SEN04329-11

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)

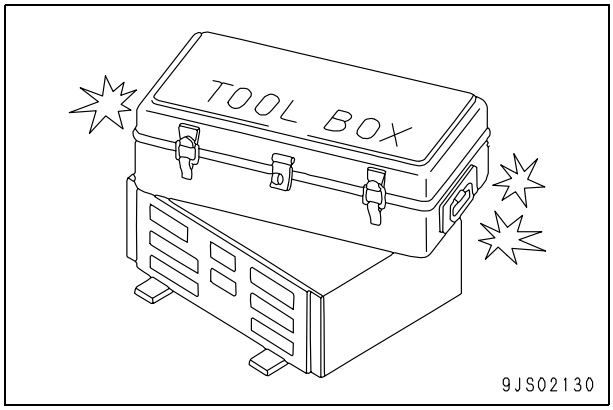
- Chassis volume
  This section gives hydraulic circuit diagrams and electrical circuit diagrams.
- Engine volume
  This section explains the method of reproducing, repairing, and replacing parts.

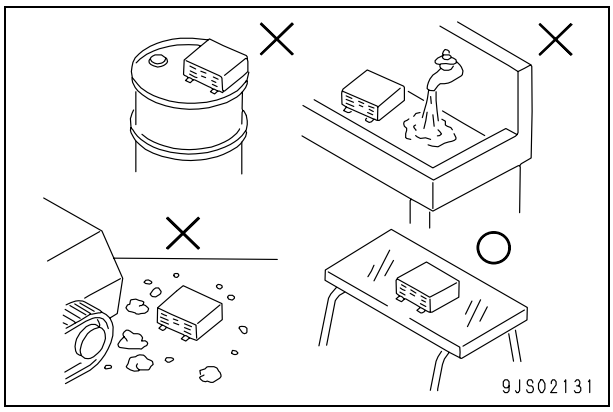
2. Revision and distribution

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

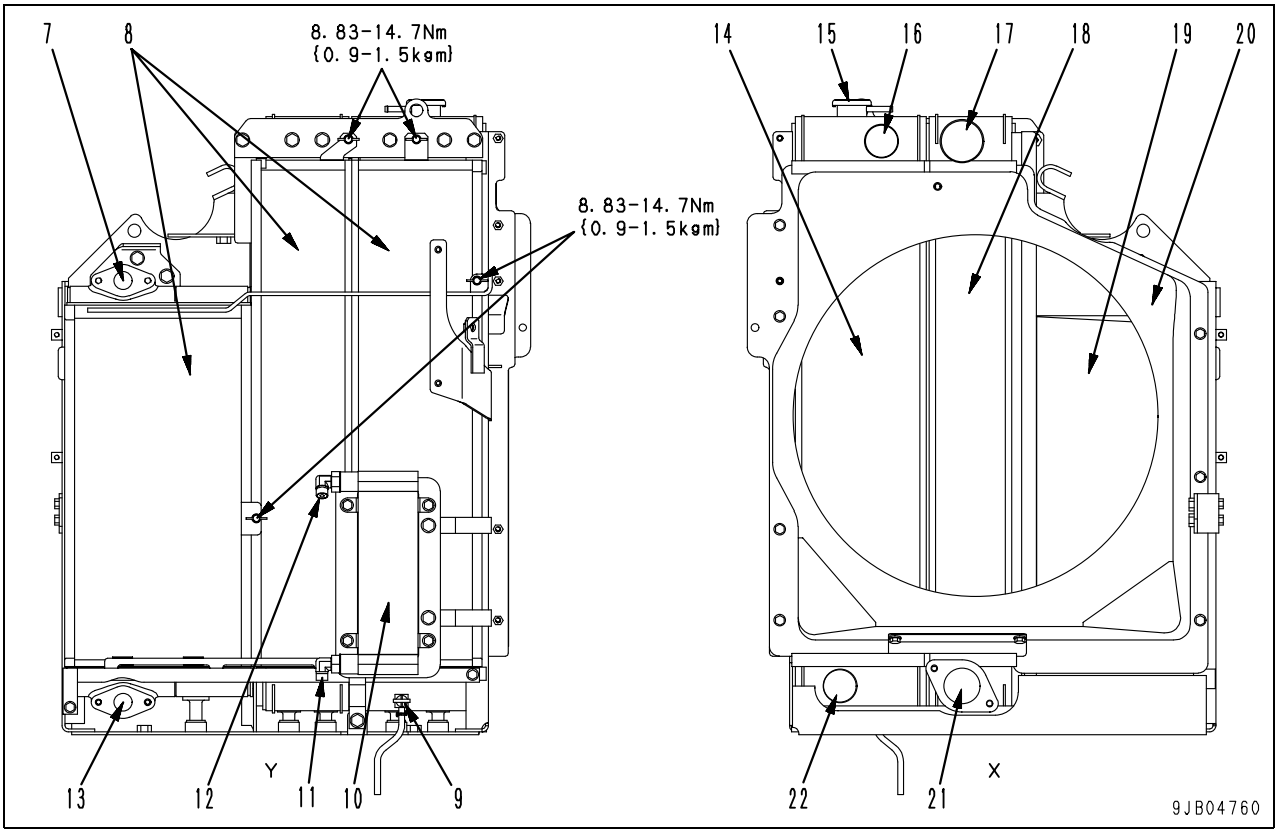
Liters to U.S. Gallons

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

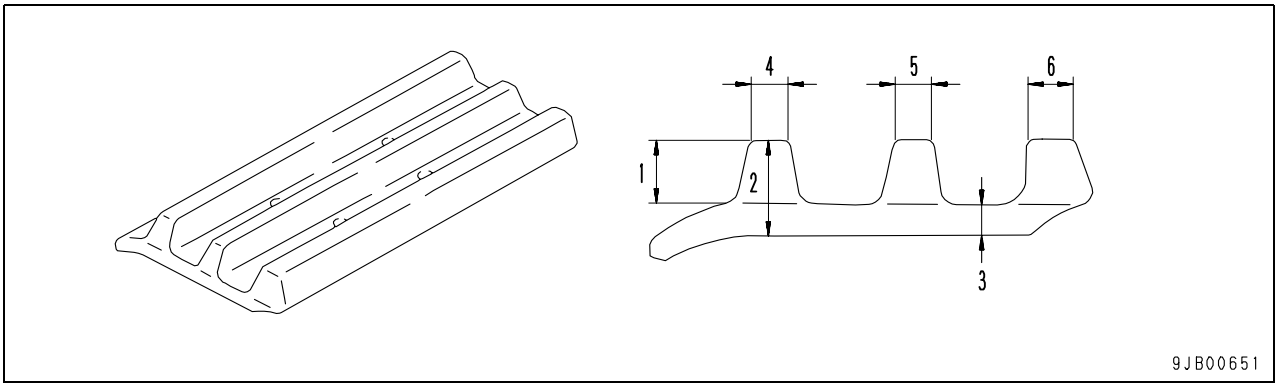
PC88MR-8

Machine model	Serial number
PC88MR-8	5001 and up

10 Structure, function and maintenance standard

300 Undercarriage and frame

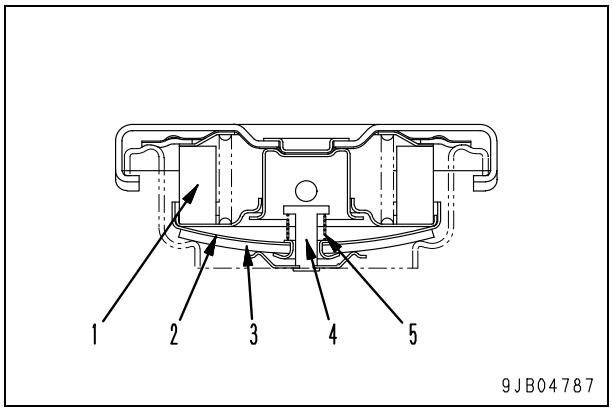
City pad shoe, triple grouser shoe



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})

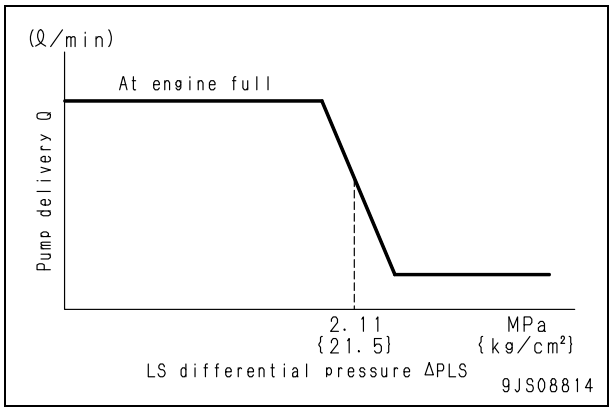
Prevention of pressure rise in tank

- 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

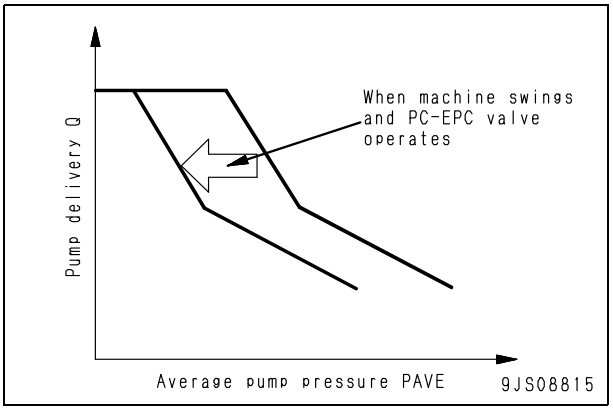
LS valve

- 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

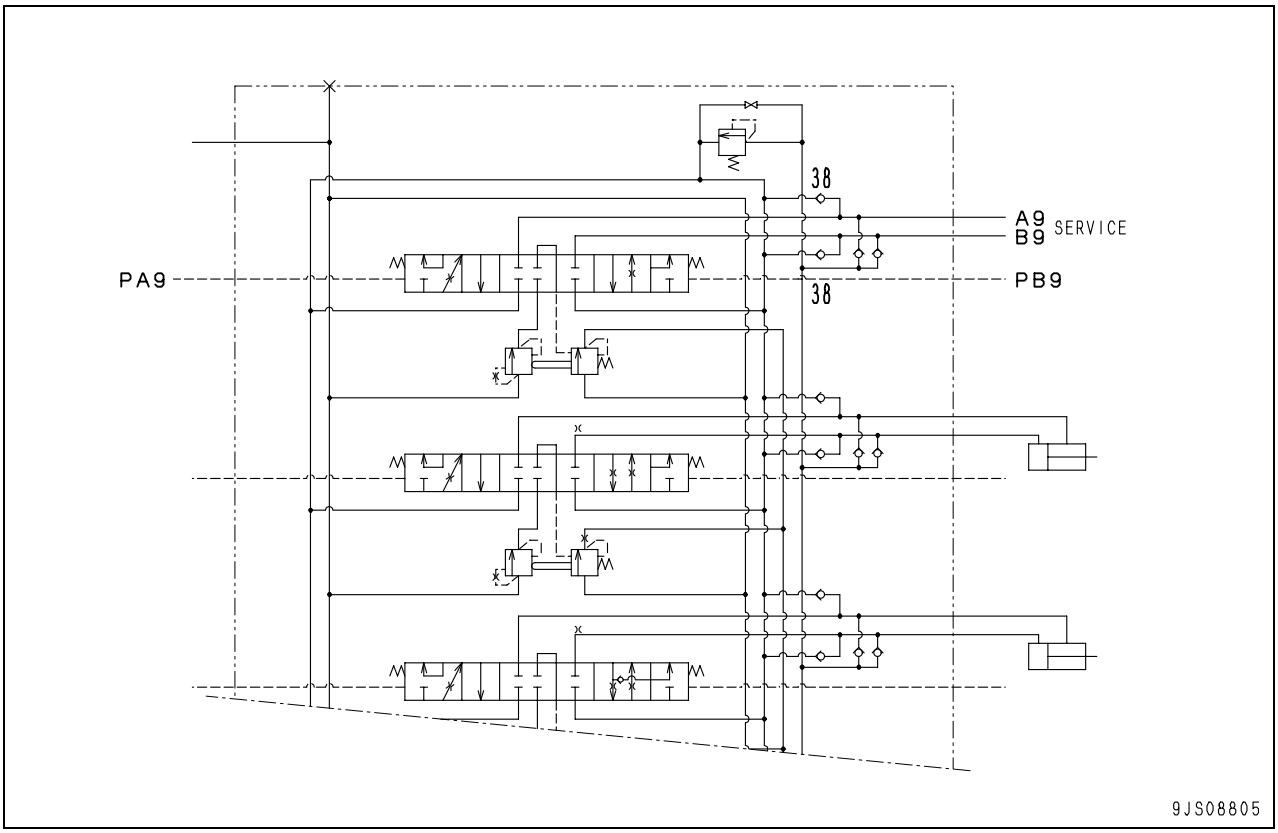
F: Flow control valve
R: Pressure reducing valve

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)



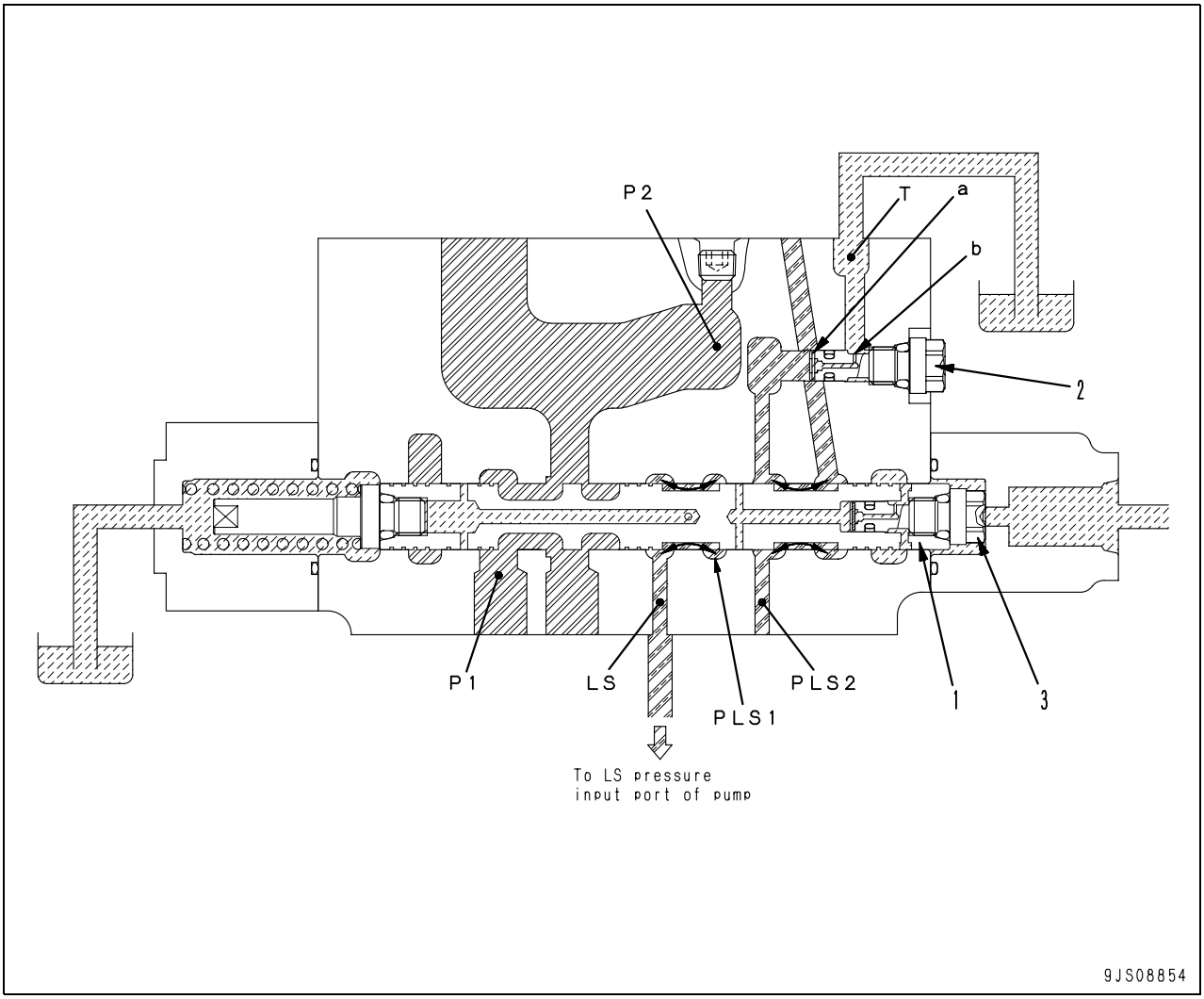
38. Suction valve

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.

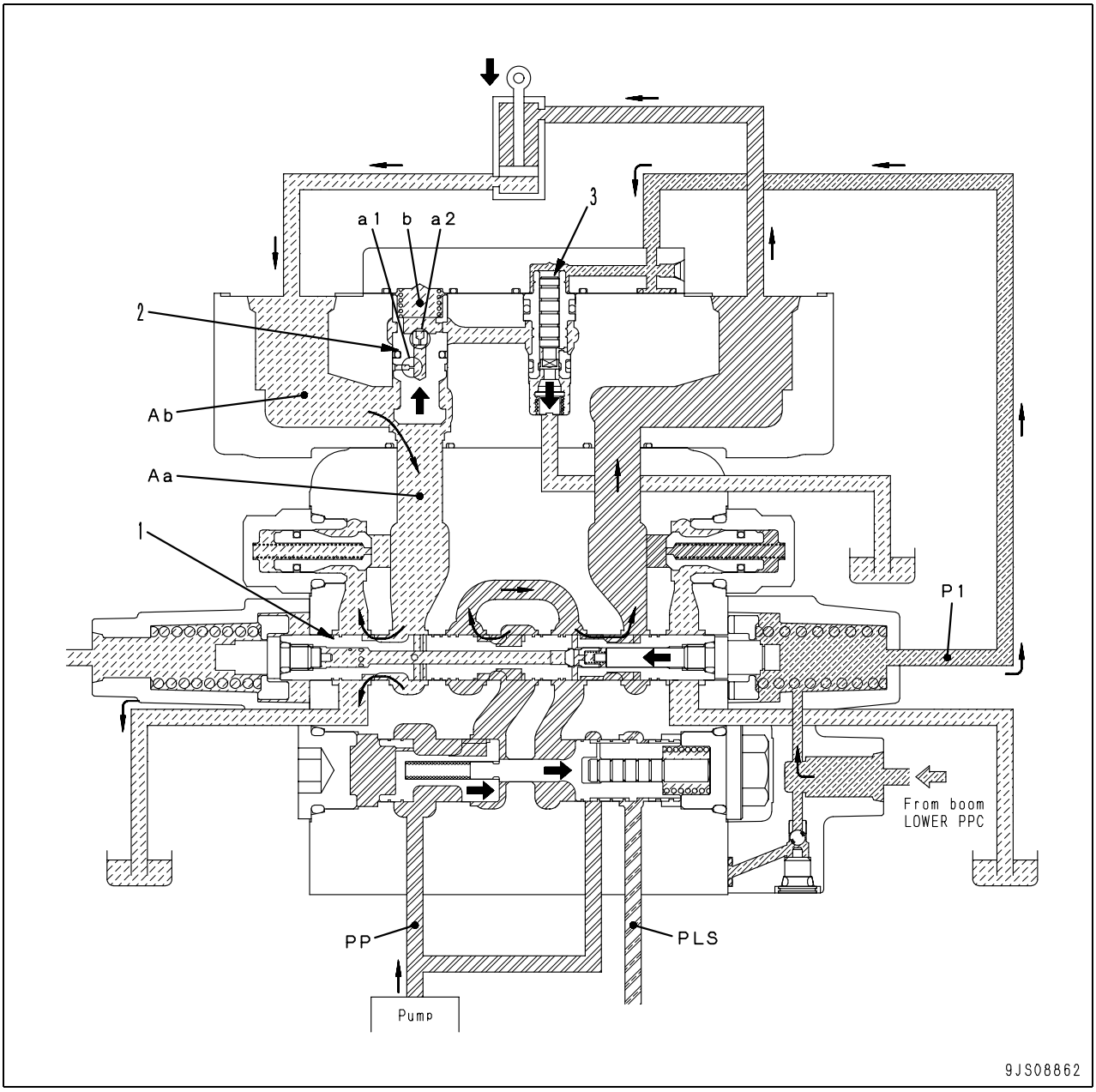
When work equipment valve is operated (including compound operation of work equipment + travel)



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

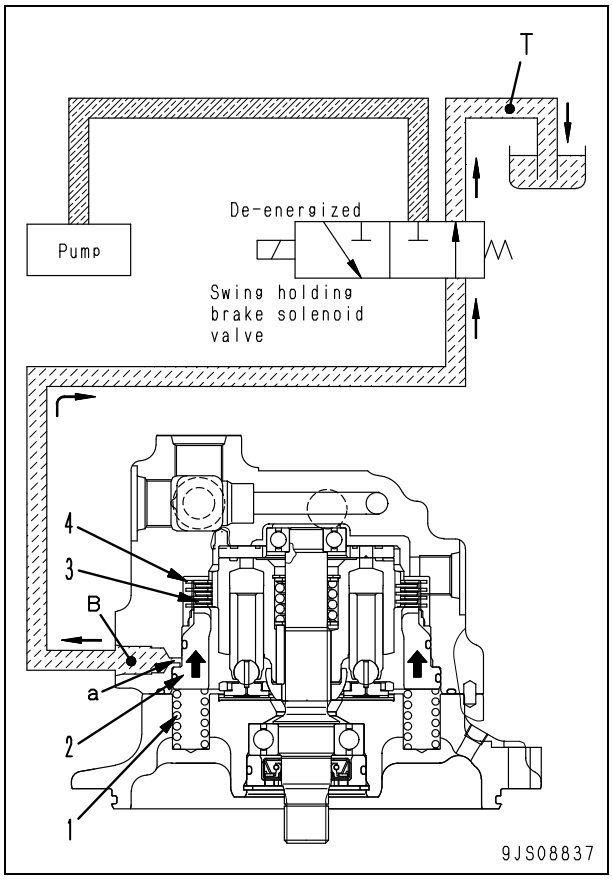
No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
7	Centering spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace spring.
		48.57 x 15.5	32.5	108 N {11 kg}	—	86.3 N {8.8 kg}	
8	Metering spring	26.53 x 8.15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

Swing holding brake

Operation

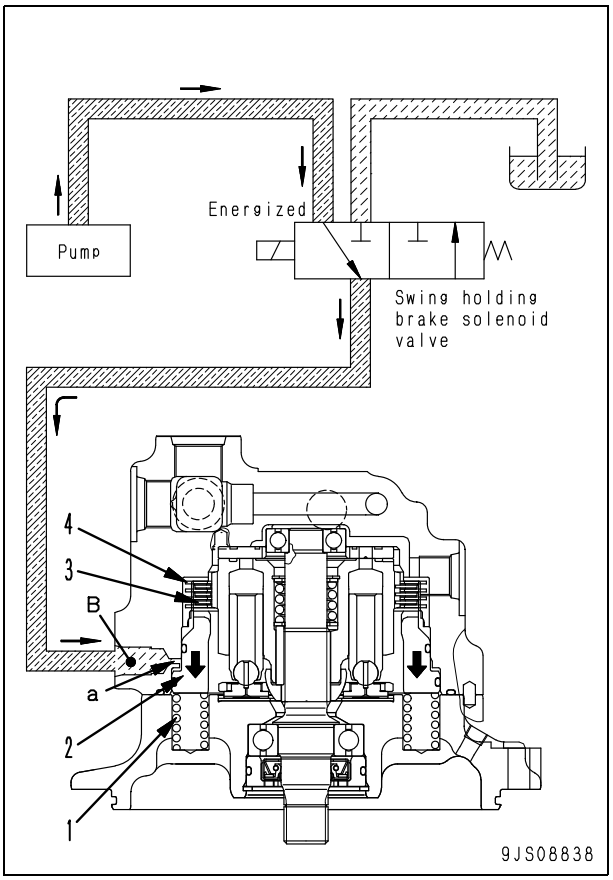
When solenoid valve is de-energized

- 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.

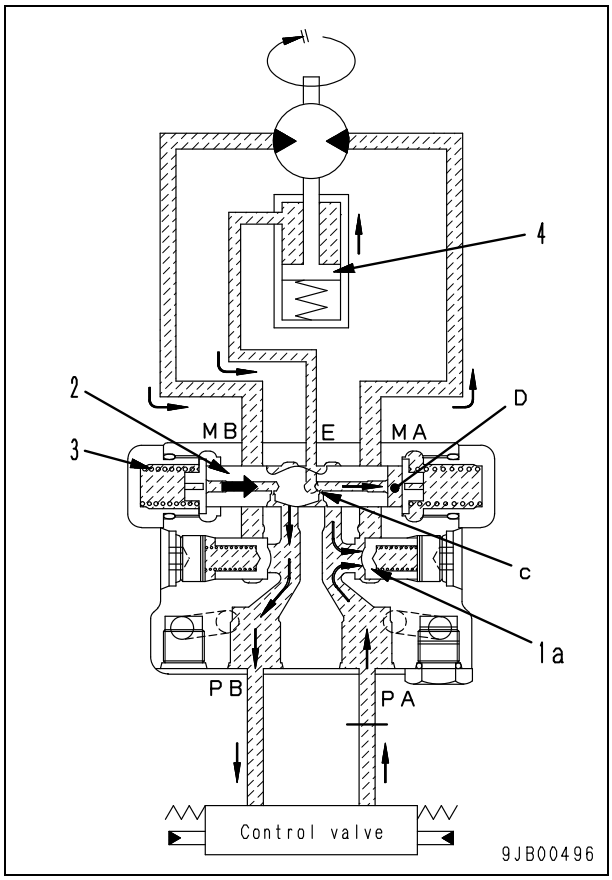


When solenoid valve is energized

- 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.

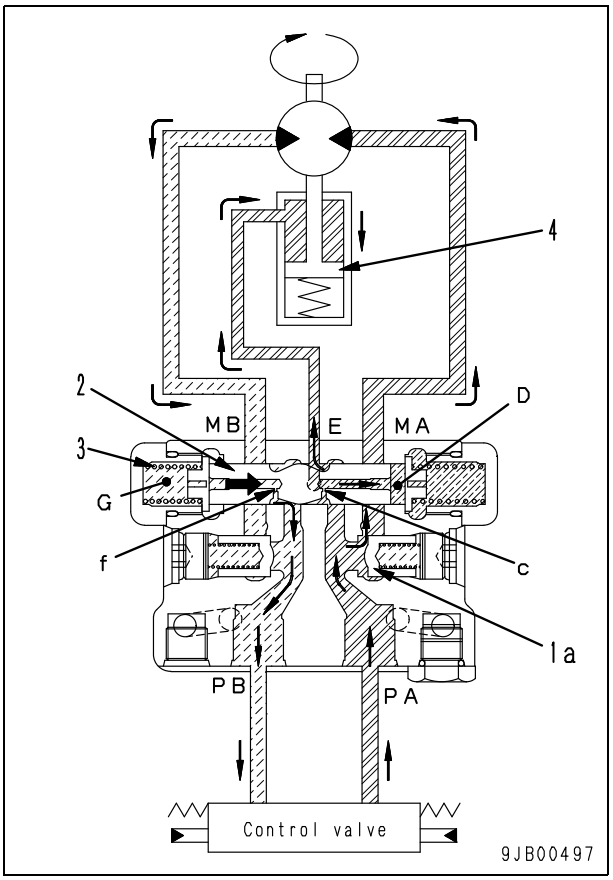


Operation when pressure is shut off



- 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.

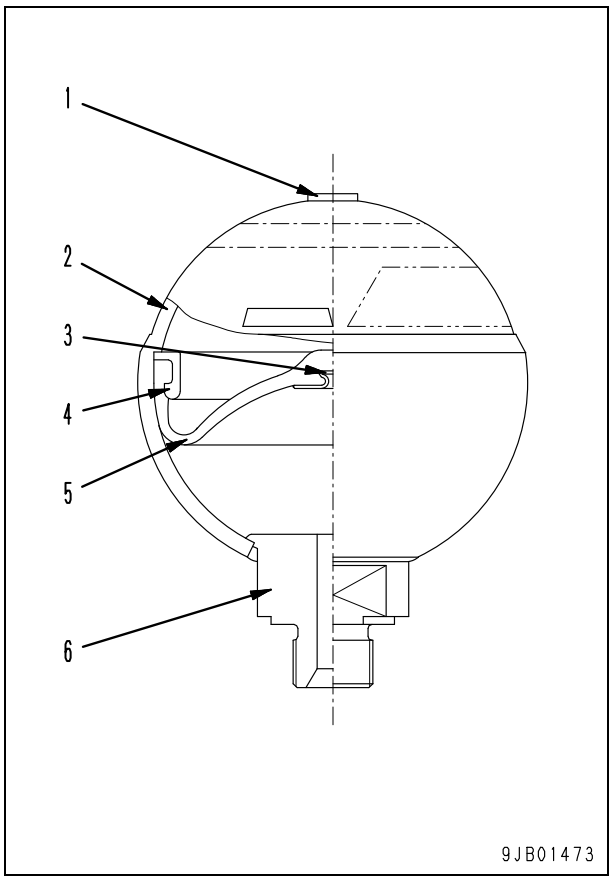
Brake operation at travelling downhill



- 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}

HYDRAULIC EXCAVATOR

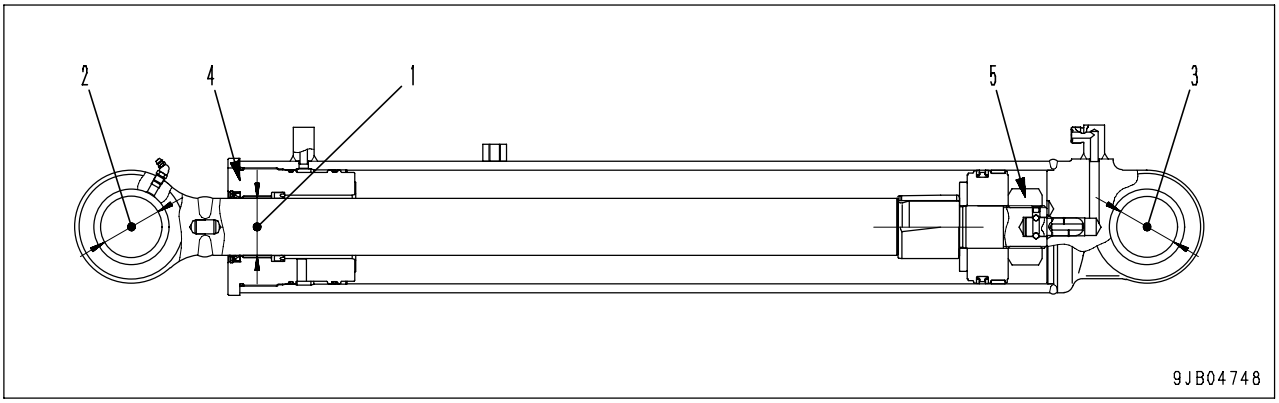
PC88MR-8

Machine model Serial number
PC88MR-8 5001-

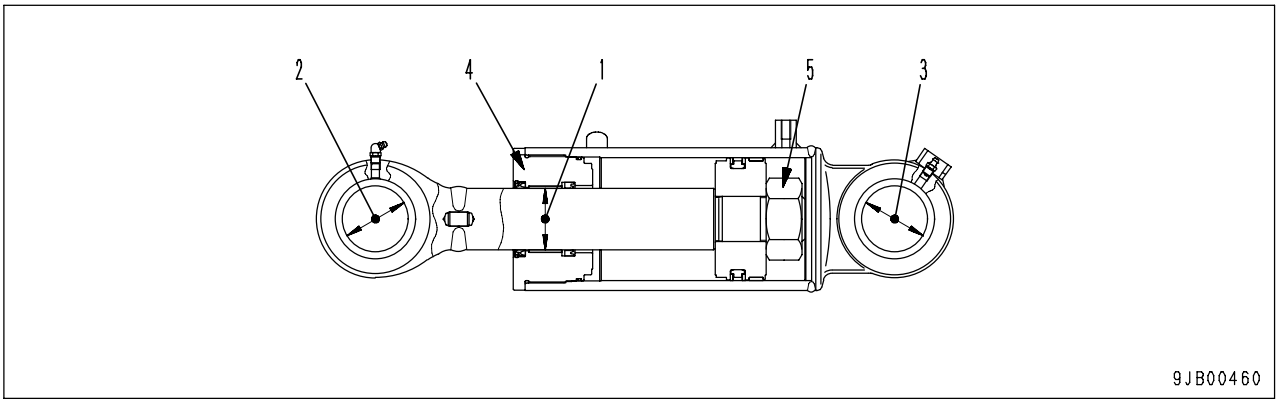
10 Structure, function and maintenance standard

500 Work equipment

Boom swing cylinder



Blade cylinder



A: From condenser
B: To compressor
C: Hot water inlet
D: Hot water outlet

1. Evaporator
2. Heater core
3. Expansion valve
4. Blower motor
5. Air mix damper actuator
6. Air mix damper
7. Mode selector damper actuator
8. Mode selector damper
9. Recirculation/fresh air changeover damper actuator
10. Recirculation/fresh air changeover damper
11. Power transistor
12. Evaporator temperature sensor
13. Recirculation air temperature sensor
14. Recirculation air filter

Outline

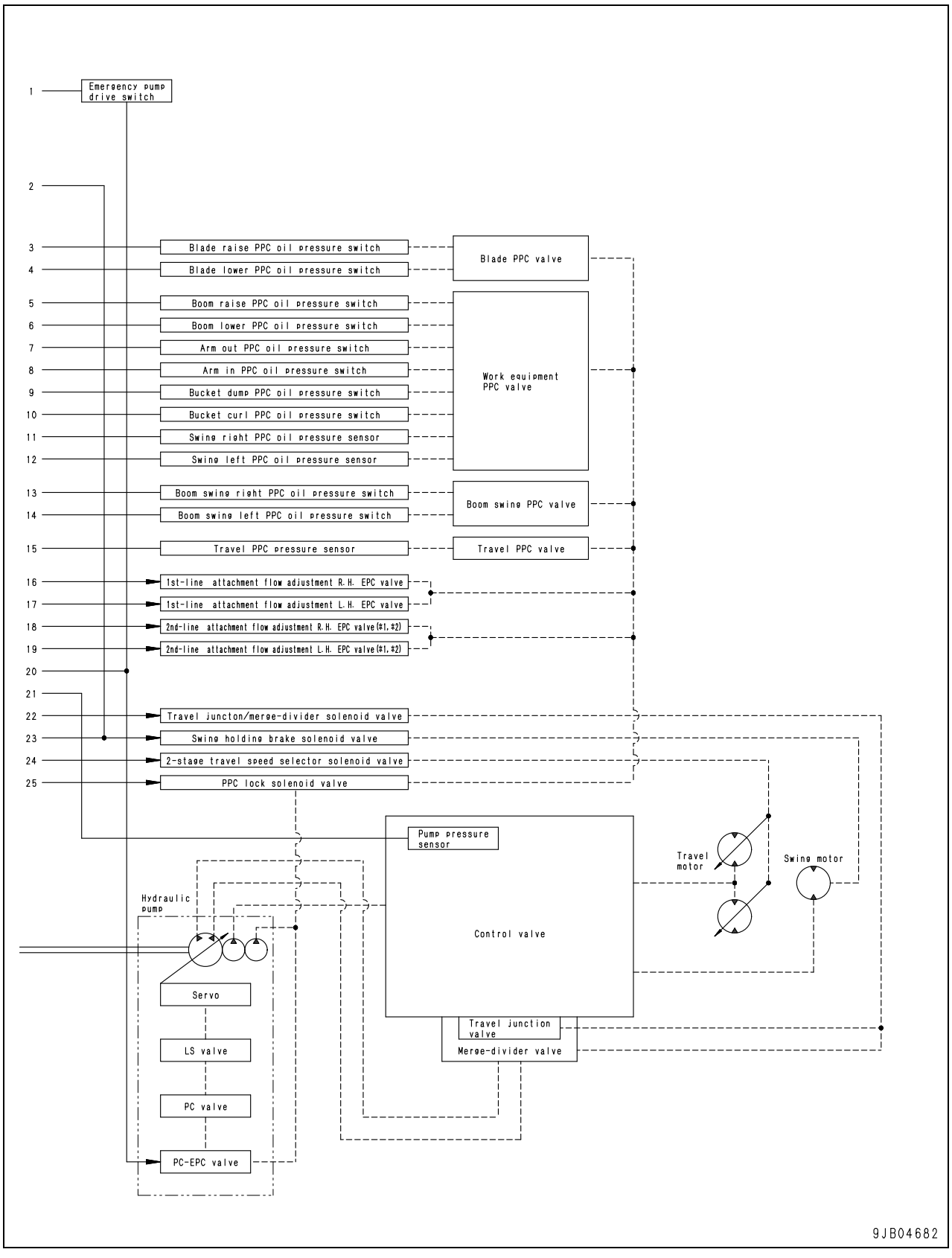
- This is the horizontal air conditioner unit on which evaporator (1) and heater core (2) is arranged in parallel. Blower motor (4) is driven to generate cool and hot air.
- Selecting the temperature on the machine monitor controls air mix damper (6) to adjust the discharged air temperature.

Cooler

- The cooler circulates refrigerant through evaporator (1) to cause heat exchange (dehumidification and cooling).
- Air taken in by blower motor (4) is cooled with evaporator (1) and then blown out from the duct and grille.

Heater

- The heater circulates engine coolant in heater core (2) to cause heat exchange (heating).
- Air taken in by blower motor (4) is heated with heater core (2) and then blown out through the duct and grille.


1
Emergency pump drive switch
2
3
Blade raise PPC oil pressure switch
4
Blade lower PPC oil pressure switch
Blade PPC valve
5
Boom raise PPC oil pressure switch
6
Boom lower PPC oil pressure switch
7
Arm out PPC oil pressure switch
8
Arm in PPC oil pressure switch
9
Bucket dump PPC oil pressure switch
10
Bucket curl PPC oil pressure switch
11
Swing right PPC oil pressure sensor
12
Swing left PPC oil pressure sensor
Work equipment PPC valve
13
Boom swing right PPC oil pressure switch
14
Boom swing left PPC oil pressure switch
Boom swing PPC valve
15
Travel PPC pressure sensor
Travel PPC valve
16
1st-line attachment flow adjustment R.H. EPC valve
17
1st-line attachment flow adjustment L.H. EPC valve
18
2nd-line attachment flow adjustment R.H. EPC valve(*1, *2)
19
2nd-line attachment flow adjustment L.H. EPC valve(*1, *2)
20
21
22
Travel juncton/merge-divider solenoid valve
23
Swing holding brake solenoid valve
24
2-stage travel speed selector solenoid valve
25
PPC lock solenoid valve
Pump pressure sensor
Travel motor
Swing motor
Hydraulic pump
Control valve
Servo
LS valve
PC valve
PC-EPC valve
Travel junction valve
Merge-divider valve
9JB04682

Function

- Raises the engine speed automatically to warm up the engine if the coolant temperature is low after start-up of the engine.
- There are two types of automatic warm-up of engine depending on purposes; one is "heater warm-up" and the other is "normal warm-up".
  1) Purpose of heater warm-up
     To raise the coolant temperature to improve efficiency of air conditioner heating.
  2) Purpose of normal warm-up
     To warm up the engine body to prevent engine from getting damaged by low temperature.

Operating conditions 1
Machine specification: with air conditioner Air conditioner: blower "ON" Coolant temperature: Max. 55 °C Ambient temperature: below 5 °C

↓ ↓

If any of operating conditions 1 is not satisfied
Heater warm-up is disabled (normal warm-up)

Operational conditions 2 (all required)
Coolant temperature: Max. 30 °C Fuel control dial: below 70% of full speed (MAX)

↓

Operation
Engine speed: 1,200 rpm

↓

Cancellation conditions (either one required)	
Auto	Coolant temperature: Min. 30 °C
	Duration of automatic warming-up: Min. 10 minutes
Man-ual	Fuel control dial: held at over 70% of maximum speed for 3 seconds or more

↓

When all of operating conditions 1 are satisfied
Heater warm-up is enabled

↓

Operation
Engine speed: 1,300 rpm

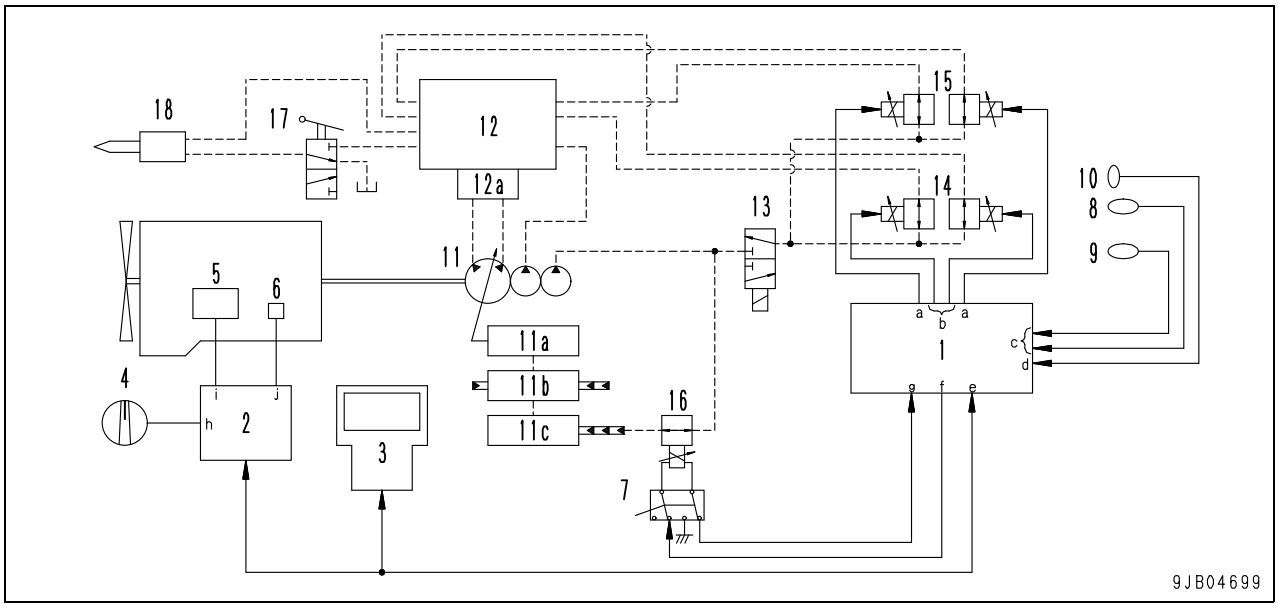
↓

Cancellation for cancellation
Coolant temperature: Min. 60 °C Ambient temperature: min. 10 °C

↓

Cancellation
Engine speed: as desired

Oil flow adjuster function for attachment
(Machine ready for attachment)



1. Pump controller
2. Engine controller
3. Machine monitor
4. Fuel control dial
5. Fuel supply pump
6. Sensors
7. Emergency pump drive switch
8. 1st-line attachment proportional switch
9. 2nd-line attachment proportional switch
   [EU specification (if equipped)]
10. Breaker operation switch
11. Hydraulic pump
    11a. Servo
    11b. LS valve
    11c. PC valve
12. Control valve
    12a. Pump merge-divider valve
13. PPC lock solenoid valve
14. Oil flow adjuster EPC valve for 1st-line attachment
15. Oil flow adjuster EPC valve for 2nd-line attachment
    [EU specification (if equipped)]
16. PC-EPC valve
17. Attachment circuit selector valve
18. Attachment

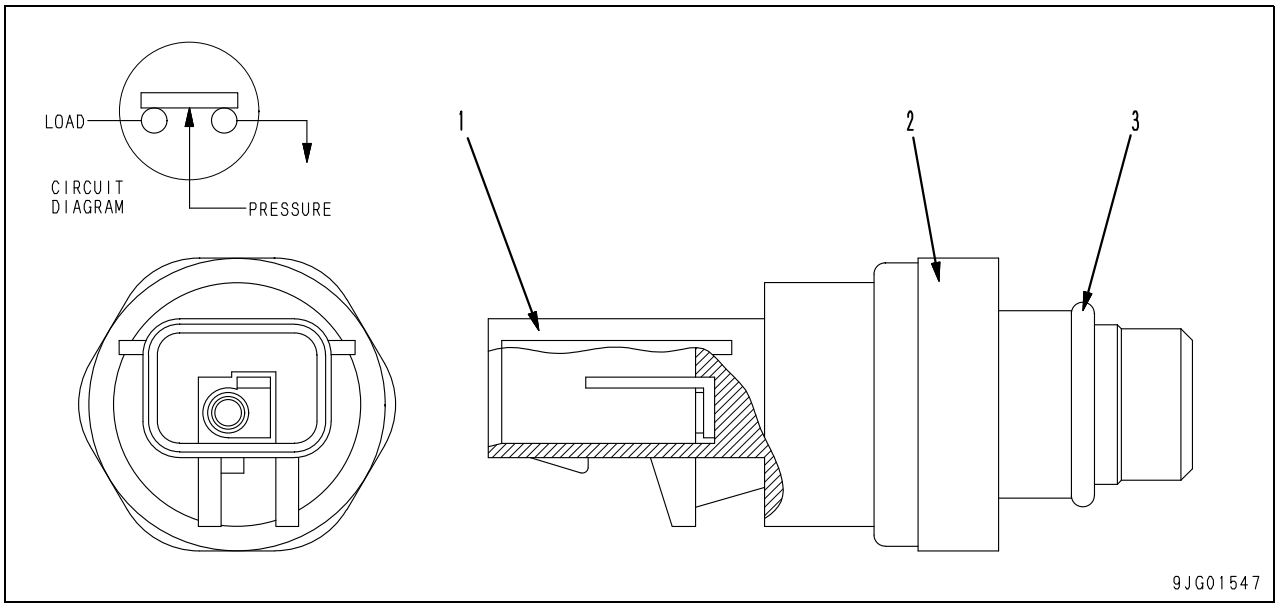
Input and output signals

a. Oil flow adjuster EPC valve drive signal for 2nd-line attachment
b. Oil flow adjuster EPC valve drive signal for 1st-line attachment
c. Switch potentiometer signal
d. Breaker operation switch signal
e. CAN signal
f. PC-EPC valve drive signal
g. Solenoid valve GND
h. Throttle signal
i. Fuel supply pump control signal
j. Sensor signals

Function

- The oil flow rate to the attachment can be controlled by selecting ATT/P or ATT/E mode and setting of the oil flow rate by the machine monitor when the attachment proportional switches are operated all the way.

Engine oil pressure switch



1. Connector
2. Sensor
3. O-ring

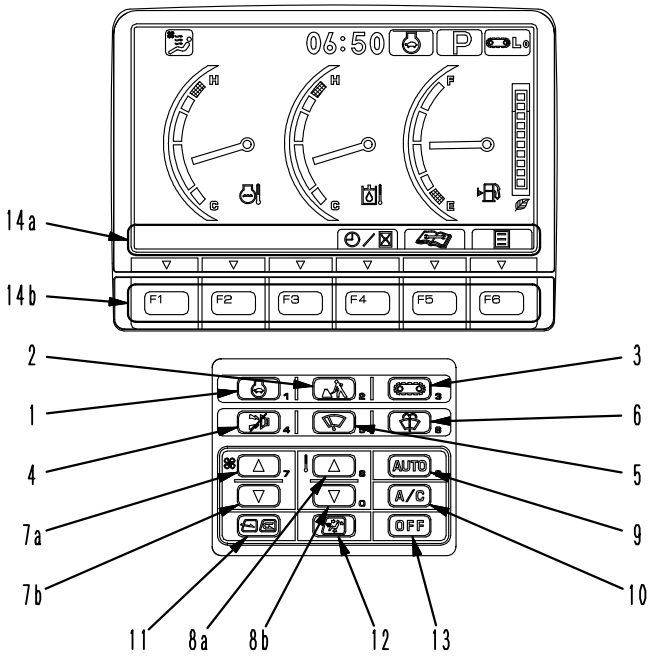
Specifications

Contact type: Normal close

Function

- This oil pressure switch is installed in the cylinder block. It detects engine oil pressure, and turns the switch "ON" when the pressure goes below the specified value.

Switches

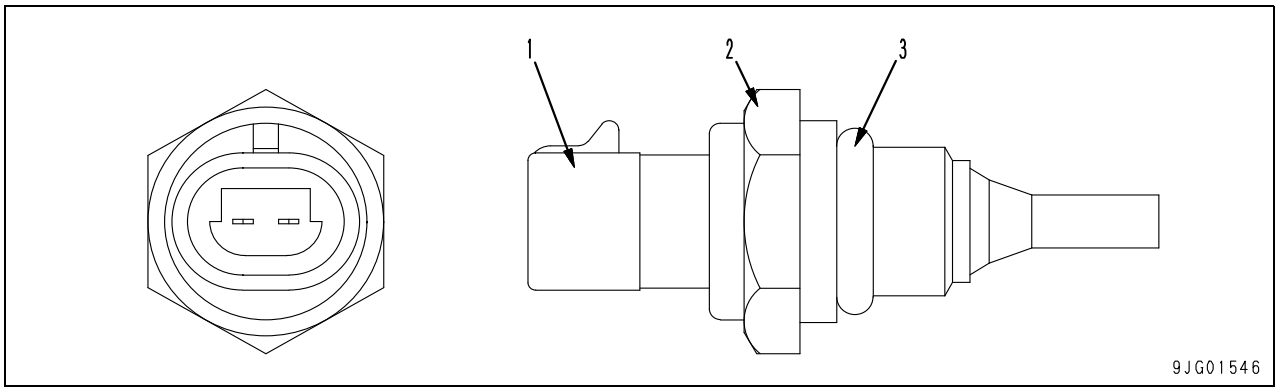


9JB04702

No.	Name	Function	Operation
1	Auto-decelerator switch [Numeric keypad: 1]	Turns the auto-decelerator function ON/OFF. Light ON: ON Light OFF: OFF	• When the working mode is in "L", the auto-decelerator does not work. ON ⟷ OFF
2	(*1) Working mode selector switch [Numeric keypad: 2]	Displays the working mode selector screen.	P: Heavy-duty operation E: Low-fuel consumption operation L: Fine operation B: Breaker operation ATT: Double-acting attachment operation
3	Travel speed selector switch [Numeric keypad: 3]	Changes the travel speed. Lo light ON: Low speed Hi light ON: High speed	Lo (low speed) ⟷ Hi (high speed)
4	Buzzer cancel switch [Numeric keypad: 4]	Stops the alarm buzzer. (Some alarm buzzer does not stop even if the switch is pressed.)	• Stops the alarm buzzer. • The alarm buzzer resumes when another error is detected.
5	(*2) Wiper switch [Numeric keypad: 5]	Operates the front glass wiper. INT: Intermittent ON: Continuous Light OFF: Stop	→ INT → ON → OFF → ↑ (Intermittent) (Continuous) (Stop) ↓ ← ← ←
6	(*2) Window washer switch [Numeric keypad: 6]	Sprays washer fluid onto the front glass.	ON: Washer fluid is sprayed and wiper works continuously. [When wiper is not working] OFF: Wiper works twice and stops after the switch is released. [When wiper is working intermittently] OFF: Wiper works twice continuously and returns to intermittent operation after the switch is released.

*1: When the working mode is changed, the auto-decelerator function turns "ON".
*2: When the front window is open, windshield wiper and washer do not operate even if the switch is pressed.

Coolant temperature sensor

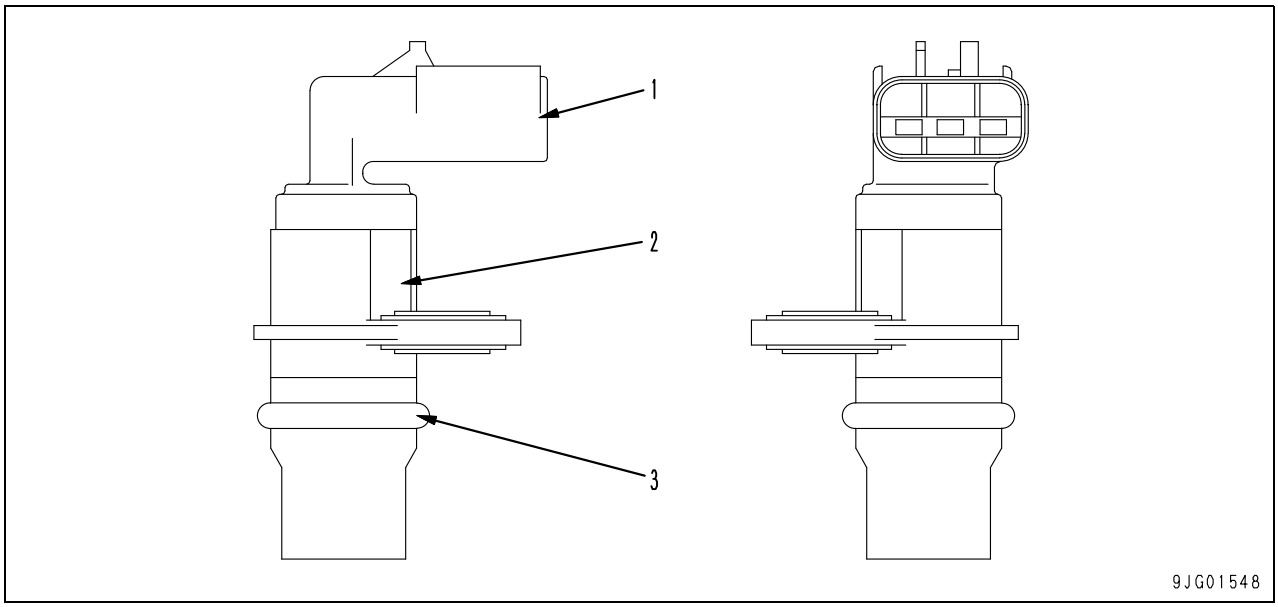


1. Connector
2. Sensor
3. O-ring

Function

- This sensor is installed in the water pump.
- This sensor senses the coolant temperature and converts it into an electric signal and then outputs that signal.

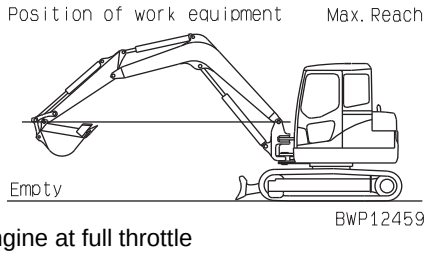
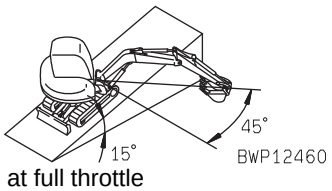
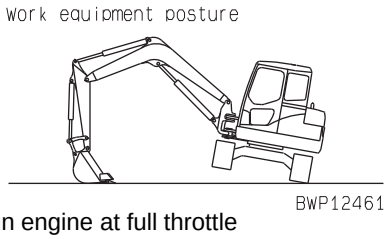
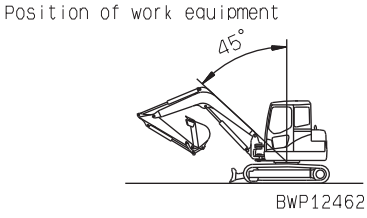
Crankshaft speed sensor
Camshaft speed sensor



1. Connector
2. Sensor
3. O-ring

Function

- The crankshaft speed sensor is installed in the gear of the flywheel, and the camshaft speed sensor is installed in the gear of the camshaft.
- These sensors sense the gear rotations and convert them into pulse signals and then output those signals.

Machine Model					PC88MR-8	
Cate-gory	Item	Measurement Conditions		Unit	Standard Value for New Machine	Service Limit Value
Swing	Time required to finish swinging	 • Run engine at full throttle • Hydraulic oil temperature: 45 – 55°C • Time required to swing 5 turns after swinging 1 turn		sec.	30 ± 3	Max. 35
	Hydraulic drift of swing	Position of work equipment: Extend to max. reach with bucket under rated load or filled with dirt and sand (Rated load: 450 kg)  • Run engine at full throttle • Hydraulic oil temperature: 45 – 55°C • Swing upper structure to 45° on slope of 15° • Make match marks on swing circle outer race and track frame • Measure deviation of marks made in 15 minutes		mm (deg)	0 (0)	0 (0)
	Leakage from swing motor	• Run engine at full throttle • Hydraulic oil temperature: 45 – 55°C • Relieve swing circle		ℓ/min.	Max. 3.5	Max. 7.0
Travel	Travel speed (1)	 • Run engine at full throttle • Hydraulic oil temperature: 45 – 55°C • Raise either track and measure time required to move 5 turns after finishing 1 turn.	Low speed	sec	36 ± 4	Max. 43
			High speed		21 ± 2	Max. 25
	Travel speed (2)	 • Run engine at full throttle • Hydraulic oil temperature: 45 – 55°C • Measure time required to travel 20 m after run-up of at least 10 m on flat surface	Low speed		25 ± 2	Max. 29
			High speed		14 ± 2	Max. 18

Tools for testing, adjusting, and troubleshooting

Testing/Adjusting item	Symbol		Part No.	Part name	Q'ty	Remarks
Exhaust temperatures	R		799-101-1502	Digital thermometer	1	-99.9 – 1,299°C
Checking exhaust gas color	A	1	799-201-9001	Handy smoke checker	1	Bosch index: 0 – 9
		2	Commercially available	Smoke meter	1	
Adjusting valve clearance	B		Commercially available	Clearance gauge	1	Intake: 0.35 mm Exhaust: 0.57 mm
Testing compression pressure	C	1	795-502-1590	Compression gauge	1	0 – 7 MPa {0 – 70 kg/cm^2}
		2	795-502-1370	Adapter	1	For 95E-5 engine
			6271-11-3880	Gasket	1	
Testing blow-by pressure	D	1	799-201-1504	Blow-by checker	1	0 – 5 kPa {0 – 500 mmH_2O}
Testing engine oil pressure	E	1	799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 6, 40, 60 MPa {25, 60, 400, 600 kg/cm^2}
			799-261-1204	Digital hydraulic tester	1	Pressure gauge: 60 MPa {600 kg/cm^2}
		2	799-401-2320	Gauge	1	Pressure gauge: 1.0 MPa {10 kg/cm^2}
		3	6732-81-3170	Adapter	1	Size: 10 x 1.0
			07002-11023	O-ring	1	
Testing fuel pressure	F	1	799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 6, 40, 60 MPa {25, 60, 400, 600 kg/cm^2}
			790-261-1204	Digital hydraulic tester	1	Pressure gauge: 60 MPa {600 kg/cm^2}
		2	795-471-1450	Adapter	1	Size: 8 x 1.25 mm
			07005-00812	Washer	1	
		3	799-201-2202	Boost gauge kit	1	
Testing fuel return rate and leakage	G	1	6151-51-8490	Spacer	1	ø14
		2	6164-81-5750	Joint	1	ø14
		3	07042-20108	Plug	1	
		4	Commercially available	Hose	1	Internal dimensions: Approx. 12 mm
		5	Commercially available	Hose	1	Internal dimensions: Approx. 5 mm
		6	Commercially available	Measuring cylinder	1	
		7	Commercially available	Stopwatch	1	
Testing swing circle bearing clearance	H		Commercially available	Dial gauge	1	
Testing and adjusting oil pressure in work equipment, swing, and travel circuits	J	1	799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 6, 40, 60 MPa {25, 60, 400, 600 kg/cm^2}
			790-261-1204	Digital hydraulic tester	1	Pressure gauge: 60 MPa {600 kg/cm^2}
		2	799-101-5220	Nipple	1	Size: 10 x 1.25 mm
			07002-11023	O-ring	1	

Testing compression pressure

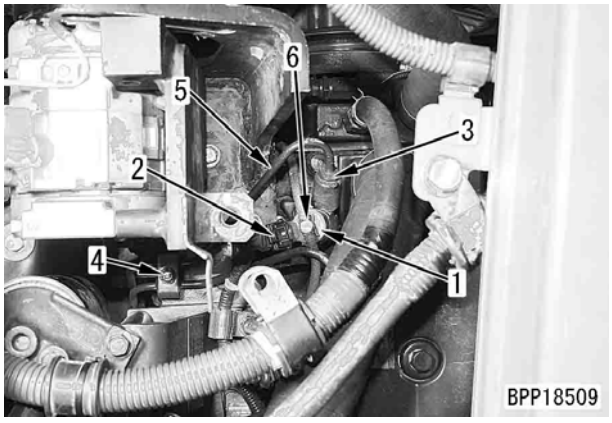
★ Testing tools for compression pressure

Symbol		Part No.	Part name
C	1	795-502-1590	Compression gauge
	2	795-502-1370	Adapter
		6271-11-3880	Gasket

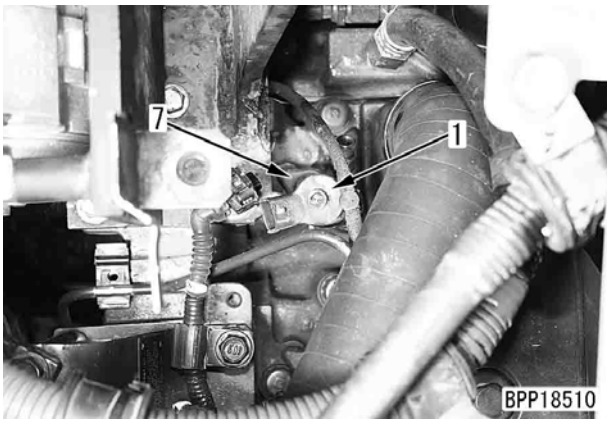
⚠ **When testing the compression pressure, take care not to burn yourself on the exhaust manifold or muffler or get caught in a rotating part.**

★ Test the compression pressure after the engine is warmed up.
(Engine oil temperature: 40 – 60°C)

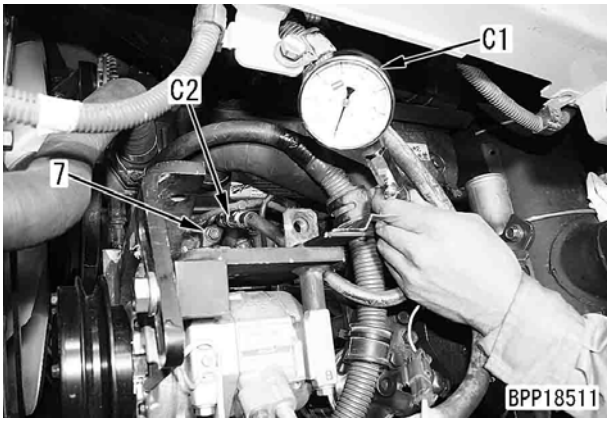
1. Remove the injector of the cylinder to be tested according to the following procedure.
   ★ Test of the No. 1 cylinder is explained below as an example.
   1) Remove the heater hose clamp.
   2) Remove wiring harness connector (2) from injector (1).
   3) Move fuel scatter prevention cover (3) from the joint.
   4) Remove clamp (4) and high-pressure pipe (5).
   5) Pull spill hose connector (6) out of injector (1).



   6) Remove holder (7) and injector (1).
      ★ If the injector is stuck and is not removed easily, pass a wire under the fuel inlet and pull it up to remove the injector.
      ★ Do not apply an external force to the terminal at the injector top.



2. Install adapter **C2** to the injector mounting part with holder (7) and connect compression gauge **C1**.
   ★ Fit the gasket to the adapter end without fail.
   Holder mounting bolt:
   27 – 30 Nm {2.8 – 3.1 kgm}
   ★ Tighten the mounting bolt after the fulcrum of the holder is seated perfectly.



Checking fuel circuit for leakage

⚠ **Very high pressure is generated in the high-pressure circuit of the fuel system. If fuel leaks while the engine is running, it is dangerous since it can catch fire.**
After checking the fuel system or removing its parts, check it for fuel leakage according to the following procedure.

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

★ Clean and degrease the engine and the parts around it in advance so that you can check it easily for fuel leakage.

1. Spray color checker (developer) over the fuel supply pump, common rail, fuel injector, and joints of the high-pressure piping.

2. Start the engine, keep its speed at low idle, and stop it when its speed is stabilized.

3. Check the fuel piping and devices for fuel leakage.
   ★ Check mainly around the high-pressure circuit parts coated with the color checker for fuel leakage.
   ★ If any fuel leakage is detected, repair it and check again from step 2.

4. Run the engine at low idle.

5. Check the fuel piping and devices for fuel leakage.
   ★ Check mainly around the high-pressure circuit parts coated with the color checker for fuel leakage.
   ★ If any fuel leakage is detected, repair it and check again from step 2.

6. Run the engine at high idle.

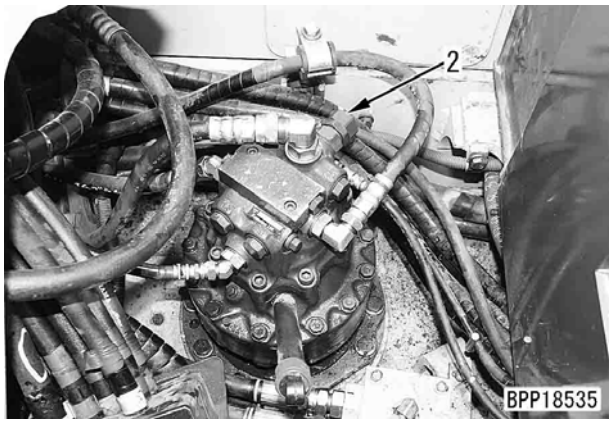
7. Check the fuel piping and devices for fuel leakage.
   ★ Check around the high-pressure circuit parts coated with the color checker for fuel leakage.
   ★ If any fuel leakage is detected, repair it and check again from step 2.

8. Run the engine at high idle and load it.
   ★ Relieve the arm circuit at the IN stroke end.

9. Check the fuel piping and devices for fuel leakage.
   ★ Check mainly around the high-pressure circuit parts coated with the color checker for fuel leakage.
   ★ If any fuel leakage is detected, repair it and check again from step 2.
   ★ If no fuel leakage is detected, check is completed.

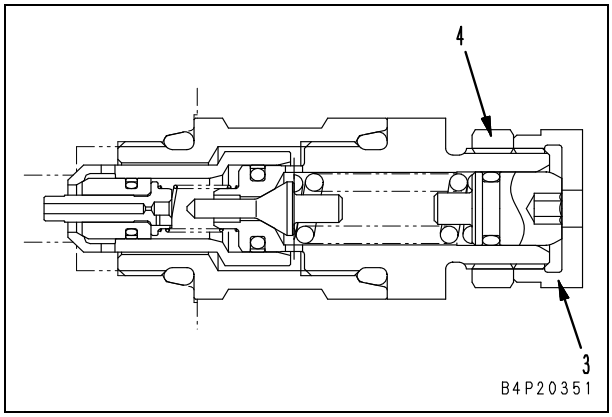
6. Adjusting swing relief pressure

★ If the swing relief pressure is abnormal, adjust swing motor safety valve (2) according to the following procedure.



⚠ **Do not turn end cap (3) counterclockwise more than one revolution or end cap (3) could fly off.**

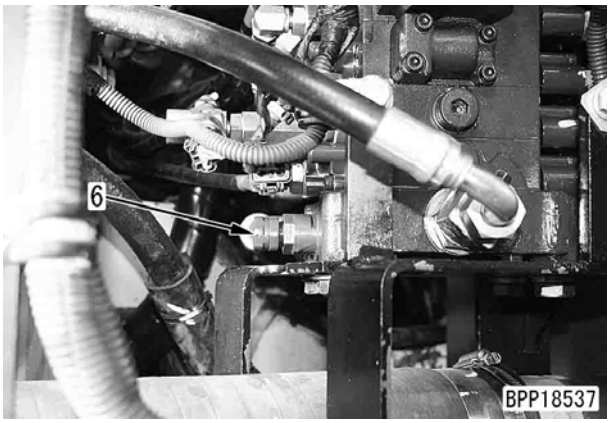
1) Loosen locknut (4) on swing motor safety valve (2) and adjust swing relief pressure by turning end cap (3).
   - ★ When the end cap (3) is:
     - Turned clockwise to the right, the set pressure is increased.
     - Turned counterclockwise to the left, the set pressure is decreased.
   - ★ The amount of adjustment per turn of end cap (3): 4.8 MPa {49.3 kg/cm²}
2) After adjusting, tighten locknut (4) to end cap (3).
   - Locknut: **93.2 – 117.7 Nm {9.5 – 12 kgm}**



3) After finishing adjustment, check again that the oil pressure is normal according to the above testing procedure.

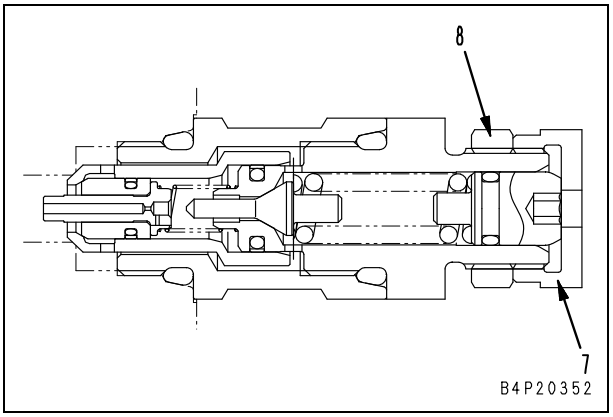
7. Adjusting blade (lower) relief pressure

★ If the blade (lower) relief pressure is abnormal, adjust main relief valve (6) according to the following procedure.



⚠ **Do not turn end cap (7) counterclockwise more than one revolution or end cap (7) could fly off.**

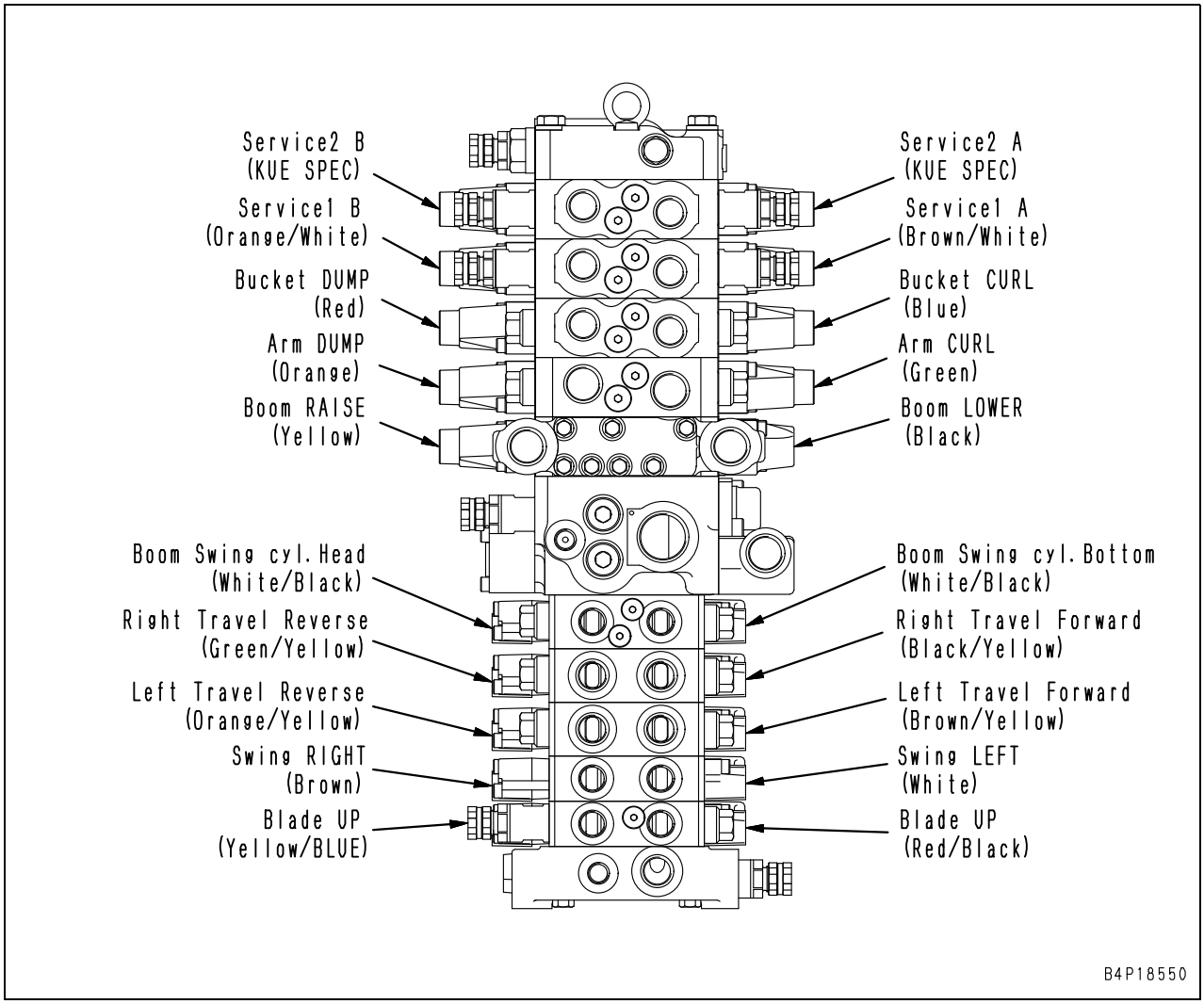
1) Loosen locknut (8) on main relief valve (6) and adjust blade (lower) relief pressure by turning end cap (7).
   - ★ When the end cap (7) is:
     - Turned clockwise to the right, the set pressure is increased.
     - Turned counterclockwise to the left, the set pressure is decreased.
   - ★ The amount of adjustment per turn of end cap (7): 19.6 MPa {200 kg/cm²}
2) After adjusting, tighten locknut (8) to end cap (7).
   - Locknut: **39 – 49 Nm {4 – 5 kgm}**



3) After finishing adjustment, check again that the oil pressure is normal according to the above testing procedure.

Testing PPC valve output pressure

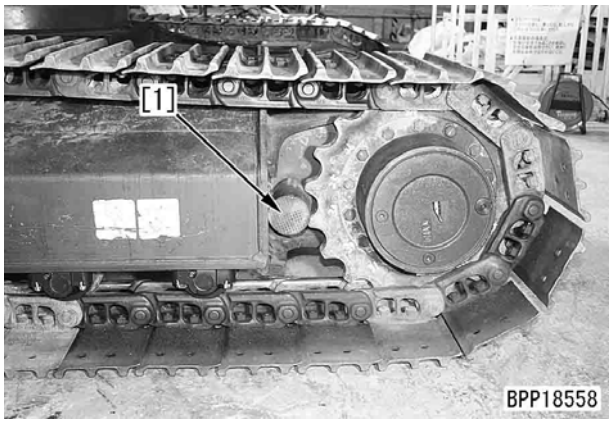
PPC piping connecting positions



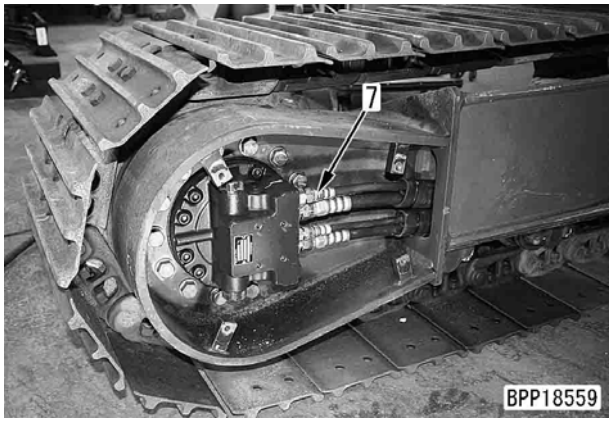
★ The above figure shows the connecting positions of the PPC piping of the 1-attachment specification.
The colors in ( ) are the colors of the bands installed for piping distinction.

5. Testing oil leakage from travel motor

1) Remove the travel motor cover.
2) Run the engine, lock the travel mechanism, and stop the engine.
   ⚠ **Put pin [1] between the sprocket and track frame to lock the travel mechanism securely.**



3) Disconnect drain hose (5) of the travel motor and block the hose side with a plug.
   ★ Use the following part to block the hose side.
   07376-70315 (Plug #03)



4) Run the engine at high idle, relieve the travel circuit, and test the oil leakage.
   ⚠ **Before operating the travel lever, check the position and locking direction of the locked sprocket again.**
   ⚠ **Wrong operation of the lever can cause an accident. Accordingly, make signs and checks securely.**
   ★ Start testing the oil leakage 30 seconds after relieving is started and test for 1 minute.
   ★ Test several times, moving the motor a little (changing the position of the valve plate and cylinder and that of the cylinder and piston) each time.
5) After finishing test, return the removed parts.

Upper section of machine monitor (Display section)

(a): Multi-display

★ When the engine is started, the battery voltage may lower suddenly, depending on the ambient temperature and the condition of the battery. In this case, the machine monitor goes off for a moment. This phenomenon is not a failure, however.

Upper section of machine monitor (Switch section)

[F1]: F1 function switch
[F2]: F2 function switch
[F3]: F3 function switch
[F4]: F4 function switch
[F5]: F5 function switch
[F6]: F6 function switch

★ The function of each function switch is indicated by graphic mark in the multi-display (a) above that function switch.
★ If the graphic mark of a function switch is not displayed, that function switch is not working.

Lower section of machine monitor (Switch section)

[1]: Numeral 1 input switch/Auto-decelerator switch
[2]: Numeral 2 input switch/Working mode selector switch
[3]: Numeral 3 input switch/Travel speed shifting switch
[4]: Numeral 4 input switch/Alarm buzzer cancel switch
[5]: Numeral 5 input switch/Wiper switch
[6]: Numeral 6 input switch/Windshield washer switch
[7]: Numeral 7 input switch/Air conditioner or heater switch
[8]: Numeral 8 input switch/Air conditioner or heater switch
[9]: Numeral 9 input switch/Air conditioner or heater switch
[0]: Numeral 0 input switch/Air conditioner or heater switch

Switch having no numerals: Air conditioner or heater switch

★ Each switch has the function indicated by graphic mark and the function of inputting a numeral.
★ The machine monitor automatically judges which function of each switch is currently effective, according to the display condition of multi-display.

Reference

For the setup procedure after replacing the machine monitor assembly, see Servise News (AT07196).

[KOMTRAX message]

- There are 2 types of KOMTRAX message; 1 is for the user and the other is for the service.
- For user:
  A message transmitted from the KOMTRAX base station for the user. If it is received, the message monitor is displayed on the ordinary screen. To see the contents of the message, operate "User Message" in the above user menu.
- For service:
  A message transmitted from the KOMTRAX base station for the service. Even if it is received, nothing is displayed on the ordinary screen. To see the contents of the message, operate "KOMTRAX message" display in the service menu.

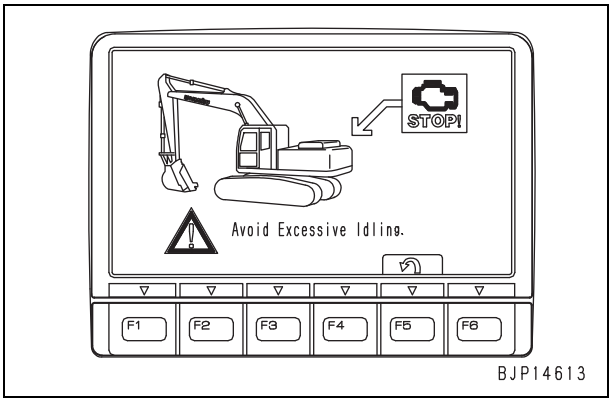
Display of energy-saving guidance

When the machine is set in a certain operating condition, the energy-saving guidance screen is displayed automatically to urge the operator to the energy-saving operation.

★ The energy-saving guidance is displayed when the following condition is satisfied while the display setting is set effective in the service mode.

★ Condition for display:
  Engine is running + All levers have been in neutral for 5 minutes + Caution (Note) or user code is not generated (Note).
  Note: Excluding hydraulic oil low temperature caution.

★ If any lever or pedal is operated, or [F5] is pressed, the screen returns to the ordinary screen.



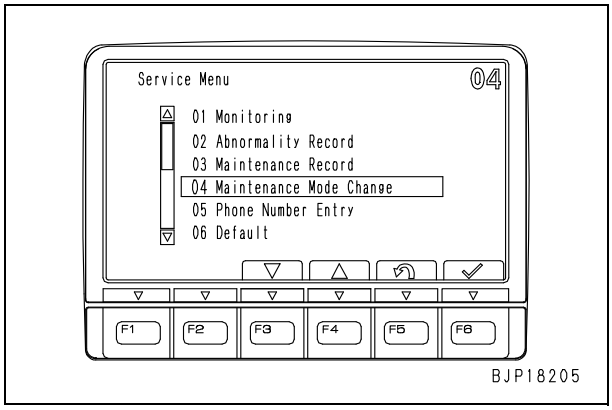
Code No.	Monitoring item (Display on screen)		Unit (Initial setting: ISO)			Component in charge	Remarks
			ISO	meter	inch		
15900	Boom bottom pressure		MPa	kg/cm^2	psi	PUMP	
01900	Pressure switch 1	Boom lower	ON•OFF			PUMP	
		Boom raise	ON•OFF			PUMP	
		Arm curl (IN)	ON•OFF			PUMP	
		Arm dump (OUT)	ON•OFF			PUMP	
01901	Pressure switch 2	Bucket curl	ON•OFF			PUMP	
		Bucket dump	ON•OFF			PUMP	
		Service	ON•OFF			PUMP	
01902	Pressure switch 3	Blade Up	ON•OFF			PUMP	
		Blade Down	ON•OFF			PUMP	
		Boom Swing Left	ON•OFF			PUMP	
		Boom Swing Right	ON•OFF			PUMP	
02300	Solenoid valve 1	Swing Brake	ON•OFF			PUMP	
		Merge-divider	ON•OFF			PUMP	
		Travel speed	ON•OFF			PUMP	
02200	Switch input 1	Swing Release Sw	ON•OFF			PUMP	
02201	Switch input 2	Blade Spec	ON•OFF			PUMP	
		UU Spec	ON•OFF			PUMP	
		Overload Alarm	ON•OFF			PUMP	
02202	Switch input 3	Key Switch (ACC)	ON•OFF			PUMP	
02203	Switch input 4	Aircon SW	ON•OFF			PUMP	
		Lock Lever Sw	ON•OFF			PUMP	
		Breaker Sw	ON•OFF			PUMP	
		Quick Coupler	ON•OFF			PUMP	
02204	Switch input 5	Window Limit SW.	ON•OFF			PUMP	
		P Limit SW.	ON•OFF			PUMP	
		W Limit SW.	ON•OFF			PUMP	
02209	Switch input 6	Model Select 1	ON•OFF			PUMP	
		Model Select 2	ON•OFF			PUMP	
		Model Select 3	ON•OFF			PUMP	
		Model Select 4	ON•OFF			PUMP	
		Model Select 5	ON•OFF			PUMP	
03701	Controller output 2	Travel Alarm	ON•OFF			PUMP	
04500	Monitor input	Key switch	ON•OFF			MON	
		Start	ON•OFF			MON	
		Preheat	ON•OFF			MON	
		Light	ON•OFF			MON	
		Rad. Level	ON•OFF			MON	
04501	Monitor input 2	Battery charge	ON•OFF			MON	
04503	Monitor function switches	F1	ON•OFF			MON	
		F2	ON•OFF			MON	
		F3	ON•OFF			MON	
		F4	ON•OFF			MON	
		F5	ON•OFF			MON	
		F6	ON•OFF			MON	

Maintenance Mode Change

The operating condition for maintenance function in the operation mode can be set and changed with this menu.

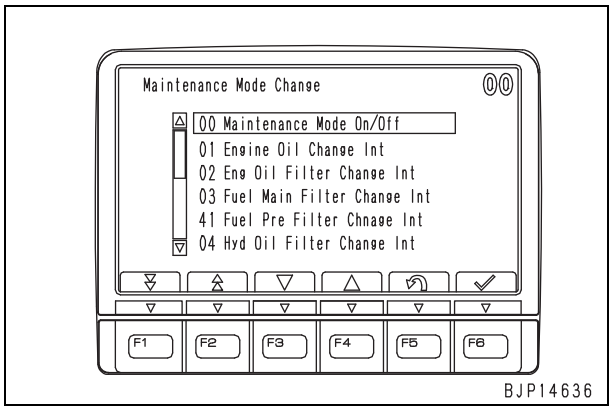
- Set function effective or ineffective
- Change set replacement interval (by items)
- Initialize all set replacement intervals

1. Selecting menu
   Select of "Maintenance Mode Change" on the "Service Menu" screen.



2. Selecting sub menu
   After the "Maintenance Mode Change" screen is displayed, select an item to change the setting with the function switches or numeral input switches.
   - [F1]: Move to next page (screen)
   - [F2]: Move to previous page (screen)
   - [F3]: Move to lower item
   - [F4]: Move to upper item
   - [F5]: Return to service menu screen

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

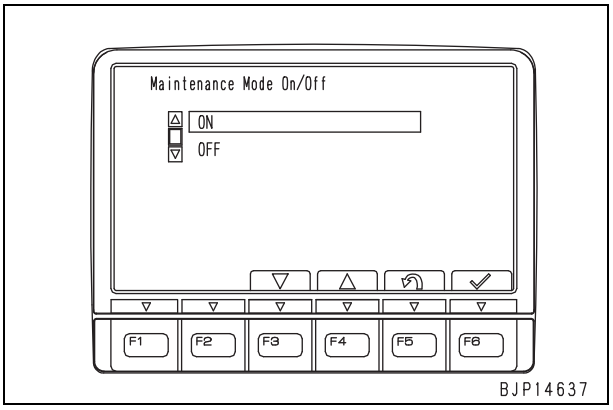


★ The following items can be selected on the “Maintenance Mode Change” screen.

00 Maintenance mode on/off
01 Engine oil change int.
02 Engine oil filter change int.
03 Fuel main filter change int.
41 Fuel pre filter change int.
04 Hyd oil filter change int.
05 Hyd tank breather change int.
06 Corrosion resistor change int.
07 Damper case service int.
08 Final drive case oil change int.
09 Machinery case change int.
10 Hydraulic oil change int.
99 Initialize all items

3. Contents of setting of “Maintenance Mode On/Off”
   After selecting "Maintenance Mode On/Off", if the screen is displayed, set ON or OFF with the function switches.
   - ON: Functions of all maintenance items are set effective in operator mode
   - OFF: Functions of all maintenance items are set ineffective in operator mode
   - [F3]: Move to lower item
   - [F4]: Move to upper item
   - [F5]: Cancel selection and return to “Maintenance Mode Change” screen
   - [F6]: Confirm selection and return to “Maintenance Mode Change” screen

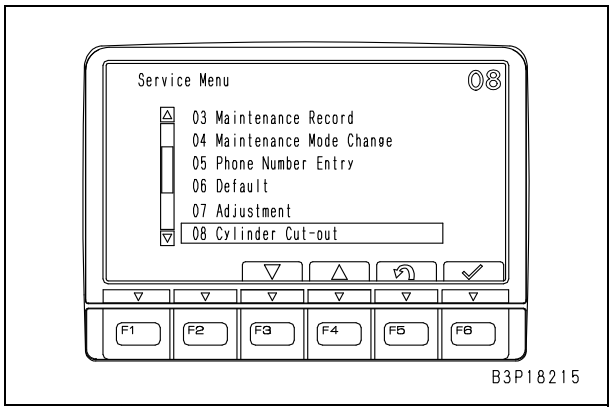
   ★ Even if ON/OFF of each item has been set, if the above setting is changed, it is applied.



Cylinder Cut-Out

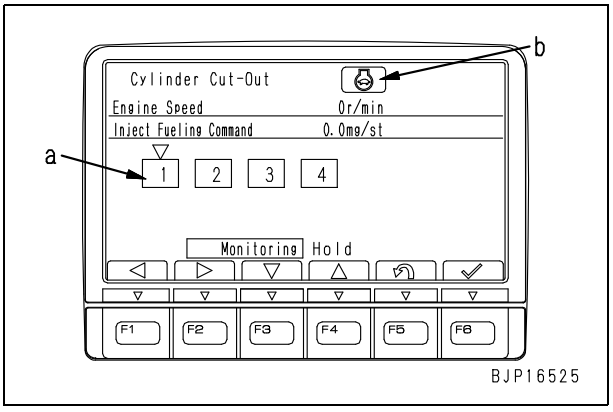
The operator can perform "Cylinder Cut-Out" operation with the machine monitor.
"Cylinder Cut-Out" operation means to run the engine with 1 or more fuel injectors disabled electrically to reduce the number of effective cylinders. This operation is used to find out a cylinder which does not output power normally (combustion in it is abnormal).

1. Selecting menu
   Select "Cylinder Cut-Out" on the "Service Menu" screen.



2. Selecting cylinder to be disabled
   After the "Cylinder Cut-Out" screen is displayed, select a cylinder to be Cut-Out with the function switches.
   - [F1]: Move selection mark (▽) to left
   - [F2]: Move selection mark (▽) to right
   - [F3]: Reset holding
   - [F4]: Hold
   - [F5]: Return to service menu screen
   - [F6]: Confirm selection

   ★ This operation may be performed while the engine is running.
   ★ When [F6] is pressed, if background (a) of the selected cylinder No. becomes white, the cylinder is Cut-Out.
   ★ If the machine monitor Cut-Out a cylinder but the engine controller cannot Cut-Out that cylinder, the background (a) of the cylinder No. becomes yellow.
   ★ One or more cylinders can be Cut-Out.
   ★ In the cylinder Cut-Out operation, the auto-deceleration function can be selected. If the auto-deceleration is turned ON, auto-deceleration monitor (b) is displayed.

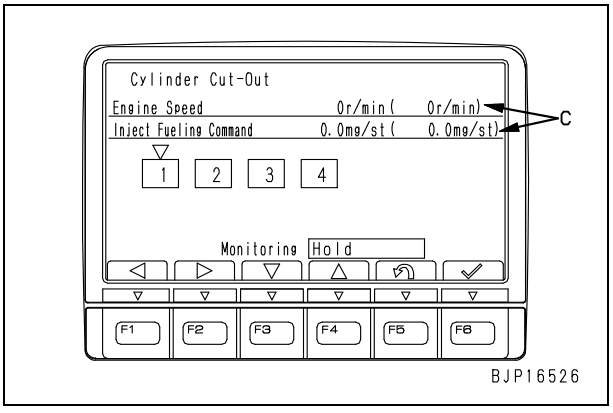


3. Resetting Cut-Out cylinder
   When changing a cylinder to be Cut-Out or when Cylinder Cut-Out operation is finished, select a Cut-Out cylinder to be reset with the function switches.

   ★ This operation may be performed while the engine is running.
   ★ When [F6] is pressed, if background (a) of the selected cylinder No. becomes blue, the cylinder is reset.
   ★ If the machine monitor resets a Cut-Out cylinder but the engine controller cannot reset that Cut-Out cylinder, the background (a) of the cylinder No. becomes red.
   ★ The Cut-Out operation is not automatically reset after the screen returns to the operator mode. Accordingly, be sure to perform the resetting operation after the cylinder cut-out operation is finished.

4. Function of holding displayed information
   If [F4] is pressed during the cylinder Cut-Out operation, the displayed information is newly held (c) (The real-time information is kept displayed on the left side).
   While the information is held, if [F3] is pressed, the holding function is reset.

   ★ The holding function is effective, regardless of setting of the reduced cylinder mode operation.



HYDRAULIC EXCAVATOR
PC88MR-8

Machine model	Serial number
PC88MR-8	5001 and up

30 Testing and adjusting
130 Testing and adjusting, Part 3

4. Hydraulic circuit

No.	Checked part	Checking condition			[1]	[2]	[3]	[4]	[5]	Good	Bad
					600K	600K	600K	600K	60K		
		Fuel control dial	Working mode	Operation of work equipment	Pump main 1	Pump main 2	Pump LS 1	Pump LS 2	Control		
1	Pilot relief valve	MAX	P	All lever in neutral	—	—	—	—	A		
2	Main relief valve			Arm OUT relief	B	B	—	—	—		
3	Unload valve			All levers in neutral	C1	C1	C2	C2	—		
4	LS valve			Right track driven idle Lever moved halfway	D1	—	D2	—	—		
				Left track driven idle Lever moved halfway	—	D1	—	D2	—		
5	Swing motor safety valve			Swing lock Right swing relief	E	E	—	—	—		
				Swing lock Left swing relief	E	E	—	—	—		
6	Main relief valve Travel motor Safety valve Travel junction valve			Right travel lock Right forward relief	F	—	—	—	—		
				Right travel lock Right reverse relief	F	—	—	—	—		
				Left travel lock Left forward relief	—	F	—	—	—		
				Left travel lock Left reverse relief	—	F	—	—	—		

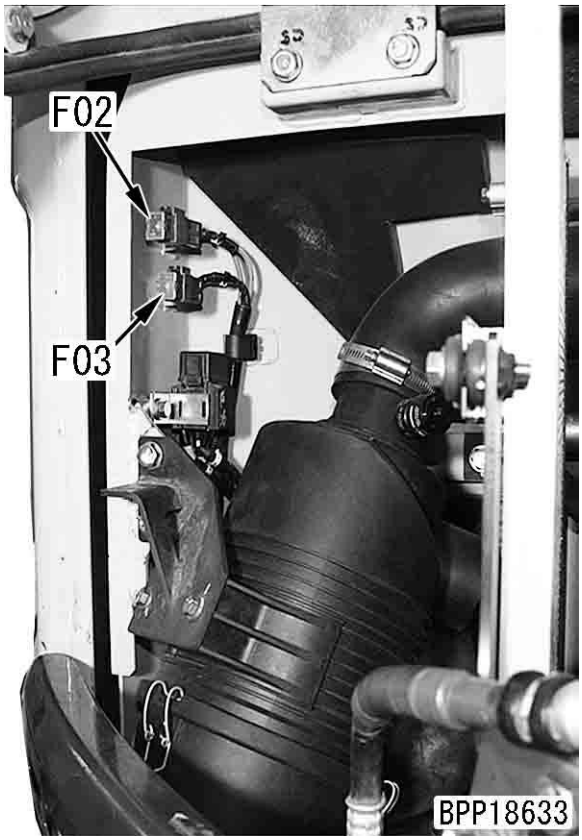
Standard value	Checked oil pressure	Unit	Standard value for new machine	Service limit value
	A (Control circuit basic pressure)	MPa {kg/cm²}	2.84 – 3.43 {29 – 35}	2.65 – 3.63 {27 – 37}
	B (Work equipment relief pressure)		25.52 – 27.48 {260 – 280}	25.03 – 27.97 {255 – 285}
	C (Unload pressure)		1.8 – 3.8 {18 – 38}	1.8 – 3.8 {18 – 38}
	D (LS differential pressure)		2.5 – 4.4 {25 – 45}	2.1 – 2.3 {21.5 – 23.5}
	E (Swing relief pressure)		19.52 – 21.48 {200 – 220}	19.03 – 21.97 {195 – 225}
	F (Travel relief pressure)		25.52 – 27.48 {260 – 280}	25.03 – 27.97 {255 – 285}

*** Gauge changing work: Change hoses of gauges [3] and [4].**

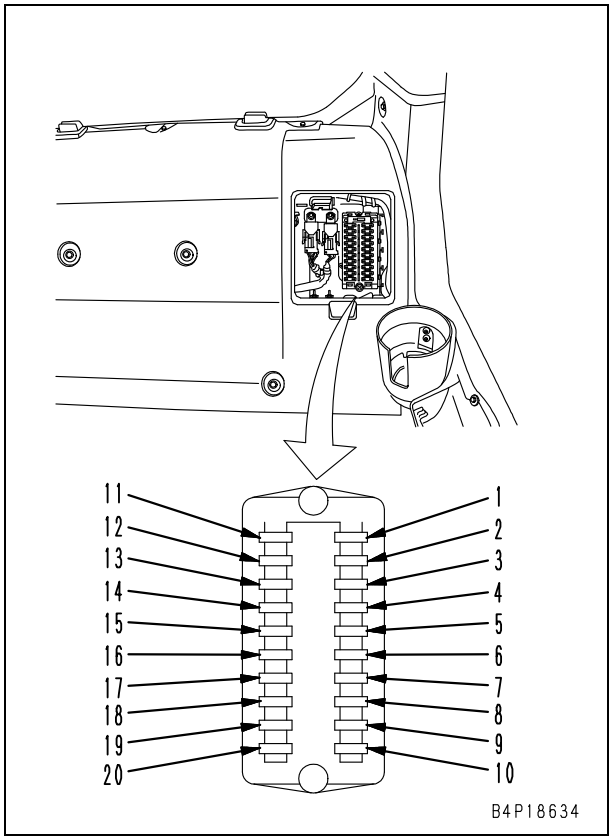
No.	Check item	Checking condition			[1]	[2]	[3a]	[4a]	[5]	Good	Bad
					600K	600K	600K	600K	60K		
		Fuel control dial	Working mode	Operation of work equipment	F pump main	R pump main	F pump servo	R pump servo	Control		
7	Servo piston	MAX	P	Arm OUT relief	H1	H1	H2	H2	—		

Standard value	Checked oil pressure	Unit	Standard value for new machine	Service limit value
	H (Servo control pressure)	—	H1 : H2 = 1 : 0.6 (Oil pressure ratio)	

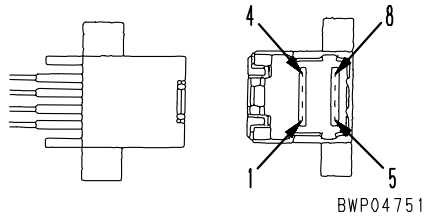
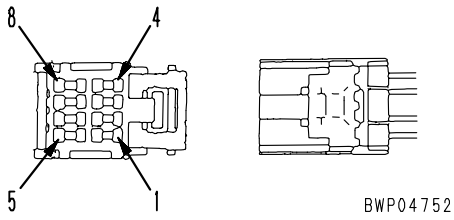
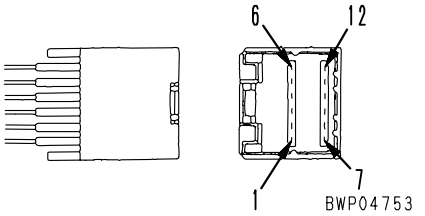
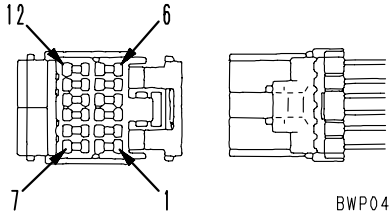
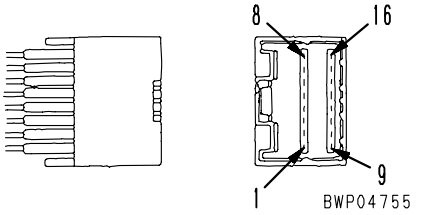
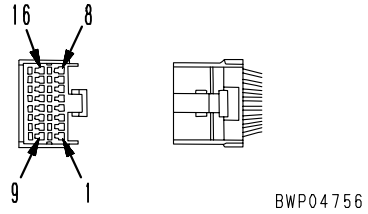
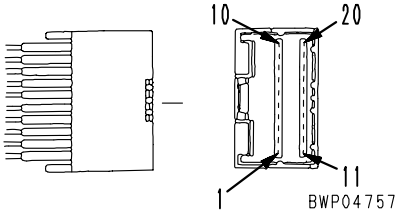
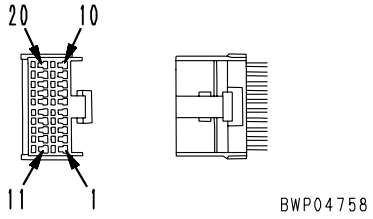
Locations of fusible links



Location of fuse box and fuse Nos.

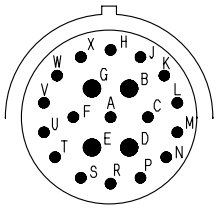
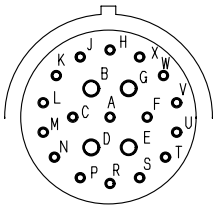
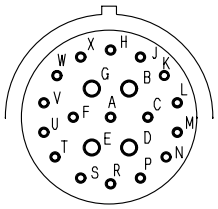
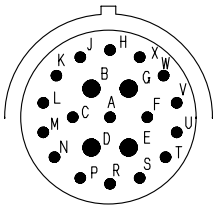
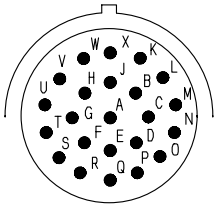
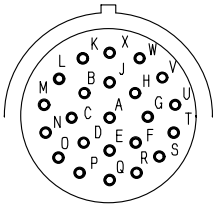
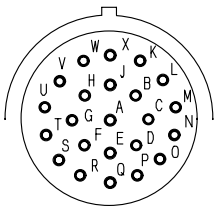
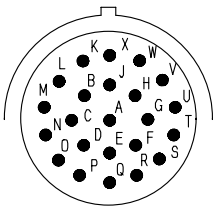


No.	Phenomena looking like troubles	Troubleshooting			
		Display of code	**E-mode**	**H-mode**	**S-mode**
34	Speed or power of blade is low			H-10	
35	Work equipment does not move in its single operation			H-11	
36	Hydraulic drift of work equipment is large			H-12	
37	Time lag of work equipment is large			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)	

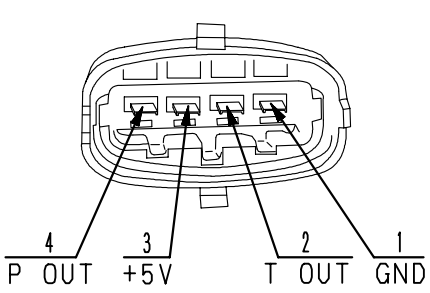
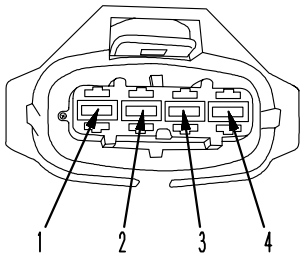
B4D18198

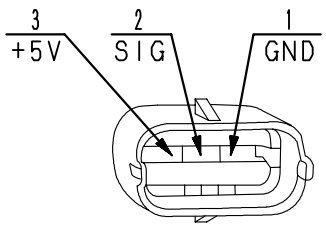
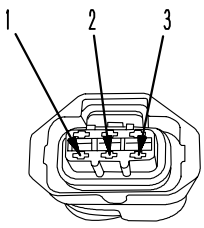
[The pin No. is also marked on the connector(electric wire insertion end)]

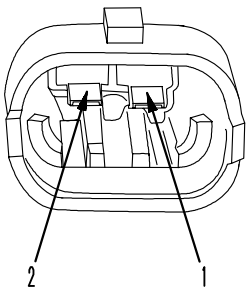
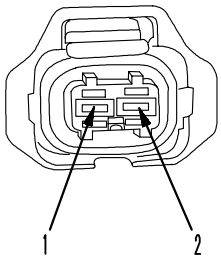
Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	Testing connection use special tool Part No.
24-21 (7)	Pin (male terminal)	Socket (female terminal)	799-601-9270 (T-adapter)
	 BWP05025	 BWP05026	
	Part No. :08191-71201, 08191-71202, 08191-71205, 08191-71206	Part No. :08191-74101, 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	—															●

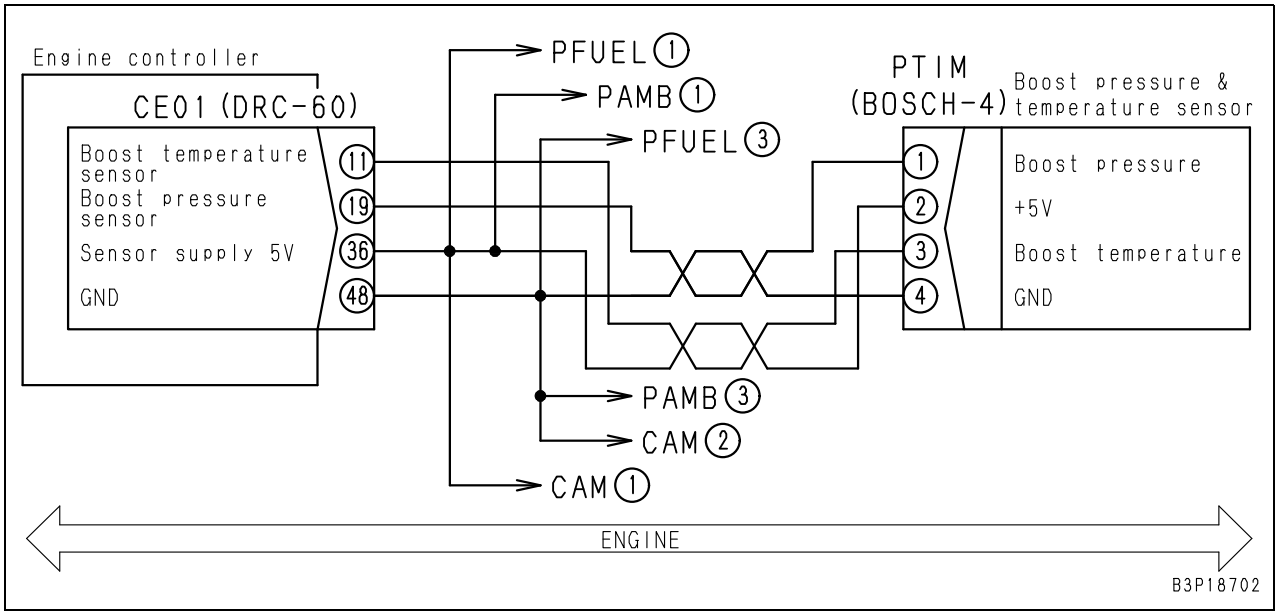
"*" Shows not T-adapter but socket.

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

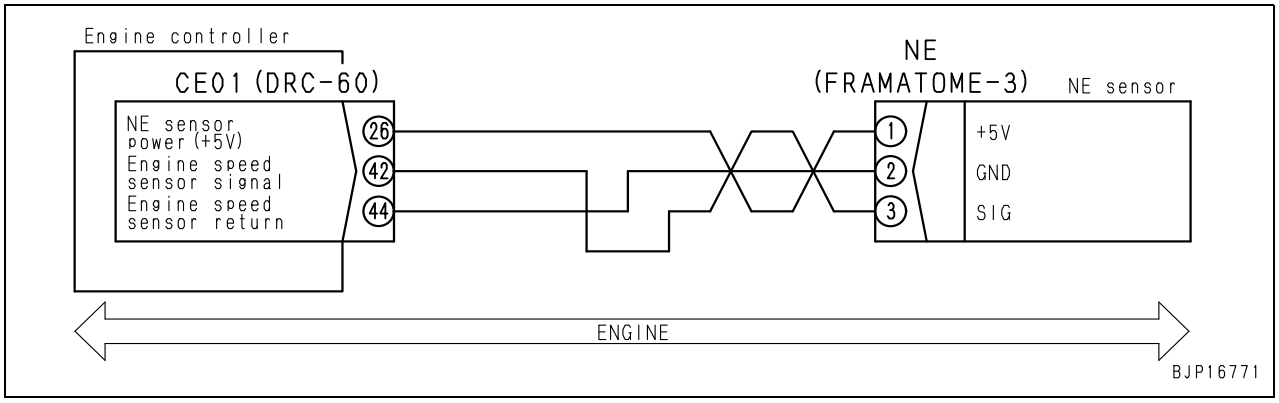
User code	Failure code	Trouble	Engine oil pressure low (Engine controller system)
—	**B@BAZG**		
Contents of trouble	• While engine was running, signal circuit of engine oil pressure switch detected low engine oil pressure (sensor contact opened).		
Action of controller	• Displays engine oil pressure 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**].

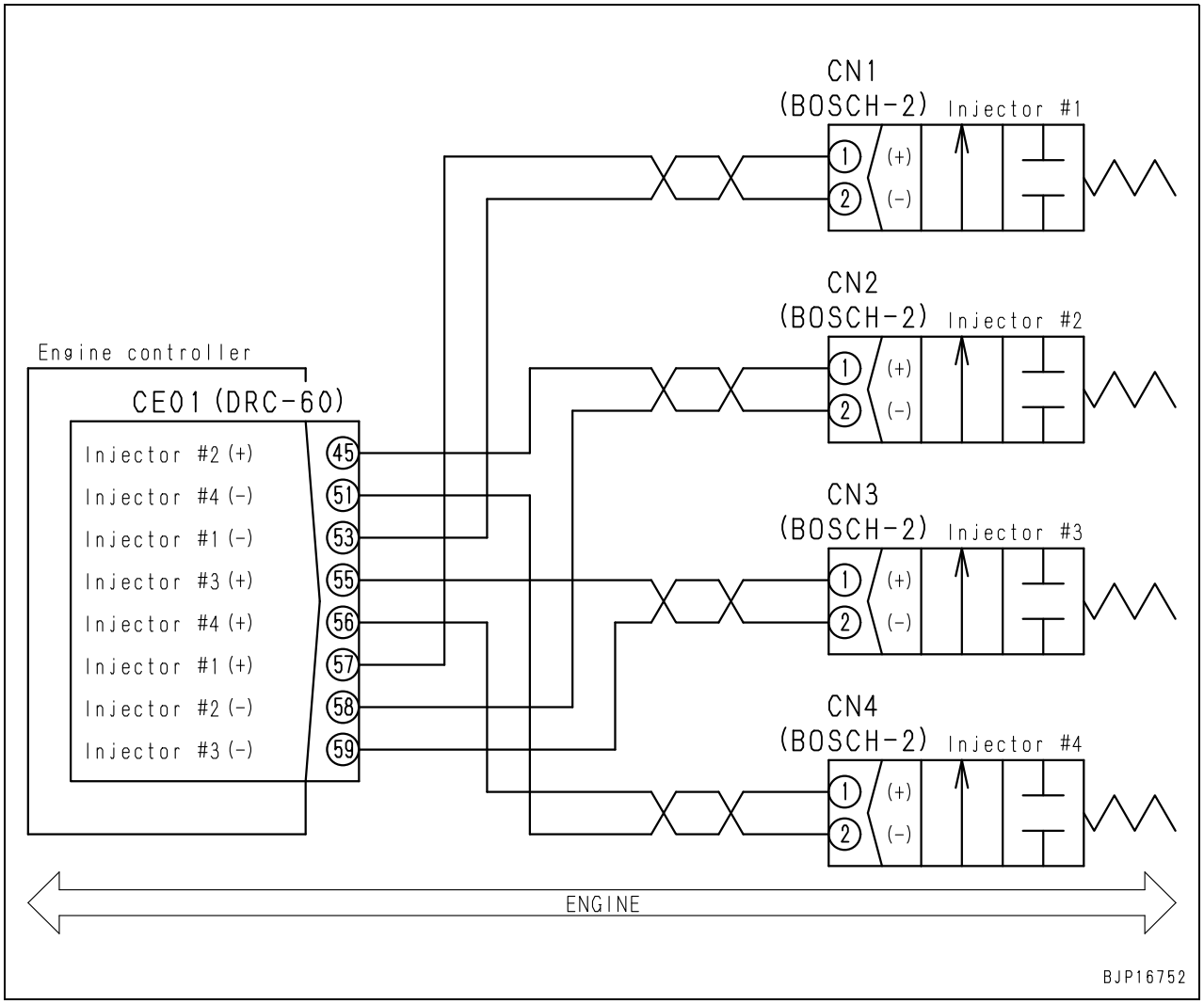
Related circuit diagram



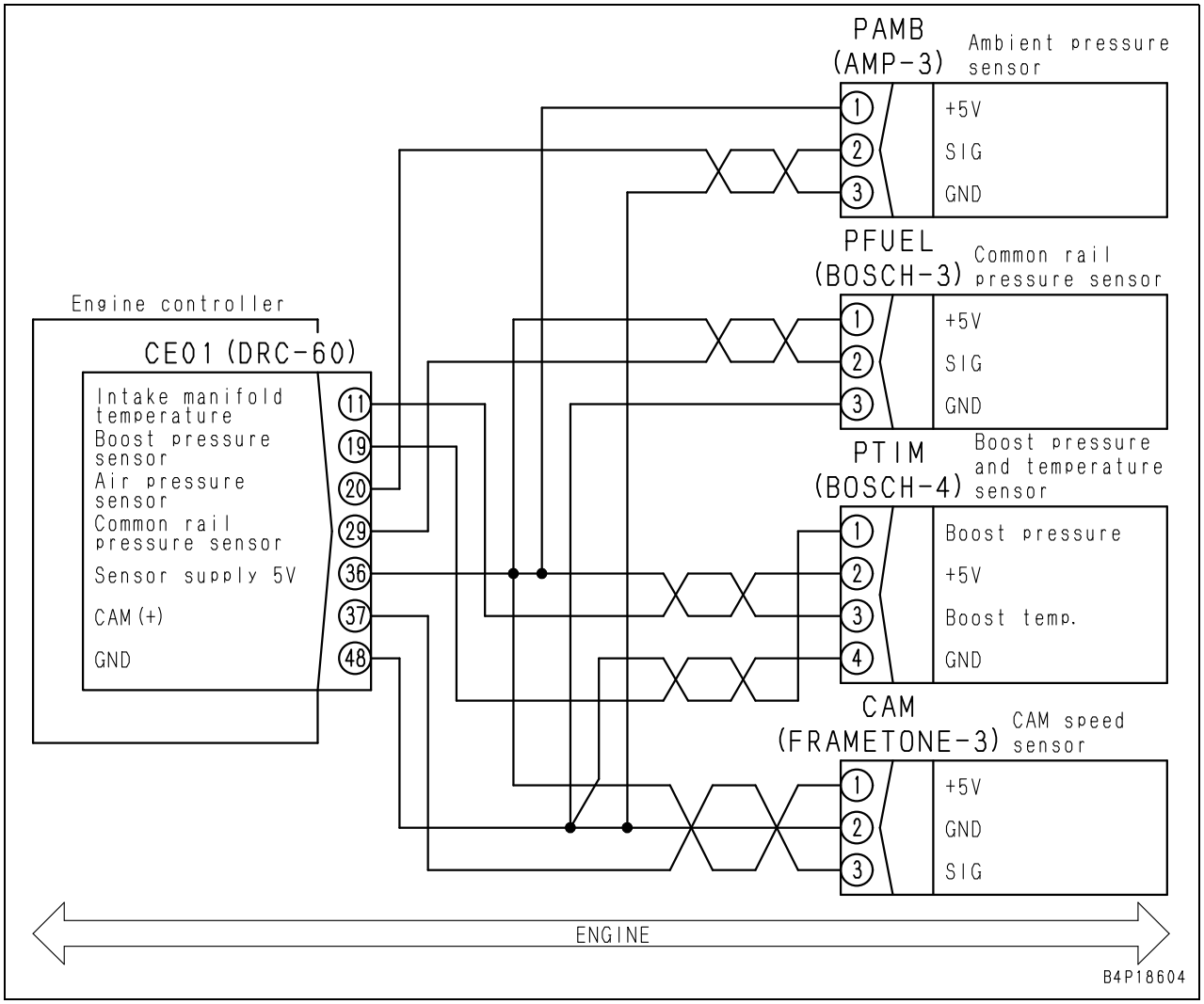
Related circuit diagram



Related circuit diagram



Related circuit diagram

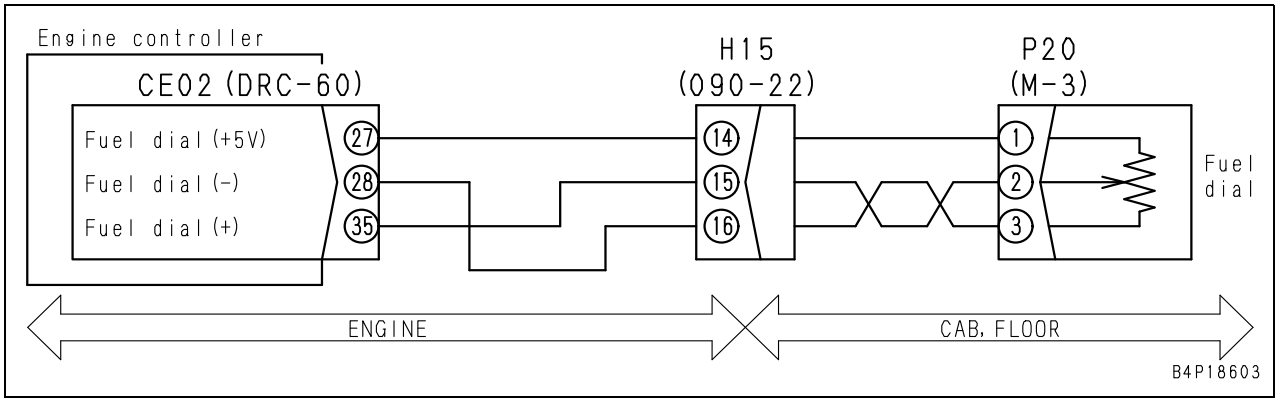


*1 – *10:
See Testing and adjusting, "Special functions of machine monitor", Monitoring items table.

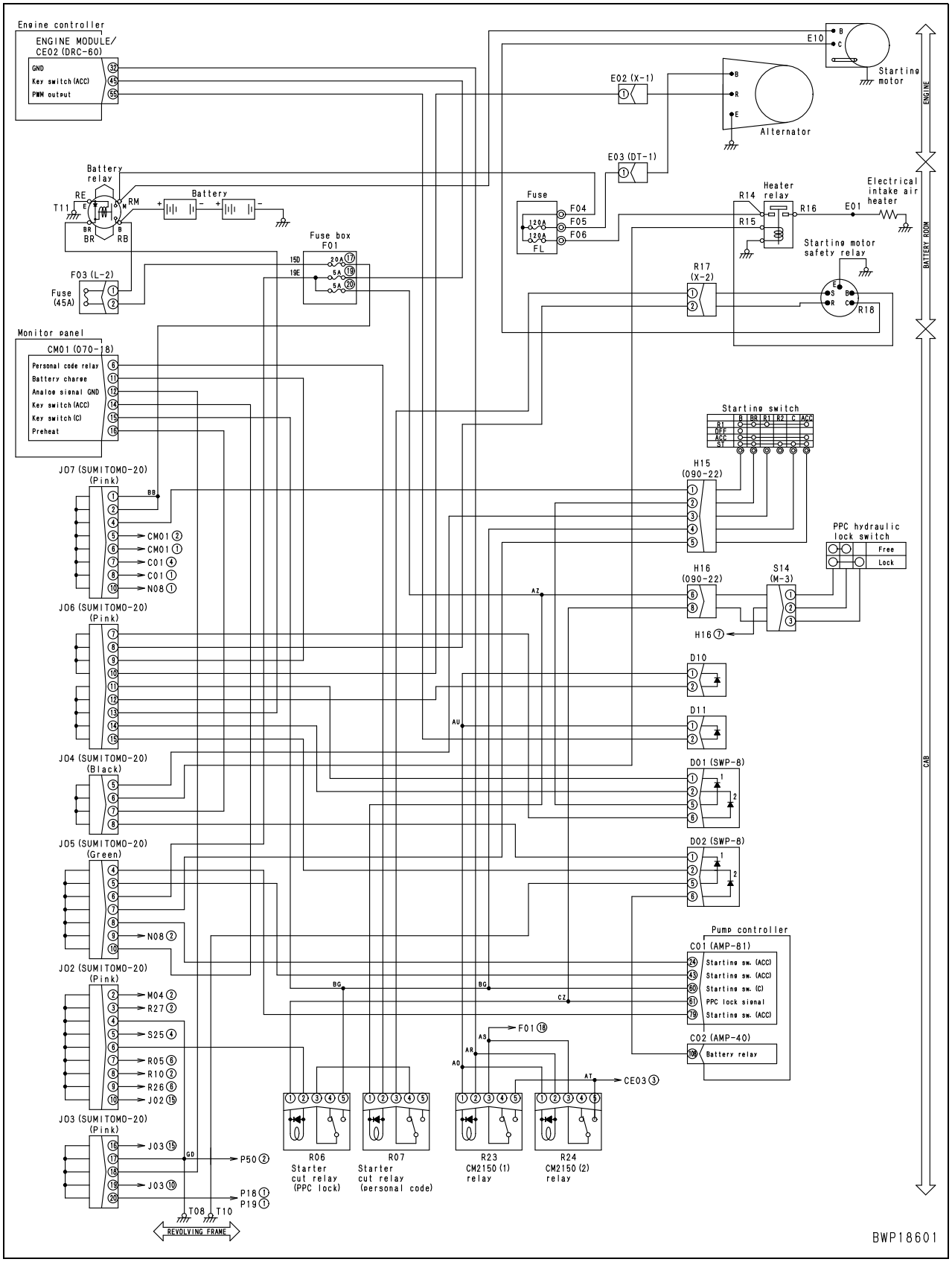
(*): A limit value is the value mentioned above, but a standard value in normalcy is "0 cc/min. (no leak)".

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)

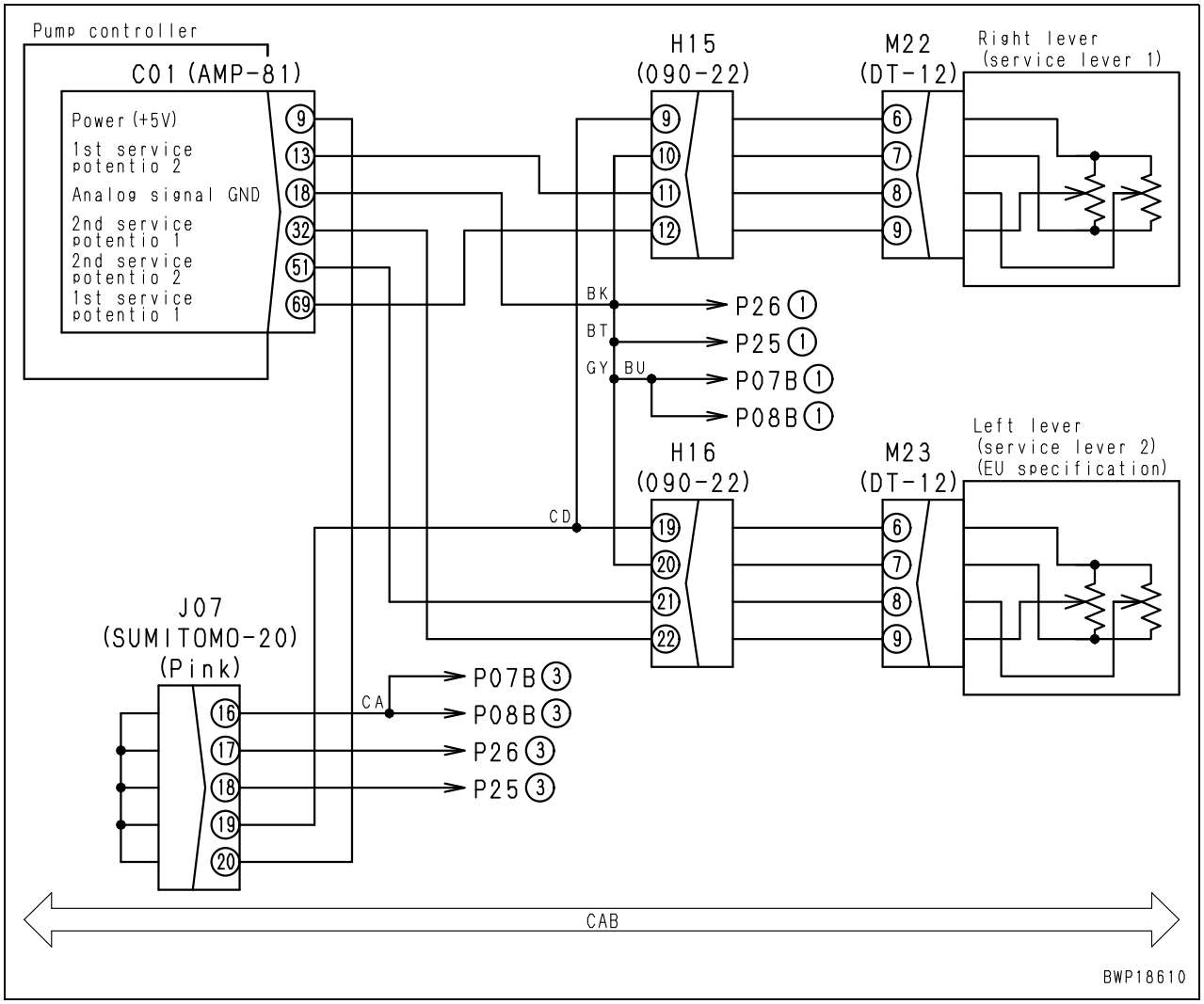


HYDRAULIC EXCAVATOR
PC88MR-8

Machine model	Serial number
PC88MR-8	5001 and up

40 Troubleshooting
330 Troubleshooting by failure code, Part 3

Related circuit diagram

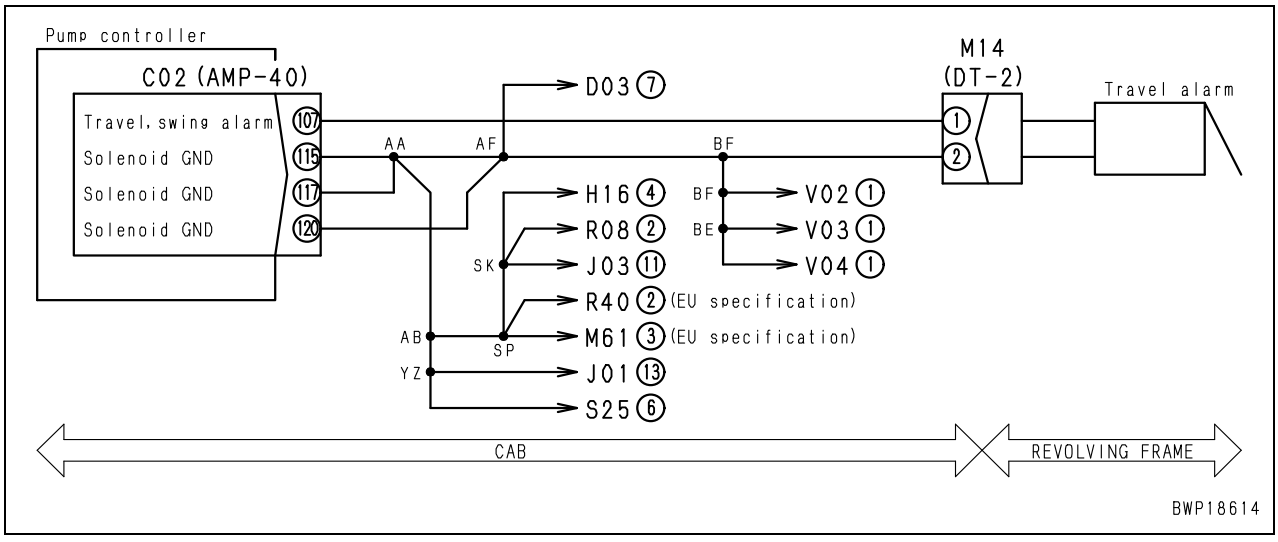


Failure code [DV20KB] Travel alarm short circuit

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

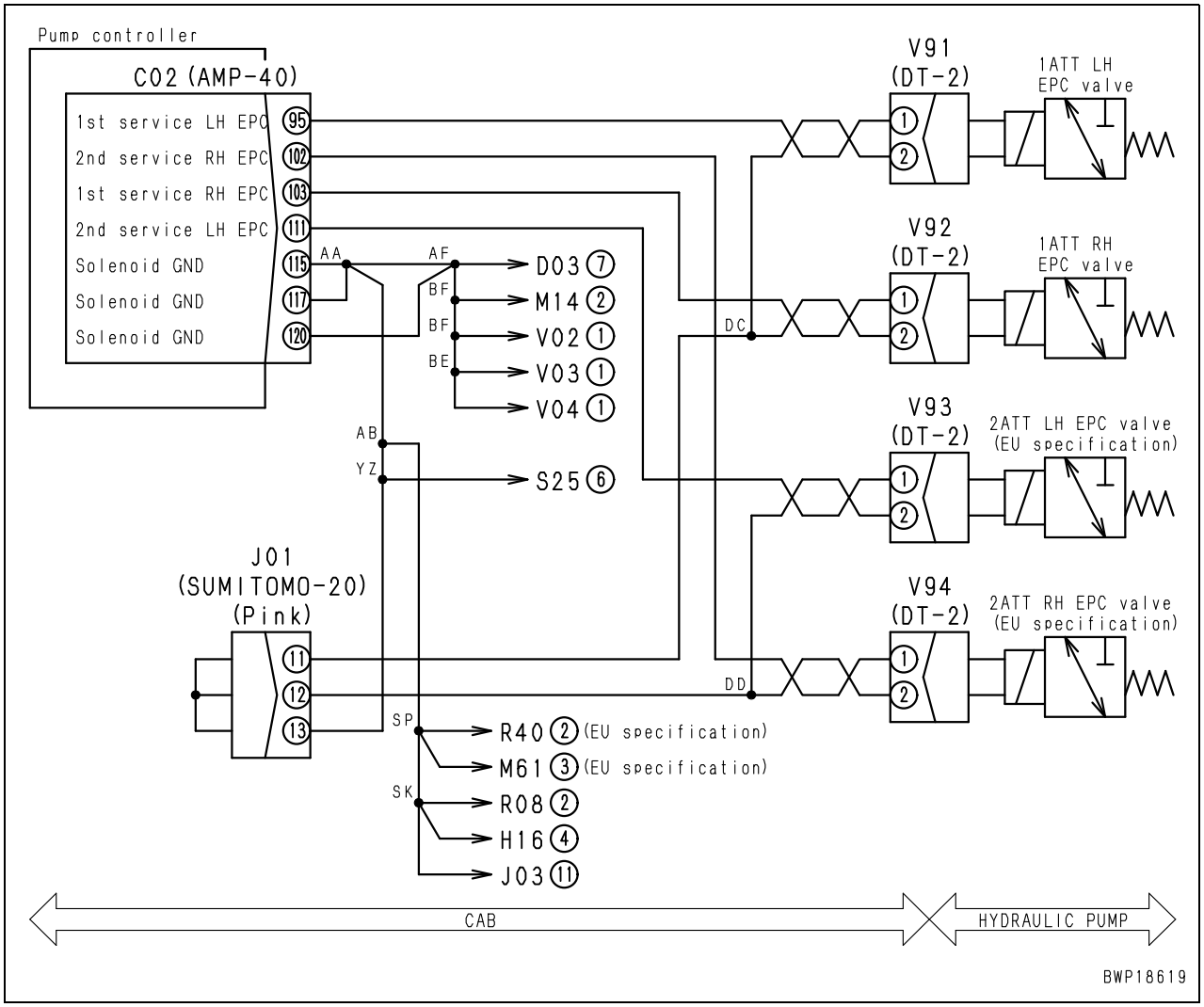


HYDRAULIC EXCAVATOR
PC88MR-8

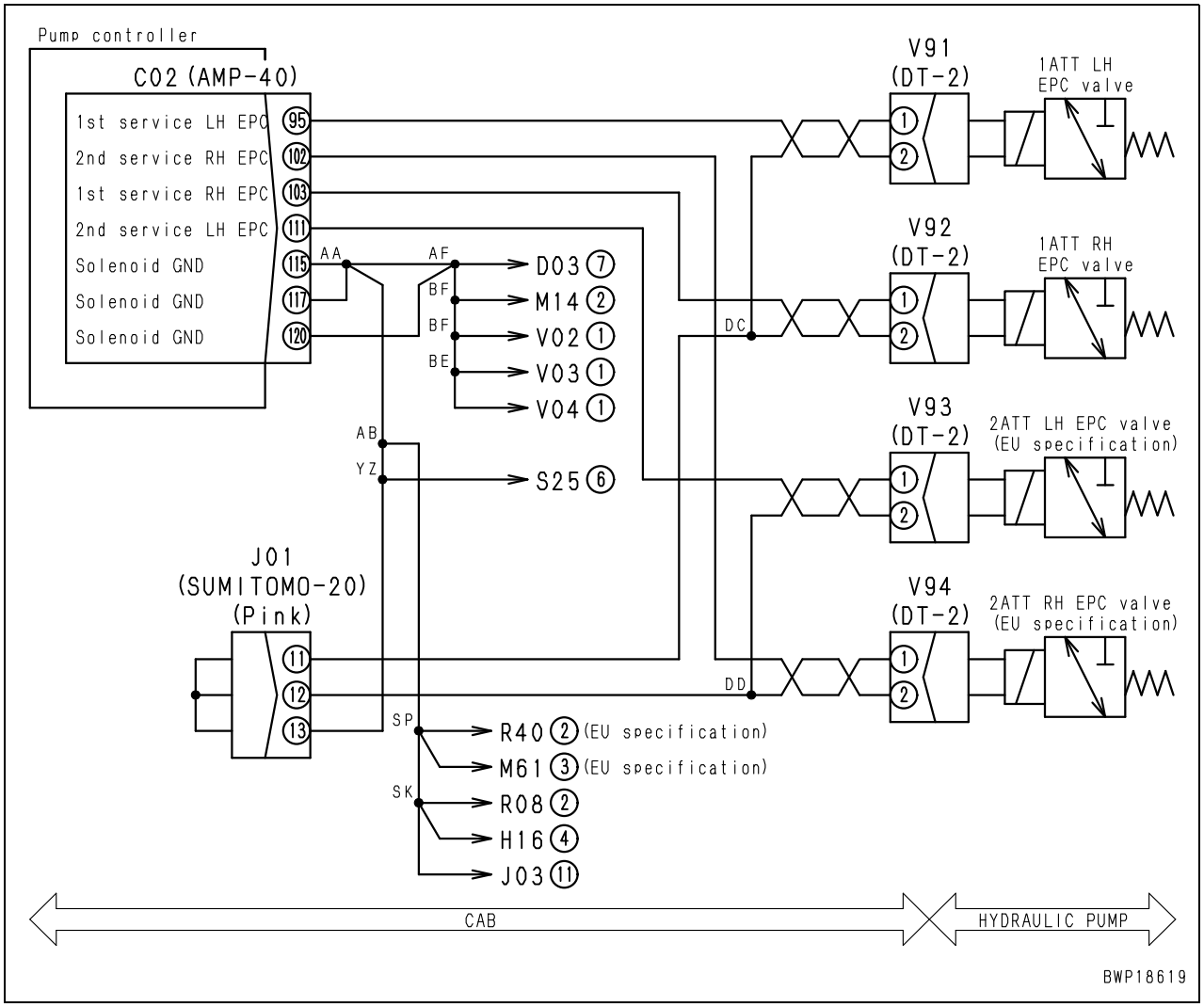
Machine model	Serial number
PC88MR-8	5001 and up

40 Troubleshooting
340 Troubleshooting by failure code, Part 4

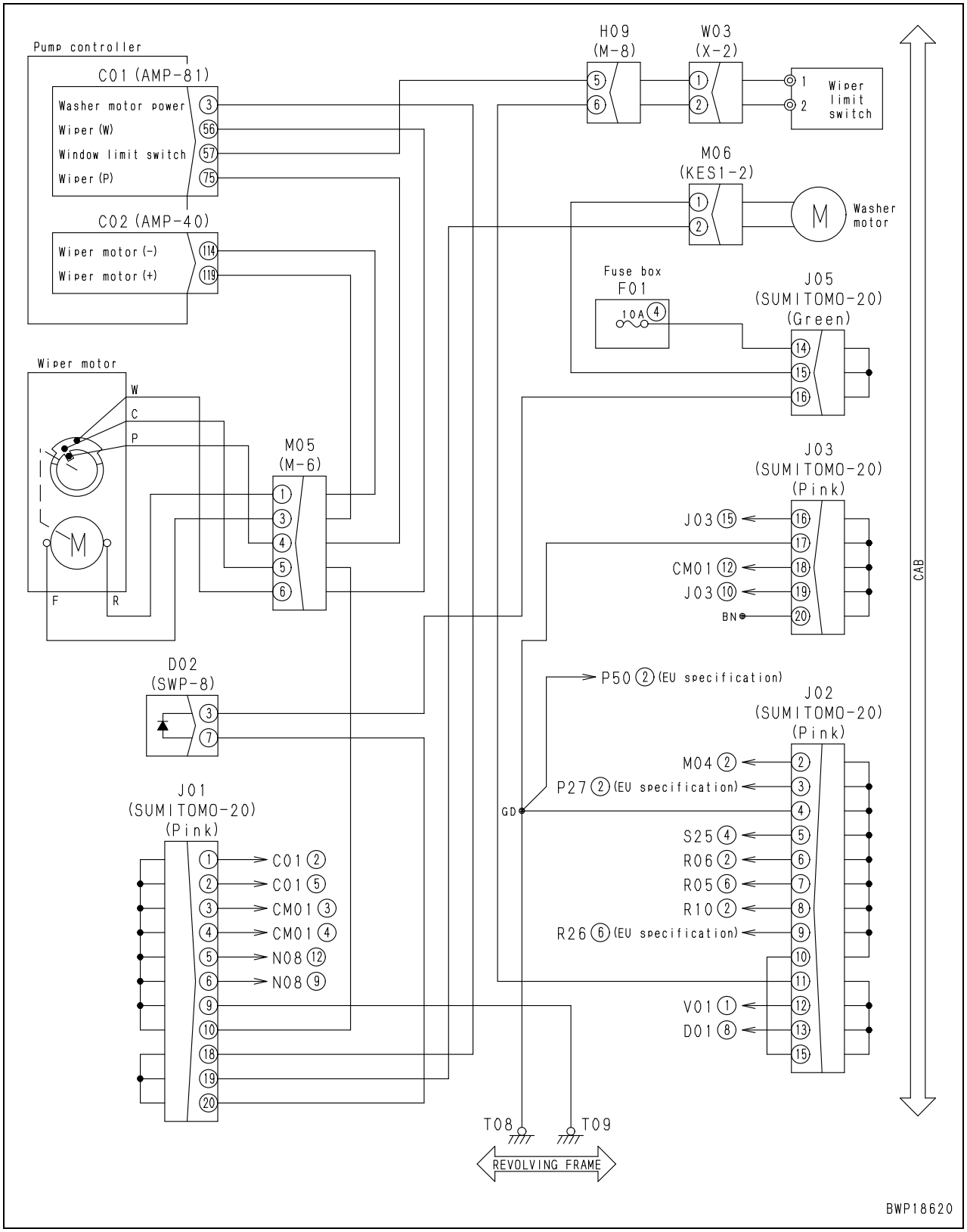
Related circuit diagram



Related circuit diagram



Related circuit diagram

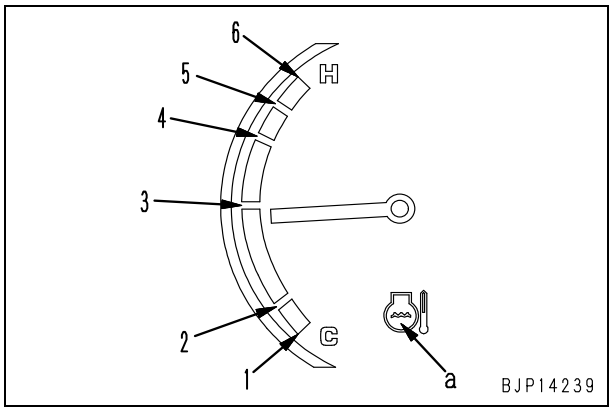


E-4 Automatic warm-up system does not operate (in cold season)

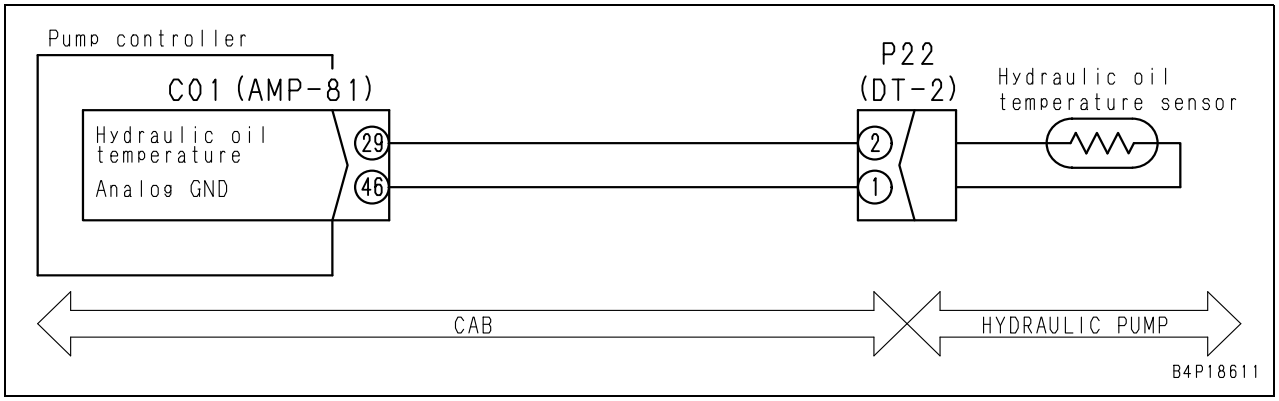
Trouble	• Automatic warm-up system does not operate (in cold season).
Related information	• When engine coolant temperature is below 30°C, automatic warm-up system raises engine speed to 1,300 rpm. • If fuel control dial is opened more than 70% for 3 seconds when starting switch is turned ON or after 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>

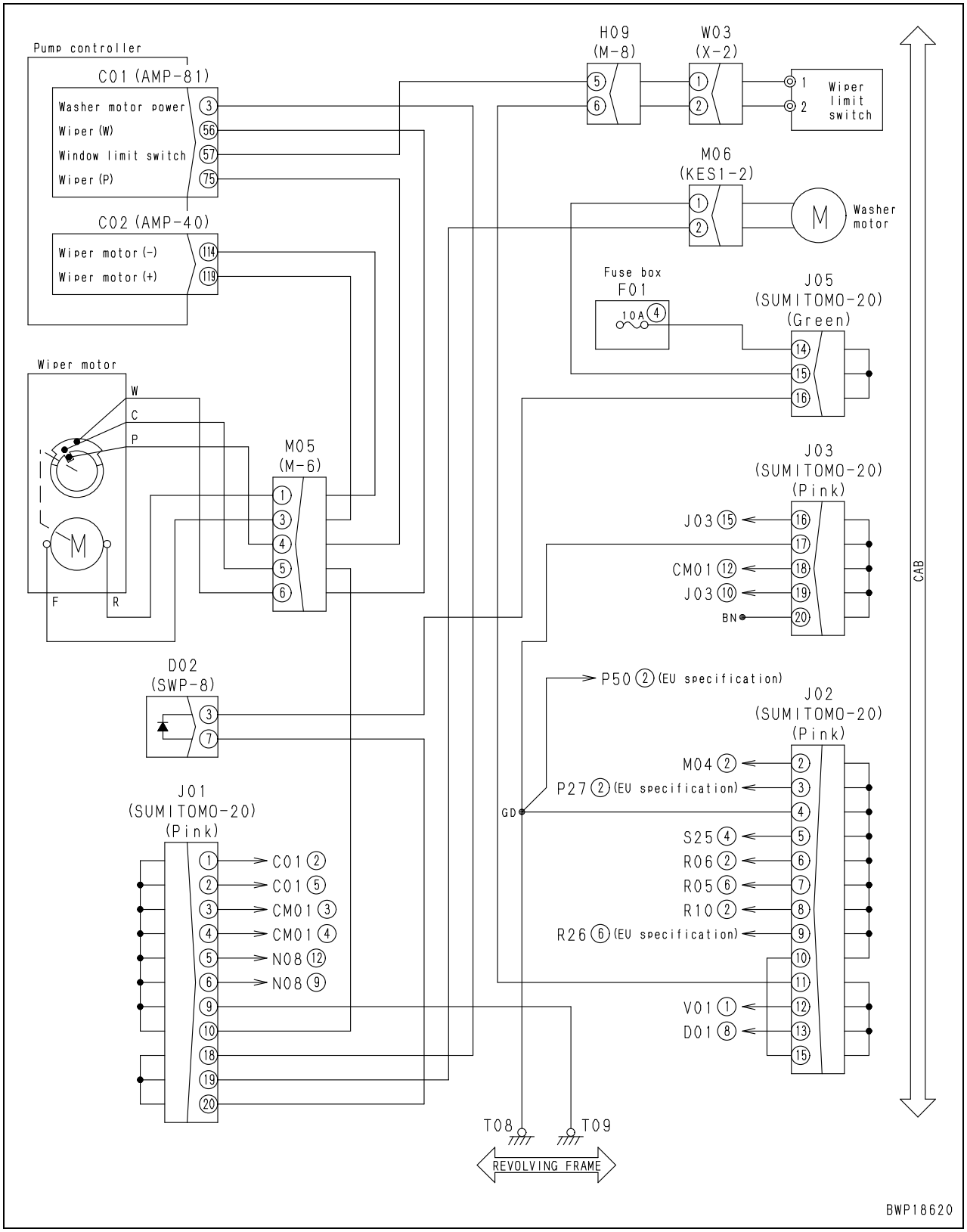
Engine coolant temperature gauge and engine coolant temperature monitor



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.

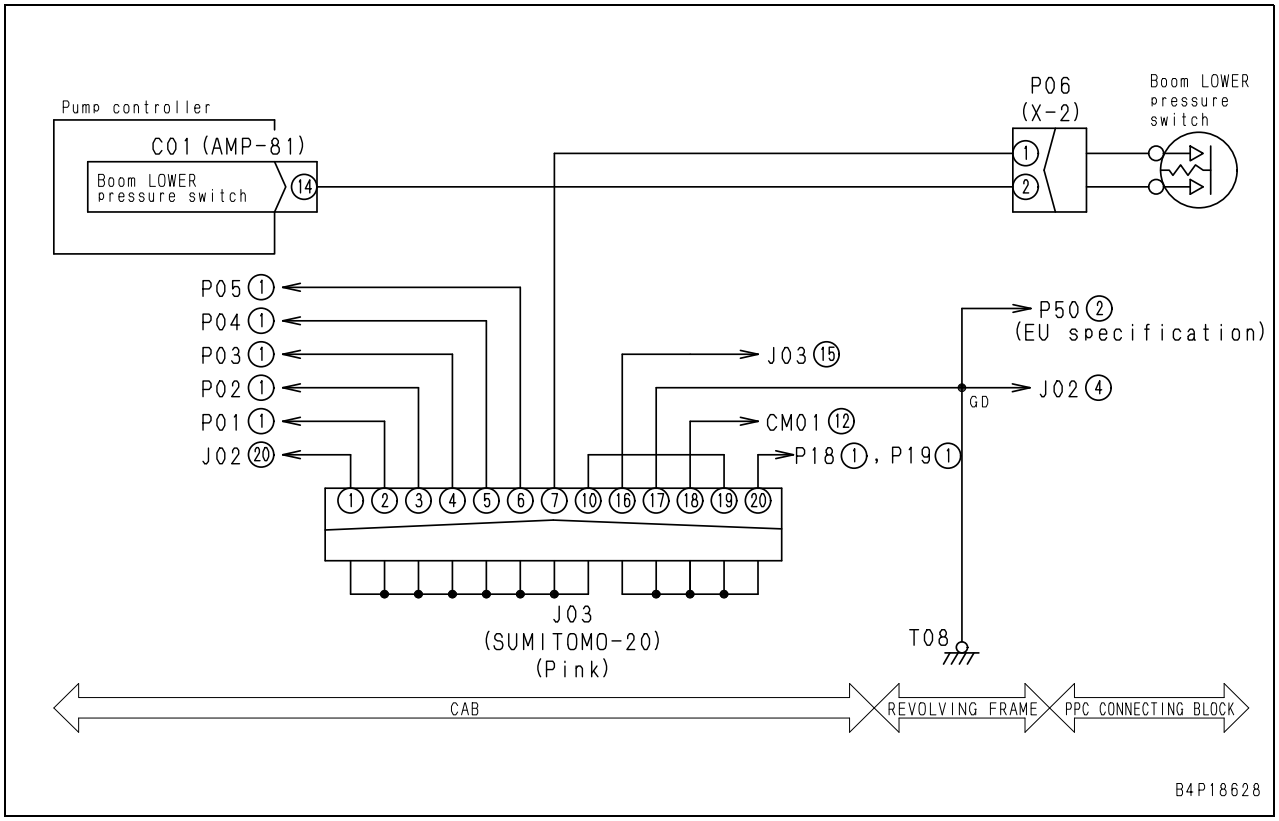
	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state					
	1	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning 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)

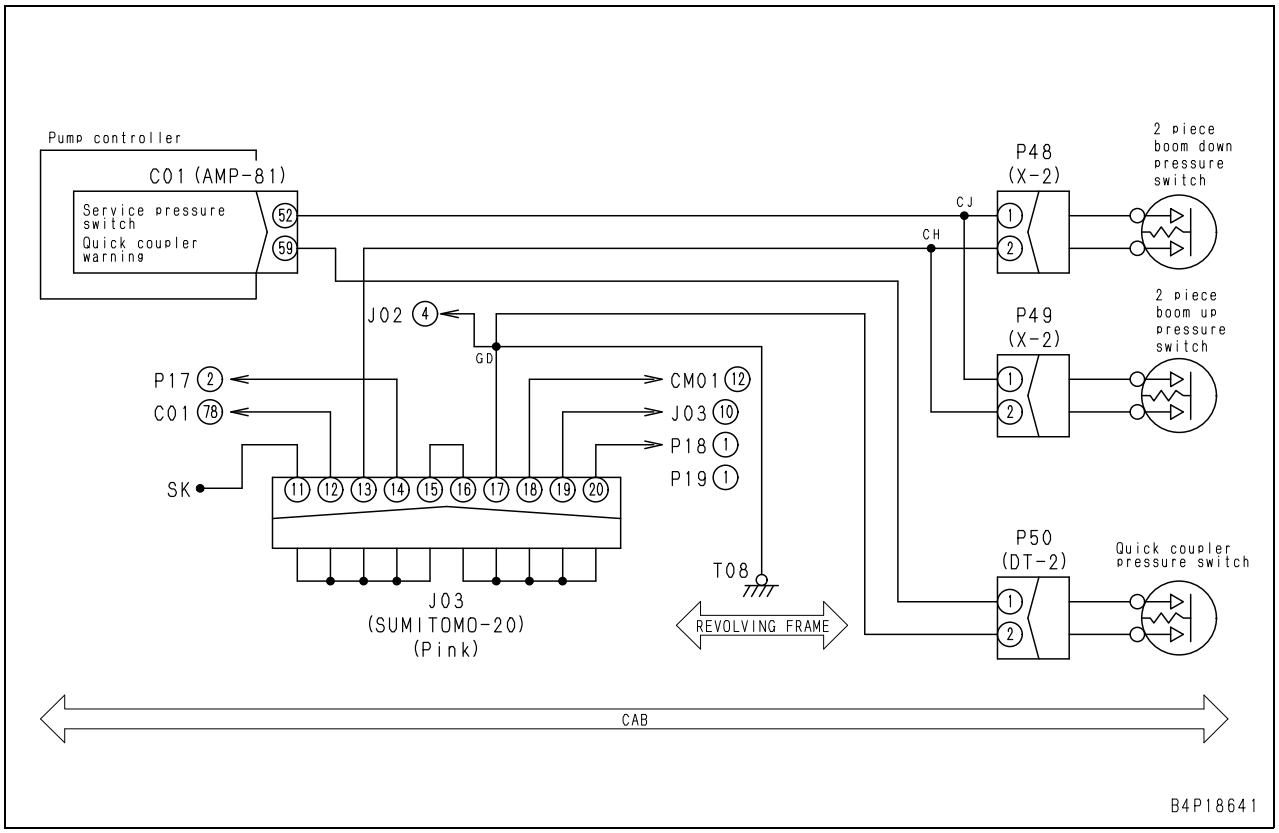
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective machine monitor	Machine monitor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

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

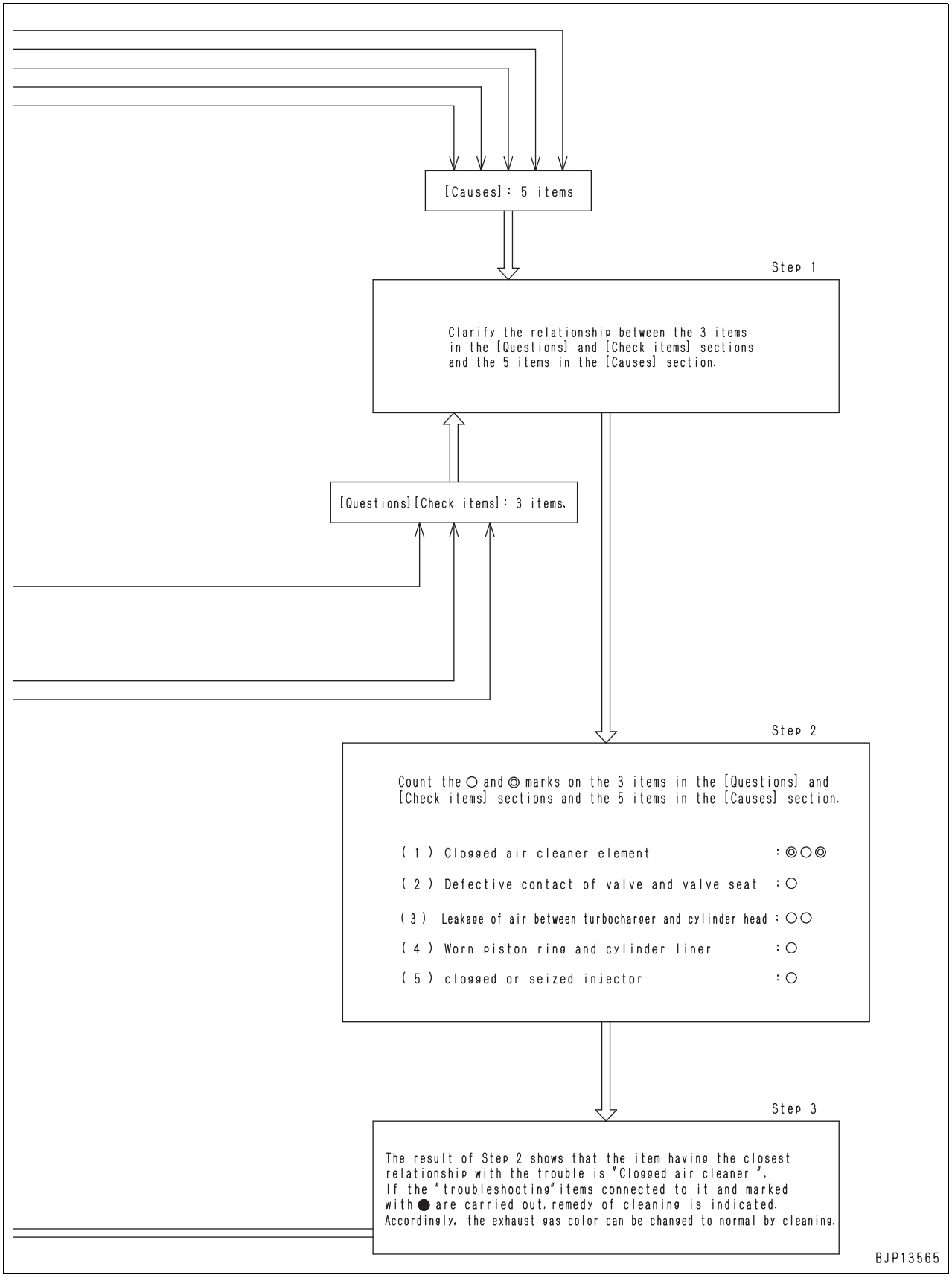
Trouble	• Excessive overrun when stopping swing.	(1) Overrun of upper structure is large in both directions.
Related information	• Conduct the troubleshooting in working mode P. • Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. • When starting troubleshooting,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

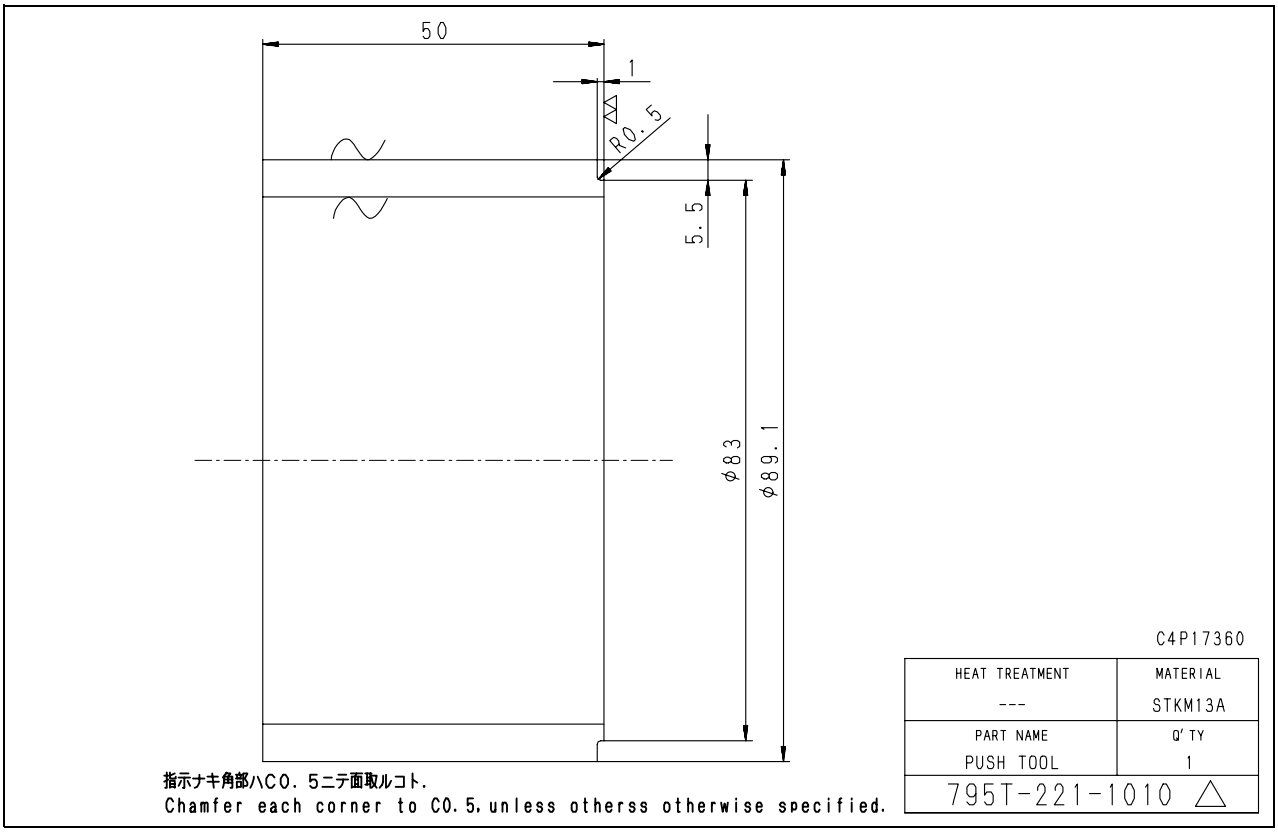
50 Disassembly and assembly

100 General information on disassembly and assembly

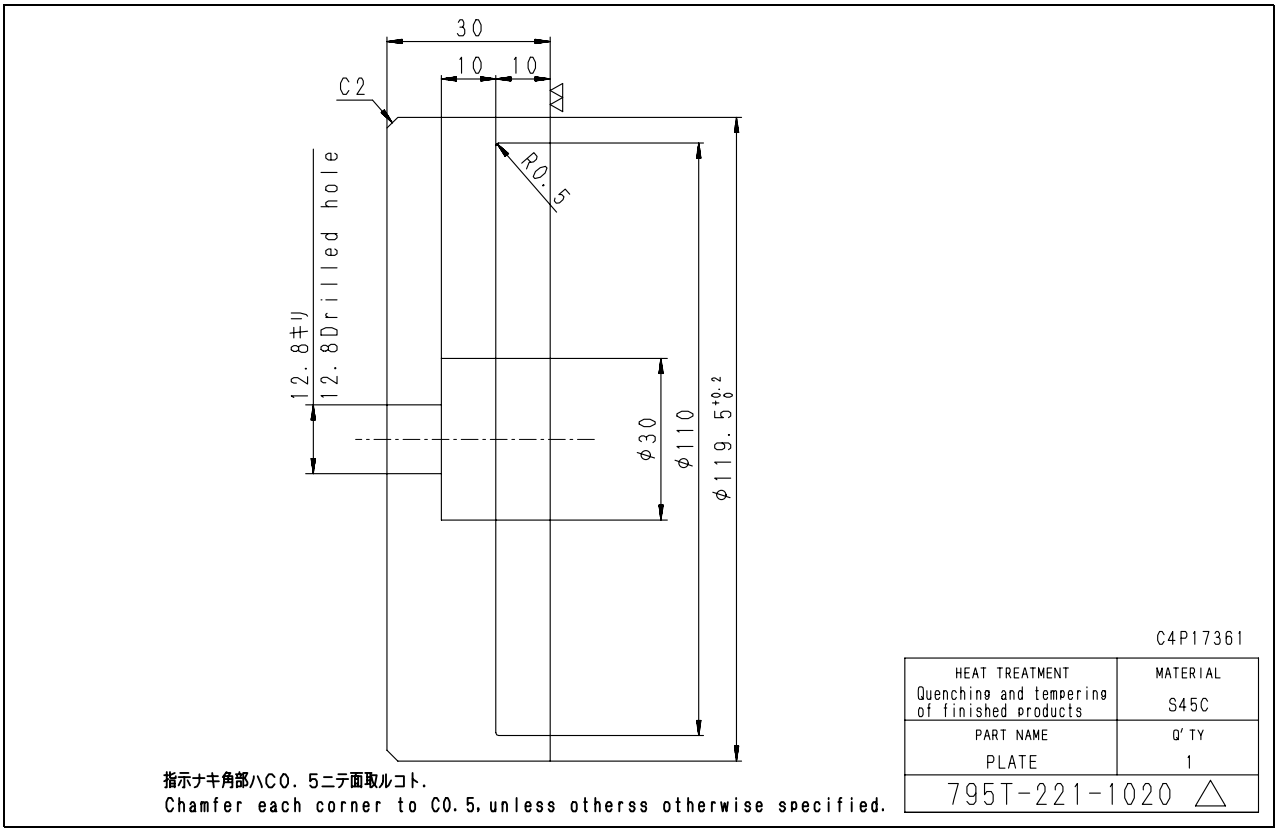
Sketches of special tools

Note: Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.

A1 Push tool



A3 Plate



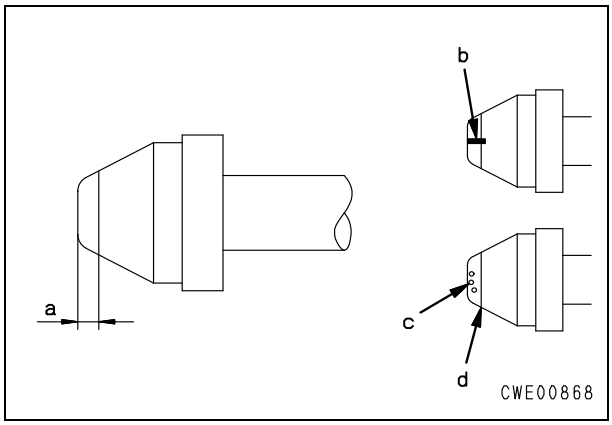
[*4]

⚠ **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}

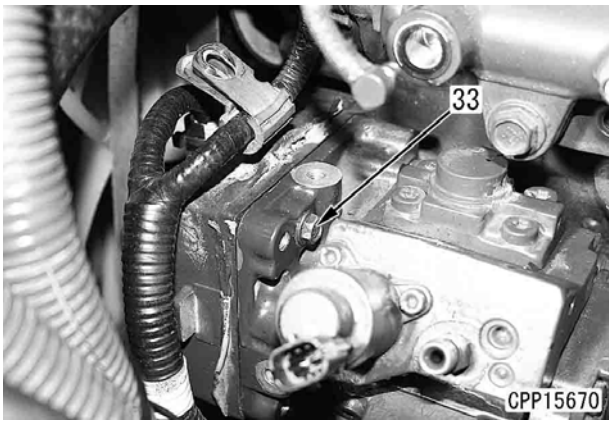
Fuel supply pump side (23):
18 – 23 Nm {1.9 – 2.3 kgm}

[*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}

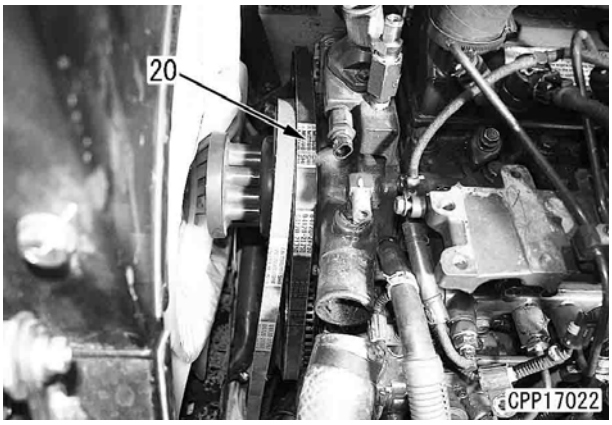
[*8]

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

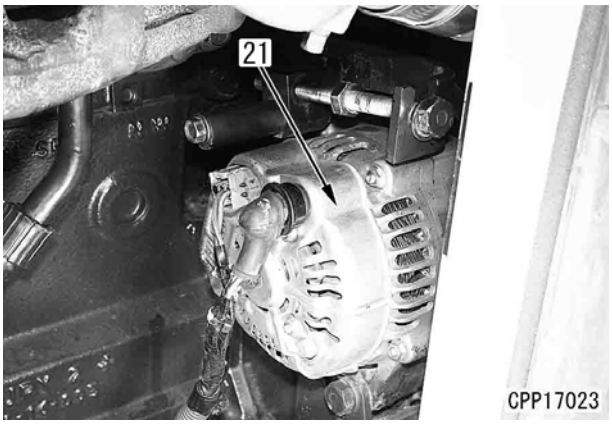
[*9]

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

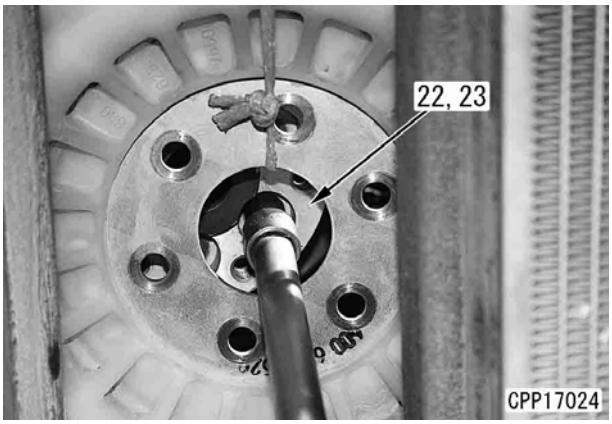
4) Loosen alternator mounting bolts and remove fan belt (20). [*4]



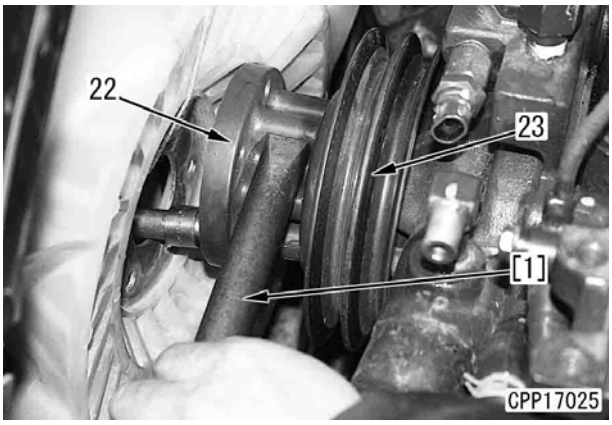
★ Loosen the mounting bolts of alternator (21) through the hole of the partition cover removed in step 2).



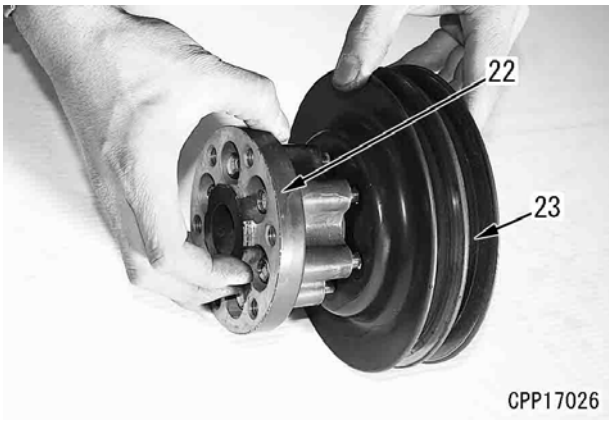
5) Remove the 6 mounting bolts through the hole of the slung fan and remove spacer (22) and pulley (23) from the water pump. [*5]



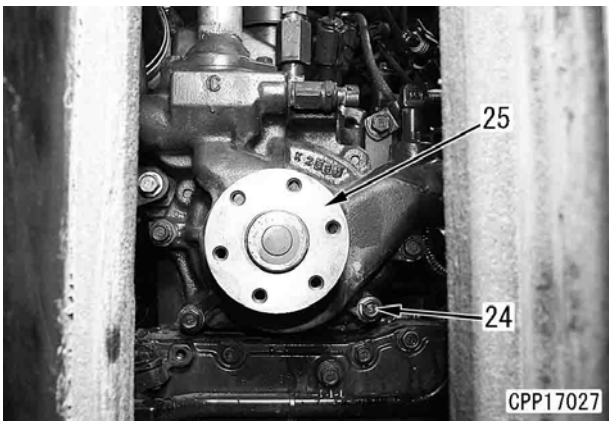
1] Lock spacer (22) with bar [1] and loosen the mounting bolts. [*6]



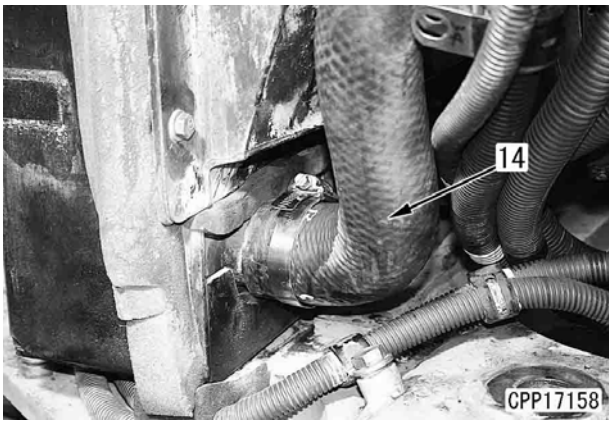
2] Remove the mounting bolts, taking care that spacer (22) and pulley (23) will not fall.



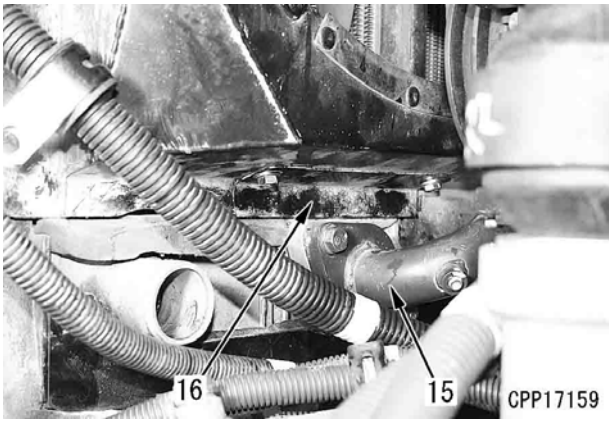
6) Remove 4 mounting bolts (24) and water pump assembly (25). [*7]



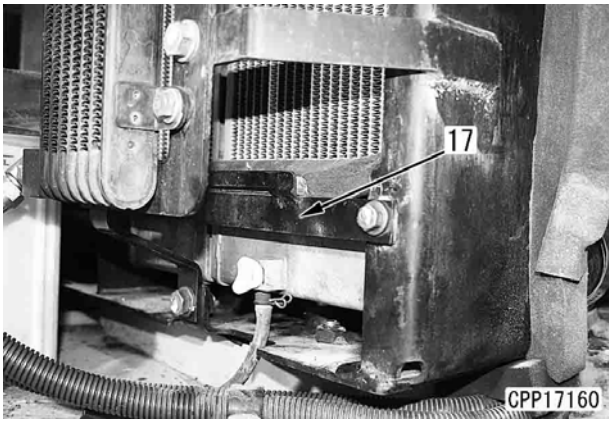
10. Disconnect radiator lower hose (14). [*3]



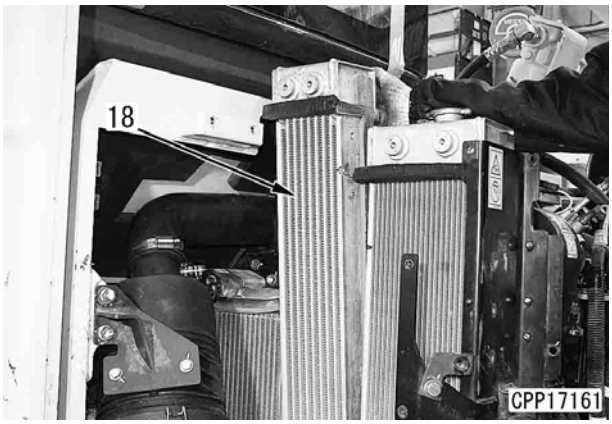
11. Disconnect aftercooler lower tube (15) and remove cover (16).



12. Remove net rail (17).



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

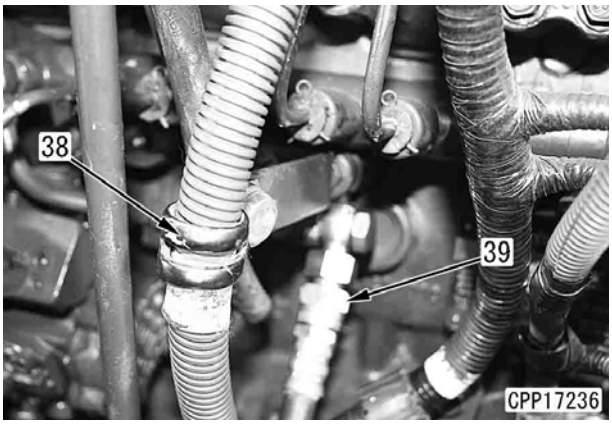


14. While moving radiator assembly (19) toward the removed aftercooler, lift up and remove it.

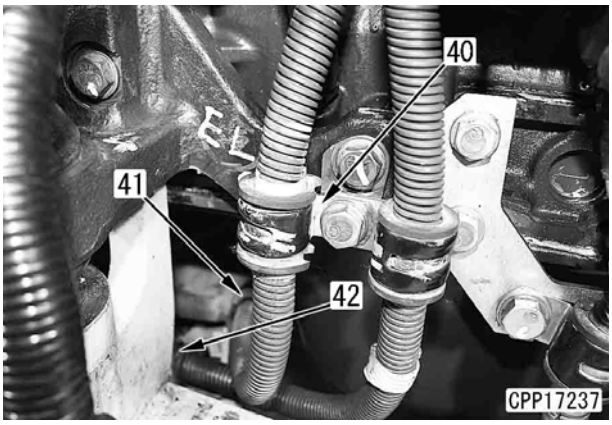
18. Disconnect fuel hoses (35) and (36) from fuel main filter (37). [*7]

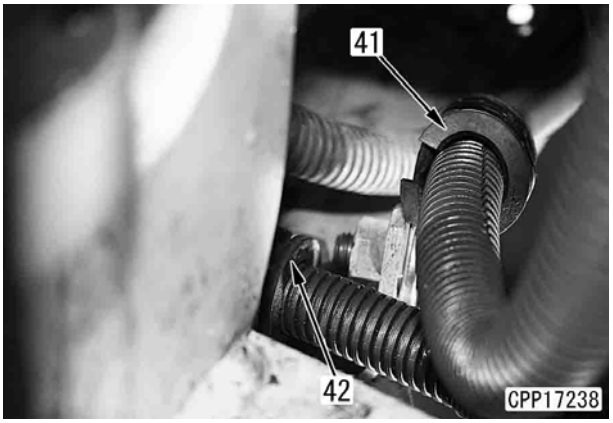
19. Remove clamp (38).

20. Disconnect hose (39).



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

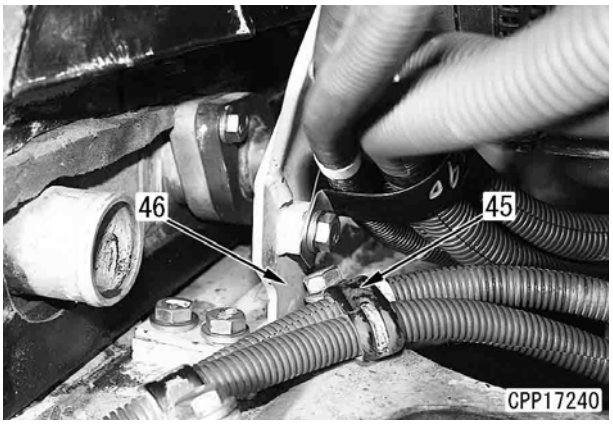




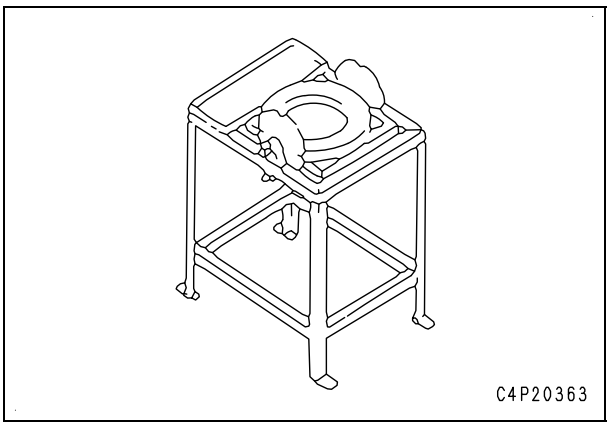
22. Disconnect air conditioner heater return hose (43).

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

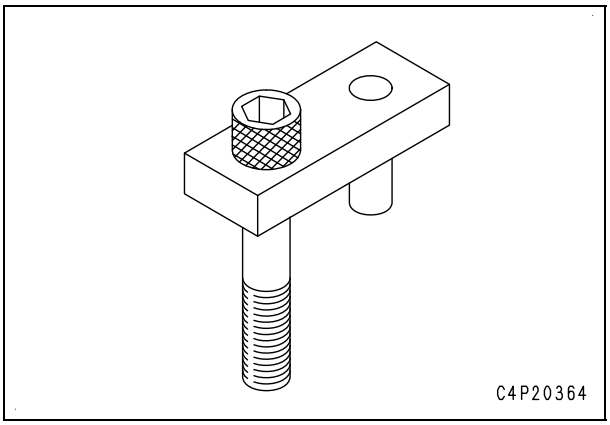
24. Remove clamp (45) and bracket (46).



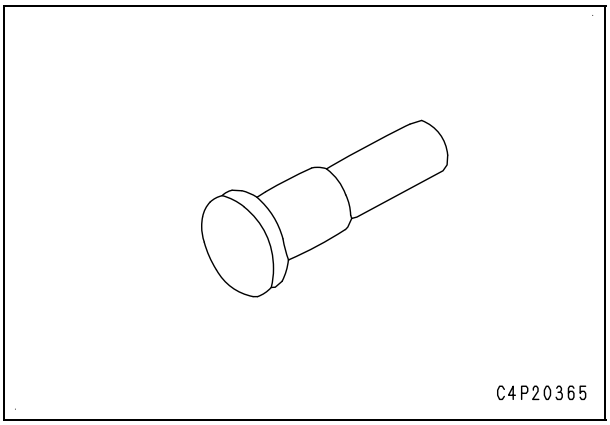
4) Tools to be manufactured
Work stand [1]
- Used to fix the travel motor for disassembly and assembly.



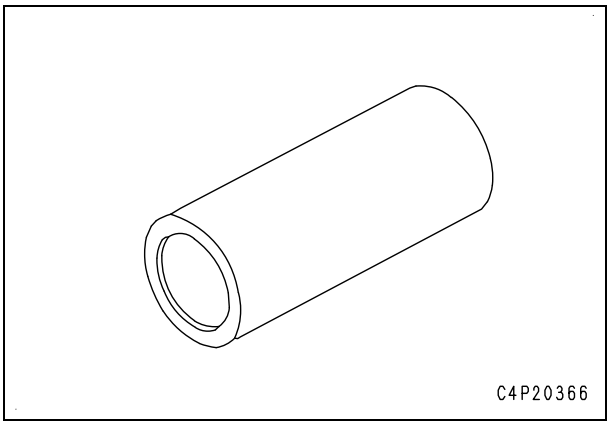
Jig [2]
- Used to fix spindle (2) and hub (1) when they are connected.



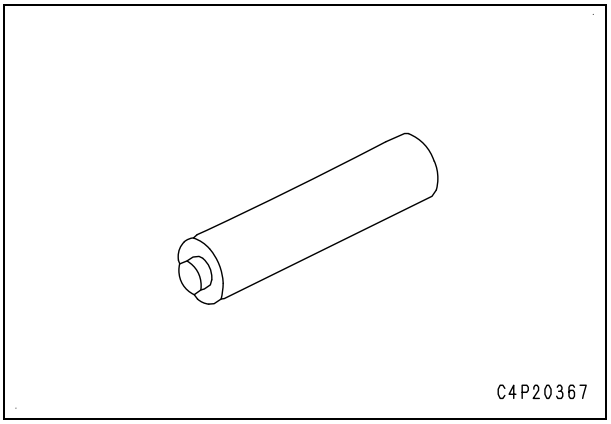
No. 1 holder [3]
- Used to install spring (114), washer (110), and snap ring (145) to cylinder block (104).
- Used to remove spring (114) from cylinder block (104).



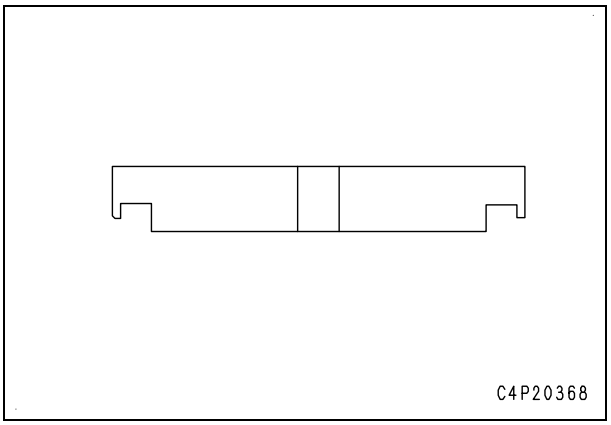
No. 2 holder [4]
- Used to remove ball bearing (149) from shaft (102).



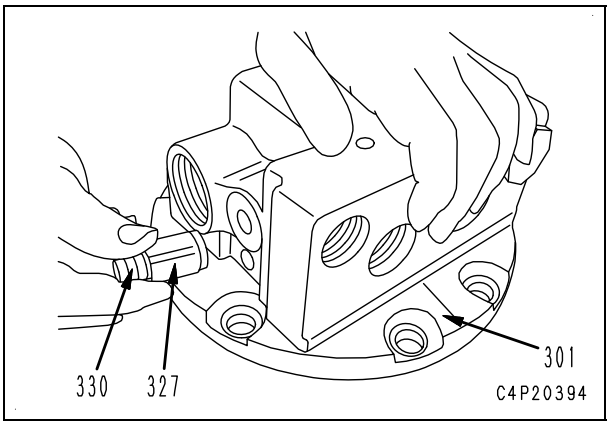
Push tool [5]
- Used to press fit oil seal (132) to spindle (2).



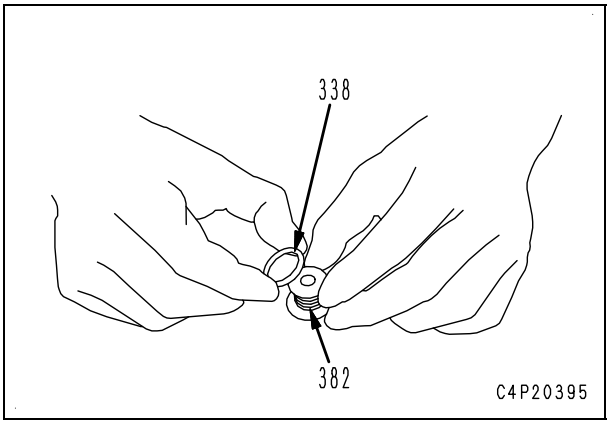
Push tool [6]
- Used to press fit ball bearing (24) to hub (1).



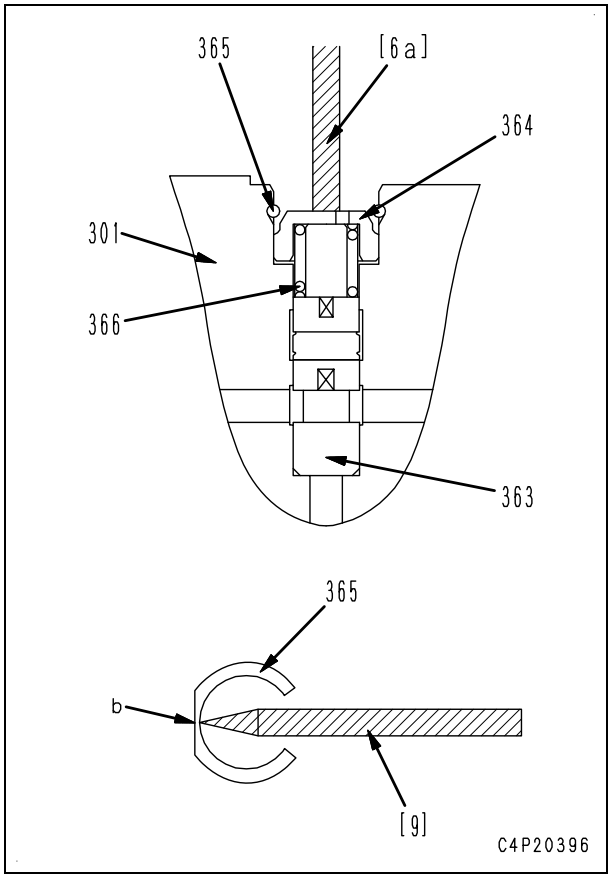
6) Remove two springs (330) and two valves (327) from rear flange (301).



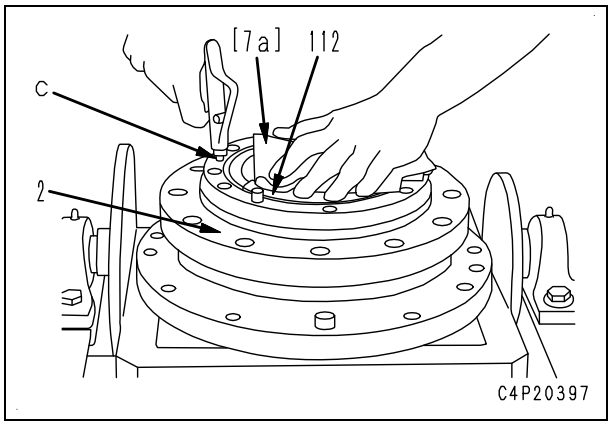
7) Remove O-ring (338) from plug (382).
   ★ Do not reuse removed O-ring (338).



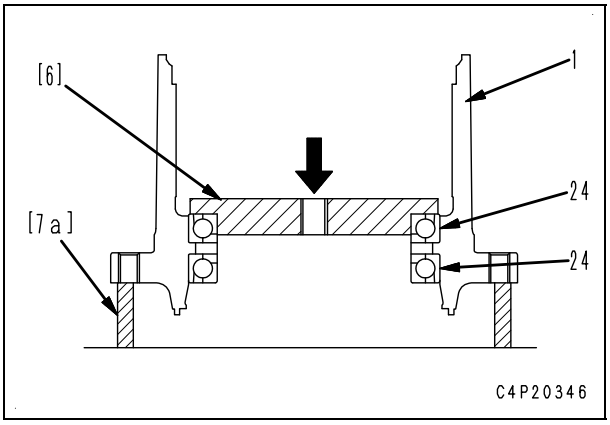
11. **Removal of pilot valve**
   1) Use steel bar [6a] to press stopper (364).
   2) Use pin punch [9] under the above condition to press notch (**b**) of ring (365).
      ★ Ring (365) is deformed by this work and it can be removed.
   3) Remove ring (365) from rear flange (301).
      ★ Do not reuse 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.**



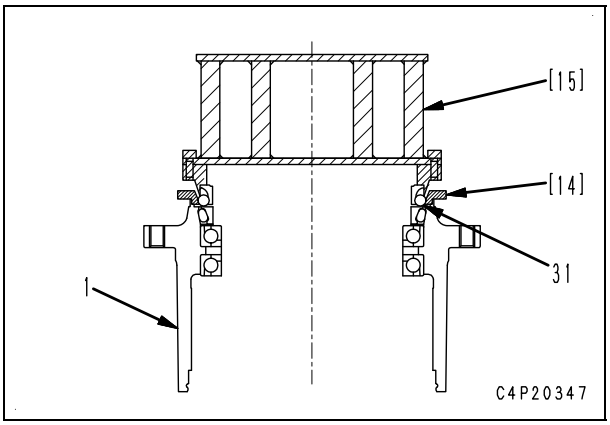
12. **Disassembly of parking brake**
   1) Supply compressed air through parking brake oil passage (**c**) of spindle (2) to take out piston (112).
      ⚠ **If compressed air is blown suddenly, piston (112) jumps out, and that is dangerous. Accordingly, blow compressed air gradually. Place protective 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).



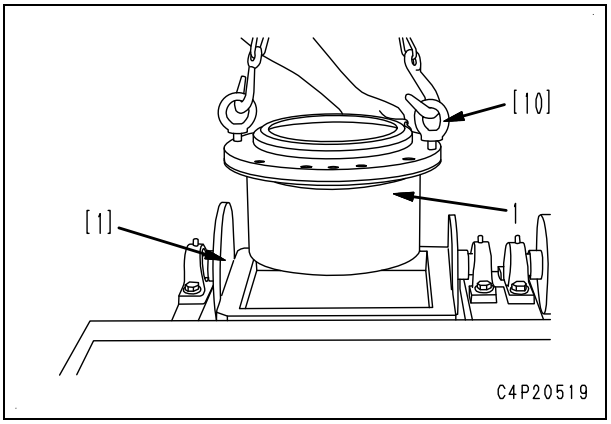
1. **Assembly of hub**
   1) Set hub (1) to cylinder [7a] on the press stand.
   2) Install ball bearing (24) to hub (1) and press fit it by using push tool [6].
   3) Reverse hub (1) and install ball bearing (24) on the opposite side similarly.
      ★ When installing ball bearing (24), check its direction.



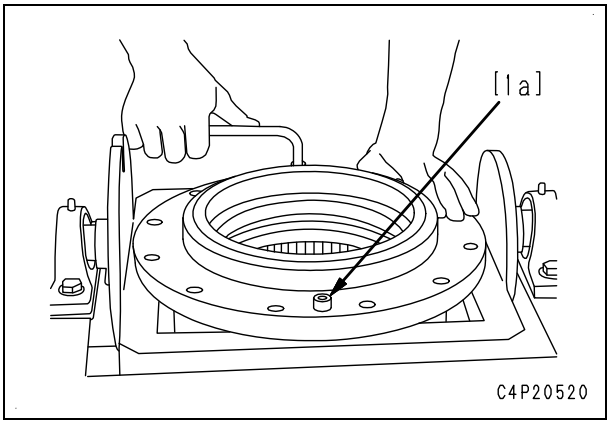
   4) Apply grease (G2-LI) to the O-ring of floating seal (31) and install it to hub (1).
      ★ Remove the O-ring and apply grease thinly all over its surfaces.
   5) Set No. 1 mounting jig [14] and No. 2 mounting jig [15] to hub (1) in order and push in No. 2 mounting jig [15] until it touches No. 1 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**

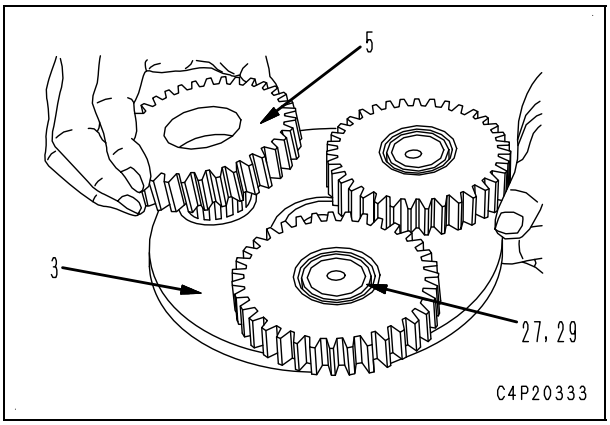


   8) Install two hexagonal socket head bolts [1a] to symmetrical positions.
      ⚠ **Securely tighten two hexagonal socket head bolts [1a] (to prevent the travel motor assembly from falling off the work stand when it is reversed).**

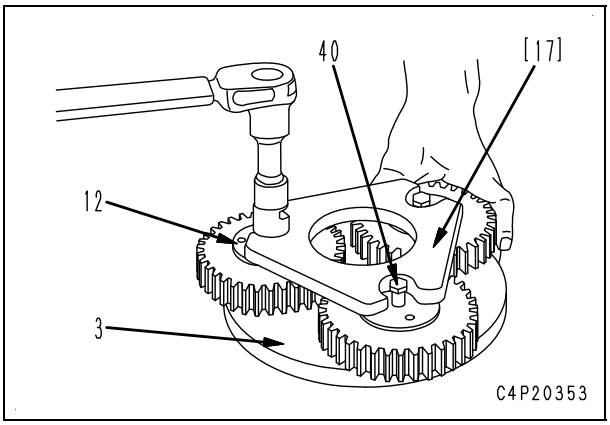


2. **Assembly of spindle assembly**
   1) Apply grease (G2-LI) to the O-ring of floating seal (31) and install it to spindle (2).
      ★ Remove the O-ring and apply grease thinly all over its surface.
   2) Set No. 3 mounting jig [16] and No. 2 mounting jig [15] to spindle (2) in order and push in No. 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.

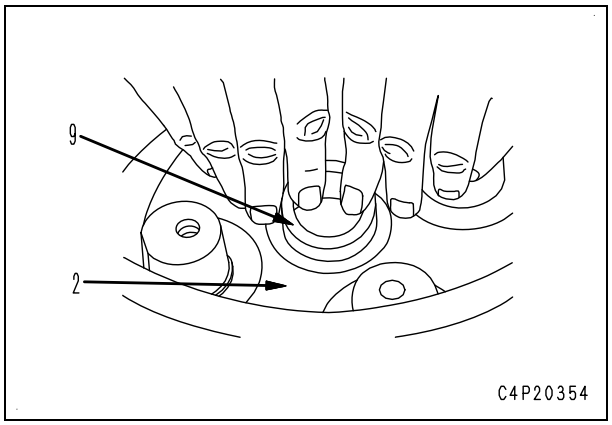
3) Install three inner bearings (29), three needle bearing cages (27), and three No. 1 planetary gears (5) to carrier (3) in order.



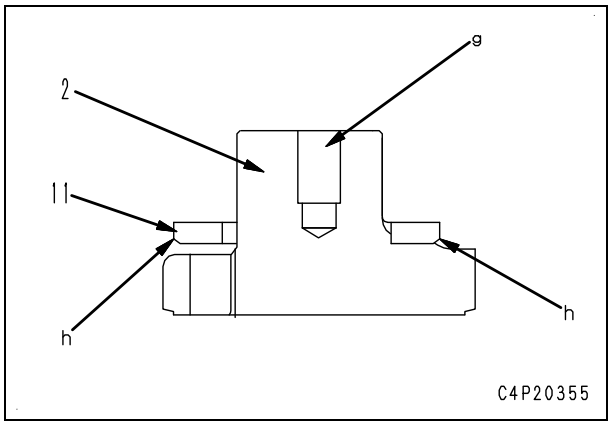
4) Set jig [17] to carrier (3) and install three No. 1 thrust washers (12).
5) Tighten three bolts (40).
   Bolt (40):
   33.3 ± 4.9 Nm {3.4 ± 0.5 kgm}
   ★ When not using jig [17] to position No. 1 thrust washers (12), take care that No. 1 thrust washers (12) are not dragged by bolts (40).
   ★ After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



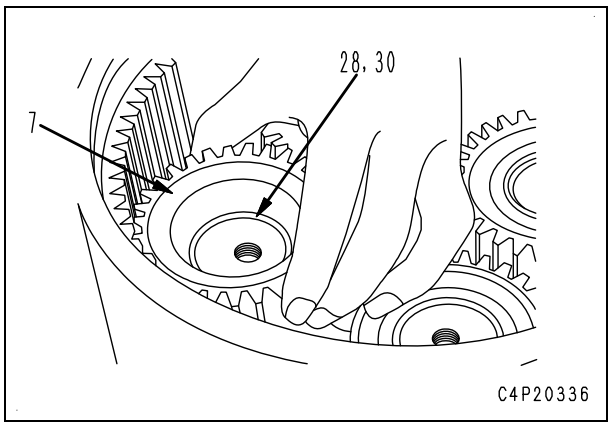
12. **Installation of No. 2 planetary gear**
1) Install No. 1 thrust collar (9) to spindle (2).



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.

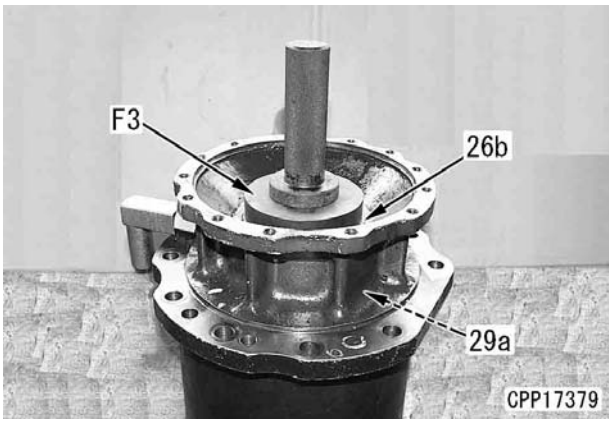
1. Bearing outer race

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)

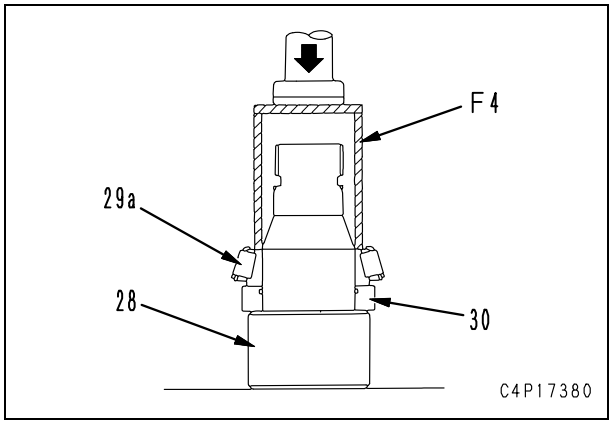
★ Press fitting force: Main bearing outer race (29b)
Max. 10.8 kN {Max. 1.1 ton}

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

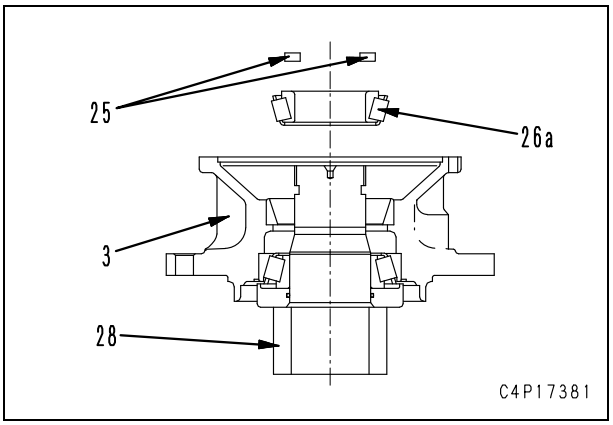


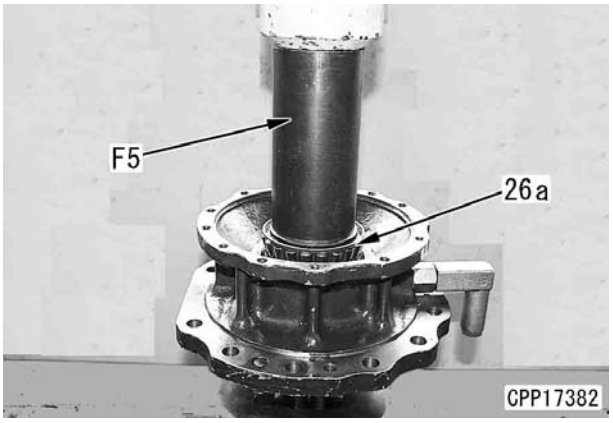
2. Shaft assembly

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.



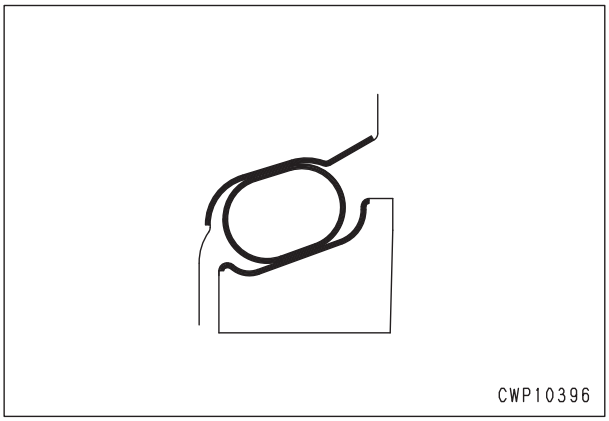
3) Set case (3) to shaft assembly (28).
4) Using tool **F5**, press fit sub-bearing inner race (26a) with the press to a position where 2-piece collar (25) can be inserted.
   ★ Limit the press fitting force of the bearing inner race to **11.8 kN {1.2 ton}**. Rotate the case 2 – 3 turns to fit the bearing 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.



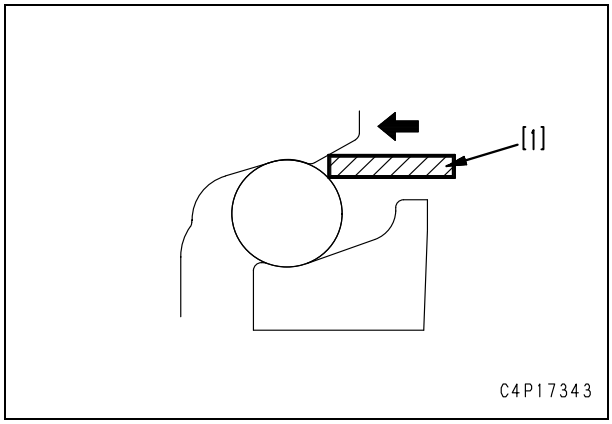


Assembly

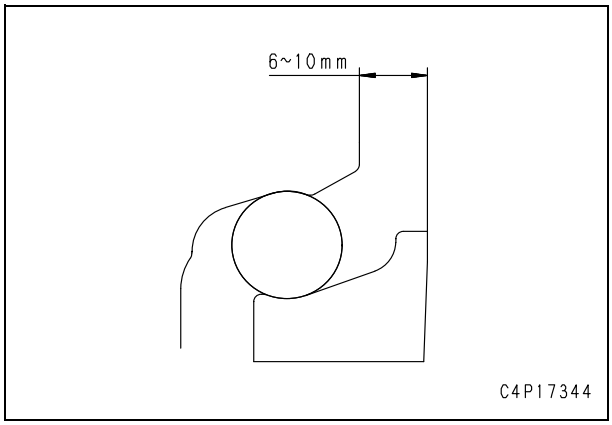
★ When installing the floating seal, thoroughly clean, degrease, and dry the parts marked with the thick lines (the load ring and faces in contact with the load ring).
Check that the contact surfaces of the floating seal are free from dirt.



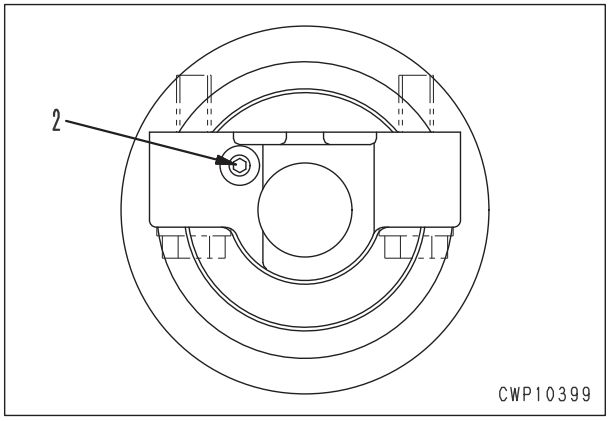
★ When inserting the floating seal assembly in the housing, use the push jig. This push jig must push the load ring.
[1]: Cylindrical push jig



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

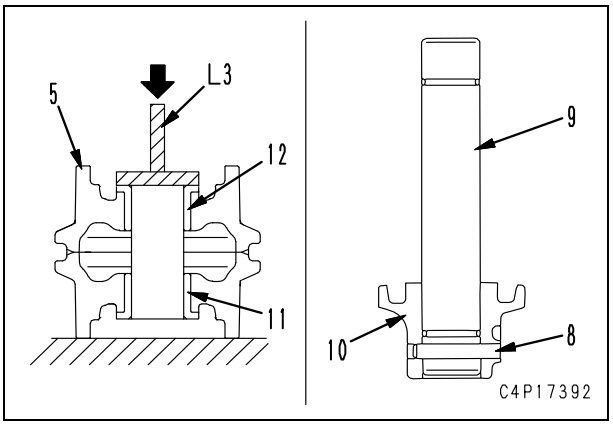


★ The metallic faces of the floating seal which are in contact with each other must be free from dirt.
★ Supply GO140 oil.
Quantity of oil: 160 – 180 cc
★ Thoroughly clean the parts to be in contact with the supplied oil. After cleaning them, the dirt remaining on these parts of 1 roller assembly must 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).



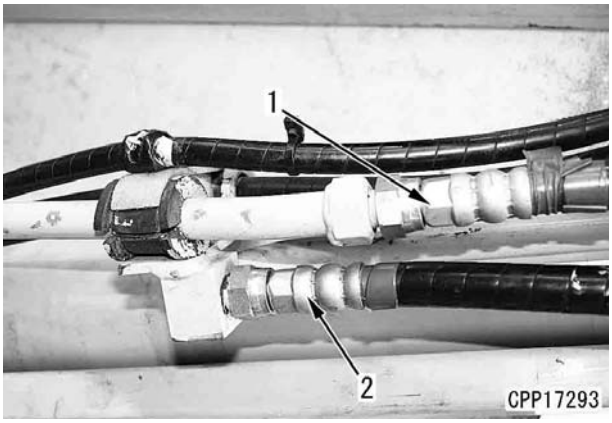
Removal and installation of revolving frame assembly

Removal

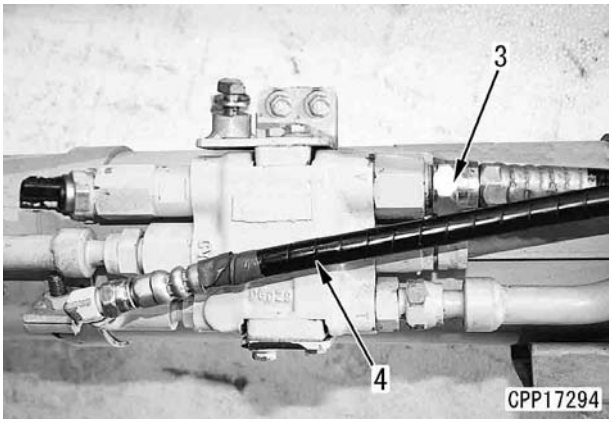
- ⚠ **Loosen the hydraulic tank cap to release the pressure inside the hydraulic tank.**
- ⚠ **Release the residual pressure in the hydraulic circuit. For details, see Testing and adjusting, "Releasing residual pressure from hydraulic circuit".**
- ⚠ **Disconnect the cable from the negative (–) terminal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

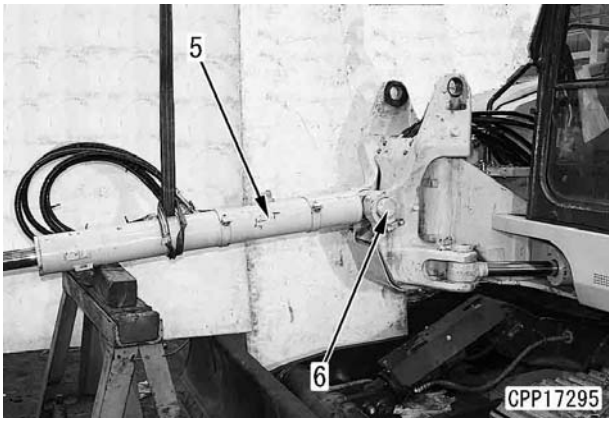


   (3): Boom cylinder bottom hose (Band color: Yellow)
   (4): Boom hydraulic drift prevention valve Pi hose (Band color: Black)



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

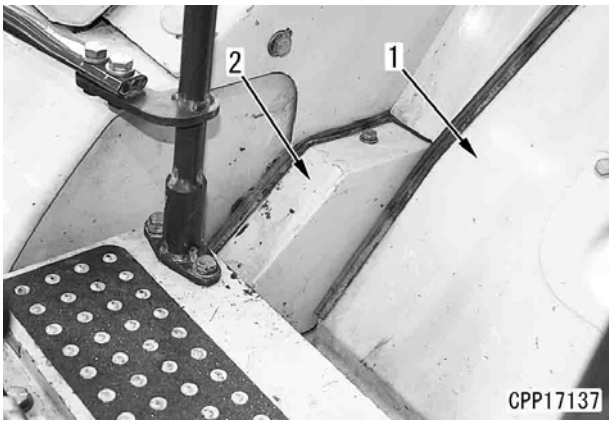
- ⚠ **Park the machine on a level ground, lower the work equipment to the ground, stop the engine, and set the lock lever in the lock position.**
- ⚠ **Loosen the hydraulic tank cap to release the pressure inside the hydraulic tank.**
- ⚠ **Release the residual pressure in the hydraulic circuit. For 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)

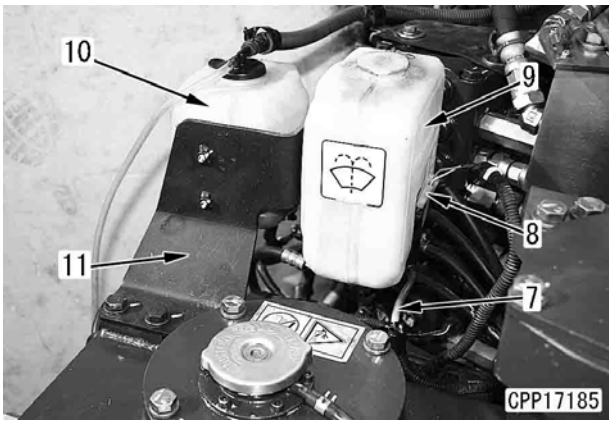
2. Remove the machine right side cover assembly according to the following procedure.
   1) Remove covers (1) and (2).

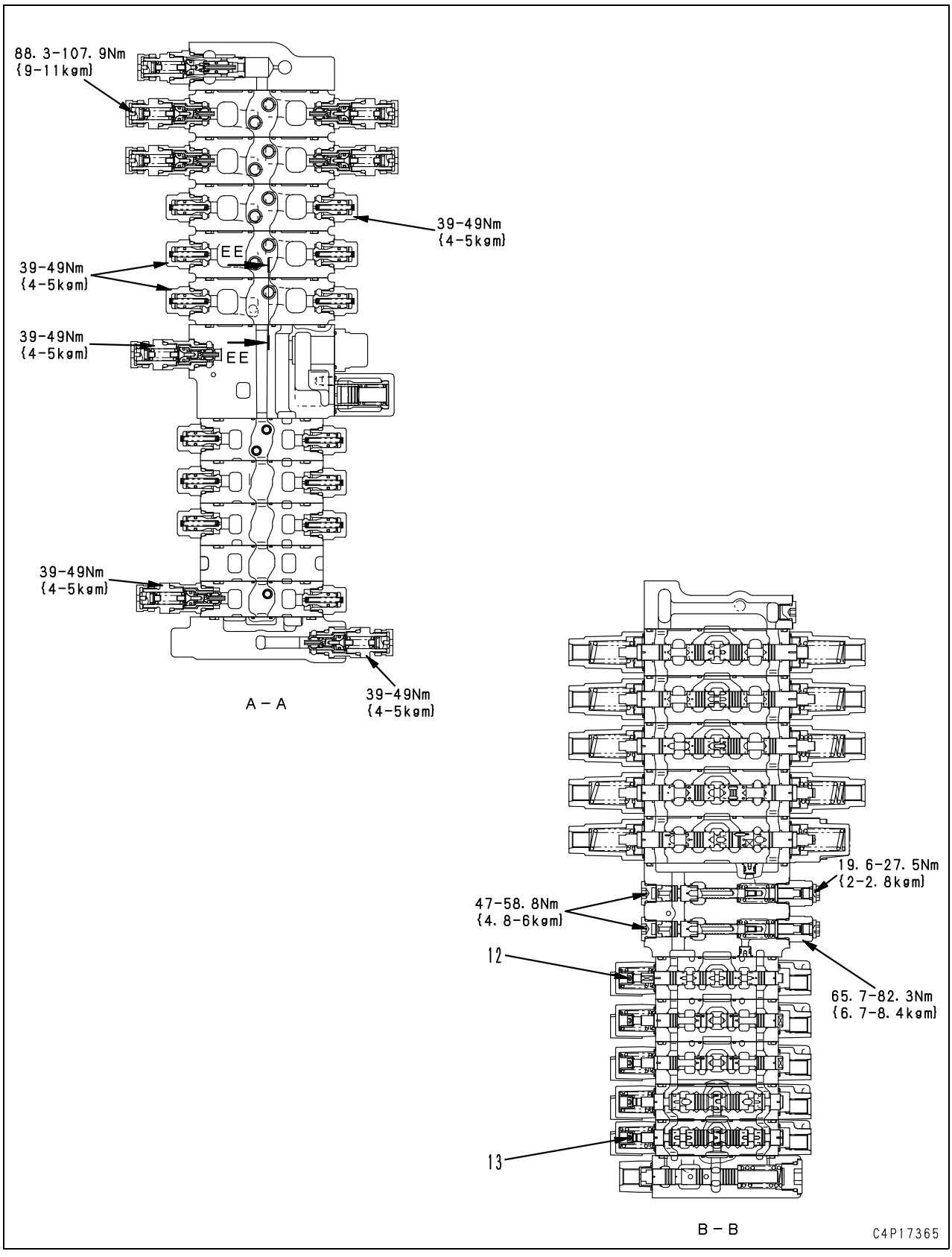


   2) Remove stay (3) and step (4).
   3) Move cover (5) to a position where side cover (6) can be removed.

   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}
EE
39-49Nm
{4-5kgm}
39-49Nm
{4-5kgm}
EE
39-49Nm
{4-5kgm}
A - A
39-49Nm
{4-5kgm}
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

Installation

- Carry out installation in the reverse order to removal.

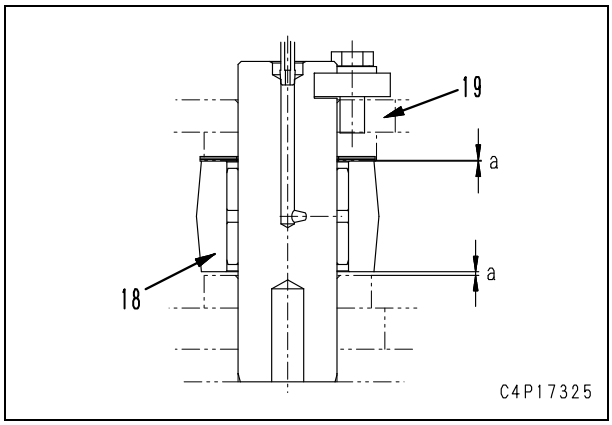
[*1]

Sliding surface of mounting pin (When assembling): **Hyper white grease (G2-T)**

Mounting pin (Greasing after assembly): **Hyper white grease (G2-T)**

⚠ When aligning the pin holes, never insert your fingers in them.

- Adjust the shim so that clearance "a" between boom swing cylinder (18) and frame (19) will be 1.0 mm or less.
  - ★ Shim thickness: t = 1.0 mm



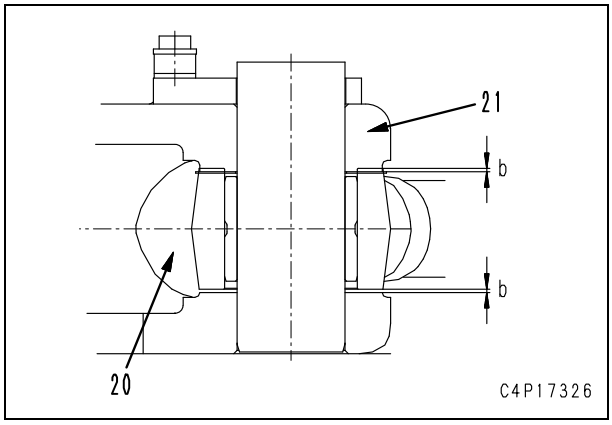
[*2]

Sliding surface of mounting pin (When assembling): **Hyper white grease (G2-T)**

Mounting pin (Greasing after assembly): **Hyper white grease (G2-T)**

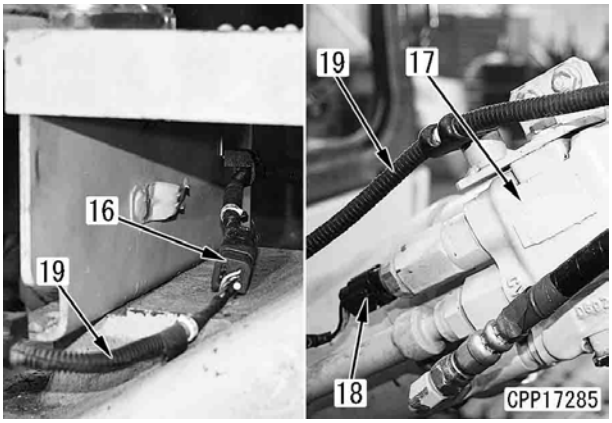
⚠ When aligning the pin holes, never insert your fingers in them.

- Adjust the shim so that clearance "b" between boom swing cylinder rod (20) and boom swing bracket (21) will be 1.0 mm or less.
  - ★ Shim thickness: t = 1.0 mm

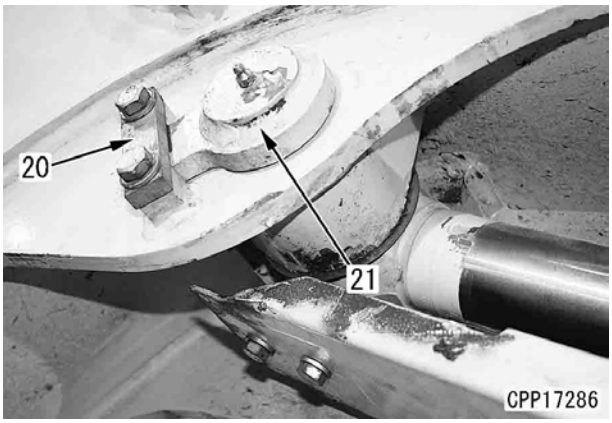


- **Refilling with oil (Hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

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

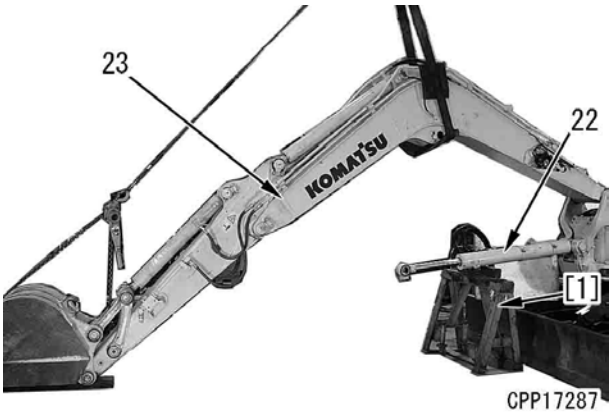


9. Sling the boom cylinder, remove lock plate (20) on the head side, and pull out pin (21). [*1]
   ★ Check the quantity and positions of the inserted shims.

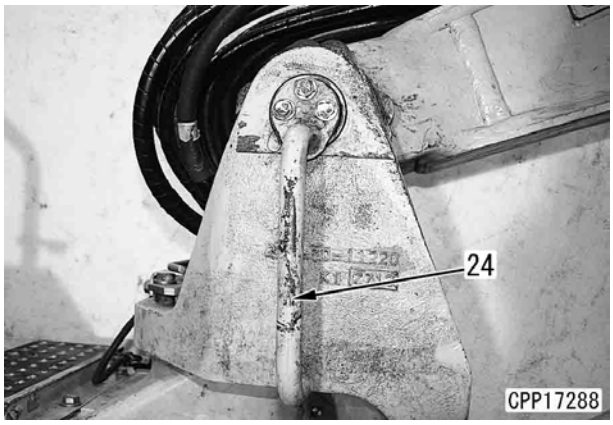


10. Lower boom cylinder assembly (22) onto support stand [1].
    ★ Connect the negative (–) terminal cable of the battery, start the engine, and retract the boom cylinder piston rod.
    ★ Disconnect the cable from the negative (–) terminal of the battery again.

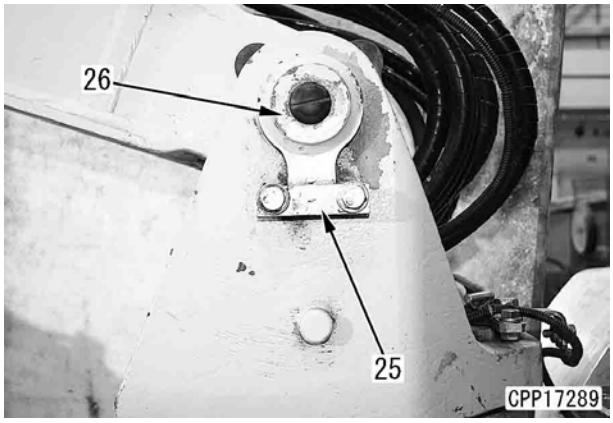
11. Sling work equipment assembly (23).



12. Remove handrail (24) installed to the boom and swing bracket mounting pin.



13. Remove lock plate (25) and pull out boom and swing bracket mounting pin (26). [*2]
    ★ Check the quantity and positions of the inserted shims.



14. Lift off work equipment assembly (23).
    ★ Lift up and remove the assembly slowly while checking it balance.

    Work equipment assembly: **1,000 kg**