SEN06728-04

Shop Manual

HYDRAULIC
EXCAVATOR

PC290LC-8

SERIAL NUMBERS 30742 and up

ecot3

KOMATSU

Foreword and general information

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

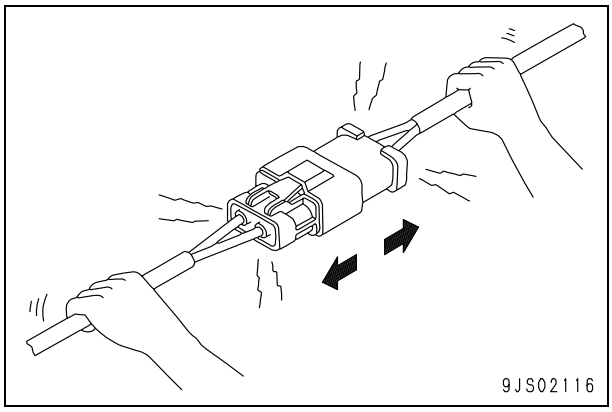
⚠ **Mistakes in operation are extremely dangerous. Read the Operation and Maintenance Manual carefully before operating the machine. In addition, read this manual and understand its contents before starting the work.**

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

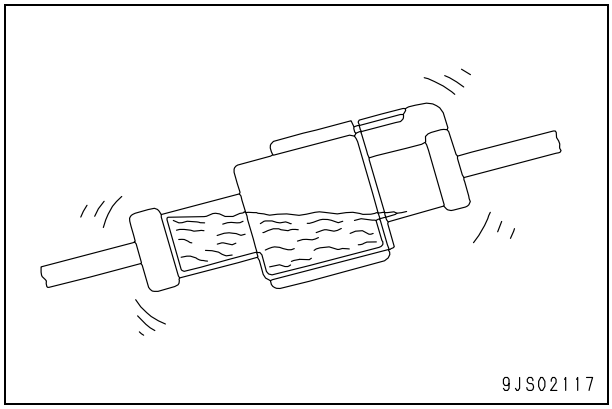
Safety points

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

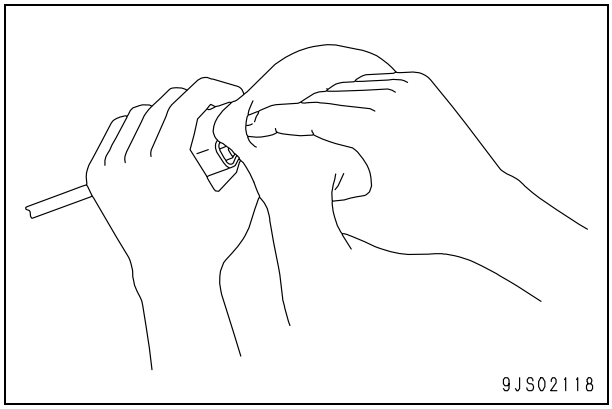
3) Disconnections in wiring
If the wiring is held and the connectors are pulled apart, or components are lifted with a crane with the wiring still connected, or a heavy object hits the wiring, the crimping of the connector may separate, or the soldering may be damaged, or the wiring may be broken.



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



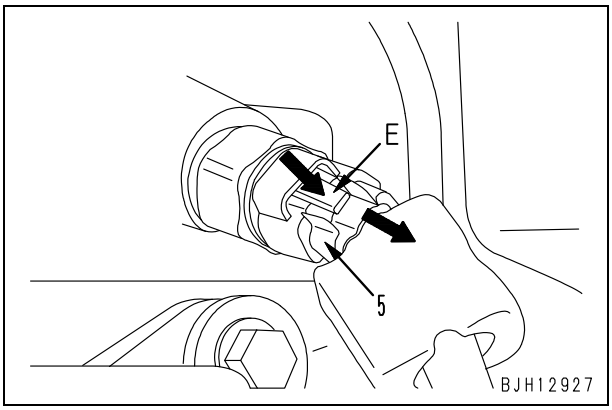
5) Oil or dirt stuck to connector
If oil or grease are stuck to the connector and an oil film is formed on the mating surface between the male and female pins, the oil will not let the electricity pass, so there will be defective contact. If there is oil or grease stuck to the connector, wipe it off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



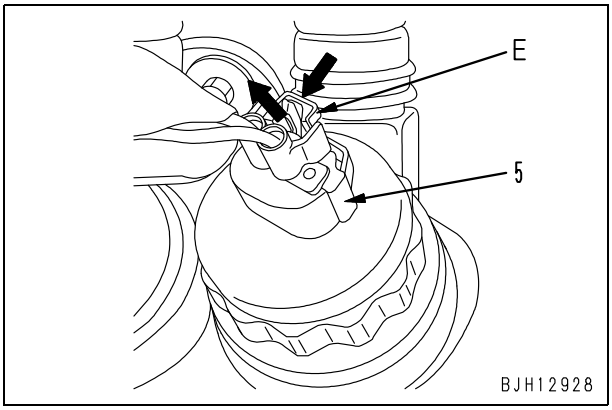
- 95, 125 – 170, 12V140 engines

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

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

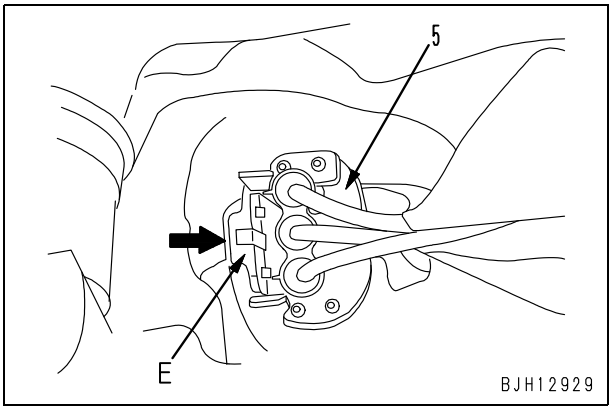


Example)
Injection pressure control valve of fuel supply pump: PCV (**SUMITOMO-2**)



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

★ Pull the connector straight up.



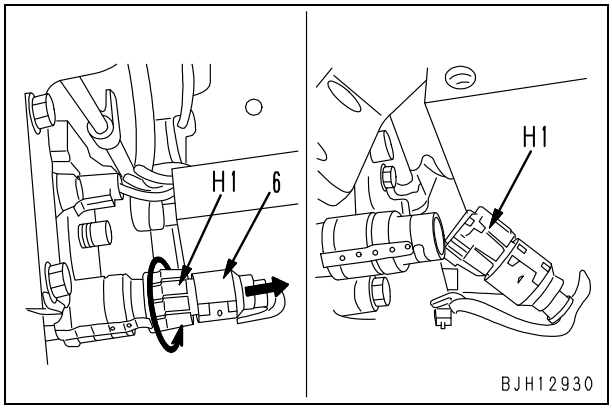
4. Turn-housing type (Round green connector)

- 140 engine

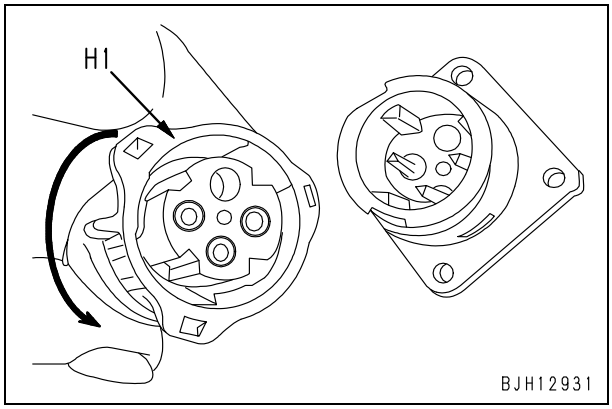
Example)
Intake air pressure sensor in intake manifold (CANNON-04): PIM etc.

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

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



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



Standard tightening torque table

1. Table of tightening torques for bolts and nuts

★ Unless there are special instructions, tighten metric nuts and bolts to the torque below.

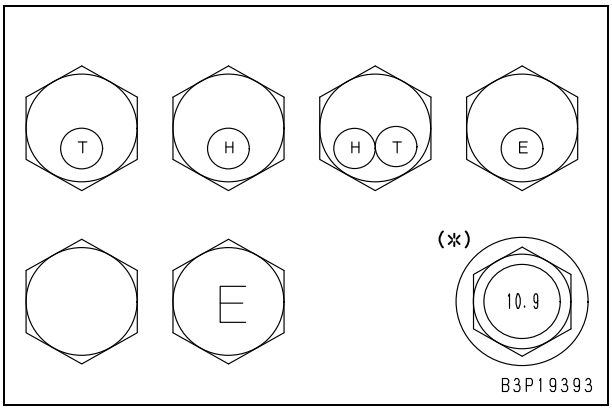
★ The following table applies to the bolts in Fig. A.

Thread diameter of bolt	Width across flats	Tightening torque	
mm	mm	Nm	kgm
6	10	11.8 – 14.7	1.2 – 1.5
8	13	27 – 34	2.8 – 3.5
10	17	59 – 74	6.0 – 7.5
12	19	98 – 123	10.0 – 12.5
14	22	157 – 196	16 – 20
16	24	245 – 309	25 – 31.5
18	27	343 – 427	35 – 43.5
20	30	490 – 608	50 – 62
22	32	662 – 829	67.5 – 84.5
24	36	824 – 1,030	84 – 105
27	41	1,180 – 1,470	120 – 150
30	46	1,520 – 1,910	155 – 195
33	50	1,960 – 2,450	200 – 250
36	55	2,450 – 3,040	250 – 310
39	60	2,890 – 3,630	295 – 370

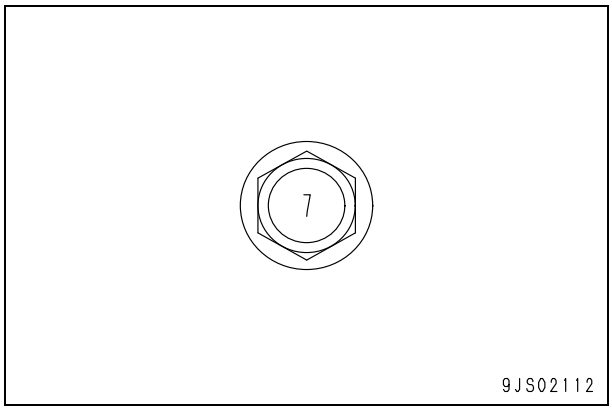
★ The following table applies to the bolts in Fig. B.

Thread diameter of bolt	Width across flats	Tightening torque	
mm	mm	Nm	kgm
6	10	5.9 – 9.8	0.6 – 1.0
8	12	13.7 – 23.5	1.4 – 2.4
10	14	34.3 – 46.1	3.5 – 4.7
12	17	74.5 – 90.2	7.6 – 9.2

★ Fig. A



★ Fig. B



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

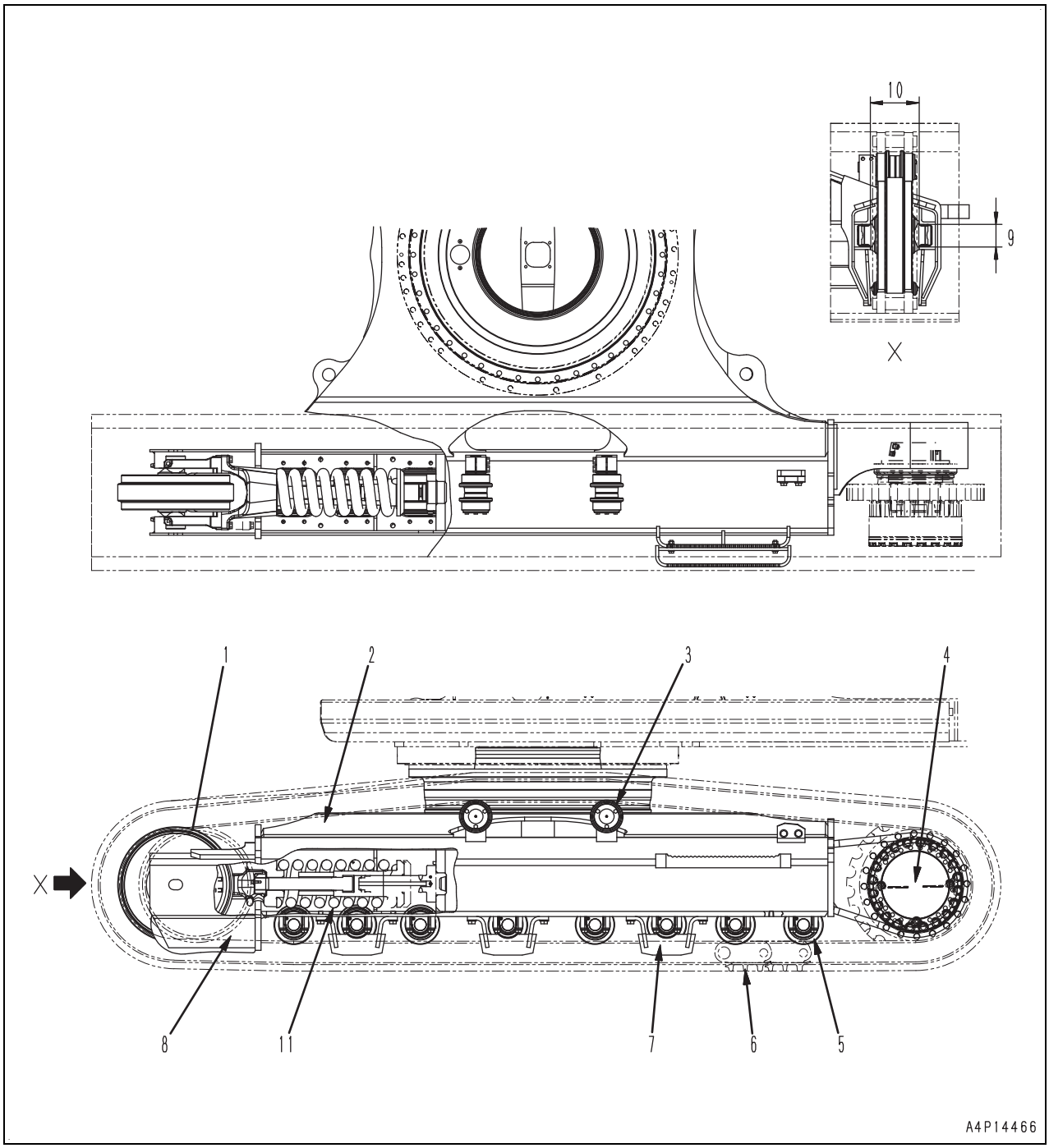
01 Specification

10 Structure, function and maintenance standard

Undercarriage and frame

Track frame and recoil spring

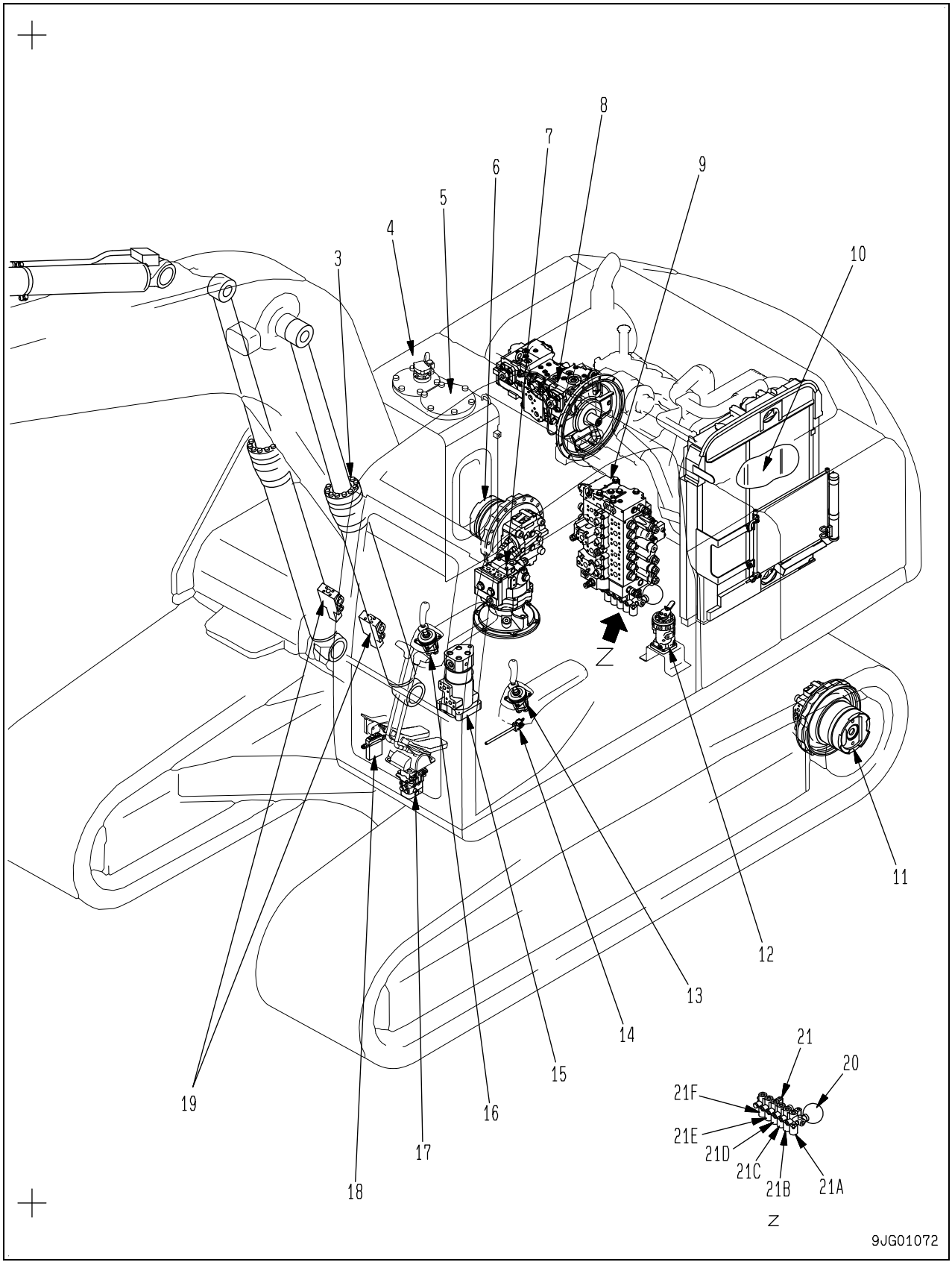
★ The following drawing indicates PC290LC-8.



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)
PC290LC-8	8


8
7
6
9
5
4
3
10
Z
11
12
13
14
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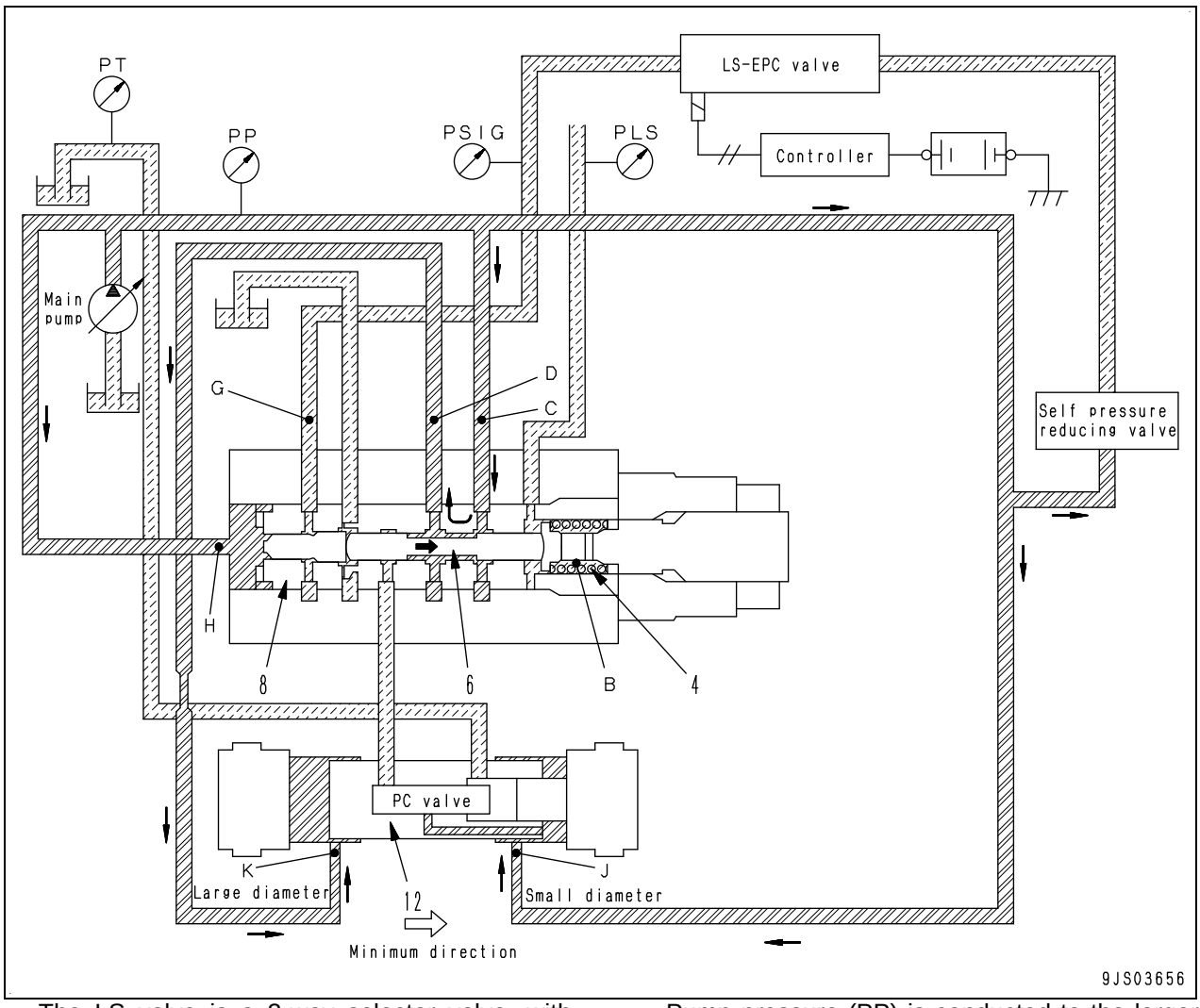
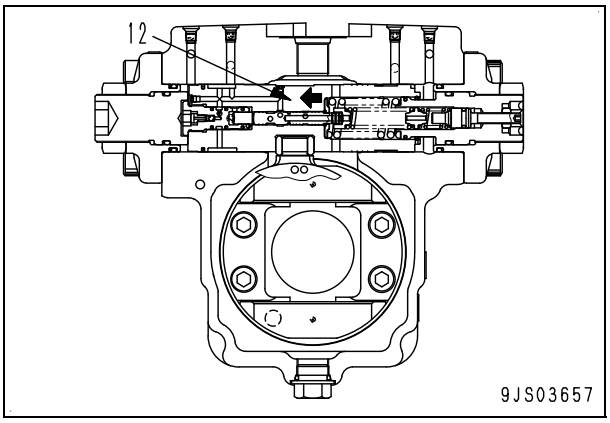
16
17
18
19
21
20
21F
21E
21D
21C
21B
21A
Z
9JG01072

Operation

1) When the control valve is situated at neutral

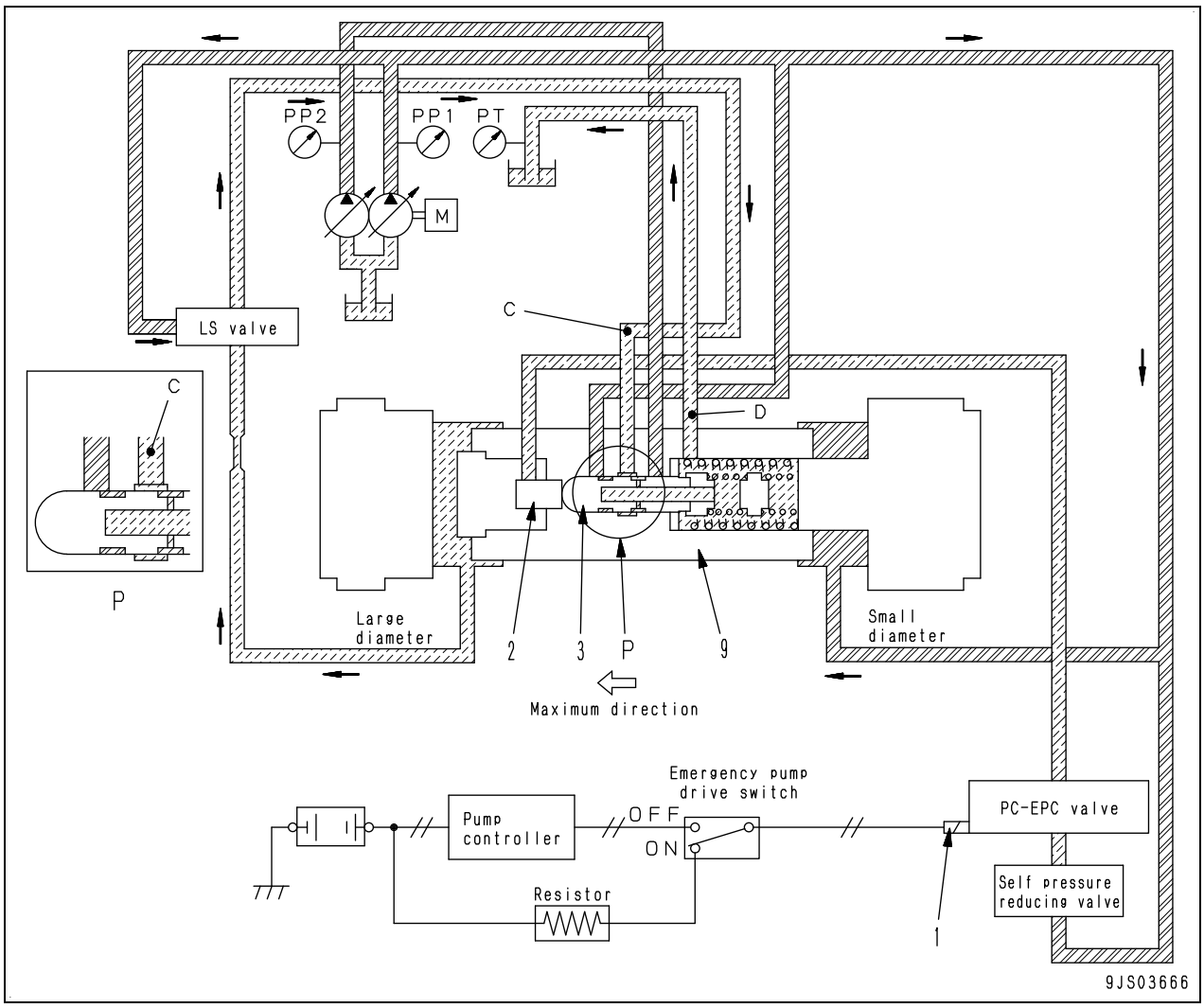


- The LS valve is a 3-way selector valve, with pressure (PLS) (LS pressure) from the outlet port of the control valve brought to spring chamber (B), and main pump discharge pressure (PP) brought to port (H) of sleeve (8).
- Magnitude of the force resulting from this LS pressure (PLS), force of spring (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 left. (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.



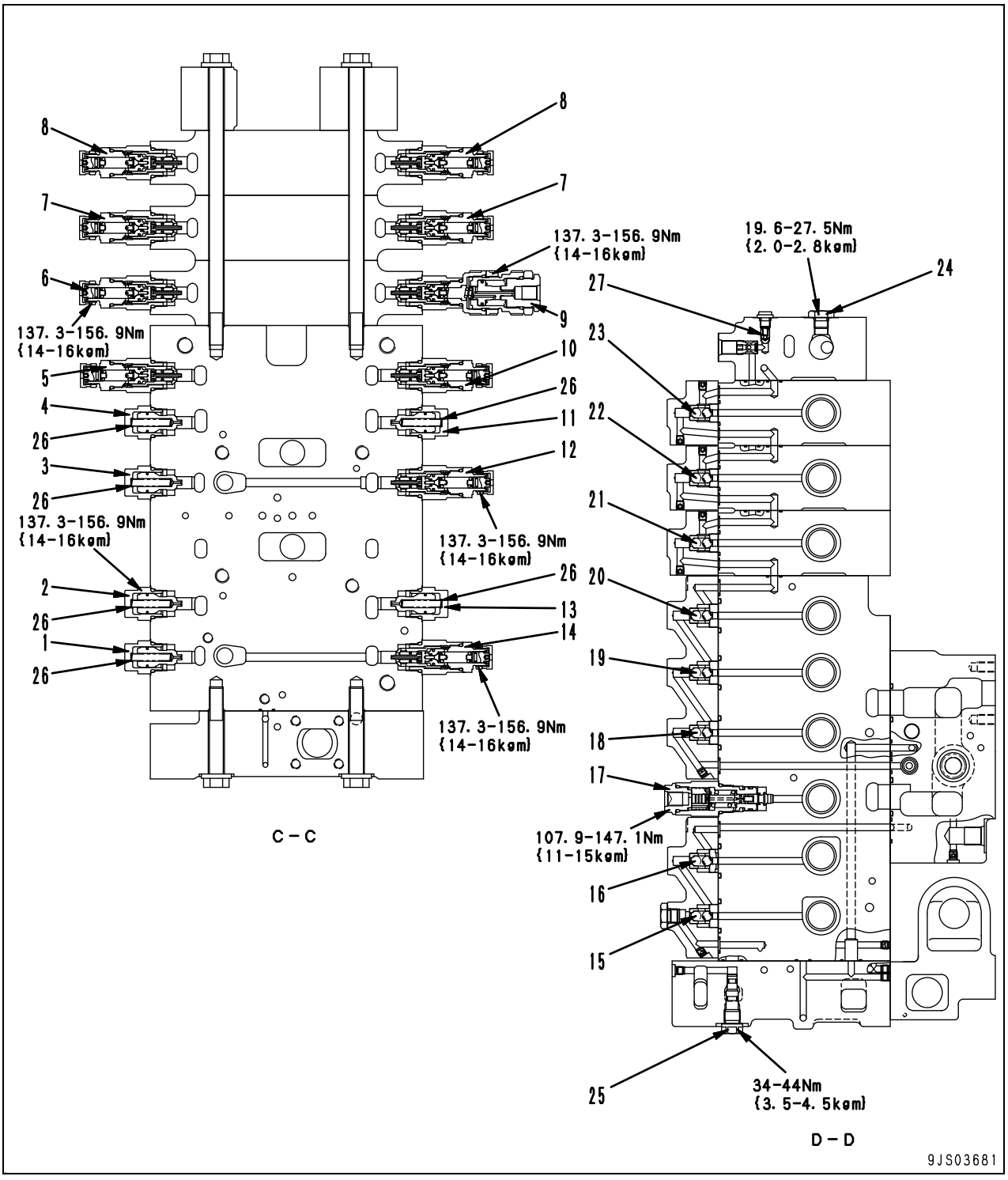
2) As the emergency pump drive switch is turned on due to failure on the pump controller

(1) When the main pump is under light load

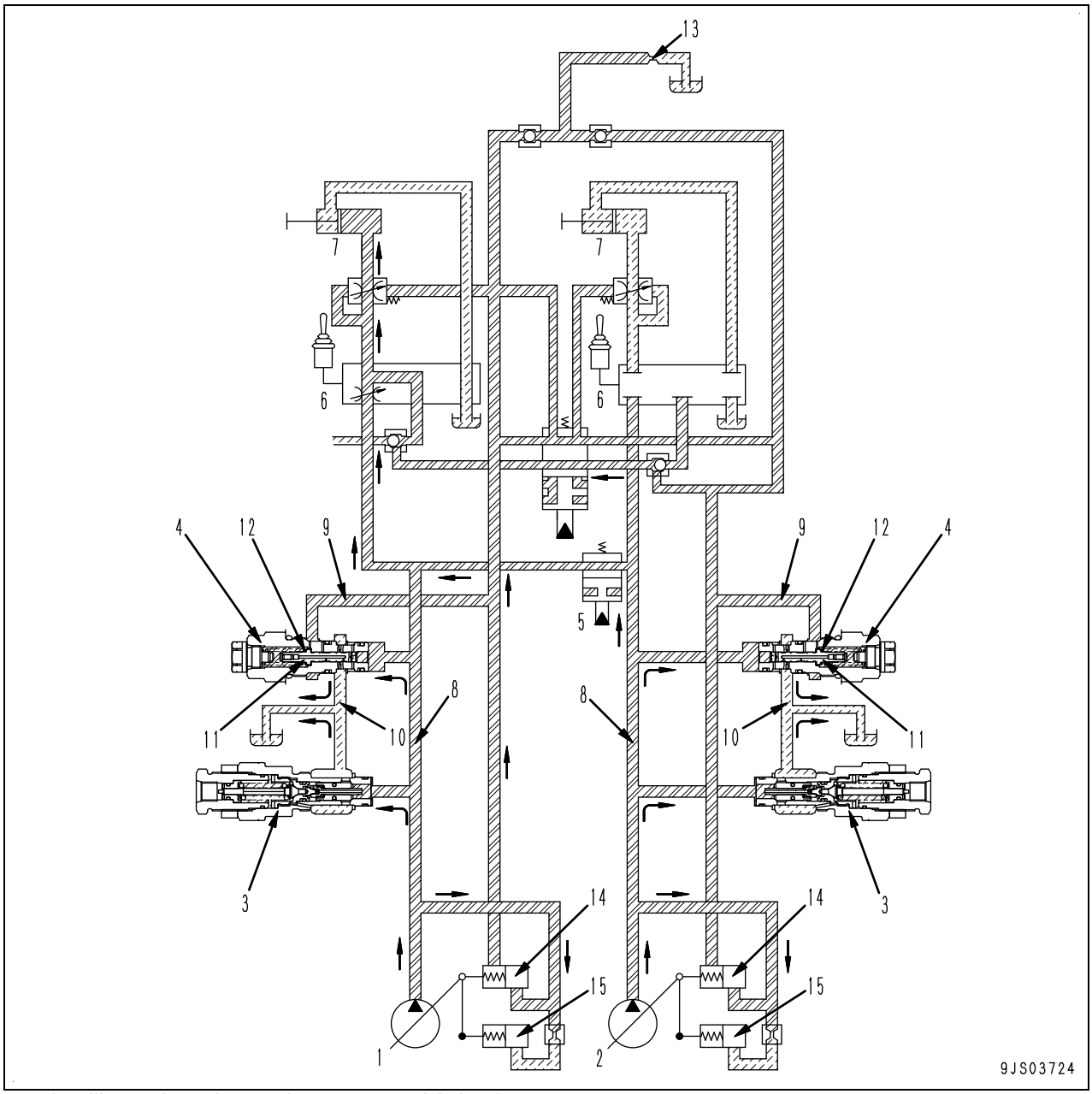


- If there is a failure in the pump controller, the emergency pump drive switch is turned on to hand the control to the resistor side.
- In this case, the power is directly supplied from the battery. The current, however, is too large as is, so the resistor is set in between to control the current flowing 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.

(2/5)


8
7
6
137. 3-156. 9Nm
{14-16kgm}
5
4
26
3
26
137. 3-156. 9Nm
{14-16kgm}
2
26
1
26
C – C
9
10
26
11
12
137. 3-156. 9Nm
{14-16kgm}
26
13
14
137. 3-156. 9Nm
{14-16kgm}
137. 3-156. 9Nm
{14-16kgm}
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
25
34-44Nm
{3. 5-4. 5kgm}
D – D
9JS03681

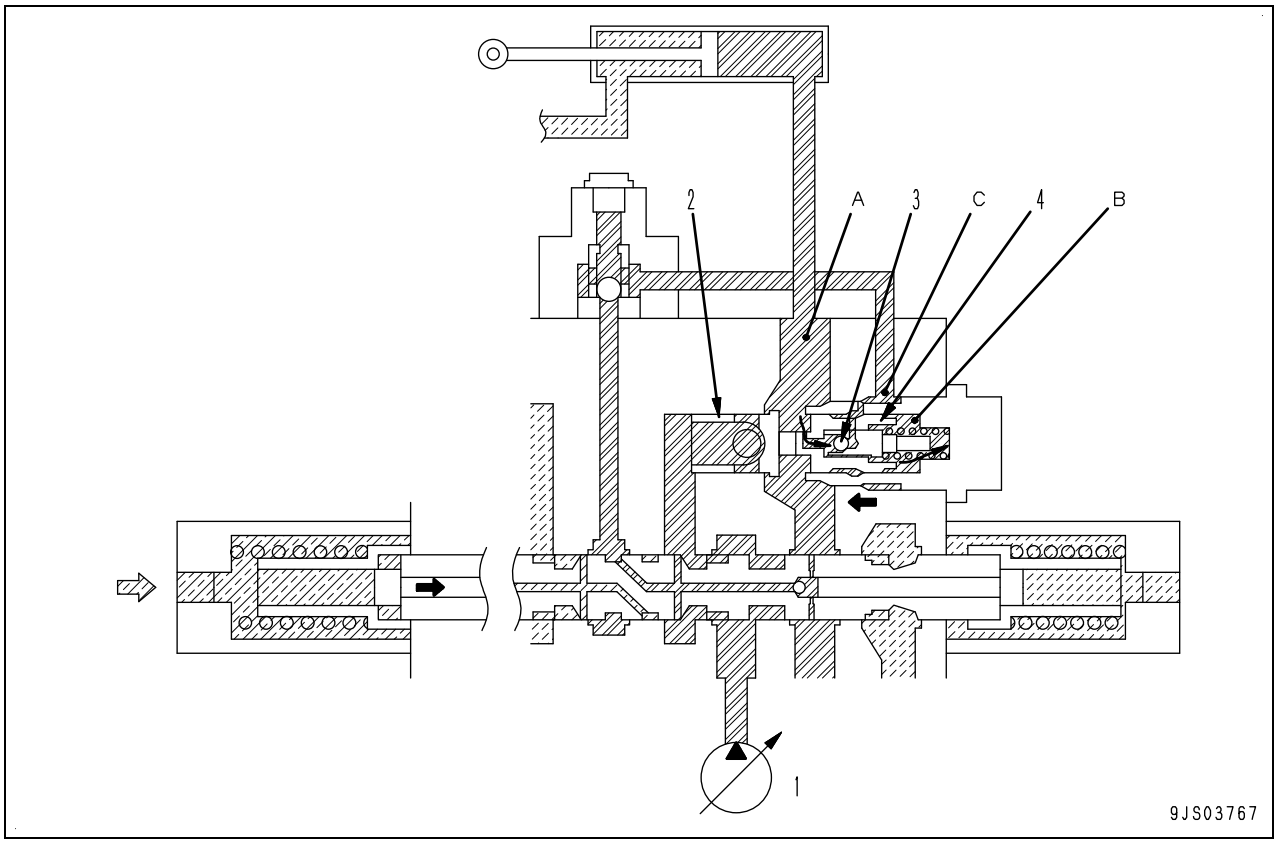
3. System diagram



★ 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

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

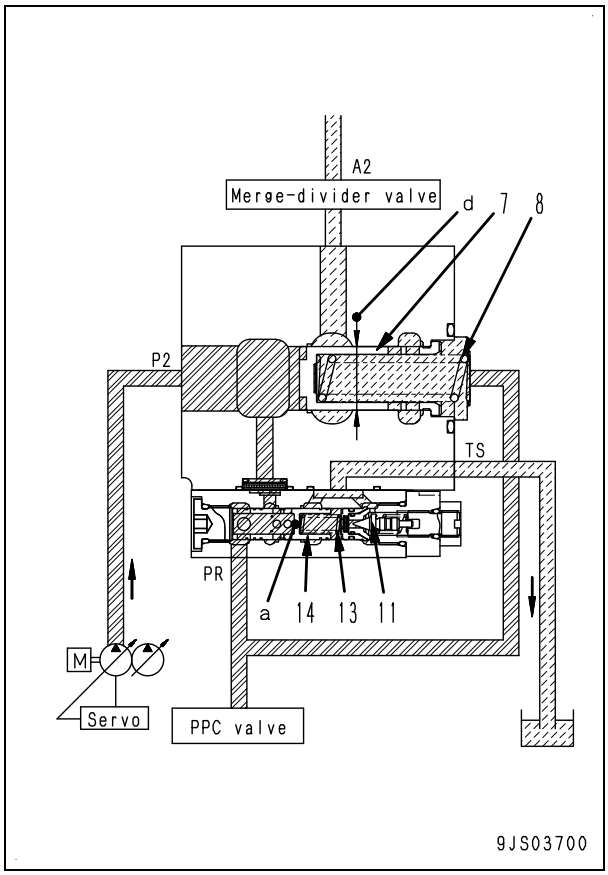
Function

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

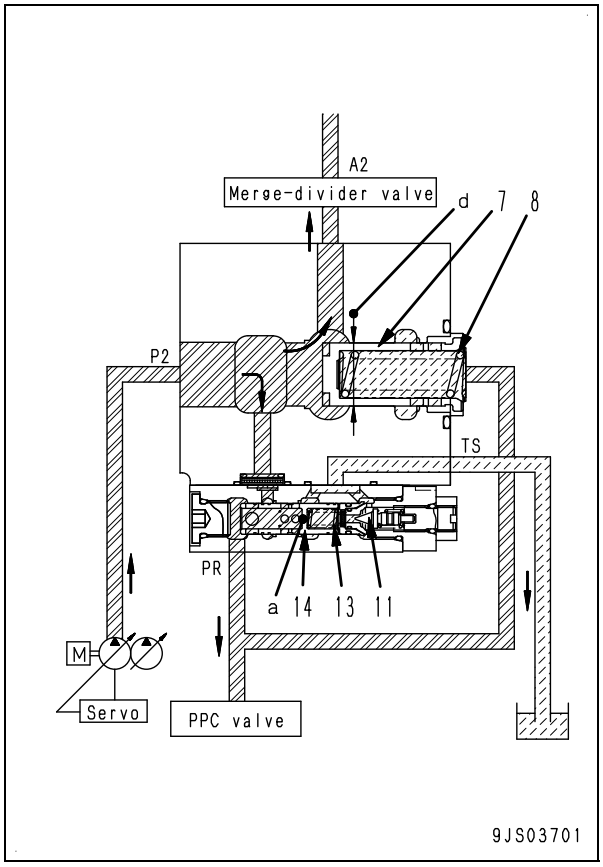
★ When load pressure (A2) is lower than self pressure reducing valve output pressure (PR)

- Valve (7) is pressed to the closing direction of circuit between ports (P2) and (A2) by spring (8) and under pressure (PR) (which is 0MPa {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).

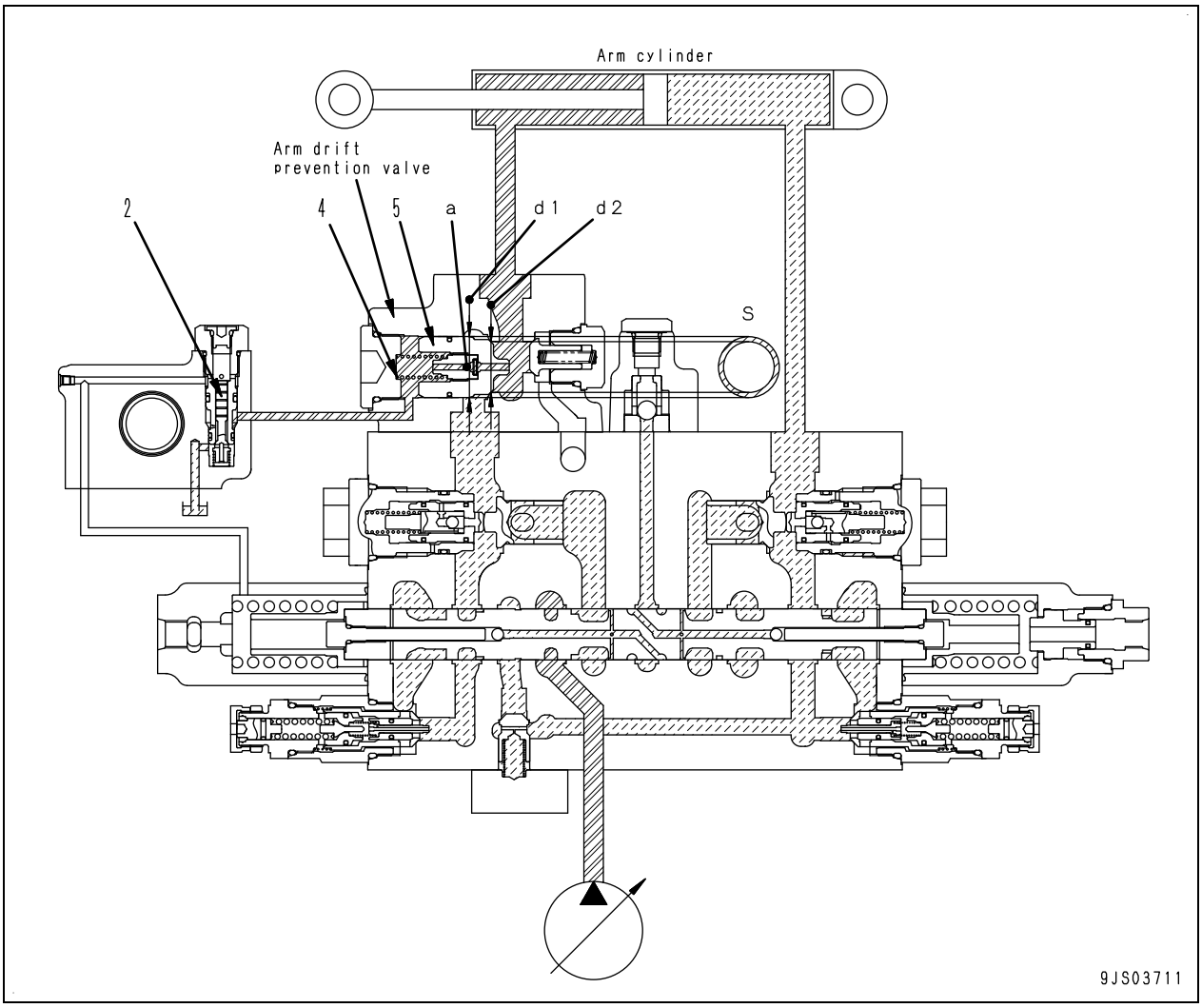


3. When load pressure (P2) is high

- 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.
- Pressurized oil flows from port (PR) to orifice (a) in spool (14), then flows to seal drain port (TS) from poppet (11) opening.
- 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).

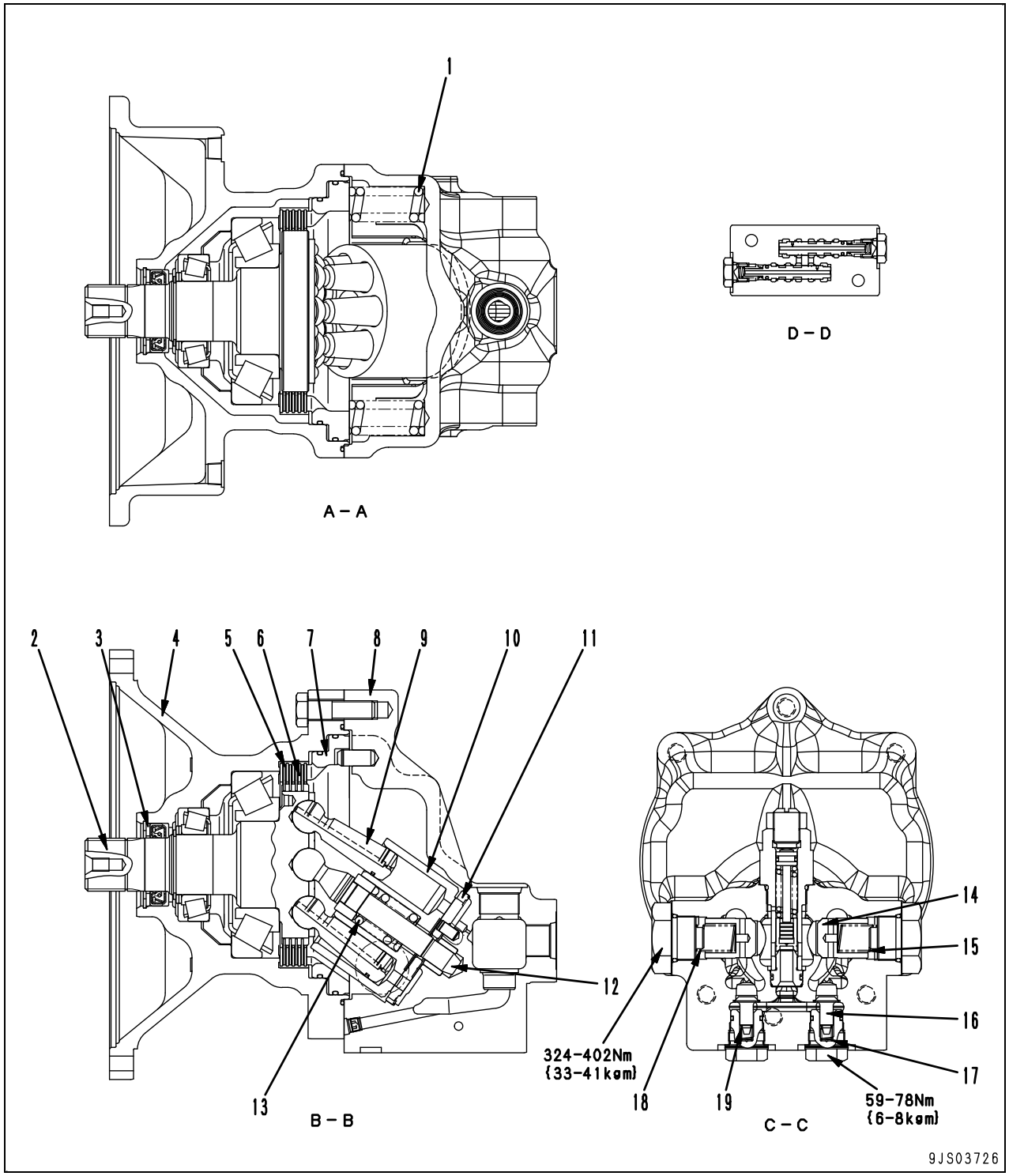


2. When the arm is in neutral



Operation

- Moves the lever to neutral with the arm dumped.
- Pressurized oil flown inside poppet (5) from orifice (a) of poppet (5) is closed by pilot piston (2).
- Pressurized oil from the control valve and the holding pressure of the arm cylinder head are shut off.
- The holding pressure of arm cylinder head works on ring-shaped area (S) caused by the difference between outside diameter (d1) of poppet (5) and seat diameter (d2) to move it to the right.
- The sum of this force and the force of spring (4) closes poppet (5).
- Pressurized oil from the control valve and the holding pressure of the arm cylinder head are shut off.


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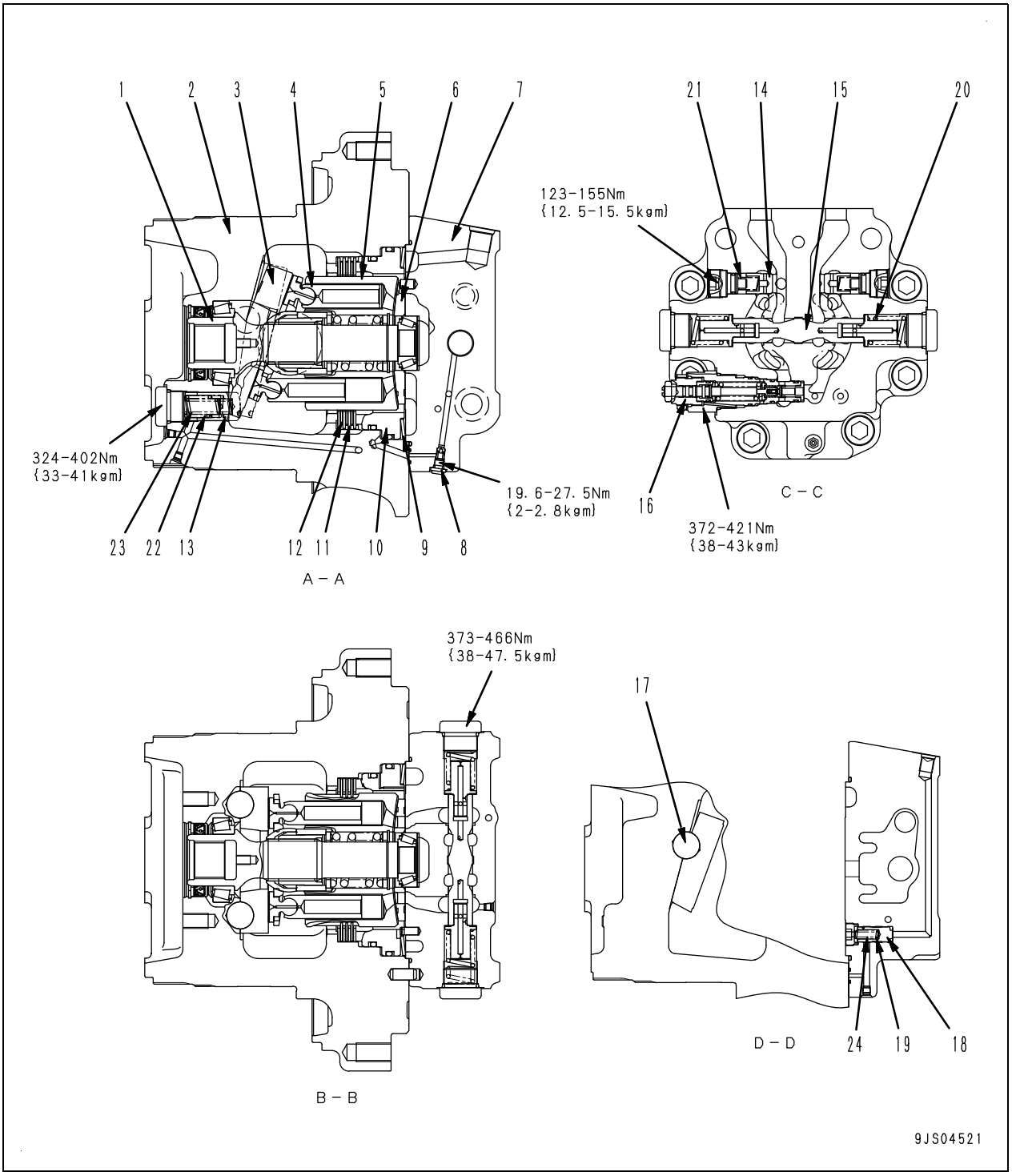
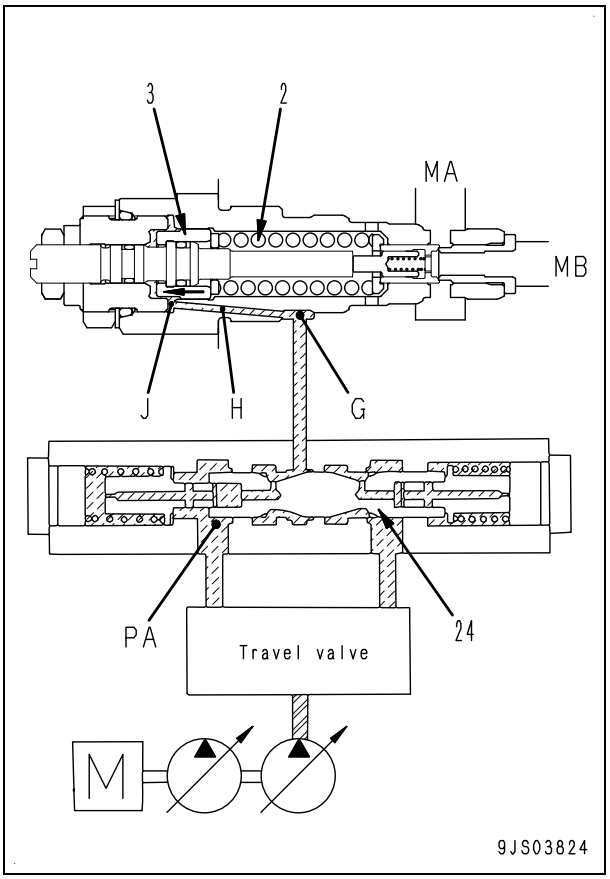
18
19
324-402Nm
{33-41kgm}
59-78Nm
{6-8kgm}
C – C
9JS03726


1
2
3
4
5
6
7
324-402Nm
{33-41kgm}
19.6-27.5Nm
{2-2.8kgm}
23
22
13
12
11
10
9
8
A - A
21
14
15
20
123-155Nm
{12.5-15.5kgm}
16
372-421Nm
{38-43kgm}
C - C
373-466Nm
{38-47.5kgm}
B - B
17
D - D
24
19
18
9JS04521

2) When travel is stopped (low-pressure setting)

- When the travel lever is placed in neutral, the pressure in chamber (PA) drops and spool (24) returns to the neutral position.
- When spool (24) is in the process of returning to the neutral position, the pressurized oil in chamber (J) flows to chamber (PA) through passage (H) and chamber (G).
- Piston (3) moves to the left side, decreasing the set load.
- The safety valve is set the low pressure setting, thereby attenuating the shocks when the speed is reduced.



Set pressure of safety valve

High pressure setting:

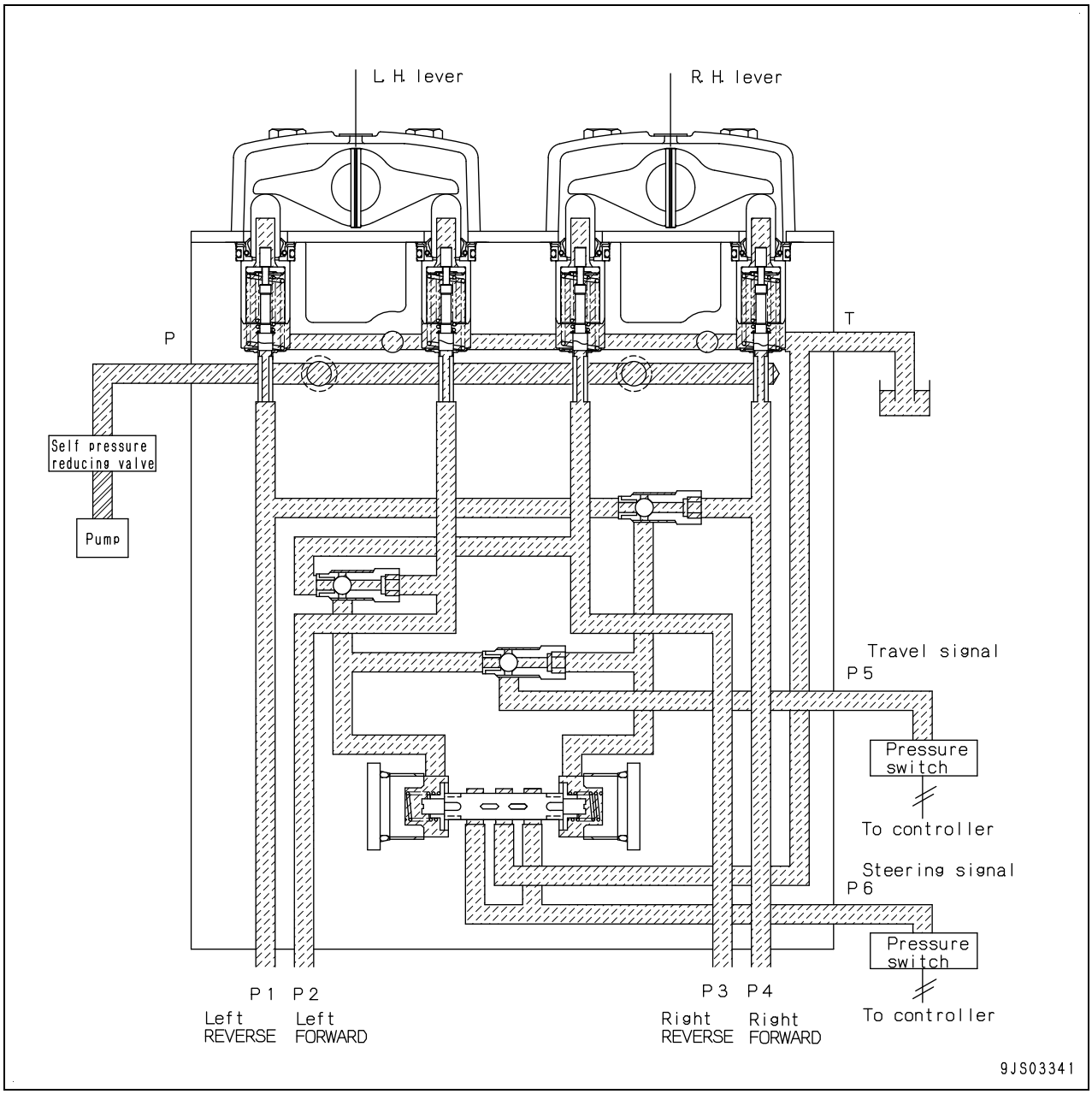
40.2 MPa {410 kg/cm^2}

(at start of travel and during travel)

Low pressure setting:

27.5 MPa {280 kg/cm^2} (during stop)

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)].

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

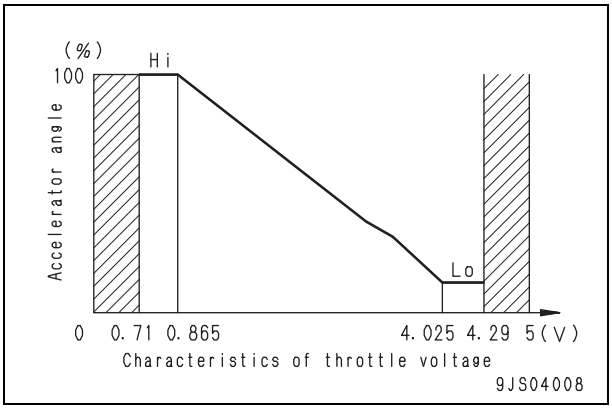
No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
7	Centering spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring.
		33.9 x 15.3	28.4	125 N {12.7 kg}	—	100 N {10.2 kg}	
8	Metering spring	22.7 x 8.10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

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	100	–0.036 –0.090	+0.257 +0.047	0.083 – 0.347	0.437	Replace bushing
		Arm	110	–0.036 –0.090	+0.261 +0.047	0.083 – 0.351	0.451	
		Bucket	100	–0.036 –0.090	+0.257 +0.047	0.083 – 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	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	0.100 – 0.250	1.0	
		Arm	100	–0.036 –0.090	+0.190 +0.070	0.106 – 0.280	1.0	
		Bucket	80	–0.030 –0.076	+0.190 +0.070	0.100 – 0.266	1.0	

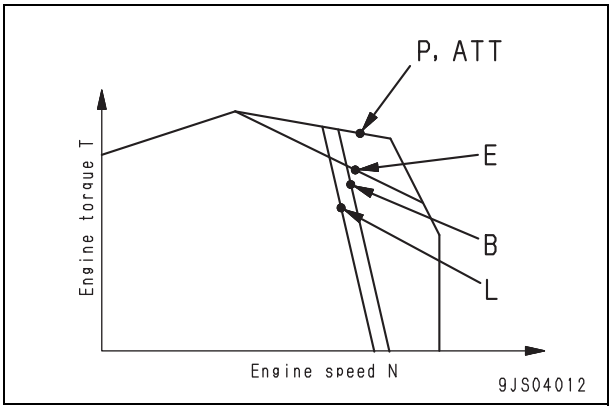
Function

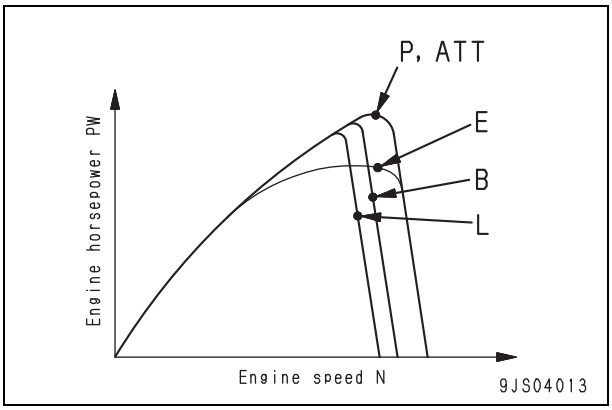
- The fuel control dial is installed under the machine monitor.
- Turning knob (1) rotates the shaft of potentiometer (5).
- The rotation of the shaft changes the resistance of the variable resistor in potentiometer (5), sending any throttle signal to the engine controller.
- The hatched area in the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

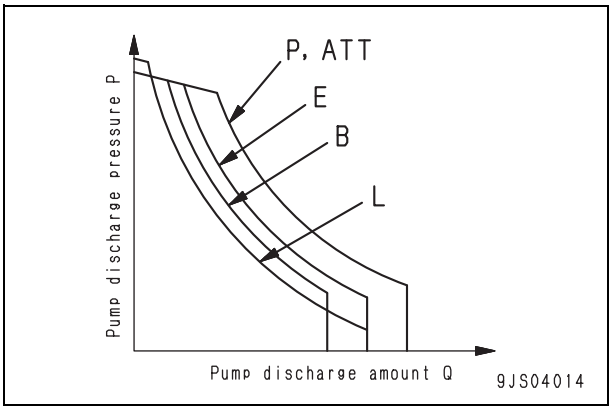


Function

- 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.







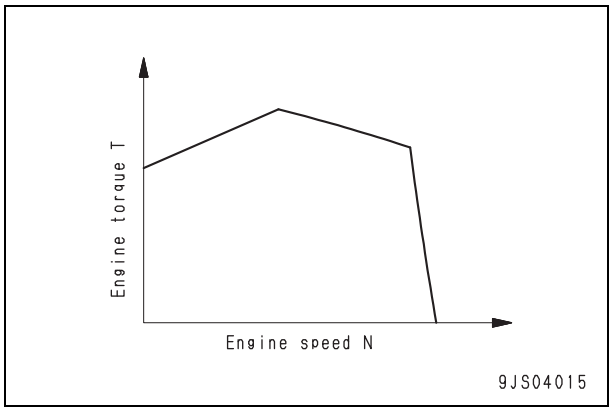
1) Control method in each mode

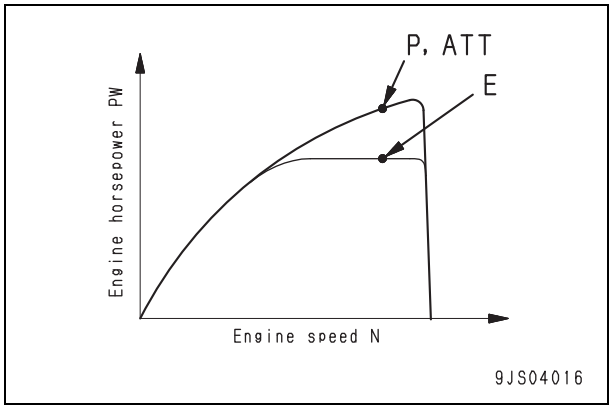
P mode, E mode, and ATT mode

- Matching point:

Mode \ Models	PC290LC-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}

- 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.





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

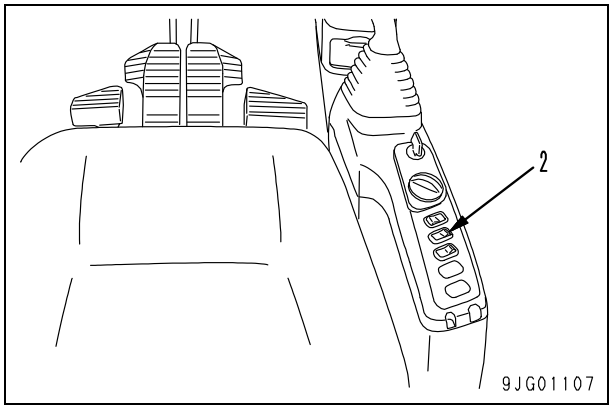
- If the controller, etc. has a problem, the swing holding brake does not work normally, and the machine cannot swing, the swing lock can be reset with the swing holding brake cancel switch.

Swing holding brake cancel switch	ON (when controller has trouble)		OFF (when controller is normal)	
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.

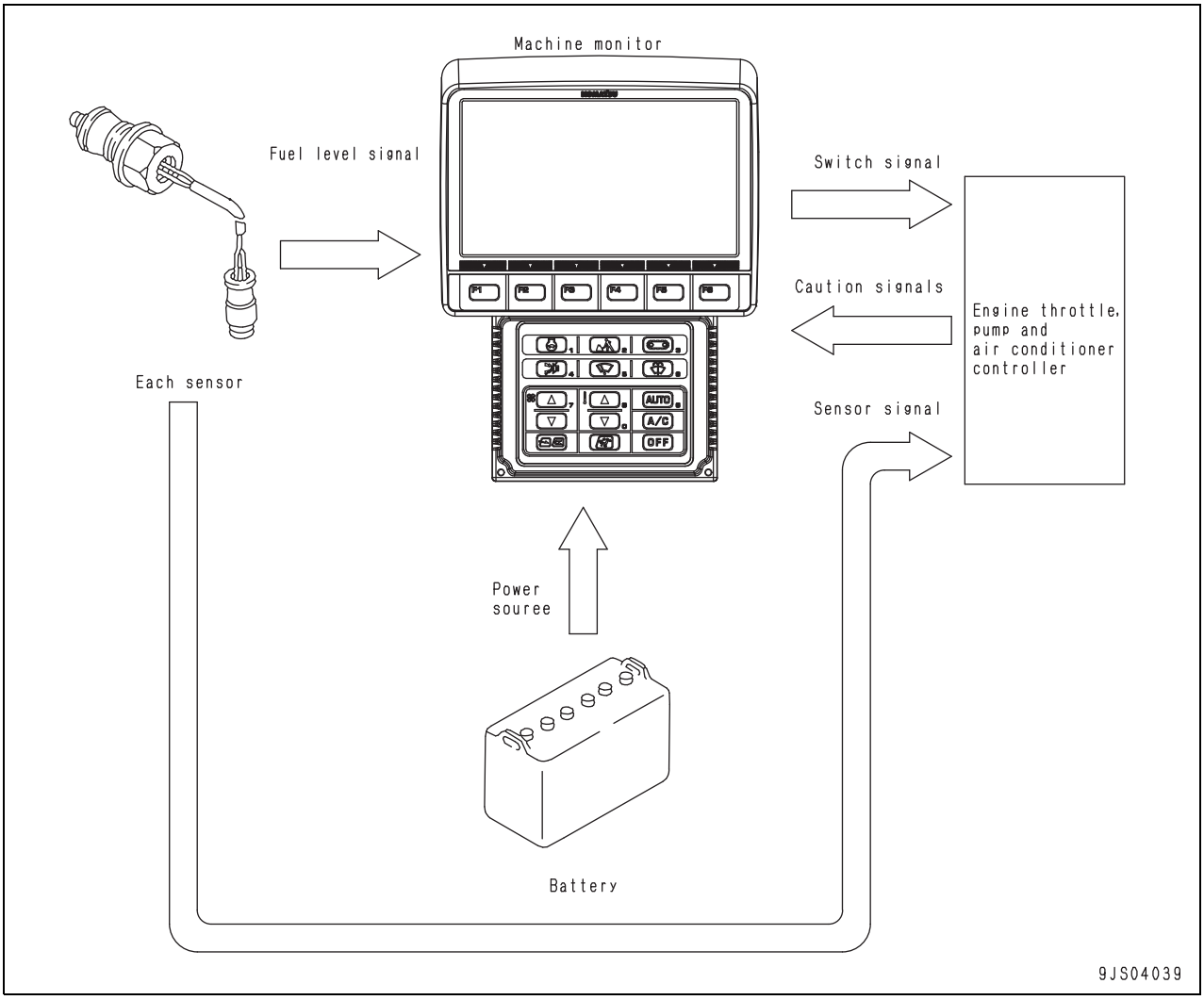
- Even if the swing holding brake cancel switch is turned on, if the swing lock switch is turned on, the swing brake is not released.
- If the swing lock is reset, only the hydraulic brake is applied by the safety valve. Note that if swinging is stopped on a slope, the upper structure may swing by its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

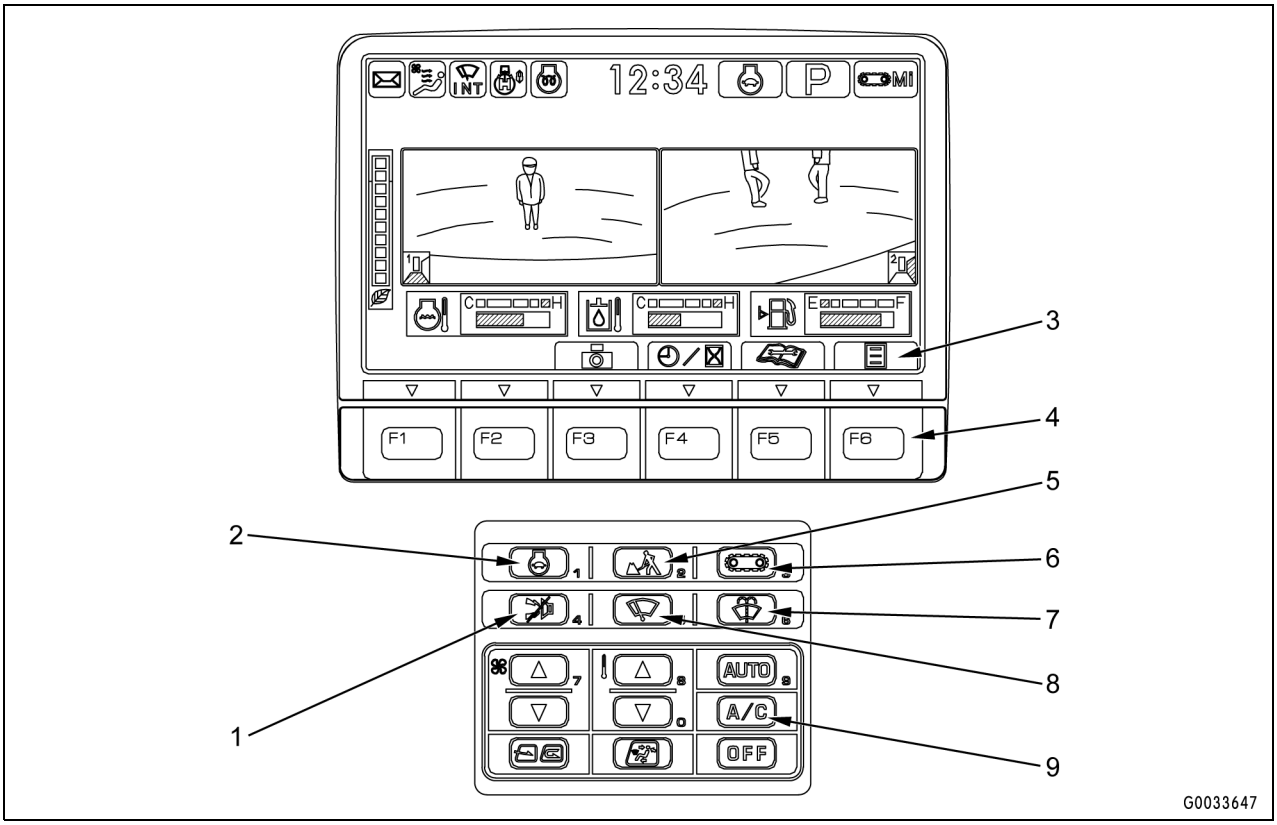


Monitor system



- 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.)
- Also, the machine monitor is provided with various mode selector switches that function as the operation unit of the machine control system.

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.

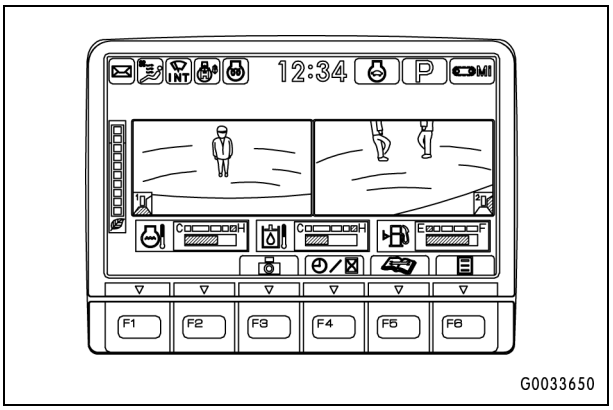
★ The auto-deceleration function does not work in L mode.

Guidance icon and function switch

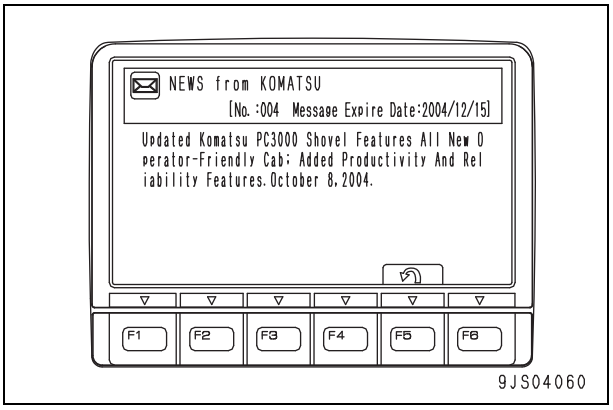
The function switches differ depending on the screen display. Each guidance icon shows the function of the switch below it.
Switches with no guidance icon are disabled.
The functions shown by the guidance icons are as shown in the table below.

Message display

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

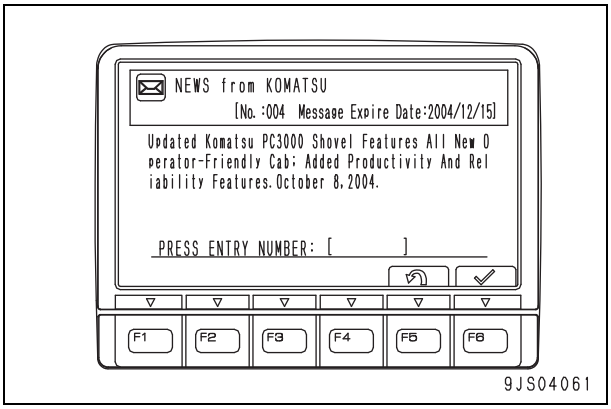


- Press F6 to enter user mode and select “Message display” and you can view (open) the messages.



F6 : Returns to the user mode screen.

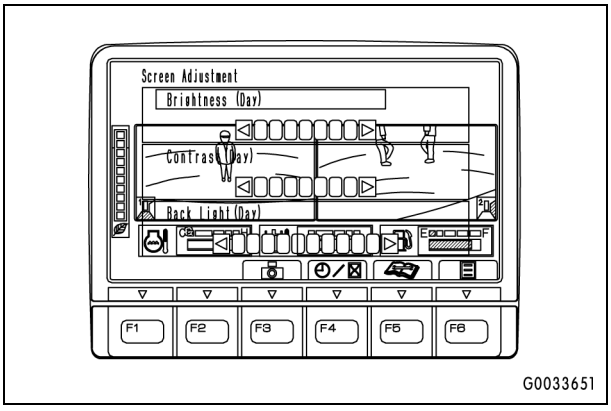
- Under messages that accept replies, “Value to be entered with 10-key: [ ]” appears.If it appears, enter the selected item number provided in the message using the switches of the machine monitor, and press F6.
- “Do you want to transmit the entered value?” appears under the message. Press F6 and the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

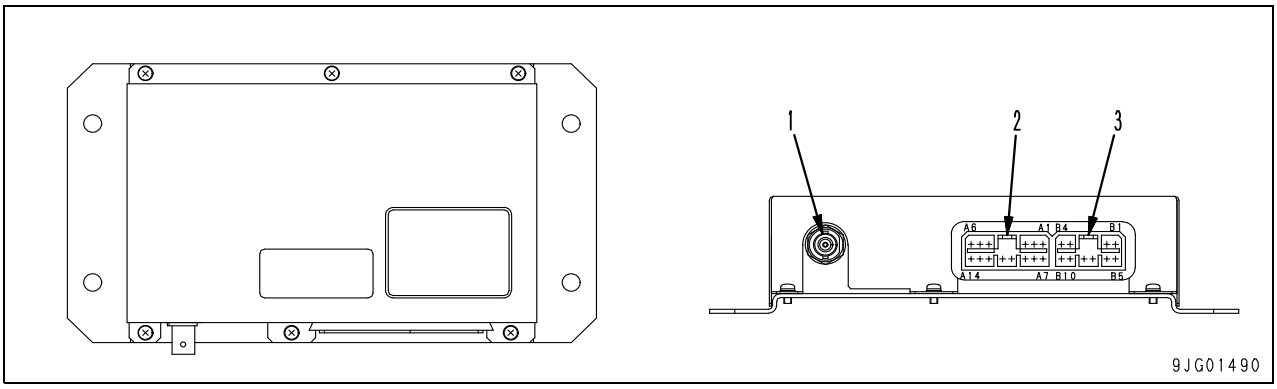


F2 : Returns all adjusted values to the defaults.
F3 : Decreases the value indicated by the indicator one graduation left.
F4 : Increases the value indicated by the indicator one graduation right.
F5 : Cancels changes you made before confirming them with F6 to return to the menu screen.
F6 : Confirms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

KOMTRAX terminal

Model: TH300

- The KOMTRAX system uses satellite communication technology.



1. Communication antenna connection
2. Machine harness connection (AMP-14P)
3. Machine harness connection (AMP-10P)

Input and output signals

AMP-14P [CN-CK01]

Pin No.	Signal name	Input/Output signal
A-1	Power supply (12 V)	Input
A-2	NC (*)	—
A-3	NC (*)	—
A-4	Selection of power supply voltage	Output
A-5	NC (*)	—
A-6	NC (*)	—
A-7	GND	—
A-8	GND	—
A-9	NC (*)	—
A-10	NC (*)	—
A-11	NC (*)	—
A-12	NC (*)	—
A-13	NC (*)	—
A-14	NC (*)	—

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

AMP-10P [CN-CK02]

Pin No.	Signal name	Input/Output siginal
B-1	RS232C DCD	Output
B-2	RS232C RXD	Output
B-3	RS232C TXD	Input
B-4	RS232C DTR	Input
B-5	RS232C SGND	Input
B-6	RS232C DSR	Output
B-7	NC (*)	—
B-8	NC (*)	—
B-9	NC (*)	—
B-10	NC (*)	—

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

Outline

- This terminal sends various machine information based on the network signals and input signals obtained through the machine monitor, as well as GPS position data, via wireless communication. This terminal can send information via communication antenna.
- Conditions of this terminal can be checked with the "KOMTRAX Settings" in the service mode of the machine monitor.
- This terminal cannot be used in the countries or territories where it is not authorized by the law.

★ When starting to use the KOMTRAX system or changing the country where it is used, you are required to notify the country where it will be used in advance.

★ When using the KOMTRAX system in Japan, the terminal special to Japan must be mounted.

Applicable model					PC290LC-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 leakage	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
—	Discharge amount of hydraulic pump		See performance of hydraulic pump (next page)			

Testing/Adjusting item	Sym-bol	Part No.	Part name	Q'ty	Remarks
Troubleshooting for chassis Sensors/wiring harnesses	—	799-601-4101 or 799-601-4201 or 799-601-9000 or 799-601-9200	T-adapter assembly	1	
	—	799-601-4350 or 799-601-9320	Measurement box	1	For ECONO (Does not include 799-601-4201/ 799-601-9000 and 799-601-9200)
	—			1	For ECONO (Does not include 799-601-4101/ 799-601-4201 and 799-601-9200)
	—	799-601-9020	Adapter for DT	1	For DT2P
	—	799-601-9030	Adapter for DT	1	For DT3P (Does not include 799-601-4101 and 799-601-4201)
	—	799-601-4260	Adapter for DT	1	For DTP4 (Does not include 799-601-9000 and 799-601-9200)
	—	799-601-7000 or 799-601-7100 or 799-601-7400 or 799-601-8000	T-adapter assembly	1	
	—	799-601-2600	Measurement box	1	For ECONO (Does not include 799-601-7000)
	—	799-601-7090	Adapter for M	1	For M2P
	—	799-601-7110	Adapter for M	1	For M3P
	—	799-601-7120	Adapter for M	1	For M4P
	—	799-601-7140	Adapter for S	1	For S8P
	—	799-601-7050	Adapter for SWP	1	For SW6P (Does not include 799-601-8000)
	—	799-601-7060	Adapter for SWP	1	For SW8P (Does not include 799-601-8000)
	—	799-601-7010	Adapter for X	1	For X1P (Does not include 799-601-7000 and 799-601-7100)
	—	799-601-7020	Adapter for X	1	For X2P
	—	799-601-7360	Adapter for relay	1	For REL-5P
	—	799-601-7310	Adapter for SWP	1	For SW12P
	—	799-601-9890	Adapter for multiple	1	For DT-2, 3, 4/DTM-2
	—	799-601-4280	Measurement box	1	For pump controller
Testing coolant temperature and oil temperature	—	799-101-1502	Digital thermometer	1	– 99.9 – 1,299°C
Testing 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}
Testing stroke and hydraulic drift	—	Commercially available	Ruler	1	
Testing work equipment speed	—	Commercially available	Stopwatch	1	
Testing voltage and resistance	—	Commercially available	Circuit tester	1	

Testing blow-by pressure

★ Measuring tools for blow-by pressure

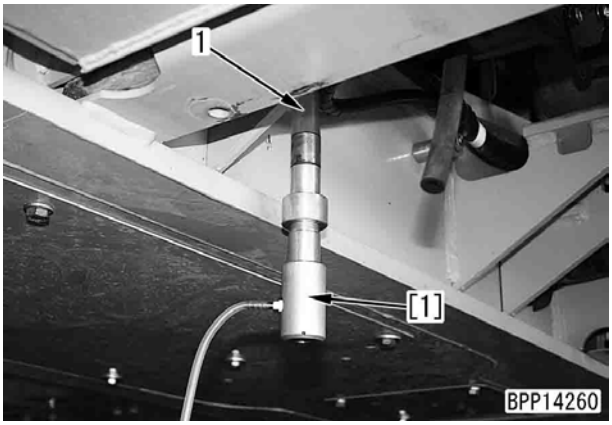
Symbol		Part No.	Part name
D	1	799-201-1504	Blow-by checker
	2	795-790-3300	Blow-by tool

⚠ **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.

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.

Testing 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

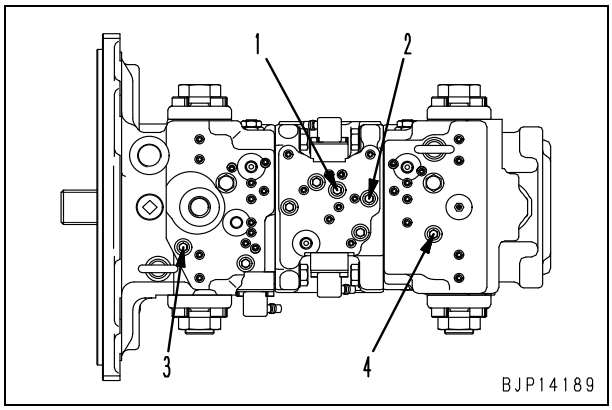
★ Before measuring the oil pressure in the PC control circuit, check that the oil pressure in the work equipment, swing, and travel circuits and the basic pressure of the control circuit are normal.

★ Measure the oil pressure in the pump PC control circuit under the following condition.
- Hydraulic oil temperature: Within operating range

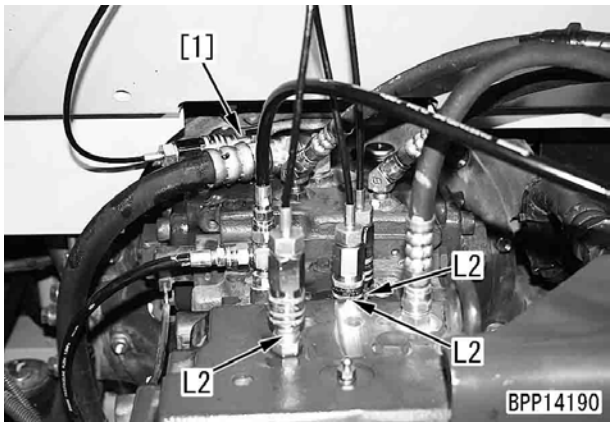
1. Measuring PC valve output pressure (servo piston inlet pressure)

★ 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



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 60 MPa {600 kg/cm^2}.



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.

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			
Travel speed switch is at Mi/Hi	Travel signal is OFF		
	Travel signal is ON	F or R pump pressure is 24.5 MPa {250 kg/cm^2} or higher	
		F or R pump pressure is 15.3 MPa {150 kg/cm^2} or below	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

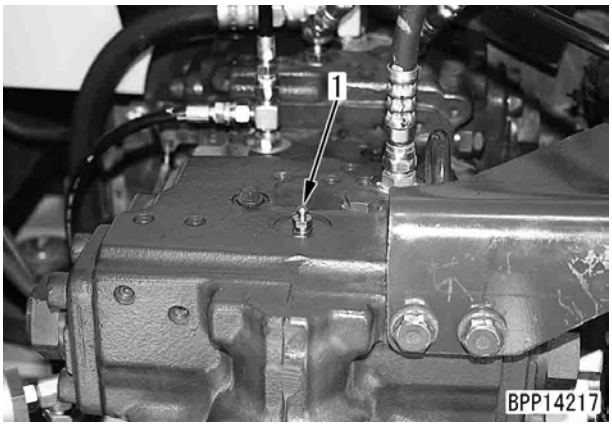
Bleeding air from each part

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.



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.

■ 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).

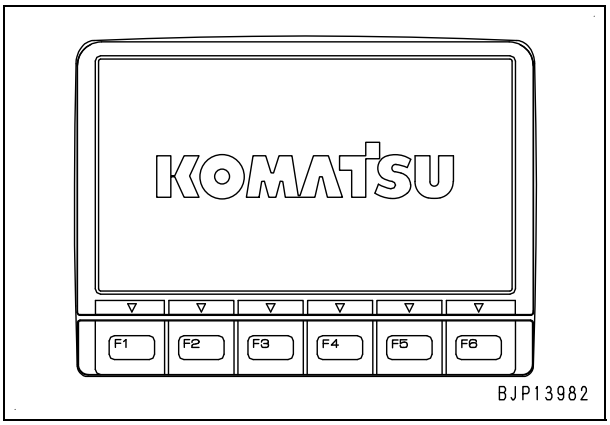
	Display pattern				
	A	B	C	D	E
Display of KOMATSU logo	1	1	1	1	1
Display of inputting password	2	—	—	—	—
Display of check of breaker mode	—	—	2	—	—
Display of check before starting	3	2	3	4	4
Display of warning after check before starting	—	—	—	3	—
Display of ending of maintenance interval	—	—	—	—	3
Display 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".

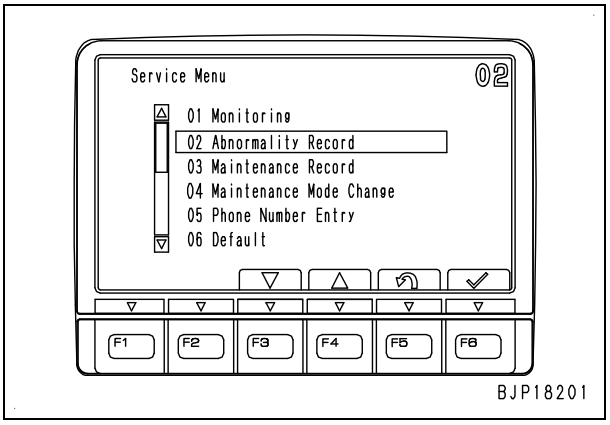


★ Remedies given by displayed user codes to operator to take (The following table is an excerpt from the Operation and Maintenance Manual)

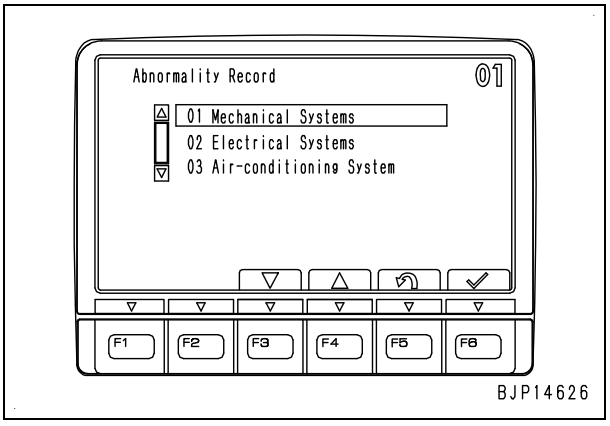
User code	Failure mode	Action
E02	Pump control system error	When emergency pump drive switch is at the up (emergency) position, normal operations become possible, but have inspection carried out immediately.
E03	Swing brake system error	Have inspection carried out immediately.
E10	Engine controller power 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.

Abnormality Record (Mechanical 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 or heater system.
To check the mechanical system abnormality record, perform the following procedures.

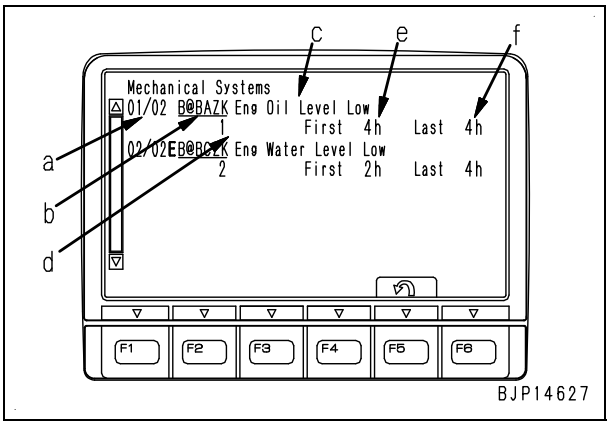
1. Selecting menu
   Select "Abnormality Record" on the "Service Menu" screen.



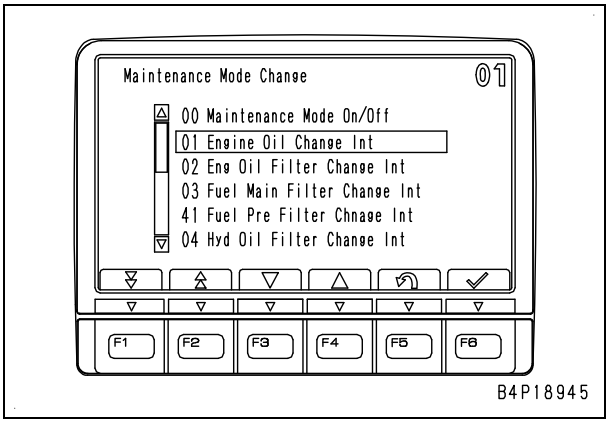
2. Selecting sub menu
   After the "Abnormality Record" screen is displayed, select "Mechanical Systems" with the function switches or numeral input switches.
   - [F3]: Move to lower item
   - [F4]: Move to upper item
   - [F5]: Return to service menu screen
   - [F6]: Confirm selection
   - ★ You may 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 (Displayable range: 0 – 65,535 times)
   (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)".



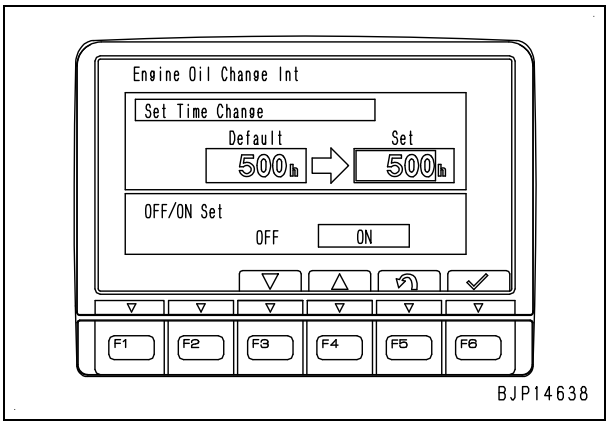
4. Contents of setting of each maintenance item
   After selecting each maintenance item, if the screen is displayed, set the item with the function switches.



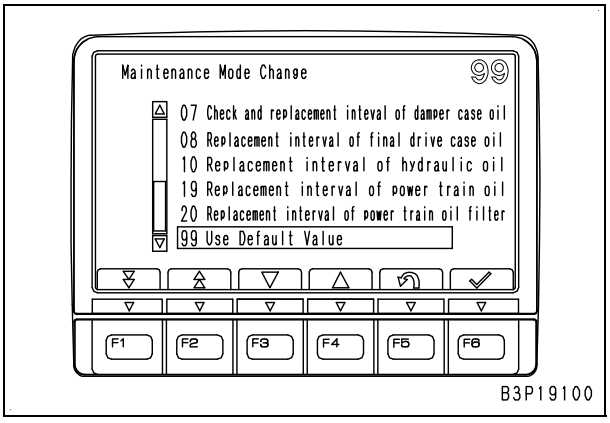
- Initial value: Maintenance interval set in machine monitor (Recommended by manufacturer and not changeable).
- Set value: Maintenance interval which can be set freely. Maintenance functions in operator mode operate on basis of this set time (which is increased or decreased by 50 hours).
- ON: Maintenance 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.

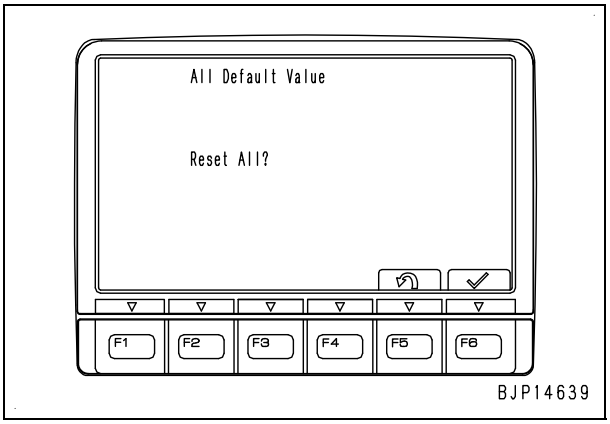


5. Function of initializing all items
   After selecting "99 Use Default Value", if the screen is displayed, set with the function switches.



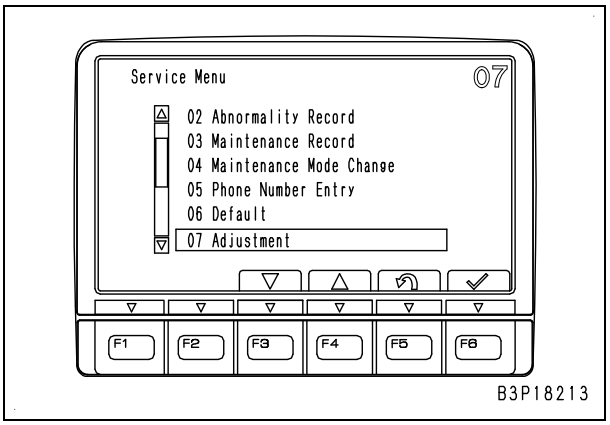
- If this operation is executed, the set values of all the maintenance items are initialized.
- [F5]: Return to Maintenance mode change screen
- [F6]: Execute initialization

★ A while after [F6] is pressed, the initialization completion screen is displayed. Then, if the "Maintenance Mode Change" screen is displayed, initialization is completed.

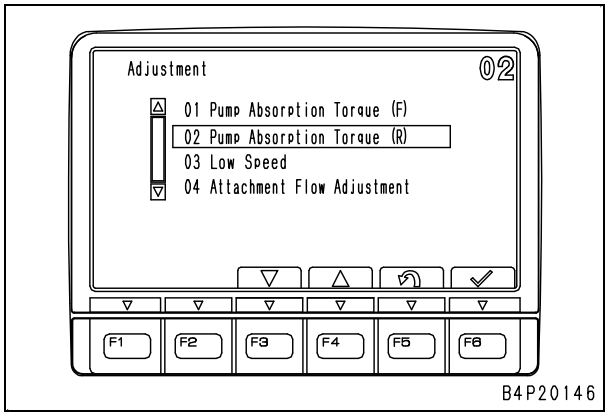


Adjustment (Pump Absorption Torque (R))
The operator can adjust various items related to the machine with the machine monitor.
The pump absorption torque (R) function is used to finely adjust the absorption torque on the rear side of the hydraulic pump.

1. Selecting menu
   Select "Adjustment" on the "Service Menu" screen.

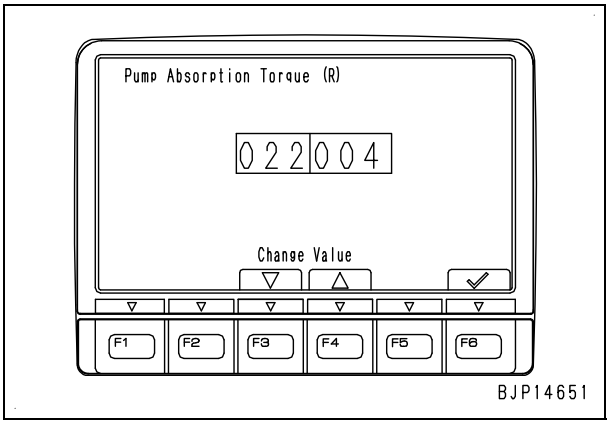


2. Selecting sub menu
   After the "Adjustment" screen is displayed, select "Pump Absorption Torque (R)" with the function switches or numeral input switches.
   ★ Select this item similarly to an item on the "Service Menu" screen.



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

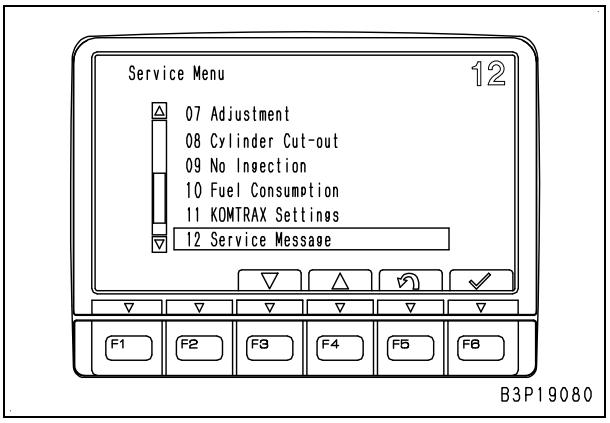
Code	Set value	Torque adjustment value
022	000	+39.2 Nm {+4 kgm}
	001	+29.4 Nm {+3 kgm}
	002	+19.6 Nm {+2 kgm}
	003	+9.8 Nm {+1 kgm}
	004	0 Nm {0 kgm}
	005	–9.8 Nm {–1 kgm}
	006	–19.6 Nm {–2 kgm}
	007	–29.4 Nm {–3 kgm}
	008	–39.2 Nm {–4 kgm}

Display of Service message

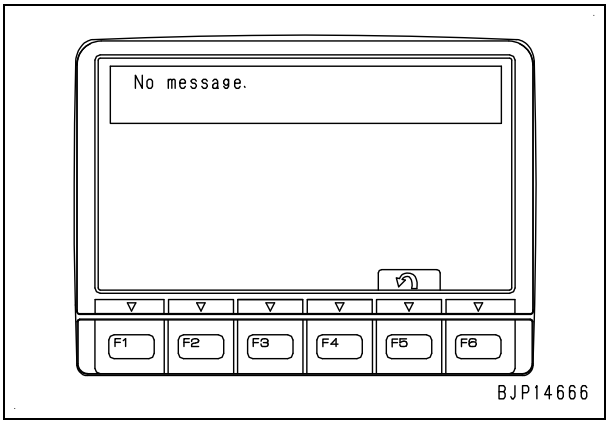
Special messages for the serviceman sent from the KOMTRAX base station (a distributor, etc.) can be checked with this function.

If there is setting in a message, a return mail can be sent by using numeral input switches.

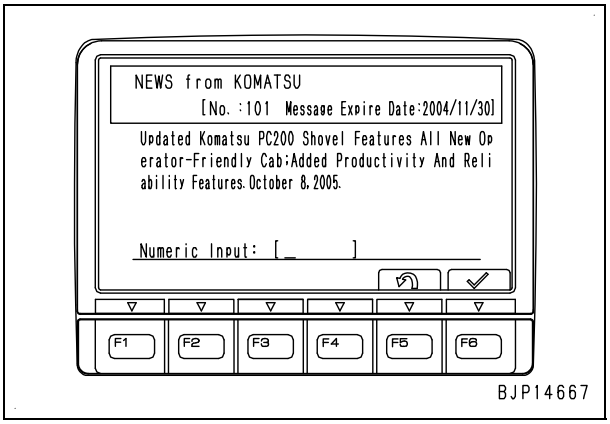
1. Operation to display menu
   Select "Service message" on the "Service Menu" screen.



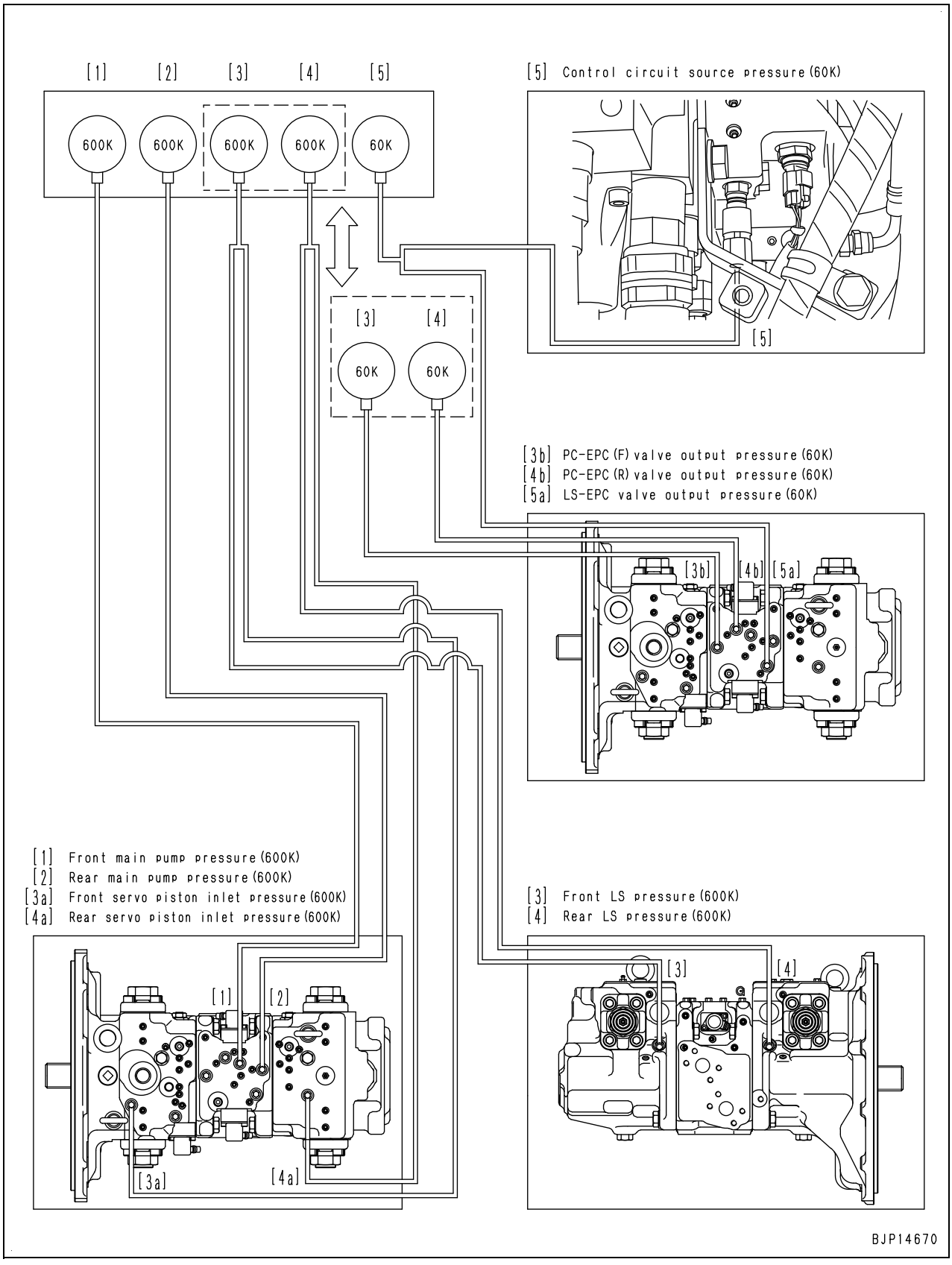
2. Display of message (Read-only)
   If there is a message, its contents are displayed. If there is not a message, "No message" is displayed.
   - [F5]: Return to "Service Menu" screen
   - ★ This message is different from a message transmitted to the operator in the operator mode.
   - ★ Since this message is special for the serviceman, the message monitor is not displayed when it is received as in the operator mode.



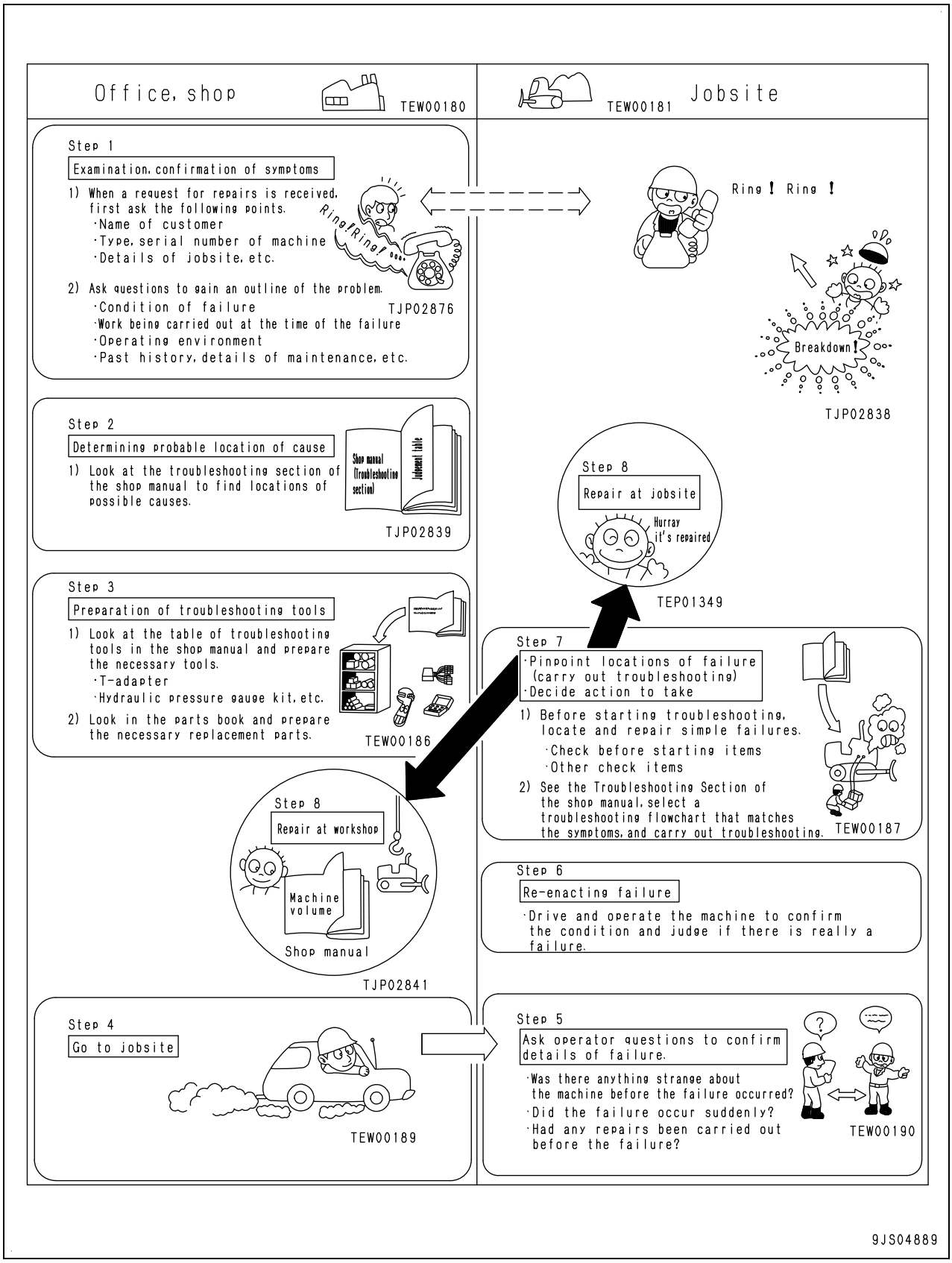
3. Display of message (with return mail function)
   If a box to enter a value with the numeral keys is displayed under the message, enter a proper number with the numeral input switches and function switches and confirm it, and the information is returned to the KOMTRAX base station.
   - [F5]: Return 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.



Items related to oil pressure



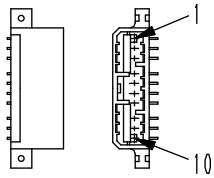
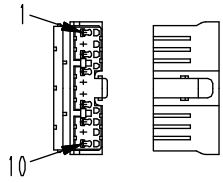
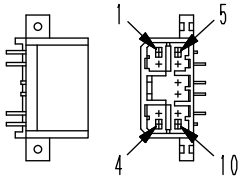
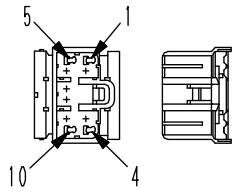
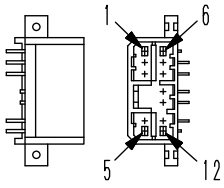
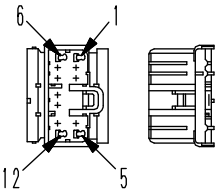
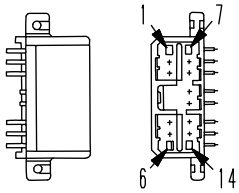
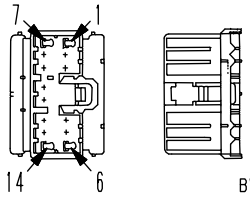
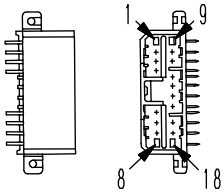
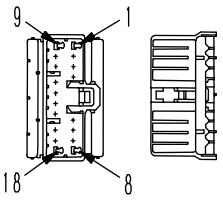
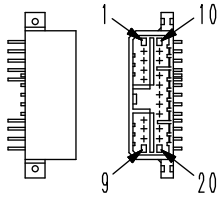
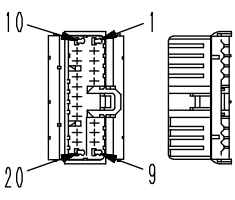
Sequence of events in troubleshooting



Related circuit diagram

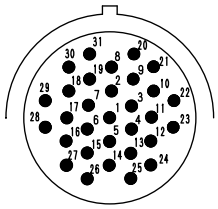
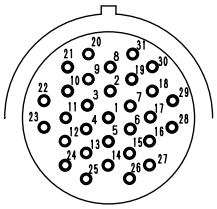
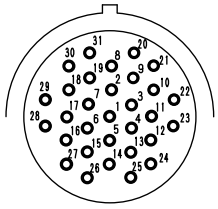
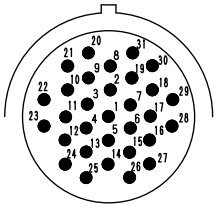
This drawing is a part of the electric circuit diagram related to troubleshooting.

- 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.

No. of pins	AMP070 type connector		
	Male (female housing)	Female (male housing)	Testing connection use special tool Part No.
10	 BWP04759	 BWP04760	—
	—	—	
10	 9JS02245	 9JS02246	799-601-7510 (T-adapter)
	—	Part No. :7821-92-7330	
12	 BWP04761	 BWP04762	799-601-7520 (T-adapter)
	—	Part No. :7821-92-7340	
14	 BWP04763	 BWP04764	799-601-7530 (T-adapter)
	—	Part No. :7821-92-7350	
18	 BWP04765	 BWP04766	799-601-7540 (T-adapter)
	—	Part No. :7821-92-7360	
20	 BWP04767	 BWP04768	799-601-7550 (T-adapter)
	—	Part No. :7821-92-7370	

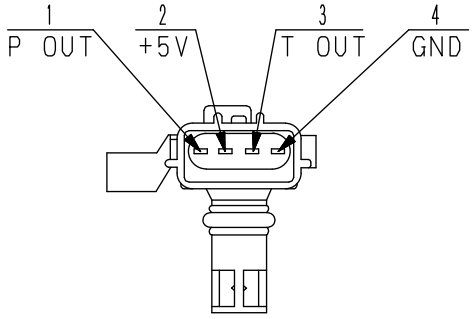
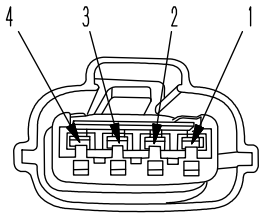
B4D18199

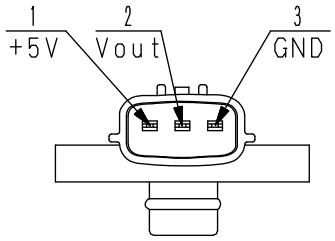
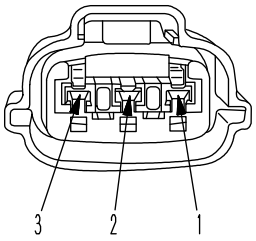
[The pin No. is also marked on the connector (electric wire insertion end)]

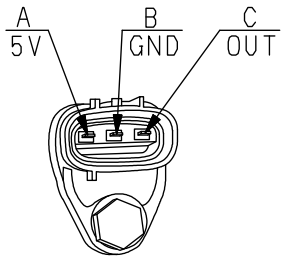
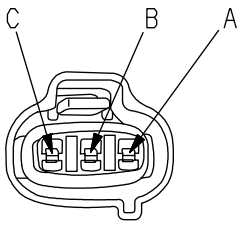
Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	Testing connection use special tool Part No.
24-31 (9)	Pin (male terminal)	Socket (female terminal)	799-601-9290 (T-adapter)
	 BWP05033	 BWP05034	
	Part No. :08191-91203, 08191-91204, 08191-91205, 08191-91206	Part No. :08191-94103, 08191-94104, 08191-94105, 08191-94106	
	Socket (female terminal)	Pin (male termial)	799-601-9290 (T-adapter)
	 BWP05035	 BWP05036	
	Part No. :08191-92203, 08191-92204, 08191-92205, 08191-92206	Part No. :08191-93103, 08191-93104, 08191-93105, 08191-93106	

B4D18409

SUMITOMO connector for engine

No. of pins	Boost (air intake) pressure and temeperature sensor (107, 114 engine)		
	Sensor side (plug)	Harness side (receptacle)	Testing connection use special tool Part No.
4			799-601-4230 (Socket) (Kit:799-601-4101) (Kit:799-601-4201)
	-	-	

No. of pins	Boost (air intake) pressure sensor (125, 170, 12V140 engine)		
	Sensor side (plug)	Harness side (receptacle)	
3			799-601-4250 (Socket) (Kit:799-601-4101) (Kit:799-601-4201)
	-	-	

No. of pins	G sensor (fuel supply pump speed sensor) (125, 140, 170, 12V140 engine)		
	Sensor side (plug)	Harness side (receptacle)	
3			799-601-4330 (Socket) (Kit:799-601-4101) (Kit:799-601-4201)
	-	-	

B4D18419

Failure codes table

★ This failure codes table is the same as that in Testing and adjusting, “Special functions of machine monitor”.

User code	Failure code	Trouble (Displayed on screen)	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

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.		

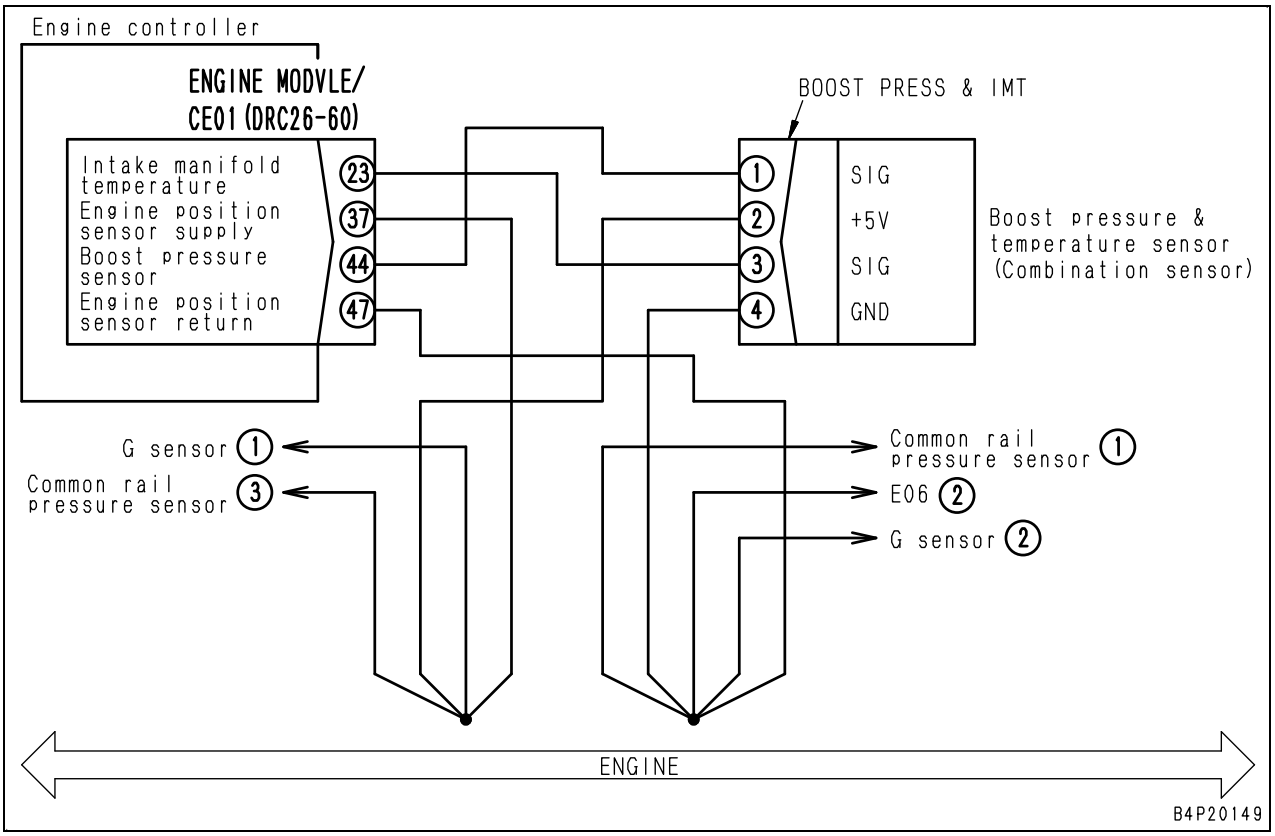
Possible causes and standard value in normal state		Cause	Standard value in normal state/Remarks on troubleshooting
	1	Defective engine controller	If this failure code is displayed repeatedly, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Failure code [AA10NX] Air Cleaner Clogging

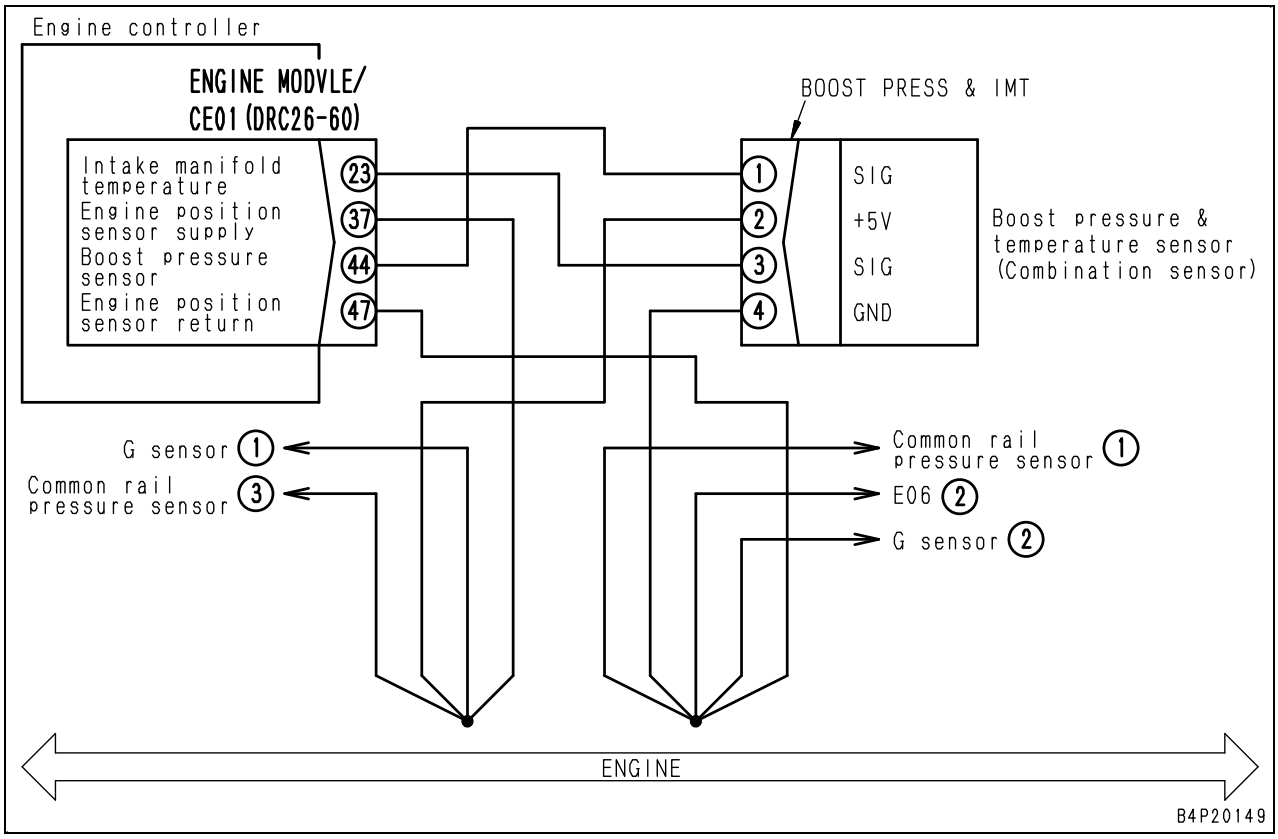
User code	Failure code	Trouble	Air cleaner clogging (Machine monitor system)
—	**AA10NX**		
Contents of trouble	● While engine was running, signal circuit of air cleaner clogging switch detected clogging of air cleaner (sensor contact opened).		
Action of machine monitor	● Displays air cleaner clogging 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.

Circuit diagram related to boost pressure/temperature sensor (Combination sensor)



Circuit diagram related to boost pressure/temperature sensor (Combination sensor)

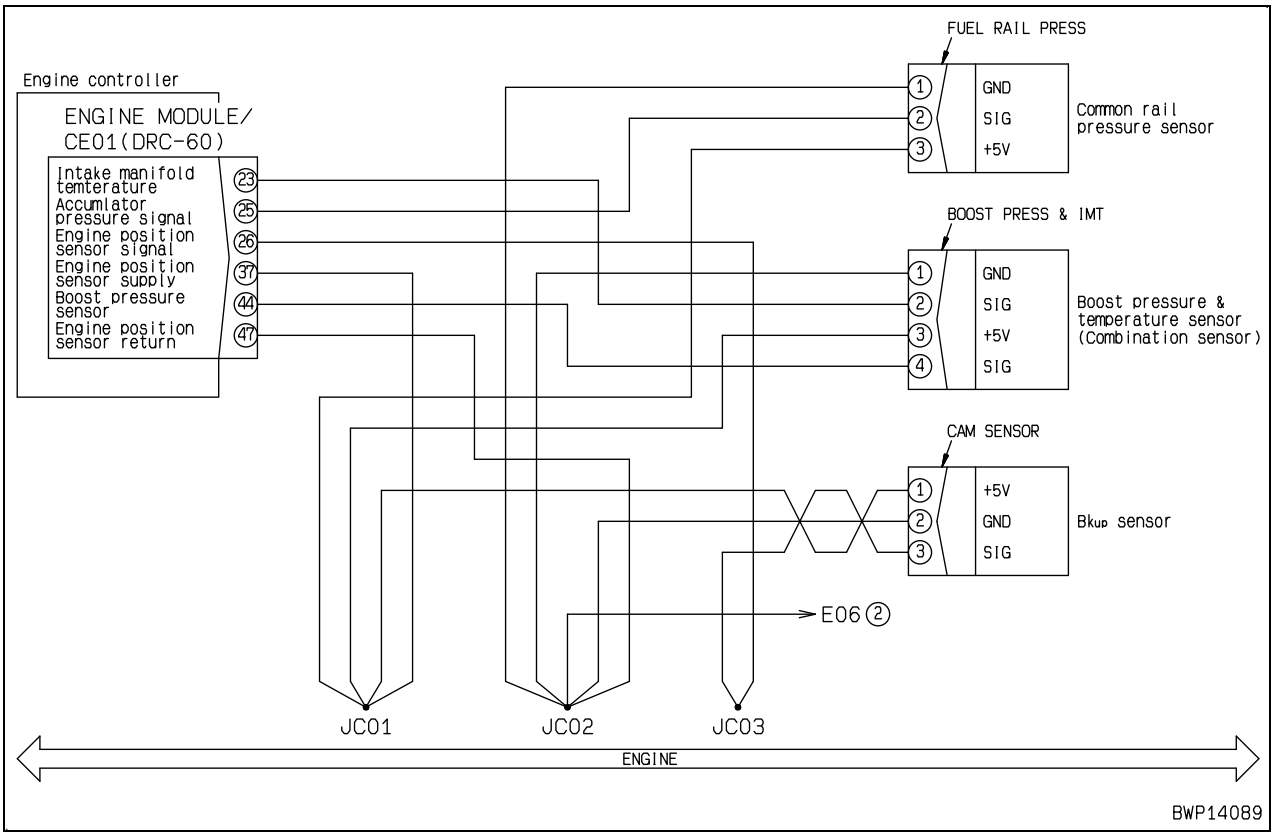


Failure code [CA227] Sens Supply 2 Volt High Error

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

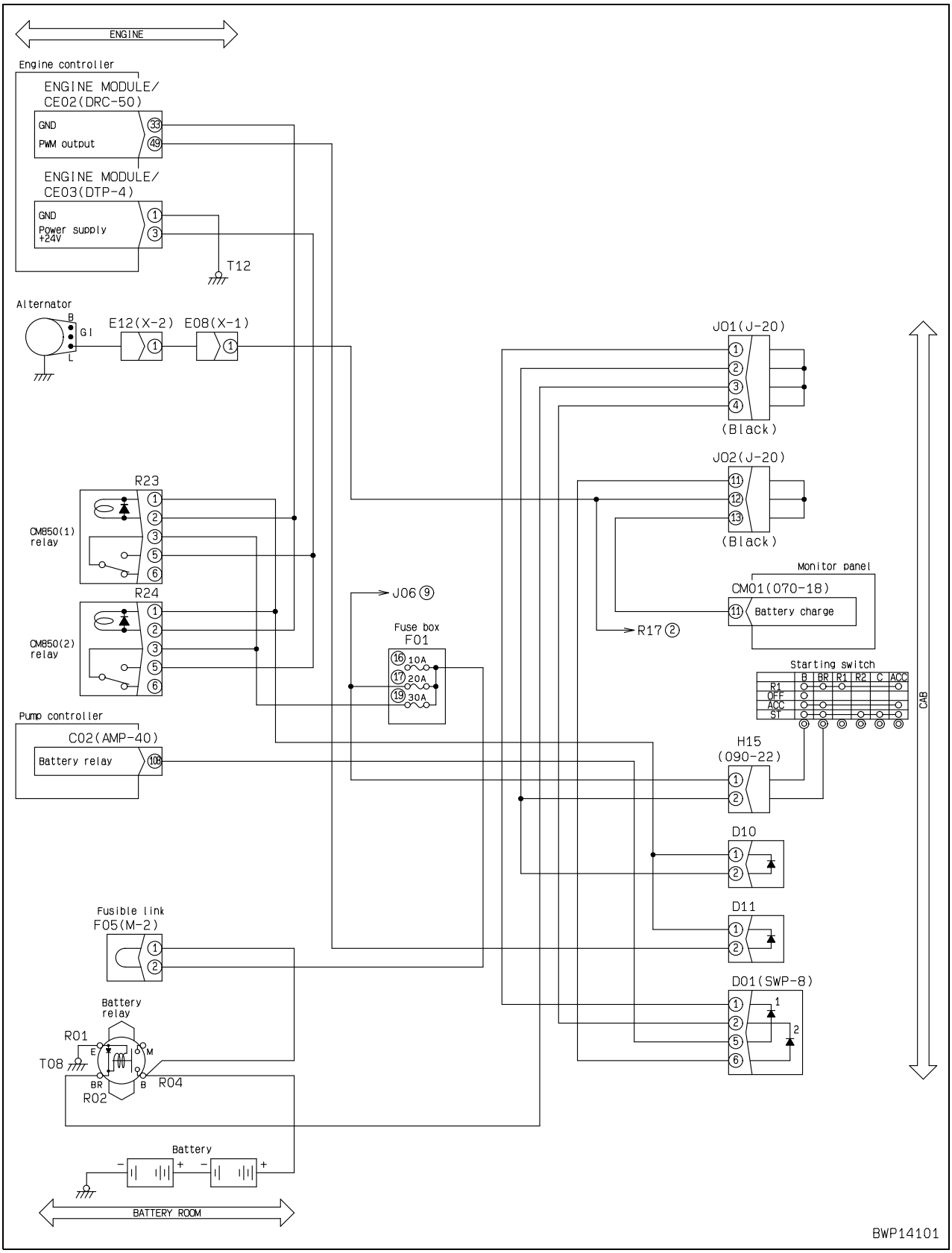


Failure code [CA324] Inj #3 Open/Short Error

User code	Failure code	Trouble	Injector #3 open/short circuit error (Engine controller system)
E11	**CA324**		
Contents of trouble	● Open 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 No. 3 injector	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			INJ CYL 3	Resistance		
			Between (1) – (2)	Max. 2 Ω		
			Between (1) – chassis ground	Min. 100 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) (55) – INJ CYL 3 (1)	Resistance	Max. 2 Ω	
			Wiring harness between CE01 (female) (52) – INJ CYL 3 (2)	Resistance	Max. 2 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 CE01 (female) (55) – INJ CYL 3 (1) and chassis ground	Resistance	Min. 100 kΩ	
	4	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring 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	
	5	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			
	6	Defective other cylinder injectors or wiring harness	If the failure codes of other injectors are displayed, carry out troubleshooting of them, too.			
	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 engine controller



<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>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="4">9</td><td rowspan="4">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>

Failure code [CA553] Rail Press High Error

User code	Failure code	Trouble	Common rail pressure high error (Engine controller system)
E15	**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.		

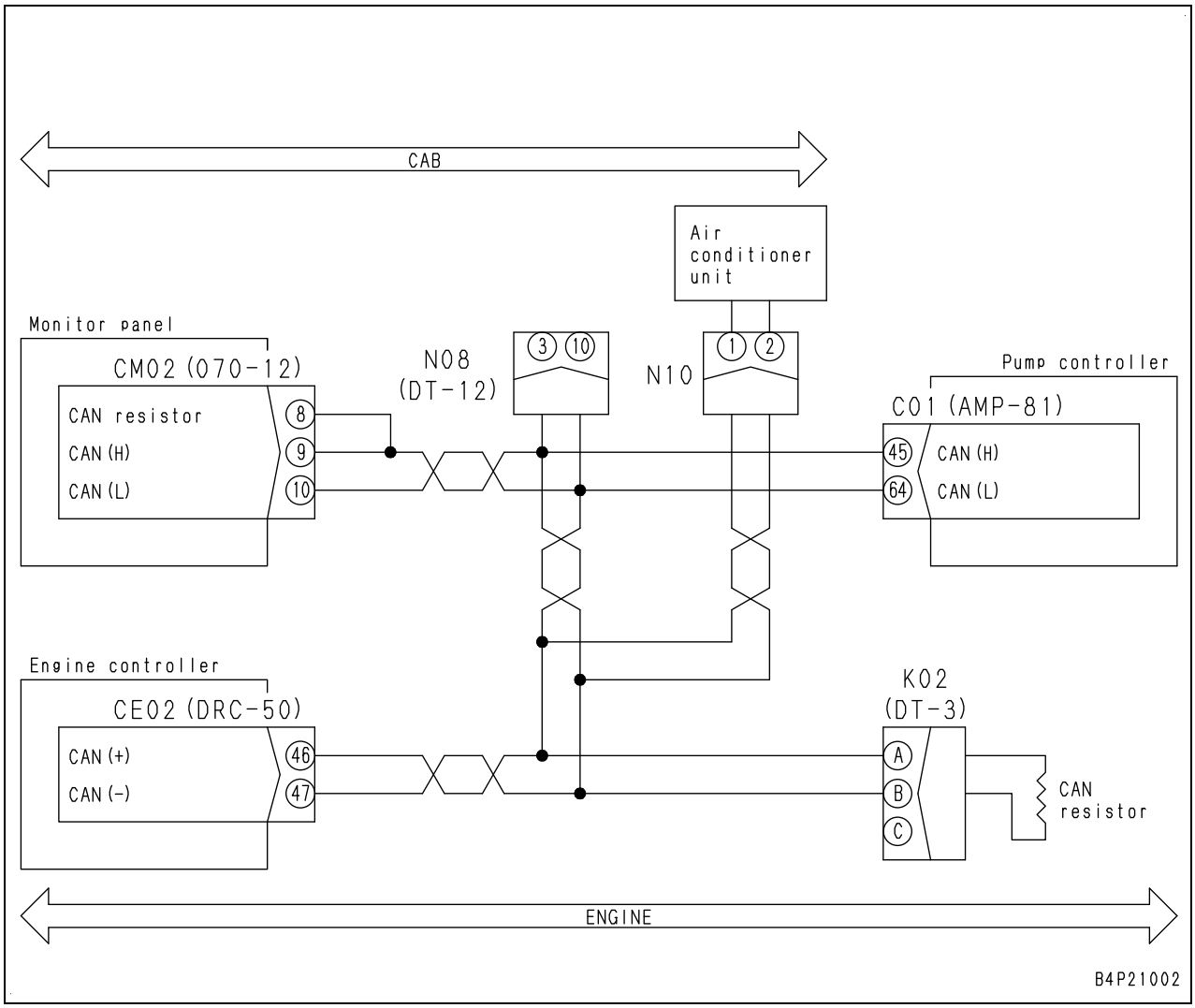
	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Defect in related system	If another failure code is displayed, carry out troubleshooting for it.
	2	Defective connection of ground terminal	Ground terminal may be connected defectively. 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 [CA1633] KOMNET Datalink Timeout Error

User code	Failure code	Trouble	KOMNET Datalink timeout error (Engine controller system)
E0E	**CA1633**		
Failure description	• Engine controller detected communication error in KOMNET communication circuit between engine controller and pump controller or machine monitor.		
Action of controller	• Continues operation in default mode. • If cause of failure disappears, system resets itself.		
Indication of problem 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 to ON position.		

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	1	Perform troubleshooting for failure code [**DA2RMC**].

Related circuit diagram

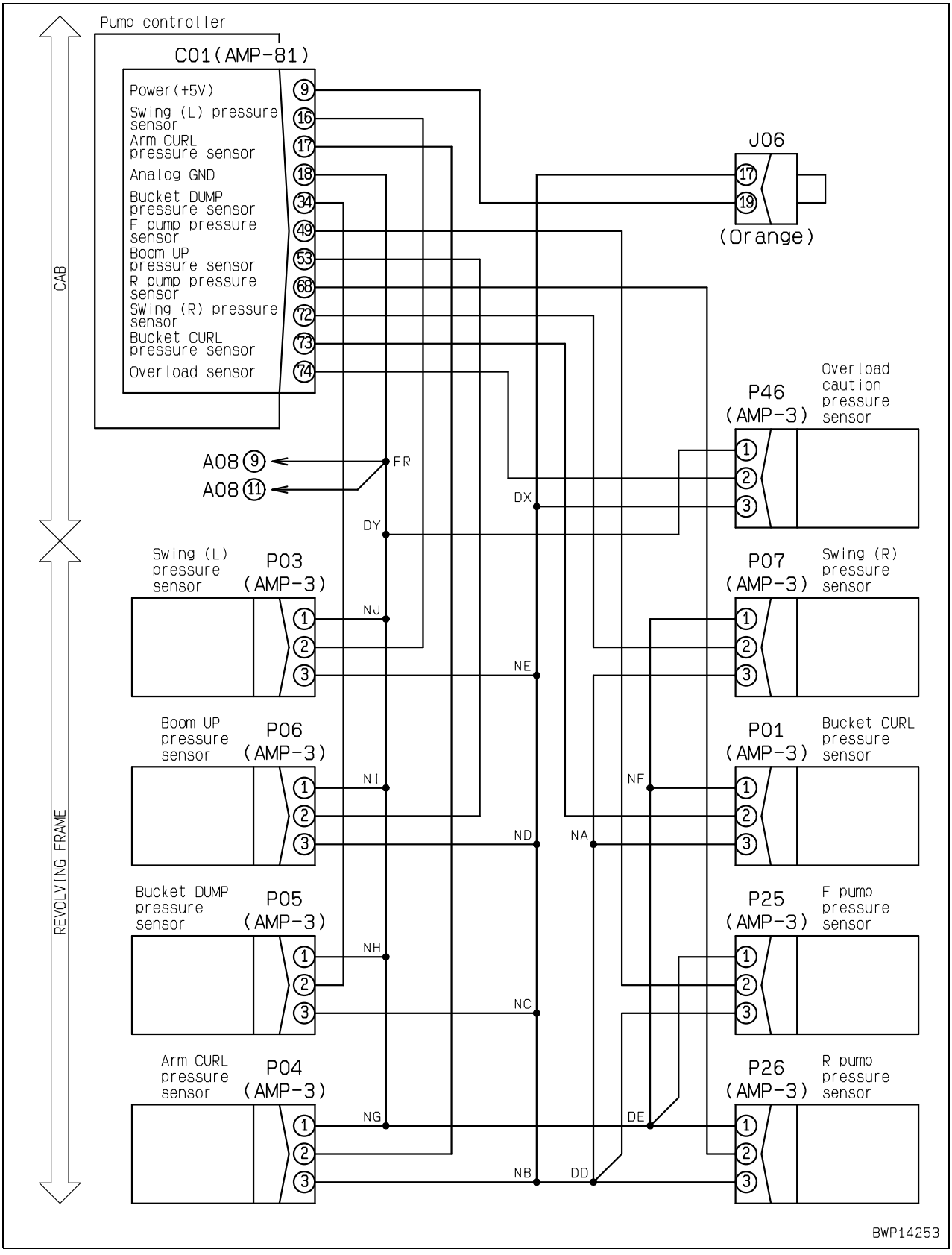


Failure code [D19JKZ] Personal Code Relay Abnormality

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. (when short circuit is detected).		
Problem that appears on machine			
Related information	• This failure code is displayed only when engine lock function is effective. • 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) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between R07 (female) (2) – CM01 (female) (6) and chassis ground	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 pump controller 5V sensor power supply output 1 (Overload alarm monitor display specification)



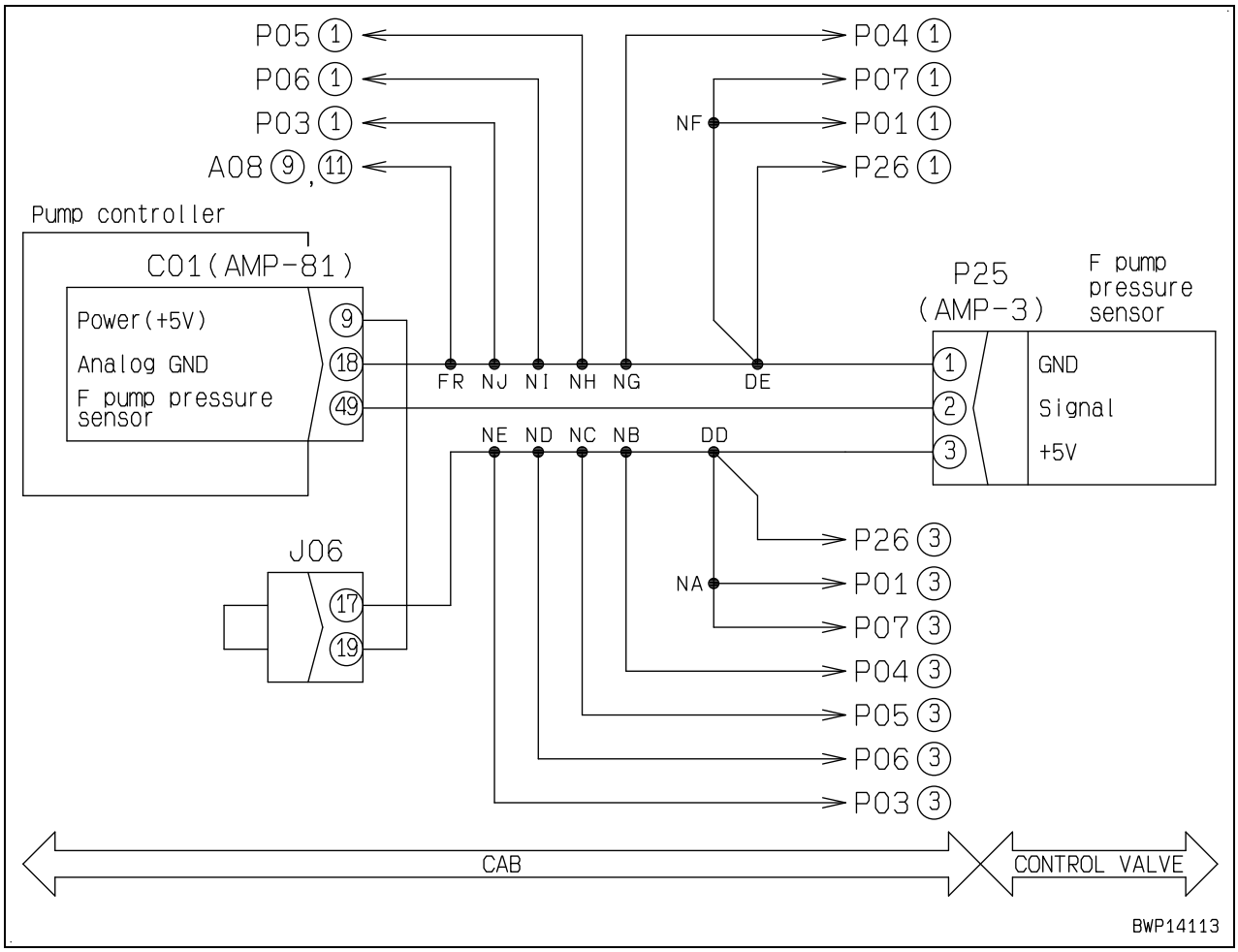
Failure code [DAF8KB] Short circuit in camera power supply

Serial number 30001 and up

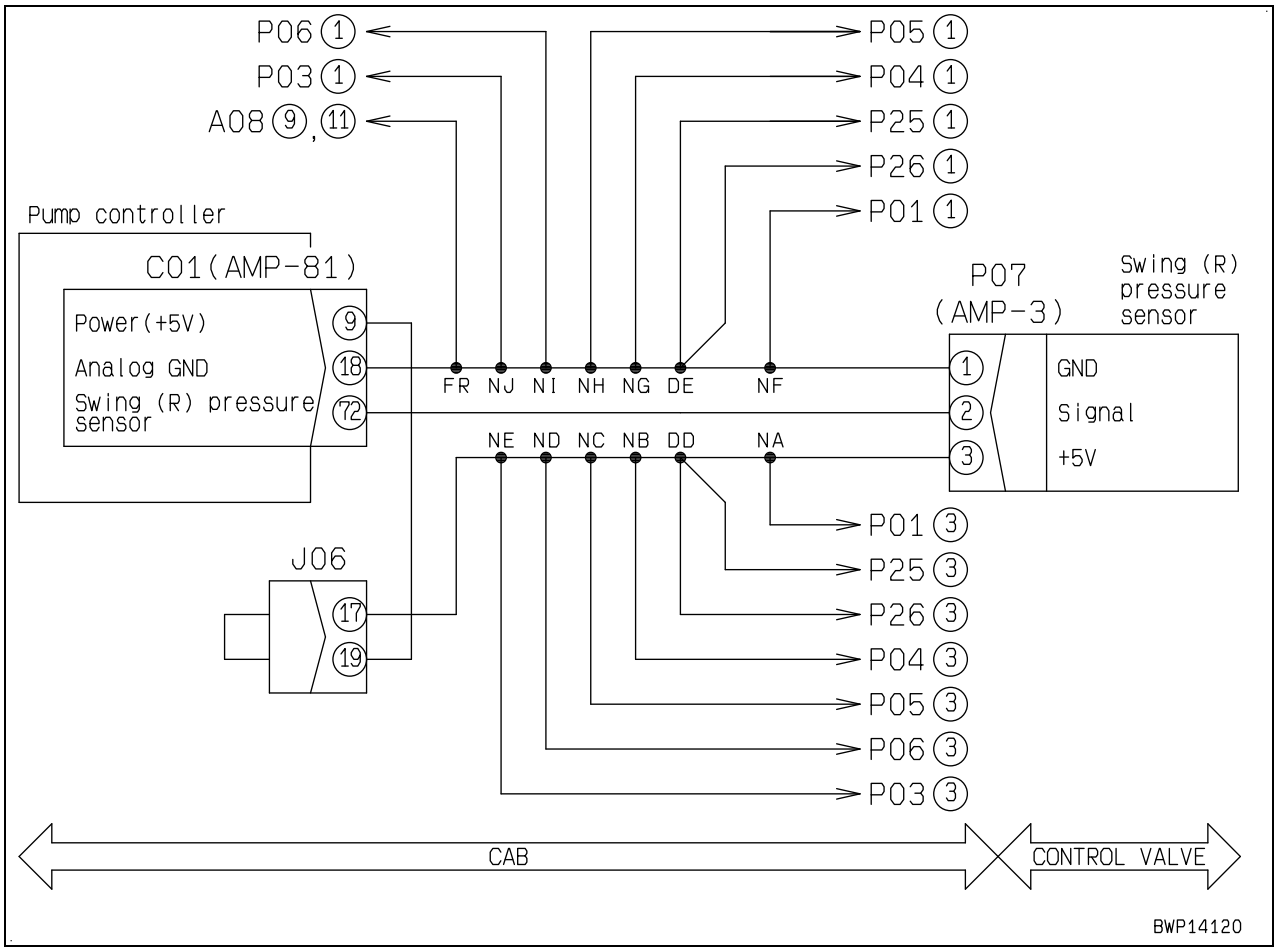
User code	Failure code	Trouble	Short circuit in camera power supply (Machine monitor system)
—	**DAF8KB**		
Contents of trouble	● Output power supply voltage (Rating: 8 V) from machine monitor to camera is below 6.0 V or above 10 V.		
Action of machine monitor	● Turns output power supply voltage (Rating: 8 V) to camera OFF. ● Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	● Camera image is not displayed on monitor screen.		
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 camera (Internal short circuit)	★ Disconnect camera with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Disconnect camera and perform failure reproduction operation. If failure code disappears at this time, camera is defective.		
	2	Ground fault in wiring harness (Contact with GND circuit)	★ Disconnect camera with starting switch OFF, then turn starting switch ON and carry out troubleshooting. (Disconnect camera and check that it is not defective in advance.)		
			Between CM05 (female) (1) – CAMERA (female) (F) wiring harness and chassis ground	Voltage	Min. 6 V
	3	Hot short (Contact with 24V circuit) in wiring harness	★ Disconnect camera with starting switch OFF, then turn starting switch ON and carry out troubleshooting. (Disconnect camera and check that it is not defective in advance.)		
			Between CM05 (female) (1) – CAMERA (female) (F) wiring harness and ground	Voltage	Max. 10 V
	4	Defective machine monitor	If causes 1 – 3 are not detected, machine monitor may be detective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related to F pump pressure sensor



Circuit diagram related to swing right PPC pressure sensor



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	● Travel speed does not change to Hi. (Machine monitor changes to the normal state.)		
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.		

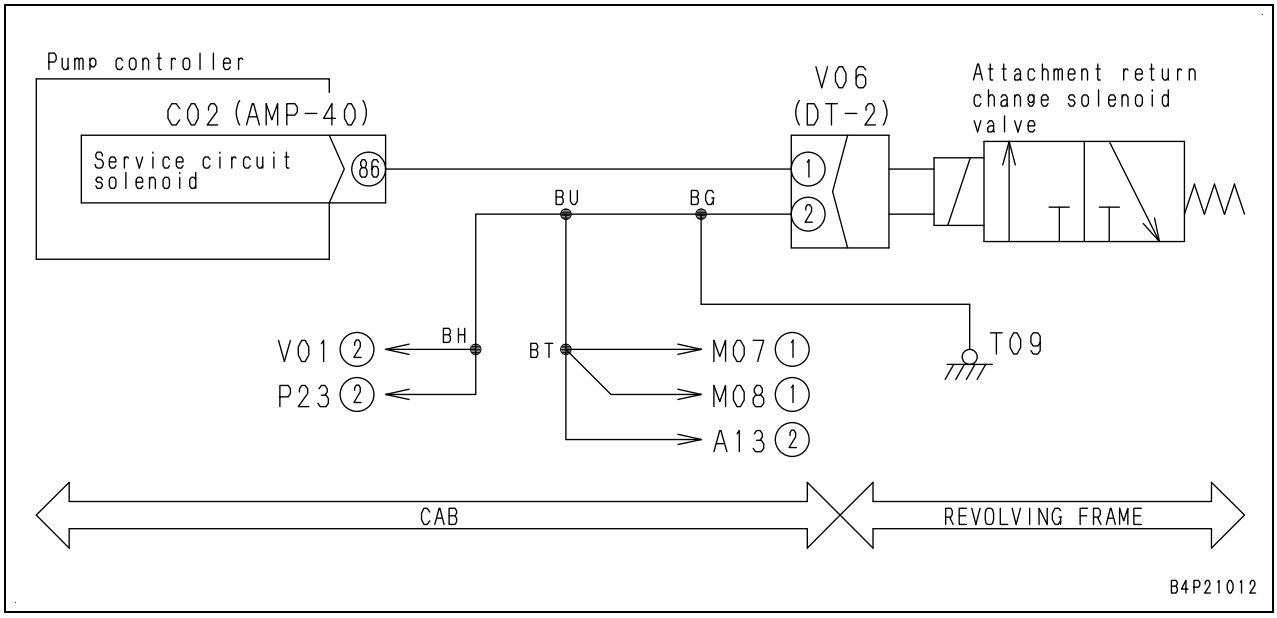
	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective travel speed shifting solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			V04 (male)	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) and chassis ground	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	

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 [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	Max. 1 Ω
			Wiring harness between S25 (female) (8) – V12 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between C02 (female) (115), (117), (120) – S25 (female) (12)		Resistance	Max. 1 Ω
			Wiring harness between S25 (female) (11) – V12 (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 (104) – (115), (117), (120)		7 – 14 Ω	

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	
	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) (97) – V30 (female) (1) and chassis ground	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 (97) – (115), (117), (120)	7 – 14 Ω	
			Between (97) – chassis ground	Min. 1 MΩ	

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	
			Between (1) – (3)	All range	Max. 20 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) (56) – M05 (male) (6)		Resistance	Max. 1 Ω
			Wiring harness between M05 (female) (5) – J04 – chassis ground (T05, T06)		Resistance	Max. 1 Ω
			Wiring harness between C02 (female) (114) – M05 (male) (1)		Resistance	Max. 1 Ω
			Wiring harness between C02 (female) (119) – M05 (male) (3)		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	
			Between (114) – (119)	All range	Max. 20 Ω	

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.		

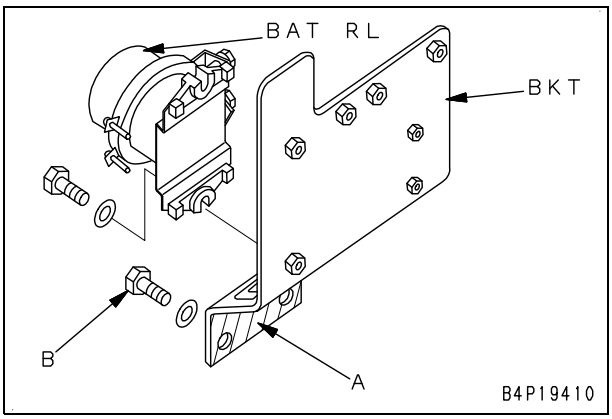
	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective wiper motor (Internal short circuit or ground fault)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			M05 (female)	Continuity/Resistance	
			Between (1) – (3)	There is continuity	
			Between (1) – chassis ground	Min. 1 MΩ	
	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) (114) – M05 (male) (1) and chassis ground	Resistance	Min. 1 MΩ
	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.)		

E-3 Engine does not start (Engine does not crank)

Trouble	• Engine does not start (Engine does not crank).
Related information	• Engine starting circuit has following two start lock mechanisms. 1) Start lock with password of machine monitor 2) Start lock with lock lever

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Loose terminal connection or disconnection at terminal	1. Turn starting switch to OFF position.		
			Check terminals of starting motor, alternator, battery relay, etc. for looseness.		
	2	Defective contact (grounding) between battery relay bracket and frame	1. Turn starting switch to OFF position.		
			Between battery relay (terminal R01) and ground ★ Use machine frame as ground.	Resistance	Max. 1 Ω
			★ Perform followings when the above check result is abnormal (grounding is defective). ★ See figure. 1. Disconnect battery ground cable. 2. Remove battery relay (BAT RL). 3. Remove battery relay bracket (BKT). • Check contact faces (BKT) of battery relay bracket (A) and frame for rust and dirt (Check frame side, too). ★ If there is rust etc., remove it. • Check mounting bolt (B) for rust. ★ If mounting bolt (B) is rusted, be sure to replace it with plated one. • Tighten mounting bolt (B) to specified torque.		
	3	Low charge level of battery	★ Prepare with starting switch OFF, then perform troubleshooting without turning starting switch ON.		
			Battery voltage (two pieces)	Min. 24 V	
			Electrolyte specific gravity (one piece)	Min. 1.26	
	4	Defective fusible links F04 or F05	1. Turn starting switch to OFF position. 2. Remove fusible links F04 and F05.		
			Between terminals on F04 and F05	Resistance	Max. 1 Ω
	5	Defective fuses F01-3 or F01-17	If fuse is blown, circuit probably has ground fault. (See cause 13.)		

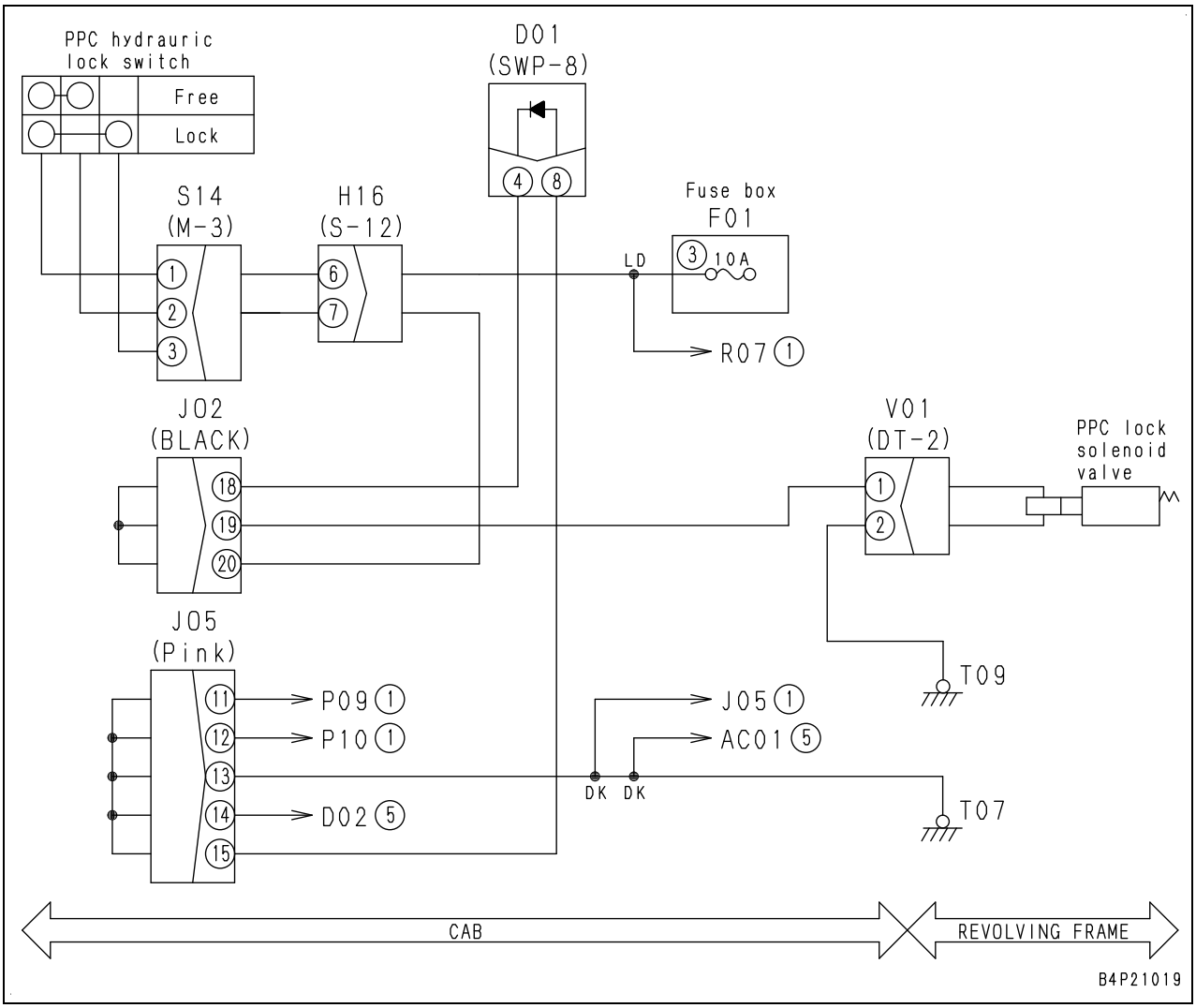
- Battery relay bracket (BKT)



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

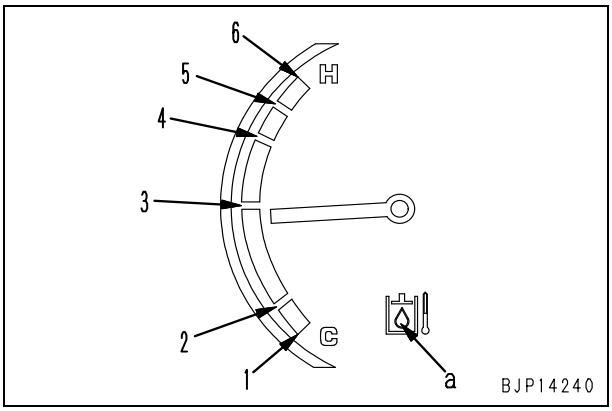
Circuit diagram related to PPC lock solenoid



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

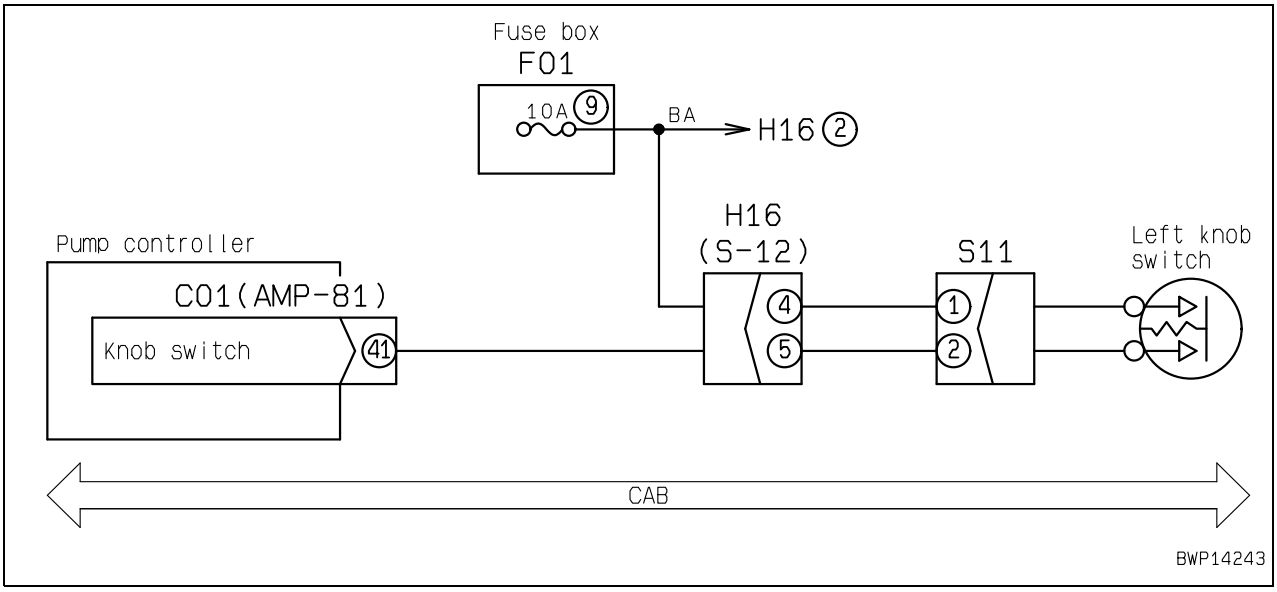


E-19 Power maximizing function does not operate normally

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) and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between S11 (female) (2) – C01 (female) (41) and chassis ground		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



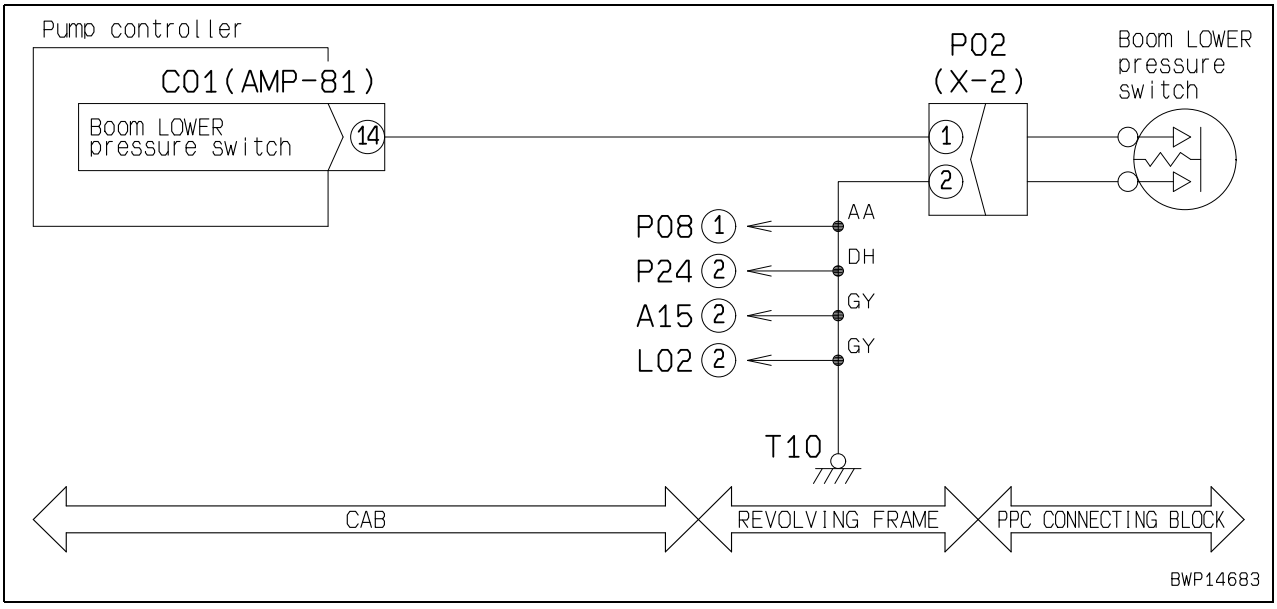
Trouble	(5) Air conditioner abnormality record: Communication condition "CAN disconnection", Communication condition "Abnormal"
Related information	• While abnormality in communication is being detected, "CAN disconnection" is displayed. • If abnormality in communication has been detected and reset, "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) and chassis ground	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) and chassis ground	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.)		

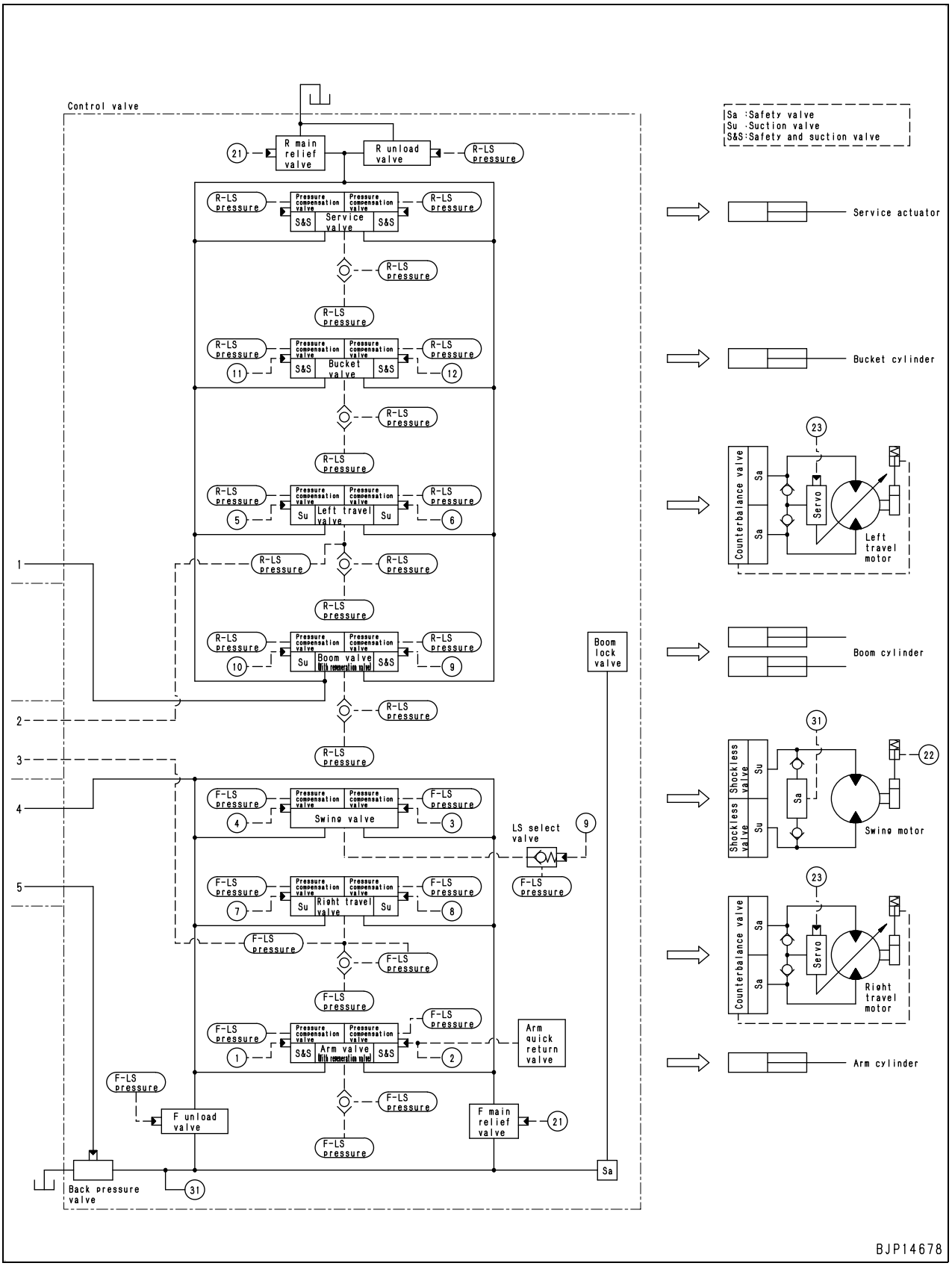
Trouble	(5) Boom lower operation is not displayed normally by monitoring function.
Related information	• Monitoring code: 01900 Pressure switch 1

	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) and chassis ground		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



★ This system diagram is a rough general hydraulic circuit diagram made as reference material for trouble-shooting of the hydraulic and mechanical systems.



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.

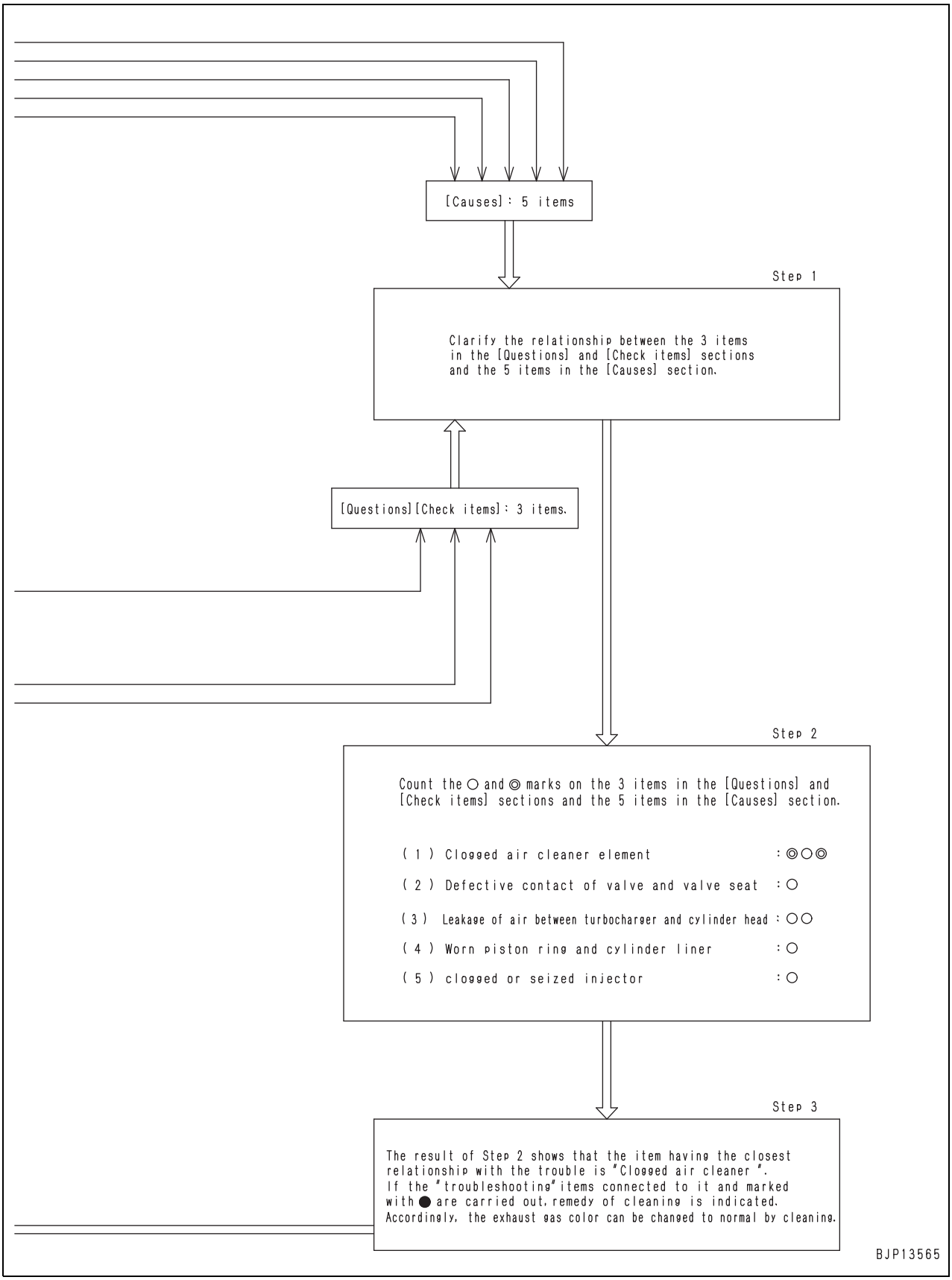
	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Defective arm cylinder	★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.	
			Left work equipment control lever	Leakage from arm cylinder
			Arm 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.	

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.

	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 control valve (spool)	Spool of swing control valve may have malfunction. Check it 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 checked by abnormal sound, abnormal heating, metal chips in drain oil, etc.		

There is a causal relationship between 3 items in the [Questions] and [Check items] sections and 5 items in the [Causes] section.
The method of pinpointing the “cause” from the causal relationship and approaching the “troubleshooting” is explained according to Step 1 – Step 3 shown below.



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 parts in lubrication system

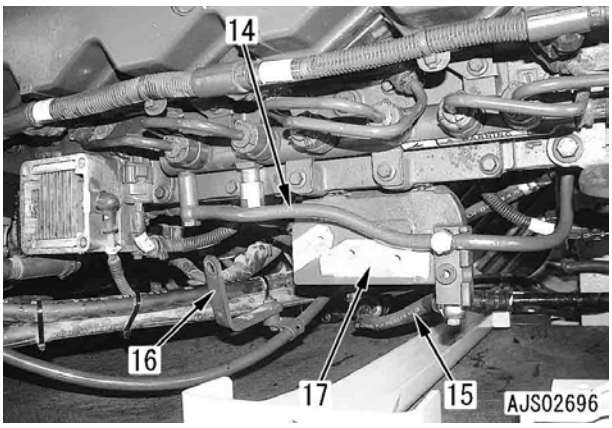
			Causes														
			Dust sucked in from intake system	Worn, damaged valve (stem, guide, seal)	Turbocharger: Worn seal at turbocharger end	Turbocharger: Worn seal at blower end	Clogged breather, breather hose	Broken piston ring	Worn piston ring, cylinder liner	Worn, damaged rear oil seal	Broken oil 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	

50 Disassembly and assembly

Work item	Symbol		Part number	Part name	Necessity	Q'ty	N/R	Sketch	Work content
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 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 (490 kN {50 ton} long)	■	1			
			790-101-1102	Pump (294 kN {30 ton})	■	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			
Counterweight assembly	Z		Commercially available	Impact wrench	●	1			Removal and installation of the counterweight mounting bolt
			Commercially available	Socket wrench (width across flats: 41 mm)	●	1			

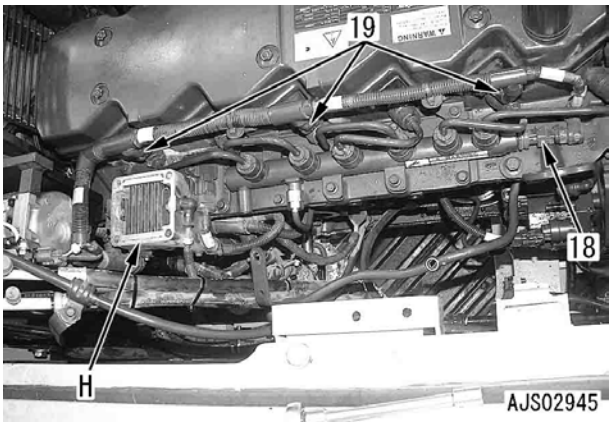
★ (9) – (13): Unused numbers

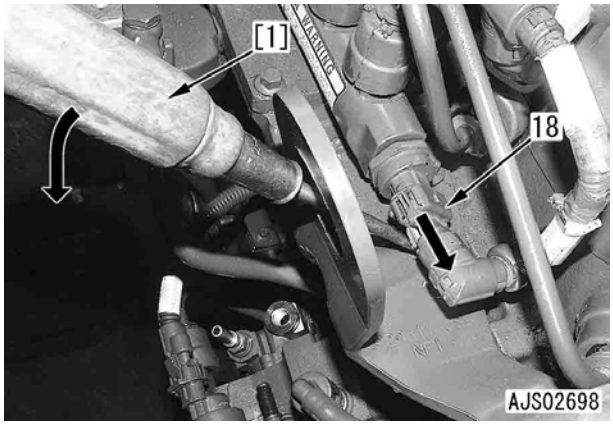
8. Disconnect fuel return hose (14). [*4]
9. Disconnect fuel return hose (15).
10. Disconnect bracket (16). [*5]
11. Remove fuel block (17). [*6]

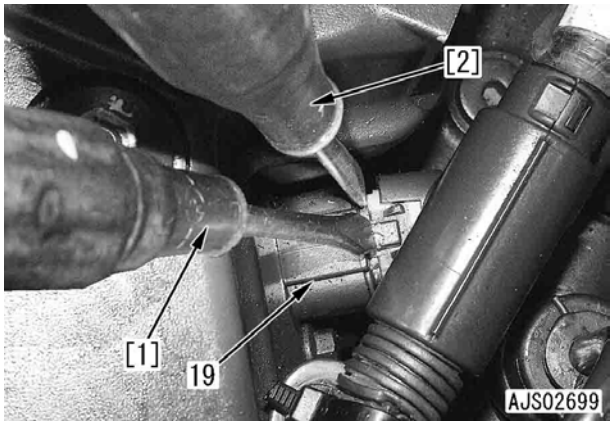


12. Disconnect connector (18).
    ★ Pull out connecter (18) in the direction of the arrow while pushing up its lock with flat-head screwdriver [1].

13. Disconnect connector (19).
    ★ As you cannot hold the connector, remove it as follows, using 2 flat-head screwdrivers.
    1) Keep pushing the lock of connector (19) with flat-head 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. [*7]

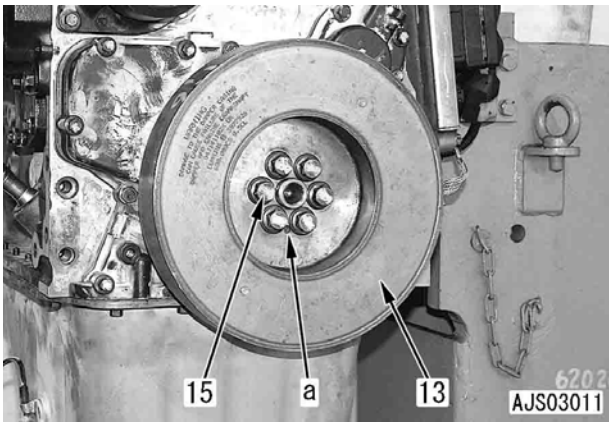




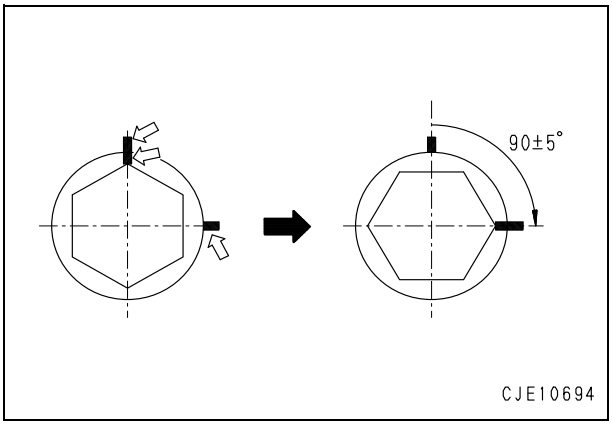


2. Vibration damper

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] Tighten an additional 90° ± 5°.
      ★ Tool **A6**: wrench is adopted for angle tightening. (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 section of “Checking and adjusting air conditioner compressor belt tension” in the Testing and adjusting chapter in this manual.

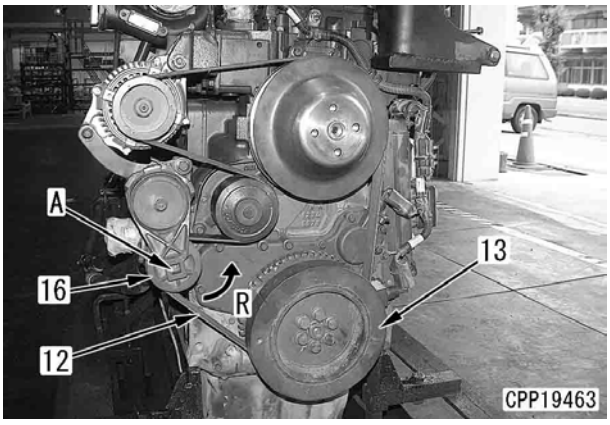
[*3]

★ Install fan belt (12) as follows.
- Insert a wrench to the portion (A) (width across flats □ 12.7 mm) of the tensioner assembly (16), and rotate it to the opposite to the winding-up direction (R) to decrease the fan belt (12) tension, then install.

⚠ Make sure that the wrench is secured at the portion (A) before rotating it. (The spring of the tensioner assembly (16) is strong. If the wrench is loosely inserted, the wrench may accidentally come off while being rotated and it is extremely dangerous.)

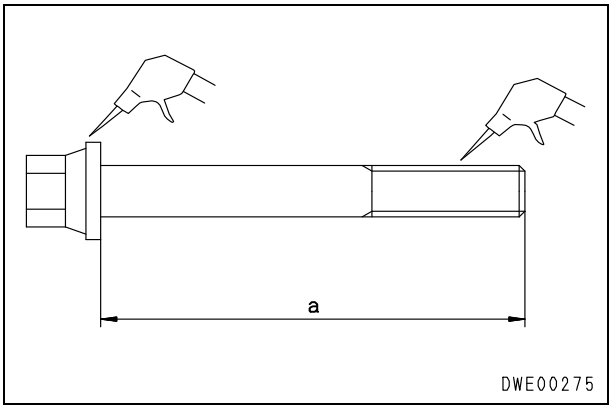
⚠ After removing the fan belt (12), return the tensioner assembly (16) slowly with care.

⚠ Be careful not to get your fingers caught between the pulley and fan belt (12) during work.

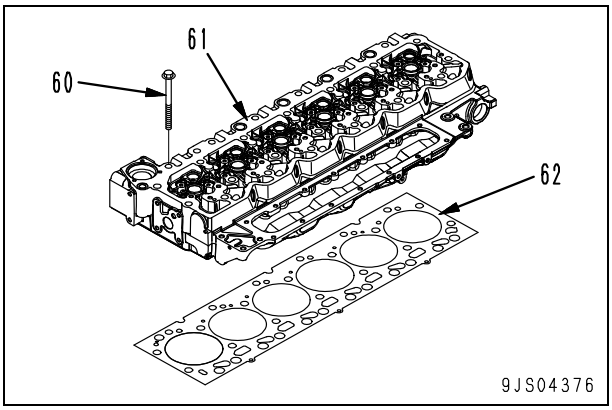


Installation

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.)

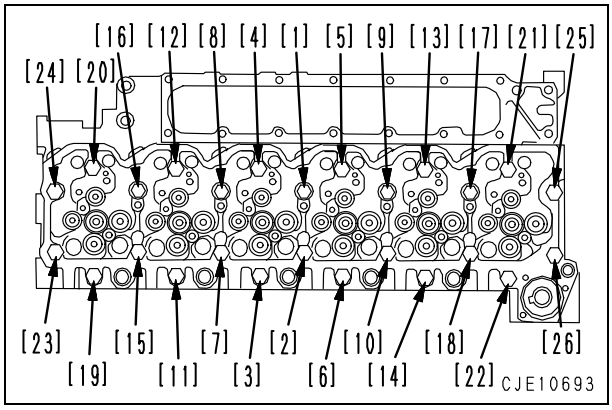


   2) Set head cylinder gasket (62) after checking that there is no dust or foreign material on the cylinder head mounting face and inside the cylinders.
      - ★ Check that the gasket is properly matched with the cylinder head holes.
   3) Set cylinder head assembly (61) on the cylinder block, screw in 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)**.

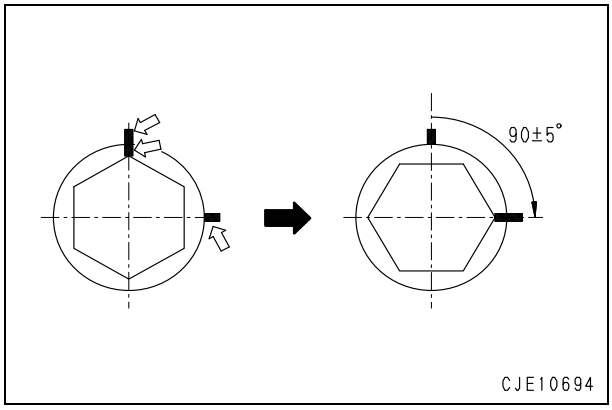


      - How to tighten mounting bolts (60)

      - ★ 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.)



- 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°**.



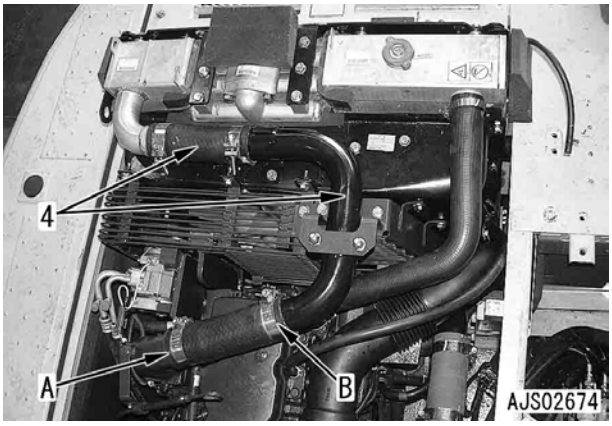
2. Install rocker housing assembly (59).
   - Mounting bolt:
   24 ± 4 Nm {2.4 ± 0.4 kgm}

Installation

- Installation is done in the reverse order of removal.

[*1]

1. Install hose and tube assembly (4).
   - ★ Use a new MIKALOR clamp.
   1) 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

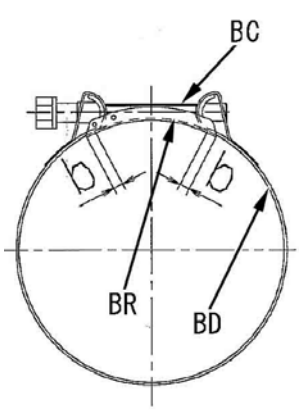


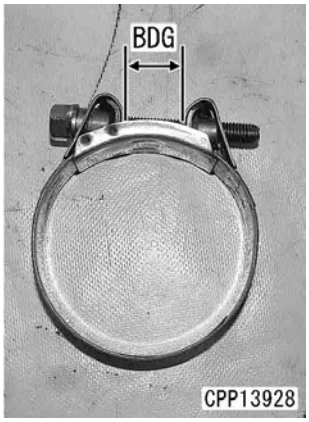
   2) Set the bridge (BR) under the clamp bolt and lap it over band (BD) at least (b) reaches 5 mm.
   3) Tightening of the clamp.
   - ★ Do not use an impact wrench.

   Clamp bolt (BC): **Lubricating oil (THREEBOND PANDO 18B)**

   - **When reusing the hose**
     Install the clamp to the clamp mark made on the hose.
     Tighten to torque of at least **6 Nm {0.6 kgm}**.

   - **When using a new hose**
     Tighten until dimension (BDG) is **7 – 10 mm**.





[*2]

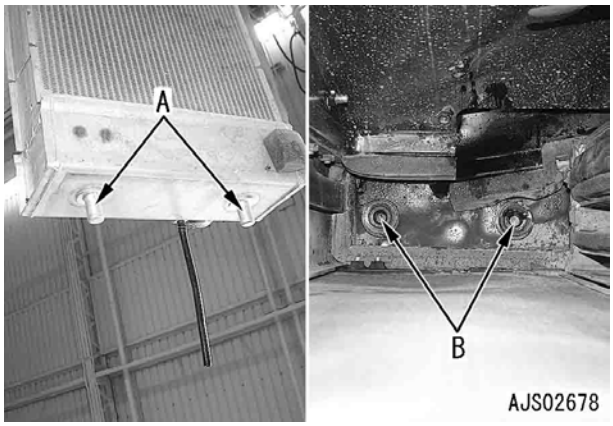
- ★ Align the hose to the original position (marking position).
- ★ Align the clamp to the original position.
- ★ Reference
  Inserted air hose length
  - 45 mm (Both upper and lower side)

  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).

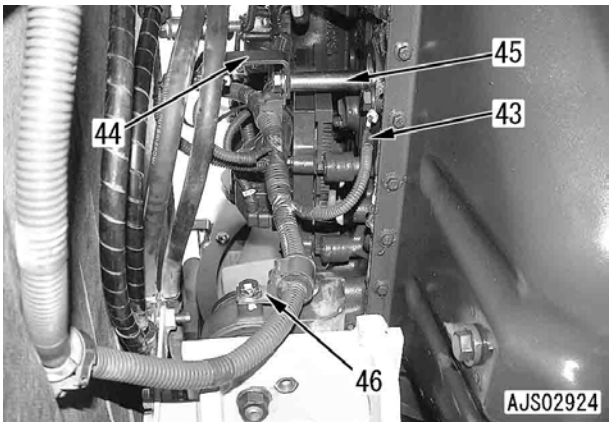


- **Refilling engine coolant**
  Refill coolant through the coolant filler port up to the specified level. Start the engine and circulate the coolant, and then check the coolant level.
  Coolant : **Approx. 21.5 ℓ**

41. Disconnect engine controller ground T12 (43).

42. Disconnect bracket (44) and remove spacer (45).

43. Disconnect clamp (46).

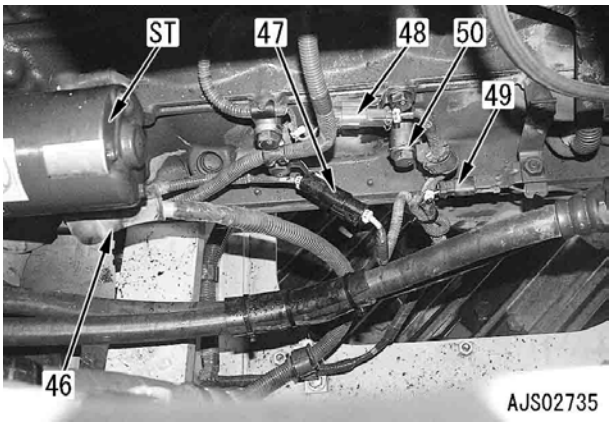


44. Disconnect terminal (46) from the starter (ST).

45. Disconnect connector E10 (47).
    ★ Connector at the starting motor side: T13

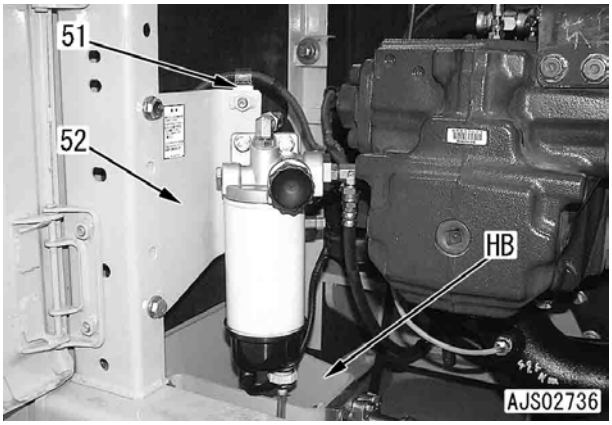
46. Disconnect connectors E08 (48) and P44 (49).

47. Disconnect clamp (50).



48. Disconnect clamp (51).

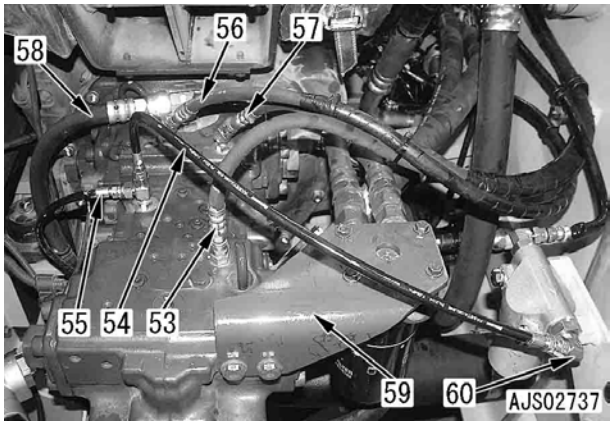
49. Remove filter and bracket assembly (52).
    ★ Put it on hose bracket (HB).



50. Disconnect 6 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

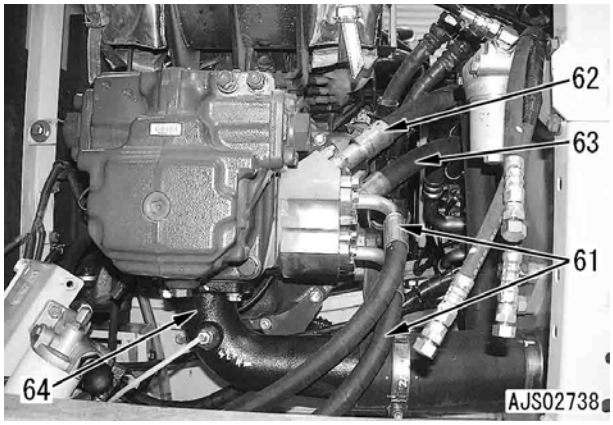
51. Disconnect bracket (59).

52. Turn elbow (60) downward.
    ★ Not to be obstructive in removing the engine.



53. Disconnect 4 hoses and 1 tube.
    - (61): Branch hose
    - (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.)



2. Nut

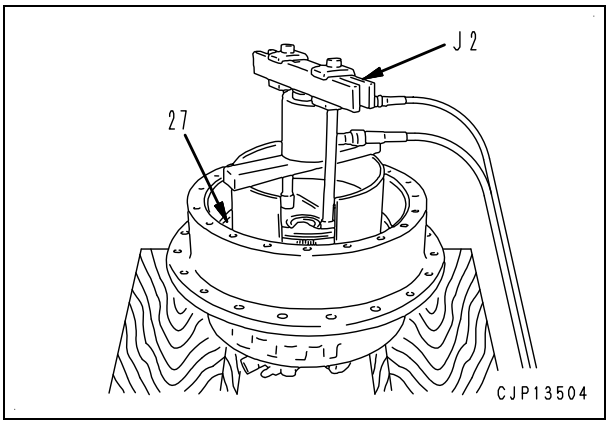
1) Install nut as follows.

1] Using tool **J2**, push bearing inner race (27).

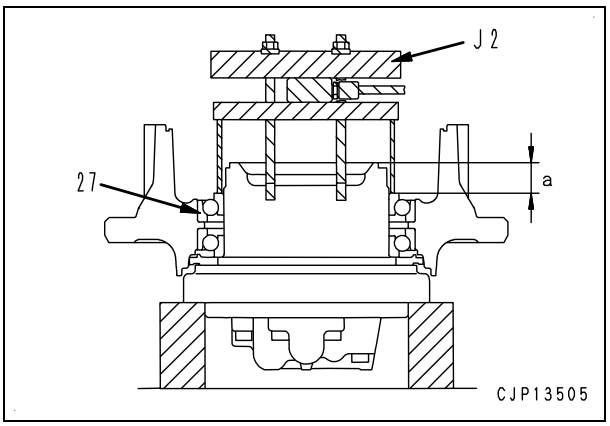
★ Pushing force:

12.7 – 16.7 kN {1.3 – 1.7 tons}

★ Rotate the hub 2 – 3 times before applying the pushing force to the bearing inner race.



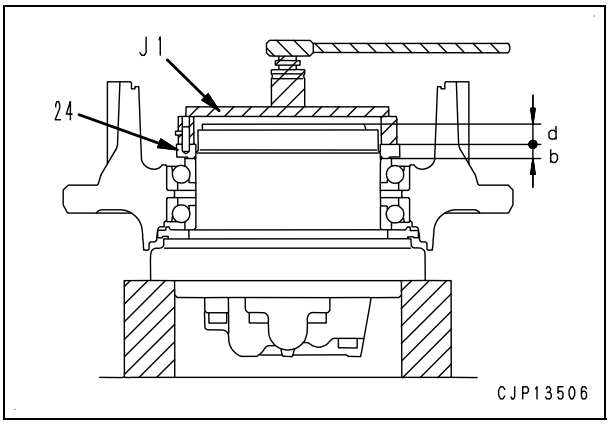
2] Measure dimension (a) in the condition in Step 1] above.



3] Measure thickness (b) of nut (24) as an individual part.

4] Calculate **a – b = c**.

5] Tighten nut (24) with tool **J1** until dimension (c) is obtained.

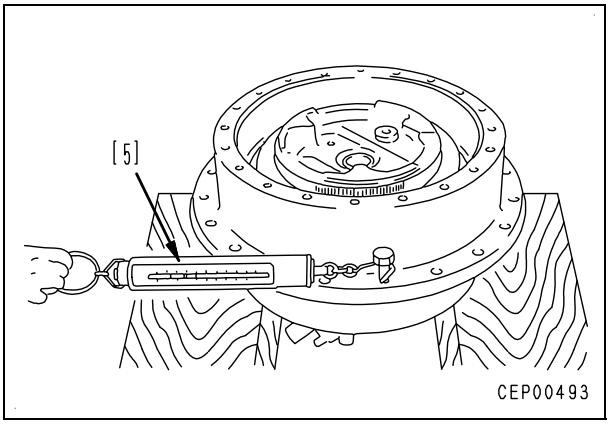


6] Using push-pull scale [5], measure tangential force in the direction of rotation of the hub in relation to the motor case.

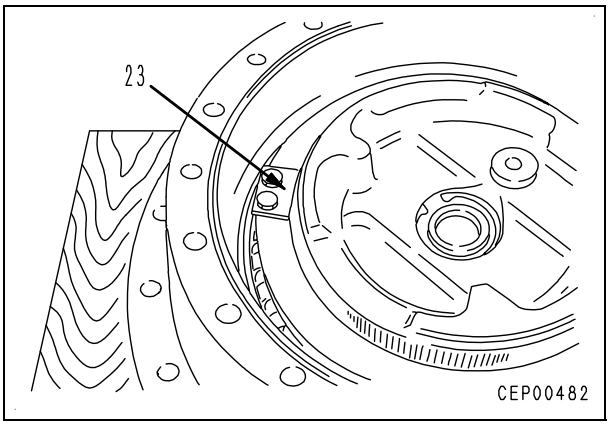
★ Tangential force:

Max. 490 N {50 kg}

★ The tangential force is the maximum force when starting rotation.



7] Install lock plate (23).



★ Install the lock plate as shown in the diagram below.

Thread of mounting bolt:

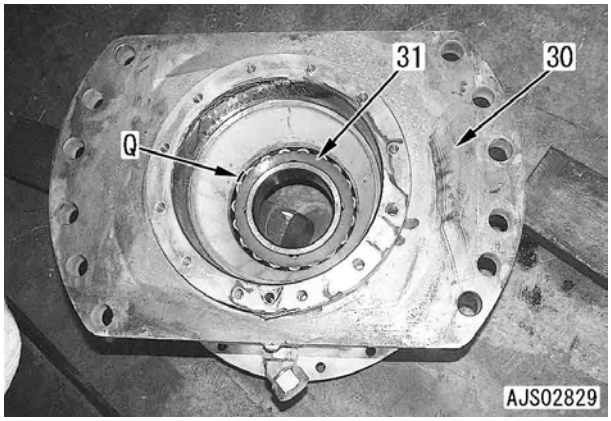
Thread tightener (LT-2)

Mounting bolt:

49 – 74 Nm {6 – 7.5 kgm}

★ Do not coat the threaded portion of the nut with thread tightener (LT-2).

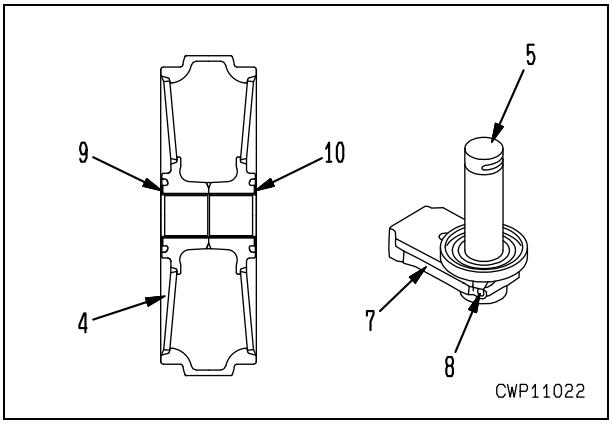
14. Remove bearing (31) from case (30).
    - ★ Apply a suitable tool on the circumference of the outer race (thick line: Q section), strike the tool on the circumference with the hammer lightly, equally, by turns, and remove the bearing gradually.
    - ★ If the outer race is made incline, bearing becomes hard, so remove it horizontally.



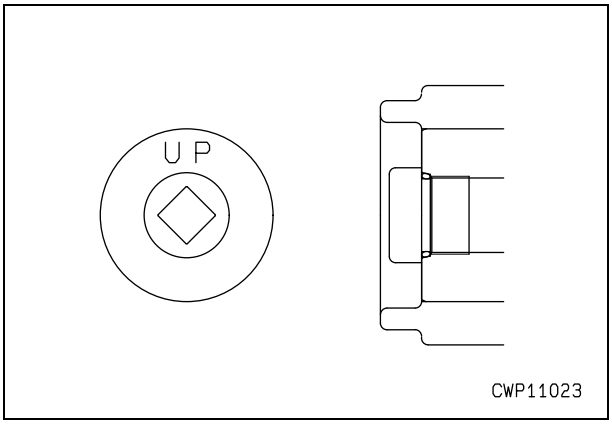
Assembly

1. Press fit bushings (9) and (10) to idler (4).

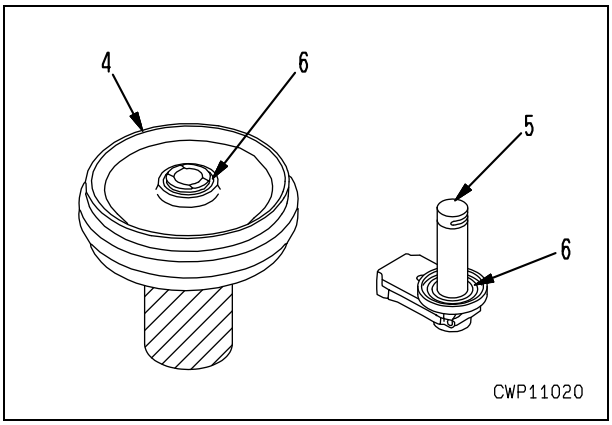
2. Fit O-ring and install support (7) to shaft (5) with dowel pin (8).



★ Install the shaft with UP mark facing upward.

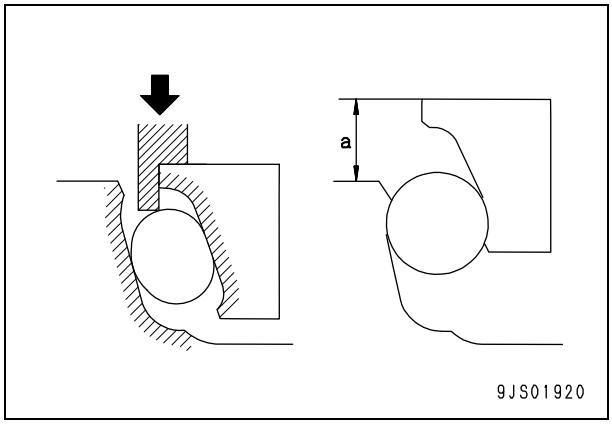


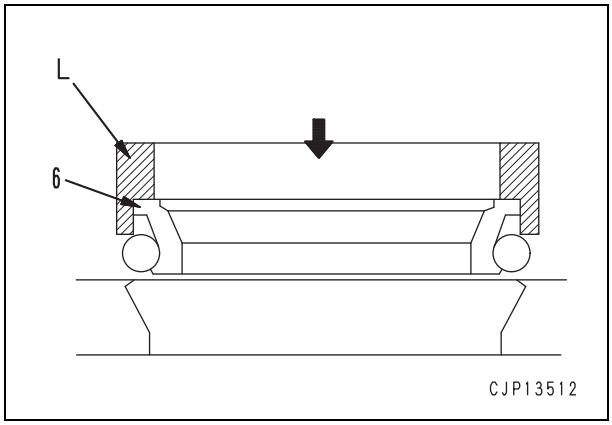
3. Using tool **L**, install floating seal (6) to idler (4), shaft (5) and support (7) assembly.



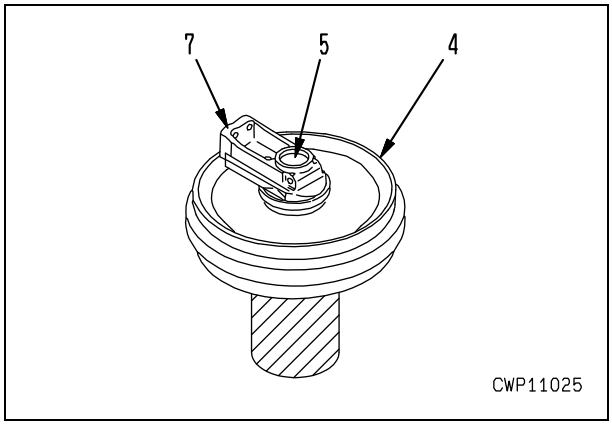
★ Before installing the floating seal, completely degrease both contact surfaces of the O-ring and the floating seal (hatched area in the illustration). Furthermore, take care so that no dust or dirt sticks to the contact surface of the floating seal.

★ After inserting the floating seal, check that inclination of the seal is less than 1 mm and that protrusion (a) of the seal remains within the range of 5 – 7 mm.





4. Assemble shaft (5) and support (7) assembly to idler (4).

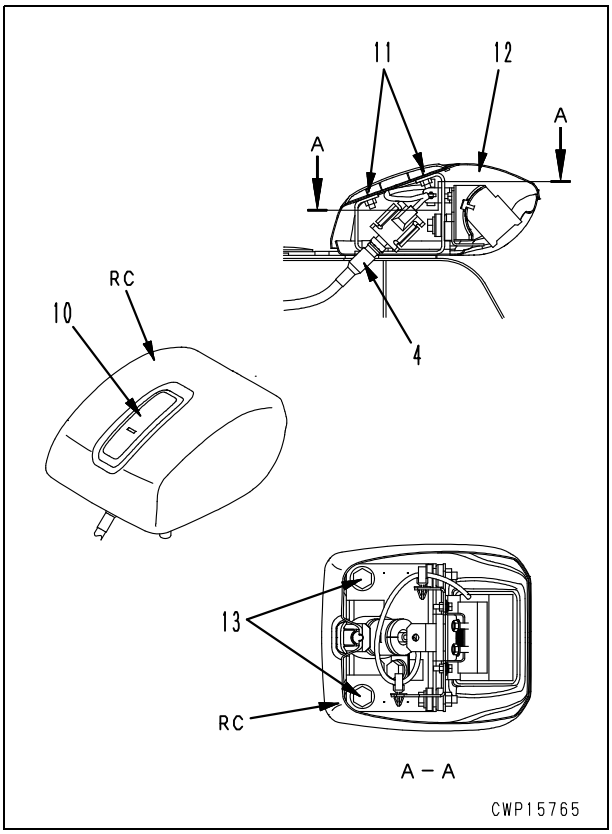


Reference

Removal of rear camera (RC)

★ Serial number: #30001 and up

★ Disconnect connector (4) in advance.
1. Remove cover (10).
2. Remove bolts (11).
3. Remove cover (12).
4. Remove bolts (13) and rear camera (RC).



Installation

- Installation is done in the reverse order of removal.

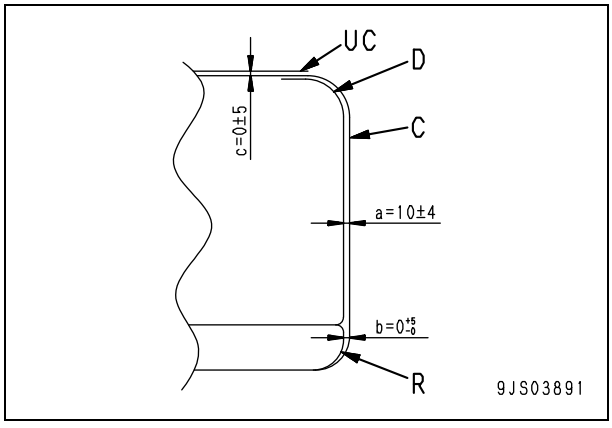
[*1]

Mounting bolt threaded section:
Adhesive compound (LT-2)

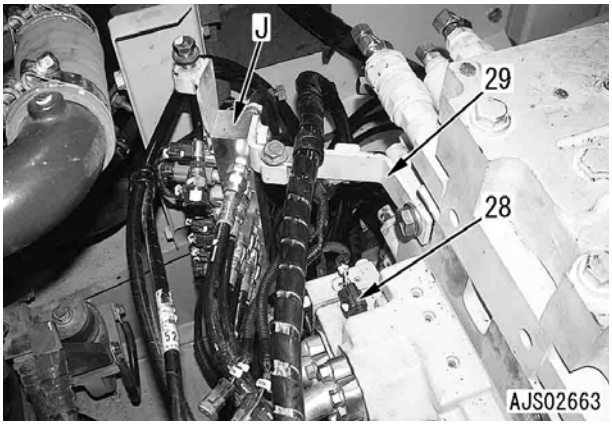
Mounting bolts:
1,180 – 1,470 Nm {120 – 150 kgm}

[*2]

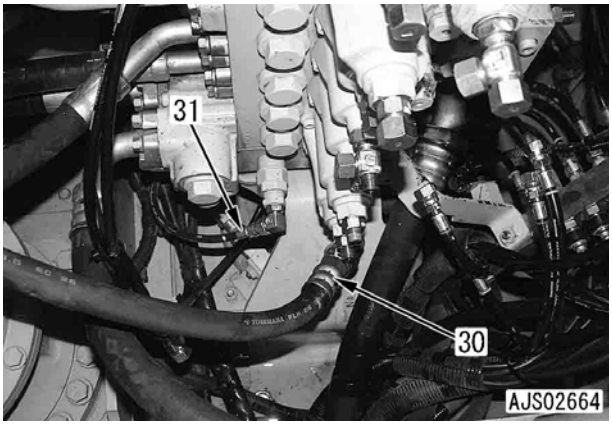
★ Installing and adjusting counterweight
1) Using shims, adjust the differences in level or gaps between the counterweight and the exterior of body work.
   ★ Shims: 20Y-46-11410
2) Fix the counterweight so that the clearances in the direction of front and rear are even and within the limit of 10 ± 5 mm 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 counterweight (C)
   (a): 10 ± 4 mm
   The difference in level in left to right direction between the revolving frame (R) and the counterweight (C)
   (b): 5 mm or less
   The difference in level in up and down direction between the exterior upper cover (UC) and the counterweight (C)
   (c): 0 ± 5 mm
   are the respective limits for the mounting adjustment.
   ★ Rear view (Enlarged drawing for right hand side)



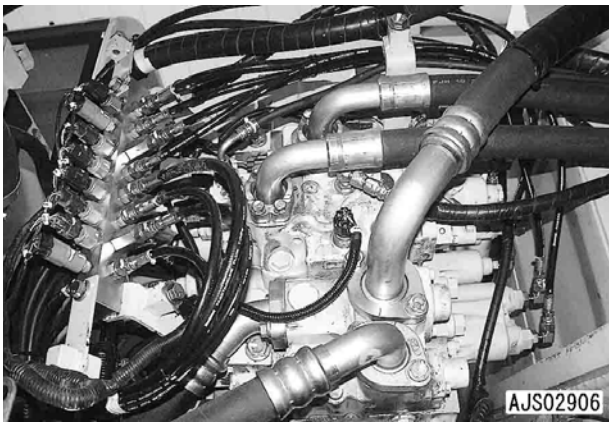
21. Disconnect connector P26 (28).
(Front pump pressure sensor)
22. Disconnect bracket (29), then bracket junction box (J).



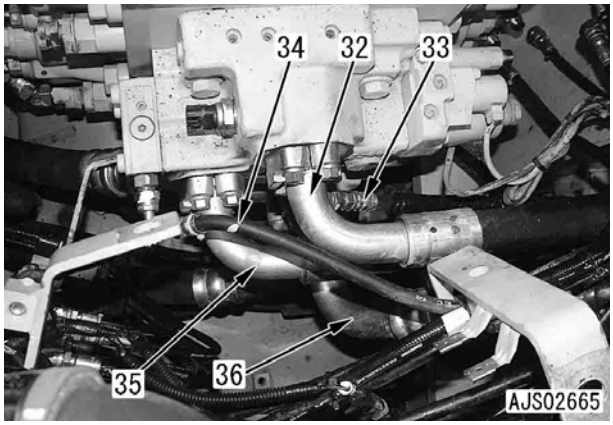
23. Disconnect hoses (30) and (31).
- (30): Between control valve and swing motor
- (31): Between control valve and hydraulic tank



★ Reference rear figure



24. Disconnect hoses (32) through (36) from the rear side.
- (32): PP1 port hose (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 hoses (38) and (39).
- (38): ATT port hose (filter) (if equipped)
- (39): T port hose (under the oil cooler)

25. Lift off hydraulic pump assembly (37) to remove it. [*1]
    - Hydraulic pump assembly: **220 kg**

Installation

- Installation is done in the reverse order of removal.

[*1]
- Hydraulic pump involute spline: **Antifriction agent (LM-G)**
- Mating face of the hydraulic pump case: **Gasket sealant (LG-6)**

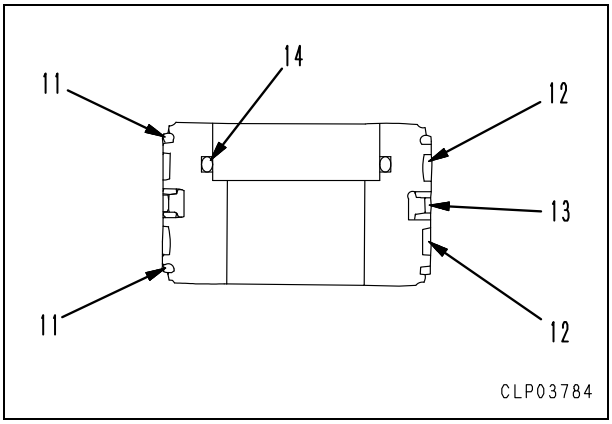
★ Since flywheel housing is made of aluminum, be careful not to over torque.
★ Impact wrench is not applicable to use.

- **Refilling with oil (damper case)**
  Refill oil through the oil filler port to the specified level.
  - Damper case: **EO30 Approx. 0.65 ℓ**

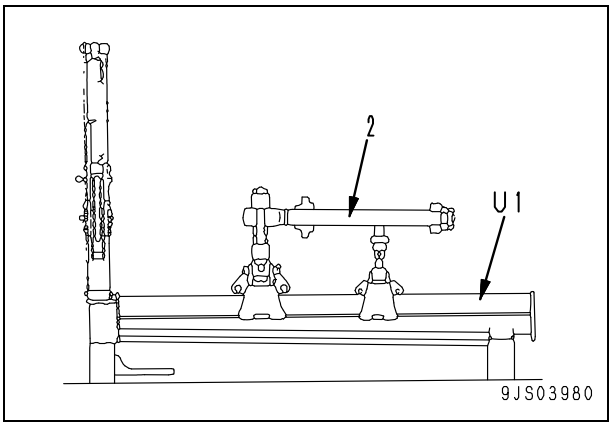
- **Refilling with oil (hydraulic tank)**
  Refill hydraulic oil through the oil filler port to the specified level. Let the oil circulate in the hydraulic system by starting the engine. Then check the oil level again.
  - Hydraulic tank: **Approx. 244 ℓ**
  - Hydraulic tank drain plug: **58.8 – 78.5 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, “Bleeding air from each part”.

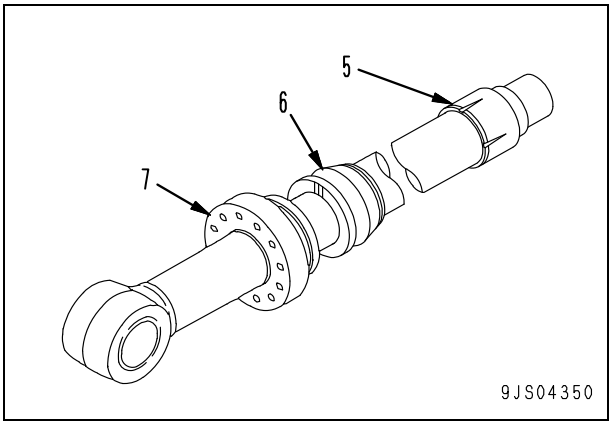
3) Install the backup ring and O-ring (14).
4) Assemble wear ring (12).
5) Assemble ring (11).
   ★ Be careful not to open the end gap of the ring too wide.
   Ring groove: **Grease (G2-LI)**



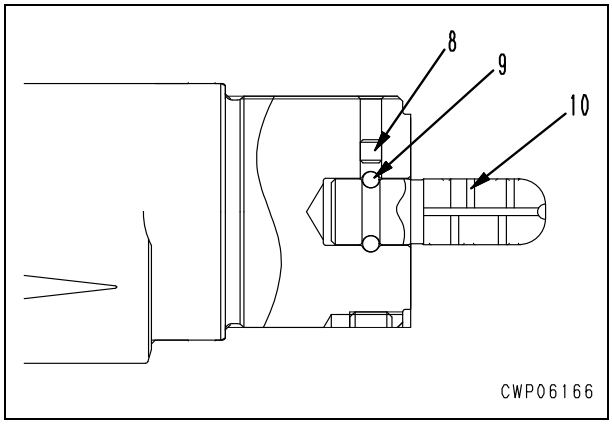
3. Piston rod assembly
1) Set piston rod assembly (2) in tool **U1**.



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



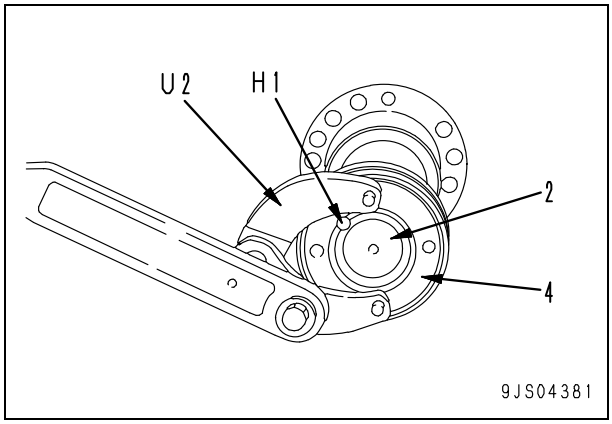
5) Set plunger (10) on the piston rod, assemble 12 balls (9) to it and secure with cap (8).
   ★ Check that there is a small amount of play at the tip of the plunger.
   ★ Put a mark on the end face of the rod so that the processing hole position of cap (8) is visual from outside.
   ● Arm cylinder only



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.



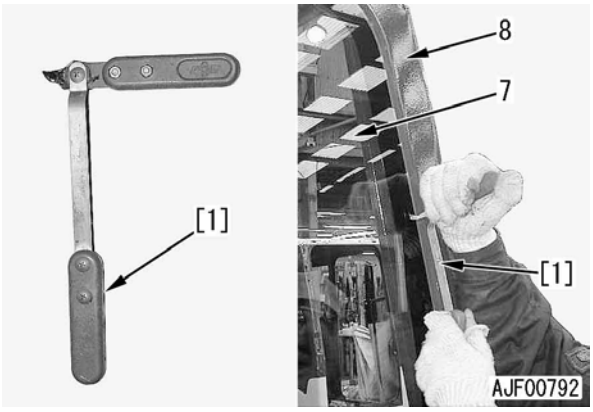
Special tools

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.

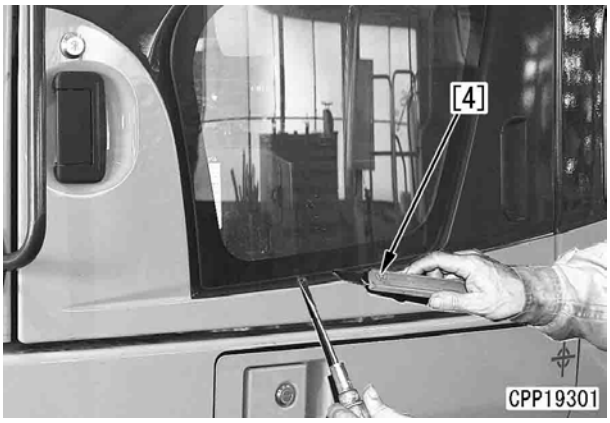
1. Using seal cutter [1], cut the adhesive between broken window glass (7) and operator's cab (metal sheet) (8).



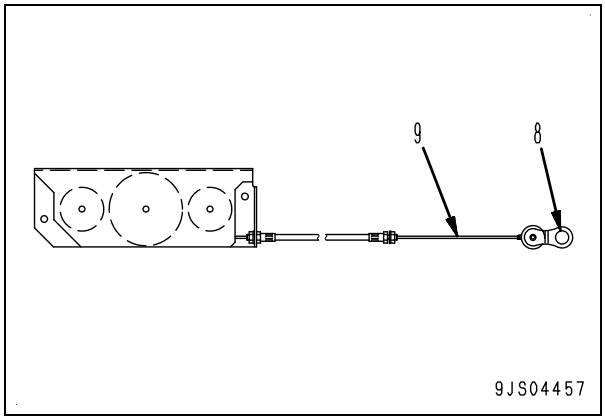
★ If a seal cutter is not available, make holes on the adhesive and dam rubber with a drill and pass a fine wire (piano wire, etc.) [2] through the holes. Then, grip the both ends of the wire with pliers [3], etc. (or hold them by winding them onto something) and move the wire to the right and left to cut the adhesive and dam rubber.
Since the wire may be broken by the frictional heat, apply lubricant to the wire.

★ If the window glass is broken finely, it may be removed with a knife [4] and a screwdriver.

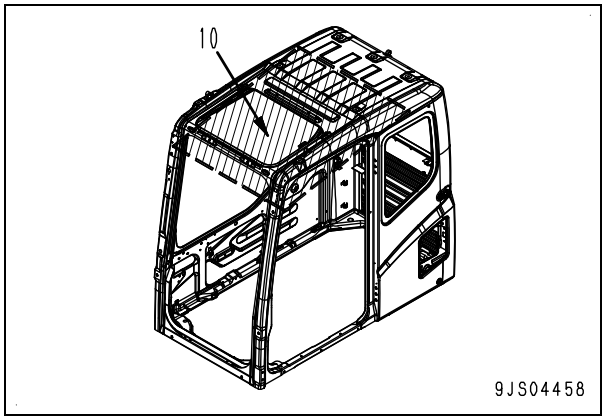
★ Widening the cut with a flat blade screwdriver, cut the dam rubber and adhesive with knife [4].



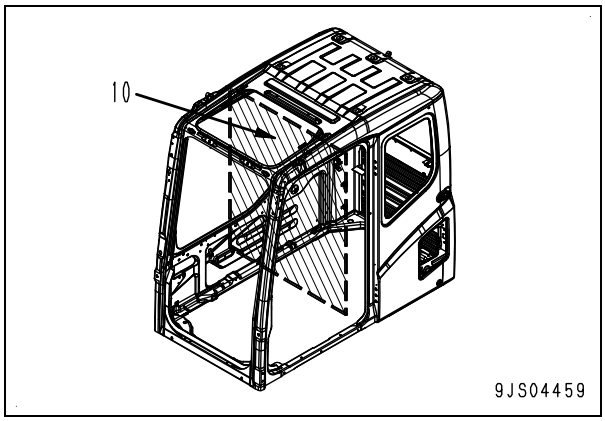
2. Remove the window glass.



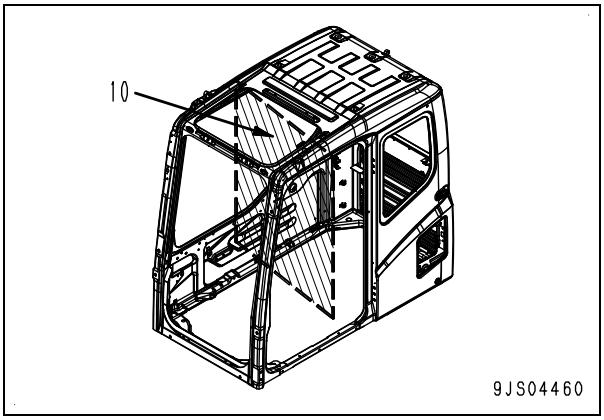
7. Pull out the bottom of front window assembly (10) though the rail opening portion and lower it gradually.

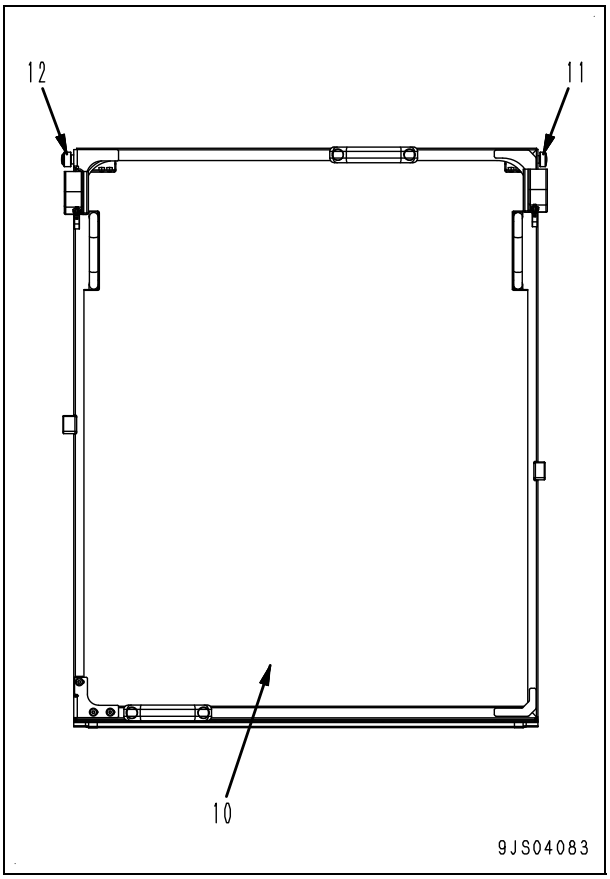


8. Lower front window assembly (10) completely.
   ★ Do not let the front window assembly touch the monitor.



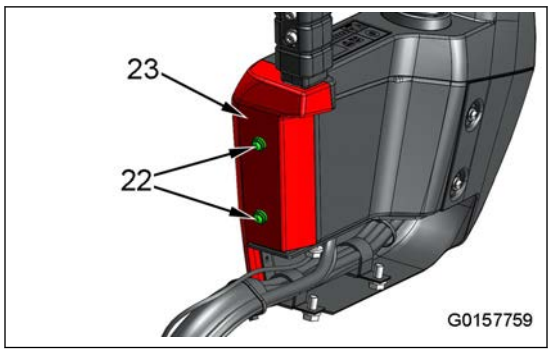
9. Twist front window assembly (10) to the right and left to remove both upper rollers (11) and (12) from the rails, and then remove front window assembly (10).





7. Install the cover (23) with the 2 bolts (22).

   Bolt (22): 6.8Nm{1.0kgfm}

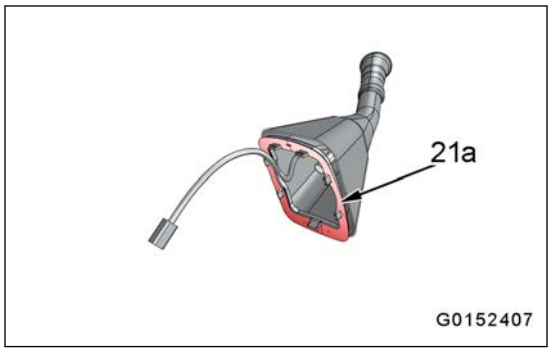


Right hand lever

8. Install the seat (21a) to the work equipment control lever assembly (21).

   REMARK

   - Use a new work equipment control lever assembly.
   - When you install the seat, put it onto the latches of the boot.
   - The seat is not installed on some machines which were made earlier.



9. Install the work equipment control lever assembly as follows.
   - Threaded type

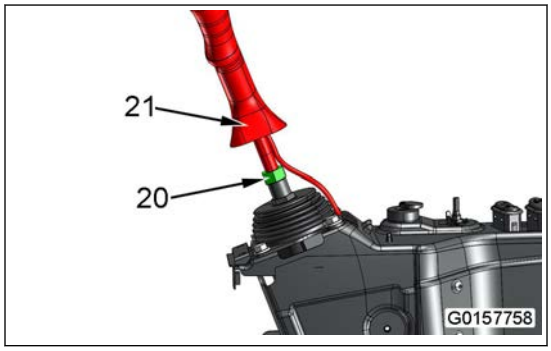
   1) Install the work equipment control lever assembly (21) with the nut (20).

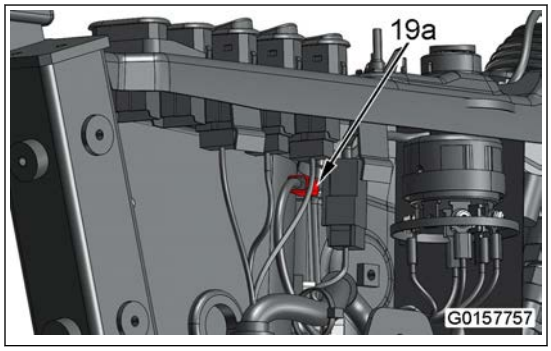
      REMARK

      - Screw in the lever to the bottom of the valve.
      - After you tighten it, turn it back by 3 and a half turns. Adjust the lever height and direction, and tighten and fix it.

      Nut (20): 34.3 to 58.8Nm{3.5 to 6.0kgfm}

   2) Connect the connector (19a).





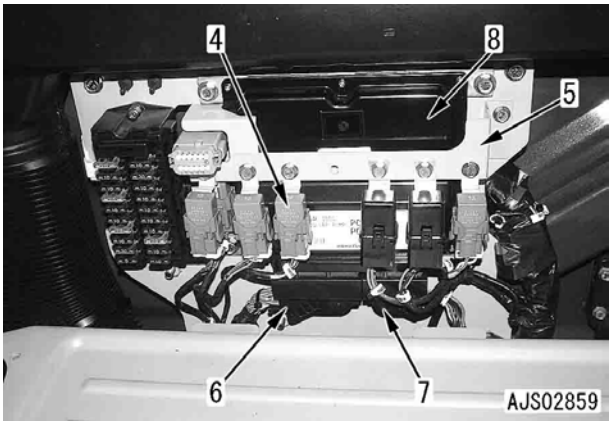
Removal and installation of pump controller assembly

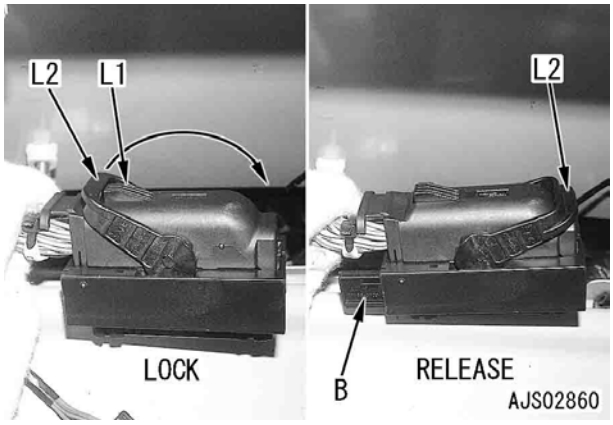
Removal

⚠ **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).



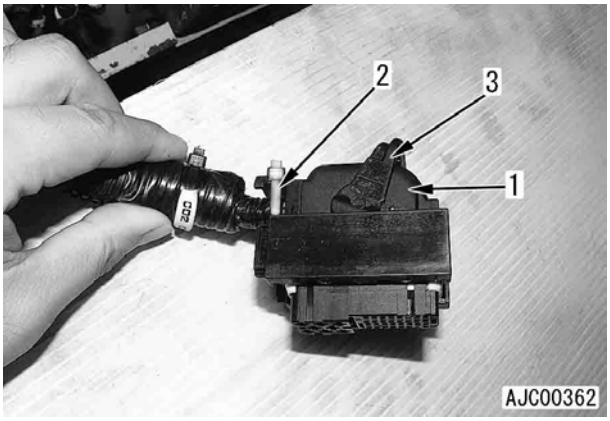


Installation

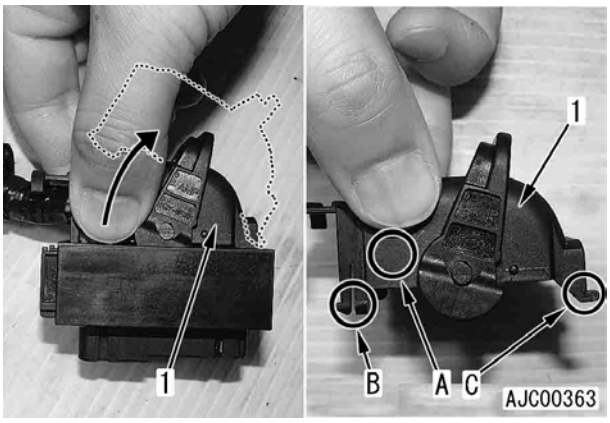
- Installation is done in the reverse order of removal.

★ Reference

1. Procedure for removing connector cover (1)
   1) Cut and remove cable tie (2).
   2) Move lever (3) up.



   3) Lightly push part (A) of connector cover (1) from both sides to unfasten claw (B).
   4) Remove connector cover (1) around claw (C).



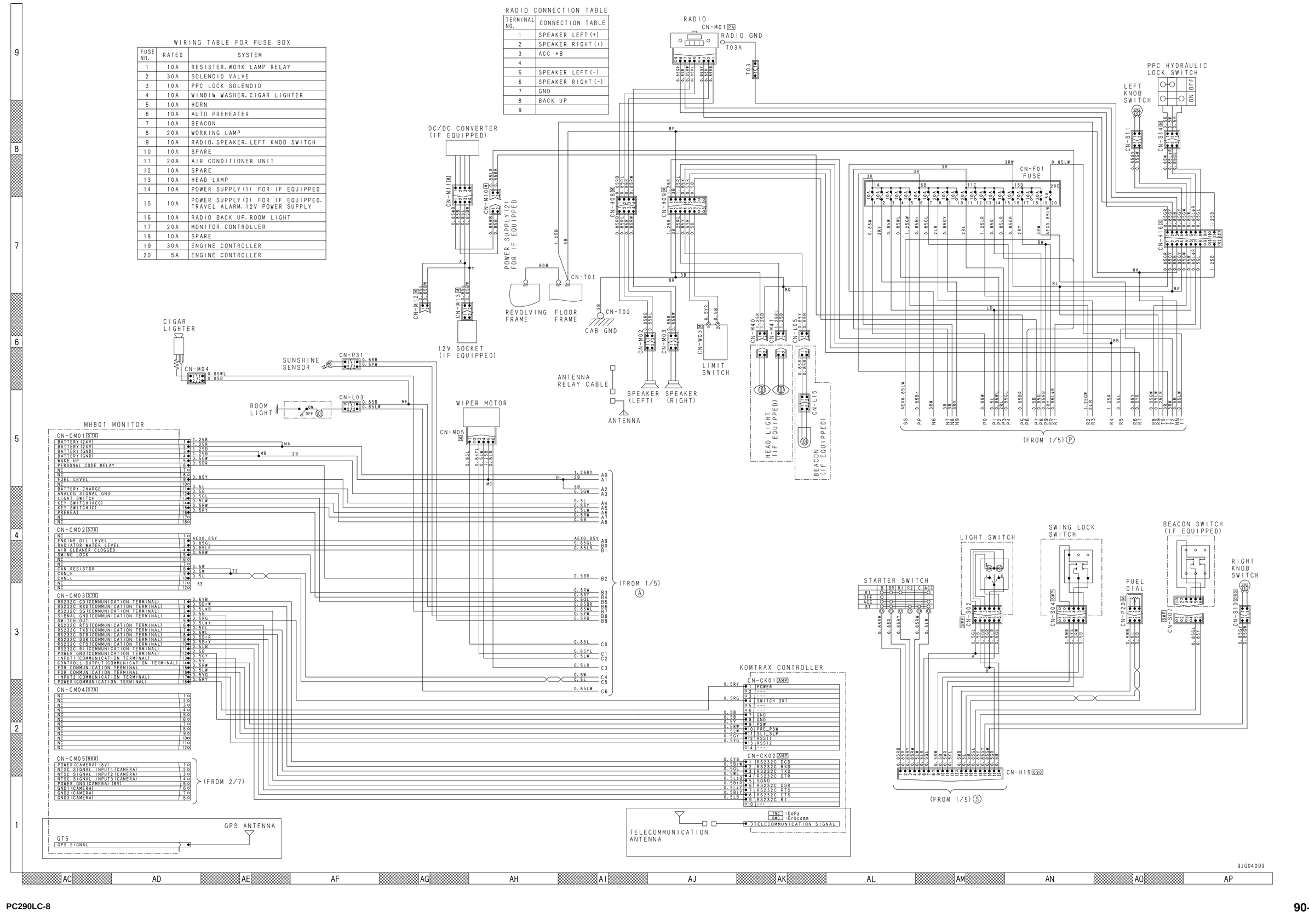
Electrical circuit diagram (3/5)

WIRING TABLE FOR FUSE BOX

FUSE NO.	RATED	SYSTEM
1	10A	RESISTER. WORK LAMP RELAY
2	30A	SOLENOID VALVE
3	10A	PPC LOCK SOLENOID
4	10A	WINDIW WASHER. CIGAR LIGHTER
5	10A	HORN
6	10A	AUTO PREHEATER
7	10A	BEACON
8	20A	WORKING LAMP
9	10A	RADIO. SPEAKER. LEFT KNOB SWITCH
10	10A	SPARE
11	20A	AIR CONDITIONER UNIT
12	10A	SPARE
13	10A	HEAD LAMP
14	10A	POWER SUPPLY(1) FOR IF EQUIPPED
15	10A	POWER SUPPLY(2) FOR IF EQUIPPED. TRAVEL ALARM. 12V POWER SUPPLY
16	10A	RADIO BACK UP. ROOM LIGHT
17	20A	MONITOR. CONTROLLER
18	10A	SPARE
19	30A	ENGINE CONTROLLER
20	5A	ENGINE CONTROLLER

RADIO CONNECTION TABLE

TERMINAL NO.	CONNECTION TABLE
1	SPEAKER LEFT(+)
2	SPEAKER RIGHT(+)
3	ACC +B
4	
5	SPEAKER LEFT(-)
6	SPEAKER RIGHT(-)
7	GND
8	BACK UP
9	



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