SHOP MANUAL

KOMATSU

PC200-6 CUSTOM
PC200LC-6 CUSTOM
PC220-6 CUSTOM
PC220LC-6 CUSTOM

MACHINE MODEL	SERIAL NO.
PC200-6	**83952 and up**
PC200LC-6	**83952 and up**
PC220-6	**50310 and up**
PC220LC-6	**50310 and up**

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

- PC200, PC200LC-6 CUSTOM mount the S6D95L-1 engine;
  PC220, PC220LC-6 CUSTOM mount the SA6D95L-1 engine.
  For details of the engine, see the 95 Series Engine Shop Manual.

Printed in Japan 07-97(01)00503

HOISTING INSTRUCTIONS

HOISTING

Heavy parts (25 kg or more) must be lifted with a hoist, etc. In the **DISASSEMBLY AND ASSEMBLY** section, every part weighing 25 kg or more is indicated clearly with the symbol kg

- If a part cannot be smoothly removed from the machine by hoisting, the following checks should be made:
  1) Check for removal of all bolts fastening the part to the relative parts.
  2) Check for existence of another part causing interference with the part to be removed.

WIRE ROPES

1) Use adequate ropes depending on the weight of parts to be hoisted, referring to the table below:

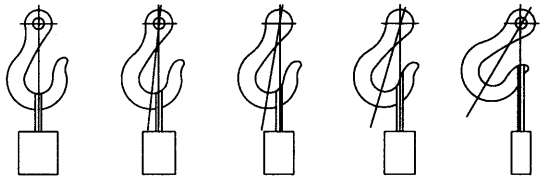
Wire ropes
(Standard "Z" or "S" twist ropes without galvanizing)

Rope diameter	Allowable load	
mm	kN	tons
10	9.8	1.0
11.2	13.7	1.4
12.5	15.7	1.6
14	21.6	2.2
16	27.5	2.8
18	35.3	3.6
20	43.1	4.4
22.4	54.9	5.6
30	98.1	10.0
40	176.5	18.0
50	274.6	28.0
60	392.2	40.0

★ The allowable load value is estimated to be one-sixth or one-seventh of the breaking strength of the rope used.

2) Sling wire ropes from the middle portion of the hook.

Slinging near the edge of the hook may cause the rope to slip off the hook during hoisting, and a serious accident can result. Hooks have maximum strength at the middle portion.



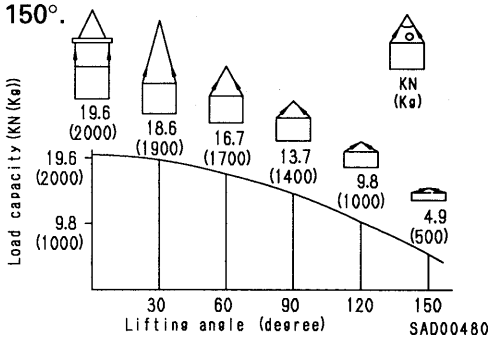
100% 88% 79% 71% 41%

SAD00479

3) Do not sling a heavy load with one rope alone, but sling with two or more ropes symmetrically wound onto the load.

⚠ Slinging with one rope may cause turning of the load during hoisting, untwisting of the rope, or slipping of the rope from its original winding position on the load, which can result in a dangerous accident.

4) Do not sling a heavy load with ropes forming a wide hanging angle from the hook. When hoisting a load with two or more ropes, the force subjected to each rope will increase with the hanging angles. The table below shows the variation of allowable load kN {kg} when hoisting is made with two ropes, each of which is allowed to sling up to 9.8 kN {1000 kg} vertically, at various hanging angles.
When two ropes sling a load vertically, up to 19.6 kN {2000 kg} of total weight can be suspended. This weight becomes 9.8 kN {1000 kg} when two ropes make a 120° hanging angle. On the other hand, two ropes are subjected to an excessive force as large as 39.2 kN {4000 kg} if they sling a 19.6 kN {2000 kg} load at a lifting angle of 150°.



SAD00480

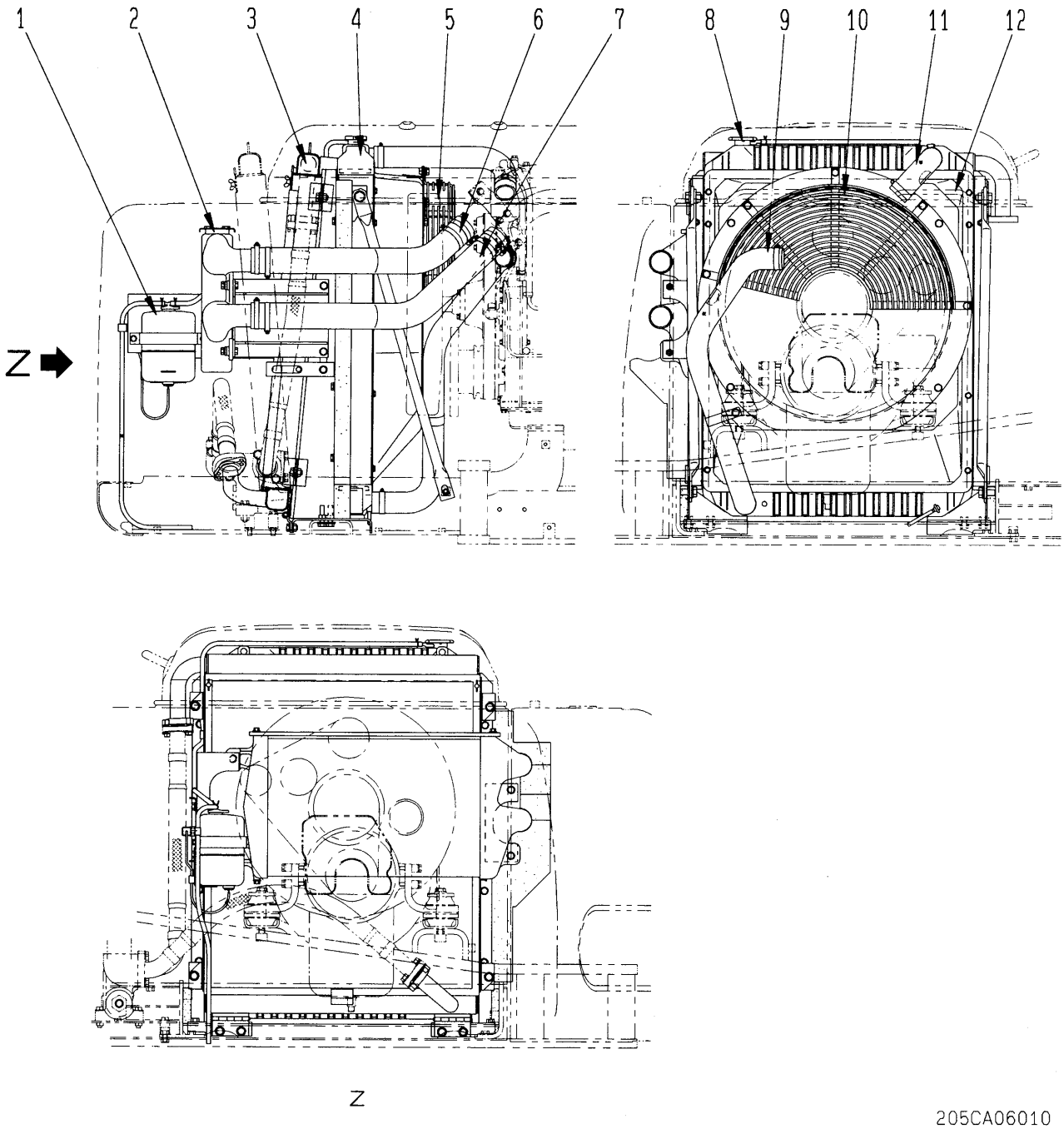
kgm to ft. lb

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	1352.6	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

Machine model				PC220-6 CUSTOM	PC220LC-6 CUSTOM
Serial Number				50310 and up	50310 and up
Engine		Model		SA6D95L-1	
		Type		4-cycle, water-cooled, in-line, vertical, direct injection, with turbocharger and aftercooler	
		No. of cylinders – bore x stroke	(mm)	6 – 95 x 115	
		Piston displacement	(cc)	4,891	
	Performance	Flywheel horsepower	(kW(HP)/rpm)	115.5(154.8)/2,150	
		Maximum torque	(Nm(kgm)/rpm)	553.7(56.5)/1,600	
		High idling speed	(rpm)	2,400 ± 70	
		Low idling speed	(rpm)	970 ± 50	
		Minimum fuel consumption	(g/kWh(g/HPh))	215 (152)	
		Starting motor		24 V, 5.5 kW	
		Alternator		24 V, 30 A	
		Battery		12 V, 110 Ah x 2	
		Radiator core type		CWX-4	
Undercarriage		Carrier roller		2 on each side	2 on each side
		Track roller		8 on each side	10 on each side
		Track shoe		Assembly-type triple grouser	Assembly-type triple grouser
Hydraulic system	Hydraulic pump	Type, No.		Variable displacement piston type x 2, gear type x 1	
		Delivery	(ℓ/min)	Piston type: 201 x 2, gear type: 31	
	Control valve	Type, No.		6-spool type x 1	
		Control method		Hydraulic type	
	Hydraulic motor	Travel motor		Piston type (with brake valve, parking brake) x 2	
		Swing motor		Piston type (with safety valve, parking brake) x 1	
		Hydraulic tank		Box-shaped, open	
		Hydraulic filter		Tank return side	
		Hydraulic cooler		Air cooled (SF-3)	

0205C6



Z

205CA06010

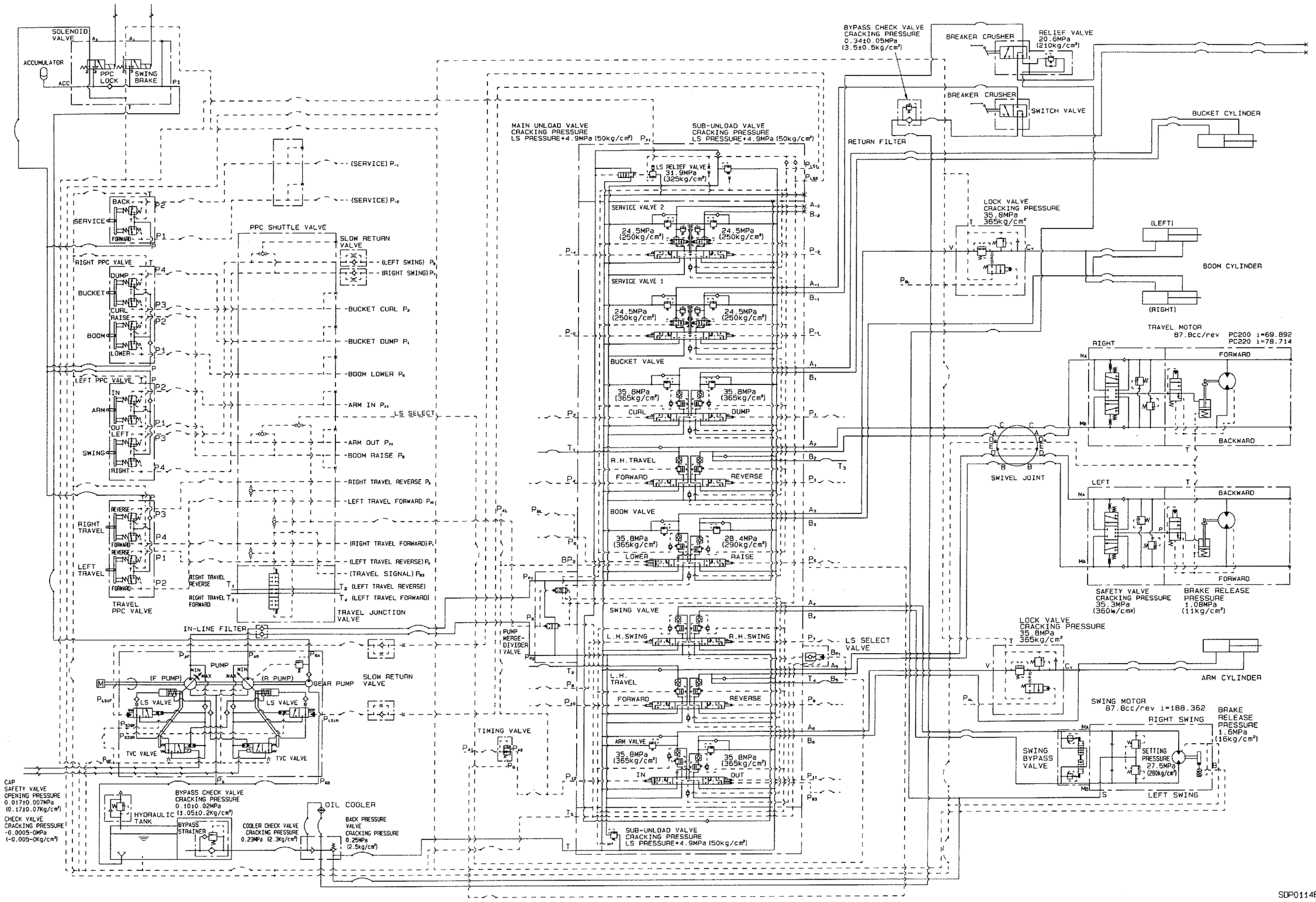
0205C6

1. Reservoir tank
2. Aftercooler
3. Oil cooler
4. Radiator
5. Fan
6. Aftercooler inlet hose
7. Aftercooler outlet hose
8. Radiator cap
9. Radiator outlet hose
10. Net
11. Radiator inlet hose
12. Shroud

SPECIFICATIONS

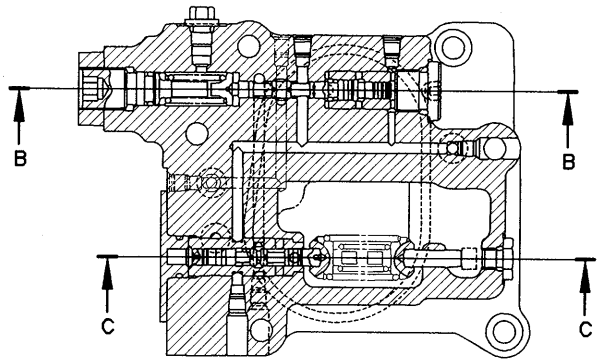
Radiator : CWX-4
Oil cooler : SF-3
Aftercooler: 6 lines

PC200, 200LC-6 Serial No.: 86942 and up
PC220, 220LC-6 Serial No.: 50704 and up

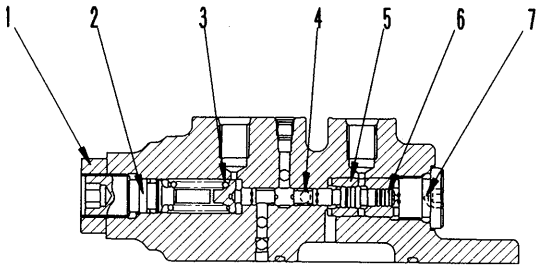


0205C6

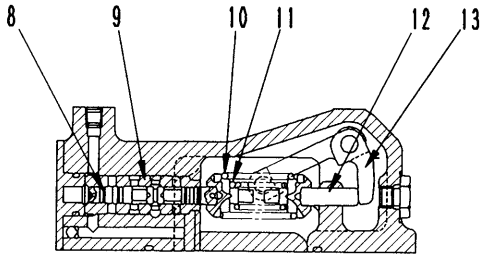
SDP01148



A – A



B – B



C – C

SEP00895

0205C6

LS VALVE

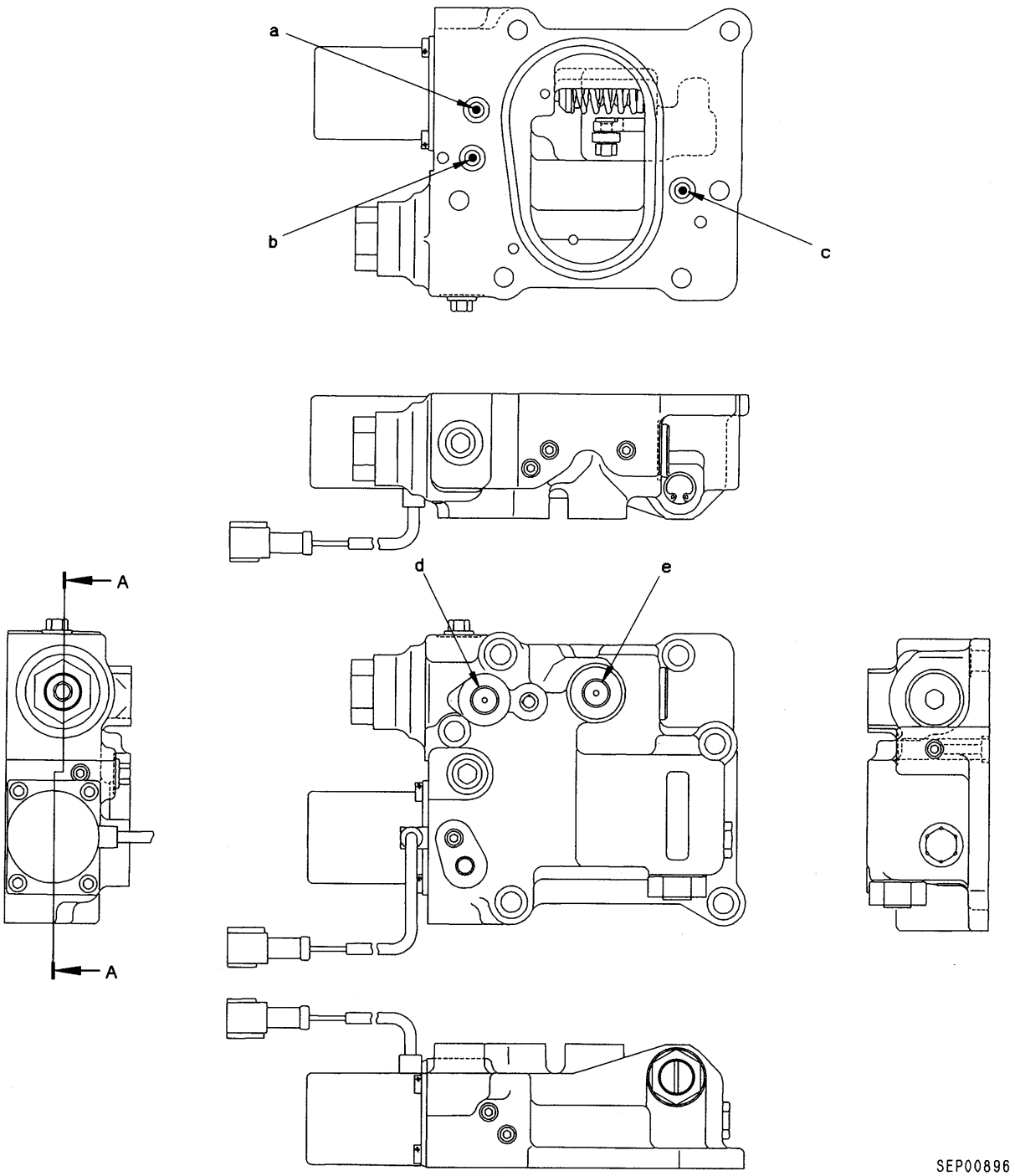
1. Locknut
2. Plug
3. Spring
4. Spool
5. Sleeve
6. Piston
7. Plug

TCC VALVE

8. Piston
9. Sleeve
10. Spring
11. Spring
12. Piston
13. Lever

2B. TVC • LS VALVE

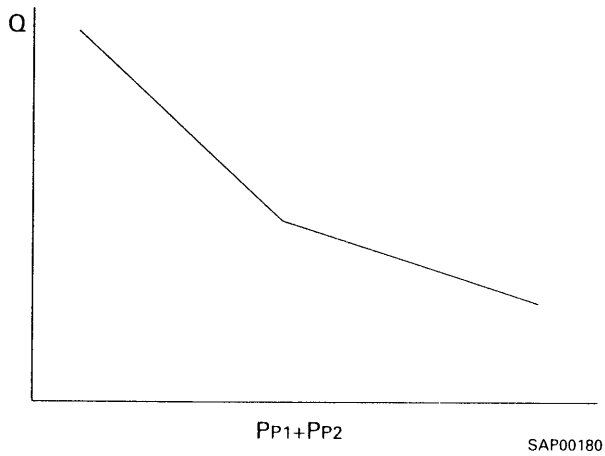
PC200, 200LC-6 Serial No.: 86942 and up
PC220, 220LC-6 Serial No.: 50704 and up



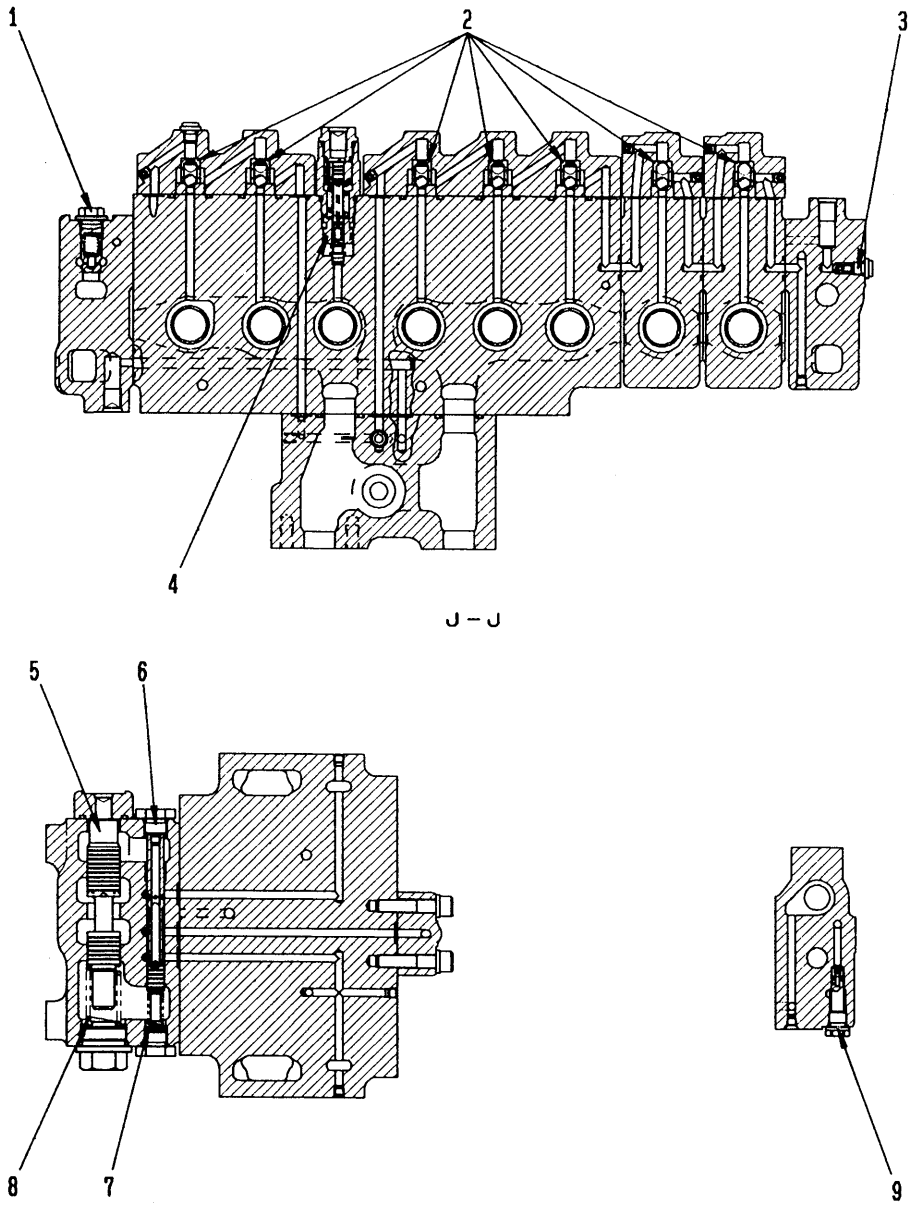
0205C6

a. Port PA2 (Rear pump delivery pressure inlet port)
b. Port PEN (Signal pressure outlet port)
c. Port PA1 (Front pump delivery pressure inlet port)
d. Port PLS (Control valve LS pressure inlet port)
e. Port PSIG (LS control inlet port)

- The relation of pump pressures **PP1** + **PP2** and the position of servo piston (9) forms a bent line because of the double-spring effect of springs (3) and (4). The relationship between pump pressures **PP1** + **PP2** and pump discharge amount **Q** is shown in the figure on the right.



0205C6

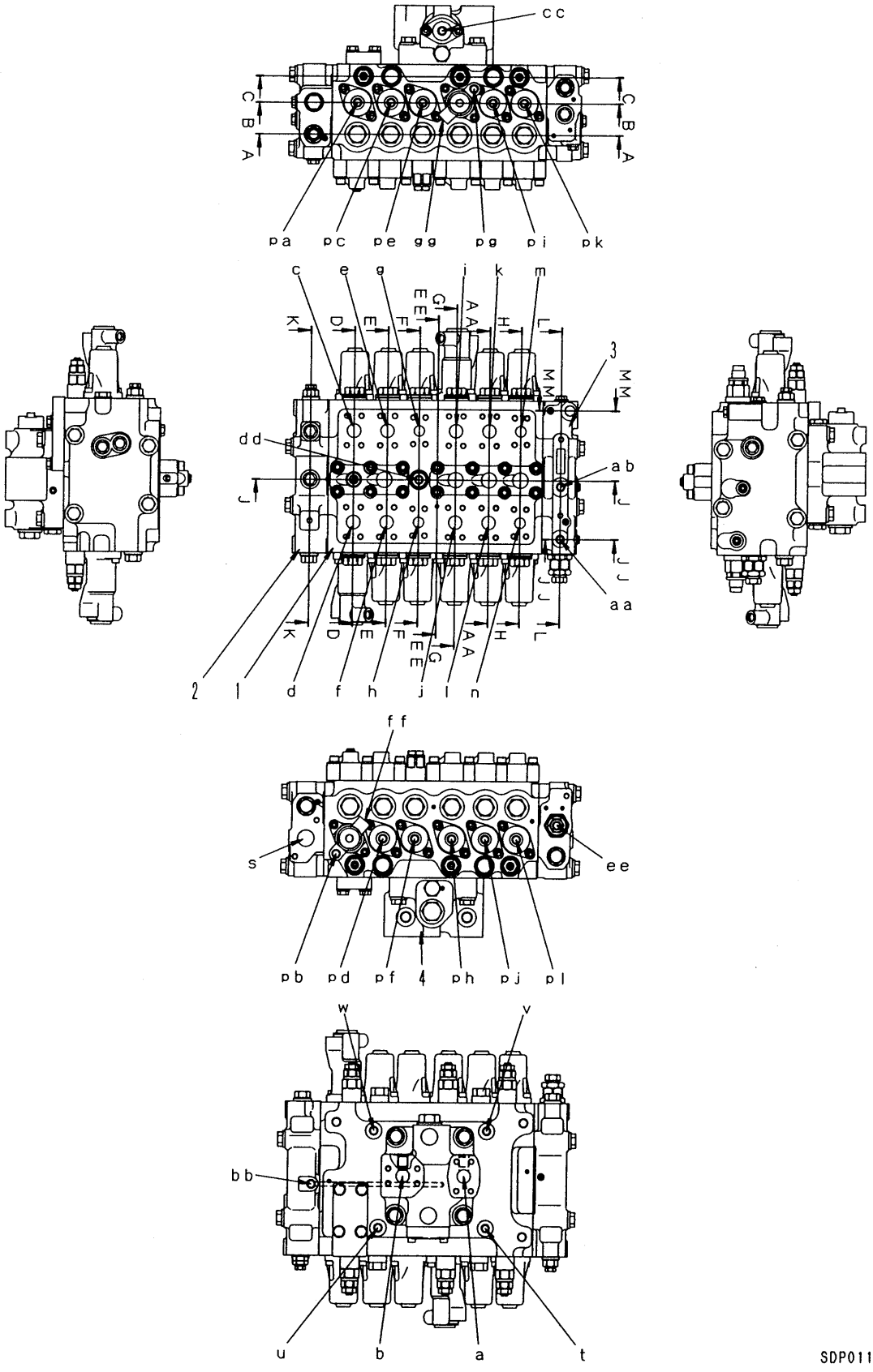


0205C6

1. Main check valve
2. LS shuttle valve
3. LS check valve
4. LS select valve
5. Pump merge-divider valve (for main)
6. Pump merge-divider valve (for LS)
7. Return spring
8. Return spring
9. LS bypass plug

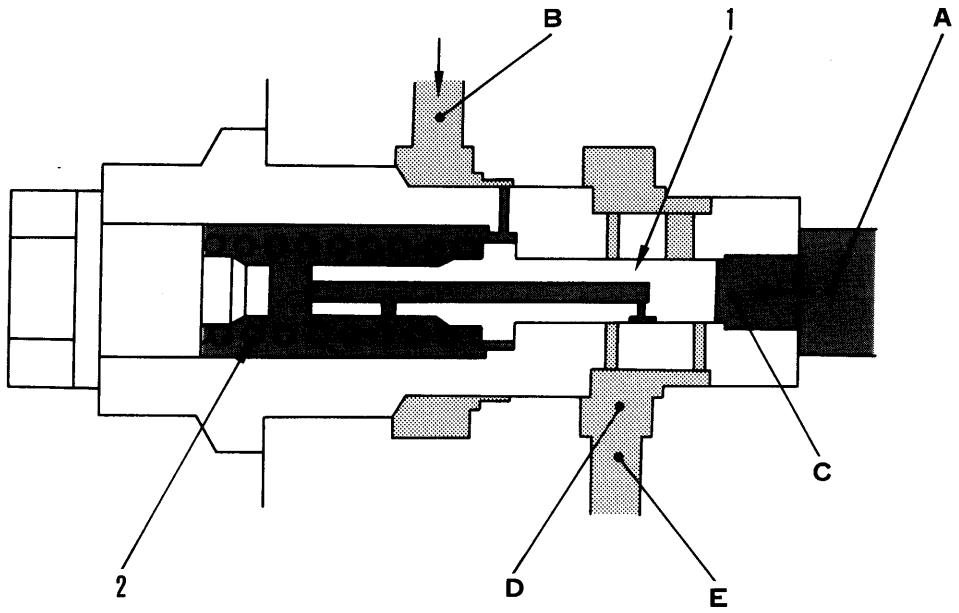
6-SPOOL VALVE (STANDARD)

★ For details of the names of the ports and the main structure, see 8-SPOOL VALVE.



0205C6

2. Sub-unload valve



205F06047A

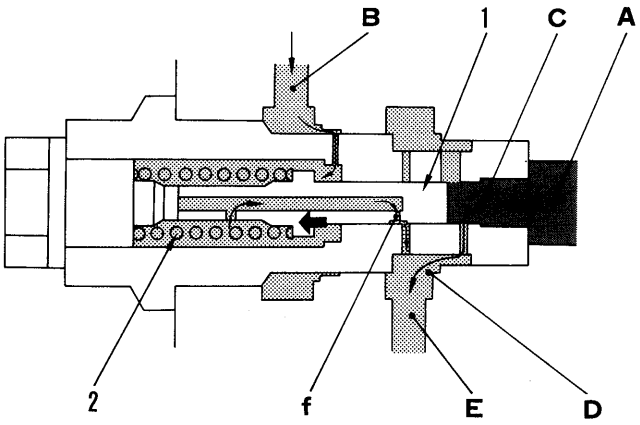
0205C6

Function

- When the pump flow is divided and the control valve group on one side is actuated (with the remaining control valve group at neutral), the sub-unload valve drains the pump flow to the group that is at neutral.

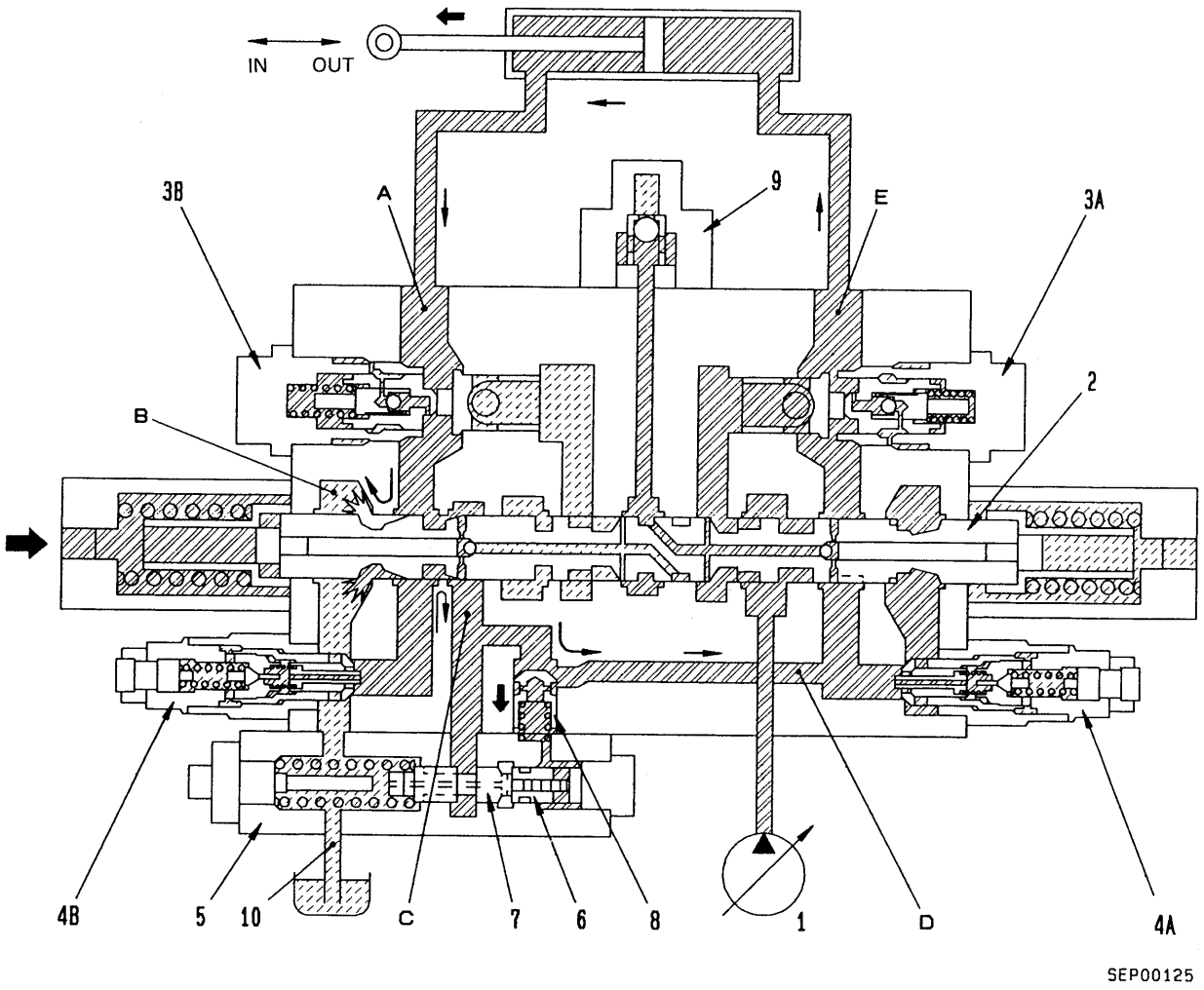
Operation

- The pressure in pump passage **A** is received at the end portion of valve (1). The control valve is at neutral, so the pressure of LS circuit **B** is 0 MPa (0 kg/cm^2).
- The pressurized oil in pump passage **A** is stopped by valve (1) and cannot escape, so the pressure rises. When this pressure becomes larger than the force of spring (2), valve (1) moves to the left, ports **C** and **D** are interconnected, and the pump pressure flows to tank passage **E**. In addition, the pressurized oil in LS circuit **B** passes from orifice **f** through port **D** and is drained to tank passage **E**. Therefore, in this operation, LS pressure ≒ tank pressure.
- In this unload operation, pump discharge pressure – LS circuit pressure is greater than the pump LS control pressure, so a signal is sent to set the pump swash plate to the minimum angle.



205F06048A

8. Arm regeneration circuit, counterbalance valve



0205C6

1. Main pump
2. Main spool
3A. Pressure compensation valve
3B. Pressure compensation valve
4A. Safety valve (with safety)
4B. Safety valve (with safety)
5. Arm counterbalance valve
6. Piston
7. Spool
8. Check valve for arm regeneration circuit
9. LS shuttle valve

Function

1) Cylinder head pressure > cylinder bottom pressure

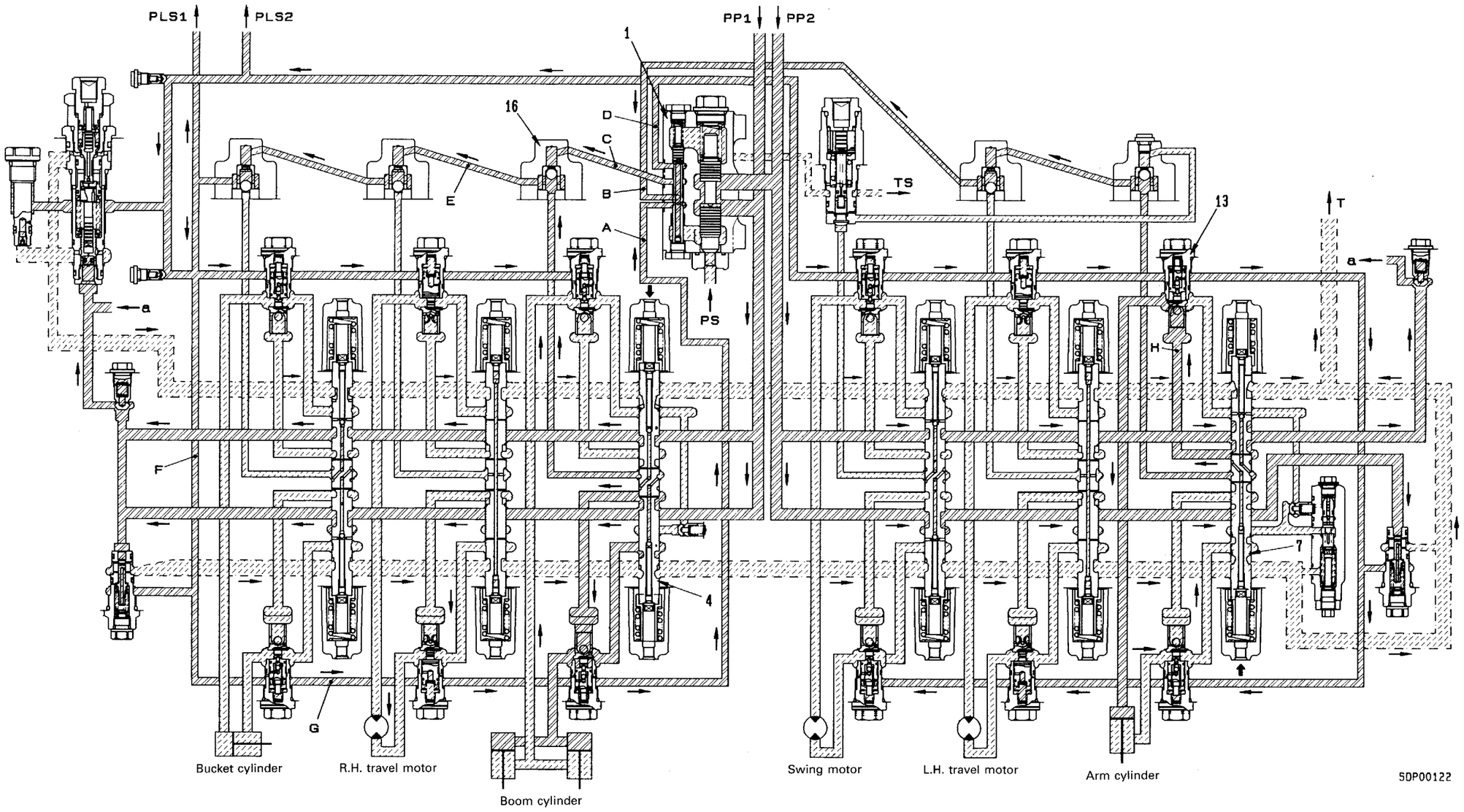
- A return flow circuit is provided from the cylinder head to the cylinder bottom so that when the arm is moved in, the flow of oil to the cylinder becomes the pump discharge amount + the return flow, and this increases the cylinder speed.

Operation

- When the cylinder head pressure > cylinder bottom pressure, the pressurized oil from the cylinder head passes through the notch in spool (2), enters port **C** and opens check valve (8), then passes through ports **D** and **E** to flow back to the cylinder bottom.

5. Boom, arm operated simultaneously

- The diagram shows simultaneous operation of the boom RAISE and arm IN.



0205C6

Operation

When condition is boom RAISE load > arm IN load

- The load pressure at the boom RAISE side is higher than the load at the arm IN side, so the LS pressure passing through the inside of boom spool (4) goes from boom LS shuttle valve (16) to ports **E, F,** and **G,** and from pump merge/divider valve (1) port **A** to port **D** and arm pressure compensation valve (13). In this way it acts to raise the set pressure of arm pressure compensation valve (13).
- Because of this, the pressure at inlet port **H** of arm pressure compensation valve (13) rises, and the spool meter-in differential pressure (pump pressure – LS pressure = LS differential pressure (**ΔPLS**)) becomes the same as at the boom side.
- In this way, the oil flow is divided proportionally according to the size of the area of opening of the spools of boom spool (4) and arm spool (7).

BRAKE VALVE

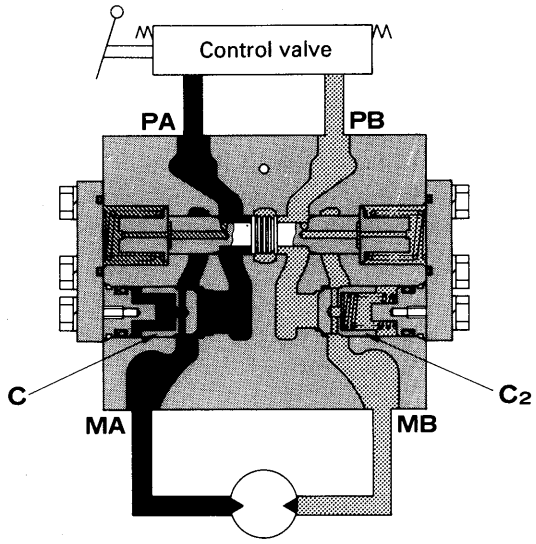
1) Counterbalance valve

Function

When driving the machine downhill, the sprocket rotates more quickly than the revolution of travel motor due to its own weight, thus tending to accelerate motors. However, with the employment of the counterbalance valve, load is applied to the motor so that the machine will travel in confirmity with the engine speed.

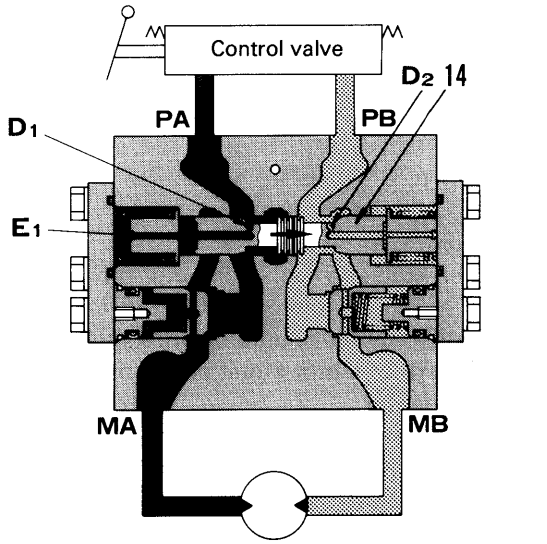
Operation

- **When oil starts flowing:**
  When the travel control lever is changed either to "F" or "R", oil from the main pump enters **PA** port via the travel control valve, and pushes check valve **C1**.
  When the hydraulic pressure applied to check valve **C1** is increased, check valve **C1** is moved and oil flows to motor outlet port **MB** via motor inlet port **MA**, and then to the opposing side of the spool. However, the outlet (**PB** port) is closed with check valve **C2**; therefore, the oil flow stops. As a result, the travel motors do not rotate. And the oil pressure is further increased, the oil pressure in chamber **E1** at the left of spool (14), increases.
  When the oil pressure is boosted to 0.72 – 0.95 MPa (7.3 – 9.7 kg/cm^2), spool (14) moves to the right, allowing the oil to flow out from **D2** of spool (14) to **PB** port. The oil finally returns to the hydraulic tank. In this way, the travel motor starts rotating.

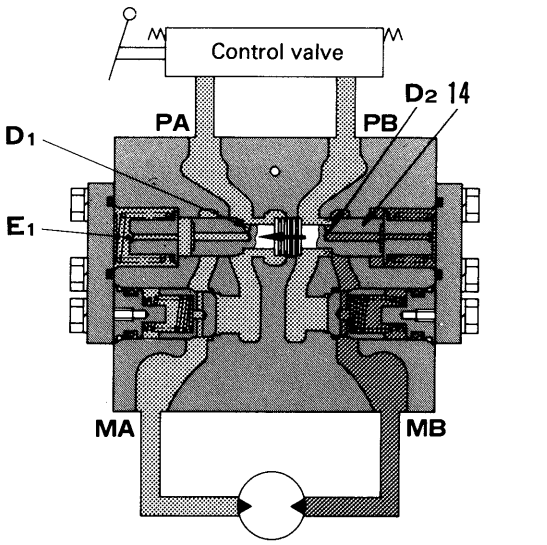


205F2041

- **When the machine is traveling downhill:**
  Due to its own weight, the travel motor rotates quickly than the revolution of motor normally with the oil. Therefore, the oil pressure on the inlet side **MA** of the motor decreases.
  When the oil pressure in chamber **E1** decreases to less than 0.72 – 0.95 MPa (7.3 – 9.7 kg/cm^2), spool (14) moves to the left, thus blocking the oil from flowing out from **D2** of spool (14). As a result, the oil pressure on the outlet side **MB** of the motor rises.
  As this oil pressure works as a resistance to the motor, the machine is prevented from traveling at a speed higher than the engine speed. As it is clear from the above, the machine cannot travel at a higher speed other than that conforms to the regulated engine speed.



205F2042



205F2043

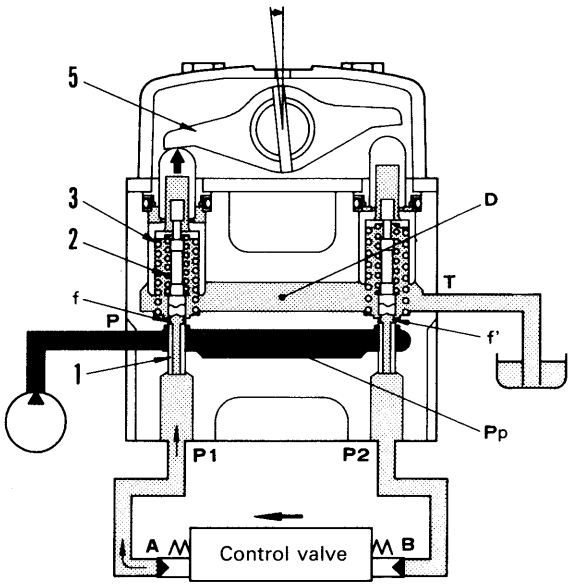
3. Fine control (control lever returned)

When disc (5) starts to be returned, spool (1) is pushed up by the force of centering spring (3) and the pressure at port **P1**.

Because of this, fine control hole **f** is connected to drain chamber **D**, and the pressurized oil at port **P1** is released.

If the pressure at port **P1** drops too much, spool (1) is pushed up by metering spring (2), so fine control hole **f** is shut off from drain chamber **D**. At almost the same time, it is connected to pump pressure chamber **PP**, so the pressure at port **P1** supplies the pump pressure until the pressure recovers to a pressure equivalent to the position of the lever.

When the control valve returns, oil in drain chamber **D** flows in from fine control hole **f'** of the valve on the side that is not moving. It passes through port **P2** and goes to chamber **B** to charge the oil. (Fig. 3)



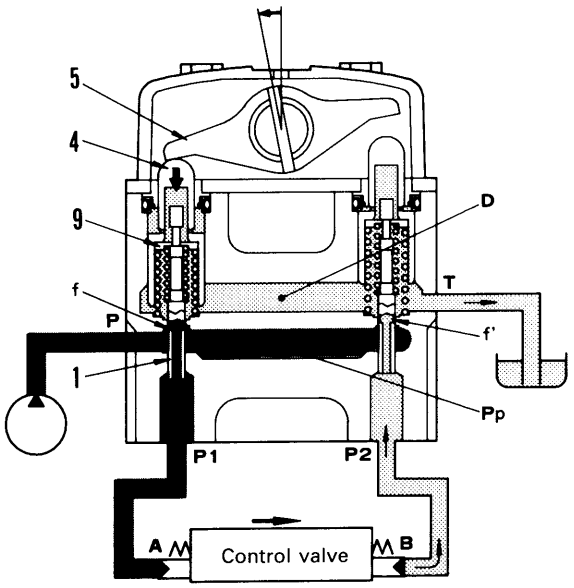
22TF01096

(Fig. 3)

0205C6

4) At full stroke

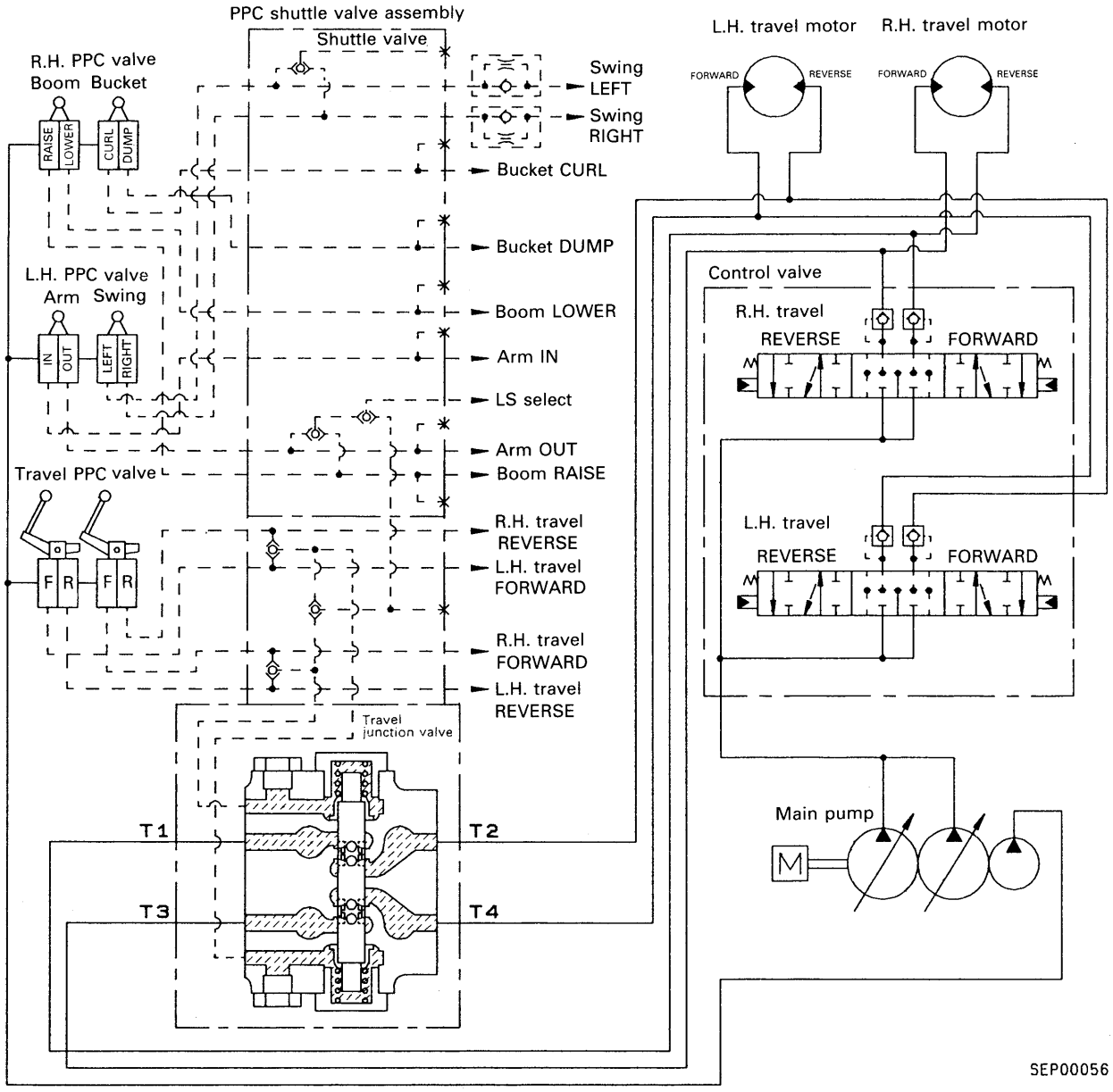
Disc (5) pushes down piston (4), and retainer (9) pushes down spool (1). Fine control hole **f** is shut off from drain chamber **D**, and is connected to pump pressure chamber **PP**. Therefore, the pilot pressure oil from the control pump passes through fine control hole **f** and flows to chamber **A** from port **P1** to push the control valve spool. The return oil from chamber **B** passes from port **P2** through fine control hole **f'** and flows to drain chamber **D**. (Fig. 4)



22TF01097

(Fig. 4)

STRAIGHT-TRAVEL SYSTEM



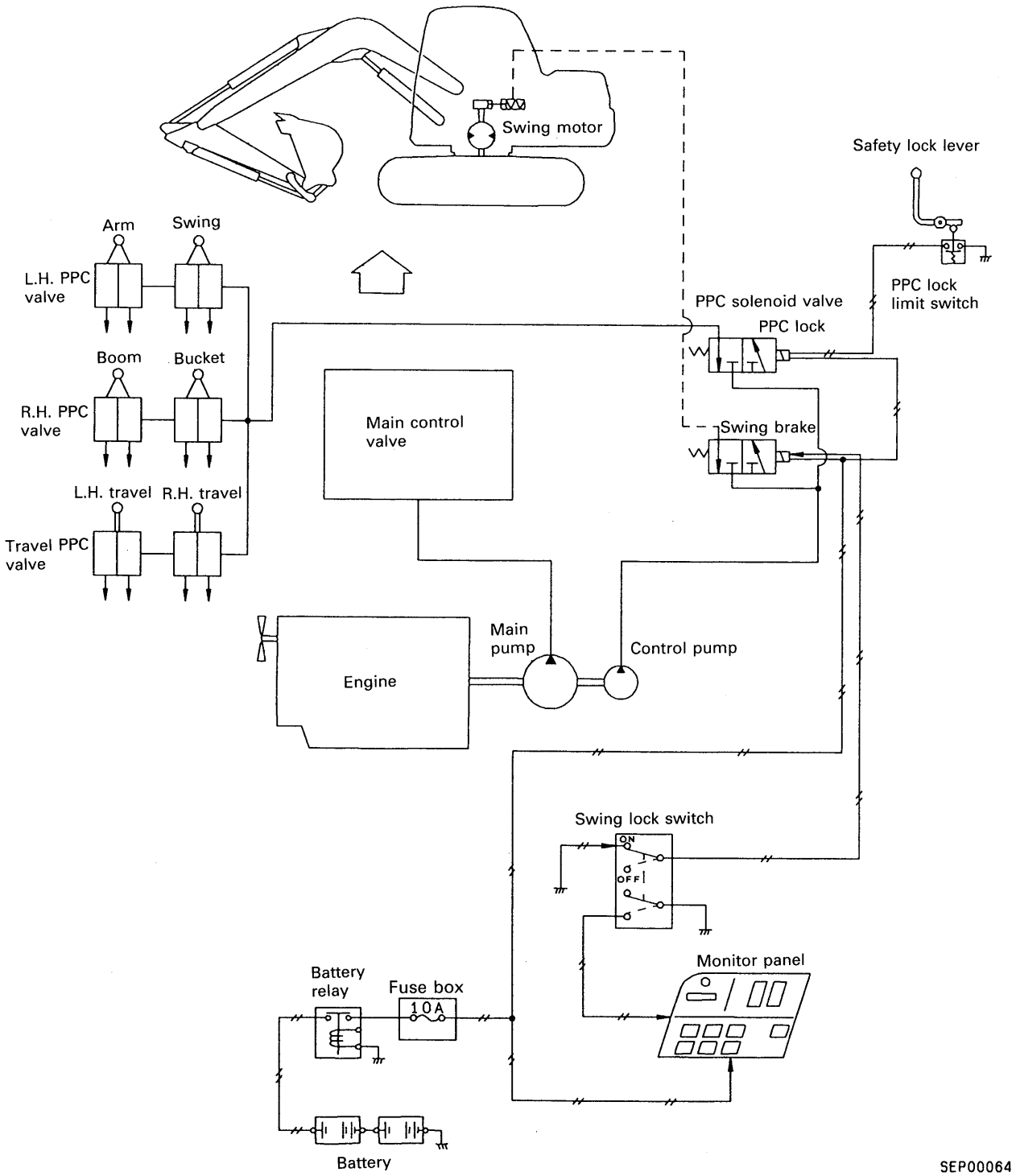
0205C6

FUNCTION

- A travel junction valve is installed between the travel valve and travel motor to compensate for any difference in the oil flow to the left and right travel circuits when traveling in a straight line.
- Because of this, the flow of oil to the left and right travel motors when traveling in a straight line is almost the same, so there is no travel deviation.
- The travel junction valve interconnects the travel circuits when the straight-travel is operated independently or when the straight travel + another actuator are operated simultaneously.
- When steering, if the difference in the movement of the travel levers is more than approx. 10 mm, the travel junction valve is switched, and the left and right travel circuits are shut off.

1. Alarm buzzer
2. Resistor
3. Fuel control lever limit switch
4. Horn switch
5. Speaker
6. Monitor panel
7. Starting switch
8. Fuse box
9. Radio
10. Wiper switch
11. Swing lock switch
12. Additional light switch
13. PPC lock switch
14. Heater
15. Lamp relay
16. Fuel level sensor
17. Working lamp
18. LS control EPC solenoid valve
19. Engine oil pressure switch
20. Washer tank
21. EPC solenoid valve
22. Travel alarm
23. Horn (high sound)
24. Horn (low sound)
25. Battery relay
26. Battery
27. Front lamp
28. R.H. additional front lamp
29. Room lamp
30. L.H. additional front lamp
31. Wiper motor
32. Alternator
33. Engine water temperature sensor
34. Electrical intake air heater
35. Heater relay
36. Starting motor
37. Air compressor magnet switch

2. SWING LOCK, PPC LOCK FUNCTION



0205C6

Machine model					PC200, PC220-6 CUSTOM	
Category	Item	Measurement conditions		Unit	Standard value	Permissible value
Hydraulic pressure	Main unload valve	• Hydraulic oil temperature: 45 – 55°C • Engine at high idling • All levers at neutral		MPa (kg/cm²)	3.73 ± 0.69 (38 ± 7)	3.73 ± 0.69 (38 ± 7)
	Sub-unload valve	• Hydraulic oil temperature: 45 – 55°C • Engine at high idling • When measuring front pump: R.H. travel rotating freely • When measuring rear pump: L.H. travel rotating freely			5.88 ± 0.98 (60 ± 10)	5.88 ± 0.98 (60 ± 10)
	Boom	• Hydraulic oil temperature: 45 – 55°C • Relief pressure with engine at high idling (Relieve only circuit to be measured) • Pump outlet port pressure ★: For travel, measure oil pressure for relief on one side			31.85 ± 0.98 (325 ± 10)	Max. 33.81 (Max. 345) Min. 30.38 (Min. 310)
	Arm					
	Bucket					
	Swing				$28.91^{+1.47}_{-0.98}$ $\left(295^{+15}_{-10}\right)$	Max. 30.87 (Max. 315) Min. 27.44 (Min. 280)
	Travel				31.87 ± 0.98	Max. 33.83 (Max. 345) Min. 30.40 (Min. 310)
	Control pump				$2.94^{+0.59}_{0}$ $\left(30^{+6}_{0}\right)$	Max. 3.53 (Max. 36) Min. 2.94 (Min. 30)
	LS differential pressure	• Hydraulic oil temperature: 45 – 55°C • Engine at high idling	Levers at neutral		2.94 ± 0.98 (30 ± 10)	2.94 ± 0.98 (30 ± 10)
			Travel speed, rotating under no load		2.16 ± 0.098 (22 ± 1)	2.16 ± 0.098 (22 ± 1)

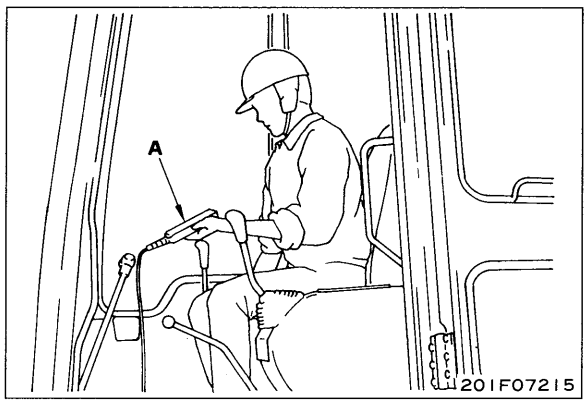
0205C6

TESTING AND ADJUSTING

0205C6

- Move the operator's seat fully to the rear, then remove the side cover.

1. Adjust the length of rod (1) so that the distance between the pins of rod (1) is dimension **a**.
   - ★ Distance **a** between rod pins: 289.6 mm
2. Adjust installed dimension of yoke (3) of cable (2) to dimension **b**.
   - ★ Installed dimension **b** of yoke: 12 mm
3. Set fuel control lever (4) to the low idling position, then adjust the installed dimension of cable (2) to dimensions **c** and **f**.
   - ★ Installed dimension **c** of cable: 239.8 mm
   - Installed dimension **f** of cable: 205 mm
4. After installing cable (2), adjust thread **Q** to adjust the engine low idling speed.
   - ★ Use tool **A** to carry out the above adjustment. For details, see MEASURING ENGINE SPEED.
   - ★ Engine low idling speed: 970 (±50) rpm
5. Set fuel control lever (4) to the STOP position, check that governor lever (5) is at the STOP position, then adjust as follows.
   - ★ Adjust stopper bolt (6) so that the clearance is 0 between fuel control lever (4) and stopper bolt (6) at the STOP end.
   - ★ Standard dimension **d** of stopper bolt: 12 mm
   - ★ After adjusting, tighten the locknut of the stopper bolt securely.
6. Set fuel control lever (4) to the high idling position, check that governor lever (5) is at the high idling position, then adjust as follows.
   - Adjust stopper bolt (7) so that the clearance is 0 between fuel control lever (4) and stopper bolt (7) at the high idling end.
   - ★ Standard dimension **e** of stopper bolt: 18 mm
   - ★ After adjusting, tighten the locknut of the stopper bolt securely.
7. Move fuel control lever (4) from low idling position to the high idling position, and secure fuel control lever (4) at the position where the engine speed becomes the specified speed.
   - ★ Use tool **A** to carry out the above adjustment. For details, see MEASURING ENGINE SPEED.
   - ★ Specified speed: 1450 (±100) rpm
8. Loosen bolt (8), move bracket (10) until limit switch (9) comes ON, then tighten bolt (8).
   - ★ Secure the bracket in position at the point where limit switch (9) changes from OFF to ON.



0205C6

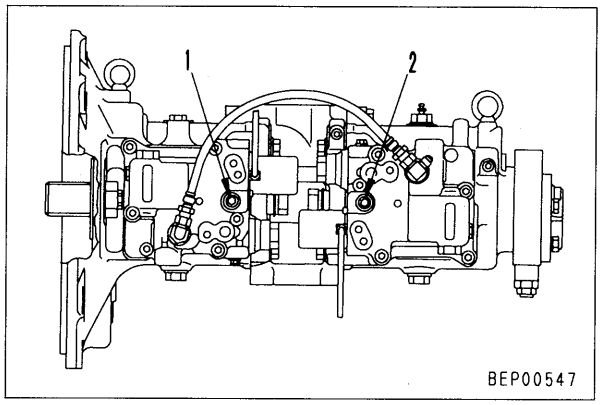
TESTING AND ADJUSTING LS VALVE OUTPUT PRESSURE (SERVO PISTON INPUT PRESSURE) AND LS DIFFERENTIAL PRESSURE

PC200, 200LC-6 Serial No.: 86942 and up
PC220, 220LC-6 Serial No.: 50704 and up

★ Hydraulic oil temperature when measuring: 45 – 55°C

MEASURING

1. Measuring LS valve output pressure (servo piston input pressure)
   1) Remove pressure measurement plugs (1), (2), (3), and (4) (Thread dia. = 10 mm, Pitch = 1.5 mm), and install oil pressure gauge **C1**.
      ★ Install a 39.2 MPa (400 kg/cm²) gauge to the servo valve end, and a 58.8 MPa (600 kg/cm²) gauge to the pump outlet port end.
   - Oil pressure when travel is rotating under no load on one side
      i) Use the work equipment to raise the track assembly on one side.
      ii) Measure the oil pressure with the engine at high idling and the travel lever operated to the end of its stroke to rotate the track under no load.



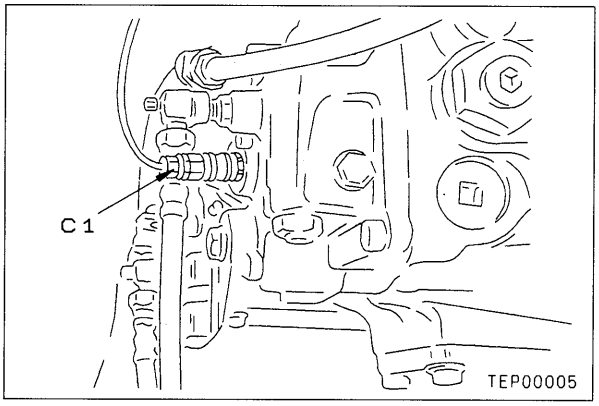
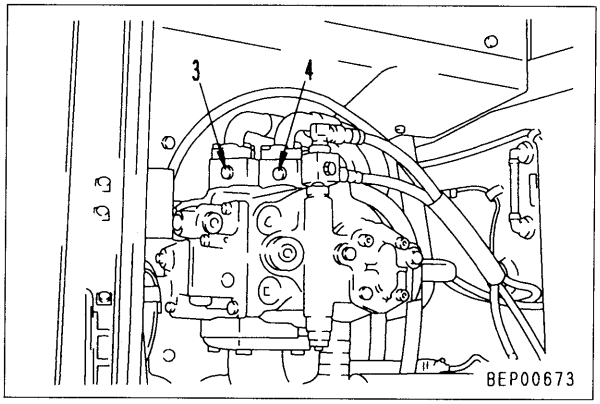
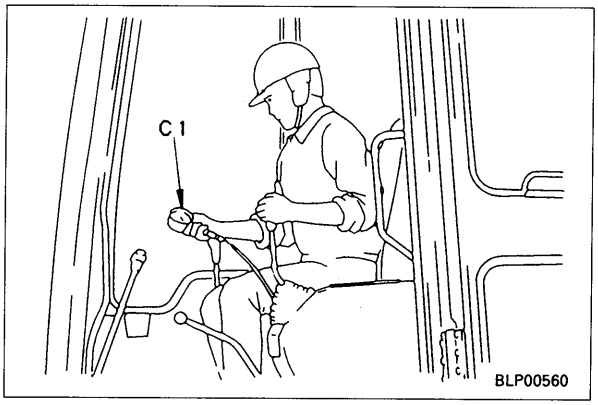
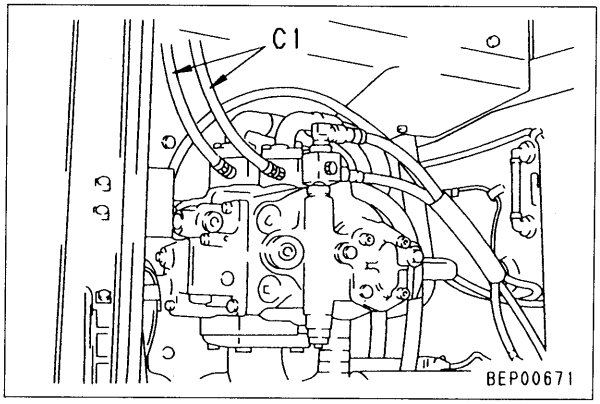


Table 1

Travel lever	Pump pressure (MPa (kg/cm²))	Servo piston inlet port pressure (MPa (kg/cm²))	Remarks
Neutral	3.72 ± 0.69 (38 ± 7)	3.72 ± 0.69 (38 ± 7)	About same pressure
Full	8.82 ± 1.96 (90 ± 20)	4.41 ± 0.98 (45 ± 10)	About 1/2 of pressure



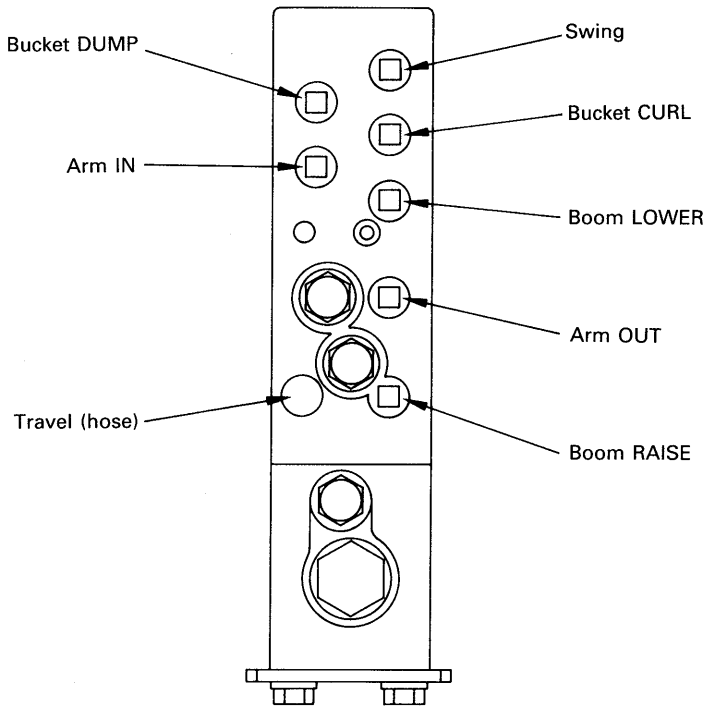




0205C6

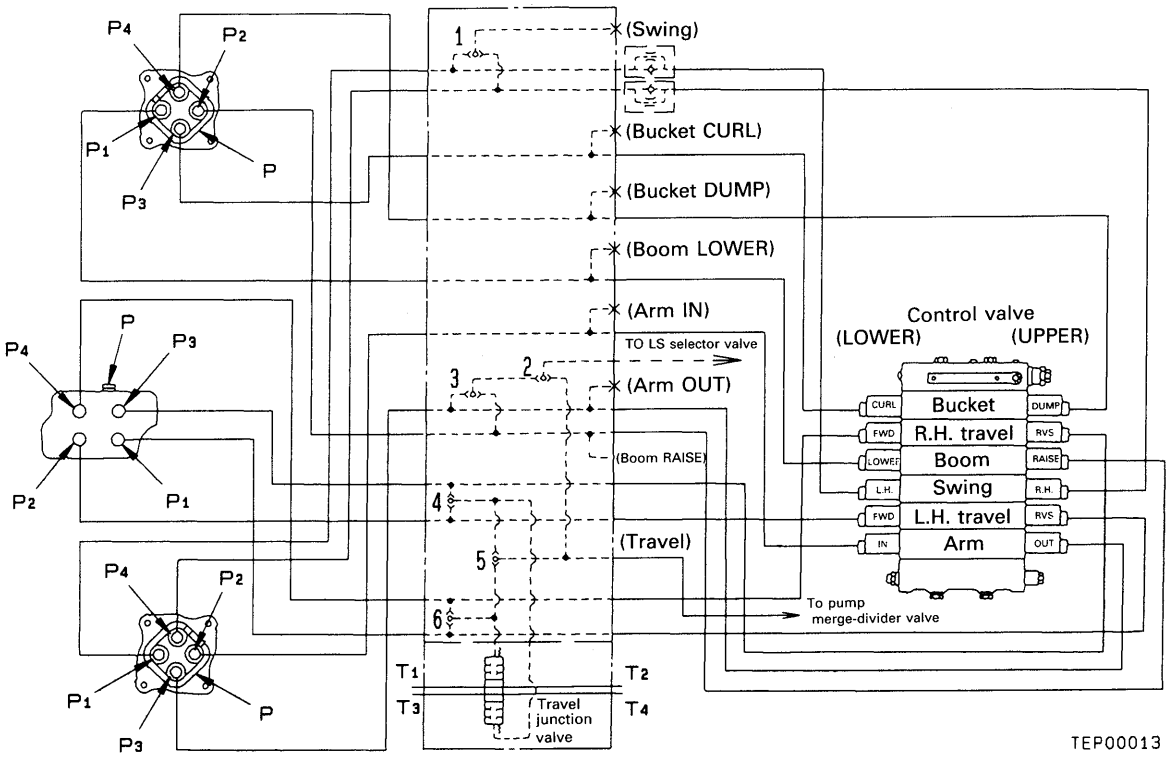
Plug location diagram

★ PPC shuttle block seen from rear of machine



205FC06205

0205C6



TEP00013

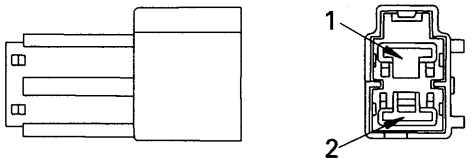
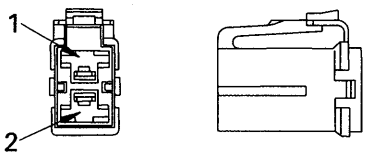
TROUBLESHOOTING

0205C6

CHECKS BEFORE TROUBLESHOOTING

	Item	Judgement standard	Remedy
Lubricating oil, cooling water	1. Check fuel level	–	Add fuel
	2. Check for dirt or water in fuel	–	Clean, drain
	3. Check hydraulic oil level	–	Add oil
	4. Check hydraulic oil strainer	–	Clean, drain
	5. Check swing machinery oil level	–	Add oil
	6. Check engine oil level (Level of oil in oil pan)	–	Add oil
	7. Check cooling water level	–	Add water
	8. Check condition of dust indicator	–	Clean or replace
	9. Check hydraulic oil filter		Replace
Electrical equipments	1. Check for loose or corroded battery terminals	–	Tighten or replace
	2. Check for loose or corroded alternator terminals	–	Tighten or replace
	3. Check for loose or corroded straight motor terminals	–	Tighten or replace
Hydraulic, mechanical equipments	1. Check for abnormal noise or smell	–	Repair
	2. Check for oil leakage	–	Repair
	3. Bleed air from system	–	Bleed air
Electrical components	1. Check battery voltage (engine stopped)	20 – 30 V	Replace
	2. Check level of battery electrolyte	–	Add or replace
	3. Check for discolored, burnt, or bare wiring	–	Replace
	4. Check for missing wiring clamps, hanging wires	–	Repair
	5. Checks for getting wet onto wiring (check carefully getting wet at connectors and terminals)	–	Disconnect connector and dry connection
	6. Check for broken or corroded fuses	–	Replace
	7. Check alternator voltage (engine running at over half throttle)	27.5 – 29.6 V	Replace
	8. Noise when battery relay is operated (switch starting switch from ON to OFF)	–	Replace

0205C6

No. of pins	L type type connector	
	Male (female housing)	Female (male housing)
2	 TEW00257	 TEW00258

0205C6

S-1 Starting performance is poor (starting always takes time)

★ General causes why exhaust smoke comes out but engine takes time to start
- Defective electrical system
- Insufficient supply of fuel
- Insufficient intake of air
- Improper selection of fuel
  (At ambient temperature of 10°C or below, use ASTM D975 No. 1)

★ Battery charging rate

Ambient temperature \ Charging rate	100%	90%	80%	75%	70%
20°C	1.28	1.26	1.24	1.23	1.22
0°C	1.29	1.27	1.25	1.24	1.23
−10°C	1.30	1.28	1.26	1.25	1.24

- The specific gravity should exceed the value for the charging rate of 70% in the above table.
- In cold areas the specific gravity must exceed the value for the charging rate of 75% in the above table.

Legend
○ : Possible causes (judging from Questions and check items)
◎ : Most probable causes (judging from Questions and Check items)
△ : Possible causes due to length of use (used for a long period)
● : Items to confirm the cause

			Causes: Worn piston ring, cylinder	Defective contact of valve, valve seat	Clogged air cleaner element	Clogged fuel filter, strainer	Clogged feed pump strainer	Starting aid	Defective regulator	Electrical	Defective alternator	Defective or deteriorated battery	Defective injection nozzle	Defective injection timing	Leakage, clogging, pump (rack, plunger stuck)	Clogged air breather hole in fuel tank cap	Clogged fuel piping
Questions	Confirm recent repair history																
	Degree of use of machine	Operated for long period			△	△	△			△							
	Ease of starting	Gradually became worse	◎	◎	○	○	○										
		Starts when warm					◎		◎								
	Indicator lamp does not light up						◎										
	Engine oil must be added more frequently		◎														
	Replacement of filters has not been carried out according to Operation Manual				◎	◎	◎				○		○				
	Dust indicator is red				◎												
	Non-specified fuel is being used					○	○				○		○				
Check items	Battery charge lamp is ON							◎	◎								
	Starting motor cranks engine slowly									◎							
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low										◎						
	Engine does not pick up smoothly, and combustion is irregular		○	○							◎						
	Blow-by gas is excessive		◎														
	Match marks on fuel injection pump are out of alignment											◎					
	Mud is stuck to fuel tank cap															○	
	When engine is cranked with starting motor, 1) Little fuel comes out even when injection pump sleeve nut is loosened												◎				
	2) Little fuel comes out even when fuel filter air bleed plug is loosened				◎	◎							◎				
	Leakage from fuel piping												○	◎			
	There is hunting from engine (rotation is irregular)				○	○									◎	○	
Troubleshooting	When compression pressure is measured, it is found to be low		●	●													
	When air cleaner element is inspected directly, it is found to be clogged				●												
	When fuel filter, strainer are inspected directly, they are found to be clogged					●										●	
	When feed pump strainer is inspected directly, it is found to be clogged						●										
	Heater mount does not become warm							●									
	Is voltage 26 – 30V between alternator terminal R and terminal E with engine at low idling?	Yes ※							●								
		No								●							
	Either specific gravity of electrolyte or voltage of battery is low										●						
	Speed does not change when operation of certain cylinders is stopped											●					
	When check is made using delivery method, injection timing is found to be incorrect												●				
	When control rack is pushed, it is found to be heavy or does not return (when blind cover at rear of pump is removed, it can be seen that plunger control sleeve does not move)													●			
	When fuel cap is inspected directly, it is found to be clogged																●
		Remedy	Replace	Correct	Clean	Clean	Replace	Replace	Replace	Replace	Replace	Adjust	Replace	Correct	Clean		

※ It is not permitted to replace only the regulator.

0205C6

S-9 Oil becomes contaminated quickly

General causes why oil becomes contaminated quickly

- Intake of exhaust gas due to internal wear
- Clogging of lubrication passage
- Improper fuel
- Improper oil used
- Operation under excessive load

Legend
◯ : Possible causes (judging from Questions and check items)
◎ : Most probable causes (judging from Questions and Check items)
△ : Possible causes due to length of use (used for a long period)
● : Items to confirm the cause.

			Causes: Worn piston ring, cylinder liner	Clogged breather, breather hose	Clogged oil filter	Worn valve, valve guide	Clogged oil cooler	Clogged turbocharger drain pipe	Defective seal at turbocharger turbine end	Defective safety valve	Exhaust smoke is black
Questions	Confirm recent repair history										
	Degree of use of machine	Operated for long period	△			△			△		
	Engine oil must be added more frequently		◎								
	Non-specified oil is being used				◯						
Check items	Color of exhaust gas	Blue under light load	◎								
		Black									◎
	Amount of blow-by gas	Excessive	◎			◯		◯	◯		
		None		◎							
	When oil filter is inspected, metal particles are found		◯		◎	◯					
	When exhaust pipe is removed, inside is found to be dirty with oil					◎					
	Engine oil temperature rises quickly						◎				
Troubleshooting	When compression pressure is measured, it is found to be low		●			●					
	When breather element is inspected directly, hose is broken or is found to be clogged with dirty oil			●							
	When oil filter is inspected directly, it is found to be clogged				●						
	When oil cooler is inspected directly, it is found to be clogged						●				
	Turbocharger drain tube is clogged							●			
	Excessive play of turbocharger shaft								●		
	When safety valve is directly inspected, spring is found to be catching or broken									●	
											Carry out troubleshooting for "Exhaust smoke is black".
	Remedy		Replace	Clean	Replace	Replace	Clean	Clean	Replace	Replace	—

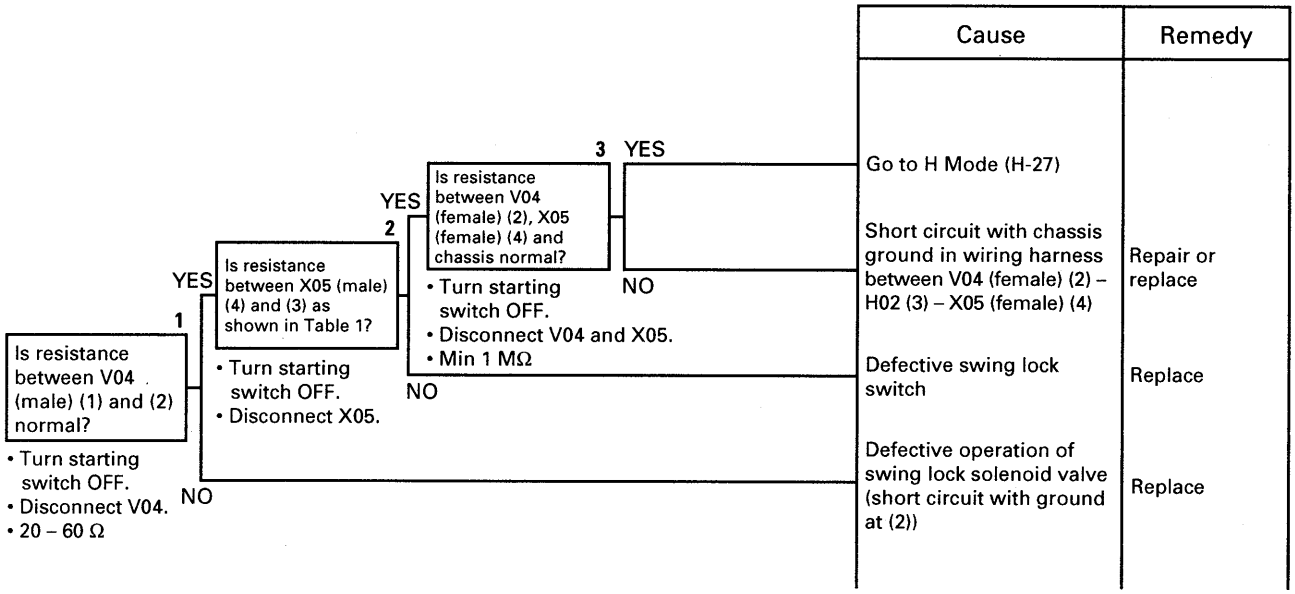
0205C6

TVC solenoid (※ ※)	Swing holding brake solenoid	PPC oil pressure lock solenoid	Troubleshooting code for Hydraulic and Mechanical system when Electrical system (E Mode) is normal.
1. Insert T-adapter into TVC solenoid connector (C13). 2. Turn starting switch ON. 3. Is voltage between C13 (1) and chassis as shown in table below?	1. Insert T-adapter into swing holding brake solenoid connector (V04). 2. Turn starting switch ON. 3. Is voltage between V04 (1) and (2) as shown in table below?	1. Insert T-adapter into PPC oil pressure lock solenoid connector (V07). 2. Turn starting switch ON. 3. Is voltage between V07 (1) and (2) as shown in table below?	
(Normal) Fuel control lever: At low idling — Voltage measurement: 20 – 30 V Fuel control lever: At high idling — Voltage measurement: 10 – 19 V	(Normal) Swing lock switch: OFF — Voltage measurement: 20 – 30 V Swing lock switch: ON — Voltage measurement: 0 V	(Normal) Safety lock lever: FREE — Voltage measurement: 20 – 30 V Safety lock lever: LOCK — Voltage measurement: 0 V	
○			H-1
○			H-2
		○	H-3
			H-4
			H-5
			H-6
			H-7
			H-8
			H-9
			H-10
			H-11
			H-12
			H-13
			H-14
			H-15
			H-16
			H-17
			H-18
			H-19
			H-20
	○		H-21
			H-22
			H-23
			H-24
			H-25
	○		H-26
E-2	E-3	E-4	

※ ※ PC200, 200LC-6 Serial No.: 83942 and up
PC220, 220LC-6 Serial No.: 50704 and up

0205C6

b) Remains actuated (swing cannot be locked)



0205C6

Table 1

Swing lock switch	Resistance value
OFF	Max. 1 Ω
LOCK	Min. 1 MΩ

E-3-b) Related electrical circuit diagram

★ See E-3-a) Related electrical circuit diagram.

Cause	Remedy
Defective adjustment of TCC (TVC) valve	Adjust
Defective servo assembly (Defective TVC valve)	Repair or replace
Defective piston pump	Repair or replace
Defective servo assembly	Repair or replace
Defective piston pump (servo piston)	Correct or replace
※ Defective operation of LS-EPC solenoid valve	Replace
Defective operation of LS relief, main unload valve assembly	Replace
Defective operation of sub-unload valve	Correct or replace
Defective hydraulic equipment in control pump circuit (For details, see TESTING AND ADJUSTING.)	Adjust or replace

0205C6

H-15 In swing + arm OUT, arm OUT is slow

★ See H-14.

(If the operation is normal when the swing and arm OUT are operated independently
If troubleshooting Item 1 shows that there is defective operation of the arm OUT (operated slightly) and the LS shuttle valve (in the Cause column), the cause is in the arm OUT and the LS select shuttle valve.)

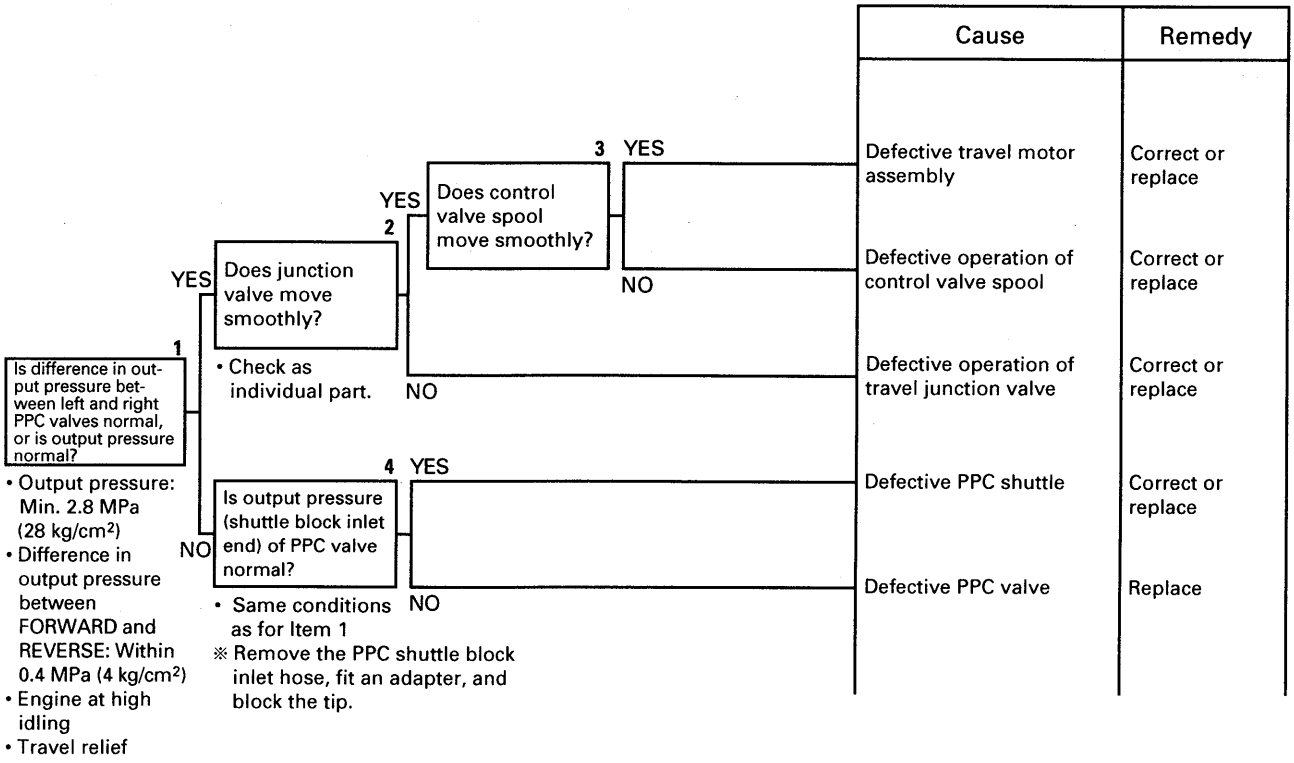
H-16 In swing + travel, travel speed drops excessively

★ See H-14.

(If the operation is normal when the swing and travel are operated independently.
If troubleshooting Item 1 shows that there is defective operation of the travel (operated slightly) and the LS shuttle valve (in the Cause column), the cause is in the LS select shuttle valve.)

H-17 Travel deviation (excessive during normal travel, when starting)

a) When there is deviation in normal travel



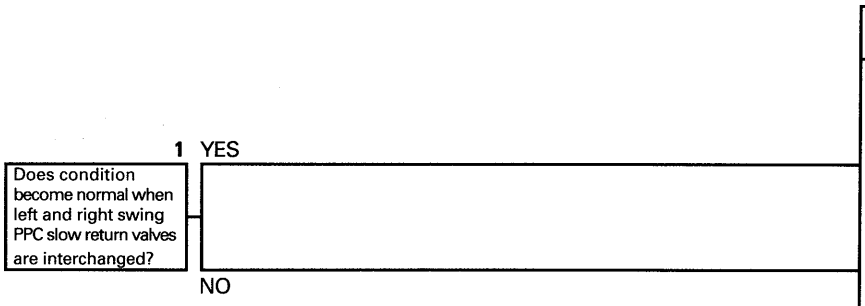
0205C6

※ If the adapter for blocking the circuit is not available, interchange the travel PPC hoses with the PPC hoses for the bucket (CURL, DUMP), boom (LOWER), or arm (IN) at both the inlet and outlet ports of the shuttle block, and check the operation.

b) Excessive travel deviation when starting

Cause	Remedy
Defective operation of travel counterbalance valve	Correct or replace
Clogging of throttle inside servo of front or rear pump	Correct or replace

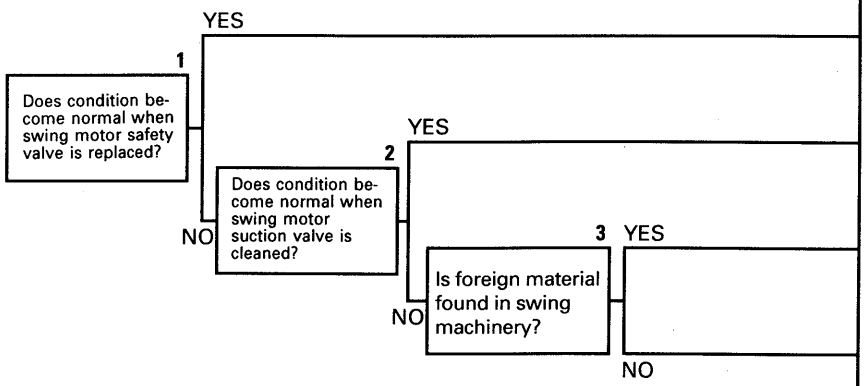
H-24 Excessive shock when stopping swing (one direction only)



Cause	Remedy
Defective swing PPC slow return valve (check valve)	Correct or replace
Defective PPC valve	Replace

0205C6

H-25 Excessive abnormal noise when stopping swing

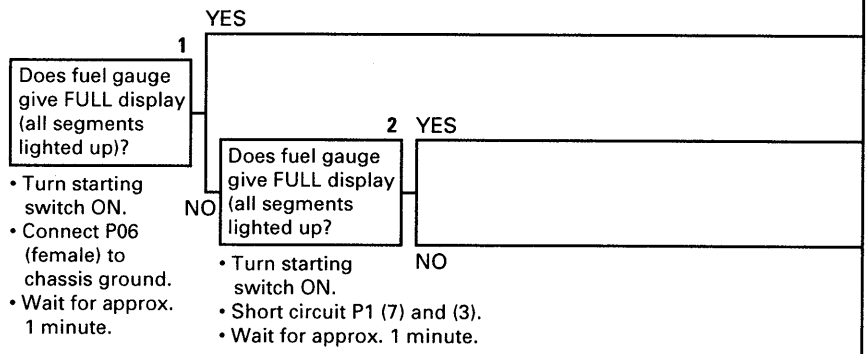


Cause	Remedy
Defective swing motor safety valve	Replace
Defective swing motor suction valve	Replace
Defective swing machinery	Repair or replace
Defective back pressure valve	Repair or replace

M-11 Abnormality in fuel gauge

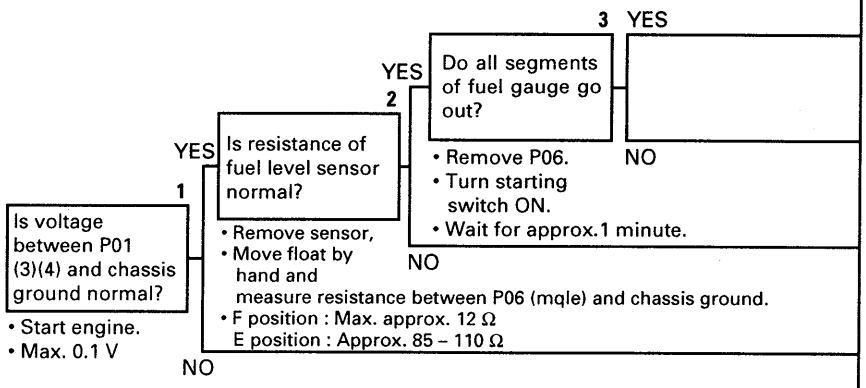
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

a) all fuel gauge segments go out



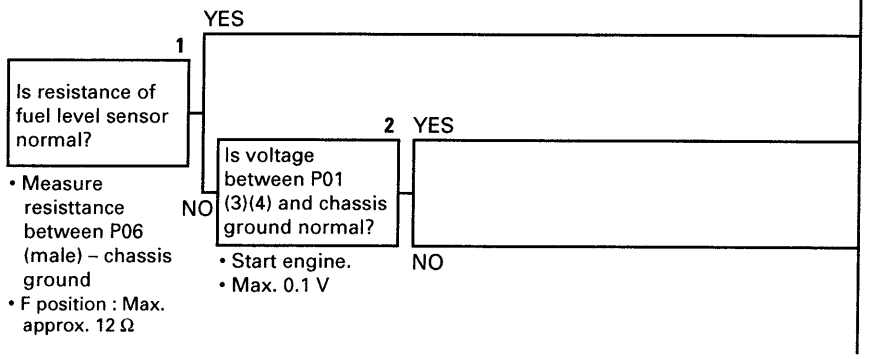
Cause	Remedy
Defective fuel level sensor (failure in disconnection mode)	Replace
Defective contact or disconnection in wiring harness between P01 (female) (7) – H06 (6) –P06 (female) (1)	Repair or replace
Defective monitor panel	Replace

b) Even when fuel level goes down, fuel gauge continues to show FULL



Cause	Remedy
Defective monitor panel	Replace
Contact chassis ground with wiring harness between P01 (female) (7) – H06 (6) – P6 (female) (1)	Repair or replace
Defective fuel level sensor	Replace
Defective contact or disconnection in wiring harness between P01 (female) (3)(4) – H03 (11) – chassis ground	After inspection, repair

c) Even when tank is filled, fuel gauge does not show FULL



Cause	Remedy
Defective monitor panel	Replace
Defective contact or disconnection in wiring harness between P01 (female) (3)(4) – H03 (11) – chassis ground	After inspection, repair
Defective fuel level sensor	Replace

0205C6

PRECAUTIONS WHEN CARRYING OUT OPERATION

[When carrying out removal or installation (disassembly or assembly) of units, be sure to follow the general precautions given below when carrying out the operation.]

1. Precautions when carrying out removal work

- If the coolant contains antifreeze, dispose of it correctly.
- After disconnecting hoses or tubes, cover them or fit blind plugs to prevent dirt or dust from entering.
- When draining oil, prepare a container of adequate size to catch the oil.
- Confirm the match marks showing the installation position, and make match marks in the necessary places before removal to prevent any mistake when assembling.
- To prevent any excessive force from being applied to the wiring, always hold the connectors when disconnecting the connectors.
- Fit wires and hoses with tags to show their installation position to prevent any mistake when installing.
- Check the number and thickness of the shims, and keep in a safe place.
- When raising components, be sure to use lifting equipment of ample strength.
- When using forcing screws to remove any components, tighten the forcing screws alternately.
- Befor removing any unit, clean the surrounding area and fit a cover to prevent any dust or dirt from entering after removal.

★ **Precautions when handling piping during disassembling**

Fit the following blind plugs into the piping after disconnecting it during disassembly operations.

1) Hoses and tubes using sleeve nuts

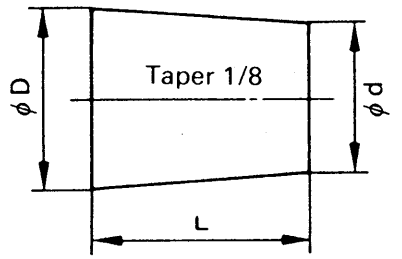
Nominal number	Plug (nut end)	Sleeve nut (elbow end) Use the two items below as a set
02	07376-50210	07221-20210 (Nut), 07222-00210 (Plug)
03	07376-50315	07221-20315 (Nut), 07222-00312 (Plug)
04	07376-50422	07221-20422 (Nut), 07222-00414 (Plug)
05	07376-50522	07221-20522 (Nut), 07222-00515 (Plug)
06	07376-50628	07221-20628 (Nut), 07222-00616 (Plug)
10	07376-51034	07221-21034 (Nut), 07222-01018 (Plug)
12	07376-51234	07221-21234 (Nut), 07222-01219 (Plug)

2) Split flange type hoses and tubes

Nominal number	Flange (hose end)	Sleeve head (tube end)	Split flange
04	07379-00400	07378-10400	07371-30400
05	07379-00500	07378-10500	07371-30500

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

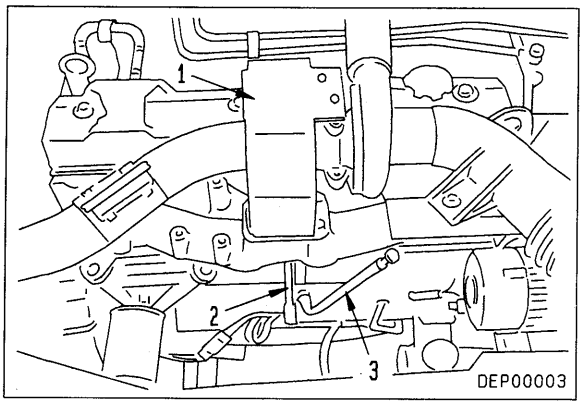


202F2001

0205C6

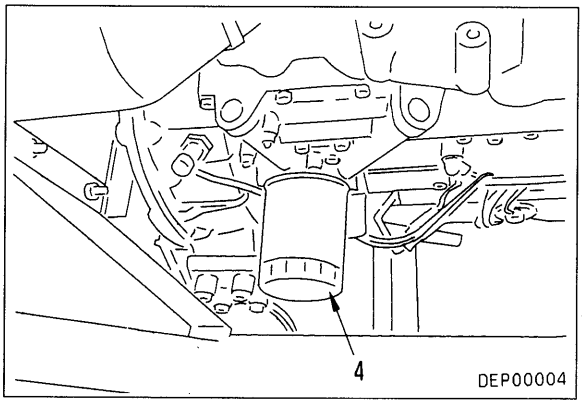
REMOVAL OF ENGINE OIL COOLER CORE ASSEMBLY

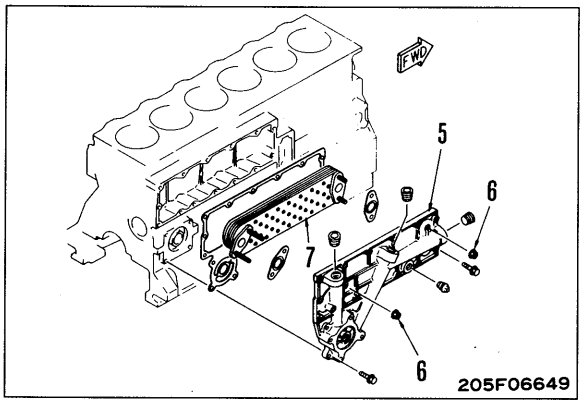
1. Open engine hood and remove turbocharger heat insulation cover (1).
2. Disconnect turbocharger lubrication inlet tube (2) and oil level detection pipe (3).
3. Remove oil filter (4).
4. Remove oil cooler and cover assembly (5).
5. Remove nut (6) from oil cooler and cover assembly (5), then remove cooler core (7).



INSTALLATION OF ENGINE OIL COOLER CORE ASSEMBLY

- Carry out installation in the reverse order to removal.





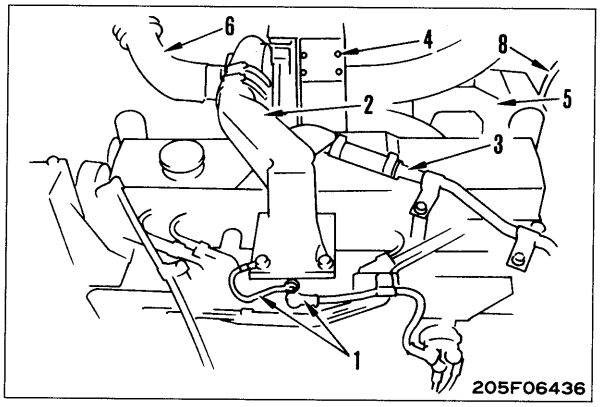
0205C6

REMOVAL OF CYLINDER HEAD ASSEMBLY

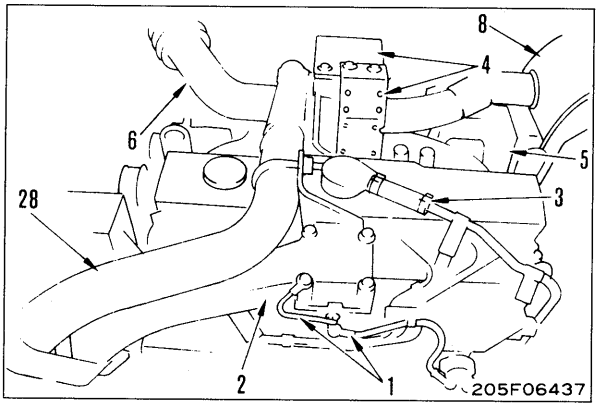
⚠ Disconnect the cable from the negative (−) terminal of the battery.

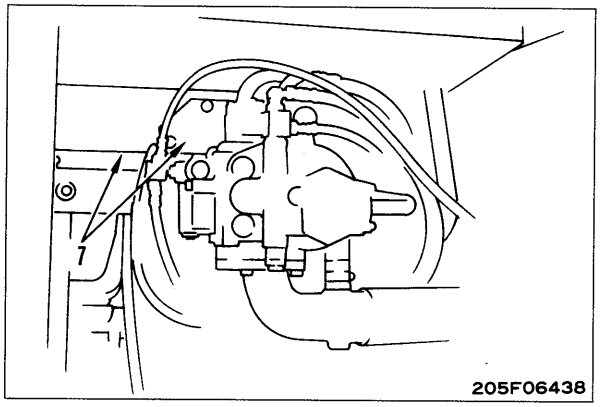
1. Remove water pump assembly. For details, see REMOVAL OF WATER PUMP ASSEMBLY.
2. Remove pipe (28) between turbocharger and aftercooler (PC220-6), remove heater relay wiring (1), then remove intake connector (2).
3. Remove blow-by hose (3) and turbocharger heat insulation cover (4), and oil filter cover (5), then remove intake connector (6).
4. Open side cover at main pump end, remove partition plate (7), then remove mounting bolts of bracket of exhaust muffler assembly (8) to make it possible to move exhaust muffler assembly (8).
5. Remove turbocharger lubrication inlet tube (9) and return tube (10).
   - ★ When removing the mounting bolts on the inside of the lubrication return tube, first remove head cover (11). ※1
   - ★ After removing the bolts, fit head cover (11) again temporarily to prevent the entry of dirt and dust.
6. Remove mounting nut of tube (12) of exhaust muffler assembly (8), move exhaust muffler assembly to side together with tube, then disconnect from turbocharger.
7. Remove engine oil level gauge pipe (13), then remove turbocharger and exhaust manifold assembly (14). ※2
8. Remove fuel control cable (15) and 2 hoses (16) between fuel injection pump and filter.

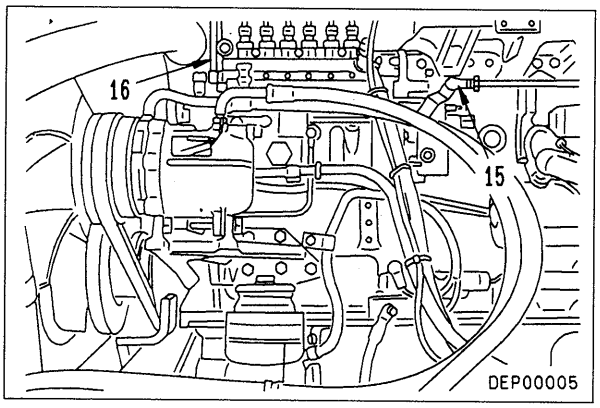
PC200-6

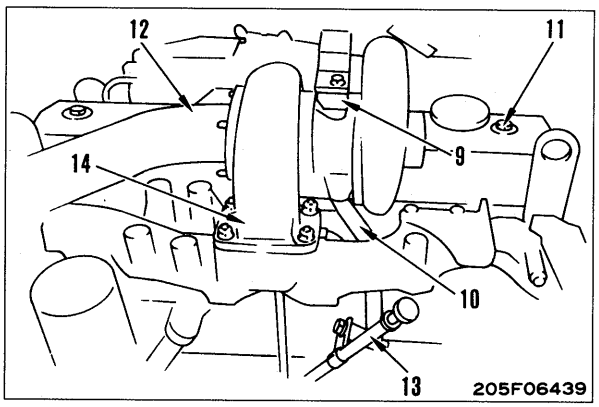


PC220-6





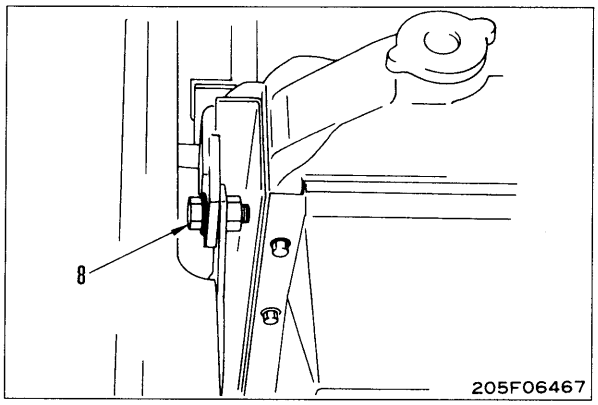


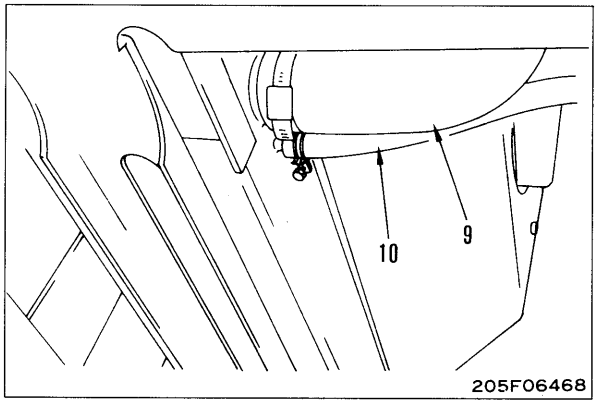


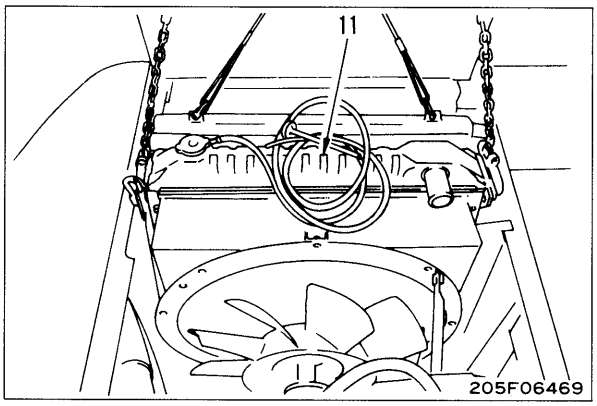
0205C6

7. Disconnect radiator lower hose (9) and heater hose (10), and remove 4 radiator mounting bolts.
   ★ The radiator lower hose is fixed by a clamp to the radiator, so always disconnect the clamp.

8. Sling radiator and hydraulic oil cooler assembly (11), remove 4 bottom mounting bolts, then lift off radiator and hydraulic oil cooler assembly.
   ★ When raising the radiator and hydraulic oil coller assembly, check the position carefully and do not let it hit the fan when removing it.
   kg Radiator · hydraulic oil cooler assembly: 125 kg.







INSTALLATION OF RADIATOR · HYDRAULIC OIL COOLER ASSEMBLY

PC220-6

- Carry out installation in the reverse order to removal.

- Refilling with water
  ★ Add water through the water filler to the specified level. Run the engine to circulate the water through the system. Then check the water level again.

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

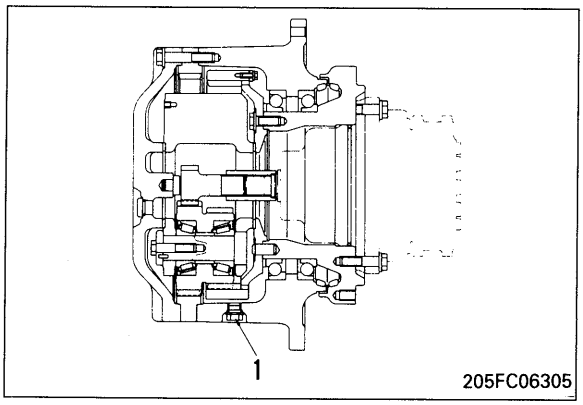
0205C6

DISASSEMBLY OF FINAL DRIVE ASSEMBLY

1. Draining oil

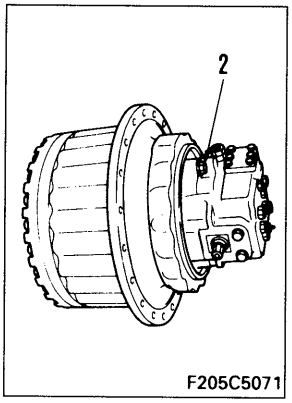
Remove drain plug (1) and drain oil from final drive case.

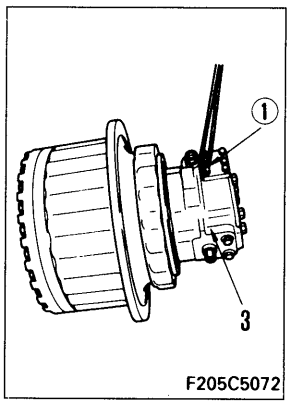
Final drive case: Approx. 3.7 ℓ



2. Travel motor assembly

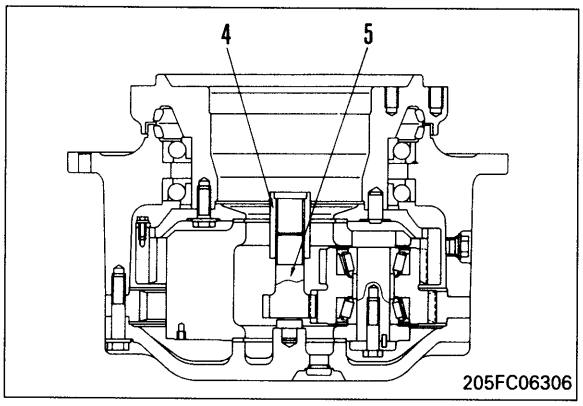
1) Remove 2 mounting bolts (2).
2) Remove travel motor assembly (3), by using eyebolts ①.





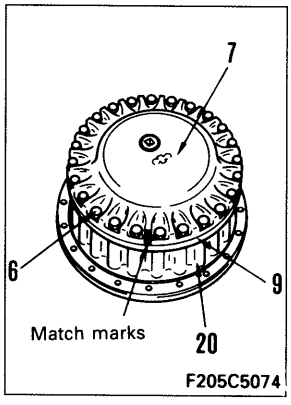
3. Coupling, sun gear

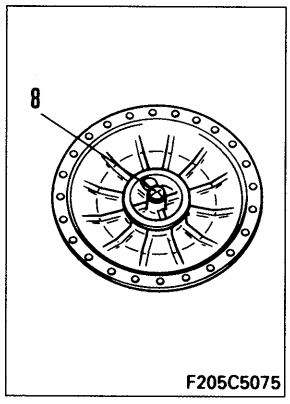
1) Remove coupling (4).
2) Remove sun gear (5).



4. Cover

1) Make match marks on cover (7), ring gear (9) and hub (20).
2) Remove mounting bolt (6) and then remove cover (7).
3) Remove button (8) from cover.

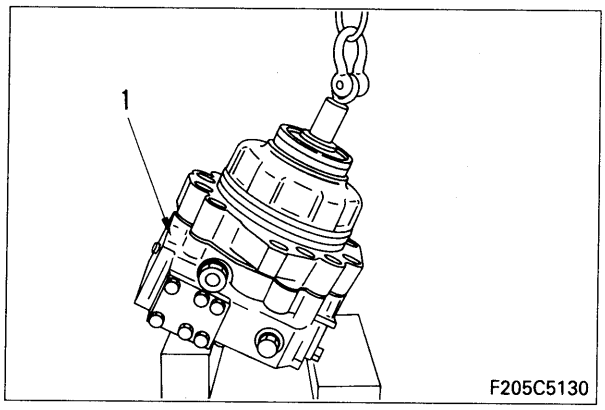




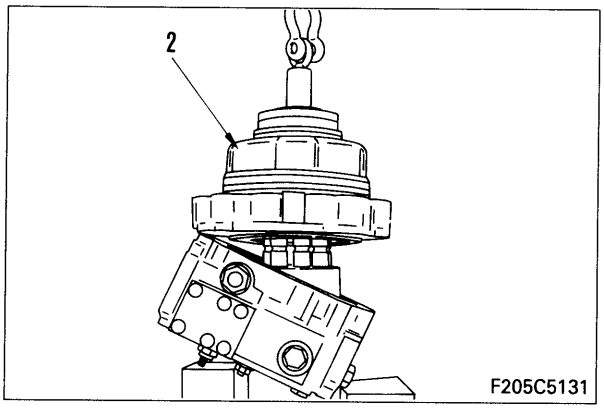
0205C6

DISASSEMBLY OF TRAVEL MOTOR ASSEMBLY

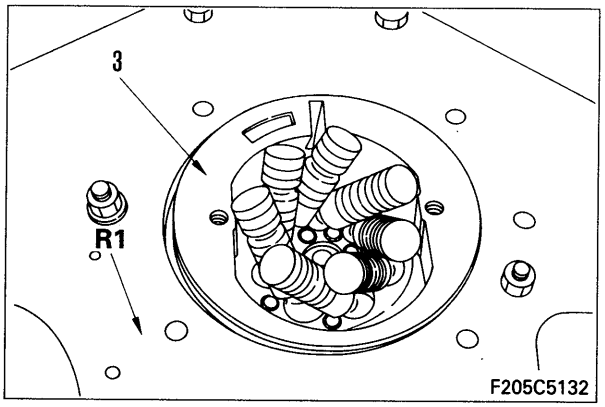
- **Preparatory work**
  Using a block, set the swing motor assembly (1) at an angle of 25°.



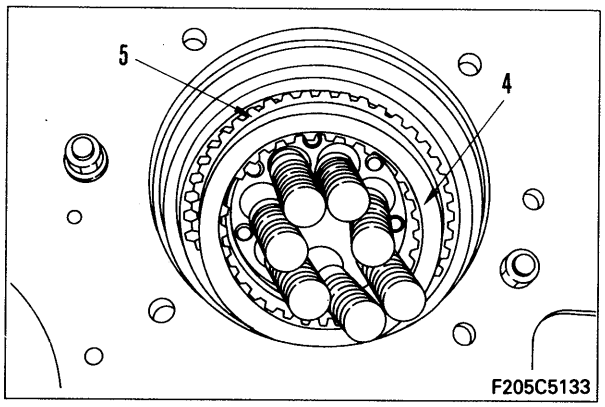
1. **Brake case assembly**
   Using eye bolt (Dia. 10 mm, Pitch 1.5 mm), lift off brake case assembly (2).



2. **Brake piston**
   Set brake case assembly on unit repair stand **R1**, then remove brake piston (3).



3. **Disc, plate**
   Remove disc (4) and plate (5).

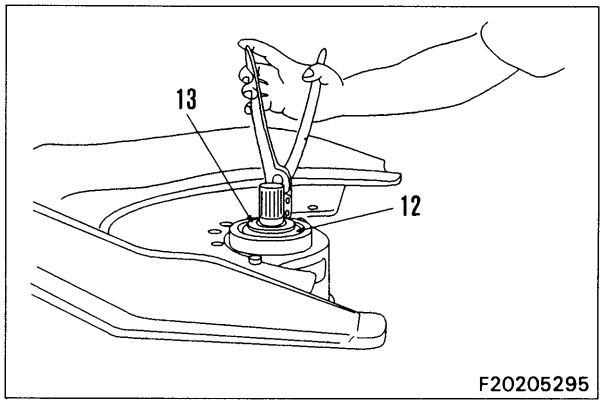


0205C6

5. Cover

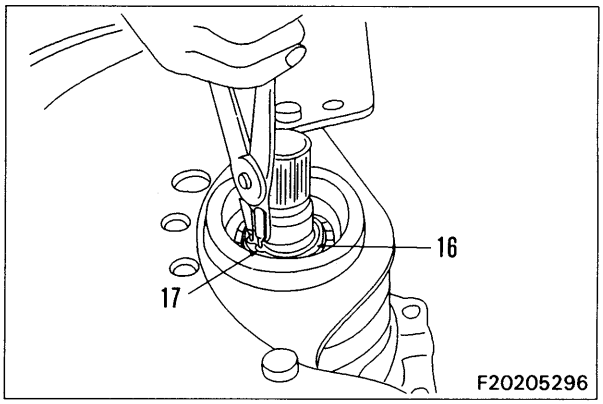
Remove snap ring (12), then remove cover (13).

★ Lever the groove with a screwdriver.



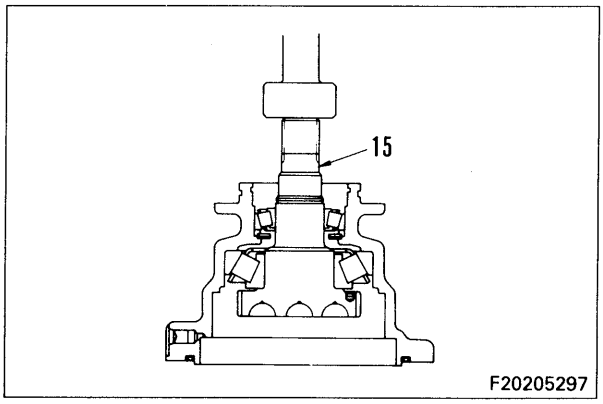
6. Drive shaft

1) Remove snap ring (17), then remove spacer (16).



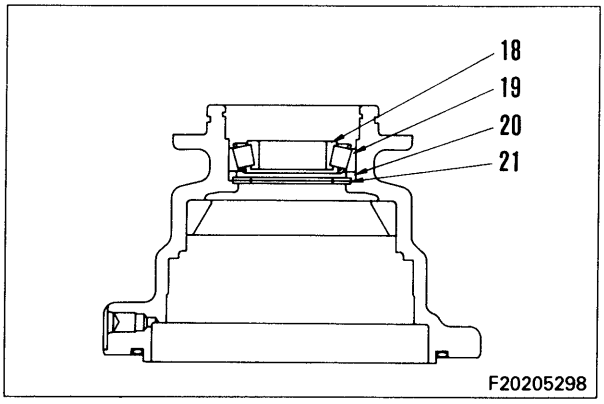
0205C6

2) Push down drive shaft (15) with press and remove.

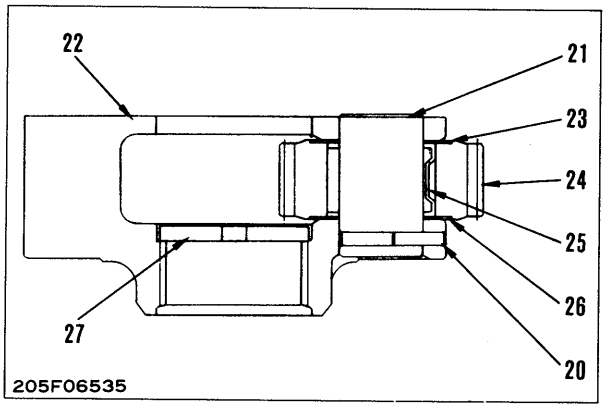


3) Remove bearing (18), then remove outer race (19), and remove seat (20) and spring (21).

★ The outer race can be pulled out by hand.

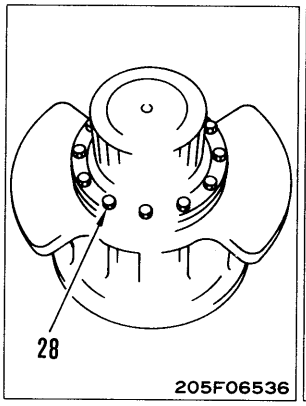


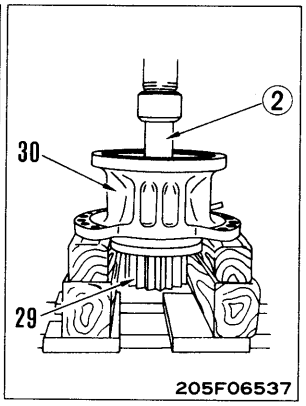
2) Disassemble No. 2 carrier assembly as follows.
   i) Push in pin (20), and knock out shaft (21) from carrier (22).
      ★ After removing the shaft, remove pin (20).
   ii) Remove thrust washer (23), gear (24), bearing (25), and thrust washer (26).
   iii) Remove plate (27).



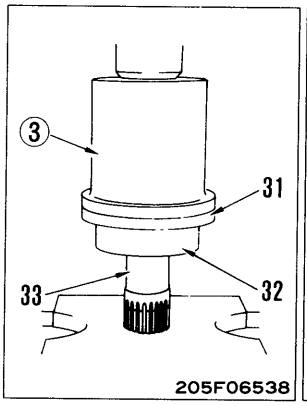
12. Shaft assembly

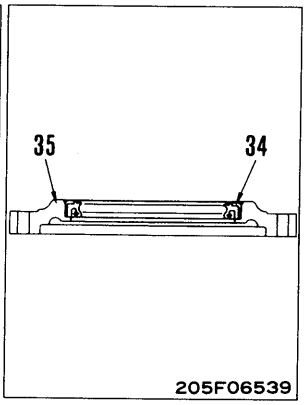
1) Remove mounting bolts (28).
2) Set shaft and case assembly to press, then using push tool ②, remove shaft assembly (29) from case assembly (30).





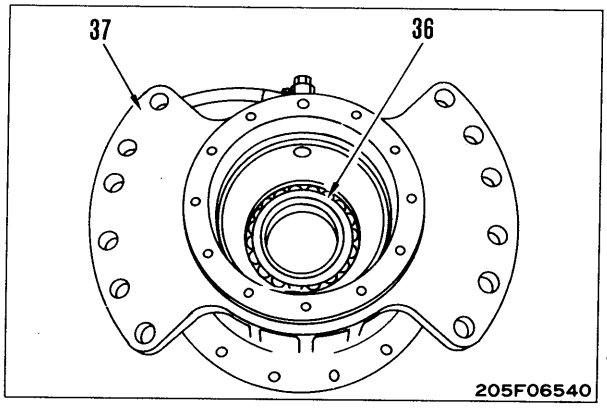
3) Disassemble shaft assembly as follows.
   i) Using push tool ③, remove cover assembly (31) and bearing (32) from shaft (33).
   ii) Remove oil seal (34) from cover (35).





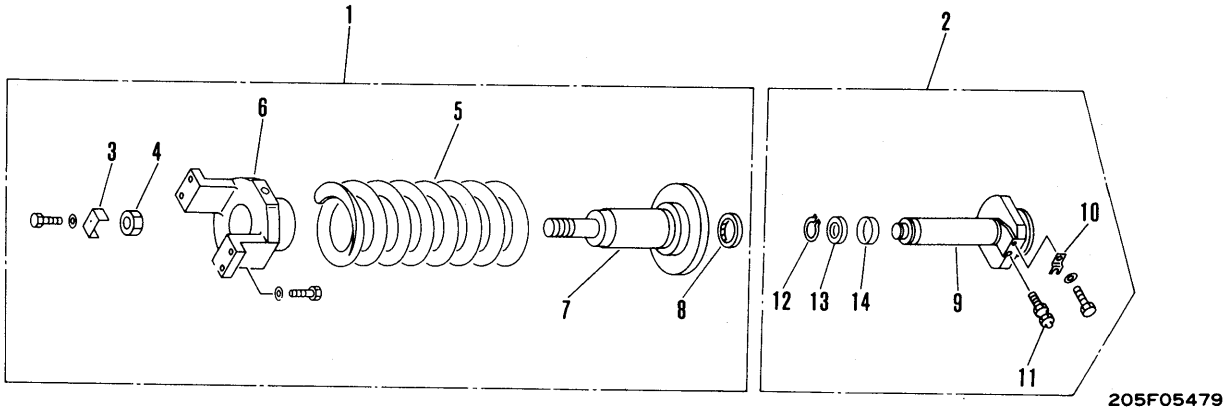
13. Bearing

Using push tool, remove bearing (36) from case (37).

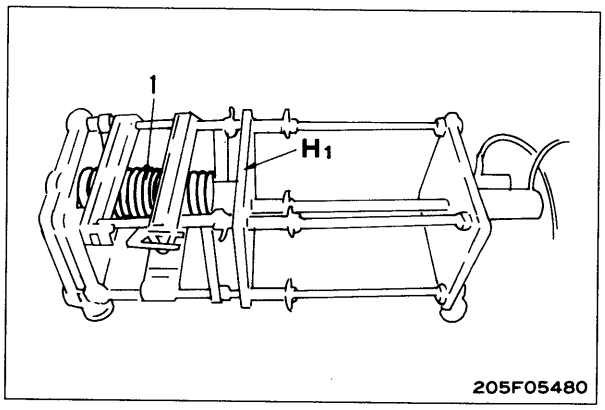


0205C6

DISASSEMBLY OF RECOIL SPRING ASSEMBLY



1. Remove piston assembly (2) from recoil spring assembly (1).



2. **Disassembly of recoil spring assembly**
   1) Set recoil spring assembly (1) to tool **H1**.
      ⚠ The recoil spring is under large installed load, so be sure to set the tool properly. Failure to do this is dangerous.
   ★ Installed load of spring
   PC200: 108,780 N (11,100 kg)
   PC200LC, 220, 220LC: 126,420 N (12,900 kg)

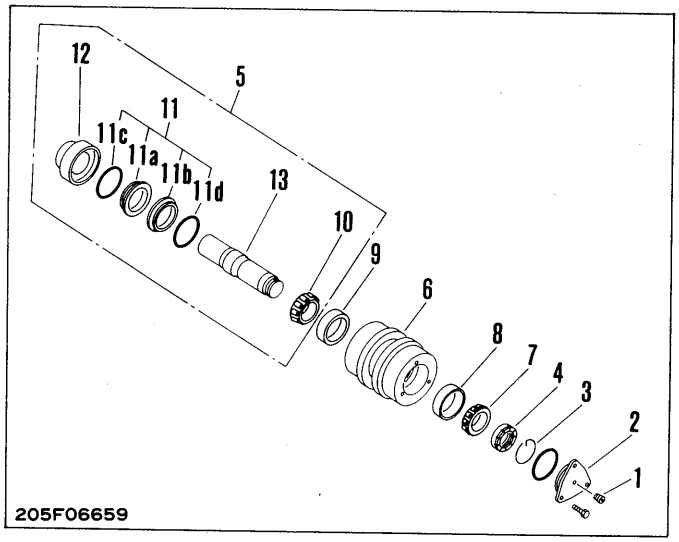
   2) Apply hydraulic pressure slowly to compress spring, and remove lock plate (3), then remove nut (4).
      ★ Compress the spring to a point where the nut becomes loose.
      ★ Release the hydraulic pressure slowly and release the tension of the spring.
      ★ Free length of spring
      PC200: 558 mm
      PC200LC, 220, 220LC: 603.5 mm

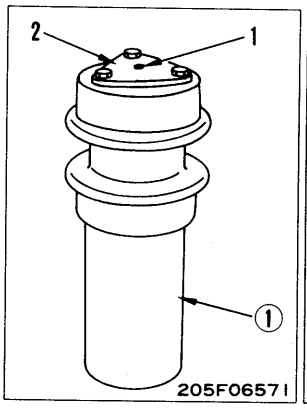
   3) Remove yoke (6), cylinder (7), and dust seal (8) from spring (5).

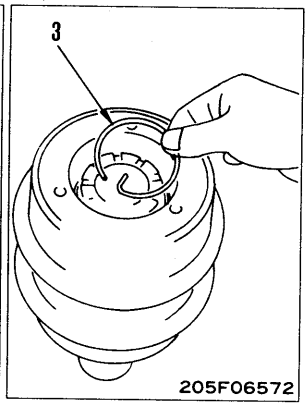
3. **Disassembly of piston assembly**
   1) Remove lock plate (10) from piston (9), then remove valve(11).
   2) Remove snap ring (12), then remove U-packing (13) and ring (14).

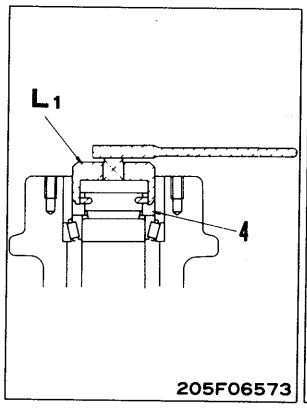
0205C6

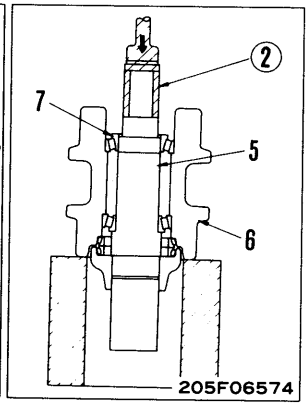
DISASSEMBLY OF CARRIER ROLLER ASSEMBLY

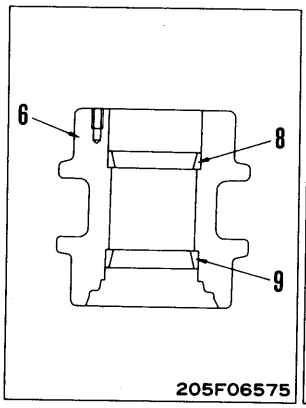


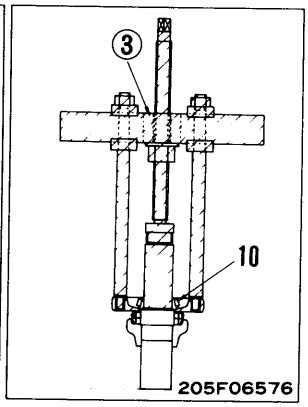


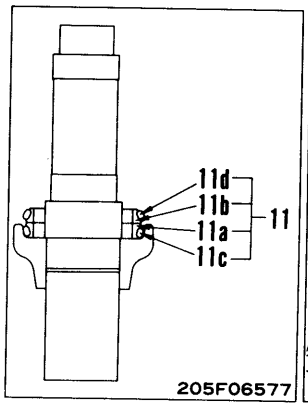


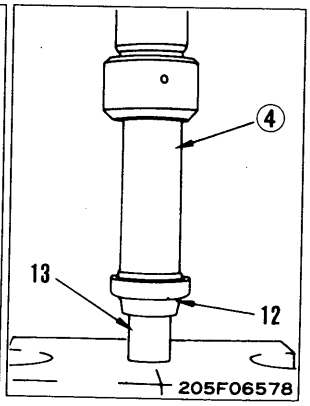












0205C6

1. Remove plug (1) and drain oil.
   Carrier roller assembly : 230 — 250 cc
2. Set carrier roller assembly on stand ①.
3. Remove cover (2).
4. Remove ring (3).
5. Using tool **L1**, remove nut (4).
6. Using push tool ②, pull out shaft assembly (5) from roller (6) with press, then remove inner race (7).
7. Remove outer races (8) and (9) from roller (6).

8. **Disassembly of shaft assembly**
   1) Using puller ③, remove inner race (10).
   2) Remove floating seals (11).
   3) Using push tool ④, remove collar (12) from shaft (13).

INSTALLATION OF MAIN PUMP ASSEMBLY

PC200, 200LC-6 Serial No.: 86942 and up
PC220, 220LC-6 Serial No.: 50704 and up

- Carry out installation in the reverse order to removal.

※1


Involute spline of main pump:
Anti-friction compound (LM-G)


Mating surface of main pump case:
Gasket sealant (LG-6)

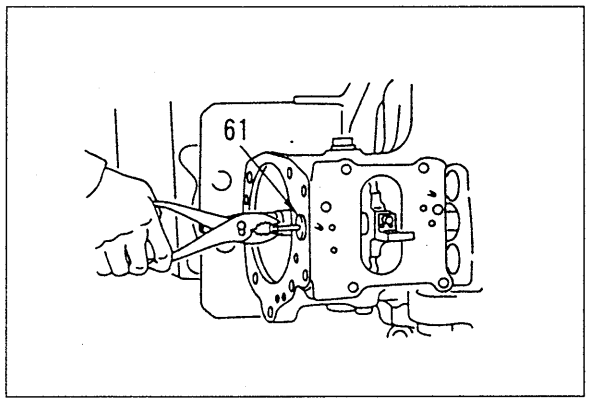
- Refilling with oil (damper)
  - ★ Add engine oil through the oil filler to the specified level. Then check the oil level again.

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

- Bleeding air
  - ★ Bleed the air from main pump. For details, see TESTING AND ADJUSTING, Bleeding air.

0205C6

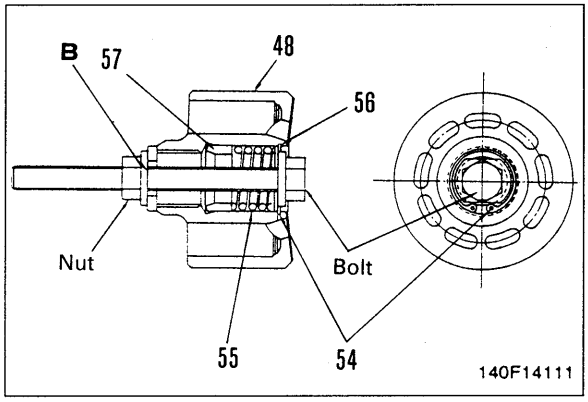
5) Assemble backup ring and O-ring to stopper (61), and install to case.



5. Cylinder block, piston assembly

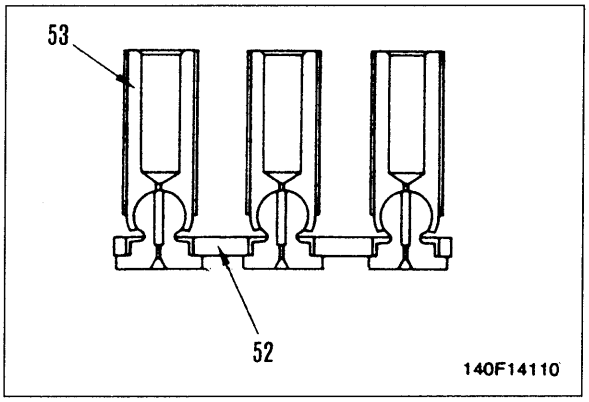
- **Assembly of cylinder block**

1) Assemble seat (57), spring (55), and seat (56) to cylinder block (48).
   ★ Assemble with the tapered portion on the inside of seat (57) facing down.
2) Set tool **B** to cylinder block (48).
   ★ Tool **B**: Bolt (790-201-3330)
   Washer (792-422-1120)
   Washer (01643-32460)
   Washer (01643-31845)
   Nut (01580-01815)
3) Hold bolt of tool **B** with wrench, tighten nut to compress spring (55), then install snap ring (54).
   ★ Check that the snap ring is fitted securely in the groove.
4) Remove tool **B**.



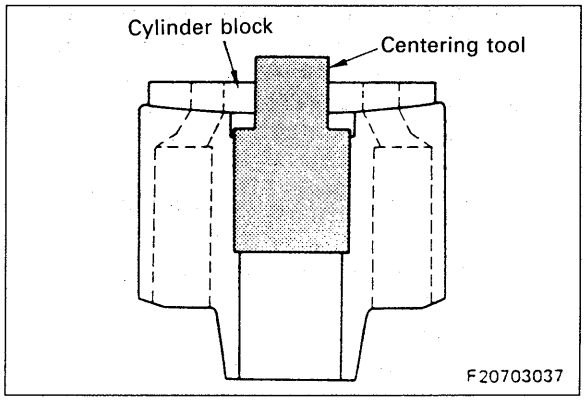
- **Assembly of piston assembly**

Assemble piston (53) to retainer shoe (52).



0205C6

CHECKING CONTACT BETWEEN CYLINDER BLOCK AND VALVE PLATE, ROCKER CAM AND CRADLE



Valve plate and end cap

1. Checking contact between cylinder block and valve plate

★ This check is unnecessary if both the cylinder block and valve plate are replacement parts (new parts).

★ This check applies if one of the parts is a replacement part or a restored part.

1) Make a centering tool for the cylinder block and valve plate.
   ★ The tool can be made from plastic, bakelite or any other soft material.

2) Remove all oil and grease from the parts to be checked.
   ★ Do not wipe with a cloth.

3) Set the tool in position, then paint the cylinder block with inspection paint.
   ★ Coat thinly with paint.

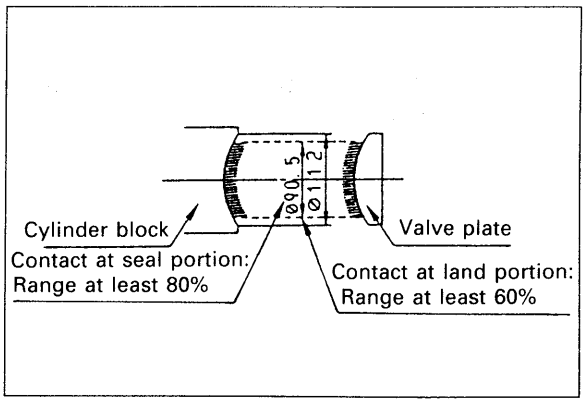
4) Push the valve plate with a force of 39.2 – 49.0 N (4 – 5 kg) against the cylinder block, turn the valve plate 90°, then turn it back to the original position.
   Repeat this process 2 or 3 times.

5) Remove the valve plate, transfer the contact surface to a tape, and check the contact surface.
   ★ The contact of the spherical surface of the valve plate and cylinder block must fulfill the conditions below and cover the whole circumference without any break.

   i) The contact at the seal portion (range from bottom to ϕ90.5) must be at least 80%.

   ii) The contact at the land portion (range from ϕ90.5 to ϕ112) must be at least 60%.

	Seal portion	Land portion
Valve plate	Min. 80%	Min. 60%
Cylinder block	Min. 80%	Min. 60%



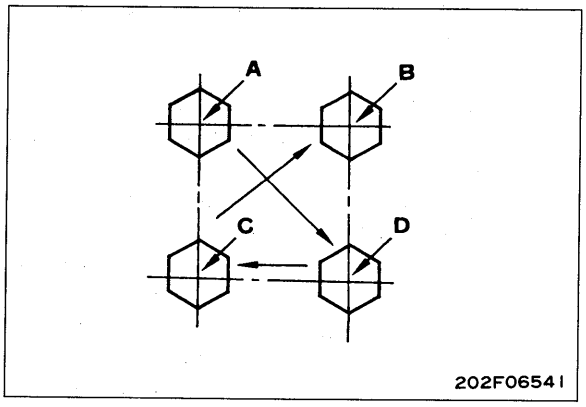
0205C6

5. **LS shuttle valve, pump merge-divider valve, arm counterbalance valve**
   1) Assemble valve (36) and spring (35) to valve body, and install arm counterbalance valve (34).
      kgm Mounting bolt:
      66.7 ± 7.4 Nm (6.8 ± 0.8 kgm)
      ★ Tighten the mounting bolts in the order shown in the diagram.
   2) Assemble valve (33) and spring (32) to valve body, and install pump merge-divider valve (31).
      kgm Mounting bolt:
      166.7 ± 9.8 Nm (17 ± 1 kgm)
      ★ Tighten the mounting bolts in the order shown in the diagram.
   2) Install LS shuttle valves (30) and (29).
      kgm Mounting bolt:
      66.7 ± 7.4 Nm (6.8 ± 0.8 kgm)

6. **LS select valve**
   Install LS select valve (28).
   kgm LS select valve:
   127.5 ± 19.6 Nm (13 ± 2 kgm)

7. **Pressure compensation valves**
   - Check marks made on each pressure compensation valve when disassembling, and install in correct position.

   1) Before installing pressure compensation valves below, install check valves (27) and (20).
   2) Fit O-rings, then install arm IN pressure compensation valve (26), L.H. travel FORWARD pressure compensation valve (25), left swing pressure compensation valve (24), boom LOWER pressure compensation valve (23), R.H. travel FORWARD pressure compensation valve (22), and bucket CURL pressure compensation valve (21).
   3) Fir O-rings, then install arm OUT pressure compensation valve (19), L.H. travel REVERSE pressure compensation valve (18), right swing pressure compensation valve (17), boom RAISE pressure compensation valve (16), R.H. travel REVERSE pressure compensation valve (15), and bucket DUMP pressure compensation valve (14).
      kgm Pressure compensation valve:
      225.5 ± 19.6 Nm (23 ± 2 kgm)



8. **Sub-unload valves, safety-suction valves, suction valves**
   1) Fit O-rings and install suction valves (13), (12), (11), and (10).
      kgm Suction valve:
      147.1 ± 9.8 Nm (15 ± 1 kgm)
   2) Fit O-ring and install safety-suction valves (9), (8), (7), (6), (5), and (4).
      kgm Safety-suction valve:
      147.1 ± 9.8 Nm (15 ± 1 kgm)
   3) Fit O-ring and install sub-unload valves (3) and (2).
      kgm Sub-unload valve:
      166.7 ± 19.6 Nm (17 ± 2 kgm)

9. **Main unload • LS relief valve**
   1) Fit O-ring and install main unload • LS relief valve (1).
      kgm Main unload • LS relief valve:
      86.3 ± 7.8 Nm (8.8 ± 0.8 kgm)

0205C6

DISASSEMBLY OF WORK EQUIPMENT PPC VALVE ASSEMBLY

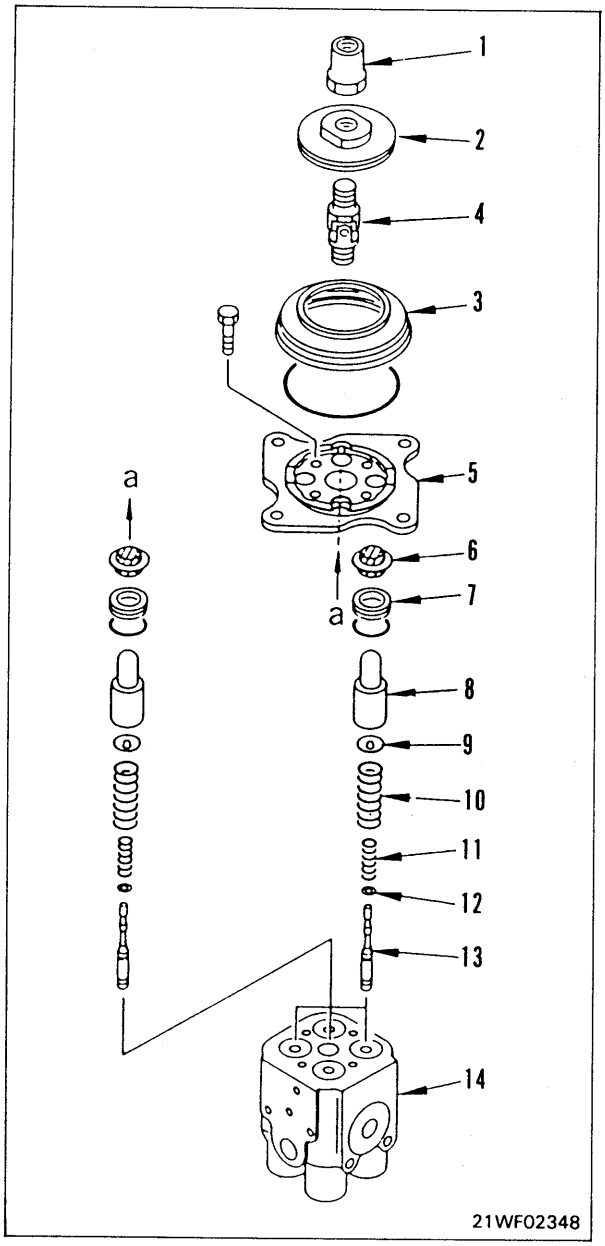
1. Remove nut (1), then remove disc (2) and boot (3).

2. Remove bolts, then remove plate (5).
   ★ Do not remove joint (4) unless it is to be replaced.

3. Remove seal (6) and collar (7).

4. Pull out piston (8), and remove retainer (9), springs (10) and (11), and shim (12).
   ★ Spring (10) consists of a set of two types of springs with different installed loads, so check the mounting position (oil port) and mark with tags to prevent mistakes when installing.

5. Pull out valve (13) from body (14).

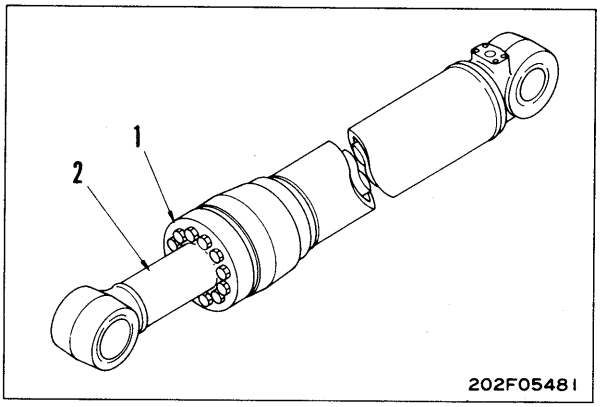


0205C6

DISASSEMBLY OF HYDRAULIC CYLINDER ASSEMBLY

1. Piston rod assembly

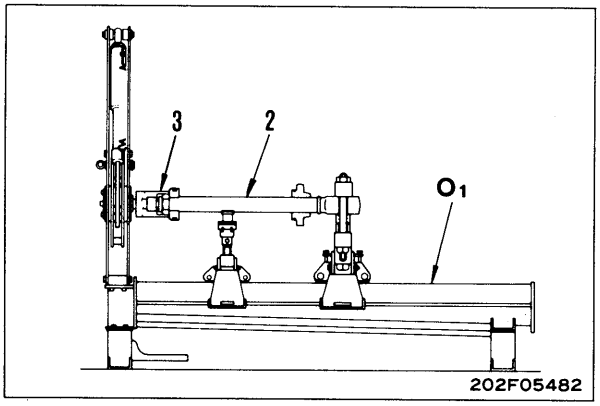
1) Remove piping from cylinder assembly.
2) Remove mounting bolts, and disconnect head assembly (1).
3) Pull out piston rod assembly (2).
   ★ Place a container to catch the oil under the cylinder.



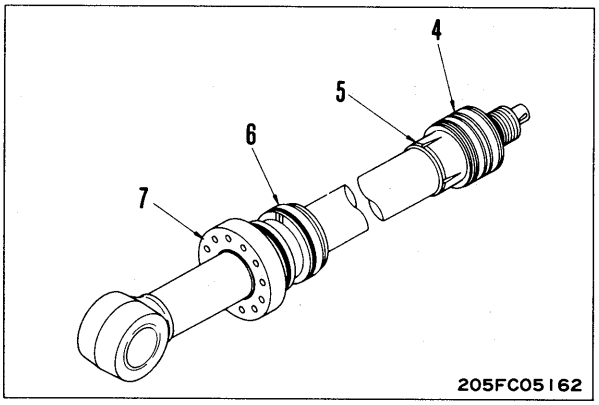
4) Disassemble piston rod assembly as follows.
   i) Set piston rod assembly (2) in tool **O1**.
   ii) Using tool **O2**, remove nut (3).
   ★ Width across flats of nut

Unit: mm

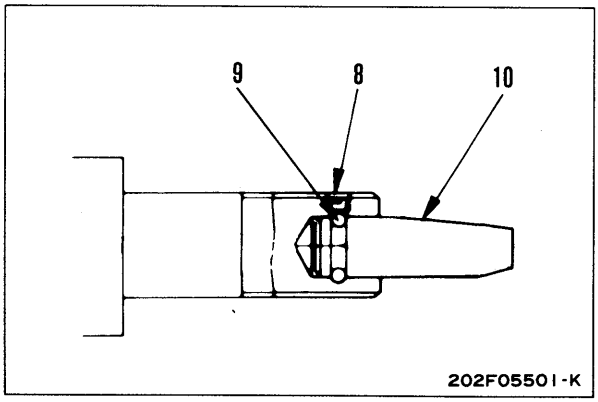
Model \ Cylinder	Boom	Arm	Bucket
PC200	85	95	85
PC220	95	95	95



   iii) Remove piston assembly (4).
   iv) Remove plunger (5).
   • Boom and arm cylinder only
   v) Remove collar (6).
   • Boom and arm cylinder only
   vi) Remove head assembly (7).



   vii) Remove cap (8), and pull out 12 balls (9), then remove plunger (10).
   • Arm cylinder only



0205C6

INSTALLATION OF ARM ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

Inside surface of bushing when assembling pin: Anti-friction compound (LM-P)

Grease after assembling pin: Grease (LM-G)

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

※ 2

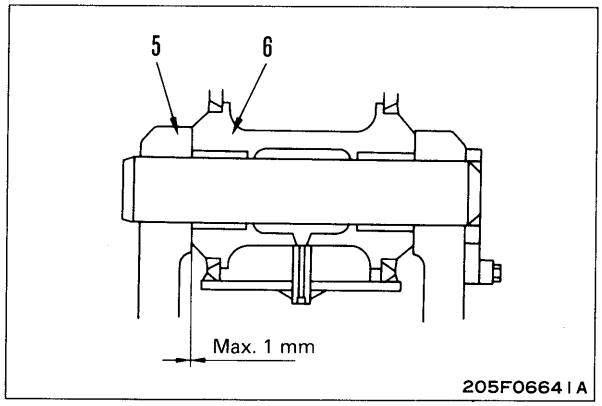
Inside surface of bushing when assembling pin: Anti-friction compound (LM-P)

Grease after assembling pin: Grease (LM-G)

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

★ Adjust the shim thickness so that the clearance between boom top (5) and arm bottom (6) is below 1.0 mm.

★ Standard shim thickness: 0.8 mm



- Refilling with oil (hydraulic tank)

★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.

- Bleeding air

★ Bleed the air from the cylinder. For details, see TESTING AND ADJUSTING, Bleeding air from hydraulic cylinder.

0205C6

0205C6

Unit: mm

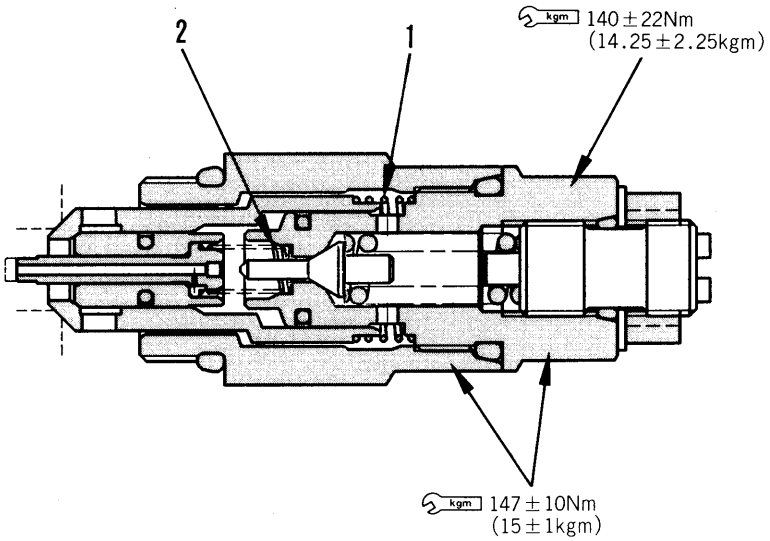
No.	Check item	Criteria		Remedy
1	Backlash between swing motor shaft and No.1 sun gear	Standard clearance	Clearance limit	Replace
		0.07 – 0.18	—	
2	Backlash between No. 1 sun gear and No. 1 planetary gear	0.13 – 0.32	0.90	
3	Backlash between No. 1 planetary gear and ring gear	0.14 – 0.43	0.90	
4	Backlash between No. 1 planetary carrier and coupling	0.09 – 0.19	—	
5	Backlash between coupling and No.2 sun gear	0.35 – 0.58	1.10	
6	Backlash between No. 2 sun gear and No. 2 planetary gear	0.12 – 0.49	1.00	
7	Backlash between No. 2 planetary gear and ring gear	0.15 – 0.57	1.10	
8	Backlash between No. 2 planetary carrier and swing pinion	0.09 – 0.20	—	
9	Backlash between swing pinion and swing circle	0.22 – 1.32	2.00	
10	Clearance between plate and planetary carrier	0.38 – 1.16	—	
11	Wear of swing pinion surface contacting with oil seal	Standard size	Repair limit	Apply hard chrome plating recondition, or replace
		$125\ ^{0}_{-0.100}$	124.7	

0205C6

Unit: mm

No.	Check item		Criteria					Remedy
1	Link pitch		Standard size		Repair limit			Turn or replace
			190.25		194.25			
2	Outside diameter of bushing		59.3		54.3			
3	Height of grouser	Triple	26		16			Lug welding, rebuild or replace
		Swamp	102.5		90.5			
4	Height of link		105		97			
5	Interference between bushing and link		Standard size	Tolerance		Standard interference	Interference limit	Replace with over size
				Shaft	Hole			
			59	+0.304 +0.264	+0.074 0	0.190 – 0.304	0.100	
6	Interference between regular pin and link		38	+0.222 +0.072	–0.138 –0.200	0.210 – 0.422	0.140	
7	Interference between master pin and link		37.8	+0.230 +0.200	+0.062 0	0.138 – 0.230	0.130	
8	Protrusion of bushing		4.85					Adjust
9	Tightening torque of shoe bolt		Initial tightening torque: 392 ± 39.2 Nm (40 ± 4 kgm) Additional tightening angle: 120° ± 10°					Tighten

SAFETY-SUCTION VALVE FOR SERVICE VALVE



205F06268

0205C6

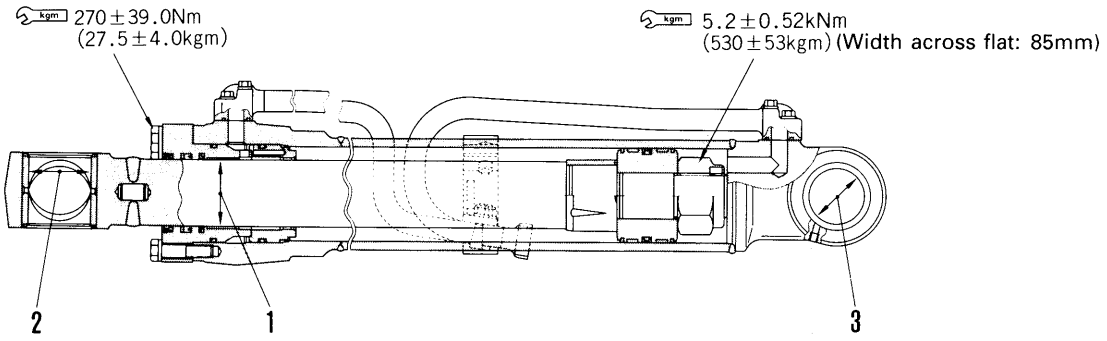
Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
1	Suction valve spring	Free length x O.D.	Installed length	Installed load	Free length	Installed load	Replace spring if any damages or deformations are found.
		16.3 x 21.3	1.5	2.1 N (0.21 kg)	—	1.6 N (0.16 kg)	
2	Piston spring	20 x 7	14	2.1 N (0.21 kg)	—	1.6 N (0.16 kg)	

HYDRAULIC CYLINDER

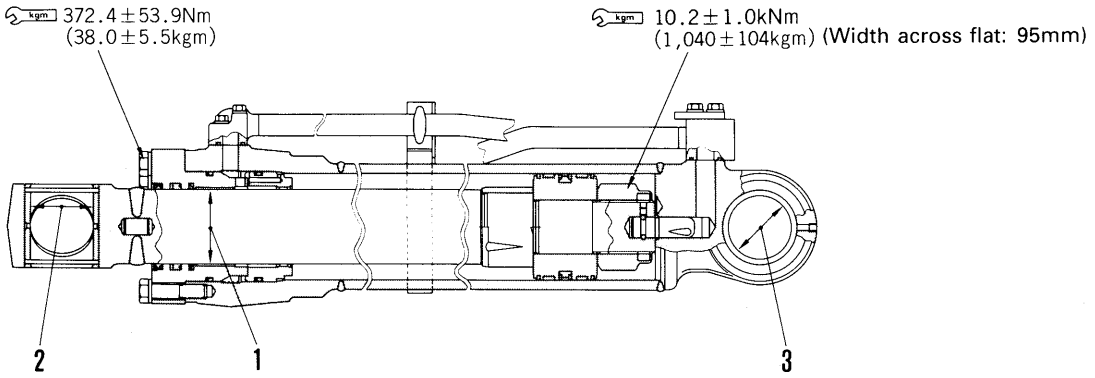
PC200•200LC-6

BOOM CYLINDER



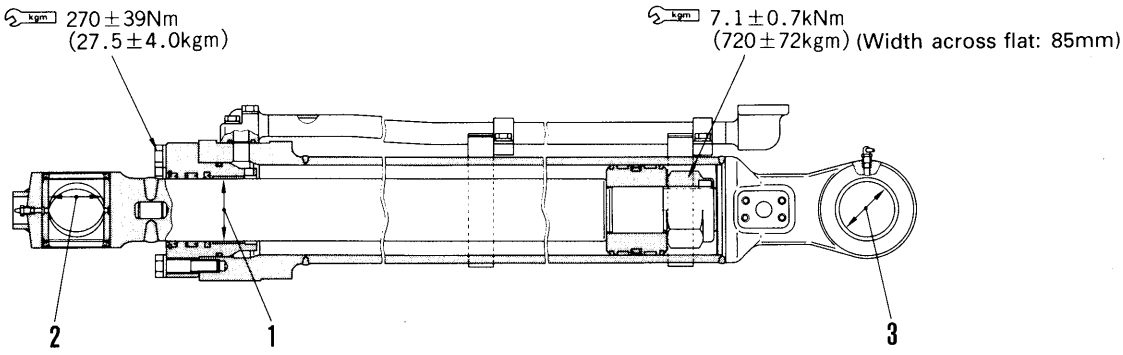
205F06279

ARM CYLINDER



205F06280

BUCKET CYLINDER



205F06281

0205C6