CEBM014600

Shop Manual

GALEO

PC270LL-7L

LOGGING EXCAVATOR

SERIAL NUMBERS **PC270LL-7L** **A86001** and UP

It is our policy to improve our products whenever it is possible and practical to do so. We reserve the right to make changes or add improvements at any time without incurring any obligation to install such changes on products sold previously.

Due to this continuous program of research and development, periodic revisions may be made to this publication. It is recommended that customers contact their distributor for information on the latest revision.

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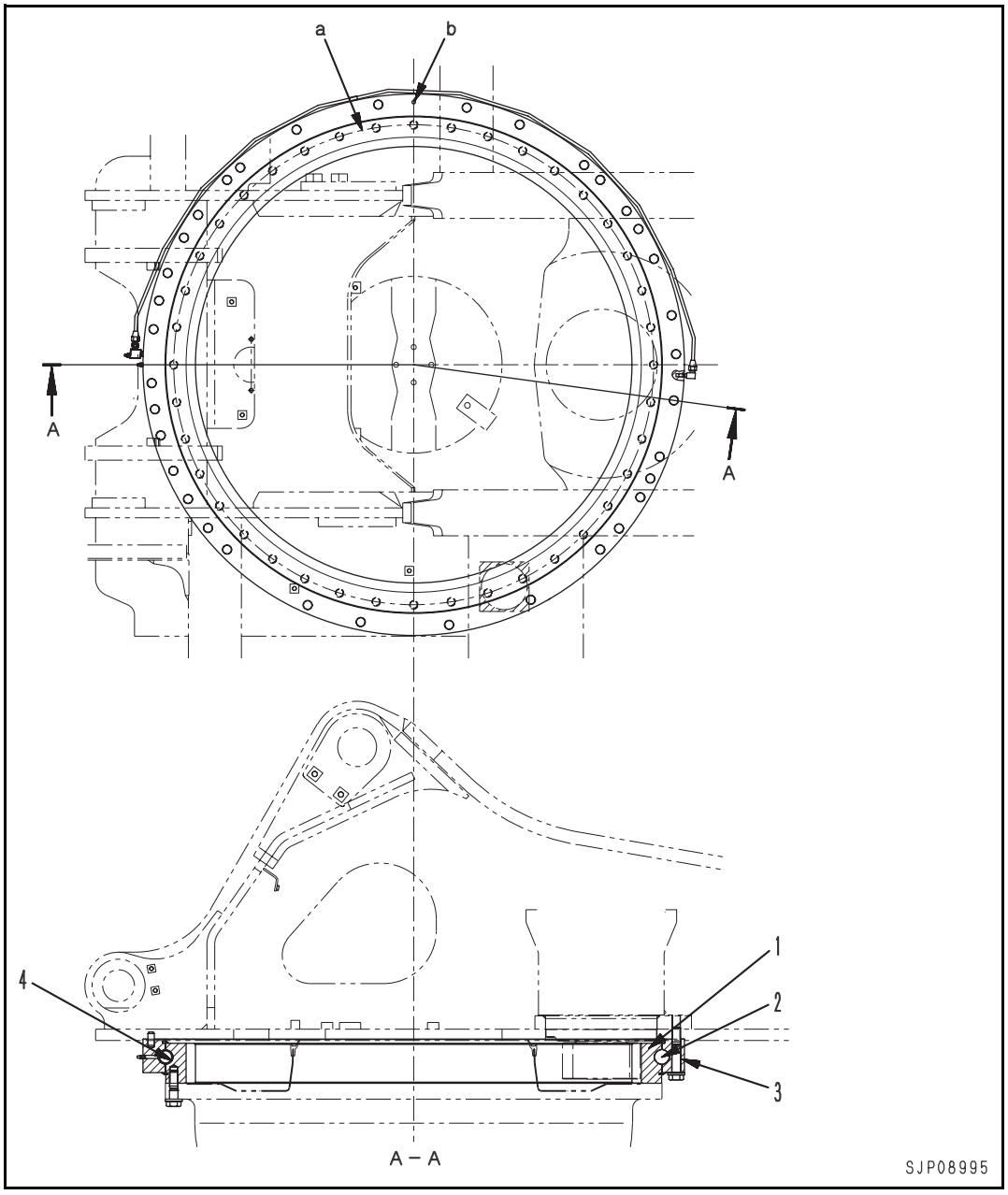
Category	Code	Part No.	Quantity	Container	Main applications, features
Gasket sealant	LG-4	790-129-9020	200 g	Tube	● Features: Resistance to water, oil ● Used as sealant for flange surface, thread. ● Also possible to use as sealant for flanges with large clearance. ● Used as sealant for mating surfaces of final drive case, transmission case.
	LG-5	790-129-9080	1 kg	Polyethylene container	● Used as sealant for various threads, pipe joints, flanges. ● Used as sealant for tapered plugs, elbows, nipples of hydraulic piping.
	LG-6	09940-00011	250 g	Tube	● Features: Silicon based, resistant to heat, cold. ● Used as sealant for flange surface, thread. ● Used as sealant for oil pan, final drive case, etc.
	LG-7	09920-00150	150 g	Tube	● Features: Silicon based, quick hardening type. ● Used as sealant for flywheel housing, intake manifold, oil pan, thermostat housing, etc.
	Three bond 1211	790-129-9090	100 g	Tube	● Used as heat-resisting sealant for repairing engines.
Molybdenum disulphide lubricant	LM-G	09940-00051	60 g	Can	● Used as lubricant for sliding parts (to prevent squeaking).
	LM-P	09940-00040	200 g	Tube	● Used to prevent seizure or scuffing of the thread when press fitting or shrink fitting. ● Used as lubricant for linkage, bearings, etc.
Grease	G2-LI	SYG2-400LI SYG2-350LI SYG2-400LI-A SYG2-160LI SYGA160CNLI	Various	Various	● General purpose type
	G2-CA	SYG2-400CA SYG2-350CA SYG2-400CA-A SYG2-160CA SYG2-160CNCA	Various	Various	● Used for normal temperature, light load bearing at places in contact with water or steam.
	Molybdenum disulphide lubricant	SYG2-400M	400 g (10 per case)	Belows type	● Used for places with heavy load.

01 GENERAL

10 STRUCTURE AND FUNCTION

SWING CIRCLE



1. Swing circle inner race (No. of teeth: 90)
2. Ball
3. Swing circle outer race

a. Inner race soft zone S position
b. Outer race soft zone S position

SPECIFICATIONS

Reduction ratio: $-\frac{90}{13} = -6.923$

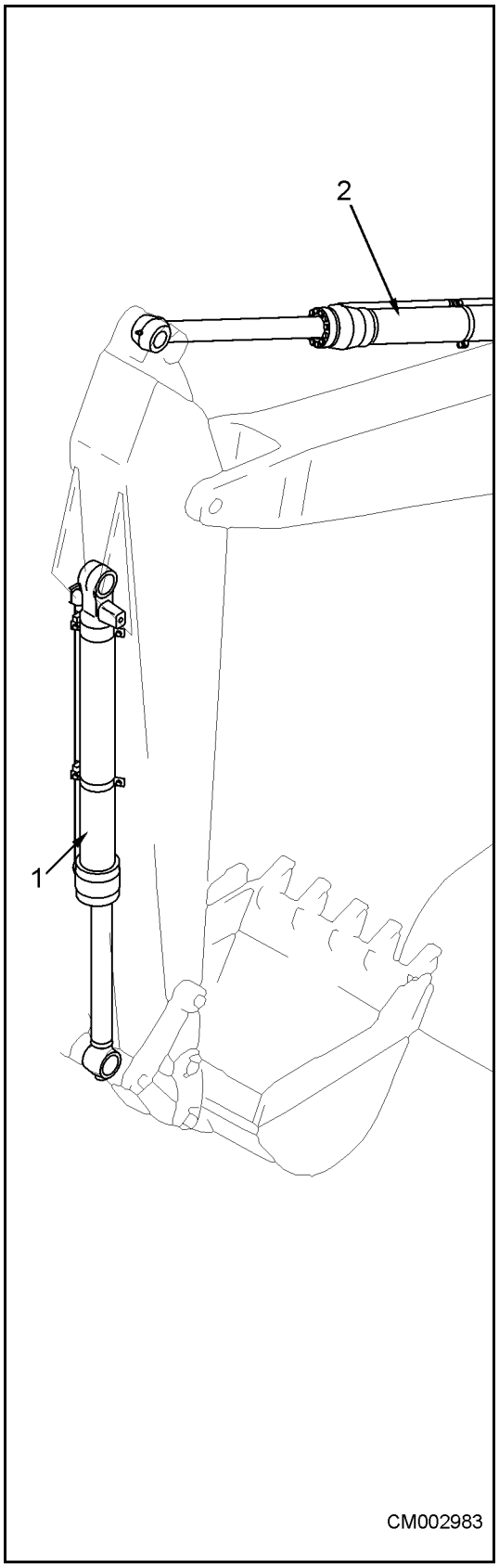
Amount of grease: 33 L (G2-LI)

Unit: mm

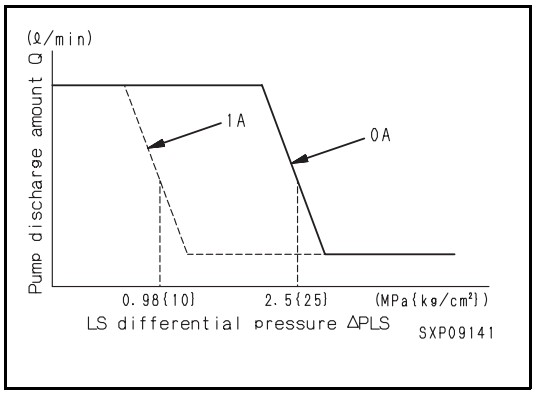
No.	Check item	Criteria		Remedy
4	Axial clearance of bearing (when mounted on chassis)	Standard clearance	Clearance limit	Replace
		0.5 ~ 1.6	3.2	

HYDRAULIC EQUIPMENT

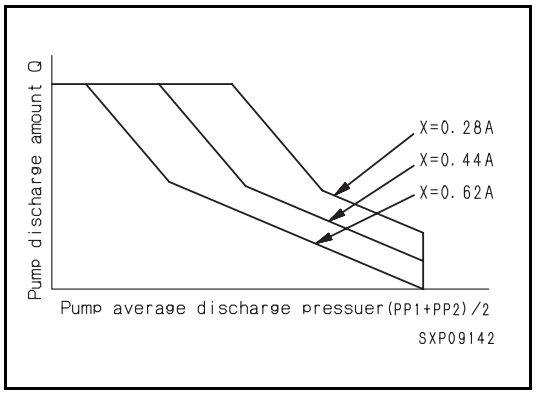
1. Bucket Cylinder
2. Arm Cylinder
3. Boom Cylinder
4. Hydraulic Tank
5. Hydraulic Filter
6. Right. Travel Motor
7. Swing Motor
8. Hydraulic Pump
9. Control Valve
10. Oil Cooler
11. Left Travel Motor
12. Not used
13. Left. PPC Valve
14. Safety Lever (Electric Type)
15. Center Swivel Joint
16. Right. PPC Valve
17. Travel PPC Valve
18. Attachment Circuit Selector Valve
19. Holding Valve
20. Accumulator
21. Solenoid Valve Assembly
    - 21A PPC Lock Solenoid
    - 21B Travel Junction Solenoid
    - 21C Pump Merge/Divider Solenoid
    - 21D Travel Speed Solenoid
    - 21E Swing Brake Solenoid
    - 21F 2 Stage Relief Solenoid
22. Attachment Solenoid Valve
    - 22A Attachment Solenoid 1
    - 22B Attachment Solenoid 2
    - 22C Attachment Solenoid 3
    - 22D Attachment Solenoid 4
    - 22E Attachment Solenoid 5
    - 22F Attachment Solenoid 6



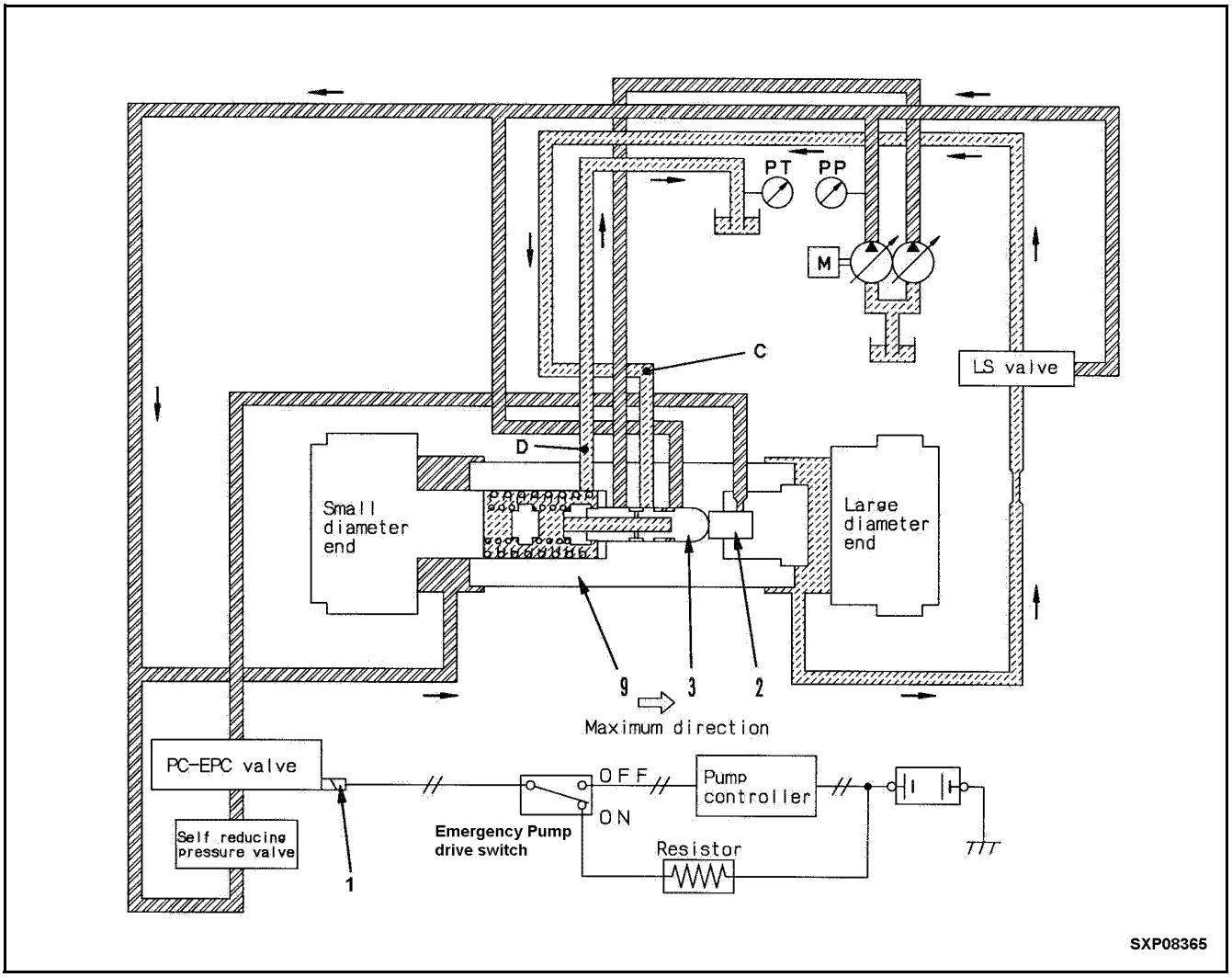
FUNCTION



1. LS valve
   The LS valve detects the load and controls the discharge amount.
   This valve controls main pump discharge amount **Q** according to differential pressure Δ**PLS** (=**PP - PLS**) [called the LS differential pressure] (the difference between main pump pressure **PP** and control valve outlet port pressure **PLS**).
   Main pump pressure **PP**, pressure **PLS** (called the LS pressure) coming from the control valve output, and pressure **PSIG** (called the LS selector pressure) from the proportional solenoid valve enter this valve. The relationship between discharge amount **Q** and differential pressure Δ**PLS**, (the difference between main pump pressure **PP** and LS pressure **PLS**) (= **PP - PLS**) changes as shown in the diagram at the right according to LS pressure selector current **ISIG** of the LS-EPC valve.
   When **ISIG** changes between 0 and 1A, the set pressure of the spring changes according to this, and the selector point for the pump discharge amount changes at the rated central valve between 0.98 ↔ 2.5 MPa (10 ↔ 25 kg/cm²).



2. PC valve
   When the pump discharge pressure **PP1** (self-pressure) and **PP2** (other pump pressure) are high, the PC valve controls the pump so that no more oil than the constant flow (in accordance with the discharge pressure) flows even if the stroke of the control valve becomes larger. In this way, it carries out equal horsepower control so that the horsepower absorbed by the pump does not exceed the engine horsepower.
   In other words, If the load during the operation becomes larger and the pump discharge pressure rises, it reduces the discharge amount from the pump; and if the pump discharge pressure drops, it increases the discharge amount from the pump. The relationship between the average of the front and rear pump discharge pressures (average discharge amount of F, R pumps (**PP1 + PP2)/2)** and pump discharge amount **Q** is shown on the right, with the current given to the PC-EPC valve solenoid shown as a parameter. The controller senses the actual speed of the engine, and if the speed drops because of an increase in the load, it reduces the pump discharge amount to allow the speed to recover. In other words, when the load increases and the engine speed drops below the set value, the command current to the PC-EPC valve solenoid from the controller increases according to the drop in the engine speed to reduce the pump swash plate angle.

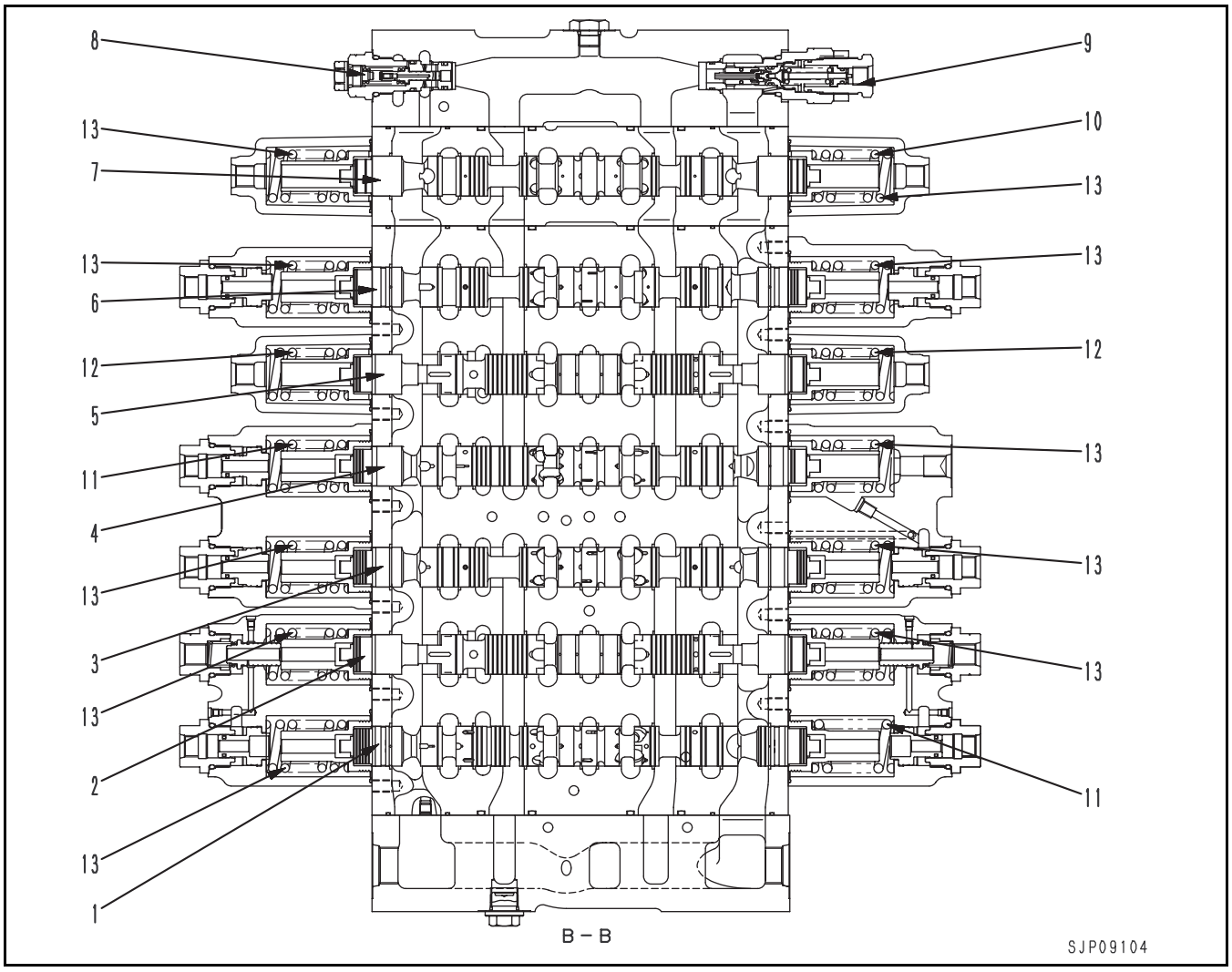


B. When pump controller is abnormal and PC prolix switch is ON

i. When load on main pump is light

- If there is a failure in the pump controller, turn emergency pump drive switch **ON** to switch to the resistor side. In this case, the power source is taken directly from the battery. But if the current is used as it is, it is too large, so use the resistor to control the current flowing to PC-EPC valve solenoid (1).
- When this is done, the current becomes constant, so the force pushing piston (2) is also constant.
- If the main pump pressure **PP1** and **PP2** are low, the combined force of the pump pressure and the force of PC-EPC valve solenoid (1) is weaker than the spring set force, so spool (3) is balanced at a position to the left.
- At this point, port **C** is connected to the drain pressure of port **D**, and the large diameter end of the piston of servo piston (9) also becomes the drain pressure **PT** through the LS valve. When this happens, the pressure at the small diameter end of the piston is large, so servo piston (9) moves in the direction to make the discharge amount larger.

(4/9)



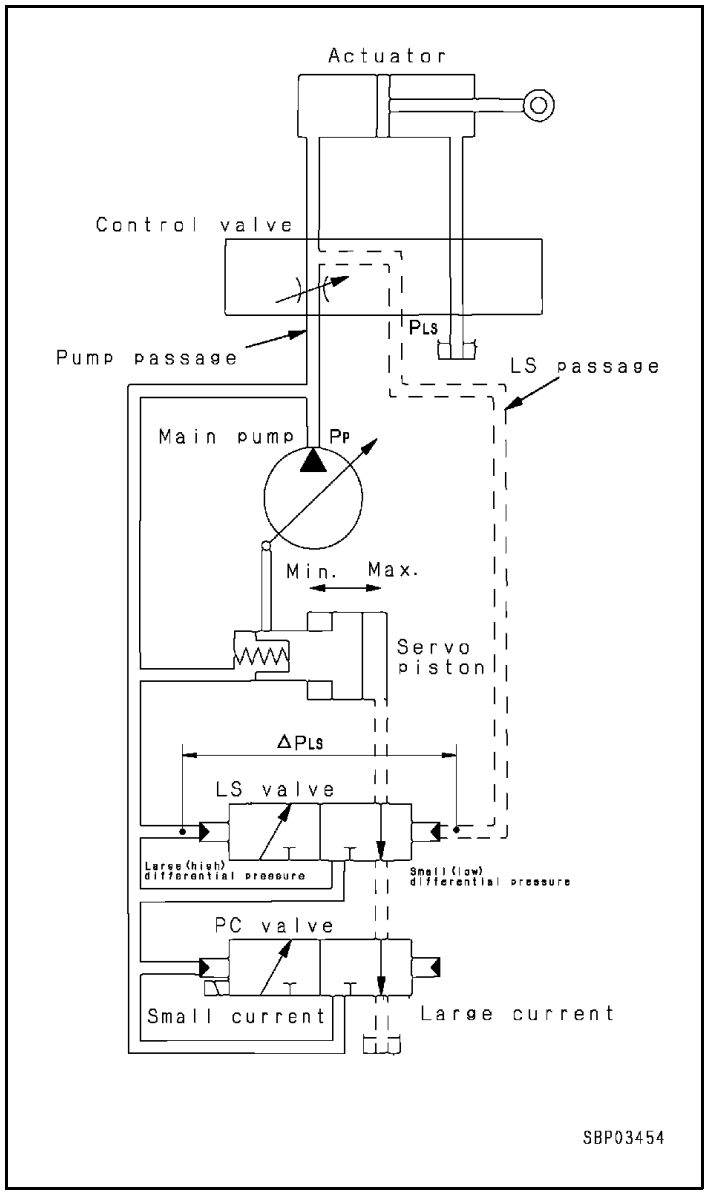
1. Spool (Arm)
2. Spool (Right travel)
3. Spool (Swing)
4. Spool (Boom)
5. Spool (Left travel)
6. Spool (Bucket)
7. Spool (Service)
8. Unload valve
9. Main relief valve
10. Spool return spring

Unit: mm

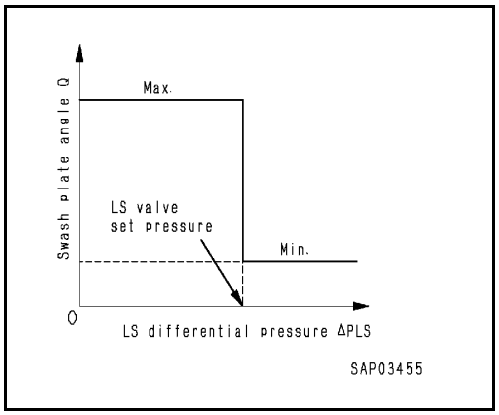
No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	
11	Spool return spring	54.2 x 34.8	51.2	416.5 N (42.5 kg)	—	333.2 N (34 kg)	If damaged or deformed, replace spring
12	Spool return spring	54.6 x 34.8	51.2	429.9 N (42.9 kg)	—	336.1 N (34.3 kg)	
13	Spool return spring	54.5 x 34.8	51.2	393 N (40.1 kg)	—	314.6 N (32.1 kg)	

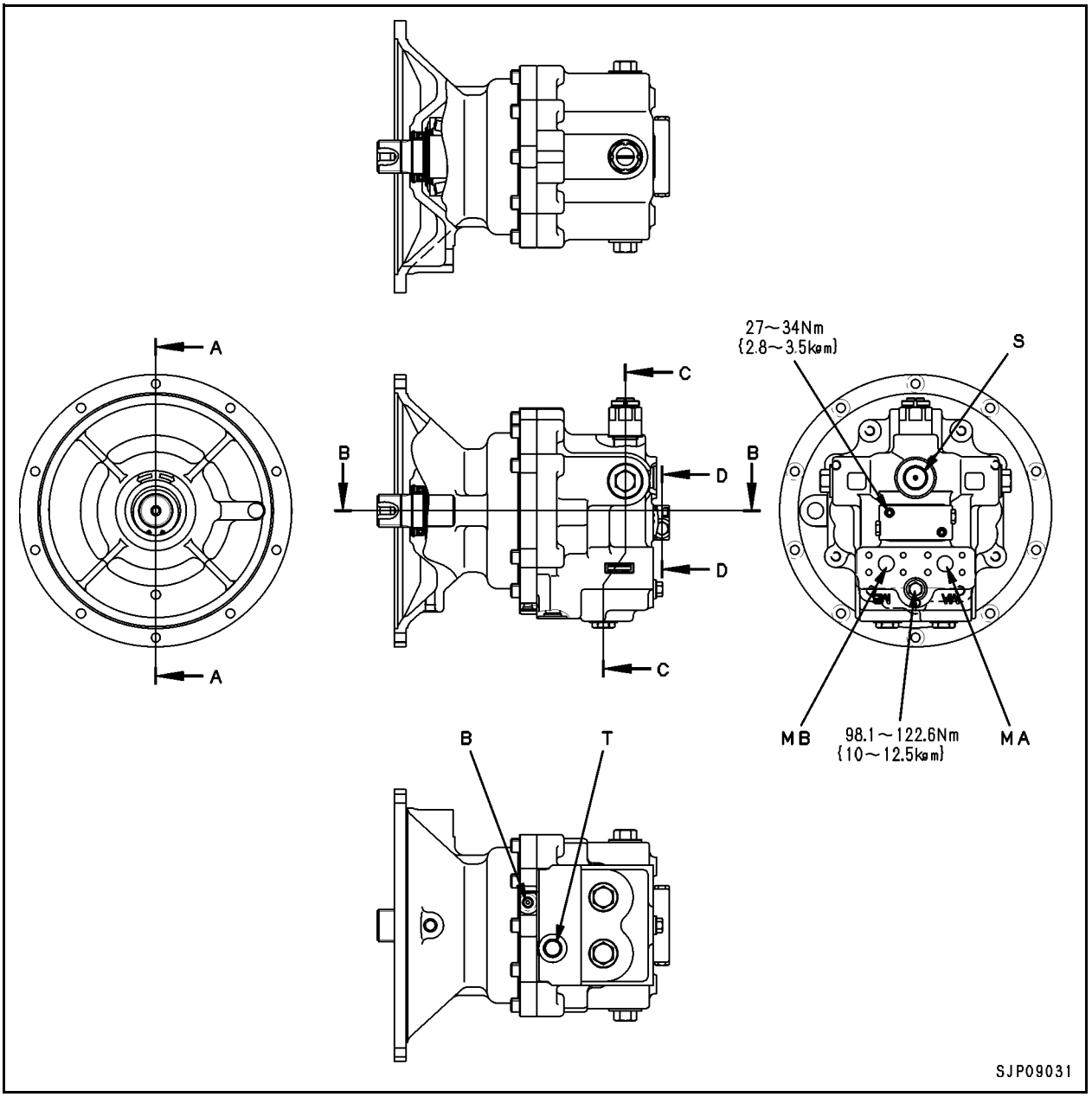
BASIC PRINCIPLE

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

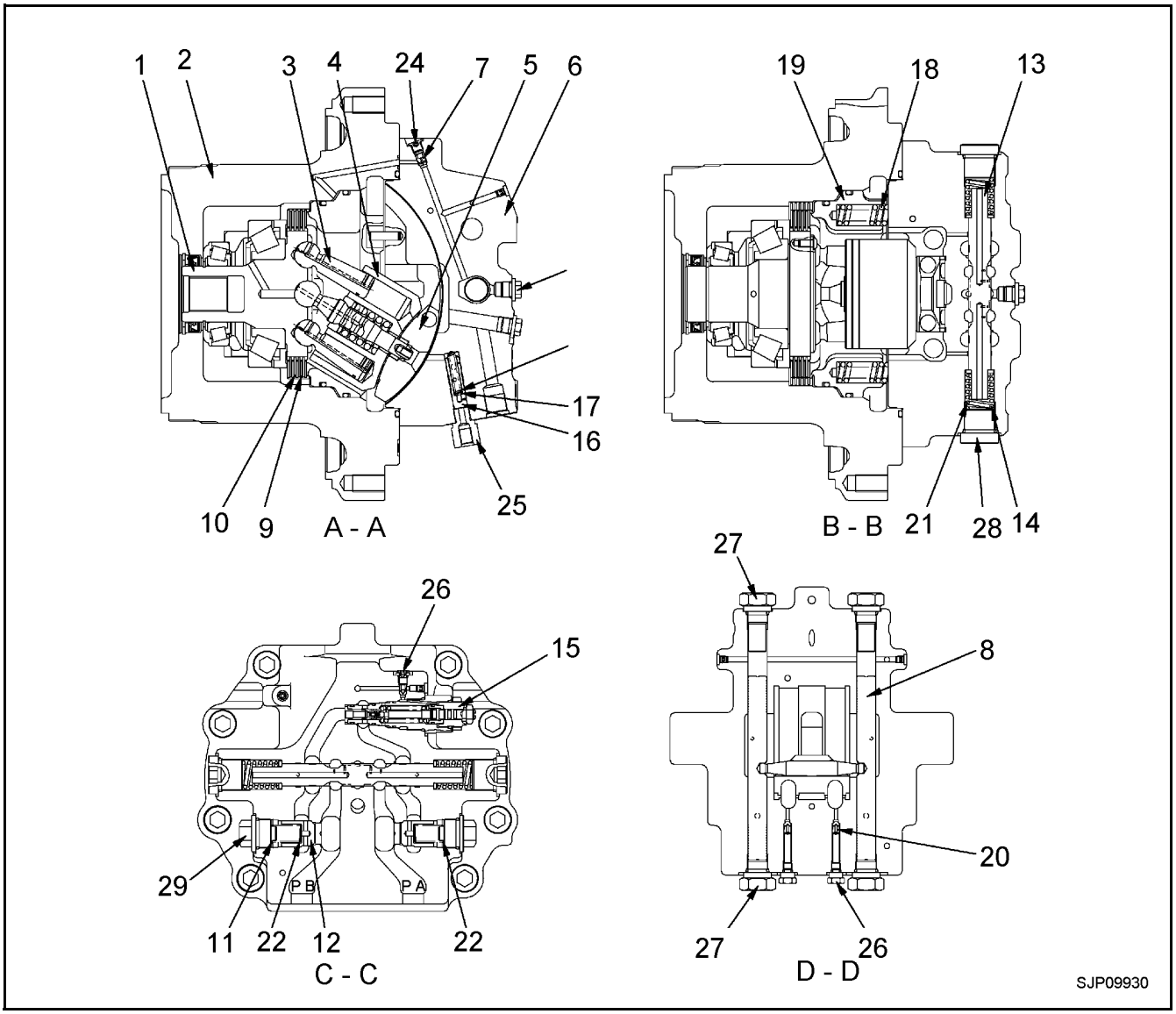


   - If LS differential pressure **ΔPLS** becomes lower than the set pressure of the LS valve (when the actuator load pressure is high), the pump swash plate moves towards the maximum position; if it becomes higher than the set pressure of the LS valve (when the actuator load pressure is low), the pump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





1. Brake spring
2. Drive shaft
3. Spacer
4. Case
5. Disc
6. Plate
7. Brake piston
8. Housing
9. Piston
10. Cylinder block
11. Valve plate
12. Reverse prevention valve
13. Center shaft
14. Center spring
15. Safety valve
16. Check valve
17. Shuttle valve



1. Output shaft
2. Motor case
3. Piston
4. Cylinder
5. Valve plate
6. End cover
7. Slow return valve
8. Regulator piston
9. Plate
10. Disc
11. Check valve spring
12. Check valve
13. Counterbalance valve
14. Spool return spring
15. Safety valve
16. Regulator valve
17. Spring
18. Brake spring
19. Brake piston
20. Check valve

TRAVEL JUNCTION VALVE

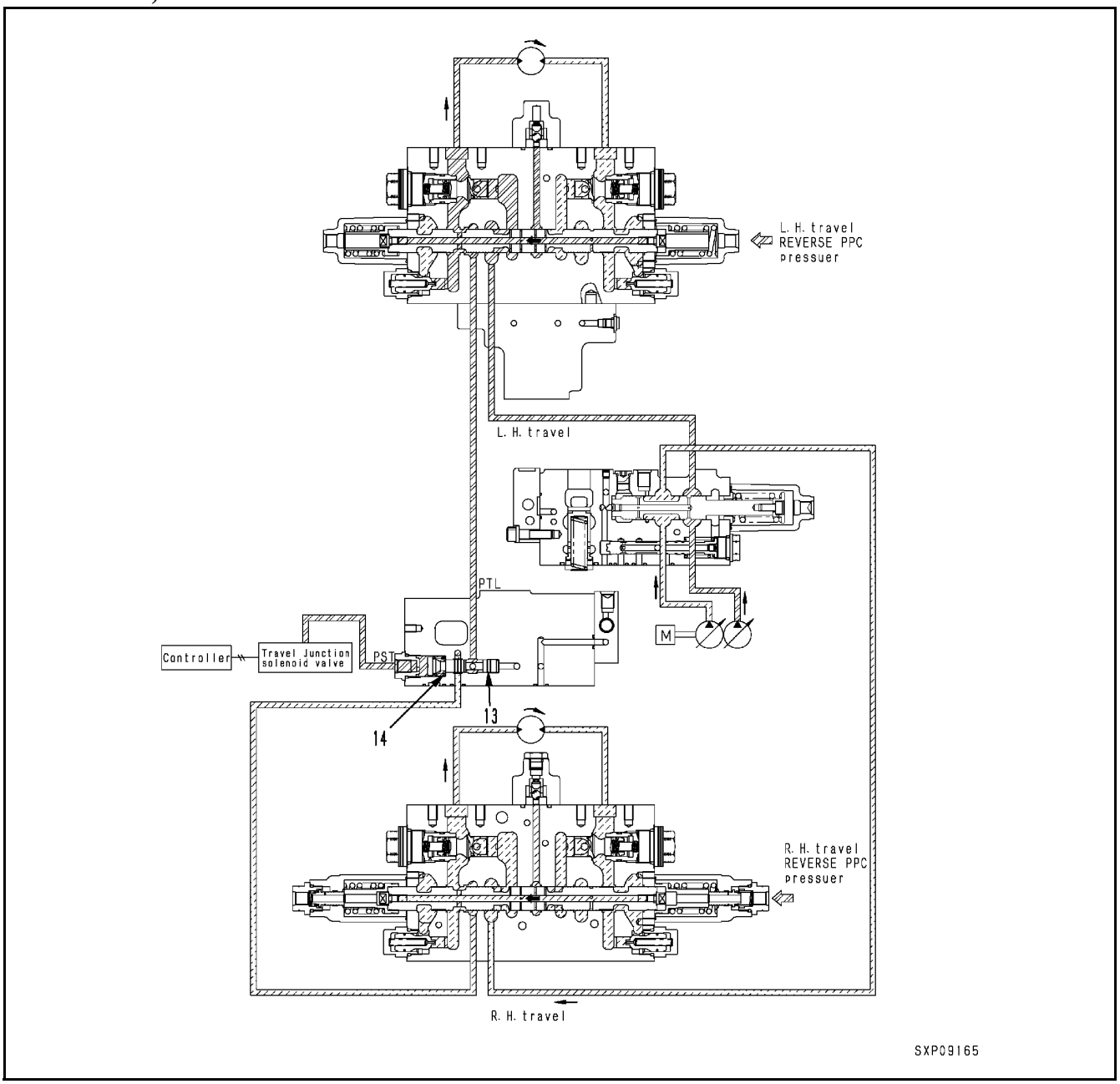
Function

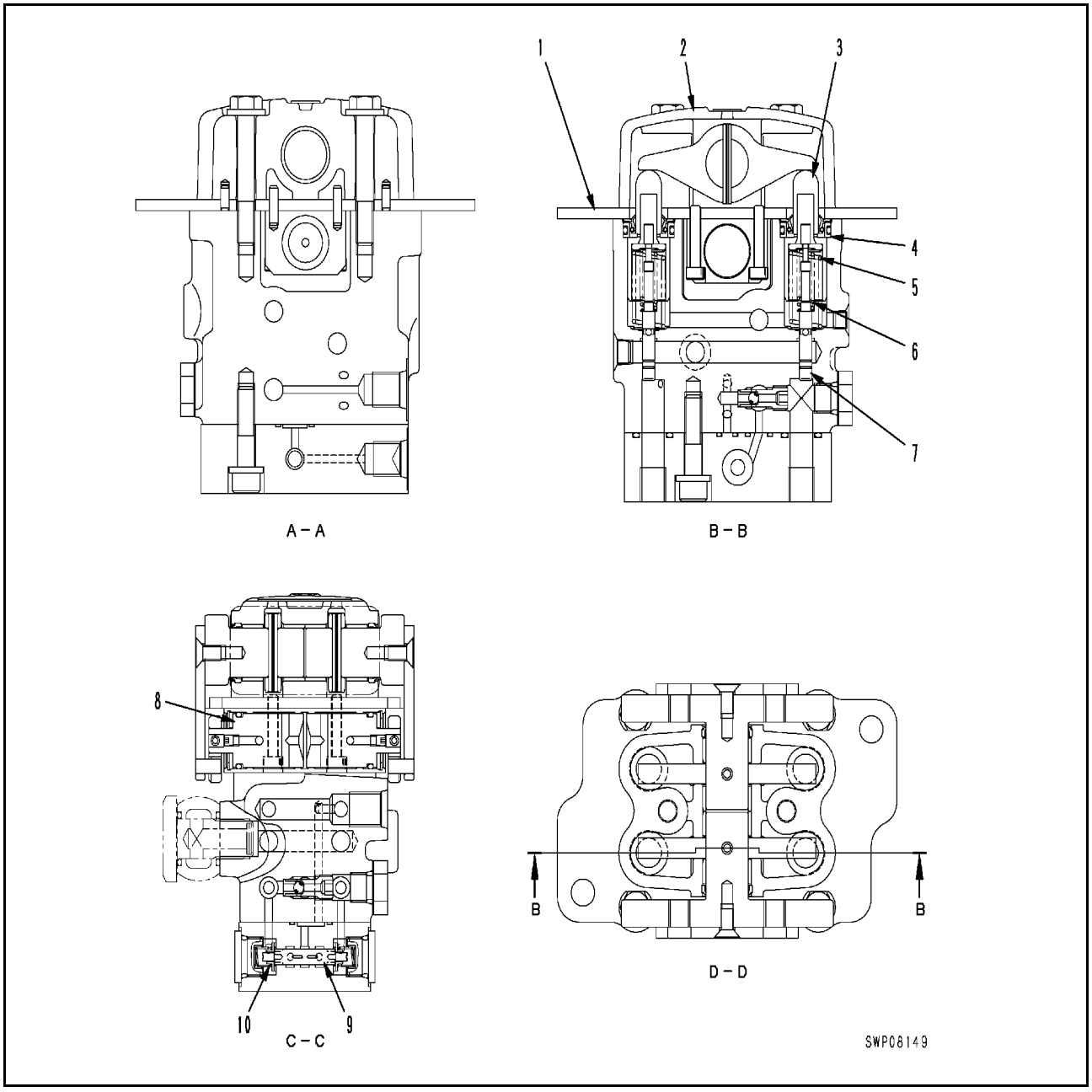
- This valve connects both travel circuits to each other so that the hydraulic oil will be supplied evenly to both travel motors and the machine will travel straight.
- When the machine is steered, outside pilot pressure **PST** closes the travel junction valve to secure high steering performance.

Operation

When pilot pressure is turned ON

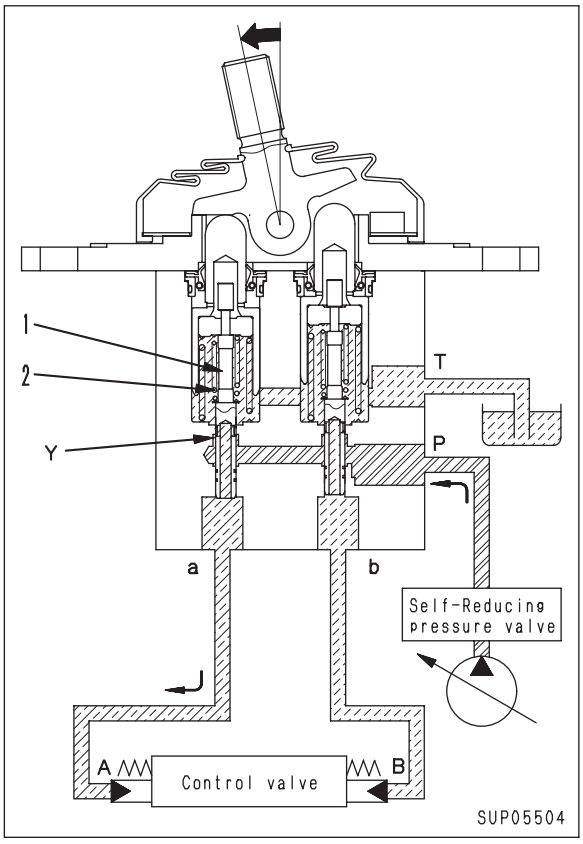
- If the pilot pressure from the travel junction solenoid valve becomes higher than the force of spring (14), travel junction spool (13) moves to the left stroke end and the junction circuit between port **PTL** (Left travel circuit) and **PTR** (Right travel circuit) is closed.





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

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

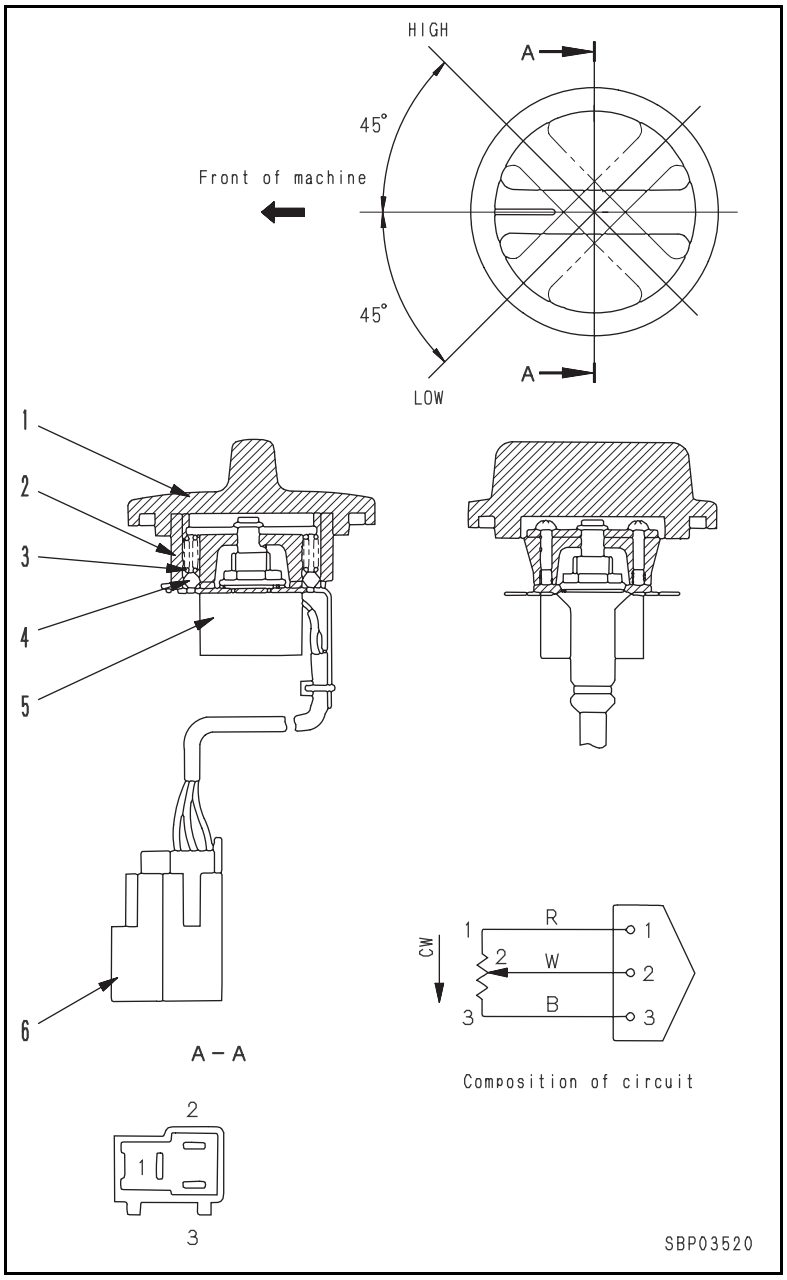


Unit: mm

No.	Check item		Criteria					Remedy
		Cylinder	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
1	Clearance between piston rod and bushing	Boom	100	-0.036 -0.090	+0.257 +0.047	0.083 ~ 0.347	0.412	Replace bushing
		Arm	110	-0.036 -0.090	+0.261 +0.047	0.083 ~ 0.351	0.412	
		Bucket	100	-0.030 -0.076	+0.257 +0.047	0.083 ~ 0.347	0.447	
2	Clearance between piston rod support pin and bushing	Boom	80	-0.030 -0.060	+0.190 +0.070	0.100 ~ 0.250	—	Replace pin or bushing
		Arm	80	-0.030 -0.076	+0.175 +0.075	0.105 ~ 0.251	—	
		Bucket	80	-0.030 -0.076	+0.175 +0.075	0.105 ~ 0.251	—	
3	Clearance between cylinder bottom support pin and bushing	Boom	80	-0.030 -0.060	+0.190 +0.070	0.075 ~ 0.225	—	
		Arm	100	-0.036 -0.090	+0.190 +0.070	0.106 ~ 0.280	—	
		Bucket	80	-0.030 -0.076	+0.175 +0.075	0.105 ~ 0.251	—	

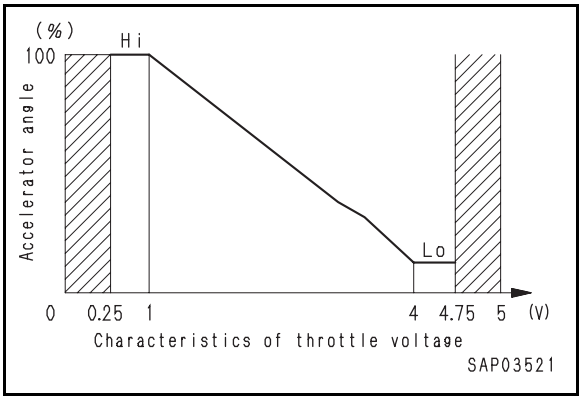
FUEL CONTROL DIAL

1. Knob
2. Dial
3. Spring
4. Ball
5. Potentiometer
6. Connector



FUNCTION

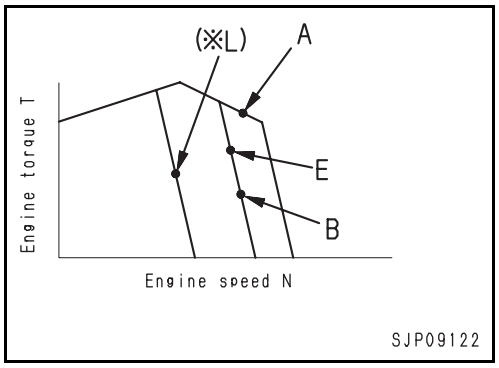
- The fuel control dial is installed under the monitor panel, and a potentiometer is installed under the knob. The potentiometer shaft is turned by turning the knob.
- As the potentiometer shaft is turned, the resistance of the variable resistor in the potentiometer changes and a throttle signal is sent to the engine throttle and pump controller.
  The hatched area in the graph shown at right is the abnormality detection area.

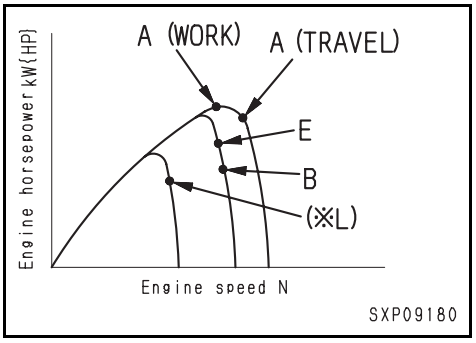


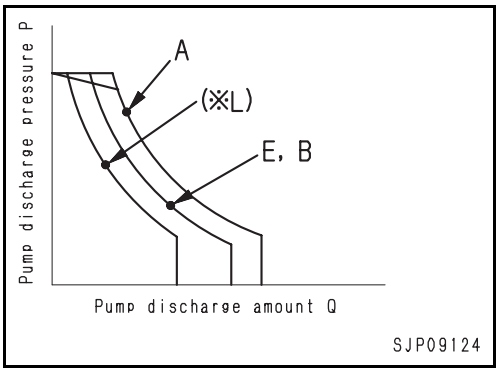
FUNCTION

- The operator can set the work mode switch on the monitor panel to mode A, E, or B (or ※L) and select proper engine torque and pump absorption torque according to the type of work.
- The engine throttle and pump controller detects the speed of the engine governor set with the fuel control dial and the actual engine speed and controls them so that the pump will absorb all the torque at each output point of the engine, according to the pump absorption torque set in each mode.

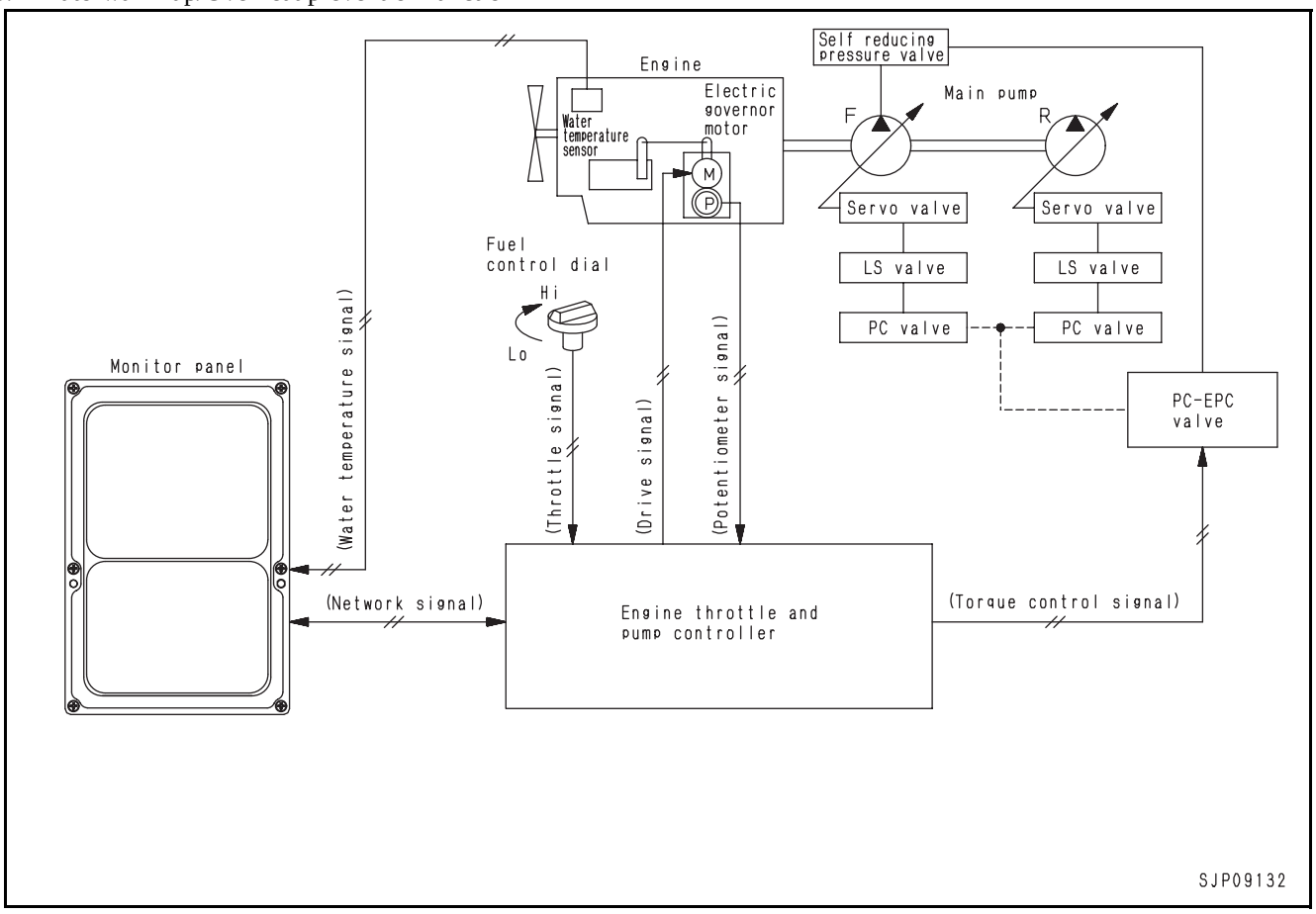
※ : The L mode is on the multi-monitor specification machine only.







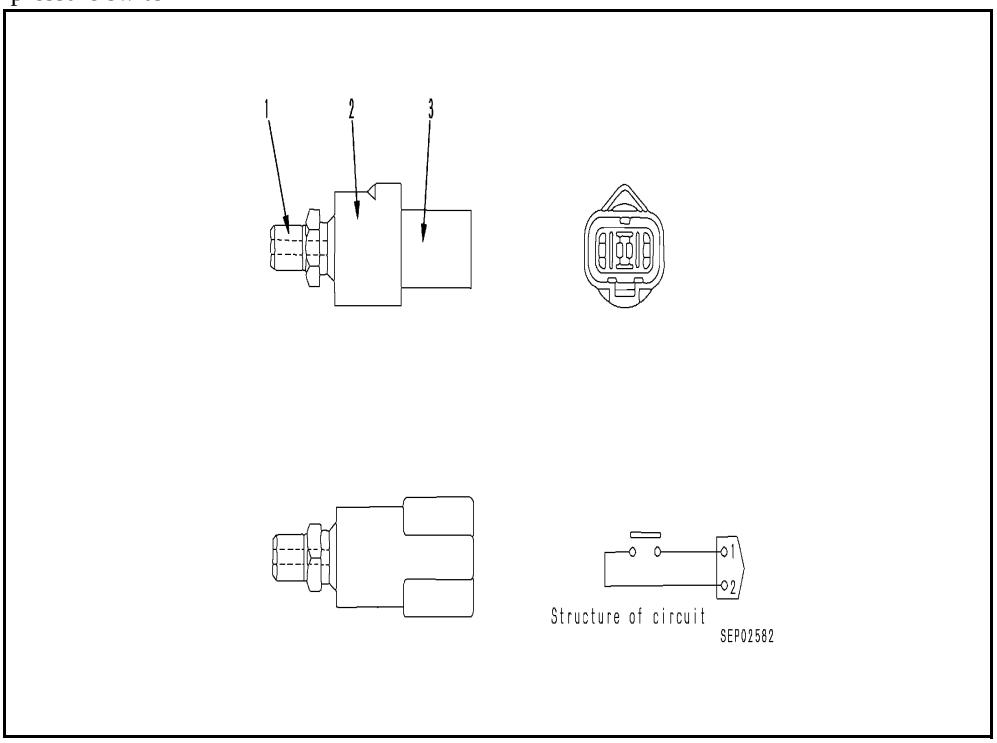
5. Auto-warm-up/Overheat prevention function



FUNCTION

After the engine is started, if the engine cooling water temperature is low, the engine speed is raised automatically to warm up the engine. If the engine cooling water temperature rises too high during work, the pump load is reduced to prevent overheating.

B. PPC oil pressure switch



1. Plug
2. Switch
3. Connector

SPECIFICATIONS

Type of contacts: Normally open contacts

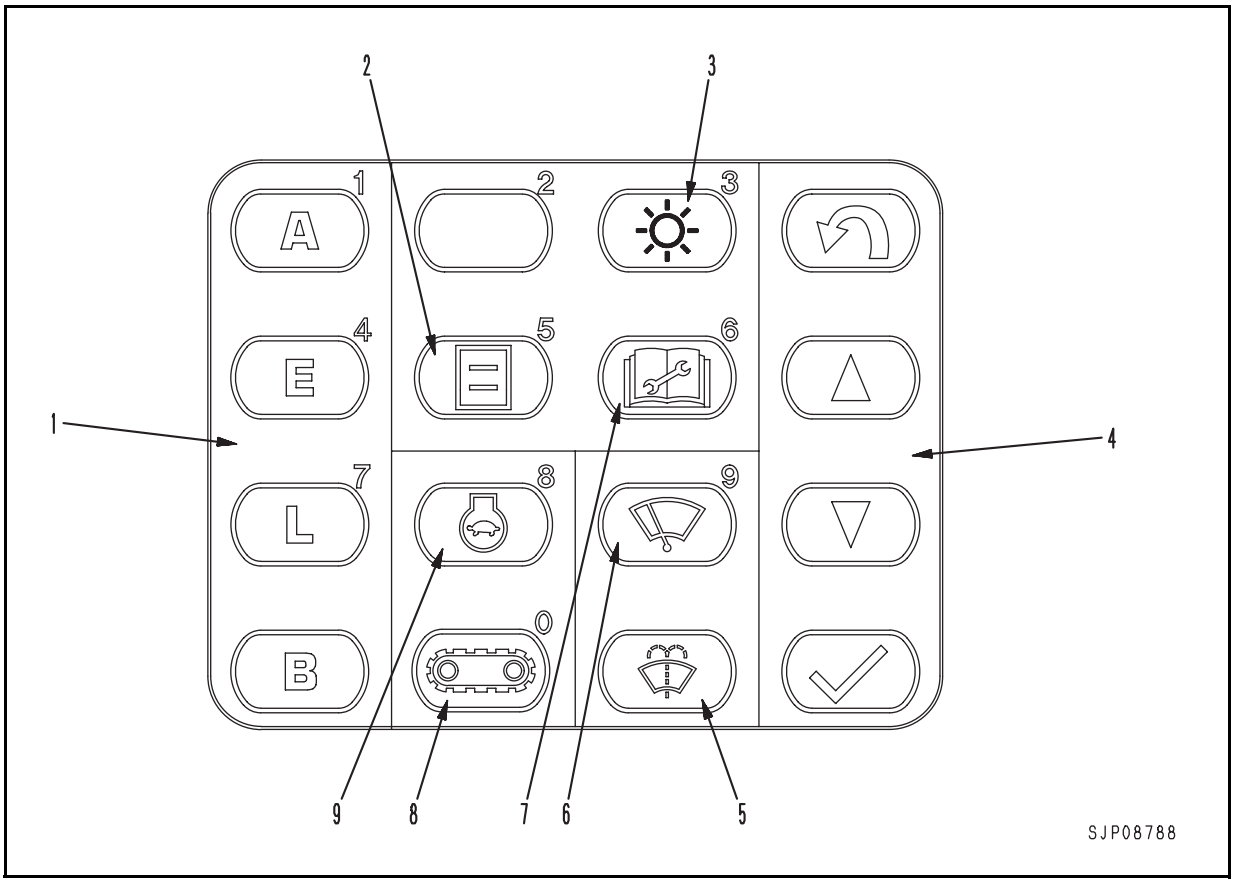
Operating (ON) pressure: 0.5 ± 0.1 MPa
(5.0 ± 1.0 kg/cm²)

Resetting (OFF) Pressure: 0.3 ± 0.5 MPa
(3.0 ± 0.5 kg/cm²)

FUNCTION

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

SWITCHES



1. Working mode selector switch
2. Selector switch
3. Display brightness, contrast adjustment switch
4. Control switch
5. Window washer switch
6. Wiper switch
7. Maintenance switch
8. Travel speed selector switch
9. Auto-deceleration switch

SENSORS

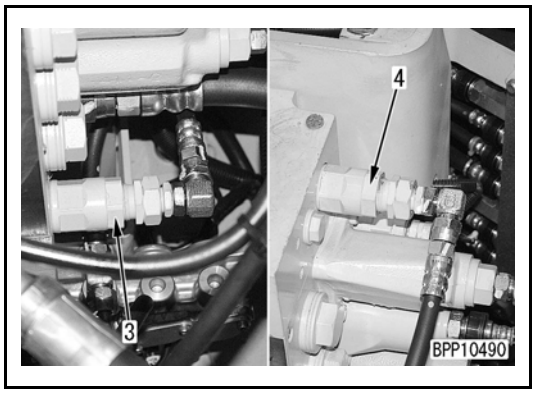
The signals from the sensors are input to the panel directly. Either side of a sensor of contact type is always connected to the chassis ground.

Sensor name	Type of sensor	When normal	When abnormal
Engine oil level	Contact	ON (Closed)	OFF (Open)
Engine oil pressure	Contact	OFF Open)	ON (Closed)
Hydraulic oil temperature	Resistance	—	—
Coolant temperature	Resistance	—	—
Fuel level	Resistance	—	—
Air cleaner clogging	Contact	OFF (Closed)	ON (Open)

Applicable model					PC270LL-7L	
Category	**Item**		**Measurement condition**	**Unit**	**Standard value**	**Permissible value**
Operation force of control levers	Boom control valve		• Hydraulic oil temperature: Within operation range • Engine at high idle • At center of control lever grip • At tip in case of pedal • Max reading up to stroke end	N (lbf)	15.7 ±3.9 (3.52 ±0.87)	Max 24.5 (Max 5.50)
	Arm control valve				15.7 ±3.9 (3.52 ±0.87)	Max 24.5 (Max 5.50)
	Bucket control valve				12.7 ±2.9 (2.85 ±0.65)	Max 21.6 (Max 4.85)
	Swing control valve				12.7 ±2.9 (2.85 ±0.65)	Max 21.6 (Max 4.85)
	Travel control valve	Lever			24.5 ±5.9 (5.50 ±1.32)	Max 39.2 (Max 8.81)
		Pedal			74.5 ±18.6 (16.74 ±4.18)	Max 107.2 (Max 24.09)

TESTING AND ADJUSTING

ADJUSTMENT



★ The unload valve and the safety valve for boom LOWER cannot be adjusted.

1. Adjustment of main relief pressure (high pressure setting side)
   ★ If relief pressure of the high pressure in the work equipment and travel circuits is not normal, adjust the high pressure setting side of main relief valves (3) and (4) in the following manner.
   - Main relief valve (3): For the front hydraulic pump circuit
   - Main relief valve (4): For the rear hydraulic pump circuit

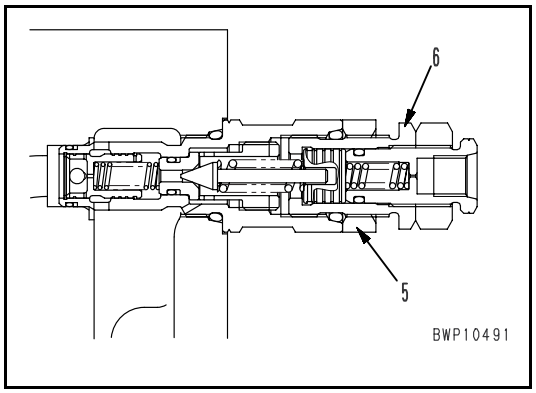
   ★ The relief pressure at high pressure indicates that when the 2-stage relief valve is ON and pilot pressure is applied to the switching port.

   A. Disconnect the pilot hose.

   B. Loosen lock nut (5) and adjust the pressure by turning holder (6).
      ★ If the holder is turned to the right, the pressure rises. If the holder is turned to the left, the pressure falls.
      ★ Adjustment amount per turn of holder:

Approximately 128 kg/cm² (1820 psi)

Lock nut: 53.5 ±4.9 Nm (39.4 ±3.6 lbf ft)



   C. Check the pressure again after the adjustment, following the aforementioned steps for measurement.
      ★ When measuring the pressure, connect the pilot hose.
      ★ If high pressure setting side is adjusted, low pressure setting side is also affected, so adjust it, too.

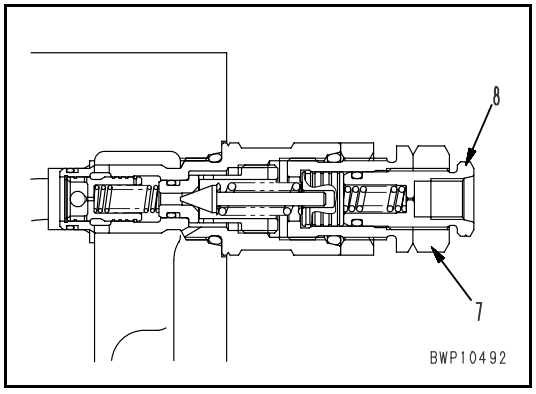
2. Adjustment of main relief pressure (low pressure setting side)
   ★ When low pressure relief pressure of the work equipment is not normal, or when adjustment is made of the high pressure setting side, adjust the low pressure side of the main relief valve, too.
   ★ The relief pressure at high pressure indicates that when the 2-stage relief valve is OFF and pilot pressure is not applied to the switching port.

   A. Disconnect pilot hose.

   B. Loosen lock nut (7) and adjust the pressure by turning holder (8).
      ★ If the holder is turned to the right, the pressure rises. If the holder is turned to the left, the pressure falls.
      ★ Adjustment amount per turn of holder:

Approximately 128 kg/cm² (1820 psi)

Lock nut: 53.5 ±4.9 Nm (39.4 ±3.6 lbf ft)



   C. Check the pressure again after the adjustment, following the aforementioned steps for measurement.

D. Measure the oil pressure when the engine is running at high idle and the travel speed switch and travel lever are operated.

★ If LS-EPC valve output pressure changes to the following values, the pressure is normal.

Travel Speed	Travel Control Lever	Hydraulic Pressure
Lo	Neutral	Approximately 30 kg/cm^2 (426 psi)
Hi	Fine control (Note)	0 (0)

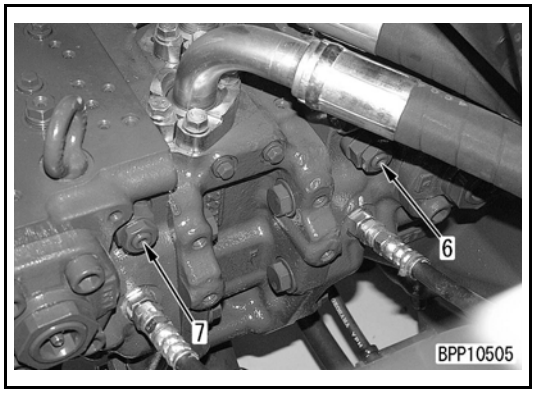
Remark

Operate the travel control lever slightly to the extent that the PPC hydraulic oil pressure is turned ON. (Stop the operation short of starting the machine)

E. Detach all the measurement tools after the measurement, and make sure that the machine is back to normal condition.

ADJUSTMENT

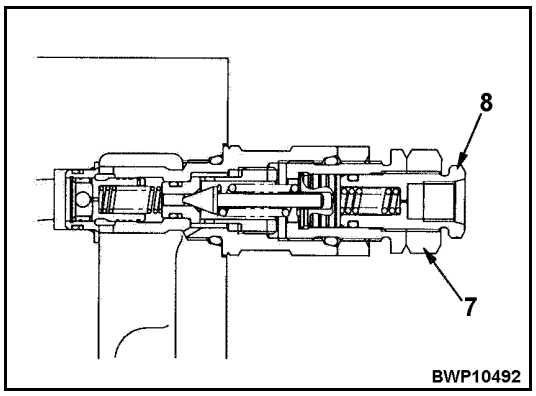
★ When LS differential pressure is not normal, adjust it with LS valves (6) and (7).



1. Loosen lock nut (8) and adjust the pressure by tuning adjusting screw (9).
   ★ If the adjusting screw is turned to the right, the differential pressure rises.
   If the adjusting screw is turned to the left, the differential pressure falls.
   ★ Adjustment amount (LS differential pressure) per turn of adjusting screw:

13.3 kg/cm^2 (189 psi)

Lock nut: 49 - 64 Nm (36 - 47 lbf ft)



2. After the adjustment, confirm that LS differential pressure is normal, following the steps for measurement explained earlier.

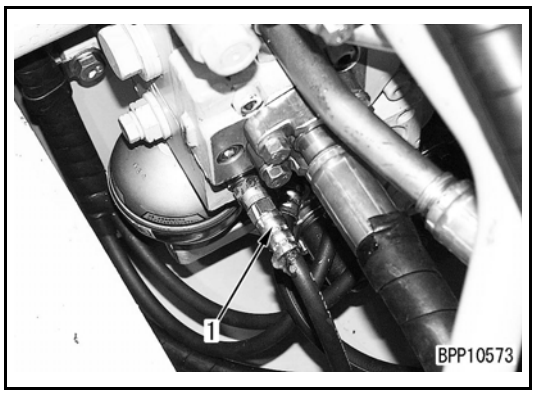
3. Inspection of boom lock valve

   A. Set the work equipment at the maximum reach and the boom top horizontal. Then stop the engine.

WARNING! Lock the work equipment control levers and release the pressure inside the hydraulic tank.

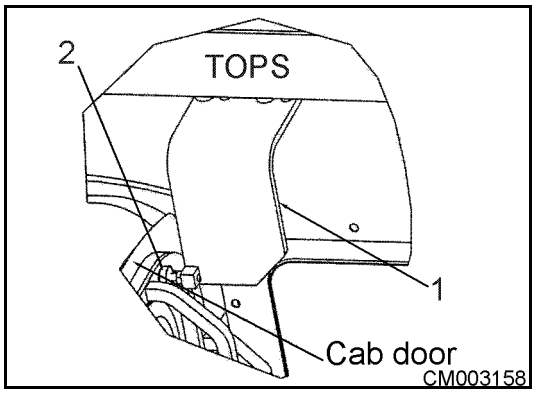
WARNING! Do not allow anyone to come under the work equipment during the work.

   B. Disconnect drain hose (1) of the control valve, and install a blind plug in the hose.
      - ● Part No. for the blind hose: 07376-70210
      - ★ Leave the control valve end open.
      - ★ If any oil leaks out from the port that is left open, following hydraulic drift of the work equipment, the boom lock valve is defective (loose contact).



4. Inspection of PPC valve
   Measure the amount of hydraulic drift of the work equipment when the accumulator is charged with pressure and the safety lock lever is put to the LOCK and FREE positions.
   - ★ Operate the control lever with the engine starting switch in the ON position.
   - ★ If pressure in the accumulator has dropped, run the engine for approximately 10 seconds to charge the accumulator again.
   - ★ If there is any difference in the hydraulic drift between LOCK and FREE positions, the PPC valve is defective (some internal failure).

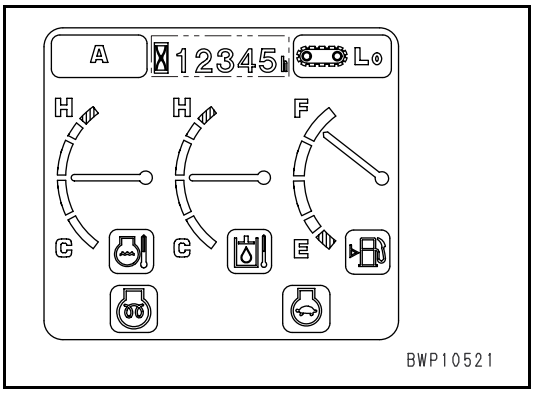
CAB DOOR STOP ADJUSTMENT



1. If WCB or OSHA window guarding attachment is installed (1), use forward set of holes.
   If no window guarding attachment is used, assemble using rear set of holes.

2. Adjust stopper (2) such that when door is open and in locked position, the rubber on the stopper is compressed 1 to 2 mm.

SERVICE MENU

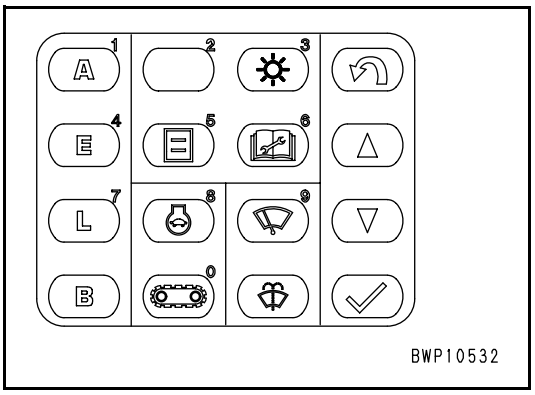


OPERATION AND DISPLAY

WAY OF SWITCHING TO SERVICE MENU

★ When using Service Menu, change the display to Service Menu display through the following special operation.

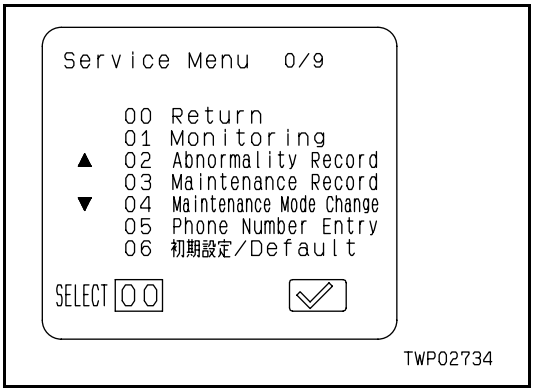
1. Confirmation of display
   Confirm that the display of ordinary items is shown.
   ★ Changing to Service Menu cannot be made from displays other than this.



2. Switch operation
   Operate the switch as instructed below.
   ● Switch operation: [△] + [1] → [2] → [3]
   (Enter a figure, depressing [△])

3. Showing Service Menu display
   The display is changed to the initial display of Service Menu program.
   Select an appropriate item from among the menu.

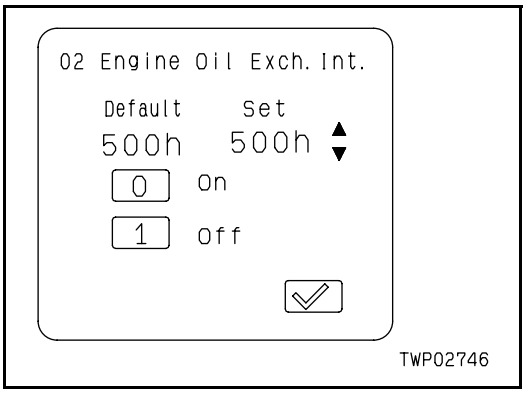
No.	Service Menu
00	Return (Termination of Service Menu)
01	Monitoring
02	Abnormality Record
03	Maintenance Record
04	Maintenance Mode Change
05	Phone Number Entry
06	☆☆☆☆☆ / Default
07	Adjustment
08	–



4. Termination of Service Menu function
   When terminating the initial display or any subsequent display of Service Menu, do that through any one of the following methods.
   ① Depress [↩] switch. (This method may be used for terminating any display)
   ② If "Return" switch is shown, depress it.
   ③ If "Return" menu is shown, call that menu and depress [✓] switch.

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

★ The lowest maintenance time is 50 h.



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

4. Inspection of hydraulic circuit

No.	Part to be checked	Condition setting							① 600 kg/cm²	② 600 kg/cm²	③ 600 kg/cm²	④ 600 kg/cm²	⑤ 60 kg/cm²	Remarks
		Fuel dial	Working mode	Auto-decelerator	One-touch power max. switch		Work equipment operation		F main pump	R main pump	F main pump LS	R pump LS	Control circuit pressure	
1	Self-decompression valve													Circuit pressure 3.2 MPa {33 kg/cm²}
2	Main relief valve				OFF		Arm dumping relief							34.8 → 37.3 MPa {355 → 380 kg/cm²}
3	(When power increased)				ON									
4	LS valve (LS differential pressure valve)	Full	A	OFF	OFF	Neutral	Travel without load, engine at Hi idling and control lever at half stroke	Right						Main–LS=2.5 MPa{25.0 kg/cm²} (LS pressure)
								Left						
5	Swing safety valve						Swing lock switch ON	Right relief						30.9 MPa {315 kg/cm²}
								Left relief						
6	Main relief valve, Travel safety valve, Travel interlocking valve						Track shoe locked	Right forward						38.2 MPa {390 kg/cm²}
								Right reverse						
								Left forward						
								Left reverse						

Connection to be changed to hoses ③ and ④

No.	Part to be checked	Condition setting				① 600 kg/cm²	② 600 kg/cm²	③ 600 kg/cm²	④ 600 kg/cm²	⑤ 60 kg/cm²	Remarks
		Fuel dial	Working mode	Auto-decelerator	One-touch power max. switch	F main pump	R main pump	F pump servo	R pump servo	Control circuit pressure	
7	Servo	Full	A	OFF	OFF	Arm dumping relief					Main servo pressure balance ③/① ≒ ④/② ≒ 3/5

Connection to be changed to hoses ③ and ④, and gauge to be replaced with one with 60 K capacity.

No.	Part to be checked	Condition setting					① 600 kg/cm²	② 600 kg/cm²	③" 60 kg/cm²	④" 60 kg/cm²	⑤ 60 kg/cm²	Remarks <Reference value: kg/cm²>
		Fuel dial	Working mode	Auto-decelerator	One-touch power max. switch	Work equipment operation	Travel lever	F main pump	R main pump	PC EPC	LS EPC	Control circuit pressure	
8	PC-EPC valve	Low	A	OFF	OFF	Neutral	Neutral						<32> Delivery variance by switching modes < 0> <10> <11> <10> Q P TWP02760
		Full	E (※L)										
			B										
9	LS-EPC valve	Full	A	OFF	OFF	Neutral	Neutral						At neutral: 2.9 MPa {30 kg/cm²}
			(※L)			Arm dumping relief	Right lever at halfway position						When 2 pumps relieved: 0 MPa {0 kg/cm²}
							Left lever at halfway position						
						Arm IN relief	Right lever at halfway position						When one pump relieved: 1.5 MPa {15 kg/cm²}
							Left lever at halfway position						

※: The "L" mode is on the multi-monitor specification machine only

Do not travel the machine.

CM000434

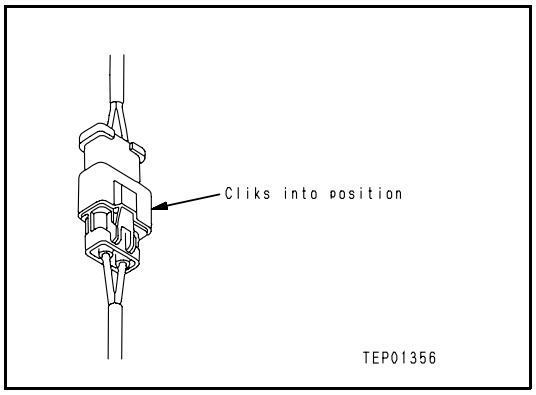
CONNECTING CONNECTORS

A. Check the connector visually.

i. Check that there is no oil, dirt, or water stuck to the connector pins (mating portion).

ii. Check that there is no deformation, defective contact, corrosion, or damage to the connector pins.

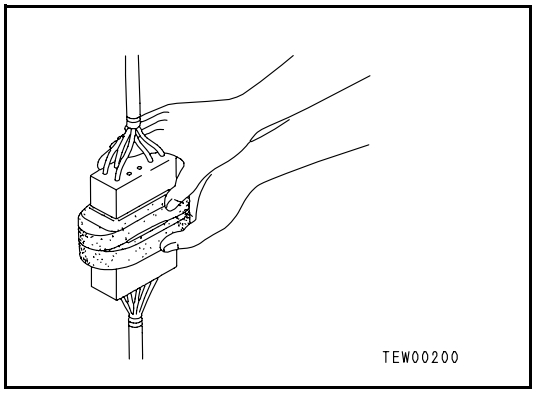
iii. Check that there is no damage or breakage to the outside of the connector.



★ 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.

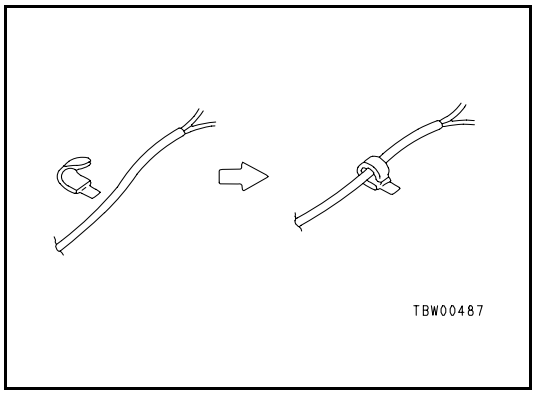
B. Fix the connector securely.
Align the position of the connector correctly, then insert it securely.
For connectors with lock stopper, push in the connector until the stopper clicks into position.



C. 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.

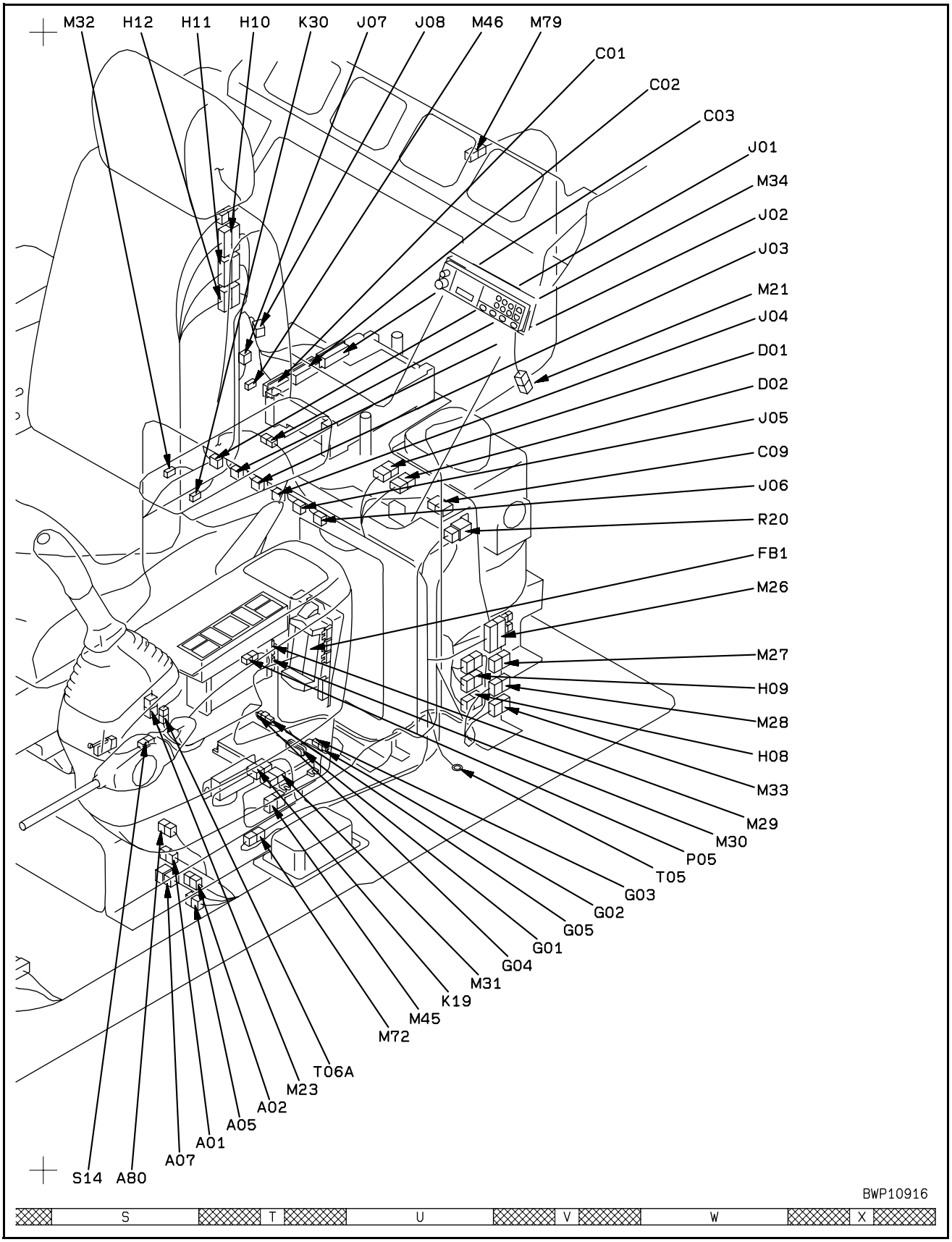
D. If the connector clamp has been removed, be sure to return it to its original position. Check also that there are no loose clamps.

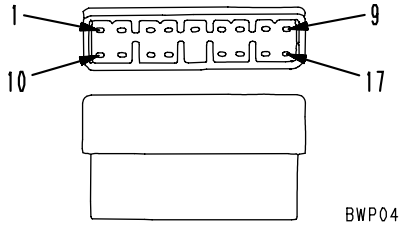
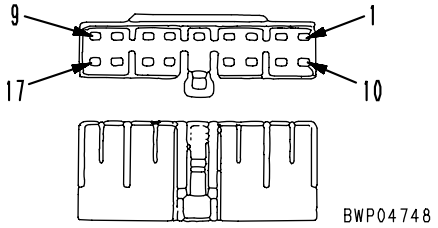
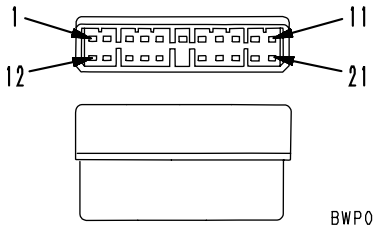
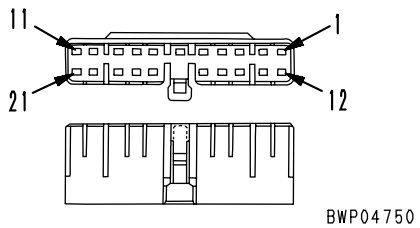


CONNECTOR LOCATION CHART

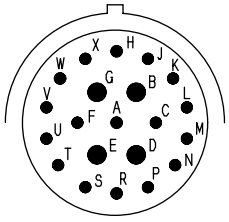
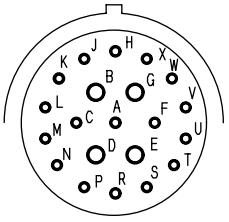
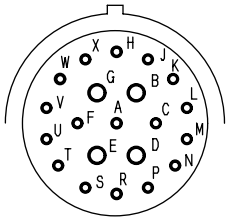
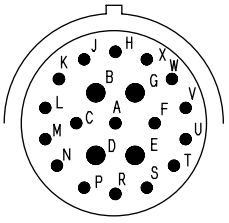
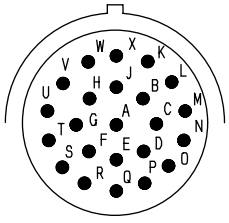
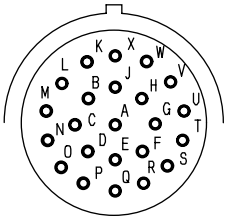
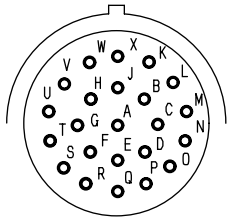
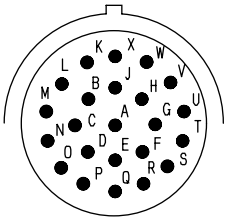
CONNECTOR TABLE

Connector No.	Type	No. of pin	Name of device	Address
A01	X	4	Intermediate connector	T-1
A02	X	4	Intermediate connector	T-1
A03	D	12	Intermediate connector	N-1
A04	SWP	12	Intermediate connector	O-1
A05	SWP	14	Intermediate connector	T-1
A06	SWP	14	Intermediate connector	N-1
A07	SWP	16	Intermediate connector	S-1
A08	SWP	12	Intermediate connector	N-2
A09	SWP	8	Intermediate connector	N-2
A10	Terminal	1	Revolving frame grounding	H-1
A11	Terminal	1	Revolving frame grounding	H-1
A12	Terminal	1	Revolving frame grounding	H-2
A13	Terminal	1	Revolving frame grounding	I-2
A14	Terminal	1	Revolving frame grounding	K-2
A15	Terminal	1	Revolving frame grounding	I-2
A16	Terminal	1	Revolving frame grounding	I-2
A20	Terminal	1	Battery relay (E terminal)	J-1
A21	Terminal	1	Battery relay (BR terminal)	J-1
A22	Terminal	1	Battery relay (M terminal)	J-1
A23	Terminal	1	Battery relay (B terminal)	J-2
A25	Terminal	1	Heater relay (coil)	L-3
A26	Terminal	1	Heater relay (contact)	L-3
A27	X	2	Starter safety relay (S and R terminals)	K-2
A29	Terminal	1	Starter safety relay (C terminal)	L-3
A30	YAZAKI	2	Air conditioner outside air temperature sensor	L-4
A31	D	2	Air cleaner clogging sensor	L-4
A33	X	2	Radiator water level sensor	L-4
A34	L	2	Fusible link (65A)	A-4
A35	M	2	Fusible link (30A)	A-5
A40	AMP	1	Alarm horn (low tone)	H-1
A41	AMP	1	Alarm horn (high tone)	H-1
A42	X	1	Intermediate connector	I-9
A43	X	2	Travel alarm	I-2
A44	M	1	Front right lamp	A-6


M32
H12
H11
H10
K30
J07
J08
M46
M79
C01
C02
C03
J01
M34
J02
J03
M21
J04
D01
D02
J05
C09
J06
R20
FB1
M26
M27
H09
M28
H08
M33
M29
M30
P05
T05
G03
G02
G05
G01
G04
M31
K19
M45
M72
T06A
M23
A02
A05
A01
A07
S14
A80
BWP10916
S
T
U
V
W
X

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

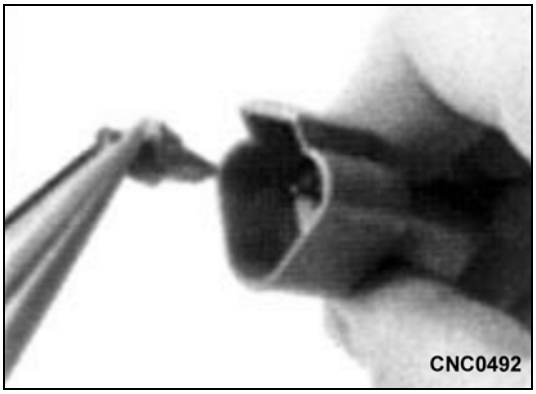
[The pin No. is also marked on the connector (electric wire insertion end)]

<table>
<tr><td rowspan="2">Type (shell size code)</td><td colspan="3">HD30 Series connector</td></tr>
<tr><td>Body (plug)</td><td>Body (receptacle)</td><td>T-adapter Part No.</td></tr>
<tr><td rowspan="6">24-21 (7)</td><td>Pin (male terminal)</td><td>Pin (female termial)</td><td rowspan="3">799-601-9270</td></tr>
<tr><td> 
BWP05025</td><td> 
BWP05026</td></tr>
<tr><td>Part No.: 08191-71201, 08191-71202,
08191-71205, 08191-71206</td><td>Part No.: 08191-74101, 08191-74102,
08191-74105, 08191-74106</td></tr>
<tr><td>Pin (female terminal)</td><td>Pin (male termial)</td><td rowspan="3">799-601-9270</td></tr>
<tr><td> 
BWP05027</td><td> 
BWP05028</td></tr>
<tr><td>Part No.: 08191-72201, 08191-72202,
08191-72205, 08191-72206</td><td>Part No.: 08191-73101, 08191-73102,
08191-73105, 08191-73106</td></tr>
<tr><td rowspan="6">24-22 (8)</td><td>Pin (male terminal)</td><td>Pin (female termial)</td><td rowspan="3">799-601-9280</td></tr>
<tr><td> 
BWP05029</td><td> 
BWP05030</td></tr>
<tr><td>Part No.: 08191-81201, 08191-81202
08191-81203, 08191-81204
08191-81205, 08191-80206</td><td>Part No.: 08191-84101, 08191-84102
08191-84103, 08191-84104
08191-84105, 08191-84106</td></tr>
<tr><td>Pin (female terminal)</td><td>Pin (male termial)</td><td rowspan="3">799-601-9280</td></tr>
<tr><td> 
BWP05031</td><td> 
BWP05032</td></tr>
<tr><td>Part No.: 08191-82201, 08191-82202
08191-82203, 08191-82204
08191-82205, 08191-82206</td><td>Part No.: 08191-83101, 08191-83102
08191-83103, 08191-83104
08191-83105, 08191-83106</td></tr>
</table>

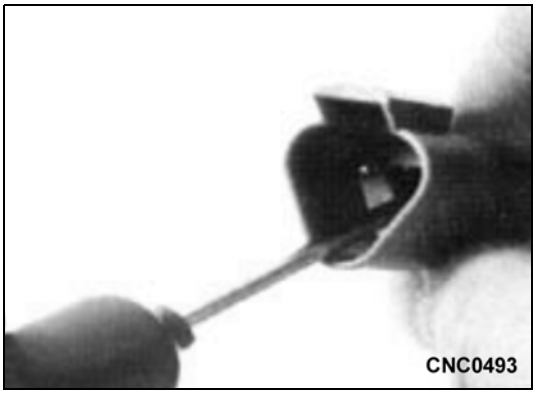
CONTACT TERMINAL REMOVAL (DT TYPE)

1. Remove the wedge lock using needle nose pliers or a hooked shaped
   wire.

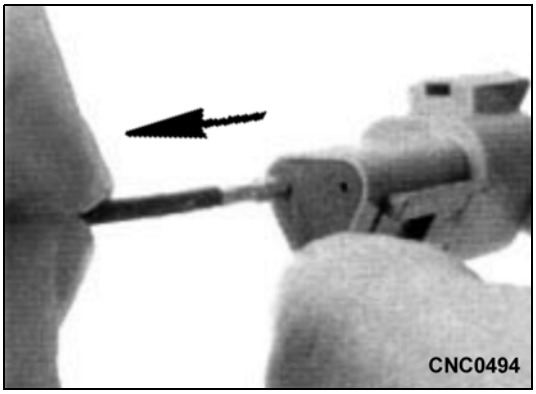
2. Pull the wedge lock straight out and save for reinstallation.



3. To remove the contact terminal gently pull the wire backwards while at the same time releasing the locking finger by pushing it away from the terminal with a small screwdriver.



4. Hold the rear seal grommet in place and pull the contact terminal out of the connector.



Electrical Circuit Diagram

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

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

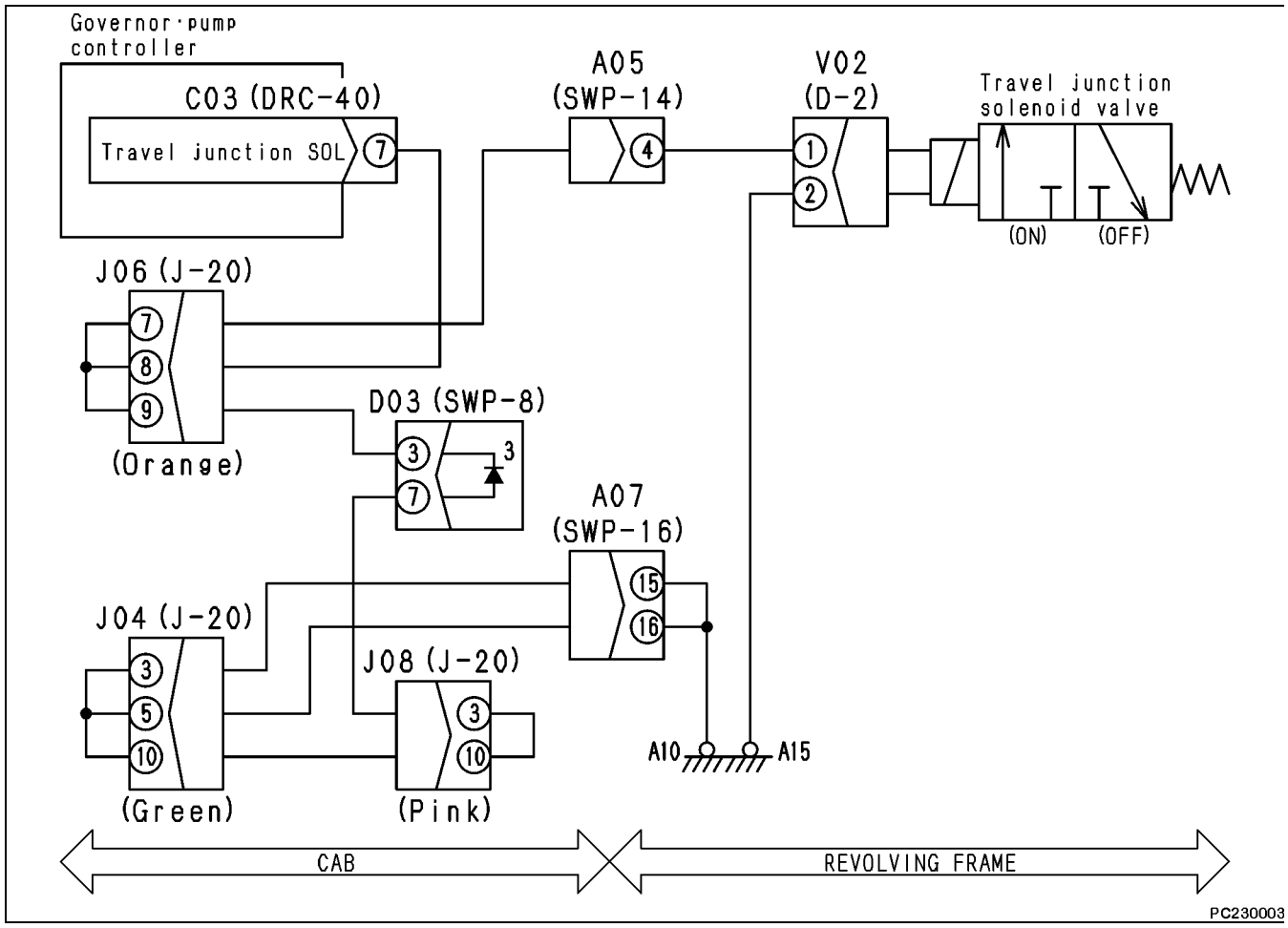
SHORT OR OPEN IN GUARD WASHER SYSTEM

Contents Of Trouble	• Possible short or open in windshield washer system • Failure code DY2CKB displayed. • Washer system does not work.

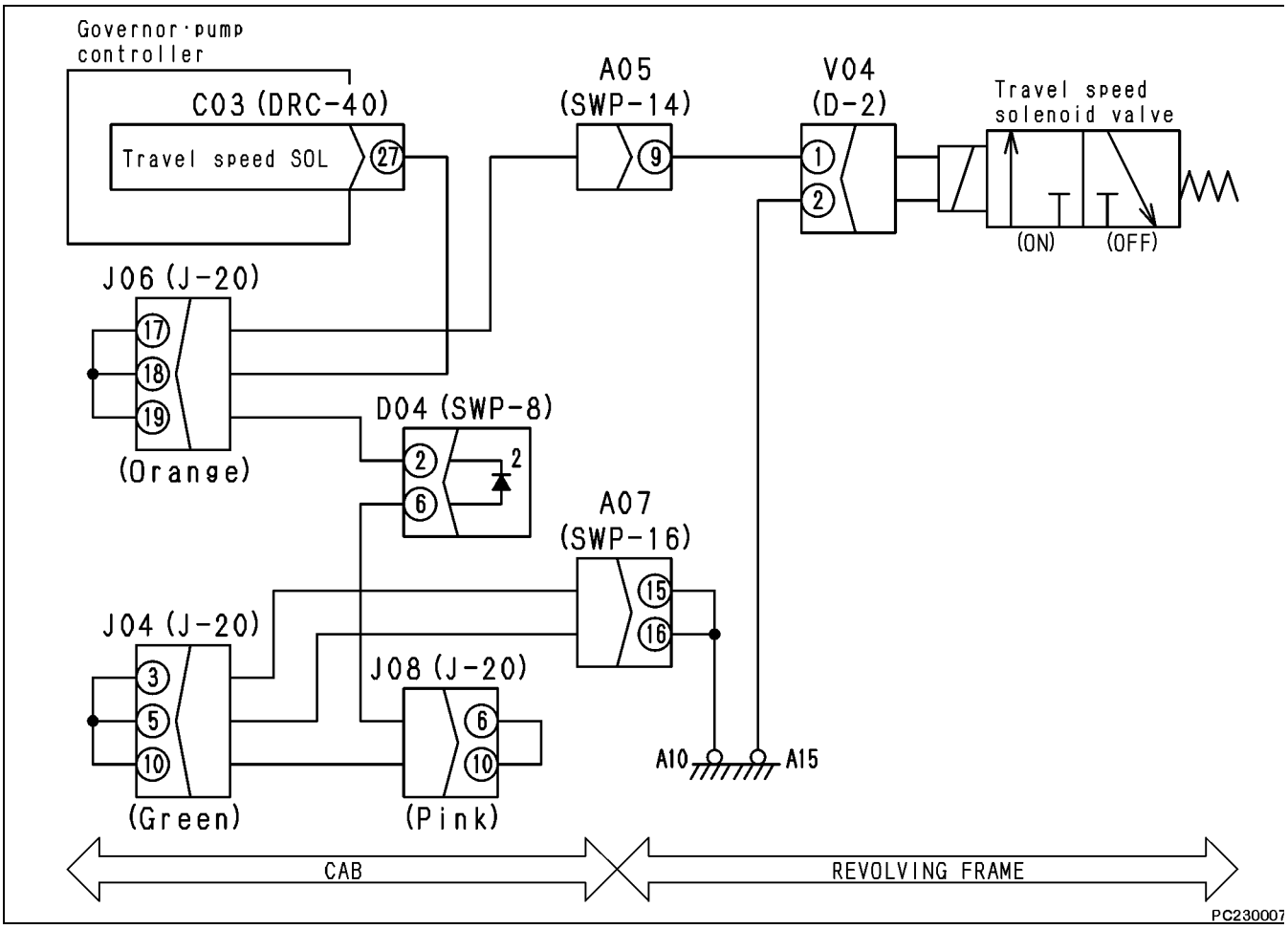
Tools and Procedures	• Digital Volt Ohm Meter. T-adapter kit. • Do not mark on original page of service manual. Remove this page from the service manual and make a copy for recording information while performing these tests. • If you are unable to copy this page, record readings on a separate paper referring 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.

Steps	Circuit Diagnostic Procedures For Service Code [E114]			Specifications	No.	Readings
Fuse		—	Check condition of fuse FB1, (4) before proceeding with these tests.	Good Condition?	**1**	Yes or No
1. Diode Test • With ignition switch in the “OFF” position. • Disconnect (D2FM) diode connector and isolate diode.						
A. Diode test		Resistance Ω	At diode D04, between (4) and (8) reversing meter lead polarity each time to check.	Continuity one way only?	**2**	Yes or No
2. Washer Motor Test • With ignition switch in the “OFF” position. • Disconnect (W3FM) connector from washer motor. • Zero meter leads for proper Ω readings.						
A. Motor test		Resistance Ω	At washer motor A50, between (1) and (2).	5 to 20Ω	**3**	
3. Wiring Harness Assembly Test • With ignition switch in the “OFF” position. • Set wiper/washer select switch to “GUARD”. • Disconnect (W3FM) connector from washer motor. • Disconnect (P01B) connector from monitor panel and install T-adapter on (P01) wiring harness connector only • ✷ Turn ignition switch to the “ON” position for this test.						
A. Open or high resistance		Voltage	✷ At connector W3FM, between (1) and chassis ground.	20 to 30V	**4**	
		Resistance Ω	Between connectors W3FM, (2) and PO1, (3)	0.0 to 1.0Ω	**5**	
B. Short to chassis ground or within harness		Resistance Ω	At connector W3FM, between (1) and chassis ground.	(OL) open	**6**	
			At connector W3FM, between (2) and chassis ground.	(OL) open	**7**	
			At connector W3FM, between (2) and (1)	(OL) open	**8**	
4. Monitor Panel Test • With ignition switch in the “OFF” position. • Set wiper/washer select switch to “GUARD”. • Disconnect (P01A) connector from monitor panel and install T-adapter between (P01A) wiring harness connector and monitor panel. • Turn ignition switch to the “ON” position.						
A. Monitor test		Voltage	Between P01, (3) and chassis ground, washer released.	20 to 30V	**9**	
			Between P01, (3) and chassis ground, washer activated.	0V	**10**	

ELECTRICAL CIRCUIT FOR TRAVEL INTERLOCKING SOLENOID PUMP CONTROLLER

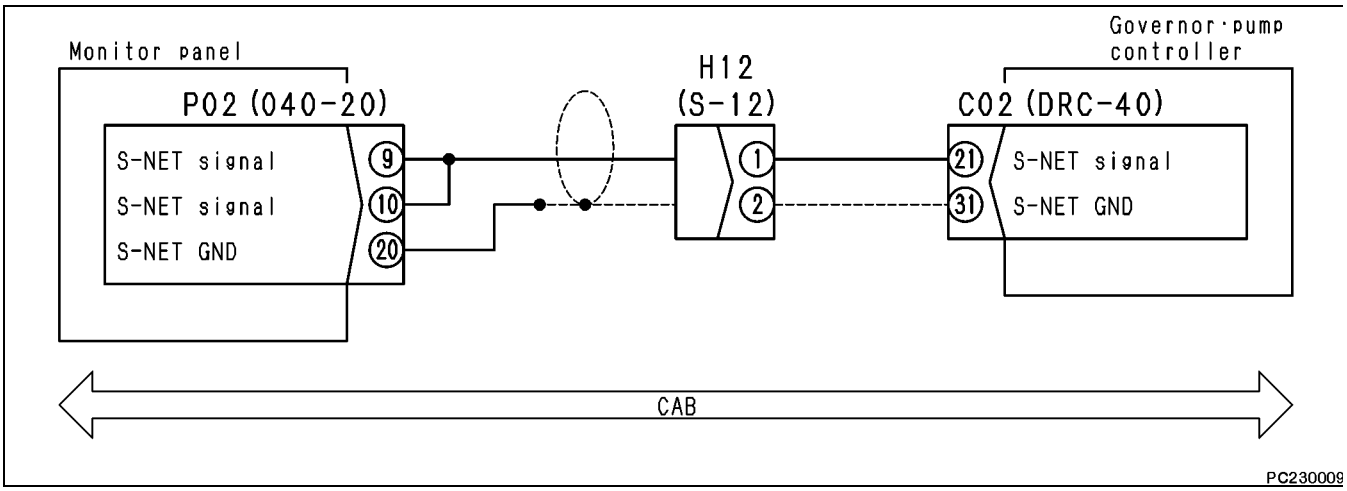


ELECTRICAL CIRCUIT DIAGRAM FOR TRAVEL SPEED SOLENOID GOVERNOR PUMP CONTROLLER

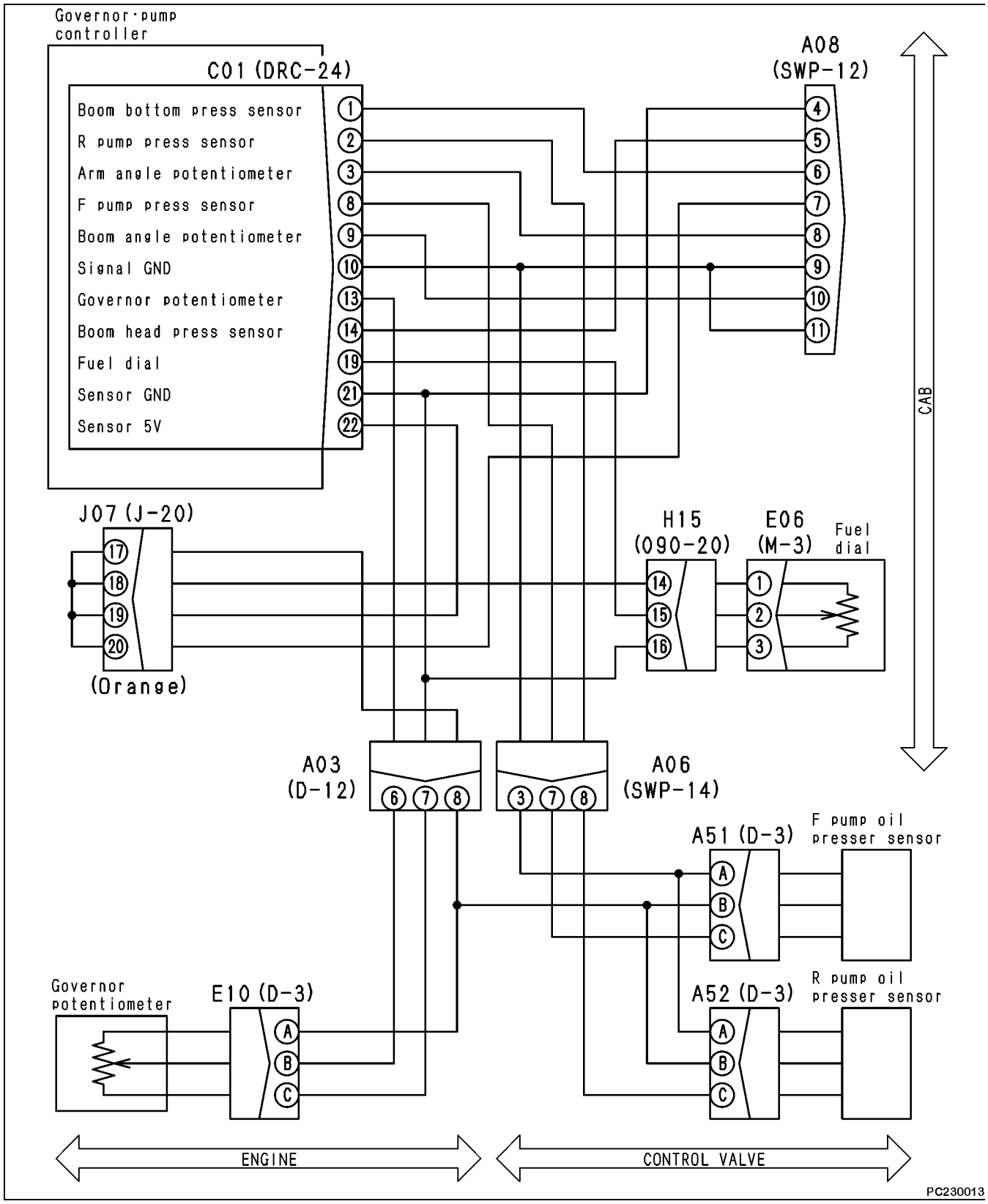


MEMORANDUM

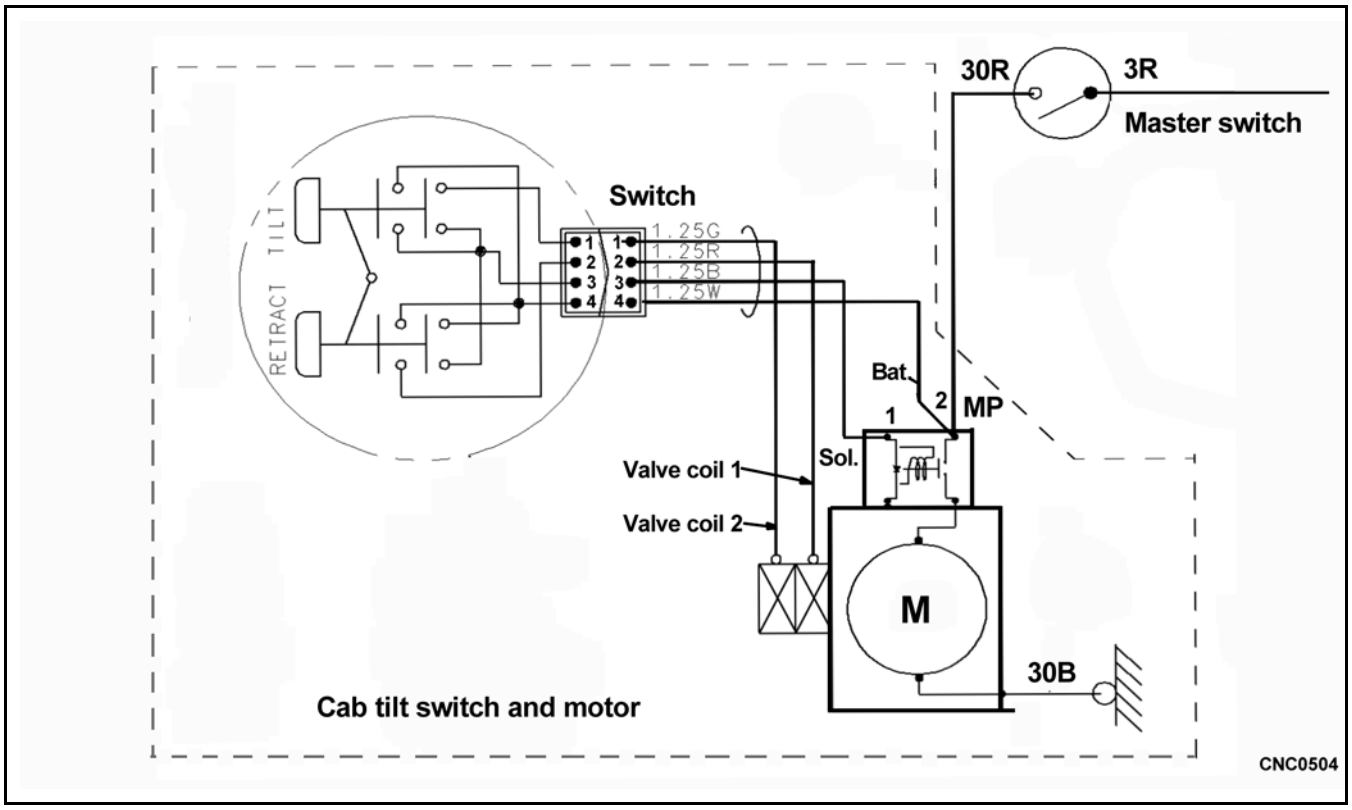
ELECTRICAL CIRCUIT DIAGRAM FOR S-NET



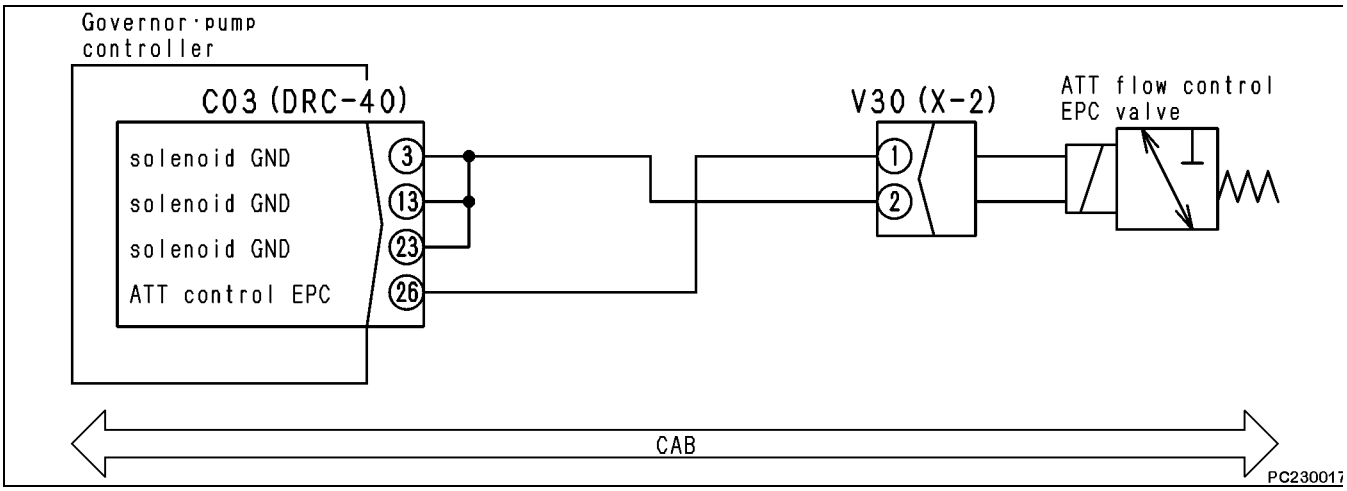
ELECTRICAL CIRCUIT DIAGRAM FOR SENSOR POWER SOURCE



ELECTRICAL CIRCUIT DIAGRAM FOR CAB TILT SYSTEM

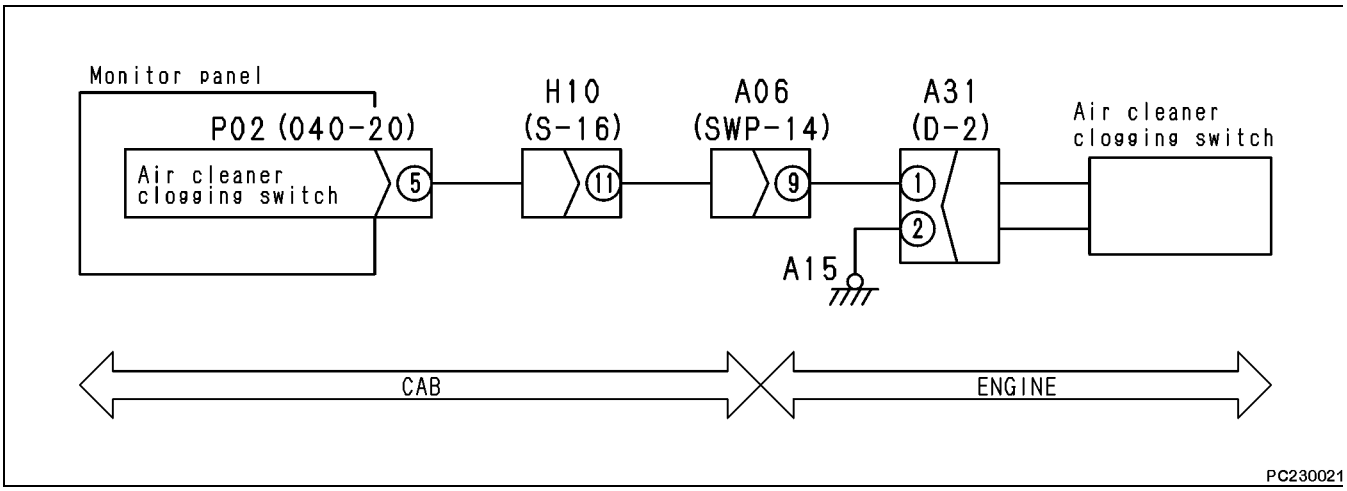


ELECTRICAL CIRCUIT DIAGRAM FOR OIL FLOW RATE ADJUSTING EPC SOLENOID

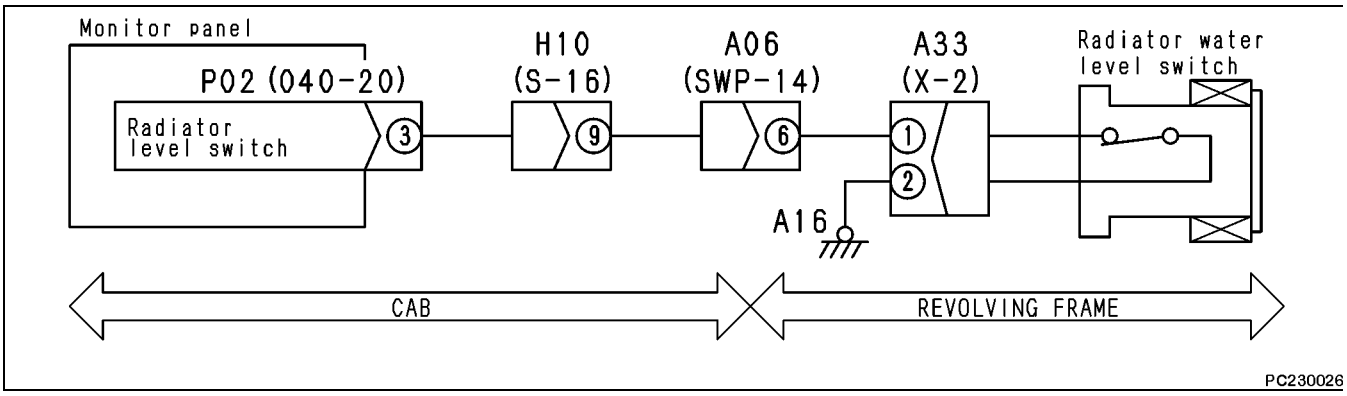


MEMORANDUM

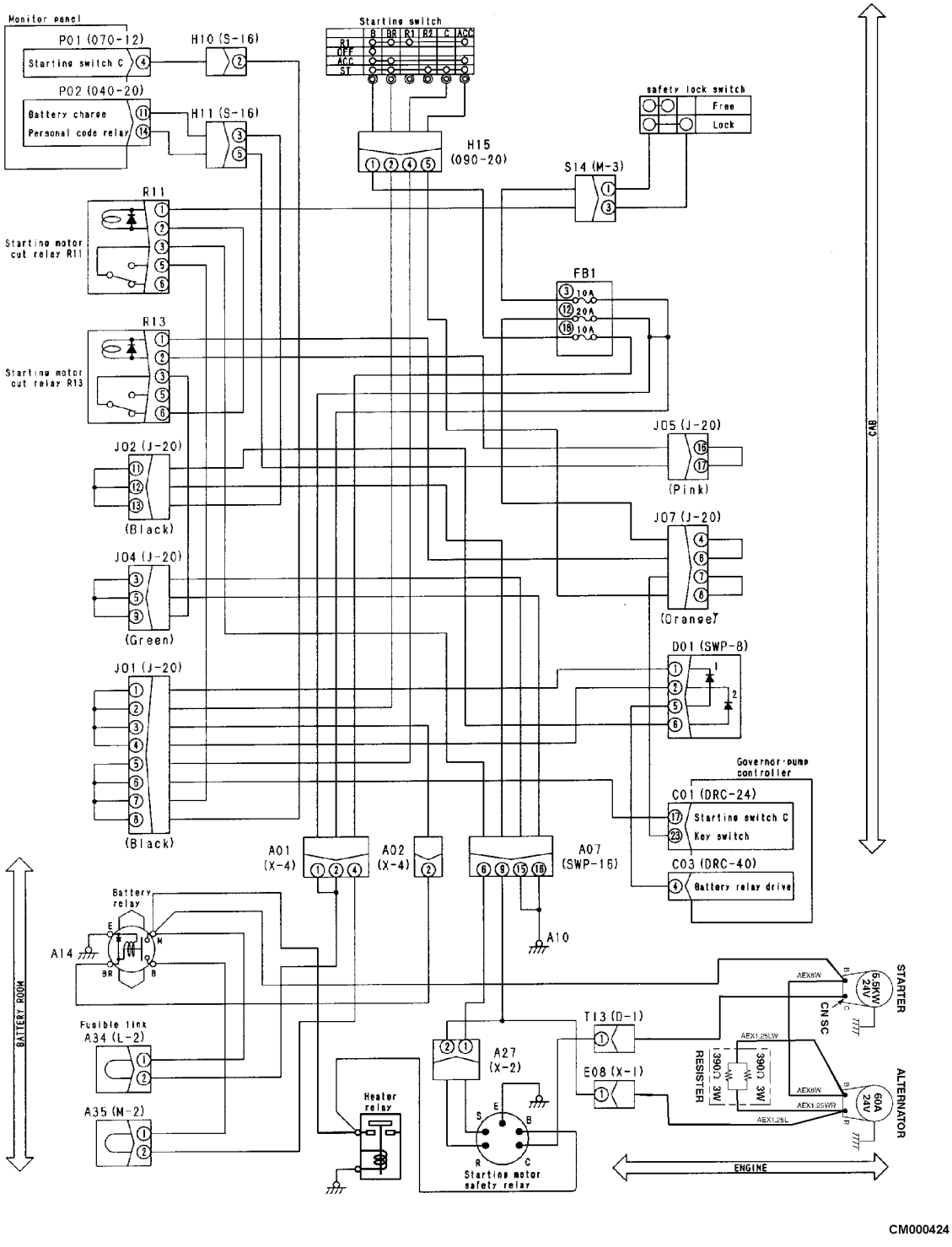
ELECTRICAL CIRCUIT FOR AIR CLEANER CLOGG SWITCH



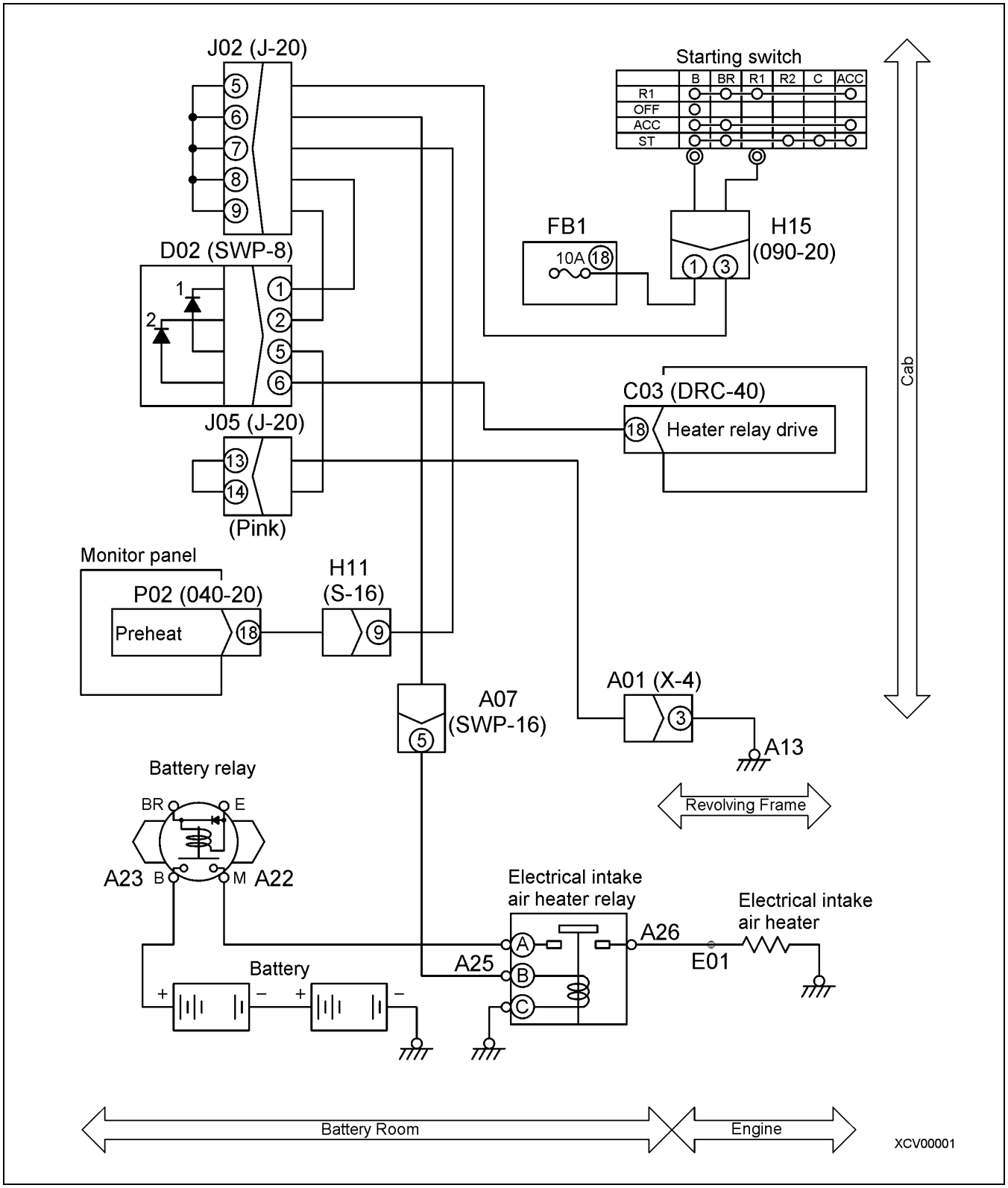
ELECTRICAL CIRCUIT DIAGRAM FOR RADIATOR WATER LEVEL SENSOR



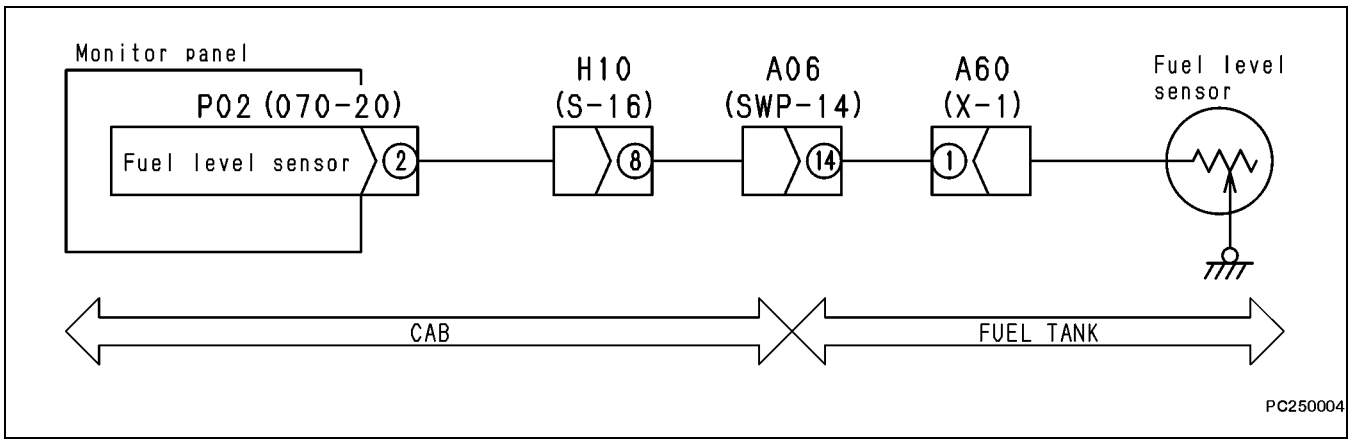
ELECTRICAL CIRCUIT DIAGRAM FOR ENGINE START, STOP AND BATTERY CHARGING



ELECTRICAL CIRCUIT DIAGRAM FOR ENGINE PREHEATER

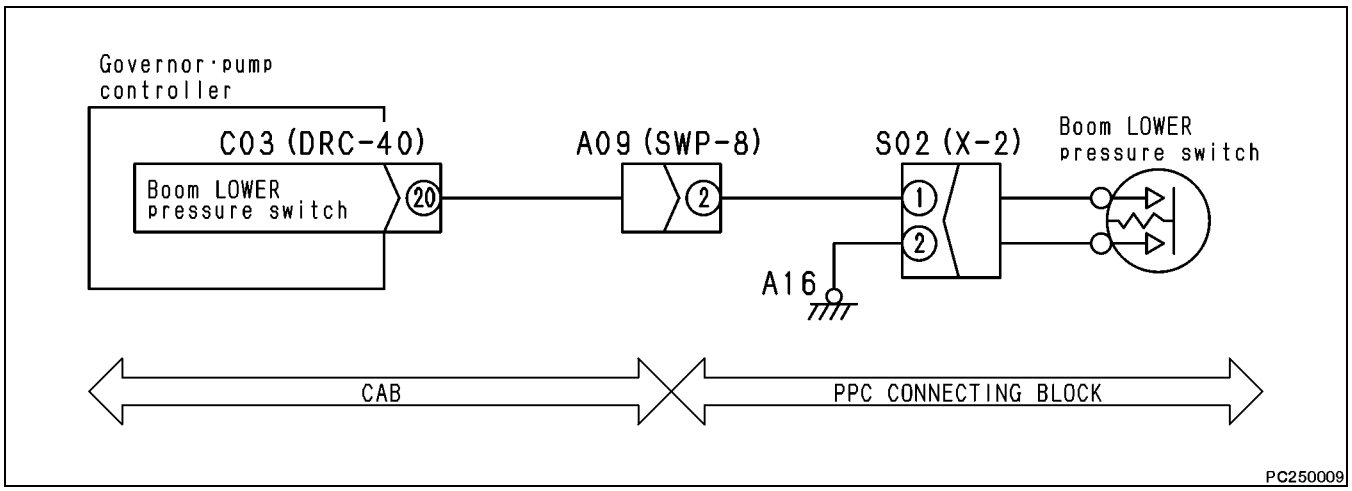


ELECTRICAL CIRCUIT DIAGRAM FOR FUEL LEVEL SENSOR

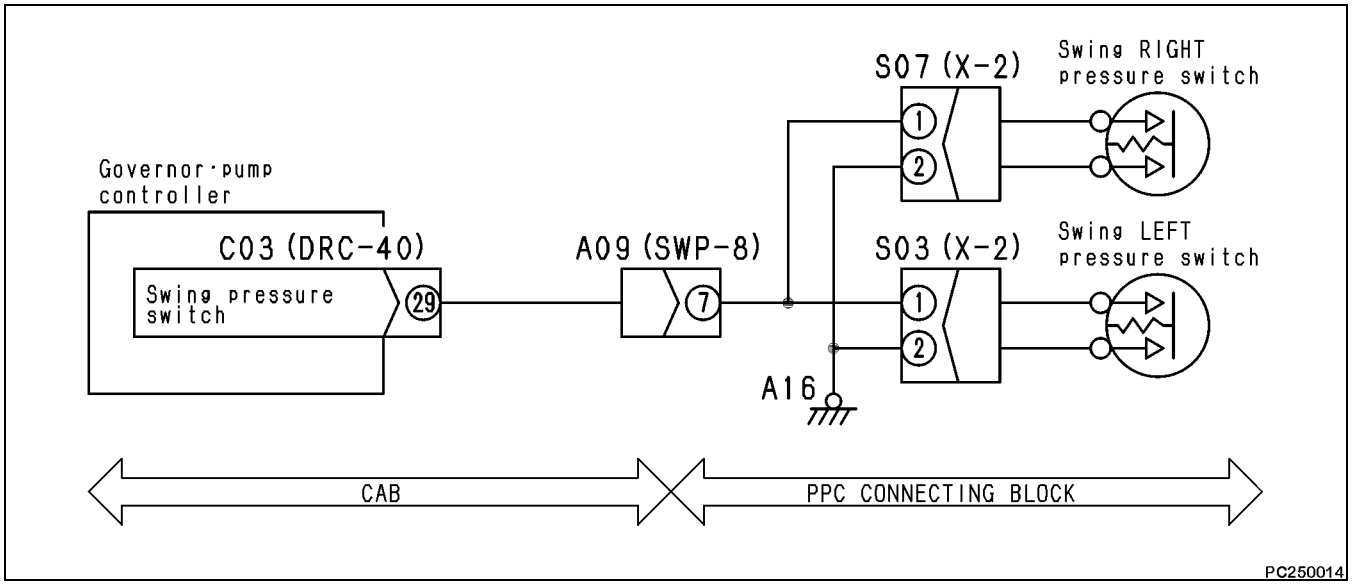


MEMORANDUM

ELECTRICAL CIRCUIT DIAGRAM FOR BOOM LOWER PPC HYDRAULIC SWITCH



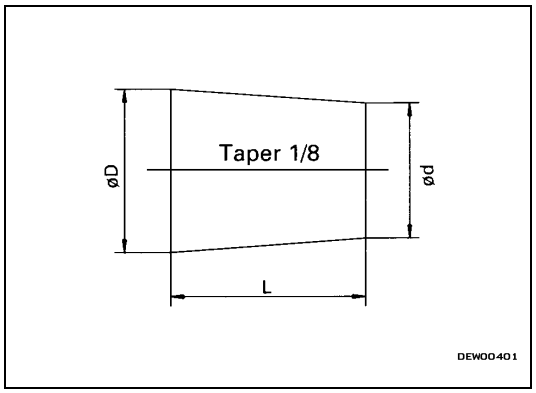
ELECTRICAL CIRCUIT DIAGRAM FOR RIGHT AND LEFT SWING PPC HYDRAULIC SWITCHES



MEMORANDUM

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

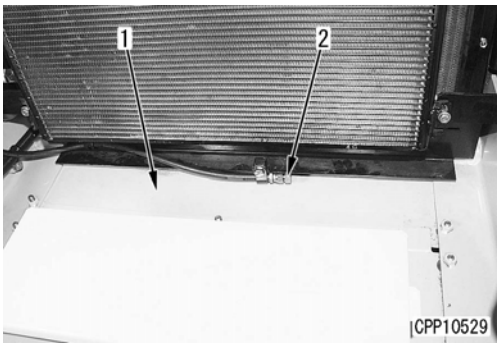


PRECAUTIONS WHEN CARRYING OUT INSTALLATION WORK

- 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.

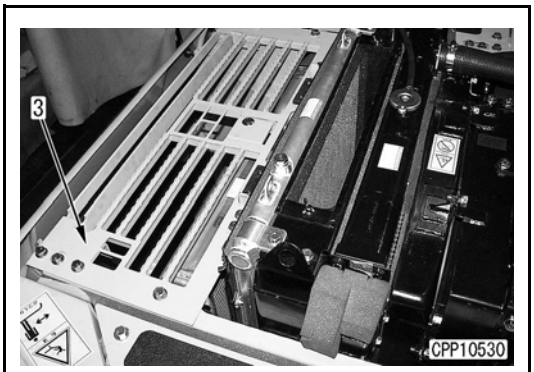
HYDRAULIC OIL COOLER

REMOVAL

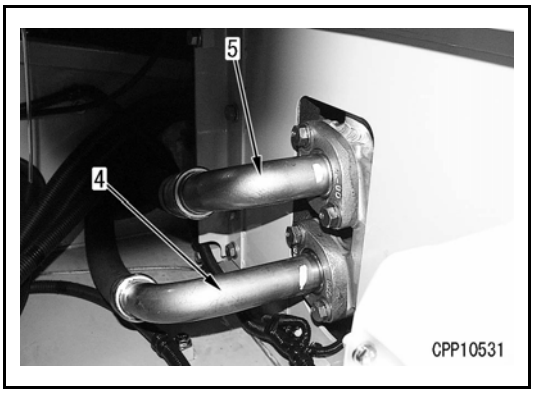


1. Open up the engine hood.
2. Remove cover (1).
3. Remove hydraulic oil cooler drain plug (2) and drain the hydraulic oil.
   - ★ Before draining oil, unscrew the hydraulic tank cap to release the pressure inside the tank, and drain oil through the cooler hose.
   - ★ If a plug on top of the hydraulic oil cooler is loosened, draining oil becomes easier.

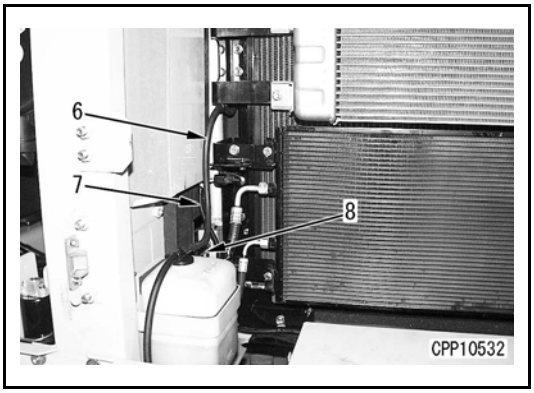
   Hydraulic oil cooler: Approximately 5.0 L (1.3 gal)



4. Remove cover (3).
5. Detach control valve drain hose (4) and tank return hose (5).
   - ★ Plug the hoses to prevent oil from flowing out.



6. Remove the mount clamp and put aside reservoir tank hose (6).
   - ★ When lifting out the hydraulic oil cooler, keep it where it will not interfere with other parts.
7. Remove the mount clamp and disconnect A30 air conditioner ambient temperature sensor (7) from the condenser bracket.
8. Disconnect hydraulic oil cooler drain hose (8).



FINAL DRIVE

SPECIAL TOOLS

Symbol		Part No.	Part Name	Necessity	Q'ty	New/Remodel	Sketch
E	1	796-627-1210	Wrench assembly	■	1		
		l 796-627-1220	l Wrench		1		
		l 796-427-1140	l Pin		3		
		l 01314-20612	l Screw		3		
	2	796T-627-1230	Push tool	■	1		O
		790-101-2510	Block	●	1		
		791-122-1130	Plate	●	1		
		790-101-2550	Leg	●	2		
		790-101-2740	Adapter	●	2		
		790-101-2570	Plate	●	4		
		790-101-2560	Nut	●	2		
		790-101-2102	Puller (30 tons)	■	1		
		790-101-1102	Pump	■	1		
	3	796-627-1020	Installer	■	1		

DISASSEMBLY

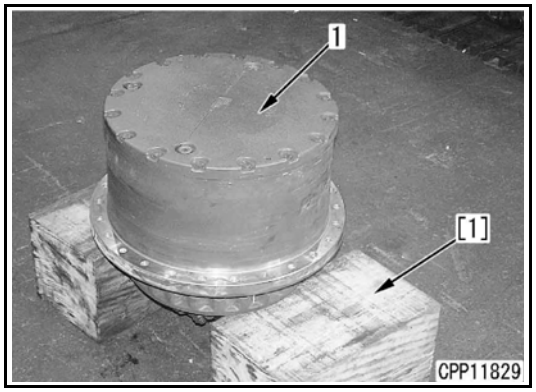
1. Draining oil
   Remove the drain plug to drain the oil from the final drive case.

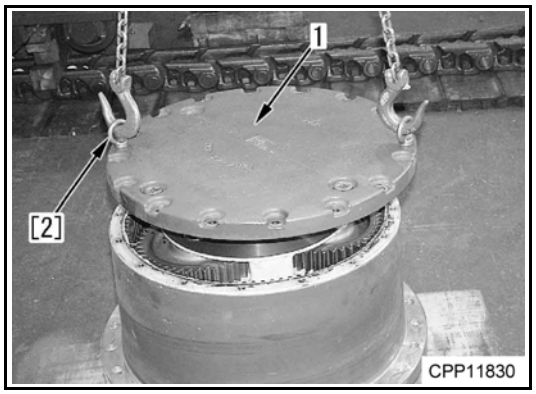
   Final drive case: Approximately 11L (3 gal)

2. Cover

   A. Place the final drive on block [1] and remove the mount bolts and cover (1).

   B. Using eyebolt [2], remove cover (1).



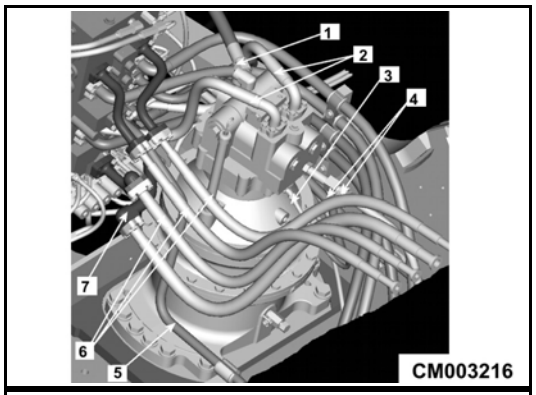


REMOVAL

WARNING! Release the residual pressure in the hydraulic circuit. Refer to the Releasing of Residual Pressure in Hydraulic Circuit section in the INSPECTION AND ADJUSTMENT chapter of this manual.

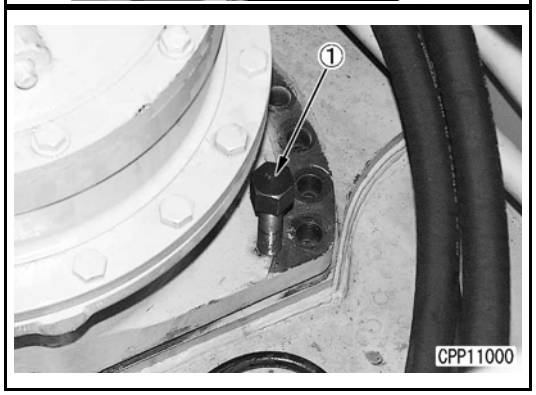
WARNING! Lower the work equipment to the ground for safety. After stopping the engine, loosen the oil filler cap on the fuel tank to release the residual pressure inside the tank and move the safety lock lever to the LOCK position.

1. Disconnect nine swing motor hoses and two tubes (1) through (7).
   - (1): Suction hose
   - (2): 2 EA swing hoses
   - (3): Swing brake release pilot hose
   - (4): 2 EA drain hoses
   - (5): Boom cylinder tube
   - (6): Three arm and bucket cylinder hoses
   - (7): Tube and hose



2. Detach the swing motor and swing machinery assembly, using forcing screw ① after removing the mount bolts.

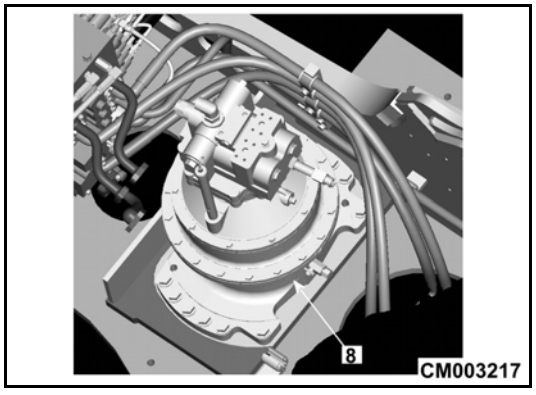
※1



3. Lift and remove swing motor and swing machinery assembly (8).
   - ★ When lifting the swing motor and swing machinery assembly for removal, do so slowly so that the hoses and other parts will not be damaged.
   - ★ Take good care, when lifting the assembly, until the spigot joint portion is pulled out.

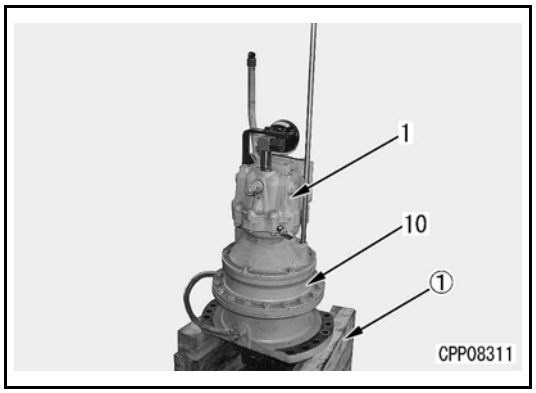
kg

Swing motor and swing machinery assembly:
450 kg (992 lb)



11. Swing motor assembly
After installing an O-ring to ring gear (10), mount the swing motor assembly (1)

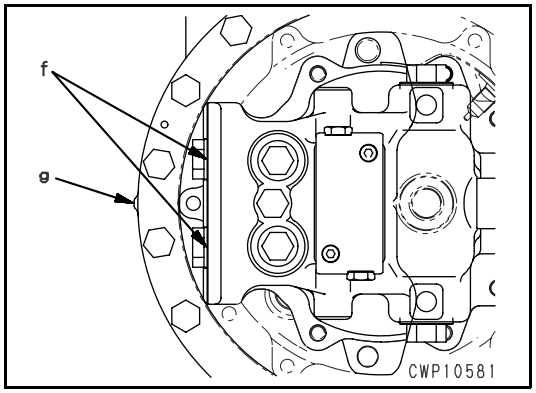
Swing motor assembly: 70 kg (154.3 lb)



★ Align the motor port position (Portion **f**) and the case convex portion (Portion **g**) as illustrated at right.

Remark

The PC220LL uses the PC300LC swing machinery with the swing motor portion turned 180° from the standard position. The PC220LL (portion F) should be 180° opposite of (portion G).



★ Degrease both mating surfaces of swing motor assembly (1) and ring gear (10).
★ Never allow gasket sealant to stick to the mating surfaces of swing motor assembly (1) and ring gear (10).

Swing motor mount bolt:
98 - 123 Nm (72 - 90 lbf ft)

12. Refilling hydraulic oil
Screw in the drain plug and refill hydraulic oil through the oil filler port to the specified level.

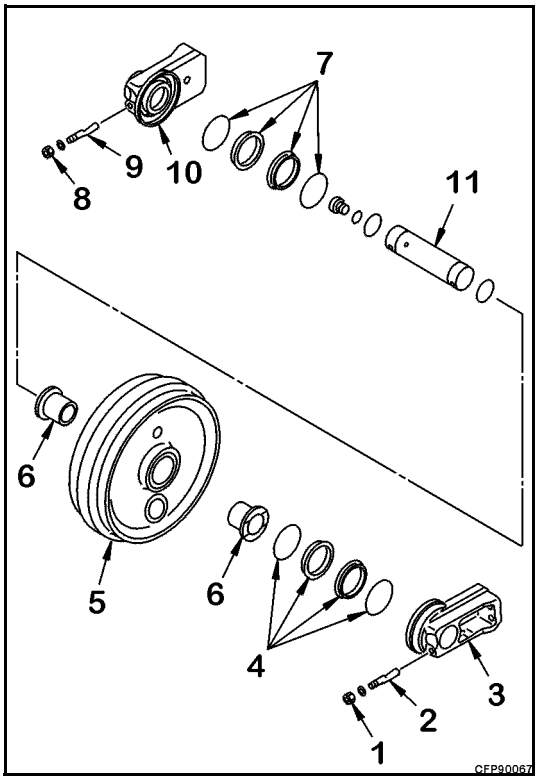
Swing machinery case:
Approximately 13.4 L (3.5 gal)

6. Install o-ring, then assemble support (3) and install bolt (2) and tighten nut (1).

7. Add oil and tighten plug.

Oil ≈ **345 cc (1 pt)**

Plug 155 ± 25 N•m (114 ± 18 ft/lbs)



ASSEMBLY

- Assemble in reverse order of expansion.

※1

★ Refer to the Inspection and Adjustment of Track Shoe Tension section in the TESTING AND ADJUSTING chapter of this manual.

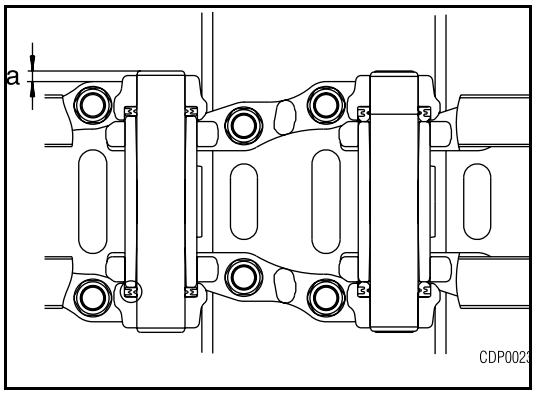
※2

Mount bolt: Anti-seizure compound (equivalent to Maruzen Molymax No. 2)

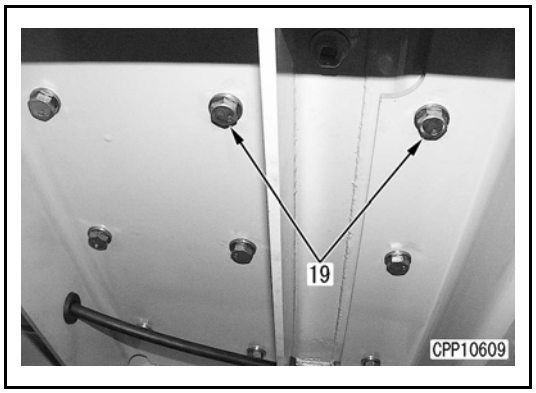
Mount bolt: 393 ± 39 Nm (289.8 ±28.7 lbf ft)

※3

★ Press-fit the master pin with a proper tool until dimension **a**, master pin protrusion amount, is obtained.
Master pin protrusion amount **a**: 4.2 ± 2 mm (0.1718 ±0.0781 in)

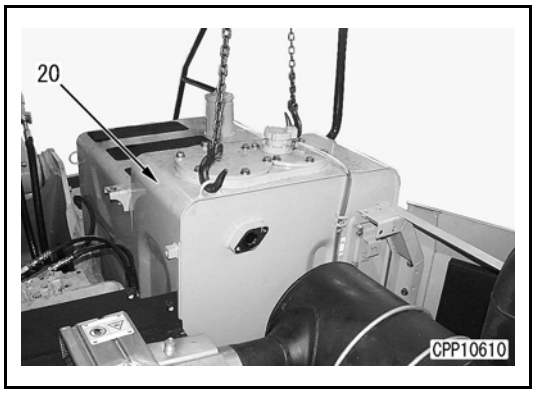


9. Sling the hydraulic tank assembly and remove six mount bolts (19). ※3

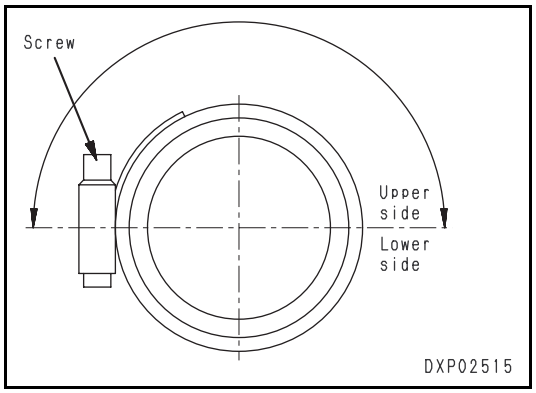


10. Lift off hydraulic tank assembly (20) to remove it.

kg Hydraulic tank: 130 kg (287 lb)



INSTALLATION



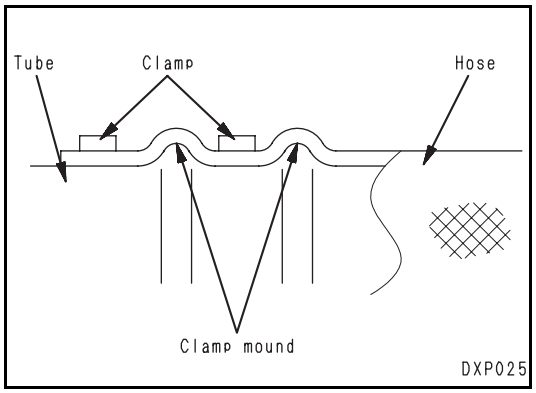
- Install in reverse order of removal.

※1

★ After tightening the hose clamp screw, check that the screw is in the position shown in the diagram at right.

Suction hose clamp screw: 8.8 ±0.5 Nm (6.4 ±0.36 lbf ft)

★ Install the hose clamp and tighten the clamp screw as shown in the diagram below.



※2

Hydraulic pump involute spline: Anti-friction compound (LM-G)

Hydraulic pump case mating surface: Gasket sealant (LG-6)

- Refilling hydraulic oil (Damper case)
  Refill hydraulic oil through the oil filler port to the specified level.

Damper hydraulic oil: Approximately 0.75 L (0.198 gal)

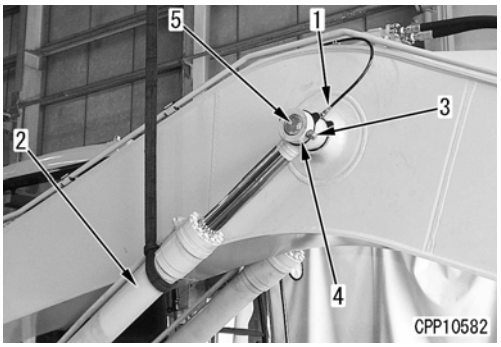
- Refilling hydraulic oil (hydraulic tank)
  Refill hydraulic oil through the oil filler port to the specified level, and let the oil circulate in the hydraulic system by starting the engine. Then check the oil level again.

Hydraulic tank: Approximately 240 L (63.4 gal)

- Air bleeding
  Refer to the Air Bleeding of Various Parts section in the TESTING AND ADJUSTING chapter in this manual.

WORK EQUIPMENT

REMOVAL



WARNING! Extend the arm and bucket fully. Lower the work equipment to the ground and set the safety lock lever to the lock position.

WARNING! Release the residual pressure in the hydraulic circuit. Refer to the Release of Remaining Pressure in Hydraulic Circuit section in the TESTING AND ADJUSTING chapter of this manual.

1. Disconnect grease hose (1).
2. Sling boom cylinder assembly (2), and remove lock bolt (3).
3. Remove plate (4), then remove head pin (5).

※1

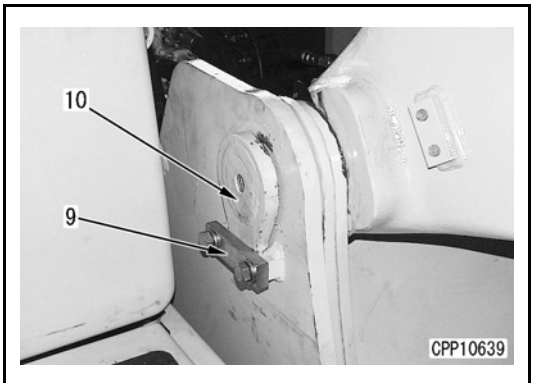
★ There are shims installed, so check the number and thickness, and keep them in a safe place.

4. Start the engine and retract the piston rod.
   ★ Fasten the piston rod with wire so that it will not slip out and lower the cylinder onto a stand, or place a support under the bottom of the cylinder to support it. In the latter case, remove the grease fitting on the bottom side first.
   ★ Remove the boom cylinder on the other side in the same manner.
5. Disconnect bucket cylinder hoses (6) and arm cylinder hoses (7), two for each.
   ★ Plug the hoses to prevent oil flow-out, and fasten them on the valve side.
6. Disconnect intermediate connector CN-A42 (8) for a working lamp.
7. Lift off the work equipment and remove plate (9) and then pin (10) at the foot.

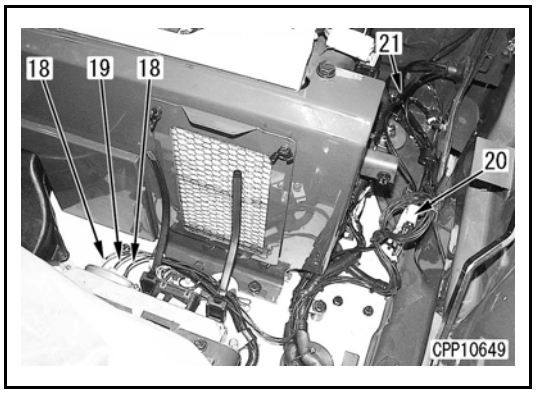
※2

When removing them, first remove plate (9) and then remove pin (10) at the foot, using Tool **R**.

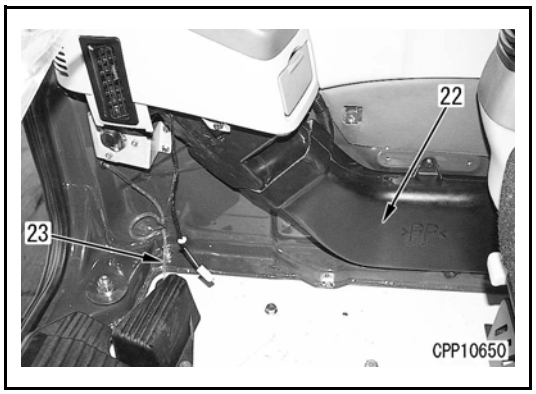
★ Shims are installed, so do not forget to check their number and each location of installation.



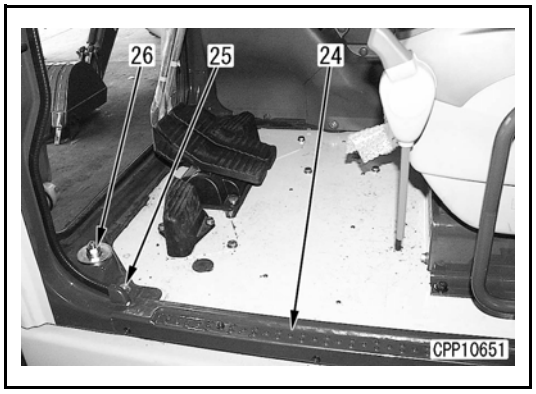
11. Disconnect cab wiring intermediate connectors (20) at the following two points.
    - H09: Upper side
    - H08: Lower side
12. Disconnect radio antenna (21).



13. Remove duct (22) on the right side.
14. Remove window washer hose (23).



15. Remove step plate (24).
16. Remove five mount bolts (25) and four mount nuts (26).
    ★ Check the bolt length beforehand.



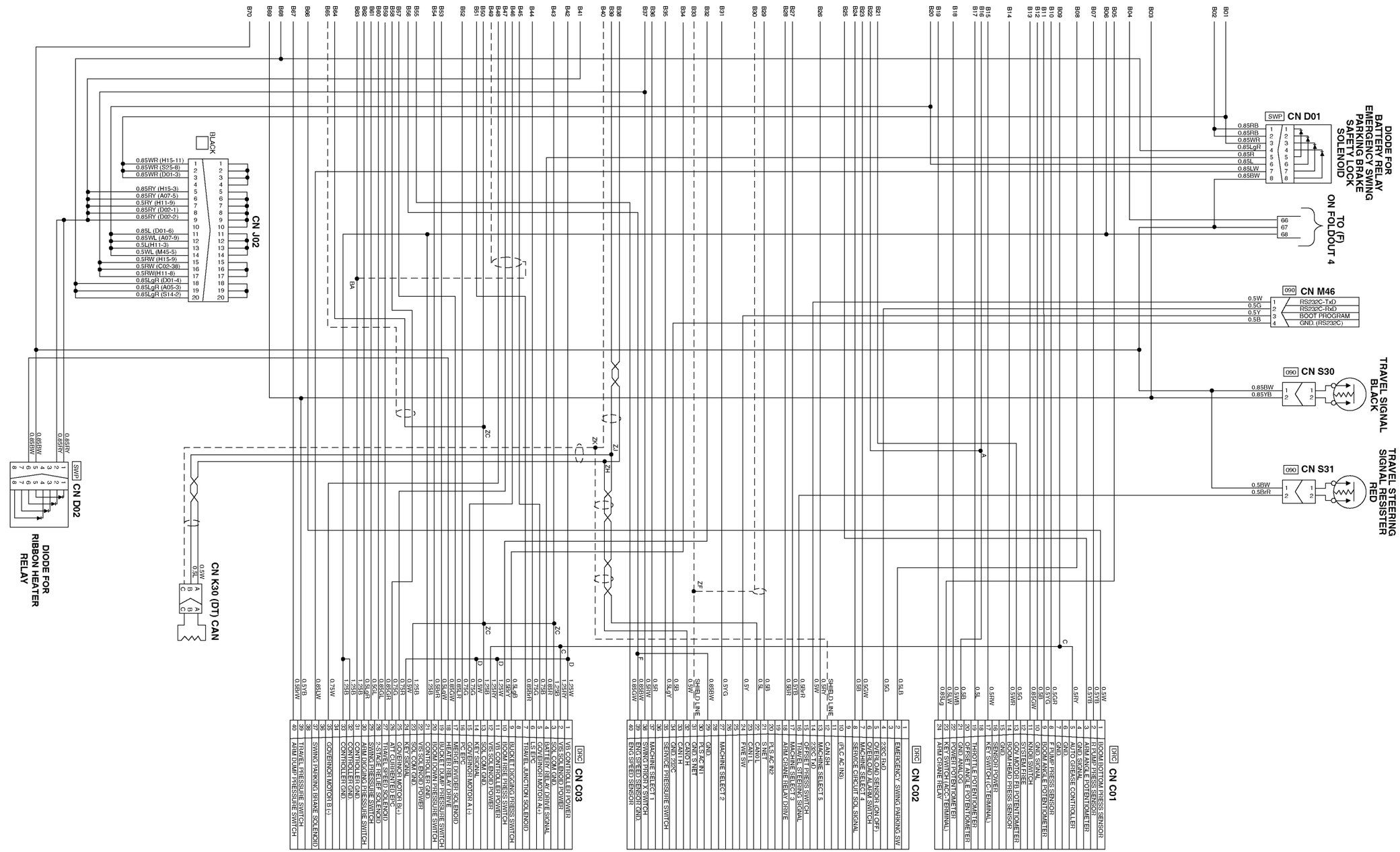
17. Lift off operator's cab assembly (27) to remove it.

kg Operator's cab assembly: 290 kg (640 lb)

INSTALLATION

- Install in reverse order of removal.

CIRCUIT DIAGRAM SHEET 1 (PART 3 OF 3)



SHEET 1 (PART 3 OF 3) CM000402

CIRCUIT DIAGRAM SHEET 4 (PART 2 OF 2)