW91KA	Travel Junction Sol Discon		PUMP	Electrical system
	DW91KB	Travel Junction Sol Short		PUMP	Electrical system
	DWA2KA	Service Sol Discon		PUMP	Electrical system
	DWA2KB	Service Sol Short		PUMP	Electrical system
	DWK0KA	2-stage Relief Sol Discon		PUMP	Electrical system
	DWK0KB	2-stage Relief Sol Short		PUMP	Electrical system
E02	**DXA8KA**	PC-EPC (F) Sol Discon	●	PUMP	Electrical system
E02	**DXA8KB**	PC-EPC (F) Sol Short	●	PUMP	Electrical system

User code	Failure code	Trouble (Displayed on screen)	Alarm buzzer	Component in charge	Category of record
E02	**DXA9KA**	PC-EPC (R) Sol Discon	●	PUMP	Electrical system
E02	**DXA9KB**	PC-EPC (R) Sol Short	●	PUMP	Electrical system
	DXE0KA	LS-EPC Sol Discon		PUMP	Electrical system
	DXE0KB	LS-EPC Sol Short		PUMP	Electrical system
	DXE4KA	Service Current EPC Discon		PUMP	Electrical system
	DXE4KB	Service Current EPC Short		PUMP	Electrical system
	DXE5KA	Merge-divider Main Sol Discon		PUMP	Electrical system
	DXE5KB	Merge-divider Main Sol Short		PUMP	Electrical system
	DXE6KA	Merge-divider LS Sol Discon		PUMP	Electrical system
	DXE6KB	Merge-divider LS Sol Short		PUMP	Electrical system
	DY20KA	Wiper Working Abnormality		PUMP	Electrical system
	DY20MA	Wiper Parking Abnormality		PUMP	Electrical system
	DY2CKA	Washer Drive Discon		PUMP	Electrical system
	DY2CKB	Washer Drive Short		PUMP	Electrical system
	DY2DKB	Wiper Drive (For) Short		PUMP	Electrical system
	DY2EKB	Wiper Drive (Rev) Short		PUMP	Electrical system

★ Entry order of items in table
The items are entered in the order of their failure codes (incremental order).

★ User code
Attached : If the failure code is detected, the user code, failure code, and telephone No. (if registered) are displayed on the ordinary screen to notify the operator of the abnormality.
Not attached: Even if the failure code is detected, the machine monitor does not notify the operator of the abnormality.

★ Alarm buzzer
● : When occurrence of an error is notified to the operator, the buzzer sounds (The operator can stop the buzzer with the alarm buzzer cancel switch).
▲: Since the caution monitor is also turned ON, its function sounds the buzzer.

★ Component in charge
MON: The machine monitor is in charge of detection of abnormality.
MON2: The KOMTRAX section of the machine monitor is in charge of detection of abnormality.
ENG: The engine controller is in charge of detection of abnormality.
PUMP: The pump controller is in charge of detection of abnormality.

★ Category of record
Mechanical system: Abnormality information is recorded in the mechanical system abnormality record.
Electrical system: Abnormality information is recorded in the electrical system abnormality record.

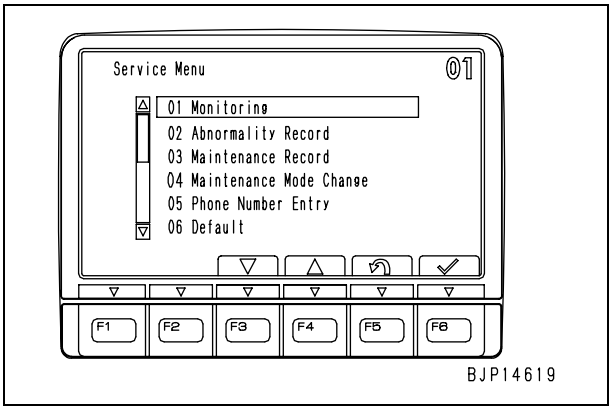
Abnormality record (Air-conditioning abnormality record/Heater abnormality record)

The machine monitor classifies and records the abnormalities which occurred in the past or which are occurring at present into the mechanical systems, electrical systems, and air-conditioning abnormalities or heater abnormalities.

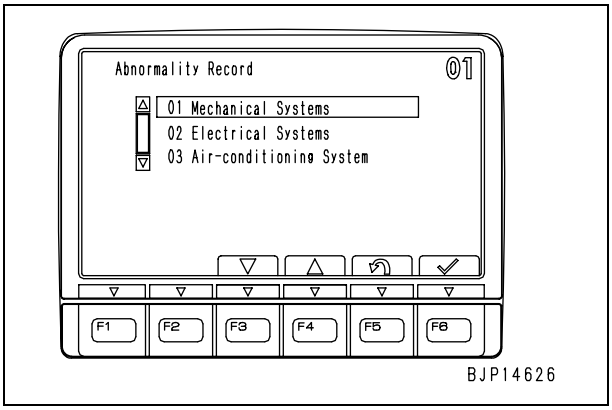
To check the air-conditioning abnormality record or heater abnormality record, perform the following procedures.

★ All the following figures show the air conditioner specification.

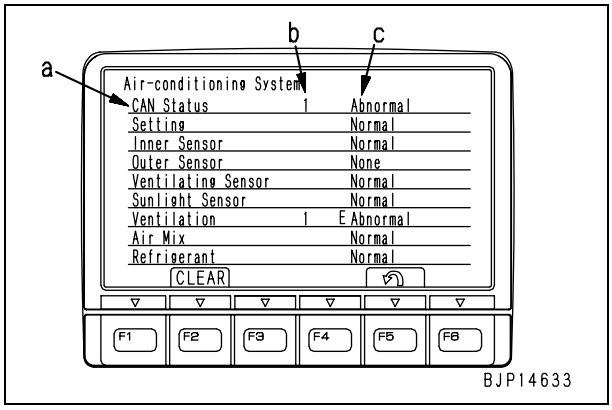
1. Selecting menu
   Select “Abnormality record” on the service menu screen.



2. Selecting sub menu
   After the “Abnormality record” screen is displayed, select air-conditioning system or heater system with the function switches or numeral input switches.
   - [F3]: Move to lower item
   - [F4]: Move to upper item
   - [F5]: Return to service menu screen
   - [F6]: Confirm selection
   - ★ You may enter a 2-digit code with the numeral input switches to select the record of that code and confirm it with [F6].



3. Information displayed on “abnormality record” screen
   On the air-conditioning system or heater system screen, the following information is displayed.
   (a): System/Component name
   (b): Number of occurrence time
   (c): Condition (Normal or abnormal)
   - [F2]: Reset abnormality record
   - [F5]: Return to abnormality record screen
   - ★ If [**E**] is displayed on the left of a condition, the abnormality is still occurring or resetting of it has not been confirmed.
   - ★ If CAN disconnection is displayed in Communication condition, communication cannot be carried out normally. Accordingly, the conditions of other items are turned OFF.



4. Resetting abnormality record
   While the “abnormality record” screen is displayed, press [F2], and the number of occurrence time of abnormality is reset. If it is confirmed at this time that the abnormality has been reset, the display changes to Normal.

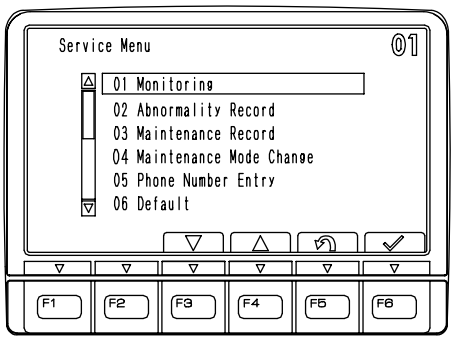
★ Heater specification
In the heater specification, the display of Air-conditioning is replaced with Heater and the items which are not related to the heater are not displayed.

★ Heaterless specification
In the heaterless specification, the abnormality record menu and screen are not displayed.

Maintenance record

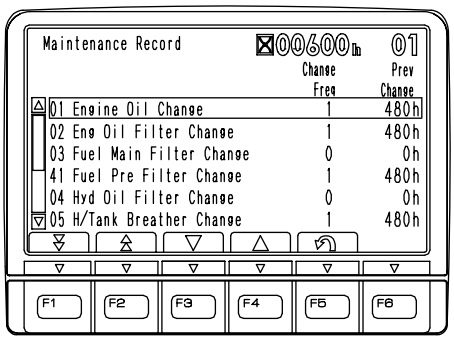
The machine monitor records the maintenance information of the filters, oils, etc., which the operator can display and check by the following operations. When maintenance is carried out, if the data are reset in the operator mode, the number of the times of maintenance is recorded in this section.

1. Selecting menu
   Select “Maintenance record” on the service menu screen.



2. Selecting maintenance record item
   After the “Maintenance record” screen is displayed, select an item to be checked with the function switches or numeral input switches.
   - [F1]: Move to next page (screen)
   - [F2]: Move to previous page (screen)
   - [F3]: Move to lower item
   - [F4]: Move to upper item
   - [F5]: Return to service menu screen

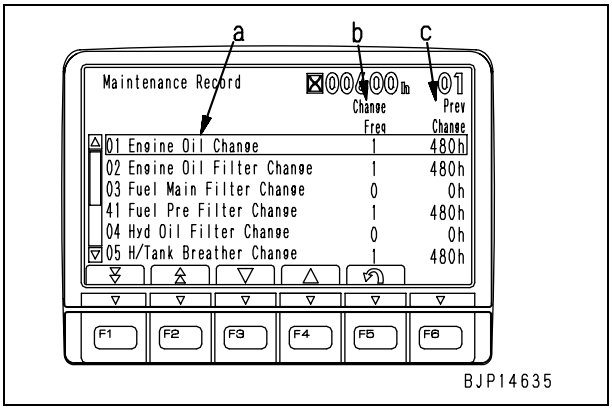
   ★ You may enter a 2-digit code with the numeral input switches to select the item of that code.



★ The following items can be selected in the maintenance record.

01 Engine oil change
02 Engine oil filter change
03 Fuel main filter change
41 Fuel pre-filter change
04 Hydraulic oil filter change
05 Hydraulic tank breather change
06 Corrosion resistor change
07 Damper case service
08 Final drive case oil change
09 Machinery case oil change
10 Hydraulic oil change

3. Items displayed on maintenance record screen
   The following items are displayed.
   (a) : Maintenance items
   (b) : Number of times of replacement up to now
   (c) : Service meter reading (SMR) at previous replacement

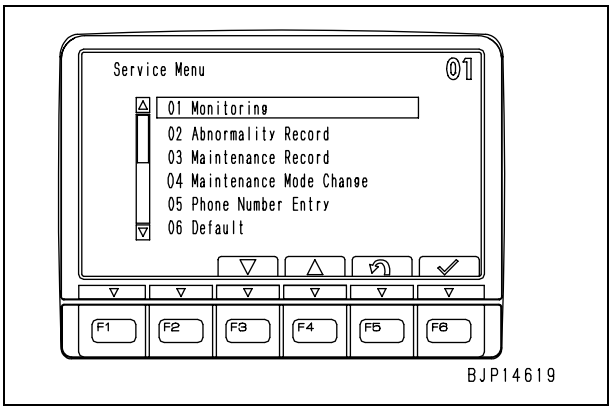


Change of maintenance mode

The operating condition for maintenance function in the operation mode can be set and changed with this menu.

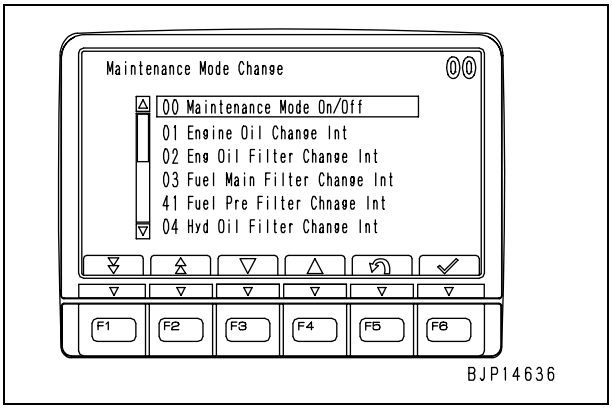
- Set function effective or ineffective
- Change set replacement interval (by items)
- Initialize all set replacement intervals

1. Selecting menu
   Select of "Maintenance mode change" on the service menu screen.



2. Selecting sub menu
   After the "Maintenance mode change" screen is displayed, select an item to be monitored with the function switches or numeral input switches.
   - [F1]: Move to next page (screen)
   - [F2]: Move to previous page (screen)
   - [F3]: Move to lower item
   - [F4]: Move to upper item
   - [F5]: Return to service menu screen

   ★ You may enter a 2-digit code with the numeral input switches to select the item of that code and confirm it with [F6].

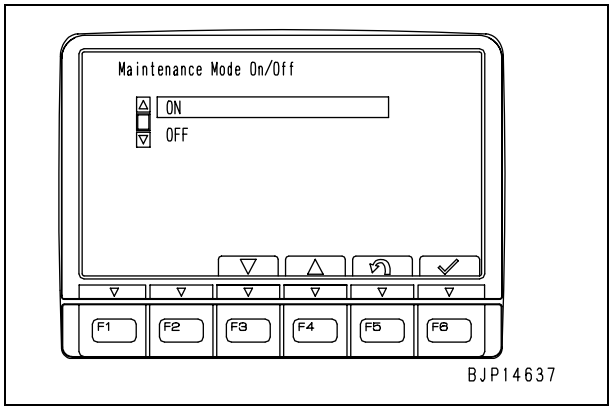


★ The following items can be selected on the Change of maintenance mode screen.

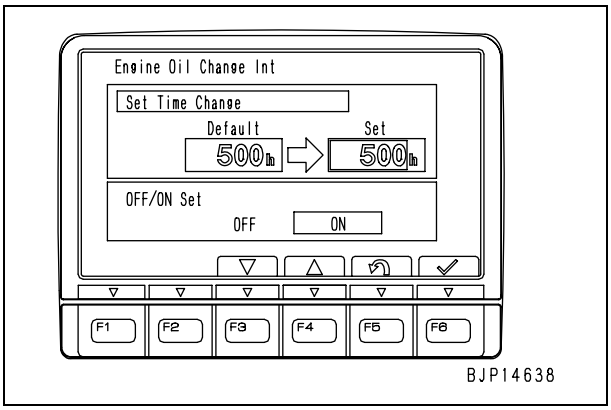
00 Maintenance mode on/off
01 Engine oil change int.
02 Engine oil filter change int.
03 Fuel main filter change int.
41 Fuel pre filter change int.
04 Hyd oil filter change int.
05 Hyd tank breather change int.
06 Corrosion resistor change int.
07 Damper case service int.
08 Final drive case oil change int.
09 Machinery case change int.
10 Hydraulic oil change int.
99 Initialize all items

3. Contents of setting of Maintenance mode on/off
   After selecting Maintenance mode on/off, if the screen is displayed, set ON or OFF with the function switches.
   - ON: Functions of all maintenance items are set effective in operator mode
   - OFF: Functions of all maintenance items are set ineffective in operator mode
   - [F3]: Move to lower item
   - [F4]: Move to upper item
   - [F5]: Cancel selection and return to Maintenance mode change screen
   - [F6]: Confirm selection and return to Maintenance mode change screen

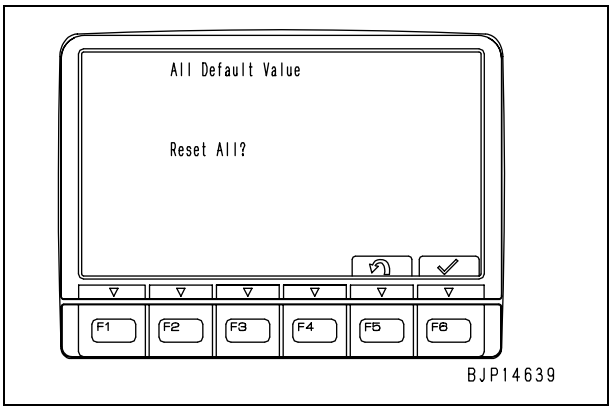
   ★ Even if ON/OFF of each item has been set, if the above setting is changed, it is applied.



4. Contents of setting of each maintenance item
   After selecting each maintenance item, if the screen is displayed, set the item with the function switches.
   - Initial value: Maintenance interval set in machine monitor (Recommended by manufacturer and not changeable).
   - Set value: Maintenance interval which can be set freely. Maintenance functions in operator mode operate on basis of this set time (which is increased or decreased by 50 hours).
   - ON: Maintenance function of this item is set effective in operator mode.
   - OFF: Maintenance function of this item is set ineffective in operator mode.
   - [F3]: Select Reduce set value (Upper) or OFF (Lower).
   - [F4]: Select Increase set value (Upper) or ON (Lower).
   - [F5]: Cancel setting before confirmation and return to Maintenance mode change screen.
   - [F6]: Confirm setting of upper or lower line.
   - ★ After the setting of the upper and lower lines is confirmed with [F6] and the screen changes to the Maintenance mode change screen with [F5], the setting is effective.
   - ★ If the set value of an item set to ON is changed after 1 or more operating hours since the start of setting, the change is recognized as a resetting operation.



5. Function of initializing all items
   After selecting "All default value", if the screen is displayed, set with the function switches.
   - If this operation is executed, the set values of all the maintenance items are initialized.
   - [F5]: Return to Maintenance mode change screen
   - [F6]: Execute initialization
   - ★ A while after [F6] is pressed, the initialization completion screen is displayed. Then, if the Maintenance mode change screen is displayed, initialization is completed.

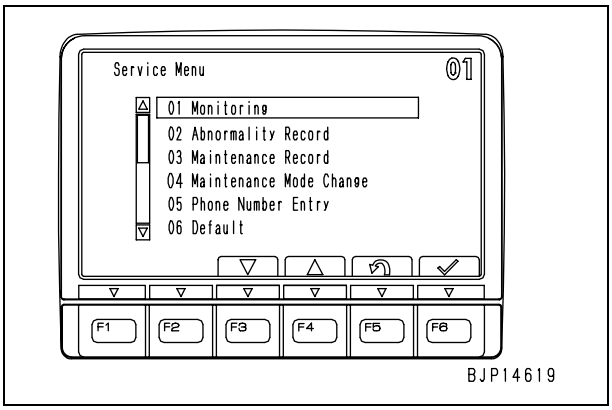


Setting of telephone No.

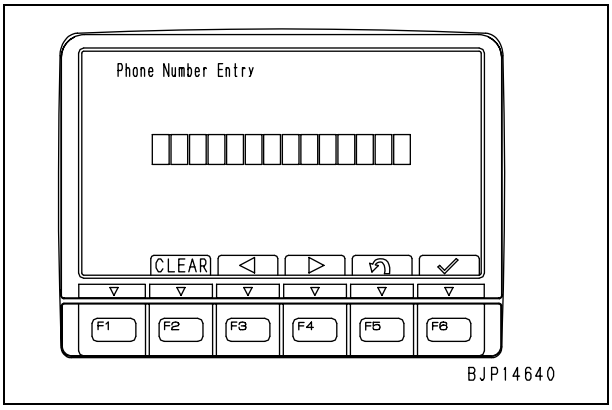
The telephone No. displayed when the user code/ failure code is displayed in the operator mode can be input and changed according to the following procedure.

If a telephone No. is not input with this function, no telephone No. is displayed in the operator mode.

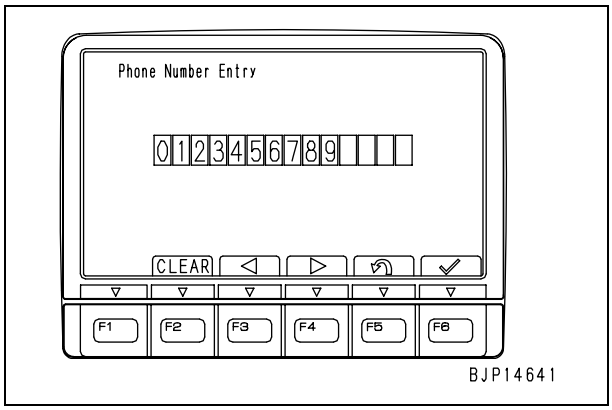
1. Selecting menu
   Select “Phone number entry” on the service menu screen.



2. Registering and changing telephone No.
   After the “Phone number entry” screen is displayed, register or change the telephone No.
   - [F2]: Reset all input No.
   - [F3]: Move to left position (if not blank)
   - [F4]: Move to right position (if not blank)
   - [F5]: Reset input digit/Return to service menu
   - [F6]: Confirm input



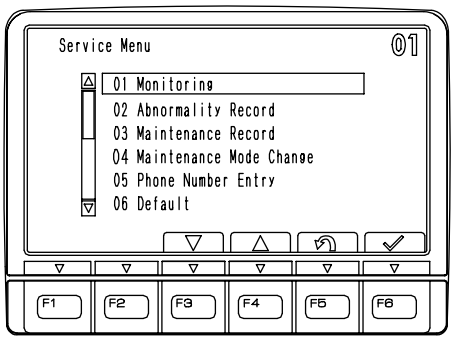
   ★ Up to 14 digits can be input from the left. Input nothing in the surplus positions.
   ★ If one of the input digits is wrong, move to that digit (orange background) and overwrite it with the correct digit.
   ★ If [F6] is pressed without inputting a digit, there is not information of telephone No. Accordingly, no telephone No. is displayed in the operator mode.



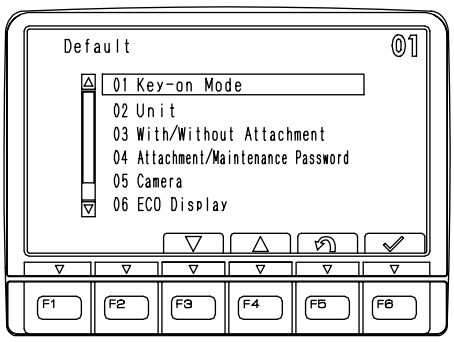
Default (Working mode with key ON)

Check or change various settings related to the machine monitor and machine by "Default".
The function of working mode with key ON is used to set the working mode displayed on the machine monitor when the starting switch is turned ON.

1. Selecting menu
   Select “Default” on the service menu screen.

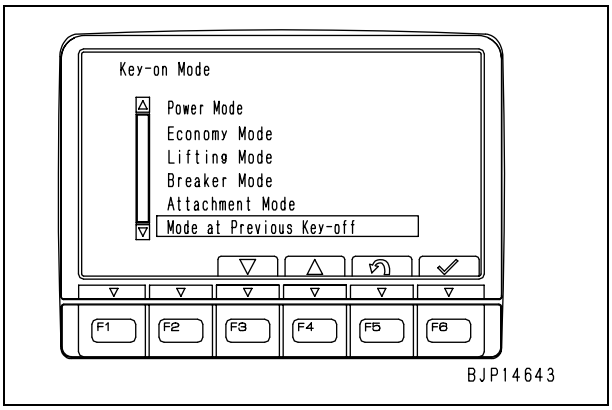


2. Selecting sub menu
   After the “Default” screen is displayed, select “Key-on mode” with the function switches or numeral input switches.
   ★ Select this item similarly to an item on the Service menu screen.



3. Selecting mode
   After the “Key-on mode” screen is displayed, select the mode to be set with the function switches.
   - Power mode: [P] is displayed when key is ON
   - Economy mode: [E] is displayed when key is ON
   - Lifting mode: [L] is displayed when key is ON
   - Breaker mode: [B] is displayed when key is ON
   - Attachment mode: [ATT] is displayed when key is ON
   - Mode at previous key-OFF: Final mode in previous operation is displayed when key is ON
   - [F3]: Move to lower item
   - [F4]: Move to upper item
   - [F5]: Cancel selection and return to “Default” screen
   - [F6]: Confirm selection and return to “Default” screen

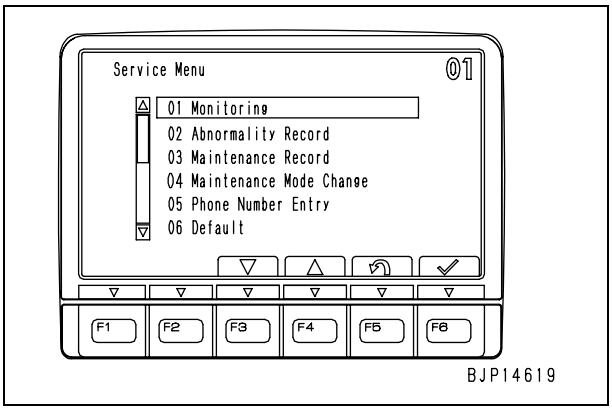
   ★ When the machine is delivered, Mode at previous key-OFF is set.
   ★ If "With attachment" is not set, the attachment mode cannot be selected.
   ★ While Attachment mode [ATT] is selected, if "Without attachment" is set, Power mode [P] is displayed when the key is turned ON.
   ★ If the engine is stopped while breaker mode [B] is selected in the operator mode, Breaker mode [B] is always displayed, regardless of the above setting.



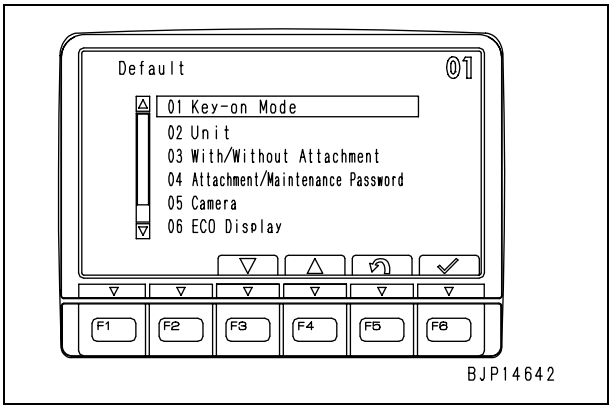
Default (Setting of unit)

Check or change various settings related to the machine monitor and machine by "Default".
The unit setting function is used to select the unit of the data displayed for monitoring, etc.

1. Selecting menu
   Select “Default” on the service menu screen.

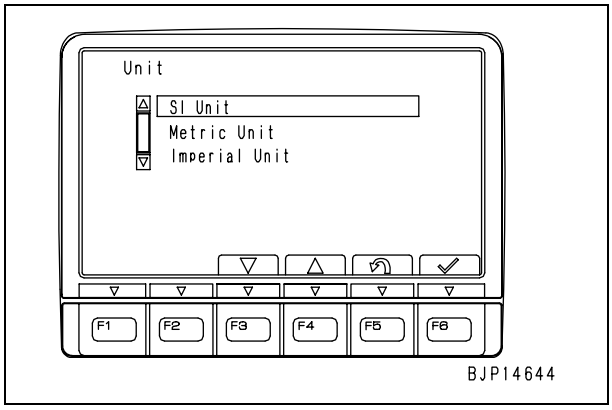


2. Selecting sub menu
   After the “Default” screen is displayed, select “Unit” with the function switches or numeral input switches.
   ★ Select this item similarly to an item on the Service menu screen.



3. Selecting unit
   After the “Unit” screen is displayed, select the unit to be set with the function switches.
   - [F3]: Move to lower unit
   - [F4]: Move to upper unit
   - [F5]: Cancel selection and return to “Default” screen
   - [F6]: Confirm selection and return to “Default” screen

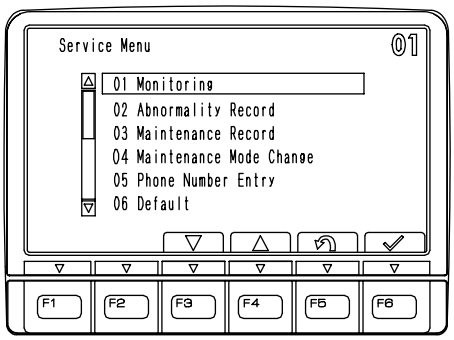
★ When the machine is delivered, the SI unit system is set.



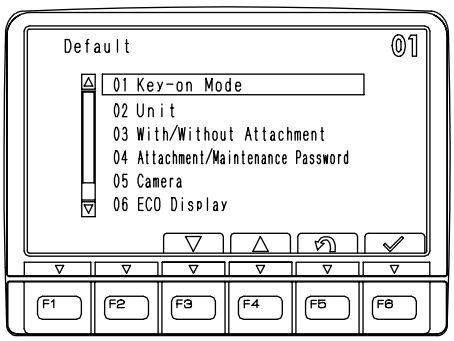
Default (With/Without attachment)

Check or change various settings related to the machine monitor and machine by "Default".
The "With/Without attachment" function is used to set an installed or a remove attachment.

1. Selecting menu
   Select "Default" on the service menu screen.

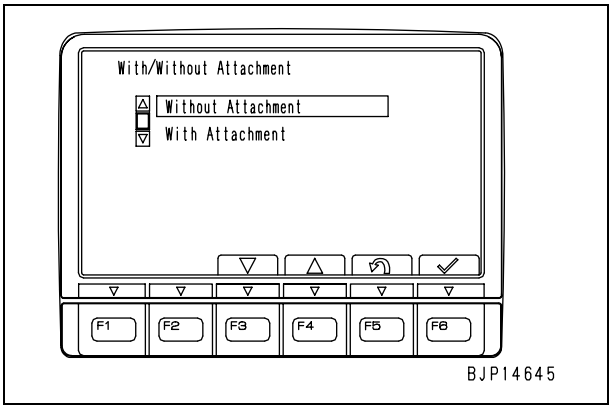


2. Selecting sub menu
   After the "Default" screen is displayed, select With/Without attachment with the function switches or numeral input switches.
   ★ Select this item similarly to an item on the Service menu screen.



3. Selecting With/Without
   After the "With/Without attachment" screen is displayed, select the setting with the function switches.
   - Without: When attachment is not installed
   - With : When attachment is installed
   - [F3] : Move to lower item
   - [F4] : Move to upper item
   - [F5] : Cancel selection and return to Default screen
   - [F6] : Confirm selection and return to Default screen

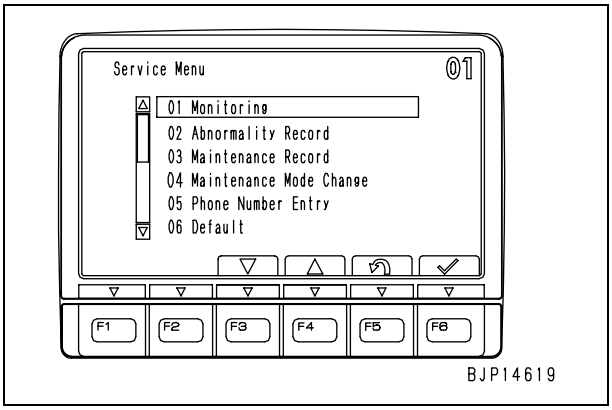
   ★ When an attachment is installed, if this setting is not carried out normally, the attachment cannot be set in the operator mode. As a result, the attachment may not work normally or the hydraulic components may have trouble.



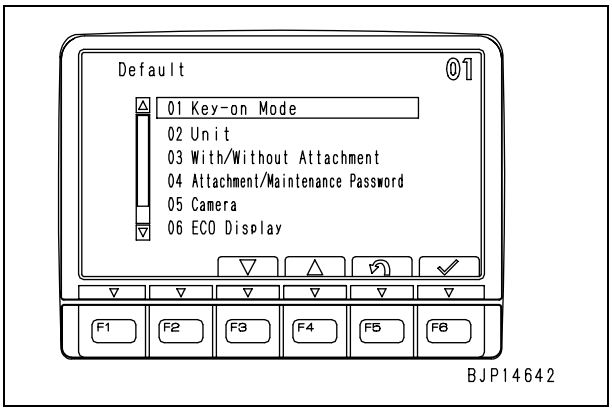
Default (Setting of attachment/maintenance password)

Check or change various settings related to the machine monitor and machine by "Default".
The function of setting attachment/maintenance password is used to set the display of the password screen when the functions related to the attachment and maintenance are used in the operator mode.

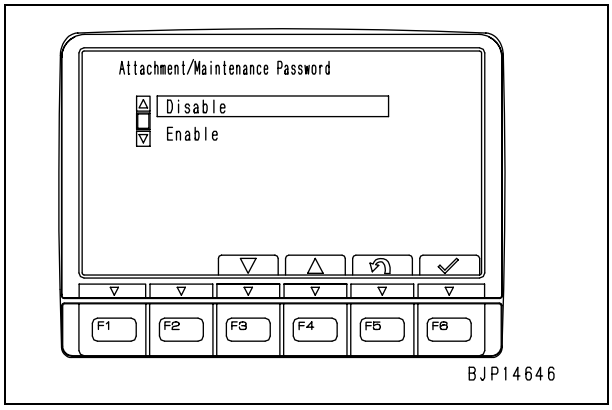
1. Selecting menu
   Select "Default" on the service menu screen.



2. Selecting sub menu
   After the "Default" screen is displayed, select Attachment/Maintenance password with the function switches or numeral input switches.
   ★ Select this item similarly to an item on the Service menu screen.



3. Selecting Disable/Enable
   After the With/Without attachment screen is displayed, select the setting with the function switches.
   - Disable : Password screen is not displayed
   - Enable : Password screen is displayed
   - [F3] : Move to lower item
   - [F4] : Move to upper item
   - [F5] : Cancel selection and return to "Default" screen
   - [F6] : Confirm selection and return to "Default" screen



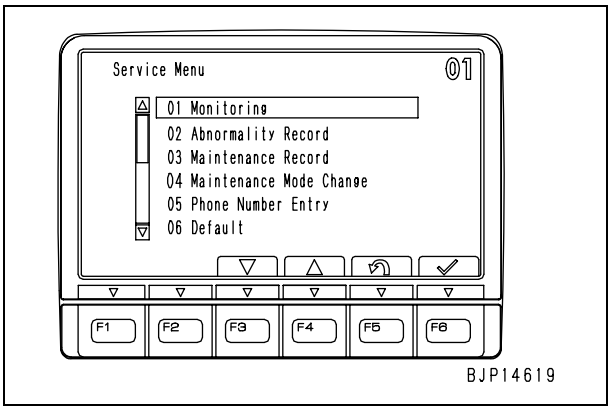
4. Displaying attachment/maintenance password screen
   When the following operation is performed, the password screen is displayed in the operator mode.
   - Maintenance mode: The Maintenance table screen is changed to the Maintenance interval reset screen.
   - User mode: On the User menu screen, the Breaker/Attachment setting menu is selected and the screen is changed to the Attachment setting menu screen.

5. Changing attachment/maintenance password
   The password can be changed by operating the switches specially in the operator mode.
   ★ See Attachment/Maintenance password changing function in the operator mode.
   ★ Default password: [000000]
   ★ If the password setting is changed from Enable to Disable, the password is reset to the default. When Enable is set again, be sure to set a new password.
   ★ The attachment/maintenance password is different from the engine start lock password.

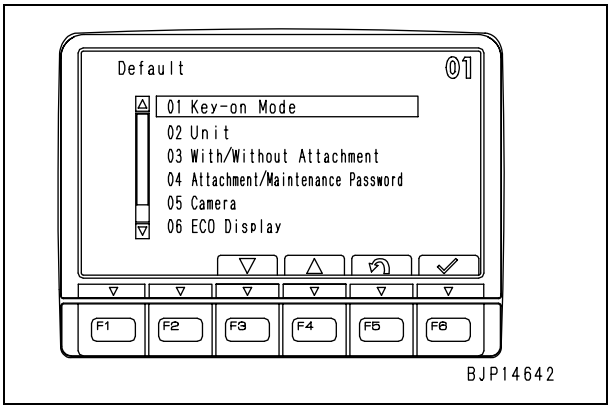
Default (Setting of camera)

Check or change various settings related to the machine monitor and machine by "Default".
The camera setting function is used to set installation and removal of a camera.

1. Selecting menu
   Select "Default" on the service menu screen.

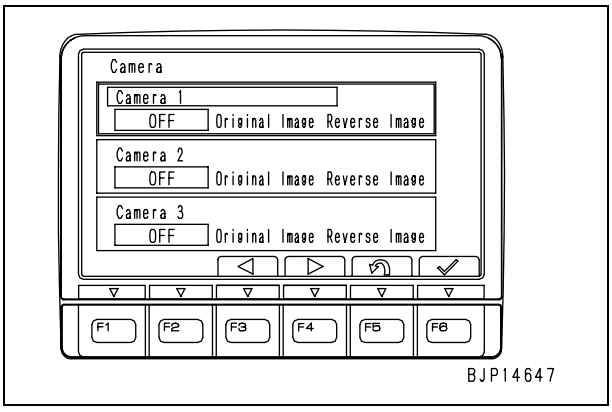


2. Selecting sub menu
   After the "Default" screen is displayed, select Camera with the function switches or numeral input switches.
   ★ Select this item similarly to an item on the Service menu screen.



3. Selecting camera setting
   After the camera setting screen is displayed, select the setting with the function switches.
   - OFF: Camera is not used
   - Original image: Image of connected camera is displayed in original position (as in mirror, used as back monitor)
   - Reverse image: Image of connected camera is displayed in reverse position (as seen directly, used as front or side monitor)
   - [F3]: Move to left item
   - [F4]: Move to right item
   - [F5]: Cancel setting before confirmation and return to "Default" screen
   - [F6]: Confirm selection in each line

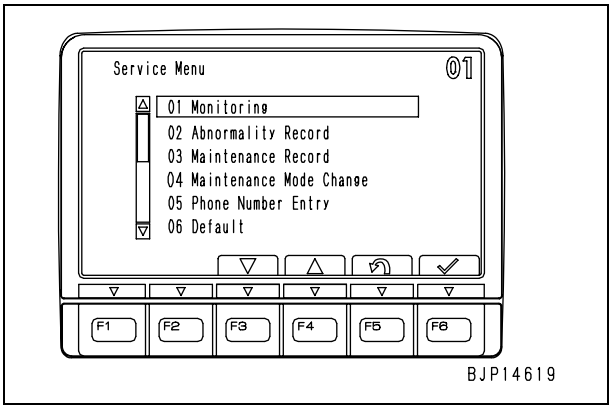
   ★ After Camera screen is displayed, camera 1 can be always set. When 2 or more cameras are connected, if camera 1 is set, the screen changes to setting of camera 2 automatically.
   ★ After confirming the setting of each line with [F6], return to the "Default" screen with [F5], and the setting is effective.
   ★ If a camera is connected but not set normally with this function, the graphic mark of camera is not displayed at [F3] in the operator mode. Accordingly, the image of the camera cannot be used.
   ★ If 2 or more cameras are connected, be sure to set the use of them from camera 1 in order.
   ★ The function of displaying 2 images simultaneously is effective when use of camera 1 and camera 2 is set.
   ★ When a camera is installed, check that the displayed image is not inverted horizontally.



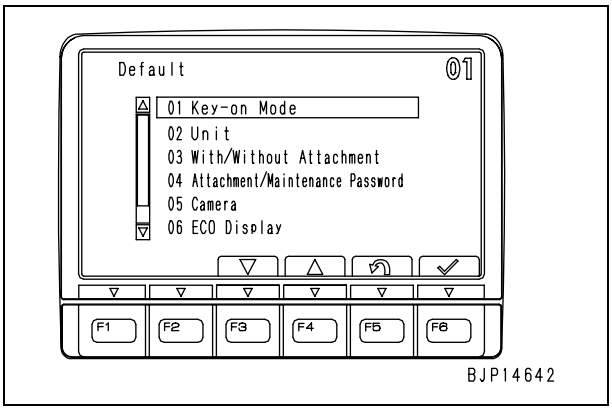
Default (Setting of ECO display)

Check or change various settings related to the machine monitor and machine by "Default".
The ECO display setting function is used to set the display of the ECO gauge and energy saving guidance.

1. Selecting menu
   Select "Default" on the service menu screen.



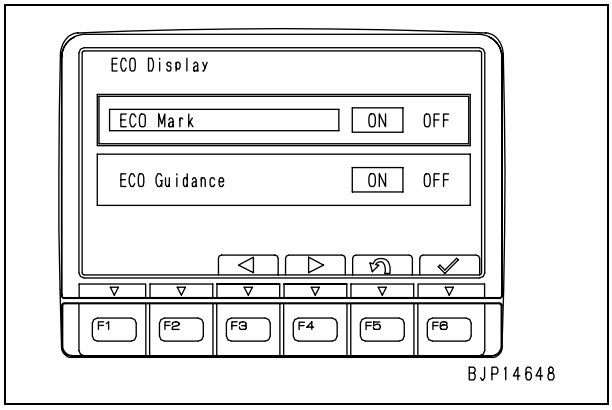
2. Selecting sub menu
   After the "Default" screen is displayed, select ECO display with the function switches or numeral input switches.
   ★ Select this item similarly to an item on the Service menu screen.



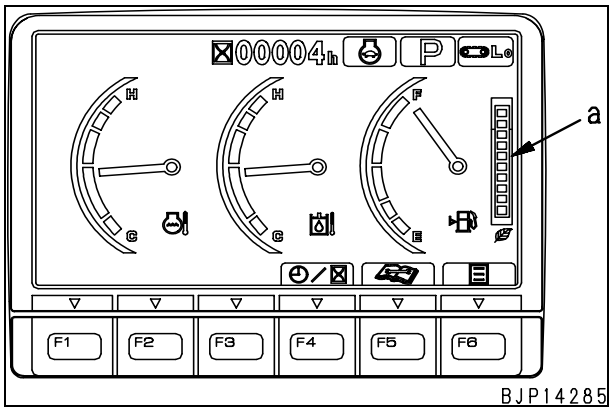
3. Selecting display setting
   After the ECO display screen is displayed, select the setting with the function switches.
   - ON : Display ECO
   - OFF: Do not display ECO
   - [F3] : Move to left item
   - [F4] : Move to right item
   - [F5] : Cancel setting before confirmation and return to "Default" screen
   - [F6] : Confirm selection in each line

   ★ After confirming the setting of the upper and lower lines with [F6], return to the "Default" screen with [F5], and the setting is effective.

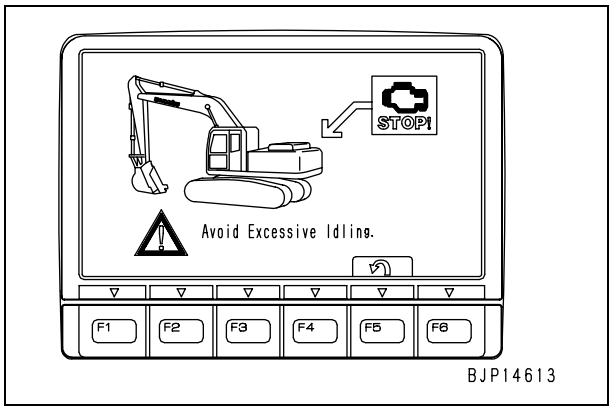
★ If ECO display is turned ON, ECO is displayed when the screen changes to the ordinary screen. Even if the energy saving guidance is turned ON, however, it is not displayed if the condition for display is not satisfied on the ordinary screen.



★ Display of ECO gauge (a)



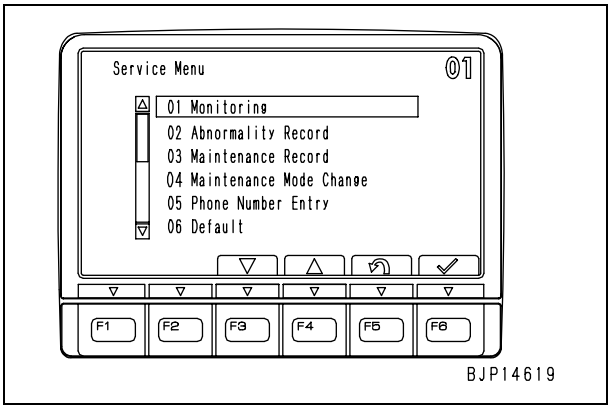
★ Display of energy saving guidance



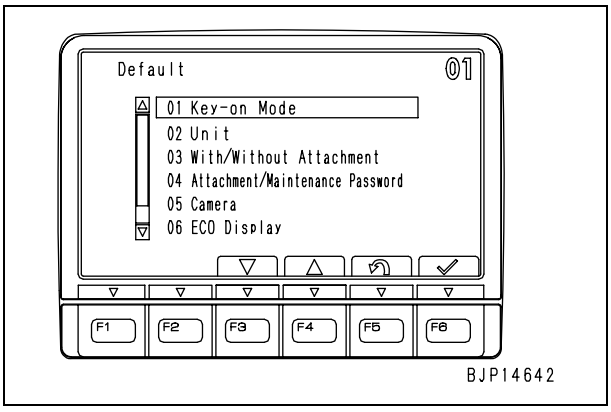
Default (Setting of Breaker Detect)

Check or change various settings related to the machine monitor and machine by "Default".
The function of setting breaker automatic judgment is used to set the display to give warning when the breaker is used in an improper working mode.

1. Selecting menu
   Select "Default" on the service menu screen.

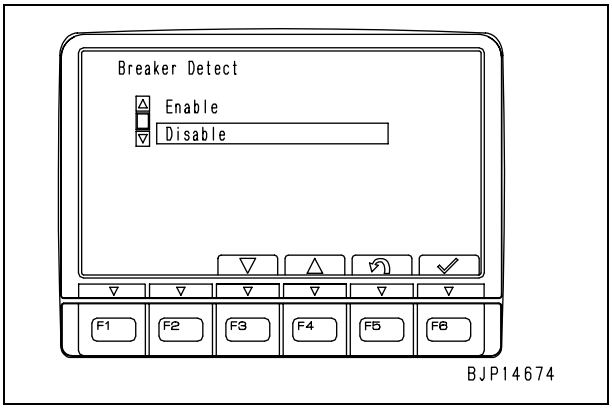


2. Selecting sub menu
   After the "Default" screen is displayed, select "Breaker Detect" with the function switches or numeral input switches.
   ★ Select this item similarly to an item on the Service menu screen.

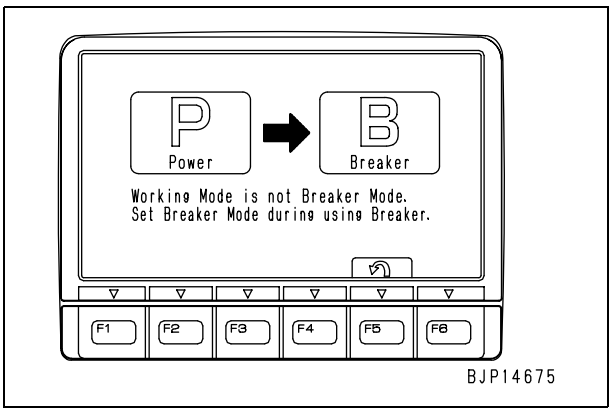


3. Selecting display setting
   After the "Breaker Detect" screen is displayed, select the setting with the function switches.
   - [F3]: Move to lower item
   - [F4]: Move to upper item
   - [F5]: Cancel selection and return to Default screen
   - [F6]: Confirm selection and return to Default screen

   ★ When the machine is delivered, Disable is set.



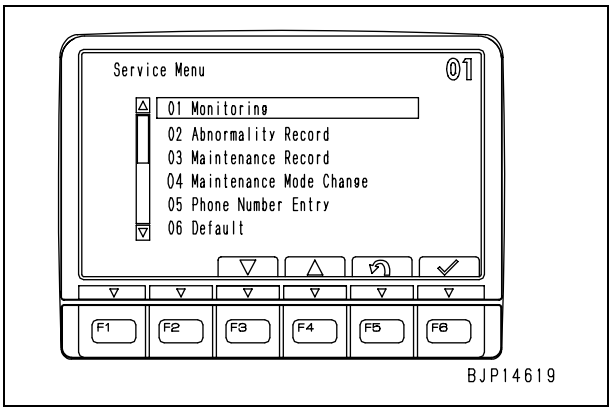
★ Display of "Breaker Detect"



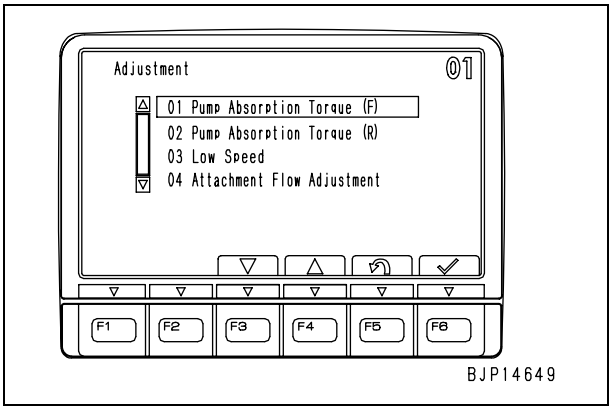
Adjustment (Setting of Pump absorption torque (F))

The operator can adjust various items related to the machine with the machine monitor.
The pump absorption torque (F) function is used to finely adjust the absorption torque on the front side of the hydraulic pump.

1. Selecting menu
   Select "Adjustment" on the service menu screen.

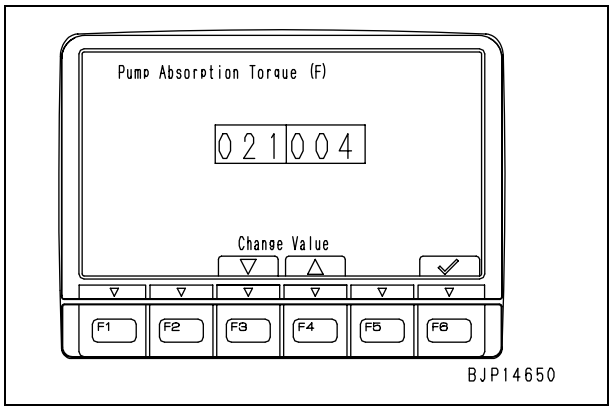


2. Selecting sub menu
   After the Adjustment screen is displayed, select "Pump Absorption Torque (F)" with the function switches or numeral input switches.
   ★ Select this item similarly to an item on the Service menu screen.



3. Selecting absorption torque
   After the "Pump Absorption Torque (F)" screen is displayed, select a set value on the right side with the function switches.
   - Set value: For actual torque adjustment value, see table
   - [F3]: Increase set value
   - [F4]: Decrease set value
   - [F6]: Confirm setting and return to Adjustment menu screen

   ★ The 3 digits on the left side do not vary since they are the code of this function.



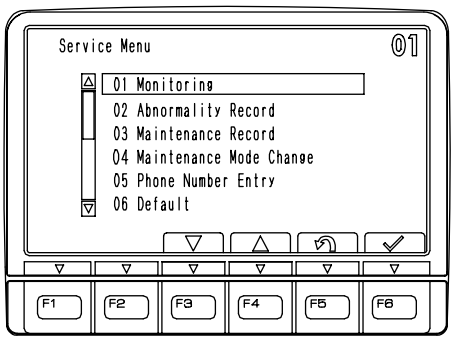
★ Relationship between set value and torque adjustment value

Code	Set value	Torque adjustment value
021	000	+39.2 Nm {+4 kgm}
	001	+29.4 Nm {+3 kgm}
	002	+19.6 Nm {+2 kgm}
	003	+9.8 Nm {+1 kgm}
	004	0 Nm {0 kgm}
	005	–9.8 Nm {–1 kgm}
	006	–19.6 Nm {–2 kgm}
	007	–29.4 Nm {–3 kgm}
	008	–39.2 Nm {–4 kgm}

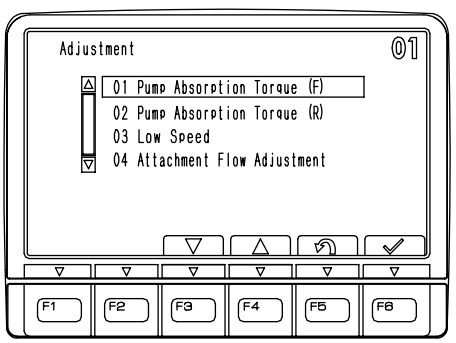
Adjustment (Setting of Pump absorption torque (R))

The operator can adjust various items related to the machine with the machine monitor.
The pump absorption torque (R) function is used to finely adjust the absorption torque on the rear side of the hydraulic pump.

1. Selecting menu
   Select "Adjustment" on the service menu screen.

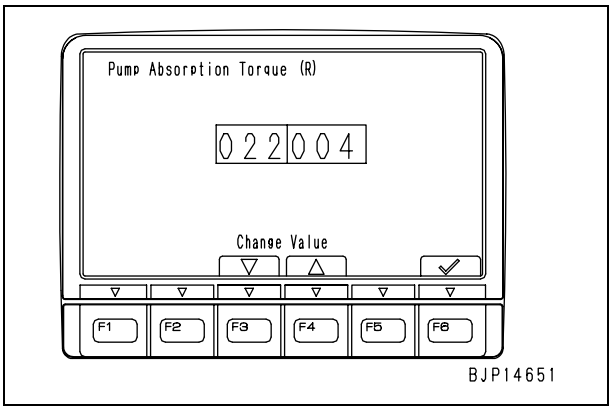


2. Selecting sub menu
   After the Adjustment screen is displayed, select "Pump Absorption Torque (R)" with the function switches or numeral input switches.
   ★ Select this item similarly to an item on the Service menu screen.



3. Selecting absorption torque
   After the "Pump Absorption Torque (R)" screen is displayed, select a set value on the right side with the function switches.
   - Set value: For actual torque adjustment value, see table
   - [F3]: Increase set value
   - [F4]: Decrease set value
   - [F6]: Confirm setting and return to Adjustment menu screen

   ★ The 3 digits on the left side do not vary since they are the code of this function.



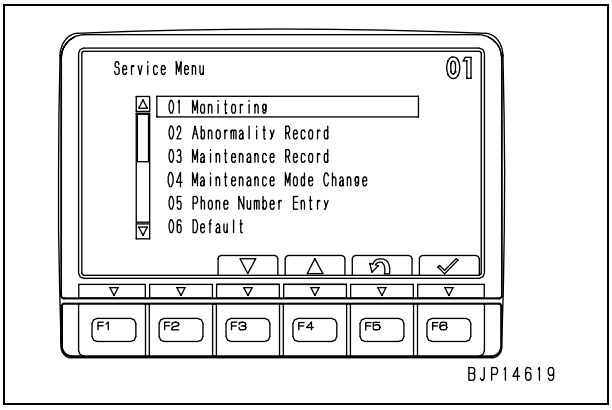
★ Relationship between set value and torque adjustment value

Code	Set value	Torque adjustment value
022	000	+39.2 Nm {+4 kgm}
	001	+29.4 Nm {+3 kgm}
	002	+19.6 Nm {+2 kgm}
	003	+9.8 Nm {+1 kgm}
	004	0 Nm {0 kgm}
	005	–9.8 Nm {–1 kgm}
	006	–19.6 Nm {–2 kgm}
	007	–29.4 Nm {–3 kgm}
	008	–39.2 Nm {–4 kgm}

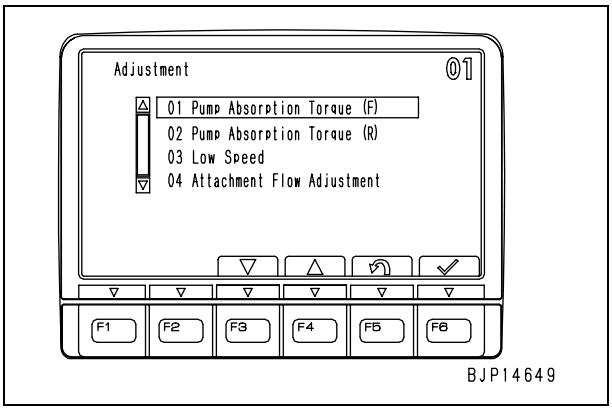
Adjustment (Setting of travel Lo speed)

The operator can adjust various items related to the machine with the machine monitor.
The travel Lo speed setting function is used to finely adjust the travel Lo speed.

1. Selecting menu
   Select "Adjustment" on the service menu screen.

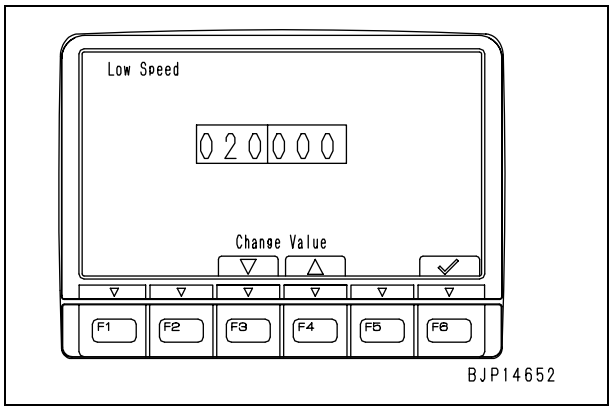


2. Selecting sub menu
   After the Adjustment screen is displayed, select "Low speed" with the function switches or numeral input switches.
   ★ Select this item similarly to an item on the Service menu screen.



3. Selecting travel Lo speed
   After the "Low Speed" setting screen is displayed, select a set value on the right side with the function switches.
   - Set value: For actual travel Lo speed value, see table
   - [F3]: Increase set value
   - [F4]: Decrease set value
   - [F6]: Confirm setting and return to Adjustment menu screen

   ★ The 3 digits on the left side do not vary since they are the code of this function.



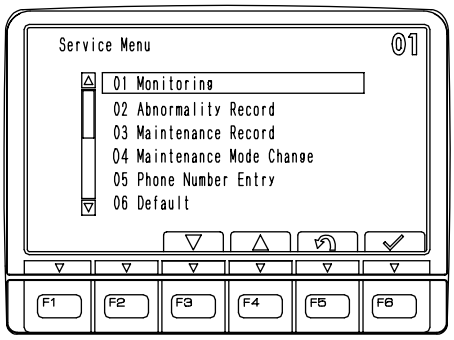
★ Relationship between set value and travel Lo speed value

Code	Set value	Travel Lo speed value
020	000	3.0 km/h
	001	2.8 km/h
	002	3.2 km/h
	003	3.4 km/h

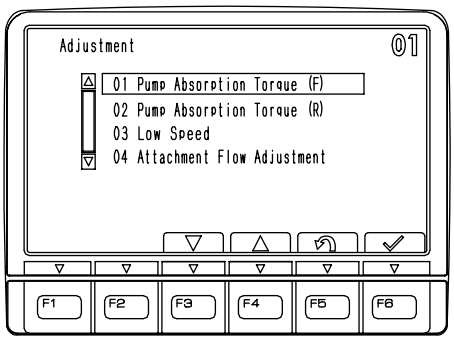
Adjustment (Setting of Attachment flow adjustment)

The operator can adjust various items related to the machine with the machine monitor.
The function of "Attachment Flow Adjustment" is used to finely adjust the oil flow to the attachment in compound operation.

1. Selecting menu
   Select "Adjustment" on the service menu screen.

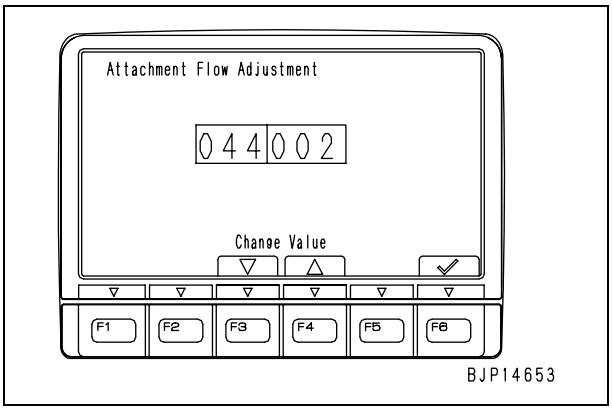


2. Selecting sub menu
   After the Adjustment screen is displayed, select "Attachment Flow Adjustment" with the function switches or numeral input switches.
   ★ Select this item similarly to an item on the Service menu screen.



3. Selecting distribution of oil flow
   After the screen of "Attachment Flow Adjustment" is displayed, select a set value on the right side with the function switches.
   - Set value: For actual distribution of flow, see table
   - [F3]: Increase set value
   - [F4]: Decrease set value
   - [F6]: Confirm setting and return to Adjustment menu screen

   ★ The 3 digits on the left side do not vary since they are the code of this function.



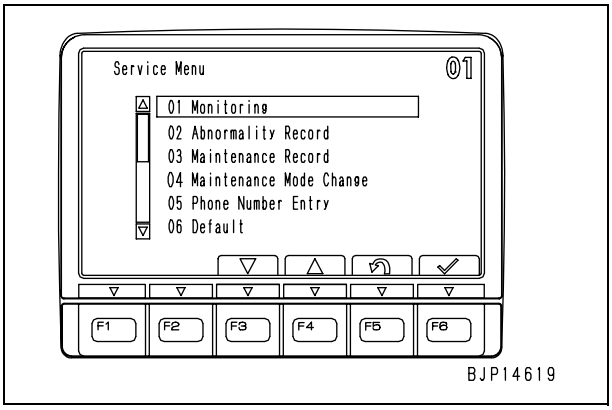
★ Relationship between set value and distribution of flow to attachment

Code	Set value	Distribution of flow to attachment
044	000	50 %
	001	70 %
	002	100 %
	003	40 %

Cylinder Cut-Out operation

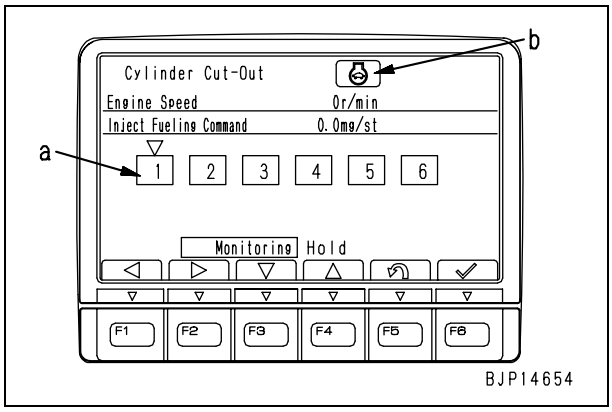
The operator can perform "Cylinder Cut-Out" operation with the machine monitor.
"Cylinder Cut-Out" operation means to run the engine with 1 or more fuel injectors disabled electrically to reduce the number of effective cylinders. This operation is used to find out a cylinder which does not output power normally (combustion in it is abnormal).

1. Selecting menu
   Select "Cylinder Cut-Out" on the service menu screen.



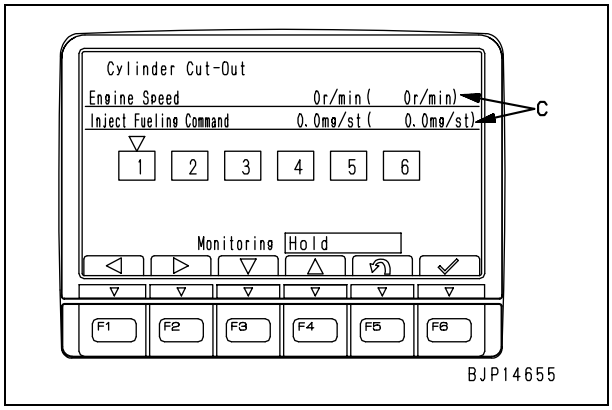
2. Selecting cylinder to be disabled
   After the "Cylinder Cut-Out" screen is displayed, select a cylinder to be Cut-Out with the function switches.
   - [F1]: Move selection mark (▽) to left
   - [F2]: Move selection mark (▽) to right
   - [F3]: Reset holding
   - [F4]: Hold
   - [F5]: Return to service menu screen
   - [F6]: Confirm selection

   ★ This operation may be performed while the engine is running.
   ★ When [F6] is pressed, if background (a) of the selected cylinder No. becomes white, the cylinder is Cut-Out.
   ★ If the machine monitor Cut-Out a cylinder but the engine controller cannot Cut-Out that cylinder, the background of the cylinder No. becomes yellow.
   ★ If the machine monitor resets a Cut-Out cylinder but the engine controller cannot reset that Cut-Out cylinder, the background of the cylinder No. becomes red.
   ★ One or more cylinders can be Cut-Out.
   ★ In the cylinder Cut-Out operation, the auto-deceleration function can be selected. If the auto-deceleration is turned ON, auto-deceleration monitor (b) is displayed.



3. Resetting Cut-Out cylinder
   When changing a cylinder to be Cut-Out or when Cylinder Cut-Out operation is finished, select a Cut-Out cylinder to be reset with the function switches.
   ★ This operation may be performed while the engine is running.
   ★ When [F6] is pressed, if background (a) of the selected cylinder No. becomes blue, the cylinder is reset.
   ★ The Cut-Out operation is not automatically reset after the screen returns to the operator mode. Accordingly, be sure to perform the resetting operation after the cylinder cut-out operation is finished.

4. Function of holding displayed information
   If [F4] is pressed during the cylinder Cut-Out operation, the displayed information is newly held (c) (The real-time information is kept displayed on the left side).
   While the information is held, if [F3] is pressed, the holding function is reset.
   ★ The holding function is effective, regardless of setting of the reduced cylinder mode operation.



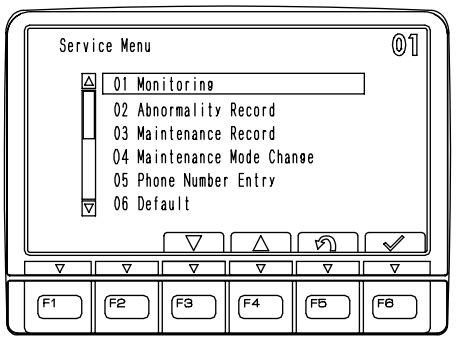
[Reference]

- If a normally operating cylinder is Cut-Out, the following phenomena occur.
  1) Lowering of engine speed
  2) Increase of final injection rate command (quantity)
- If the engine is running near the high idle, however, the engine speed may not lower for the reason of engine control.
- In this case, lower the engine speed with the fuel control dial and judge by increase of the injection rate command.

No injection cranking

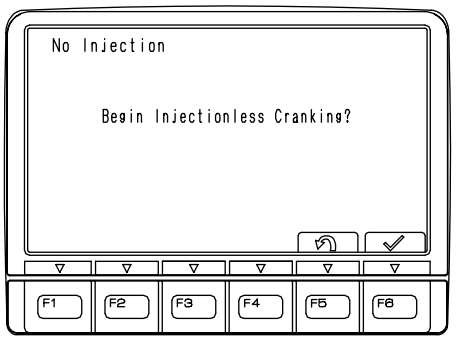
If the engine is operated after long storage of the machine, it may be worn or damaged because of insufficient lubrication with oil. To prevent this, the function to lubricate the engine before starting it by cranking it without injecting fuel is installed.
Set the no-injection cranking while the engine is stopped.

1. Selecting menu
   Select "No injection" on the service menu screen.

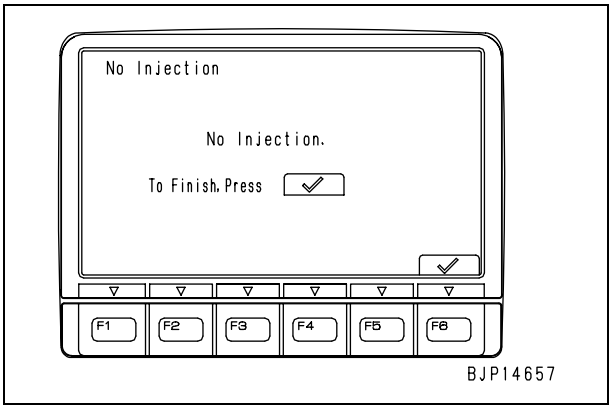


2. Displaying check screen
   If the "No injection" screen is displayed, the machine monitor asks the operator if no injection cranking should be performed. Answer with the function switch.
   - [F5]: Do not perform (Return to Service menu screen)
   - [F6]: Perform

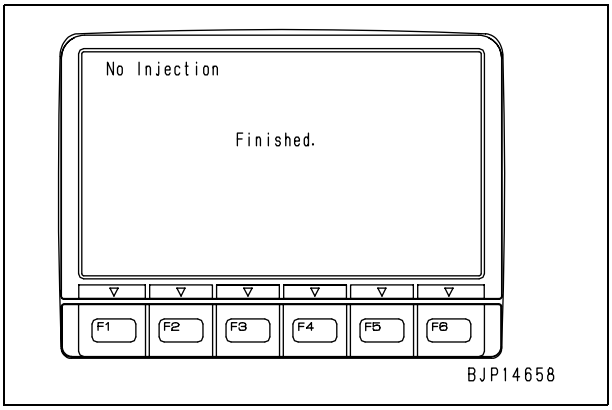
   ★ While the screen is changing to the following screen, the screen of "Communication between controllers is being checked" is displayed.



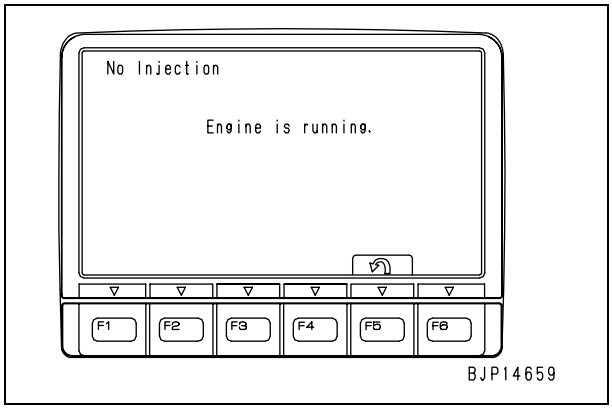
3. Starting no injection cranking
   If no injection cranking (Fuel injection in no cylinders) becomes effective, that is displayed on the screen. Under this condition, crank the engine with the starting motor.
   ★ While the screen is changing to the following screen, the screen of "Setting is being prepared" is displayed.
   ★ Limit the cranking time to 20 seconds to protect the starting motor.



4. Finishing no injection cranking
   After completing the no injection cranking operation, press [F6], and finish of no injection cranking is displayed and the screen returns to the Service menu screen automatically.



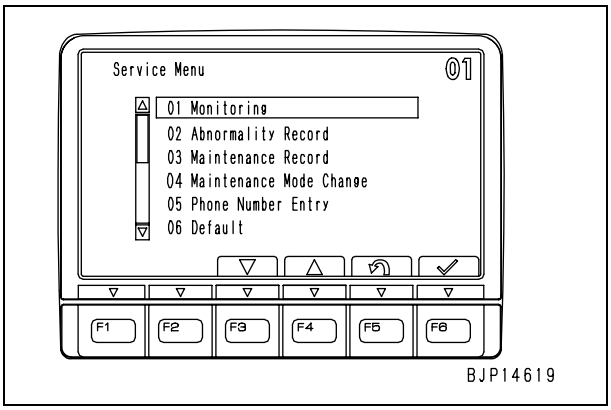
5. Prohibiting no injection cranking
   If the operator tries to perform the no injection cranking while the engine is running, the message that the engine is running is displayed and the no injection cranking is not set effective.
   ★ This function can be selected even while the engine is running. If the no injection cranking is performed, however, the message of "Engine is running" is displayed on the screen.



Display of fuel consumption

This function calculates the hourly fuel consumption from the actual fuel consumption in a measuring period and indicates it.

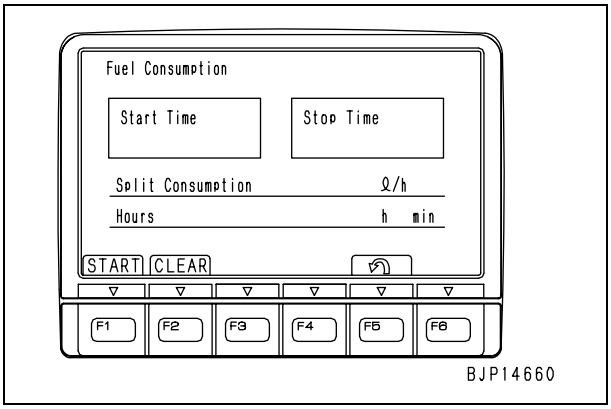
1. Selecting menu
   Select "Fuel consumption" on the service menu screen.



2. Starting measurement
   After the screen of Fuel consumption is displayed, start measurement with the function switches.
   - [F1]: Start
   - [F2]: Clear
   - [F5]: Return to Service menu screen

   ★ When the screen of Fuel consumption is displayed, if a data is indicated, it is the data of the previous measurement. This data is not an obstacle to new measurement and can be reset by pressing [F2].

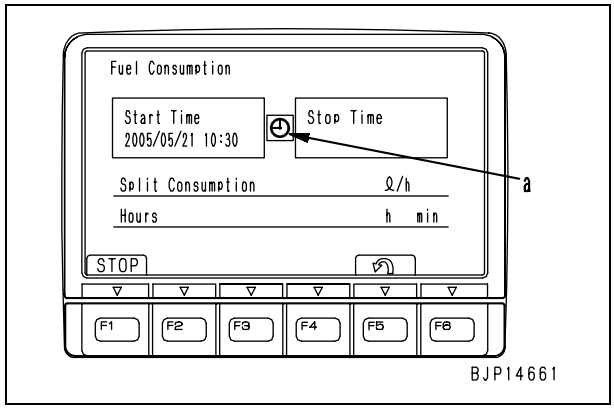
   ★ If [F1] is pressed, the data is displayed on the starting date and time side and measurement starts.



   ★ The display unit of the fuel changes according to the unit set with the default (unit setting) function.
   SI and meter: ℓ/h
   inch: gal/h

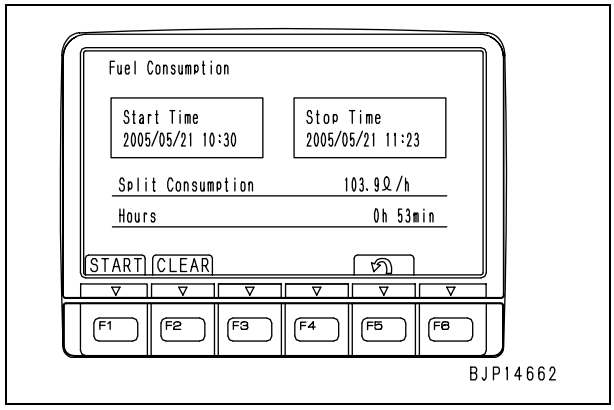
3. Display and function during measurement
   Clock mark (a) flashes during measurement.

   ★ While the fuel consumption is being measured, the operator can work with the operator mode and other functions. Measurement is not finished until this screen is displayed again and [F1] is pressed (Even if the starting switch is turned OFF, this function is kept effective, although fuel consumption is measured only while the engine is running).



4. Finishing measurement
   Press [F1], and measurement is finished and the data are displayed on the finishing date and time side.

5. Displaying fuel consumption
   If the measurement is finished, the hourly fuel consumption calculated from the fuel consumption calculated by the engine controller and the elapsed time are displayed.

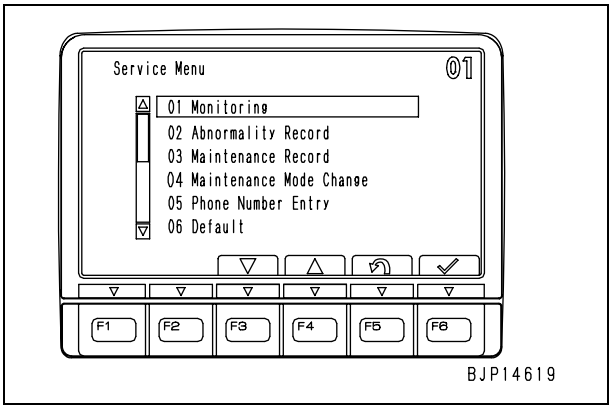


Display of KOMTRAX (Terminal status)

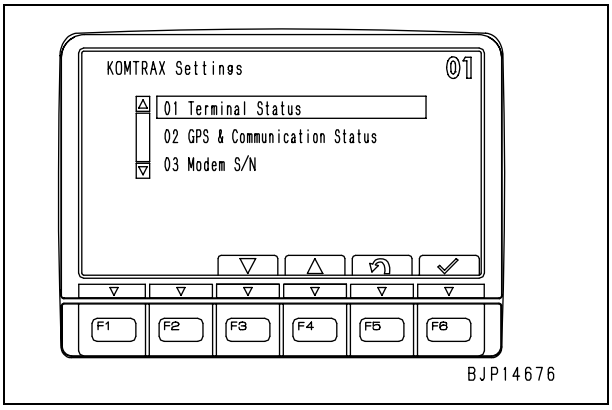
The setting condition and operating condition of KOMTRAX can be checked with Display of KOMTRAX setting.

Setting condition of terminal is used to check the setting condition of the KOMTRAX terminal.

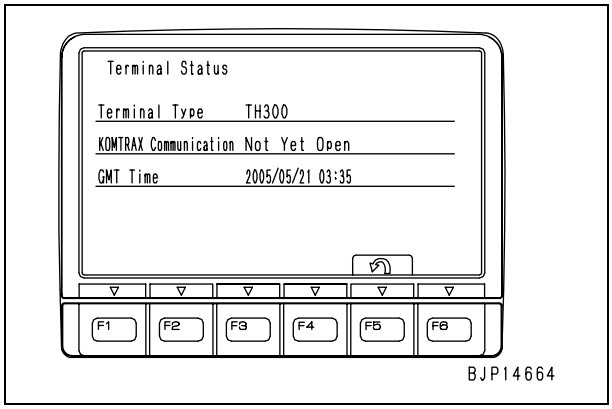
1. Selecting menu
   Select "KOMTRAX Settings" on the service menu screen.



2. Selecting sub menu
   After the KOMTRAX settings screen is displayed, select "Terminal Status" with the function switches or numeral input switches.
   - ★ Select this item similarly to an item on the Service menu screen.
   - ★ The following figure shows the display when Model TH300 KOMTRAX is installed. When TH200 is installed, "03 IP Adress" is displayed.



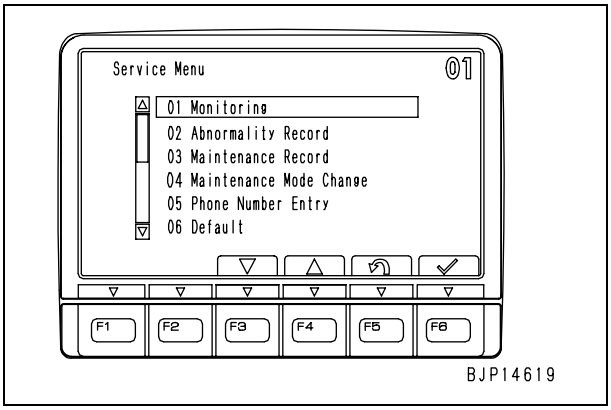
3. Contents of display of terminal status
   On the Terminal status screen, the following items are displayed.
   - Terminal type: Model name of KOMTRAX communication MODEM
   - KOMTRAX communication: Executing condition of station opening inspection
   - GMT time: Greenwich Meant Time
   - [F5]: Return to KOMTRAX settings screen



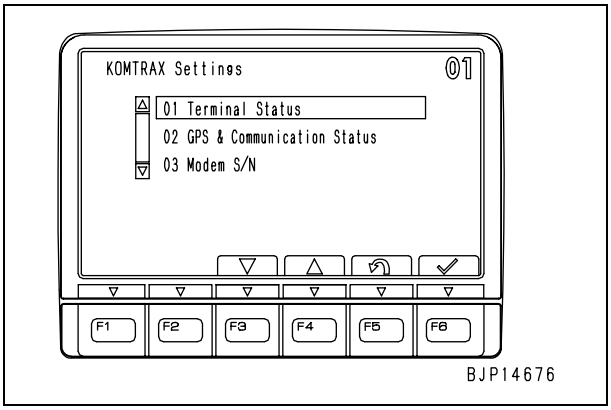
Display of KOMTRAX (GPS & communication status)

The setting condition and operating condition of KOMTRAX can be checked with "KOMTRAX Settings".
GPS & communication status is used to check the condition of positioning and communication of the KOMTRAX terminal.

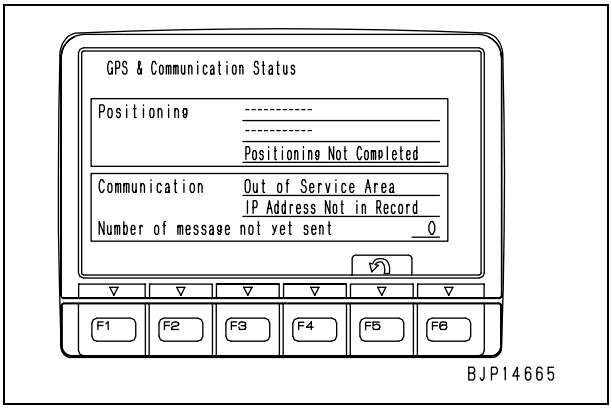
1. Selecting menu
   Select "KOMTRAX Settings" on the service menu screen.



2. Selecting sub menu
   After the KOMTRAX settings screen is displayed, select GPS & communication status with the function switches or numeral input switches.
   ★ Select this item similarly to an item on the Service menu screen.
   ★ The following figure shows the display when Model TH300 KOMTRAX is installed. When TH200 is installed, "03 IP Adress" is displayed.



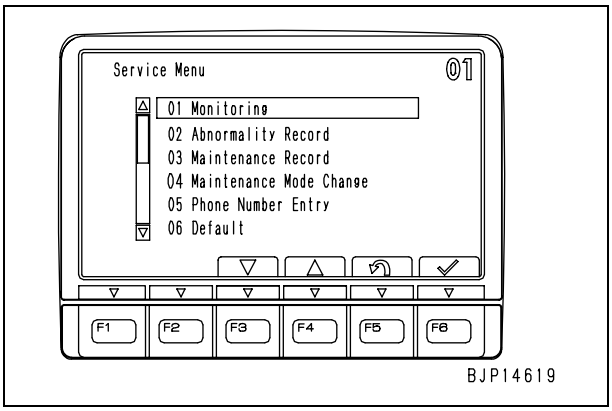
3. Contents of display of GPS & communication status
   On the screen of GPS & communication status, the following items are displayed.
   - Positioning: Positioning condition of GPS
   - Communication: Communication environment of communication MODEM and connecting condition of communication MODEM
   - Number of message not yet sent: Number of mails which are saved in machine monitor and not transmitted yet
   - [F5]: Return to KOMTRAX settings screen



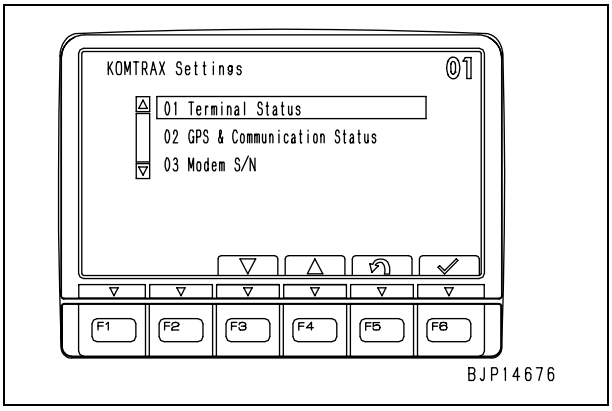
Display of KOMTRAX (MODEM S/N: Model TH300)

The setting condition and operating condition of KOMTRAX can be checked with Display of KOMTRAX setting.
MODEM S/N is used to check the serial No. of the KOMTRAX communication MODEM.

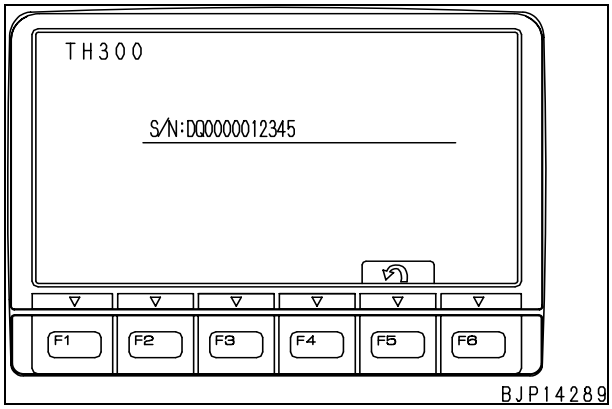
1. Selecting menu
   Select "KOMTRAX Settings" on the service menu screen.



2. Selecting sub menu
   After the KOMTRAX settings screen is displayed, select "Modem S/N" with the function switches or numeral input switches.
   ★ Select this item similarly to an item on the Service menu screen.



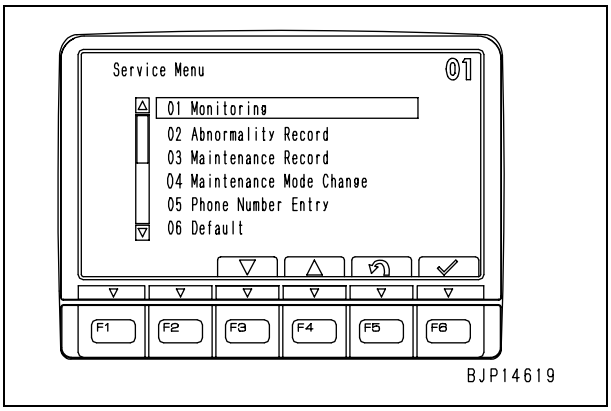
3. Contents of display of Modem S/N
   The serial No. of TH300 Modem is displayed.
   - [F5]: Return to KOMTRAX settings screen



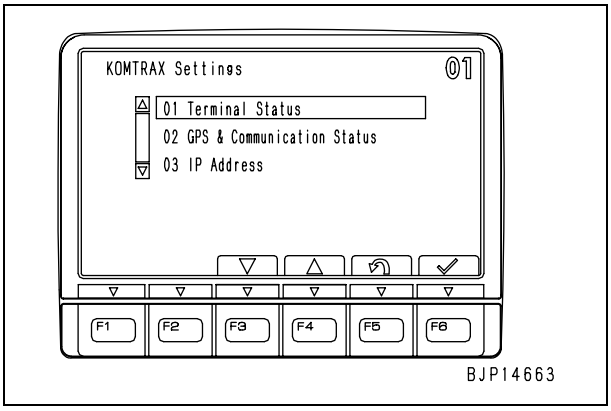
Display of KOMTRAX (IP address: Model TH200)

The setting condition and operating condition of KOMTRAX can be checked with Display of KOMTRAX settings.
IP address is used to check the IP address of the KOMTRAX communication MODEM.

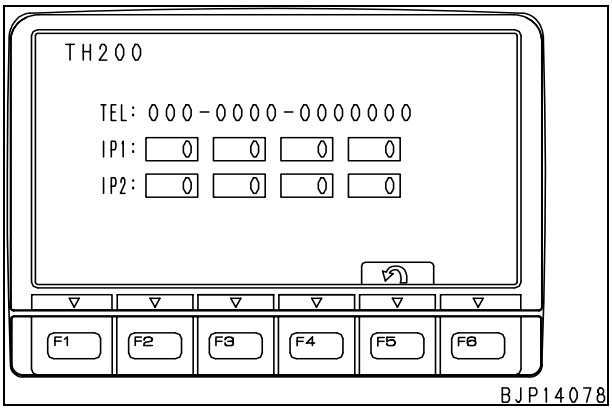
1. Selecting menu
   Select "KOMTRAX Settings" on the service menu screen.



2. Selecting sub menu
   After the KOMTRAX settings screen is displayed, select "IP Address" with the function switches or numeral input switches.
   ★ Select this item similarly to an item on the Service menu screen.



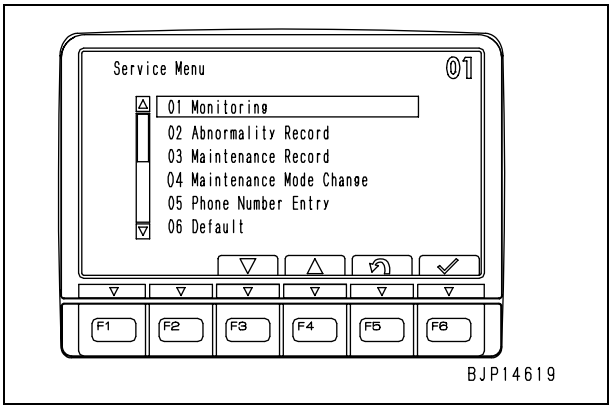
3. Contents of display of IP address
   The telephone No. and IP address (2 systems) of TH200 MODEM are displayed.
   - [F5]: Return to KOMTRAX setting screen
   ★ The IP address is a No. specific to each MODEM which is required when communication is made between the MODEM and the server.



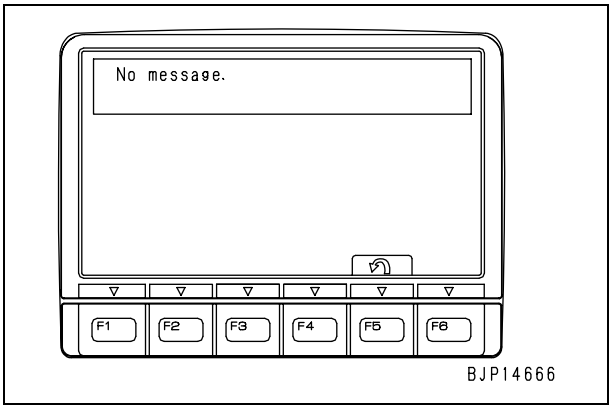
Display of KOMTRAX message

Special messages for the serviceman sent from the KOMTRAX base station (a distributor, etc.) can be checked with this function.
If there is setting in a message, a return mail can be sent by using numeral input switches.

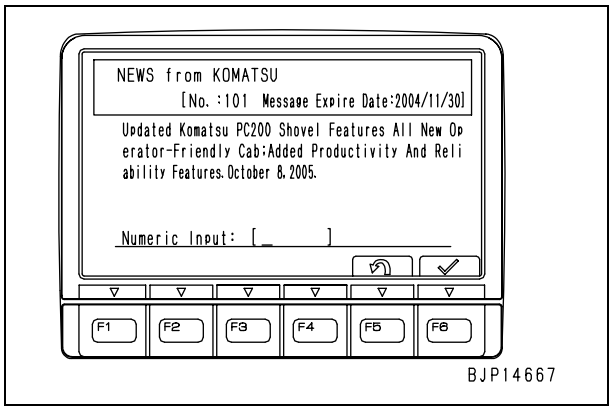
1. Operation to display menu
   Select "Service message" on the service menu screen.



2. Display of message (Read-only)
   If there is a message, its contents are displayed. If there is not a message, "No message" is displayed.
   - [F5]: Return to service menu screen
   - ★ This message is different from a message transmitted to the operator in the operator mode.
   - ★ Since this message is special for the serviceman, the message monitor is not displayed when it is received as in the operator mode.



3. Display of message (with return mail function)
   If a box to enter a value with the numeral keys is displayed under the message, enter a proper number with the numeral input switches and function switches and confirm it, and the information is returned to the KOMTRAX base station.
   - [F5]: Return to service menu screen
   - [F6]: Confirm and return input value
   - ★ This message is different from a message transmitted to the operator in the operator mode.
   - ★ Since this message is special for the serviceman, the message monitor is not displayed when it is received as in the operator mode.



PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00229-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

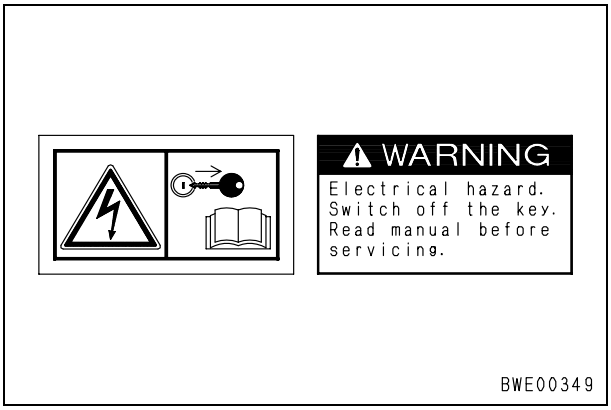
Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

30 Testing and adjusting

Testing and adjusting, Part 3

Testing and adjusting, Part 3

Handling high-voltage circuit of engine controller



⚠ **The engine controller uses a high-voltage circuit (max. 65 V) to drive the injector. Accordingly, the high-voltage circuit is connected to the wiring harnesses and connectors between the engine controller and injector.**

★ Normally, the engine controller keeps outputting the high voltage to the injector only while the engine is running and stops outputting when the engine stops.

⚠ **If you touch the high-voltage circuit directly, you may get an electric shock. To avoid this, observe the following precautions when testing.**

1. The following connectors are used in the high-voltage circuit.
   - Engine controller connector: **CE01**
   - Injector intermediate connectors:
     INJ CYL 1 and 2, INJ CYL 3 and 4, INJ CYL 4 and 5
   - Injector head terminal (in head cover)

2. When disconnecting or connecting a connector related to the high-voltage circuit, be sure to turn the starting switch OFF.

3. If a T-adapter is inserted in or connected to a connector related to the high-voltage circuit for troubleshooting, do not start the engine.
   ★ You may turn the starting switch to the OFF or ON position but must not turn it to the START position.

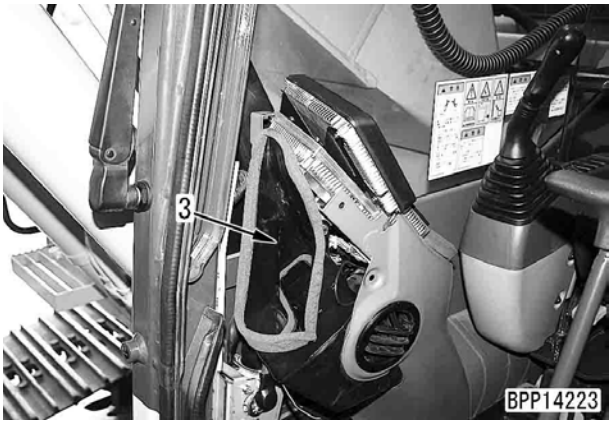
Preparation work for troubleshooting of electrical system

★ When carrying out troubleshooting of an electric circuit related to the machine monitor, engine controller, pump controller, or KOMTRAX communication MODEM, expose the related connectors according to the following procedure.
★ Disconnect and connect the connectors having special locking mechanisms according to the procedure shown below.

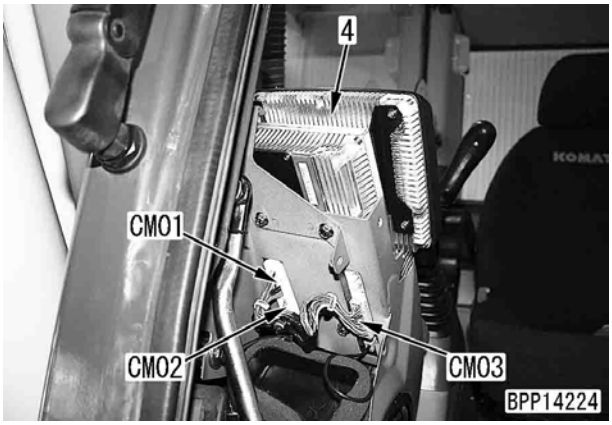
1. Machine monitor

1) Remove mounting bolts (2) and cover (1).
   ★ One of the mounting bolts is installed in the cover on the right of the daylight sensor.
   ★ While removing the mounting bolts, disconnect connector **P31** of the daylight sensor.
2) Remove cover (1).
   ★ The cover is fixed with clips. Remove it by pull it up.
   ★ While removing the cover, disconnect connector **M04** of the cigarette lighter.

3) Remove 1 mounting bolt and duct (3).

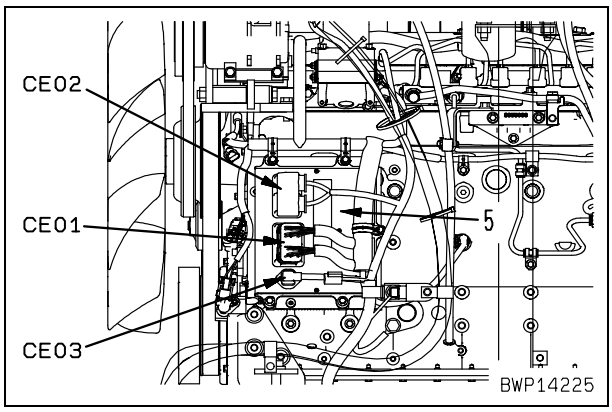


4) Insert or connect troubleshooting T-adapters in or to connectors **CM01**, **CM02**, and **CM03** of machine monitor (4).
   ★ Connectors **CM02** and **CM03** are of the same type. When returning them, check the mark plates of the mounting brackets and take care not to make a wrong connection.



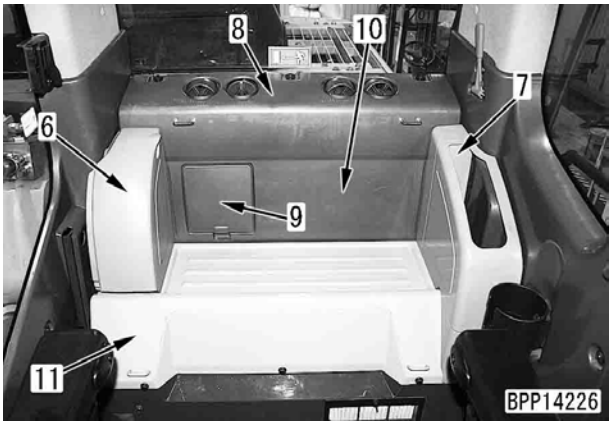
2. Engine controller

1) Open the engine hood.
   ★ The engine controller is mounted on the engine (on the counterweight side).
2) Insert or connect troubleshooting T-adapters in or to connectors **CE01**, **CE02**, and **CE03** of engine controller (5).
   ★ Connectors **CE01** and **CE02** are fixed with screws. When disconnecting them, loosen the screws.
   ★ When returning connectors **CE01** and **CE02**, tighten the screws to the specified torque.
   Screw: **3 ± 1 Nm {0.3 ± 0.1 kgm}**

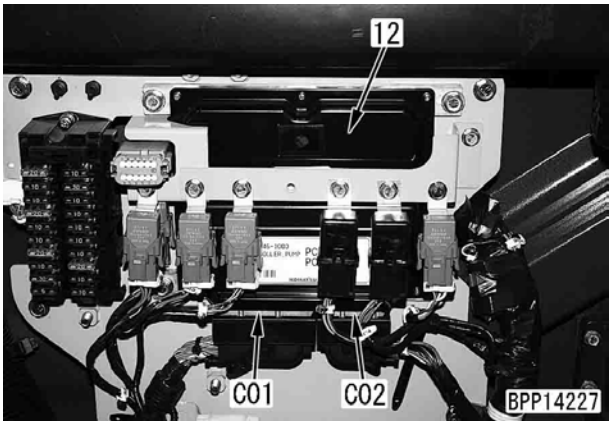


3. Pump controller

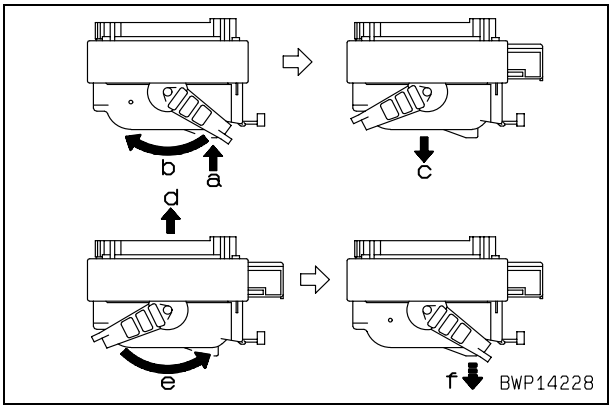
1) Slide the operator's seat and seat stand to the forward end.
2) Remove the 5 mounting bolts and cool & hot box (6).
   ★ While removing the cool & hot box, disconnect the drain hose.
3) Remove the 2 mounting bolts, 1 fastener, and magazine box (7).
4) Remove the 3 mounting bolts and cover (8).
5) Remove fuse box cover (9) and cover (10).
   ★ Since the underside of cover (10) is clamped, pull it up.
6) Remove the 7 mounting bolts and cover (11).



7) Connect the troubleshooting adapters to connectors **C01** and **C02** of pump controller (12).
   ★ Install the adapters to only the wiring harness side.

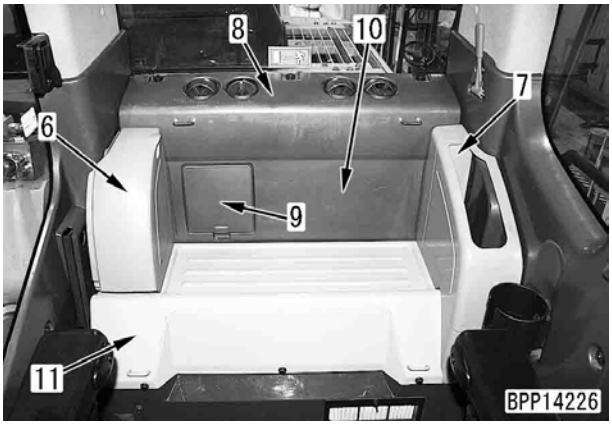


★ The connectors of the pump controller have a special locking mechanism. Disconnect them according to steps (a) – (c) and connect them according to steps (d) – (f) as shown below.
Disconnection: (a) Unlock – (b) Slide lever – (c) Disconnect connector.
Connection: (d) Position connector – (e) Slide lever – (f) Lock.

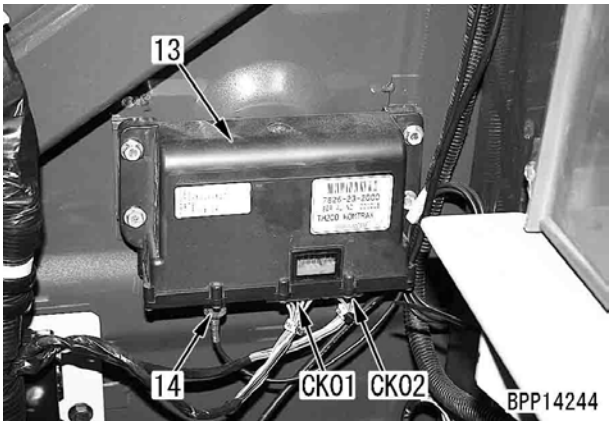


4. KOMTRAX communication module

1) Slide the operator's seat and seat stand to the forward end.
2) Remove the 5 mounting bolts and cool & hot box (6).
   ★ While removing the cool & hot box, disconnect the drain hose.
3) Remove the 2 mounting bolts, 1 fastener, and magazine box (7).
4) Remove the 3 mounting bolts and cover (8).
5) Remove fuse box cover (9) and cover (10).
   ★ Since the underside of cover (10) is clamped, pull it up.
6) Remove the 7 mounting bolts and cover (11).

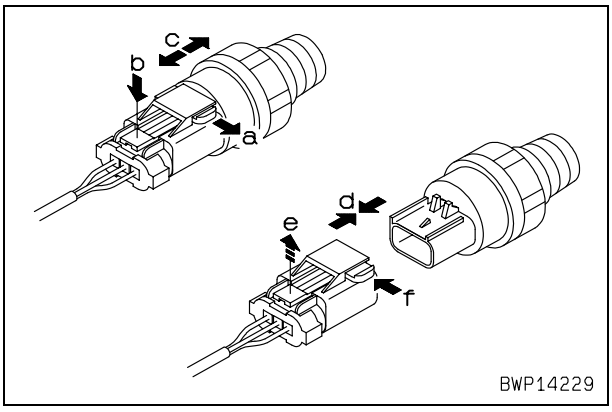


7) Connect troubleshooting T-adapters to connectors **CK01** and **CK02** of KOMTRAX communication module (13).
★ Cable (14) is for the communication antenna.



5. Atmospheric pressure sensor (AMBAIR PRESSURE)
Engine Ne speed sensor (CRANK SENSOR)
Engine Bkup speed sensor (CAM SENSOR)
Engine oil pressure switch (OIL PRESSURE SWITCH)

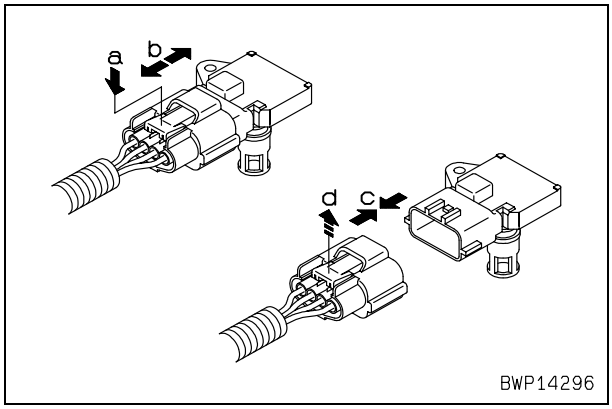
★ **Disconnection and connection of connectors**
The connectors of the atmospheric pressure sensor, engine Ne speed sensor, engine Bkup speed sensor, engine oil pressure switch have a special locking mechanism. Disconnect them according to steps (a) – (c) and connect them according to steps (d) – (f) as shown below.
Disconnection: (a) Slide lever – (b) Unlock – (c) Disconnect connector.
Connection: (d) Connect connector – (e) Lock – (f) Slide lever.



★ **Removal and installation of sensor**
A deep socket is necessary for removal and installation of the engine oil pressure switch. See "Tools for testing, adjusting, and troubleshooting".

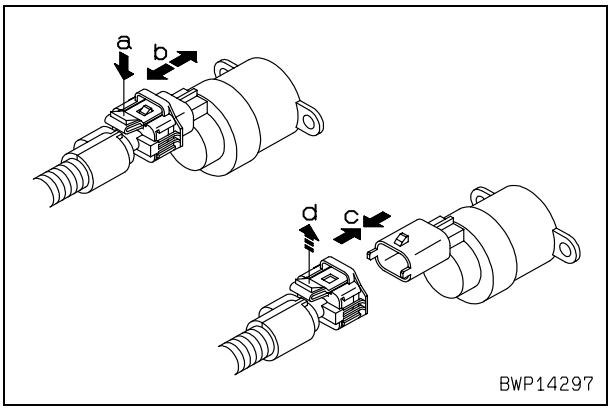
6. Boost pressure and temperature sensor (BOOST PRESS & IMT)

★ **Disconnection and connection of connector**
The connector of the boost pressure and temperature sensor has a special locking mechanism. Disconnect it according to steps (a) – (b) and connect it according to steps (c) – (d) as shown below.
Disconnection: (a) Unlock – (b) Disconnect connector.
Connection: (c) Connect connector – (d) Lock.

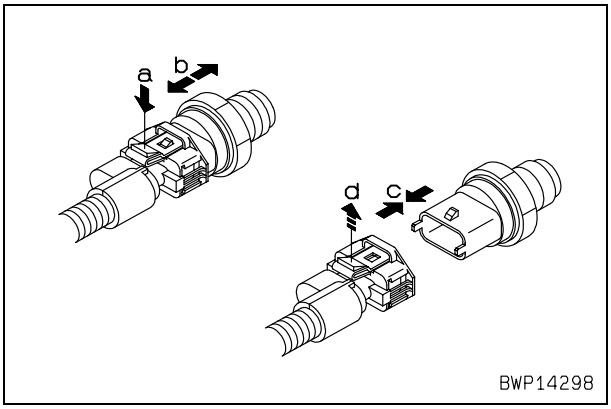


★ **Removal and installation of sensor**
A torque wrench is necessary for removal and installation of the boost pressure and temperature sensor. See "Tools for testing, adjusting, and troubleshooting".

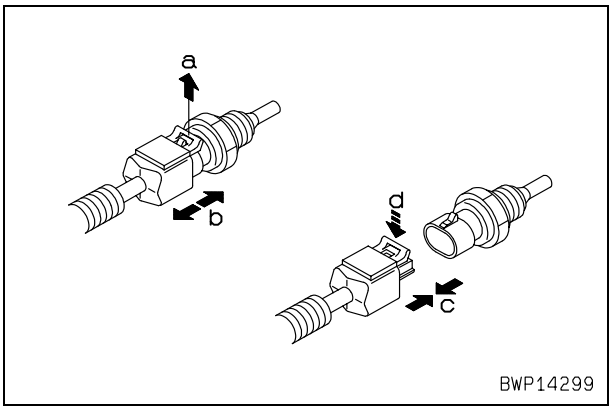
7. **Supply pump IMV solenoid (FUEL REGULATOR)**
   - ★ **Disconnection and connection of connector**
     The connector of the supply pump IMV solenoid has a special locking mechanism. Disconnect it according to steps (a) – (b) and connect it according to steps (c) – (d) as shown below.
     Disconnection: (a) Unlock – (b) Disconnect connector.
     Connection: (c) Connect connector – (d) Lock.



8. **Common rail pressure sensor (FUEL RAIL PRESS)**
   - ★ **Disconnection and connection of connector**
     The connector of the common rail pressure sensor has a special locking mechanism. Disconnect it according to steps (a) – (b) and connect it according to steps (c) – (d) as shown below.
     Disconnection: (a) Unlock – (b) Disconnect connector.
     Connection: (c) Connect connector – (d) Lock.



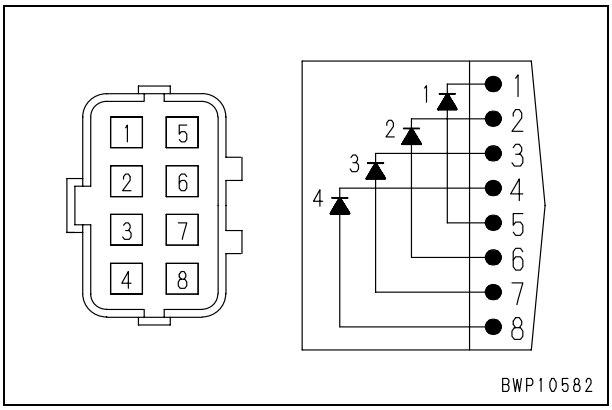
9. **Engine coolant temperature sensor (COOLANT TEMP)**
   - ★ **Disconnection and connection of connector**
     The connector of the engine coolant temperature sensor has a special locking mechanism. Disconnect it according to steps (a) – (b) and connect it according to steps (c) – (d) as shown below.
     Disconnection: (a) Unlock – (b) Disconnect connector.
     Connection: (c) Connect connector – (d) Lock.



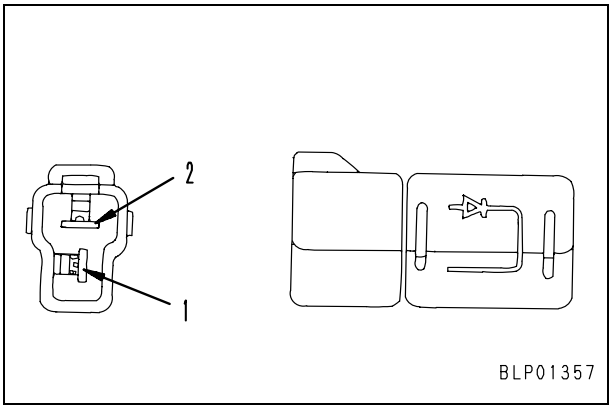
   - ★ **Removal and installation of sensor**
     A deep socket is necessary for removal and installation of the engine coolant temperature sensor. See "Tools for testing, adjusting, and troubleshooting".

Procedure for testing diodes

★ Test the assembled-type diode (8-pin) and the single diode (2-pin) according to the following procedure.
★ The conductive directions of the assembled-type diode are as follows.



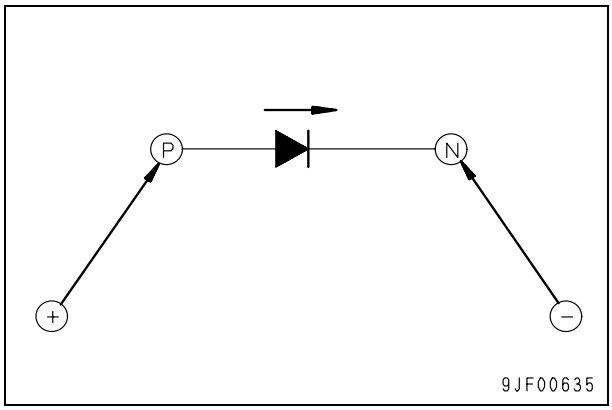
★ The conductive direction of the single diode is indicated on the surface of the diode.



1. When using digital circuit tester

1) Set the tester in the diode range and check the indicated value.
   ★ When an ordinary circuit tester is used, the voltage of the internal battery is indicated.
2) Apply the red (+) lead of the tester to the anode (P) side of the diode and apply the black (–) lead to the cathode (N) side and check the indicated value.
3) Judge the condition of the diode by the indicated value.
   - The indicated value does not change: The diode does not have conductivity (Defective).
     The indicated value changes: The diode has conductivity (Normal).

   Note: In the case of a silicon diode, a value in the range from 460 to 600 is indicated.



2. When using analog circuit tester

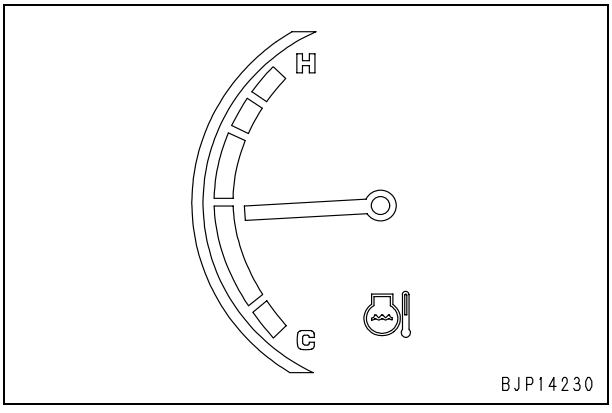
1) Set the tester in the resistance range.
2) Apply the leads of the tester as explained below and check the movement of the pointer.
   i) Apply the red (+) lead of the tester to the anode (P) side of the diode and apply the black (–) lead to the cathode (N) side.
   ii) Apply the red (+) lead of the tester to the cathode (N) side of the diode and apply the black (–) lead to the anode (P) side.
3) Judge the condition of the diode by the movement of the pointer.
   - The pointer does not move in i) but moves in ii): The diode is normal (The moving range (resistance) depends on the type and selected range of the tester, however).
   - The pointer moves in both i) and ii): The diode is defective (Internal short circuit).
   - The pointer moves in neither of i) and ii): The diode is defective (Internal disconnection).

Pm Clinic service

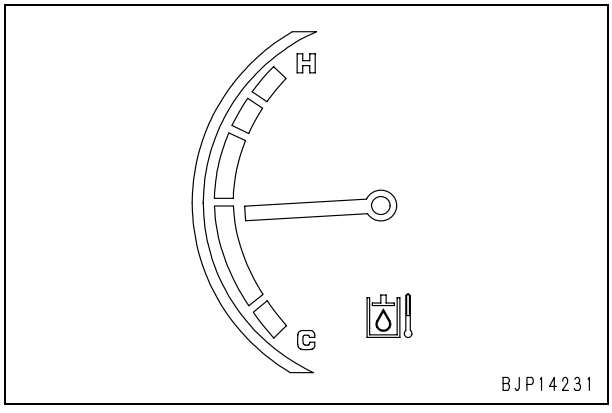
Model name	Serial No.	Service meter
□ PC210/LC/NLC-8 □ PC230NHD-8		h
User's name	Date of execution	Inspector
	/ /	
Specifications		
Main components	Attachments	Shoe width
Boom □ Standard □ ( ) Arm □ Standard □ ( ) Bucket □ Standard □ ( )	□ Breaker □ ( ) □ ( )	□ 600 mm □ 700 mm □ ( )
Check of oil/coolant level		
□ Radiator coolant □ Engine oil □ Hydraulic oil	When necessary □ Damper case oil □ Final drive case oil	□ Machinery case oil □ ( )
Ambient temperature	Altitude	
°C	m	
Operator's opinion		
Result of visual inspection		

Mechanical equipment system fault history				Electrical equipment system fault history			
989EKX	times/1st time	h/last	h		times/1st time	h/last	h
AA10NX	times/1st time	h/last	h		times/1st time	h/last	h
AB00KE	times/1st time	h/last	h		times/1st time	h/last	h
B@BAZG	times/1st time	h/last	h		times/1st time	h/last	h
B@BAZK	times/1st time	h/last	h		times/1st time	h/last	h
B@BCNS	times/1st time	h/last	h		times/1st time	h/last	h
B@BCZK	times/1st time	h/last	h		times/1st time	h/last	h
B@HANS	times/1st time	h/last	h		times/1st time	h/last	h
CA234	times/1st time	h/last	h		times/1st time	h/last	h

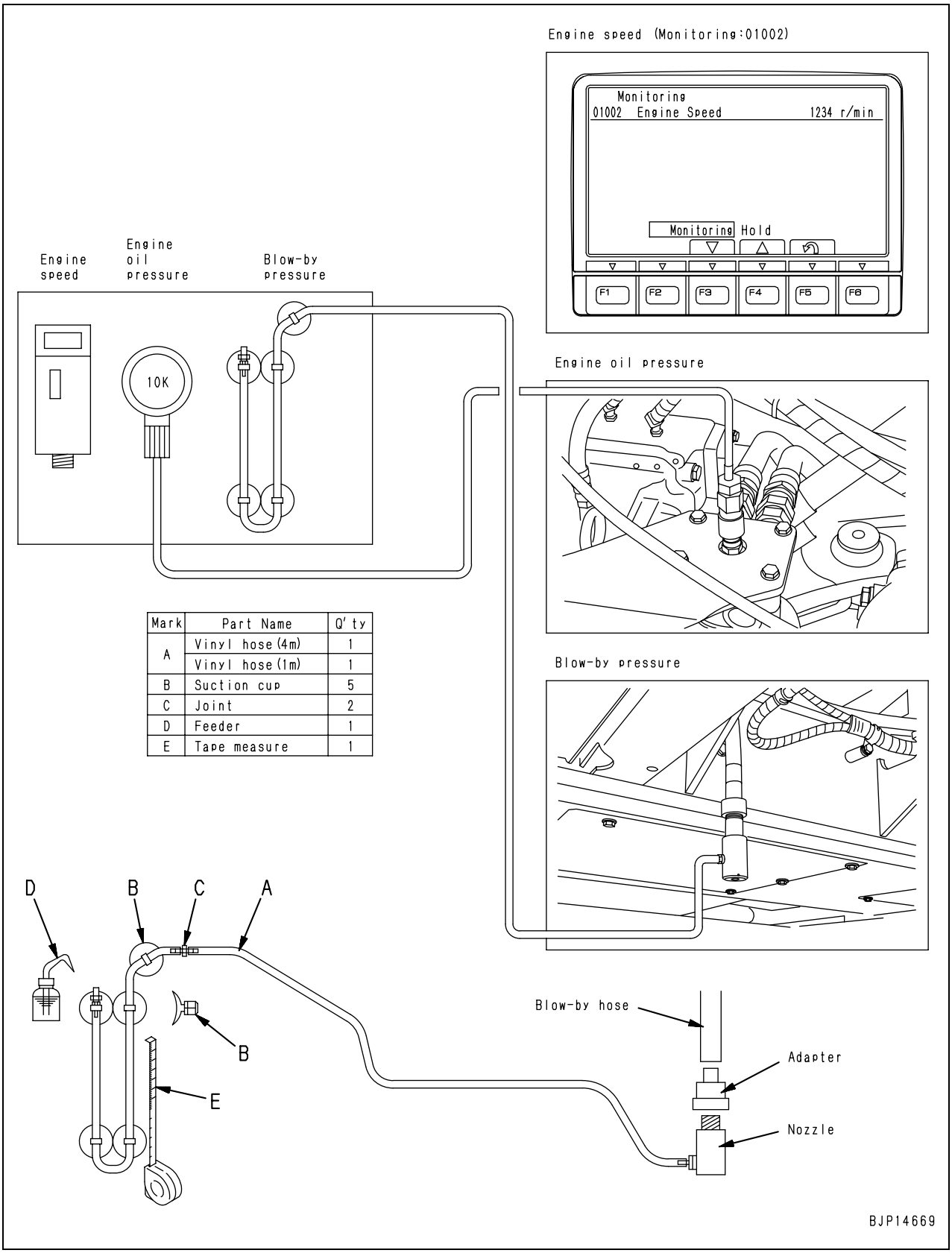
Max. range of engine coolant temperature gauge



Max. range of hydraulic oil temperature gauge

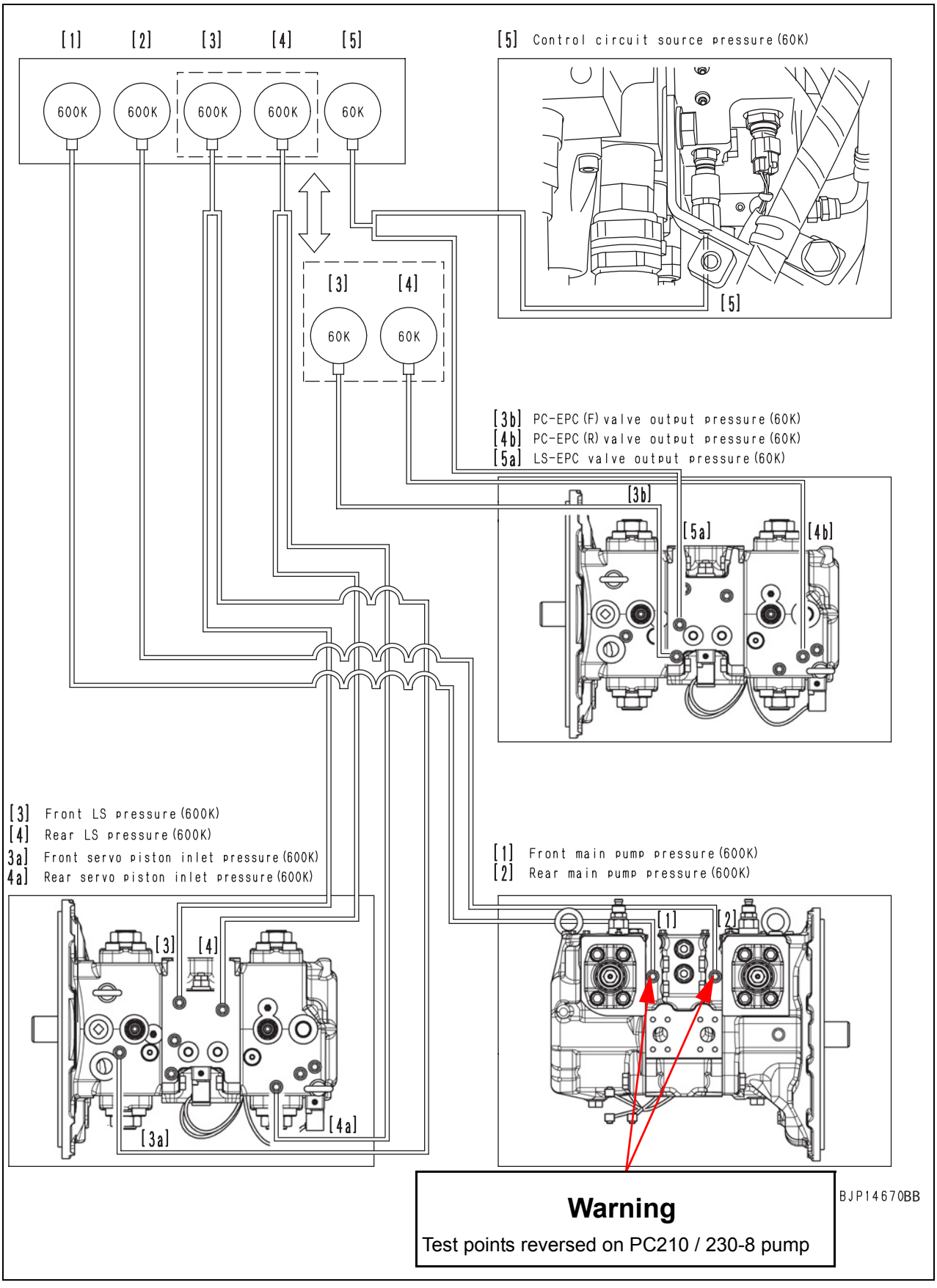


Items related to engine



Mark	Part Name	Q'ty
A	Vinyl hose (4m)	1
	Vinyl hose (1m)	1
B	Suction cup	5
C	Joint	2
D	Feeder	1
E	Tape measure	1

Items related to oil pressure



Check sheet (PC210/LC/NLC-8/PC230NHD-8)

Model	Serial No.	Service meter	User's name	Date of execution	Inspector
				/ /	

1. Engine

No.	Check item	Checking condition					Unit	Standard value for new machine	Service limit value	Measured value	Good	Bad
		Fuel control dial	Working mode	Auto-deceleration	Left knob switch	Operation of work equipment						
1	Engine speed	MAX	P	OFF	OFF	All levers in neutral	rpm	1,990 – 2,130	1,990 – 2,130			
2	Engine oil pressure						MPa {kg/cm^2}	Min. 0.29 {Min. 3.0}	0.25 {2.5}			
3	Engine speed	MIN				All levers in neutral	rpm	1,000 – 1,100	1,000 – 1,100			
4	Engine oil pressure						MPa {kg/cm^2}	Min. 0.10 {Min. 1.0}	0.07 {0.7}			
5	Engine speed	MAX			ON	Arm IN relief	rpm	1,850 – 2,050	1,850 – 2,050			
6	Blow-by pressure						kPa {mmH$_2$O}	Max. 0.98 {Max. 100}	1.96 {200}			
7	Engine oil pressure			ON	OFF	All levers in neutral	rpm	1,300 – 1,500	1,300 – 1,500			

2. Work equipment speed

No.	Check item	Checking condition					Unit	Standard value for new machine	Service limit value	Measured value	Good	Bad
		Fuel control dial	Working mode	Checking posture, etc.								
1	Boom RAISE	MAX	P	Work equipment extended fully			sec	2.9 – 3.7	Max. 4.7			
2	Arm IN		P	Boom top horizontal			sec	3.1 – 3.9	Max. 4.5			
			E				sec	3.2 – 4.0	Max. 4.6			
			L				sec	6.0 – 7.4	Max. 7.7			
3	Arm OUT		P				sec	2.4 – 3.0	Max. 3.5			
4	Bucket CURL			Boom top horizontal Arm cylinder retracted fully			sec	2.3 – 2.9	Max. 3.3			
5	Swing (5 turns)			Work equipment extended fully Swing right and left			sec	21.7 – 26.7	Max. 30			
6	Travel (5 idle turns)			One side of track pushed up and turned forward and backward	LO	STD	sec	46.2 – 56.4	46.2 – 60.4			
						LC/NLC		50.3 – 61.5	50.3 – 65.5			
						NHD		55.7 – 68.1	55.7 – 72.5			
					MI	STD	sec	33.7 – 41.3	33.7 – 45.3			
						LC/NLC		36.7 – 44.9	36.7 – 48.9			
						NHD		40.1 – 49.1	40.1 – 53.6			
					HI	STD	sec	25.2 – 27.8	25.2 – 29.8			
						LC/NLC		27.3 – 30.3	27.3 – 32.3			
						NHD		26.7 – 29.7	26.7 – 31.6			

3. Hydraulic drift of work equipment

No.	Check item	Checking condition			Unit	Standard value for new machine	Service limit value	Measured value	Good	Bad
		Fuel control dial	Working mode	Checking posture, etc.						
1	Hydraulic drift of bucket tip	Engine stopped		Boom top horizontal Arm cylinder retracted fully Bucket loaded	mm/ 15 min	Max. 600	Max. 900			

4. Hydraulic circuit

No.	Checked part	Checking condition				[1]	[2]	[3]	[4]	[5]	Good	Bad
						600K	600K	600K	600K	60K		
		Fuel control dial	Working mode	Left knob switch	Operation of work equipment	F pump main	R pump main	F pump LS	R pump LS	Control		
1	Self pressure reducing valve	MAX	P	OFF	All lever in neutral	—	—	—	—	A		
2	Main relief valve (Low pressure)				Arm out relief	B	B	B	B	—		
3	Main relief valve (Low pressure)			ON		C	C	C	C	—		
4	Unload valve			OFF	All levers in neutral	D1	D1	D2	D2	—		
5	LS valve				Right track driven idle Lever moved halfway	E1	—	E2	—	—		
					Left track driven idle Lever moved halfway	—	E1	—	E2	—		
6	Swing motor safety valve				Swing lock Right swing relief	F	F	—	—	—		
					Swing lock Left swing relief	F	F	—	—	—		
7	Main relief valve Travel motor Safety valve Travel junction valve				Right travel lock Right forward relief	G	—	—	—	—		
					Right travel lock Right reverse relief	G	—	—	—	—		
					Left travel lock Left forward relief	—	G	—	—	—		
					Left travel lock Left reverse relief	—	G	—	—	—		

Standard value	Checked oil pressure	Unit	Standard value for new machine	Service limit value
	A (Control circuit basic pressure)	MPa {kg/cm^2}	2.93 – 3.43 {30 – 35}	2.74 – 3.43 {28 – 35}
	B (Work equipment relief pressure, low)		33.8 – 35.8 {345 – 365}	33.3 – 36.8 {340 – 375}
	C (Work equipment relief pressure, high)		36.3 – 38.3 {370 – 380}	36.3 – 39.2 {370 – 400}
	D (Unload pressure)		D1 – D2 = 2.5 – 4.5 {26 – 46}	D1 – D2 = 2.5 – 4.5 {26 – 46}
	E (LS differential pressure)		E1 – E2 = 1.7 – 1.9 {17 – 19}	E1 – E2 = 1.7 – 1.9 {17 – 19}
	F (Swing relief pressure)		28.8 – 31.8 {295 – 325}	28.4 – 32.3 {290 – 330}
	G (Travel relief pressure)		36.7 – 39.7 {375 – 405}	36.8 – 40.2 {375 – 410}

*** Gauge changing work: Change hoses of gauges [3] and [4].**

No.	Check item	Checking condition				[1]	[2]	[3a]	[4a]	[5]	Good	Bad
						600K	600K	600K	600K	60K		
		Fuel control dial	Working mode	Left knob switch	Operation of work equipment	F pump main	R pump main	F pump servo	R pump servo	Control		
8	Servo piston	MAX	P	OFF	Arm out relief	H1	H1	H2	H2	—		

Standard value	Checked oil pressure	Unit	Standard value for new machine	Service limit value
	H (Servo control pressure)	—	H1 : H2 = 1 : 0.6 (Oil pressure ratio)	

*** Gauge changing work: Change [3] and [4] to 60K and change hoses of [3], [4], and [5].**

No.	Check item	Checking condition				[1]	[2]	[3b]	[4b]	[5a]	Good	Bad
						600K	600K	60K	60K	60K		
		Fuel control dial	Working mode	Left knob switch	Operation of work equipment	F pump main	R pump main	F pump (F)	R pump (R)	LS-EPC		
9	PC-EPC (F) valve PC-EPC (R) valve	MIN	P	OFF	All levers in neutral	—	—	J1	J1	—		
		MAX	P			—	—	J2	J2	—		
			E			—	—	J3	J3	—		
			L			—	—	J4	J4	—		
			B			—	—	J5	J5	—		
10	LS-EPC valve		P		Travel speed: Lo Travel lever in neutral	—	—	—	—	K1		
					Travel speed: Mi Travel lever operated	—	—	—	—	K2		
					Travel speed: Hi Travel lever operated	—	—	—	—	K3		

Standard value	Checked oil pressure	Unit	Standard value for new machine	Service limit value
	J1 (PC-EPC valve output pressure 1)	MPa {kg/cm^2}	Approx. 2.9 {Approx. 30}	
	J2 (PC-EPC valve output pressure 2)		Approx. 0.7 {Approx. 7}	
	J3 (PC-EPC valve output pressure 3)		Approx. 0.78 {Approx. 8}	
	J4 (PC-EPC valve output pressure 4)		Approx. 1.7 {Approx. 17.5}	
	J5 (PC-EPC valve output pressure 5)		Approx. 1.57 {Approx. 16}	
	K1 (LS-EPC valve output pressure 1)		Approx. 2.45 {Approx. 25}	
	K2 (LS-EPC valve output pressure 2)		Approx. 0.74 {Approx. 7.5}	
	K3 (LS-EPC valve output pressure 3)		0 {0}	

Pm Clinic service

Model name	Serial No.	Service meter
□ PC240LC/NLC-8		h
User's name	Date of execution	Inspector
	/ /	

Specifications		
Main components	Attachments	Shoe width
Boom □ Standard □ ( ) Arm □ Standard □ ( ) Bucket □ Standard □ ( )	□ Breaker □ ( ) □ ( )	□ 600 mm □ 700 mm □ ( )

Check of oil/coolant level		
□ Radiator coolant □ Engine oil □ Hydraulic oil	When necessary □ Damper case oil □ Final drive case oil	□ Machinery case oil □ ( )

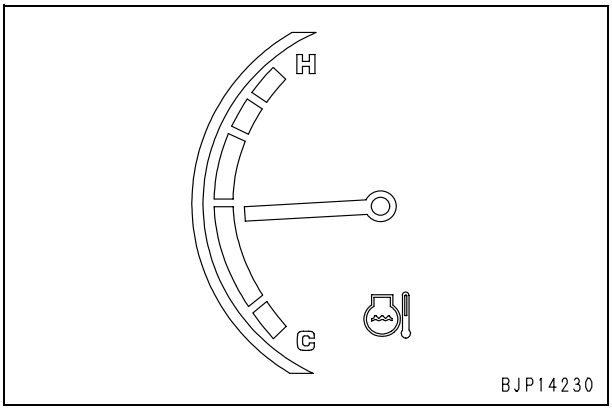
Ambient temperature	Altitude
°C	m

Operator's opinion

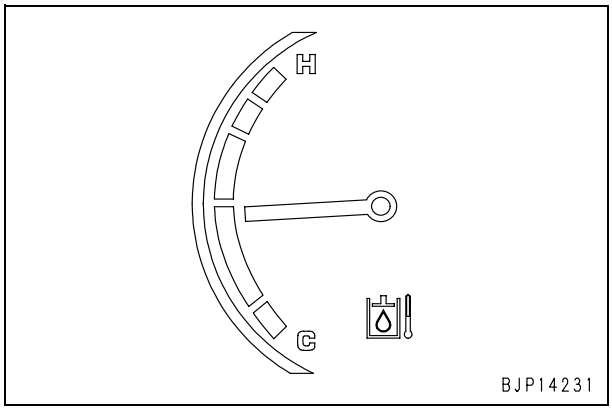
Result of visual inspection

Mechanical equipment system fault history				Electrical equipment system fault history			
989EKX	times/1st time	h/last	h		times/1st time	h/last	h
AA10NX	times/1st time	h/last	h		times/1st time	h/last	h
AB00KE	times/1st time	h/last	h		times/1st time	h/last	h
B@BAZG	times/1st time	h/last	h		times/1st time	h/last	h
B@BAZK	times/1st time	h/last	h		times/1st time	h/last	h
B@BCNS	times/1st time	h/last	h		times/1st time	h/last	h
B@BCZK	times/1st time	h/last	h		times/1st time	h/last	h
B@HANS	times/1st time	h/last	h		times/1st time	h/last	h
CA234	times/1st time	h/last	h		times/1st time	h/last	h

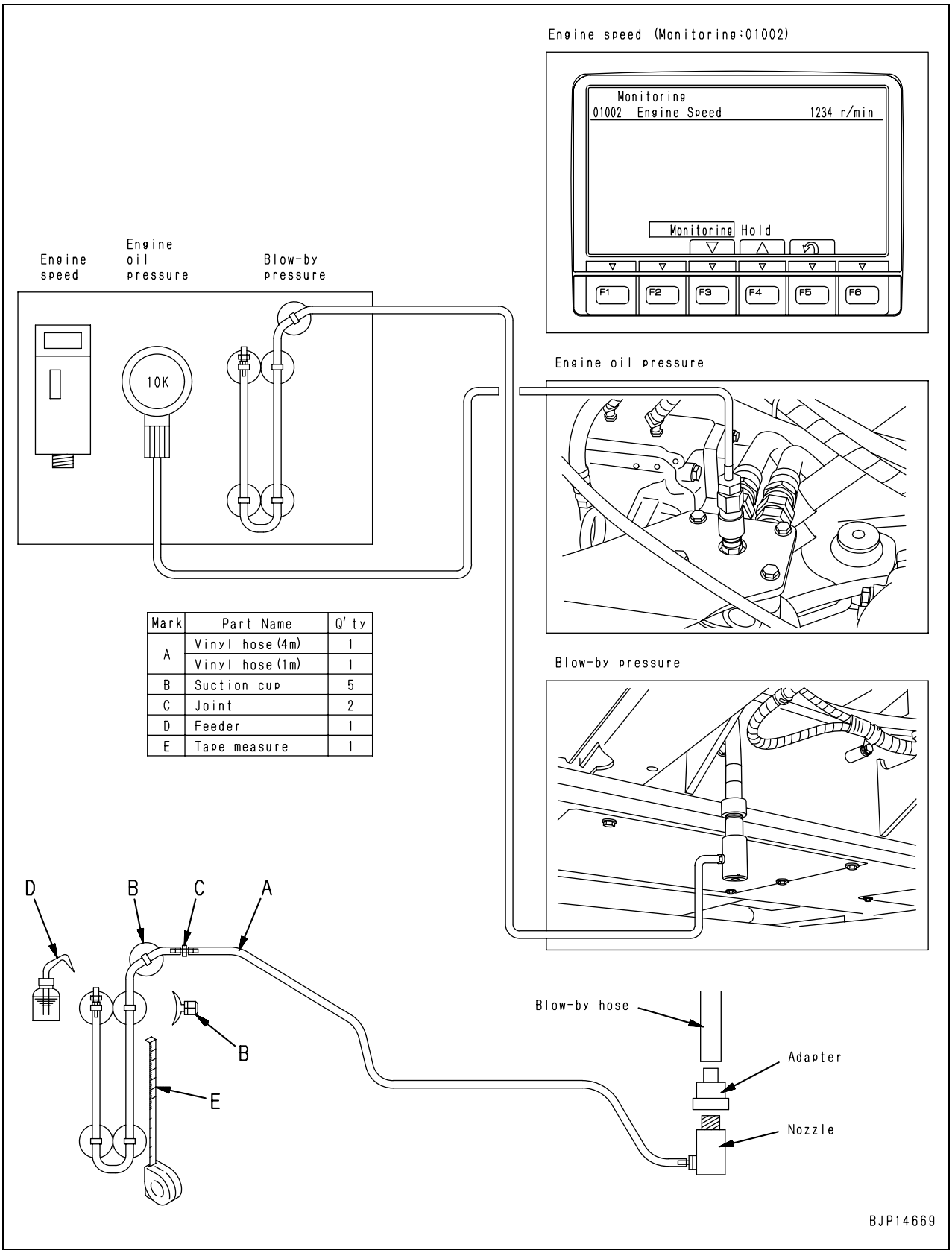
Max. range of engine coolant temperature gauge



Max. range of hydraulic oil temperature gauge

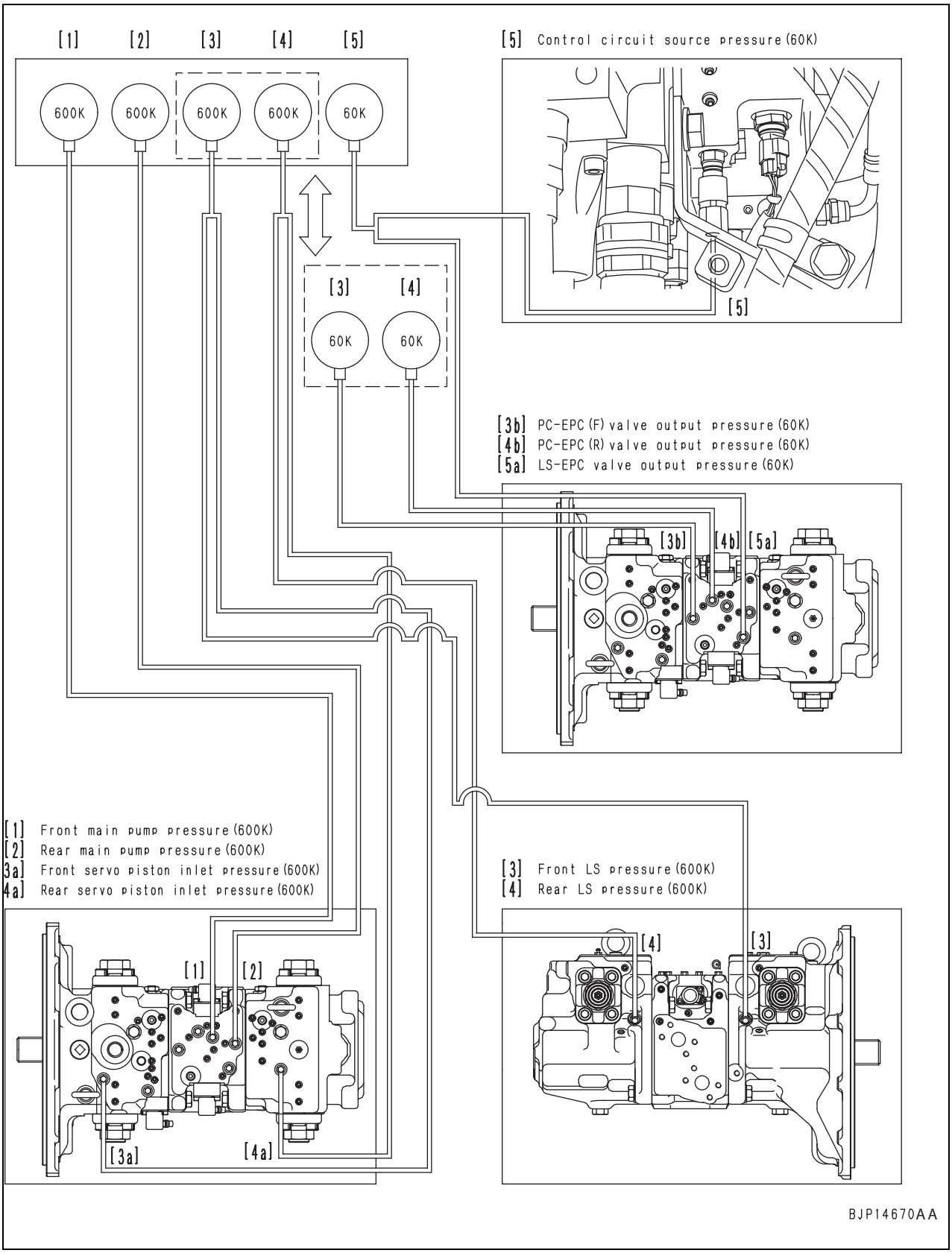


Items related to engine



Mark	Part Name	Q'ty
A	Vinyl hose (4m)	1
	Vinyl hose (1m)	1
B	Suction cup	5
C	Joint	2
D	Feeder	1
E	Tape measure	1

Items related to engine



Check sheet (PC240LC/NLC-8)

Model	Serial No.	Service meter	User's name	Date of execution	Inspector
				/ /	

1. Engine

No.	Check item	Checking condition					Unit	Standard value for new machine	Service limit value	Measured value	Good	Bad
		Fuel control dial	Working mode	Auto-deceleration	Left knob switch	Operation of work equipment						
1	Engine speed	MAX	P	OFF	OFF	All levers in neutral	rpm	2,090 – 2,230	2,090 – 2,230			
2	Engine oil pressure						MPa {kg/cm^2}	Min. 0.29 {Min. 3.0}	0.25 {2.5}			
3	Engine speed	MIN				All levers in neutral	rpm	1,000 – 1,100	1,000 – 1,100			
4	Engine oil pressure						MPa {kg/cm^2}	Min. 0.10 {Min. 1.0}	0.07 {0.7}			
5	Engine speed	MAX			ON	Arm IN relief	rpm	1,850 – 2,050	1,850 – 2,050			
6	Blow-by pressure						kPa {mmH2O}	Max. 0.98 {Max. 100}	1.96 {200}			
7	Engine oil pressure			ON	OFF	All levers in neutral	rpm	1,300 – 1,500	1,300 – 1,500			

2. Work equipment speed

No.	Check item	Checking condition					Unit	Standard value for new machine	Service limit value	Measured value	Good	Bad
		Fuel control dial	Working mode	Checking posture, etc.								
1	Boom RAISE	MAX	P	Work equipment extended fully			sec	3.1 – 3.9	Max. 4.9			
2	Arm IN		P	Boom top horizontal			sec	3.6 – 4.4	Max. 4.7			
			E				sec	3.8 – 4.6	Max. 4.9			
			L				sec	7.0 – 8.6	Max. 9.0			
3	Arm OUT		P				sec	2.7 – 3.3	Max. 3.5			
								2.8 – 3.4	Max. 3.5			
4	Bucket CURL			Boom top horizontal Arm cylinder retracted fully			sec	2.4 – 3.0	Max. 3.3			
5	Swing (5 turns)			Work equipment extended fully Swing right and left			sec	22.9 – 28.5	Max. 31			
6	Travel (5 idle turns)			One side of track pushed up and turned forward and backward	LO	LC	sec	52.8 – 64.6	52.8 – 68.6			
						NLC						
					MI	LC	sec	38.6 – 46.9	38.6 – 51.2			
						NLC						
					HI	LC	sec	28.9 – 31.9	28.9 – 33.9			
						NLC						

3. Hydraulic drift of work equipment

No.	Check item	Checking condition			Unit	Standard value for new machine	Service limit value	Measured value	Good	Bad
		Fuel control dial	Working mode	Checking posture, etc.						
1	Hydraulic drift of bucket tip	Engine stopped		Boom top horizontal Arm cylinder retracted fully Bucket loaded	mm/ 15 min	Max. 600	Max. 900			

4. Hydraulic circuit

No.	Checked part	Checking condition				[1]	[2]	[3]	[4]	[5]	Good	Bad
						600K	600K	600K	600K	60K		
		Fuel control dial	Working mode	Left knob switch	Operation of work equipment	F pump main	R pump main	F pump LS	R pump LS	Control		
1	Self pressure reducing valve	MAX	P	OFF	All lever in neutral	—	—	—	—	A		
2	Main relief valve (Low pressure)				Arm out relief	B	B	B	B	—		
3	Main relief valve (Low pressure)			ON		C	C	C	C	—		
4	Unload valve			OFF	All levers in neutral	D1	D1	D2	D2	—		
5	LS valve				Right track driven idle Lever moved halfway	E1	—	E2	—	—		
					Left track driven idle Lever moved halfway	—	E1	—	E2	—		
6	Swing motor safety valve				Swing lock Right swing relief	F	F	—	—	—		
					Swing lock Left swing relief	F	F	—	—	—		
7	Main relief valve Travel motor Safety valve Travel junction valve				Right travel lock Right forward relief	G	—	—	—	—		
					Right travel lock Right reverse relief	G	—	—	—	—		
					Left travel lock Left forward relief	—	G	—	—	—		
					Left travel lock Left reverse relief	—	G	—	—	—		

Standard value	Checked oil pressure	Unit	Standard value for new machine	Service limit value
	A (Control circuit basic pressure)	MPa {kg/cm^2}	2.93 – 3.43 {30 – 35}	2.74 – 3.43 {28 – 35}
	B (Work equipment relief pressure, low)		33.8 – 35.8 {345 – 365}	33.3 – 36.8 {340 – 375}
	C (Work equipment relief pressure, high)		36.3 – 38.3 {370 – 380}	36.3 – 39.2 {370 – 400}
	D (Unload pressure)		D1 – D2 = 2.5 – 4.5 {26 – 46}	D1 – D2 = 2.5 – 4.5 {26 – 46}
	E (LS differential pressure)		E1 – E2 = 1.7 – 1.9 {17 – 19}	E1 – E2 = 1.7 – 1.9 {17 – 19}
	F (Swing relief pressure)		28.8 – 31.8 {295 – 325}	28.4 – 32.3 {290 – 330}
	G (Travel relief pressure)		36.7 – 39.7 {375 – 405}	36.8 – 40.2 {375 – 410}

*** Gauge changing work: Change hoses of gauges [3] and [4].**

No.	Check item	Checking condition				[1] 600K	[2] 600K	[3a] 600K	[4a] 600K	[5] 60K	Good	Bad
		Fuel control dial	Working mode	Left knob switch	Operation of work equipment	F pump main	R pump main	F pump servo	R pump servo	Control		
8	Servo piston	MAX	P	OFF	Arm out relief	H1	H1	H2	H2	—		

Standard value	Checked oil pressure	Unit	Standard value for new machine	Service limit value
	H (Servo control pressure)	—	H1 : H2 = 1 : 0.6 (Oil pressure ratio)	

*** Gauge changing work: Change [3] and [4] to 60K and change hoses of [3], [4], and [5].**

No.	Check item	Checking condition				[1] 600K	[2] 600K	[3b] 60K	[4b] 60K	[5a] 60K	Good	Bad
		Fuel control dial	Working mode	Left knob switch	Operation of work equipment	F pump main	R pump main	PC-EPC (F)	PC-EPC (R)	LS-EPC		
9	PC-EPC (F) valve PC-EPC (R) valve	MIN	P	OFF	All levers in neutral	—	—	J1	J1	—		
		MAX	P			—	—	J2	J2	—		
			E			—	—	J3	J3	—		
			L			—	—	J4	J4	—		
			B			—	—	J5	J5	—		
10	LS-EPC valve		P		Travel speed: Lo Travel lever in neutral	—	—	—	—	K1		
					Travel speed: Mi Travel lever operated	—	—	—	—	K2		
					Travel speed: Hi Travel lever operated	—	—	—	—	K3		

Standard value	Checked oil pressure	Unit	Standard value for new machine	Service limit value
	J1 (PC-EPC valve output pressure 1)	MPa {kg/cm^2}	Approx. 2.9 {Approx. 30}	
	J2 (PC-EPC valve output pressure 2)		Approx. 0.7 {Approx. 7}	
	J3 (PC-EPC valve output pressure 3)		Approx. 0.78 {Approx. 8}	
	J4 (PC-EPC valve output pressure 4)		2.01 {21}	
	J5 (PC-EPC valve output pressure 5)		Approx. 1.57 {Approx. 16}	
	K1 (LS-EPC valve output pressure 1)		Approx. 2.45 {Approx. 25}	
	K2 (LS-EPC valve output pressure 2)		Approx. 1.7 {Approx. 17.5}	
	K3 (LS-EPC valve output pressure 3)		0 {0}	

PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00230-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

40 Troubleshooting

General information on troubleshooting

General information on troubleshooting

Points to remember when troubleshooting

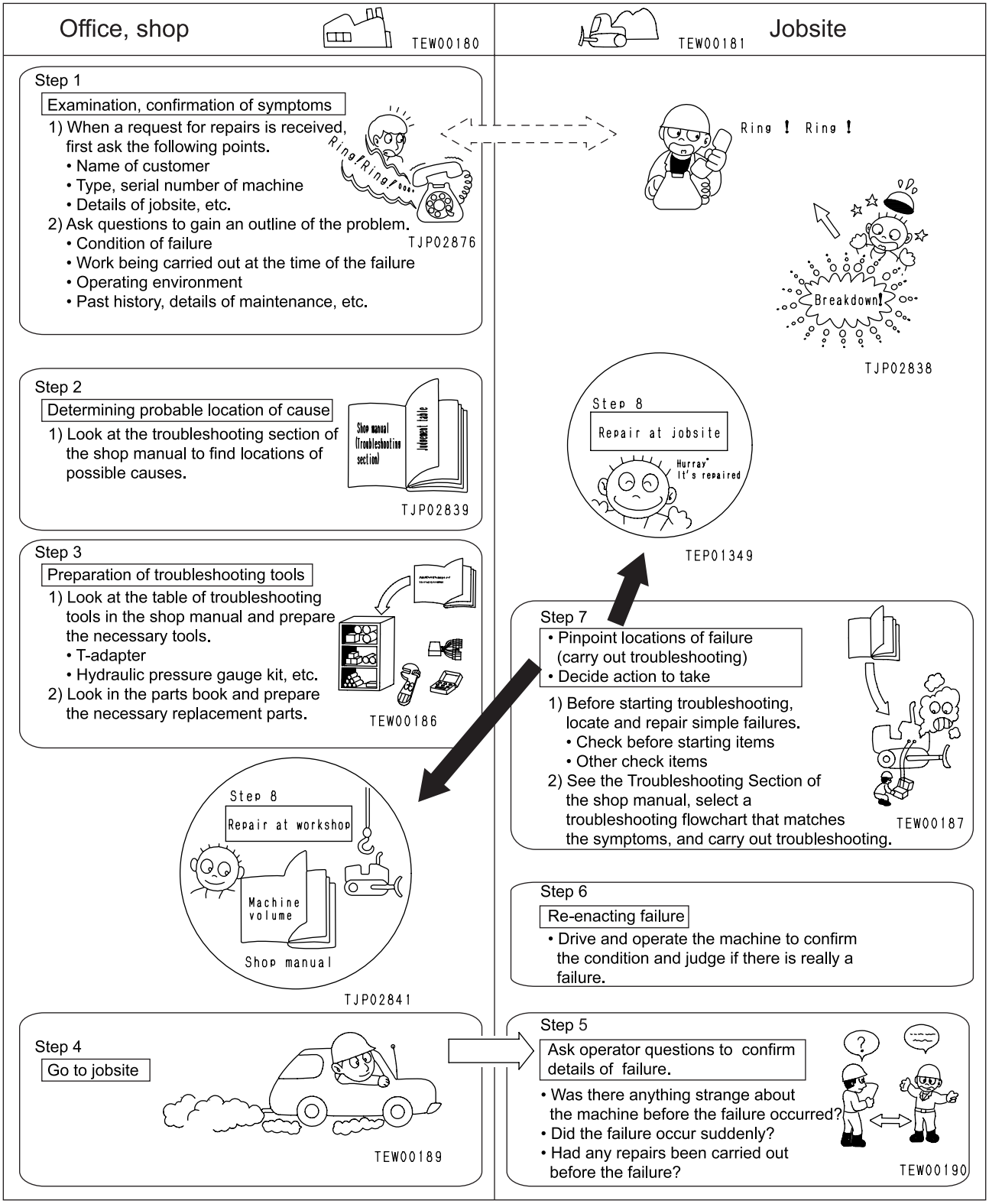
- ⚠ **Stop the machine in a level ground, and check that the lock pin, blocks, and parking brake are securely fitted.**
- ⚠ **When carrying out the operation with two or more workers, keep strictly to the agreed signals, and do not allow any unauthorized person to come near.**
- ⚠ **If the radiator cap 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



Check before troubleshooting

	Item	Criterion	Remedy
Lubricating oil/Coolant	1. Check of level and type of fuel	—	Add fuel
	2. Check of fuel for foreign matter	—	Clean and drain
	3. Check of hydraulic oil level	Between H – L	Add oil
	4. Check of hydraulic oil strainer	—	Clean and drain
	5. Check of swing machinery oil level	Between H – L	Add oil
	6. Check of level and type of engine oil (in oil pan)	Between H – L	Add oil
	7. Check of coolant level (in sub tank)	Between H – L	Add coolant
	8. Check of dust indicator for clogging	No red part	Clean or replace
	9. Check of hydraulic oil filter	—	Replace
Hydraulic/ Mechanical equipment	1. Check for abnormal noise/smell	—	Repair
	2. Check for oil leakage	—	Repair
	3. Bleeding air	—	Bleed air
Electric, electrical equipment	1. Check of battery terminals and wiring for looseness and corrosion	—	Retighten or replace
	2. Check of alternator terminals and wiring for looseness and corrosion	—	Retighten or replace
	3. Check of starting motor terminals and wiring for looseness and corrosion	—	Retighten or replace
	4. Check of battery voltage (with engine stopped)	20 – 30 V	Charge or replace
	5. Check of electrolyte level	Between H – L	Add or replace
	6. Check of wires for discoloration, burn, and removal of cover	—	Repair or replace
	7. Check for released wire clamp and drooping wire	—	Repair
	8. Check of wires for wetness (Check connectors and terminals for wetness, in particular)	—	Dry
	9. Check of fuse for disconnection and corrosion	—	Replace
	10. Check of alternator voltage (while engine speed is at middle or higher)	After operating for several minutes: 27.5 – 29.5 V	Replace
	11. Check of battery relay for operating sound (when starting switch is turned ON or OFF)	—	Replace

Classification and procedures for troubleshooting

Classification for troubleshooting

Mode	Contents
Display of code	Troubleshooting by failure code
E-mode	Troubleshooting of electrical system
H-mode	Troubleshooting of hydraulic and mechanical system
S-mode	Troubleshooting of engine

Procedure for troubleshooting

If a phenomenon looking like a trouble occurs in the machine, select a proper troubleshooting No. according to the following procedure, and then go to the corresponding troubleshooting section.

1. **Procedure for troubleshooting to be taken when user code and failure code are displayed on machine monitor:**
   If a user 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 error code or mechanical system error code is recorded in abnormality record:**
   If a user code and a failure code are not displayed on the machine monitor, check a mechanical system failure code and an electrical system failure code with the abnormality record function of the machine monitor.
   If a code is recorded, carry out troubleshooting for the corresponding "**Display of code**" according to the recorded 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.
   - ★ An error code of the mechanical system cannot be deleted.
   - ★ If a trouble is displayed in the air conditioner abnormality record or heater abnormality record by the abnormality record function, carry out the corresponding troubleshooting in **E-mode**.

3. **When user code and failure code is not displayed and no failure code is recorded in abnormality record:**
   If a user code and failure code are not displayed on the machine monitor and no failure code is recorded in the abnormality record, 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 trouble-shooting corresponding to that phenomenon in the "**E-mode**", "**H-mode**", or "**S-mode**".

Phenomena looking like troubles and troubleshooting Nos.

No.	Phenomena looking like troubles	Troubleshooting			
		Display of code	**E-mode**	**H-mode**	**S-mode**
Phenomena related to user code/failure code					
1	User code and failure code are displayed on ordinary screen of machine monitor	According to displayed code			
2	When abnormality record is checked, failure code is displayed in mechanical system abnormality record				
3	When abnormality record is checked, failure code is displayed in electrical system abnormality record				
4	When abnormality record is checked, failure code is displayed in air conditioner or heater abnormality record		E-23		
Phenomena related to engine					
5	Starting performance is poor				S-1
6	Engine does not start		E-3		S-2
7	Engine does not pick up smoothly				S-3
8	Engine stops during operations				S-4
9	Engine does not rotate smoothly				S-5
10	Engine lacks output (or lacks power)				S-6
11	Exhaust smoke is black (incomplete combustion)				S-7
12	Oil consumption is excessive (or exhaust smoke is blue)				S-8
13	Oil becomes contaminated quickly				S-9
14	Fuel consumption is excessive				S-10
15	Oil is in coolant (or coolant spurts back or coolant level goes down)				S-11
16	Oil pressure drops				S-12
17	Oil level rises (Entry of coolant/fuel)				S-13
18	Coolant temperature becomes too high (overheating)				S-14
19	Abnormal noise is made				S-15
20	Vibration is excessive				S-16
21	Preheater does not operate		E-4		
22	Automatic warm-up system does not operate (in cold season)		E-5		
23	Auto-decelerator does not operate normally		E-15	H-5	
Phenomena related to work equipment/swing/travel					
24	Work equipment, swing, and travel mechanism do not move or cannot be locked		E-6	H-3	
25	Speed or power of whole work equipment, swing, and travel is low			H-1	
26	Engine speed lowers extremely or engine stalls			H-2	S-6
27	Working mode does not change		E-16		
28	Abnormal sound comes out from around hydraulic pump			H-4	
29	Fine control performance or response is low			H-6	
Phenomena related to work equipment					
30	Speed or power of boom is low			H-7	
31	Speed or power of arm is low			H-8	
32	Speed or power of bucket is low			H-9	
33	Work equipment does not move singly			H-10	
34	Hydraulic drift of work equipment is large			H-11	

No.	Phenomena looking like troubles	Troubleshooting			
		Display of code	**E-mode**	**H-mode**	**S-mode**
35	Time lag of work equipment is large			H-12	
36	When part of work equipment is relieved singly, other parts of work equipment move			H-13	
37	Power maximizing function does not work		E20	H-14	
38	Attachment circuit is not changed (when attachment is installed)			H-29	
39	Oil flow in attachment circuit cannot be controlled (when attachment is installed)			H-30	
	Phenomena related to compound operation				
40	In compound operation of work equipment, speed of part loaded more is low			H-15	
41	When machine swings and raises boom simultaneously, boom rising speed is low			H-16	
42	When machine swings and travels simultaneously, travel speed lowers largely			H-17	
	Phenomena related to travel				
43	Machine deviates during travel			H-18	
44	Travel speed is low			H-19	
45	Machine is not steered well or steering power is low			H-20	
46	Travel speed does not change or travel speed is low/high		E-17	H-21	
47	Travel system does not move (only one side)			H-22	
48	Travel alarm does not sound or does not stop sounding		E-22		
	Phenomena related to swing				
49	Upper structure does not swing			H-23	
50	Swing acceleration or swing speed is low			H-24	
51	Upper structure overruns remarkably when it stops swinging			H-25	
52	Large shock is made when upper structure stops swinging			H-26	
53	Large sound is made when upper structure stops swinging			H-27	
54	Swing holding brake does not operate normally Hydraulic drift of swing is large		E-21	H-28	
	Phenomena related to machine monitor				
55	When starting switch turned ON, machine monitor displays nothing		E-1		
56	When starting switch turned ON (before starting engine), basic check item lights up		E-2		
57	Precaution lights up while engine is running		E-7		
58	Emergency stop item lights up while engine is running		E-8		
59	Engine coolant temperature gauge does not indicate normally		E-9		
60	Hydraulic oil temperature gauge does not indicate normally		E-10		
61	Fuel level gauge does not indicate normally		E-11		
62	Contents of display by machine monitor are different from applicable machine		E-12		
63	Machine monitor does not display some items		E-13		
64	Function switch does not work		E-14		
65	Alarm buzzer cannot be stopped		E-18		
66	Windshield wiper and window washer do not operate		E-19		
67	Air conditioner does not operate normally		E-23		
68	When starting switch is turned OFF, service meter is not displayed		E-24		

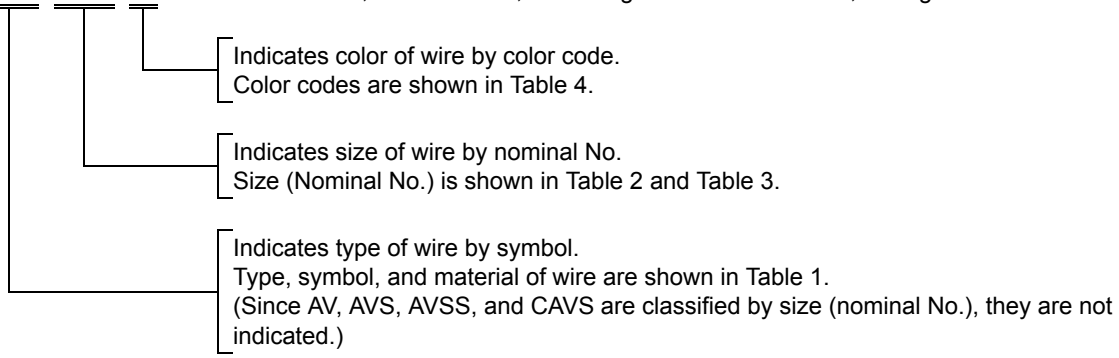
No.	Phenomena looking like troubles	Troubleshooting			
		Display of code	**E-mode**	**H-mode**	**S-mode**
69	Machine monitor cannot be set in service mode		E-25		
70	Monitoring function does not display lever control signal normally		E-26		
	Other phenomena				
71	KOMTRAX system does not operate normally		E-27		

How to read electric wire code

★ In this section, electric wire codes specific to PC210 and PC240 are explained.

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.

Example: AEX 0.85 L - - - Indicates blue, heat-resistant, low-voltage wire for automobile, having nominal No. of 0.85



1. Type, symbol, and material

AV, AVS, and AVSS 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, AVS, and AVSS in material of the cover. CAVS has circularly compressed conductor and is different from AV and AVS in outside diameter.

(Table 1)

Type	Symbol	Material		Using temperature range (°C)	Example of use for reference
Low-voltage wire for automobile	AV	Conductor	Annealed copper for electric appliance	–30 to +60	General wiring (Nominal No. 8 and above)
		Insulator	Soft polyvinyl chloride		
Thin-cover, low-voltage wire for automobile	AVS AVSS	Conductor	Annealed copper for electric appliance		AVS: General wiring (Nominal No. 3 – 5) AVSS: General wiring (Nominal No. 2)
		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		
Thin-cover, low-voltage, circularly compressed wire for automobile	CAVS	Conductor	Annealed copper for electric appliance	–30 to +60	General wiring (Nominal No. 0.5 – 1.25)
		Insulator	Soft polyvinyl chloride		

2. Dimensions

AVS, AV, AEX, AVSS

(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	—		—		—		—	—	3.5	3.6	4.4
	AV	Standard	—		—		—		—	—	—	—	—
	AEX	Standard	2.0		2.2		2.7		3.0	3.1	—	3.8	4.6
	AVSS	Standard	—		—		—		2.7	2.7	—	—	—

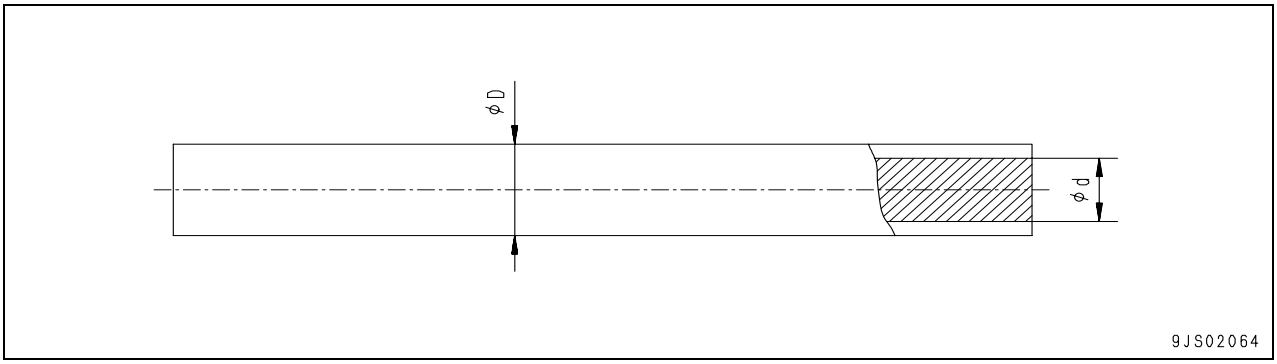
Nominal No.			8	15	20	30	40	50	60	85	100
Conductor		Number of strands/ Diameter of strand	50/0.45	84/0.45	41/0.80	70/0.80	85/0.80	108/0.80	127/0.80	169/0.80	217/0.80
		Sectional area (mm^2)	7.95	13.36	20.61	35.19	42.73	54.29	63.84	84.96	109.1
		d (Approx.)	3.7	4.8	6.0	8.0	8.6	9.8	10.4	12.0	13.6
Cover 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
	AVSS	Standard	—	—	—	—	—	—	—	—	—

CAVS

(Table 3)

Nominal No.			0.5	0.85	1.25
Conductor		Number of strands/ Diameter of strand	7/Compressed circularly	11/Compressed circularly	16/Compressed circularly
		Sectional area (mm^2)	0.56	0.88	1.29
		d (Approx.)	0.9	1.1	1.4
Cover D	CAVS	Standard	1.7	1.9	2.2

"f" of nominal No. denotes "flexible".



3. Color codes table

(Table 4)

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

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

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

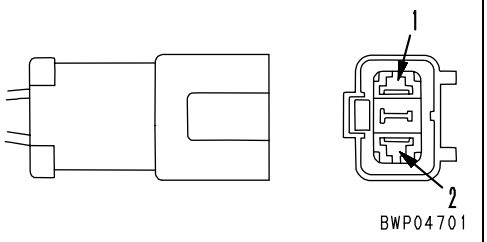
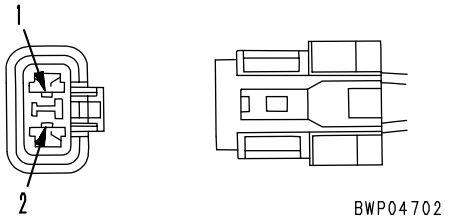
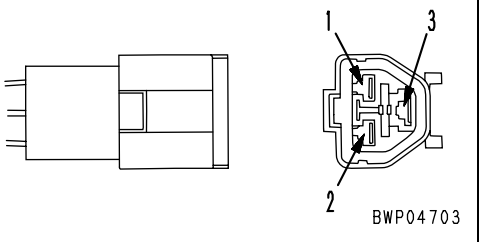
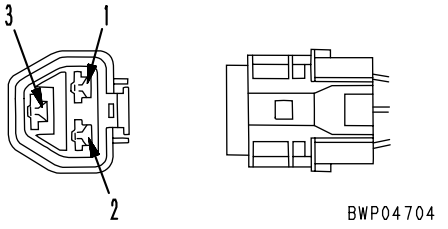
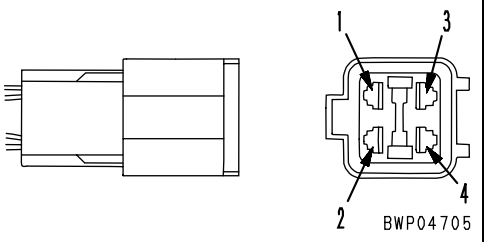
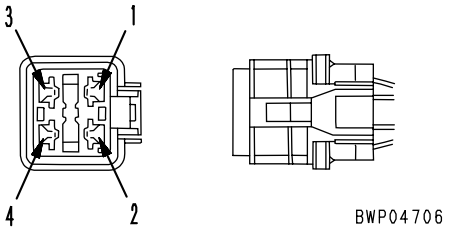
4. Types of circuits and color codes

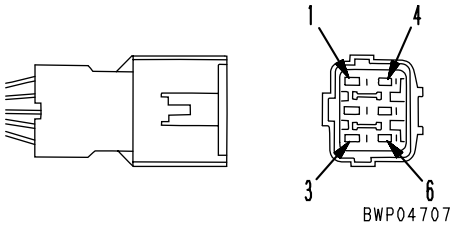
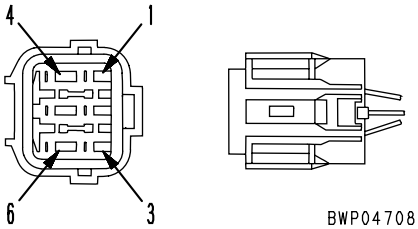
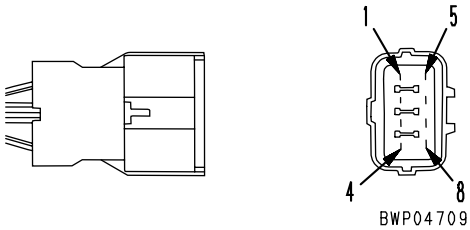
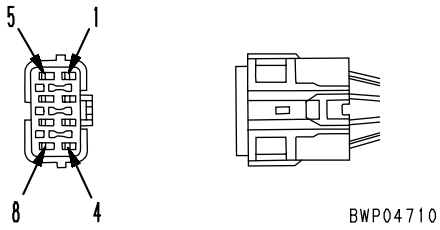
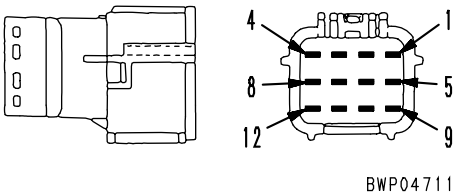
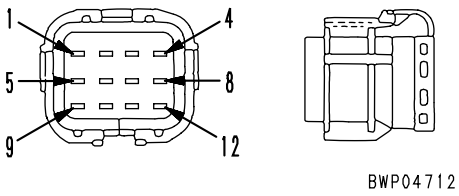
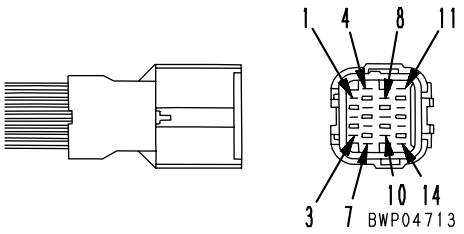
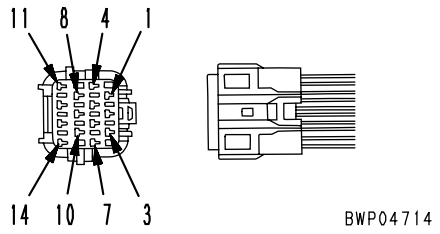
(Table 5)

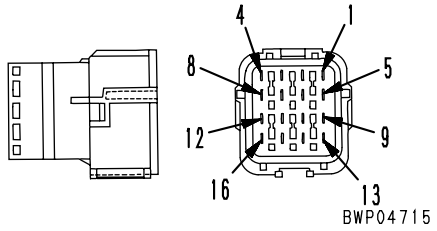
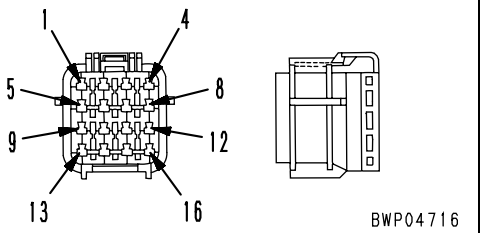
Type of wire		AVS or AV						AEX	
Type of circuit	Charge	R	WG	—	—	—	—	R	—
	Ground	B	—	—	—	—	—	B	—
	Start	R	—	—	—	—	—	R	—
	Light	RW	RB	RY	RG	RL	—	D	—
	Instrument	Y	YR	YB	YG	YL	YW	Y	Gr
	Signal	G	GW	GR	GY	GB	GL	G	Br
	Others	L	LW	LR	LY	LB	—	L	—
		Br	BrW	BrR	BrY	BrB	—	—	—
		Lg	LgR	LgY	LgB	LgW	—	—	—
		O	—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

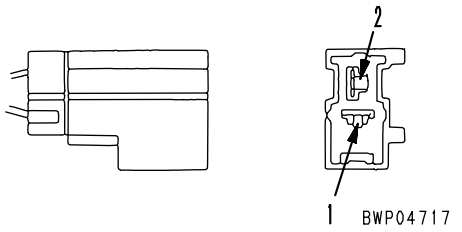
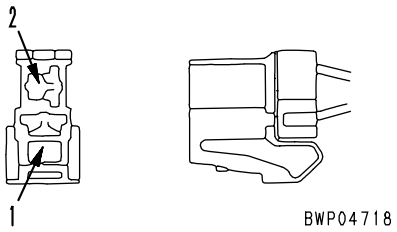
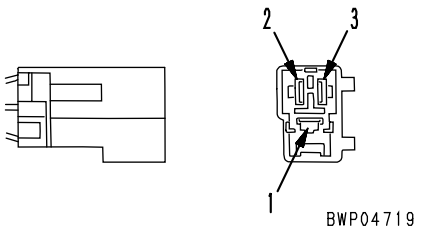
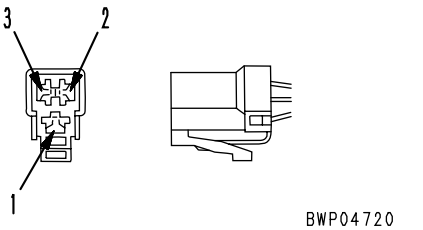
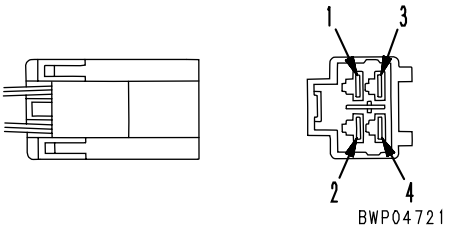
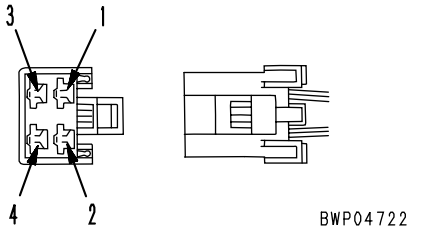
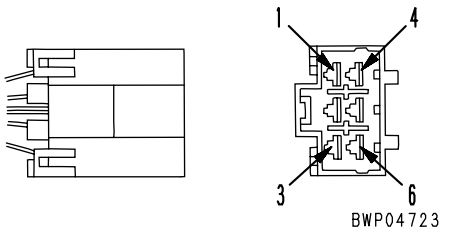
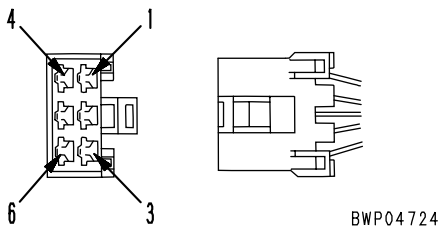
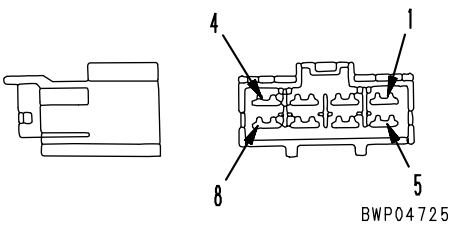
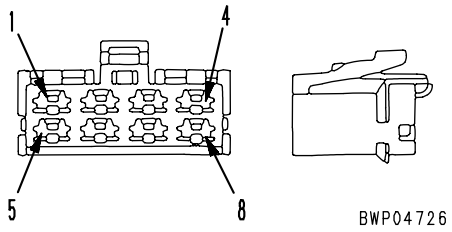
Connection table for connector pin numbers

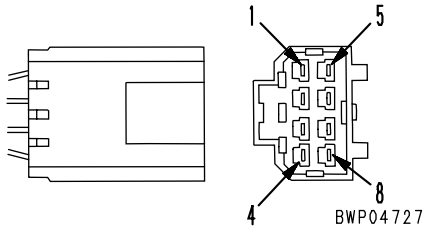
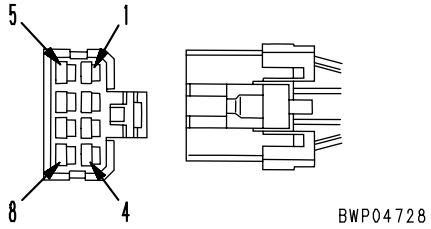
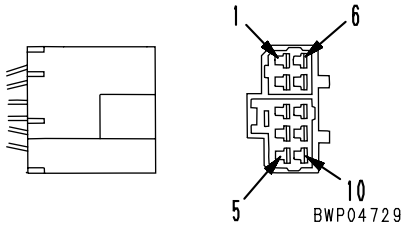
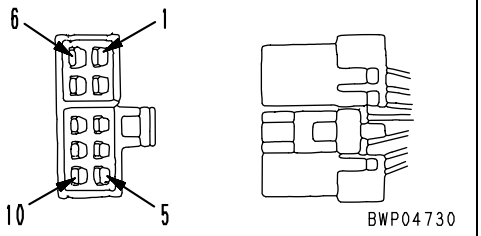
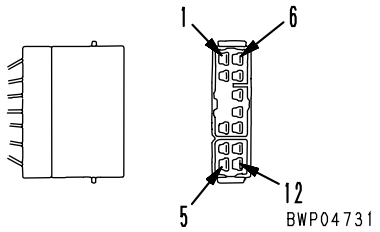
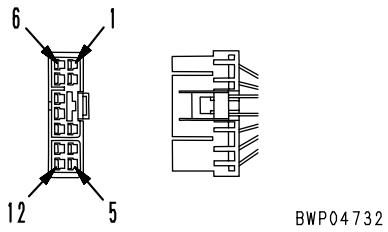
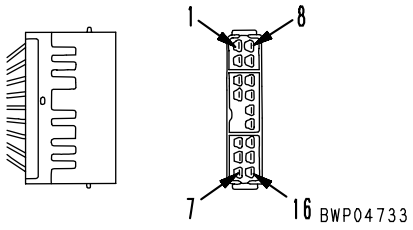
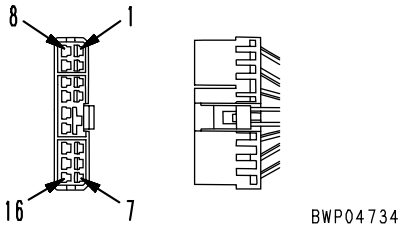
★ The terms male and female refer to the pins, while the terms male housing and female housing refer to the mating portion of the housing.

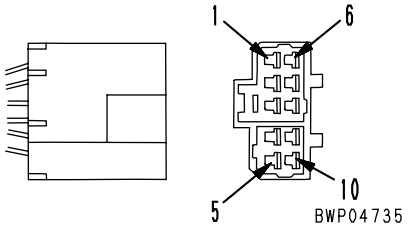
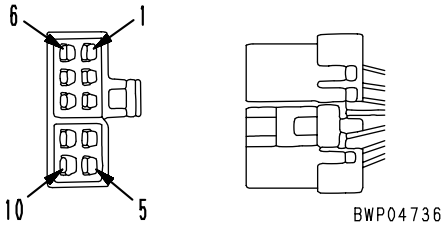
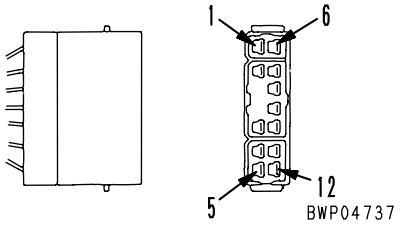
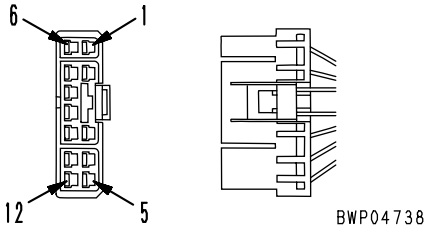
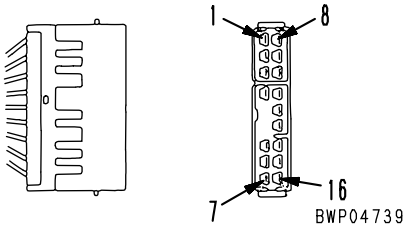
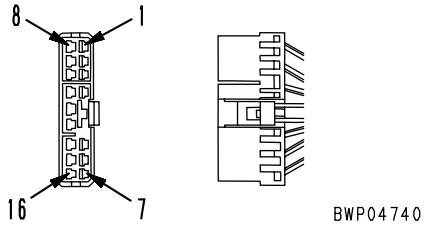
No.of pins	X type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
1	Part No.: 08055-00181	Part No.: 08055-00191	799-601-7010
2			799-601-7020
	Part No.: 08055-00282	Part No.: 08055-00292	
3			799-601-7030
	Part No.: 08055-00381	Part No.: 08055-00391	
4			799-601-7040
	Part No.: 08055-00481	Part No.: 08055-00491	
—	Terminal part No.: 79A-222-3370 • Electric wire size: 0.85 • Grommet: Black • Q'ty: 20	Terminal part No.: 79A-222-3390 • Electric wire size: 0.85 • Grommet: Black • Q'ty : 20	—
—	Terminal part No.: 79A-222-3380 • Electric wire size: 2.0 • Grommet: Red • Q'ty: 20	Terminal part No.: 79A-222-3410 • Electric wire size: 2.0 • Grommet: Red • Q'ty: 20	—

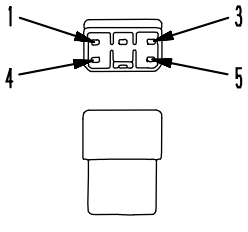
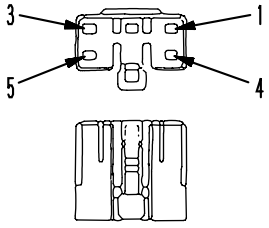
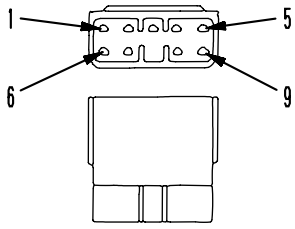
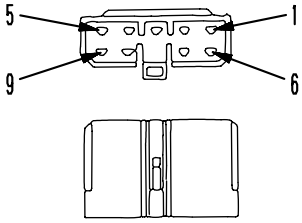
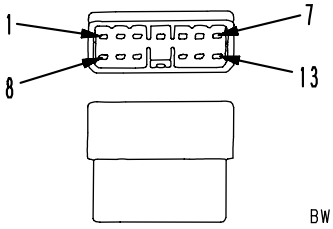
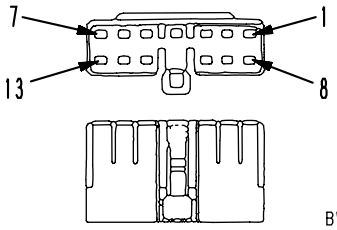
No.of pins	SWP type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
6			799-601-7050
	Part No.: 08055-10681	Part No.: 08055-10691	
8			799-601-7060
	Part No.: 08055-10881	Part No.: 08055-10891	
12			799-601-7310
	Part No.: 08055-11281	Part No.: 08055-11291	
14			799-601-7070
	Part No.: 08055-11481	Part No.: 08055-11491	

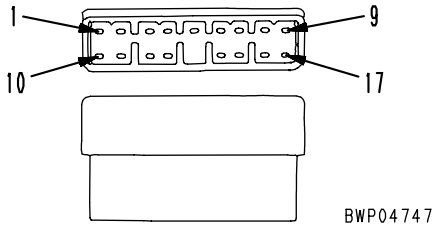
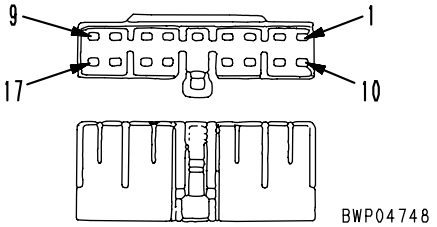
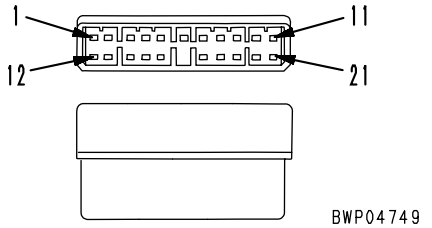
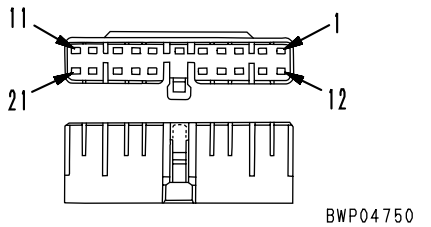
No. of pins	SWP type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
16			799-601-7320
	Part No.: 08055-11681	Part No.: 08055-11691	
—	Terminal part No.: • Electric wire size: 0.85 • Grommet: Black • Q'ty: 20	Terminal part No.: • Electric wire size: 0.85 • Grommet: Black • Q'ty: 20	—
—	Terminal part No.: • Electric wire size: 1.25 • Grommet: Red • Q'ty: 20	Terminal part No.: • Electric wire size: 1.25 • Grommet: Red • Q'ty: 20	—

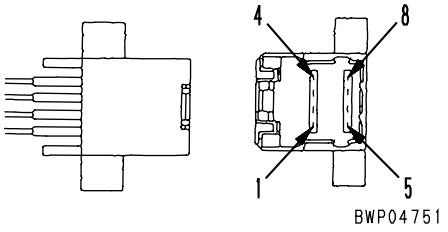
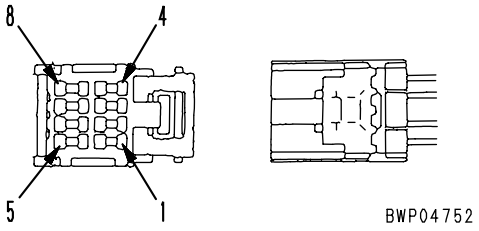
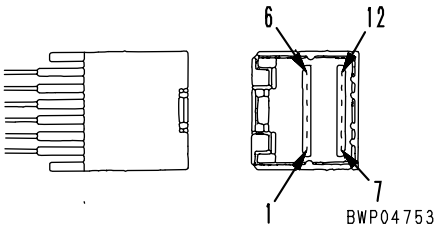
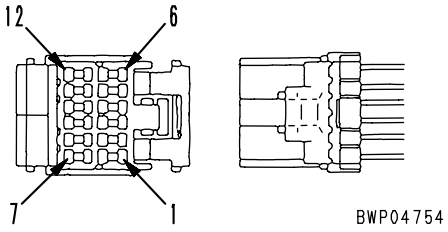
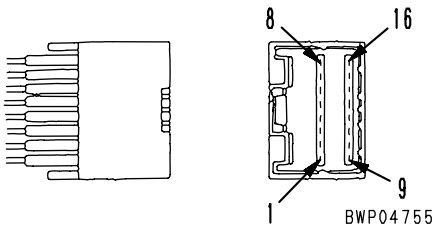
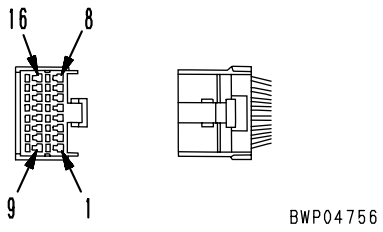
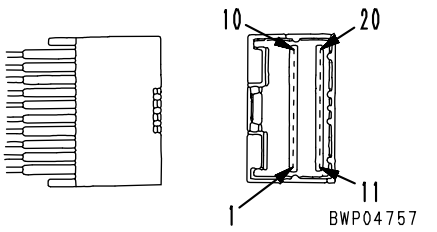
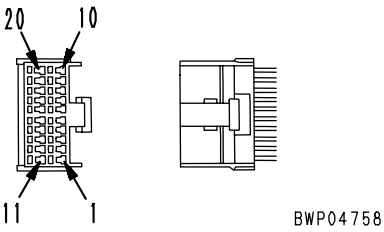
No.of pins	M type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
1	Part No.: 08056-00171	Part No.: 08056-00181	799-601-7080
2			799-601-7090
	Part No.: 08056-00271	Part No.: 08056-00281	
3			799-601-7110
	Part No.: 08056-00371	Part No.: 08056-00381	
4			799-601-7120
	Part No.: 08056-00471	Part No.: 08056-00481	
6			799-601-7130
	Part No.: 08056-00671	Part No.: 08056-00681	
8			799-601-7340
	Part No.: 08056-00871	Part No.: 08056-00881	

No.of pins	S type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
8			799-601-7140
	Part No.: 08056-10871	Part No.: 08056-10881	
10 (White)			799-601-7150
	Part No.: 08056-11071	Part No.: 08056-11081	
12 (White)			799-601-7350
	Part No.: 08056-11271	Part No.: 08056-11281	
16 (White)			799-601-7330
	Part No.: 08056-11671	Part No.: 08056-11681	

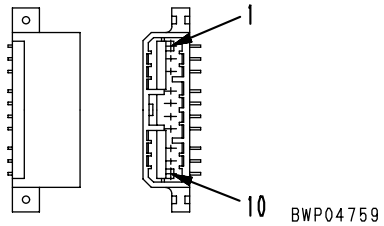
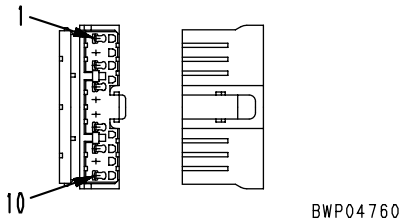
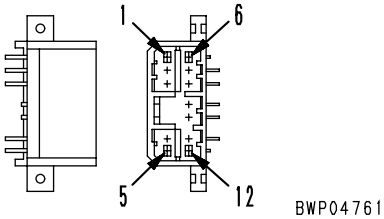
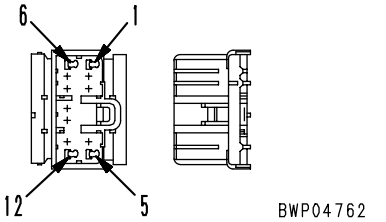
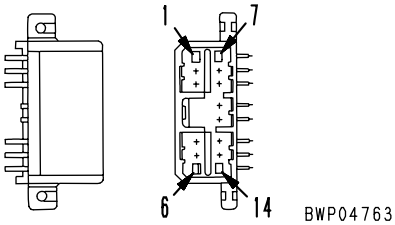
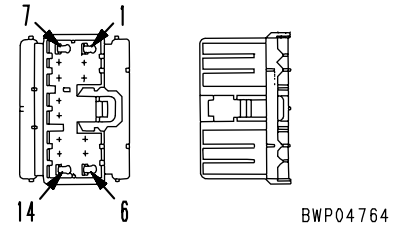
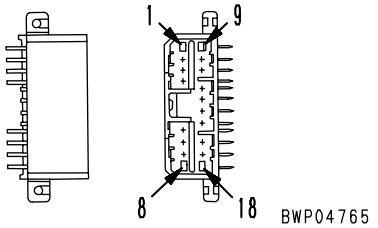
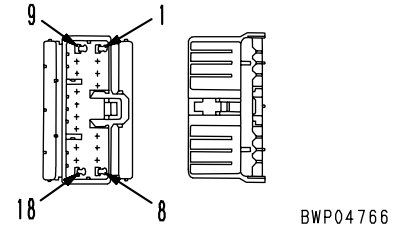
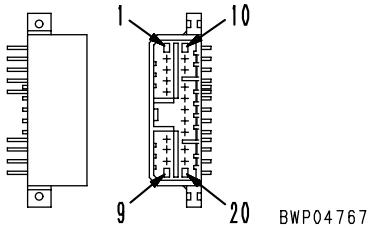
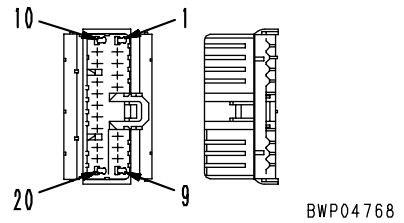
No.of pins	S type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
10 (Blue)			—
	—	—	
12 (Blue)			799-601-7160
	Part No.: 08056-11272	Part No.: 08056-11282	
16 (Blue)			799-601-7170
	Part No.: 08056-11672	Part No.: 08056-11682	

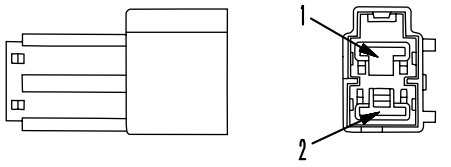
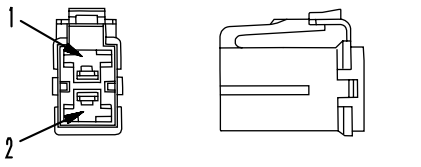
No.of pins	MIC type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
7	Body part No.: 79A-222-2640 (Q'ty: 5)	Body part No.: 79A-222-2630 (Q'ty: 5)	—
11	Body part No.: 79A-222-2680 (Q'ty: 5)	Body part No.: 79A-222-2670 (Q'ty: 5)	—
5	 BWP04741	 BWP04742	799-601-2710
	Body part No.: 79A-222-2620 (Q'ty: 5)	Body part No.: 79A-222-2610 (Q'ty: 5)	
9	 BWP04743	 BWP04744	799-601-2950
	Body part No.: 79A-222-2660 (Q'ty: 5)	Body part No.: 79A-222-2650 (Q'ty: 5)	
13	 BWP04745	 BWP04746	799-601-2720
	Body part No.: 79A-222-2710 (Q'ty: 2)	Body part No.: 79A-222-2690 (Q'ty: 2)	

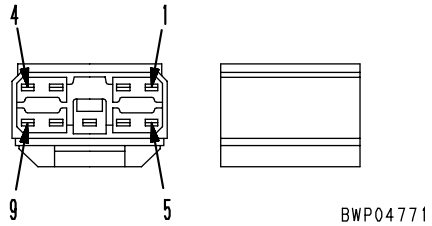
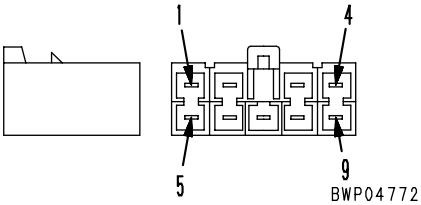
No.of pins	MIC type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
17			799-601-2730
	Body part No.: 79A-222-2730 (Q'ty: 2)	Body part No.: 79A-222-2720 (Q'ty: 2)	
21			799-601-2740
	Body part No.: 79A-222-2750 (Q'ty: 2)	Body part No.: 79A-222-2740 (Q'ty: 2)	
	Terminal part No.: 79A-222-2770 (Q'ty: 50)	Terminal part No.: 79A-222-2760 (Q'ty: 50)	—

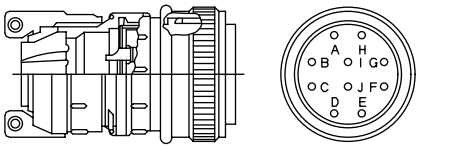
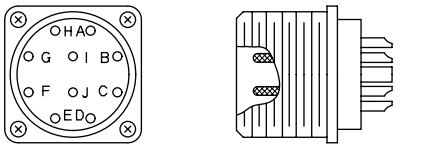
No.of pins	AMP040 type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
8			799-601-7180
	—	Housing part No.: 79A-222-3430 (Q'ty: 5)	
12			799-601-7190
	—	Housing part No.: 79A-222-3440 (Q'ty: 5)	
16			799-601-7210
	—	Housing part No.: 79A-222-3450 (Q'ty: 5)	
20			799-601-7220
	—	Housing part No.: 79A-222-3460 (Q'ty: 5)	

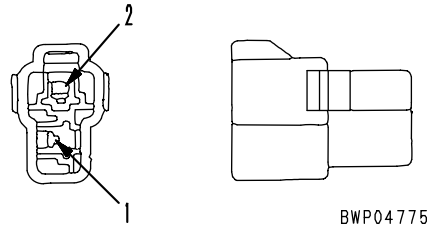
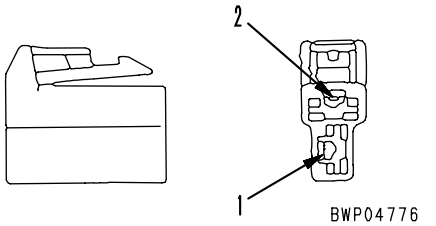
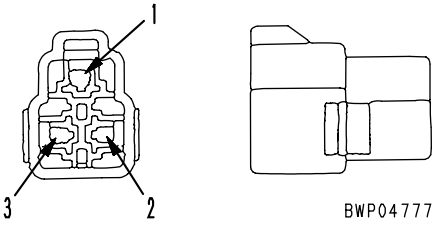
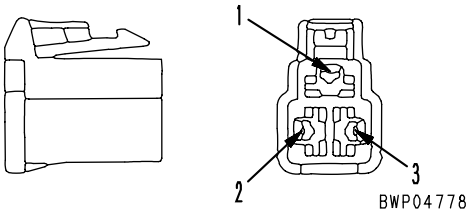
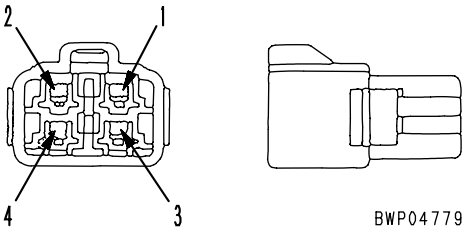
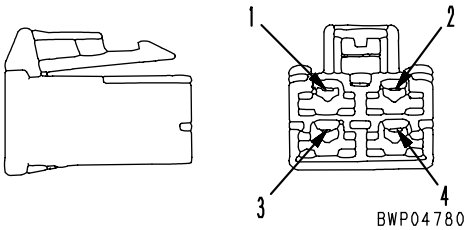
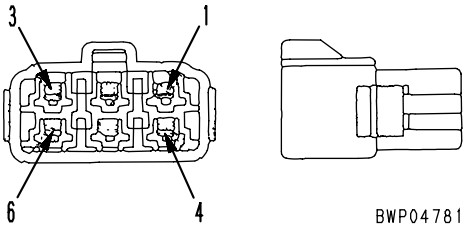
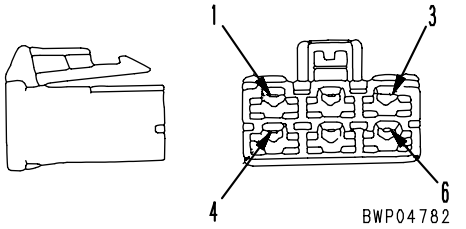
★ Terminal part No.: 79A-222-3470 (No relation with number of pins)

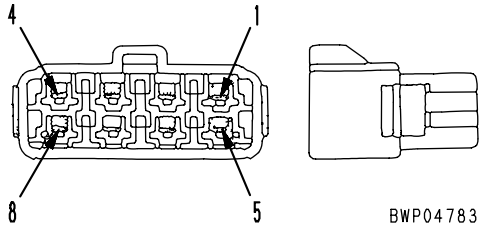
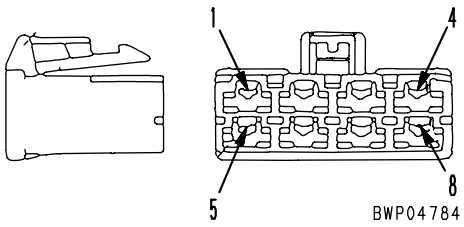
No.of pins	AMP070 type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
10			799-601-7510
	—	Part No.: 08195-10210	
12			799-601-7520
	—	Part No.: 08195-12210	
14			799-601-7530
	—	Part No.: 08195-14210	
18			799-601-7540
	—	Part No.: 08195-18210	
20			799-601-7550
	—	Part No.: 08195-20210	

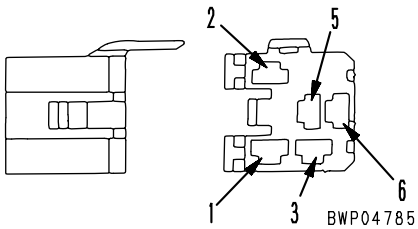
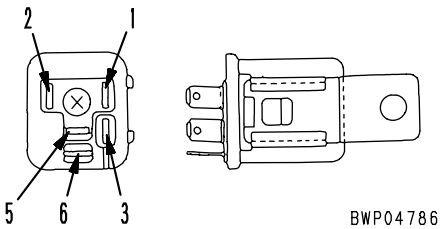
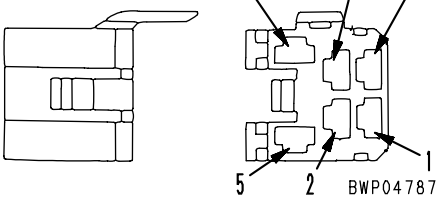
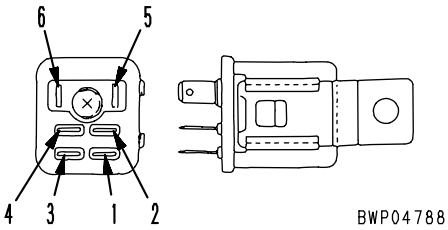
No.of pins	L type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
2	 BWP04769	 BWP04770	—
	—	—	

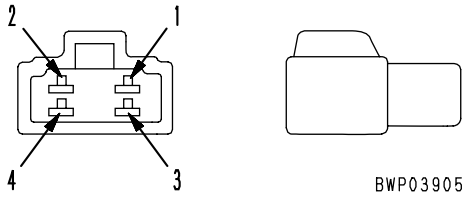
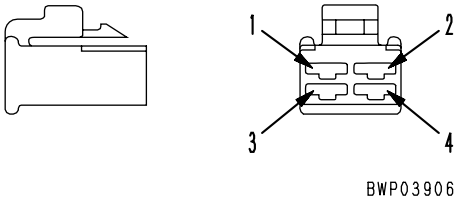
No.of pins	Connector for PA		
	Male (female housing)	Female (male housing)	T-adapter Part No.
9	 BWP04771	 BWP04772	—
	—	—	

No.of pins	Bendix MS connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
10	 BWP04773	 BWP04774	799-601-3460
	—	—	

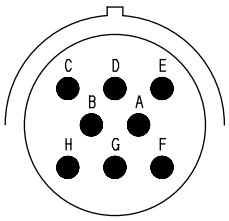
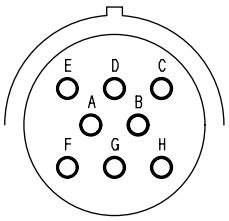
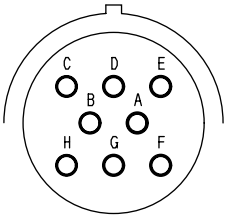
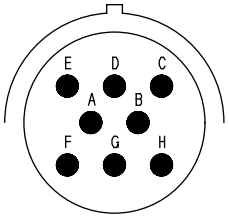
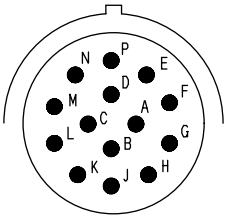
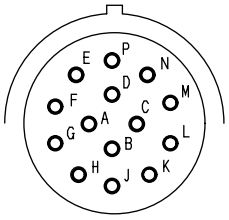
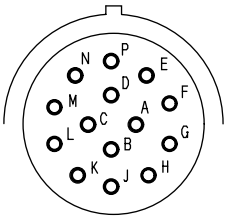
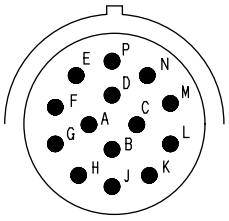
No.of pins	KES 1 (Automobile) connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
2			—
	Part No.: 08027-10210 (Natural color) 08027-10220 (Black)	Part No.: 08027-10260 (Natural color) 08027-10270 (Black)	
3			—
	Part No.:08027-10310	Part No.:08027-10360	
4			—
	Part No.: 08027-10410 (Natural color) 08027-10420 (Black)	Part No.: 08027-10460 (Natural color) 08027-10470 (Black)	
6			—
	Part No.: 08027-10610 (Natural color) 08027-10620 (Black)	Part No.: 08027-10660 (Natural color) 08027-10670 (Black)	

No.of pins	KES 1 (Automobile) connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
8			—
	Part No.: 08027-10810 (Natural color) 08027-10820 (Black)	Part No.: 08027-10860 (Natural color) 08027-10870 (Black)	

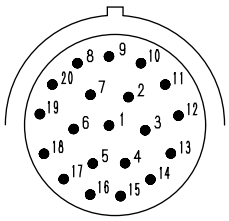
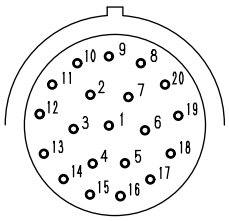
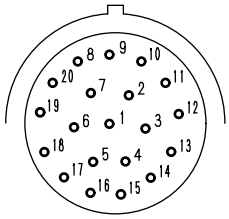
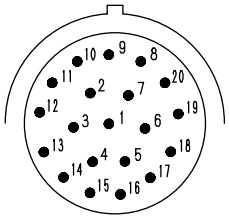
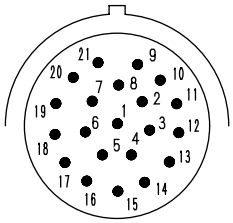
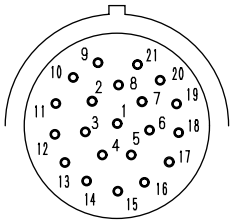
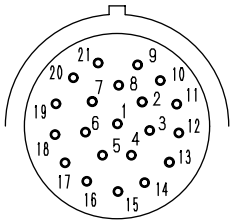
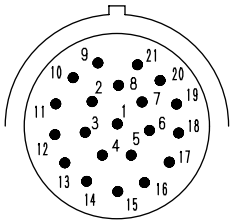
No.of pins	Connector for relay (Socket type)		
	Male (female housing)	Female (male housing)	T-adapter Part No.
5			799-601-7360
	—	—	
6			799-601-7370
	—	—	

No.of pins	F type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
4	 BWP03905	 BWP03906	—
	—	—	

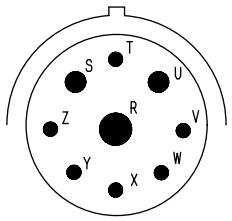
[The pin No. is also marked on the connector (electric wire insertion end)]

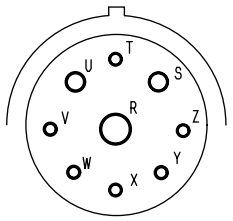
Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
18-8 (1)	Pin (male terminal)	Pin (female termial)	799-601-9210
	 BWP05001	 BWP05002	
	Part No.: 08191-11201, 08191-11202, 08191-11205, 08191-11206	Part No.: 08191-14101, 08191-14102, 08191-14105, 08191-14106	
	Pin (female terminal)	Pin (male termial)	799-601-9210
	 BWP05003	 BWP05004	
	Part No.: 08191-12201, 08191-12202, 08191-12205, 08191-12206	Part No.: 08191-13101, 08191-13102, 08191-13105, 08191-13106	
18-14 (2)	Pin (male terminal)	Pin (female termial)	799-601-9220
	 BWP05005	 BWP05006	
	Part No.: 08191-21201, 08191-12202, 08191-21205, 08191-12206	Part No.: 08191-24101, 08191-24102, 08191-24105, 08191-24106	
	Pin (female terminal)	Pin (male termial)	799-601-9220
	 BWP05007	 BWP05008	
	Part No.: 08191-22201, 08191-22202, 08191-22205, 08191-22206	Part No.: 08191-23101, 08191-23102, 08191-23105, 08191-23106	

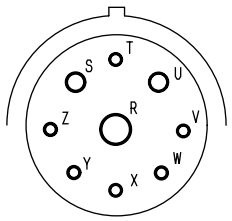
[The pin No. is also marked on the connector (electric wire insertion end)]

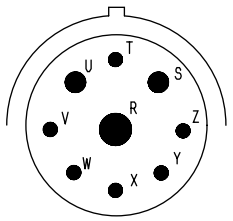
Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
18-20 (3)	Pin (male terminal)	Pin (female termial)	799-601-9230
	 BWP05009	 BWP05010	
	Part No.:08191-31201, 08191-31202	Part No.:08191-34101, 08191-34102	
	Pin (female terminal)	Pin (male termial)	799-601-9230
	 BWP05011	 BWP05012	
	Part No.:08191-32201, 08191-32202	Part No.:08191-33101, 08191-33102	
18-21 (4)	Pin (male terminal)	Pin (female termial)	799-601-9240
	 BWP05013	 BWP05014	
	Part No.:08191-41201, 08191-42202	Part No.:08191-44101, 08191-44102	
	Pin (female terminal)	Pin (male termial)	799-601-9240
	 BWP05015	 BWP05016	
	Part No.:08191-42201, 08191-42202	Part No.:08191-43101, 08191-43102	

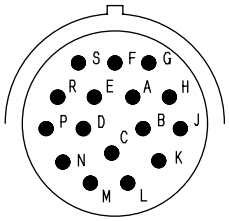
[The pin No. is also marked on the connector (electric wire insertion end)]

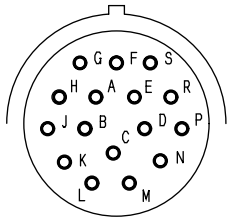
<table>
<tr><td rowspan="2">Type (shell size code)</td><td colspan="3">HD30 Series connector</td></tr>
<tr><td>Body (plug)</td><td>Body (receptacle)</td><td>T-adapter Part No.</td></tr>
<tr><td rowspan="4">24-9 (5)</td><td>Pin (male terminal)</td><td>Pin (female termial)</td><td rowspan="2">799-601-9250</td></tr>
<tr><td> 

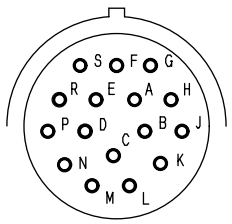
BWP05017</td><td> 

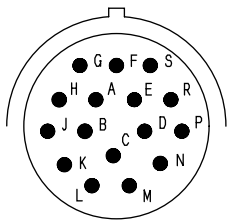
BWP05018</td></tr>
<tr><td>Part No.:08191-51201, 08191-51202</td><td>Part No.:08191-54101, 08191-54102</td></tr>
<tr><td>Pin (female terminal)</td><td>Pin (male termial)</td><td rowspan="2">799-601-9250</td></tr>
<tr><td> 

BWP05019</td><td> 

BWP05020</td></tr>
<tr><td>Part No.:08191-52201, 08191-52202</td><td>Part No.:08191-53101, 08191-53102</td></tr>
<tr><td rowspan="4">24-16 (6)</td><td>Pin (male terminal)</td><td>Pin (female termial)</td><td rowspan="2">799-601-9260</td></tr>
<tr><td> 

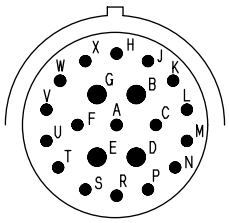
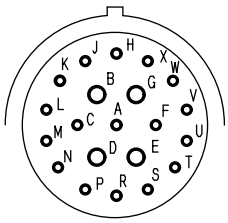
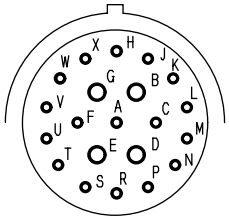
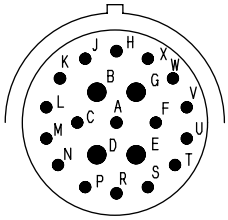
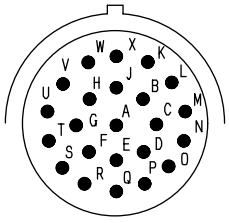
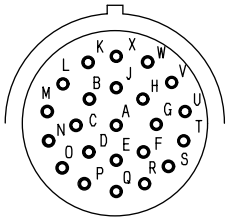
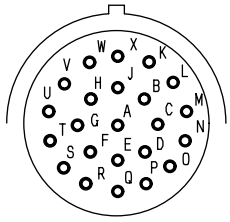
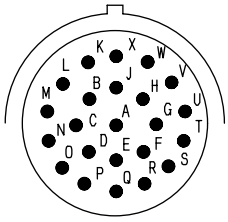
BWP05021</td><td> 

BWP05022</td></tr>
<tr><td>Part No.: 08191-61201, 08191-62202,
08191-61205, 08191-62206</td><td>Part No.: 08191-64101, 08191-64102,
08191-64105, 08191-64106</td></tr>
<tr><td>Pin (female terminal)</td><td>Pin (male termial)</td><td rowspan="2">799-601-9260</td></tr>
<tr><td> 

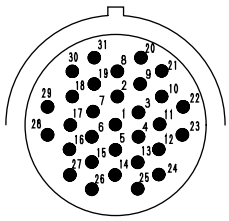
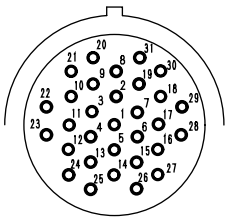
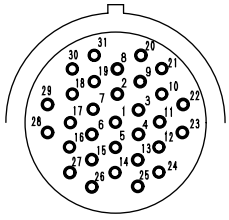
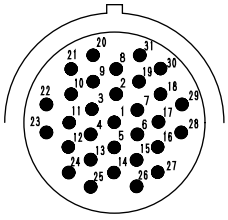
BWP05023</td><td> 

BWP05024</td></tr>
<tr><td>Part No.: 08191-62201, 08191-62202,
08191-62205, 08191-62206</td><td>Part No.: 08191-63101, 08191-63102,
08191-63105, 08191-63106</td></tr>
</table>

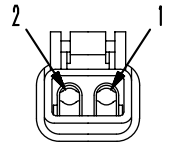
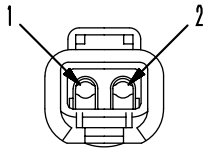
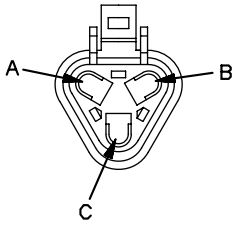
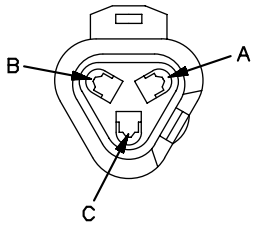
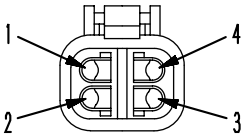
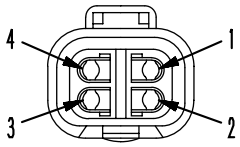
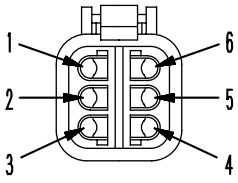
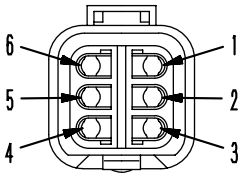
[The pin No. is also marked on the connector (electric wire insertion end)]

Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
24-21 (7)	Pin (male terminal)	Pin (female termial)	799-601-9270
	 BWP05025	 BWP05026	
	Part No.: 08191-71201, 08191-71202, 08191-71205, 08191-71206	Part No.: 08191-74101, 08191-74102, 08191-74105, 08191-74106	
	Pin (female terminal)	Pin (male termial)	799-601-9270
	 BWP05027	 BWP05028	
	Part No.: 08191-72201, 08191-72202, 08191-72205, 08191-72206	Part No.: 08191-73101, 08191-73102, 08191-73105, 08191-73106	
24-23 (8)	Pin (male terminal)	Pin (female termial)	799-601-9280
	 BWP05029	 BWP05030	
	Part No.: 08191-81201, 08191-81202 08191-81203, 08191-81204 08191-81205, 08191-80206	Part No.: 08191-84101, 08191-84102 08191-84103, 08191-84104 08191-84105, 08191-84106	
	Pin (female terminal)	Pin (male termial)	799-601-9280
	 BWP05031	 BWP05032	
	Part No.: 08191-82201, 08191-82202 08191-82203, 08191-82204 08191-82205, 08191-82206	Part No.: 08191-83101, 08191-83102 08191-83103, 08191-83104 08191-83105, 08191-83106	

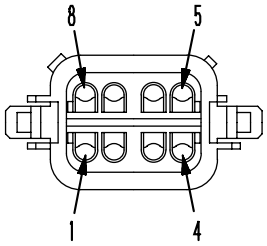
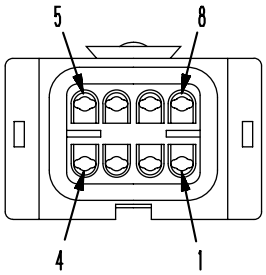
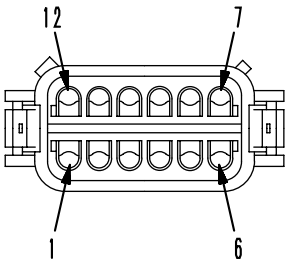
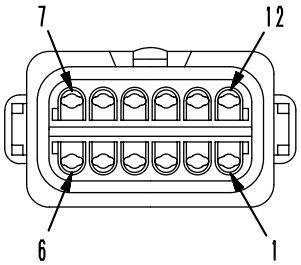
[The pin No. is also marked on the connector (electric wire insertion end)]

Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
24-31 (9)	Pin (male termial)	Pin (female terminal)	799-601-9290
	 BWP05033	 BWP05034	
	Part No.: 08191-91203, 08191-91204, 08191-91205, 08191-91206	Part No.: 08191-94103, 08191-94104, 08191-94105, 08191-94106	
	Pin (female terminal)	Pin (male termial)	799-601-9290
	 BWP05035	 BWP05036	
	Part No.: 08191-92203, 08191-92204, 08191-92205, 08191-92206	Part No.: 08191-93103, 08191-93104, 08191-93105, 08191-93106	

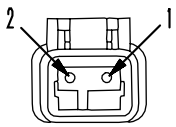
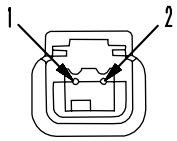
[The pin No. is also marked on the connector (electric wire insertion end)]

No.of pins	DT Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
2	 BWP05037	 BWP05038	799-601-9020
	Part No.: 08192-12200 (normal type) 08192-22200 (fine wire type)	Part No.: 08192-12100 (normal type) 08192-22100 (fine wire type)	
3	 BWP05039	 BWP05040	799-601-9030
	Part No.: 08192-13200 (normal type) 08192-23200 (fine wire type)	Part No.: 08192-13100 (normal type) 08192-23100 (fine wire type)	
4	 BWP05041	 BWP05042	799-601-9040
	Part No.: 08192-14200 (normal type) 08192-24200 (fine wire type)	Part No.: 08192-14100 (normal type) 08192-24100 (fine wire type)	
6	 BWP05043	 BWP05044	799-601-9050
	Part No.: 08192-16200 (normal type) 08192-26200 (fine wire type)	Part No.: 08192-16100 (normal type) 08192-26100 (fine wire type)	

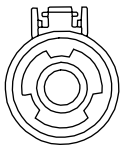
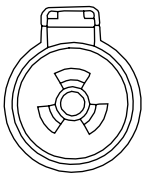
[The pin No. is also marked on the connector (electric wire insertion end)]

No.of pins	DT Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
8	 BWP05045	 BWP05046	8GR: 799-601-9060 8B: 799-601-9070 8G: 799-601-9080 8BR: 799-601-9090
	Part No.: 08192-1820☐ (normal type) 08192-2820☐ (fine wire type)	Part No.: 08192-1810☐ (normal type) 08192-2810☐ (fine wire type)	
12	 BWP05047	 BWP05048	12GR:799-601-9110 12B: 799-601-9120 12G: 799-601-9130 12BR:799-601-9140
	Part No.: 08192-1920☐ (normal type) 08192-2920☐ (fine wire type)	Part No.: 08192-1910☐ (normal type) 08192-2910☐ (fine wire type)	

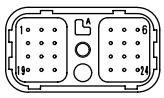
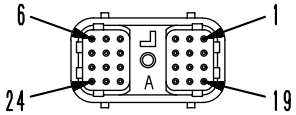
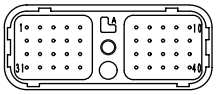
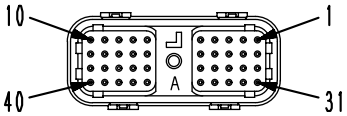
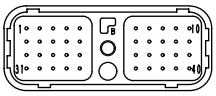
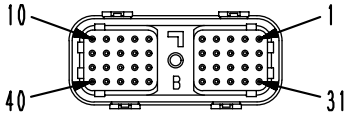
[The pin No. is also marked on the connector (electric wire insertion end)]

No.of pins	DTM Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
2	 BWP05049	 BWP05050	799-601-9010
	Part No.: 08192-02200	Part No.: 08192-02100	

[The pin No. is also marked on the connector (electric wire insertion end)]

No.of pins	DTHD Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
2	 BWP05051	 BWP05052	—
	Part No.: 08192-31200 (Contact size#12) 08192-41200 (Contact size #8) 08192-51200 (Contact size #4)	Part No.: 08192-31100 (Contact size#12) 08192-41100 (Contact size #8) 08192-51100 (Contact size #4)	

[The pin No. is also marked on the connector (electric wire insertion end)]

No.of pins	DRC26 Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
24	 BJD12722	 BJD12723	799-601-9360
	—	Part No.:7821-93-3110	
40 (A)	 BJD12724	 BJD12725	799-601-9350
	—	Part No.:7821-93-3120	
40 (B)	 BJD12726	 BJD12727	799-601-9350
	—	Part No.:7821-93-3130	

T-boxes and T-adapters table

★ The Nos. in the columns are the part Nos. of the T-boxes, T-adapters, and other parts. The Nos. in the lines are the kit Nos. of the T-adapter kits.

Part No.	Part name	Number of pins	Identification symbol	T-adapter kit																	Out of kit
				799-601-2500	799-601-2700	799-601-2800	799-601-2900	799-601-3000	799-601-5500	799-601-6000	799-601-6500	799-601-7000	799-601-7100	799-601-7400	799-601-7500	799-601-8000	799-601-9000	799-601-9100	799-601-9200	799-601-9300	
799-601-2600	T-box (for ECONO)	21		●		●	●						●	●		●					
799-601-3100	T-box (for MS)	37						●													
799-601-3200	T-box (for MS)	37						●													
799-601-3300	T-box (for ECONO)	24								●											
799-601-3360	• Plate for MS (24-pin)									●											
799-601-3370	• Plate for MS (17-pin)									●											
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-5S						●	●											
799-601-3520	Adapter for BENDIX (MS)	17	MS-17P						●	●											
799-601-3530	Adapter for BENDIX (MS)	19	MS-19P							●	●										
799-601-2910	Adapter for BENDIX (MS)	14	MS-14P						●	●											
799-601-3470	Case									●											
799-601-2710	Adapter for MIC	5	MIC-5P	●	●		●							●							
799-601-2720	Adapter for MIC	13	MIC-13P	●	●		●							●							
799-601-2730	Adapter for MIC	17	MIC-17P	●	●	●	●						●	●		●					
799-601-2740	Adapter for MIC	21	MIC-21P	●	●	●	●						●	●		●					
799-601-2950	Adapter for MIC	9	MIC-9P									●	●	●		●					
799-601-2750	Adapter for ECONO	2	ECONO2P	●	●																
799-601-2760	Adapter for ECONO	3	ECONO13P	●	●																
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			●																	
799-601-4210	Adapter for DRC	50	DRC50																		●
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																		●

Part No.	Part name	Number of pins	Identification symbol	T-adapter kit																	Out of kit
				799-601-2500	799-601-2700	799-601-2800	799-601-2900	799-601-3000	799-601-5500	799-601-6000	799-601-6500	799-601-7000	799-601-7100	799-601-7400	799-601-7500	799-601-8000	799-601-9000	799-601-9100	799-601-9200	799-601-9300	
799-601-7070	Adapter for SWP	14	SW14P											●		●					
799-601-7320	Adapter for SWP	16	SW16P																		●
799-601-7080	Adapter for M (T-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									●	●	●		●					
799-601-7160	Adapter for S (Blue)	12	S12P									●	●	●							
799-601-7170	Adapter for S (Blue)	16	S16P									●	●	●		●					
799-601-7330	Adapter for S (White)	16	S16PW													●					
799-601-7350	Adapter for S (White)	12	S12PW																		●
799-601-7180	Adapter for AMP040	8	A8P											●							
799-601-7190	Adapter for AMP040	12	A12P											●		●					
799-601-7210	Adapter for AMP040	16	A16P									●	●	●		●					
799-601-7220	Adapter for AMP040	20	A20P									●	●	●		●					
799-601-7230	Short connector for X	2										●	●	●		●					
799-601-7240	Case											●	●								
799-601-7270	Case													●							
799-601-7510	Adapter for 070	10	07-10												●						
799-601-7520	Adapter for 070	12	07-12												●						
799-601-7530	Adapter for 070	14	07-14												●						
799-601-7540	Adapter for 070	18	07-18												●						
799-601-7550	Adapter for 070	20	07-20												●						
799-601-7360	Adapter for relay	5	REL-5P																		●
799-601-7370	Adapter for relay	6	REL-6P																		●
799-601-7380	Adapter for JFC	2																			●
799-601-9010	Adapter for DTM	2	DTM2														●		●		
799-601-9020	Adapter for DT	2	DT2														●		●		
799-601-9030	Adapter for DT	3	DT3														●		●		
799-601-9040	Adapter for DT	4	DT4														●		●		
799-601-9050	Adapter for DT	6	DT6														●		●		
799-601-9060	Adapter for DT (Gray)	8	DT8GR														●		●		
799-601-9070	Adapter for DT (Black)	8	DT8B														●		●		
799-601-9080	Adapter for DT (Green)	8	DT8G														●		●		
799-601-9090	Adapter for DT (Brown)	8	DT8BR														●		●		
799-601-9110	Adapter for DT (Gray)	12	DT12GR														●		●		
799-601-9120	Adapter for DT (Black)	12	DT12B														●		●		
799-601-9130	Adapter for DT (Green)	12	DT12G														●		●		
799-601-9140	Adapter for DT	12	DT12BR														●		●		
799-601-9210	Adapter for HD30-18	8	D18-8														●	●			
799-601-9220	Adapter for HD30-18	14	D18-14														●	●			
799-601-9230	Adapter for HD30-18	20	D18-20														●	●			

Part No.	Part name	Number of pins	Identification symbol	T-adapter kit																Out of kit
				799-601-2500	799-601-2700	799-601-2800	799-601-2900	799-601-3000	799-601-5500	799-601-6000	799-601-6500	799-601-7000	799-601-7100	799-601-7400	799-601-7500	799-601-8000	799-601-9000	799-601-9100	799-601-9200	799-601-9300	
799-601-9240	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 DT/HD)	12															●	●		●	
799-601-9330	Case																●				
799-601-9340	Case																	●			
799-601-9350	Adapter for DRC	40	DRC-40																	●	
799-601-9360	Adapter for DRC	24	DRC-24																	●	
799-601-9410	Adapter for engine (CRI-T2)	2	G																		●
799-601-9420	Adapter for engine (CRI-T2) Adapter for engine (CRI-T3)	3	A3																		●
799-601-9430	Adapter for engine (CRI-T2) Adapter for engine (CRI-T3)	2	P																		●
799-601-9440	Adapter for engine (CRI-T2)	3	1,2,3																		●
795-799-5520	Adapter for engine (HPI-T2)	2	S																		●
795-799-5530	Adapter for engine (HPI-T2) Adapter for engine (CRI-T3)	2	C																		●
795-799-5540	Adapter for engine (HPI-T2) Adapter for engine (CRI-T3)	2	A																		●
795-799-5460	Adapter for engine (HPI-T2)	3																			●
795-799-5470	Adapter for engine (HPI-T2)	3																			●
795-799-5480	Adapter for engine (HPI-T2)	3																			●
799-601-4160	Adapter for engine (CRI-T3)	2	OIL																		●
799-601-4340	Adapter for engine (CRI-T3)	2	1,2,3																		●
799-601-4130	Adapter for engine (CRI-T3)	3	FCIN																		●
799-601-4140	Adapter for engine (CRI-T3)	3	FCIG																		●
799-601-4150	Adapter for engine (CRI-T3)	3	FCIB																		●
799-601-4180	Adapter for engine (CRI-T3)	3	FCIP3																		●
799-601-4190	Adapter for engine (CRI-T3)	3	1,2,3																		●
799-601-4240	Adapter for engine (CRI-T3)	3	1,2,3																		●
799-601-4250	Adapter for engine (CRI-T3)	3	1,2,3																		●
799-601-4330	Adapter for engine (CRI-T3)	3	1,2,3																		●
799-601-4230	Adapter for engine (CRI-T3)	4	1,2,3,4																		●
799-601-4260	Adapter for controller (ENG)	4	DTP4																		●
799-601-4210	Adapter for controller (ENG)	50	DRC50																		●
799-601-4220	Adapter for controller (ENG)	60	DRC60																		●
799-601-4280	Box for controller (PUMP)	121																			●
799-601-9720	Adapter for controller (HST)	16	HST16A																		●
799-601-9710	Adapter for controller (HST)	16	HST16B																		●
799-601-9370	Adapter for controller (HST)	26	HST26A																		●

PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00231-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

40 Troubleshooting

Troubleshooting by failure code (Display of code), Part 1

Troubleshooting by failure code (Display of code), Part 1

Failure codes table

User code	Failure code	Trouble (Displayed on screen)	Alarm buzzer	Device in charge	Category of history
	989L00	Engine Controller Lock Caution 1		MON	Electrical system
	989M00	Engine Controller Lock Caution 2		MON	Electrical system
	989N00	Engine Controller Lock Caution 3		MON	Electrical system
	AA10NX	Air Cleaner Clogging		MON	Mechanical system
	AB00KE	Charge Voltage Low		MON	Mechanical system
	B@BAZG	Eng Oil Press. Low	▲	ENG	Mechanical system
	B@BAZK	Eng Oil Level Low		MON	Mechanical system
	B@BCNS	Eng Water Overheat	▲	ENG	Mechanical system
	B@BCZK	Eng Water Level Low	▲	MON	Mechanical system
	B@HANS	Hydr Oil Overheat	▲	PUMP	Mechanical system
E10	CA111	EMC Critical Internal Failure	●	ENG	Electrical system
E10	CA115	Eng Ne and Bkup Speed Sens Error	●	ENG	Electrical system
E11	CA122	Chg Air Press Sensor High Error	●	ENG	Electrical system
E11	CA123	Chg Air Press Sensor Low Error	●	ENG	Electrical system
E14	CA131	Throttle Sensor High Error	●	ENG	Electrical system
E14	CA132	Throttle Sensor Low Error	●	ENG	Electrical system
E15	CA144	Coolant Temp Sens High Error	●	ENG	Electrical system
E15	CA145	Coolant Temp Sens Low Error	●	ENG	Electrical system
E15	CA153	Chg Air Temp Sensor High Error	●	ENG	Electrical system
E15	CA154	Chg Air Temp Sensor Low Error	●	ENG	Electrical system
E11	CA155	Chg Air Temp High Speed Derate	●	ENG	Electrical system
E15	CA187	Sens Supply 2 Volt Low Error	●	ENG	Electrical system
E11	CA221	Ambient Press Sens High Error	●	ENG	Electrical system
E11	CA222	Ambient Press Sens Low Error	●	ENG	Electrical system

User code	Failure code	Trouble (Displayed on screen)	Alarm buzzer	Device in charge	Category of history
E15	CA227	Sens Supply 2 Volt High Error	●	ENG	Electrical system
	CA234	Eng Overspeed		ENG	Mechani-cal system
E15	CA238	Ne Speed Sens Supply Volt Error	●	ENG	Electrical system
E10	CA271	IMV/PCV1 Short Error	●	ENG	Electrical system
E10	CA272	IMV/PCV1 Open Error	●	ENG	Electrical system
E11	CA322	Inj #1 (L#1) Open/Short Error	●	ENG	Electrical system
E11	CA323	Inj #5 (L#5) Open/Short Error	●	ENG	Electrical system
E11	CA324	Inj #3 (L#3) Open/Short Error	●	ENG	Electrical system
E11	CA325	Inj #6 (L#6) Open/Short Error	●	ENG	Electrical system
E11	CA331	Inj #2 (L#2) Open/Short Error	●	ENG	Electrical system
E11	CA332	Inj #4 (L#4) Open/Short Error	●	ENG	Electrical system
E10	CA342	Calibration Code Incompatibility	●	ENG	Electrical system
E10	CA351	Injectors Drive Circuit Error	●	ENG	Electrical system
E15	CA352	Sens Supply 1 Volt Low Error	●	ENG	Electrical system
E15	CA386	Sens Supply 1 Volt High Error	●	ENG	Electrical system
E15	CA428	Water in Fuel Sensor High Error	●	ENG	Electrical system
E15	CA429	Water in Fuel Sensor Low Error	●	ENG	Electrical system
E15	CA435	Eng Oil Press Sw Error	●	ENG	Electrical system
E10	CA441	Battery Voltage Low Error	●	ENG	Electrical system
E10	CA442	Battery Voltage High Error	●	ENG	Electrical system
E11	CA449	Rail Press Very High Error	●	ENG	Electrical system
E11	CA451	Rail Press Sensor High Error	●	ENG	Electrical system
E11	CA452	Rail Press Sensor Low Error	●	ENG	Electrical system
E11	CA488	Chg Air Temp High Torque Derate	●	ENG	Electrical system
E15	CA553	Rail Press High Error	●	ENG	Electrical system

User code	Failure code	Trouble (Displayed on screen)	Alarm buzzer	Device in charge	Category of history
E15	CA559	Rail Press Low Error	●	ENG	Electrical system
E15	CA689	Eng Ne Speed Sensor Error	●	ENG	Electrical system
E15	CA731	Eng Bkup Speed Sens Phase Error	●	ENG	Electrical system
E10	CA757	All Continuous Data Lost Error	●	ENG	Electrical system
E15	CA778	Eng Bkup Speed Sensor Error	●	ENG	Electrical system
E0E	CA1633	KOMNET Datalink Timeout Error	●	ENG	Electrical system
E14	CA2185	Throt Sens Sup Volt High Error	●	ENG	Electrical system
E14	CA2186	Throt Sens Sup Volt Low Error	●	ENG	Electrical system
E11	CA2249	Rail Press Very Low Error	●	ENG	Electrical system
E11	CA2311	IMV Solenoid Error	●	ENG	Electrical system
E15	CA2555	Grid Htr Relay Volt High Error	●	ENG	Electrical system
E15	CA2556	Grid Htr Relay Volt Low Error	●	ENG	Electrical system
E01	D19JKZ	Personal Code Relay Abnormality	●	MON2	Electrical system
	D862KA	GPS Antenna Discon		MON2	Electrical system
	DA25KP	5V Sensor 1 Power Abnormality		PUMP	Electrical system
	DA29KQ	Model Selection Abnormality		PUMP	Electrical system
E0E	DA2RMC	CAN Discon (Pump Con Detected)	●	PUMP	Electrical system
	DAFGMC	GPS Module Error		MON2	Electrical system
E0E	DAFRMC	CAN Discon (Monitor Detected)	●	MON	Electrical system
	DGH2KB	Hydr Oil Sensor Short		PUMP	Electrical system
	DHPAMA	F Pump Press Sensor Abnormality		PUMP	Electrical system
	DHPBMA	R Pump Press Sensor Abnormality		PUMP	Electrical system
	DHS3MA	Arm Curl PPC Press Sensor Abnormality		PUMP	Electrical system
	DHS4MA	Bucket Curl PPC Press Sensor Abnormality		PUMP	Electrical system
	DHS8MA	Boom Raise PPC Press Sensor Abnormality		PUMP	Electrical system

User code	Failure code	Trouble (Displayed on screen)	Alarm buzzer	Device in charge	Category of history
	DHSAMA	Swing RH PPC Press Sensor Abnormality		PUMP	Electrical system
	DHSBMA	Swing LH PPC Press Sensor Abnormality		PUMP	Electrical system
	DHSDMA	Bucket Dump PPC Press Sensor Abnormality		PUMP	Electrical system
	DHX1MA	Overload Sensor Abnormality (Analog)		PUMP	Electrical system
	DW43KA	Travel Speed Sol Discon		PUMP	Electrical system
	DW43KB	Travel Speed Sol Short		PUMP	Electrical system
E03	DW45KA	Swing Brake Sol Discon	●	PUMP	Electrical system
E03	DW45KB	Swing Brake Sol Short	●	PUMP	Electrical system
	DW91KA	Travel Junction Sol Discon		PUMP	Electrical system
	DW91KB	Travel Junction Sol Short		PUMP	Electrical system
	DWA2KA	Service Sol Discon		PUMP	Electrical system
	DWA2KB	Service Sol Short		PUMP	Electrical system
	DWK0KA	2-stage Relief Sol Discon		PUMP	Electrical system
	DWK0KB	2-stage Relief Sol Short		PUMP	Electrical system
E02	DXA8KA	PC-EPC (F) Sol Discon	●	PUMP	Electrical system
E02	DXA8KB	PC-EPC (F) Sol Short	●	PUMP	Electrical system
E02	DXA9KA	PC-EPC (R) Sol Discon	●	PUMP	Electrical system
E02	DXA9KB	PC-EPC (R) Sol Short	●	PUMP	Electrical system
	DXE0KA	LS-EPC Sol Discon		PUMP	Electrical system
	DXE0KB	LS-EPC Sol Short		PUMP	Electrical system
	DXE4KA	Service Current EPC Discon		PUMP	Electrical system
	DXE4KB	Service Current EPC Short		PUMP	Electrical system
	DXE5KA	Merge-divider Main Sol Discon		PUMP	Electrical system
	DXE5KB	Merge-divider Main Sol Short		PUMP	Electrical system
	DXE6KA	Merge-divider LS Sol Discon		PUMP	Electrical system

User code	Failure code	Trouble (Displayed on screen)	Alarm buzzer	Device in charge	Category of history
	DXE6KB	Merge-divider LS Sol Short		PUMP	Electrical system
	DY20KA	Wiper Working Abnormality		PUMP	Electrical system
	DY20MA	Wiper Parking Abnormality		PUMP	Electrical system
	DY2CKA	Washer Drive Discon		PUMP	Electrical system
	DY2CKB	Washer Drive Short		PUMP	Electrical system
	DY2DKB	Wiper Drive (For) Short		PUMP	Electrical system
	DY2EKB	Wiper Drive (Rev) Short		PUMP	Electrical system

★ This failure codes table is the same as that in Testing and adjusting, Special functions of machine monitor.

Before carrying out troubleshooting when failure code is displayed

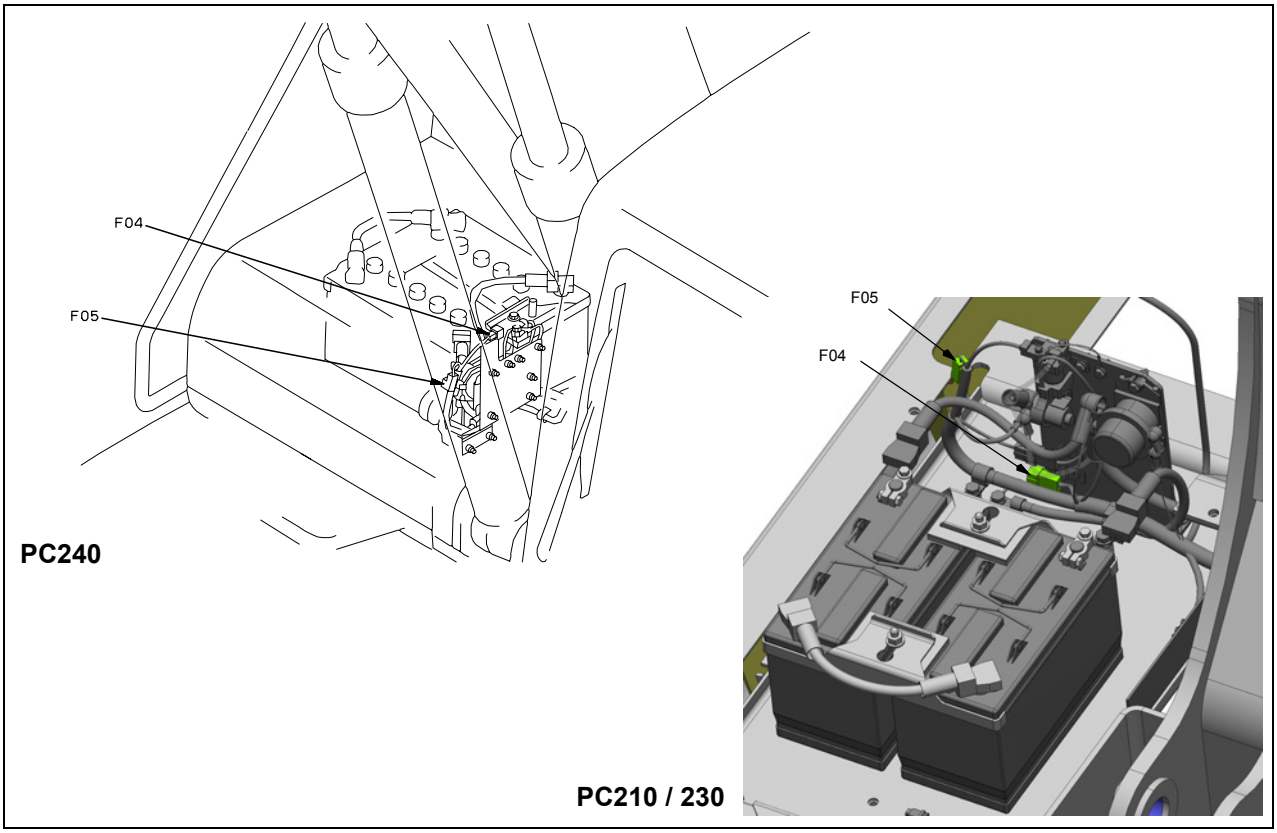
Connection table of fuse box

★ This connection table shows the devices to which each power supply of the fuse box supplies power (A switch power supply is a device which supplies power while the starting switch is in the ON position and a constant power supply is a device which supplies power while the starting switch is in the OFF and ON positions).

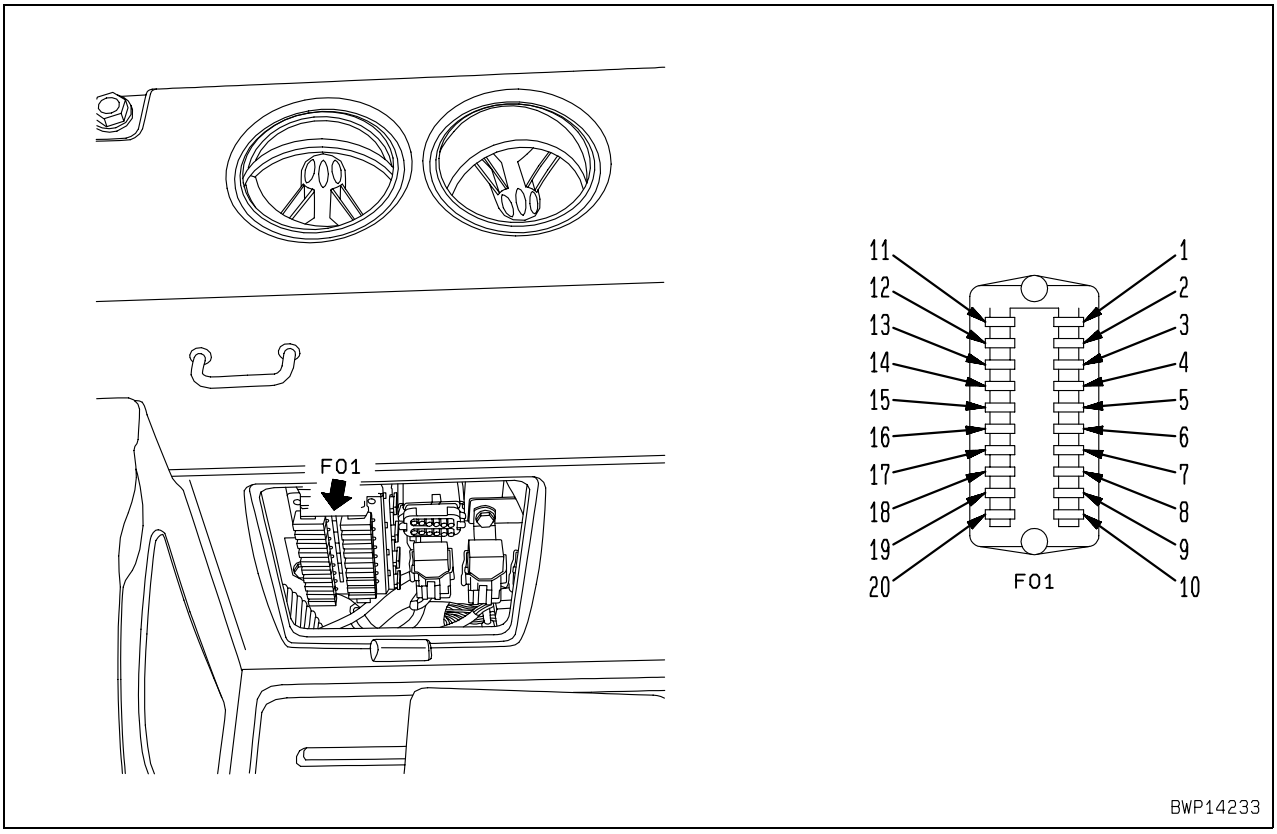
★ When carrying out troubleshooting related to the electrical system, you should check the fuses and fusible links to see if the power is supplied normally.

Type of power supply	Fusible link	Fuse No.	Fuse capacity	Destination of power
Switch power supply	F04 (65 A)	1	10 A	Lamp relay
				PC-EPC (F) solenoid valve, PC-EPC (R) solenoid valve [When pump drive switch is operated in emergency]
				Swing holding brake solenoid valve [When swing holding brake release switch is operated]
		2	30 A	Pump controller (Solenoid power supply)
		3	10 A	PPC oil pressure lock solenoid valve
				Starting motor cut-out relay (PPC lock)
				Starting motor cut-out relay (Personal code)
		4	10 A	Cigarette lighter
				Windshield washer motor
		5	10 A	Horn relay, horn
Switch power supply	F04 (65 A)	6	10 A	Lower wiper
		7	10 A	Beacon
		8	25 A	Working lamp (Front and boom)
		9	10 A	Radio, speaker
				Left knob switch (pump controller input)
		10	10 A	Refuel pump
Switch power supply	F04 (65 A)	11	20 A	Air conditioner unit
				Air conditioner compressor electromagnetic clutch
		12	20 A	Cab lamp (rear), rear worklamp lamp relay
		13	20 A	Cab lamp (headlamp)
		14	10 A	Optional power supply (1)
		15	20 A	Travel alarm, heated seat, 12v power port
				Optional power supply (2)
Constant power supply	F05 (30 A)	16	10 A	Radio (backup power supply)
				Room lamp
		17	20 A	Starting switch
				Machine monitor
				Pump controller
		18	10 A	(Spare)
		19	30 A	Engine controller
Switch power supply	Starting switch ACC	20	5 A	Engine controller (ACC signal)

Locations of fusible links



Location of fuse box and fuse Nos.

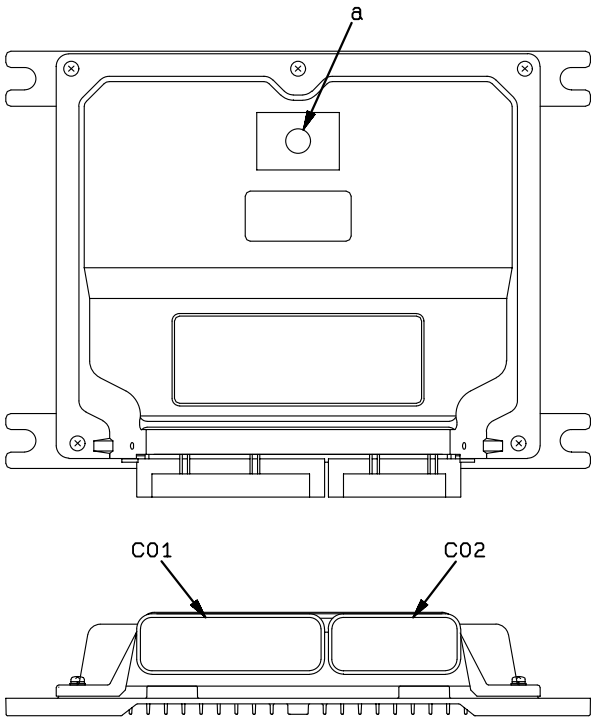


Troubles that occur when power supply of pump controller is defective

★ The controller power supply (F01-17) of the pump controller drives the controller system. Accordingly, if it is turned off, the controller cannot control the system and the troubles shown below occur simultaneously (The following is an example of the troubles).
- The working mode cannot be changed.
- The auto-decelerator does not work or is not reset.
- The travel speed does not change.
- The power maximizing function does not work.
- The swing holding brake cannot be reset automatically.
- The machine deviates during travel.

★ If the above problems occur, check the related fuse (F01-17) and "green LED" of the pump controller to see if the power is supplied normally.
- Lighting: The controller power is supplied (There is not an error and the power supply is normal).
- Flashing: The controller power is supplied (There is an error).
- Put out: The controller power is not supplied.

★ Green LED of pump controller (a)



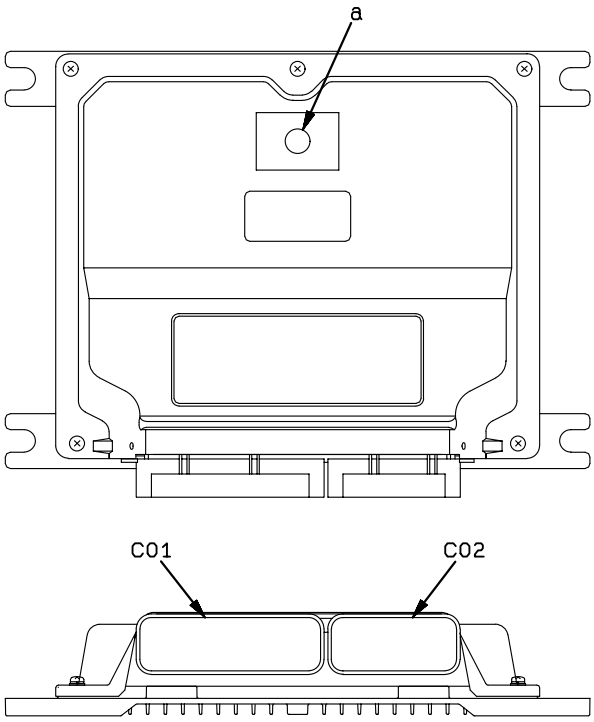
BWP14084

Troubles that occur when power supply of pump controller is defective

★ The solenoid power supply (F01-2) of the pump controller is used by the controller to drive the solenoids and relays. Accordingly, if the solenoid power supply is turned off, when the controller outputs the power to the solenoids or relays, the power is not supplied to any of the solenoids and relays and all or some of the following failure codes are displayed simultaneously.
- [DW43KA], [DW43KB]: Travel speed solenoid system
- [DW45KA], [DW45KB]: Swing holding brake solenoid system
- [DW4WKA], [DW4WKB]: Bucket dump prohibit solenoid system
- [DW91KA], [DW91KB]: Travel junction solenoid system
- [DWA2KA], [DWA2KB]: Service solenoid system
- [DWK0KA], [DWK0KB]: 2-stage relief solenoid system
- [DXA8KA], [DXA8KB]: PC-EPC (F) solenoid system
- [DXA9KA], [DXA9KB]: PC-EPC (R) solenoid system
- [DXE0KA], [DXE0KB]: LS-EPC solenoid system
- [DXE4KA], [DXE4KB]: Service current EPC system (if attachment is installed)
- [DXE5KA], [DXE5KB]: Merge-divider main solenoid system
- [DXE6KA], [DXE6KB]: Merge-divider LS solenoid system

★ If the above problems occur, check the related fuse (F01-2) and inlet voltage of the pump controller.
1) Disconnect connector C02 of the controller and connect a T-adapter to the wiring harness side.
2) Turn the starting switch ON.
3) Measure the voltage between each of pins (116), (118), and (121) and each of pins (115), (117), and (120).
   ★ Pins (116), (118), and (121) are the power supply and pins (115), (117), and (120) are the chassis ground.
   ★ If the voltage is 20 – 30 V, it is normal.

★ Power supply connector (C02) of pump controller



BWP14084

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.

User code	Failure code	Trouble	
Display on machine monitor	**Display on machine monitor**	Trouble	**Trouble name displayed in abnormality record 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 engine controller detects trouble**		
Problem that appears on machine	**Problem that appears on machine as result of action taken by machine monitor or controller (shown above)**		
Related information	**Information related to detected trouble or troubleshooting**		

	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Possible causes of trouble (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 imperfectly 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.

Failure code [989L00] Engine Controller Lock Caution 1

User code	Failure code	Trouble	Engine controller lock caution 1 (Machine monitor system)
—	**989L00**		
Contents of trouble	• Engine controller lock is detected (Factor 1).		
Action of machine monitor	• None in particular. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Engine cannot be started.		
Related information	• If this failure code is displayed after machine monitor is replaced, user password must be changed to one before replacement. • Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Replacement of machine monitor	This trouble may be caused by replacement of machine monitor.

Failure code [989M00] Engine Controller Lock Caution 2

User code	Failure code	Trouble	Engine controller lock caution 2 (Machine monitor system)
—	**989M00**		
Contents of trouble	• Engine controller lock is detected (Factor 2).		
Action of machine monitor	• None in particular. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Engine cannot be started.		
Related information	• If this failure code is displayed after machine monitor is replaced, user password must be changed to one before replacement. • Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Replacement of machine monitor	This trouble may be caused by replacement of machine monitor.
	2	Defective machine monitor	If this failure code is displayed while machine monitor is not replaced, machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Failure code [989N00] Engine Controller Lock Caution 3

User code	Failure code	Trouble	Engine controller lock caution 3 (Machine monitor system)
—	**989N00**		
Contents of trouble	• Engine controller lock is detected (Factor 3).		
Action of machine monitor	• Tries automatic resetting. • If cause of failure disappears, system resets itself.		
Problem that appears on machine			
Related information	• Method of reproducing failure code: Failure code is not reproduced since system is reset automatically.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective engine controller	If this failure code is displayed repeatedly, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Failure code [AA10NX] Air Cleaner Clogging

User code	Failure code	Trouble	Air cleaner clogging (Machine monitor system)
—	**AA10NX**		
Contents of trouble	• While engine was running, signal circuit of air cleaner clogging switch detected clogging of air cleaner (sensor contact opened).		
Action of machine monitor	• Displays air cleaner clogging monitor on machine monitor. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• If machine is operated as it is, engine may be damaged.		
Related information	• Condition of air cleaner clogging switch signal can be checked with monitoring function. (Code: 04501 Monitor input 2) • Method of reproducing failure code: Start engine.		

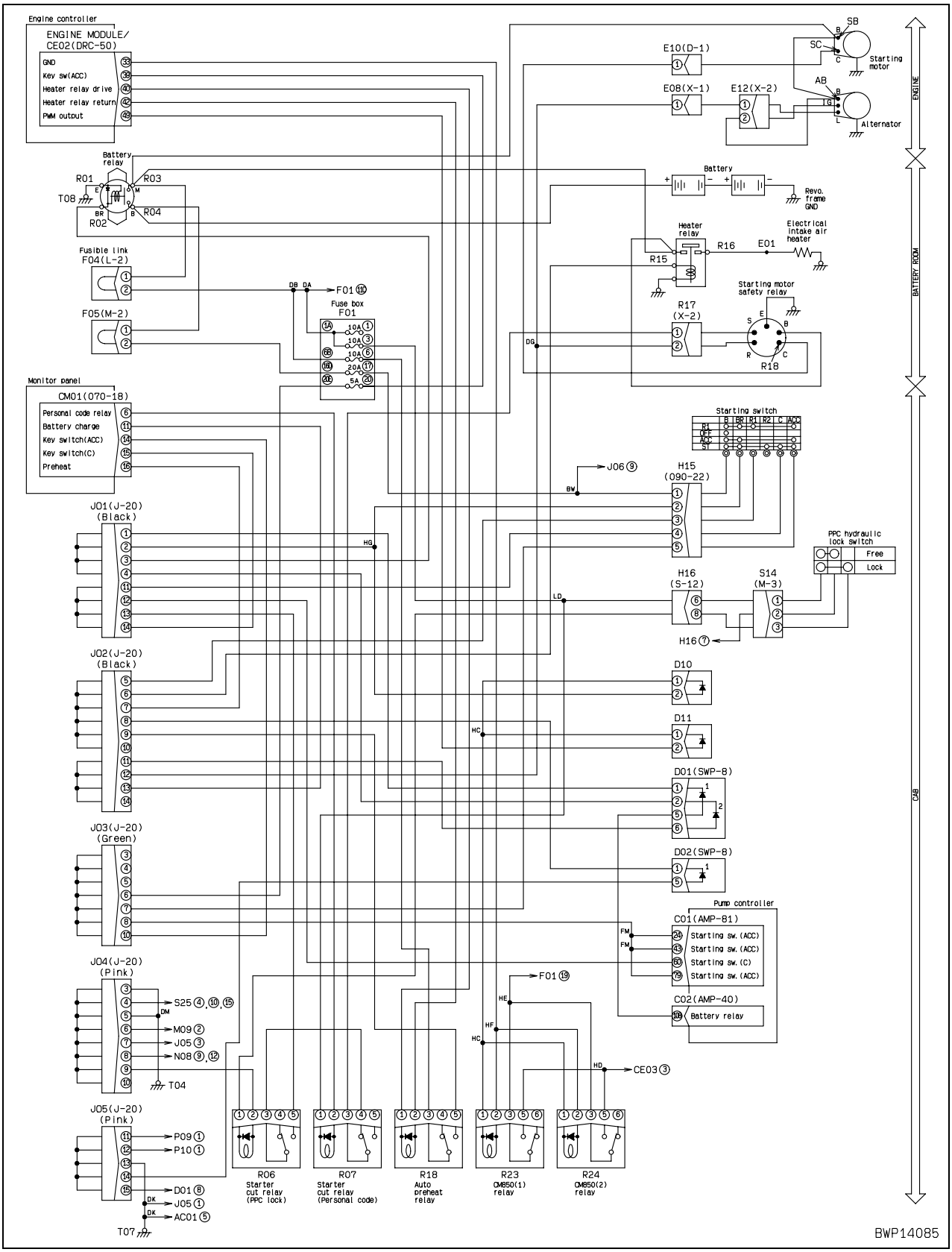
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Clogging of air cleaner (when system is normal)	Air cleaner may be clogged. Check it for clogging and then clean or replace if clogged.
	2	Defective air cleaner clogging monitor system	If cause 1 is not detected, air cleaner clogging monitor system may be defective. Carry out troubleshooting for "E-7 Caution item flashes while engine is running" in E-mode.

Failure code [AB00KE] Charge Voltage Low

User code	Failure code	Trouble	Charge voltage low (Machine monitor system)
—	**AB00KE**		
Contents of trouble	• While engine is running, signal circuit of alternator detected low charge voltage (below 7.8 V).		
Action of machine monitor	• Displays charge level monitor on machine monitor. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• If machine is operated as it is, battery may not be charged.		
Related information	• Signal voltage of alternator can be checked with monitoring function. (Code: 04300 Charge voltage) • Method of reproducing failure code: Start engine.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective charge of alternator (when system is normal)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.		
			E12 (male)	Engine speed	Voltage
			Between (1) – chassis ground	Min. medium speed	27.5 – 29.5 V
	2	Defective charge level monitor	If cause 1 is not detected, charge level monitor system may be defective. Carry out troubleshooting for "E-7 Caution item flashes while engine is running" in E-mode.		

Circuit diagram related to preheating/starting of engine and charge of battery



Failure code [B@BAZG] Eng Oil Press. Low

User code	Failure code	Trouble	Engine oil pressure low (Engine controller system)
—	**B@BAZG**		
Contents of trouble	• While engine was running, signal circuit of engine oil pressure switch detected low engine oil pressure (sensor contact opened).		
Action of controller	• Displays engine oil pressure monitor on machine monitor. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• If machine is operated as it is, engine may be damaged.		
Related information	• Engine oil pressure switch signal is input to engine controller and then transmitted to machine monitor. • Method of reproducing failure code: Start engine.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Lowering of engine oil pressure (when system is normal)	Engine oil pressure may be low. Check it and remove cause if it is low.
	2	Defective engine oil pressure monitor system	If cause 1 is not detected, engine oil pressure monitor system may be defective. Carry out troubleshooting for "E-8 Emergency stop item lights up while engine is running" in E-mode.

Failure code [B@BAZK] Eng Oil Level Low

User code	Failure code	Trouble	Engine oil level low (Machine monitor system)
—	**B@BAZK**		
Contents of trouble	• When starting switch is turned ON (but engine is not started), signal circuit of engine oil level switch detected low engine oil level (sensor contact opened).		
Action of machine monitor	• Displays engine oil level monitor on machine monitor. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• If machine is operated as it is, engine may be damaged.		
Related information	• Engine oil level switch signal can be checked with monitoring function. (Code: 04501 Monitor input 2) • Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Lowering of engine oil level (when system is normal)	Engine oil level may be low. Check it and add new oil if it is low.
	2	Defective engine oil level monitor system	If cause 1 is not detected, engine oil level monitor system may be defective. Carry out troubleshooting for "E-2 Basic check item lights up when starting switch is turned ON (but engine is not started)" in E-mode.

Failure code [B@BCNS] Eng Water Overheat

User code	Failure code	Trouble	Engine coolant overheat (Engine controller system)
—	**B@BCNS**		
Contents of trouble	• While engine was running, signal circuit of engine coolant temperature sensor detected overheating of engine coolant (above about 102°C).		
Action of controller	• Displays engine coolant temperature monitor with red on machine monitor. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• If machine is operated as it is, engine may be seized.		
Related information	• Engine coolant temperature sensor signal is input to engine controller and then transmitted to machine monitor. • Engine coolant temperature can be checked with monitoring function (Code: 04107 Engine coolant temperature) • 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	Overheating of engine coolant (when system is normal)	Engine coolant may be overheating. Check it and remove cause if it is overheating.
	2	Defective engine coolant temperature gauge system	If cause 1 is not detected, engine coolant temperature gauge system may be defective. Carry out troubleshooting for "E-9 Engine coolant temperature gauge does not work normally" in E-mode.

Failure code [B@BCZK] Eng Water Level Low

User code	Failure code	Trouble	Engine coolant level low (Machine monitor system)
—	**B@BCZK**		
Contents of trouble	• When starting switch is turned ON (but engine is not started), signal circuit of radiator coolant level sensor detected low radiator coolant level (sensor contact opened).		
Action of machine monitor	• Displays radiator coolant level monitor on machine monitor. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• If machine is operated as it is, engine may overheats.		
Related information	• Condition of radiator coolant level switch can be checked with monitoring function (Code: 04500 Monitor input 1) • 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	Lowering of radiator coolant level (when system is normal)	Radiator coolant level may be low. Check it and add coolant if it is low.
	2	Defective radiator coolant level monitor system	If cause 1 is not detected, radiator coolant level monitor system may be defective. Carry out troubleshooting for "E-2 Basic check item lights up when starting switch is turned ON (but engine is not started)" in E-mode.

Failure code [B@HANS] Hydr Oil Overheat

User code	Failure code	Trouble	Hydraulic oil overheat (Pump controller system)
—	**B@HANS**		
Contents of trouble	• While engine was running, signal circuit of hydraulic oil temperature sensor detected overheating of hydraulic oil (above about 102°C).		
Action of controller	• Displays hydraulic oil temperature monitor with red on machine monitor. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• If machine is operated as it is, engine may be seized.		
Related information	• Hydraulic oil temperature sensor signal is input to engine controller and then transmitted to machine monitor. • Hydraulic oil temperature can be checked with monitoring function (Code: 04401 Hydraulic oil temperature) • Method of reproducing failure code: Start engine.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Overheating of hydraulic oil (when system is normal)	Hydraulic oil may be overheating. Check it and remove cause if it is overheating.
	2	Defective hydraulic oil temperature gauge system	If cause 1 is not detected, hydraulic oil temperature gauge system may be defective. Carry out troubleshooting for "E-10 Hydraulic oil temperature gauge does not work normally" in E-mode.

Failure code [CA111] EMC Critical Internal Failure

User code	Failure code	Trouble	Critical internal failure (Engine controller system)
E10	**CA111**		
Contents of trouble	• Memory or power supply circuit in engine controller is defective.		
Action of controller	• None in particular.		
Problem that appears on machine	• Engine does not start.		
Related information			

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective engine controller	Engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Failure code [CA115] Eng Ne and Bkup Speed Sens Error

User code	Failure code	Trouble	Engine Ne and Bkup speed sensor error (Engine controller system)
E10	**CA115**		
Contents of trouble	• Both signals of engine Ne speed sensor and engine Bkup speed sensor are abnormal.		
Action of controller	• None in particular.		
Problem that appears on machine	• Engine stops. • Engine does not start.		
Related information	• Method of reproducing failure code: Start engine.		

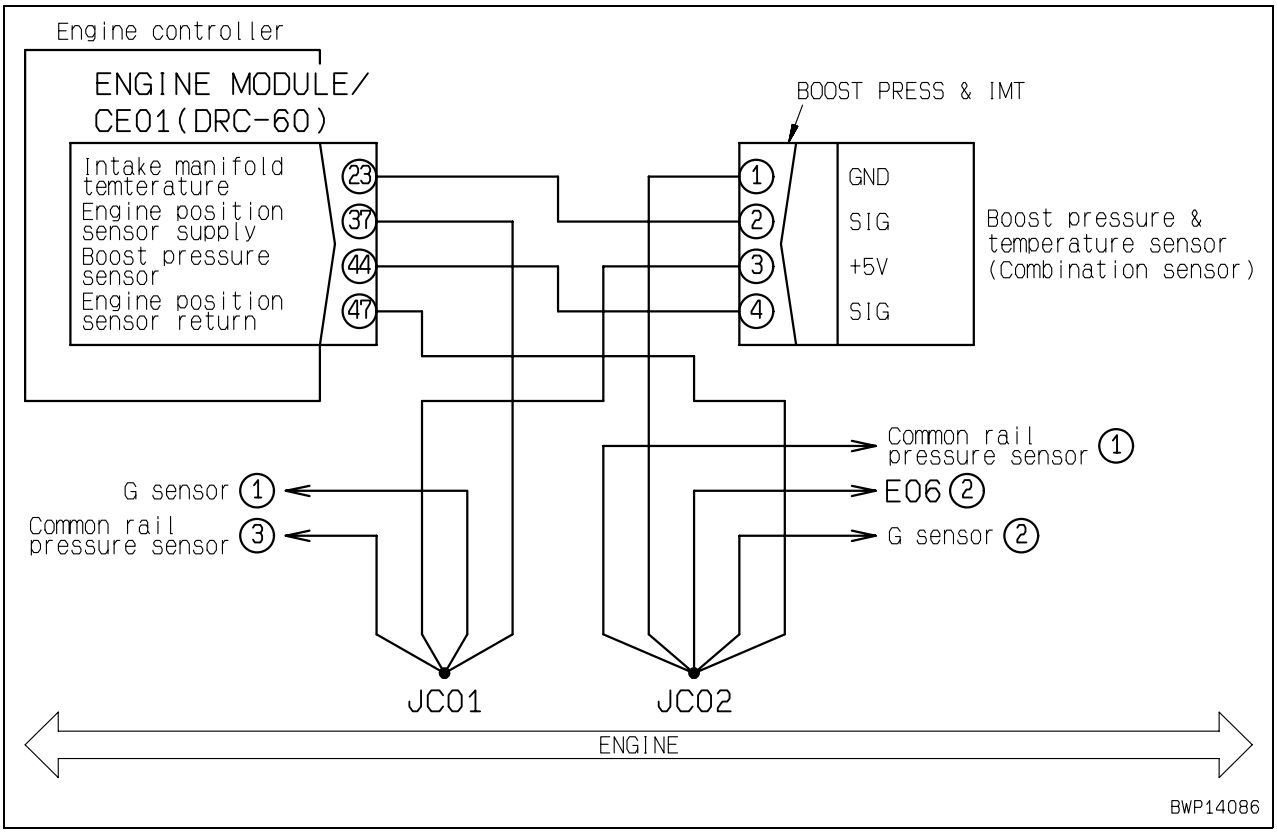
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective connection of sensor connector	Connectors of Ne speed sensor and Bkup speed sensor may be connected defectively (or connected to wrong parts). Check them directly.

Failure code [CA122] Chg Air Press Sensor High Error

User code	Failure code	Trouble	Charge air pressure sensor high error (Engine controller system)
E11	**CA122**		
Contents of trouble	• Pressure signal circuit of boost pressure/temperature sensor detected high voltage.		
Action of controller	• Fixes charge pressure value and continues operation.		
Problem that appears on machine	• Engine output lowers.		
Related information	• Signal voltage on boost pressure side of boost pressure/temperature sensor can be checked with monitoring function. (Code: 36501 Boost pressure sensor voltage) • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective sensor power supply 2 system	If failure code [**CA227**] is also indicated, carry out troubleshooting for it first.			
	2	Defective boost pressure/temperature sensor [pressure signal system]	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			BOOST PRESS & IMT		Voltage	
			Between (3) – (1)	Power supply	4.75 – 5.25 V	
			Voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.			
	3	Hot short (Short circuit with 5 V/24 V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between CE01 (female) (44) – BOOST PRESS & IMT (female) (4)		Voltage	Max. 1 V
	4	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE01 (female) (44) – BOOST PRESS & IMT (female) (4) and between CE01 (female) (37) – JC01 – BOOST PRESS & IMT (female) (3)		Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts between boost pressure/temperature sensor – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation			
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			CE01		Voltage	
			Between (37) – (47)	Power supply	4.75 – 5.25 V	

Circuit diagram related to boost pressure/temperature sensor (Combination sensor)

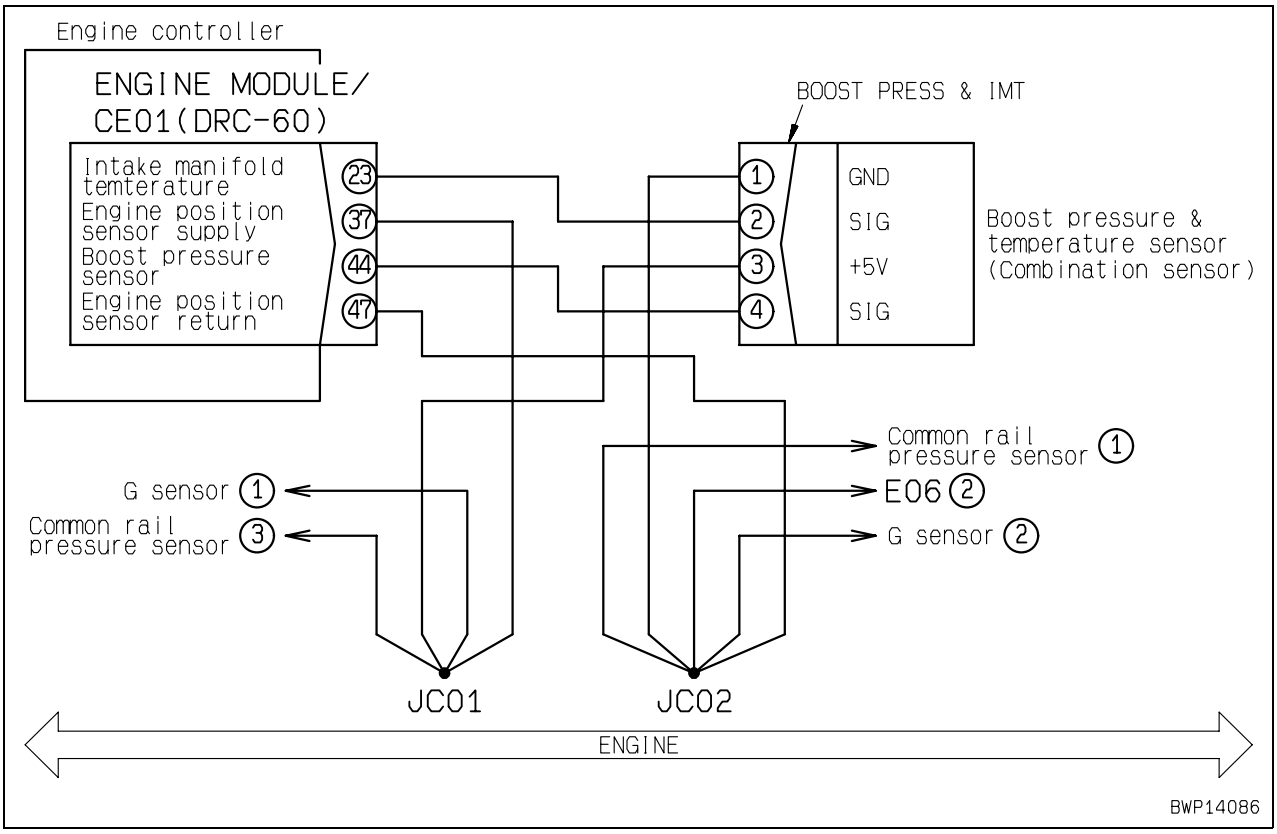


Failure code [CA123] Chg Air Press Sensor Low Error

User code	Failure code	Trouble	Charge air pressure sensor low error (Engine controller system)
E11	**CA123**		
Contents of trouble	• Pressure signal circuit of boost pressure/temperature sensor detected low voltage.		
Action of controller	• Fixes charge pressure value and continues operation.		
Problem that appears on machine	• Engine output lowers.		
Related information	• Signal voltage on boost pressure side of boost pressure/temperature sensor can be checked with monitoring function. (Code: 36501 Boost pressure sensor voltage) • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective sensor power supply 2 system	If failure code [**CA187**] is also indicated, carry out troubleshooting for it first.		
	2	Defective boost pressure/ temperature sensor [pressure signal system]	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			BOOST PRESS & IMT		Voltage
			Between (3) – (1)	Power supply	4.75 – 5.25 V
			Voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.		
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (44) – BOOST PRESS & IMT (female) (4)	Resistance	Min. 100 kΩ
	4	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (44) – BOOST PRESS & IMT (female) (4) and between CE01 (female) (47) – JC02 – BOOST PRESS & IMT (female) (1)	Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts between boost pressure/temperature sensor – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation		
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			CE01		Voltage
			Between (37) – (47)	Power supply	4.75 – 5.25 V

Circuit diagram related to boost pressure/temperature sensor (Combination sensor)

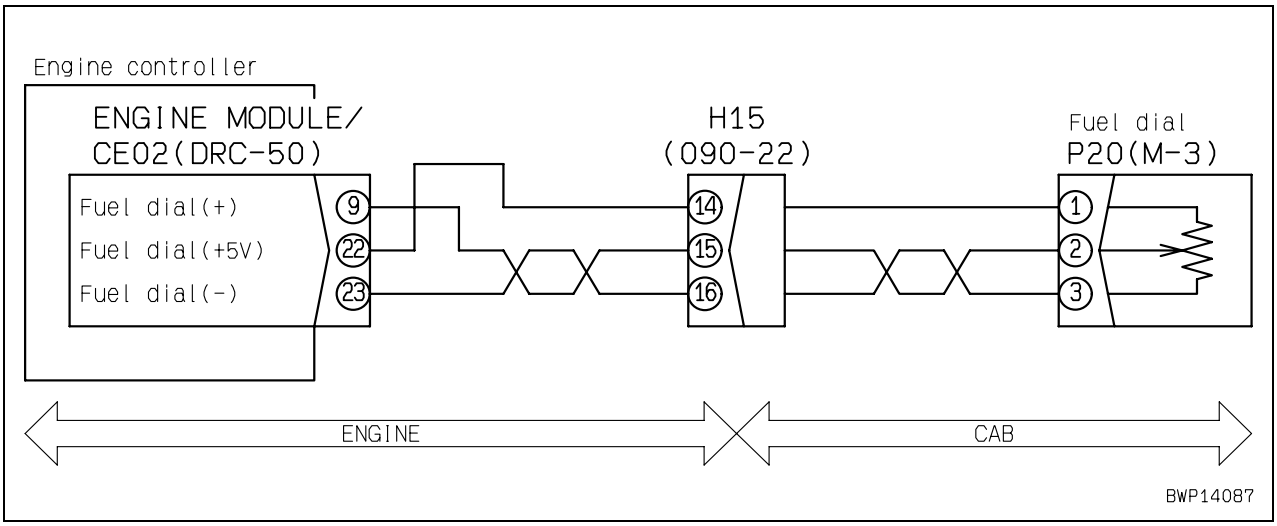


Failure code [CA131] Throttle Sensor High Error

User code	Failure code	Trouble	Throttle sensor high error (Engine controller system)
E14	**CA131**		
Contents of trouble	• Signal circuit of fuel control dial detected high voltage.		
Action of controller	• If trouble occurs while starting switch is in ON position, controller fixes voltage value to level just before detection of trouble and continues operation. • If starting switch is turned ON while voltage is abnormally high, controller continues operation with voltage at 100% value.		
Problem that appears on machine	• Engine speed cannot be controlled with fuel control dial.		
Related information	• Signal voltage of fuel control dial can be checked with monitoring function. (Code: 03000 Fuel control dial voltage) • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective throttle sensor power supply system	If failure code [**CA2185**] is also indicated, carry out troubleshooting for it first.			
	2	Defective fuel control dial	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			P20		Voltage	
			Between (1) – (3)	Power supply	4.75 – 5.25 V	
			Voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.			
	3	Hot short (Short circuit with 5 V/24 V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between CE02 (female) (9) – P20 (female) (2)		Voltage	Max. 1 V
	4	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE02 (female) (9) – P20 (female) (2) and between CE02 (female) (22) – P20 (female) (1)		Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts between fuel control dial – machine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation			
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			CE02		Voltage	
			Between (22) – (23)	Power supply	4.75 – 5.25 V	

Circuit diagram related to fuel control dial

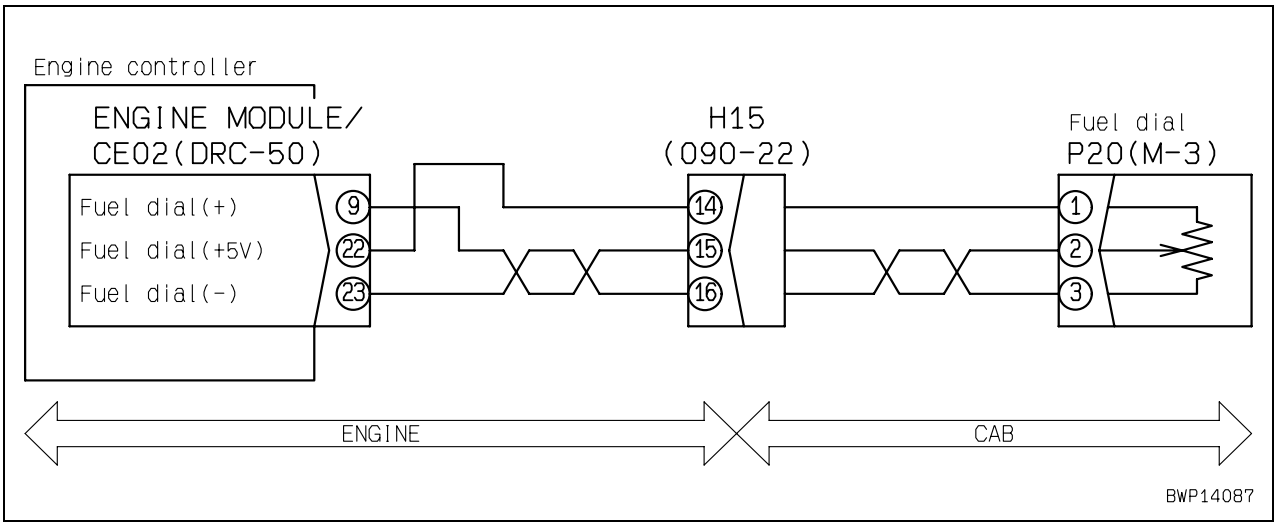


Failure code [CA132] Throttle Sensor Low Error

User code	Failure code	Trouble	Throttle sensor low error (Engine controller system)
E14	**CA132**		
Contents of trouble	• Signal circuit of fuel control dial detected low voltage.		
Action of controller	• If trouble occurs while starting switch is in ON position, controller fixes voltage value to level just before detection of trouble and continues operation. • If starting switch is turned ON while voltage is abnormally high, controller continues operation with voltage at 100% value.		
Problem that appears on machine	• Engine speed cannot be controlled with fuel control dial.		
Related information	• Signal voltage of fuel control dial can be checked with monitoring function. (Code: 03000 Fuel control dial voltage) • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective throttle sensor power supply system	If failure code [**CA2186**] is also indicated, carry out troubleshooting for it first.			
	2	Defective fuel control dial	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			P20		Voltage	
			Between (1) – (3)	Power supply	4.75 – 5.25 V	
			Voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.			
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE02 (female) (9) – P20 (female) (2)		Resistance	Min. 100 kΩ
	4	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE02 (female) (9) – P20 (female) (2) and between CE02 (female) (23) – P20 (female) (3)		Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts between fuel control dial – machine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation			
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			CE02		Voltage	
			Between (22) – (23)	Power supply	4.75 – 5.25 V	

Circuit diagram related to fuel control dial

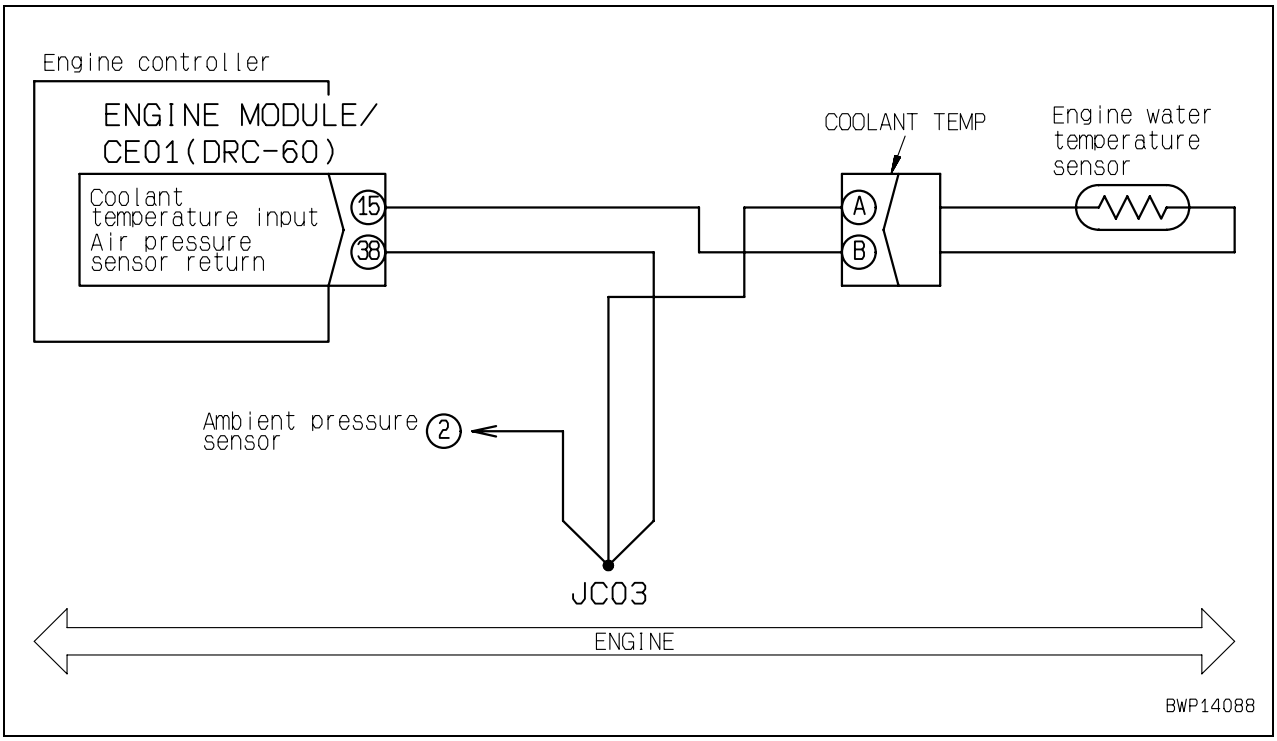


Failure code [CA144] Coolant Temp Sens High Error

User code	Failure code	Trouble	Coolant temperature sensor high error (Engine controller system)
E15	**CA144**		
Contents of trouble	• Signal circuit of coolant temperature sensor detected high voltage.		
Action of controller	• Fixes coolant temperature value and continues operation.		
Problem that appears on machine	• Exhaust gas becomes white. • Overheat prevention function does not work.		
Related information	• Signal voltage of coolant temperature sensor can be checked with monitoring function. (Code: 04105 Coolant temperature sensor voltage) • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective coolant temperature sensor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			COOLANT TEMP (male)	Resistance	
			Between (A) – (B)	0.18 – 160 kΩ	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (15) – COOLANT TEMP (female) (B)	Resistance	Max. 10 Ω
			Wiring harness between CE01 (female) (38) – JC03 – COOLANT TEMP (female) (A)	Resistance	Max. 10 Ω
	3	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (15) – each of CE01 (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ
	4	Defective wiring harness connector	Connecting parts between coolant temperature sensor – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation		
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CE01 (female)	Resistance	
			Between (15) – (38)	0.18 – 160 kΩ	

Circuit diagram related to coolant temperature sensor

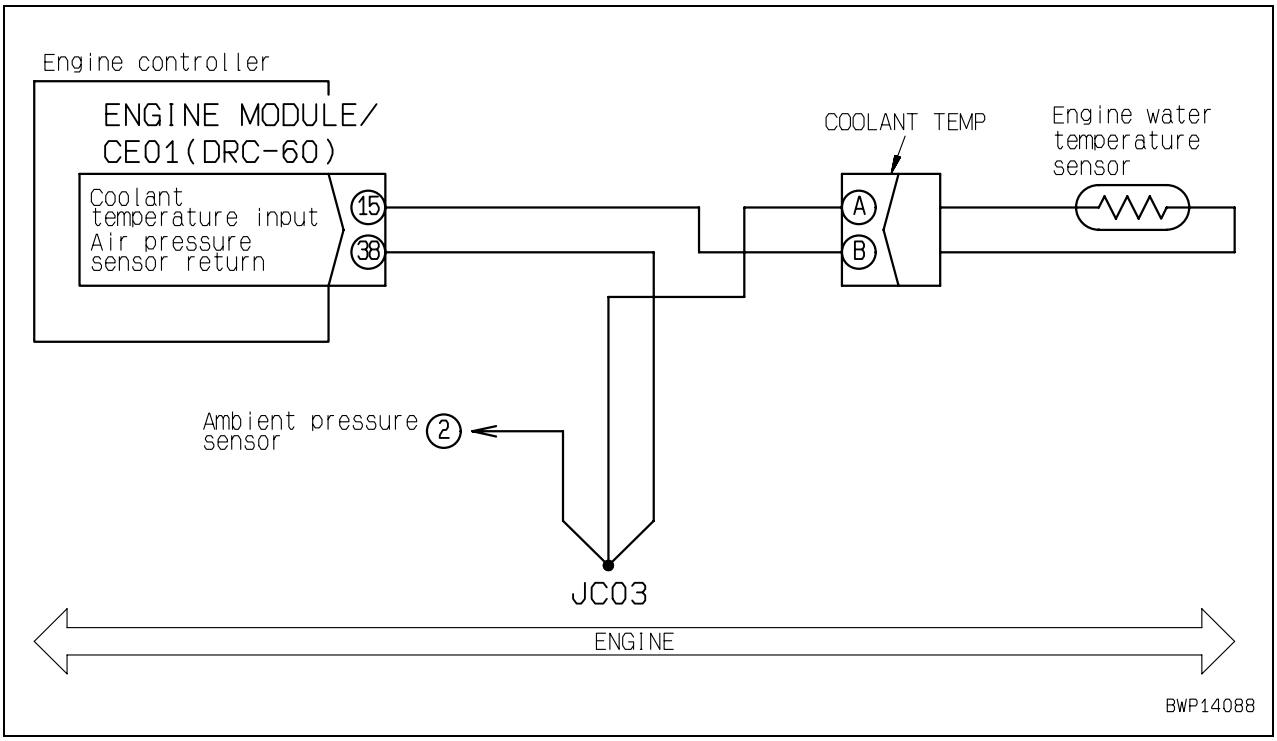


Failure code [CA145] Coolant Temp Sens Low Error

User code	Failure code	Trouble	Coolant temperature sensor low error (Engine controller system)
E15	**CA145**		
Contents of trouble	• Signal circuit of coolant temperature sensor detected low voltage.		
Action of controller	• Fixes coolant temperature value and continues operation.		
Problem that appears on machine	• Exhaust gas becomes white. • Overheat prevention function does not work.		
Related information	• Signal voltage of coolant temperature sensor can be checked with monitoring function. (Code: 04105 Coolant temperature sensor voltage) • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective coolant temperature sensor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			COOLANT TEMP (male)	Resistance		
			Between (A) – (B)	0.18 – 160 kΩ		
			Between (B) – chassis ground	Min. 100 kΩ		
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE01 (female) (15) – COOLANT TEMP (female) (B)	Resistance	Min. 100 kΩ	
	3	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE01 (female) (15) – each of CE01 (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ	
	4	Defective wiring harness connector	Connecting parts between coolant temperature sensor – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation			
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			CE01 (female)	Resistance		
			Between (15) – (38)	0.18 – 160 kΩ		
			Between (15) – chassis ground	Min. 100 kΩ		

Circuit diagram related to coolant temperature sensor

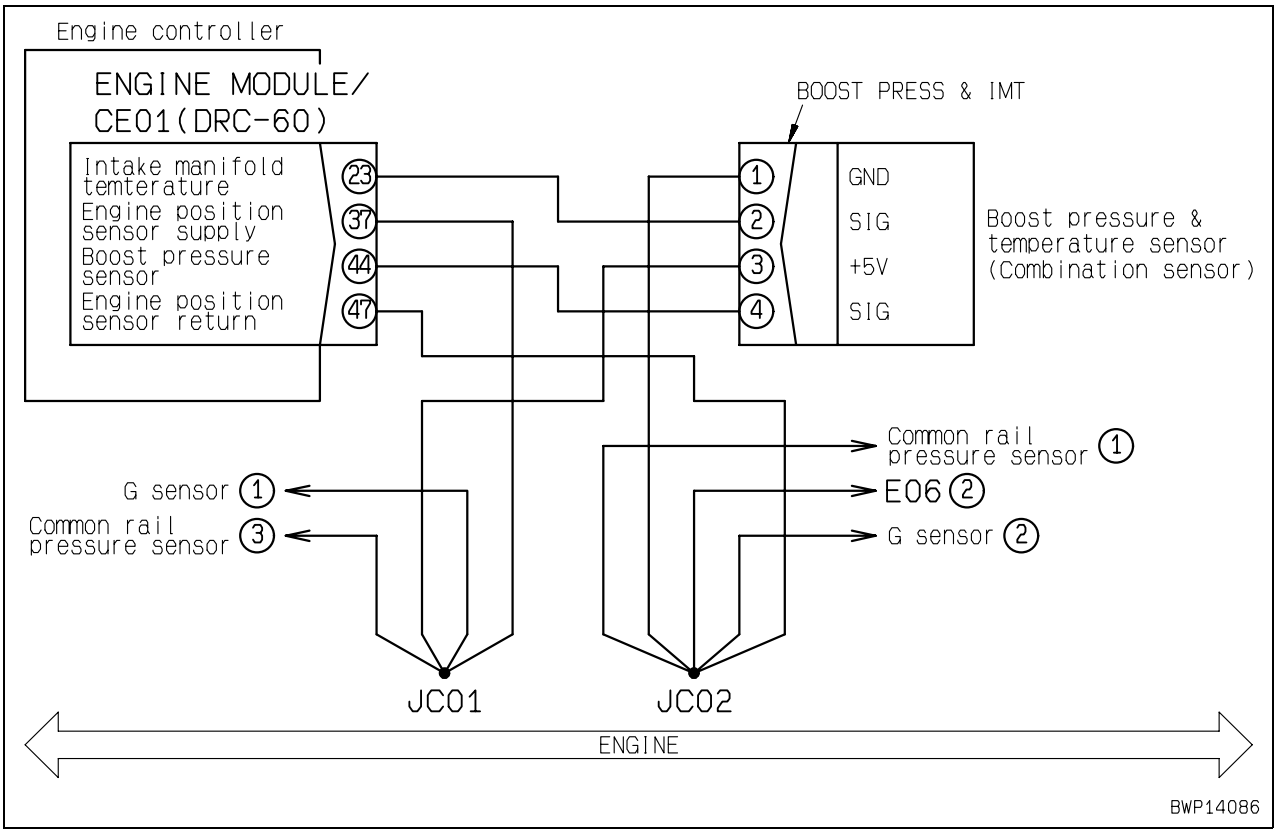


Failure code [CA153] Chg Air Temp Sensor High Error

User code	Failure code	Trouble	Charge air temperature sensor high error (Engine controller system)
E15	**CA153**		
Contents of trouble	• Temperature signal circuit of boost pressure/temperature sensor detected high voltage.		
Action of controller	• Fixes charge temperature value and continues operation.		
Problem that appears on machine	• Exhaust gas becomes white. • Engine protection function based on boost temperature does not work		
Related information	• Signal voltage on boost temperature side of boost pressure/temperature sensor can be checked with monitoring function. (Code: 18501 Boost temperature sensor voltage) • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective boost pressure/ temperature sensor [temperature signal system]	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			BOOST PRESS & IMT (male)	Resistance		
			Between (2) – (1)	0.18 – 160 kΩ		
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE01 (female) (23) – BOOST PRESS & IMT (female) (2)	Resistance	Max. 10 Ω	
			Wiring harness between CE01 (female) (47) – JC02 – BOOST PRESS & IMT (female) (1)	Resistance	Max. 10 Ω	
	3	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE01 (female) (23) – each of CE01 (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ	
	4	Defective wiring harness connector	Connecting parts between boost pressure/temperature sensor – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation			
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			CE01 (female)	Resistance		
			Between (23) – (47)	0.18 – 160 kΩ		

Circuit diagram related to boost pressure/temperature sensor (Combination sensor)

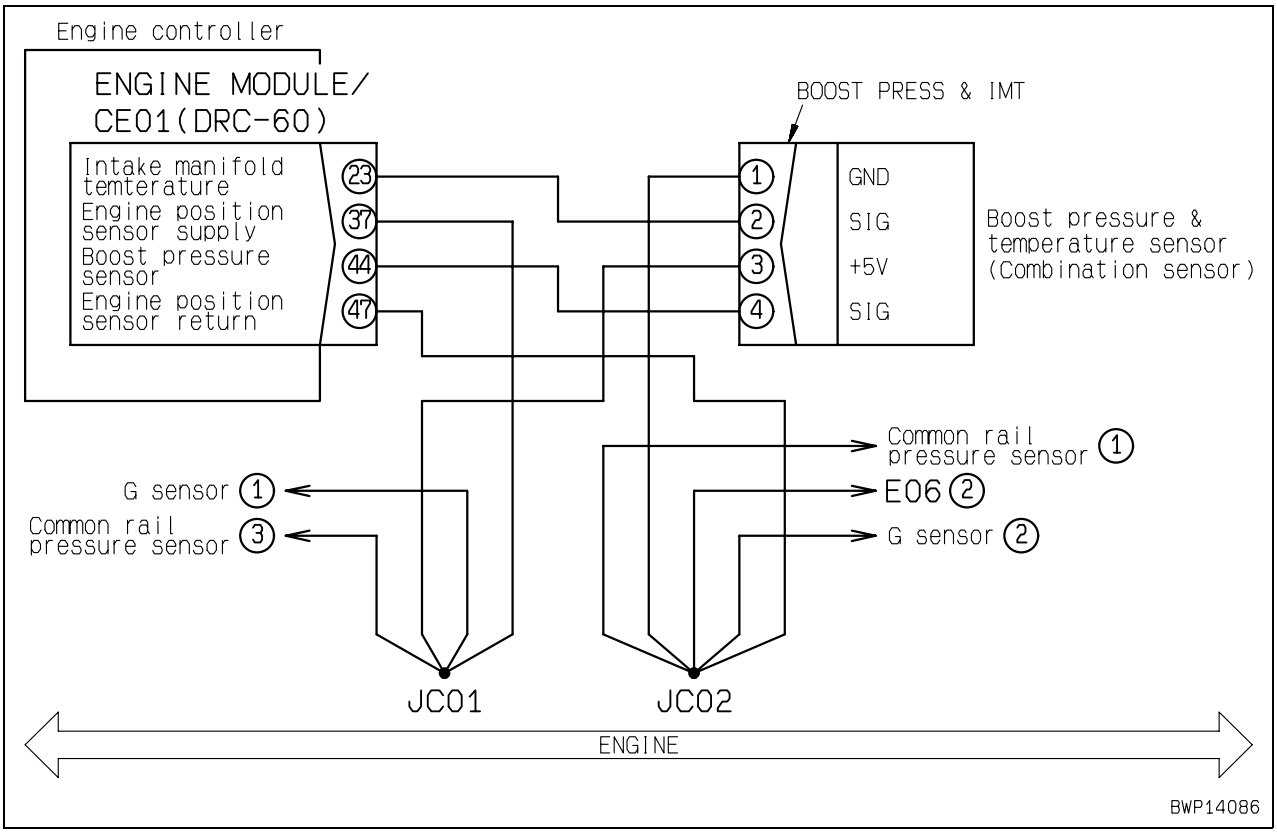


Failure code [CA154] Chg Air Temp Sensor Low Error

User code	Failure code	Trouble	Charge air temperature sensor low error (Engine controller system)
E15	**CA154**		
Contents of trouble	• Temperature signal circuit of boost pressure/temperature sensor detected low voltage.		
Action of controller	• Fixes charge temperature value and continues operation.		
Problem that appears on machine	• Exhaust gas becomes white. • Engine protection function based on boost temperature does not work		
Related information	• Signal voltage on boost temperature side of boost pressure/temperature sensor can be checked with monitoring function. (Code: 18501 Boost temperature sensor voltage) • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective boost pressure/ temperature sensor [temperature signal system]	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			BOOST PRESS & IMT (male)	Resistance		
			Between (2) – (1)	0.18 – 160 kΩ		
			Between (2) – chassis ground	Min. 100 kΩ		
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE01 (female) (23) – BOOST PRESS & IMT (female) (2)	Resistance	Min. 100 kΩ	
	3	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE01 (female) (23) – each of CE01 (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ	
	4	Defective wiring harness connector	Connecting parts between boost pressure/temperature sensor – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation			
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			CE01 (female)	Resistance		
			Between (23) – (47)	0.18 – 160 kΩ		
			Between (23) – chassis ground	Min. 100 kΩ		

Circuit diagram related to boost pressure/temperature sensor (Combination sensor)



Failure code [CA155] Chg Air Temp High Speed Derate

User code	Failure code	Trouble	Charge air temperature high speed derate (Engine controller system)
E11	**CA155**		
Contents of trouble	• Temperature signal of boost pressure/temperature sensor exceeded control upper temperature limit.		
Action of controller	• Limits output and continues operation.		
Problem that appears on machine	• Engine output lowers. • Engine stops.		
Related information	• Boost temperature can be checked with monitoring function. (Code: 18500 Boost temperature) • Method of reproducing failure code: Start engine		

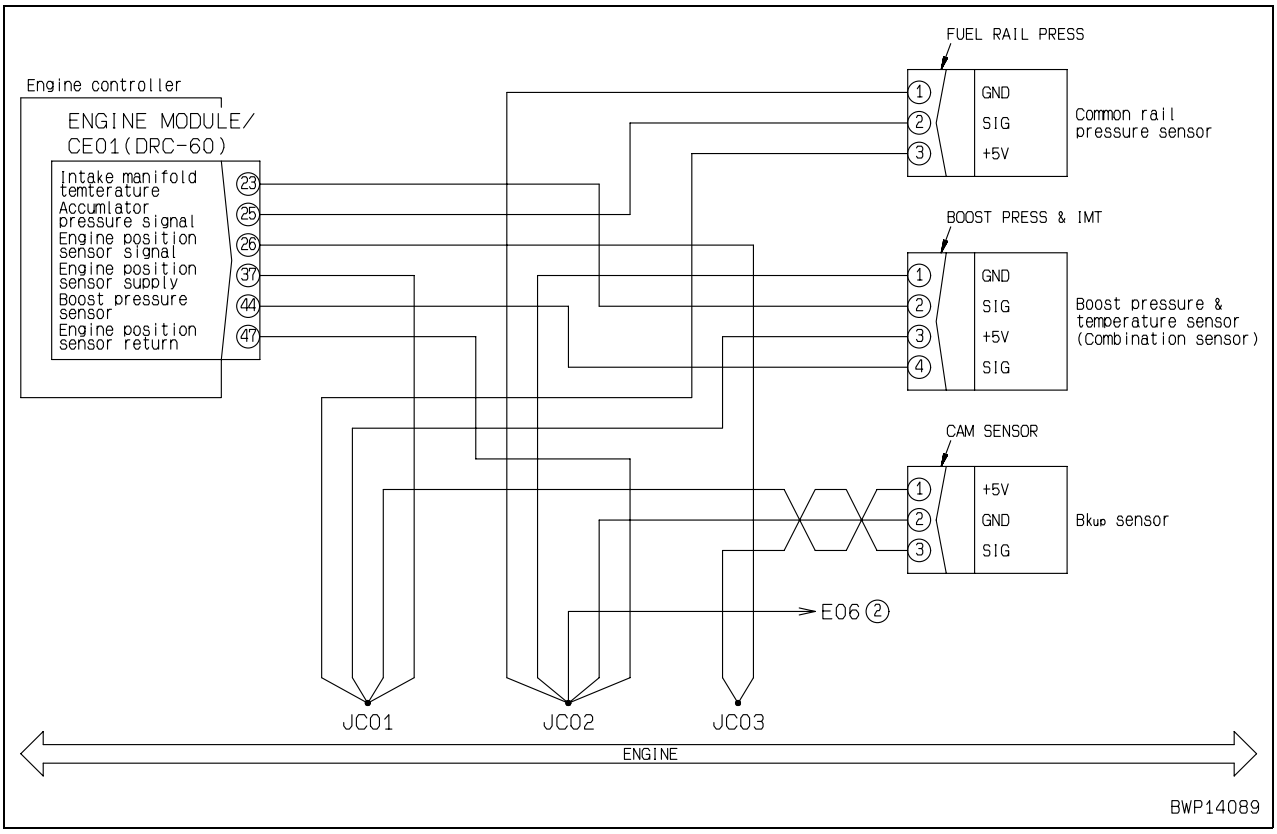
	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Lowering of cooling performance of aftercooler	Cooling performance of aftercooler may be low. Check following points directly. • Looseness and breakage of fan belt. • Insufficiency of cooling air • Clogging of aftercooler fins
	2	Abnormal rise of turbocharger outlet temperature	Outlet temperature of turbocharger may be abnormally high. Check related parts directly.
	3	Defective engine controller	If causes 1 – 2 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Failure code [CA187] Sens Supply 2 Volt Low Error

User code	Failure code	Trouble	Sensor power supply 2 voltage low error (Engine controller system)
E15	**CA187**		
Contents of trouble	• Low voltage was detected in sensor power supply 2 circuit.		
Action of controller	• Fixes boost pressure value and continues operation. • Fixes charge temperature value and continues operation. • Limits output and continues operation.		
Problem that appears on machine	• Engine output lowers.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state			★ Disconnect connector with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
	1	Defective sensor or wiring harness	Disconnect sensors and wiring harness at right in order and carry out operation to reproduce trouble. If "E" of failure code goes off when a sensor or wiring harness is disconnected, that sensor or wiring harness is defective.	Boost pressure/temperature sensor	BOOST PRESS & IMT
				Common rail pressure sensor	FUEL RAIL PRESS
				Bkup sensor	CAM SENSOR
				Engine wiring harness	CE01
	2	Defective wiring harness connector	Connecting parts between each sensor – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation		
	3	Defective engine controller	If causes 1 – 2 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related to sensor power supply 2

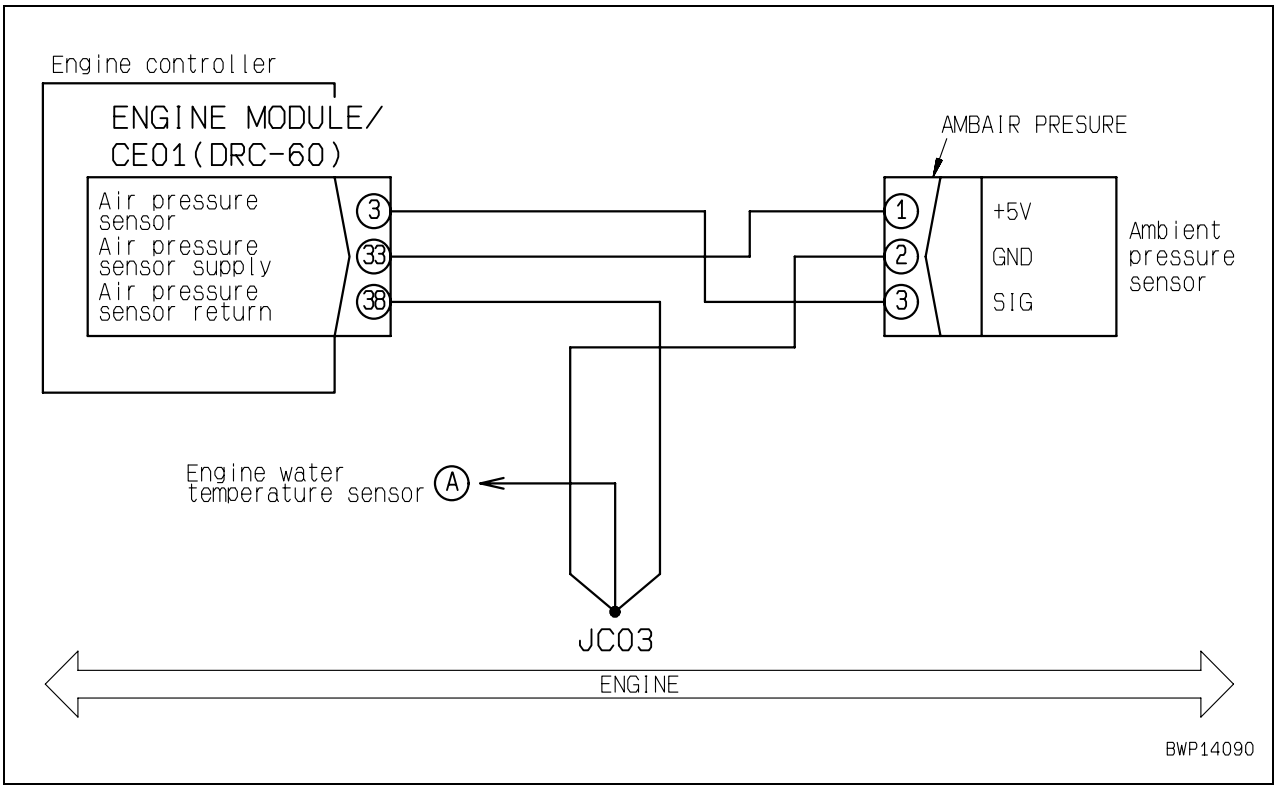


Failure code [CA221] Ambient Press Sens High Error

User code	Failure code	Trouble	Ambient pressure sensor high error (Engine controller system)
E11	**CA221**		
Contents of trouble	• High voltage was detected in signal circuit of ambient pressure sensor.		
Action of controller	• Fixes ambient pressure value and continues operation.		
Problem that appears on machine	• Engine does not start easily. • Engine output lowers.		
Related information	• Signal voltage of ambient pressure sensor can be checked with monitoring function. (Code: 37401 Ambient pressure sensor voltage • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective sensor power supply 1 system	If failure code [**CA386**] is also indicated, carry out troubleshooting for it first.		
	2	Defective ambient pressure sensor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			AMBAIR PRESURE		Voltage
			Between (1) – (2)	Power supply	4.75 – 5.25V
			Voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.		
	3	Hot short (Short circuit with 5V/24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between CE01 (female) (3) – AMBAIR PRESSURE (female) (3)	Voltage	Max. 1 V
	4	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (3) – AMBAIR PRESSURE (female) (3) and between CE01 (female) (33) – AMBAIR PRESSURE (female) (1)	Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts between ambient pressure sensor – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation		
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			CE01		Voltage
			Between (33) – (38)	Voltage	4.75 – 5.25 V

Circuit diagram related to ambient pressure sensor

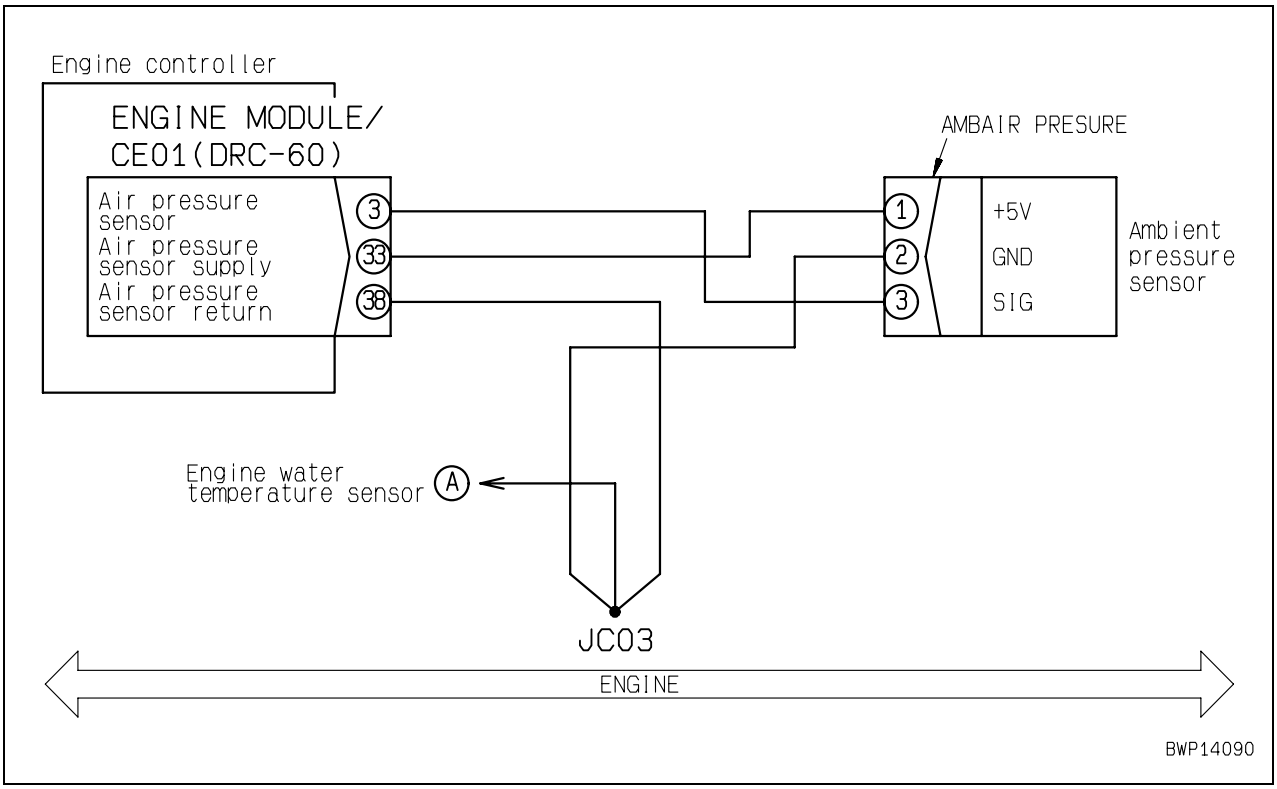


Failure code [CA222] Ambient Press Sens Low Error

User code	Failure code	Trouble	Ambient pressure sensor low error (Engine controller system)
E11	**CA222**		
Contents of trouble	• Low voltage was detected in signal circuit of ambient pressure sensor.		
Action of controller	• Fixes ambient pressure value and continues operation.		
Problem that appears on machine	• Engine does not start easily. • Engine output lowers.		
Related information	• Signal voltage of ambient pressure sensor can be checked with monitoring function. (Code: 37401 Ambient pressure sensor voltage • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective sensor power supply 1 system	If failure code [**CA352**] is also indicated, carry out troubleshooting for it first.		
	2	Defective ambient pressure sensor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			AMBAIR PRESURE		Voltage
			Between (1) – (2)	Power supply	4.75 – 5.25V
			Voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.		
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (3) – AMBAIR PRESSURE (female) (3)	Resistance	Min. 100 kΩ
	4	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (3) – AMBAIR PRESSURE (female) (3) and between CE01 (female) (38) – JC03 – AMBAIR PRESSURE (female) (2)	Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts between ambient pressure sensor – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation		
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			CE01		Voltage
			Between (33) – (38)	Voltage	4.75 – 5.25 V

Circuit diagram related to ambient pressure sensor

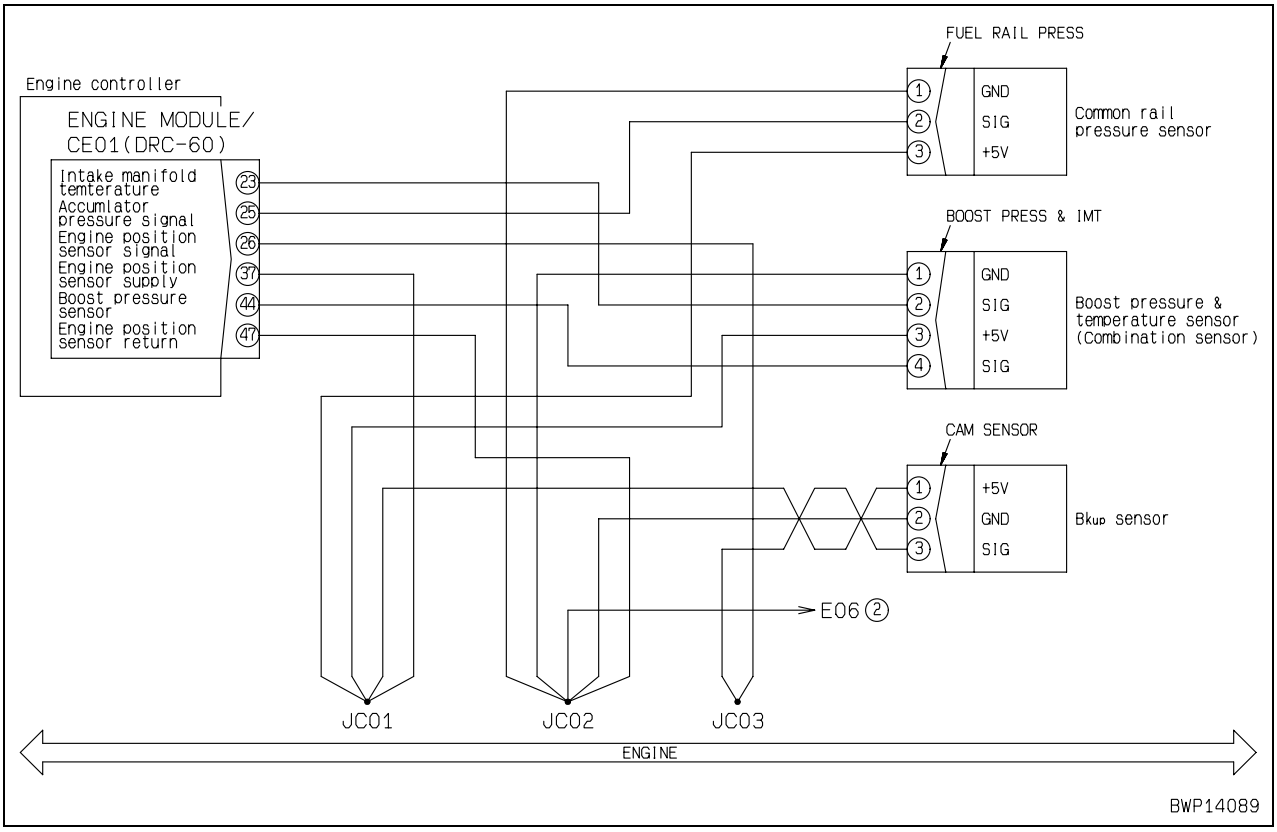


Failure code [CA227] Sens Supply 2 Volt High Error

User code	Failure code	Trouble	Sensor power supply 2 voltage high error (Engine controller system)
E15	**CA227**		
Contents of trouble	• High voltage was detected in sensor power supply 2 circuit.		
Action of controller	• Fixes boost pressure value and continues operation. • Fixes charge temperature value and continues operation. • Limits output and continues operation.		
Problem that appears on machine	• Engine output lowers.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Defective wiring harness connector	Connecting parts between each sensor – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation
	2	Defective engine controller	If cause 1 is not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Circuit diagram related to sensor power supply 2



Failure code [CA234] Eng Overspeed

User code	Failure code	Trouble	Engine overspeed (Engine controller system)
—	**CA234**		
Contents of trouble	• Engine speed exceeded control upper speed limit.		
Action of controller	• Stops injection until engine speed lowers to normal level.		
Problem that appears on machine	• Engine speed fluctuates.		
Related information	• Engine speed can be checked with monitoring function. (Code: 01002 Engine speed) • Method of reproducing failure code: Run engine at high idle.		

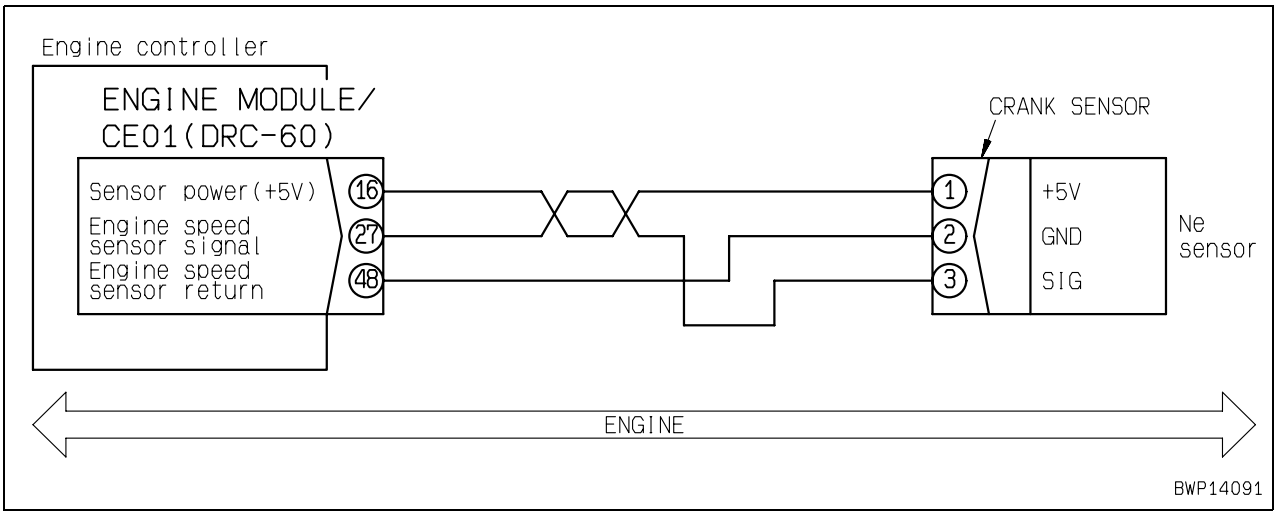
		Cause	Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Use of improper fuel	Fuel used may be improper. Check it directly.
	2	Improper use	Machine may be used improperly. Teach operator proper using method.
	3	Defective engine controller	If cause 1 is not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Failure code [CA238] Ne Speed Sens Supply Volt Error

User code	Failure code	Trouble	Ne speed sensor power supply voltage error (Engine controller system)
E15	**CA238**		
Contents of trouble	• Low voltage was detected in power supply circuit of engine Ne speed sensor.		
Action of controller	• Continues control with signal from engine Bkup speed sensor.		
Problem that appears on machine	• Engine does not start easily. • Engine hunts.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective sensor or wiring harness	★ Disconnect connector with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Disconnect sensor and wiring harness at right in order and carry out operation to reproduce trouble. If "E" of failure code goes off when sensor or wiring harness is disconnected, that sensor or wiring harness is defective.	Ne speed sensor	CRANK SENSOR
				Engine wiring harness	CE01
	2	Defective wiring harness connector	Connecting parts between each sensor – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation		

Circuit diagram related to engine Ne speed sensor

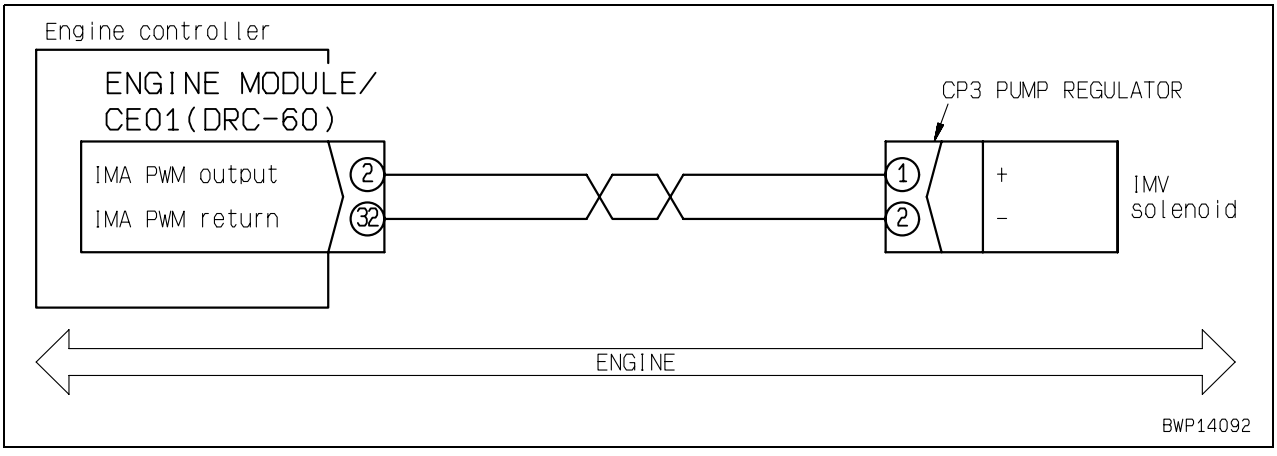


Failure code [CA271] IMV/PCV1 Short Error

User code	Failure code	Trouble	IMV/PCV1 short circuit error (Engine controller system)
E10	**CA271**		
Contents of trouble	• Short circuit was detected in drive circuit of supply pump actuator.		
Action of controller	• None in particular.		
Problem that appears on machine	• Engine speed does not rise from low idle. • Engine output lowers. • Common rail fuel pressure rises above command value.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective supply pump actuator	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CP3 PUMP REGULATOR (male)	Resistance	
			Between (1) – chassis ground	Min. 100 kΩ	
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (2) – CP3 PUMP REGULATOR (female) (1)	Resistance	Min. 100 kΩ
	3	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (2) – each of CE01 (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ
	4	Defective wiring harness connector	Connecting parts between supply pump actuator – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation		
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CE01 (female)	Resistance	
			Between (2) – chassis ground	Min. 100 kΩ	

Circuit diagram related to supply pump actuator (metering unit)

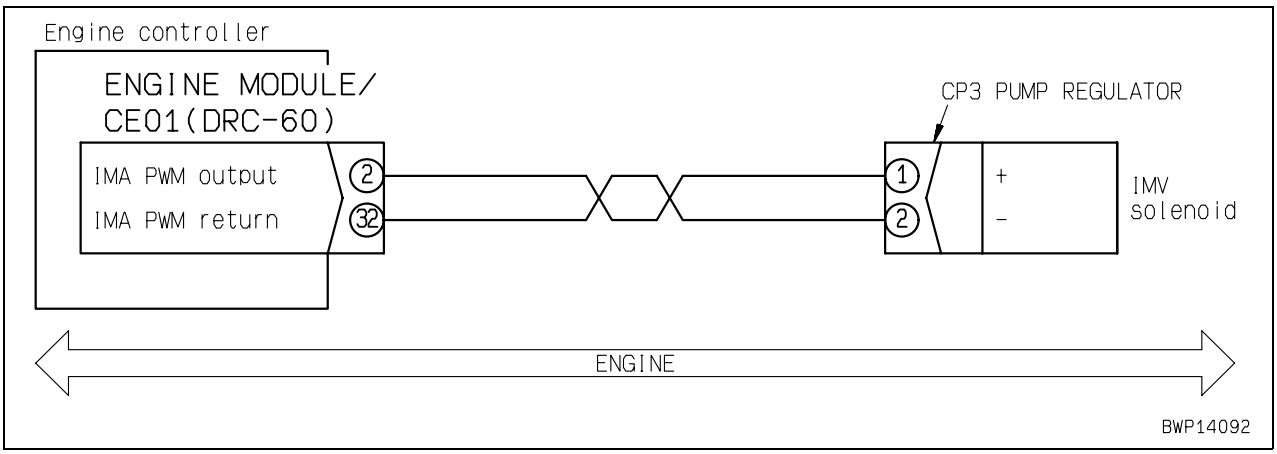


Failure code [CA272] IMV/PCV1 Open Error

User code	Failure code	Trouble	IMV/PCV1 open error (Engine controller system)
E10	**CA272**		
Contents of trouble	• Opening was detected in drive circuit of supply pump actuator.		
Action of controller	• None in particular.		
Problem that appears on machine	• Engine runs but its operation is unstable. • Common rail fuel pressure rises above command value.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective supply pump actuator	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CP3 PUMP REGULATOR (male)	Resistance	
			Between (1) – (2)	Max. 5 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (2) – CP3 PUMP REGULATOR (female) (1)	Resistance	Max. 10 Ω
			Wiring harness between CE01 (female) (32) – CP3 PUMP REGULATOR (female) (2)	Resistance	Max. 10 Ω
	3	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between CE01 (female) (2) – CP3 PUMP REGULATOR (female) (1)	Voltage	Max. 3 V
	4	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (2) – each of CE01 (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts between supply pump actuator – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation		
	6	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CE01 (female)	Resistance	
			Between (2) – (32)	Max. 5 Ω	

Circuit diagram related to supply pump actuator (metering unit)

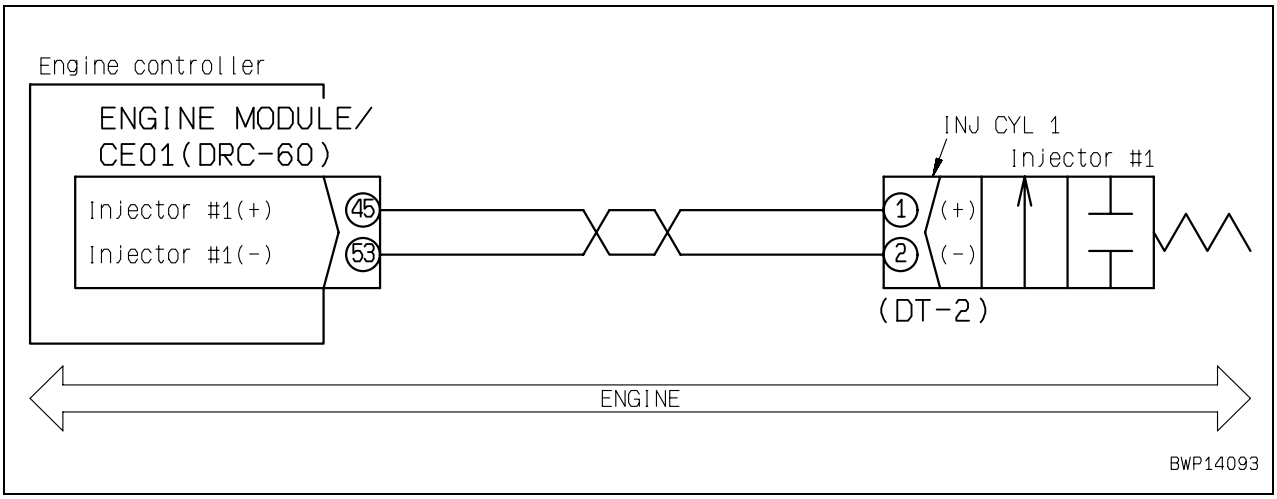


Failure code [CA322] Inj #1 (L#1) Open/Short Error

User code	Failure code	Trouble	Injector #1 (L#1) open/short circuit error (Engine controller system)
E11	**CA322**		
Contents of trouble	• Opening or short circuit was detected in drive circuit of No. 1 injector.		
Action of controller	• None in particular.		
Problem that appears on machine	• Combustion becomes irregular or engine hunts. • Engine output lowers.		
Related information	• Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective engine controller	If following failure codes are also displayed, trouble is in engine controller. [**CA322**], [**CA324**], [**CA331**]			
	2	Defective No. 1 injector	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			INJ CYL 1 (male)	Resistance		
			Between (1) – (2)	Max. 2 Ω		
			Between (1) – chassis ground	Min. 100 kΩ		
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE01 (female) (45) – INJ CYL 1 (female) (1)	Resistance	Max. 2 Ω	
			Wiring harness between CE01 (female) (53) – INJ CYL 1 (female) (2)	Resistance	Max. 2 Ω	
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE01 (female) (45) – INJ CYL 1 (female) (1)	Resistance	Max. 2 Ω	
	5	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE01 (female) (45) – each of CE01 (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ	
			Wiring harness between CE01 (female) (53) – each of CE01 (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ	
	6	Defective wiring harness connector	Connecting parts between No. 1 injector – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation			
	7	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			CE01 (female)	Resistance		
			Between (45) – (53)	Max. 2 Ω		
			Between (45) – chassis ground	Min. 100 kΩ		

Circuit diagram related to No. 1 injector

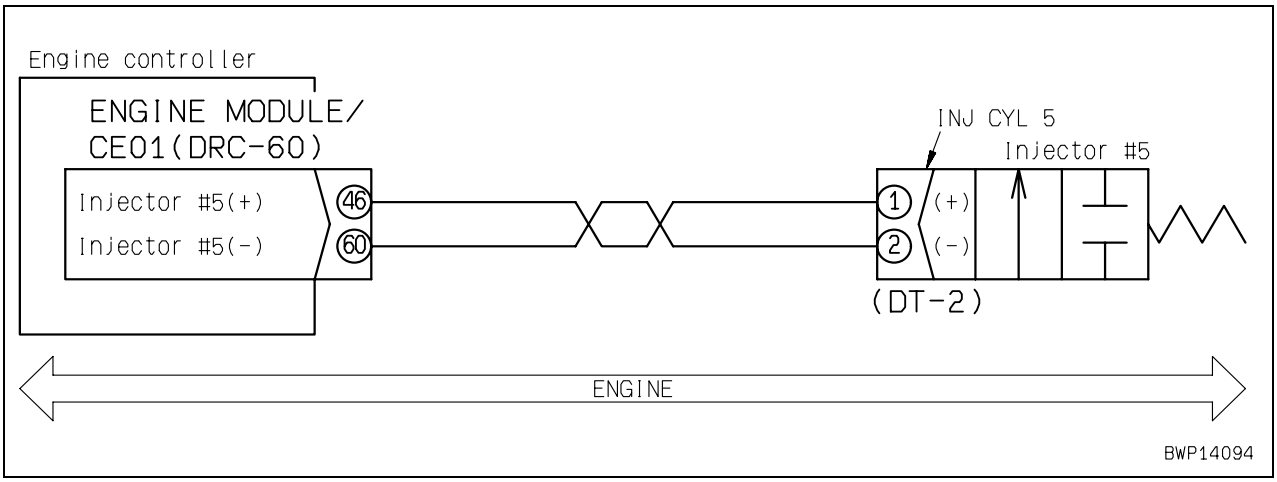


Failure code [CA323] Inj #5 (L#5) Open/Short Error

User code	Failure code	Trouble	Injector #5 (L#5) open/short circuit error (Engine controller system)
E11	**CA323**		
Contents of trouble	• Opening or short circuit was detected in drive circuit of No. 5 injector.		
Action of controller	• None in particular.		
Problem that appears on machine	• Combustion becomes irregular or engine hunts. • Engine output lowers.		
Related information	• Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective engine controller	If following failure codes are also displayed, trouble is in engine controller. [**CA323**], [**CA325**], [**CA332**]		
	2	Defective No. 5 injector	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			INJ CYL 5 (male)	Resistance	
			Between (1) – (2)	Max. 2 Ω	
			Between (1) – chassis ground	Min. 100 kΩ	
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (46) – INJ CYL 5 (female) (1)	Resistance	Max. 2 Ω
			Wiring harness between CE01 (female) (60) – INJ CYL 5 (female) (2)	Resistance	Max. 2 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (46) – INJ CYL 5 (female) (1)	Resistance	Max. 2 Ω
	5	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (46) – each of CE01 (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ
			Wiring harness between CE01 (female) (60) – each of CE01 (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ
	6	Defective wiring harness connector	Connecting parts between No. 5 injector – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation		
	7	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CE01 (female)	Resistance	
			Between (46) – (60)	Max. 2 Ω	
			Between (46) – chassis ground	Min. 100 kΩ	

Circuit diagram related to No. 5 injector

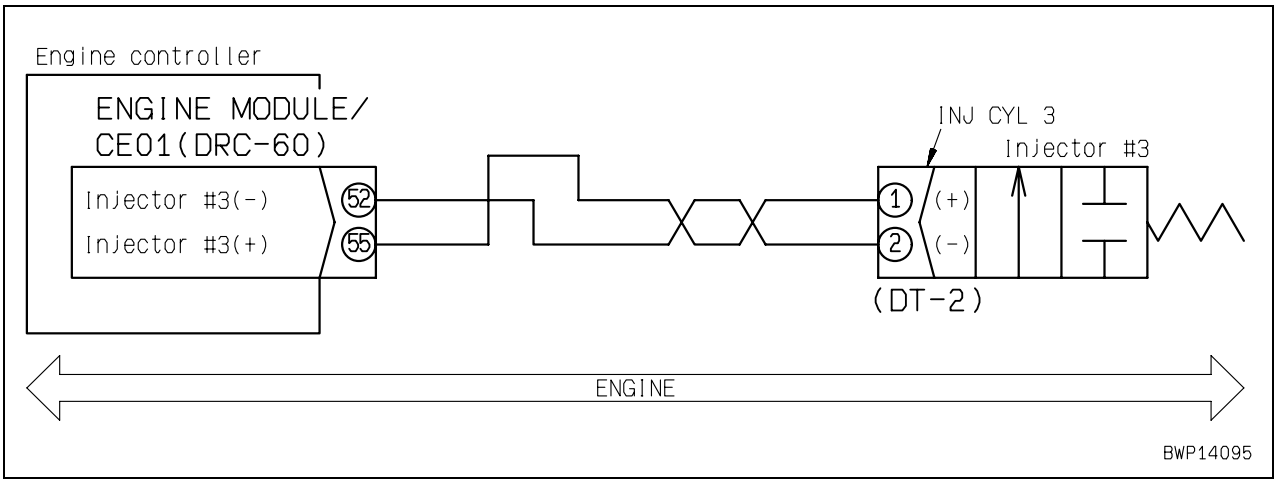


Failure code [CA324] Inj #3 (L#3) Open/Short Error

User code	Failure code	Trouble	Injector #3 (L#3) open/short circuit error (Engine controller system)
E11	**CA324**		
Contents of trouble	• Opening or short circuit was detected in drive circuit of No. 3 injector.		
Action of controller	• None in particular.		
Problem that appears on machine	• Combustion becomes irregular or engine hunts. • Engine output lowers.		
Related information	• Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective engine controller	If following failure codes are also displayed, trouble is in engine controller. [**CA322**], [**CA324**], [**CA331**]		
	2	Defective No. 3 injector	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			INJ CYL 3 (male)	Resistance	
			Between (1) – (2)	Max. 2 Ω	
			Between (1) – chassis ground	Min. 100 kΩ	
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (55) – INJ CYL 3 (female) (1)	Resistance	Max. 2 Ω
			Wiring harness between CE01 (female) (52) – INJ CYL 3 (female) (2)	Resistance	Max. 2 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (55) – INJ CYL 3 (female) (1)	Resistance	Max. 2 Ω
	5	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (55) – each of CE01 (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ
			Wiring harness between CE01 (female) (52) – each of CE01 (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ
	6	Defective wiring harness connector	Connecting parts between No. 3 injector – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation		
	7	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CE01 (female)	Resistance	
			Between (55) – (52)	Max. 2 Ω	
			Between (55) – chassis ground	Min. 100 kΩ	

Circuit diagram related to No. 3 injector

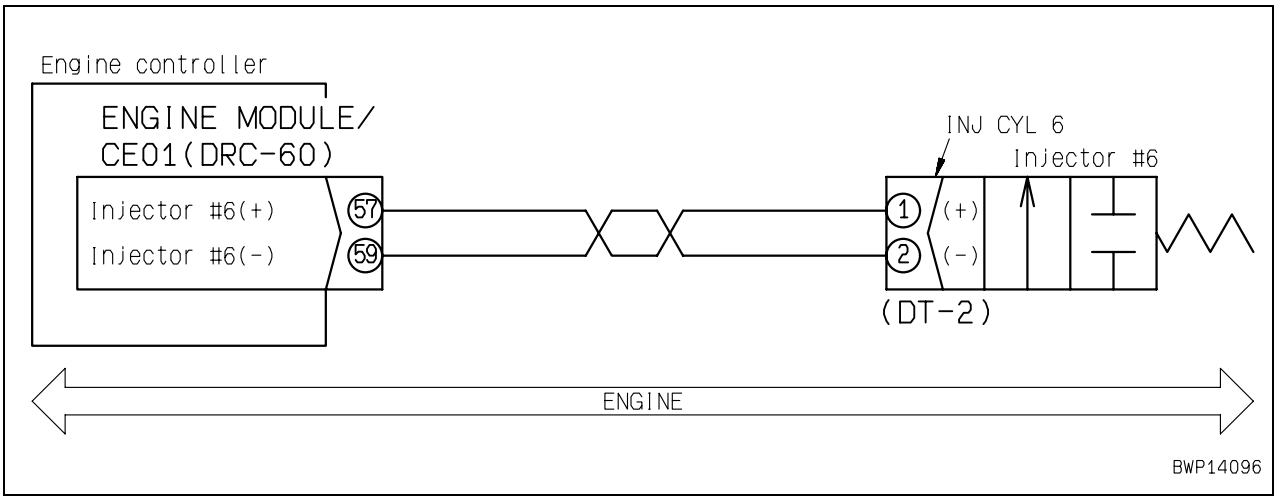


Failure code [CA325] Inj #6 (L#6) Open/Short Error

User code	Failure code	Trouble	Injector #6 (L#6) open/short circuit error (Engine controller system)
E11	**CA325**		
Contents of trouble	• Opening or short circuit was detected in drive circuit of No. 6 injector.		
Action of controller	• None in particular.		
Problem that appears on machine	• Combustion becomes irregular or engine hunts. • Engine output lowers.		
Related information	• Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective engine controller	If following failure codes are also displayed, trouble is in engine controller. [**CA323**], [**CA325**], [**CA332**]			
	2	Defective No. 6 injector	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			INJ CYL 6 (male)	Resistance		
			Between (1) – (2)	Max. 2 Ω		
			Between (1) – chassis ground	Min. 100 kΩ		
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE01 (female) (57) – INJ CYL 6 (female) (1)	Resistance	Max. 2 Ω	
			Wiring harness between CE01 (female) (59) – INJ CYL 6 (female) (2)	Resistance	Max. 2 Ω	
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE01 (female) (57) – INJ CYL 6 (female) (1)	Resistance	Max. 2 Ω	
	5	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE01 (female) (57) – each of CE01 (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ	
			Wiring harness between CE01 (female) (59) – each of CE01 (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ	
	6	Defective wiring harness connector	Connecting parts between No. 6 injector – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation			
	7	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			CE01 (female)	Resistance		
			Between (57) – (59)	Max. 2 Ω		
			Between (57) – chassis ground	Min. 100 kΩ		

Circuit diagram related to No. 6 injector

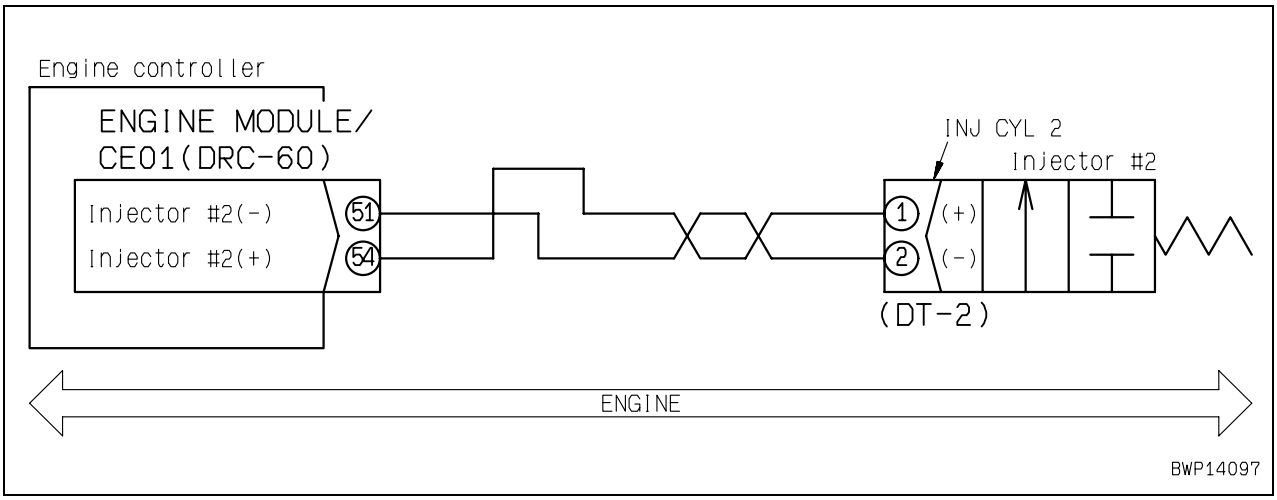


Failure code [CA331] Inj #2 (L#2) Open/Short Error

User code	Failure code	Trouble	Injector #2 (L#2) open/short circuit error (Engine controller system)
E11	**CA331**		
Contents of trouble	• Opening or short circuit was detected in drive circuit of No. 2 injector.		
Action of controller	• None in particular.		
Problem that appears on machine	• Combustion becomes irregular or engine hunts. • Engine output lowers.		
Related information	• Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective engine controller	If following failure codes are also displayed, trouble is in engine controller. [**CA322**], [**CA324**], [**CA331**]			
	2	Defective No. 2 injector	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			INJ CYL 2 (male)	Resistance		
			Between (1) – (2)	Max. 2 Ω		
			Between (1) – chassis ground	Min. 100 kΩ		
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE01 (female) (54) – INJ CYL 2 (female) (1)	Resistance	Max. 2 Ω	
			Wiring harness between CE01 (female) (51) – INJ CYL 2 (female) (2)	Resistance	Max. 2 Ω	
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE01 (female) (54) – INJ CYL 2 (female) (1)	Resistance	Max. 2 Ω	
	5	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE01 (female) (54) – each of CE01 (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ	
			Wiring harness between CE01 (female) (51) – each of CE01 (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ	
	6	Defective wiring harness connector	Connecting parts between No. 2 injector – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation			
	7	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			CE01 (female)	Resistance		
			Between (54) – (51)	Max. 2 Ω		
			Between (54) – chassis ground	Min. 100 kΩ		

Circuit diagram related to No. 2 injector

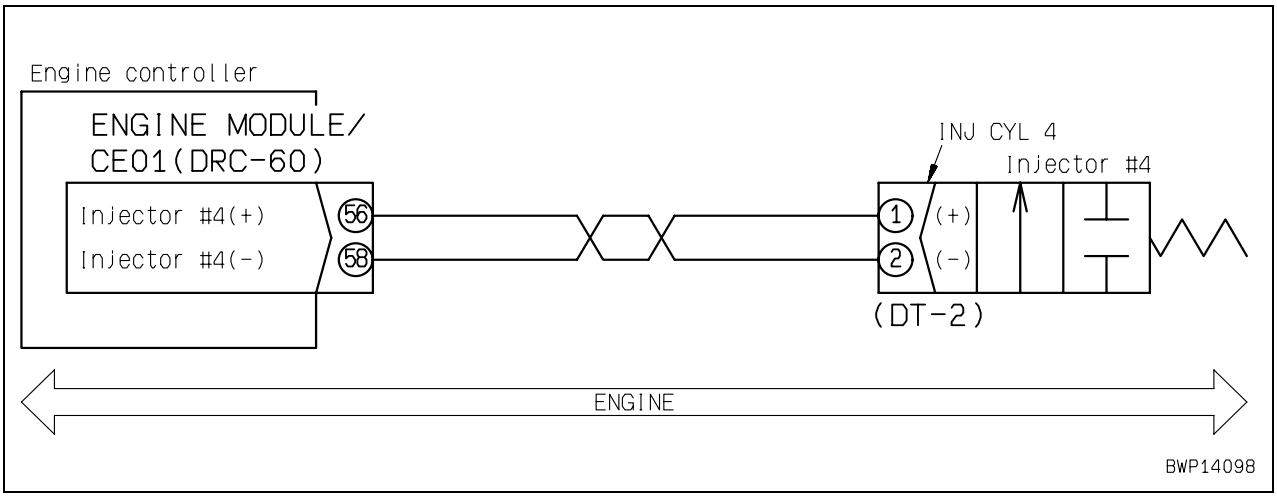


Failure code [CA332] Inj #4 (L#4) Open/Short Error

User code	Failure code	Trouble	Injector #4 (L#4) open/short circuit error (Engine controller system)
E11	**CA332**		
Contents of trouble	• Opening or short circuit was detected in drive circuit of No. 4 injector.		
Action of controller	• None in particular.		
Problem that appears on machine	• Combustion becomes irregular or engine hunts. • Engine output lowers.		
Related information	• Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective engine controller	If following failure codes are also displayed, trouble is in engine controller. [**CA323**], [**CA325**], [**CA332**]			
	2	Defective No. 4 injector	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			INJ CYL 4 (male)	Resistance		
			Between (1) – (2)	Max. 2 Ω		
			Between (1) – chassis ground	Min. 100 kΩ		
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE01 (female) (56) – INJ CYL 4 (female) (1)	Resistance	Max. 2 Ω	
			Wiring harness between CE01 (female) (58) – INJ CYL 4 (female) (2)	Resistance	Max. 2 Ω	
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE01 (female) (56) – INJ CYL 4 (female) (1)	Resistance	Max. 2 Ω	
	5	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE01 (female) (56) – each of CE01 (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ	
			Wiring harness between CE01 (female) (58) – each of CE01 (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ	
	6	Defective wiring harness connector	Connecting parts between No. 4 injector – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation			
	7	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			CE01 (female)	Resistance		
			Between (56) – (58)	Max. 2 Ω		
			Between (56) – chassis ground	Min. 100 kΩ		

Circuit diagram related to No. 4 injector



PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00240-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

40 Troubleshooting

Troubleshooting by failure code (Display of code), Part 2

Troubleshooting by failure code (Display of code), Part 2

Failure code [CA342] Calibration Code Incompatibility

User code	Failure code	Trouble	Calibration code incompatibility (Engine controller system)
E10	**CA342**		
Contents of trouble	• Incompatibility of data occurred in engine controller.		
Action of controller	• None in particular.		
Problem that appears on machine	• Continues normal operation. • Engine stops or does not start.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

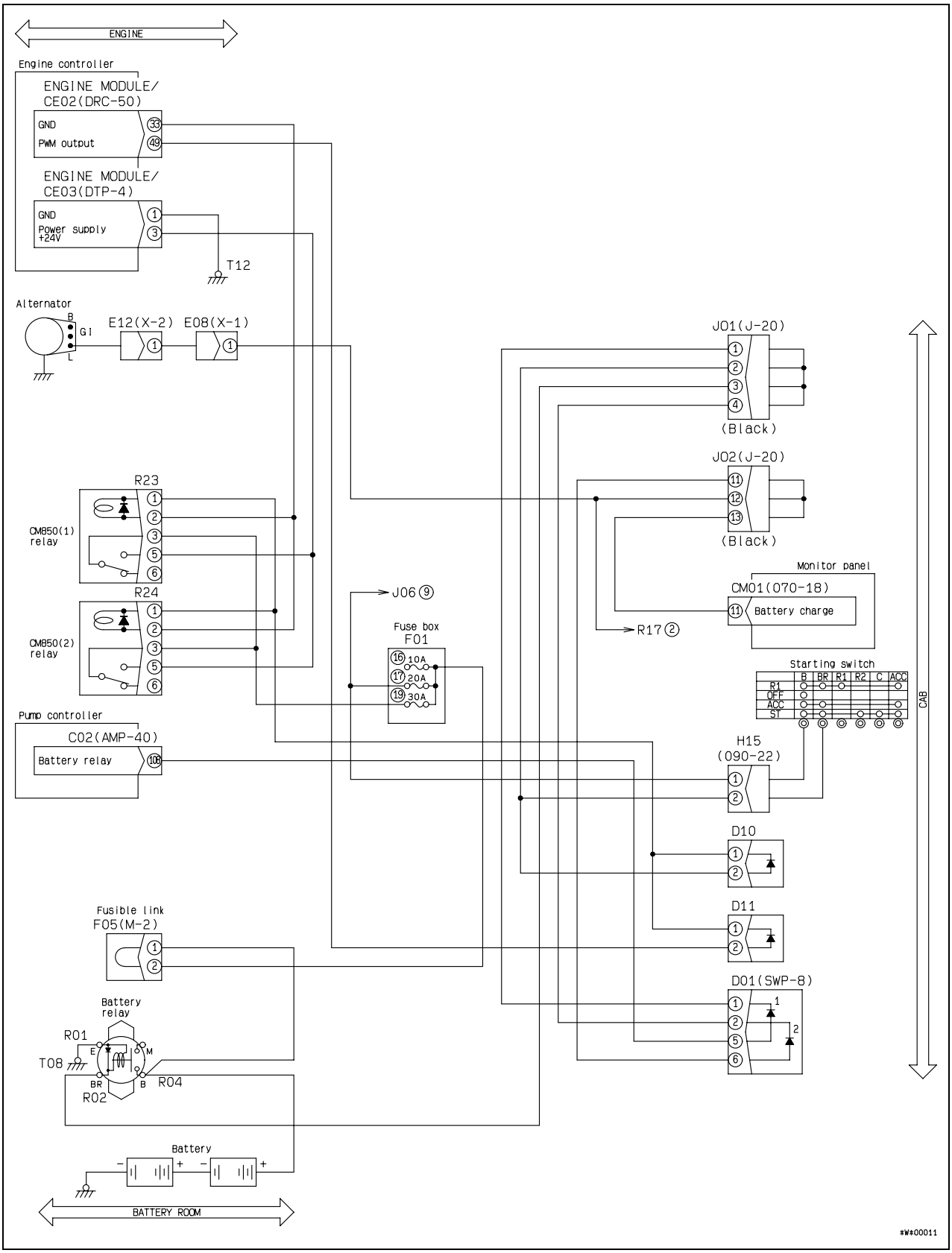
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defect in related system	If another failure code is displayed, carry out troubleshooting for it.
	2	Defective engine controller	Engine controller may be defective. (Troubleshooting cannot be carried out.)

Failure code [CA351] Injectors Drive Circuit Error

User code	Failure code	Trouble	Injectors Drive Circuit Error (Engine controller system)
E10	**CA351**		
Contents of trouble	• There is error in drive power circuit of injector.		
Action of controller	• Limits output and continues operation.		
Problem that appears on machine	• Exhaust gas becomes black. • Combustion becomes irregular. • Engine output lowers. • Engine cannot be started.		
Related information	• Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defect in related system	If another failure code is displayed, carry out troubleshooting for it.		
	2	Defective fuse No. 19	If fuse is broken, circuit probably has ground fault.		
	3	Defective relay for engine controller power supply	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Replace relay (R23, R24) for engine controller with another relay and perform reproducing operation. If "E" of failure code goes off at this time, replaced relay is defective.		
	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 F01-19 – R23, R24 (female) (3)	Resistance	Max. 0.5 Ω
			Wiring harness between R23, R24 (female) (5) – CE03 (female) (3)	Resistance	Max. 0.5 Ω
			Wiring harness between CE03 (female) (1) – chassis ground (T12)	Resistance	Max. 10 Ω
	5	Defective engine controller	If causes 1 – 4 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related to engine controller

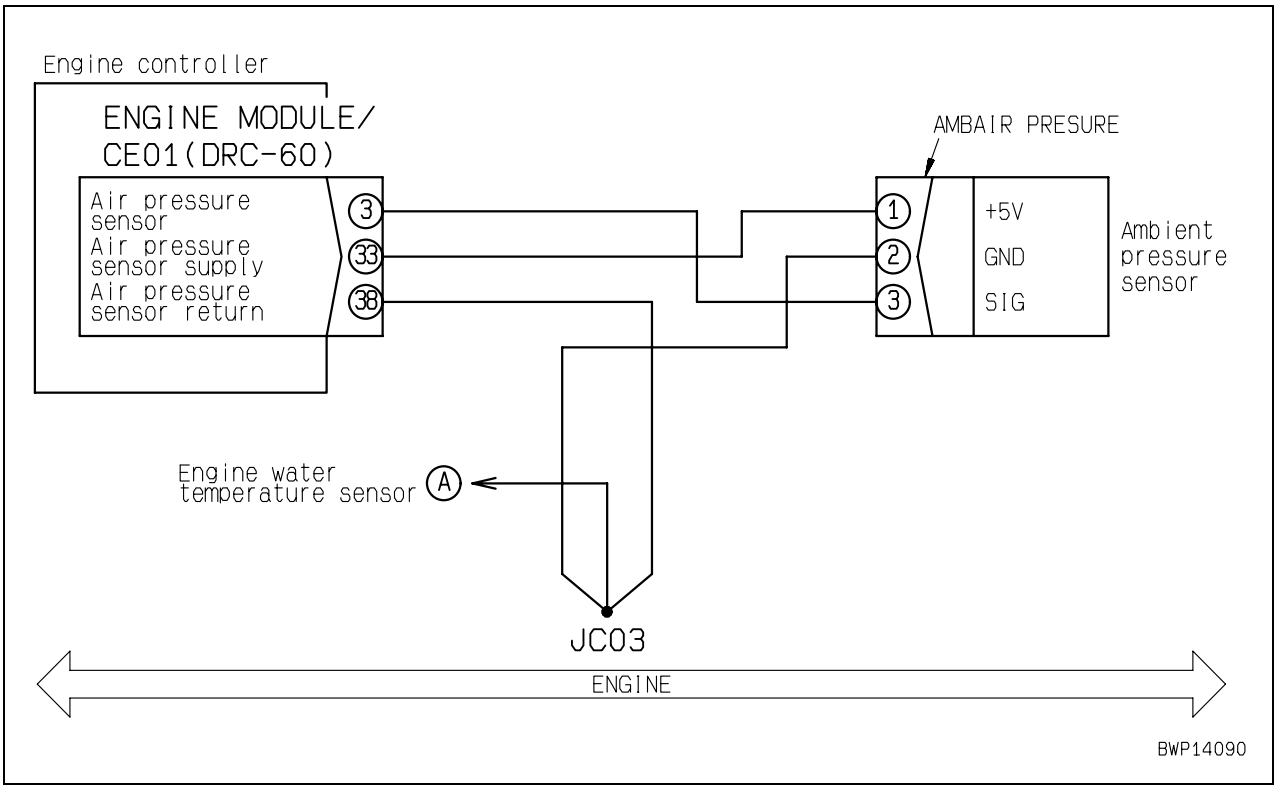


Failure code [CA352] Sens Supply 1 Volt Low Error

User code	Failure code	Trouble	Sensor power supply 1 voltage low error (Engine controller system)
E15	**CA352**		
Contents of trouble	• Low voltage was detected in sensor power supply 1 circuit.		
Action of controller	• Fixes ambient pressure value and continues operation.		
Problem that appears on machine	• Engine does not start easily. • Engine output lowers.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective sensor or wiring harness	★ Disconnect connector with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Disconnect sensor and wiring harness at right in order and carry out operation to reproduce trouble. If "E" of failure code goes off when sensor or wiring harness is disconnected, that sensor or wiring harness is defective.	Ambient pressure sensor	AMBAIR PRESURE
				Engine wiring harness	CE01
	2	Defective wiring harness connector	Connecting parts between ambient pressure sensor – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation		
	3	Defective engine controller	If causes 1 – 2 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related to sensor power supply 1

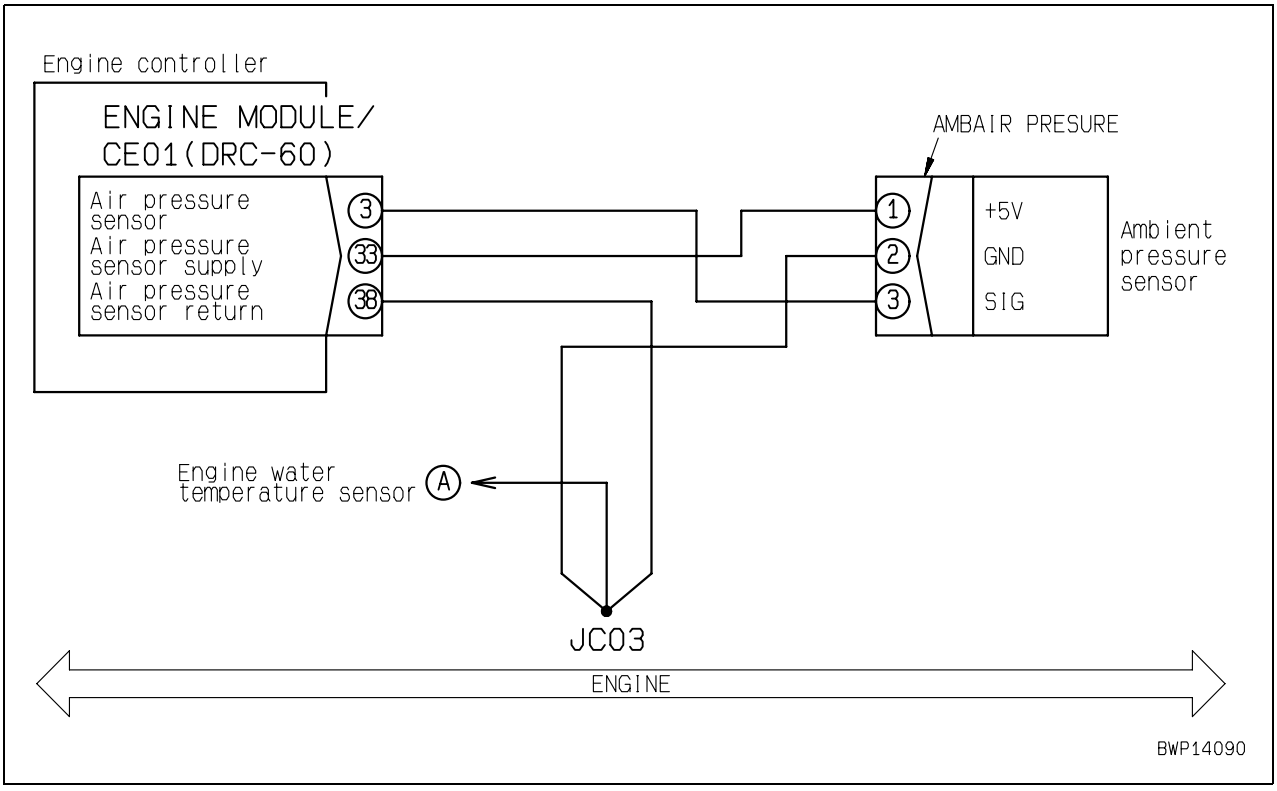


Failure code [CA386] Sens Supply 1 Volt High Error

User code	Failure code	Trouble	Sensor power supply 1 voltage high error (Engine controller system)
E15	**CA386**		
Contents of trouble	• High voltage was detected in sensor power supply 1 circuit.		
Action of controller	• Fixes ambient pressure value and continues operation.		
Problem that appears on machine	• Engine does not start easily. • Engine output lowers.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Defective wiring harness connector	Connecting parts between ambient pressure sensor – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation
	2	Defective engine controller	If cause 1 is not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Circuit diagram related to sensor power supply 1

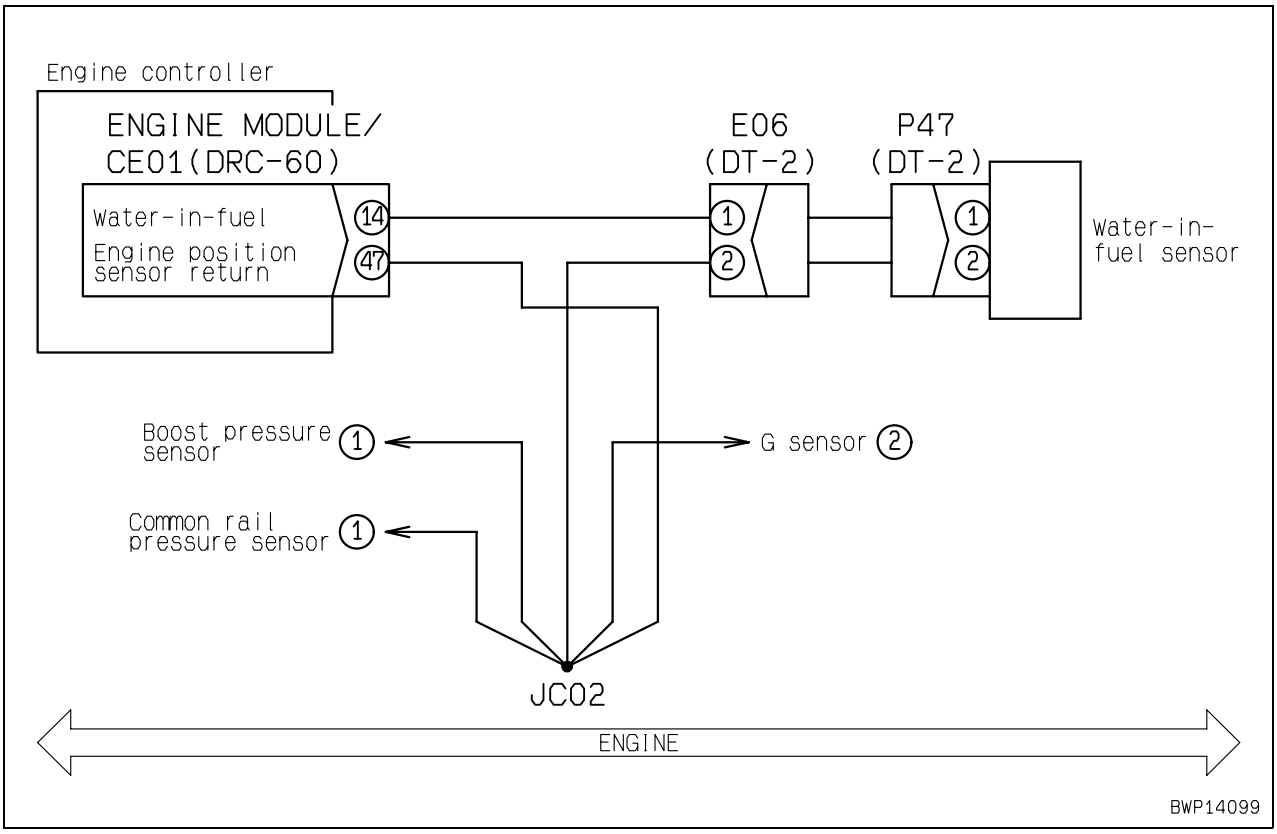


Failure code [CA428] Water in Fuel Sensor High Error

User code	Failure code	Trouble	Water-in-fuel sensor high error (Engine controller system)
E15	**CA428**		
Contents of trouble	• High voltage was detected in signal circuit of water-in-fuel sensor.		
Action of controller	• None in particular.		
Problem that appears on machine	• Water separator monitor does not display normally.		
Related information	• Condition water-in-fuel sensor signal can be checked with monitoring function. (Code: 18800 Condition of WIF sensor) • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective water-in-fuel sensor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			P47 (female)	Resistance	
			Between (1) – (2)	Max. 10 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (14) – P47 (male) (1)	Resistance	Max. 10 Ω
			Wiring harness between CE01 (female) (47) – JC02 – P47 (male) (2)	Resistance	Max. 10 Ω
	3	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (14) – each of CE01 (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ
	4	Defective wiring harness connector	Connecting parts between water-in-fuel sensor – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation		
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CE01 (female)	Resistance	
			Between (14) – (47)	Max. 10 Ω	

Circuit diagram related to water-in-fuel sensor

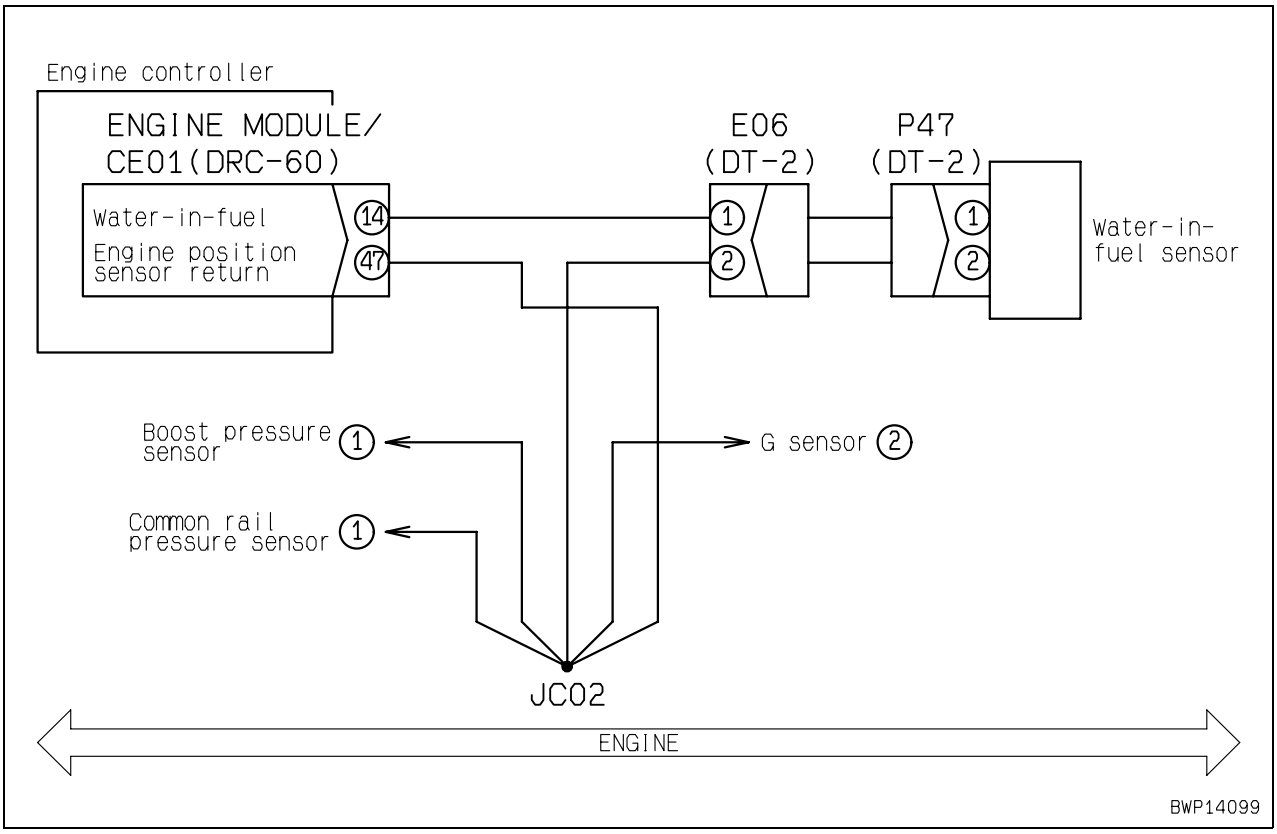


Failure code [CA429] Water in Fuel Sensor Low Error

User code	Failure code	Trouble	Water-in-fuel sensor low error (Engine controller system)
E15	**CA429**		
Contents of trouble	• Low voltage was detected in signal circuit of water-in-fuel sensor.		
Action of controller	• None in particular.		
Problem that appears on machine	• Water separator monitor does not display normally.		
Related information	• Condition water-in-fuel sensor signal can be checked with monitoring function. (Code: 18800 Condition of WIF sensor) • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective water-in-fuel sensor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			P47 (female)	Resistance	
			Between (1) – (2)	Max. 10 Ω	
			Between (1) – chassis ground	Min. 100 kΩ	
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (14) – P47 (male) (1)	Resistance	Min. 100 kΩ
	3	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (14) – each of CE01 (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ
	4	Defective wiring harness connector	Connecting parts between water-in-fuel sensor – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation		
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CE01 (female)	Resistance	
			Between (14) – (47)	Max. 10 Ω	
			Between (14) – chassis ground	Min. 100 kΩ	

Circuit diagram related to water-in-fuel sensor

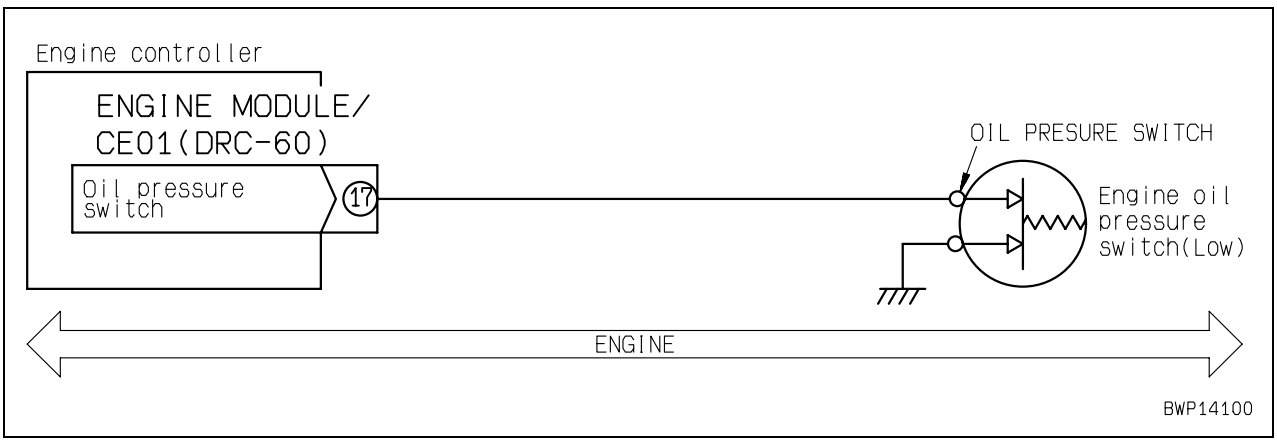


Failure code [CA435] Eng Oil Press Sw Error

User code	Failure code	Trouble	Engine oil pressure switch error (Engine controller system)
E15	**CA435**		
Contents of trouble	• There is error in signal circuit of engine oil pressure switch.		
Action of controller	• None in particular.		
Problem that appears on machine	• Engine protection function based on engine oil pressure does not work. • Engine oil pressure monitor does not display normally		
Related information	• Method of reproducing failure code: Turn starting switch ON or start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective engine oil pressure switch	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			OIL PRESSURE SWITCH (male)	Resistance	
			Between (1) – chassis ground	Max. 10 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (17) – OIL PRESSURE SWITCH (male) (1)	Resistance	Max. 10 Ω
	3	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (17) – each of CE01 (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ
	4	Defective wiring harness connector	Connecting parts between engine oil pressure switch – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation		
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CE01 (female)	Resistance	
			Between (17) – chassis ground	Max. 10 Ω	

Circuit diagram related to engine oil pressure switch



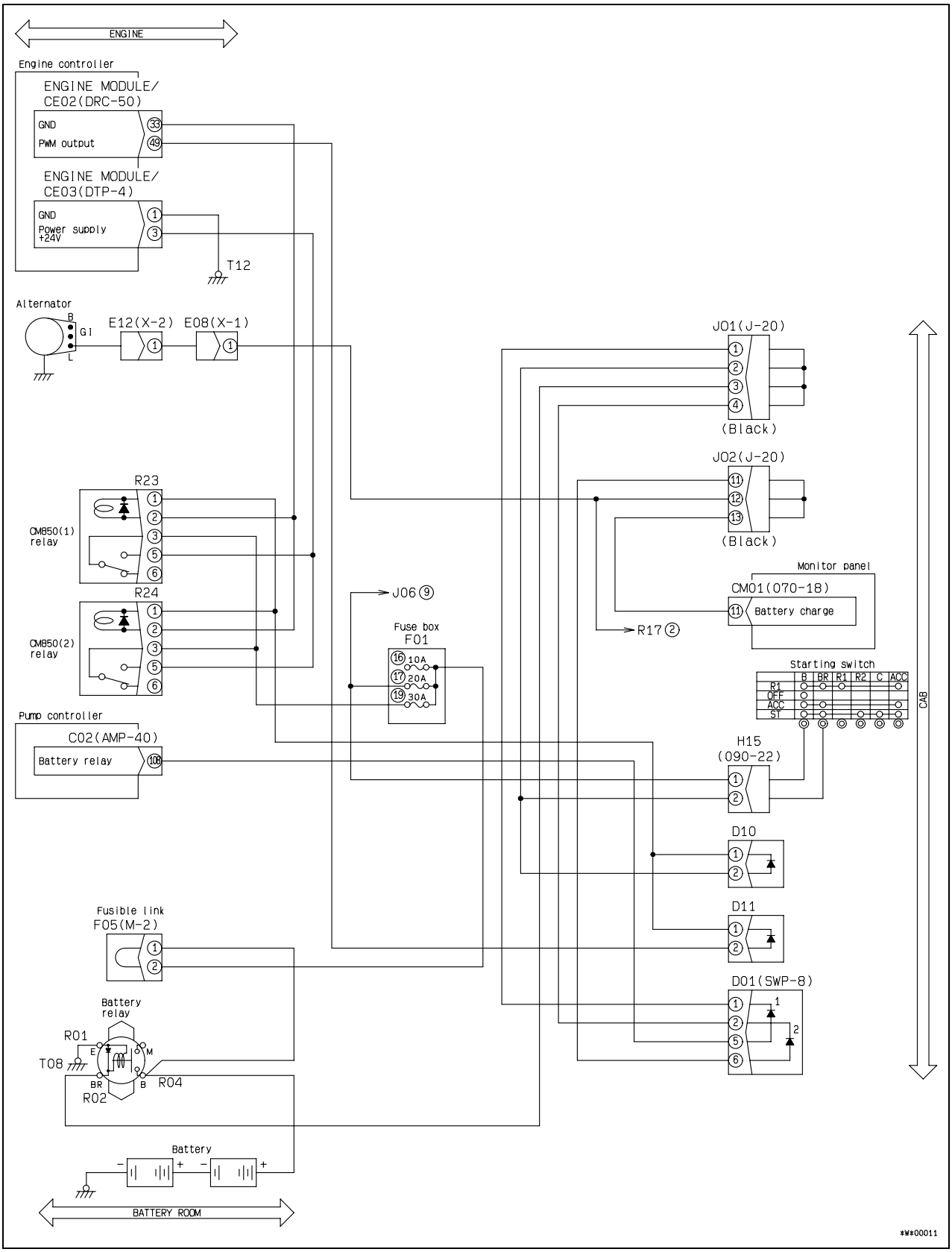
Failure code [CA441] Battery Voltage Low Error

User code	Failure code	Trouble	Battery voltage low error (Engine controller system)
E10	**CA441**		
Contents of trouble	• There is low voltage in controller power supply circuit.		
Action of controller	• None in particular.		
Problem that appears on machine	• Engine stops. • Engine does not start easily.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Looseness or corrosion of battery terminal	Battery terminal may be loosened or corroded. Check it directly.		
	2	Low battery voltage	★ Prepare with starting switch OFF, then keep starting switch OFF and start engine and carry out troubleshooting in each case.		
			Battery (1 piece)	Starting switch	Voltage
			Between (+) – (–) terminals	OFF	Min. 12 V
				START	Min. 6.2 V
	3	Defective fuse No. 19	If fuse is broken, circuit probably has ground fault. (See Cause 6)		
	4	Defective relay for engine controller power supply	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Replace relay (R23, R24) for engine controller with another relay and perform reproducing operation. If "E" of failure code goes off at this time, replaced relay is defective.		
	5	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 F01-19 – R23, R24 (female) (3)	Resistance	Max. 10 Ω
			Wiring harness between R23, R24 (female) (5) – CE03 (female) (3)	Resistance	Max. 10 Ω
			Wiring harness between CE03 (female) (1) – chassis ground (T12)	Resistance	Max. 10 Ω
	6	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 F01-19 – R23, R24 (female) (3)	Resistance	Min. 100 kΩ
			Wiring harness between R23, R24 (female) (5) – CE03 (female) (3)	Resistance	Max. 10 Ω
	7	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE03 (female) (3) – CE03 (female) (1) pin (with battery terminal disconnected)	Resistance	Min. 100 kΩ
			Wiring harness between CE03 (female) (3) – each of CE02 (female) pins (With battery terminal disconnected)	Resistance	Min. 100 kΩ
			Wiring harness between CE03 (female) (1) – each of CE02 (female) pins (With battery terminal disconnected)	Resistance	Min. 100 kΩ

<table>
<tr><td rowspan="4">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>8</td><td>Defective wiring harness connector</td><td colspan="3">Connecting parts between fuse No. 19 – machine wiring harness – engine controller may be defective. Check them directly.
• Looseness of connector, breakage of lock, or breakage of seal
• Corrosion, bend, breakage, push-in, or expansion of pin
• Moisture or dirt in connector or defective insulation</td></tr>
<tr><td rowspan="3">9</td><td rowspan="3">Defective engine controller</td><td colspan="3">★ Prepare with starting switch OFF, then turn starting switch ON and start engine and carry out troubleshooting in each case.</td></tr>
<tr><td>CE03 (female)</td><td>Starting switch</td><td>Voltage</td></tr>
<tr><td rowspan="2">Between (3) – (1)</td><td>ON</td><td>Min. 24 V</td></tr>
<tr><td>START</td><td>Min. 12 V</td></tr>
</table>

Circuit diagram related to engine controller power supply

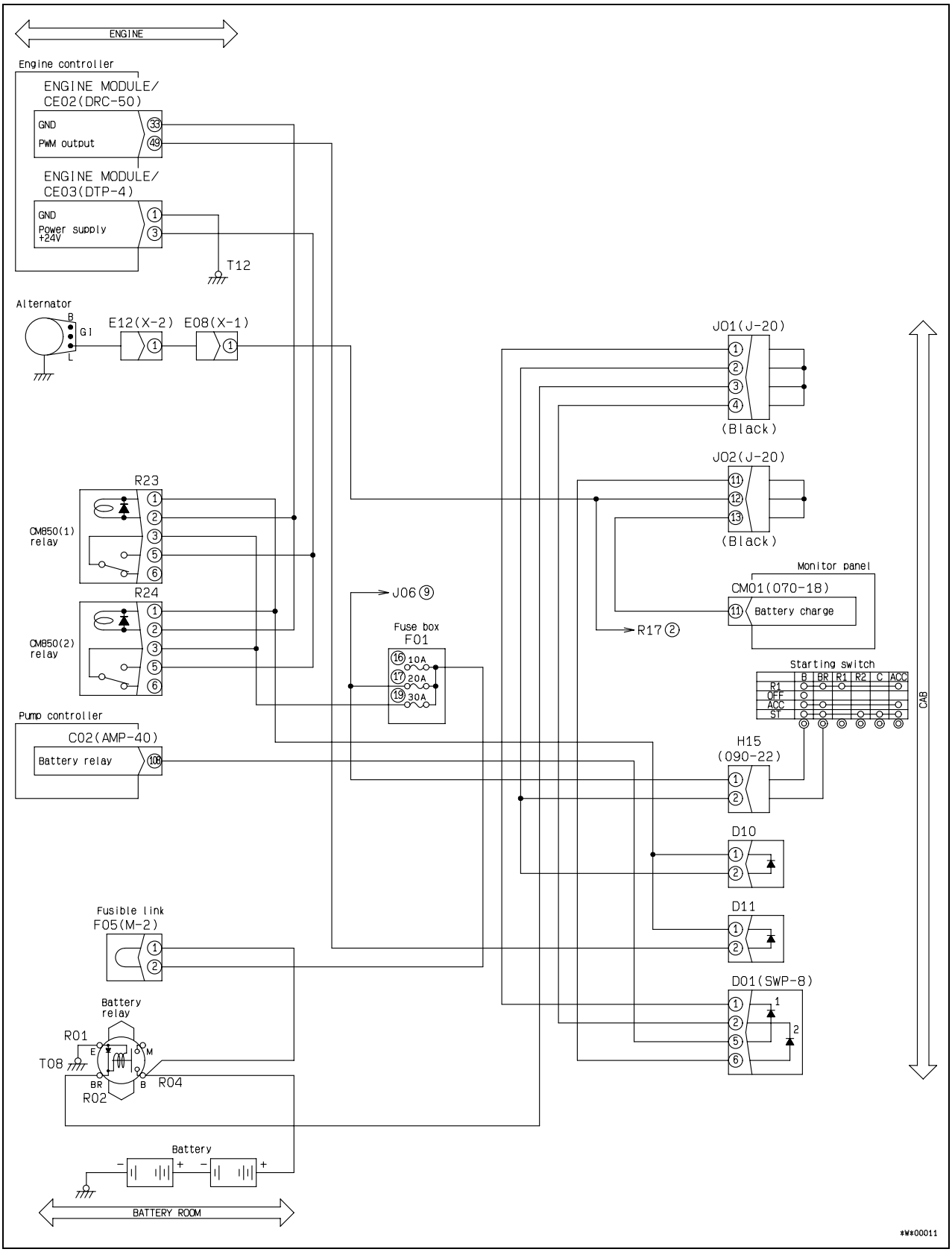


Failure code [CA442] Battery Voltage High Error

User code	Failure code	Trouble	Battery voltage high error (Engine controller system)
E10	**CA442**		
Contents of trouble	• There is high voltage (36 V or higher) in controller power supply circuit.		
Action of controller	• None in particular.		
Problem that appears on machine	• Engine may stop.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective battery voltage	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Battery		Voltage
			Between (+) – (–) terminals		Max. 32 V
	2	Defective alternator	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.		
			E12 (male)	Engine speed	Voltage
			Between (1) – chassis ground	Medium or higher	27.5 – 29.5 V
	3	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			CE03 (female)		Voltage
			Between (3) – (1)		Max. 32 V

Circuit diagram related to engine controller power supply



Failure code [CA449] Rail Press Very High Error

User code	Failure code	Trouble	Common rail pressure very high error (Engine controller system)
E11	**CA449**		
Contents of trouble	• There is high pressure error in common rail circuit.		
Action of controller	• Limits output and continues operation.		
Problem that appears on machine	• Engine sound becomes large when no or light load is applied. • Engine output lowers.		
Related information	• Common rail pressure can be checked with monitoring function. (Code: 36400 Common rail pressure) • Method of reproducing failure code: Start engine.		

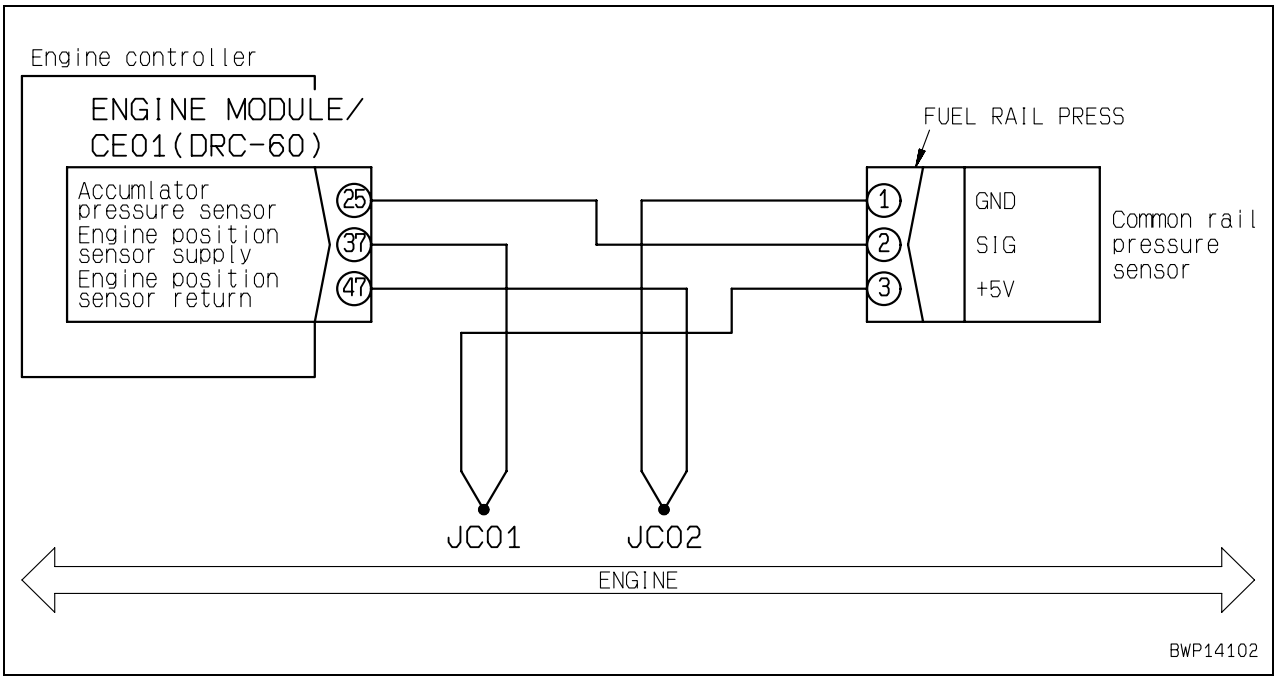
	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defect in related system	If another failure code is displayed, carry out troubleshooting for it.		
	2	Air in low pressure circuit	There may be air in low pressure circuit. Check it directly according to the following procedure. 1) Remove pressure pickup plug (outlet side) of fuel main filter. 2) Operate feed pump of fuel pre-filter. 3) Check pressure pickup plug for leakage of fuel and air.		
	3	Defect in fuel return circuit parts	★ For check of fuel return circuit pressure, see Testing and adjusting, Checking fuel pressure.		
			Fuel return circuit pressure	Low idle running or cranking	Max. 0.02 MPa {Max. 0.19 kg/cm^2}
	4	Defective common rail pressure sensor	★ Prepare with starting switch ON, then keep starting switch ON and carry out troubleshooting in each case.		
			Monitoring code (Machine monitor)	Monitoring information	
			36400 Common rail pressure	While engine is stopped	0 ± 0.39 MPa {0 ± 4 kg/cm^2}
	5	Defective pressure limiter	★ For check of leakage through pressure limiter, see Testing and adjusting, Checking fuel return rate and leakage.		
			Leakage through pressure limiter	During low idle	0 cc (No leakage)
	6	Defective supply pump	If causes 1 – 5 are not detected, supply pump may be defective.		

Failure code [CA451] Rail Press Sensor High Error

User code	Failure code	Trouble	Common rail pressure sensor high error (Engine controller system)
E11	**CA451**		
Contents of trouble	• There is high voltage in signal circuit of common rail pressure sensor.		
Action of controller	• Limits output and continues operation.		
Problem that appears on machine	• Engine does not start. • Engine speed or output lowers.		
Related information	• Signal voltage of common rail pressure sensor can be checked with monitoring function. (Code: 36401 Common rail pressure sensor voltage) • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective sensor power supply 2 system	If failure code [**CA227**] is also displayed, carry out troubleshooting for it first.			
	2	Defective common rail pressure sensor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			FUEL RAIL PRESS		Voltage	
			Between (3) – (1)	Power supply	4.75 – 5.25 V	
			Voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.			
	3	Hot short (Short circuit with 5V/24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between CE01 (female) (25) – FUEL RAIL PRESS (female) (2)		Voltage	Max. 1 V
	4	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE01 (female) (25) – FUEL RAIL PRESS (female) (2) and between CE01 (female) (37) – JC01 – FUEL RAIL PRESS (female) (3)		Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts between common rail pressure sensor – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation			
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			CE01		Voltage	
			Between (37) – (47)	Power supply	4.75 – 5.25 V	

Circuit diagram related to common rail pressure sensor

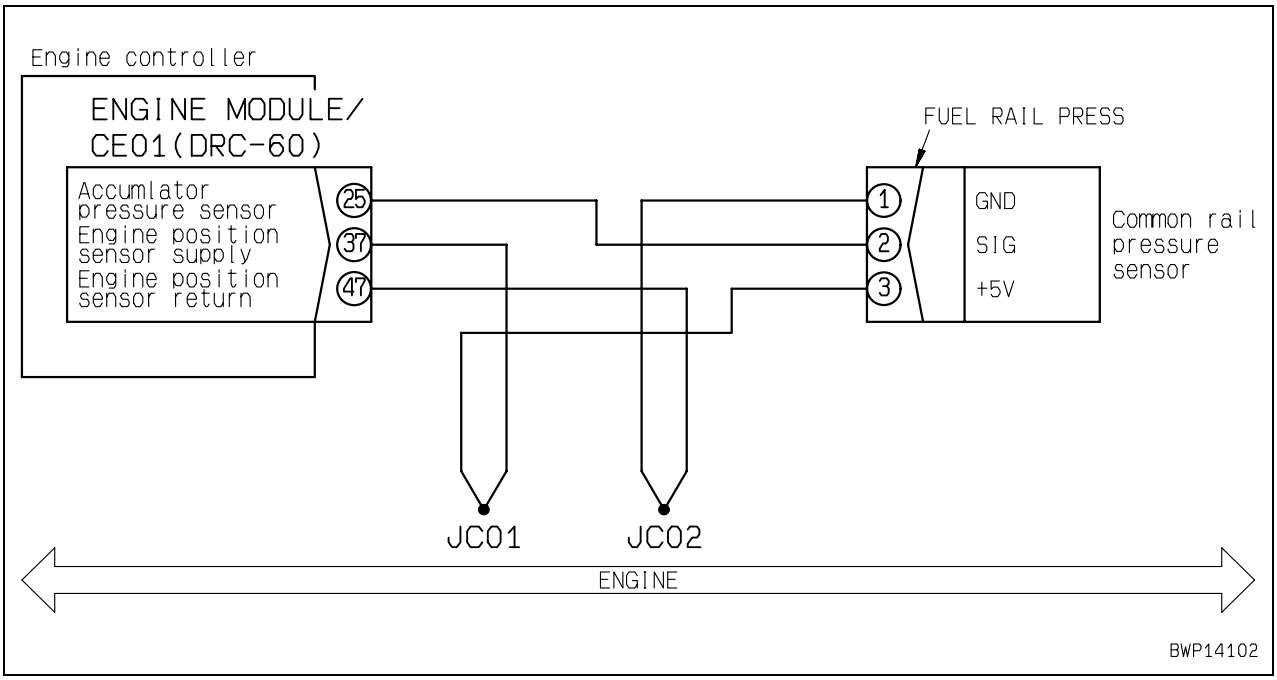


Failure code [CA452] Rail Press Sensor Low Error

User code	Failure code	Trouble	Common rail pressure sensor low error (Engine controller system)
E11	**CA452**		
Contents of trouble	• There is low voltage in signal circuit of common rail pressure sensor.		
Action of controller	• Limits output and continues operation.		
Problem that appears on machine	• Engine does not start. • Engine speed or output lowers.		
Related information	• Signal voltage of common rail pressure sensor can be checked with monitoring function. (Code: 36401 Common rail pressure sensor voltage) • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective sensor power supply 2 system	If failure code [**CA187**] is also displayed, carry out troubleshooting for it first.		
	2	Defective common rail pressure sensor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			FUEL RAIL PRESS		Voltage
			Between (3) – (1)	Power supply	4.75 – 5.25 V
			Voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.		
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between CE01 (female) (25) – FUEL RAIL PRESS (female) (2)	Resistance	Min. 100 kΩ
	4	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (25) – FUEL RAIL PRESS (female) (2) and between CE01 (female) (47) – JC02 – FUEL RAIL PRESS (female) (1)	Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts between common rail pressure sensor – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation		
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			CE01		Voltage
			Between (37) – (47)	Power supply	4.75 – 5.25 V

Circuit diagram related to common rail pressure sensor



Failure code [CA488] Chg Air Temp High Torque Derate

User code	Failure code	Trouble	Charge air temperature high torque derate (Engine controller system)
E15	**CA488**		
Contents of trouble	• Temperature signal of boost pressure/temperature sensor exceeded control upper temperature limit.		
Action of controller	• Limits output and continues operation.		
Problem that appears on machine	• Engine output lowers.		
Related information	• Boost temperature can be checked with monitoring function. (Code: 18500 Boost temperature) • 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 cooling performance of aftercooler	Cooling performance of aftercooler may be low. Check following points directly. • Looseness and breakage of fan belt. • Insufficiency of cooling air • Clogging of aftercooler fins
	2	Abnormal rise of turbocharger outlet temperature	Outlet temperature of turbocharger may be abnormally high. Check related parts directly.
	3	Defective engine controller	If causes 1 – 2 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Failure code [CA553] Rail Press High Error

User code	Failure code	Trouble	Common rail pressure high error (Engine controller system)
E11	**CA553**		
Contents of trouble	• There is high pressure error in common rail circuit.		
Action of machine monitor	• None in particular.		
Problem that appears on machine	• Engine sound becomes large when no or light load is applied. • Engine output lowers.		
Related information	• Common rail pressure can be checked with monitoring function. (Code: 36400 Common rail pressure) • Method of reproducing failure code: Start engine.		

		Cause	Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Defect in related system	If another failure code is displayed, carry out troubleshooting for it.
	2	Defective connection of ground terminal	Ground terminal may be connected defectively. Check following terminals directly. • Ground terminal of machine ((–) terminal of battery) • Ground terminal of engine • Ground terminal of engine controller • Ground terminal of starting motor
	3	Breakage of O-ring of supply pump actuator	O-ring of supply pump actuator may be broken. Check it directly.

Failure code [CA559] Rail Press Low Error

User code	Failure code	Trouble	Common rail pressure low error (Engine controller system)
E15	**CA459**		
Contents of trouble	• There is low pressure error in common rail circuit.		
Action of controller	• None in particular.		
Problem that appears on machine	• Engine does not start at all or does not start easily. • Exhaust gas becomes black. • Engine output lowers.		
Related information	• Common rail pressure can be checked with monitoring function. (Code: 36400 Common rail pressure) • 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	Fuel leakage to outside	Fuel may be leaking to outside. Check it directly (Check visually while running engine at low idle).		
	2	Defect in low pressure circuit parts	★ For check of pressure in fuel low pressure circuit, see Testing and adjusting, Checking fuel pressure.		
			Pressure in fuel low-pressure circuit	During cranking (if engine cannot be started)	0.3 – 1.1 MPa {3.1 – 11.3 kg/cm^2}
				During low idle (if engine can be started)	0.5 – 1.3 MPa {5.1 – 13.3 kg/cm^2}
	3	Defective pressure limiter	★ For check of leakage through pressure limiter, see Testing and adjusting, Checking fuel return rate and leakage.		
			Leakage through pressure limiter	During low idle	0 cc (No leakage)
	4	Defective injector (including high pressure piping in head)	★ For check of return rate from injector, see Testing and adjusting, Checking fuel return rate and leakage.		
			Return rate from injector	During cranking (if engine cannot be started)	Max. 90 cc/min.
				During low idle (if engine can be started)	Max. 180 cc/min.
	5	Defective supply pump	★ For check of return rate from supply pump, see Testing and adjusting, Checking fuel return rate and leakage.		
			Return rate from supply pump	During cranking (if engine cannot be started)	Max. 140 cc/min.
				During low idle (if engine can be started)	Max. 1,000 cc/min.

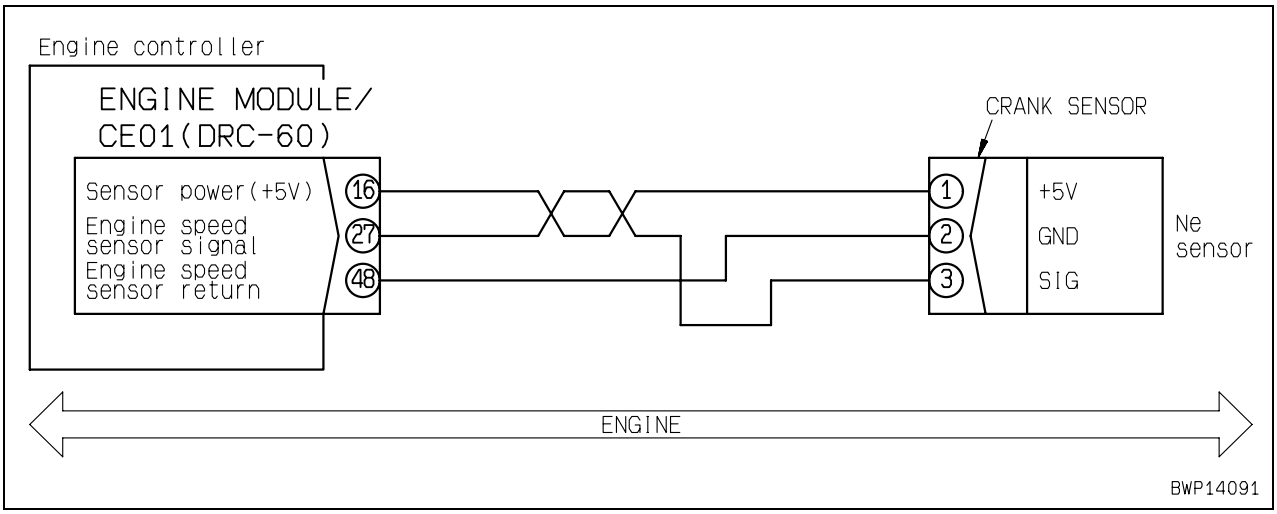
Failure code [CA689] Eng Ne Speed Sensor Error

User code	Failure code	Trouble	Engine Ne speed sensor error (Engine controller system)
E15	**CA689**		
Contents of trouble	• There is error in signal from engine Ne speed sensor.		
Action of controller	• Continues control with signal from engine Bkup speed sensor.		
Problem that appears on machine	• Engine hunts. • Engine does not start easily. • Engine output lowers.		
Related information	• Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective Ne speed sensor power supply system	If failure code [**CA238**] is also displayed, carry out troubleshooting for it first.		
	2	Defective engine Ne speed sensor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			CRANK SENSOR		Voltage
			Between (1) – (2)	Power supply	4.75 – 5.25 V
			Voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.		
	3	Breakage or improper clearance of engine Ne speed sensor	Engine Ne speed sensor may be broken or may have improper clearance. Check it directly.		
	4	Breakage of rotation sensor wheel	Rotation sensor wheel may be broken. Check it directly.		
	5	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 CE01 (female) (27) – CRANK SENSOR (female) (3)	Resistance	Max. 10 Ω
	6	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 CE01 (female) (27) – CRANK SENSOR (female) (3)	Resistance	Min. 100 kΩ
	7	Hot short (Short circuit with 5V/24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between CE01 (female) (27) – CRANK SENSOR (female) (3)	Voltage	Max. 1 V
	8	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (27) – CRANK SENSOR (female) (3) or between CE01 (female) (16) – CRANK SENSOR (female) (1)	Resistance	Min. 100 kΩ
			Wiring harness between CE01 (female) (27) – CRANK SENSOR (female) (3) or between CE01 (female) (48) – CRANK SENSOR (female) (2)	Resistance	Min. 100 kΩ

<table>
<tr><td rowspan="4">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>9</td><td>Defective wiring harness connector</td><td colspan="3">Connecting parts between engine Ne speed sensor – engine wiring harness – engine controller may be defective. Check them directly.
• Looseness of connector, breakage of lock, or breakage of seal
• Corrosion, bend, breakage, push-in, or expansion of pin
• Moisture or dirt in connector or defective insulation</td></tr>
<tr><td rowspan="3">10</td><td rowspan="3">Defective engine controller</td><td colspan="3">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td colspan="2">CE01</td><td>Voltage</td></tr>
<tr><td>Between (16) – (48)</td><td>Power supply</td><td>4.75 – 5.25 V</td></tr>
</table>

Circuit diagram related to engine Ne speed sensor



Failure code [CA731] Eng Bkup Speed Sens Phase Error

User code	Failure code	Trouble	Engine Bkup speed sensor phase error (Engine controller system)
E15	**CA731**		
Contents of trouble	• Phase error was detected in signals from engine Ne speed sensor and engine Bkup speed sensor		
Action of controller	• Continues control with signal from engine Ne speed sensor.		
Problem that appears on machine	• Engine does not start at all or does not start easily. • Idle speed is unstable. • Exhaust gas becomes black.		
Related information	• Method of reproducing failure code: Start engine.		

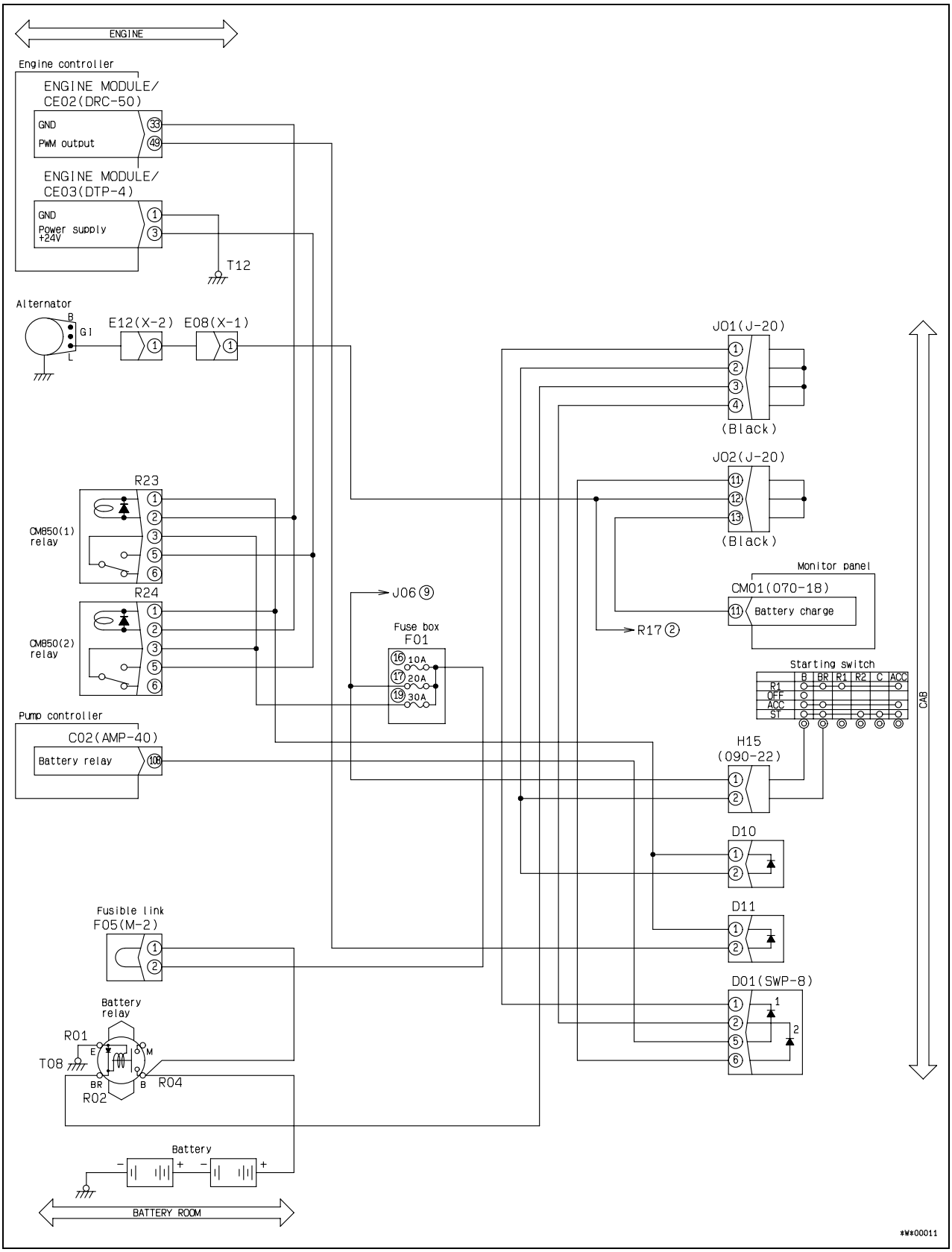
	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Breakage of engine Ne speed sensor	Engine Ne speed sensor may be broken. Check it directly.
	2	Breakage of engine Bkup speed sensor	Engine Bkup speed sensor may be broken. Check it directly.
	3	Defective installation or breakage of rotation sensor wheel on crankshaft side	Rotation sensor wheel on crankshaft side may be installed defectively or broken. Check it according to the following procedure. 1) Set No. 1 cylinder at compression top dead center (Match stamped mark). 2) If center of oblong hole of rotation sensor wheel is at tip of Ne speed sensor, rotation sensor wheel is installed normally.
	4	Defective installation or breakage of rotation sensor ring on camshaft side	Rotation sensor ring on camshaft side may be installed defectively or broken. Check it according to the following procedure. 1) Set No. 1 cylinder at compression top dead center (Match stamped mark). 2) Remove Bkup speed sensor. 3) If 2 grooves (1 crest) of rotation sensor ring are seen through sensor mounting hole, rotation sensor ring is installed normally.
	5	Defective timing of crankshaft and camshaft	Timing of crankshaft and camshaft may be defective. Check it directly.
	6	Defective connection of ground terminal	Ground terminal may be connected defectively. Check following terminals directly. • Ground terminal of machine ((–) terminal of battery) • Ground terminal of engine • Ground terminal of engine controller • Ground terminal of starting motor

Failure code [CA757] All Continuous Data Lost Error

User code	Failure code	Trouble	All continuous data lost error (Engine controller system)
E10	**CA757**		
Contents of trouble	• All data in engine controller are lost.		
Action of controller	• None in particular.		
Problem that appears on machine	• Engine may stop and may not be started again. • Monitoring function of machine monitor (engine controller system) may not work normally.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defect in related system	If another failure code is displayed, carry out troubleshooting for it.			
	2	Looseness or corrosion of battery terminal	Battery terminal may be loosened or corroded. Check it directly.			
	3	Low battery voltage	★ Prepare with starting switch OFF, then keep starting switch OFF and start engine and carry out troubleshooting in each case.			
			Battery (1 piece)	Starting switch	Voltage	
			Between (+) – (–) terminals	OFF	Min. 12 V	
				START	Min. 6.2 V	
	4	Defective fuse No. 19	If fuse is broken, circuit probably has ground fault.			
	5	Defective relay for engine controller power supply	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Replace relay (R23, R24) for engine controller with another relay and perform reproducing operation. If "E" of failure code goes off at this time, replaced relay is defective.			
	6	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 F01-19 – R23, R24 (female) (3)		Resistance	Max. 10 Ω
			Wiring harness between R23, R24 (female) (5) – CE03 (female) (3)		Resistance	Max. 10 Ω
			Wiring harness between CE03 (female) (1) – chassis ground (T12)		Resistance	Max. 10 Ω
	7	Defective wiring harness connector	Connecting parts between fuse No. 19 – machine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation			
	8	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and start engine and carry out troubleshooting in each case.			
			CE03 (female)	Starting switch	Voltage	
			Between (3) – (1)	ON	Min. 24 V	
				START	Min. 12 V	

Circuit diagram related to engine controller power supply



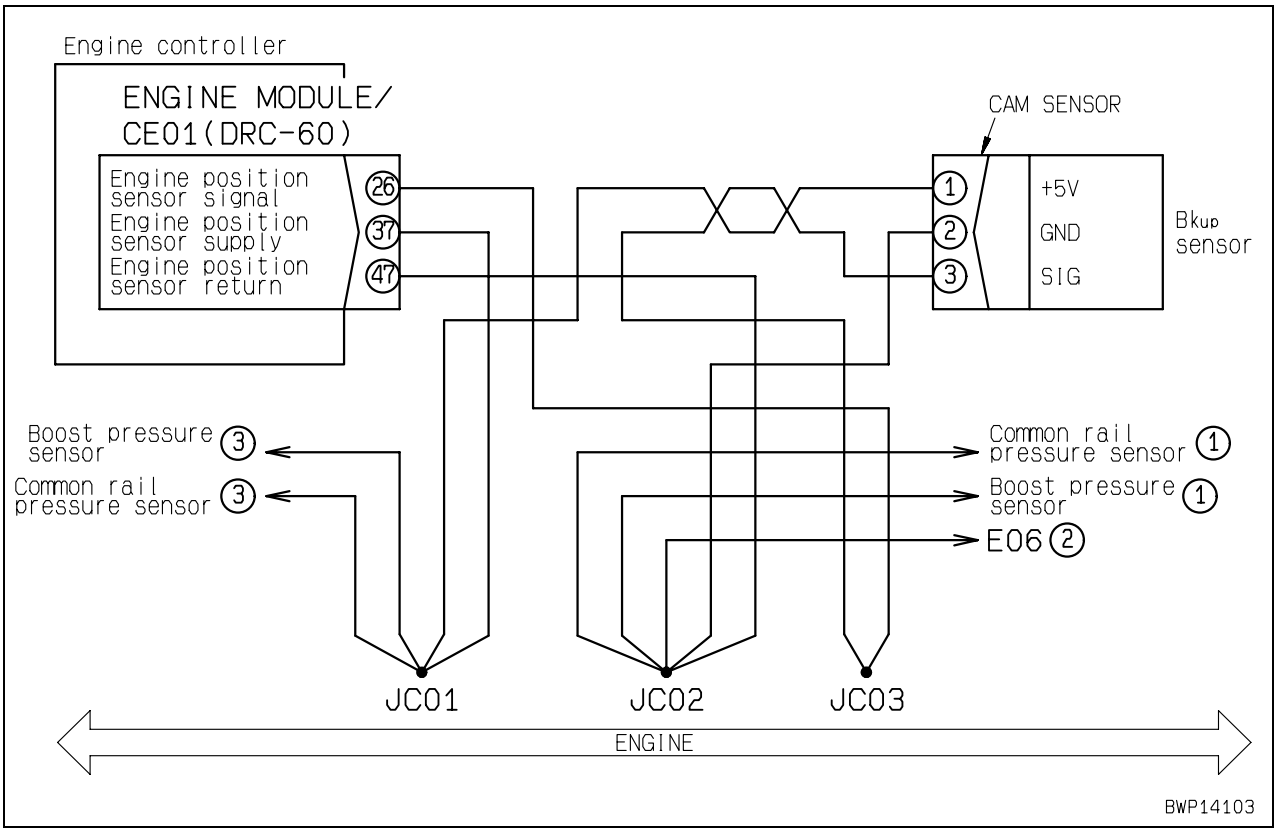
Failure code [CA778] Eng Bkup Speed Sensor Error

User code	Failure code	Trouble	Engine Bkup speed sensor error (Engine controller system)
E15	**CA778**		
Contents of trouble	• There is error in signal from engine Bkup speed sensor.		
Action of controller	• Continues control with signal from engine Ne speed sensor.		
Problem that appears on machine	• Engine does not start easily. • Engine output lowers.		
Related information	• Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective sensor power supply 2 system	If failure code [CA187] is also displayed, carry out troubleshooting for it first.		
	2	Defective engine Bkup speed sensor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			CAM SENSOR		Voltage
			Between (1) – (2)	Power supply	4.75 – 5.25 V
			Voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.		
	3	Breakage or improper clearance of engine Bkup speed sensor	Engine Bkup speed sensor may be broken or may have improper clearance. Check it directly.		
	4	Breakage of rotation sensor ring	Rotation sensor ring may be broken. Check it directly.		
	5	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 CE01 (female) (26) – JC03 – CAM SENSOR (female) (3)	Resistance	Max. 10 Ω
	6	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 CE01 (female) (26) – JC03 – CAM SENSOR (female) (3)	Resistance	Min. 100 kΩ
	7	Hot short (Short circuit with 5V/24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between CE01 (female) (26) – JC03 – CAM SENSOR (female) (3)	Voltage	Max. 1 V
	8	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (26) – JC03 – CAM SENSOR (female) (3) or between CE01 (female) (37) – JC01 – CAM SENSOR (female) (1)	Resistance	Min. 100 kΩ
			Wiring harness between CE01 (female) (26) – JC03 – CAM SENSOR (female) (3) or between CE01 (female) (47) – JC02 – CAM SENSOR (female) (2)	Resistance	Min. 100 kΩ

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	9	Defective wiring harness connector	Connecting parts between engine Bkup speed sensor – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation		
	10	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			CE01		Voltage
			Between (37) – (47)	Power supply	4.75 – 5.25 V

Circuit diagram related to engine Bkup speed sensor

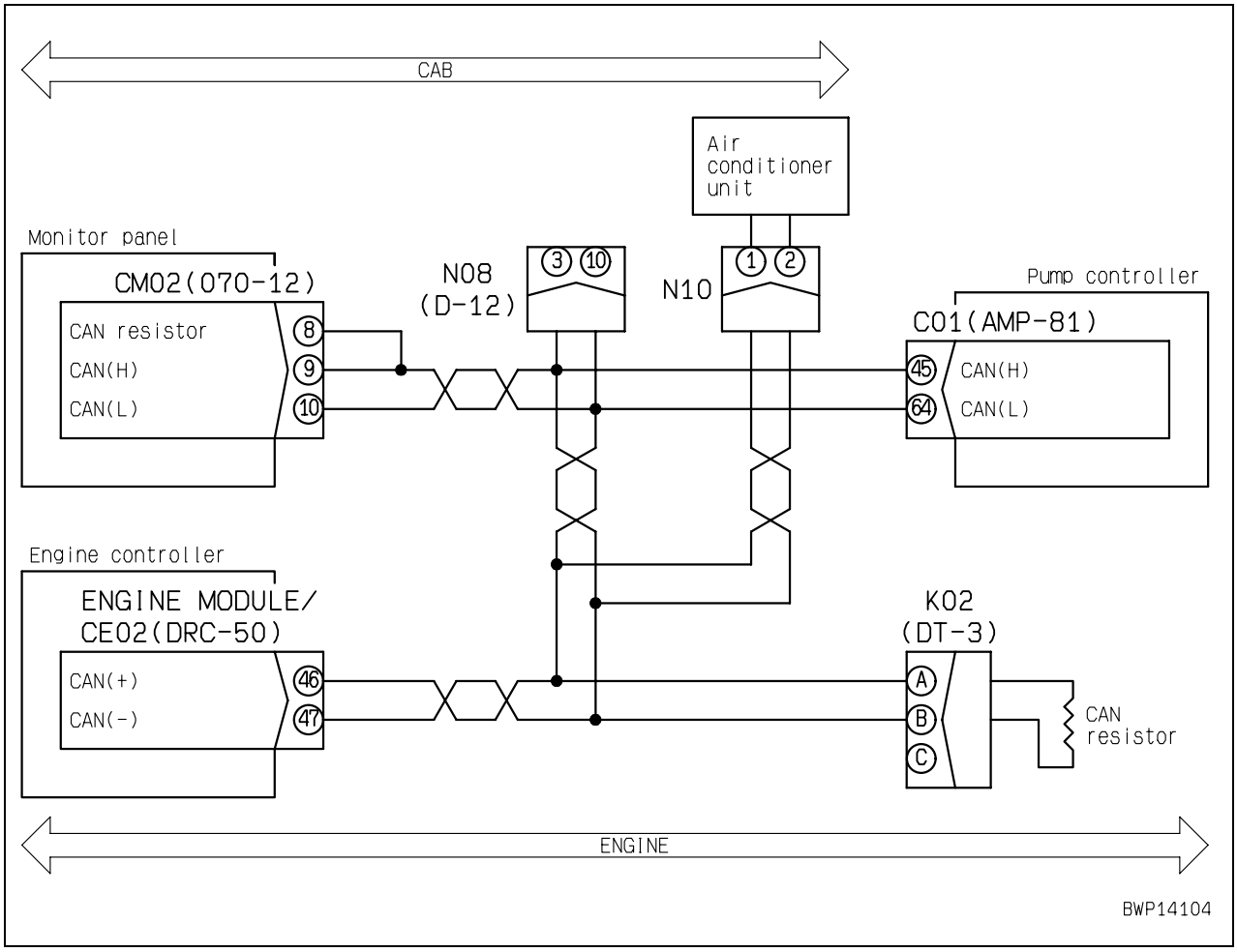


Failure code [CA1633] KOMNET Datalink Timeout Error

User code	Failure code	Trouble	KOMNET Datalink timeout error (Engine controller system)
E0E	**CA1633**		
Contents of trouble	• Engine controller detected communication error in KOMNET communication circuit between pump controller and machine monitor.		
Action of controller	• Continues operation in default mode. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Information may not transmitted normally by KOMNET communication and machine may not operate normally. (Trouble phenomenon depends on failed section.)		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	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 CM02 (female) (8), (9) – C01 (female) (45), – CE02 (female) (46), – K02 (female) (A)	Resistance	Max. 1 Ω
			Wiring harness between CM02 (female) (10) – C01 (female) (64), – CE02 (female) (47), – K02 (female) (B)	Resistance	Max. 1 Ω
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CM02 (female) (8), (9) – C01 (female) (45), – CE02 (female) (46), – K02 (female) (A), – N08 (male) (3)	Resistance	Min. 1 MΩ
			Wiring harness between CM02 (female) (10) – C01 (female) (64), – CE02 (female) (47), – K02 (female) (B), – N08 (male) (10)	Resistance	Min. 1 MΩ
	3	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between CM02 (female) (8), (9) – C01 (female) (45), – CE02 (female) (46), – K02 (female) (A), – N08 (male) (3)	Voltage	Max. 5.5 V
			Wiring harness between CM02 (female) (10) – C01 (female) (64), – CE02 (female) (47), – K02 (female) (B), – N08 (male) (10)	Voltage	Max. 5.5 V
	4	Defective CAN terminal resistance (Internal short circuit or disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			K02 (male)	Resistance	
			Between (A) – (B)	120 ± 12 Ω	
	5	Defective pump controller	If causes 1 – 4 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related to CAN communication

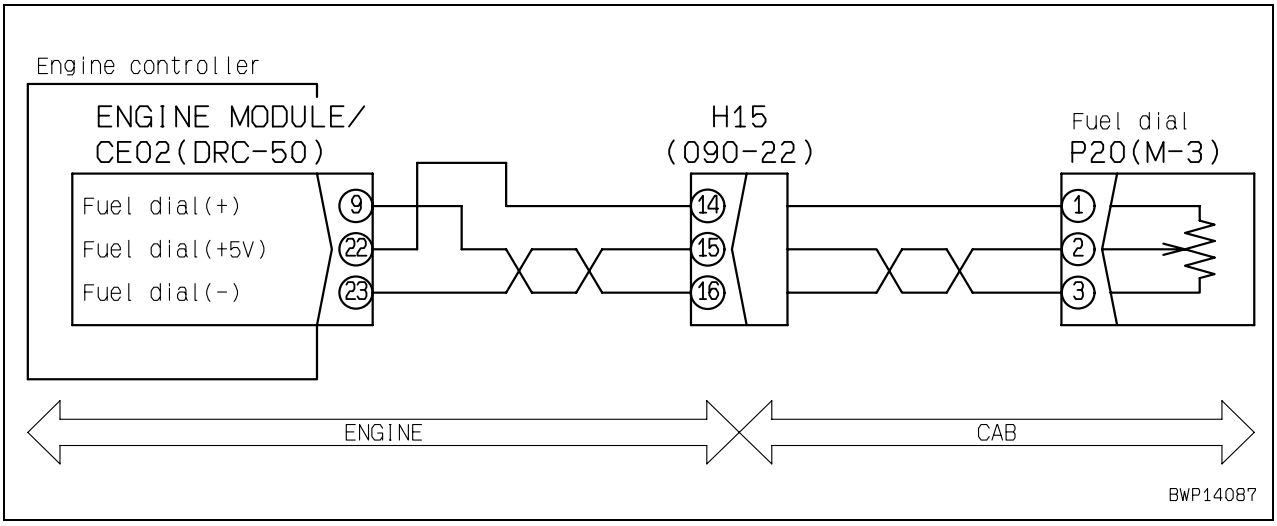


Failure code [CA2185] Throt Sens Sup Volt High Error

User code	Failure code	Trouble	Throttle sensor supply voltage high error (Engine controller system)
E14	**CA2185**		
Contents of trouble	• High voltage (5.25 V or higher) was detected in throttle sensor power supply circuit.		
Action of controller	• If trouble occurs while starting switch is in ON position, controller fixes voltage value to level just before detection of trouble and continues operation. • If starting switch is turned ON while voltage is abnormally high, controller continues operation with voltage at 100% value.		
Problem that appears on machine	• Engine speed cannot be controlled with fuel control dial.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
	1	Short circuit in wiring harness (with another wiring harness)	Wiring harness between CE02 (female) (22) – each of CE02 (female) pins (With P20 disconnected)	Resistance	Min. 100 kΩ
			Wiring harness between CE02 (female) (22) – CE03 (female) (3) (With P20 disconnected)	Resistance	Min. 100 kΩ
	2	Defective wiring harness connector	Connecting parts between fuel control dial – machine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation		
	3	Defective engine controller	If causes 1 – 2 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related to fuel control dial

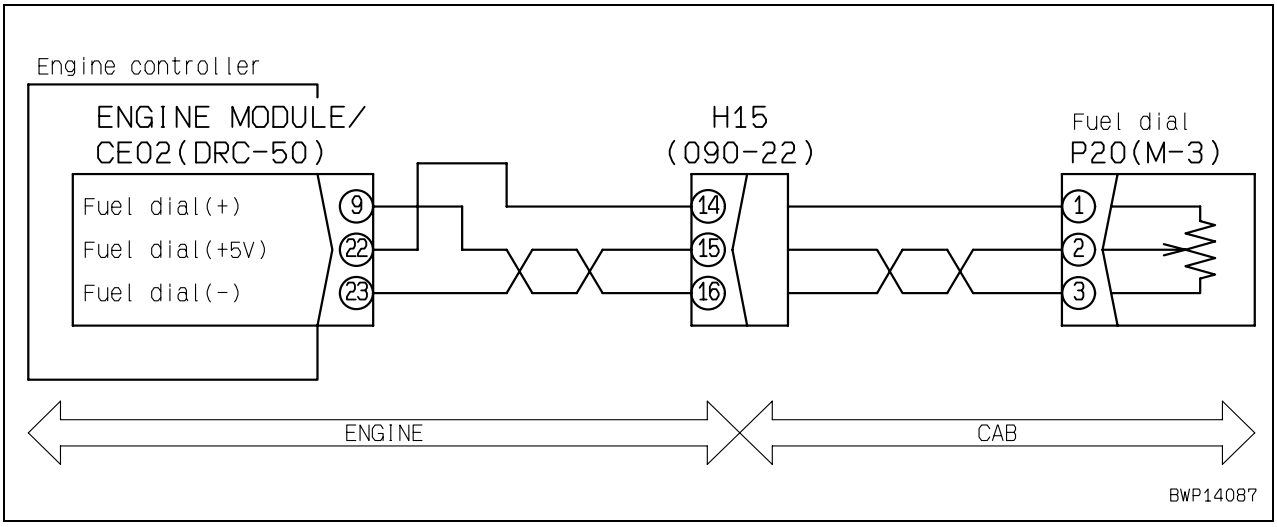


Failure code [CA2186] Throt Sens Sup Volt Low Error

User code	Failure code	Trouble	Throttle sensor supply voltage low error (Engine controller system)
E14	**CA2186**		
Contents of trouble	• Low voltage was detected in throttle sensor power supply circuit.		
Action of controller	• If trouble occurs while starting switch is in ON position, controller fixes voltage value to level just before detection of trouble and continues operation. • If starting switch is turned ON while voltage is abnormally high, controller continues operation with voltage at 100% value.		
Problem that appears on machine	• Engine speed cannot be controlled with fuel control dial.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	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 CE02 (female) (22) – P20 (female) (1)	Resistance	Min. 100 kΩ
	2	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE02 (female) (9) – each of CE02 (female) pins (With P20 disconnected)	Resistance	Min. 100 kΩ
	3	Defective wiring harness connector	Connecting parts between fuel control dial – machine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation		
	4	Defective engine controller	If causes 1 – 3 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related to fuel control dial



Failure code [CA2249] Rail Press Very Low Error

User code	Failure code	Trouble	Common rail pressure very low error (Engine controller system)
E11	**CA2249**		
Contents of trouble	• There is low pressure error in common rail circuit.		
Action of controller	• Limits output and continues operation.		
Problem that appears on machine	• Engine does not start easily. • Exhaust gas becomes black. • Engine output lowers.		
Related information	• Common rail pressure can be checked with monitoring function. (Code: 36400 Common rail pressure) • Method of reproducing failure code: Start engine.		

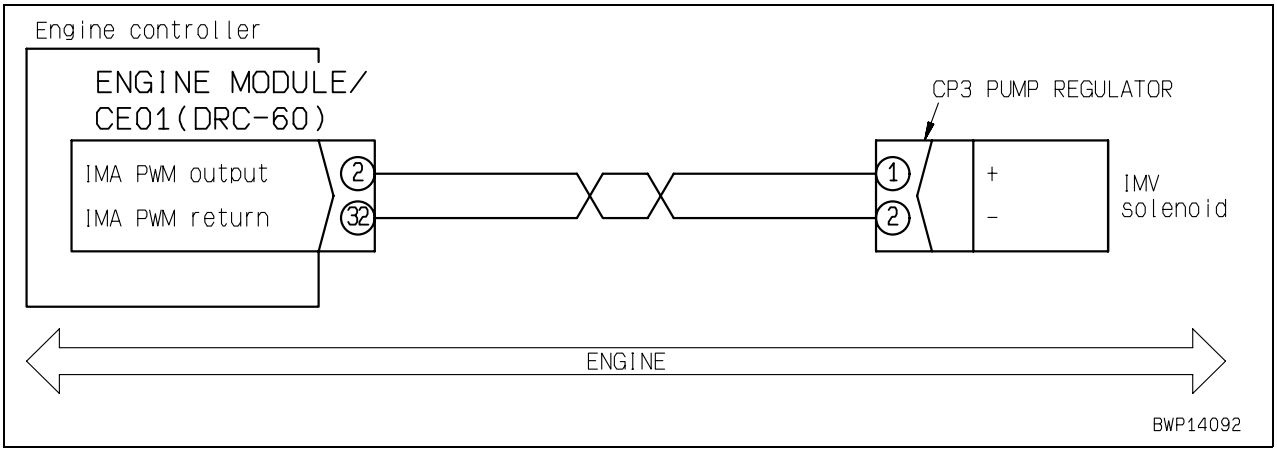
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Carry out troubleshooting for failure code [CA559].	

Failure code [CA2311] IMV Solenoid Error

User code	Failure code	Trouble	IMV solenoid error (Engine controller system)
E11	**CA2311**		
Contents of trouble	• Resistance of supply pump actuator circuit is abnormally high or low.		
Action of controller	• None in particular.		
Problem that appears on machine	• Engine output lowers.		
Related information	• Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defect in related system	If another failure code is displayed, carry out troubleshooting for it.			
	2	Defective supply pump actuator	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			CP3 PUMP REGULATOR (male)	Resistance		
			Between (1) – (2)	Max. 5 Ω		
			Between (1) – chassis ground	Min. 100 kΩ		
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE01 (female) (2) – CP3 PUMP REGULATOR (female) (1)	Resistance	Max. 5 Ω	
			Wiring harness between CE01 (female) (32) – CP3 PUMP REGULATOR (female) (2)	Resistance	Max. 5 Ω	
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE01 (female) (2) – CP3 PUMP REGULATOR (female) (1)	Resistance	Min. 100 kΩ	
	5	Defective wiring harness connector	Connecting parts between supply pump actuator – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation			
	6	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			CE01 (female)	Resistance		
			Between (2) – (32)	Max. 5 Ω		
			Between (2) – chassis ground	Min. 100 kΩ		

Circuit diagram related to supply pump actuator (metering unit)

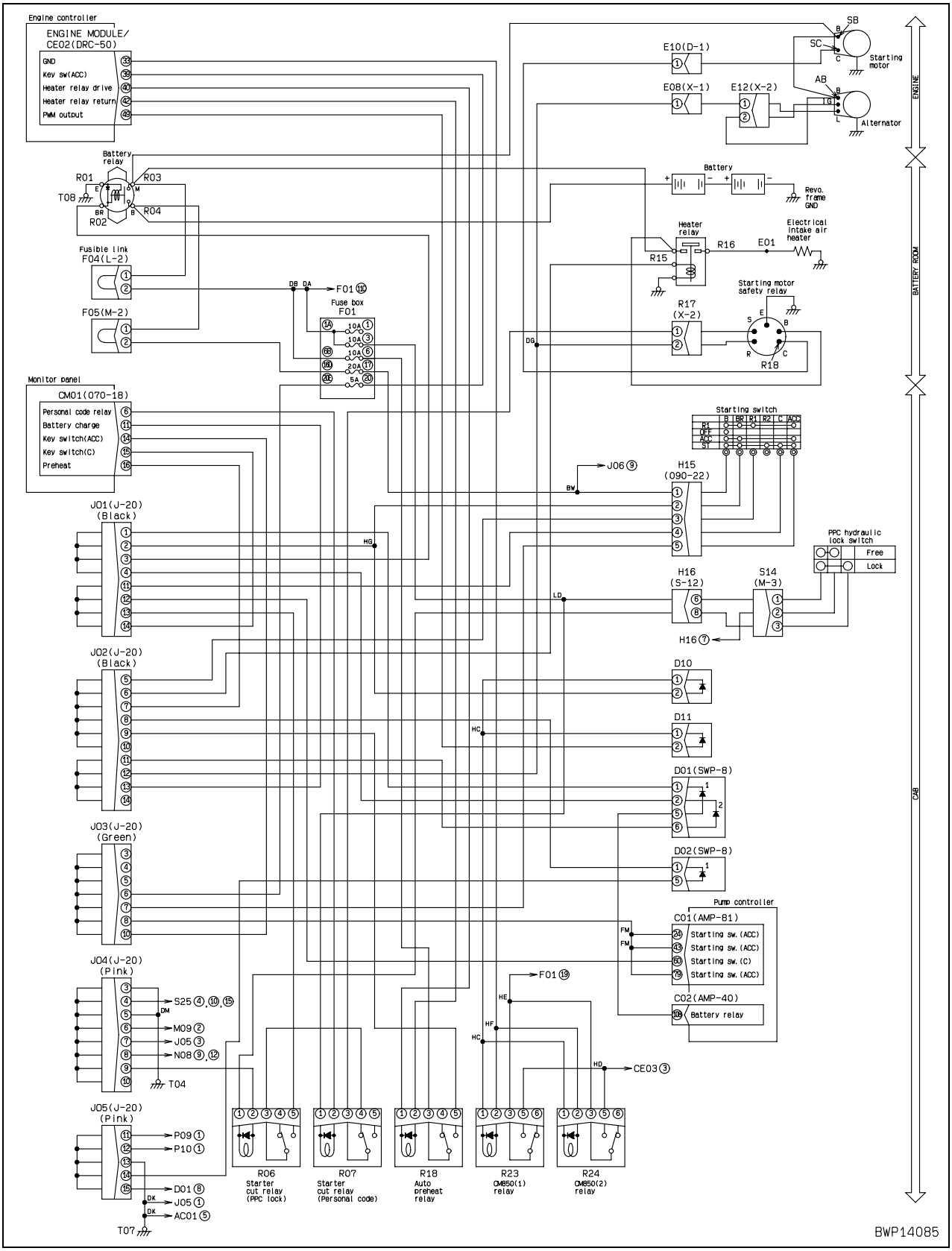


Failure code [CA2555] Grid Htr Relay Volt High Error

User code	Failure code	Trouble	Grid heater relay volt high error (Engine controller system)
E15	**CA2555**		
Contents of trouble	• Disconnection was detected in drive circuit of intake air heater relay.		
Action of controller	• None in particular.		
Problem that appears on machine	• Intake air heater does not work (Engine does not start easily and exhaust gas becomes white at low temperature).		
Related information	• Method of reproducing failure code: Turn starting switch ON when engine coolant temperature is below –4°C.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective automatic preheater relay (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON. (Troubleshooting for relay unit)		
			R18 (male)	Resistance	
			Between (1) – (2)	300 – 600 Ω	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting. (Troubleshooting by replacement)		
			Replace automatic preheater relay (R18)) with another relay and perform reproducing operation. If "E" of failure code goes off at this time, replaced relay is defective.		
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE02 (female) (40) – R18 (female) (1)	Resistance	Max. 10 Ω
			Wiring harness between CE02 (female) (42) – R18 (female) (2)	Resistance	Max. 10 Ω
	3	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE02 (female) (40) – each of CE02 (female) pins (With R18 disconnected)	Resistance	Min. 100 kΩ
	4	Defective wiring harness connector	Connecting parts between automatic preheater relay – machine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation		
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CE02 (female)	Resistance	
			Between (40) – (42)	300 – 600 Ω	

Circuit diagram related to engine preheater/starting motor/charging system

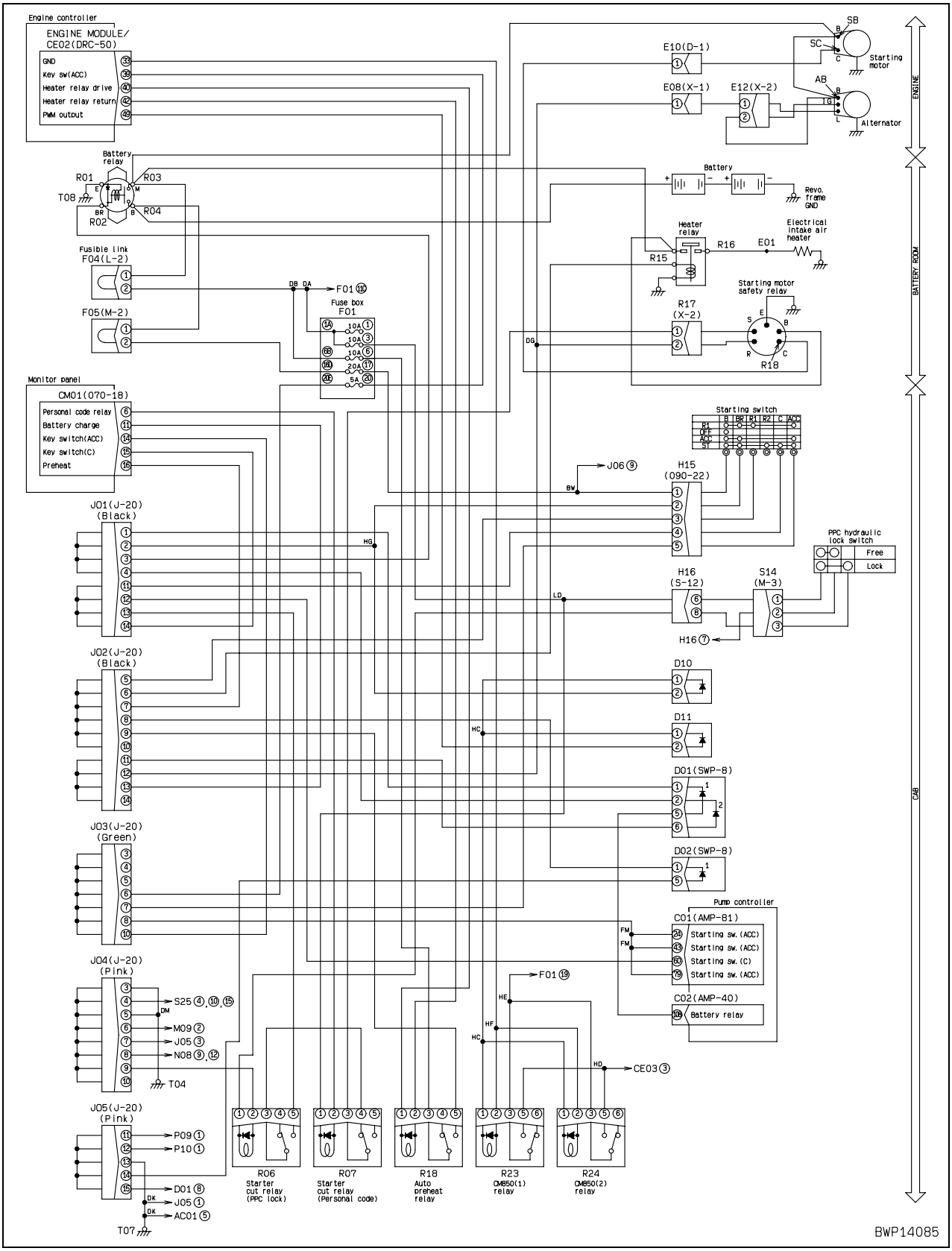


Failure code [CA2556] Grid Htr Relay Volt Low Error

User code	Failure code	Trouble	Grid heater relay volt low error (Engine controller system)
E15	**CA2556**		
Contents of trouble	• Short circuit was detected in drive circuit of intake air heater relay.		
Action of controller	• None in particular.		
Problem that appears on machine	• Intake air heater does not work (Engine does not start easily and exhaust gas becomes white at low temperature).		
Related information	• Method of reproducing failure code: Turn starting switch ON when engine coolant temperature is below –4°C.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective automatic preheater relay (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON. (Troubleshooting for relay unit)		
			R18 (male)	Resistance	
			Between (1) – (2)	300 – 600 Ω	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting. (Troubleshooting by replacement)		
			Replace automatic preheater relay (R18)) with another relay and perform reproducing operation. If "E" of failure code goes off at this time, replaced relay is defective.		
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE02 (female) (40) – R18 (female) (1)	Resistance	Min. 100 kΩ
	3	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE02 (female) (40) – each of CE02 (female) pins (With R18 disconnected)	Resistance	Min. 100 kΩ
	4	Defective wiring harness connector	Connecting parts between automatic preheater relay – machine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation		
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CE02 (female)	Resistance	
			Between (40) – (42)	300 – 600 Ω	

Circuit diagram related to engine preheater/starting motor/charging system

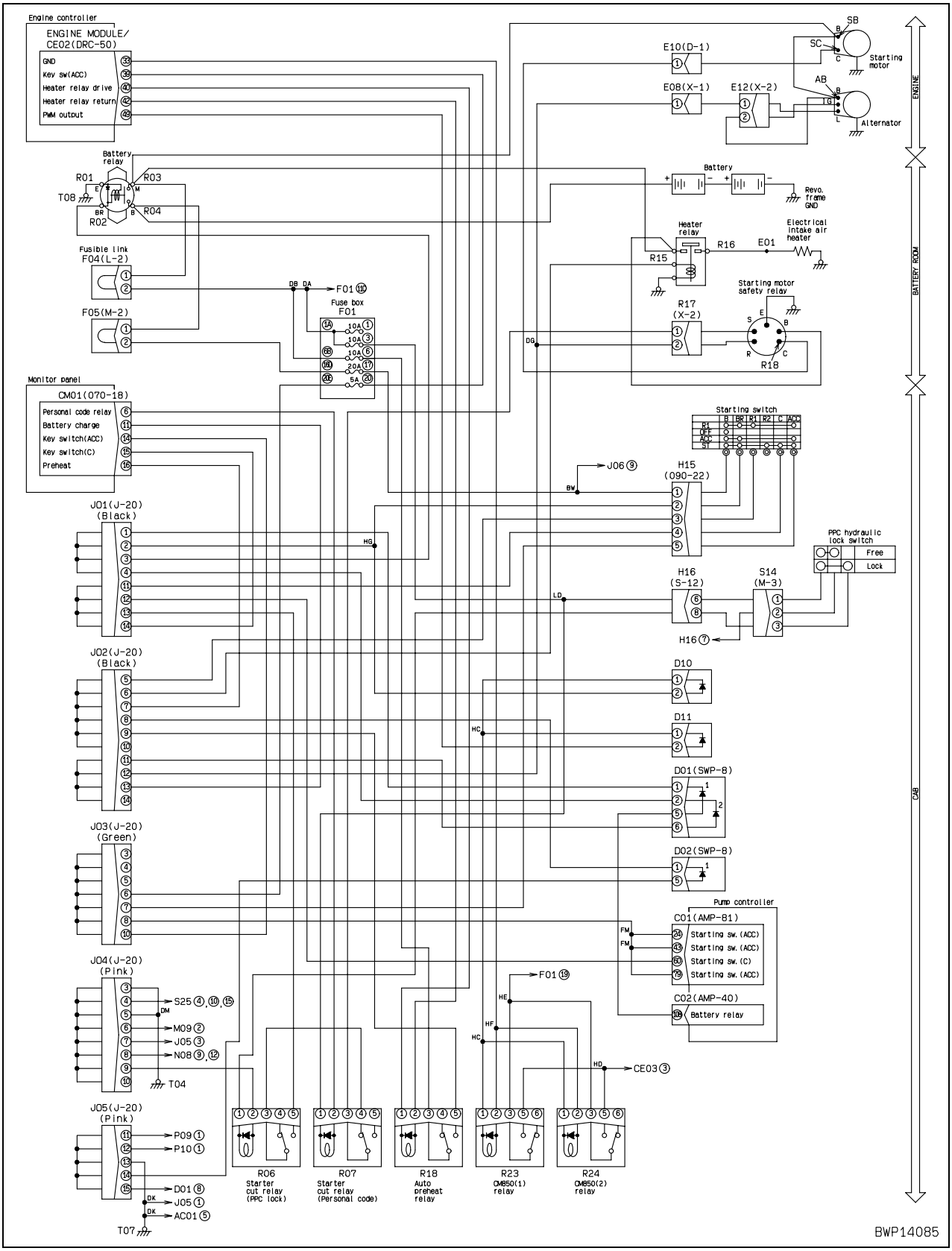


Failure code [D19JKZ] Personal Code Relay Abnormality

User code	Failure code	Trouble	Personal code relay abnormality (KOMTRAX system in machine monitor)
E01	**D19JKZ**		
Contents of trouble	• Disconnection or short circuit was detected in personal code relay circuit.		
Action of controller	• None in particular (when disconnection is detected). • Turns output to personal code relay OFF (when short circuit is detected). • If cause of failure disappears, system resets itself (when disconnection is detected). • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine			
Related information	• Method of reproducing failure code: Turn starting switch ON (Disconnection). Trouble cannot be reproduced on machine (Short circuit).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fuse No. 3	If fuse is broken, circuit probably has ground fault (See cause 4).		
	2	Defective personal code relay (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON. (Troubleshooting for relay unit)		
			R07 (male)	Resistance	
			Between (1) – (2)	(300 – 600 Ω)	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting. (Troubleshooting by replacement)		
			Replace personal code relay (R07)) with another relay and perform reproducing operation. If "E" of failure code goes off at this time, replaced relay is defective.		
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between F01 (3) – R07 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between R07 (female) (2) – CM01 (female) (6)	Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between F01 (3) – R07 (female) (1)	Resistance	Min. 1 MΩ
			Wiring harness between R07 (female) (2) – CM01 (female) (6)	Resistance	Min. 1 MΩ
	5	Defective machine monitor (KOMTRAX section)	If causes 1 – 4 are not detected, machine monitor (KOMTRAX) may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related to engine preheater/starting motor/charging system

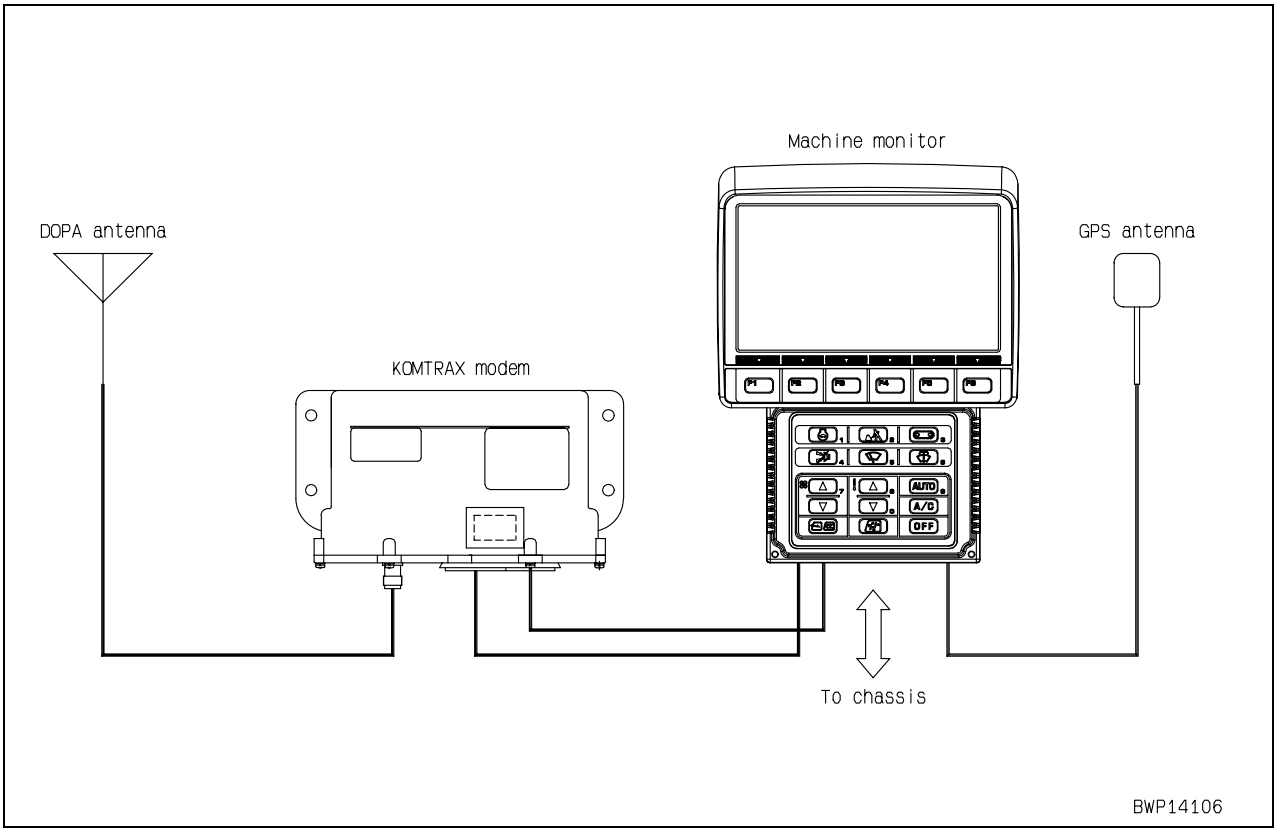


Failure code [D862KA] GPS Antenna Discon

User code	Failure code	Trouble	GPS antenna disconnection (KOMTRAX system in machine monitor)
—	**D862KA**		
Contents of trouble	• Disconnection was detected in GPS antenna circuit.		
Action of controller	• None in particular. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• GPS cannot measure position.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective GPS antenna or antenna cable	GPS antenna may be defective and antenna cable may be disconnected or shorted and antenna cable may be connected defectively.

Configuration diagram of KOMTRAX system



Failure code [DA25KP] 5V Sensor 1 Power Abnormality

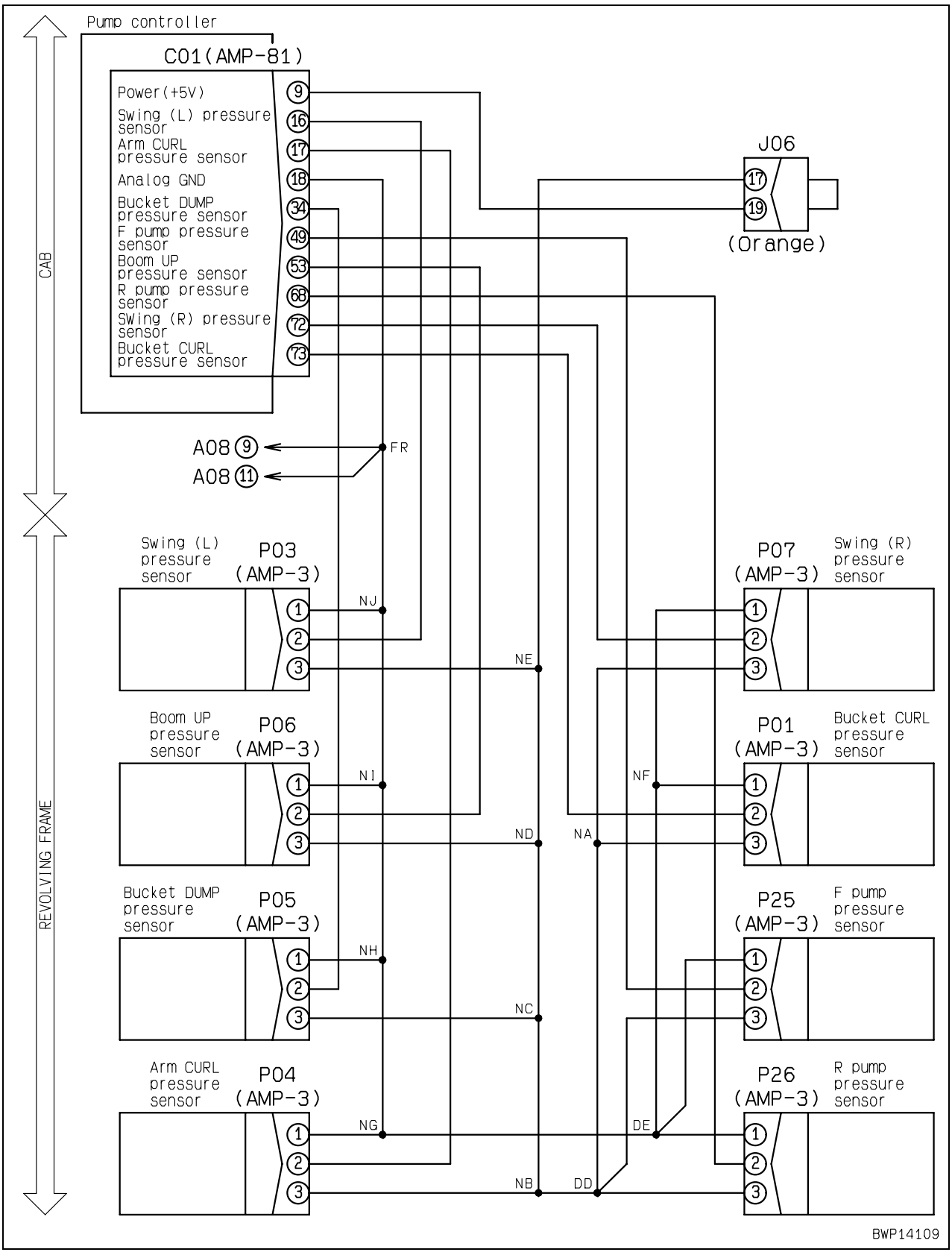
Overload alarm monitor non-display specification

User code	Failure code	Trouble	5V sensor power supply output 1 abnormality (Pump controller system)
—	**DA25KP**		
Contents of trouble	• Voltage of 5V sensor power supply output 1 circuit is below 2.5 V or above 6.0 V.		
Action of controller	• Turns output of 5V sensor power supply output 1 OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Automatic gear shifting function does not work (pump pressure sensor system). • Fine control performance of work equipment lowers (PPC pressure sensor system).		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state			★ Disconnect connector with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
	1	Defective pressure sensor (Internal short circuit)	Disconnect sensors at right in order and carry out operation to reproduce trouble. If "E" of failure code goes off when a sensor is disconnected, that sensor is defective.	Bucket CURL PPC pressure sensor	P01
				Swing LEFT PPC pressure sensor	P03
				Arm IN PPC pressure sensor	P04
				Bucket DUMP PPC pressure sensor	P05
				Boom RAISE PPC pressure sensor	P06
				Swing RIGHT PPC pressure sensor	P07
				F pump pressure sensor	P25
				R pump pressure sensor	P26
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between C01 (female) (9) – J06 – P01 (female) (3) [Bucket CURL PPC pressure sensor system]	Resistance	Min. 1 MΩ
			Wiring harness between C01 (female) (9) – J06 – P03 (female) (3) [Swing LEFT PPC pressure sensor system]	Resistance	Min. 1 MΩ
			Wiring harness between C01 (female) (9) – J06 – P04 (female) (3) [Arm IN PPC pressure sensor system]	Resistance	Min. 1 MΩ
			Wiring harness between C01 (female) (9) – P05 (female) (3) [Bucket DUMP PPC pressure sensor system]	Resistance	Min. 1 MΩ
			Wiring harness between C01 (female) (9) – J06 – P06 (female) (3) [Boom RAISE PPC pressure sensor system]	Resistance	Min. 1 MΩ

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	2	Ground fault in wiring harness (Short circuit with GND circuit)	Wiring harness between C01 (female) (9) – J06 – P07 (female) (3) [Swing RIGHT PPC pressure sensor system]	Resistance	Min. 1 MΩ
			Wiring harness between C01 (female) (9) – J06 – P25 (female) (3) [F pump pressure sensor system]	Resistance	Min. 1 MΩ
			Wiring harness between C01 (female) (9) – J06 – P26 (female) (3) [R pump pressure sensor system]	Resistance	Min. 1 MΩ
	3	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between C01 (female) (9) – J06 – P01 (female) (3) [Bucket CURL PPC pressure sensor system]	Voltage	Max. 1 V
			Wiring harness between C01 (female) (9) – J06 – P03 (female) (3) [Swing LEFT PPC pressure sensor system]	Voltage	Max. 1 V
			Wiring harness between C01 (female) (9) – J06 – P04 (female) (3) [Arm IN PPC pressure sensor system]	Voltage	Max. 1 V
			Wiring harness between C01 (female) (9) – P05 (female) (3) [Bucket DUMP PPC pressure sensor system]	Voltage	Max. 1 V
			Wiring harness between C01 (female) (9) – J06 – P06 (female) (3) [Boom RAISE PPC pressure sensor system]	Voltage	Max. 1 V
			Wiring harness between C01 (female) (9) – J06 – P07 (female) (3) [Swing RIGHT PPC pressure sensor system]	Voltage	Max. 1 V
			Wiring harness between C01 (female) (9) – J06 – P25 (female) (3) [F pump pressure sensor system]	Voltage	Max. 1 V
			Wiring harness between C01 (female) (9) – J06 – P26 (female) (3) [R pump pressure sensor system]	Voltage	Max. 1 V
	4	Defective pump controller	If causes 1 – 3 are not detected, pump controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related to pump controller 5V sensor power supply output 1 (Overload alarm monitor non-display specification)



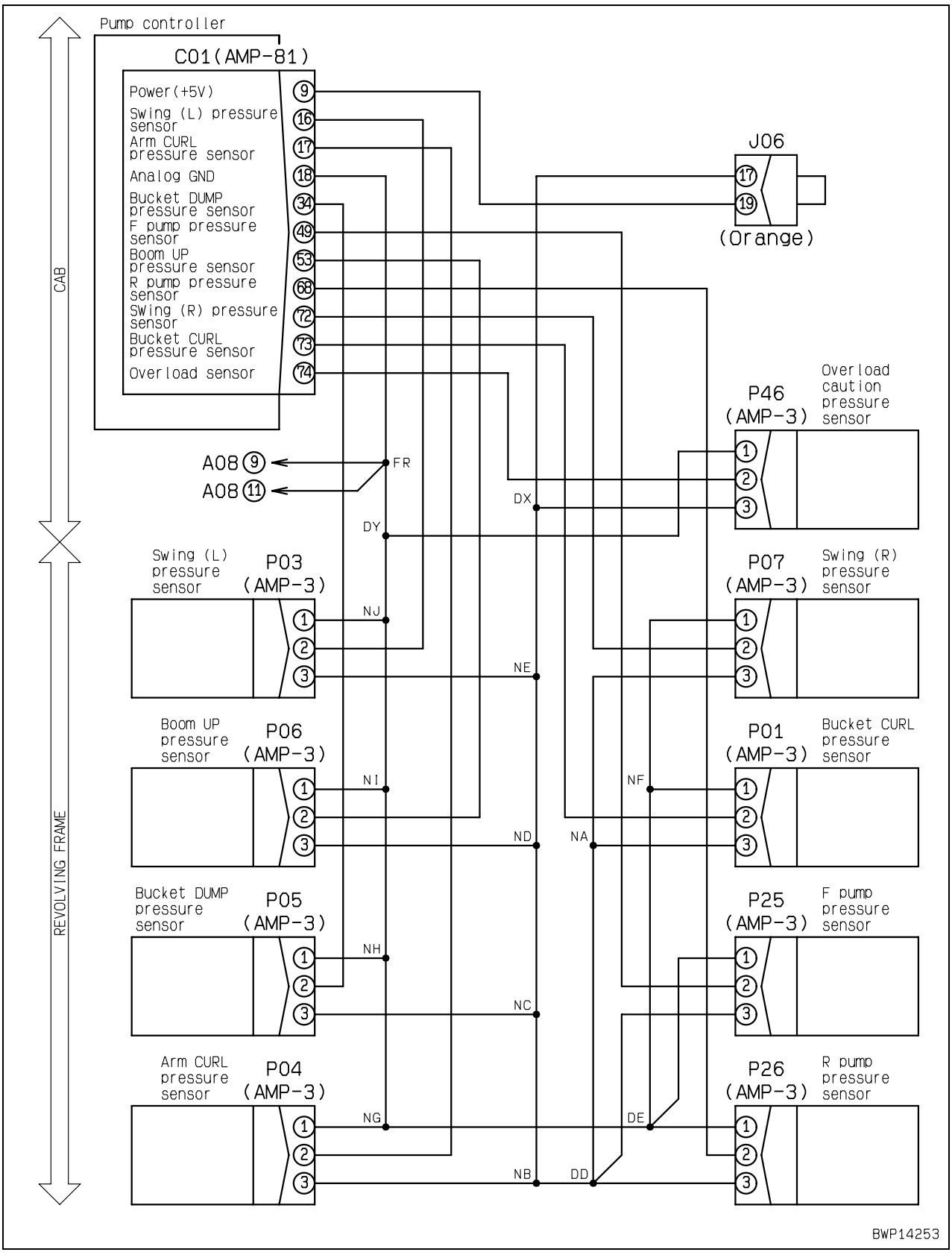
Overload alarm monitor display specification

User code	Failure code	Trouble	5V sensor power supply output 1 abnormality (Pump controller system)
—	**DA25KP**		
Contents of trouble	• Voltage of 5V sensor power supply output 1 circuit is below 2.5 V or above 6.0 V.		
Action of controller	• Turns output of 5V sensor power supply output 1 OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Automatic gear shifting function does not work (pump pressure sensor system). • Fine control performance of work equipment lowers (PPC pressure sensor system). • Overload alarm monitor does not display normally (Overload alarm pressure sensor system)		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective pressure sensor (Internal short circuit)	★ Disconnect connector with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Disconnect sensors at right in order and carry out operation to reproduce trouble. If "E" of failure code goes off when a sensor is disconnected, that sensor is defective.	Bucket CURL PPC pressure sensor	P01
				Swing LEFT PPC pressure sensor	P03
				Arm IN PPC pressure sensor	P04
				Bucket DUMP PPC pressure sensor	P05
				Boom RAISE PPC pressure sensor	P06
				Swing RIGHT PPC pressure sensor	P07
				F pump pressure sensor	P25
				R pump pressure sensor	P26
				Overload alarm pressure sensor	P46
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between C01 (female) (9) – J06 – P01 (female) (3) [Bucket CURL PPC pressure sensor system]	Resistance	Min. 1 MΩ
			Wiring harness between C01 (female) (9) – J06 – P03 (female) (3) [Swing LEFT PPC pressure sensor system]	Resistance	Min. 1 MΩ
			Wiring harness between C01 (female) (9) – J06 – P04 (female) (3) [Arm IN PPC pressure sensor system]	Resistance	Min. 1 MΩ
			Wiring harness between C01 (female) (9) – P05 (female) (3) [Bucket DUMP PPC pressure sensor system]	Resistance	Min. 1 MΩ
			Wiring harness between C01 (female) (9) – J06 – P06 (female) (3) [Boom RAISE PPC pressure sensor system]	Resistance	Min. 1 MΩ

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	2	Ground fault in wiring harness (Short circuit with GND circuit)	Wiring harness between C01 (female) (9) – J06 – P07 (female) (3) [Swing RIGHT PPC pressure sensor system]	Resistance	Min. 1 MΩ
			Wiring harness between C01 (female) (9) – J06 – P25 (female) (3) [F pump pressure sensor system]	Resistance	Min. 1 MΩ
			Wiring harness between C01 (female) (9) – J06 – P26 (female) (3) [R pump pressure sensor system]	Resistance	Min. 1 MΩ
			Wiring harness between C01 (female) (9) – J06 – P46 (female) (3) [Overload alarm pressure sensor system]	Resistance	Min. 1 MΩ
	3	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between C01 (female) (9) – J06 – P01 (female) (3) [Bucket CURL PPC pressure sensor system]	Voltage	Max. 1 V
			Wiring harness between C01 (female) (9) – J06 – P03 (female) (3) [Swing LEFT PPC pressure sensor system]	Voltage	Max. 1 V
			Wiring harness between C01 (female) (9) – J06 – P04 (female) (3) [Arm IN PPC pressure sensor system]	Voltage	Max. 1 V
			Wiring harness between C01 (female) (9) – P05 (female) (3) [Bucket DUMP PPC pressure sensor system]	Voltage	Max. 1 V
			Wiring harness between C01 (female) (9) – J06 – P06 (female) (3) [Boom RAISE PPC pressure sensor system]	Voltage	Max. 1 V
			Wiring harness between C01 (female) (9) – J06 – P07 (female) (3) [Swing RIGHT PPC pressure sensor system]	Voltage	Max. 1 V
			Wiring harness between C01 (female) (9) – J06 – P25 (female) (3) [F pump pressure sensor system]	Voltage	Max. 1 V
			Wiring harness between C01 (female) (9) – J06 – P26 (female) (3) [R pump pressure sensor system]	Voltage	Max. 1 V
			Wiring harness between C01 (female) (9) – J06 – P46 (female) (3) [Overload alarm pressure sensor system]	Voltage	Max. 1 V
	4	Defective pump controller	If causes 1 – 3 are not detected, pump controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related to pump controller 5V sensor power supply output 1 (Overload alarm monitor display specification)



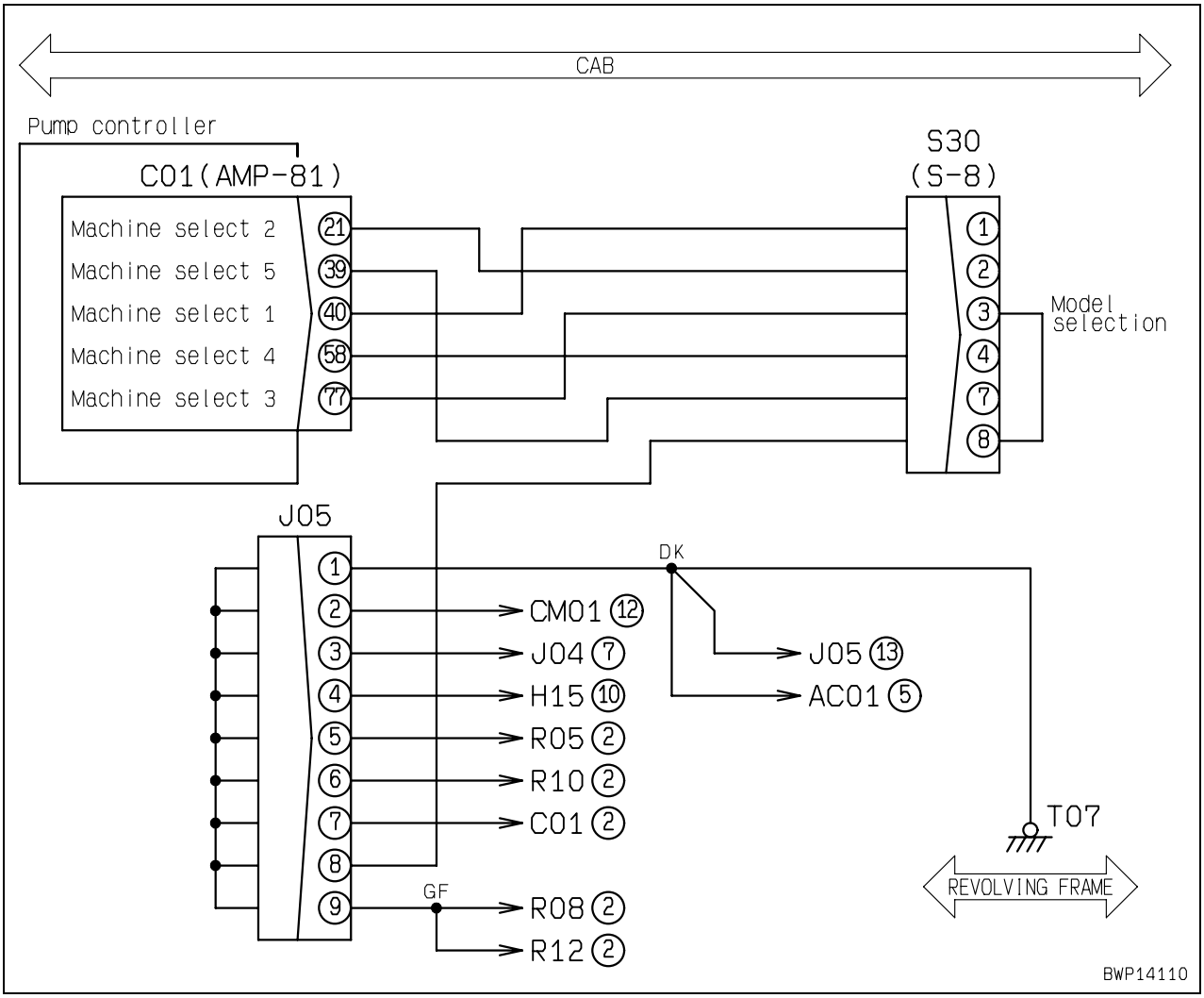
Failure code [DA29KQ] Model Selection Abnormality

PC210, 210LC-8

User code	Failure code	Trouble	Model selection abnormality (Pump controller system)
—	**DA29KQ**		
Contents of trouble	• Model code signal for model which is not registered in controller is input.		
Action of controller	• Changes input model code to code of default model (PC210) and continues control. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Since control is carried out on assumption that model is PC210, no particular problem occur.		
Related information	• Model code of pump controller can be checked with monitoring function. (Code: 00200 Controller model code) • Condition of model selection signal can be checked with monitoring function. (Code: 02201 Switch input 2) • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective model selection connector (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S30 (female)	Resistance		
			Between (1), (2), (4), (7) – (8)	Min. 1 MΩ		
			Between (3) – (8)	Max. 1 Ω		
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (77) – S30 (male) (3)	Resistance	Max. 1 Ω	
			Wiring harness between S30 (male) (8) – J05 – chassis ground (T07)	Resistance	Max. 1 Ω	
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			iring harness between C01 (female) (40) – S30 (male) (1)	Resistance	Min. 1 MΩ	
			Wiring harness between C01 (female) (21) – S30 (male) (2)	Resistance	Min. 1 MΩ	
			Wiring harness between C01 (female) (58) – S30 (male) (4)	Resistance	Min. 1 MΩ	
			Wiring harness between C01 (female) (39) – S30 (male) (7)	Resistance	Min. 1 MΩ	
	4	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C01 (female)	Resistance		
			Between (21), (39), (40), (68) – chassis ground	Min. 1 MΩ		
			Between (77) – chassis ground	Max. 1 Ω		

Circuit diagram related to model selection connector (PC210, 210LC-8)

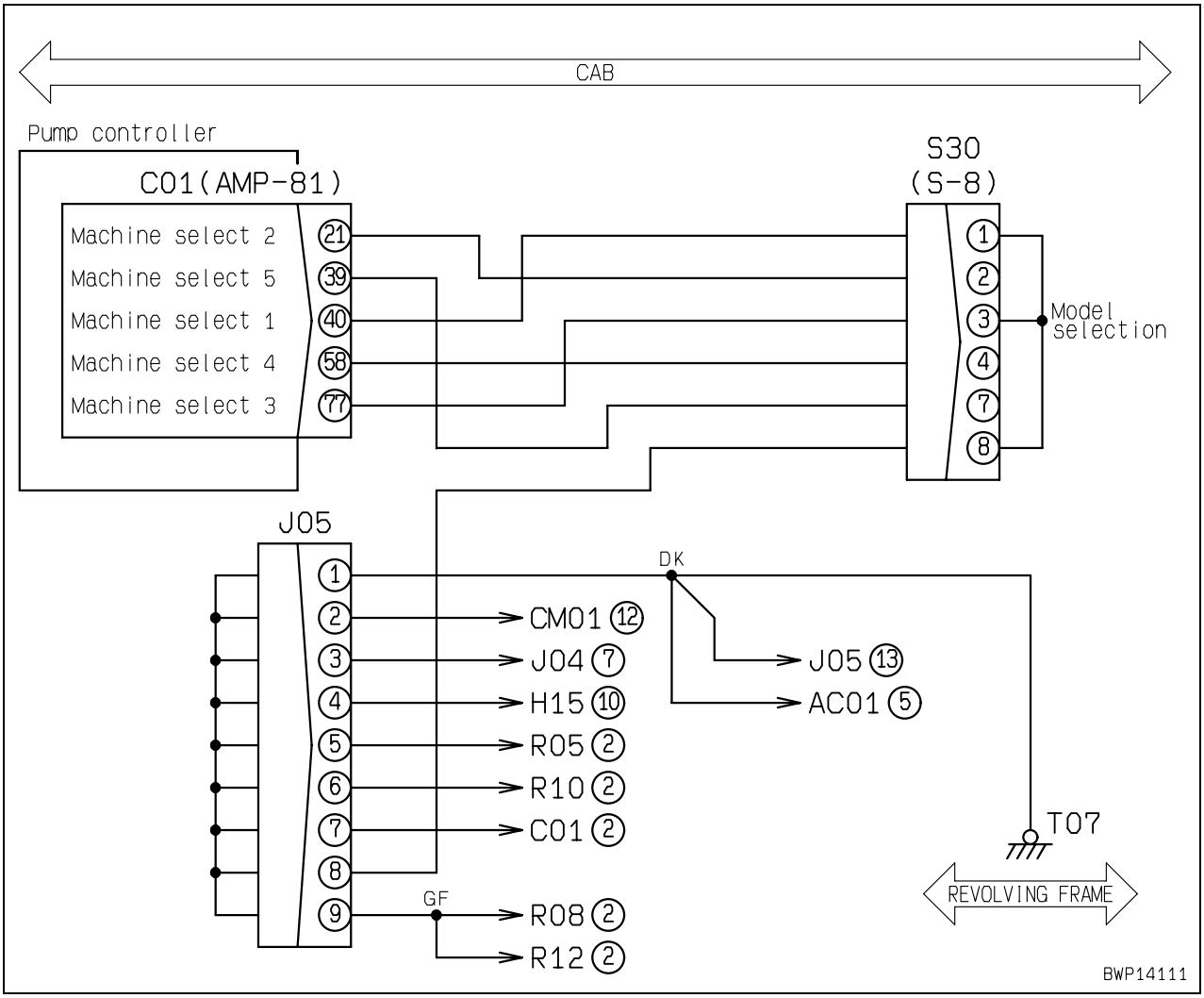


PC240LC-8

User code	Failure code	Trouble	Model selection abnormality (Pump controller system)
—	**DA29KQ**		
Contents of trouble	• Model code signal for model which is not registered in controller is input.		
Action of controller	• Changes input model code to code of default model (PC210) and continues control. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Since control is carried out on assumption that model is PC210, power or speed is low.		
Related information	• Model code of pump controller can be checked with monitoring function. (Code: 00200 Controller model code) • Condition of model selection signal can be checked with monitoring function. (Code: 02201 Switch input 2) • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective model selection connector (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S30 (female)	Resistance		
			Between (2), (4), (7) – (8)	Min. 1 MΩ		
			Between (1), (3) – (8)	Max. 1 Ω		
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (40) – S30 (male) (1)	Resistance	Max. 1 Ω	
			Wiring harness between C01 (female) (77) – S30 (male) (3)	Resistance	Max. 1 Ω	
			Wiring harness between S30 (male) (8) – J05 – chassis ground (T07)	Resistance	Max. 1 Ω	
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (21) – S30 (male) (2)	Resistance	Min. 1 MΩ	
			Wiring harness between C01 (female) (58) – S30 (male) (4)	Resistance	Min. 1 MΩ	
			Wiring harness between C01 (female) (39) – S30 (male) (7)	Resistance	Min. 1 MΩ	
	4	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C01 (female)	Resistance		
			Between (21), (39), (68) – chassis ground	Min. 1 MΩ		
			Between (40), (77) – chassis ground	Max. 1 Ω		

Circuit diagram related to model selection connector (PC240LC-8)



PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00241-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

40 Troubleshooting

Troubleshooting by failure code (Display of code), Part 3

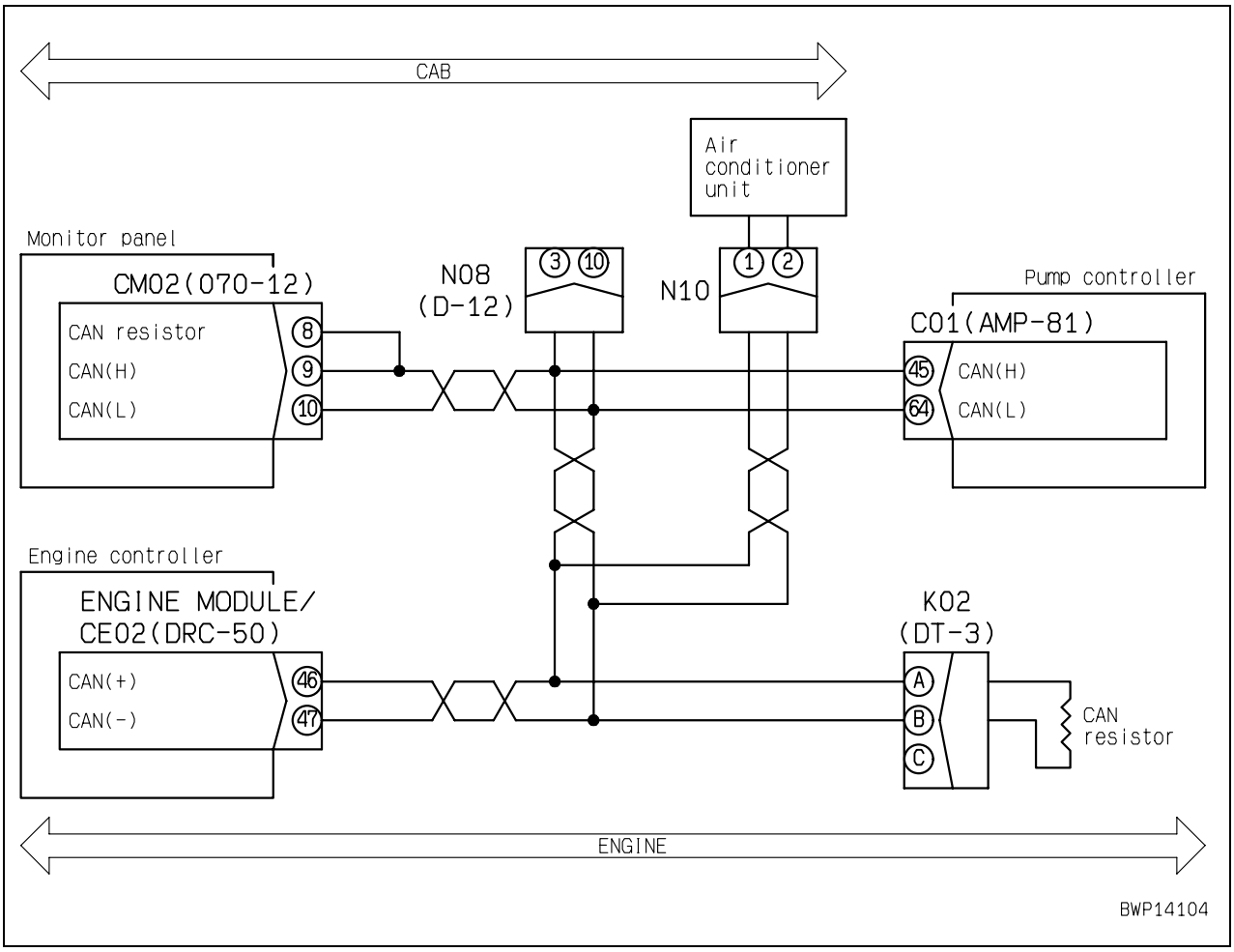
Troubleshooting by failure code (Display of code), Part 3

Failure code [DA2RMC] CAN Discon (Pump Con Detected)

User code	Failure code	Trouble	CAN disconnection (Pump controller detected) (Pump controller system)
E0E	**DA2RMC**		
Contents of trouble	• Pump controller detected communication error in CAN communication circuit between machine monitor and engine controller.		
Action of controller	• Continues operation with information of CAN communication just before detection of error. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Information may not transmitted normally by CAN communication and machine may not operate normally. (Trouble phenomenon depends on failed section.)		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	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 CM02 (female) (8), (9) – C01 (female) (45), – CE02 (female) (46), – K02 (female) (A)	Resistance	Max. 1 Ω
			Wiring harness between CM02 (female) (10) – C01 (female) (64), – CE02 (female) (47), – K02 (female) (B)	Resistance	Max. 1 Ω
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CM02 (female) (8), (9) – C01 (female) (45), – CE02 (female) (46), – K02 (female) (A), – N08 (male) (3)	Resistance	Min. 1 MΩ
			Wiring harness between CM02 (female) (10) – C01 (female) (64), – CE02 (female) (47), – K02 (female) (B), – N08 (male) (10)	Resistance	Min. 1 MΩ
	3	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between CM02 (female) (8), (9) – C01 (female) (45), – CE02 (female) (46), – K02 (female) (A), – N08 (male) (3)	Voltage	Max. 5.5 V
			Wiring harness between CM02 (female) (10) – C01 (female) (64), – CE02 (female) (47), – K02 (female) (B), – N08 (male) (10)	Voltage	Max. 5.5 V
	4	Defective CAN terminal resistance (Internal short circuit or disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			K02 (male)	Resistance	
			Between (A) – (B)	120 ± 12 Ω	
	5	Defective pump controller	If causes 1 – 4 are not detected, pump controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related to CAN communication



Failure code [DAFGMC] GPS Module Error

User code	Failure code	Trouble	GPS module operation error (KOMTRAX system in machine monitor)
—	**DAFGMC**		
Contents of trouble	• Position data is not sent from GPS module (in machine monitor) to KOMTRAX communication MODEM in 50 seconds after KOMTRAX is started.		
Action of machine monitor	• None in particular. • If cause of failure disappears, system resets itself.		
Problem that appears on machine			
Related information	• Method of reproducing failure code: Turn starting switch ON (At least 50 seconds after starting switch is turned ON).		

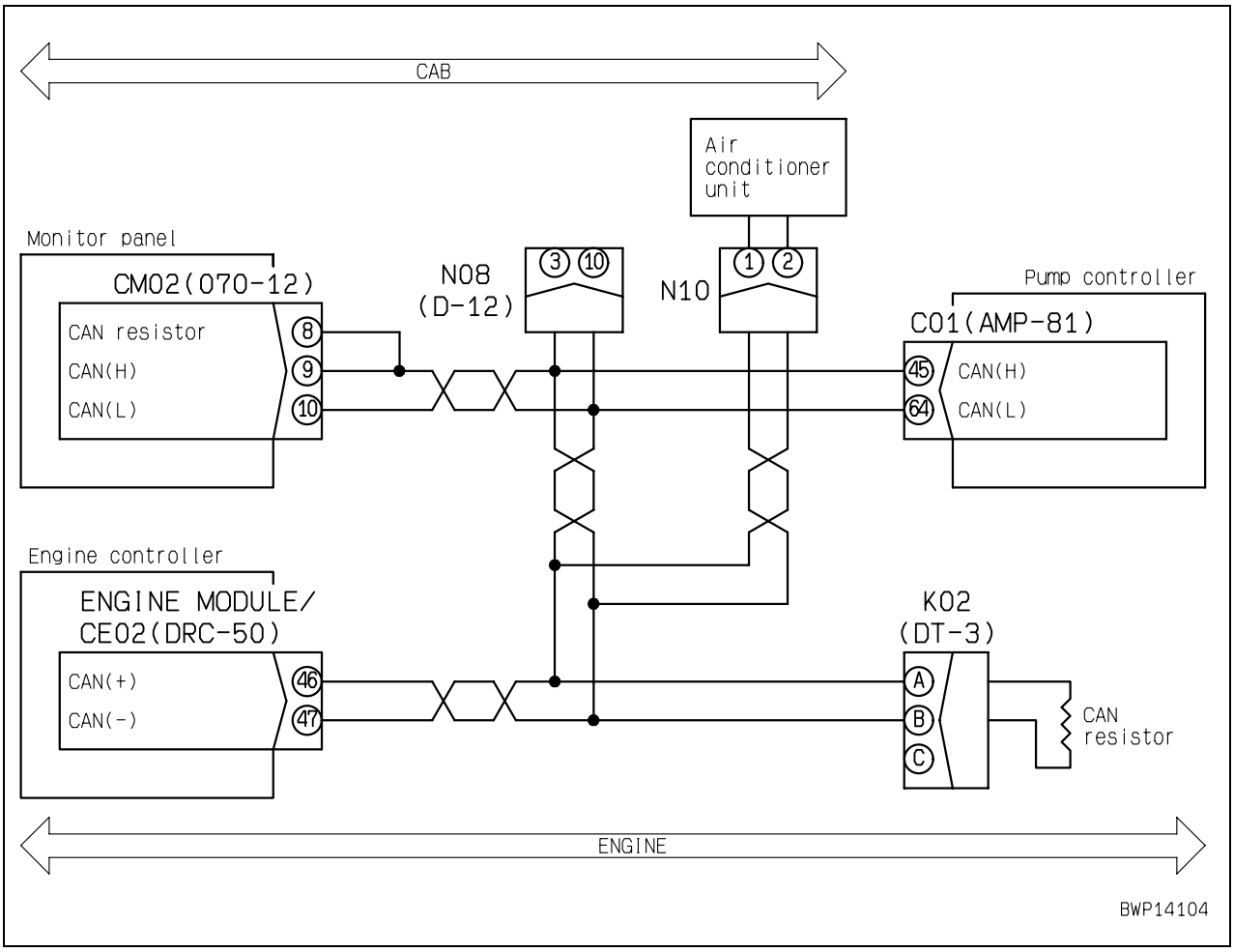
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective machine monitor	GPS module of machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Failure code [DAFRMC] CAN Discon (Monitor Detected)

User code	Failure code	Trouble	CAN disconnection (Monitor detected) (Machine monitor system)
E0E	**DAFRMC**		
Contents of trouble	• Machine monitor detected communication error in CAN communication circuit between pump controller and engine controller.		
Action of machine monitor	• If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Information may not transmitted normally by CAN communication and machine may not operate normally. (Trouble phenomenon depends on failed section.)		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	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 CM02 (female) (8), (9) – C01 (female) (45), – CE02 (female) (46), – K02 (female) (A)	Resistance	Max. 1 Ω
			Wiring harness between CM02 (female) (10) – C01 (female) (64), – CE02 (female) (47), – K02 (female) (B)	Resistance	Max. 1 Ω
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CM02 (female) (8), (9) – C01 (female) (45), – CE02 (female) (46), – K02 (female) (A), – N08 (male) (3)	Resistance	Min. 1 MΩ
			Wiring harness between CM02 (female) (10) – C01 (female) (64), – CE02 (female) (47), – K02 (female) (B), – N08 (male) (10)	Resistance	Min. 1 MΩ
	3	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between CM02 (female) (8), (9) – C01 (female) (45), – CE02 (female) (46), – K02 (female) (A), – N08 (male) (3)	Voltage	Max. 5.5 V
			Wiring harness between CM02 (female) (10) – C01 (female) (64), – CE02 (female) (47), – K02 (female) (B), – N08 (male) (10)	Voltage	Max. 5.5 V
	4	Defective CAN terminal resistance (Internal short circuit or disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			K02 (male)	Resistance	
			Between (A) – (B)	120 ± 12 Ω	
	5	Defective machine monitor	If causes 1 – 4 are not detected, machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related to CAN communication

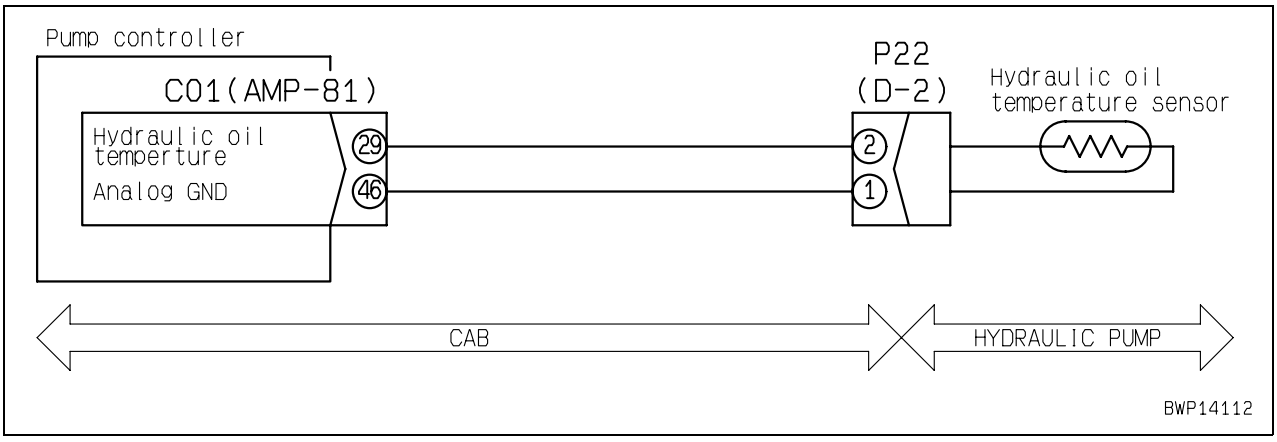


Failure code [DGH2KB] Hydr Oil Sensor Short

User code	Failure code	Trouble	Hydraulic oil temperature sensor short (Pump controller system)
—	**DGH2KB**		
Contents of trouble	• Ground fault was detected in hydraulic oil temperature sensor circuit.		
Action of controller	• Fixes hydraulic oil temperature value at 40°C and continues operation. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• While hydraulic oil temperature rises normally, hydraulic oil temperature gauge does not move from top of white range (bottom of green range).		
Related information	• Signal voltage of hydraulic oil temperature sensor can be checked with monitoring function. (Code: 04402 Hydraulic oil temperature sensor voltage) • Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective hydraulic oil temperature sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			P22 (male)	Resistance	
			Between (1) – (2)	3.5 – 90 kΩ	
			Between (2) – chassis ground	Min. 1 MΩ	
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between C01 (female) (29) – P22 (female) (2)	Resistance	Min. 1 MΩ
	3	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			C01 (female)	Resistance	
			Between (29) – (46)	3.5 – 90 kΩ	
			Between (29) – chassis ground	Min. 1 MΩ	

Circuit diagram related to hydraulic oil temperature sensor

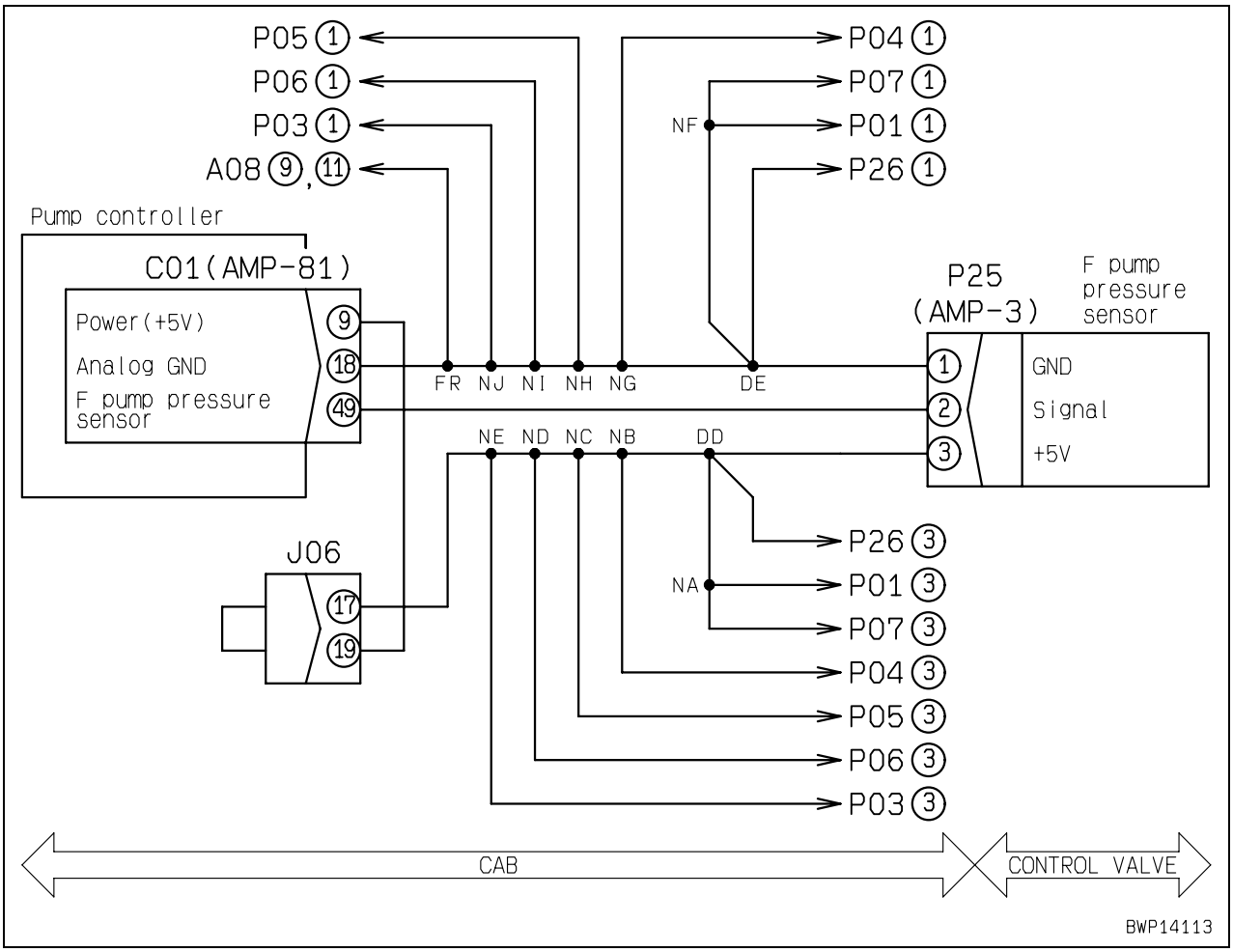


Failure code [DHPAMA] F Pump Press Sensor Abnormality

User code	Failure code	Trouble	F pump pressure sensor abnormality (Pump controller system)
—	**DHPAMA**		
Contents of trouble	• Signal voltage of F pump pressure sensor circuit is below 0.3 V or above 4.5 V.		
Action of controller	• Fixes F pump pressure at 0 MPa {0 kg/cm^2} and continues control. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Automatic gear shifting function does not work. • Straight travel performance or steering performance lowers.		
Related information	★ If 5V circuit (3) and ground circuit (1) of pressure sensor are connected inversely, pressure sensor will be broken. Accordingly, take extreme care when checking. • F pump pressure can be checked with monitoring function. (Code: 01100 F pump pressure) • Method of reproducing failure code: Turn starting switch ON or start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 5V sensor power supply 1 system	★ If failure code [**DA25KP**] is also displayed, carry out troubleshooting for it first.			
	2	Defective F pump pressure sensor (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON or start engine and carry out troubleshooting in each case.			
			P25		Voltage	
			Between (3) – (1)	Power supply	4.5 – 5.5 V	
			Between (2) – (1)	Signal	0.3 – 4.5 V	
			If voltage is abnormal, replace F pump pressure sensor with R pump pressure sensor and check failure code. (If "E" of failure code goes off at this time, F pump pressure sensor is defective.)			
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (18) – P25 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between C01 (female) (49) – P25 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between C01 (female) (9) – J06 – P25 (female) (3)		Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (49) – P25 (female) (2)		Resistance	Min. 1 MΩ
	5	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 C01 (female) (49) – P25 (female) (2)		Voltage	Max. 1 V
	6	Defective pump controller	If causes 1 – 5 are not detected, pump controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)			

Circuit diagram related to F pump pressure sensor

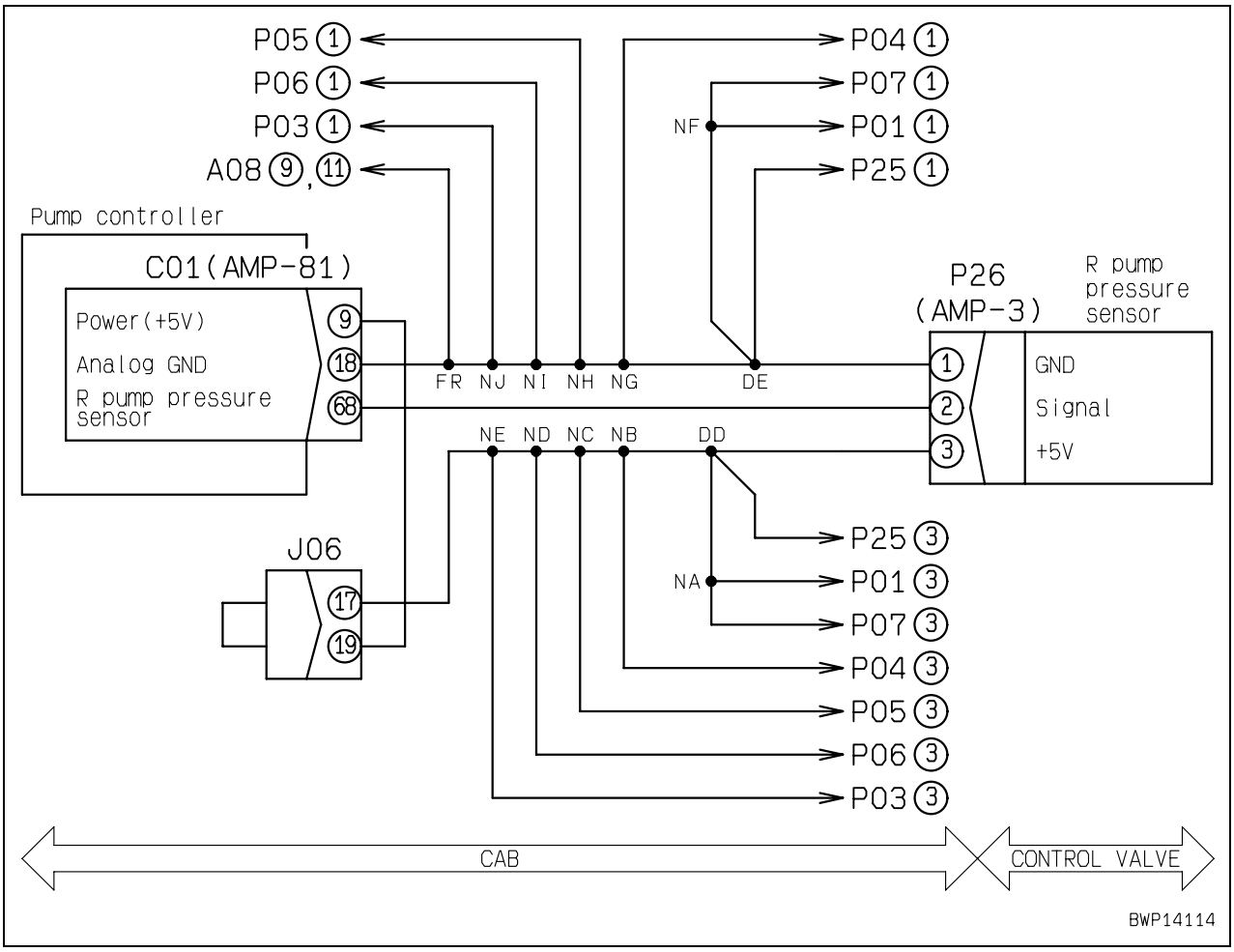


Failure code [DHPBMA] R Pump Press Sensor Abnormality

User code	Failure code	Trouble	R pump pressure sensor abnormality (Pump controller system)
—	**DHPBMA**		
Contents of trouble	• Signal voltage of R pump pressure sensor circuit is below 0.3 V or above 4.5 V.		
Action of controller	• Fixes R pump pressure at 0 MPa {0 kg/cm^2} and continues control. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Automatic gear shifting function does not work. • Straight travel performance or steering performance lowers.		
Related information	★ If 5V circuit (3) and ground circuit (1) of pressure sensor are connected inversely, pressure sensor will be broken. Accordingly, take extreme care when checking. • R pump pressure can be checked with monitoring function. (Code: 01101 R pump pressure) • Method of reproducing failure code: Turn starting switch ON or start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 5V sensor power supply 1 system	If failure code [**DA25KP**] is also displayed, carry out troubleshooting for it first.			
	2	Defective R pump pressure sensor (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON or start engine and carry out troubleshooting in each case.			
			P26		Voltage	
			Between (3) – (1)	Power supply	4.5 – 5.5 V	
			Between (2) – (1)	Signal	0.3 – 4.5 V	
			If voltage is abnormal, replace R pump pressure sensor with F pump pressure sensor and check failure code. (If "E" of failure code goes off at this time, R pump pressure sensor is defective.)			
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (18) – P26 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between C01 (female) (68) – P26 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between C01 (female) (9) – J06 – P26 (female) (3)		Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (68) – P26 (female) (2)		Resistance	Min. 1 MΩ
	5	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 C01 (female) (68) – P26 (female) (2)		Voltage	Max. 1 V
	6	Defective pump controller	If causes 1 – 5 are not detected, pump controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)			

Circuit diagram related to R pump pressure sensor

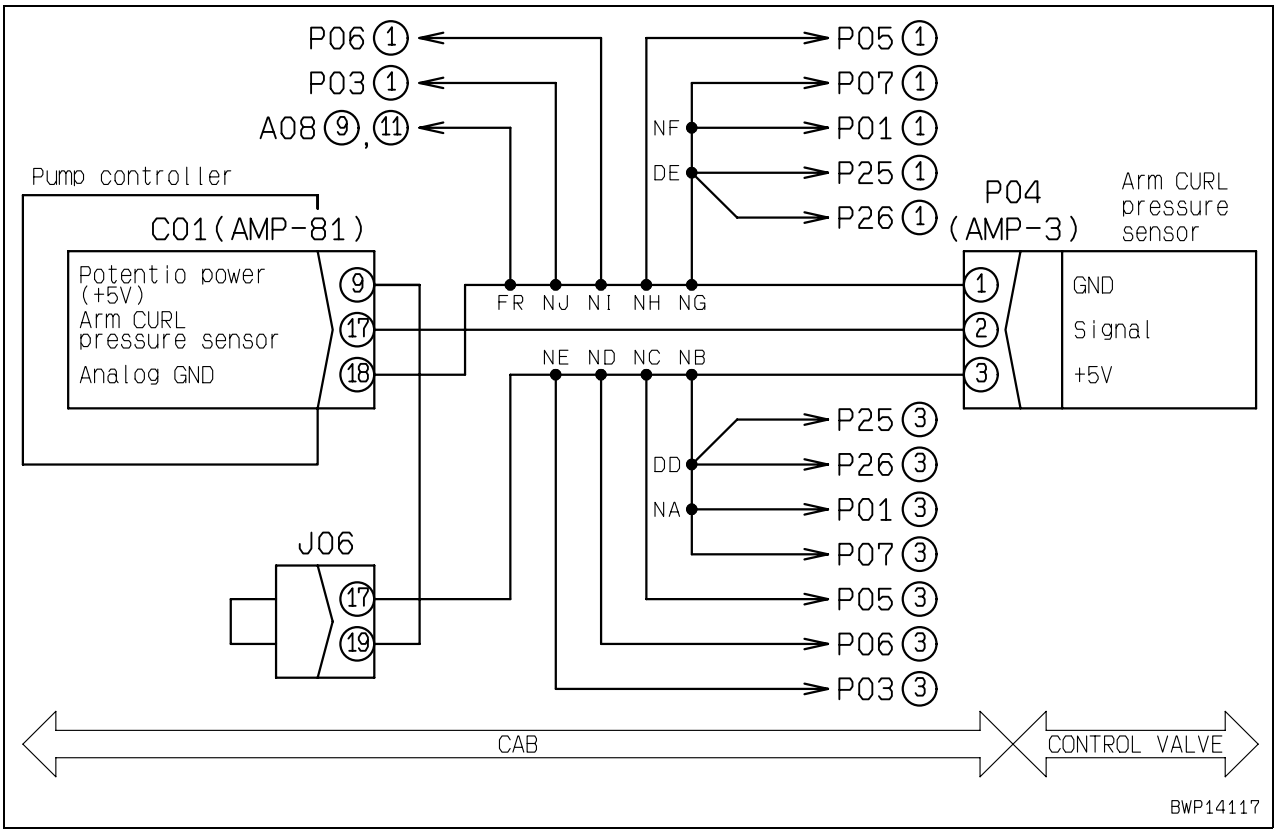


Failure code [DHS3MA] Arm Curl PPC Press Sensor Abnormality

User code	Failure code	Trouble	Arm curl PPC pressure sensor abnormality (Pump controller system)
—	**DHS3MA**		
Contents of trouble	• Signal voltage of arm curl PPC pressure sensor circuit is below 0.3 V or above 4.5 V.		
Action of controller	• Fixes arm curl PPC pressure at 0 MPa {0 kg/cm^2} and continues control. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Automatic decelerator cannot be reset. • Arm curl performance lowers.		
Related information	★ If 5V circuit (3) and ground circuit (1) of pressure sensor are connected inversely, pressure sensor will be broken. Accordingly, take extreme care when checking. • Arm curl PPC pressure can be checked with monitoring function. (Code: 07200 Arm curl PPC pressure) • Method of reproducing failure code: Turn starting switch ON or start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 5V sensor power supply 1 system	If failure code [**DA25KP**] is also displayed, carry out troubleshooting for it first.			
	2	Defective arm curl PPC pressure sensor (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON or start engine and carry out troubleshooting in each case.			
			P04		Voltage	
			Between (3) – (1)	Power supply	4.5 – 5.5 V	
			Between (2) – (1)	Signal	0.3 – 4.5 V	
			If voltage is abnormal, replace arm curl PPC pressure sensor with another PPC pressure sensor and check failure code. (If "E" of failure code goes off at this time, arm curl PPC pressure sensor is defective.)			
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (18) – P04 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between C01 (female) (17) – P04 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between C01 (female) (9) – J06 – P04 (female) (3)		Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (17) – P04 (female) (2)		Resistance	Min. 1 MΩ
	5	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 C01 (female) (17) – P04 (female) (2)		Voltage	Max. 1 V
	6	Defective pump controller	If causes 1 – 5 are not detected, pump controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)			

Circuit diagram related to arm curl PPC pressure sensor

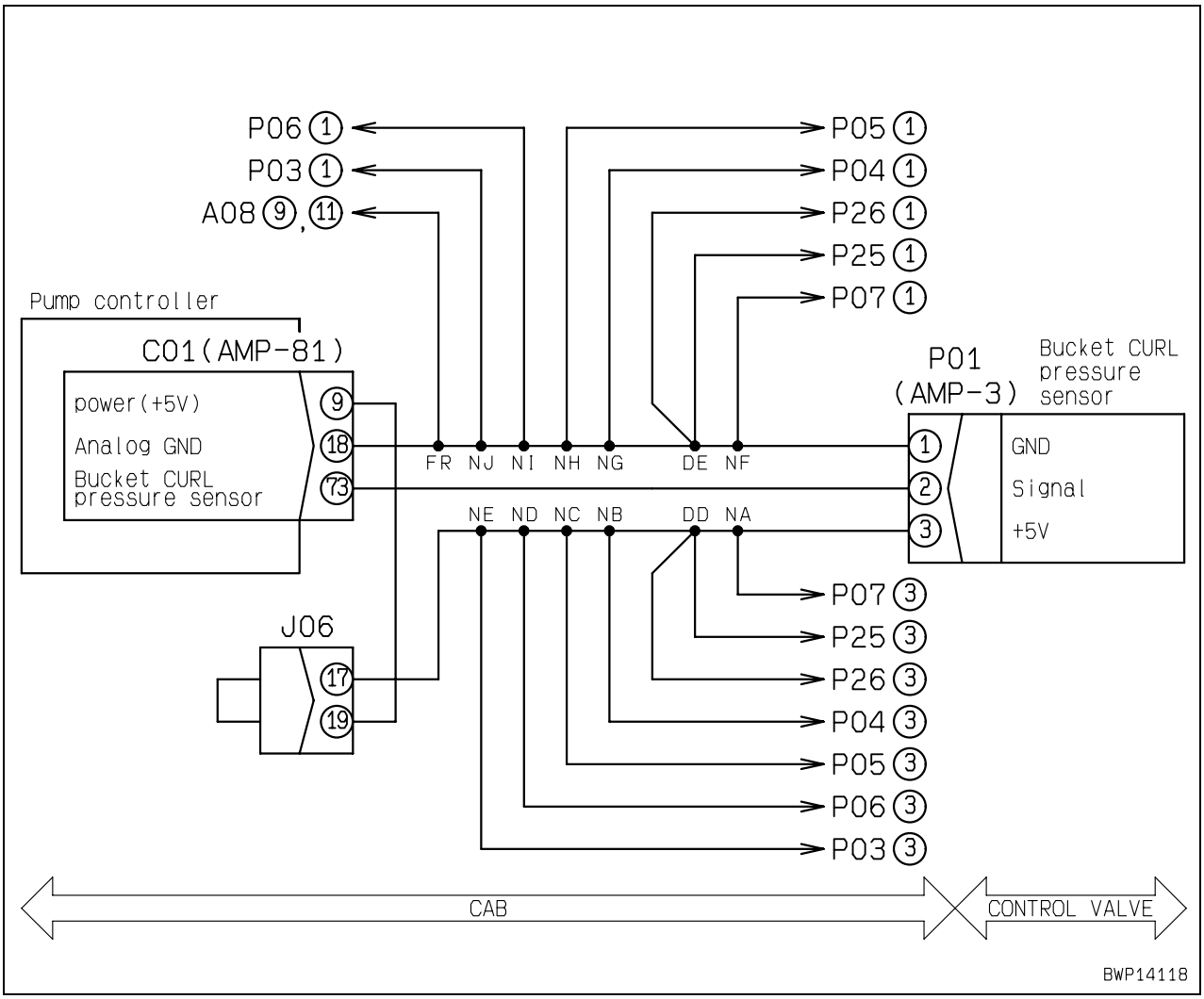


Failure code [DHS4MA] Bucket Curl PPC Press Sensor Abnormality

User code	Failure code	Trouble	Bucket curl PPC pressure sensor abnormality (Pump controller system)
—	**DHS4MA**		
Contents of trouble	• Signal voltage of bucket curl PPC pressure sensor circuit is below 0.3 V or above 4.5 V.		
Action of controller	• Fixes bucket curl PPC pressure at 0 MPa {0 kg/cm^2} and continues control. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Automatic decelerator cannot be reset. • Bucket curl performance lowers.		
Related information	★ If 5V circuit (3) and ground circuit (1) of pressure sensor are connected inversely, pressure sensor will be broken. Accordingly, take extreme care when checking. • Bucket curl PPC pressure can be checked with monitoring function. (Code: 07300 Bucket curl PPC pressure) • Method of reproducing failure code: Turn starting switch ON or start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 5V sensor power supply 1 system	If failure code [**DA25KP**] is also displayed, carry out troubleshooting for it first.			
	2	Defective bucket curl PPC pressure sensor (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON or start engine and carry out troubleshooting in each case.			
			P01		Voltage	
			Between (3) – (1)	Power supply	4.5 – 5.5 V	
			Between (2) – (1)	Signal	0.3 – 4.5 V	
			If voltage is abnormal, replace bucket curl PPC pressure sensor with another PPC pressure sensor and check failure code. (If "E" of failure code goes off at this time, bucket curl PPC pressure sensor is defective.)			
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (18) – P01 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between C01 (female) (73) – P01 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between C01 (female) (9) – J06 – P01 (female) (3)		Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (73) – P01 (female) (2)		Resistance	Min. 1 MΩ
	5	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 C01 (female) (73) – P01 (female) (2)		Voltage	Max. 1 V
	6	Defective pump controller	If causes 1 – 5 are not detected, pump controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)			

Circuit diagram related to bucket curl PPC pressure sensor

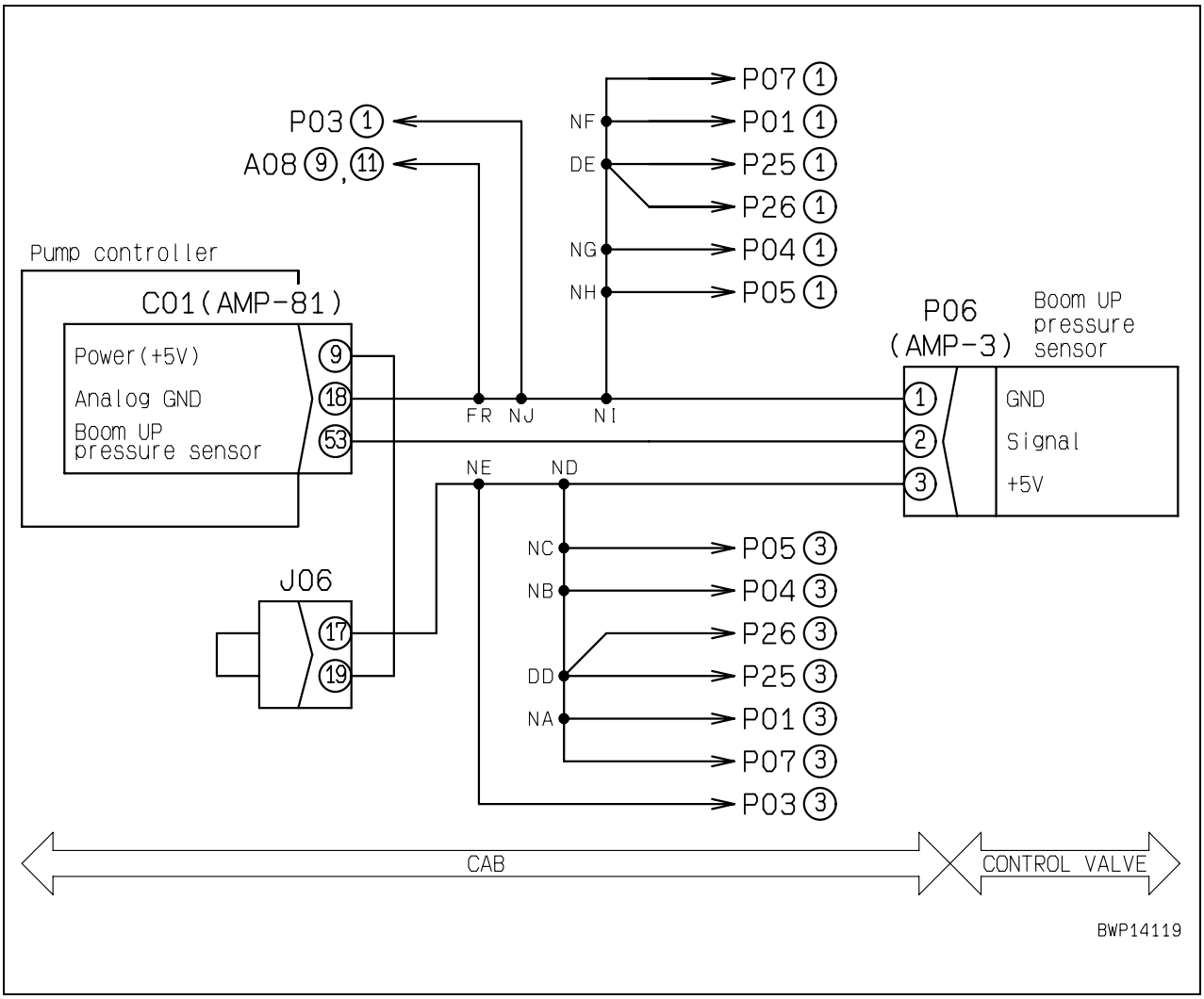


Failure code [DHS8MA] Boom Raise PPC Press Sensor Abnormality

User code	Failure code	Trouble	Boom raise PPC pressure sensor abnormality (Pump controller system)
—	**DHS8MA**		
Contents of trouble	• Signal voltage of boom raise PPC pressure sensor circuit is below 0.3 V or above 4.5 V.		
Action of controller	• Fixes boom raise PPC pressure at 0 MPa {0 kg/cm^2} and continues control. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Automatic decelerator cannot be reset. • Boom raise performance lowers.		
Related information	★ If 5V circuit (3) and ground circuit (1) of pressure sensor are connected inversely, pressure sensor will be broken. Accordingly, take extreme care when checking. • Boom raise PPC pressure can be checked with monitoring function. (Code: 07400 Boom raise PPC pressure) • Method of reproducing failure code: Turn starting switch ON or start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 5V sensor power supply 1 system	If failure code [**DA25KP**] is also displayed, carry out troubleshooting for it first.			
	2	Defective boom raise PPC pressure sensor (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON or start engine and carry out troubleshooting in each case.			
			P06		Voltage	
			Between (3) – (1)	Power supply	4.5 – 5.5 V	
			Between (2) – (1)	Signal	0.3 – 4.5 V	
			If voltage is abnormal, replace boom raise PPC pressure sensor with another PPC pressure sensor and check failure code. (If "E" of failure code goes off at this time, boom raise PPC pressure sensor is defective.)			
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (18) – P06 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between C01 (female) (53) – P06 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between C01 (female) (9) – J06 – P06 (female) (3)		Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (53) – P06 (female) (2)		Resistance	Min. 1 MΩ
	5	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 C01 (female) (53) – P06 (female) (2)		Voltage	Max. 1 V
	6	Defective pump controller	If causes 1 – 5 are not detected, pump controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)			

Circuit diagram related to boom raise PPC pressure sensor

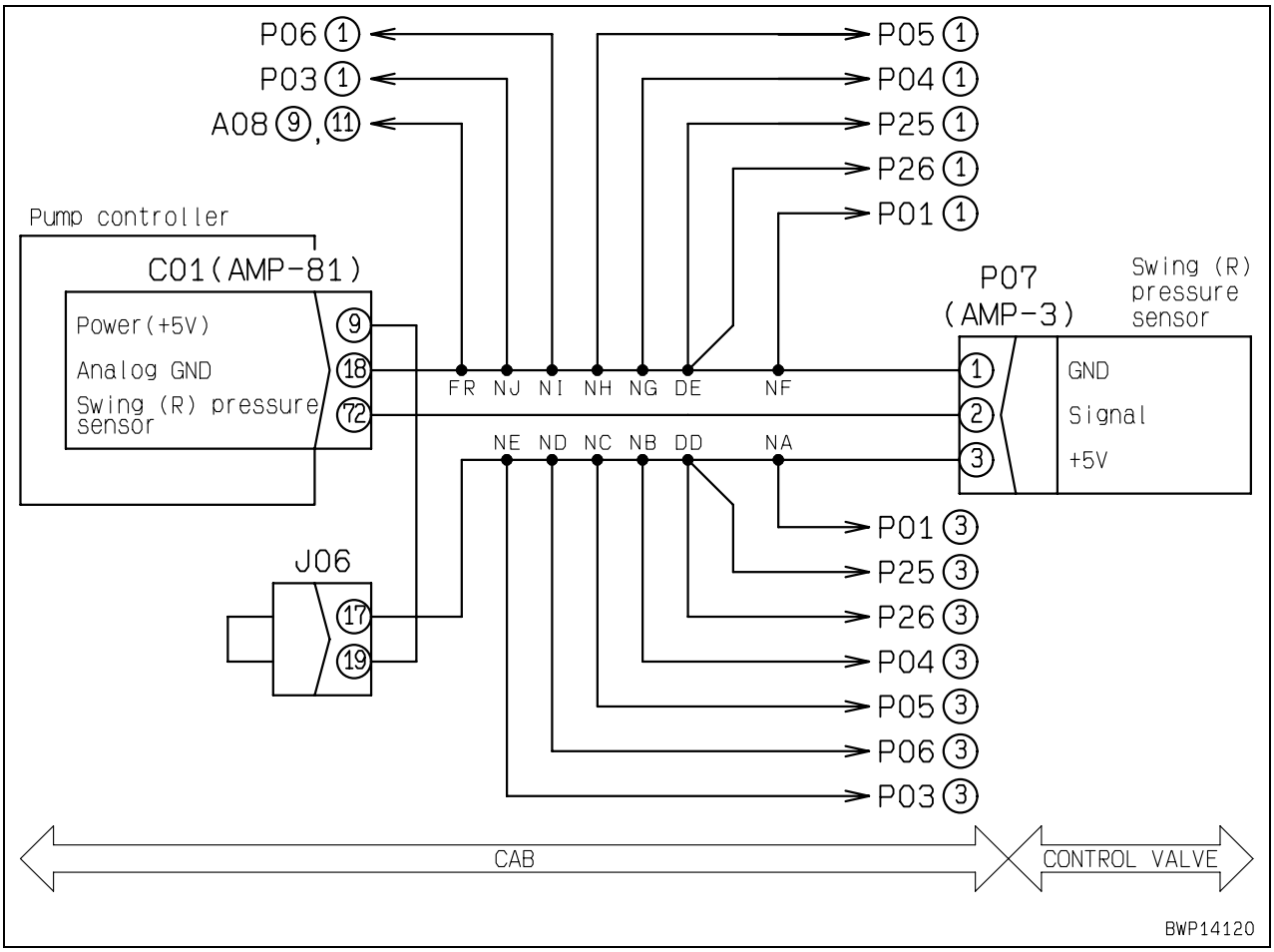


Failure code [DHSAMA] Swing RH PPC Press Sensor Abnormality

User code	Failure code	Trouble	Swing right PPC pressure sensor abnormality (Pump controller system)
—	**DHSAMA**		
Contents of trouble	• Signal voltage of swing right PPC pressure sensor circuit is below 0.3 V or above 4.5 V.		
Action of controller	• Fixes swing right PPC pressure at 0 MPa {0 kg/cm^2} and continues control. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Automatic decelerator and swing holding brake cannot be reset. • Swing right performance lowers.		
Related information	★ If 5V circuit (3) and ground circuit (1) of pressure sensor are connected inversely, pressure sensor will be broken. Accordingly, take extreme care when checking. • Swing right PPC pressure can be checked with monitoring function. (Code: 09002 Swing right PPC pressure) • Method of reproducing failure code: Turn starting switch ON or start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 5V sensor power supply 1 system	If failure code [**DA25KP**] is also displayed, carry out troubleshooting for it first.			
	2	Defective swing right PPC pressure sensor (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON or start engine and carry out troubleshooting in each case.			
			P07		Voltage	
			Between (3) – (1)	Power supply	4.5 – 5.5 V	
			Between (2) – (1)	Signal	0.3 – 4.5 V	
			If voltage is abnormal, replace swing right PPC pressure sensor with another PPC pressure sensor and check failure code. (If "E" of failure code goes off at this time, swing right PPC pressure sensor is defective.)			
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (18) – P07 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between C01 (female) (72) – P07 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between C01 (female) (9) – J06 – P07 (female) (3)		Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (72) – P07 (female) (2)		Resistance	Min. 1 MΩ
	5	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 C01 (female) (72) – P07 (female) (2)		Voltage	Max. 1 V
	6	Defective pump controller	If causes 1 – 5 are not detected, pump controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)			

Circuit diagram related to swing right PPC pressure sensor

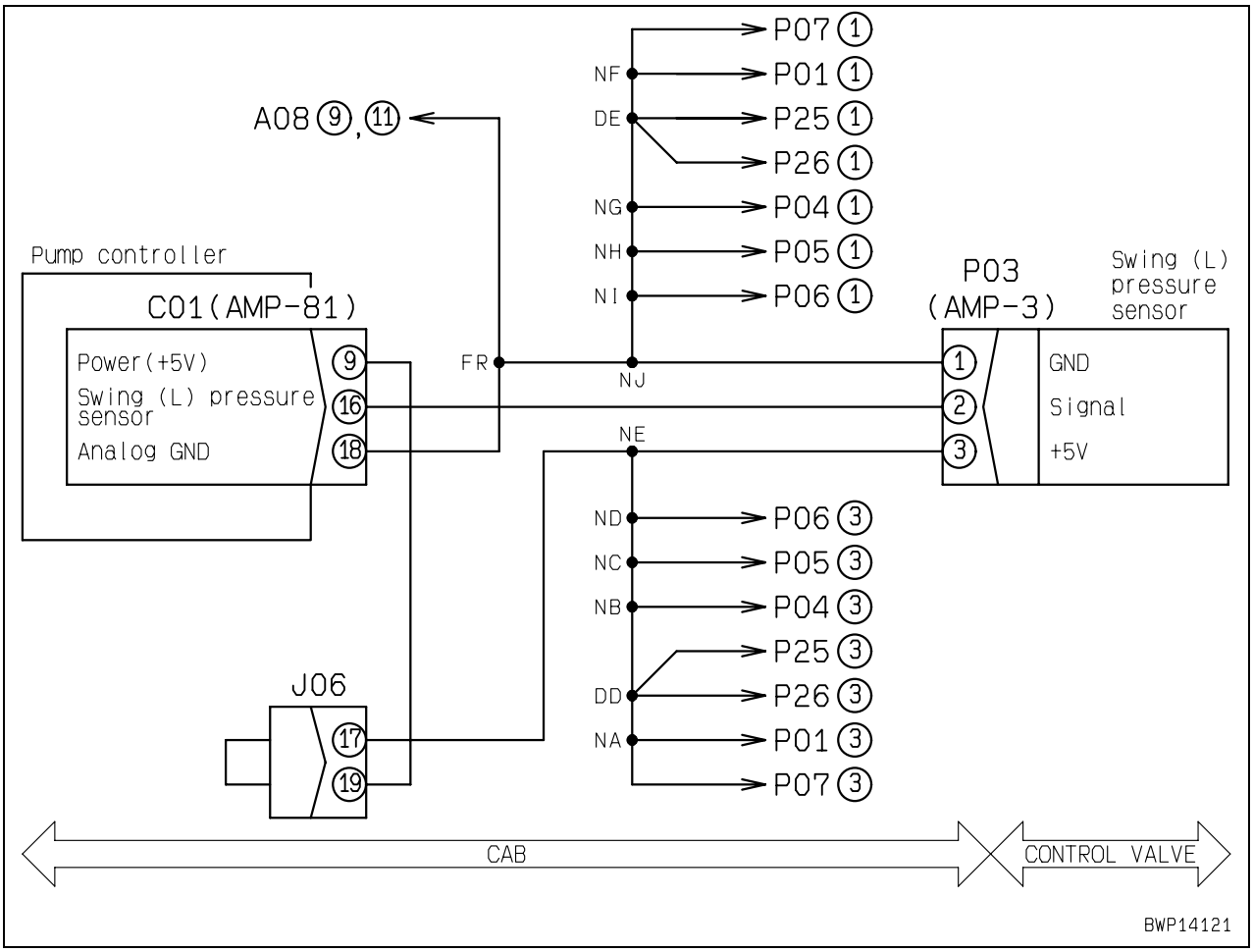


Failure code [DHSBMA] Swing LH PPC Press Sensor Abnormality

User code	Failure code	Trouble	Swing left PPC pressure sensor abnormality (Pump controller system)
—	**DHSBMA**		
Contents of trouble	• Signal voltage of swing left PPC pressure sensor circuit is below 0.3 V or above 4.5 V.		
Action of controller	• Fixes swing left PPC pressure at 0 MPa {0 kg/cm^2} and continues control. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Automatic decelerator and swing holding brake cannot be reset. • Swing left performance lowers.		
Related information	★ If 5V circuit (3) and ground circuit (1) of pressure sensor are connected inversely, pressure sensor will be broken. Accordingly, take extreme care when checking. • Swing left PPC pressure can be checked with monitoring function. (Code: 09002 Swing left PPC pressure) • Method of reproducing failure code: Turn starting switch ON or start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 5V sensor power supply 1 system	If failure code [**DA25KP**] is also displayed, carry out troubleshooting for it first.			
	2	Defective swing left PPC pressure sensor (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON or start engine and carry out troubleshooting in each case.			
			P03		Voltage	
			Between (3) – (1)	Power supply	4.5 – 5.5 V	
			Between (2) – (1)	Signal	0.3 – 4.5 V	
			If voltage is abnormal, replace swing left PPC pressure sensor with another PPC pressure sensor and check failure code. (If "E" of failure code goes off at this time, swing left PPC pressure sensor is defective.)			
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (18) – P03 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between C01 (female) (16) – P03 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between C01 (female) (9) – J06 – P03 (female) (3)		Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (16) – P03 (female) (2)		Resistance	Min. 1 MΩ
	5	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 C01 (female) (16) – P03 (female) (2)		Voltage	Max. 1 V
	6	Defective pump controller	If causes 1 – 5 are not detected, pump controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)			

Circuit diagram related to swing left PPC pressure sensor

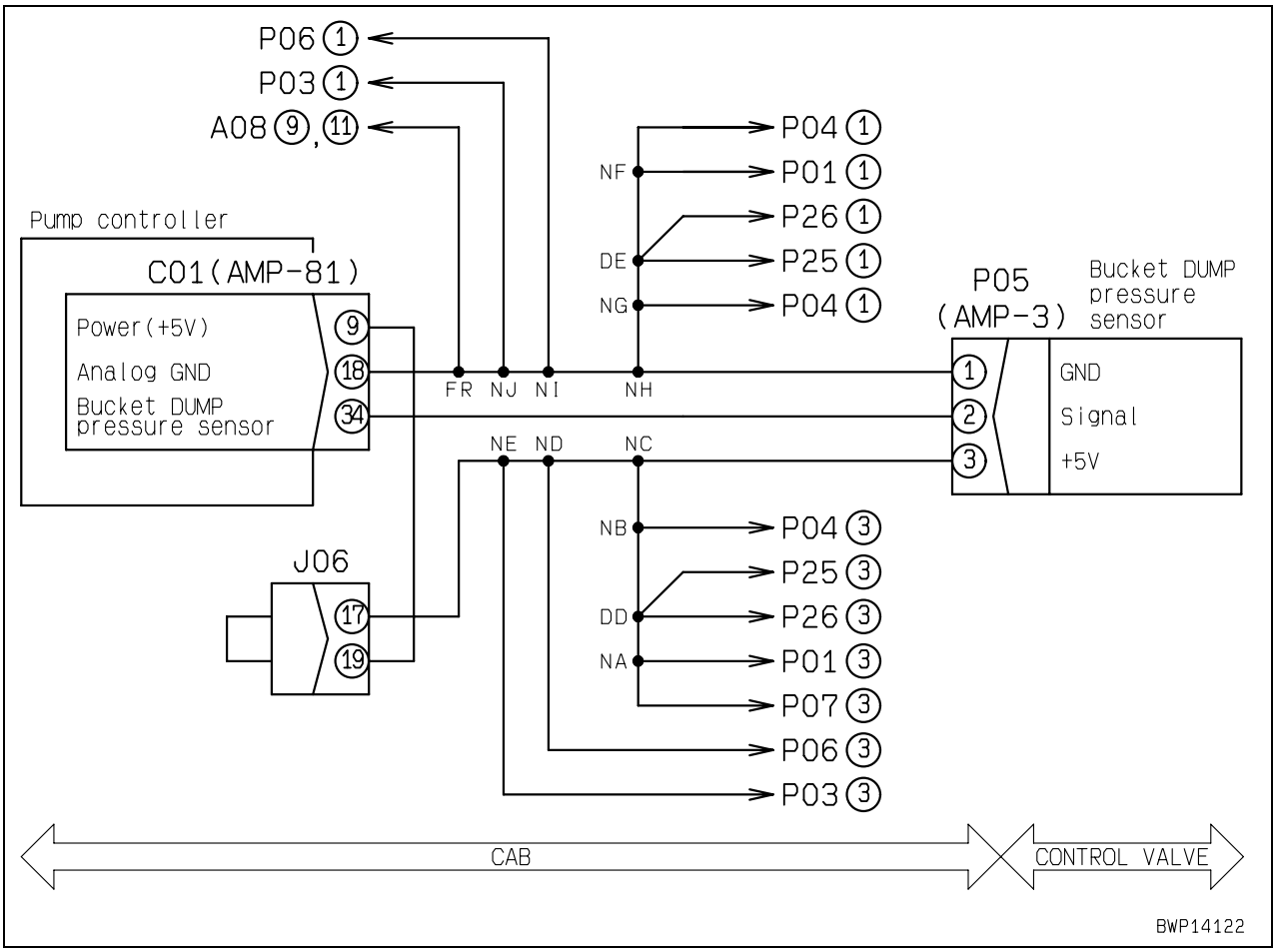


Failure code [DHSDMA] Bucket Dump PPC Press Sensor Abnormality

User code	Failure code	Trouble	Bucket dump PPC pressure sensor abnormality (Pump controller system)
—	**DHSDMA**		
Contents of trouble	• Signal voltage of bucket dump PPC pressure sensor circuit is below 0.3 V or above 4.5 V.		
Action of controller	• Fixes bucket dump PPC pressure at 0 MPa {0 kg/cm^2} and continues control. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Automatic decelerator cannot be reset. • Bucket dump performance lowers.		
Related information	★ If 5V circuit (3) and ground circuit (1) of pressure sensor are connected inversely, pressure sensor will be broken. Accordingly, take extreme care when checking. • Bucket dump PPC pressure can be checked with monitoring function. (Code: 07301 Bucket dump PPC pressure) • Method of reproducing failure code: Turn starting switch ON or start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 5V sensor power supply 1 system	If failure code [**DA25KP**] is also displayed, carry out troubleshooting for it first.			
	2	Defective bucket dump PPC pressure sensor (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON or start engine and carry out troubleshooting in each case.			
			P05		Voltage	
			Between (3) – (1)	Power supply	4.5 – 5.5 V	
			Between (2) – (1)	Signal	0.3 – 4.5 V	
			If voltage is abnormal, replace bucket dump PPC pressure sensor with another PPC pressure sensor and check failure code. (If "E" of failure code goes off at this time, bucket dump PPC pressure sensor is defective.)			
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (18) – P05 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between C01 (female) (34) – P05 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between C01 (female) (9) – J06 – P05 (female) (3)		Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (34) – P05 (female) (2)		Resistance	Min. 1 MΩ
	5	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 C01 (female) (34) – P05 (female) (2)		Voltage	Max. 1 V
	6	Defective pump controller	If causes 1 – 5 are not detected, pump controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)			

Circuit diagram related to bucket dump PPC pressure sensor

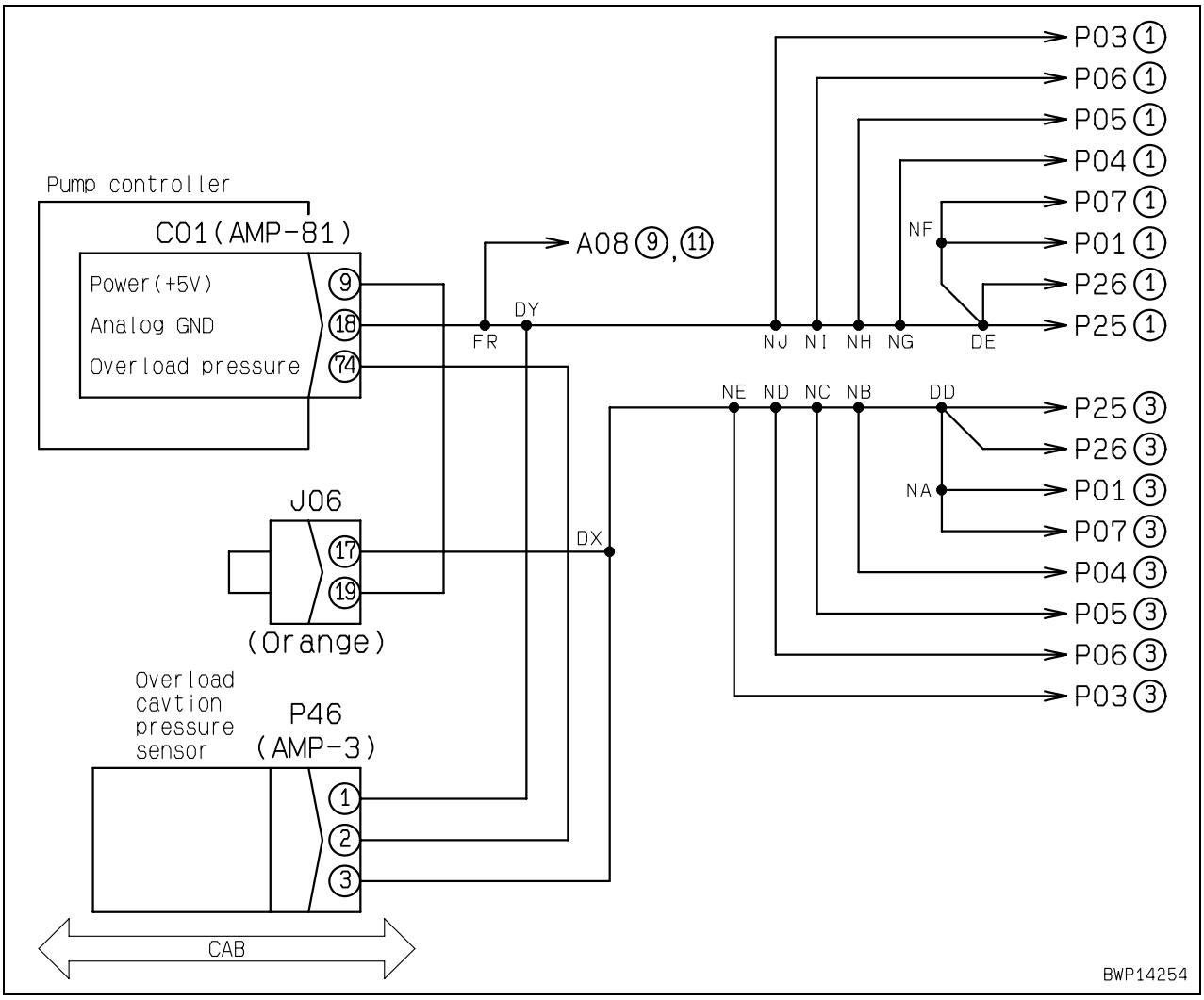


Failure code [DHX1MA] Overload Sensor Abnormality (Analog)

User code	Failure code	Trouble	Overload sensor (analog) (Pump controller system)
—	**DHX1MA**		
Contents of trouble	• Signal voltage of overload alarm pressure sensor circuit is below 0.3 V or above 4.4 V.		
Action of controller	• Outputs overload alarm constantly. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• If display of overload alarm monitor is set, overload alarm monitor is displayed constantly.		
Related information	• Overload alarm pressure sensor is installed to only machine on which display of overload alarm monitor is set. ★ If 5V circuit (3) and ground circuit (1) of pressure sensor are connected inversely, pressure sensor will be broken. Accordingly, take extreme care when checking. • Overload alarm pressure (Boom cylinder bottom pressure) can be checked with monitoring function. (Code: 15900 Boom bottom pressure) • Method of reproducing failure code: Turn starting switch ON or start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 5V sensor power supply 1 system	If failure code [**DA25KP**] is also displayed, carry out troubleshooting for it first.			
	2	Defective overload alarm pressure sensor (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON or start engine and carry out troubleshooting in each case.			
			P46		Voltage	
			Between (3) – (1)	Power supply	4.5 – 5.5 V	
			Between (2) – (1)	Signal	0.3 – 4.4 V	
			If voltage is abnormal, replace overload alarm pressure sensor with F pump pressure sensor or R pump pressure sensor and check failure code. (If "E" of failure code goes off at this time, overload alarm pressure sensor is defective.)			
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (18) – P46 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between C01 (female) (74) – P46 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between C01 (female) (9) – J06 – P46 (female) (3)		Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (9) – P46 (female) (2)		Resistance	Min. 1 MΩ
	5	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 C01 (female) (9) – P46 (female) (2)		Voltage	Max. 1 V
	6	Defective pump controller	If causes 1 – 5 are not detected, pump controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)			

Circuit diagram related to overload alarm pressure sensor

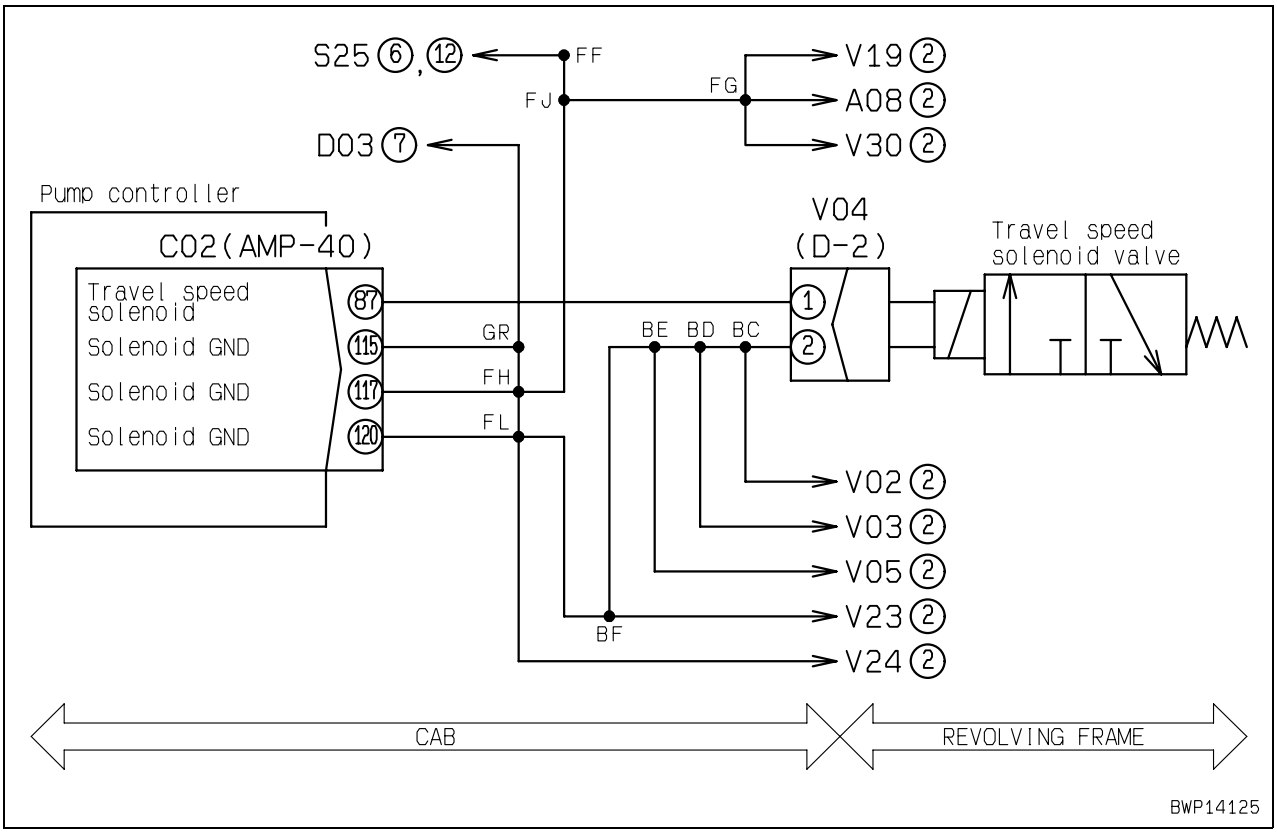


Failure code [DW43KA] Travel Speed Sol Discon

User code	Failure code	Trouble	Travel speed solenoid system disconnection (Pump controller system)
—	**DW43KA**		
Contents of trouble	• When output to travel speed shifting solenoid was turned ON, disconnection was detected in circuit.		
Action of controller	• None in particular. (Since no current flows, solenoid does not operate.) • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• PC210: Speed is low at High travel speed position (Machine monitor is set to High but actual speed is about Middle). • PC240: Speed is low at High and Middle travel speed position (Machine monitor is set to High or Middle but actual speed is about Low).		
Related information	• Operating condition of travel speed shifting solenoid can be checked with monitoring function. (Code: 02300: Solenoid 1) • Method of reproducing failure code: Start engine + Set travel speed to High + Operate travel lever.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective travel speed shifting solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V04 (male)	Resistance		
			Between (1) – (2)	20 – 60 Ω		
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C02 (female) (87) – V04 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between C02 (female) (115), (117), (120) – V04 (female) (2)	Resistance	Max. 1 Ω	
	3	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C01 (female)	Resistance		
			Between (87) – (115), (117), (120)	20 – 60 Ω		

Circuit diagram related to travel speed shifting solenoid

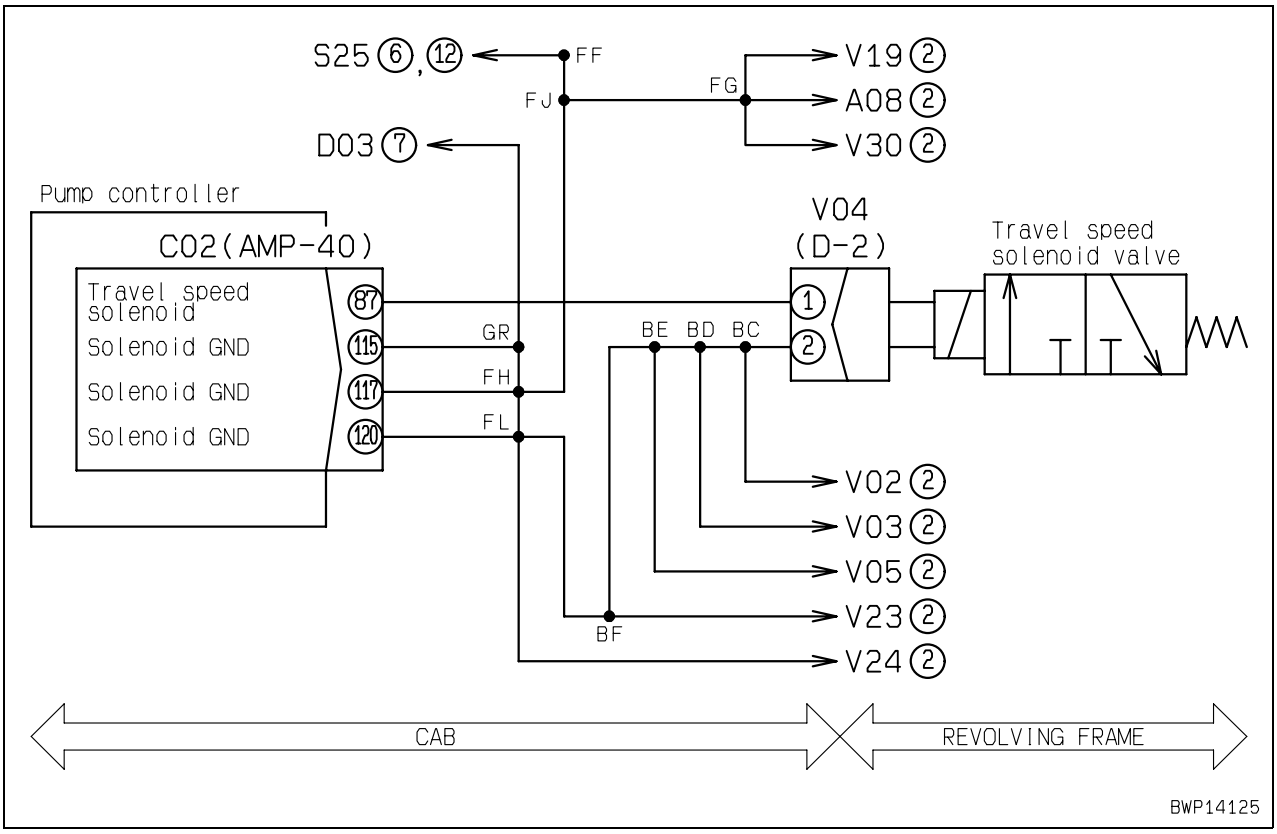


Failure code [DW43KB] Travel Speed Sol Short

User code	Failure code	Trouble	Travel speed solenoid system short (Pump controller system)
—	**DW43KB**		
Contents of trouble	• When output to travel speed shifting solenoid was turned ON, short circuit was detected in circuit.		
Action of controller	• Turns output to travel speed shifting solenoid OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• PC210: Speed is low at High travel speed position (Machine monitor is set to High but actual speed is about Middle). • PC240: Speed is low at High and Middle travel speed position (Machine monitor is set to High or Middle but actual speed is about Low).		
Related information	• Operating condition of travel speed shifting solenoid can be checked with monitoring function. (Code: 02300: Solenoid 1) • Method of reproducing failure code: Start engine + Set travel speed to High + Operate travel lever.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective travel speed shifting solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			V04 (male)	Resistance	
			Between (1) – (2)	20 – 60 Ω	
			Between (1) – chassis ground	Min. 1 MΩ	
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between C02 (female) (87) – V04 (female) (1)	Resistance	Min. 1 MΩ
	3	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			C02 (female)	Resistance	
			Between (87) – (115), (117), (120)	20 – 60 Ω	
			Between (87) – chassis ground	Min. 1 MΩ	

Circuit diagram related to travel speed shifting solenoid

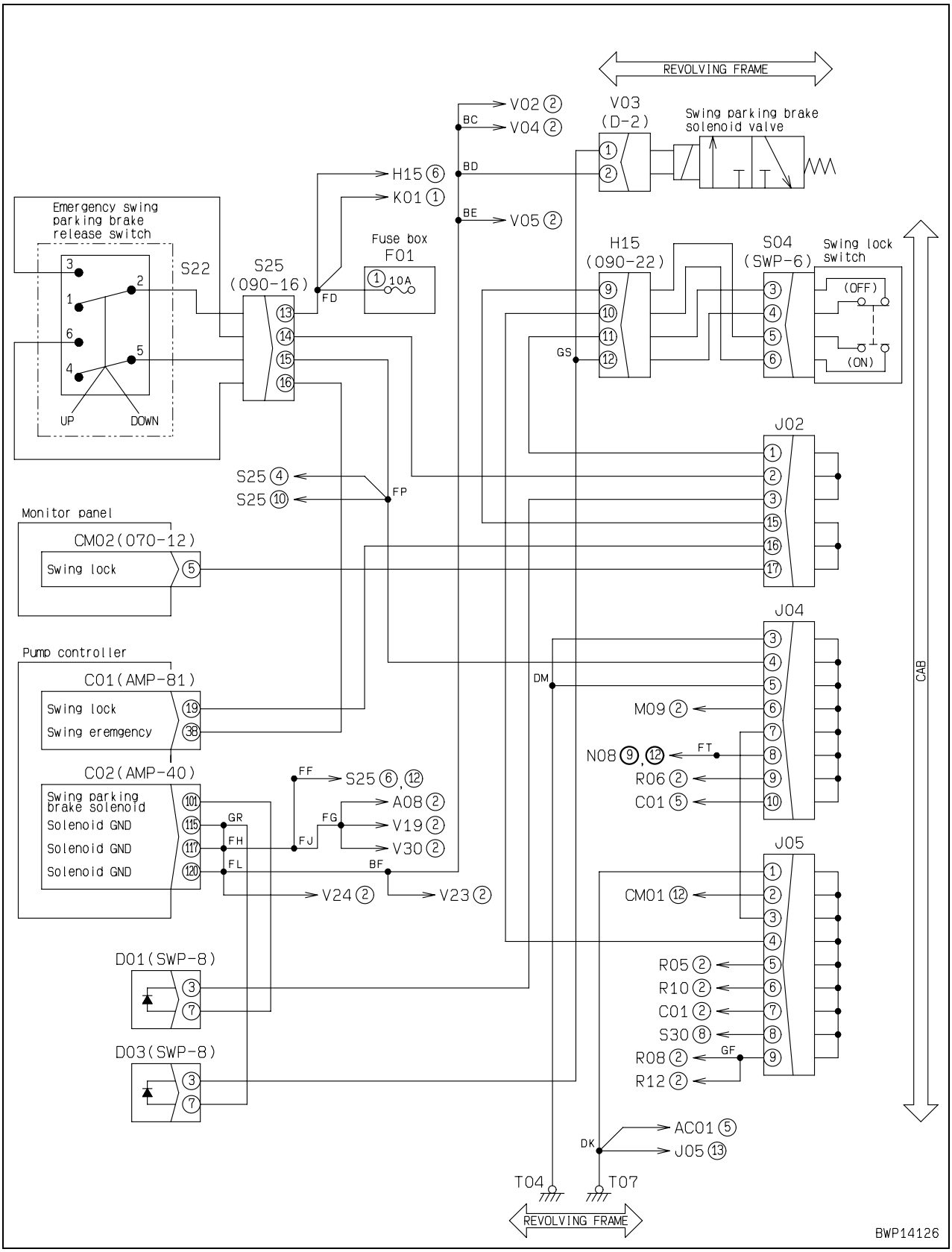


Failure code [DW45KA] Swing Brake Sol Discon

User code	Failure code	Trouble	Swing holding brake solenoid system disconnection (Pump controller system)
E03	**DW45KA**		
Contents of trouble	• When output to swing holding brake solenoid was turned OFF, disconnection was detected in circuit.		
Action of controller	• None in particular. (Since no current flows, solenoid does not operate.) • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Machine cannot swing (Swing holding brake is not reset).		
Related information	• If solenoid and wiring harness are normal, operator can swing machine by setting swing holding brake release switch in release position (Swing holding brake does not work, however, when machine stops). • Keep swing lock switch in OFF position and swing holding brake release switch in release position during troubleshooting. • Operating condition of swing holding brake solenoid can be checked with monitoring function. (Code: 02300: Solenoid 1) • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective swing holding brake solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V03 (male)		Resistance	
			Between (1) – (2)		20 – 60 Ω	
	2	Defective assembled-type diode D01 (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			D01 (male)	Digital circuit tester	Continuity	
			Between (7) – (3)	Diode mode	There is continuity	
	3	Defective swing lock switch (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S04 (male)	Swing lock switch	Resistance	
			Between (3) – (4)	OFF	Max. 1 Ω	
				ON	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 C02 (female) (101) – D01 (female) (7)		Resistance	Max. 1 Ω
			Wiring harness between D01 (female) (3) – J02 – S04 (female) (3)		Resistance	Max. 1 Ω
			Wiring harness between S04 (female) (4) – V03 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between C02 (female) (115), (117), (120) – V03 (female) (2)		Resistance	Max. 1 Ω
	5	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C02 (female)	Disconnect D01 and connect pins (3) and (7) on female side directly.	Resistance	
			Between (101) – (115), (117), (120)		20 – 60 Ω	

Circuit diagram related to swing holding brake solenoid

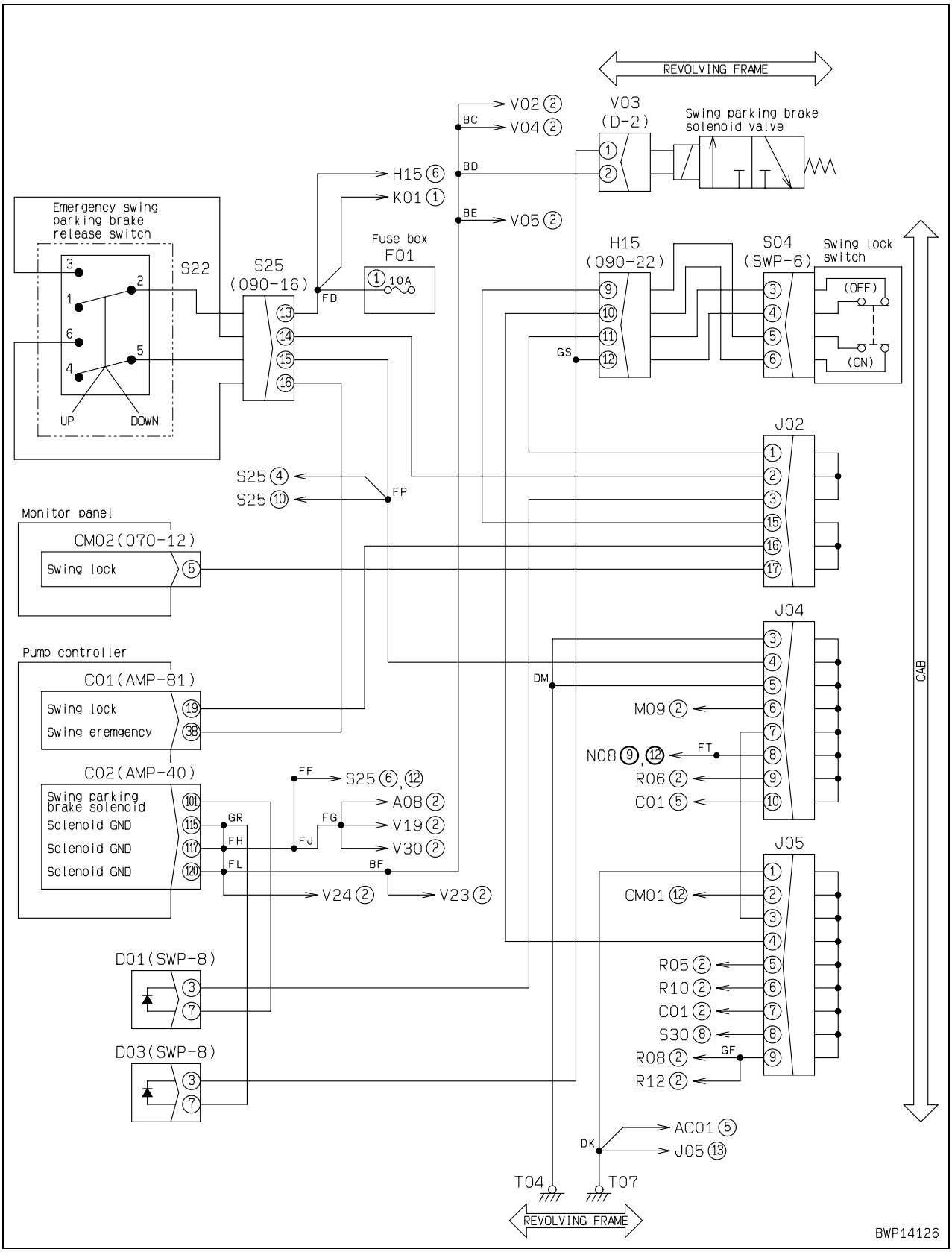


Failure code [DW45KB] Swing Brake Sol Short

User code	Failure code	Trouble	Swing holding brake solenoid system short (Pump controller system)
E03	**DW45KB**		
Contents of trouble	• When output to swing holding brake solenoid was turned ON, short circuit was detected in circuit.		
Action of controller	• Turns output to swing holding brake solenoid OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Machine cannot swing (Swing holding brake is not reset).		
Related information	• If solenoid and wiring harness are normal, operator can swing machine by setting swing holding brake release switch in release position (Swing holding brake does not work, however, when machine stops). • Keep swing lock switch in OFF position and swing holding brake release switch in release position during troubleshooting. • Operating condition of swing holding brake solenoid can be checked with monitoring function. (Code: 02300: Solenoid 1) • Method of reproducing failure code: Start engine + Swing with left work equipment control lever.		

<table>
<tr><td rowspan="11">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Defective swing holding brake solenoid (Internal short circuit or ground fault)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">V03 (male)</td><td colspan="2">Resistance</td></tr>
<tr><td colspan="2">Between (1) – (2)</td><td colspan="2">20 – 60 Ω</td></tr>
<tr><td colspan="2">Between (1) – chassis ground</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Ground fault in wiring harness (Disconnection in wiring or defective contact in connector)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between C02 (female) (101) – D01 – J02 – S04 – V03 (female) (1), – S25 (female) (14)</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="4">3</td><td rowspan="4">Defective pump controller</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>C02 (female)</td><td rowspan="3">Disconnect D01 and connect pins (3) and (7) on female side directly.</td><td colspan="2">Resistance</td></tr>
<tr><td>Between (101) – (115), (117), (120)</td><td colspan="2">20 – 60 Ω</td></tr>
<tr><td>Between (101) – chassis ground</td><td colspan="2">Min. 1 MΩ</td></tr>
</table>

Circuit diagram related to swing holding brake solenoid

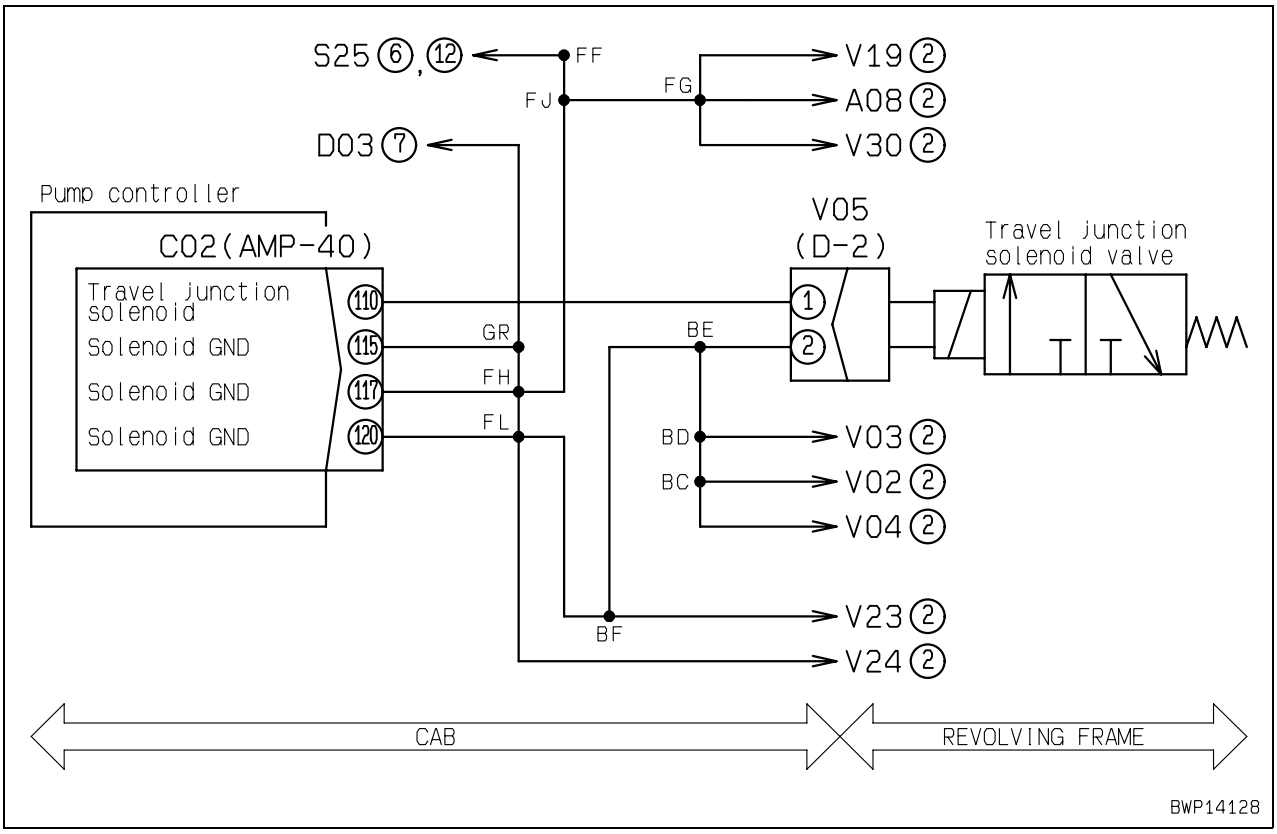


Failure code [DW91KA] Travel Junction Sol Discon

User code	Failure code	Trouble	Travel junction solenoid system disconnection (Pump controller system)
—	**DW91KA**		
Contents of trouble	• When output to travel junction solenoid was turned ON, disconnection was detected in circuit.		
Action of controller	• None in particular. (Since no current flows, solenoid does not operate.) • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Machine is not steered easily during travel.		
Related information	• Operating condition of travel junction solenoid can be checked with monitoring function. (Code: 02300 Solenoid 1) • Method of reproducing failure code: Start engine + Steer machine with right and left travel levers.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective travel junction solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V05 (male)	Resistance		
			Between (1) – (2)	20 – 60 Ω		
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C02 (female) (110) – V05 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between C02 (female) (115), (117), (120) – V05 (female) (2)	Resistance	Max. 1 Ω	
	3	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C02 (female)	Resistance		
			Between (110) – (115), (117), (120)	20 – 60 Ω		

Circuit diagram related to travel junction solenoid

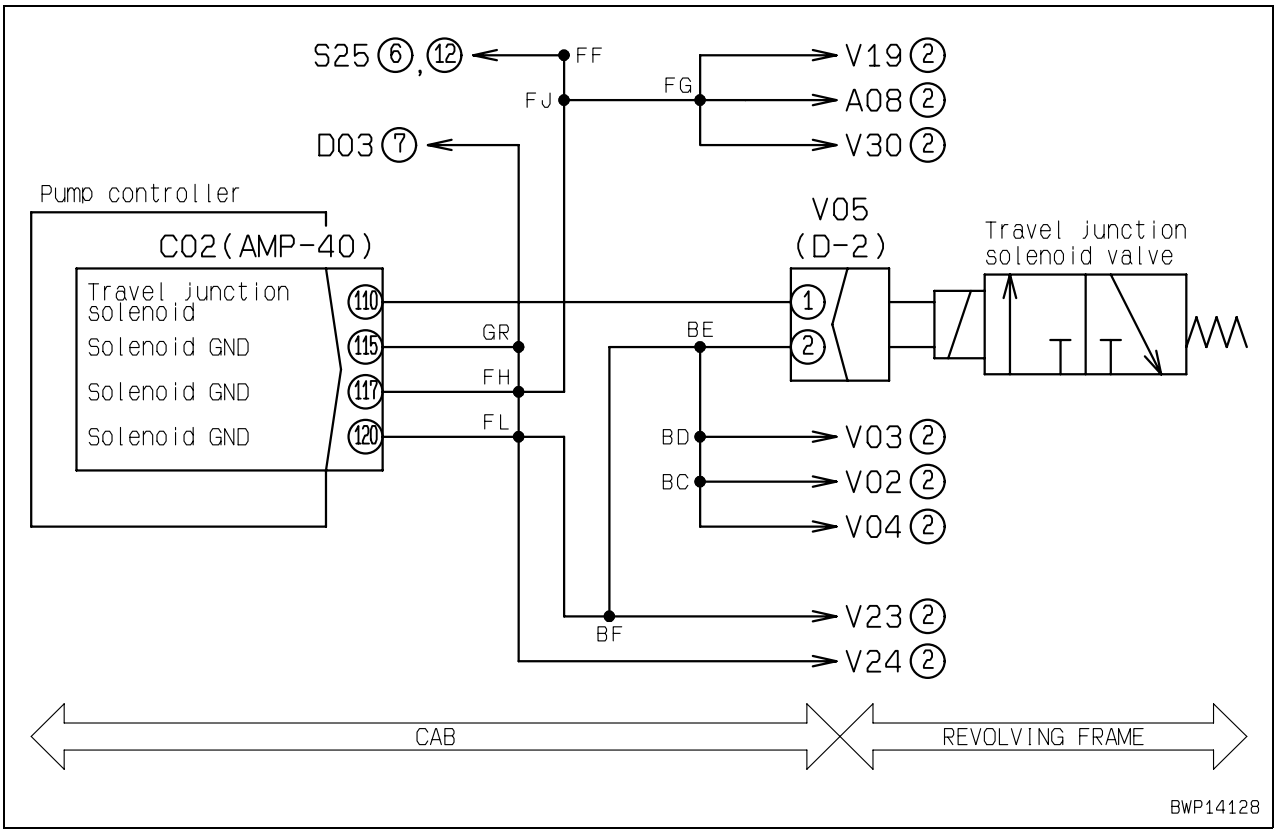


Failure code [DW91KB] Travel Junction Sol Short

User code	Failure code	Trouble	Travel junction solenoid system short (Pump controller system)
—	**DW91KB**		
Contents of trouble	• When output to travel junction solenoid was turned ON, short circuit was detected in circuit.		
Action of controller	• Turns output to travel junction solenoid OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Machine is not steered easily during travel.		
Related information	• Operating condition of travel junction solenoid can be checked with monitoring function. (Code: 02300 Solenoid 1) • Method of reproducing failure code: Start engine + Steer machine with right and left travel levers.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective travel junction solenoid (Internal short circuit or ground fault)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			V05 (male)	Resistance	
			Between (1) – (2)	20 – 60 Ω	
			Between (1) – chassis ground	Min. 1 MΩ	
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between C02 (female) (110) – V05 (female) (1)	Resistance	Min. 1 MΩ
	3	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			C02 (female)	Resistance	
			Between (110) – (115), (117), (120)	20 – 60 Ω	
			Between (110) – chassis ground	Min. 1 MΩ	

Circuit diagram related to travel junction solenoid

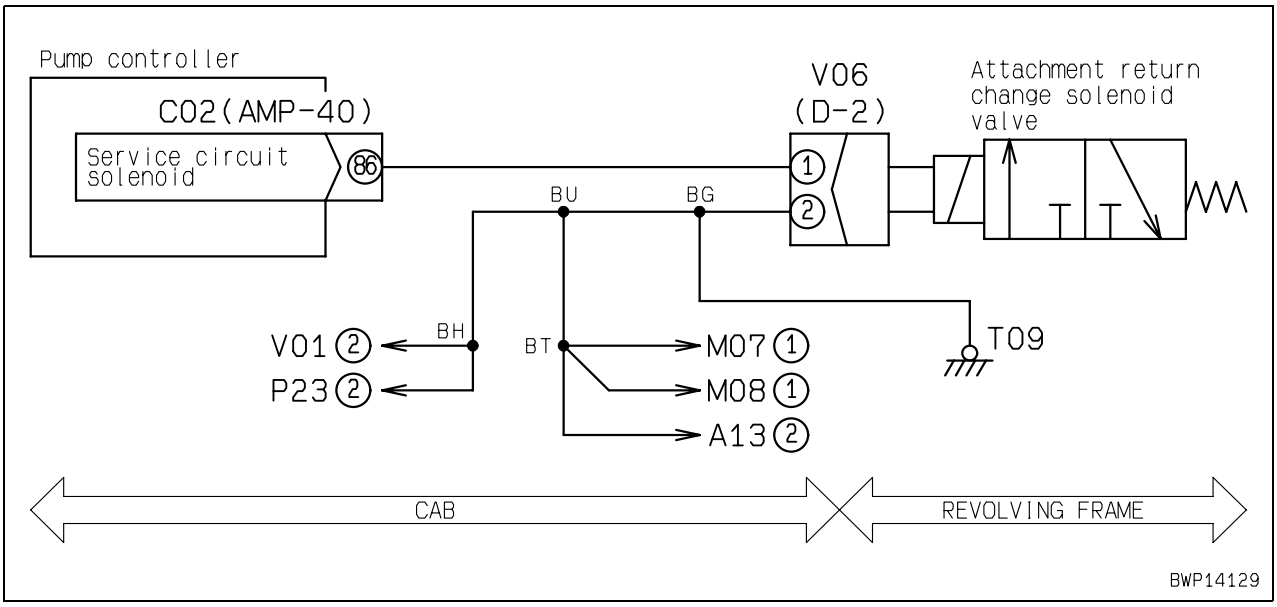


Failure code [DWA2KA] Service Sol Discon

User code	Failure code	Trouble	Service solenoid disconnection (Pump controller system)
—	**DWA2KA**		
Contents of trouble	• When output to service solenoid is turned OFF, disconnection was detected in circuit.		
Action of controller	• None in particular. (Since no current flows, solenoid does not operate.) • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Hydraulic circuit for attachment does not change to single operation circuit.		
Related information	• Operating condition of service solenoid can be checked with monitoring function. (Code: 02301 Solenoid 2) • Method of reproducing failure code: Turn starting switch ON + Set machine in mode other than breaker mode (B).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective service solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V06 (male)	Resistance		
			Between (1) – (2)	20 – 60 Ω		
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C02 (female) (86) – V06 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between V06 (female) (2) – chassis ground (T09)	Resistance	Max. 1 Ω	
	3	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C02 (female)	Resistance		
			Between (86) – chassis ground	20 – 60 Ω		

Circuit diagram related to service solenoid

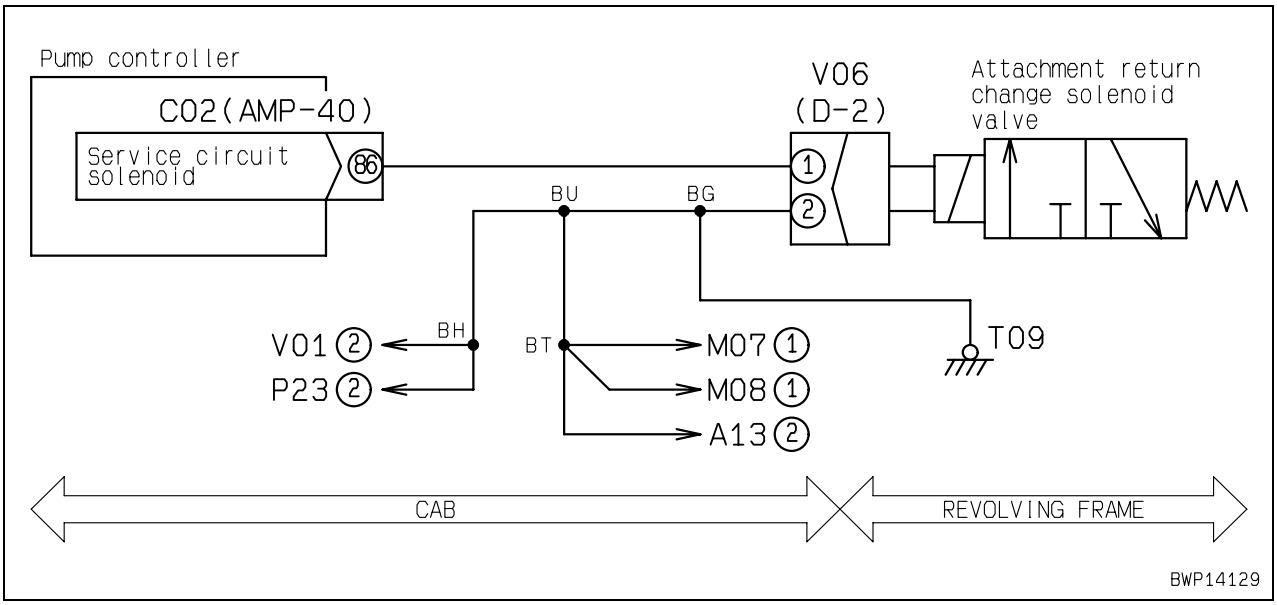


Failure code [DWA2KB] Service Sol Short

User code	Failure code	Trouble	Service solenoid short (Pump controller system)
—	**DWA2KB**		
Contents of trouble	• When output to service solenoid is turned ON, short circuit was detected in circuit.		
Action of controller	• Turns output to service solenoid OFF • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Hydraulic circuit for attachment is not does not change to single operation circuit.		
Related information	• Operating condition of service solenoid can be checked with monitoring function. (Code: 02301 Solenoid 2) • Method of reproducing failure code: Turn starting switch ON + Set machine in breaker mode (B).		

Possible causes and standard value in normal state		Cause	Standard value in normal state/Remarks on troubleshooting		
	1	Defective service solenoid (Internal short circuit or ground fault)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			V06 (male)	Resistance	
			Between (1) – (2)	20 – 60 Ω	
			Between (1) – chassis ground	Min. 1 MΩ	
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between C02 (female) (86) – V06 (female) (1)	Resistance	Min. 1 MΩ
	3	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			C02 (female)	Resistance	
			Between (86) – chassis ground	20 – 60 Ω	

Circuit diagram related to service solenoid

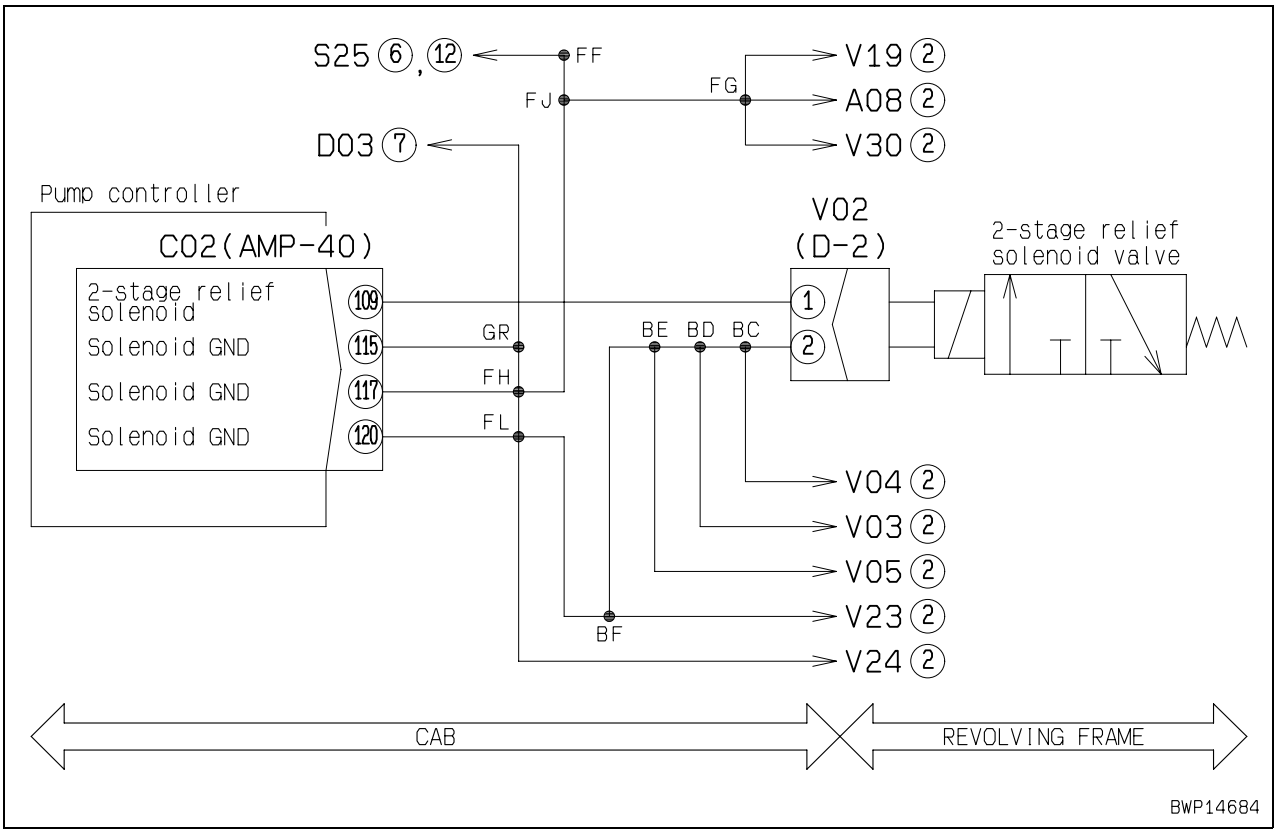


Failure code [DWK0KA] 2-stage Relief Sol Discon

User code	Failure code	Trouble	2-stage relief solenoid disconnection (Pump controller system)
—	**DWK0KA**		
Contents of trouble	• When output to 2-stage relief solenoid is turned OFF, disconnection was detected in circuit.		
Action of controller	• None in particular. (Since no current flows, solenoid does not operate.) • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Power maximizing function does not work. • Travel power is low.		
Related information	• Operating condition of 2-stage relief solenoid can be checked with monitoring function. (Code: 02300 Solenoid 1) • Method of reproducing failure code: Turn starting switch ON + Set machine in mode other than (L).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective 2-stage relief solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V02 (male)	Resistance		
			Between (1) – (2)	20 – 60 Ω		
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C02 (female) (109) – V02 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between C02 (female) (115), (117), (120) – V02 (female) (2)	Resistance	Max. 1 Ω	
	3	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C02 (female)	Resistance		
			Between (109) – (115), (117), (120)	20 – 60 Ω		

Circuit diagram related to 2-stage relief solenoid

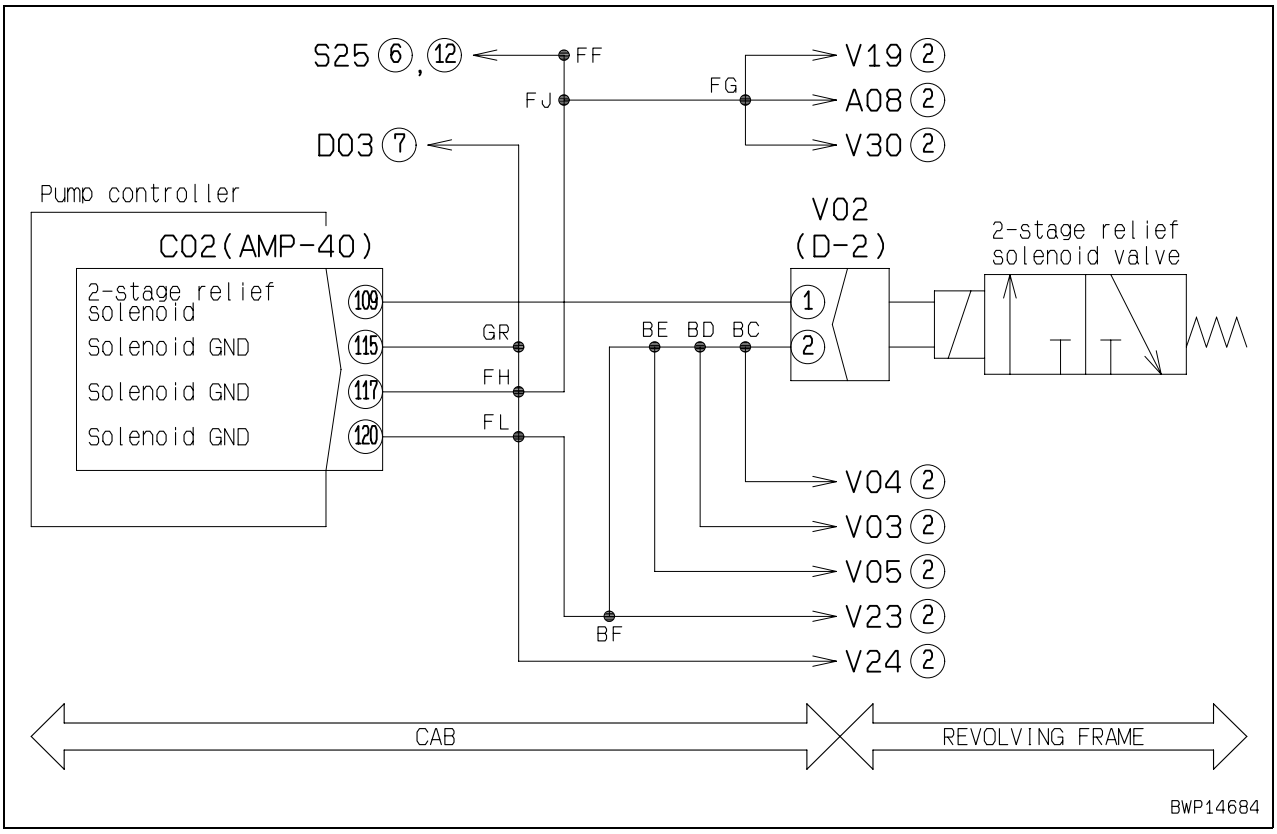


Failure code [DWK0KB] 2-stage Relief Sol Short

User code	Failure code	Trouble	2-stage relief solenoid short (Pump controller system)
—	**DWK0KB**		
Contents of trouble	• When output to 2-stage relief solenoid is turned ON, short circuit was detected in circuit.		
Action of controller	• Turns output to 2-stage relief solenoid OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Power maximizing function does not work. • Travel power is low.		
Related information	• Operating condition of 2-stage relief solenoid can be checked with monitoring function. (Code: 02300 Solenoid 1) • Method of reproducing failure code: Turn starting switch ON + Set machine in working mode (L).		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective 2-stage relief solenoid (Internal short circuit or ground fault)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			V02 (male)	Resistance	
			Between (1) – (2)	20 – 60 Ω	
			Between (1) – chassis ground	Min. 1 MΩ	
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between C02 (female) (109) – V02 (female) (1)	Resistance	Min. 1 MΩ
	3	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			C02 (female)	Resistance	
			Between (109) – (115), (117), (120)	20 – 60 Ω	
			Between (109) – chassis ground	Min. 1 MΩ	

Circuit diagram related to 2-stage relief solenoid



PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00242-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

40 Troubleshooting

Troubleshooting by failure code (Display of code), Part 4

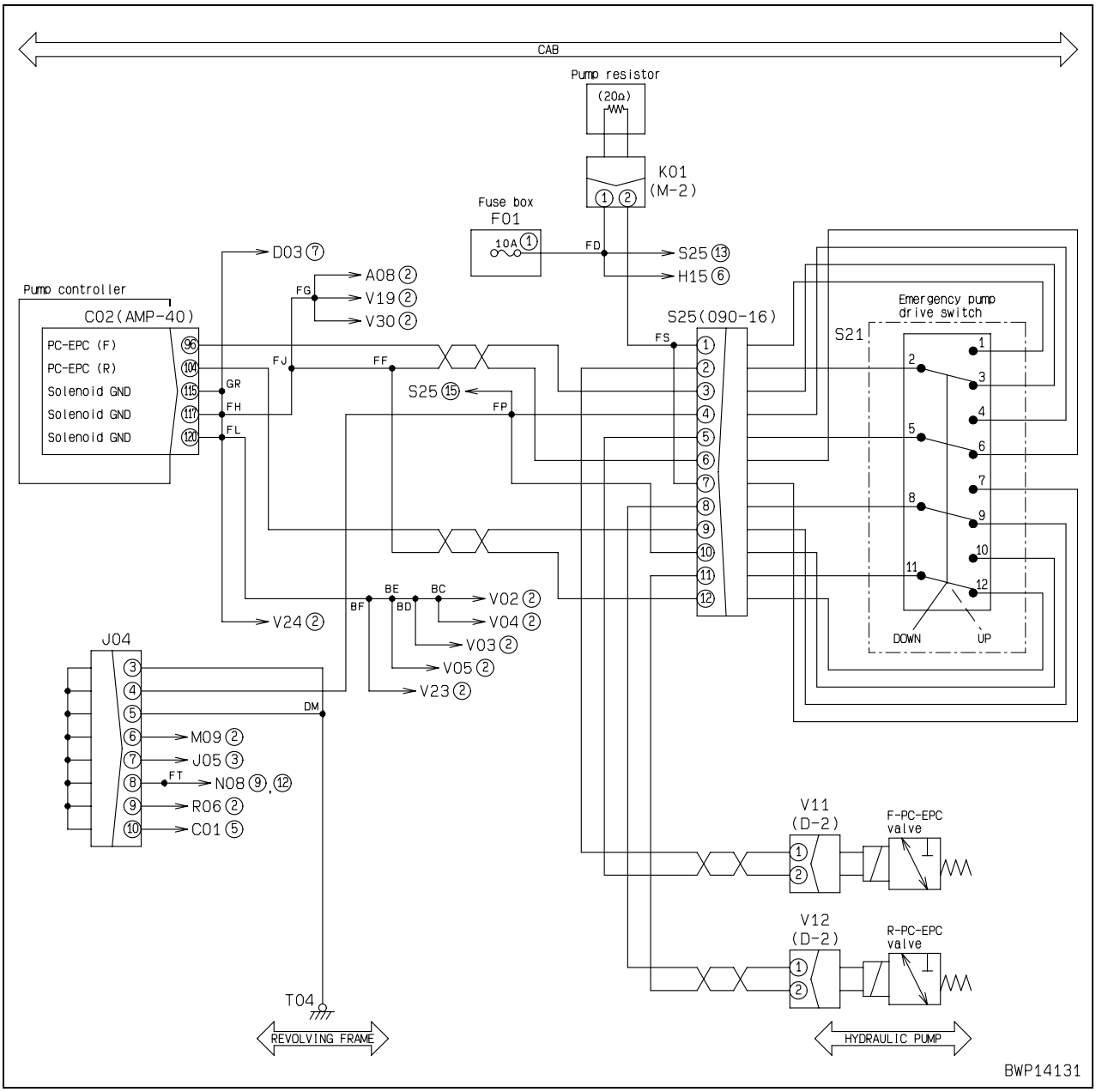
Troubleshooting by failure code (Display of code), Part 4

Failure code [DXA8KA] PC-EPC (F) Sol Discon

User code	Failure code	Trouble	PC-EPC (F) solenoid system disconnection (Pump controller system)
E02	**DXA8KA**		
Contents of trouble	• When PC-EPC (F) solenoid was driven, disconnection was detected in circuit.		
Action of controller	• None in particular (Since no current flows, solenoid does not operate). • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• If pump load increases, engine speed lowers largely and engine may stall.		
Related information	• Drive current of PC-EPC (F) solenoid can be checked with monitoring function. (Code: 01300 PC-EPC solenoid current (F)) • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective PC-EPC (F) solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V11 (male)		Resistance	
			Between (1) – (2)		7 – 14 Ω	
	2	Defective emergency pump drive switch (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S25 (male)	Emergency pump drive switch	Resistance	
			Between (3) – (2)	Normal	Max. 1 Ω	
				Emergency	Min. 1 MΩ	
			Between (6) – (5)	Normal	Max. 1 Ω	
				Emergency	Min. 1 MΩ	
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C02 (female) (96) – S25 (female) (3)		Resistance	Max. 1 Ω
			Wiring harness between S25 (female) (2) – V11 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between C02 (female) (115), (117), (120) – S25 (female) (6)		Resistance	Max. 1 Ω
			Wiring harness between S25 (female) (5) – V11 (female) (2)		Resistance	Max. 1 Ω
	4	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C02 (female)		Resistance	
			Between (96) – (115), (117), (120)		7 – 14 Ω	

Circuit diagram related to PC-EPC (F) solenoid and PC-EPC (R) solenoid

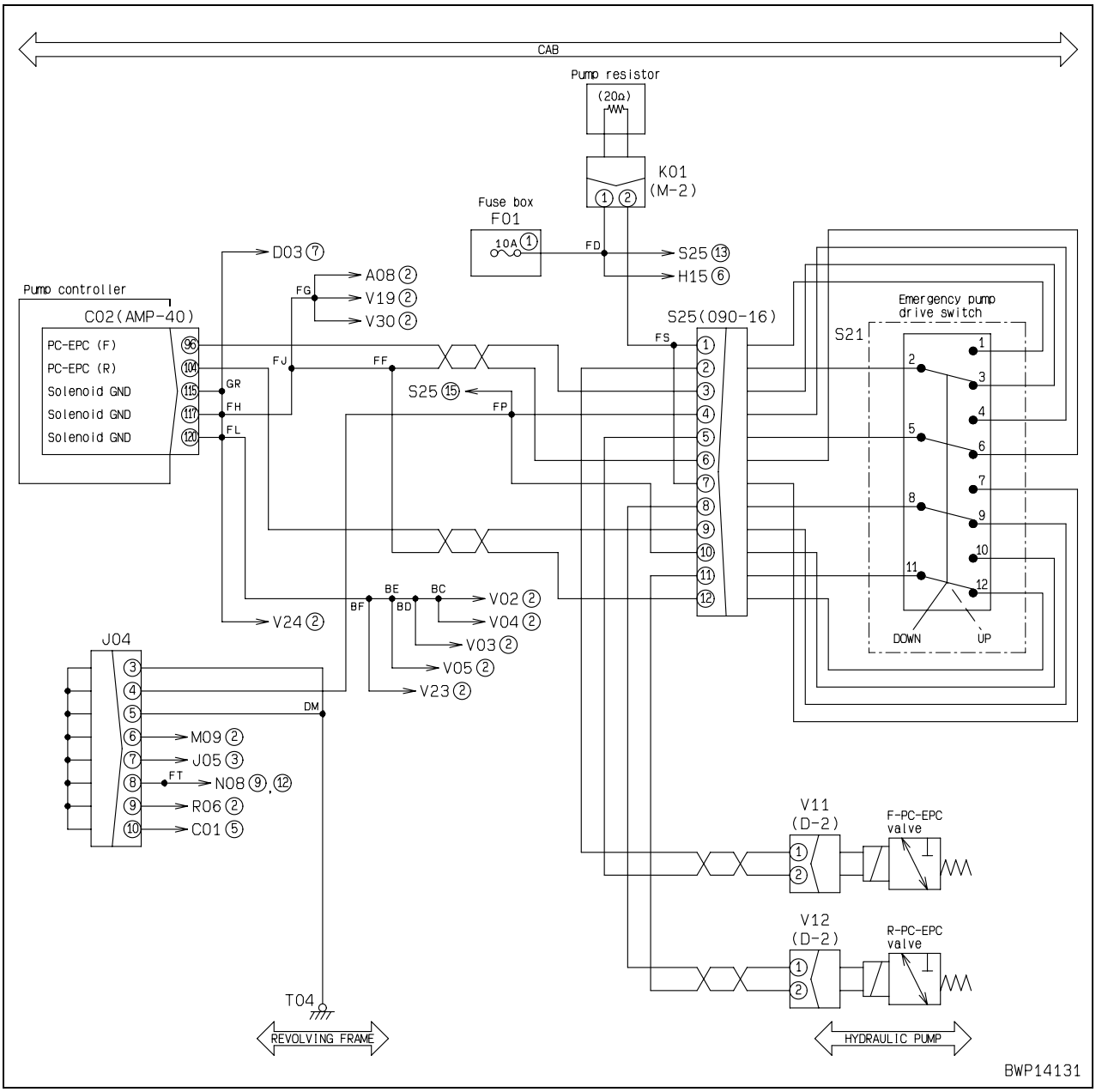


Failure code [DXA8KB] PC-EPC (F) Sol Short

User code	Failure code	Trouble	PC-EPC (F) solenoid system short (Pump controller system)
E02	**DXA8KB**		
Contents of trouble	• When PC-EPC (F) solenoid was driven, short circuit was detected in circuit.		
Action of controller	• Turns output to PC-EPC (F) solenoid OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• If pump load increases, engine speed lowers largely and engine may stall.		
Related information	• Drive current of PC-EPC (F) solenoid can be checked with monitoring function. (Code: 01300 PC-EPC solenoid current (F)) • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective PC-EPC (F) solenoid (Internal short circuit or ground fault)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V11 (male)		Resistance	
			Between (1) – (2)		7 – 14 Ω	
			Between (1) – chassis ground		Min. 1 MΩ	
	2	Defective emergency pump drive switch (Internal short circuit or ground fault)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S25 (male)	Emergency pump drive switch	Resistance	
			Between (2), (3) – (4)	Normal	Min. 1 MΩ	
			Between (2), (3) – chassis ground		Min. 1 MΩ	
	3	Ground fault in wiring harness (Contact with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C02 (female) (96) – S25 (female) (3)		Resistance	Min. 1 MΩ
			Wiring harness between S25 (female) (5) – V11 (female) (2)		Resistance	Min. 1 MΩ
	4	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C02 (female)		Resistance	
			Between (96) – (115), (117), (120)		7 – 14 Ω	
			Between (96) – chassis ground		Min. 1 MΩ	

Circuit diagram related to PC-EPC (F) solenoid and PC-EPC (R) solenoid

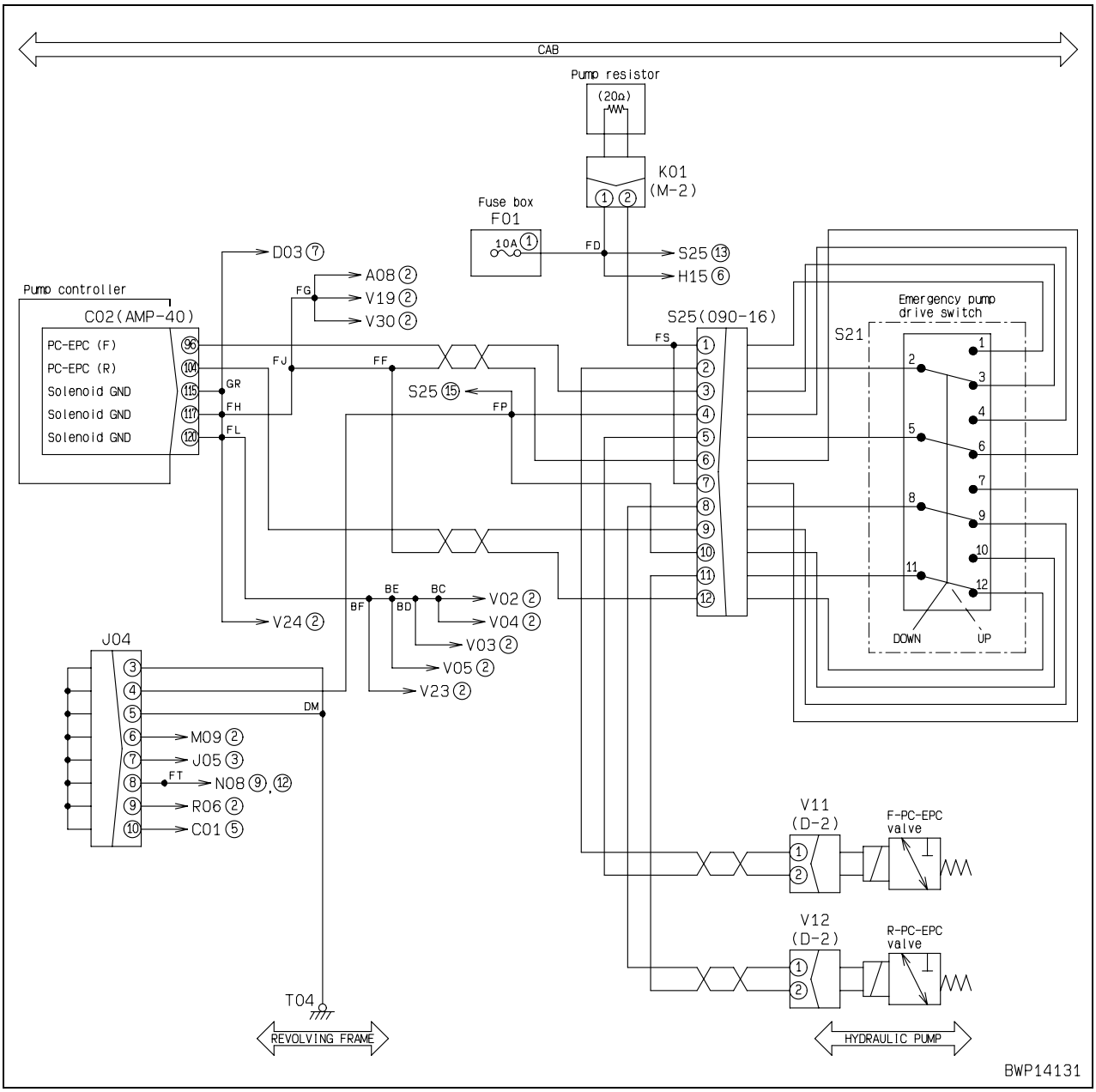


Failure code [DXA9KA] PC-EPC (R) Sol Discon

User code	Failure code	Trouble	PC-EPC (R) solenoid system disconnection (Pump controller system)
E02	**DXA9KA**		
Contents of trouble	• When PC-EPC (R) solenoid was driven, disconnection was detected in circuit.		
Action of controller	• None in particular (Since no current flows, solenoid does not operate). • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• If pump load increases, engine speed lowers largely and engine may stall.		
Related information	• Drive current of PC-EPC (R) solenoid can be checked with monitoring function. (Code: 01302 PC-EPC solenoid current (R)) • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective PC-EPC (R) solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V12 (male)		Resistance	
			Between (1) – (2)		7 – 14 Ω	
	2	Defective emergency pump drive switch (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S25 (male)	Emergency pump drive switch	Resistance	
			Between (9) – (8)	Normal	Max. 1 Ω	
				Emergency	Min. 1 MΩ	
			Between (12) – (11)	Normal	Max. 1 Ω	
				Emergency	Min. 1 MΩ	
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C02 (female) (104) – S25 (female) (9)		Resistance	Min. 1 MΩ
			Wiring harness between S25 (female) (8) – V12 (female) (1)		Resistance	Min. 1 MΩ
			Wiring harness between C02 (female) (115), (117), (120) – S25 (female) (12)		Resistance	Min. 1 MΩ
			Wiring harness between S25 (female) (11) – V12 (female) (2)		Resistance	Min. 1 MΩ
	4	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C02 (female)		Resistance	
			Between (104) – (115), (117), (120)		7 – 14 Ω	

Circuit diagram related to PC-EPC (F) solenoid and PC-EPC (R) solenoid

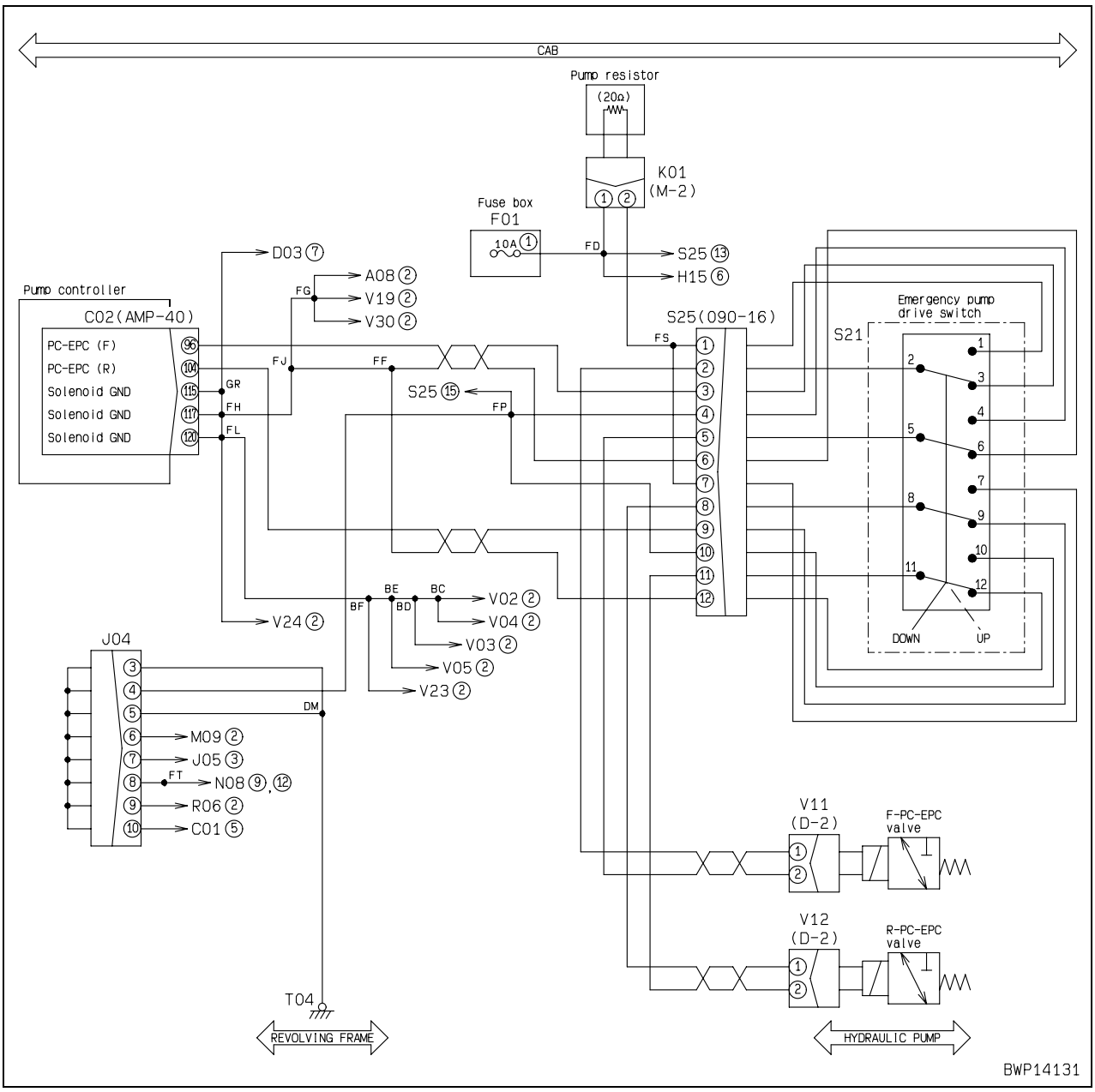


Failure code [DXA9KB] PC-EPC (R) Sol Short

User code	Failure code	Trouble	PC-EPC (R) solenoid system short (Pump controller system)
E02	**DXA9KB**		
Contents of trouble	• When PC-EPC (R) solenoid was driven, short circuit was detected in circuit.		
Action of controller	• Turns output to PC-EPC (R) solenoid OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• If pump load increases, engine speed lowers largely and engine may stall.		
Related information	• Drive current of PC-EPC (R) solenoid can be checked with monitoring function. (Code: 01302 PC-EPC solenoid current (R)) • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective PC-EPC (R) solenoid (Internal short circuit or ground fault)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V12 (male)		Resistance	
			Between (1) – (2)		7 – 14 Ω	
			Between (1) – chassis ground		Min. 1 MΩ	
	2	Defective emergency pump drive switch (Internal short circuit or ground fault)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S25 (male)	Emergency pump drive switch	Resistance	
			Between (8), (9) – (10)	Normal	Min. 1 MΩ	
			Between (8), (9) – chassis ground		Min. 1 MΩ	
	3	Ground fault in wiring harness (Contact with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C02 (female) (104) – S25 (female) (9)		Resistance	Min. 1 MΩ
			Wiring harness between S25 (female) (8) – V12 (female) (1)		Resistance	Min. 1 MΩ
	4	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C02 (female)		Resistance	
			Between (104) – (115), (117), (120)		7 – 14 Ω	
			Between (104) – chassis ground		Min. 1 MΩ	

Circuit diagram related to PC-EPC (F) solenoid and PC-EPC (R) solenoid

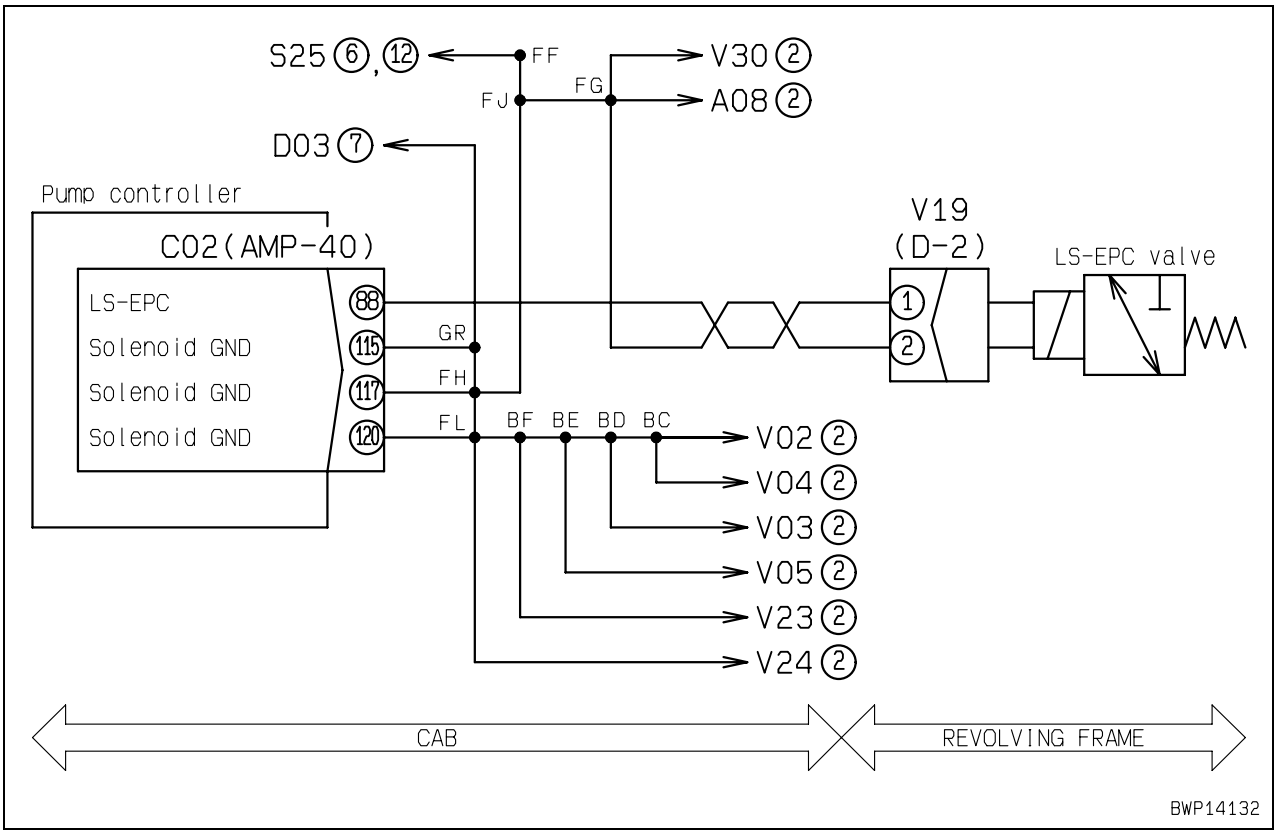


Failure code [DXE0KA] LS-EPC Sol Discon

User code	Failure code	Trouble	LS-EPC solenoid system disconnection (Pump controller system)
—	**DXE0KA**		
Contents of trouble	• When LS-EPC solenoid was driven, disconnection was detected in circuit.		
Action of controller	• None in particular (Since no current flows, solenoid does not operate). • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Travel speed is high at Lo and Mi. • Work equipment speed and swing speed are high in lifting mode (L).		
Related information	• Drive current of LS-EPC solenoid can be checked with monitoring function. (Code: 01500 LS-EPC solenoid current) • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective LS-EPC solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V19 (male)	Resistance		
			Between (1) – (2)	7 – 14 Ω		
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C02 (female) (88) – V19 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between C02 (female) (115), (117), (120) – V19 (female) (2)	Resistance	Max. 1 Ω	
	3	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C02 (female)	Resistance		
			Between (88) – (115), (117), (120)	7 – 14 Ω		

Circuit diagram related to LS-EPC solenoid

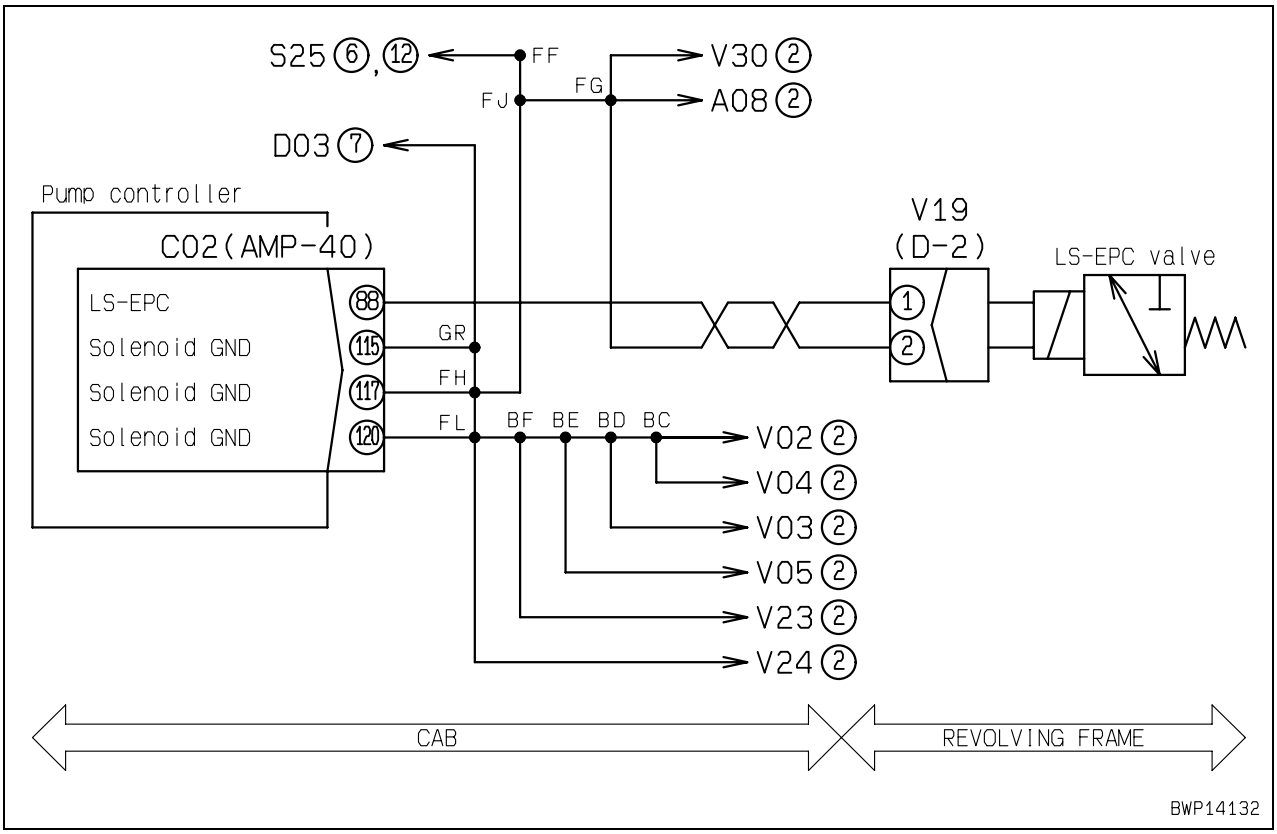


Failure code [DXE0KB] LS-EPC Sol Short

User code	Failure code	Trouble	LS-EPC solenoid system short (Pump controller system)
—	**DXE0KB**		
Contents of trouble	• When LS-EPC solenoid was driven, short circuit was detected in circuit.		
Action of controller	• Turns output to LS-EPC solenoid OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Travel speed is high at Lo and Mi. • Work equipment speed and swing speed are high in lifting mode (L).		
Related information	• Drive current of LS-EPC solenoid can be checked with monitoring function. (Code: 01500 LS-EPC solenoid current) • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective LS-EPC solenoid (Internal short circuit or ground fault)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			V19 (male)	Resistance	
			Between (1) – (2)	7 – 14 Ω	
			Between (1) – chassis ground	Min. 1 MΩ	
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between C02 (female) (88) – V19 (female) (1)	Resistance	Min. 1 MΩ
	3	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			C02 (female)	Resistance	
			Between (88) – (115), (117), (120)	7 – 14 Ω	
			Between (88) – chassis ground	Min. 1 MΩ	

Circuit diagram related to LS-EPC solenoid

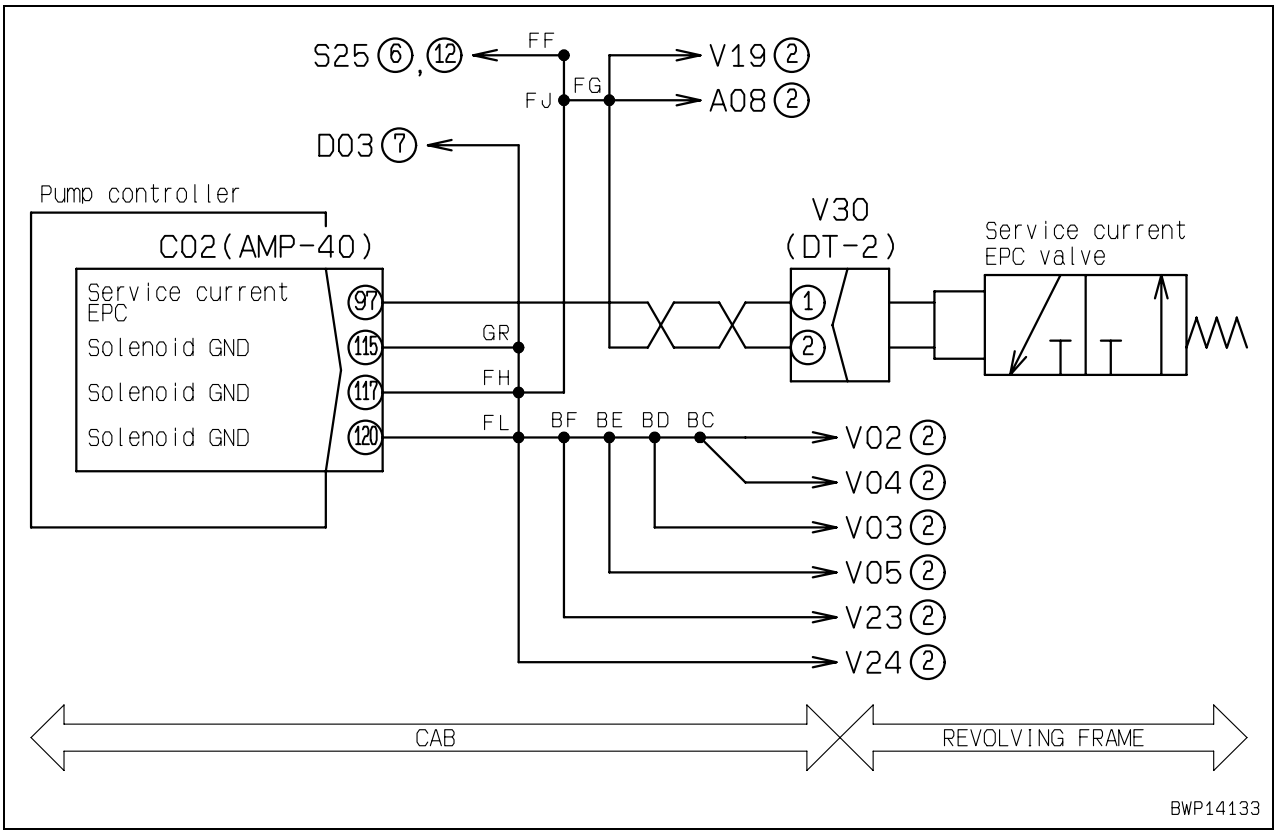


Failure code [DXE4KA] Service Current EPC Discon

User code	Failure code	Trouble	Service current EPC solenoid disconnection (Pump controller system)
—	**DXE4KA**		
Contents of trouble	• When service EPC solenoid was driven, disconnection was detected in circuit.		
Action of controller	• None in particular (Since no current flows, solenoid does not operate). • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Attachment does not operate.		
Related information	• Drive current of service EPC solenoid can be checked with monitoring function. (Code: 01700 service solenoid current) • Method of reproducing failure code: Turn starting switch ON + Set in attachment mode (ATT).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective service EPC solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V30 (male)	Resistance		
			Between (1) – (2)	7 – 14 Ω		
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C02 (female) (97) – V30 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between C02 (female) (115), (117), (120) – V30 (female) (2)	Resistance	Max. 1 Ω	
	3	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C02 (female)	Resistance		
			Between (97) – (115), (117), (120)	7 – 14 Ω		

Circuit diagram related to service EPC solenoid

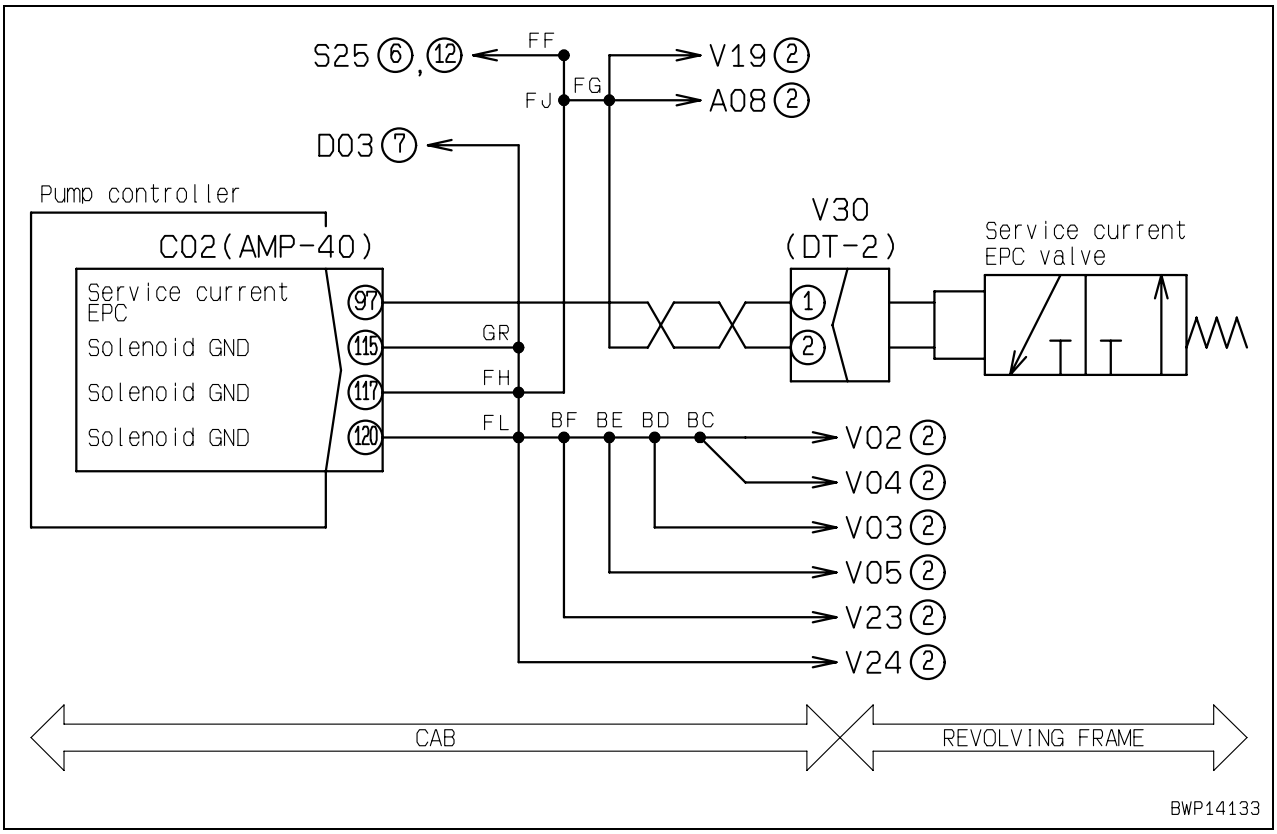


Failure code [DXE4KB] Service Current EPC Short

User code	Failure code	Trouble	Service current EPC solenoid short (Pump controller system)
—	**DXE4KB**		
Contents of trouble	• When service EPC solenoid was driven, short circuit was detected in circuit.		
Action of controller	• Turns output to service EPC solenoid OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Attachment does not operate.		
Related information	• Drive current of service EPC solenoid can be checked with monitoring function. (Code: 01700 service EPC solenoid current) • Method of reproducing failure code: Turn starting switch ON + Set in attachment mode (ATT).		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective service EPC solenoid (Internal short circuit or ground fault)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V30 (male)	Resistance		
			Between (1) – (2)	7 – 14 Ω		
			Between (1) – chassis ground	Min. 1 MΩ		
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C02 (female) (97) – V30 (female) (1)	Resistance	Min. 1 MΩ	
	4	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C02 (female)	Resistance		
			Between (97) – (115), (117), (120)	7 – 14 Ω		
			Between (97) – chassis ground	Min. 1 MΩ		

Circuit diagram related to service EPC solenoid

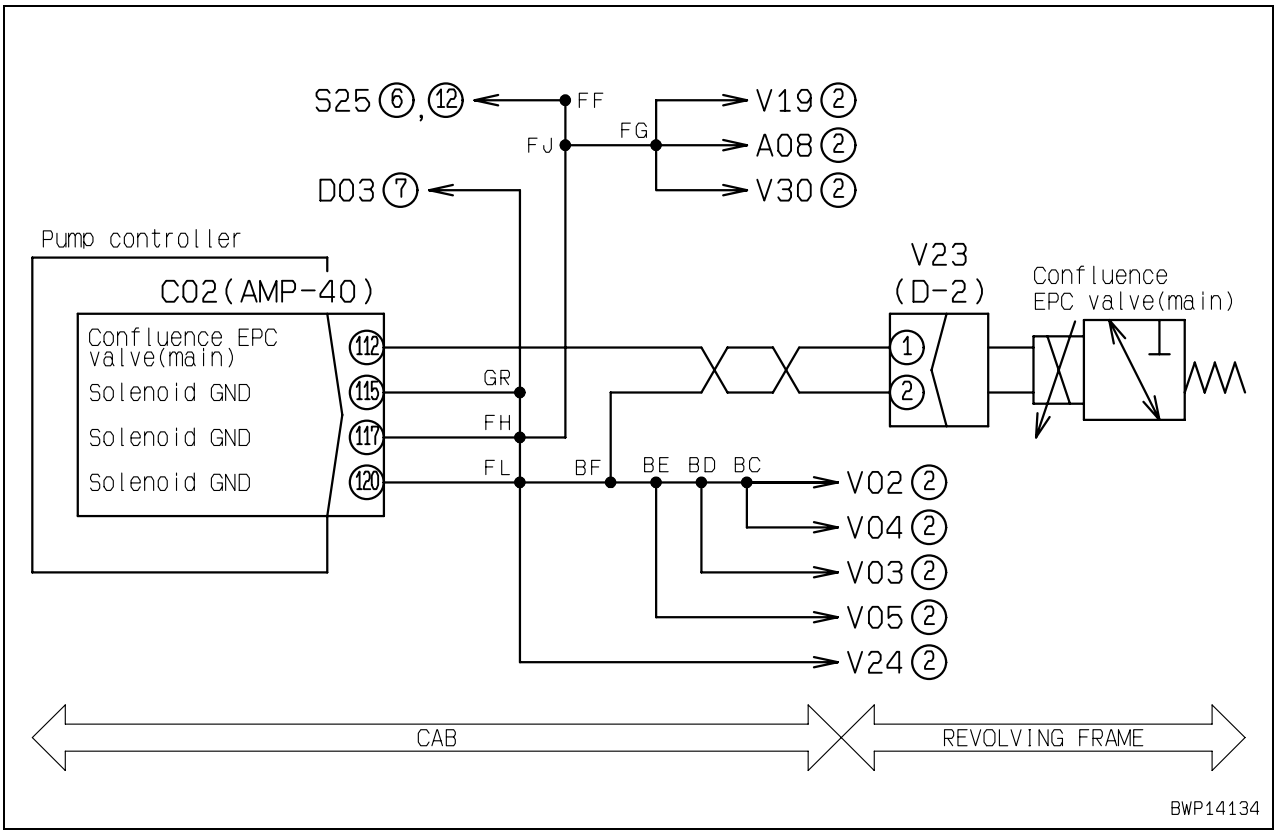


Failure code [DXE5KA] Merge-divider Main Sol Discon

User code	Failure code	Trouble	Merge-divider main solenoid disconnection (Pump controller system)
—	**DXE5KA**		
Contents of trouble	• When merge-divider main EPC solenoid was driven, disconnection was detected in circuit.		
Action of controller	• None in particular (Since no current flows, solenoid does not operate). • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Single operation speed of work equipment and swing is high in lifting mode (L).		
Related information	• Drive current of merge-divider main EPC solenoid can be checked with monitoring function. (Code: 08000 merge-divider main solenoid current) • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective merge-divider main EPC solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V23 (male)	Resistance		
			Between (1) – (2)	7 – 14 Ω		
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C02 (female) (112) – V23 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between C02 (female) (115), (117), (120) – V23 (female) (2)	Resistance	Max. 1 Ω	
	3	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C02 (female)	Resistance		
			Between (112) – (115), (117), (120)	7 – 14 Ω		

Circuit diagram related to merge-divider main EPC solenoid

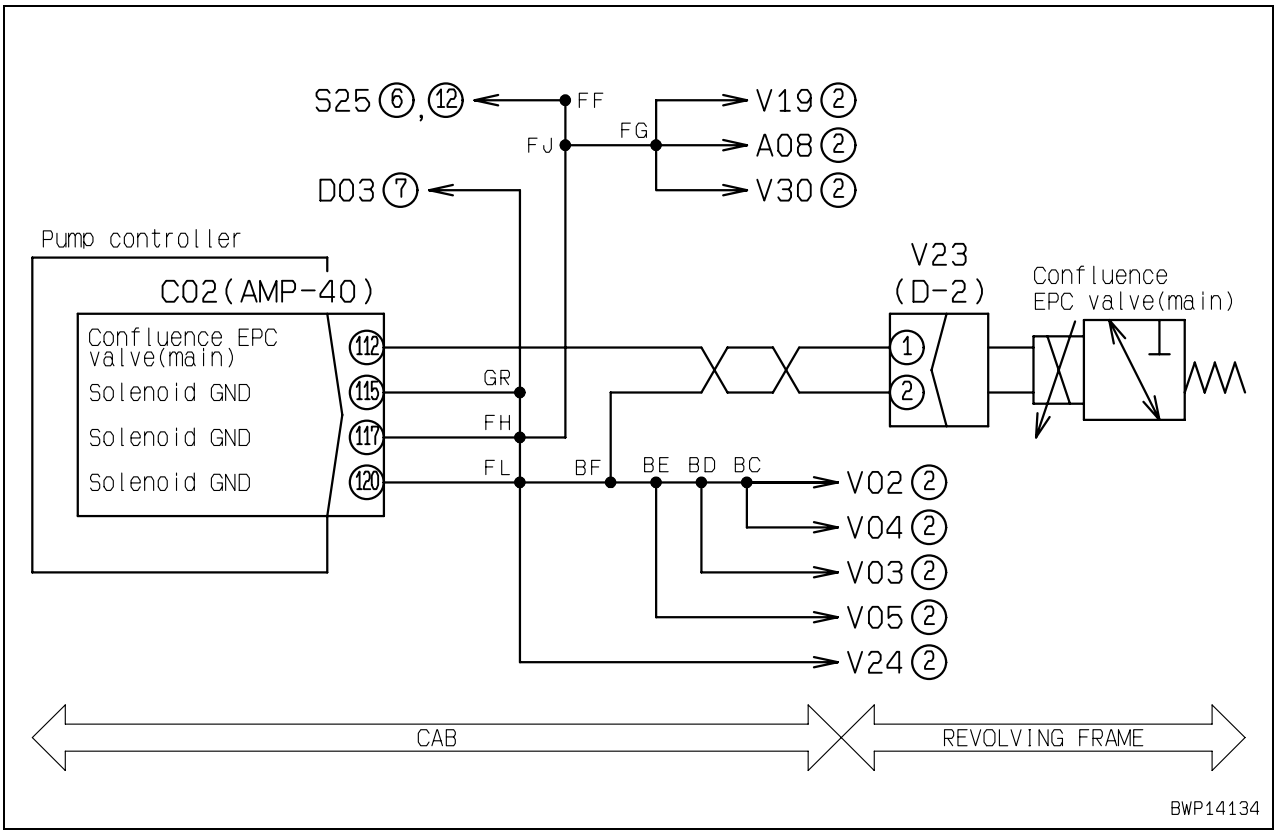


Failure code [DXE5KB] Merge-divider Main Sol Short

User code	Failure code	Trouble	Merge-divider main solenoid short (Pump controller system)
—	DXE5KB		
Contents of trouble	• When merge-divider main EPC solenoid was driven, short circuit was detected in circuit.		
Action of controller	• Turns output to merge-divider main EPC solenoid OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Single operation speed of work equipment and swing is high in lifting mode (L).		
Related information	• Drive current of merge-divider main EPC solenoid can be checked with monitoring function. (Code: 08000 merge-divider main EPC solenoid current) • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective merge-divider main EPC solenoid (Internal short circuit or ground fault)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V23 (male)	Resistance		
			Between (1) – (2)	7 – 14 Ω		
			Between (1) – chassis ground	Min. 1 MΩ		
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C02 (female) (112) – V23 (female) (1)	Resistance	Min. 1 MΩ	
	3	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C02 (female)	Resistance		
			Between (112) – (115), (117), (120)	7 – 14 Ω		
			Between (112) – chassis ground	Min. 1 MΩ		

Circuit diagram related to merge-divider main EPC solenoid

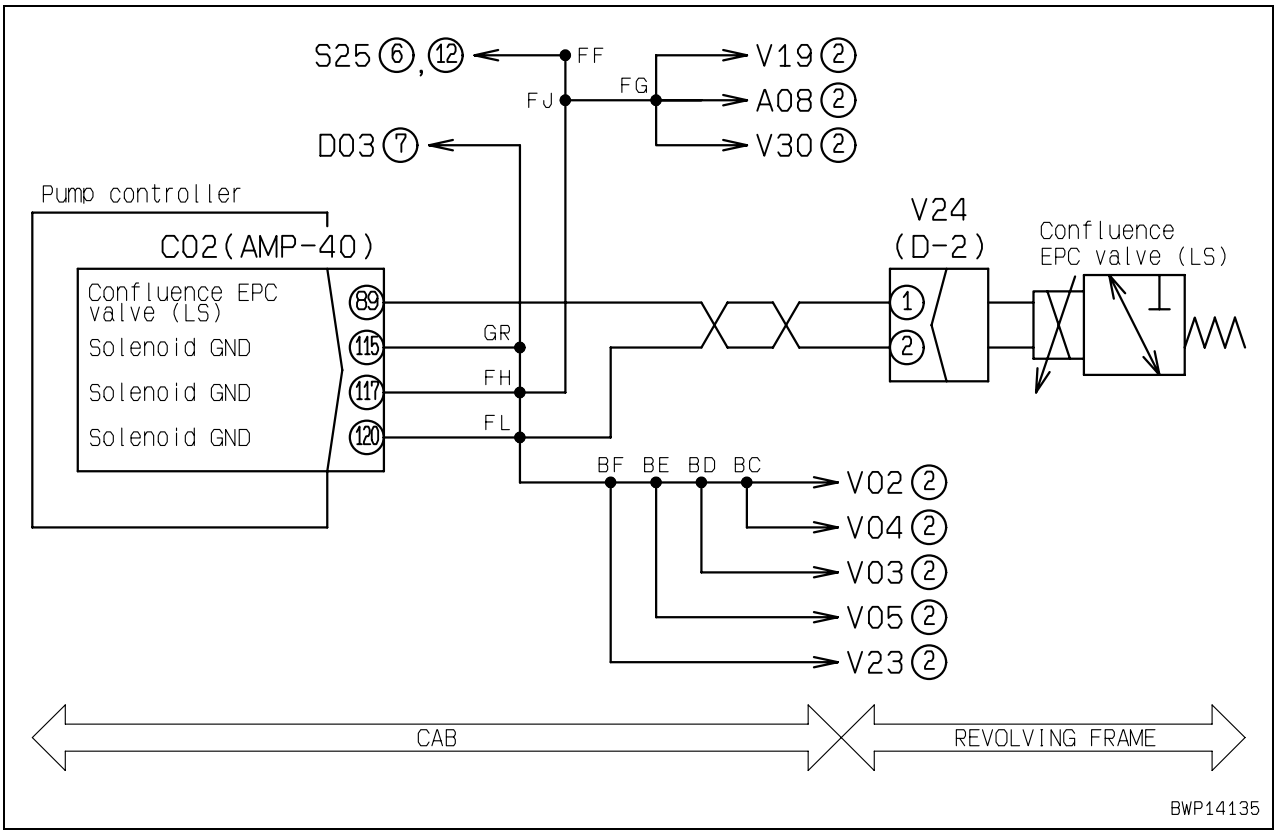


Failure code [DXE6KA] Merge-divider LS Sol Discon

User code	Failure code	Trouble	Merge-divider LS solenoid disconnection (Pump controller system)
—	**DXE6KA**		
Contents of trouble	• When merge-divider LS EPC solenoid was driven, disconnection was detected in circuit.		
Action of controller	• None in particular (Since no current flows, solenoid does not operate). • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Single operation speed of work equipment and swing is high in lifting mode (L).		
Related information	• Drive current of merge-divider LS EPC solenoid can be checked with monitoring function. (Code: 08001 merge-divider LS solenoid current) • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective merge-divider LS EPC solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V24 (male)	Resistance		
			Between (1) – (2)	7 – 14 Ω		
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C02 (female) (89) – V24 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between C02 (female) (115), (117), (120) – V24 (female) (2)	Resistance	Max. 1 Ω	
	3	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C02 (female)	Resistance		
			Between (89) – (115), (117), (120)	7 – 14 Ω		

Circuit diagram related to merge-divider LS EPC solenoid

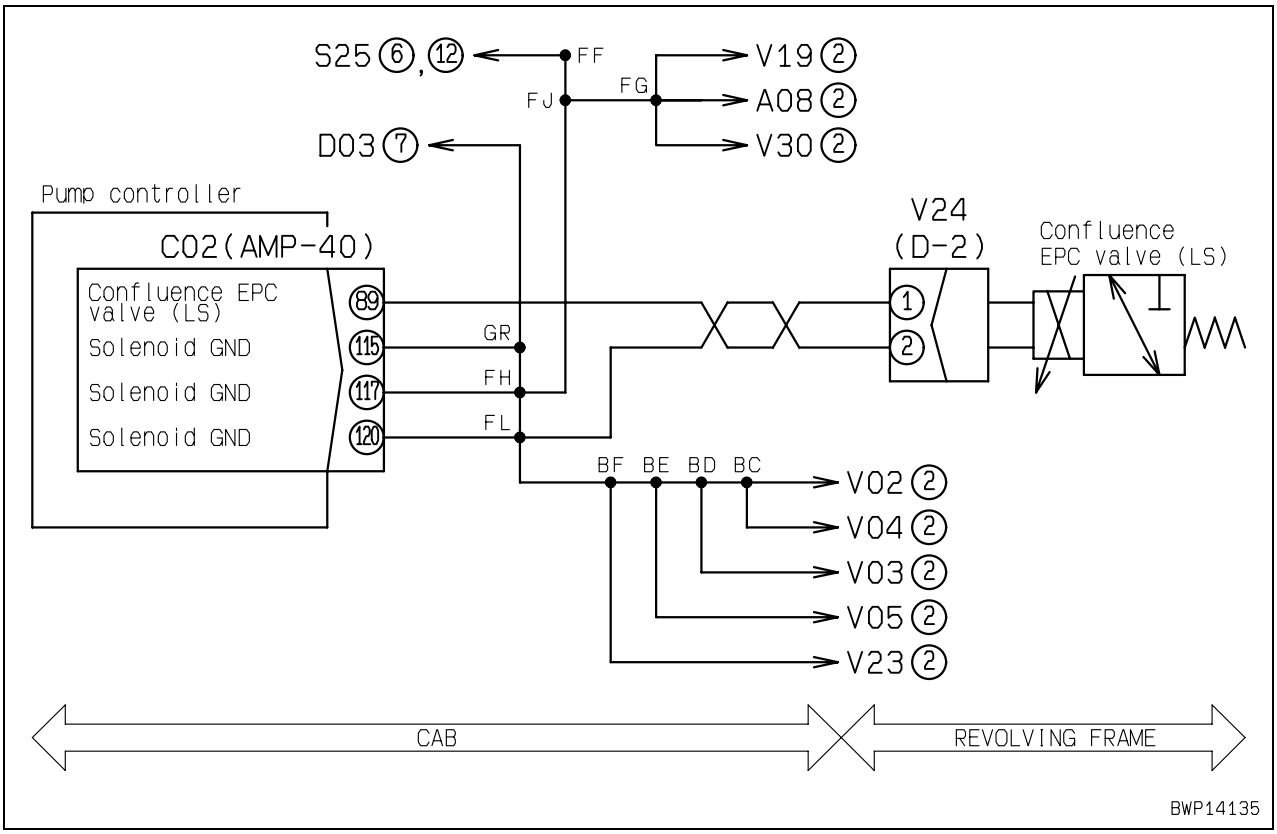


Failure code [DXE6KB] Merge-divider LS Sol Short

User code	Failure code	Trouble	Merge-divider LS solenoid short (Pump controller system)
—	**DXE6KB**		
Contents of trouble	• When merge-divider LS EPC solenoid was driven, short circuit was detected in circuit.		
Action of controller	• Turns output to merge-divider LS EPC solenoid OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Single operation speed of work equipment and swing is re high in lifting mode (L).		
Related information	• Drive current of merge-divider LS EPC solenoid can be checked with monitoring function. (Code: 08000 merge-divider LS EPC solenoid current) • Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective merge-divider LS EPC solenoid (Internal short circuit or ground fault)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			V24 (male)	Resistance	
			Between (1) – (2)	7 – 14 Ω	
			Between (1) – chassis ground	Min. 1 MΩ	
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between C02 (female) (89) – V24 (female) (1)	Resistance	Min. 1 MΩ
	3	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			C02 (female)	Resistance	
			Between (89) – (115), (117), (120)	7 – 14 Ω	
			Between (89) – chassis ground	Min. 1 MΩ	

Circuit diagram related to merge-divider LS EPC solenoid

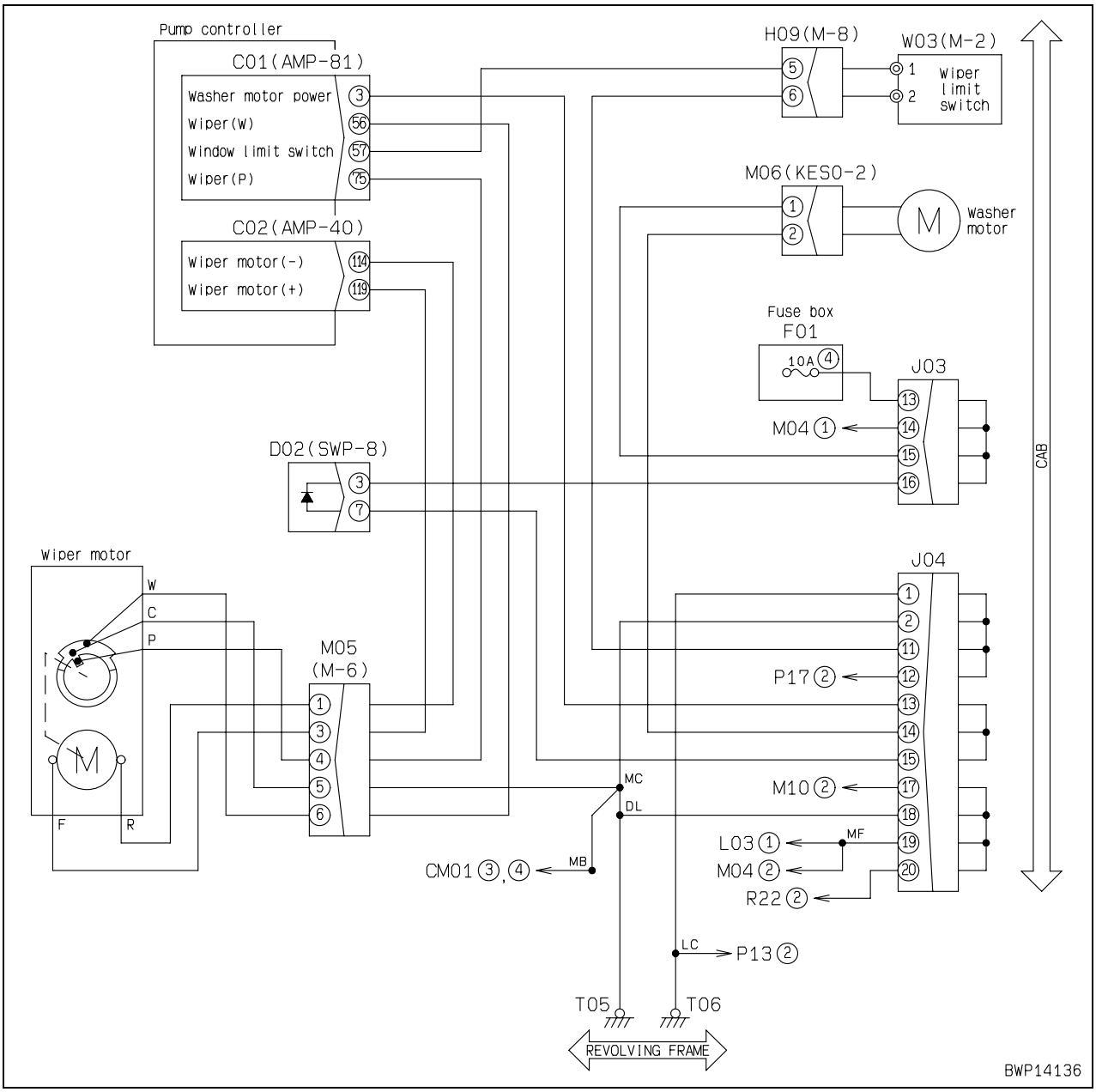


Failure code [DY20KA] Wiper Working Abnormality

User code	Failure code	Trouble	Wiper working abnormality (Pump controller system)
—	**DY20KA**		
Contents of trouble	• When windshield wiper works, W signal of working ends is not input.		
Action of controller	• Turns working output to wiper motor OFF. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Wiper motor does not work.		
Related information	• Condition of W contact signal of wiper working area can be checked with monitoring function. (Code: 02204 switch 5) • Method of reproducing failure code: Turn starting switch ON + Set wiper switch to INT or ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective wiper motor (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			M05 (female)	Wiper blade	Resistance	
			Between (6) – (5)	Operating range top	Max. 1 Ω	
				Other than operating range top	Min. 1 MΩ	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (56) – M05 (male) (6)		Resistance	Max. 1 Ω
			Wiring harness between M05 (female) (5) – J04 – chassis ground (T05, T06)		Resistance	Max. 1 Ω
	3	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C01 (female)	Wiper blade	Resistance	
			Between (56) – chassis ground	Operating range top	Max. 1 Ω	
				Other than operating range top	Min. 1 MΩ	

Circuit diagram related to windshield wiper and window washer

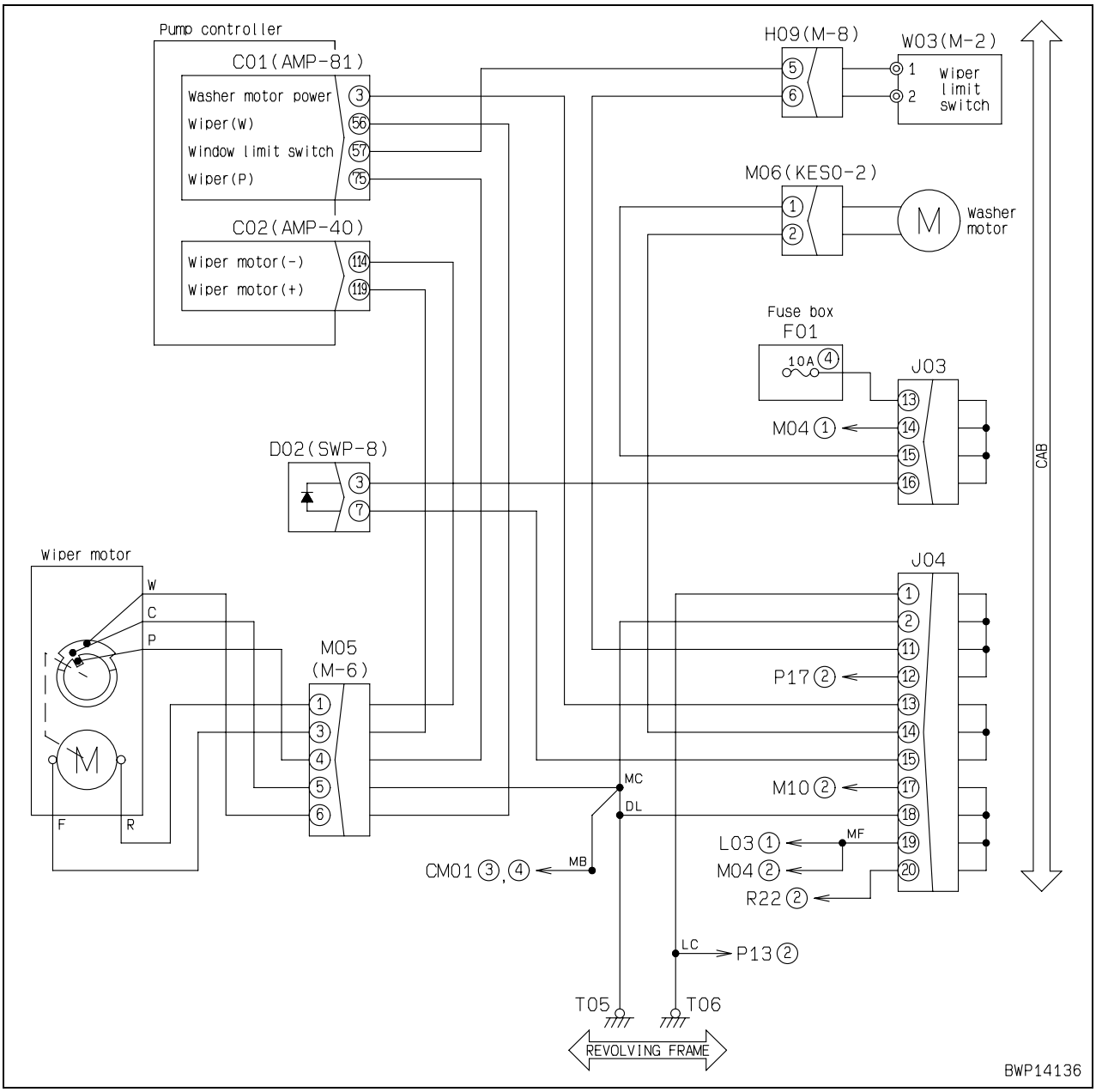


Failure code [DY20MA] Wiper Parking Abnormality

User code	Failure code	Trouble	Wiper parking abnormality (Pump controller system)
—	**DY20MA**		
Contents of trouble	• When windshield wiper parks, P signal of storage area is not input.		
Action of controller	• Turns parking output to wiper motor OFF. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Wiper motor does not park.		
Related information	• Condition of P contact signal of wiper parking area can be checked with monitoring function. (Code: 02204 switch 5) • Method of reproducing failure code: Turn starting switch ON + Set wiper switch to INT/ON to OFF.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective wiper motor (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			M05 (female)	Wiper blade	Resistance	
			Between (4) – (5)	Storage area	Max. 1 Ω	
				Working area	Min. 1 MΩ	
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (75) – M05 (male) (4)		Resistance	Max. 1 Ω
			Wiring harness between M05 (female) (5) – J04 – chassis ground (T05, T06)		Resistance	Max. 1 Ω
	4	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C01 (female)	Wiper blade	Resistance	
			Between (75) – chassis ground	Storage area	Max. 1 Ω	
				Working area	Min. 1 MΩ	

Circuit diagram related to windshield wiper and window washer

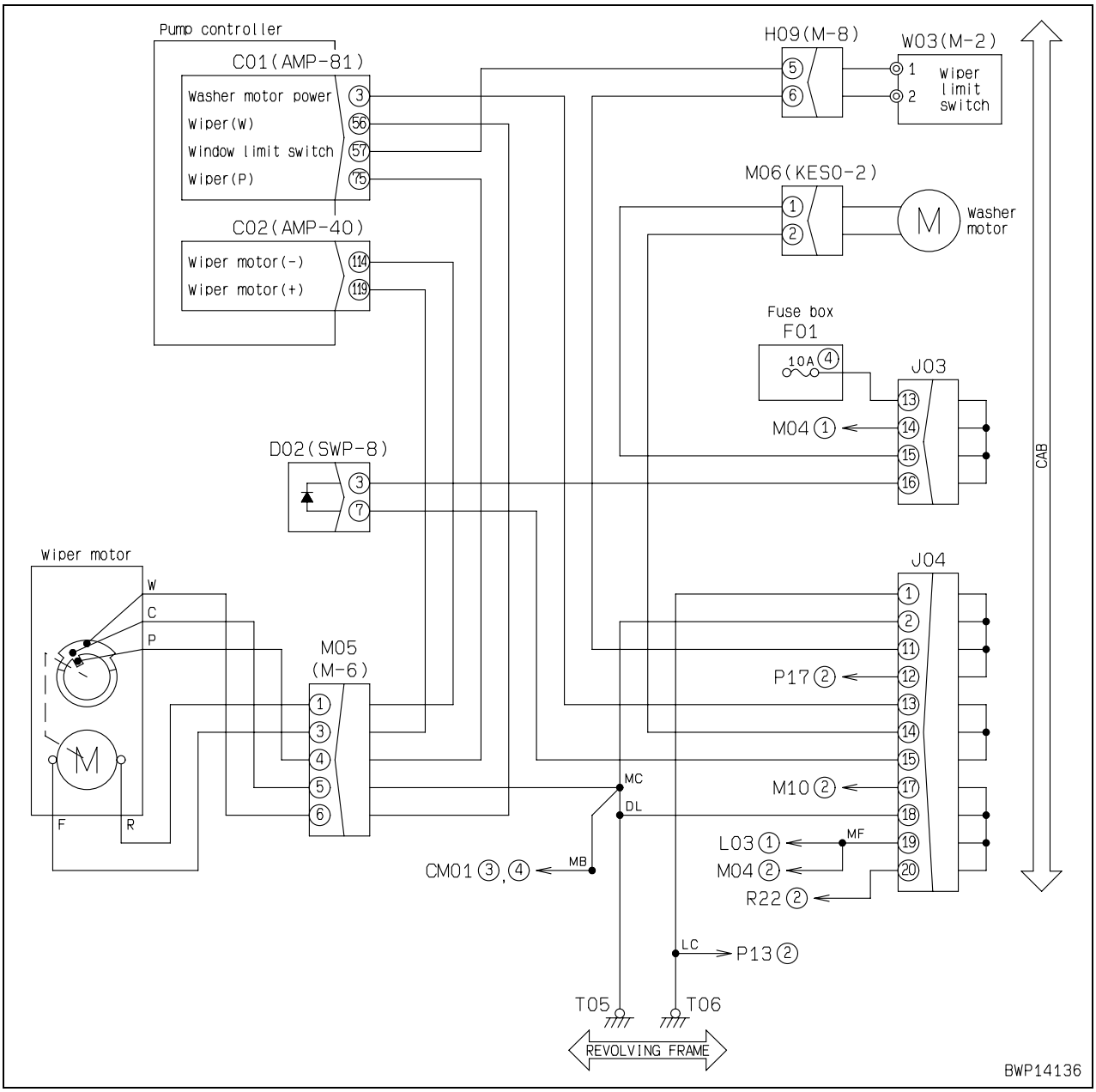


Failure code [DY2CKA] Washer Drive Discon

User code	Failure code	Trouble	Window washer drive system disconnection (Pump controller system)
—	**DY2CKA**		
Contents of trouble	• When output to window washer drive system was turned OFF (when ground circuit was connected), disconnection was detected in circuit.		
Action of controller	• None in particular (Since no current flows, washer motor does not operate). • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Window washer does not operate.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fuse No. 4	If fuse is broken, circuit probably has ground fault. (See cause 5.)			
	2	Defective washer motor (Internal short circuit or ground fault)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			M06 (male)	Resistance		
			Between (1) – (2)	5 – 20 Ω		
			Between (1), (2) – chassis ground	Min. 1 MΩ		
	3	Defective assembled-type diode D02 (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			D02 (female)	Continuity (Resistance)		
			Between (3) – (7)	No continuity (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 F01 (4) – J03 – M06 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between C01 (female) (3) – J04 – M06 (female) (2)	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 F01 (4) – J03 – M06 (female) (1), – D02 (female) (3)	Resistance	Min. 1 MΩ	
			Wiring harness between C01 (female) (3) – J04 – M06 (female) (2), – D02 (female) (7)	Resistance	Min. 1 MΩ	
	6	Defective pump controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			C01 (female)	Voltage		
			Between (3) – chassis ground	20 – 30 V		

Circuit diagram related to windshield wiper and window washer

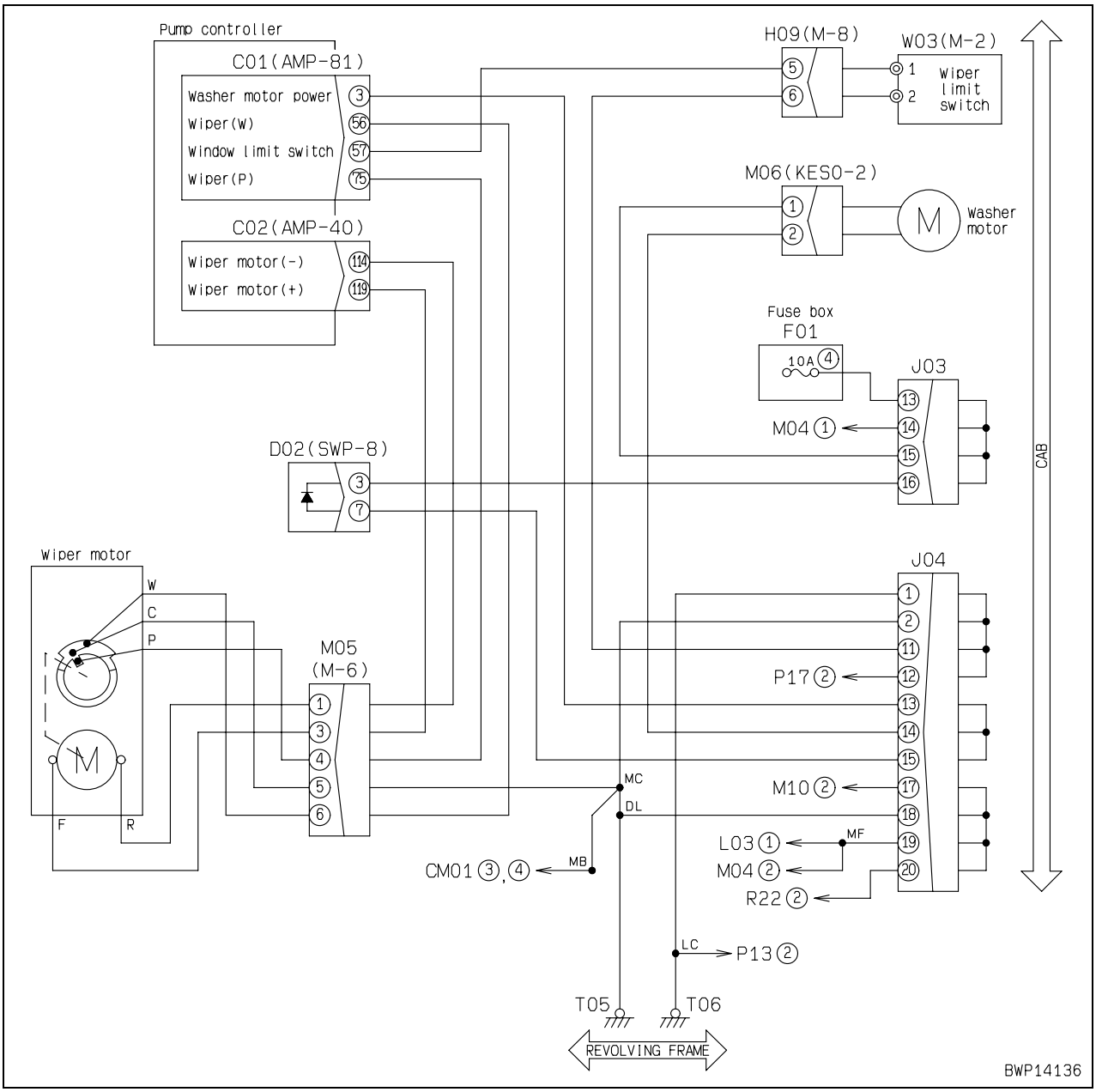


Failure code [DY2CKB] Washer Drive Short

User code	Failure code	Trouble	Window washer drive system short (Pump controller system)
—	**DY2CKB**		
Contents of trouble	• When output to window washer drive system was turned ON (ground circuit was disconnected), short circuit was detected in circuit.		
Action of controller	• Turns output to washer motor OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Window washer does not operate.		
Related information	• Method of reproducing failure code: Turn starting switch ON + Turn washer switch ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective washer motor (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			M06 (male)	Resistance	
			Between (1) – (2)	5 – 20 Ω	
	2	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 C01 (female) (3) – J04 – M6 (female) (2), – D02 (female) (7)	Voltage	Max. 1 V
	3	Defective pump controller	If causes 1 and 2 are not detected, pump controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related to windshield wiper and window washer

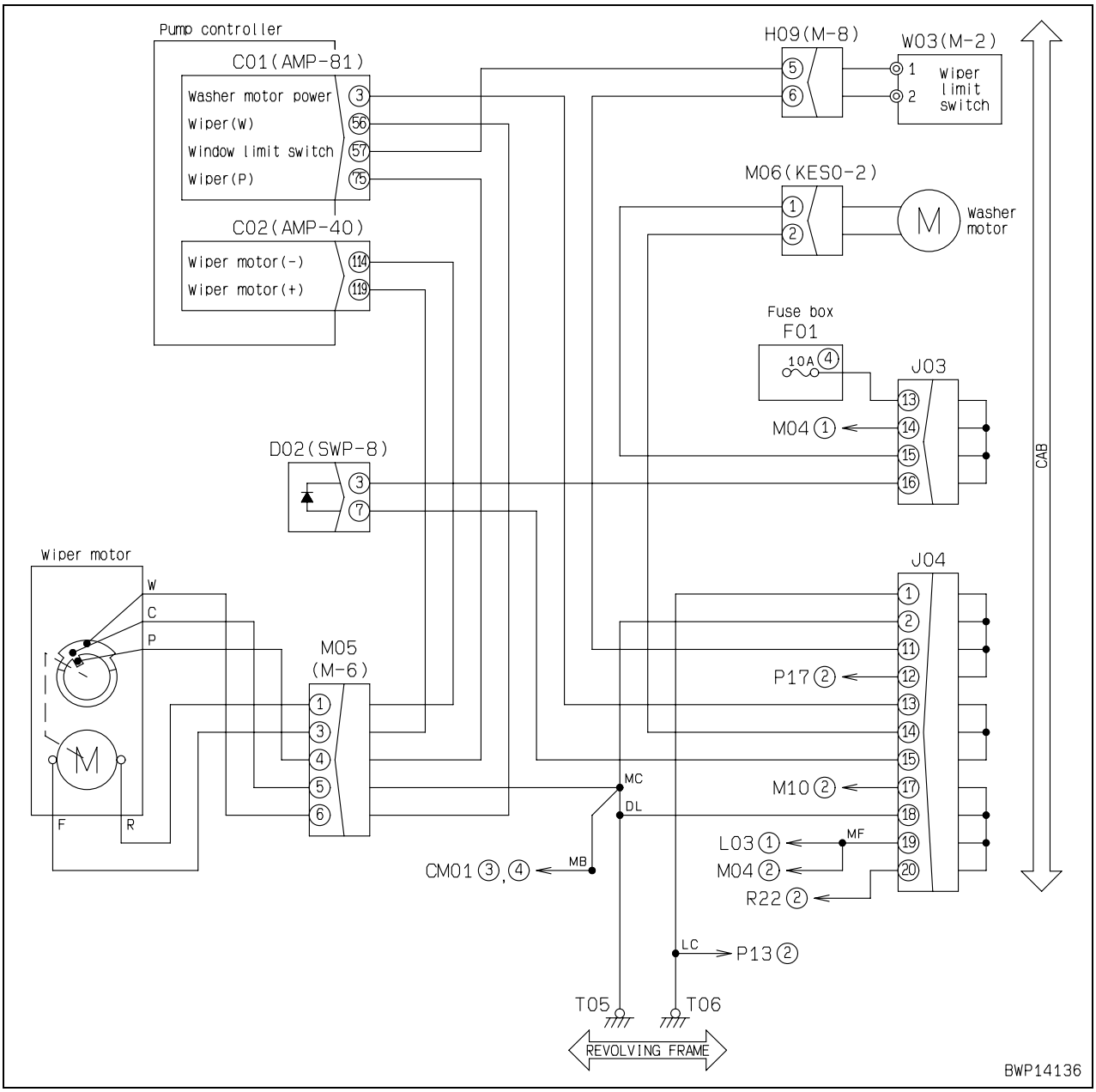


Failure code [DY2DKB] Wiper Drive (For) Short

User code	Failure code	Trouble	Wiper motor drive forward system short (Pump controller system)
—	**DY2DKB**		
Contents of trouble	• When output to wiper motor drive forward side was turned ON, short circuit was detected in circuit.		
Action of controller	• Turns output to wiper motor drive forward side OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Windshield wiper does not operate.		
Related information	• Method of reproducing failure code: Turn starting switch ON + Set wiper switch to INT or ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective wiper motor (Internal short circuit or ground fault)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			M05 (female)	Resistance		
			Between (3) – (1)	There is continuity		
			Between (3) – chassis ground	Min. 1 MΩ		
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C02 (female) (119) – M05 (male) (3)	Resistance	Min. 1 MΩ	
	4	Defective pump controller	If causes 1 and 2 are not detected, pump controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)			

Circuit diagram related to windshield wiper and window washer

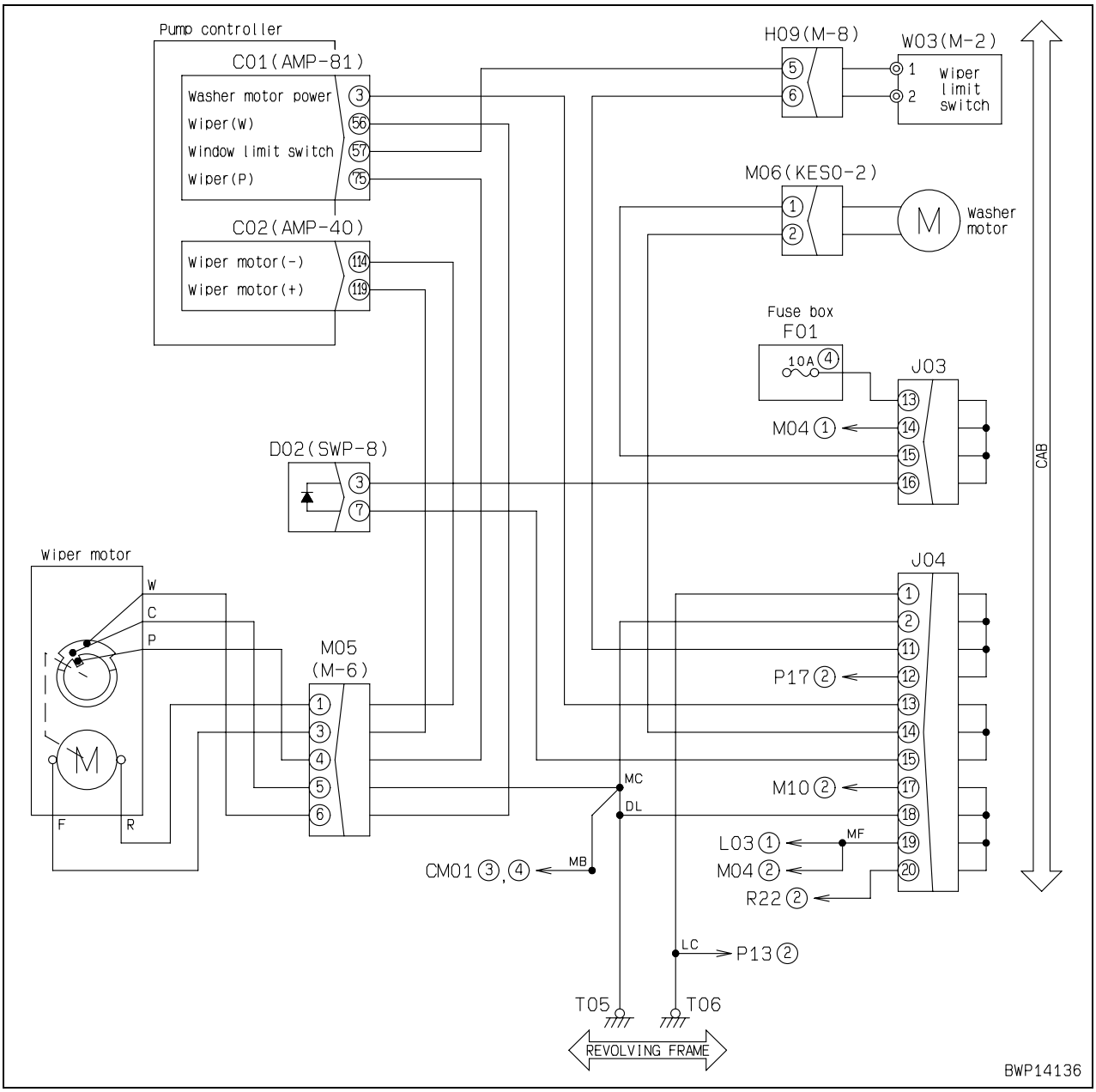


Failure code [DY2EKB] Wiper Drive (Rev) Short

User code	Failure code	Trouble	Wiper motor drive reverse system short (Pump controller system)
—	**DY2EKB**		
Contents of trouble	• When output to wiper motor drive reverse side was turned ON, short circuit was detected in circuit.		
Action of controller	• Turns output to wiper motor drive reverse side OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Windshield wiper does not operate.		
Related information	• Method of reproducing failure code: Turn starting switch ON + Set wiper switch to INT or ON.		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective wiper motor (Internal short circuit or ground fault)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			M05 (female)	Continuity/Resistance		
			Between (1) – (3)	There is continuity		
			Between (1) – chassis ground	Min. 1 MΩ		
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C02 (female) (114) – M05 (male) (1)	Resistance	Min. 1 MΩ	
	4	Defective pump controller	If causes 1 and 2 are not detected, pump controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)			

Circuit diagram related to windshield wiper and window washer



PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00243-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

40 Troubleshooting

Troubleshooting of electrical system (E-mode)

Troubleshooting of electrical system (E-mode)

Before carrying out troubleshooting of electrical system

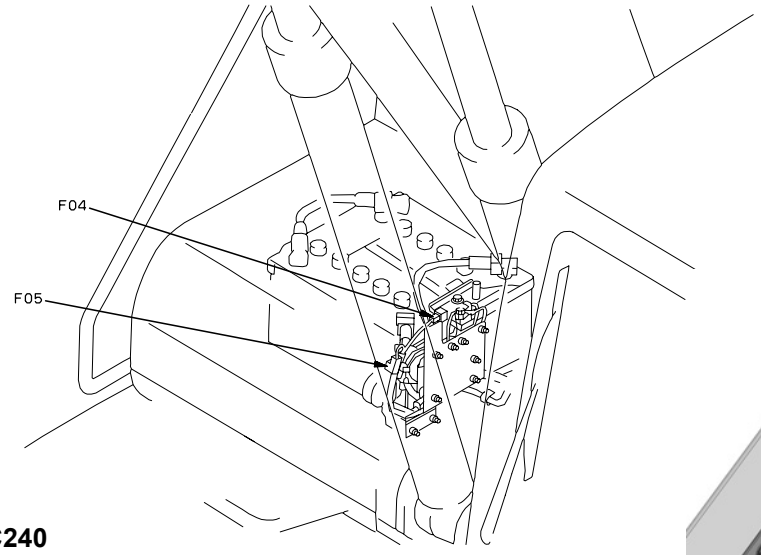
Connection table of fuse box

★ This connection table shows the devices to which each power supply of the fuse box supplies power (A switch power supply is a device which supplies power while the starting switch is in the ON position and a constant power supply is a device which supplies power while the starting switch is in the OFF and ON positions).

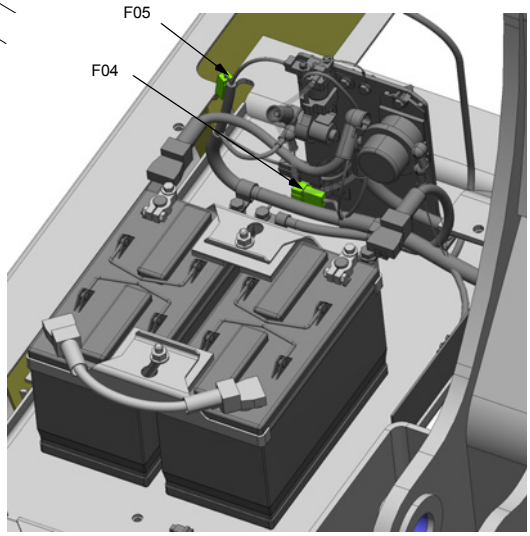
★ When carrying out troubleshooting related to the electrical system, you should check the fuses and fusible links to see if the power is supplied normally.

Type of power supply	Fusible link	Fuse No.	Fuse capacity	Destination of power
Switch power supply	F04 (65 A)	1	10 A	Lamp relay
				PC-EPC (F) solenoid valve, PC-EPC (R) solenoid valve [When pump drive switch is operated in emergency]
				Swing holding brake solenoid valve [When swing holding brake release switch is operated]
		2	30 A	Pump controller (Solenoid power supply)
		3	10 A	PPC oil pressure lock solenoid valve
				Starting motor cut-out relay (PPC lock)
				Starting motor cut-out relay (Personal code)
		4	10 A	Cigarette lighter
				Windshield washer motor
		5	10 A	Horn relay, horn
Switch power supply	F04 (65 A)	6	10 A	Lower wiper
		7	10 A	Beacon
		8	25 A	Working lamp (Front and boom)
		9	10 A	Radio, speaker
				Left knob switch (pump controller input)
		10	10 A	Refuel pump
Switch power supply	F04 (65 A)	11	20 A	Air conditioner unit
				Air conditioner compressor electromagnetic clutch
		12	20 A	Cab lamp (rear), rear worklamp lamp relay
		13	20 A	Cab lamp (headlamp)
		14	10 A	Optional power supply (1)
		15	20 A	Travel alarm, heated seat, 12v power port
				Optional power supply (2)
Constant power supply	F05 (30 A)	16	10 A	Radio (backup power supply)
				Room lamp
		17	20 A	Starting switch
				Machine monitor
				Pump controller
		18	10 A	(Spare)
		19	30 A	Engine controller
Switch power supply	Starting switch ACC	20	5 A	Engine controller (ACC signal)

Locations of fusible links

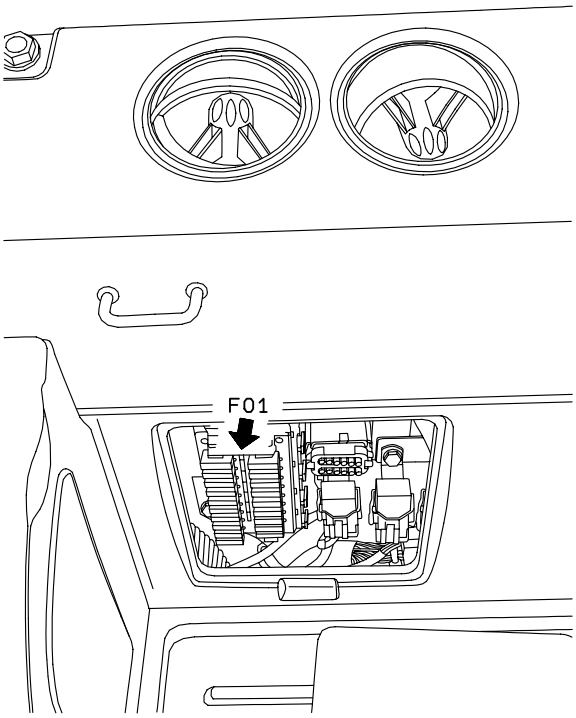


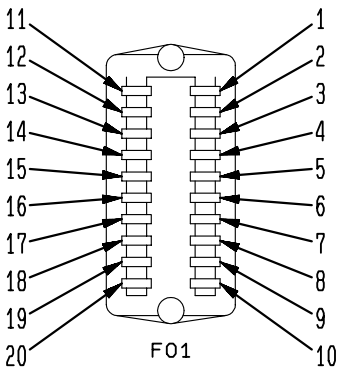
PC240



PC210 / 230

Location of fuse box and fuse Nos.





BWP14233

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 2 3 4	**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 imperfectly 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.**

Related circuit diagram

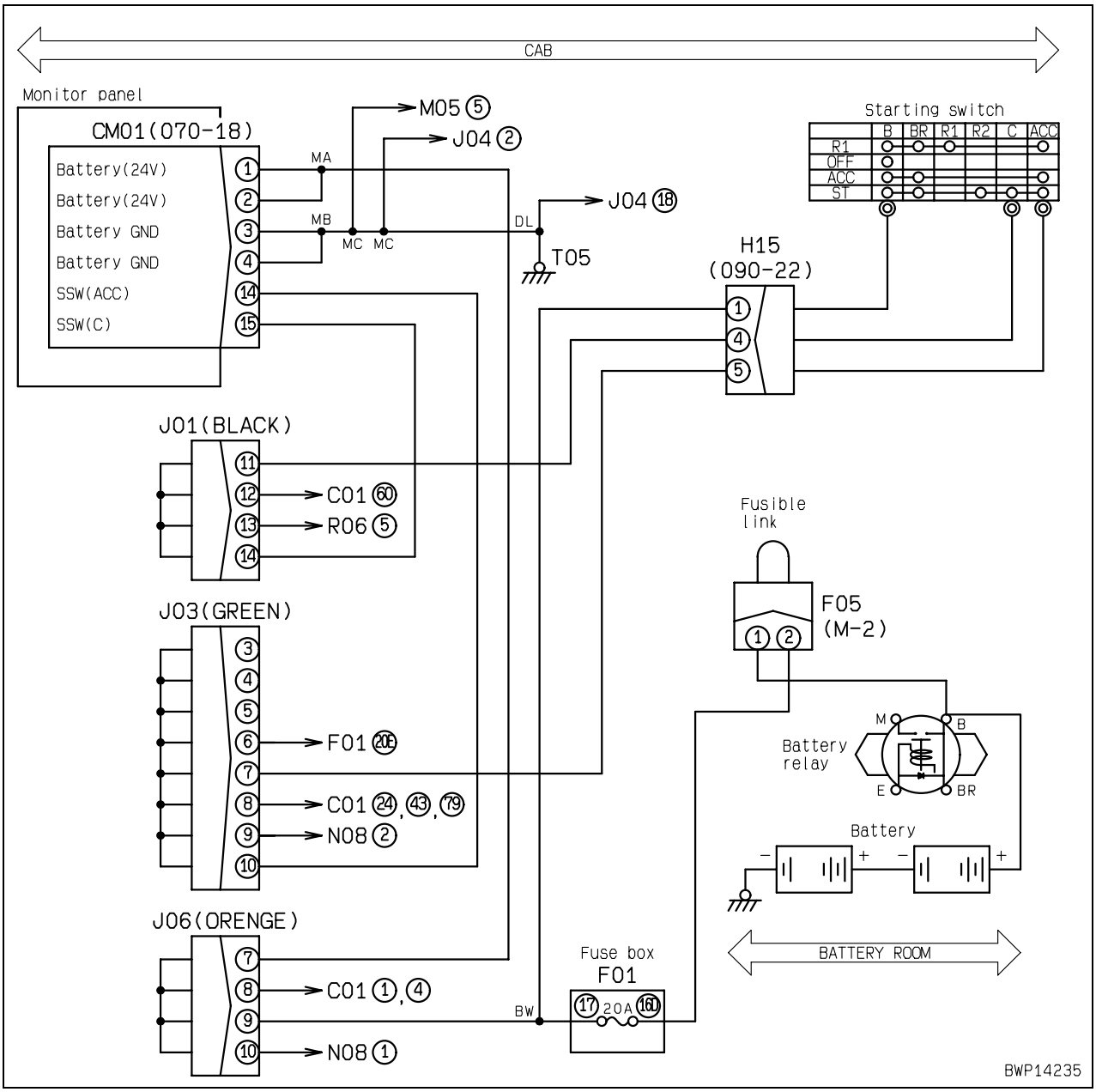
This drawing is a part of the circuit diagram related to troubleshooting.
- Connector No.: Indicates (Model – Number of pins) and (Color).
- "Connector No. and pin No." from each branching/merging point: Shows the ends of branch or source of merging within the parts of the same wiring harness.
- Arrow (↔): Roughly shows the location on the machine.

E-1 When starting switch turned ON, machine monitor displays nothing

Trouble	• When starting switch turned ON, machine monitor displays nothing.
Related information	• When starting switch is turned ON, machine monitor displays KOMATSU logo, screen to input password (if set), screen to check breaker mode (if set), screen of check before starting, screen to check working mode and travel speed, and ordinary screen in order. • When the engine is started, the battery voltage may lower suddenly, depending on the ambient temperature and the condition of the battery.

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Low charge level of battery	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Battery voltage (2 pieces)		Electrolyte specific gravity (1 piece)	
			Min. 24 V		Min. 1.26	
	2	Defective fusible link F05 or fuse No. 20	If fusible link or fuse is broken, circuit probably has ground fault. (See Cause 5.)			
	3	Wrong connection of connector	Machine monitor connector may be connected wrongly. Check it directly. (Check mounting bracket plate with connector.)			
	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 battery (–) – chassis ground		Resistance	Max. 1 Ω
			Wiring harness between battery (+) – R04 – F05 (male) (1)		Resistance	Max. 1 Ω
			Wiring harness between F05 (male) (2) – F01-16D		Resistance	Max. 1 Ω
			Wiring harness between F01-17 – J06 – CM01 (female) (1), (2)		Resistance	Max. 1 Ω
			Wiring harness between CM01 (female) (3), (4) – chassis ground (T05)		Resistance	Max. 1 Ω
			Wiring harness between F01-17 – H15 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between H15 (female) (5) – J03 – CM01 (female) (14)		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 battery (+) – R04 – F05 (male) (1)		Resistance	Min. 1 MΩ
			Wiring harness between F05 (male) (2) – F01-16D		Resistance	Min. 1 MΩ
			Wiring harness between F01-17 – J06 – CM01 (female) (1), (2)		Resistance	Min. 1 MΩ
			Wiring harness between F01-17 – H15 (female) (1)		Resistance	Min. 1 MΩ
			Wiring harness between H15 (female) (5) – J03 – CM01 (female) (14)		Resistance	Min. 1 MΩ
	6	Defective machine monitor	★ Prepare with starting switch OFF, then hold starting switch OFF and ON and carry out troubleshooting in each case.			
			CM01	Starting switch	Voltage	
			Between (1), (2) – (3), (4)	OFF	20 – 30 V	
			Between (14) – (3), (4)	ON	20 – 30 V	

Circuit diagram related to machine monitor power supply

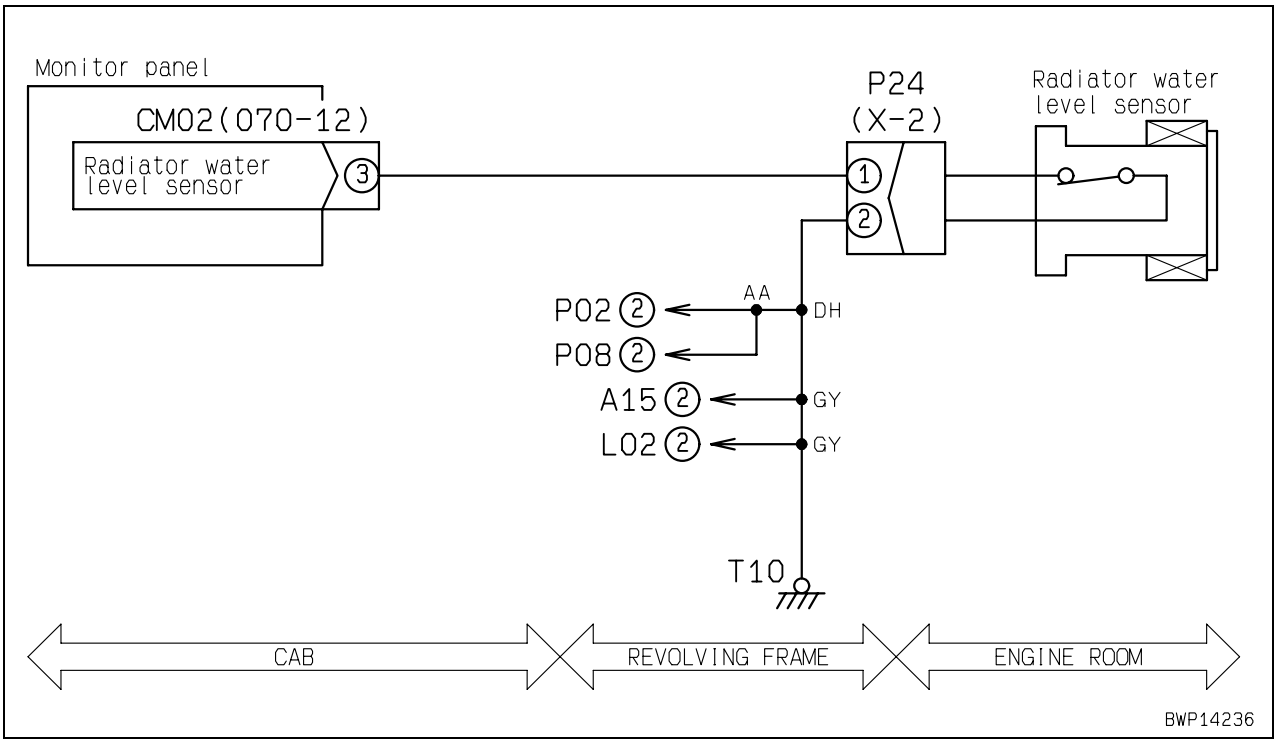


E-2 When starting switch turned ON (before starting engine), basic check item lights up

Trouble	(1) Radiator coolant level monitor lights up red.
Related information	• Although radiator coolant level monitor is basic check item, it is also checked while engine is running. (If monitor lights up red while engine is running, carry out this troubleshooting, too.) • Condition of radiator coolant level switch signal can be checked with monitoring function. (Code: 04500 Monitor input 1)

<table>
<tr><td rowspan="11">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="5">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>1</td><td>Lowering of radiator coolant level (When system is normal)</td><td colspan="5">Coolant level in radiator sub tank may be low. Check it and add coolant if necessary.</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Defective radiator coolant level switch (Internal disconnection)</td><td colspan="5">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>P24 (male)</td><td colspan="2">Sub tank coolant level</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">Between (1) – (2)</td><td colspan="2">Between FULL – LOW</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td colspan="2">Below LOW</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)</td><td colspan="5">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="3">Wiring harness between CM02 (female) (3) – P24 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between P24 (female) (2) – chassis ground (T10)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Defective machine monitor</td><td colspan="5">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td>CM02</td><td colspan="2">Sub tank coolant level</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Between (3) – chassis ground</td><td colspan="2">Between FULL – LOW</td><td colspan="2">Max. 1 V</td></tr>
<tr><td colspan="2">Below LOW</td><td colspan="2">20 – 30 V</td></tr>
</table>

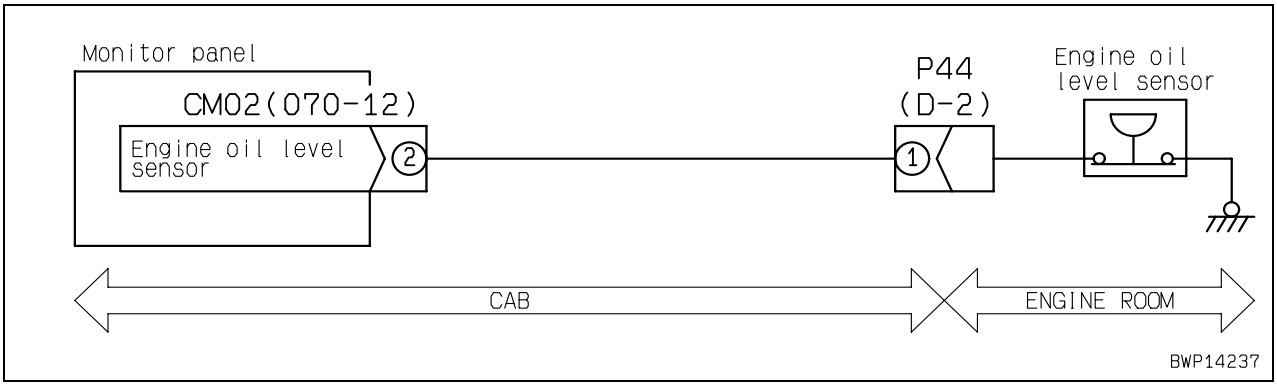
Circuit diagram related to radiator coolant level switch



Trouble	(2) Engine oil level monitor lights up red.
Related information	• Condition of engine oil level switch signal can be checked with monitoring function. (Code: 04501 Monitor input 2)

		Cause	Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Lowering of engine oil level (When system is normal)	Engine oil level may be low. Check it and add oil if necessary.		
	2	Defective engine oil level switch (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			P44 (male)	Engine oil level	Resistance
			Between (1) – chassis ground	Between H – L	Max. 1 Ω
				Below L	Min. 1 MΩ
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CM02 (female) (2) – P44 (female) (1)	Resistance	Max. 1 Ω
	4	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			CM02	Engine oil level	Voltage
			Between (2) – chassis ground	Between H – L	Max. 1 V
				Below L	20 – 30 V

Circuit diagram related to engine oil level switch



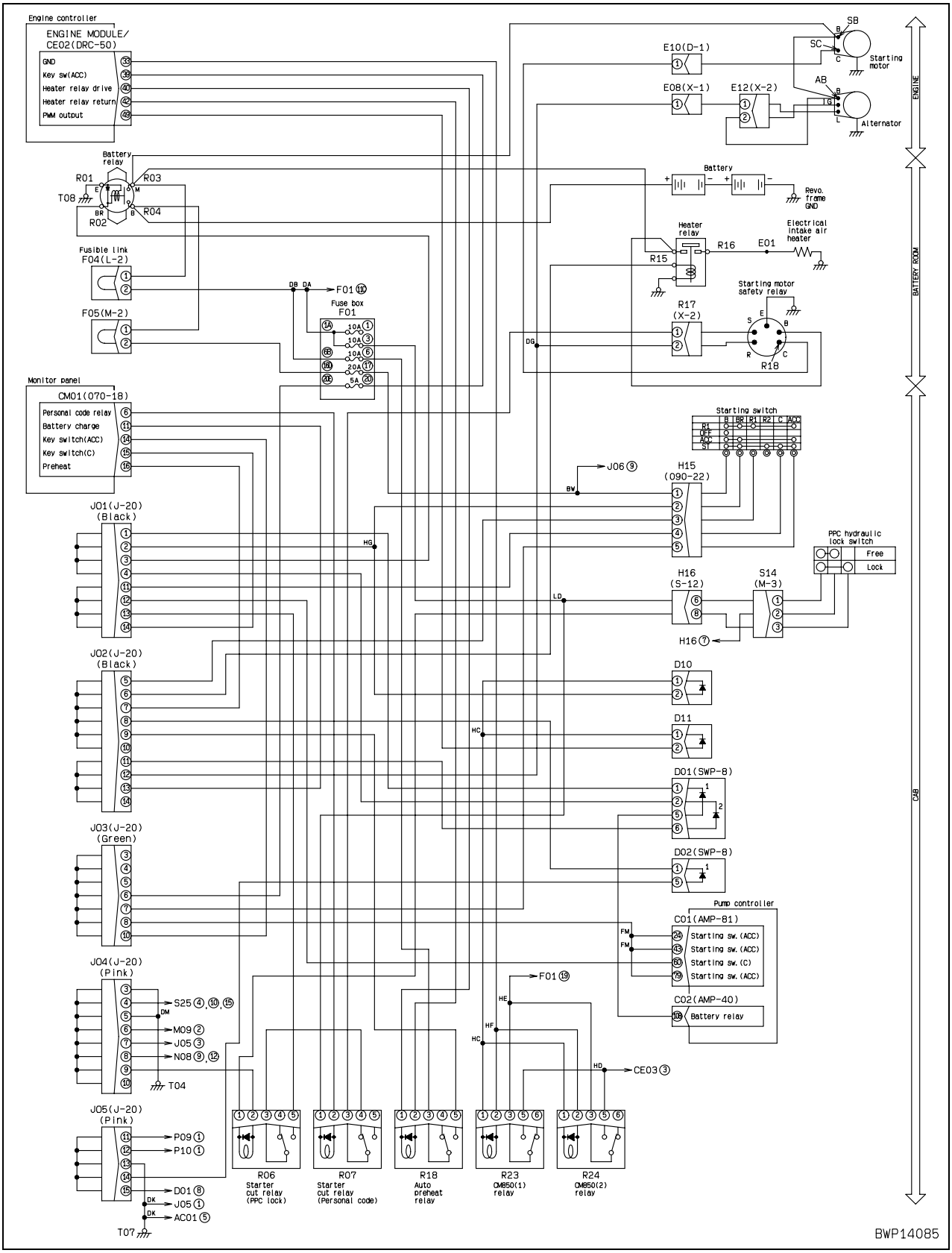
E-3 Engine does not start (Engine does not turn)

Trouble	• Engine does not start (Engine does not turn).
Related information	• Engine starting circuit has following 2 start lock mechanisms. 1) Start lock with password of machine monitor 2) Start lock with lock lever

<table>
<tr><td rowspan="20">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Low charge level of battery</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Battery voltage (2 pieces)</td><td colspan="2">Electrolyte specific gravity (1 piece)</td></tr>
<tr><td colspan="2">Min. 24 V</td><td colspan="2">Min. 1.26</td></tr>
<tr><td>2</td><td>Defective fuse No. 3</td><td colspan="4">If fuse is broken, circuit probably has ground fault. (See cause 10.)</td></tr>
<tr><td rowspan="4">3</td><td rowspan="4">Defective starting switch (Internal disconnection)</td><td colspan="4">★ Prepare with starting switch OFF, then keep starting switch OFF and turn it to START and carry out troubleshooting in each case.</td></tr>
<tr><td>H15 (male)</td><td>Starting switch</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">Between (1) – (4)</td><td>OFF</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>START</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Defective lock lever switch (Internal disconnection)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>S14 (female)</td><td>Lock lever</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">Between (1) – (3)</td><td>Free</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>Lock</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td rowspan="5">5</td><td rowspan="5">Defective starting motor cut-out relay R06 or R07 (Internal disconnection or short circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="3">R06 (male), R07 (male)</td><td>Resistance</td></tr>
<tr><td colspan="3">Between (1) – (2)</td><td>300 – 600 Ω</td></tr>
<tr><td colspan="3">Between (3) – (4)</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Between (3) – (5)</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="6">6</td><td rowspan="6">Defective starting motor safety relay (Internal defect)</td><td colspan="4">★ Prepare with starting switch OFF (with only terminal C disconnected), then turn starting switch to START and carry out troubleshooting.</td></tr>
<tr><td colspan="2">Safety relay terminal</td><td>Voltage</td></tr>
<tr><td>Between B – E</td><td>Power supply</td><td>20 – 30 V</td></tr>
<tr><td>Between R (R17-2) – E</td><td>Generation input</td><td>Max. 1 V</td></tr>
<tr><td>Between S (R17-1) – E</td><td>Starting input</td><td>20 – 30 V</td></tr>
<tr><td>Between C (R18) – E</td><td>Starting output</td><td>20 – 30 V</td></tr>
<tr><td colspan="4">If power supply, generation input, and starting input are normal but starting output is not normal, starting motor safety relay is defective.</td></tr>
</table>

<table>
<tr><td rowspan="20">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="4">7</td><td rowspan="4">Defective starting motor (Internal defect)</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch to START and carry out troubleshooting.</td></tr>
<tr><td colspan="2">Starting motor terminals</td><td colspan="2">Voltage</td></tr>
<tr><td>Between B (SB) – chassis ground</td><td>Power supply</td><td colspan="2">20 – 30 V</td></tr>
<tr><td>Between C (SC) – chassis ground</td><td>Starting input</td><td colspan="2">20 – 30 V</td></tr>
<tr><td colspan="4">If power supply and starting input are normal but starting motor does not turn, starting motor is defective.</td></tr>
<tr><td rowspan="3">8</td><td rowspan="3">Defective alternator (Internal short circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td colspan="2">Alternator</td><td colspan="2">Voltage</td></tr>
<tr><td>Between L – chassis ground</td><td>Generation output</td><td colspan="2">Max. 1 V</td></tr>
<tr><td rowspan="10">9</td><td rowspan="10">Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between H15 (female) (4) – J01 – R06 (female) (5)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between R06 (female) (3) – R07 (female) (4)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between R07 (female) (3) – R17 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between starting motor safety relay B – heater relay – battery relay B</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between starting motor safety relay E – chassis ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between starting motor safety relay C – starting motor C (SC)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between F01-3 – S14 (male) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between S14 (male) (3) – R06 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between R06 (female) (2) – J04 – chassis ground (T04)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="8">10</td><td rowspan="8">Ground fault in wiring harness (Short circuit with GND circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between H15 (female) (4) – J01 – R06 (female) (5), – circuit branch end</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="2">Wiring harness between R06 (female) (3) – R07 (female) (4)</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="2">Wiring harness between R07 (female) (3) – R17 (female) (1)</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="2">Wiring harness between starting motor safety relay B – heater relay – battery relay B</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="2">Wiring harness between starting motor safety relay C – starting motor C (SC)</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="2">Wiring harness between F01-3 – S14 (male) (1)</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="2">Wiring harness between S14 (male) (3) – R06 (female) (1)</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="2">11</td><td rowspan="2">Hot short (Short circuit with 24V circuit) in wiring harness</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td colspan="2">Wiring harness between R17 (female) (2) – alternator L, – circuit branch end</td><td>Voltage</td><td>Max. 1 V</td></tr>
</table>

Circuit diagram related to preheating/starting of engine and charge of battery



E-4 Preheater does not operate

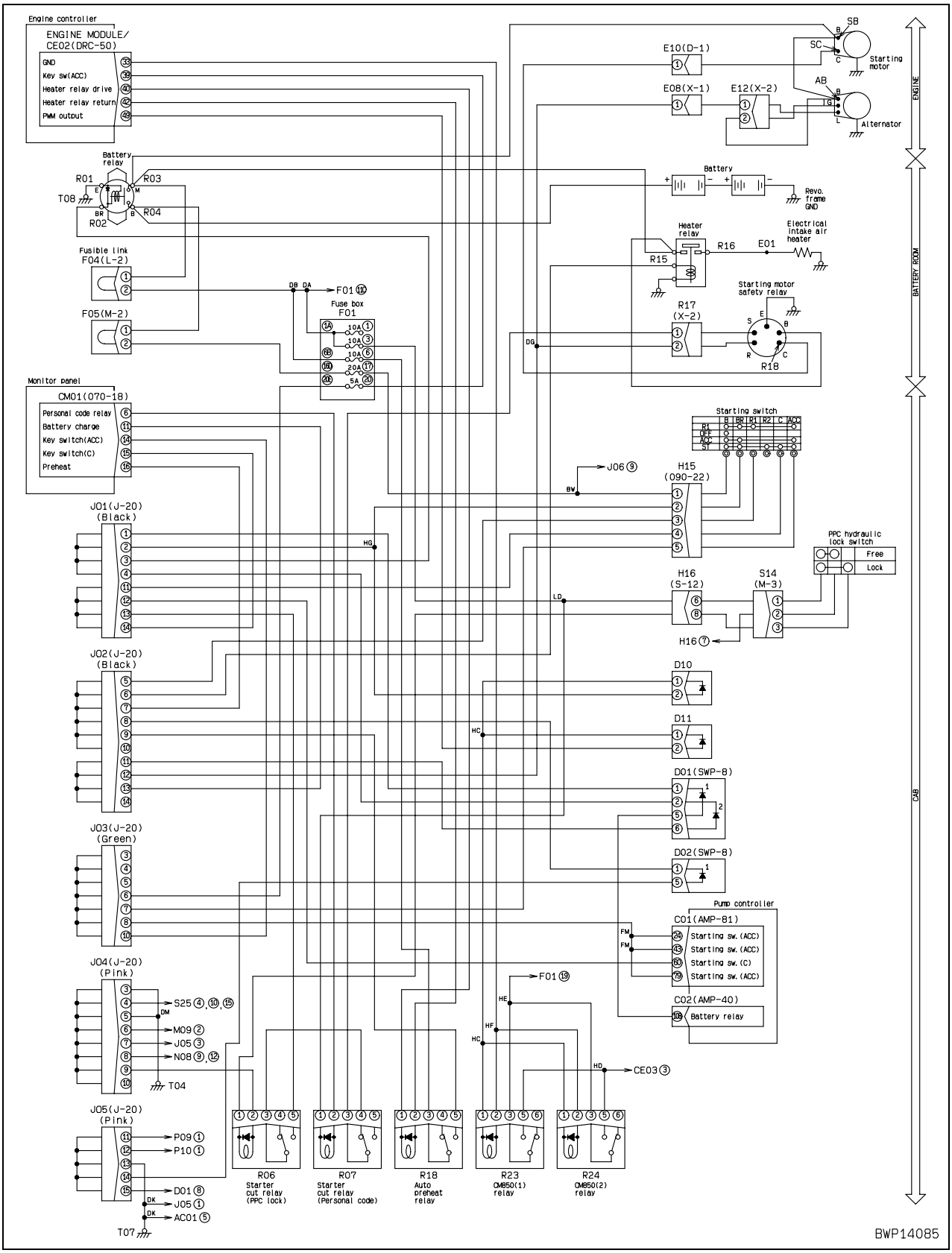
Trouble	(1) When starting switch is turned to HEAT position, preheating monitor does not light up or flash.
Related information	• Preheater monitor lights up when starting switch is turned to HEAT and starts flashing about 30 seconds after to notify completion of preheating (It stops flashing about 10 seconds after). • If engine coolant temperature is below 20°C, automatic warm-up system operates and preheating monitor lights up for up to 30 seconds. • Condition of starting switch (preheating) signal can be checked with the monitoring function. (Code: 04500 Monitor input 1)

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective starting switch (Internal disconnection)	★ Prepare with starting switch OFF, then keep starting switch OFF and turn it to HEAT and carry out troubleshooting in each case.			
			H15 (male)	Starting switch	Resistance	
			Between (1) – (3)	OFF	Min. 1 MΩ	
				HEAT	Max. 1 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CM01 (female) (16) – J02 – H15 (female) (3)		Resistance	Max. 1 Ω
	3	Defective machine monitor	★ Prepare with starting switch OFF, then keep starting switch OFF and turn it to HEAT and carry out troubleshooting in each case.			
			CE02	Starting switch	Voltage	
			Between (16) – chassis ground	OFF	Max. 1 V	
				HEAT	20 – 30 V	

Trouble	(2) When starting switch is turned to HEAT position, intake air heater mounting part does not become warm.
Related information	• Check that engine can be turned with starting motor (If engine cannot be turned, carry out troubleshooting for E-1 Engine does not start (Engine does not turn)).

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective heater relay (Internal disconnection)	★ Prepare with starting switch OFF (with wiring harness connected), then keep starting switch OFF and turn it to HEAT and carry out troubleshooting in each case.			
			Heater relay	Starting switch	Continuity/Resistance	
			Between R15 – chassis ground	OFF	There is continuity	
			Between power supply terminal – R16	HEAT	Max. 1 Ω	
	2	Defective intake air heater (Internal disconnection)	★ Prepare with starting switch OFF (with wiring harness connected), then turn starting switch to HEAT and carry out troubleshooting in each case.			
			E01	Starting switch	Voltage	
			Between terminal – chassis ground	HEAT	20 – 30 V	
			If voltage is normal but heater mounting part does not become warm, intake air heater is defective.			
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between H15 (female) (3) – J02 – heater relay R15		Resistance	Max. 1 Ω
			Wiring harness between battery relay R03 – heater relay contact terminal		Resistance	Max. 1 Ω
			Wiring harness between heater relay R16 – intake air heater E01		Resistance	Max. 1 Ω

Circuit diagram related to preheating/starting of engine and charge of battery

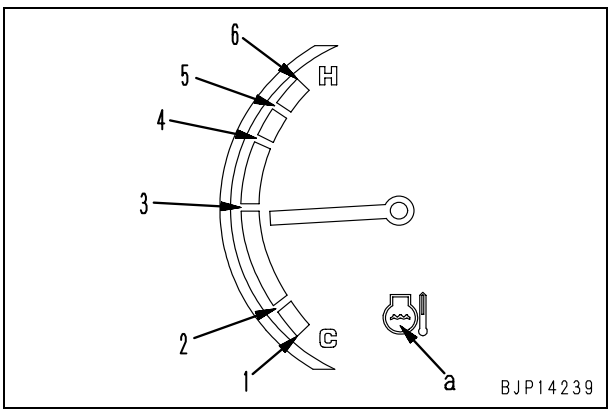


E-5 Automatic warm-up system does not operate (in cold season)

Trouble	• Automatic warm-up system does not operate (in cold season).
Related information	• When engine coolant temperature is below 30°C automatic warm-up system raises engine speed to 1,200 rpm. • If fuel control dial is opened more than 70% for 3 seconds when starting switch is turned ON or after engine is started, automatic warm-up system is turned OFF. (Automatic warm-up system stops automatically after operating for 10 minutes.) • If engine coolant temperature is below 10°C turbocharger protection function operates to keep the engine speed at low idle.

<table>
<tr><td rowspan="10">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="8">1</td><td rowspan="8">Defective engine coolant temperature signal system</td><td colspan="3">★ Turn starting switch ON or start engine and carry out troubleshooting.</td></tr>
<tr><td>Monitoring code</td><td>Engine coolant temperature</td><td>Coolant temperature level</td></tr>
<tr><td rowspan="6">04107
Engine coolant temperature</td><td>105°C</td><td>6 (a: Red)</td></tr>
<tr><td>102°C</td><td>5 (a: Red)</td></tr>
<tr><td>100°C</td><td>4 (a: Blue)</td></tr>
<tr><td>85°C</td><td>3 (a: Blue)</td></tr>
<tr><td>60°C</td><td>2 (a: Blue)</td></tr>
<tr><td>30°C</td><td>1 (a: White)</td></tr>
<tr><td colspan="3">If level of coolant temperature gauge is different from actual coolant temperature, carry out troubleshooting for E-9 Engine coolant temperature gauge does not indicate normally.</td></tr>
<tr><td>2</td><td>Defective engine controller</td><td colspan="3">If cause 1 is not detected, engine controller may be defective.
(Since trouble is in system, troubleshooting cannot be carried out.)</td></tr>
</table>

Engine coolant temperature gauge and engine coolant temperature monitor



E-6 All work equipment, swing, and travel mechanism do not move or cannot be locked

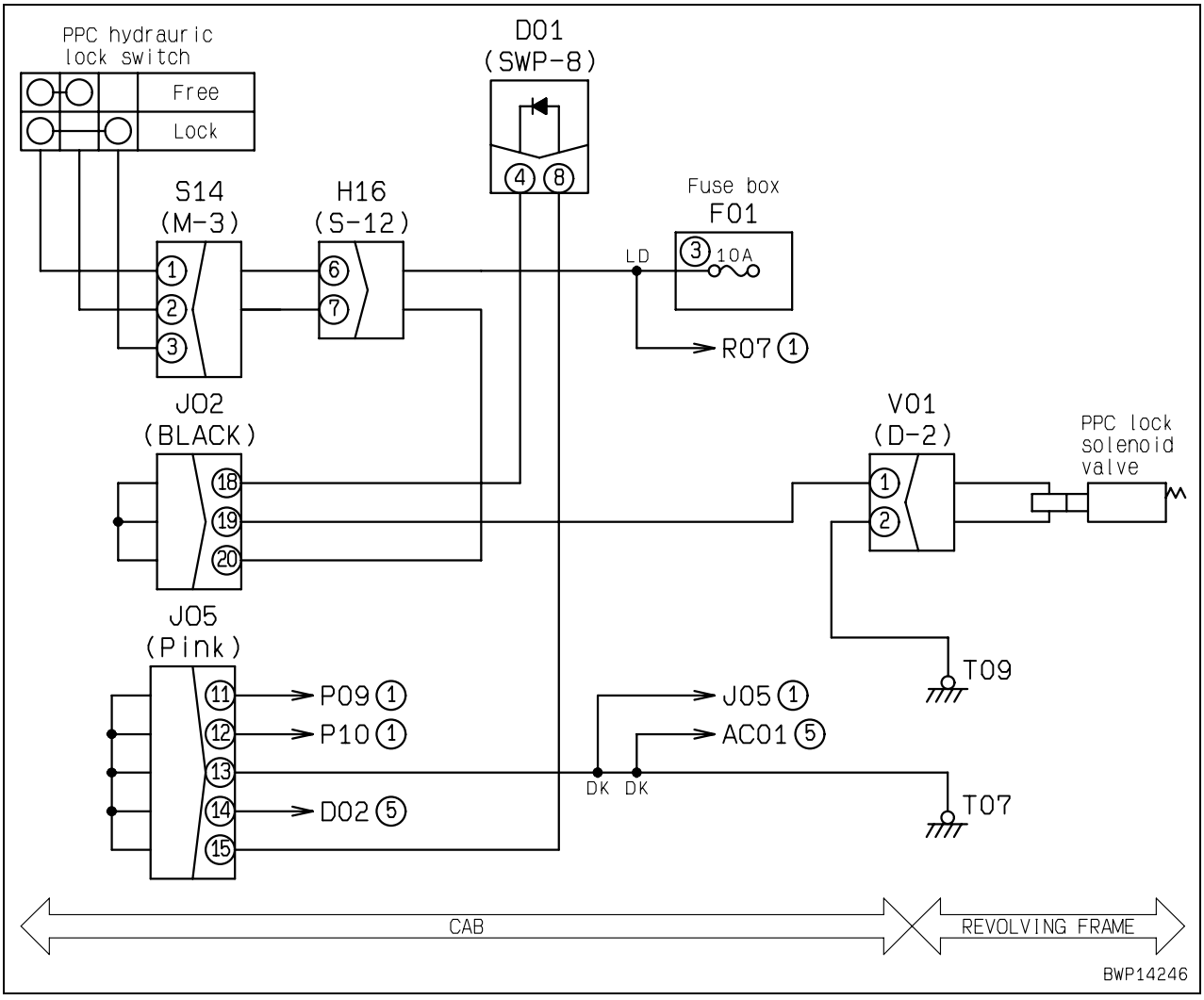
Trouble	(1) All work equipment, swing, and travel mechanism do not move.
Related information	

<table>
<tr><td rowspan="20">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>1</td><td>Defective fuse No. 3</td><td colspan="4">If fuse is broken, circuit probably has ground fault. (See cause 6.)</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Defective lock lever switch (Internal disconnection)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>S14 (female)</td><td>Lock lever</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">Between (1) – (2)</td><td>Lock</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>Free</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td rowspan="4">3</td><td rowspan="4">Defective PPC lock solenoid (Internal disconnection or short circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">V01 (male)</td><td colspan="2">Resistance</td></tr>
<tr><td colspan="2">Between (1) – (2)</td><td colspan="2">20 – 60 Ω</td></tr>
<tr><td colspan="2">Between (1) – chassis ground</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td rowspan="3">4</td><td rowspan="3">Defective assembled-type diode D01 (Internal short circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">D01 (male)</td><td colspan="2">Resistance (Continuity)</td></tr>
<tr><td colspan="2">Between (4) – (8)</td><td colspan="2">Min. 1 MΩ (No continuity)</td></tr>
<tr><td rowspan="4">5</td><td rowspan="4">Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between F01-3 – S14 (male) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between S14 (male) (2) – V01 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between V01 (female) (2) – chassis ground (T09)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="4">6</td><td rowspan="4">Ground fault in wiring harness (Short circuit with GND circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between F01-3 – S14 (male) (1), – circuit branch end</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="2">Wiring harness between S14 (male) (2) – V01 (female) (1), – D01 (female) (4)</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
</table>

Trouble	(2) All work equipment, swing, and travel mechanism cannot be locked.
Related information	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective lock lever switch (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S14 (female)	Lock lever	Resistance	
			Between (1) – (2)	Lock	Min. 1 MΩ	
				Free	Max. 1 Ω	
	2	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 S14 (male) (2) – V01 (female) (1), – D01 (female) (4)		Voltage	Max. 1 V

Circuit diagram related to PPC lock solenoid

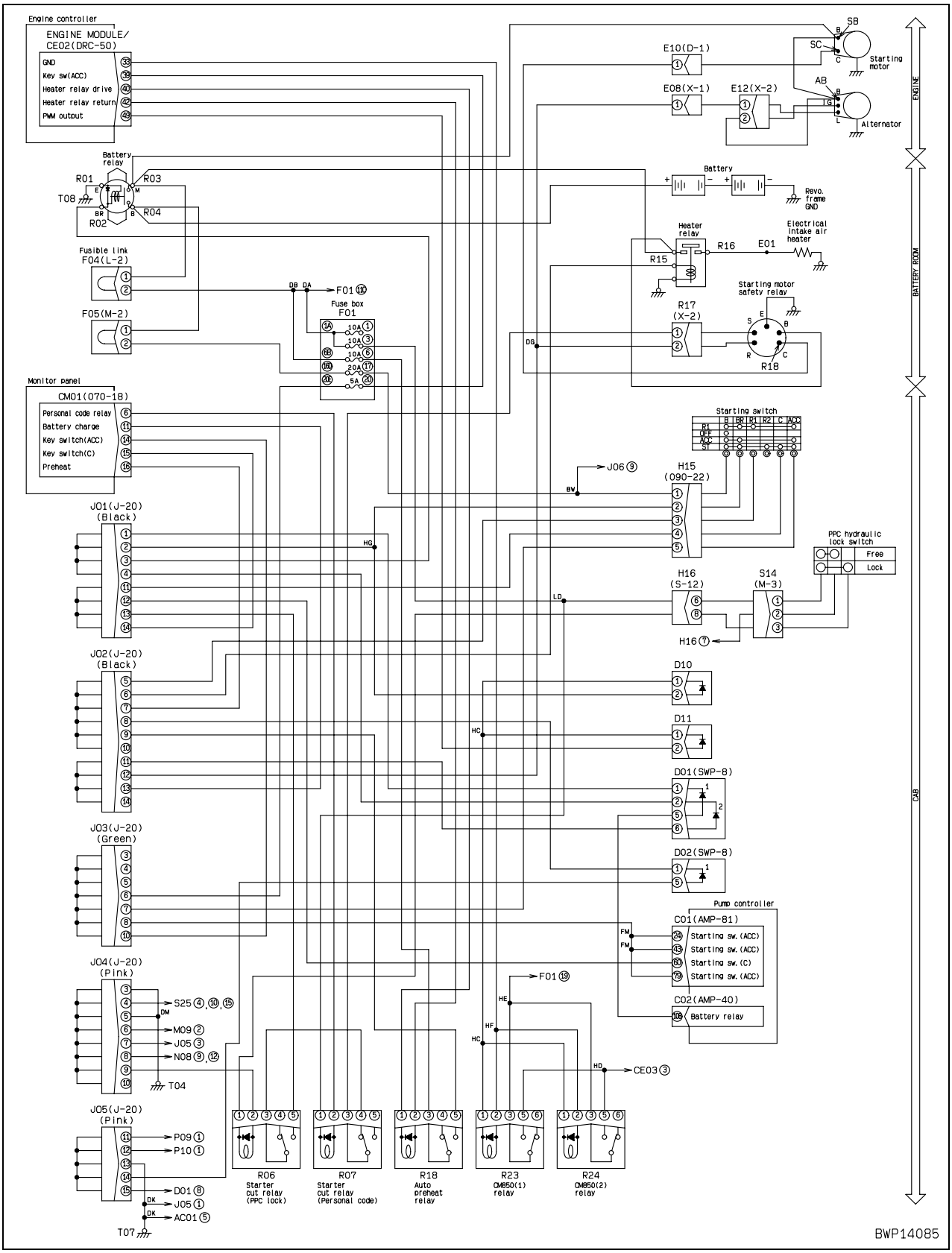


E-7 Precaution lights up while engine is running

Trouble	(1) Charge level monitor lights up red.
Related information	• Signal voltage of alternator can be checked with monitoring function. (Code: 04300 Charge voltage)

<table>
<tr><td rowspan="11">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Defective generation by alternator (when system is normal)</td><td colspan="4">★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.</td></tr>
<tr><td>E12 (male)</td><td>Engine speed</td><td colspan="2">Voltage</td></tr>
<tr><td>Between (1) – chassis ground</td><td>Middle or higher</td><td colspan="2">27.5 – 29.5 V</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between CM01 (female) (11) – J02 – E12 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Ground fault in wiring harness (Short circuit with GND circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between CM01 (female) (11) – J02 – E12 (female) (1), – circuit branch end</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="3">4</td><td rowspan="3">Defective machine monitor</td><td colspan="4">★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.</td></tr>
<tr><td>CM02</td><td>Engine</td><td colspan="2">Voltage</td></tr>
<tr><td>Between (11) – chassis ground</td><td>Running</td><td colspan="2">Min. 7.8 V</td></tr>
</table>

Circuit diagram related to preheating/starting of engine and charge of battery



Trouble	(2) Fuel level monitor lights up red.
Related information	• Signal voltage of fuel sensor can be checked with monitoring function. (Code: 04200 Fuel sensor voltage)

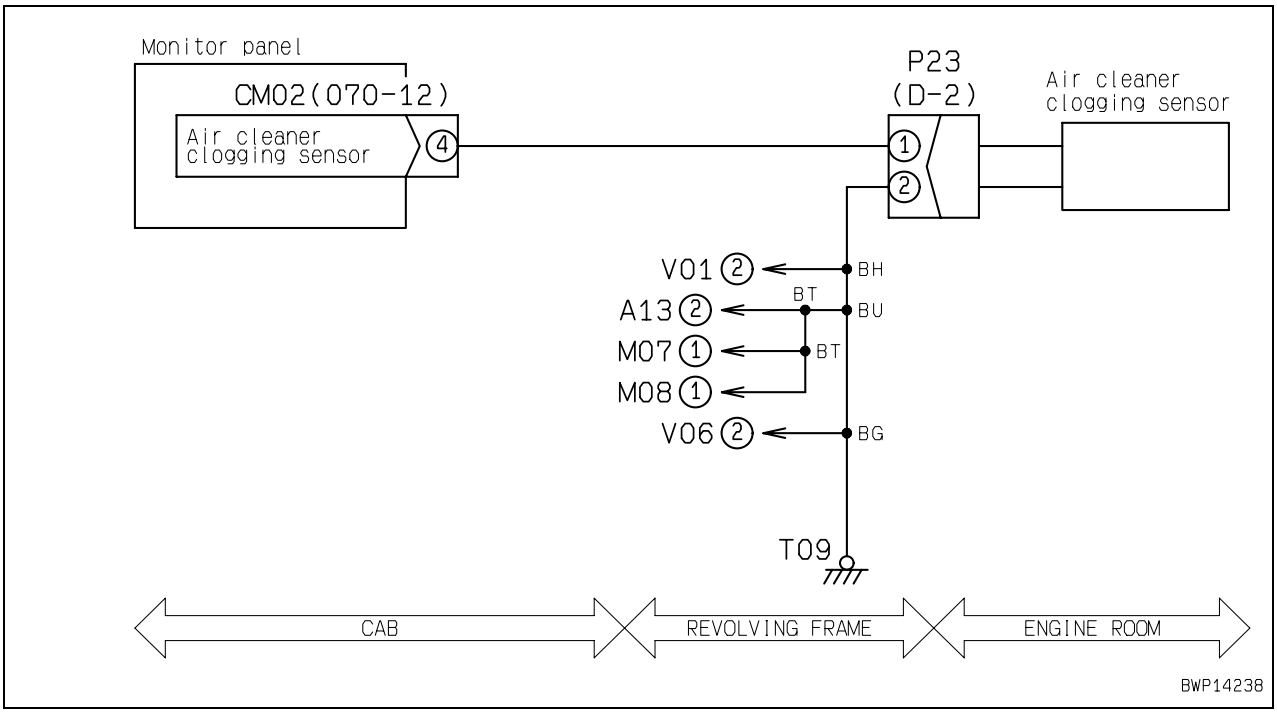
	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Low fuel level (when system is normal)	Fuel level may be low (below about 41 ℓ). Check it and add fuel if necessary.
	2	Defective fuel level gauge system	If cause 1 is not detected, fuel level gauge system may be defective. Carry out troubleshooting for E-11 Fuel level gauge does not indicate normally.

Trouble	(3) Air cleaner clogging monitor lights up red.
Related information	• Condition of signal of air cleaner clogging switch can be checked with monitoring function. (Code: 04501 Monitor input 2)

<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>Clogging of air cleaner (when system is normal)</td><td colspan="4">Air cleaner may be clogged. Check it, then clean or replace if necessary.</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Defective air cleaner clogging switch (Internal disconnection)</td><td colspan="4">★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.</td></tr>
<tr><td>P23 (male)</td><td>Air cleaner</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">Between (1) – (2)</td><td>When normal (Air intake resistance: *1)</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>When clogged (Air intake resistance: *2)</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between CM02 (female) (4) – P23 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between P23 (female) (2) – chassis ground (T09)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Defective machine monitor</td><td colspan="4">★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.</td></tr>
<tr><td>CM02</td><td>Air cleaner</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Between (4) – chassis ground</td><td>When normal (Air intake resistance: *1)</td><td colspan="2">Max. 1 V</td></tr>
<tr><td>When clogged (Air intake resistance: *2)</td><td colspan="2">20 – 30 V</td></tr>
</table>

*1: Max. –3,430 Pa {Max. –350 mmH_2O}
*2: –7,470 ± 490 Pa {–762 ± 50 mmH_2O}

Circuit diagram related to air cleaner clogging switch



Trouble	(4) Engine coolant temperature monitor lights up white.
Related information	• Signals of engine coolant temperature sensor are input to engine controller and then transmitted to machine monitor through communication system. • Engine coolant temperature can be checked with monitoring function. (Code: 04107 Engine coolant temperature)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Insufficient warm-up of machine (when system is normal)	If monitor lights up white, engine coolant temperature may be low (below about 30°C). Warm up engine. • Lighting up white: Engine coolant temperature is low. • Lighting up blue: Engine coolant temperature is proper.
	2	Defective engine coolant temperature gauge system	If cause 1 is not detected, engine coolant temperature gauge system may be defective. Carry out troubleshooting for E-9 Engine coolant temperature gauge does not indicate normally.

Trouble	(5) Water separator monitor lights up red.
Related information	• Condition of signal of water-in-fuel sensor switch can be checked with monitoring function. (Code: 18800 WIF sensor condition)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Water separator is full (when system is normal)	Water separator may be full of water. Check it, then drain if full.
	2	Defective water-in-fuel sensor system	If cause 1 is not detected, water-in-fuel sensor system may be defective. Carry out troubleshooting for failure codes [**CA428**] and [**CA429**].

Trouble	(6) Hydraulic oil temperature monitor lights up white.
Related information	• Signals of hydraulic oil temperature sensor are input to pump controller and then transmitted to machine monitor through communication system. • Hydraulic oil temperature can be checked with monitoring function. (Code: 04401 Hydraulic oil temperature)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Insufficient warm-up of machine (when system is normal)	If monitor lights up white, hydraulic oil temperature may be low (below about 20°C). Warm up engine. • Lighting up white: Hydraulic oil temperature is low. • Lighting up blue: Hydraulic oil temperature is proper.
	2	Defective hydraulic oil temperature gauge system	If cause 1 is not detected, hydraulic oil temperature gauge system may be defective. Carry out troubleshooting for E-10 Hydraulic oil temperature gauge does not indicate normally.

E-8 Emergency stop item lights up while engine is running

Trouble	(1) Engine coolant temperature monitor lights up red.
Related information	• Signals of engine coolant temperature sensor are input to engine controller and then transmitted to machine monitor through communication system. • Engine coolant temperature can be checked with monitoring function. (Code: 04107 Engine coolant temperature)

	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Overheating of engine coolant (when system is normal)	If monitor lights up red, engine coolant temperature may be high (above about 102°C). Cool down engine coolant (Run engine at low idle). • Lighting up red: Engine coolant temperature is high (overheating). • Lighting up blue: Engine coolant temperature is proper.
	2	Defective engine coolant temperature gauge system	If cause 1 is not detected, engine coolant temperature gauge system may be defective. Carry out troubleshooting for E-9 Engine coolant temperature gauge does not indicate normally.

Trouble	(2) Hydraulic oil temperature monitor lights up red.
Related information	• Signals of hydraulic oil temperature sensor are input to pump controller and then transmitted to machine monitor through communication system. • Hydraulic oil temperature can be checked with monitoring function. (Code: 04401 Hydraulic oil temperature)

	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Overheating of hydraulic oil (when system is normal)	If monitor lights up red, hydraulic oil temperature may be high (above about 102°C). Cool down hydraulic oil (Run engine at low idle). • Lighting up red: Hydraulic oil temperature is high (overheating). • Lighting up blue: Hydraulic oil temperature is proper.
	2	Defective hydraulic oil temperature gauge system	If cause 1 is not detected, hydraulic oil temperature gauge system may be defective. Carry out troubleshooting for E-10 Hydraulic oil temperature gauge does not indicate normally.

Trouble	(3) Engine oil pressure monitor lights up red.
Related information	• Signals of engine oil pressure switch are input to engine controller and then transmitted to machine monitor through communication system.

	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. If it is low, carry out troubleshooting for S-12 Oil pressure lowers.
	2	Defective engine oil pressure switch system	If cause 1 is not detected, engine oil pressure gauge system may be defective. Carry out troubleshooting for failure code [**CA435**].

E-9 Engine coolant temperature gauge does not indicate normally

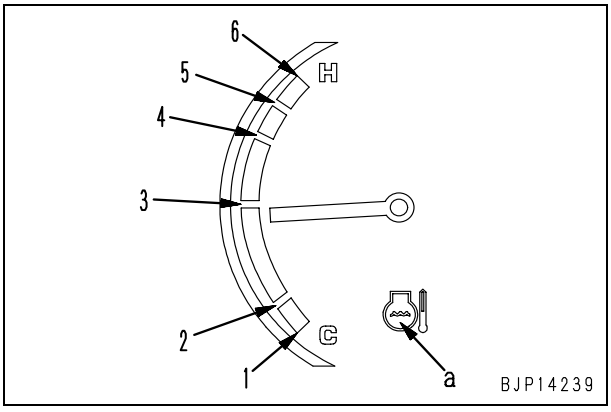
Trouble	(1) While engine coolant temperature is rising normally, temperature gauge does not rise from white range (C). (2) While engine coolant temperature is stabilized normally, temperature gauge rises to red range (H).
Related information	• Signals of engine coolant temperature sensor are input to engine controller and then transmitted to machine monitor through communication system. • Engine coolant temperature can be checked with monitoring function. (Code: 04107 Engine coolant temperature)

	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Defective engine coolant temperature sensor system	If cause 1 is not detected, engine coolant temperature sensor system may be defective. Carry out troubleshooting for failure codes [**CA144**] and [**CA145**].
	2	Defective machine monitor	If cause 1 is not detected, machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Trouble	(3) Display of coolant temperature gauge is different from actual engine coolant temperature. (4) Display of engine coolant temperature gauge is different from display of engine coolant temperature monitor.
Related information	• Signals of engine coolant temperature sensor are input to engine controller and then transmitted to machine monitor through communication system. • Engine coolant temperature can be checked with monitoring function. (Code: 04107 Engine coolant temperature)

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective machine monitor	★ Turn starting switch ON or start engine and carry out troubleshooting.		
			Engine coolant temperature	Coolant temperature level	Color of monitor light (a)
			105°C	6	Red
			102°C	5	
			100°C	4	Blue
			85°C	3	
			60°C	2	
			30°C	1	White

Engine coolant temperature gauge and engine coolant temperature monitor

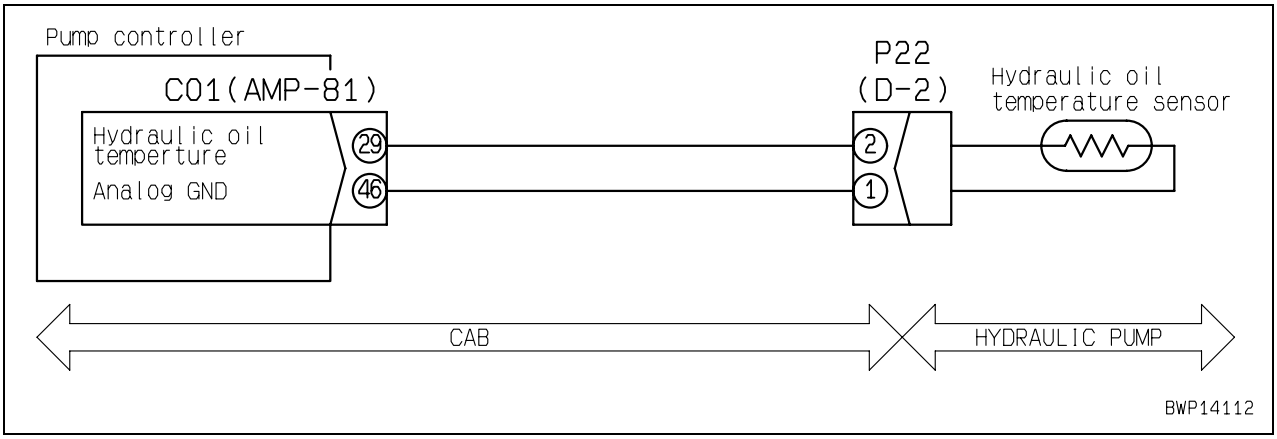


E-10 Hydraulic oil temperature gauge does not indicate normally

Trouble	(1) While hydraulic oil temperature is rising normally, temperature gauge does not rise from white range (C). (2) While hydraulic oil temperature is stabilized normally, temperature gauge rises to red range (H).
Related information	• Signals of hydraulic oil temperature sensor are input to pump controller and then transmitted to machine monitor through communication system. • Hydraulic oil temperature can be checked with monitoring function. (Code: 04401 Hydraulic oil temperature)

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective hydraulic oil temperature sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			P22 (male)	Resistance		
			Between (1) – (2)	3.5 – 90 kΩ		
			Between (2) – chassis ground	Min. 1 MΩ		
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (29) – P22 (female) (2)	Resistance	Max. 1 Ω	
			Wiring harness between C01 (female) (46) – P22 (female) (1)	Resistance	Max. 1 Ω	
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (29) – P22 (female) (2)	Resistance	Min. 1 MΩ	
	4	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between C01 (female) (29) – P22 (female) (2)	Voltage	Max. 1 V	
	5	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C01 (female)	Resistance		
			Between (29) – (46)	3.5 – 90 kΩ		
			Between (29) – chassis ground	Min. 1 MΩ		
	6	Defective machine monitor	If causes 1 – 5 are not detected, machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)			

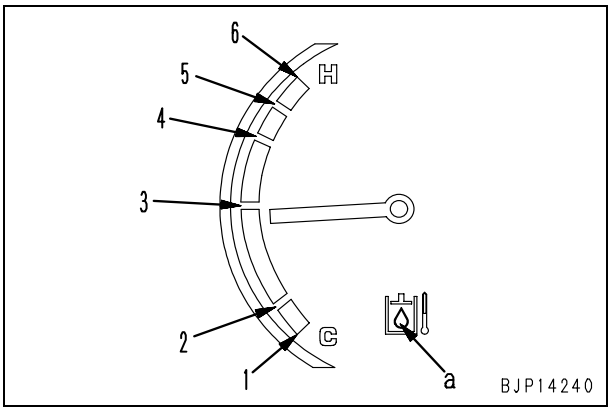
Circuit diagram related to hydraulic oil temperature sensor



Trouble	(3) Display of hydraulic oil temperature gauge is different from actual hydraulic oil temperature. (4) Display of hydraulic oil temperature gauge is different from display of hydraulic oil temperature monitor.
Related information	• Signals of hydraulic oil temperature sensor are input to pump controller and then transmitted to machine monitor through communication system. • Hydraulic oil temperature can be checked with monitoring function. (Code: 04401 Hydraulic oil temperature)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
			★ Turn starting switch ON or start engine and carry out troubleshooting.		
			Hydraulic oil temperature	Hydraulic oil temperature level	Color of monitor light (a)
	1	Defective machine monitor	105°C	6	Red
			102°C	5	
			100°C	4	Blue
			85°C	3	
			40°C	2	
			20°C	1	White

Hydraulic oil temperature gauge and hydraulic oil temperature monitor

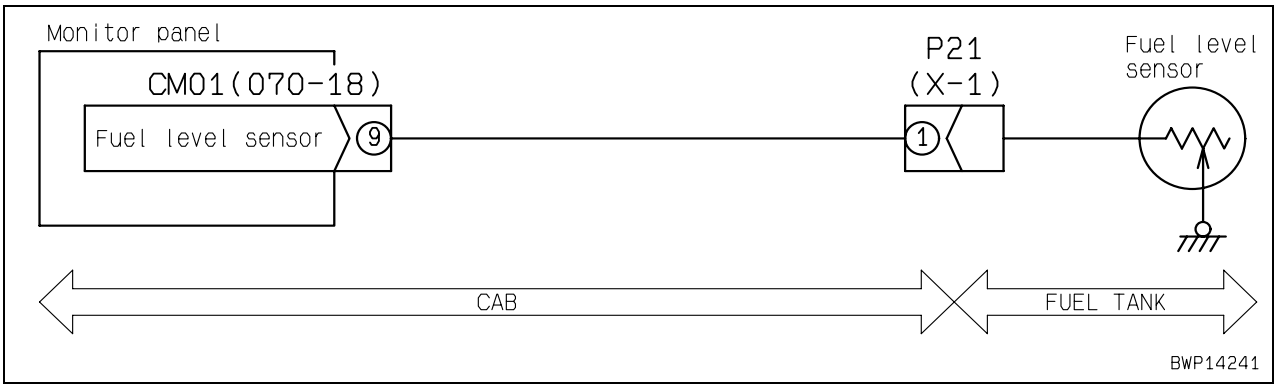


E-11 Fuel level gauge does not indicate normally

Trouble	(1) While fuel is added, fuel level gauge does not rise from red range (E). (2) While fuel level is low, fuel level gauge does not lower from green range top (F)
Related information	• Signal voltage of fuel level sensor can be checked with monitoring function. (Code: 04200 Fuel level sensor voltage)

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fuel level sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			P21 (male)	Fuel level	Resistance	
			Between (1) – chassis ground	FULL	7 – 11 Ω	
				EMPTY	85 – 95 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CM01 (female) (9) – P21 (female) (1)		Resistance	Max. 1 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CM01 (female) (9) – P21 (female) (1)		Resistance	Min. 1 MΩ
	4	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between CM01 (female) (9) – P21 (female) (1)		Voltage	Max. 1 V
	5	Defective machine monitor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			CM01 (female)	Fuel level	Resistance	
			Between (9) – chassis ground	FULL	7 – 11 Ω	
				EMPTY	85 – 95 Ω	

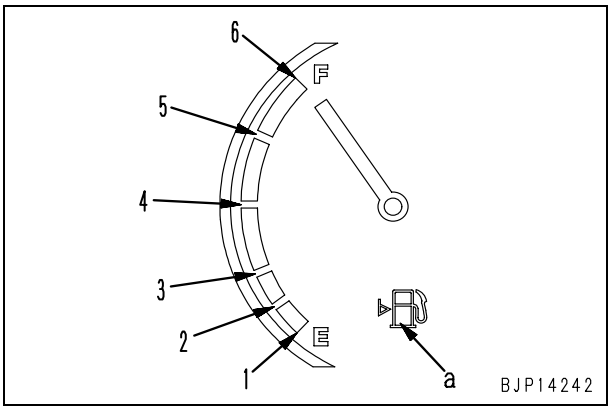
Circuit diagram related to fuel level sensor



Trouble	(3) Display of fuel level gauge is different from actual fuel level. (4) Display of fuel level gauge is different from display of fuel level monitor.
Related information	• Signal voltage of fuel level sensor can be checked with monitoring function. (Code: 04200 Fuel level sensor voltage)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
			★ Turn starting switch ON or start engine and carry out troubleshooting.		
			Quantity of fuel	Reading of fuel level gauge	Color of monitor light (a)
	1	Defective machine monitor	289 ℓ	6	Blue
			244.5 ℓ	5	
			200 ℓ	4	
			100 ℓ	3	
			60 ℓ	2	
			41 ℓ	1	Red

Fuel level gauge and fuel level monitor



E-12 Contents of display by machine monitor are different from applicable machine

Trouble	Contents of display by machine monitor are different from applicable machine.
Related information	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Defective model code signal	★ Turn starting switch ON and carry out troubleshooting (with monitoring function).	
			Monitoring code	Normal display
			00200 Controller model code	PC210-8: PC210 PC240-8: PC240
			If display of monitoring is abnormal, carry out troubleshooting for failure code [**DA29KQ**].	
	2	Defective machine monitor	If cause 1 is not detected, machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)	

E-13 Machine monitor does not display some items

Trouble	• Machine monitor does not display some items.
Related information	• The LCD panel sometimes has black points (points which are not lighted) and bright points (points which do not go off) for the reason of its characteristics. If the number of the bright points and black points does not exceed 10, those points are not a failure or a defect.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective machine monitor (LCD panel)	★ Turn starting switch ON and carry out troubleshooting.
			When following switches are operated, if all LCD panel is lighted up (all surface becomes white), LCD panel is normal. • Operation of switches: [4] + [F2] (Press simultaneously)
	2	Defective machine monitor (body)	If cause 1 is not detected, machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

E-14 Function switch does not work

Trouble	• Function switch does not work.
Related information	• Condition of signal of function switch can be checked with monitoring function. (Code: 04503 Monitor function switch)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective machine monitor	Machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

E-15 Auto-decelerator does not operate normally

Trouble	(1) When auto-decelerator switch is operated, auto-decelerator monitor does not light up or does not go off.
Related information	• Condition of signal of auto-decelerator switch can be checked with monitoring function. (Code: 04504 Monitor 1st, 2nd line switches)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective machine monitor	Machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Trouble	(2) Auto-decelerator is not operated or reset with lever.
Related information	• Set speed of auto-decelerator is 1,400 rpm. If fuel control dial is not set above this speed, auto-decelerator is not operated or reset.

<table>
<tr><td rowspan="11">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="9">1</td><td rowspan="9">Defective PPC pressure signal</td><td colspan="3">★ Start engine and carry out troubleshooting (with monitoring function).</td></tr>
<tr><td>Monitoring code</td><td>Item</td><td>Normal display</td></tr>
<tr><td rowspan="6">01900
Pressure switch 1</td><td>Swing</td><td rowspan="6">When lever is operated: ON
When lever is in neutral: OFF</td></tr>
<tr><td>Travel</td></tr>
<tr><td>Boom lower</td></tr>
<tr><td>Boom raise</td></tr>
<tr><td>Arm curl</td></tr>
<tr><td>Arm dump</td></tr>
<tr><td rowspan="3">01901
Pressure switch 2</td><td>Bucket curl</td><td rowspan="3">When lever is operated: ON
When lever is in neutral: OFF</td></tr>
<tr><td>Bucket dump</td></tr>
<tr><td>Service</td></tr>
<tr><td colspan="3">If display of monitoring is abnormal, carry out troubleshooting for E-26 Monitoring function does not display lever control signal normally.</td></tr>
<tr><td>2</td><td>Defective machine monitor</td><td colspan="3">If cause 1 is not detected, machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)</td></tr>
<tr><td>3</td><td>Defective pump controller</td><td colspan="3">If cause 1 is not detected, pump controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)</td></tr>
<tr><td>4</td><td>Defective engine controller</td><td colspan="3">If cause 1 is not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)</td></tr>
</table>

E-16 Working mode does not change

Trouble	(1) When working mode switch is operated, working mode selection screen is not displayed.
Related information	• Condition of signal of working mode switch can be checked with monitoring function. (Code: 04504 Monitor 1st, 2nd line switches)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective machine monitor	Machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Trouble	(2) When working mode is changed, setting of engine and hydraulic pump is not changed.
Related information	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective machine monitor	Machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)
	2	Defective pump controller	Pump controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

E-17 Travel speed does not change

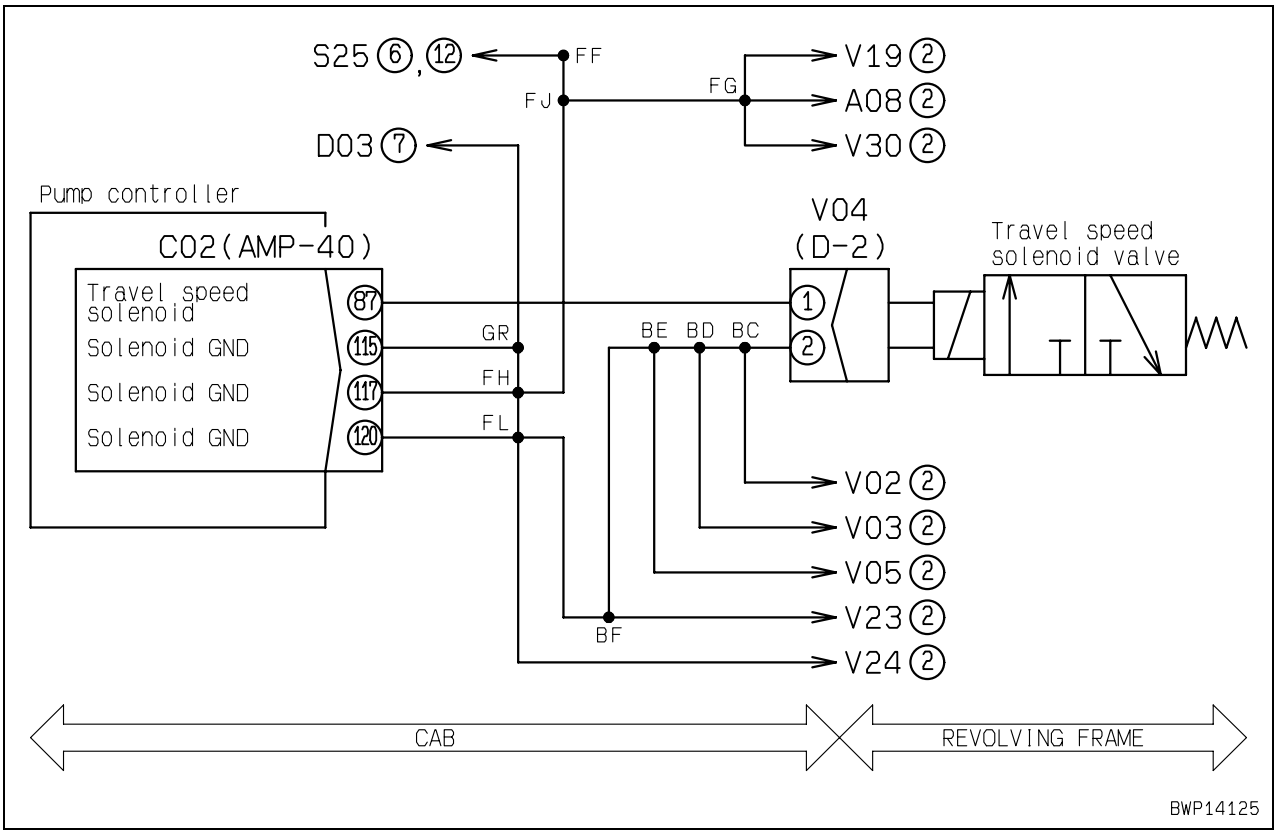
Trouble	(1) When travel speed switch is operated, travel speed monitor does not change.
Related information	• Condition of signal of travel speed switch can be checked with monitoring function. (Code: 04504 Monitor 1st, 2nd line switches)

Possible causes and standard value in normal state		Cause	Standard value in normal state/Remarks on troubleshooting
	1	Defective machine monitor	Machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Trouble	(2) When travel speed is shifted, actual travel speed does not change.
Related information	• If cause 1 occurs, actual travel speed does not lower when travel speed is shifted to Lo.

Possible causes and standard value in normal state		Cause	Standard value in normal state/Remarks on troubleshooting		
	1	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 C02 (female) (87) – V04 (female) (1)	Voltage	Max. 1 V
	2	Defective machine monitor	If cause 1 is not detected, machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		
	3	Defective pump controller	If cause 1 is not detected, pump controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related to travel speed shifting solenoid



E-18 Alarm buzzer cannot be stopped

Trouble	• Alarm buzzer cannot be stopped.
Related information	• Condition of signal of alarm buzzer cancel switch can be checked with monitoring function. (Code: 04503 Monitor 1st, 2nd line switches)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective machine monitor	Machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

E-19 Windshield wiper and window washer do not operate

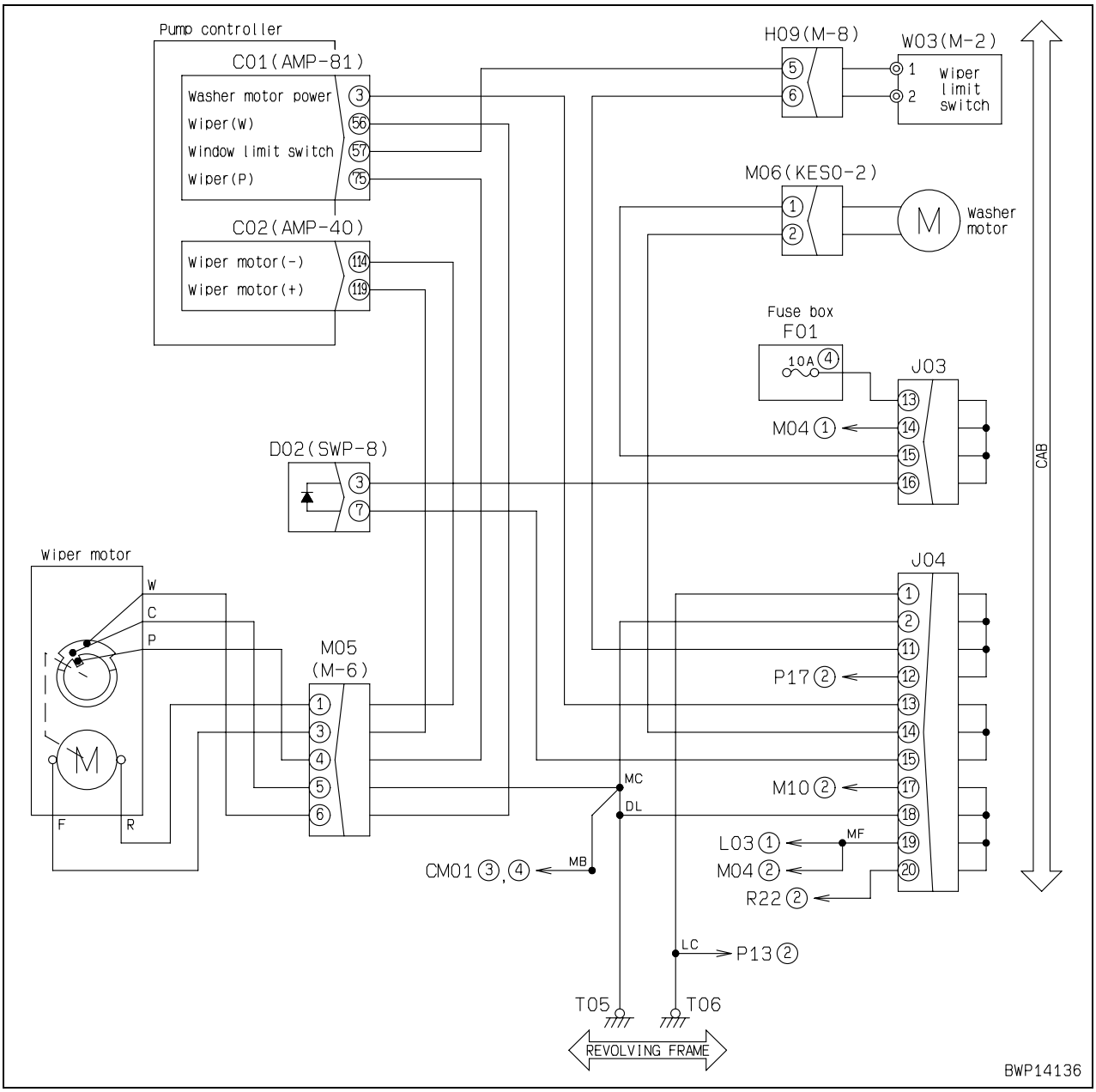
Trouble	(1) When wiper switch is operated, wiper monitor does not light up or go off.
Related information	• Condition of wiper switch signal can be checked with monitoring function. (Code: 04504 Monitor 1st, 2nd line switches)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective machine monitor	Machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Trouble	(2) When wiper switch is operated, wiper does not operate.
Related information	• Condition of window rear limit switch signal can be checked with monitoring function. (Code: 02204 Switch 5)

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective window rear limit switch (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			W03 (male)	Front window	Resistance	
			Between (1) – (2)	When installed to front	Min. 1 MΩ	
				When retracted to rear	Max. 1 Ω	
	2	Defective wiper motor (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			M05 (female)		Continuity	
			Between (1) – (3)		There is continuity	
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C02 (female) (119) – M05 (male) (3)		Resistance	Max. 1 Ω
			Wiring harness between C02 (female) (114) – M05 (male) (1)		Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C01 (female) (57) – W03 (female) (1)		Resistance	Min. 1 MΩ
	5	Defective pump controller (Rear limit switch system)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C01 (female)	Front window	Resistance	
			Between (57) – chassis ground	When installed to front	Min. 1 MΩ	
				When retracted to rear	Max. 1 Ω	
		Defective pump controller (Wiper motor system)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C02 (female)		Continuity	
			Between (119) – (114)		There is continuity	

Circuit diagram related to windshield wiper and window washer



Trouble	(3) When window washer switch is operated, window washer does not operate.
Related information	• Condition of window washer switch signal can be checked with monitoring function. (Code: 04504 Monitor 1st, 2nd line switches)

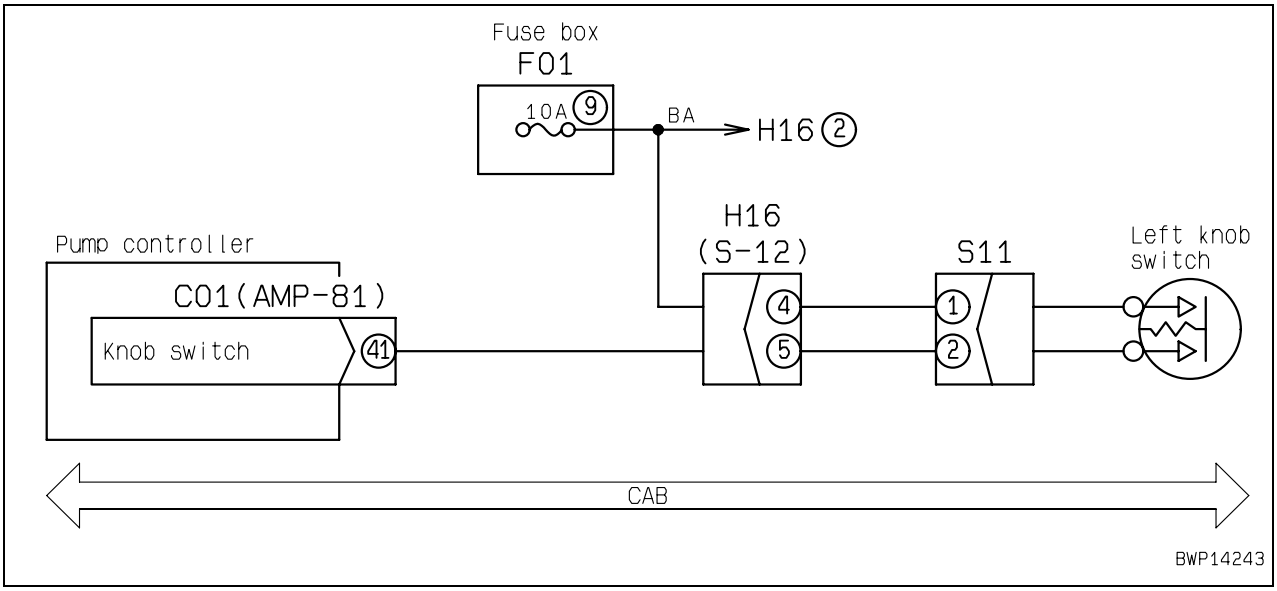
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective machine monitor	Machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

E-20 Power maximizing function does not operate normally

Trouble	(1) When left knob switch is pressed, one-touch power maximizing monitor is not displayed. (2) When left knob switch is pressed, work equipment power is not increased.
Related information	• One-touch power maximizing function does not work when working mode is not power mode (P) or economy mode (E). • Condition of left knob switch signal can be checked with monitoring function. (Code: 02200 Switch input 1)

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fuse No. 9	If fuse is broken, circuit probably has ground fault. (See cause 4.)			
	2	Defective left knob switch (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S11 (male)	Left knob switch	Resistance	
			Between (1) – (2)	Released	Min. 1 MΩ	
				Pressed	Max. 1 Ω	
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between F01-9 – S11 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between S11 (female) (2) – C01 (female) (41)		Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between F01-9 – S11 (female) (1)		Resistance	Min. 1 MΩ
			Wiring harness between S11 (female) (2) – C01 (female) (41)		Resistance	Min. 1 MΩ
	5	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			C01 (female)	Left knob switch	Resistance	
			Between (41) – chassis ground	Released	Min. 1 MΩ	
				Pressed	Max. 1 Ω	
	6	Defective machine monitor	Machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)			

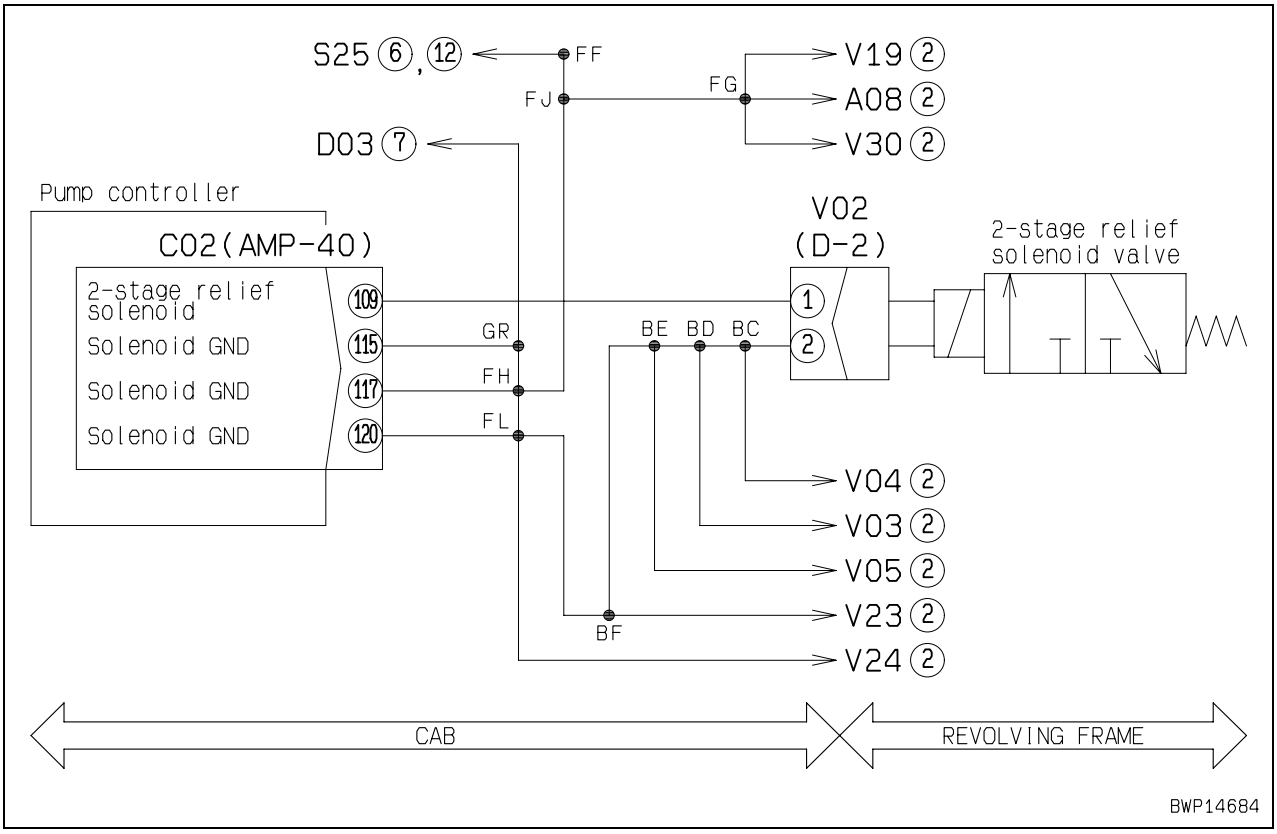
Circuit diagram related to left knob switch



Trouble	(3) When left knob switch is released, work equipment power does not return to normal level.
Related information	• Condition of left knob switch signal can be checked with monitoring function. (Code: 02200 Switch input 1)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	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 C02 (female) (109) – V02 (female) (1)	Voltage	Max. 1 V
	2	Defective pump controller	If cause 1 is not detected, pump controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related to 2-stage relief solenoid



E-21 Swing holding brake does not operate normally

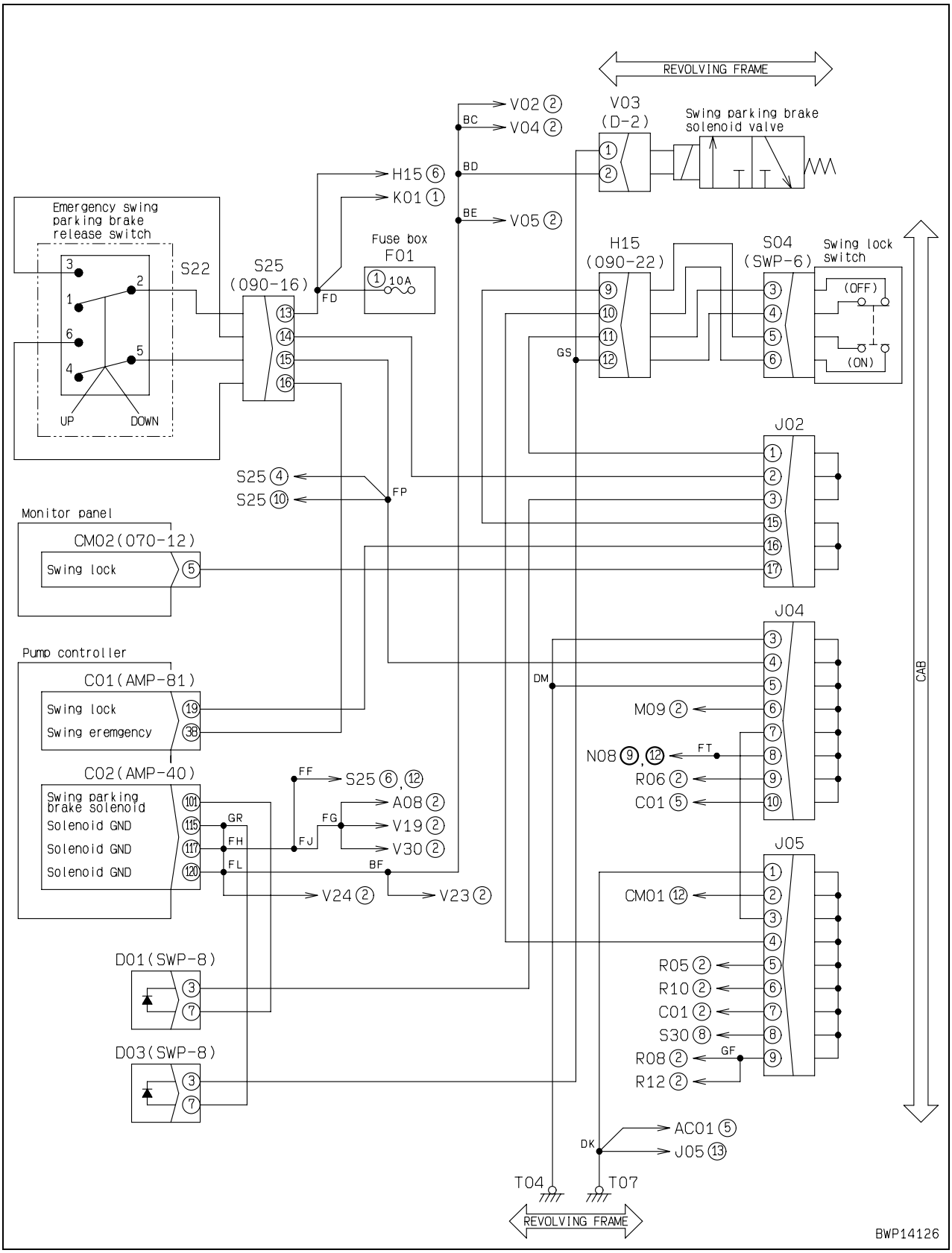
Trouble	(1) When swing lock switch is operated, swing lock monitor does not light up or go off.
Related information	• Condition of swing lock switch signal can be checked with monitoring function. (Machine monitor system code: 04502 Monitor input 3) (Pump controller system code: 02200 Switch input 1)

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective swing lock switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S04 (male)	Swing lock switch	Resistance	
			Between (5) – (6)	OFF	Min. 1 MΩ	
				ON	Max. 1 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CM02 (female) (5) – J02 – S04 (female) (5)		Resistance	Max. 1 Ω
			Wiring harness between S04 (female) (6) – J05 – chassis ground (T07)		Resistance	Max. 1 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CM02 (female) (5) – J02 – S04 (female) (5), – C01 (female) (19)		Resistance	Min. 1 MΩ
	4	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			CM02	Swing lock switch	Voltage	
			Between (5) – chassis ground	OFF	20 – 30 V	
				ON	Max. 1 V	

Trouble	(2) When swing lock switch is turned ON, swing lock does not operate. (Hydraulic drift of swing occurs on slope.)
Related information	

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective swing lock switch (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S04 (male)	Swing lock switch	Resistance	
			Between (3) – (4)	OFF	Min. 1 MΩ	
				ON	Max. 1 Ω	
	2	Defective swing holding brake release switch (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S25 (male)	Swing holding brake release switch	Resistance	
			Between (13) – (14)	Lock	Min. 1 MΩ	
				Release	Max. 1 Ω	
	3	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between D01 (female) (3) – J02 – S04 (female) (3), – S25 (female) (14)		Voltage	Max. 1 V
			Wiring harness between S04 (female) (4) – V03 (female) (1), – D03 (female) (3)		Voltage	Max. 1 V

Circuit diagram related to swing holding brake solenoid



E-22 Travel alarm does not sound or does not stop sounding

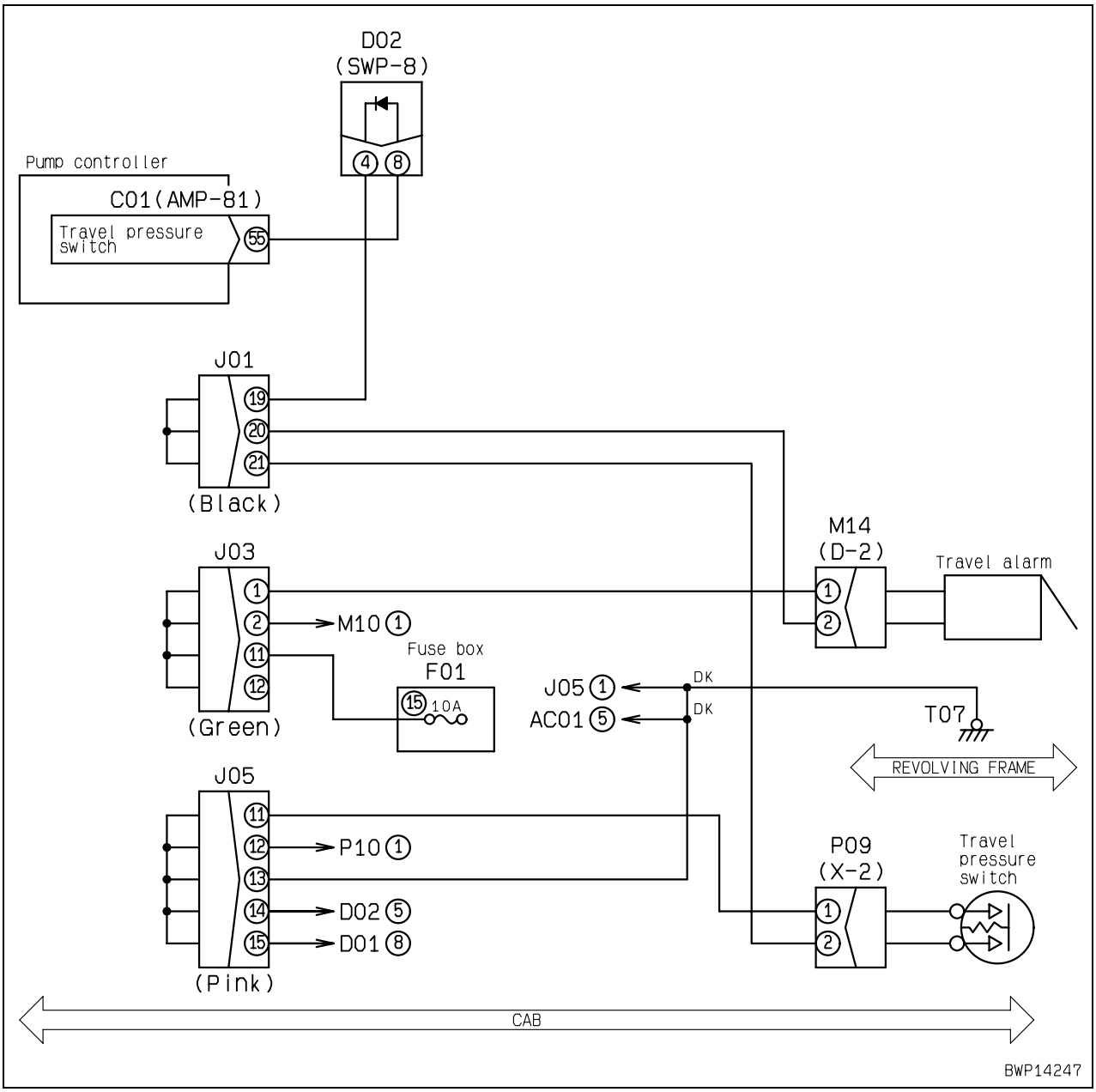
Trouble	(1) Alarm does not sound during travel.
Related information	

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fuse No. 15	If fuse is broken, circuit probably has ground fault. (See cause 4.)			
	2	Defective travel signal system	★ Start engine and carry out troubleshooting.			
			Monitoring code	Item	Normal display	
			01900 Pressure switch 1	Travel	When lever is operated: ON When lever is in neutral: OFF	
			If display of monitoring is abnormal, carry out troubleshooting for E-26 Monitoring function does not display lever control signal normally.			
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between F01-15 – J03 – M14 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between M14 (female) (2) – J01 (19) – P09 (female) (2)		Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between F01-15 – J03 – M14 (female) (1), – circuit branch end		Resistance	Min. 1 MΩ
	5	Defective travel alarm (Internal defect)	If causes 1 – 4 are not detected, travel alarm is defective.			

Trouble	(2) Alarm does not stop sounding while machine is stopped.
Related information	

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective travel signal system	★ Start engine and carry out troubleshooting.		
			Monitoring code	Item	Normal display
			Pressure switch 1	Travel	When lever is operated: ON When lever is in neutral: OFF
			If display of monitoring is abnormal, carry out troubleshooting for E-26 Monitoring function does not display lever control signal normally.		
	2	Defective assembled-type diode D05 (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			D02 (male)		Continuity
			Between (4) – (8)		No continuity
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between M14 (female) (2) – J01 (19) – P09 (female) (2), – D02 (female) (4)	Resistance	Min. 1 MΩ

Circuit diagram related to travel alarm and travel PPC oil pressure switch



E-23 Air conditioner does not operate normally (including air conditioner abnormality record)

Trouble	(1) When air conditioner switch is operated, air conditioner control screen is not displayed.
Related information	• Condition of air conditioner switch signal can be checked with monitoring function. (Code: 04505 Monitor 3rd, 4th line switches, 04506 Monitor 5th line switch)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective machine monitor	Machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Trouble	(2) When air conditioner switch is operated, air conditioner does not operate at all.
Related information	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective fuse No. 11	If fuse is broken, circuit probably has ground fault. (See cause 4.)		
	2	Defective fuse in unit	If fuse in unit is broken, circuit in unit probably has ground fault. (See cause 4.)		
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between F01-11 – fuse in unit – ACW (wiring side) (6)	Resistance	Max. 1 Ω
			Wiring harness between ACW (wiring side) (16) – chassis ground (T07)	Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between F01-11 – fuse in unit – ACW (wiring side) (6), – circuit branch end	Resistance	Min. 1 MΩ
	5	Defective air conditioner controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			ACW (wiring side)	Voltage	
			Between (6) – (16)	20 – 30 V	
			If above voltage is normal, air conditioner controller may be defective.		
	6	Defective machine monitor	If causes 1 – 5 are not detected, machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Trouble	(3) Air does not come out (Air flow is insufficient).
Related information	

<table>
<tr><td rowspan="20">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="5">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Defective blower relay (Internal disconnection)</td><td colspan="5">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON (coil side).</td></tr>
<tr><td colspan="3">R20 (male)</td><td colspan="2">Resistance</td></tr>
<tr><td colspan="3">Between (1) – (3)</td><td colspan="2">140 – 340 Ω</td></tr>
<tr><td colspan="5">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (contact side).</td></tr>
<tr><td>R20</td><td>Air conditioner switch</td><td>Voltage</td><td colspan="2"></td></tr>
<tr><td>Between (4) – chassis ground</td><td>Air blow position</td><td>20 – 30 V</td><td colspan="2"></td></tr>
<tr><td rowspan="3">2</td><td rowspan="3">Defective power transistor (Internal defect)</td><td colspan="5">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td colspan="2">Fan switch</td><td colspan="3" rowspan="2">If air flow changes according to operation of fan switch, power transistor is normal.</td></tr>
<tr><td colspan="2">Operate between Low and Medium and High.</td></tr>
<tr><td rowspan="4">3</td><td rowspan="4">Defective blower motor (Internal defect)</td><td colspan="5">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td>MB (wiring side)</td><td>Air conditioner switch</td><td>Voltage</td><td colspan="2"></td></tr>
<tr><td>Between (1) – (2)</td><td>Air blow position</td><td>20 – 30 V</td><td colspan="2"></td></tr>
<tr><td colspan="5">If above voltage is normal and blower motor does not revolve, blower motor is defective.</td></tr>
<tr><td rowspan="9">4</td><td rowspan="9">Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)</td><td colspan="5">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="3">Wiring harness between F01-11 – fuse in unit – R20 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between R20 (female) (3) – ACW (wiring side) (36)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between F01-11 – R20 (female) (5)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between R20 (female) (4) – MB (wiring side) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between MB (wiring side) (2) – PTR (wiring side) (3)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between PTR (wiring side) (1) – chassis ground (T07)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between PTR (wiring side) (2) – ACW (wiring side) (8)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between PTR (wiring side) (4) – ACW (wiring side) (7)</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	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 R20 (female) (3) – ACW (wiring side) (36)	Resistance	Min. 1 MΩ
			Wiring harness between R20 (female) (4) – MB (wiring side) (1)	Resistance	Min. 1 MΩ
			Wiring harness between MB (wiring side) (2) – PTR (wiring side) (3)	Resistance	Min. 1 MΩ
			Wiring harness between PTR (wiring side) (2) – ACW (wiring side) (8)	Resistance	Min. 1 MΩ
	6	Defective air conditioner controller	If causes 1 – 5 are not detected, air conditioner controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		
	7	Defective air conditioner system	If causes 1 – 5 are not detected, air conditioner system may be defective. See Machine Component Volume of Shop Manual, Air conditioner, Troubleshooting.		

Trouble	(4) Air is not cooled (Cooling performance is insufficient).
Related information	

<table>
<tr><td rowspan="20">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="5">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Defective compressor relay (Internal disconnection)</td><td colspan="5">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON (coil side).</td></tr>
<tr><td colspan="3">R21 (male)</td><td colspan="2">Resistance</td></tr>
<tr><td colspan="3">Between (1) – (3)</td><td colspan="2">140 – 340 Ω</td></tr>
<tr><td colspan="5">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (contact side).</td></tr>
<tr><td>R21</td><td>Air conditioner switch</td><td colspan="3">Voltage</td></tr>
<tr><td>Between (2) – chassis ground</td><td>Cooling position</td><td colspan="3">20 – 30 V</td></tr>
<tr><td>2</td><td>Defective internal air sensor</td><td colspan="5">Internal air sensor may be defective. Carry out troubleshooting for Abnormality in internal air sensor.</td></tr>
<tr><td>3</td><td>Defective high and low pressure switches</td><td colspan="5">High and low pressure switches may be defective. Carry out troubleshooting for “Abnormality in refrigerant”.</td></tr>
<tr><td>4</td><td>Defective compressor clutch (Internal defect)</td><td colspan="5">Compressor clutch may be defective. Check it directly.</td></tr>
<tr><td>5</td><td>Defective compressor (Internal defect)</td><td colspan="5">Compressor may be defective. Check it directly.</td></tr>
<tr><td rowspan="5">6</td><td rowspan="5">Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)</td><td colspan="5">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="3">Wiring harness between F01-11 – fuse in unit – R21 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between R21 (female) (3) – ACW (wiring side) (35)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between F01-11 – R21 (female) (4)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="3">Wiring harness between R21 (female) (2) – AC02 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="3">7</td><td rowspan="3">Ground fault in wiring harness (Short circuit with GND circuit)</td><td colspan="5">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="3">Wiring harness between R21 (female) (3) – ACW (wiring side) (35)</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="3">Wiring harness between R21 (female) (2) – AC02 (female) (1)</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td>8</td><td>Defective air conditioner controller</td><td colspan="5">If causes 1 – 7 are not detected, air conditioner controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)</td></tr>
<tr><td>9</td><td>Defective air conditioner system</td><td colspan="5">If causes 1 – 7 are not detected, air conditioner system may be defective. See Machine Component Volume of Shop Manual, Air conditioner, Troubleshooting.</td></tr>
</table>

Trouble	(5) Air conditioner abnormality record: Communication condition "CAN disconnection", Communication condition "Abnormal"
Related information	• While abnormality in communication is being detected, "CAN disconnection" is displayed. • If abnormality in communication has been detected and reset, "Abnormality" is displayed. • If "CAN disconnection" is displayed as communication condition, communication cannot be carried out normally. Accordingly, condition of other items is not displayed. • Method of reproducing abnormality record: Turn starting switch ON.

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between N10 (female) (2) – CM02 (female) (8), (9)	Resistance	Max. 1 Ω
			Wiring harness between N10 (female) (1) – CM02 (female) (10)	Resistance	Max. 1 Ω
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between N10 (male) (2) – CM02 (female) (8), (9), – C01 (female) (45), – CE02 (female) (46), – K02 (female) (A), – N08 (male) (3)	Resistance	Min. 1 MΩ
			Wiring harness between N10 (female) (1) – CM02 (female) (10), – C01 (female) (64), – CE02 (female) (47), – K02 (female) (B), – N08 (male) (10)	Resistance	Min. 1 MΩ
	3	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			N10 (male) (2) – CM02 (female) (8), (9), – C01 (female) (45), – CE02 (female) (46), – K02 (female) (A), – N08 (male) (3)	Voltage	Max. 5.5 V
			Wiring harness between N10 (female) (1) – CM02 (female) (10), – C01 (female) (64), – CE02 (female) (47), – K02 (female) (B), – N08 (male) (10)	Voltage	Max. 5.5 V
	4	Defective CAN terminal resistance (Internal short circuit or disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			K02 (male)	Resistance	
			Between (A) – (B)	47 – 67 Ω	
	5	Defective air conditioner controller	If causes 1 – 4 are not detected, air conditioner controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		
	6	Defective machine monitor	If causes 1 – 4 are not detected, machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Trouble	(6) Air conditioner abnormality record: Setting condition "Abnormality"
Related information	• If setting of air conditioner controller model is different from setting of machine monitor model, "Abnormality" is displayed. • If "CAN disconnection" is displayed as communication condition, communication cannot be carried out normally. Accordingly, this condition is not displayed. • Method of reproducing abnormality record: Turn starting switch ON.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective air conditioner controller	Air conditioner controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)
	2	Defective machine monitor	Machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Trouble	(7) Air conditioner abnormality record: Internal air sensor "Abnormality"
Related information	• If "CAN disconnection" is displayed as communication condition, communication cannot be carried out normally. Accordingly, this condition is not displayed. • Method of reproducing abnormality record: Turn starting switch ON + Turn air conditioner (A/C) switch ON.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective internal air sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			THI (device side)	Resistance	
			Between (1) – (2)	300 Ω – 430 kΩ	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ACW (wiring side) (11) – THI (wiring side) (2)	Resistance	Max. 1 Ω
			Wiring harness between ACW (wiring side) (27) – THI (wiring side) (1)	Resistance	Max. 1 Ω
	3	Short circuit in wiring harness (with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ACW (wiring side) (11) – THI (wiring side) (2)	Resistance	Min. 1 MΩ
	4	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between ACW (wiring side) (11) – THI (wiring side) (2)	Voltage	Max. 1 V
	5	Defective air conditioner controller	If causes 1 – 4 are not detected, air conditioner controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Trouble	(8) Air conditioner abnormality record: External air sensor "Unused"
Related information	• External air sensor is not used in air conditioner system of this machine. • If "CAN disconnection" is displayed as communication condition, communication cannot be carried out normally. Accordingly, this condition is not displayed.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Normal display	Since external air sensor is not used in air conditioner system of this machine, above display is normal.

Trouble	(9) Air conditioner abnormality record: Air flow sensor "Abnormality"
Related information	• If "CAN disconnection" is displayed as communication condition, communication cannot be carried out normally. Accordingly, this condition is not displayed. • Method of reproducing abnormality record: Turn starting switch ON + Turn air conditioner (A/C) switch ON.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective air flow sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			TH_F (device side)	Resistance		
			Between (1) – (2)	100 Ω – 115 kΩ		
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between AC_W (wiring side) (12) – TH_F (wiring side) (2)	Resistance	Max. 1 Ω	
			Wiring harness between AC_W (wiring side) (27) – TH_F (wiring side) (1)	Resistance	Max. 1 Ω	
	3	Short circuit in wiring harness (with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between AC_W (wiring side) (12) – TH_F (wiring side) (2)	Resistance	Min. 1 MΩ	
	4	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between AC_W (wiring side) (12) – TH_F (wiring side) (2)	Voltage	Max. 1 V	
	5	Defective air conditioner controller	If causes 1 – 4 are not detected, air conditioner controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)			

Trouble	(10) Air conditioner abnormality record: Daylight sensor "Abnormality"
Related information	• If "CAN disconnection" is displayed as communication condition, communication cannot be carried out normally. Accordingly, this condition is not displayed. • Method of reproducing abnormality record: Turn starting switch ON + Turn air conditioner (A/C) switch ON.

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective daylight sensor (Internal defect)	Daylight sensor may be defective.		
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ACw (wiring side) (3) – P31 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between ACw (wiring side) (15) – P31 (female) (2)	Resistance	Max. 1 Ω
	3	Short circuit in wiring harness (with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ACw (wiring side) (3) – P31 (female) (1), – circuit branch end	Resistance	Min. 1 MΩ
			Wiring harness between ACw (wiring side) (15) – P31 (female) (2)	Resistance	Min. 1 MΩ
	4	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between ACw (wiring side) (3) – P31 (female) (1), – circuit branch end	Voltage	Max. 1 V
			Wiring harness between ACw (wiring side) (15) – P31 (female) (2)	Voltage	Max. 1 V
	5	Defective air conditioner controller	If causes 1 – 4 are not detected, air conditioner controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Trouble	(11) Air conditioner abnormality record: Air outlet damper "Abnormality"
Related information	• If "CAN disconnection" is displayed as communication condition, communication cannot be carried out normally. Accordingly, this condition is not displayed. • Method of reproducing abnormality record: Turn starting switch ON + Turn air conditioner (A/C) switch ON.

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective air outlet servomotor (Internal defect)	Air outlet servomotor may be defective.		
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between MV1 (wiring side) (1) – ACW (wiring side) (3)	Resistance	Max. 1 Ω
			Wiring harness between MV1 (wiring side) (3) – ACW (wiring side) (27)	Resistance	Max. 1 Ω
			Wiring harness between MV1 (wiring side) (5) – ACW (wiring side) (9)	Resistance	Max. 1 Ω
			Wiring harness between MV1 (wiring side) (6) – ACW (wiring side) (24)	Resistance	Max. 1 Ω
			Wiring harness between MV1 (wiring side) (7) – ACW (wiring side) (23)	Resistance	Max. 1 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between MV1 (wiring side) (1) – ACW (wiring side) (3), – circuit branch end	Resistance	Min. 1 MΩ
			Wiring harness between MV1 (wiring side) (5) – ACW (wiring side) (9), – circuit branch end	Resistance	Min. 1 MΩ
			Wiring harness between MV1 (wiring side) (6) – ACW (wiring side) (24), – circuit branch end	Resistance	Min. 1 MΩ
			Wiring harness between MV1 (wiring side) (7) – ACW (wiring side) (23), – circuit branch end	Resistance	Min. 1 MΩ
	4	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between MV1 (wiring side) (1) – ACW (wiring side) (3), – circuit branch end	Voltage	Max. 1 V
			Wiring harness between MV1 (wiring side) (5) – ACW (wiring side) (9), – circuit branch end	Voltage	Max. 1 V
			Wiring harness between MV1 (wiring side) (6) – ACW (wiring side) (24), – circuit branch end	Voltage	Max. 1 V
			Wiring harness between MV1 (wiring side) (7) – ACW (wiring side) (23), – circuit branch end	Voltage	Max. 1 V
	5	Defective air conditioner controller	If causes 1 – 4 are not detected, air conditioner controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

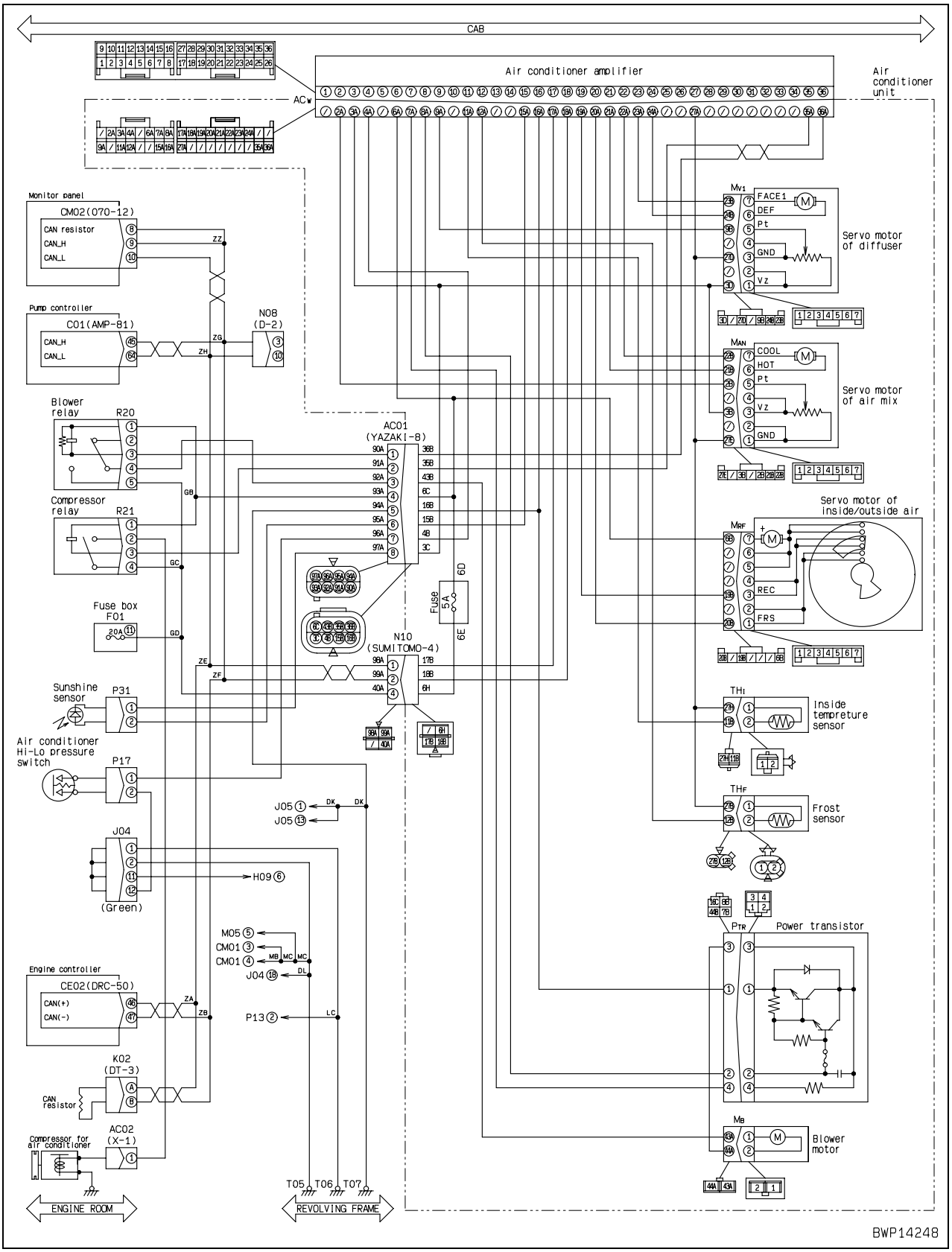
Trouble	(12) Air conditioner abnormality record: A/M damper "Abnormality"
Related information	• If "CAN disconnection" is displayed as communication condition, communication cannot be carried out normally. Accordingly, this condition is not displayed. • Method of reproducing abnormality record: Turn starting switch ON + Turn air conditioner (A/C) switch ON.

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective air mix servomotor (Internal defect)	Air mix servomotor may be defective.		
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between MAM (wiring side) (1) – ACW (wiring side) (27)	Resistance	Max. 1 Ω
			Wiring harness between MAM (wiring side) (3) – ACW (wiring side) (3)	Resistance	Max. 1 Ω
			Wiring harness between MAM (wiring side) (5) – ACW (wiring side) (2)	Resistance	Max. 1 Ω
			Wiring harness between MAM (wiring side) (6) – ACW (wiring side) (21)	Resistance	Max. 1 Ω
			Wiring harness between MAM (wiring side) (7) – ACW (wiring side) (22)	Resistance	Max. 1 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between MAM (wiring side) (3) – ACW (wiring side) (3), – circuit branch end	Resistance	Min. 1 MΩ
			Wiring harness between MAM (wiring side) (5) – ACW (wiring side) (2), – circuit branch end	Resistance	Min. 1 MΩ
			Wiring harness between MAM (wiring side) (6) – ACW (wiring side) (21), – circuit branch end	Resistance	Min. 1 MΩ
			Wiring harness between MAM (wiring side) (7) – ACW (wiring side) (22), – circuit branch end	Resistance	Min. 1 MΩ
	4	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between MAM (wiring side) (3) – ACW (wiring side) (3), – circuit branch end	Voltage	Max. 1 V
			Wiring harness between MAM (wiring side) (5) – ACW (wiring side) (2), – circuit branch end	Voltage	Max. 1 V
			Wiring harness between MAM (wiring side) (6) – ACW (wiring side) (21), – circuit branch end	Voltage	Max. 1 V
			Wiring harness between MAM (wiring side) (7) – ACW (wiring side) (22), – circuit branch end	Voltage	Max. 1 V
	5	Defective air conditioner controller	If causes 1 – 4 are not detected, air conditioner controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Trouble	(13) Air conditioner abnormality record: Refrigerant "Abnormality"
Related information	• If "CAN disconnection" is displayed as communication condition, communication cannot be carried out normally. Accordingly, this condition is not displayed. • Method of reproducing abnormality record: Turn starting switch ON + Turn air conditioner (A/C) switch ON.

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Insufficient refrigerant (gas) (when system is normal)	Refrigerant (gas) may be insufficient. Check it directly.			
	2	Defective high and low pressure switches (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			P17 (male)	Resistance		
			Between (1) – (2)	Max. 1 Ω		
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ACW (wiring side) (4) – P17 (female) (1)	Resistance	Max. 1 Ω	
			Wiring harness between P17 (female) (2) – chassis ground (T06)	Resistance	Max. 1 Ω	
	4	Defective air conditioner controller	If causes 1 – 3 are not detected, air conditioner controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)			

Circuit diagram related to air conditioner



E-24 When starting switch is turned OFF, service meter is not displayed

Trouble	• When starting switch is turned OFF, service meter is not displayed.
Related information	• While starting switch is at OFF position, if following switches are operated, service meter is displayed at top center of screen. Operation of switches: [4] + [1] (Press simultaneously)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective backup power supply system	When starting switch is turned ON, if machine monitor displays nothing, backup power supply system may be defective. In this case, carry out troubleshooting for "E-1 When starting switch turned ON, machine monitor displays nothing".
	2	Defective machine monitor	If cause 1 is not detected, machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

E-25 Machine monitor cannot be set in service mode

Trouble	• Machine monitor cannot be set in service mode.
Related information	• If following switches are operated, machine monitor is set in service mode. Operation of switches: [4] + [1] → [2] → [3] (While pressing [4], press other switches in order)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective machine monitor	Machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

E-26 Monitoring function does not display lever control signal normally

Trouble	(1) Boom raise operation is not displayed normally by monitoring function.
Related information	• Monitoring code: 01900 Pressure switch 1

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective boom raise PPC pressure sensor system	Carry out troubleshooting for failure code [**DHS8MA**].

Trouble	(2) Arm curl operation is not displayed normally by monitoring function.
Related information	• Monitoring code: 01900 Pressure switch 1

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective arm curl PPC pressure sensor system	Carry out troubleshooting for failure code [**DHS3MA**].

Trouble	(3) Bucket curl operation is not displayed normally by monitoring function.
Related information	• Monitoring code: 01901 Pressure switch 2

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective bucket curl PPC pressure sensor system	Carry out troubleshooting for failure code [**DHS4MA**].

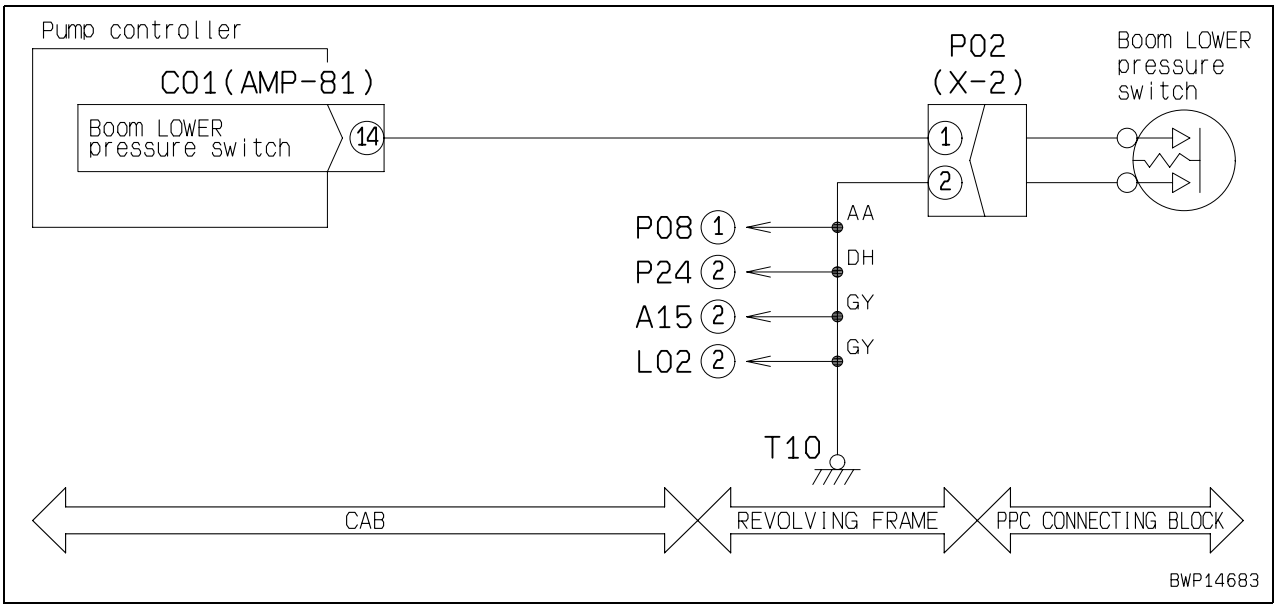
Trouble	(4) Bucket dump operation is not displayed normally by monitoring function.
Related information	• Monitoring code: 01901 Pressure switch 2

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective bucket dump PPC pressure sensor system	Carry out troubleshooting for failure code [**DHSDMA**].

Trouble	(5) Boom lower operation is not displayed normally by monitoring function.
Related information	• Monitoring code: 01900 Pressure switch 1

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective boom lower PPC pressure switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			P02 (male)	Right work equipment control lever	Resistance	
			Between (1) – (2)	Neutral	Min. 1 MΩ	
				Boom raise	Max. 1 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (14) – P02 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between P02 (female) (2) – chassis ground (T10)		Resistance	Max. 1 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (14) – P02 (female) (1)		Resistance	Min. 1 MΩ
	4	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between C01 (female) (14) – P02 (female) (1)		Voltage	Max. 1 V
	5	Defective pump controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			C01 (female)	Right work equipment control lever	Resistance	
			Between (14) – chassis ground	Neutral	Min. 1 MΩ	
				Boom raise	Max. 1 Ω	

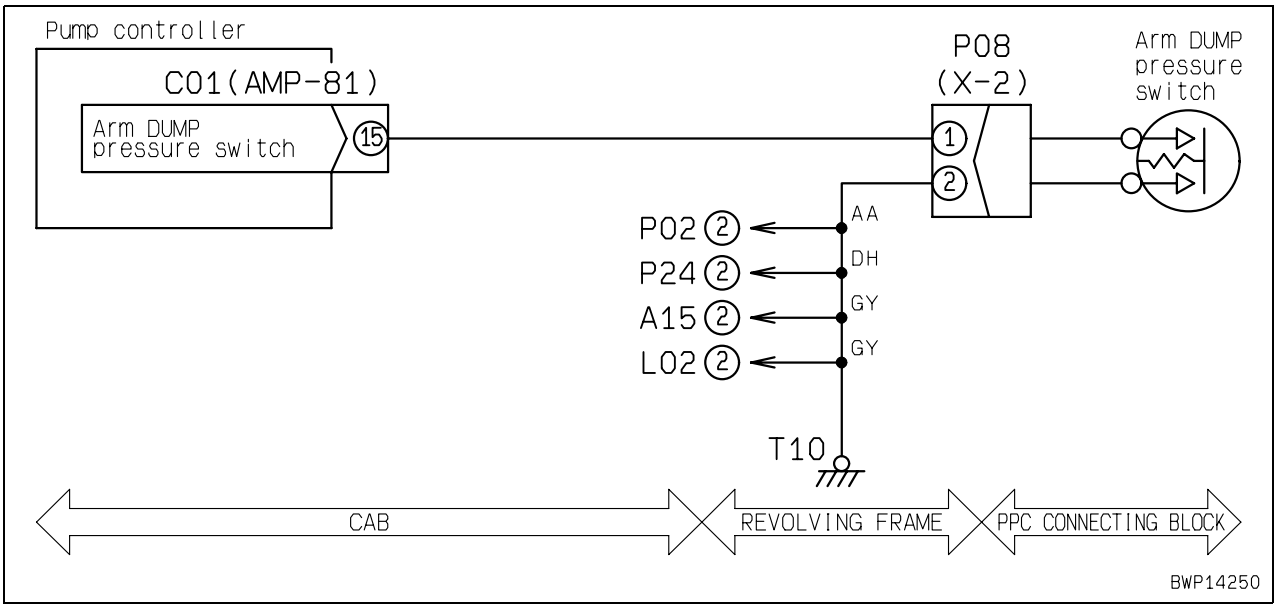
Circuit diagram related to boom lower PPC pressure switch



Trouble	(6) Arm dump operation is not displayed normally by monitoring function.
Related information	• Monitoring code: 01900 Pressure switch 1

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective arm dump PPC pressure switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			P08 (male)	Left work equipment control lever	Resistance	
			Between (1) – (2)	Neutral	Min. 1 MΩ	
				Arm dump	Max. 1 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (15) – P08 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between P08 (female) (2) – chassis ground (T10)		Resistance	Max. 1 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (15) – P08 (female) (1)		Resistance	Min. 1 MΩ
	4	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between C01 (female) (15) – P08 (female) (1)		Voltage	Max. 1 V
	5	Defective pump controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			C01 (female)	Left work equipment control lever	Resistance	
			Between (15) – chassis ground	Neutral	Min. 1 MΩ	
				Arm dump	Max. 1 Ω	

Circuit diagram related to arm dump PPC pressure switch



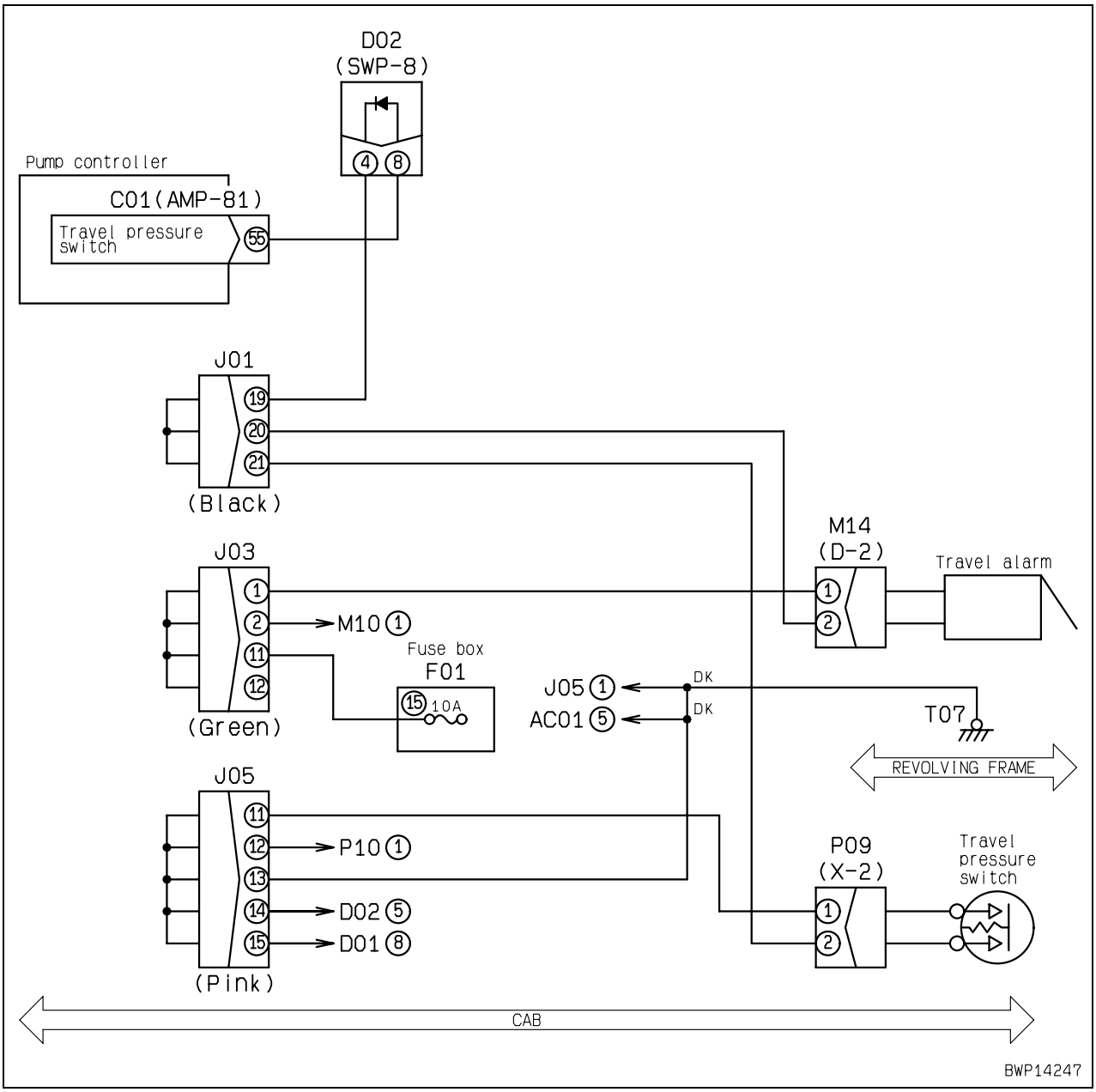
Trouble	(7) Swing operation is not displayed normally by monitoring function.
Related information	• Monitoring code: 01900 Pressure switch 1

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective swing right PPC pressure sensor system	Carry out troubleshooting for failure code [**DHSAMA**].
	2	Defective swing left PPC pressure sensor system	Carry out troubleshooting for failure code [**DHSBMA**].

Trouble	(8) Travel operation is not displayed normally by monitoring function.
Related information	• Monitoring code: 01900 Pressure switch 1

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective travel PPC pressure switch (Internal disconnection or short circuit)	Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			P09 (male)	Travel lever	Resistance	
			Between (1) – (2)	Neutral	Min. 1 MΩ	
				Travel forward or reverse	Max. 1 Ω	
	2	Defective assembled-type diode D02 (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			D02 (male)		Continuity	
			Between (8) – (4)		There is continuity	
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (55) – D01 (female) (8)		Resistance	Max. 1 Ω
			Wiring harness between D01 (female) (4) – J01 – P09 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between P09 (female) (1) – J05 – chassis ground (T07)		Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (55) – D01 (female) (8)		Resistance	Min. 1 MΩ
			Wiring harness between D01 (female) (4) – J01 – P09 (female) (2), – circuit branch end		Resistance	Min. 1 MΩ
	5	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 C01 (female) (55) – D01 (female) (8)		Voltage	Max. 1 V
	6	Defective pump controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			C01 (female)	Travel lever	Continuity	
			Between (55) – chassis ground	Neutral	No continuity	
				Travel forward or reverse	There is continuity	

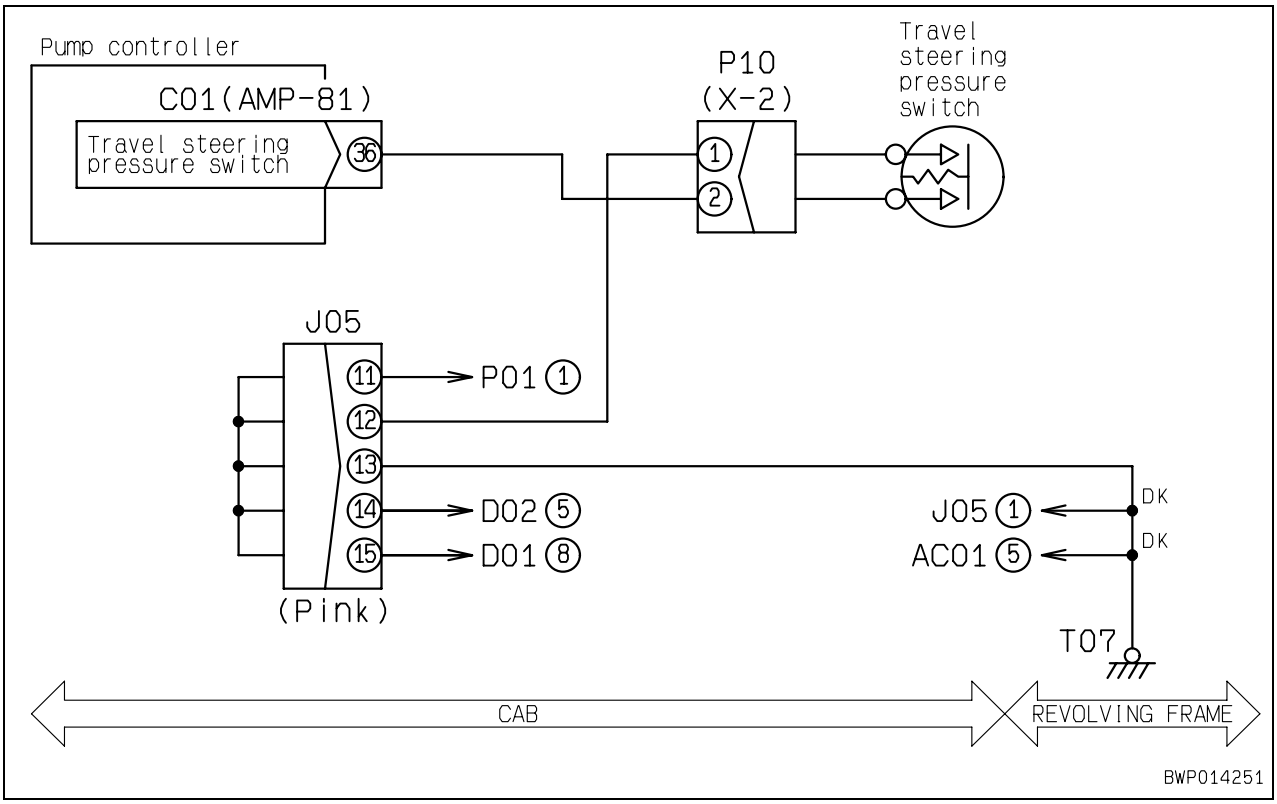
Circuit diagram related to travel PPC pressure switch and travel alarm



Trouble	(9) Travel differential pressure is not displayed normally by monitoring function.
Related information	• Monitoring code: 01901 Pressure switch 2

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective travel steering PPC pressure switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			P09 (male)	Travel lever	Resistance	
			Between (1) – (2)	Neutral	Min. 1 MΩ	
				Only 1 side operated	Max. 1 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (36) – P10 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between P10 (female) (1) – J05 – chassis ground (T07)		Resistance	Max. 1 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (36) – P10 (female) (2)		Resistance	Min. 1 MΩ
	4	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between C01 (female) (36) – P10 (female) (2)		Voltage	Max. 1 V
	5	Defective pump controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			C01 (female)	Travel lever	Resistance	
			Between (36) – chassis ground	Neutral	Min. 1 MΩ	
				Only one side operated	Max. 1 Ω	

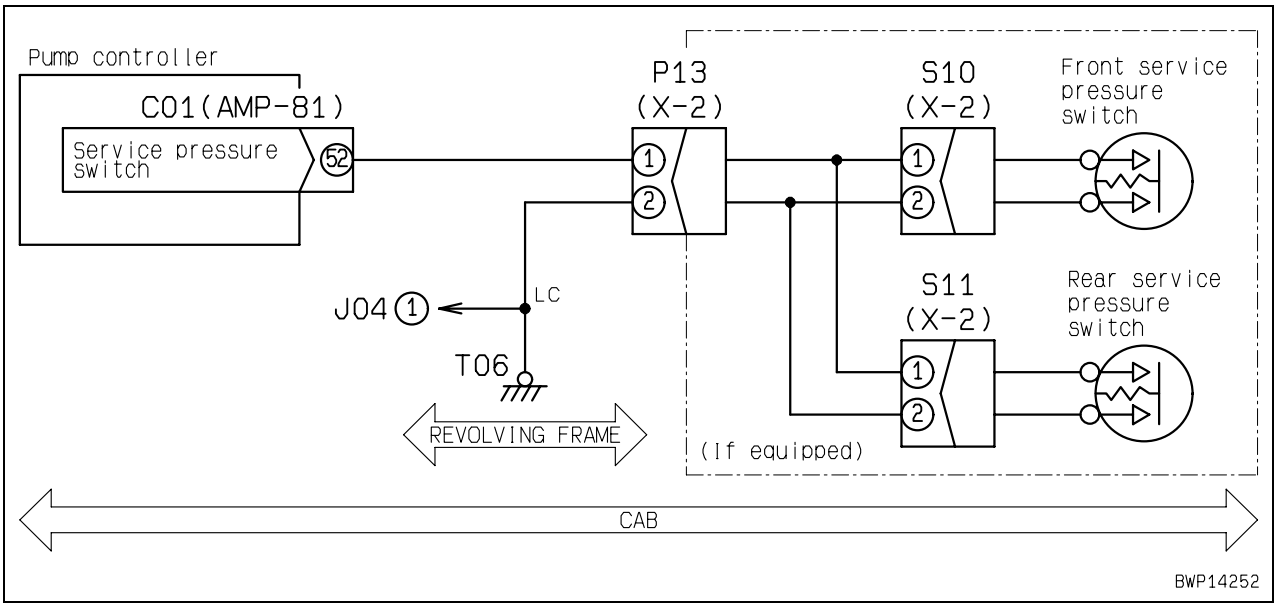
Circuit diagram related to travel steering PPC pressure switch



Trouble	(10) Service operation is not displayed normally by monitoring function.
Related information	• Monitoring code: 01901 Pressure switch 2

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective service front PPC pressure switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			S10 (male)	Service pedal	Resistance	
			Between (1) – (2)	Neutral	Min. 1 MΩ	
				Forward	Max. 1 Ω	
	2	Defective service rear PPC pressure switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			S11 (male)	Service pedal	Resistance	
			Between (1) – (2)	Neutral	Min. 1 MΩ	
				Reverse	Max. 1 Ω	
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (62) – S10 (female) (1), – S11 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between S10 (female) (2) – chassis ground (T06)		Resistance	Max. 1 Ω
			Wiring harness between S11 (female) (2) – chassis ground (T06)		Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between C01 (female) (62) – S10 (female) (1), – S11 (female) (1)		Resistance	Min. 1 MΩ
	5	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 C01 (female) (62) – S10 (female) (1), – S11 (female) (1)		Voltage	Max. 1 V
	6	Defective pump controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			C01 (female)	Service pedal	Resistance	
			Between (62) – chassis ground	Neutral	Min. 1 MΩ	
				Forward or reverse	Max. 1 Ω	

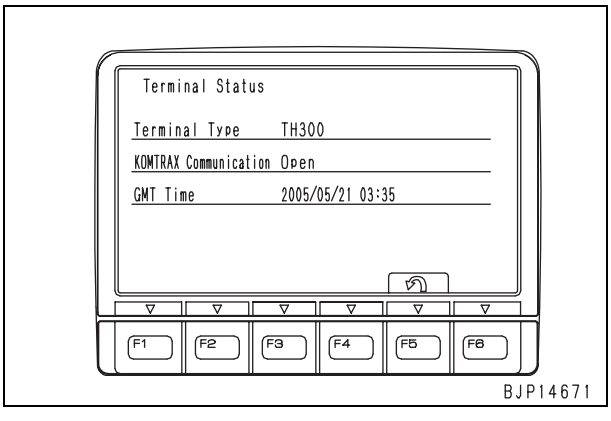
Circuit diagram related to service PPC pressure switch

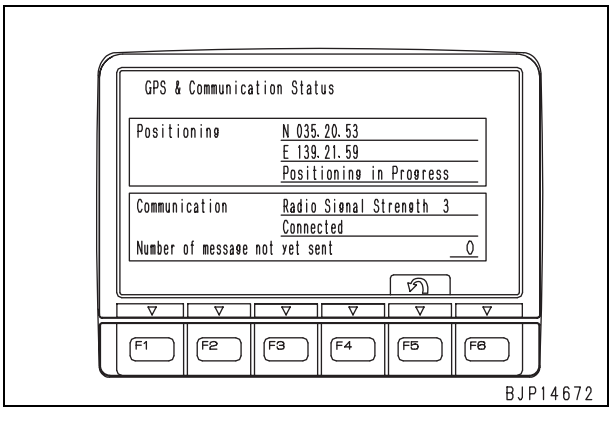


E-27 KOMTRAX system does not operate normally

Trouble	• KOMTRAX system does not operate normally.
Related information	• If KOMTRAX system administrator makes request for checking system on machine side for trouble, carry out following troubleshooting. • Even if KOMTRAX system has trouble, it does not particularly appear on machine. • Carry out all troubleshooting on service menu screen of machine monitor.

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Defective communication 1	★ Turn starting switch ON and check "Setting condition or terminal" screen.	
			Check item	Normal display
			Communication start check	Completion
	2	Defective GPS	★ Turn starting switch ON and check "Condition of positioning and communication" screen.	
			Check item	Normal display
			Positioning	N ###,##,## (Latitude)
				E ###,##,## (Longitude)
				In positioning
			If display is abnormal, notify KOMTRAX service hot line.	
	3	Defective communication environment	★ Turn starting switch ON and check "Condition of positioning and communication" screen.	
			Check item	Normal display
			Communication	Zone level 1 – Zone level 3
				In communication
			If display is abnormal, notify KOMTRAX service hot line.	
	4	Defective communication 2	★ Turn starting switch ON and check "Condition of positioning and communication" screen.	
			Check item	Normal display
			Number of items not transmitted	0 – 9





PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00244-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

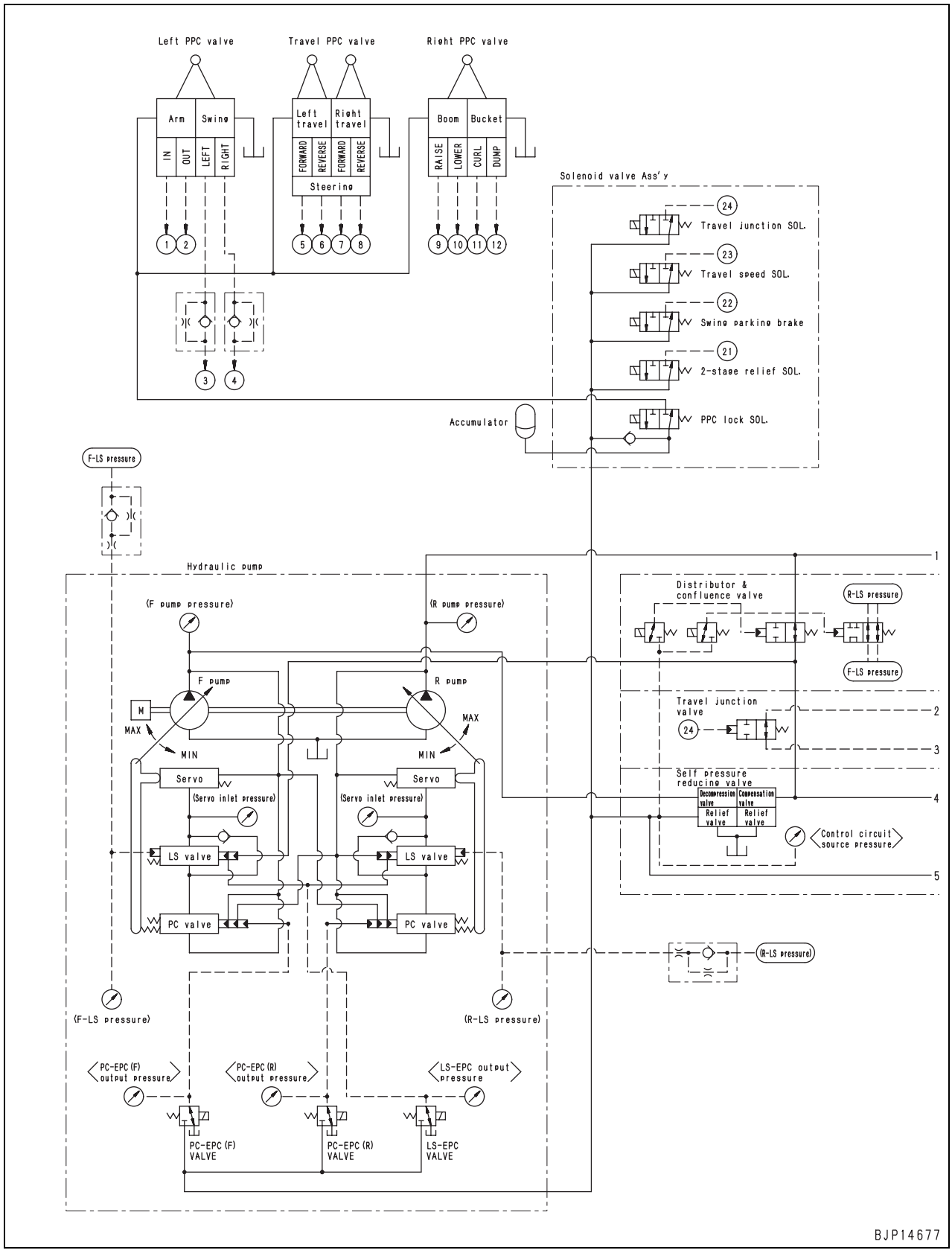
Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

40 Troubleshooting

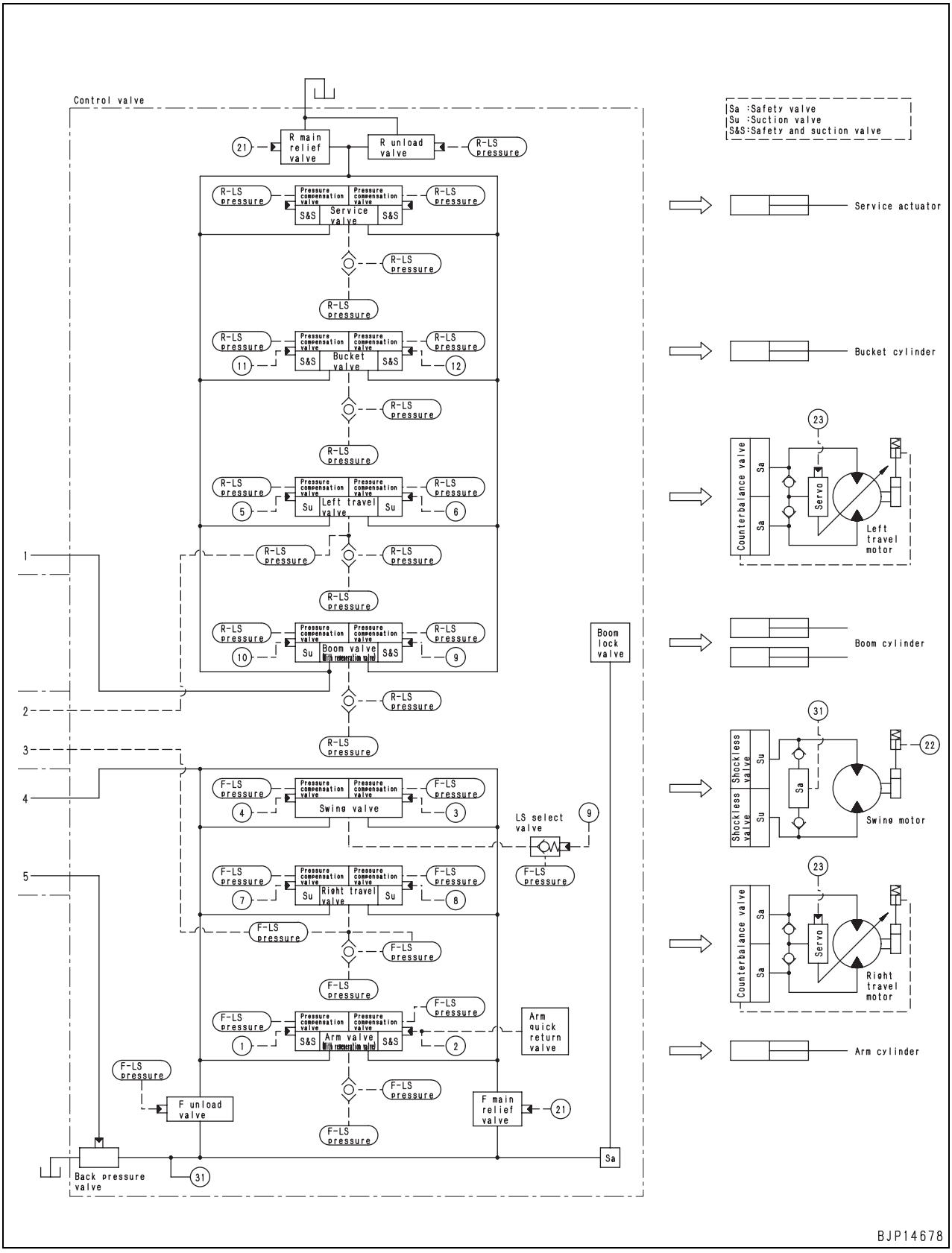
Troubleshooting of hydraulic and mechanical system (H-mode)

Troubleshooting of hydraulic and mechanical system (H-mode)

System diagram of hydraulic and mechanical system



★ This system diagram is a rough general hydraulic circuit diagram made as reference material for troubleshooting of the hydraulic and mechanical systems.



Information in troubleshooting table

★ The following information is summarized in the troubleshooting table. Before carrying out troubleshooting, understand that information fully.

Trouble	**Trouble which occurred in 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**
	2		
	3		
	4		

H-1 Speed or power of whole work equipment, swing, and travel is low

Trouble	• Speed or power of whole work equipment, swing, and travel is low.
Related information	• Carry out all troubleshooting in power mode (P) of working mode.

<table>
<tr><td rowspan="20">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Malfunction of unload valve</td><td colspan="4">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td colspan="2">Control levers</td><td colspan="2">Unload pressure</td></tr>
<tr><td colspan="2">All levers in neutral</td><td colspan="2">3.5 ± 1.0 MPa
{36 ± 10 kg/cm^2}</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Defective adjustment or malfunction of main relief valve</td><td colspan="4">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td colspan="2">Left work equipment control lever</td><td colspan="2">Main relief pressure</td></tr>
<tr><td colspan="2">Arm curl relief</td><td colspan="2">33.3 – 36.8 MPa
{340 – 375 kg/cm^2}</td></tr>
<tr><td colspan="4">If oil pressure does not become normal after adjustment, main relief valve may have malfunction or internal defect. Check main relief valve directly.</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Malfunction of self-reducing pressure valve</td><td colspan="4">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td colspan="2">Control levers</td><td colspan="2">Control circuit basic pressure</td></tr>
<tr><td colspan="2">All levers in neutral</td><td colspan="2">2.84 – 3.43 MPa
{29 – 35 kg/cm^2}</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Malfunction of PC-EPC valve</td><td colspan="4">★ Prepare with engine stopped, then run engine at high idle and low idle and carry out troubleshooting at each speed.</td></tr>
<tr><td>Engine</td><td>Control lever</td><td colspan="2">PC-EPC valve output pressure</td></tr>
<tr><td>Low idle</td><td rowspan="2">All levers in neutral</td><td colspan="2">2.9 MPa
{30 kg/cm^2}</td></tr>
<tr><td>High idle</td><td colspan="2">0.52 – 0.91 MPa
{5.3 – 9.3 kg/cm^2}</td></tr>
<tr><td rowspan="4">5</td><td rowspan="4">Defective adjustment or malfunction of PC valve</td><td colspan="4">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td>Measured oil pressure</td><td>Measurement condition</td><td colspan="2">Oil pressure ratio</td></tr>
<tr><td>Pump discharge pressure</td><td rowspan="2">Swing lock switch: ON
Arm curl relief</td><td colspan="2">1</td></tr>
<tr><td>PC valve output pressure</td><td colspan="2">Approx. 0.6
(Approx. 3/5)</td></tr>
<tr><td colspan="4">If oil pressure does not become normal after adjustment, PC valve may have malfunction or internal defect. Check PC valve directly.</td></tr>
<tr><td rowspan="4">6</td><td rowspan="4">Malfunction of LS-EPC valve</td><td colspan="4">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td>Travel speed</td><td>Travel lever</td><td colspan="2">LS-EPC valve output pressure</td></tr>
<tr><td>Lo</td><td>Neutral</td><td colspan="2">Approx. 2.9 MPa
{30 kg/cm^2}</td></tr>
<tr><td>Hi</td><td>Operated</td><td colspan="2">0 MPa
{0 kg/cm^2}</td></tr>
</table>

<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="5">7</td><td rowspan="5">Defective adjustment or malfunction of LS valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td rowspan="2">Measured oil pressure</td><td colspan="2">Operation of levers and oil pressure ratio</td></tr>
<tr><td>All levers in neutral</td><td>Travel with no load (Lever operated halfway)</td></tr>
<tr><td>Pump discharge pressure</td><td rowspan="2">Almost same pressure</td><td>1</td></tr>
<tr><td>PC valve output pressure</td><td>Approx. 0.6 (Approx. 3/5)</td></tr>
<tr><td colspan="3">If oil pressure does not become normal after adjustment, LS valve may have malfunction or internal defect. Check LS valve directly.</td></tr>
<tr><td>8</td><td>Malfunction of servo piston</td><td colspan="3">Servo piston may have malfunction. Check it directly.</td></tr>
<tr><td>9</td><td>Defective piston pump</td><td colspan="3">Cause may be lowering of performance, malfunction, or internal defect of piston pump.</td></tr>
</table>

H-2 Engine speed lowers extremely or engine stalls

Trouble	• Engine speed lowers extremely or engine stalls.
Related information	• Carry out all troubleshooting in power mode (P) of working mode.

<table>
<tr><td rowspan="15">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Defective adjustment or malfunction of main relief valve</td><td colspan="4">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td colspan="2">Left work equipment control lever</td><td colspan="2">Main relief pressure</td></tr>
<tr><td colspan="2">Arm curl relief</td><td colspan="2">33.3 – 36.8 MPa
{340 – 375 kg/cm^2}</td></tr>
<tr><td colspan="5">If oil pressure does not become normal after adjustment, main relief valve may have malfunction or internal defect. Check main relief valve directly.</td></tr>
<tr><td rowspan="3">2</td><td rowspan="3">Malfunction of PC-EPC valve</td><td colspan="4">★ Prepare with engine stopped, then run engine at high idle and low idle and carry out troubleshooting at each speed.</td></tr>
<tr><td>Engine</td><td>Control lever</td><td colspan="2">PC-EPC valve output pressure</td></tr>
<tr><td>Low idle</td><td rowspan="2">All levers in neutral</td><td colspan="2">2.9 MPa
{30 kg/cm^2}</td></tr>
<tr><td>High idle</td><td colspan="2">0.52 – 0.91 MPa
{5.3 – 9.3 kg/cm^2}</td></tr>
<tr><td rowspan="4">3</td><td rowspan="4">Defective adjustment or malfunction of PC valve</td><td colspan="4">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td>Measured oil pressure</td><td>Measurement condition</td><td colspan="2">Oil pressure ratio</td></tr>
<tr><td>Pump discharge pressure</td><td rowspan="2">Swing lock switch: ON
Arm curl relief</td><td colspan="2">1</td></tr>
<tr><td>PC valve output pressure</td><td colspan="2">Approx. 0.6
(Approx. 3/5)</td></tr>
<tr><td colspan="5">If oil pressure does not become normal after adjustment, PC valve may have malfunction or internal defect. Check PC valve directly.</td></tr>
<tr><td rowspan="5">4</td><td rowspan="5">Defective adjustment or malfunction of LS valve</td><td colspan="4">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td rowspan="2">Measured oil pressure</td><td colspan="3">Operation of levers and oil pressure ratio</td></tr>
<tr><td>All levers in neutral</td><td colspan="2">Travel with no load (Lever operated half-way)</td></tr>
<tr><td>Pump discharge pressure</td><td rowspan="2">Almost same pressure</td><td colspan="2">1</td></tr>
<tr><td>PC valve output pressure</td><td colspan="2">Approx. 0.6
(Approx. 3/5)</td></tr>
<tr><td colspan="5">If oil pressure does not become normal after adjustment, LS valve may have malfunction or internal defect. Check LS valve directly.</td></tr>
<tr><td>5</td><td>Clogging of orifice or filter in serve devices</td><td colspan="4">Orifices or filters in pump servo devices may be clogged. Check them directly.</td></tr>
<tr><td>6</td><td>Malfunction of servo piston</td><td colspan="4">Servo piston may have malfunction. Check it directly.</td></tr>
</table>

H-3 Work equipment, swing, and travel systems do not work

Trouble	• Whole work equipment, swing, and travel systems do not work.
Related information	• Carry out all troubleshooting in power mode (P) of working mode.

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Malfunction of PPC lock solenoid valve	★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.	
			Lock lever	PPC lock solenoid valve output pressure
			Lock	0 MPa {0 kg/cm^2}
			Free	2.9 MPa {30 kg/cm^2}
	2	Malfunction of self pressure reducing valve	★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.	
			Control lever	Control circuit basic pressure
			All levers in neutral	2.84 – 3.43 MPa {29 – 35 kg/cm^2}
	3	Defective piston pump	Piston pump may have malfunction or internal defect. Check it by following method. 1) Remove pump discharge pressure pickup plugs (F and R). 2) Crank engine at flywheel (manually). 3) If oil flows out of pickup plugs, piston pump is normal.	
	4	Defective damper	Pump shaft may not revolve because of defect in damper. Check damper directly.	

H-4 Abnormal sound comes out from around hydraulic pump

Trouble	• Abnormal sound comes out from around hydraulic pump
Related information	

	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Lowering of hydraulic oil level	Hydraulic oil level may be low. Check it directly.
	2	Defective hydraulic oil	Air may be in hydraulic oil. Check oil directly.
	3	Clogging of hydraulic tank cap	Negative pressure may be generated in hydraulic tank because of clogged hydraulic tank cap. Check cap directly.
	4	Clogging of hydraulic tank strainer	Negative pressure may be generated in suction circuit because of clogged hydraulic tank strainer. Check strainer directly.
	5	Defective piston pump	Piston pump may have internal defect. Check it directly.

H-5 Auto-decelerator does not operate

Trouble	• Auto-decelerator does not operate.
Related information	• Carry out this troubleshooting if auto-decelerator does not operate when travel lever is operated. Shuttle valve (in PPC valve) is installed between PPC valve and oil pressure switch of only in travel circuit. • Carry out all troubleshooting in power mode (P) of working mode.

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Malfunction of travel PPC valve (shuttle valve)	★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.	
			Travel lever	PPC valve output pressure
			Neutral	0 MPa {0 kg/cm^2}
			Forward Reverse	2.84 – 3.43 MPa {29 – 35 kg/cm^2}

H-6 Fine control performance or response is low

Trouble	• Fine control performance or response is low.
Related information	• Carry out all troubleshooting in power mode (P) of working mode.

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Malfunction of LS-EPC valve	★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.		
			Travel speed	Travel lever	LS-EPC valve output pressure
			Lo	Neutral	Approx. 2.9 MPa {Approx. 30 kg/cm^2}
			Hi	Operated	0 MPa {0 kg/cm^2}
	2	Clogging of LS circuit orifice	Orifice of LS circuit (between pump – piping – control valve) may be clogged. Check it directly.		
	3	Defective adjustment or malfunction of LS valve	★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.		
			Measured oil pressure	Operation of levers and oil pressure ratio	
				All levers in neutral	Travel with no load (Lever operated half-way)
			Pump discharge pressure	Almost same pressure	1
			PC valve output pressure		Approx. 0.6 (Approx. 3/5)
			If oil pressure does not become normal after adjustment, LS valve may have malfunction or internal defect. Check LS valve directly.		
	4	Malfunction of servo piston	Servo piston may have malfunction. Check it directly.		

H-7 Speed or power of boom is low

Trouble	• Speed or power of boom is low
Related information	• Carry out all troubleshooting in power mode (P) of working mode.

<table>
<tr><td rowspan="18">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="2">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Malfunction of right PPC valve (boom circuit)</td><td colspan="2">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td>Right work equipment control lever</td><td>PPC valve output pressure</td></tr>
<tr><td>Neutral</td><td>0 MPa
{0 kg/cm^2}</td></tr>
<tr><td>Boom raise
Boom lower</td><td>2.84 – 3.43 MPa
{29 – 35 kg/cm^2}</td></tr>
<tr><td>2</td><td>Malfunction of merge-divider main EPC valve</td><td colspan="2">Merge-divider main EPC valve may have malfunction. Check it directly.</td></tr>
<tr><td>3</td><td>Malfunction of merge-divider LS-EPC valve</td><td colspan="2">Merge-divider LS-EPC valve may have malfunction. Check it directly.</td></tr>
<tr><td>4</td><td>Malfunction of merge-divider main valve</td><td colspan="2">Merge-divider main valve may have malfunction. Check it directly.</td></tr>
<tr><td>5</td><td>Malfunction of merge-divider LS valve</td><td colspan="2">Merge-divider LS valve may have malfunction. Check it directly.</td></tr>
<tr><td>6</td><td>Malfunction of boom control valve (spool)</td><td colspan="2">Spool of boom control valve may have malfunction. Check it directly.</td></tr>
<tr><td>7</td><td>Malfunction of boom control valve (pressure compensation valve)</td><td colspan="2">Pressure compensation valve of boom control valve may have malfunction. Check it directly.</td></tr>
<tr><td>8</td><td>Malfunction of boom control valve (regeneration valve)</td><td colspan="2">Regeneration valve of boom control valve may have malfunction. Check it directly.</td></tr>
<tr><td>9</td><td>Malfunction of boom control valve (lock valve)</td><td colspan="2">Lock valve of boom control valve may have malfunction. Check it directly.</td></tr>
<tr><td>10</td><td>Malfunction or defective seal of safety valve for lock valve</td><td colspan="2">Safety valve for lock valve may have malfunction or defective seal. Check it directly.</td></tr>
<tr><td>11</td><td>Malfunction or defective seal of boom control valve (suction valve)</td><td colspan="2">Suction valve of boom control valve may have malfunction or defective seal. Check it directly.</td></tr>
<tr><td>12</td><td>Malfunction or defective seal of boom control valve (safety-suction valve)</td><td colspan="2">Safety-suction valve of boom control valve may have malfunction or defective seal. Check it directly.</td></tr>
<tr><td>13</td><td>Malfunction of each control valve (LS shuttle valve)</td><td colspan="2">LS shuttle valve of left travel control valve, bucket control valve, or service control valve may have malfunction. Check it directly.</td></tr>
<tr><td rowspan="3">14</td><td rowspan="3">Defective boom cylinder</td><td colspan="2">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td>Right work equipment control lever</td><td>Leakage from boom cylinder</td></tr>
<tr><td>Boom raise relief</td><td>20 cc/min</td></tr>
</table>

H-8 Speed or power of arm is low

Trouble	• Speed or power of arm is low
Related information	• Carry out all troubleshooting in power mode (P) of working mode.

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Malfunction of left PPC valve (arm circuit)	★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.	
			Left work equipment control lever	PPC valve output pressure
			Neutral	0 MPa {0 kg/cm^2}
			Arm curl Arm dump	2.84 – 3.43 MPa {29 – 35 kg/cm^2}
	2	Malfunction of merge-divider main EPC valve	Merge-divider main EPC valve may have malfunction. Check it directly.	
	3	Malfunction of merge-divider LS-EPC valve	Merge-divider LS-EPC valve may have malfunction. Check it directly.	
	4	Malfunction of merge-divider main valve	Merge-divider main valve may have malfunction. Check it directly.	
	5	Malfunction of merge-divider LS valve	Merge-divider LS valve may have malfunction. Check it directly.	
	6	Malfunction of arm control valve (spool)	Spool of arm control valve may have malfunction. Check it directly.	
	7	Malfunction of arm control valve (pressure compensation valve)	Pressure compensation valve of arm control valve may have malfunction. Check it directly.	
	8	Malfunction of arm control valve (regeneration valve)	Regeneration valve of arm control valve may have malfunction. Check it directly.	
	9	Malfunction of arm control valve (quick return valve)	Quick return valve of arm control valve may have malfunction. Check it directly.	
	10	Malfunction or defective seal of safety valve for lock valve	Safety valve for lock valve may have malfunction or defective seal. Check it directly.	
	11	Malfunction or defective seal of arm control valve (suction valve)	Suction valve of arm control valve may have malfunction or defective seal. Check it directly.	
	12	Malfunction or defective seal of arm control valve (safety-suction valve)	Safety-suction valve of arm control valve may have malfunction or defective seal. Check it directly.	
	13	Malfunction of each control valve (LS shuttle valve)	LS shuttle valve of right travel control valve, boom control valve, left travel control valve, bucket control valve, or service control valve may have malfunction. Check it directly.	
	14	Defective arm cylinder	★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.	
			Left work equipment control lever	Leakage from arm cylinder
			Arm curl relief	20 cc/min

H-9 Speed or power of bucket is low

Trouble	• Speed or power of bucket is low.
Related information	• Carry out all troubleshooting in power mode (P) of working mode.

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Malfunction of right PPC valve (bucket circuit)	★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.	
			Right work equipment control lever	PPC valve output pressure
			Neutral	0 MPa {0 kg/cm^2}
			Bucket curl Bucket dump	2.84 – 3.43MPa {29 – 35 kg/cm^2}
	2	Malfunction of bucket control valve (spool)	Spool of bucket control valve may have malfunction. Check it directly.	
	3	Malfunction of bucket control valve (pressure compensation valve)	Pressure compensation valve of bucket control valve may have malfunction. Check it directly.	
	4	Malfunction or defective seal of bucket control valve (safety-suction valve)	Safety-suction valve of bucket control valve may have malfunction or defective seal. Check it directly.	
	5	Malfunction of service control valve (LS shuttle valve)	LS shuttle valve of service control valve may have malfunction. Check it directly.	
	6	Defective bucket cylinder	★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.	
			Right work equipment control lever	Leakage from bucket cylinder
			Bucket curl relief	20 cc/min

H-10 Work equipment does not move singly

Trouble	(1) Boom does not move singly. (2) Arm does not move singly. (3) Bucket does not move singly.
Related information	• Carry out all troubleshooting in power mode (P) of working mode.

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Malfunction of PPC valve	★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.	
			Work equipment control lever	PPC valve output pressure
			Neutral	0 MPa {0 kg/cm^2}
			Operated	2.84 – 3.43 MPa {29 – 35 kg/cm^2}
	2	Malfunction of control valve (spool)	Spool of control valve may have malfunction. Check it directly.	

H-11 Hydraulic drift of work equipment is large

Trouble	(1) Hydraulic drift of boom is large.
Related information	• Carry out all troubleshooting in power mode (P) of working mode.

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Defective boom cylinder	★ Prepare with engine stopped, then run engine at high idling and carry out troubleshooting.	
			Right work equipment control lever	Leakage from boom cylinder
			Boom raise relief	20 cc/min
	2	Defective seal of boom control valve (lock valve)	Seal of lock valve of boom control valve may be defective. Check it directly.	
	3	Defective seal of safety valve for lock valve	Seal of safety valve for lock valve may be defective. Check it directly.	

Trouble	(2) Hydraulic drift of arm is large.
Related information	• Carry out all troubleshooting in power mode (P) of working mode.

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Defective arm cylinder	★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.	
			Left work equipment control lever	Leakage from arm cylinder
			Arm curl relief	20 cc/min
	2	Defective seal of arm control valve (spool)	Seal of arm control valve spool may be defective. Check it directly.	
	3	Defective seal of arm control valve (pressure compensation valve)	Seal of pressure compensation valve of arm control valve may be defective. Check it directly.	
	4	Defective seal of arm control valve (suction valve)	Seal of suction valve of arm control valve may be defective. Check it directly. ★ This suction valve may be checked by replacing it with another suction valve and seeing change of condition.	
	5	Defective seal of safety valve for lock valve	Seal of safety valve for lock valve may be defective. Check it directly.	

Trouble	(3) Hydraulic drift of bucket is large.
Related information	• Carry out all troubleshooting in power mode (P) of working mode.

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Defective bucket cylinder	★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.	
			Left work equipment control lever	Leakage from bucket cylinder
			Bucket curl relief	20 cc/min
	2	Defective seal of bucket control valve (spool)	Seal of bucket control valve spool may be defective. Check it directly.	
	3	Defective seal of bucket control valve (pressure compensation valve)	Seal of pressure compensation valve of bucket control valve may be defective. Check it directly.	
	4	Defective seal of bucket control valve (safety-suction valve)	Seal of safety-suction valve of bucket control valve may defective. Check it directly. ★ Safety-suction valves on bottom side and head side may be checked by replacing them with each other and seeing change of condition.	

H-12 Time lag of work equipment is large

Trouble	• Time lag of work equipment is large.
Related information	• Carry out all troubleshooting in power mode (P) of working mode.

<table>
<tr><td rowspan="5">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Malfunction of LS-EPC valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td>Travel speed</td><td>Travel lever</td><td>LS-EPC valve output pressure</td></tr>
<tr><td>Lo</td><td>Neutral</td><td>Approx. 2.9 MPa {Approx. 30 kg/cm^2}</td></tr>
<tr><td>Hi</td><td>Operated</td><td>0 MPa {0 kg/cm^2}</td></tr>
<tr><td>2</td><td>Malfunction of control valve (regeneration valve) [Boom and arm only]</td><td colspan="3">Regeneration valve of control valve may have malfunction. Check it directly.</td></tr>
<tr><td>3</td><td>Malfunction of control valve (safety-suction valve)</td><td colspan="3">Safety-suction valve of control valve may have malfunction. Check it directly.
★ This safety-suction valve may be checked by replacing it with safety-suction valve of normal control valve and seeing change of condition. (Set pressure of safety-suction valve for boom head circuit is different, however.)</td></tr>
<tr><td>4</td><td>Malfunction of control valve (pressure compensation valve)</td><td colspan="3">Pressure compensation valve of control valve may have malfunction. Check it directly.</td></tr>
</table>

H-13 When part of work equipment is relieved singly, other parts of work equipment move

Trouble	• When part of work equipment is relieved singly, other parts of work equipment move
Related information	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective seal of control valve (pressure compensation valve) on moving side	Seal of pressure compensation valve of control valve on moving side may be defective. Check it directly.

H-14 Power maximizing function does not work

Trouble	• Power maximizing function does not work.
Related information	• Carry out all troubleshooting in power mode (P) of working mode.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Malfunction of 2-stage relief solenoid valve	★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.	
			Swing lock switch	2-stage relief solenoid valve output pressure
			OFF	0 MPa {0 kg/cm^2}
			ON	2.9 MPa {30 kg/cm^2}
	2	Malfunction of main relief valve	Main relief valve may have malfunction. Check it directly.	

H-15 In compound operation of work equipment, speed of part loaded more is low

Trouble	• In compound operation of work equipment, speed of part loaded more is low.
Related information	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Malfunction of control valve (pressure compensation valve) on less load side	Pressure compensation valve of control valve on less load side may have malfunction. Check it directly.		
			Compound operation	Larger load side	Less load side
			Boom raise + Arm curl	Boom raise	Arm curl
			Boom raise + Arm dump	Arm dump	Boom raise
			Boom raise + Bucket curl	Boom raise	Bucket curl
			Arm dump + Bucket curl	Arm dump	Bucket curl
			Boom lower + Arm dump	Arm dump	Boom lower

H-16 When machine swings and raises boom simultaneously, boom rising speed is low

Trouble	• When machine swings and raises boom simultaneously, boom rising speed is low.
Related information	• If speed of single boom raise operation is also low, carry out troubleshooting for "H-7 Speed or power of boom is low" first.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Malfunction or defective seal of swing control valve (LS selector valve)	LS selector valve of control valve may have malfunction or defective seal. Check it directly.

H-17 When machine swings and travels simultaneously, travel speed lowers largely

Trouble	• When machine swings and travels simultaneously, travel speed lowers largely.
Related information	• If speed of single travel operation is also low, carry out troubleshooting for "H-19 Travel speed is low" first.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Malfunction of each control valve (LS shuttle valve)	LS shuttle valve of left travel control valve or swing control valve may have malfunction. Check it directly.

H-18 Machine deviates during travel

Trouble	• Machine deviates during travel.
Related information	• Carry out all troubleshooting in power mode (P) of working mode.

<table>
<tr><td rowspan="20">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Malfunction of travel PPC valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td>Travel lever</td><td colspan="2">PPC valve output pressure</td></tr>
<tr><td>Neutral</td><td colspan="2">0 MPa
{0 kg/cm^2}</td></tr>
<tr><td>Forward
Reverse</td><td colspan="2">2.84 – 3.43 MPa
{29 – 35 kg/cm^2}</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Malfunction of self pressure reducing valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td>Control lever</td><td colspan="2">Control circuit basic pressure</td></tr>
<tr><td>All levers in neutral</td><td colspan="2">2.84 – 3.43 MPa
{29 – 35 kg/cm^2}</td></tr>
<tr><td></td></tr>
<tr><td rowspan="5">3</td><td rowspan="5">Defective adjustment or malfunction of LS valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td rowspan="2">Measured oil pressure</td><td colspan="2">Operation of levers and oil pressure ratio</td></tr>
<tr><td>All levers in neutral</td><td>Travel with no load (Lever operated half-way)</td></tr>
<tr><td>Pump discharge pressure</td><td rowspan="2">Almost same pressure</td><td>1</td></tr>
<tr><td>PC valve output pressure</td><td>Approx. 0.6
(Approx. 3/5)</td></tr>
<tr><td colspan="3">If oil pressure does not become normal after adjustment, LS valve may have malfunction or internal defect. Check LS valve directly.</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Malfunction of travel junction solenoid valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td>Travel lever</td><td colspan="2">Travel junction solenoid valve output pressure</td></tr>
<tr><td>Both sides in neutral</td><td colspan="2">0 MPa
{0 kg/cm^2}</td></tr>
<tr><td>Either side operated</td><td colspan="2">2.9 MPa
{30 kg/cm^2}</td></tr>
<tr><td>5</td><td>Malfunction of travel junction valve</td><td colspan="3">Travel junction valve may have malfunction. Check it directly.</td></tr>
<tr><td>6</td><td>Malfunction of travel control valve (spool)</td><td colspan="3">Spool of travel control valve may have malfunction. Check it directly.</td></tr>
<tr><td rowspan="3">7</td><td rowspan="3">Defective travel motor</td><td colspan="3">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td>Travel lever</td><td colspan="2">Leakage from travel motor</td></tr>
<tr><td>Travel relief</td><td colspan="2">27.2 ℓ/min</td></tr>
<tr><td>8</td><td>Defective final drive</td><td colspan="3">Final drive may have internal defect. Check it directly.
★ It may be checked by abnormal sound, abnormal heating, metal chips in drain oil, etc.</td></tr>
</table>

H-19 Travel speed is low

Trouble	• Travel speed is low.
Related information	• Carry out all troubleshooting in power mode (P) of working mode.

<table>
<tr><td rowspan="20">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Malfunction of travel PPC valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td colspan="2">Travel lever</td><td>PPC valve output pressure</td></tr>
<tr><td colspan="2">Neutral</td><td>0 MPa
{0 kg/cm^2}</td></tr>
<tr><td colspan="2">Forward
Reverse</td><td>2.84 – 3.43 MPa
{29 – 35 kg/cm^2}</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Malfunction of self pressure reducing valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td colspan="2">Control lever</td><td>Control circuit basic pressure</td></tr>
<tr><td colspan="2">All levers in neutral</td><td>2.84 – 3.43 MPa
{29 – 35 kg/cm^2}</td></tr>
<tr><td></td></tr>
<tr><td rowspan="4">3</td><td rowspan="4">Malfunction of LS-EPC valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td>Measured oil pressure</td><td>Travel lever</td><td>LS-EPC valve output pressure</td></tr>
<tr><td>Lo</td><td>Neutral</td><td>Approx. 2.9 MPa
{Approx. 30 kg/cm^2}</td></tr>
<tr><td>Hi</td><td>Operated</td><td>0 MPa
{0 kg/cm^2}</td></tr>
<tr><td>4</td><td>Malfunction of travel control valve (spool)</td><td colspan="3">Spool of travel control valve may have malfunction. Check it directly.</td></tr>
<tr><td>5</td><td>Malfunction of travel control valve (pressure compensation valve)</td><td colspan="3">Pressure compensation valve of control valve may have malfunction. Check it directly.</td></tr>
<tr><td>6</td><td>Malfunction of travel control valve (suction valve)</td><td colspan="3">Suction valve of control valve may have malfunction. Check it directly.</td></tr>
<tr><td>7</td><td>Malfunction of bucket control valve (LS shuttle valve)</td><td colspan="3">LS shuttle valve of bucket control valve may have malfunction. Check it directly.</td></tr>
<tr><td rowspan="3">8</td><td rowspan="3">Defective travel motor</td><td colspan="3">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td colspan="2">Travel lever</td><td>Leakage from travel motor</td></tr>
<tr><td colspan="2">Travel relief</td><td>27.2 ℓ/min</td></tr>
<tr><td>9</td><td>Defective final drive</td><td colspan="3">Final drive may have internal defect. Check it directly.
★ It may be checked by abnormal sound, abnormal heating, metal chips in drain oil, etc.</td></tr>
</table>

H-20 Machine is not steered well or steering power is low

Trouble	• Machine is not steered well or steering power is low
Related information	• Carry out all troubleshooting in power mode (P) of working mode.

<table>
<tr><td rowspan="16">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="2">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Malfunction of travel PPC valve (steering spool)</td><td colspan="2">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td>Travel lever</td><td>PPC valve output pressure (Steering)</td></tr>
<tr><td>Both sides in neutral</td><td>0 MPa
{0 kg/cm^2}</td></tr>
<tr><td>Either side operated</td><td>2.84 – 3.43 MPa
{29 – 35 kg/cm^2}</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Malfunction of travel junction solenoid valve</td><td colspan="2">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td>Travel lever</td><td>Travel junction solenoid valve output pressure</td></tr>
<tr><td>Both sides in neutral</td><td>0 MPa
{0 kg/cm^2}</td></tr>
<tr><td>Either side operated</td><td>2.9 MPa
{30 kg/cm^2}</td></tr>
<tr><td>3</td><td>Malfunction of travel junction valve</td><td colspan="2">Travel junction valve may have malfunction. Check it directly.</td></tr>
<tr><td>4</td><td>Malfunction of merge-divider main EPC valve</td><td colspan="2">Merge-divider main EPC valve may have malfunction. Check it directly.</td></tr>
<tr><td>5</td><td>Malfunction of merge-divider LS-EPC valve</td><td colspan="2">Merge-divider LS-EPC valve may have malfunction. Check it directly.</td></tr>
<tr><td>6</td><td>Malfunction of merge-divider main valve</td><td colspan="2">Merge-divider main valve may have malfunction. Check it directly.</td></tr>
<tr><td>7</td><td>Malfunction of merge-divider LS valve</td><td colspan="2">Merge-divider LS valve may have malfunction. Check it directly.</td></tr>
<tr><td>8</td><td>Malfunction of travel control valve (spool)</td><td colspan="2">Spool of travel control valve may have malfunction. Check it directly.</td></tr>
<tr><td>9</td><td>Malfunction of travel control valve (pressure compensation valve)</td><td colspan="2">Pressure compensation valve of travel control valve may have malfunction. Check it directly.</td></tr>
<tr><td>10</td><td>Malfunction of travel control valve (suction valve)</td><td colspan="2">Suction valve of travel control valve may have malfunction. Check it directly.</td></tr>
<tr><td>11</td><td>Malfunction of bucket control valve (LS shuttle valve)</td><td colspan="2">LS shuttle valve of bucket control valve may have malfunction. Check it directly.</td></tr>
<tr><td>12</td><td>Defective seal of check valve of LS pressure sensing part (control valve side)</td><td colspan="2">Seal of check valve of LS pressure sensing part (control valve side) may be defective. Check it directly.</td></tr>
<tr><td>13</td><td>Defective seal of travel motor (safety valve)</td><td colspan="2">Seal of safety valve of travel motor may be defective. Check it directly.
★ Motors of same type on forward and reverse sides or on right and left sides may be checked by replacing them with each other and seeing change of condition.</td></tr>
<tr><td>14</td><td>Defective seal of travel motor (check valve)</td><td colspan="2">Seal of check valve of travel motor may be defective. Check it directly.
★ Motors of same type on forward and reverse sides or on right and left sides may be checked by replacing them with each other and seeing change of condition.</td></tr>
</table>

H-21 Travel speed does not change or travel speed is low/high

Trouble	• Travel speed does not change or travel speed is low/high
Related information	• Carry out all troubleshooting in power mode (P) of working mode.

<table>
<tr><td rowspan="15">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="8">1</td><td rowspan="8">Malfunction of LS-EPC valve</td><td colspan="3">★ Run engine at high idle and carry out troubleshooting (with monitoring function).</td></tr>
<tr><td>Travel speed</td><td>Travel lever</td><td>Monitoring code: 01500</td></tr>
<tr><td>Lo</td><td rowspan="3">Operated</td><td>663 mA (PC210-8)
578 mA (PC240-8)
(* Reference)</td></tr>
<tr><td>Mi</td><td>424 mA (PC210-8)
641 mA (PC240-8)</td></tr>
<tr><td>Hi</td><td>0 mA</td></tr>
<tr><td colspan="3">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td>Travel speed</td><td>Travel lever</td><td>LS-EPC valve output pressure</td></tr>
<tr><td>Lo</td><td>Neutral</td><td>Approx. 2.9 MPa
{Approx. 30 kg/cm^2}</td></tr>
<tr><td>Hi</td><td>Operated</td><td>0 MPa
{0 kg/cm^2}</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Malfunction of travel speed shifting solenoid valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td>Travel speed</td><td>Travel lever</td><td>Travel speed shifting solenoid valve output pressure</td></tr>
<tr><td>Lo</td><td>Neutral</td><td>0 MPa
{0 kg/cm^2}</td></tr>
<tr><td>Hi</td><td>Operated</td><td>Approx. 2.9 MPa
{Approx. 30 kg/cm^2}</td></tr>
<tr><td>3</td><td>Malfunction of travel motor (speed shifting section)</td><td colspan="3">Speed shifting section of travel motor may have malfunction. Check it directly.</td></tr>
</table>

*: Travel speed Lo can be adjusted with the adjusting function of the machine monitor. Accordingly, if the initial value has been changed, the measured value varies more or less.

H-22 Travel system does not move (only one side)

Trouble	• Travel system does not move (only one side).
Related information	• Carry out all troubleshooting in power mode (P) of working mode.

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Defective seal of travel control valve (suction valve)	Seal of suction valve of travel control valve may have malfunction. Check it directly.	
	2	Defective seal of travel motor (safety valve)	Seal of safety valve of travel control valve may have malfunction. Check it directly. ★ Motors of same type on forward and reverse sides or on right and left sides may be checked by replacing them with each other and seeing change of condition.	
	3	Defective seal of travel motor (check valve)	Seal of check valve of travel control valve may have malfunction. Check it directly. ★ Motors of same type on forward and reverse sides or on right and left sides may be checked by replacing them with each other and seeing change of condition.	
	4	Malfunction of travel motor (parking brake)	Parking brake of travel motor may have malfunction. Check it directly.	
	5	Defective travel motor	★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.	
			Travel lever	Leakage from travel motor
			Travel system relief	27.2 ℓ/min
	6	Defective final drive	Final drive may have internal defect. Check it directly. ★ It may be checked by abnormal sound, abnormal heating, metal chips in drain oil, etc.	

H-23 Upper structure does not swing

Trouble	(1) Upper structure does not swing in either direction.
Related information	• Carry out all troubleshooting in power mode (P) of working mode.

<table>
<tr><td rowspan="15">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Malfunction of swing holding brake solenoid valve</td><td colspan="3">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td colspan="2">Left work equipment control lever</td><td>Swing holding brake solenoid valve output pressure</td></tr>
<tr><td colspan="2">Neutral</td><td>0 MPa
{0 kg/cm^2}</td></tr>
<tr><td colspan="2">Left swing
Right swing</td><td>2.9 MPa
{30 kg/cm^2}</td></tr>
<tr><td>2</td><td>Malfunction of swing control valve (spool)</td><td colspan="3">Spool of swing control valve may have malfunction. Check it directly.</td></tr>
<tr><td>3</td><td>Malfunction of swing motor (parking brake)</td><td colspan="3">Parking brake of swing motor may have malfunction. Check it directly.</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Defective adjustment or malfunction of swing motor (safety valve)</td><td colspan="3">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td>Swing lock switch</td><td>Left work equipment control lever</td><td>Swing relief pressure</td></tr>
<tr><td>ON</td><td>Swing relief</td><td>28.9 – 32.9 MPa
{295 – 335 kg/cm^2}</td></tr>
<tr><td colspan="3">If oil pressure does not become normal after adjustment, swing motor safety valve may have malfunction or internal defect. Check safety valve directly.</td></tr>
<tr><td rowspan="3">5</td><td rowspan="3">Defective swing motor</td><td colspan="3">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td>Swing lock switch</td><td>Left work equipment control lever</td><td>Leakage from swing motor</td></tr>
<tr><td>ON</td><td>Swing relief</td><td>Max. 10 ℓ/min</td></tr>
<tr><td>6</td><td>Defective swing machinery</td><td colspan="3">Swing machinery may have internal defect. Check it directly.
★ It may be checked by abnormal sound, abnormal heating, metal chips in drain oil, etc.</td></tr>
</table>

Trouble	(2) Upper structure swings only in one direction.
Related information	• Carry out all troubleshooting in power mode (P) of working mode.

<table>
<tr><td rowspan="6">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="2">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Malfunction of swing PPC valve</td><td colspan="2">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td>Left work equipment control lever</td><td>PPC valve output pressure</td></tr>
<tr><td>Neutral</td><td>0 MPa
{0 kg/cm^2}</td></tr>
<tr><td>Left swing
Right swing</td><td>2.84 – 3.43 MPa
{29 – 35 kg/cm^2}</td></tr>
<tr><td>2</td><td>Malfunction of swing control valve (spool)</td><td colspan="2">Spool of swing control valve may have malfunction. Check it directly.</td></tr>
<tr><td>3</td><td>Malfunction of swing motor (suction valve)</td><td colspan="2">Suction valve of swing motor may have malfunction. Check it directly.
★ Suction valves on right side and left side may be checked by replacing them with each other and seeing change of condition.</td></tr>
<tr><td>4</td><td>Malfunction of swing motor (check valve)</td><td colspan="2">Check valve of swing motor may have malfunction. Check it directly.
★ Check valves on right side and left side may be checked by replacing them with each other and seeing change of condition.</td></tr>
</table>

H-24 Swing acceleration or swing speed is low

Trouble	(1) Swing acceleration or swing speed is low in both directions.
Related information	• Carry out all troubleshooting in power mode (P) of working mode.

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Malfunction of swing control valve (spool)	Spool of swing control valve may have malfunction. Check it directly.		
	2	Malfunction of all control valves (LS shuttle valves)	LS shuttle valves of all control valves may have malfunction. Check them directly.		
	3	Malfunction of swing motor (parking brake)	Parking brake of swing motor may have malfunction. Check it directly.		
	4	Defective adjustment or malfunction of swing motor (safety valve)	★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.		
			Swing lock switch	Left work equipment control lever	Swing relief pressure
			ON	Swing relief	28.9 – 32.9 MPa {295 – 335 kg/cm^2}
			If oil pressure does not become normal after adjustment, swing motor safety valve may have malfunction or internal defect. Check safety valve directly.		
	5	Defective swing motor	★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.		
			Swing lock switch	Left work equipment control lever	Leakage from swing motor
			ON	Swing relief	Max. 10 ℓ/min
	6	Defective swing machinery	Swing machinery may have internal defect. Check it directly. ★ It may be check by abnormal sound, abnormal heating, metal chips in drain oil, etc.		

Trouble	(2) Swing acceleration or swing speed is low in only one direction.
Related information	• Carry out all troubleshooting in power mode (P) of working mode.

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Malfunction of swing PPC valve	★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.	
			Left work equipment control lever	PPC valve output pressure
			Neutral	0 MPa {0 kg/cm^2}
			Left swing Right swing	2.84 – 3.43 MPa {29 – 35 kg/cm^2}
	2	Malfunction of swing control valve (spool)	Spool of swing control valve may have malfunction. Check it directly.	
	3	Malfunction of swing control valve (pressure compensation valve)	Pressure compensation valve of swing control valve may have malfunction. Check it directly.	
	4	Malfunction of swing motor (suction valve)	Suction valve of swing motor may have malfunction. Check it directly. ★ Suction valves on right side and left side may be checked by replacing them with each other and seeing change of condition.	
	5	Malfunction of swing motor (check valve)	Check valve of swing motor may have malfunction. Check it directly. ★ Check valves on right side and left side may be checked by replacing them with each other and seeing change of condition.	

H-25 Upper structure overruns remarkably when it stops swinging

Trouble	(1) Upper structure overruns remarkably when it stops swinging in both directions.
Related information	• Carry out all troubleshooting in power mode (P) of working mode.

<table>
<tr><td rowspan="6">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Defective adjustment or malfunction of swing motor (safety valve)</td><td colspan="3">• Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td>Swing lock switch</td><td>Left work equipment control lever</td><td>Swing relief pressure</td></tr>
<tr><td>ON</td><td>Swing relief</td><td>28.9 – 32.9 MPa
{295 – 335 kg/cm^2}</td></tr>
<tr><td colspan="3">If oil pressure does not become normal after adjustment, swing motor safety valve may have malfunction or internal defect. Check safety valve directly.</td></tr>
<tr><td rowspan="3">2</td><td rowspan="3">Defective swing motor</td><td colspan="3">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td>Swing lock switch</td><td>Left work equipment control lever</td><td>Leakage from swing motor</td></tr>
<tr><td>ON</td><td>Swing relief</td><td>Max. 10 ℓ/min</td></tr>
</table>

Trouble	(2) Upper structure overruns remarkably when it stops swinging in only one direction.
Related information	• Carry out all troubleshooting in power mode (P) of working mode.

<table>
<tr><td rowspan="8">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="2">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Malfunction of swing PPC valve</td><td colspan="2">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td>Left work equipment control lever</td><td>PPC valve output pressure</td></tr>
<tr><td>Neutral</td><td>0 MPa
{0 kg/cm^2}</td></tr>
<tr><td>2</td><td>Clogging of swing PPC slow return valve</td><td colspan="2">Swing PPC slow return valve may have malfunction. Check it directly.
★ Slow return valves on right side and left side may be checked by replacing them with each other and seeing change of condition.</td></tr>
<tr><td>3</td><td>Malfunction of swing control valve (spool)</td><td colspan="2">Spool of swing control valve may have malfunction. Check it directly.</td></tr>
<tr><td>4</td><td>Malfunction of swing motor (suction valve)</td><td colspan="2">Suction valve of swing motor may have malfunction. Check it directly.
★ Suction valves on right side and left side may be checked by replacing them with each other and seeing change of condition.</td></tr>
<tr><td>5</td><td>Malfunction of swing motor (check valve)</td><td colspan="2">Check valve of swing motor may have malfunction. Check it directly.
★ Check valves on right side and left side may be checked by replacing them with each other and seeing change of condition.</td></tr>
<tr><td colspan="5"></td></tr>
</table>

H-26 Large shock is made when upper structure stops swinging

Trouble	• Large shock is made when upper structure stops swinging.
Related information	• Carry out all troubleshooting in power mode (P) of working mode.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Malfunction of swing PPC valve	★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.	
			Left work equipment control lever	PPC valve output pressure
			Neutral	0 MPa {0 kg/cm^2}
			Left swing Right swing	2.84 – 3.43 MPa {29 – 35 kg/cm^2}
	2	Clogging of swing PPC slow return valve	Swing PPC slow return valve may have malfunction. Check it directly. ★ Slow return valves on right side and left side may be checked by replacing them with each other and seeing change of condition.	
	3	Malfunction of swing motor (shockless valve)	Shockless valve of swing motor may have malfunction. Check it directly.	

H-27 Large sound is made when upper structure stops swinging

Trouble	• Large sound is made when upper structure stops swinging.
Related information	• Carry out all troubleshooting in power mode (P) of working mode.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Malfunction of back pressure valve	Back pressure valve may have malfunction. Check it directly.
	2	Malfunction of swing motor (safety valve)	Safety valve of swing motor may have malfunction. Check it directly.
	3	Malfunction of swing motor (suction valve)	Suction valve of swing motor may have malfunction. Check it directly. ★ Suction valves on right side and left side may be checked by replacing them with each other and seeing change of condition.
	4	Defective swing machinery	Swing machinery may have internal defect. Check it directly. ★ It may be checked by abnormal sound, abnormal heating, metal chips in drain oil, etc.

H-28 Hydraulic drift of swing is large

Trouble	(1) Hydraulic drift of swing is large (when swing holding brake is applied).
Related information	• When swing lock switch is turned ON or when swing holding brake release switch is in normal position, swing holding brake operates and upper structure is fixed with disc brake. • Carry out all troubleshooting in power mode (P) of working mode.

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Malfunction of swing holding brake solenoid valve	★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.	
			Left work equipment control lever	Swing holding brake solenoid valve output pressure
			Neutral	0 MPa {0 kg/cm^2}
			Left swing Right swing	2.9 MPa {30 kg/cm^2}
	2	Malfunction of swing motor (parking brake)	Parking brake of swing motor may have malfunction. Check it directly.	

Trouble	(2) Hydraulic drift of swing is large (when swing holding brake is released).
Related information	• When swing holding brake release switch is in release position, swing holding brake is released and upper structure is secured by only hydraulic pressure. • Carry out all troubleshooting in power mode (P) of working mode.

	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Malfunction or defective seal of swing control valve (spool)	Swing control valve spool may have malfunction or defective seal. Check it directly.
	2	Defective seal of swing control valve (pressure compensation valve)	Seal of pressure compensation valve of swing control valve may be defective. Check it directly.
	3	Defective seal of swing motor (safety valve)	Seal of safety valve of swing motor may be defective. Check it directly.
	4	Defective seal of swing motor (suction valve)	Seal of suction valve of swing motor may be defective. Check it directly.
	5	Defective seal of swing motor (check valve)	Seal of check valve of swing motor may be defective. Check it directly.
	6	Defective seal of swing motor (shockless valve)	Seal of shockless valve of swing motor may be defective. Check it directly.

H-29 Attachment circuit is not changed

Attachment installation specification

Trouble	• Attachment circuit is not changed.
Related information	• When attachment installation specification is employed, service circuit is changed as follows according to selected working mode. 1) ATT mode: Service circuit is changed to double acting circuit and safety valve is set to low pressure. 2) B mode: Service circuit is changed to single acting circuit and safety valve is set to high pressure. • Safety valve set pressure on only B port side is changed; that on A port side is kept low.

<table>
<tr><td rowspan="5">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="2">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Malfunction of ATT return selector solenoid valve</td><td colspan="2">★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.</td></tr>
<tr><td>Working mode</td><td>ATT return selector solenoid valve output pressure</td></tr>
<tr><td>ATT mode</td><td>0 MPa
{0 kg/cm^2}</td></tr>
<tr><td>B mode</td><td>2.9 MPa
{30 kg/cm^2}</td></tr>
<tr><td>2</td><td>Malfunction of ATT return selector valve</td><td colspan="2">ATT return selector valve may have malfunction. Check it directly.</td></tr>
<tr><td>3</td><td>Malfunction of service control valve (safety valve)</td><td colspan="2">Safety valve (B port side) of service control valve may have malfunction. Check it directly.</td></tr>
</table>

H-30 Oil flow in attachment circuit cannot be controlled

Attachment installation specification

Trouble	• Oil flow in attachment circuit cannot be controlled.
Related information	• When attachment installation specification is employed, oil flow in service circuit changes according to selected user mode. • Procedure for adjusting oil flow in ATT mode of working mode is different from that in B mode. For details, see Operation and Maintenance Manual.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Malfunction of ATT flow adjustment EPC valve	ATT flow adjustment EPC valve may have malfunction. Check it directly.
	2	Malfunction of service PPC valve	Service PPC valve may have malfunction. Check it directly.

PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00245-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

40 Troubleshooting

Troubleshooting of engine (S-mode)

Troubleshooting of engine (S-mode)

Method of using troubleshooting chart

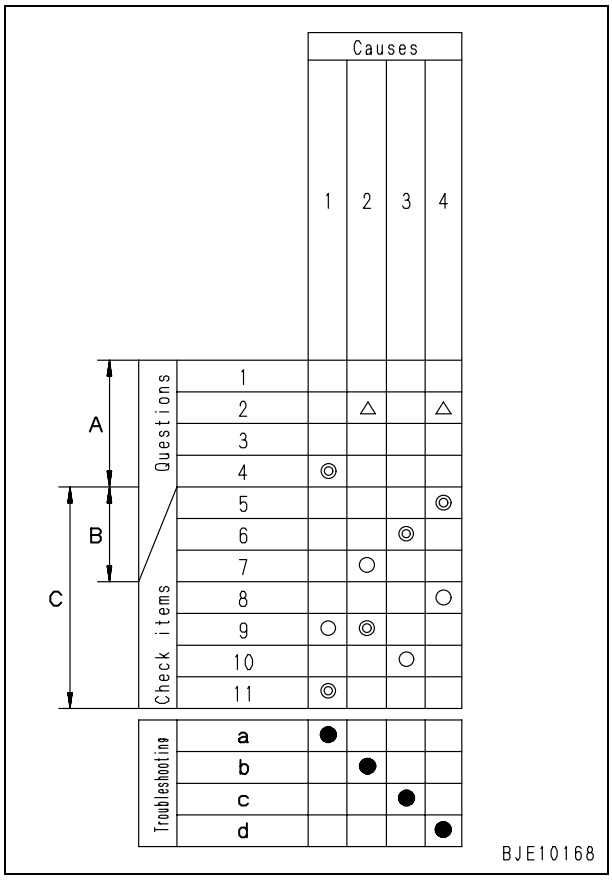
The troubleshooting chart consists of the "questions", "check items", "causes", and "troubleshooting" blocks.
The questions and check items are used to pinpoint high probability causes by simple inspection or from phenomena without using troubleshooting tools.
Next, troubleshooting tools or direct inspection are applied to check the narrowed causes in order from the most probable one to make final confirmation according to the troubleshooting procedure.

[Questions]
Items to be drawn from the user or operator. They correspond to **A** and **B** in the chart on the right. The items in **A** are basic ones. The items in **B** can be drawn from the user or operator, depending on their level.

[Check items]
Simple check items used by the serviceman to narrow the causes. They correspond to **C** in the chart on the right.

[Causes]
Items to be narrowed from the questions and check items. The serviceman narrows down the probable causes from **A**, **B**, and **C**.

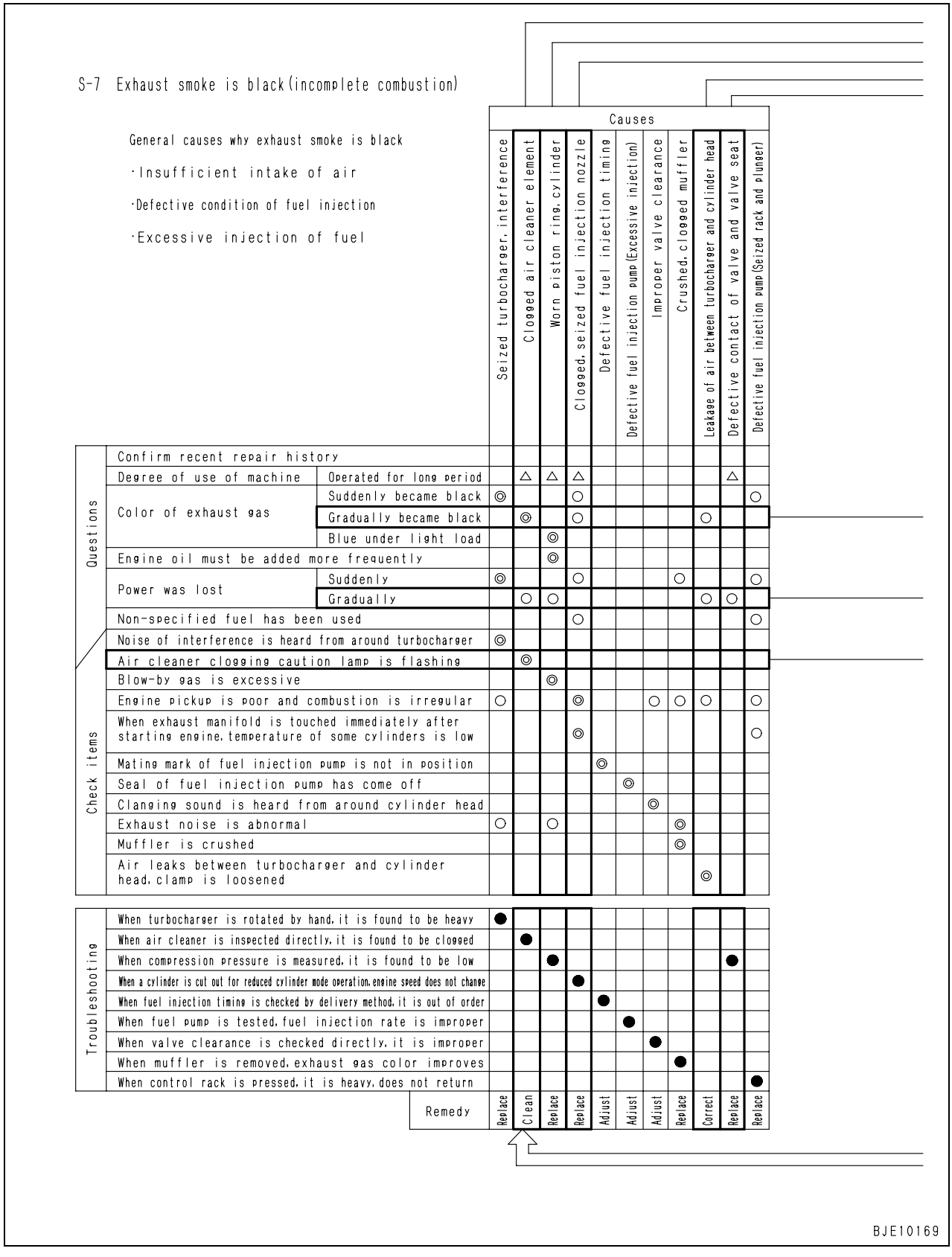
[Troubleshooting]
Items used to find out the true cause by verifying the narrowed causes finally in order from the most probable one by applying troubleshooting tools or direct inspection.



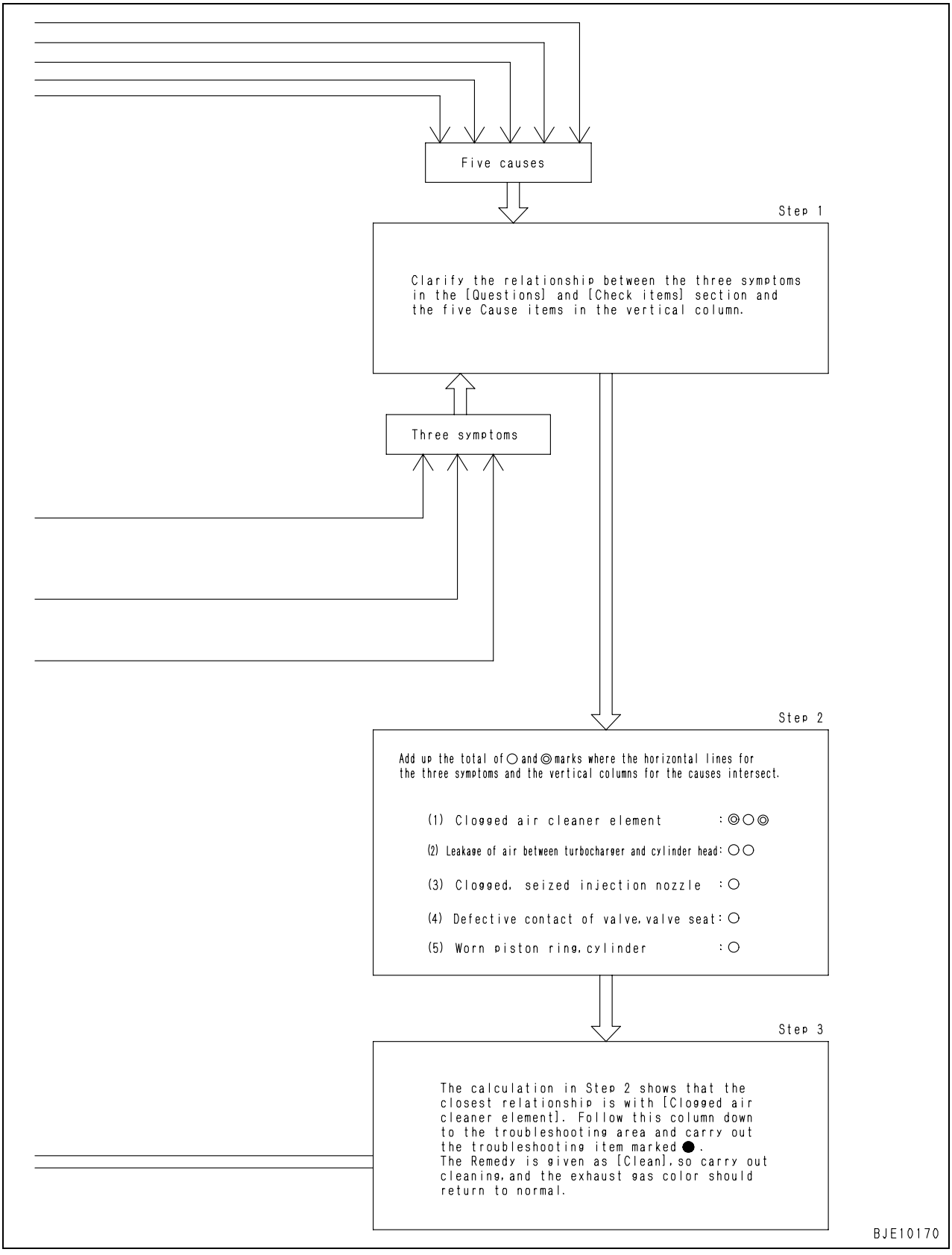
Items listed in the [Questions] and [Check items] and related to the [Causes] are marked with △, ○, and ◎.
△: Causes to be referred to for questions and check items
○ : Causes related to questions and check items
◎ : Causes highly probable among ones marked with ○

★ When narrowing the "causes", apply the items marked with ◎ before those marked with ○.
When narrowing the causes, do not apply the items marked with △. (If no items have other marks and the causes cannot be narrowed, however, you may apply them.)

<Example of troubleshooting> Exhaust gas is black
Let us assume that [Clogged air cleaner] is taken to be the cause of black exhaust gas. Three symptoms have causal relationship with this problem: [Exhaust gas slowly became black], [Power slowly became weaker], and [Air cleaner clogging caution lamp is flashing].



If we look from these three symptoms to find the causes, we find that there is a relationship with five causes. Let us explain here the method of using this causal relationship to pinpoint the most probable cause.



S-1 Starting performance is poor

General causes why starting performance is poor
- Defective electrical system
- Insufficient supply of fuel
- Insufficient intake of air
- Improper selection of fuel

★ The common rail fuel injection system (CRI) recognizes the fuel injection timing electrically. Accordingly, even if the starting operation is carried out, the engine may not start until the crankshaft revolves 2 turns at maximum. This phenomenon does not indicate a trouble, however.

			Causes												
			Clogged air cleaner element	Defective contact of valve, vale seat	Worn piston ring, cylinder	Clogged air breather hole of fuel tank cap	Leaking or clogged fuel piping, entry of air	Clogged fuel filter, element	Stuck, seized supply pump plunger	Defective injector	Defective intake air heater system	Defective alternator (regulator section)	Defective alternator (generator section)	Defective, deteriorated battery
Questions	Confirm recent repair history													
	Degree of use of machine	Operated for long period	△					△						△
	Starting performance	Became worse gradually	○	◎	◎			○						
		Engine starts easily when warm									◎			◎
	Non-specified fuel is being used							○	○	○				
	Replacement of filters has not been carried out according to Operation and Maintenance Manual		◎					◎	○	○				
	Engine oil must be added more frequently				◎									
	When engine is preheated or when temperature is low, preheating monitor does not indicate normally										◎			
	During operation, charge level monitor indicates abnormal charge											◎	◎	
Check items	Dust indicator is red		◎											
	Air breather hole of fuel tank cap is clogged					◎								
	Fuel is leaking from fuel piping						◎		○					
	When priming pump is operated, it makes no reaction or it is heavy						◎	○						
	Starting motor cranks engine slowly													◎
	While engine is cranked with starting motor	If air bleeding plug of fuel filter is removed, fuel does not flow out						◎						
		If spill hose from injector is disconnected, little fuel spills							◎					
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low									◎				
	Engine does not pick up smoothly and combustion is irregular			○	○					◎				
	There is hunting from engine (rotation is irregular)					○	◎	○						
	Blow-by gas is excessive				◎									

Troubleshooting	Inspect air cleaner directly		●											
	When compression pressure is measured, it is found to be low			●	●									
	When air is bled from fuel system, air comes out						●							
	Inspect fuel filter, strainer directly							●						
	Carry out troubleshooting according to "Rail Press (Very) Low Error (*1)" indicated by code								●					
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change									●				
	When starting switch is turned to HEAT, intake air heater mount does not become warm										●			
	Is voltage 20 – 30 V between alternator terminal B and terminal E with engine at low idle?	Yes										●		
		No											●	
	When specific gravity of electrolyte and voltage of battery are measured, they are low													●
		Remedy	Clean	Replace	Replace	Clean	correct	Clean	Replace	Replace	Replace	Replace	Replace	Replace

*1: Displayed failure codes [CA559] and [CA2249]

S-2 Engine does not start

a) Engine does not turn

General causes why engine does not turn

- Internal parts of engine seized
  → See "S-4 Engine stops during operations
- Defective electrical system
- Problem in drive devices on applicable machine side
  → Carry out troubleshooting for devices on applicable machine

			Causes							
			Broken flywheel ring gear	Defective or deteriorated battery	Defective connection of battery terminal	Defective battery relay	Defective starting switch	Defective safety relay	Defective starting motor (motor section)	Defective starting circuit wiring
Questions	Confirm recent repair history									
	Degree of use of machine	Operated for long period	△	△						
	Condition of horn when starting switch is turned ON	Horn does not sound			○		○			◎
		Horn volume is low		◎						
Check items	Battery electrolyte is low			◎						
	Battery terminal is loose				◎					
	When starting switch is turned ON, there is no operating sound from battery relay			○		◎				
	When starting switch is turned to START, starting pinion does not move out			○			○			◎
	When starting switch is turned to START, starting pinion moves out, but	Speed of rotation is low		◎						
		Makes grating noise	◎						◎	
		Soon disengages again						◎		
		Makes rattling noise and does not turn		○				○	○	
Troubleshooting	Inspect flywheel ring gear directly		●							Carry out troubleshooting on applicable machine side
	When specific gravity of electrolyte and voltage of battery are measured, they are low			●						
	Turn starting switch OFF, connect cord, and carry out troubleshooting at ON	There is not voltage (20 – 30 V) between battery relay terminal B and terminal E				●				
		When terminal B and terminal C of starting switch are connected, engine starts					●			
		When terminal B and terminal C at safety relay outlet are connected, engine starts						●		
		Even if terminal B and terminal C at safety relay outlet are connected, engine does not start							●	
		When safety switch terminal and terminal B of starting motor are connected, engine starts							●	
		Remedy	Replace	Replace	Correct	Replace	Replace	Replace	Replace	—

b) Engine turns but no exhaust smoke comes out

General causes why engine turns but no exhaust smoke comes out

- Fuel is not being supplied
- Supply of fuel is extremely small
- Improper selection of fuel (particularly in winter)

			Causes												
			Use of improper fuel	Insufficient fuel in tank	Clogged air breather hole of fuel tank cap	Leaking or clogged fuel piping, entry of air	Clogged fuel filter element	Seized, abnormally worn feed pump	Broken supply pump shaft	Stuck, seized supply pump plunger	Defective supply pump MPROP	Defective operation of overflow valve (Does not close)	Defective common rail pressure limiter	Defective fuel injector
Questions	Confirm recent repair history													
Questions	Degree of use of machine	Operated for long period				△	△							
Questions	Exhaust smoke suddenly stopped coming out (when starting again)							◎	○	◎	◎			△
Questions	Replacement of filters has not been carried out according to Operation and Maintenance Manual						◎			△				○
Check items	When fuel tank is inspected, it is found to be empty			◎										
Check items	Air breather hole of fuel tank cap is clogged			○	◎									
Check items	Rust and water are found when fuel tank is drained						○	△		△	△			
Check items	When fuel filter is removed, there is not fuel in it		◎			◎								
Check items	Fuel is leaking from fuel piping					◎								
Check items	When priming pump is operated, it makes no reaction or it is heavy					◎	○							
Check items	While engine is cranked with starting motor	If air bleeding plug of fuel filter is removed, fuel does not flow out		○		○		◎	○					
Check items	While engine is cranked with starting motor	If spill hose from injector is disconnected, little fuel spills				○			◎	◎	◎			○
Troubleshooting	When air is bled from fuel system, air comes out					●								
Troubleshooting	Inspect fuel filter directly						●							
Troubleshooting	Inspect feed pump directly							●						
Troubleshooting	Carry out troubleshooting according to "Rail Press (Very) Low Error (*1)" indicated by code								●	●				
Troubleshooting	Carry out troubleshooting according to "IMV/PCV1 Short (Open) Error (*2)" indicated by code										●			
Troubleshooting	Inspect overflow valve directly											●		
Troubleshooting	Engine can be started in reduced cylinder mode.													●
Troubleshooting	If pressure limiter return pipe is disconnected, fuel flows out												●	
		Remedy	Replace	Add	Correct	Correct	Replace	Replace	Replace	Replace	Replace	Replace	Replace	Replace

*1: Displayed failure codes [CA559] and [CA2249]

*2: Displayed failure codes [CA271] and [CA272]

c) Exhaust smoke comes 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 dynamic valve system (Valve, rocker lever, etc.)	Worn piston ring, cylinder liner	Use of improper fuel	Clogged air breather hole of fuel tank cap	Leaking or clogged fuel system, entry of air	Clogged fuel filter	Stuck, seized supply pump plunger	Clogged injector, defective spray	Defective, deteriorated battery	Defective coolant temperature sensor, wiring harness	Defective intake air heater system
Questions	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		◎						◎					
	Engine oil must be added more frequently				◎									
	When engine is preheated or when temperature is low, preheating monitor does not indicate normally													◎
Check items	Dust indicator is red		◎											
	Air breather hole of fuel tank cap is clogged						○							
	Rust and water are found when fuel tank is drained								◎					
	When fuel filter is removed, there is not fuel in it					◎								
	Fuel is leaking from fuel piping							◎						
	When priming pump is operated, it makes no reaction or it is heavy							◎	○					
	Starting motor cranks engine slowly											◎		
	When engine is cranked, abnormal sound is generated around cylinder head			◎										
	While engine is cranked with starting motor,	If air bleeding plug of fuel filter is removed, fuel does not flow out				○			◎					
		If spill hose from injector is disconnected, little fuel spills								◎				
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low										◎			
Troubleshooting	Inspect air cleaner directly		●											
	Inspect dynamic 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 directly								●					
	Carry out troubleshooting according to "Rail Press (Very) Low Error (*1)" indicated by code									●				
	Engine can be started in reduced cylinder mode.										●			
	When specific gravity of electrolyte and voltage of battery are measured, they are low											●		
	Coolant temperature gauge does not indicate normally												●	
	When starting switch is turned to HEAT, intake air heater mount does not become warm													●
		Remedy	Clean	Replace	Replace	Replace	Clean	Correct	Clean	Replace	Replace	Replace	Replace	Replace

*1: Displayed failure codes [CA559] and [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 spray
- Improper selection of fuel
- Controller is controlling in derate mode (limiting injection rate (output) because of an error in electrical system)

			Causes										
			Clogged air cleaner element	Defective contact of valve and valve seat	Improper valve clearance	Seized turbocharger, interference of turbocharger	Worn piston ring, cylinder liner	Clogged air breather hole of fuel tank cap	Leaking or clogged fuel piping, entry of air	Clogged fuel filter	Stuck, seized supply pump plunger	Clogged injector, defective spray
Questions	Confirm recent repair history											
	Degree of use of machine	Operated for long period	△	△			△			△		
	Engine pick-up suddenly became worse					◎		○	○			○
	Non-specified fuel is being used									◎	◎	◎
	Replacement of filters has not been carried out according to Operation and Maintenance Manual		◎							◎		
	Oil must be added more frequently						◎					
Check items	Dust indicator is red		◎									
	Air breather hole of fuel tank cap is clogged							◎				
	Rust and water are found when fuel tank is drained									◎		
	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	Blue under light load					◎					
		Black	◎	○		◎						◎
	When engine is cranked, abnormal sound is generated around cylinder head				◎							
	When engine is cranked, interference sound is generated around turbocharger					◎						
	High idle speed under no load is normal, but speed suddenly drops when load is applied							○		◎		
	There is hunting from engine (rotation is irregular)							○		○		○
	Blow-by gas is excessive						◎					

Troubleshooting	Inspect air cleaner directly		●									
	When compression pressure is measured, 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, strainer directly									●		
	Carry out troubleshooting according to "Rail Press (Very) Low Error (*1)" indicated by code										●	
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change											●
		Remedy	Clean	Replace	Adjust	Replace	Replace	Clean	Correct	Clean	Replace	Replace

*1: Displayed failure codes [CA559] and [CA2249]

S-4 Engine stops during operations

General causes why engine stops during operations
- Seized parts inside engine
- Insufficient supply of fuel
- There is overheating
- Problem in drive devices on applicable machine side
  → Carry out troubleshooting for devices on applicable machine

			Causes												
			Broken dynamic valve system (valve, rocker arm, etc.)	Broken, seized piston, connecting rod	Broken, seized crankshaft bearing	Broken, seized gear train	Insufficient fuel in tank	Clogged air breather hole of fuel tank cap	Leaking, clogged fuel piping	Clogged fuel filter	Broken, seized feed pump	Broken supply pump shaft	Stuck, seized supply pump plunger	Broken auxiliary equipment (pump, compressor, etc.)	Problem in drive devices on applicable machine side
Questions	Confirm recent repair history														
	Degree of use of machine	Operated for long period								△					
	Condition when engine stopped	Abnormal noise was heard and engine stopped suddenly	◎	◎	◎	◎					○	◎	○	◎	◎
		Engine overheated and stopped		◎	○									○	
		Engine stopped slowly					◎			○					
		There was hunting and engine stopped					◎	○		○	○				
	Non-specified fuel is being used									○	○		○		
	Replacement of filters 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 of fuel tank cap is clogged							◎							
	Fuel is leaking from fuel piping								◎						
	When priming pump is operated, it makes no reaction or it is heavy								◎	○					
	Rust and water are found when fuel tank is drained									◎					
	Metal particles are found when oil is drained		◎	◎	◎						○				
	When engine is cranked by hand	Does not turn at all		◎	◎										
		Turns in opposite direction	◎												
		Moves by amount of gear backlash				◎								◎	
		Supply pump shaft does not turn										◎			
	Engine turns, but stops when load is applied to machine														◎
Troubleshooting	Inspect dynamic valve system directly		●												Carry out troubleshooting on applicable machine
	Inspect piston, connecting rod directly			●											
	Inspect crankshaft bearing directly				●										
	Inspect gear train directly					●									
	Inspect fuel filter, strainer directly									●					
	Inspect feed pump directly										●				
	Carry out troubleshooting according to "Rail Press (Very) Low Error (*1)" indicated by code											●	●		
	Engine rotates when pump auxiliary equipment (pump, compressor, etc.) is removed													●	
		Remedy	Replace	Replace	Replace	Replace	Add	Clean	Correct	Clean	Replace	Replace	Replace	Replace	—

*1: Displayed failure codes [CA559] and [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)

			Causes						
			Insufficient fuel in tank	Clogged air breather hole of fuel tank cap	Leaking or clogged fuel piping, entry of air	Clogged fuel filter	Clogged injector, defective spray (dirt in injector)	Defective Ne speed sensor, wiring harness	Defective Bkup speed sensor, 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 of fuel tank cap is clogged			◎					
	Rust and water are found when fuel tank is drained					○			
	Fuel is leaking from fuel piping				◎				
	When priming pump is operated, it makes no reaction or it is heavy				◎	○			

Troubleshooting	When air is bled from fuel system, air comes out			●				
	Inspect fuel filter, strainer directly				●			
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change					●		
	Carry out troubleshooting according to "Eng Ne Speed Sensor Error (*1)" indicated by code						●	
	Carry out troubleshooting according to "Eng Bkup Speed Sensor Error (*2)" indicated by code							●
	Remedy	Add	Clean	Replace	Replace	Replace	Replace	Replace

*1: Displayed failure codes [CA689]
*2: Displayed failure code [CA778]

S-6 Engine lack output (or lacks power)

General causes why engine lacks output

- Insufficient intake of air
- Insufficient supply of fuel
- Defective spray condition of fuel
- Improper selection of fuel
- There 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, interference of turbocharger	Defective contact of valve and valve seat	Improper valve clearance	Worn piston ring, cylinder liner	Clogged air breather hole of fuel tank cap	Leaking, clogged fuel piping	Clogged fuel filter	Stuck, seized supply pump plunger	Clogged injector, defective spray (dirt in injector)	Defective drive of injector (signal, solenoid)	Defective installation of boost pressure sensor (air leakage)	Defective boost pressure sensor, wiring harness	Clogged spill piping
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		◎								◎							
	Engine oil must be added more frequently					○		○										
Check items	Dust indicator is red		◎	◎														
	Air breather hole of fuel tank cap is clogged				◎				◎									
	Fuel is leaking from fuel piping									◎								
	Output becomes insufficient after short stop of operation			◎														
	Color of exhaust gas	Black			◎		◎											
		Blue under light load						◎										
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low												◎	◎				
	When engine is cranked, interference sound is generated around turbocharger				◎													
	When engine is cranked, abnormal sound is generated around cylinder head						◎											
	High idle speed is too high													○				
	High idle speed under no load is normal, but speed suddenly drops when load is applied								○		◎	○	○					
	Engine does not pick up smoothly and combustion is irregular			◎	◎				○	○			◎					
	There is hunting from engine (rotation is irregular)								○	○	○		○	○				
	Blow-by gas is excessive				◎			◎										
Troubleshooting	Inspect air cleaner directly		●															
	Inspect air intake piping directly			●														
	When boost pressure is measured, it is found to be low		●	●	●													
	When compression pressure is measured, it is found to be low					●		●										
	Inspect valve clearance directly						●											
	Inspect fuel piping									●								
	Inspect fuel filter, strainer directly										●							
	Inspect spill port check valve directly																	●
	Carry out troubleshooting according to "Rail Press (Very) Low Error (*1)" indicated by code											●						
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change												●	●				
	Inspect boost pressure sensor mount directly														●			
	Carry out troubleshooting according to "Chg Air Press Sensor High (Low) Error (*2)" indicated by code																●	
		Remedy	Clean	Correct	Replace	Replace	Adjust	Replace	Clean	Correct	Replace	Replace	Replace	Replace	Correct		Replace	Replace

*1: Displayed failure codes [CA559] and [CA2249]
*2: Displayed failure codes [CA122] and [CA123]

S-7 Exhaust smoke is black (incomplete combustion)

General causes why exhaust smoke is black
- Insufficient intake of air
- Defective condition of fuel injection
- Improper selection of fuel
- There 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	Seized turbocharger, interference of turbocharger	Defective contact of valve and valve seat	Improper valve clearance	Leakage of air between turbocharger and cylinder head	Crushed, clogged muffler	Worn piston ring, cylinder liner	Stuck, seized supply pump plunger	Clogged, seized injector	Abnormally worn injector	Improper fuel injection timing	Improper fuel injection pressure	Defective coolant temperature sensor, wiring harness
Questions	Confirm recent repair history														
	Degree of use of machine	Operated for long period	△		△				△		△				
	Color of exhaust gas	Suddenly became black		◎			◎			○	○	○			
		Gradually became black	◎				○				○				
		Blue under light load							◎						
	Non-specified fuel is being used									○	○				
	Oil must be added more frequently								◎						
	Power was lost	Suddenly		◎				○		○	○				
		Gradually	○		○		○		○						
Check items	Dust indicator is red		◎												
	Muffler is crushed							◎							
	Air leaks between turbocharger and cylinder head, clamp is loosened						◎								
	Engine is operated in low-temperature mode at normal temperature												○	○	○
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low									○	◎				
	When engine is cranked, interference sound is generated around turbocharger		◎												
	When engine is cranked, abnormal sound is generated around cylinder head				◎										
	Pump relief speed is high (Fuel is injected excessively)										○				
	Exhaust noise is abnormal		○				◎			○					
	Engine does not pick up smoothly and combustion is irregular		○		○	○	○		○	◎					
	Blow-by gas is excessive							◎							
	If spill hose from injector is disconnected, abnormally much fuel spills										◎				
Troubleshooting	Inspect air cleaner directly		●												
	When turbocharger is rotated by hand, it is found to be heavy			●											
	When compression pressure is measured, it is found to be low				●				●						
	Inspect valve clearance directly					●									
	When muffler is removed, exhaust sound improves							●							
	Carry out troubleshooting according to "Rail Press (Very) Low Error (*1)" indicated by code									●		●			
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change										●				
	Carry out troubleshooting according to "Coolant Temp Sens High (Low) Error (*2)" indicated by code														●
	Check with monitoring function												●	●	
		Remedy	Clean	Replace	Replace	Adjust	Correct	Replace	Replace	Replace	Replace	Replace	Replace	Replace	Replace

*1: Displayed failure codes [CA559] and [CA2249]
*2: Displayed failure codes [CA144] and [CA145]

S-8 Oil consumption is excessive (or exhaust smoke is blue)

General causes why oil consumption is excessive
- Abnormal consumption 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 pats in lubrication system

			Causes														
			Dust sucked in from intake system	Worn, damaged valve (stem, guide, seal)	Turbocharger: Worn seal at turbocharger end	Turbocharger: Worn seal at blower end	Clogged breather, breather hose	Broken piston ring	Worn piston ring, cylinder liner	Worn, damaged rear oil seal	Broken oil cooler	Oil leakage from oil cooler	Oil leakage from oil filter	Oil leakage from oil piping	Oil leakage from oil drain plug	Oil leakage from oil pan, cylinder head, etc.
Questions	Confirm recent repair history																
	Degree of use of machine	Operated for long period		△	△	△			△								
	Oil consumption suddenly increased							◎			○						
	Oil must be added more frequently								◎		○						
	Oil becomes contaminated quickly						○	○	◎								
Check items	Outside of engine is dirty with oil											◎	◎	◎	◎	◎
	There are loose piping clamps in intake system		◎														
	Inside of turbocharger intake outlet pipe is dirty with oil					◎											
	Inside of turbocharger exhaust outlet pipe is dirty with oil			○	◎												
	There is oil in coolant										◎						
	Oil level in damper chamber of applicable machine is high									◎							
	Exhaust smoke is blue under light load							◎	◎								
	Amount of blow-by gas	Excessive		○		○		◎	◎								
		None					◎										
Troubleshooting	When intake manifold is removed, dust is found inside		●														
	When intake manifold is removed, inside is found to be dirty abnormally			●													
	Excessive play of turbocharger shaft				●	●											
	Check breather and breather hose directly						●										
	When compression pressure is measured, it is found to be low							●	●								
	Inspect rear oil seal directly									●							
	Pressure-tightness test of oil cooler shows there is leakage										●	●					
	There is external leakage of oil from engine												●	●	●	●	
		Remedy	Correct	Correct	Replace	Replace	Clean	Replace	Replace	Correct	Replace	Replace	Correct	Correct	Correct	Correct	

S-9 Oil becomes contaminated quickly

General causes why oil becomes contaminated quickly
- 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 valve, valve guide	Worn piston ring, cylinder liner	Clogged breather, breather hose	Clogged oil cooler	Clogged oil filter	Defective oil filter safety valve	Clogged turbocharger lubrication drain tube	Exhaust smoke is bad
Questions	Confirm recent repair history										
Questions	Degree of use of machine	Operated for long period	△	△	△						
Questions	Non-specified fuel is being used				○			○			
Questions	Engine oil must be added more frequently				◎						
Check items	Metal particles are found when oil is drained			○	○			◎			
Check items	Inside of exhaust pipe is dirty with oil			◎							
Check items	Engine oil temperature rises quickly						◎				
Check items	Color of exhaust gas color	Blue under light load			◎						
Check items	Color of exhaust gas color	Black									◎
Check items	Amount of blow-by gas	Excessive	○	○	◎					○	
Check items	Amount of blow-by gas	None				◎					

Troubleshooting	Excessive play of turbocharger shaft		●								See S-7
Troubleshooting	When compression pressure is measured, it is found to be low			●	●						
Troubleshooting	Check breather and breather hose directly					●					
Troubleshooting	Inspect oil cooler directly						●				
Troubleshooting	Inspect oil filter directly							●			
Troubleshooting	Spring of oil filter safety valve is hitched or broken								●		
Troubleshooting	Inspect turbocharger lubrication drain tube directly									●	
		Remedy	Replace	Replace	Replace	Clean	Clean	Replace	Replace	Clean	—

S-10 Fuel consumption is excessive

General causes why fuel consumption is excessive
- Leakage of fuel
- 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 pressure	Defective spray by injector	Defective operation of injector	Improper fuel injection timing	Defective coolant temperature sensor, wiring harness
Questions	Confirm recent repair history										
	Degree of use of machine	Operated for long period			△	△		△			
	Condition of fuel consumption	More than for other machines of same model					○		○	○	○
		Gradually increased				○		○			
		Suddenly increased	○	○							
Check items	There is external leakage of fuel from engine			◎							
	Combustion is irregular							◎			
	Engine oil level rises and oil smells of diesel fuel		◎		◎						
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low							◎			
	Low idle speed is high								○		
	Pump relief speed is high								○		
	Exhaust smoke color	Black					○	○		○	○
		White	○								
Troubleshooting	Remove and inspect head cover directly		●								
	Inspect feed pump oil seal directly				●						
	Carry out troubleshooting according to "Rail Press (Very) Low Error (*1)" indicated by code					●					
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change							●			
	If spill hose from injector is disconnected, much fuel spills								●		
	Carry out troubleshooting according to "Coolant Temp Sens High (Low) Error (*2)" indicated by code										●
	Check with monitoring function						●			●	
		Remedy	Correct	Correct	Replace	Replace	Correct	Replace	Replace	Replace	Replace

*1: Displayed failure codes [CA559] and [CA2249]
*2: Displayed failure codes [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, head gasket	Internal cracks in cylinder block	Holes caused by pitting	Broken oil cooler core, O-ring	Broken hydraulic oil cooler on applicable machine side
Questions	Confirm recent repair history						
	Degree of use of machine	Operated for long period			△	△	
	Oil level	Suddenly increased	○			○	○
		Gradually increased		○	○		
	Hard water is being used as coolant				○	○	
Check items	Oil level has risen, oil is milky			○	○	◎	
	There are excessive air bubbles in radiator, coolant spurts back		◎				
	Hydraulic oil on applicable machine side is milky						◎
	When hydraulic oil on applicable machine side is drained, water is found						◎
Trouble-shooting	Pressure-tightness test of cylinder head shows there is leakage		●				Carry out troubleshooting on applicable machine side
	Inspect cylinder block, liner directly			●	●		
	Pressure-tightness test of oil cooler shows there is leakage					●	
		Remedy	Replace	Replace	Replace	Replace	—

S-12 Oil pressure drops

General causes why oil pressure drops
- Leakage, clogging, wear of lubrication system
- Defective oil pressure control
- Improper selection of fuel (improper viscosity)
- Deterioration of oil due to overheating

			Causes										
			Worn journal of bearing	Lack of oil in oil pan	Coolant, fuel in oil	Clogged strainer in oil pan	Clogged, broken pipe in oil pan	Defective oil pump	Defective regulator valve	Clogged oil filter	Leaking, crushed, clogged hydraulic piping	Defective oil level sensor, wiring harness
Questions	Confirm recent repair history											
	Degree of use of machine	Operated for long period	△					△		△		
	Oil pressure monitor indicates low oil pressure								○	◎		
	Non-specified oil is being used		○							○		
	Replacement of filters has not been carried out according to Operation and Maintenance Manual									◎		
Check items	Oil pressure monitor (if installed)	Indicates pressure drop at low idle	◎									
		Indicates pressure drop at low, high idle		○		◎	◎	◎	○			
		Indicates pressure drop on slopes		◎								
		Sometimes indicates pressure drop							◎			○
	Oil level monitor indicates oil level drop			◎								◎
	Oil level in oil pan is low			◎								
	External hydraulic piping is leaking, crushed										◎	
	Oil is milky or smells of diesel oil				◎							
	Metal particles are found when oil pan is drained		◎									
	Metal particles are found when oil filter is drained		◎					○				
Troubleshooting	Metal particles are found in oil filter		●		See S-13							
	Inspect oil pan strainer, pipe directly					●	●					
	Oil pump rotation is heavy, there is play in oil pump							●				
	Valve spring of regulator valve is fatigued, damaged								●			
	Inspect oil filter directly									●		
	If oil level sensor is replaced, oil pressure monitor indicates normally											●
		Remedy	Clean	Add	—	Clean	Clean	Replace	Adjust	Clean	Correct	Replace

S-13 Oil level rises (Entry of coolant/fuel)

General causes why oil level rises
- Coolant in oil (milky)
- Fuel in oil (smells diluted diesel fuel)

★ If oil is in coolant, carry out troubleshooting for "S-11 Oil is in coolant"

			Causes								
			Broken cylinder head, head gasket	Broken injector O-ring	Cracks inside cylinder block	Holes caused by pitting	Worn, damaged rear oil seal	Broken oil cooler core, O-ring	Defects in supply pump	Defective seal of auxiliary equipment (pump, compressor)
Questions	Confirm recent repair history									
	Degree of use of machine	Operated for long period		△		△	△			△
	Fuel must be added more frequently			◎					◎	
	Coolant must be added more frequently		○		○					
Check items	There is oil in coolant		○	○	○	○		◎		
	Oil smells of diesel fuel			◎					◎	
	Oil is milky		○			○				
	When engine is started, drops of water come from muffler		○							
	When radiator cap is removed and engine is run at low idle, an abnormal number of bubbles appear, or coolant spurts back		◎			○				
	Exhaust smoke is white			○						
	Oil level in damper chamber of applicable machine is low						◎			
	Oil level in hydraulic tank of applicable machine is low									◎
Troubleshooting	When compression pressure is measured, it is found to be low		●							
	Remove injector and inspect O-ring			●						
	Inspect cylinder block, liner directly				●	●				
	Inspect rear oil seal directly						●			
	Pressure-tightness test of oil cooler shows there is leakage							●		
	Remove and inspect supply pump directly								●	
	Inspect seal of auxiliary equipment directly									●
		Remedy	Replace	Correct	Replace	Replace	Correct	Replace	Replace	Replace

S-14 Coolant temperature becomes too high (overheating)

General causes why coolant temperature becomes too high
- Lack of cooling air (deformation, damage of fan)
- Drop in heat dissipation efficiency
- Problem in coolant circulation system
- Rise in oil temperature in power train
  → Carry out troubleshooting for machine

			Causes												
			Broken cylinder head, head gasket	Holes caused by pitting	Clogged, broken oil cooler	Lack of coolant	Broken water pump	Defective operation of thermostat	Clogged, crushed radiator fins	Clogged radiator core	Defective radiator cap (pressure valve)	Slipping fan belt, worn fan pulley	Defective coolant temperature gauge	Rise of hydraulic oil temperature on applicable machine side
Questions	Confirm recent repair history													
	Degree of use of machine	Operated for long period	△	△					△	△				
	Condition of overheating	Sudden overheated				○	◎					○		
		Always tends to overheat						○	◎	◎		○		
	Coolant temperature gauge (if 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 low											◎		
	When fan belt is turned, it has play						◎							
	Milky oil is floating on coolant				◎									
	There are excessive air bubbles in radiator, coolant spurts back		◎											
	When light bulb is held behind radiator core, no light passes through								◎					
	Radiator shroud, inside of underguard on applicable machine side are clogged with dirt or mud								◎			◎		
	Coolant is leaking because of cracks in hose or loose clamps					◎								
	Coolant flows out from radiator overflow hose										◎			
	Fan belt whines under sudden acceleration											◎		
	Hydraulic oil temperature enters red range faster than engine coolant temperature													◎

Troubleshooting	When compression pressure is measured, it is found to be low	●											Carry out troubleshooting on applicable machine side
	Inspect cylinder liner directly		●										
	Inspect oil cooler directly			●									
	Temperature difference between upper and lower tanks of radiator is large					●							
	When operation of thermostat is carried out, it does not open at cracking temperature						●						
	Temperature difference between upper and lower tanks of radiator is slight							●					
	Inspect radiator core directly								●				
	When operation of radiator cap is carried out, its cracking pressure is low									●			
	Inspect fan belt, pulley directly										●		
	When coolant temperature is measured, it is fount to be normal											●	
	Remedy	Replace	Replace	Replace	Add	Replace	Replace	Correct	Correct	Replace	Correct	Replace	—

S-15 Abnormal noise is made

General causes why abnormal noise is made
- Abnormality due to defective parts
- Abnormal combustion
- Air sucked in from intake system

★ Judge if 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 3 seconds. This does not indicate abnormality, however.

			Causes												
			Leakage of air between turbocharger and cylinder head	Interference of turbocharger, seized turbocharger	Broken dynamic valve system (valve, rocker lever)	Defective inside of muffler (dividing board out of position)	Improper valve clearance	Excessive wear of piston ring, cylinder liner	Improper gear train backlash	Removed, seized bushing	Deformed cooling fan, loose fan belt, interference of fan belt	Clogged, seized injector	Dirt caught in injector	Improper fuel injection timing (abnormality in coolant low temperature sensor, boost temperature sensor)
Questions	Confirm recent repair history													
	Degree of use of machine	Operated for long period						△						
	Condition of abnormal noise	Gradually occurred						○			○			
		Sudden occurred		○	○					○				
	Non-specified fuel is being used											○		
	Oil must be added more frequently							◎						
Check items	Metal particles are found when oil filter is drained							◎		◎				
	Air leaks between turbocharger and cylinder head		◎											
	When engine is cranked, interference sound is generated around turbocharger			◎										
	When engine is cranked, abnormal sound is generated around cylinder head				◎		◎							
	When engine is cranked, beat noise is generated around muffler					◎								
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low											◎	○	
	Color of exhaust gas	Blue under light load						◎						
		Black	○	◎			○							
	Engine does not pick up smoothly and combustion is irregular											◎		
	Abnormal noise is loud when engine is accelerated						○		○		○	○		
	Blow-by gas is excessive							◎						
Troubleshooting	When turbocharger is rotated by hand, it is fount to be heavy			●										
	Inspect dynamic valve system directly				●									
	When muffler is removed, abnormal noise disappears					●								
	Inspect valve clearance directly						●							
	When compression pressure is measured, it is found to be low							●						
	Inspect gear train directly								●	●				
	Inspect fan and fan belt directly										●			
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change											●	●	
	Abnormal noise is heard only when engine is started												●	
	Confirm with INSITE or monitoring function on applicable machine side													●
		Remedy	Replace	Replace	Correct	Replace	Replace	Replace	Replace	Replace	Correct	Replace	Replace	Replace

S-16 Vibration is excessive

General causes why vibration is excessive
- Defective parts (abnormal wear, breakage)
- Misalignment between engine and chassis
- Abnormal combustion

★ If abnormal noise is made and vibration is excessive, carry out trouble-shooting for "S-15 Abnormal noise is made", too.

			Causes								
			Stuck dynamic valve system (valve, rocker lever)	Worn main bearing, connecting rod bearing	Improper gear train backlash	Worn camshaft bushing	Improper injection timing (Abnormality in coolant temperature sensor, boost temperature sensor)	Loose engine mounting bolts, broken cushions	Misalignment between engine and devices on applicable machine side	Broken output shaft, parts in damper on applicable machine side
Questions	Confirm recent repair history									
	Degree of use of machine	Operated for long period		△		△		△		
	Condition of vibration	Suddenly increased	○							○
		Gradually increased		○		○		○		
Check items	Non-specified oil is being used			○		○				
	Metal particles are found when oil filter is drained			◎		◎				
	Metal particles are found when oil pan is drained			◎		◎				
	Oil pressure is low at low idle			○		○				
	Vibration occurs at mid-range speed							○		○
	Vibration follows engine speed				○			○	○	○
	Exhaust smoke is black		◎				○			
Troubleshooting	Inspect dynamic valve system directly		●							
	Inspect main bearing and connecting rod bearing directly			●						
	Inspect gear train directly				●					
	Inspect camshaft bushing directly					●				
	Check with monitoring function						●			
	Inspect engine mounting bolts and cushions directly							●		
	When alignment is checked, radial runout or facial runout is detected								●	
	Inspect inside of damper directly									●
		Remedy	Replace	Replace	Replace	Replace	Replace	Replace	Adjust	Replace

PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00246-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

50 Disassembly and assembly

Disassembly and assembly related information

Disassembly and assembly related information

How to read this manual

1. Removal and installation of assemblies

Special tools

- Special tools which are deemed necessary for removal or installation of parts are described as **A1**,•••**X1** etc. and their part names, part numbers 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 (installed).
   - ● : Special tools that will be useful if available and are substitutable with commercially available tools.
2) Distinction of new and existing special tools
   - N : Tools newly developed for this model. They respectively have a new part number.
   - R : Tools with upgraded part numbers. They are remodeled from already available tools for other models.
   - Blank: Tools already available for other models. They can be used without any modification.
3) Circle mark ○ in sketch column:
   - The sketch of the special tool is presented in the section of "Sketches of special tools".
   - Part No. of special tools starting with 79*T-***-****:
     means that they can not be supplied from Komatsu in Japan (i.e. locally made parts).

★ General tools that are necessary for removal or installation are described as [1],[2]•••etc. and their part names, part numbers and quantities are not described.

Removal

- The [Removal] section contains procedures and precautions for implementing the work, know how and the amount of oil or water to be drained.
- Various symbols used in the Removal Section are explained and listed below.

⚠ : This mark indicates safety-related precautions that must be followed when implementing the work.

★: Know-how or precautions for work

[*1] : This mark shows that there are instructions or precautions for installing parts.

: This mark shows the amount of oil or water to be drained.

: Weight of part or component

Installation

- Except where otherwise instructed, installation of parts is done in the reverse order of removal.
- Instructions and precautions for installing parts are shown with mark in the Installation Section, identifying which step the instructions are intended for.
- Marks shown in the Installation Section stand for the following.

⚠ : Precautions related to safety in execution of work.

⊕ : Work that must be carried out with extreme care for safety of machine.

★: Know-how or precautions for work

: Type of coating material

: Tightening torque

: Quantity of oil or coolant to be added

Sketches of special tools

- Various special tools are illustrated for the convenience of local manufacture.

2. Disassembly and assembly of assemblies

Special tools

- Special tools which are deemed necessary for removal or installation of parts are described as **A1**,•••**X1** etc. and their part names, part numbers 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 (installed).
   - ● : Special tools that will be useful if available and are substitutable with commercially available tools.
2) Distinction of new and existing special tools
   - N : Tools newly developed for this model. They respectively have a new part number.
   - R : Tools with upgraded part numbers. They are remodeled from already available tools for other models.
   - Blank : Tools already available for other models. They can be used without any modification.
3) Circle mark ○ in sketch column:
   - The sketch of the special tool is presented in the section of "Sketches of special tools".
   - Part No. of special tools starting with 79∗T-∗∗∗-∗∗∗∗:
     means that they can not be supplied from Komatsu in Japan (i.e. locally made parts).

   ★ General tools that are necessary for removal or installation are described as [1],[2]•••etc. and their part names, part numbers and quantities are not described.

Disassembly

- In Disassembly section, the work procedures, precautions and know-how for carrying out those procedures, and quantity of the oil and coolant drained are described.
- The meanings of the symbols used in Disassembly section are as follows.

⚠ : This mark indicates safety-related precautions that must be followed when implementing the work.

★ : Know-how or precautions for work

: Quantity of oil or coolant drained

Assembly

- In Assembly section, the work procedures, precautions and know-how for carrying out those procedures, and quantity of the oil and coolant added are described.
- The meanings of the symbols used in Assembly section are as follows.

⚠ : Precautions related to safety in execution of work

⊕ : Work that must be carried out with extreme care for safety of machine.

★ : Know-how or precautions for work

: Type of coating material

: Tightening torque

: Quantity of oil or coolant to be added

Sketches of special tools

- Various special tools are illustrated for the convenience of local manufacture.

List of adhesives

★ The recommended coating materials such as adhesives, gasket sealants, and greases used for disassembly and assembly are listed below.
★ For coating materials not listed below, use the equivalent of products shown in this list.

Category	Komatsu code	Part No.	Q'ty	Container	Main features and applications
Adhesive	LT-1A	790-129-9030	150 g	Tube	• Used to prevent rubber gaskets, rubber cushions, and cork plugs from coming out.
	LT-1B	790-129-9050	20 g (2 pcs.)	Polyethylene container	• Used for plastic (except polyethylene, polypropylene, tetrafluoroethylene and vinyl chloride), rubber, metal, and non-metal parts which require immediate and strong adhesion.
	LT-2	09940-00030	50 g	Polyethylene container	• Features: Resistance to heat and chemicals. • Used to fix and seal bolts and plugs.
	LT-3	790-129-9060 (Set of adhesive and hardener)	Adhesive: 1 kg Hardener: 500 g	Can	• Used to stick and seal metal, glass, and plastics.
	LT-4	790-129-9040	250 g	Polyethylene container	• Used to seal plugs.
	Holtz MH 705	790-129-9120	75 g	Tube	• Heat-resistant seal used to repair engines.
	ThreeBond 1735	790-129-9140	50 g	Polyethylene container	• Quick-setting adhesive. • Setting time: Within 5 sec. to 3 min. • Used mainly to stick metals, rubbers, plastics, and woods.
	Aron-alpha 201	790-129-9130	2 g	Polyethylene container	• Quick-setting adhesive. • Quick-setting type. (max. strength is obtained after 30 minutes) • Used mainly to stick rubbers, plastics, and metals.
	Loctite 648-50	79A-129-9110	50 cc	Polyethylene container	• Features: Resistance to heat and chemicals. • Used for fitted portions used at high temperatures.
Gasket sealant	LG-1	790-129-9010	200 g	Tube	• Used to stick or seal gaskets and packings of power train case, etc.
	LG-5	790-129-9080	1 kg	Polyethylene container	• Used to seal various threaded portions, pipe joints, and flanges. • Used to seal tapered plugs, elbows, and nipples of hydraulic piping.
	LG-6	790-129-9020	200 g	Tube	• Features: Silicon-based heat and cold-resistant sealant. • Used to seal flange surfaces and threaded portions. • Used to seal oil pan, final drive case, etc.
	LG-7	790-129-9070	1 kg	Tube	• Features: Silicon-based quick-setting sealant. • Used to seal flywheel housing, intake manifold, oil pan, thermostat housing, etc.
	ThreeBond 1211	790-129-9090	100 g	Tube	• Gasket sealant used to repair engine.
	ThreeBond 1207B	419-15-18131	100 g	Tube	• Features: Silicon-based, heat and cold-resistant, vibration-resistant, impact-resistant sealant. • Used to seal transfer case, etc.

Classi-fication	Komatsu code	Part number	Content	Container	Main feature, application
Lubricant with molybdenum disulphide	LM-G	09940-00051	60g	Can	• To be used as lubricant (anti squeaking) for sliding part.
	LM-P	09940-00040	200g	Tube	• To be used for press fit, shrink fit and preventing scratching or seizure of thread. • To be used as lubricant for linkage and bearing etc.
Grease	G2-LI	SYG2-400LI SYG2-350LI SYG2-400LI-A SYG2-160LI SYGA-160CNLI	Various kinds	Various kinds	• Versatile type
	G2-CA	SYG2-400CA SYG2-350CA SYG2-400CA-A SYG2-160CA SYGA-160CNCA	Various kinds	Various kinds	• To be used for the place where the bearing designed for normal temperature and low load condition is used and contacts water and steam.
	Grease with molybdenum disulphide LM-G(G2-M)	SYG2-400M SYG2-400M-A SYGA-16CNM	400gx10 400gx20 16kg	Bellows type Can	• To be used for heavy load places.
	Hyper white grease G2-T GO-T(*) *: For cold region	SYG2-400T-A SYG2-16CNT SYG0-400T-A (*) SYG0-16CNT (*)	400g 16Kg	Bellows type Can	• Higher anti seizure and heat resistance than grease with molybdenum disulphide • Body dirt is not distinctive due to white color.
	Biological grease G2-B G2-BT(*) *: For heat resistance and heavy load	SYG2-400B SYGA-16CNB SYG2-400BT (*) SYGA-16CNBT (*)	400g 16Kg	Bellows type Can	• To be shortly dissolved by a bacteria in nature so that the influence to microorganism and animals and plants is suppressed to the minimum.
Primer	Sunstar primer for painting plane 580 super	417-926-3910	20ml	Glass container	For adhesion of cab glass: • To be used as primer for cab side. (Term of validity: 4 months after manufacturing)
	Sunstar primer for glass 580 super		20ml	Glass container	For adhesion of cab glass: • To be used as primer for glass side. (Term of validity: 4 months after manufacturing)
	Sunstar primer for painting plane 435-95	22M-54-27230	20ml	Glass container	For adhesion of cab glass: • To be used as primer for painting plane of cab side. (Term of validity: 4 months after manufacturing)
	Sunstar primer for glass 435-41	22M-54-27240	150ml	Can	For adhesion of cab glass: • To be used as primer for black ceramic coated plane of glass side and polycarbonate hard coat plane. (Term of validity: 4 months after manufacturing)
	Sunstar primer for sash GP-402	22M-54-27250	20ml	Glass container	For adhesion of cab glass: • To be used as primer for sash (Alumite surface treatment) (Term of validity: 4 months after manufacturing)

Classification	Komatsu code	Part number	Content	Container	Main feature, application	
Adhesive compound	Sunstar penguin seal 580 super "S" or "W"	417-926-3910	320ml	Polyethylene container	For adhesion of cab glass	• "S" and "W" are used as glass adhesive compound in high temperature (April - October) and in low temperature (October -April) respectively. (Term of validity: 4 months after manufacturing)
	Sika Ltd, Japan Sika Flex 256HV	20Y-54-39850	310ml	Polyethylene container		• To be used as glass adhesive compound. (Term of validity: 6 months after manufacturing)
	Sunstar pengiun super 560	22M-54-27210	320ml	ECOCART (special container)		• To be used as glass adhesive compound. (Term of validity: 6 months after manufacturing)
Cooking compound	Sunstar pengiun seal No. 2505	417-926-3920	320ml	Polyethylene container		• To be used as seal for joints of glass. (Term of validity: 4 months after manufacturing)
	Sekisui silicone sealant	20Y-54-55130	333ml	Polyethylene container		• To be used for seal of front window. (Term of validity: 6 months after manufacturing)
	GE Toshiba Silicones Tosseal 381	22M-54-27220	333ml	Cartridge		• To be used as seal for joints of glass. semi-transparent white seal (Term of validity: 12 months after manufacturing)

Special tool list

★ Tool part number 79○T-○○○-○○○○ indicates an interchangeable part (locally produced)
★ Necessity : ■ . . . . . Special tools which cannot be substituted and should be always installed (used)
: ● . . . . . Special tools which are very useful if available. They can be substituted with commercially available tools.
★ Distinction of new and existing special tools.
: N . . . . . Tools with new part numbers. They are newly developed for this model.
: R . . . . . Tools with upgraded part numbers. They are remodeled from already available tools for other models.
: Blank . . . Tools already available for other models and usable without any modification.
★ Circle (○) in sketch column: A circle mark means that a sketch of the special tool is presented in the section of Sketches for Special Tools.

Work item	Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch	Work content
Engine front seal	A	1	795-799-6400	Seal puller	■	1	N		Installation of engine front seal
Engine rear seal		2	795-799-6500	Seal puller	■	1	N		Installation of engine rear seal
Cylinder head assembly, fuel injector assembly		3	795-799-6700	Primer	■	1	N		Removal of fuel injector
		4	795-799-1131	Gear	■	1			Positioning with 3RD and 4TH cylinder Top
		5	795-799-8150	Remover	●	1	N		Removal of inlet connector
Cylinder head assembly		6	790-331-1120	Wrench (Angle)	●	1			Angle tightening of bolt
		7	795-790-4510	Gauge	●	1	N		Judgment of cylinder head bolt length
Engine and hydraulic pump assembly		8	796T-401-1110	Plate	●	1	N	○	Removal and installation of engine and hydraulic pump assembly
		9	795-790-9300	Lifting tool	●	1	N		
Hydraulic pump assembly, Engine and hydraulic pump assembly, Control valve assembly, Center swivel joint assembly		10	796-460-1210	Oil stopper	●	1			Stopping oil
		11	796-770-1320	Adaptor	●	1			
Swing motor and swing machinery assembly	F	1	796T-426-1410	Push tool	■	1		○	Press fit of main bearing (PC210/230-8)
			790-201-2860		■	1			Press fit of main bearing (PC210/230-8)
		2	796-426-1120	Push tool	■	1			Press fit of sub bearing
		3	796T-426-1130	Plate	■	1		○	Press fit of oil seal
			790-101-5421	Grip	■	1			
			01010-81240	Bolt	■	1			
Final drive assembly	J	1	796-427-1400	Wrench assembly	■	1	N		Removal and installation of nut
			• 796-427-1410	• Wrench		1	N		
			• 796-427-1140	• Pin		3			
			• 01314-20612	• Screw		3			

Work item	Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch	Work content
Final drive assembly	J	2	796T-427-1510	Push tool	■	1	N	○	Installation of bearing
			790-101-2510	Block	■	1			
			790-101-3310	Block	■	1			
			790-101-2610	Rod	■	2			
			790-101-2730	Adaptor	■	2			
			01580-11613	Nut	■	2			
			790-101-2570	Plate	■	2			
			01643-31645	Washer	■	2			
			790-101-2102	Puller (30 ton)	■	1			
			790-101-1102	Pump	■	1			
		3	796-427-1520	Installer	■	1	N		Installation of floating seal
		4	796-427-1200	Wrench	■	1			Removal and installation of nut
		5	791-545-1510	Installer	■	1			Installation of floating seal
		6	796T-427-1220	Push tool	■	1		○	Installation of bearing
			790-101-2510	Block	■	1			
			792-104-3940	Bolt	■	2			
			05180-11610	Nut	■	2			
			01613-31645	Washer	■	2			
			790-105-2100	Jack	■	1			
			790-101-1102	Hydraulic pump	■	1			
		7	790-331-1110	Wrench	■	1			Angle tightening of bolt
Carrier roller assembly	L	1	790-434-1660	Installer	■	1			Installation of floating seal
Track roller assembly		2	796-670-1020	Installer	■	1			
Idler assembly		3	791-530-1510	Installer	■	1			
Recoil spring assembly	M	1	791-600-2001	Compressor (A)	■	1			Disassembly and assembly of recoil spring assembly
			or						
			791-685-8006	Compressor (B)	■	1			
			790-201-2780	Spacer					
			791-635-3160	Extension	■	1			
			790-101-1600	Cylinder (686kN{70ton})	■	1			
			790-101-1102	Pump	■	1			
			790-640-2180	Guide bolt	■	1			
		2	790-101-5201	Push tool kit (B)	●	1			
			• 790-101-5241	• Plate		1			
			• 790-101-5221	• Grip		1			
			• 01010-51225	• Bolt		2			
		3	790-201-1500	Push tool kit	●	1			
			• 790-201-1620	• Plate		1			
			• 790-101-5021	• Grip		1			
			• 01010-50816	• Bolt		1			

Work item	Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch	Work content
Track shoe assembly	R		791-630-3000	Remover & installer	■	1			Separation and installation of track shoe assembly
			790-101-1300	Cylinder (980kN{100ton})	■	1			
			790-101-1102	Pump	■	1			
Hydraulic pump assembly	S		796T-467-2410	Push tool	■	1	N	○	Press fit of input shaft oil seal
Center swivel joint assembly	T	1	790-101-2501	Push puller	●	1			Disassembly and assembly of center swivel joint assembly
			• 790-101-2510	• Block		1			
			• 790-101-2520	• Screw		1			
			• 791-112-1180	• Nut		1			
			• 790-101-2540	• Washer		1			
			• 790-101-2630	• Leg		2			
			• 790-101-2570	• Plate		4			
			• 790-101-2560	• Nut		2			
			• 790-101-2650	• Adapter		2			
Control valve assembly	T	2	796-946-1310	Guide ø21.8	■	1			Replacement of pressure compensation valve seal
			(For 723-46-40100)						
			796-946-1610	Guide ø21.4	■	1			
			(For 723-46-41100)						
			796-946-1810	Guide ø21.2	■	1			
			(For 723-46-43100 and 723-46-43400)						
			796-946-1910	Guide ø21.0	■	1			
			(For 723-46-46101 and 723-46-46300)						
			796-946-2210	Guide ø21.6	■	1			
			(For 723-46-45100 and 723-46-45700)						
		3	796-946-1320	Guide ø21.8	■	1			
			(For 723-46-40100)						
			796-946-1620	Guide ø21.4	■	1			
			(For 723-46-41100)						
			796-946-1820	Guide ø21.2	■	1			
			(For 723-46-43100 and 723-46-43400)						
			796-946-1920	Guide ø21.0	■	1			
			(For 723-46-46101 and 723-46-46300)						
			796-946-2220	Guide ø21.6	■	1			
			(For 723-46-45100)						
			796-946-1420	Guide ø21.6	■	1			
			(For 723-46-42700)						

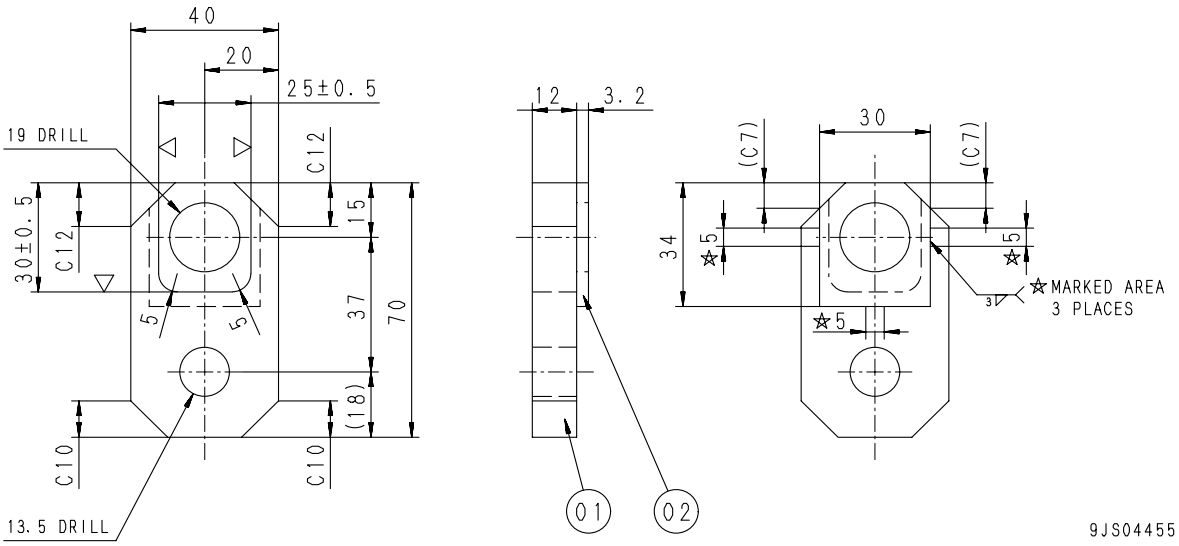
Work item	Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch	Work content
Control valve assembly	T	4	796-946-1330	Sleeve	■	1			Replacement of pressure compensation valve seal
			(For 723-46-40100)						
			796-946-1630	Sleeve	■	1			
			(For 723-46-41100)						
			796-946-1830	Sleeve	■	1			
			(For 723-46-43100 and 723-46-43400)						
			796-946-1930	Sleeve	■	1			
			(For 723-46-46101 and 723-46-46300)						
			796-946-2230	Sleeve	■	1			
			(For 723-46-45100)						
			796-946-1430	Sleeve	■	1			
			(For 723-46-42700)						
Hydraulic cylinder assembly	U	1	790-502-1003	Cylinder repair stand	●	1			Disassembly and assembly of hydraulic cylinder assembly
			790-101-1102	Pump	●	1			
		2	790-102-4300	Wrench assembly	■	1			Removal and installation of piston assembly
			790-102-4310	Pin	■	2			
		3	790-720-1000	Expander	●	1			Installation of piston ring
		4	796-720-1670	Rubber band (for boom and arm)	●	1			
			07281-01279	Clamp	●	1			
			796-720-1660	Rubber band (for bucket)	●	1			
			07281-01159	Clamp	●	1			
		5	790-201-1702	Push tool kit	■	1			Press fit of bushing
			• 790-201-1831	• Push tool (for bucket)		1			
			• 790-201-1930	• Push tool (for arm)		1			
			• 790-201-1940	• Push tool (for boom)		1			
			• 790-101-5021	• Grip		1			
			• 01010-50816	• Bolt		1			
		6	790-201-1500	Push tool kit (for bucket)	●	1			Press fit of dust seal
			• 790-201-1640	• Push tool		1			
			• 790-101-5021	• Grip		1			
			• 01010-50816	• Bolt		1			
			790-201-1980	Plate (for boom)	●	1			
			790-201-1990	Plate (for arm)	●	1			
			790-101-5021	Grip	●	1			
			01010-50816	Bolt	●	1			

Work item	Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch	Work content
Work equipment assembly	V		796-900-1200	Remover	■	1			Removal of foot pin
			• 796-900-1210	• Sleeve		1			
			• 792-900-1520	• Plate		1			
			• 799-900-1230	• Screw		1			
			• 796-900-1240	• Adapter		1			
			• 01643-33080	• Washer		1			
			• 01803-13034	• Nut		1			
			790-101-4000	Puller (490kN{50ton}long)	■	1			
			790-101-1102	Pump (294kN{30ton})	■	1			
Air conditioner assembly	X	1	799-703-1200	Service tool kit	■	1			Filling of air conditioning gas
			799-703-1100	Vacuum pump (100V)	■	1			
			799-703-1111	Vacuum pump (220V)	■	1			
			799-703-1121	Vacuum pump (240V)	■	1			
			799-703-1401	Gas leak detector	■	1			
Operator cab glass (adhesion) glass	X	2	793-498-1210	Lifter (Suction cup)	■	2			Installation of operator cab glass (adhesion) 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.

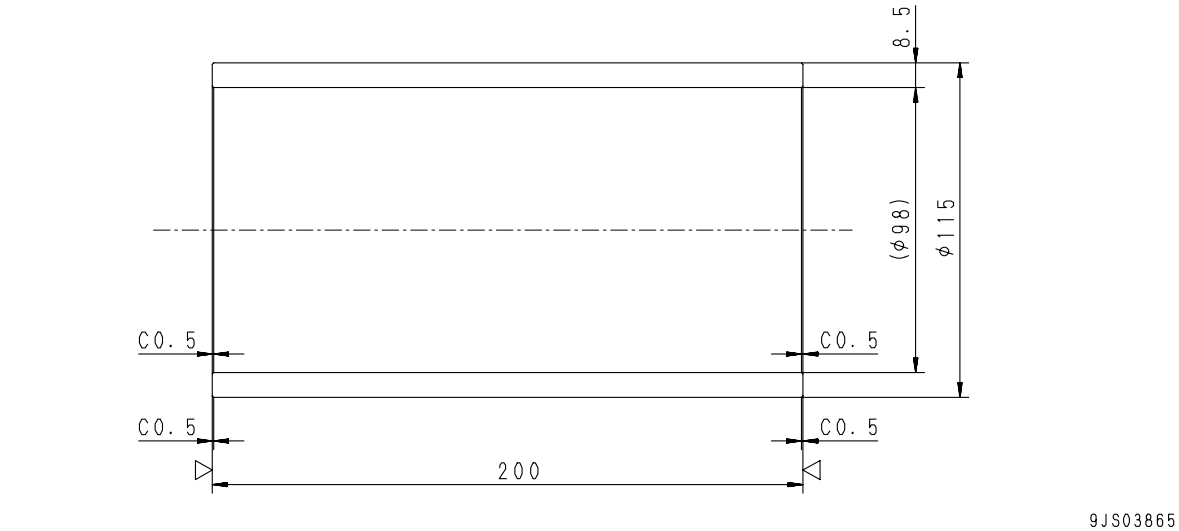
A8 Plate



HEAT TREATMENT	MATERIAL
----	WELD
PART NAME	Q'TY
PLATE	----
796T-401-1110 △	

SYM.	PART NAME	MATERIAL	QTY/SET	MASS (kg)	REMARKS
02	PLATE	SS400P	1	0.17	----
01	PLATE	SS400P	1	0.02	----

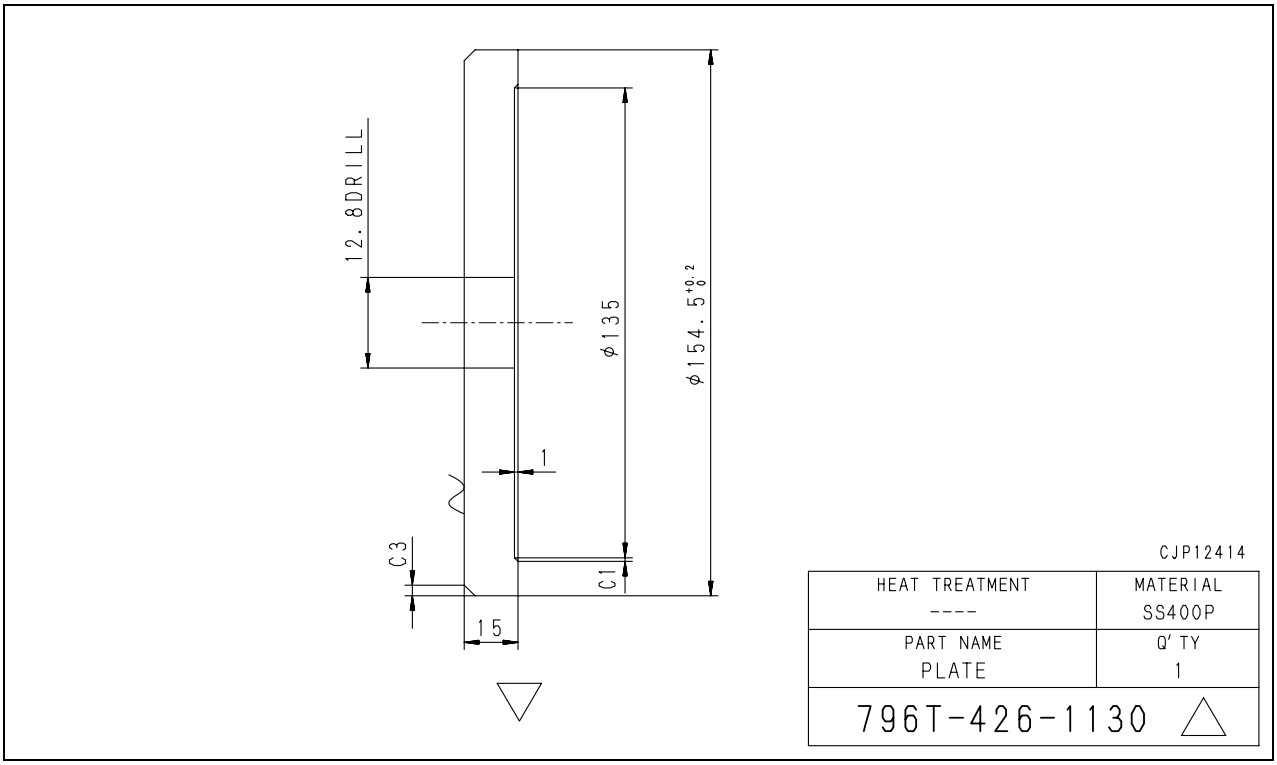
F1 Push tool



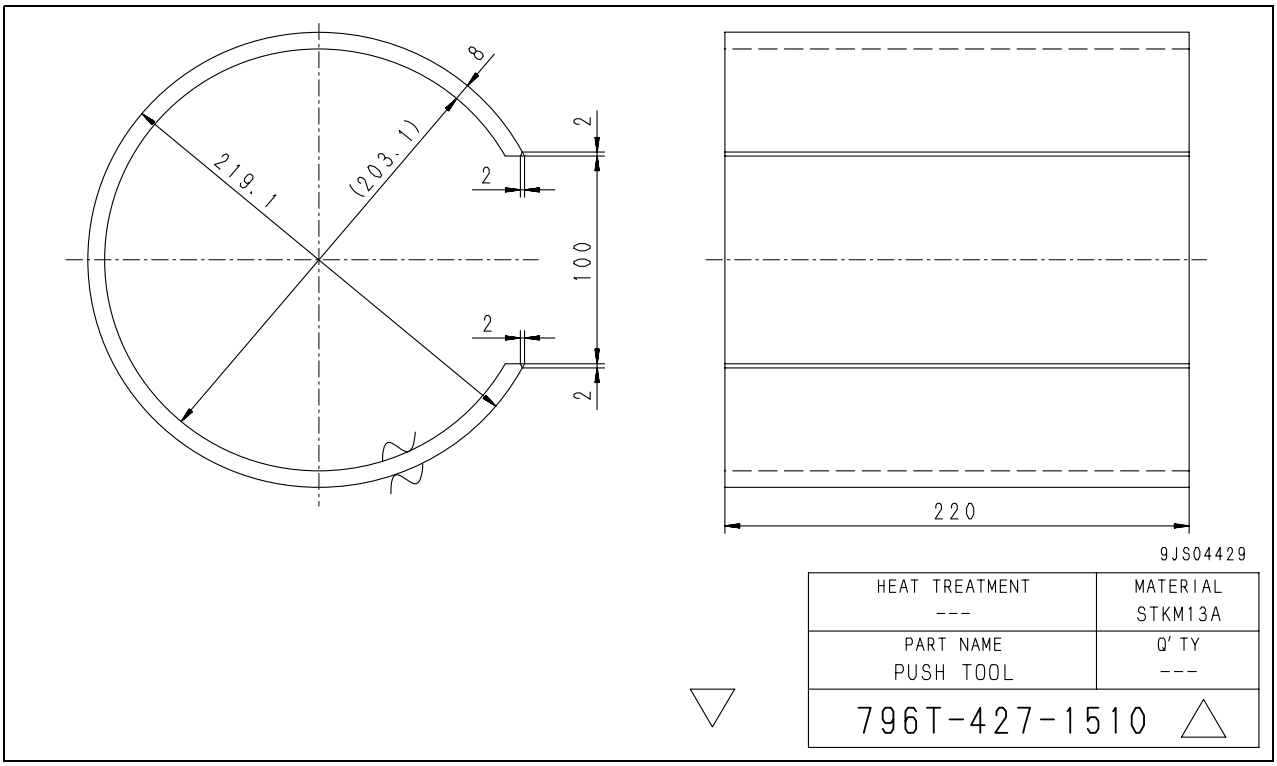
HEAT TREATMENT	MATERIAL
----	STKM13A
PART NAME	Q'TY
PUSH TOOL	1
796T-426-1410 △	

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

F3 Plate

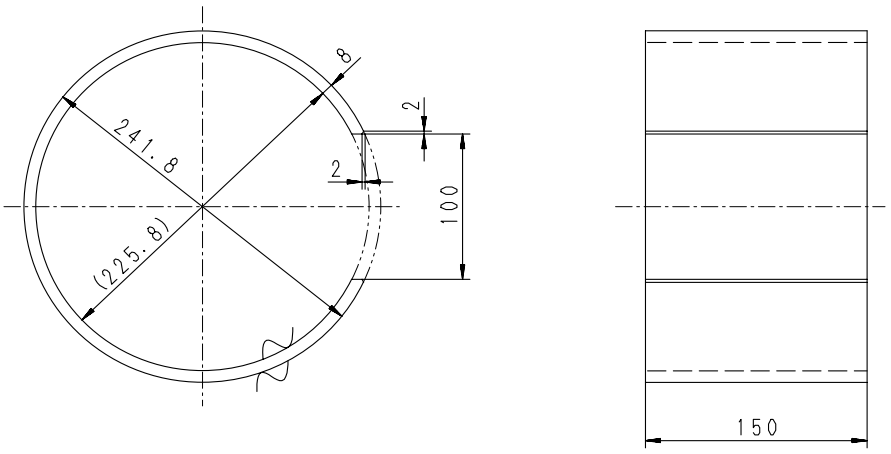


J2 Push tool



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

J6 Push tool

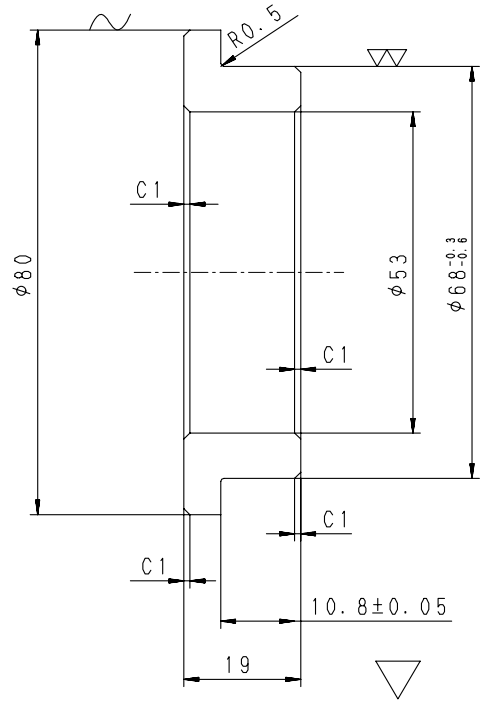


9JS04583

HEAT TREATMENT	MATERIAL
----	STKM13A
PART NAME	Q'TY
PUSH TOOL	1
796T-427-1220 △	

▽

S Push tool



9JS04428

HEAT TREATMENT	MATERIAL
1225001400	S43C
PART NAME	Q'TY
PUSH TOOL	1
796T-467-2410 △	

▽

PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00659-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

50 Disassembly and assembly

Engine cooling related

Engine cooling related

Removal and installation of fuel supply pump assembly

Removal

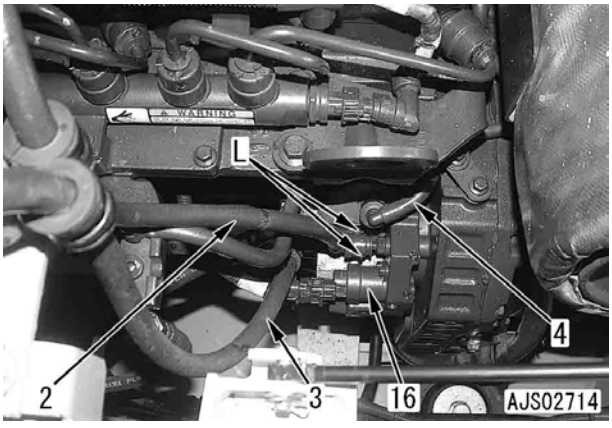
⚠ **Disconnect the negative terminal (–) of the battery before starting with the work.**

1. Turn the upper structure by 90 degrees.
2. Remove the cover under the fuel tank (B section).
3. Close the fuel stop valve.
4. Remove cover (1).

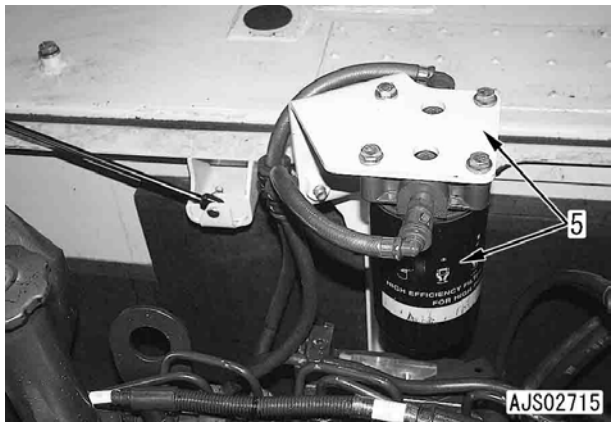
5. Open the engine hood.

6. Disconnect fuel filter hoses (2) and (3) from fuel supply pump (16).
   - ★ Remove dirt on the connector in advance. (Because dirt sometimes makes lock (L) fit tight.)
   - ★ Pull out the hose while pushing lock (L) from both sides.
   - ★ When disconnecting the hoses, oil will flow out. Stop the flow by inserting plugs into the mouthpieces.
   - ★ Wooden plugs should not be used because wood chips may get into the fuel line.

7. Disconnect fuel return hose (4).

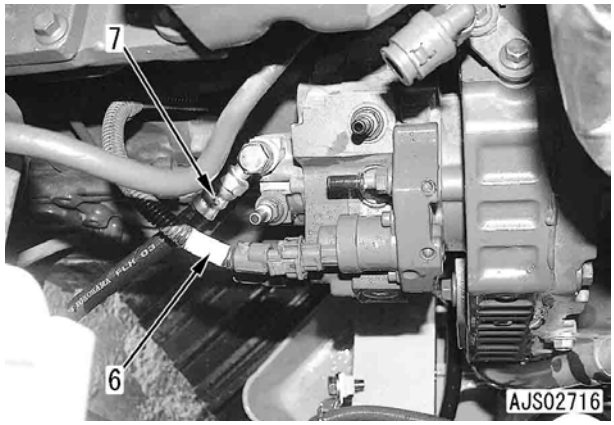


8. Remove fuel filter and bracket assembly (5).



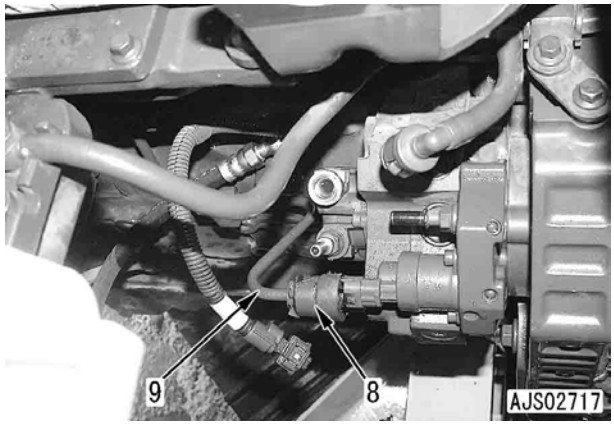
9. Disconnect connector CP3 (6).

10. Disconnect fuel supply hose (7).

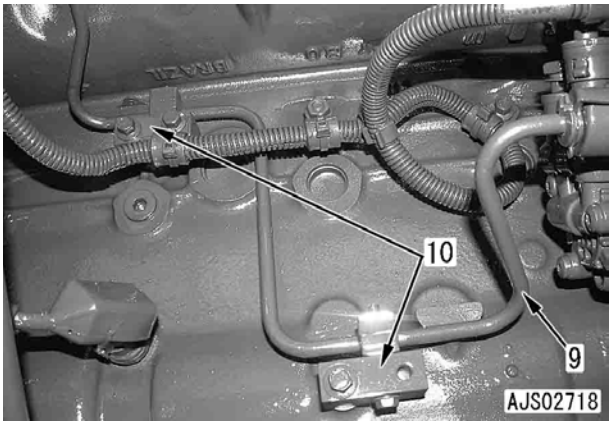


11. Remove bellows (8). [*1]

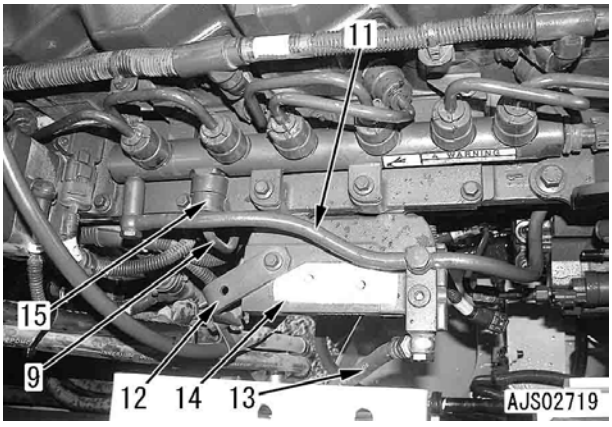
12. Disconnect high-pressure pipe (9). [*1]



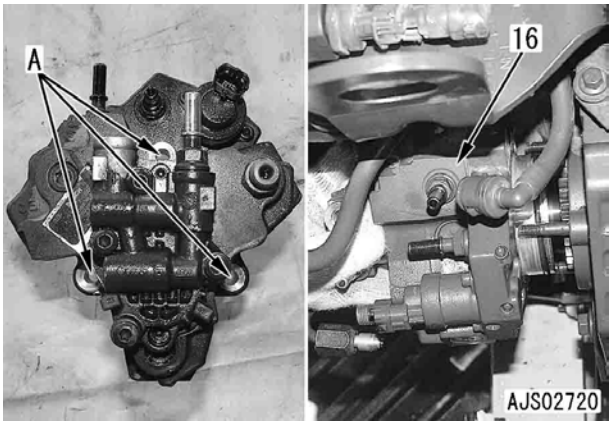
13. Disconnect two tube clamps (10). [*1]



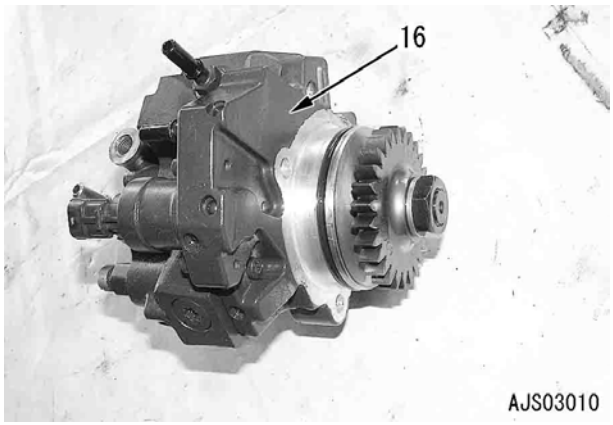
14. Disconnect fuel return tube (11). [*2]
15. Disconnect bracket (12).
16. Disconnect fuel return hose (13).
17. Remove fuel block (14). [*3]
18. Remove bellows (15).
19. Disconnect tube (9). [*1]



20. Remove three nuts (A parts) and remove fuel injection pump assembly (16). [*4]



★ Fuel injection pump assembly (16) comes off in one piece with the gear. No treatment (tooth thinning etc.) has been given to the gear teeth for aligning the 1st and 6th cylinder tops.



Installation

- Installation is done in the reverse order of removal.

★ Figure: Refer to **Removal**.

[*1]

- How to install high-pressure pipe (9)

1. Tighten the sleeve nuts by hand. (both sides)
2. Tighten the sleeve nuts in the order of firstly the pump side, then the common rail side.
   Sleeve nut:
   35 ± 3.5 Nm {3.57 ± 0.36 kgm}
3. Install two tube clamps (10).
   Clamp mounting bolt:
   24 ± 4 Nm {2.45 ± 0.41 kgm}
4. Install bellows (8) and (15).
   ★ Set the slits of each bellows out and down.
   ★ The bellows are installed so that fuel will not spout over the hot parts of the engine and catch fire when it leaks for some reason.

[*2]

Fuel return tube (11) mounting bolt:
24 ± 4 Nm {2.45 ± 0.41 kgm}

[*3]

Fuel block mounting bolt:
32 ± 4 Nm {3.26 ± 0.41 kgm}

[*4]

Fuel supply pump mounting nut:
24 ± 4 Nm {2.45 ± 0.41 kgm}

- **Air bleeding**
  Bleed air from the fuel injection system.

★ Refer to the Testing and adjustment chapter.

Removal and installation of fuel injector assembly

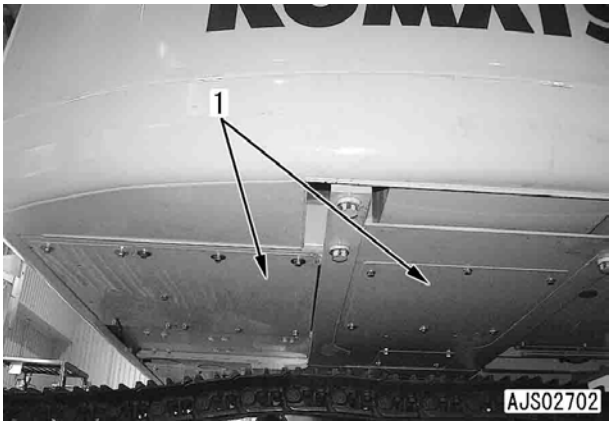
Special tools

Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch
A	3	795-799-6700	Primer	■	1	N	
	4	795-799-1131	Gear	■	1		
	5	795-799-8150	Remover	●	1	N	

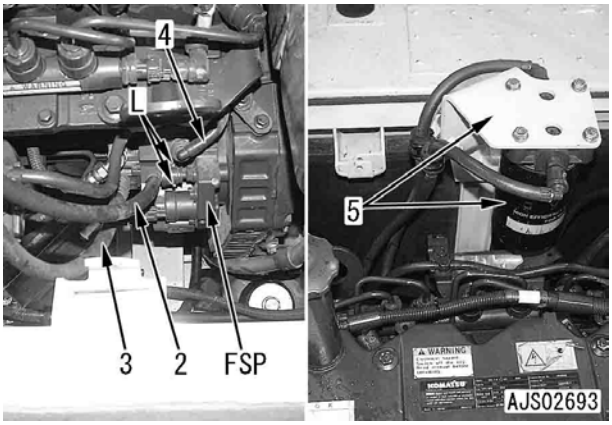
Removal

⚠ **Disconnect the negative terminal (–) of the battery before starting with the work.**

1. Remove cover (1).

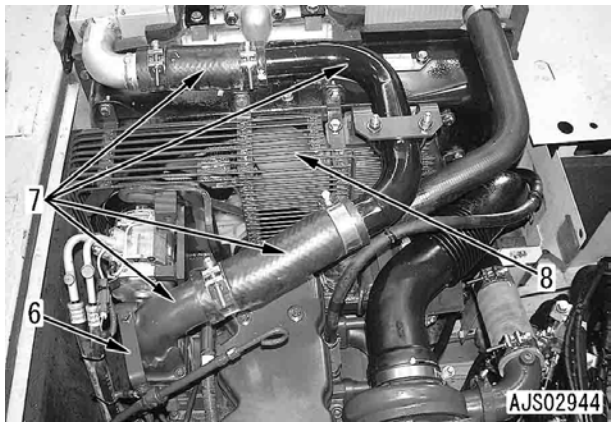


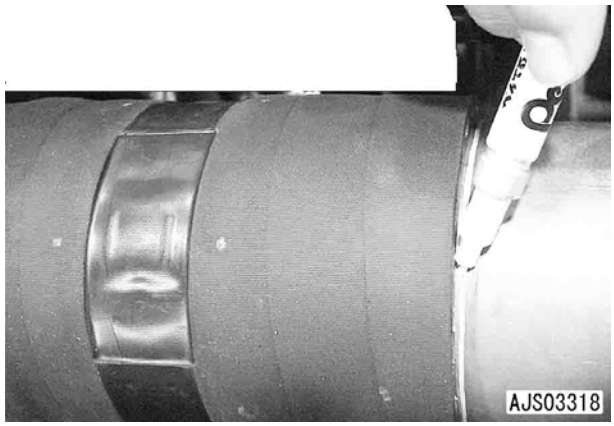
2. Disconnect fuel filter hoses (2) and (3) from fuel supply pump (FSP).
   ★ Pull out the hose while pushing lock (L) from both sides.
3. Disconnect fuel return hose (4).
4. Remove fuel filter and bracket assembly (5).



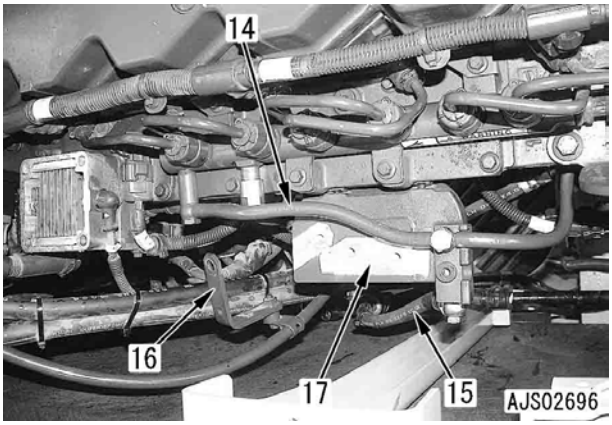
5. Disconnect bracket (6). [*1]

6. Remove hose, tube and air intake connector assembly (7). [*2]
   ★ Remove it without separating from the bracket.
   ★ Mark the hose edge and tube to show the original hose installation positions. (See figure below.)
   ★ When removing the cylinder head cover only, it is not necessary to remove hose, tube and air intake connector assembly (7).
7. Remove fan guard (8).
   ★ Remove it for checking the 3rd and 4th cylinder tops.



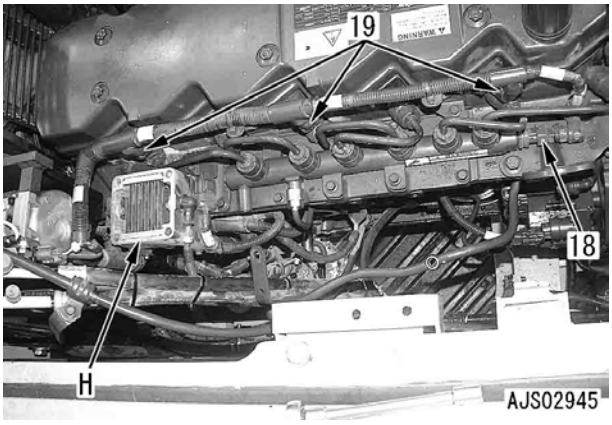


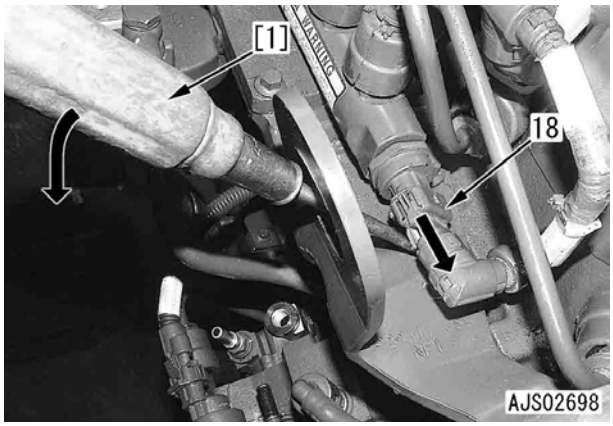
★ (9) – (13): Unused numbers
8. Disconnect fuel return hose (14). [*3]
9. Disconnect fuel return hose (15).
10. Disconnect bracket (16). [*4]
11. Remove fuel block (17). [*5]

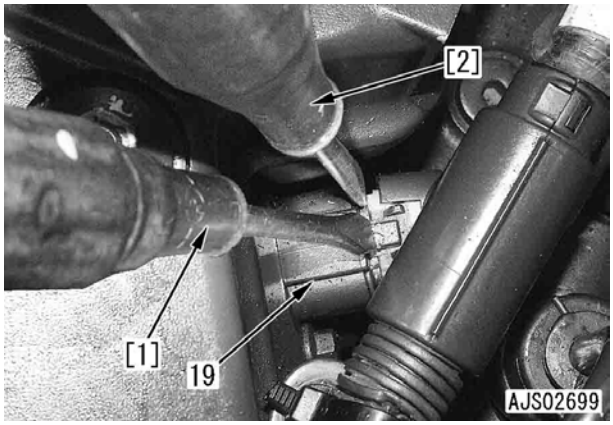


12. Disconnect connector (18).
    ★ Pull out connector (18) in the direction of the arrow while pushing up its lock with flat-head screwdriver [1].
13. Disconnect connector (19).
    ★ As you cannot hold the connector, remove it as follows, using two flat-head screwdrivers.
    1) Keep pushing the lock of connector (19) with flat-had screwdriver [1].
    2) Insert flat-head screwdriver [2] to the gap between the left or right side of the lock and the connector. Then twist the screwdriver from side to side gently to remove the connector gradually.

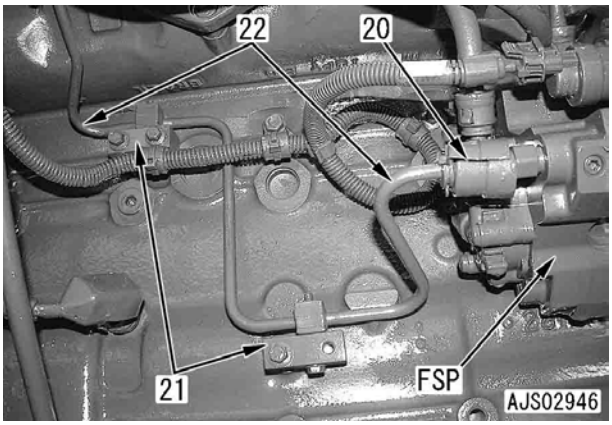
★ Keep electrical intake air heater (H) drawn to the counterweight side.
★ Keep the harness drawn to the counterweight side. [*6]

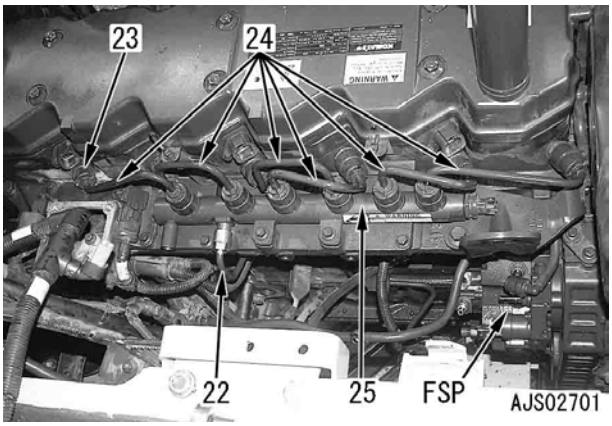




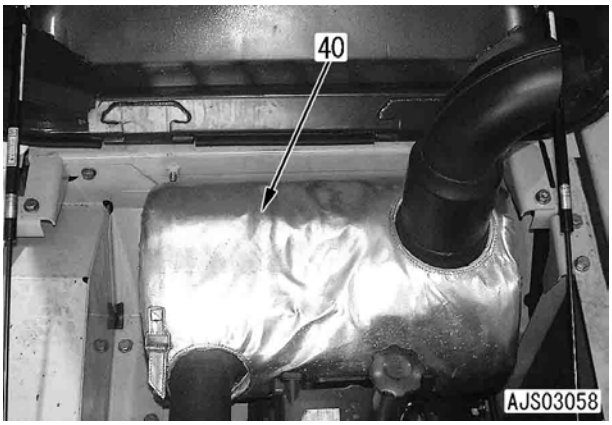


14. Remove bellows (20). [*7]
15. Remove clamp (21) from the cylinder block and disconnect fuel supply tube (22). [*8]
    ★ FSP: Fuel supply pump
16. Remove six bellows (23). [*9]
    ★ Cylinder head side only
17. Disconnect six high-pressure pipes (24) at the cylinder head side. [*10]
18. Remove common rail and high-pressure pipe assembly (25). [*11]

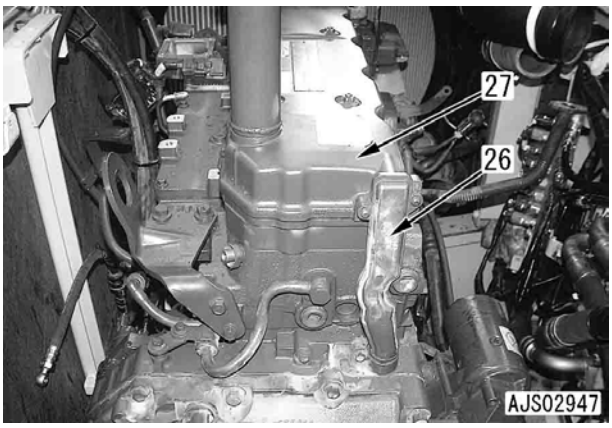




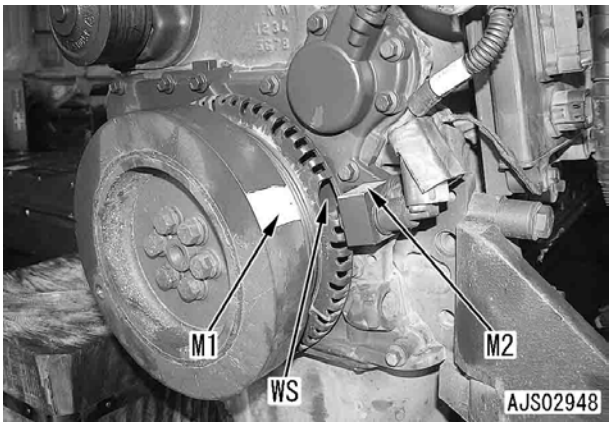
19. Remove muffler heat insulation cover (40).
    ★ Secure space to remove blow-by duct (26).



20. Remove blow-by duct (26). [*12]
21. Remove head cover (27). [*13]



22. By cranking, align mark 1 (M1) at the damper side with mark 2 (M2) at the engine speed sensor side.
    ★ Be careful that the aligning position is not the 1st and 6th cylinder top position but the 3rd and 4th cylinder top position.
    ★ Mark 1 (M1) corresponds to wide-width slit (WS).
    ★ Refer to the Adjusting of Valve Clearance section in the Testing and adjusting chapter of this manual.
    ★ Use tool **A4** (refer to the tool list) for cranking.



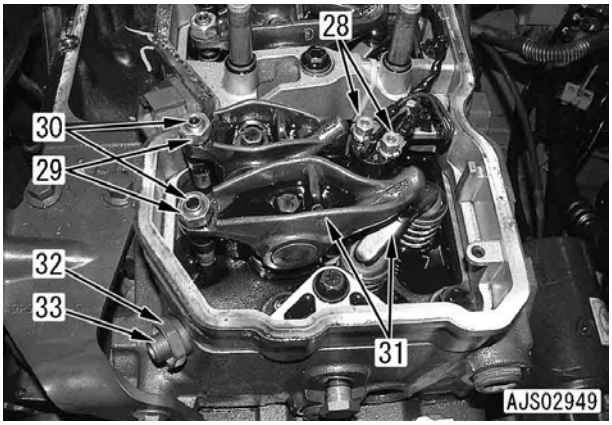
23. Remove nuts (28) for the harnesses from the injector. [*14]

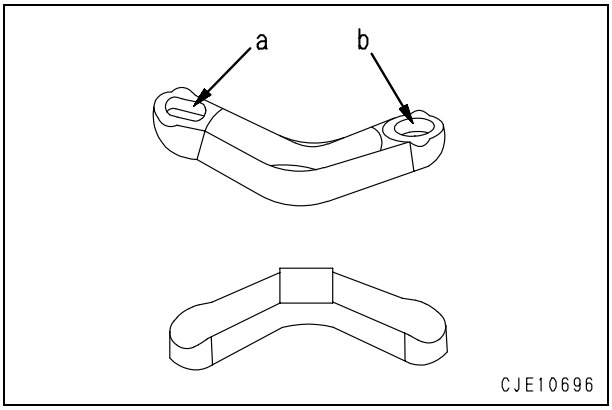
Harness color	Cylinder No.
White	1, 3, 5
Black	2, 4, 6

24. Remove 12 mounting bolts and remove six rocker arm and crosshead assemblies (31).
    ★ Loosen locknut (29) and then loosen adjustment screw (30) a few turns so that excessive force is not put on the push rod when the rocker arm is installed.

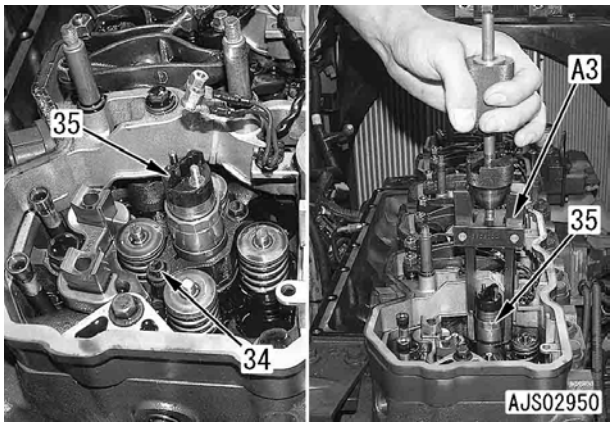
★ Keep records of installation position and direction of the crosshead (hole shape of **a** and **b** parts) (Install it in the same direction when reinstalling.)

25. Remove retainers (32) and then remove six inlet connectors (33).
    ★ Remove and flush dirt etc., off the surrounding area in advance to prevent them from entering the connector holes.
    ★ Tool **A5**: remover is adopted for removing inlet connectors (33). (Refer to the tool list.)





26. Remove two mounting bolts (34) for fuel injector assembly (35).
27. Remove fuel injector assembly (35) using tool **A3**.
    ★ Be careful not to let any dust or foreign materials enter the fuel injector assembly mounting portion.

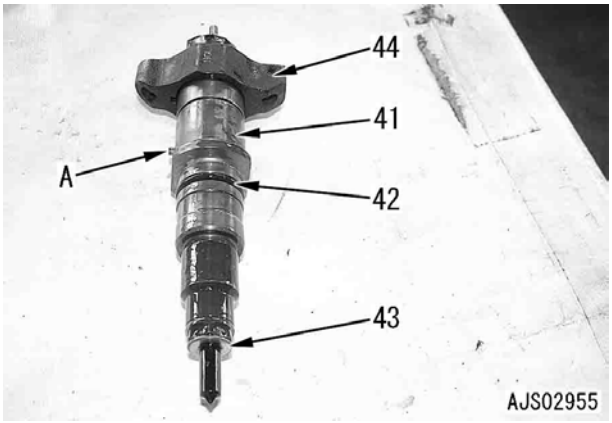


Installation

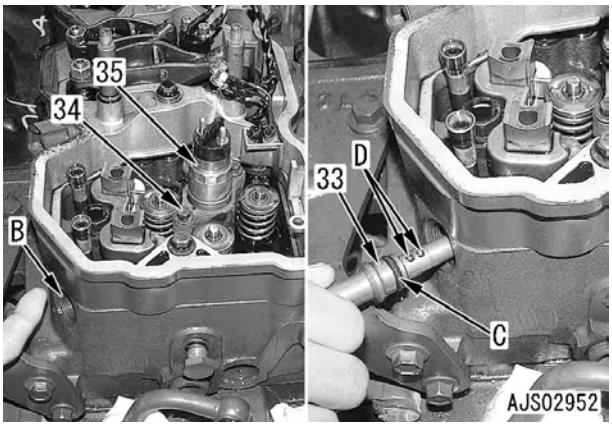
1. Fuel injector assembly

★ Check that there is no damage or dust on the fuel injector sleeve.

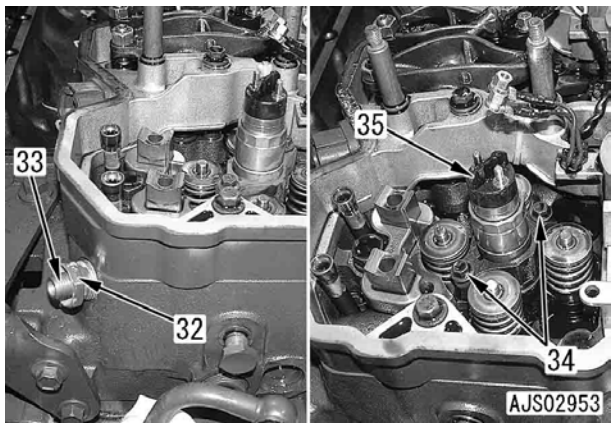
1) Install O-ring (42) and gasket (43) to fuel injector (41).
2) Coat O-ring (42) and the head side of fuel injector (41) with engine oil (EO15W-40).
   O-ring (42) and the head side of fuel injector (41): **engine oil (EO15W-40)**
3) Install holder (44) to fuel injector (41) with concavity and convexity (A) fitted together.



4) Assemble fuel injector assembly (35) to the cylinder head with its fuel inlet hole facing the intake manifold side.
5) Tighten bolts (34) three or four turns.
6) Coat the head side (B part) of inlet connector (33) with engine oil (EO15W-40).
7) Coat O-ring (C) of inlet connector (33) with engine oil (EO15W-40). Then insert inlet connector (33) completely, aligning (D part) with the side groove of the head.

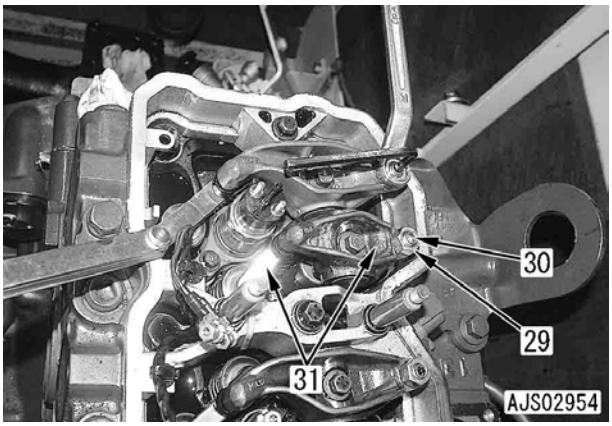


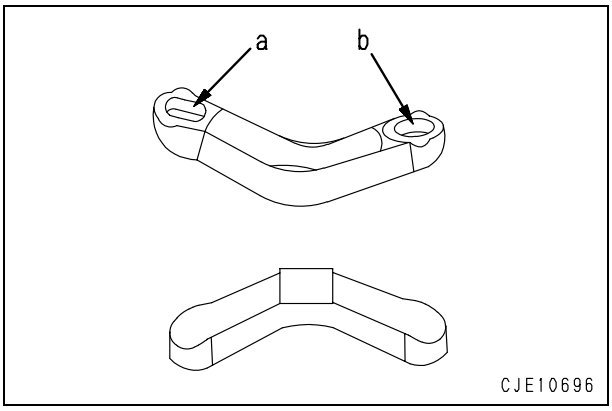
8) Tighten inlet connector (33) with retainer (32) by hand. (Push it into the injector hole.)
9) Tighten mounting bolts (34) for fuel injector assembly (35) alternately.
   Bolt: **8 ± 0.8 Nm {0.81 ± 0.08 kgm}**
10) Tighten retainer (32).
   Retainer: **50 ± 5 Nm {5.1 ± 0.5 kgm}**



2. Rocker arm and crosshead assembly

1) Install rocker arm and crosshead assembly (31).
   ★ When reusing the crosshead, install the same intake and exhaust valves in the same direction because the shapes of its holes **a** and **b** are different,
   ★ Tighten the mounting bolt after checking that the ball portion of adjustment screw (30) is well seated in the push rod socket.
   Mounting bolt:
   36 ± 5 Nm {3.7 ± 0.5 kgm}
2) Adjust the valve clearances.
   ★ Refer to the Adjusting of Valve Clearance section in the Testing and adjusting chapter of this manual.
   Locknut (29):
   24 ± 4 Nm {2.4 ± 0.4 kgm}



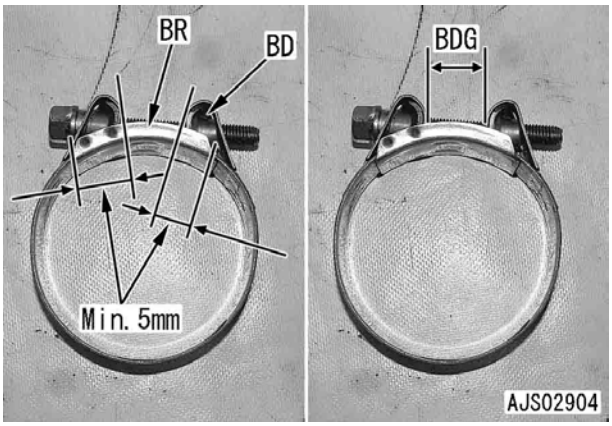


- Carry out the rest of installation in the reverse order to removal.

[*1]
Bracket mounting bolt:
43 ± 6 Nm {4.4 ± 0.6 kgm}

[*2]
Air intake connector mounting bolt:
24 ± 4 Nm {2.4 ± 0.4 kgm}

- MIKALOR clamp
★ Use a new clamp.
★ Align the hose to the original position (marking position).
★ Reference
  Depth of insertion: 60mm (aftercooler side)
★ Set bridge (BR) under the clamp tightening bolt as the lap with band (BR) is Min.5mm.
★ Align the clamp to the original position.
★ Impact wrench is not applicable to use.
Clamp: **16 – 18 Nm {1.6 – 1.8 kgm}**
★ When the tightening torque force is less than 16Nm{1.6kgm}, tighten it until the hand gap is adhered (BDG size is 0).



[*3]
Joint bolt: **24 ± 4 Nm {2.4 ± 0.4 kgm}**

[*4]
Mounting bolt: **24 ± 4 Nm {2.4 ± 0.4 kgm}**

[*5]
Fuel block mounting bolt:
32 ± 4 Nm {3.3 ± 0.4 kgm}

[*6]
⚠ **When installing, keep the distance of more than 10 mm between the high-pressure pipe and the harness.**

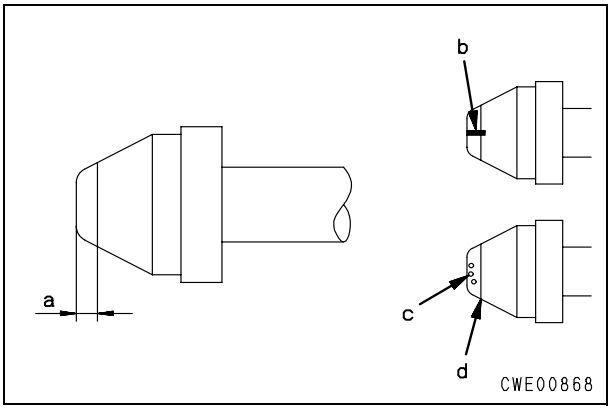
[*7], [*8], [*9], [*10], [*11]

- **High-pressure pipes and common rail**

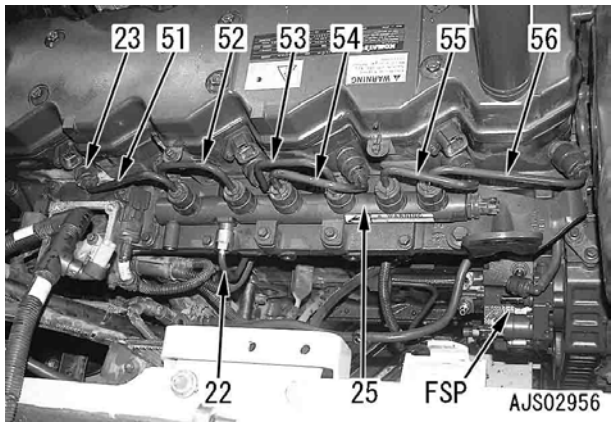
⚠ **Do not use high-pressure pipes with bending modification.**

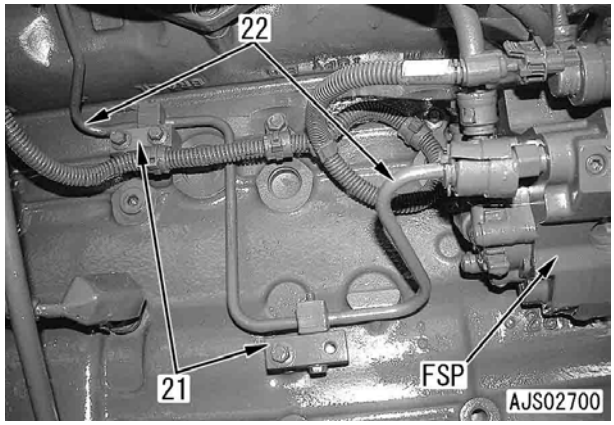
⚠ **Be sure to use a genuine high-pressure pipe fixing clamp and observe strictly the tightening torque.**

★ A high-pressure pipe which has depressions such as visible vertical slit scar (b), patchy scars (c) etc. on the taper seal section of its connector ((a) part: within 2mm from the tip), or a high-pressure pipe whose (d) part (end of the taper seal section: 2mm from the tip) catches on a finger nail due to fatigue, may cause fuel leakage. In these cases, replace the high-pressure pipe.



3) Assemble common rail (25) and high-pressure pipes (51) -(56) temporarily.
   Sleeve nut and mounting bolt:
   0.2 – 0.8 Nm {0.02 – 0.08 kgm}
4) Tighten high-pressure pipes (51) - (56) according to the following procedure.
   Sleeve nut:
   35 ± 3.5 Nm {3.6 ± 0.4 kgm}
   1] Head side of high-pressure pipes (51) and (56)
   2] Common rail (25) side of high-pressure pipes (51) and (56)
   3] Head side of high-pressure pipes (52), (53), (54) and (55)
   4] Common rail (25) side of high-pressure pipes (52), (53), (54) and (55)
5) Tighten the sleeve nut of high-pressure pipe (22) temporarily.
6) Tighten high-pressure pipe (22) in the order of firstly pump (FSP) side, then common rail (25) side.
   Sleeve nut:
   35 ± 3.5 Nm {3.6 ± 0.4 kgm}
7) Tighten clamp (21) of high-pressure pipe (22).
   Mounting bolt:
   24 ± 4 Nm {2.4 ± 0.4 kgm}
8) Tighten common rail (25) with four bolts.
   ★ Coat the two bolt threads on the inner side of the engine with sealant (LG-7).
   Mounting bolt:
   24 ± 4 Nm {2.4 ± 0.4 kgm}
9) Install bellows (23) to each high-pressure pipe. (14 pieces)
   ★ Set the slits of each bellows out and down.
   ★ The bellows are installed so that fuel will not spout over the hot parts of the engine and catch fire when it leaks for some reason.
   ★ FSP: Fuel supply pump





[*12]
Blow-by duct mounting bolt:
10 ± 2 Nm {1.0 ± 0.2 kgm}

[*13]
Head cover mounting nut:
24 ± 4 Nm {2.4 ± 0.4 kgm}

[*14]
★ Harness installation position

Harness color	Cylinder No.
White	1, 3, 5
Black	2, 4, 6

Harness mounting nut:
1.5 ± 0.25 Nm {0.15 ± 0.03 kgm}

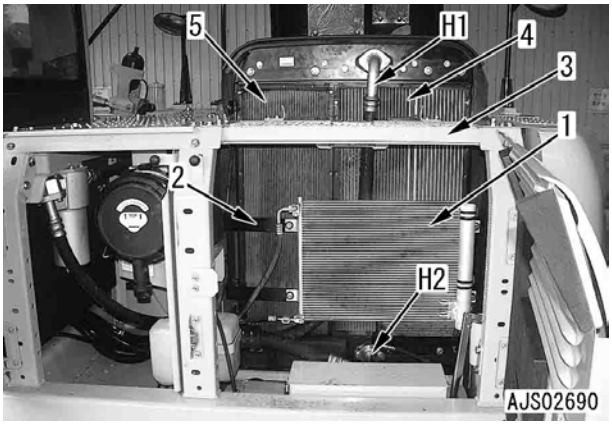
Removal and installation of engine front seal

Special tools

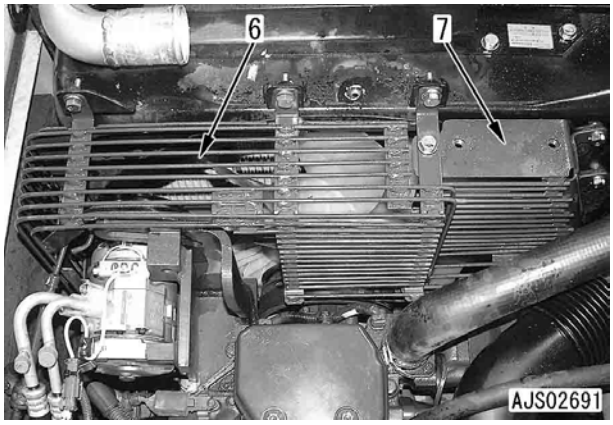
Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch
A	1	795-799-6400	Seal puller	■	1	N	
	6	790-331-1120	Wrench (Angle)	●	1		

Removal

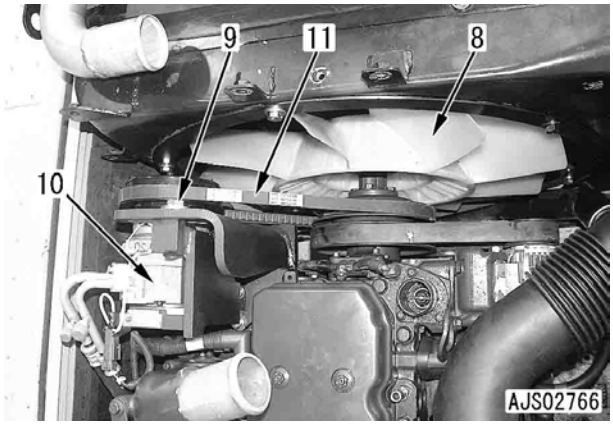
1. Remove the radiator assembly referring to the section of Removing Radiator Assembly.
2. Remove the hydraulic oil cooler assembly referring to the section of Removing Hydraulic Oil Cooler Assembly.
3. Remove the aftercooler assembly referring to the section of Removing Aftercooler Assembly.
4. Remove mounting bolts for air conditioner condenser (1) and put aside air conditioner condenser (1).
5. Remove bracket (2).
6. Remove cover (3).
7. Remove nets (4) and (5).
   ★ Hydraulic oil cooler hoses **H1** and **H2** have already been removed with removal



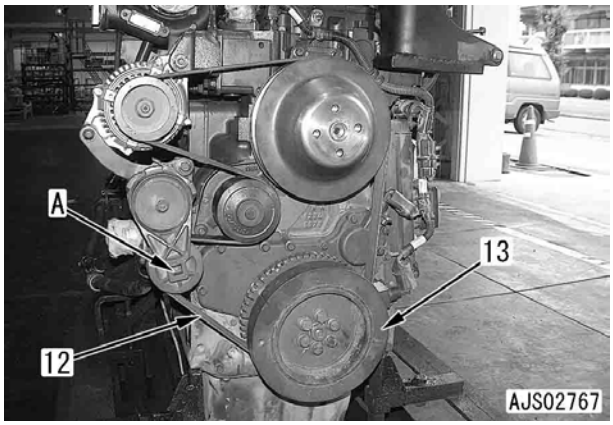
8. Remove fan guards (6) and (7).



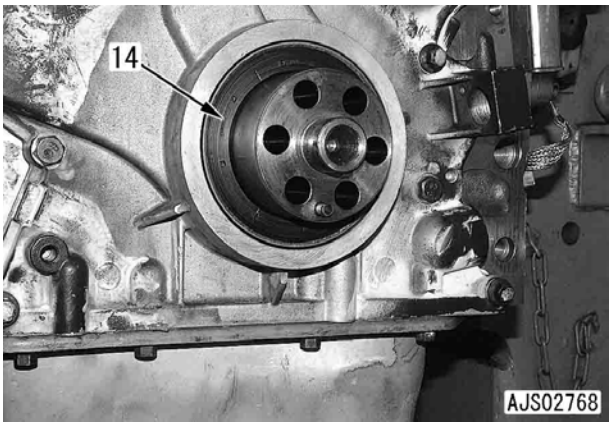
9. Remove fan (8). [*1]
10. Loosen air conditioner compressor bracket adjustment bolts (9).
    ★ There is another bolt behind.
11. Move air conditioner compressor assembly (10).
12. Remove air conditioner compressor drive belt (11). [*2]



13. Loosen tension by inserting a wrench to **A** part, and remove alternator belt (12).
14. Remove six mounting bolts and remove vibration damper (13).

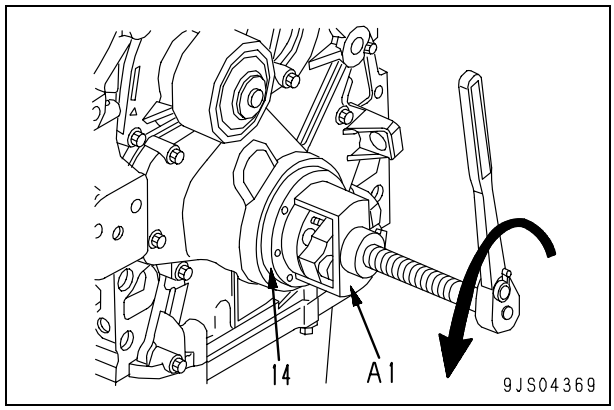


15. Remove seal (14).

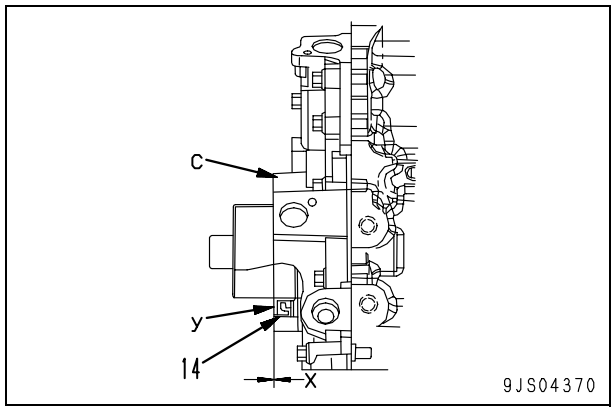


Installation

1. Install front seal (14) using tool **A1**.
   - ★ Before installing the seal, check that the end corners and lip sliding surfaces of the crankshaft are free from flaw, burr, and rust of the housing.
   - ★ When installing the seal, do not coat the shaft and seal lip with oil, grease etc. Also, wipe off grease from the shaft completely.

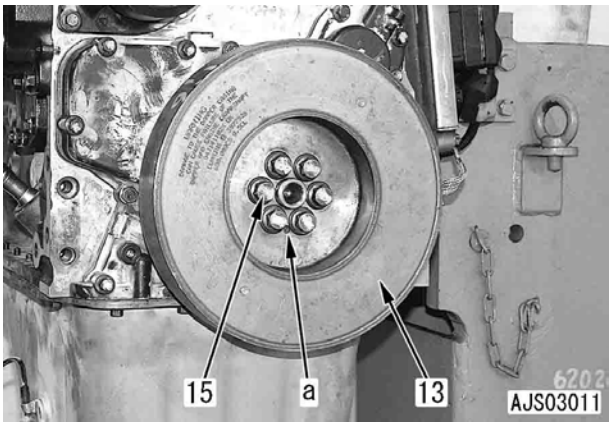


   - ★ From cover (C) of seal (14)
     - Extrusion **x**: **less than 0.38 mm**
     - Facial run out (TIR: total indicator reading) **y**: **less than 0.25 mm**

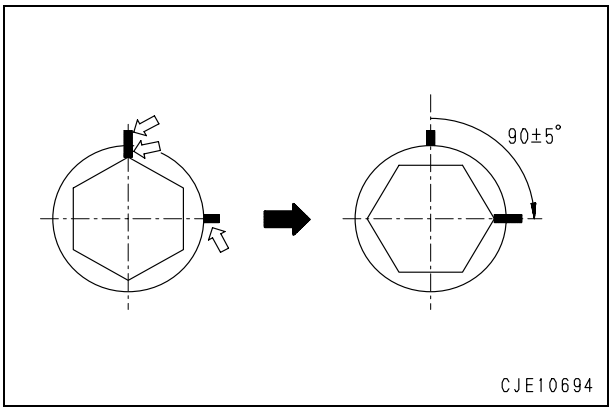


2. Vibration damper

1) Install vibration damper (13), aligning its dowel hole with dowel pin **a** of the crankshaft.
2) Tightening procedure of bolts (15)
   1] Tighten to a torque of 55 ± 5 Nm {5.6 ± 0.5 kgm} in diagonal order.
   2] Loosen the bolts 180°.
   3] Tighten to a torque of 55 ± 5 Nm {5.6 ± 0.5 kgm} in diagonal order.
   4] 90° ± 5°
      ★ Tool **A6**: wrench is adopted for angle tightening. (Refer to the tool list.) (Refer to the tool list.)



- When an angle tightening tool is not used:
  Put marks on the vibration damper and bolts with a felt-tip pen, and then tighten the bolts an additional **90° ± 5°**.



- Carry out the rest of installation in the reverse order to removal.

[*1]
Fan mounting bolt:
43 ± 6 Nm {4.4 ± 0.6 kgm}

[*2]
★ Refer to the Inspection and Adjustment of Air Compressor Belt Tension section in the Testing and adjusting chapter in this manual.

Removal and installation of engine rear seal

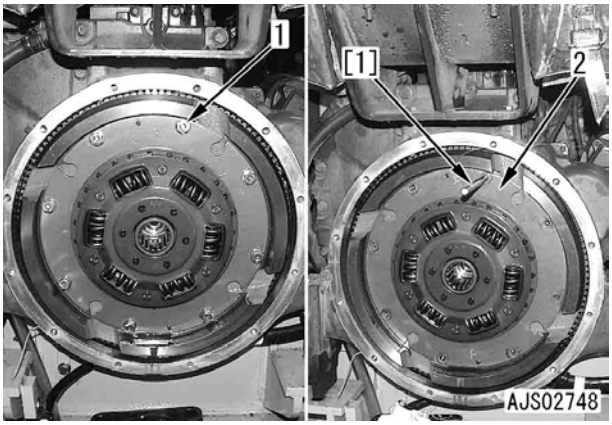
Special tools

Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch
A	2	795-799-6500	Seal puller	■	1	N	

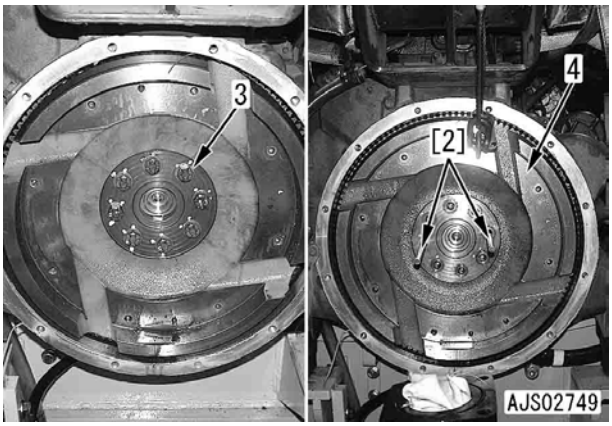
Removal

1. Remove the hydraulic pump assembly referring to the section of Removing Hydraulic Pump Assembly.

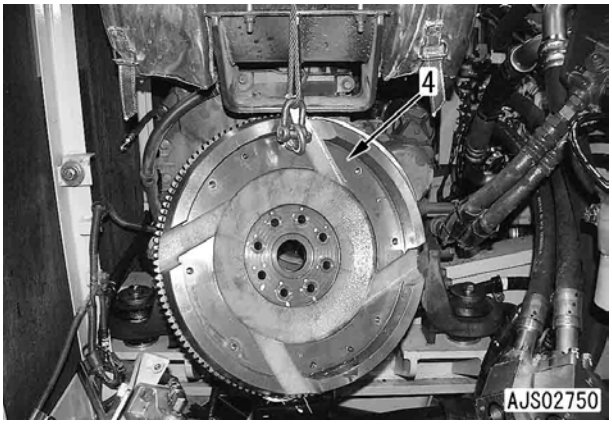
2. Remove mounting bolt (1) and set guide bolt [1].
3. Remove damper assembly (2).



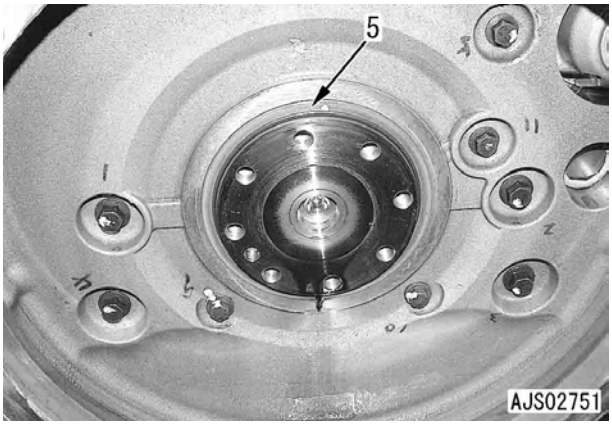
4. Remove mounting bolt (3) and insert guide bolts [2]. [*1]
   ★ Width across flats: 18 mm
5. Lift temporarily flywheel assembly (4) and pull out flywheel assembly (4).
   ★ Be careful not to let the guide bolts drop out.



6. Lift off flywheel assembly (4) to remove it.
   Flywheel assembly: **35 kg**

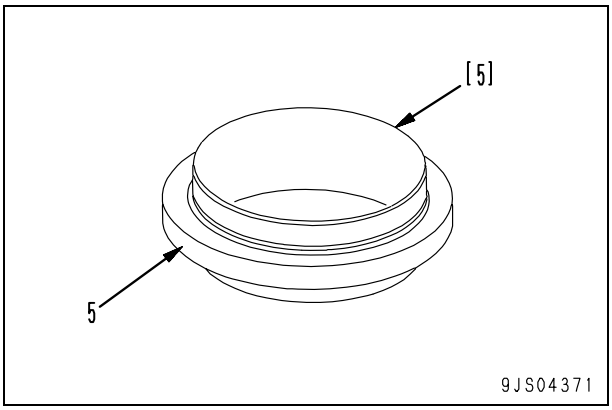


7. Remove seal (5) as follows.
   ★ Use care in the removal so that the crank shaft may not be damaged.

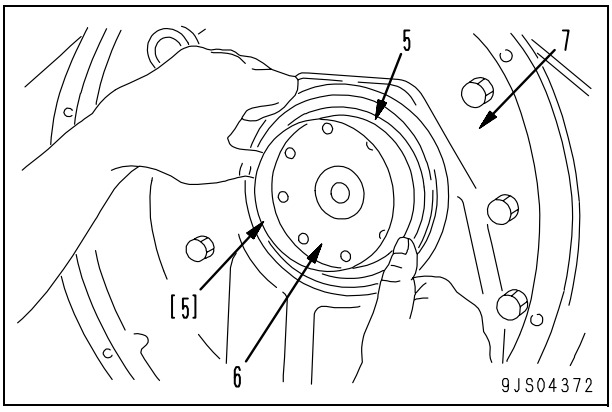


Installation

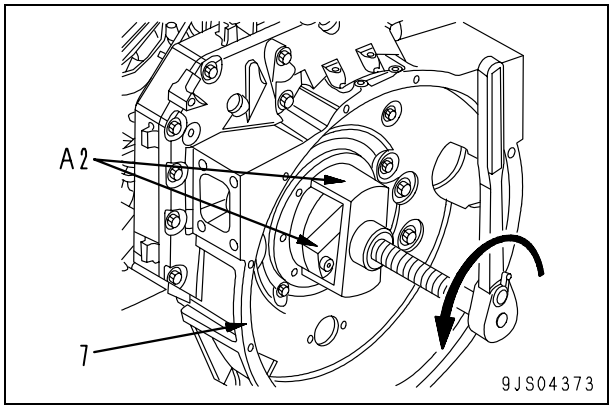
1. Install the oil seal according to the following procedure.
   - ★ Do not remove pilot [5] which is attached to oil seal (5) until oil seal (5) is inserted to the crankshaft.
   - ★ Before installing the oil seal, de-grease, clean and dry the crankshaft sealing face and the seal lip face to prevent oil leakage.

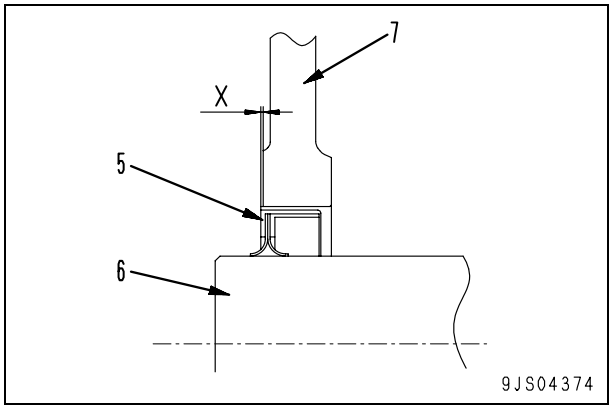


2. Insert pilot [5] to crankshaft (6) and push oil seal (5) into flywheel housing (7).
3. Push in oil seal (5) further and pull out pilot [5].



4. Install oil seal (5) on flywheel housing (7) to the proper depth by using tool **A2**.
   - ★ Push in oil seal (5) taking care that there are no bend etc. on it.
   - ★ Extrusion of oil seal (5) from flywheel housing (7)
     X: less than 0.38 mm



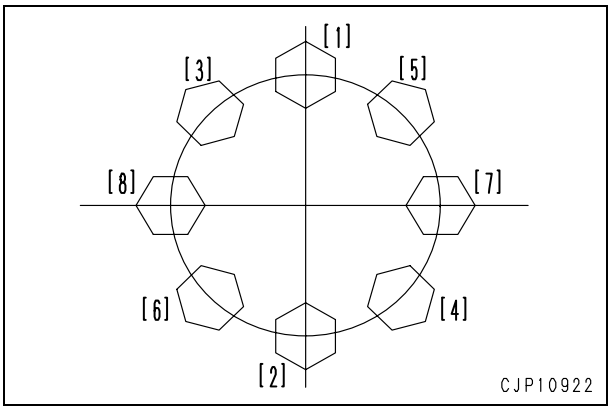


- Carry out the rest of installation in the reverse order to removal.

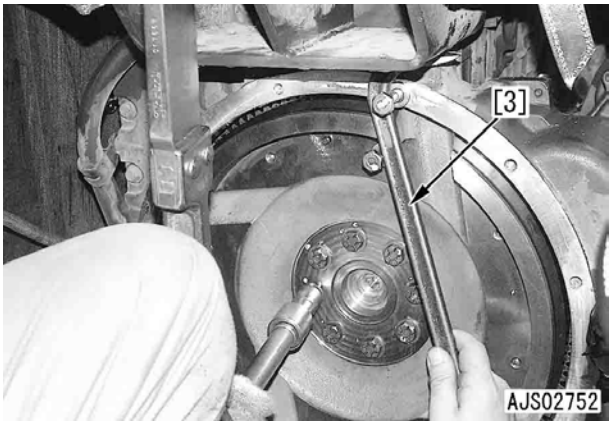
[*1]

★ Tighten the eight flywheel mounting bolts in the order of (1) through (8) as shown in the figure below.

Flywheel assembly mounting bolt:
137 ± 7 Nm {13.97 ± 0.71 kgm}

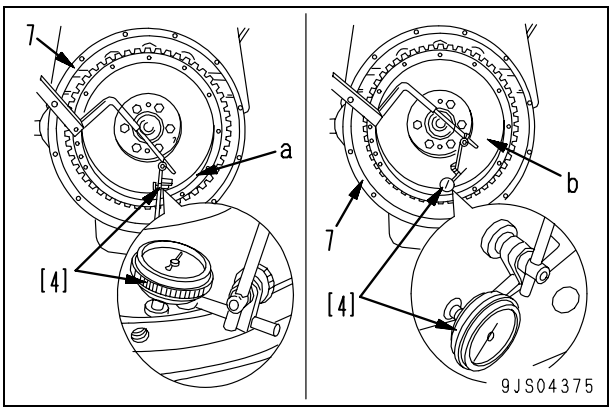


★ Tighten the bolts using bar [3] for preventing rotation of the flywheel assembly.



- Measurement of radial run out
  - ★ Radial run out: less than **0.13 mm**
  1) Set dial gauge [4] to the stand, and set it to flywheel housing (7).
  2) Bring the dial gauge probe into contact with faucet joint portion **a** or the outer perimeter surface of the flywheel at a right angle.
  3) Rotate the flywheel 360°and measure the difference of the maximum swing of the dial gauge indicator.
     - ★ Check that the dial gauge indicator is back in the original position after the flywheel is rotated 360°.

- Measurement of facial run out
  - ★ Facial run out: less than **0.20 mm**
  4) As in the case of measurement of radial run out, bring the dial gauge probe into contact with end surface **b** near the outer perimeter of the flywheel at a right angle.
     - ★ Conduct measurement pulling the crankshaft to either the front or rear side to prevent errors caused by shakiness.
  5) Rotate the flywheel 360° and measure the difference of the maximum swing of the dial gauge indicator.



Removal and installation of cylinder head assembly

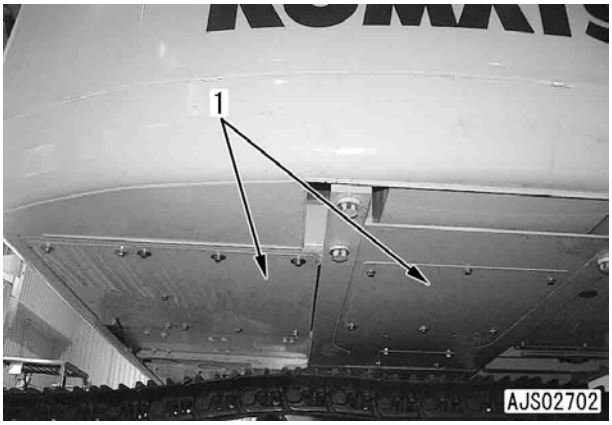
Special tools

Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch
A	3	795-799-6700	Primer	■	1	N	
	4	795-799-1131	Gear	■	1		
	5	795-799-8150	Remover	●	1	N	
	6	790-331-1120	Wrench (Angle)	●			
	7	795-790-4510	Gauge	●	1	N	

Removal

⚠ **Disconnect the negative terminal (–) of the battery before starting with the work.**

1. Remove cover (1).



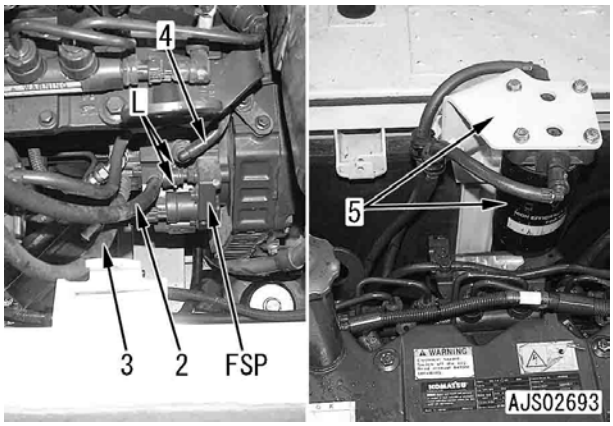
2. Drain the engine cooling water.
   Coolant: **Approx. 21.4ℓ**

3. Remove the following referring to the section of Removing Engine and Hydraulic Pump Assembly.
   - Engine hood
   - Top cover on control valve
   - Cover between hydraulic pump and engine
   - Frame between control valve and engine
   - Cover between control valve and engine

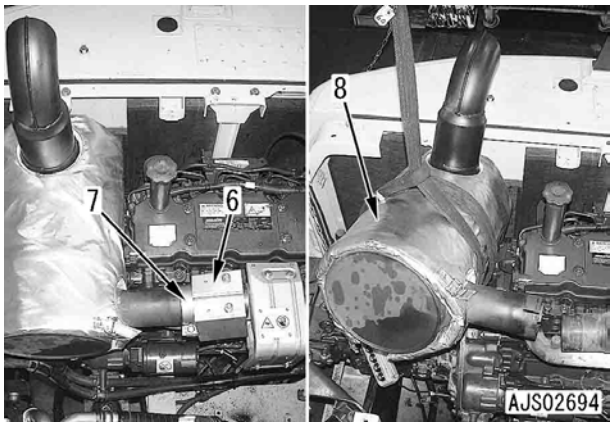
   ★ The frame between the control valve and the engine should be kept installed as a foothold.

4. Disconnect fuel filter hoses (2) and (3) from fuel supply pump (FSP).
   ★ Remove dirt on the connector in advance. (Because dirt sometimes makes lock (L) fit tight.)
   ★ Pull out the hose while pushing lock (L) from both sides.

5. Disconnect fuel return hose (4).
6. Remove fuel filter and bracket assembly (5).

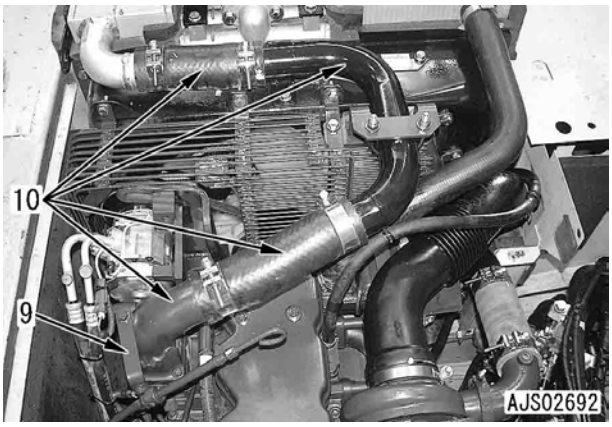


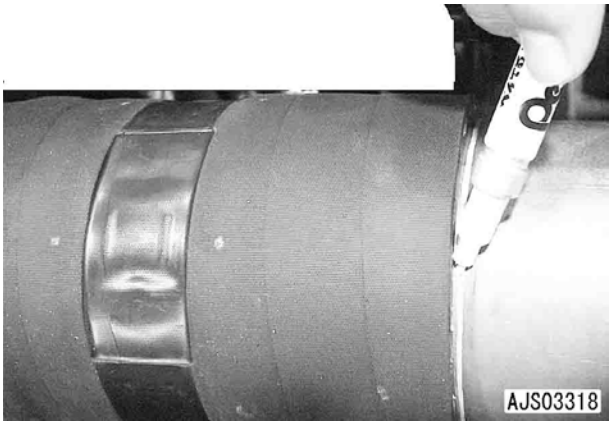
7. Remove cover (6).
8. Remove clamp (7).
9. Remove the mounting bolt and lift off muffler assembly (8) to remove it. [*1]
   ★ Space for winding the lifting tool is small.
   Muffler assembly: **35 kg**



10. Disconnect bracket (9). [*2]

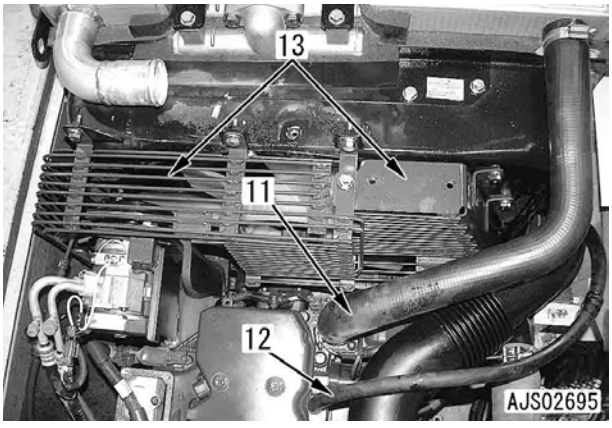
11. Remove hose, tube and air intake connector assembly (10). [*3]
    ★ Remove it without separating from the bracket.
    ★ Mark the hose edge and tube to show the original hose installation positions. (See figure below.)



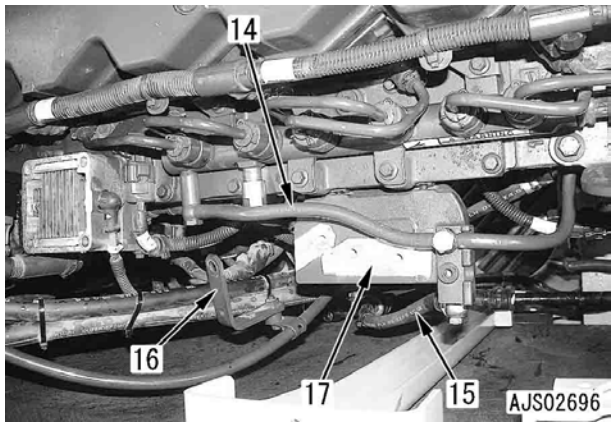


12. Disconnect radiator hose (11). [*4]

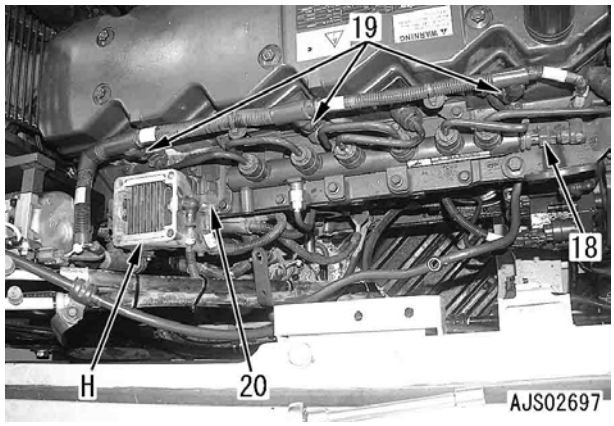
13. Disconnect heater hose (12).
14. Remove fan guard (13).

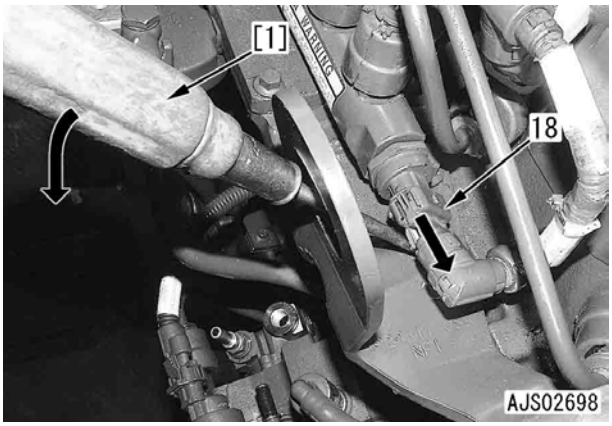


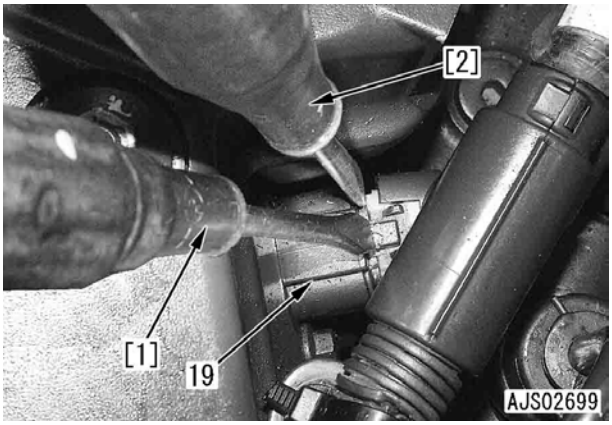
15. Disconnect fuel return hose (14). [*5]
16. Disconnect fuel return hose (15).
17. Disconnect bracket (16). [*6]
18. Remove fuel block (17). [*7]



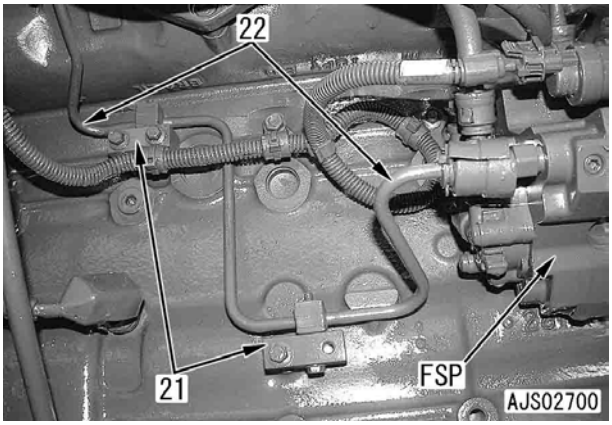
19. Disconnect connector (18).
    ★ Pull out connector (18) in the direction of the arrow while pushing up its lock with flat-head screwdriver [1].
20. Disconnect connector (19).
    ★ As you cannot hold the connector, remove it as follows, using two flat-head screwdrivers.
    1) Keep pushing the lock of connector (19) with flat-had screwdriver [1].
    2) Insert flat-head screwdriver [2] to the gap between the left or right side of the lock and the connector. Then twist the screwdriver from side to side gently to remove the connector gradually.
21. Disconnect connector with boost pressure and intake air temperature sensor (20).
    ★ Keep electrical intake air heater (H) drawn to the counterweight side.
    ★ Keep the harness drawn to the counterweight side. [*8]

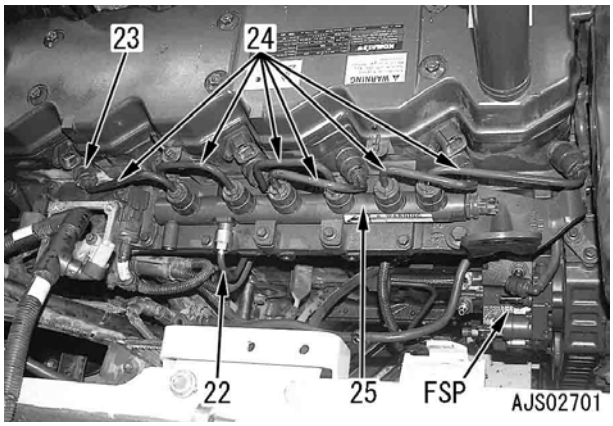




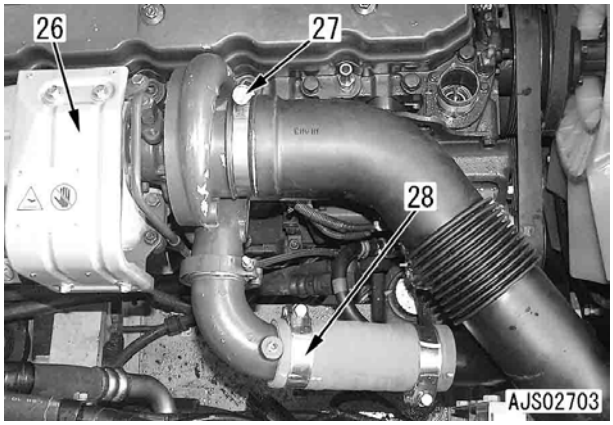


22. Remove clamp (21) from the cylinder block and disconnect high-pressure pipe (22). [*9]
    ★ FSP: Fuel supply pump
    ★ Remove the bellows from the sleeve nut portions.
23. Remove six bellows (23).
    ★ Cylinder head side only
24. Disconnect six high-pressure pipes (24) at the cylinder head side. [*9]
25. Remove common rail and high-pressure pipe assembly (25). [*10]

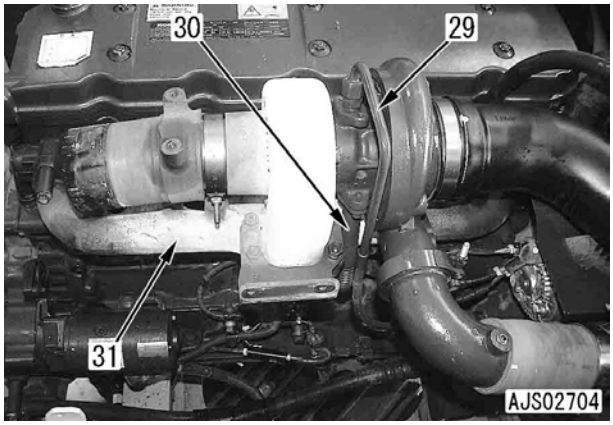




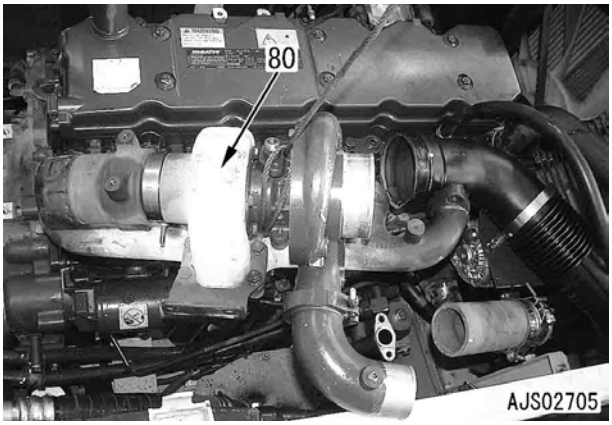
26. Remove protection cover (26).
27. Loosen air tube clamp (27). [*11]
28. Loosen hose clamp (28). [*12]



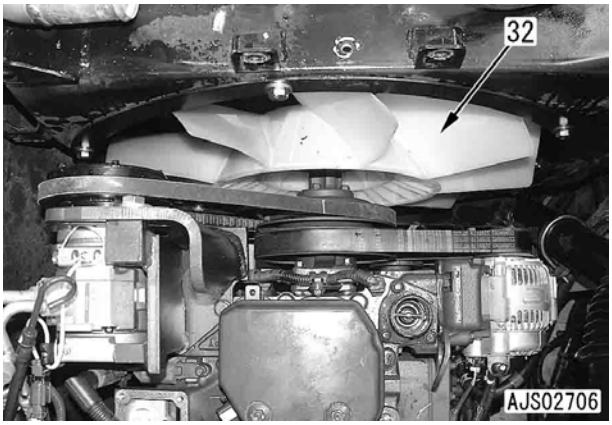
29. Disconnect lubrication inlet hose (29) and lubrication outlet hose (30).[*13]
30. Remove all the mounting bolts for exhaust manifold (31) except a few pieces. [*14]



31. Lift temporarily exhaust manifold and turbo charger assembly (80), and remove the remaining mounting bolts. [*14]
32. Lift off exhaust manifold and turbo charger assembly (80) to remove it.
    Exhaust manifold and turbo charger assembly: **25 kg**

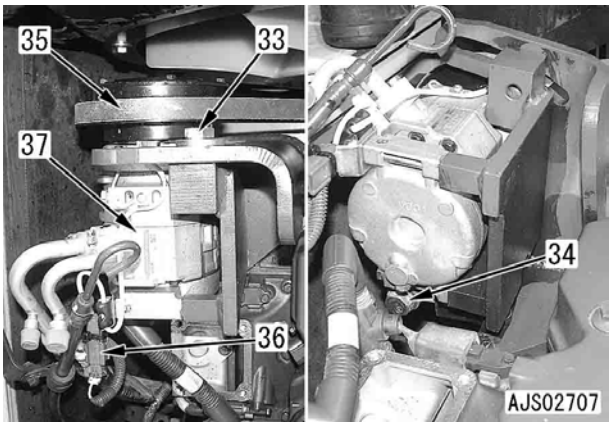


33. Remove fan (32).[*15]
    ★ Keep the fan dropped down.

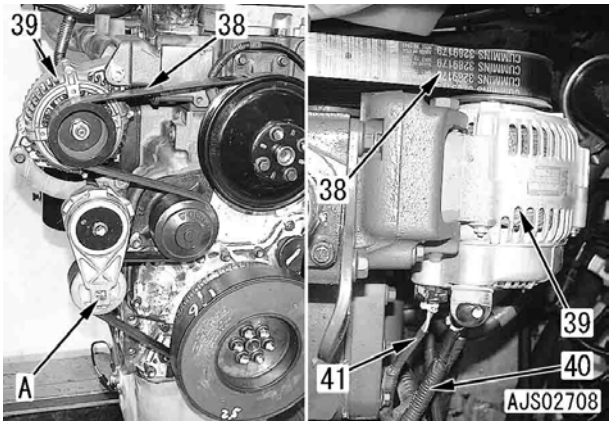


34. Loosen air conditioner compressor bracket mounting bolts (33) and (34).
35. Remove air conditioner compressor drive belt (35). [*16]

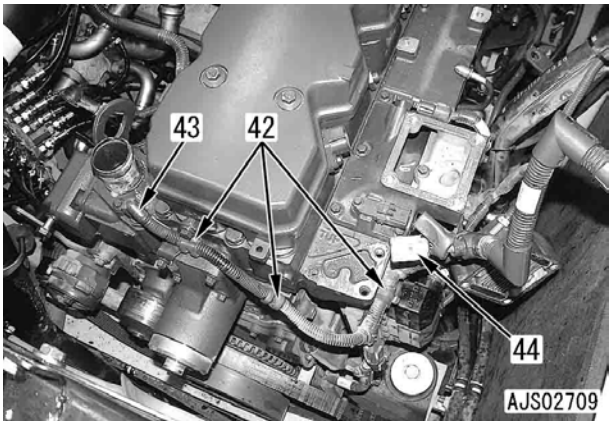
36. Disconnect connector AC02 (36).
37. Remove air conditioner compressor assembly (37).
    ★ Remove air conditioner compressor assembly in one piece with the bracket and put them on the counter weight.

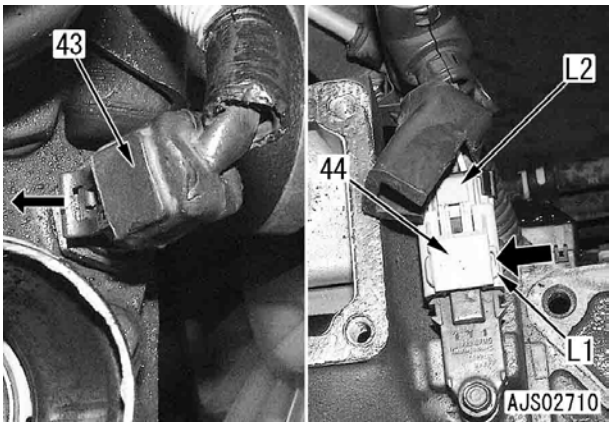


38. Insert a wrench to **A** part and remove fan belt (38) from alternator (39).
39. Disconnect connectors AB (40) and E12 (41).
40. Remove alternator (39).

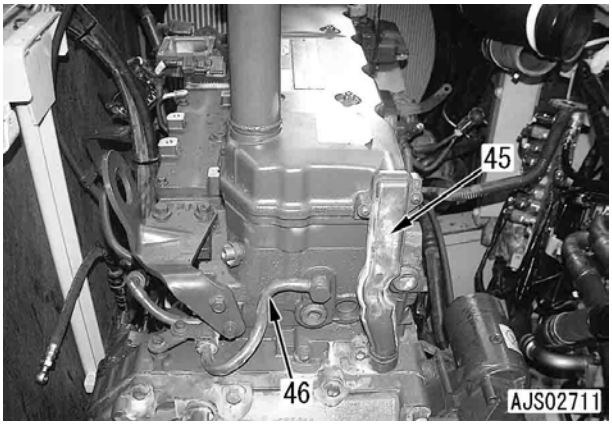


41. Disconnect clamp (42).
42. Disconnect connector with water temperature sensor (43) and air intake pressure sensor (44).
    ★ Connector with water temperature sensor (43)
    Pull the lock (female side) to the outside.
    ★ Air intake pressure sensor (44):
    1) Push lock (L1) and slide it.
    2) Pull out the connector while pushing lock (L2).

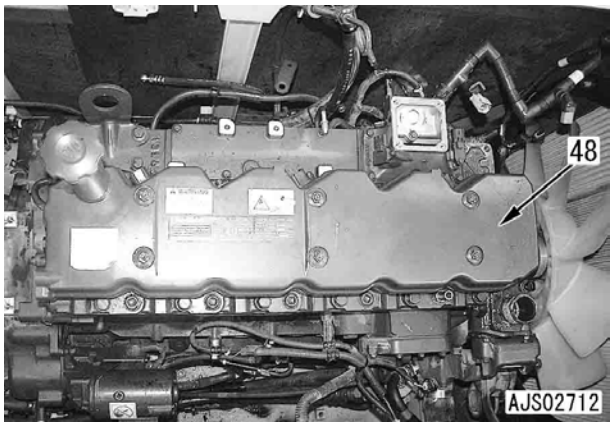




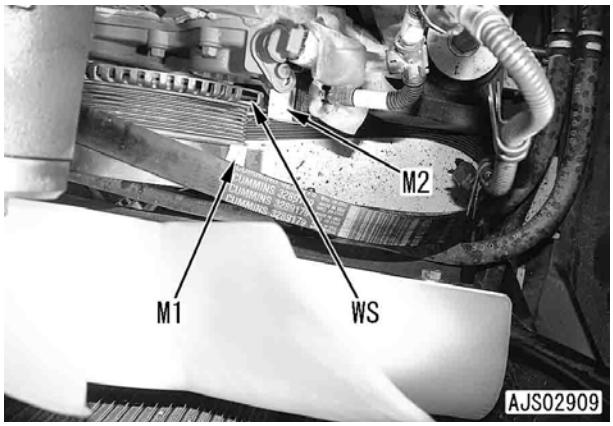
43. Remove blow-by duct (45).
44. Disconnect fuel return tube (46).



45. Remove head cover (48).



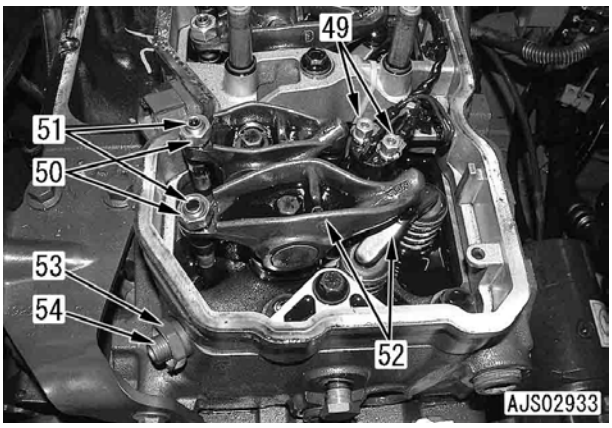
46. By cranking, align mark 1 (M1) at the damper side with mark 2 (M2) at the engine speed sensor side.
    ★ Be careful that the aligning position is not the 1st and 6th cylinder top position but the 3rd and 4th cylinder top position.
    ★ Mark 1 (M1) corresponds to wide-width slit (WS).
    ★ Refer to the Adjusting of Valve Clearance section in the Testing and adjusting chapter of this manual.
    ★ Use tool **A4** (refer to the tool list) for cranking.

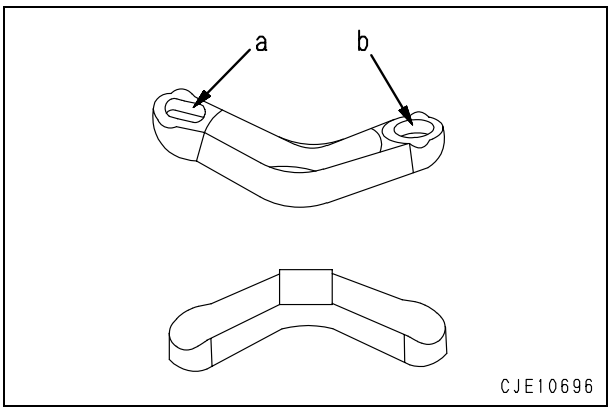


47. Remove nuts (49) for the harnesses from the injector.

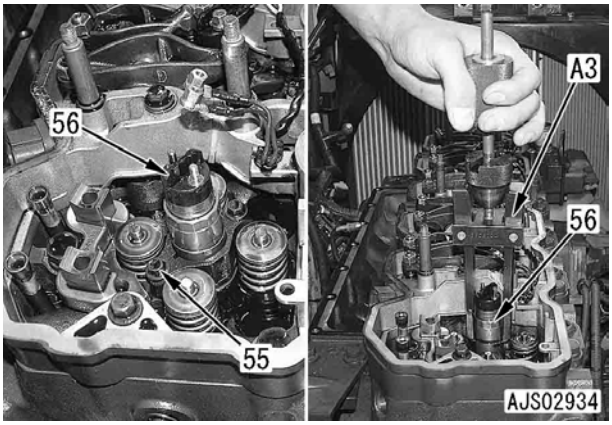
Harness color	Cylinder No.
White	1, 3, 5
Black	2, 4, 6

48. Remove 12 mounting bolts and remove six rocker arm and crosshead assemblies (52).
    - ★ Loosen locknut (50) and then loosen adjustment screw (51) a few turns so that excessive force is not put on the push rod when the rocker arm is installed.
    - ★ Keep records of installation position and direction of the crosshead (hole shape of **a** and **b** parts) (Install it in the same direction when reinstalling.)
49. Remove retainers (53) and then remove six inlet connectors (54).
    - ★ Remove and flush dirt etc., off the surrounding area in advance to prevent them from entering the connector holes.
    - ★ Tool **A5**: remover is adopted for removing inlet connectors (54). (Refer to the tool list.)

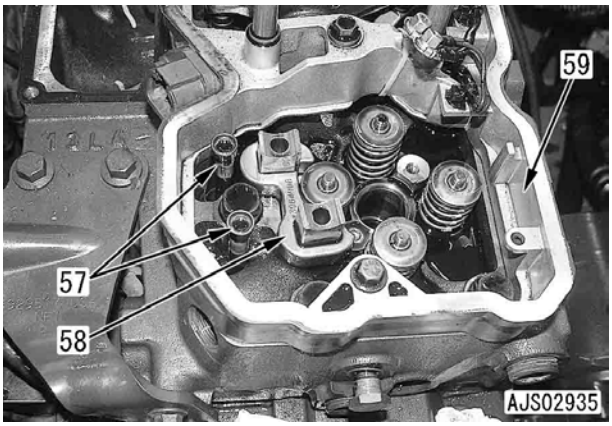




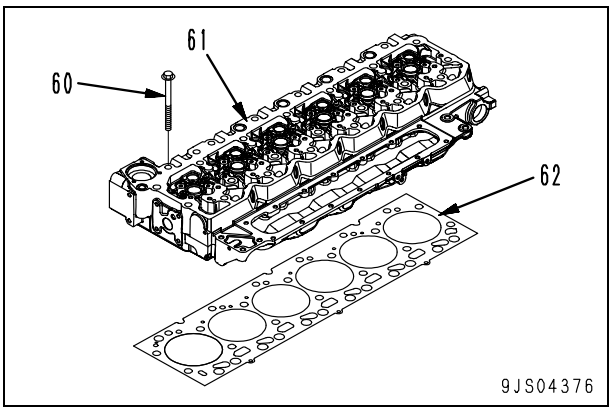
50. Remove two mounting bolts (55) for injector assembly (56).
51. Remove injector assembly (56) using tool **A3**.
    - ★ Be careful not to let any dust or foreign materials enter the fuel injector assembly mounting portion.



52. Remove push rods (57).
53. Remove rocker arm support (58).
54. Remove rocker housing assembly (59).

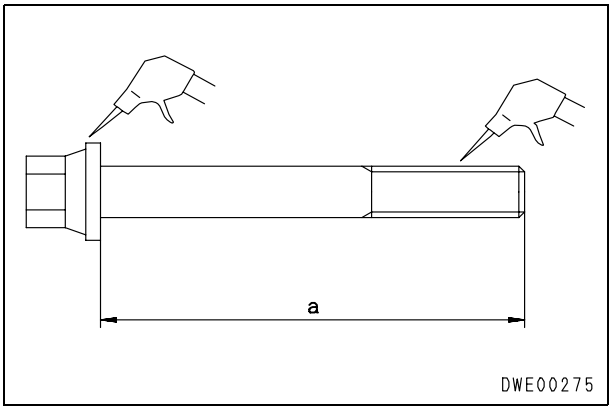


55. Remove 26 mounting bolts (60) and lift off cylinder head assembly (61) to remove it.
    Cylinder head assembly: **75 kg**
56. Remove cylinder head gasket (62).

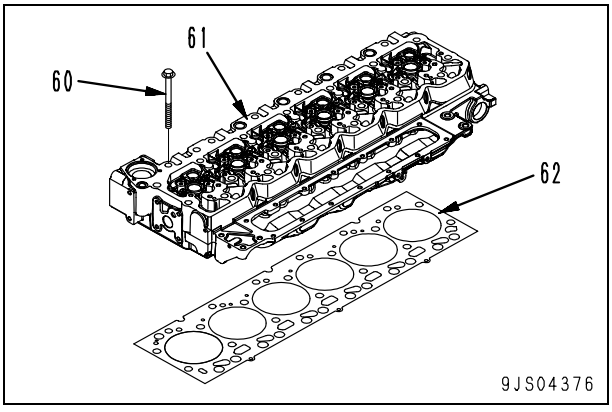


Installation

1. Cylinder head assembly
   1) Measure under head length **a** of all the cylinder head mounting bolts to check that they are within the length limit.
      - Bolt length limit: **less than 132.1 mm**
      - ★ If a bolt is longer than the using limit, do not reuse it but replace it.
      - ★ Tool **A7**: gauge is adopted for the measurement. (Refer to the tool list.)



   2) Set head cylinder gasket (62) after checking that there is no dust or foreign material on the cylinder head mounting face and inside the cylinders.
      - ★ Check that the gasket is properly matched with the cylinder head holes.
   3) Set cylinder head assembly (61) on the cylinder block, screw in mounting bolts (60) by hand a few turns, and tighten them according to the following procedure.
      - : Coat the threads and seat surface of the mounting bolts with **engine oil (EO15W-40)**.



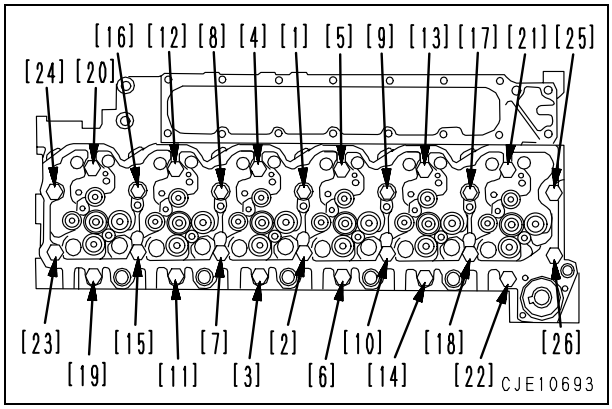
- How to tighten mounting bolts (60)

★ Tighten the bolts in the order shown below.

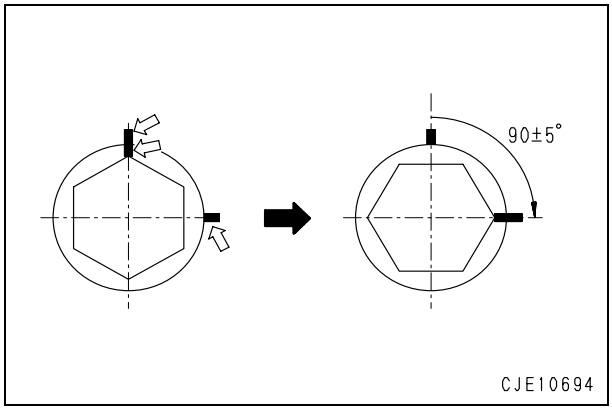
1] **90 ± 3 Nm {9.2 ± 0.3 kgm}**

2] Recheck the torque:
90 ± 3 Nm {9.2 ± 0.3 kgm}.

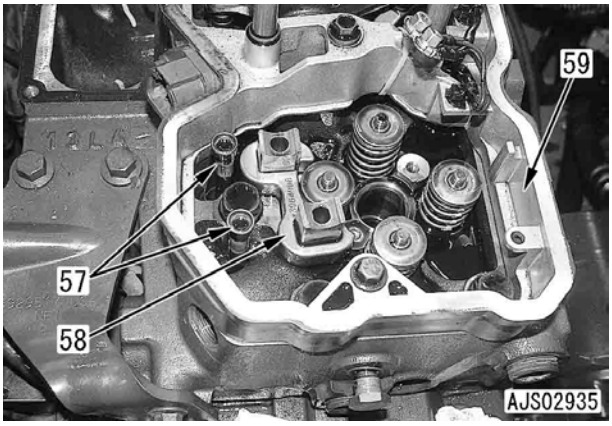
3] **90° ± 5°** (Tighten with an angle tightening tool.)
   - ★ Tool **A6**: wrench is adopted for angle tightening. (Refer to the tool list.) (Refer to the tool list.)



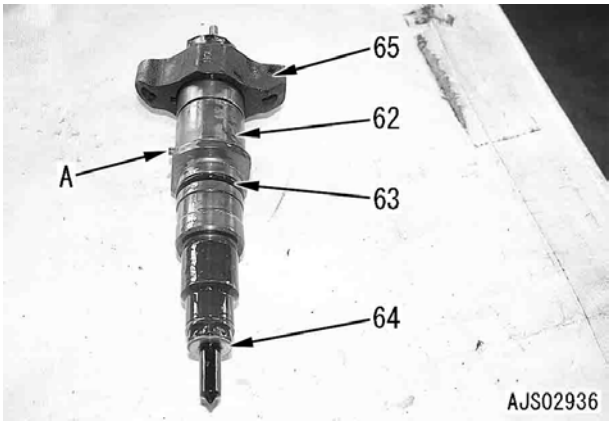
- When an angle tightening tool is not used:
  Put marks on the cylinder head and bolts with a felt-tip pen, and then tighten the bolts an additional **90° ± 5°**.



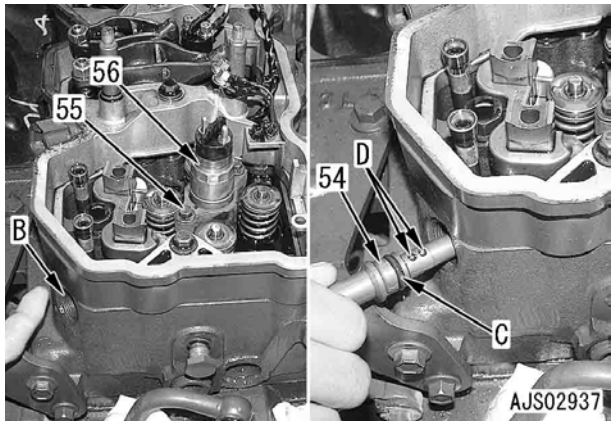
2. Install rocker housing assembly (59).
   Mounting bolt:
   24 ± 4 Nm {2.4 ± 0.4 kgm}
3. Install push rods (57).
4. Install rocker arm support (58).



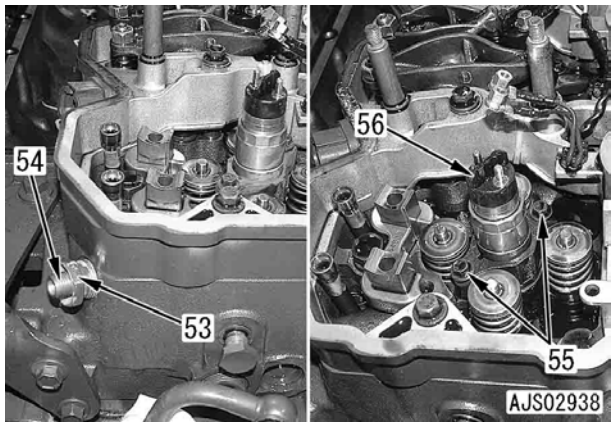
5. Fuel injector assembly
   ★ Check that there is no damage or dust on the fuel injector sleeve.
   1) Install O-ring (63) and gasket (64) to fuel injector (62).
   2) Coat O-ring (63) and the head side of fuel injector (62) with engine oil (EO15W-40).
      O-ring (63) and the head side of fuel injector (62):
      engine oil (EO15W-40)
   3) Install holder (65) to fuel injector (62) with concavity and convexity (A) fitted together.



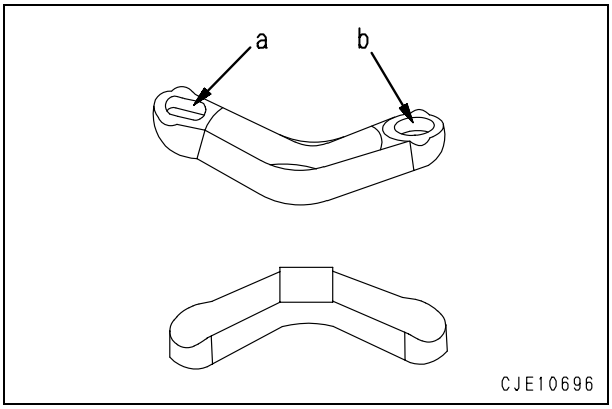
   4) Assemble fuel injector assembly (56) to the cylinder head with its fuel inlet hole facing the intake manifold side.
   5) Tighten bolts (55) three or four turns.
   6) Coat the head side (B part) of inlet connector (54) with engine oil (EO15W-40).
   7) Coat O-ring (C) of inlet connector (54) with engine oil (EO15W-40). Then insert inlet connector (54) completely, aligning (D part) with the side groove of the head.

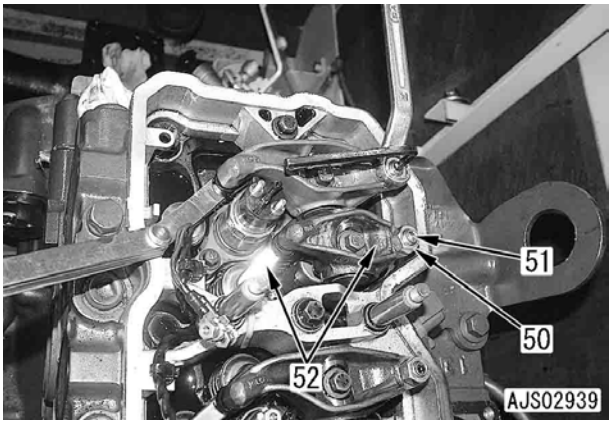


   8) Tighten inlet connector (54) with retainer (53) by hand. (Push it into the injector hole.)
   9) Tighten mounting bolts (55) for fuel injector assembly (56) alternately.
      Bolt: **8 ± 0.8 Nm {0.81 ± 0.08 kgm}**
   10) Tighten retainer (53).
      Retainer:
      50 ± 5 Nm {5.1 ± 0.5 kgm}



6. Rocker arm and crosshead assembly
   1) Install rocker arm and crosshead assembly (52).
      ★ When reusing the crosshead, install the same intake and exhaust valves in the same direction because the shapes of its holes **a** and **b** are different,
      ★ Tighten the mounting bolt after checking that the ball portion of adjustment screw (51) is well seated in the push rod socket.
      Mounting bolt:
      36 ± 5 Nm {3.7 ± 0.5 kgm}
   2) Adjust the valve clearances.
      ★ Refer to the Adjusting of Valve Clearance section in the TESTING AND ADJUSTING chapter of this manual.
      Locknut (50):
      24 ± 4 Nm {2.4 ± 0.4 kgm}

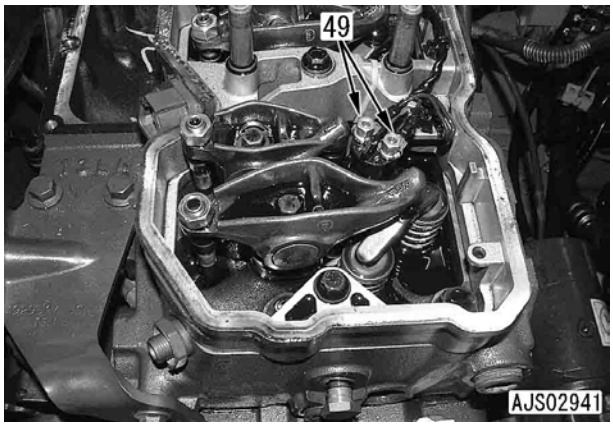




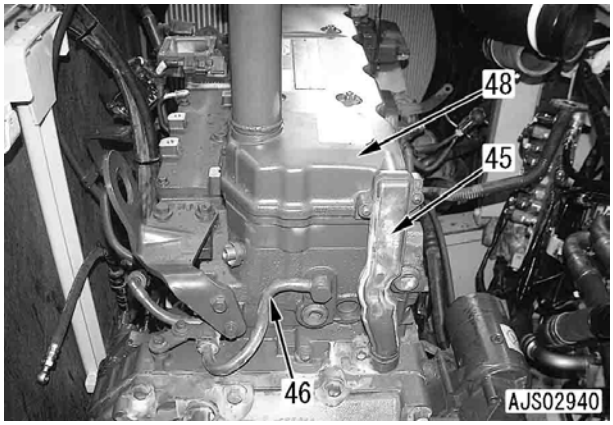
7. Install harnesses (49).
   ★ Harness installation position

Harness color	Cylinder No.
White	1, 3, 5
Black	2, 4, 6

   Mounting nut:
   1.5 ± 0.25 Nm {0.15 ± 0.03 kgm}

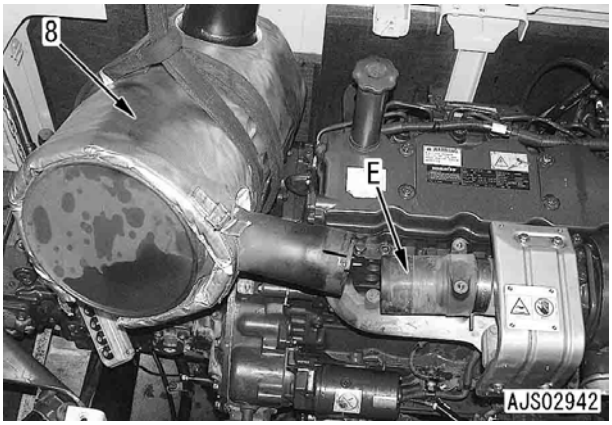


8. Fit the O-ring and install head cover (48).
   Mounting nut:
   24 ± 4 Nm {2.4 ± 0.4 kgm}
9. Install blow-by duct (45).
   Blow-by duct mounting bolt:
   10 ± 2 Nm {1.0 ± 0.2 kgm}
10. Install fuel drain hose (46).
    Joint bolt: **24 ± 4 Nm {2.4 ± 0.4 kgm}**



- Carry out the following installation in the reverse order to removal.

[*1]
Install muffler (8) after coating it with thermosetting sealant.
Entire perimeter of E section: thermosetting sealant (equivalent of **Holts Firegum**)

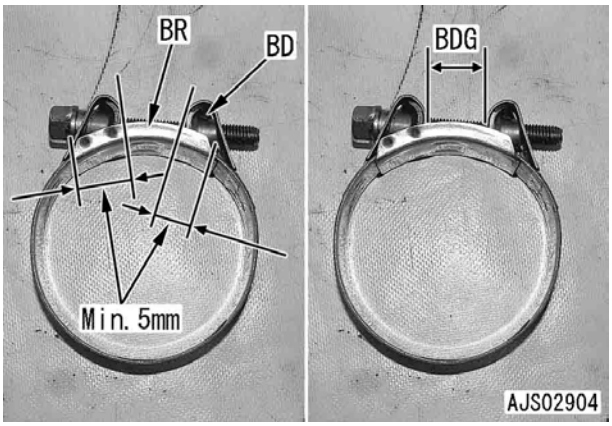


[*2]
Bracket mounting bolt:
43 ± 6 Nm {4.4 ± 0.6 kgm}

[*3]
Air intake connector mounting bolt:
24 ± 4 Nm {2.4 ± 0.4 kgm}

- MIKALOR clamp

★ Use a new clamp.
★ Align the hose to the original position (marking position).
★ Reference
Depth of insertion: 60mm (aftercooler side)
★ Set bridge (BR) under the clamp tightening bolt as the lap with band (BR) is Min.5mm.
★ Align the clamp to the original position.
★ Impact wrench is not applicable to use.
Clamp: **16 – 18 Nm {1.6 – 1.8 kgm}**
★ When the tightening torque force is less than 16 Nm {1.6 kgm}, tighten it until the hand gap is adhered (BDG size is 0).



[*4]
Radiator hose clamp:
10.8 – 11.8 Nm {1.1 – 1.2 kgm}

[*5]
Joint bolt: **24 ± 4 Nm {2.4 ± 0.4 kgm}**

[*6]
Mounting bolt: **24 ± 4 Nm {2.4 ± 0.4 kgm}**

[*7]
Fuel block mounting bolt:
32 ± 4 Nm {3.3 ± 0.4 kgm}

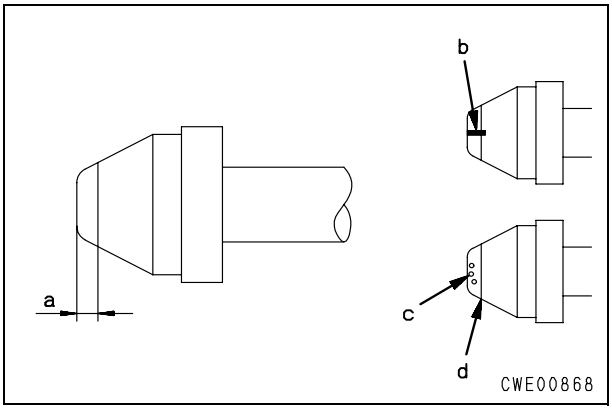
[*8]
⚠ **When installing, keep the distance of more than 10 mm between the high-pressure pipe and the harness.**

[*9], [*10]
- High-pressure pipes and common rail

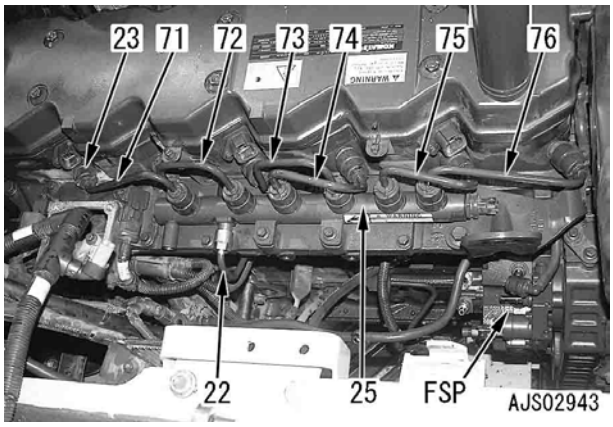
⚠ **Do not use high-pressure pipes with bending modification.**

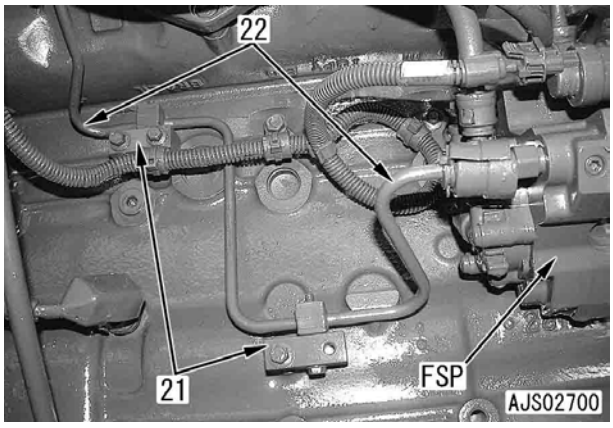
⚠ **Be sure to use a genuine high-pressure pipe fixing clamp and observe strictly the tightening torque.**

★ A high-pressure pipe which has depressions such as visible vertical slit scar (b), patchy scars (c) etc. on the taper seal section of its connector ((a) part: within 2 mm from the tip), or a high-pressure pipe whose (d) part (end of the taper seal section: 2 mm from the tip) catches on a finger nail due to fatigue, may cause fuel leakage. In these cases, replace the high-pressure pipe.



1) Assemble common rail (25) and high-pressure pipes (71) – (76) temporarily.
   Sleeve nut and mounting bolt:
   0.2 – 0.8 Nm {0.02 – 0.08 kgm}
2) Tighten high-pressure pipes (71) – (76) according to the following procedure.
   Sleeve nut:
   35 ± 3.5 Nm {3.6 ± 0.4 kgm}
   1] Head side of high-pressure pipes (71) and (76)
   2] Common rail side of high-pressure pipes (76) and (71)
   3] Head side of high-pressure pipes (72), (73), (74) and (75)
   4] Common rail side of high-pressure pipes (72), (73), (74) and (75)
3) Tighten the sleeve nut of high-pressure pipe (22) temporarily.
4) Tighten high-pressure pipe (22) in the order of firstly pump (FSP) side, then common rail (25) side.
   Sleeve nut:
   35 ± 3.5 Nm {3.6 ± 0.4 kgm}
5) Tighten clamp (21) of high-pressure pipe (22).
   Mounting bolt:
   24 ± 4 Nm {2.4 ± 0.4 kgm}
6) Tighten common rail (25) with four bolts.
   ★ Coat the two bolt threads on the inner side of the engine with sealant (LG-7).
   Mounting bolt:
   24 ± 4 Nm {2.4 ± 0.4 kgm}
7) Install bellows (23) to each high-pressure pipe. (14 pieces)
   ★ Set the slits of each bellows out and down.
   ★ The bellows are installed so that fuel will not spout over the hot parts of the engine and catch fire when it leaks for some reason.
   ★ FSP: Fuel supply pump





[*11]
Air tube clamp:
10.0 – 11.0 Nm {1.02 – 1.12 kgm}

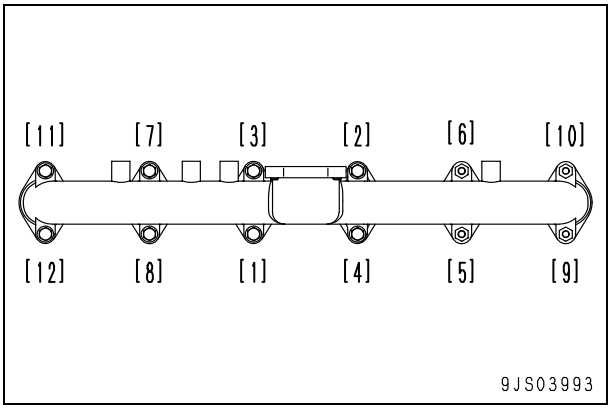
[*12]
- MIKALOR clamp

★ Reference
Length of insertion: 40 mm (turbocharger side)

★ Refer to [*3].

[*13]
Lubrication inlet hose tightening nut:
35 ± 5 Nm {3.5 ± 0.5 kgm}
Lubrication outlet hose mounting bolt:
24 ± 4 Nm {2.4 ± 0.4 kgm}

[*14]
★ Tighten the bolts in the order shown below.
Exhaust manifold mounting bolt:
First time: in the order of [1] – [12]
Tighten to a torque of
24 ± 4 Nm {2.4 ± 0.4 kgm}.
Second time: in the order of [2] – [12]
Tighten to a torque of
53 ± 6 Nm {5.4 ± 0.6 kgm}.
Third time: in the order of [1] – [4]
Tighten to a torque of
53 ± 6 Nm {5.4 ± 0.6 kgm}.



[*15]
Fan mounting bolt:
43 ± 6 Nm {4.4 ± 0.6 kgm}

[*16]
★ Refer to the Inspection and Adjustment of Air Compressor Belt Tension section in the Testing and adjusting chapter of this manual.

- Refilling engine coolant
  Refill water through the water filler port up to the specified level. Start the engine and circulate the water, and then check the water level.
  Coolant: **Approx. 21.4ℓ**

Removal and installation of radiator assembly

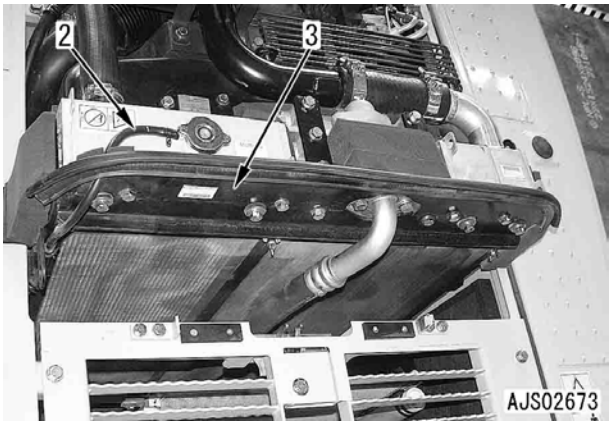
Removal

1. Turn the upper structure by 90 degrees.
2. Remove cover (1).

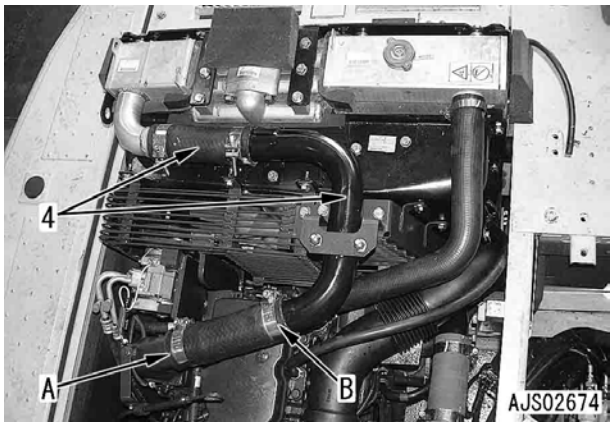
3. Drain the engine cooling water.
   Coolant:
   Approx. 21ℓ (PC210, 230)
   Approx. 20.4ℓ (PC240)

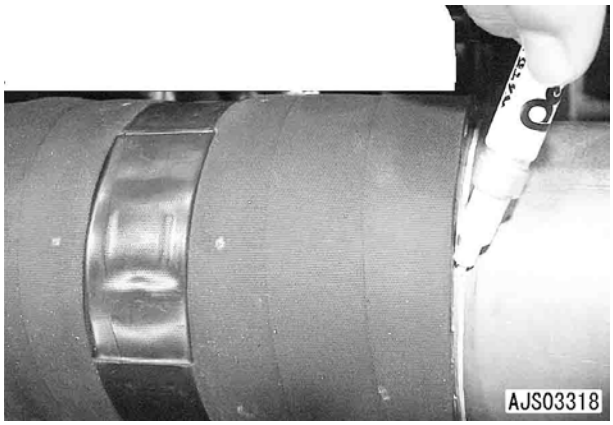
4. Open up the engine hood.

5. Disconnect reservoir tank hose (2).
6. Remove cover (3).

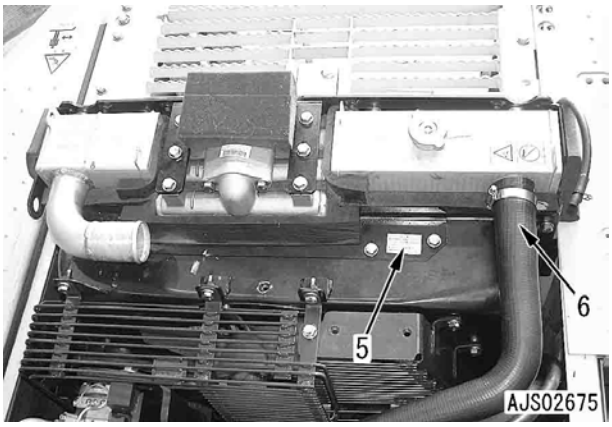


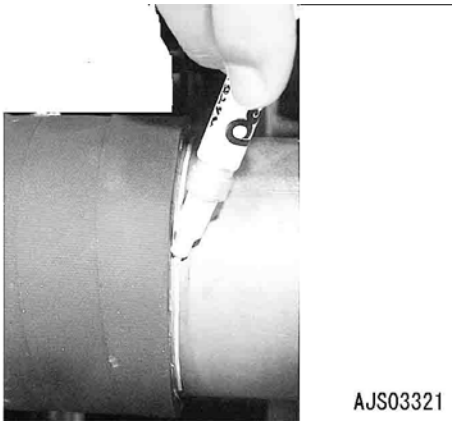
7. Remove hose and tube assembly (4). [*1]
   - ★ Remove it without separating from the bracket.
   - ★ MIKALOR clamp
   - ★ Mark the hose edge and tube to show the original hose installation positions. (See figure below.)
   - ★ Inserted air hose length
     - **A**: 80 mm
     - **B**: 65 mm



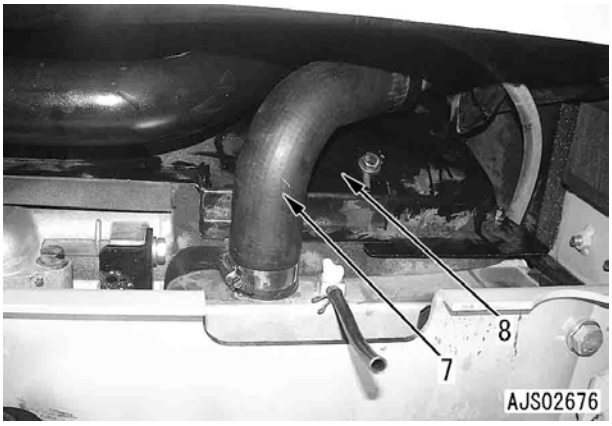


8. Remove cover (5).
9. Disconnect radiator hose (6). [*2]
   ★ Mark the hose edge and tube to show the original hose installation positions. (See figure below.)

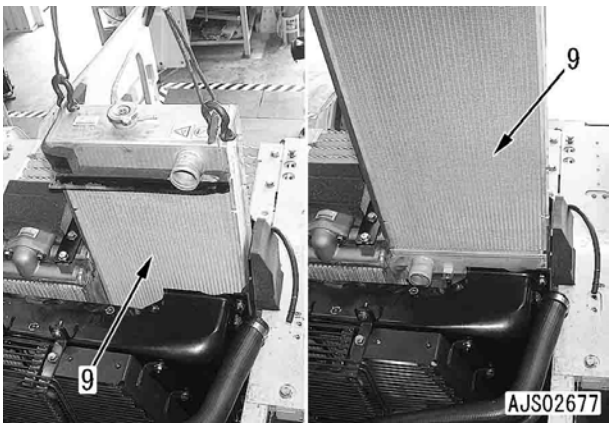




10. Disconnect radiator hose (7). [*2]
    ★ Mark the hose edge and tube to show the original hose installation positions. (Refer to the above figure.)
11. Move cover (8).
    ★ In order to avoid the contact with the flange.



12. Remove the mounting bolts and lift out radiator assembly (9). [*3]
    Radiator assembly: **15 kg**

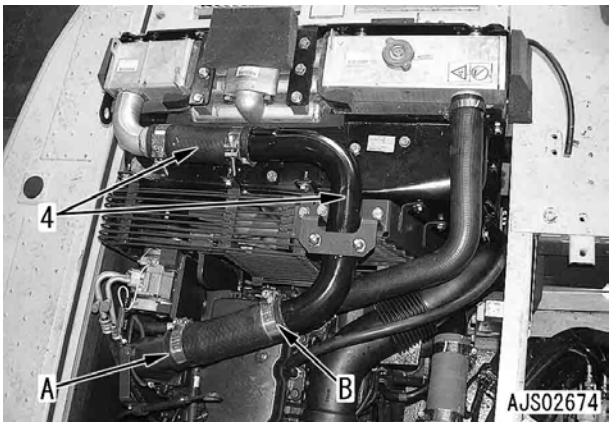


Installation

- Installation is done in the reverse order of removal.

[*1]

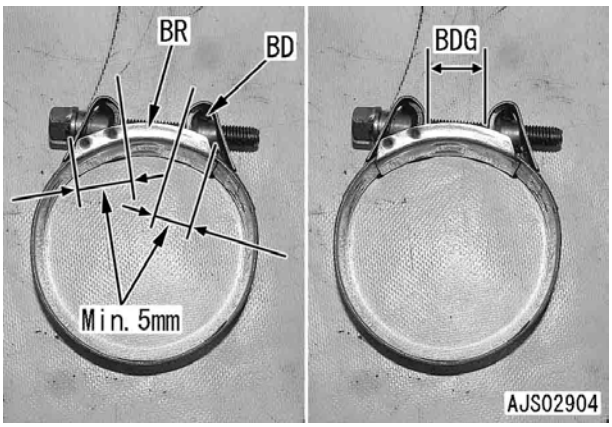
1. Install hose and tube assembly (4).
   - ★ Use brand new article for MIKALOR clamp.
   - ★ Align the hose to the original position (marking position).
   - ★ Inserted air hose length
     - Aftercooler side: 60 mm
     - Engine side **A**: 80 mm
     - Engine side **B**: 65 mm



   - ★ Set bridge (BR) under the clamp tightening bolt as the lap with band (BR) is Min.5mm.
   - ★ Align the clamp to the original position.
   - ★ Impact wrench is not applicable to use.

   MIKALOR clamp:
   16 – 17 Nm {1.6 – 1.7 kgm}

   - ★ When the tightening torque force is less than 16Nm{1.6kgm}, tighten it until the hand gap is adhered (BDG size is 0).



[*2]

- ★ Align the hose to the original position (marking position).
- ★ Align the clamp to the original position.

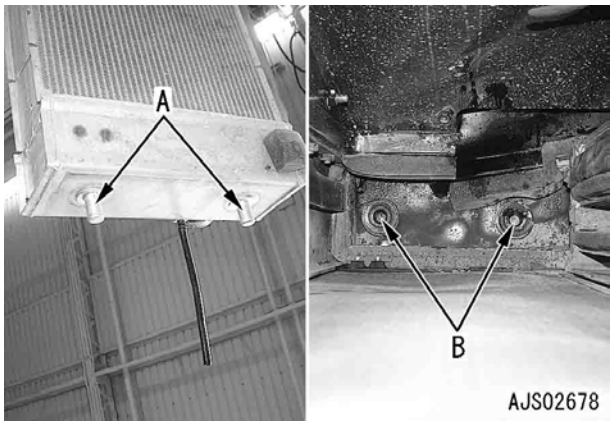
- ★ Reference
  Inserted air hose length
  - 45 mm (Both upper and lower side)

  Radiator hose clamp:
  10.8 – 11.8 Nm {1.1 – 1.2 kgm}

[*3]

- ★ Confirm that the heat insulating seal material (sponge) of the radiator peripheral part is not damaged. If the heat insulating seal material (sponge) is damaged, replace it to the new one.

  Confirm from the under cover side that convexity (A) of the radiator is correctly set to concavity (B).



- Refilling engine coolant
  Refill water through the water filler port up to the specified level. Start the engine and circulate the water, and then check the water level.

  Coolant:
  Approx. 21ℓ (PC210, 230)
  Approx. 20.4ℓ (PC240)

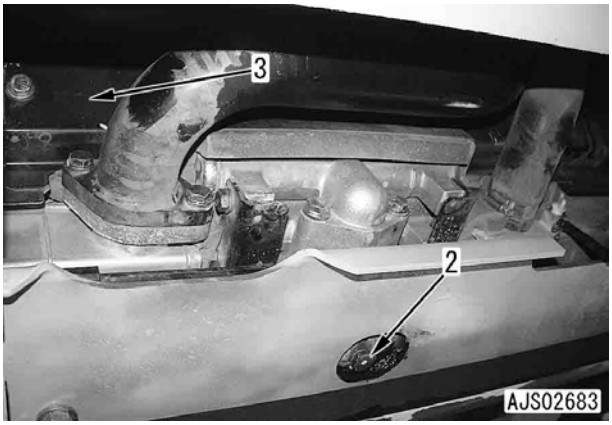
Removal and installation of assembly hydraulic oil cooler assembly

Removal

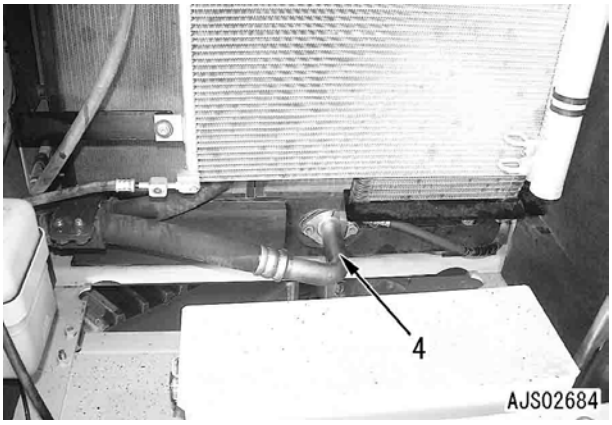
⚠ **Lower the work equipment to the ground completely, after the engine is stopped, loosen the hydraulic tank cap gradually to reduce the pressure inside, and set the lock lever in the lock position.**

1. Turn the upper structure by 90 degrees.
2. Remove cover (1).

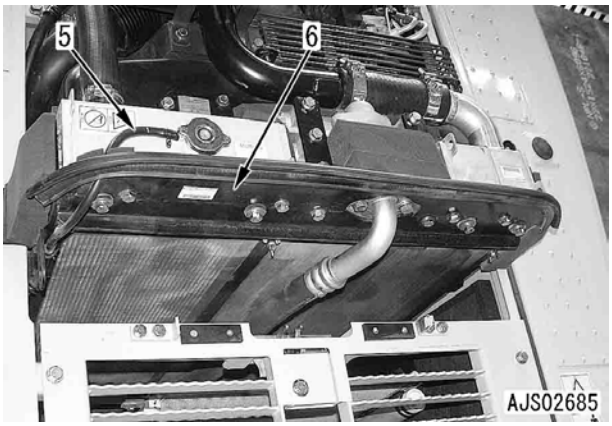
3. Open up the engine hood.
4. Remove hydraulic oil cooler drain plug (2) to drain the hydraulic oil.
   ★ Loosen upper side (return) hose (7) of the hydraulic tank and induce air into the tank.
   Hydraulic oil cooler: **Approx. 7ℓ**
5. Move cover (3).



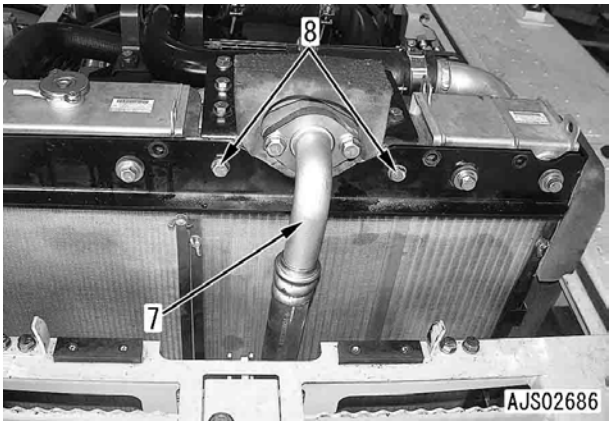
6. Open the left side cover.
7. Disconnect control valve drain hose (4).
   ★ Stop oil flow.



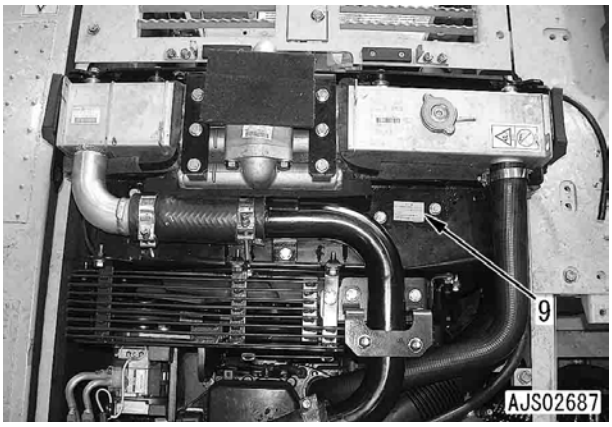
8. Disconnect reservoir tank hose (5).
9. Remove cover (6).



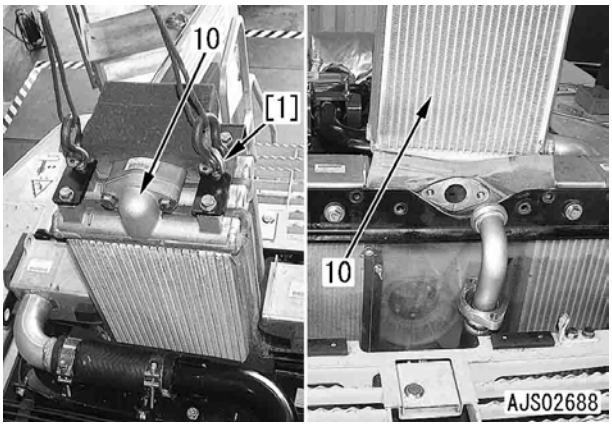
10. Disconnect hydraulic tank return hose (7).
    ★ Stop oil flow.
11. Remove hydraulic oil cooler mounting bolt (8).



12. Move cover (9).



13. Lift out hydraulic oil cooler assembly (10) by using eyebolt (M10) [1]. [*1]
    Hydraulic oil cooler assembly: **25 kg**



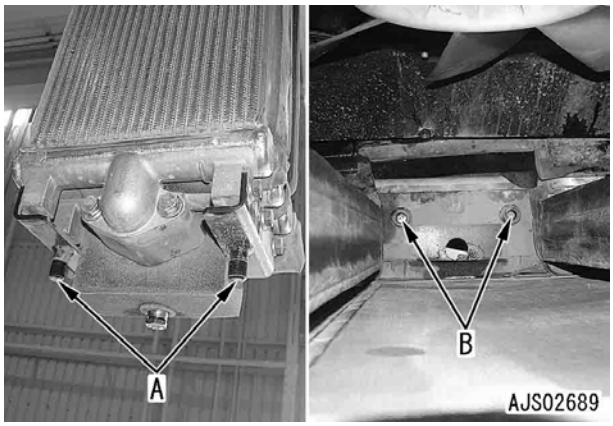
Installation

- Installation is done in the reverse order of removal.

[*1]

★ Confirm that the heat insulating seal material (sponge) of the radiator peripheral part is not damaged. If the heat insulating seal material (sponge) is damaged, replace it to the new one.

Confirm from the under cover side that convexity (A) of the radiator is correctly set to concavity (B).



- **Refilling with oil (hydraulic tank)**
  Refill hydraulic oil through the oil filler port to the specified level. Let the oil circulate in the hydraulic system by starting the engine. Then check the oil level again.

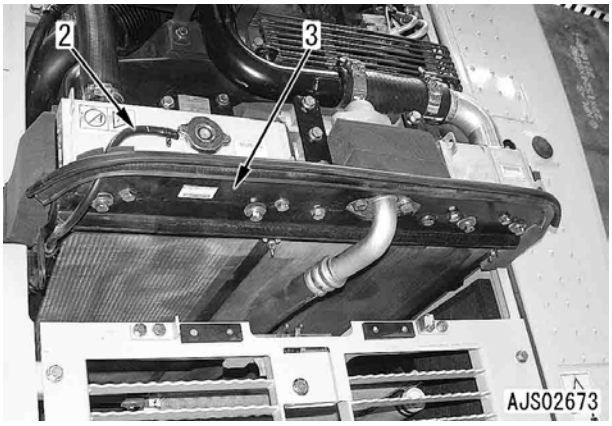
Removal and installation of aftercooler assembly.

Removal

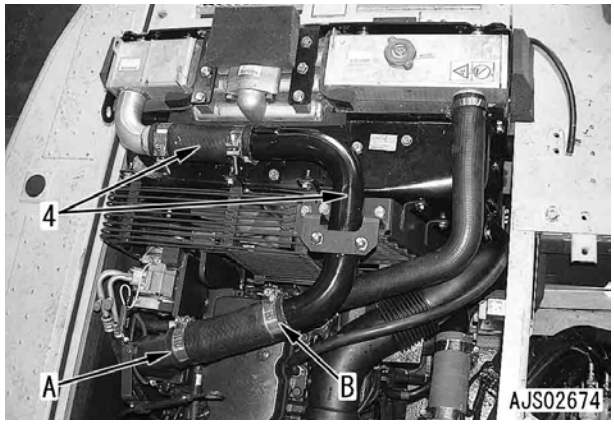
1. Turn the upper structure by 90 degrees.
2. Remove cover (1).

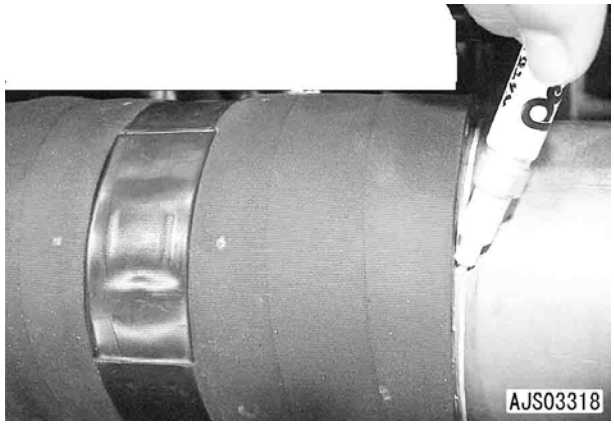
3. Open up the engine hood.

4. Disconnect reservoir tank hose (2).
5. Remove cover (3).

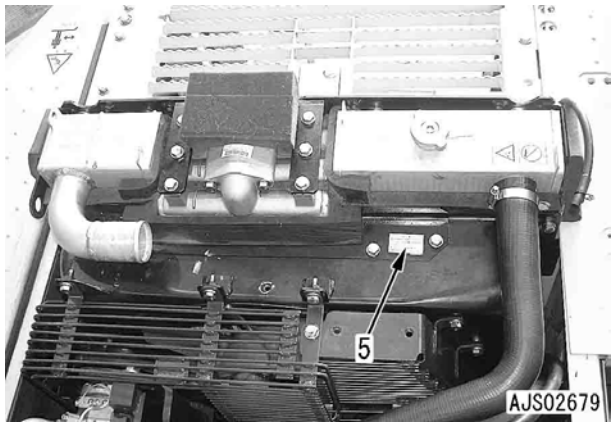


6. Remove hose and tube assembly (4). [*1]
   - ★ MIKALOR clamp
   - ★ Mark the hose edge and tube to show the original hose installation positions. (See figure below.)
   - ★ Inserted air hose length
     - **A**: 80 mm
     - **B**: 65 mm

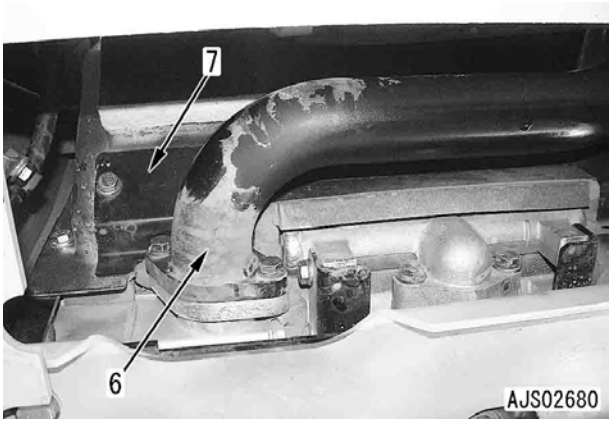




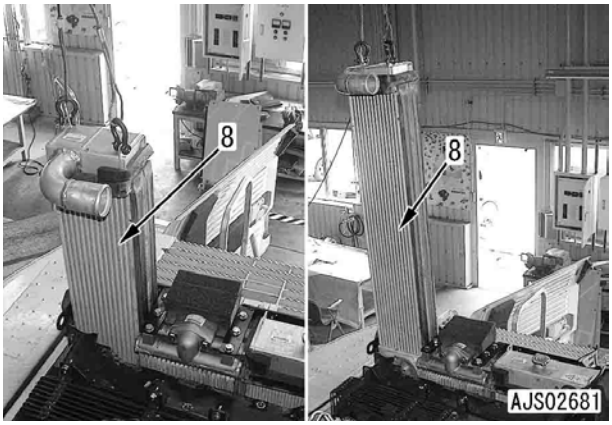
7. Remove cover (5).



8. Disconnect tube (6) from the lower side. [*2]
9. Move cover (7).
   ★ In order to avoid the contact with the flange.



10. Remove the mounting bolt and lift out radiator assembly (8). [*3]
    Aftercooler assembly: **15 kg**

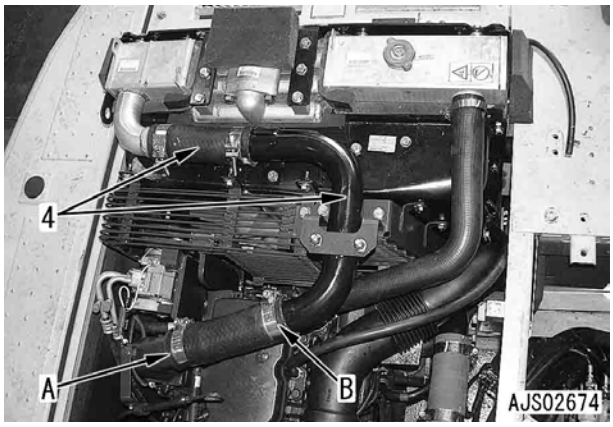


Installation

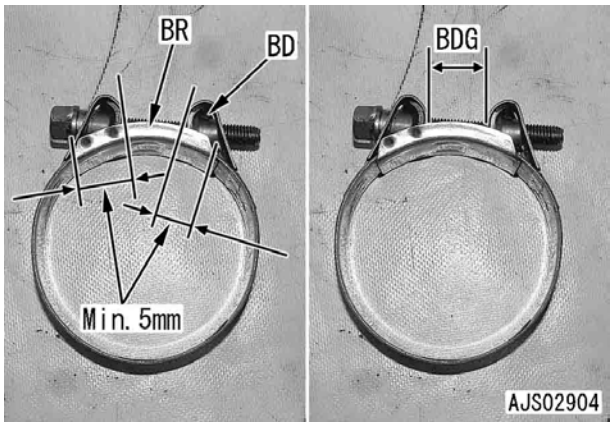
- Installation is done in the reverse order of removal.

[*1]

1. Install hose and tube assembly (4).
   ★ Use brand new article for MIKALOR clamp.
   ★ Align the hose to the original position (marking position).
   ★ Inserted air hose length
   - Aftercooler side: 60 mm
   - Engine side **A**: 80 mm
   - Engine side **B**: 65 mm

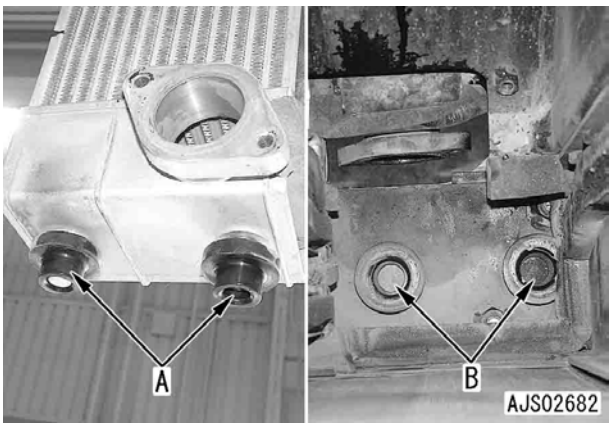


   ★ Set bridge (BR) under the clamp tightening bolt as the lap with band (BR) is Min.5mm.
   ★ Align the clamp to the original position.
   ★ Impact wrench is not applicable to use.
   Clamp: **16 – 18 Nm {1.6 – 1.8 kgm}**
   ★ When the tightening torque force is less than 16 Nm {1.6 kgm}, tighten it until the hand gap is adhered (BDG size is 0).



[*2]
★ Replace the O-ring to the new one.
[*3]
★ Confirm that the heat insulating seal material (sponge) of the radiator peripheral part is not damaged. If the heat insulating seal material (sponge) is damaged, replace it to the new one.

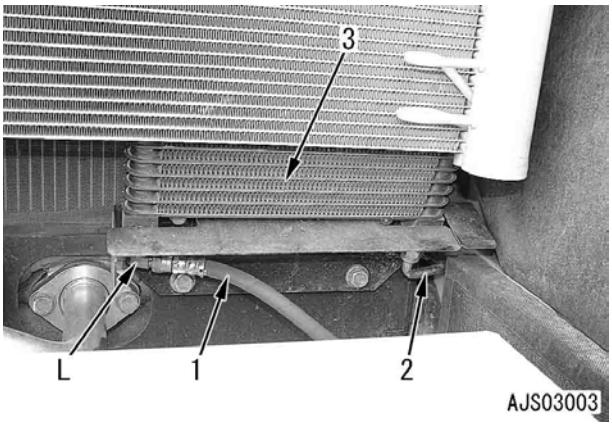
Confirm from the under cover side that convexity (A) of the radiator is correctly set to concavity (B).

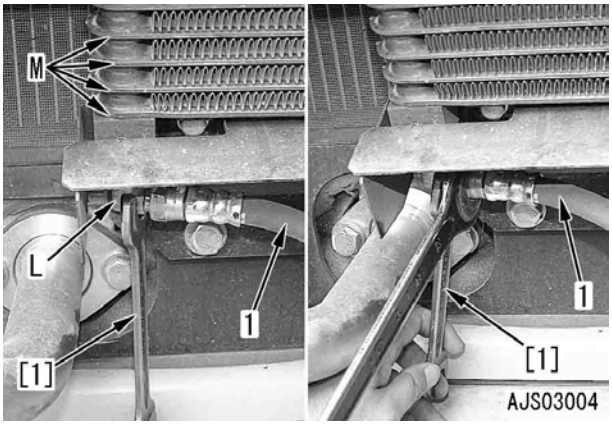


Removal and installation of fuel cooler assembly

Removal

★ If the fuel is too much, drain the fuel in order to stop the fuel flow from the fuel tank return hose.
1. Disconnect fuel hose (1) and (2) with the precaution described below.
   ★ Be sure to disconnect the hoses in avoiding the input force to the cooler body by fixing elbow (L) with wrench (1).
   ★ Be sure to use wrench [1], otherwise the force is loaded to the cooler body and the weld portion (M) may be separated.
2. Remove fuel cooler assembly (3).





Installation

- Installation is done in the reverse order of removal.

Removal and installation of engine and hydraulic pump assemblies

Special tools

Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch
A	8	796T-401-1110	Plate	●	1	N	○
	9	795-790-9300	Lifting tool	●	1	N	
	10	796-460-1210	Oil stopper	●	1		
	11	796-770-1320	Adaptor	●	1		

Removal

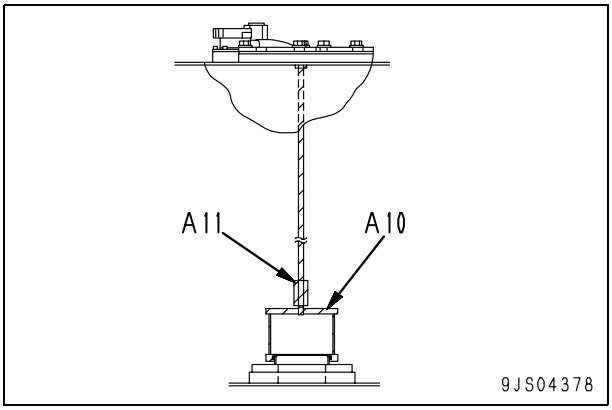
⚠ **Disconnect the negative terminal (–) of the battery before starting the work.**

⚠ **After lowering the work equipment to the ground completely and stopping the engine, release the internal pressure of the hydraulic tank by gradually loosening the cap of the hydraulic tank.**

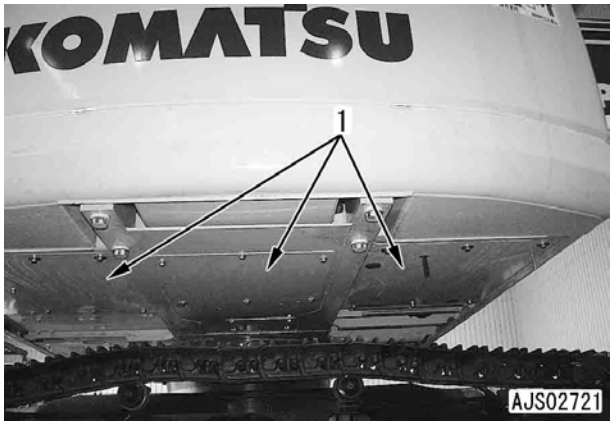
★ Attach an identification tag to each piping to avoid a mistake in the position of installation later.

1. Turn the upper structure by 90 degrees.

2. Remove hydraulic tank strainer and stop oil flow-out using tool **A10, A11**.
   ★ If tool **A10,A11** are not used, remove the drain plug and drain oil from the hydraulic tank and piping.
   Hydraulic tank:
   Approx. 234ℓ (PC210, 230)
   Approx. 239ℓ (PC240)

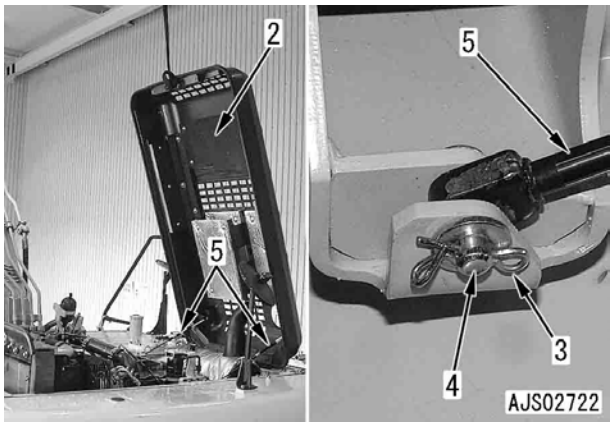


3. Remove cover (1).

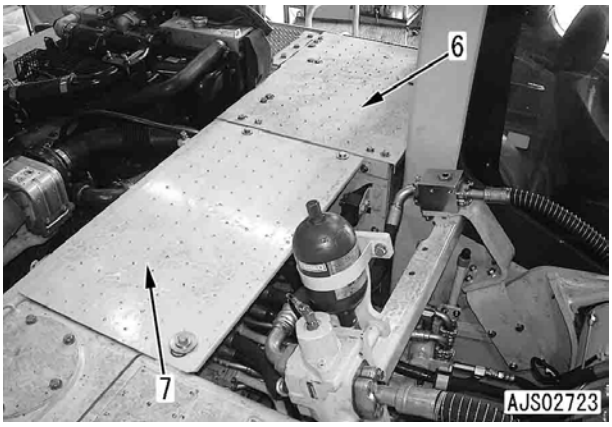


4. Drain the engine cooling water.
   Coolant:
   Approx. 21ℓ (PC210, 230)
   Approx. 20.4ℓ (PC240)

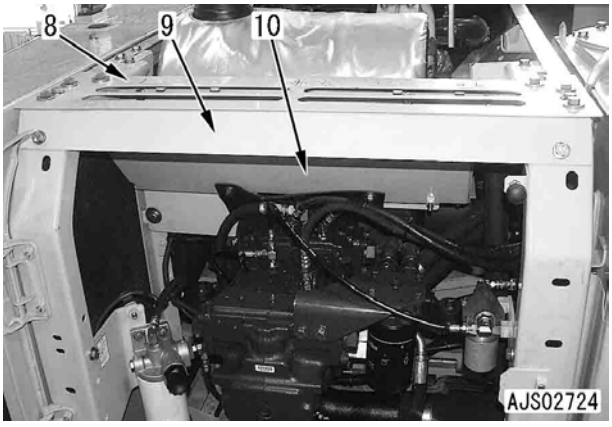
5. Temporary sling engine hood (2).
   ★ When slinging the engine hood, use care not to damage the rubber seal.
6. Remove pin (3) and (4), then remove two gas springs (5).
7. Lift off engine hood (2) to remove it.
   Engine hood: **50 kg**

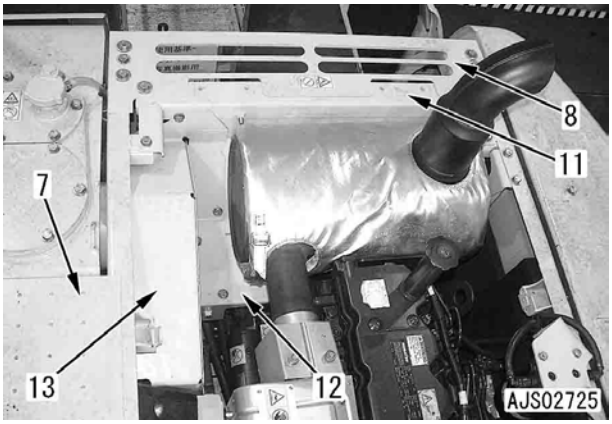


8. Remove cover (6) and (7).

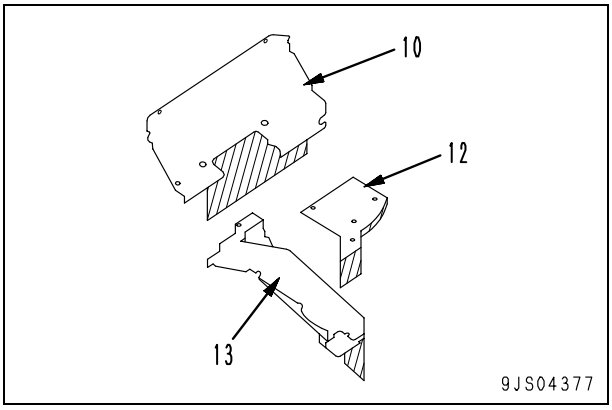


9. Remove cover (8).
10. Remove flame (9).
11. Remove cover (10).
12. Remove flame (11).
13. Remove cover (12) and (13).
    ★ Cover (13) cannot be removed unless removing cover (17).

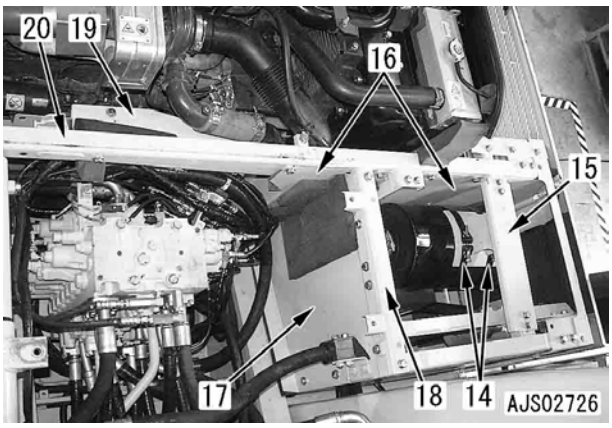


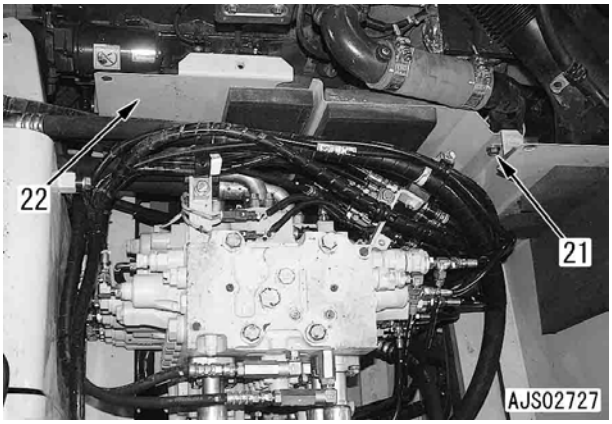


★ The hatched area is made of rubber (lower side).

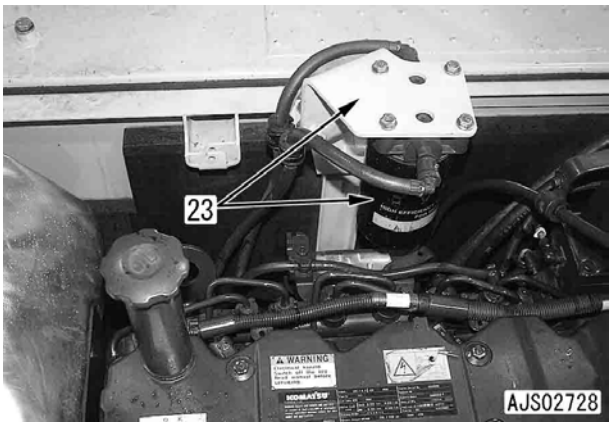


14. Remove air cleaner band (14).
15. Remove flame (15).
16. Remove cover (16) and (17).
17. Remove flame (18).
18. Remove cover (19).
19. Remove flame (20).
    ★ Cover (22) can be removed after removing frame (20).
20. Remove mounting bolt (21) and remove cover (22) upwards.
    ★ As cover (22) is just stuck, there is no need to remove the lower bolt.
    ★ Install frame (20). (For scaffold)

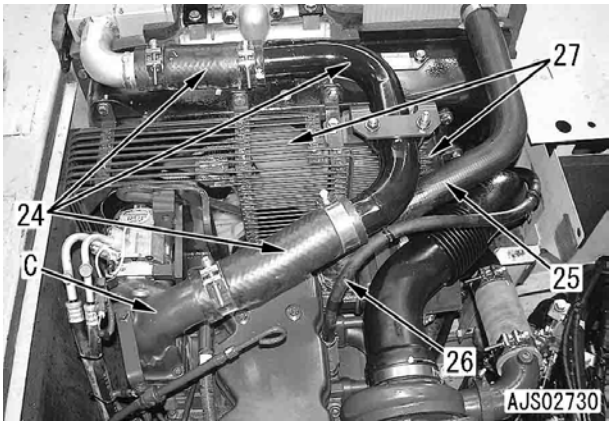


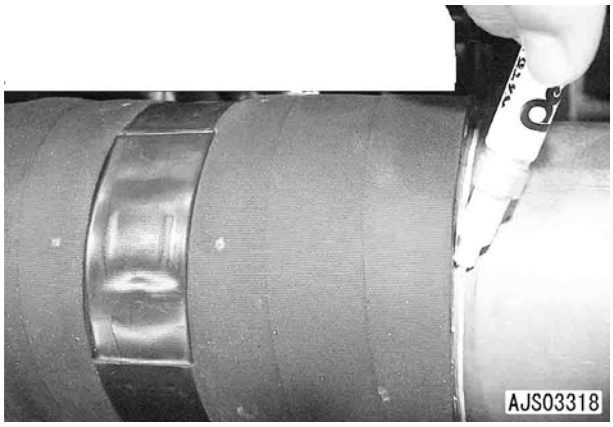


21. Remove fuel filter and bracket assembly (23).
    ★ Put it on the engine.

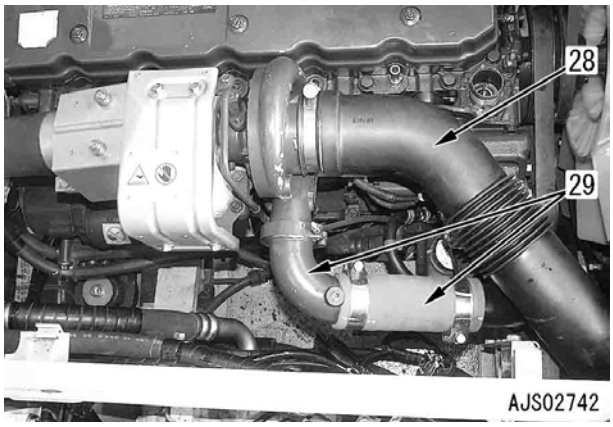


22. Remove hose and tube assembly (24).
    ★ Remove it without separating from the bracket.
    ★ MIKALOR clamp [*2]
    ★ Mark the hose edge and tube to show the original hose installation positions. (See figure below.)
    ★ If disconnecting air intake connector (C), replace the gasket.
23. Disconnect radiator hose (25). [*3]
    ★ Mark the hose edge and tube to show the original hose installation positions.
24. Disconnect heater hose (26).
25. Remove fan guard (27).

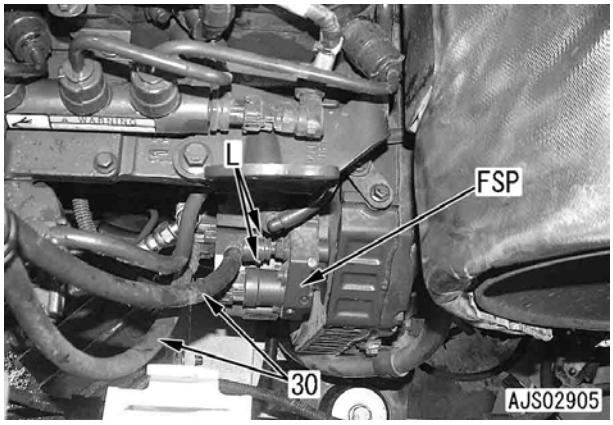




26. Disconnect air cleaner tube (28). [*4]
27. Remove after cooler hose and tube assembly (29).
    ★ MIKALOR clamp [*5]
    ★ Mark the hose edge and tube to show the original hose installation positions. (See figure below.)

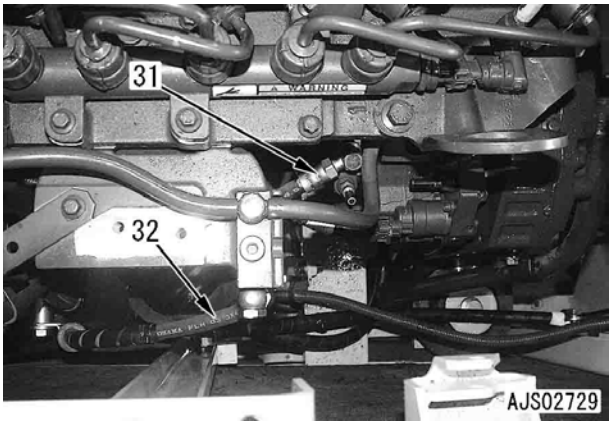


28. Disconnect fuel filter hose (30) from fuel supply pump (FSP).
    ★ The fuel filter hose can be disconnected by pushing locks (L) at both sides.



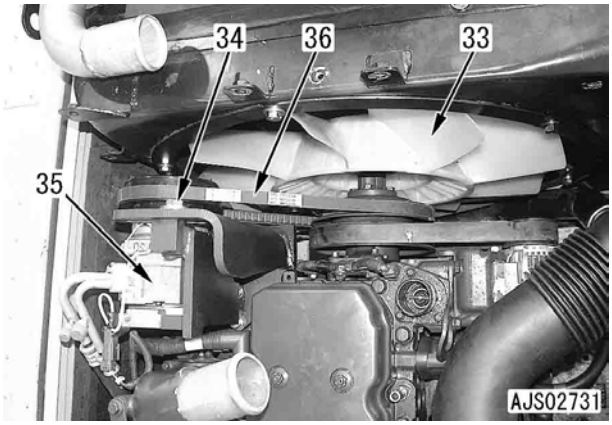
29. Disconnect fuel supply hose (31).

30. Disconnect fuel return hose (32).
    ★ Disconnect the clamp.

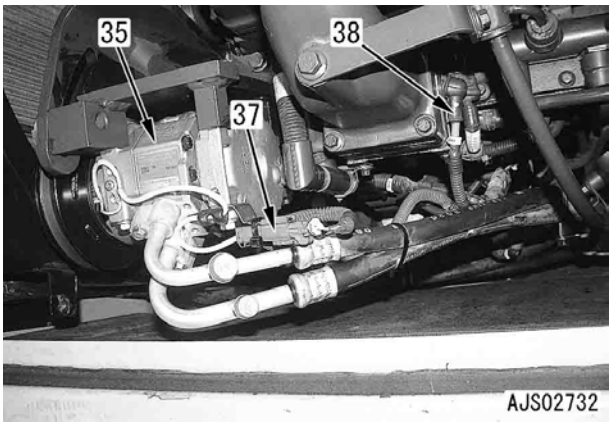


31. Remove fan (33). [*6]

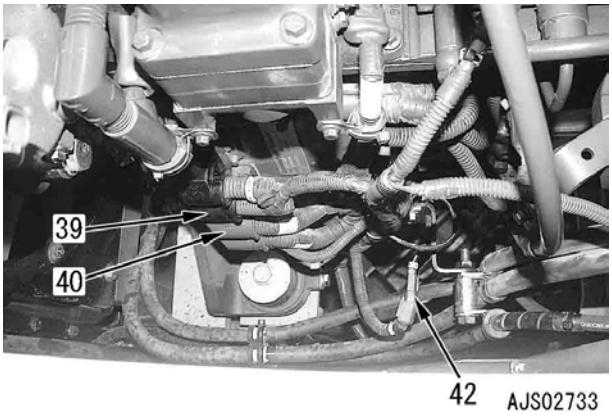
32. Loosen air conditioner compressor bracket adjusting bolt (34).
    ★ There is another bolt behind.
33. Move air conditioner compressor assembly (35). [*7]
34. Remove fan belt (36).

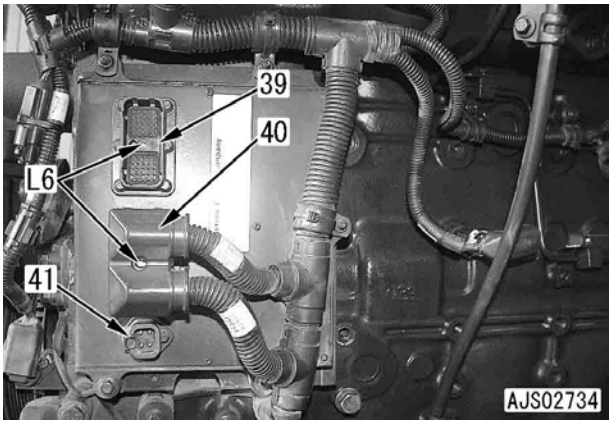


35. Disconnect connector AC02 (37).
36. Remove air conditioner compressor assembly (35).
    ★ Remove air conditioner compressor assembly in one piece with the bracket and put them on the counter weight.
37. Disconnect ribbon heater connector E01 (38).

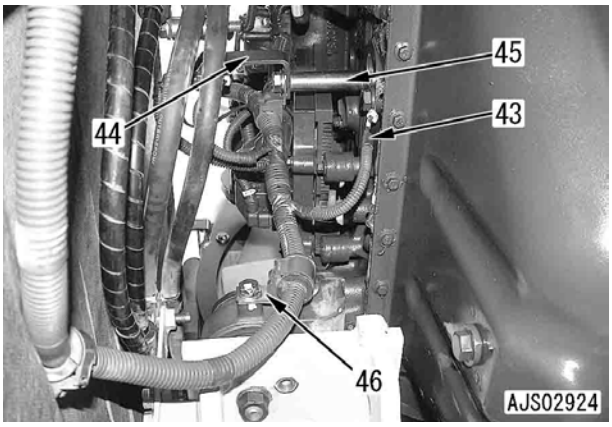


38. Disconnect connectors CE02 (39) and (40) from the engine controller.
    ★ The connector is locked with the inside hex head bolt L6 (4 mm).
    ★ Connector (40) is attached at the engine side, however it needs to be removed not to be obstructive in removing the engine mounting bolts.
39. Disconnect connector (41) from the engine controller by pushing the lock.
40. Disconnect connector E06 (42).

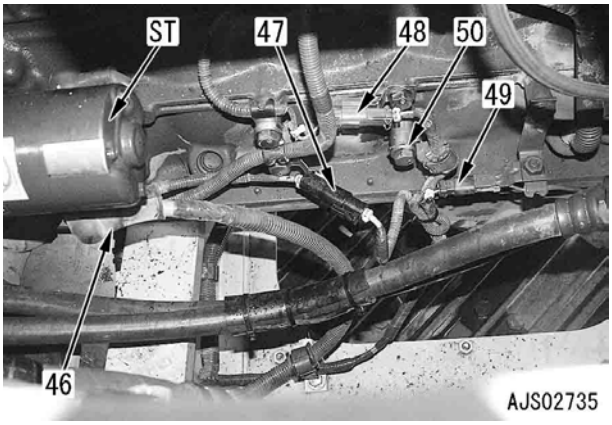




41. Disconnect engine controller ground T12 (43).
42. Disconnect bracket (44) and remove spacer (45).
43. Disconnect clamp (46).



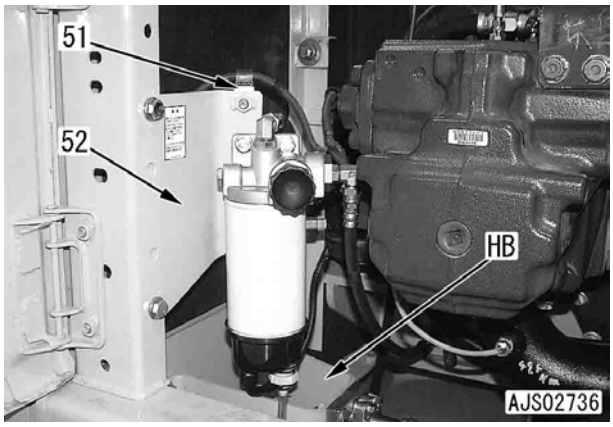
44. Disconnect terminal (46) from the starter ST.
45. Disconnect connector E10 (47).
    ★ Connector at the starting motor side:T13
46. Disconnect connectors E08 (48) and P44 (49).
47. Disconnect clamp (50).



48. Disconnect clamp (51). (PC240-8 only)
49. Remove filter and bracket assembly (52).
    ★ Put it on hose bracket (HB).

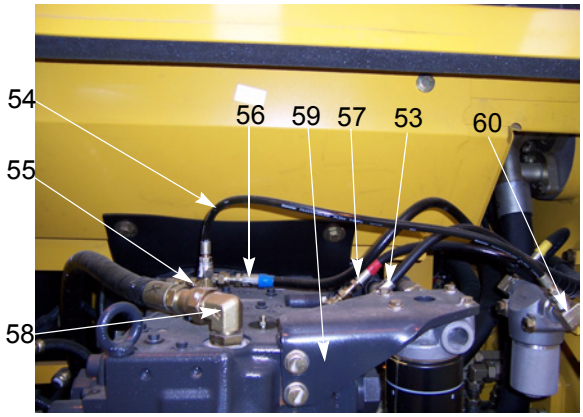
PC210/230-8

PC240-8

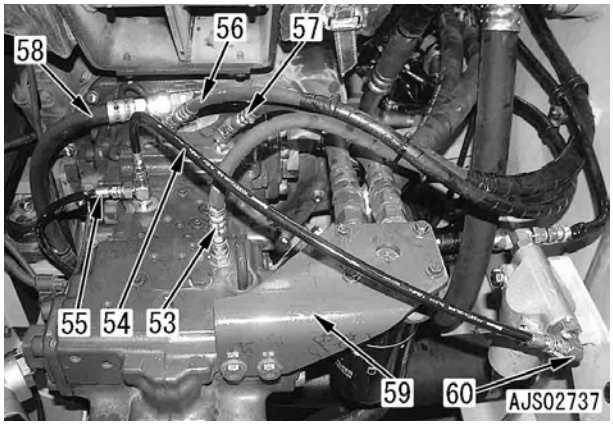


50. Disconnect six hoses.
    - (53): Rear load pressure input port hose (Color band: No color)
    - (54), (55): EPC basic pressure port hose (Color band: No color)
    - (56): Pump pressure input port hose (Color band: blue)
    - (57): Front load pressure input port hose (Color band: red)
    - (58): Drain port hose
51. Disconnect bracket (59).
52. Turn elbow (60) downward.
    ★ To be not obstructive in removing the engine.

PC210/230-8

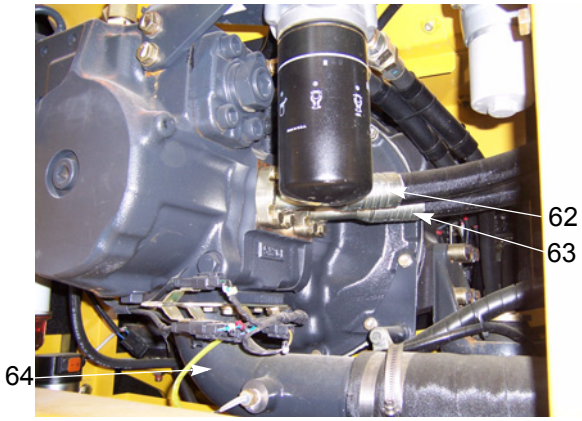


PC240-8

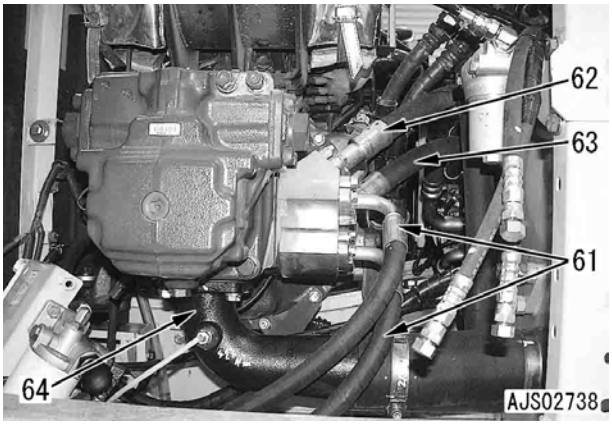


53. Disconnect four hoses and one tube.
    - (61): Branch hose (PC240-8 only)
    - (62): Rear pump discharge port hose
    - (63): Front pump discharge port hose
    - (64): Pump suction port tube
54. Return bracket (59) to the original position. (Install it to the pump.)

PC210/230-8

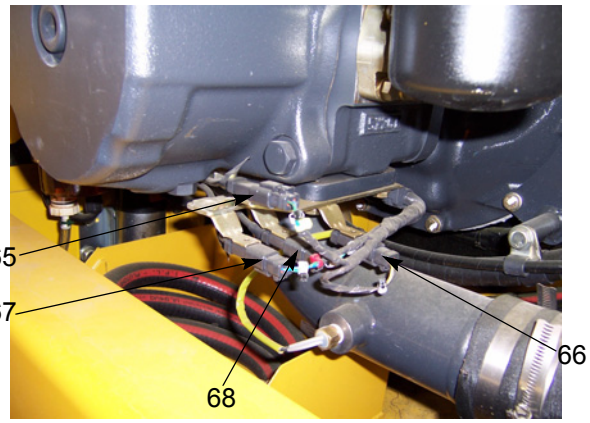


PC240-8

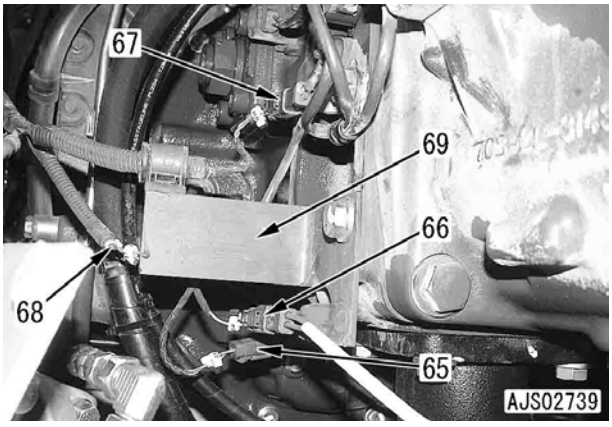


55. Disconnect pump wiring connectors at four points.
    - (65): V12 PC-EPC R solenoid valve (Color band: yellow)
    - (66): P22 hydraulic oil temperature (Color band: no color)
    - (67): V19 LS-EPC solenoid valve (Color band: red)
    - (68): V11 PC-EPC F solenoid valve (Color band: white)
      ★ It is behind bracket (69).
56. Disconnect bracket (69).

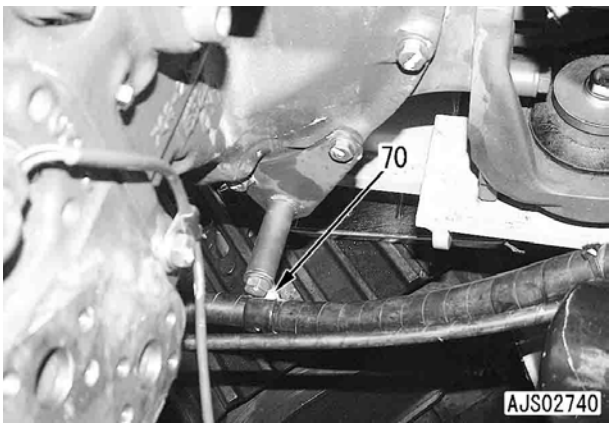
PC210/230-8



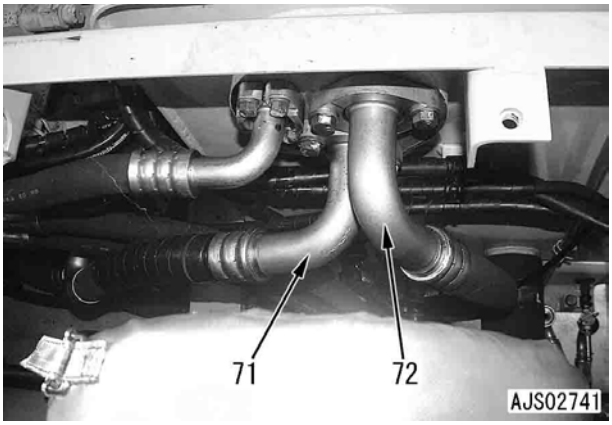
PC240-8



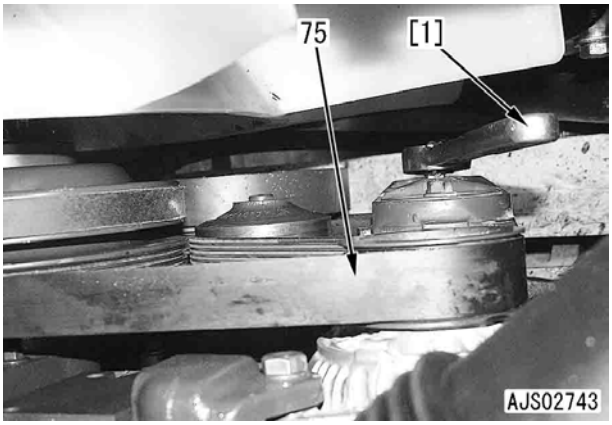
57. Disconnect clamp (70).



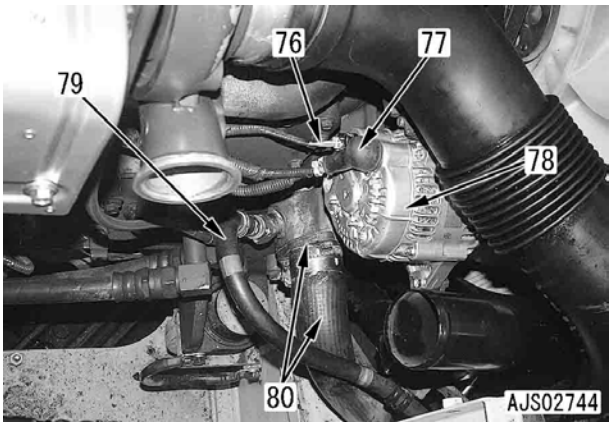
58. Disconnect hydraulic tank hoses (71) and (72).
    ★ To be not obstructive in removing the engine.



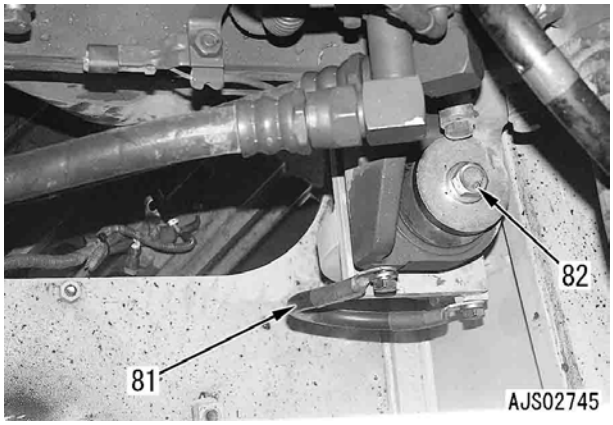
59. Remove fan belt (75) from the alternator with wrench [1].

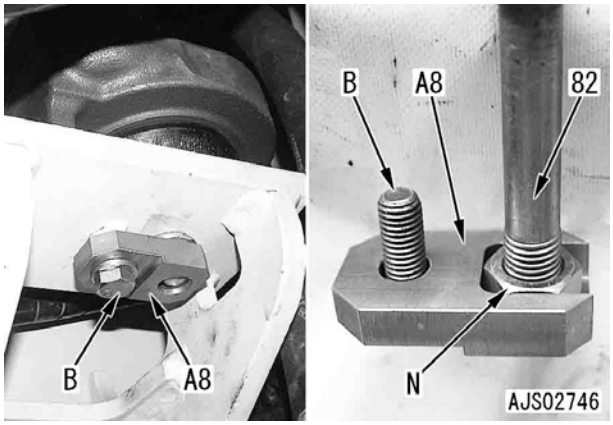


60. Disconnect connectors AB (76) and E12 (77).
61. Remove alternator (78).
62. Disconnect heater hose (79).
63. Remove three bolts and disconnect radiator hose and flange assembly (80). [*8]



64. Disconnect engine ground (81).
65. Remove four engine mounting bolts (82).[*9]
    ★ The nut is not welded except at the engine ground point. Due to that reason firstly fix nut locking tool (plate) **A8** with bolt (B) to strict nut (N) turn, then remove engine mounting bolt (82).

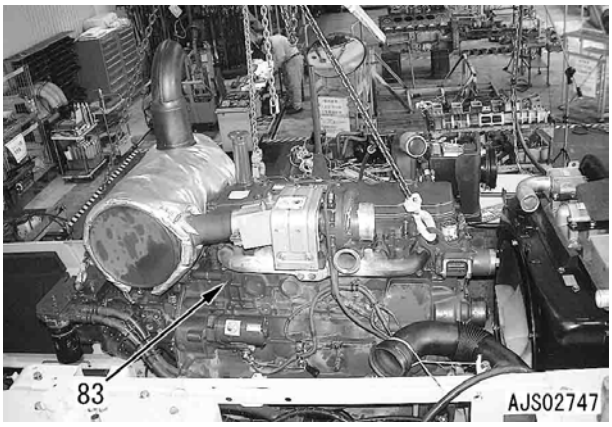




66. Lift out engine and hydraulic pump assembly (83).
    ★ Lift it at the three points, i.e. two points at the engine and one point at the hydraulic pump.
    Recommended lifting tool **A9** (Refer to the special tool list) is proposed from Cummins.

★ Before removing the assembly, make sure that all the necessary wiring and piping are disconnected.

Engine and hydraulic pump assembly: **800 kg**



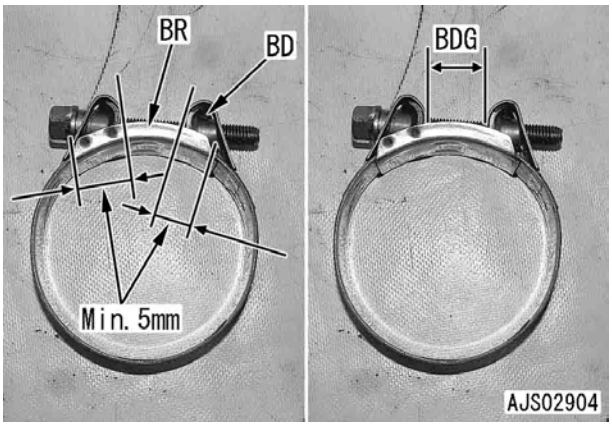
Installation

- Installation is done in the reverse order of removal.

[*1]
Air cleaner band:
8.8 – 10.8 Nm {0.9 – 1.1 kgm}

[*2], [*5]
★ Use brand new article for MIKALOR clamp.
★ Align the hose to the original position (marking position).
★ Reference
Inserted air hose length
- Aftercooler side: 60 mm
- Engine side **A**: 80 mm
- Turbocharger side: 65 mm

★ Set bridge (BR) under the clamp tightening bolt as the lap with band (BR) is Min. 5 mm.
★ Align the clamp to the original position.
★ Impact wrench is not applicable to use.
MIKALOR clamp:
16 – 17 Nm {1.6 – 1.7 kgm}
★ When the tightening torque force is less than 16 Nm {1.6 kgm}, tighten it until the hand gap is adhered (BDG size is 0).



[*3]
★ Align the hose to the original position (marking position).
★ Align the clamp to the original position.
★ Reference
Inserted air hose length
• 49mm
Radiator hose clamp:
10.8 – 11.8 Nm {1.1 – 1.2 kgm}

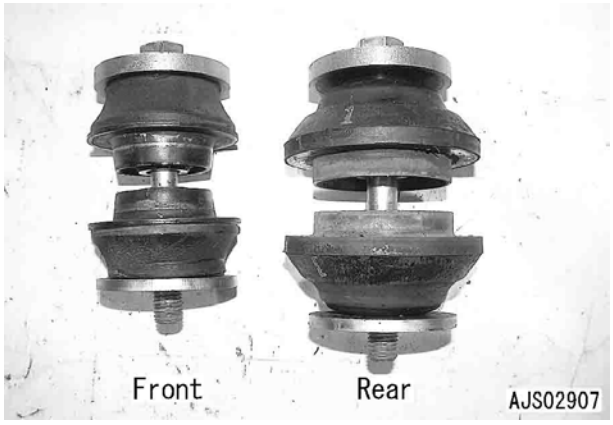
[*4]
Tube clamp:
10.0 – 11.0 Nm {1.02 – 1.12 kgm}
Refer to [*5] [*2].

[*6]
Fan mounting bolt:
43 ± 6 Nm {4.4 ± 0.6 kgm}

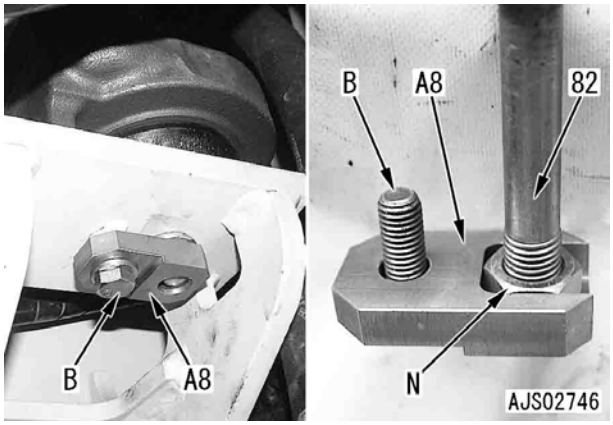
[*7]
★ Refer to the Inspection and Adjustment of Air Compressor Belt Tension section in the Testing and adjusting chapter in this manual.

[*8]
Flange mounting bolt:
43 ± 6 Nm {4.4 ± 0.6 kgm}
★ Reference
Inserted radiator hose length: **40 mm**
Radiator hose clamp:
10.8 – 11.8 Nm {1.1 – 1.2 kgm}

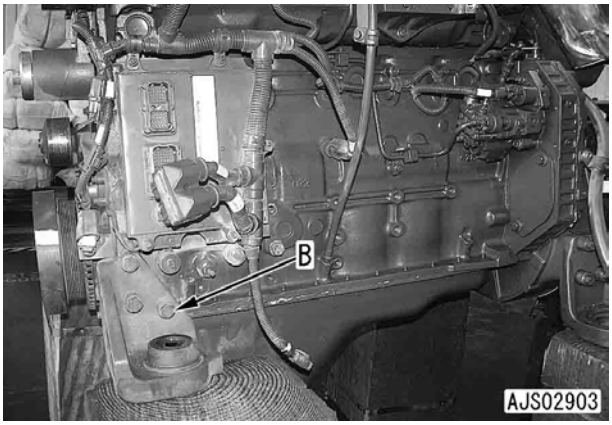
[*9]
★ The bolt length of the engine front side is shorter than that of rear side.
★ The engine mounting rubber size of the engine front side is smaller than that of rear side.



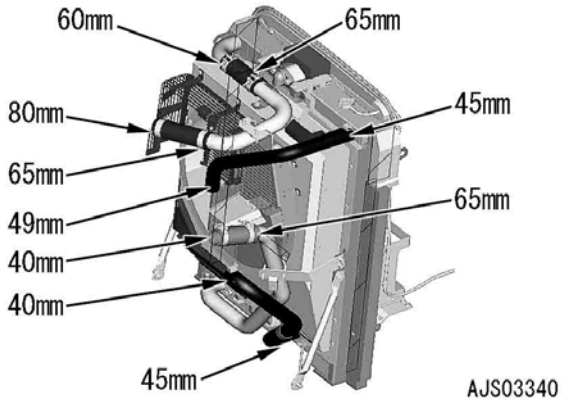
Engine mounting bolt (4 points):
245 – 308.9 Nm {25 – 31.5 kgm}
★ The nut is not welded except at the engine ground point. Due to that reason firstly fix nut locking tool (plate) **A8** with bolt (B) to strict nut (N) turn, then remove engine mounting bolt (82).



★ Reference
Engine mounting bracket (4 points) bolts:
122.5 – 147 Nm {12.5 – 15 kgm}



★ Reference
Overview of the inserted length of the air hoses and radiator hoses.



- **Refilling engine coolant**
  Refill water through the water filler port up to the specified level. Start the engine and circulate the water, and then check the water level.
  Coolant: **Approx. 21ℓ (PC210, 230)**
  Approx. 20.4ℓ (PC240)

- **Refilling with oil (hydraulic tank)**
  Refill hydraulic oil through the oil filler port to the specified level. Let the oil circulate in the hydraulic system by starting the engine. Then check the oil level again.

  Hydraulic tank:
  Approx. 234ℓ (PC210, 230)
  Approx. 239ℓ (PC240)
  Hydraulic tank drain plug:
  58.8 – 78.5 Nm {6.0 – 8.0 kgm}

- **Air bleeding**
  Bleed the air from the circuit between the valve and the hydraulic cylinder. For details, see Testing and adjusting, Air Bleeding of Various Parts.

PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00660-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

50 Disassembly and assembly

Power train

Power train

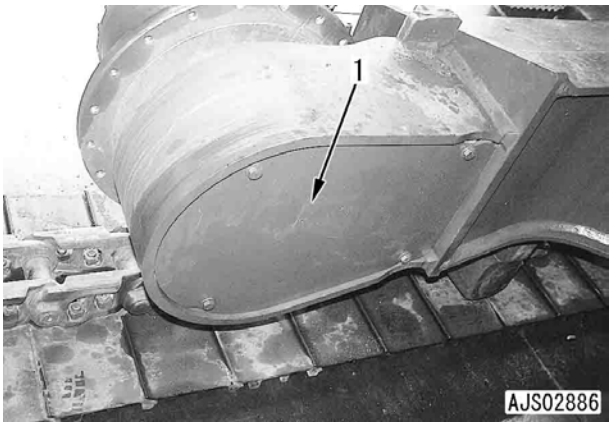
Removal and installation of final drive assembly

Removal

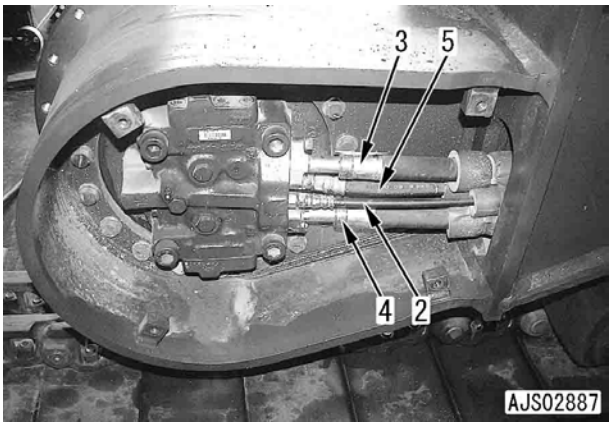
1. Remove the sprocket, refer to the Removing Sprocket section in this manual.

   ⚠ **Completely lower the work equipment to the ground and stop the engine. Then loosen the oil filler cap for the hydraulic tank to release the pressure inside the tank.**

2. Remove cover (1).



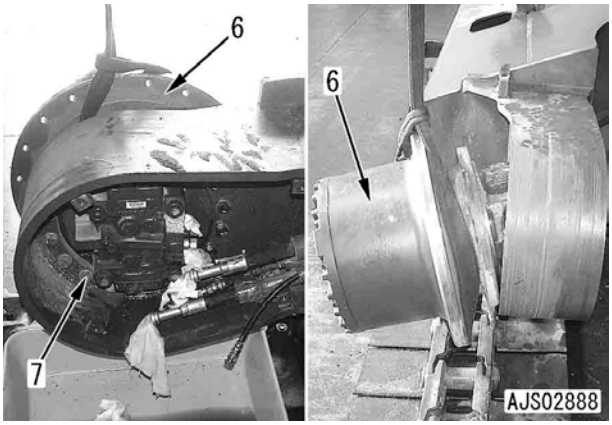
3. Disconnect the travel speed selector hose (2), the motor hose (3), and the drain hose (5).



★ **PC210-8, PC210LC-8, PC210NLC-8**

4. Temporarily hoist the final drive assembly (6).
5. Remove 18 mounting bolts (7) and hoist final drive assembly (6) to remove it. [*1]
   ★ Be careful so that the nipple sealing surface on the hose mounting block may not be damaged.

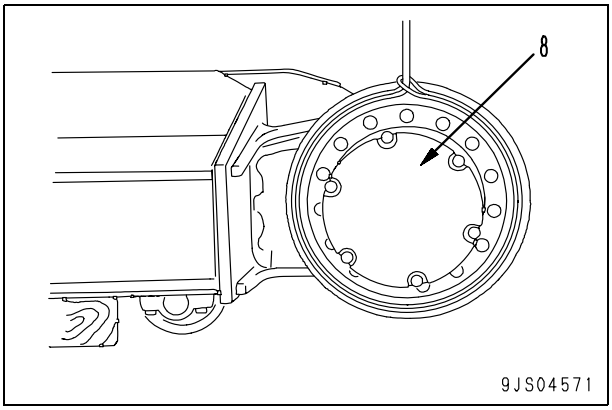
   Final drive assembly: **300 kg**



★ **PC230-8, PC240LC-8, PC240NLC-8**

6. Temporarily hoist the final drive assembly (8).
7. Remove 18 mounting bolts and hoist final drive assembly (8) to remove it. [*2]
   ★ Be careful so that the nipple sealing surface on the hose mounting block may not be damaged.

   Final drive assembly: **380 kg**



Installation

- Installation is done in the reverse order of removal.

[*1]
Mounting bolts:
245 – 309 Nm {25 – 31.5 kgm}

[*2]
Mounting bolts:
265 – 309 Nm {27 – 31.5 kgm}
(Average torque: 275 Nm or more {28 kgm or more})

- **Refilling with oil**
  Fill the power train oil (**TO30**) via the oil filler port to the specified level. Start the engine to circulate the oil through the pipings and recheck the oil level.

- **Air bleeding**
  Refer to the Air Bleeding of Various Parts section in the Testing and adjusting chapter of this manual.

Disassembly and assembly of final drive assembly

★ **PC210-8, PC210LC-8, PC210NLC-8**

Special tools

Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch
J	1	796-427-1400	Wrench assembly	■	1	N	
		796-427-1410	• Wrench		1	N	
		796-427-1140	• Pin		3		
		01314-20612	• Screw		3		
	2	796T-427-1510	Push tool	■	1	N	○
		790-101-2510	Block	■	1		
		790-101-3310	Block	■	1		
		790-101-2610	Rod	■	2		
		790-101-2730	Adaptor	■	2		
		01580-11613	Nut	■	2		
		790-101-2570	Plate	■	2		
		01643-31645	Washer	■	2		
		790-101-2102	Puller (30 t)	■	1		
		790-101-1102	Pump	■	1		
	3	796-427-1520	Installer	■	1	N	

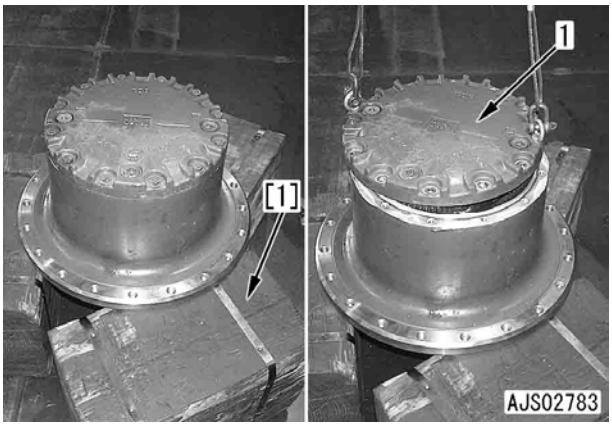
Disassembly

1. Oil draining

Remove drain plug and drain oil from final drive case.

Final drive case: **Approx. 3.5ℓ**

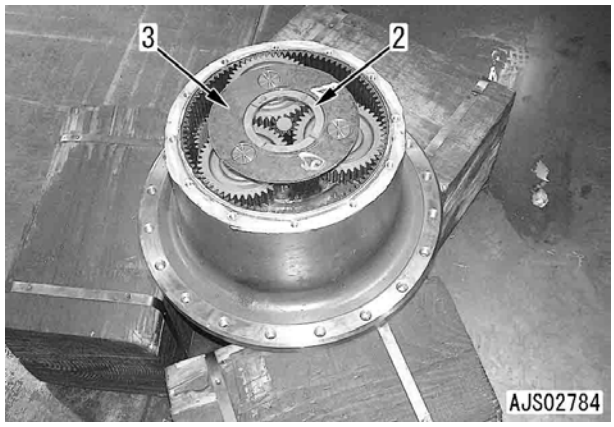
2. Set the final drive assembly on the block [1].
3. Remove mounting bolts to remove cover (1).
   ★ When cover (1) is difficult to be separated, tap the cover (1) with a plastic hammer.



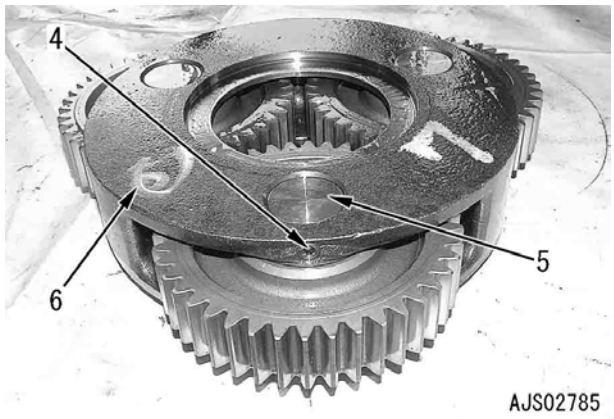
4. Remove spacer (2).

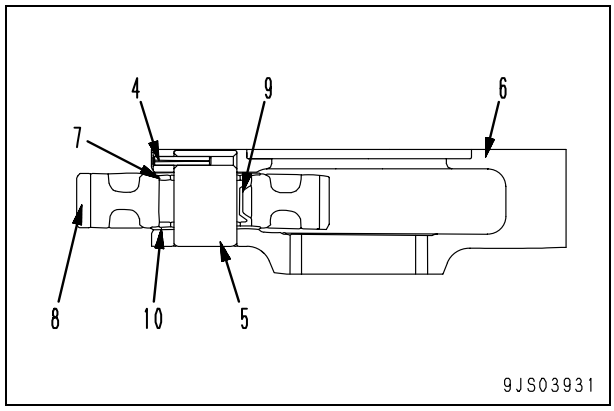
5. No.1 carrier assembly

1) Remove No.1 carrier assembly (3).



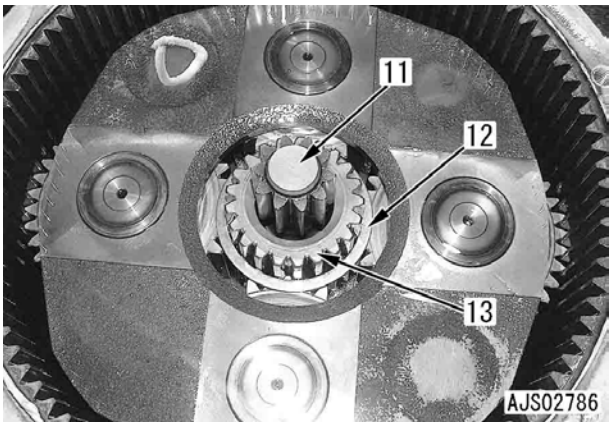
2) Disassemble No. 1 carrier assembly as follows.
   1] Insert pin (4) and drive shaft (5) out of carrier (6).
      ★ After removing the shaft, remove pin (4).
   2] Remove thrust washer (7), gear (8), bearing (9), and thrust washer (10) from carrier (6).





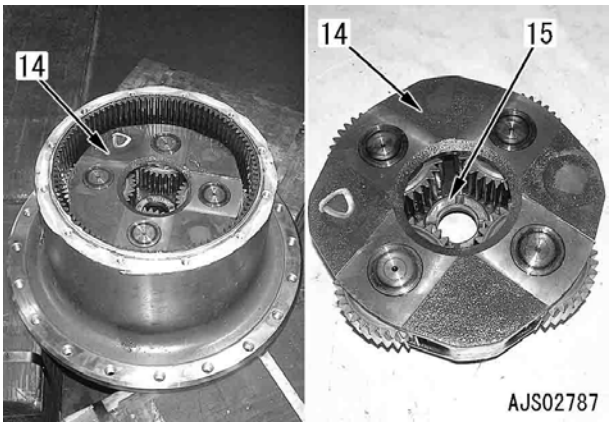
6. Remove No. 1 sun gear shaft (11).

7. Remove thrust washer (12).
8. Remove No. 2 sun gear (13).

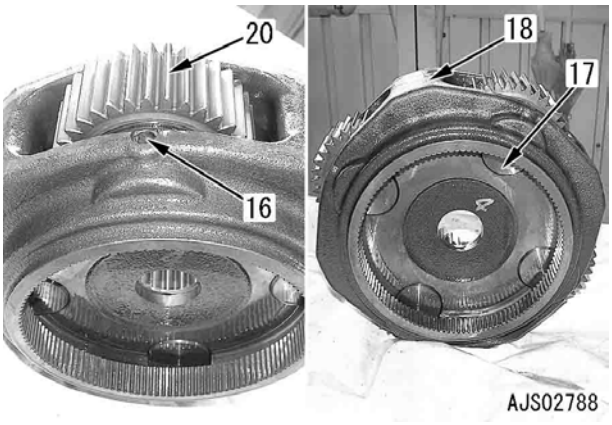


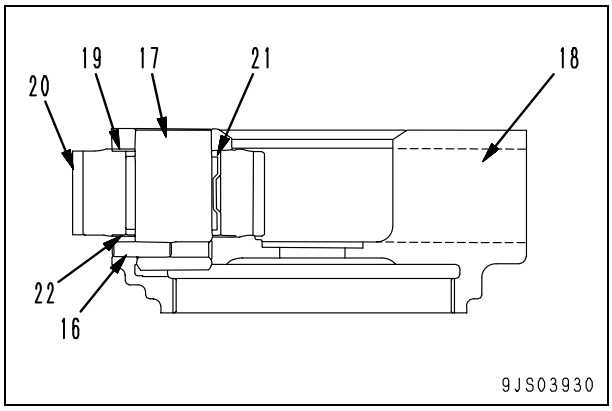
9. No.2 carrier assembly

1) Remove No. 2 carrier assembly (14).
   No. 2 carrier assembly: **35 kg**
2) Remove thrust washer (15).



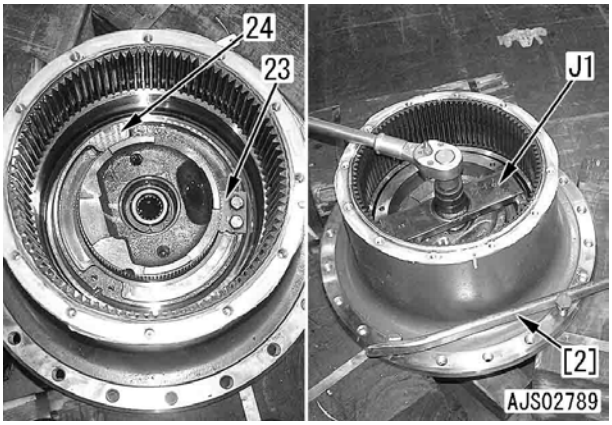
3) Disassemble No. 2 carrier assembly as follows.
   1] Insert pin (16) and drive shaft (17) out of carrier (18).
      ★ After removing the shaft, remove pin (16).
   2] Remove thrust washer (19), gear (20), bearing (21), and thrust washer (22).





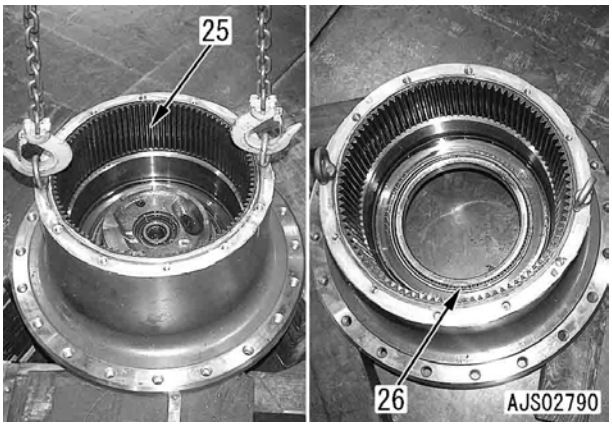
10. Nut

1) Remove lock plate (23).
2) Use the tool **J1** to remove nut (24).
   ★ Use bar [2] to hold.

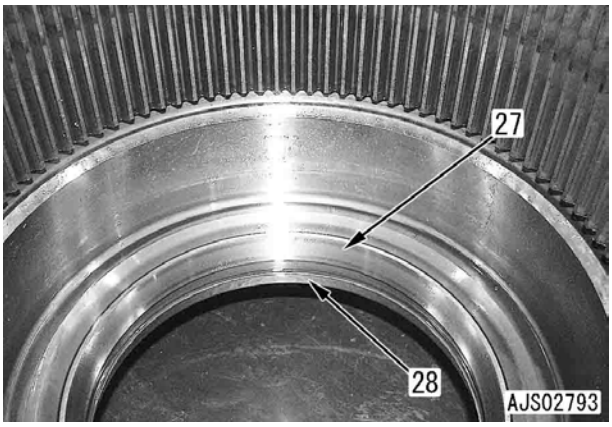


11. Hub assembly

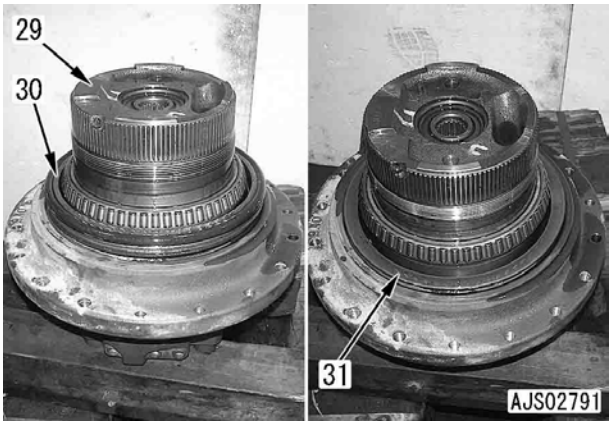
1) Hoist hub assembly (25) and remove from travel motor.
2) Remove bearing (26).



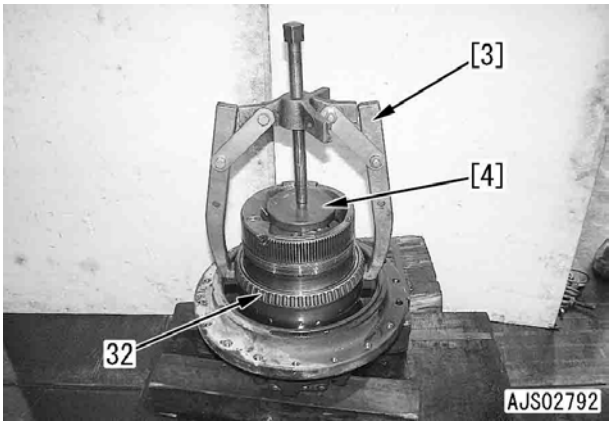
3) Remove bearing outer races (27) and (28).



12. Remove floating seals (30) and (31) from travel motor (29).
    ★ The floating seal (30) may be on the hub assembly (25).



13. Use the puller [3] and push tool [4] to remove bearing (32).
    ★ Bearing may come off without using the puller.



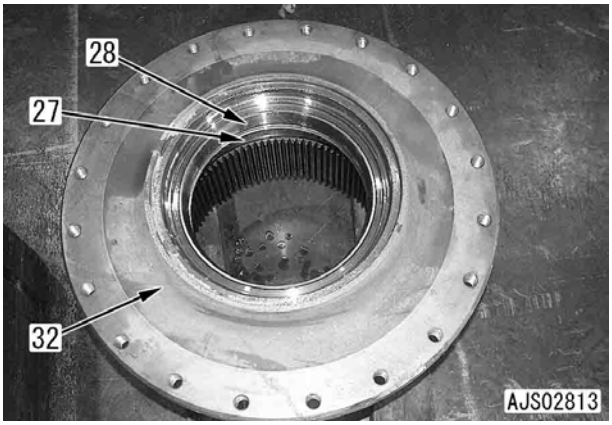
★ **PC210-8, PC210LC-8, PC210NLC-8**

Assembly

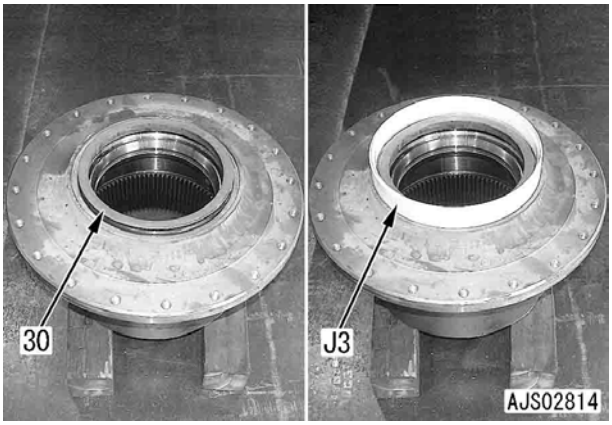
★ Clean the parts completely and inspect them for any foreign material or damage. Apply power train oil (**TO30**) on the sliding surfaces before assembly.

1. Hub assembly

1) Use push tool to press fit bearing outer races (27) and (28) into hub (32).

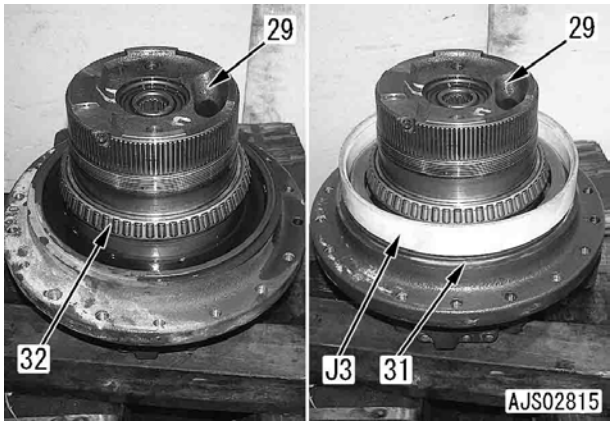


2) Use the tool **J3** to install floating seal (30).
   - ★ Install floating seal with the O-ring and O-ring contact surface de-greased and dried completely.
   - ★ After installing the floating seal, check that the angle of the floating seal is within 1 mm.
   - ★ After floating seal installation, apply a thin coat of power train oil (**TO30**) on the sliding surfaces.

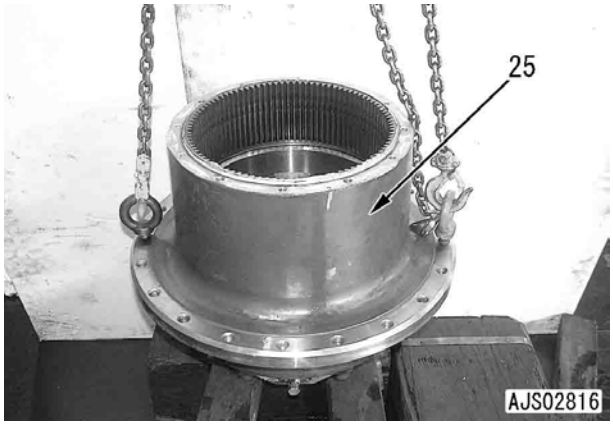


2. Install bearing (32) to travel motor (29).
   - ★ Warm the inner race of the bearing (32) to 50 – 70 °C with heater.
   - ★ Cool the bearing (32) down. Tap the bearing (32) with a drift and listen to the sound to check that it is fully seated.

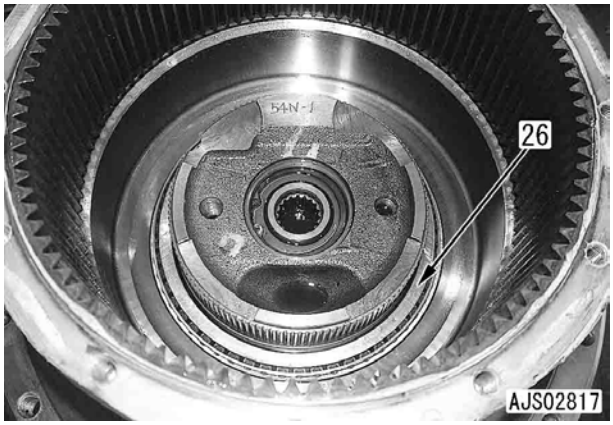
3. Use the tool **J3** to install floating seal (31) to travel motor (29).
   - ★ Install floating seal with the O-ring and O-ring contact surface de-greased and dried completely.
   - ★ After installing the floating seal, check that the angle of the floating seal is within 1 mm.
   - ★ After floating seal installation, apply a thin coat of power train oil (**TO30**) on the sliding surfaces.



4. Set hub assembly (25) to travel motor.

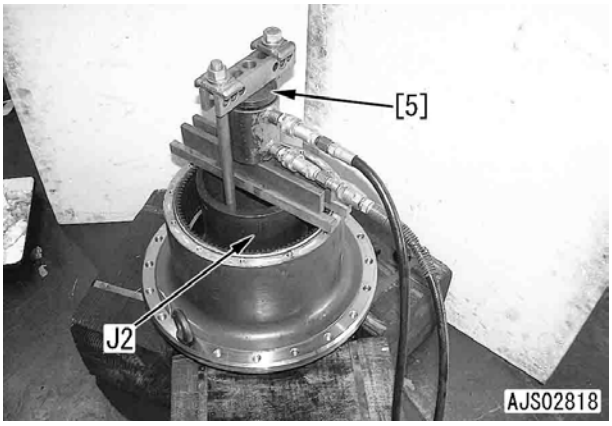


5. Install bearing (26) by tapping it lightly with the push tool.

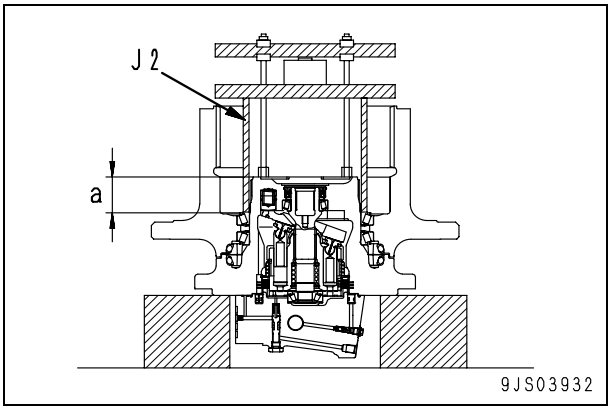


6. Nut

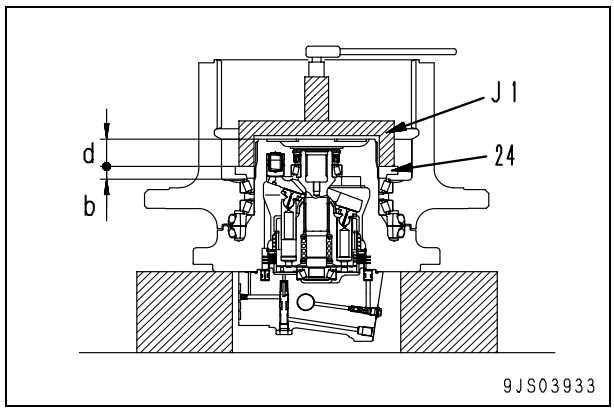
1) Install nut as follows.
   1] Rotate the hub 2-3 times.
   2] Use the tool **J2** and the push tool [5] to press the inner race of the bearing (26).
      ★ Pressing force:
      29.4 – 38.2 kN {3.0 – 3.9 ton}
   3] Rotate the hub to the both directions at least 5 times in total with the bearing inner race pressed.
   4] Release the pressing force.
   5] Press the bearing again.
      ★ Pressing force:
      17.7 – 21.6 kN {1.8 – 2.2 ton}
   6] Rotate the hub 2 – 3 times.



   7] Measure the size **a** under the condition described in 6] above.

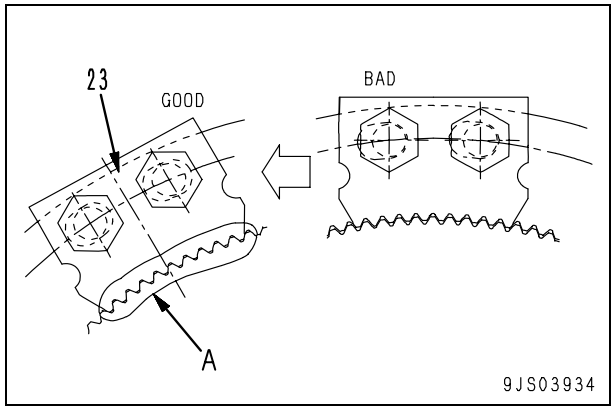


   8] Measure thickness **"b"** off the independent nut (24).
   9] Determine Calculate **a – b = c**
   10] Use the tool **J1** to tighten nut (24) until the following condition is met:
   size d: c +0.06/-0.04



2) Measure the tangential force of the hub against the motor case in the rotation direction using the push scale [6].
   ★ Tangential force:
   490 N or less {50 kg or less}
   ★ The tangential force denotes the maximum force at start of the rotation.

3) Install lock plate (23).
   ★ Install the lock plate so that the splines (A) of the lock plate and the motor are in full contact.
   Mounting bolt thread:
   Adhesive (LT-2)
   ★ Do no apply the adhesive (LT-2) to the tapped portion of the nut.

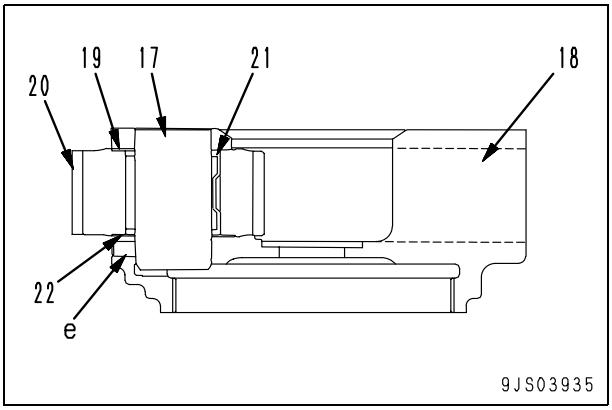


7. No.2 carrier assembly

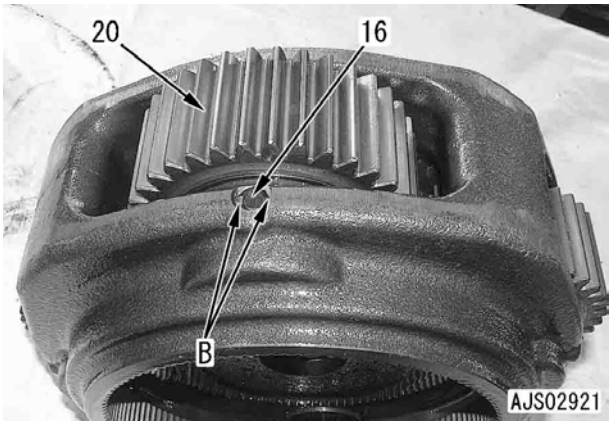
1) Assemble No. 2 carrier assembly as follows.
   - ★ Replace thrust washers (19) and (22) as well as pin (16) with new ones.
   - ★ There are traces of expansion on the end surface of carrier side hole “e“ which were originally caused when the pin was inserted. Make such the end surfaces are smooth enough before reassembly.

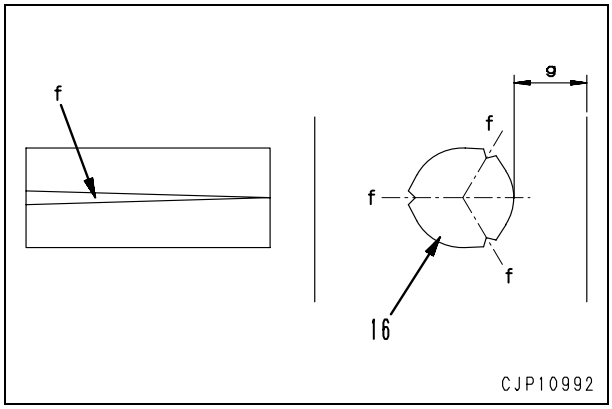
   1] Assemble bearing (21) to gear (20), fit top and bottom thrust washers (19) and (22) and then set the gear assembly on carrier (18).

   2] Align the pin holes on the shaft (17) and the carrier, and install the shaft (17) by tapping it lightly with a plastic hammer.
      - ★ Install the shaft, rotating the planetary gear. Take care so the thrust washer is not damaged.



   3] Insert pin (16).
      - ★ When inserting the pin, take care so that any of the three pawls on the circumference (Portion **f**) may not touch the thin-walled portion on the carrier (Portion **g**).Take note, however, that the thin-walled portion is likely to be on the opposite side of the carrier, depending on actual individual items. Pay attention so that a pin pawl will not come to the slender side of the carrier any way.And when traces of the groove are present, assembly must be done avoiding such locations.
      - ★ After assembling the carrier assembly, check that gear (20) rotates smoothly.
      - ★ After the pin is inserted, stake the pin (B) on the carrier.

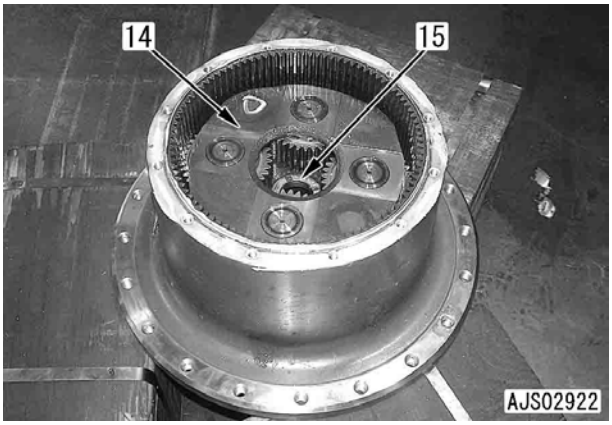




2) Install No. 2 carrier assembly (14).
   - ★ Align the 4 gear shaft ends of the carrier assembly with the 4 dimples on the motor case end surface to install.

8. Thrust washer

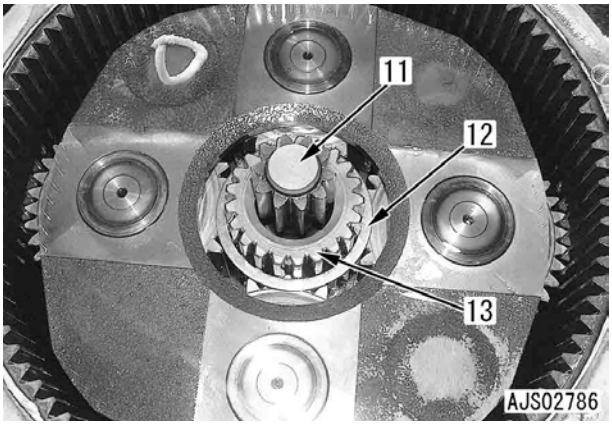
Install thrust washer (15).



9. No. 2 sun gear
Install No. 2 sun gear (13).

10. No. 1 sun gear
Install No. 1 sun gear (11).

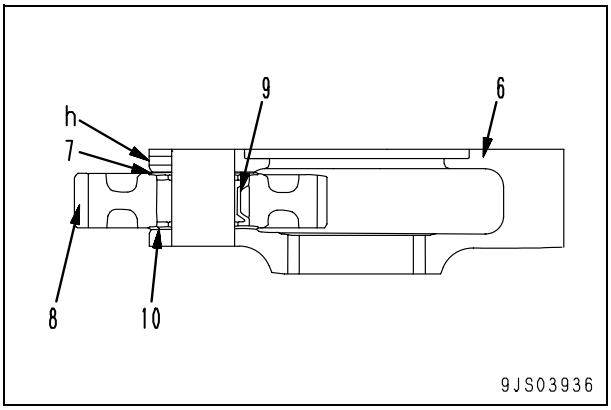
11. Thrust washer
Install thrust washer (12).



12. No.1 carrier assembly

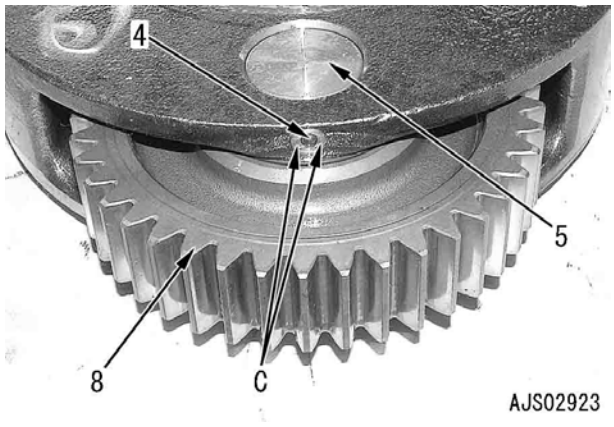
1) Assemble No. 1 carrier assembly as follows.
   - ★ Replace thrust washers (7) and (10) and pin (4) with new ones. (Refer to Pin (4): 3].)
   - ★ There are remains of caulking when the pin is inserted at the end face of hole “h“ at the side of the carrier. Remove the caulked metal from the inside diameter of the hole before starting to assemble.

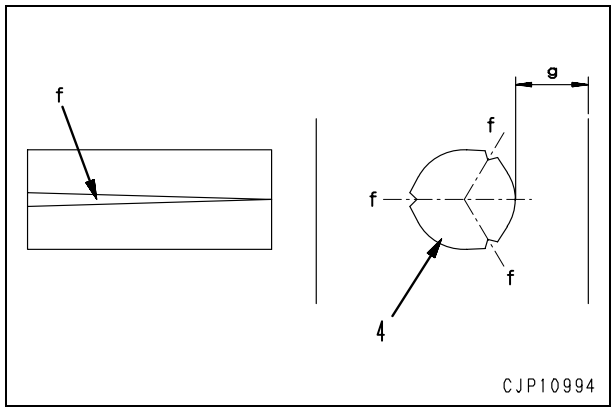
   1] Assemble bearings (8) and (9), fit top and bottom thrust washers (7) and (10) and then set the gear assembly on carrier (6).



2] Align the pin holes on the shaft (5) and the carrier, and install the shaft (5) by tapping it lightly with a plastic hammer.
   - ★ Install the shaft, rotating the planetary gear. Take care so the thrust washer is not damaged.

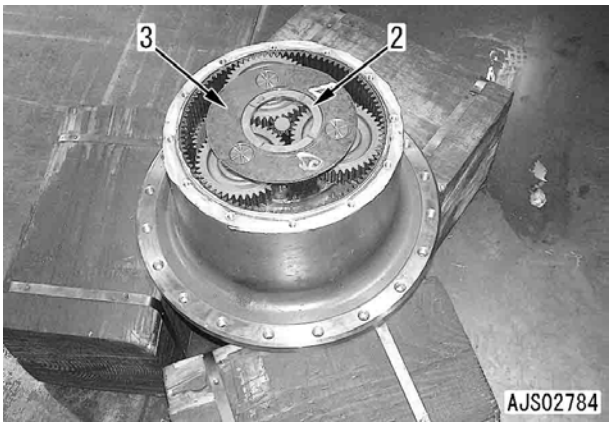
3] Insert pin (4).
   - ★ When inserting the pin, take care so that any of the three pawls on the circumference (Portion **f**) may not touch the thin-walled portion on the carrier (Portion **g**).Take note, however, that the thin-walled portion is likely to be on the opposite side of the carrier, depending on actual individual items. Pay attention so that a pin pawl will not come to the slender side of the carrier any way.And when traces of the groove are present, assembly must be done avoiding such locations.
   - ★ After assembling the carrier assembly, check that gear (8) rotates smoothly.
   - ★ After the pin is inserted, stake the pins (C) on the carrier at 2 locations.



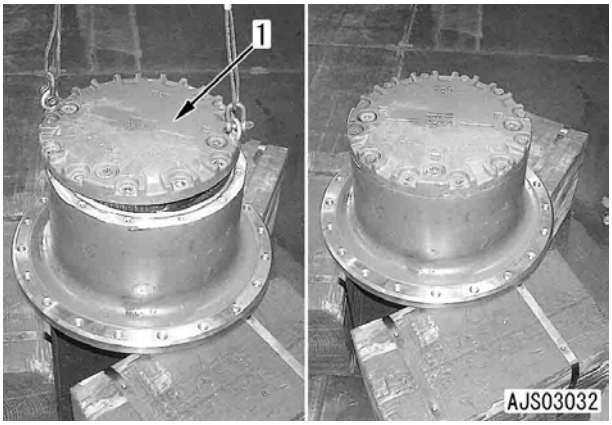


2) Install No.2 carrier assembly (3).

13. Spacer
Install spacer (2).



14. Cover
Install cover (1).
Cover mounting surface:
liquid gasket (LG-6)
Mounting bolts:
98 – 123 Nm {10 – 12.5 kgm}



15. Oil refill
Tighten drain plug and fill power train oil (**TO30**) from the oil filler port.

Final drive case: **Approx. 3.5ℓ**
★ Do a final check of the oil level at the determined position after installing the final drive assembly to the chassis.

★ **PC230-8, PC240LC-8, PC240NLC-8**

Special tools

Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch
J	4	796-427-1200	Wrench	■	1		
	5	791-545-1510	Installer	■	1		
	6	796T-427-1220	Push tool	■	1		○
		790-101-2510	Block	■	1		
		792-104-3940	Bolt	■	2		
		05180-11610	Nut	■	2		
		01613-31645	Washer	■	2		
		790-105-2100	Jack	■	1		
		790-101-1102	Hydraulic pump	■	1		
	7	790-331-1110	Wrench	■	1		

Disassembly

1. Oil drain

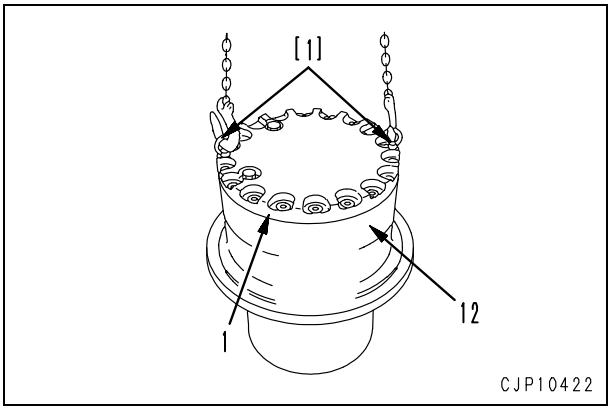
Remove drain plug to drain the oil from final drive case.

Final drive case: **5.4ℓ**

2. Cover

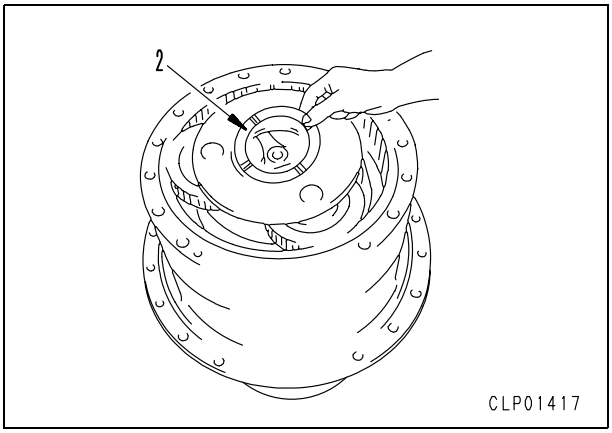
Remove 20 mounting bolts and hoist cover (1) using an eyebolt [1] to remove it.

★ When ring gear (12) is lifted together, separate the ring gear by lightly tapping it with a plastic hammer.



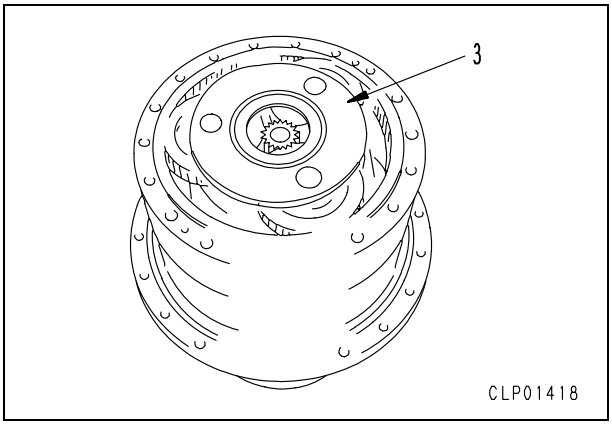
3. Washer

Remove washer (2).



4. No.1 carrier assembly

1) Remove No. 1 carrier assembly (3).

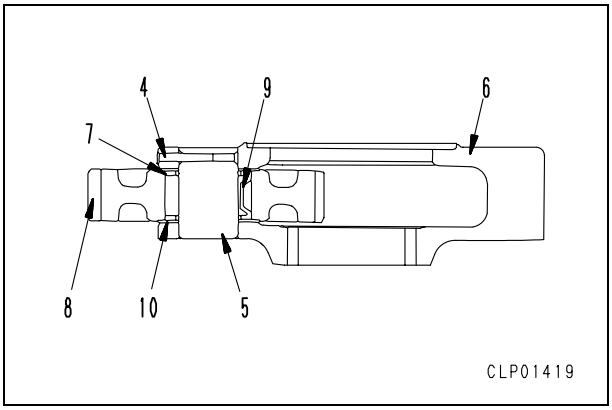


2) Disassemble No. 1 carrier assembly in the following procedure.

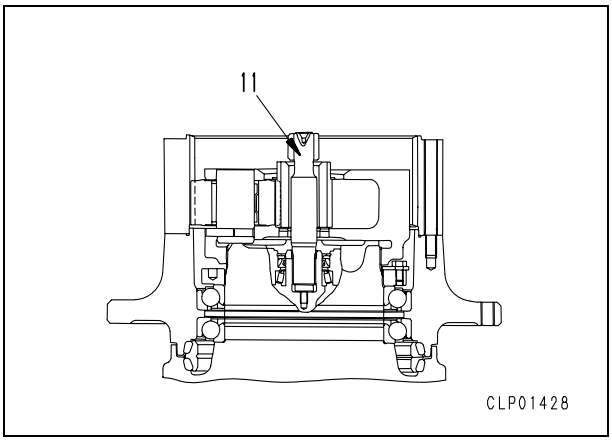
1] Drive pin (4) into pin (5) to remove pin (5) from carrier (6).

★ Remove pin (4) from pin (5) after pin (5) is removed.

2] Remove thrust washer (7), No. 1 planetary gear (8), needle bearing (9) and thrust washer (10).



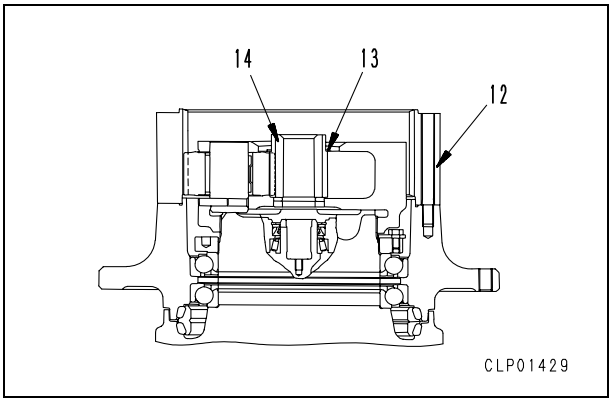
5. No.1 sun gear shaft
Remove No. 1 sun gear shaft (11).



6. No.1 & No.2 ring gears
Remove No.1& No.2 ring gears (12).

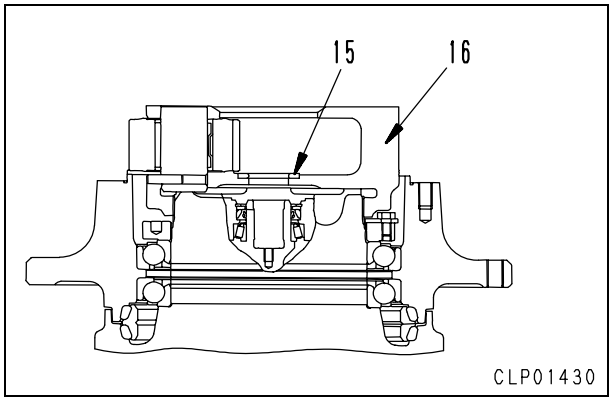
7. Thrust washer
Remove thrust washer (13).

8. No. 2 sun gear
Remove No. 2 sun gear (14).

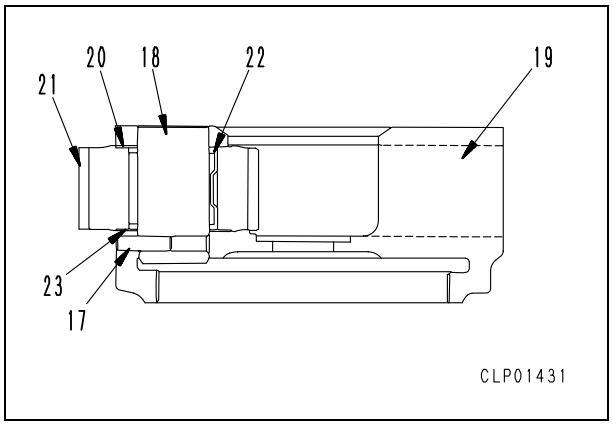


9. Washer
Remove washer (15).

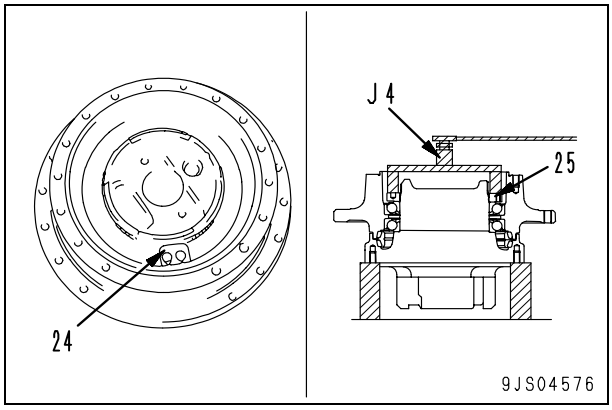
10. No.2 carrier assembly
1) Remove No. 2 carrier assembly (16).



2) Disassemble No. 2 carrier assembly in the following procedure.
   1] Drive pin (17) into pin (18) to remove pin (18) from carrier (19).
      ★ Remove pin (17) from pin (18) after pin (18) is removed.
   2] Remove thrust washer (20), No. 2 planetary gear (21), needle bearing (22) and thrust washer (23).

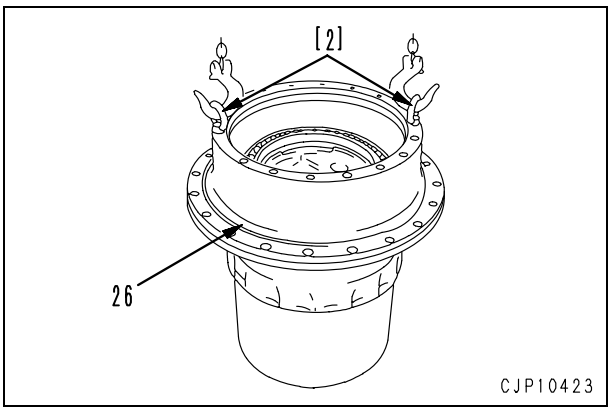


11. Locked
1) Remove lock (24).
2) Use the tool **J4** to remove lock (25).

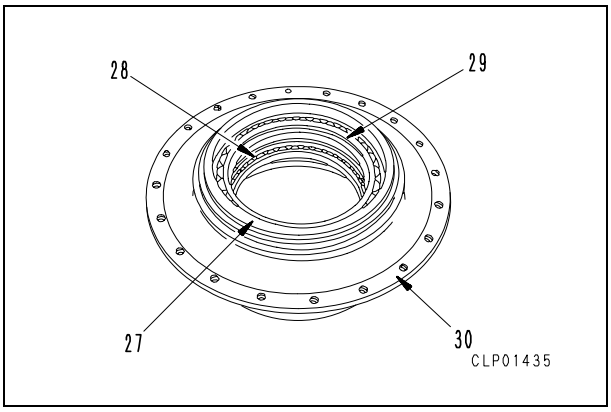


12. Hub assembly

1) Use an eyebolt [2] to remove hub assembly.

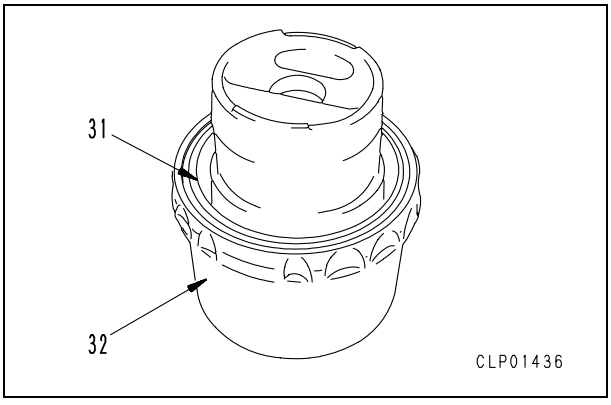


2) Disassemble hub assembly in the following procedure.
   1] Remove floating seal (27).
   2] Remove ball bearings (28) and (29) from hub (30).



13. Travel motor assembly

Remove floating seal (31) from travel motor (32).



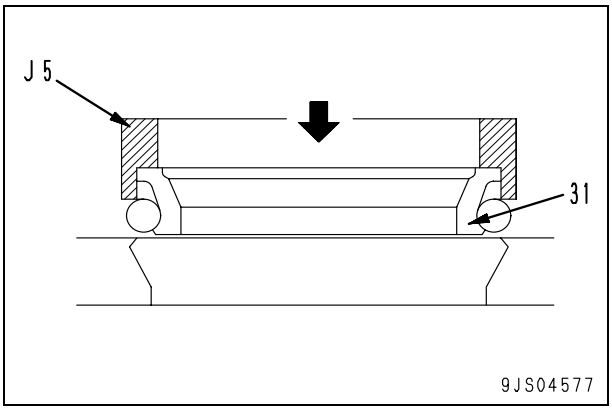
★ PC230-8, PC240LC-8, PC240NLC-8

Assembly

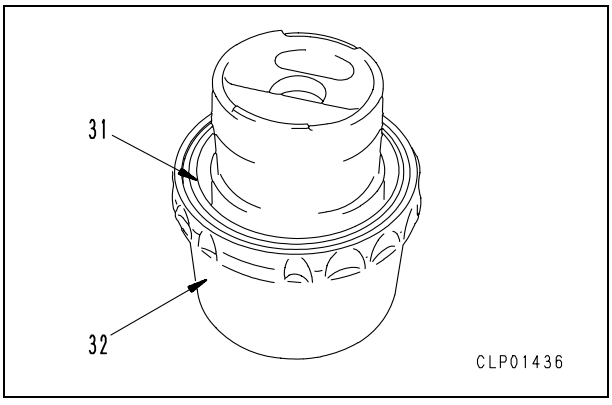
★ Clean the parts completely and inspect them for any foreign material or damage. Apply power train oil (**TO30**) on the sliding surfaces before assembly.

1. Travel motor assembly

1) Set floating seal (31) to the tool **J5**.
   ★ Install floating seal with the O-ring and O-ring contact surface degreased and dried completely.

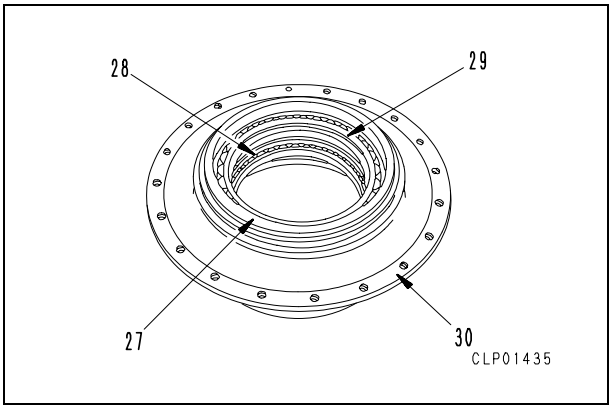


2) Install floating seal (31) to travel motor (32).
   ★ After the floating seal installation, check that the inclination of the seal is 1 mm or less.
   ★ After floating seal installation, check the sliding surfaces for any foreign material and then apply a thin coat of power train oil (TO30) on it.

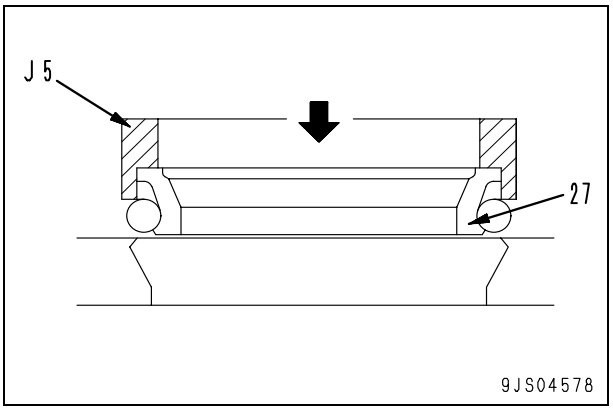


2. Hub assembly

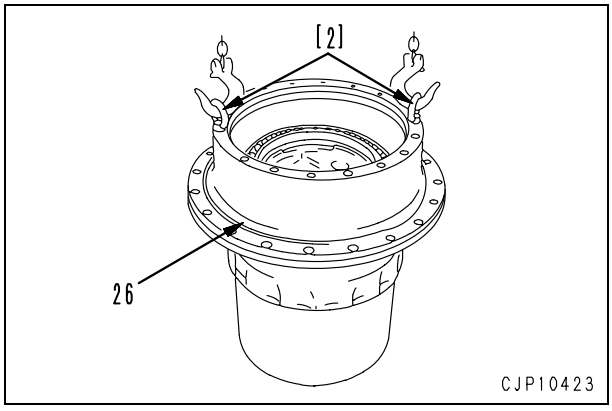
1) Assemble hub assembly in the following procedure.
   1] Use push tool to press fit ball bearings (29) and (28) into hub (30).



   2] Set floating seal (27) to the tool **J5**.
      ★ Install floating seal with the O-ring and O-ring contact surface de-greased and dried completely.
   3] Install floating seal (27) to hub (30).
      ★ After the floating seal installation, check that the inclination of the seal is 1 mm or less.
      ★ After floating seal installation, check the sliding surfaces for any foreign material and then apply a thin coat of power train oil (TO30) on it.

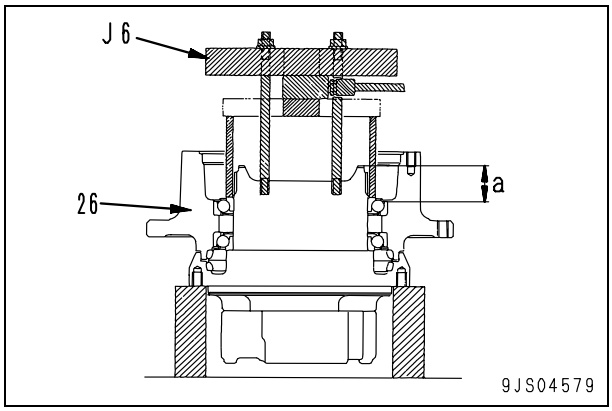


2) Use an eyebolt [2] to set hub assembly (26) to travel motor.
   ★ When hub assembly is difficult to install, install it by lightly tapping the bearing inner race with push tool.



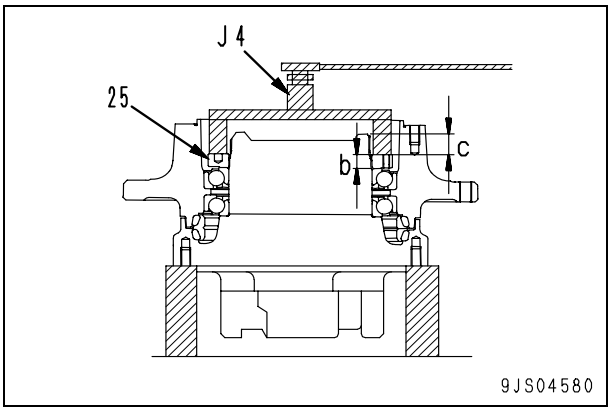
3. Locked

1) Use tool **J6** to press the inner race of the ball bearing.
   ● Specified pressing force:
   8.8 – 12.7 kN {0.9 – 1.3 ton}
2) Rotate hub assembly (26) 2 – 3 times with the bearing pressed.
3) With this condition, measure size (a) from the top surface of travel motor to the top surface of the bearing inner race.
   ★ When measurement is complete, remove tool **J6**.

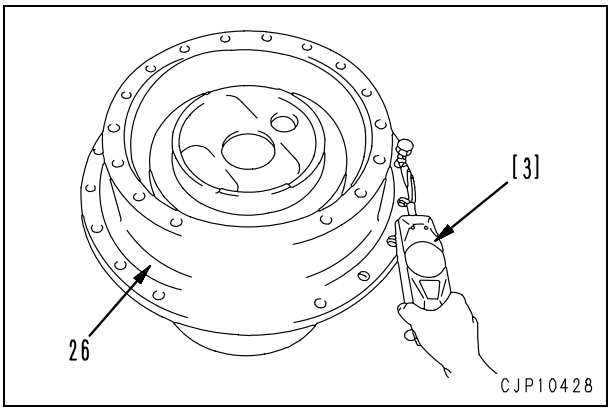


4) Measure the thickness (b) of the lock (25) as a unit.
5) Calculate the screwing depth (c) using the measurements (a) and (b).
   ● c = a – b – (0 – 0.1)

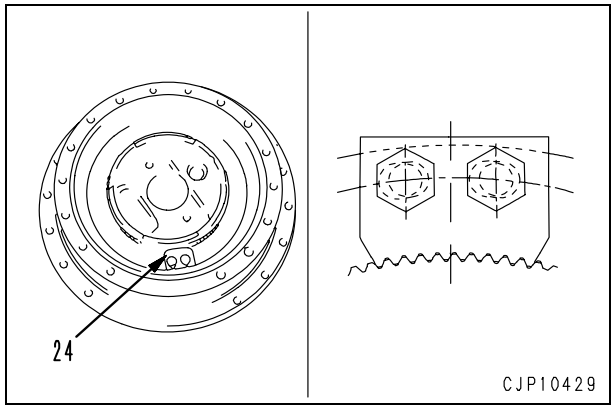
6) Using the tool **J4**, screw in the lock (25) to the calculated depth (c).
★ The screwing depth (c) is the size between the top surface of the travel motor and the top surface of the lock.



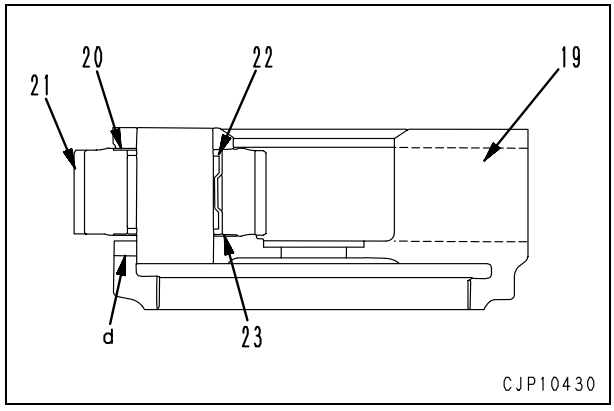
7) Use push-pull scale [3] to measure the tangential force (starting force) of hub assembly.
★ The location for tangential force (starting force) measurement is the bolt hole for the sprocket mounting bolt.
● Tangential force (starting force): 294 N or less {30 kg or less}
★ If the tangential force (starting force) is not normal, disassemble again to find the cause.



8) Install lock (24).
Mounting bolt:
Liquid adhesive (LT-2)
★ Do not apply the liquid adhesive to the screw hole in the lock.
★ Install the lock so that it is in full contact with the travel motor spline.

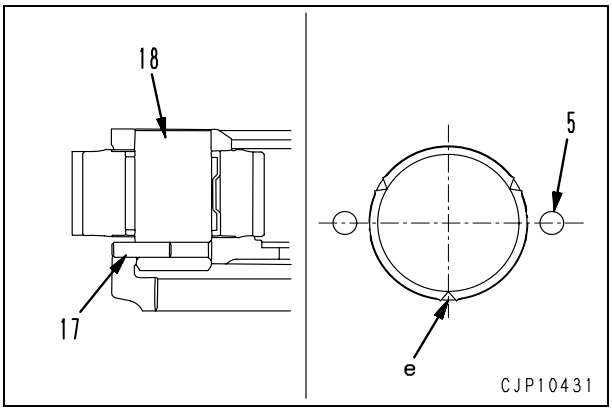


4. No.2 carrier assembly
1) Assemble No. 2 carrier assembly in the following procedure.
1] Assemble thrust washer (23), needle bearing (22), No. 2 planetary gear (21), and thrust washer (20) into carrier (19).
★ If the disassembled carrier is reused, recover the staking remaining on the pin hole (d) in the carrier in advance.
★ Replace thrust washer with new one.

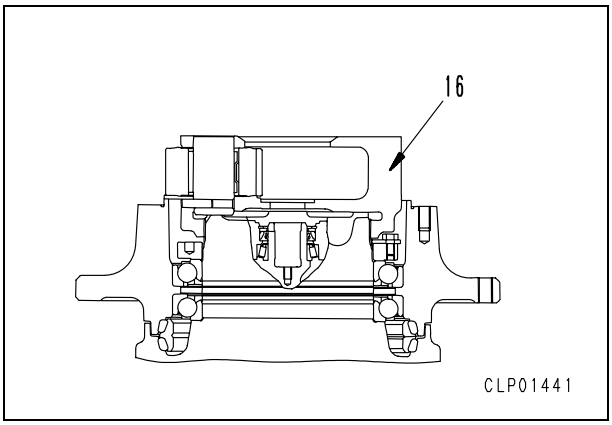


2] Install pin (18).
- ★ Align the pin hole and the hole in the carrier before pin is completely inserted.
- ★ When installing the shaft, be careful not to damage thrust washer while rotating the planetary gear.

3] Install pin (17).
- ★ Replace pin with new one.
- ★ Before inserting the pin, check the orientation so that the 3 pawls (e) on the outer circumference of the pin do not seat on the thin portion of the carrier.
- ★ After inserting the pin, stake at 2 locations around the pin hole to prevent the pin from coming out.
- ★ When assembling of the No. 2 carrier assembly is complete, check that all gears rotate smoothly.



2) Install No. 2 carrier assembly (16).
- ★ Align the 4 lower ends of the pin in No. 2 carrier assembly with the 4 dimples in the motor case.

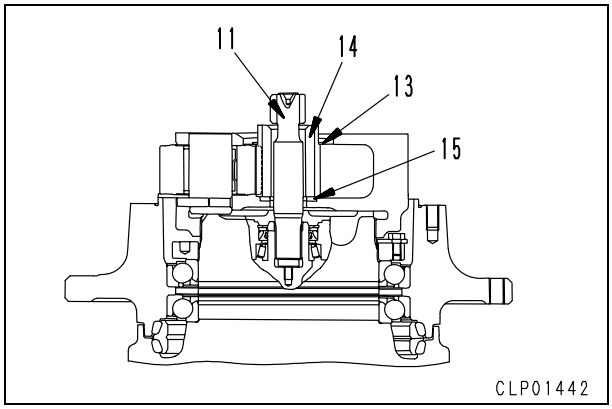


5. Washer
Install washer (15).

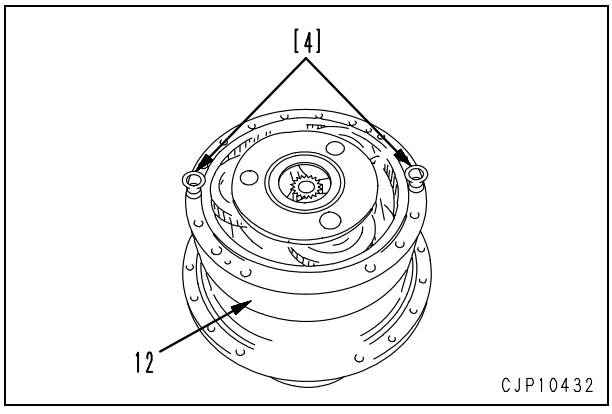
6. No. 2 sun gear
Install No. 2 sun gear (14).

7. Thrust washer
Install thrust washer (13).

8. No. 1 sun gear shaft
Install No. 1 sun gear shaft (11).

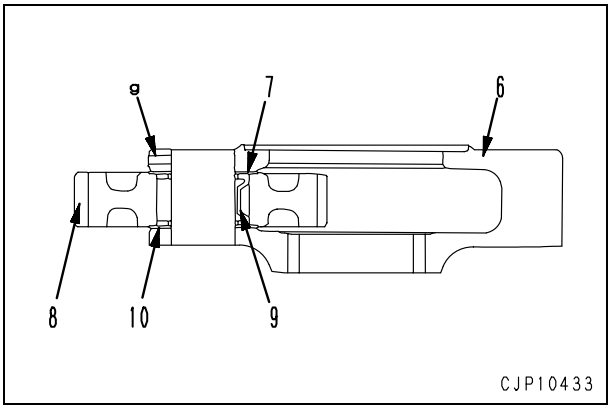


9. No.1 & No.2 ring gears
1) Install O-ring to the hub.
2) Use an eyebolt [4] to install No. 1 & No. 2 ring gears (12) to hub.
- ★ De-grease the mating surfaces of the ring gear and the hub, and do not apply liquid gasket on the mating surfaces.
- ★ Align the holes in the ring gear and the hub.

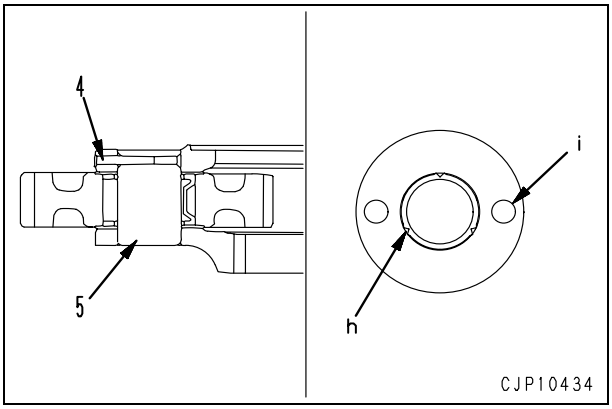


10. No.1 carrier assembly

1) Assemble No. 1 carrier assembly in the following procedure.
   1] Assemble thrust washer (10), needle bearing (9), No. 2 planetary gear (8), and thrust washer (7) into carrier (6).
      ★ If the disassembled carrier is reused, recover the staking remaining on the pin hole (g) in the carrier in advance.
      ★ Replace thrust washer with new one.



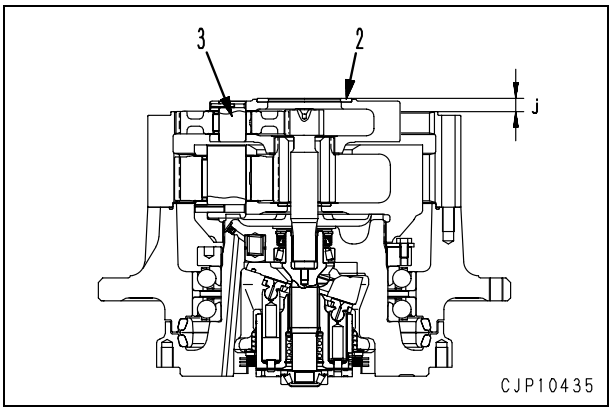
   2] Install pin (5).
      ★ Align the pin hole and the hole in the carrier before pin is completely inserted.
      ★ When installing the shaft, be careful not to damage thrust washer while rotating the planetary gear.
   3] Install pin (4).
      ★ Replace pin with new one.
      ★ Before inserting the pin, check the orientation so that the 3 pawls (h) on the outer circumference of the pin do not seat on the thin portion of the carrier.
      ★ After inserting the pin, stake at 2 locations (i) around the pin hole to prevent the pin from coming out.
      ★ When assembling of the No. 1 carrier assembly is complete, check that all gears rotate smoothly.



2) Install No. 1 carrier assembly (3).
   ★ Check that all gears are smoothly in mesh. If the meshing is not proper, shake the hub in the rotation direction several times to properly mesh them.

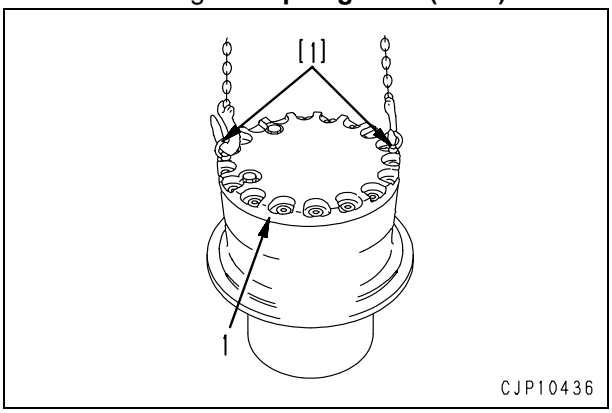
11. Washer

Install washer (2).
★ After washer installation, measure the size (j) from the top surface of the washer to the top end surface of the ring gear to check the condition of assembly.
★ Gears are properly assembled if the size (j) is 19 mm or less.

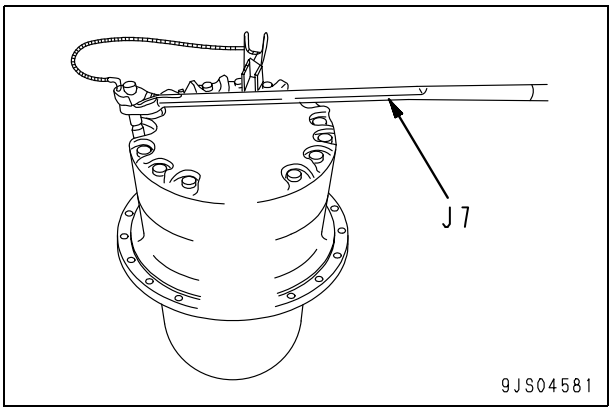


12. Cover

1) Use an eyebolt [1] to install cover (1).
   Mating surfaces of cover and ring gear: **liquid gasket (LG-6)**



2) Use the tool **J7** to tighten 20 mounting bolts.
   mounting bolts:
   first time: 147 Nm {15 kgm}
   second time: 85 – 95° (rotating angle)



13. Oil refill

Tighten drain plug and fill power train oil (**TO30**) from the oil filler port.

Final drive case: **Approx. 5.4ℓ**

★ Do a final check of the oil level at the determined position after installing the final drive assembly to the chassis.

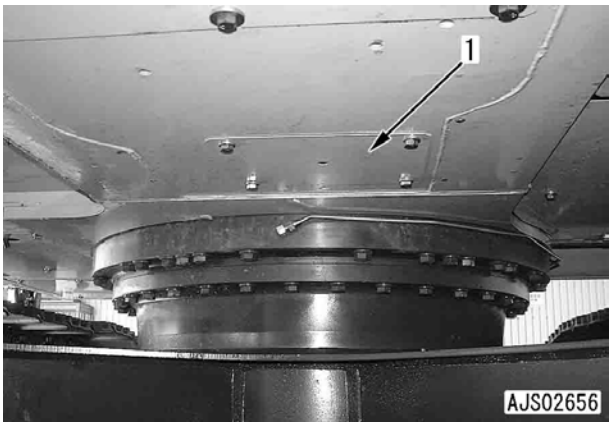
Removal and installation of swing motor and swing machinery assembly

Removal

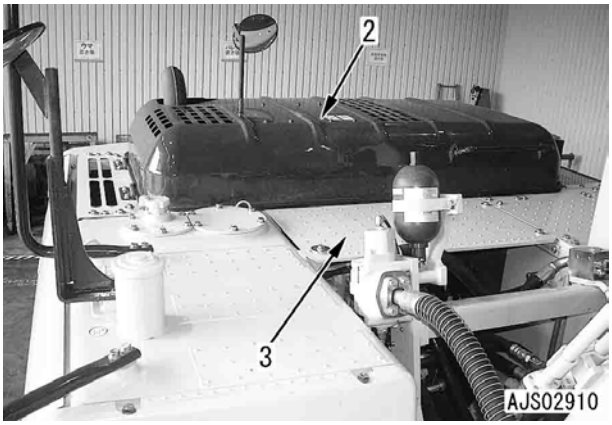
⚠ **Lower the work equipment to the ground completely, after the engine is stopped, loosen the hydraulic tank cap gradually to reduce the pressure inside, and set the lock lever in the lock position.**

★ Attach an identification tag to each piping to avoid a mistake in the position of installation later.

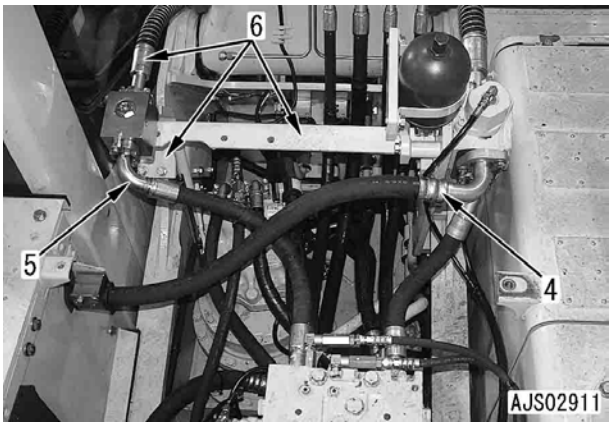
1. Remove cover (1).



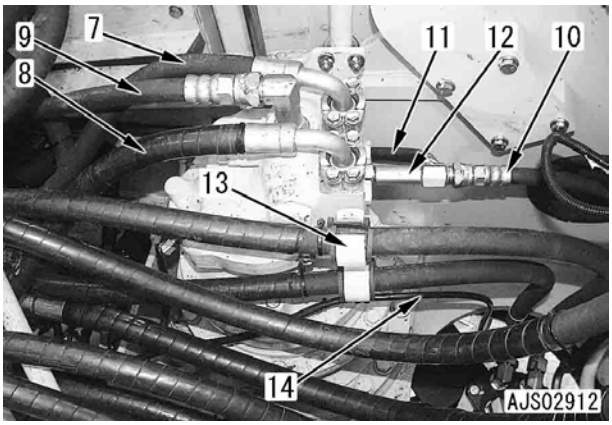
2. Open engine hood (2) and remove cover (3).



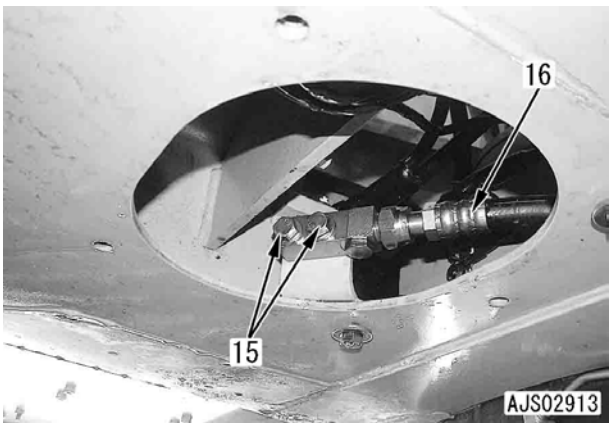
3. Disconnect hose (4) and (5). (If equipped)
4. Disconnect the bracket hose Assembly (6). (If equipped)



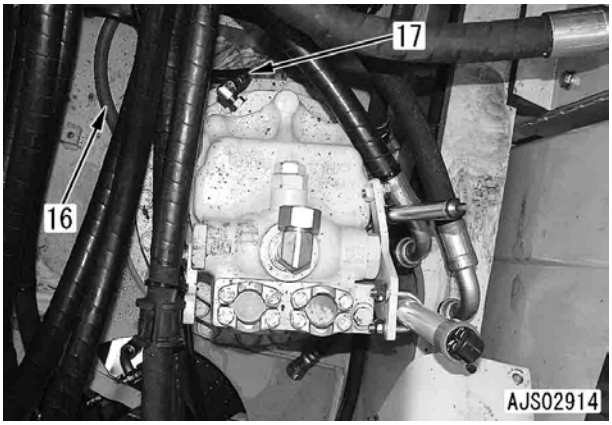
5. Disconnect 5 pcs. of swing motor hose (7) – (11).
   - (7): Between the swing motor – the control valve (port MA)
   - (8): Between the swing motor – the control valve (port MB)
   - (9): Suction hose (port S)
   - (10), (11): Drain hose (port T)
6. Remove nipple (12) (port T).
7. Disconnect clamp (13).
8. Disconnect hose (14).



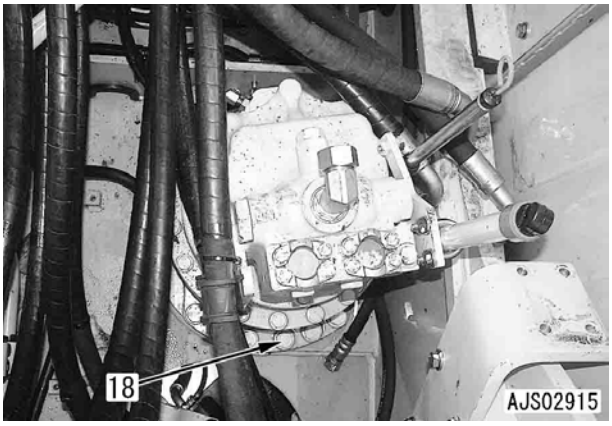
9. Remove mounting bolt (15) and disconnect drain hose (16).



10. Pull drain hose (16) out.
11. Disconnect pilot hose to cancel swing brake (17)(B port).

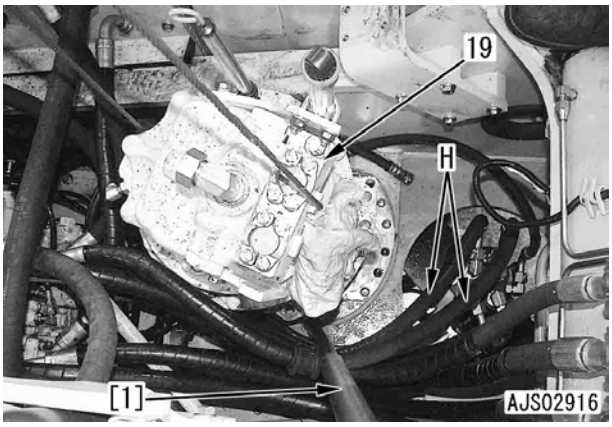


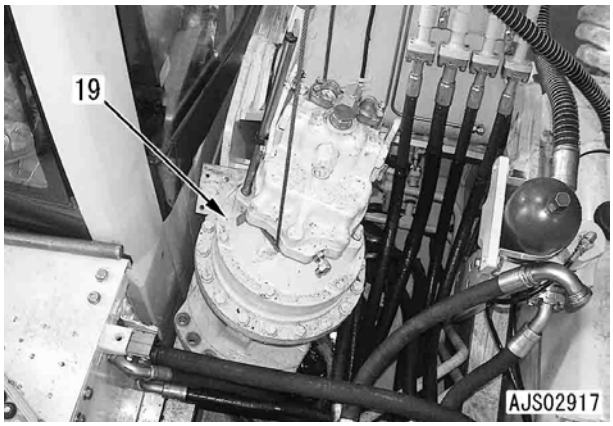
12. Remove 12 pcs. of mounting bolt (18). [*1]



13. Lift and remove the swing motor and swing machinery Assembly (19).
    - ★ Being careful not to damage hose (H), etc. with bar [1], lift the swing motor and swing machinery Assembly gradually and remove them.
    - ★ Being very careful for the drain hose, lift them.
    - ★ Lift them with full attention until surpass the hose of the center swivel joint.

    Swing motor and swing machinery Assembly: **250 kg**





Installation

- Installation is done in the reverse order of removal.

[*1]

Mounting bolt:
490 – 608 Nm {50 – 62 kgm}

- **Refilling with oil (hydraulic tank)**
  Refill hydraulic oil through the oil filler port to the specified level. Let the oil circulate in the hydraulic system by starting the engine. Then check the oil level again.

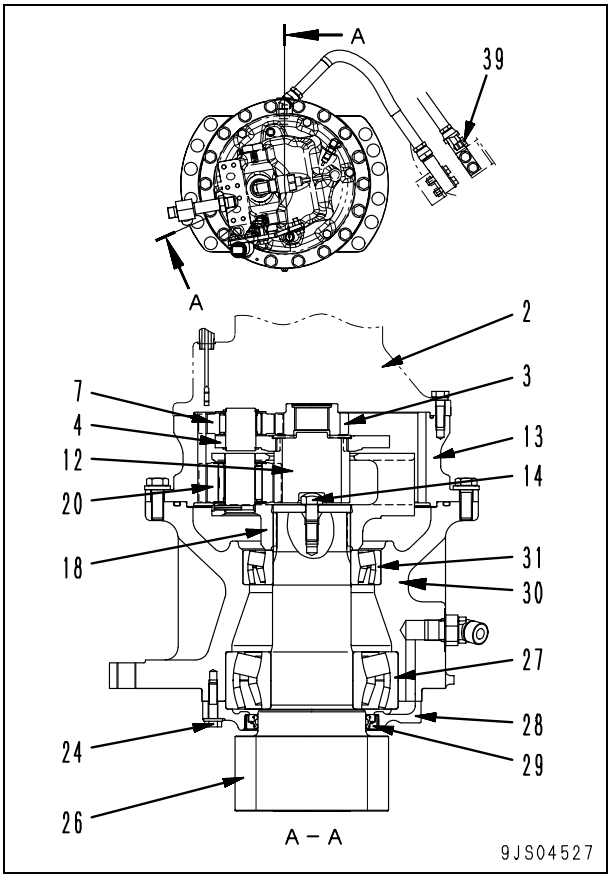
- **Air bleeding**
  Bleed the air from the circuit between the valve and the hydraulic cylinder. For details, see Testing and adjusting, air bleeding of various parts.

Disassembly and assembly of swing motor and swing machinery assembly

Special tools

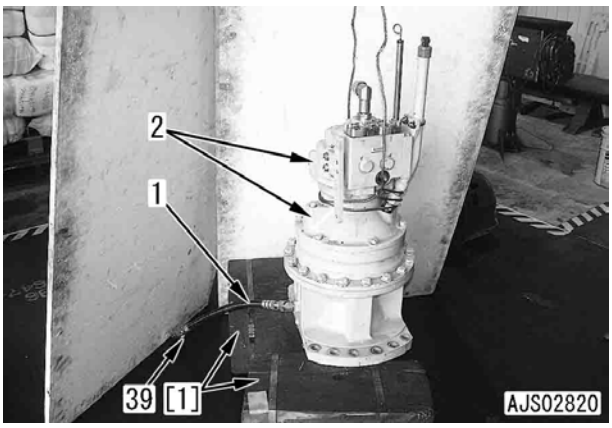
Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch
F	1	796T-426-1410 (PC210/230-8)	Push tool	■	1		○
		790-201-2860 (PC210/230-8)	Push tool	■	1		
	2	796-426-1120	Push tool	■	1		
	3	796T-426-1130	Plate	■	1		○
		790-101-5421	Grip	■	1		
		01010-81240	Bolt	■	1		

- Sectional view
- ★ A number shows the number in the text.
- ★ Though the drawing is for PC210/230/240-8 also operates in a similar way basically. The different parts are indicated in the text.

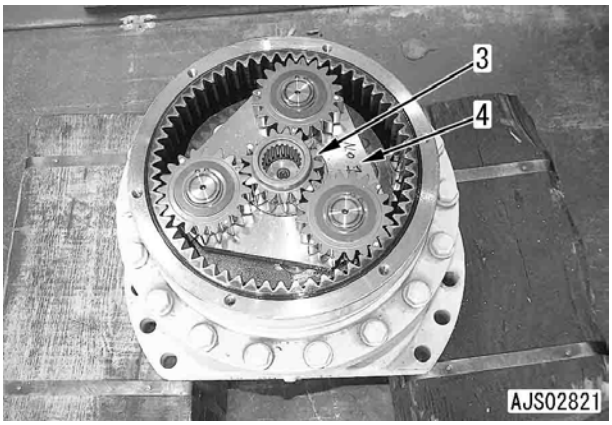


Disassembly

1. Set the swing motor and the swing machinery Assembly into block [1].
2. **Oil drain**
   Loosen drain plug (39) and drain the oil inside the swing machinery case. [*1]
   Swing machinery case: **Approx. 6.7ℓ**
3. Remove drain hose (1).
4. Remove 6 pcs. of the mounting bolt and remove the swing motor Assembly (2).
   Swing motor Assembly: **70 kg**

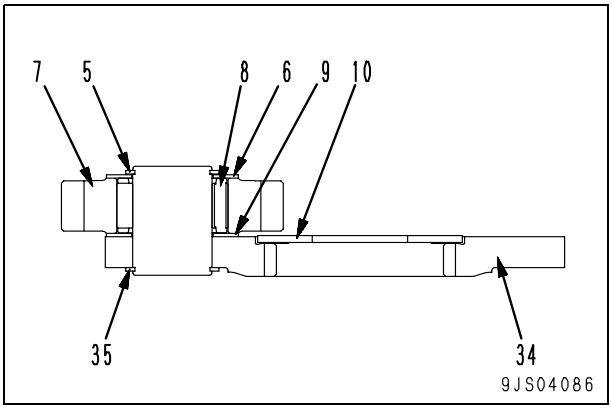


5. Remove No. 1 sun gear (3).
6. **No.1 carrier assembly**
   1) Remove No. 1 carrier assembly (4).

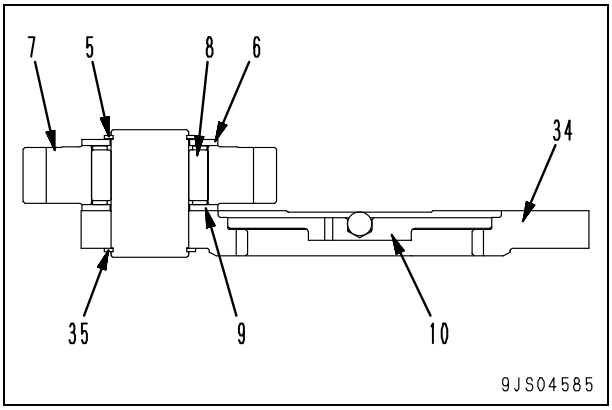


2) Disassemble No. 1 carrier Assembly by the following order.
   1] Remove snap ring (5), thrust washer (6), gear (7), bearing (8), snap ring (9) in order.
   2] Remove plate (10).
   3] Reverse carrier (34) and remove snap ring (35).

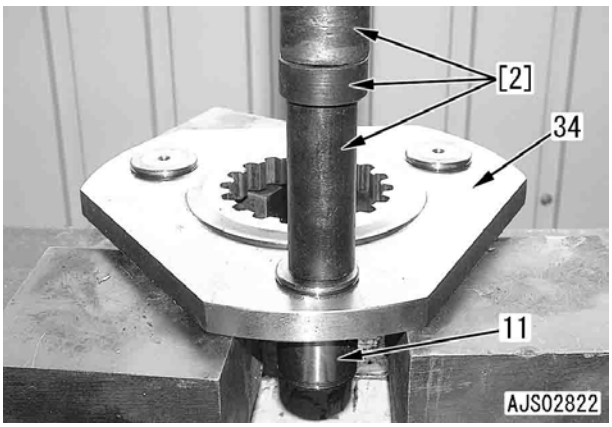
★ PC210-8, PC210LC-8, PC210NLC-8, PC230-8



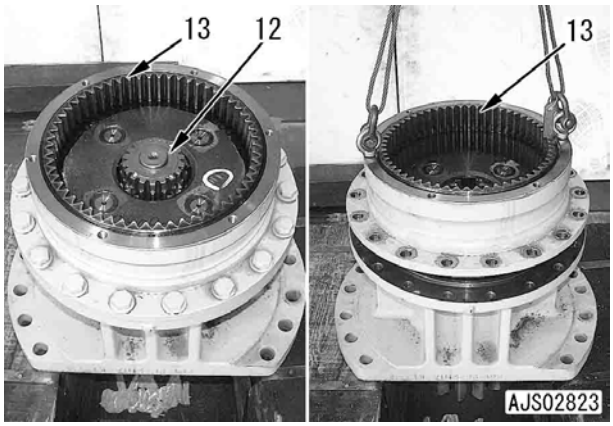
★ PC240LC-8, PC240NLC-8



3) Using push tool [2], remove shaft (11) from carrier (34).
   ● Input pin press (reference): 11.2 – 25.8 kN {1,140 – 2,630 kg}



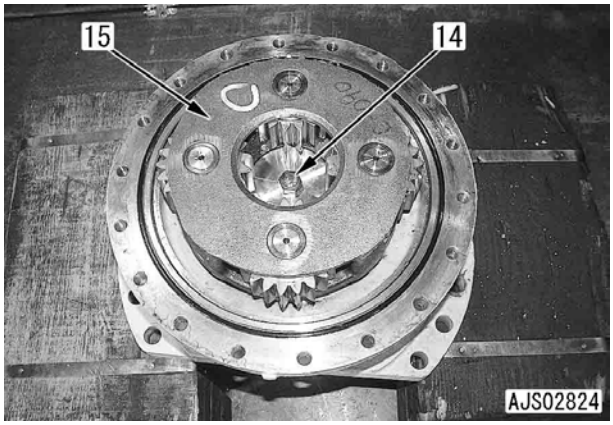
7. Remove No. 2 sun gear (12).
8. Remove the mounting bolt and remove ring gear (13).



9. Remove holder mounting bolt (14).

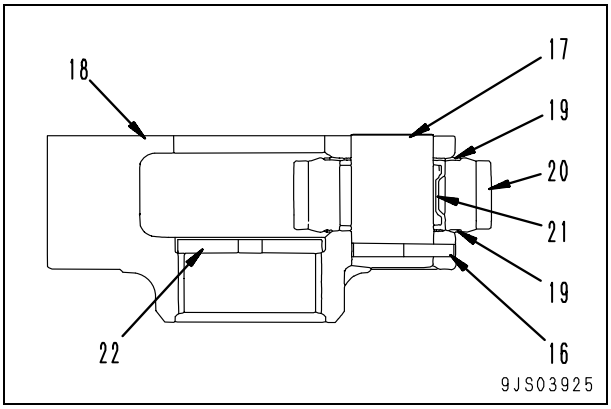
10. No.2 carrier assembly

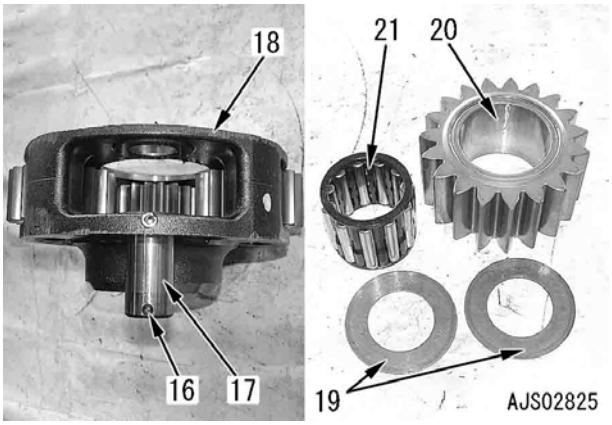
1) Remove No. 2 carrier assembly (15).



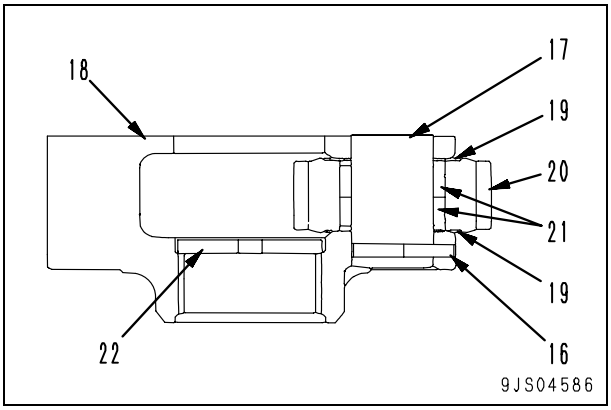
2) Disassemble No. 2 carrier assembly as follows.
   1] Push pin (16) and pierce shaft (17) from carrier (18).
      ★ After removing the shaft, remove pin (16).
   2] Remove thrust washer (19), gear (20), and bearing (21).
   3] Remove plate (22).

★ PC210-8, PC210LC-8, PC210NLC-8, PC230-8



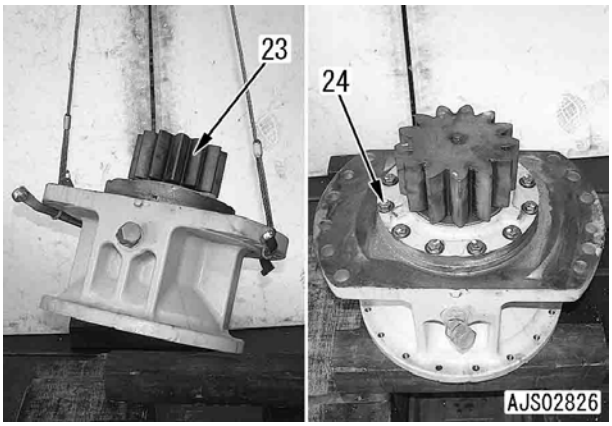


★ PC240LC-8, PC240NLC-8

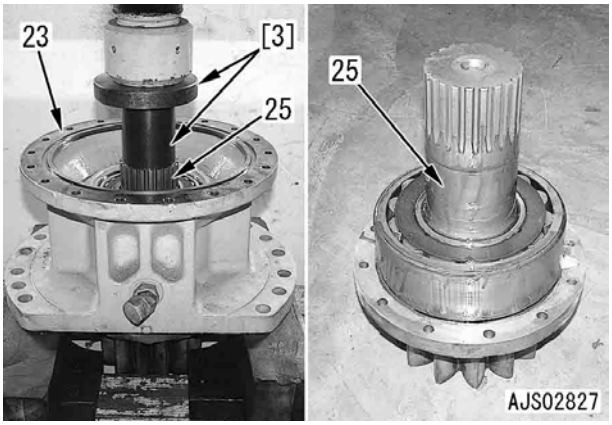


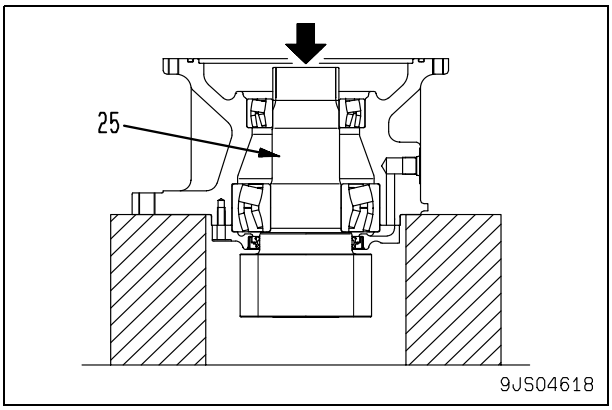
11. Shaft and case Assembly

1) Reverse shaft and case Assembly (23).
2) Remove cover mounting bolt (24).



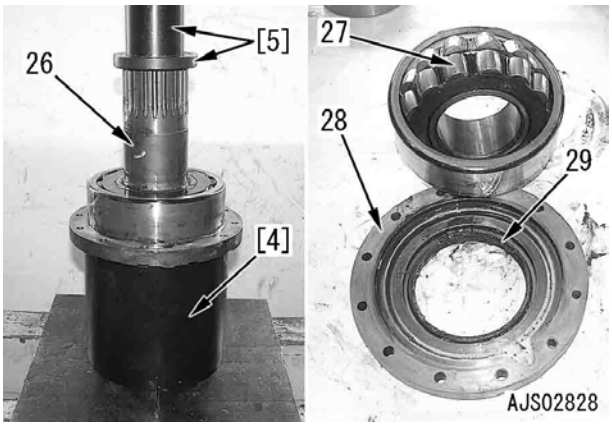
3) Reverse Shaft ·Case Assembly (23) again and set to the press.
4) Using push tool [3], remove shaft Assembly (25) from shaft and case Assembly (23).

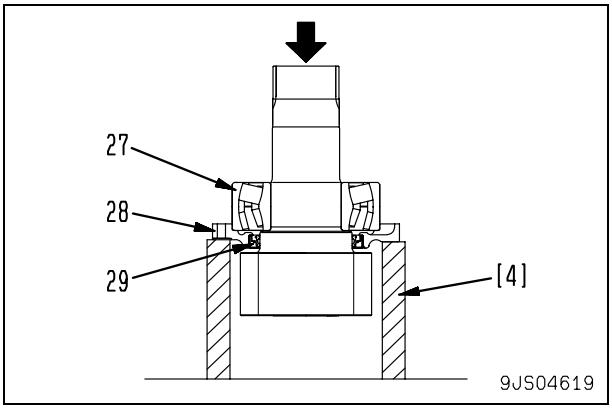




12. Shaft assembly

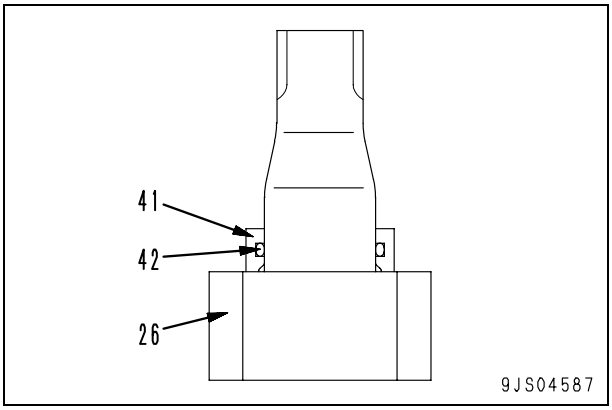
1) Using push tool [4], [5], remove shaft (26).
2) Remove bearing (27) and oil seal (29) from cover (28).





★ Only PC240LC-8, PC240NLC-8

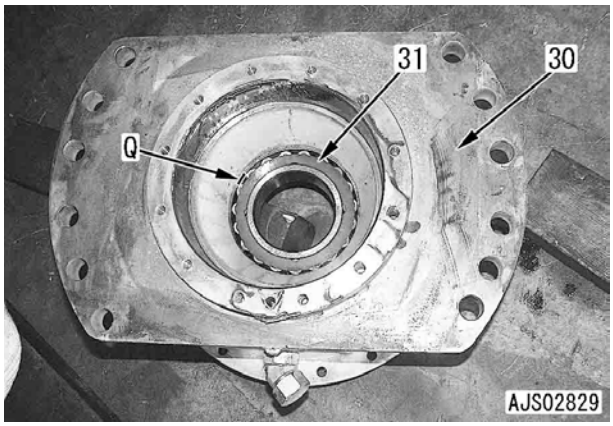
13. Remove spacer (41) and O ring (42) from shaft (26).



14. Remove bearing (31) from case (30).

★ Apply a suitable tool on the circumference of the outer race (thick line: Q section), strike the tool on the circumference with the hammer lightly, equally, by turns, and remove the bearing gradually.

★ If the outer race is made incline, bearing becomes hard, so remove it horizontally.



Assembly

★ Wash each part finely and check if there are not a garbage, a crack, etc., and apply power line oil to the sliding portion and assemble them.

★ The bearing and the oil seal, which were removed, are not re-used. New ones should be used.

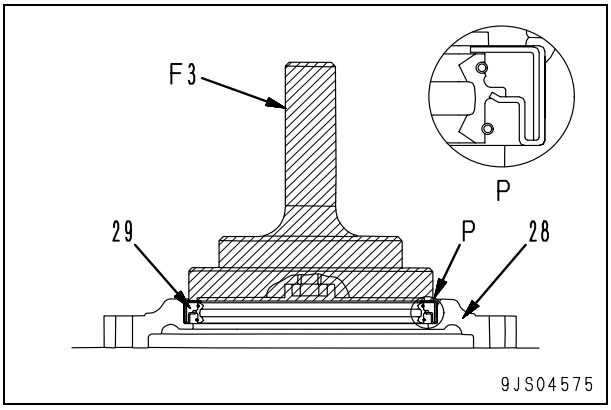
1. Oil seal

Using tool **F3**, install oil seal (29) into cover (28).

★ Be careful for the direction of the oil seal (up and down).

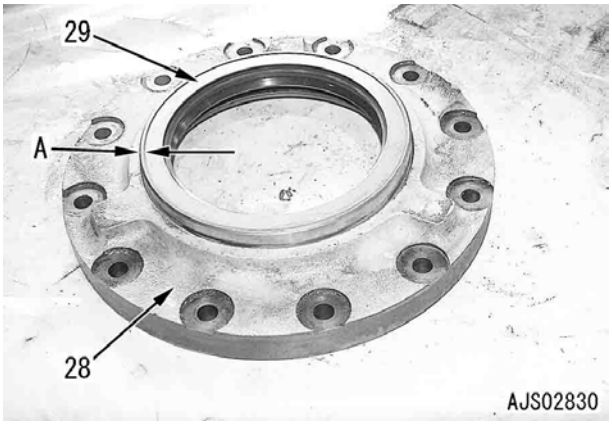
Outside perimeter of oil seal:
Gasket sealant (LG-6)

★ When press-fitting, take care so that gasket sealant (LG-6) will not stick to the lip surface of the oil seal.



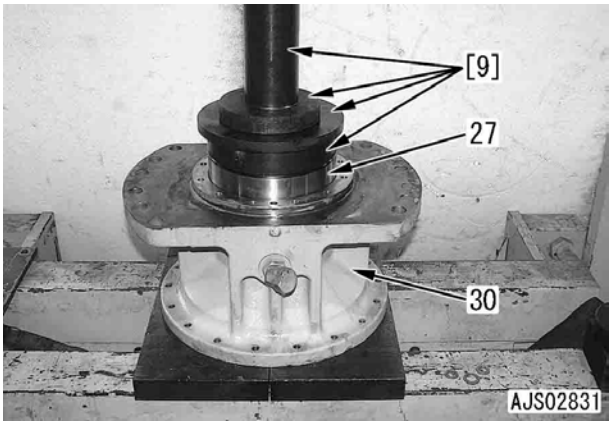
★ If tool **F3** is not used, use the push tool which can push outside perimeter section (A) of oil seal (29).

★ Be careful not to incline oil seal (29).



2. Using push tool [9], press fit bearing (27) into case (30).

★ Use the new bearing.

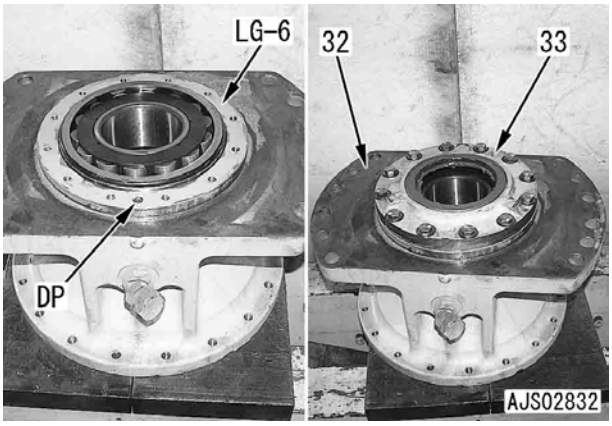


3. Install cover Assembly (33) into case Assembly (32).

Cover mounting face:
Gasket sealant (LG-6)

★ Be careful not to adhere gasket sealant (LG-6) to drain port section (DP).

★ Align the drain process section of cover into the drain port section (DP).



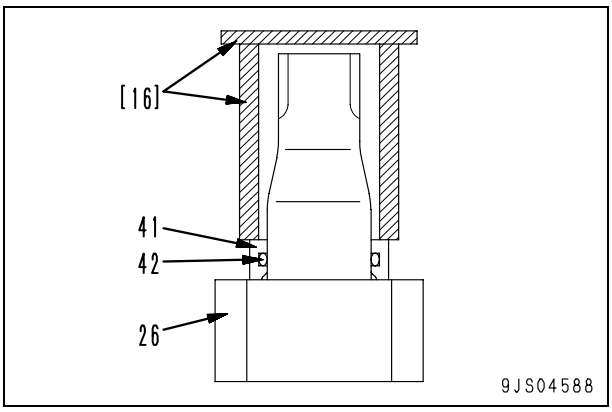
4. Shaft and case Assembly

★ 1) and 2) for PC240LC-8, PC240NLC-8 only.

1) Install O ring (42) into spacer (41).

2) Using push tool [16], press fit spacer (41) into shaft (26).

★ Be careful not to bite O ring (42).



3) Set case Assembly (32) into shaft (26).

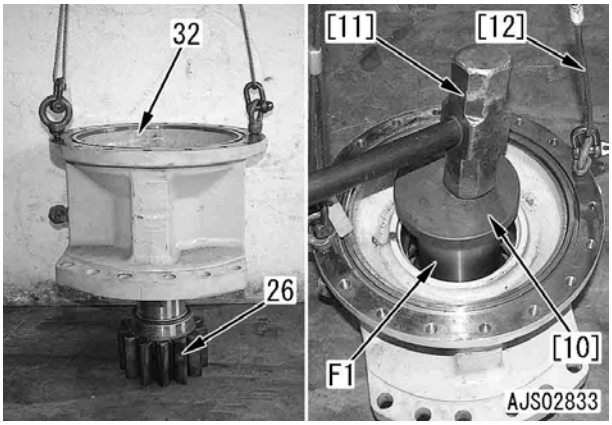
Oil seal lip section:

Grease (G2-LI)

★ Put case Assembly not to interfere the oil seal.

4) Using tool **F1**, push tool [10], and hammer [11], strike inner race section of bearing (27) not to fall down the shaft.

★ Let lifting tool [12] be slacked.



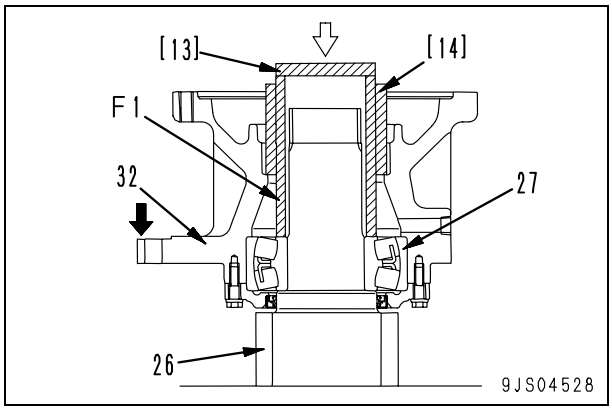
5) Set into the press.

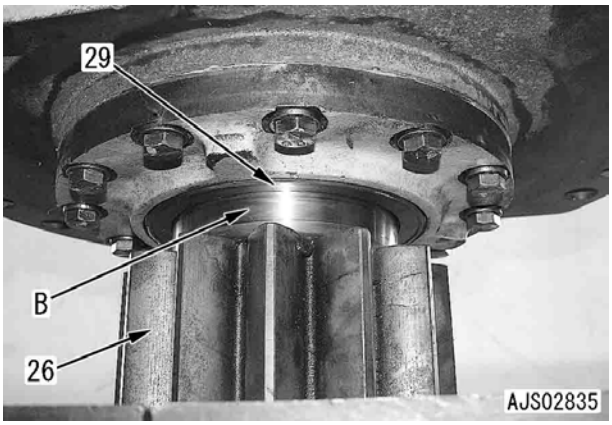
6) Using tool **F1**, push tool [13], [14], press fit inner race section of bearing (27).

★ Put in push tool [14] for the cases that the case Assembly is inclined a lot.

★ If case Assembly (32) is inclined, strike the flange section lightly and corrected it.

★ Just before oil seal (29) goes into shaft (B) part, case Assembly (32) is leveled so that case Assembly (32) may be located at the center of shaft (26), and be careful not to damage the oil seal lip part.





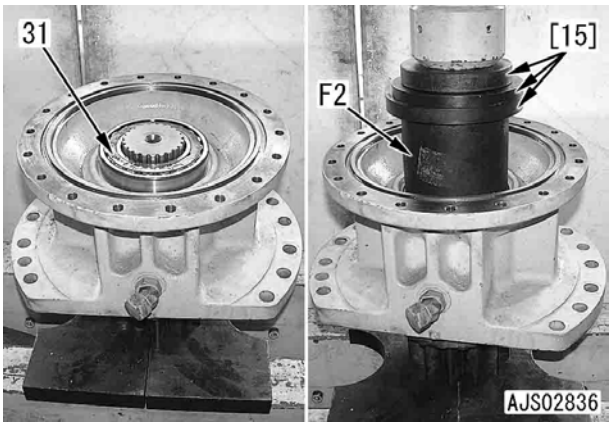
5. Bearing

Using tool **F2** and push tool [15], press fit bearing (31).

★ When press-fitting the bearing, press both inner and outer races of the bearing at the same time. Avoid pressing the inner race only.

● Input pin press (reference):
Inner side 9.4 – 26.6 kN {960 – 2,710 kg}
Outer side 0 – 8.9 kN {0 – 910 kg}

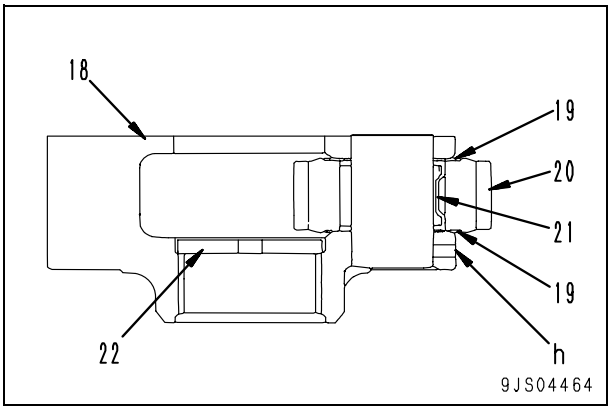
★ After the bearing is press-fitted, check that the case will turn freely.



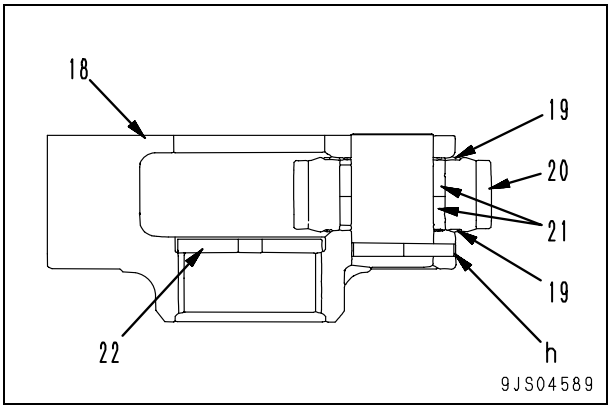
6. No.2 carrier assembly

1) Assemble No. 2 carrier assembly as follows.
   ★ Since there is a mark to be caulked in the side hole h of career (18) at the time of pin insertion, remove climax for hole inner diameter beforehand. (Refer to 5])
   1] Incorporate plate (22) into career (18).
   2] Incorporate bearing (21) and 2 pcs. of upper and lower thrust washer (19) into gear (20).
   3] Set gear Assembly into career (18).

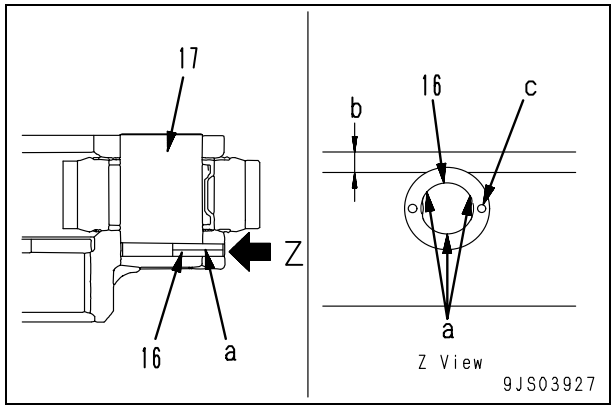
★ PC210-8, PC210LC-8, PC210NLC-8, PC230-8



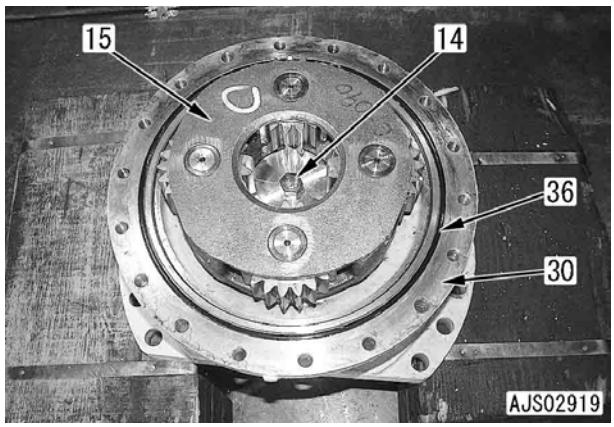
★ PC240LC-8, PC240NLC-8



   4] Strike lightly with plastic hammer, etc., align pin hole location of shaft (17) and career and install shaft (17).
      ★ Install the shaft, rotating the planetary gear. Take care so the thrust washer is not damaged.
   5] Insert pin (16),
      ★ As inserting the pin, install not to interfere claw section (**a** section) which is in 3 places on circumference into career thin part (**b** section).
      However, actual thing may have the thin section on the other side. So make sure to confirm the actual thing and assemble not to interfere claw section of the pin into the thin part.
      ★ After inserting the pin, caulk 2 parts of the career (c) around the pin hole.



2) Install No.2 career Assembly (15) with bolt (14).
   Mounting bolt threaded section: **Adhesive compound (LT-2)**
   mounting bolts: **157 – 196 Nm {16 – 20 kgm}**
3) Install O ring (36) into case (30).



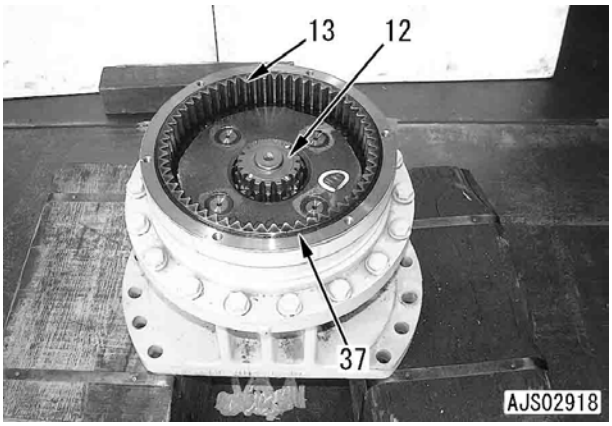
7. No. 2 sun gear
Install No. 2 sun gear (12).

8. Ring gear
Using eyebolt (M10 x 1.5), install ring gear (13).

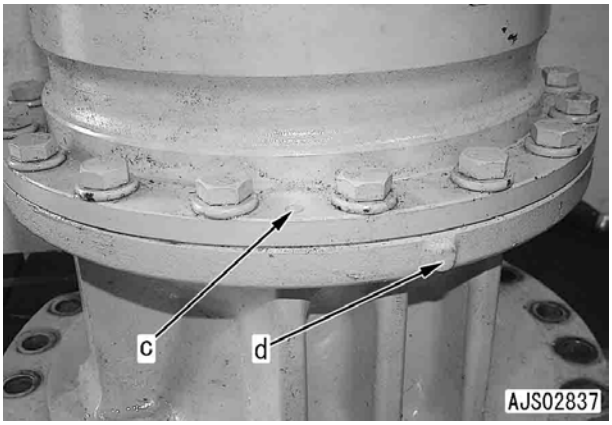
★ De-grease mating face of ring gear (13) and case (30).
★ Not to adhere gasket sealant in mating face of the ring gear and the case.
★ Align the counter mark on the ring gear (Portion **c**) and the convex portion on the case flange (Portion **d**) in the position illustrated in the following figure, and then install it.

mounting bolts:
157 – 196Nm {16 – 20 kgm}

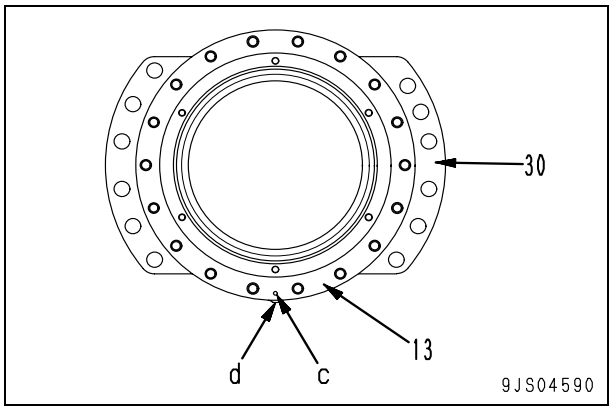
9. Install O ring (37).



★ PC210-8, PC210LC-8, PC210NLC-8, PC230-8

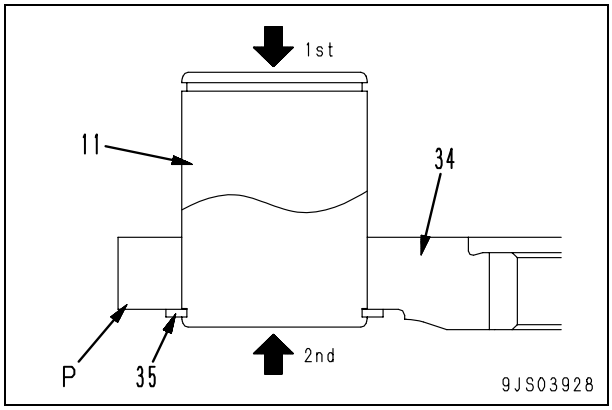


★ PC240LC-8, PC240NLC-8



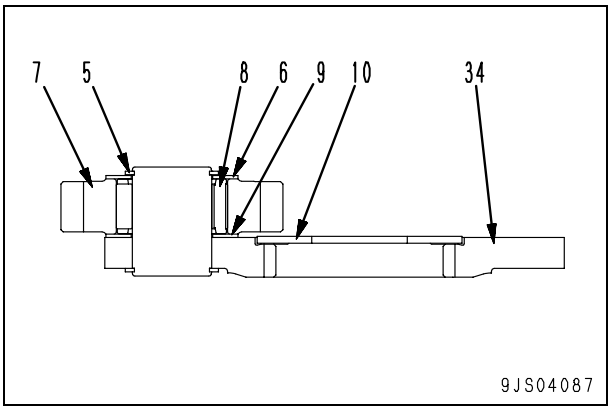
10. No.1 carrier assembly

1) Assemble No. 1 carrier assembly as follows.
   1] Press fit shaft (11) into career (34) in the arrow direction (1st) until the slot on the snap ring can be seen.
   2] After installing snap ring (35), push back (to the 2nd direction) from the opposite side until the snap ring adheres to the carrier P surface. Be careful no to push too much.
   - Input pin press (reference):
     11.2 – 25.8 kN {1,140 – 2,630 kg}

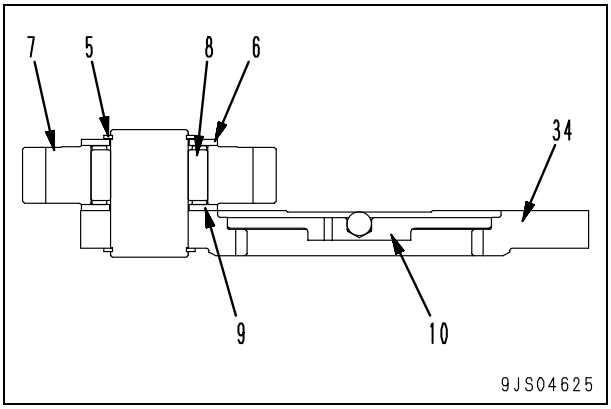


3] Install plate (10) into carrier (34).
4] Install thrust washer (9), bearing (8), gear (7), thrust washer (6), snap ring (5) in order.

★ PC210-8, PC210LC-8, PC210NLC-8, PC230-8



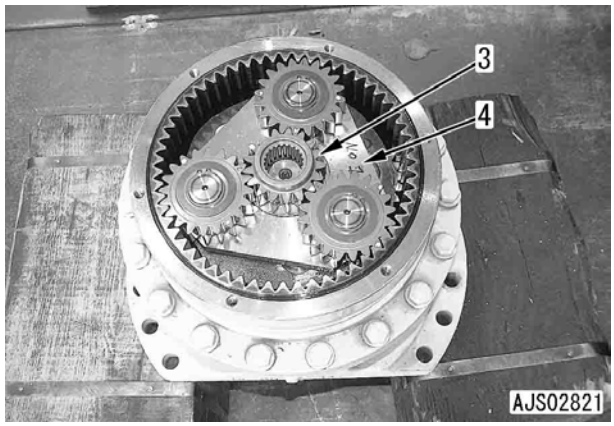
★ PC240LC-8, PC240NLC-8



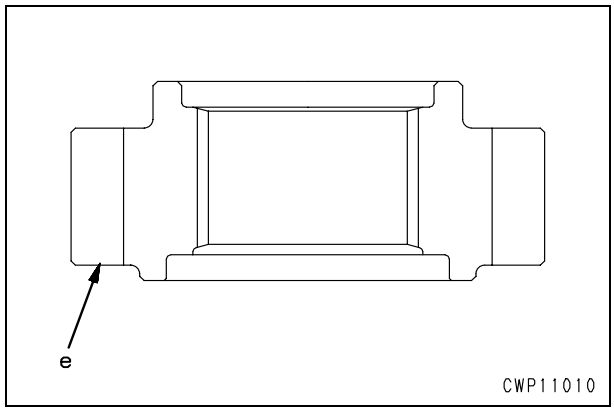
2) Install No. 1 carrier assembly (4).

11. No.1 sun gear Assembly
Install No. 1 sun gear (3).

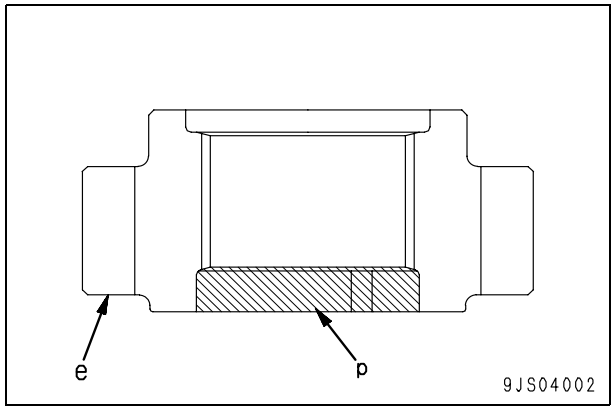
★ When installing the No. 1 sun gear, be careful not to install it upside down.
★ Install the No. 1 sun gear with the tooth portion (Portion **e**) facing down.



★ PC210-8, PC210LC-8, PC210NLC-8, PC230-8



★ PC240LC-8, PC240NLC-8
★ **p**: Press fit plate



12. Swing motor Assembly

Put Swing motor Assembly (2) on ring gear (13).

Swing motor Assembly: **70 kg**

★ De-grease mating face of swing motor Assembly (2) and ring gear (13).

★ Not to adhere gasket sealant in mating face of swing motor Assembly (2) and ring gear (13).

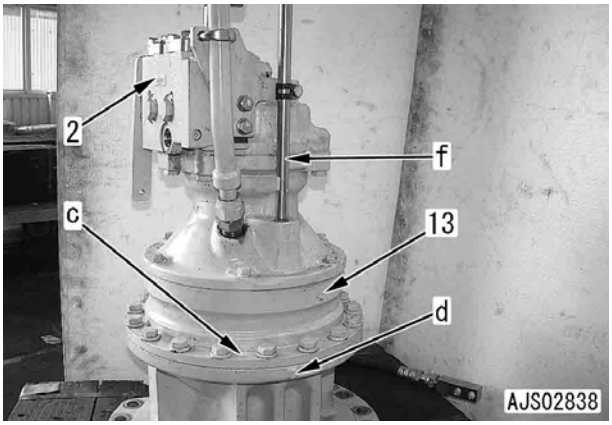
★ After aligning the position of swing motor Assembly (2) and ring gear (13) as follows and install them.

mounting bolts:

59 – 74 Nm {6.0 – 7.5 kgm}

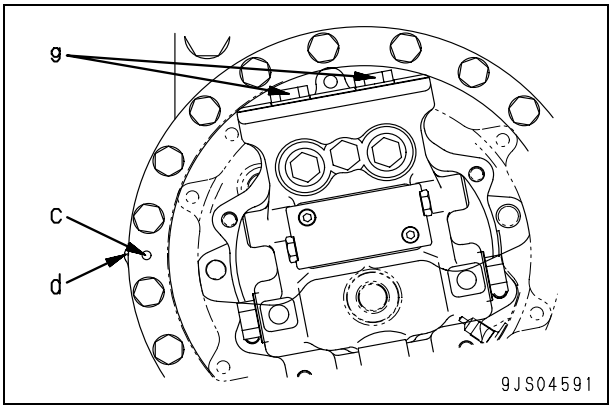
★ PC210-8, PC210LC-8, PC210NLC-8, PC230-8

- Align the relation between the positions of the filler (**f** section) and convex portion of the case (**d** section) as mentioned in the drawing and install them.(**c,d**: Above-mentioned)



★ PC240LC-8, PC240NLC-8

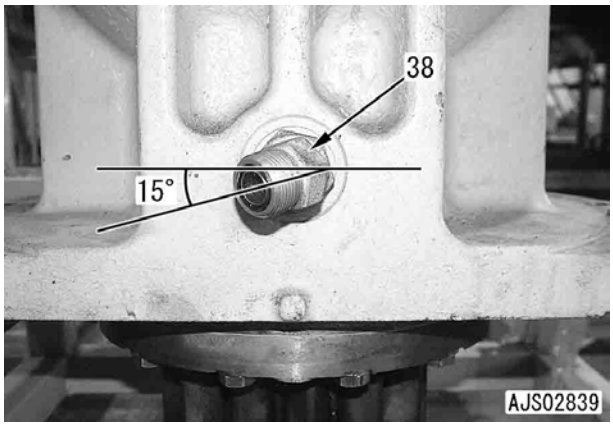
- Align the relation between the positions of the motor port (**g** section) and convex portion of the case (**d** section) as mentioned in the drawing and install them. (**c,d**: Above-mentioned)



13. Confirm mounting angle of elbow for drain (38): 15°and the tightening torque.

Elbow mounting nut:

128 – 186 Nm {13.0 – 19.0 kgm}



14. Install the drain hose.

★ As installing the hose, be careful that the drain plug to be downward.

Drain hose:

128 – 186 Nm {13.0 – 19.0 kgm}

15. Oil refill

Fill the power line oil(**TO30**) from oil filler port up to the standard level by tightening the drain plug.

Drain plug:

19.6 – 24.5 Nm {2.0 – 2.5 kgm}

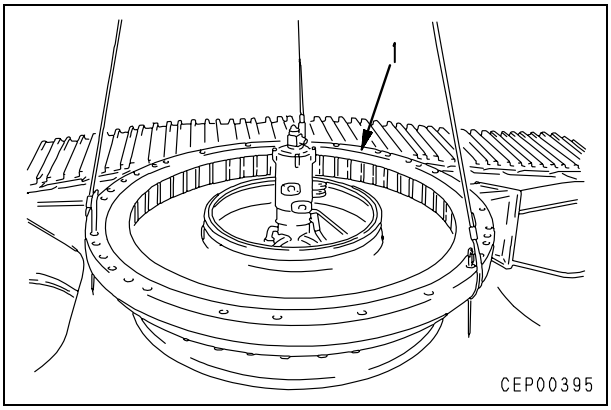
Swing machinery case: **Approx. 6.7ℓ**

Removal and installation of swing circle assembly

Removal

1. Disassemble the revolving frame assembly referring to the Disassembling Revolving Frame Assembly section in this manual.

2. Sling swing circle assembly (1) at three points and remove the mounting bolt to remove the assembly. [*1]
   Swing circle Assembly: **300 kg**



Installation

- Installation is done in the reverse order of removal.

[*1]
★ Let the soft zone position S mark of an inner race: a and the soft zone position S mark of an outer race: b to be right side of the body as mentioned below and install it to the track frame.
Amount of filled grease:
Grease (G2-LI) 15.8ℓ

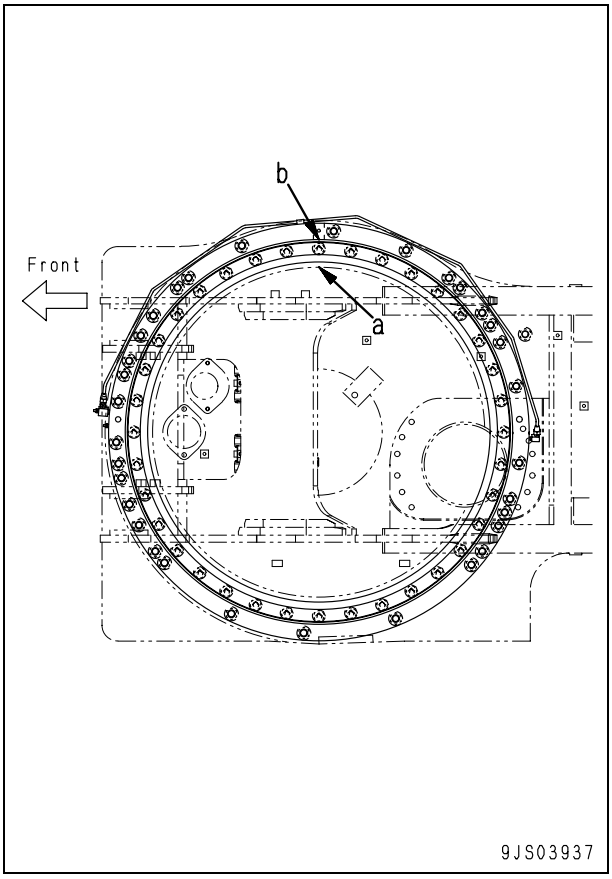
Swing circle mounting bolt threaded portion:
Adhesive compound (LT-2)

- In case of torque tightening:

Swing circle mounting bolt:
716 – 814 Nm {73 – 83 kgm}

- In case of angle tightening:

Swing circle mounting bolt:
1) Initial torque:
294.2 ± 29.4 Nm {30 ± 3 kgm}
2) After that, rotate the bolt 60 ± 6 °



PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00661-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

50 Disassembly and assembly

Under carriage and frame

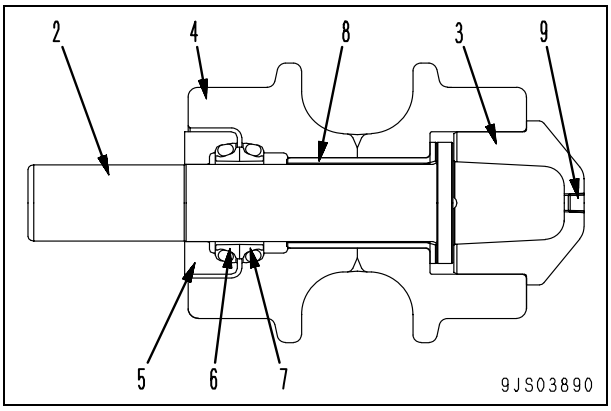
Under carriage and frame

Disassembly and assembly of carrier roller

Special tools

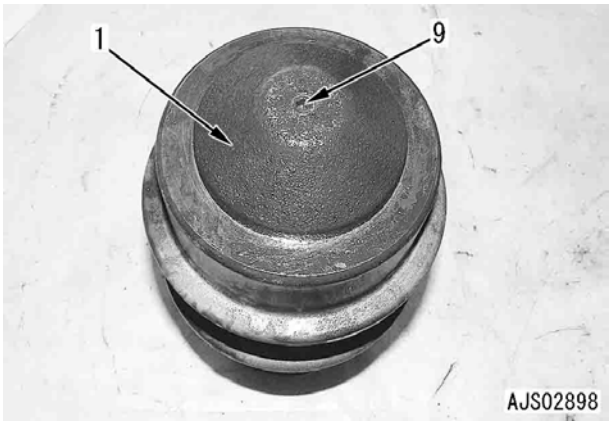
Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch
L	1	790-434-1660	Installer	■	1		

- Sectional view
- ★ A number shows the number in the text.

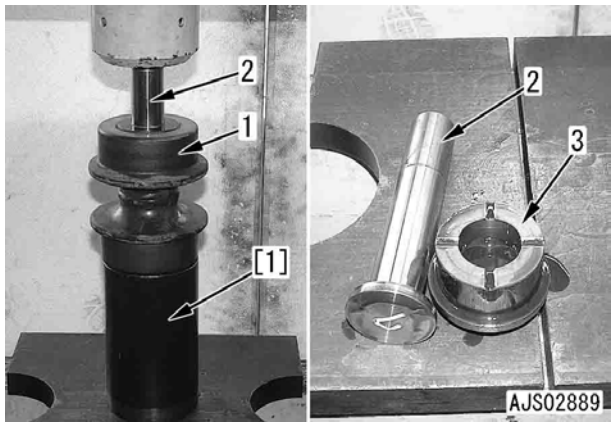


Disassembly

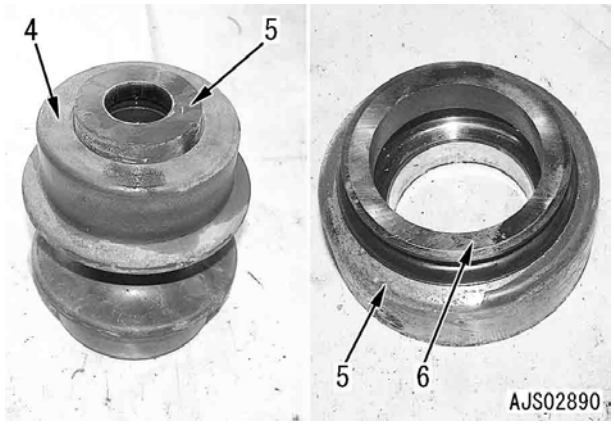
1. Remove plug (9) and drain the oil from carrier roller (1).
   Carrier roller **75 – 85mℓ**



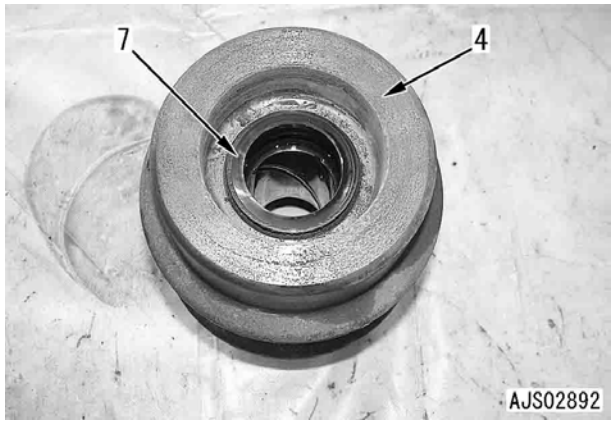
2. Using push tool [1], push the end surface of a shaft and remove followings from carrier roller (1):
   - Roller (4) ·ring (5) assembly, shaft (2) and cover (3).
   - Press fitting force (reference):
     59 kN {6,000 kg} Min
   - ★ The press fitted shaft (2) and ring (5), and also roller (4) and cover (3) will be both disassembled.
   - ★ Cover (3) is placed under shaft (2).



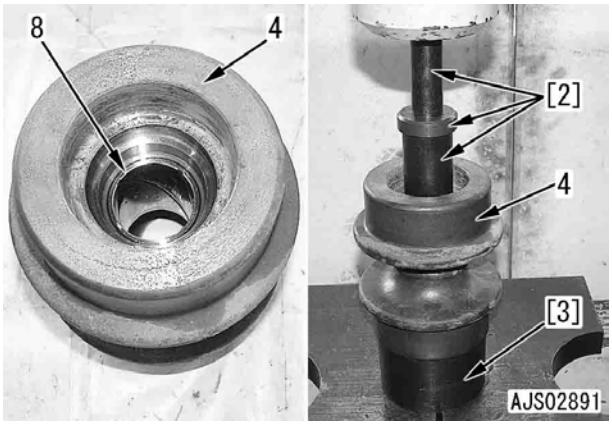
3. Remove ring (5) from roller (4).
4. Remove floating seal (6) from ring (5).
   - ★ Take care not to damage the sealing surface.



5. Remove floating seal (7) from roller (4).
   - ★ Take care not to damage the sealing surface.

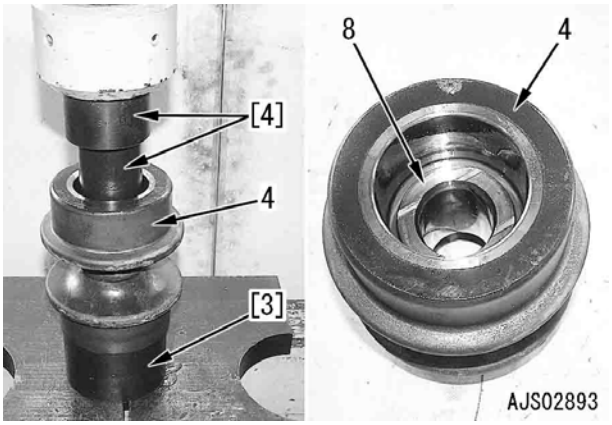


6. Using push tools [2] and [3], remove bushing (8) from roller (4).



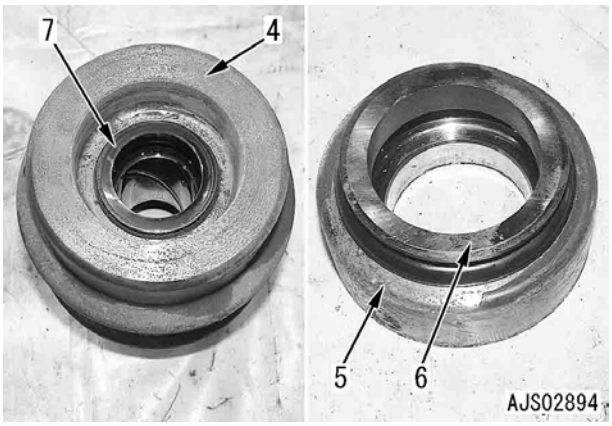
Assembly

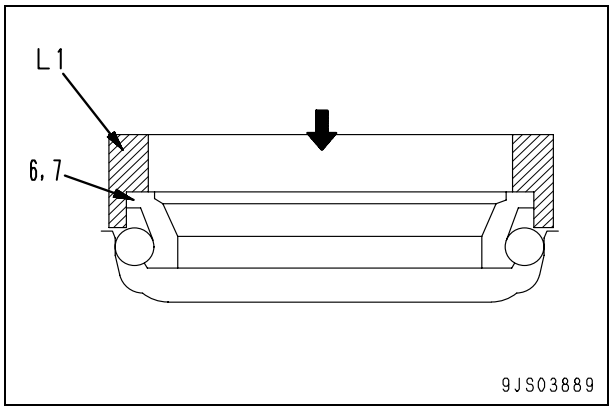
1. Using push tools [3] and [4], press fit bushing (8) to roller (4).
   ★ Press it from the side of cover (3)

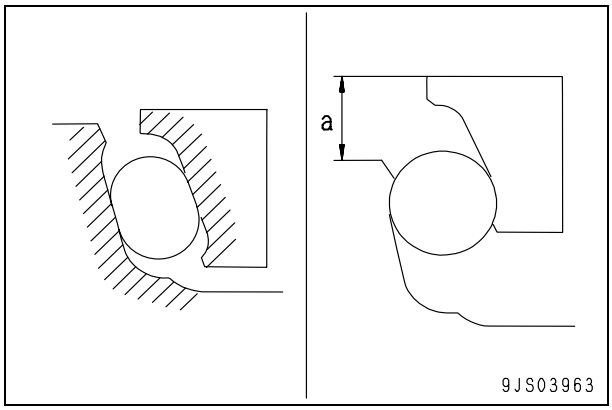


2. floating seal

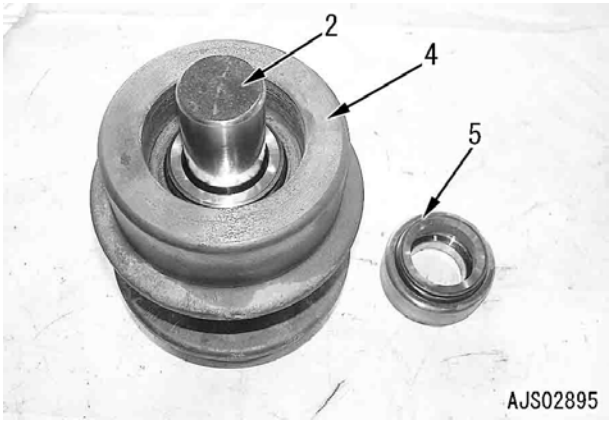
1) Using tool **L1**, install floating seal (7) to roller (4).
2) Using tool **L1**, install floating seal (6) to roller (5).
   ★ When installing the floating seal, completely wash and de-grease and dry both O-ring and the surfaces where the O-ring and the floating seal will contact each other (hatched in the sketch). And take care that there is no dust sticking on the contact surface of floating seal.
   ★ When fitting the floating seal, use a tool **L1** and be sure that the O-ring is pushed during the insertion.
   ★ After inserting the floating seal, verify that the inclination of the seal is less than 1 mm per its diameter and that the protrusion height of the seal shown as a in the illustration falls within the range of 7 – 11 mm.



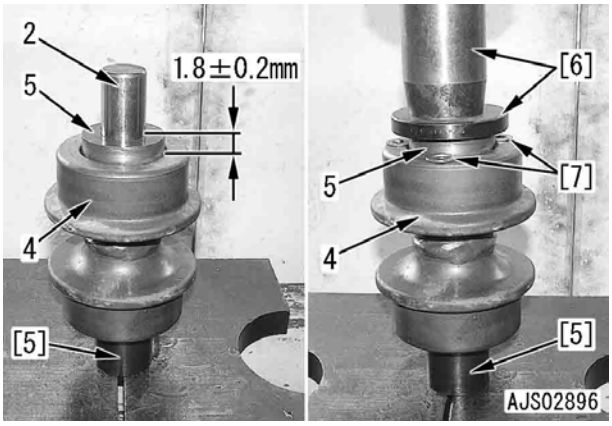




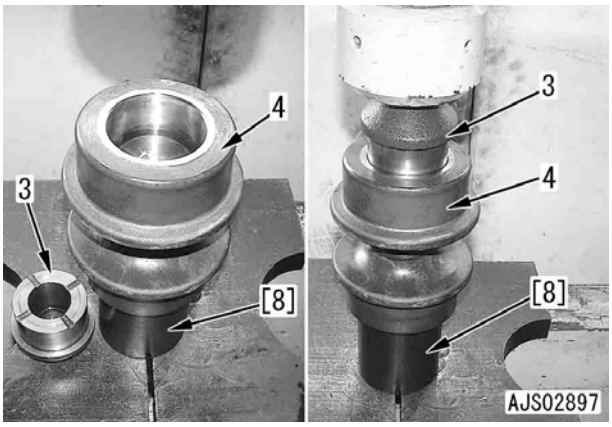
3. Install roller (4) and ring (5) to shaft (2).
   ★ On the sliding surfaces of floating seals, apply some oil and take care not to have any dirt stuck on them.



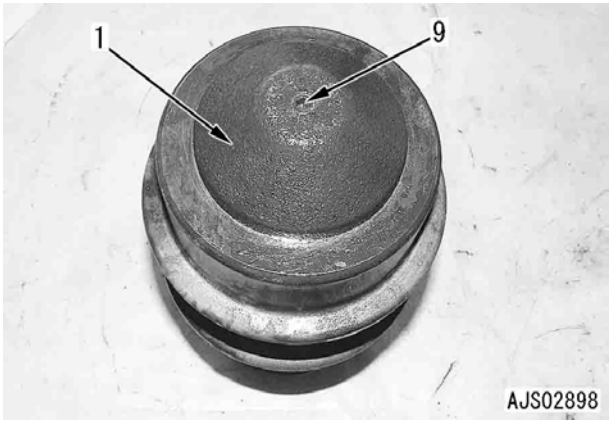
4. To make the height gap between roller (4) and ring (5) **1.8 ± 0.2 mm**, put washer [7] between push tool [6] and roller (4), then press fit ring (5) to shaft (2).
   ★ The thickness of washer [7] is **1.8 ± 0.2 mm.**
   ★ Use push tool [5] to support shaft (2) on it.



5. Using push tool [8], press fit cover (3) to roller (4).
   ★ De-grease, wash and dry the surfaces where roller (4) and cover (3) fit tight.
   ● Press fitting force (reference):
   59 kN {6,000 kg} Min



6. Fill carrier roller assembly (1) with oil and tighten plug (9).
   Carrier roller: **75 – 85cc (E030-CD)**
   Plug: **15 ± 5 Nm {1.5 ± 0.5 kgm}**



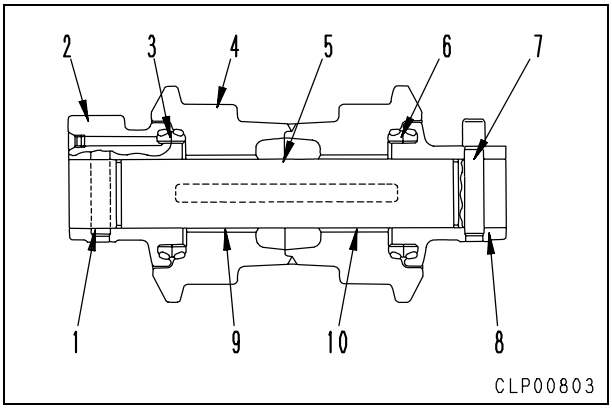
Disassembly and assembly of track roller assembly

Special tools

Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch
L	2	796-670-1020	Installer	■	1		

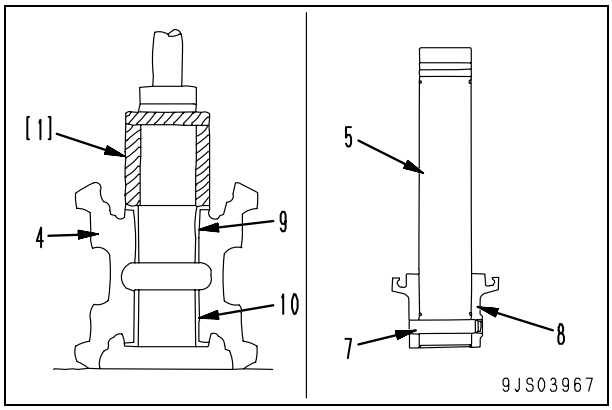
Disassembly

1. Remove pin (1) and then collar (2).
2. Remove floating seal (3) from collar (2) and roller (4).
3. Pull out roller (4) from shaft (5) and collar (8) assembly.
   ★ Since 195 cc of oil is filled in, drain it at this timing, or underlay some cloth to prevent any careless smearing.
4. Pull out other side floating seal (6) from roller (4), shaft (5) and collar (8) assembly.
5. Remove pin (7) and then collar (8) from shaft (5).
6. Remove bushing (9) and (10) from roller (4).

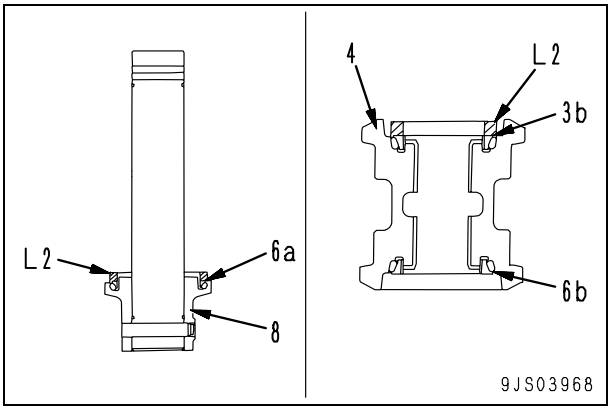


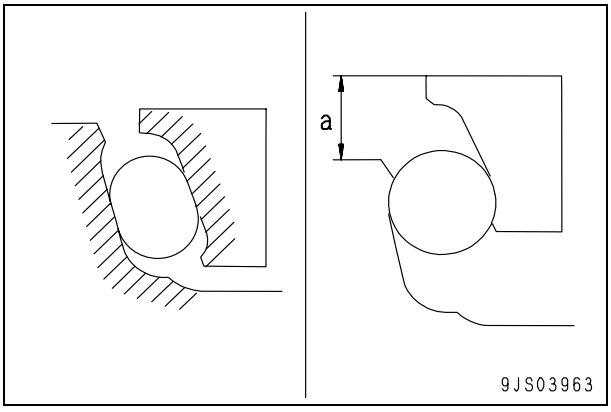
Assembly

1. Using push tool [1], press fit bushing (9) and (10) to roller (4).
2. Fit an O-ring and install collar (8) to shaft (5), and insert pin (7).



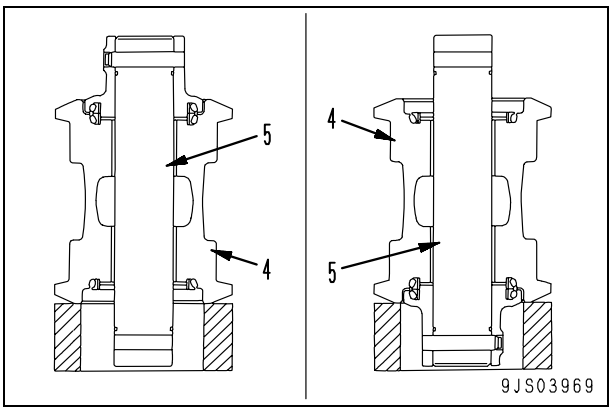
3. Using tool **L2**, install floating seal (6a) to collar (8).
   - ★ When installing the floating seal, completely wash, de-grease and dry both O-ring and the surfaces of floating seal where they contact each other (shown hatched in the illustration). And take care that there is no dust sticking on the contact surfaces of floating seal.
   - ★ After inserting the floating seal, verify that the inclination of the seal is less than 1 mm per its diameter and that the protrusion height shown as **a** in the illustration falls within the range of 7 – 11 mm.
4. Using tool **L2**, install floating seals (6b) and (3b) to roller (4).
   - ★ As to notes for installation of floating seals (6b) and (3b), refer to ★ marked comments in the section 3.





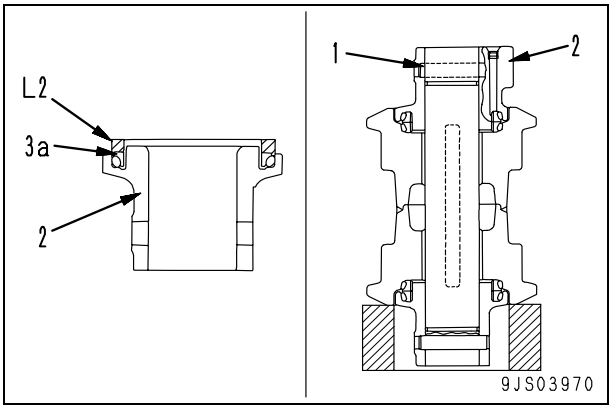
5. Install shaft (5) to roller (4).

6. Put roller (4) and shaft (5) assembly up side down.



7. Using tool **L2**, install floating seal (3a) to collar (2).
   - ★ As to notes for installation of floating seal (3a), refer to ★ marked comments in the section 3.
   - ★ On the sliding surfaces of the floating seals, apply some oil and take care not to have any dust stuck on them.

8. Fit an O-ring and install collar (2) to the shaft with pin (1).



9. Add oil and tighten the plug.

   Amount of oil: **190 – 200 cc (E030-CD)**
   Plug: **15 ± 5 Nm {1.5 ± 0.5 kgm}**

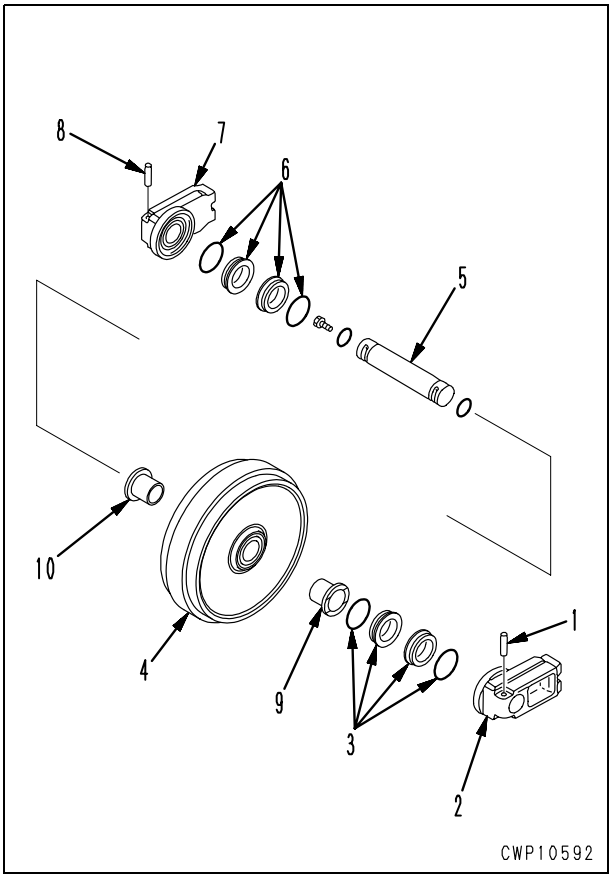
Disassembly and assembly of idler assembly

Special tools

Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch
L	3	791-530-1510	Installer	■	1		

Disassembly

- Structural illustration

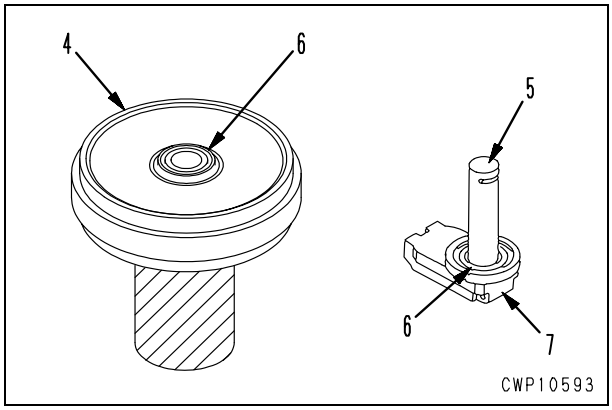


1. Remove the dowel pin (1) to dismount the support (2).

2. Remove the floating seal (3) from the support (2) and idler (4).

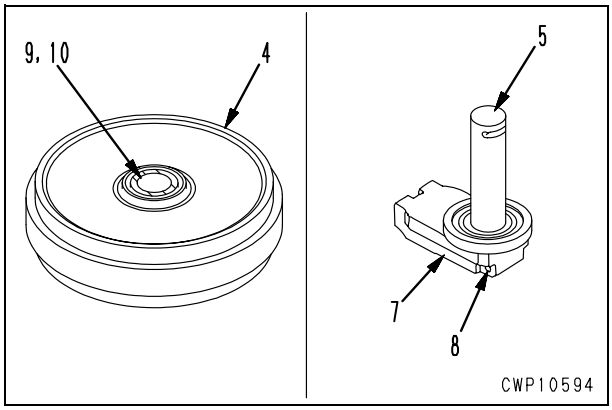
3. Detach idler the (4) from shaft (5) and support assembly (7).
   ★ Since 250cc of oil is filled in, drain it at this timing, or underlay some cloth to prevent any careless smearing.

4. Remove floating seal (6) on the opposite side from idler (4), shaft (5) and support assembly (7).



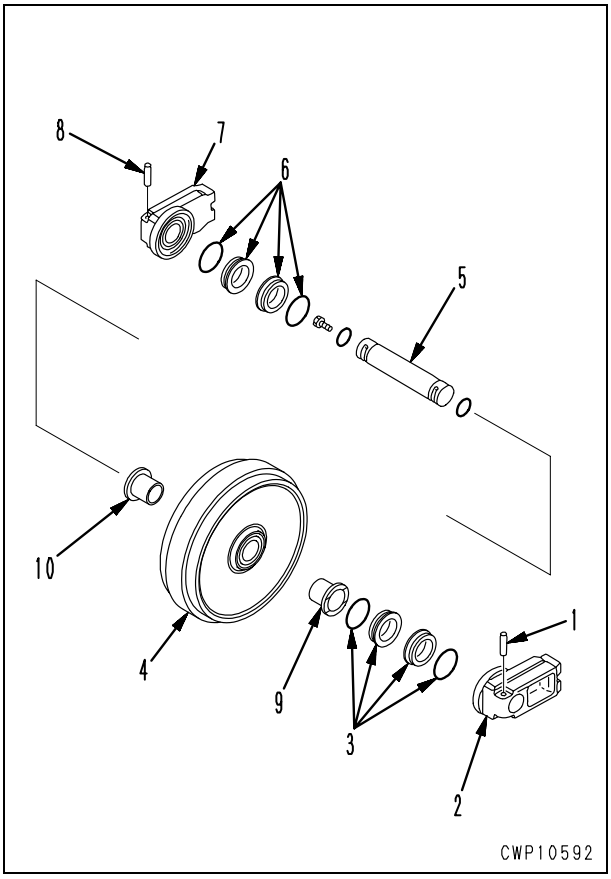
5. Remove dowel pin (8) to detach support (7) from shaft (5).

6. Remove bushings (9) and (10) from idler (4).

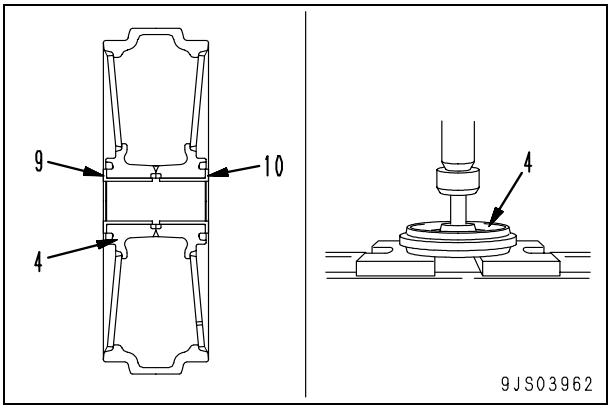


Assembly

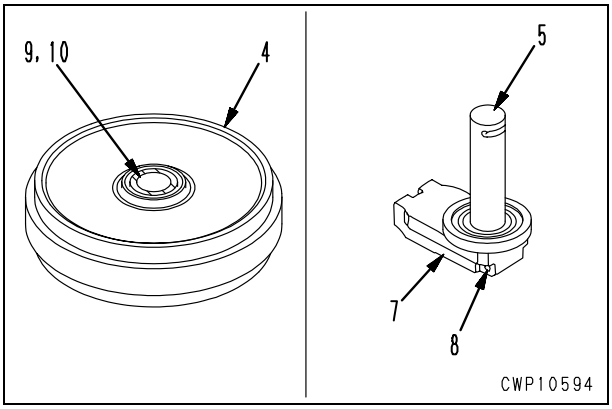
- Structural illustration



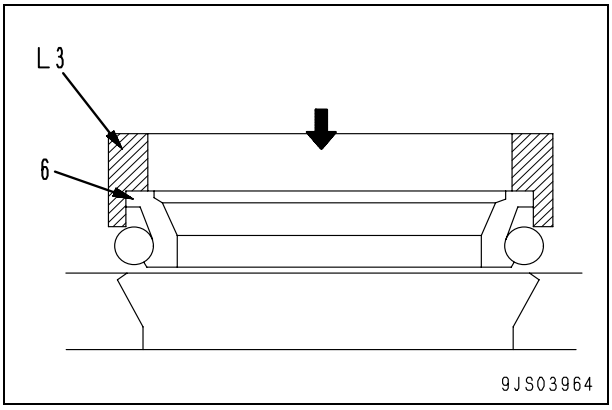
1. Press fit bushings (9) and (10) to idler (4).

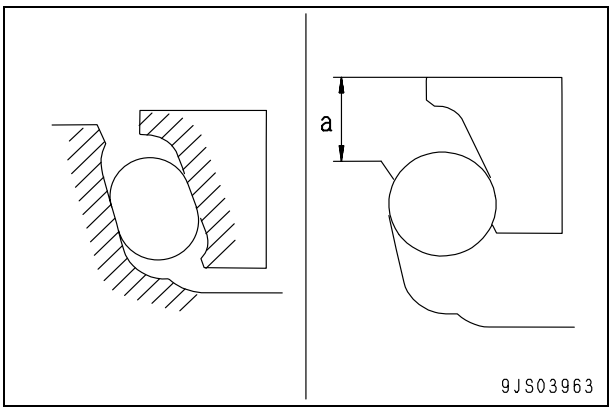


2. Fit an O-ring and install support (7) to shaft (5) with dowel pin (8).

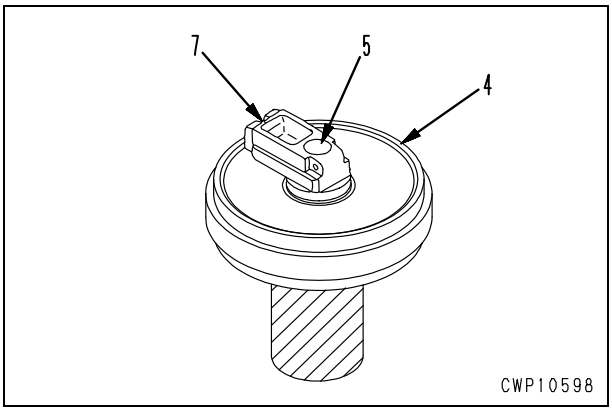


3. Using tool **L3**, install floating seals (6) to idler (4) and to shaft (5) and support (7) assembly.
   - ★ Completely wash, de-grease and dry both O-rings and the surfaces (shown hatched in the illustration) of floating seals where they contact each other.
   - ★ Coat the sliding surface of the floating seal with oil, and be careful not to let any dirt or dust get stuck to it.
   - ★ After inserting the floating seal, verify that the inclination of the seal is less than 1 mm per its diameter and that the protrusion height shown as **a** in the illustration falls within the range of 7 – 11 mm.

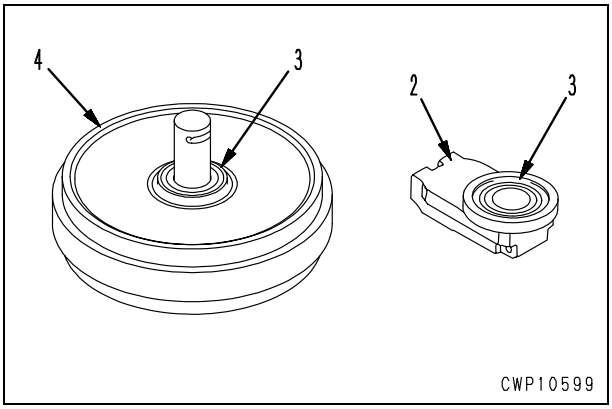


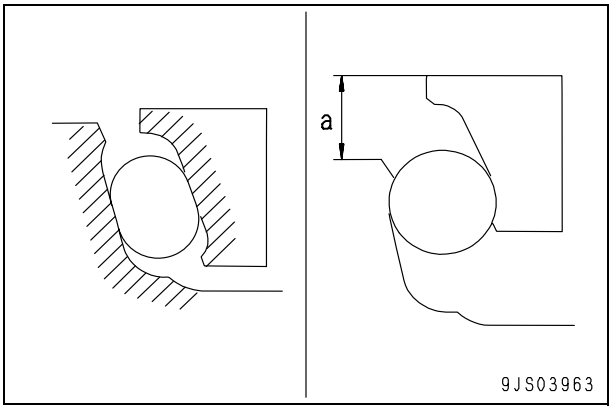


4. Assemble shaft (5) and support (7) assembly to idler (4).



5. Using tool **L3**, install floating seals (3) to idler (4) and to support (2).
   - ★ Completely wash, de-grease and dry both O-rings and the surfaces (shown hatched in the illustration) of floating seals where they contact each other.
   - ★ Coat the sliding surface of the floating seal with oil, and be careful not to let any dirt or dust get stuck to it.
   - ★ After inserting the floating seal, verify that the inclination of the seal is less than 1 mm per its diameter and that the protrusion height shown as **a** in the illustration falls within the range of 7 – 11 mm.





6. Fit an O-ring and install support (2) to the shaft with dowel pin (1).
   - ★ See structual illustration.

7. Add oil and tighten the plug.
   - Amount of oil: **245 – 255 cc (E030-CD)**
   - Plug: **205.8 ± 49 Nm {21 ± 5 kgm}**

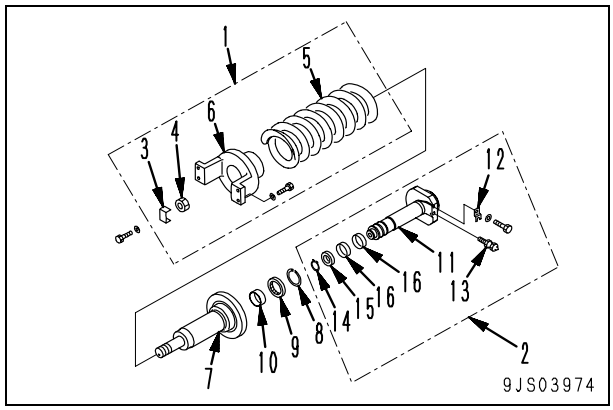
Disassembly and assembly of recoil spring

Special tools

Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch
M	1	791-600-2001	Compressor (A)	■	1		
		or					
		791-685-8006	Compressor (B)	■	1		
		790-201-2780	Spacer				
		791-635-3160	Extension	■	1		
		790-101-1600	Cylinder (686kN{70ton})	■	1		
		790-101-1102	Pump	■	1		
		790-640-2180	Guide bolt	■	1		
	2	790-101-5201	Push tool kit (B)	●	1		
		• 790-101-5241	• Plate		1		
		• 790-101-5221	• Grip		1		
		• 01010-51225	• Bolt		2		
	3	790-201-1500	Push tool kit	●	1		
		• 790-201-1620	• Plate		1		
		• 790-101-5021	• Grip		1		
		• 01010-50816	• Bolt		1		

Disassembly

- Structural illustration



1. Remove piston assembly (2) from recoil spring assembly (1).

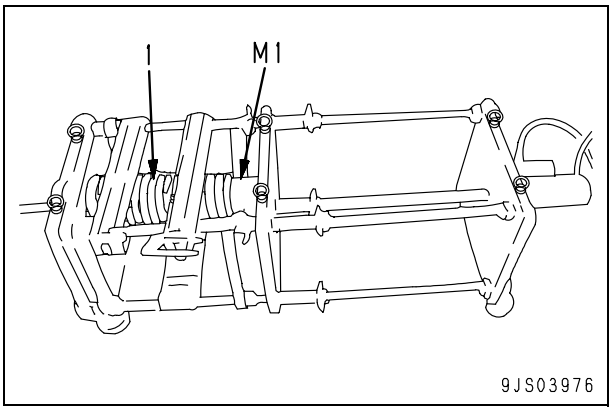
2. Disassembly of recoil spring assembly

1) Set tool **M1** to recoil spring assembly (1)

⚠ **Since the recoil spring will be pressed to a high installation load, be very sure to set the tool properly to prevent any risk.**

★ Installation load

137.3kN {14,010 kg}



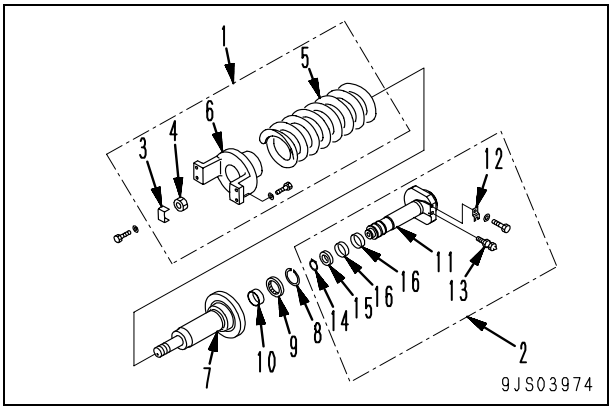
2) Apply hydraulic pressure gradually to remove lock plate (3) then nut (4).
   - ★ Compress the spring up to the point where the nut gets loose.
   - ★ Release the hydraulic pressure slowly and release the tension of the spring.
   - ★ Free length of spring **556 mm**
3) Remove yoke (6) and cylinder (7) from spring (5).
4) Remove snap ring (8), dust seal (9) and bushing (10), one after the other, from cylinder (7).

3. Further disassembly of piston assembly(2)

1) Remove lock plate (12) from piston (11), and then valve (13).
2) Remove snap ring (14), and then U-packing (15) and ring (16).

Assembly

- Structural illustration

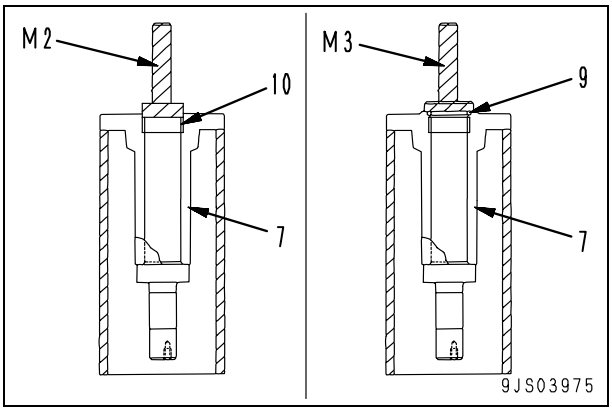


1. Assembly of piston assembly(2)

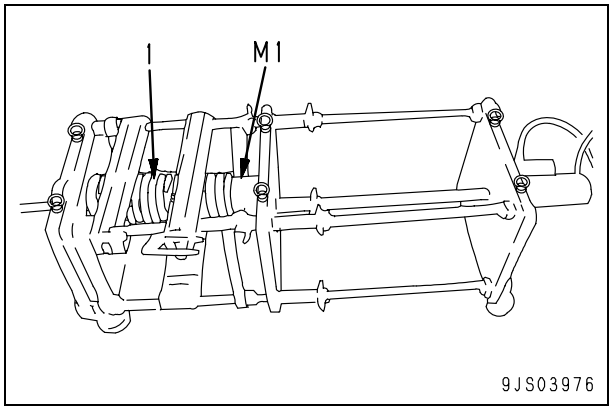
1) Assemble ring (16) and U-packing (15) to piston (11), and secure them with snap ring (14).
2) Tighten valve (13) temporarily, and secure it with lock plate (12).

2. Disassembly of recoil spring assembly

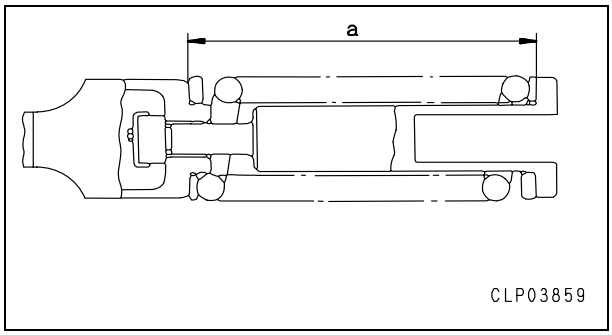
1) Using tool **M2**, press fit bushing (10) to cylinder (7).
2) Using tool **M3**, assemble dust seal (9) to cylinder (7).
3) Secure them with snap ring (8).



4) Assemble cylinder (7) and yoke (6) to spring (5), and set them to tool **M1**.
   Sliding portion of cylinder: **Grease (G2-LI)**



5) Apply hydraulic pressure slowly to compress the spring, and then tighten nut (4) so that the installed length of the spring is dimension **"a"** and secure it with lock plate (3).
   ★ Installed length of spring **a**
   433 mm



6) Remove recoil spring assembly (1) from tool **M1**.

3. Assemble piston assembly (2) to recoil spring assembly (1).
   Sliding portion of cylinder: **Grease (G2-LI)**
   Wear ring: **Grease (G2-LI)**
   ★ Install the piston assembly so the valve installing position is on the outside.
   ★ Fill the cylinder with 300cc of grease (G2-LI), purging air, and see the grease comes out of the grease hole.

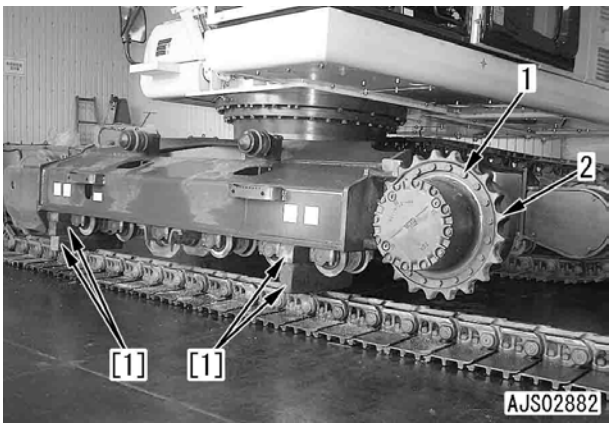
Removal and installation of sprocket

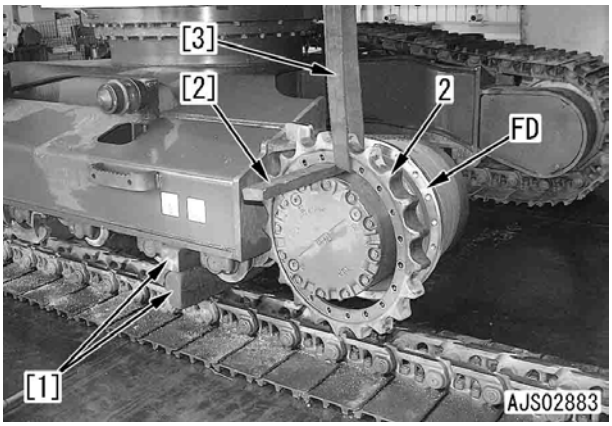
Removal

1. Expand the track shoe assembly referring Expanding track shoe assembly.

2. Swing work equipment 90°, push up chassis with work equipment and place block (1) between track frame and track shoe.

3. Remove sprocket (2), sling as follows.
   1) Remove fixing bolt (1). [*1]
      ★ Before removing the final fixing bolt, Place block [2] under sprocket (2).
   2) Put sprocket (2) on block [2], make a clearance from final drive (FD), and lead sling [3] in between.
      Sprocket **40 kg**





Installation

- Installation is done in the reverse order of removal.

[*1]
Thead of sprocket mounting bolts:
Adhesive compound (LT-2)
Sprocket mounting bolts:
441 – 490 Nm {45 – 50 kgm}

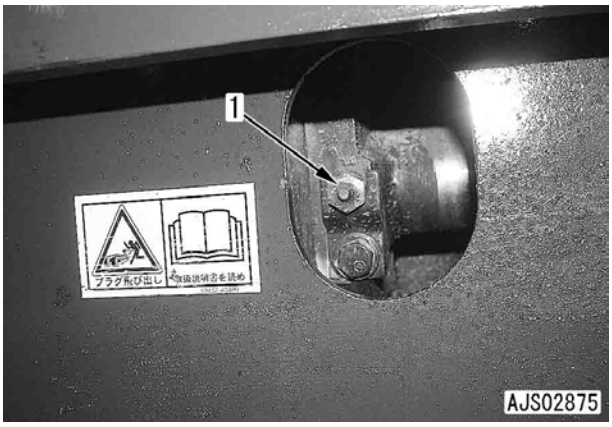
Expansion and installation of track shoe assembly

Special tools

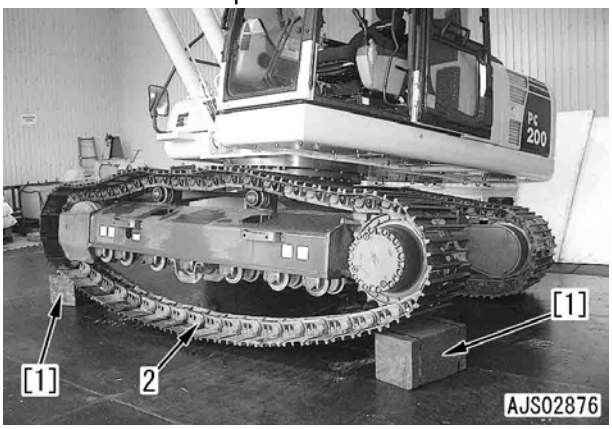
Symbol	Part number	Part name	Necessity	Q'ty	N/R	Sketch
R	791-630-3000	Remover and installer	■	1		
	790-101-1300	Cylinder (980kN{100ton})	■	1		
	790-101-1102	Pump	■	1		

Development of track shoe

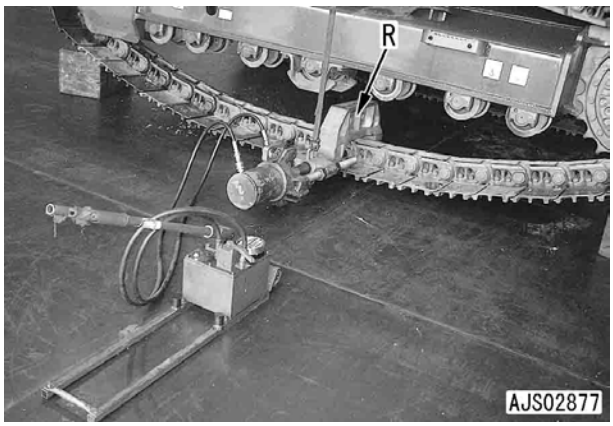
1. Turn the upper structure by 90 degrees.
2. Loosening lubricator (1), slacken the tension of track shoes. [*1]
   ⚠ **Since the inner pressure of adjusting cylinder is extremely high, never loosen the lubricator more than one turn. If the grease does not come out smoothly, move the machine back and forth.**

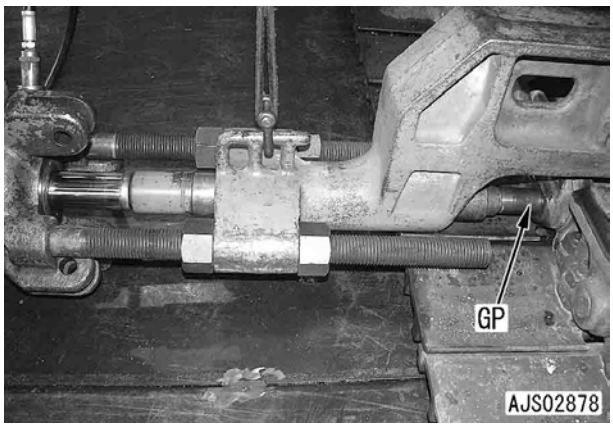


3. Set the location of master pin (2).
   1) Pushing against ground with the work equipment, lift the track shoes.
   2) Locate master pin (2) at around the center of lower track shoes and between two track rollers.
   3) Set blocks [1] under both track shoes at idler and sprocket.

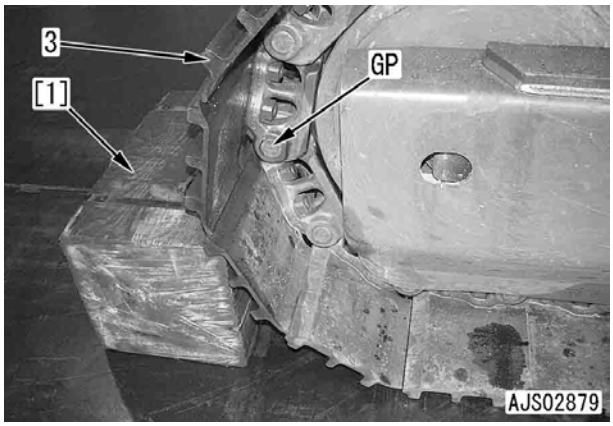


4. Using tool **R**, remove master pin (2). [*2]
   ★ Press fit guide pin (GP), so that master pin (2) will be pushed out.





5. Set the location of guide pin (GP).
   1) Pushing against ground with the work equipment, lift the track shoes.
   2) Take away blocks [1] under both track shoes at idler and sprocket.
   3) Bring guide pin (GP) at the front of the idler.
   4) Relieve the work equipment, and lower the machine body.
   5) Set block [1] under track shoe (3) at front of the idler.



6. Pull out guide pin (GP), and drive the machine back slowly to lay track shoes (3) down. [*3]
   ★ Put some blocks between upper track shoes and the track frame to prevent damages.

Installation of track shoe

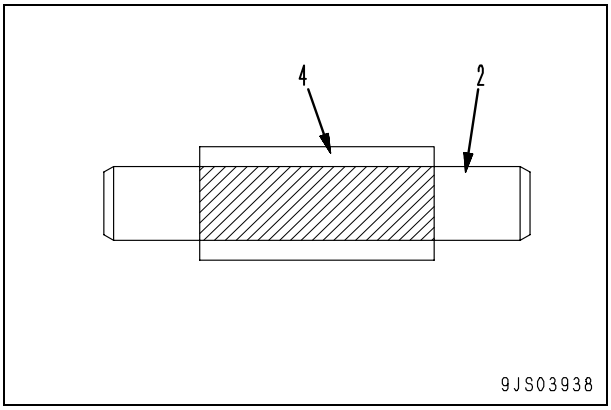
- Installation is done in the reverse order of removal.

[*1]

★ Refer to the Inspection and Adjustment of Track Shoe Tension section in the Testing and adjusting chapter of this manual.

[*2]

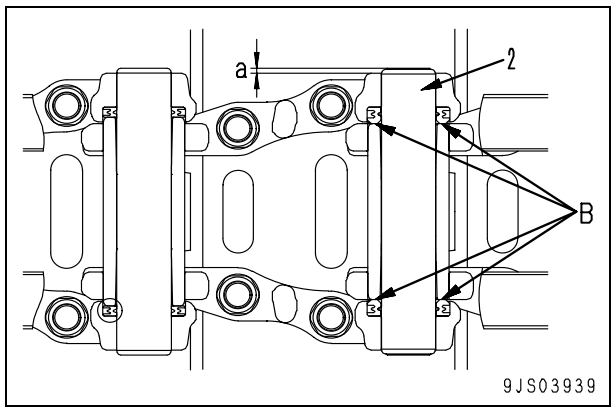
7. Apply grease on master pin (2). (At the area where bushing (4) and master pin (2) come contact: shown hatched)
   Between the bushing and the master pin (shown hatched):
   Grease
   Nigutaite LYK-2 from nihon grease co.,ltd.: part no.44392708.



★ When replacing dust seals, apply some grease on the end surfaces of bushing and the contact surface (B) of dust seals.
Contact surface (B portion) between bushing and dust seal:
Grease
Nigutaite LYK-2 from nihon grease co.,ltd.: part no.44392708.

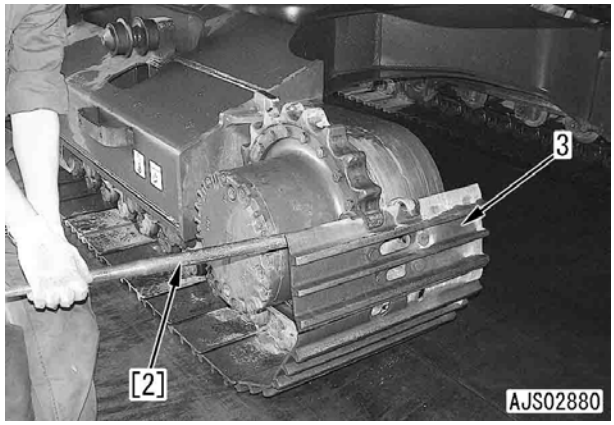
★ Press fit master pin (2) and push guide pin (GP) out.

★ Using tool **R**, press fit the master pin, so that the protrusion amount **a** of master pin (2) will be the dimension designated below.
Protruding amount of the master pin **a**:
2.5 ± 1 mm

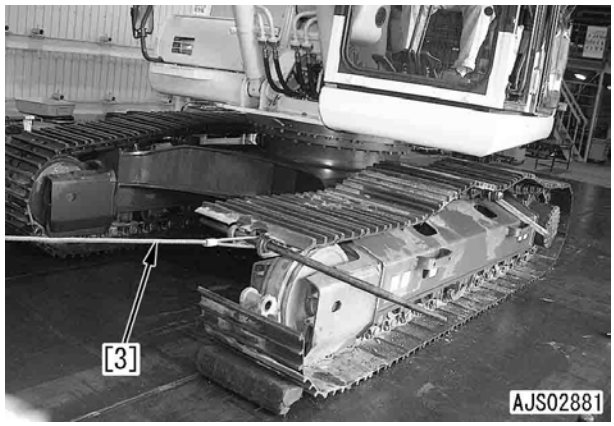


[*3]

1) Using bar [2], roll up track shoes (3) while the machine drives forward slowly.



2) Latter half of the operation, use a fork lift or the work equipment, to pull wire [3] to fix the track shoes.



Removal and installation of revolving frame assembly

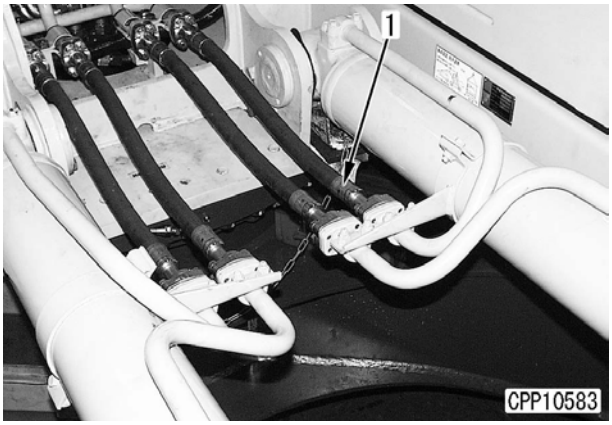
Removal

⚠ **Safely lower the work equipment to the ground by extending the arm and the bucket completely. Set the lock lever in the lock position,**

1. Disassemble the work equipment assembly, referring to the Disassembling Work Equipment Assembly section in this manual.

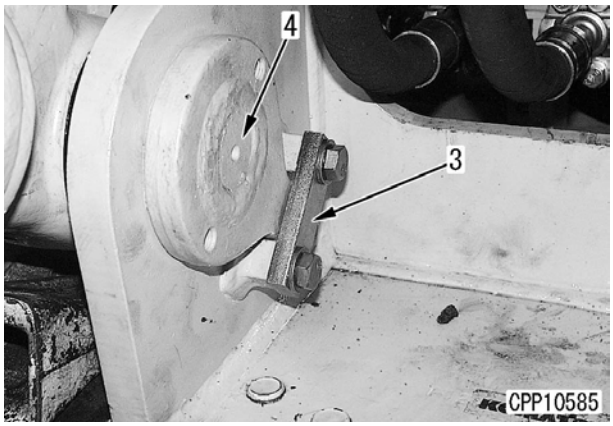
2. Disassemble the work equipment assembly, referring to the Disassembling Work Equipment Assembly section in this manual.

3. Disconnect four boom cylinder hoses (1).
   ★ Plug the hose to stop oil flow-out.

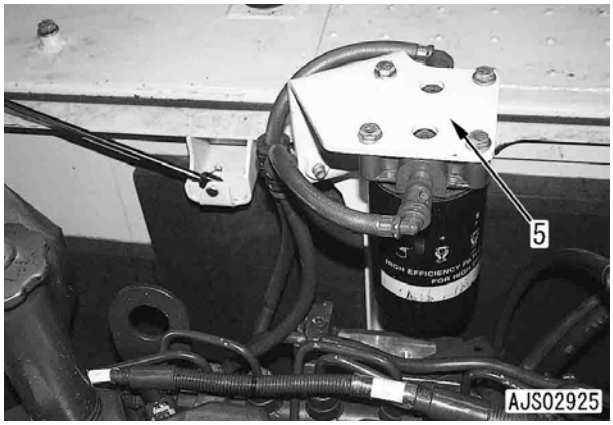


4. Sling boom cylinder assembly (2).

5. Remove plate (3) and pin (4), and then lift boom cylinder assembly (2) to remove.
   ★ Remove the boom cylinder assembly on the opposite side in the same manner.
   Boom cylinder assembly:
   180 kg (PC210, PC230)
   200 kg (PC240)

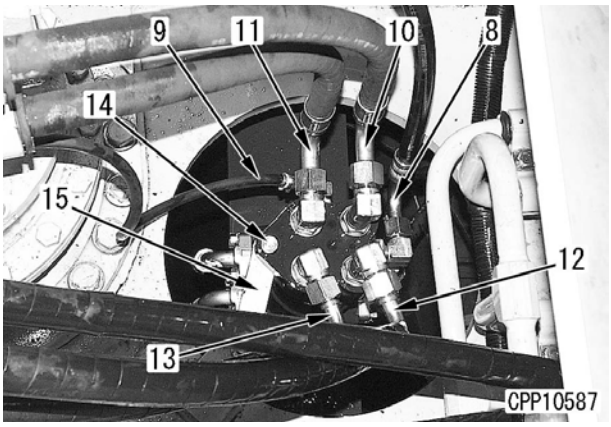


6. Remove fuel filter and bracket assembly (5).
   ★ Fix it temporarily on the engine.
   ★ When other parts can interfere with the lifting hook in removal of the revolving frame, such parts must be removed beforehand.

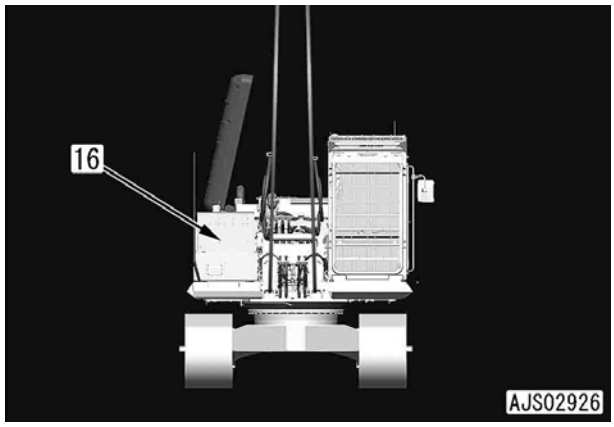


7. From center swivel joint assembly, disconnect 6 hoses (8) – (13).
   - (8): Center swivel joint (D port) – Swing motor (T port)
   - (9): Center swivel joint (E port) – solenoid valve
   - (10): Center swivel joint (B port) – L.H. travel control valve (A2 port)
   - (11): Center swivel joint (D port) – R.H. travel control valve (B5 port)
   - (12): Center swivel joint (A port) – L.H. travel control valve (B2 port)
   - (13): Center swivel joint (C port) – R.H. travel control valve (A5 port)

8. Pull out pin (14) on the center swivel joint, and detach jam plate (15) from the center swivel joint.



9. Remove 32 mounting bolts, and dismount revolving frame assembly (16) off slinging it up. [*1]
   ★ Using levers and blocks, hold the balance of revolving frame assembly front and rear, and left and right.
   ⚠ **When dismounting the revolving frame assembly, take care so that it does not hit the center swivel joint assembly.**
   Revolving frame assembly
   PC210/230-8 : 5,100kg
   PC240-8 : 5,500kg



Installation

- Installation is done in the reverse order of removal.

[*1]
Swivel circle mating surface: **Gasket sealant (LG-1)**
Thead of revolving frame mounting bolts: **Adhesive compound (LT-2)**
- In case of torque tightening:
  mounting bolts: **716 – 814 Nm {73 – 83 kgm}**
- In case of angle tightening:
  mounting bolts:
  1) Initial torque: **294.2 ± 29.4 Nm {30 ± 3 kgm}**
  2) Then tighten the bolts turning by 60 ± 6°.

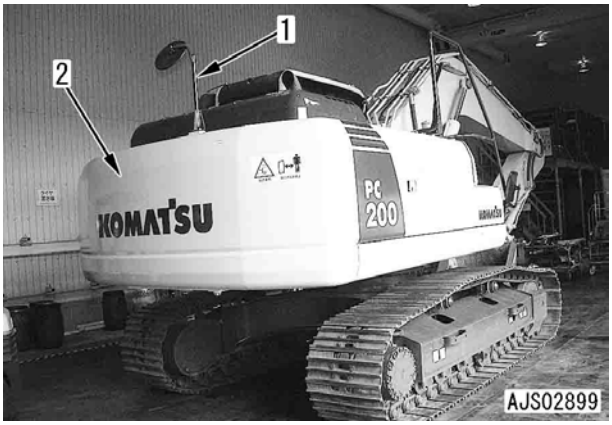
- **Refilling with oil (Hydraulic tank)**
  Refill hydraulic oil through the oil filler port to the specified level. Let the oil circulate in the hydraulic system by starting the engine. Then check the oil level again.

- **Air bleeding**
  Bleed air from the travel motor referencing the Air Bleeding of Various Parts section in the Testing and adjusting chapter of this manual.

Removal and installation of counterweight assembly

Removal

1. Remove mirror (1).
2. Sling counter weight assembly (2) temporarily.



3. Remove 4 pcs. of mounting bolt (3). [*1]
   ★ Record the locations where the shims were used.

4. Sling take counter weight assembly (2) off. [*2]
   ★ Be careful not to bump it against the engine or radiator or cooler assembly.
   Counter weight assembly:
   4,000kg (PC210/210LC-8)
   4,300kg (PC210NLC/230-8)
   5,250kg (PC240LC/240NLC-8)

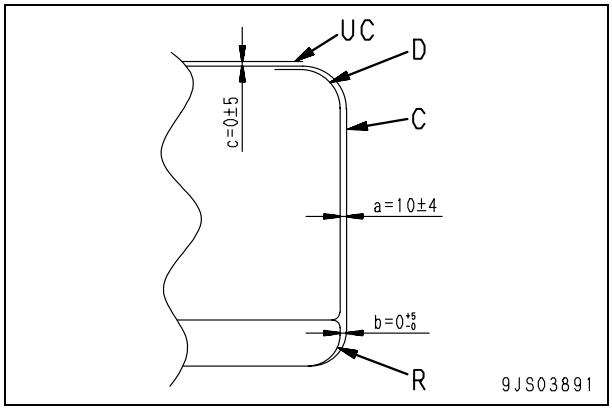
Installation

- Installation is done in the reverse order of removal.

[*1]
Mounting bolt threaded section:
Adhesive compound (LT-2)
mounting bolts:
PC210/230: 1,960 – 2,450 {200 – 250 kgm}
PC240: 1,180 – 1,470 Nm {120 – 150 kgm}

[*2]
★ Installing and adjusting counterweight
1) Using shims, adjust the differences in level or gaps between the counter weight and the exterior of body work.
   ★ Shims:20Y-46-11410
2) Fix the counter weight so that the clearances in the direction of front and rear are even and within the limit of 10±5mm for both from the doors and from the revolving frame.

3) The difference in level in left to right direction between the exterior of the door (D) and the counter weight (C)
   a: 10 ± 4 mm
   The difference in level in left to right direction between the revolving frame (R) and the counter weight (C)
   b: 5 mm or less
   The difference in level in up and down direction between the exterior upper cover (UC) and the counter weight (C)
   c: 0 ± 5 mm
   are the respective limits for the mounting adjustment.
   ★ Rear view (Enlarged drawing for right hand side)



PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00662-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

50 Disassembly and assembly

Hydraulic system

Hydraulic system

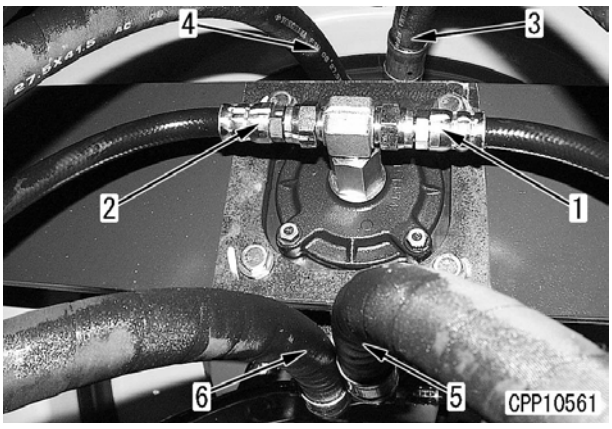
Removal and installation of center swivel joint assembly

Removal

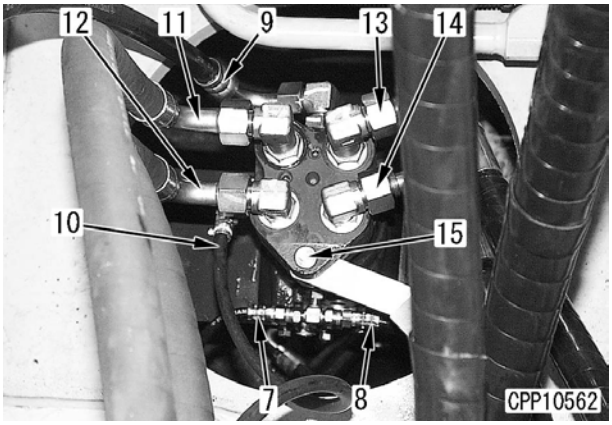
⚠ **Lower the work equipment to the ground completely, after the engine is stopped, loosen the hydraulic tank cap gradually to reduce the pressure inside, and set the lock lever in the lock position.**

★ Attach an identification tag to each piping to avoid a mistake in the position of installation later.

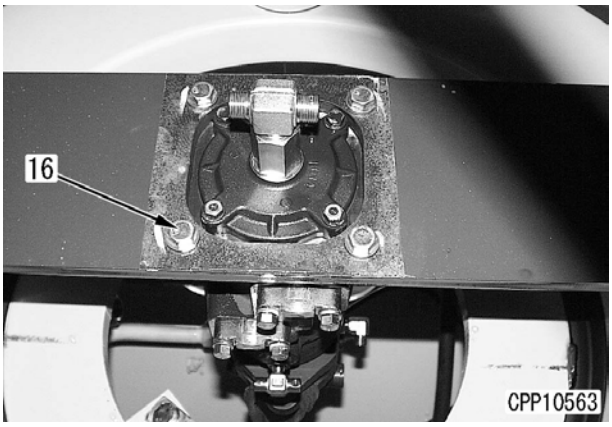
1. Swing to right 45 degree. (For hydraulic tank oil drain)
   ★ For the way not to drain the hydraulic tank oil by using oil stopper, see Removal and installation of hydraulic pump assembly.
2. Drain hydraulic tank oil.
   Hydraulic tank:
   Approx. 234ℓ (PC210, 230)
   Approx. 239ℓ (PC240)
3. Disconnect six center swivel joint horses (1) through (6) from the travel motor.
   - (1): Center swivel joint (T port) – L.H. travel motor (T port)
   - (2): Center swivel joint (T port) – R.H. travel motor (T port)
   - (3): Center swivel joint (B port) – L.H travel motor (PA port)
   - (4): Center swivel joint (D port) – R.H travel motor (PB port)
   - (5): Center swivel joint (A port) – L.H travel motor (PB port)
   - (6): Center swivel joint (C port) – R.H travel motor (PA port)



4. Disconnect eight hoses (7) through (14).
   - (7): Center swivel joint (E port) – L.H travel motor (P port)
   - (8): Center swivel joint (E port) – R.H travel motor (P port)
   - (9): Center swivel joint (D port) – Swing motor (T port)
   - (10): Center swivel joint (E port) – solenoid valve
   - (11): Center swivel joint (B port) – L.H. travel control valve (A2 port)
   - (12): Center swivel joint (D port) – R.H. travel control valve (B5 port)
   - (13): Center swivel joint (A port) – L.H. travel control valve (B2 port)
   - (14): Center swivel joint (C port) – R.H. travel control valve (A5 port)
5. Pull out pin (15) on the center swivel joint side, and remove the jam plate from center swivel joint.



6. Remove 4 pcs. of mounting bolt (16).

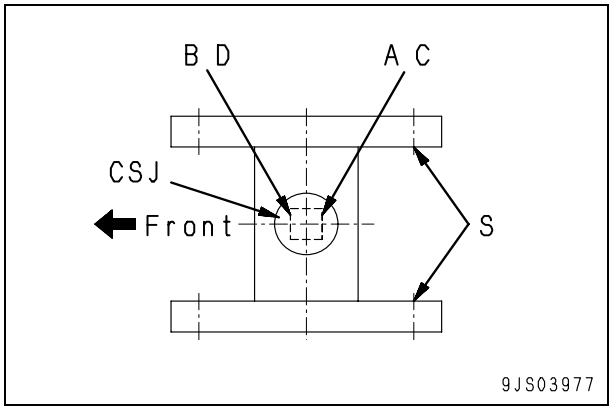


7. Lift off center swivel joint assembly (17) to remove. [*1]
   Center swivel joint assembly: **40 kg**

Installation

- Installation is done in the reverse order of removal.

[*1]
Install the center swivel joint CSJ facing in the direction shown in the figure. (The figure shows the machine body as seen from above.)
★ S: Sprocket
A-D: Port name



- **Refilling with oil (hydraulic tank)**
  Refill hydraulic oil through the oil filler port to the specified level. Let the oil circulate in the hydraulic system by starting the engine. Then check the oil level again.
  Hydraulic tank:
  Approx. 234ℓ (PC210, 230)
  Approx. 239ℓ (PC240)
  Hydraulic tank drain plug:
  58.8 – 78.5 Nm {6.0 – 8.0 kgm}

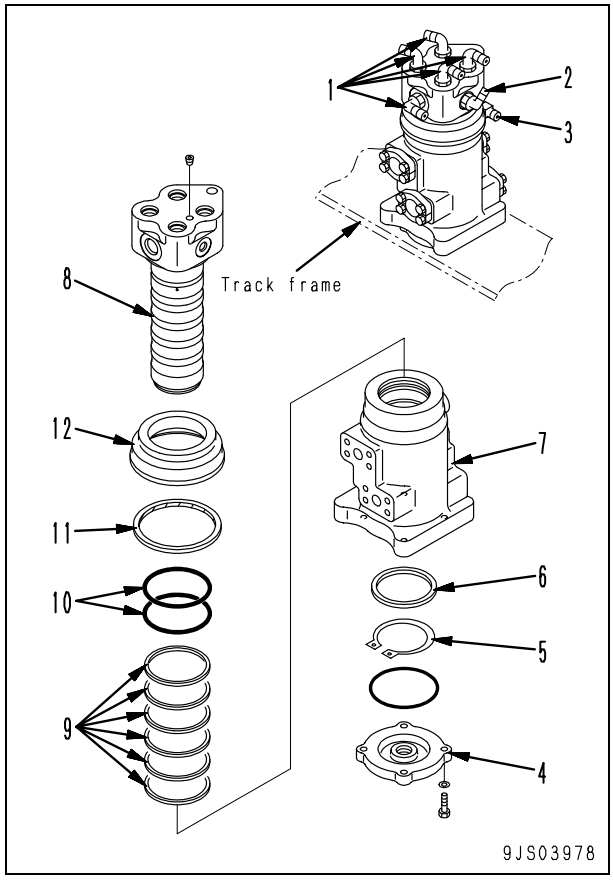
- **Air bleeding**
  Bleed the air from the circuit between the valve and the hydraulic cylinder. For details, see Testing and adjusting, air bleeding of various parts.

Disassembly and assembly of center swivel joint assembly

Special tools

Symbol	Part number	Part name	Necessity	Q'ty	N/R	Sketch
T1	790-101-2501	Push puller	●	1		
	• 790-101-2510	• Block		1		
	• 790-101-2520	• Screw		1		
	• 791-112-1180	• Nut		1		
	• 790-101-2540	• Washer		1		
	• 790-101-2630	• Leg		2		
	• 790-101-2570	• Plate		4		
	• 790-101-2560	• Nut		2		
	• 790-101-2650	• Adapter		2		

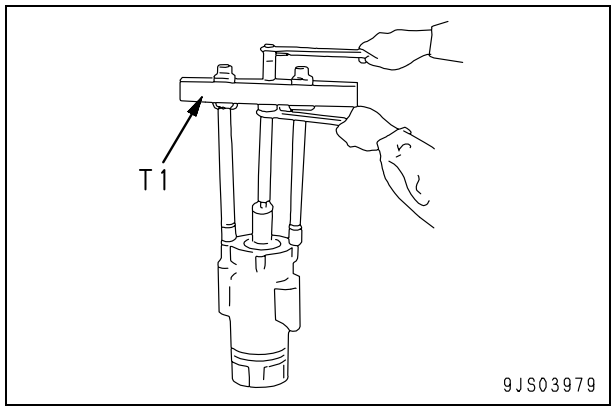
Disassembly



1. Remove elbow (1), (2) and tee (3).

2. Remove cover (4).
3. Remove snap ring (5) and ring (6).

4. Using tool **T1**, pull out swivel shaft (7) from swivel shaft (8).



5. Remove seal (9) and O-ring (10) from swivel rotor (7).
6. Remove dust seal (11) from cover (12).

Assembly

★ See figure at left.

1. Install seal (9) and O-ring (10) to swivel rotor (7).
2. Install dust seal (11) to cover (12).
3. install cover (12) to swivel shaft (8).

4. Set swivel shaft (8) to block, then using push tool, tap swivel rotor (7) with a plastic hammer to install.
   - Contact surface of rotor, shaft: **Grease (G2-LI)**
   - ★ When installing rotor, be extremely careful not to damage the dust seal and O-ring.

5. Install ring (6) and fix with snap ring (5).
6. Fit O-ring and install cover (4).
   - mounting bolts: **31.4 ± 2.9 Nm {3.2 ± 0.3 kgm}**

7. Install elbow (1), (2) and tee (3).
   - Elbow (1): **128 – 186 Nm {13 – 19 kgm}**
   - Elbow (2), tee (3): **35 – 63 Nm {3.2 – 6.5 kgm}**

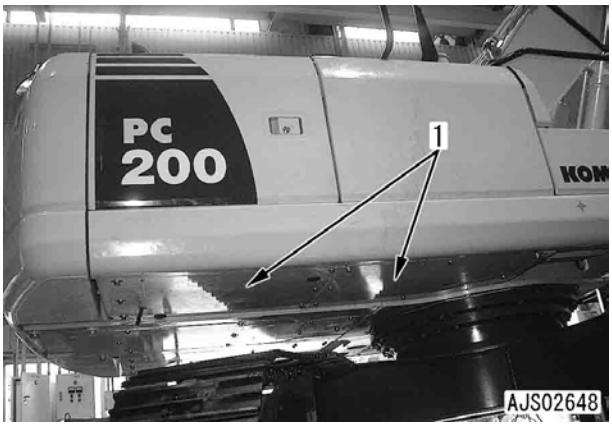
Removal and installation of hydraulic tank assembly

⚠ **Lower the work equipment to the ground completely, after the engine is stopped, loosen the hydraulic tank cap gradually to reduce the pressure inside, and set the lock lever in the lock position.**

Removal

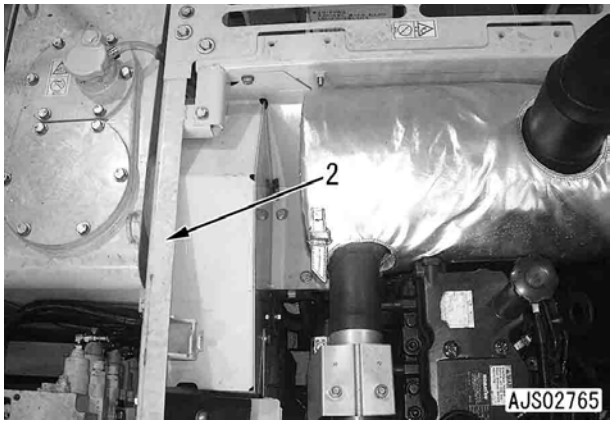
★ Attach an identification tag to each piping to avoid a mistake in the position of installation later.

1. Swing to right 45 degree. (For hydraulic tank oil drain)
2. Remove cover (1).

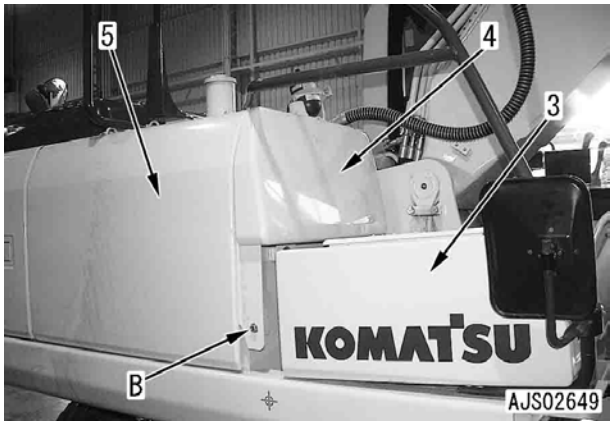


3. Drain hydraulic tank oil. [*1]
   Hydraulic tank:
   Approx. 234ℓ (PC210, 230)
   Approx. 239ℓ (PC240)

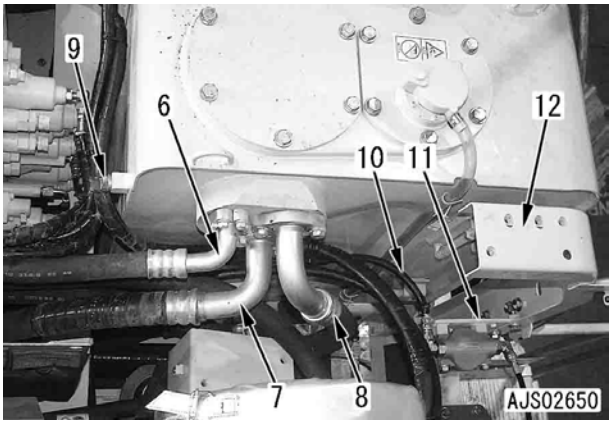
4. See Removal and installation of engine and oil pressure pump assembly to remove flame (2) between hydraulic tank and engine. For that purpose, remove below mainly.
   - Engine hood
   - Control valve upper cover
   - Cover between hydraulic pump and engine
   - Air cleaner upper cover

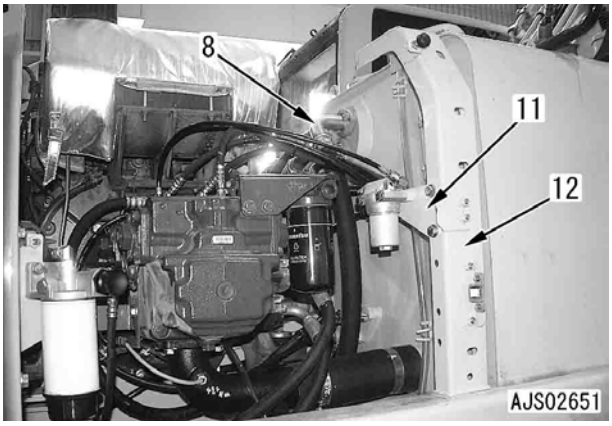


5. Shift cover (3) forward.
   ★ Keep away from bolt B.
6. Remove cover (4) and (5).

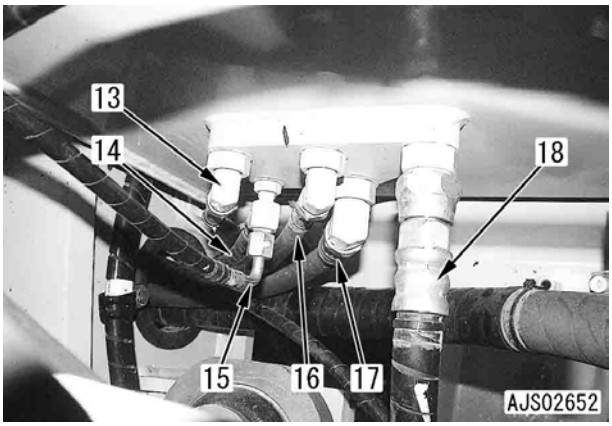


7. Disconnect drain hose (6) through (8).
   - (6), (7): From control valve
   - (8): From oil cooler upper side
8. Disconnect clamp (9).
9. Disconnect hose (10) form the filter.
   ★ Hose band color: Yellow
10. Disconnect filter bracket (11).
11. Remove flame (12).

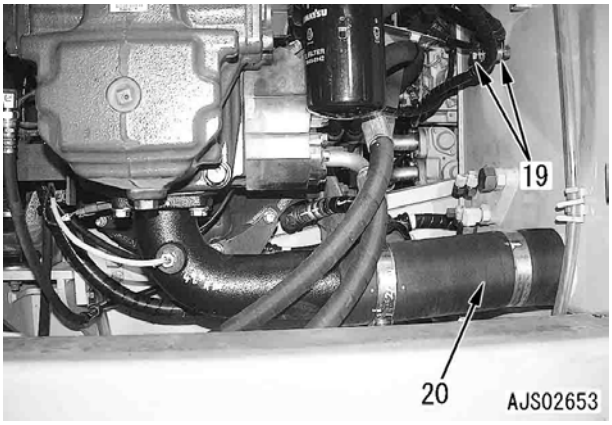


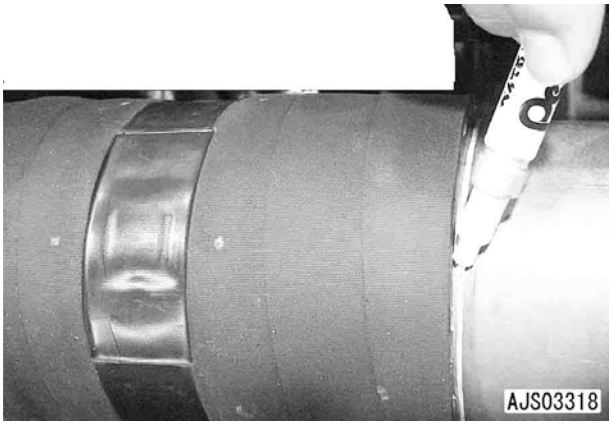


12. Disconnect drain hose (13) through (18).
    - (13): Solenoid valve drain
    - (14): Main valve drain
    - (15): Pressure reducing valve drain
    - (16): PPC drain
    - (17): Swing motor drain
    - (18): Pump drain

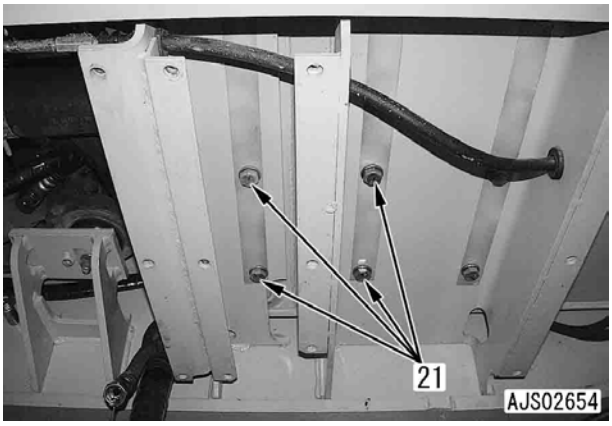


13. Disconnect clamp (19).
14. Disconnect suction hose (20). [*2]
    ★ Mark the hose edge and tube to show the original hose installation positions. (See figure below.)

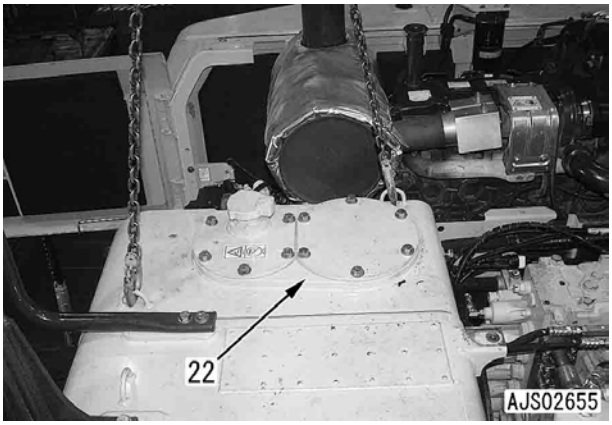




15. Remove six mounting bolts (21). [*3]



16. Lift off hydraulic tank assembly (22) to remove it.
    Hydraulic tank assembly: **130 kg**



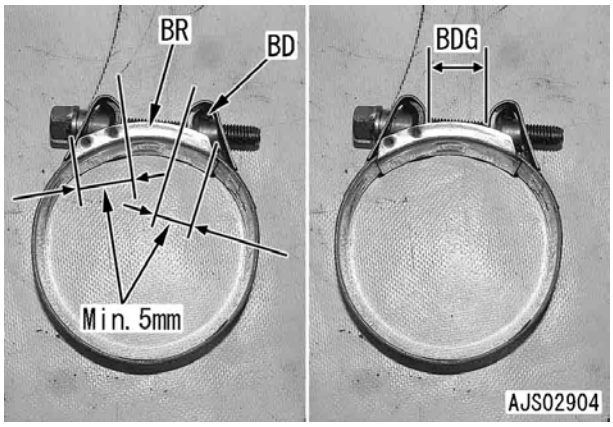
Installation

- Installation is done in the reverse order of removal.

[*1]
Hydraulic tank drain plug:
58.8 – 78.5 Nm {6.0 – 8.0 kgm}

[*2]
★ Use brand new article for MIKALOR clamp.
★ Align the hose to the original position (marking position).
★ Reference
Hose insertion length:85mm (L.H and R.H)

★ Set bridge (BR) under the clamp tightening bolt as the lap with band (BR) is Min.5mm.
★ Align the clamp to the original position.
Clamp: **20 – 22 Nm {2.0 – 2.2 kgm}**
★ Impact wrench is not applicable to use.
★ When the tightening torque force is less than 16 Nm {1.6 kgm}, tighten it until the hand gap is adhered (BDG size is 0).



[*3]
Mounting bolt:
245 – 309 Nm {25 – 31.5 kgm}

- **Refilling with oil (hydraulic tank)**
  Refill hydraulic oil through the oil filler port to the specified level. Let the oil circulate in the hydraulic system by starting the engine. Then check the oil level again.
  Hydraulic tank:
  Approx. 234ℓ (PC210, 230)
  Approx. 239ℓ (PC240)

- **Air bleeding**
  Bleed the air from the circuit between the valve and the hydraulic cylinder. For details, see Testing and adjusting, air bleeding of various parts.

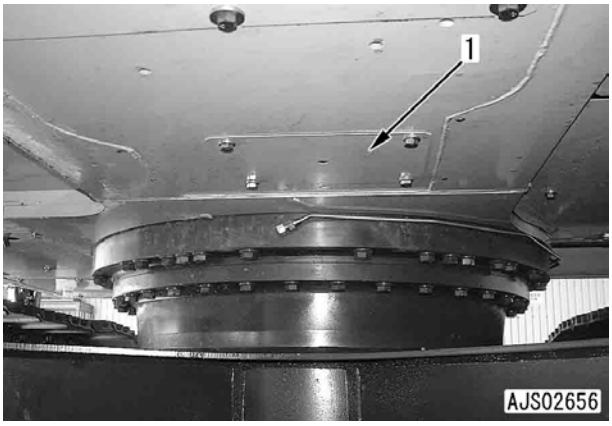
Removal and installation of control valve assembly

⚠ **Release the remaining pressure in the hydraulic circuit. For details, see Testing and adjusting, release of remaining pressure in hydraulic circuit.**

Removal

★ Attach an identification tag to each piping to avoid a mistake in the position of installation later.

1. Remove cover (1).

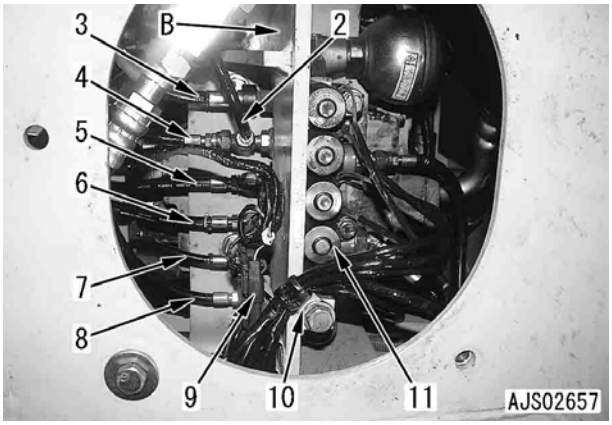


2. Drain hydraulic tank oil.
   ★ Make the swing speed almost 0 degree for below (3. – 6.) and to remove the control valve mounting bolt.
   Hydraulic tank:
   Approx. 234ℓ (PC210, 230)
   Approx. 239ℓ (PC240)
   ★ For the way not to drain the hydraulic tank oil by using oil stopper, see Removal and installation of hydraulic pump assembly.

3. Disconnect drain hose (2) through (8). Band:
   - (2): No color
   - (3): Red
   - (4): No color
   - (5): No color
   - (6): Red and yellow
   - (7): Brown
   - (8): No color

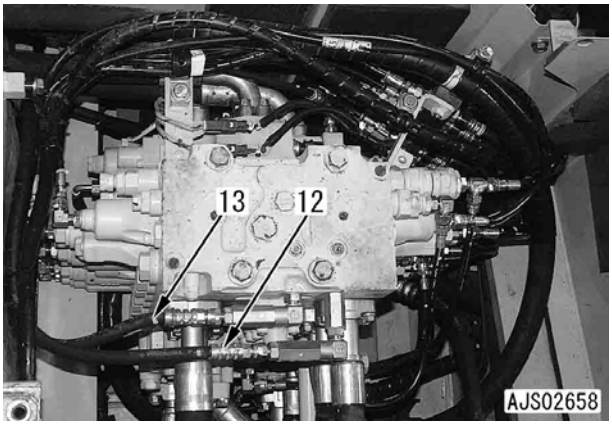
4. Disconnect connector (9) from clip. From the top,
   V06
   V05
   V04
   V03
   V02
   V01

5. Disconnect clamp (10).
6. Keep away solenoid assembly (11) from control valve bracket (B).

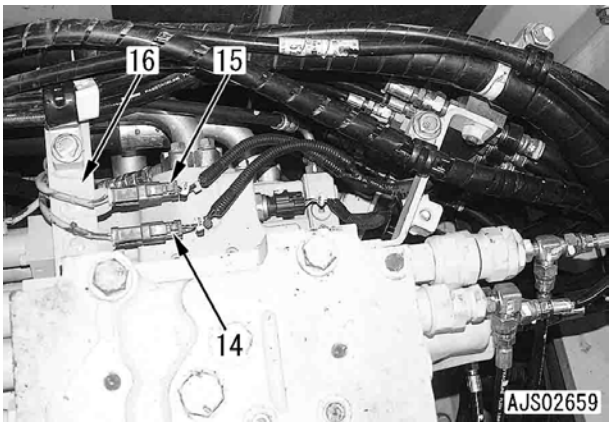


7. See Removal and installation of engine and oil pressure pump assembly to remove below.
   - Engine hood
   - Control valve upper cover
   - Cover between hydraulic pump and engine
   - Flame between control valve and engine
   - Cover between control valve and engine

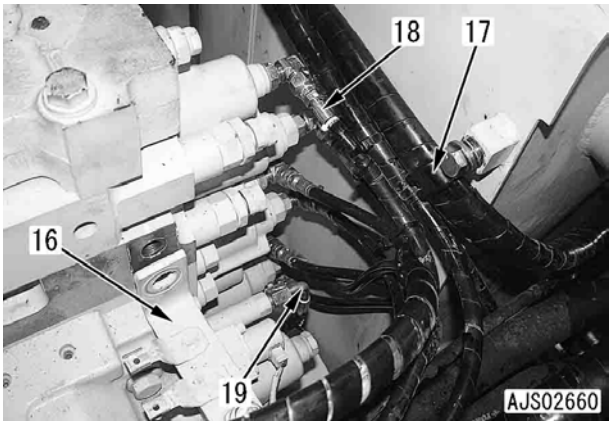
8. Disconnect PLS1 port hose (12).
   ★ Hose band: No color
9. Disconnect PLS2 port hose (13).
   ★ Hose band: red



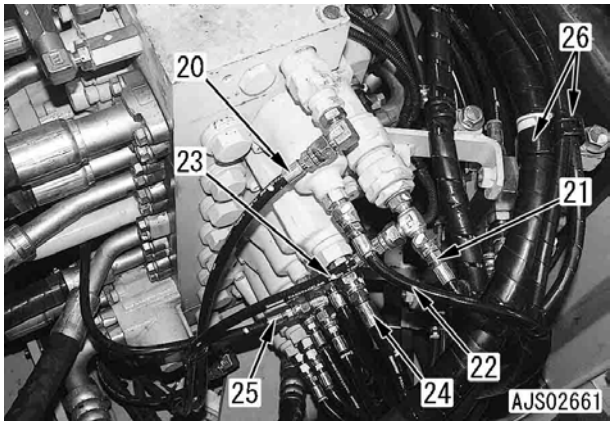
10. Disconnect connector V 23 (14) and V24 (15).
    ★ Band: (14) red, (15) white
11. Disconnect connector (14) and (15) from clip.
12. Disconnect bracket (16).



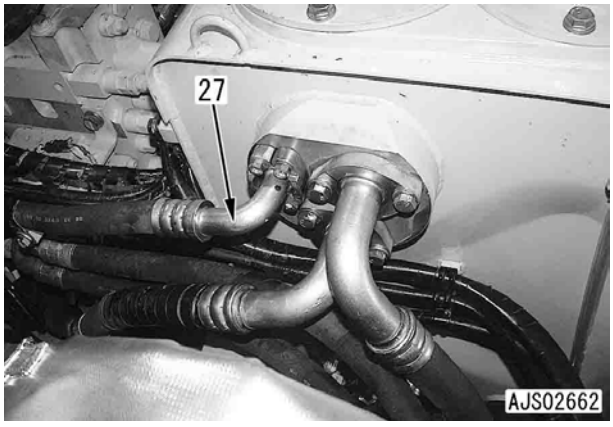
13. Disconnect clamp (17).
14. Disconnect R.H.PPC hose (18). From the top,
    OPT (Hose band: Yellow)
    Bucket digging (Hose band: white)
    L.H. travel forward (Hose band: red)
    Boom lower (Hose band: brown)
    Right swing (Hose band: no color)
    R.H. travel forward (Hose band; green)
    Arm digging (Hose band: blue)
15. Disconnect hose (19). (Hose band: brown)
    ● (19): PST port hose (solenoid)



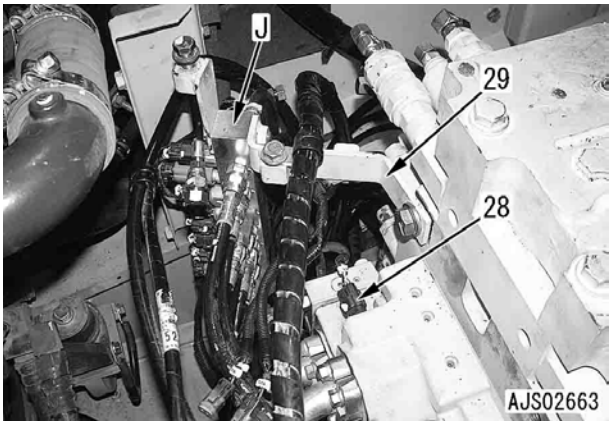
16. Disconnect hose (20) through (23).
    ★ Hose band: No all
    ● (20): relief valve
    ● (21) – (23): OPT
17. Disconnect L.H. PPC hose (24). From the top,
    Bucket dump (Hose band: black)
    L.H. travel reverse (Hose band: no color)
    Boom raise (Hose band: green)
    L.H. swing (Hose band: red)
    R.H. travel reverse (Hose band: blue)
    Arm dump (Hose band: Yellow)
18. Disconnect Ls separation hose (25).
19. Disconnect clamp (26).



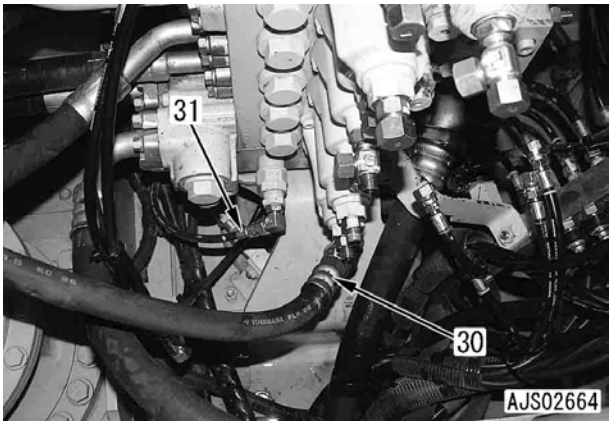
20. Disconnect drain hose (27).
    ★ Disconnect the hose clamp.



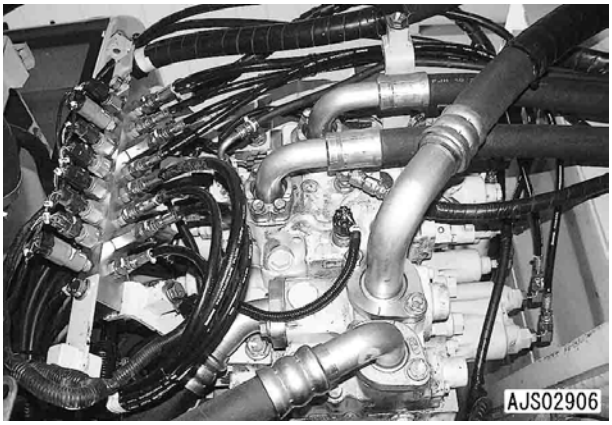
21. Disconnect connector P26 (28).
(front pump pressure sensor)
22. Disconnect bracket (29), then bracket junction box (J).



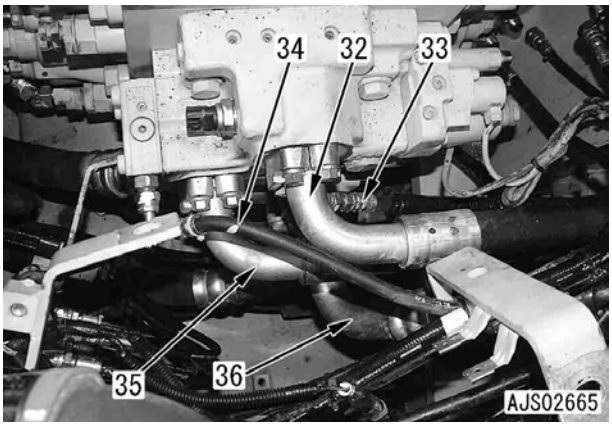
23. Disconnect hose (30) and (31).
- (30): Between control valve and swing motor
- (31): Between control valve and hydraulic tank



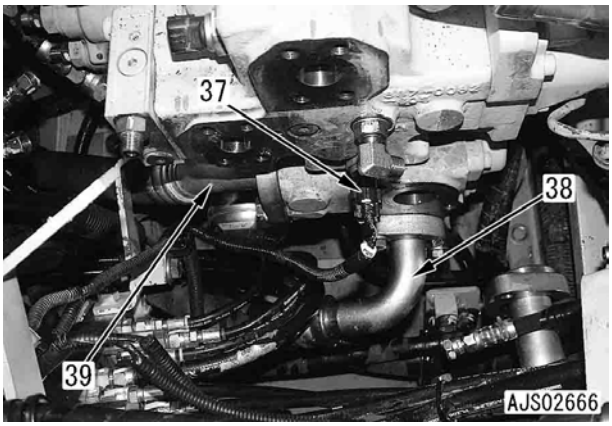
★ Reference rear figure



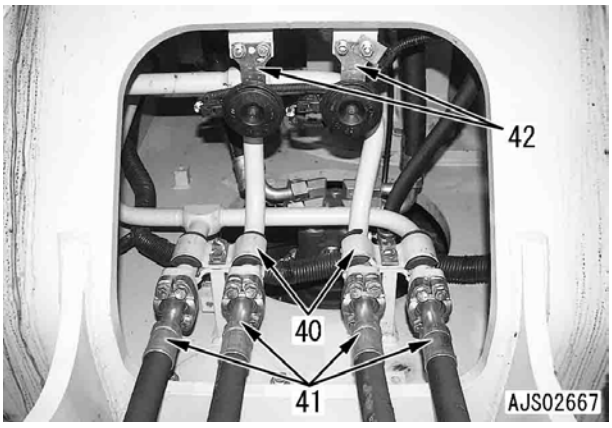
24. Disconnect hose (32) through (36) from the rear side.
- (32): PP1 port pump (rear pump)
- (33): PPS2 port hose (front pump)
Hose band: blue
- (34): PR port hose (pump)
Hose band: yellow
- (35): PP2 port hose (front pump)
- (36): Drain hose (hydraulic tank)



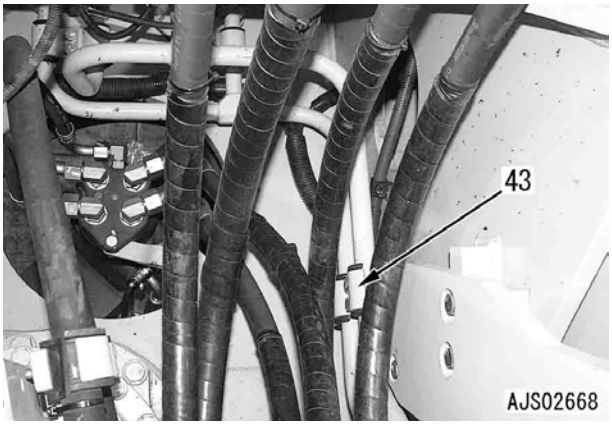
25. Disconnect connector P25 (37).
(Rear pump pressure sensor)
26. Disconnect hose (38) and (39).
- (38): ATT port hose (filter) (OPT)
- (39): T port hose (under the oil cooler)



27. Remove boom tube mounting clamp (40).
28. Disconnect four boom hoses (41).
29. Disconnect horn (42) from bracket.

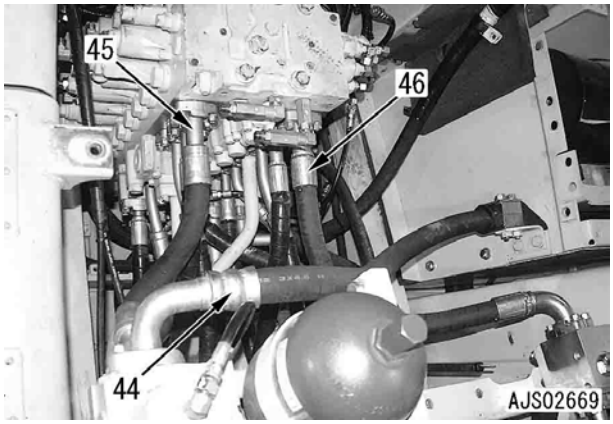


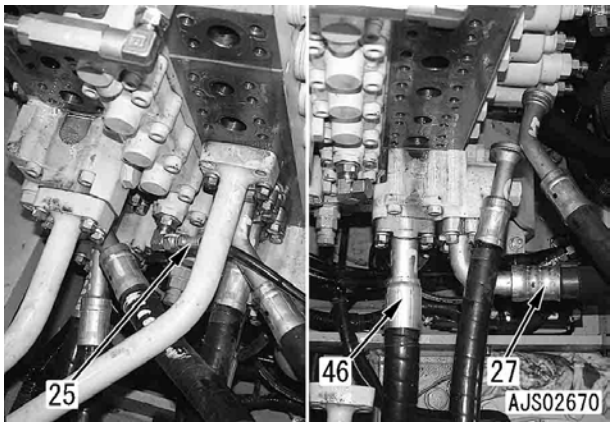
30. Remove boom tube mounting clamp (43).



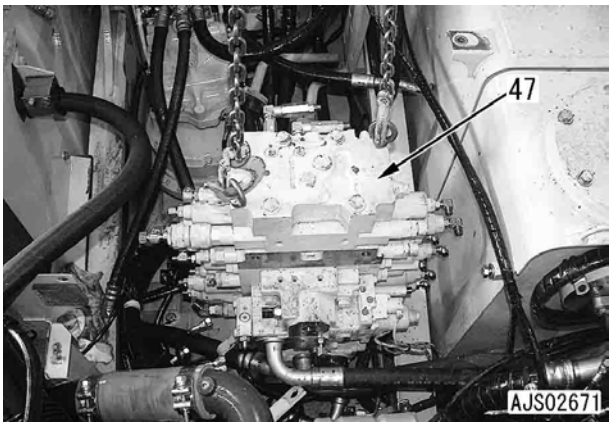
31. Disconnect hose (44).

32. Disconnect fourteen control valve hoses and two tubes.
    - (45): From the top
      A-1 port hose (OPT)
      A1 port hose (bucket head side)
      A2 port hose (Swivel joint B port)
      A3 port tube (boom bottom side)
      A4 port hose (Swing motor MA port)
      A5 port hose (Swivel joint C port)
      A6 port hose (arm head side)
    - (46): From the top
      B-1 port hose (OPT)
      B1 port hose (bucket bottom side)
      B2 port hose (Swivel joint A port)
      B3 port tube (boom head side)
      B4 port hose (Swing motor MB port)
      B5 port hose (Swivel joint D port)
      B6 port hose (arm bottom side)
    - BP1 port hose (25)(above)
    - T1 port (drain) hose (27)(above)





33. Remove mounting bolt, and lift off control valve assembly (47) to remove.
    Control valve assembly: **260 kg**



Installation

- Installation is done in the reverse order of removal.

- **Refilling with oil (hydraulic tank)**
  Refill hydraulic oil through the oil filler port to the specified level. Let the oil circulate in the hydraulic system by starting the engine. Then check the oil level again.
  Hydraulic tank:
  Approx. 234ℓ (PC210, 230)
  Approx. 239ℓ (PC240)
  Hydraulic tank drain plug:
  58.8 – 78.5 Nm {6.0 – 8.0 kgm}

- **Air bleeding**
  Bleed the air from the circuit between the valve and the hydraulic cylinder. For details, see Testing and adjusting, air bleeding of various parts.

Disassembly and assembly of control valve assembly

★ This section deals with only precautions to be followed when reassembling the control valve assembly.

Special tools

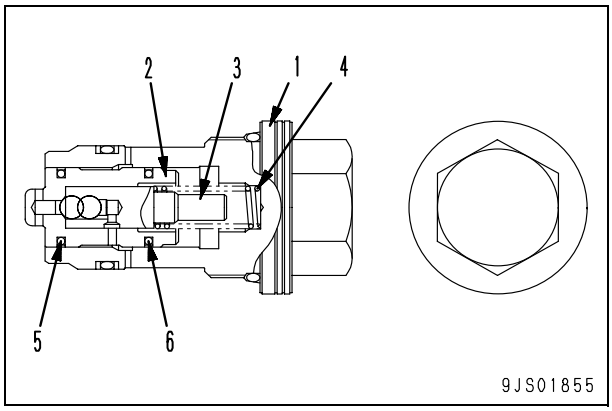
Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch
T	2	796-946-1310	Guide ø21.8	■	1		
		(For 723-46-40100)					
		796-946-1610	Guide ø21.4	■	1		
		(For 723-46-41100)					
		796-946-1810	Guide ø21.2	■	1		
		(For 723-46-43100 and 723-46-43400)					
		796-946-1910	Guide ø21.0	■	1		
		(For 723-46-46101 and 723-46-46300)					
		796-946-2210	Guide ø21.6	■	1		
		(For 723-46-45100 and 723-46-45700)					
	3	796-946-1320	Guide ø21.8	■	1		
		(For 723-46-40100)					
		796-946-1620	Guide ø21.4	■	1		
		(For 723-46-41100)					
		796-946-1820	Guide ø21.2	■	1		
		(For 723-46-43100 and 723-46-43400)					
		796-946-1920	Guide ø21.0	■	1		
		(For 723-46-46101 and 723-46-46300)					
		796-946-2220	Guide ø21.6	■	1		
		(For 723-46-45100)					
		796-946-1420	Guide ø21.6	■	1		
		(For 723-46-42700)					
	4	796-946-1330	Sleeve	■	1		
		(For 723-46-40100)					
		796-946-1630	Sleeve	■	1		
		(For 723-46-41100)					
		796-946-1830	Sleeve	■	1		
		(For 723-46-43100 and 723-46-43400)					
		796-946-1930	Sleeve	■	1		
		(For 723-46-46101 and 723-46-46300)					
		796-946-2230	Sleeve	■	1		
		(For 723-46-45100)					
		796-946-1430	Sleeve	■	1		
		(For 723-46-42700)					

Procedures for replacing pressure compensation valve seal

★ Since there are many types of pressure compensation valve, mark the positions when removing to correspond to the original.

1. Remove piston (2), plug (3) and spring (4) from pressure compensation valve (1).

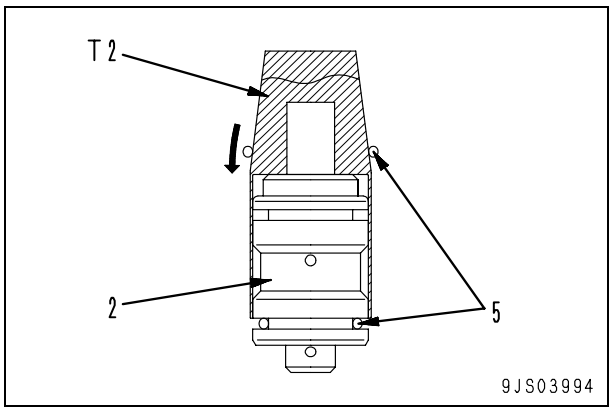
2. Remove piston (2) from seal (5) and (6).



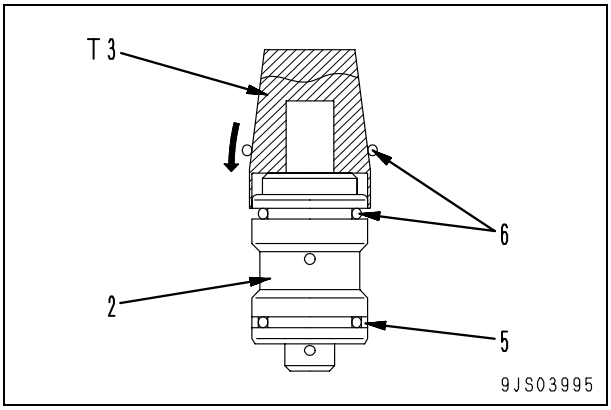
★ There are many types of piston.

3. Set tool **T2** to piston (2) and push it in slowly by hand so that seal (5) may spread out evenly.

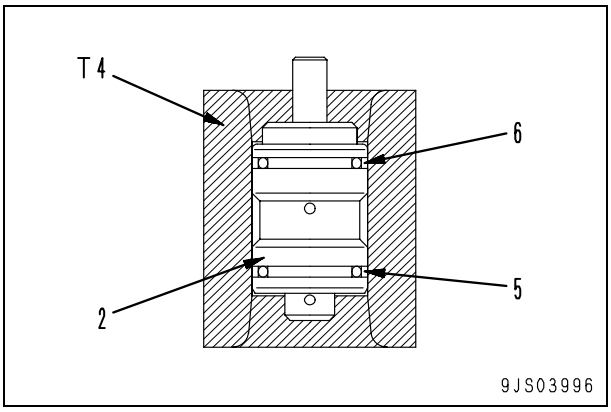
★ The seal may be also fitted by pushing it down to the flat surface of the tool and then pushing it in with the tool fitted to the piston.



4. Likewise, set tool **T3** to piston (2) in the same direction and push it slowly by hand so that another seal (6) may be spread out evenly.
   ★ The seal may be also fitted by pushing it down to the flat surface of the tool and then pushing it in with the tool fitted to the piston.

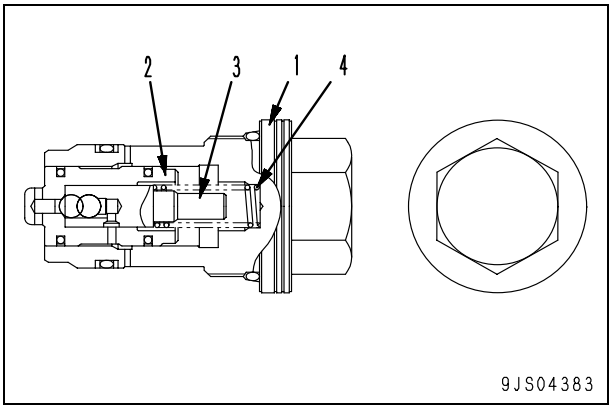


5. Keep compensation tool **T4** fitted to piston (2) for about one minutes so that seal (5) and (6) are adapted well.
   ★ Check that there is no protrusion or cut on the seal.

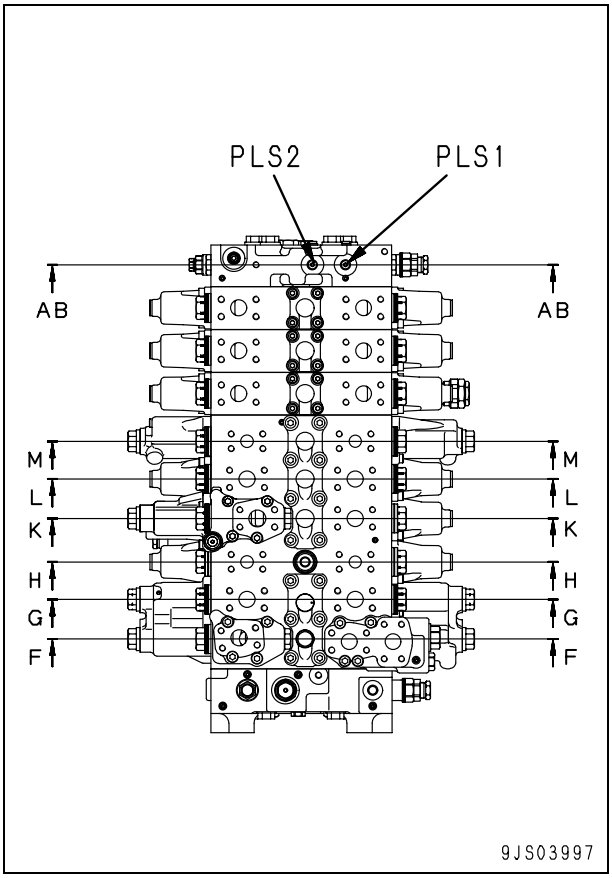


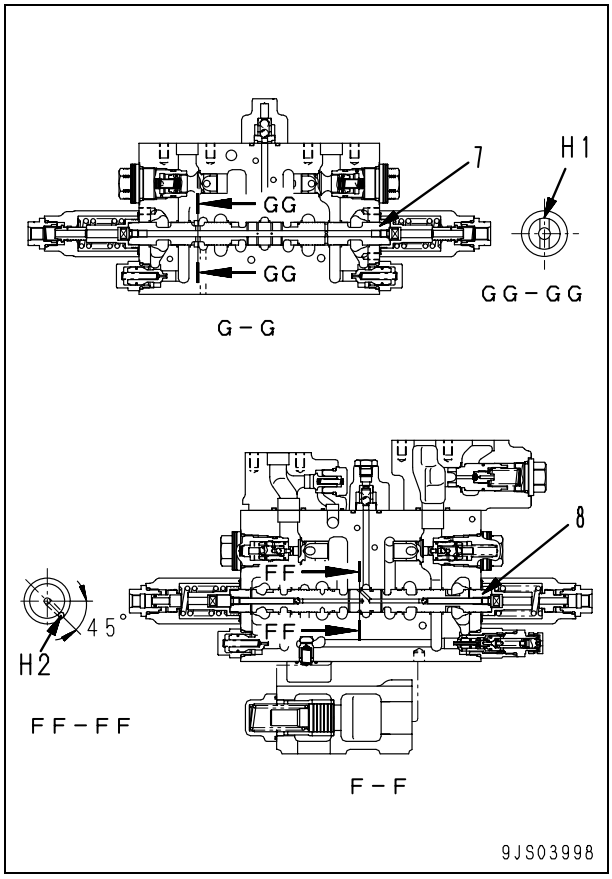
6. Assemble the piston in the sleeve.
   ★ If it is found difficult to install the piston, do not attempt to push it in forcibly, but set it to compensation tool **T4** again and install the piston to the sleeve after adapting the seal.

7. Fit plug (3) and spring (4) to piston (2), then assemble pressure compensation valve (1).
   ★ After the installation, push the piston by hand and check that the piston reacts only with spring force.



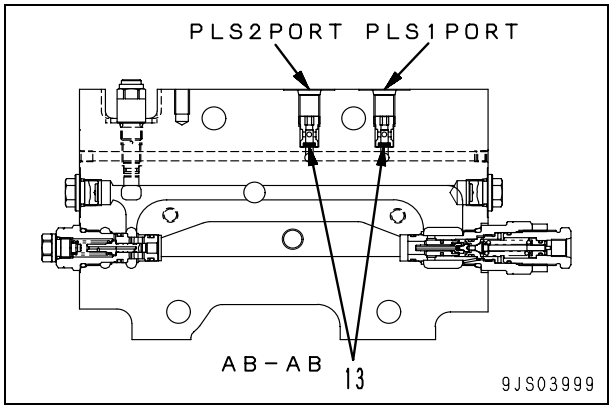
Assembly of Control Valve Assembly



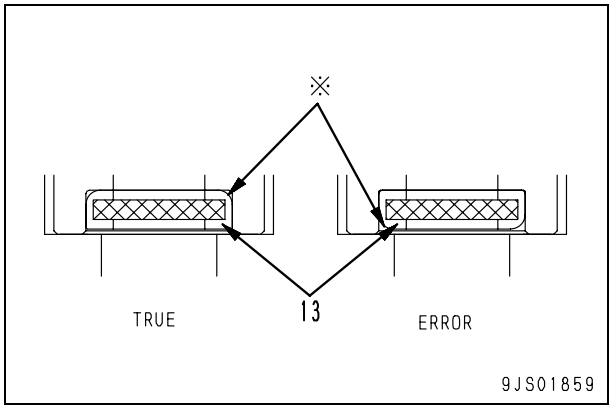


- Coat the sliding surface with engine oil and then reassemble the control valve assembly.
- When assemble spool (7) and (8) to the valve chamber, turn drill hole (H1) and (H2) to the direction as the diagram.

★ In the same way for section H-H,K-K,L-L,M-M.



- Filter (13) installed on the bottom of PLS1 PORT and PLS2 PORT is to be assembled in the direction shown in the diagram below. (Be careful on *caulking section.)



- Upper and lower control valve cover

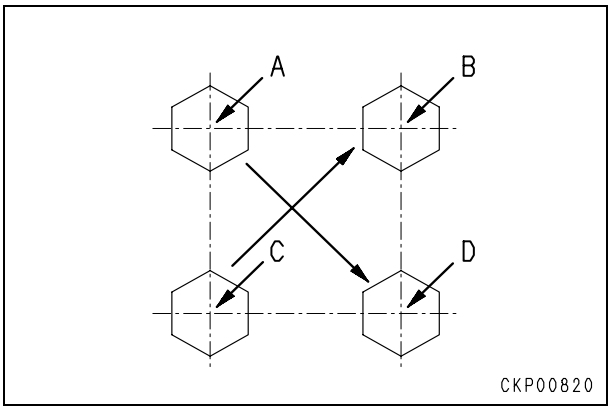
Mating face of upper and lower control valve cover block (SE):

SEALEND 242 or equivalent

- Tighten the mounting bolts for the upper and lower control valve cover in order of figure.(A→D→C→B)

Mounting bolt for upper and lower control covers:

156.9 – 176.5 Nm {16 – 18 kgm}



- Pump merge-divider valve

Mating faces of merge-divider valve (SE2):

SEALEND 242 or equivalent

- Tighten the mounting bolts for the merge-divider valve in the same sequence as that for the control valve cover mounting bolts.

Merge-divider valve mounting bolt:

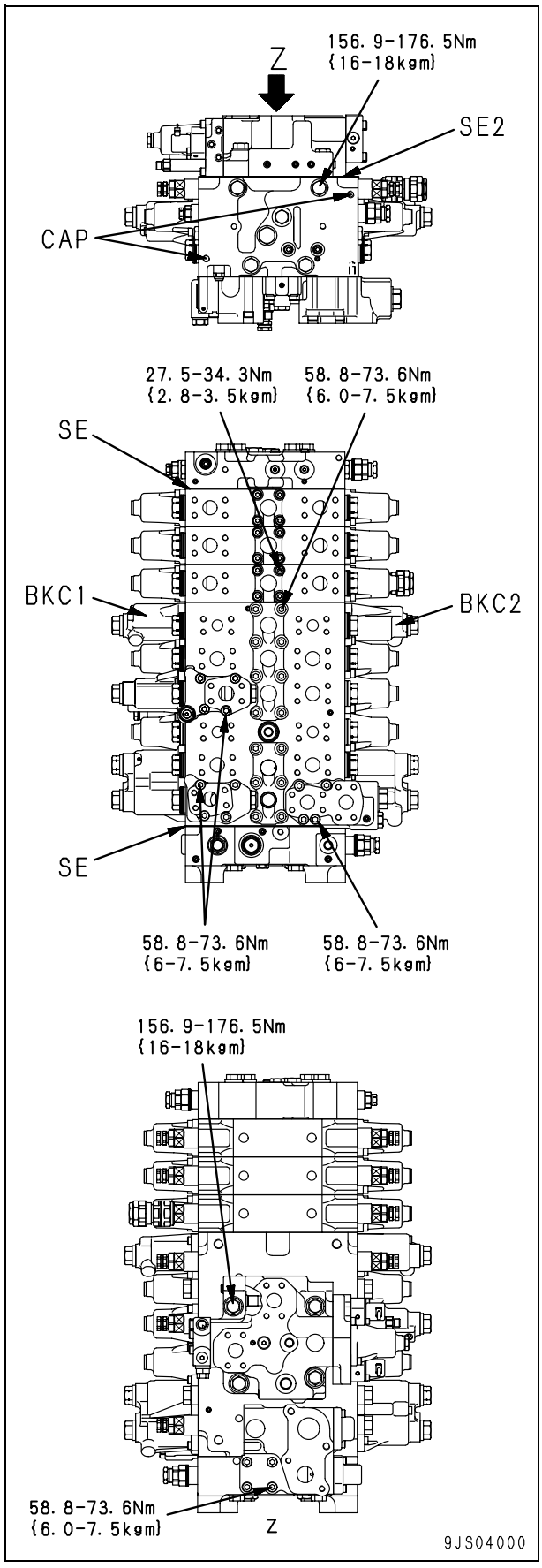
156.9 – 176.5 Nm {16 – 18 kgm}

- Tighten back pressure valve, boom lock valve, arm quick return valve, arm check valve and mounting bolts in the same order as that for the control valve cover.

Back pressure valve, boom lock valve, arm quick return valve, arm check valve mounting bolt:

58.8 – 73.6 Nm {6 – 7 kgm}

- After assembling, put a stopper (CAP) so that not to flow into oil and detergent liquid from ø12 hole.
- Pressure compensation valve
  - ★ Install each pressure compensation valve, paying attention to the counter mark that was put when removing it. Especially, do not install BKC1 and BKC2 adversely.
- Main relief valve assembly After assembling the main relief valve assembly in the control valve, refer to the section of Inspection and Adjustment of Hydraulic Oil Pressure in Hydraulic Circuit for Work Equipment, Swing and Travel in the chapter, Testing and adjusting, in this manual.



Removal and installation of hydraulic pump assembly

Special tools

Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch
A	10	796-460-1210	Oil stopper	●	1		
	11	796-770-1320	Adaptor	●	1		

Removal

⚠ **Disconnect the negative terminal (–) of the battery before starting the work.**

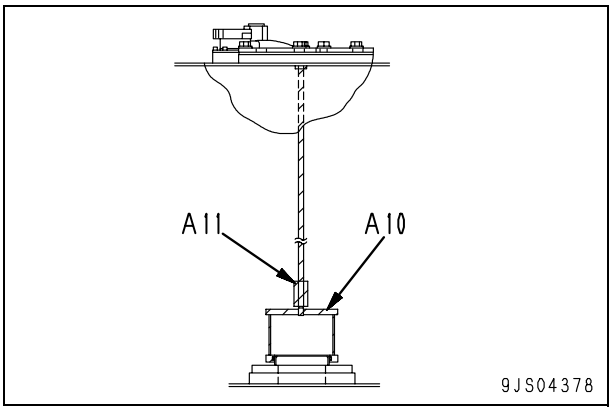
⚠ **Lower the work equipment to the ground completely, after the engine is stopped, loosen the hydraulic tank cap gradually to reduce the pressure inside, and set the lock lever in the lock position.**

★ Attach an identification tag to each piping to avoid a mistake in the position of installation later.

★ Attach an identification tag to each piping to avoid a mistake in the position of installation later.

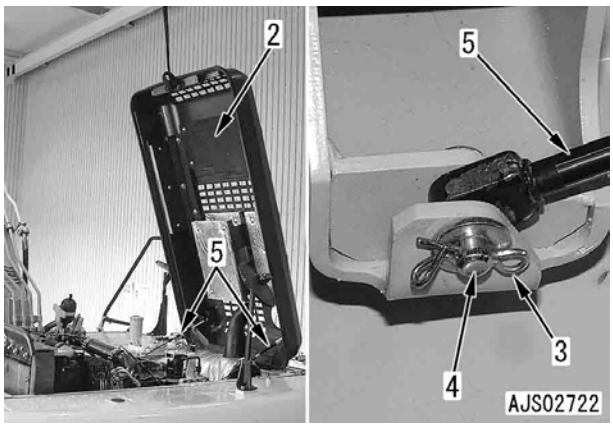
1. Swing to right 45 degree. (For hydraulic tank oil drain)

2. Remove hydraulic tank strainer and stop oil flow-out using tool **A10, A11**.
   ★ If tool **A10,A11** are not used, remove the drain plug and drain oil from the hydraulic tank and piping.
   Hydraulic tank:
   Approx. 234ℓ (PC210, 230)
   Approx. 239ℓ (PC240)

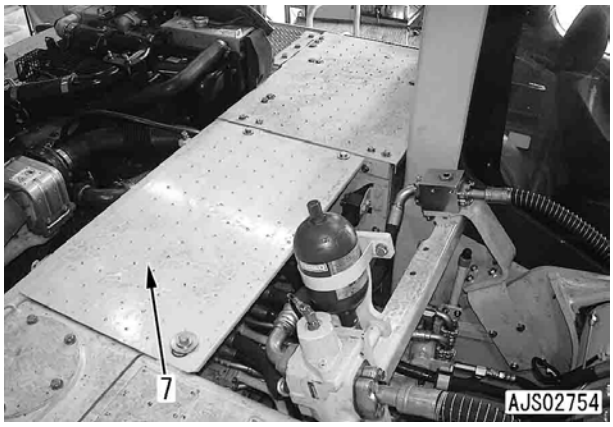


3. Remove cover (1).

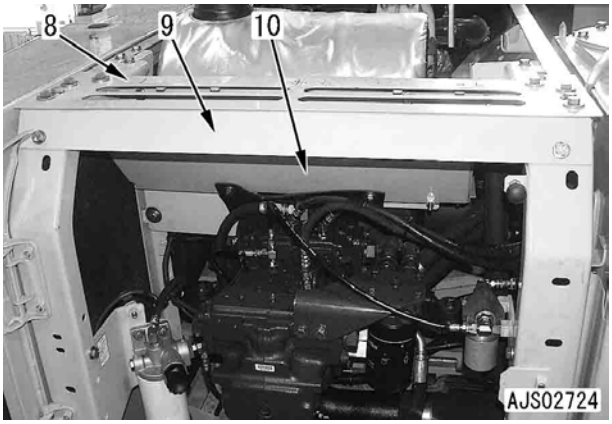
4. Temporary sling engine hood (2).
   ★ When slinging the engine hood, use care not to damage the rubber seal.
5. Remove pin (3) and (4), then remove two gas springs (5).
6. Lift off engine hood (2) to remove it.

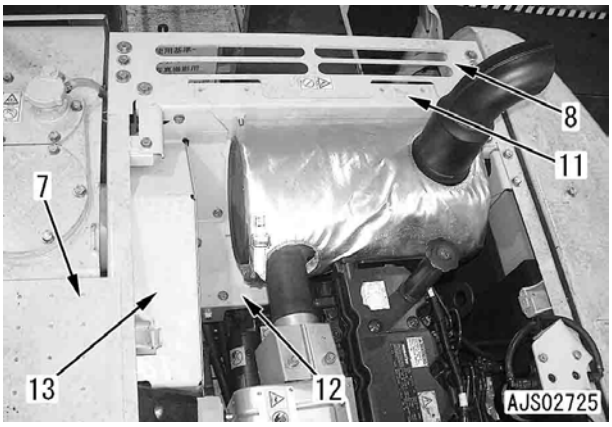


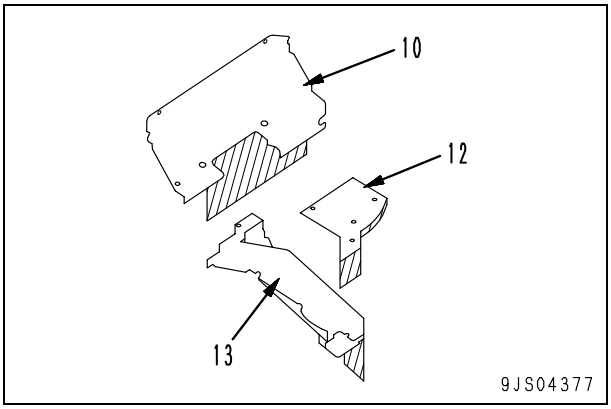
7. Remove cover (7).



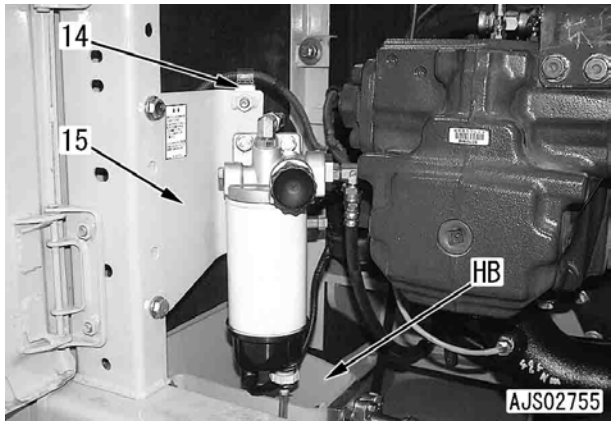
8. Remove cover (8).
9. Remove flame (9).
10. Remove cover (10).
11. Remove flame (11).
12. Remove cover (12) and (13).
    ★ Cover (13) cannot be removed unless removing cover (17).





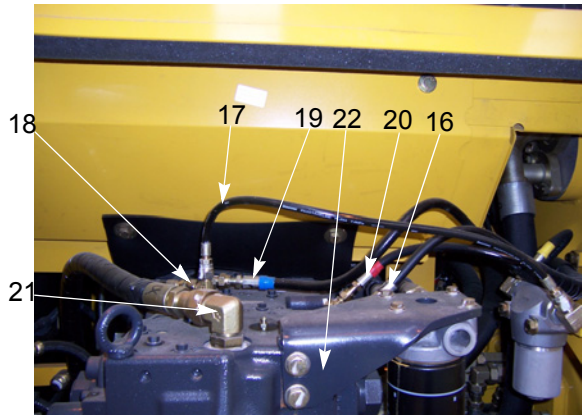


13. Disconnect clamp (14).
14. Remove filter and bracket assembly (15).
    ★ Put it on hose bracket (HB).

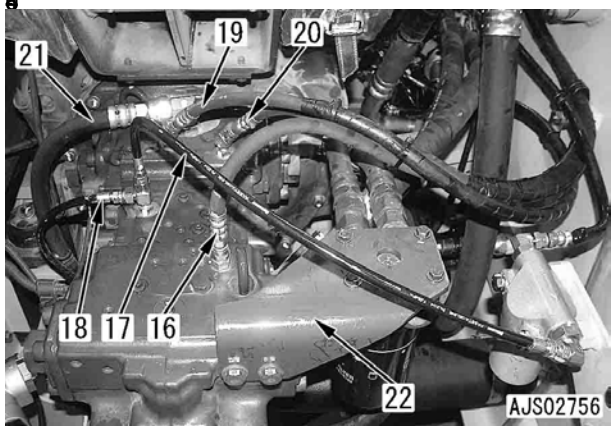


15. Disconnect six hoses.
    - (16): Rear load pressure input port hose (Color band: No color)
    - (17), (18): EPC basic pressure port hose (Color band: No color)
    - (19): Pump pressure input port hose (Color band: blue)
    - (20): Front load pressure input port hose (Color band: red)
    - (21): Drain port hose
16. Disconnect bracket (22).

PC210/230-8

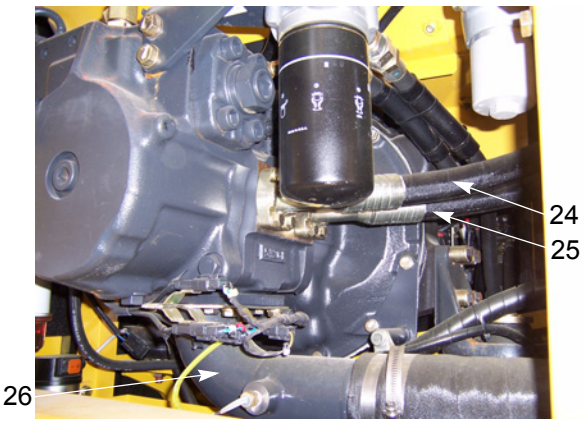


PC240-8

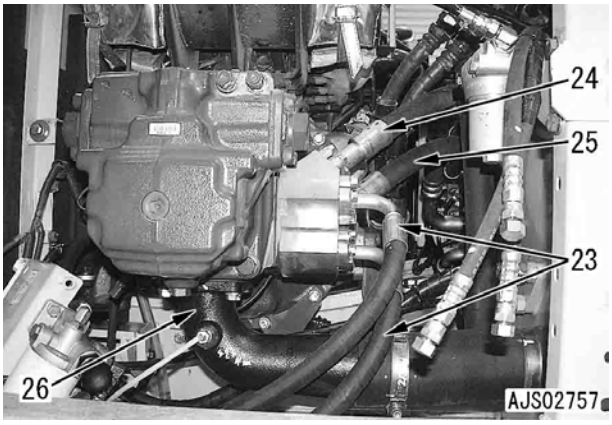


17. Disconnect four hoses and one tube.
    - (23): Branch hose (PC240-8 only)
    - (24): Rear pump discharge port hose
    - (25): Front pump discharge port hose
    - (26): Pump suction port tube

PC210/230-8



PC240-8



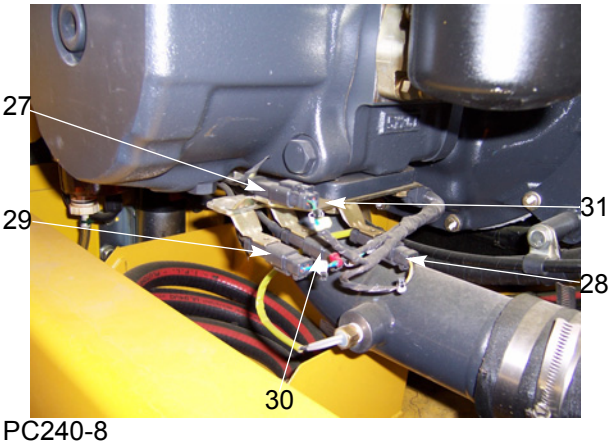
18. Drain oil from the damper case.
    Damper case: **Approx. 0.65ℓ**

19. Disconnect pump wiring connectors at four points.
    - (27): V12 PC-EPC R solenoid valve
      Color band: yellow
    - (28): P22 hydraulic oil temperature
      Color band: no color
    - (29): V19 LS-EPC solenoid valve
      Color band: red
    - (30): V11 PC-EPC F solenoid valve
      Color band: white

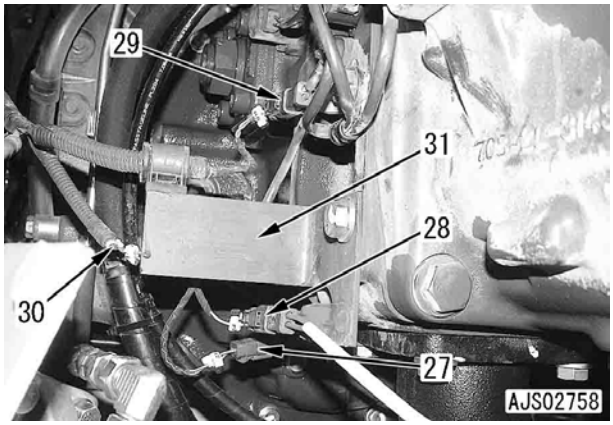
    ★ It is behind bracket (31).

20. Disconnect bracket (31).

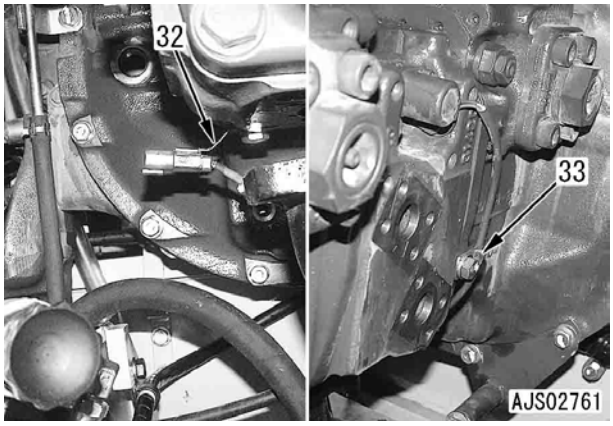
PC210/230-8



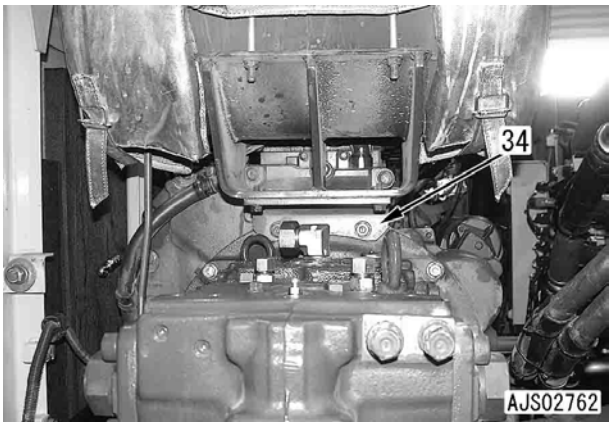
PC240-8



21. Remove clip (32).
22. Remove clip (33).

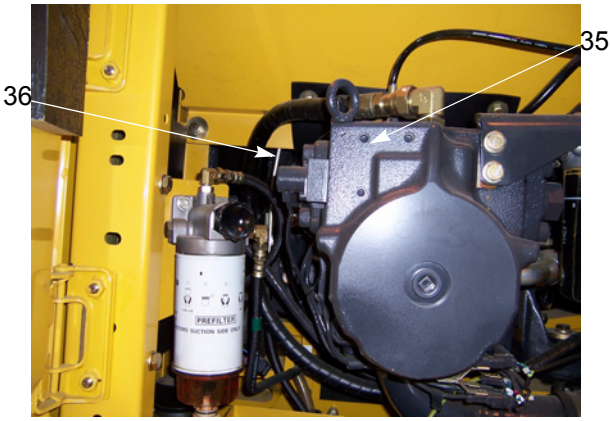


23. Remove muffler bracket (34).

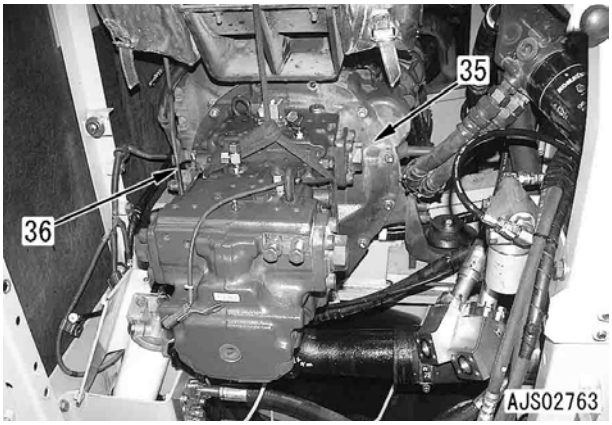


24. Lift off hydraulic pump Ass'y (35) to remove the mounting bolt. [*1]
    ★ Muffler drain tube (36) is double tightened.

PC210/230-8



PC240-8



25. Lift off hydraulic pump Ass'y (37) to remove it. [*1]
    Hydraulic pump Ass'y: **220 kg**

PC240-8 pump shown

Installation

- Installation is done in the reverse order of removal.

[*1]

Hydraulic pump involute spline:
Anti-friction agent (LM-G)

Mating face of the hydraulic pump case:
Gasket sealant (LG-6)

★ Since flywheel housing is made of aluminum, be careful not to over torque.

★ Impact wrench is not applicable to use.

- **Refilling with oil (damper case)**
  Refill hydraulic oil through the oil filler port to the specified level.
  Damper case: **EO30-CD Approx. 0.65ℓ**

- **Refilling with oil (hydraulic tank)**
  Refill hydraulic oil through the oil filler port to the specified level. Let the oil circulate in the hydraulic system by starting the engine. Then check the oil level again.
  Hydraulic tank:
  Approx. 234ℓ (PC210, 230)
  Approx. 239ℓ (PC240)
  Hydraulic tank drain plug:
  58.8 – 78.5 Nm {6.0 – 8.0 kgm}

- **Air bleeding**
  Bleed the air from the circuit between the valve and the hydraulic cylinder. For details, see Testing and adjusting, air bleeding of various parts.

Removal and installation of oil seal in hydraulic pump input shaft

Special tools

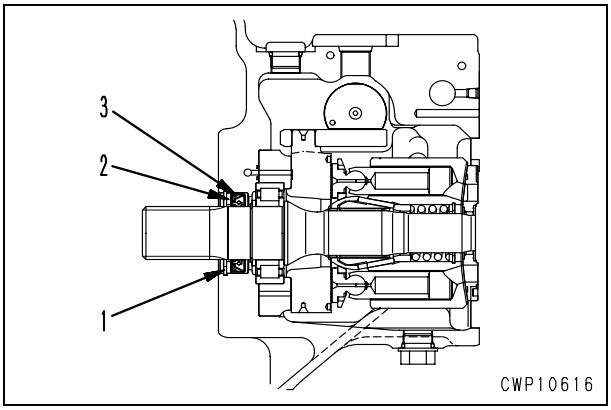
Symbol	Part number	Part name	Necessity	Q'ty	N/R	Sketch
S	796T-467-2410	Push tool	■	1	N	○

Removal

1. Remove the hydraulic pump assembly referring to the section of Removing Hydraulic Pump Assembly.

2. Remove snap ring (1) and then remove spacer (2).

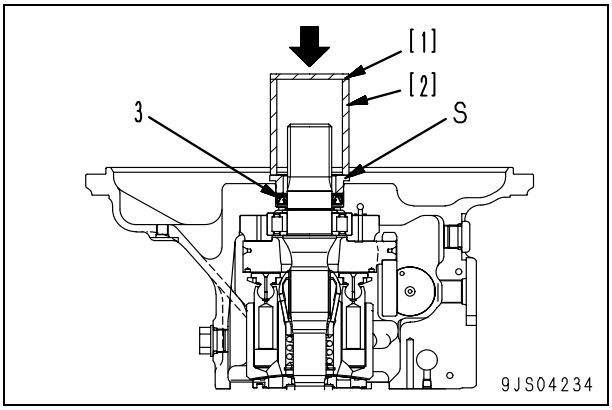
3. Pry off oil seal (3) with a screwdriver. [*1]
   ★ Use care in removing the oil seal so that the shaft may not be damaged.



Installation

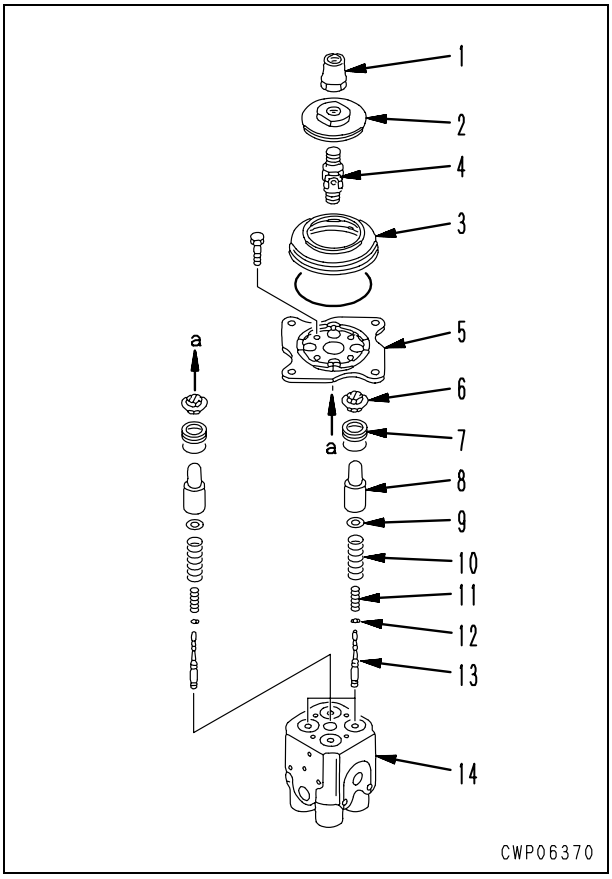
- Installation is done in the reverse order of removal.

[*1]
Oil seal lip portion: **Grease (G2-LI)**
Oil seal outer circumference:
Grease (G2-LI)
★ Coat the oil seal outer circumference thinly with grease.
★ Press fit oil seal (3) with tool **S**, [1], [2].



Disassembly and assembly of work equipment PPC valve assembly

★ This section deals with only precautions to be followed when reassembling the PPC valve assembly for work equipment.



Assembly

- Work equipment PPC valve reassembly

★ When assembling spring (11), be sure to face its smaller end turn (inner diameter) side toward shim (12).

★ Springs (10) in use differ in the number of turns according to hydraulic ports as classified in the table below. Hence take care when installing one.

Port position	Spring free length
P1 and P2	44.4 mm
P3 and P4	42.4 mm

★ The location of each port is stamped in the lower part of the valve body.

Piston (8): **Grease (G2-LI)**

★ When assembling piston (8), coat the piston outer periphery and body hole inner periphery with grease.

Mounting bolt for plate (5):
11.8 – 14.7Nm {1.2 – 1.5 kgm}

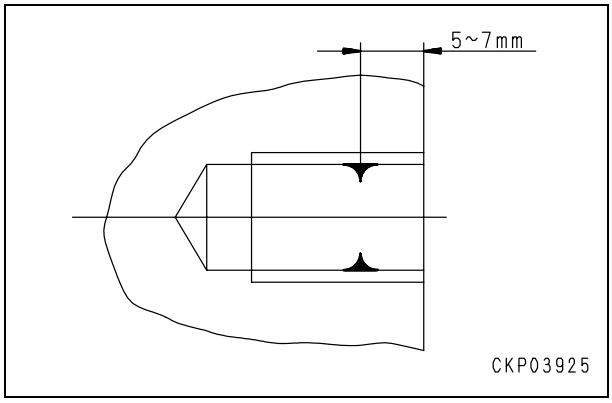
Joint (4) sliding portion.
Grease 2 – 4 cc (G2-LI)

Body female screw portion:
Adhesive compound (LT-2)

★ Coat the female screw body with Loctite at two spots as shown in the diagram below. Each spot is to be coated with a drop (approx. 0.02g).

Joint (4): **39 – 49 Nm {4 – 5 kgm}**

★ Strictly follow the specified torque for the joint.



Contact surfaces of the piston and disc (2):
Grease 0.3 – 0.8 cc (G2-LI)

Nut (1): **98 – 127 Nm {10 – 13 kgm}**

★ After assembling the disc, refer to the Adjustment of Work Equipment and Swing PPC Valve section of the Testing and adjusting chapter of this manual.

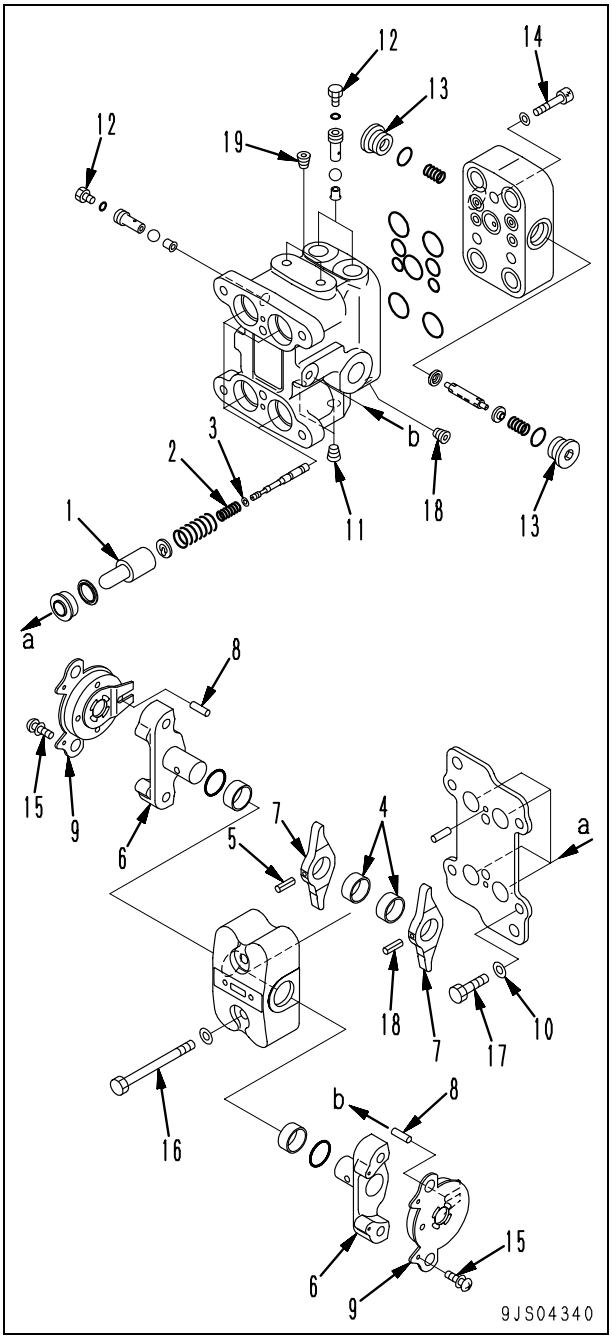
Disassembly and assembly of travel PPC valve assembly

★ This chapter deals only with precautions to be followed when assembling the travel PPC valve assembly.

Assembly

★ When assembling, clean and inspect the parts closely and take care fully so that dirt, rush, flaw, etc. never cause a trouble.

1. When assembling piston (1), apply grease (G2-LI) to its outside and inside of the body hole.
2. Install spring (2) with its small diameter side of the end coil diameter on the shim (3) side.
   - End coil diameter of the spring (inside diameter)
     Small diameter end: ø4.9 large diameter end: ø5.55
3. Do not drive in bushing (4) by hitting it directly with a hammer.
4. Do not drive in pin (5) by hitting it directly with a hammer.
5. Apply grease (G2-LI) to the swaying part of shaft (6), the contact surfaces of lever (7) and piston (1), contact surfaces of damper (9) lever and pin (8).
   Applying quantity of grease (G2-LI)
   Swing part of shaft (6):
   4 – 8cc/all-around
   Contact surface of lever (7) and piston (1): **0.3 – 0.8cc/1 place**
   Contact surface of damper (9) lever and pin (8): **0.3 – 0.8cc/1 place**
6. Install washer (10) 1.6 mm thick first. If the difference between both sides at the stroke and of the lever exceeds 0.7°, change the washer thickness to reduce the difference to below 0.7°. (If the washer thickness is reduced by 0.3 mm, the stroke end angle is increased by 0.39°.)
   - Thickness of washers=1.0, 1.3, 1.6
7. Tighten each part to the following torque.
   - Plug (11): **34 – 44 Nm {3.5 – 4.5 kgm}**
   - Plug (12): **9.8 – 14.7 Nm {1 – 1.5 kgm}**
   - Plug (13): **24.5 – 34.3 Nm {2.5 – 3.5 kgm}**
   - Bolt (14): **19.6 – 27.4 Nm {2.0 – 2.8 kgm}**
   - Screw (15):
     0.441 – 0.588 Nm {0.045 – 0.06 kgm}
   - Bolt (16): **25 – 31 Nm {2.5 – 3.2 kgm}**
   - Bolt (17): **27 – 34 Nm {2.8 – 3.5 kgm}**
   - Plug (18): **6 – 11 Nm {0.6 – 1.1 kgm}**
   - Plug (19): **4 – 9 Nm {0.4 – 0.9 kgm}**



Disassembly and assembly of hydraulic cylinder assembly

Special tools

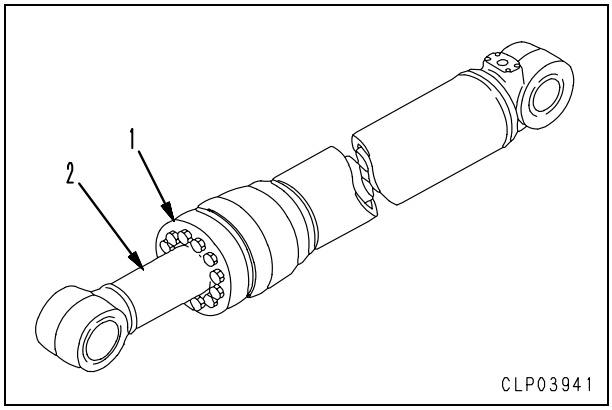
Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch
U	1	790-502-1003	Cylinder repair stand	●	1		
		790-101-1102	Pump	●	1		
	2	790-102-4300	Wrench assembly	■	1		
		790-102-4310	Pin	■	2		
	3	790-720-1000	Expander	●	1		
	4	796-720-1670	Rubber band (for boom and arm)	●	1		
		07281-01279	Clamp	●	1		
		796-720-1660	Rubber band (for bucket)	●	1		
		07281-01159	Clamp	●	1		
	5	790-201-1702	Push tool kit	■	1		
		• 790-201-1831	• Push tool (for bucket)		1		
		• 790-201-1930	• Push tool (for arm)		1		
		• 790-201-1940	• Push tool (for boom)		1		
		• 790-101-5021	• Grip		1		
		• 01010-50816	• Bolt		1		
	6	790-201-1500	Push tool kit (for bucket)	●	1		
		• 790-201-1640	• Push tool		1		
		• 790-101-5021	• Grip		1		
		• 01010-50816	• Bolt		1		
		790-201-1980	Plate (for boom)	●	1		
		790-201-1990	Plate (for arm)	●	1		
		790-101-5021	Grip	●	1		
		01010-50816	Bolt	●	1		

Disassembly

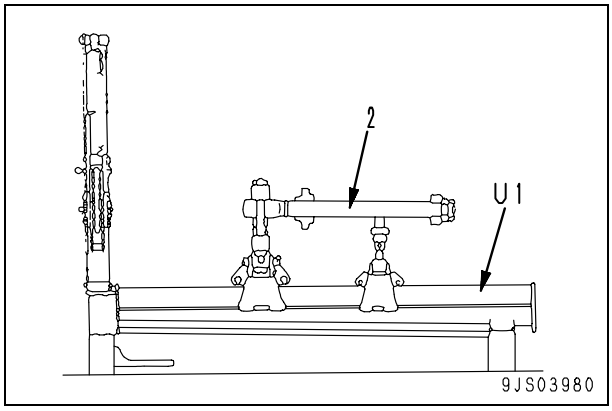
1. Piston rod assembly

1) Remove piping from the cylinder assembly.
2) Remove the mounting bolts and then disconnect head assembly (1).
3) Pull out piston rod assembly (2).

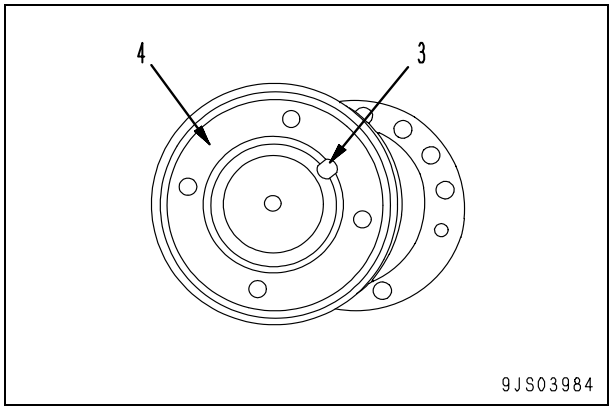
★ Place a container under the cylinder to catch the oil.



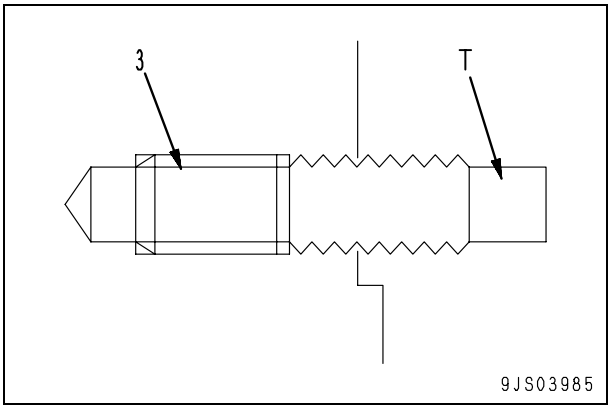
4) Disassemble the piston rod assembly as follows.
   1] Set piston rod assembly (2) in tool **U1**.



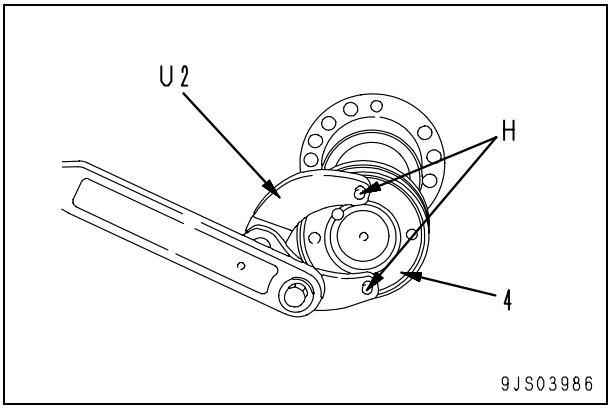
   2] Remove stopper screw (3) of piston assembly.
   ★ Common to the boom, arm and bucket cylinder. Screw size:
   M12 x Pitch 1.75



★ If the caulking of screw (3) is too strong and it cannot be removed, tighten the screw fully, then fit tap (T) to the thread and remove the screw.



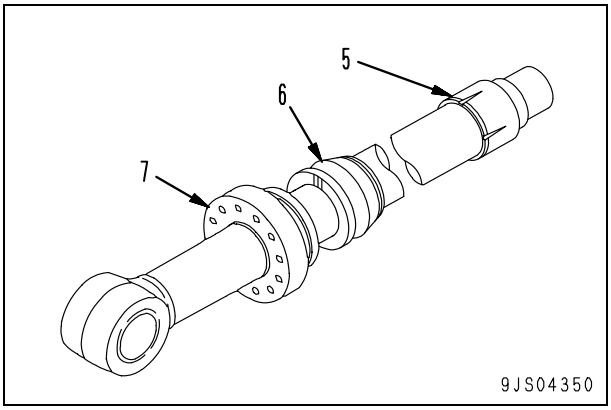
3] Using tool **U2**, remove piston assembly (4).
- When not using tool **U2**, use the drill holes (H)(ø10: 2 places) and loosen piston assembly.



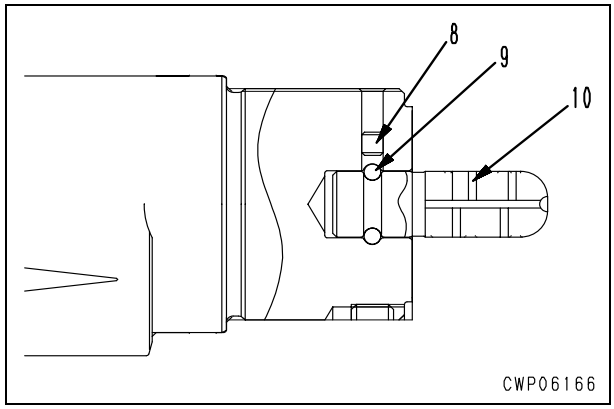
4] Remove plunger
- Boom and arm cylinder only

5] Remove collar (6).
- Boom and arm cylinder only

6] Remove head assembly (7).

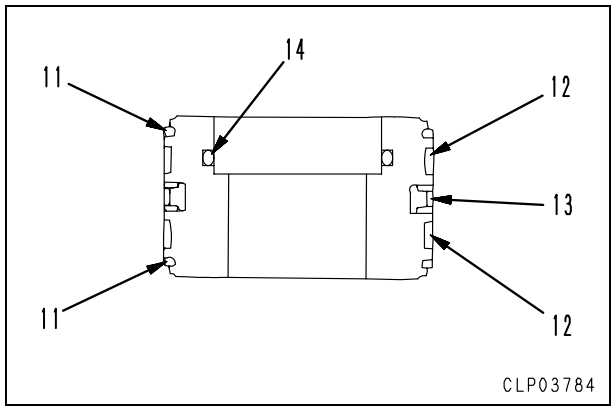


7] Remove cap (8), and pull twelve balls (9), then remove plunger (10).
- Arm cylinder only



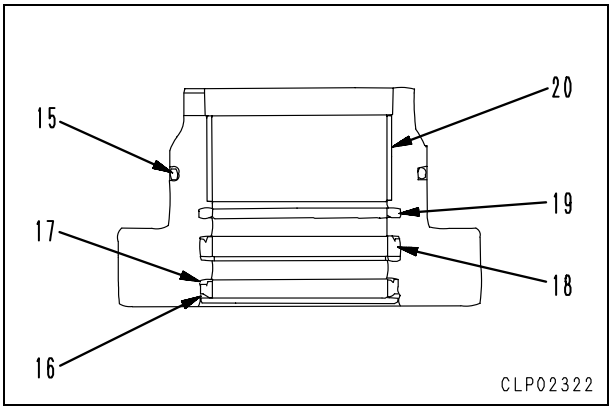
2. Disassembly of piston assembly

1) Remove ring (11).
2) Remove wear ring (12).
3) Remove piston ring (13).
4) Remove O-ring and backup ring (14).



3. Disassembly of cylinder head assembly

1) Remove O-ring and backup ring (15).
2) Remove snap ring (16) and then remove dust seal (17).
3) Remove rod packing (18).
4) Remove buffer ring (19).
5) Remove busing (20).

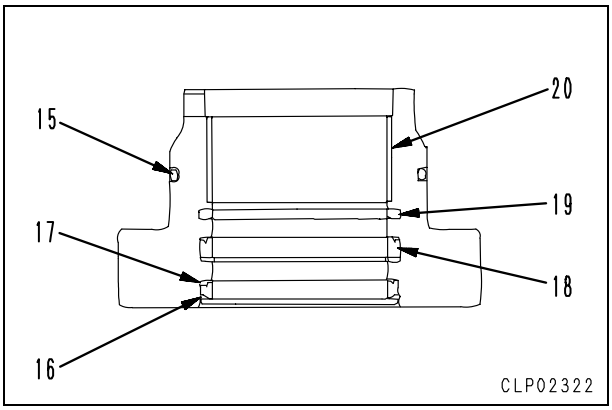


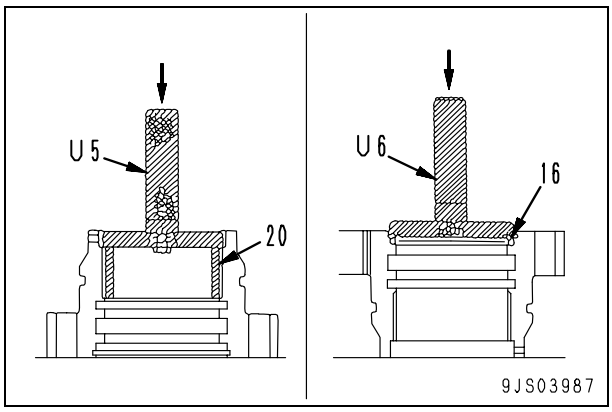
Assembly

★ Be careful not to damage the packing, dust seals, and O-rings.
★ Clean each part, then cover the piping ports and pin-inserting hole to prevent dust from entering them.
★ Do not try to force the backup ring into position. Warm it in warm water (50 – 60°C) before installing it.

1. Disassembly of recoil spring assembly

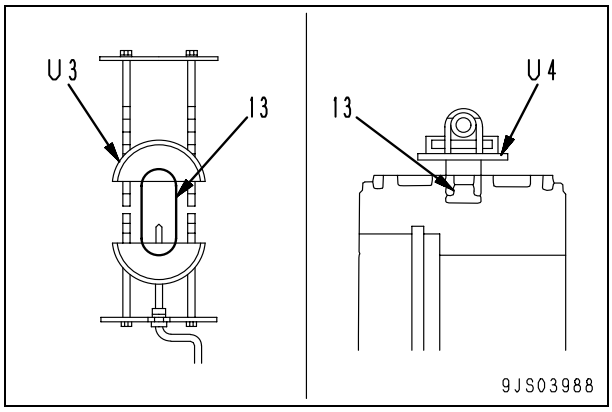
1) Using tool **U5**, press fit bushing (20).
2) Assemble buffer ring (19).
3) Assemble rod packing (18).
4) Using tool **U6**, install dust seal (17), and secure with snap ring (16).
5) Install the backup ring and O-ring (15).



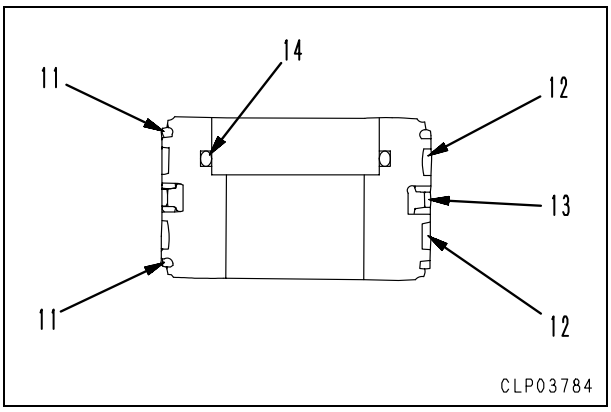


2. Disassembly of piston assembly

1) Using tool **U3**, expand piston ring (13).
   ★ Set the piston ring on tool **U3**, and turn the handle 8-10 times to expand the ring.
2) Set tool **U4**, and compress piston ring (13).

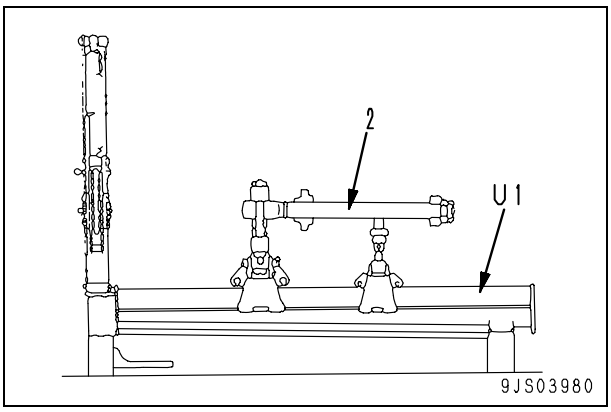


3) Install the backup ring and O-ring (14).
4) Assemble wear ring (12).
5) Assemble ring (11).
   ★ Be careful not to open the end gap of the ring too wide.
   Ring groove: **Grease (G2-LI)**

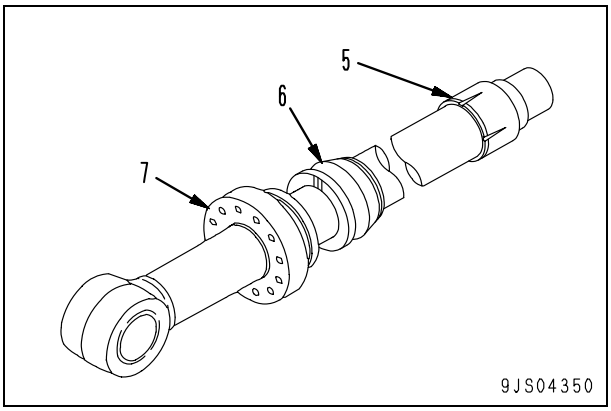


3. Piston rod assembly

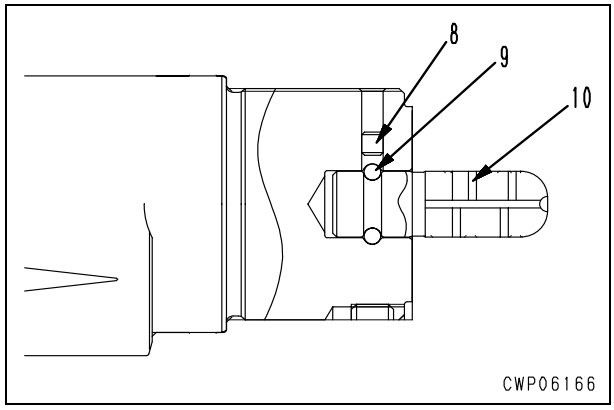
1) Set piston rod assembly (2) in tool **U1**.



2) Assemble head assembly (7).
3) Fit O-ring and backup ring to collar (6), then assemble.
   - Boom and arm cylinder only
4) Assemble plunger (5).
   - Boom and arm cylinder only



5) Set plunger (10) on the piston rod, assemble 12 balls (9) to it and secure with cap (8).
   ★ Check that there is a small amount of play at the tip of the plunger.
   ★ Put a mark on the end face of the rod so that the processing hole position of cap (8) is visual from outside.
   - Arm cylinder only

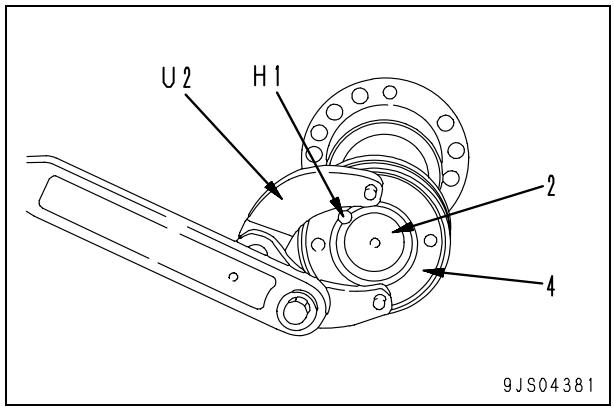


6) Assemble piston assembly (4) as follows.

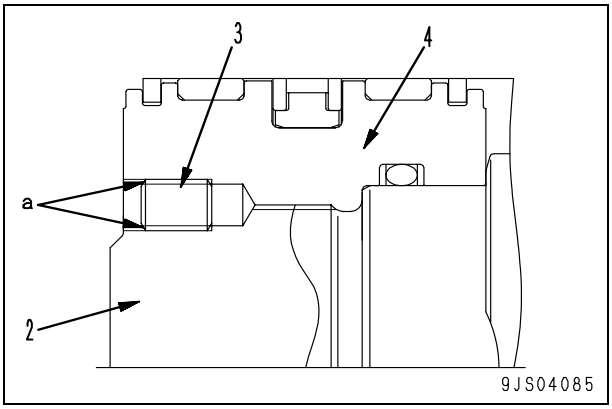
   - **When using piston rod assembly (2) and piston assembly (4) again**

★ Wash thoroughly and remove all metal particles and dirt.

1] Screw in piston assembly (4) by using tool **U2**, and tighten piston assembly (4) until the position of the screw thread hole (H1) which is in piston rod assembly (2) halfway matches.
   ★ Remove all burrs and flashes on the threaded portion with a file.



2] Tighten screw (3).
Screw part female screw side:
Loctite No.262
Screw:
58.9 – 73.6 Nm {6 – 7.5 kgm}
3] Caulk thread at four places (a) of screw (3) with punch.

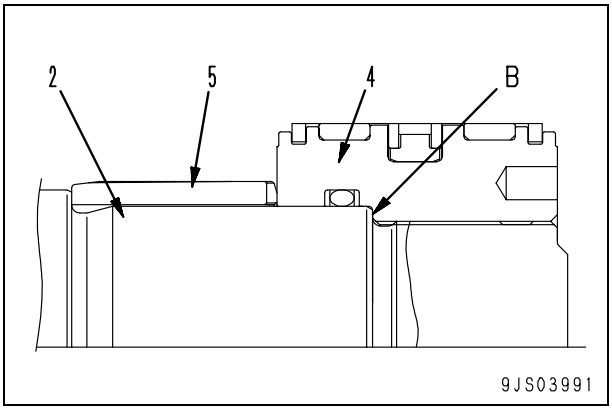


- **When using a new part for either or both of piston rod assembly (2) and piston assembly (4)**

★ For the rod with bottom cushion, mark the cap position on the end surface of rod. (See step 3.5.)
- Arm cylinder only

1] Screw in until piston assembly (4) contacts end surface (B) of rod, then use tool to tighten.
Piston assembly:
294 ± 29.4 Nm {30 ± 3.0 kgm}

★ After tightening the piston, check that there is play in plunger (5).
- Boom, arm cylinder only

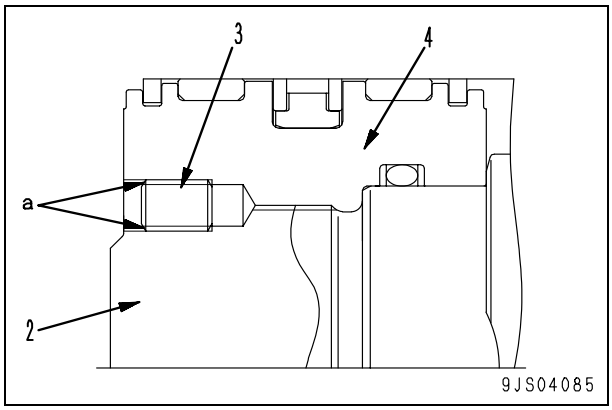


2] Machine one of the hole used to install screw (3).
★ Align a drill horizontal with the V-groove of the thread of piston rod assembly (2) and piston assembly (4), then carry out machining.
★ For the arm cylinder, avoid the cap machining holes position when machining. (See step 3.5.)
- Screw machining dimension (mm)

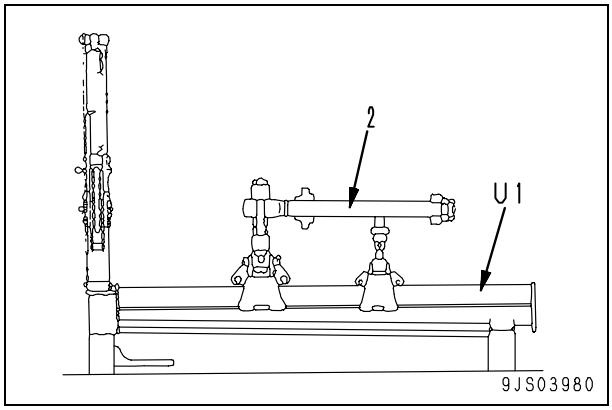
Bottom hole drill diameter	Bottom hole depth	Tap used	Tap depth
10.3	24	12x1.75	20

3] After machining, wash thoroughly to remove all metal particles and dust.

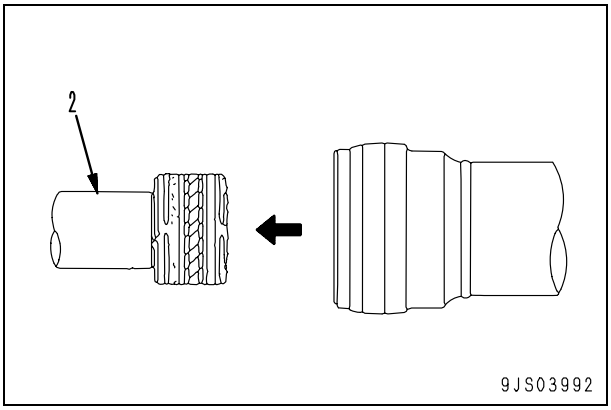
4] Tighten screw (3).
Screw part female screw side:
Loctite No.262
Screw:
58.9 – 73.6 Nm {6 – 7.5 kgm}
5] Caulk thread at four places (a) of screw (3) with punch.



7) Set piston rod assembly (2) in tool **U1**.



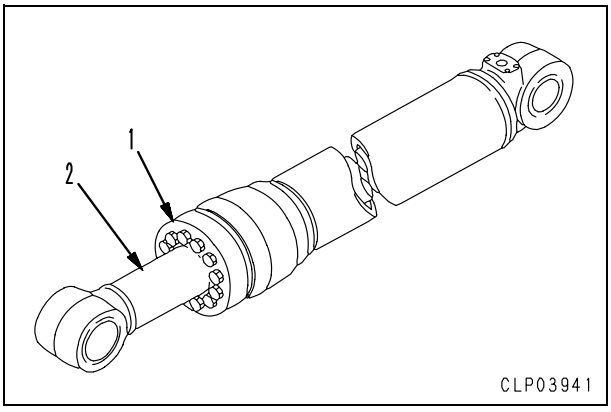
8) Assemble the cylinder tube to piston rod assembly (2).
   ★ Align axial center of the cylinder tube, then insert.
   ★ Check that the ring is not broken and has not come out, then push in fully.



9) Tighten head assembly (1) with mounting bolts.
   Mounting bolt:

Cylinder name	Tightening torque
Bucket	270±39Nm {27.5±4.0kgm}
Arm	373±54Nm {38.0±5.5kgm}
Boom	270±39Nm {27.5±4.0kgm}
* Adjust cylinder	892±137Nm {91.0±14.0kgm}

* Variable 2 pieces boom specification



10) Install piping.

PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00663-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

50 Disassembly and assembly

Work equipment

Work equipment

Removal and installation of the work equipment assembly

Special tools

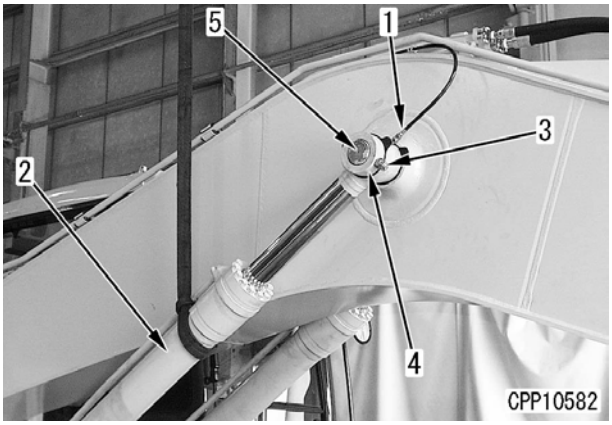
Symbol	Part number	Part name	Essentiality	Quantity	N/R	Illustration
V	796-900-1200	Remover	■	1		
	• 796-900-1210	• Sleeve		1		
	• 792-900-1520	• Plate		1		
	• 799-900-1230	• Screw		1		
	• 796-900-1240	• Adapter		1		
	• 01643-33080	• Washer		1		
	• 01803-13034	• Nut		1		
	790-101-4000	Puller (490kN {50 ton} long)	■	1		
	790-101-1102	Pump (294 kN {30 ton})	■	1		

Removal

⚠ **Safely lower the work equipment to the ground by extending the arm and the bucket completely. Set the lock lever in the lock position,**

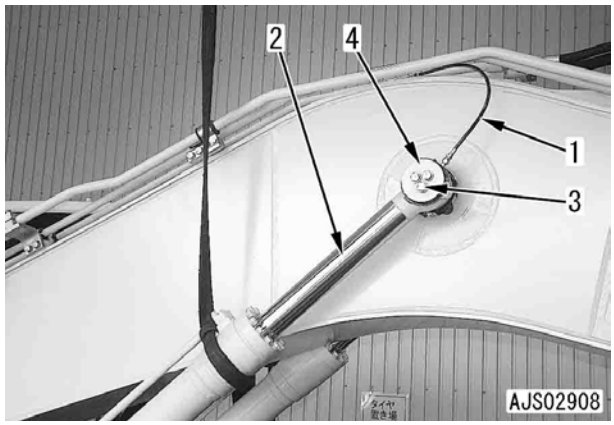
⚠ **Release the residual pressure in the hydraulic circuit. Refer to the Release of Remaining Pressure in Hydraulic Circuit section in the Testing and adjusting chapter of this manual.**

1. Disconnect grease hose (1).
2. Sling the boom cylinder Assembly (2).
   - ● Demolition spec.
   - ★ Articles 3. & 4. for the demolition spec.
3. Remove the lock bolt and nut (3). [*1]
4. Remove plate (4), then remove head pin (5). [*2]
   - ★ Check the number as well as locations of the shims used.

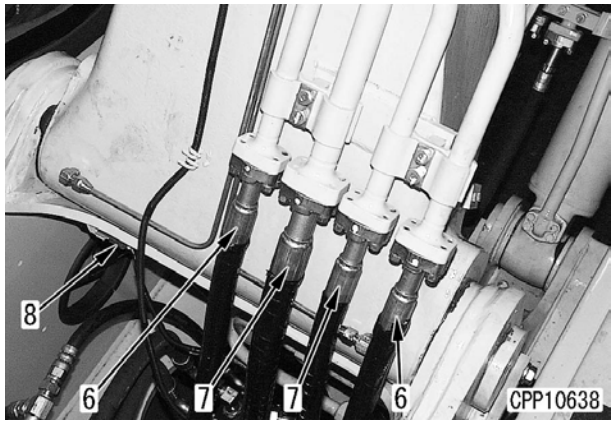


- ● Except demolition spec.
- ★ Articles 5. & 6. for except the demolition spec.

5. Remove lock bolt (3).
6. Remove plate (4) and remove the head pin. [*3]
   - ★ Check the number as well as locations of the shims used.



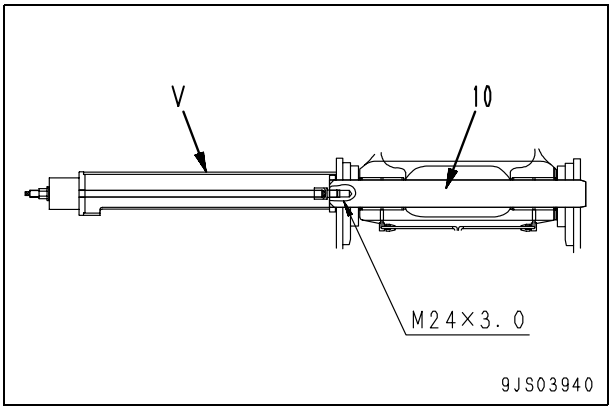
7. Start the engine and then retract the piston rod.
   - ★ Bind the piston rod with wire etc. and put it down the blocking tools so that the piston rod does not slip out or allot a support so that the cylinder doesn't fall down to the bottom side. If a support is allotted, remove the grease fitting at the bottom side.
   - ★ Remove the boom cylinder on the other side in the same manner.
   - ★ If bumping of the lifting hook against the work equipment lamp is anticipated in lifting the work equipment, the lamp must be removed.
8. Disconnect 2 pcs. of bucket cylinder hose (6) & 2 pcs. of arm cylinder hose (7).
   - ★ Apply the oil restraining plug and then fix the hoses to the valve side by use of ropes.
9. Disconnect intermediate connector for working lamp A13 (8).



10. Lift the work equipment Assembly, remove plate (9) and pin (10) at the foot. [*4]

- In case to remove using tool **V**
  Remove plate (9) and remove pin (10) at the foot using tool **V**.

★ Check the number as well as locations of the shims used.



11. Remove work assembly (11).
    Work equipment Assembly:
    PC210/230-8: 3,300 kg

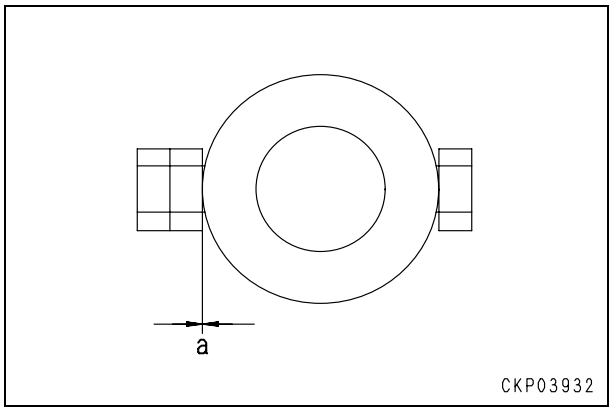
Installation

- Installation is done in the reverse order of removal.

[*1]

- Demolition spec.

★ When tightening the locknut, make sure that 0.5 – 1.5 mm clearance is maintained between the plate and nut after the tightening.



[*2]

Inside surface of bushing when assembling pin: **Anti-friction agent (LM-P)**

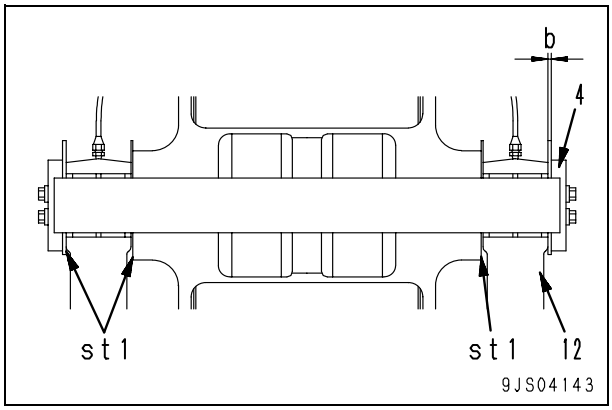
Greasing after assembling the pin: **Grease (LM-G)**

⚠ **When aligning the position of the pin hole, never insert your fingers into the pin hole.**

★ st1:resin shim (thickness **1.0mm**)

★ Adjust the clearance **(b)** between cylinder rod (12) and plate (4) to 1.5mm or less using shims: **1.0 and 2.0 mm**

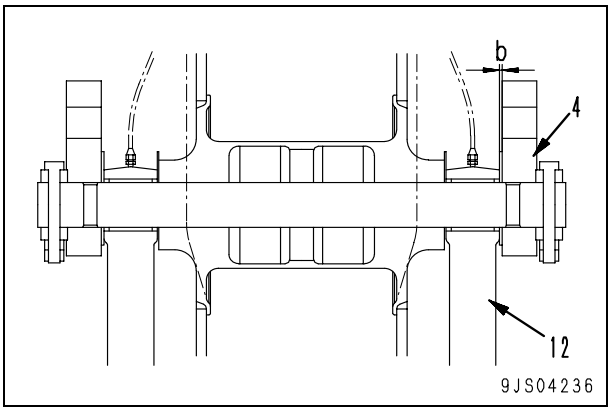
- Except demolition spec.



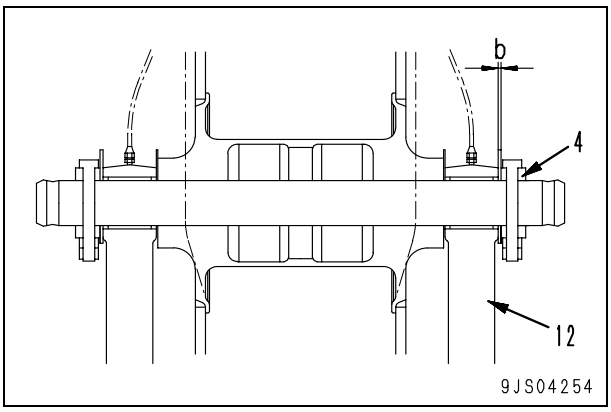
- Demolition spec.

★ Insert the resin shim (thickness **1.0mm**) as well as except demolition spec.

1) Ring lifting



2) As running

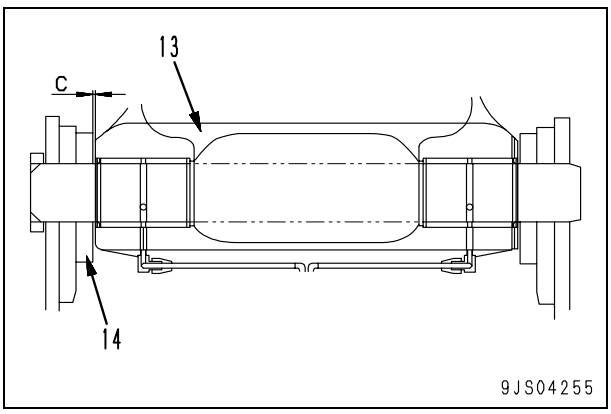


[*3]

Inner surface of bushing as assembling the pin: **Anti-friction compound (LM-P)**

Feed grease after assembling pin: **Grease (LM-G)**

★ Adjust the clearance **(c)** between the foot's end face of boom (13) and bracket (14) to 1 mm or less by use of shims. Thickness of standard shim: **2.0, 2.5, 3.0 and 3.5 mm**



- **Air bleeding**
  Bleed the air from the circuit between the valve and the hydraulic cylinder. For details, see Testing and adjusting, air bleeding of various parts.

- **Refilling with oil (hydraulic tank)**
  Refill hydraulic oil through the oil filler port to the specified level. Let the oil circulate in the hydraulic system by starting the engine. Then check the oil level again.

PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00664-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

50 Disassembly and assembly

Cab related

Cab related

Removal and installation of operator's cab assembly

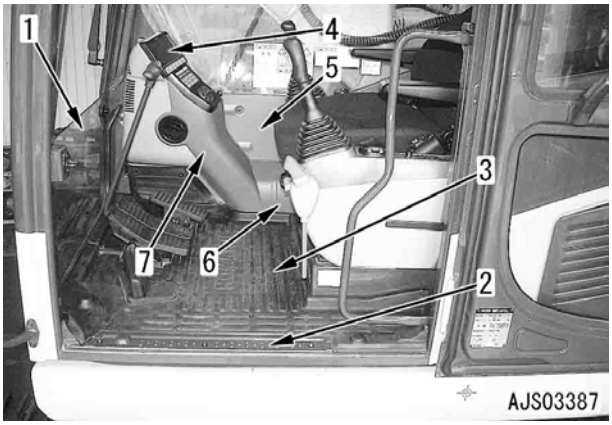
Removal

⚠ **Disconnect the negative terminal (–) of the battery before starting the work.**

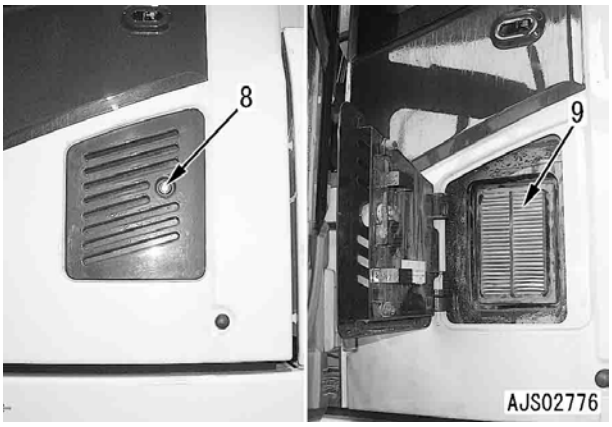
1. Remove front window (1).
2. Remove step plate (2).
3. Remove floor mat (3).

4. Refer to “Removal and installation of monitor assembly“, and remove monitor assembly (4).

5. Remove cover (5) and (6).
6. Remove cover duct assembly (7).



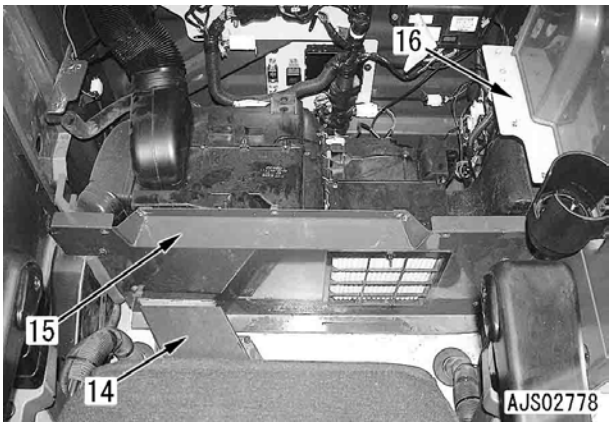
7. Insert key (8), turn it right, and open the outside-air filter cover.
8. Remove outside air-filter(9).



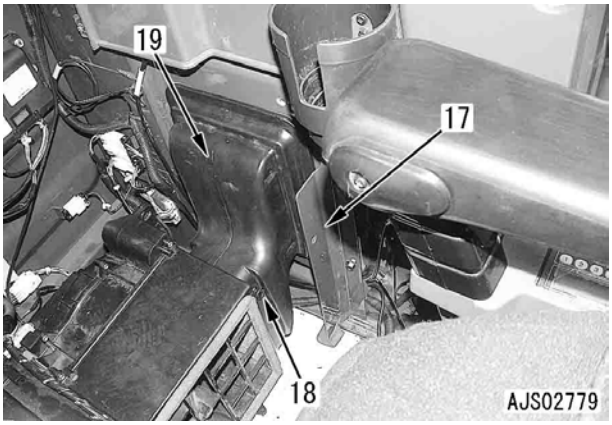
9. Remove rear cover (10) to (13).

10. Remove duct (14).
11. Remove cover (15).
    ★ Disconnect connector H15 fixed on the back from the clip.

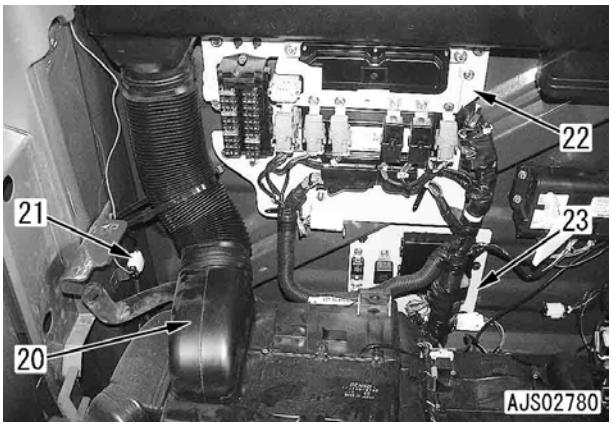
12. Remove plate (16).



13. Remove plate (17).
14. Remove lock pin (18) and remove duct (19).

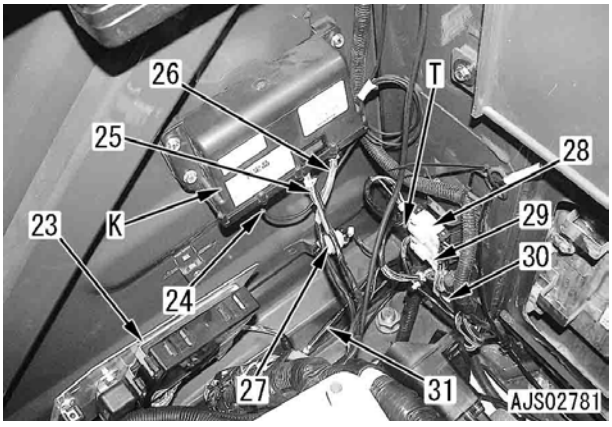


15. Remove duct (20).
16. Disconnect connector (21).
17. Remove plates (22) and (23) from the operator cab.

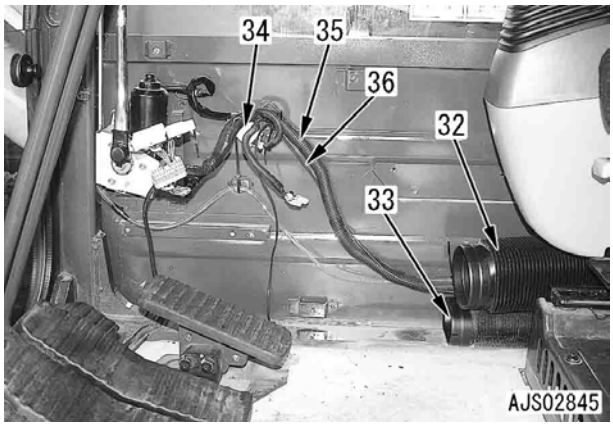


18. Pass over and disconnect antenna (24) from KOMTRAX communication modem.
19. Disconnect connectors K01(25) and CK02 (26).
20. Disconnect connector M10(27) from the operator's cab. (If equipped)

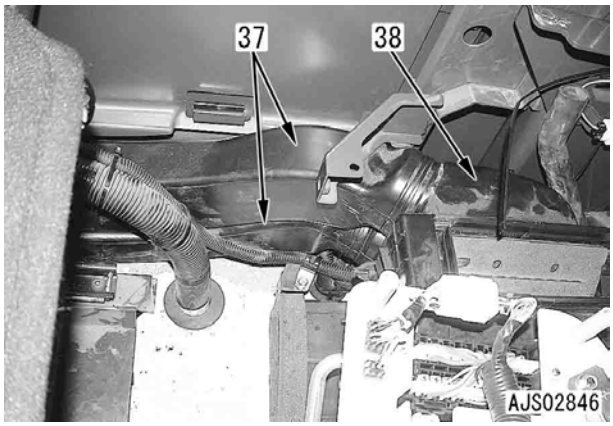
21. Disconnect cab wiring intermediate connectors H09(28), H08(29), and H16(30).
    ★ Cut tie-wrap (T),
22. Disconnect radio antenna (31).



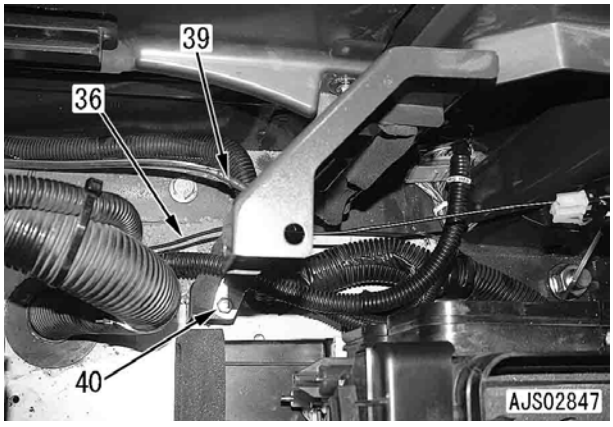
23. Remove ducts (32) and (33).
    ★ Cut tie-wrap.
24. Disconnect wiper motor connector M05(34).
25. Remove harness (35) and antenna (36) from the cab wall.
    ★ Cut 2 points of tie-wrap.



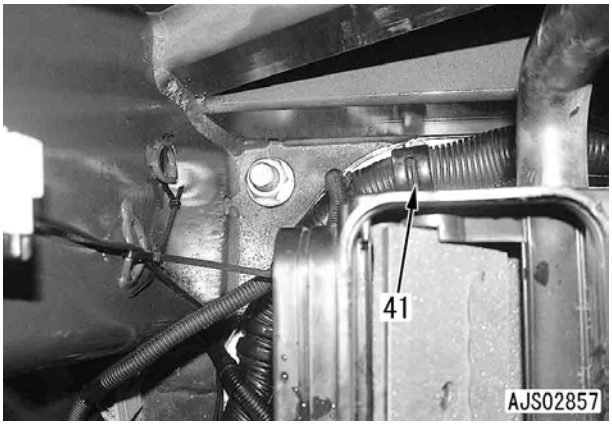
26. Remove duct (37).
27. Remove duct (38) upper and lower.



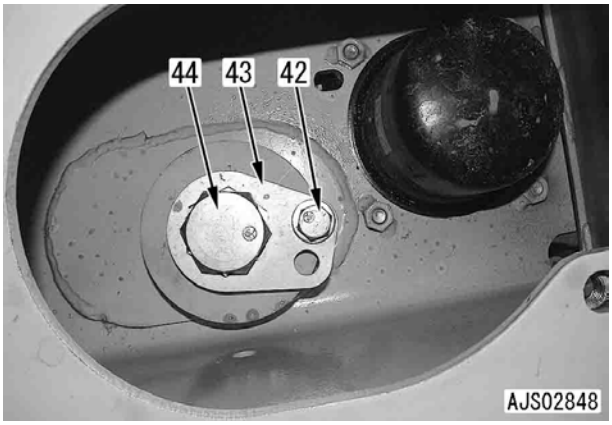
28. Disconnect window washer hose (39).
29. Disconnect harness clamp (40).
30. Haul in antenna (36).



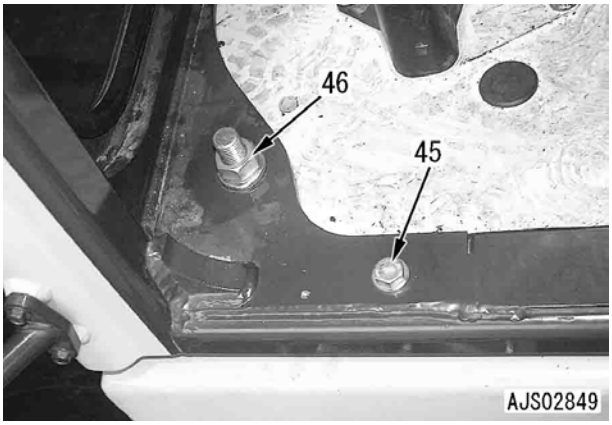
31. Detach harness clamp (41) from the right back side of cab.



32. Remove bolt (42) under the cab and remove lock plate (43). [*1]
33. Remove bolt (44). [*2]



34. Dismount 6 mounting bolts (45) and mounting nuts (46).
    ★ Check the bolt length beforehand.



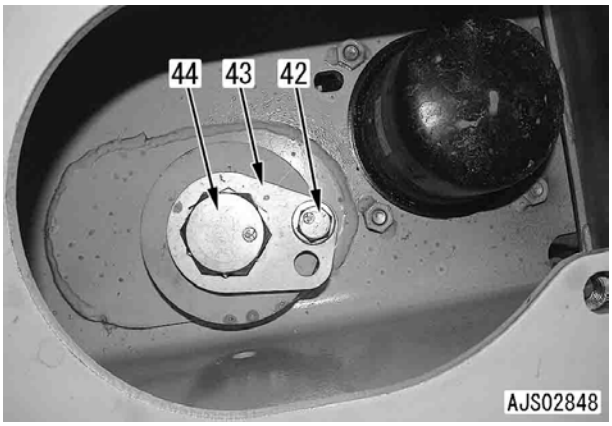
35. Lift off and remove operator's cab assembly (47).
    Operator's cab assembly: **470 kg**

Installation

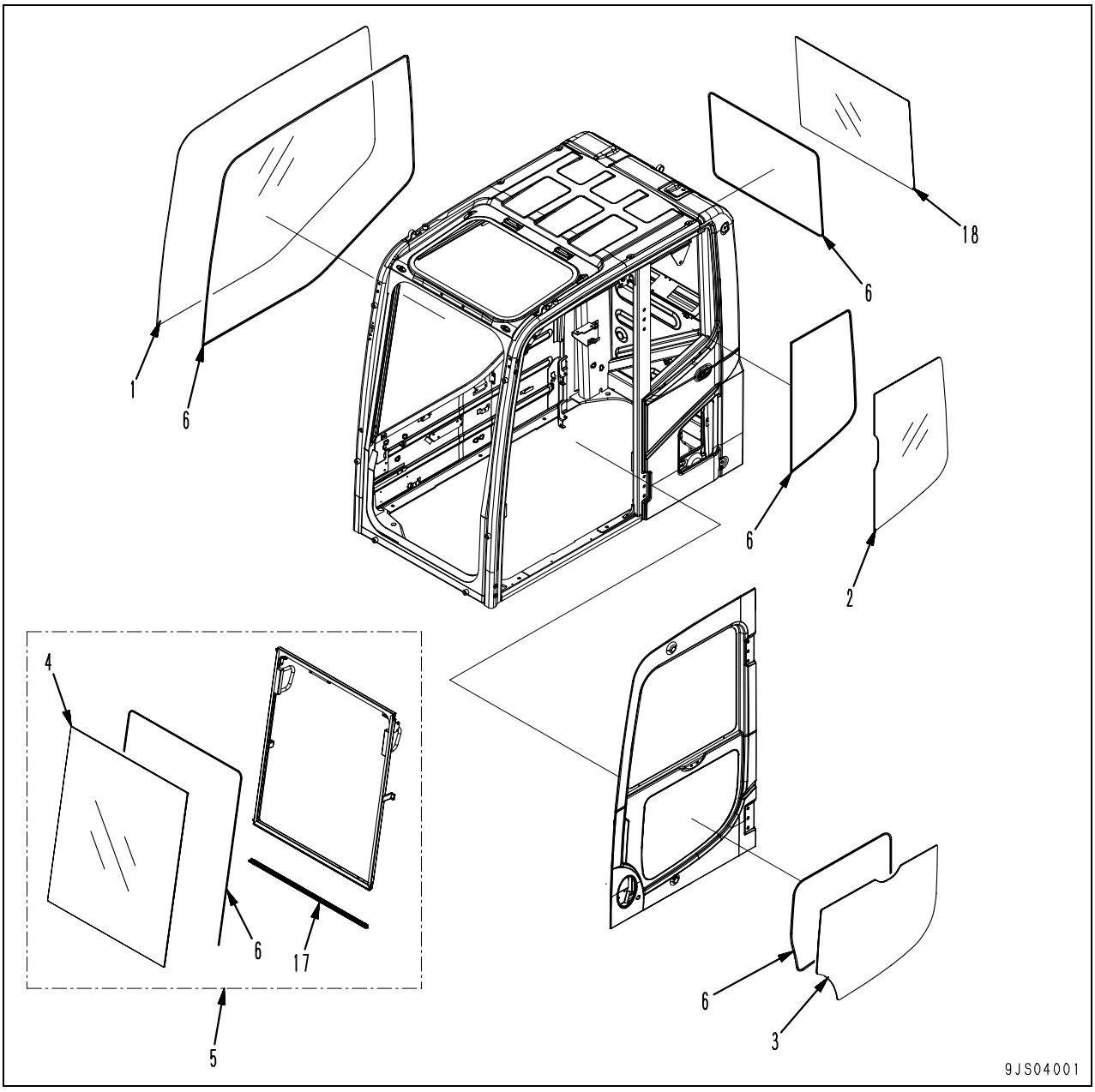
- Installation is done in the reverse order of removal.

[*1]
Mounting bolt of lock plate (43):
98 – 123 Nm {10 – 12.5 kgm}

[*2]
Bolt (44):
245 – 309 Nm {25 – 31.5 kgm}



Removal and installation of operator cab glass (stuck glass)



★ Among the panes of window glass on the 4 sides of the operator's cab, 5 panes (1) to (4) and (18) are stuck.
★ In this section, the procedure for replacing the stuck glasses is explained.
★ When replacing front window glass (4), remove front window assembly (5). (It is impossible to replace only the front window glass while the front window assembly is installed to the operator's cab.)
★ For the procedure for replacing the front window assembly, see “Removal and installation of front window assembly“.

(1) : Right side window glass
(2) : Left side rear window glass
(3) : Door lower window glass
(4) : Front window glass
(5) : Front window assembly
(Front window glass + Front frame)
(6) : Dam rubber
(17) : Center trim seal
(18) : Rear glass

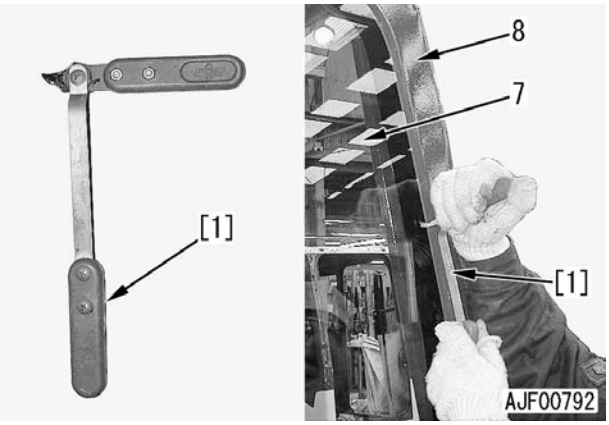
Special tools

Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch
X	2	793-498-1210	Lifter (Suction cup)	■	2		
	3	20Y-54-13180	Stopper rubber	■	2		

Removal

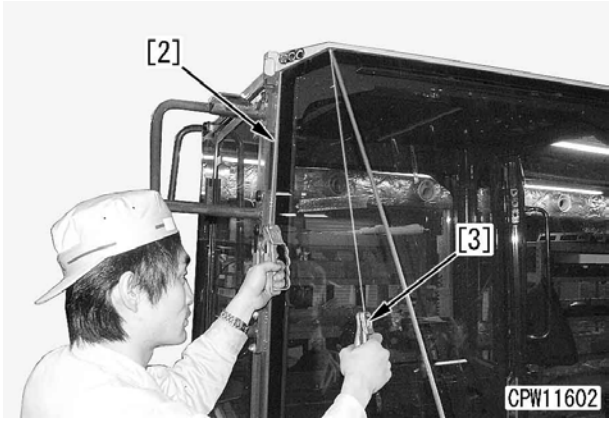
★ Remove the window glass to be replaced according to the following procedure.

1. Using seal cutter [1], cut the adhesive between broken window glass (7) and operator's cab (metal sheet)(8).



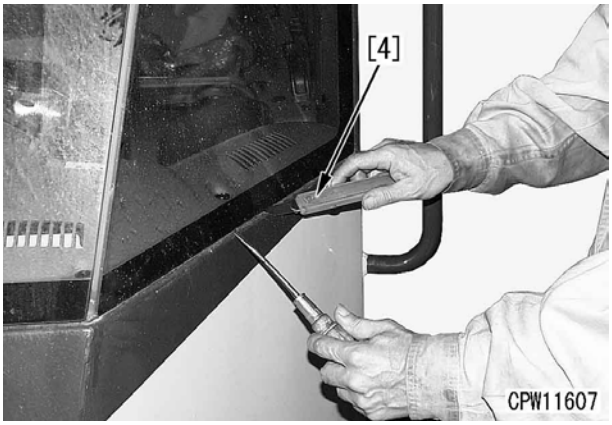
★ If a seal cutter is not available, make holes on the adhesive and dam rubber with a drill and pass a fine wire (piano wire, etc.) [2] through the holes. Then, grip the both ends of the wire with priors [3], etc.(or hold them by winding them onto something) and move the wire to the right and left to cut the adhesive and dam rubber.
Since the wire may be broken by the frictional heat, apply lubricant to the wire.

(The figure shows the operator's cab of a wheel loader.)



★ If the window glass is broken finely, it may be removed with a knife [4] and a screwdriver.
★ Widening the cut with a flat blade screwdriver, cut the dam rubber and adhesive with knife [4].

(The figure shows the operator's cab of a wheel loader.)

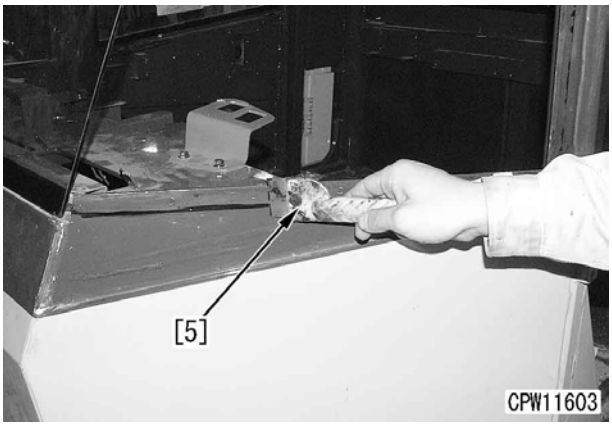


2. Remove the window glass.

Installation

1. Using a knife and scraper [5], remove the remaining adhesive and dam rubber from the metal sheets (glass sticking surfaces) of the operator's cab.
   ★ Remove the adhesive and dam rubber to a degree that they will not affect adhesion of the new adhesive. Take care not to scratch the painted surfaces.
   (If the painted surfaces are scratched, adhesion will be lowered.)

(The figure shows the operator's cab of a wheel loader.)

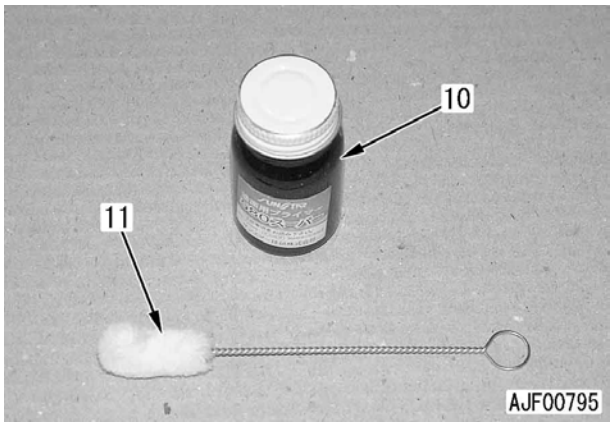


2. Remove oil, dust, and dirt, etc. form the sticking surfaces of cab (8) and window glass (9) with white gasoline.
   ★ If the sticking surfaces are not cleaned well, the glass may not be stuck perfectly.
   ★ Clean the all black part on the back side of the window glass.
   ★ After cleaning the sticking surfaces, leave them for at lease 5 minutes to dry.

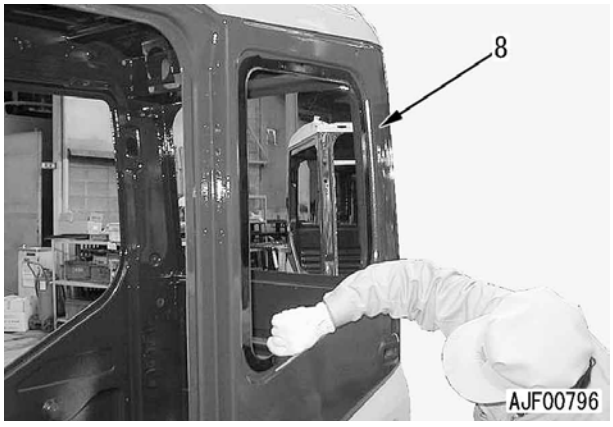
(The figure shows the operator's cab of a wheel loader.)

3. Apply primer (10).
   ★ The using limit of primer is 4 months after the date of manufacture. Do not use the primer after this limit.
   ★ Use the primer within 2 hours after unpacking it.
   ★ Even if the primer is packed again just after it is unpacked, use it within 24 hours after it is unpacked for the first time.
   (Discard the primer 24 hours after it is unpacked.)

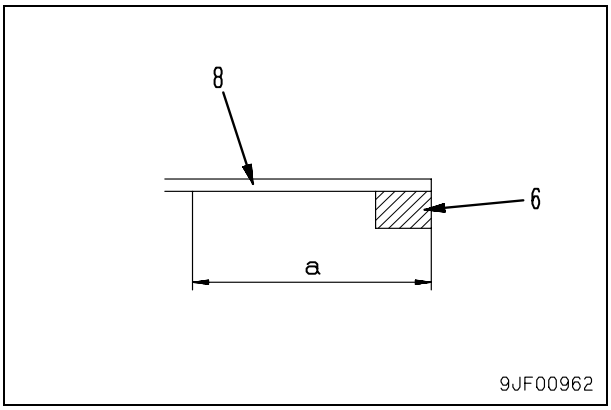
1) Stir the primers for both of paint and glass sufficiently before using them.
   ★ If the primer has been stored in a refrigerator, leave it at the room temperature for at least half a day before stirring it.
   (If the primer is unpacked just after taken out of the refrigerator, water will be condensed. Accordingly, leave the primer at the room temperature for a sufficient time.)
2) When reusing primer brush (11), wash it in white gasoline.
   ★ After washing the brush, check it again for dirt and foreign matter.
   ★ Prepare respective brushes for the paint primer and glass primer.



3) Evenly apply the paint primer to the surfaces to stick dam rubber and its outside surfaces to apply adhesive on operator's cab (8).
   Paint primer:
   Sunstar primer for painting plane 580 super
   ★ Do not apply the primer more than 2 times.
   (If it is applied more than 2 times, its performance will be lowered.)

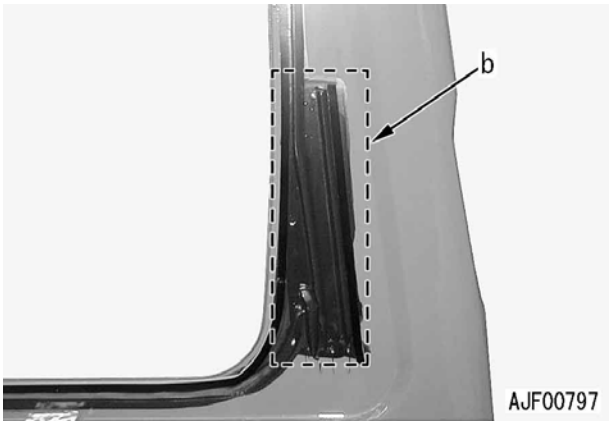


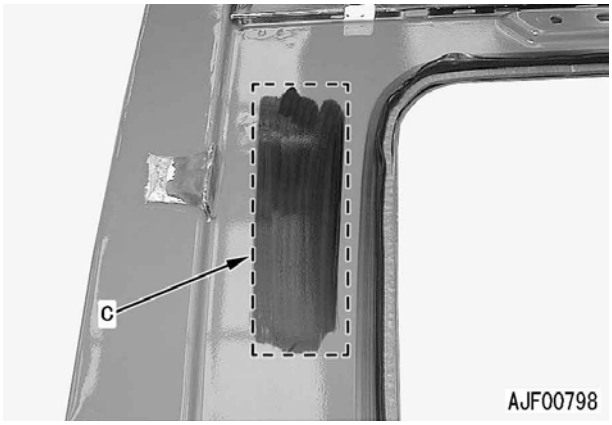
★ Parts to be coated with primer; Apply the primer all over dimension (a).
- Dimension to apply primer (a)**: 25 mm**



★ In addition to the above parts, additionally apply the primer to right side window glass (1) and door lower window glass (3).
- Range to apply primer additionally for right side window glass (1): (b)
- Range to apply primer additionally for door lower window glass (3): (c)

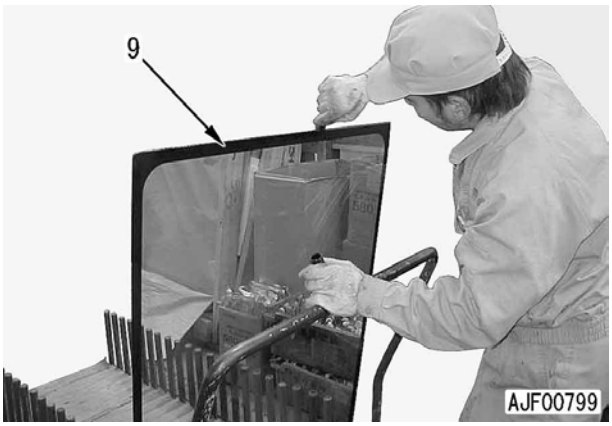
★ After applying the primer, leave it for at least 5 minutes (within 8 hours) to dry.



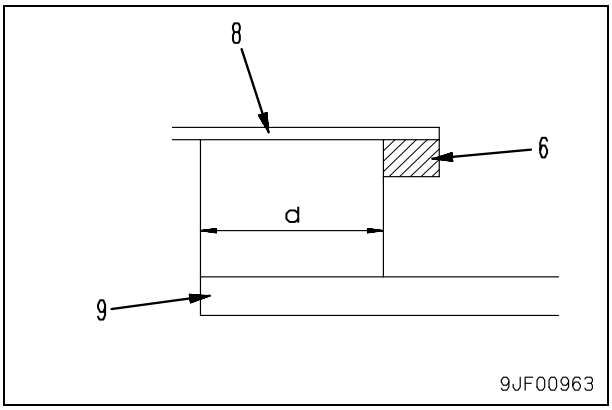


★ Never apply the wrong primer.
If the glass primer, etc. is applied by mistake, wipe it off with white gasoline.

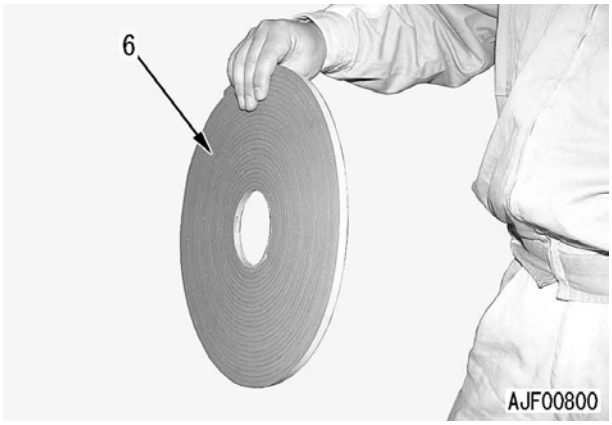
4) Apply the glass primer to the sticking surfaces of window glass (9).
   Glass primer;
   Sunstar primer for glass 580 super
   ★ Do not apply the primer more than 2 times.
   (If it is applied more than 2 times, its performance will be lowered.)



★ Parts to be coated with primer; Apply the primer to all around of sticking surface (d) of window glass (9) for dam rubber (6) installation position and operator's cab (8).
★ Do not apply the primer to the boarder about 5mm wide between the black part and transparent part of the glass.
★ After applying the primer, leave it for at least 5 minutes (within 8 hours) to dry.
★ Never apply the wrong primer.
If the paint primer, etc. is applied by mistake, wipe it off with white gasoline.



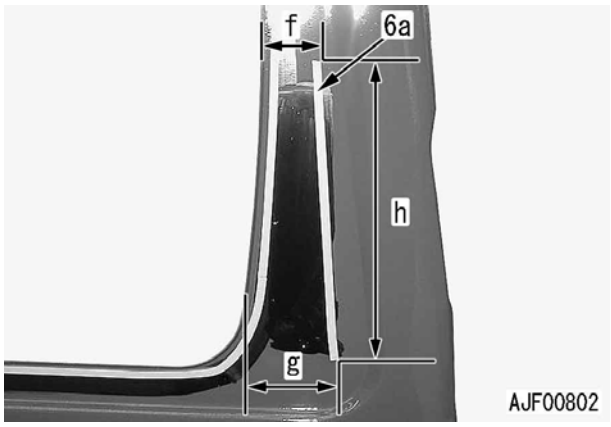
4. Stick dam rubber (both-sided adhesive tape)(6) along the inside edge of the glass sticking section.
   - ★ Do not remove the release tape of dam rubber on the glass sticking side before sticking the glass.
   - ★ When sticking the dam rubber, do not touch the cleaned surface to the utmost.
   - ★ Exercise care should be taken to not to float the dam rubber of each sticking corner.



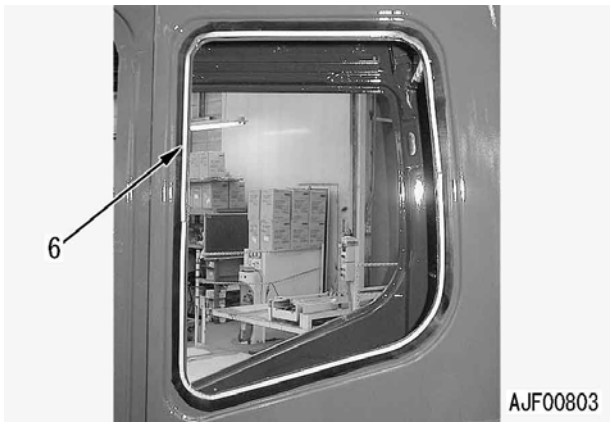
   - ★ When sticking dam rubber (6) around a frame, do not lap its finishing end over the starting end. Or, make clearance of about 5mm between them(e).

   1) Stick dam rubber (6) for right side window glass (1) to the position as shown in the figure.

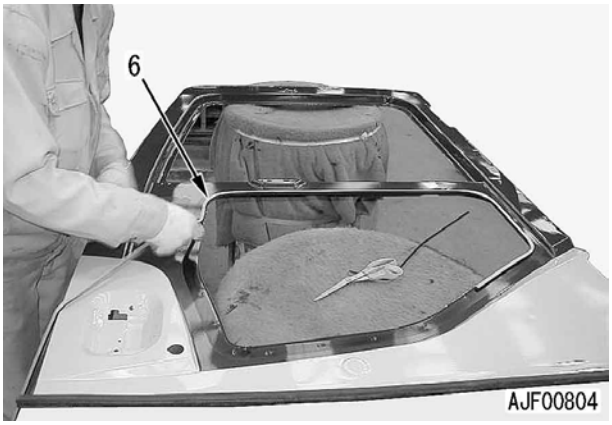
   - ★ Stick dam rubber (6a) additionally to right side window glass (1).
   - ● Positions to stick additional dam rubber to the right side window glass:
     (f): **50 mm**
     (g): **90 mm**
     (h): **250 mm**



   2) Stick dam rubber (6) for left side window glass (2) to the position as shown in the figure.

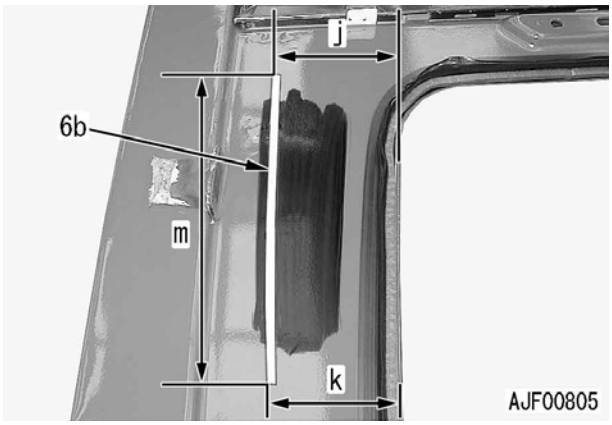


3) Stick dam rubber (6) for door lower window glass (3) to the position as shown in the figure.

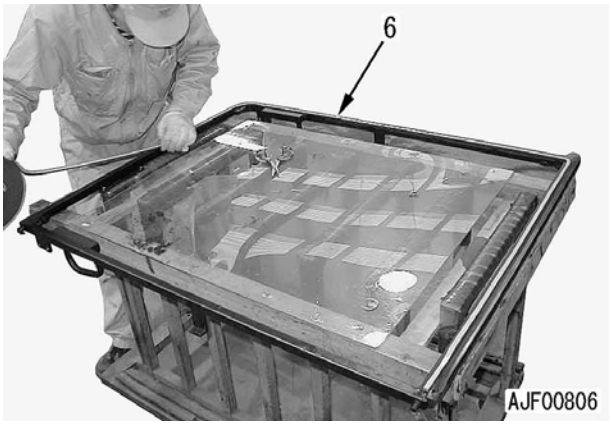


★ Stick dam rubber (6b) additionally to door lower window glass (3).
- Positions to stick additional dam rubber to the door lower window class:

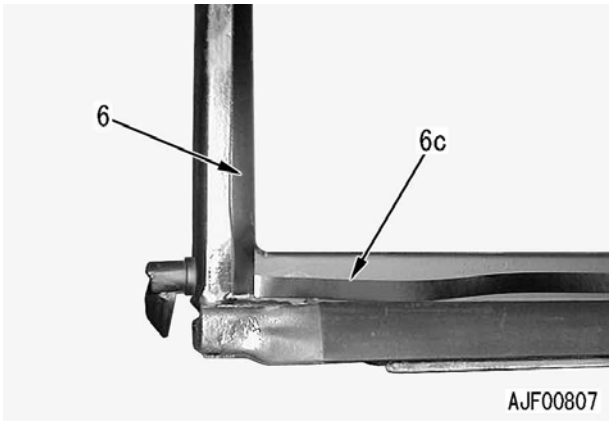
(j) : **110 mm**
(k) : **90 mm**
(m) : **200 mm**



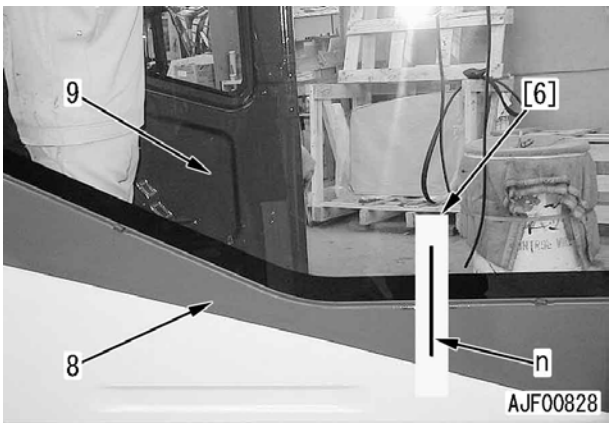
4) Stick dam rubber (6) for front window glass (4) to the position as shown in the figure.

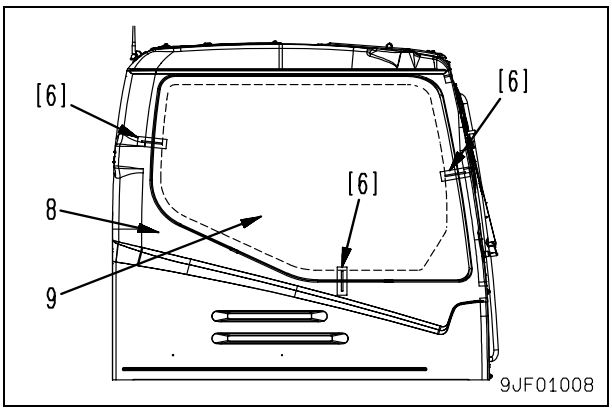


★ Stick dam rubber (6c) of the lower side of the front window glass along the outside edge of the lower line, differently from other dam rubbers (6). (If it is stuck along the inside, it will be seen through the transparent part of the glass.)

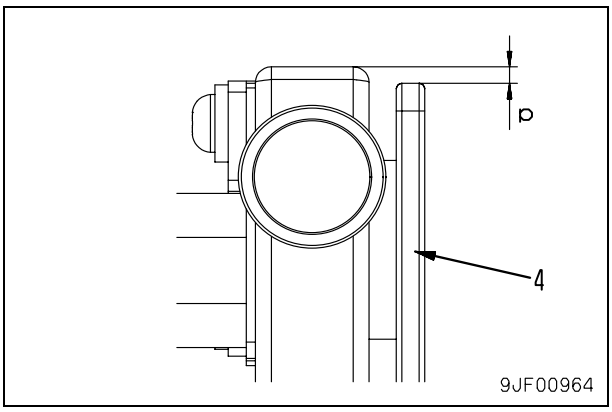


5. Position the new window glass.
   1) Check the clearance between the window glass and the operator's cab on the right, left, upper, and lower sides, and then position the window glass to be the clearances evenly.
   2) Stick tapes [6] between window glass (9) and operator's cab (8) and draw positioning line (n).
      ★ Stick tapes [6] for positioning to 3 points, that is, right, left and lower parts of the right side window glass, left side rear window glass, and door lower window glass for accurate positioning.
   3) Cut the tape between window glass (9) and operator's cab (8) with a knife, etc. and then remove the window glass.
      ★ Do not remove the tapes left on the window glass and the operator's cab before installing the window glass.

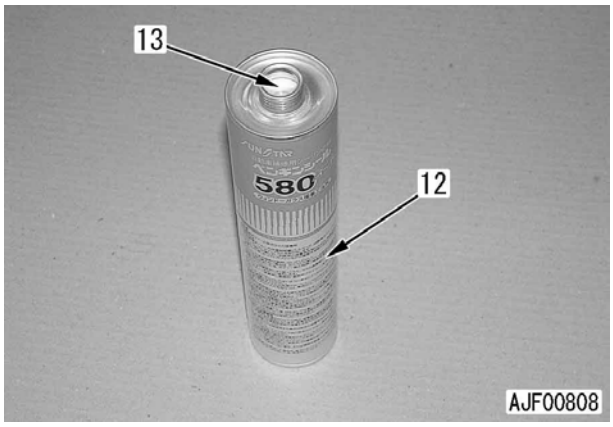




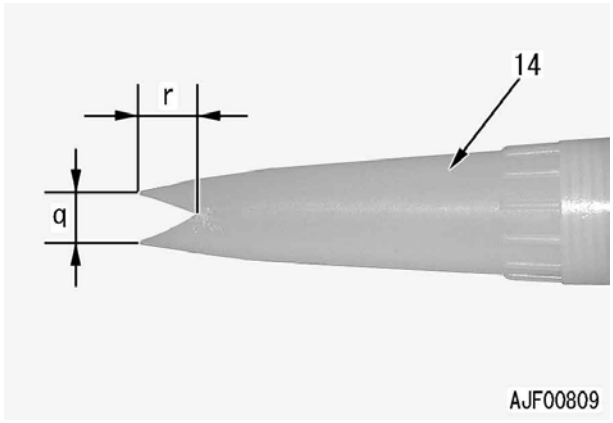
★ When positioning front window glass (4), set its horizontal position to the frame width.
And set its vertical position to make the height difference (p) between the frame top and the front window glass 3 mm.



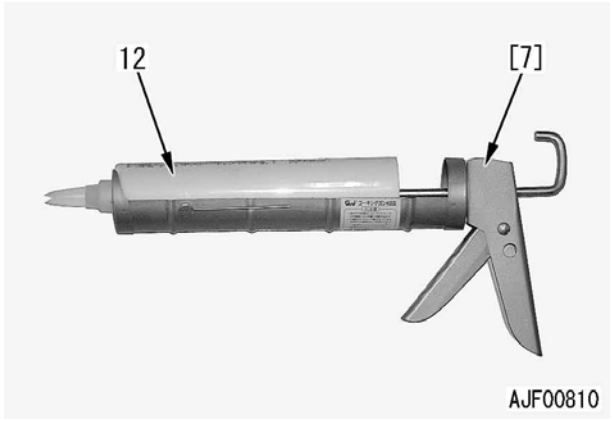
6. Apply adhesive.
★ Use either of two types of adhesives according to the season.
Adhesive (Apr. to Oct.):
Sunstar penguine seal 580 super "S"
Adhesive (Oct. to Apr.):
Sunstar penguine seal 580 super "W"
★ The using limit of the adhesive is 4 months after the date of manufacture. Do not use the adhesive after this limit.
★ Keep the adhesive in a dark place where the temperature is below 25°C.
★ Never heat the adhesive higher than 30°C.
★ When reusing the adhesive, remove the all hardened part form the nozzle tip.
1) Break aluminum seal (13) of the outlet of adhesive cartridge (12) and install the nozzle.



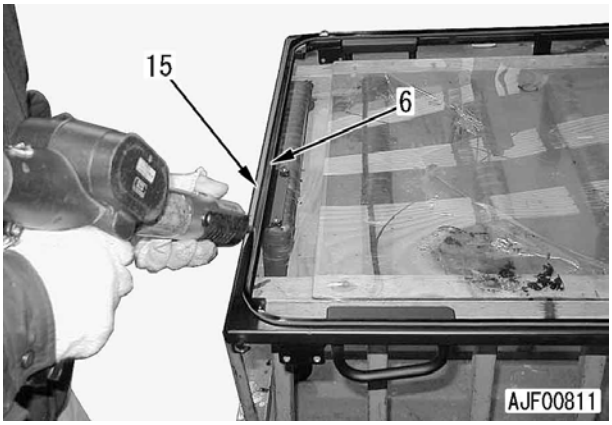
2) Cut the tip of the adhesive nozzle (14) so that dimensions (q) and (r) will be as follows.
- Dimension (q): **10 mm**
- Dimension (r): **15 mm**



3) Set adhesive cartridge (12) to caulking gun [7].
★ An electric caulking gun is more efficient.

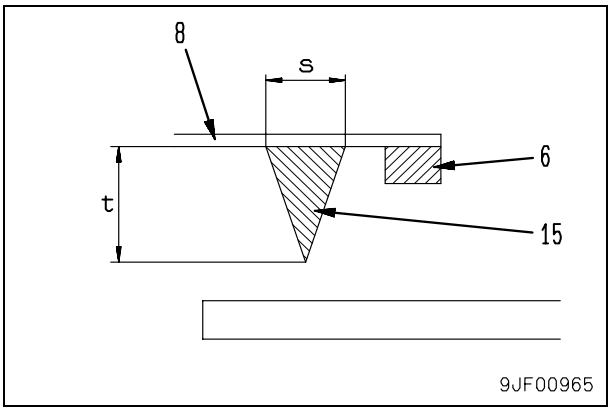


4) Remove the release tape of dam rubber on the glass adhesive side.
5) Apply adhesive (15) to the outside of dam rubber (6) of the operator's cab.

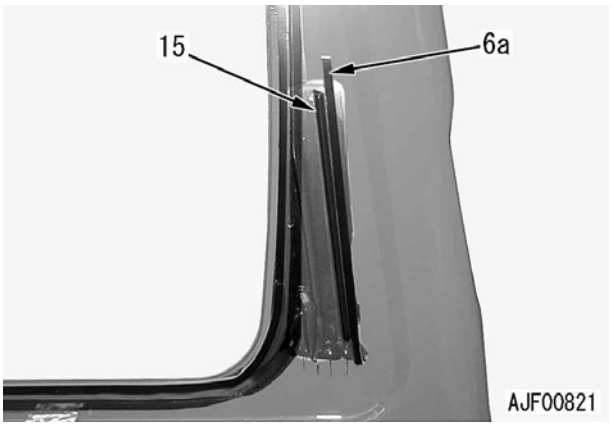


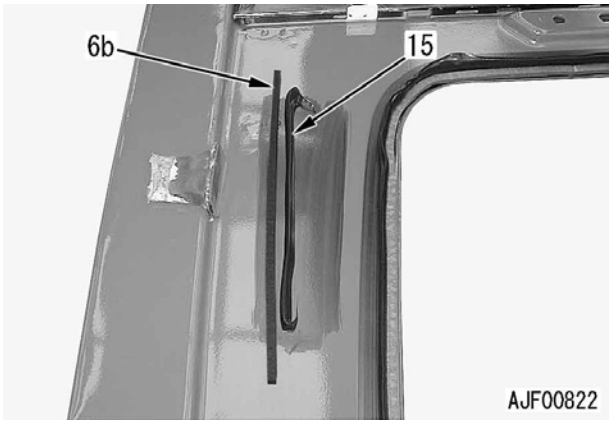
★ Apply adhesive (15) with dimensions (s) and (t) for dam rubber (6) of operator's cab (8).
- Dimension (s): **10 mm**
- Dimension (t): **15 mm**

★ Apply adhesive (15) higher than dam rubber(6).
★ Apply the adhesive evenly with same height level.



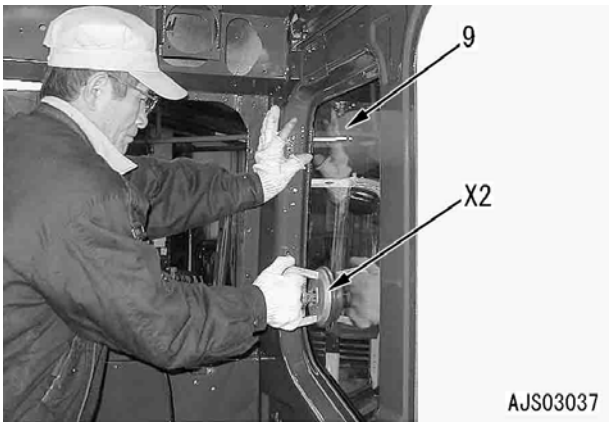
★ Apply adhesive (15) additionally to additional dam rubber(6a) of right side window glass and additional dam rubber(6b) of door lower window glass.





7. Install the window glass.
1) Install window class (9), matching it to the lines of the positioning tapes drawn in step 5.
★ Since the window glass cannot be removed and stuck again, stick it with utmost caution.
★ Stick the glass within 5 minutes after applying the adhesive.
2) After sticking window glass (9), press all around of it until it sticks to the dam rubber closely.
★ Press the corners of the window glass firmly.

★ You can perform this work efficiently by pulling window glass (9) from inside of the operator's cab with suction cup **X2**.



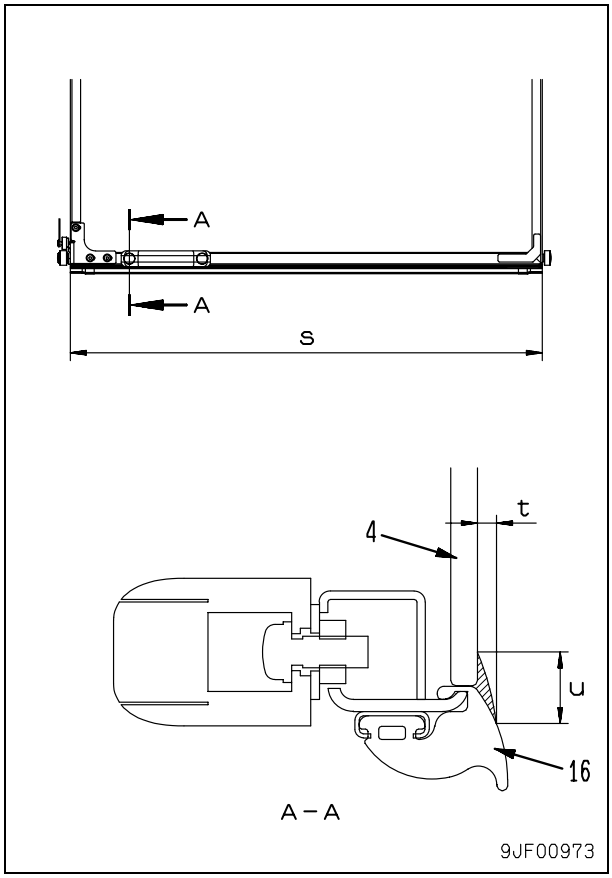
★ After installing front window glass (4), fill the clearances between it and center trim seal (16) with caulking material in range (s) with dimensions (t) and (u).
After applying the primer to glass (4) of section A-A, apply the adhesive as caulking material.
- Caulking dimension (t): **2 mm**
- Caulking dimension (u): **5 mm**

★ When caulking, mask the glass side and form the adhesive with a rubber spatula as shown in the figure.

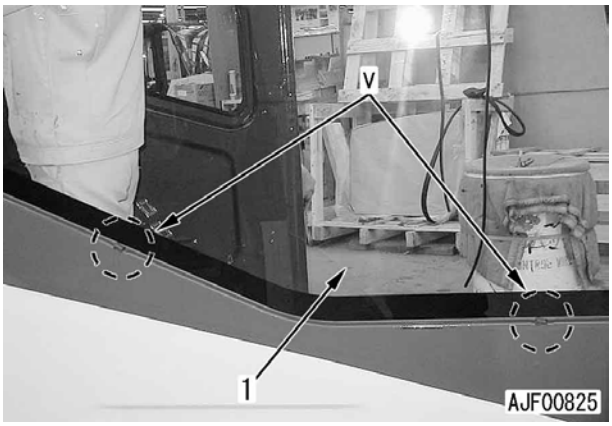
★ Wipe off the projected adhesive.

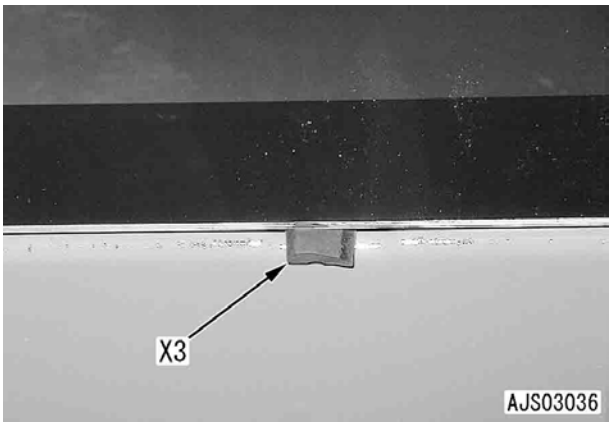
Glass primer;
Sunstar primer for glass 580 super

Adhesive:
SUNSTAR penguine seal 580 super “S“ or “W“



8. Fix the window glass.
   1) After installing right window glass (1) to the operator's cab, insert stopper rubbers **X3** to 2 places (v) at the bottom of the glass to fix the glass.





   2) By using styrene foam blocks [9] and rubber bands [10], fix the window glass and the dam rubber to fit them completely.

9. After installing the window glass, remove any excess of the primer and adhesive from the operator's cab and window glass.
   ★ By using the white gasoline, wipe off the adhesive before it is dried up.
   ★ When cleaning the glass, do not give an impact on it.

10. Protect the stuck window glass.
    1) Keep the stopper rubbers, styrene foam blocks, and rubber bands installed for 10 hours.
       (at temperature of 20°C and humidity of 60%)
    2) After removing the stopper rubbers, styrene foam blokes, and rubber bands, wait at least 14 hours, that is, at least 24 hours in total, before operating the machine actually.

Removal and installation of front window assembly

⚠ **Lower the work equipment completely to the ground and stop the engine.**

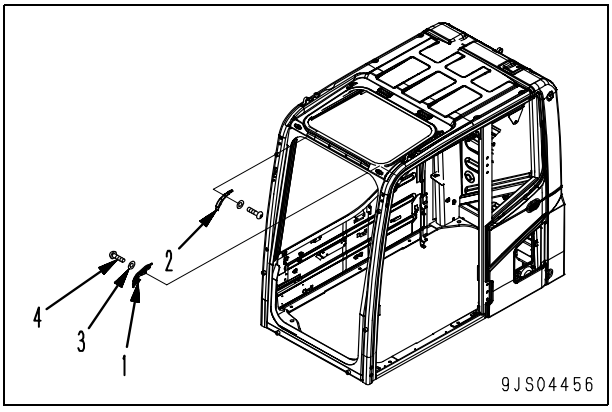
★ To replace the front window glass, the front window assembly must be removed from the operator's cab. The procedure for removing and installing the front window assembly (front frame and front window glass) is explained below.

Removal

1. Raise the front window assembly to the ceiling and fix it with the rear locks (on both sides).

2. Remove left corner block (1) and right corner block (2). [*1]

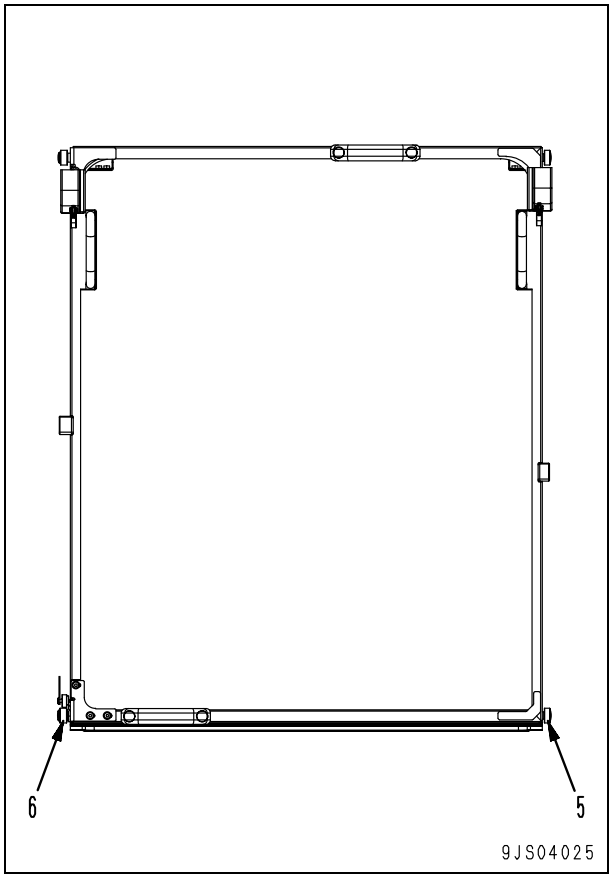
   ★ Mounting bolt (4) and washer (3) for left corner block are used to hang the pull-up assist cable in the following step 6.



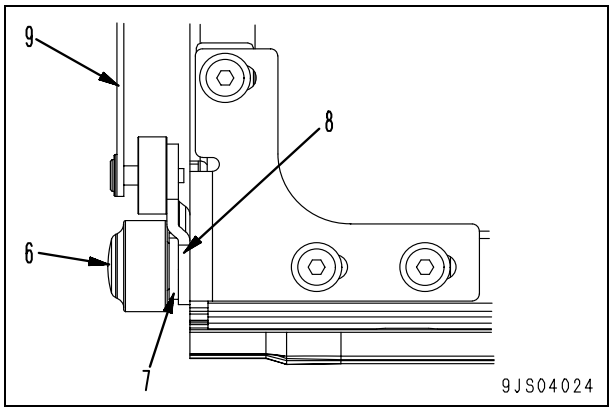
3. Release the rear lock of the cab.

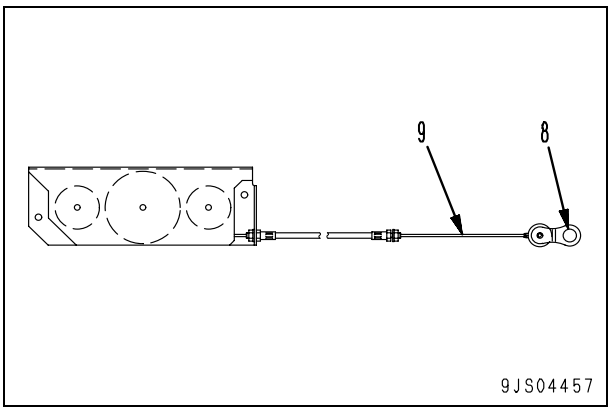
4. Lower the front window assembly carefully a little. Put out rollers (5) and (6) under the both sides of the front window through the portion from which the corner blocks were removed in the above step 2 (the portion where the rail is open) and hold them.

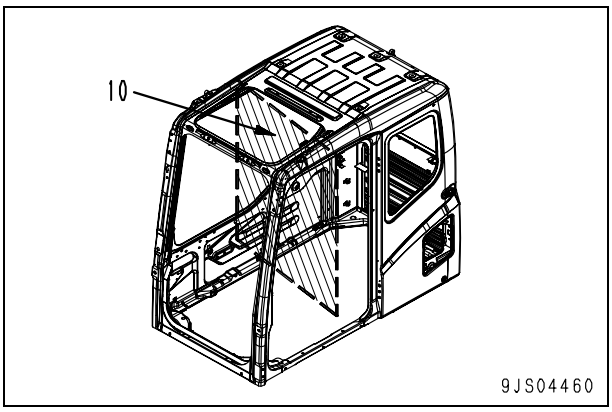
5. Remove rollers (5) and (6) under the both sides of the front window.



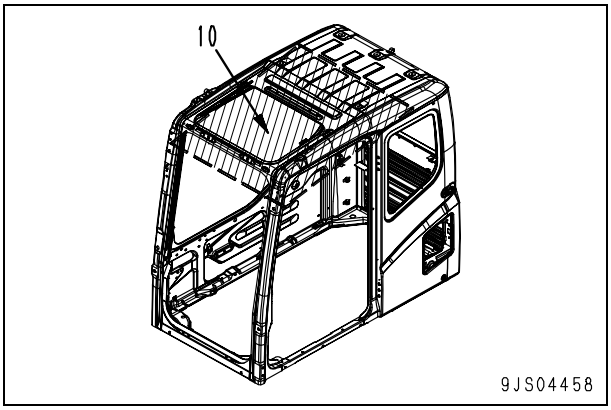
6. Remove left lower pin (7). [*2]
   ★ By removing left lower pin (7), plate (8) at the end of pull-up assist cable (9) comes off.
   ★ Hang plate (8) on the mounting bolt of left corner block (use washer) and set in place.
   ⚠ **The return load of 58.8 N {6 kg} is applied to the rear of the operator's cab. Accordingly, take care when removing left lower pin (7) to disconnect pull-up assist cable (9).**



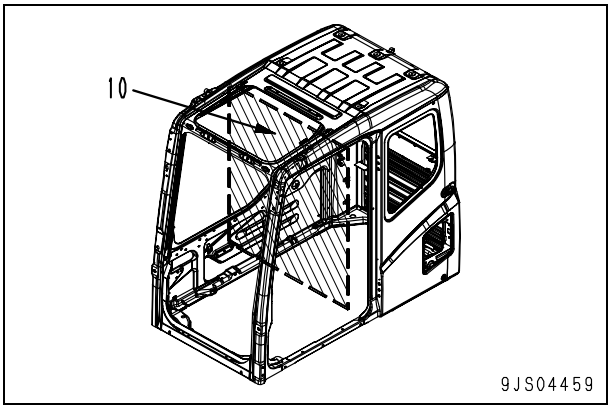




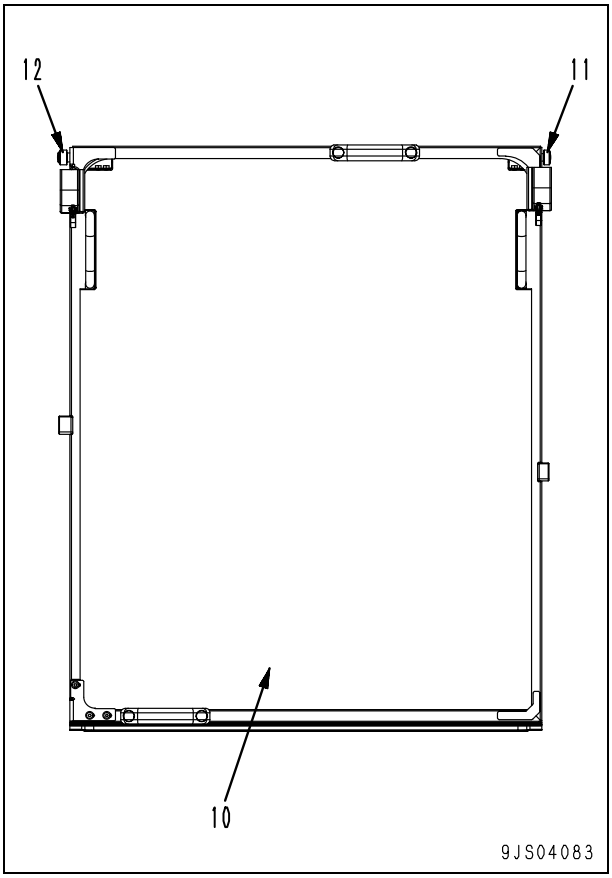
7. Pull out the bottom of front window assembly (10) though the rail opening portion and lower it gradually.



8. Lower front window assembly (10) completely.
   ★ Do not let the front window assembly touch the monitor.



9. Twist front window assembly (13) to the right and left to remove both upper rollers (11) and (12) from the rails, and then remove front window assembly (10).



Installation

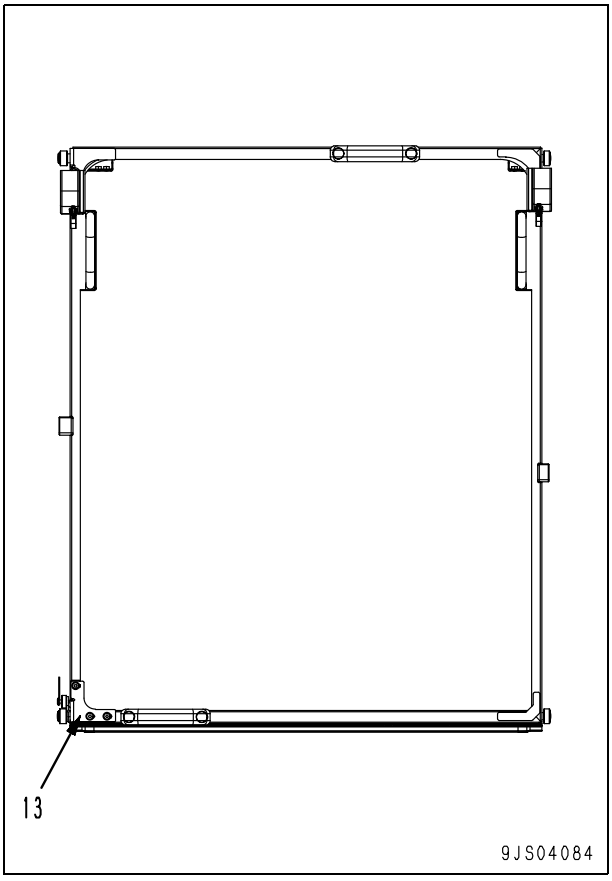
- Carry out installation in the reverse order to removal.

[*1]

- Adjust opening and closing of the front window assembly according to the following procedure.

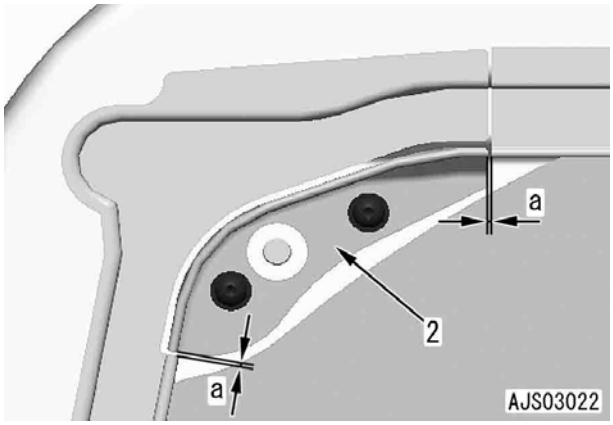
1. Open and close the front window to check that it does not interfere with the rails and that the rollers are not hitched.
2. If there is any problem in opening and closing of the front window, loosen the mounting bolt of roller adjustment bracket (13) and adjust the condition of the front window, and then tighten the mounting bolt again.
   - ★ Make sure that bracket (13) is not mounted on the angle.

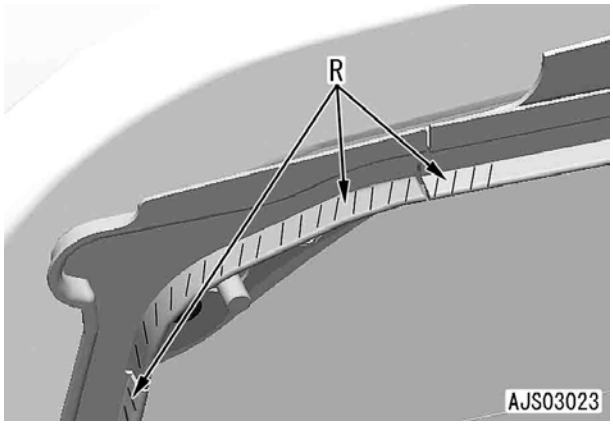
   Mounting bolt: **34.3 Nm {3.5 kgm}**



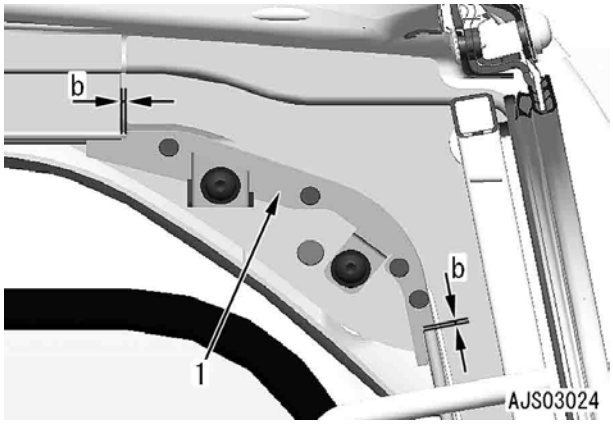
3. Raise the front window assembly and fix it with the rear locks (on both sides).
   - ★ Check that the locks in the rear of the operator's cab are securely fastened.

4. Install right corner block (2).
   - ★ Fully tighten the block after adjusting the “Close“ position in the following step 6.
   - ★ Install the right corner block so that clearance (a) between the rail and right corner block (2) becomes 0 – 2.0 mm.
   - ★ Install the right corner block so that there is no level difference at the rolling surface (R) of the roller.

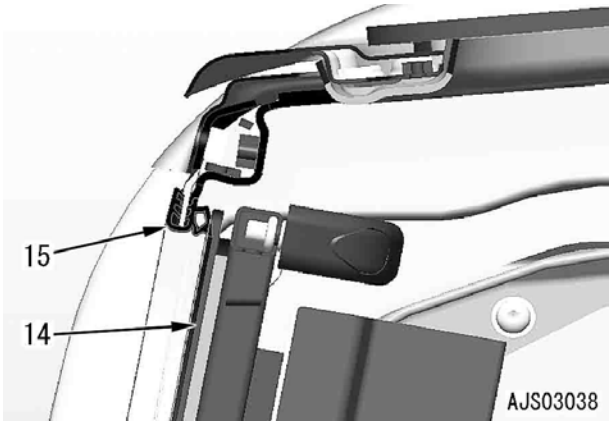




5. Install left corner block (1).
   - ★ Fully tighten the block after adjusting the “Close“ position in the following step 6.
   - ★ Install the left corner block so that clearance (b) between the rail and left corner block (1) becomes 0 – 2.0 mm.
   - ★ Install the right corner block so that there is no level difference at the rolling surface (R) of the roller. (Refer to the above figure.)



6. Adjust the “Close“ position of the front window assembly lock according to the following procedure.
   1) Tighten left and right corner blocks (1) and (2) at roughly right positions so that front window glass (14) is attached firmly to cab-side trim seal (19).

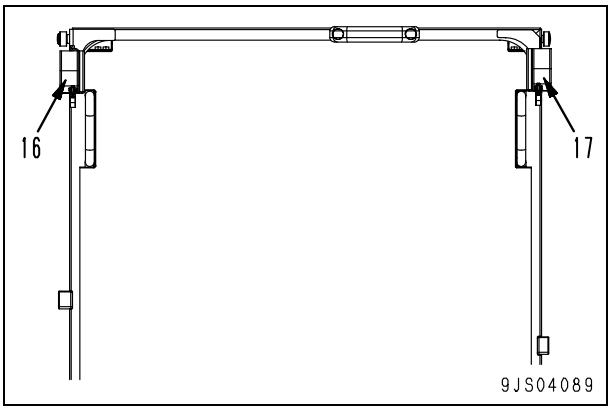


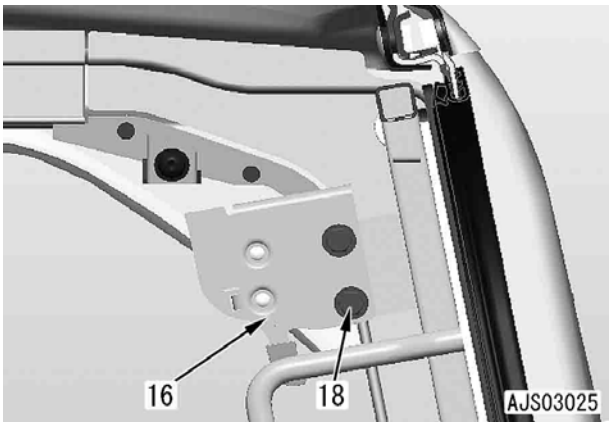
   2) Check the working condition of right and left locks (16) and (17) when opening and closing the front window assembly.
      - If right and left locks (16) and (17) do not work normally.

      1] Loosen lock fitting bolt (18), move lock (16) forward, and then tighten the bolt again.
         ★ The same applies to the right side.

      2] After moving the lock, recheck the fitness of front window glass (14) and cab-side trim seal (15) which was checked in step 1).

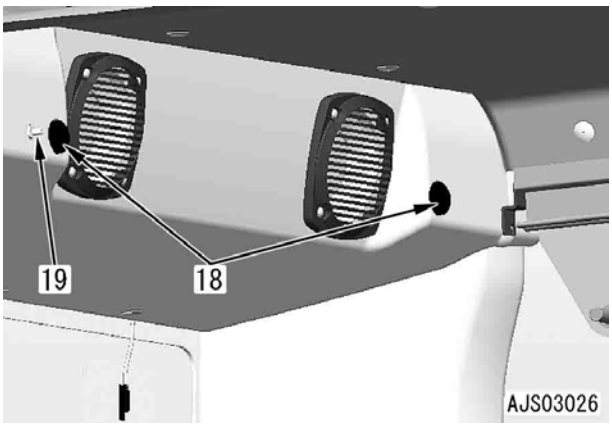
      3] Repeat the work in 1] and 2] until the fitness of the front window glass and the working condition of locks (16) and (17) are both acceptable, and then tighten the mounting bolts of the right and left corner blocks.



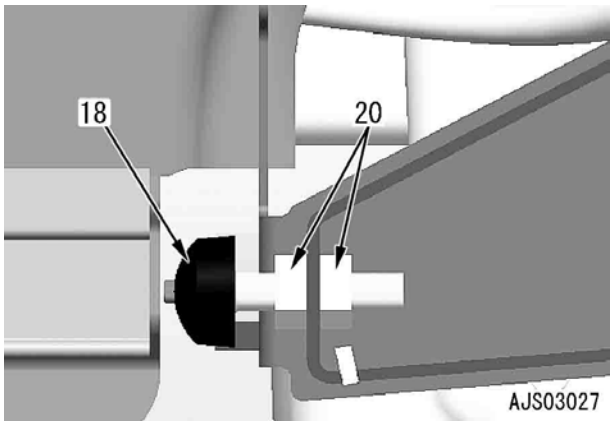


7. After the adjustment, splash water heavily over the front window glass and check that the water does not leak into the cab.

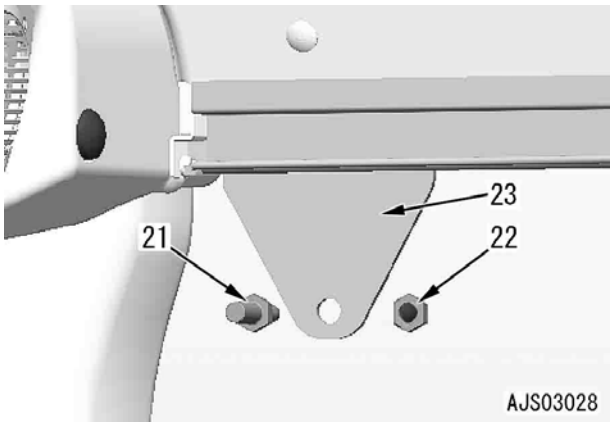
8. Adjust the “Open“ position of the front window assembly lock.
   1) After adjusting the “Close“ position of the front window assembly lock in steps 6 and 7, raise the front window assembly to the ceiling.
   2) Set the front window assembly locks at the both sides of rear of the operator's cab to the “Open“ position, and then check the following items.
      - Check the working condition of right and left locks (16) and (17) (as explained above).
      - Front window assembly must be in contact with the right and left rubber stoppers (18) and furthermore, must be pushing them backward for 1.5 – 3.0 mm.
      - The front window assembly must be pushing the limit switch backward for 4 – 7 mm.
      - ★ The position of limit switch (19) cannot be adjusted. Therefore, the “Open“ position of the front window assembly is decided within the range where this switch works.
      - ★ Limit switch (19) is used to prevent the windshield wiper from moving when turning the wiper switch on by mistake when the front window assembly is in “Open“ position. If the wiper operates when there is no glass in the front, the wiper falls down inside the cab and causes trouble.
        To check whether limit switch (19) is working, turn the key switch on and see that, even if the wiper switch is turned on, the wiper does not operate when the front window assembly is in “Open“ position.



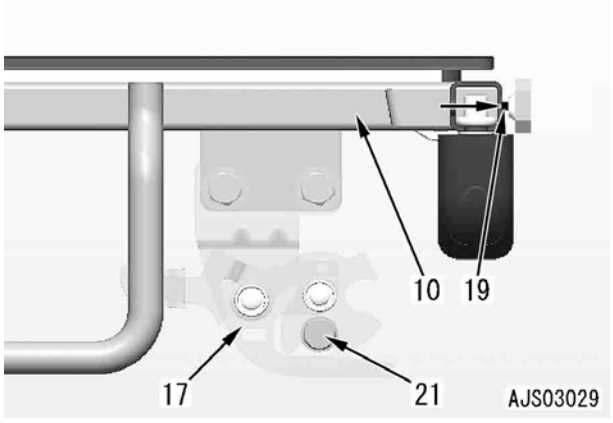
      - After checking the above items, if it becomes necessary to do the adjustment.
   3) Close front window assembly (10).
   4) Loosen locknut (20) of right and left side of rubber stoppers (18), and then pull back both rubber stoppers (18) so that they won't contact with the front window assembly when it is in “Open“ position.



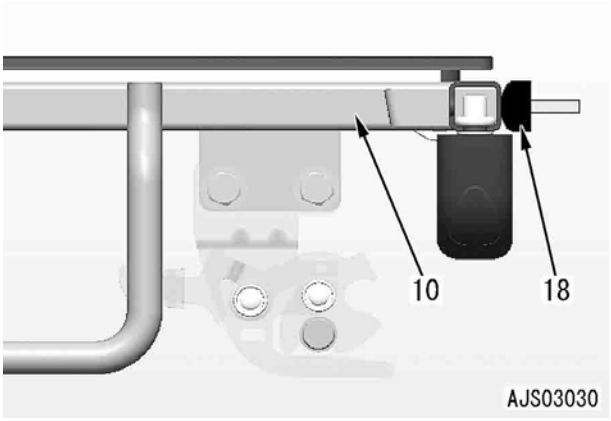
   5) Loosen both sides of locknuts (22), and adjust the position of striker bolt (21).
      - ★ Striker bolt (21): M10, inner diameter of plate (23): ø14.5 mm



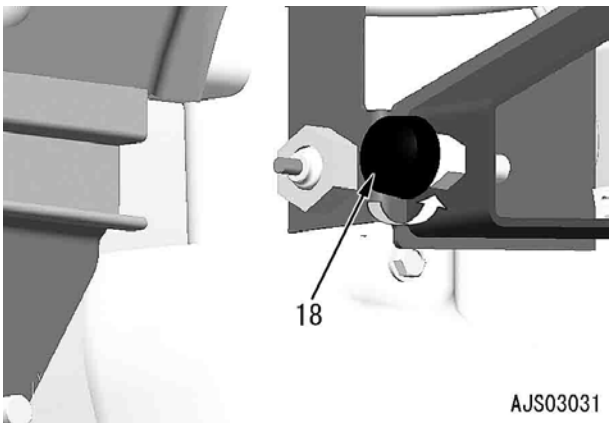
      1] Front window assembly (10) must be pushing the limit switch backward for 4 – 7 mm (at “Open“ position).
      2] Working condition of lock (17).



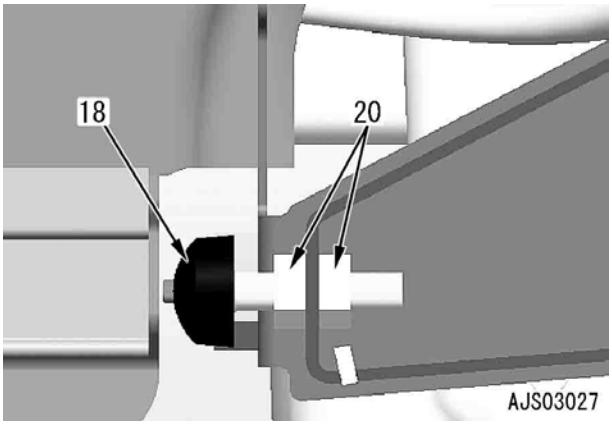
6) Adjustment of right and left rubber stoppers (18).
   1] Bring front window assembly (10) (the lock should be in “Open“ position) into contact with right and left rubber stoppers (18).



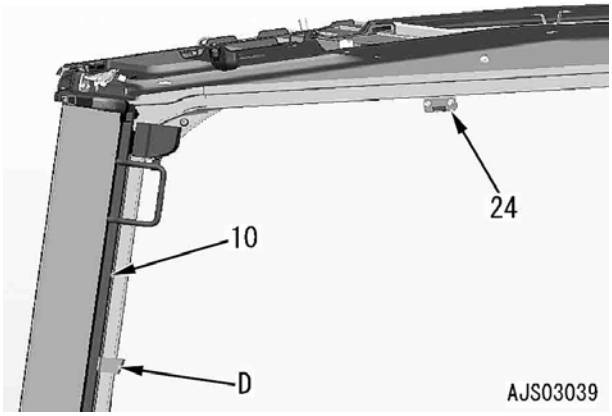
   2] Close front window assembly (10).
   3] Turn right and left rubber stoppers (18) **to the left for one and a half rotation.**
      ★ One turn of rubber stopper (18) to the left is equivalent to squashing the rubber for approximately 1.5 mm.
      ★ When the front window assembly is in “Open“ position, the front window assembly must be pushing right and left rubber stoppers (18) for 1.5 – 3.0 mm.

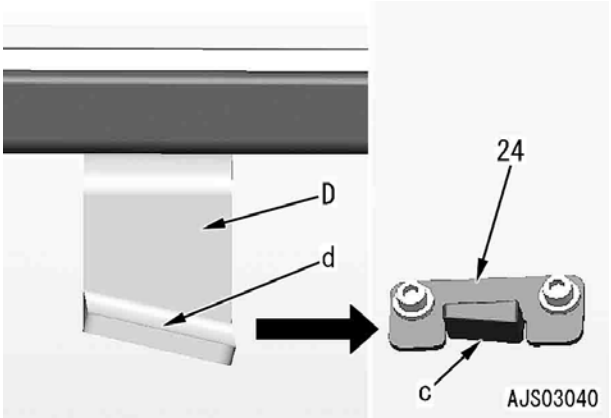


   4] Tighten locknuts (20) of the both sides of rubber stopper (18).

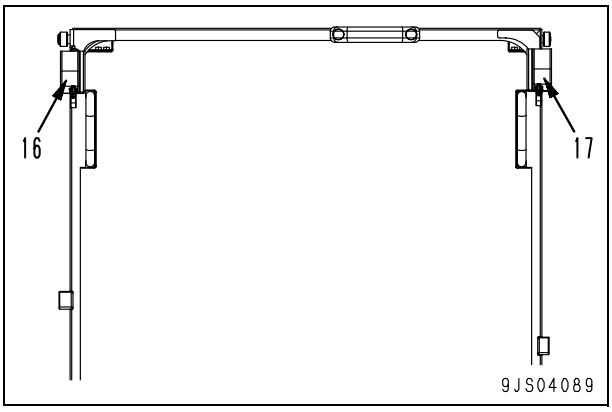


9. Adjust stopper (24) of the front window assembly.
   1) Adjust and lock both sides of stopper (24) so that when pulling up the front window assembly, surface (d) of stopper (D) of front window assembly (10) is in contact with surface (c) of stopper (24).





10. Check the operating effort of the lock of the front window assembly.
    1) After finishing the adjustment of steps 6 - 9, check that latching efforts of both right and left locks (16) and (17) are even.
       ★ Check the latching efforts on both “Close“ side (in the front of the operator's cab) and “Open“ side (in the rear of the operator's cab).



[*2]
Left lower pin:
27 – 34 Nm {2.75 – 3.47 kgm}
Mounting bolt: **Adhesive (LT-2)**

Removal and installation of floor frame assembly

Special tools

Symbol	Part number	Part name	Necessity	Q'ty	N/R	Sketch
X1	799-703-1200	Service tool kit	■	1		
	799-703-1100	Vacuum pump (100V)	■	1		
	799-703-1111	Vacuum pump (220V)	■	1		
	799-703-1121	Vacuum pump (240V)	■	1		
	799-703-1401	Gas leak detector	■	1		

Removal

⚠ **Disconnect the negative terminal (–) of the battery before starting the work.**

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

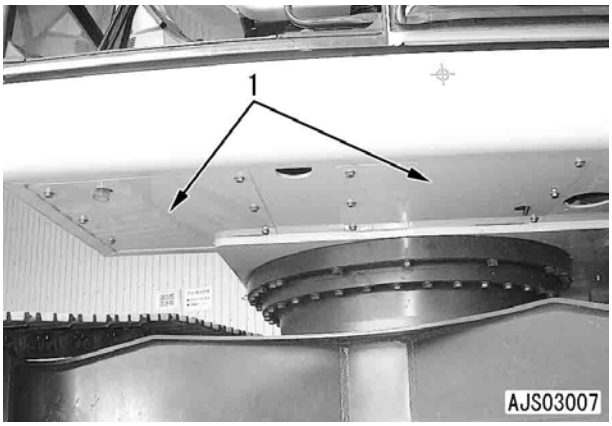
⚠ **If the air conditioner gas (R134a) gets inside one's eyes, it may cause blindness. Therefore, make sure to wear protective glasses when collecting or filling the gas. Collecting and filling work must be conducted by a qualified person.**

1. Turn the upper structure by 90 degrees.

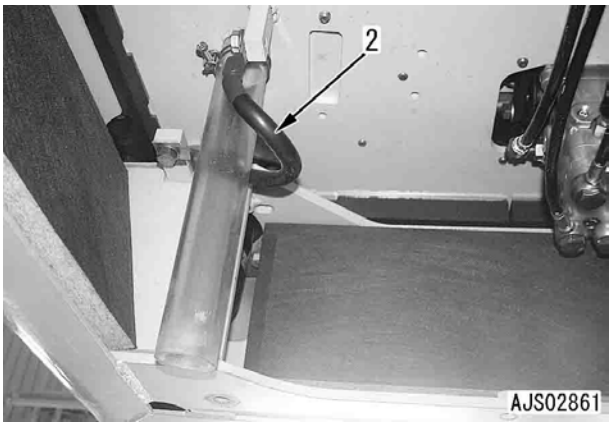
2. Drain the engine cooling water.
   Coolant:
   Approx. 21ℓ (PC210, 230)
   Approx. 20.4ℓ (PC240)

3. Remove the operator's cab assembly by referring “Removal and installation of operator's cab assembly“.

4. Remove cover (1).



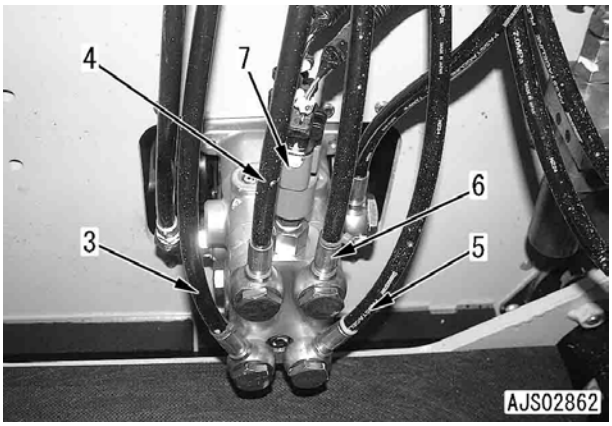
5. Disconnect ground (2).



6. Disconnect the following PPC hoses from the travel PPC valve. The color of the band is;
   - (3): Red
   - (4): No color
   - (5): Green
   - (6): Blue

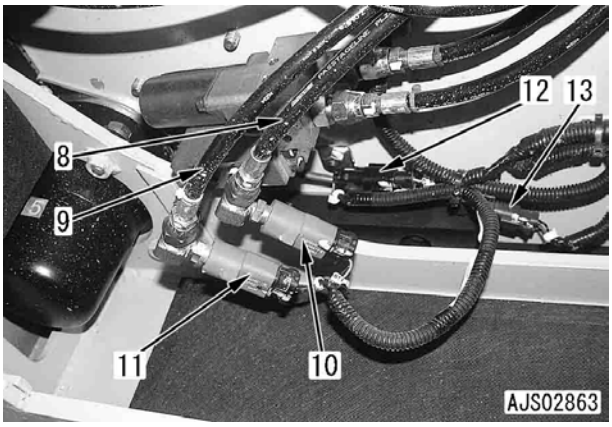
   ★ Prepare an oil sump.

7. Disconnect top and bottom of connector (7).
   Top: P09
   Bottom: P10

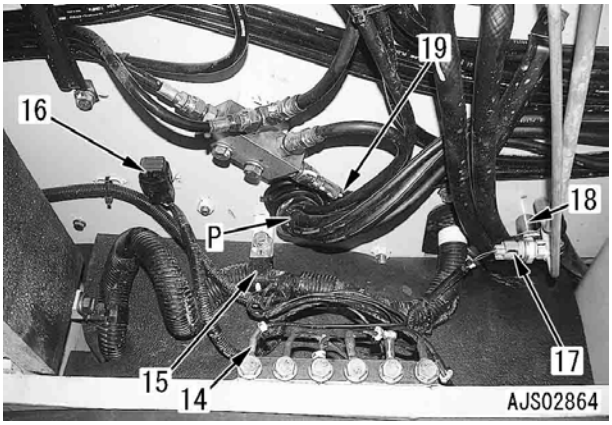


- Step 8 – 10 is optional (for breaker).

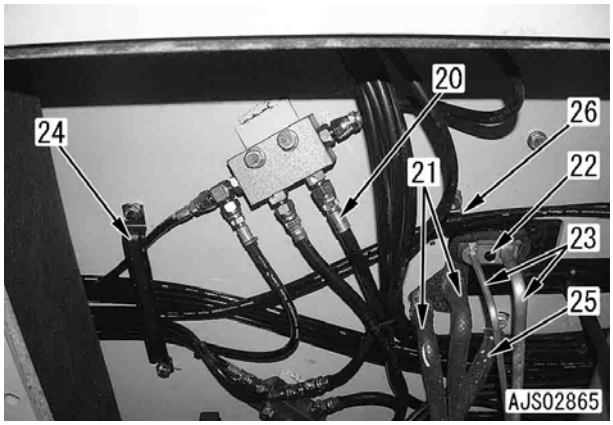
8. Disconnect the following PPC hoses from the PPC valve. The color of the band is;
   - (8): Yellow
   - (9): No color
   - ★ Plug the hose to stop oil flow-out.
9. Disconnect connectors S11 (10) and S10 (11).
10. Disconnect connectors P13 (12) and V30 (13).



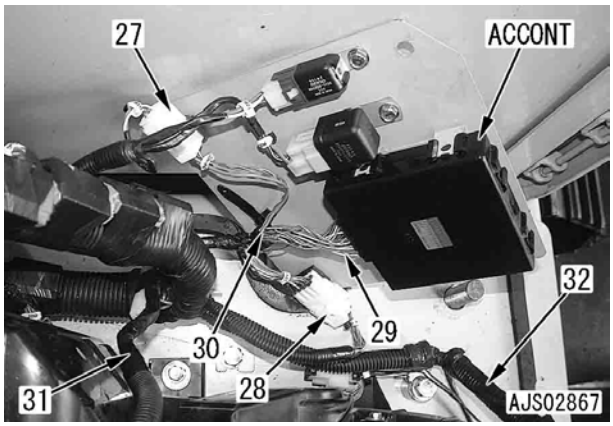
11. Disconnect ground (14). From the left, T04,T05,T06,T07,T09,T10
12. Disconnect clamp (15).
13. Disconnect connector A08 (16) from the clip.
14. Disconnect connector P17 (17) from the air conditioner tube.
15. Remove the clamp and disconnect spacer (18).
16. Disconnect hose (19).
    - ★ Check the connecting point.
    - ★ Plug the hose to stop oil flow-out.
    - ★ Disconnect the work equipment PPC at joint box side.



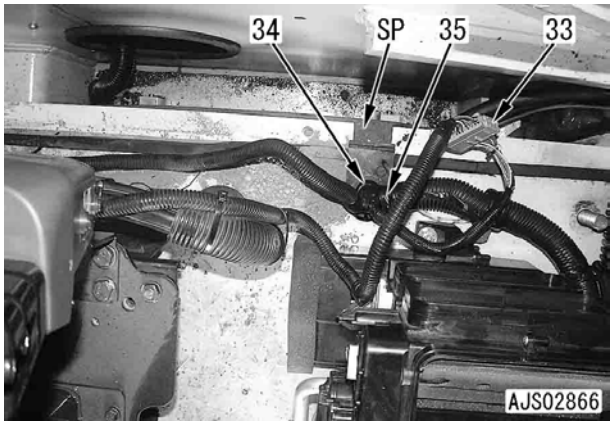
17. Disconnect hose (20).
    - ★ Check the connecting point.
    - ★ Plug the hose to stop oil flow-out.
18. Disconnect heater hose (21).
    - ★ Check the connecting point.
19. Remove mounting bolt (22) and disconnect air conditioner tube (23). [*1]
20. Remove clamps (24) and (25). [*2]
21. Disconnect clamp (26). (If equipped)



22. Disconnect connectors N10 (27) and AC01 (28).
23. Disconnect connectors ECU10 and ECU11 (29) from the air conditioner controller (ACCONT).
24. Cut tie-wrap (30) and draw in wiring harness (31).
25. Disconnect the clamp of wiring harness (32).

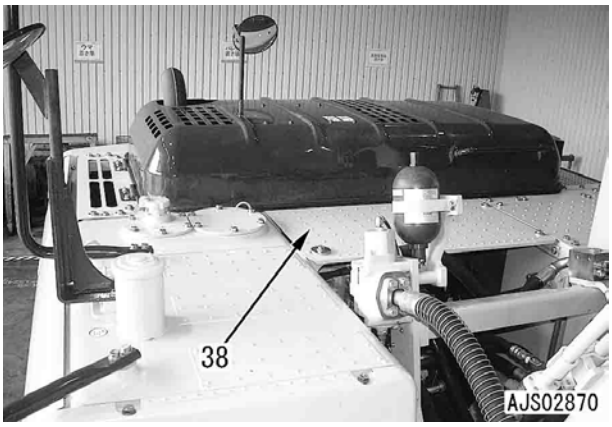


26. Disconnect connector H15 (33).
27. Remove grommet (34).
28. Move wiring harness (35) to the outside of the floor frame.
    - ★ (SP) is made of sponge.

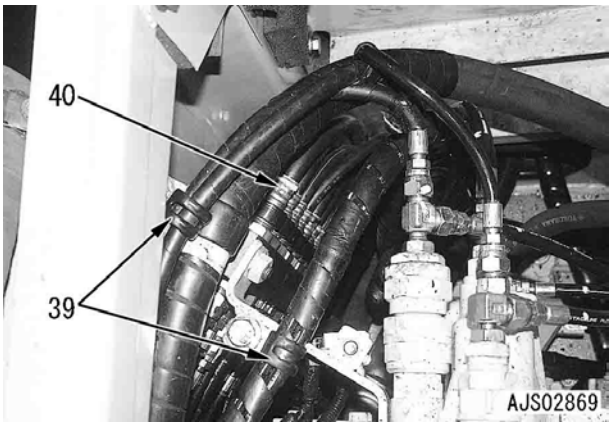


29. Disconnect the clamp of wiring harness (35).
30. Move plates (36) and (37) together with wiring harness (35) to the boom side.

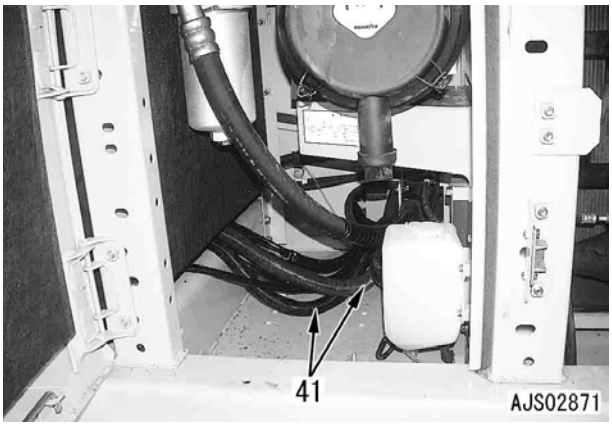
31. Open the engine hood and remove cover (38).



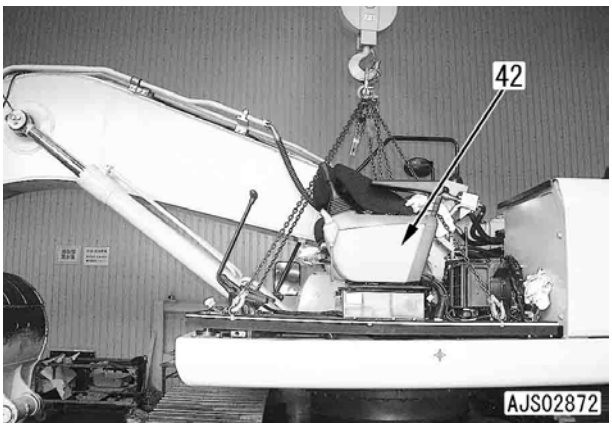
32. Disconnect clamp (39).
33. Disconnect PPC hose (40) of the work equipment. From the top, the color of the band is:
    White
    Brown
    None
    Blue
    Black
    Green
    Red
    Yellow
    ★ Prepare an oil sump.



34. Pull out PPC hose assembly (41) of the work equipment.



35. Sling floor flame assembly (42) and remove it.
    ★ Make sure that the hoses, connectors, clamps, and so on are disconnected without fail.
    Floor frame assembly: **250 kg**



Installation

- Installation is done in the reverse order of removal.

[*1]

★ When installing the air conditioner circuit hoses, use care so that dirt, water, may not enter.
★ Make sure before the installation that there is O ring at the piping connector of the air conditioner hose.
★ Check that there is no defect or deterioration on the O ring.
★ When connecting the refrigerant piping, coat the O ring with compressor oil **for new refrigerant (R134a) (Denso: ND-OIL8, Zexcel: ZXL100PG (PAG 46 or equivalent))**.

☞ Mounting bolt: **8 – 12 Nm {0.8 – 1.2 kgm}**

[*2]

★ Make sure that the hoses do not lap over.

- Filling of air conditioning gas
  By using tool **X1**, fill the air conditioner gas **(R134a)** inside the air conditioner circuit.
  ★ Filling quantity: **850 ± 50 g**

PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00665-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

50 Disassembly and assembly

Electric components

Electric components

Removal and installation of air conditioner unit assembly

Special tools

Symbol	Part number	Part name	Necessity	Q'ty	N/R	Sketch
X1	799-703-1200	Service tool kit	■	1		
	799-703-1100	Vacuum pump (100V)	■	1		
	799-703-1111	Vacuum pump (220V)	■	1		
	799-703-1121	Vacuum pump (240V)	■	1		
	799-703-1401	Gas leak detector	■	1		

Removal

⚠ **Disconnect the negative terminal (–) of the battery before starting the work.**

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

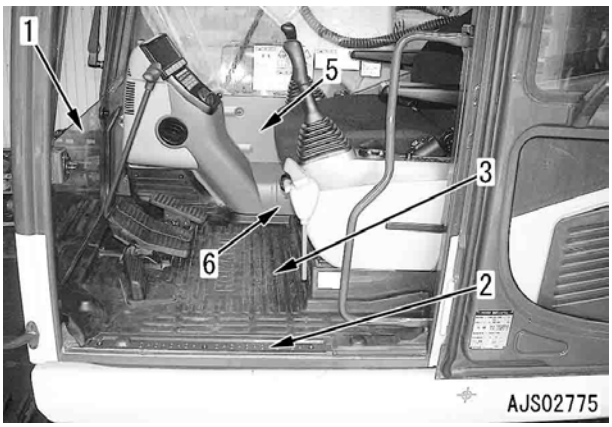
⚠ **If the air conditioner gas (R134a) gets inside one's eyes, it may cause blindness. Therefore, make sure to wear protective glasses when collecting or filling the gas. Collecting and filling work must be conducted by a qualified person.**

1. Turn the upper structure by 90 degrees.

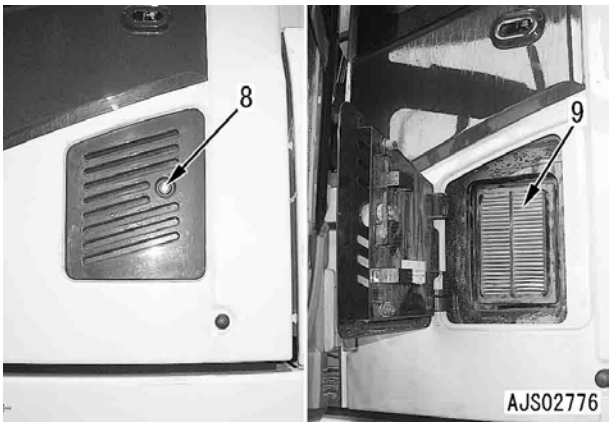
2. Drain the engine cooling water.
   Coolant: **Approx. 21.4ℓ**

3. Remove front window (1).
4. Remove step plate (2).
5. Remove floor mat (3).

6. Remove cover (5) and (6).

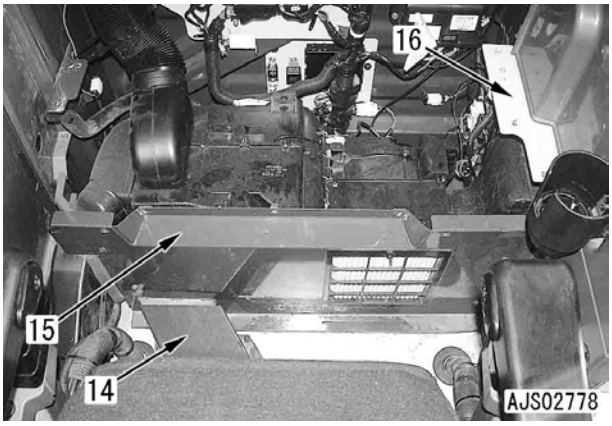


7. Pull down opening and closing lever (8) of the outside air filter cover.
8. Remove outside air-filter(9).

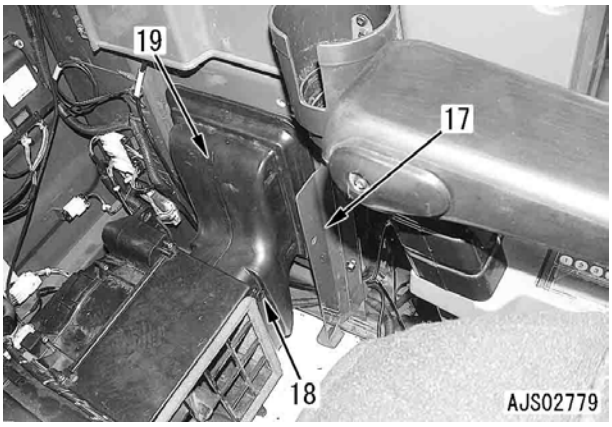


9. Remove rear cover (10) to (13).

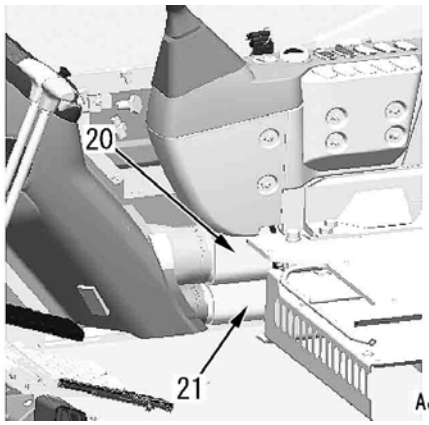
10. Remove duct (14).
11. Remove cover (15).
    ★ Disconnect connector H15 fixed on the back from the clip.
12. Remove plate (16).

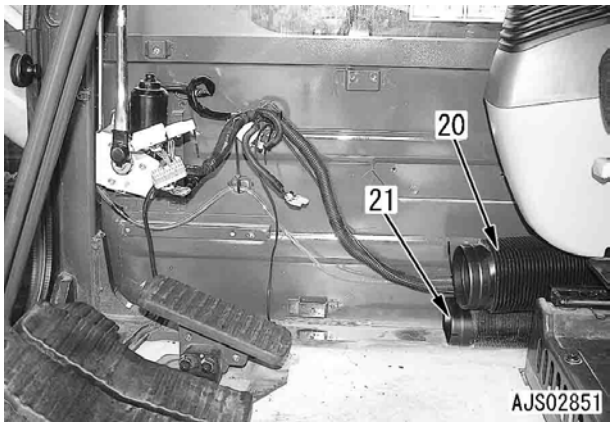


13. Remove plate (17).
14. Remove lock pin (18) and remove duct (19).

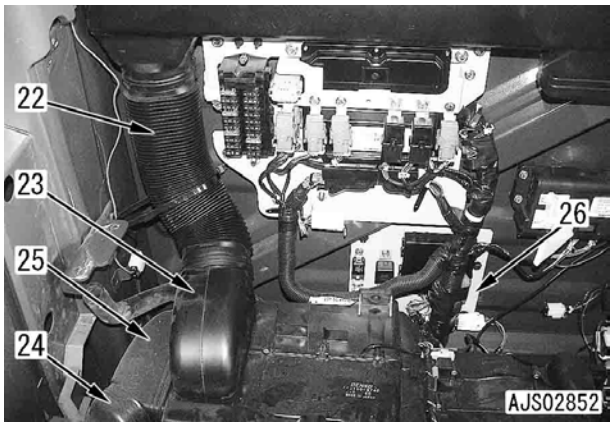


15. Remove ducts (20) and (21).
    ★ Cut tie-wrap.



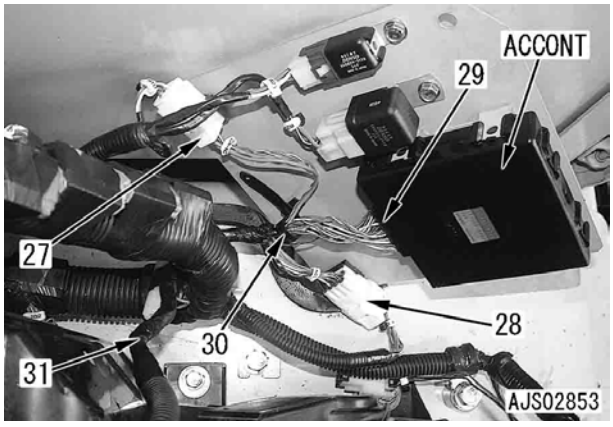


16. Remove ducts (22) and (23).
    ★ Cut tie-wrap.
17. Remove duct (24) upper and lower.
18. Remove duct (25) upper and lower.
19. Disconnect plate (26) from the cab wall.

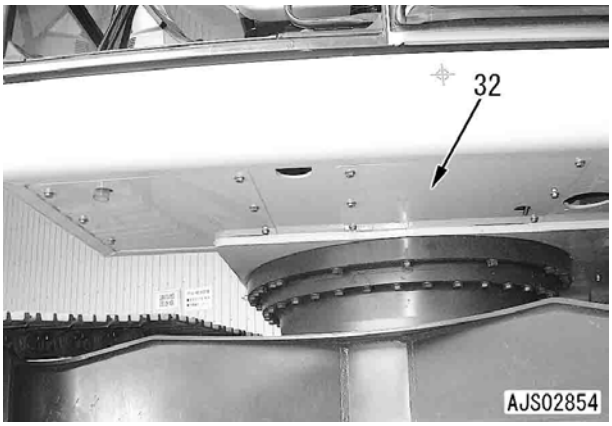


20. Disconnect connectors N10 (27) and AC01 (28).
21. Disconnect connectors ECU10 and ECU11 (29) from the air conditioner controller (ACCONT).

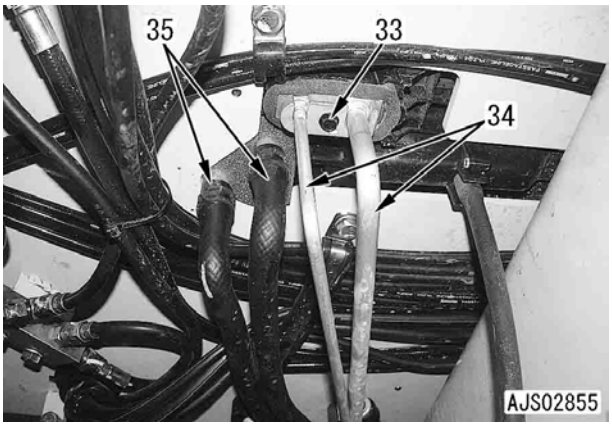
22. Loosen tie-wrap (30) and draw in wiring harness (31).



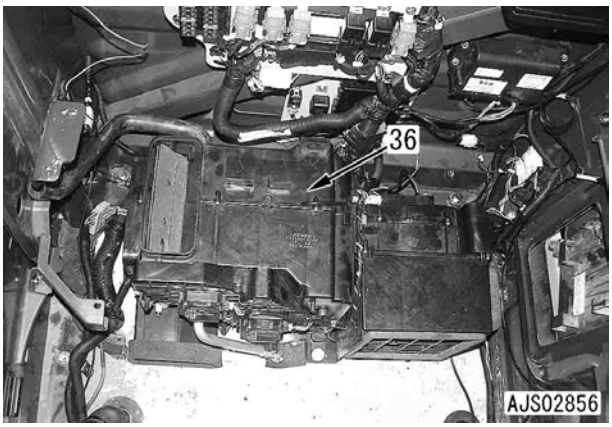
23. Remove cover (32).



24. Remove mounting bolt (33) and disconnect air conditioner tube (34). [*1]
25. Disconnect heater hose (35).
    ★ Check the connecting point.



26. Remove the 7 mounting bolts and air conditioner unit assembly (36).



Installation

- Installation is done in the reverse order of removal.

[*1]

★ When installing the air conditioner circuit hoses, use care so that dirt, water, may not enter.
★ Make sure before the installation that there is O ring at the piping connector of the air conditioner hose.
★ Check that there is no defect or deterioration on the O ring.
★ When connecting the refrigerant piping, coat the O ring with compressor oil **for new refrigerant (R134a) (Denso: ND-OIL8, Zexcel: ZXL100PG (PAG 46 or equivalent))**.

Mounting bolt: **8 – 12 Nm {0.8 – 1.2 kgm}**

- **Filling of air conditioning gas**
  By using tool **X1**, fill the air conditioner gas **(R134a)** inside the air conditioner circuit.
  ★ Filling quantity:**850 ± 50 g**

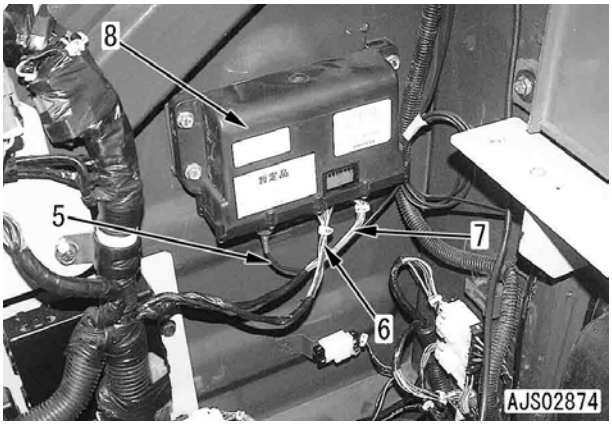
Removal and installation of KOMTRAX communication modem assembly

Removal

⚠ **Disconnect the negative terminal (–) of the battery before starting the work.**

1. Remove covers (1) – (4).

2. Twist antenna wire (5) and disconnect it.
3. Disconnect connectors K01(6) and CK02 (7).
4. Remove the 4 mounting bolts and KOMTRAX communication modem assembly (8).



Installation

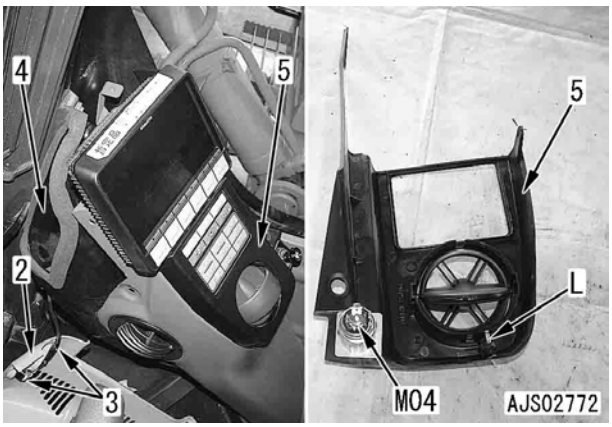
- Installation is done in the reverse order of removal.

Removal and installation of monitor assembly

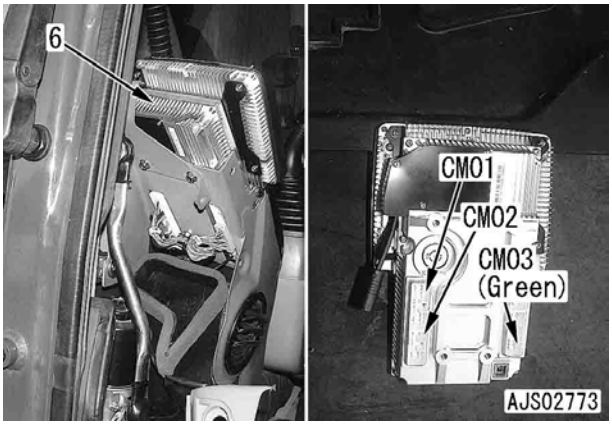
Removal

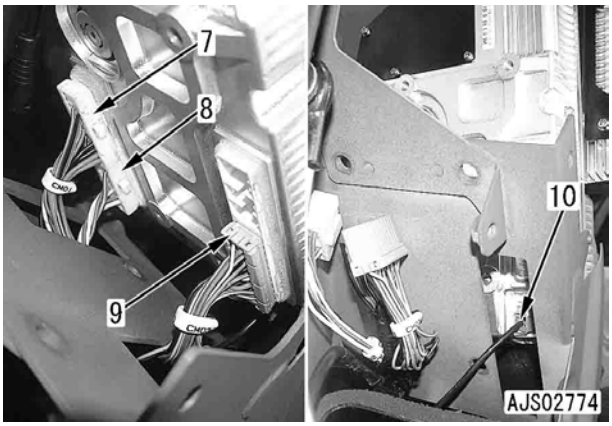
⚠ **Disconnect the negative terminal (–) of the battery before starting the work.**

1. Remove cap (1).
2. Remove cover (2) and then disconnect wiring connector P31 (3) for air conditioner sunlight sensor (S).
3. Remove duct (4).
4. Remove cover (5) as follows. [*1]
   1) Insert flat-head screwdriver inside slit (SL) and push it upward.
   2) Release lock (L) and remove the cover.
   3) Disconnect wiring connector M04 of the cigarette lighter from the back of cover (5).



5. Remove the 4 mounting bolts and lift monitor assembly (6). [*2]
6. Disconnect connectors CM01 (7), CM02 (8) and CM03 (9).
   ★ Since CM02 (8) and CM03 (9) can be installed reversely, be careful not to mistake. CM 03 (9) is a green connector.
7. Disconnect connector (10).





Installation

[*1], [*2]

1) Temporary install monitor assembly (6) with 4 mounting bolts, and then install cover (5).
2) With cover (5) installed, tighten the mounting bolts of monitor assembly.

- Carry out the rest of installation in the reverse order to removal.

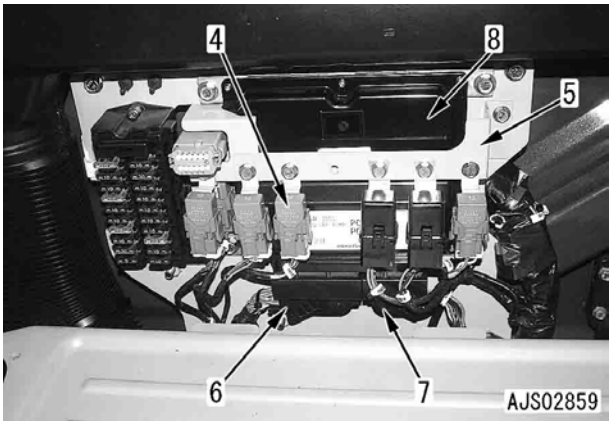
Removal and installation of pump controller assembly

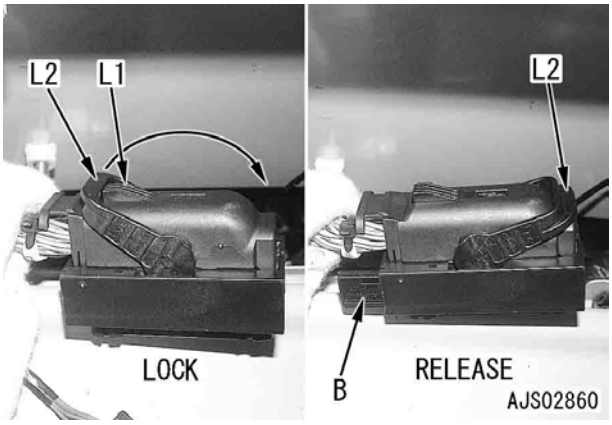
Removal

⚠ **Disconnect the negative terminal (–) of the battery before starting the work.**

1. Remove cover (1).

2. Disconnect relay R08 (4) from the clip.
3. Disconnect bracket (5) and put it to the right side.
4. Disconnect wiring connectors C01 (6) and C02 (7) as follows.
   - Tilt lock (L12) inside while pressing lock (L1).
   - ★ Bar (B) comes out and the lock is released.
5. Remove the 4 mounting bolts and pump controller assembly (8).





Installation

- Installation is done in the reverse order of removal.

Removal and installation of engine controller assembly

Removal

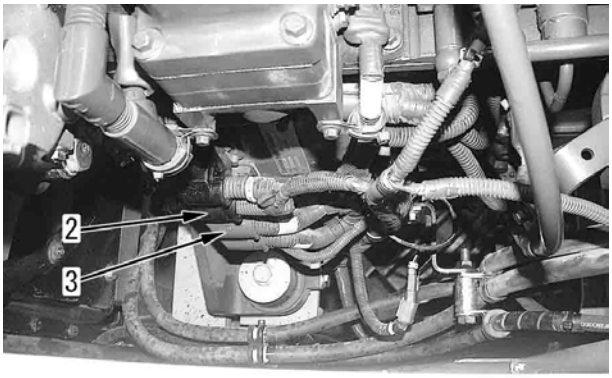
⚠ **Disconnect the negative terminal (–) of the battery before starting with the work.**

1. Turn the upper structure by 90 degrees.

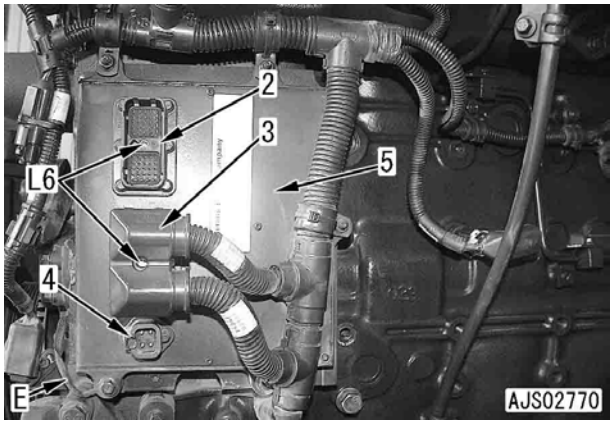
2. Remove cover (1).

3. Open the engine hood.

4. Disconnect connectors CE02 (2) and (3) from the engine controller.
   ★ The connector is locked with the inside hex head bolt L6 (4 mm).
5. Disconnect connector (4) from the engine controller by pushing the lock.
6. Remove the mounting bolt and engine controller (5).
   ★ Ground (E) and harness clamp are tightened together with.



AJS02769



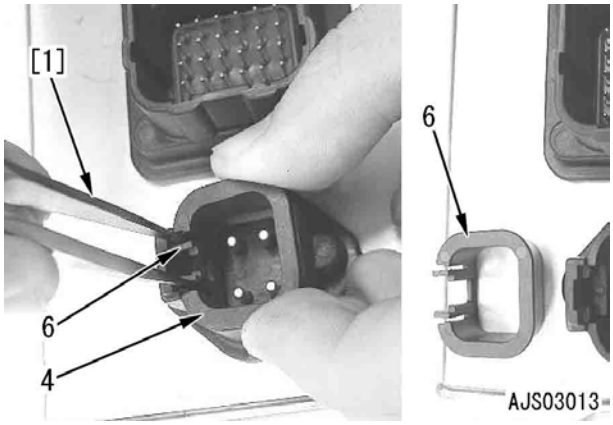
Installation

- Carry out installation in the reverse order to removal

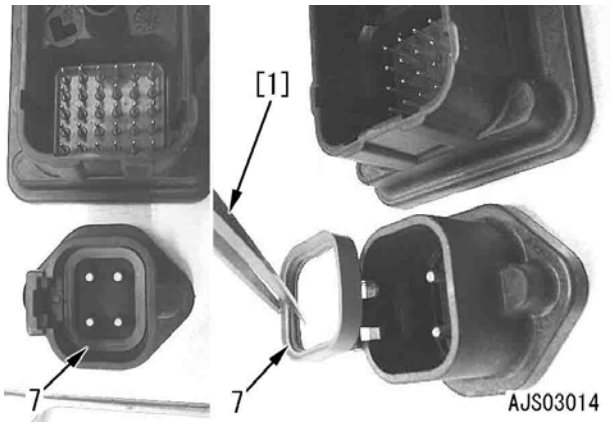
★ **Reference**

- How to replace the seal of O ring of power source connector (4).
  Seal of O ring:
  1010-074-0406 (NIHON-DEUTSCH Ltd.)

1) Remove cover (6) by nipping the tab with tweezers [1].



2) Remove O ring (7) with tweezers [1].



PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00666-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

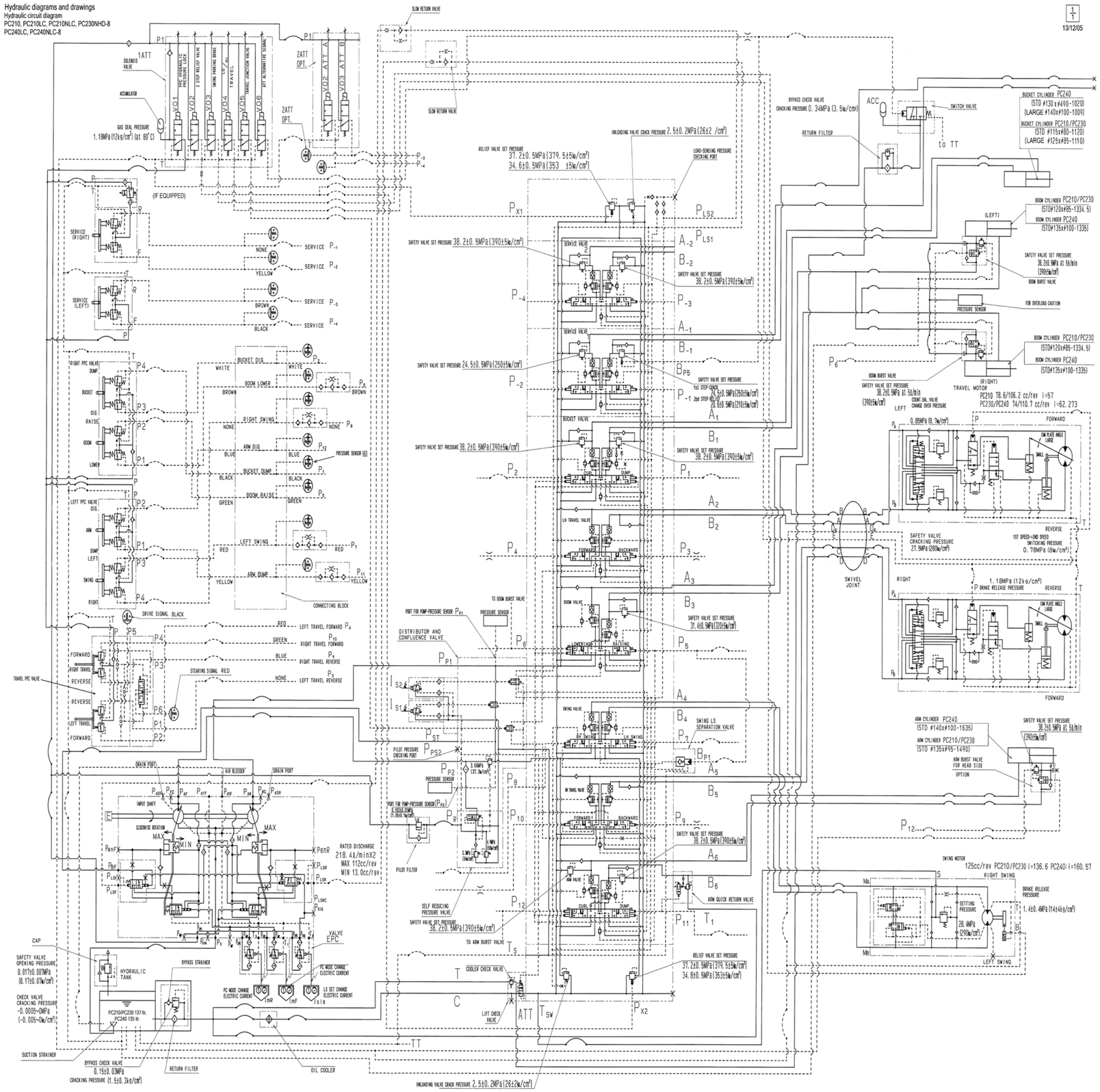
Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

90 Diagrams and drawings

Hydraulic diagrams and drawings

Hydraulic diagrams and drawings

Hydraulic circuit diagram



PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00112-00

HYDRAULIC EXCAVATOR

PC210-8
PC210LC-8
PC210NLC-8
PC230NHD-8
PC240LC-8
PC240NLC-8

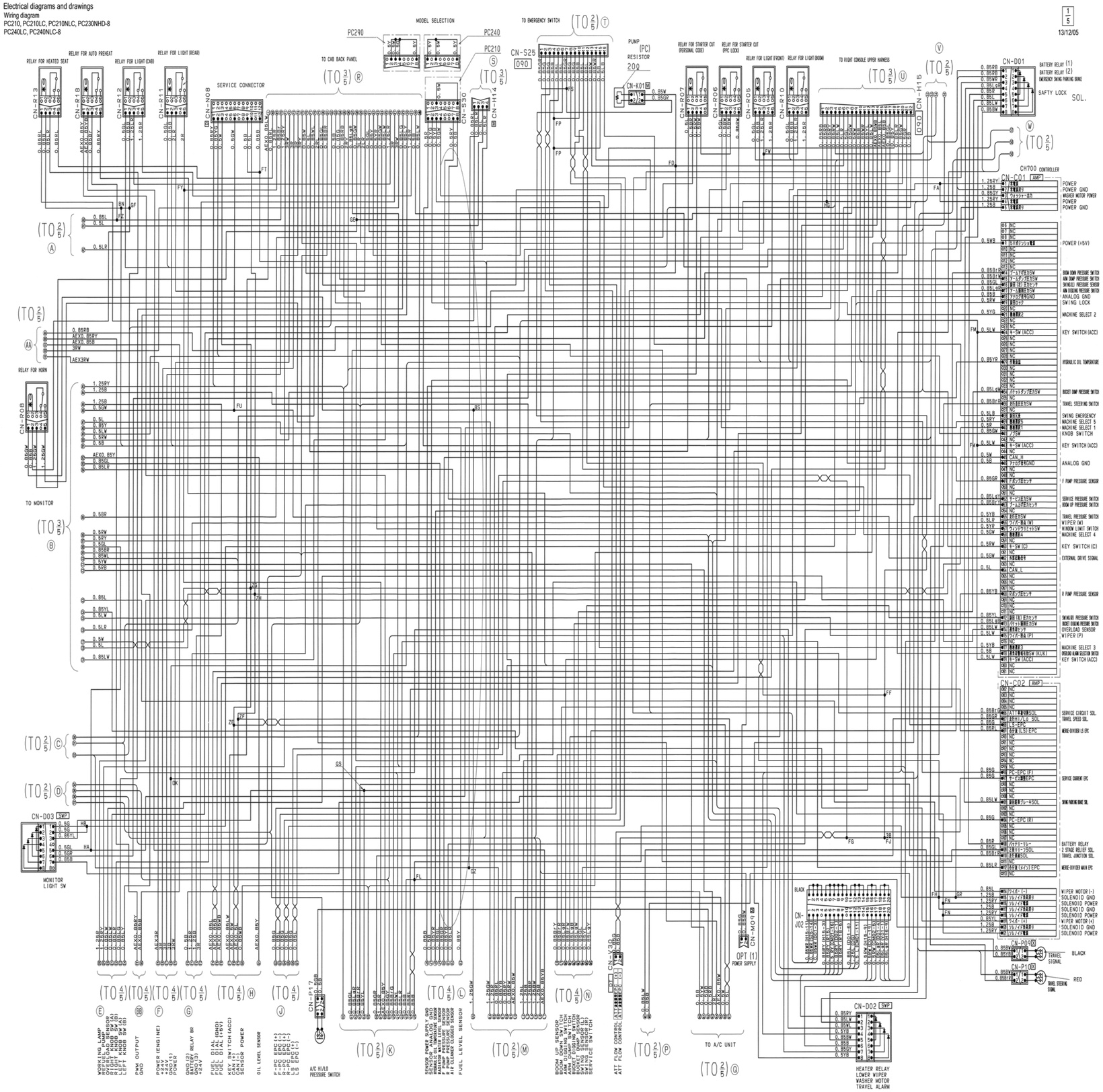
Machine model	Serial number
PC210-8	K50001 and up
PC210LC-8	K50001 and up
PC210NLC-8	K50001 and up
PC230NHD-8	K50001 and up
PC240LC-8	K50001 and up
PC240NLC-8	K50001 and up

90 Diagrams and drawings

Electrical diagrams and drawings

Electrical diagrams and drawings

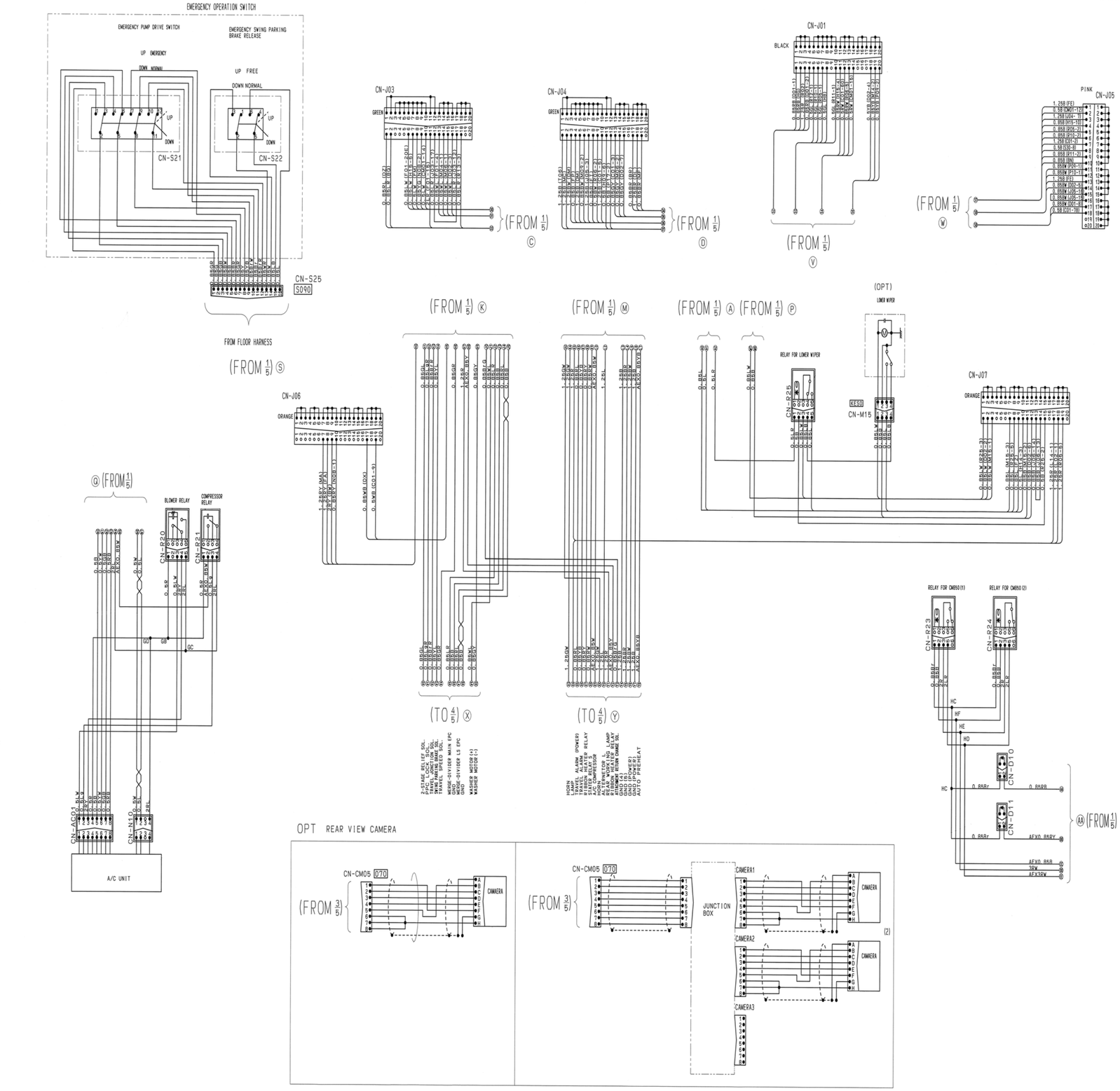
Electrical circuit diagram (1/5)



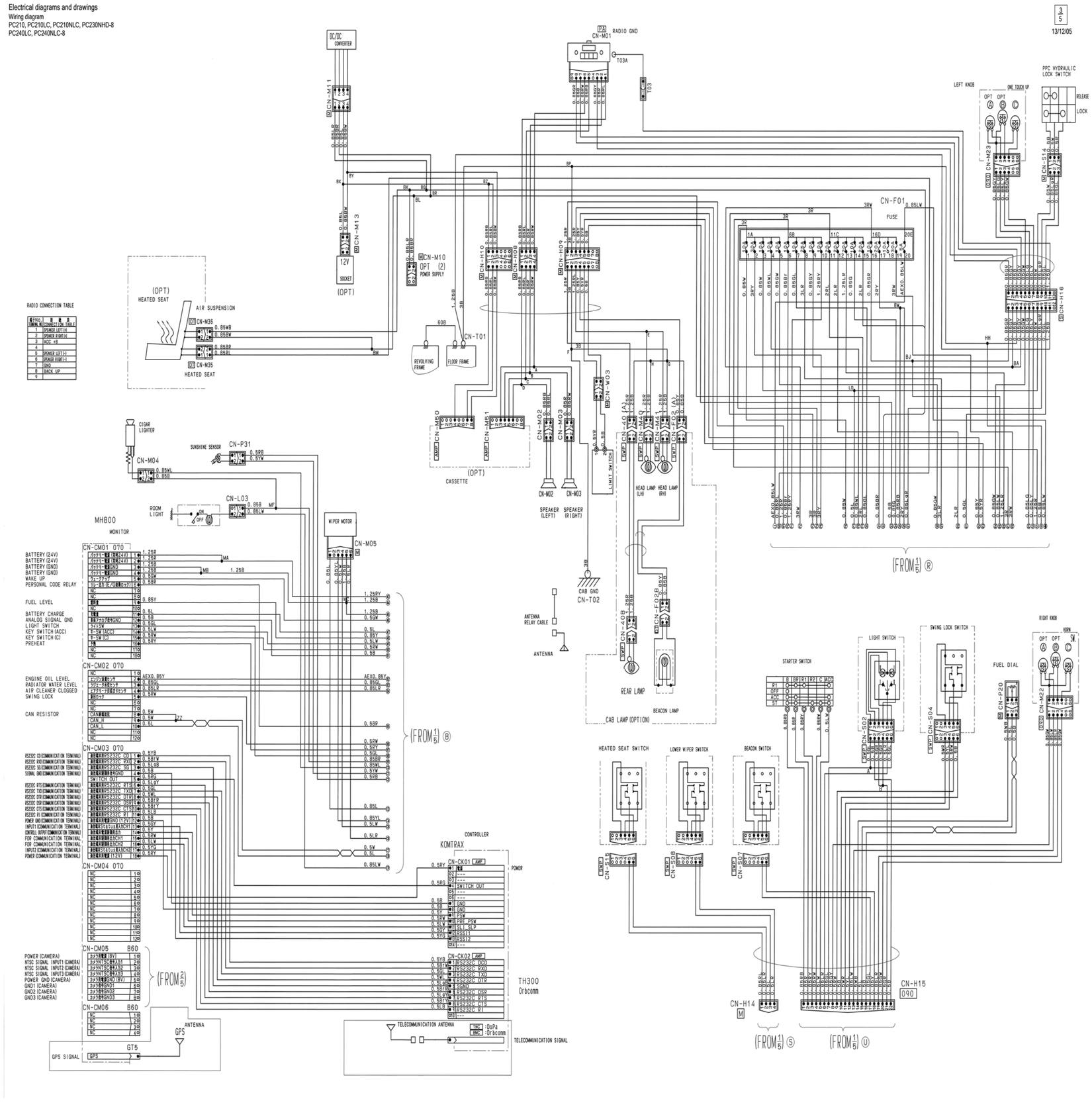
Electrical circuit diagram (2/5)

Electrical diagrams and drawings
Wiring diagram
PC210, PC210LC, PC210NLC, PC230NHD-8
PC240LC, PC240NLC-8

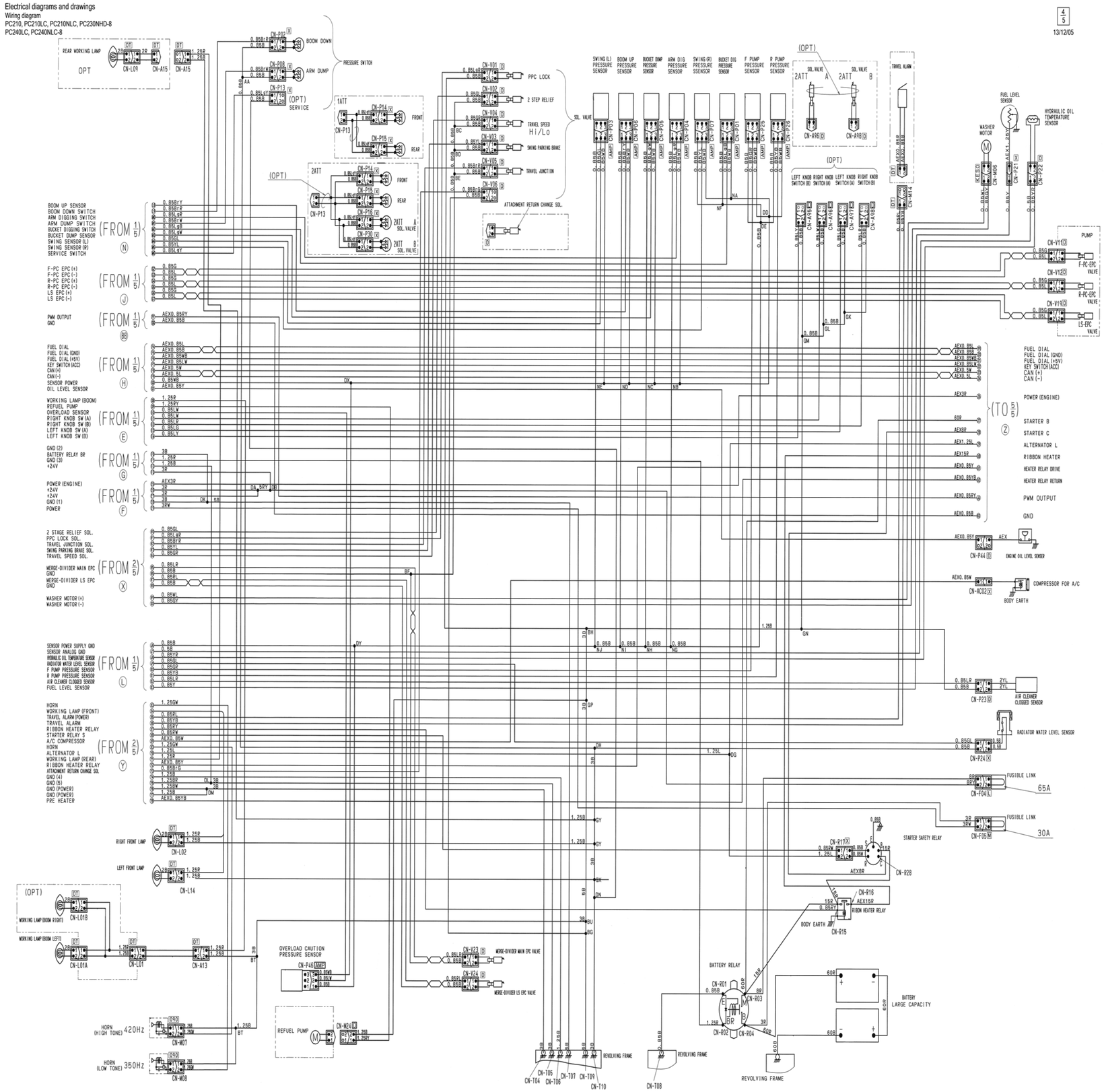
2/5
13/12/05



Electrical circuit diagram (3/5)

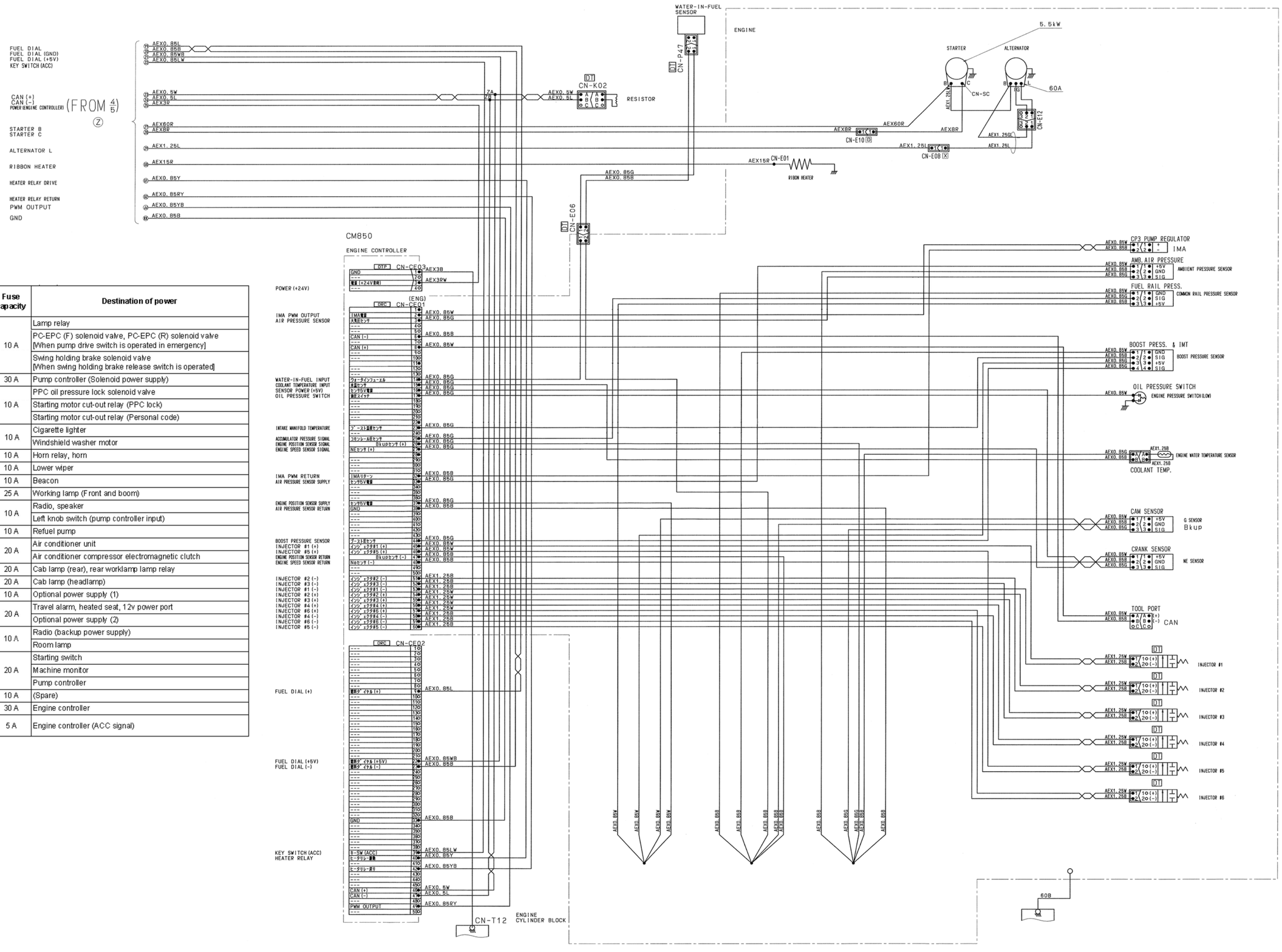


Electrical circuit diagram (4/5)



Electrical circuit diagram (5/5)

Fuse No.	Fuse capacity	Destination of power
1	10 A	Lamp relay
		PC-EPC (F) solenoid valve, PC-EPC (R) solenoid valve [When pump drive switch is operated in emergency]
		Swing holding brake solenoid valve [When swing holding brake release switch is operated]
2	30 A	Pump controller (Solenoid power supply)
3	10 A	PPC oil pressure lock solenoid valve
		Starting motor cut-out relay (PPC lock)
		Starting motor cut-out relay (Personal code)
4	10 A	Cigarette lighter
		Windshield washer motor
5	10 A	Horn relay, horn
6	10 A	Lower wiper
7	10 A	Beacon
8	25 A	Working lamp (Front and boom)
9	10 A	Radio, speaker
		Left knob switch (pump controller input)
10	10 A	Refuel pump
11	20 A	Air conditioner unit
		Air conditioner compressor electromagnetic clutch
12	20 A	Cab lamp (rear), rear worklamp lamp relay
13	20 A	Cab lamp (headlamp)
14	10 A	Optional power supply (1)
15	20 A	Travel alarm, heated seat, 12v power port
		Optional power supply (2)
16	10 A	Radio (backup power supply)
		Room lamp
17	20 A	Starting switch
		Machine monitor
		Pump controller
18	10 A	(Spare)
19	30 A	Engine controller
20	5 A	Engine controller (ACC signal)



PC210, 230NHD, 240-8 Hydraulic excavator
Form No. UEN00113-00