

Shop Manual

PC200LC-6LE

PC210LC-6LE

PC220LC-6LE

PC250LC-6LE

HYDRAULIC EXCAVATOR

	PC200LC-6LE	A83001	
	PC210LC-6LE	A83001	
SERIAL NUMBERS	PC220LC-6LE	A83001	and UP
	PC250LC-6LE	A83001	

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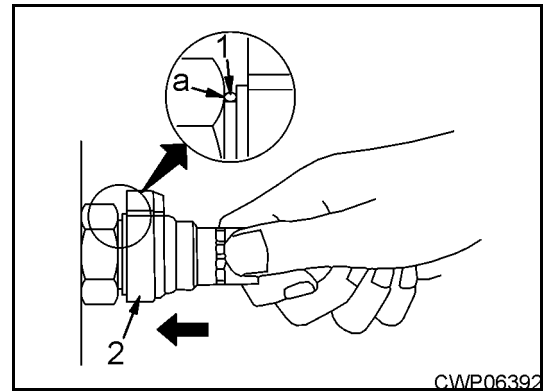
FOREWORD

Mark	Page	Rev	Mark	Page	Rev	Mark	Page	Rev	Mark	Page	Rev
○	20-722	②	○	20-814	②	○	20-847	②	●	30-19	②
○	20-723	②	○	20-815	②	○	20-848	②	●	30-20	②
○	20-724	②	○	20-816	②	○	20-849	②	●	30-21	②
○	20-725	②	○	20-817	②	○	20-850	②	●	30-22	②
○	20-726	②	○	20-818	②	○	20-851	②	●	30-23	②
○	20-727	②	○	20-819	②	○	20-852	②	●	30-24	②
○	20-728	②	○	20-820	②	○	20-853	②	●	30-25	②
○	20-729	②	○	20-821	②	○	20-854	②	●	30-26	②
○	20-730	②	○	20-822	②	○	20-855	②	●	30-27	②
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○	20-733	②	○	20-825	②	○	20-858	②	●	30-30	②
○	20-734	②	○	20-826	②	○	20-859	②	●	30-31	②
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○	20-737	②	○	20-829	②	●	30-1	②	●	30-34	②
○	20-738	②	○	20-830	②	●	30-2	②	●	30-35	②
○	20-739	②	○	20-831	②	●	30-3	②	●	30-36	②
○	20-740	②	○	20-832	②	●	30-4	②	●	30-37	②
			○	20-833	②	●	30-5	②	●	30-38	②
○	20-801	②	○	20-834	②	●	30-6	②	●	30-39	②
○	20-802	②	○	20-835	②	●	30-7	②	●	30-40	②
○	20-803	②	○	20-836	②	●	30-8	②	●	30-41	②
○	20-804	②	○	20-837	②	●	30-9	②	●	30-42	②
○	20-805	②	○	20-838	②	●	30-10	②	●	30-43	②
○	20-806	②	○	20-839	②	●	30-11	②	●	30-44	②
○	20-807	②	○	20-840	②	●	30-12	②	●	30-45	②
○	20-808	②	○	20-841	②	●	30-13	②	●	30-46	②
○	20-809	②	○	20-842	②	●	30-14	②	●	30-47	②
○	20-810	②	○	20-843	②	●	30-15	②	●	30-48	②
○	20-811	②	○	20-844	②	●	30-16	②	●	30-49	②
○	20-812	②	○	20-845	②	●	30-17	②	●	30-50	②
○	20-813	②	○	20-846	②	●	30-18	②	●	30-51	②

TYPE 2

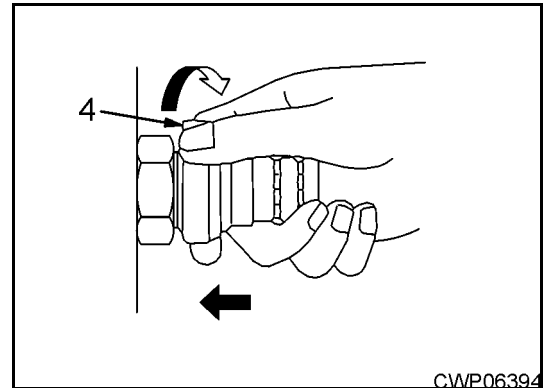
DISCONNECTION

1. Hold the mouthpiece of the tightening portion and push body (2) in straight until sliding prevention ring (1) contacts contact surface **a** of the hexagonal portion at the male end.



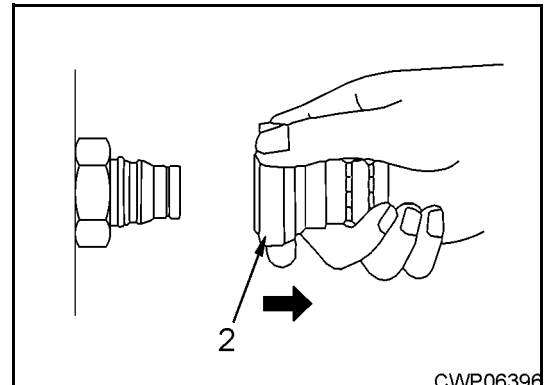
CWP06392

2. Hold in the condition in Step 1, and turn the lever (4) to the right - clockwise.



CWP06394

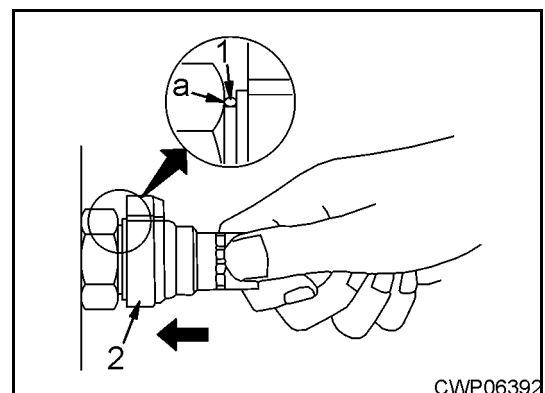
3. Hold in the condition in Steps 1 and 2, and pull out the whole body (2) to disconnect it.



CWP06396

CONNECTION

1. Hold the mouthpiece of the tightening portion and push body (2) in straight until sliding prevention ring (1) contacts surface **a** of the hexagonal portion at the male end to connect it.



CWP06392

kgm to ft. lb.

1 kgm = 7.233 ft. lb.

	0	1	2	3	4	5	6	7	8	9
0	0	7.2	14.5	21.7	28.9	36.2	43.4	50.6	57.9	65.1
10	72.3	79.6	86.8	94.0	101.3	108.5	115.7	123.0	130.2	137.4
20	144.7	151.9	159.1	166.4	173.6	180.8	188.1	195.3	202.5	209.8
30	217.0	224.2	231.5	238.7	245.9	253.2	260.4	267.6	274.9	282.1
40	289.3	296.6	303.8	311.0	318.3	325.5	332.7	340.0	347.2	354.4
50	361.7	368.9	376.1	383.4	390.6	397.8	405.1	412.3	419.5	426.8
60	434.0	441.2	448.5	455.7	462.9	470.2	477.4	484.6	491.8	499.1
70	506.3	513.5	520.8	528.0	535.2	542.5	549.7	556.9	564.2	571.4
80	578.6	585.9	593.1	600.3	607.6	614.8	622.0	629.3	636.5	643.7
90	651.0	658.2	665.4	672.7	679.9	687.1	694.4	701.6	708.8	716.1
100	723.3	730.5	737.8	745.0	752.2	759.5	766.7	773.9	781.2	788.4
110	795.6	802.9	810.1	817.3	824.6	831.8	839.0	846.3	853.5	860.7
120	868.0	875.2	882.4	889.7	896.9	904.1	911.4	918.6	925.8	933.1
130	940.3	947.5	954.8	962.0	969.2	976.5	983.7	990.9	998.2	1005.4
140	1012.6	1019.9	1027.1	1034.3	1041.5	1048.8	1056.0	1063.2	1070.5	1077.7
150	1084.9	1092.2	1099.4	1106.6	1113.9	1121.1	1128.3	1135.6	1142.8	1150.0
160	1157.3	1164.5	1171.7	1179.0	1186.2	1193.4	1200.7	1207.9	1215.1	1222.4
170	1129.6	1236.8	1244.1	1251.3	1258.5	1265.8	1273.0	1280.1	1287.5	1294.7
180	1301.9	1309.2	1316.4	1323.6	1330.9	1338.1	1345.3	1352.63	1359.8	1367.0
190	1374.3	1381.5	1388.7	1396.0	1403.2	1410.4	1417.7	1424.9	1432.1	1439.4

SPECIFICATIONS

PC200LC-6LE

Machine Model		PC200LC-6LE			
Serial numbers		A83001 and up			
Bucket capacity		m ³	0.8		
Operating weight		kg	21,300		
PERFORMANCE	WORKING RANGE	Maximum digging depth	mm	6,620	
		Maximum vertical wall depth	mm	5,980	
		Maximum digging reach	mm	9,875	
		Maximum digging reach at ground level	mm	9,700	
		Maximum digging height	mm	9,305	
		Maximum dumping height	mm	6,475	
	Maximum digging force (when using power max.)		kN(kg)	111.7 (11,400) (124.5 (12,700))	
	Swing speed		rpm	12.4	
	Swing maximum slope angle		°	20	
	Travel speed		km/h	Lo: 3.0 Mi: 4.1 Hi: 5.5	
	Gradeability		°	35	
	Ground pressure (shoe width: 700 mm)		kPa(kg/cm ²)	37.27 (0.38)	
	DIMENSIONS	Overall length (for transport)		mm	9,425
		Overall width		mm	3,080
Overall width of track		mm	3,080		
Overall height (for transport)		mm	2,970		
Overall height to top of cab		mm	2,905		
Ground clearance of counterweight		mm	1,085		
Minimum ground clearance		mm	440		
Tail swing radius		mm	2,740		
Minimum swing radius of work equipment		mm	3,630		
Height of work equipment at minimum swing radius		mm	7,570		
Length of track on ground		mm	3,640		
Track gauge		mm	2,380		
Height of machine cab		mm	2,315		

PC220LC-6LE, PC250LC-6LE

Unit: kg (lb)

Machine model	PC220LC-6LE	PC250LC-6LE
Serial number	A83001 and up	A83001 and up
Engine assembly	770 (1,698)	770 (1,698)
! Engine	545 (1,202)	545 (1,202)
! Damper	6 (14)	6 (14)
! Hydraulic pump	150 (331)	150 (331)
Radiator ! oil cooler assembly	124 (274)	124 (274)
Hydraulic tank ! filter assembly (excl. oil)	136 (300)	136 (300)
Fuel tank assembly (excl. fuel)	122 (269)	122 (269)
Revolving frame	1,846 (4070)	1,980 (4,366)
Operator's cab	300 (662)	300 (662)
Operator's seat	29 (64)	29 (64)
Counterweight	4,880 (10,759)	4,880 (10,759)
Swing machinery	205 (452)	164 (362)
Control valve	170 (375)	170 (375)
Swing motor	53 (117)	53 (117)
Travel motor	98 (216) x 2	98 (216) x 2
Center swivel joint	42 (93)	51 (113)
Track frame assembly	5,294 (11,672)	8,670 (19,115)
! Track frame	2,940 (6,482)	5,295 (11,674)
! Swing circle	280 (618)	716 (1,579)
! Idler	140 (309) x 2	166 (366) x 2
! Idler cushion	135 (298) x 2	257 (567) x 2
! Carrier roller	21 (47) x 4	31 (69) x 4
! Track roller	40 (89) x 18	52 (115) x 16
! Travel motor ! final drive	340 (750) x 2	629 (1,389) x 2
Track shoe assembly		
! Standard triple grouser shoe (600 mm)	1,480 (3,263) x 2	1,480 (3,263) x 2
! Standard triple grouser shoe (700 mm)	1,625 (3,583) x 2	1,625 (3,583) x 2
! Wide triple grouser shoe (800 mm)	1,770 (3,903) x 2	1,770 (3,903) x 2
Boom assembly	1,950 (4,300)	2,000 (4,410)
Arm assembly	1,110 (2,448)	1,250 (2,756)
Bucket assembly	660 - 1,110 (1,456 - 2,448)	765 - 1,270 (1,687 - 2,800)
Boom cylinder assembly	245 (541) x 2	245 (541) x 2
Arm cylinder assembly	300 (662)	300 (662)
Bucket cylinder assembly	213 (470)	213 (470)
Link (large) assembly	80 (177)	80 (177)
Link (small) assembly	22 (49) x 2	22 (49) x 2
Boom pin	51 + 10 x 2 + 31 + 10 + 26 (113 + 23 x 2 + 69 + 23 + 58)	51 + 10 x 2 + 31 + 10 + 26 (113 + 23 x 2 + 69 + 23 + 58)
Arm pin	10 (22) x 2	10 (22) x 2
Bucket pin	20 (45) x 2	20 (45) x 2
Link pin	17 (38) x 2	17 (38) x 2

PC200LC-6LE, PC210LC-6LE, PC220LC-6LE

Unit: mm

No.	Check item	Criteria		Remedy
1	Backlash between No. 1 sun gear and No. 1 planetary gear	Standard clearance	Clearance limit	Replace
		0.15 - 0.49	1.00	
2	Backlash between No. 1 planetary gear and ring gear	0.17 - 0.57	1.10	
3	Backlash between No. 1 planetary carrier and motor	0.06 - 0.25	---	
4	Backlash between No. 2 sun gear and No. 2 planetary gear	0.14 - 0.46	1.00	
5	Backlash between No. 2 planetary gear and ring gear	0.17 - 0.57	1.10	
6	Backlash between No. 2 planetary carrier and No. 1 sun gear	0.38 - 0.66	1.00	
7	End play of sprocket shaft	0 - 0.10	---	
8	Amount of wear on sprocket tooth	Repair limit: 6		Rebuild or replace
9	Width of sprocket tooth	Standard size	Repair limit	
		71	68	
10	Bolt	Torque Nm	Torque lbf ft	
		68.6±9.8	50.5±7	
11	Bolt	1st: 98 2nd: 85±5°	1st: 72 2nd: 85±5°	
12	Bolt	524.5±83.5	386±61	
13	Bolt	277±32	204±23	

PC200LC-6LE, PC210LC-6LE, PC220LC-6LE

Unit: mm

No.	Check item	Criteria		Remedy
		Standard clearance	Clearance limit	
1	Backlash between swing motor shaft and No. 1 sun gear	0.07 - 0.18	---	Replace
		0.13 - 0.32	0.90	
2	Backlash between No. 1 sun gear and No. 1 planetary gear	0.14 - 0.43	0.90	
3	Backlash between No. 1 planetary gear and ring gear	0.09 - 0.19	---	
4	Backlash between No. 1 planetary carrier and coupling	0.35 - 0.58	1.10	
5	Backlash between coupling and No. 2 sun gear	0.12 - 0.49	1.00	
6	Backlash between No. 2 sun gear and No. 2 planetary gear	0.15 - 0.57	1.10	
7	Backlash between No. 2 planetary gear and ring gear	0.09 - 0.20	---	
8	Backlash between No. 2 planetary carrier and swing pinion	0.22 - 1.32	2.00	
9	Backlash between swing pinion and swing circle	0.38 - 1.16	---	
10	Clearance between plate and planetary carrier	Standard size	Repair limit	
11	Wear of swing pinion surface contacting with oil seal	125 ⁰ - 0.100	124.7	
		Torque Nm	Torque lbf ft	
12	Bolt	66.5±7.5	49.0±5.5	
13	Bolt	549±59	404±43	
14	Bolt	277±32	204±23	
15	Bolt	110.5±12.5	81.5±9.2	
16	Bolt	4.4±1.5	3.2±1.1	
17	Bolt	176.5±19.5	130±14.3	
18	Bolt	3.3±0.49	2.4±0.036	

PC250LC-6LE

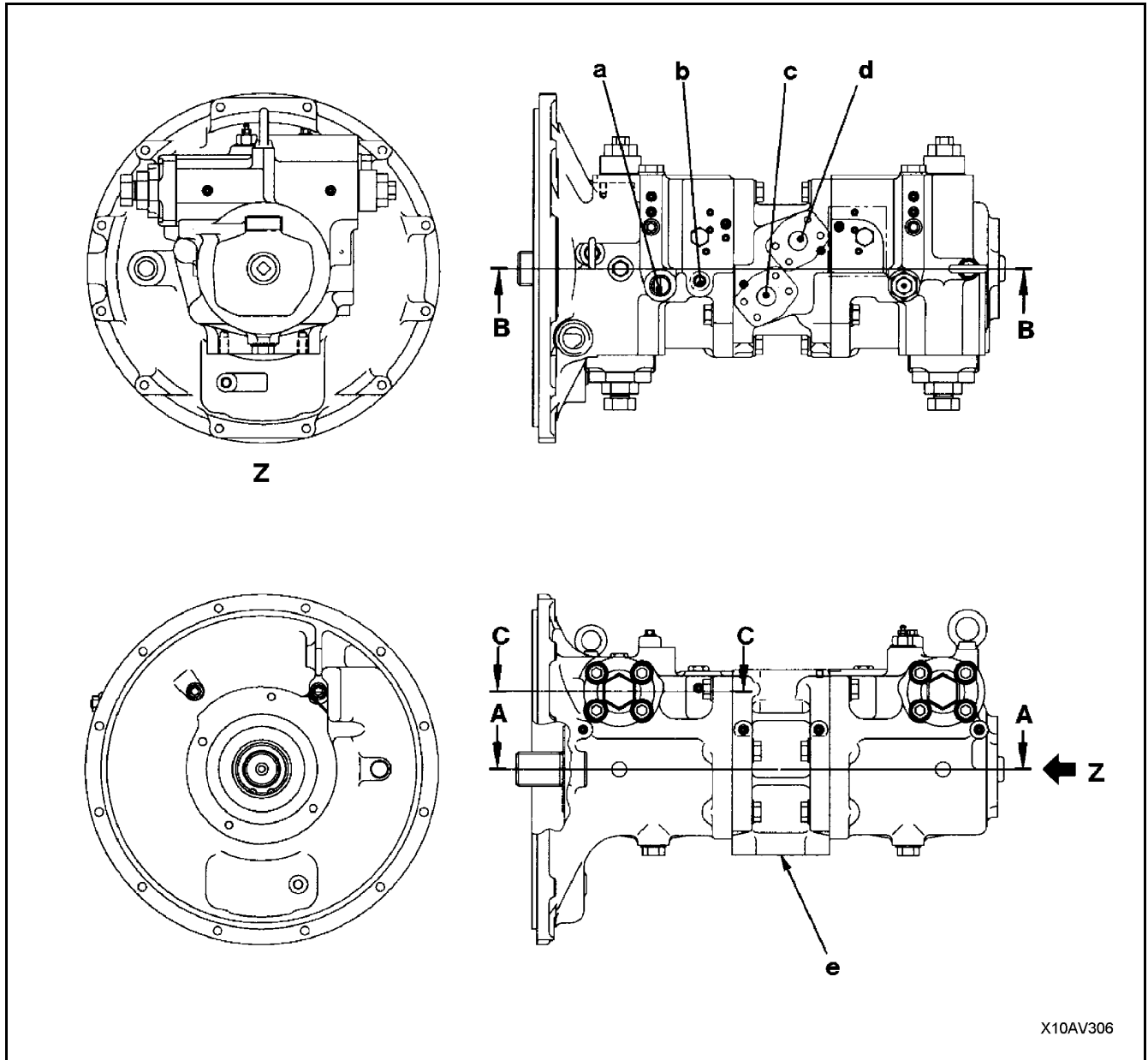
Unit: mm

No.	Check item	Criteria				Remedy
1	Outside diameter of protrusion	Standard size		Repair limit		Rebuild or replace
		630		---		
2	Outside diameter of tread	590		578		
3	Width of protrusion	101		---		
4	Total width	190		---		
5	Width of tread	44.5		50.5		
6	Clearance between shaft and bushing	Standard size	Tolerance		Standard clearance	Clearance limit
			Shaft	Hole		
		80	-0.225 -0.325	+0.130 -0.010	0.215-0.455	1.5
7	Clearance between shaft and support	80	-0.225 -0.290	-0.085 -0.195	0.03-0.205	---
8	Interference between idler and bushing	Standard size	Tolerance		Standard interference	Interference limit
			Shaft	Hole		
		87.6	+0.087 +0.037	-0.027 -0.079	0.064-0.166	---
9	Side clearance of idler (each)	Standard clearance		Clearance limit		
		0.68-1.22		2		
10	Bolt	Torque Nm		Torque lbf ft		
		152.0±24.5		112±18		

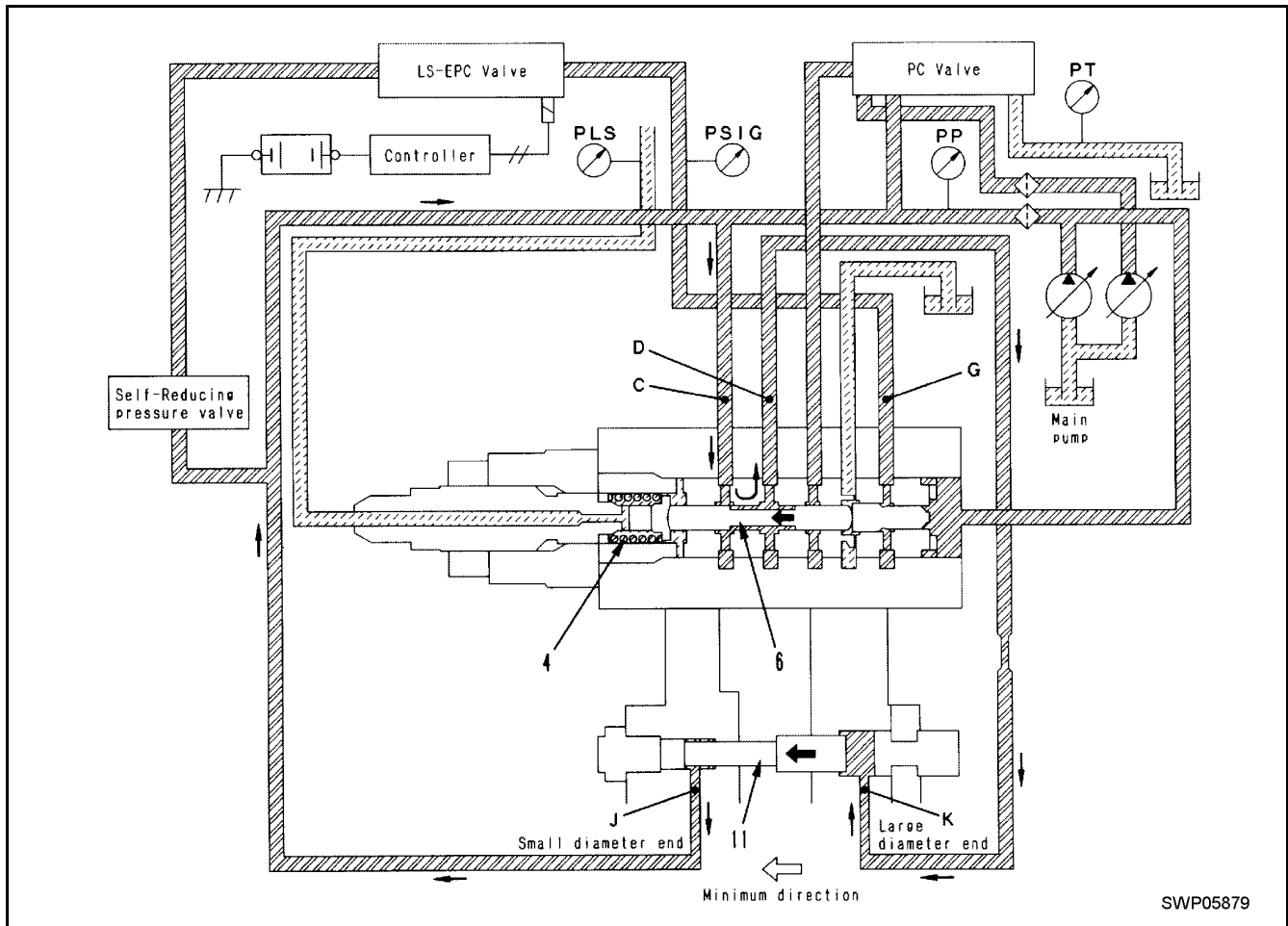
PC250LC-6LE

Unit: mm

No.	Check item	Criteria				Remedy	
		Standard size		Repair limit			
1	Link pitch	216		---		Turn or replace	
2	Outside diameter of bushing	66.5		61			
3	Height of grouser	Triple	36		---		Lug welding, rebuild or replace
4	Height of link	116		107			
5	Interference between bushing and link	Standard size	Tolerance		Standard interference	Interference limit	
			Shaft	Hole			
		66.5	+0.464 +0.424	+0.074 0	0.350-0.464	0.100	Replace with over size
6	Interference between regular pin and link	44.6 (Shaft) 44.35 (Hole)	+0.235 +0.085	+0.062 0	0.273-0.485	0.140	
7	Interference between master pin and link	44.6 (Shaft) 44.35 (Hole)	+0.300 0	+0.062 0	0.188-0.280	0.140	
8	Protrusion of bushing	5.25±0.3				Adjust	
9	Tightening torque of shoe bolt	Initial tightening torque: 196.1±19.6 Nm (144.6±14.8 lbf ft) Additional tightening angle: 120° ± 10°				Tighten	



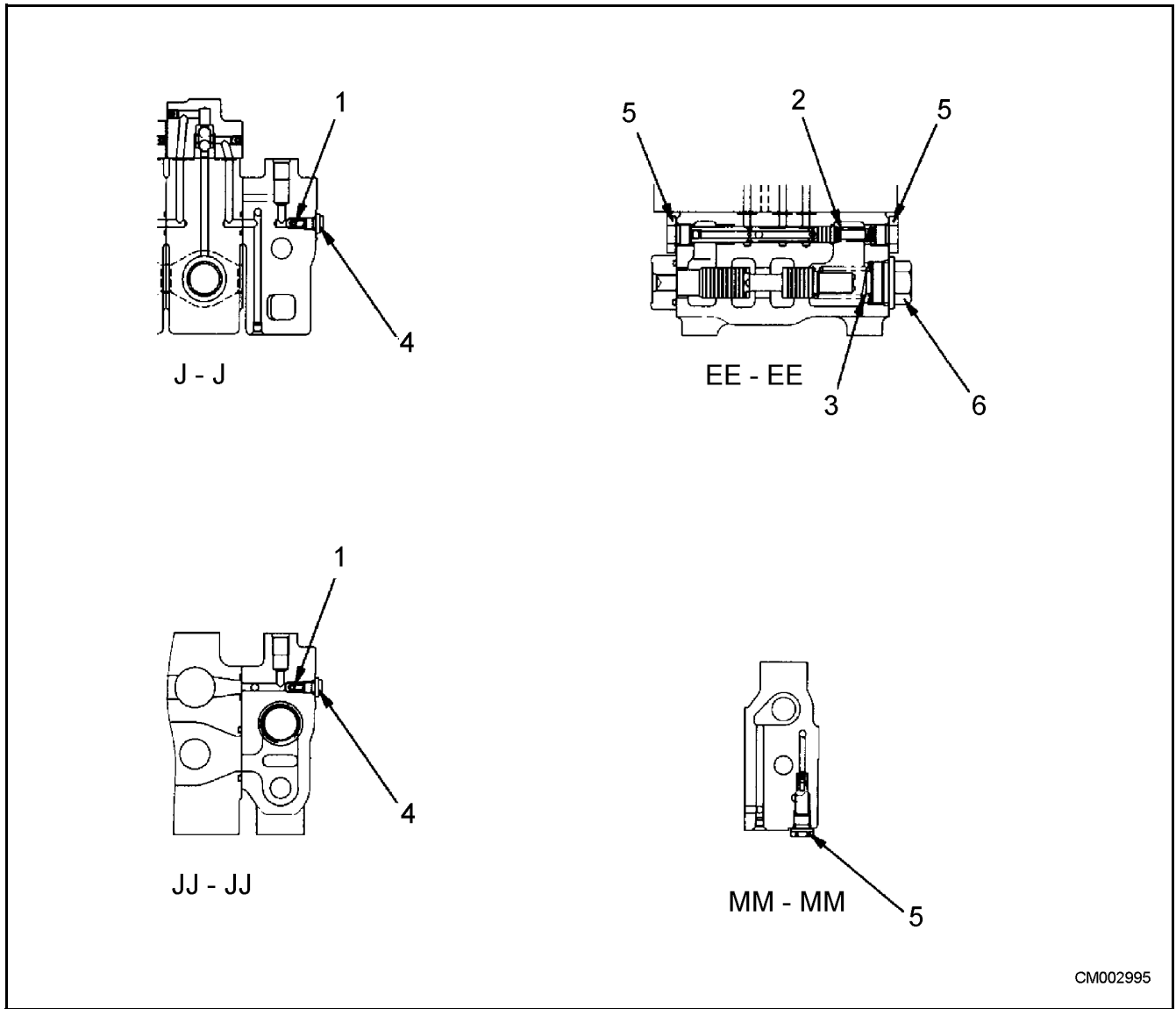
- a. **Pd1F** port (pump drain)
- b. **PBF** port (pump pressure input)
- c. **PAF** port (front pump delivery)
- d. **PAR** port (rear pump delivery)
- e. **Ps** port (suction)



3. Operation in minimum direction for pump discharge amount.

- A. When LS differential pressure ΔPLS becomes larger (for example, when the area of the opening of the control valve becomes smaller and pump pressure **PP** rises), pump pressure **PP** pushes spool (6) to the left.
- B. When spool (6) moves, main pump pressure **PP** flows from port **C** to port **D**, and from port **K**, it enters the large diameter end of the piston.
- C. Main pump pressure **PP** also enters port **J** at the small diameter end of the piston, but because of the difference in area between the large diameter end and the small diameter end of servo piston (11), servo piston (11) is pushed to the left. As a result, the swash plate moves in the direction to make the angle smaller.
- D. If LS selection pressure **PSIG** enters port **G**, it acts to make the set pressure of spring (4) weaker.

MEMORANDUM



CM002995

Unit: mm

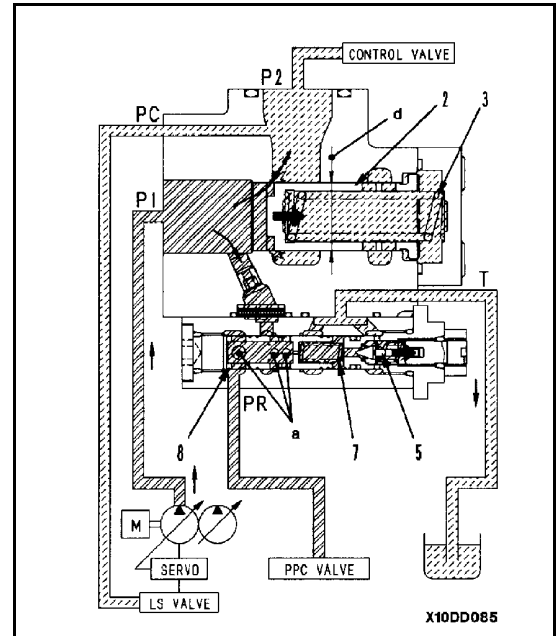
No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
1	Check valve spring	Free length X O.D.	Installed length	Installed load	Free length	Installed load	Replace spring if any damages or deformations are found.
		11.5 X 4.6	8.5	1.5 N (0.33 lbf)	---	1.2 N (0.26 lbf)	
2	Spool return spring	65.5 X 27.2	50	167.6 N (37.6 lbf)	---	134.3 N (30.1 lbf)	
3	Spool return spring	13.6 X 5.5	10	2.0 N (0.44 lbf)	---	1.5 N (0.33 lbf)	
4	Plug	Torque Nm		Torque lbf ft			
		27±7.4		20±5			
5	Plug	39.2±4.9		29±3			
6	Plug	152±24.5		112±18			

2. At neutral and when load pressure **P2** is low (when moving down under own weight (boom LOWER or arm IN)).

Remark

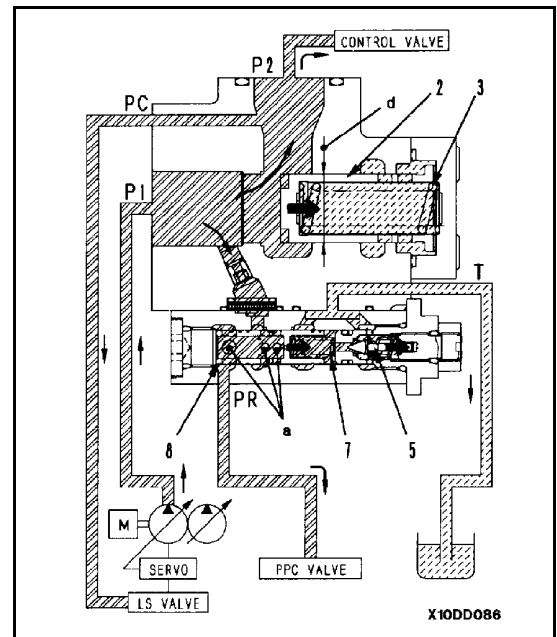
When load pressure **P2** is lower than output pressure **PR** of the self-reducing pressure valve.

- A. Valve (2) receives force in the direction to close the passage from port **P1** → **P2** from spring (3) and pressure **PR** (when engine is stopped, the pressure is 0 kgf/cm² [0 psi]). However, when hydraulic oil flows in from port **P1**, the pressure is balanced so that pressure **P1** ≈ force of spring (7) + (area φd X pressure **PR**), and the opening from port **P1** → **P2** is adjusted so that pressure **P1** is kept at a certain value above pressure **PR**.
- B. When pressure **PR** goes above the set pressure, poppet (5) opens, and the hydraulic oil flows in the following circuit: port **PR** → hole **a** inside spool (8) → opening of poppet (5) → tank port **T**. As a result, a pressure difference is created on both sides of hole **a** inside spool (8), so spool (8) moves in the direction to close the opening from port **P1** → **PR**. Pressure **P1** is reduced to a certain pressure (set pressure) by the amount of opening at this point, and is supplied as pressure **PR**. (See figure at right.)



3. When the load pressure **P2** is high.

- A. If load pressure **P2** increases and the pump discharge amount also increases because of digging operations, pressure **P1** also increases (pressure **P1** > force of spring (7) + area φd X pressure **PR**), so valve (2) moves to the right to the end of the stroke. As a result, the amount of opening from port **P1** → **P2** increases and the resistance in the passage is reduced, so the loss of engine horsepower is reduced.
- B. If pressure **PR** goes above the set pressure, poppet (5) opens and the hydraulic oil flows in the following circuit: port **PR** → hole **a** inside spool (8) → opening of poppet (5) → tank port **T**. As a result, a pressure difference is created on both sides of hole **a** inside of spool (8), so that spool (8) moves in the direction to close the opening from port **P1** → **PR**. Pressure **P1** is reduced to a certain pressure (set pressure) by the amount of opening at this point, and is supplied as pressure **PR**. (See figure at right.)



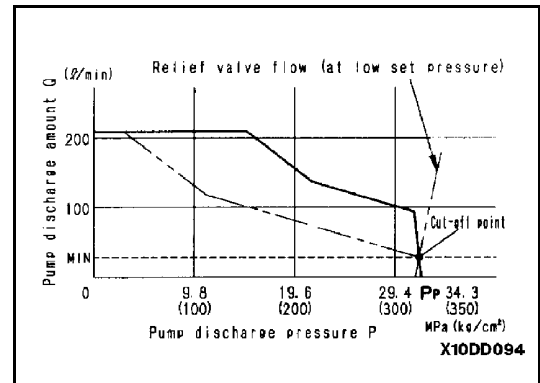
During cut-off control

Function

This function uses the pump pressure sensor, pump controller, and PC valve. When pump discharge pressure **PP** is greater than the set pressure, pump discharge amount **Q** is the minimum.

Operation

1. If the pump pressure sensor detects that pump discharge pressure **PP** has become higher than the set pressure, it informs the pump controller.
2. When the pump controller receives this signal, it increases the value of the signal current going to the PC valve and reduces pump discharge amount **Q** to the minimum (minimum swash plate angle).
3. When this happens, the oil discharged from the pump passes through the relief valve (low set pressure) and is drained.

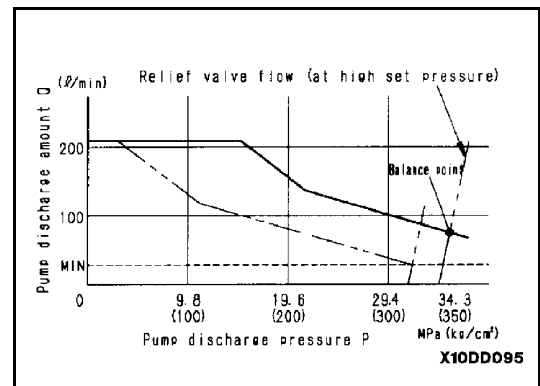


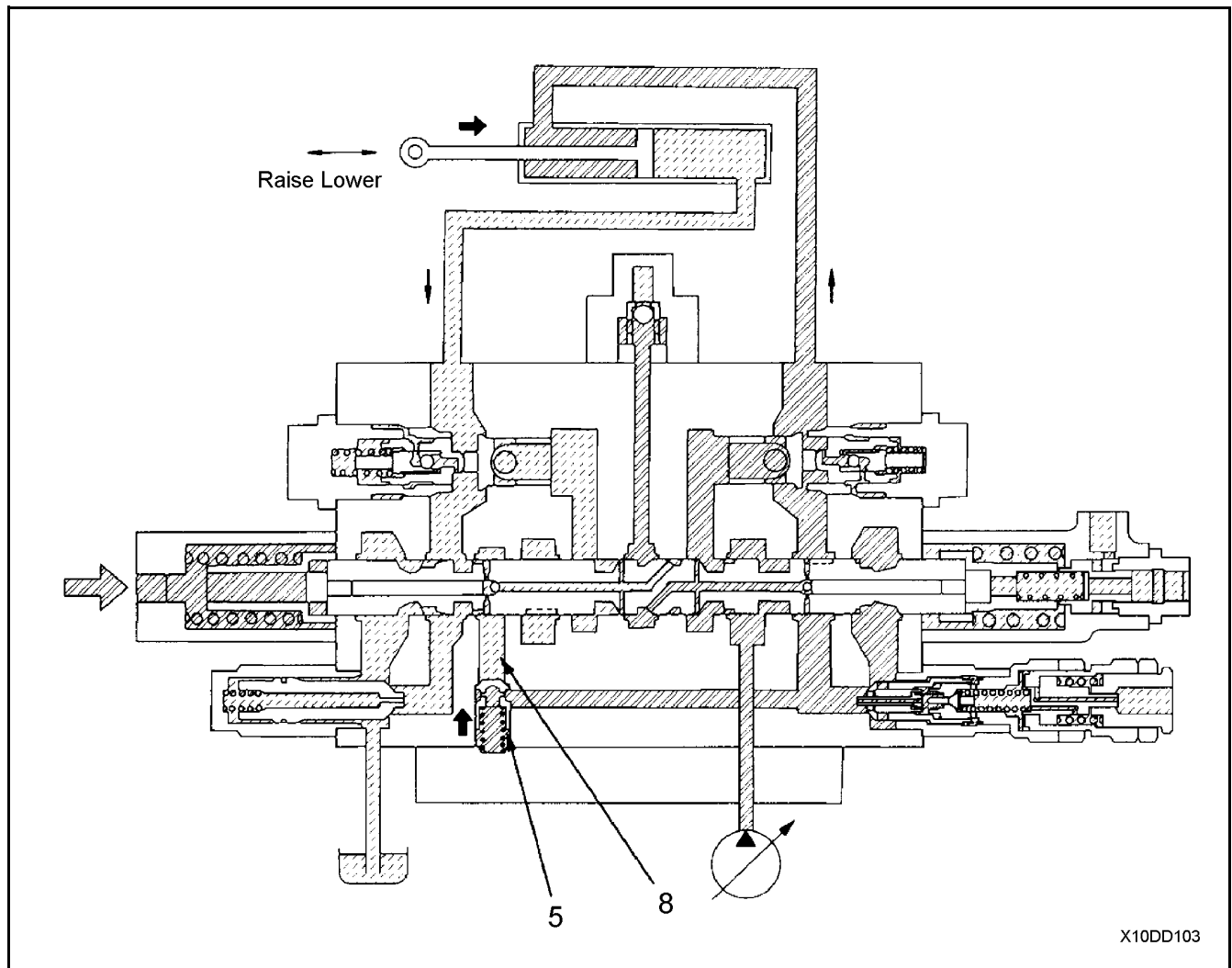
When power max. is actuated (when cut-off is canceled)

Function, operation

In the power max. mode, the torque cut-off signal is not output, so the torque moves along the pump discharge curve.

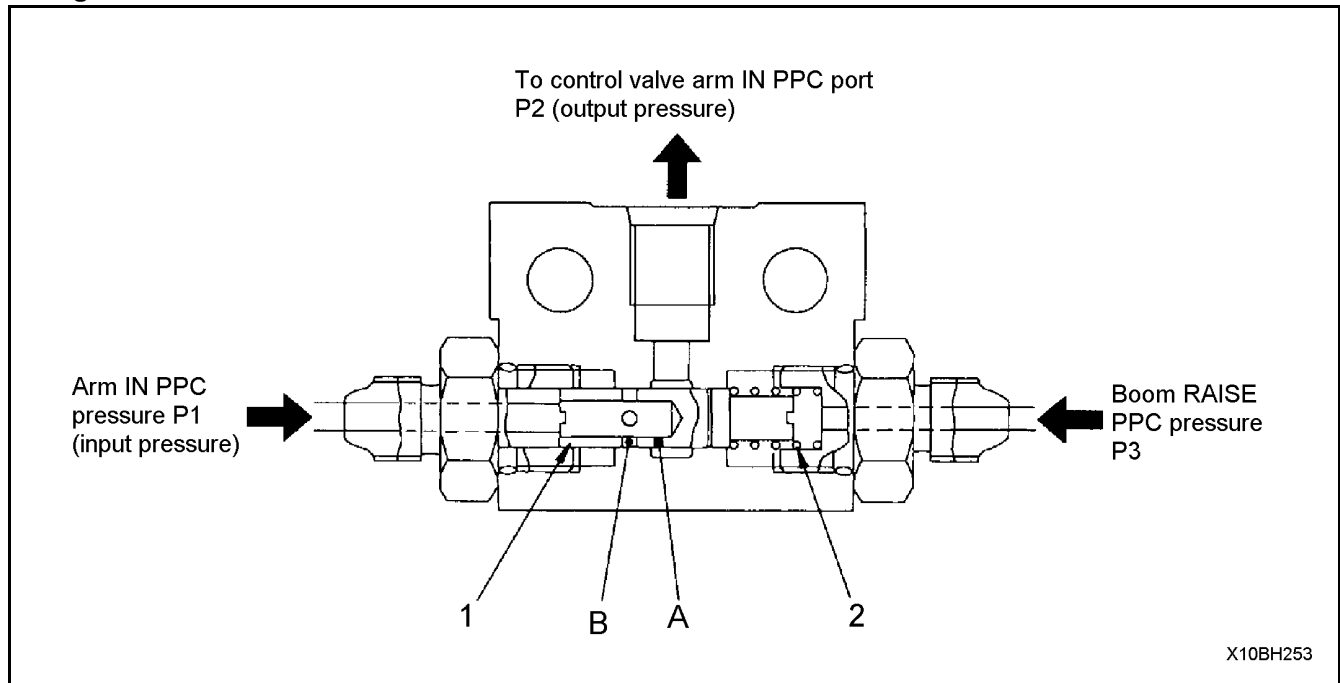
When this happens, the oil discharged from the pump is relieved through the relief valve to maintain the overall balance.





2. Cylinder head pressure > cylinder bottom pressure (digging operations, etc.)
 - Check valve (5) in regeneration circuit (8) acts to shut off the flow from the cylinder head to the cylinder bottom.

Timing valve



X10BH253

1. Spool
2. Spring

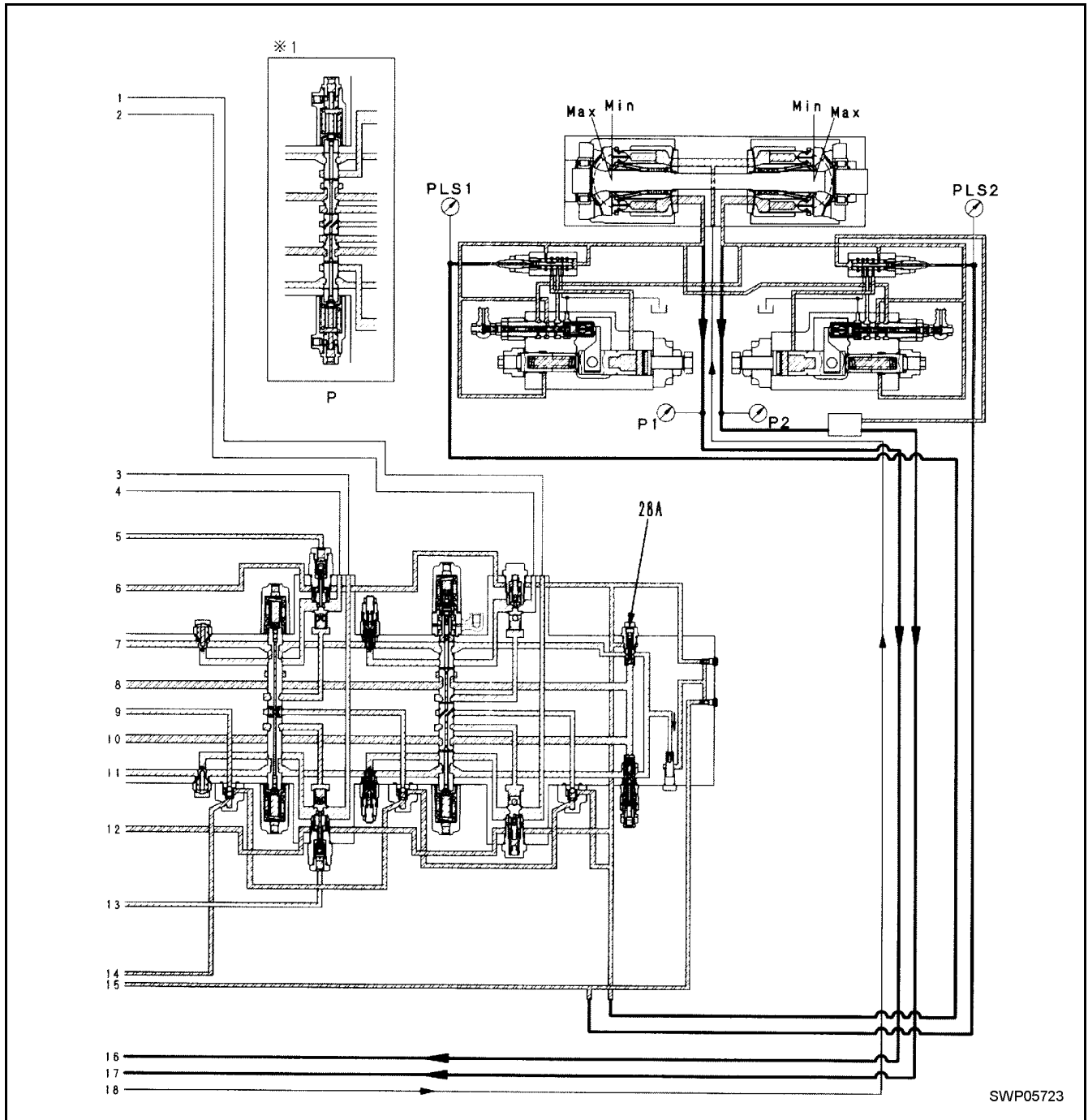
Function

When the arm IN and boom RAISE are operated at the same time, the timing valve throttles the arm IN PPC pressure supplied to the control valve.

Operation

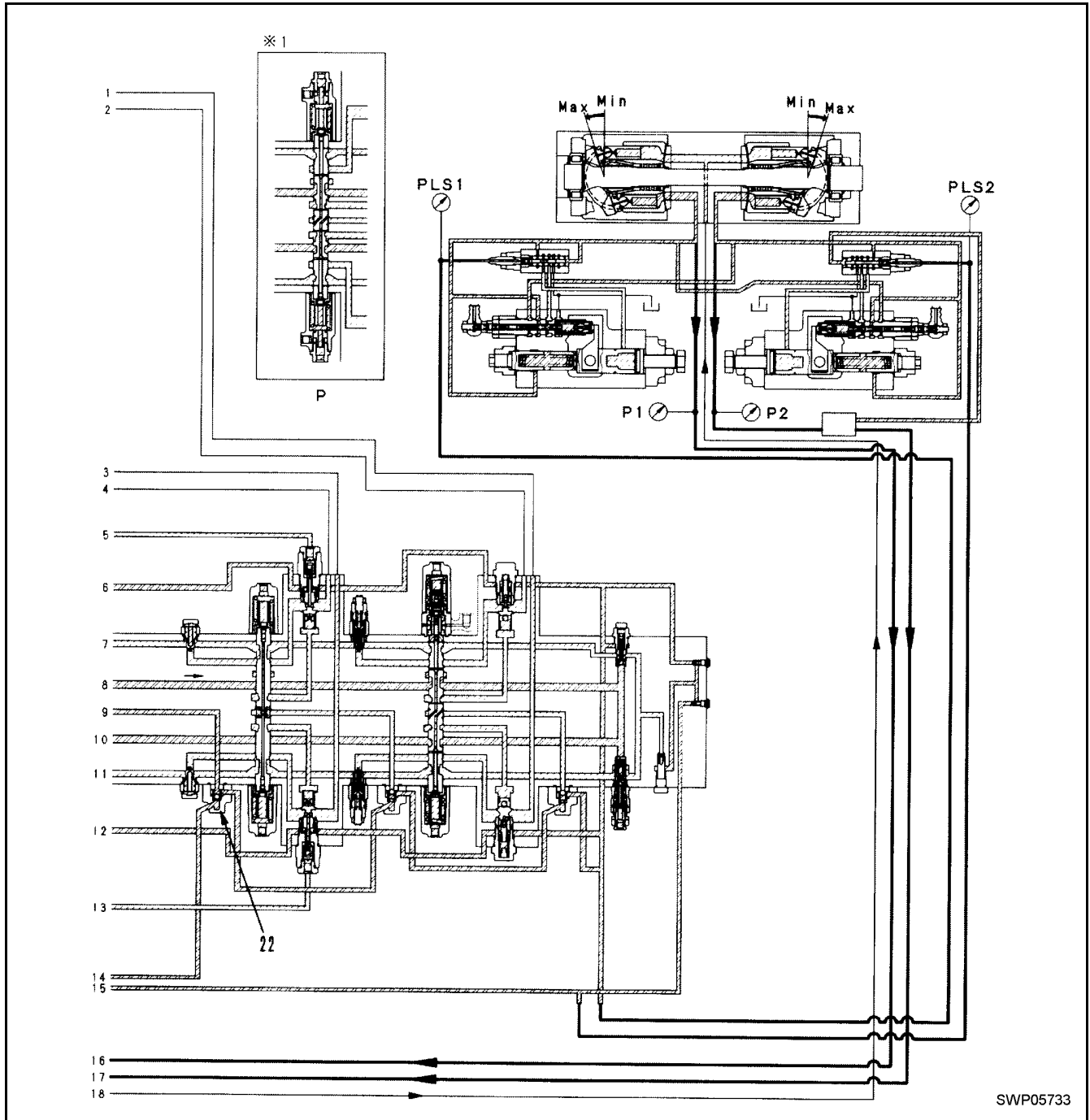
1. When arm IN is operated independently
The PPC pressure acts on port **P1** and pushes spool (1) fully to the right against the force of spring (2). Port **P1** and **P2** are interconnected through **B**.
2. Arm IN and boom RAISE operated simultaneously
If the boom RAISE is operated, the boom PPC pressure acts on port **P3** and pushes spool (1) to the left. If the lever is operated fully for both arm IN and boom RAISE, the force acting on spool (1) becomes as shown in the formula below, and spool (1) is pushed fully to the left.
P1 pressure \leq **P2** pressure + spring force. When this happens, **B** is shut off, so the arm IN PPC pressure passes through throttle **A** and is sent from port **P1** to port **P2**.

* - PC200/220LC-6LE S/N A85001 and UP



- When this happens, the pump pressure sensor detects it and increases the PC-EPC current (electronic cut-off control) to set the pump swash plate angle to the minimum.

* - PC200/220LC-6LE S/N A85001 and UP



- Because of the above operation, the oil flow is divided in proportion to the size of the opening area of boom spool (8) and the opening area of arm spool (11). Meter-in LS differential pressure ΔPLS during boom RAISE + arm IN is $\Delta PLS <$ boom LS control pressure, so the main pump swash plate angle is set to maximum.

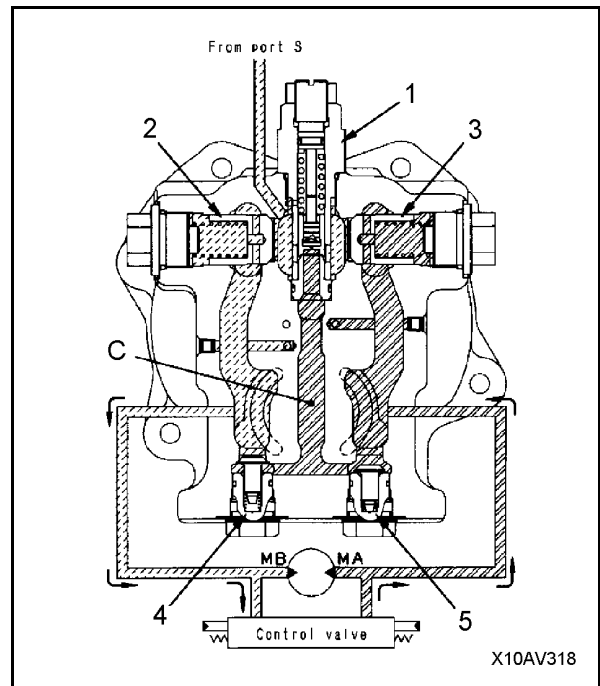
RELIEF VALVE PORTION

Outline

The relief valve portion consists of check valves (2) and (3), shuttle valves (4) and (5), and relief valve (1).

Function

When the swing is stopped, the outer port circuit of the motor from the control valve is closed, but the motor continues to rotate under inertia, so the pressure at the output side of the motor becomes abnormally high and this may damage the motor. To prevent this, the abnormally high pressure oil is relieved to port **S** from the outlet port of the motor (high-pressure side) to prevent any damage to the motor.



Operation

1. When starting swing

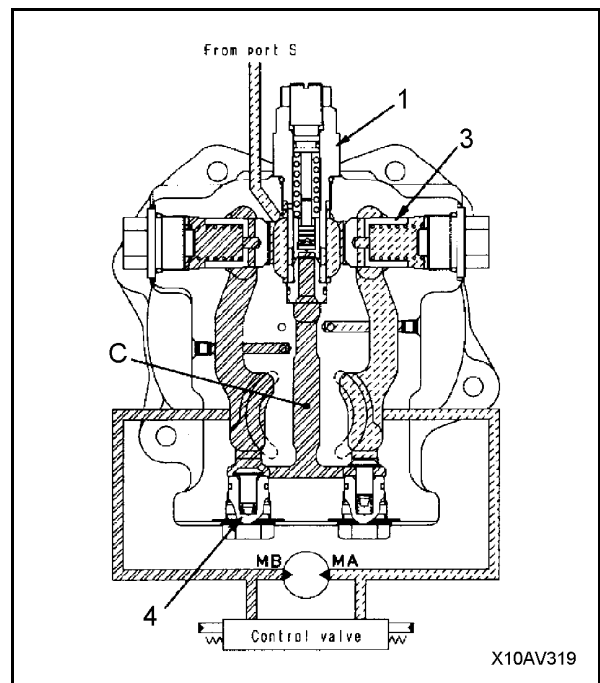
When the swing control lever is operated to swing right, the pressure oil from the pump passes through the control valve and is supplied to port **MA**. As a result, the pressure at port **MA** rises, the starting torque is generated in the motor and the motor starts to rotate. The oil from the outlet port of the motor passes from port **MB** through the control valve and returns to tank.

2. When stopping swing

A. When the swing control lever is returned to neutral, the supply of pressure oil from the pump to port **MA** is stopped. With the oil from the outlet port of the motor, the return circuit to the tank is closed by the control valve, so the pressure at port **MB** rises. As a result, rotation resistance is generated in the motor, so the braking effect starts.

B. If the pressure at port **MB** becomes higher than the pressure at port **MA**, it pushes shuttle valve **A** (4) and chamber **c** becomes the same pressure as port **MB**. The oil pressure rises further until it reaches the set pressure of relief valve (1). As a result, a high braking torque acts on the motor and stops the motor.

C. When the relief valve (1) is being actuated, the relief oil and oil from port **S** passes through check valve **B** (3) and is supplied to port **MA**. This prevents cavitation at port **MA**.

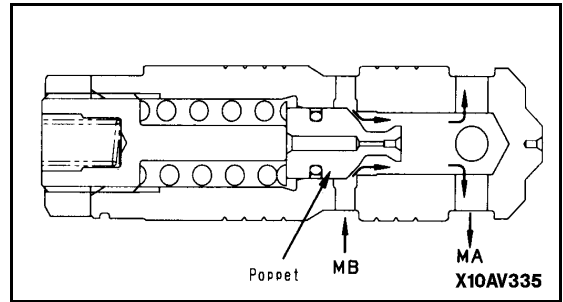


Unit: mm

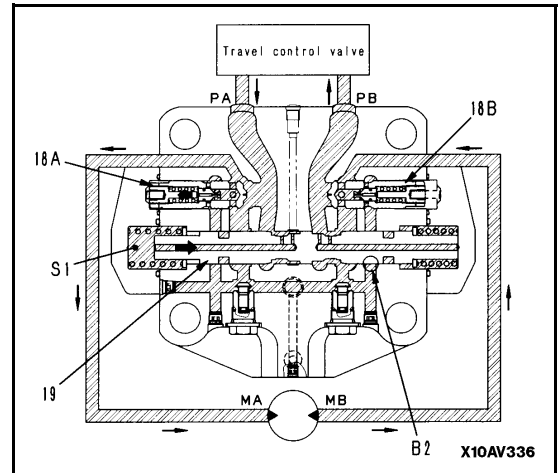
No	Check item	Criteria				Remedy	
		Standard size		Repair limit			
1	Check valve spring	Free length X O.D.	Installed length	Installed load	Free length	Installed load	Replace spring if any damages or deformations are found.
		31.6 X 6.5	24.2	2.55 N (0.57 lbf)	---	2.06 N (0.46 lbf)	
2	Check valve spring	13.0 X 6.5	9.5	1.96 N (0.44 lbf)	---	1.57 N (0.35 lbf)	
3	Return spring	58.43 X 30	42.6	411 N (92.3 lbf)	---	329 N (73.9 lbf)	
4	Bolt	Torque Nm		Torque lbf ft			
		23.5±3.9		17±2.8			
5	Bolt	110.5±12.5		81±9.2			
6	Bolt	711.0±49.0		524±36			
7	Bolt	39.2±4.9		28±3.6			
8	Bolt	31.4±3.9		23±2.8			
9	Bolt	74.05±8.35		56±6.1			

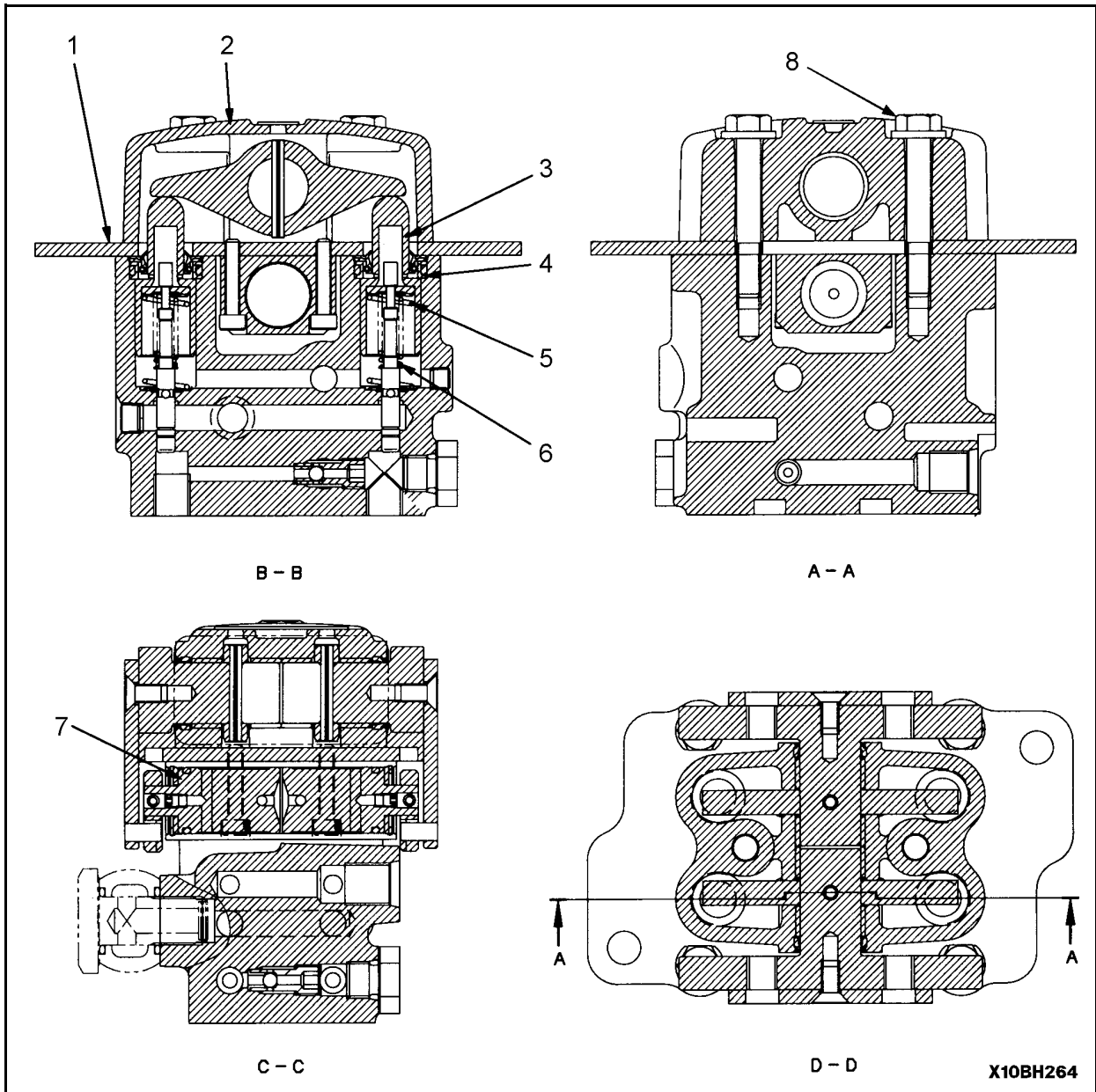
- ii. If the pressure goes above the set pressure of suction-safety valve (18A), the poppet opens. The oil then passes through large notch **A1** in counterbalance valve spool (19) and flows the chamber **MA** in the circuit on the opposite side.

- C. When rotating to the left.
The operation is the reverse of when rotating to the right.



- D. When starting travel (or during normal travel)
When the travel lever is operated, the pressurized oil from the pump moves counterbalance valve spool (19) to the right. When this happens, the passage to the suction safety valve becomes the circuit flowing through the small notch in the counterbalance valve spool. As a result, a big difference in pressure is created, and the pump pressure rises the provide a powerful drawbar pull.



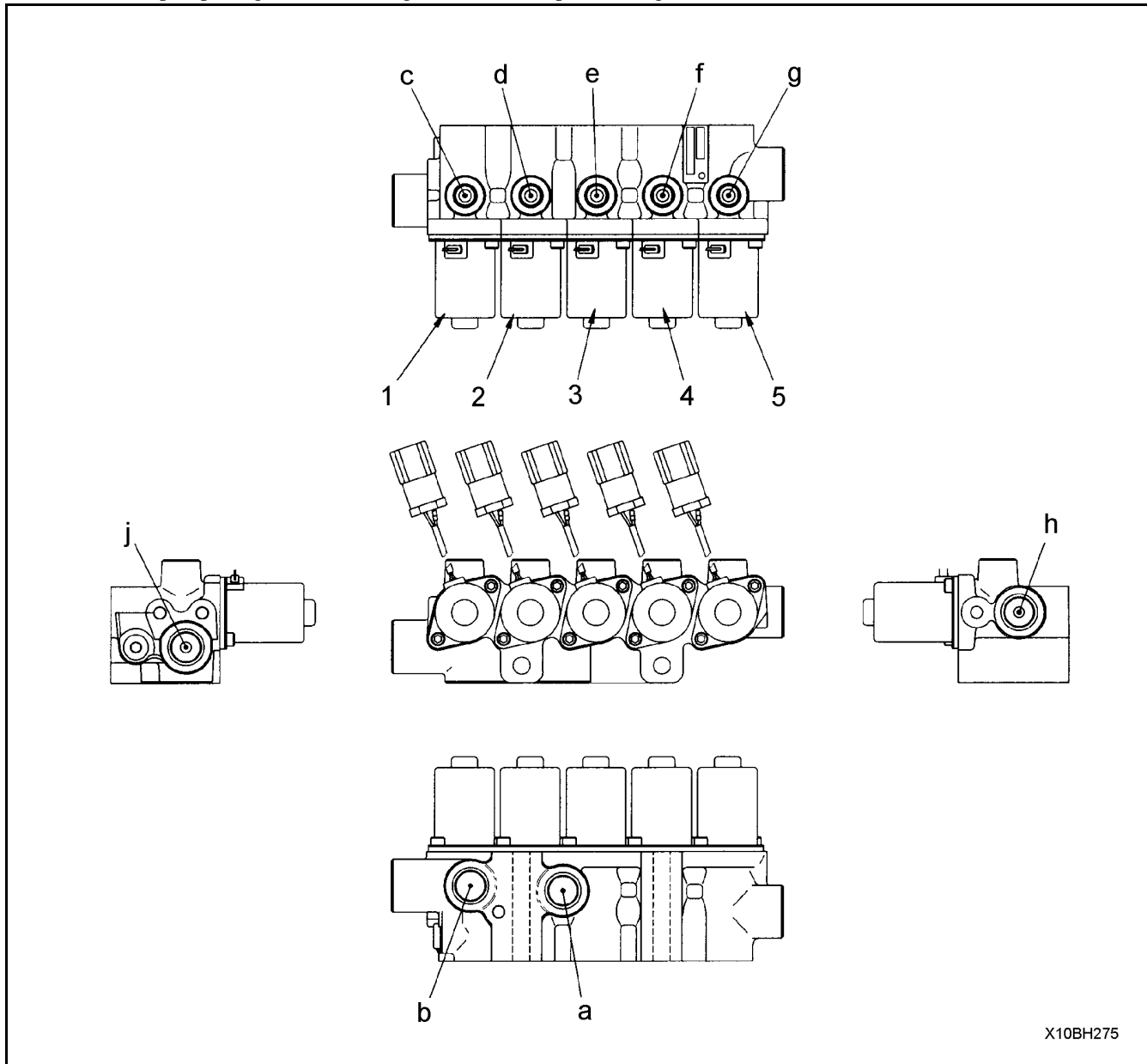


- | | |
|-----------|---------------------|
| 1. Plate | 5. Metering spring |
| 2. Body | 6. Centering spring |
| 3. Piston | 7. Valve |
| 4. Collar | 8. Bolt |

X10BH264

EPC SOLENOID VALVE

For active mode, pump merge-divider, 2-stage relief, travel speed, swing brake solenoid valve.



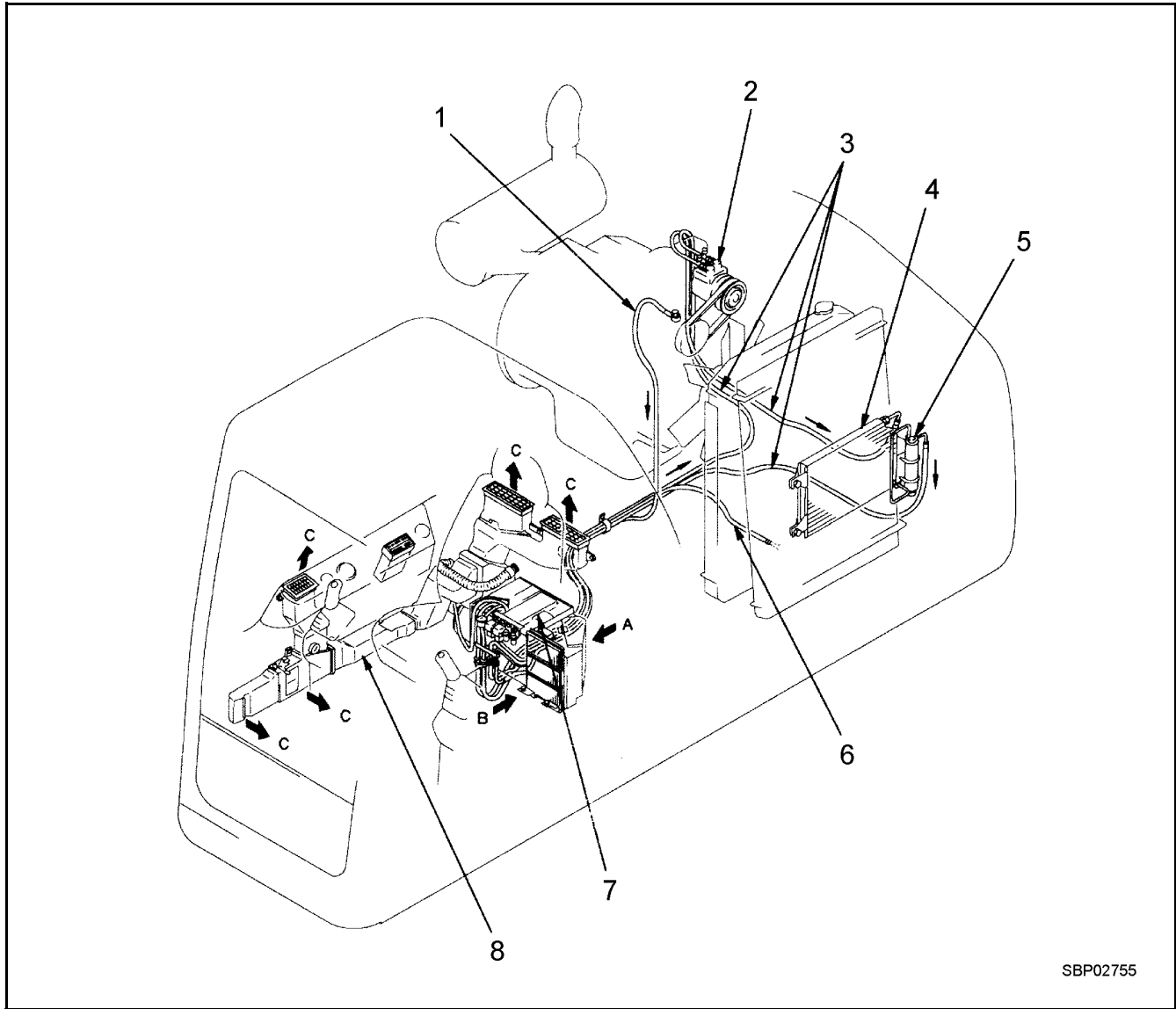
X10BH275

- | | |
|--|--|
| <ul style="list-style-type: none"> 1. Active mode solenoid valve 2. 2-stage relief solenoid valve 3. Pump merge-divider solenoid valve 4. Travel speed solenoid valve 5. Swing brake solenoid valve | <ul style="list-style-type: none"> a. To tank b. To PPC/EPC valve c. To main valve (active mode) d. To main valve (2-stage relief valve) e. To main valve (pump merge-divider valve) f. To L.H. and R.H. travel motor g. To swing motor h. From main pump i. To accumulator |
|--|--|

Unit: mm

No.	Model	PC200-6LE	PC210-6LE	PC220-6LE	PC250-6LE
1		$\phi 80 + 0.1$	$\phi 80 + 0.1$	$\phi 80 + 0.1$	$\phi 80 + 0.1$
2		107.3+1.5	107.3+1.5	107.3+1.5	107.3+1.5
3		310+0.5	310+0.5	310+0.5	310+0.5
4		$\phi 90 - 0.036$ to -0.071	$\phi 90 - 0.036$ to -0.071	$\phi 90 - 0.036$ to -0.071	$\phi 90 - 0.036$ to -0.071
5		361.7 ± 1	361.7 ± 1	403.9 ± 1	408 ± 1
6		187.2 ± 0.5	187.2 ± 0.5	200 ± 0.5	200 ± 0.5
7		829.1 ± 1	829.1 ± 1	920 ± 1	920 ± 1
8		2,919	2,919	3,038	3,038
9		$2,631.3 \pm 1$	$2,631.3 \pm 1$	$2,563.2 \pm 1$	$2,563.2 \pm 1$
10		410 ± 1	410 ± 1	465 ± 1	465 ± 1
11		640 ± 0.2	640 ± 0.2	585 ± 0.2	585 ± 0.2
12		600 ± 0.5	600 ± 0.5	600 ± 0.5	600 ± 0.5
13		458.1	458.1	446.3	446.3
14		1,486	1,498.3	1,551.7	1,575.5
15		$\phi 80$	$\phi 80$	$\phi 80$	$\phi 80$
16		326.5 ± 1	326.5 ± 1	326.5 ± 1	326.5 ± 1
17		$\phi 80$	$\phi 80$	$\phi 80$	$\phi 80$
18	Arm width	311 -0.5	311 -0.5	311 -0.5	311 -0.5
	Bushing installed	325	325	325	325
19	Min.	1,680	1,680	1,605	1,605
	Max.	2,800	2,800	2,625	2,625

For machines equipped with Nippon Denso air conditioner.



SBP02755

- 1. Hot water pickup piping
- 2. Air conditioner compressor
- 3. Refrigerant piping
- 4. Condenser
- 5. Receiver-drier tank
- 6. Hot water return piping
- 7. Air conditioner unit
- 8. Duct

- A. Fresh air
- B. Recirculated air
- C. Hot/cold air

Refrigerator oil (lube oil)

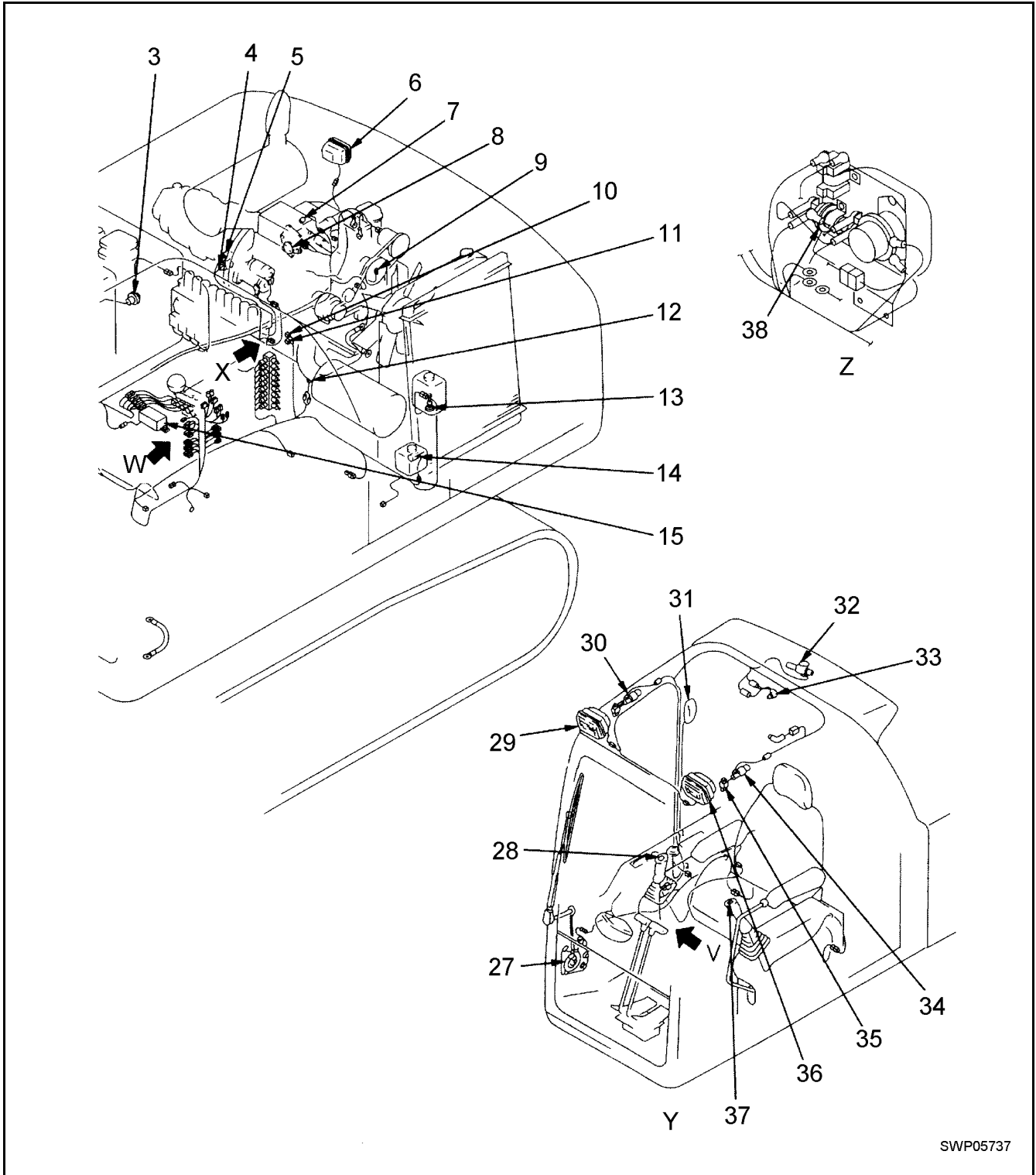
The lubricant used in air conditioners is generally called refrigerator oil. In the compressor it helps minimize wear of the piston, cylinder walls, and other frictional parts like bearings, and helps prevent them from seizing by removing the heat created by friction. In addition, the substance helps prevent leakage of refrigerant by maintaining a uniform thin oil film on the contact surfaces of parts.

Freon type refrigerant dissolves in oil more readily than ammonia. When the freon is dissolved in oil, the freezing point of the oil goes down, which causes no hindrance to the use of the oil at low temperatures. The flash point and the ignition point of the refrigerant oil are ordinarily 160°C to 170°C and 200°C to 220°C, respectively.

The lube oil in an air conditioner will contact refrigerant. So the viscosity of the oil when mixed with refrigerant is an important factor its selection. The lube oil used in air conditioners is a mineral oil refined from petroleum, and various types are available. The refrigerant has a large effect on the durability of the compressor and therefore, the oil must conform to the specifications for each compressor.

Characteristics of SUNISO (SUNISO is a U.S. specification) refrigerator oil:

1. Chemical stability
The oil is resistant to chemical reactions with the refrigerant or any other substance in the system.
2. Thermal stability
No carbon deposits are formed at high temperatures in the valve and delivery (discharge) portion of the compressor.
3. Low wax content
The flocculent material does not separate from the oil-refrigerant mixture in the low-temperature portion of the refrigeration system.
4. Low pour point
The oil in the refrigeration system does not freeze because the pour point is lower than the lowest temperature in the system.
5. High insulation resistance
6. Proper viscosity
Excessive wear of the compressor is prevented because the proper viscosity is maintained even at high temperatures. Sufficient fluidity of the oil is maintained at low temperatures and a satisfactory oil film is formed at all times.
7. Cleanliness of oil
No dust, or foreign matter that accelerate the deterioration of oil are mixed in the oil. Thus, the cylinder liners and bearings will not get flawed and oil grooves will not get clogged.

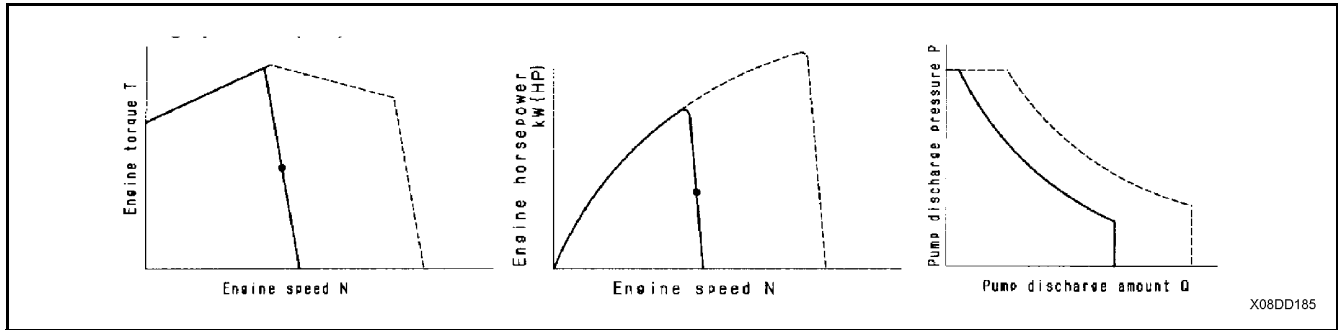


SWP05737

Input and output signals

CN-1			CN-3			CN-5		
Pin no.	Name of signal	Input/output	Pin no.	Name of signal	Input/output	Pin no.	Name of signal	Input/output
1	Battery relay drive output	Output	1	Engine water temperature sensor	Input	1	Engine speed sensor GND	Input
2	Pump merge-divider solenoid	Output	2	Fuel level sensor	Input	2	Engine speed sensor	Input
3	Swing holding brake solenoid	Output	3	Pump F pressure input	Input	3	GND	Input
4	NC	---	4	Throttle potentiometer input	Input	4	GND	Input
5	NC	---	5	NC	---	5	Swing pressure switch	Input
6	GND	Input	6	Pressure sensor power source (+24V)	Output	6	Service valve pressure switch	Input
7	Power source (+24V)	Input	7	Potentiometer power source (+5V)	Output	7	NC	---
8	Active mode solenoid	Output	8	Starting switch (ACC)	Input	8	Radiator water level sensor	Input
9	Travel selector solenoid	Output	9	Knob switch	Input	9	Hydraulic oil level sensor	Input
10	2-stage relief solenoid	Output	10	NC	---	10	Engine speed sensor GND	Input
11	NC	---	11	NC	---	11	Bucket CURL pressure switch	Input
12	GND	Input	12	Battery charge (alternator terminal R)	Input	12	Bucket DUMP pressure switch	Input
13	Power source (-24V)	Input	13	Pump R pressure input	Input	13	Travel pressure switch	Input
CN-2			14	Feedback potentiometer input	Input	14	NC	---
			15	NC	---	15	Engine oil pressure sensor (Low)	Input
			16	Pressure sensor GND	Input	16	Engine oil level sensor	Input
1	Solenoid power source (+24V)	Input	17	Potentiometer GND	Input	17	Air cleaner clogging sensor	Input
2	Governor motor phase A (+)	Output	18	Starting switch (terminal C)	Input			
3	Governor motor phase A (-)	Output	19	NC	---			
4	Governor motor phase B (+)	Output	20	NC	---			
5	Governor motor phase B (-)	Output	21	PPC pressure	Input			
6	NC	---	22	Boom RAISE pressure switch	Input			
7	LS-EPC solenoid (+)	Output	23	Arm IN pressure switch	Input			
8	PC-EPC solenoid (+)	Output	24	S-NET (+)	Both			
9	NC	---	25	Model selection 1	Input			
10	NC	---	26	Model selection 3	Input			
11	PGND	Input	27	Model selection 5	Input			
12	Solenoid power source (+24V)	Input	28	Swing prolix switch	Input			
13	NC	---	29	NC	---			
14	NC	---	30	Boom LOWER pressure switch	Input			
15	NC	---	31	Arm OUT pressure switch	Input			
16	NC	---	32	S-NET (+)	Both			
17	LS-EPC solenoid (-)	Output	33	Model selection 2	Input			
18	PC-EPC solenoid (-)	Output	34	Model selection 4	Input			
19	NC	---	35	Kerosene mode selection	Input			
20	NC	---	36	Swing lock switch	Input			
21	PGNC	Input						

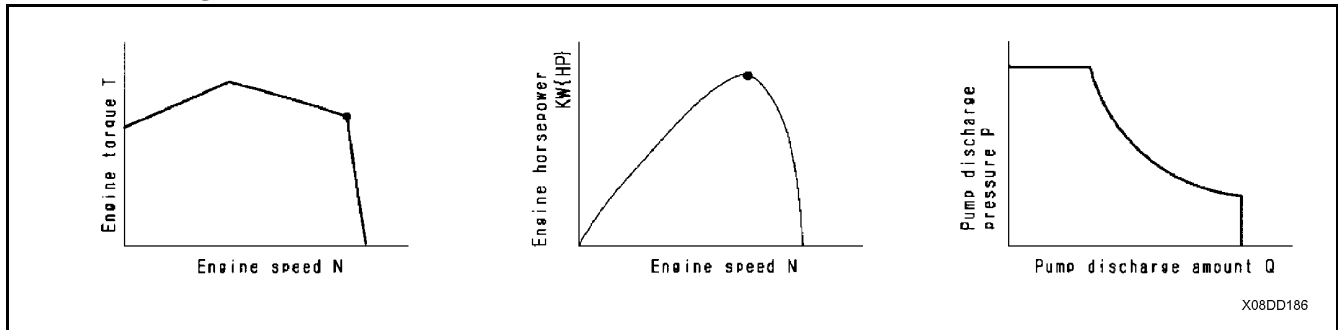
Lifting operation (L/O) mode



- Matching point in lifting operation mode: 60% partial output point
- When the lifting operation mode is selected, the engine speed is automatically lowered to the partial position. In this condition, control is carried out in the same way as for the general operation, finishing operation, and breaker operation modes to match the load on the pump. In this way, the fuel consumption is reduced and the fine control ability is improved.

Mode	Model	PC200LC-6LE PC210LC-6LE	PC220LC-6LE PC250LC-6LE
Lifting operation (L/O)		57 kW/1,500 rpm 76 HP/1,500 rpm	76 kW/1,500 rpm 102 HP/1,500 rpm

Power maximizing mode



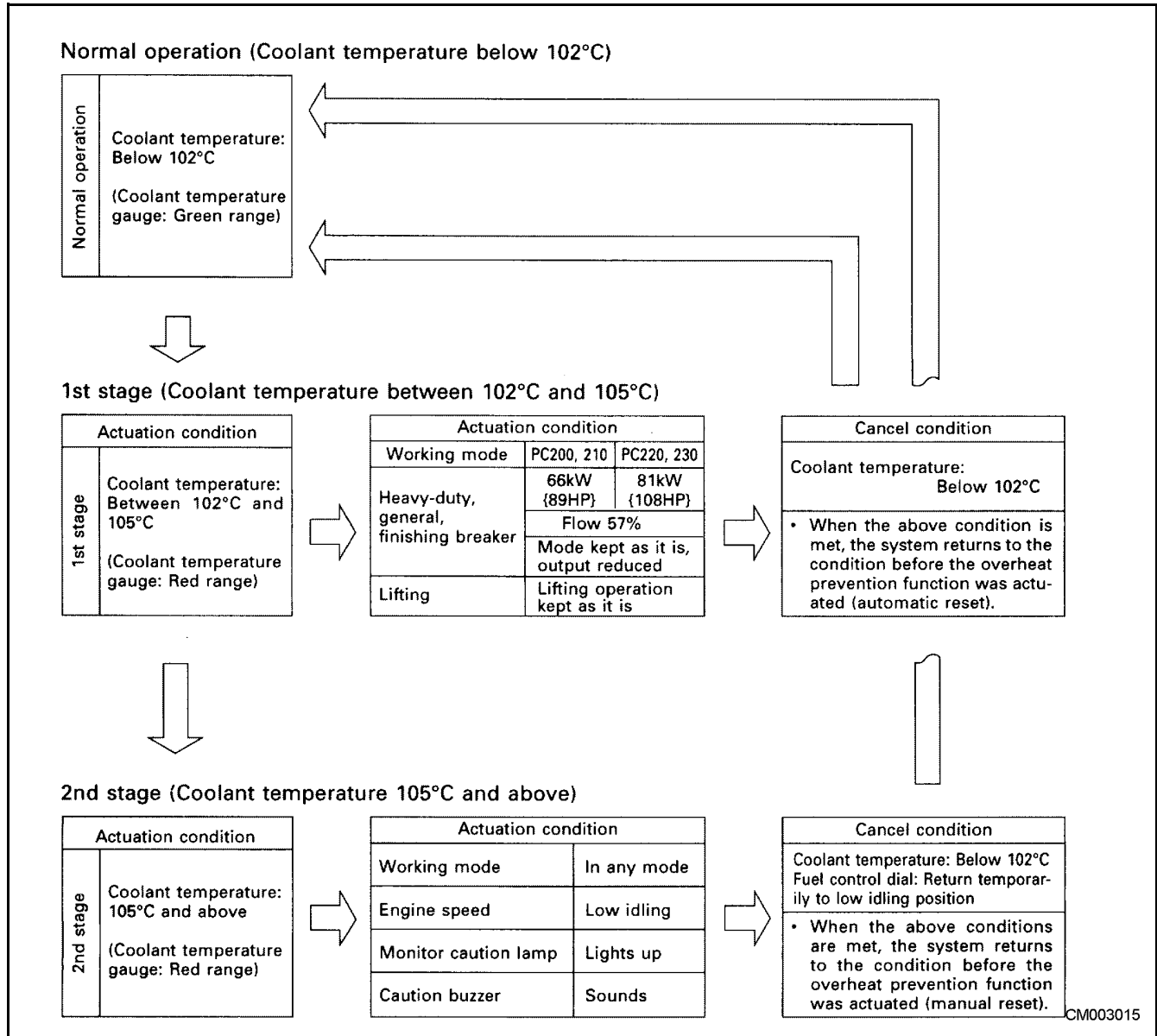
- Matching point in power max. mode: Rated output point
- When the pump load increases, the engine speed drops. When this happens, the pump discharge is reduced to prevent the engine speed from going down and to ensure that the engine is used at near the rated output point.

Mode	Model	PC200LC-6LE PC210LC-6LE	PC220LC-6LE PC250LC-6LE
Power Max.		99 kW/2,000 rpm 133 HP/2,000 rpm	117 kW/2,000 rpm 158 HP/2,000 rpm

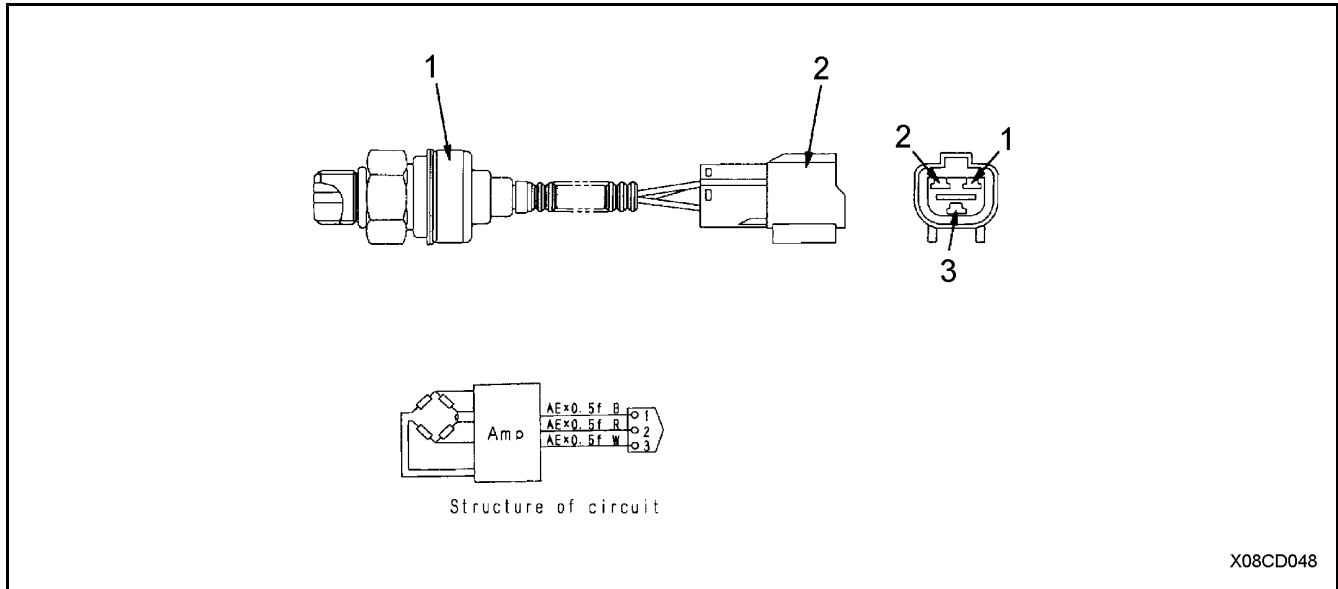
Engine overheat prevention function

This function protects the engine by lowering the pump load and engine speed to prevent the overheating when the engine coolant temperature has risen too high.

This system is actuated in two stages. The first stage is when the coolant temperature is between 102EC and 105EC, and the second stage is when the coolant temperature is 105EC and above.



Pump pressure sensor

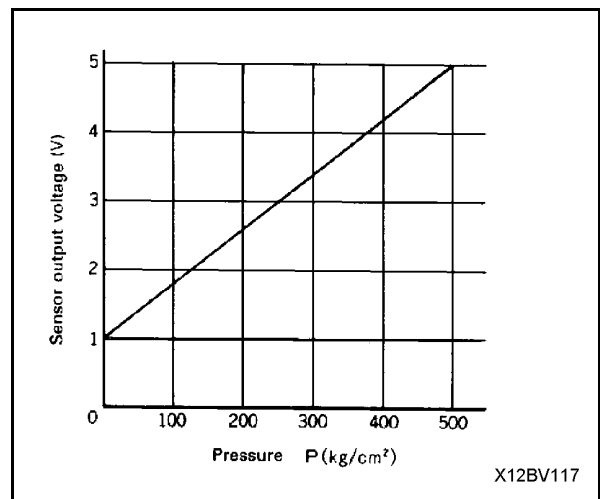
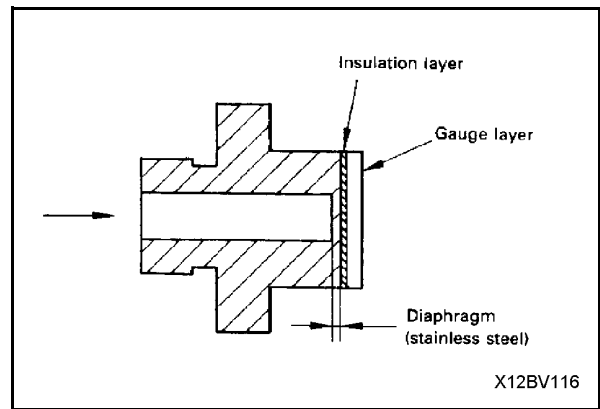


Function

- Two sensors are mounted in each actuator circuit of the boom and arm (four sensors in all). The load pressure on the actuator is converted to the voltage and sent to the controller.

Operation

1. When the oil entering from the pressure inlet applies pressure to the diaphragm of the oil pressure detector, the diaphragm is deflected and deformed.
2. A gauge layer is mounted at the opposite side of the diaphragm and the resistance value of the gauge converts the deflection of the diaphragm into the output voltage and sends it to the amplifier (voltage amplifier).
3. The amplifier sends the signal to the governor and pump controller.
4. The relational expression of the pressure P (kgf/cm^2) and the output voltage V : $V = 0.008 \times P + 1.0$

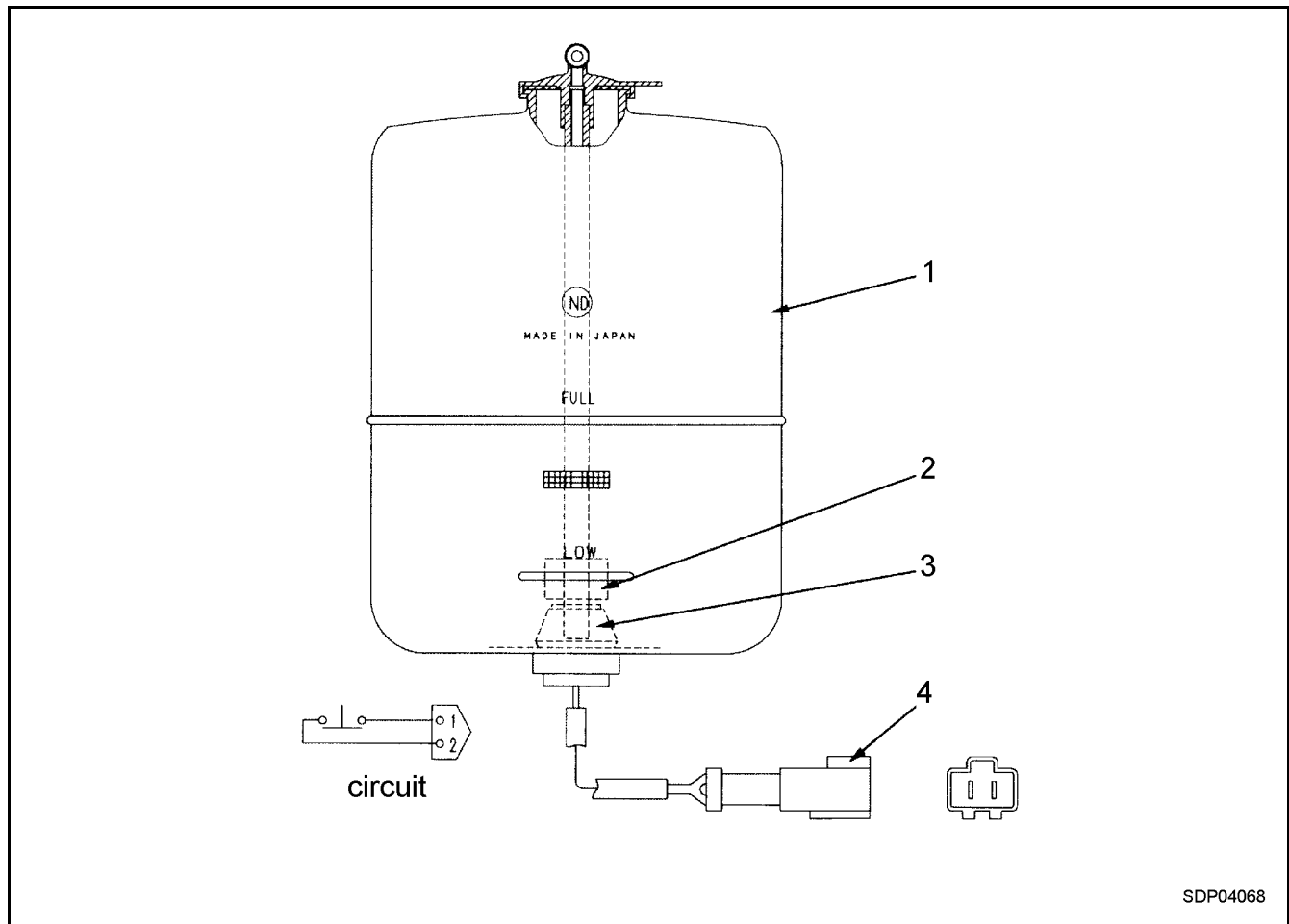


SENSORS

- The signals from the sensors are input directly to the monitor panel. The contact type sensors are always connected at one end to the chassis GND.

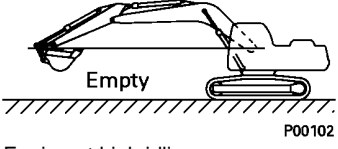
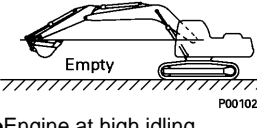
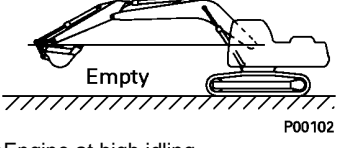
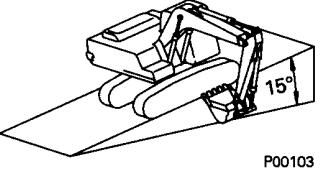
Name of sensor	Type of sensor	When normal	When abnormal
Coolant level	Contact type	ON (closed)	OFF (open)
Engine oil level	Contact type	ON (closed)	OFF (open)
Hydraulic oil level	Contact type	ON (closed)	OFF (open)
Engine oil pressure	Contact type	OFF (open)	ON (closed)
Coolant temperature	Resistance type	---	---
Fuel level	Resistance type	---	---
Air cleaner clogging	Contact type	ON (closed)	OFF (open)

Coolant level sensor



SDP04068

1. Sub-tank
2. Float
3. Sensor
4. Connector

Machine model		PC200LC-6LE, PC210LC-6LE, PC220LC-6LE, PC250LC-6LE						
Category	Item	Measurement conditions	Unit	Standard value		Permissible value		
				PC200 PC210	PC220 PC250	PC200 PC210	PC220 PC250	
Swing	Swing break angle	Work equipment posture-Max reach  P00102 <ul style="list-style-type: none"> ●Engine at high idling ●Hydraulic oil temperature: 45 - 55 °C ●Stop after swinging one turn and measure distance that swing circle moves 	mm	Max 100	Max 130	Max 130	Max 160	
	Time taken to start swing	Work equipment posture - Max reach  P00102 <ul style="list-style-type: none"> ●Engine at high idling ●Hydraulic oil temperature: 45-55°C ●In H/O mode ●Time taken to swing 90° and 180° from starting positions 	90°	Sec.	3.1 ± 0.3	3.2 ± 0.3	Max. 3.7	Max 3.8
		180°	4.4 ± 0.8	4.5 ± 0.8	Max 5.6	Max 5.7		
	Time taken to swing	Work equipment posture - Max reach  P00102 <ul style="list-style-type: none"> ●Engine at high idling ●Hydraulic oil temperature: 45-55°C ●In H/O mode ●Swing one turn, and measure time taken to swing next 5 turns 	Sec.	24 ± 3.5	24 ± 3.5	Max 30	Max 30	
	Hydraulic drift of swing	 P00103 <ul style="list-style-type: none"> ●Engine stopped ●Hydraulic oil temperature: 45-55°C ●Set machine on 15° slope and set upper structure at 90° to the side. ●Make match marks on swing circle outer race and track frame ●Measure distance that match marks move apart after 5 min. 	mm	0	0			
Leakage from swing motor	<ul style="list-style-type: none"> ●Engine at high idling ●Hydraulic oil temperature: 45-55°C ●Swing lock switch ON ●Relieve swing circuit 	L/min	Max 5	Max 10				

System	Name of component	Connect or No.	Inspection method	Judgement table	Measurement conditions	
Control system	Engine throttle-pump controller	Travel speed solenoid	Measure voltage	If the condition is as shown in the table below, it is normal.		<ol style="list-style-type: none"> Start engine Insert T-adapter Turn fuel control dial to MAX position. Operate the lever slightly, but not enough to move the machine. To check that the solenoid is OFF, measure with the fuel control dial at LOW (1200 rpm or below).
				With travel speed switch at Hi or Mi (solenoid ON, travel motor swash plate angle MIN)	20 - 30 V	
		When travel speed switch is at Lo (solenoid OFF, travel motor swash plate angle MAX)		Between (9) - (6),(12) 0 - 3 V		
		If the condition is as shown in the table below, it is normal.		<ol style="list-style-type: none"> Start engine Insert T-adapter. ★ The lever can be operated slightly (without moving the equipment). 		
		When swing lock switch is OFF, and swing and travel levers are operated simultaneously (solenoid ON, LS divided)			Between (8) - (6),(12) 20 - 30 V	
		When swing lock is ON (solenoid OFF, LS not divided)		0 - 3 V		
	Pump merge/divider valve solenoid	C01	Measure voltage	If the condition is as shown in the table below, it is normal.		<ol style="list-style-type: none"> Start engine Insert T-adapter. ★ The lever can be operated slightly (without moving the equipment).
				When travel is operated independently (solenoid ON, divided)	Between (2) - (6),(12) 20 - 30 V	
	When levers and pedals are at neutral (solenoid OFF, merged)	0 - 3 V				
	If the condition is as shown in the table below, it is normal.			<ol style="list-style-type: none"> Start engine Insert T-adapter. 		
	Swing lock switch ON (solenoid ON: High pressure)	Between (10) - (6),(12) 20 - 30 V				
	Swing lock switch OFF (solenoid OFF: Low pressure)	0 - 3 V				
2-stage relief solenoid	C01	Measure current	If the condition is as shown in the table below, it is normal.		<ol style="list-style-type: none"> Turn starting switch ON. Turn fuel control dial to MAX position. Turn prolix switch OFF. All levers at neutral. 	
			Between (8) - (18)	PC200: 580 ± 100 mA PC220: 570 ± 100 mA		

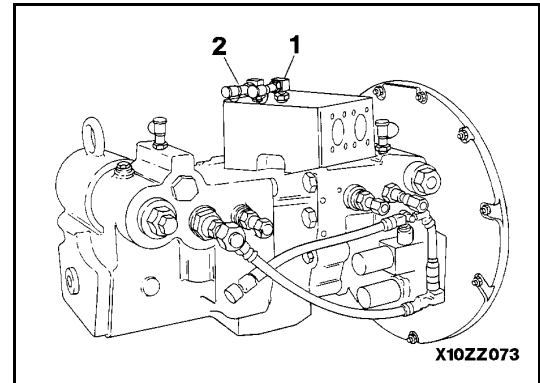
HYDRAULIC PRESSURE IN WORK EQUIPMENT, SWING, AND TRAVEL CIRCUIT

1. Measuring

★ Hydraulic oil temperature when measuring: 45 - 55°C (113 - 131°F).



WARNING! Lower the work equipment to the ground and stop the engine. Loosen the oil filler cap slowly to release the pressure inside the hydraulic tank. Then put the safety lock lever in the LOCK position. Install oil pressure gauge **C1** 600 kg/cm² (8534 psi) to the 2 quick disconnect (1) or (2) for the circuit to be measured.



A. Measuring main unload pressure

Unload pressure when front and rear pump flows are merged. Measure the oil pressure in H/O mode with the engine at high idling and the control levers at neutral.

★ With this procedure, the unload pressure of the unload valve of the left and right control valves is measured.

B. Measuring sub-unload pressure

★ Use this procedure to measure when it is desired to measure each unload circuit.

- The unload pressure in the circuit which is not under load when the front and rear pump flows are divided.

i. Set to H/O mode.

ii. Operate the travel lever a little at a time (or connect a short connector to the travel oil pressure switch connector (CN-S01)), then measure the pressure in the pump circuit on the opposite side.

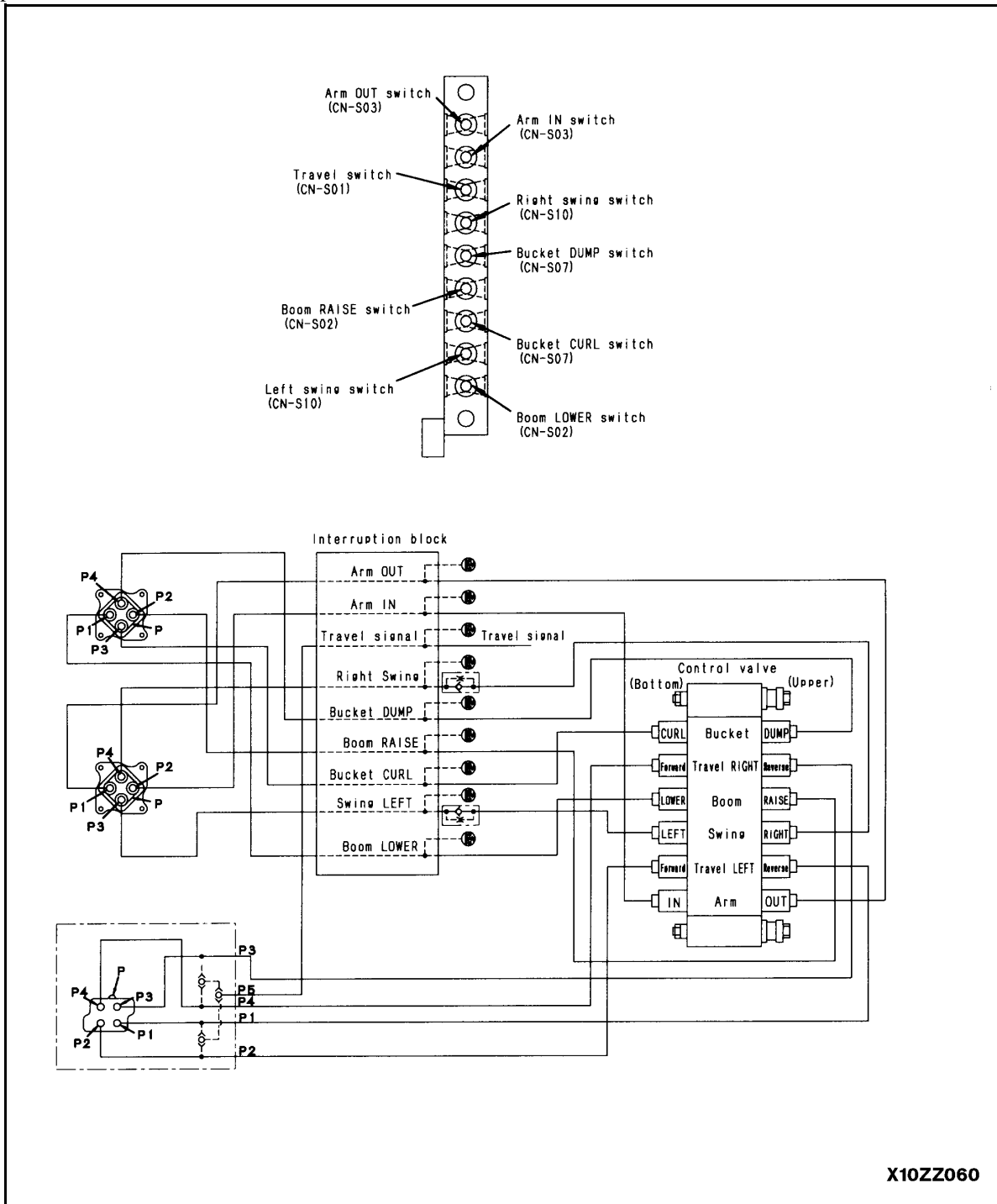
Table 1 Combination of pumps and actuators controlled when flow from front and rear pumps is divided.

Pump	Controlled actuator
Fuel pump	<ul style="list-style-type: none"> ● Arm cylinder ● Swing motor * ● LH travel motor
Rear pump	<ul style="list-style-type: none"> ● Boom cylinder * ● Bucket cylinder ● RH travel motor

* The set pressure of the safety valve at the head end and the swing motor (active mode OFF) is lower than the set pressure of the main relief valve.

Pressure switch piping diagram

Interruption block seen from the rear of the machine.



2. Bleeding air from hydraulic cylinders

- A. Start the engine and run at idling for approximately 5 minutes.
- B. Run the engine at low idling, then raise and lower the boom 4 -5 times in succession.
 - ★ Operate the piston rod to approximately 100 mm (3.9 in) before the end of its stroke. Do not relieve the circuit under any circumstances.
- C. Run the engine at full throttle and repeat Step B.

After that, run the engine at low idling and operate the piston rod to the end of its stroke to relieve the circuit.
- D. Repeat Steps B and C to bleed the air from the arm and bucket cylinders.

Remark


When the cylinder had been replaced, bleed the air before connecting the piston rod. Be particularly careful not to operate the cylinder to the end of its stroke when the piston rod had been connected to the LOWER end of the boom cylinder.

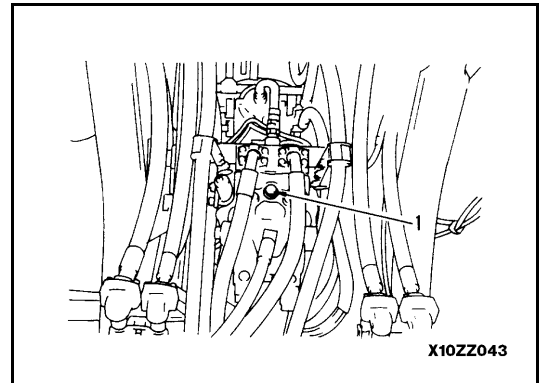
3. Bleeding air from swing motor.

- A. Run the engine at low idling, loosen air bleed plug (1), and check that oil oozes out.

If no oil oozes out from the air bleed plug:

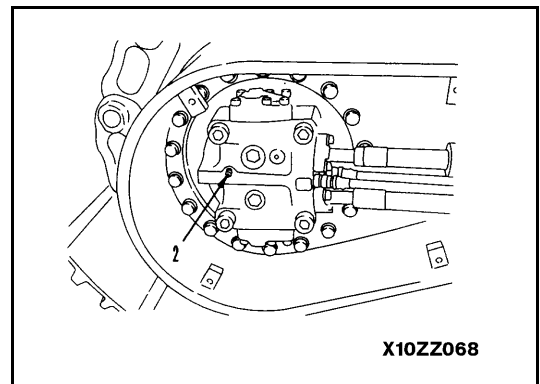
- B. Stop the engine and pour oil into the motor case through plug (1).
- C. Tighten air bleed plug (1).

 Plug: 166.6 ± 19.6 Nm (122.8 ± 14.4 lbf ft)



4. Bleeding air from travel motor.

Run the engine at low idling, loosen air bleed plug (2), and when oil flows out, tighten the plug again.

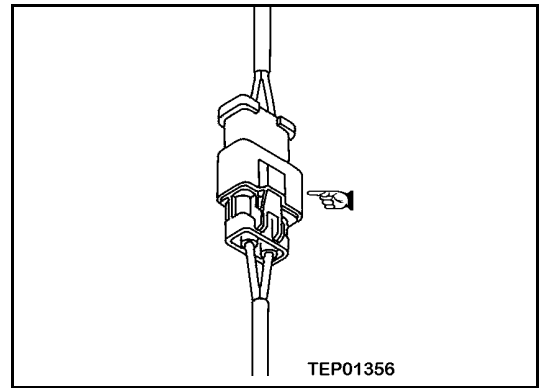


TROUBLESHOOTING POINTS TO REMEMBER WHEN CARRYING OUT MAINTENANCE

CONNECTING CONNECTORS

1. Check the Connector Visually

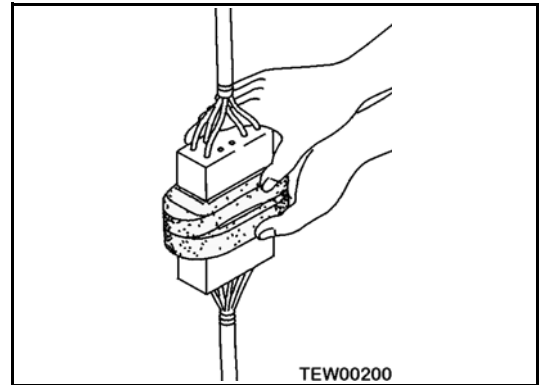
- A. Check that there is no oil, dirt, or water stuck to the connector pins (mating portion).
- B. Check that there is no deformation, faulty contact, corrosion, or damage to the connector pins.
- C. Check that there is no damage or breakage to the outside of the connector.



- ★ If there is any oil, water, or dirt stuck to the connector, wipe it off with a dry cloth. If any water has got inside the connector, warm the inside of the wiring with a dryer, but be careful not to make it too hot as this will cause short circuits.
- ★ If there is any damage or breakage, replace the connector.

2. Fix the Connector Securely

Align the position of the connector correctly, then insert it securely. For connectors with lock stopper, push in the connector until the stopper clicks into position.

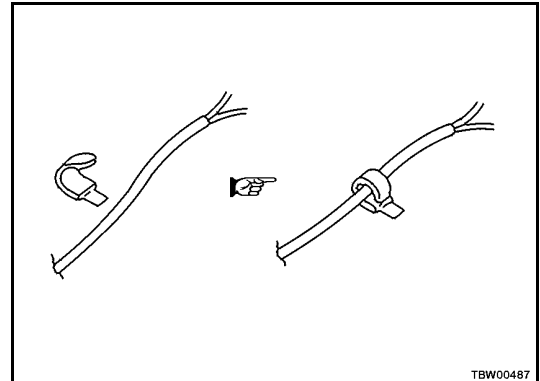


3. Correct any protrusion of the boot and any misalignment of the wiring harness

For connectors fitted with boots, correct any protrusion of the boot. In addition, if the wiring harness is misaligned, or the clamp is out of position, adjust it to its correct position.

- ★ If the connector cannot be corrected easily, remove the clamp and adjust the position.

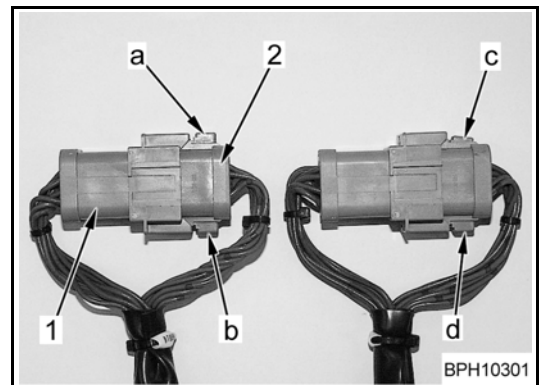
4. If the connector clamp has been removed, be sure to return it to its original position. Check also that there are no loose clamps.

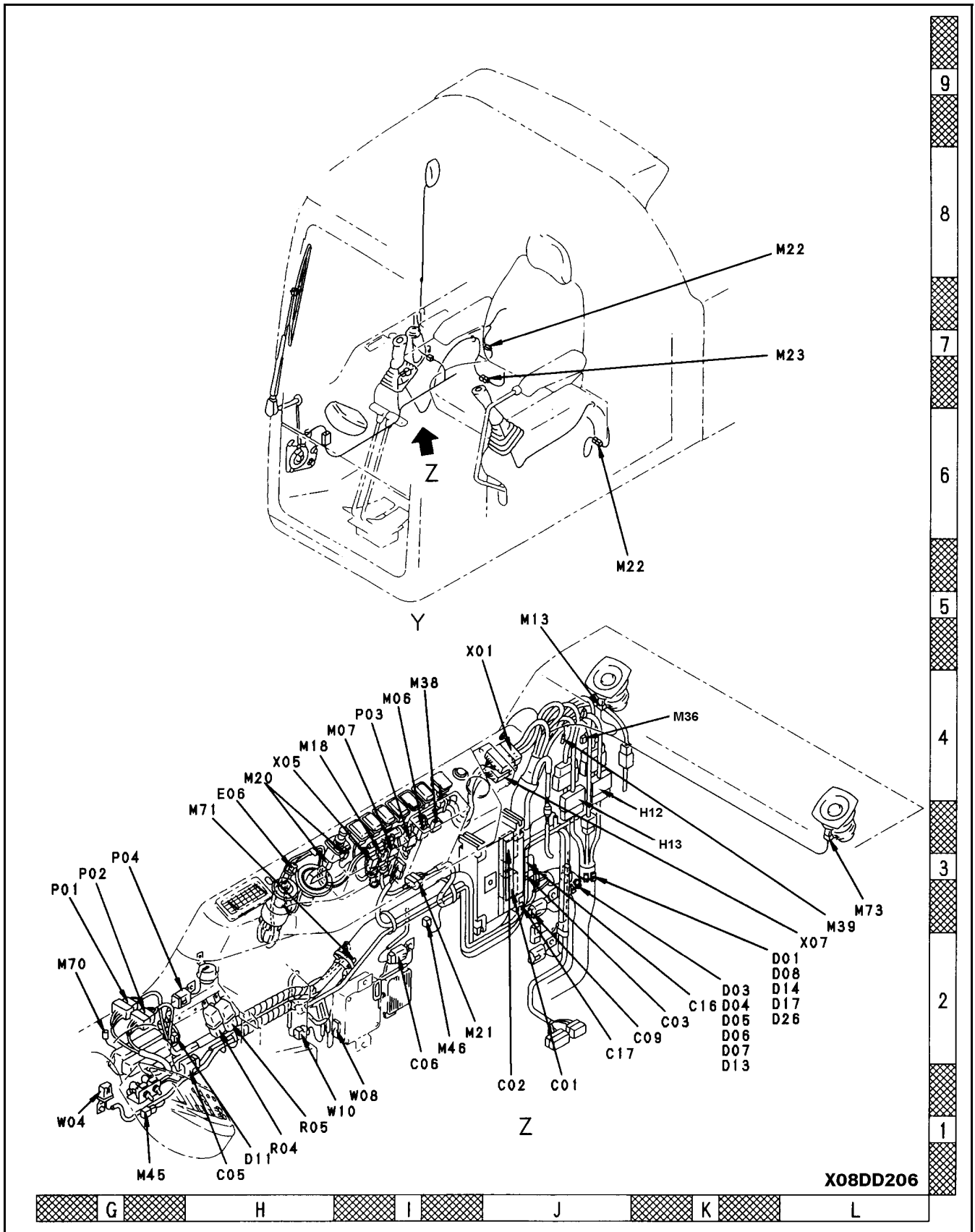


5. Connecting connectors (DT type connector)

Since the DT 8-pole and 12-pole DT type connectors have 2 latches respectively, push them in until they click 2 times.

- A. Male connector, 2. Female connector
 - Normal locking state (Horizontal): **a, b, d**
 - Incomplete locking state (Diagonal): **c**





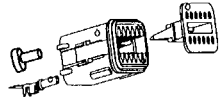
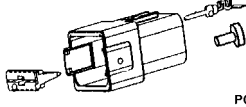
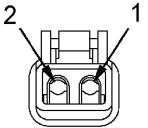
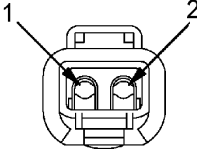
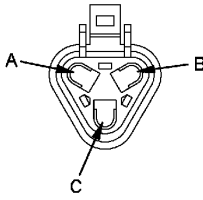
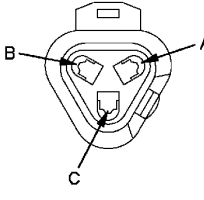
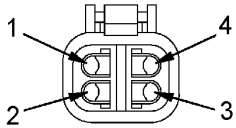
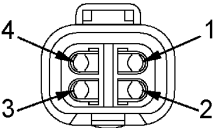
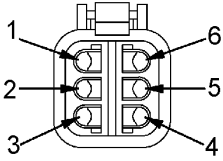
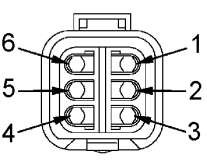
No. of pins	AMP040 type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
8	<p>BWP04751</p>	<p>BWP04752</p>	799-601-7180
---	---	Housing part No.: 79A-222-3430 (Q'ty: 5)	
12	<p>BWP04753</p>	<p>BWP04754</p>	799-601-7190
---	---	Housing part No.: 79A-222-3440 (Q'ty: 5)	
16	<p>BWP04755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

★ Terminal part No.: 79A-222-3470 (No relation with number of pins)

No. of pins	AMP070 type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
8	<p>X08DD237</p>	<p>X08DD238</p>	---
---	---	Part No.:	

Remark

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

No. of pins	DT Series connector		T-adapter Part No.
	Body (plug)	Body (receptacle)	
	 <p>PC220151</p>	 <p>PC220152</p>	
2	 <p>BWP05037</p>	 <p>BWP05038</p>	799-601-9020
	Part No.: 08192-12200 (normal type) 08192-22200 (fine wire type)	Part No.: 08192-12100 (normal type) 08192-22100 (fine wire type)	
3	 <p>BWP05039</p>	 <p>BWP05040</p>	799-601-9030
	Part No.: 08192-13200 (normal type) 08192-23200 (fine wire type)	Part No.: 08192-13100 (normal type) 08192-23100 (fine wire type)	
4	 <p>BWP05041</p>	 <p>BWP05042</p>	799-601-9040
	Part No.: 08192-14200 (normal type) 08192-24200 (fine wire type)	Part No.: 08192-14100 (normal type) 08192-24100 (fine wire type)	
6	 <p>BWP05043</p>	 <p>BWP05044</p>	799-601-9050
	Part No.: 08192-16200 (normal type) 08192-26200 (fine wire type)	Part No.: 08192-16100 (normal type) 08192-26100 (fine wire type)	

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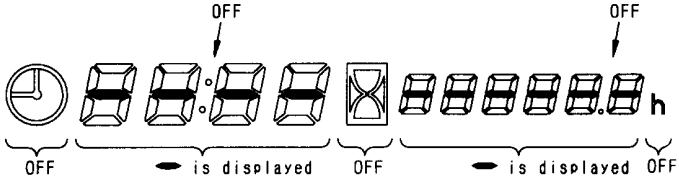
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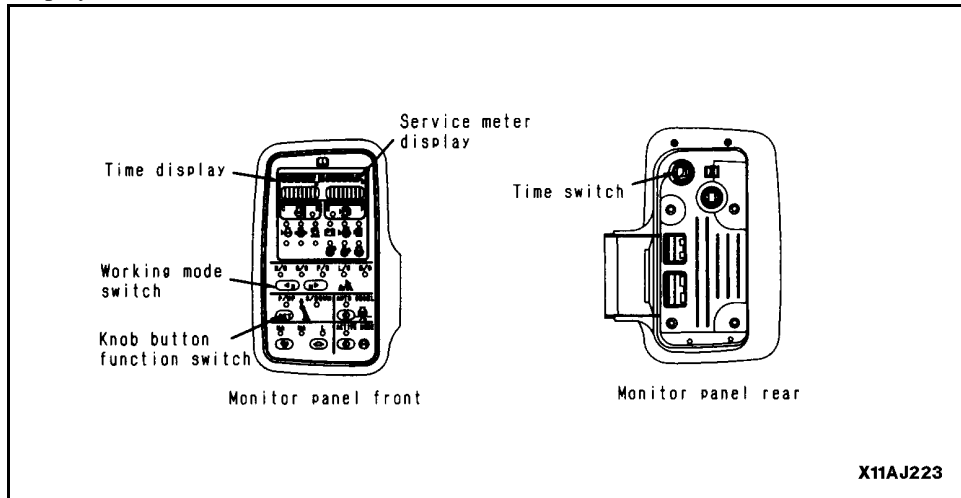
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TROUBLESHOOTING DISPLAY METHOD AND SPECIAL FUNCTIONS OF MONITOR PAN-

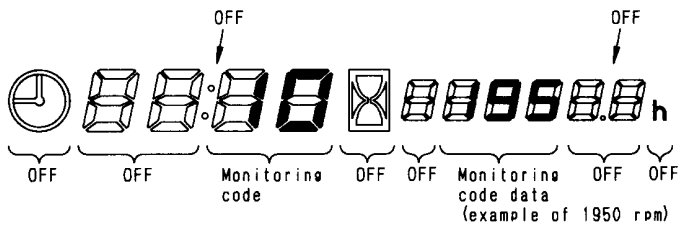
Operation	Display
<p>4. To finish with the trouble data display mode, keep the TIME switch + L.H. travel speed switch pressed for 2.5 seconds.</p> <p>5. To erase the memory, keep the time switch pressed, turn the starting switch from OFF to ON, and keep the time switch pressed for 5 seconds.</p>	<p>3) If there is no abnormality code in memory.</p>  <p style="text-align: right;">X11AJ222</p>

3. Machine data monitoring function

The input signals from the sensors and the output signals to drive the solenoid are displayed on the time display and service meter display.



A. Method of displaying monitoring code.

Operation	Display
<p>1. To set to the machine data monitoring mode, do as follows. Keep the time switch + knob button function switch pressed for 2.5 seconds.</p> <p>Note: This is possible at the following times.</p> <ol style="list-style-type: none"> 1) During the normal mode. 2) During the user code display mode. 3) During the time adjustment mode. 4) During the trouble data display mode. 	<p>1. On the time display and service meter display, the monitoring code and data are displayed.</p> <p>Example of display.</p> <p>1) When engine speed is monitored (monitoring code 10).</p>  <p style="text-align: right;">X11AJ224</p>

TROUBLESHOOTINGDETAILS OF TROUBLESHOOTING AND TROUBLESHOOTING PRO-

C. Checking travel speed selection signal

- i. Set to the monitoring mode and display monitoring code 23.
- ii. Change the speed selector switch to Hi or Mi and run the engine at 1500 rpm or above. Check that bit (6) lights up when traveling at Hi or Mi (front or rear pump oil pressure: 180 - 240 kg/cm² (2561 - 3413 psi).

2. Checking input signal of engine throttle-pump controller

Check the input signals for each controller as follows.

A. Pump control system.

- i. Check input signal
 - a. Check hydraulic switch
 - (1) Set to the monitoring mode and display monitoring codes 20 and 21.
 - (2) Operate each work equipment lever and check how the bit pattern lights up.

★ For details of the bit pattern chart, see MONITOR PANEL DISPLAY AND SPECIAL FUNCTIONS.
 - b. Check speed sensor (check engine speed)
 - (1) Set to the monitoring mode and display monitoring code 10.
 - (2) Use the fuel control dial to change the speed and measure the speed when this is done.
 - c. Check pump discharge pressure sensor
 - (1) Set to the monitoring mode and display monitoring codes 11 and 12.
Code 11 is for the front pump and code 12 is for the rear pump.
 - (2) Refer to Table 2 and measure the hydraulic pressure at the front or rear pump.

Table 2 Pump merge/flow logic and pump actuated by control levers

	Independent operation (basic flow merged)	
	Front pump	Rear pump
L.H. Travel	○	
Swing	○	○
Arm	○	○
Boom	○	○
Bucket	○	○
R.H. Travel		○

The pumps are only divided when the travel levers are operated either independently or together. If the travel and any other operation is actuated, the pumps are merged.

- d. Check kerosene mode input signal
 - (1) Set to the monitoring mode and display monitoring code 22.
 - (2) If the CN-M36 is connected (Kerosene mode), bit (5) lights up.
- e. Check left hand joystick switch input signal.
 - (1) Set to the monitoring mode and display monitoring code 22.
 - (2) Press the button on the left joystick and check that bit (6) lights up.

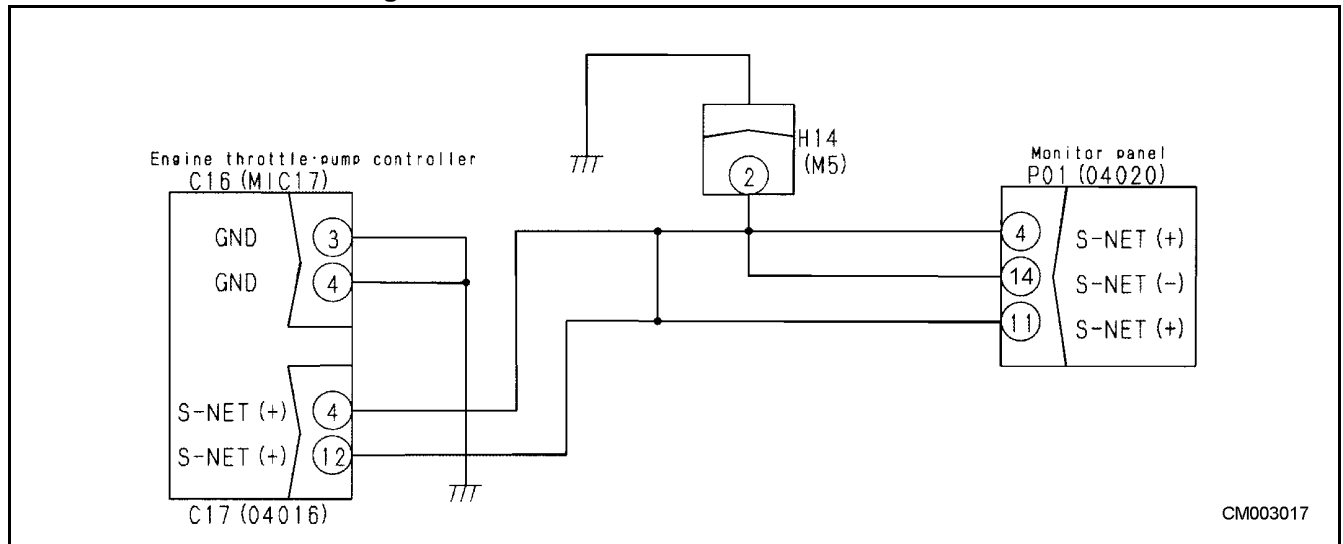
Table 1	Monitoring code	Display	
		PC200, PC210	PC220, PC250
01	Monitor panel model code	200	220
02	Engine throttle-pump controller model code	200	220
03	Engine throttle-pump controller model code	200	220

- When each controller is not connected to the network, “— — —” is displayed. If the correct letter or number is not displayed (another model is displayed), there is an abnormality in the controller model selection.

Table 2		Display
Monitoring code		
08	Network connection condition	

- Light up when connected
 - ① Engine throttle-pump controller;
 - ② Engine throttle-pump controller;
 - ③ (Not used) EPC valve controller;
 - ④ (Not used) GX panel;
 - ⑤ (Not used) GX controller;
 - ⑥ (Not used) Valve controller for expansion (for radio control).
- Checks can be carried out with code 08 only when there is a disconnection in the network. When there is a short circuit with the ground, the display does not change. Therefore, the basic situation is to use Table 1 to check the connection condition when there is a short circuit with the ground.

N-1 Related electric circuit diagram

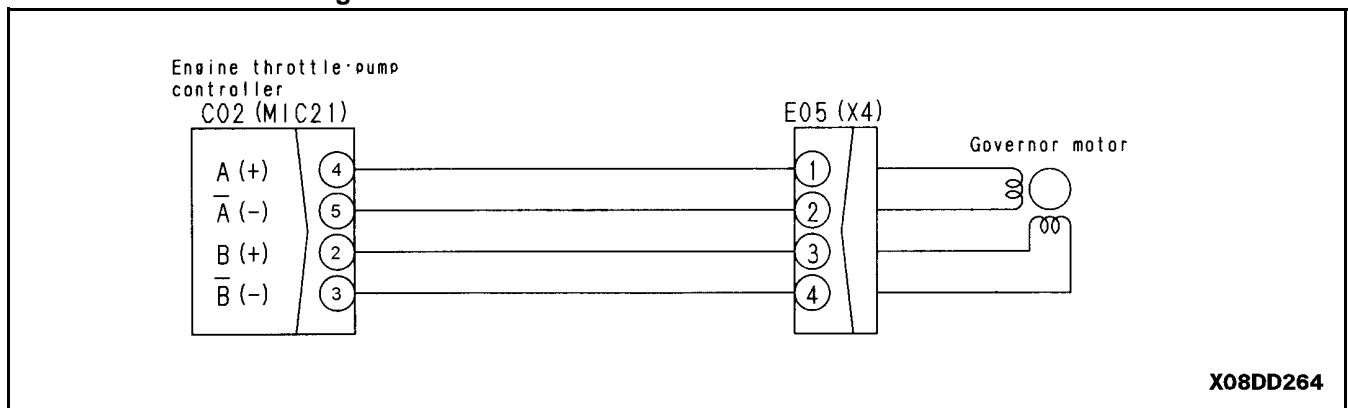


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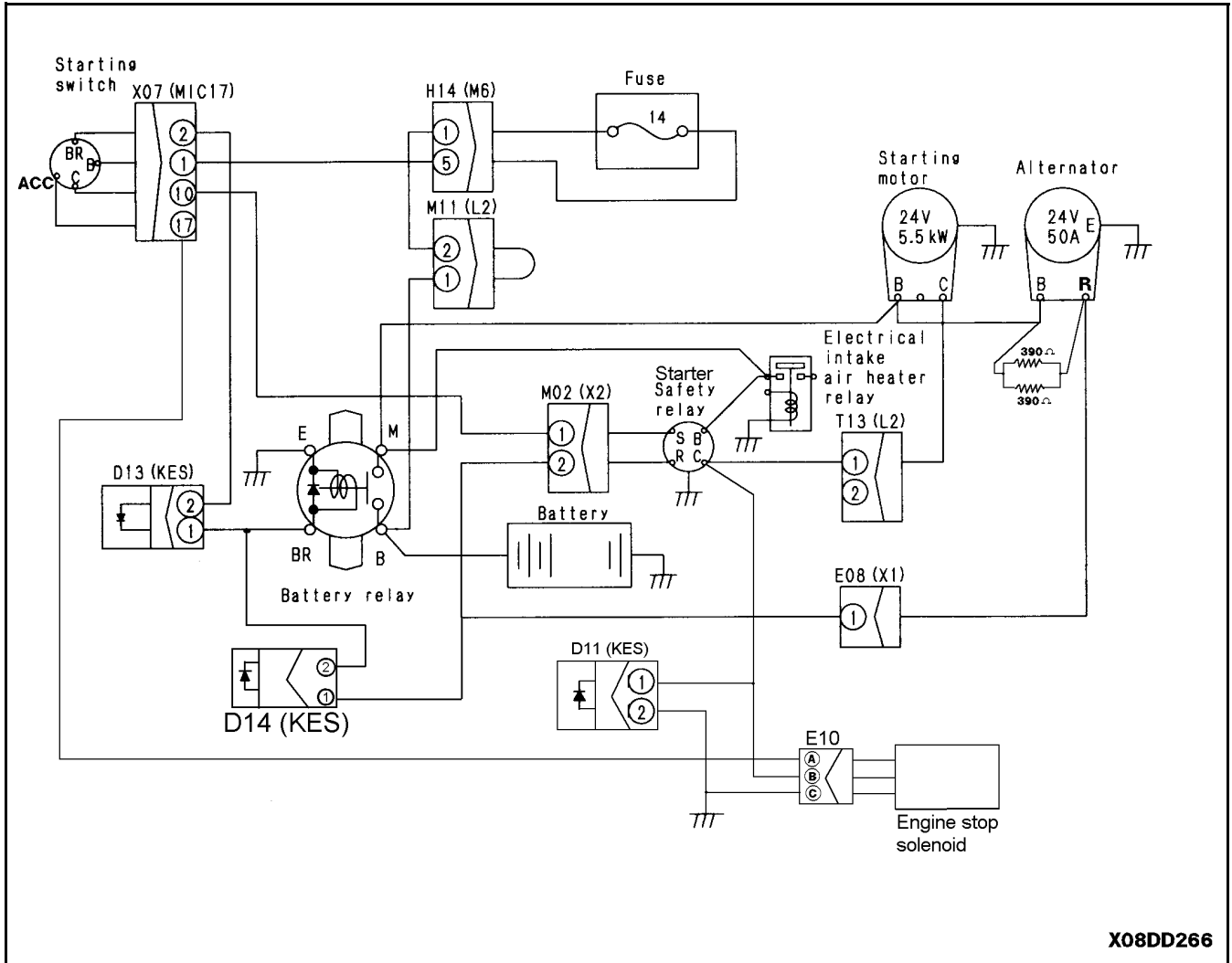
Condition when normal (voltage, current, resistance)			Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality
E306				
C03 (female)	E06 (male)	Resistance value	Calculates position of motor and carries out control from value of voltage immediately before abnormality occurred.	1. Precision of engine speed control may be reduced. For Example: A. Engine does not rise to high idling speed (a little too low) B. Engine does not go down to low idling speed (a little too high) C. Defective engine speed for auto deceleration or automatic warming-up. D. Engine may not stop. ★ The governor motor moves in the direction to stop the engine, but the motor may not move completely to the position to stop the engine. E. There are cases of hunting
(7) - (14)	(1) - (2)	0.25 - 7 kΩ		
(7) - (17)	(2) - (3)	0.25 - 7 kΩ		
(14) - (17)	---	2 - 3 kΩ		
---	(1) - (3)	4 - 6 kΩ		
Between each pin and chassis	---	No continuity		
E315				
Between C03 (1) and chassis: 20-30 V			Sets battery relay drive current to 0.	Engine does not stop
★ Holds with the motor in the stop position for 2 - 2.5 sec, returns to the low idling position, then turns the battery relay OFF.				
E316				
1. Linkage adjustment correct			1. Displays when returning from high idling to low idling.	Engine speed cannot be controlled (particularly at high idling), so there is
2. Must move lightly when connector is removed.			☆ Starts again (repeats step-out).	
3. Normal			2. In some cases it may not display when returning from partial speed to low idling.	

TROUBLESHOOTING E-3 [E317] OPEN IN GOVERNOR MOTOR PHASE "A" AND "B"

Related electric circuit diagram



Related electric circuit diagram



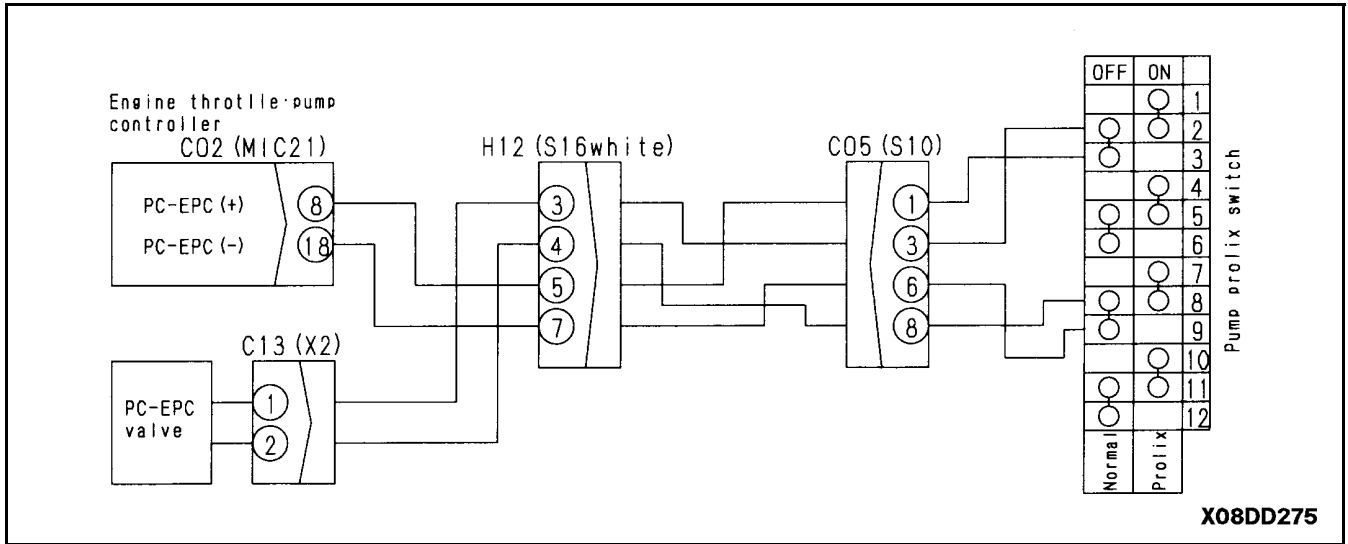
TROUBLESHOOTING OF ENGINE THROTTLE-PUMP CONTROLLER C-MODE

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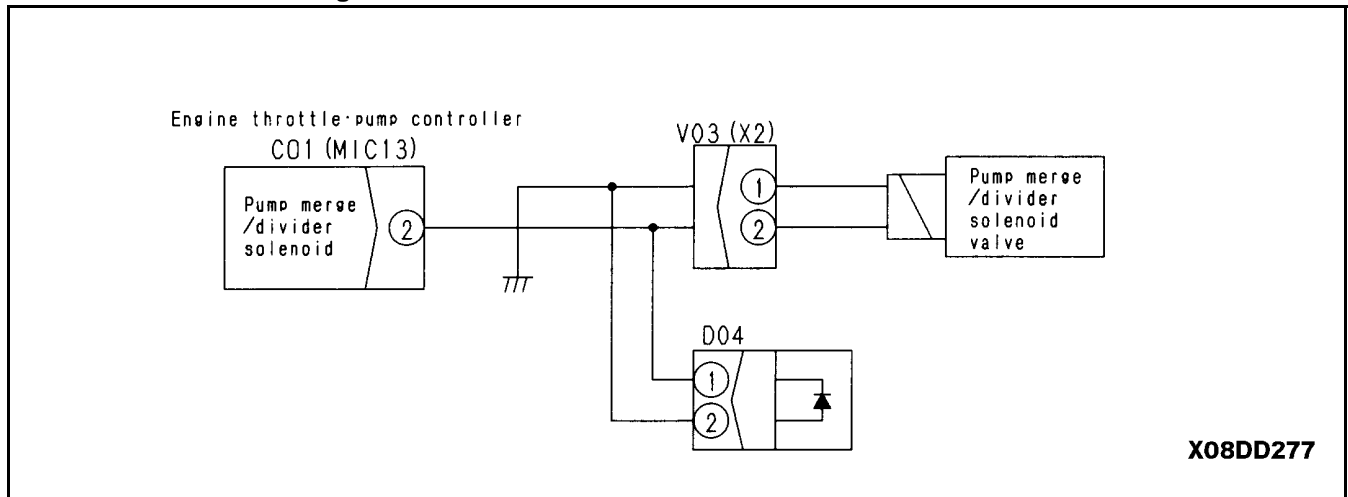
TROUBLESHOOTING ACTION TAKEN BY CONTROLLER WHEN ABNORMALITY OCCURS

Condition when normal (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality
Between C03 (13) and (16): 0.5 - 4.5 V Between C03 (6) and (16): 18 - 28 V Between C03 (female) (13) and (16), (13) and chassis Resistance: No continuity (Disconnect connectors C03 and C07)	1. Takes front pump pressure as 0 kg/cm ² (0 psi) when actuating ★ If the abnormality is restored by the vibration of the machine, it resets the power source to restore to the proper condition. (However, the service code display does not go out.)	1. The travel speed does not automatically shift (it does not change from Hi to Lo) ★ If the button is operated manually, the panel display is switched
Voltage between C03 (6) and (16): 18 - 28 V	1. Takes front pump and rear pump pressure as 0 kg/cm ² (0 psi) when actuating	1. The travel speed does not automatically shift (it does not change from Hi to Lo) ★ If the button is operated manually, the panel display is switched
Resistance: 500 - 1000Ω Voltage (AC range): 0.5 - 3.0 V (engine started)	It functions in the equivalent of the G/O mode (the speed rises)	It operates about the same as G/O mode (prolix) (the power is slightly lower)
Resistance of solenoid: 20 - 60 Ω	1. Makes output to solenoid 0. ★ If the abnormality is restored, the condition will return to normal when the power source is reset. (However, the service code does not go out.)	For swing + boom RAISE in active mode, rise in boom becomes smaller.
Resistance of solenoid: 20 - 60 Ω	1. No current flows to solenoid. ★ If the abnormality is restored, the condition will return to normal automatically. (However, the service code does not go out.)	For swing + boom RAISE in active mode, rise in boom becomes smaller.

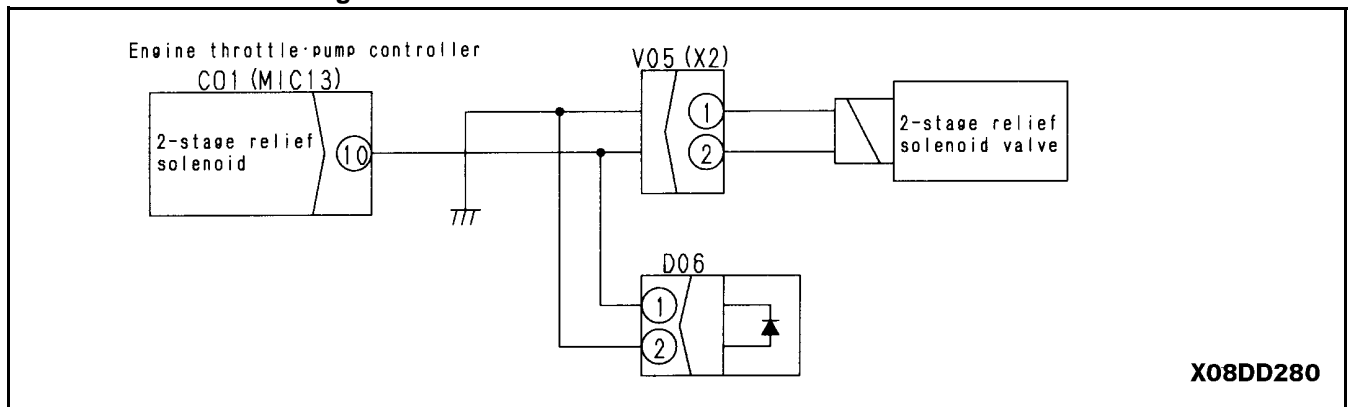
Related electric circuit diagram



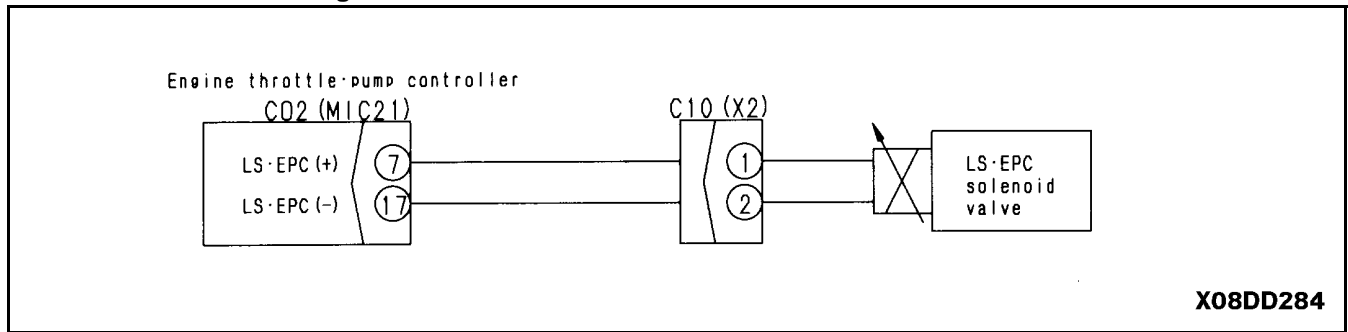
Related electric circuit diagram



Related electric circuit diagram



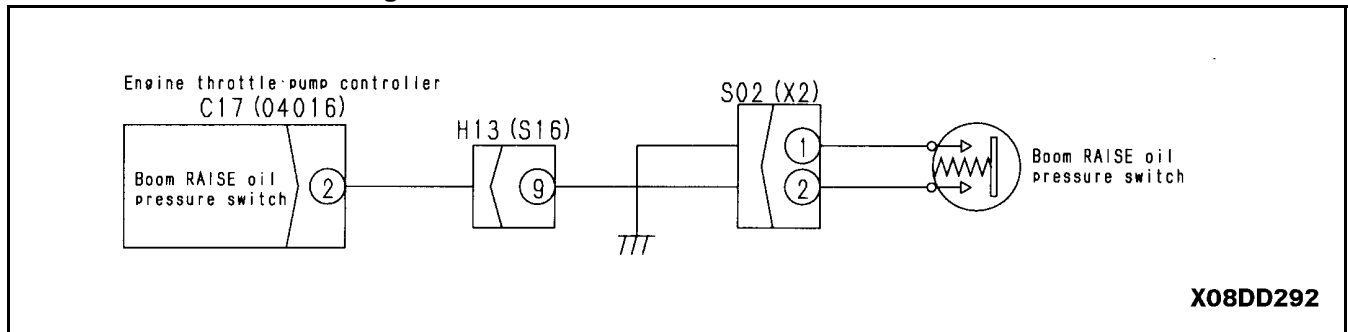
Related electric circuit diagram



TROUBLESHOOTING OF ENGINE THROTTLE-PUMP CONTROLLER F-MODE

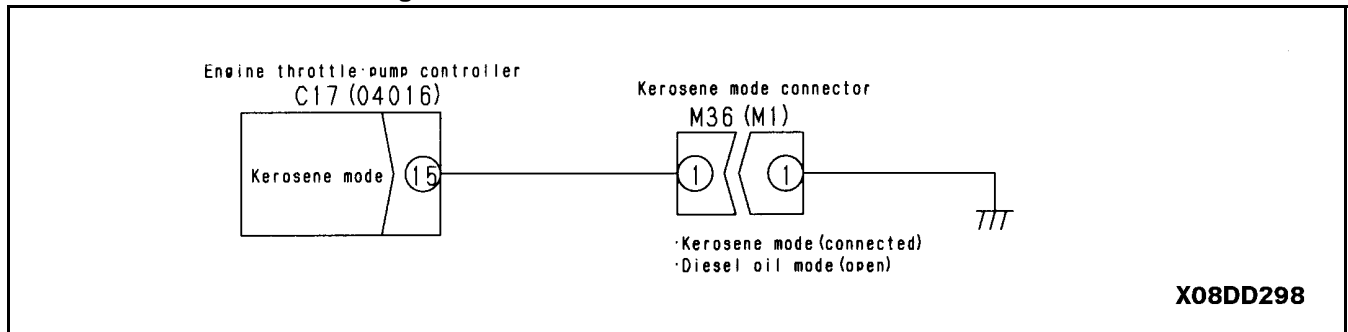
F-1 SWING OIL PRESSURE SWITCH DOES NOT LIGHT UP	20-602
F-2 TRAVEL OIL PRESSURE SWITCH DOES NOT LIGHT UP	20-604
F-3 BOOM LOWER OIL PRESSURE SWITCH DOES NOT LIGHT UP	20-606
F-4 BOOM RAISE OIL PRESSURE SWITCH DOES NOT LIGHT UP	20-608
F-5 ARM IN OIL PRESSURE SWITCH DOES NOT LIGHT UP	20-610
F-6 ARM OUT OIL PRESSURE SWITCH DOES NOT LIGHT UP	20-612
F-7 BUCKET CURL OIL PRESSURE SWITCH DOES NOT LIGHT UP	20-614
F-8 BUCKET DUMP OIL PRESSURE SWITCH DOES NOT LIGHT UP	20-616
F-9 SWING LOCK SWITCH DOES NOT LIGHT UP	20-618
F-10 KEROSENE MODE CONNECTION DOES NOT LIGHT UP	20-620
F-11 LH KNOB SWITCH DOES NOT LIGHT UP	20-622

F-5 Related electric circuit diagram



TROUBLESHOOTING F-10 KEROSENE MODE CONNECTION DOES NOT LIGHT UP

F-10 Related electric circuit diagram



PUMP MERGE/DIVIDER LOGIC

Flow divided	Flow merged																												
Solenoid ON (excited)	Solenoid OFF (de-energized)																												
<ul style="list-style-type: none"> Breaker mode + service switch ON 																													
<ul style="list-style-type: none"> In L/O mode, except for Conditions 1, 2, or 3 <ol style="list-style-type: none"> Any of travel + (boom or arm or bucket or swing) operated independently Any of travel + (boom or arm or bucket or swing) operated simultaneously Swing + boom RAISE (hoist swing) 	<ul style="list-style-type: none"> L/O mode, under Conditions 1, 2, or 3 <ol style="list-style-type: none"> Any of travel + (boom or arm or bucket or swing) operated independently Any of travel + (boom or arm or bucket or swing) operated simultaneously Swing + boom RAISE (hoist swing) 																												
<ul style="list-style-type: none"> In other modes (breaker mode + service switch ON or any other mode except L/O mode) <table border="1" style="margin-left: 20px;"> <tr> <td> <ul style="list-style-type: none"> Independent operation of travel </td> <td></td> </tr> <tr> <td> <ul style="list-style-type: none"> With travel OFF </td> <td></td> </tr> <tr> <td> <ul style="list-style-type: none"> Swing lock switch OFF </td> <td></td> </tr> <tr> <td> <ul style="list-style-type: none"> F/O mode + arm IN </td> <td style="text-align: center;">a</td> </tr> <tr> <td> <ul style="list-style-type: none"> Operation except operation a except in active mode (in standard mode) + swing mode OFF </td> <td></td> </tr> <tr> <td> <ul style="list-style-type: none"> Arm OUT + service ON + pressure sensor (F pump pressure or R pump pressure) more than 200 kg/cm² (2844 psi) </td> <td style="text-align: center;">b</td> </tr> </table>	<ul style="list-style-type: none"> Independent operation of travel 		<ul style="list-style-type: none"> With travel OFF 		<ul style="list-style-type: none"> Swing lock switch OFF 		<ul style="list-style-type: none"> F/O mode + arm IN 	a	<ul style="list-style-type: none"> Operation except operation a except in active mode (in standard mode) + swing mode OFF 		<ul style="list-style-type: none"> Arm OUT + service ON + pressure sensor (F pump pressure or R pump pressure) more than 200 kg/cm² (2844 psi) 	b	<ul style="list-style-type: none"> In other modes (breaker mode + service switch ON or any other mode except L/O mode) <table border="1" style="margin-left: 20px;"> <tr> <td> <ul style="list-style-type: none"> Compound operation of travel (Travel + other work equipment) </td> <td></td> </tr> <tr> <td> <ul style="list-style-type: none"> With travel OFF </td> <td></td> </tr> <tr> <td> <ul style="list-style-type: none"> With swing lock switch ON </td> <td></td> </tr> <tr> <td> <ul style="list-style-type: none"> With swing lock switch OFF </td> <td></td> </tr> <tr> <td> <ul style="list-style-type: none"> Except operation a on left, in active mode </td> <td></td> </tr> <tr> <td> <ul style="list-style-type: none"> Except operation a on left, in active mode </td> <td></td> </tr> <tr> <td> <ul style="list-style-type: none"> With swing ON </td> <td></td> </tr> <tr> <td> <ul style="list-style-type: none"> With swing OFF except operation b on left </td> <td></td> </tr> </table>	<ul style="list-style-type: none"> Compound operation of travel (Travel + other work equipment) 		<ul style="list-style-type: none"> With travel OFF 		<ul style="list-style-type: none"> With swing lock switch ON 		<ul style="list-style-type: none"> With swing lock switch OFF 		<ul style="list-style-type: none"> Except operation a on left, in active mode 		<ul style="list-style-type: none"> Except operation a on left, in active mode 		<ul style="list-style-type: none"> With swing ON 		<ul style="list-style-type: none"> With swing OFF except operation b on left 	
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<ul style="list-style-type: none"> With swing OFF except operation b on left 																													

- ★ The higher pressure of the F or R pumps is as follows:
 When pressure rises: 1200 kg/cm² (2844 psi)
 When pressure goes down: 1150 kg/cm² (2133 psi)

H-8 ARM MOVES SLOWLY OR LACKS POWER

Failure information	The arm moves slowly, or lacks power.
Relative information	Set the working mode at A mode for the testing.

		Cause	Standard value and references for testing	
Presumed cause and standard value	1	Malfunctioning of left PPC valve (arm circuit)	★ Test with engine speed set at high idle.	
			Arm lever	PPC valve output pressure
			NEUTRAL	0
			Dig or dump	Above 28 kg/cm ² (398 psi)
	2	Malfunctioning of front and rear pumps relief valve	★ Test with engine speed set at high idle.	
			Relief valve pressure normal when arm circuit is relieved?	310 - 330 kgf/cm ² (4409 - 4693 psi)
	3	Malfunctioning of merge/divide solenoid valve	★ Test with engine speed set at high idle.	
			Working mode	Solenoid output pressure
			M/O mode	0
	4	Malfunctioning of merge/divide valve (main and LS valves)	The merge/divide valve (main and LS valves) is presumed to malfunction. Check the valve itself.	
5	Malfunctioning of arm control valve (spool)	The spool in the arm control valve is presumed to malfunction. Check the valve itself.		
6	Malfunctioning of arm control valve (pressure compensation valve)	The pressure compensation valve in the arm control valve is presumed to malfunction. Check the valve itself.		
7	Malfunctioning of arm control valve (regeneration valve)	The generation valve in the arm control valve is presumed to malfunction, or the seal is suspected to be defective. Check the valve itself.		
8	Malfunctioning of arm control valve (safety and suction valves) or seal defective	The safety and suction valves in the arm control valve are presumed to malfunction, or the seal is suspected of defect. Check those valves themselves.		
9	Malfunctioning of LS shuttle valve (right travel, boom, left travel, bucket and service valves)	LS shuttle valves in the right travel control valve, boom control valve, left travel control valve, bucket control valve and service valve are presumed to malfunction. Check those valves themselves.		
10	Arm cylinder defective	★ Test with engine speed set at high idle.		
		Arm lever	Amount oil leakage from cylinder	
		Digging relief	0.02 L/min (.068 oz)	

If the auto-deceleration is canceled when arm IN or arm OUT is operated, the system is normal.
After inspection, do not forget to return the interchanged valves to the original position.

H-18 SWING AND TRAVEL, TRAVEL SPEED DROPS SHARPLY

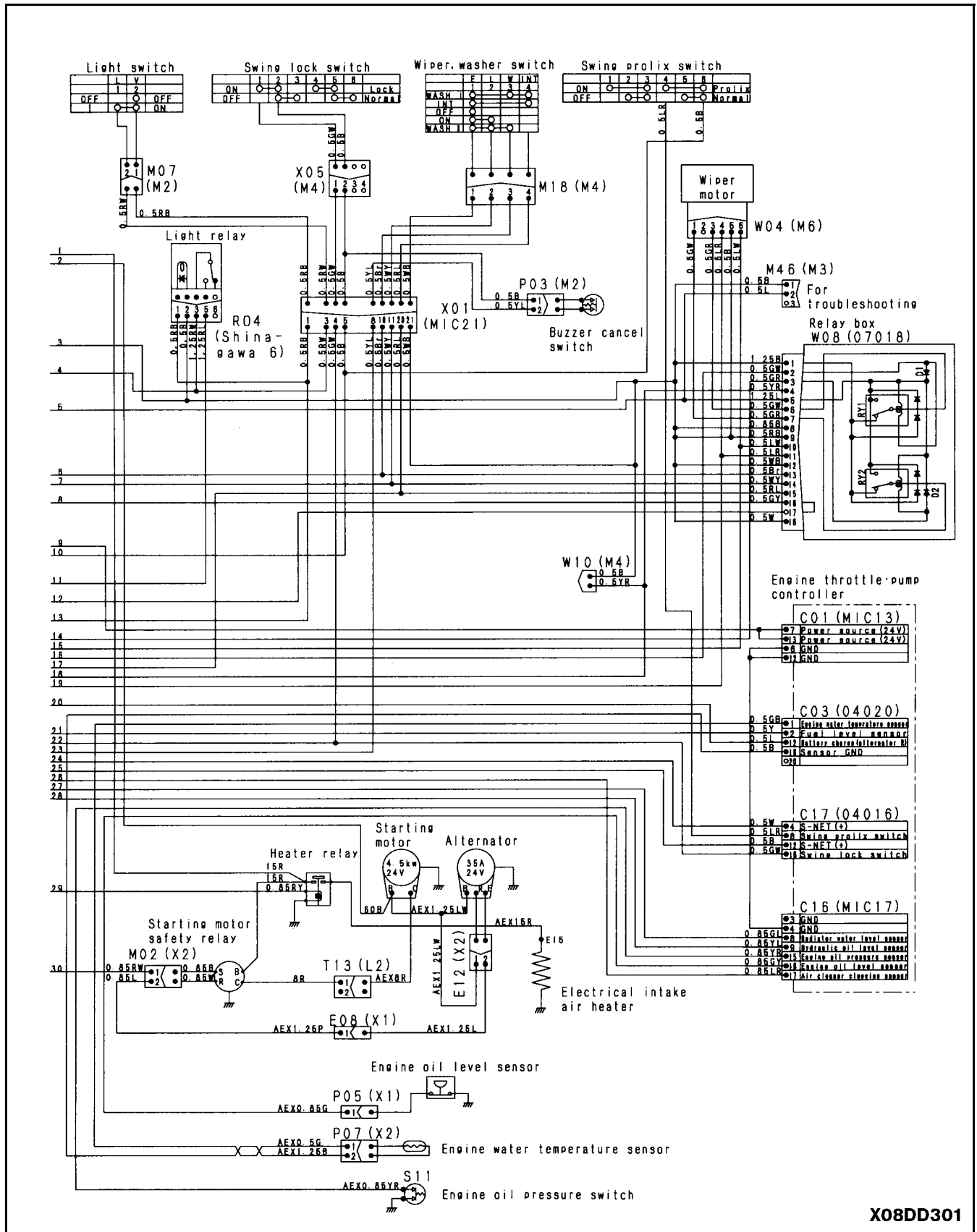
Failure information	In a compound operation of swing and travel, the travel speed drops sharply.
Relative information	If the travel speed is slow in the single operation of travel, carry out the H-19 check first.

Presumed cause and standard value	Cause		Standard value and references for testing
	1	Malfunctioning of LS shuttle valve (left travel and swing)	The LS shuttle valve in the left travel control valve or the swing control valve is presumed to malfunction. Check both of them directly.

H-28 ABNORMAL NOISE WHEN STOPPING SWING

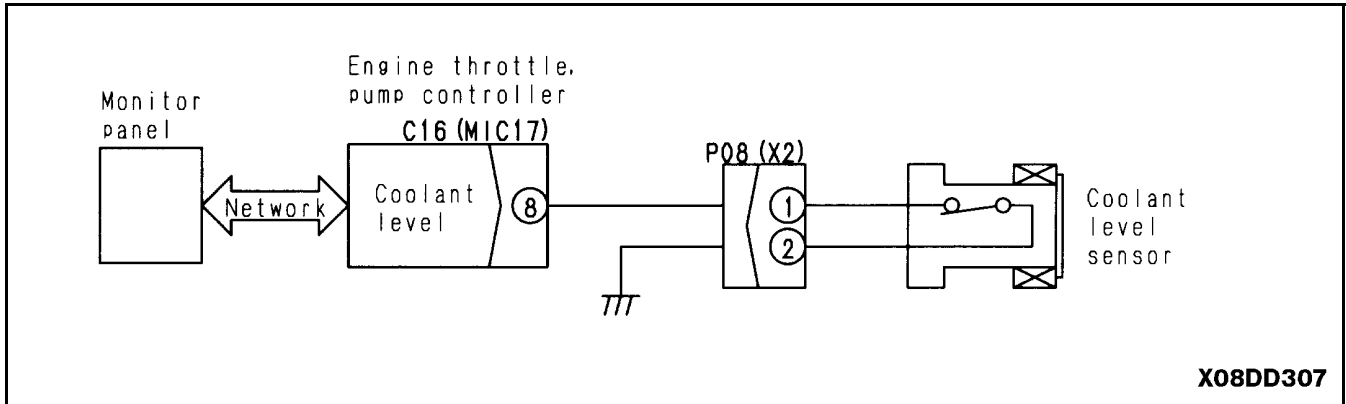
Failure information	There is a sudden abnormal noise caused when stopping a swing motion.
Relative information	Set the working mode at H/O mode for the testing.

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



TROUBLESHOOTINGM-8 WHEN STARTING SWITCH IS TURNED ON (ENGINE STOPPED),

M-8 A. related electric circuit diagram



TROUBLESHOOTINGM-12 WHEN STARTING SWITCH IS TURNED ON, ENGINE STARTED,

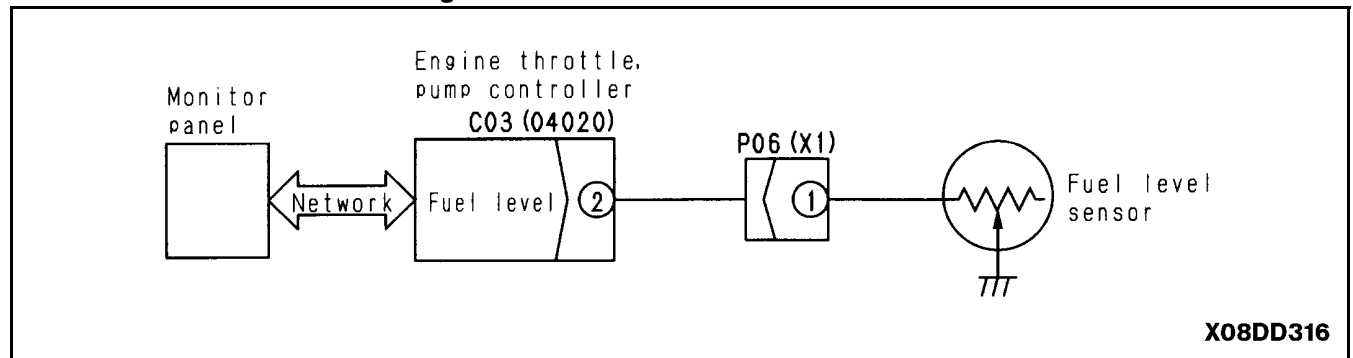
E. FUEL LEVEL FLASHES

Failure information	When starting switch is turned ON (engine started), caution items, emergency items flash (when there is no abnormality in engine or items to check before troubleshooting).
Relative information	Check that there is fuel before carrying out troubleshooting.

Tools and Procedures	<ul style="list-style-type: none"> • Digital Volt Ohm Meter. T-adaptor kit. • Do not mark on original page of service manual. Remove this page from the service manual and make a copy for recording information while performing these tests. • If you are unable to copy this page, record readings on a separate paper referring to the (No.) numbers listed on the right of the procedure. • Follow each step throughout this procedure, do not skip steps, jump ahead or stop when a fault is found unless otherwise instructed to in the procedure. It is important to complete all steps and record information for final analyzing.
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Check		Standard value and references for testing	Readings
1	Is fuel gauge in red range?	Start engine.	
		Yes - see item two. No - defective monitor panel.	
2	When P06 (1) is connected to chassis ground, do all lamps to level 14 (right-hand) of gauge display light up?	Start engine. Wait for approximately 2 minutes. (The fuel level may vary, so the display is given a time delay.)	
		Yes - defective fuel level sensor system (See M-24). No - see item three.	
3	Is voltage between C03 (2) and (16) normal?	connect P06 (1) to chassis ground. Turn starting switch ON. Max. 0.3V.	
		Yes - defective engine throttle-pump controller. No - defective contact or disconnection in wiring harness between C03 (2) and P06 (1).	

M-12 E. Related electric circuit diagram



TROUBLESHOOTINGM-21 SWING PROLIX SWITCH IS TURNED ON, BUT MONITOR DOES

M-21 SWING PROLIX SWITCH IS TURNED ON, BUT MONITOR DOES NOT FLASH

Failure information	Swing prolix lock switch is turned ON (prolix) but swing lock monitor does not light up.
Relative information	Carry out this troubleshooting ONLY if the swing prolix is actually being actuated.

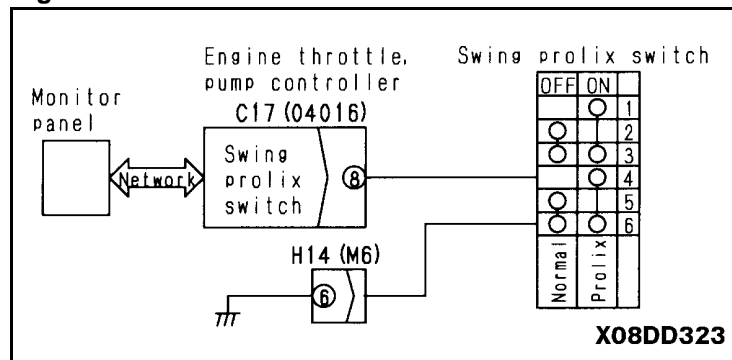
Tools and Procedures	<ul style="list-style-type: none"> • Digital Volt Ohm Meter. T-adapter kit. • Do not mark on original page of service manual. Remove this page from the service manual and make a copy for recording information while performing these tests. • If you are unable to copy this page, record readings on a separate paper referring to the (No.) numbers listed on the right of the procedure. • Follow each step throughout this procedure, do not skip steps, jump ahead or stop when a fault is found unless otherwise instructed to in the procedure. It is important to complete all steps and record information for final analyzing.
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Check		Standard value and references for testing	Readings
1	Is voltage between C17 (8) and chassis as shown in table 1, below?	Turn starting switch ON.	
		Yes - see item two. No - defective monitor.	
2	Is bit (6) of monitor code 21 lighted up?	Turn starting switch ON. Set to monitoring code 21.	
		Yes - defective monitor. No - defective contact or disconnection in wiring harness between C17 (8) and prolix switch.	

Table 1

Swing lock switch ON	Max. 1V
Swing lock switch OFF	20 - 30V

Related electric circuit diagram



MEMORANDUM

TROUBLESHOOTING M-30 WASHER MOTOR DOES NOT WORK OR SWITCH IS NOT BE-

M-30 WASHER MOTOR DOES NOT WORK OR SWITCH IS NOT BEING USED, BUT WASHER MOTOR IS ACTUATED

A. WASHER MOTOR DOES NOT WORK

A1. WHEN E114 IS DISPLAYED

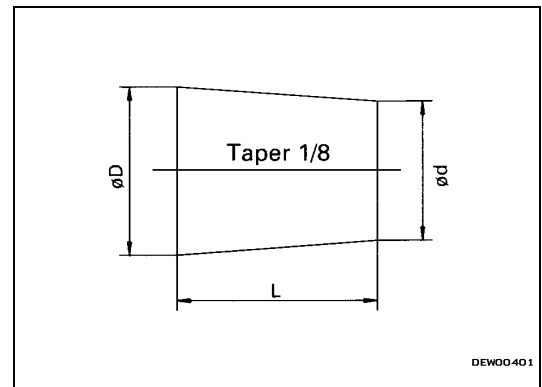
Failure information	Washer motor does not work, when E114 is displayed.
Relative information	---

Tools and Procedures	<ul style="list-style-type: none"> • Digital Volt Ohm Meter. T-adapter kit. • Do not mark on original page of service manual. Remove this page from the service manual and make a copy for recording information while performing these tests. • If you are unable to copy this page, record readings on a separate paper referring to the (No.) numbers listed on the right of the procedure. • Follow each step throughout this procedure, do not skip steps, jump ahead or stop when a fault is found unless otherwise instructed to in the procedure. It is important to complete all steps and record information for final analyzing.
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Check		Standard value and references for testing	Readings
1	Is voltage between P02 (2), (10), M28 (1) and chassis normal?	Turn starting switch OFF. Disconnect P02, M28. Connect T-adapter to P02 or M28. Turn starting switch to ON or OFF. Max. 1V.	
		Yes - see item two. No - short circuit in wiring harness between P02 (2), (9) and M28 (1).	
2	Is resistance of washer motor normal?	Turn starting switch OFF. Disconnect W28, check individual part. 5 - 20Ω.	
		Yes - defective monitor panel. No - defective washer motor (internal short circuit).	

3. If the part is not under hydraulic pressure, the following corks can be used:

Nominal number	Part Number	Dimensions		
		D	d	L
06	07049-00608	6	5	8
08	07049-00811	8	6.5	11
10	07049-01012	10	8.5	12
12	07049-01215	12	10	15
14	07049-01418	14	11.5	18
16	07049-01620	16	13.5	20
18	07049-01822	18	15	22
20	07049-02025	20	17	25
22	07049-02228	22	18.5	28
24	07049-02430	24	20	30
27	07049-02734	27	22.5	34

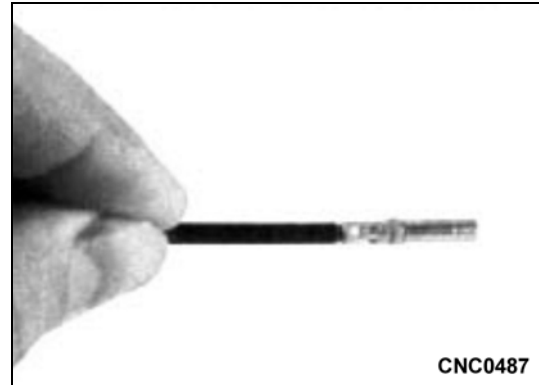


PRECAUTIONS WHEN CARRYING OUT INSTALLATION WORK

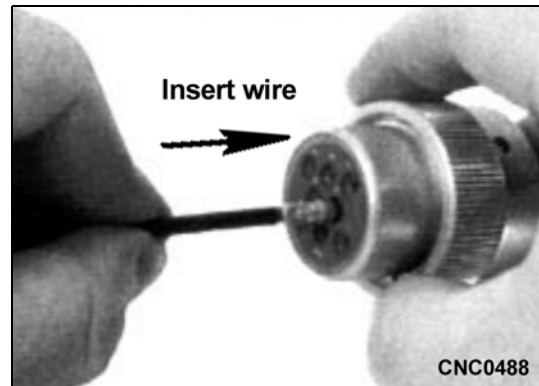
- Tighten all bolts and nuts (sleeve nuts) to the specified (KES) torque.
- Install the hoses without twisting or interference.
- Replace all gaskets, O-rings, cotter pins, and lock plates with new parts.
- Bend the cotter pin or lock plate securely.
- When coating with adhesive, clean the part and remove all oil and grease, then coat the threaded portion with two or three 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 eye bolts, check that there is no deformation or deterioration, screw them fully, and align the direction of the hook.
- When tightening split flanges, tighten uniformly in turn to prevent excessive tightening on one side.

INSERTION OF CONTACT TERMINAL (HD30 TYPE)

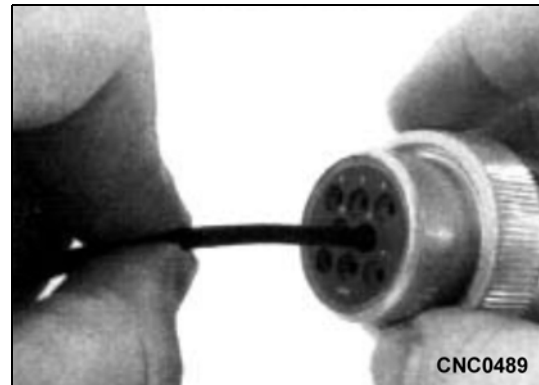
1. Grasp contact terminal approximately 25.2mm (1in) behind the crimped barrel.



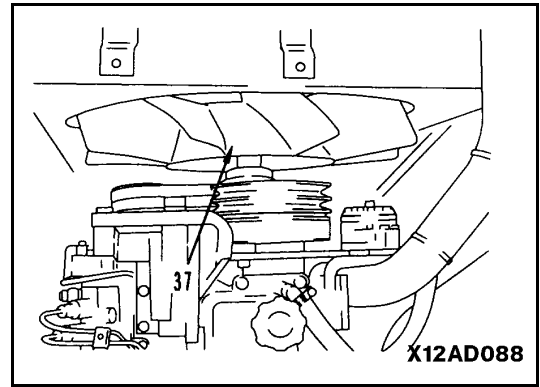
2. Holding connector with rear grommet facing you.
3. Insert completed contact terminal straight into connector grommet until a positive stop is felt.



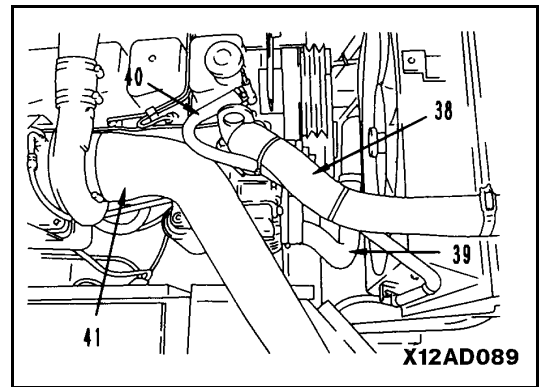
4. Once contact terminal is in connector, a slight tug will confirm that the contact terminal is properly locked in place.
5. For unused wire cavities, insert sealing plugs for full environmental sealing.



19. Remove fan (37) and move towards radiator.



20. Remove radiator upper hose (38), radiator lower hose (39), heater hose (40), and air cleaner connector (41).



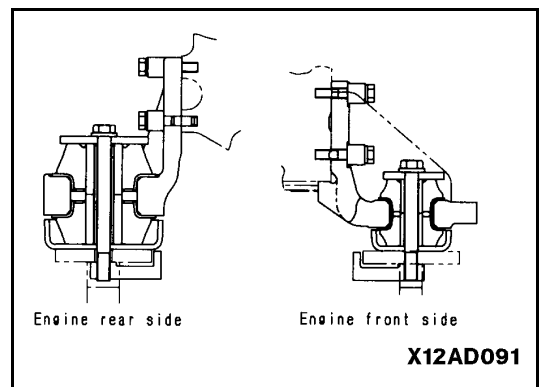
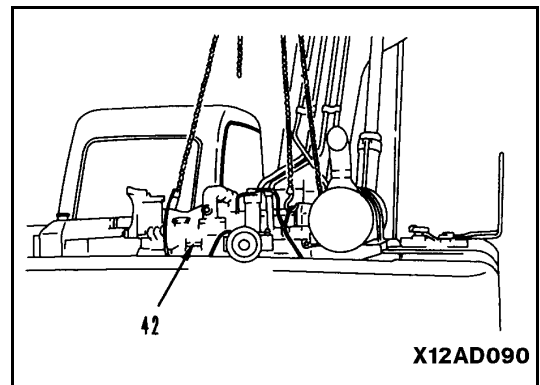
21. Remove engine mount bolts, then raise engine and main pump assembly (42) slowly and lift off.



★ When removing the engine and main pump assembly, check that all the wiring and piping has been disconnected.



Main pump assembly: 770 kg (1698 lb)

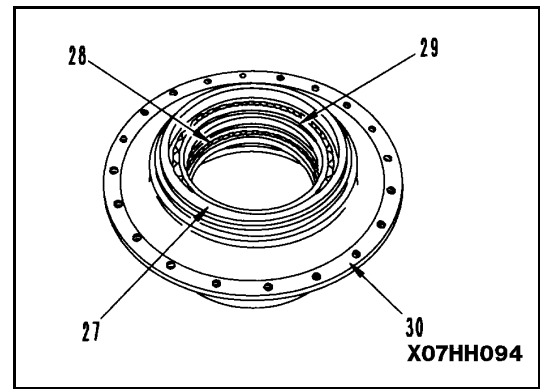


ASSEMBLY PC200/210/220LC-6LE

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

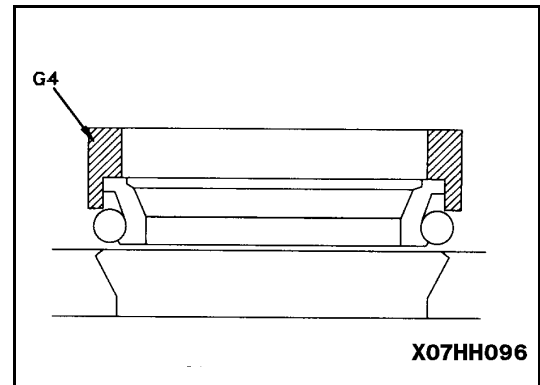
1. Hub assembly

- A. Using push tool, press fit bearings (28) and (29) to hub (30).



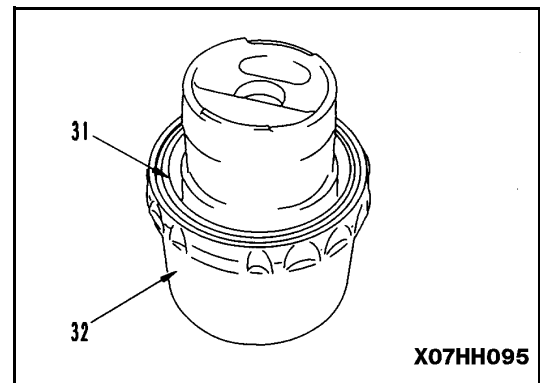
- B. Using tool G4, install floating seal (26).

- ★ Remove all oil and grease from the O-ring and O-ring contact surface, and dry the parts before installing the floating seal.
- ★ After installing the floating seal, check that the angle of the floating seal is within 1 mm.
- ★ After installing the floating seal, coat the sliding surface thinly with engine oil.

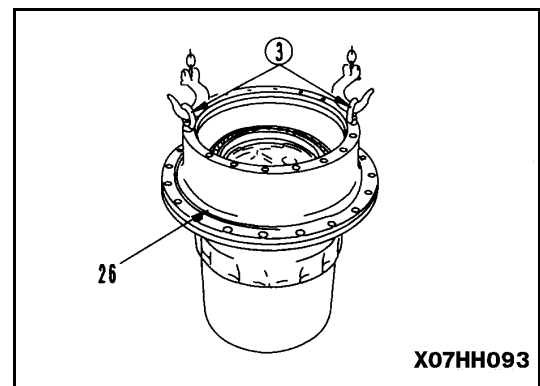


- C. Using tool G4, install floating seal (31) to travel motor (32).

- ★ The procedure for installation is the same as in Step B. above.



- D. Using eyebolts D , set hub assembly (26) to travel motor, then using push tool, tap to press fit bearing portion.



iii. Set carrier assembly (16) in press, assemble gear assembly (19), then using push tool ③, press fit pin (18).

★ When press fitting the pin, be extremely careful of the angle of the pin, and rotate the gear while press fitting.

★ After assembling the carrier assembly, check that gear (19) rotates smoothly.

iv. Fit holder and tighten with mount bolts (17).

Mount bolt: Thread tightener (LT-2)



Mount bolt: 382.2 ± 39.2 Nm (281.8 ± 28.9 lbf ft)



B. Install carrier assembly (16).

6. Assemble thrust washer (15).

7. Assemble No. 2 sun gear (14).

8. No. 1 ring gear

A. Install ring (13).

Mount surface of ring: Gasket sealant (LG-6)



B. Align with teeth surface of carrier, and install ring gear (12).

Ring gear mount surface: Gasket sealant (LG-6)



9. No. 1 carrier assembly

A. Assemble carrier assembly as follows.

★ The inner race, outer race and spacer from one set are similar to the other set, so assemble the sets with the same marks.

i. Using push tool, press fit outer race (11) in gear (8).

ii. Assemble spacer (10) and bearing (9).

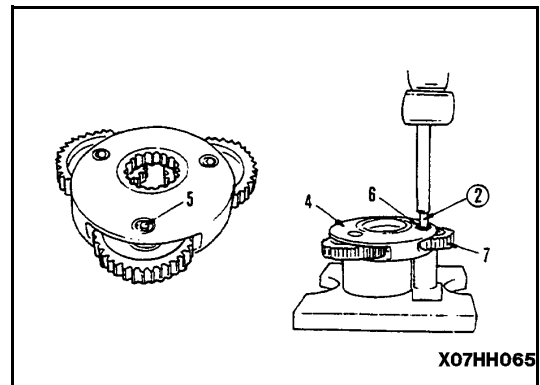
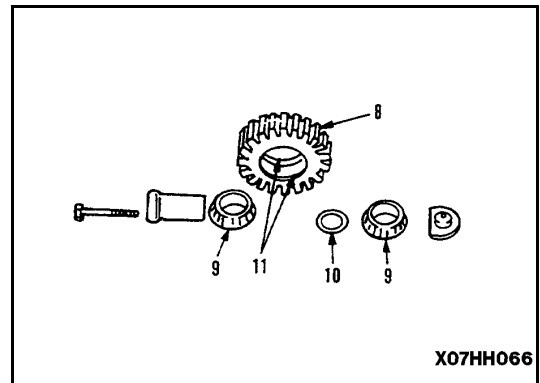
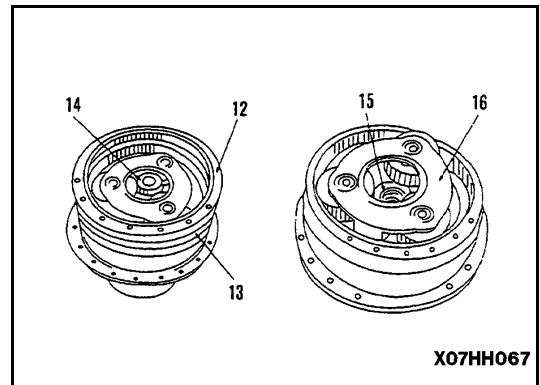
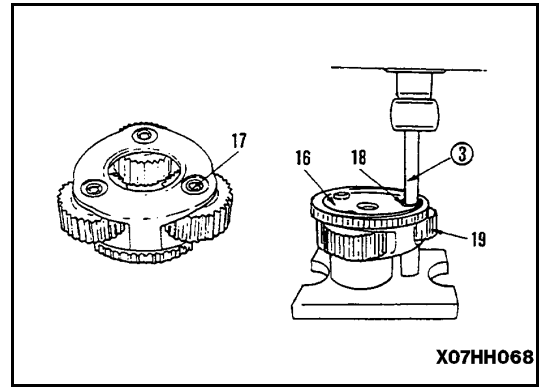
iii. Set carrier assembly (4) in press, assemble gear assembly (7), then using push tool ②, press fit pin (6).

★ When press fitting the pin, be extremely careful of the angle of the pin, and rotate the gear while press fitting.

★ After assembling the carrier assembly, check that gear (19) rotates smoothly.

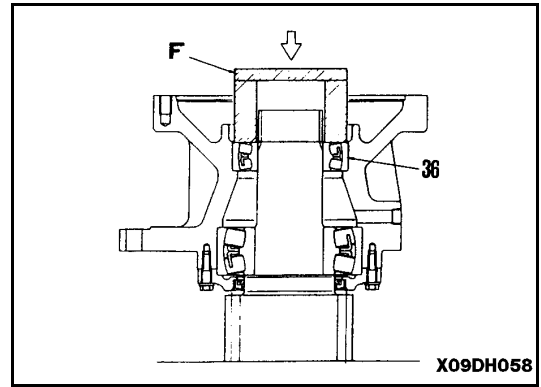
iv. Fit holder and tighten with the mount bolts (5).

Mount bolt: Thread tightener (LT-2)



4. Using tool **F**, press fit bearing (36).

- ★ Press the bearing inner race and outer race at the same time when press fitting. Do not press only the inner race when press fitting.
- ★ After press fitting the bearing, check that the case rotates smoothly.

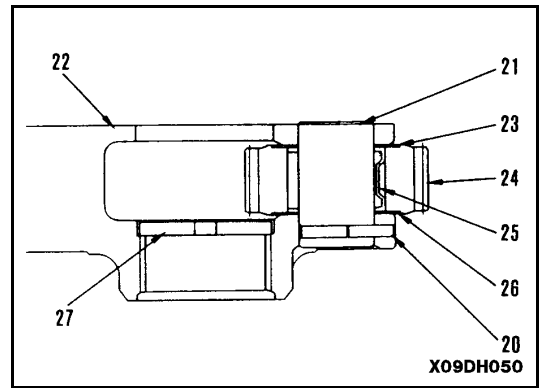


5. No. 2 carrier assembly

A. Assemble No. 2 carrier assembly as follows.

- ★ There are the remains of the caulking when the pin is inserted at the end face of hole h at the side of the carrier, so remove the caulked metal from the inside diameter of the hole before starting to assemble.

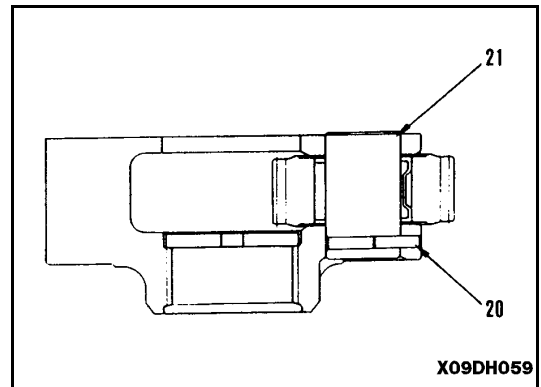
- i. Assemble plate (27) to carrier (22).
- ii. Assemble bearing (25) to gear (24), fit top and bottom thrust washers (23) and (26) and set gear assembly to carrier (22).



iii. Align position of pin holes of shaft and carrier, then tap with a plastic hammer to install shaft (21).

- ★ When installing the shaft, rotate the planetary gear. Be careful not to damage the thrust washer.

- iv. Insert pin (20).
- ★ After inserting the pin, caulk the pin portion of the carrier.



B. Install No. 2 carrier assembly (19).

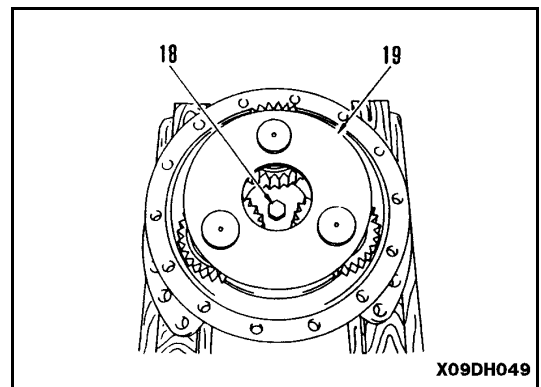
6. Tighten bolt (18).



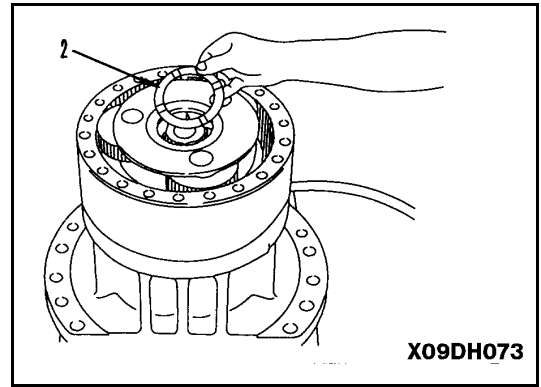
Thread of mount bolt: Thread tightener (LT-2)




Mount bolt: 176.4 ± 19.6 Nm (130 ± 14.4 lbf ft)




12. Install No. 1 thrust washer (2).

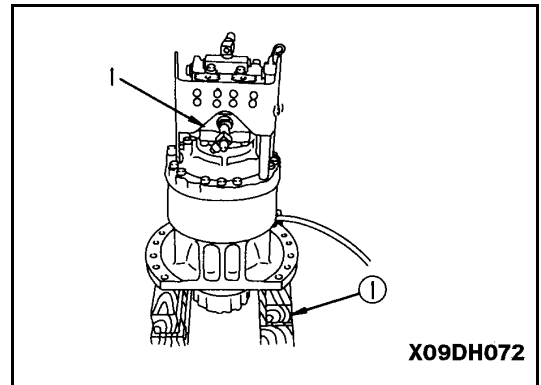


13. Install swing motor assembly (1).

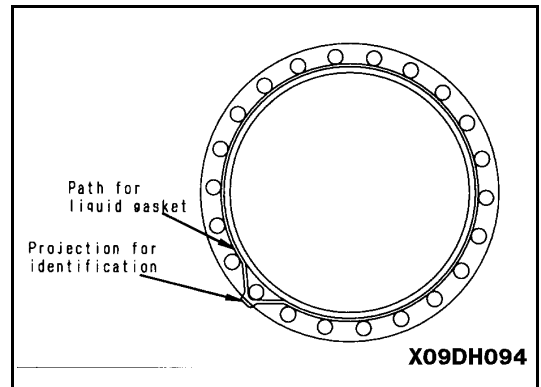
 Ring gear side mount surface:
Gasket sealant (LG-6)

★ Coat the outside diameter of the hole only at the hole in the ring gear where there is a distinguishing protrusion on the case. (See the diagram on the right.)

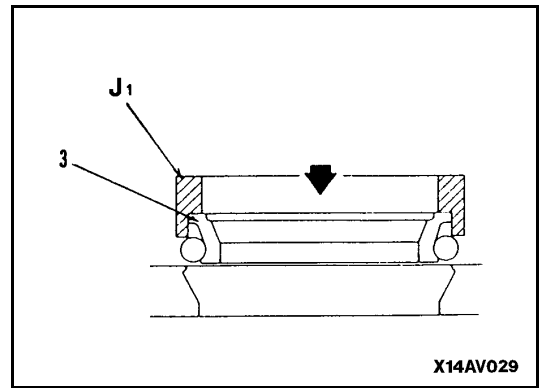
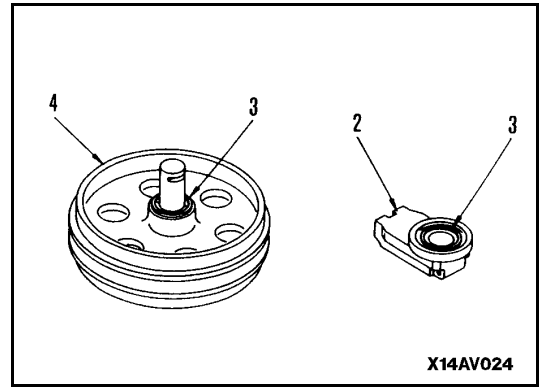
 Mount bolt: 176.5 ± 19.6 Nm (130 ± 14.4 lbf ft)




14. Tighten drain plug and add engine oil through oil filler to specified level.




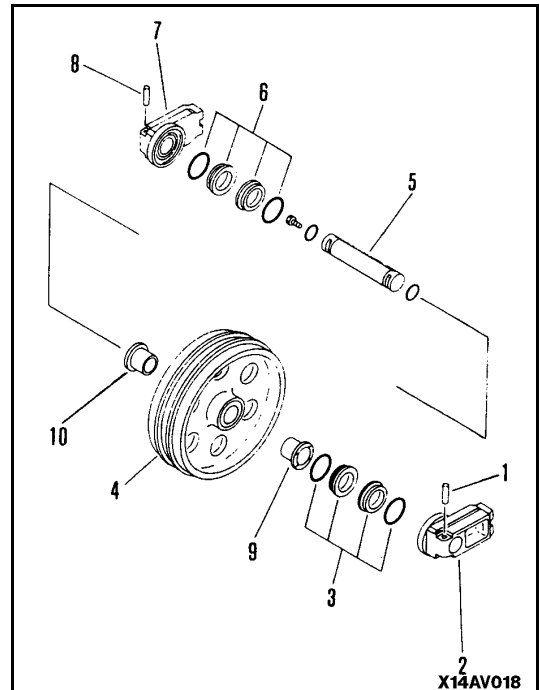
5. Using tool **J1**, install floating seal (3) to idler (4) and support (2).
 - ★ Coat the sliding surface of the floating seal with oil, and be careful not to let any dirt or dust get stuck to it.
 - ★ Remove all grease and oil from the contact surface of the O-ring and the floating seal.



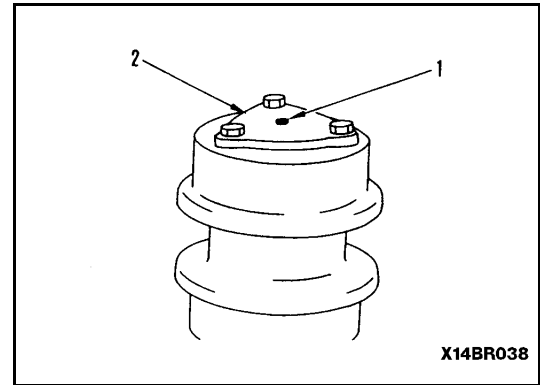
6. Install O-ring, then install support (2) with dowel pin (1).
7. Add oil and tighten plug.

 Oil: PC200/210/220 Approximately 80 cc (2.71 oz.) (SAE 30)
 PC250 Approximately 230 cc (7.78 oz.) (SAE 30)

 Plug: PC200/210/220 - 205.9 ± 49 Nm (151.8 ± 36 lbf ft)
 PC250 - 151.9 ± 24.5 Nm (112.0 ± 18.0 lbf ft)

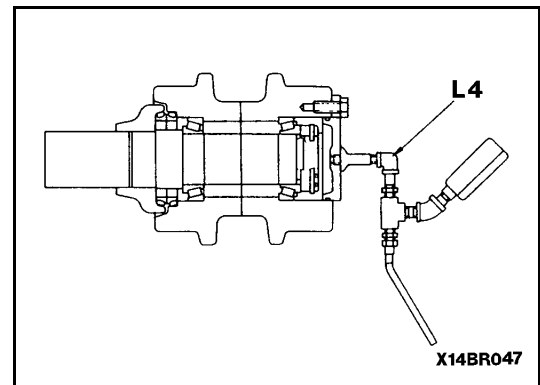


8. Fit O-ring and install cover (2).



9. Using tool **L4**, apply basic pressure to roller oil filler port, and check for leakage of air from seal.

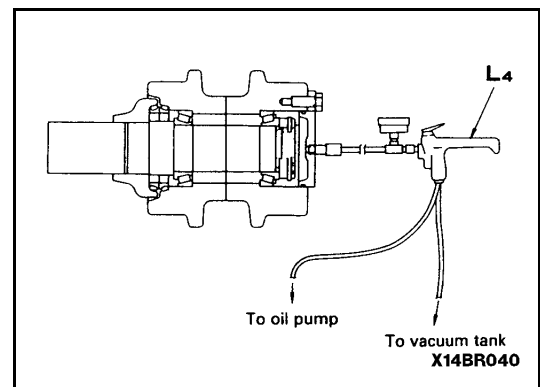
- ★ Basic pressure: 1 kg/cm² (14.22 psi)
- ★ Method of checking: The basic pressure shall be maintained for 10 seconds and the indicator of the gauge shall not go down.



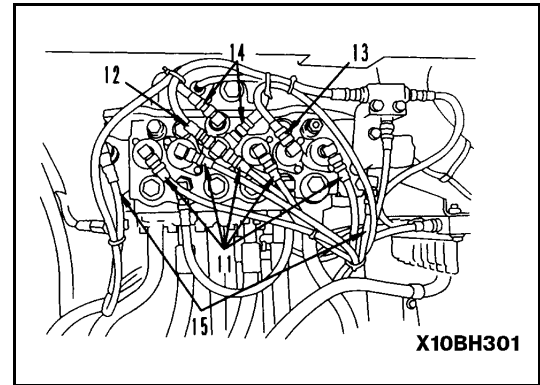
10. Using tool **L4**, fill carrier roller assembly with oil, then tighten plug (1).



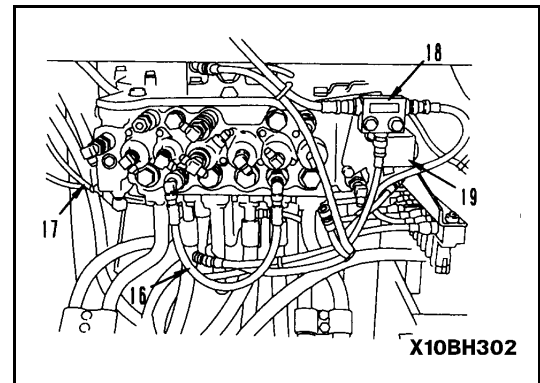
Carrier roller assembly:
 PC200/210/220 = 230 - 250 cc (7.78 - 8.45 oz.);
 PC250 = 450 - 500 cc (15.2 - 16.9 oz.)



6. Disconnect 5 hoses (11) between control valve and relay block, hose (12) between control valve and timing valve, travel valve pilot hose (13), 2 boom valve pilot hoses (14), and 2 relief valve pilot hoses (15).
- ★ After disconnecting the hoses, fit tags to distinguish them.
 - ★ Protect with the sleeve nut to prevent damage to the nipple or elbow taper seal portion.



7. Disconnect 2 travel valve junction hoses (16).
8. Disconnect 2 LS pressure pilot hoses (17).
- ★ After disconnecting the hoses, fit tags to distinguish them.

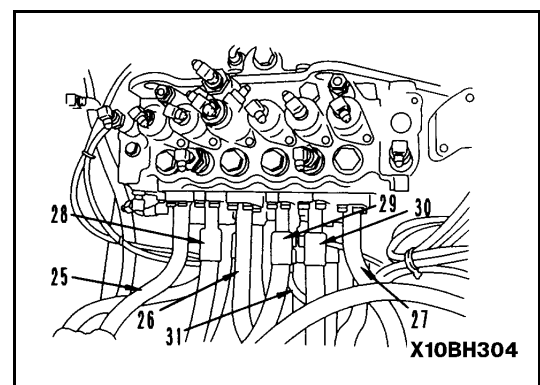
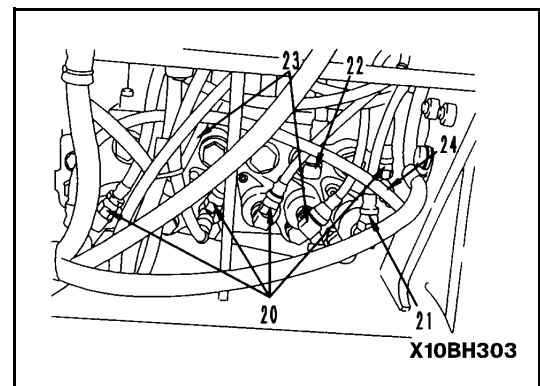


9. Remove timing valve (18) and drain tube (19).
10. Disconnect 4 hoses (20) between control valve and relay block, hose (21) between control valve and timing valve, travel valve junction hose (22), travel valve pilot hoses (23), and pilot hose (24) between arm and bucket.
- ★ After disconnecting the hoses, fit tags to distinguish them.
 - ★ Protect with the sleeve nut to prevent damage to the nipple or elbow taper seal portion.

11. Disconnect 2 each of bucket valve tube (25), boom valve tube (26), and arm valve tube (27).

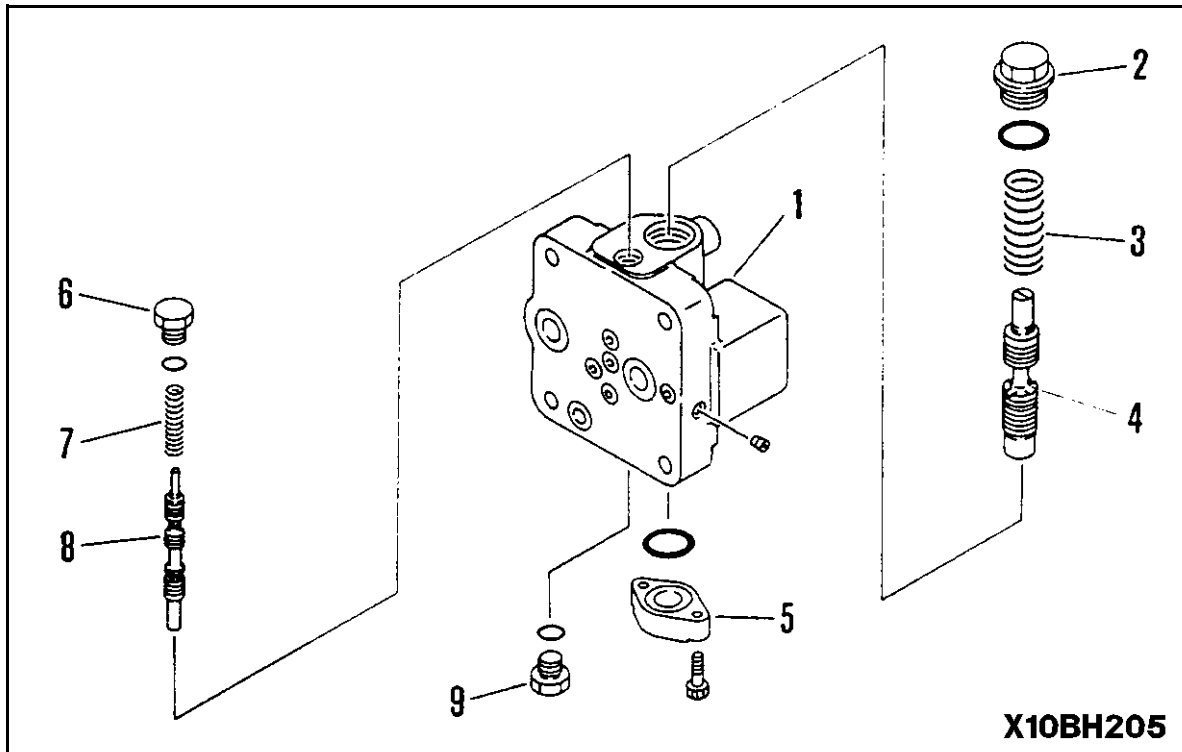
12. Disconnect 2 each of right hand travel valve hose (28), swing valve hose (29), and left travel valve hose (30).

13. Disconnect 2 LS select valve pilot hoses (31).



PUMP MERGE-DIVIDER VALVE

DISASSEMBLY




1. Remove plug (2) from valve body (1), then remove spring (3) and spool (4).
 2. Remove plate (5).
 3. Remove plug (6), then remove spring (7) and spool (8).
 4. Remove plug (9).
- ★ After disassembling, if there is any abnormality in body (1) or spools (4) or (8), replace the whole pump merge-divider valve assembly.


ASSEMBLY

- Before assembling, coat the sliding surface with engine oil.

1. Fit O-ring to plug (9) and install to valve body (1).


 Plug (9): 39.2 ± 5.88 Nm (28.9 ± 4.33 lbf ft)

2. Assemble spool (8) and spring (7), then fit O-ring to plug (6) and install.

 Plug (9): 39.2 ± 5.88 Nm (28.9 ± 4.33 lbf ft)

3. Fit O-ring to plate (5) and install to valve body.

4. Assemble spool (4) and spring (3), then fit O-ring to plug (2) and install.

 Plug (2): 151.9 ± 24.5 Nm (112 ± 18 lbf ft)

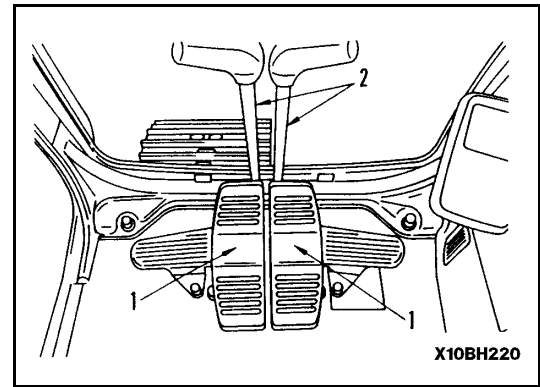
TRAVEL PPC VALVE

REMOVAL

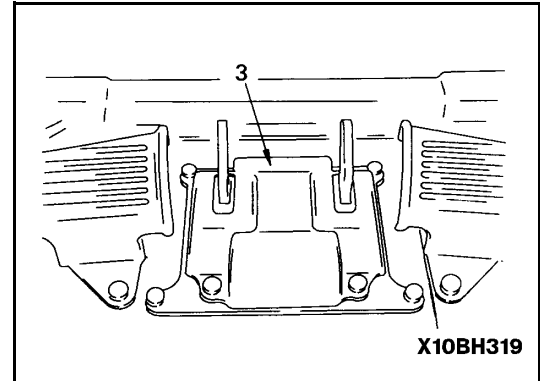


WARNING! Lower the work equipment completely to the ground and stop the engine. Then loosen the oil filler cap slowly to release the pressure inside the hydraulic tank.

1. Remove floor mat.
2. Remove travel PPC valve bottom cover.
3. Remove pedals (1) and levers (2).
4. Remove cover (3).

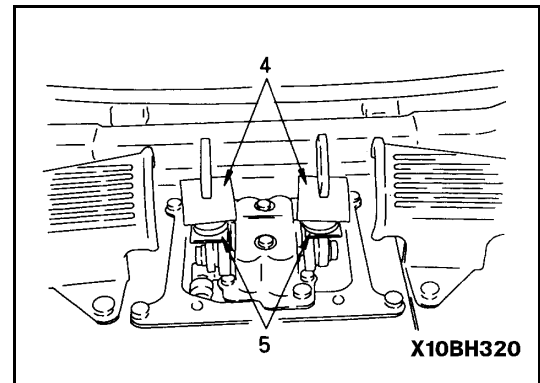


※1



5. Remove covers (4), then remove springs (5).
6. Disconnect 6 PPC hoses (7), then remove travel PPC valve assembly (8).

※2



INSTALLATION

Carry out installation in the reverse order to removal.

※1



Cover mount bolt: 19.6 ± 2 Nm (14.4 ± 1.4 lbf ft)

※2



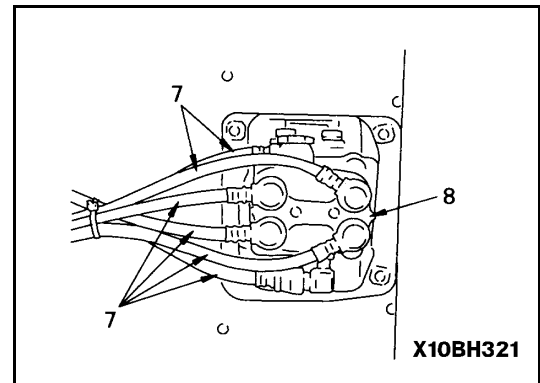
Hose mount joint bolt (width across flats: 30 mm [1.1811 in]): 39.2 ± 4.9 Nm (28.9 ± 3.6 lbf ft)



Hose mount elbow: (width across flats: 22 mm [0.8661 in]) 34.3 ± 4.9 Nm (25.2 ± 3.6 lbf ft)



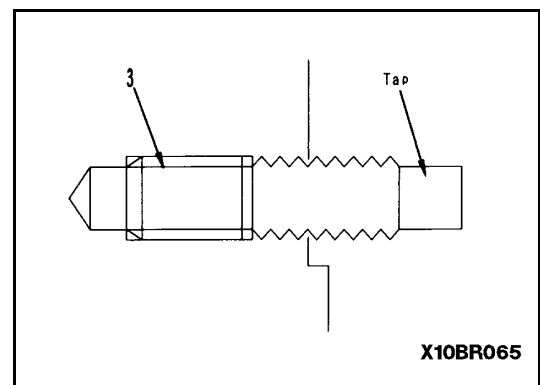
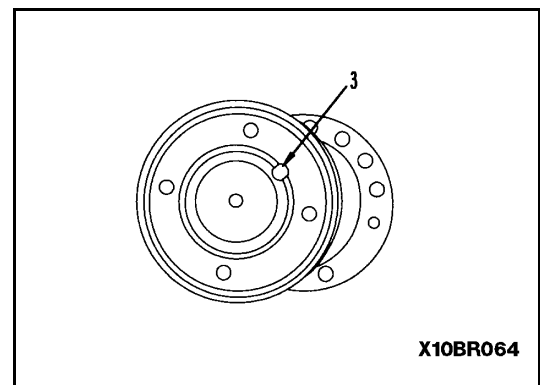
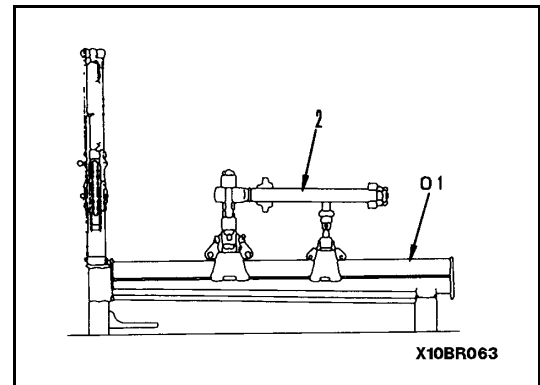
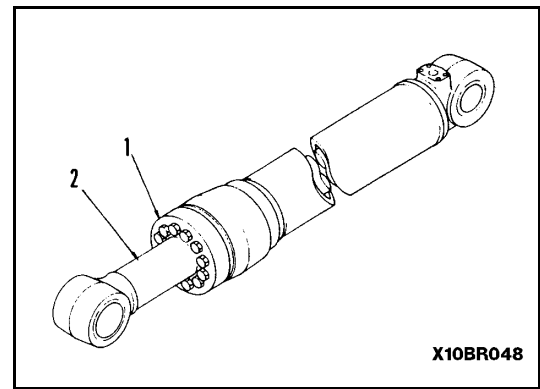
Hose mount joint bolt (width across flats: 17 mm [0.6692 in]): 24.5 ± 4.9 Nm (18 ± 3.6 lbf ft)



HYDRAULIC CYLINDER

DISASSEMBLY

1. Piston rod assembly
 - A. Remove piping from cylinder assembly.
 - B. Remove mount bolts and disconnect head assembly (1).
 - C. Pull out piston rod assembly (2).
 - ★ Place a container under the cylinder to catch the oil.
 - D. Disassemble piston rod assembly as follows.
 - i. Set piston rod assembly (2) in tool **O1**.
 - ii. Remove stopper screw (3) of piston assembly.
 - ★ Common screw size for boom, arm, and bucket cylinder: M12 X Pitch 1.75.
- ★ If the caulking of screw (3) is too strong and it cannot be removed, tighten the screw fully, then fit a tap to the thread and remove the screw.



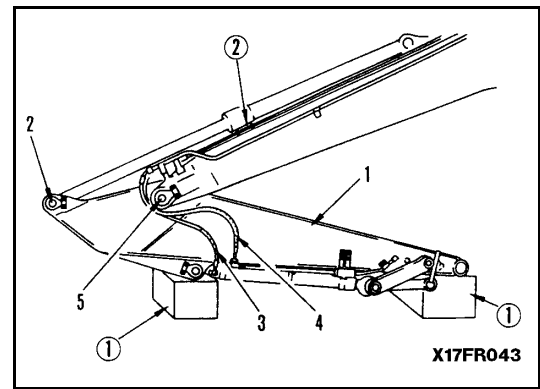
ARM


REMOVAL

1. Remove bucket assembly. For details, see BUCKET, Removal.
2. Secure front link to arm with wire.
3. Pull in arm so that it is easy to remove pin at arm cylinder head, then lower arm and bucket cylinder assembly (1) on to block ①.




WARNING! Set the safety lock lever to the LOCK position.



4. Set block ② between arm cylinder and boom.
5. Remove plate, then remove arm cylinder head pin (2).  1
6. Start engine, and retract piston rod, then tie piston rod with wire to prevent it from coming out.



WARNING! Release the remaining pressure in the hydraulic circuit. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic circuit.

7. Disconnect 2 hoses (3) and 2 hoses (4).
 - ★ Install blind plugs at the male end and in the disconnected hoses.
 - ★ Hoses (4) are for machines equipped with an additional attachment circuit.
8. Remove plate, then remove connecting pin (5) between arm and boom.  2
 - ★ There are shims installed, so check the number and thickness, and keep in a safe place.
9. After raising boom, swing to remove arm and bucket cylinder assembly (1).



Arm, bucket cylinder assembly:

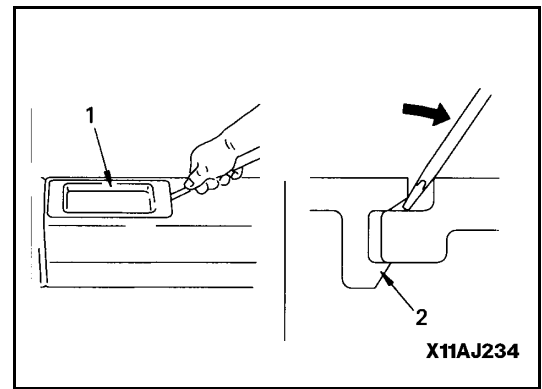
PC200: 950 kg (2095 lb)
 PC210: 1100 kg (2426 lb)
 PC220: 1100 kg (2426 lb)
 PC250: 1250 kg (2756 lb)

CONTROL STAND CASE

REMOVAL

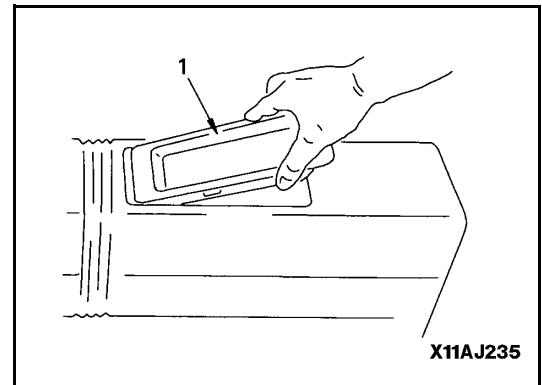
1. Tray

- A. Insert a thin flat-headed screwdriver into notch at rear tray (1) and lever up lightly to release rear claw (2).
 ★ The claw can only be released from the rear.



- B. Pull tray (1) to rear to remove.

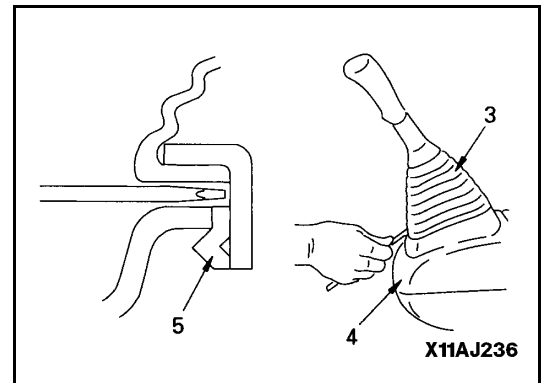
※ 1



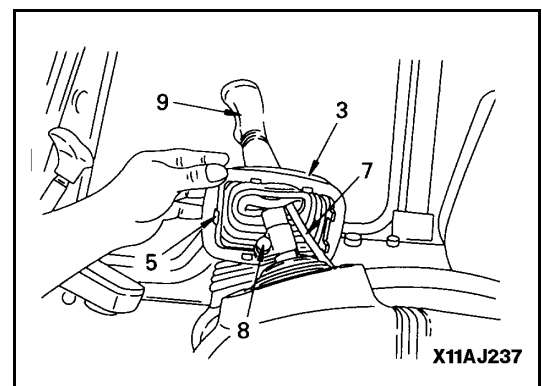
2. Boot

- A. Insert a thin flat-headed screwdriver between boot (3) and upper case (4), remove claw (5) at front of boot from upper case, then raise front.
 B. Pull boot (3) to front to remove claw at rear of boot.

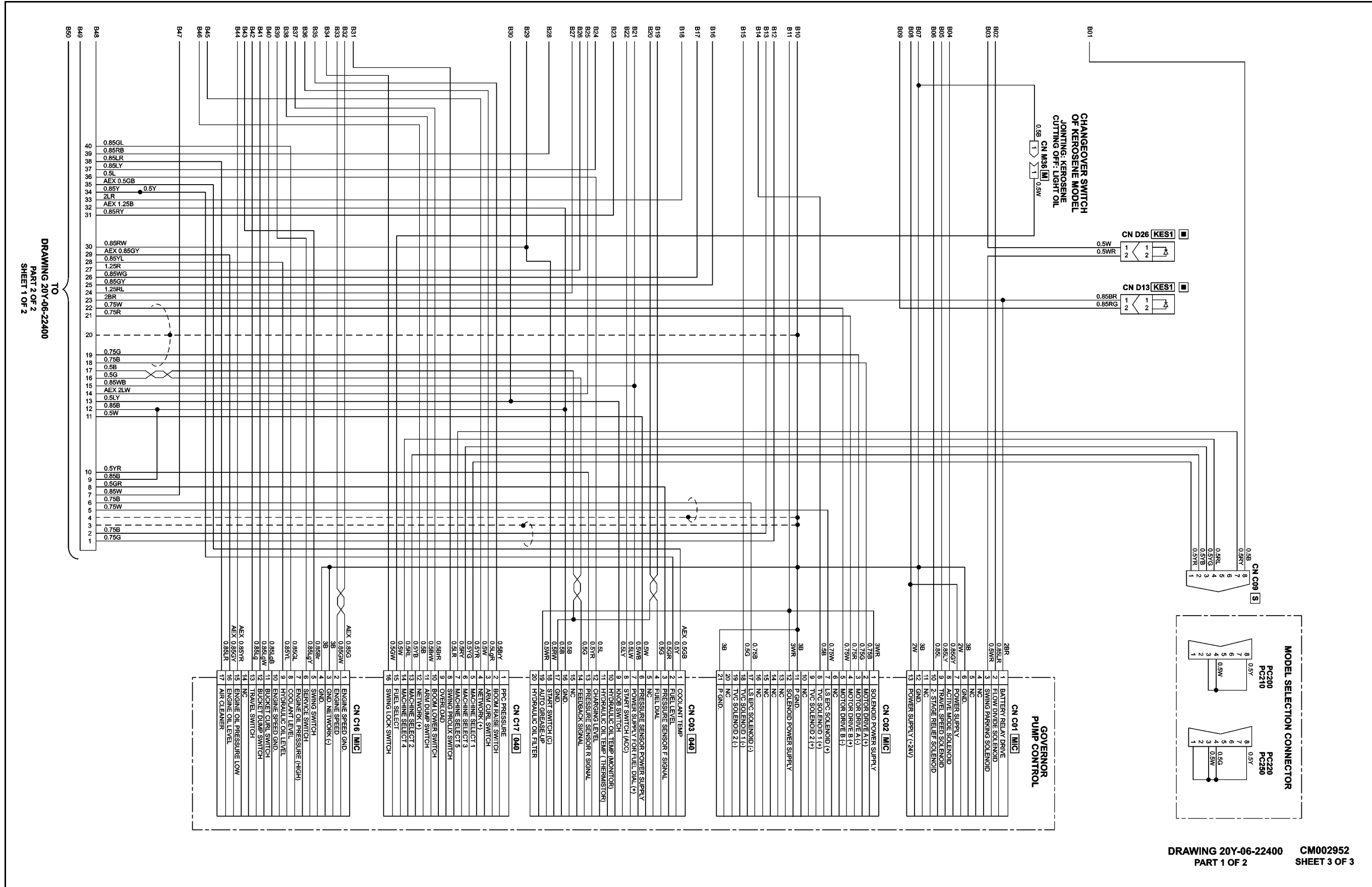
※ 2



- C. Disconnect wiring connector (7) from hole for removed tray.
 D. Push boot (3) up, remove bolt (8), then remove lever (9) and boot (3).
 ★ Check the direction of the lever.

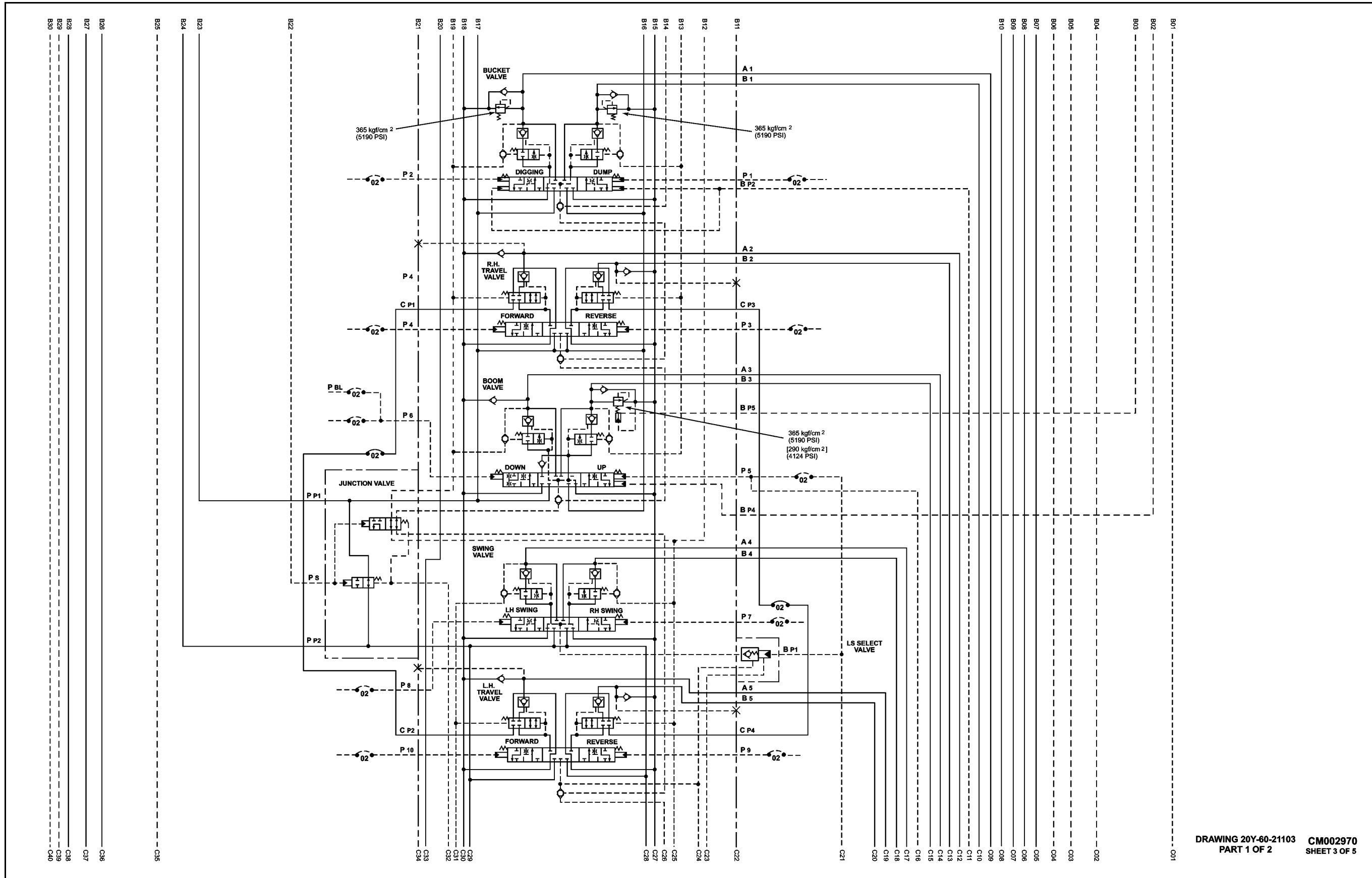


ELECTRICAL DIAGRAM PART 1 OF 2 (SHEET 3 OF 3) - S/N A83001 & UP - FOLDOUT 3



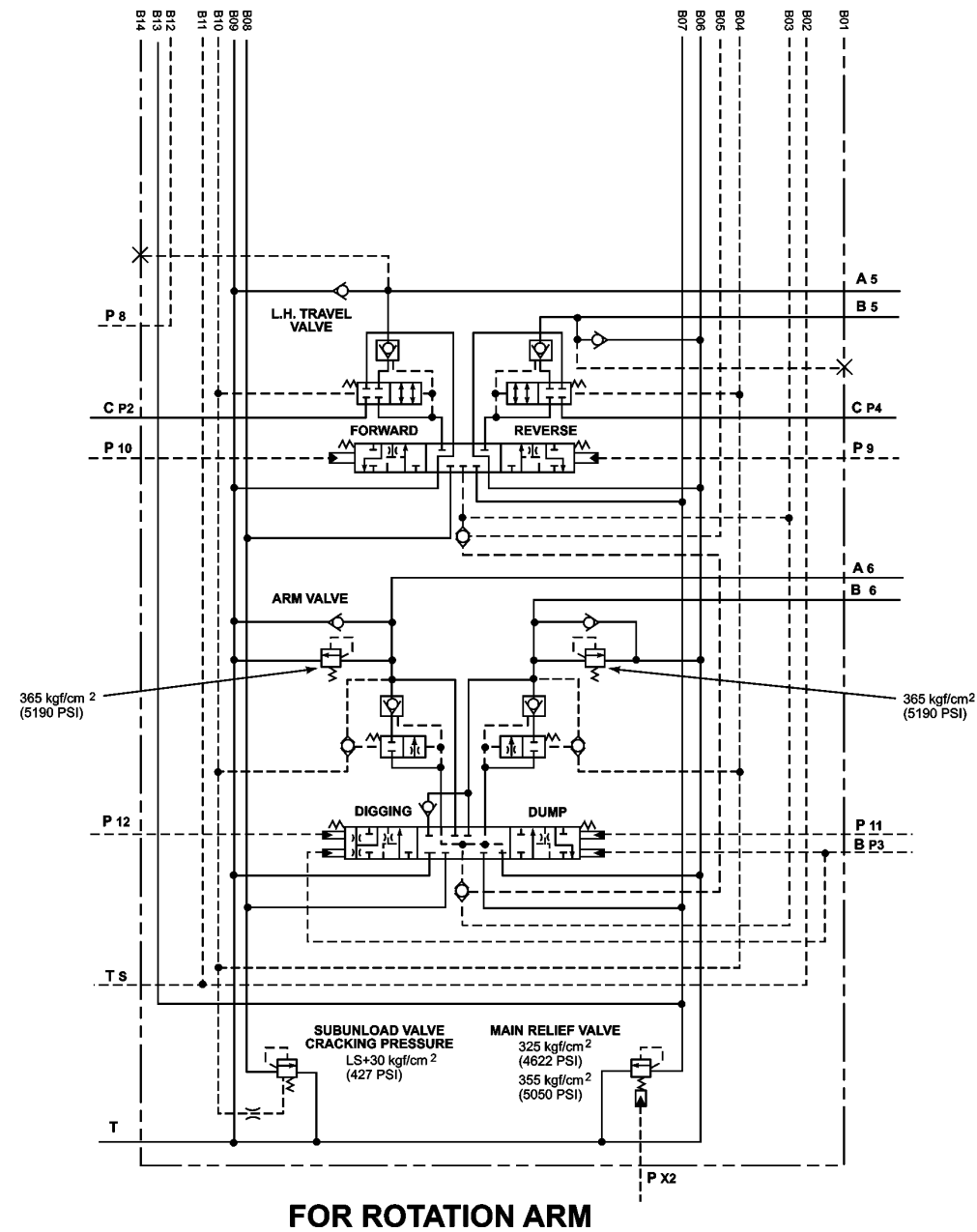
DRAWING 20Y-06-22400
PART 2 OF 2
SHEET 1 OF 2

HYDRAULIC DIAGRAM - PART 1 OF 2 (SHEET 3 OF 5) - S/N A83001 & UP - FOLDOUT 13



DRAWING 20Y-60-21103 CM002970
PART 1 OF 2 SHEET 3 OF 5

HYDRAULIC DIAGRAM - PART 2 OF 2 (SHEET 3 OF 3) - S/N A83001 & UP - FOLDOUT 18



CONNECTION OF PPC HOSES

SPEC	PPC BLOCK PORT	(A)	(B)	(C)	(D)
1 ATT	MAIN VALVE PORT	P-1	P-2	—	—
2 ATT		P-1	P-2	P-3	P-4
2P BOOM		P-3	P-4	—	—
ROT ARM		P-6	P-5	—	—
2P BOOM + ROT ARM		P-3	P-4	P-6	P-5
CS HANDLER		P-1	P-2	P-5	P-6

DRAWING 20Y-60-21103 CM002975
PART 2 OF 2 SHEET 3 OF 3

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