SHOP MANUAL

KOMATSU

PC210, 210LC, 210NLC
PC240LC, 240NLC-7K

MACHINE MODEL	SERIAL NUMBER
PC210-7K	**K40001 AND UP**
PC210LC-7K	**K40001 AND UP**
PC210-NLC-7K	**K40001 AND UP**
PC240LC-7K	**K40001 AND UP**
PC240NLC-7K	**K40001 AND UP**

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

Printed in Belgium 06-02

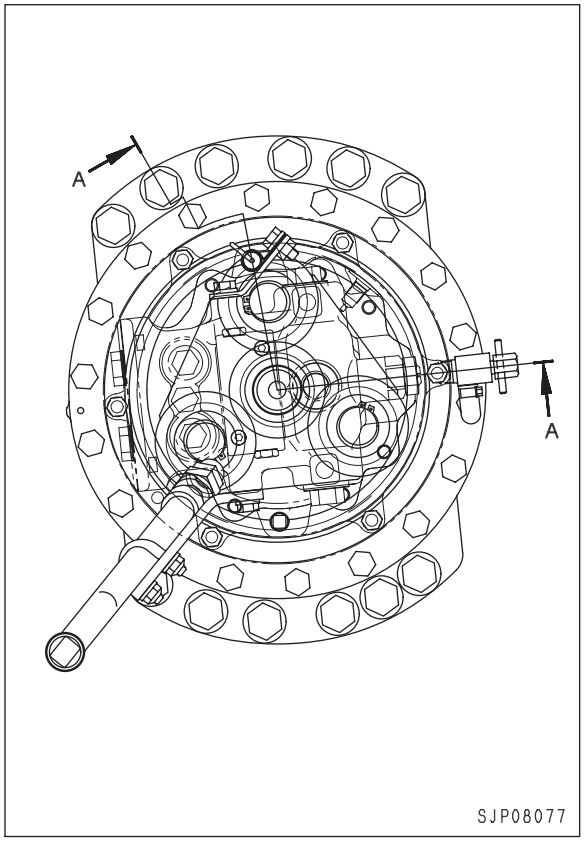
DIMENSIONS

	Item	Unit	PC240LC-7K	PC240NLC-7K
A	Overall length	mm	9,885	9,885
B	Overall height	mm	3,160	3,160
C	Overall width	mm	2,980	3,280
D	Track shoe width	mm	600	700
E	Height of cab	mm	3,015	3,015
F	Tail swing radius	mm	2,940	2,940
G	Track overall length	mm	4,250	4,640
H	Length of track on ground	mm	3,460	3,845
	Min. ground clearance	mm	440	400

WORKING RANGES

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

10 STRUCTURE, FUNCTION, AND MAINTENANCE STANDARD



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

SPECIFICATIONS

Reduction ratio:

$$\left(\frac{17+58}{17}\right)\times\left(\frac{14+58}{14}\right)=22.689$$

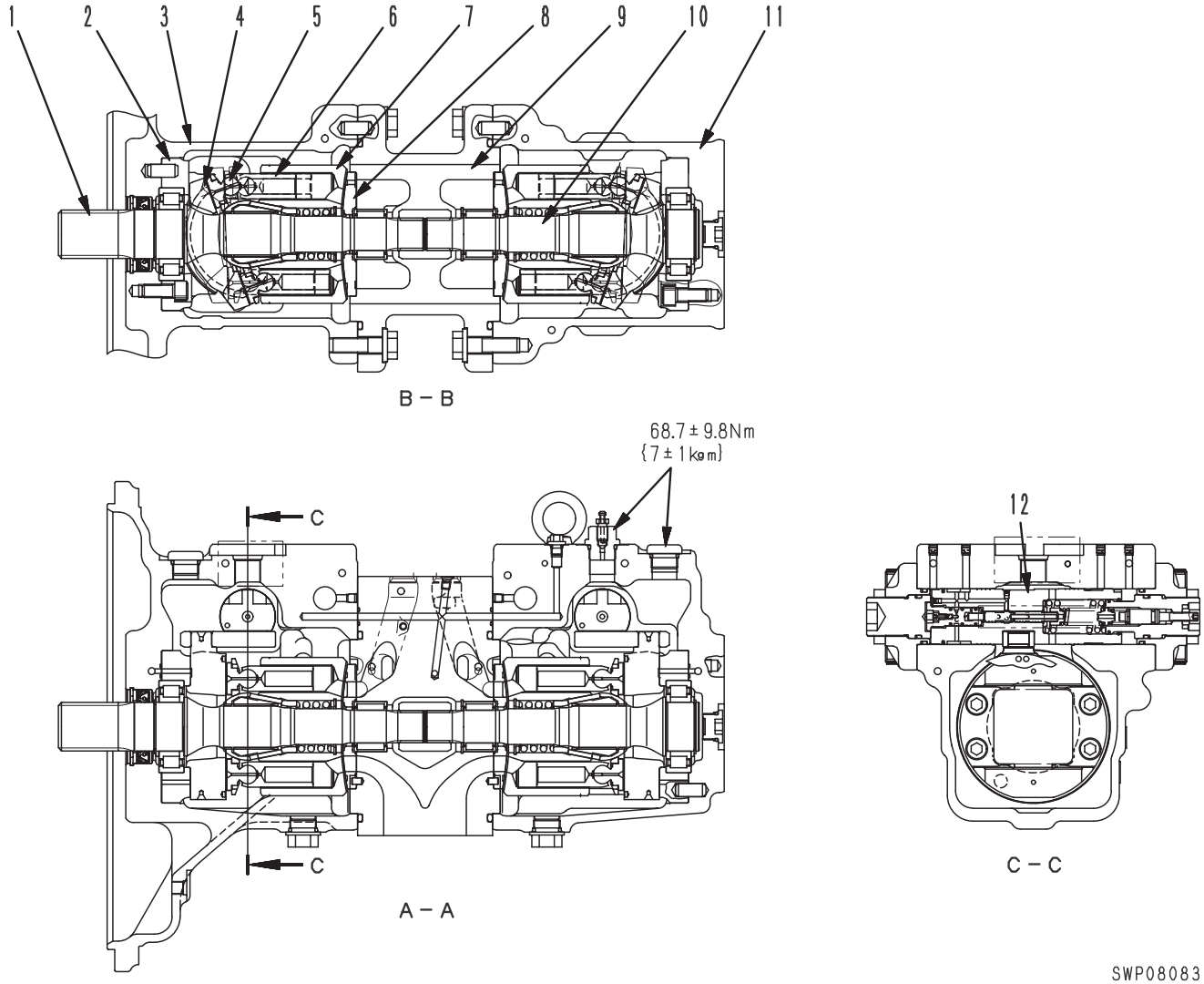
Unit: mm

No.	Check item	Criteria		Remedy
14	Backlash between swing motor shaft and No. 1 sun gear	Standard clearance	Clearance limit	Replace
		0.18 - 0.28	—	
15	Backlash between No. 1 sun gear and No. 1 planetary gear	0.16 - 0.59	1.00	
16	Backlash between No. 1 planetary gear and ring gear	0.18 - 0.50	1.10	
17	Backlash between No. 1 planetary carrier and No. 2 sun gear	0.39 - 0.64	1.20	
18	Backlash between No. 2 sun gear and No. 2 planetary gear	0.16 - 0.44	0.90	
19	Backlash between No. 2 planetary gear and ring gear	0.18 - 0.56	1.00	
20	Backlash between No. 2 planetary carrier and swing pinion	0.08 - 0.23	—	
21	Backlash between swing pinion and swing circle	0.23 - 1.37	2.00	
22	Clearance between plate and planetary carrier	0.58 - 0.62	—	
23	Wear of swing pinion surface contacting with oil seal	Standard size	Repair limit	Apply hard chrome plating, recondition, or replace
		115 $^{0}_{-0.100}$	—	

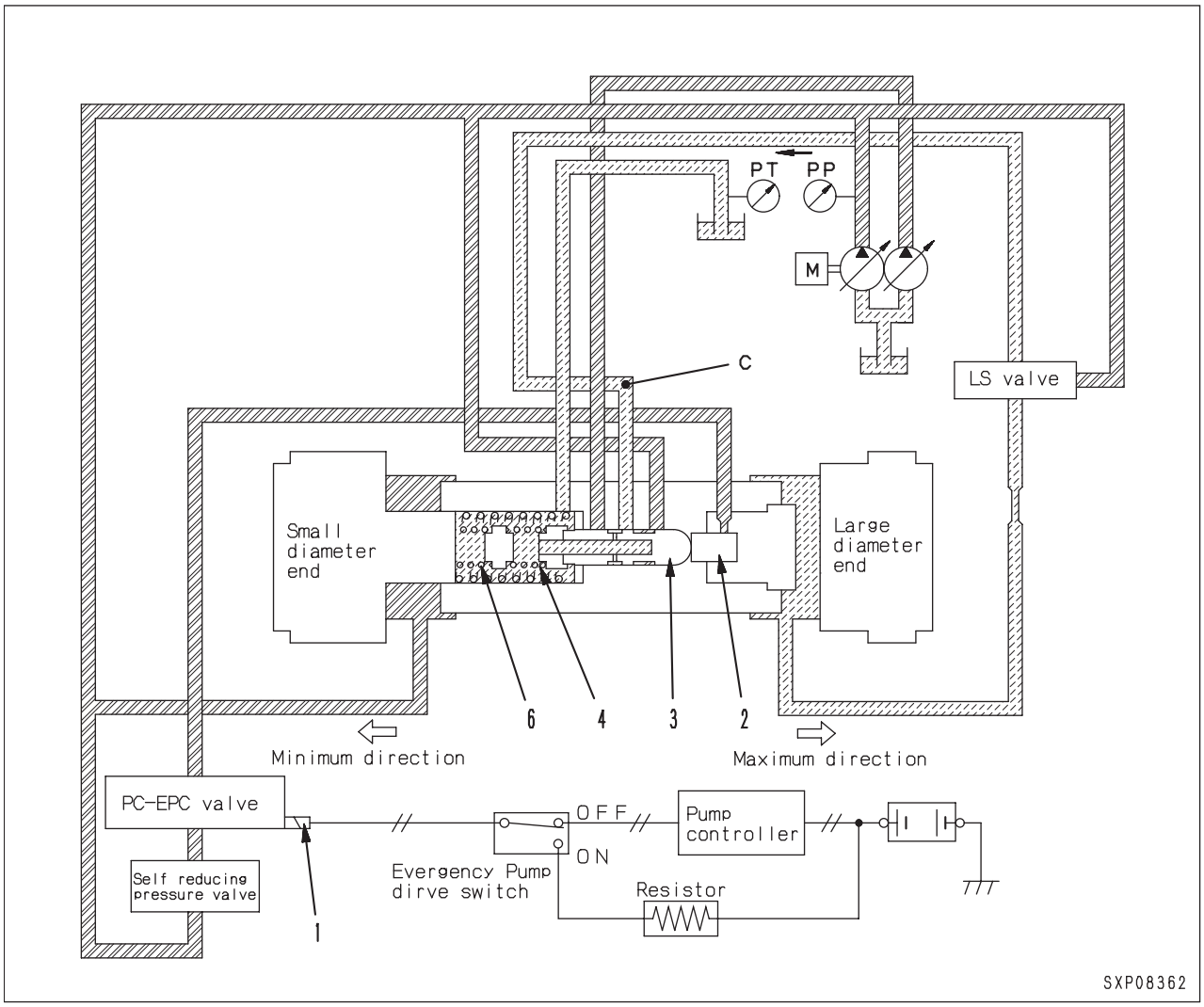
Unit: mm

No.	Check item		Criteria			Remedy
1	Link pitch		Standard size	Repair limit		Reverse or replace
			190.25	194.25		
2	Bushing outside diameter		Standard size	When turned		
				Normal load	Impact load	
			59.3	—	54.3	
3	Link height		Standard size	Repair limit		Repair or replace
			105	97		
4	Thickness of link metal (bushing press-fitting portion)		28.5	20.5		
5	Shoe bolt pitch		160.4			Adjust or replace
6			62			
7			18			
8	Link	Inside width	84.8			
9		Overall width	45.4			
10		Tread width	39.6			
11	Protrusion of pin	Regular	2.5			
		Master	2.5			
12	Protrusion of bushing	Regular	4.85			
		Master	0.0			
13	Overall length of pin	Regular	212			
		Master	212			
14	Overall length of bushing	Regular	138.5			
		Master	128.7			
15	Thickness of bushing metal	Standard	10.4			Reverse or replace
		When turned / Impact Load	5.4			
16	Thickness of spacer		—			—
17	Press-fitting force	Bushing	88.2 - 245 kN {9 - 25 ton}			
18		Regular pin	127.4 - 274.4 kN {13 - 28 ton}			
※ 19		Master pin	78.4 - 147 kN {8 - 15 ton}			

※ : Dry type track link



1. Shaft (Front)
2. Cradle
3. Case (Front)
4. Rocker cam
5. Shoe
6. Piston
7. Cylinder block
8. Valve plate
9. End cap
10. Shaft (Rear)
11. Case (Rear)
12. Servo piston



(2) PC Valve

1) When pump controller is normal

a. When the load on the actuator is small and pump pressures PP1 and PP2 are low

① Movement of PC-EPC solenoid (1)

- The command current from the pump controller flows to PC-EPC solenoid (1).This command current acts on the PC-EPC valve and outputs the signal pressure. When this signal pressure is received, the force pushing piston (2) is changed.
- On the opposite side to the force pushing this piston (2) is the spring set pressure of springs (4) and (6) and pump pressure **PP1** (self pressure) and **PP2** (other pump pressure) pushing spool (3). Piston (2) stops at a position where the combined force pushing spool (3) is balanced, and
- the pressure (pressure of port **C**) output from the PC valve changes according to this position.
- The size of command current **X** is determined by the nature of the operation (lever operation), the selection of the working mode, and the set value and actual value for the engine speed.

★ Other pump pressure

This is the pressure of the pump at the opposite end.

For the F pump, it is the R pump pressure

For the R pump, it is the F pump pressure

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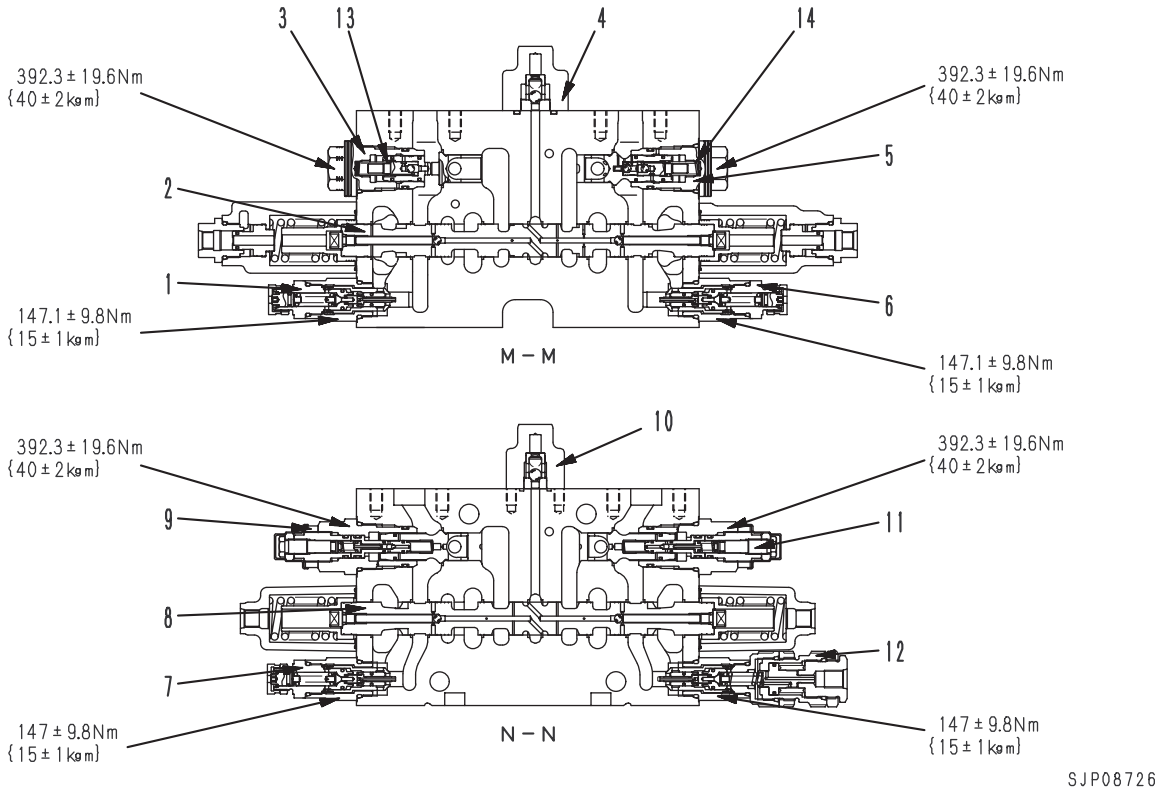

BUCKET CONTROL VALVE

1. Safety-suction valve
2. Spool
3. Pressure compensation valve (DUMP)
4. LS shuttle valve
5. Pressure compensation valve (CURL)
6. Safety-suction valve

SERVICE VALVE

7. Safety-suction valve
8. Spool
9. Pressure compensation valve
10. LS shuttle valve
11. Pressure compensation valve
12. Safety-suction valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
13	Piston return spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring
		48.1 x 10.8	28	17.5 N {1.8 kg}	—	14.0 N {1.4 kg}	
14	Piston return spring	36.9 x 11.1	28	29.4 N {3 kg}	—	23.5 N {2.4 kg}	

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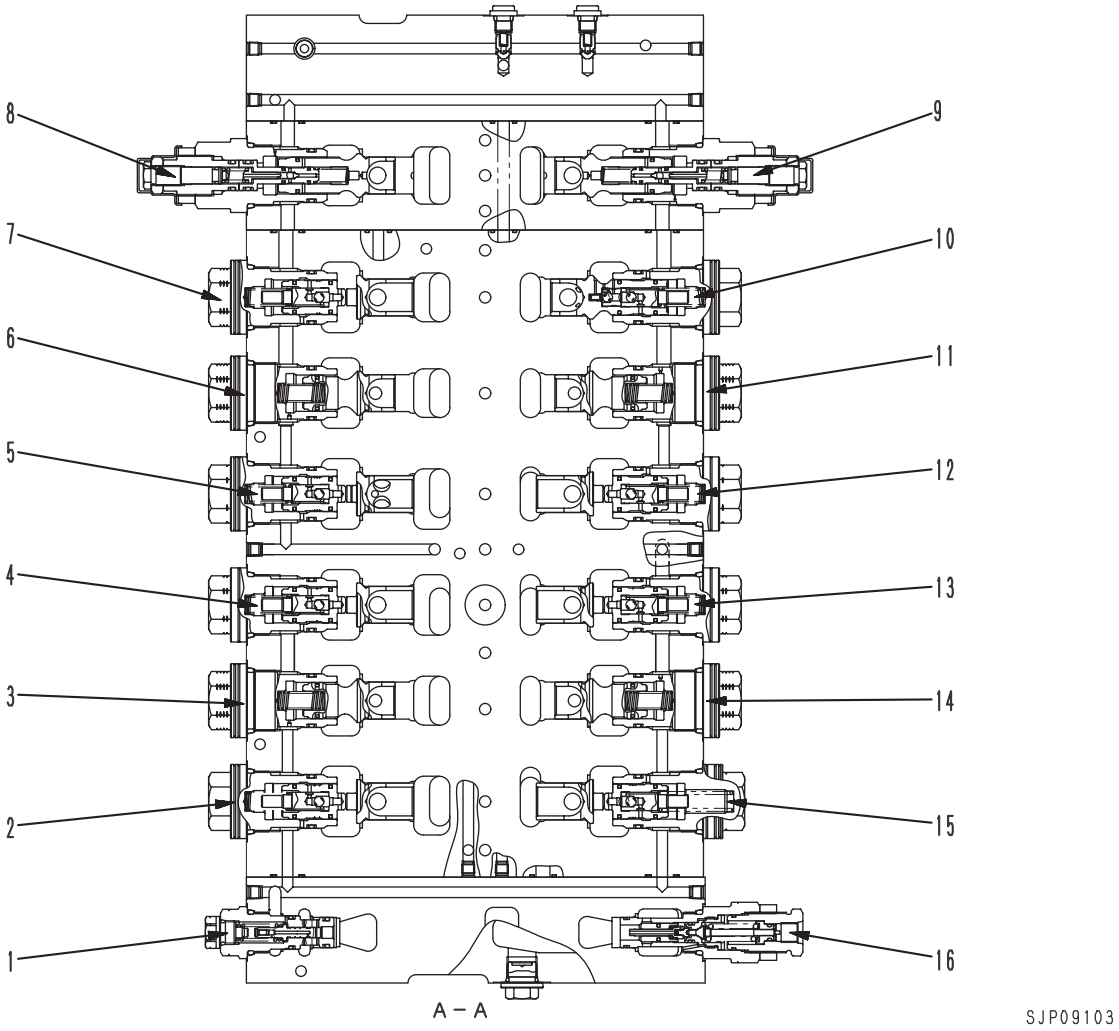


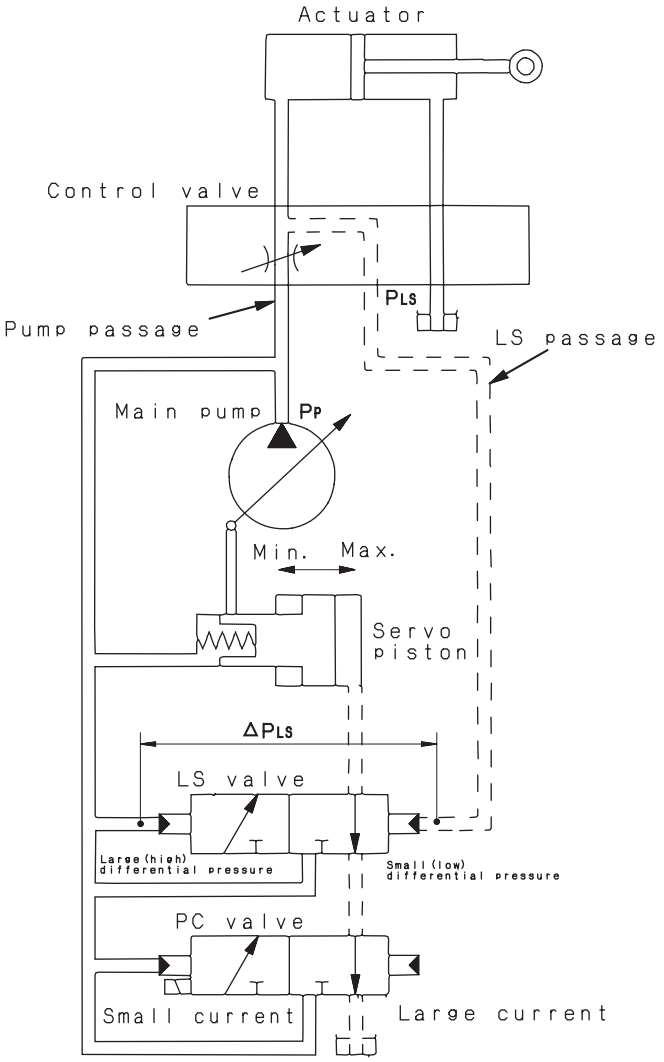
1. Unload valve
2. Pressure compensation valve (Arm OUT)
3. Pressure compensation valve (Right travel Reverse)
4. Pressure compensation valve (Left swing)
5. Pressure compensation valve (Boom RAISE)
6. Pressure compensation valve (Left travel reverse)
7. Pressure compensation valve (Bucket DUMP)
8. Pressure compensation valve (Service)
9. Pressure compensation valve (Service)
10. Pressure compensation valve (Bucket CURL)
11. Pressure compensation valve (Left travel forward)
12. Pressure compensation valve (Boom LOWER)
13. Pressure compensation valve (Right swing)
14. Pressure compensation valve (Right travel forward)
15. Pressure compensation valve (Arm IN)
16. Main relief valve

Basic principle

1) Control of pump swash plate

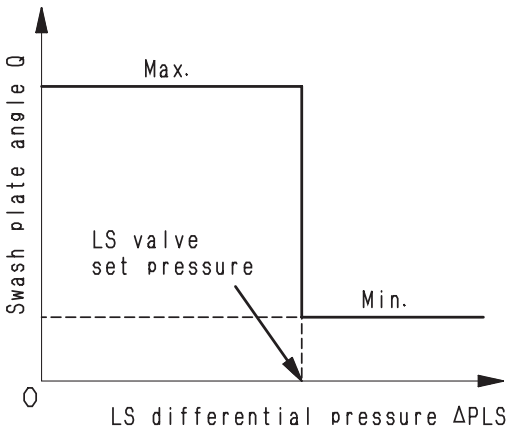
- The pump swash plate angle (pump discharge amount) is controlled so that LS differential pressure **ΔPLS** (the difference between pump pressure **PP** and control valve outlet port LS pressure **PLS**) (load pressure of actuator) is constant.

  (LS pressure **ΔPLS** = Pump discharge pressure **PP** – LS pressure **PLS**)



SBP03454

- If LS differential pressure **ΔPLS** becomes lower than the set pressure of the LS valve (when the actuator load pressure is high), the pump swash plate moves towards the maximum position; if it becomes higher than the set pressure of the LS valve (when the actuator load pressure is low), the pump swash plate moves towards the minimum position.



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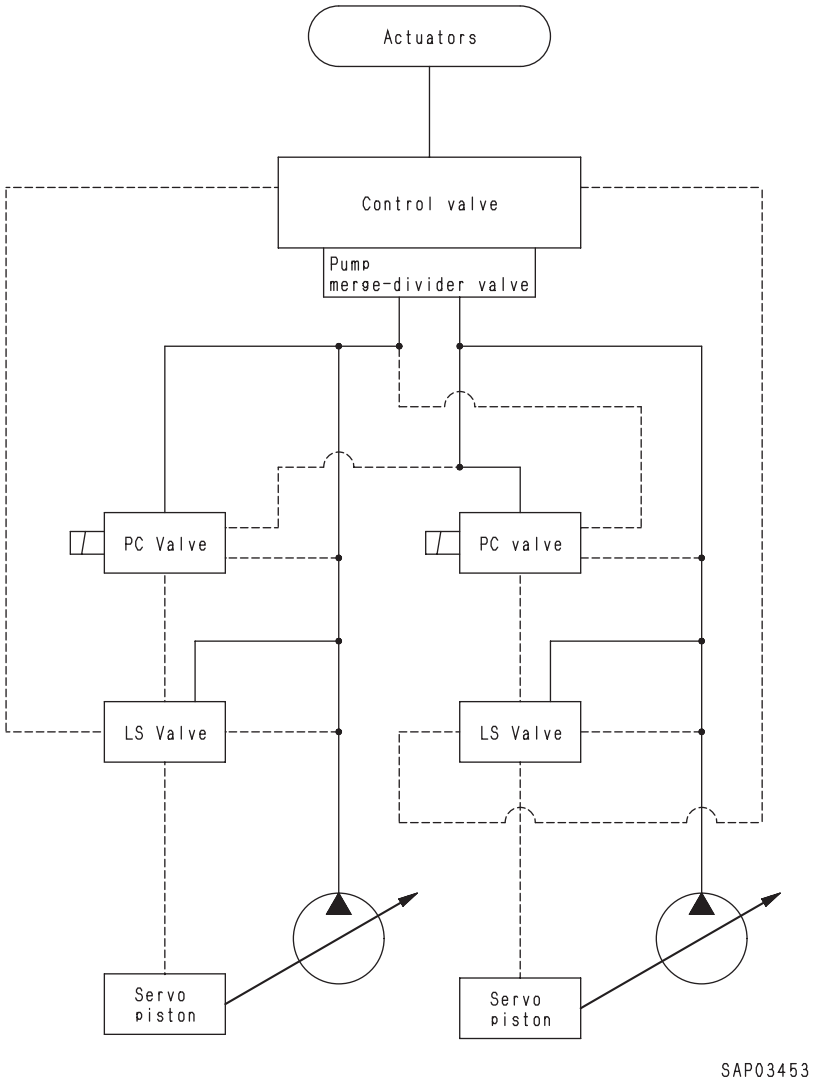
CLSS

OUTLINE OF CLSS



FEATURES

- CLSS stands for Closed center Load Sensing System, and has the following features.

1) Fine control not influenced by load
2) Control enabling digging even with fine control
3) Ease of compound operation ensured by flow divider function using area of opening of spool during compound operations
4) Energy saving using variable pump control

STRUCTURE

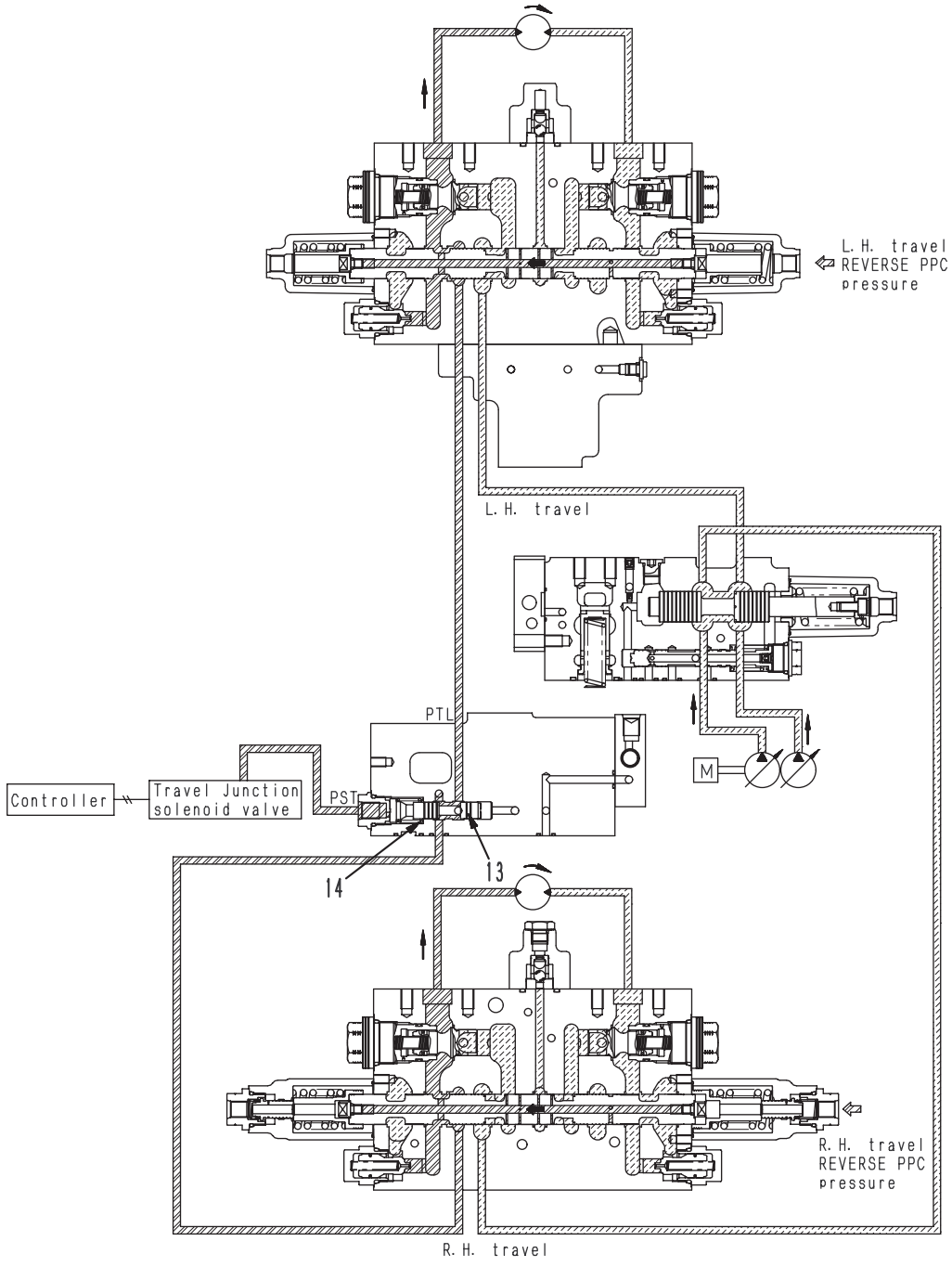
- The CLSS consists of a main pump (2 pumps), control valve, and actuators for the work equipment.
- The main pump body consists of the pump itself, the PC valve and LS valve.

SPECIFICATIONS

Item \ Model		PC210-7K	PC240-7K
Type		HMV110-2	
Theoretical Delivery	Min.	78.6 cm³/rev	74 cm³/rev
	Max.	106.2 cm³/rev	110.7 cm³/rev
Set pressure		37.3 MPa {380 kg/cm²}	
Rated speed	Min. Capacity	2,805 rpm	3,046 rpm
	Max. capacity	1,842 rpm	1,588 rpm
Brake releasing pressure		1.2 MPa {12 kg/cm²}	
Travel speed switching pressure	Differential pressure	0.8 MPa {8 kg/cm²}	

When pilot pressure is turned OFF

- If pilot pressure PST from the solenoid valve is 0, travel junction spool (13) is pressed by the force of spring (14) against the right side and the pass between ports PTL and PTR is open.
- If the oil flow rates in both travel motors become different from each other, the oil flows through the route between port PTL, travel junction spool (13), and port PTR so that the oil flow rates will be equalized again.



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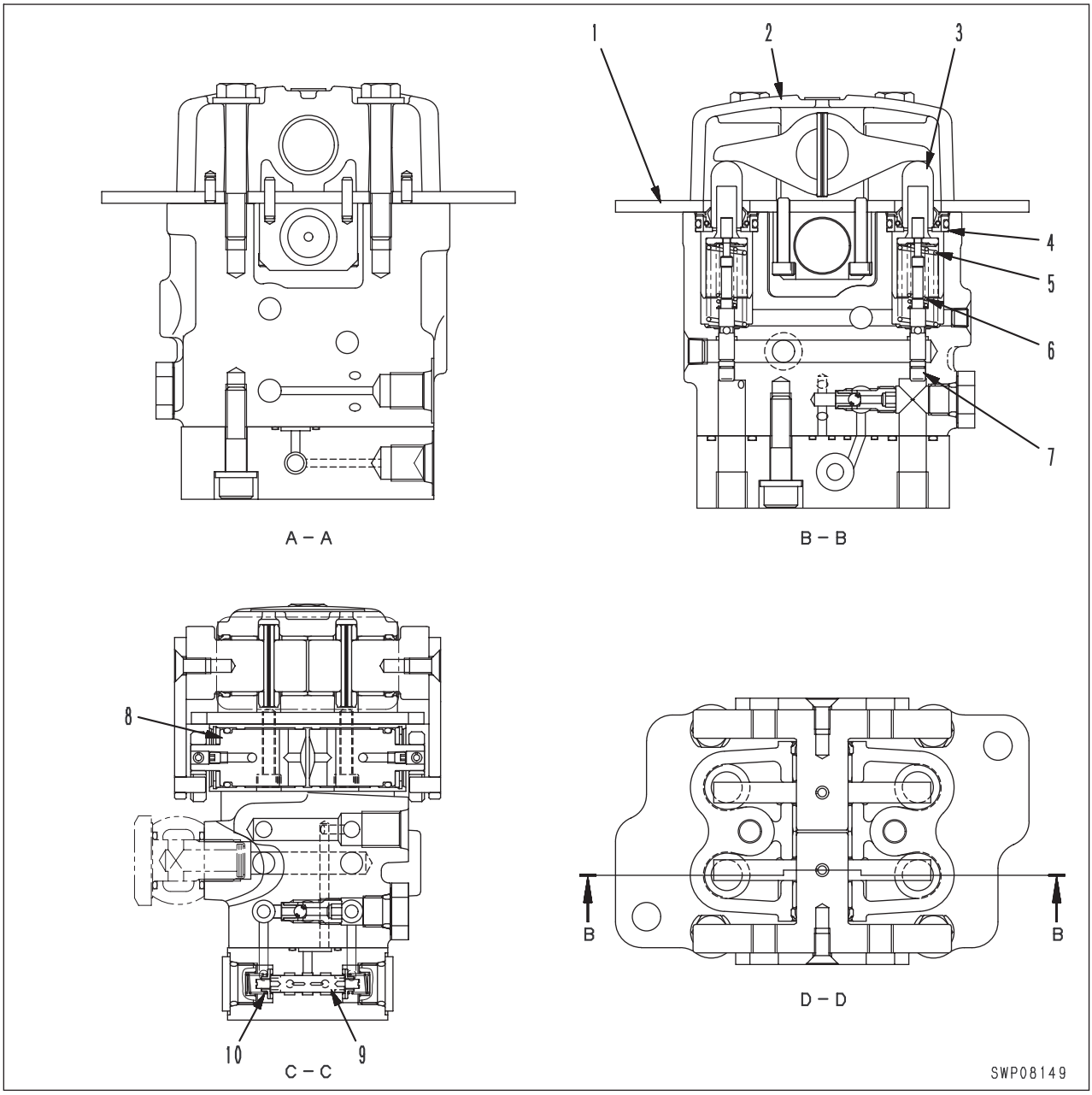
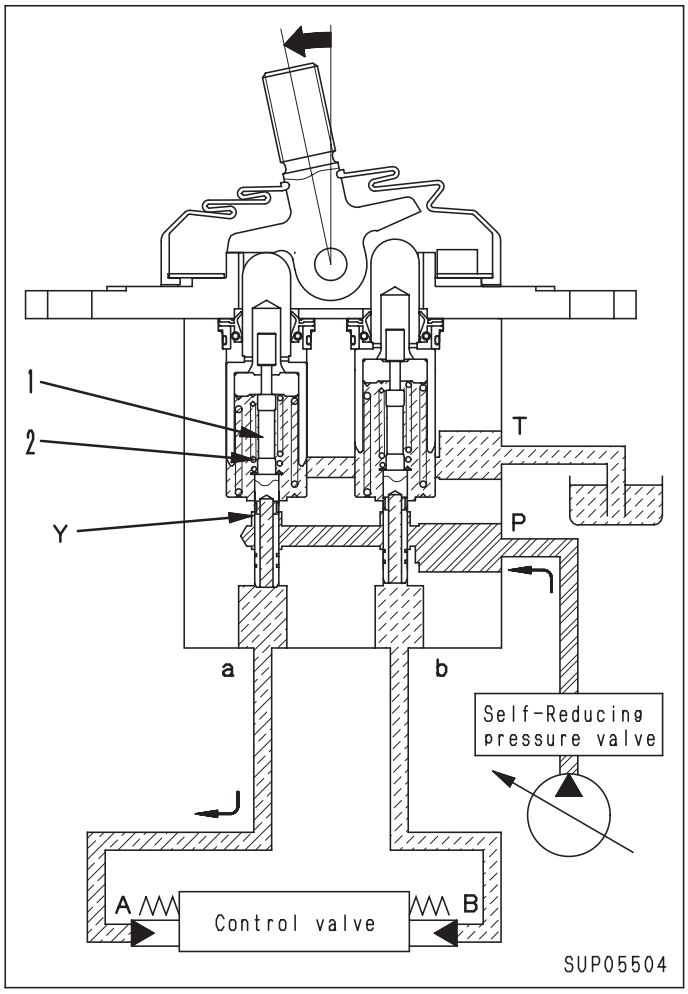


1. Plate
2. Body
3. Piston
4. Collar
5. Metering spring
6. Centering spring
7. Valve
8. Damper
9. Steering signal
10. Steering signal valve spring

- When the pressure at port **a** becomes higher, spool (1) is pushed back by the force acting on the end of the spool, and fine control portion **Y** closes.
- As a result, spool (1) moves up and down to balance the force at port **a** and the force at metering spring (2).
- Therefore, metering spring (2) is compressed in proportion to the amount the control lever is moved. The spring force becomes larger, so the pressure at port **a** also increases in proportion to the amount the control lever is operated.

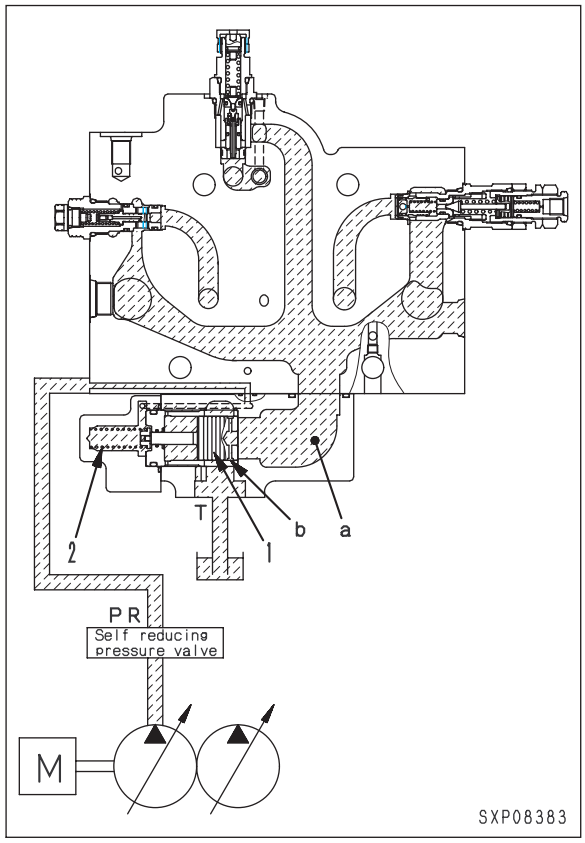
  In this way, the control valve spool moves to a position where the pressure of port **A** (the same as the pressure at port **a**) is balanced with the force of the return spring of the control valve spool.



LIFT CHECK VALVE

Function

This valve applies back pressure to the drain circuit to prevent generation of negative pressure on the hydraulic devices for the work equipment (motors, cylinders, etc.)

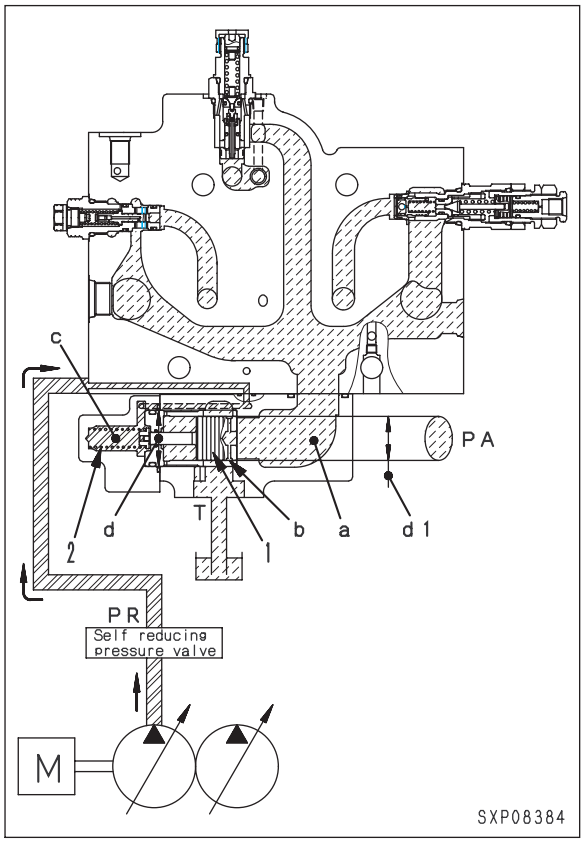


Operation

1. **While engine is stopped**
   Any oil is not supplied from the pump to the self-pressure reducing valve and valve (1) is pressed by only the force of spring (2) toward the right and drain circuit "a" of the control valve is connected through orifice "b" of valve (1) to port T.

2. **While engine is running**

- Output pressure PR of the self-pressure reducing valve is applied through the control valve to spring chamber "c" of the back pressure valve.
- Output pressure PR applied to spring chamber "c" is applied to the left end of valve (1) (area of ⌀d) to push valve (1) to the right.
- At this time, pressure PA of drain circuit "a" of the control valve is applied to the right end of valve (1) (area of ⌀d1) to push valve (1) to the left.
- Valve (1) is balanced so that the back pressure PA will be as follows.
  PA = {(Area of ⌀d) x PR + Force of spring (2)} / (Area of ⌀d1)



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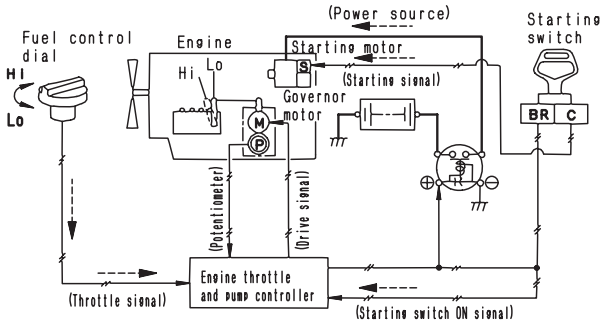
1. OPERATION OF SYSTEM

Starting engine

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

  When this happens, the engine throttle and pump controller checks the signal from the fuel control dial and sets the engine speed to the speed set by the fuel control dial.



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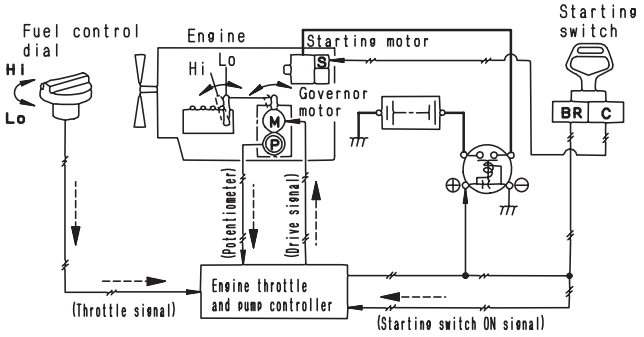
Engine speed control

- The fuel control dial sends a signal to the engine throttle and pump controller according to the position of the dial. The engine throttle and pump controller calculates the angle of the governor motor according to this signal, and sends a signal to drive the governor motor so that it is at that angle.

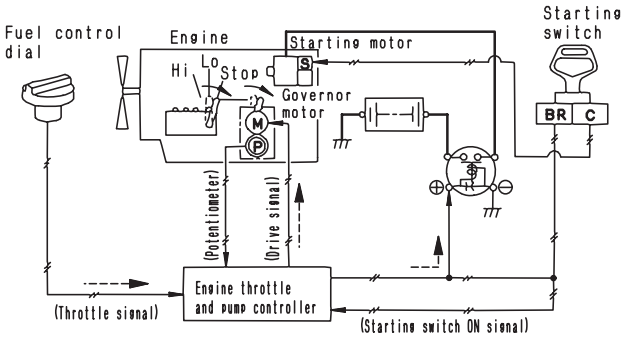
  When this happens, the operating angle of the governor motor is detected by the potentiometer, and feedback is sent to the engine throttle and pump controller, so that it can observe the operation of the governor motor.



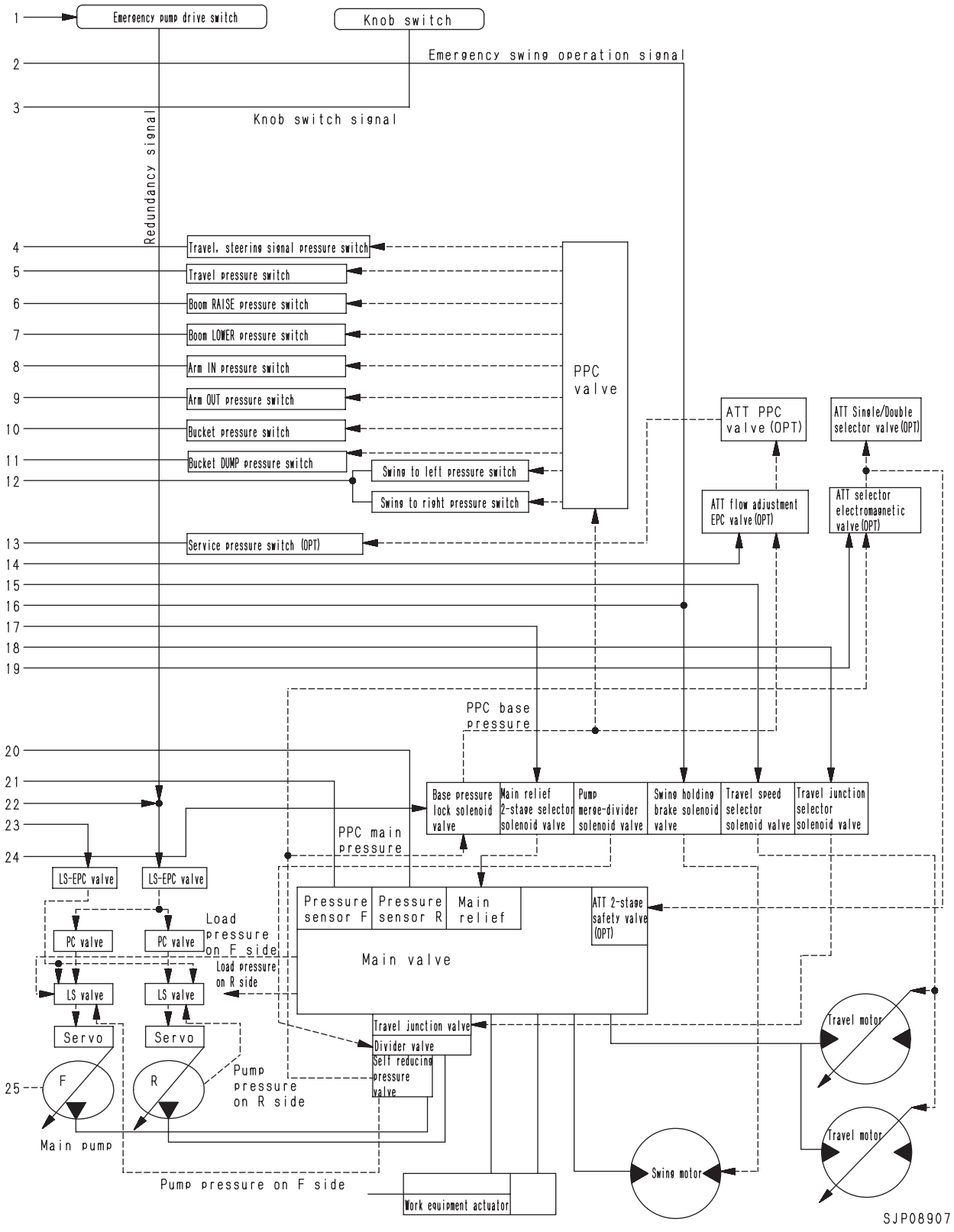
SJP08904

Stopping engine

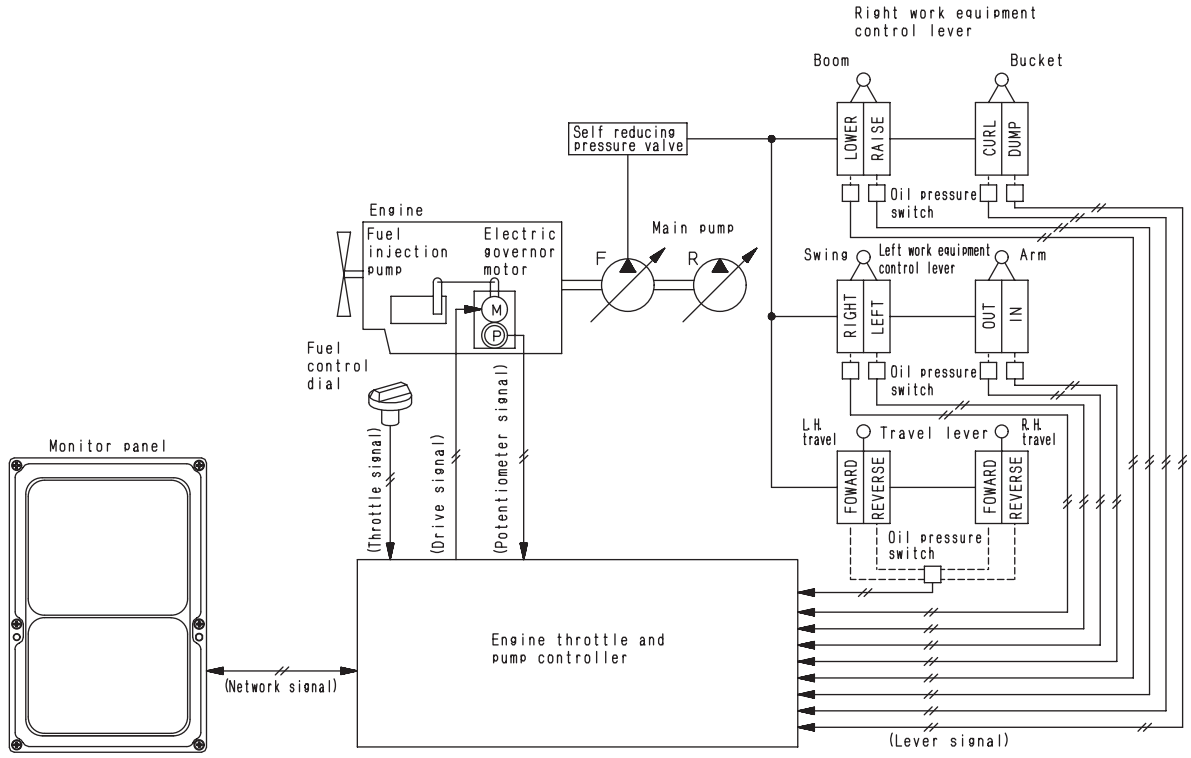
- When the starting switch is turned to the STOP position, the engine throttle and pump controller drives the governor motor so that the governor lever is set to the NO INJECTION position.
- When this happens, to maintain the electric power in the system until the engine stops completely, the engine throttle and pump controller itself drives the battery relay.



SJP08905


1
Emergency pump drive switch
Knob switch
2
Emergency swing operation signal
3
Knob switch signal
Redundancy signal
4
Travel, steering signal pressure switch
5
Travel pressure switch
6
Boom RAISE pressure switch
7
Boom LOWER pressure switch
8
Arm IN pressure switch
9
Arm OUT pressure switch
10
Bucket pressure switch
11
Bucket DUMP pressure switch
12
Swing to left pressure switch
Swing to right pressure switch
PPC valve
ATT PPC valve (OPT)
ATT Single/Double selector valve (OPT)
ATT flow adjustment EPC valve (OPT)
ATT selector electromagnetic valve (OPT)
13
Service pressure switch (OPT)
14
15
16
17
18
19
PPC base pressure
20
21
22
23
24
Base pressure lock solenoid valve
Main relief 2-stage selector solenoid valve
Pump merge-divider solenoid valve
Swing holding brake solenoid valve
Travel speed selector solenoid valve
Travel junction selector solenoid valve
PPC main pressure
LS-EPC valve
LS-EPC valve
Pressure sensor F
Pressure sensor R
Main relief
ATT 2-stage safety valve (OPT)
Load pressure on F side
PC valve
PC valve
Load pressure on R side
Main valve
LS valve
LS valve
Servo
Servo
Travel junction valve
Divider valve
Self reducing pressure valve
Travel motor
Travel motor
25
F
R
Pump pressure on R side
Main pump
Pump pressure on F side
Swing motor
Work equipment actuator
SJP08907

4. Auto-deceleration function

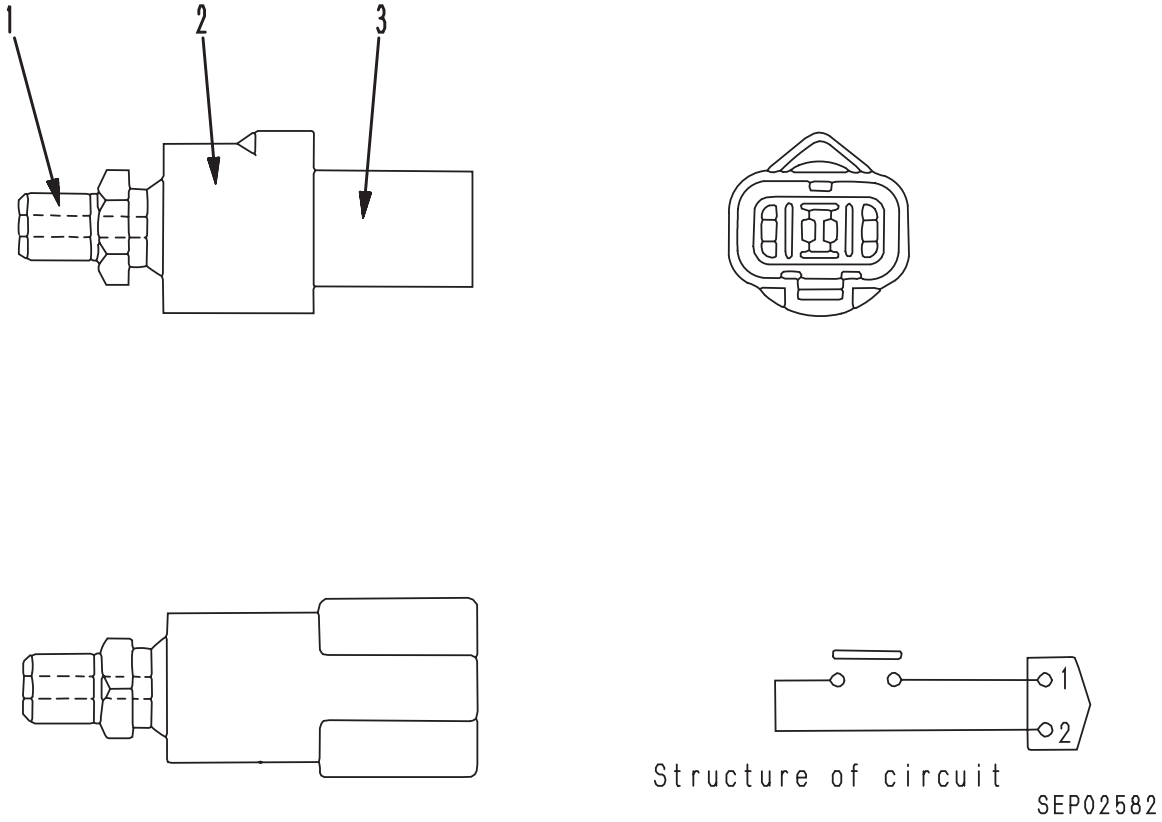


SJP09131

FUNCTION

- If the all control levers are set in NEUTRAL while waiting for a dump truck or work, the engine speed is lowered to the medium level automatically to reduce the fuel consumption and noise.
- If any lever is operated, the engine speed rises to the set level instantly.

2) PPC oil pressure switch



1. Plug
2. Switch
3. Connector

SPECIFICATIONS

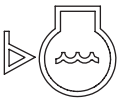
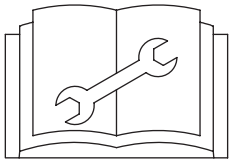
Type of contacts: Normally open contacts

Operating (ON) pressure:	0.5 ± 0.1 MPa {5.0 ± 1.0 kg/cm²}
Resetting (OFF) Pressure:	0.3 ± 0.5 MPa {3.0 ± 0.5 kg/cm²}

FUNCTION

- The junction block has 9 pressure switches, which check the operating condition of each actuator by the PPC pressure and transmit it to the governor/pump controller.

Checks before starting (caution lamps all light up), when maintenance interval is exceeded.
If the checks before starting or maintenance interval is exceeded items light up, the display of the hydraulic oil temperature gauge and the hydraulic oil temperature monitor are stopped, and the following cautions are displayed.

Symbol	Display item	Check before starting item	When engine is stopped	When engine is running
 SAP00520	Engine oil pressure	●	--	When abnormal, lights up and buzzer sounds
 SAP00522	Battery charge	●	--	Lights up when abnormal
 SAP00519	Radiator water level	●	Lights up when abnormal	When abnormal, lights up and buzzer sounds
 SAP00523	Engine oil level	●	Lights up when abnormal	--
 SAP00521	Air cleaner clogging	●	--	Lights up when abnormal
 SJP08780	Maintenance		Lights up when there is a warning. Lights up for only 30 sec. after key is turned ON, then goes out.	

The problems that have occurred are displayed in order from the left.

When the above cautions are displayed, if the hydraulic oil temperature is high or low, only the symbol is displayed.

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

BRIGHTNESS, CONTRAST ADJUSTMENT FUNCTION

This function is used to adjust the brightness and contrast of the display.

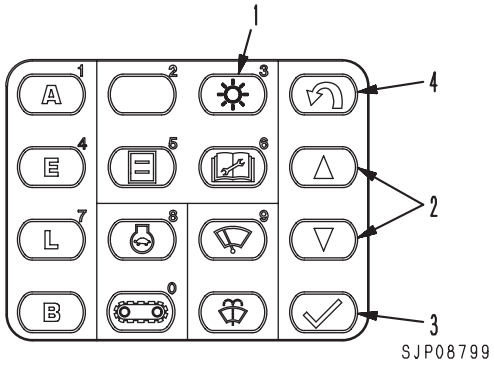
ADJUSTMENT METHOD

★ Operate as follows when on the operator screen.

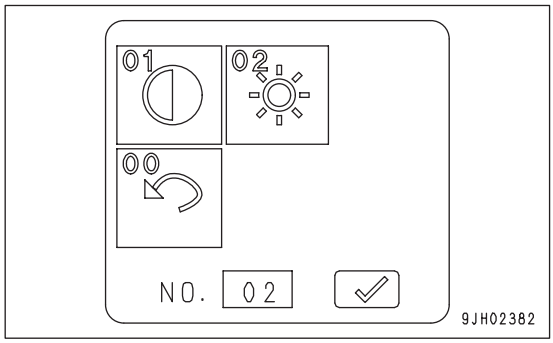
1. Press display brightness/contrast adjustment switch (1) and switch to the adjustment screen.

★ Relationship between menu symbol and content.

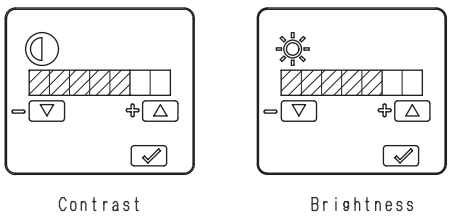
No.	Symbol	Content
01	Return mark	Return
02	SJP08935	Contrast
03	SJP08936	Brightness



2. Press control switch (2), or use the 10-key pad to input the number (00 - 02) to select either contrast or brightness.
   After completing the selection, press input confirmation switch (3) and return to the adjustment screen. Then press return switch (4) or use the 10-key pas to set to [00] and press input confirmation switch (3) to return to the normal screen.
3. Press control switch (2) and adjust the brightness and contrast as desired.



Control switch	Actuation
SJP08933	Flow level bar graph extends to the right
SJP08934	Flow level bar graph retracts to the left



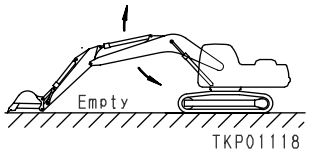
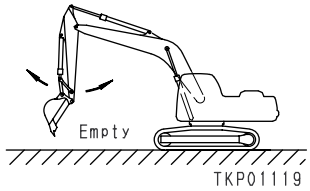
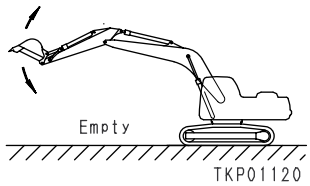
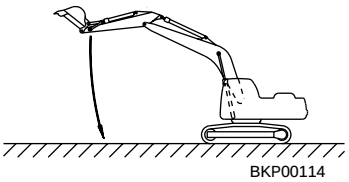
SJP08937

20 TESTING AND ADJUSTING

★ Note the following when making judgements using the standard value tables for testing, adjusting, or troubleshooting.

1. The standard value for a new machine given in the table is the value used when shipping the machine from the factory and is given for reference. It is used as a guideline for judging the progress of wear after the machine has been operated, and as a reference value when carrying out repairs.
2. The service limit value given in the tables is the estimated value for the shipped machine based on the results of various tests. It is used for reference together with the state of repair and the history of operation to judge if there is a failure.
3. These standard values are not the standards used in dealing with claims.

k When carrying out testing, adjusting, or troubleshooting, park the machine on level ground, insert the safety pins, and use blocks to prevent the machine from moving.
k When carrying out work together with other workers, always use signals and do not let unauthorized people near the machine.
k When checking the water level, always wait for the water to cool down. If the radiator cap is removed when the water is still hot, the water will spurt out and cause burns.
k Be careful not to get caught in the fan, fan belt or other rotating parts.

Applicable model					PC210, 210LC, PC210NLC-7K		PC240LC, 240NLC-7K	
Cate-gory	Item	Measurement Condition		Unit	Standard value	Permissible value	Standard value	Permissible value
Work equipment	Work equipment speed	Boom	 • Hydraulic oil temperature: Within operation range • Engine running at high idling • Working mode: A mode • Time required from raise stroke end till bucket touches ground	RAISE	sec.	3.3±0.4	Max. 4.7	$3.4^{+0.5}_{-0.3}$	Max. 4.9
				LOWER		2.4±0.3	Max. 3.7	2.7±0.3	Max. 4.4
		Arm	 • Hydraulic oil temperature: Within operation range • Engine running at high idling • Working mode: A mode • Time required from dumping stroke end to digging stroke end	IN		3.5±0.3	Max. 4.5	3.8±0.4	Max. 4.5
				OUT		2.7±0.3	Max. 3.5	$2.9^{+0.4}_{-0.2}$	Max. 3.5
		Bucket	 • Hydraulic oil temperature: Within operation range • Engine running at high idling • Working mode: A mode • Time required from dumping stroke end to digging stroke end	CURL		2.6±0.3	Max. 3.3	2.9±0.3	Max. 3.3
				DUMP		1.9±0.2	Max. 2.7	2.2±0.3	Max. 2.7
	Time lag	Boom	 • Hydraulic oil temperature: Within operation range • Engine running at low idling • Working mode: A mode • Time required from raise stroke end till bucket touches ground and pushes up machine front		sec.	Max. 1.0	Max. 1.2	Max. 1.0	Max. 1.2

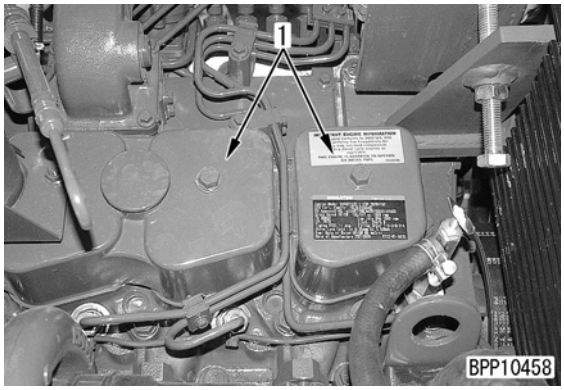
ADJUSTMENT OF VALVE CLEARANCE

★ Valve clearance adjustment tools

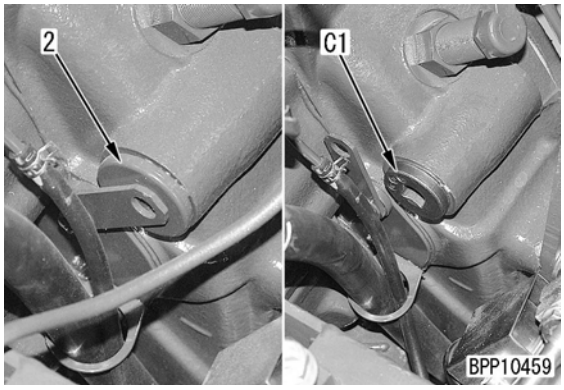
Mark		Part No.	Part Name
C	1	795-799-1131	Gear
	2	Commercial product	Filler Gauge

1. Open up the engine hood, and remove the fan guard on the counterweight side.

2. Remove all cylinder head covers (1).

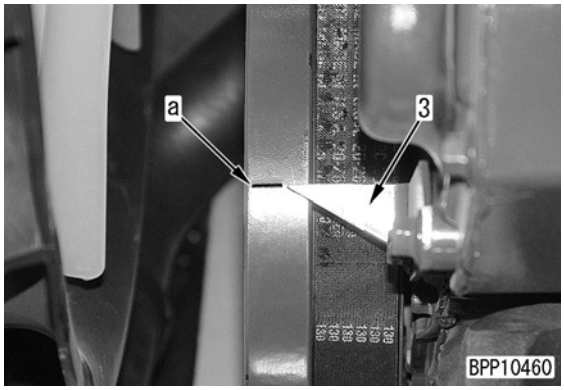


3. Take off cap (2) and fit gear **C1**.

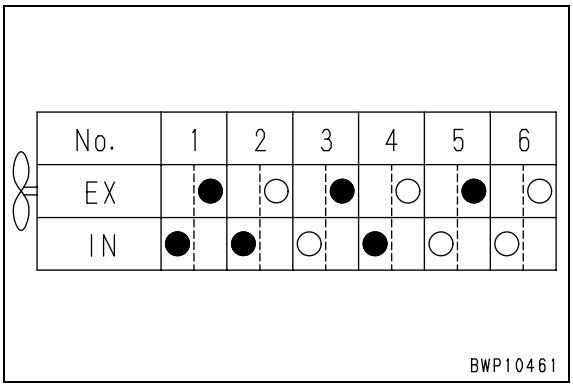


4. Turn the crankshaft clockwise with gear **C1**, then match 1.6 TOP notch "**a**" of the crank pulley with pointer (3), and bring up No.1 cylinder to the top dead center.

★ When No. 1 cylinder is at the top dead center, its rocker arm can be manually moved as much as the valve clearance. If it cannot be moved, that means that No. 1 cylinder is not yet at the top dead center. In that case, rotate it by one more turn.



5. When No. 1 cylinder is at the top dead center, adjust valve clearances indicated with a black bullet mark (●) in the chart below in the following manner.



1) Insert filler gauge **C2** in between rocker arm (4) and valve stem (5), and adjust the valve clearance with adjusting screw (6).
   ★ For the adjustment, turn the adjusting screw with filler gauge **C2** inserted to the extent that filler gauge **C2** can be lightly moved.
2) Fix adjusting screw (6) and then tighten lock nut (7).
   3 Lock nut: **24±4 Nm{2.45±0.41kgm}**
   ★ Check the valve clearance again after tightening lock nut (7).

★ Proceed to the next step once all the adjustments of valve clearance indicated with a black bullet mark (●) have been completed.

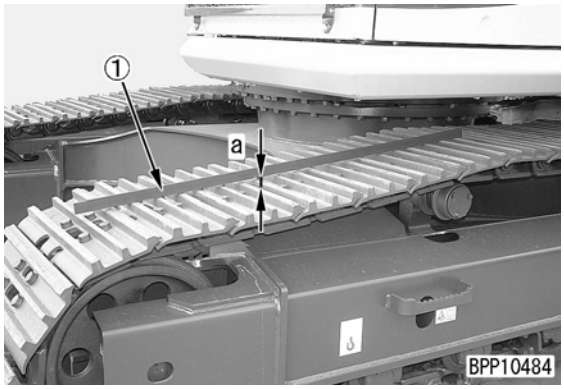
INSPECTION AND ADJUSTMENT OF TRACK SHOE TENSION

Inspection

1. Travel the machine forward by the length of track on ground, keeping the engine at low idling, and stop the machine slowly.

2. Place straight bar ① on the track shoe between the idler and the 1st carrier roller.
   ★ L beam is recommended for bar ①, because of its deflection-free nature.

3. Measure max. clearance **a** between bar ① and the track shoe.
   • Max. standard clearance **a**: 10–30 mm

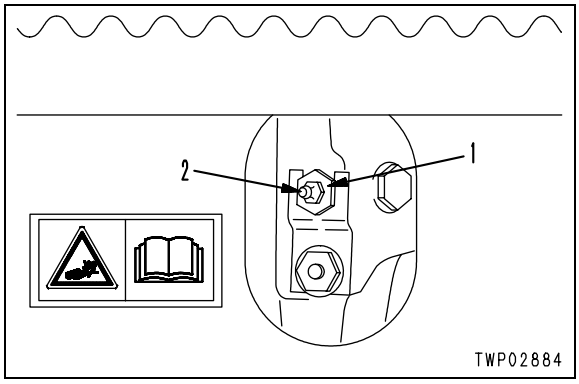


Adjustment

★ If the track shoe tension is not proper, adjust it in the following manner.

1. **When the tension is too strong**
   Discharge grease by loosening valve (1).
   k Do not loosen valve (1) by more than one turn, because grease will spurt out due to its internal high pressure.

2. **When the tension is too weak**
   Add grease through grease fitting (2).
   ★ If the normal track shoe tension is not restored even after greasing, move the machine slowly back and forth.



3) Start the engine and keep it running until the hydraulic oil temperature rises to the operating range.

4) Measure the pump delivery pressure and PC valve output pressure (servo piston inlet pressure) together with the engine running at high idling, after setting the machine at the following conditions.
   - Working mode: A mode
   - Swing lock switch: ON (switched to high pressure relief with 2-stage relief turned ON)
   - Work equipment, swing and travel circuit: Arm digging relief

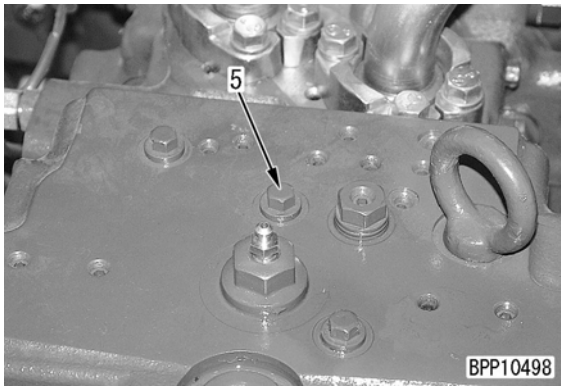
   ★ Judgement method:
   When the ratio between the pump delivery pressure and PC valve output pressure (servo piston output pressure) reaches the following values, both pressures are judged normal.

Pressure to be measured	Pressure ratio
Pump delivery pressure	1
PC valve outlet pressure	Approx. 3/5

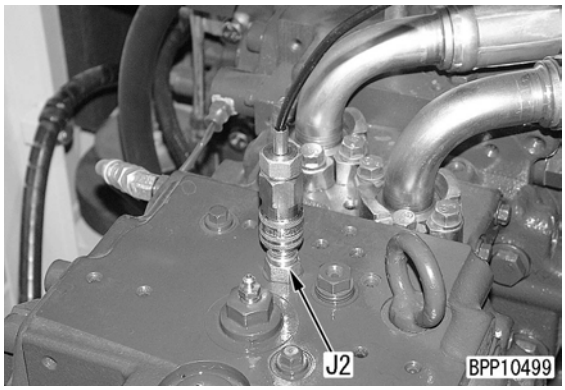
   ★ If there is any abnormality with PC valve or servo piston, the PC valve output pressure (servo piston output pressure) equals to the pump delivery pressure, or approximates to 0 pressure.

2. Measurement of PC-EPC output pressure

1) Remove oil pressure measurement plug (5).



2) Fit fitting **J2** and connect it to oil pressure gauge ① of hydraulic tester **J1**.
   ★ Use an oil pressure gauge with the capacity of 5.9 MPa{60 kg/cm^2}.



3) Start the engine and keep it running until the hydraulic oil pressure rises to the operating range.

MEASUREMENT OF SOLENOID VALVE OUTPUT PRESSURE

★ Solenoid valve output pressure measurement tools

Mark		Part No.	Part Name
L	1	799-101-5002	Hydraulic Tester
		790-261-1203	Digital Type Hydraulic Tester
	2	799-401-2910	Grease Fitting (Size 02)
		07002-*1423	O-ring

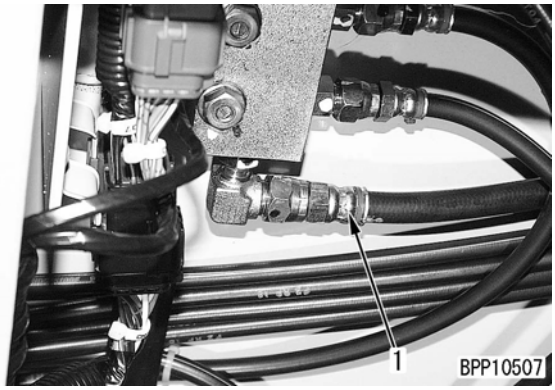
★ Measure solenoid valve output pressure after confirming that control circuit original pressure is normal.

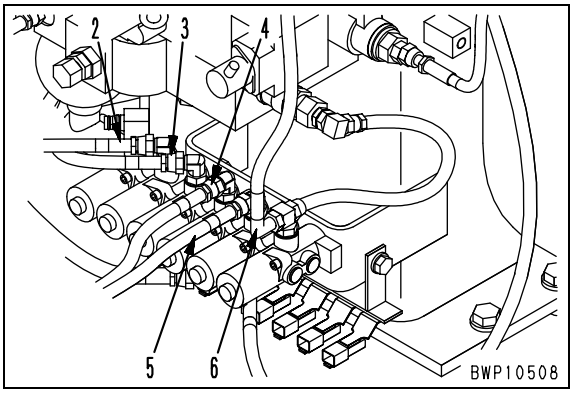
k Lower the work equipment to the ground and stop the engine. After the engine stops, operate the control lever several times to release the remaining pressure in the piping. Then loosen the oil filler cap to release the pressure inside the hydraulic tank.

1. Disconnect the hoses of solenoid valve to be measured at the outlet side.

No.	Solenoid valve to be measured
1	PPC lock solenoid valve
2	Travel interconnection solenoid valve
3	Merge/divide solenoid valve
4	Travel speed shifting solenoid valve
5	Swing and parking brake solenoid valve
6	2-stage relief solenoid valve

★ Hose (1) is installed at the rear of operator's cab, and hoses (2) through (6) are installed at the center of revolving frame.

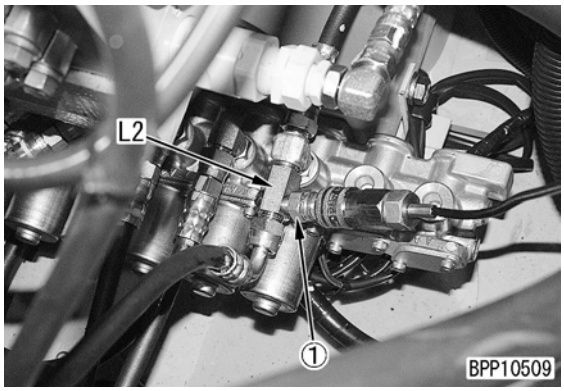




2. Fit fitting **L2** and connect hoses (1) through (6) again.

3. Fit fitting ① of hydraulic tester **L1** and connect it to oil pressure gauge ②.

★ Use an oil pressure gauge with the capacity of 5.9 MPa{60 kg/cm^2}.



4. Start the engine and keep it running until the hydraulic oil temperature rises to the operating range.

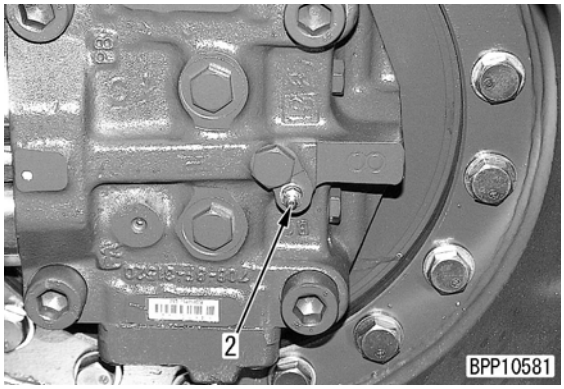
3. Air bleeding from swing motor

1) Start the engine and run it at low idling.
2) Bleed air from the motor by swinging the upper structure slowly.

4. Air bleeding from travel motor

1) Start the engine and run it at low idling.
2) Loosen air bleeding plug (2) and confirm that oil seeps out from the plug.
3) If the oil seepage is confirmed, tighten air bleeding plug (2).

3 Air bleeding plug:
27.5–35.3 Nm{2.8–3.6 kgm}

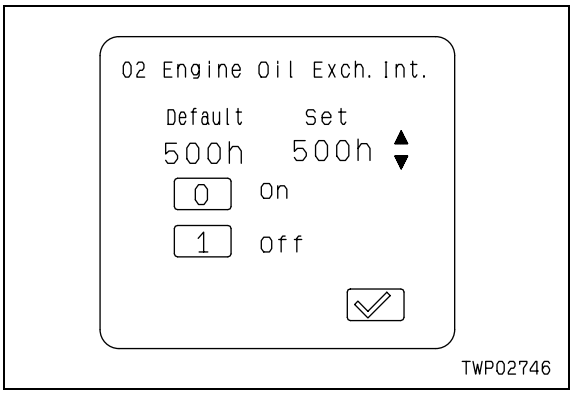


User Code No.	Service Code		Failure Code			Failure Classification
	Code No.	Content	Code No.	Location	Phenomenon	
E05	E317	Disconnection in both governor motors A and B	DY10KA	Governor motor	Disconnection	Electrical system
E05	E318	Short circuit in both governor motors A and B	DY10KB	Governor motor	Short circuit	
E50	E501	No setting in model selection	DA2AKM	Governor pump controller	Error in operation or setting	
E50	E502	Malfunction in model selecting signal	DA20KT	Governor pump controller	Abnormality in data	
E50	E511	Abnormality in boom angle sensor (short circuit in power source)	DKA0KB	Boom angle sensor	Short circuit	
–	None	Engine high idling out of rate	A000N1	Engine	Overrunning	Mechanical system
–	None	Engine low idling out of rate	A000N2	Engine	Low idling out of rate	
–	None	Air cleaner clogged	AA10NX	Air cleaner element	Clogging	
–	None	Charging voltage abnormally low	AB00KE	Alternator	Insufficient charging	
–	None	Engine oil pressure abnormally low	B@BAZG	Engine oil	Oil pressure lowered	
–	None	Engine oil level abnormally low	B@BAZK	Engine oil	Oil level lowered	
–	None	Engine cooling water overheated	B@BCNS	Engine cooling water	Overheating	
–	None	Radiator water level abnormally low	B@BCZK	Engine cooling water	Cooling water level lowered	
–	None	Hydraulic oil overheated	B@HANS	Hydraulic oil	Overheating	
–	None	Auto-lubrication system abnormal	DA80MA	Auto-lubrication system controller	Malfunction	

★ This table is arranged in the sequence of Service Code No.
★ In case there is no number assigned in the column of User Code No., or in case "none" is described in the column of Code No. of Service Code, the corresponding service code or failure code is not shown in the display of ordinary items, even if some abnormality occurs. It is recorded only in the failure history (either in electrical system or mechanical system) of Service Menu.
★ History Classification indicates that a specific failure is classified as belonging to either electrical system or mechanical system, when it is recorded in Service Menu.
★ "E" at the head of Code No. of Service Code means the following status of a specific failure.
- With "E": The failure is yet to be dissolved and continues.
- Without "E": The failure has already been dissolved.

4) Set contents of individual items
   ①: Default: The maintenance time set in the monitor (recommended by the manufacturer and cannot be changed).
   ②: Set: Maintenance time that can be freely set. The maintenance mode program functions based on this maintenance time. (The maintenance time can be increased or decreased by 50 hours with [△] or [▽] switch)
   ③: On: Maintenance display function with this instruction becomes effectual.
   ④: Off: Maintenance display with this instruction becomes ineffectual.
   ★ The lowest maintenance time is 50 h.

5) Set contents of "Use Default Values"
   When selecting this menu and depressing the switch [✓], all individual time settings are reduced to the initial settings.



Model	Serial No.	Service meter reading	Client user's name	Implemented on:	Inspected by:

1. Engine (PC210, 210LC, PC210NLC-7)

No.	Condition setting					Measurement item	Unit	Standard value		Measured value	Judgement
	Fuel dial	Working mode	Auto decelerator	One-touch power max. switch	Work equipment operation			New machine	Failure judgement		
1	Full	A	OFF	OFF	Operating travel control lever (Do not travel machine)	Engine rotation	rpm	2,080 – 2,220	—		Good / No good
2						Engine oil pressure	MPa{kg/cm²}	0.39 – 0.64{4.0 – 6.5}	0.25{2.6}		Good / No good
3	Low				All control levers in NEUTRAL	Engine rotation	rpm	980 – 1,080	—		Good / No good
4						Engine oil pressure	MPa{kg/cm²}	Min. 0.15{Min. 1.5}	0.09{2.9}		Good / No good
5	Full			ON	Arm (extended) relief	Engine rotation	rpm	1,800 – 2,000	—		Good / No good
6						Blow-by pressure	kPa{mmH$_2$O}	Max. 1.2{Max. 123}	5.1{520}		Good / No good
7			ON	OFF	All control levers in NEUTRAL	Engine rotation	rpm	1,300 – 1,500	—		Good / No good

2. Work equipment speed (PC210, 210LC, PC210NLC-7)

Hydraulic oil temperature (45 – 55°C)

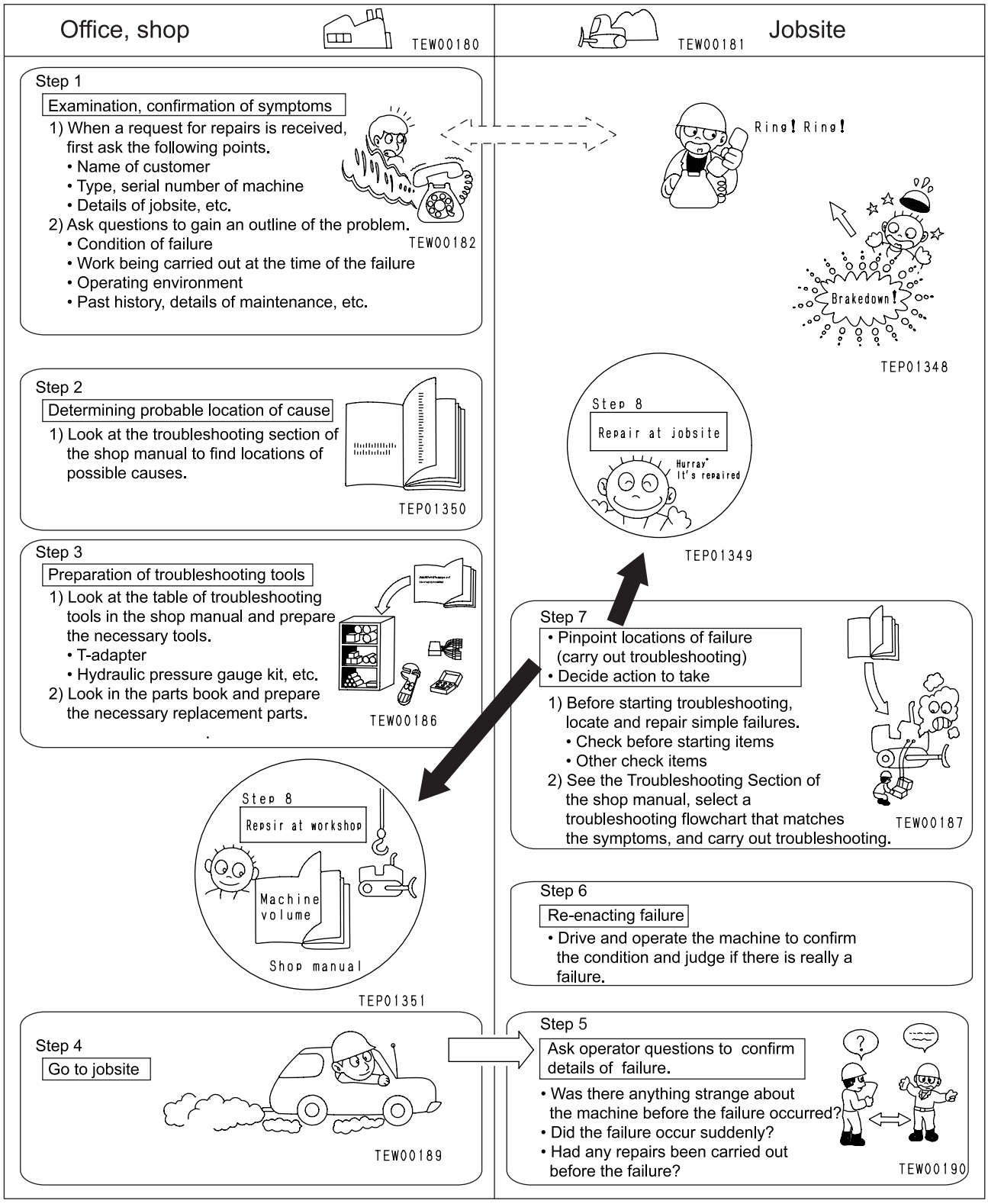
No.	Condition setting			Measurement item			Unit	Standard value				Measured value	Judgement
								PC210-7		PC210LC,PC210NLC			
	Fuel dial	Working mode	Work equipment posture					New model	Failure judgement	New model	Failure judgement		
1	Full	A	No load, fully extended	Boom RAISE			Sec.	2.9 – 3.7	Max. 4.7	2.9 – 3.7	Max. 4.7		Good / No good
2			Boom held level	Arm DUMPING				2.4 – 3.0	Max. 3.5	2.4 – 3.0	Max. 3.5		Good / No good
3				Arm DIGGING				3.2 – 3.8	Max. 4.5	3.2 – 3.8	Max. 4.5		Good / No good
4		E						3.3 – 3.9	Max. 4.6	3.3 – 3.9	Max. 4.6		Good / No good
5		(※L)						5.8 – 7.0	Max. 7.4	5.8 – 7.0	Max. 7.4		Good / No good
6		A	Boom and arm held level	Bucket DIGGING				2.3 – 2.9	Max. 3.3	2.3 – 2.9	Max. 3.3		Good / No good
7			Fully extended	Swing (5 turns)		Right		21.7 – 26.7	Max. 30	21.7 – 26.7	Max. 30		Good / No good
						Left							Good / No good
8			Track shoe raised at one side	Travel (5 turns)	Lo	Right		46.2 – 56.4	46.2 – 60.4	50.3 – 61.5	50.3 – 65.5		Good / No good
						Left							Good / No good
					(※Mi)	Right		33.7 – 41.3	33.7 – 45.3	36.7 – 44.9	36.7 – 48.9		Good / No good
						Left							Good / No good
					Hi	Right		26.6 – 29.4	26.6 – 31.4	29.0 – 32.0	29.0 – 34.0		Good / No good
						Left							Good / No good

3. Work equipment hydraulic drift amount (PC210, 210LC, PC210NLC-7)

Hydraulic oil temperature (45 – 55°C)

No.	Condition setting			Measurement item	Unit	Standard value				Measured value	Judgement
						PC210-7		PC210LC, PC210NLC-7			
	Fuel dial	Working mode	Work equipment posture			New model	Failure judgement	New model	Failure judgement		
1	Engine stop		Boom and arm held level, Bucket loaded	Hydraulic drift amount at bucket tooth tip (15 min.)	mm	600	Max. 900	600	Max. 900		Good / No good

SEQUENCE OF EVENTS IN TROUBLESHOOTING



CLASSIFICATION AND STEPS FOR TROUBLESHOOTING

Classification of troubleshooting

Mode	Content
Code display	Troubleshooting when Service Code (electrical system) and Failure Code (mechanical system) are displayed.
E mode	Troubleshooting of electrical system
H mode	Troubleshooting of hydraulic and mechanical systems
(Engine)	Troubleshooting of engine assembly (refer to the shop manual for engine in 102 series)

Steps for troubleshooting

If some phenomenon occurs on a machine that looks like a failure, identify the corresponding troubleshooting No. and proceed to the explanations for diagnosis.

1. **Troubleshooting steps when calling User Code display in the monitor panel**
   In the User Code display, select and depress [✓] switch to display Service Code. Following displayed Service Code for the electrical system, carry out the troubleshooting along the corresponding code display.

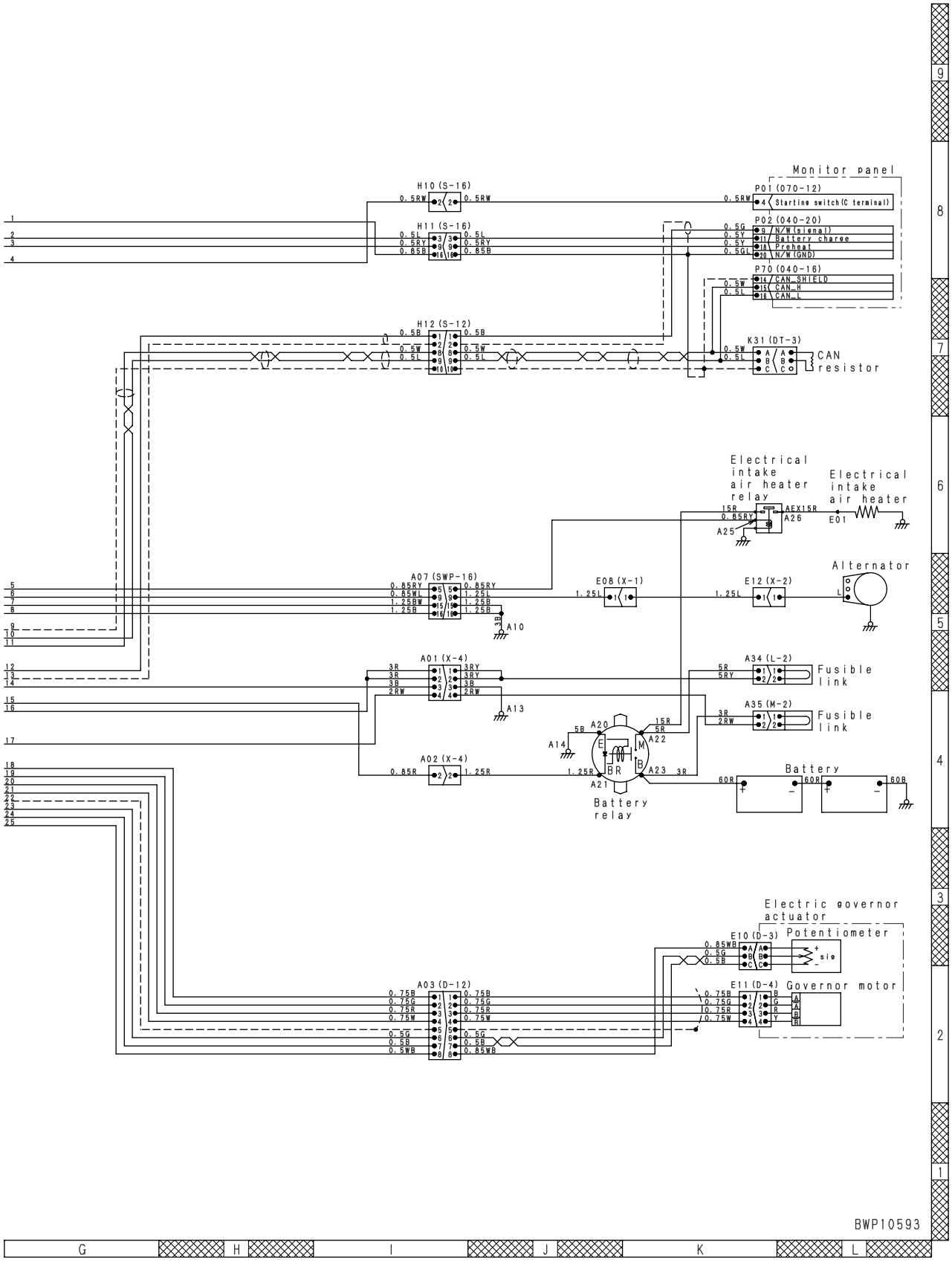
2. **Troubleshooting steps when the electrical system Service Code or mechanical system Failure Code is recorded in the failure history:**
   If not calling User Code in the monitor panel, check the electrical system Service Code or mechanical system Failure Code, using the failure history function of the monitor panel.
   - ★ If Service Code in the electrical system is recorded, delete the all codes once and revive the code in the display again to check if the same abnormality still persists.
   - ★ Failure Code in the mechanical system cannot be deleted.

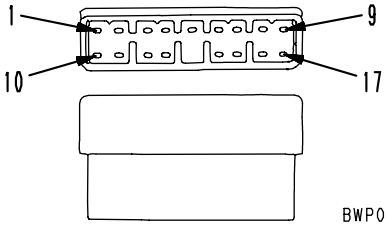
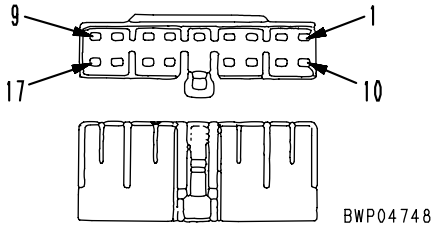
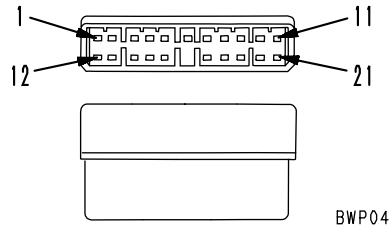
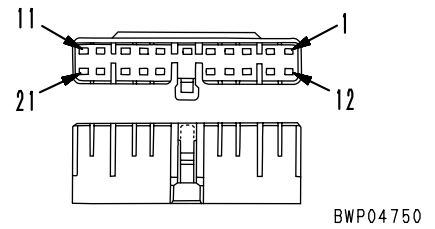
3. **Troubleshooting steps without User Code display and no failure history is available**
   If there is no display of User Code nor the failure history in the monitor panel, it is possible that a failure that the monitor panel cannot diagnose by itself may have occurred in any of the electrical, hydraulic or mechanical system. In such a case, reexamine the phenomenon, find out the most similar phenomenon from among "Failure like Phenomena and Troubleshooting No." and carry out E mode or H mode troubleshooting related to the phenomenon in question.

Connector No.	Detailed information
D or DT	Japanese and German makes DT type connector (08192-XXXXX)
L	Product of Yazaki Corporation L type connector (08056-2XXXX)
J	Product of Sumitomo Wiring Systems 090 type splice
M	Product of Yazaki M type connector (08056-0XXXX)
R	Product of Ryosei Electro-Circuit Systems* PH166-05020 type connector
S	Product of Yazaki S type connector (08056-1XXXX)
X	Product of Yazaki X type connector (08055-0XXXX)
PA	Product of Yazaki PA type connector
SWP	Product of Yazaki SWP type connector (08055-1XXXX)
DRC	Japanese and German makes DRC type connector
040	Product of Japan AMP 040 type connector
070	Product of Japan AMP 070 type connector
Y050	Product of Yazaki 050 type connector
S090	Product of Sumitomo 090 type connector
Y090	Product of Yazaki 090 type connector
YAZAKI	Yazaki-made connector
KES0	KESO type connector (08027-0XXXX)
Terminal	Round pin type single terminal connector
Terminal	Round terminal

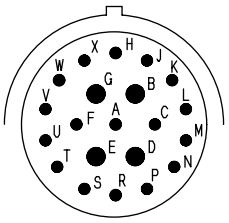
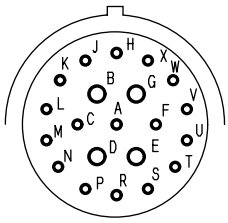
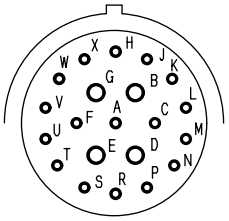
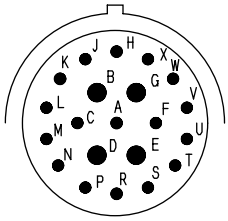
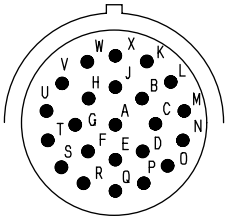
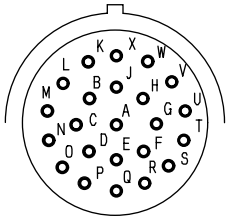
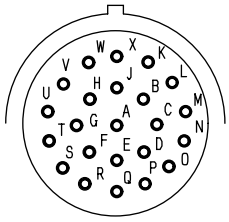
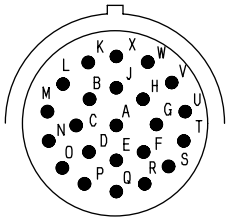
*An affiliated company of Mitsubishi Cable Industries, Ltd.

★ This circuit diagram has been compiled by extracting the governor•pump controller system (power source, governor control, model selection and communication) from the overall electrical circuit diagram.



No.of pins	MIC type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
17			799-601-2730
	Body part No.: 79A-222-2730 (Q'ty: 2)	Body part No.: 79A-222-2720 (Q'ty: 2)	
21			799-601-2740
	Body part No.: 79A-222-2750 (Q'ty: 2)	Body part No.: 79A-222-2740 (Q'ty: 2)	
	Terminal part No.: 79A-222-2770 (Q'ty: 50)	Terminal part No.: 79A-222-2760 (Q'ty: 50)	—

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

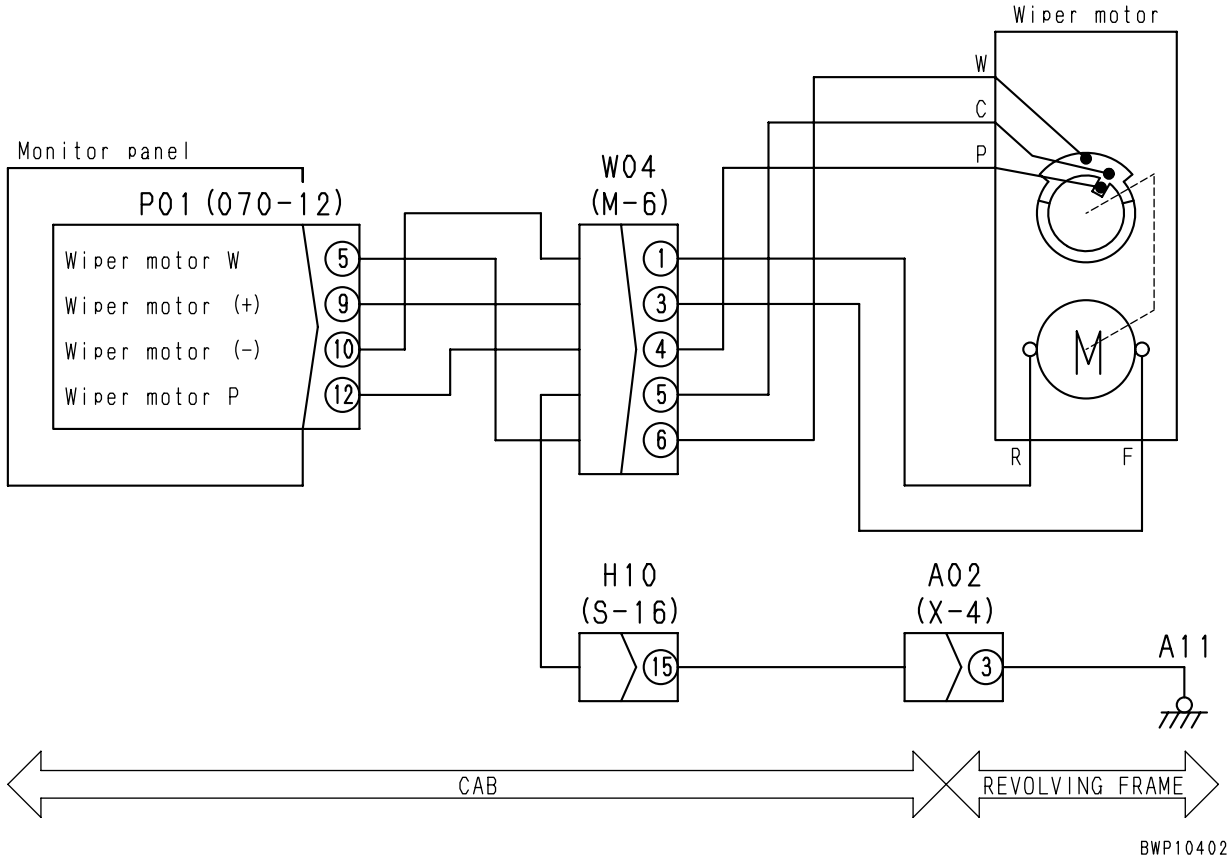
<table>
<tr><td rowspan="2">Type (shell size code)</td><td colspan="3">HD30 Series connector</td></tr>
<tr><td>Body (plug)</td><td>Body (receptacle)</td><td>T-adapter Part No.</td></tr>
<tr><td rowspan="4">24-21 (7)</td><td>Pin (male terminal)</td><td>Pin (female termial)</td><td rowspan="2">799-601-9270</td></tr>
<tr><td> 
BWP05025</td><td> 
BWP05026</td></tr>
<tr><td>Part No.: 08191-71201, 08191-71202,
08191-71205, 08191-71206</td><td>Part No.: 08191-74101, 08191-74102,
08191-74105, 08191-74106</td><td rowspan="3">799-601-9270</td></tr>
<tr><td>Pin (female terminal)</td><td>Pin (male termial)</td></tr>
<tr><td> 
BWP05027</td><td> 
BWP05028</td></tr>
<tr><td>Part No.: 08191-72201, 08191-72202,
08191-72205, 08191-72206</td><td>Part No.: 08191-73101, 08191-73102,
08191-73105, 08191-73106</td></tr>
<tr><td rowspan="4">24-22 (8)</td><td>Pin (male terminal)</td><td>Pin (female termial)</td><td rowspan="2">799-601-9280</td></tr>
<tr><td> 
BWP05029</td><td> 
BWP05030</td></tr>
<tr><td>Part No.: 08191-81201, 08191-81202
08191-81203, 08191-81204
08191-81205, 08191-80206</td><td>Part No.: 08191-84101, 08191-84102
08191-84103, 08191-84104
08191-84105, 08191-84106</td><td rowspan="3">799-601-9280</td></tr>
<tr><td>Pin (female terminal)</td><td>Pin (male termial)</td></tr>
<tr><td> 
BWP05031</td><td> 
BWP05032</td></tr>
<tr><td>Part No.: 08191-82201, 08191-82202
08191-82203, 08191-82204
08191-82205, 08191-82206</td><td>Part No.: 08191-83101, 08191-83102
08191-83103, 08191-83104
08191-83105, 08191-83106</td></tr>
</table>

Relative Electrical Circuit Diagram

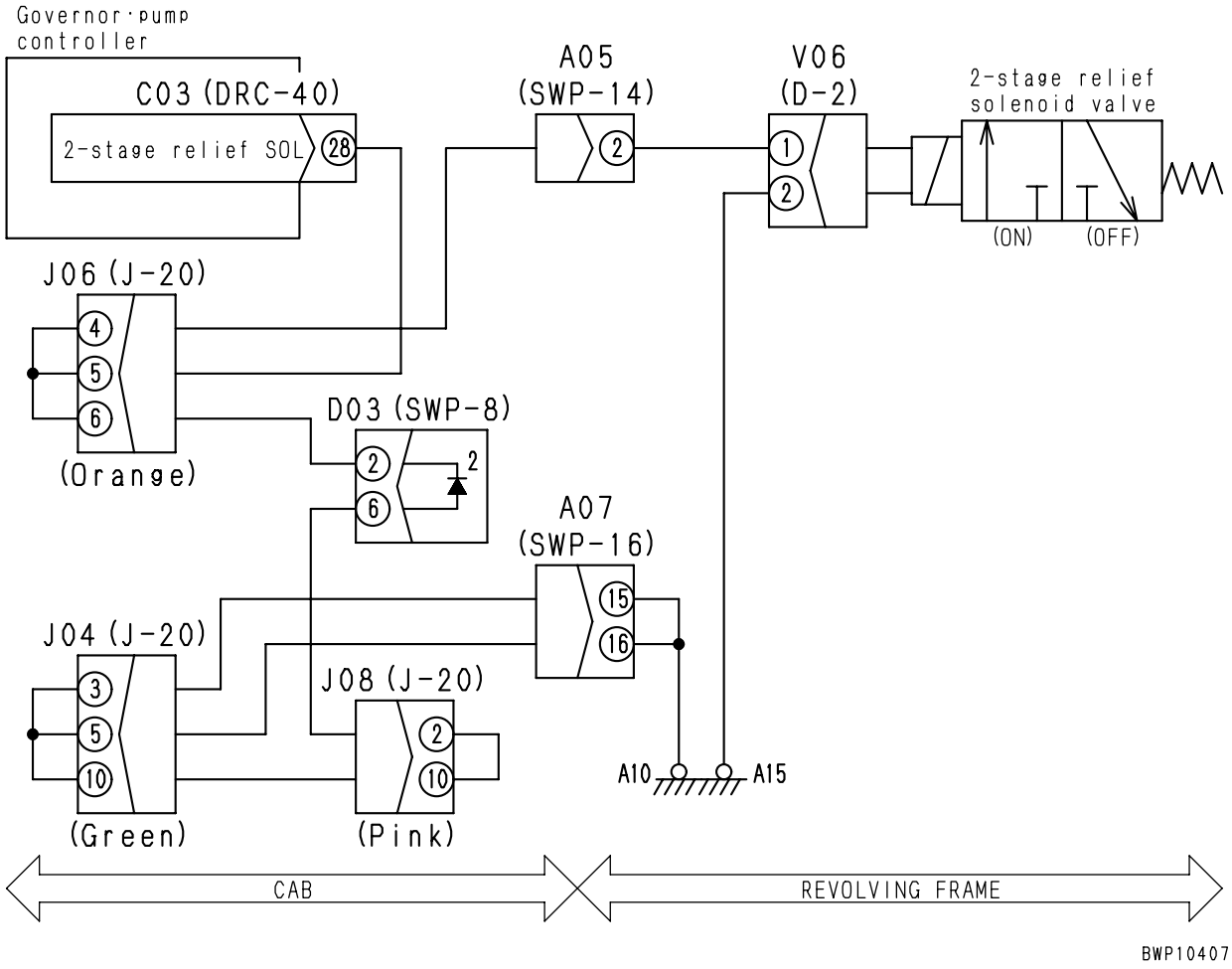
This is part of the electrical circuit diagram which shows the portion where the failure occurred.

- Connector No.: Indicates (Type - numbers of a pin) (color)
- Arrow: Roughly indicates the location in the machine where it is installed.

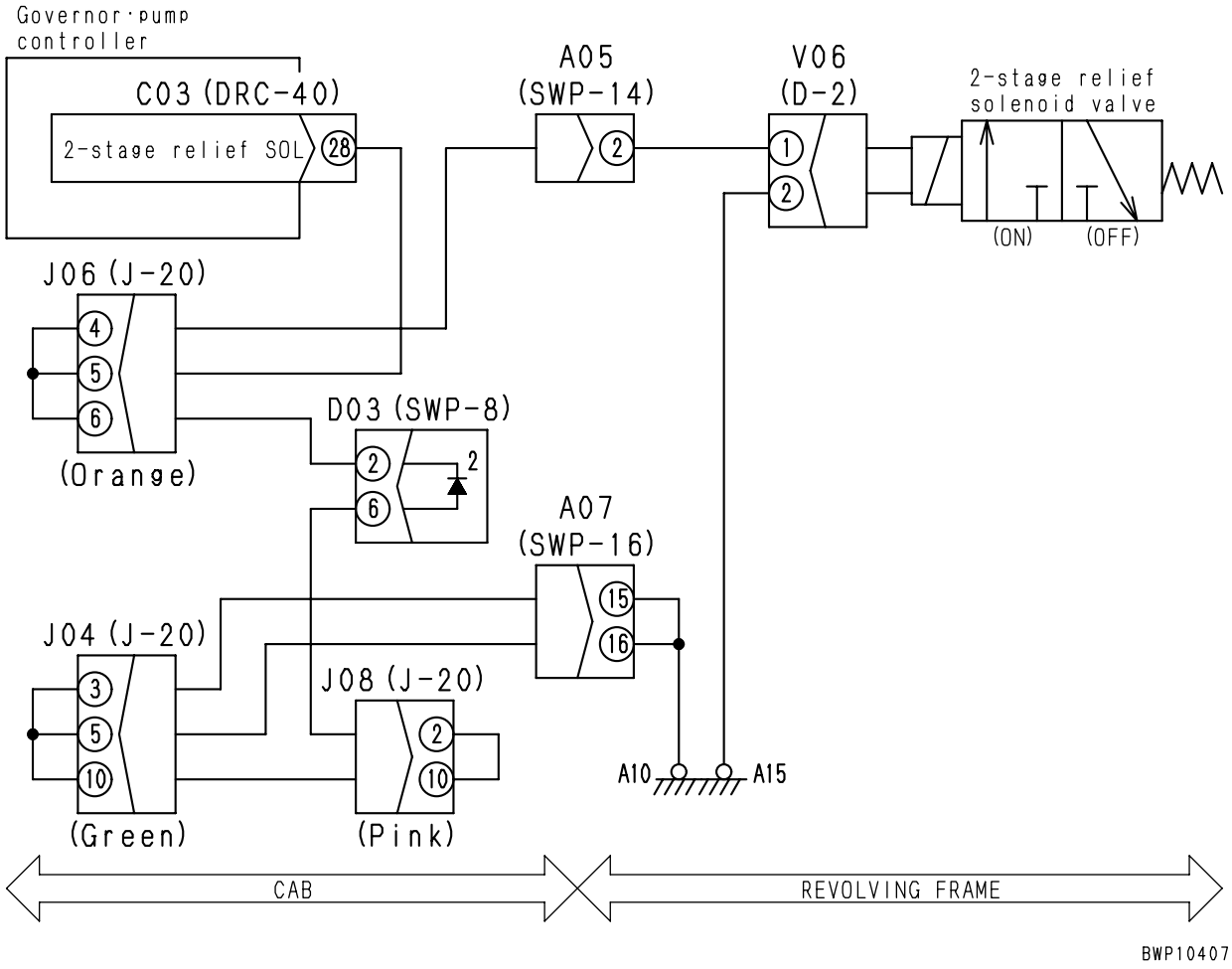
Monitor Panel Windshield Wiper Motor Electrical Circuit Diagram



Electric Circuit Diagram for 2-stage Relief Solenoid in Governor • Pump Controller



Electrical Circuit Diagram for 2-stage Relief Solenoid in Governor • Pump Controller

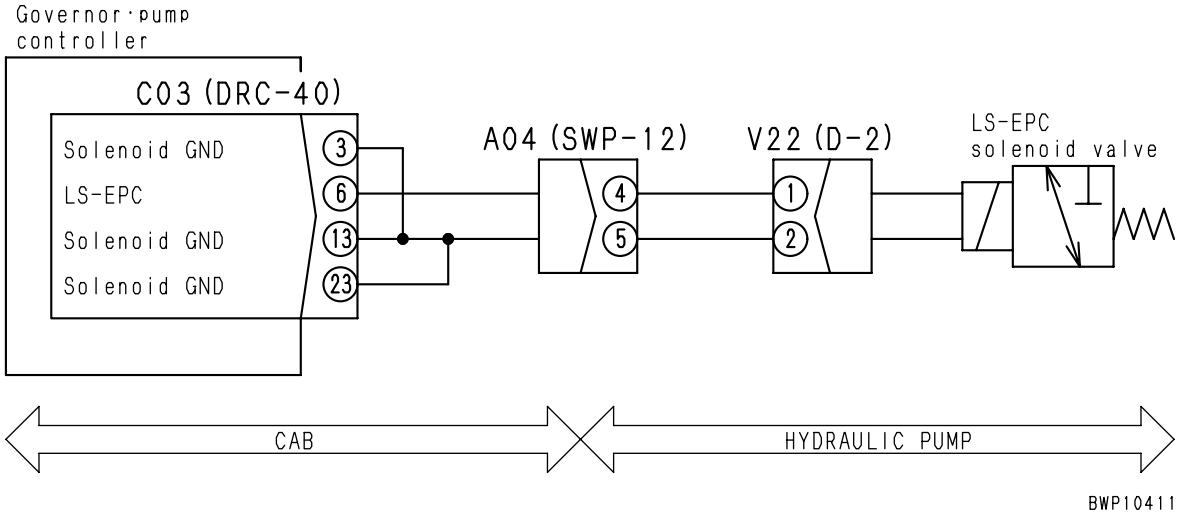


Service Code in Electrical System E223 (Disconnection in LS-EPC solenoid system)

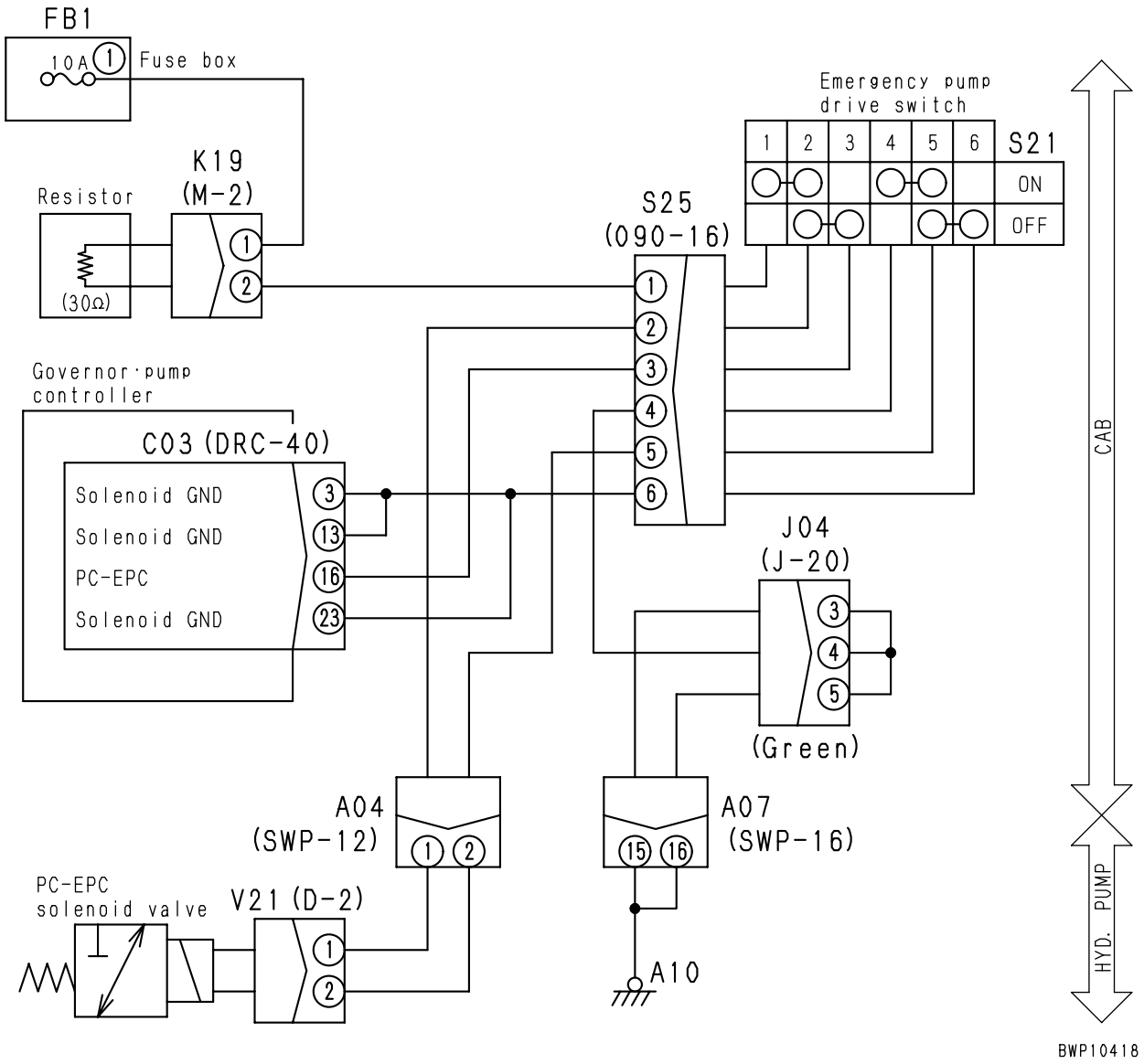
User Code	Service Code	Failure Code	Failure phenomenon	Disconnection in LS-EPC solenoid (in governor • pump controller system)
—	**E223**	**DXE0KA**		
Failure content	• No current flows to the LS-EPC solenoid circuit.			
Response from controller	• None in particular (The solenoid does not function as there is no current flowing to it) • When the failure cause disappears of itself, the machine operation returns to normalcy.			
Phenomenon occurring on machine	• The travel speed is slow at Mi and Lo. • In L mode, speeds of the work equipment and swing are too fast.			
Relative information	• Output to LS-EPC solenoid (ampere) can be confirmed in the monitor function. (Code No. 015: LS-EPC solenoid current)			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	LS-EPC solenoid defective (Internal short-circuiting)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			V22 (male)	Resistance value		
			Between ① and ②	7 – 14 Ω		
	2	Disconnection of wiring harness (Disconnection or defective contact with connector)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			Between wiring harness between C03 (female) ⑥ and V22 (female) ① and grounding	Resistance value	Below 1 Ω	
			Wiring harness between C03 (female) ③ ⑬ ㉓ and V22 (female) ②	Resistance value	Below 1 Ω	
	3	Short-circuiting of wiring harness (Contact with 24 V circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.			
			Between wiring harness between C03 (female) ⑥ and V22 (female) ① and grounding	Voltage	Below 1 V	
	4	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			C03 (female)	Resistance value		
			Between ⑥ and ③ ⑬ ㉓	7 – 14 Ω		

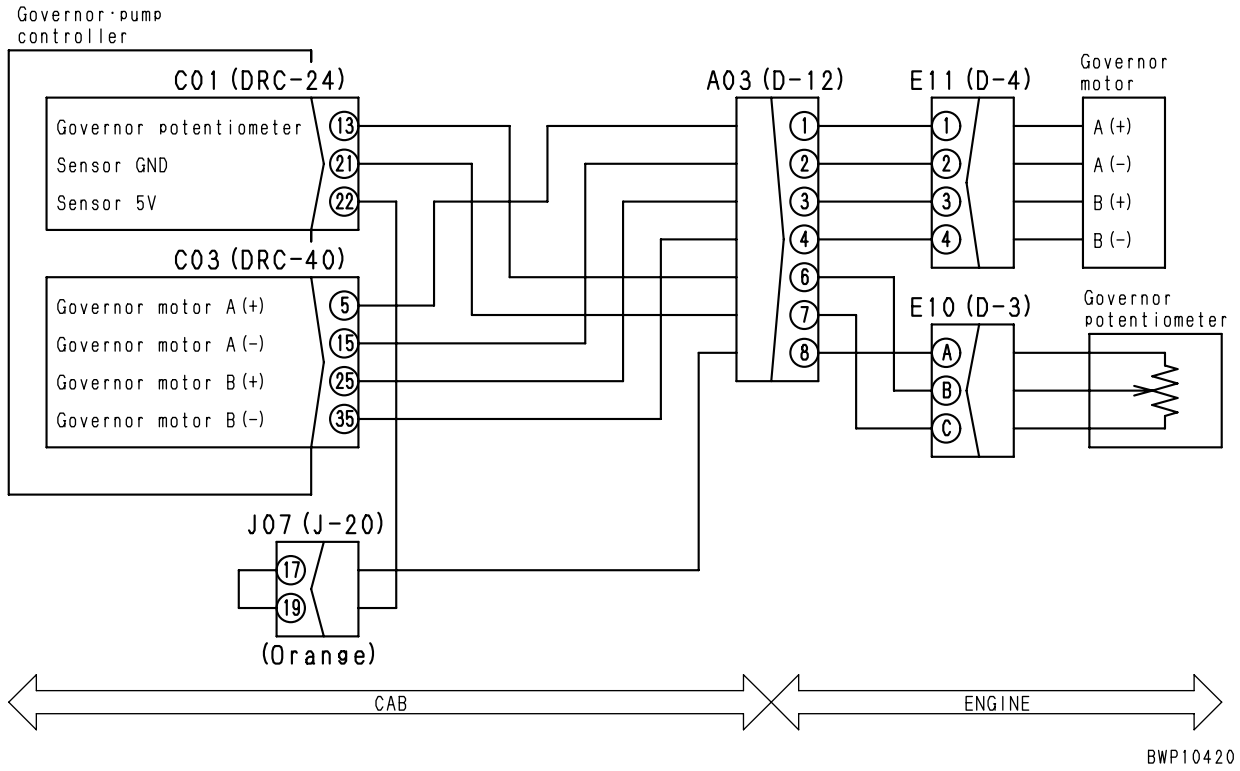
Electrical Circuit Diagram for LS-EPC Solenoid in Governor • Pump Controller



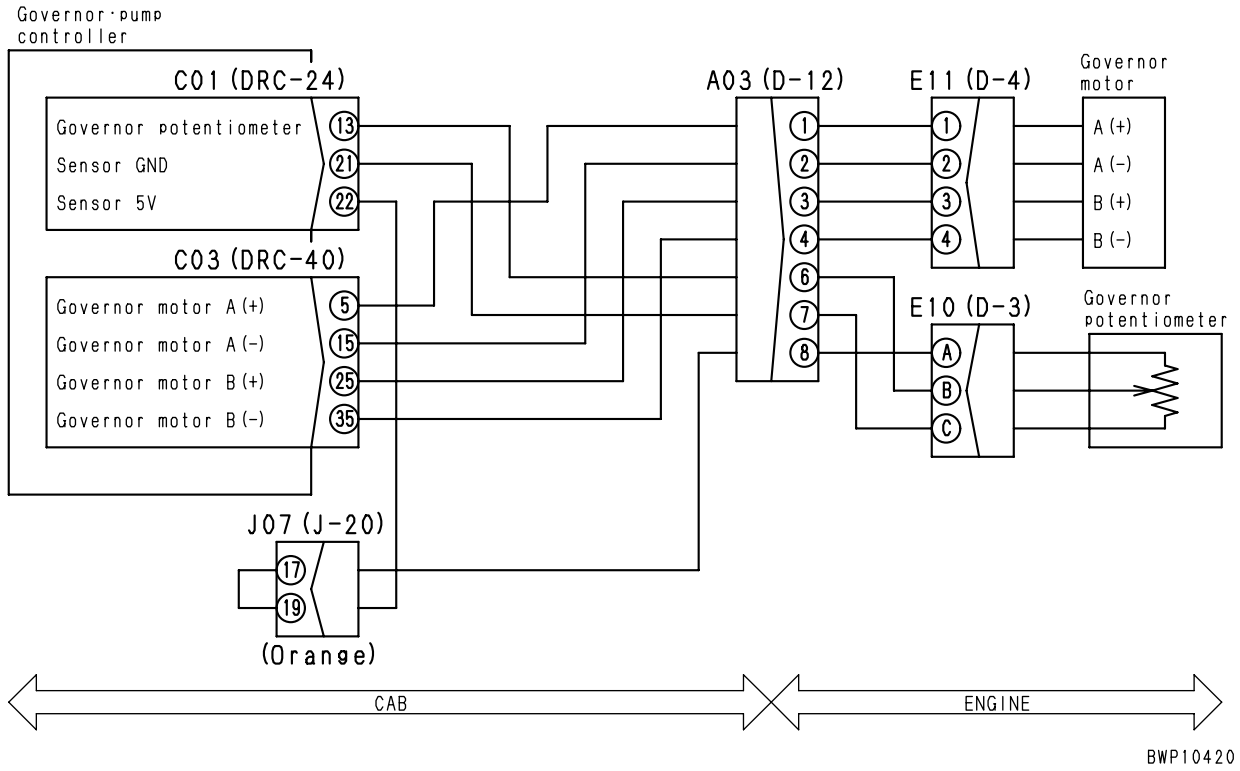
Electrical Circuit Diagram for PC-EPC Solenoid in Governor • Pump Controller



Electrical Circuit Diagram for Governor Motor in Governor • Pump Controller



Electrical Circuit Diagram for Governor Motor in Governor • Pump Controller



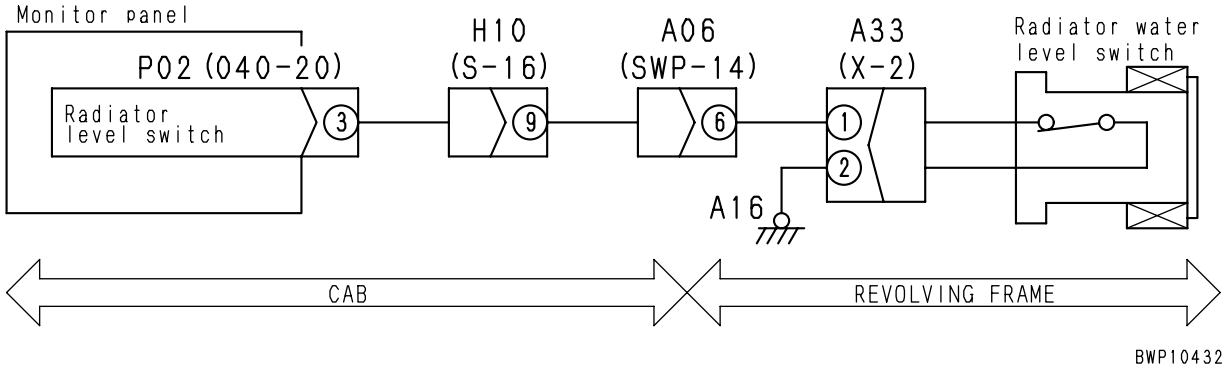
Failure Code in Mechanical System B@BCZK (Abnormally lowered radiator water level)

(Multi-monitor only)

User Code	Service Code	Failure Code	Failure phenomenon	Radiator water level abnormally lowered (in mechanical system)
—	—	**B@BCZK**		
Failure content	• The signal circuit in the radiator water level switch was opened (i.e. disconnected from grounding).			
Response from controller	• None in particular			
Phenomenon occurring on machine	• There is a possibility that the engine seizes, if it is kept running without a corrective action.			
Relative information	• This Failure Code is recorded, if the radiator water level caution symbol is displayed in the monitor panel, when the engine is running. • Input from the radiator water level switch (ON or OFF) can be confirmed in the monitor function. (Code No. 045: Monitor input 1)			

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Radiator water level lowered (system in normal condition)	★Check the water level and refill cooling water. (If this phenomenon occurs frequently, check the cause)			
	2	Radiator water level switch defective (Internal disconnection)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			A33 (male)	Engine cooling water level	Resistance value	
			Between ① and ②	When in normal condition	Below 1 Ω	
				When lowered	Above 1 MΩ	
	3	Disconnection of wiring harness (Disconnection or defective contact with connector)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			Wiring harness between P02 (female) ③ and A33 (female) ①		Resistance value	Below 1 Ω
			Wiring harness between A33 (female) ② and grounding		Resistance value	Below 1 Ω
	4	Monitor panel defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.			
			P02	Engine water temperature	Resistance value	
			Between ③ and grounding	When in normal condition	Below 1 V	
				When lowered	20 – 30 V	

Electrical Circuit Diagram for Radiator Water Level Switch in Monitor Panel



BWP10432

E-4 Engine does not stop

Failure information	• The engine does not stop.
Relative information	• The Governor • pump controller drives the battery relay for the min. 4 seconds and max. 7 seconds from the moment the engine starting switch is turned OFF to the moment the engine completely stops. • It can be confirmed in the monitor function how the battery relay works (ON or OFF) (Code No. 037: Controller output)

Presumed cause and standard value in normalcy	Cause		Standard value in normalcy and references for troubleshooting			
	1	Battery relay fault	If operating sound is heard from the battery relay contact, when turning the engine starting switch, the battery relay is judged as normal. • Starting switch OFF→ON→OFF			
	2	Assembled-type diode D01 fault (Internal disconnection)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			D01 (male)	Digital type circuit tester	Continuity	
			Between ⑤ and ①	Diode mode	Continued	
	3	Disconnection of wiring harness (Disconnection or defective contact with connector)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			Wiring harness between C03 (female) ④ and D01 (female) ⑤		Resistance value	Below 1 Ω
			Wiring harness from D01 (female) ① to J01 to battery relay BR terminal (A21)		Resistance value	Below 1 Ω
			Wiring harness between battery relay E terminal (A20) and grounding		Resistance value	Below 1 Ω
	4	Governor • pump controller defective	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.			
			C03	Engine starting switch	Voltage	
			Between ④ and grounding	ON→OFF	20 – 30 V (for 4 to 7 seconds)	

E-11 Part of display on monitor panel is missing

Failure information	• Part of the display in the monitor panel is missing.
Relative information	—

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting
	1	Monitor panel LCD fault	If all the LCD in the monitor panel light up (i.e. the screen becomes totally white) by the following switching operation, then the monitor panel is normal. • Switching operation: [↩] + [A] (simultaneous switching operation)
	2	Monitor panel defective	As this is an internal failure, troubleshooting cannot be conducted. (If there is no problem with the above switching operation, the monitor panel is judged as defective)

E-12 Monitor panel displays contents irrelevant to the model

Failure information	• The monitor panels displays contents that have nothing to do with the model on which it is installed.
Relative information	—

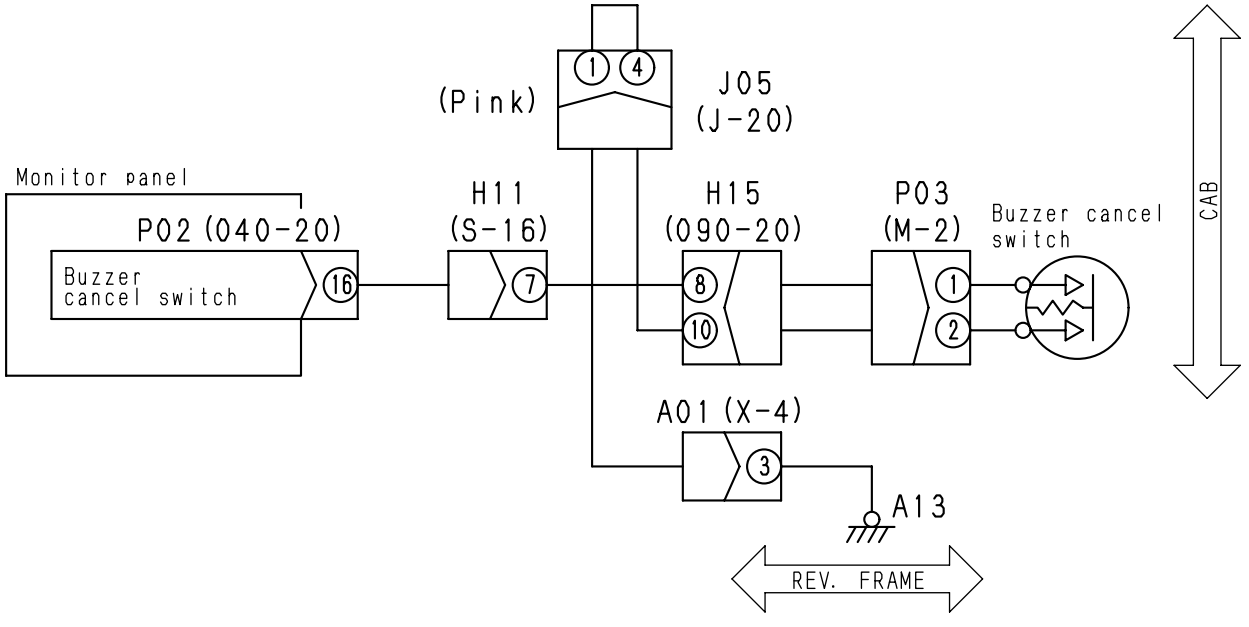
Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting		
	1	Model code signal fault (Internal failure)	If the display on the monitor panel is normal, proceed to Service Code [E217].		
			Monitoring code	Item	Normal display
			002 003	Controller model code	200
	2	Monitor panel defective	As this is an internal failure, troubleshooting cannot be conducted. (If there is no problem with the above switching operation, the monitor panel is judged as defective)		

E-20 Alarming buzzer cannot be cancelled

Failure information	• The alarming buzzer cannot be cancelled.
Relative information	• Input from the alarming buzzer cancellation switch (ON or OFF) can be confirmed in the monitor function. (Code No. 049: Monitor input 3)

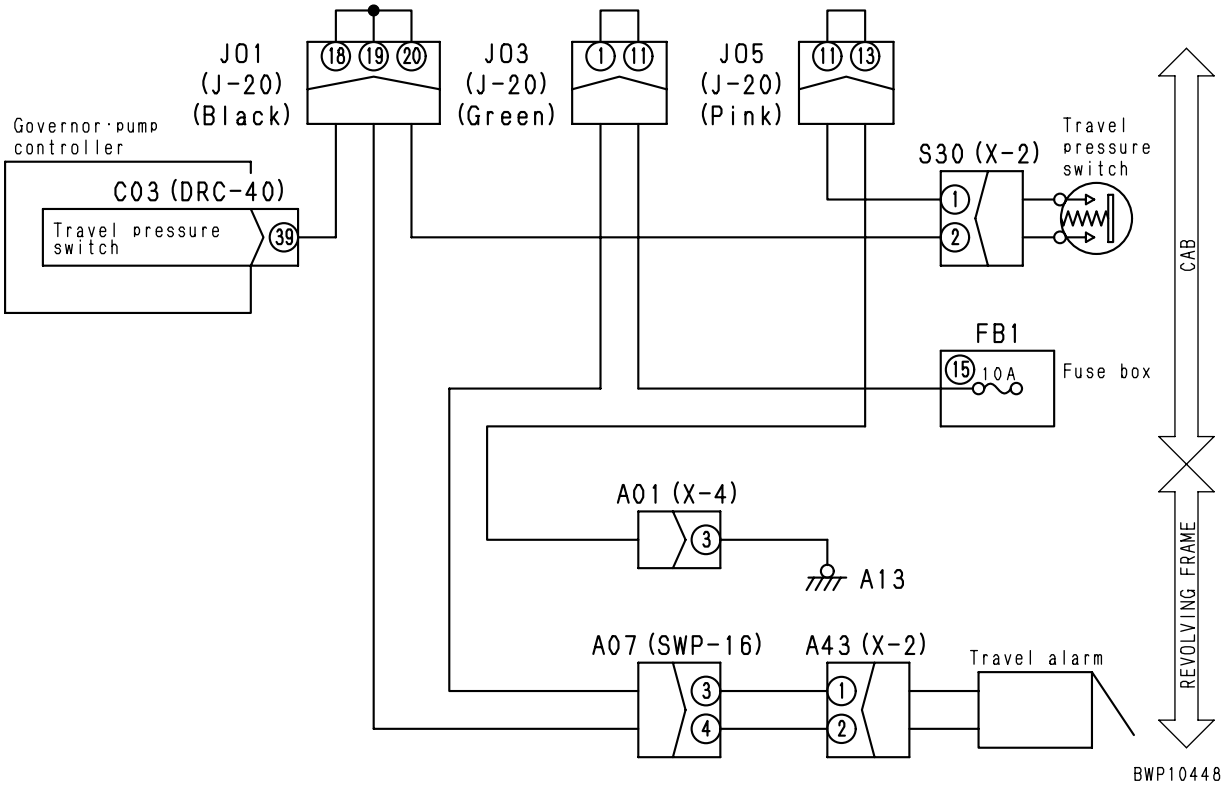
Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting			
	1	Alarming buzzer cancellation switch fault (Internal disconnection or short-circuiting)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			P03 (female)	Alarming buzzer cancellation switch	Resistance value	
			Between ① and ②	Release	Above 1 MΩ	
				Depress	Below 1 Ω	
	2	Disconnection of wiring harness (Disconnection or defective contact with connector)	★Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			Wiring harness between P02 (female) ⑯ and P03 (male) ①		Resistance value	Below 1 Ω
			Wiring harness from P03 (male) ② to J05 to grounding		Resistance value	Below 1 Ω
	3	Short-circuiting of wiring harness (Contact with 24 V circuit)	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.			
			Between wiring harness between P02 (female) ⑯ and P03 (male) ① and grounding		Voltage	Below 1 V
	4	Monitor panel fault	★Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.			
			P02	Alarming buzzer cancellation switch	Voltage	
			Between ⑯ and grounding	Release	20 – 30 V	
				Depress	Below 1 V	

Electrical Circuit Diagram for Alarming Buzzer Cancellation Switch

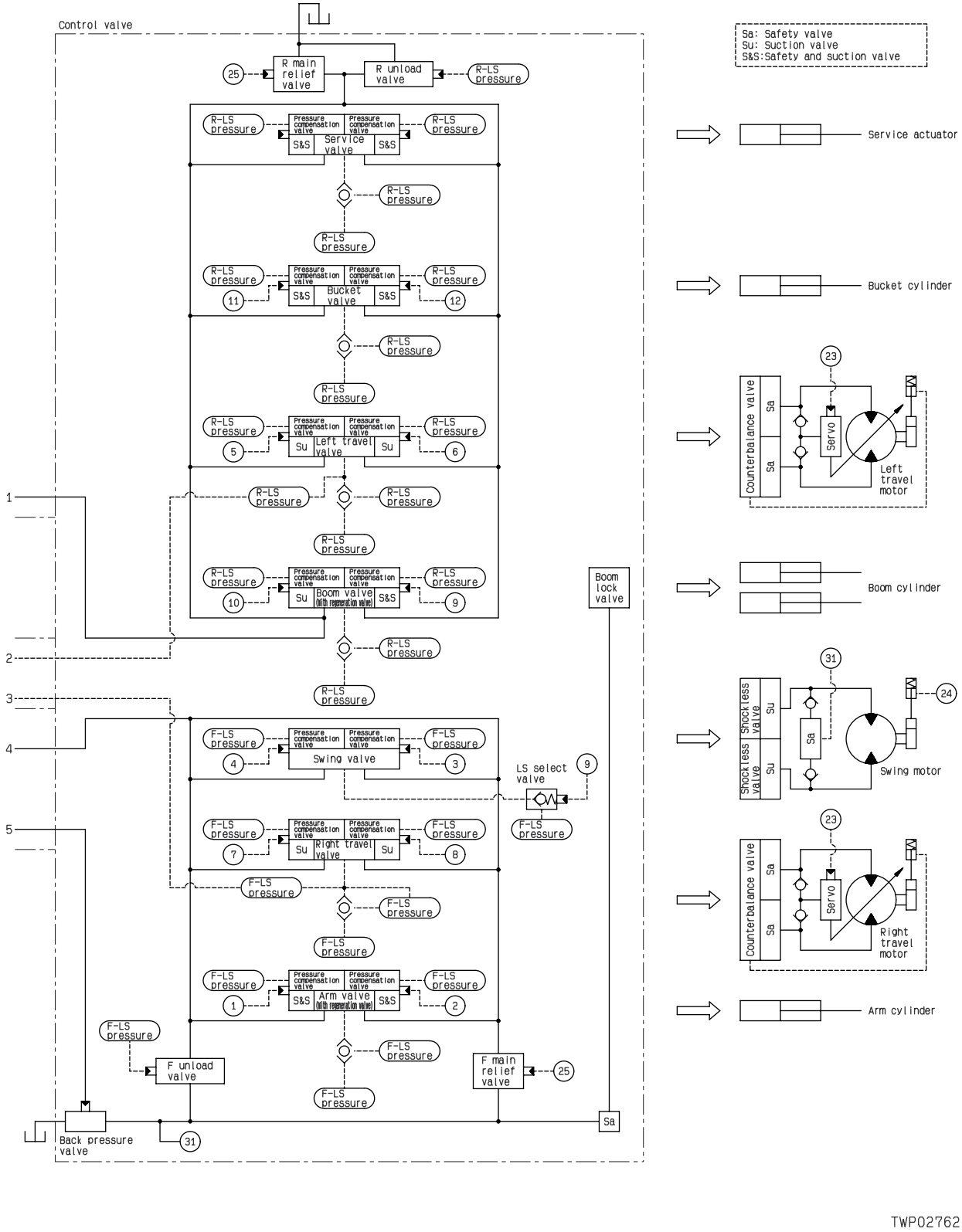


BWP10437

Electrical Circuit Diagram for Travel PPC hydraulic Switch and Travel Alarm



★ This is a system chart that has been drawn up by simplifying the whole hydraulic circuit chart. Use it as a reference material when troubleshooting the hydraulic and mechanical systems.



H-12 Work equipment has big time lag

Failure information	• The work equipment has a big time lag.
Relative information	• Set the working mode at A mode for the troubleshooting.

<table>
<tr><td rowspan="6">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="3">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Malfunctioning of LS-EPC valve</td><td colspan="3">★Stop engine for preparations. Start troubleshooting at engine high idling.</td></tr>
<tr><td>Travel speed</td><td>Travel control lever</td><td>LS-EPC valve output pressure</td></tr>
<tr><td>Lo</td><td>NEUTRAL</td><td>Approx. 2.9 MPa {approx. 30 kg/cm^2}</td></tr>
<tr><td>Hi</td><td>Operation</td><td>0{0}</td></tr>
<tr><td>2</td><td>Malfunctioning of control valve (regeneration valve) - with boom and arm only</td><td colspan="3">The regeneration valve in the control valve is presumed to malfunction. Check the valve itself.</td></tr>
<tr><td>3</td><td>Malfunctioning of control valves (safety & suction valve)</td><td colspan="3">The safety and suction valves of the control valve are presumed to malfunction. Check those valves themselves directly.
★For the arm and boom, whether they are defective or not may well be determined by changing them for other safety and suction valves. (Do not attempt to change them for the safety and suction valves for the boom LOWER and the lock valve, because each set pressure differs)</td></tr>
<tr><td>4</td><td>Malfunctioning of control valve (pressure compensation valve)</td><td colspan="3">The pressure compensation valve of the control valve is presumed to malfunction. Check the valve itself directly.</td></tr>
</table>

H-13 Other work equipment moves when relieving single circuit

Failure information	• Other work equipment moves when relieving the single circuit of specific work equipment.
Relative information	• Set the working mode at A mode for the troubleshooting.

Presumed cause and standard value in normalcy	Cause		Standard value in normalcy and references for troubleshooting
	1	Control valve (pressure compensation valve) seal defective	The seal for pressure compression valve in the control valve is suspected to be defective. Check the seal itself.

H-14 One-touch power max. switch does not operate

Failure information	• The one-touch power max. switch does not operate.
Relative information	• Set the working mode at A mode for the troubleshooting.

<table>
<tr><td rowspan="5">Presumed cause and standard value in normalcy</td><td colspan="2">Cause</td><td colspan="2">Standard value in normalcy and references for troubleshooting</td></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Malfunctioning of 2-stage solenoid valve</td><td colspan="2">★Stop engine for preparations. Start troubleshooting at engine high idling.</td></tr>
<tr><td>Swing lock switch</td><td>Solenoid valve output pressure</td></tr>
<tr><td>OFF</td><td>0{0}</td></tr>
<tr><td>ON</td><td>2.84 – 3.43 MPa {29 – 35kg/cm^2}</td></tr>
<tr><td>2</td><td>Malfunctioning of main relief valve</td><td colspan="2">The main relief valve is presumed to malfunction. Check the valve itself.</td></tr>
</table>

H-26 There is big shock when stopping swing

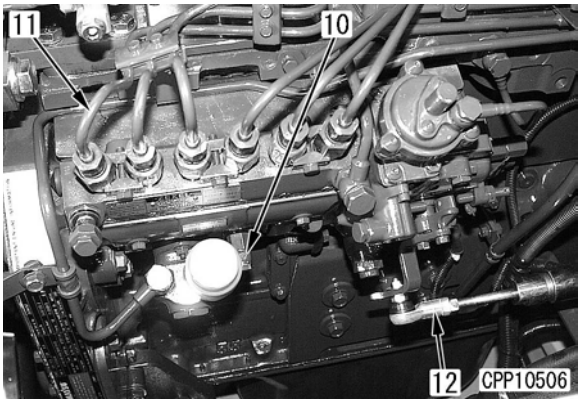
Failure information	• There is a big shock caused when stopping a swing motion.
Relative information	• Set the working mode at A mode for the troubleshooting.

Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting	
	1	Malfunctioning of swing PPC valve	★Stop engine for preparations. Start troubleshooting at engine high idling.	
			Swing control lever	PPC valve output pressure
			NEUTRAL	0 {0}
			Left or right	Above 2.7 MPa {Above 28 kg/cm^2}
	2	Malfunctioning of swing PPC slow return valve	The swing PPC slow return valve is presumed to malfunction. Check the valve itself. ★Whether the valve malfunctions or not may well be determined by swapping the right and left valves and watching the result.	

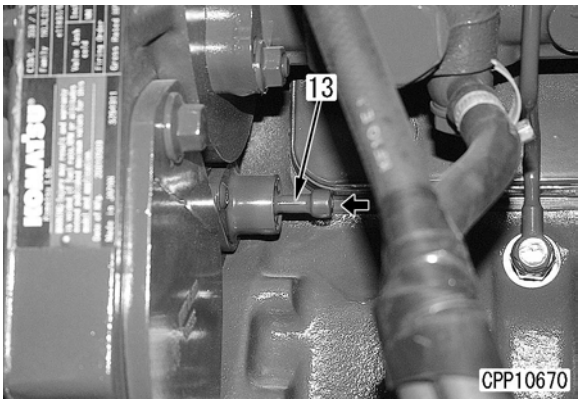
H-27 There is big abnormal noise caused when stopping swing

Failure information	• There is a big abnormal noise caused when stopping a swing motion.
Relative information	• Set the working mode at A mode for the troubleshooting.

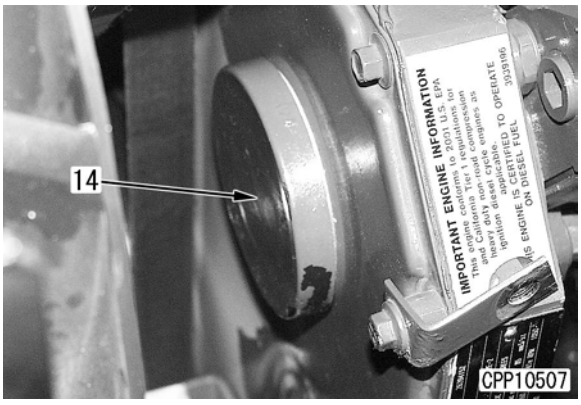
Presumed cause and standard value in normalcy		Cause	Standard value in normalcy and references for troubleshooting
	1	Malfunctioning of backpressure valve	The backpressure valve is presumed to malfunction. Check the valve itself.
	2	Malfunction of swing motor (safety valve)	The safety valve in the swing motor is presumed to malfunction. Check the valve itself.
	3	Malfunction of swing motor (suction valve)	The seal in suction valve of the swing motor is suspected of defect. Check the seal itself. ★Whether the seal is defective or not may well be determined by swapping the right and left valves and watching the result.
	4	Swing machinery defective	The swing machinery is suspected of an internal failure. Check the inside of the machinery itself. ★A failure inside the swing machinery may well be determined by monitoring abnormal noise, abnormal heat generated or metal dust or chips contained in the drained oil.



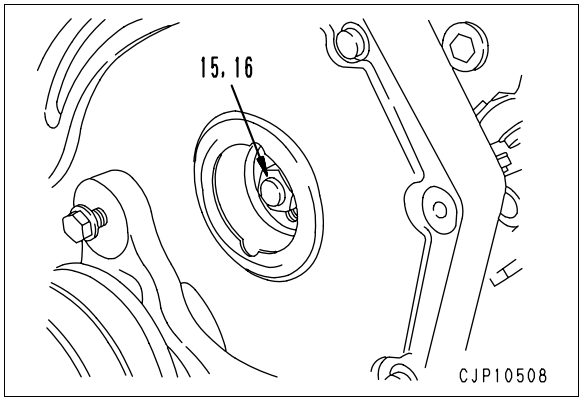
10. Adjust the timing gear to the injection timing, using timing pin (13) on the timing gear side.
    ★ Refer to the Inspection and Adjustment of Fuel Injection Timing Section.



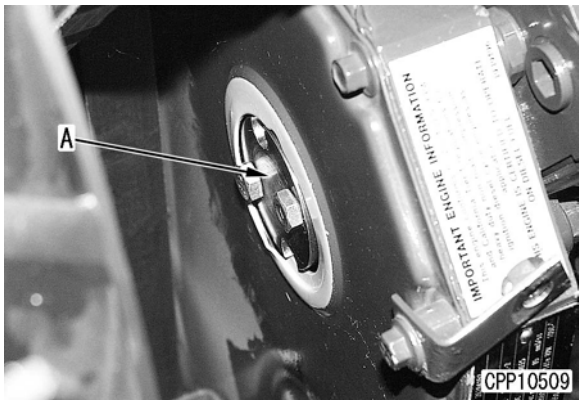
11. Unscrew cap (14) to remove it.
    ★ Use a filter wrench to unscrew the cap.



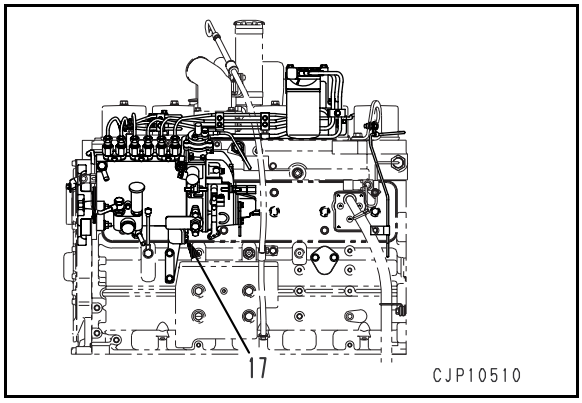
12. Remove nut (15) and washer (16) from the fuel injection pump. ※6
    ★ Be careful not to drop the nut or washer inside the case.



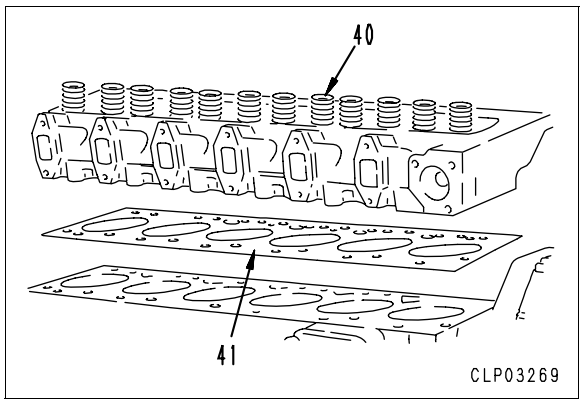
13. Separate the fuel injection pump shaft and drive gear, using tool **A**.



14. Remove two bracket mounting bolts (17) on the lower part of the fuel injection pump.



36. Remove cylinder head gasket (41). ※18



INSTALLATION

- Install in reverse order of removal.

※1

★ Coat the threads of the clamp bolt (used for securing the engine oil level gauge guide) with gasket sealant.

※2

N·m Air intake hose clamp bolt:
5.4 - 6.4 Nm (0.55 - 0.65 kgm)

※3

N·m Joint bolt:
19.6 - 29.4 Nm (2.0 - 3.0 kgm)

※4

★ Coat the threads of only one bolt on the head cover side of the fuel filter bracket with gasket sealant.

※5

N·m Sleeve nut:
24 ± 4 Nm (2.45 ± 0.41 kgm)

※6

N·m Air cleaner suction hose clamp bolt: 5.4 - 6.4 Nm (0.55 - 0.65 kgm)

※7

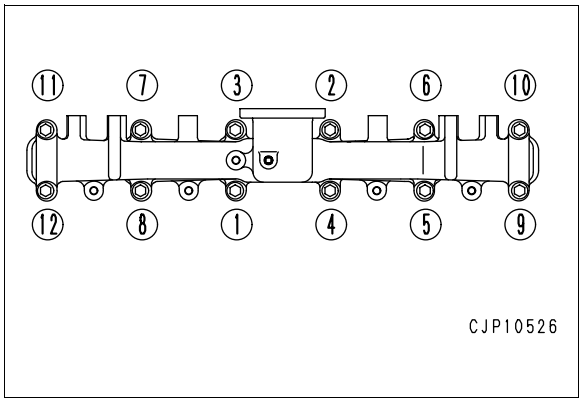
N·m Intake air hose clamp bolt:
5.4 - 6.4 Nm (0.55 - 0.65 kgm)

※8

★ Tighten the exhaust manifold mounting bolts in the sequence illustrated below.

N·m Exhaust manifold mounting bolt:

1st step: Tighten to 24 ± 4 Nm (2.45 ± 0.41 kgm) in the sequence of (1) through (12).
2nd step: Tighten to 43 ± 6 Nm (4.38 ± 0.61 kgm) in the sequence of (1) through (12).
3rd step: Tighten to 43 ± 6 Nm (4.38 ± 0.61 kgm) in the sequence of (1) through (4).



※9

★ Refer to the Inspection and Adjustment of Air Compressor Belt Tension section in the TESTING AND ADJUSTING chapter in this manual.

※10

N·m Radiator fan and fan pulley mounting bolt:
33 ± 5 Nm (3.37 ± 0.51 kgm)

※11

N·m Radiator inlet hose clamp bolt:
8.3 - 9.3 Nm (0.85 - 0.95 kgm)

N·m Heater hose clamp bolt:
8.83 - 14.7 Nm (0.9 - 1.5 kgm)

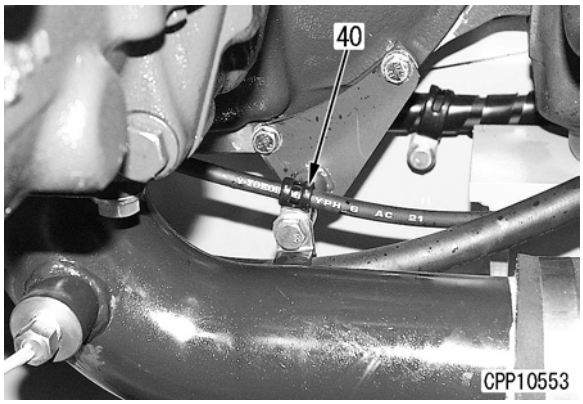
※12

N·m Spill tube bolt:
30 ± 5 Nm (3.06 ± 0.51 kgm)

※13

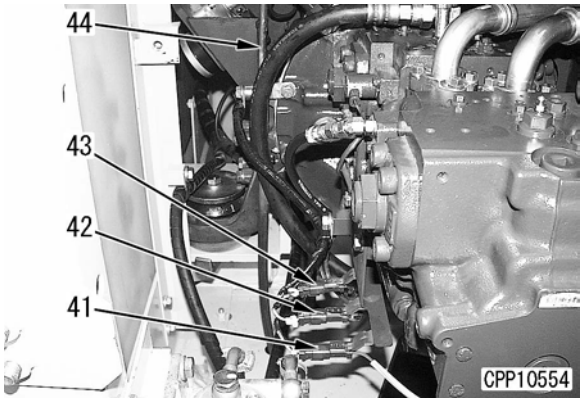
N·m Nozzle holder assembly:
60 ± 9 Nm (6.12 ± 0.92 kgm)

21. Remove clamp (40).



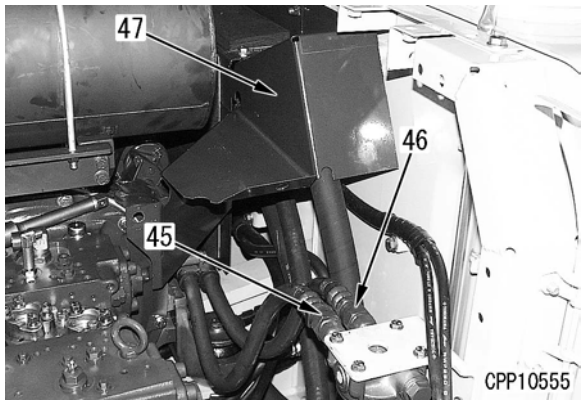
22. Disconnect the pump wiring connectors at the following three points.
    - (41): A61 (Hydraulic oil temperature sensor)
      Color band, white
    - (42): V21 (PC-EPC solenoid valve)
      Color band, white
    - (43): V22 (LS-EPC solenoid valve)
      Color band, red

23. Disconnect exhaust muffler drain tube (44).



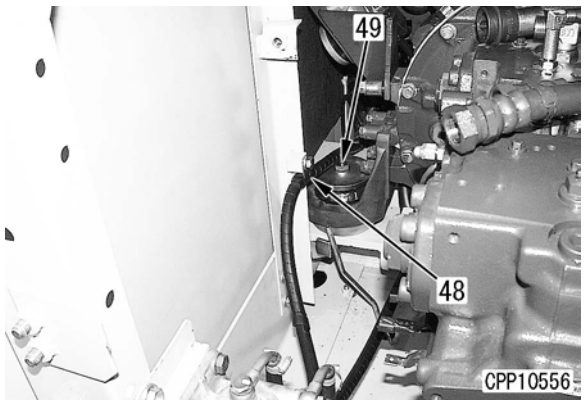
24. Disconnect engine oil filter outlet hose (45) and engine oil filter inlet hose (46).

25. Remove cover (47).



26. Remove water separator wiring clamp (48).

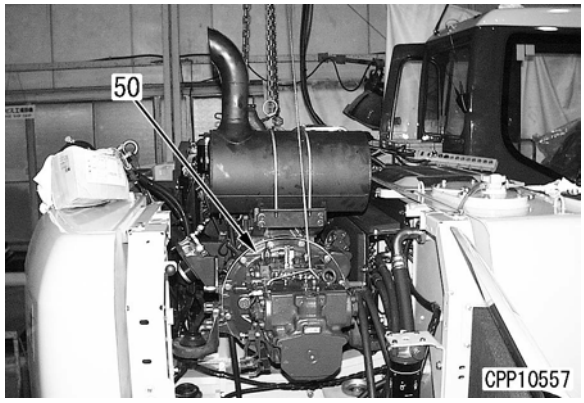
27. Remove four engine mounting bolts (49) at the front and rear. ※6



★ Check that there is no wiring or piping still connected.

28. Lift out engine and hydraulic pump assembly (50).

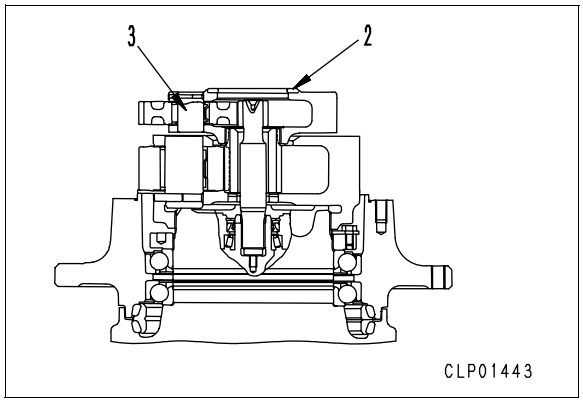
kg Engine and hydraulic pump assembly: 770 kg



2) Install No. 1 carrier assembly (3).

9. Spacer

Install spacer (2).

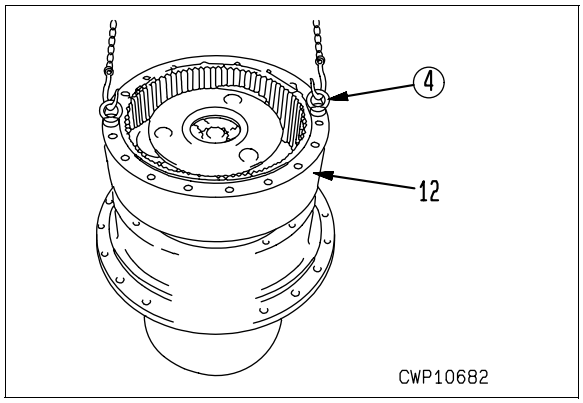


10. Ring gear

Fit O-ring to hub end. Then using eyebolts e, align the position of the bolt holes on hub and ring gear (12), and install.

★ Remove all grease and oil from the mating surface of the ring gear and hub.

★ Do not put any gasket sealant on the mating surface of the ring gear and hub under any circumstances.

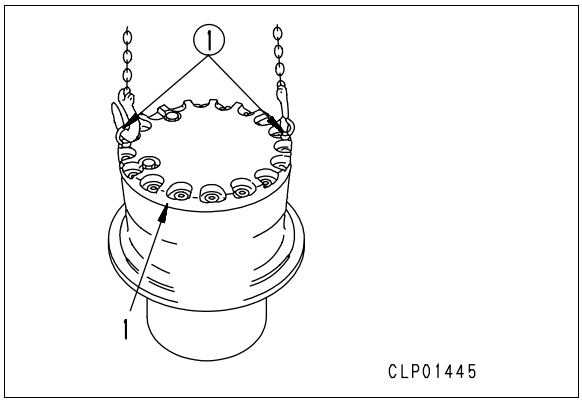


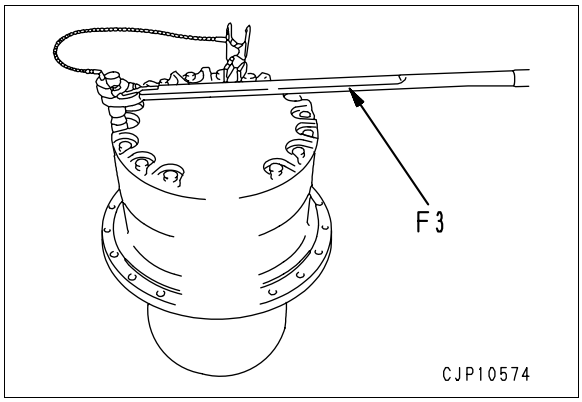
11. Cover

Using eyebolts b, fit cover (1), then tighten mounting bolts with angle tightening wrench F3.

Mounting surface of cover:
Gasket sealant (LG-6)

Mounting bolt:
1st pass: **98 Nm {10 kgm}**
2nd pass: **Turn 80 - 90°**





12. Refilling with oil

Tighten drain plug and add engine oil through oil filler.

Final drive case: **Approx. 4.7 l**

★ Do a final check of the oil level at the determined position after installing the final drive assembly to the chassis.

DISASSEMBLY AND ASSEMBLY OF CARRIER ROLLER ASSEMBLY

★ This section deals with only precautions to be followed when reassembling the carrier roller assembly.

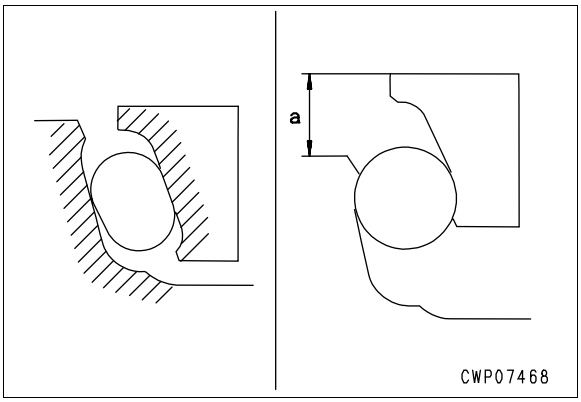
SPECIAL TOOLS

Mark	Part No.	Part Name	Necessity	Qty	Distinction*	Sketch
K	790-101-5001	Push tool kit	●	1		
	• 790-101-5081	• Plate				
	• 790-101-5021	• Grip				
	• 01010-50816	• Bolt				
	790-434-1660	Installer	■	1		
	790-101-1000	Oil pump	■	1		

*Distinction between new and existing part.

ASSEMBLY

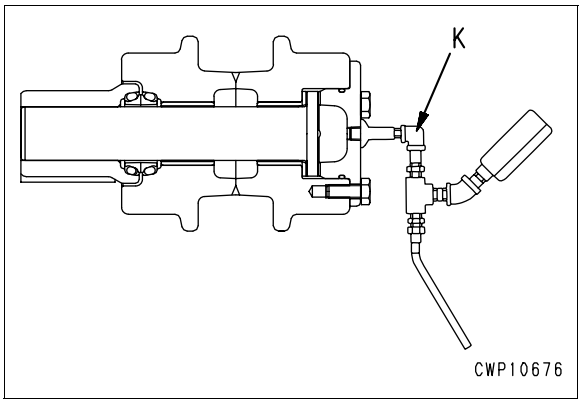
- Floating seal
  - ★ Before installing a floating seal, completely degrease both contact surfaces of the O-ring and the floating seal (hatched area in the illustration). Furthermore, take care so that no dust will stick to the contact surface of the floating seal.
  - ★ After inserting the floating seal, check that inclination of the seal is less than 1 mm and that protrusion **a** of the seal remains within the range of 9 - 11 mm.



- Carrier roller cover mounting bolt

  N·m Carrier roller cover mounting bolt: 44.12 - 53.93 Nm (4.5 - 5.5 kgm)

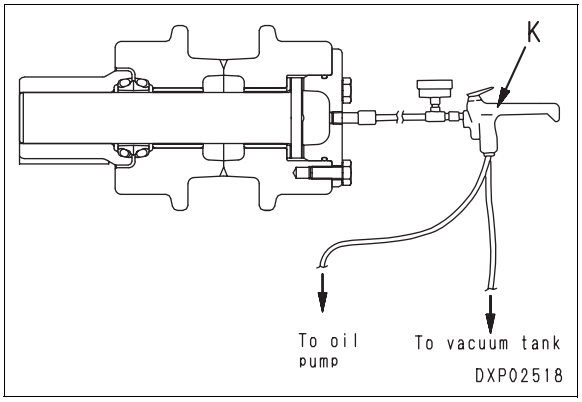
- Carrier roller
  - ★ Check the amount of air leakage from the seal with tool **K** by applying the standard pressure to the oil filler port.
  - ★ Check that the gauge needle does not go down, when the below standard pressure is applied for 10 seconds.
    Standard pressure: **0.1 Mpa (1 kg/cm²)**



  - ★ Fill the carrier roller assembly with oil, using tool **K**, and screw in the plug.

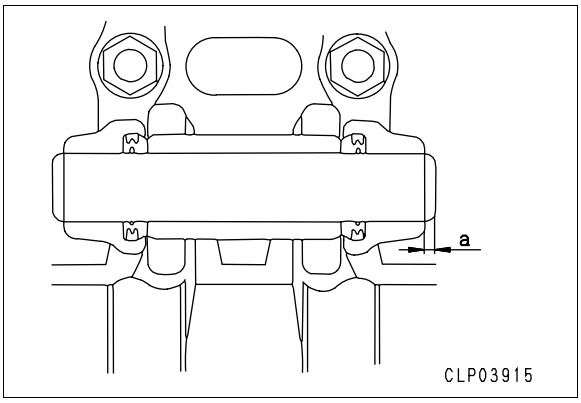
    Carrier roller: 75 - 85 cc (E030-CD)

    N·m Carrier roller plug: 30.89 - 37.75 Nm (3.15 - 3.85 kgm)



※2

★ Press-fit the master pin, using tool **M**, in such a way that the master pin protrusion amount is the following dimension **a**.
Master pin protrusion amount **a**:
2.5 ± 1 mm



※3

★ Before installing a dust seal, coat its contact surface with the bushing with grease (G2-LI).

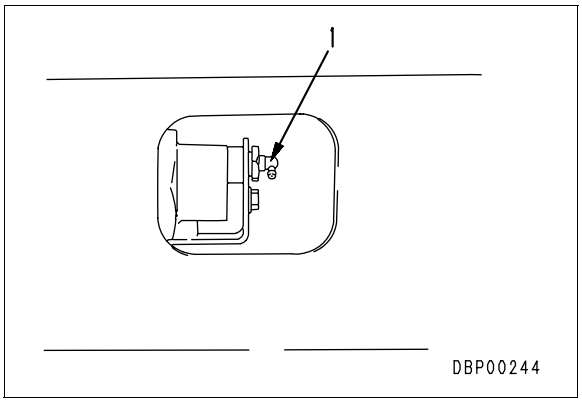
★ If you have road liners (rubber pad type shoe plates), replace the shoe plates with new ones immediately when it is discovered that the rubber is worn out or broken. Otherwise, the shoe bolt heads will be damaged. Once the bolt heads are crushed, it becomes extremely difficult to remove them.

REMOVAL AND EXPANSION OF ROAD LINERS

1. Stop the machine so the master pin is right above the idler and the track shoe assembly can be expanded to the front and to the rear.

2. Lower the work equipment to the ground, and unscrew lubricator (1) to loosen track shoe tensi※1

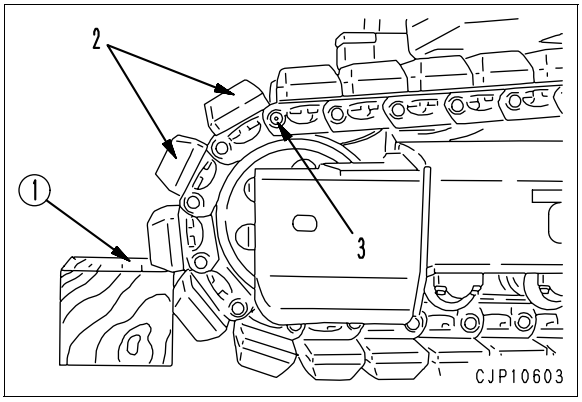
⚠ The pressure inside the adjusting cylinder is kept quite high. Do not attempt to unscrew lubricator (1) by more than one turn. If grease inside oozes out poorly, move the machine back and forth.



3. Remove road liners (2). ※2

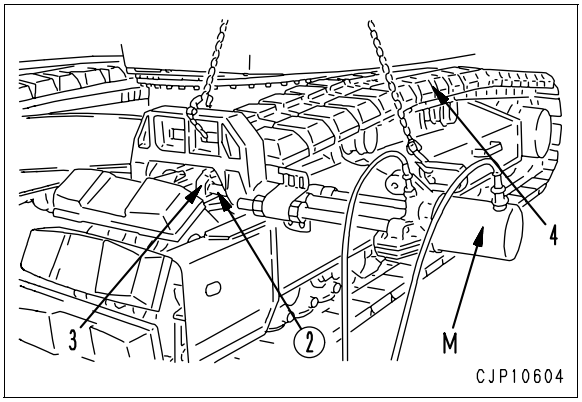
4. Place block B against the shoe assembly.

5. Using tool **M** and dumb pin C, pull out master pi※3



6. Take tool M away, move the machine forward and pull out with dumb pin (2).

7. Remove the dust seal and expand track shoe assembly (4), while moving the machine forward. ※4



REMOVAL AND INSTALLATION OF CONTROL VALVE ASSEMBLY

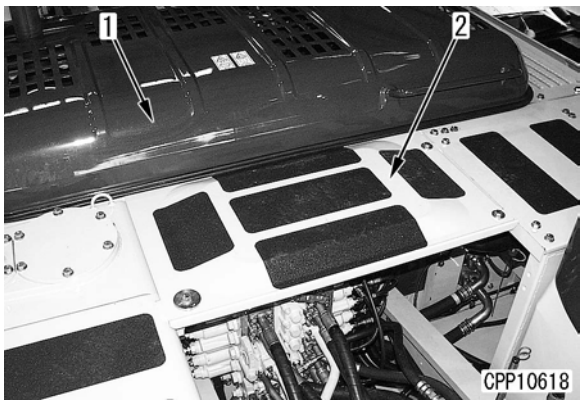
REMOVAL

⚠ Lower the work equipment to the ground for safety and stop the engine. Unscrew the oil filler cap on the hydraulic tank slowly to release pressure inside the tank. Then move the safety lock lever to the LOCK position.

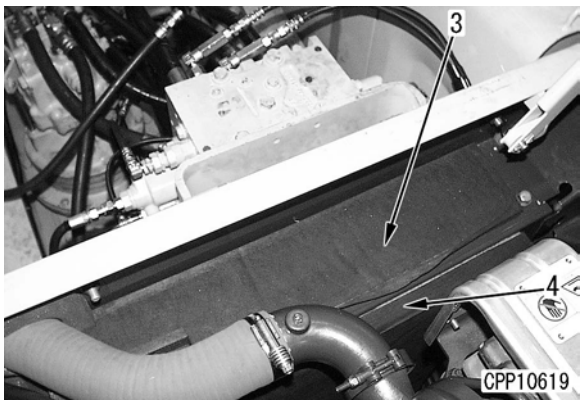
★ Attach an identification tag to each piping to avoid a mistake in the position of installation later.

1. Open up engine hood (1).

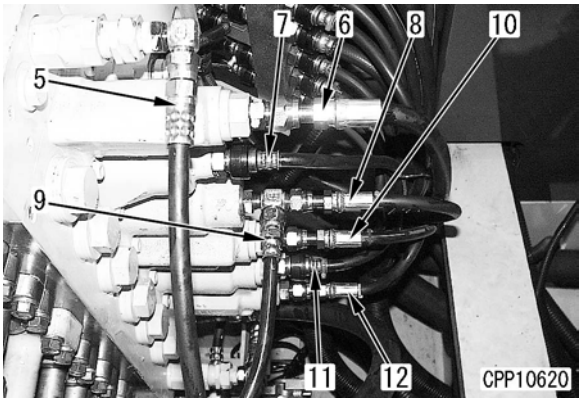
2. Remove control valve upper cover (2).



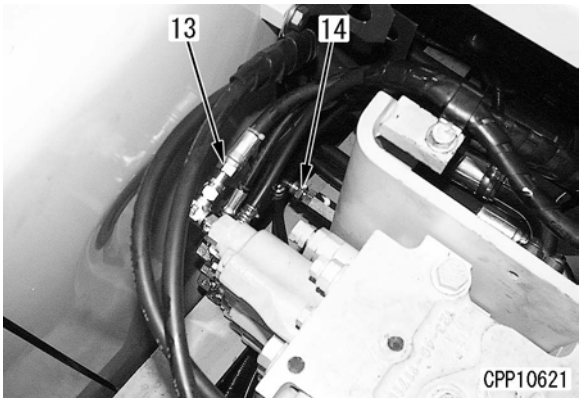
3. Remove engine partition cover (3) and control valve partition cover (4).



4. Disconnect the eight PPC hoses at left.
   - (5): Relief valve hose
   - (6): Bucket dump hose (Hose band, black)
   - (7): Travel left front and reverse hose
   - (8): Boom raise hose (Hose band, green)
   - (9): Swing LS separator valve hose
   - (10): Left swing hose (Hose band, red)
   - (11): Travel right front and reverse hose (Hose band, blue)
   - (12): Arm dump hose (Hose band, yellow)

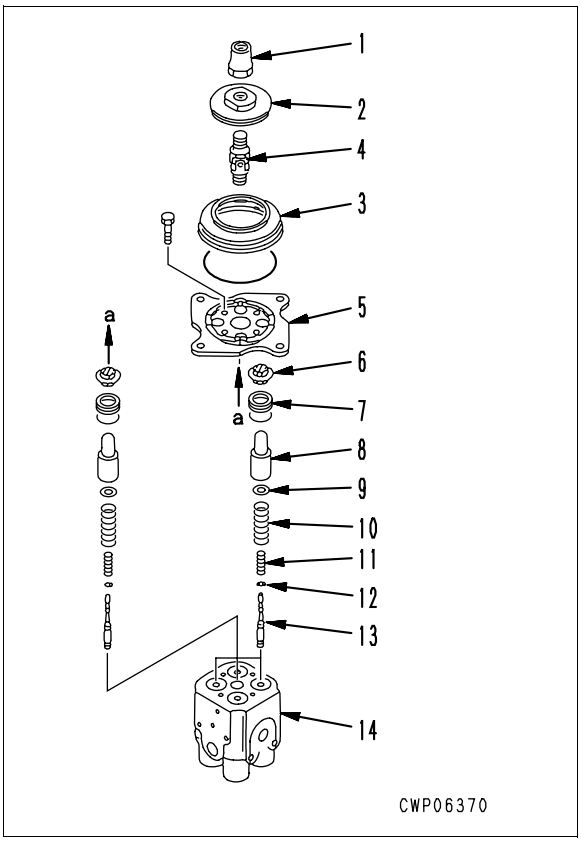


5. Disconnect the seven PPC hoses at right.
   - (13): PPC hoses from the top to bottom
     Bucket digging (Hose band, white)
     Travel left front and reverse (Hose band, red)
     Boom lower (Hose band, brown)
     Right swing
     Travel right front (Hose band, green)
     Arm digging (Hose band, blue)
   - (14): Divide/merge valve hose (Hose band, yellow blue)



DISASSEMBLY AND ASSEMBLY OF WORK EQUIPMENT PPC VALVE ASSEMBLY

★ This section deals with only precautions to be followed when reassembling the PPC valve assembly for work equipment.



ASSEMBLY

- Reassembling work equipment PPC valve reassembly
  - ★ Install spring (11) so that the end surface of smaller end coil diameter (inner diameter) will face the shim (12) side.
  - ★ Springs (10) in use differ in the number of turns according to hydraulic ports as classified in the table below. Hence take care when installing one.

Port location	Spring free length
P1, P2	44.4 mm
P3, P4	42.4 mm

  - ★ The location of each port is stamped in the lower part of the valve body.

Piston (8): Grease (G2-LI)

★ When assembling piston (8), coat the piston outer periphery and body hole inner periphery with grease.

N·m Plate (5) mounting bolt: 11.8 - 14.7 Nm (1.2 -1.5 kgm)

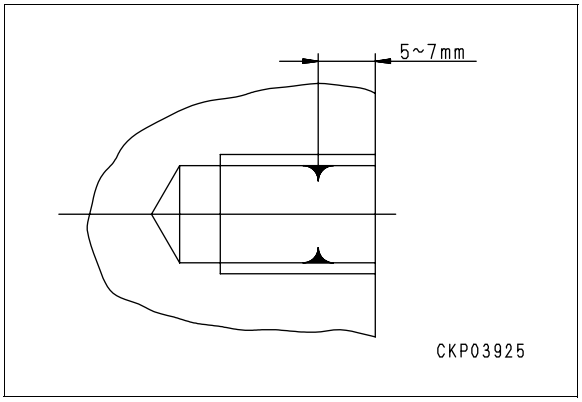
Joint (4) sliding surface: Grease 2 - 4 cc (G2-LI)

Body female screw portion: Adhesive compound (LT-2)

★ Coat the female screw body with Loctite at two spots as shown in the diagram below. Each spot is to be coated with a drop (approx. 0.02 g).

N·m Joint (4): 39 - 49 Nm (4 - 5 kgm)

★ Strictly follow the specified torque for the joint.



Contact surfaces of piston and disc (2): Grease 0.3 - 0.8 cc (G2-LI)

N·m Nut (1): 98 - 127 Nm (10 - 13 kgm)

★ After assembling the disc, refer to the Adjustment of Work Equipment and Swing PPC Valve section of the TESTING AND ADJUSTING chapter of this manual.

※2

Inside surface of bushing when assembling pin:

Anti-friction compound (LM-P)

Grease after assembling pin:

Grease (LM-G)

When aligning the position of the pin hole, never insert your fingers into the pin hole.

- **Bleeding air**
  - ★ Bleed the air from the cylinder. For details, see TESTING AND ADJUSTING, Air Bleeding of Various Parts.
- **Refilling with oil (hydraulic tank)**
  - ★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.

90 OTHERS