

Shop Manual

HYDRAULIC
EXCAVATOR

PC228USLC-10

SERIAL NUMBERS 1002 and up

KOMATSU

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
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REMARK

The symbol  shows the weight of the parts with weight of 20 kg or more for convenience of workers. But the weight can possibly be shown even if it is less than 20 kg in accordance with the work environment. Do the work safely in response to the work environment and the physical build, preexisting condition, and physical condition of the operator. And obey the laws and regulations of each country.

- Before starting work, check the wire ropes, brake, clutch, controller, rails, over winding prevention device, ground fault circuit interrupter for electric shock prevention, crane collision prevention device, and energizing warning lamp, and check the following safety items.
- Observe the signals for sling work.
- Operate the hoist at a safe place.
- Be sure to check the directions of the direction indication plate (north, south, east and west) and the operating button.
- Do not sling a load at an angle. Do not move the crane while the slung load is swinging.
- Do not raise or lower a load while the crane is moving longitudinally or laterally.
- Do not drag a sling.
- When lifting up a load, stop it just after it leaves the ground and check safety, and then lift it up.
- Consider the travel route in advance and lift up a load to a safe height.
- Place the control switch in a position where it will not be an obstacle to work and passage.
- After operating the hoist, do not swing the control switch.
- Remember the position of the main switch so that you can turn off the power immediately in an emergency.
- Shut down the main switch when the hoist stops because of a blackout. When turning on a switch which is turned OFF by the ground fault circuit interrupter for electric shock prevention, check that the devices related to that switch are not in operating condition.
- If you find an obstacle around the hoist, stop the operation.
- After finishing the work, stop the hoist at the specified position and raise the hook to at least 2 meters above the floor. Do not leave the sling attached to the hook.

Selecting wire ropes

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

Wire rope (JIS G3525, 6 x 37 - Type A)
(Standard Z twist wire ropes without galvanizing)

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

- ★ The allowable load is calculated as one sixth of the breaking load of the rope to be used (safety coefficient: 6).

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

Disconnection

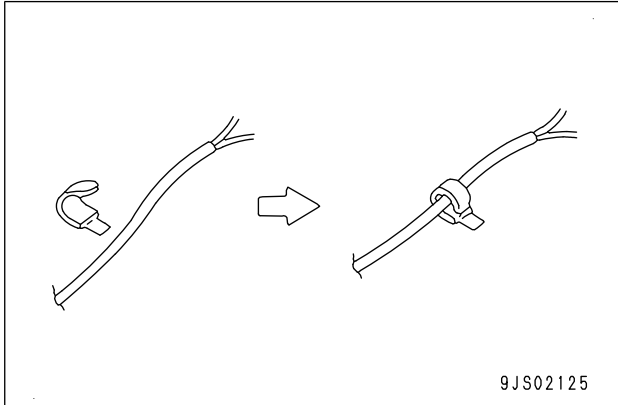
⚠ When replacing the air conditioner unit, air conditioner compressor, condenser or receiver drier, etc., collect the refrigerant (air conditioner gas: R134a) from the air conditioner circuit before disconnecting the air conditioner hoses.

- ★ Ask a qualified person for collecting, adding and filling operations of the refrigerant (air conditioner gas: R134a). (Only registered persons can work.)
- ★ Never release the refrigerant (air conditioner gas: R134a) to the atmosphere.

⚠ If refrigerant gas (air conditioner gas: R134a) gets in your eyes, you may lose your sight. And if it touches your skin, you may suffer from frostbite. Put on protective eyeglasses, gloves and working clothes with long sleeves while collecting the refrigerant or filling the air conditioner circuit with the refrigerant.

- When loosening the nuts fixing air conditioner hoses and tubes, be sure to use 2 wrenches; use one wrench to fix and use the other one to loosen the nut.

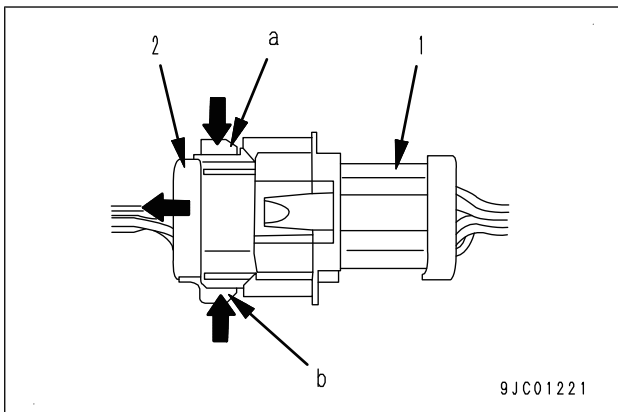
- If the connector clamp is removed, be sure to return it to its original position. And check that it is securely installed.



Handling of Deutsch connector (DT8-pin, DT12-pin)

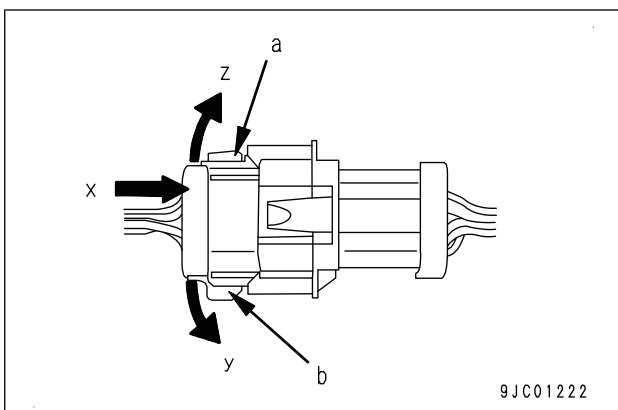
Disconnection

1. While pressing locks (a) and (b) from each side respectively, pull out female connector (2).



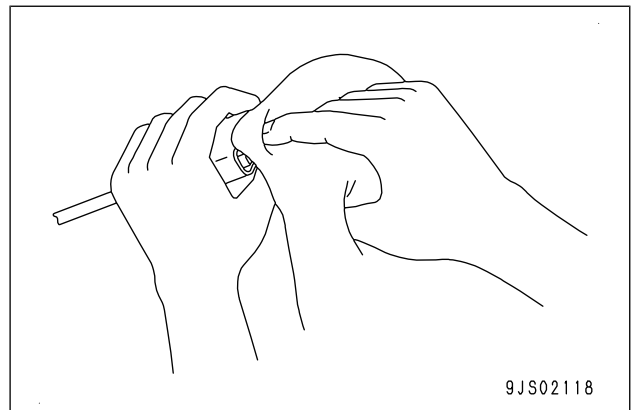
Connection

1. Push in female connector (2) horizontally until the lock clicks. (Arrow: x)
 2. Since locks (a) and (b) may not be set completely, push in female connector (2) with curving movement until the locks are set normally. (Arrow: x, y, and z)
- ★ Lock (a) in the figure is pulled down (not set completely), and lock (b) is set completely.

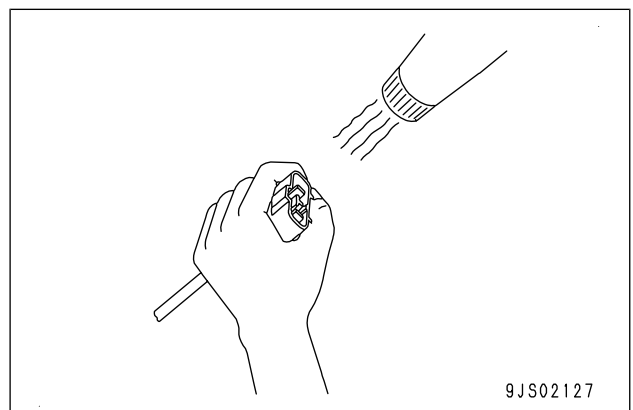


Drying wiring harness

- If there is any oil or dirt on the wiring harness, wipe it off with a dry cloth. Avoid washing by using steam. If the wire harness must be washed in water, do not apply high pressure water or steam directly to the wiring harness. If water gets directly on the connector, do as follows.
 1. Disconnect the connector and wipe off the water with a dry cloth.
 - ★ If the connector is to be blown with dry compressed air, there is a risk that oil in the air may cause defective contact of the conditioner, remove oil and water in the air before starting air blow.



2. Dry the inside of the connector with a dryer. If water gets inside the connector, use a dryer to dry the connector.
 - ★ Hot air from the dryer can be used, but regulate the time to use hot air in order to prevent the connector or related parts from becoming too hot, as it causes deformation or damage to the connector.

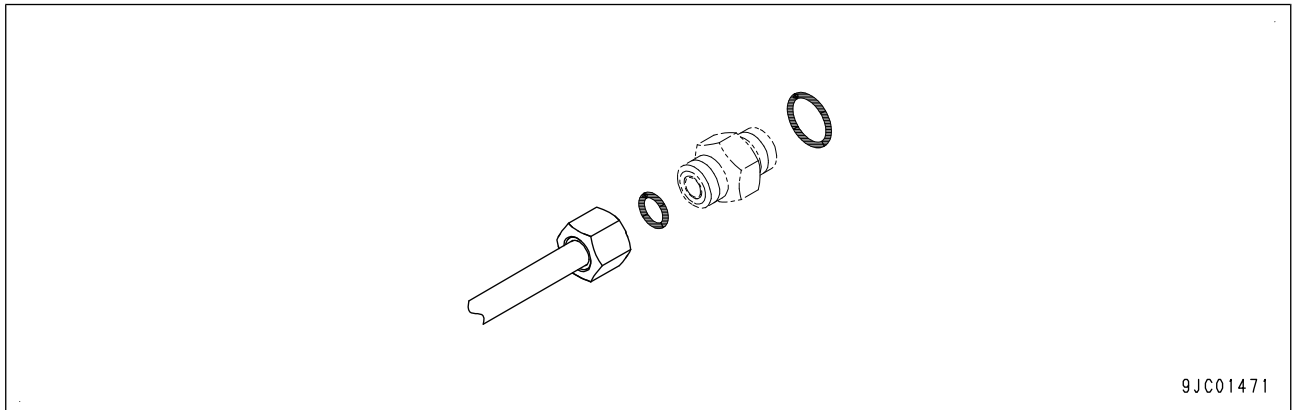


3. Perform a continuity test on the connector. After drying, leave the wiring harness disconnected and perform a continuity test to check for any short circuits between pins caused by water.
 - ★ After the connector is completely dried, blow the contact restorer and reassemble them.

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

Table of tightening torque for face seal joints

- ★ The tightening torque table below applies to the seal joint (sleeve nut type)
- ★ The table is applied to the threads coated with engine oil (wet threads).



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

Reference: The face seal joint of the dimension in () is also used, depending on the specification.

Tightening torque table for bolts and nuts on 102,107 and 114 series engines

- ★ Unless otherwise specified, tighten the metric threads bolts and nuts used on the 102, 107 and 114 series engines to the torques shown in the table below.

Thread diameter (mm)	Tightening torque (Nm {kgm})
6	10 ± 2 {1.02 ± 0.20}
8	24 ± 4 {2.45 ± 0.41}
10	43 ± 6 {4.38 ± 0.61}
12	77 ± 12 {7.85 ± 1.22}
14	—

Machine model	Unit	PC228USLC-10
Serial No.		1002 and up

Hydraulic system

Hydraulic pump		Variable displacement piston type (HPV125 + 125) x 2 pcs. 245 x 2 37.2 {380}
Type x quantity		
Discharged volume Set pressure		
Control valve		7-spool type x 1 piece Hydraulic
Type x quantity Operating method		
Travel motor		Variable displacement piston type (HVM120-2) x 2 pieces (with brake valve and parking brake)
Type x quantity		
Swing motor		fixed displacement piston type (KMF125ABE-6) x 1 piece (with safety valve and parking brake)
Type x quantity		
Boom cylinder		Double-acting piston type 130 90 1,385 3,255 1,870
Type		
Cylinder bore		
Piston rod diameter		
Stroke		
Max. distance between pins Min. distance between pins		
Arm cylinder (*4)		Double-acting piston type 135 95 1,490 3,565 2,075
Type		
Cylinder bore		
Piston rod diameter		
Stroke		
Max. distance between pins Min. distance between pins		
Bucket cylinder		Double-acting piston type 115 80 1,120 2,800 1,680
Type		
Cylinder bore		
Piston rod diameter		
Stroke		
Max. distance between pins Min. distance between pins		
Hydraulic tank	-	Box-shaped sealed type
Hydraulic oil filter	-	Tank return side
Hydraulic oil cooler	-	Air-cooled type (CF91)

*4: With cushions on head side and bottom side.

- When EGR valve (7) opens, a part of the exhaust gas (EGR gas) flows from exhaust manifold (12) through EGR piping to EGR cooler (6).
- The exhaust gas cooled by EGR cooler (6) flows through EGR valve (7) and mixes with the intake air in the air intake connector, and then flows in the air intake manifold (14).

4. No.2 planetary gear (number of teeth: 19)
5. No. 1 planetary carrier
6. No.1 planetary gear (number of teeth: 20)
7. Swing motor
8. No. 1 sun gear (number of teeth: 17)
9. Ring gear (number of teeth: 58)
10. Swing machinery case
11. Drain plug
12. Dipstick
13. Oil filler cap

Specifications (PC228-J130-030-K-00-A)

Reduction ratio	$((17 + 58)/17) \times ((18 + 58)/18) = 18.627$
Swing reduction ratio	$18.627 \times (96/13) = 137.553$
Swing speed (rpm)	11.0

- 15. Spline
- 16. Bearing
- 17. LS valve

Structure

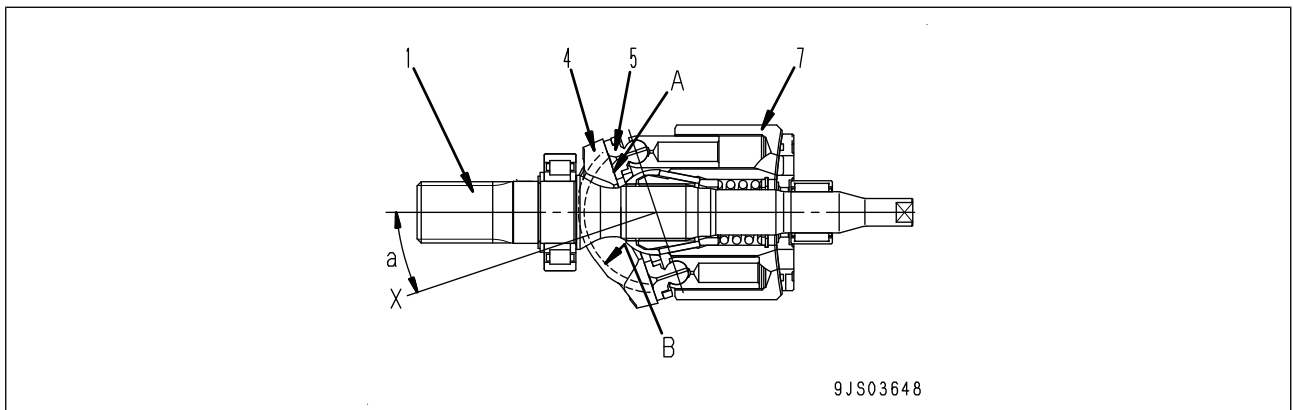
- This pump consists of 2 variable displacement swash plate type piston pumps, PC valve, LS valve, EPC valve, and swash plate sensor.
- Cylinder block (7) is supported to shaft (1) by spline (15).
- Shaft (1) is supported by each bearing (16) at the front and rear.
- The tip of piston (6) is shaped as a concave sphere and crimped together with shoe (5).
- Piston (6) and shoe (5) form a spherical bearing.
- Rocker cam (4) has flat surface (A), and shoe (5) is always pressed against this surface while sliding in a circular pattern.
- Rocker cam (4) rocks on cylindrical surface (B) of cradle (2) fixed to the case. High-pressure oil is supplied between them to form a static pressure bearing.
- Piston (6) moves relatively in the axial direction in each cylinder chamber of cylinder block (7).
- Cylinder block (7) rotates relative to valve plate (8) while sealing the pressurized oil.
- The oil pressure is balanced properly on this surface.
- The pressurized oil is sucked in and discharged from each cylinder chamber in cylinder block (7) through valve plate (8).

Function

- It converts the rotation and torque of the engine transmitted to pump shaft (1) into hydraulic pressure and discharges pressurized oil in accordance with the load.
- It is possible to change the discharged volume by changing the swash plate angle.

Operation (PC220-C200-044-K-00-A)

- Cylinder block (7) rotates together with shaft (1) and shoe (5) slides on plane (A).
- Rocker cam (4) moves along cylindrical surface (B). As a result, angle (a) between center line (X) of rocker cam (4) and the axis of cylinder block (7) changes.
- Angle (a) is called the swash plate angle.

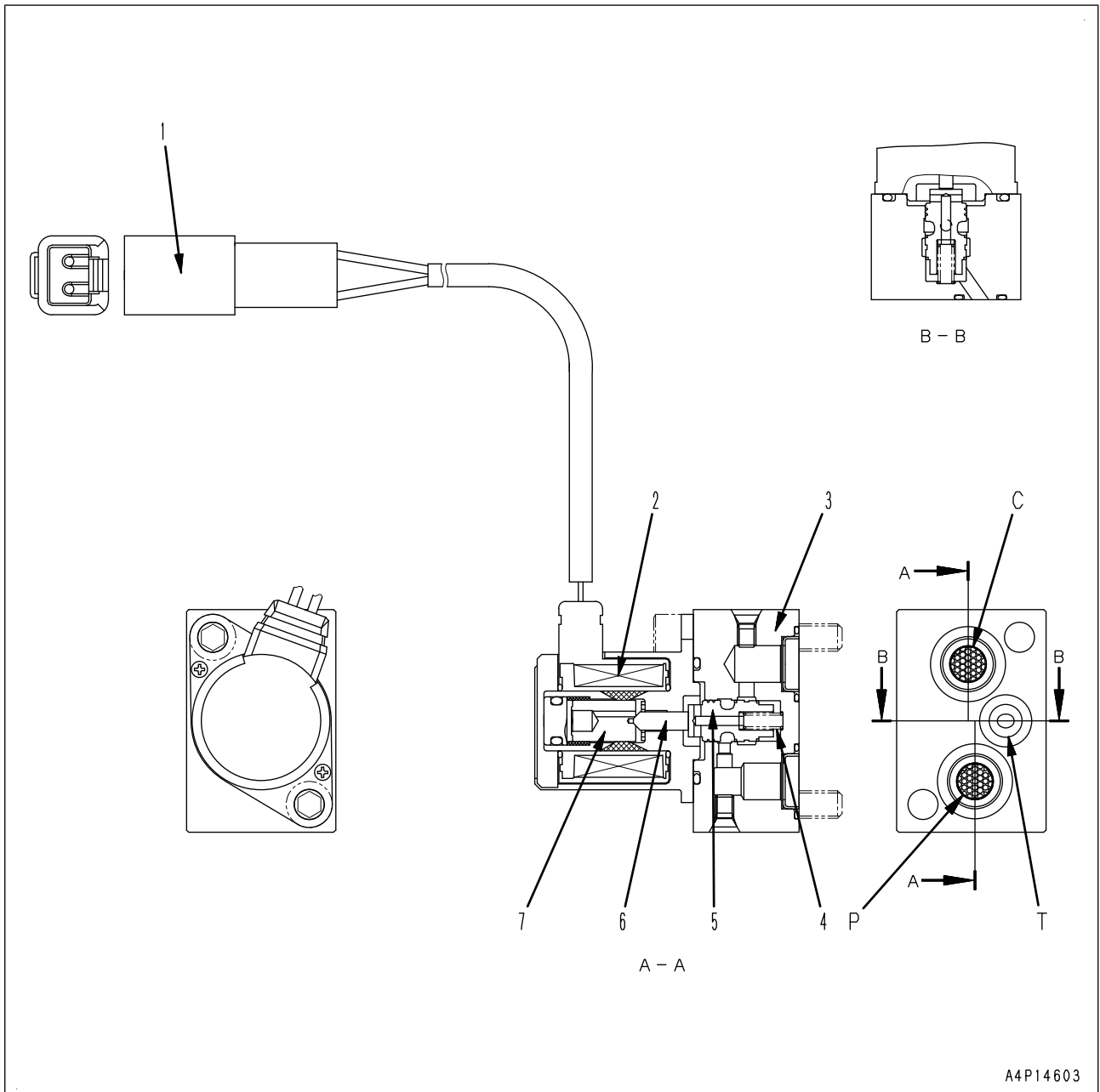


- If swash plate angle (a) is made between center line (X) of rocker cam (4) and the axis of cylinder block (7), plane (A) functions as a cam against shoe (5).
- Piston (6) reciprocates inside cylinder block (7) and a difference is made between volumes (E) and (F) in cylinder block (7).
- Each piston (6) sucks and discharges oil by (F) - (E).
- Oil is discharged while cylinder block (7) rotates and the volume of chamber (E) decreases.
- The volume of chamber (F) grows larger and, in this process, the oil is sucked.

LS-EPC valve (HB380-C2M0-041-K-00-A)

★ LS: Abbreviation for Load Sensing

★ EPC: Abbreviation for Electromagnetic Proportional Control



C: To LS valve

P: From self-pressure reducing valve

T: To hydraulic tank

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

- 9. Suction safety valve (arm IN)
- 10. Cooler check valve
- 11. Check valve for regeneration circuit
- 12. Suction valve (arm OUT)
- 13. Pressure compensation valve (arm OUT)

R.H. travel valve

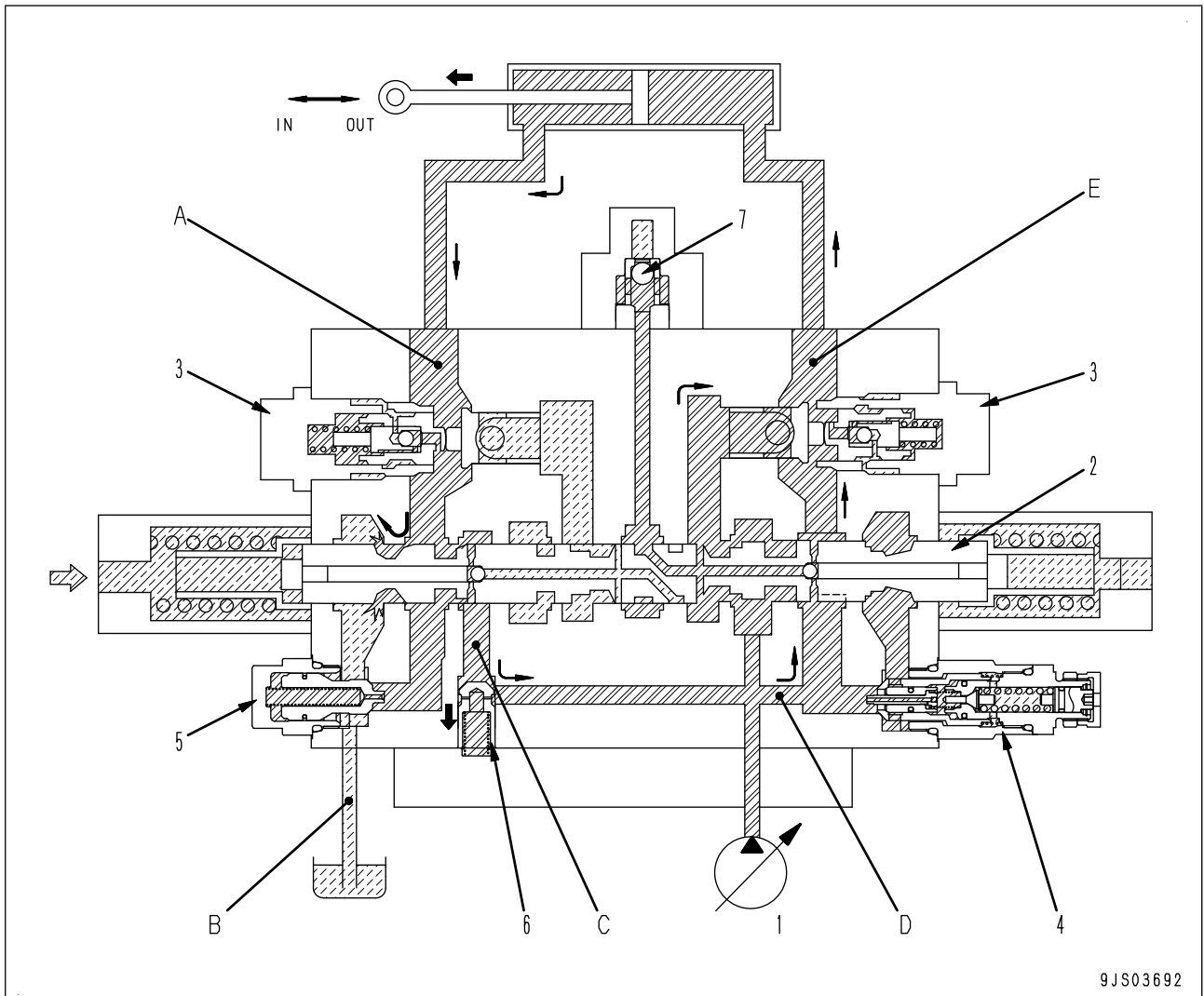
- 14. Pressure compensation valve (REVERSE)
- 15. LS shuttle valve
- 16. Pressure compensation valve (FORWARD)
- 17. Spool
- 18. Suction valve (FORWARD)
- 19. Suction valve (REVERSE)

Swing valve

- 20. Pressure compensation valve (right)
- 21. LS selector valve
- 22. Pressure compensation valve (left)
- 23. Spool

Arm regeneration circuit (PC220-L911-040-K-00-A)

When cylinder head pressure is higher than bottom pressure



9JS03692

1. Main pump
2. Arm valve spool
3. Pressure compensation valve
4. Suction safety valve
5. Suction valve
6. Check valve
7. LS shuttle valve

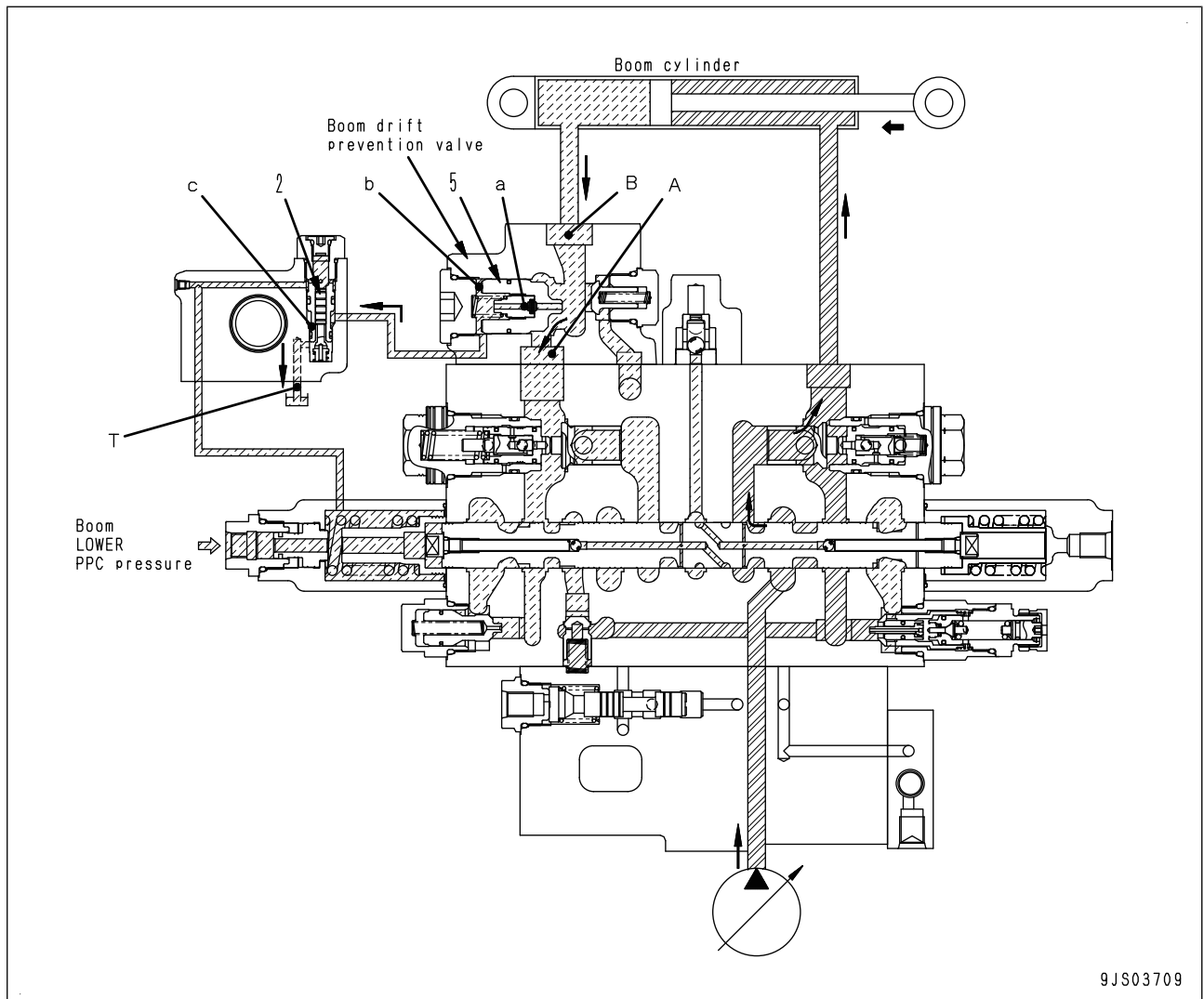
Function

- The regeneration circuit installed between the cylinder head and cylinder bottom increases the oil flowing to the cylinder bottom (pump discharged volume + regeneration flow) during arm IN operation in order to accelerate the cylinder.

Operation

- When the cylinder head pressure is higher than the bottom pressure, part of pressurized oil (A) from the cylinder head flows to drain circuit (B) through the notch of arm spool (2).
- The remaining oil flows to the regeneration circuit (C), opens check valve (6), and flows to the cylinder bottom through circuit (D).
- Flow from regeneration circuit (C) merges into the oil from pump (1) in circuit (E).

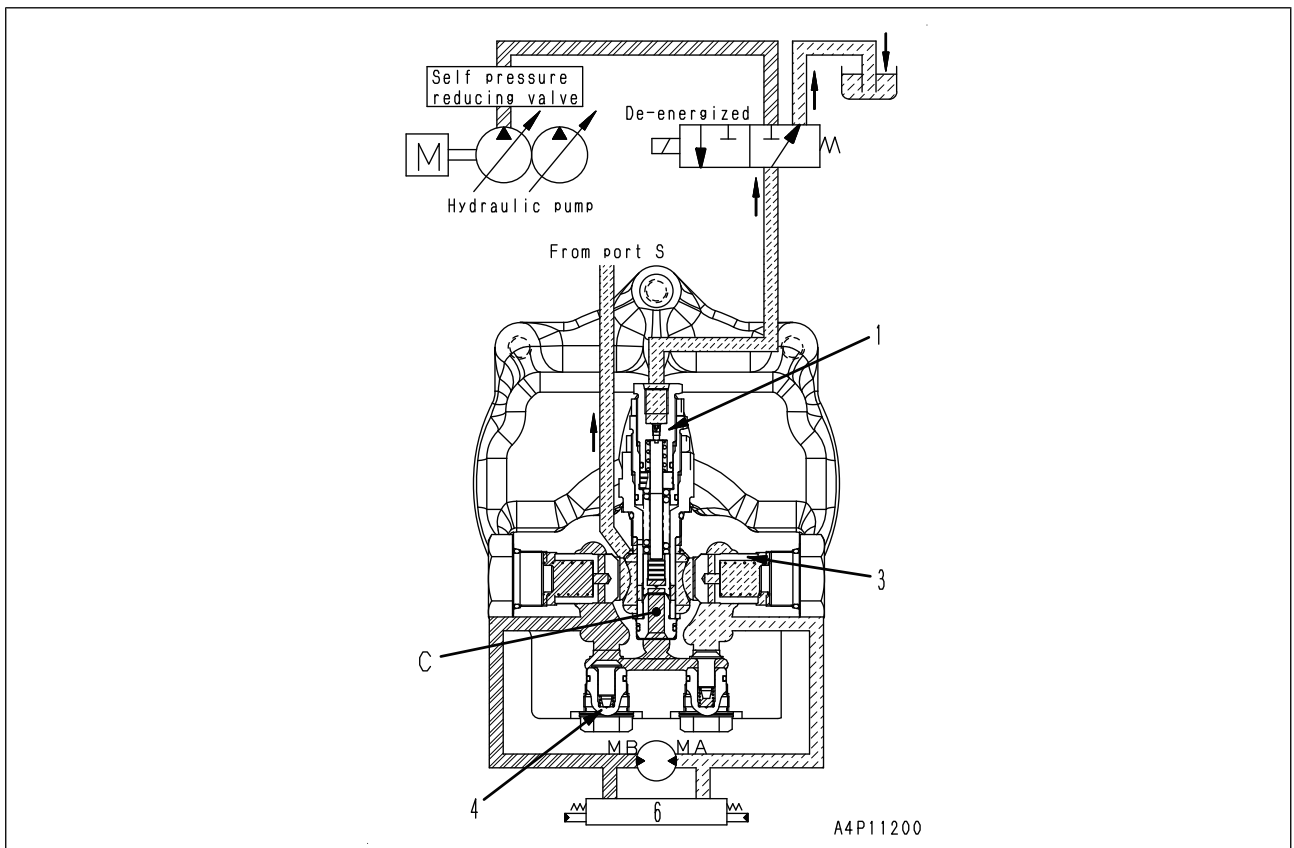
In boom "LOWER" operation



9JS03709

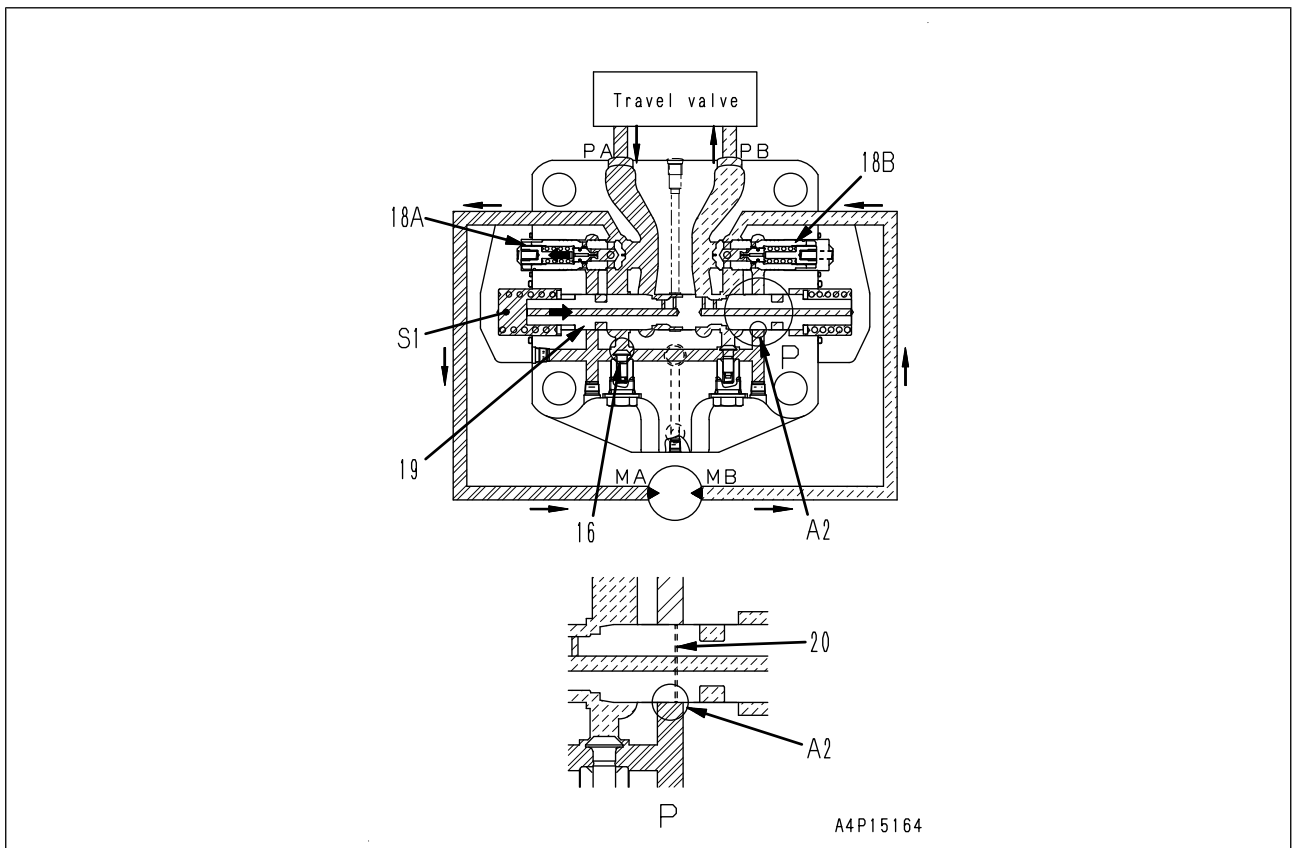
- When operating boom "LOWER", the pilot pressure from the PPC valve pushes pilot piston (2).
- The pressurized oil of the boom cylinder bottom flows from orifice (c) to drain port (T) through orifice (a) and chamber (b).
- Chamber (b) inside poppet and drain port (T) are interconnected, and the pressure of chamber (b) drops.
- As the pressure of chamber (b) becomes less than the pressure of port (B), poppet (5) opens.
- As poppet (5) opens, the pressurized oil from port (B) flows to port (A) and then flows to the control valve.

When swing is stopped



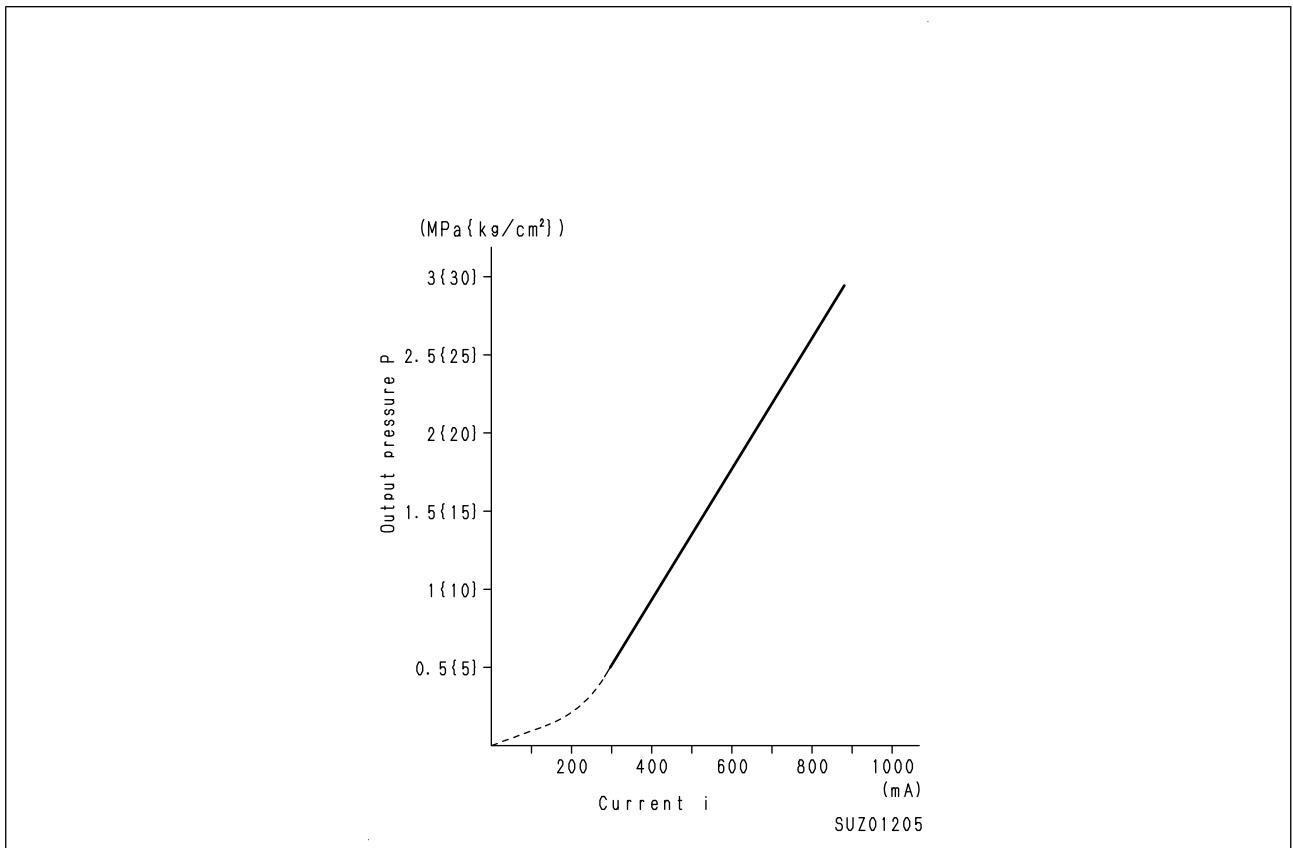
- When the swing control lever is returned to "NEUTRAL" from "swing RIGHT" position, the supply of pressurized oil from the pump to port (MA) is stopped.
- The pressurized oil from the motor outlet cannot return to the tank since the return circuit to the tank is blocked by control valve (6). Thus, pressure in port (MB) increases.
- If the pressure in port (MB) becomes too high, the pressurized oil returns to the hydraulic tank through relief valve (1) and port (S).
- Rotation resistance is exerted on the motor and the brake starts working.
- If the pressure in port (MB) becomes higher than that in port (MA), it presses shuttle valve (4).
- The pressure in chamber (C) becomes the same as that in port (MB), and increases to the set pressure of relief valve (1).
- A high braking torque works on the motor, thereby stopping the motor.
- While relief valve (1) is actuated, the relieved pressurized oil and the pressurized oil from port (S) are routed to port (MA) through the check valve (3).
- Thus, cavitations in port (MA) is prevented.

When starting travel (or when traveling normally)



- When the travel lever is operated, the pressurized oil from the pump moves spool (19) to the right.
- The pressurized oil flows to suction safety valve (18B) through check valve (16) and port (A2).
- Since the pressurized oil flowing through the circuit is throttled at notch (20), the pressure difference between the inlet side and outlet side increases.
- The pump pressure rises and the large drawbar pull is obtained.

Function (PC-PL2B-042-K-00-A)

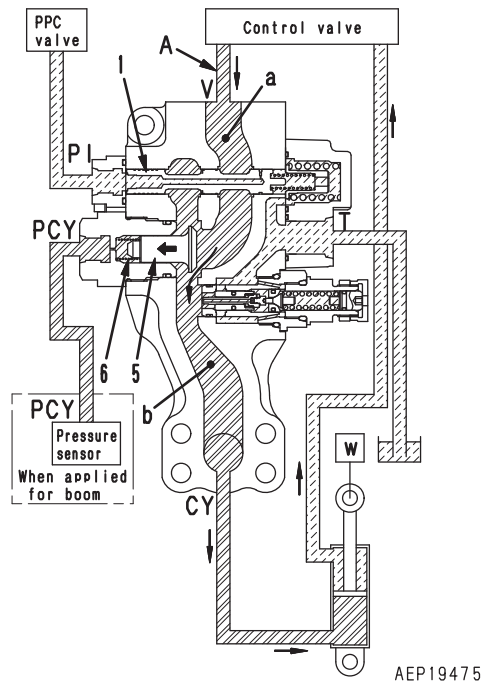


- The EPC valve consists of the proportional solenoid part and the hydraulic valve part.
- When a signal current (i) from the pump controller is received, the EPC output pressure proportional to the amperage of current is generated and outputted to the control valve.

When there is no damage in the piping

1. When there is a damage in the piping (A) between the control valve and the work equipment cylinder, chamber (a) and chamber (b) are disconnect
2. The pressure of the work equipment is held to prevent the work equipment from sudden lowering.

When the pressurized oil flows from the control valve to the work equipment cylinder



When there is no damage in the piping

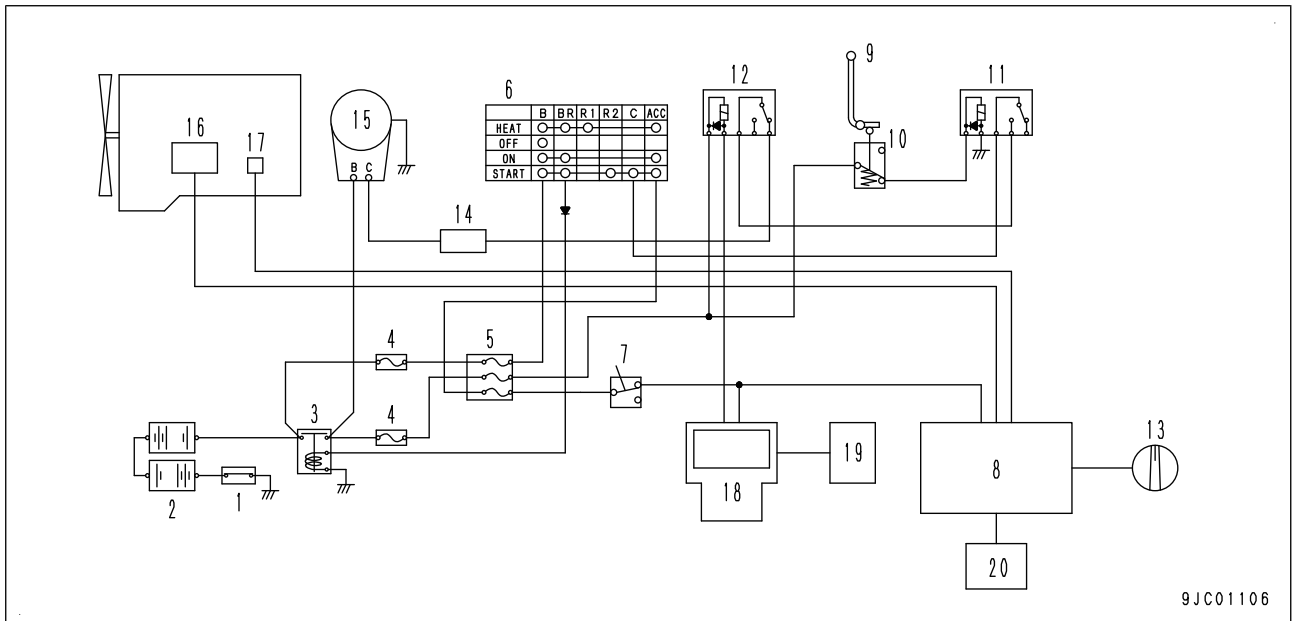
1. The pressurized oil which is led from the control valve to chamber (a) becomes higher than the combined force of the pressure of chamber (b) of work equipment cylinder circuit and spring (6).
2. Check valve (5) opens, and chamber (a) and chamber (b) are connected.
3. The pressurized oil flows from the control valve to the work equipment cylinder.

When there is a damage in the piping

When there is a damage in the piping

1. When there is a damage in the piping (A) between the control valve and the work equipment cylinder, the pressurized oil of chamber (a) leaks through the damaged part to the outside.
2. The pressure of chamber (a) drops. The pressure of chamber (a) becomes lower than the combined force of the pressure of chamber (b) and spring (6).
3. Check valve (5) closes, and chamber (a) and chamber (b) are disconnected.
4. The pressure of the work equipment is held to prevent the work equipment from sudden lowering.

Engine control function (PC220-AK60-042-K-00-A)



1. Battery disconnect switch
2. Battery
3. Battery relay
4. Fusible link
5. Fuse box
6. Starting switch
7. Engine shutdown secondary switch
8. Engine controller
9. Lock lever
10. PPC lock switch
11. Starting motor cut-off relay (for PPC lock)
12. Starting motor cut-off relay (for personal code)
13. Fuel control dial
14. Safety relay
15. Starting motor
16. Fuel supply pump
17. Sensors
18. Machine monitor
19. KOMTRAX terminal
20. Pump controller

Function

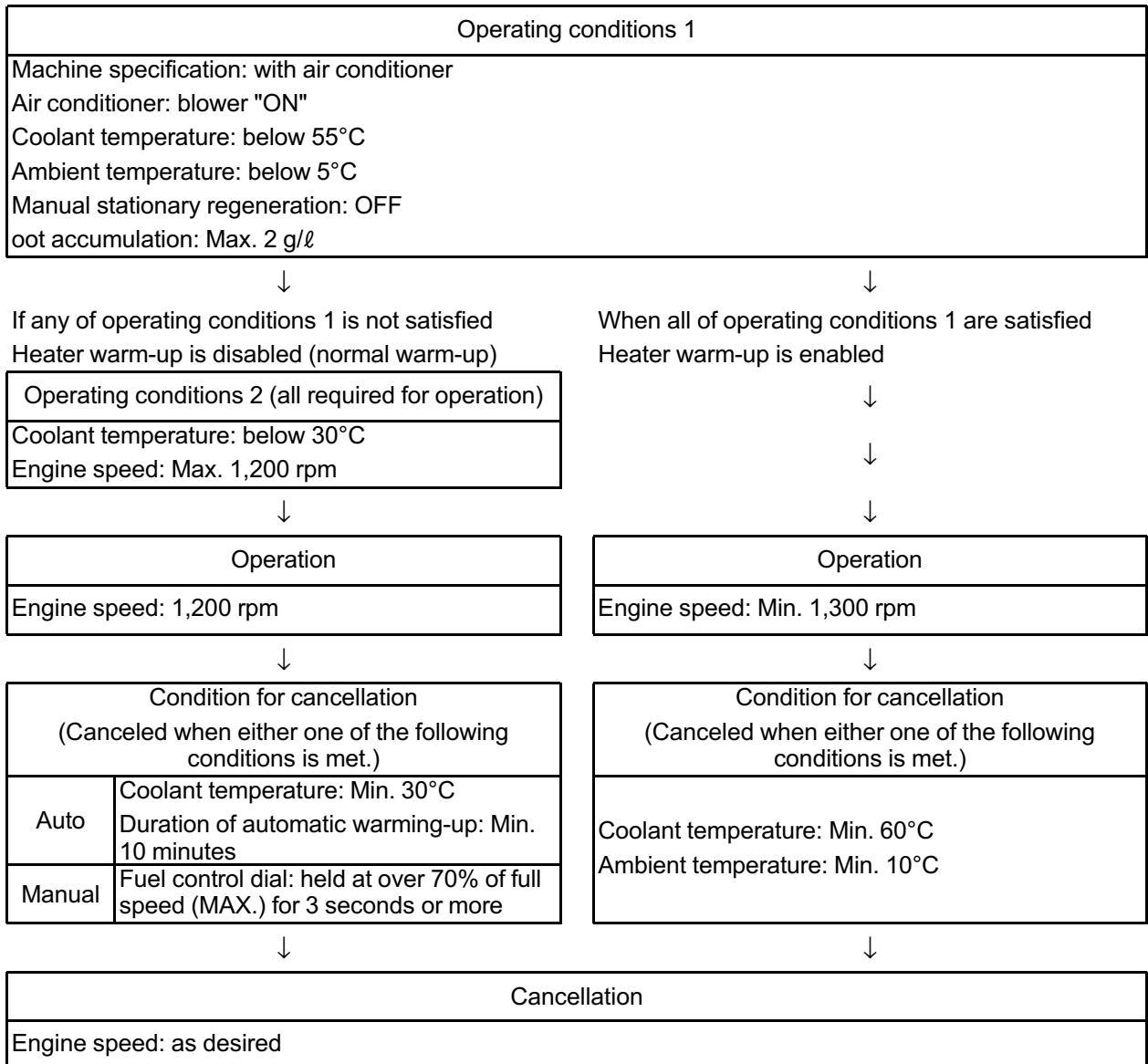
- The neutral safety circuit is employed to secure safety when the engine is started.
 - ★ The engine does not start until the lock lever is set to the "LOCK" position.
- The KOMTRAX engine cut circuit is employed to disable the engine from starting when the KOMTRAX terminal receives an engine cut command issued through external operation.
- When you cannot stop the engine due to stuck starting switch (6), engine shutdown secondary switch (7) is usable for stopping the engine.

Starting the engine

- If starting switch (6) is turned to "ON" position, engine controller (8) sends command current to fuel supply pump (16).

Function

- This is a function that raises the engine speed automatically to warm up the engine if the coolant temperature is low after start-up of the engine.
- There are two types of the engine automatic warm-up function depending on the purpose; one is "Heater warm-up" and the other is "Normal warm-up"
- The purpose of the heater warm-up is to raise the coolant temperature and improve the heater efficacy.
- The purpose of the normal warm-up is to warm up the engine to prevent it from being damaged by operation in low temperature.



- 17a. Self-pressure reducing valve
- 17b. Merge-divider valve
- 17c. Travel junction valve
- 18. Attachment selector solenoid valve
- 19. PPC lock solenoid valve
- 20. Oil flow rate adjuster EPC valve for attachment
- 21. Front pump PC-EPC valve
- 22. Rear pump PC-EPC valve
- 23. Attachment circuit selector valve (high pressure side)
- 24. Attachment circuit selector valve (low pressure side)
- 25. Attachment
- 26. Accumulator

Input and output signals

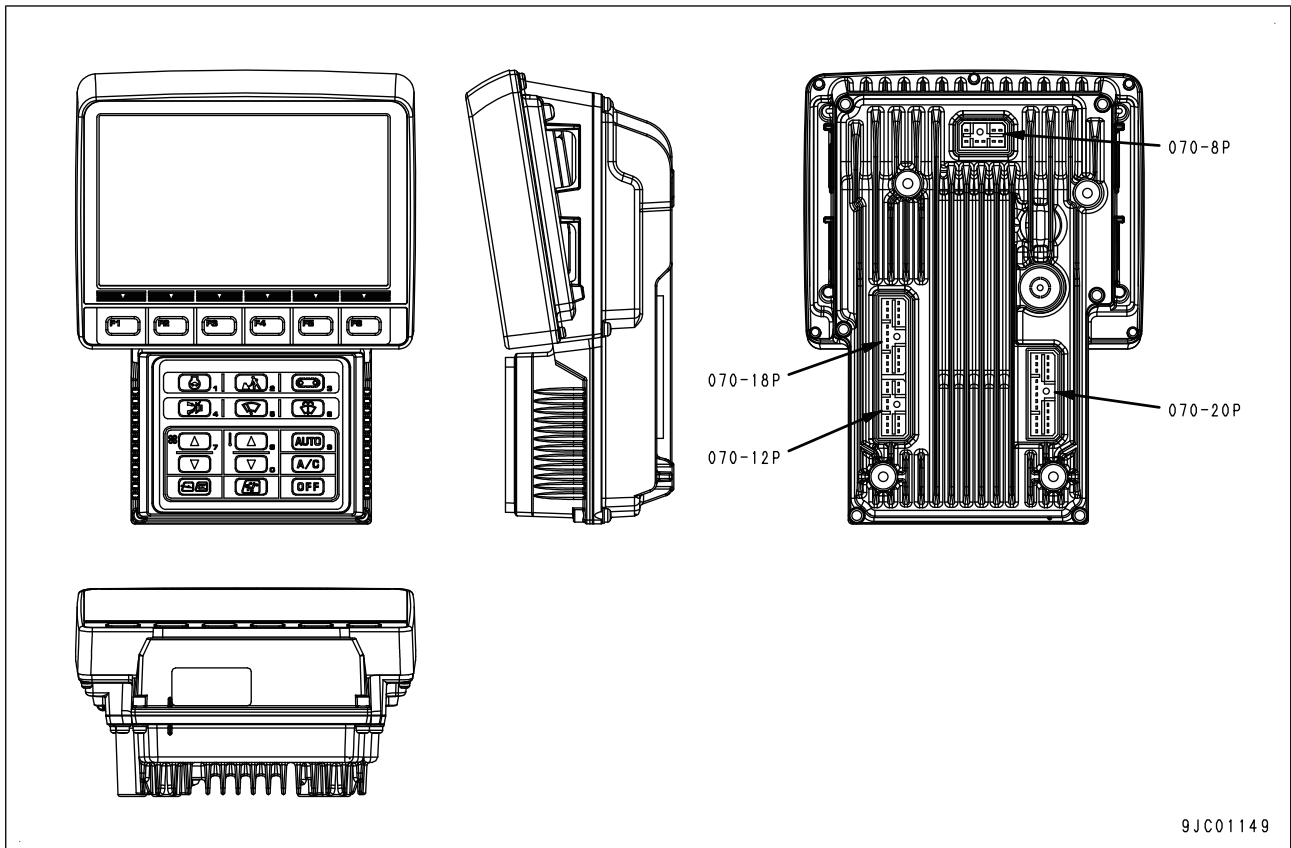
- a. Front pump PC-EPC valve drive signal
- b. Rear pump PC-EPC valve drive signal
- c. Solenoid valve GND
- d. CAN signal
- e. Attachment selector solenoid valve drive signal
- f. Oil flow rate adjuster EPC valve drive signal for attachment
- g. Oil pressure switch signal
- h. 1st throttle signal
- i. Fuel supply pump control signal
- j. Sensor signals

Function

- Setting of the working mode and oil flow rate on the machine monitor allows controlling the oil flow rate to the attachment when the attachment control pedal is fully depressed.
- Attachment operation switches depending on the working mode as shown below.

Working mode	Attachment operation
ATT/P, ATT/E	Double-acting
B	Single-acting

Machine monitor (PC-Q180-042-K-01-A)



9JC01149

Function

- The machine monitor has monitor display function, mode selection function and switch function for electrical parts etc. Also it has an alarm buzzer.
- The machine monitor has a CPU (Central Processing Unit) in it to process, display, and output the information.
- The machine monitor consists of a display and switches: the display is of LCD type, and the switches are of flat sheet switch.
- If a failure occurs in the machine monitor itself, controller or wiring circuit between monitor and controller, the monitor does not display properly.

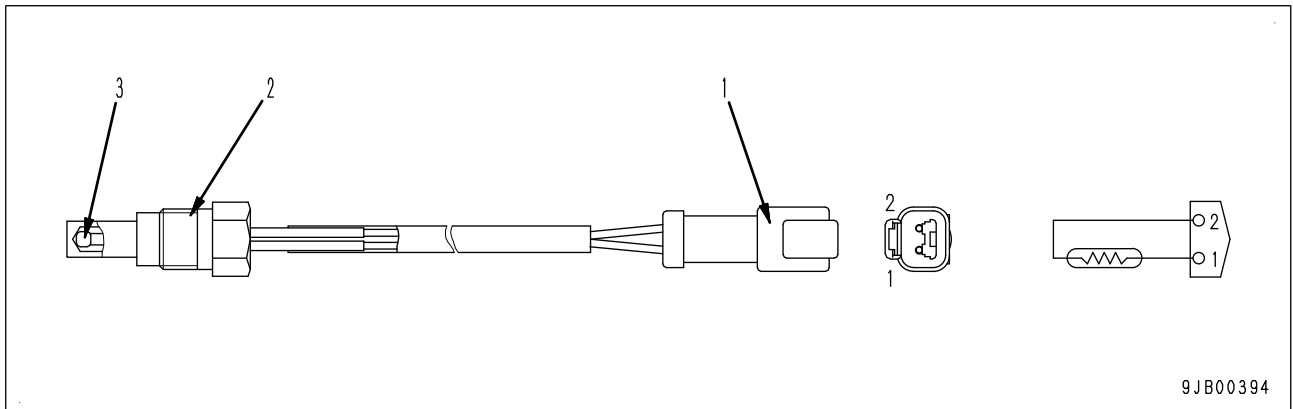
Precautions on the machine monitor display

- One of the features of liquid crystal display panels is that there may be black spots (spots that do not light up) or white spots (spots that stay lit up) on the screen. If there are fewer than 10 black or white spots, this is not a failure or a defect. Products having 10 or less black or bright spots conform the product specification; such the condition is quite normal.
- When the engine is started, the battery voltage may drop suddenly, depending on the ambient temperature and the condition of the battery. In this case, the machine monitor display may go off for a moment. However, this phenomenon is not a failure.
- Continuous operation of the machine monitor may display blue bright spots on the screen having a black background; it is quite normal. Blue bright spots can never be a problem as the screen has usually blue or white background. (White in the LCD is made up of red, green and blue.)

Z: When any item is detected as the maintenance due time is over.

- ★ For how to operate the operator mode functions, see the Operation and Maintenance Manual or "Operator mode (Outline)" section in Testing and adjusting.
- ★ For the operating method of the engine start lock function, see "Password setting and canceling manual".

Hydraulic oil temperature sensor (PC-PMT1-041-K-00-A)



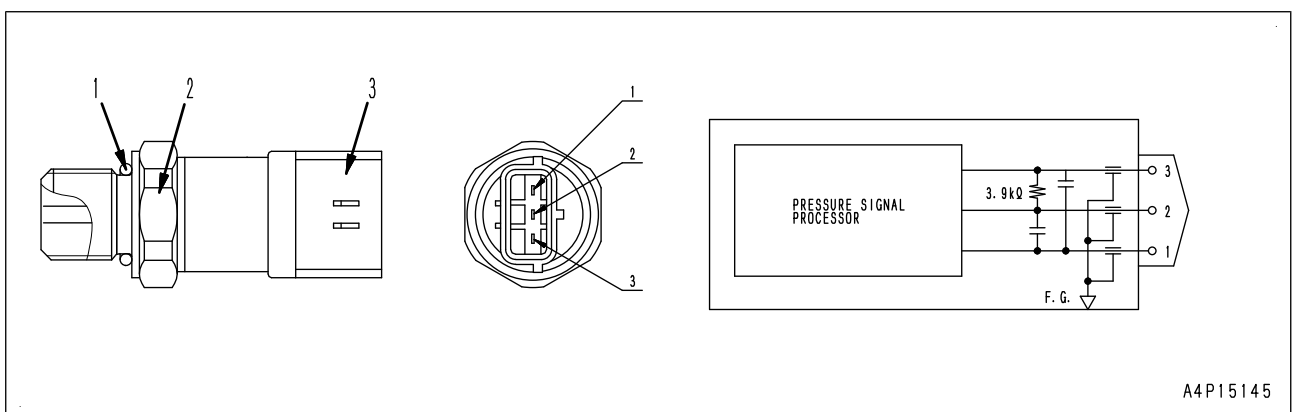
9JB00394

1. Connector
2. Plug
3. Thermistor

Function (PC-PMT1-042-K-00-A)

- This sensor, installed on the suction pipe of main pump, senses the temperature variation as the change in thermistor resistance, and outputs the corresponding signals.

Front pump oil pressure sensor (PC228-C3W4-041-K-00-A)



A4P15145

1. O-ring
2. Sensor
3. Connector

Function (PC-C3W4-042-K-00-A)

- The sensor is installed in the control valve. It detects the delivery pressure of the front pump and outputs variable voltage signal.

• Time lag

Machine model			PC228USLC-10	
Item	Measurement condition	Unit	Standard value for new machine	Repair limit
Boom time lag	<ul style="list-style-type: none"> Hydraulic oil temperature: 45 to 55°C Engine: Low idle Power mode (P) Set the boom to the maximum RAISE position. Move boom control lever to LOWER position. Measure the time before front of machine starts lifting off the ground after work equipment touches the ground. For measuring posture, see "Work equipment 5" 	sec.	Max. 1.0	Max. 1.2
Arm time lag	<ul style="list-style-type: none"> Hydraulic oil temperature: 45 to 55°C Engine: Low idle Power mode (P) Set the arm to the maximum dump position. Move arm control lever to digging side. Measure the time before the arm starts moving to the digging side again after the arm tentatively stops once near the vertical position. For measuring posture, see "Work equipment 6" 	sec.	Max. 2.0	Max. 2.8
Bucket time lag	<ul style="list-style-type: none"> Hydraulic oil temperature: 45 to 55°C Engine: Low idle Power mode (P) Set the bucket to the maximum dump position. Move bucket control lever to digging position. Measure the time before the bucket starts moving to the digging side again after the bucket tentatively stops near the vertical position. For measuring posture, see "Work equipment 7" 	sec.	Max. 1.0	Max. 3.6

• Oil leakage

Machine model			PC228USLC-10	
Item	Measurement condition	Unit	Standard value for new machine	Repair limit
Cylinder internal oil leakage	<ul style="list-style-type: none"> Hydraulic oil temperature: 45 to 55°C Engine: High idle 	cc/min	4.5	20
Center swivel joint oil leakage	<ul style="list-style-type: none"> Leakage for 1 minute during relief of cylinder to be measured or travel motor 	cc/min	10	50


HYDRAULIC EXCAVATOR

PC228USLC-10

Model Serial Number

PC228USLC- 1002 and up
10

30 Testing and adjusting

 **Holder (8) mounting bolt:**

$8 \pm 0.8 \text{ Nm}$ { $0.82 \pm 0.08 \text{ kgm}$ }

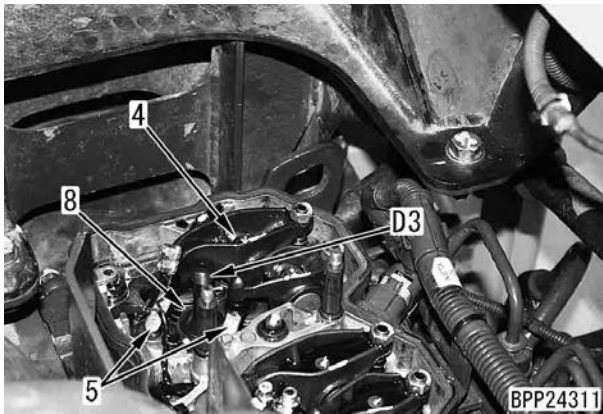
11. Install crosshead assembly (5) and rocker arm assembly (4).

 **Rocker arm assembly (4) mounting bolt:**

$36 \pm 5 \text{ Nm}$ { $3.67 \pm 0.51 \text{ kgm}$ }

12. Adjust the valve clearance.

★ See "Testing and adjusting valve clearance".



13. Connect connectors (11) to (15).

- Connector (11): KVGT position sensor (SVGT)
- Connector (12): KVGT speed sensor (VGT_REV)
- Connector (13): Connector box (INTER CONNECT)
- Connector (14): EGR gas temperature sensor (EXHAUST GAS TEMPERATURE)
- Connector (15): Intermediate connector (INJ CYL 1&2)

14. Connect hoses (16) and (17) and tube (18).

- Hose (16): KVGT control pressure circuit

 **Hose (16):**

$25 \pm 1.5 \text{ Nm}$ { $2.55 \pm 0.15 \text{ kgm}$ }

- Hose (17): KVGT drive hydraulic circuit

 **Hose (17):**

$15 \pm 1 \text{ Nm}$ { $1.53 \pm 0.1 \text{ kgm}$ }

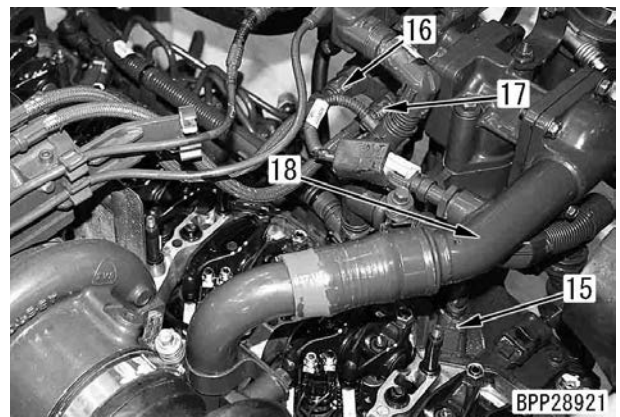
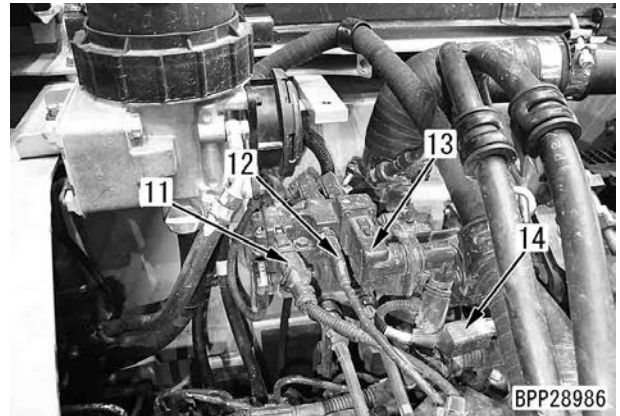
- Tube (18): EGR circuit

 **EGR circuit tube (18) (Flange side):**

$24 \pm 4 \text{ Nm}$ { $2.45 \pm 0.41 \text{ kgm}$ }

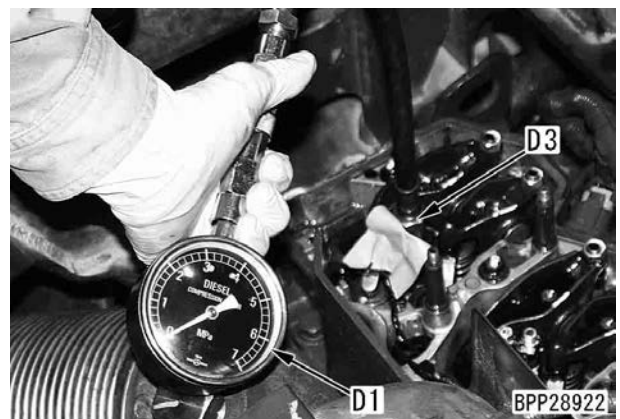
 **EGR circuit tube (18) (Tube side):**

$10.5 \pm 0.5 \text{ Nm}$ { $1.07 \pm 0.05 \text{ kgm}$ }



15. Connect gauge assembly D1 to adapter D3.

★ If a small amount of oil is applied to the connecting parts of gauge assembly D1 and adapter D3, air will not leak easily.



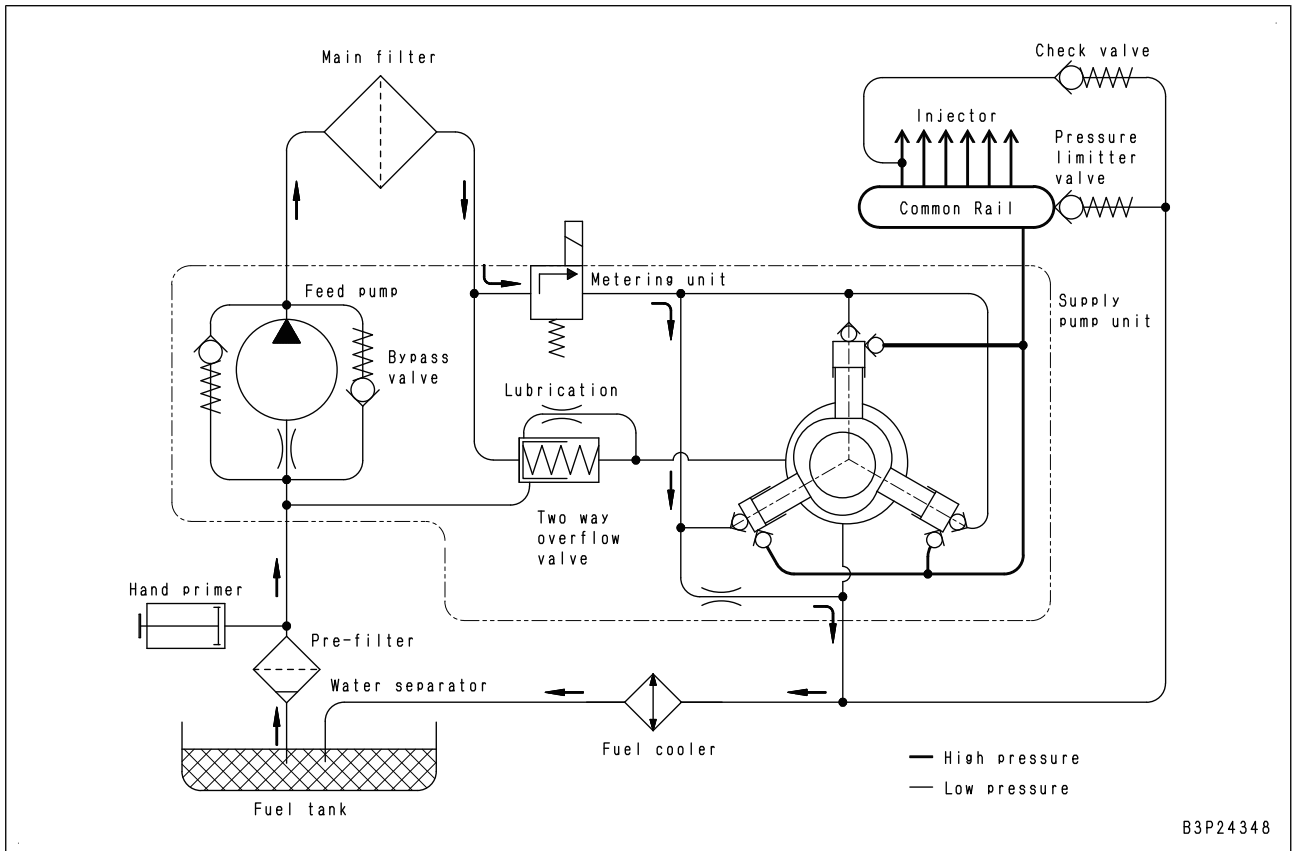
16. Set the machine monitor to "No Injection"

★ Turn the battery disconnect switch to ON position, then turn the starting switch to ON position.

★ For the method to set to "No Injection", see "Special functions of machine monitor".

Route for bleeding air from fuel circuit

Fuel tank → prefilter → feed pump → main filter → metering unit → fuel tank



Testing oil pressure of control circuit (PC228-C010-360-K-00-A)

★ Testing tools

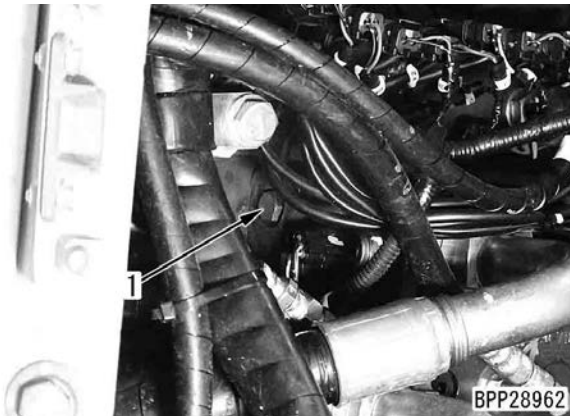
Symbol	Part No.	Part name
N 1	796T-440-1160	Sensor adapter (5 MPa {50 kg/cm ² })
	796-440-1150	• Wiring harness
	799-401-2350	• Washer
	790-261-1130	• Coupling
	7861-93-1840	• Pressure sensor
2	799-101-5220	Nipple (M10 x 1.25 mm)
	07002-11023	O-ring
3	799-101-5002	Hydraulic tester
	790-261-1204	Digital hydraulic tester

⚠ Lower the work equipment to the ground and stop the engine. Operate the control levers several times to release the remaining pressure in the piping, and then loosen the oil filler cap of the hydraulic tank slowly to release the internal pressure.

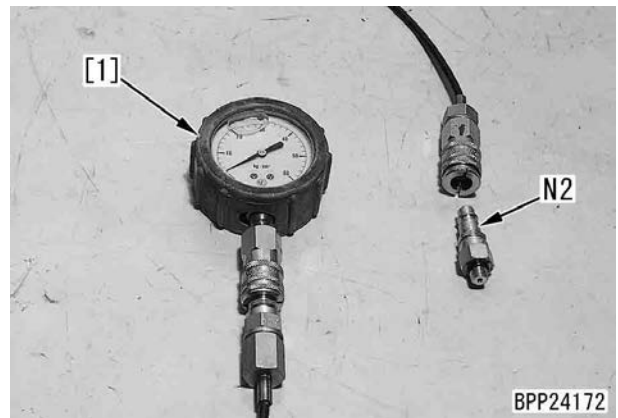
- ★ Check this item under the following conditions.
- Hydraulic oil temperature: 45 to 55°C

Testing (PC228-C010-362-K-00-A)

1. Remove oil pressure pickup plug (1) of the control valve.

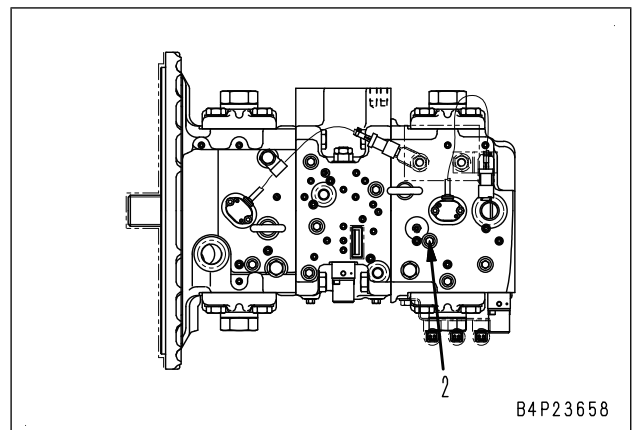


2. Install nipple N2, and connect it to oil pressure gauge [1] of hydraulic tester N3.
 - ★ Use the oil pressure gauge of 6.0 MPa {60 kg/cm²}.
 - ★ When installing nipple N2, be sure to install O-ring N2.
 - ★ The nipple and hose of the digital hydraulic tester can also be used.



3. Start the engine to increase the hydraulic oil temperature to 45 to 55°C.
4. Measure the hydraulic oil pressure, when the engine is running at full speed and all the control levers are set to NEUTRAL.
5. After finishing the test, remove the testing tools, and restore the machine.

- ★ Do not adjust the relief valve for the control circuit pressure.
- ★ The control circuit oil pressure may be tested at EPC source pressure pickup port plug (2) (P_{EPC}) (front side of machine) on the main pump.



Adjusting play of work equipment and swing PPC valves (ALL-PL28-001-K-00-A)

- ★ If the right and left work equipment levers have large play, adjust them according to the following procedure.
- ★ The play of the lever measured at a position of 200 mm from the pivot must be 0.5 to 3 mm.

Adjusting (PC-PL28-270-K-00-A)

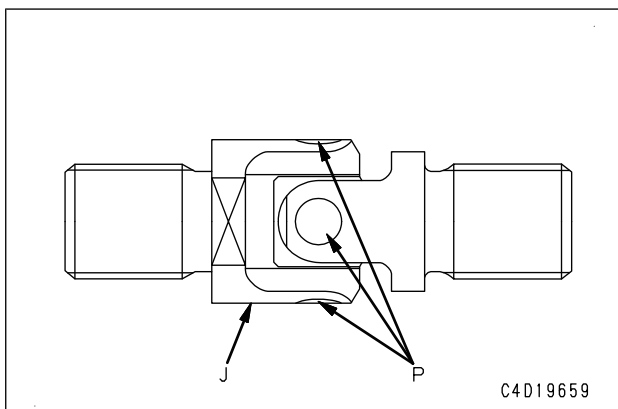
1. Remove boot (1).
2. Loosen lock nut (2) and tighten disc (3) until it comes in contact with the heads of pistons (4) (4 pieces).

★ At this time, do not move the pistons.

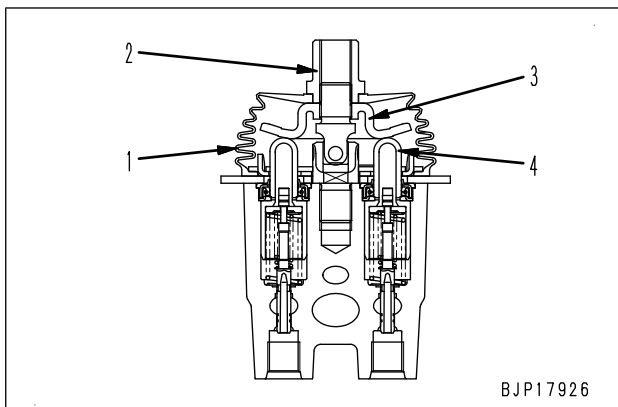
3. While fixing disc (3), tighten lock nut (2) to the specified torque.

 **Locknut: 68 to 88 Nm (7 to 9 kgm)**

4. Apply gear oil and grease (G2-L1) to the rocking portions of the joint.
Apply gear oil and grease (G2-L1) to the rocking portions of the joint.
(Portion J):
Apply grease (G2-L1) of 7 to 10 ml all around.
(Portion P):
Apply gear oil of 0.2 to 0.4 ml to the sliding parts (4 places) of the joints and pins.




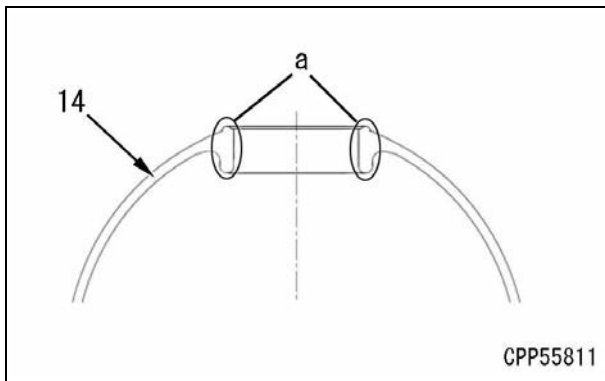
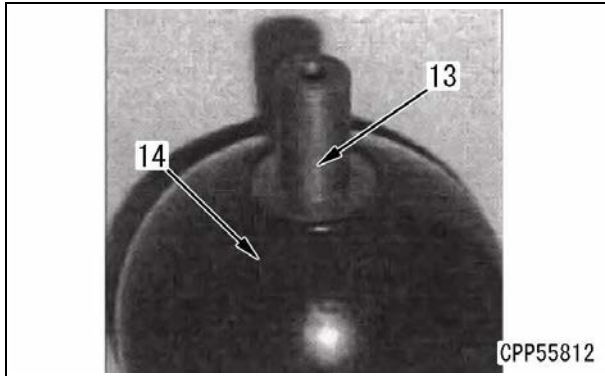
5. Install boot (1).



Assembly

1. Install the valve stem (13) to the bladder (14).
★ Check that the bladder (14) fits in the groove of the valve stem (13).

 Bladder seal part (a): **Grease (G2-LI)**

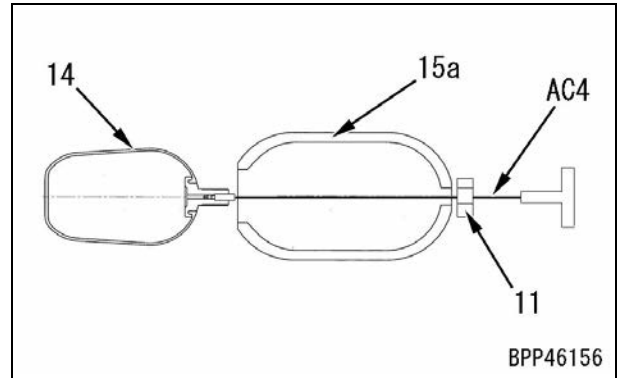


2. For lubrication, apply the hydraulic oil to the whole surface of the bladder (14).

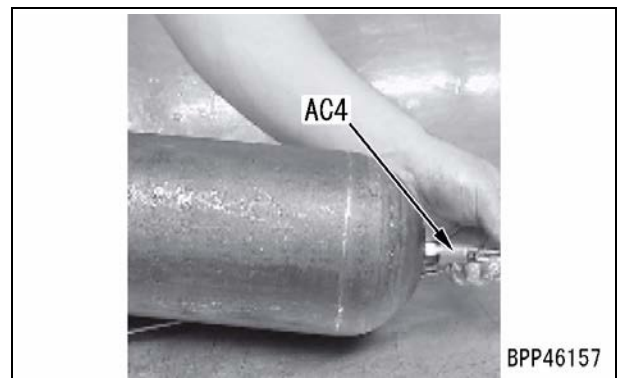
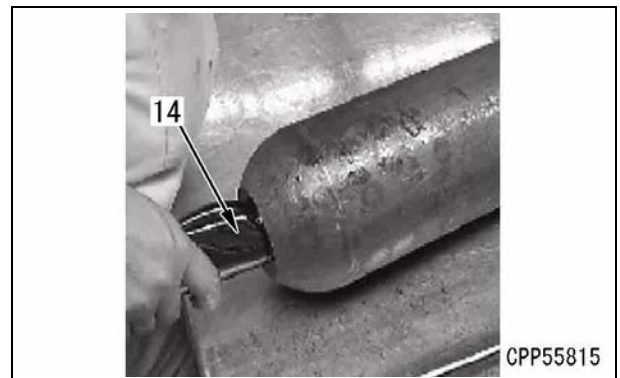
 Bladder (14): **Power train oil (TO10)**



3. Set the nut (11) to the bladder installation tool (AC4), and pull the bladder installation tool (AC4) from the valve stem side of the shell (15a) out to the oil port side.
4. Bleed air from the bladder (14), and install the bladder installation tool (AC4) as it is bent.



5. Insert the bladder (14) straight from the thread part into the shell with caution not to twist it. Pull out the bladder installation tool (AC4).



Bolt (8): Width across flats 13 mm



Bolt (8):

14.7 to 34.3 Nm {1.5 to 3.5 kgfm}

Ordinary functions and special functions of machine monitor (PC228-Q170-042-K-00-A)

The machine monitor has the ordinary functions and special functions to display the various types of information on the multi-display.

Some items are displayed automatically according to the internal setting of the machine monitor and the others are displayed according to the operation of the switches.

1. Ordinary functions: Operator mode

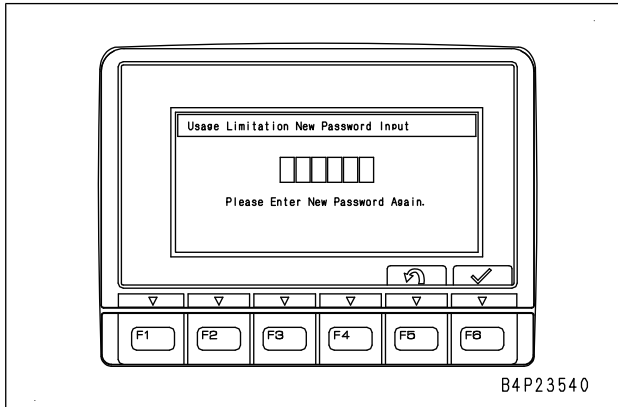
The information items in this mode are displayed ordinarily. The operator can display and set them by operating the switches (display and setting of some items need special operations of the switches).

2. Special function: Service mode

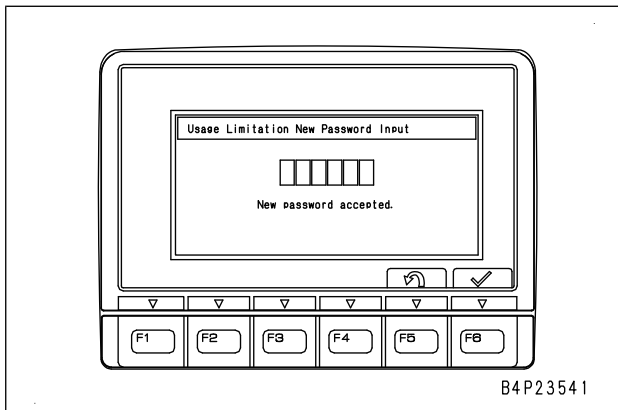
The information items in this mode are not displayed ordinarily. Each technician can display them by operating the switches specially.

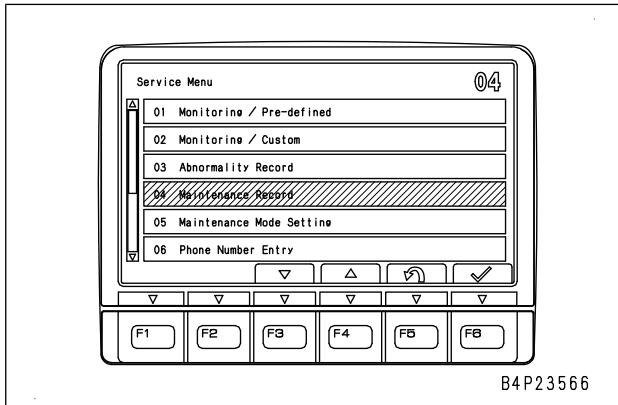
This function is used for special setting, testing, adjusting, or troubleshooting.

- ★ If the input password is different from the one input before, the message to request inputting again is displayed.

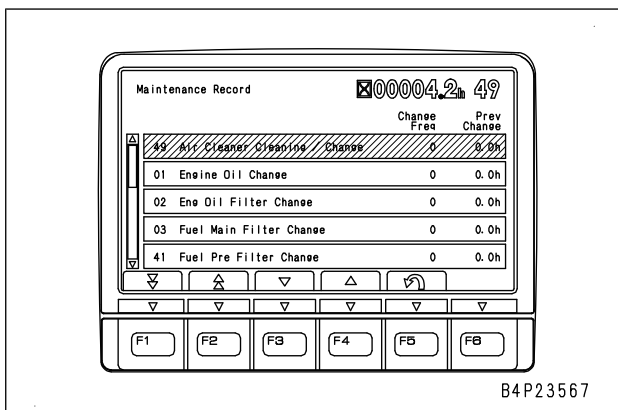


If the standard screen is displayed after the screen to notify completion of setting is displayed, the password is changed successfully.





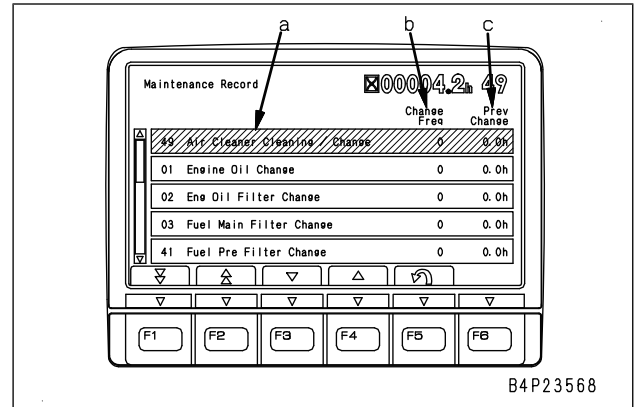
2. Selecting a maintenance record item
After the "Maintenance Record" screen is displayed, select an item to check by using the function switches or numeral input switches.
- [F1]: Moves to next page (screen)
 - [F2]: Moves to previous page (screen)
 - [F3]: Moves selection downward
 - [F4]: Moves selection upward
 - [F5]: Returns the screen to "Service Menu" screen
- ★ You may enter a 2-digit code by using the numeral input switches to select the item of that code.



- ★ The following items can be selected in the maintenance record.

"49 Air Cleaner Cleaning / Change"
"01 Engine Oil Change"
"02 Eng Oil Filter Change"
"03 Fuel Main Filter Change"
"41 Fuel Pre Filter Change"
"04 Hyd Oil Filter Change"
"05 H/Tank Breather Change"
"07 Damper Case Service"
"08 Final Drive Oil Change"
"09 S/Machinery Oil Change"
"10 Hydraulic Oil Change"
"47 KCCV Filter Change"
"48 KDPF Filter Cleaning"

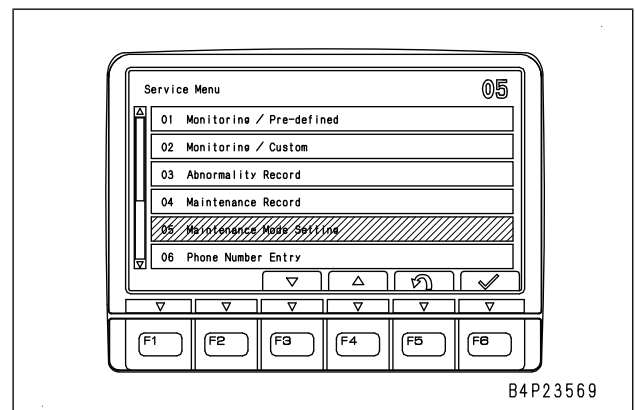
3. Items displayed on Maintenance Record screen
The following information is displayed.
- Maintenance items
 - Number of replacements up to now
 - Service meter reading (SMR) at the last replacement



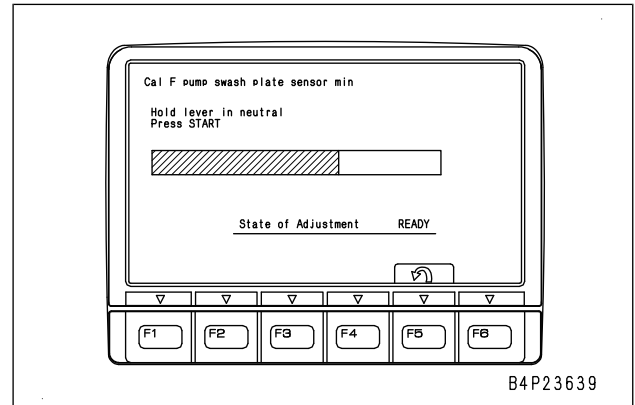
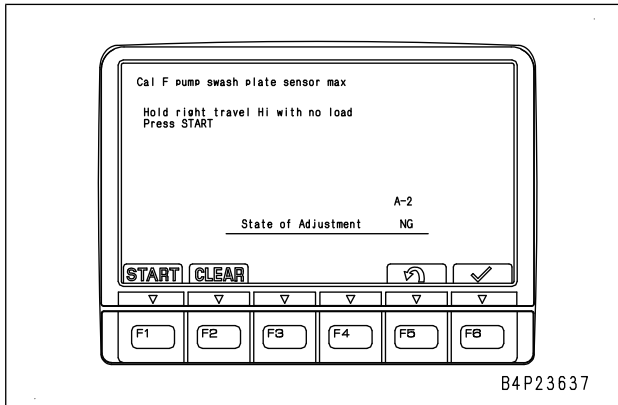
Maintenance Mode Setting (PC220-Q1F1-100-K-00-A)
The actuating condition of the maintenance function in the operator mode can be set and changed with this menu.

- To enable or disable the function
- Change replacement interval setting (by item)
- To initialize all of replacement interval setting

1. Selecting a menu
Select "Maintenance Mode Setting" on "Service Menu" screen.



2. Selecting a sub menu
After the "Maintenance Mode Setting" screen is displayed, select an item to change the setting by using the function switches or numeral input switches.
- [F1]: Moves to next page (screen)
 - [F2]: Moves to previous page (screen)
 - [F3]: Moves selection downward
 - [F4]: Moves selection upward
 - [F5]: Returns to "Service Menu" screen
 - [F6]: Enters selection



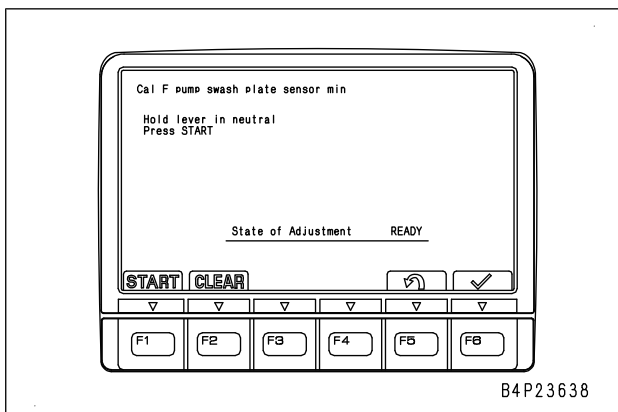
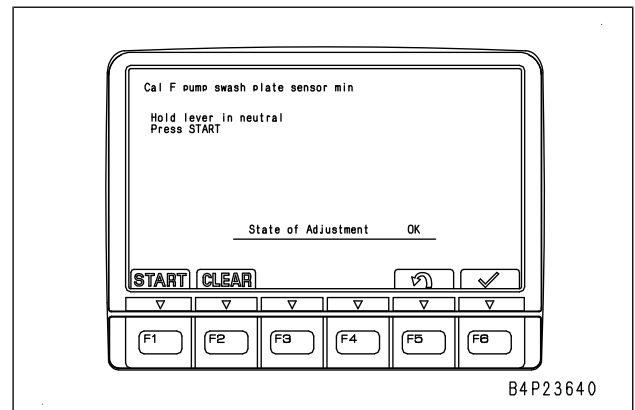
- ★ The calibration value can be initialized by holding down CLEAR button [F2].
If the calibration value is initialized, "READY" is displayed for the State of Adjustment on the screen.

- 4) When calibration is finished successfully, "OK" is displayed for the State of Adjustment to show that calibration for the minimum angle is completed.
Press [F6] to return to the Adjustment screen.

5. Calibration of front pump swash plate sensor for the minimum angle

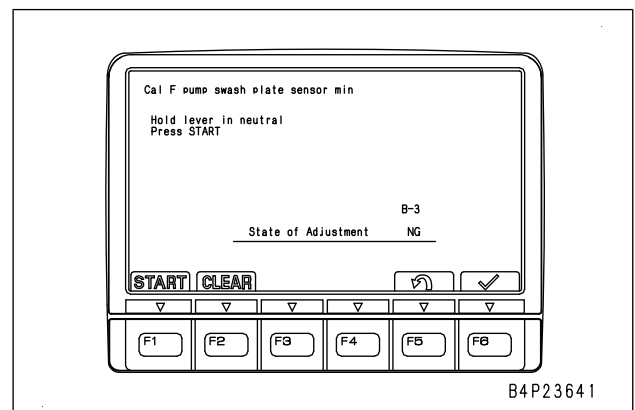
- 1) After the "Cal F pump swash plate sensor min" is displayed, set all the levers in neutral and perform calibration on the Min. side of the front pump swash plate sensor by using the function switches.

- [F1]: START
- [F2]: CLEAR
- [F5]: Returns to the adjustment screen
- [F6]: Enters setting

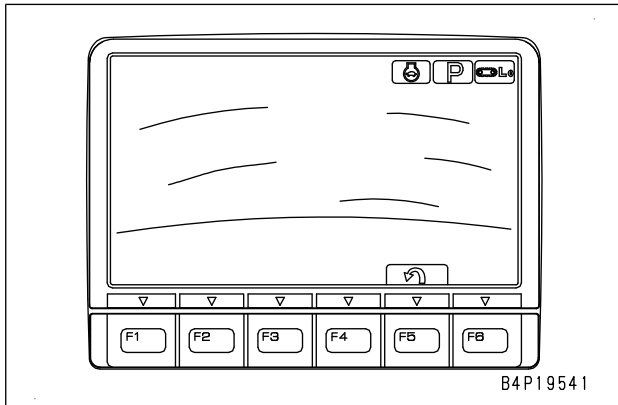


If calibration is finished unsuccessfully, "NG" is displayed for the State of Adjustment and the failure cause code is displayed. Referring to the failure cause codes in Table 1, find out and remove the cause and press [F6] to repeat the calibration for the minimum angle.


- 2) Wait under the following conditions.
 - All control levers: NEUTRAL
Fuel control dial may be at any position.
- 3) Hold down [F1] of the machine monitor to start calibration.
A bar is displayed during calibration.
Keep all the levers in NEUTRAL until calibration is finished.

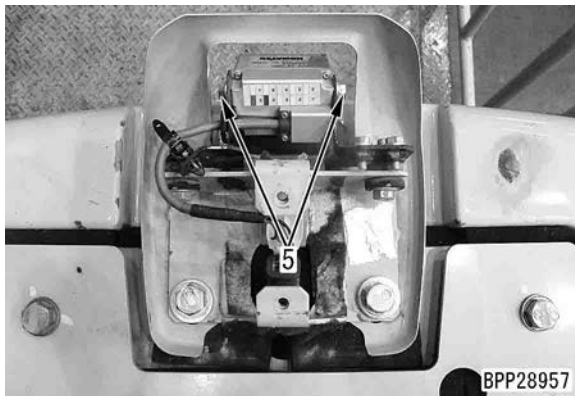


- ★ The calibration value can be initialized by holding down CLEAR button [F2].
When the calibration value is initialized, "READY" is displayed for the State of Adjustment on the screen.



5. After the adjustment, tighten bolt (5).

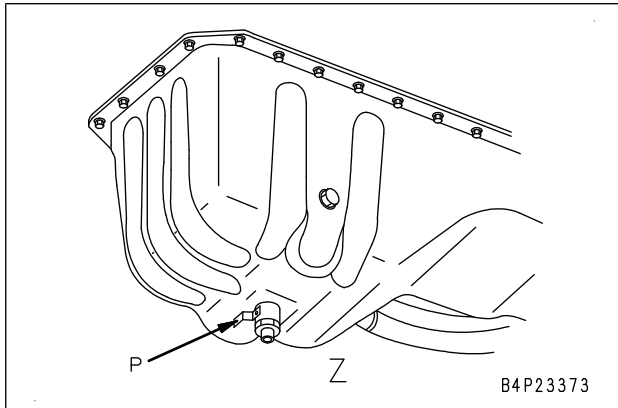
 **Camera mounting bolt:**
11.8 to 14.7 Nm {1.2 to 1.5 kgm}



6. Install covers (2) and (3).

Failure code [CA227] Sensor 2 Supply Volt High Error.....	40-170
Failure code [CA234] Eng Overspeed.....	40-171
Failure code [CA238] Ne Speed Sensor Supply Volt Error.....	40-172
Failure code [CA239] Ne Speed Sens Supply Volt High Error.....	40-173
Failure code [CA271] IMV/PCV1 Short Error.....	40-174
Failure code [CA272] IMV/PCV1 Open Error.....	40-176
Failure code [CA295] Ambient Press Sens In Range Error.....	40-178
Failure code [CA322] Inj #1(L#1) Open/Short Error.....	40-179
Failure code [CA323] Inj #5(L#5) Open/Short Error.....	40-181
Failure code [CA324] Inj #3(L#3) Open/Short Error.....	40-183
Failure code [CA325] Inj #6(L#6) Open/Short Error.....	40-185
Failure code [CA331] Inj #2(L#2) Open/Short Error.....	40-187
Failure code [CA332] Inj #4(L#4) Open/Short Error.....	40-189
Failure code [CA343] ECM Critical Internal Failure.....	40-191
Failure code [CA351] Injectors Drive Circuit Error.....	40-192
Failure code [CA352] Sensor 1 Supply Volt Low Error.....	40-193
Failure code [CA356] Mass Air Flow Sensor High Error.....	40-195
Failure code [CA357] Mass Air Flow Sensor Low Error.....	40-197
Failure code [CA386] Sensor 1 Supply Volt High Error.....	40-199
Failure code [CA428] Water in Fuel Sensor High Error.....	40-200
Failure code [CA429] Water in Fuel Sensor Low Error.....	40-202
Failure code [CA435] Eng Oil Press Sw Error.....	40-204
Failure code [CA441] Battery Voltage Low Error.....	40-205
Failure code [CA442] Battery Voltage High Error.....	40-207
Failure code [CA449] Rail Press Very High Error.....	40-208
Failure code [CA451] Rail Press Sensor High Error.....	40-209
Failure code [CA452] Rail Press Sensor Low Error.....	40-211
Failure code [CA488] Chg Air Temp High Torque Derate.....	40-213
Failure code [CA515] Rail Press Sens Sup Volt High Error.....	40-214
Failure code [CA516] Rail Press Sens Sup Volt Low Error.....	40-216
Failure code [CA553] Rail Press High Error.....	40-218
Failure code [CA555] Crankcase Press High Error 1.....	40-219
Failure code [CA556] Crankcase Press High Error 2.....	40-220
Failure code [CA559] Rail Press Low Error.....	40-221
Failure code [CA595] Turbo Speed High Error 2.....	40-223
Failure code [CA687] Turbo Speed Low Error.....	40-224
Failure code [CA689] Eng Ne Speed Sensor Error.....	40-226
Failure code [CA691] Intake Air Temp Sens High Error.....	40-228
Failure code [CA692] Intake Air Temp Sens Low Error.....	40-230
Failure code [CA697] ECM Int Temp Sensor High Error.....	40-232
Failure code [CA698] ECM Int Temp Sensor Low Error.....	40-233
Failure code [CA731] Eng Bkup Speed Sens Phase Error.....	40-234
Failure code [CA778] Eng Bkup Speed Sensor Error.....	40-236
Failure code [CA1117] Persistent Data Lost Error.....	40-241
Failure code [CA1664] KDOC Malfunction.....	40-242
Failure code [CA1691] Regeneration Ineffective.....	40-244
Failure code [CA1695] Sensor 5 Supply Volt High Error.....	40-247
Failure code [CA1696] Sensor 5 Supply Volt Low Error.....	40-249
Failure code [CA1843] Crankcase Press Sens High Error.....	40-251
Failure code [CA1844] Crankcase Press Sens Low Error.....	40-253
Failure code [CA1879] KDPF Delta P Sensor High Error.....	40-255
Failure code [CA1881] KDPF Delta P Sensor Low Error.....	40-257
Failure code [CA1883] KDPF Delta P Sens In Range Error.....	40-259
Failure code [CA1921] KDPF Soot Load High Error 1.....	40-262
Failure code [CA1922] KDPF Soot Load High Error 2.....	40-265
Failure code [CA1942] Crankcase Press Sens In Range Error.....	40-270
Failure code [CA1993] KDPF Delta Pressure Low Error.....	40-271
Failure code [CA2185] Throt Sensor Sup Volt High Error.....	40-274
Failure code [CA2186] Throt Sensor Sup Volt Low Error.....	40-276

- If the oil is at the correct level, tighten the oil filler cap securely and close the engine hood.



a12. Check of coolant level (in reservoir tank)

⚠ The radiator cap does not need to be opened for standard checks. When checking the coolant level, check it in reservoir tank when the engine is cooled down.

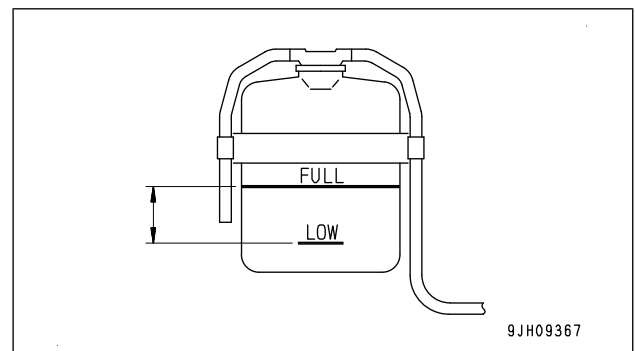
⚠ Immediately after the engine is stopped, the coolant is still very hot and the pressure is accumulated in the radiator.

If the cap is opened under these conditions, you may be scalded. If you need to remove the radiator cap, wait until the temperature drops before you do. Then turn the cap slowly to release the pressure and remove it with care.

- Open side cover on the rear left of the machine, check the coolant level is within "FULL - LOW" range at reservoir tank (1) (shown in the figure below). If coolant is insufficient, add coolant up to FULL level through water filler port at reservoir tank (1).
- After refilling with coolant, tighten the cap securely.
- If the reservoir tank is vacant, coolant may have leaked.

If any abnormality is found in the check for leakage, repair it immediately. If no abnormality is found, check the level of the coolant in the radiator. If it is low, add coolant to the radiator and then to the reservoir tank.

- If reservoir tank (1) is dirty and it is difficult to check the coolant level, clean it.



a13. Check of air cleaner for clogging

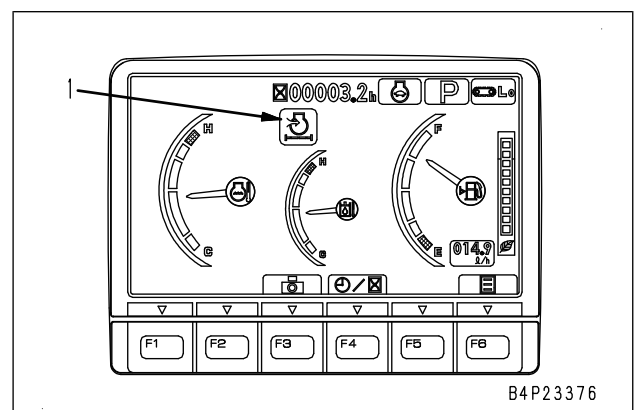
⚠ When using compressed air for cleaning, put on personal protective items such as protective eyeglasses, gloves, dust mask, etc. to protect yourself from dirt that will fly out.

⚠ When removing the outer element from the air cleaner body, do not forcibly pull it out, otherwise it can be dangerous.

Be careful not to fall from a high location on unsafe scaffolding as a reaction when pulling out the outer element.

Testing

If air cleaner clogging monitor (1) on monitor panel lights up, clean the air cleaner element.



Classification and procedure for troubleshooting (PC220-5160-40D-A-00-A)

Classification of troubleshooting

Mode	Content
Display of code	Troubleshooting by failure code
E-mode	Troubleshooting electrical system
H-mode	Troubleshooting hydraulic and mechanical system
S-mode	Troubleshooting engine

Procedure for troubleshooting

If a problem occurs in the machine, go to the corresponding troubleshooting section according to the following procedure.

1. Troubleshooting procedure to be taken when action level and failure code are displayed on machine monitor:

If an action level and a failure code are displayed on the machine monitor, carry out the troubleshooting for the corresponding [Display of code] according to the displayed failure code.

- ★ If multiple problems occur simultaneously, all the failure codes for the problems are displayed repeatedly in order. Record all the failure codes.

2. Troubleshooting procedure to be taken when action level and failure code are not displayed on normal screen of machine monitor:

Check a mechanical system failure code and an electrical system failure code with the abnormality record function of the machine monitor. (See [*1])

- 1) If a code is recorded, carry out troubleshooting for the corresponding [Display of code] according to the recorded code.

- ★ If an electrical system failure code is recorded, delete all the codes once and reproduce them, and then see if the trouble is still detected. (See [*2])

- ★ A failure code of the mechanical system cannot be deleted.

- ★ If abnormality related to air conditioner is displayed in electrical system abnormality record, perform "Check with self-diagnosis" in "Air conditioner".

- 2) If no failure code is recorded in the abnormality record, a failure that the machine cannot find out by itself may have occurred in the electrical system or hydraulic and mechanical system.

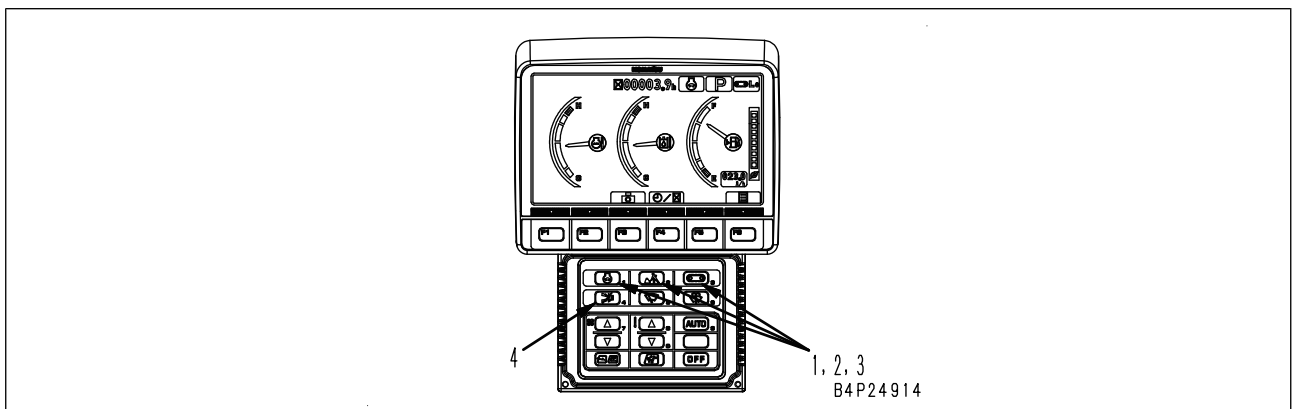
In this case, check the problem which seems to be a failure again and select the same problem from the table of "Problem which seems to be failures and troubleshooting Nos.", and then carry out troubleshooting corresponding to that problem in the [E-mode], [H-mode], or [S-mode].

3. Actions to take after failure is repaired

Referring to following page, delete all failure codes in electrical system abnormality record.

[*1],[*2]

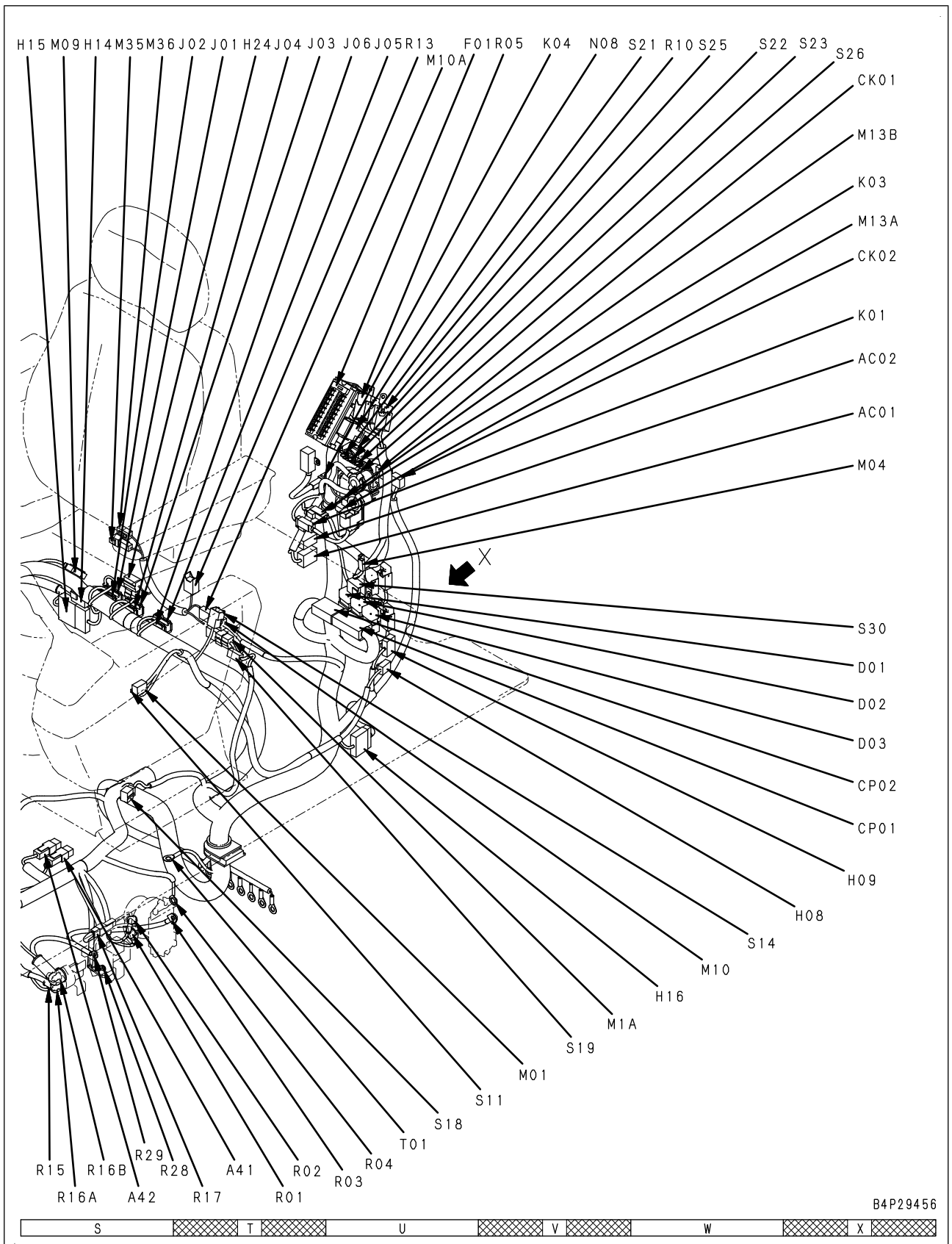
1. On the normal operation screen, while pressing number key [4] in the panel switch section, press [1], [2], and [3] in this order.



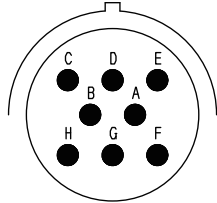
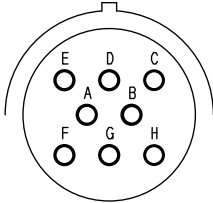
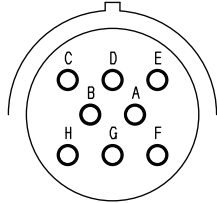
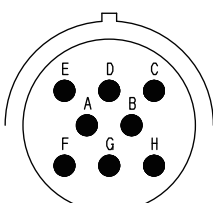
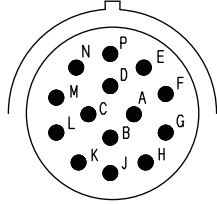
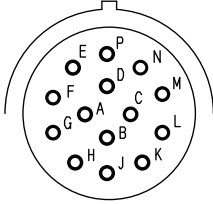
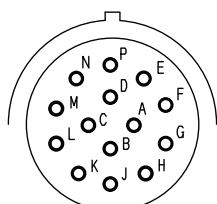
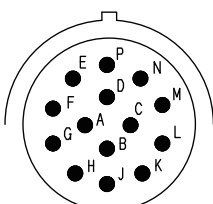
2. On the service menu screen, press switch [F3] (▽) in the panel switch section twice, and then select "03 Abnormality Record".

3. Press switch [F6] in the panel switch section to confirm, and then enter the "Abnormality record" screen.

(4/6)



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

Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	Testing connection use special tool Part No.
18-8 (1)	Pin (male terminal)  BWP05001	Socket (female terminal)  BWP05002	799-601-9210 (T-adapter)
	Part No. :08191-11201, 08191-11202, 08191-11205, 08191-11206	Part No. :08191-14101, 08191-14102, 08191-14105, 08191-14106	
	Socket (female terminal)  BWP05003	Pin (male terminal)  BWP05004	799-601-9210 (T-adapter)
	Part No. :08191-12201, 08191-12202, 08191-12205, 08191-12206	Part No. :08191-13101, 08191-13102, 08191-13105, 08191-13106	
18-14 (2)	Pin (male terminal)  BWP05005	Socket (female terminal)  BWP05006	799-601-9220 (T-adapter)
	Part No. :08191-21201, 08191-21202, 08191-21205, 08191-21206	Part No. :08191-24101, 08191-24102, 08191-24105, 08191-24106	
	Socket (female terminal)  BWP05007	Pin (male terminal)  BWP05008	799-601-9220 (T-adapter)
	Part No. :08191-22201, 08191-22202, 08191-22205, 08191-22206	Part No. :08191-23101, 08191-23102, 08191-23105, 08191-23106	

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FRAMATOME connector for engine			
No. of pins	Inter mediate connector (107, 114, 125, 140 engine)		Testing connection use special tool Part No.
	Engine side (plug)	Machine side (receptacle)	
24			799-601-4651 (T-adapter) (Kit: 799-A65-4600)
	-	-	
No. of pins	Mass air flow sensor (95, 107, 114, 125, 140 engine) KDPF temperature sensor consolidating box. KDPF delta (outlet) pressure sensor (107, 114, 125, 140 engine)		Testing connection use special tool Part No.
	Sensor side (plug)	Harness side (receptacle)	
4			799-601-4620 (T-adapter) (Kit: 799-A65-4600)
	-	-	

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Failure codes table (PC228-5520-441-A-00-A)

Failure code	Failure (Displayed on screen)	Applicable component	Action level	History category	Remarks
879AKA	Failure code [879AKA] A/C Inner Sensor Open Circuit(PAGE 40-120)	MON		Electrical system	See Chapter 80, Other items
879AKB	Failure code [879AKB] A/C Inner Sensor Short Circuit(PAGE 40-121)	MON		Electrical system	See Chapter 80, Other items
879BKA	Failure code [879BKA] A/C Outer Sensor Open Circuit(PAGE 40-122)	MON		Electrical system	See Chapter 80, Other items
879BKB	Failure code [879BKB] A/C Outer Sensor Short Circuit(PAGE 40-123)	MON		Electrical system	See Chapter 80, Other items
879CKA	Failure code [879CKA] Ventilating Sensor Open Circuit(PAGE 40-124)	MON		Electrical system	See Chapter 80, Other items
879CKB	Failure code [879CKB] Ventilating Sensor Short Circuit(PAGE 40-125)	MON		Electrical system	See Chapter 80, Other items
879DKZ	Failure code [879DKZ] Sunlight Sensor Open Or Short Circuit(PAGE 40-126)	MON		Electrical system	See Chapter 80, Other items
879EMC	Failure code [879EMC] Ventilation Damper Abnormality(PAGE 40-127)	MON	L01	Electrical system	See Chapter 80, Other items
879FMC	Failure code [879FMC] Air Mix Damper Abnormality(PAGE 40-128)	MON	L01	Electrical system	See Chapter 80, Other items
879GKX	Failure code [879GKX] Refrigerant Abnormality (PAGE 40-129)	MON	L01	Electrical system	See Chapter 80, Other items
989L00	Failure code [989L00] Engine Controller Lock Caution 1(PAGE 40-130)	MON		Electrical system	
989M00	Failure code [989M00] Engine Controller Lock Caution 2(PAGE 40-131)	MON		Electrical system	
989N00	Failure code [989N00] Engine Controller Lock Caution 3(PAGE 40-132)	MON		Electrical system	
A1U0N3	Failure code [A1U0N3] HC Desorb Request 1 (PAGE 40-133)	ENG	L01	Electrical system	
A1U0N4	Failure code [A1U0N4] HC Desorb Request 2 (PAGE 40-135)	ENG	L03	Electrical system	
AA10NX	Failure code [AA10NX] Air Cleaner Clogging (PAGE 40-137)	MON	L01	Mechanical system	
AB00KE	Failure code [AB00KE] Charge Voltage Low (PAGE 40-139)	MON	L03	Mechanical system	
B@BAZG	Failure code [B@BAZG] Eng Oil Press Low (PAGE 40-141)	ENG	L03	Mechanical system	

Failure code [879GKX] Refrigerant Abnormality (PC400-879GKX-441-A-Z0-A)

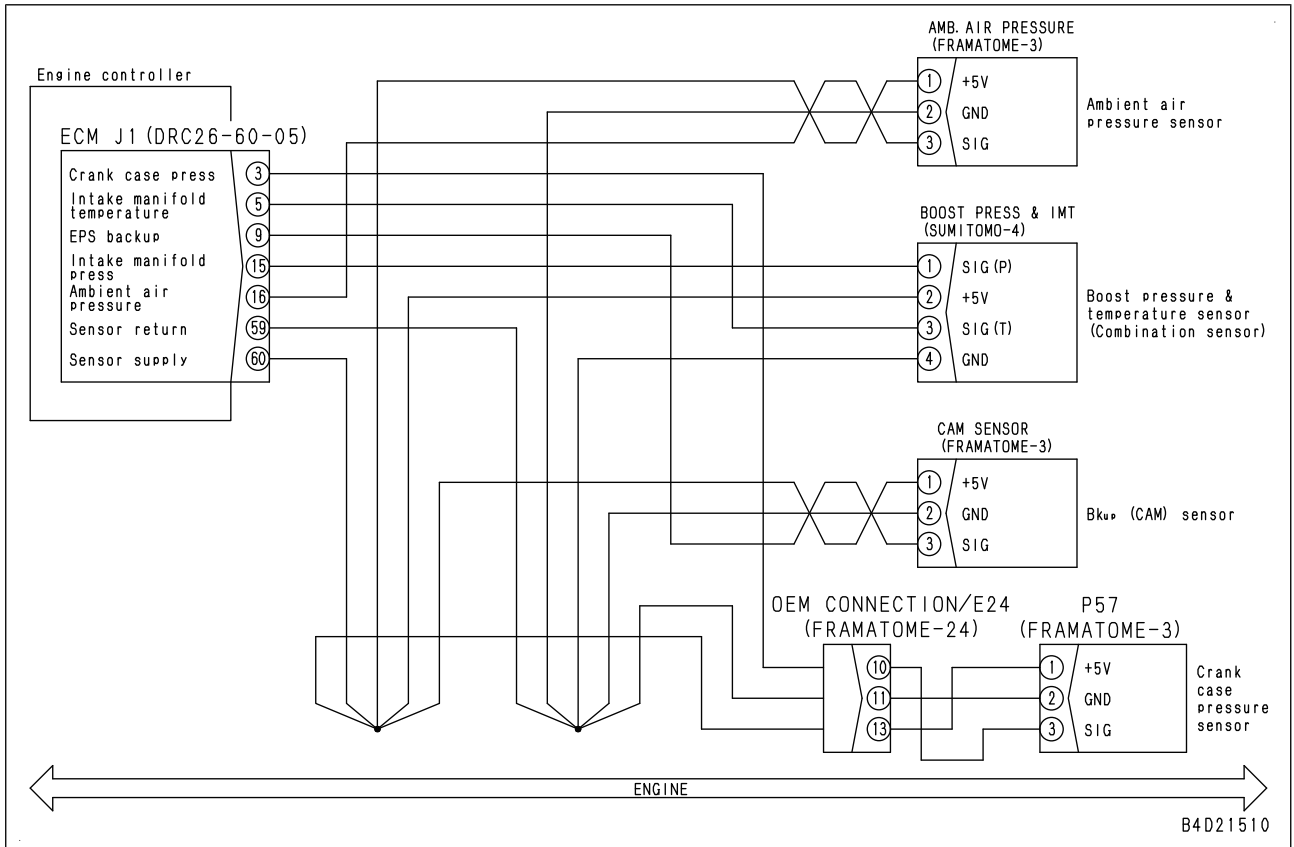
See chapter 80 Appendix "Failure code [879GKX] Refrigerant Abnormality".

Failure code [CA115] Eng Ne and Bkup Speed Sens Error (WA380_7-CA115-400-A-Z0-A)

Action level	Failure code	Failure	Engine Ne and Bkup Speed Sensor Error (Engine controller system)
L04	CA115		
Detail of failure	<ul style="list-style-type: none"> Both signals from engine Ne speed sensor and engine Bkup speed sensor are unusual. 		
Action of controller	<ul style="list-style-type: none"> None in particular. 		
Problem on machine	<ul style="list-style-type: none"> Engine stops. Engine does not start. 		
Related information	<ul style="list-style-type: none"> Method of reproducing failure code: Start engine. 		

No.	Cause	Procedure, measuring location, criteria and remarks
1	Poor connection of sensor connector	Connectors of engine Ne speed sensor and Bkup sensor may be poorly (incorrectly) connected. Check their connection.
2	Defective Ne speed sensor system	Perform troubleshooting for failure code [CA689].
3	Defective Bkup speed sensor system	Perform troubleshooting for failure code [CA778].
4	Defective engine controller	If no failure is found by above checks, engine controller is defective. (Since this is an internal defect, troubleshooting cannot be performed.)

Circuit diagram related to sensor power supply 2 circuit

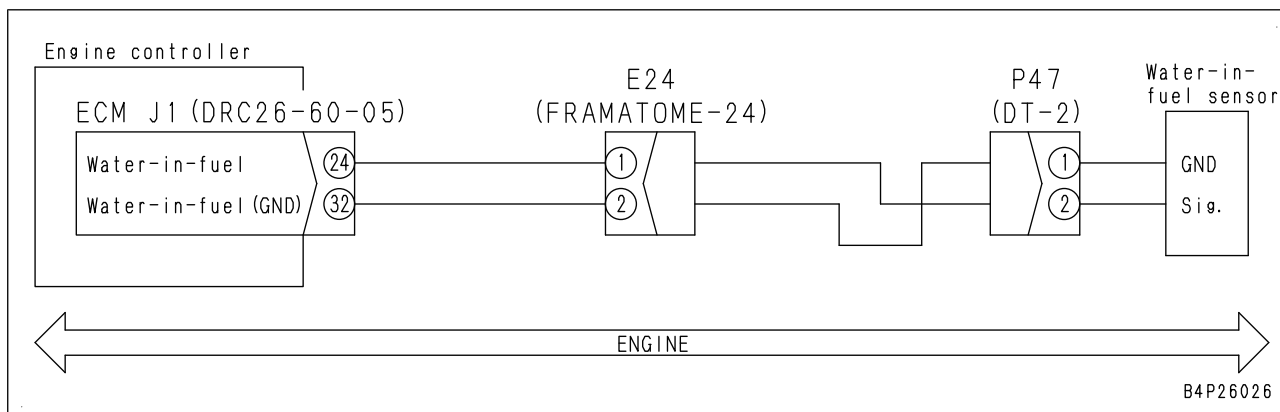


Failure code [CA324] Inj #3(L#3) Open/Short Error (D65-CA324-400-A-Z0-A)

Action level	Failure code	Failure	Injector #3(L#3) Open/Short Error (Engine controller system)
L03	CA324		
Detail of failure	<ul style="list-style-type: none"> Open or short circuit is detected in drive circuit of No. 3 injector. 		
Action of controller	<ul style="list-style-type: none"> None in particular. 		
Problem on machine	<ul style="list-style-type: none"> Engine runs with poor combustion or hunts. Engine output decreases. 		
Related information	<ul style="list-style-type: none"> Method of reproducing failure code: Start engine. While engine is running normally, approx. 65 V of pulse voltage is supplied to injector (+) side. Because it is pulse voltage, it cannot be measured by using multimeter. 		

No.	Cause	Procedure, measuring location, criteria and remarks	
1	Defective harness connector	1. See descriptions of wiring harness and connectors in "c: Electrical equipment" in "Checks before troubleshooting" of "General information on troubleshooting", and check it. 2. Turn starting switch to ON position.	
		If this failure code disappears, harness connector is defective. ★ If this failure code appears, perform following checks.	
2	Defective No. 3 injector	1. Turn starting switch to OFF position. 2. Disconnect connector INJECTOR CYL 3 & 4 and connect T-adapters to male side.	
		Resistance	Between INJECTOR CYL 3 & 4 (male) (3) and (4) Max. 2 Ω
			Between INJECTOR CYL 3 & 4 (male) (3) and ground Min. 100 kΩ
3	Open circuit or ground fault in wiring harness	1. Turn starting switch to OFF position. 2. Disconnect connector ECM J1 and connect T-adapters to female side.	
		Resistance	Between ECM J1 (female) (46) and (56) Max. 2 Ω
			Between ECM J1 (female) (46) and ground Min. 100 kΩ
4	Open circuit in wiring harness (wire breakage or defective contact of connector)	★ If no failure is found by check on cause 3, this check is not required. 1. Turn starting switch to OFF position. 2. Disconnect connectors ECM J1 and INJECTOR CYL 3 & 4, and connect T-adapters to each female side.	
		Resistance	Between ECM J1 (female) (46) and INJECTOR CYL 3 & 4 (female) (3) Max. 2 Ω
			Between ECM J1 (female) (56) and INJECTOR CYL 3 & 4 (female) (4) Max. 2 Ω
5	Ground fault in wiring harness (contact with ground circuit)	★ If no failure is found by check on cause 3, this check is not required. 1. Turn starting switch to OFF position. 2. Disconnect connectors ECM J1 and INJECTOR CYL 3 & 4, and connect T-adapters to either female side.	
		Resistance	Between ground and ECM J1 (female) (46) or INJECTOR CYL 3 & 4 (female) (3) Min. 100 kΩ

Circuit diagram related to water-in-fuel sensor



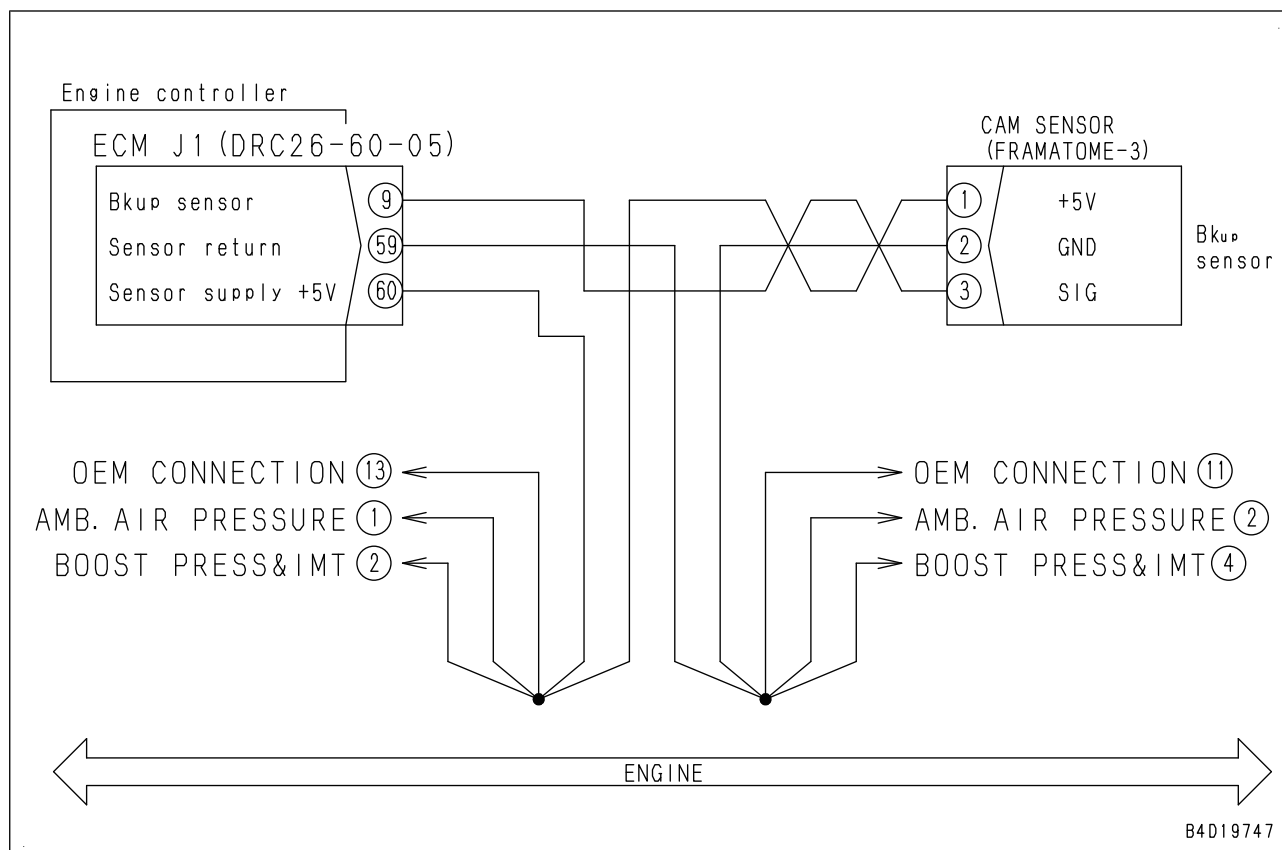
Failure code [CA555] Crankcase Press High Error 1 (PC220_10-CA555-400-A-00-A)

Action level	Failure code	Failure	Crankcase pressure high error 1 (Engine controller system)
L01	CA555		
Details of failure	<ul style="list-style-type: none"> Crankcase pressure high error (level 1) is detected. 		
Action of controller	<ul style="list-style-type: none"> None in particular 		
Problem on machine			
Related information	<ul style="list-style-type: none"> Signal voltage from crankcase pressure sensor can be checked with monitoring function. (Code: 48401 (V)) Pressure from crankcase pressure sensor can be checked with monitoring function. (Code: 48400 (MPa)) Method of reproducing failure code: Turn starting switch to ON position. 		

No.	Cause	Procedure, measuring location, criteria and remarks
1	Clogged KCCV filter	Replace KCCV filter.
2	Blocked KCCV gas piping	When KCCV filter is replaced, if this failure code does not disappear and emulsion is recognized inside KCCV, blowby gas piping of KCCV may be clogged with emulsion. Perform troubleshooting for coolant leakage.
3	Defective crankcase pressure sensor	Sensor system may be defective. Perform troubleshooting for failure codes [CA1843] and [CA1844] .

No.	Cause	Procedure, measuring location, criteria and remarks		
7	Ground fault in wiring harness (contact with ground circuit)	1. Turn starting switch to OFF position. 2. Disconnect connectors ECM J1 and CAM SENSOR, and connect T-adapters to either female side.		
		Resistance	Between ground and ECM J1 (female) (9) or CAM SENSOR (female) (3)	Min. 100 kΩ
8	Hot short circuit in wiring harness	1. Turn starting switch to OFF position. 2. Disconnect connector CAM SENSOR, and connect T-adapters to female side. 3. Turn starting switch to ON position.		
		Voltage	Between CAM SENSOR (female) (3) and ground	Max. 1 V
9	Loosened camshaft speed sensing ring	Remove engine Bkup speed (cam) sensor, and check ring through hole (H). ★ If speed sensing ring (B) is loosened, see "Reference".		
10	Defective engine Bkup speed (cam) sensor	If no failure is found by above checks, engine Bkup speed (cam) sensor is defective. (Since this is an internal defect, troubleshooting cannot be performed.)		
11	Defective engine controller	If no failure is found by above checks, engine controller is defective. (Since this is an internal defect, troubleshooting cannot be performed.)		

Circuit diagram related to engine Bkup speed sensor



Failure code [CA1879] KDPF Delta P Sensor High Error (PC200LC_10-CA1879-400-A-Z0-A)

Action level	Failure code	Failure	KDPF delta pressure sensor high error (Engine controller system)
L03	CA1879		
Detail of failure	<ul style="list-style-type: none"> High voltage appears in KDPF delta pressure sensor signal circuit. 		
Action of controller	<ul style="list-style-type: none"> Takes it that KDPF delta pressure is at recommended value and allows engine to run. (If another failure code is also generated, controller may run engine using delta pressure of 0 kPa.) Closes EGR valve. Limits engine output and allows engine to run. Stops KDPF regeneration control. 		
Problem on machine	<ul style="list-style-type: none"> Engine output lowers. 		
Related information	<p>⚠ Since the temperature of the KDPF will become higher than 500 °C , take care not to get burn injury.</p> <ul style="list-style-type: none"> KDPF delta pressure sensor and KDPF outlet pressure sensor are integrated. If failure code [CA1695] is not displayed but failure code [CA3133] is displayed, GND line may have open circuit (defective connection of connector). Signal voltage from KDPF delta pressure sensor can be checked with monitoring function. (Code: 47101(V)) Delta pressure sensed by KDPF delta pressure sensor can be checked with monitoring function. (Code: 47100 (kPa)) Method of reproducing failure code: Turn starting switch to ON position. 		

No.	Cause	Procedure, measuring location, criteria and remarks	
1	Defective wiring harness connector	1. See descriptions of wiring harness and connectors in "c: Electrical equipment" in "Checks before troubleshooting" of "General information on troubleshooting", and check it. 2. Turn starting switch to ON position.	
		If this failure code does not appear, harness connector is defective. ★ If this failure code appears, perform the following.	
2	Defective sensor power supply system	If failure code [CA1695] or [CA1696] is displayed, perform troubleshooting for it first.	
		1. Turn starting switch to OFF position. 2. Disconnect connector E25 and connect T-adapters to female side. 3. Turn starting switch to ON position.	
		Voltage	Between E25 (female) (4) and (1) 4.75 to 5.25 V
3	Defective KDPF delta pressure sensor	1. Turn starting switch to OFF position. 2. Disconnect connector E25. 3. Turn starting switch to ON position.	
		If failure code changes to [CA1881], KDPF delta pressure sensor is defective. ★ If this failure code is still displayed, the wiring harness or engine controller is defective. ★ Ignore other displayed failure codes.	
4	Open circuit in wiring harness (wire breakage or defective contact of connector)	★ If no failure is found by check on cause 2, this check is not required. 1. Turn starting switch to OFF position. 2. Disconnect connectors CE03 and E25, and connect T-adapters to each female side.	
		★ To check for open circuit in GND line	Resistance Between CE03 (female) (43) and E25 (female) (1) Max. 10 Ω

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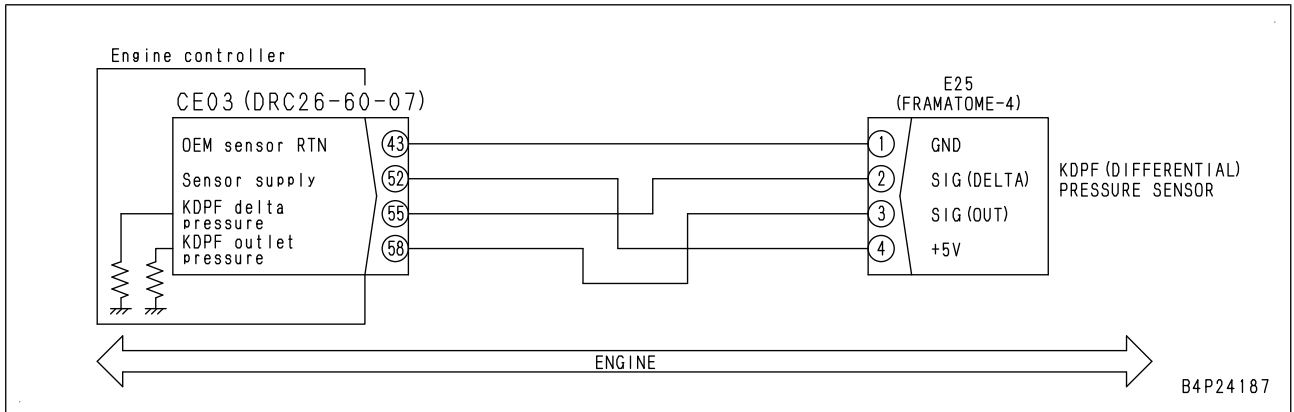
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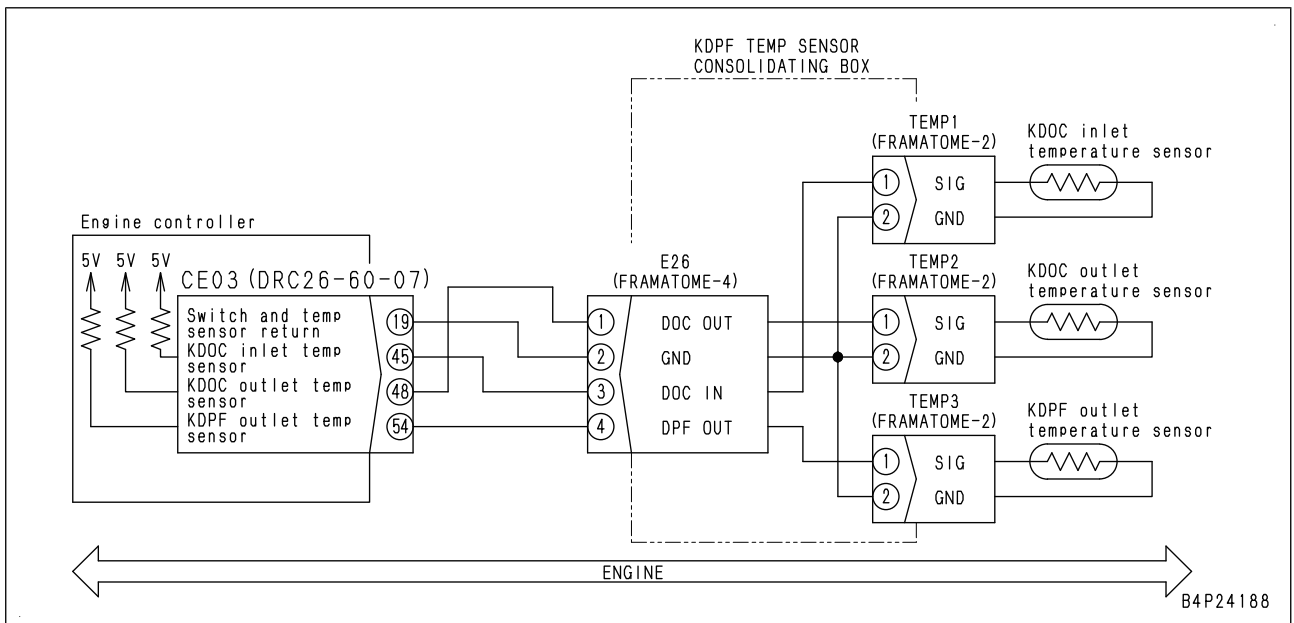
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Circuit diagram related to KDPF delta pressure sensor



Circuit diagram related to KDOC and KDPF temperature sensors



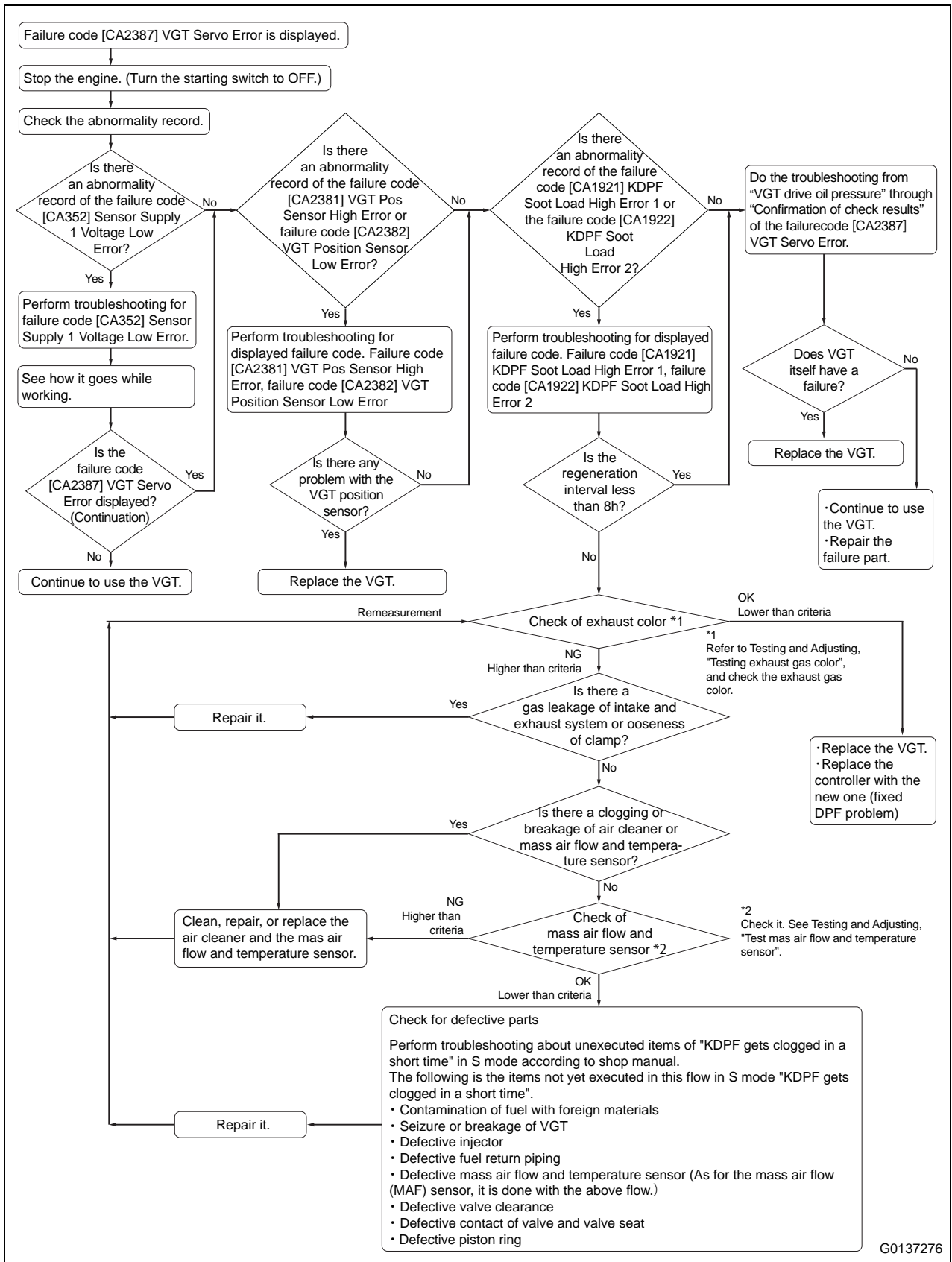
Failure code [CA2373] Exhaust Manifold Press Sens High error (D65-CA2373-400-

A-Z0-A)

Action level	Failure code	Failure	Exhaust Manifold Pressure Sensor High Error (Engine controller system)
L03	CA2373		
Detail of failure	<ul style="list-style-type: none"> High voltage appears in signal circuit of exhaust manifold pressure sensor. 		
Action of controller	<ul style="list-style-type: none"> Runs engine by setting exhaust manifold pressure to calculated value. Closes EGR valve. Limits engine output and runs engine. Stops KDPF regeneration control. 		
Problem on machine	<ul style="list-style-type: none"> Engine output lowers. 		
Related information	<ul style="list-style-type: none"> Signal voltage from exhaust manifold pressure sensor can be checked with monitoring function. (Code: 48301 (V)) Pressure sensed by exhaust manifold pressure sensor can be checked with monitoring function. (Code: 48300 (MPa)) Method of reproducing failure code: Turn starting switch to ON position. 		

No.	Cause	Procedure, measuring location, criteria and remarks		
1	Defective harness connector	1. See descriptions of wiring harness and connectors in "c: Electrical equipment" in "Checks before troubleshooting" of "General information on troubleshooting", and check it. 2. Turn starting switch to ON position.		
		If this failure code disappears, harness connector is defective. ★ If this failure code appears, perform following checks.		
2	Defective sensor power supply circuit	If failure code [CA352] or [CA386] is displayed, perform troubleshooting for [CA352] or [CA386] first.		
3	Defective boost pressure sensor (internal defect)	1. Turn starting switch to OFF position. 2. Disconnect connector EXHAUST PRESSURE. 3. Turn starting switch to ON position. If failure code [[CA2373] changes to [CA2374], exhaust manifold pressure sensor is defective.		
4	Short circuit in wiring harness (Short circuit between wiring harnesses)	1. Turn starting switch to OFF position. 2. Disconnect connectors ECM J2 and EXHAUST PRESSURE, and connect T-adapters to each female side.		
		Resis- tance	Between ECM J2 (34) and (30), or between EXHAUST PRESSURE (female) (3) and (1)	Min. 100 kΩ
5	Hot short circuit in wiring harness	1. Turn starting switch to OFF position. 2. Disconnect connector EXHAUST PRESSURE and connect T-adapters to female side. 3. Turn starting switch to ON position.		
		Voltage	Between EXHAUST PRESSURE (female) (3) and (2)	Max. 1 V
6	Defective engine controller	If no failure is found by above checks, engine controller is defective. (Since this is an internal defect, troubleshooting cannot be performed.)		
		<ul style="list-style-type: none"> Reference 1. Turn starting switch to OFF position. 2. Insert T-adapters into connector ECM J2. 3. Turn starting switch to ON position. 		
		Voltage	Between ECM J2 (34) and (47)	Sensor output 0.2 to 4.7 V

TROUBLESHOOTING FLOWCHART



G0137276

Failure code [CA3134] KDPF Outlet Press Sens Low Error (PC200LC_10-CA3134-400-A-

Z0-A)

Action level	Failure code	Failure	KDPF Outlet Pressure Sensor Low Error (Engine controller system)
L03	CA3134		
Detail of failure	<ul style="list-style-type: none"> Low voltage appears in signal circuit of KDPF outlet pressure sensor. 		
Action of controller	<ul style="list-style-type: none"> Takes it that KDPF outlet pressure is at estimated value (gauge pressure) and allows engine to run (Controller may use 0 kPa (gauge pressure) to run engine if another failure code is also displayed.) 		
Problem on machine	<ul style="list-style-type: none"> None 		
Related information	<p>⚠ Since KDPF is heated to 500°C or above, take care not to get burn injury.</p> <ul style="list-style-type: none"> KDPF delta pressure sensor and KDPF outlet pressure sensor are integrated. If failure code [CA1696] is not displayed but failure code [CA1881] is on screen, sensor connector is probably disconnected or 5 V circuit probably has open circuit (defective contact of connector). This failure code appears if sensor connector is disconnected. Signal voltage from KDPF outlet pressure sensor can be checked with monitoring function. (Code: 47001 (V)) Delta pressure sensed by KDPF outlet pressure sensor can be checked with monitoring function. (Code: 47000 (kPa)) Method of reproducing failure code: Turn starting switch to ON position. 		

No.	Cause	Procedure, measuring location, criteria and remarks		
1	Defective wiring harness connector	1. See descriptions of wiring harness and connectors in "c: Electrical equipment" in "Checks before troubleshooting" of "General information on troubleshooting", and check it. 2. Turn starting switch to ON position.		
		If this failure code disappears, wiring harness connector is defective. ★ If this failure code appears, perform following checks.		
2	Defective sensor power supply system	If failure code [CA1695] or [CA1696] is also displayed, perform troubleshooting for [CA1695] or [CA1696] first.		
		1. Turn starting switch to OFF position. 2. Disconnect connector E25 and connect T-adapter to female side. 3. Turn starting switch to ON position.		
		Voltage	Between E25 (female) (4) and (1) 4.75 to 5.25 V	
3	Open circuit in wiring harness (wire breakage or defective contact of connector)	1. Turn starting switch to OFF position. 2. Disconnect connectors CE03 and E25, and connect T-adapter to each female side.		
		Resistance	★ If no failure is found by check on cause 2, this check is not required. Between CE03 (female) (43) and E25 (female) (1)	Max. 10 Ω
			★ If no failure is found by check on cause 2, this check is not required. Between CE03 (female) (52) and E25 (female) (4)	Max. 10 Ω
			Between CE03 (female) (58) and E25 (female) (3)	Max. 10 Ω
4	Ground fault in wiring harness (contact with ground circuit)	1. Turn starting switch to OFF position. 2. Disconnect connectors CE03 and E25, and connect T-adapter to either female side.		
		Resistance	Between ground and CE03 (female) (58) or E25 (female) (3) Min. 100 kΩ	

Failure code [CA3256] KDPF Outlet Temp High Error 1 (PC200LC_10-CA3256-400-A-Z0-A)

Action level	Failure code	Failure	KDPF Outlet Temperature High Error 1 (Engine controller system)
L01	CA3256		
Detail of failure	<ul style="list-style-type: none"> • KDPF outlet temperature remains at high level. 		
Action of controller	<ul style="list-style-type: none"> • None in particular 		
Problem on machine	<ul style="list-style-type: none"> • None in particular 		
Related information	<p>⚠ Since KDPF and KDOC are heated to 500°C or above, take care not to get burn injury.</p> <ul style="list-style-type: none"> • Signal voltage from KDOC inlet temperature sensor can be checked with monitoring function. (Code: 47301 (V)) • Temperature sensed by KDOC inlet temperature sensor can be checked with monitoring function. (Code: 47300 (°C)) • Signal voltage from KDOC outlet temperature sensor can be checked with monitoring function. (Code: 47401 (V)) • Temperature sensed by KDOC outlet temperature sensor can be checked with monitoring function. (Code: 47400 (°C)) • Signal voltage from KDPF outlet temperature sensor can be checked with monitoring function. (Code: 47201 (V)) • Temperature sensed by KDPF outlet temperature sensor can be checked with monitoring function. (Code: 47200 (°C)) • KDOC inlet temperature, KDOC outlet temperature, and KDPF outlet temperature when engine is at idle (KDPF regeneration is not executed) are approx. 100 to 250°C, and difference between these temperatures is approx. 10°C. (KDOC inlet temperature > KDOC outlet temperature > KDPF outlet temperature) • Misfire of cylinder can induce following phenomena. <ol style="list-style-type: none"> 1. Combustion is impaired causing high exhaust temperature. 2. Cylinders other than disabled cylinder may increase their fuel injection in order to compensate for torque drop, causing high exhaust temperature. • As to procedure for accessing KDPF temperature sensor, see 50 Disassembly and assembly, "Removal and installation of KDPF assembly" and "Disassembly and assembly of KDPF". • Engine controller stops approximately 30 seconds after starting switch is turned to OFF position. So when you restart engine, wait 1 minute minimum before turning starting switch to ON position again. 		
Machine operation for clearing failure code	<ul style="list-style-type: none"> • When this failure code appears, perform troubleshooting according to following work flow. <ol style="list-style-type: none"> A. Identification of cause and repair <ul style="list-style-type: none"> ↓ B. Machine operation for clearing failure code ★ This failure code does not disappear by simply turning starting switch to ON position from OFF position after repair. You must perform machine operation for clearing failure code after repair trouble. 		

A. Identification of cause and repair

No.	Cause	Procedure, measuring location, criteria and remarks
1	Defective KDPF outlet temperature sensor	If failure code [CA3319], [CA3321] or [CA3322] is also displayed, perform troubleshooting for [CA3319], [CA3321] or [CA3322] first.
2	Defective wiring harness connector	1. See descriptions of wiring harness and connectors in "c: Electrical equipment" in "Checks before troubleshooting" of "General information on troubleshooting", and check it and fix trouble as needed.

No.	Cause	Procedure, measuring location, criteria and remarks		
7	Defective KDPF temperature sensor consolidating box	1. Turn starting switch to OFF position. 2. Disconnect connector E26 and connect T-adapter to male side. 3. Disconnect connectors TEMP1, TEMP2, and TEMP3, and connect T-adapter to male side of TEMP1.		
		Resistance	★ If no failure is found by check on cause 4, this check is not required. Between E26 (male) (2) and TEMP1 (male) (2)	Max. 10 Ω
			★ If no failure is found by check on cause 4, this check is not required. Between E26 (male) (3) and TEMP1 (male) (1)	Max. 10 Ω
			★ If no failure is found by check on cause 5, this check is not required. Between E26 (male) (3) and ground	Min. 100 KΩ
★ If no failure is found by check on cause 6, this check is not required. Between E26 (male) (3) and each pin other than pin (3)	Min. 100 KΩ			
8	Open circuit in wiring harness (wire breakage or defective contact of connector)	★ If no failure is found by check on cause 4, this check is not required. 1. Turn starting switch to OFF position. 2. Disconnect connectors CE03 and E26, and connect T-adapter to each female side.		
		Resistance	Between CE03 (female) (45) and E26 (female) (3)	Max. 10 Ω
Between CE03 (female) (19) and E26 (female) (2)	Max. 10 Ω			
9	Ground fault in wiring harness (contact with ground circuit)	★ If no failure is found by check on cause 5, this check is not required. 1. Turn starting switch to OFF position. 2. Disconnect connectors CE03 and E26, and connect T-adapter to either female side.		
		Resistance	Between ground and CE03 (female) (45) or E26 (female) (3)	Min. 100 KΩ
10	Short circuit in wiring harness	★ If no failure is found by check on cause 6, this check is not required. 1. Turn starting switch to OFF position. 2. Disconnect connectors CE03 and E26, and connect T-adapter to female side of CE03. ★ Check by using multimeter in continuity mode.		
		Continuity	Between CE03 (female) (45) and each pin other than pin (45)	No continuity (no sound is heard)
11	Open or short circuit in wiring harness (including wiring harness in KDPF temperature sensor consolidating box)	1. Turn starting switch to OFF position. 2. Disconnect connector CE03, and connect T-adapter to female side.		
		Resistance	Between CE03 (female) (45) and (19) ★ Use Temperature-Resistance characteristics shown below as resistance criteria.	64 Ω to 65 kΩ

No.	Cause	Procedure, measuring location, criteria and remarks			
2	Defective KDPF outlet temperature sensor	1. Turn starting switch to OFF position. 2. Disconnect TEMP3 (KDPF outlet temperature sensor). 3. Turn starting switch to ON position.			
		If this failure code changes to [CA3319], KDPF outlet temperature sensor is defective.			
		★ If this failure code remains displayed, wiring harness or engine controller is defective.			
		• Reference 1. Turn starting switch to OFF position. 2. Disconnect connector TEMP3 and connect T-adapter to female side.			
		Resistance	Between TEMP3 (female) (1) and (2) ★ Temperature-Resistance characteristics	-10°C	33 to 65 kΩ
				0°C	25 to 47 kΩ
				50°C	7.8 to 12.2 kΩ
100°C	3.2 to 4.5 kΩ				
400°C	200 to 240 Ω				
	Between TEMP3 (female) (1) and ground	700°C	64 to 69 Ω		
			Min. 100 kΩ		
3	Ground fault in wiring harness (contact with ground circuit) (including wiring harness in KDPF temperature sensor consolidating box)	1. Turn starting switch to OFF position. 2. Disconnect connectors CE03 and TEMP3, and connect T-adapters to female side of CE03 and male side of TEMP3.			
		Resistance	Between ground and CE03 (female) (54) or TEMP3 (male) (1)	Min. 100 kΩ	
4	Short circuit in wiring harness (including wiring harness in KDPF temperature sensor consolidating box)	1. Turn starting switch to OFF position. 2. Disconnect connectors CE03 and TEMP3, and connect T-adapter to female side of CE03. ★ Check by using multimeter in continuity mode.			
		Continuity	Between CE03 (female) (54) and each pin other than pin (54)	No continuity (No sound is heard)	
5	Defective KDPF temperature sensor consolidating box	★ If no failure is found by checks on causes 3 and 4, this check is not required. 1. Turn starting switch to OFF position. 2. Disconnect connector E26 and connect T-adapter to male side. 3. Disconnect connectors TEMP1, TEMP2, and TEMP3.			
		Resistance	★ If no failure is found by check on cause 3, this check is not required. Between E26 (male) (4) and ground	Min. 100 kΩ	
			★ If no failure is found by check on cause 4, this check is not required. Between E26 (male) (4) and each pin other than pin (4)	Min. 100 kΩ	
6	Ground fault in wiring harness (contact with ground circuit)	★ If no failure is found by check on cause 3, this check is not required. 1. Turn starting switch to OFF position. 2. Disconnect connectors CE03 and E26, and connect T-adapter to either female side.			
		Resistance	Between ground and CE03 (female) (54) or E26 (female) (4)	Min. 100 kΩ	

Failure code [D8ALKA] System Operating Lamp Disconnection (KOMTRAX) (PC300-D8ALKA-400-A-Z0-A)

Action level	Failure code	Failure	Operating Lamp Open Circuit (KOMTRAX) (KOMTRAX system)
—	D8ALKA		
Detail of failure	<ul style="list-style-type: none"> KOMTRAX determines that system operating lamp circuit is open because voltage of output circuit remains at approximately 5 V or less for approximately 3 seconds after starting switch is turned to ON position, during which KOMTRAX outputs no current to system operating lamp. 		
Action of controller	<ul style="list-style-type: none"> None in particular 		
Problem on machine	<ul style="list-style-type: none"> While system operating lamp is lit, battery disconnect switch must not be turned to OFF position. Turning battery disconnect switch to OFF position may destroy data stored in KOMTRAX memory. 		
Related information	<ul style="list-style-type: none"> Method of reproducing failure code: Turn starting switch to ON position. Although KOMTRAX is not able to light up system operating lamp, no trouble will result unless battery disconnect switch is turned to OFF position. When controller lights up system operating lamp, output circuit voltage is at low level. Since no controller drives system operating lamp for approximately 3 seconds after starting switch is turned to ON position, open circuit can be detected. 		

No.	Cause	Procedure, measuring location, criteria, and remarks			
1	Defective fuse No. 16 in fuse box F01.	★ If room lamp lights up, this check is not required. If fuse is blown, circuit probably has ground fault.			
2	Open circuit in wiring harness (Wire breakage or defective contact of connector)	1. Turn starting switch to OFF position. 2. Remove fuse No. 16 in fuse box F01. 3. Disconnect connectors CK01 and L19, and connect T-adapters to each female side.			
		Resistance	<table border="1" style="width: 100%;"> <tr> <td>Between CK01 (female) (15) and L19 (female) (2)</td> <td>Max. 1 Ω</td> </tr> <tr> <td>Between F01-16 and L19 (female) (1)</td> <td>Max. 1 Ω</td> </tr> </table>	Between CK01 (female) (15) and L19 (female) (2)	Max. 1 Ω
Between CK01 (female) (15) and L19 (female) (2)	Max. 1 Ω				
Between F01-16 and L19 (female) (1)	Max. 1 Ω				
3	Defective KOMTRAX terminal	If no failure is found by above checks, KOMTRAX terminal is defective. (Since this is an internal defect, troubleshooting cannot be performed.)			

Failure code [DA2RKR] CAN1 Discon (Pump Con) (PC200LC_10-DA2RKR-400-A-Z0-A)

Action level	Failure code	Failure	CAN1 Disconnection (Pump Con) (Detected by machine monitor) (Machine monitor system)
L04	DA2RKR		
Detail of failure	<ul style="list-style-type: none"> Machine monitor does not recognize pump controller through CAN communication line 1 (KOMNET/r). 		
Action of controller	<ul style="list-style-type: none"> Retains current working mode. Retains current selection of auto-deceleration. Retains current setting (Hi/Lo) of travel speed. Holds information at the time of occurrence of failure. 		
Problem on machine	<ul style="list-style-type: none"> Information to be obtained from pump controller is not displayed or special function that uses information from pump controller does not work. Or received data is no longer updated. Pump control is disabled. Hydraulic oil temperature gauge needle goes off on machine monitor screen. Wiper operation is disabled. Washer operation is disabled. Flow control of attachment hydraulic line is disabled. 		
Related information	<ul style="list-style-type: none"> Method of reproducing failure code: Turn starting switch to ON position. Start of CAN communication is recognized by each controller when ACC signal of starting switch is received. If any of failure codes [DY20KA], [DY20MA] or [DW43KA] is also displayed, pump controller may be defective. Machine monitor indicates CAN communication failure with failure codes [DA2RKR] or [DB2RKR]. If failure code [DB2RKR] is also displayed, wiring harness (CAN communication line) may have ground circuit, short circuit, or hot short circuit. Terminating resistor of CAN1 on cab side is inside machine monitor, and that on engine side is connector "B_RES". (Connector "B_RES" is not on CAN communication 1 line but connected to it via connector "J2"). Since each controller and machine monitor are connected to continuous power supply, they receive continuous power even while starting switch is at OFF position. Since signal of active CAN communication line is pulse voltage, it cannot be measured by using multimeter. This code appears even when pump controller power supply is shut off. 		

No.	Cause	Procedure, measuring location, criteria and remarks
1	Defective pump controller power supply system	Perform checks on causes 1 to 4 in troubleshooting for failure code [DA2QKR].
2	Defective CAN communication 1 system	Perform checks on causes 2 to 8 in troubleshooting for failure code [DB2RKR].
3	Defective pump controller	If no failure is found by above checks, pump controller is defective. (Since this is an internal defect, troubleshooting cannot be performed.)
4	Defective machine monitor	If no failure is found by above checks, machine monitor is defective. (Since this is an internal defect, troubleshooting cannot be performed.)

No.	Cause	Procedure, measuring location, criteria, and remarks	
		*Between CM02 (female) (8) and CC01 (female) (3)	Max. 1 Ω
		*Between CM02 (female) (9) and CC01 (female) (9)	Max. 1 Ω
		Between CE03 (female) (17) and K02 (female) (A)	Max. 1 Ω
		Between CE03 (female) (18) and K02 (female) (B)	Max. 1 Ω
7	Ground fault in wiring harness (contact with ground circuit)	<p>★ If no failure (open circuit) is found by check on cause 5, measure resistance at any one place in each case.</p> <p>1. Turn starting switch to OFF position, and set battery disconnect switch to OFF position.</p> <p>2. Disconnect related connectors and connect T-adapters to female side of connectors to be measured.</p>	
		Resistance	<p>Between ground and any of CP01 (female) (45), CM02 (female) (7), (8) and CE03 (female) (17)</p> <p>Min. 1 MΩ</p>
			<p>Between ground and any of CP01 (female) (64), CM02 (female) (9) and CE03 (female) (18)</p> <p>Min. 1 MΩ</p>
8	Open circuit or hot short circuit in wiring harness	<p>★ If no failure (open circuit) is found by check on cause 5, measure voltage at any one place in each case.</p> <p>1. Turn starting switch to OFF position, and set battery disconnect switch to OFF position.</p> <p>2. Insert T-adapters into connectors to be measured.</p> <p>3. Turn battery disconnect switch to ON position.</p> <p>4. Turn starting switch to ON position.</p> <p>★ Voltage of CAN H and CAN L is 2.5 ± 1 V including during communication, so regard wiring harness as normal if measured voltage is 1 to 4 V.</p>	
		Voltage	<p>Between ground and any of CM02 (8), CK01 (10), AC01 (2), CC01 (3) and CE03 (17)</p> <p>1 to 4 V</p>
			<p>Between ground and any of CM02 (9), CK01 (11), AC01 (1), CC01 (9) and CE03 (18)</p> <p>1 to 4 V</p>
9	Defective engine controller, pump controller, air conditioner unit, ID controller, or KOMTRAX terminal	<p>• If all 5 failure codes [DA2QKR], [DB2QKR], [D8AQKR], [DAZQKR], and [DAFQKR] are displayed</p> <p>★ To identify defective controller, repeat following steps 1. to 3. to disconnect controllers one by one from CAN communication line.</p> <p>1. Turn starting switch to OFF position, and set battery disconnect switch to OFF position.</p> <p>2. Disconnect CAN communication connector of engine controller (connector CE03), pump controller (connector CP01), air conditioner unit (connector AC01), *ID controller (connector CC01), and KOMTRAX terminal (connector CK01) one by one in turn.</p> <p>3. Turn battery disconnect switch to ON position, turn starting switch to ON position, then perform troubleshooting.</p> <p>4. Return to step 1 to check next connector.</p>	
		Has the number of displayed failure codes decreased from 5?	If YES, disconnected controller is defective.
10	Defective engine controller	If no failure is found by above checks, engine controller is defective. (Since this is an internal defect, troubleshooting cannot be performed.)	
11	Defective machine monitor	If no failure is found by above checks, machine monitor is defective. (Since this is an internal defect, troubleshooting cannot be performed.)	

* ID controller is optional setting.

No.	Cause	Procedure, measuring location, criteria and remarks		
4	Open circuit in wiring harness (wire breakage or defective contact of connector)	1. Turn starting switch to OFF position. 2. Disconnect connectors CP01 and P01, and connect T-adapters to each female side.		
		Resistance	★ If power supply voltage in check on cause 2 is normal, this check is not required. Between CP01 (female) (18) and P01 (female) (1)	Max. 1 Ω
			Between CP01 (female) (69) and P01 (female) (2)	Max. 1 Ω
	★ If power supply voltage in check on cause 2 is normal, this check is not required. Between CP01 (female) (6) and P01 (female) (3)	Max. 1 Ω		
5	Ground fault in wiring harness (contact with GND circuit)	1. Turn starting switch to OFF position. 2. Disconnect connectors CP01 and P01, and connect T-adapters to either female side.		
		Resistance	Between ground and CP01 (female) (69) or P01 (female) (2)	Min. 1 MΩ
6	Hot short circuit in wiring harness (contact with 24 V circuit)	1. Turn starting switch to OFF position. 2. Disconnect connector P01. 3. Connect T-adapters to female side of connector P01. 4. Turn starting switch to ON position.		
		Voltage	Between P01 (female) (2) and ground	Max. 1 V
7	Defective pump controller	If no failure is found by above checks, pump controller is defective. (Since this is an internal defect, troubleshooting cannot be performed.)		

No.	Cause	Procedure, measuring location, criteria and remarks		
3	Open circuit in wiring harness (wire breakage or defective contact of connector)	1. Turn starting switch to OFF position. 2. Disconnect connectors CP01 and P05, and connect T-adapters to each female side.		
		Resistance	★ If power supply voltage measured in check on cause 1 is normal, this check is not required. Between CP01 (female) (18) and P05 (female) (1)	Max. 1 Ω
			Between CP01 (female) (50) and P05 (female) (2)	Max. 1 Ω
	★ If power supply voltage measured in check on cause 1 is normal, this check is not required. Between CP01 (female) (6) and P05 (female) (3)	Max. 1 Ω		
4	Ground fault in wiring harness (contact with ground circuit)	1. Turn starting switch to OFF position. 2. Disconnect connectors CP01 and P05, and connect T-adapters to either female side.		
		Resistance	Between ground and CP01 (female) (50) or P05 (female) (2)	Min. 1 MΩ
5	Hot short circuit in wiring harness (contact with 24 V circuit)	1. Turn starting switch to OFF position. 2. Disconnect connector P05. 3. Connect T-adapters to female side of connector P05. 4. Turn starting switch to ON position.		
		Voltage	Between P05 (female) (2) and ground	Max. 1 V
6	Defective pump controller	If no failure is found by above checks, pump controller is defective. (Since this is an internal defect, troubleshooting cannot be performed.)		

Failure code [DKA0PH] Boom Angle Sensor installation error (PC228-DKA0PH-400-

A-Z0-A)

Action level	Failure code	Failure	Boom Angle Sensor installation error (Pump controller system)
L04	DKA0PH		
Detail of failure	<ul style="list-style-type: none"> Boom angle sensor signal shows that boom angle becomes bigger than maximum angle by 5 deg. and above, or boom angle becomes smaller than minimum angle by 5 deg. and above. 		
Action of controller	<ul style="list-style-type: none"> If cause of failure disappears, machine becomes normal by itself. 		
Problem on machine	<ul style="list-style-type: none"> Operating radius, actual payload, and lifting height, are not displayed on machine monitor. Boom RAISE electronic cushion does not work. 		
Related information	<ul style="list-style-type: none"> It can be controlled by turning emergency work equipment control switch to ON position. Signal voltage from boom angle sensor can be checked with monitoring function. (Code: 15100) Method of reproducing failure code: Turn starting switch to ON position. 		

Cause		Procedure, measuring location, criteria, and remarks
1	Defective installation of boom angle sensor	Since installation of boom angle sensor may be defective, check the installed condition, and repair as needed.
2	Defective pump controller	If no failure is found by checks on causes 1, pump controller may be defective. (Since this is an internal defect, troubleshooting cannot be performed.)

Failure code [DW45KB] Swing Brake Sol Short Circuit (PC228-DW45KB-400-A-Z0-A)

Action level	Failure code	Failure	Swing Brake Solenoid Short Circuit (Pump controller system)
L03	DW45KB		
Detail of failure	<ul style="list-style-type: none"> When output to swing parking brake solenoid is ON, the abnormal current flows in the circuit, so the short circuit is detected. 		
Action of controller	<ul style="list-style-type: none"> Stops driving swing parking brake solenoid. Even if cause of failure disappears, machine does not become normal until starting switch is turned to OFF position. 		
Problem on machine	<ul style="list-style-type: none"> Upper structure does not swing (swing parking brake is not released). 		
Related information	<ul style="list-style-type: none"> When solenoid and wiring harness are normal, swing operation is possible if swing parking brake cancel switch is set to RELEASE position. (Note that swing parking brake is applied when starting switch is in OFF position.) Keep the swing lock switch in OFF position and the swing parking brake cancel switch in RELEASE position during troubleshooting. When starting switch is turned to ON position in this condition, normally current can flow in swing parking brake solenoid circuit and the swing parking brake will be released. Controller's command (ON/OFF) to swing parking brake solenoid can be checked with monitoring function. (As long as controller's command to solenoid is ON, sensor state displayed on monitoring screen is ON even if solenoid is not energized due to short circuit.) (Code: 02300) Method of reproducing failure code: Turn starting switch to ON position. Power for swing parking brake solenoid circuit is supplied from pin (101) of pump controller connector C02 or fuse No.1 in fuse box F01. 		

No.	Cause	Procedure, measuring location, criteria, and remarks		
1	Defective fuse No. 1 in fuse box F01	Even if fuse is blown, perform troubleshooting according to following steps to identify cause.		
2	Defective swing brake solenoid	1. Turn starting switch to OFF position. 2. Disconnect connector V03, and connect T-adapter to male side.		
		Resistance	Between V03 (male) (1) and (2)	20 to 60 Ω
3	Defective diode array D01 or D03	1. Turn starting switch to OFF position. 2. Remove diode arrays D01 and D03, and connect T-adapter to each male side. ★ Measure it with diode range of multimeter.		
		Continuity	Between D01 (male) (3) (+) and (7) (-)	No continuity
			Between D01 (male) (7) (+) and (3) (-)	Continuity
			Between D03 (male) (1) (+) and (5) (-)	No continuity
4	Ground fault in wiring harness (Contact with ground circuit)	1. Turn starting switch to OFF position. 2. Remove fuse No.1 in fuse box F01 and diode D01. 3. Disconnect connectors CP02, D01, and V03. 4. Connect T-adapters to female side of connectors CP02 and D01.		
		Resistance	Between CP02 (female) (101) and ground	Min. 1 MΩ
5	Short circuit in wiring harness	1. Turn starting switch to OFF position. 2. Remove fuse No.1 in fuse box F01 and diode D01. 3. Disconnect connector CP02. 4. Connect T-adapters to female side of connectors D01 and CP02.		
		Resistance	Between D01 (female) (3) and CP02 (female) (115), (117), or (120)	20 to 60 Ω
6	Pump controller is defective.	If no failure is found by above checks, pump controller is defective. (Since this is an internal defect, troubleshooting cannot be performed).		

Failure code [DWK2KA] Variable Back Press Sol Open Circuit (PC228-DWK2KA-400-

A-Z0-A)

Action level	Failure code	Failure	Variable Back Pressure Solenoid Open Circuit (Pump controller system)
L01	DWK2KA		
Detail of failure	<ul style="list-style-type: none"> When output to variable back pressure solenoid is ON, no current flows in the circuit, so the open circuit is detected. 		
Action of controller	<ul style="list-style-type: none"> None in particular (Since no current flows, solenoid is not energized.) If cause of failure disappears, machine becomes normal by itself. 		
Problem on machine	<ul style="list-style-type: none"> Back pressure valve set pressure cannot be changed. 		
Related information	<ul style="list-style-type: none"> Controller's command (ON/OFF) to variable back pressure solenoid can be checked with monitoring function. (As long as controller's command to solenoid is ON, sensor state displayed on monitoring screen is ON even if solenoid is not energized due to open circuit.) (Code: 02301) When controller's command to solenoid is ON, back pressure valve set pressure is decreased. Method of reproducing failure code: Turn starting switch to ON position. 		

No.	Cause	Procedure, measuring location, criteria, and remarks		
1	Defective variable back pressure solenoid (Internal open circuit)	1. Turn starting switch to OFF position. 2. Disconnect connector V25, and connect T-adapter to male side.		
		Resistance	Between V25 (male) (1) and (2)	20 to 60 Ω
2	Open circuit, short circuit, ground fault, hot short circuit of wiring harness, or defective pump controller	1. Turn starting switch to OFF position. 2. Disconnect connector V25 and connect T-adapter to female side. 3. Turn starting switch to ON position. ★ Shake the wiring harness by hand while measuring the voltage. If the voltage drops to 0 V during shaking, there is wire breakage at around this point.		
		Voltage	Between V25 (female) (1) and (2)	1 to 4.5 V
3	Open circuit or ground fault in wiring harness	1. Turn starting switch to OFF position. 2. Disconnect connector CP02 and connect T-adapter to female side.		
		Resistance	Between CP02 (female) (113) and each of CP02 (female) (115), (117), (120)	20 to 60 Ω
4	Open circuit in wiring harness (Wire breakage or defective contact of connector)	★ If no failure is found by check on cause 2, this check is not required. 1. Turn starting switch to OFF position. 2. Disconnect connectors CP02 and V25, and connect T-adapters to each female side.		
		Resistance	Between CP02 (female) (113) and V25 (female) (1)	Max. 1 Ω
			Between V25 (female) (2) and each of CP02 (female) (115), (117), and (120)	Max. 1 Ω
5	Defective pump controller	If no failure is found by above checks, pump controller is defective. (Since this is an internal defect, troubleshooting cannot be performed).		

Failure code [DXE0KB] LS-EPC Sol Short Circuit (PC200LC_10-DXE0KB-400-A-Z0-A)

Action level	Failure code	Failure	LS-EPC Solenoid Short Circuit (Pump controller system)	
L01	DXE0KB			
Detail of failure	<ul style="list-style-type: none"> Abnormal current flows when pump controller drives LS-EPC solenoid, so pump controller determines that short circuit exists in LS-EPC solenoid circuit. 			
Action of controller	<ul style="list-style-type: none"> Stops driving LS-EPC solenoid. Even if cause of failure disappears, machine does not become normal until starting switch is turned to OFF position. 			
Problem on machine	<ul style="list-style-type: none"> Travel speed is high with speed setting at Lo and Mi. Work equipment speed and swing speed are high in fine control mode (L). 			
Related information	<ul style="list-style-type: none"> Drive current to LS-EPC solenoid can be checked with monitoring function. (Code: 01500 LS-EPC solenoid current) Method of reproducing failure code: Turn starting switch to ON position. 			

No.	Cause	Procedure, measuring location, criteria and remarks		
1	Defective LS-EPC solenoid (internal short circuit or ground fault)	1. Turn starting switch to OFF position. 2. Disconnect connector V19 and connect T-adapters to male side.		
		Resistance	Between V19 (male) (1) and (2)	3 to 14 Ω
2	Short circuit or ground fault in wiring harness	1. Turn starting switch to OFF position. 2. Disconnect connector CP02 and connect T-adapters to female side.		
		Resistance	Between CP02 (female) (88) and each of (115), (117), (120)	3 to 14 Ω
3	Ground fault in wiring harness (contact with ground circuit)	★ If no failure is found by check on cause 2, this check is not required. 1. Turn starting switch to OFF position. 2. Disconnect connectors CP02 and V19, and connect T-adapters to either female side.		
		Resistance	Between ground and CP02 (female) (88) or V19 (female) (1)	Min. 1 MΩ
4	Defective pump controller	If no failure is found by above checks, pump controller is defective. (Since this is an internal defect, troubleshooting cannot be performed.)		

Failure code [DY2CKB] Washer Drive Short Circuit (PC228-DY2CKB-400-A-Z0-A)

Action level	Failure code	Failure	Washer Drive Short Circuit (Pump controller system)
—	DY2CKB		
Detail of failure	<ul style="list-style-type: none"> When output to window washer motor is ON (contact to GND), the abnormal current flows in the circuit, so the short circuit is detected. 		
Action of controller	<ul style="list-style-type: none"> Stops output to washer motor. Even if cause of failure disappears, machine does not become normal until starting switch is turned to OFF position. 		
Problem on machine	<ul style="list-style-type: none"> Window washer does not operate. 		
Related information	<ul style="list-style-type: none"> Method of reproducing failure code: Turn starting switch to ON position and turn washer switch to ON position. 		

No.	Cause	Procedure, measuring location, criteria, and remarks			
1	Defective fuse No. 4 in fuse box F01	If fuse is blown, circuit may have ground fault, etc. (See check on cause 5.)			
2	Defective washer motor (Internal open circuit or ground fault)	1. Turn starting switch to OFF position. 2. Disconnect connector M06 and connect T-adapter to male side.			
		Resistance	<table border="1" style="width: 100%;"> <tr> <td>Between M06 (male) (1) and (2)</td> <td>5 to 20 Ω</td> </tr> <tr> <td>Between ground and each of M06 (male) (1) and (2)</td> <td>Min. 1 MΩ</td> </tr> </table>	Between M06 (male) (1) and (2)	5 to 20 Ω
Between M06 (male) (1) and (2)	5 to 20 Ω				
Between ground and each of M06 (male) (1) and (2)	Min. 1 MΩ				
3	Defective assembled-type diode D02 (Internal short circuit)	1. Turn starting switch to OFF position. 2. Disconnect connector D02 and connect T-adapter to male side. ★ Measure it with diode range of multimeter.			
		Continuity	<table border="1" style="width: 100%;"> <tr> <td>Between D02 (male) (6) (+) and (2) (-)</td> <td>Continuity</td> </tr> <tr> <td>Between D02 (male) (2) (+) and (6) (-)</td> <td>No continuity</td> </tr> </table>	Between D02 (male) (6) (+) and (2) (-)	Continuity
Between D02 (male) (6) (+) and (2) (-)	Continuity				
Between D02 (male) (2) (+) and (6) (-)	No continuity				
4	Open or short circuit in wiring harness	1. Turn starting switch to OFF position. 2. Disconnect connector CP01 and connect T-adapter to female side. 3. Turn starting switch to ON position. ★ Ignore failure codes displayed on machine monitor.			
		Voltage	<table border="1" style="width: 100%;"> <tr> <td>Between CP01 (female) (3) and ground</td> <td>20 to 30 V</td> </tr> </table>	Between CP01 (female) (3) and ground	20 to 30 V
Between CP01 (female) (3) and ground	20 to 30 V				
5	Ground fault in wiring harness (Contact with ground circuit)	★ If no failure is found in checks on cause 4, this check is not required. 1. Turn starting switch to OFF position. 2. Disconnect fuse No. 4 of fuse box F01. 3. Disconnect connectors M06, CP01, and D02, and connect T-adapter to any one of female sides.			
		Resistance	<table border="1" style="width: 100%;"> <tr> <td>Between F01-4, M06 (female) (2) or D02 (female) (2) and ground</td> <td>Min. 1 MΩ</td> </tr> <tr> <td>Between ground and any one of CP01 (female) (3), M06 (female) (1), or D02 (female) (6)</td> <td>Min. 1 MΩ</td> </tr> </table>	Between F01-4, M06 (female) (2) or D02 (female) (2) and ground	Min. 1 MΩ
Between F01-4, M06 (female) (2) or D02 (female) (2) and ground	Min. 1 MΩ				
Between ground and any one of CP01 (female) (3), M06 (female) (1), or D02 (female) (6)	Min. 1 MΩ				
6	Hot short circuit in wiring harness	1. Turn starting switch to OFF position. 2. Disconnect connectors CP01 and M06, and connect T-adapter to female side of CP01. 3. Disconnect fuse No. 4 of fuse box F01. 4. Turn starting switch to ON position. ★ Ignore failure codes displayed on machine monitor.			
		Voltage	<table border="1" style="width: 100%;"> <tr> <td>Between CP01 (female) (3) and ground</td> <td>Max. 4.5 V</td> </tr> </table>	Between CP01 (female) (3) and ground	Max. 4.5 V
Between CP01 (female) (3) and ground	Max. 4.5 V				
7	Pump controller is defective.	If no failure is found by above checks, pump controller is defective. (Since this is an internal defect, troubleshooting cannot be performed).			

E-5 When starting switch is turned to ON position, machine monitor displays nothing (PC228-FEG-400-A-Z0-A)

Failure	When starting switch is turned to ON position, machine monitor displays nothing.
Related information	<ul style="list-style-type: none"> When starting switch is turned to ON position, machine monitor displays KOMATSU logo, screen to input password (if set), screen to check breaker mode (if set), screen of check before starting, screen to check working mode, screen to check travel speed, and standard screen in order. Depending on ambient temperature and condition of battery, battery voltage may lower suddenly and machine monitor displays nothing temporarily when engine is started. But this phenomenon does not mean that machine monitor is defective.

No.	Cause	Procedure, measuring location, criteria, and remarks				
1	Battery disconnect switch left in OFF position	Turn starting switch to OFF position and check that battery disconnect switch is in ON position.				
2	Insufficient battery capacity	★ Be ready with starting switch at OFF position, then perform troubleshooting without turning starting switch to ON position.				
		Battery voltage (2 batteries)	Min. 24 V			
		Specific gravity of electrolyte (each battery)	Min. 1.26			
3	Defective fusible link F05	If fusible link is blown out, circuit probably has ground fault. (See cause 9.)				
4	Defective fuse box F01-15	If fuse is blown out, circuit may have ground fault. (See cause 9.)				
5	Defective fuse box F01-17	If fuse is blown out, circuit may have ground fault. (See cause 9.)				
6	Loose terminal or open circuit at terminal	1. Turn starting switch to OFF position.				
		Check terminals of battery relay, etc.				
7	Defective wiring harness, starting switch, or machine monitor	1. Turn starting switch to OFF position, and turn battery disconnect switch to OFF position.				
		2. Insert T-adaptor into connector CM01.				
		3. Turn battery disconnect switch to ON position, and turn starting switch to ON position (connect ACC).				
		Voltage	Between CM01 (1) and (3)	20 to 30 V		
		Between CM01 (2) and (4)	20 to 30 V			
		Between CM01 (10) and (4)	20 to 30 V			
8	Defective starting switch (Internal open circuit)	1. Turn starting switch to OFF position.				
		2. Disconnect connector H15 and connect T-adaptor to male side.				
		3. Turn starting switch to ON position and perform troubleshooting again.				
		Resistance	Between H15 (male) (1) and (5)	Turn starting switch to OFF position.	Min. 1 MΩ	
			Between H15 (male) (1) and (5)	Turn starting switch to ON position.	Max. 1 Ω	
9	Open circuit in wiring harness (Internal open circuit)	If no failure is found by check on cause 7, this check is not required.				
		1. Turn starting switch to OFF position, and turn battery disconnect switch to OFF position.				
		2. Disconnect fusible link F05, No. 15 and 17 fuses of fuse box F01, and connectors H15 and CM01.				
		3. Connect T-adaptors to male side of connector F05 and female side of H15 and CM01.				
			Resistance	Between battery (-) terminal and ground	Max. 1 Ω	
				Between battery (+) and F05 (male) (1)	Max. 1 Ω	
				Between F05 (male) (2) and F01-16F	Max. 1 Ω	
			Between F01-17 and CM01 (female) (1), (2)	Max. 1 Ω		
			Between ground (T04) and each of CM01 (female) (3) and (4)	Max. 1 Ω		
			Between F01-17 and H15 (female) (1)	Max. 1 Ω		
			Between H15 (female) (5) and F01-15E	Max. 1 Ω		

E-21 Hydraulic oil temperature gauge does not move from minimum or maximum (PC160-FGJ-400-A-Z0-A)

Failure	<ol style="list-style-type: none"> While hydraulic oil temperature is rising normally, it does not rise from white range (C). While hydraulic oil temperature is stabilized normally, it rises to red range (H).
Related information	<ul style="list-style-type: none"> Signal from hydraulic oil temperature sensor is input to pump controller and then data is transmitted to machine monitor through CAN communication system. Hydraulic oil temperature can be checked with monitoring function. (Code: 04401) <p>⚠ Loosen the oil filler cap of the hydraulic tank to release the pressure in the hydraulic tank. For details, see Testing and adjusting "Releasing remaining pressure in hydraulic circuit" when checking and replacing hydraulic oil temperature sensor. With monitoring function (Code: 04401), check that hydraulic oil temperature is 40 °C or lower and cool enough not to burn.</p>

No.	Cause	Procedure, measuring location, criteria, and remarks			
1	Defective hydraulic oil temperature sensor (Internal open or short circuit)	<ol style="list-style-type: none"> Turn starting switch to OFF position. Disconnect connector P22 and connect T-adapter to male side. 			
		Resistance	Between P22 (male) (1) and (2) ★ Thermal characteristics of oil temperature sensor	10°C	Approx. 90 kΩ
				30°C	Approx. 35 kΩ
				80°C	Approx. 6.5 kΩ
				100°C	Approx. 3.5 kΩ
Between P22 (male) (2) and ground		Min. 1 MΩ			
2	Open or short circuit in wiring harness	<ol style="list-style-type: none"> Turn starting switch to OFF position. Disconnect connector CP01 and connect T-adapter to female side. 			
		Resistance	Between CP01 (female) (28) and (46) ★ Resistance accords with thermal characteristics table in cause 1.	3.5 to 90 kΩ	
			Between CP01 (female) (28) and ground	Min. 1 MΩ	
3	Open circuit in wiring harness (Wire breakage or defective contact of connector)	<p>★ If no failure is found by check on cause 2, this check is not required.</p> <ol style="list-style-type: none"> Turn starting switch to OFF position. Disconnect connectors CP01 and P22 and connect T-adapters to each female side. 			
		Resistance	Between CP01 (female) (28) and P22 (female) (2)	Max. 1 Ω	
			Between CP01 (female) (46) and P22 (female) (1)	Max. 1 Ω	
4	Ground fault in wiring harness (Contact with ground circuit)	<p>★ If no failure is found by check on cause 2, this check is not required.</p> <ol style="list-style-type: none"> Turn starting switch to OFF position. Disconnect connectors CP01 and P22, and connect T-adapter to either female side. 			
		Resistance	Between ground and CP01 (female) (28) or P22 (female) (2)	Min. 1 MΩ	
5	Hot short circuit in wiring harness	<ol style="list-style-type: none"> Turn starting switch to OFF position. Disconnect connector P22. Insert T-adapter into connector CP01 or connect T-adapter to female side of connector P22. Turn starting switch to ON position. 			
		Voltage	Between ground and CP01 (28) or P22 (female) (2)	Approx. 5 V	
6	Pump controller is defective.	If no failure is found by above checks, pump controller is defective. (Since this is an internal defect, troubleshooting cannot be performed).			

E-37 Any of work equipment, swing and travel cannot be locked (PC228-FT7-400-

A-Z0-A)

Failure	Any of work equipment, swing, and travel cannot be locked.				
Related information					
No.	Cause	Procedure, measuring location, criteria, and remarks			
1	Defective lock lever switch (Internal short circuit)	1. Turn starting switch to OFF position. 2. Disconnect connector S14 and connect T-adapter to female side.			
		Resistance	Between S14 (female) (1) and (2)	Lock lever: LOCK	Min. 1 MΩ
				Lock lever: FREE	Max. 1 Ω
2	Hot short circuit in wiring harness	1. Turn starting switch to OFF position. 2. Disconnect connector V01 and connect T-adapter to female side. 3. Turn starting switch to ON position. 4. Turn lock lever to LOCK position.			
		Voltage	Between V01 (female) (2) and (1)	Max. 1 V	

E-48 Window washer does not operate while window washer switch is operated (PC160-FH0-400-A-Z0-A)

Failure	Window washer does not operate while window washer switch is operated.	
Related information	<ul style="list-style-type: none"> • Condition of window washer switch signal can be checked with monitoring function. (Code: 04504) • Failure in window washer is expressed by failure code [DY2CKB]. 	
No.	Cause	Procedure, measuring location, criteria, and remarks
1	Defective machine monitor	Machine monitor may be defective. (Since this is an internal defect, troubleshooting cannot be performed.)

40 Troubleshooting

Troubleshooting of hydraulic and mechanical system (H-mode)

Failed parts			Engine system	Damper	Tank			Hydraulic pump					Diagnosis codes	
					Hydraulic oil	Cap	stainer	Piston pump	Servo piston	Pump swash plate sensor	PC-EPC valve	PC valve		LS-EPC valve
Failure mode														
Swing	Machine does not swing	Upper structure swings neither to the right nor left												H-24
		Upper structure does not swing in only one direction												H-25
	Swing acceleration is poor or swing speed is low	Poor or low for both of the right and left												H-26
		Poor or low for only in one direction												H-27
	Upper structure overruns considerably when it stops swinging	Largely for both of the right and left												H-28
		Largely for only in one direction												H-29
	Large shock is made when upper structure stops swinging													H-30
	Large unusual noise is heard when upper structure stops swinging.													H-31
	Swing drift on a slope is excessive	When swing parking brake applied												H-32
		When swing parking brake released												H-33
Attachment	Attachment circuit is not switched to desired one.													H-34
	Flow rate of attachment circuit cannot be adjusted													H-35

No.	Cause	Procedure, measuring location, criteria, and remarks			
6	Malfunction of merge-divider LS spool	<ul style="list-style-type: none"> ★ Release remaining pressure from hydraulic tank and piping, and then perform troubleshooting with engine stopped. 			
		<ul style="list-style-type: none"> • Check for stuck or seized LS spool in merge-divider valve body. (Spool must move smoothly and must not be caught.) • Remove LS spool from valve body and check it for defects and dirt. • Be careful to prevent foreign matter from entering into it when re-installing spool. 			
7	Malfunction of boom control valve (spool)	<ul style="list-style-type: none"> ★ Release remaining pressure from hydraulic tank and piping, and then perform troubleshooting with engine stopped. 			
		<ul style="list-style-type: none"> • Check for stuck or seized boom spool in control valve body. (Spool must move smoothly and must not be caught.) • Remove boom spool from valve body and check it for defects and dirt. • Be careful to prevent foreign matter from entering into it when re-installing spool. 			
8	Malfunction of boom control valve (pressure compensation valve) (boom RAISE side)	<ul style="list-style-type: none"> ★ Be ready with engine stopped, then perform troubleshooting with engine at high idle. 			
		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">Boom relief pressure</td> <td style="width: 50%;">Boom RAISE hydraulic relief</td> <td style="width: 25%;">33.1 to 37.2 MPa {338 to 380 kg/cm²}</td> </tr> </table>	Boom relief pressure	Boom RAISE hydraulic relief	33.1 to 37.2 MPa {338 to 380 kg/cm ² }
		Boom relief pressure	Boom RAISE hydraulic relief	33.1 to 37.2 MPa {338 to 380 kg/cm ² }	
		<ul style="list-style-type: none"> ★ Check hydraulic drift of boom cylinder with engine stopped. 			
		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">Hydraulic drift</td> <td style="width: 50%;">Hydraulic oil temperature within operating range, bucket with rated load, boom horizontal, arm cylinder fully retracted</td> <td style="width: 25%;">If visible hydraulic drift is observed, it is abnormal.</td> </tr> </table>	Hydraulic drift	Hydraulic oil temperature within operating range, bucket with rated load, boom horizontal, arm cylinder fully retracted	If visible hydraulic drift is observed, it is abnormal.
		Hydraulic drift	Hydraulic oil temperature within operating range, bucket with rated load, boom horizontal, arm cylinder fully retracted	If visible hydraulic drift is observed, it is abnormal.	
<ul style="list-style-type: none"> ★ Check whether boom cylinder moves slowly when performing hydraulic relief of other work equipment. (If boom cylinder moves, it is abnormal.) 					
<ul style="list-style-type: none"> ★ If any failure is found in either of above check items, interchange pressure compensation valves on RAISE and LOWER sides, and check whether failure symptom changes. (Each area ratio is different, so be sure to restore it after checking the symptom.) 					
9	Malfunction of boom control valve (pressure compensation valve) (boom LOWER side)	<ul style="list-style-type: none"> ★ Be ready with engine stopped, then perform troubleshooting with engine at high idle. 			
		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">Boom relief pressure</td> <td style="width: 50%;">Boom LOWER hydraulic relief</td> <td style="width: 25%;">33.1 to 37.2 MPa {338 to 380 kg/cm²}</td> </tr> </table>	Boom relief pressure	Boom LOWER hydraulic relief	33.1 to 37.2 MPa {338 to 380 kg/cm ² }
		Boom relief pressure	Boom LOWER hydraulic relief	33.1 to 37.2 MPa {338 to 380 kg/cm ² }	
		<ul style="list-style-type: none"> ★ Check hydraulic drift of boom cylinder with engine stopped. 			
		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">Hydraulic drift</td> <td style="width: 50%;">Hydraulic oil temperature: Within operating range, arm cylinder fully extended, machine raised off ground</td> <td style="width: 25%;">If visible hydraulic drift is observed, it is abnormal.</td> </tr> </table>	Hydraulic drift	Hydraulic oil temperature: Within operating range, arm cylinder fully extended, machine raised off ground	If visible hydraulic drift is observed, it is abnormal.
		Hydraulic drift	Hydraulic oil temperature: Within operating range, arm cylinder fully extended, machine raised off ground	If visible hydraulic drift is observed, it is abnormal.	
<ul style="list-style-type: none"> ★ Check whether boom cylinder moves slowly when performing hydraulic relief of other work equipment. (If boom cylinder moves, it is abnormal.) 					
<ul style="list-style-type: none"> ★ If any failure is found in either of above check items, interchange pressure compensation valves on RAISE and LOWER sides, and check whether failure symptom changes. (Each area ratio is different, so be sure to restore it after checking the symptom.) 					
10	Malfunction of boom control valve (regeneration valve)	<ul style="list-style-type: none"> ★ Release remaining pressure from hydraulic tank and piping, and then perform troubleshooting with engine stopped. 			
		<ul style="list-style-type: none"> • Check for stuck or seized boom regeneration valve in control valve body. (Spool must move smoothly and must not be caught.) 			

H-16 In combined operation of work equipment, equipment having heavier load moves slower (PC200LC_10-D34-400-A-Z0-A)

Failure	• In combined operation of work equipment, equipment having heavier load moves slower.			
Related information				
No.	Cause	Procedure, measuring location, criteria and remarks		
1	Malfunction of control valve on smaller load side (pressure compensation valve) (arm IN)	Operations combined	Heavier load side	Smaller load side
		Boom RAISE and arm IN	Boom RAISE	Arm IN
		Pressure compensation valve of control valve on smaller load side may malfunction.		
2	Malfunction of control valve on smaller load side (pressure compensation valve) (boom RAISE)	Operations combined	Heavier load side	Smaller load side
		Boom RAISE and arm OUT	Arm OUT	Boom RAISE
		Pressure compensation valve of control valve on smaller load side may malfunction.		
3	Malfunction of control valve on smaller load side (pressure compensation valve) (bucket CURL)	Operations combined	Heavier load side	Smaller load side
		Boom RAISE and bucket CURL	Boom RAISE	Bucket CURL
		Pressure compensation valve of control valve on smaller load side may malfunction.		
		Operations combined	Heavier load side	Smaller load side
		Arm OUT and bucket CURL	Arm OUT	Bucket CURL
		Pressure compensation valve of control valve on smaller load side may malfunction.		
4	Malfunction of control valve on smaller load side (pressure compensation valve) (boom LOWER)	Operations combined	Heavier load side	Smaller load side
		Boom LOWER and arm OUT	Arm OUT	Boom LOWER
		Pressure compensation valve of control valve on smaller load side may malfunction.		

- ★ Pressure compensation valve is equipped with outer seal, inner seal, and LS check valve (ball).
 Since slipper seal is installed to inner seal, damage on O-ring inside inner seal cannot be checked visually.

H-28 Upper structure overruns excessively when it stops swinging (both right and left) (PC200LC_10-L47-400-A-Z0-A)

Failure	<ul style="list-style-type: none"> Upper structure overruns remarkably when it stops swinging in both directions (right and left).
Related information	<ul style="list-style-type: none"> Perform all troubleshooting with working mode set in P mode. If failure codes are displayed, perform troubleshooting for them first. (DWK0KA, DWK0KB) Pump pressure can be checked with monitoring function. (Code: F pump pressure 01100, R pump pressure 01101)

No.	Cause	Procedure, measuring location, criteria and remarks			
1	Defective swing motor (safety valve)	★ Be ready with engine stopped, then perform troubleshooting with engine running at high idle.			
		Swing relief pressure	Swing lock switch: ON	Swing hydraulic relief	27.4 to 31.3 MPa {280 to 320 kg/cm ² }
		If normal pressure is not obtained after adjustment, sealing of safety valve may be defective. Safety valve has 2-stage relief function, however, set pressures for Hi and Lo settings are same (relief flow rate differs).			
2	Defective swing motor	★ Be ready with engine stopped, then perform troubleshooting with engine running at high idle.			
		Leakage from swing motor	Swing lock switch: ON	Swing hydraulic relief	Max. 10ℓ /min

S-7 Engine runs rough or is unstable (PC220_10-A40-400-A-00-A)

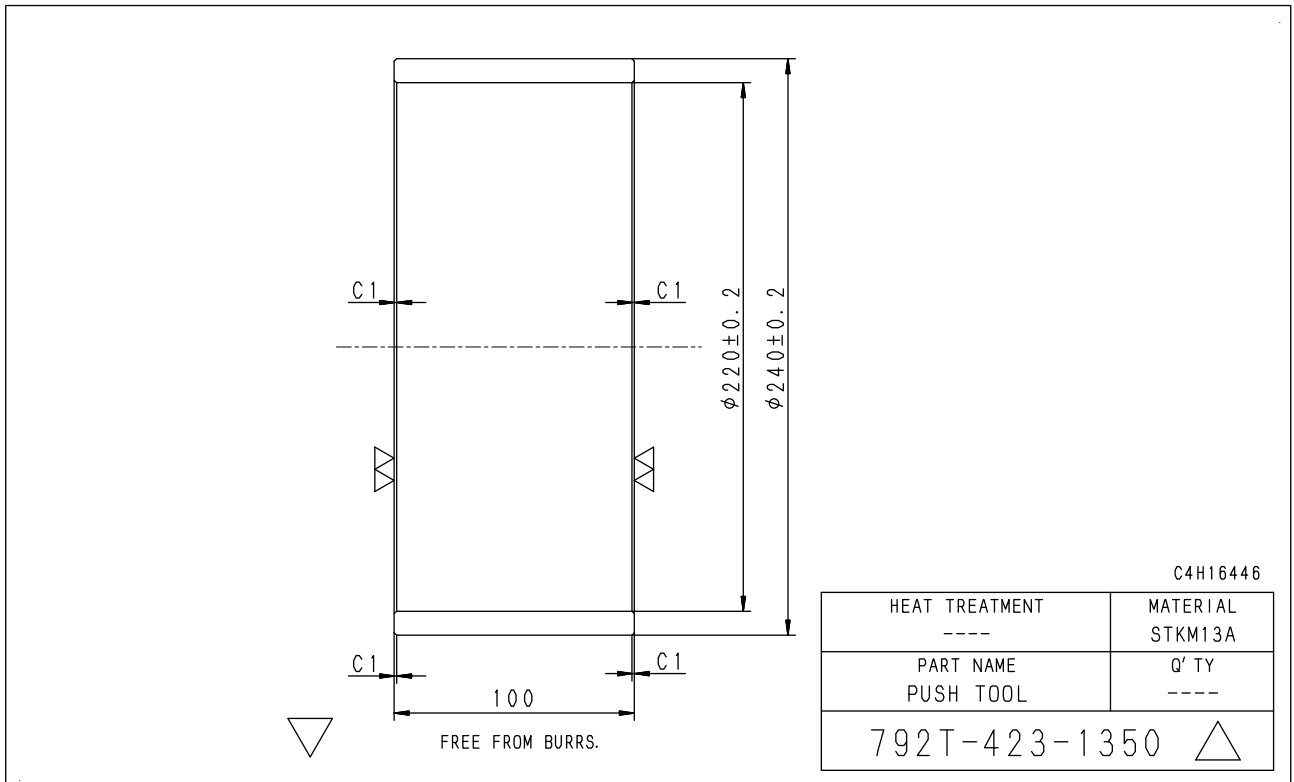
Failure	Engine runs rough or is unstable.		
Related information	<ul style="list-style-type: none"> If a failure code is displayed, troubleshoot it first. 		
No.	Cause	Check item and remarks	Remedy
1	Insufficient fuel in tank	<ul style="list-style-type: none"> When fuel tank is inspected, it is found to be empty. 	Add fuel.
2	Clogged breather hole in fuel tank cap	<ul style="list-style-type: none"> Breather hole in fuel tank cap is clogged. 	Flush air breather hole in fuel tank cap and clean surrounding area.
3	Clogged fuel filter element	<ul style="list-style-type: none"> Check used hours of fuel filter. If used beyond specified hours, fuel filter element may be clogged. 	Replace fuel filter element.
4	Foreign material in fuel	<ul style="list-style-type: none"> Rust and water are found when fuel tank is drained. 	Replace fuel.
5	Air in fuel piping	<ul style="list-style-type: none"> When air bleeding operation for fuel system is performed, air comes out. (Reference: See Testing and adjusting, "Bleeding air from fuel system".) 	Perform air bleeding operation. Correct or replace fuel piping.
6	Leakage from fuel piping system	<ul style="list-style-type: none"> Fuel is leaking from fuel piping. (Reference: See Testing and adjusting, "Testing fuel circuit for leakage".) 	Correct or replace fuel piping related parts.
7	Leakage in boost system	<ul style="list-style-type: none"> Check whether leakage is present in boost system (between KVGT outlet and aftercooler, and between aftercooler and intake manifold). 	Repair the section around boost piping or replace it.
8	Defective mass air flow and temperature sensor	<ul style="list-style-type: none"> Replace sensor and see if engine becomes normal. (Failure code may not appear due to dusts on sensor.) 	Replace mass air flow and temperature sensor.

S-23 White smoke is exhausted during active regeneration (PC400-AQ2-400-A-Z0-A)

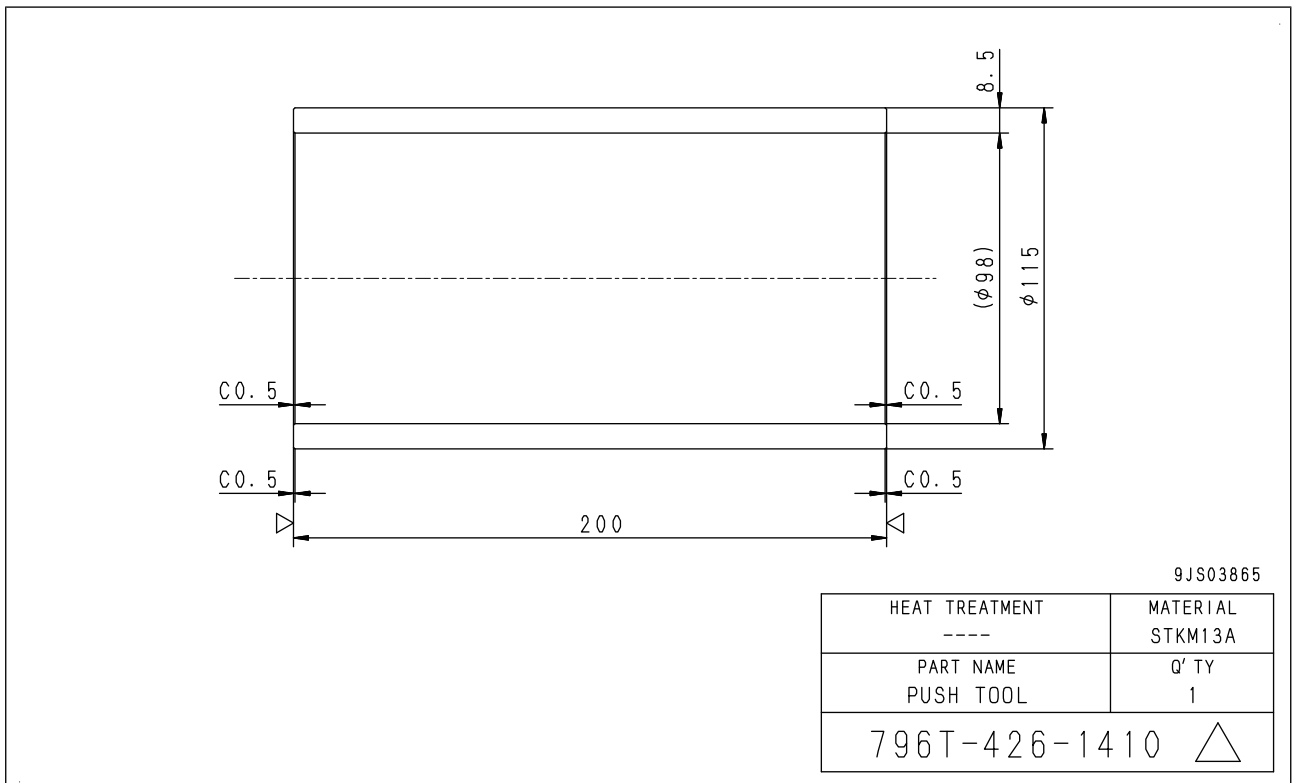
Failure	White smoke is exhausted during active regeneration.
Related information	<ul style="list-style-type: none"> • White smoke may be observed for a short time immediately after engine is started in cold weather or during regeneration, but this is normal. • If any failure code is displayed, perform troubleshooting for that code first.

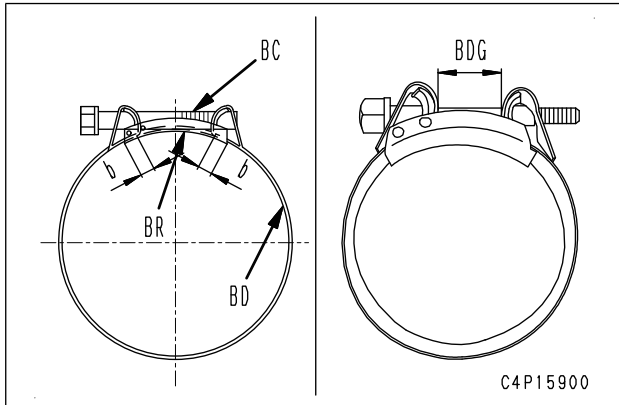
No.	Cause	Point to check, remarks	Remedy
1	Coolant leaking into exhaust system	<ul style="list-style-type: none"> • Check for low coolant level. 	Perform troubleshooting for "S-16 Water mixes into engine oil (milky)".
2	Plugged KDOC due to coolant leaking into exhaust system	<ul style="list-style-type: none"> • If white smoke problem is not resolved after remedies for cause 1 are taken, KDOC is plugged. 	Clean or replace KDOC.
3	Improper fuel used	<ul style="list-style-type: none"> • Fuel other than specified one is used. 	Use proper fuel specified in Operation and Maintenance Manual.
4	Deteriorated KDOC due to use of improper fuel	<ul style="list-style-type: none"> • KDOC is deteriorated by high sulfur content. (If white smoke problem is not resolved after remedies for causes 1 to 3 are taken, KDOC is deteriorated.) 	Replace KDOC.
5	Plugged KDOC	<ul style="list-style-type: none"> • If white smoke problem is not resolved after remedies for causes 1 to 4 are taken, KDOC is plugged. 	Clean KDOC.
6	Damaged KDOC	<ul style="list-style-type: none"> • Check KDOC for damage. 	Replace KDOC.
7	Damaged KCSF	<ul style="list-style-type: none"> • Check KCSF for damage. 	Replace KCSF.

Note) Komatsu does not take any responsibility for special tools manufactured according to these sketches.
 F7: Push tool



G1: Push tool






6) Install the gasket and install EGR valve (25).


 **EGR valve mounting bolt:**
43 ± 6 Nm {4.4 ± 0.6 kgm}

7) Install tubes (22) and (23).


 **Sleeve nut:**
25 ± 1.5 Nm {2.55 ± 0.15 kgm}

8) Install bracket (24) to EGR valve (25) with the mounting bolts (4 pieces).


- Top (EGR valve side)

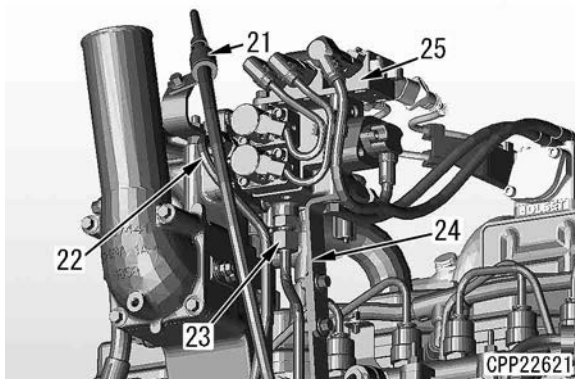
 **Mounting bolt:**
43 ± 6 Nm {4.4 ± 0.6 kgm}

- Mid position and bottom (engine side)

 **Mounting bolt:**
24 ± 4 Nm {2.45 ± 0.41 kgm}


9) Install dipstick pipe (21).

 **Mounting bolt:**
24 ± 4 Nm {2.45 ± 0.41 kgm}




- Perform subsequent installation in the reverse order to removal.

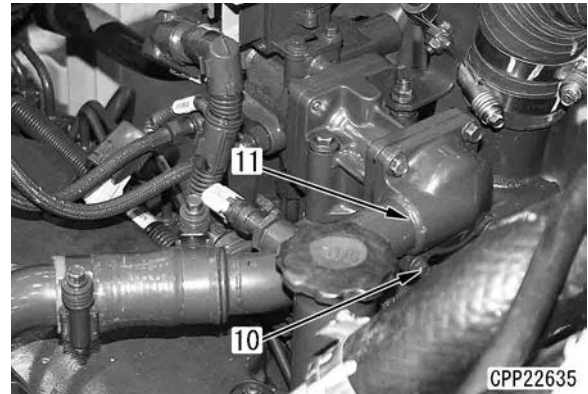
[*1]

 **Hose clamp:**
10.5 ± 0.5 Nm {1.1 ± 0.05 kgm}

[*2]


- ★ Use the open-head type torque wrench with notch since it is difficult to tighten to the normal tightening torque when installing EGR piping flange (11).

 **Mounting bolt (10):**
24 ± 4 Nm {2.45 ± 0.41 kgm}




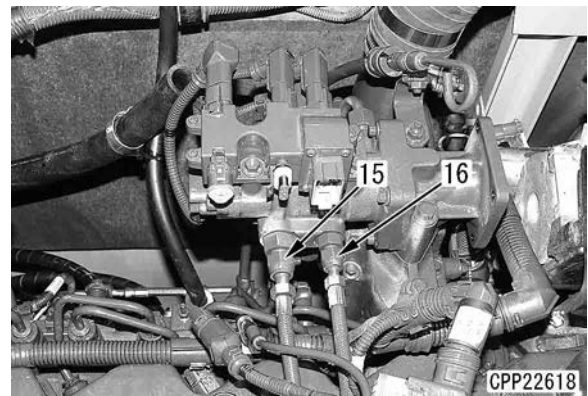
[*3]

- Hose (15): KVGT control pressure circuit


 **Sleeve nut:**
25 ± 1.5 Nm {2.6 ± 0.15 kgm}

- Hose (16): KVGT drive hydraulic circuit

 **Sleeve nut:**
15 ± 1 Nm {1.5 ± 0.1 kgm}




[*4]

 **Mounting bolt:**
34 ± 5 Nm {3.5 ± 0.5 kgm}

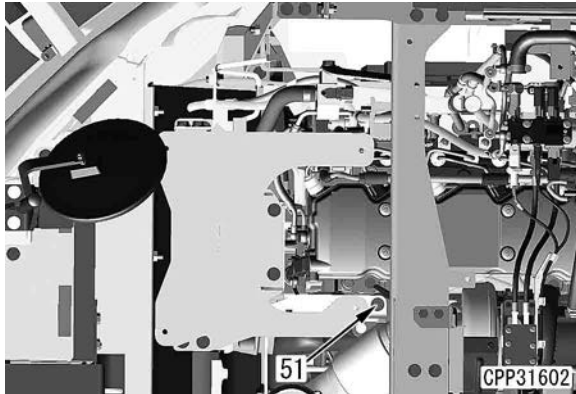
[*5]

Radiator hose insertion depth: 50 mm

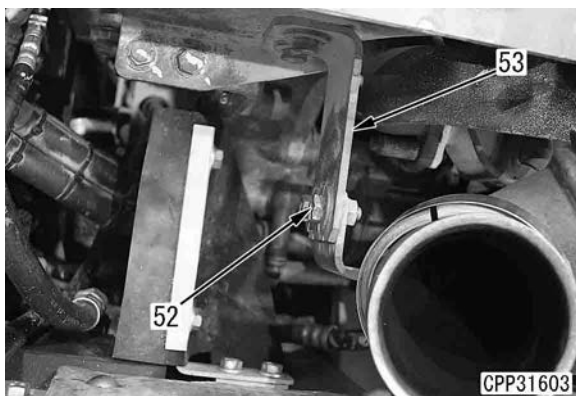
 **Hose clamp:**
10.8 to 11.8 Nm {1.1 to 1.2 kgm}

- Refilling with coolant
Refill with coolant to the specified level through the coolant filler port of the radiator. Run the engine to circulate the coolant. Then check the coolant level again.

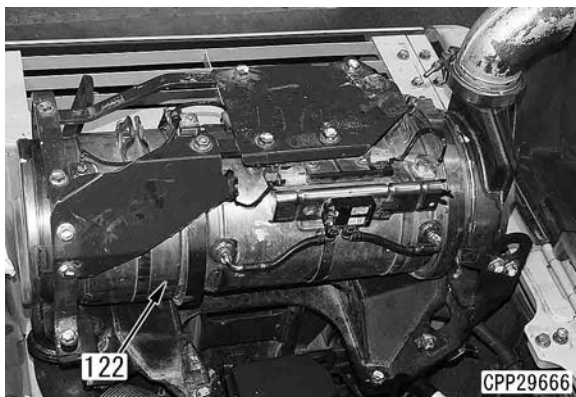
 **Radiator:**
30 ℓ



- 4) Tighten bracket (53) with mounting bolts (52) (2 pieces).



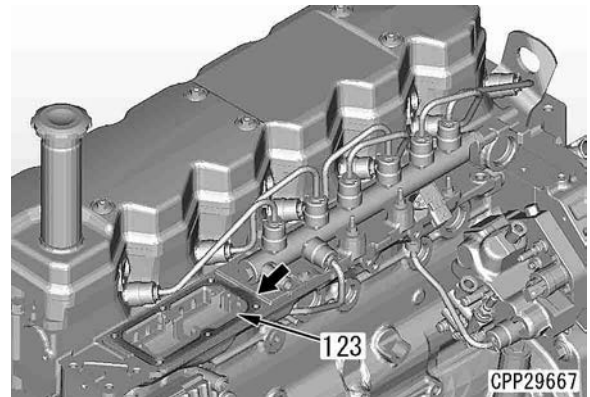
12. Install KDPF assembly (122). For details, see "Removal and installation of KDPF assembly".



13. EGR valve

- 1) Install gasket (123).

- ★ When installing gasket, be careful about direction of part number tag.



- 2) Install intake assembly (29).

- 🔧 Intake assembly mounting bolt:
24 ± 4 Nm {2.45 ± 0.41 kgm}

- 3) Install air intake heater connector E01 (28) and the wiring harness clamp.

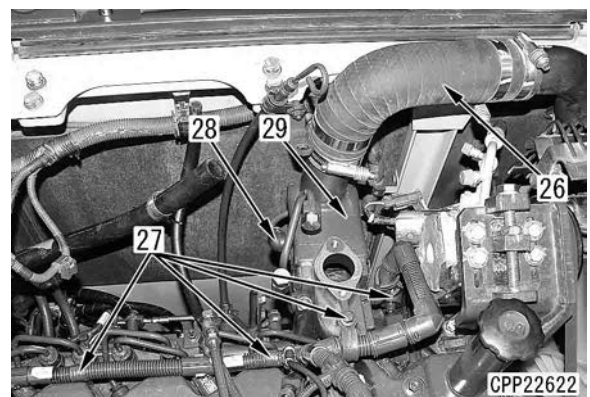
- 🔧 Air intake heater connector mounting nut:
3.4 to 4.6 Nm {0.34 to 0.47 kgm}

- 4) Install the harness connector and harness clamp (27).

- 🔧 Mounting bolt (intake assembly side position):
24 ± 4 Nm {2.45 ± 0.41 kgm}

- 🔧 Mounting bolt (intake assembly upper surface position):
43 ± 6 Nm {4.4 ± 0.6 kgm}

- 5) Install air hose (26).



- MIKALOR clamp

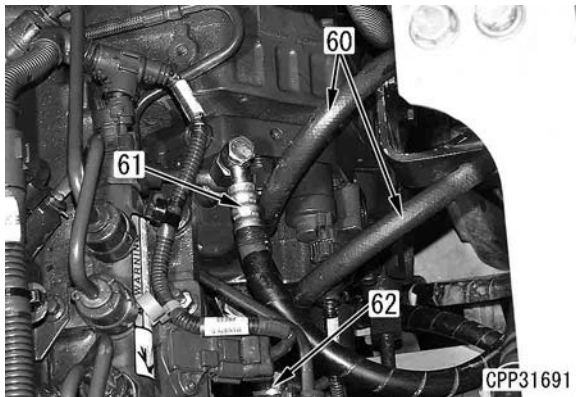
- ★ Be sure to use a new clamp.

- 1) Align hose to its original position (marked position).

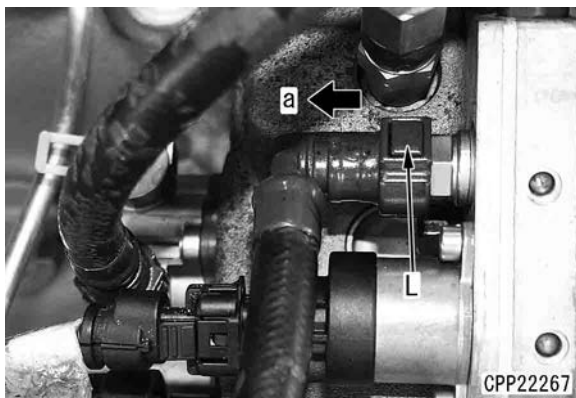
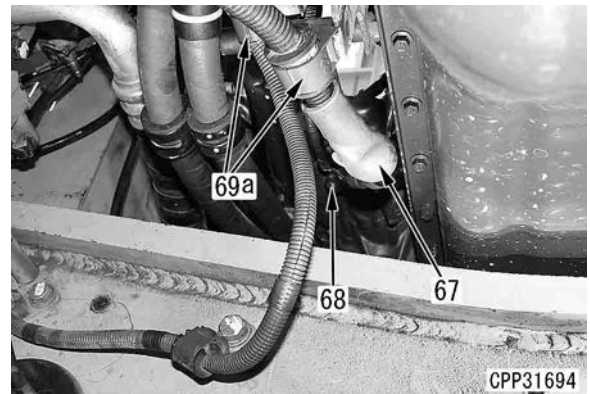
- ★ Reference

Air hose insertion depth: 80 mm (both up and down)

- 2) Set bridge (BR) under clamp fastening bolt, and adjust overlap (b) between bridge (BR) and band to Min. 5 mm.

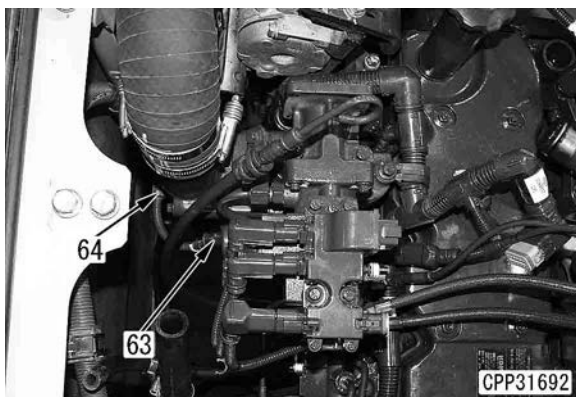
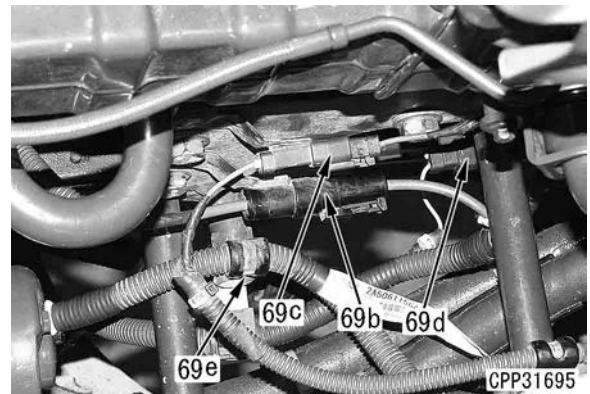


49. Disconnect terminal B (67), terminal C (68), and harness connector (69a) from starting motor. [*13]



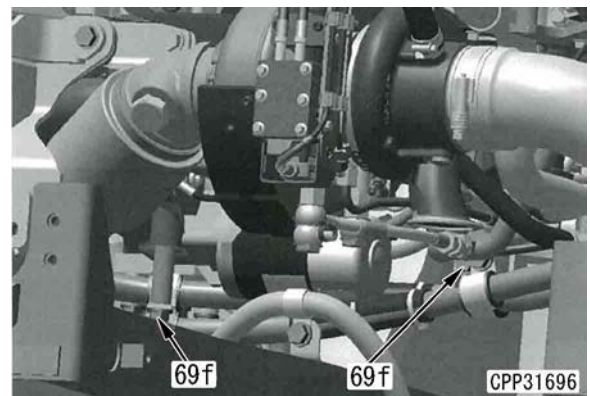
50. Disconnect connector E10 (69b).
 51. Disconnect connectors E08 (69c) and P44 (69d).
 52. Disconnect clamp (69e).

47. Disconnect air intake heater connector E01 (63) and harness clamp (64). [*12]

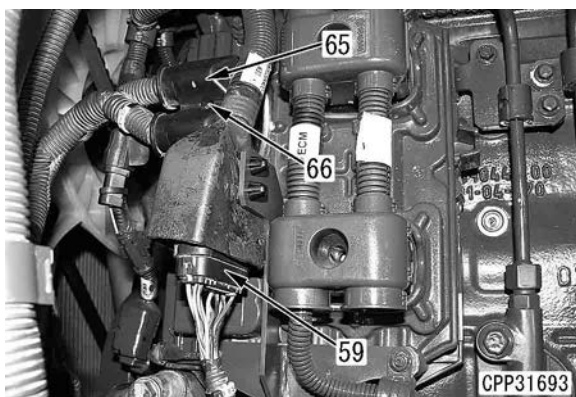


53. Hose clamp (69f):

48. Disconnect connector CE03 (65) from the engine controller.



★ Connector (65) is installed with hexagonal socket head bolt (66) (4 mm).



54. Disconnect hoses (69) and (70). [*14]

55. Disconnect elbows (71) and (72).

56. Remove mounting bolts (73) (4 pieces). [*15]

57. Sling engine assembly (74), and remove it.

- ★ Check that all the wiring, hoses, etc. are disconnected, and then sling the engine.
- ★ Use the method by which you can adjust the angle to sling at 3 points, and slowly sling the engine while adjusting the position.

Removal and installation of KDPF assembly (PC228-A9H0-924-K-00-A)

★ Special tools

Symbol	Part No.	Part name	Necessity	Q'ty	
A	11	Commercially available	Long socket (1/2 inches)	●	1
	12	Commercially available	Long socket (7/16 inches)	●	1

⚠ Place the machine on a level ground and lower the work equipment to the ground in a stable posture.

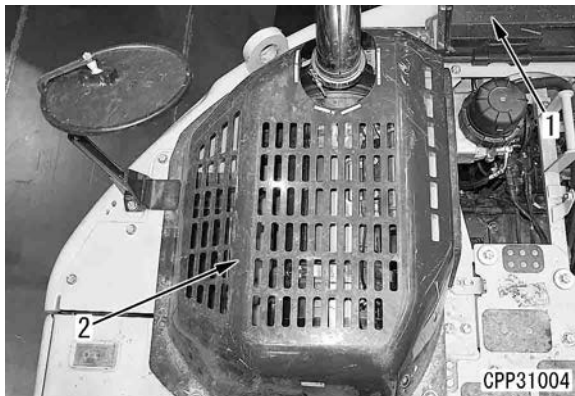
⚠ Stop the engine, turn the battery disconnect switch to OFF position, and remove the key. (For details, see Testing and adjusting, "Handling battery disconnect switch".)

⚠ Set the lock lever in LOCK position.

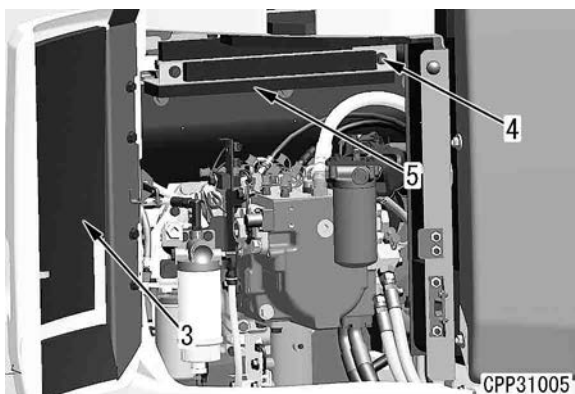
⚠ Check for any accumulated dirt and combustibles (dead leaves, twigs, etc.) on the KDPF, and remove them.

Removal (PC228-A9H0-520-K-00-A)

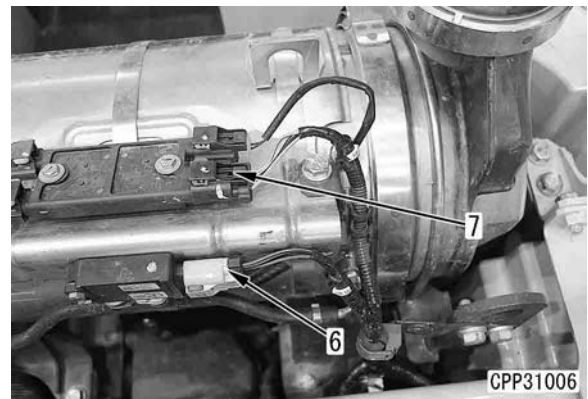
1. Open engine hood (1) and remove hood (2).



2. Open side cover (3), remove mounting bolts (4) (2 pieces), and remove bracket (5).

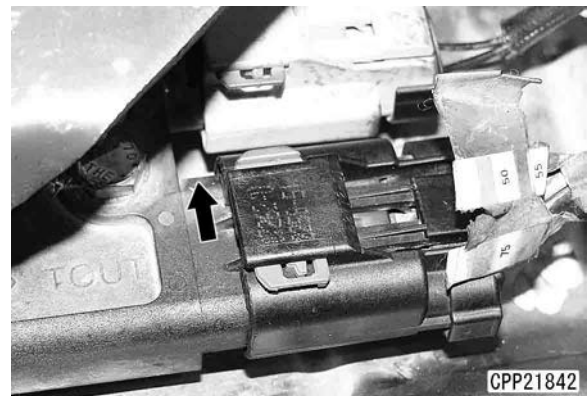


3. Disconnect connectors E25 (6) and E26 (7).



★ Procedure for disconnecting connector

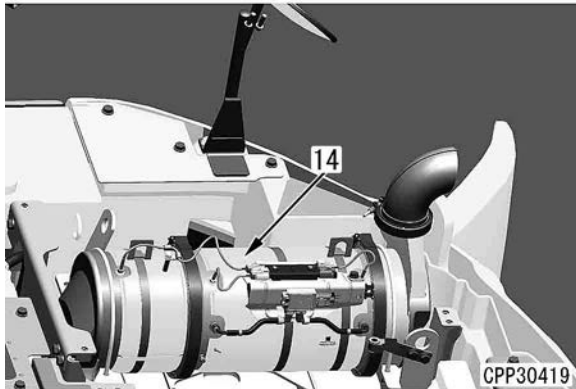
- 1) Slide the lock lever (red) of the connector in the direction of the arrow to unlock.



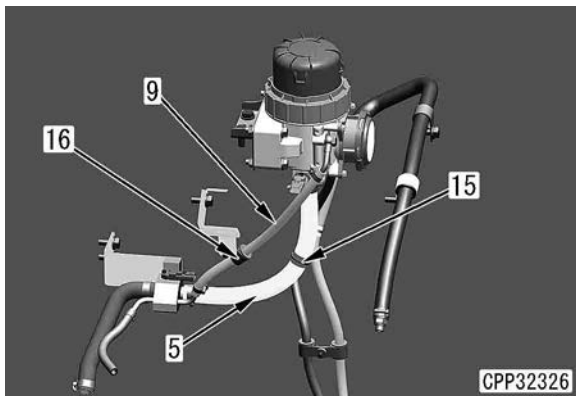
- 2) While pressing the knob on the upper portion of the connector, pull out the connector in the direction of the arrow.



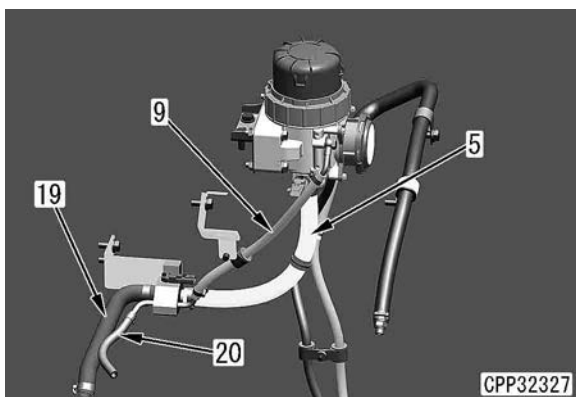
4. Remove clip (9) and clamps (10) and (11) of wiring harness (8).
5. Remove mounting bolts (12), and disconnect bracket (13).



- 2) Disconnect hose band (15) when replacing blowby gas inlet hose (5).
- 3) Disconnect hose clamp (16) when replacing coolant outlet hose (9).

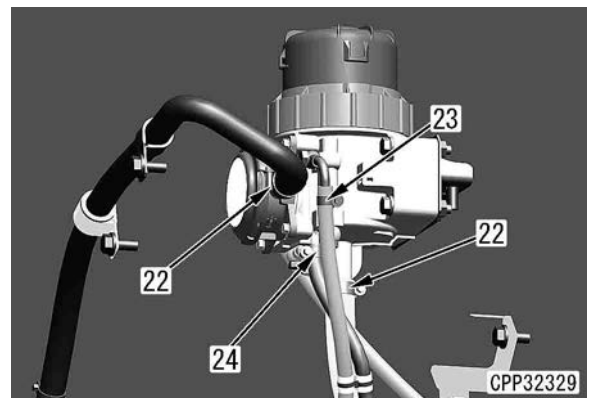
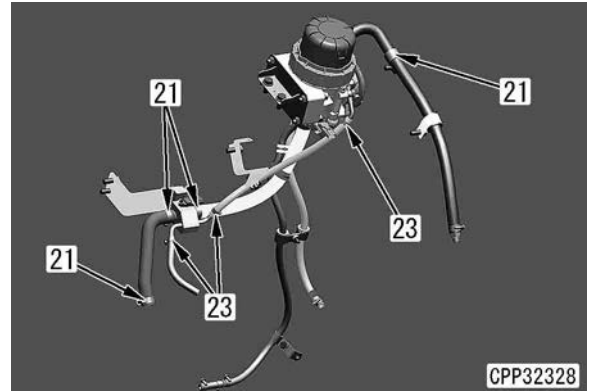


- 4) Remove all clamps that are fixing the hose on both sides, and remove hoses (5), (9), and (20). [*3]

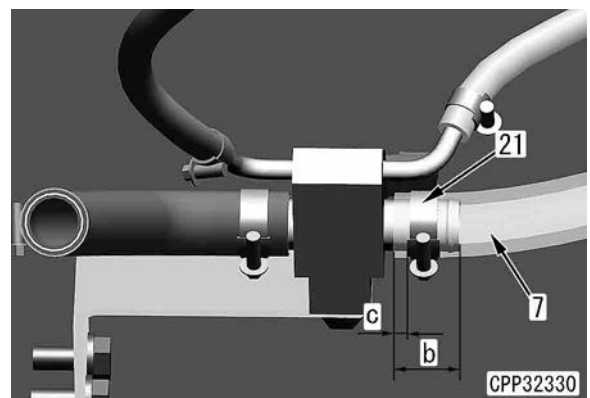


Installation (PC228-A180-720-K-00-A)

- Perform installation in the reverse order to removal.
[*1] [*3]
- ★ If oil drain hose (6) and coolant inlet hose (8) are wrongly installed, the engine may be damaged. So be careful not to install hoses wrongly.
- ★ For the installed dimension of each hose, see the following figure. (Numbers in the figure mean the clamp.)



- ★ Dimensions of blowby gas inlet hoses (5) and (19) (relay block side) and of blowby gas outlet hose (7) (KVGT side) (Blowby gas outlet hose (7) is shown as an example in the figure.)
Hose insertion depth (b): 30 mm
Between hose tip and clamp (c): 5 mm



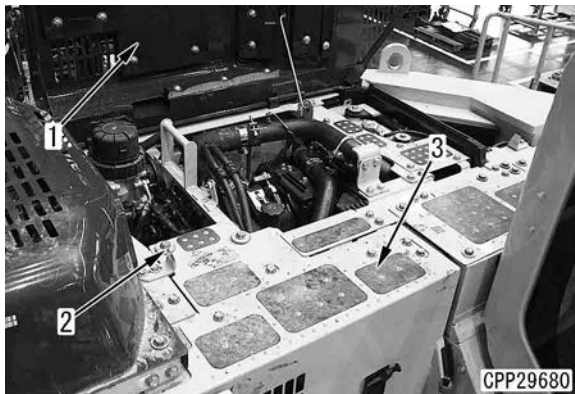
- ★ Dimensions of coolant inlet hose (8) and coolant outlet hoses (9) and (20) (Coolant inlet hose (8) is shown as an example in the figure.)
Hose insertion depth (b): 25mm
Between hose tip and clamp (c): 3 mm

Removal and installation of swing motor and swing machinery assembly (PC228-J120-924-K-00-A)

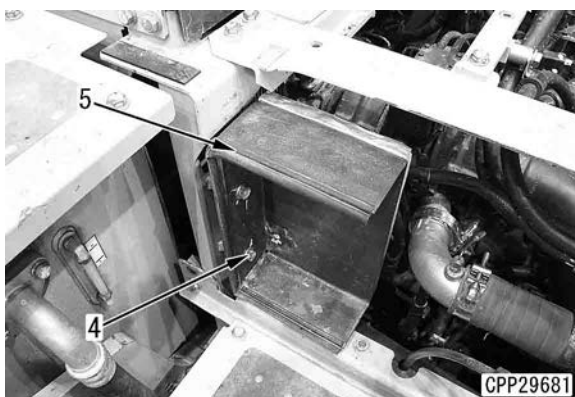
- ⚠ Place the machine on a level ground and lower the work equipment to the ground in a stable posture.
- ⚠ Release the remaining pressure in the hydraulic circuit referring to Testing and adjusting, "Releasing remaining pressure from hydraulic system".
- ⚠ Set the lock lever in LOCK position.
- ⚠ Stop the engine, turn the battery disconnect switch to OFF position, and remove the key. (For details, see Testing and adjusting, "Handling battery disconnect switch".)
- ★ Write down the connector numbers and installed positions before disconnecting wiring and hoses.
- ★ Fit a plug or flange in the place where a hydraulic hose is disconnected to prevent oil from flowing out.

Removal (PC228-J120-520-K-00-A)

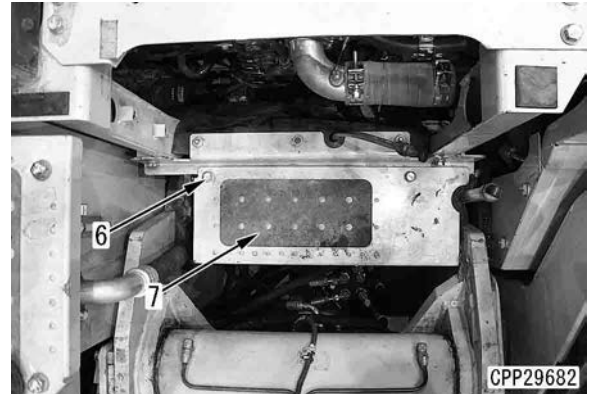
1. Open engine hood (1).
2. Remove mounting bolts (2) (6 pieces), and remove cover (3).



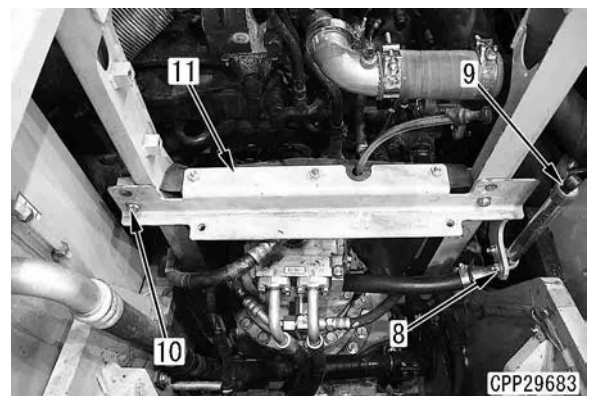
3. Remove mounting bolts (4) (2 pieces), and remove partition plate (5).



4. Remove mounting bolts (6) (2 pieces), and remove cover (7).



5. Remove mounting nuts (2) (8 pieces), and remove dipstick pipe (9).
6. Remove mounting bolts (10) (2 pieces), and remove bracket (11).

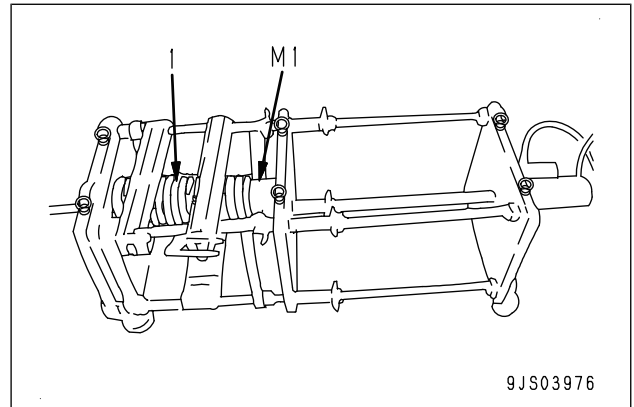


7. Disconnect swing motor hoses (12) to (18).
 - Hoses (12) and (13): Main circuit (port MA and port MB)
 - Hose (14): Suction circuit (port S)
 - Hose (15): Swing parking brake circuit (port B)
 - Hoses (16) and (17): Drain circuit (port T)
 - Hose (18): Swing 2-stage relief circuit (port PI)
- ★ Check the connector numbers and installed positions before disconnecting wiring and hoses, and write them down.
- ★ Fit a plug or flange in the place where a hydraulic hose is disconnected from to prevent oil from flowing out.

Disassembly and assembly of idler cushion assembly (PC228-DTBP-926-K-00-A)

★ Special tools

Symbol	Part No.	Part name	Necessity	Qty
1	791-600-2001 or 791-685-8006	Compressor (A) Compressor (B)	■	1
	790-201-2780	Spacer	■	1
	791-635-3160	Extension	■	1
	790-101-1600	Cylinder (686 kN {70 ton})	■	1
	790-101-1102	Pump	■	1
	791-640-2180	Guide bolt	■	1
M	790-101-5201	Push tool kit (B)	●	1
	790-101-5241	• Plate		1
	790-101-5221	• Grip		1
	01010-51225	• Bolt		2
3	790-201-1500	Push tool kit	●	1
	790-101-1620	• Plate		1
	790-101-5021	• Grip		1
	01010-50816	• Bolt		2



2) Apply oil pressure slowly to compress the spring, remove lock plate (3), and remove nut (4).

★ Compress the spring until the nut is loose.

★ Release the oil pressure slowly to release the tension of the spring.

★ Free length of spring: 561 mm

3) Remove yoke (6), plate (7a) and cylinder (7) from spring (5).

4) Remove snap ring (8), dust seal (9), and bushing (10) from cylinder (7) in this order.

3. Disassembly of piston assembly (2)

1) Remove lock plate (12) from piston (11), and remove valve (13).

2) Remove snap ring (14), and remove U-packing (15) and ring (16).

Assembly (PC228-DTBP-710-K-00-A)

1. Assembly of piston assembly (2)

1) Install ring (16) and U-packing (15) to piston (11), and fix them with snap ring (14).

2) Tighten valve (13) lightly, and secure it with lock plate (12).

2. Assembly of idler cushion assembly

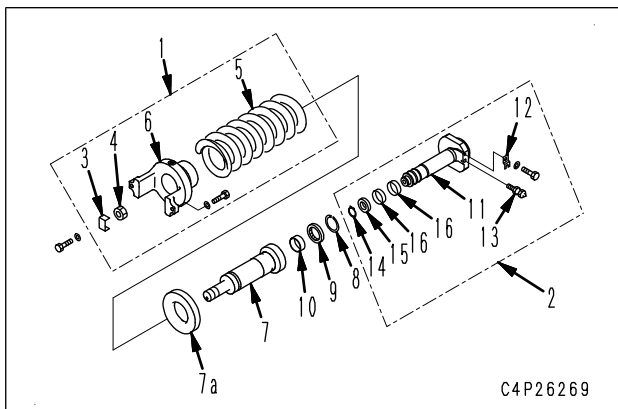
1) Press-fit bushing (10) to cylinder (7) by using tool M2.

2) Install dust seal (9) to cylinder (7) by using tool M3.

3) Secure them with snap ring (8).

⚠ Since the load at installed height of the spring is large and dangerous, set the spring securely.

★ Figure of structure



Disassembly (PC228-DTBP-530-K-00-A)

1. Remove piston assembly (2) from idler cushion assembly (1).

2. Disassembly of idler cushion assembly

1) Set idler cushion assembly (1) to tool M1.

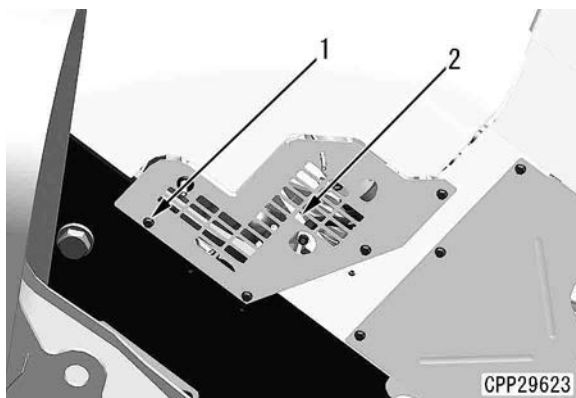
★ Load at installed length of spring: 126.3 kN {12,890 kg}

Removal and installation of hydraulic tank assembly (PC228-PM30-924-K-00-A)

- ⚠ Swing the machine 90 deg.
- ⚠ Place the machine on a level ground and lower the work equipment to the ground in a stable posture.
- ⚠ Release the remaining pressure in the hydraulic circuit referring to Testing and adjusting, "Releasing remaining pressure from hydraulic system".
- ⚠ Set the lock lever in LOCK position.
- ⚠ Stop the engine, turn the battery disconnect switch to OFF position, and remove the key. (For details, see Testing and adjusting, "Handling battery disconnect switch".)
- ★ Write down the connector numbers and installed positions before disconnecting wiring and hoses.
- ★ Fit a plug or flange in the place where a hydraulic hose is disconnected to prevent oil from flowing out.

Removal (PC228-PM30-520-K-00-A)

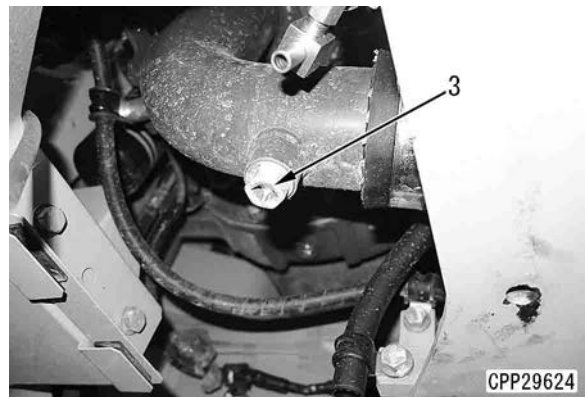
1. Remove mounting bolts (1) (4 pieces) from the bottom of the machine, and remove undercover (2).



2. Remove plug (3), and drain the oil from the hydraulic oil tank.



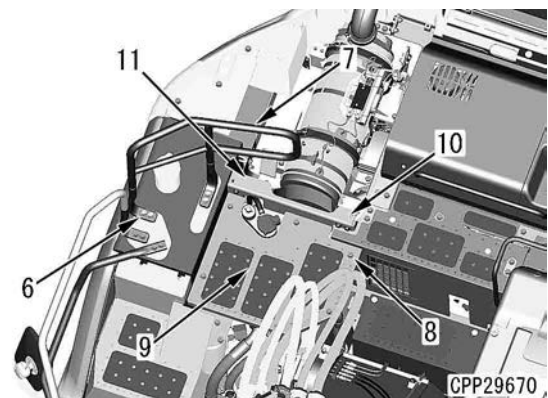
Hydraulic tank:
126 ℓ



3. Open the engine hood, and remove mounting bolts (4) (3 pieces), and remove cover (5).

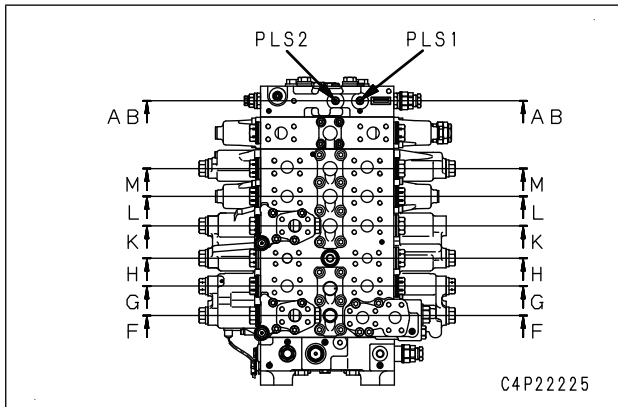


4. Remove mounting bolts (6) (4 pieces), and remove handrail (7).
5. Remove mounting bolts (8) (5 pieces), and remove cover (9).
6. Remove mounting bolts (10) (3 pieces), and remove bracket (11).

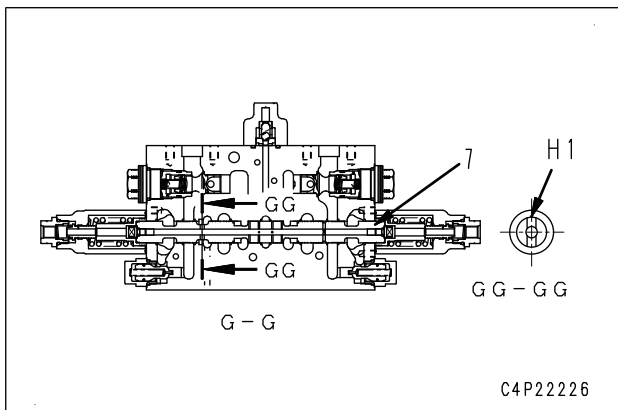


7. Remove mounting bolts (12) (4 pieces), and remove cover (13).
8. Remove mounting bolt (14), and remove cover (15).

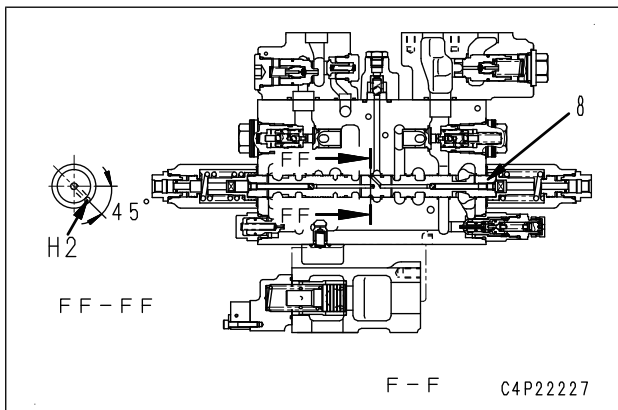
Assembly of control valve assembly (PC228-C030-530-K-00-A)



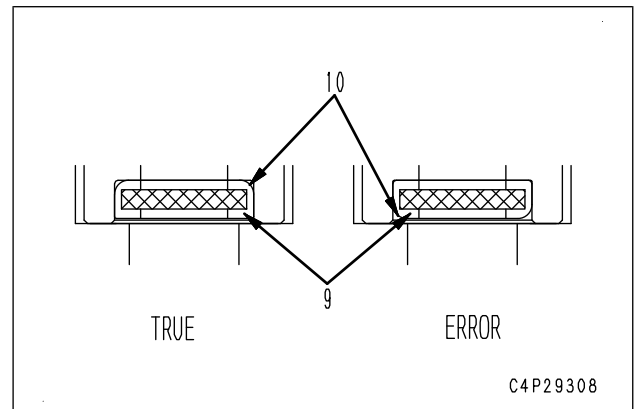
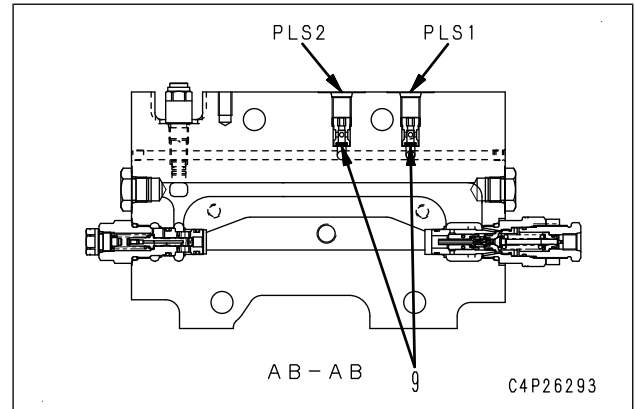
- ★ Apply engine oil on the sliding surfaces on the parts before assembling them.
- ★ When installing spool (7) to the valve chest, make sure that drilled hole (H1) faces the direction shown in the figure.
- ★ Similarly for cross section L-L.



- When installing spool (8) to the valve chest, make sure that drilled hole (H2) faces the direction shown in the figure.
- ★ Similarly for cross sections H-H, K-K, and M-M.



- ★ Install filters (9) at the bottom of ports (PLS1) and (PLS2) in the direction shown in the figure below. (Be careful with positioning of caulked part (10).)



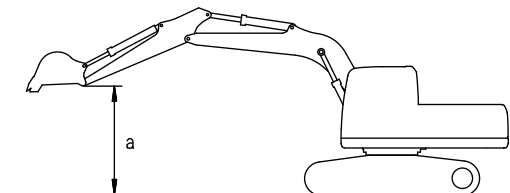
Remove and install anti-Drop valve assembly for boom (PC200-LA1Q-924-K-00-A)

- ⚠ Place the machine on a level ground.
 - ⚠ Remove the anti-drop valve assembly from the machine body, and then perform disassembling of the anti-drop valve assembly.
 - ⚠ High pressure may remain in the anti-drop valve assembly even after performing normal releasing procedure. Be sure to perform this procedure, and then perform the releasing procedure.
 - ⚠ When the arm cylinder stop moving only in one direction inside the anti-drop valve for arm, operate the cylinder to the stroke end in a movable direction. Lower the bucket to the ground, and then perform releasing the remaining pressure.
 - ⚠ If the bucket is not lowered and the anti-drop valve is removed from the cylinder, the high pressurized oil may spurt out. It is very dangerous.
- ★ Wash around the anti-drop valve assembly in order to prevent any dust or dirt from entering it, and then perform the work.
 - ★ Install a plug or flange in the place where a hydraulic hose is disconnected to prevent oil from flowing out.
 - ★ Check the connector numbers and installed positions before disconnecting wirings and hoses, and record them.

Removal (PC200-LA1Q-520-K-00-A)

1. Check for the function of PPC circuit accumulator.

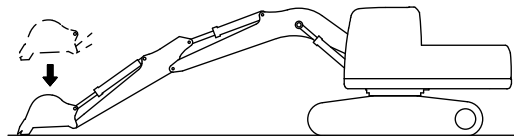
- 1) Set the arm cylinder and bucket cylinder to the most retracted position (maximum arm OUT/bucket DUMP position), and hold the work equipment at the height (a) off from the ground.
 - ★ (a) : 1.5 m



B4P34032

- 2) Keep the arm cylinder and bucket cylinder at the most retracted position. Turn the starting switch to OFF position to stop the engine.
- 3) Turn the starting switch to ON position.

- 4) Set the work equipment lock lever in FREE position.
- 5) Check that the work equipment is lowered to the ground by operating the work equipment control lever to the boom LOWER direction fully to the stroke end.



B4P34033

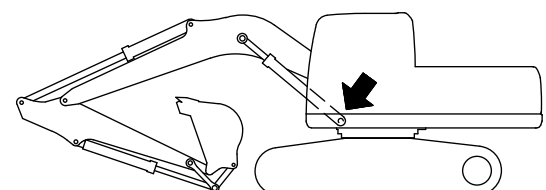
- ⚠ Perform the step 3) to 5) in 15 seconds after the engine stopped, since the battery charge in the PPC accumulator lowers gradually.

- ⚠ If the work equipment is not lowered or stops on the way, the battery charge of the PPC accumulator may be lowered. In such case, the remaining pressure cannot be released with this procedure.

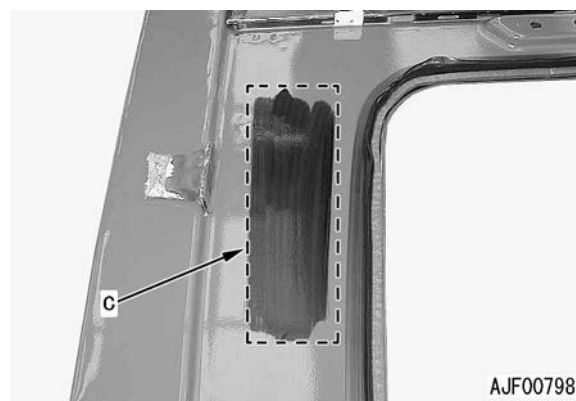
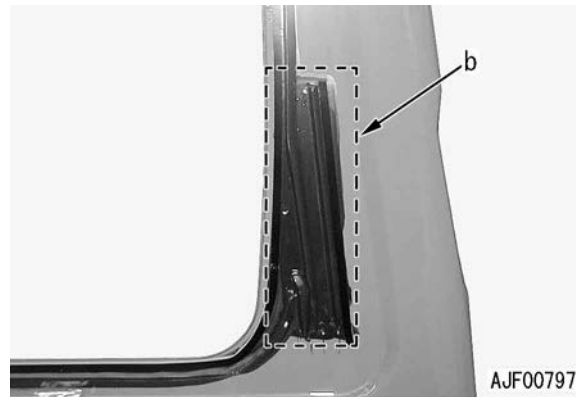
- ★ If the work equipment is lowered by its own weight to the ground, the battery charge of the PPC accumulator is normal.
- ★ PPC accumulator is a periodic inspection item and an important periodic replacement part.

2. Releasing the remaining pressure in hydraulic cylinder circuit

- 1) Start the engine.
 - 2) Set the arm cylinder and bucket cylinder to the most extended position (maximum arm IN/bucket CURL position) or the most retracted position (maximum arm OUT/bucket DUMP position), and lower the work equipment to the ground.
- ★ Anti-drop valve is installed to the bottom side of the boom cylinder. When the work equipment is lowered with this posture, the oil in the bottom side of the boom cylinder is drained, and the remaining pressure is low.



B4P34034



- ★ Never use wrong primer for coating. If a wrong primer such as glass primer is applied, wipe it out completely by using white gasoline.
- 4) Apply the glass primer to the mounting surface of window glass (9).



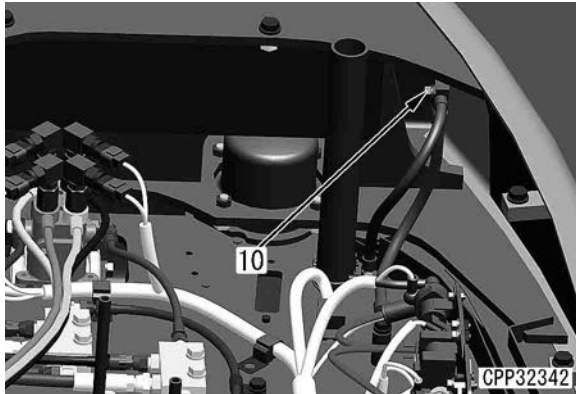
Primer for glass:

SUNSTAR PRIMER 453-41 for glass

- ★ Limit the application of the primer to 2 times. (Application beyond 2 times cause degradation.)



- ★ Places to be applied: Apply the primer to the entire area of installation position (d) which is a periphery of whole area of window glass (9) relative to dam rubber (6) mounting position and operator's cab (8).
- Primer application dimension (d): 30 mm
- ★ Do not apply the primer to about 5 mm of the border area between the black and transparent portions on the window glass.
- ★ After application, leave it for more than 5 minutes (but not longer than 8 hours) for air drying.
- ★ Never use wrong primer for coating. If a wrong primer such as painted surface primer is applied, wipe it out completely by using white gasoline.

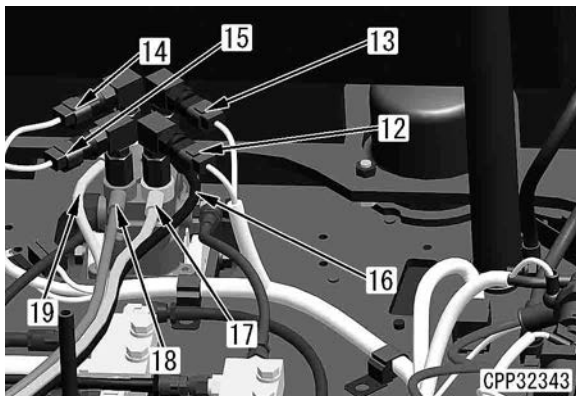


9. Disconnect connectors (12) to (15) from travel PPC valve (11).

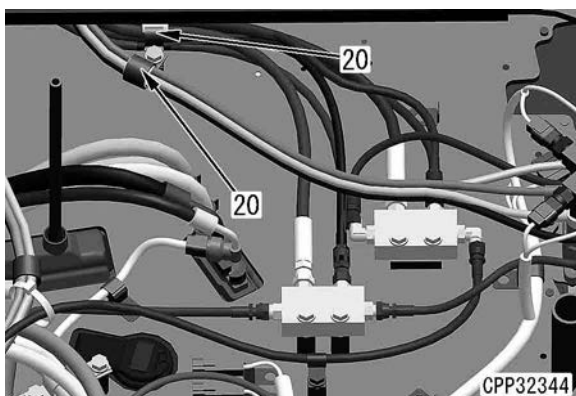
- Connector (12): L.H. reverse oil pressure sensor (P10)
- Connector (13): L.H. forward oil pressure sensor (P09)
- Connector (14): R.H. forward oil pressure sensor (P11)
- Connector (15): R.H. reverse oil pressure sensor (P12)

10. Disconnect hoses (16) to (19) from travel PPC valve (11).

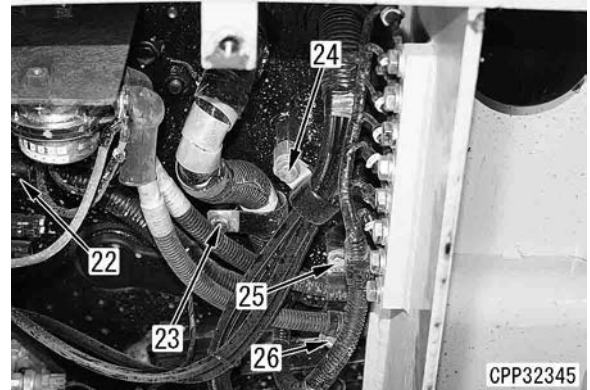
- ★ The band color of the hoses are as shown below.
- Hose (16): Red (L.H. forward port (P2))
- Hose (17): No band (L.H. reverse port (P1))
- Hose (18): Blue (R.H. reverse port (P3))
- Hose (19): Green (R.H. forward port (P4))



11. Disconnect clamp (20) (1 bolt).



12. Remove clip (22) and clamps (23), (24), (25), and (26).

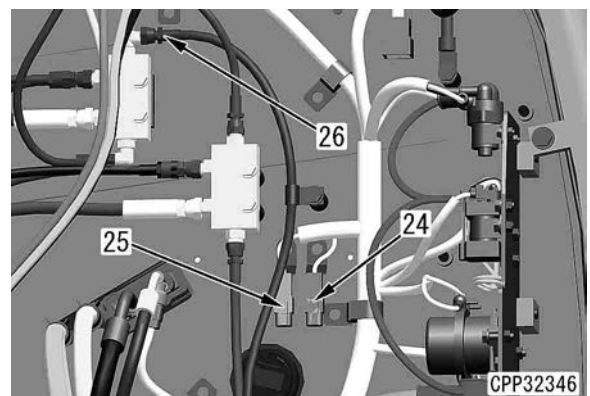


13. Pull out connectors (24) and (25) from the clip.

- Connector (24): Intermediate connector (A41) (Machine equipped with camera 2)
- Connector (25): Intermediate connector (A42) (Machine equipped with camera 3)

14. Disconnect hose (26).

- Hose (26): Port (P) (Circuit from PPC oil pressure lock solenoid valve)



15. Disconnect hose (27).

- Hose (27): Port (T) (Drain circuit to hydraulic tank)

- ★ Cut all the cable ties that are fixing the wiring harness and floor frame.

16. Disconnect connector (28).

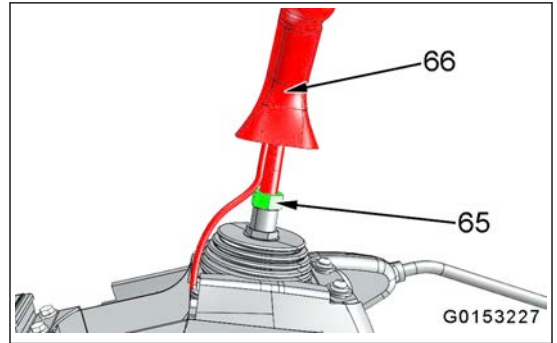
- Connector (28): Dual pressure switch (P17) of air conditioner

17. Remove bolt (29) and then disconnect air conditioner tube (30). [*2]

18. Remove clamp (31) (1 bolt) that is fixing tube (30).

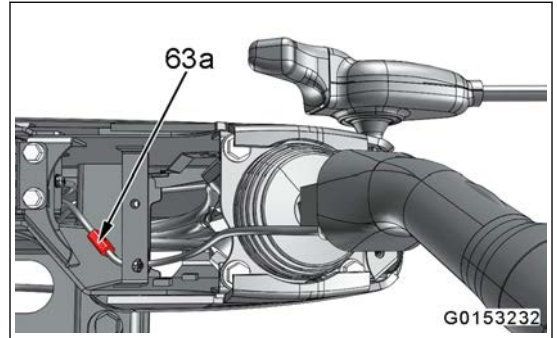
19. Disconnect heater core hose (32).

- 3) Loosen the nut (65), and remove the work equipment control lever assembly (66).

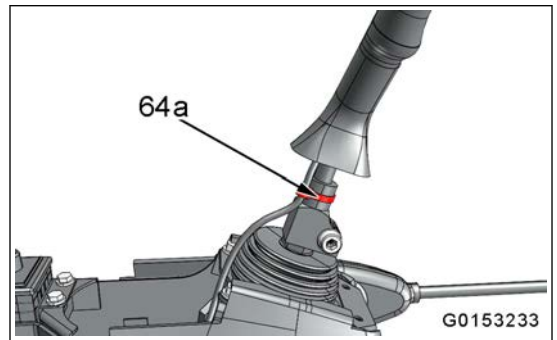


- Split boss type

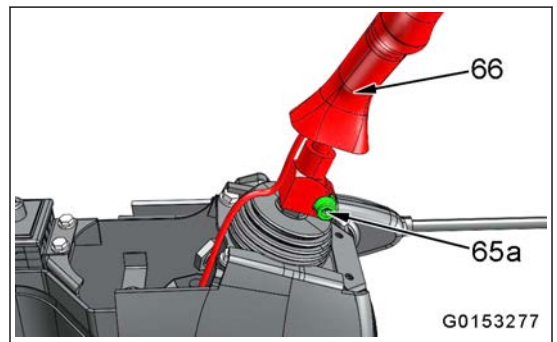
- 1) Disconnect the connector (63a).



- 2) Cut the 2 bands (64a).



- 3) Remove the bolt (65a), and remove the work equipment control lever assembly (66).



- ★ When installing the hose for the air conditioner circuit, be careful not to let dirt, dusts and water going into the hose.
- ★ Check that O-ring (14) is installed to the joints of connecting the air conditioner piping when connecting the piping.
- ★ Once O-ring (14) is used, it is deformed and deteriorated. Accordingly, do not reuse it.
- ★ When removing O-rings (14), use a soft tool so that the piping is not damaged.
- ★ Check that O-ring (14) is free from flaws and deterioration.



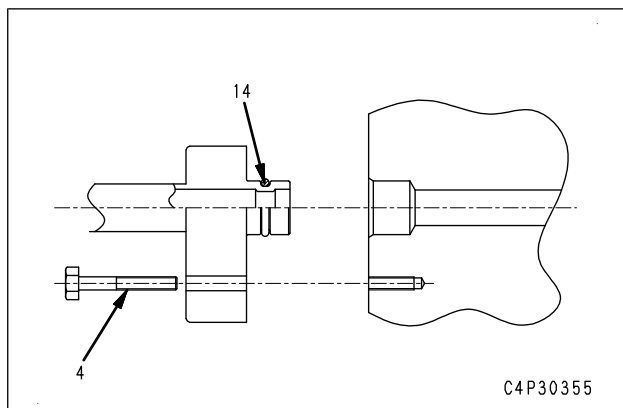
O-ring:

**Refrigerant (R134a) compressor oil
(DENSO: ND-OIL8)**



Hose clamp (M6 bolt) (4):

8 to 12 Nm {0.8 to 1.2 kgm}



[*3]

See Testing and adjusting, "Testing and adjusting air conditioner compressor belt tension".



Lock nut (10):

108 to 132 Nm {11.0 to 13.5 kgm}



Mounting bolt (9):

59 to 74 Nm {6.0 to 7.5 kgm}

[*4]



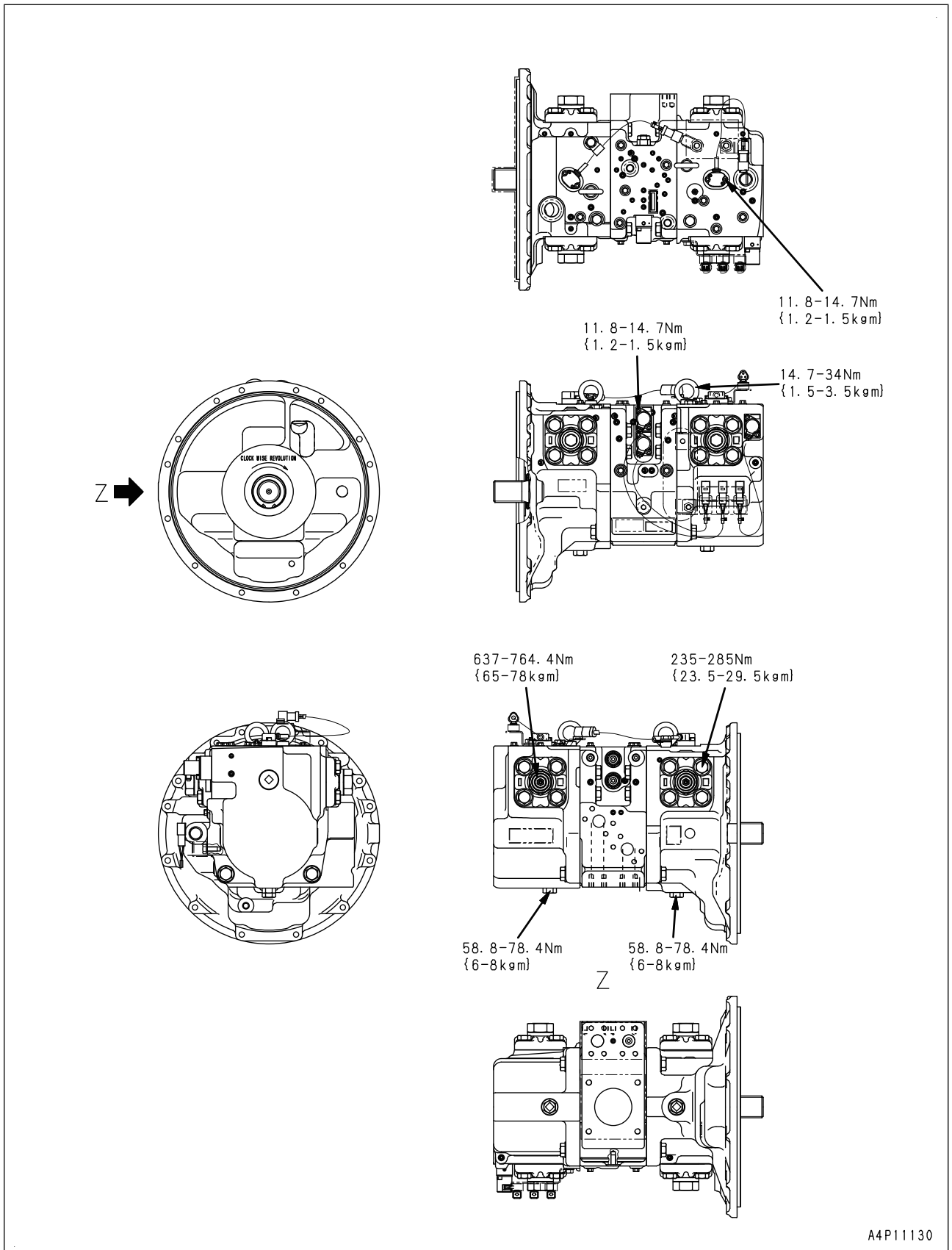
Mounting bolt (13):

24.5 to 29.4 Nm {2.5 to 3.0 kgm}

					Unit: mm
No.	Item	Criteria			Remedy
		Standard clearance	Allowable clearance		
1	Backlash between swing motor shaft and No. 1 sun gear	Standard clearance			—
		0.18 to 0.28			
2	Backlash between No. 1 sun gear and No. 1 planetary gear	0.16 to 0.50			1.00
3	Backlash between No. 1 planetary gear and ring gear	0.18 to 0.59			1.10
4	Backlash between No. 1 planetary carrier and No. 2 sun gear	0.39 to 0.71			1.20
5	Backlash between No. 2 sun gear and No. 2 planetary gear	0.16 to 0.50			0.90
6	Backlash between No. 2 planetary gear and ring gear	0.18 to 0.59			1.00
7	Backlash between No. 2 planetary carrier and swing pinion	0.07 to 0.23			—
8	Backlash between swing pinion and swing circle	0.22 to 1.32			2.00
9	Clearance between plate and No. 2 planetary carrier	0.9 ± 0.24			—
10	Clearance between plate and No. 2 sun gear	2.3 ± 0.64			—
11	Outside diameter of oil seal contact surface of spacer	Standard dimension	Tolerance	Repair limit	Repair by hard chrome plating or replace
		125	0 -0.100	—	

Replace

Main pump (PC-C200-034-K-00-A)



A4P11130

							Unit:mm
No.	Item	Criteria					Remedy
		Standard dimension			Repair limit		
		Free height x Outside diameter	Installed height	Load at installed length	Free height	Load at installed length	
1	Centering spring (for ports P3 and P4)	42.5 x 15.5	34.0	17.7 N {1.80 kg}	-	14.1 N {1.44 kg}	Replace ring if damaged or deformed
2	Centering spring (for ports P1 and P2)	44.5 x 15.5	34.0	29.4 N {3.0 kg}	-	23.5 N {2.40 kg}	
3	Metering spring	26.5 x 8.15	24.9	16.7 N {1.70 kg}	-	13.3 N {1.36 kg}	

Unit: mm

No.	Item	Criteria					Remedy
		Standard dimension	Tolerance		Clearance	Allowable clearance	
			Shaft	Hole			
1	Clearance between mounting pin and bushing of revolving frame and boom	90	-0.036 -0.071	(+0.135) (+0.074)	(0.110 to 0.206)	1.0	Replace pin and bushing
2	Inside diameter of hole to insert bushing on boom side at joint of revolving frame and boom	105	—	+0.035 0	—	—	Build up by welding, then work
3	Clearance between mounting pin and bushing of boom and arm	90	-0.036 -0.071	(+0.137) (+0.077)	(0.113 to 0.208)	1.0	Replace pin and bushing
4	Inside diameter of hole to insert bushing on arm side at joint of boom and arm	105	—	+0.054 0	—	—	Build up by welding, then work
5	Clearance between mounting pin and bushing of arm and link	70	-0.030 -0.076	(+0.335) (+0.275)	(0.305 to 0.411)	1.0	Replace pin and bushing
6	Inside diameter of hole to insert bushing on arm side at joint of arm and link	85	—	+0.054 0	—	—	Build up by welding, then work
7	Clearance between mounting pin and bushing of arm and bucket	80	-0.030 -0.076	(+0.324) (+0.270)	(0.300 to 0.400)	1.0	Replace pin and bushing
8	Inside diameter of hole to insert bushing on arm side at joint of arm and bucket	110	—	+0.035 0	—	—	Build up by welding, then work
9	Clearance between mounting pin and bushing of link and bucket	80	-0.030 -0.076	(+0.337) (+0.273)	(0.303 to 0.413)	1.0	Replace pin and bushing
10	Clearance between mounting pin and bushing of links	70	-0.030 -0.076	(+0.335) (+0.275)	(0.303 to 0.411)	1.0	

(): Reference dimension

Unit: mm

No.	Item	Greasing interval	Criteria				Standard clearance	Remedy
			Width of boss		Width of hinge			
			Standard dimension	Tolerance	Standard dimension	Tolerance		
11	Joint of revolving frame and boom	(*2) 500 hours	625.5	0 -0.5	632	+1 -2	4.5 to 8.0	Adjust clearance to 1.0 mm or less by using shims
			L11: Adjust by combining shims 2.0 mm thick (2), 2.5 mm thick (1), 3.0 mm thick (1), and 3.5 mm thick (1) R7: Insert shim 2.0 mm thick (1)					
12	(*1) Joint of revolving frame and boom cylinder	(*2) 500 hours	96	±1.2	99.3	+1.5 0	2.1 to 6.0	Adjust clearance to 1.5 mm or less by using shims
			L12: Adjust by combining shims 1.0 mm thick (1) and 2.0 mm thick (2) R12: Insert shim 1.0 mm thick (1)					

- If there is an insufficient quantity of refrigerant, all of it will be evaporated while it is passing through the evaporator. This causes evaporator efficiency to deteriorate, which will result in defective air conditioning.
- If there is excessive refrigerant, not all of it will be evaporated and part of it will be sucked into the compressor in liquid form, which will cause the compressor to compress the liquid and may damage the components.
- If water gets into the refrigeration circuit, it will freeze at a small hole in the expansion valve, lower the refrigerant flow, and may result in defective air conditioning.

Input and output signals of the air conditioner controller (ALL-K5G4-03C-K-00-A)

Controller connector: AMP 025 - 32PM

Wiring harness connector: ACECU

AMP025 - 32PF

Pin No.	Symbol	Signal name	Input/Output signal
1	+Bback	Backup power supply	Input
2	–	(*1)	–
3	SS	Sunlight sensor	Input
4	THOUT	Outside air temperature sensor	Input
5	THF	Evaporator temperature sensor	Input
6	THI	Inside air temperature sensor	Input
7	POT5 V	Servomotor potentiometer power supply (5 V)	Output
8	BWFB	Blower feedback signal	Input
9	PTRB	Power transistor control signal	Output
10	CAN_H	CAN communication signal (H)	Input/output
11	CAN_L	CAN communication signal (L)	Input/output
12	–	(*1)	–
13	MRFA	Fresh/recirculated air servomotor terminal A	Output
14	MRFB	Fresh/recirculated air servomotor terminal B	Output
15	MAMA	Air mix servomotor terminal A	Output
16	MAMB	Air mix servomotor terminal B	Output
17	+24 V	24 V power supply	Input
18	–	(*1)	–
19	SAM	Air mix servomotor potentiometer signal	Input
20	SVI	Vent (mode) changeover servomotor potentiometer signal	Input
21	PRESS SW	Dual pressure switch	Input
22	–	(*1)	–
23	–	(*1)	–
24	–	(*1)	–
25	GNDS	Sensor GND	Input
26	GND	GND	Input
27	–	(*1)	–
28	–	(*1)	–
29	RLCC	Compressor clutch relay	Output
30	–	(*1)	–
31	MV1A	Vent (mode) changeover servomotor terminal A	Output
32	MV1B	Vent (mode) changeover servomotor terminal B	Output

*1: Never connect these pins. Malfunctions or failures may occur.

Function (ALL-K5G4-042-K-00-A)

- Operation of air conditioner controller
 1. Performing CAN communication with the machine monitor, the air conditioner controller controls the air conditioner unit by inputting switches associated with air conditioning.
 2. The air conditioner controller controls three servomotors located inside the air conditioner unit in order to adjust the temperature (airmix), perform vent (mode) changeover, and perform FRESH/RECIRC air changeover.
 3. The air conditioner controller controls the ON/OFF condition of the compressor clutch relay (i.e., a switch for activating the compressor).
 4. The air conditioner controller controls the air flow volume using the power transistor.
 - ★ The power transistor has an overcurrent prevention fuse in it.

Testing sunlight sensor *(PC220-K5FH-001-K-00-A)*

⚠ Place the machine on a level ground, lower the work equipment to the ground and stop the engine.

⚠ Turn the battery disconnect switch to the OFF position and remove the key.

★ Note the connector numbers and installed positions before disconnecting wiring harnesses and hoses.

Testing *(PC220-K5FH-360-K-01-A)*

1. Remove the machine monitor cover. For details, see "Testing air leakage (duct)", Steps 6 and 7.
2. Check connector P31 at the rear of the sunlight sensor. (Check whether the connector is coming off.)
3. Disconnect connector P31, remove the sunlight sensor, and measure the voltage between the terminals on the sensor side using a circuit tester in voltage range.
 - Approximate voltage of sunlight sensor unit
 - 0.55 V: Direct sunlight
 - 0.45 V: Cloudy
 - 0.4 V: Indoors



Failure code [879DKZ] Sunlight Sensor Open or Short Circuit (PC138-879DKZ-400-A-

Z0-A)

Action level	Failure code	Failure	Sunlight Sensor Open or Short Circuit (Machine monitor system)
—	879DKZ		
Detail of failure	<ul style="list-style-type: none"> The air conditioner controller detects open circuit or short circuit in the sunlight sensor 		
Action of controller	<ul style="list-style-type: none"> The air conditioner controller sends information about open or short circuit of the sunlight sensor to the machine monitor via CAN communication. When the air conditioner is on Auto mode, the controller continues controlling the air conditioner neglecting data from the sunlight sensor. 		
Problem on machine	<ul style="list-style-type: none"> Due to an open circuit or a short circuit in the sunlight sensor for the air conditioner, the amount of sunshine is not taken into consideration for the air conditioner in Auto mode. (The air conditioner in manual mode is not affected by this failure.) 		
Related information	<ul style="list-style-type: none"> Method of reproducing failure code: Turn starting switch to ON position. Check whether this failure code is displayed on the electrical system abnormality record screen in service mode of the machine monitor. For each connector, see "Parts and connectors layout". Since T-adaptor is not provided for the connector ACECU of the air conditioner controller and the pin size is small, use the intermediate connector for troubleshooting (T-adaptor is also not provided for the intermediate connector, however, the pin size is larger). When replacing the air conditioner wiring harness between connector ACECU of the air conditioner controller and the intermediate connector, you must replace the entire air conditioner unit. 		

No.	Cause	Procedure, measuring location, criteria, and remarks			
1	Defective sunlight sensor	1. See "Testing sunlight sensor".			
		Voltage	Between sunlight sensor terminals	Direct sunlight	Approx. 0.55 V
				Cloudy	Approx. 0.45 V
				Indoor	Approx. 0.4 V
2	Open circuit in wiring harness (Wire breakage or defective contact of connector)	1. Turn starting switch to OFF position. 2. Disconnect connector P31. ★ See "Testing sunlight sensor".			
		Resistance	Between P31 (female) (1) and AC01 (female) (1)	Max. 1 Ω	
			Between P31 (female) (2) and AC01 (female) (2)	Max. 1 Ω	
3	Defective air conditioner controller	If no failures are found by the above checks, the air conditioner controller may be defective. (Since this is an internal defect, troubleshooting cannot be performed.)			
4	Defective air conditioner unit	If no failures are found by the above checks, the air conditioner unit may be defective. (Since this is an internal defect, troubleshooting cannot be performed.)			

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