SEN04329-15

Shop Manual

HYDRAULIC
EXCAVATOR

PC88MR-8

SERIAL NUMBERS 5001 and up

ecot3

KOMATSU

How to read the shop manual

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

1. Composition of shop manual

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

00. Index and foreword

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

01. Specification

This section explains the specifications of the machine.

10. Structure, function and maintenance standard

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

20. Standard value table

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

30. Testing and adjusting

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

40. Troubleshooting

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

50. Disassembly and assembly

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

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

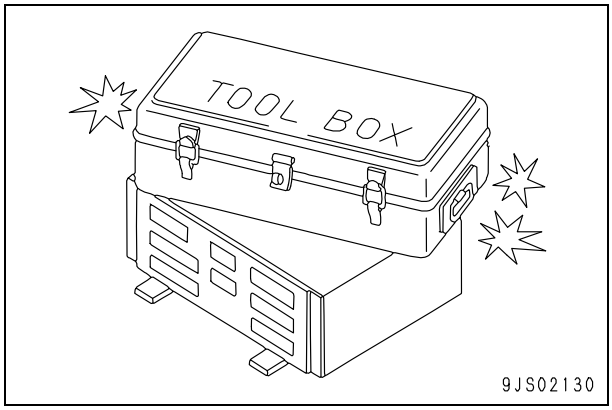
- Chassis volume
  This section gives hydraulic circuit diagrams and electrical circuit diagrams.
- Engine volume
  This section explains the method of reproducing, repairing, and replacing parts.

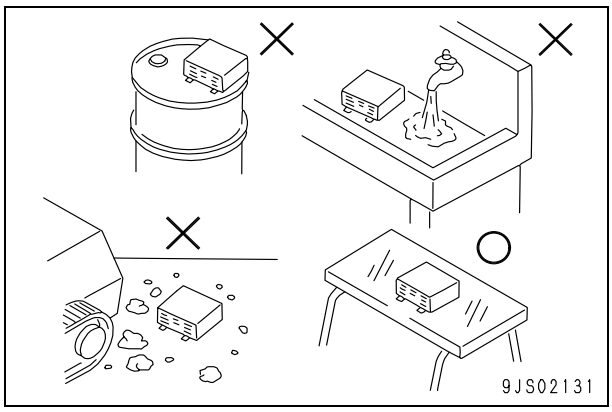
2. Revision and distribution

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

4. Handling controller

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





5. Points to remember when troubleshooting electric circuits

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

2. Precautions when carrying out installation work

- Tighten all bolts and nuts (sleeve nuts) to the specified (KES) torque.
- Install the hoses without twisting or interference and fix them with intermediate clamps, if there are any.
- Replace all gaskets, O-rings, cotter pins, and lock plates with new parts.
- Bend the cotter pins and lock plates securely.
- When coating with adhesive, clean the part and remove all oil and grease, then coat the threaded portion with 2 – 3 drops of adhesive.
- When coating with gasket sealant, clean the surface and remove all oil and grease, check that there is no dirt or damage, then coat uniformly with gasket sealant.
- Clean all parts, and correct any damage, dents, burrs, or rust.
- Coat rotating parts and sliding parts with engine oil.
- When press fitting parts, coat the surface with anti-friction compound (LM-P).
- After fitting snap rings, check that the snap ring is fitted securely in the ring groove.
- When connecting wiring connectors, clean the connector to remove all oil, dirt, or water, then connect securely.
- When using eyebolts, check that there is no deformation or deterioration, screw them in fully, and align the direction of the hook.
- When tightening split flanges, tighten uniformly in turn to prevent excessive tightening on one side.

★ When operating the hydraulic cylinders for the first time after reassembling cylinders, pumps and other hydraulic equipment removed for repair, always bleed the air as follows:
  1) Start the engine and run at low idle.
  2) Operate the work equipment control lever to operate the hydraulic cylinder 4 – 5 times, stopping the cylinder 100 mm from the end of its stroke.
  3) Next, operate the hydraulic cylinder 3 – 4 times to the end of its stroke.
  4) After doing this, run the engine at normal speed.

★ When using the machine for the first time after repair or long storage, follow the same procedure.

3. Precautions when completing the operation

1) Refilling with coolant, oil and grease
   - If the coolant has been drained, tighten the drain valve, and add coolant to the specified level. Run the engine to circulate the coolant through the system. Then check the coolant level again.
   - If the hydraulic equipment has been removed and installed again, add engine oil to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.
   - If the piping or hydraulic equipment have been removed, always bleed the air from the system after reassembling the parts.
     ★ For details, see Testing and adjusting, “Bleeding air”.
   - Add the specified amount of grease (molybdenum disulphide grease) to the work equipment parts.
2) Checking cylinder head and manifolds for looseness
   Check the cylinder head and intake and exhaust manifold for looseness.
   If any part is loosened, retighten it.
   - For the tightening torque, see “Disassembly and assembly”.
3) Checking engine piping for damage and looseness
   Intake and exhaust system
   Check the piping for damage, the mounting bolts and nuts for looseness, and the joints for air suction and exhaust gas leakage.
   If any part is loosened or damaged, retighten or repair it.
   Cooling system
   Check the piping for damage, the mounting bolts and nuts for looseness, and the joints for coolant leakage.
   If any part is loosened or damaged, retighten or repair it.
   Fuel system
   Check the piping for damage, the mounting bolts and nuts for looseness, and the joints for fuel leakage.
   If any part is loosened or damaged, retighten or repair it.

Millimeters to inches

1 mm = 0.03937 in

	0	1	2	3	4	5	6	7	8	9
0	0	0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
50	1.969	2.008	2.047	2.087	2.126	2.165	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.032	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

Kilogram to pound

1 kg = 2.2046 lb

	0	1	2	3	4	5	6	7	8	9
0	0	2.20	4.41	6.61	8.82	11.02	13.23	15.43	17.64	19.84
10	22.05	24.25	26.46	28.66	30.86	33.07	35.27	37.48	39.68	41.89
20	44.09	46.30	48.50	50.71	51.91	55.12	57.32	59.53	61.73	63.93
30	66.14	68.34	70.55	72.75	74.96	77.16	79.37	81.57	83.78	85.98
40	88.18	90.39	92.59	94.80	97.00	99.21	101.41	103.62	105.82	108.03
50	110.23	112.44	114.64	116.85	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.10	143.30	145.51	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.76	171.96	174.17
80	176.37	178.57	180.78	182.98	185.19	187.39	189.60	191.80	194.01	196.21
90	198.42	200.62	202.83	205.03	207.24	209.44	211.64	213.85	216.05	218.26

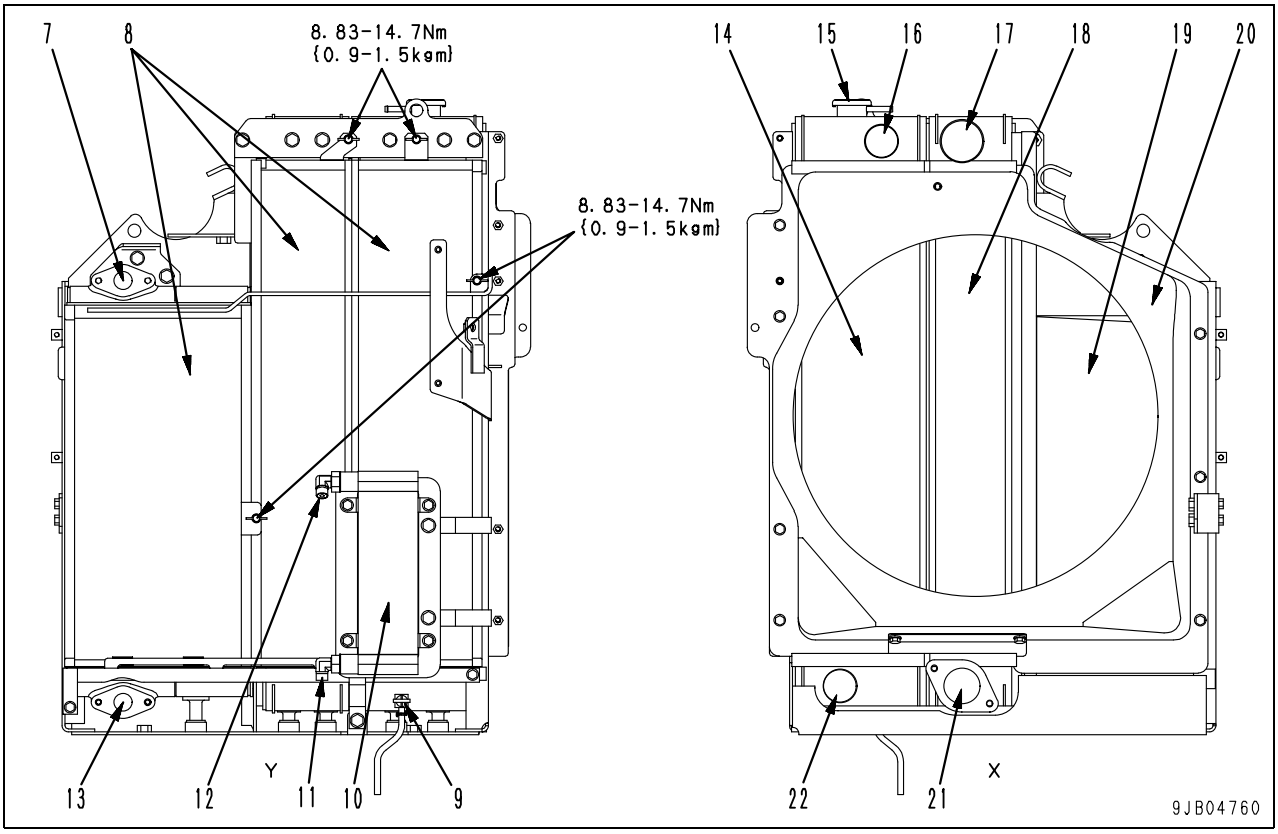
Liters to U.S. Gallons

1 ℓ = 0.2642 U.S.Gal

	0	1	2	3	4	5	6	7	8	9
0	0	0.264	0.528	0.793	1.057	1.321	1.585	1.849	2.113	2.378
10	2.642	2.906	3.170	3.434	3.698	3.963	4.227	4.491	4.755	5.019
20	5.283	5.548	5.812	6.076	6.340	6.604	6.869	7.133	7.397	7.661
30	7.925	8.189	8.454	8.718	8.982	9.246	9.510	9.774	10.039	10.303
40	10.567	10.831	11.095	11.359	11.624	11.888	12.152	12.416	12.680	12.944
50	13.209	13.473	13.737	14.001	14.265	14.529	14.795	15.058	15.322	15.586
60	15.850	16.115	16.379	16.643	16.907	17.171	17.435	17.700	17.964	18.228
70	18.492	18.756	19.020	19.285	19.549	19.813	20.077	20.341	20.605	20.870
80	21.134	21.398	21.662	21.926	22.190	22.455	22.719	22.983	23.247	23.511
90	23.775	24.040	24.304	24.568	24.832	25.096	25.361	25.625	25.889	26.153

Machine model				PC88MR-8	
				1,650 mm arm	2,100 mm arm
Serial No.				5001 and up	
Engine			Model		SAA4D95LE-5
			Type		4-cycle, water-cooled, in-line vertical, direct injection type, with turbocharger and air-cooled aftercooler
			No. of cylinders – bore x stroke	mm	4 – 95 x 115
			Total piston displacement	ℓ {cc}	3.260 {3,260}
	Performance		Rated output • Net [ISO 9249/SAE J1349] • Gross [SAE J1995]	kW{HP}/rpm	48.5 {65}/1,950 50.7 {68}/1,950
			Max. torque	Nm{kgm}/rpm	266 {27.1}/1,600
			Fuel consumption rate, at rated speed	g/kWh{g/HPh}	227 {169}
			High idle speed	rpm	2,050
			Low idle speed	rpm	1,150
			Starting motor		24 V, 4.5 kW
			Alternator • Standard specification • EU specification		 24 V, 35 A 24 V, 60 A
			Battery (*1)		12 V, 55 Ah x 2
			Radiator core type		4-array aluminum mesh core
			Aftercooler core type		Aluminum mesh core
Undercarriage			Carrier roller		1 on each side
			Track roller		5 on each side
			Track shoe • Steel shoe • Road liner • Rubber crawler		 Assembly-type triple grouser shoe, 39 on each side Assembly-type road liner, 39 on each side Unit-type rubber crawler
Hydraulic system	Hydraulic pump		Type x No.		Variable displacement swash plate piston type x 1, Gear type x 2
			Capacity	cm³/rev	44 x 2 + 36.6 + 7.0
			Set pressure • Work equipment, travel • Swing, blade • Pilot	MPa{kg/cm²}	 26.5 {270} 21.1 {215} 3.14 {32}
	Control valve		Type x No.		9-spool type x 1
			Control method		Hydraulically assisted
	Hydraulic motor		Travel motor		Variable displacement swash plate piston type (with brake valve and parking brake) x 2
			Swing motor		Fixed displacement swash plate piston type (with safety valve and holding brake) x 1
			Hydraulic tank		Box-shaped, open
			Hydraulic oil filter		Tank return side
			Oil cooler		Air-cooled (CF40)

*1. Battery capacity (Ah) is based on 5-hour rate.
★ The engine rated output is indicated in the net value and gross value. Gross denotes the rated output measured of an independent engine. While, net denotes the value measured of an engine under the condition essentially the same as that when it is installed on machine.



1. Reservoir tank
2. Aftercooler outlet hose
3. Aftercooler inlet tube
4. Radiator inlet hose
5. Radiator outlet hose
6. Fan guard
7. Oil cooler inlet
8. Net (if equipped)
9. Drain plug
10. Fuel cooler
11. Fuel cooler outlet
12. Fuel cooler inlet
13. Oil cooler outlet
14. Radiator
15. Radiator cap
16. Radiator inlet
17. Aftercooler outlet
18. Aftercooler
19. Oil cooler
20. Shroud
21. Aftercooler inlet
22. Radiator outlet

Specifications

	Radiator	Oil cooler	Aftercooler	Fuel cooler
Core type	4-array aluminum mesh core	CF40	Aluminum mesh core	Drawn cup
Fin pitch (mm)	3.5/2	3.5/2	4.0/2	4.0/2
Total heat dissipation surface (m^2)	16.44	4.12 x 2	6.17	0.59
Pressure valve cracking pressure (kPa {kg/cm^2})	49.0 ± 14.7 {0.5 ± 0.15}	—	—	—
Vacuum valve cracking pressure (kPa {kg/cm^2})	–4.9 – 0 {–0.05 – 0}	—	—	—

HYDRAULIC EXCAVATOR

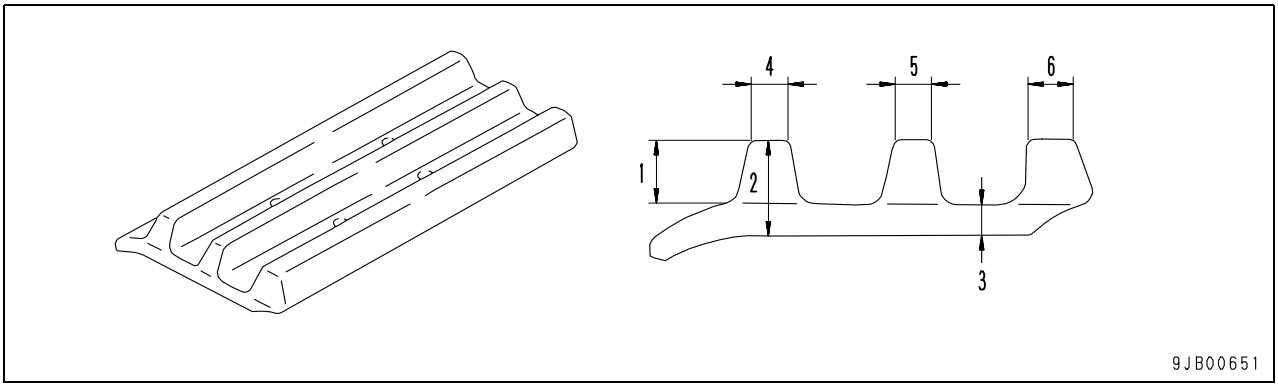
PC88MR-8

Machine model	Serial number
PC88MR-8	5001 and up

10 Structure, function and maintenance standard

300 Undercarriage and frame

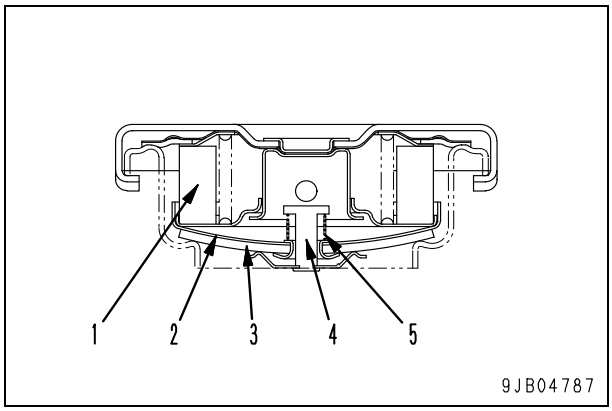
City pad shoe, triple grouser shoe



Unit: mm

No.	Item	Criteria		Remedy
		Standard size	Repair limit	
1	Grouser height	20	12	Rebuild or replace
2	Shoe overall height	26	18	
3	Plate thickness	6		
4	Grouser tip length	14		
5		10		
6		12		

Breather



1. Filter element
2. Bottom plate
3. Gasket
4. Seam valve
5. Spring

Prevention of negative pressure in tank

- The hydraulic tank is enclosed and pressurized. When the oil level in the hydraulic tank drops, negative pressure is generated in the tank.
  To prevent this negative pressure generation, seam valve (4) is opened to draw the atmosphere to the tank.
  (Intake valve set pressure:
  0 – 4.9 kPa {0 – 0.05 kg/cm^2})

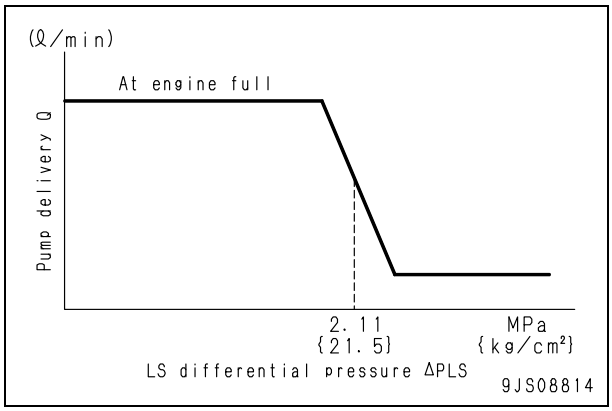
Prevention of pressure rise in tank

- When the hydraulic circuit is operating, the pressure in the hydraulic tank increases as the hydraulic cylinder operates and the oil level and temperature increase in the tank.
  If the pressure in the tank rises above the set value, bottom plate (2) is pushed up to release the pressure in the tank.
  (Exhaust valve set pressure:
  38.2 ± 14.7 kPa {0.39 ± 0.15 kg/cm^2})

Function

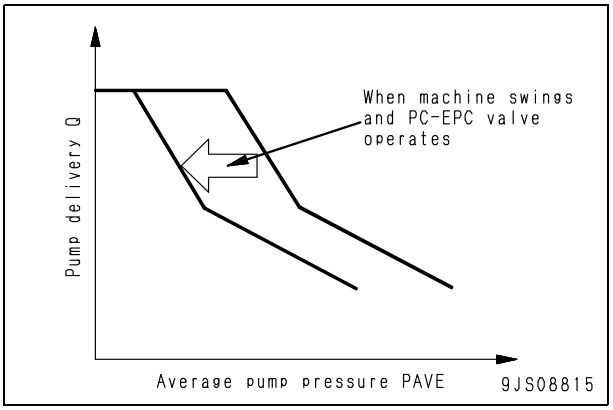
LS valve

- The LS valve controls the pump delivery according to the stroke of the control lever, or the demand flow for the actuator.
- The LS valve senses the flow rate demanded by the actuator from differential pressure (ΔPLS) between inlet pressure (PPLS) and output pressure (PLS) of the control valve and controls pump delivery (Q). [(PPLS) is called the LS pump pressure, (PLS) the LS pressure, and (ΔPLS) the LS differential pressure]
- In other words, the pressure loss caused by flow of oil through the open area of the control valve spool (= LS differential pressure (ΔPLS)) is detected, and then pump delivery (Q) is controlled to keep that pressure loss constant and supply the pump delivery according to the demand flow for the actuator.
- Pump discharge pressure (PP), LS pump pressure (PPLS) and LS pressure (PLS) are lead to the LS valve. The relationship between LS differential pressure (ΔPLS) and pump delivery (Q) changes as shown in the figure below.



PC valve

- The PC valve is an equal horsepower control valve, which limits the oil flow rate to a certain level (according to the discharge pressure) regardless of the control valve stroke so that the pump absorption horsepower will not exceed the engine horsepower when pump discharge pressure (PP) is high.
- If the load during the operation becomes larger and the pump discharge pressure rises, it reduces the pump delivery; and if the pump discharge pressure drops, it increases the pump delivery.
- This pump has 2 discharge ports and the average of their respective discharge pressures (P1) and (P2) is sensed.
- The average pressure of (P1) and (P2) is called (PAVE) and the relationship between it and the pump delivery [the deliveries of (P1) and (P2)] is as follows.



A1: To blade cylinder
A2: To swing motor
A3: To left travel motor
A4: To right travel motor
A5: To boom swing cylinder
A6: To boom cylinder
A7: To arm cylinder
A8: To bucket cylinder
A9: To attachment 1, actuator
A10: To attachment 2, actuator
B1: To blade cylinder
B2: To swing motor
B3: To left travel motor
B4: To right travel motor
B5: To boom swing cylinder
B6: To boom cylinder
B7: To arm cylinder
B8: To bucket cylinder
B9: To attachment 1, actuator
B10: To attachment 2, actuator
BP: From boom RAISE PPC valve
LS: To pump LS valve (LS pressure input)
LS1I: LS1 pressure pickup port
LS2I: LS2 pressure pickup port
P1: From pump discharge port
P1I: P1 pressure pickup port
P2: From pump discharge port
P2I: P2 pressure pickup port
P3: From pump discharge port
PA1: From blade RAISE PPC valve
PA2: From swing RIGHT PPC valve
PA3: From left travel REVERSE PPC valve
PA4: From right travel REVERSE PPC valve
PA5: From boom swing LEFT PPC valve
PA6: From boom RAISE PPC valve
PA7: From arm OUT PPC valve
PA8: From bucket DUMP PPC valve
PA9: From attachment solenoid valve
PA10: From attachment solenoid valve
PB1: From blade LOWER PPC valve
PB2: From swing LEFT PPC valve
PB3: From left travel FORWARD PPC valve
PB4: From right travel FORWARD PPC valve
PB5: From boom swing RIGHT PPC valve
PB6: From boom LOWER PPC valve
PB7: From arm IN PPC valve
PB8: From bucket CURL PPC valve
PB9: From attachment solenoid valve
PB10: From attachment solenoid valve
PP: To pump LS valve (LS pressure input)
PT: From pump merge-divider selector solenoid
PTSW: Pump pressure sensor mounting port
TB: To tank through bypass check valve
TC: To tank through bypass check valve
TS: To tank
TSW: To swing motor

1. Block
2. Blade valve
3. Swing valve
4. Left travel valve
5. Right travel valve
6. Boom swing valve
7. Pump merge-divider valve block
8. Boom valve
9. Arm valve
10. Bucket valve
11. Service 1 valve
12. Service 2 valve
13. Cover
14. LS check valve
15. Travel junction valve + LS check valve
16. Boom hydraulic drift prevention valve
17. Cooler bypass valve

Boom valve

1. Pressure compensation valve F
2. Suction valve
3. Hydraulic drift prevention valve
4. Suction valve
5. Spool
6. Pressure compensation valve R

Arm valve

7. Pressure compensation valve F
8. Suction valve
9. Suction valve
10. Spool
11. Pressure compensation valve R

Bucket valve

12. Pressure compensation valve F
13. Suction valve
14. Suction valve
15. Spool
16. Pressure compensation valve R

Service 1 valve

17. Pressure compensation valve F
18. Port relief valve
19. Port relief valve
20. Spool
21. Pressure compensation valve R

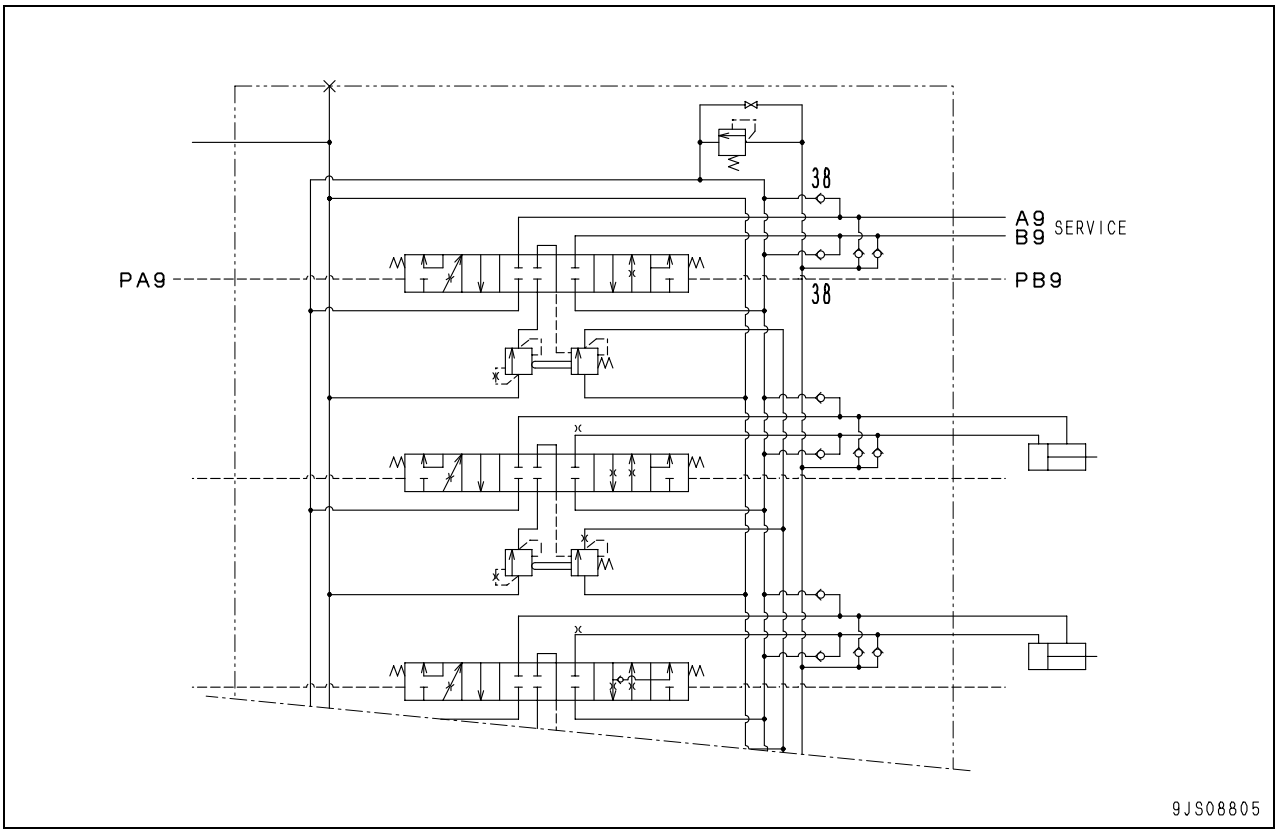
F: Flow control valve
R: Pressure reducing valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
22	Valve return spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring.
		16.6 x 13	13	11.2 N {1.14 kg}	—	9.02 N {0.92 kg}	
23	Piston return spring	13 x 8.8	7.5	10.8 N {1.1 kg}	—	8.63 N {0.88 kg}	

1. Block
2. Blade valve
3. Swing valve
4. Left travel valve
5. Right travel valve
6. Boom swing valve
7. Pump merge-divider valve block
8. Boom valve
9. Arm valve
10. Bucket valve
11. Service valve 1
12. Service valve 2
13. Cover
15. Assistant valve
15. Blade spool
16. Swing spool
17. Left travel spool
18. Right travel spool
19. Boom swing spool
20. Pump merge-divider valve
21. Boom spool
22. Arm spool
23. Bucket spool
24. Service 1 spool
25. Service 2 spool
26. Pressure compensation valve
27. Suction valve
28. LS check valve
29. Travel junction valve + LS check valve
30. Boom hydraulic drift prevention valve
31. Cooler bypass valve
32. Suction safety valve
    Set pressure: 9.8 MPa {100 kg/cm²}
33. Suction safety valve
    Set pressure: 27.9 MPa {285 kg/cm²}
34. Port relief valve
    Set pressure: 19.6 MPa {200 kg/cm²}
35. Main relief valve
    Set pressure: 21.1 MPa {215 kg/cm²}
36. Main relief valve
    Set pressure: 26.5 MPa {270 kg/cm²}
37. Unload valve

9-spool valve (North America specification)



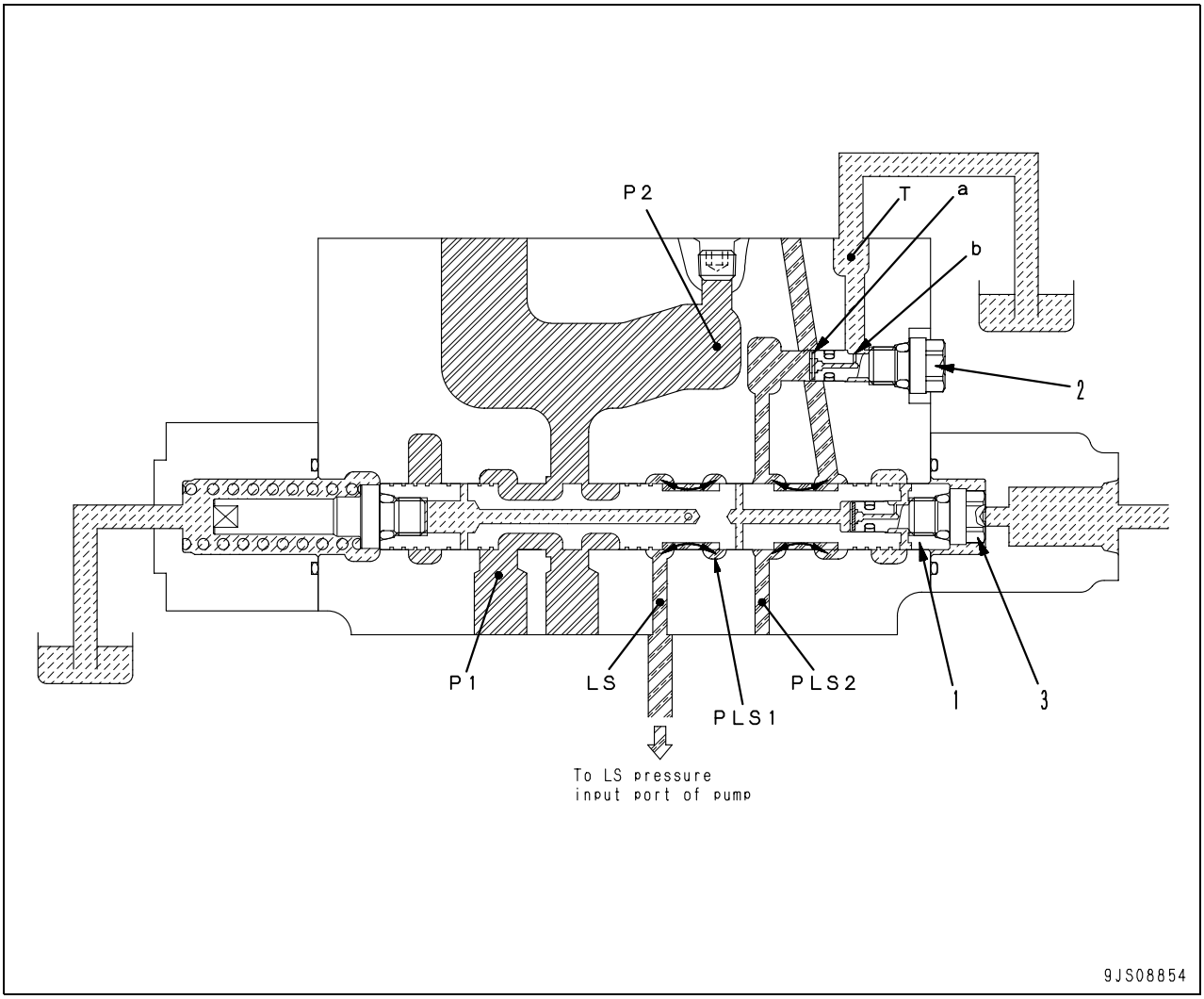
38. Suction valve

LS bypass valve

Function

- The LS bypass valve releases the remaining pressure of LS pressure (PLS).
- While moderating increasing rate of LS pressure (PLS), this valve generates pressure loss in the throttle function with this discarded throttle flow, decreasing the effective LS differential pressure and enhancing stability.

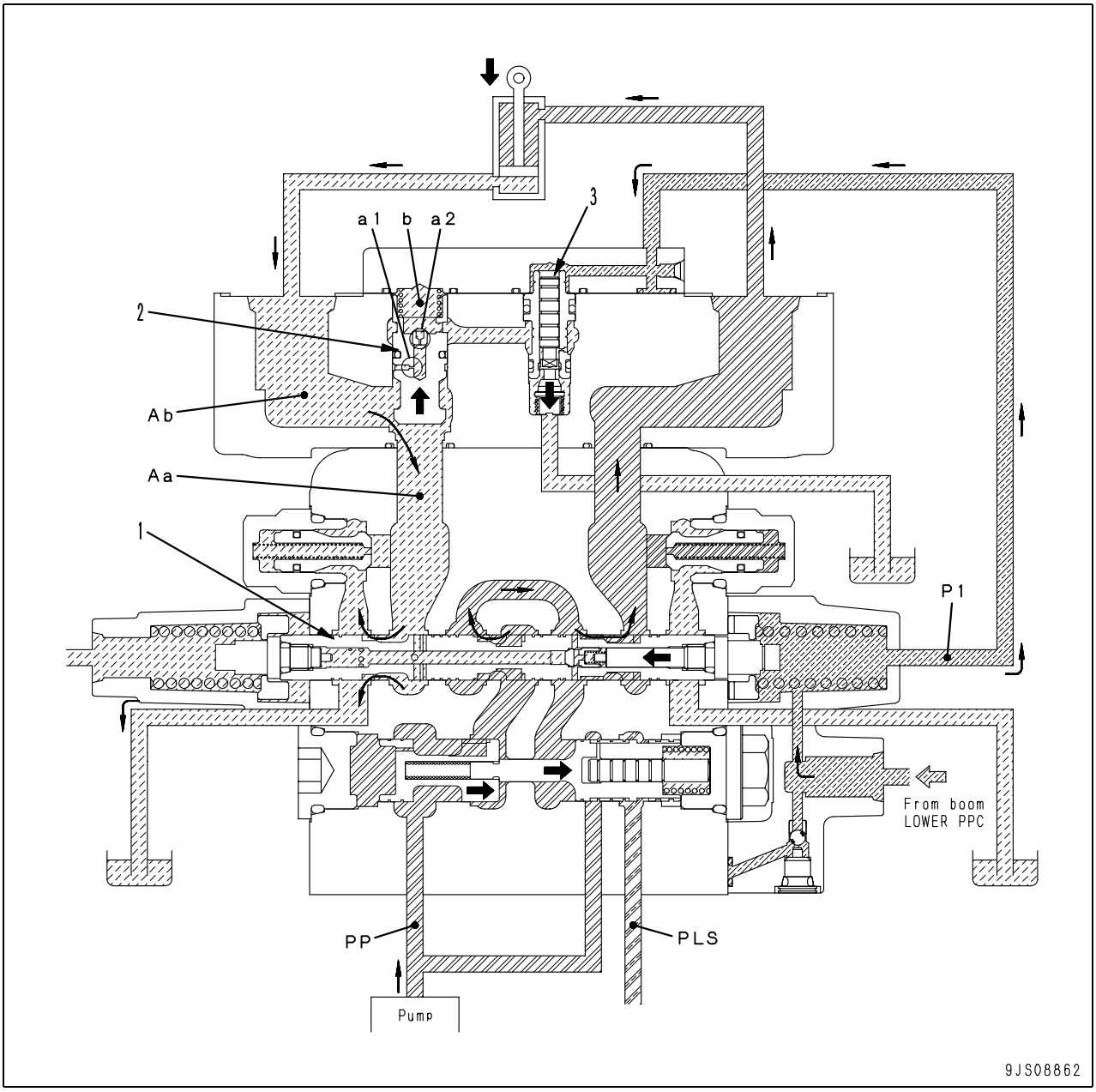
When work equipment valve is operated (including compound operation of work equipment + travel)



Operation

- Since pump merge-divider spool (1) is at the merge position, the hydraulic oil in LS circuits (PLS1), (PLS2), and (PLS3) is drained from tip filter (a) of LS bypass valve (2) on the (P2) side through orifice (b) to tank circuit (T).

When boom is lowered



Operation

- If the boom is lowered, pilot pressure (P1) from the PPC valve pushes pilot spool (3) and the pressurized oil in chamber (b) in the poppet is drained.
- The pressurized oil in port (Ab) is raised by the pressurized oil from the boom cylinder bottom, but the pressurized oil in chamber (b) is lowered by orifices (a1) and (a2).
- If the pressure in chamber (b) is lowered below the pressure in port (Ab), poppet (2) opens and the pressurized oil from port (Ab) flows through port (Aa) into the control valve.

HYDRAULIC EXCAVATOR

PC88MR-8

Machine model	Serial number
PC88MR-8	5001 and up

10 Structure, function and maintenance standard

430 Hydraulic system, Part 3

1. Plate
2. Body
3. Piston
4. Seal
5. Valve
6. Damper

Unit: mm

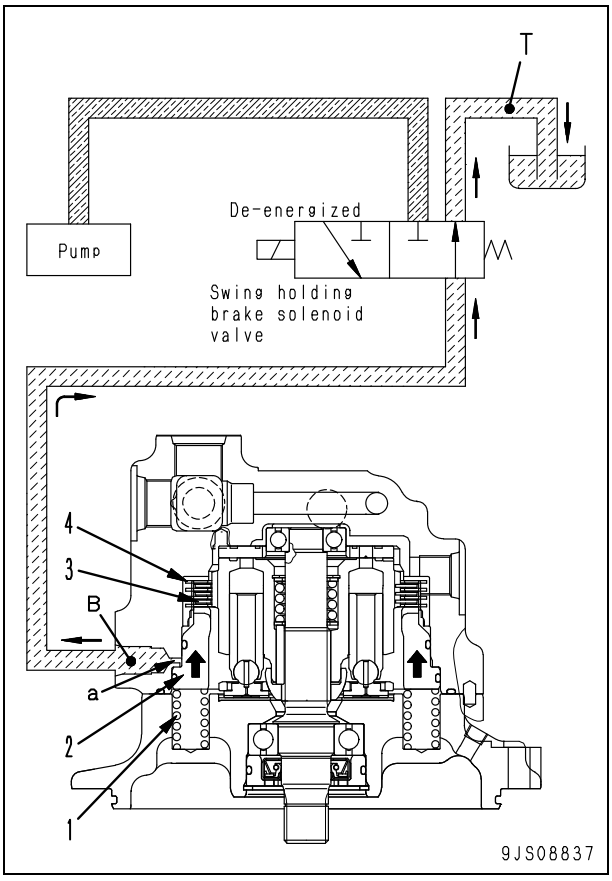
No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
7	Centering spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring.
		48.57 x 15.5	32.5	108 N {11 kg}	—	86.3 N {8.8 kg}	
8	Metering spring	26.53 x 8.15	24.9	16.7 N {1.7 kg}	—	13.3 N {1.36 kg}	

Swing holding brake

Operation

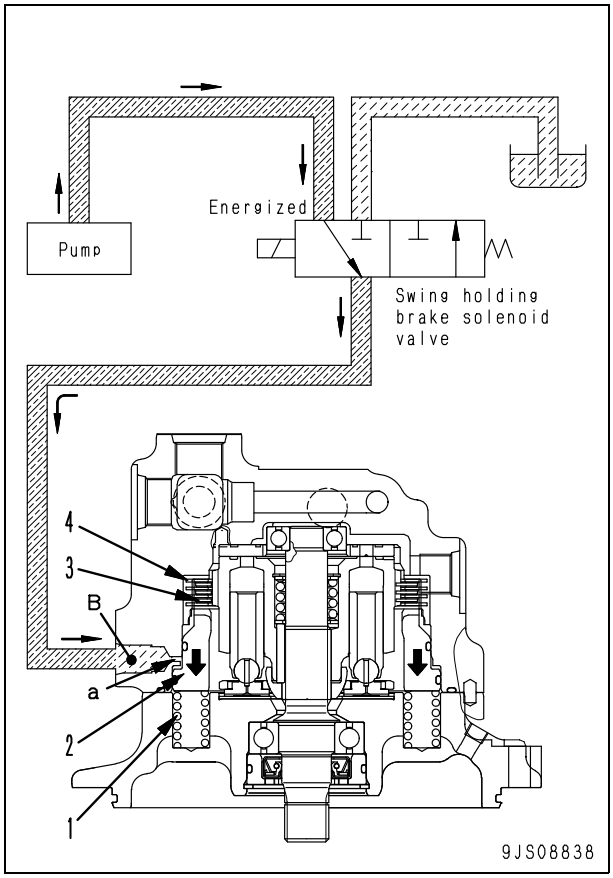
When solenoid valve is de-energized

- If the swing holding brake solenoid valve is de-energized, the pressurized oil from the charge pump is shut off.
- Port (B) is connected to tank circuit (T).
- Brake piston (2) is pushed up by brake spring (1).
- Disc (3) and plate (4) are pushed together, and the brake is applied.

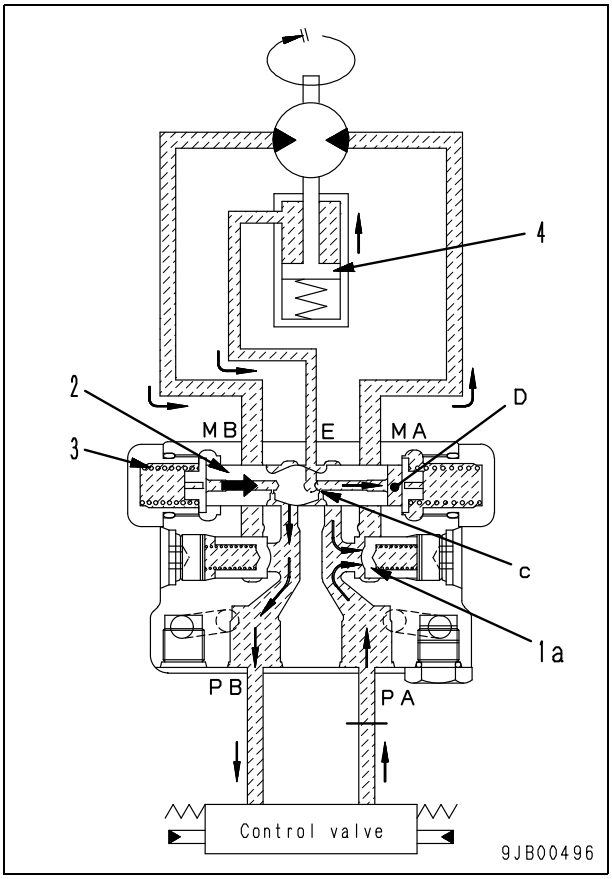


When solenoid valve is energized

- As the swing holding brake solenoid valve is energized, the valve is switched.
- The pressurized oil from the charge pump flows through port (B) to brake chamber (a).
- After entering chamber (a), the pressurized oil compresses brake spring (1) and pushes brake piston (2) down.
- Disc (3) is separated from plate (4), releasing the brake.

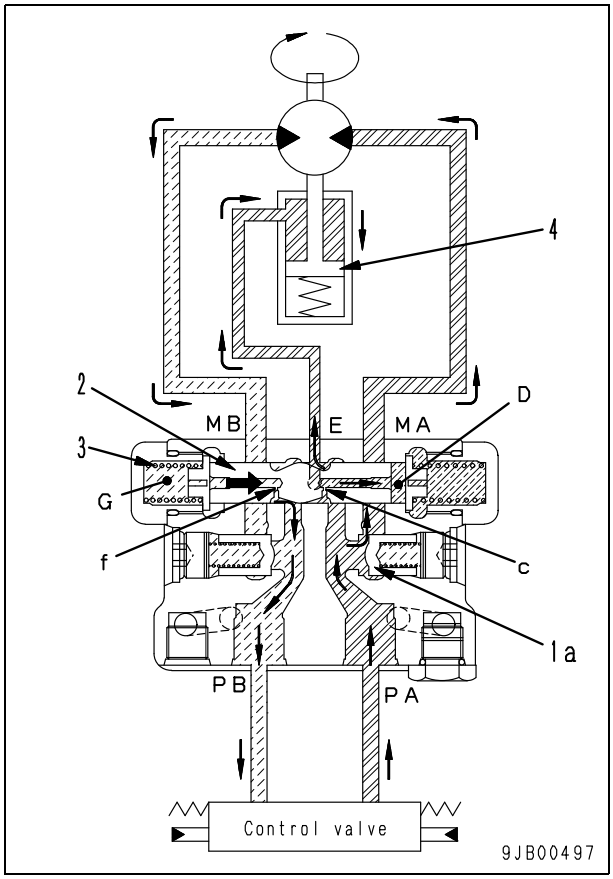


Operation when pressure is shut off



- If the travel lever is returned to neutral, the pressurized oil from the control valve is stopped.
- Counterbalance valve (2) is pushed back to the right with spring (3) reaction force.
- The oil in chamber (D) flows to port (PA) through orifice (c). However, the back pressure is generated by closing of orifice (c), controlling the return speed of counterbalance valve (2) to the right.
- The oil returning from port (MB) is controlled gradually with the moving speed of counterbalance valve (2) and the shape of the cut part to stop the motor smoothly.
- Even after the pressurized oil flowing to port (PA) is stopped, the motor continues rotation because of inertia and can cause cavitation.
- Since check valve (1a) operates at very slight negative pressure, ports (PA) and (MA) open to prevent cavitation.

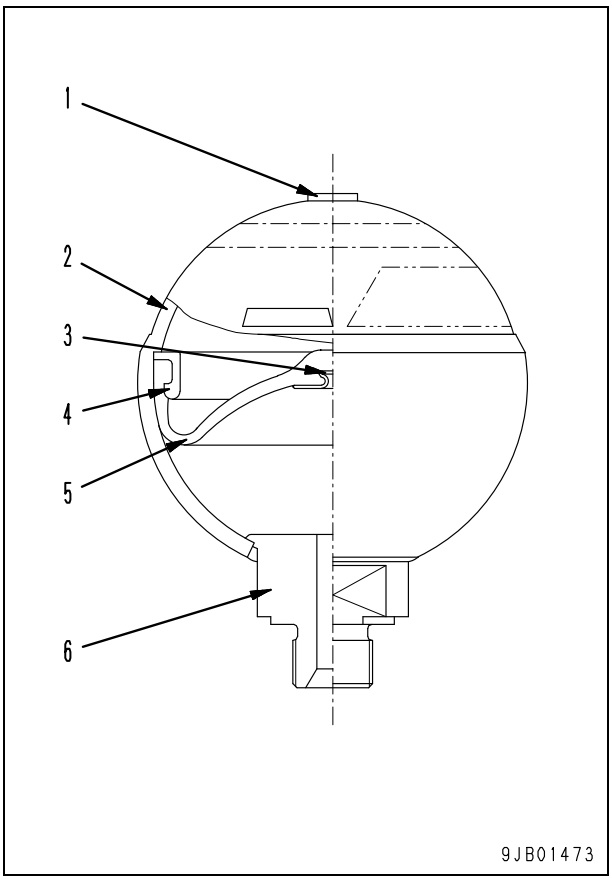
Brake operation at travelling downhill



- If the machine starts to run away on a slope, the motor runs idle and the motor inlet port (MA) pressure decreases and the pressure in chamber (D) also decreases through orifice (c).
- When the hydraulic oil pressure in chamber (D) goes below spring (3) reaction force, counterbalance valve (2) is returned to the right.
- The oil in chamber (G) flows to port (PB) through orifice (f). However, the back pressure is generated by closing of orifice (f), controlling the return speed of counterbalance valve (2) to the right.
- Counterbalance valve (2) moves to a position where the force caused by the machine weight and the hydraulic force at motor inlet port (MA) is balanced with the hydraulic force at motor outlet port (MB).
- If motor outlet port (MB) is closed, the hydraulic pressure on the outlet side increases and rotation resistance is generated.
- The travel speed is controlled according to the pump delivery to prevent the machine from running away.

PPC accumulator

For PPC circuit



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

Outline

- This accumulator is mounted on the solenoid valve. If the engine is stopped with the work equipment at a raised position, the pilot pressure is supplied to the control valve by the pressure of the compressed nitrogen gas in the accumulator. Therefore, the spool can be operated to lower the work equipment by its own weight.

Specifications

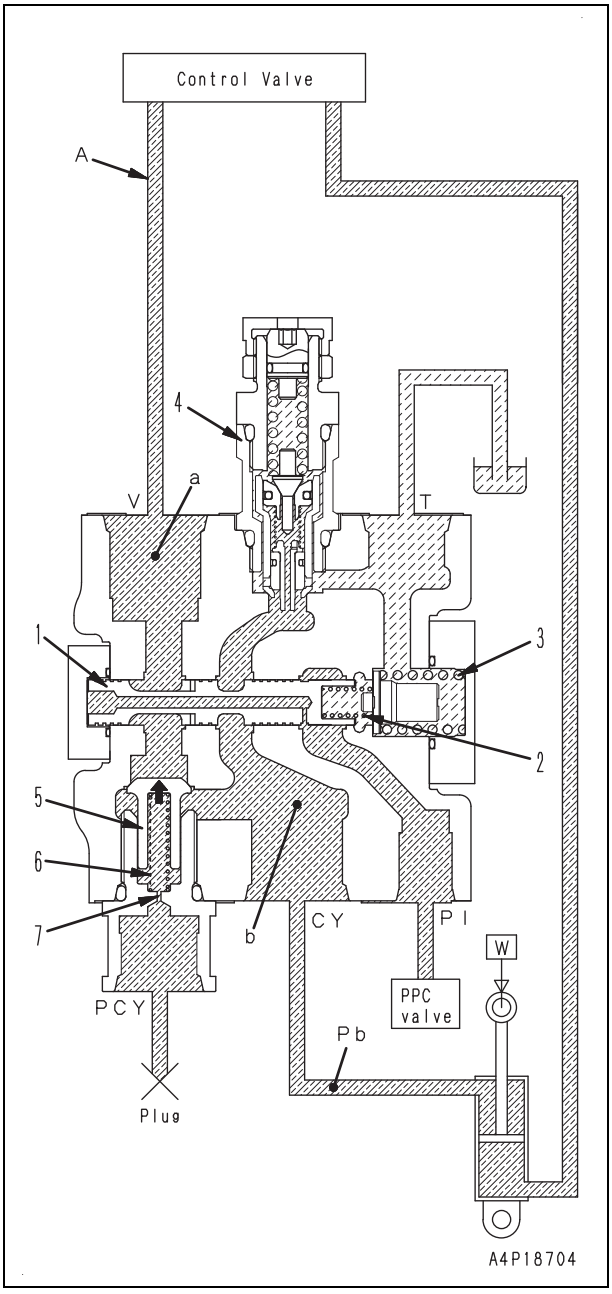
Gas to be used: Nitrogen gas
Gas capacity: 300 cc
Sealed gas pressure: 1.18 MPa
{12 kg/cm^2} (at 80°C)
Maximum operating pressure: 6.86 MPa
{70 kg/cm^2}

Function

This valve prevents the work equipment from sudden lowering by thwarting the counterflow of pressurized oil from the work equipment when the piping between the control valve and the work equipment cylinder breaks.

Operation

When work equipment is in NEUTRAL



When there is no damage in the piping

1. Holding pressure of the work equipment cylinder is led from port (CY) to chamber (b), and it closes check valve (5).
2. The pilot pressure which is led from PPC valve to port (PI) is 0 MPa{0 kg/cm2} when work equipment is in NEUTRAL.
3. Spool (1) is pressed to the left by the force of spring (2) and (3).
4. Chamber (a) and chamber (b) are disconnected.
5. The pressurized oil does not flow from control valve to work equipment cylinder. The work equipment cylinder is held.
6. When the pressure inside the work equipment cylinder is abnormally high, holding pressure of the work equipment cylinder operates safety valve (4).

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, chamber (a) and chamber (b) are disconnected.
2. The pressure of the work equipment is held to prevent the work equipment from sudden lowering.

Unit: mm

No.	PC88MR-8			
	Measurement point	Standard size	Tolerance	
			Shaft	Hole
1	—	60	–0.030 –0.100	+0.100 0
2	Arm side	71.5	+1.0 0	
	Cylinder head side	70	±1.2	
3	—	60	–0.030 –0.100	+0.100 0
4	Boom side	220	+0.5 0	
	Arm side	220	–0.5 –1.0	
5	—	142.4	±2.0	
6	—	218.8	±1.0	
7	—	458.6	±1.0	
8	—	1,650	—	
9	—	2,093.9	±3.0	
10	—	1,661.2	±1.3	
11	—	258.7	±0.3	
12	—	15.1	±1.0	
13	—	395.1	±0.1	
14	—	342	±0.1	
15	—	312.2	—	
16	—	1,066.9	—	
17	—	50	–0.225 –0.285	0 –0.150
18	Link side	200	–1.0 –2.0	
	Bucket side	200	+2.0 0	
19	—	50	–0.225 –0.285	0 –0.150
20	Arm side	188	–0.5 –1.0	
	Bucket side	211	+3.0 0	
21	Min.	1,055	±1.5	
	Max.	1,765	—	

HYDRAULIC EXCAVATOR

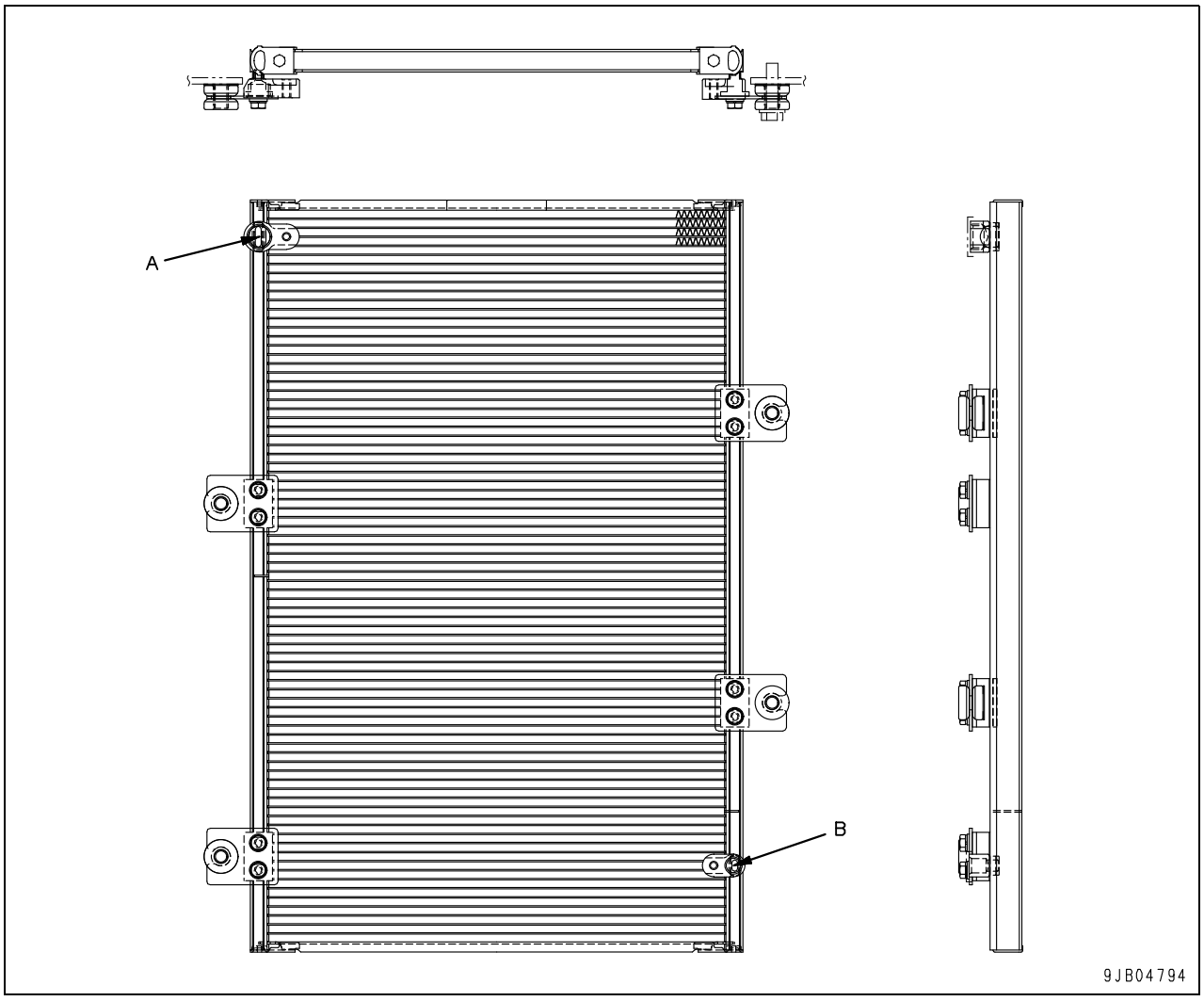
PC88MR-8

Machine model	Serial number
PC88MR-8	5001 and up

10 Structure, function and maintenance standard

600 Cab and its attachments

Condenser



A: From compressor
B: To receiver

Function

- It cools and liquefies the high-pressure and high-temperature misty refrigerant from the compressor.

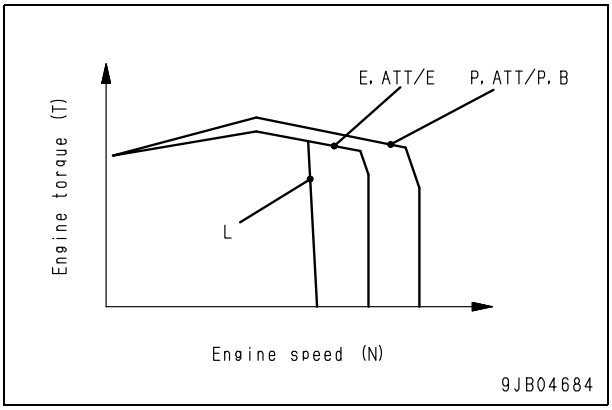
★ If the fin is crushed or is clogged with dusts, heat exchange efficiency is degraded and complete liquefaction of refrigerant becomes unavailable. As the result, pressure in the refrigerant circulation circuit will be increased, applying extra load to the engine or degrading the cooling effect. Thus, care must be used in its handling and daily inspection to prevent the fin from being crushed.

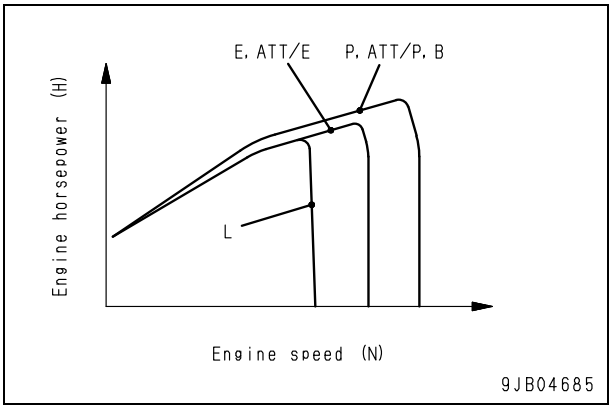
Specifications

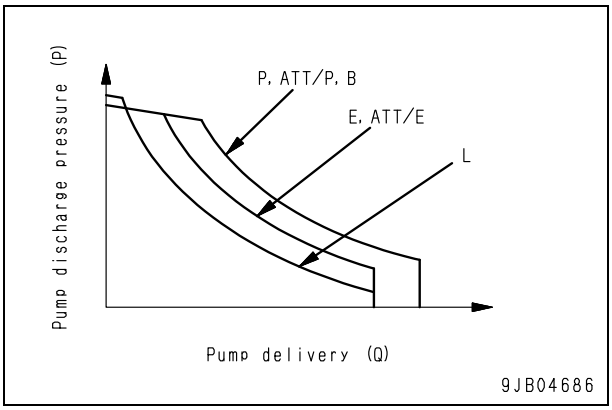
Fin pitch (mm)	3.95
Total heat dissipation area (m^2)	3.63
Max. operating pressure (MPa {kg/cm^2})	3.53 {36}

Function

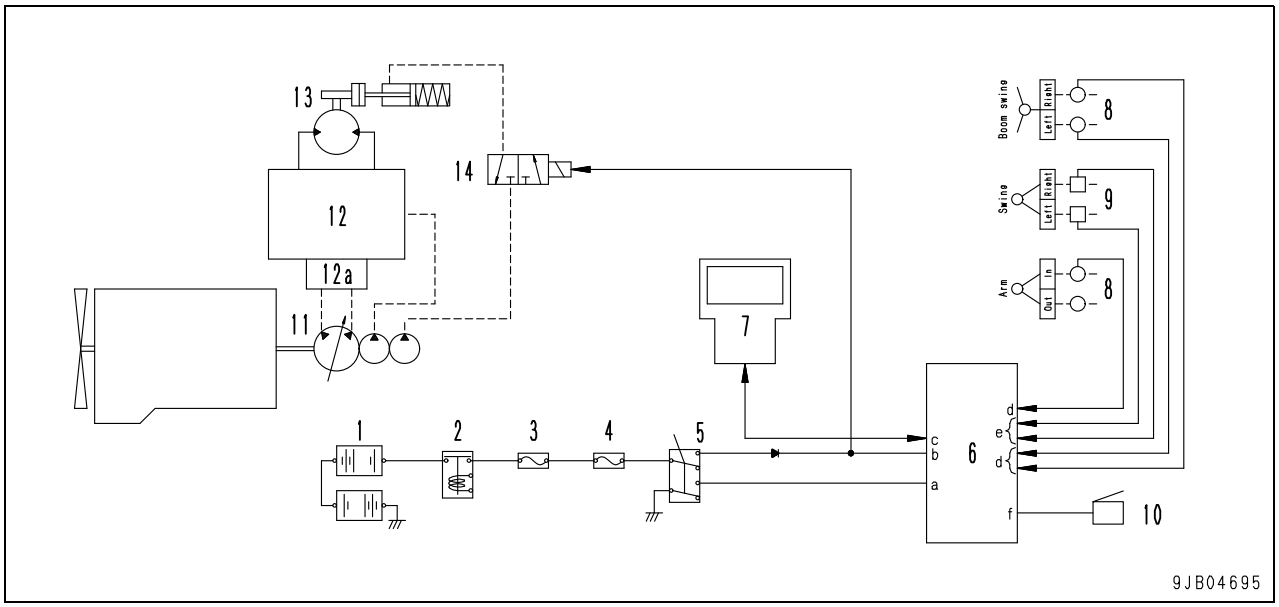
- This function is turned ON when 1 of the 5 work modes of P, E, L, ATT and B is selected with the work mode selector switch of the machine monitor. The most suitable combination of engine torque (T) and pump absorption torque can be selected for the contents of work. If "Without" is selected for the attachment on the initialization menu of the service mode, 1 of the 3 modes of P, E and L is selectable.
- If "ATT/E" is selected by attachment setting in the operator mode function of the machine monitor, the pump absorption torque becomes the same with E mode.
- According to the pump absorption torque set at each mode, based on the engine governor set speed with the fuel control dial and the actual engine speed, the controller controls so that the pump absorbs all torques at each engine output point.
- When the engine speed is lowered, the controller prevents the engine from stopping by throttling the pump absorption torque.







Swing control function



1. Battery
2. Battery relay
3. Fusible link
4. Fuse box
5. Swing holding brake release switch
6. Pump controller
7. Machine monitor
8. Oil pressure switch
9. Oil pressure sensor
10. Travel/swing alarm buzzer
11. Hydraulic pump
12. Control valve
    12a. Pump merge-divider valve
13. Swing motor
14. Swing holding brake solenoid valve

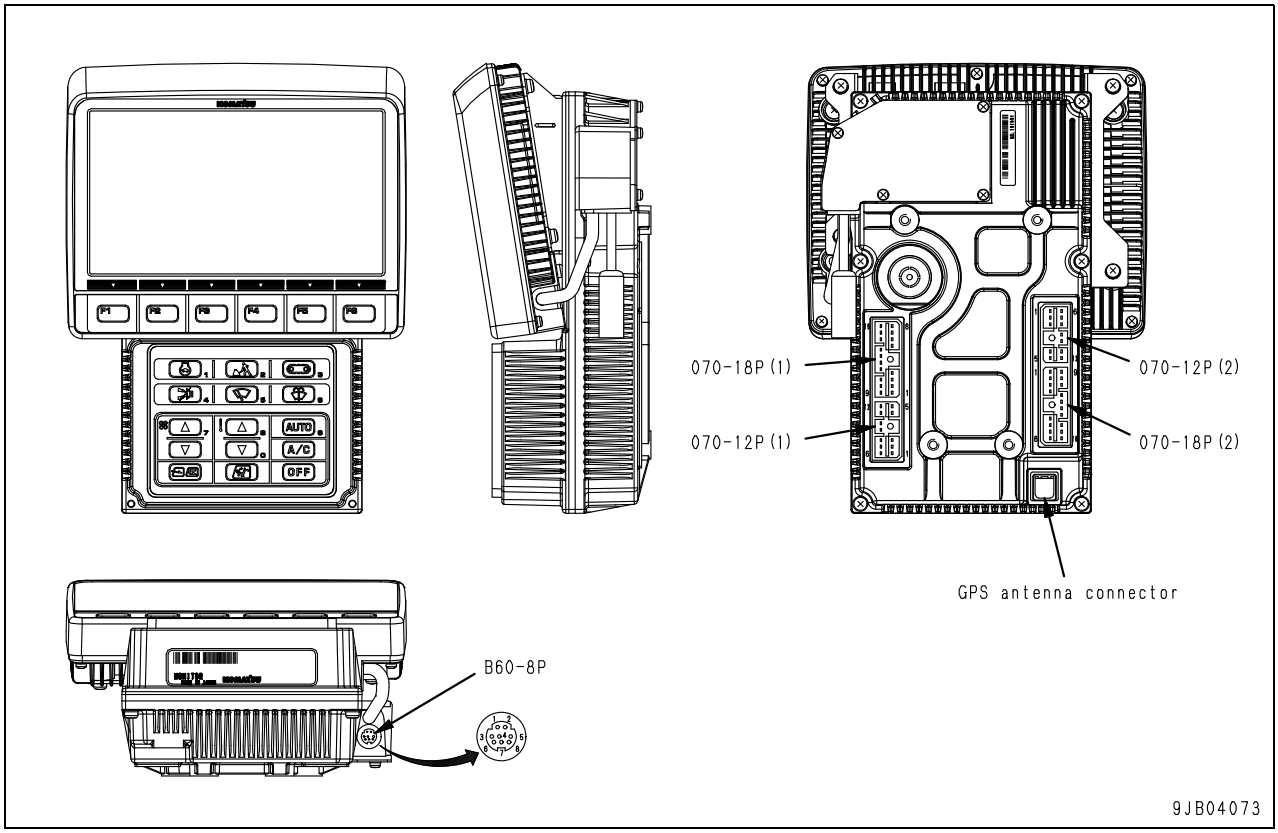
Input and output signals

a. Swing holding brake release signal
b. Swing holding brake solenoid valve drive signal
c. CAN signal
d. Oil pressure switch signal
e. Oil pressure sensor signal
f. Travel/swing alarm buzzer operation signal

Pin No.	Signal name	Signal classification
1	CAN(+)	E
2	NC	—
3	NC	—
4	NC	—
5	NC	—
6	NC	—
7	NC	—
8	NC	—
9	NC	—
10	NC	—
11	NC	—
12	NC	—
13	NC	—
14	NC	—
15	NC	—
16	NC	—
17	NC	—
18	NC	—
19	NC	—
20	NC	—
21	CAN(–)	E
22	NC	—
23	NC	—
24	NC	—
25	NC	—
26	NC	—
27	Fuel control dial (5 V)	A
28	Fuel control dial (–)	C
29	NC	—
30	NC	—

Pin No.	Signal name	Signal classification
31	NC	—
32	Engine controller power cut-off relay GND	C
33	NC	—
34	NC	—
35	Fuel control dial (+)	B
36	NC	—
37	NC	—
38	NC	—
39	NC	—
40	NC	—
41	NC	—
42	NC	—
43	NC	—
44	NC	—
45	Starting switch ACC signal	B
46	NC	—
47	NC	—
48	NC	—
49	NC	—
50	NC	—
51	NC	—
52	NC	—
53	NC	—
54	NC	—
55	Engine controller power cut-off relay	D
56	NC	—
57	NC	—
58	NC	—
59	NC	—
60	NC	—

Machine monitor



Outline

- The machine monitor provides monitor display function, mode selection function and switch function of the electrical equipment etc. Also it provides 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 display and switches: the display is of LCD type, and the switches are of flat sheet switch.
- If an error occurs in the machine monitor itself, controllers or wiring circuit between the monitor and controllers, the monitor does not display properly.

Precautions on the machine monitor display

- The LCD panel may have black points (points which are not lighted) and bright points (points which do not go off) for the reason of its characteristics. If the number of the bright points and black points does not exceed 10, it does not indicate a failure or a defect.
- When the engine is started, the battery voltage may drop suddenly depending on ambient temperatures and battery conditions. In this case, the machine monitor may go off for a moment. However, this phenomenon is not a failure.
- After the machine monitor is used continuously, blue points (points which do not go off) may be seen on the black background. This phenomenon does not indicate a failure or a defect.
  Blue points 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.)

Operator mode function

- The functions in this mode are displayed in normal operation. Display and setting of these functions are available from the operator's switch operations.
  Display and setting of some functions require special operation of the switch.
- Items available in the operator mode are as follows:

Category (*1)	Item	Display order (*2)			
		W	X	Y	Z
A	Display of KOMATSU logo	1	1	1	1
	Display of inputting password	2	—	—	—
	Display of start-up check	3	2	2	2
	Display of warning after start-up check	—	—	3	—
	Display of overdue maintenance	—	—	—	3
	Display of check of working mode and travel speed	4	3	4	4
	Display of normal operation screen	5	4	5	5
	Display of end screen				
B	Selection of auto-decelerator				
	Selection of working mode				
	Selection of travel speed				
	Operation to stop alarm buzzer				
	Operation of windshield wiper				
	Operation of windshield washer				
	Operation of air conditioner				
	Operation to display clock/service meter				
	Check of maintenance information				
	Setting and display of user mode • Breaker/attachment setting • Display of message (including KOMTRAX messages for user) • Screen adjustment • Clock adjustment • Language setting • Economy mode adjustment				
C	Display of energy-saving guidance				
	Display of caution monitor				
	Display of user code and failure code				
D	Function of checking display of LCD (Liquid Crystal Display)				
	Function of checking service meter				
	Function of changing attachment/maintenance password				

*1: The items available in the operator mode fall into the following categories.
  A: Display from the time starting switch is turned to "ON" until the normal operation screen appears. Display after the starting switch is turned to "OFF".
  B: Display when the switch of machine monitor is operated.
  C: Display when a certain condition is satisfied.
  D: Display when special switch operation is necessary.

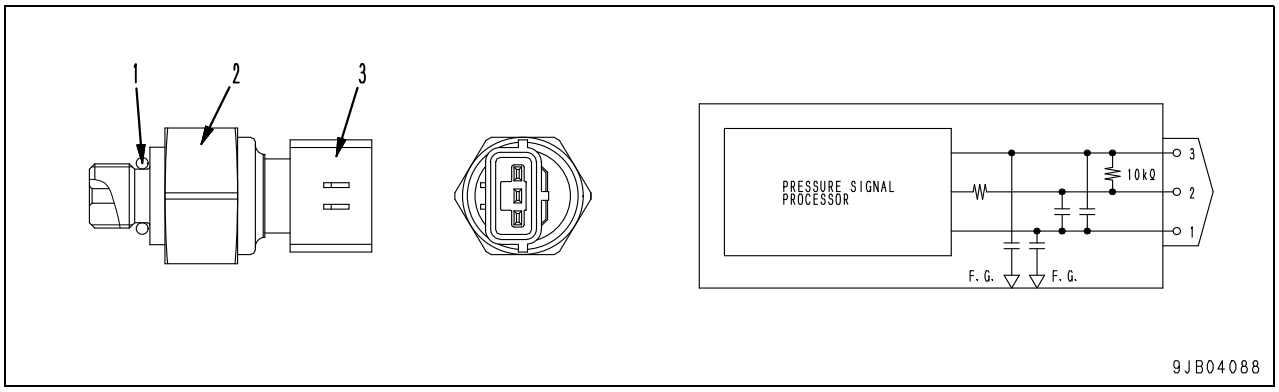
*2: For the category A, the order in which items are displayed varies depending on the setting and conditions of the machine as follows:
  W: When the engine start lock is set on.
  X: When the engine start lock is set off.
  Y: When an error is detected during start-up check.
  Z: When a maintenance overdue is detected.

★ For how to operate the operator mode functions, see the Operation and Maintenance Manual or "Special functions of machine monitor" in "Testing and adjusting".

★ For how to set the engine start lock on/off, see "Password setting/cancel manual".

PPC oil pressure sensor

(For travel and swing operation)

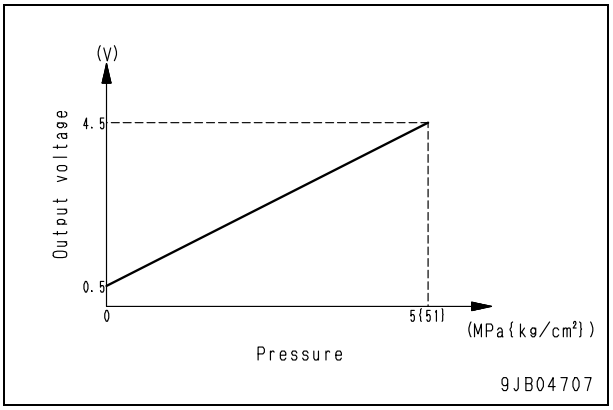


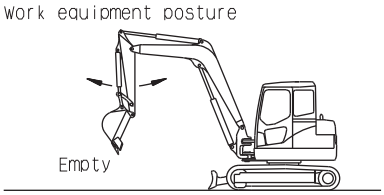
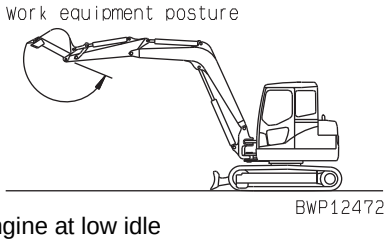
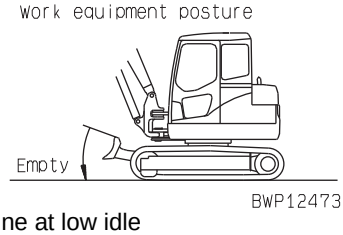
1. O-ring
2. Sensor
3. Connector

Function

- This sensor is installed in the control valve connecting part of the pilot circuit for travel and swing operation.
- This sensor senses the pilot pressure and converts it into an electric signal and then outputs that signal.

Output characteristics



Machine Model					PC88MR-8	
Cate-gory	Item		Measurement Conditions	Unit	Standard Value for New Machine	Service Limit Value
Work equipment	Time lag	Arm	 • Run engine at low idle • Hydraulic oil temperature: 45 – 55°C • Set upside of boom level and retract bucket cylinder fully. Extend bucket cylinder and measure time from when arm stops on lower side until when arm starts moving again.	sec	0	Max. 1.0
		Bucket	 • Run engine at low idle • Hydraulic oil temperature: 45 – 55°C • Set upside of boom level and retract bucket cylinder fully. Extend bucket cylinder and measure time from when arm stops on lower side until when arm starts moving again.		0	Max. 1.0
		Blade	 • Run engine at low idle • Hydraulic oil temperature: 45 – 55°C • Lower blade from max. height and measure time from when blade touches ground until when machine body rises.		Max. 1.0	Max. 2.0
	Discharge of hydraulic pump	Piston pump	See following pages	ℓ/min.	See following pages	See following pages

Testing/Adjusting item	Symbol	Part No.	Part name	Q'ty	Remarks
Troubleshooting for chassis sensors/wiring harnesses	T	799-601-7000 or 799-601-7100 or 799-601-7400 or 799-601-8000	T-adapter assembly	1	
		799-601-7010	• Adapter for X	1	For X1P (Does not include 799-601-7000 and 799-601-7100)
		799-601-7020	• Adapter for X	1	For X2P
		799-601-7050	• Adapter for SWP	1	For SW6P (Does not include 799-601-8000)
		799-601-7060	• Adapter for SWP	1	For SW6P (Does not include 799-601-8000)
		799-601-7080	• Adapter for M	1	For M1P (Does not include 799-601-7000 and 799-601-7100)
		799-601-7090	• Adapter for M	1	For M2P
		799-601-7110	• Adapter for M	1	For M3P
		799-601-7130	• Adapter for M		For M6P
		799-601-7330	• Adapter for S	1	For S16P (Does not include 799-601-7000 and 799-601-7100)
		799-601-7500	T-adapter assembly	1	
		799-601-7520	• Adapter for 070	1	For 070-12P
		799-601-7540	• Adapter for 070	1	For 070-18P
		799-601-9890	Multi-adapter	1	For DT-2, 3, 4/DTM-2P
		799-601-4280	Box for controller (PUMP)	1	
		799-601-7340	• Adapter for M	1	For M8P
		799-601-7360	Adapter for relay	1	For REL-5P
		799-601-7370	Adapter for relay	1	For REL-6P
Testing coolant temperature and oil temperature	—	799-101-1502	Digital thermometer	1	-99.9 – 1,299°C
Testing operating effort and depressing force		79A-264-0021	Push-pull scale	1	
		79A-264-0091	Push-pull scale	1	
Testing stroke and hydraulic drift	—	Commercially available	Ruler	1	
Testing work equipment speed	—	Commercially available	Stopwatch	1	
Testing voltage and resistance	—	Commercially available	Circuit tester	1	
Removal and installation of engine oil pressure switch	—	Commercially available	Deep socket	1	27 mm deep socket (hexagonal), Inside diameter: 24.5 (Equivalent to TONE 4A-27L)
Removal and installation of coolant temperature sensor	—	795T-981-1010	Deep socket	1	27 mm deep socket

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

Testing engine oil pressure

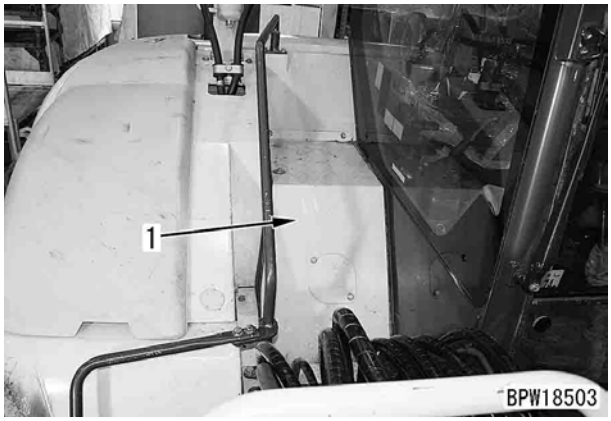
★ Testing tools for engine oil pressure

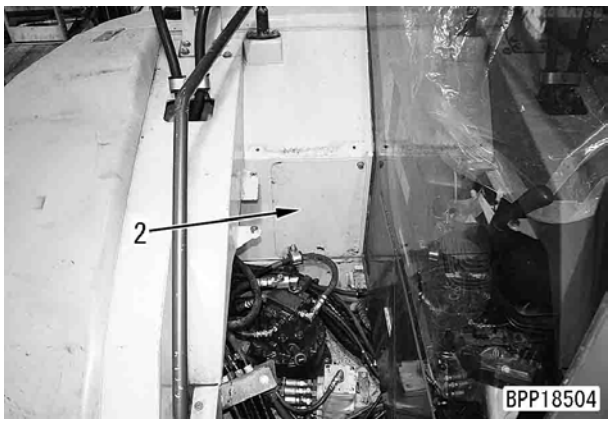
Symbol		Part No.	Part name
E	1	799-101-5002	Hydraulic tester
		790-261-1204	Digital hydraulic tester
	2	799-401-2320	Gauge
	3	6732-81-3170	Adapter
		07002-11023	O-ring

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

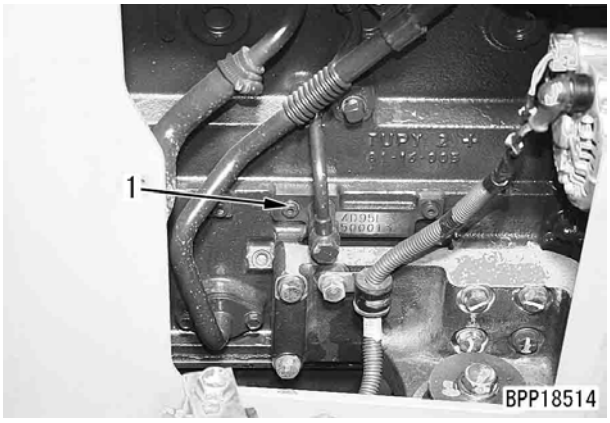
★ Test the engine oil pressure under the following condition.
- Engine coolant temperature: Within operating range

1. Remove covers (1) and (2).

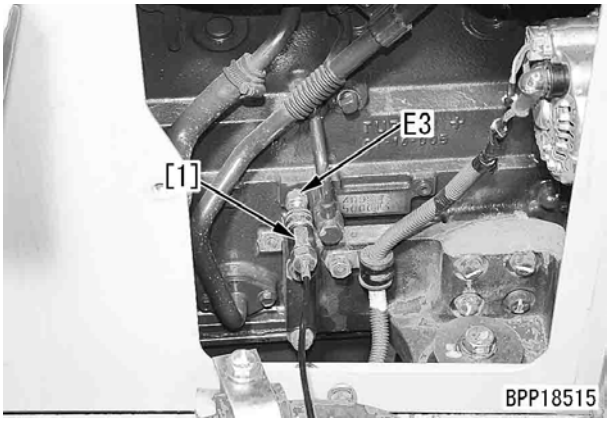




2. Remove oil pressure pickup plug (1) from the engine block.

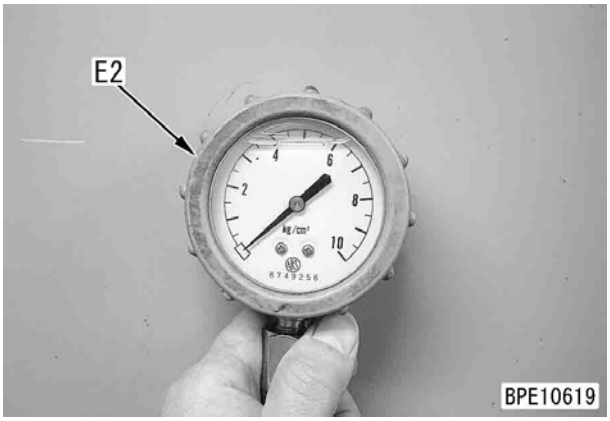


3. Install nipple [1] of hydraulic tester **E1** and adapter **E3** and connect gauge **E2**.



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

5. Test the oil pressure during low idle and high idle.



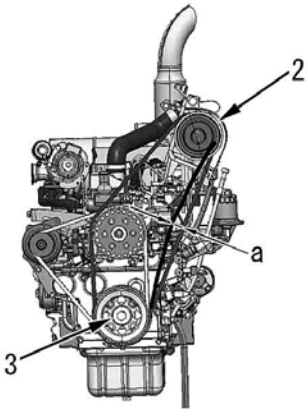
6. After finishing test, remove the testing tools and return the removed parts.
   Oil pressure pickup plug:
   20 – 22 Nm {2.0 – 2.2 kgm}

Checking and adjusting air conditioner compressor belt tension

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

Checking

1. Open the engine hood, press the middle point of the belt between compressor pulley (2) and crankshaft pulley (3) with a finger, and measure deflection (a).
   - ★ Belt pressing force: 60 N {6.1 kg}
   - ★ Deflection: 12 – 15 mm



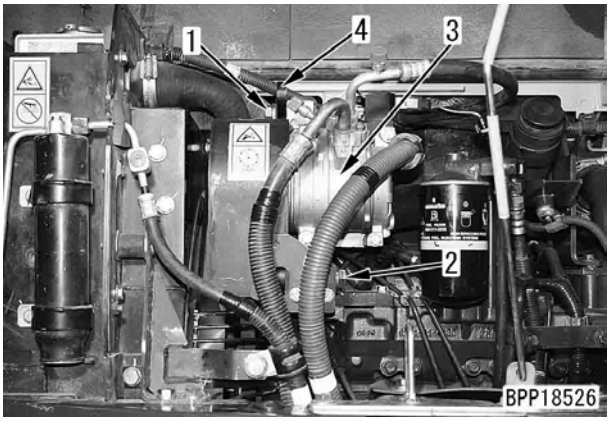
Adjusting

★ If the belt deflection is abnormal, adjust it according to the following procedure.

1. Loosen bolts (1) and (2).

2. Move compressor (3) and bracket (4) together to adjust the belt tension.

3. After positioning compressor (3), tighten bolts (1) and (2).
   - ★ Check each pulley for breakage, wear of the V-groove, and contact of the V-belt and V-groove.
   - ★ If the V-belt is so lengthened that the adjustment allowance is eliminated or it has a cut or a crack, replace it.
   - ★ If the belt is replaced, adjust their tension again after operating the machine for 1 hour.
   - ★ After tightening the bolts, check the belt tension again according the above procedure.



4. After finishing test, return the removed parts.

Testing and adjusting oil pressure in pump PC control circuit

★ Testing and adjusting tools for oil pressure in pump PC control circuit

Symbol		Part No.	Part name
M	1	799-101-5002	Hydraulic tester
		790-261-1204	Digital hydraulic tester
	2	799-101-5220	Nipple (10 × 1.25 mm)
		07002-11023	O-ring
	3	799-401-3300	Adapter (Size: 03)

⚠ **Stop the machine on a level ground and lower the work equipment to the ground. Then, release the residual pressure from the hydraulic circuit. For details, see "Releasing residual pressure from hydraulic circuit".**

Testing

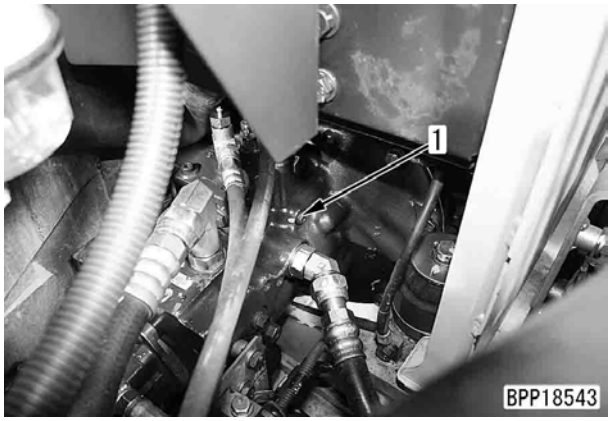
★ Before testing the oil pressure in the PC control circuit, check that the oil pressure in the work equipment, swing, and travel circuits and the basic pressure of the control circuit are normal.

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

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

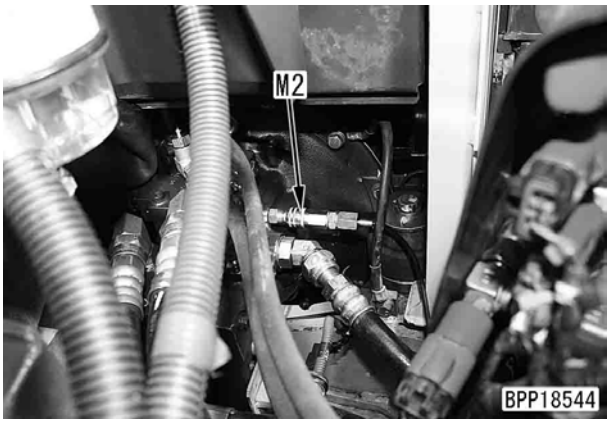
★ Test the PC valve output pressure (servo piston inlet pressure) and pump discharge pressure simultaneously and compare them.

1) Open the engine hood and remove oil pressure pickup plug (1).
- (1): PC valve output pressure pickup plug

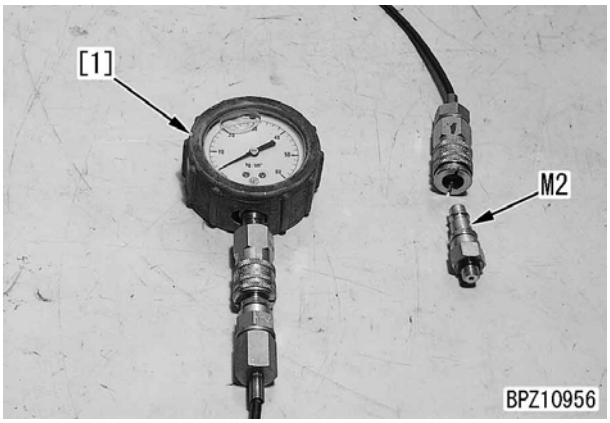


2) Install nipple **M2** and connect it to oil pressure gauge [1] of hydraulic tester **M1**.

★ Use the oil pressure gauges of 60 MPa {600 kg/cm²}.



3) Start the engine and operate the arm cylinder to the arm IN stroke end.
4) Set the working mode in the power mode (P).
5) While running the engine at high idle, operate the right work equipment control lever to relieve the arm circuit in the arm IN direction and measure the oil pressure.



★ Testing condition and method of judgment: If the pressures are in the following ratio, the PC valve is normal.

Tested oil pressure	Operation of lever	Ratio of oil pressures
Pump discharge pressure	Arm IN relief	1
PC valve output pressure		Approx. 0.6 (Approx. 3/5)

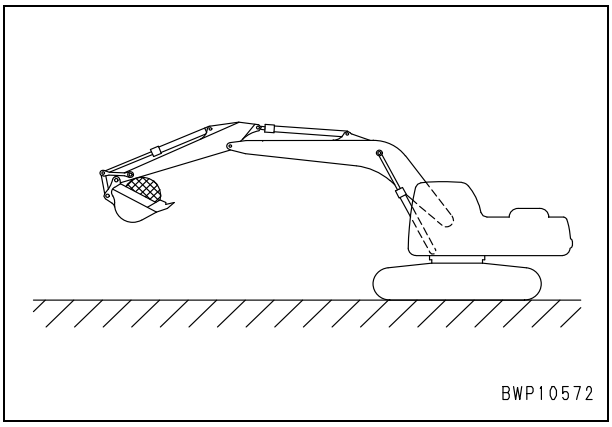
★ If the PC valve or the servo piston is abnormal, the PC valve output pressure (servo piston inlet pressure) is "the same as the pump discharge pressure" or "almost 0".

Checking parts which cause hydraulic drift of work equipment

★ If the work equipment (cylinder) drifts hydraulically, check to see if the cause is on the cylinder packing side or control valve side according to the following procedure.

1. Checking boom cylinder and bucket cylinder

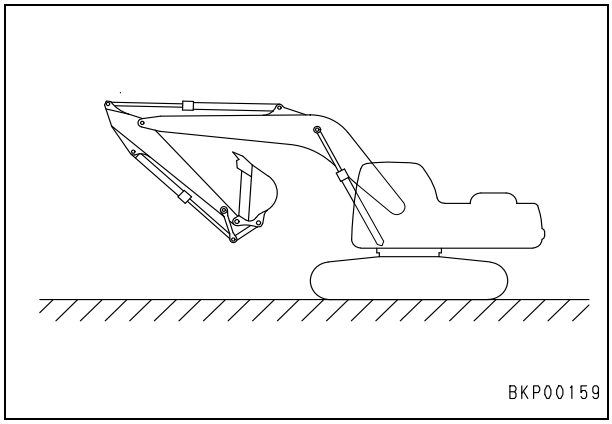
1) Set the machine in the position for testing hydraulic drift and stop the engine.
   ★ Fill the bucket with a rated load or with dirt and sand.



2) When checking the boom cylinder, set the boom control lever in the RAISE position. When checking the bucket cylinder, set the bucket control lever in the CURL position.
   - If the lowering speed is increased at this time, the cylinder packing is defective.
   - If the lowering speed does not change at this time, the control valve is defective.
   - ★ Operate the control lever while the starting switch is in the ON position.
   - ★ If the pressure in the accumulator is lost, run the engine for about 5 seconds to heighten the pressure in the accumulator.

2. Checking arm cylinder

1) Stop the arm cylinder about 100 mm before the IN stroke end and stop the engine.



2) Operate the arm control lever in the IN position.
   - If the lowering speed is increased at this time, the cylinder packing is defective.
   - If the lowering speed does not change at this time, the control valve is defective.
   - ★ Operate the control lever while the starting switch is in the ON position.
   - ★ If the pressure in the accumulator is lost, run the engine for about 5 seconds to heighten the pressure in the accumulator.

[**Reference**]

Reason why the lowering speed is increased by the above operation when the cylinder packing is the cause of the hydraulic drift:

1) If the machine is set in the above position (where the holding pressure is applied to the bottom side), the oil leaks from the bottom side to the head side. Since the volume on the head side is less than that on the bottom side by the volume of the rod, the pressure in the head side is increased by the oil flowing in from the bottom side.
2) As the pressure in the head side is increased, it is balanced at a certain level (which depends on the leakage), and then the lowering speed is lowered.
3) If the circuit on the head side is opened to the drain circuit by the above operation of the lever (the bottom side is closed by the check valve at this time), the oil on the head side flows in the drain circuit. As a result, the pressure is unbalanced and the lowering speed is increased.

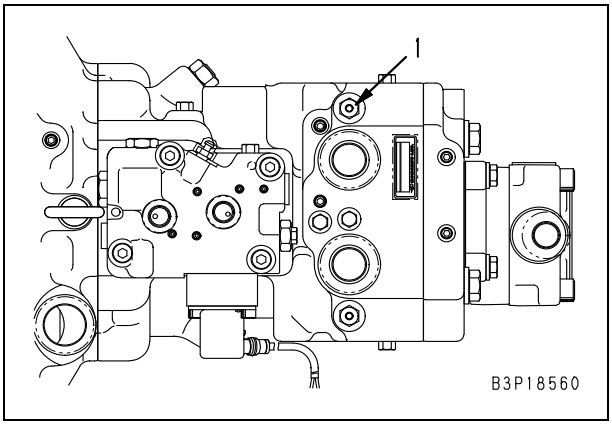
Bleeding air from each part

Air bleeding item / Contents of work	Air bleeding procedure					
	1	2	3	4	5	6
	Bleeding air from hydraulic pump	Starting engine	Bleeding air from cylinder	Bleeding air from swing motor	Bleeding air from travel motor	Checking oil level and starting operation
• Replacing hydraulic oil • Cleaning strainer	●	●	●	● (See note)	● (See note)	●
• Replacing return filter element		●	→	→	→	●
• Replacing and repairing hydraulic pump • Removing suction piping	●	●	●	→	→	●
• Replacing and repairing control valve • Removing control valve piping		●	●	→	→	●
• Replacing and repairing cylinder • Removing cylinder piping		●	●	→	→	●
• Replacing and repairing swing motor • Removing swing motor piping		●	→	●	→	●
• Replacing and repairing travel motor • Removing travel motor piping		●	→	→	●	●
• Replacing and repairing swivel joint • Removing swivel joint piping		●	→	→	→	●

Note: Bleed air from the swing motor and travel motor only when the oil in the motor cases is drained.

1. Bleeding air from hydraulic pump

1) Loosen air bleeder (1) and check that oil oozes out through the air bleeder.
2) After the oil oozes out, tighten air bleeder (1).
   Air bleeder:
   7.8 – 9.8 Nm {0.8 – 1.0 kgm}
   ★ Do not use an impact wrench to tighten the air bleeder.



2. Starting engine

When running the engine after performing step 1, keep its speed at low idle for 10 minutes.

★ If the engine coolant temperature is low and the automatic warm-up operation is started, stop the engine temporarily and reset the automatic warm-up operation with the fuel control dial (Set the starting switch in the ON position and hold the fuel control dial in the MAX position for 3 seconds, and the automatic warm-up operation is reset).

3. Bleeding air from cylinder

★ If a cylinder is replaced, bleed air from it before connecting the work equipment. In particular, the boom cylinder does not move to the lowering stroke end, if it is installed to the work equipment.

1) Run the engine at low idle for about 5 minutes.
2) While running the engine at low idle, raise and lower the boom 4 – 5 times.
   ★ Stop the piston rod about 100 mm before each stroke end. Do not relieve the oil.

★ Classification of operator mode
A: Display/Function from time when starting switch is turned ON to time when screen changes to ordinary screen and display after starting switch is turned OFF
B: Display/Function when switch of machine monitor is operated
C: Display/Function when certain condition is satisfied
D: Display/Function which needs special operation of switch

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

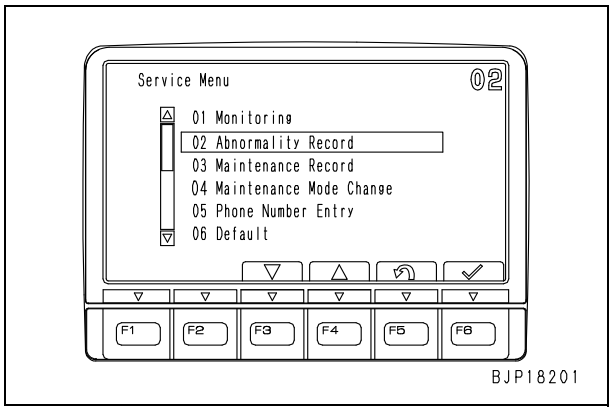
User code	Failure mode	Action
E02	Pump control system error	When emergency pump drive switch is at the up (emergency) position, normal operations become possible, but have inspection carried out immediately.
E03	Swing brake system error	Have inspection carried out immediately.
E10	Engine controller power source error Engine controller drive system circuit error (engine stopped)	Have inspection carried out immediately.
E11	Engine controller system error Output reduced to protect engine	Operate machine to a safe posture and have inspection carried out immediately.
E14	Abnormality in throttle system	Operate machine to a safe posture and have inspection carried out immediately.
E15	Engine sensor (coolant temperature, fuel pressure, oil pressure) system error	Operations are possible, but have inspection carried out immediately.
E20	Abnormality in travel system	Operations are possible, but have inspection carried out immediately.
E0E	Network error	Operate machine to a safe posture and have inspection carried out immediately.

Abnormality Record (Mechanical Systems)

The machine monitor classifies and records the abnormalities which occurred in the past or which are occurring at present into the mechanical systems, electrical systems, and air-conditioning system or heater system.

To check the mechanical system abnormality record, perform the following procedures.

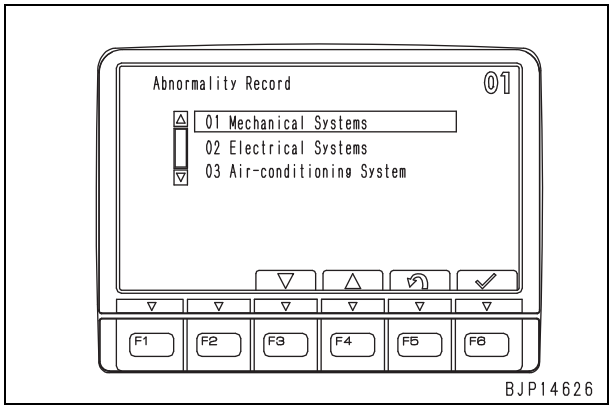
1. Selecting menu
   Select "Abnormality Record" on the "Service Menu" screen.



2. Selecting sub menu
   After the "Abnormality Record" screen is displayed, select "Mechanical Systems" with the function switches or numeral input switches.
   - [F3]: Move to lower item
   - [F4]: Move to upper item
   - [F5]: Return to service menu screen
   - [F6]: Confirm selection

   ★ You may enter a 2-digit code with the numeral input switches to select the record of that code and confirm it with [F6].

   ★ The following figure shows the display of the air conditioner specification. The heater specification and heaterless specification are different from each other in the display of "03 Air-conditioning System", which may not be displayed in the heaterless specification.



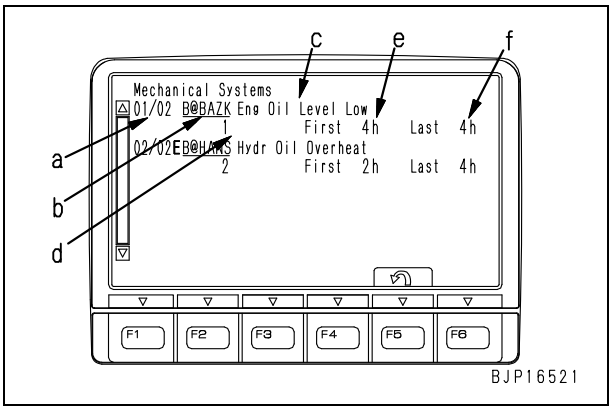
3. Information displayed on "Abnormality Record" screen
   On the "Mechanical Systems" screen, the following information is displayed.
   (a) : Occurrence order of abnormalities from latest one/Total number of records
   (b) : Failure code
   (c) : Contents of trouble
   (d) : Number of occurrence time (Displayable range: 0 – 65,535 times)
   (e) : Service meter reading at first occurrence
   (f) : Service meter reach at last occurrence
   - [F1]: Move to next page (screen) (if displayed)
   - [F2]: Move to previous page (screen) (if displayed)
   - [F5]: Return to abnormality record screen

   ★ If no abnormality record is recorded, "No abnormality record" is displayed.

   ★ If the number of occurrence time is 1 (first occurrence), the service meter reading at the first occurrence and that at the last occurrence are the same.

   ★ If [**E**] is displayed on the left of a failure code, the abnormality is still occurring or resetting of it has not been confirmed.

   ★ For all the failure codes that the machine monitor can record, see the Failure code table in "Abnormality Record (Electrical Systems)".

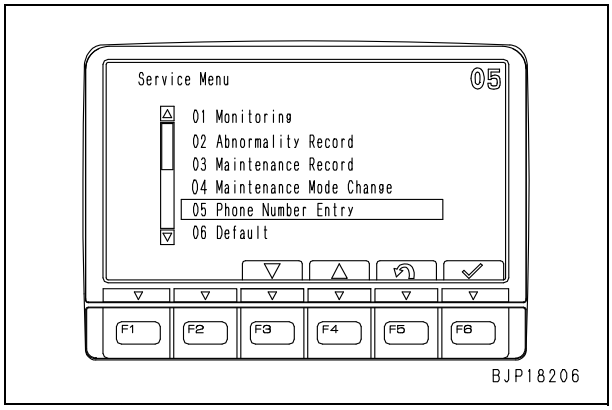


4. Resetting abnormality record
   The contents of the mechanical system abnormality record cannot be reset.

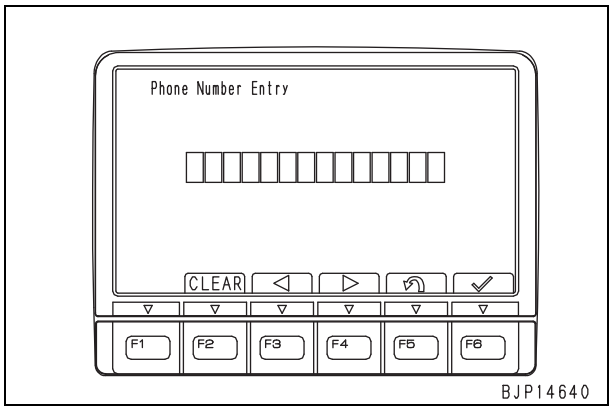
Phone Number Entry

The telephone No. displayed when the user code/ failure code is displayed in the operator mode can be input and changed according to the following procedure.
If a telephone No. is not input with this function, no telephone No. is displayed in the operator mode.

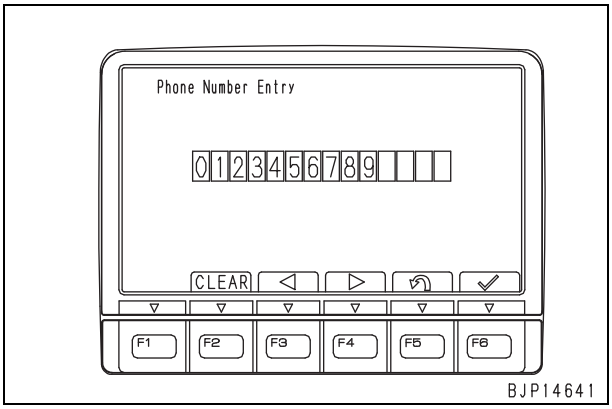
1. Selecting menu
   Select "Phone Number Entry" on the "Service Menu" screen.



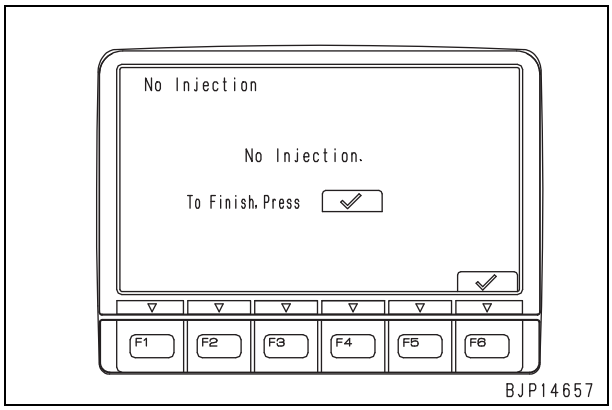
2. Registering and changing telephone No.
   After the "Phone Number Entry" screen is displayed, register or change the telephone No.
   - [F2]: Reset all input No.
   - [F3]: Move to left position (if not blank)
   - [F4]: Move to right position (if not blank)
   - [F5]: Reset input digit/Return to service menu
   - [F6]: Confirm input



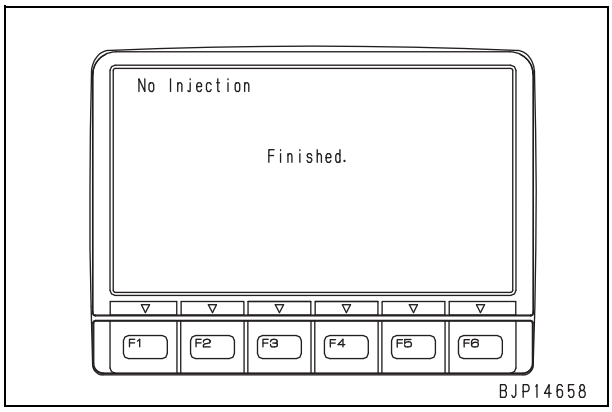
   ★ Up to 14 digits can be input from the left. Input nothing in the surplus positions.
   ★ If one of the input digits is wrong, move to that digit (orange background) and overwrite it with the correct digit.
   ★ If [F6] is pressed without inputting a digit, there is not information of telephone No. Accordingly, no telephone No. is displayed in the operator mode.



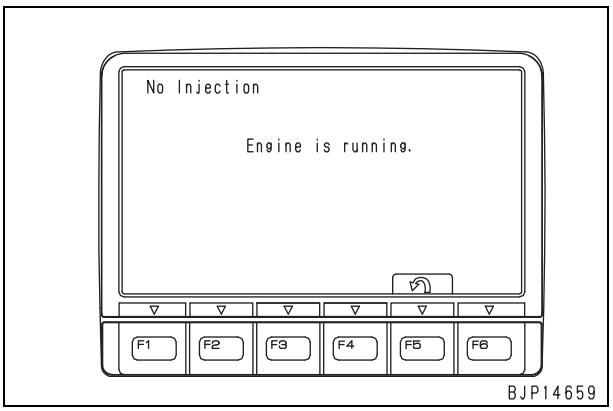
3. Starting no injection cranking
   If no injection cranking (Fuel injection in no cylinders) becomes effective, that is displayed on the screen. Under this condition, crank the engine with the starting motor.
   ★ While the screen is changing to the following screen, the screen of "Setting is being prepared" is displayed.
   ★ Limit the cranking time to 20 seconds to protect the starting motor.



4. Finishing no injection cranking
   After completing the no injection cranking operation, press [F6], and finish of no injection cranking is displayed and the screen returns to the "Service Menu" screen automatically.



5. Prohibiting no injection cranking
   If the operator tries to perform the no injection cranking while the engine is running, the message that the “Engine is running” is displayed and the no injection cranking is not set effective.
   ★ This function can be selected even while the engine is running. If the no injection cranking is performed, however, the message of "Engine is running" is displayed on the screen.



Preparation work for troubleshooting of electrical system

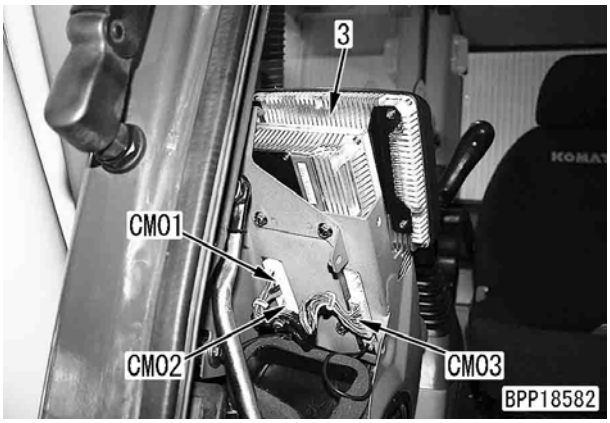
★ When carrying out troubleshooting of an electric circuit related to the machine monitor, engine controller, pump controller, or KOMTRAX communication MODEM, expose the related connectors according to the following procedure.
★ Disconnect and connect the connectors having special locking mechanisms according to the procedure shown below.

1. Machine monitor

1) Remove 3 mounting bolts and cover (1).
   ★ One of the mounting bolts is installed in the cover on the right of the sunlight sensor.
   ★ While removing the mounting bolts, disconnect connector **P31** of the sunlight sensor.

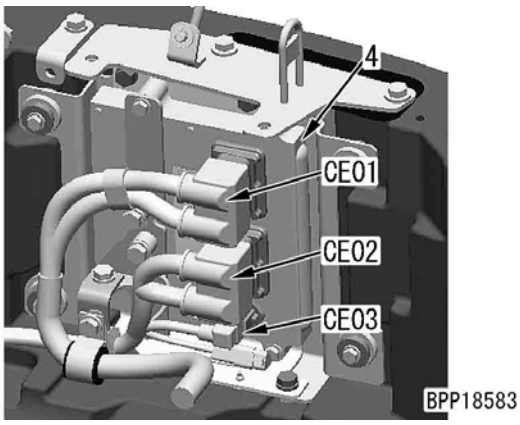
2) Remove 1 mounting bolt and duct (2).

3) Insert or connect troubleshooting T-adapters in or to connectors **CM01**, **CM02**, and **CM03** of machine monitor (3).
   ★ Connectors **CM02** and **CM03** are of the same type. When returning them, check the mark plates of the mounting brackets and take care not to make a wrong connection.

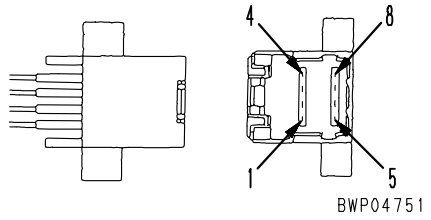
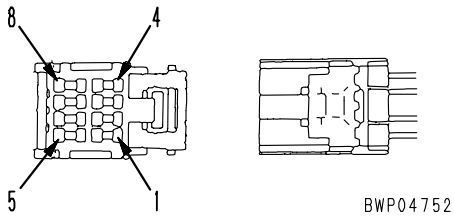
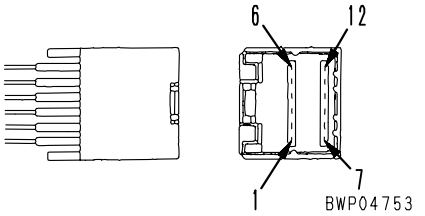
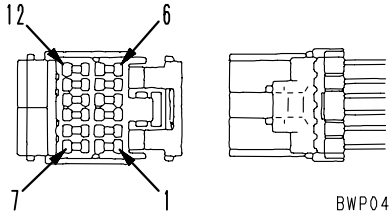
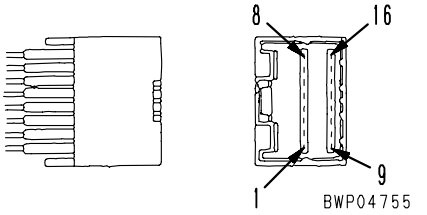
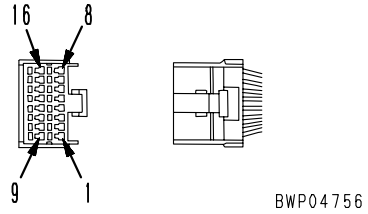
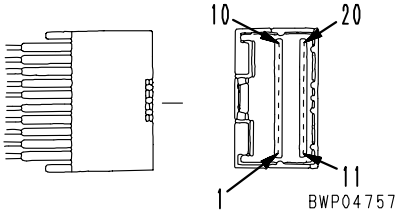
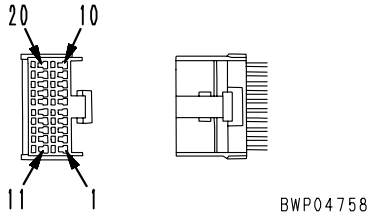


2. Engine controller

1) Open the engine hood.
   ★ The engine controller is mounted on the engine (on the counterweight side).
2) Insert or connect troubleshooting T-adapters in or to connectors **CE01**, **CE02**, and **CE03** of engine controller (4).
   ★ Connectors **CE01** and **CE02** are fixed with screws. When disconnecting them, loosen the screws.
   ★ When returning connectors **CE01** and **CE02**, tighten the screws to the specified torque.
   Screw: **3 ± 1 Nm {0.3 ± 0.1 kgm}**

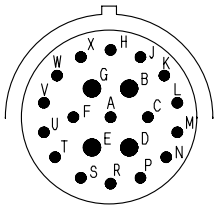
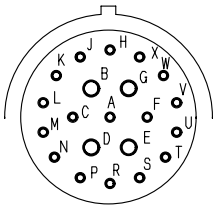
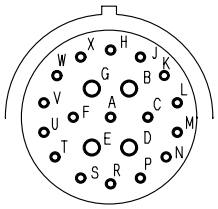
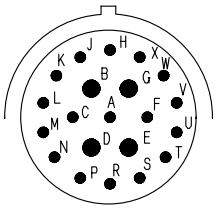
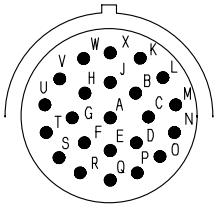
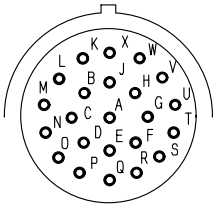
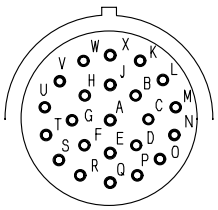
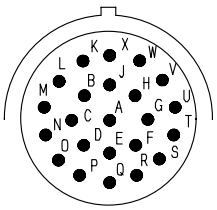


No.	Phenomena looking like troubles	Troubleshooting			
		Display of code	**E-mode**	**H-mode**	**S-mode**
34	Speed or power of blade is low			H-10	
35	Work equipment does not move in its single operation			H-11	
36	Hydraulic drift of work equipment is large			H-12	
37	Time lag of work equipment is large			H-13	
38	Flow rate in attachment circuit cannot be adjusted (when attachment is installed)			H-28	
Phenomena related to compound operation					
39	Work equipment loaded more is slower during compound operation			H-14	
40	Boom RAISE speed is low in compound operation of swing + boom RAISE			H-15	
41	Travel speed lowers significantly during compound operation of work equipment/swing + travel			H-16	
Phenomena related to travel					
42	Machine deviates during travel			H-17	
43	Travel speed is low			H-18	
44	Machine cannot be steered easily or steering power is low			H-19	
45	Travel speed does not change or it is kept low or high		E-16	H-20	
46	Track does not move (Only either side)			H-21	
47	Travel alarm does not sound or does not stop sounding		E-20		
Phenomena related to swing					
48	Machine does not swing			H-22	
49	Swing acceleration or swing speed is low			H-23	
50	Excessive overrun when stopping swing			H-24	
51	When upper structure stops swinging, it makes large shock			H-25	
52	When upper structure stops swinging, it makes large sound			H-26	
53	Swing holding brake does not operate normally Hydraulic drift of swing is large		E-19	H-27	
Phenomena related to machine monitor					
54	When starting switch is turned ON, machine monitor displays nothing		E-1		
55	Precaution lights up while engine is running		E-6		
56	Emergency stop item lights up while engine is running		E-7		
57	Engine coolant temperature gauge does not indicate normally		E-8		
58	Hydraulic oil temperature gauge does not indicate normally		E-9		
59	Fuel level gauge does not indicate normally		E-10		
60	Contents of display by machine monitor are different from applicable machine		E-11		
61	Machine monitor does not display some items		E-12		
62	Function switch does not work		E-13		
63	Alarm buzzer cannot be stopped		E-17		
64	Windshield wiper and window washer do not operate		E-18		
65	Air conditioner does not operate normally (including air conditioner abnormality record)		E-21		
66	While starting switch is in OFF position, service meter is not displayed		E-22		
67	Machine monitor cannot be set in service mode		E-23		

No. of pins	AMP040 type connector		
	Male (female housing)	Female (male housing)	Testing connection use special tool Part No.
8	 BWP04751	 BWP04752	799-601-7180 (T-adapter)
	—	Housing part No. : 79A-222-3430 (Q'ty:5)	
12	 BWP04753	 BWP04754	799-601-7190 (T-adapter)
	—	Housing part No. : 79A-222-3440 (Q'ty:5)	
16	 BWP04755	 BWP04756	799-601-7210 (T-adapter)
	—	Housing part No. : 79A-222-3450 (Q'ty:5)	
20	 BWP04757	 BWP04758	799-601-7220 (T-adapter)
	—	Housing part No. : 79A-222-3460 (Q'ty:5)	

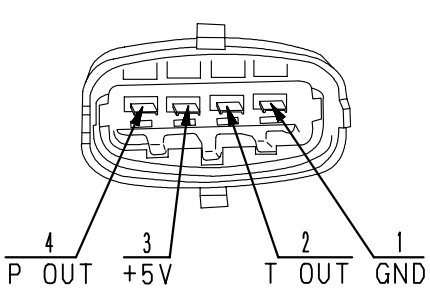
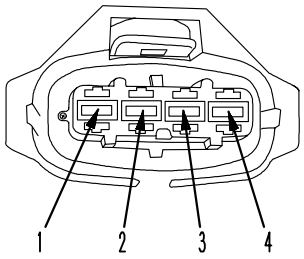
B4D18198

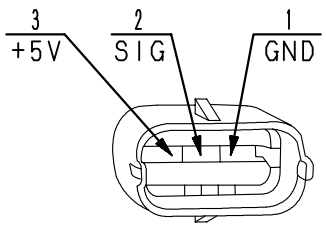
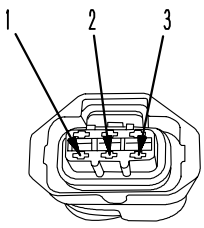
[The pin No. is also marked on the connector(electric wire insertion end)]

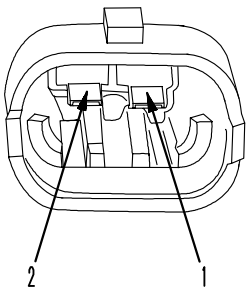
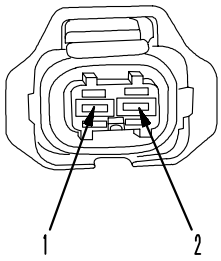
Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	Testing connection use special tool Part No.
24-21 (7)	Pin (male terminal)	Socket (female terminal)	799-601-9270 (T-adapter)
	 BWP05025	 BWP05026	
	Part No. :08191-71201, 08191-71202, 08191-71205, 08191-71206	Part No. :08191-74101, 08191-74102, 08191-74105, 08191-74106	
	Socket (female terminal)	Pin (male termial)	799-601-9270 (T-adapter)
	 BWP05027	 BWP05028	
	Part No. :08191-72201, 08191-72202, 08191-72205, 08191-72206	Part No. :08191-73101, 08191-73102, 08191-73105, 08191-73106	
24-23 (8)	Pin (male terminal)	Socket (female terminal)	799-601-9280 (T-adapter)
	 BWP05029	 BWP05030	
	Part No. :08191-81201, 08191-81202, 08191-81203, 08191-81204, 08191-81205, 08191-80206	Part No. :08191-84101, 08191-84102, 08191-84103, 08191-84104, 08191-84105, 08191-84106	
	Socket (female terminal)	Pin (male termial)	799-601-9280 (T-adapter)
	 BWP05031	 BWP05032	
	Part No. :08191-82201, 08191-82202, 08191-82203, 08191-82204, 08191-82205, 08191-82206	Part No. :08191-83101, 08191-83102, 08191-83103, 08191-83104, 08191-83105, 08191-83106	

B4D18408

BOSCH connector for engine

No. of pins	Boost (air intake) pressure and temperature sensor (95 engine)		Testing connection use special tool Part No.
	Sensor side (plug)	Harness side (receptacle)	
4			799-601-4380 (Socket)
	—	—	

No. of pins	Common rail (fuel) pressure sensor (95, 107, 114 engine)		
	Sensor side (plug)	Harness side (receptacle)	
3			799-601-4190 (Socket) (Kit:799-601-4101) (Kit:799-601-4201)
	—	—	

No. of pins	Fuel supply pump (95, 107 engine) and fuel injector (95 engine)		
	Valve side (plug)	Harness side (receptacle)	
2			799-601-4340 (Socket) (Kit:799-601-4101) (Kit:799-601-4201)
	—	—	

B4D18418

Part No.	Part name	Number of pins	Identification symbol	T-adapter kit														Out of kit
				799-601-2500	799-601-2700	799-601-2800	799-601-7000	799-601-7100	799-601-7400	799-601-7500	799-601-8000	799-601-9000	799-601-9100	799-601-9200	799-601-9300	799-601-4101	799-601-4201	
799-601-9330	Case											●						
799-601-9340	Case												●					
799-601-9350	Adapter for DRC	40	DRC-40												●			
799-601-9360	Adapter for DRC	24	DRC-24												●			
799-601-9410*	Socket for engine (CRI-T2)	2	G															●
799-601-9420	Adapter for engine (CRI-T2) Adapter for engine (CRI-T3) PFUEL Oil pressure sensor	3	A3													●	●	
799-601-9430*	Socket for engine (CRI-T2) Socket for engine (CRI-T3) PCV	2	P													●	●	
799-601-9440*	Socket for engine (CRI-T2)	3	1,2,3															●
795-799-5520*	Socket for engine (HPI-T2)	2	S															●
795-799-5530*	Socket for engine (HPI-T2) Socket for engine (CRI-T3) Temperature sensor	2	C													●	●	
795-799-5540*	Socket for engine (HPI-T2) Socket for engine (CRI-T3) TIM	2	A													●	●	
795-799-5460	Cable for engine (HPI-T2)	3	—															●
795-799-5470	Cable for engine (HPI-T2)	3	—															●
795-799-5480	Cable for engine (HPI-T2)	3	—															●
799-601-4110	Adapter for engine (140-T3) PIM	4	ITT3N													●	●	
799-601-4130	Adapter for engine (CRI-T3) NE, CAM	3	FCIN													●	●	
799-601-4140	Adapter for engine (CRI-T3) Atomosphere pressure	3	FCIG													●	●	
799-601-4150	Adapter for engine (CRI-T3) POIL	3	FCIB													●	●	
799-601-4160	Adapter for engine (CRI-T3) Oil pressure switch	2	4160													●	●	
799-601-4180	Adapter for engine (CRI-T3) PEVA	3	4180													●	●	
799-601-4190*	Socket for engine (CRI-T3) Commonrail pressure	3	1,2,3L													●	●	
799-601-4230*	Socket for engine (CRI-T3) Air intake pressure/temperature	4	1,2,3,4C													●	●	
799-601-4240*	Socket for engine (CRI-T3) PAMB	3	1,2,3A													●	●	
799-601-4250*	Socket for engine (CRI-T3) PIM	3	1,2,3B													●	●	
799-601-4330*	Socket for engine (CRI-T3) G	3	1,2,3,G													●	●	
799-601-4340*	Socket for engine (CRI-T3) Pump actuator	2	2,PA													●	●	
799-601-4380*	Socket for engine (CRI-T3)(95) Air intake pressure/temperature	4	1,2,3,4T															●
799-601-4260	Adapter for controller (ENG)	4	DTP4													●	●	
799-601-4211	Adapter for controller (ENG)	50	DRC50													●		
799-601-4220	Adapter for controller (ENG)	60	DRC60													●		
799-601-4390*	Socket for controller (95 ENG)	60	—															●
799-601-4280*	Box for controller (PUMP)	121	—															●
799-601-9720	Adapter for controller (HST)	16	HST16A															●
799-601-9710	Adapter for controller (HST)	16	HST16B															●
799-601-9730	Adapter for controller (HST)	26	HST26A															●
799-601-9890	Multi-adapter for DT2 – 4 and DTM2	2, 3, 4	—															●

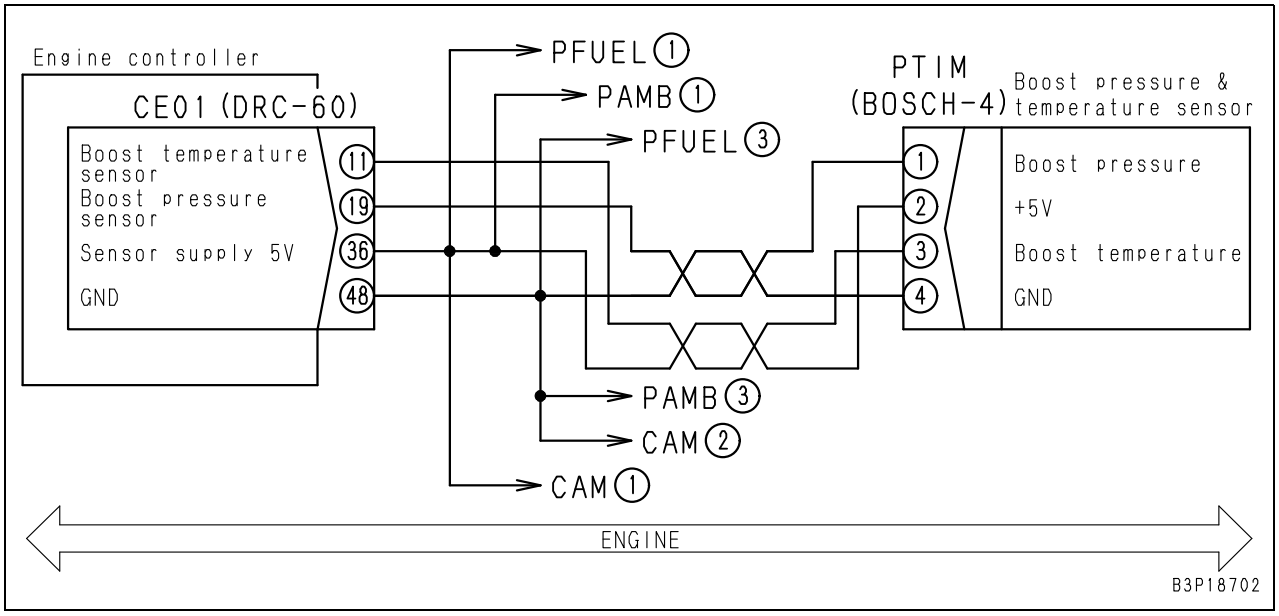
"*" Shows not T-adapter but socket.

Failure code [B@BAZG] Eng oil press. low

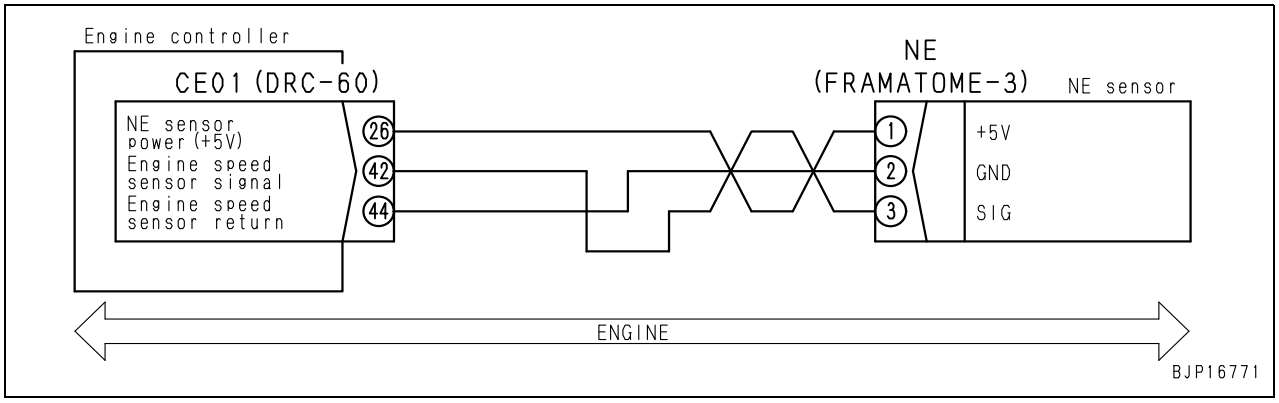
User code	Failure code	Trouble	Engine oil pressure low (Engine controller system)
—	**B@BAZG**		
Contents of trouble	• While engine was running, signal circuit of engine oil pressure switch detected low engine oil pressure (sensor contact opened).		
Action of controller	• Displays engine oil pressure monitor on machine monitor. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• If machine is operated as it is, engine may be damaged.		
Related information	• Engine oil pressure switch signal is input to engine controller and then transmitted to machine monitor. • Method of reproducing failure code: Start engine.		

	Cause		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Lowering of engine oil pressure (when system is normal)	Engine oil pressure may be low. Check it and remove cause if it is low.
	2	Defective engine oil pressure switch system	If cause 1 is not detected, engine oil pressure switch system may be defective. Carry out troubleshooting for failure code [**CA435**].

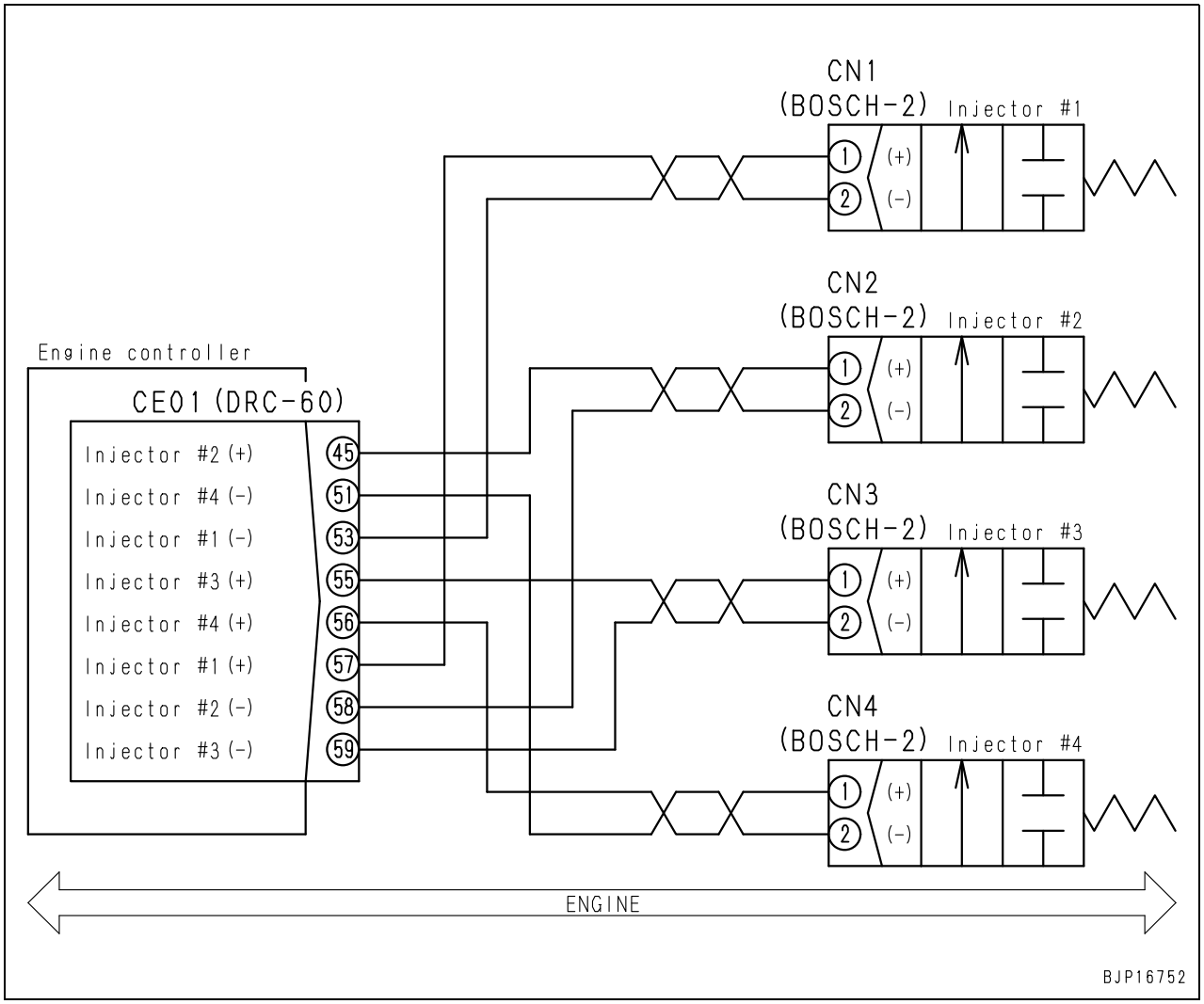
Related circuit diagram



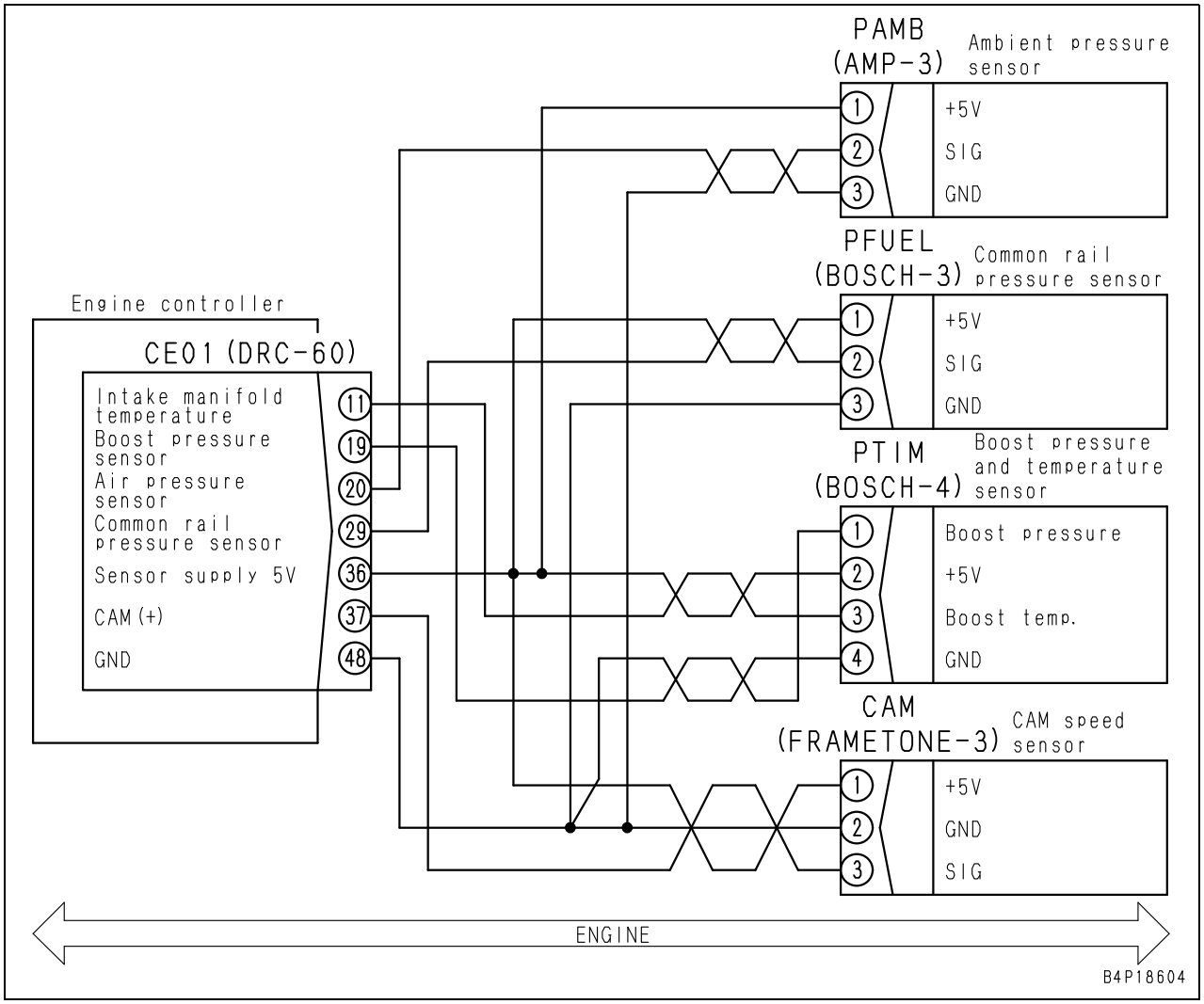
Related circuit diagram



Related circuit diagram



Related circuit diagram

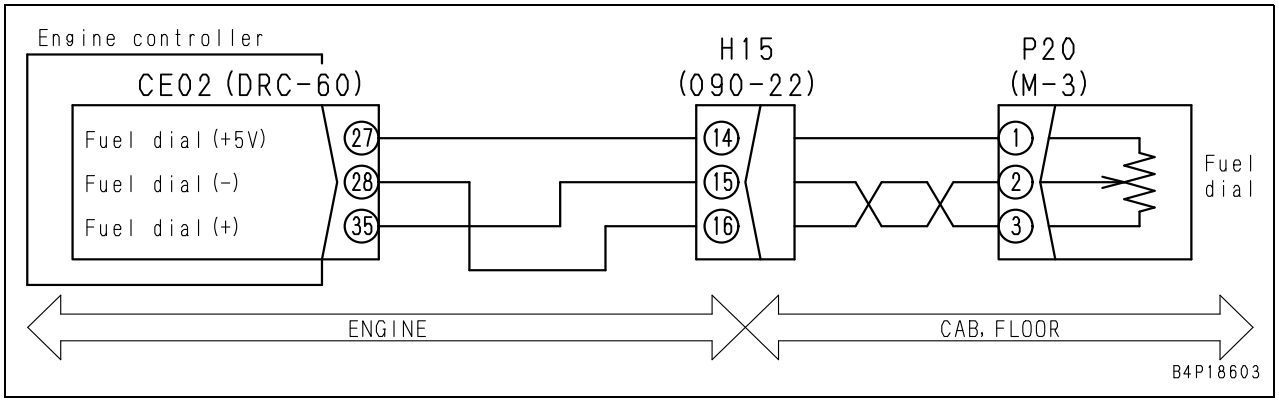


*1 – *10:
See Testing and adjusting, "Special functions of machine monitor", Monitoring items table.

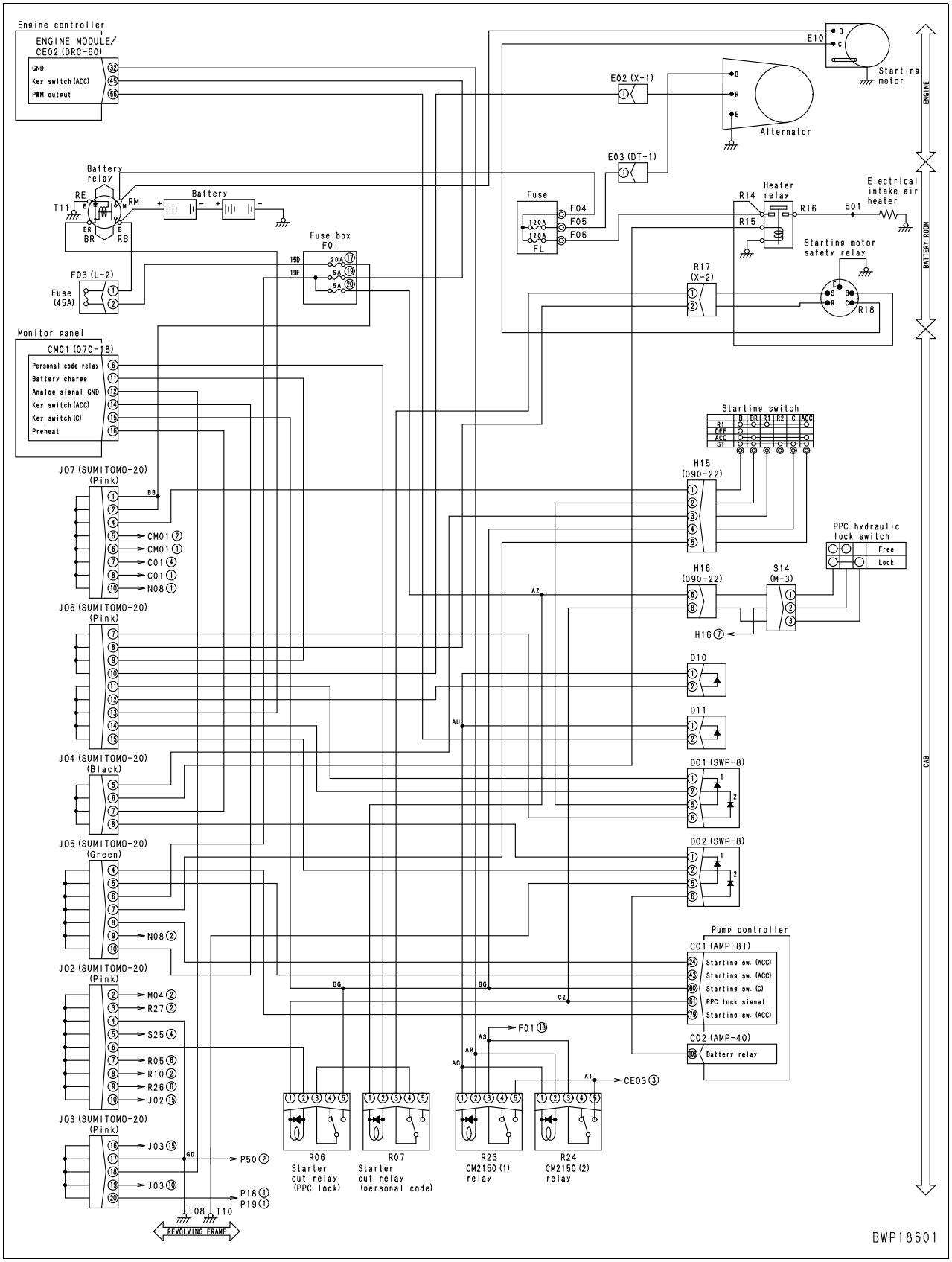
(*): A limit value is the value mentioned above, but a standard value in normalcy is "0 cc/min. (no leak)".

Rating or equivalent:
Relieve the circuit under the following condition.
1) Engine: Full throttle
2) Mode: P
3) Boom: Raise

Related circuit diagram



Related circuit diagram (EU specification)



HYDRAULIC EXCAVATOR

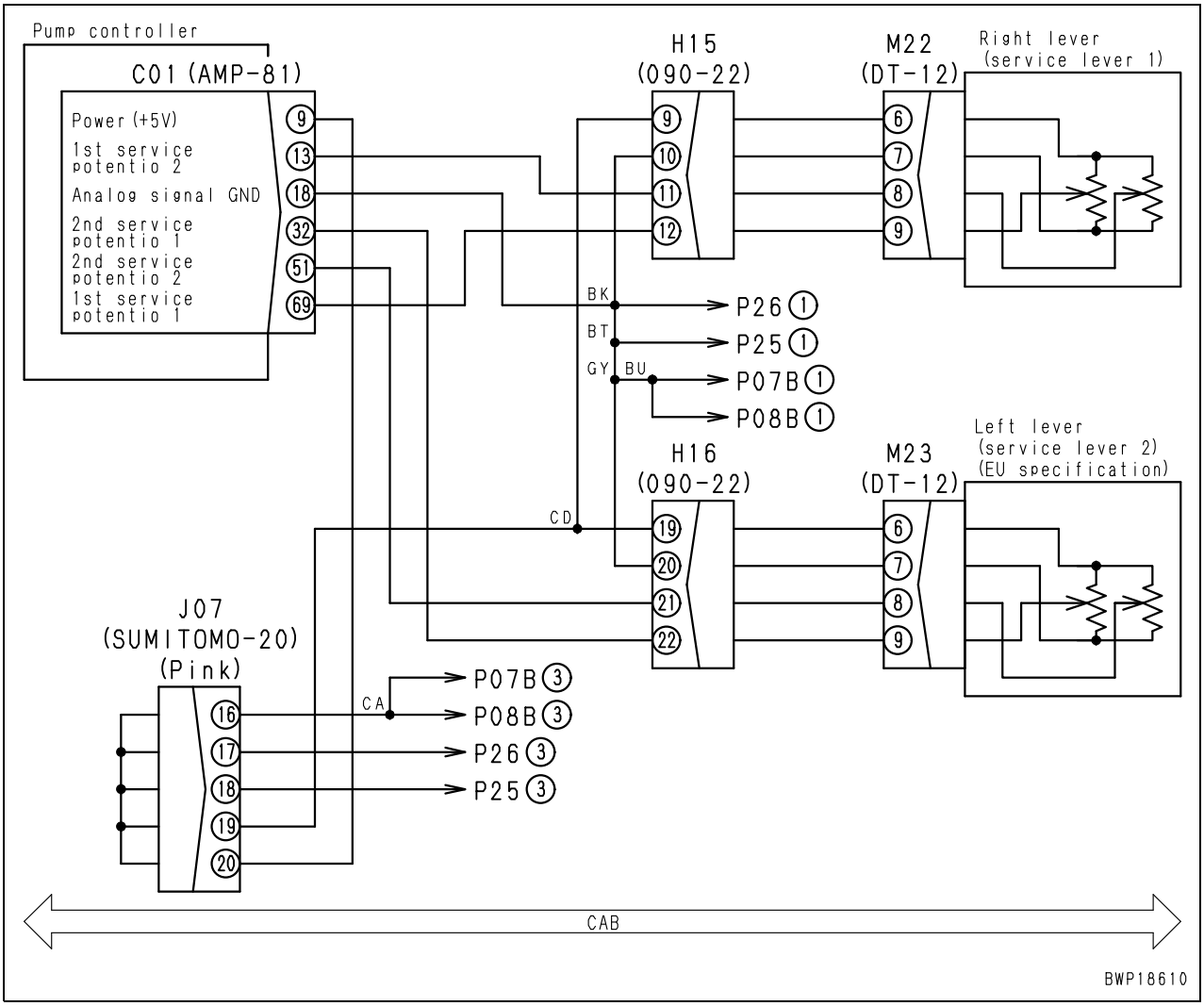
PC88MR-8

Machine model	Serial number
PC88MR-8	5001 and up

40 Troubleshooting

330 Troubleshooting by failure code, Part 3

Related circuit diagram

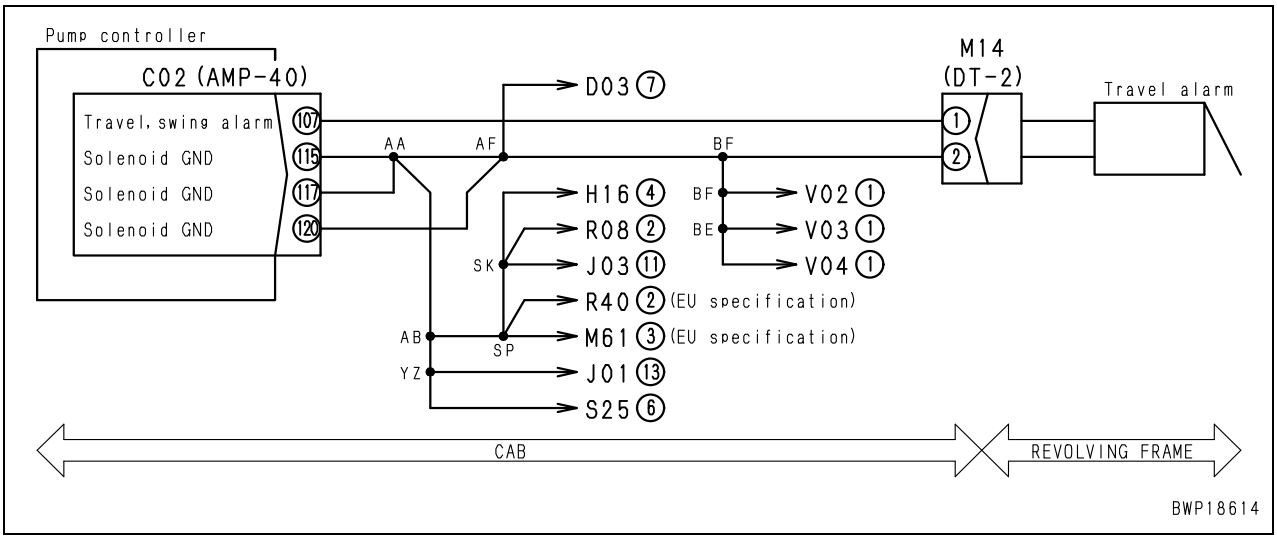


Failure code [DV20KB] Travel alarm short circuit

User code	Failure code	Trouble	Travel alarm short circuit (Pump controller system)
—	**DV20KB**		
Contents of trouble	• Abnormal current flowed in the travel alarm circuit, when power is supplied to the circuit.		
Action of controller	• Power to the travel alarm circuit is switched OFF. • Even after the failure cause disappears of itself, the machine operation does not return to normalcy, unless the engine starting switch is once turned OFF.		
Problem that appears on machine	• The travel alarm does not sound.		
Related information	• Operation of the travel alarm (ON or OFF) can be checked in the monitoring function. (Code: **03701** Controller output 2)		

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Travel alarm defective (Internal defect)	★ Turn the engine starting switch OFF for the preparations, and keep the engine running during the troubleshooting.			
			M14 (female)	Travel lever	Voltage	
			Between (1) and (2)	Neutral	Max. 1 V	
				Operated	20 – 30 V	
			If the above voltage is normal but the travel alarm does not operate, the travel alarm is defective.			
	2	Grounding fault of wiring harness (Contact with grounding circuit)	★ Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			Between wiring harness between C02 (female) (107) and M14 (female) (1) and ground		Resistance	Min. 1 MΩ
	3	Pump controller defective	★ Turn the engine starting switch OFF for the preparations, and keep the engine running during the troubleshooting.			
			C02	Travel lever	Voltage	
			Between (107) – chassis ground	Neutral	Max. 1 V	
				Operated	20 – 30 V	

Related circuit diagram

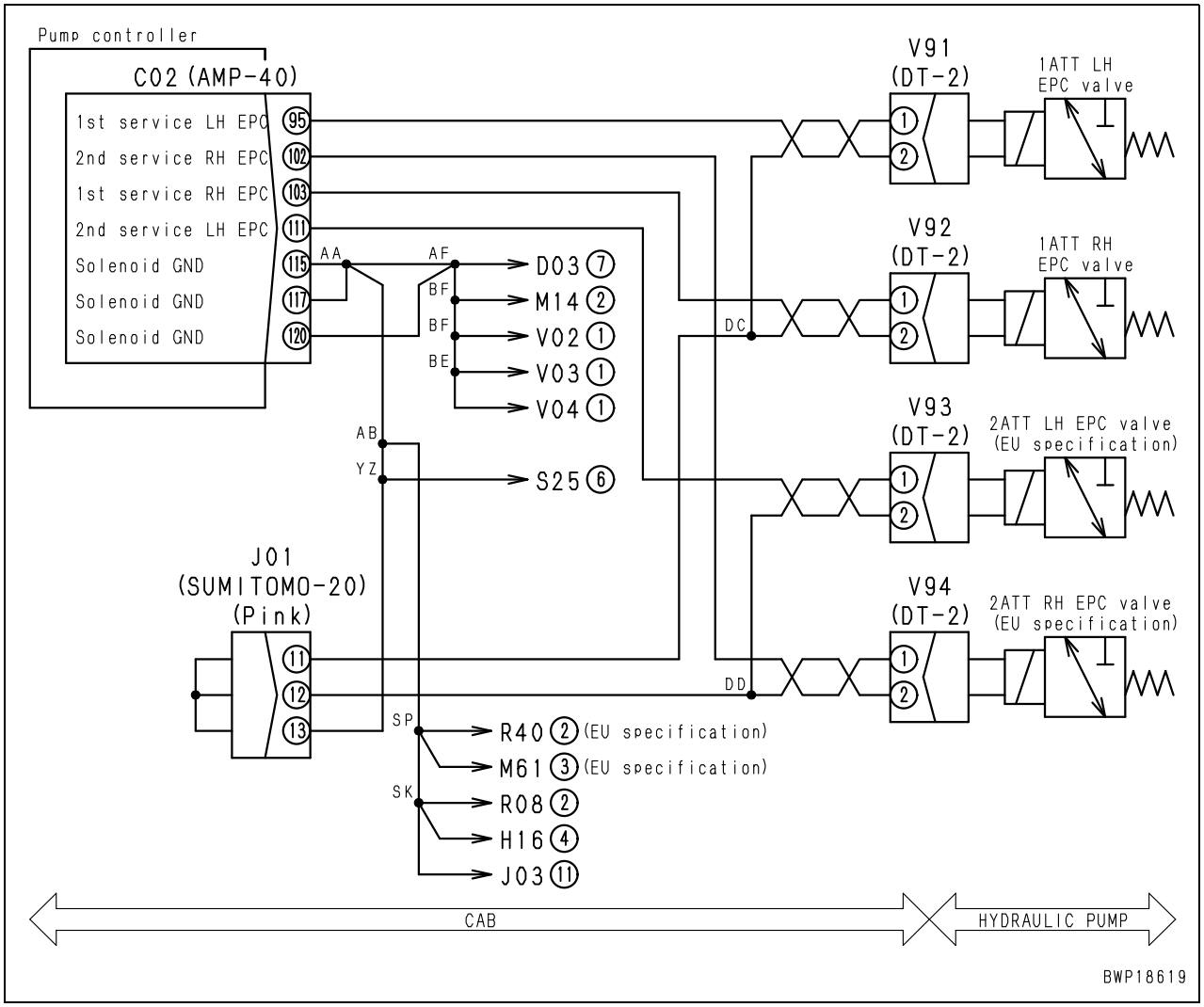


HYDRAULIC EXCAVATOR
PC88MR-8

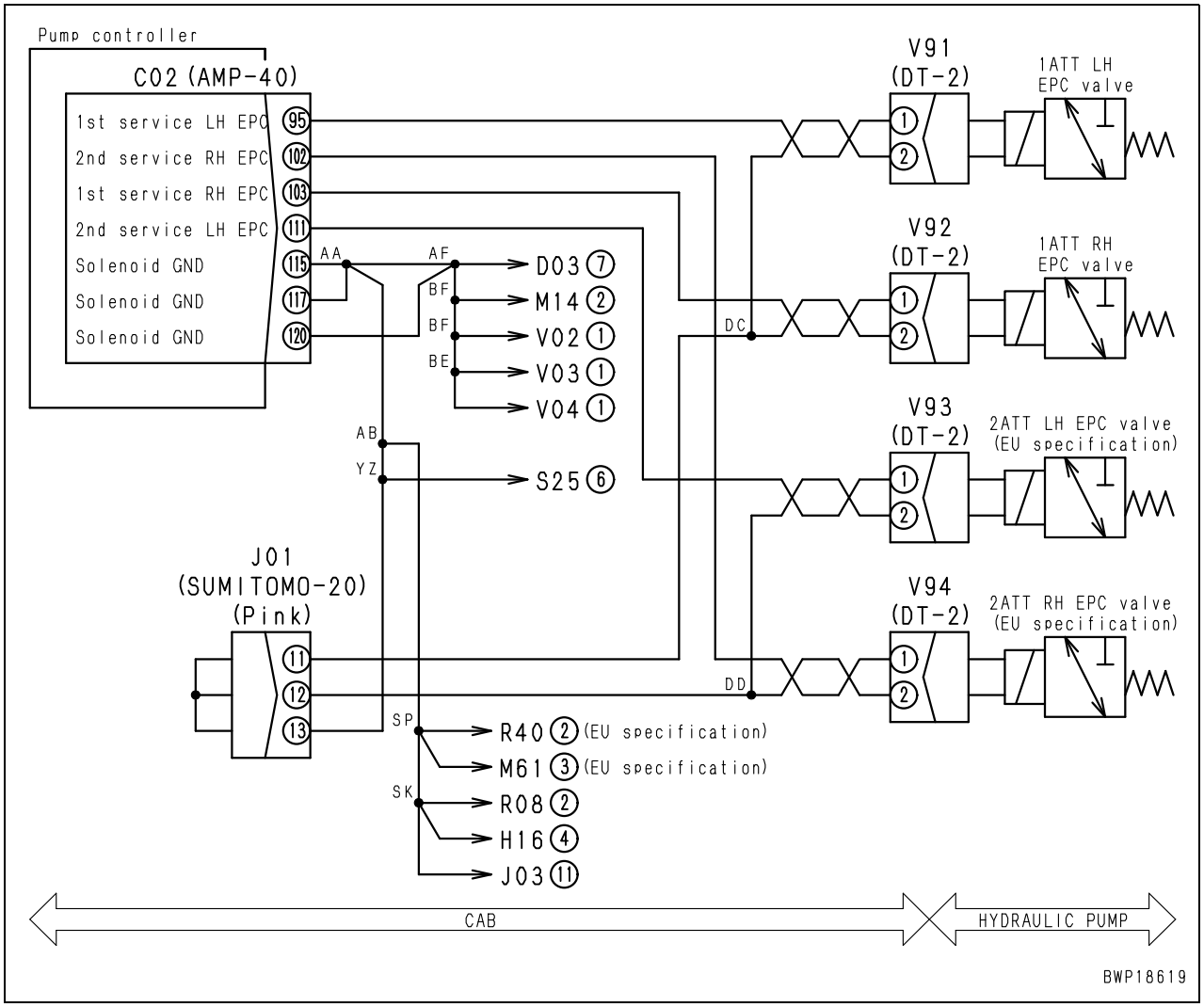
Machine model	Serial number
PC88MR-8	5001 and up

40 Troubleshooting
340 Troubleshooting by failure code, Part 4

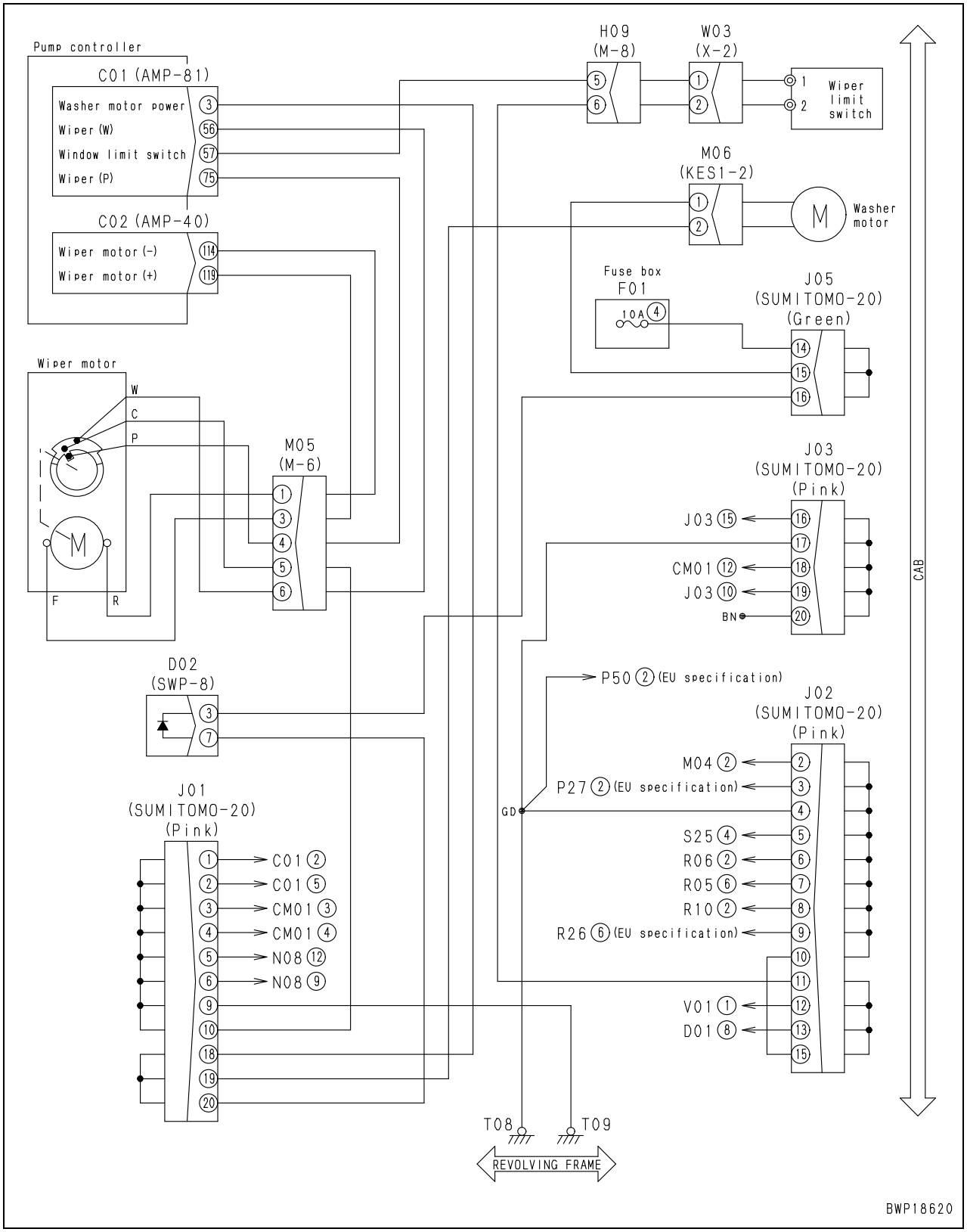
Related circuit diagram



Related circuit diagram



Related circuit diagram

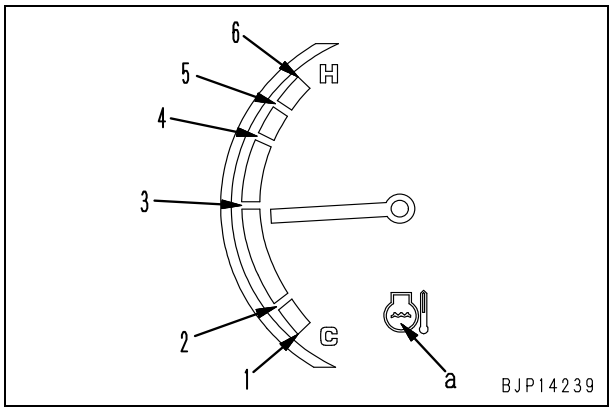


E-4 Automatic warm-up system does not operate (in cold season)

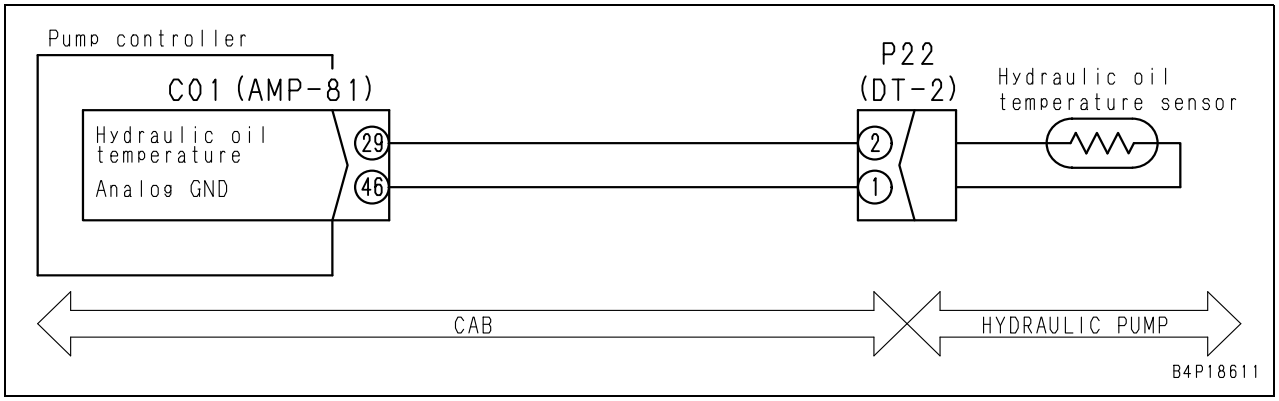
Trouble	• Automatic warm-up system does not operate (in cold season).
Related information	• When engine coolant temperature is below 30°C, automatic warm-up system raises engine speed to 1,300 rpm. • If fuel control dial is opened more than 70% for 3 seconds when starting switch is turned ON or after engine is started, automatic warm-up system is turned OFF. (Automatic warm-up system stops automatically after operating for 10 minutes.) • If engine coolant temperature is below 10°C, turbocharger protection function operates to keep the engine speed at low idle.

<table>
<tr><td rowspan="6">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Defective engine coolant temperature signal system</td><td colspan="3">★ Turn starting switch ON or start engine and carry out trouble-shooting.</td></tr>
<tr><td>Monitoring code</td><td>Engine coolant temperature</td><td>Coolant temperature level</td></tr>
<tr><td rowspan="6">04107
Engine coolant temperature</td><td>105°C</td><td>6 (a: Red)</td></tr>
<tr><td>102°C</td><td>5 (a: Red)</td></tr>
<tr><td>100°C</td><td>4 (a: Blue)</td></tr>
<tr><td>85°C</td><td>3 (a: Blue)</td></tr>
<tr><td>60°C</td><td>2 (a: Blue)</td></tr>
<tr><td>30°C</td><td>1 (a: White)</td></tr>
<tr><td></td><td></td><td colspan="3">If level of coolant temperature gauge is different from actual coolant temperature, carry out troubleshooting for “E-8 Engine coolant temperature gauge does not indicate normally”.</td></tr>
<tr><td>2</td><td>Defective engine controller</td><td colspan="3">If cause 1 is not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)</td></tr>
</table>

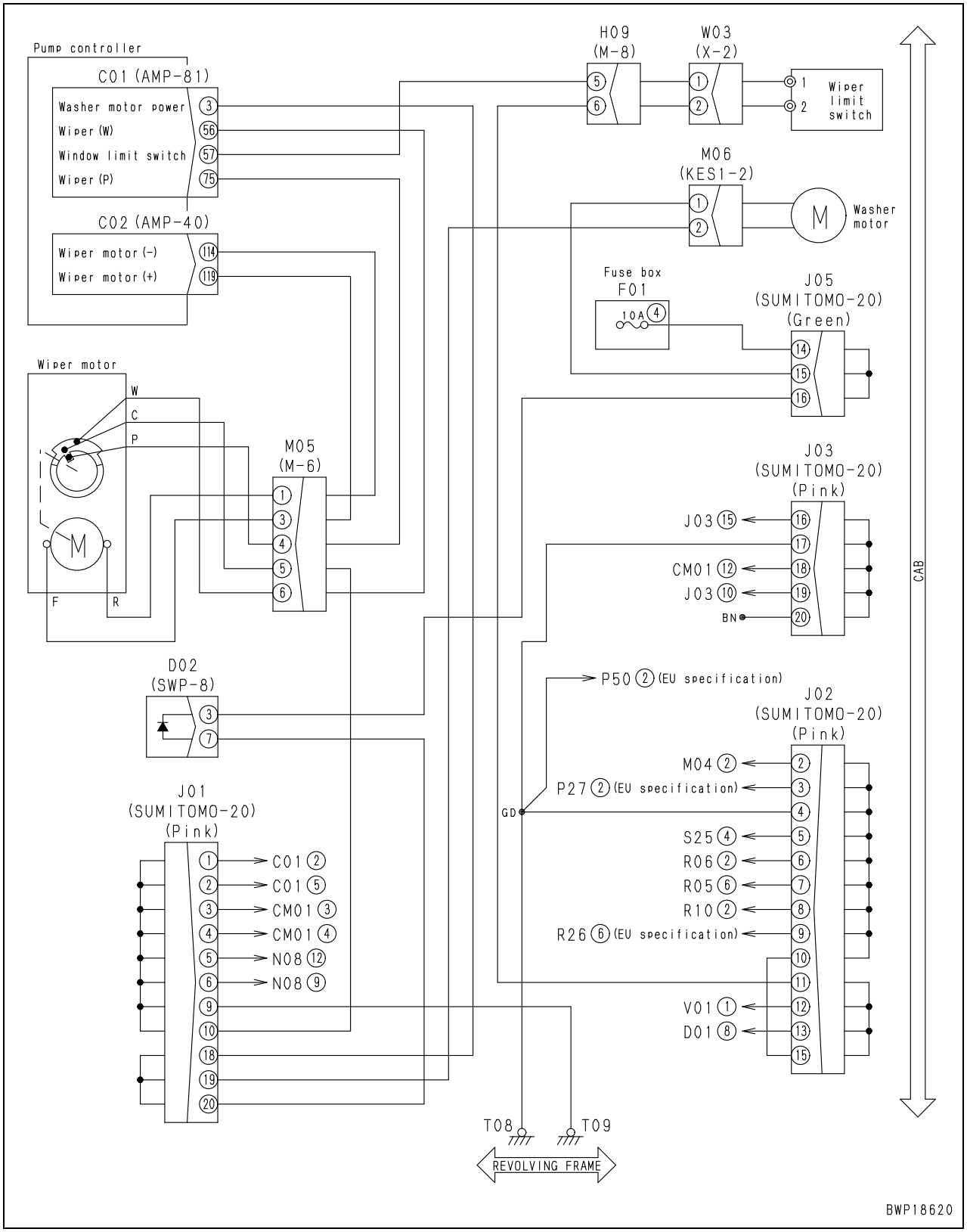
Engine coolant temperature gauge and engine coolant temperature monitor



Related circuit diagram



Related circuit diagram



Trouble	(5) Air conditioner abnormality record: Communication condition **"**CAN disconnection**"**, Communication condition **"**Abnormal**"**
Related information	• While abnormality in communication is being detected, **"**CAN disconnection**"** is displayed. • If abnormality in communication has been detected and reset, **"**Abnormality**"** is displayed. • If **"**CAN disconnection**"** is displayed as communication condition, communication cannot be carried out normally. Accordingly, condition of other items is not displayed. • Method of reproducing abnormality record: Turn starting switch ON.

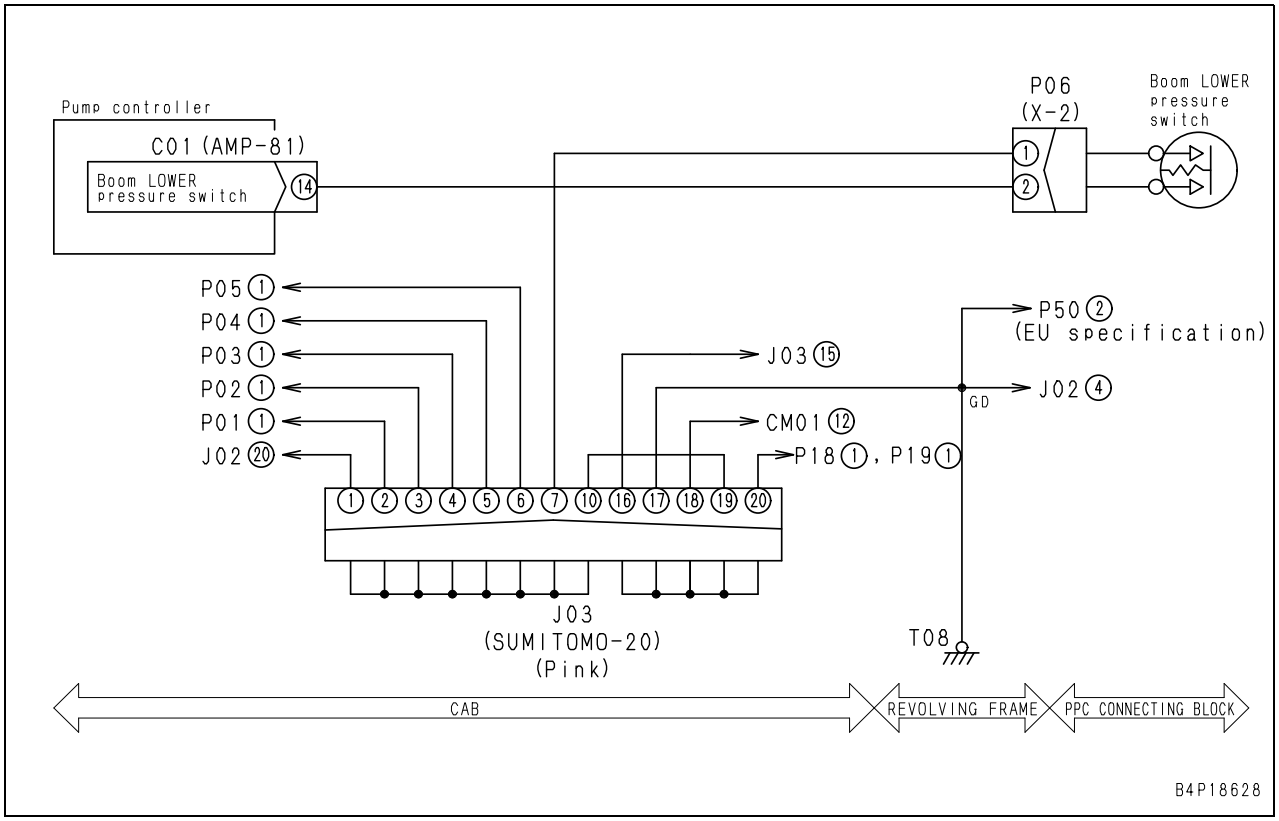
	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state					
	1	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between N10 (female) (1) – CM02 (female) (8), (9)	Resistance	Max. 1 Ω
			Wiring harness between N10 (female) (2) – CM02 (female) (10)	Resistance	Max. 1 Ω
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between N10 (male) (1) – CM02 (female) (8), (9), – C01 (female) (45), – CE02 (female) (1), – K02 (female) (A), – N08 (male) (3)	Resistance	Min. 1 MΩ
			Wiring harness between N10 (female) (2) – CM02 (female) (10), – C01 (female) (64), – CE02 (female) (21), – K02 (female) (B), – N08 (male) (10)	Resistance	Min. 1 MΩ
	3	Hot short (Short circuit with 24 V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			N10 (male) (1) – CM02 (female) (8), (9), – C01 (female) (45), – CE02 (female) (1), – K02 (female) (A), – N08 (male) (3)	Voltage	Max. 5.5 V
			Wiring harness between N10 (female) (2) – CM02 (female) (10), – C01 (female) (64), – CE02 (female) (21), – K02 (female) (B), – N08 (male) (10)	Voltage	Max. 5.5 V
	4	Defective CAN terminal resistance (Internal short circuit or disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			K02 (male)	Resistance	
			Between (A) – (B)	47 – 67 Ω	
	5	Defective air conditioner controller	If causes 1 – 4 are not detected, air conditioner controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		
	6	Defective machine monitor	If causes 1 – 5 are not detected, machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

E-23 Machine monitor cannot be set in service mode

Trouble	• Machine monitor cannot be set in service mode.
Related information	• If following switches are operated, machine monitor is set in service mode. Operation of switches: [4] + [1] → [2] → [3] (While pressing [4], press other switches in order)

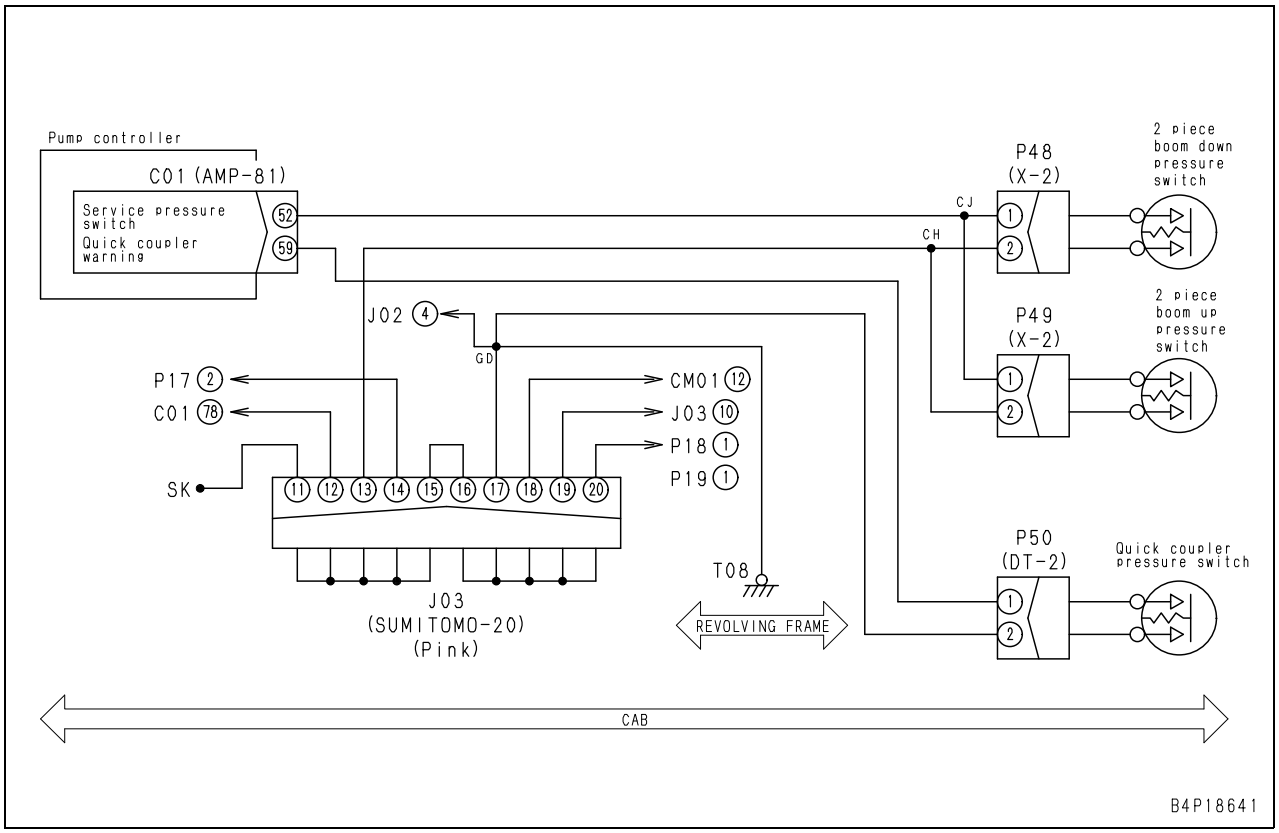
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective machine monitor	Machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Related circuit diagram



	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	7	Defective pump controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.		
			C01 (female)	Service lever	Resistance
			Between (52) – chassis ground	Neutral	Min. 1 MΩ
				RAISE, LOWER	Max. 1 Ω
			C01 (male)	Quick coupler operation switch	Resistance
			Between (59) – chassis ground	OFF	Min. 1 MΩ
				ON	Max. 1 Ω

Related circuit diagram



H-2 Engine speed sharply drops or engine stalls

Trouble	• Engine speed sharply drops or engine stalls.
Related information	• Conduct the troubleshooting in working mode P. • Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

<table>
<tr><td rowspan="11">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Defective adjustment or operation of main relief valve</td><td colspan="4">★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.</td></tr>
<tr><td colspan="2">Control lever</td><td colspan="2">Main relief pressure</td></tr>
<tr><td colspan="2">Arm relieved in IN direction</td><td colspan="2">26.5 ± 1.5 MPa
{270 ± 15 kg/cm²}</td></tr>
<tr><td colspan="4">If the oil pressure cannot be set normally by adjustment, the main relief valve may be malfunction or may have an internal defect. Check the main relief valve directly.</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Defective adjustment or operation of PC valve</td><td colspan="4">★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.</td></tr>
<tr><td>Measured oil pressure</td><td>Measurement conditions</td><td colspan="2">Oil pressure ratio</td></tr>
<tr><td>Pump discharge pressure</td><td rowspan="2">Arm: Relieved in IN direction</td><td colspan="2">1</td></tr>
<tr><td>PC valve output pressure</td><td colspan="2">Approx. 0.23
(Approx. 1/4)</td></tr>
<tr><td colspan="4">If the oil pressure cannot be set normally by adjustment, the PC valve may be malfunction or may have an internal defect. Check the PC valve directly.</td></tr>
<tr><td rowspan="4">3</td><td rowspan="4">Defective adjustment or operation of LS valve</td><td rowspan="2">Measured oil pressure</td><td>Oil pressure ratio</td><td colspan="2">LS differential pressure</td></tr>
<tr><td>All levers in NEUTRAL</td><td colspan="2">Bucket curled
(Lever at stroke end)</td></tr>
<tr><td>Pump discharge pressure</td><td rowspan="2">Almost same pressure</td><td colspan="2" rowspan="2">Approx. 2.11 MPa
{21.5 kg/cm²}</td></tr>
<tr><td>LS valve output pressure</td></tr>
<tr><td colspan="4">If the oil pressure cannot be set normally by adjustment, the LS valve may be malfunction or may have an internal defect. Check the LS valve directly.</td></tr>
<tr><td>4</td><td>Orifice or filter in servo equipment clogged</td><td colspan="4">The orifice or filter in the pump servo equipment is suspected of clogging. Check the equipment itself.</td></tr>
<tr><td>5</td><td>Malfunction of servo piston</td><td colspan="4">The servo piston may have malfunction. Check it directly.</td></tr>
</table>

Trouble	• Hydraulic drift of work equipment is large.	(4) Hydraulic drift of blade is large.
Related information	• Set the working mode to P mode and carry out the troubleshooting. • Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.	

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Defective blade cylinder	★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.	
			Blade cylinder	Leakage through cylinder
			Blade DOWN relief	7.5 cc/min
	2	Defective seal of blade control valve (spool)	Blade control valve spool seal may be defective. Check it directly.	
	3	Defective blade control valve (suction valve and safety valve) seals	Suction valve seal and safety valve seal of blade control valve may be defective. Check them directly.	
	4	Defective seals of centralized safety and suction valves	Centralized safety and suction valves of control valve may have defective seals. Check them directly.	

H-24 Excessive overrun when stopping swing

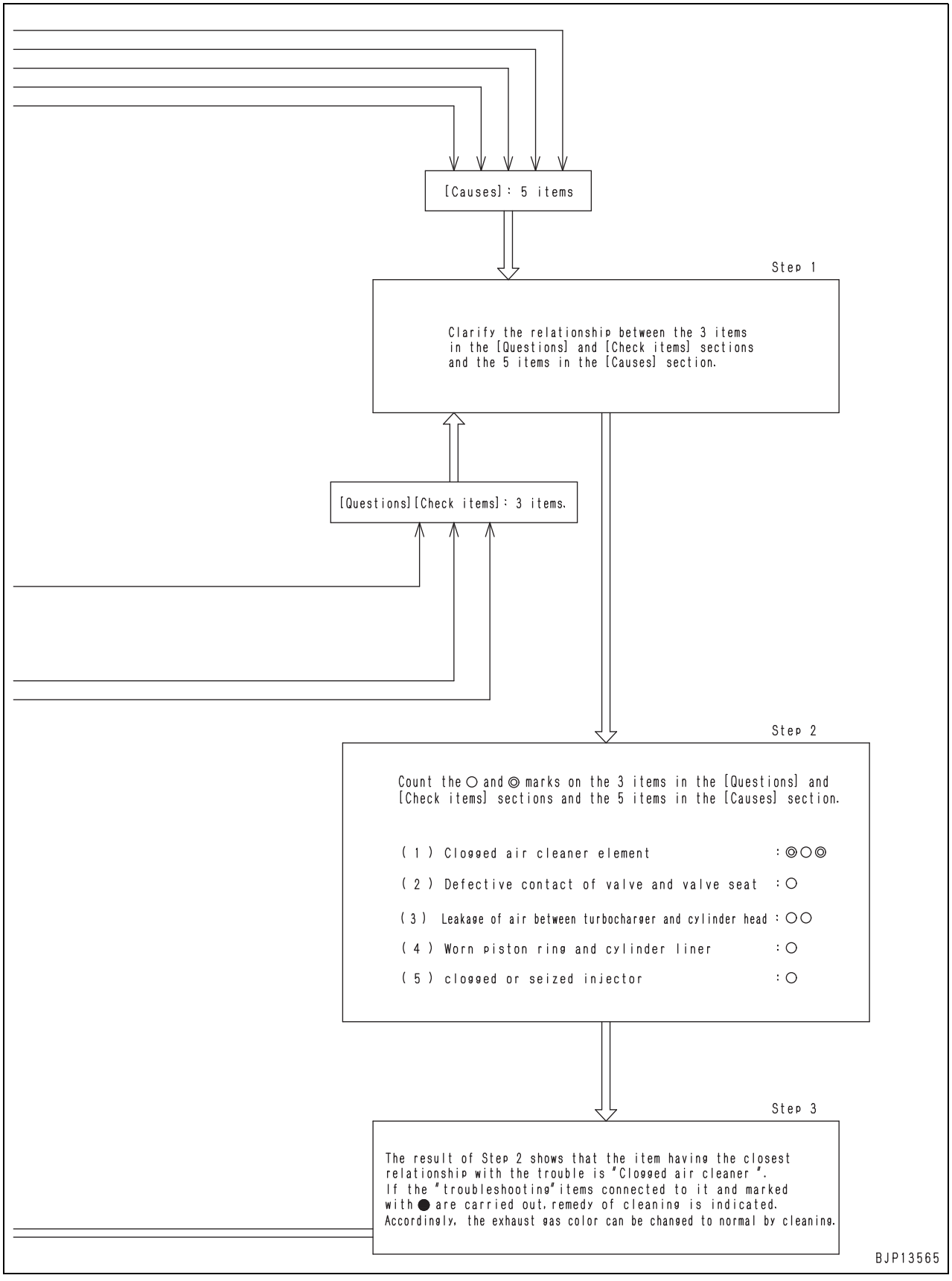
Trouble	• Excessive overrun when stopping swing.	(1) Overrun of upper structure is large in both directions.
Related information	• Conduct the troubleshooting in working mode P. • Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Air in swing PPC circuit and swing motor	Air may be in swing PPC circuit and swing motor. Bleed air.		
	2	Clogging of swing PPC circuit orifice or slow return valve	Swing PPC circuit orifice or slow return valve may be clogged. Check them directly.		
	3	Defective swing motor	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.		
			Left work equipment control lever	Leakage from swing motor	
			Swing circuit relieved	Max. 7 ℓ/min	

Trouble	• Excessive overrun when stopping swing. (2) Overrun of upper structure is large in only one direction.
Related information	• Conduct the troubleshooting in working mode P. • Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Air in swing PPC circuit and swing motor	Air may be in swing PPC circuit and swing motor. Bleed air.		
	2	Clogging of swing PPC circuit orifice or slow return valve	Swing PPC circuit orifice or slow return valve may be clogged. Check them directly.		
	3	Malfunction of swing PPC valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.		
			Left work equipment control lever	PPC valve output pressure	
			In NEUTRAL	0 MPa {0 kg/cm²}	
			Operated for swing	Min. 2.65 MPa {Min. 27 kg/cm²}	
	4	Malfunction of swing control valve (spool)	The spool of the swing control valve may have a malfunction. Check it directly.		
	5	Defective adjustment or malfunction of swing motor (safety valve)	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.		
			Swing lock switch	Left work equipment control lever	Swing relief pressure (Pump pressure)
			ON	Swing circuits relieved (separately on both sides)	20.5 ± 1.5 MPa {210 ± 15 kg/cm²}
	6	Defective sealing of swing motor (suction valve)	Sealing of the suction valve of the swing motor may be defective. Check it directly.		
	7	Malfunction of swing motor (reverse prevention valve)	Sealing of the reverse prevention valve of the swing motor may be defective. Check it directly.		

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



S-8 Oil consumption is excessive (or exhaust smoke is blue)

General causes why oil consumption is excessive

- Abnormal consumption of oil
- Long-time operation of engine at low idle or high idle (Do not run engine at idle for more than 20 minutes continuously)
- External leakage of oil
- Wear of parts in lubrication system

			Causes														
					Turbocharger												
			Dust sucked in from intake system	Worn, damaged valve (stem, guide, seal)	Worn seal at turbine end	Worn seal at blower end	Clogged breather, breather hose	Broken piston ring	Worn piston ring, cylinder	Worn, damaged rear oil seal	Broken oil cooler	Oil leakage from oil cooler	Oil leakage from oil filter	Oil leakage from oil piping	Oil leakage from oil drain plug	Oil leakage from oil pan, cylinder head, etc.
Questions	Confirm recent repair history																
	Degree of use of machine	Operated for long period		△	△	△			△								
	Oil consumption suddenly increased							◎			○						
	Oil must be added more frequently								◎		○						
	Oil becomes contaminated quickly						○	○	◎								
Check items	Outside of engine is dirty with oil											◎	◎	◎	◎	◎
	There are loose piping clamps in intake system		◎														
	Inside of turbocharger intake outlet pipe is dirty with oil					◎											
	Inside of turbocharger exhaust outlet pipe is dirty with oil			○	◎												
	There is oil in coolant										◎						
	Oil level in clutch chamber or damper chamber is high									◎							
	Exhaust smoke is blue under light load							◎	◎								
	Amount of blow-by gas	Excessive		○		○		◎	◎								
		None					◎										
Troubleshooting	When intake manifold is removed, dust is found inside		●														
	When intake manifold is removed, inside is found to be dirty abnormally			●													
	Excessive play of turbocharger shaft				●	●											
	Check breather and breather hose directly						●										
	When compression pressure is measured, it is found to be low							●	●								
	Inspect rear oil seal directly									●							
	Pressure-tightness test of oil cooler shows there is leakage										●	●					
	There is external leakage of oil from engine												●	●	●	●	
		Remedy	Correct	Replace	Replace	Replace	Clean	Replace	Replace	Replace	Replace	Replace	Correct	Correct	Correct	Correct	

HYDRAULIC EXCAVATOR

PC88MR-8

Machine model	Serial number
PC88MR-8	5001 and up

50 Disassembly and assembly

100 General information on disassembly and assembly

Component	Sym-bol		Part No.	Part name	Necessity	Q'ty	New/remodel	Sketch	Nature of work, remarks	
Disassembly and assembly of hydraulic cylinder assembly	U	7	790-201-1500	Push tool kit	●	1			Boom, blade	Press fitting of cylinder head dust seal
			790-201-1610	• Plate		1				
			790-101-5021	• Grip		1				
			01010-50816	• Bolt		1				
			790-201-1500	Push tool kit	●	1			Arm, boom swing	
			790-201-1590	• Plate		1				
			790-101-5021	• Grip		1				
			01010-50816	• Bolt		1				
			790-201-1500	Push tool kit	●	1			Bucket	
			790-201-1580	• Plate		1				
			790-101-5021	• Grip		1				
			01010-50816	• Bolt		1				
Removal and installation of operator's cab glass (stuck glass)	X	1	793-498-1210	Lifter (Suction cup)	■	2			Removal and installation of operator's cab glass (stuck glass)	
		2	20Y-54-13180	Adapter	■	2				

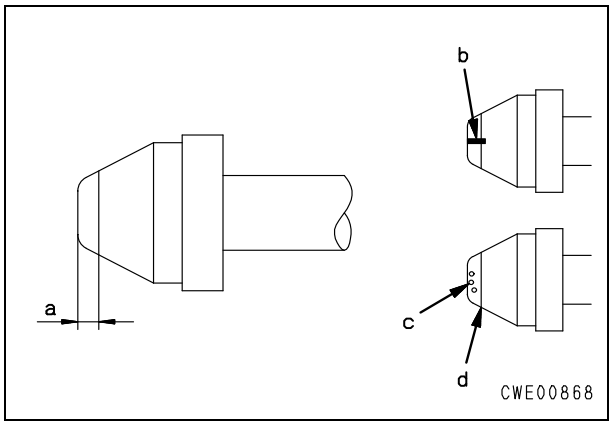
[*4]

⚠ **Never bend a high-pressure pipe for the convenience sake.**

⚠ **Be sure to install the boot to the sleeve nut after installing the high-pressure pipe.**

★ Before installing a high-pressure pipe, confirm the following points. If any abnormality was found, replace it with new one. Otherwise, leakage of fuel can result.

- No visible striations (b) or patchy dents (c) in the taper seal portion of the connection ((a) portion: area 2 mm inside the tip).
- No deformation in portion (d) (at the end of the taper seal portion: 2 mm inside the tip).



Sleeve nut (22) on common rail side:
25.5 – 29.4 Nm {2.6 – 3.0 kgm}

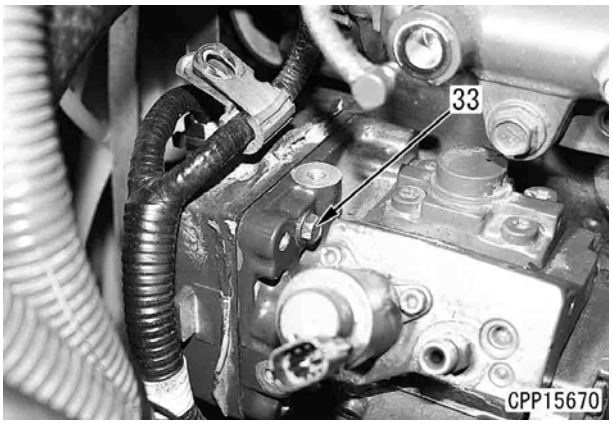
Fuel supply pump side (23):
18 – 23 Nm {1.9 – 2.3 kgm}

[*5]

Joint bolts (28) and (29):
24.5 – 34.3 Nm {2.5 – 3.5 kgm}

[*6]

- Temporarily fix the fuel supply pump with temporary fixing bolt (33) and then tighten the 4 mounting bolts from the gear case side.



[*7]

Fuel tube joint bolt (35):
19.6 – 29.4 Nm {2.0 – 3.0 kgm}

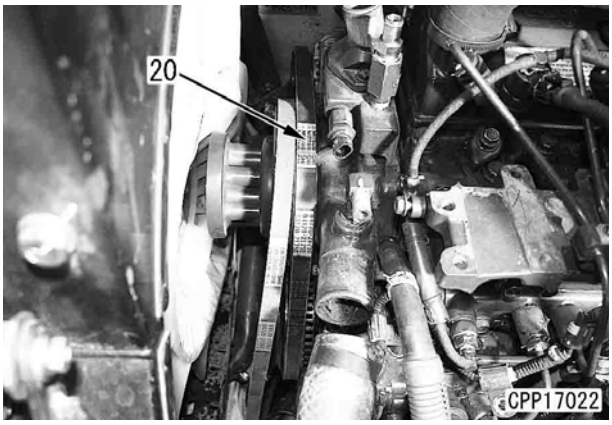
[*8]

Pump gear mounting nut (36):
65 – 75 Nm {6.6 – 7.6 kgm}

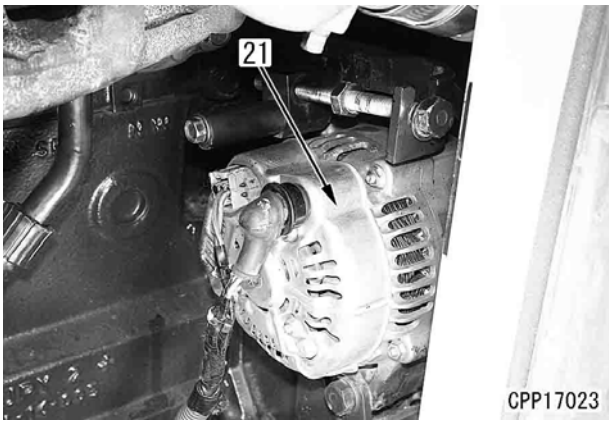
[*9]

- When installing the pump holder, always install the temporary fixing bolt.

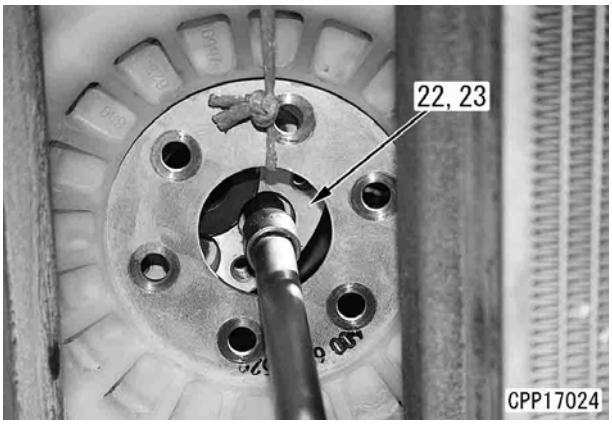
4) Loosen alternator mounting bolts and remove fan belt (20). [*4]



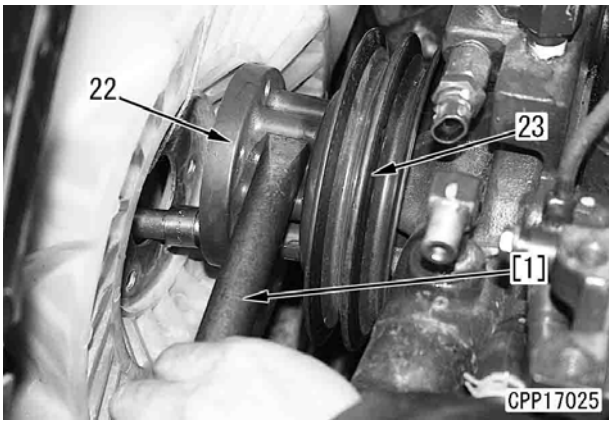
★ Loosen the mounting bolts of alternator (21) through the hole of the partition cover removed in step 2).



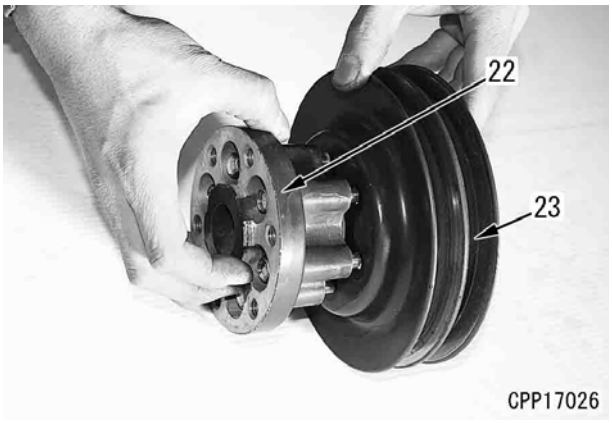
5) Remove the 6 mounting bolts through the hole of the slung fan and remove spacer (22) and pulley (23) from the water pump. [*5]



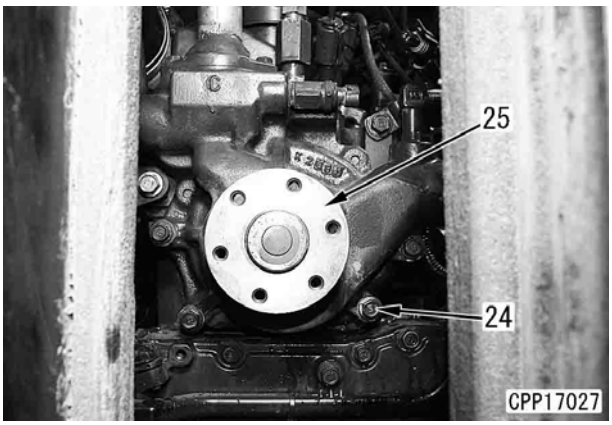
1] Lock spacer (22) with bar [1] and loosen the mounting bolts. [*6]



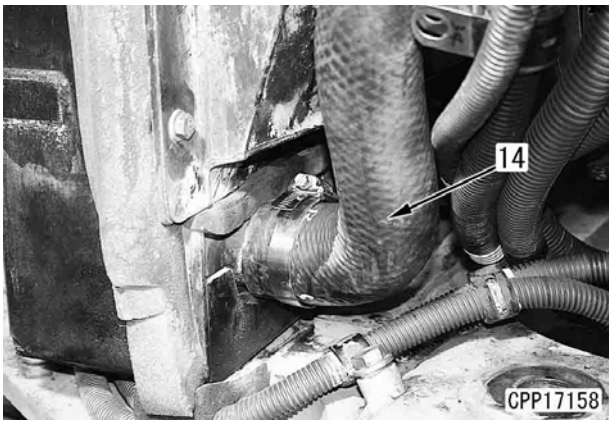
2] Remove the mounting bolts, taking care that spacer (22) and pulley (23) will not fall.



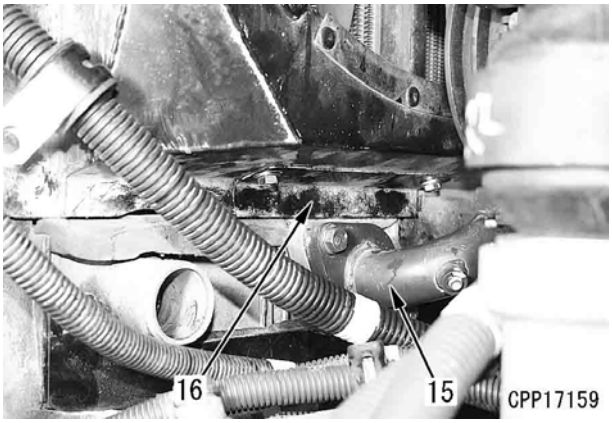
6) Remove 4 mounting bolts (24) and water pump assembly (25). [*7]



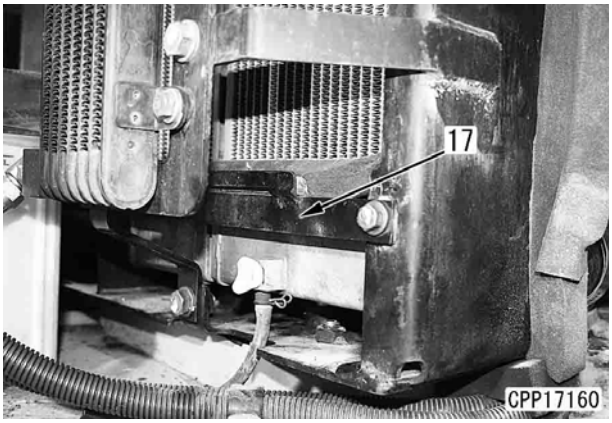
10. Disconnect radiator lower hose (14). [*3]



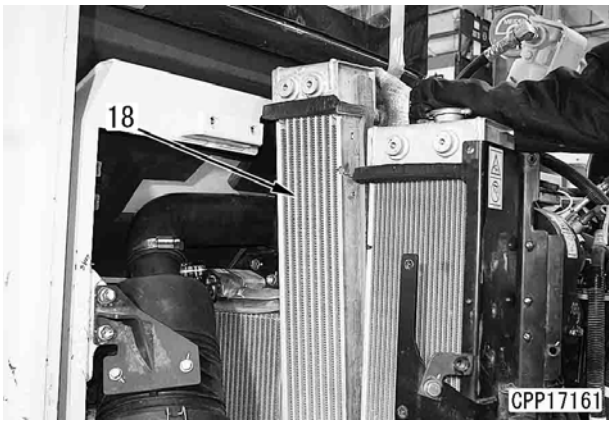
11. Disconnect aftercooler lower tube (15) and remove cover (16).



12. Remove net rail (17).



13. Lift up and remove aftercooler assembly (18).

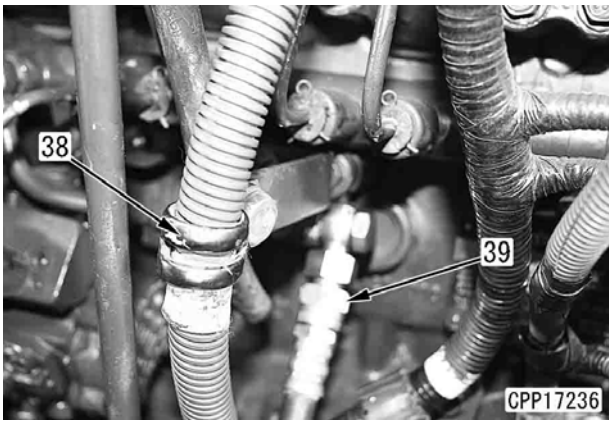


14. While moving radiator assembly (19) toward the removed aftercooler, lift up and remove it.

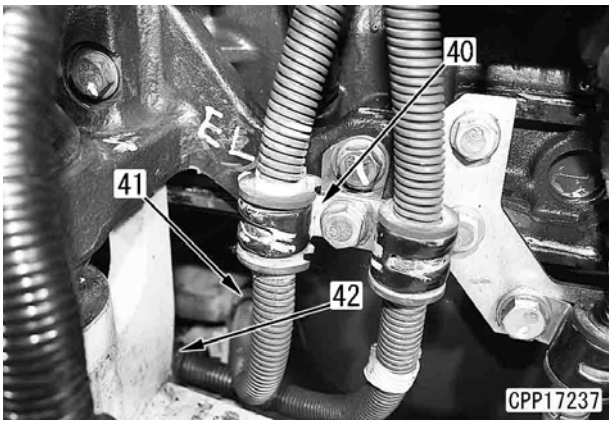
18. Disconnect fuel hoses (35) and (36) from fuel main filter (37). [*7]

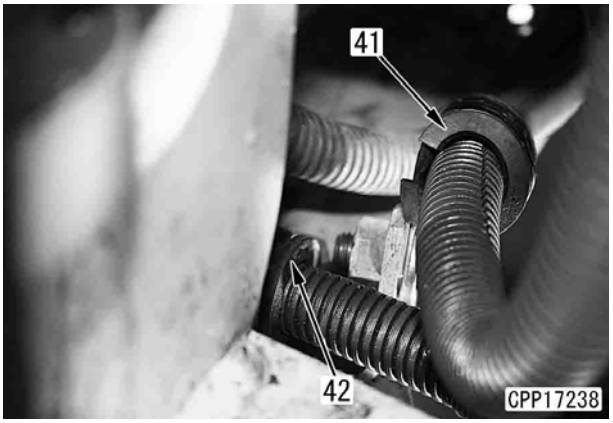
19. Remove clamp (38).

20. Disconnect hose (39).



21. Remove 3 clamps (40), (41) and (42).

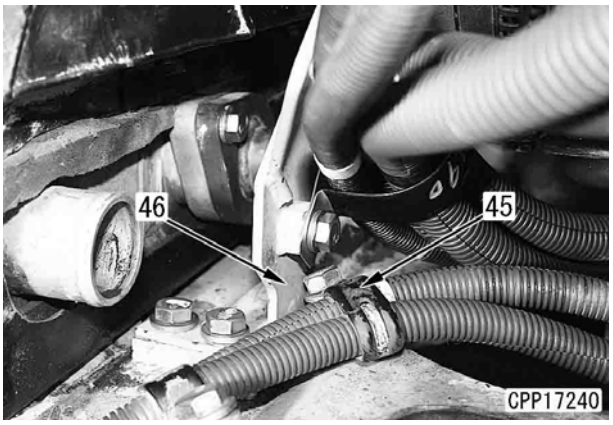




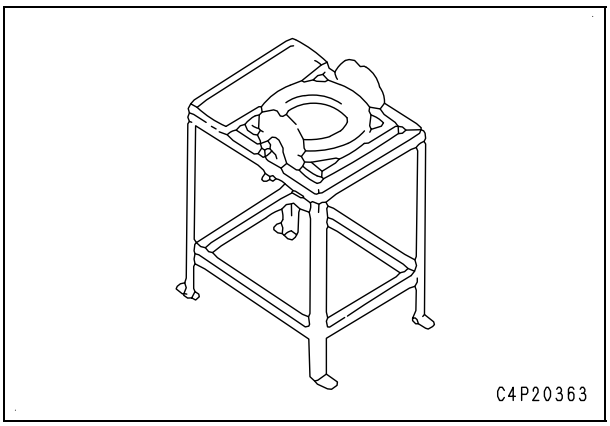
22. Disconnect air conditioner heater return hose (43).

23. Disconnect radiator lower hose (44). [*8]

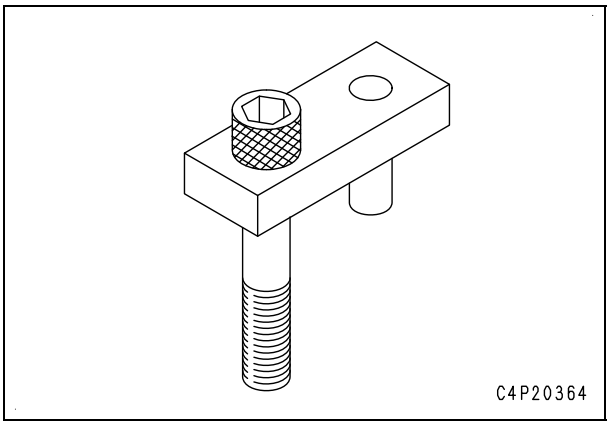
24. Remove clamp (45) and bracket (46).



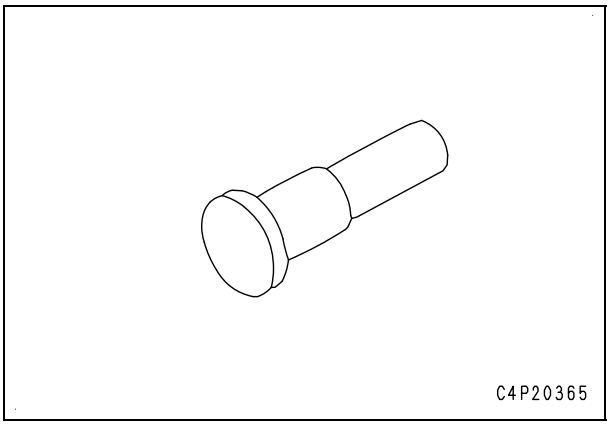
4) Tools to be manufactured
Work stand [1]
- Used to fix the travel motor for disassembly and assembly.



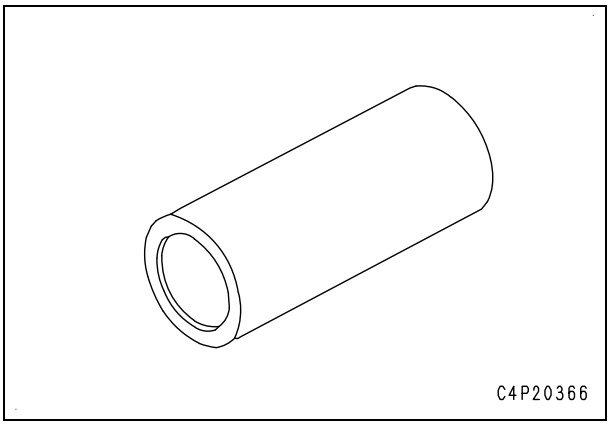
Jig [2]
- Used to fix spindle (2) and hub (1) when they are connected.



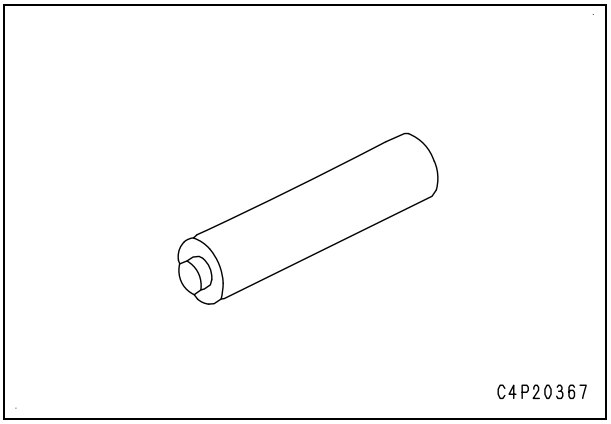
No. 1 holder [3]
- Used to install spring (114), washer (110), and snap ring (145) to cylinder block (104).
- Used to remove spring (114) from cylinder block (104).



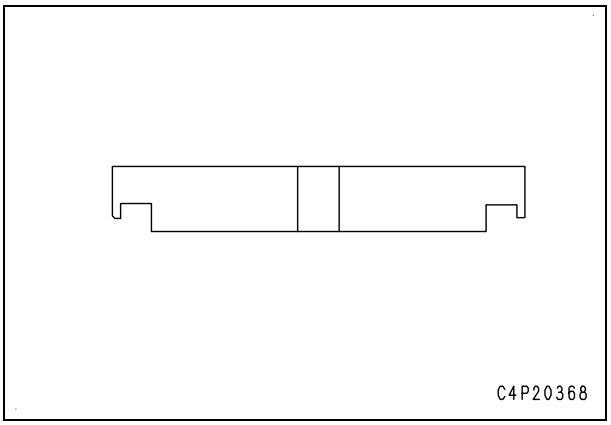
No. 2 holder [4]
- Used to remove ball bearing (149) from shaft (102).



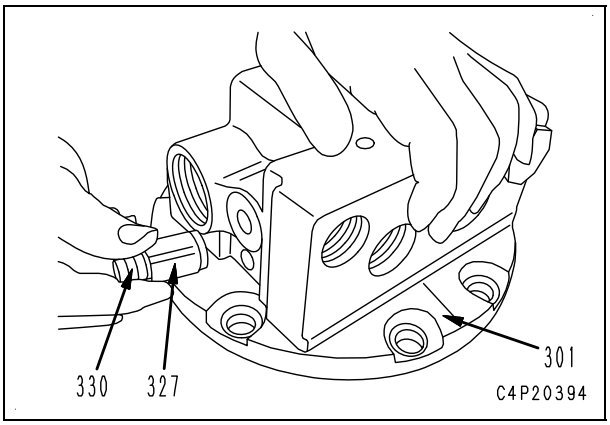
Push tool [5]
- Used to press fit oil seal (132) to spindle (2).



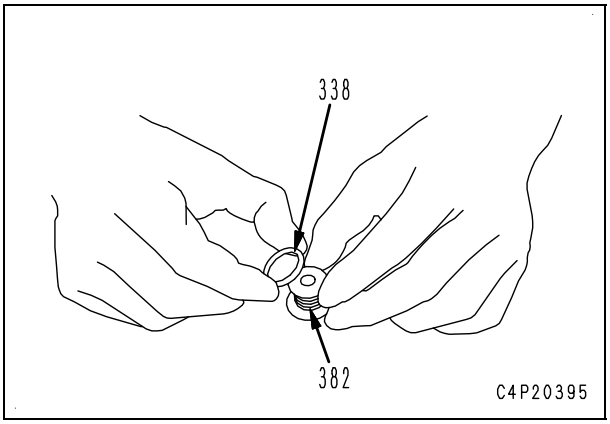
Push tool [6]
- Used to press fit ball bearing (24) to hub (1).



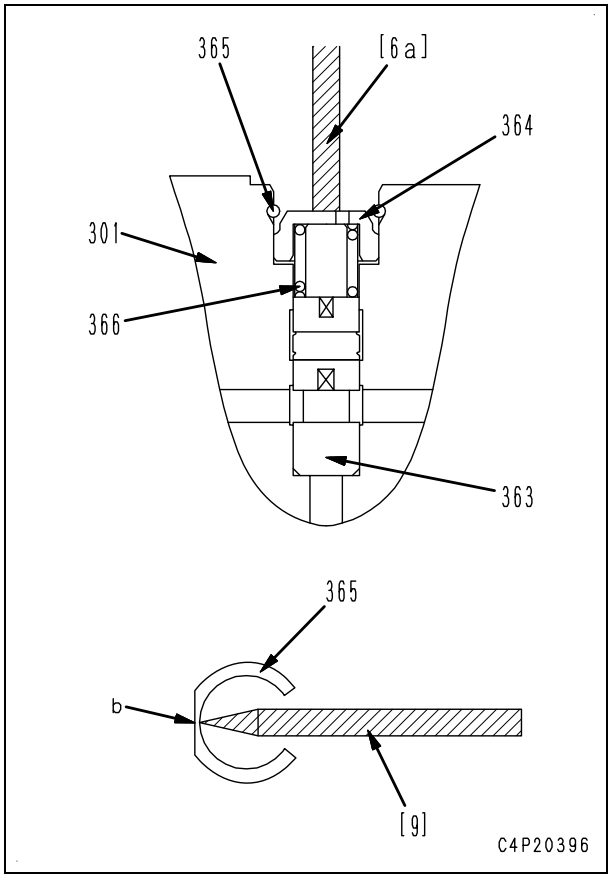
6) Remove two springs (330) and two valves (327) from rear flange (301).



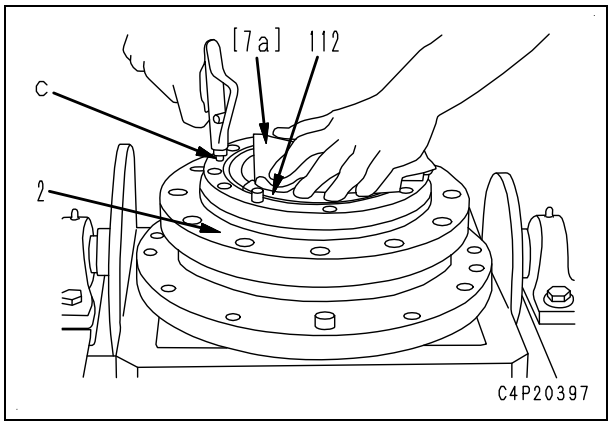
7) Remove O-ring (338) from plug (382).
   ★ Do not reuse removed O-ring (338).



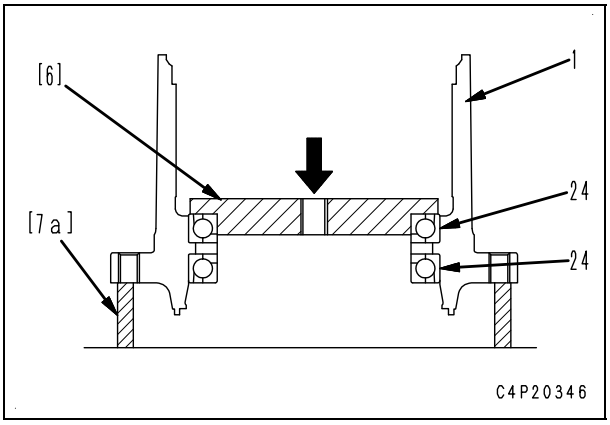
11. **Removal of pilot valve**
   1) Use steel bar [6a] to press stopper (364).
   2) Use pin punch [9] under the above condition to press notch (**b**) of ring (365).
      ★ Ring (365) is deformed by this work and it can be removed.
   3) Remove ring (365) from rear flange (301).
      ★ Do not reuse ring (365).
      ★ Remove ring (365) only when replacing valve (363).
      ★ If ring 365 is removed, the hole is scratched. After disassembling, remove the scratches on the hole wall.
      ★ If valve (353) does not come out when the hole is faced straight down, blow compressed air through the 2nd travel speed selection port to push out the valve.
      ⚠ **If compressed air is blown suddenly, the part will jump out, and that is dangerous. Accordingly, blow compressed air gradually.**



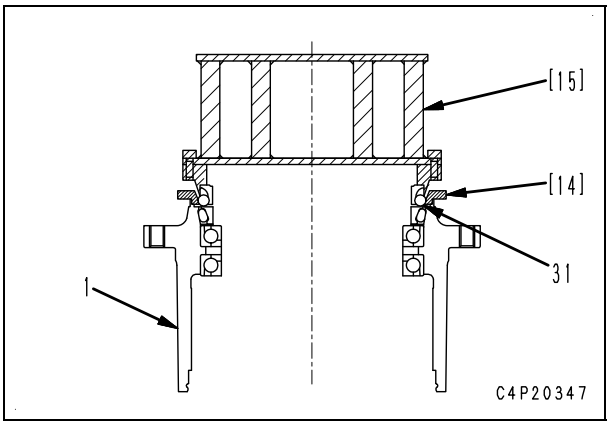
12. **Disassembly of parking brake**
   1) Supply compressed air through parking brake oil passage (**c**) of spindle (2) to take out piston (112).
      ⚠ **If compressed air is blown suddenly, piston (112) jumps out, and that is dangerous. Accordingly, blow compressed air gradually. Place protective cover [7a] for safety in advance.**
   2) Remove O-rings (135) and (139) from piston (112).
      ★ Do not reuse removed piston rings (135) and (139).



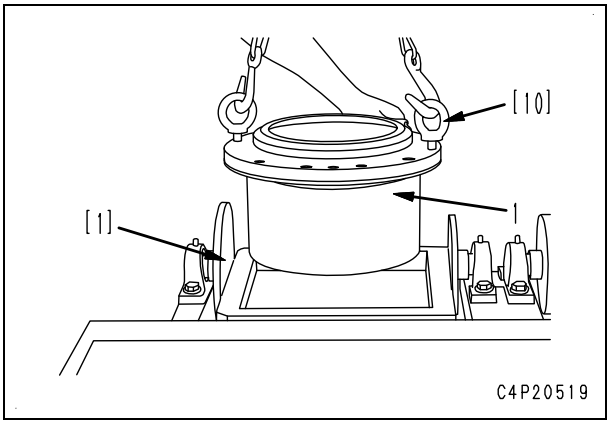
1. **Assembly of hub**
   1) Set hub (1) to cylinder [7a] on the press stand.
   2) Install ball bearing (24) to hub (1) and press fit it by using push tool [6].
   3) Reverse hub (1) and install ball bearing (24) on the opposite side similarly.
      ★ When installing ball bearing (24), check its direction.



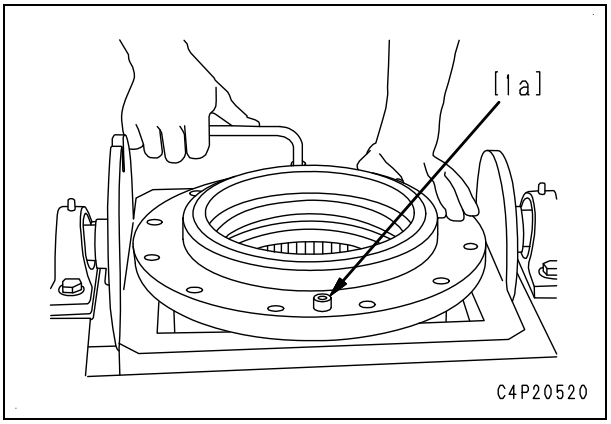
   4) Apply grease (G2-LI) to the O-ring of floating seal (31) and install it to hub (1).
      ★ Remove the O-ring and apply grease thinly all over its surfaces.
   5) Set No. 1 mounting jig [14] and No. 2 mounting jig [15] to hub (1) in order and push in No. 2 mounting jig [15] until it touches No. 1 mounting jig [14].
      ★ Remove No. 1 mounting jig [14] and No. 2 mounting jig [15].
      ★ Check that the parallelism between the end face of hub (1) and the sealing face of floating seal (31) is 1 mm or below.



   6) Install two eyebolts [10] to the mounting bolt holes of hub (1).
      ★ Install two eyebolts [10] to symmetrical positions.
   7) Sling hub (1) and set it to work stand [1].
      Hub (1): **25 kg**

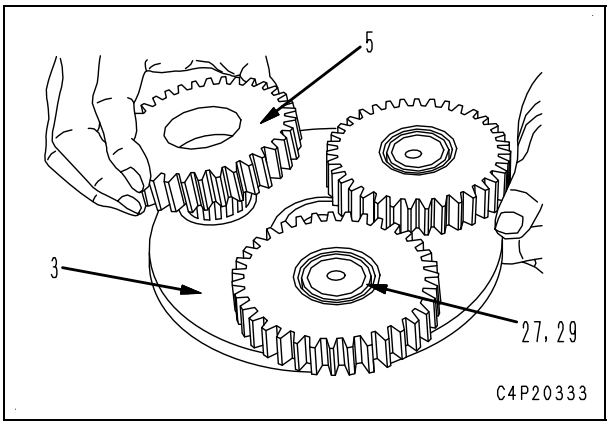


   8) Install two hexagonal socket head bolts [1a] to symmetrical positions.
      ⚠ **Securely tighten two hexagonal socket head bolts [1a] (to prevent the travel motor assembly from falling off the work stand when it is reversed).**

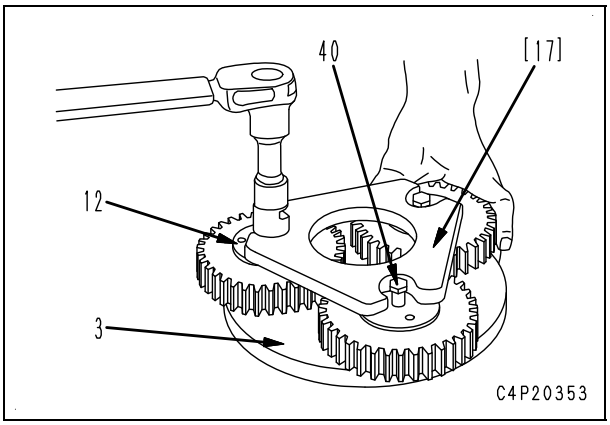


2. **Assembly of spindle assembly**
   1) Apply grease (G2-LI) to the O-ring of floating seal (31) and install it to spindle (2).
      ★ Remove the O-ring and apply grease thinly all over its surface.
   2) Set No. 3 mounting jig [16] and No. 2 mounting jig [15] to spindle (2) in order and push in No. 2 mounting jig [15] until it touches No. 3 mounting jig [16].
      ★ Remove No. 3 mounting jig [16] and No. 2 mounting jig [15].
      ★ Check that the parallelism between the end face of spindle (2) and the sealing face of floating seal (31) is 1 mm or below.

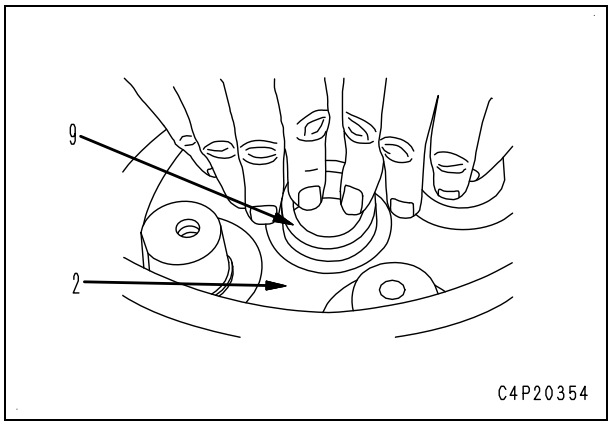
3) Install three inner bearings (29), three needle bearing cages (27), and three No. 1 planetary gears (5) to carrier (3) in order.



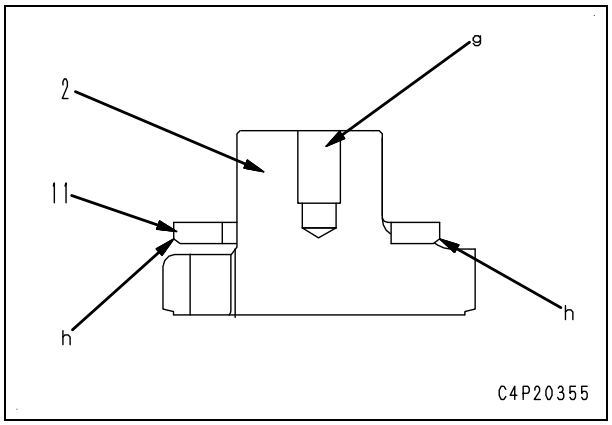
4) Set jig [17] to carrier (3) and install three No. 1 thrust washers (12).
5) Tighten three bolts (40).
   Bolt (40):
   33.3 ± 4.9 Nm {3.4 ± 0.5 kgm}
   ★ When not using jig [17] to position No. 1 thrust washers (12), take care that No. 1 thrust washers (12) are not dragged by bolts (40).
   ★ After tightening bolts (40), remove positioning jig [17].



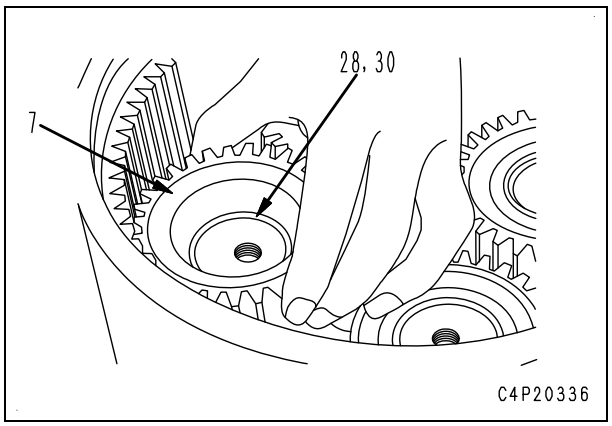
12. **Installation of No. 2 planetary gear**
1) Install No. 1 thrust collar (9) to spindle (2).



2) Install four thrust washers (11) to spindle (2).
   ★ Adhesive (LT-2) is sticking to threaded hole (**g**) at the carrier shaft end of spindle (2). Re-tap (M8, P1.25) the threaded hole and then remove dirt by blowing compressed air.
   ★ When installing No. 2 thrust washer (11), face the large chamfer (**h**) downward.



3) Install four inner bearings (30), four needle bearing cages (28), and four No. 2 planetary gears (7).
   ★ When installing No. 2 planetary gear (7), mesh it with the internal teeth of the hub.



Assembly

★ Clean all the parts and check them for dirt or damage. Coat their sliding surfaces with engine oil before installing.

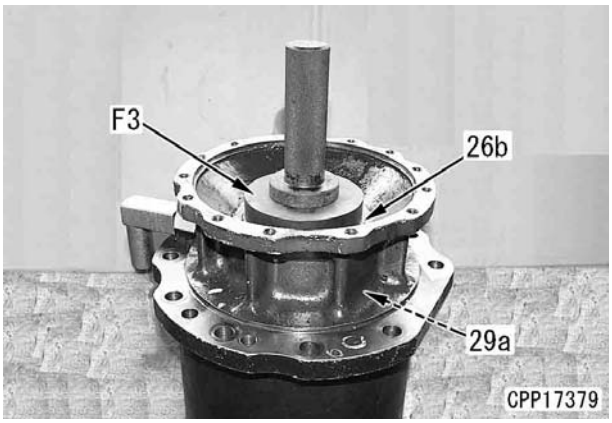
1. Bearing outer race

Using tool **F3**, press fit main bearing outer race (29b) and sub-bearing outer race (26b) to case (3).

Periphery of outer race:
Gasket sealant (LG-5)

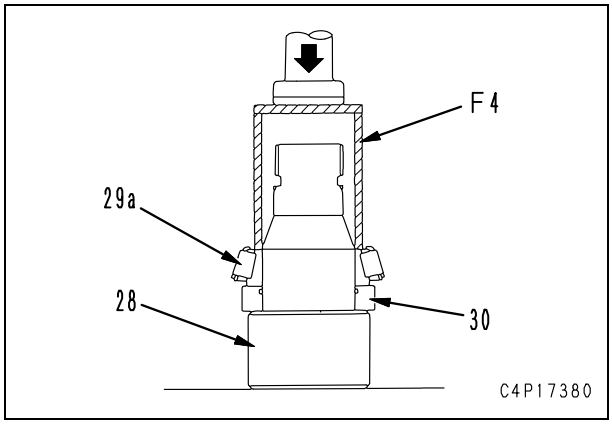
★ Press fitting force: Main bearing outer race (29b)
Max. 10.8 kN {Max. 1.1 ton}

★ Press fitting force: Sub-bearing outer race (26b)
Max. 7.7 kN {Max. 0.78 ton}

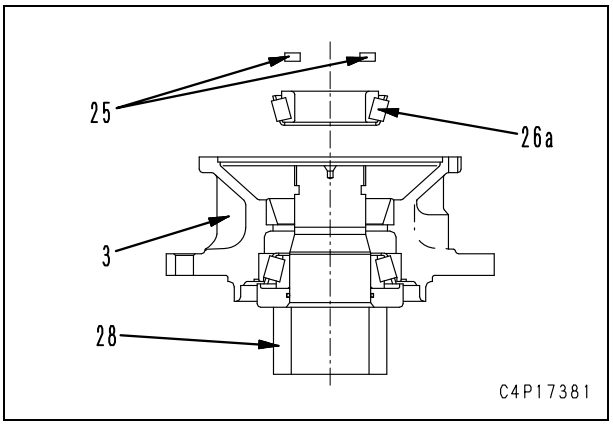


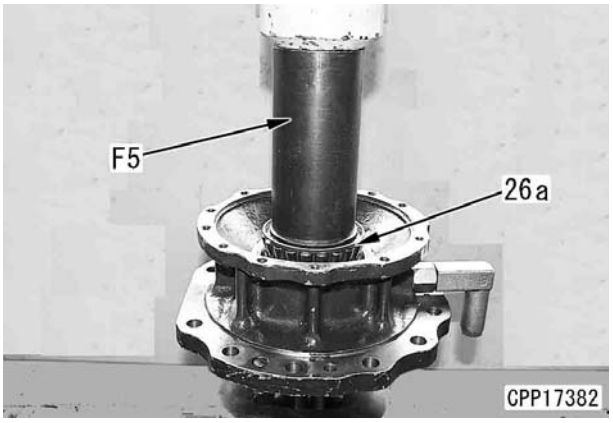
2. Shaft assembly

1) Fit the O-ring to the inside of collar (30) and install them to shaft (28).
2) Using tool **F4**, press fit main bearing inner race (29a) to shaft (28) with the press.
   ★ Press fitting force:
   11.8 – 31.4 kN {1.2 – 3.4 ton}
   ★ Take care not to damage the bearing retainer.



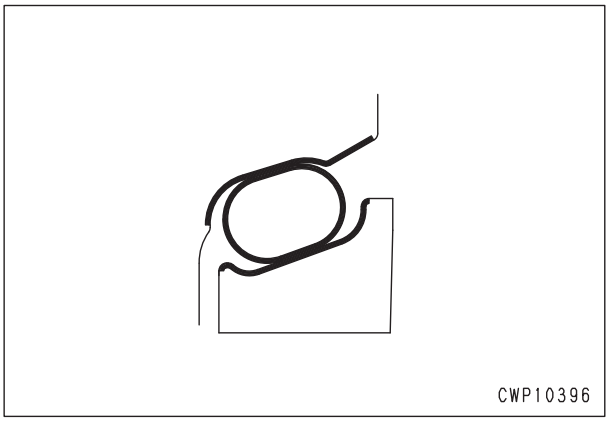
3) Set case (3) to shaft assembly (28).
4) Using tool **F5**, press fit sub-bearing inner race (26a) with the press to a position where 2-piece collar (25) can be inserted.
   ★ Limit the press fitting force of the bearing inner race to **11.8 kN {1.2 ton}**. Rotate the case 2 – 3 turns to fit the bearing rollers.
   ★ When the bearing inner race is not press fitted sufficiently and 2-piece collar (25) cannot be inserted, it may be pressed again with a force **up to 14.7 kN {1.5 ton}** after the bearing rollers are fitted.



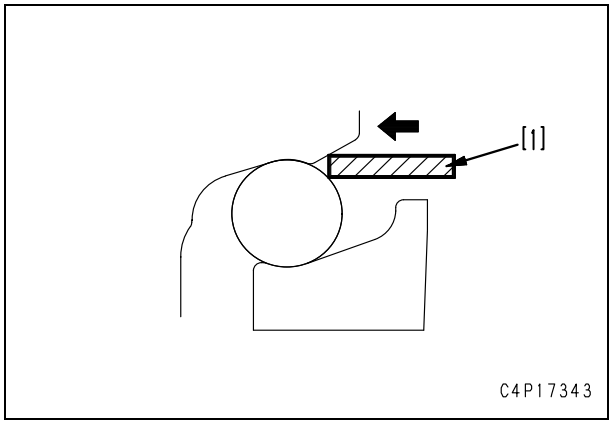


Assembly

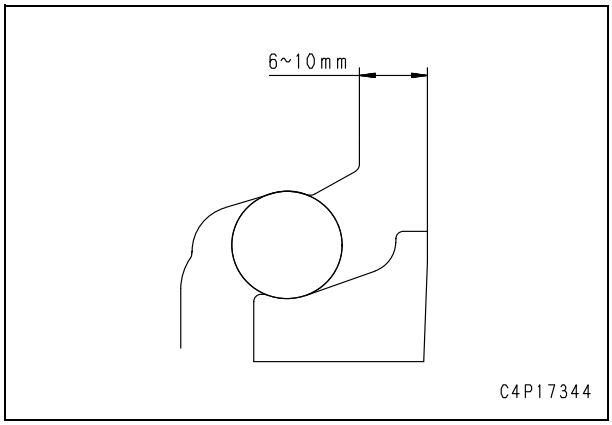
★ When installing the floating seal, thoroughly clean, degrease, and dry the parts marked with the thick lines (the load ring and faces in contact with the load ring).
Check that the contact surfaces of the floating seal are free from dirt.



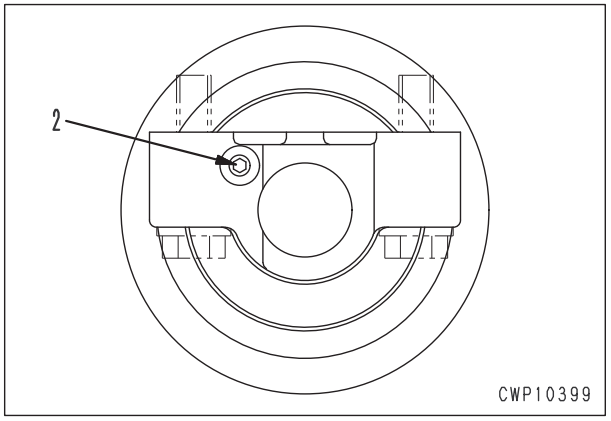
★ When inserting the floating seal assembly in the housing, use the push jig. This push jig must push the load ring.
[1]: Cylindrical push jig



★ After the floating seal is inserted, check that it does not slant more than 1 mm and its projection is as follows.

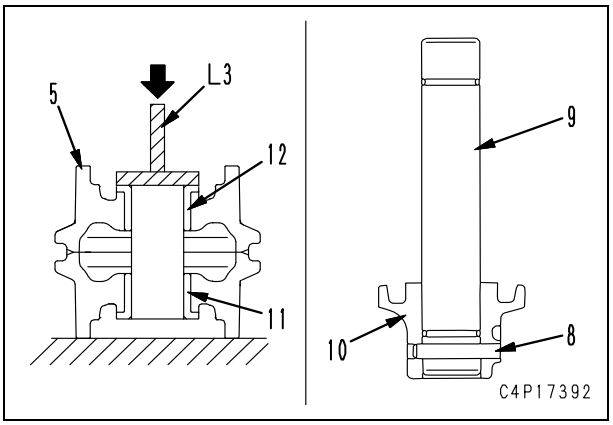


★ The metallic faces of the floating seal which are in contact with each other must be free from dirt.
★ Supply GO140 oil.
Quantity of oil: 160 – 180 cc
★ Thoroughly clean the parts to be in contact with the supplied oil. After cleaning them, the dirt remaining on these parts of 1 roller assembly must be below 25 mg and the size of the dirt must be below 0.3.
★ Set plug (2) on the outside of the machine body.



1. Using tool **L3**, press fit bushing (12) to roller (5).
   ★ Press fit bushing (11) similarly.

2. Fit the O-ring to shaft (9), then install collar (10) and pin (8) to shaft (9).



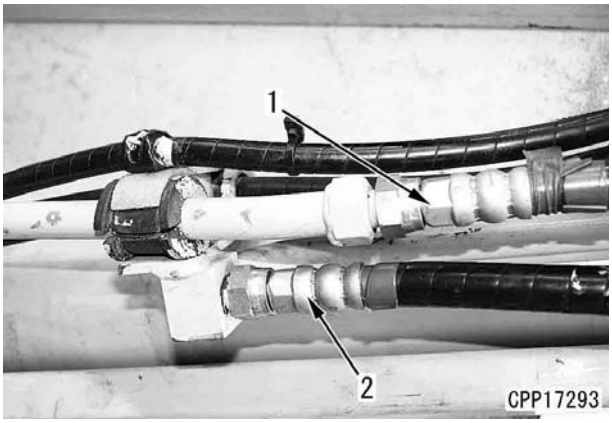
Removal and installation of revolving frame assembly

Removal

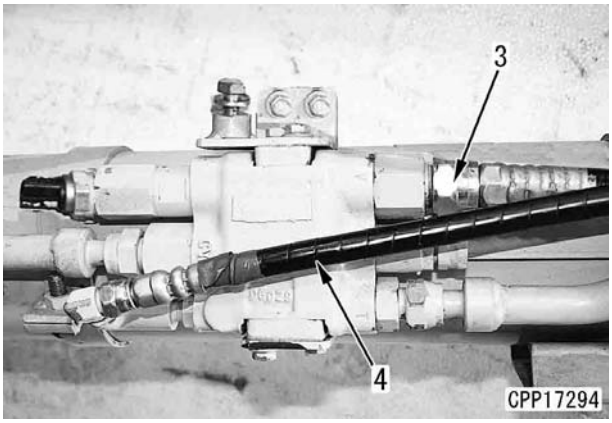
- ⚠ **Loosen the hydraulic tank cap to release the pressure inside the hydraulic tank.**
- ⚠ **Release the residual pressure in the hydraulic circuit. For details, see Testing and adjusting, "Releasing residual pressure from hydraulic circuit".**
- ⚠ **Disconnect the cable from the negative (–) terminal of the battery.**

1. Remove the work equipment assembly. For details, see "Removal and installation of work equipment assembly".

2. Disconnect the 4 hoses from the boom cylinder.
   (1): Boom hydraulic drift prevention valve drain hose
   (2): Boom cylinder head hose (Band color: Black)

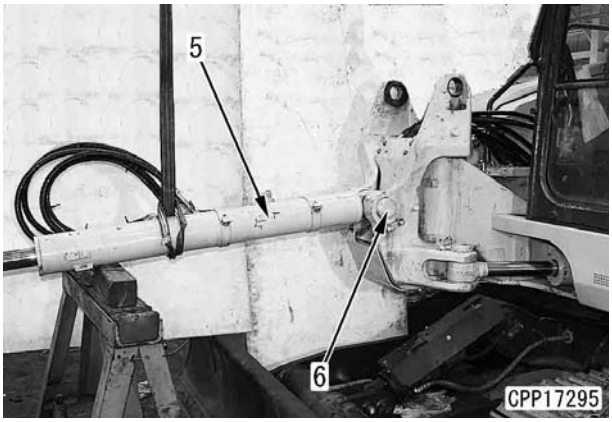


   (3): Boom cylinder bottom hose (Band color: Yellow)
   (4): Boom hydraulic drift prevention valve Pi hose (Band color: Black)



3. Sling boom cylinder assembly (5).

4. Remove the lock plate, pull out mounting pin (6), and remove boom cylinder assembly (5). [*1]
   ★ Check the quantity and positions of the inserted shims.
   Boom cylinder assembly: **120 kg**



5. Remove engine hood assembly (7).
   Engine hood assembly: **20 kg**

6. Remove the operator cab assembly. For details, see "Removal and installation of operator cab assembly".

Installation

- Carry out installation in the reverse order to removal.

[*1]
Center swivel joint mounting bolt:
98 – 123 Nm {10.0 – 12.5 kgm}

- **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.
  Hydraulic tank:
  56 ℓ (Specified oil quantity: 100 ℓ)

- **Bleeding air**
  Bleed air. For details, see Testing and adjusting, "Bleeding air from each part".

Removal and installation of control valve assembly

Removal

⚠ **Park the machine on a level ground, lower the work equipment to the ground, stop the engine, and set the lock lever in the lock position.**

⚠ **Loosen the hydraulic tank cap to release the pressure inside the hydraulic tank.**

⚠ **Release the residual pressure in the hydraulic circuit. For details, see Testing and adjusting, "Releasing residual pressure in the hydraulic circuit".**

⚠ **Disconnect the cable from the negative (–) terminal of the battery.**

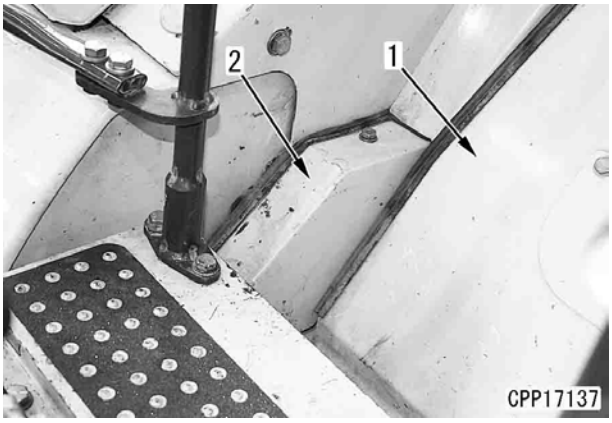
★ Record the positions of the disconnected pipings and wiring connectors to prevent a mistake in reconnecting them.

1. Loosen the hydraulic tank drain plug to drain the oil. [*1]

   Hydraulic tank:

   56 ℓ (Specified oil quantity: 100 ℓ)

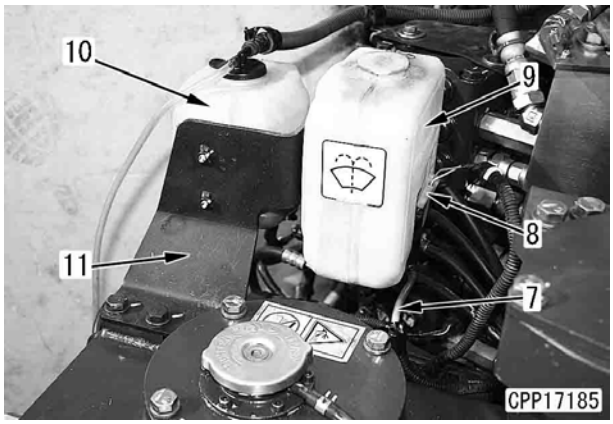
2. Remove the machine right side cover assembly according to the following procedure.
   1) Remove covers (1) and (2).

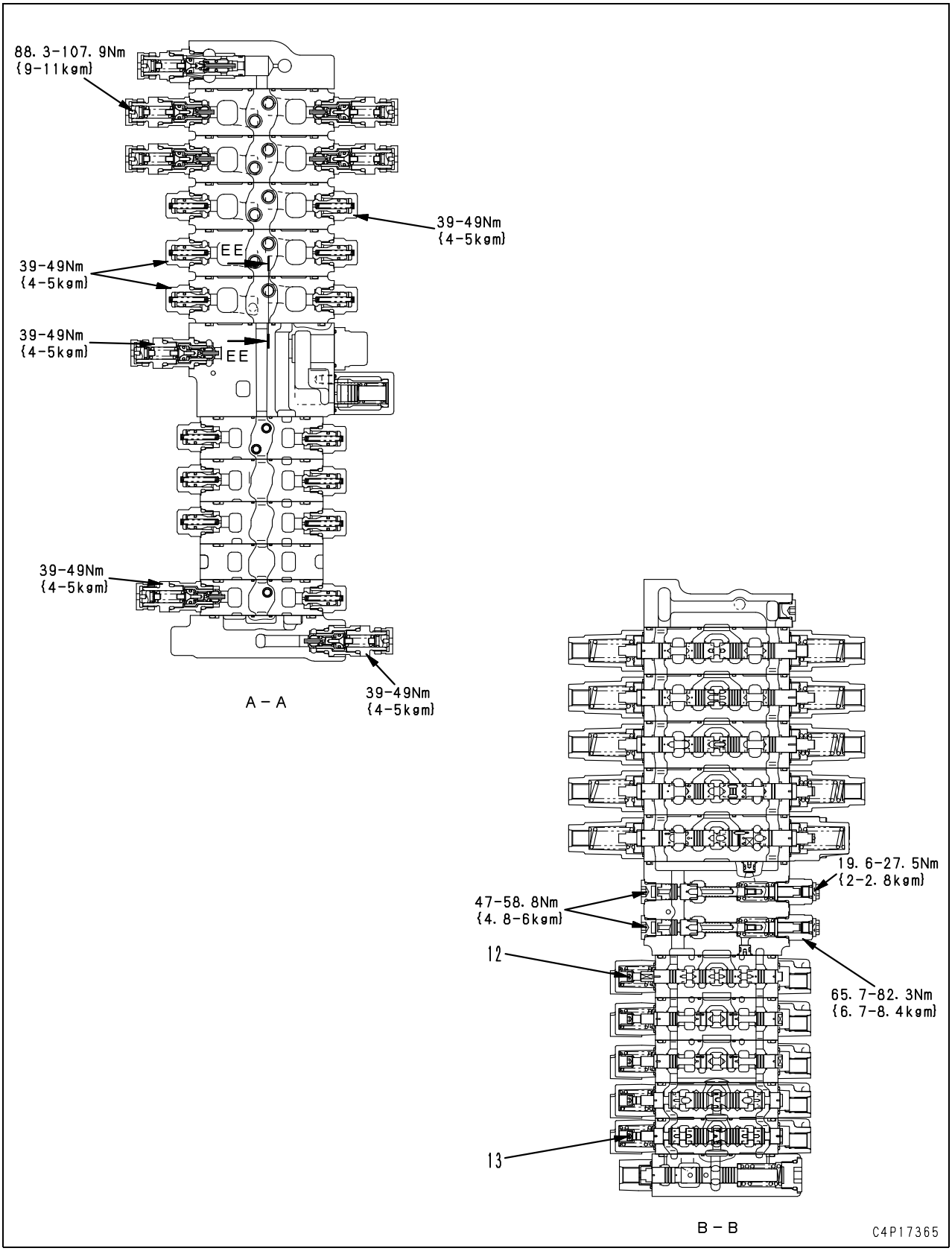


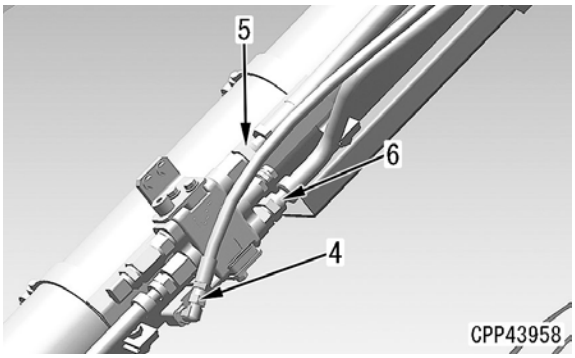
   2) Remove stay (3) and step (4).
   3) Move cover (5) to a position where side cover (6) can be removed.

   4) Lift off side cover assembly (6).
      Side cover assembly: **30 kg**

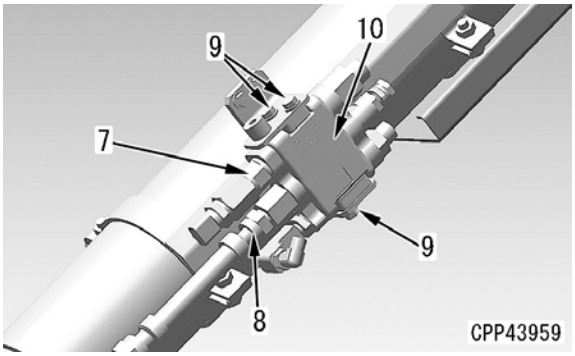
3. Remove the washer tank and radiator reservoir tank.
   1) Disconnect vinyl tube (7) from the washer tank.
   2) Disconnect washer motor connector M06 (8).
   3) Remove washer tank (9), radiator reservoir tank (10) and bracket (11) together.




88.3-107.9Nm
{9-11kgm}
39-49Nm
{4-5kgm}
39-49Nm
{4-5kgm}
39-49Nm
{4-5kgm}
39-49Nm
{4-5kgm}
39-49Nm
{4-5kgm}
EE
EE
A-A
19.6-27.5Nm
{2-2.8kgm}
47-58.8Nm
{4.8-6kgm}
12
65.7-82.3Nm
{6.7-8.4kgm}
13
B-B
C4P17365

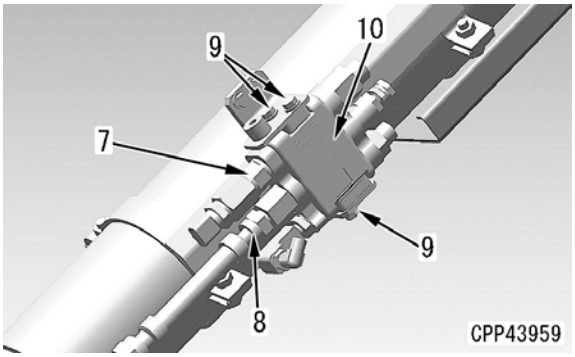


7) Remove the adapter (7).
8) Disconnect the tube (8).
   ⚠ **Slowly loosen the fitting of the tube so that the remaining pressure in the circuit between the anti-drop valve and the cylinder is released. The remaining pressure may damage the O-ring, and the oil may be splashed. Therefore, loosen the tube while pressing the fitting and around it with a cloth, etc.**
9) Remove the bolts (9) (4 pieces), and remove the anti-drop valve assembly (10).

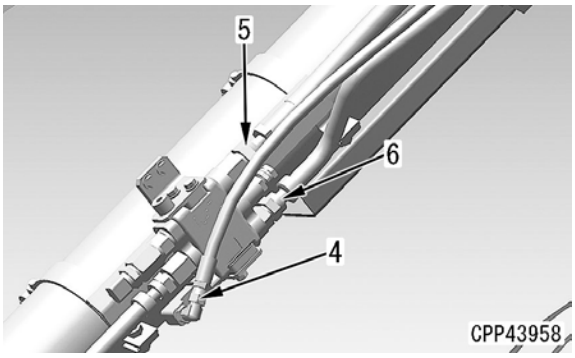


Installation

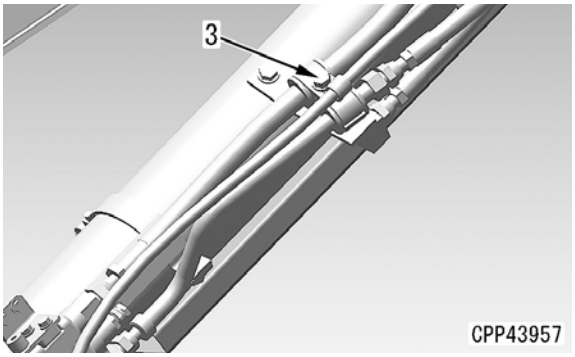
1. Anti-drop valve assembly
   1) Install the anti-drop valve assembly (10) with the bolts (9) (4 pieces).
   2) Connect the tube (8).
   3) Install the adapter (7).



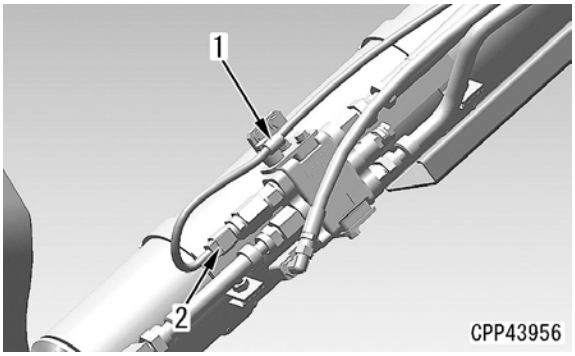
   4) Connect the tube (6).
   5) Connect the hoses (5), and (4).



   6) Install the clamp (3).



   7) Connect the connector P46 (2).
   8) Install the clamp (1).



2. Refilling with oil
   ★ Refill with oil to the specified level through the oil filler port of the hydraulic tank. Start the engine to circulate the oil through the piping. Then check the oil level again.
3. Air bleeding
   ★ Bleed air from the hydraulic circuit. See TESTING AND ADJUSTING, “BLEED AIR FROM HYDRAULIC CIRCUIT”.