

SHOP MANUAL **KOMATSU** **WF650T-3**

MACHINE MODEL

SERIAL NUMBER

WF650T-3

50001 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.
- WA650T-3 mounts the SA6D170E-2 engine.
For details of the engine, see the 6D170-2 Series Engine Shop Manual.

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


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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 

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

WIRE ROPES

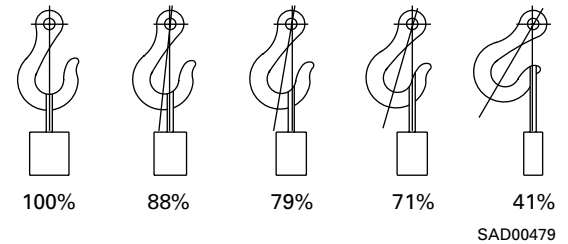
- Use adequate ropes depending on the weight of parts to be hoisted, referring to the table below:

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

Rope diameter	Allowable load	
	kN	tons
mm		
10	9.8	1.0
11.5	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.
- 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.

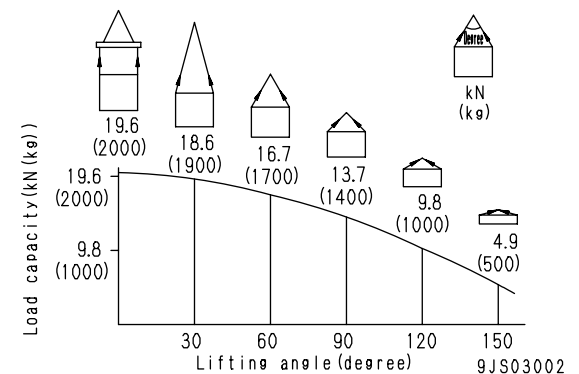


- Do not sling a heavy load with one rope alone, but sling with two or more ropes symmetrically wound onto the load.

! 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.

- 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°.



Millimeters to Inches

1 mm = 0.03937 in

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

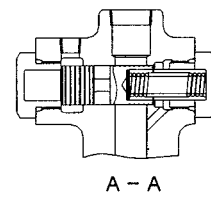
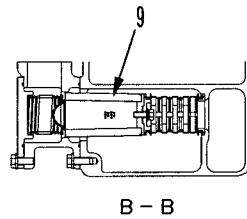
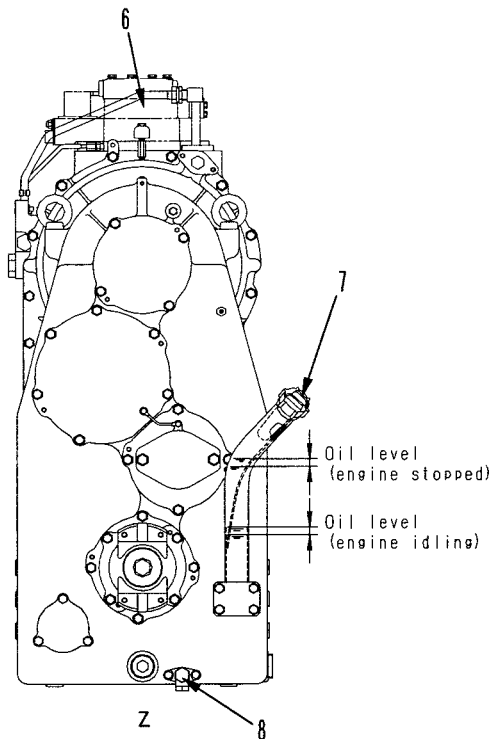
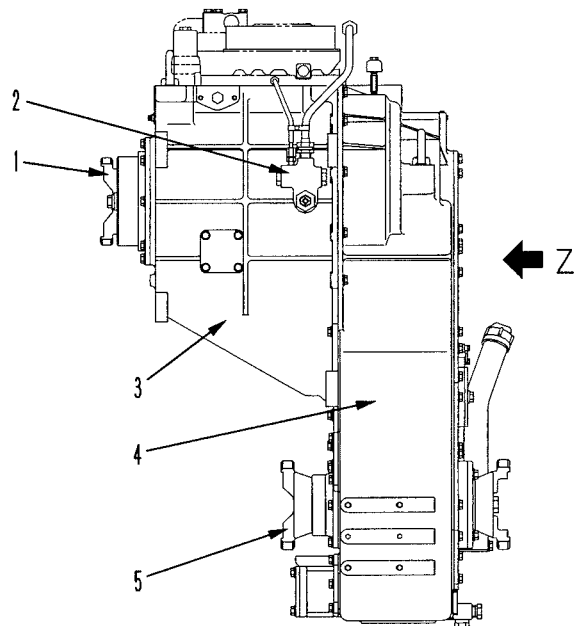
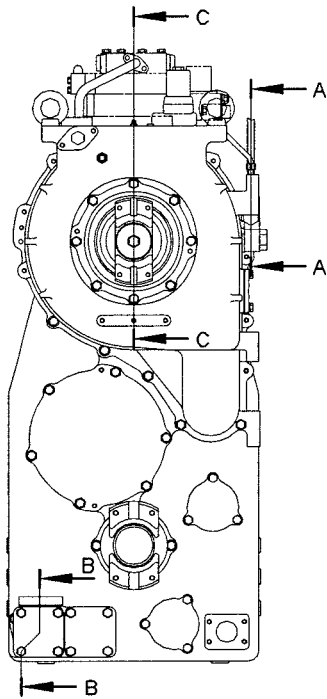
Kilogram to Pound

1 kg = 2.2046 lb

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

Machine model			WF650T-3
Serial Number			50001 and up
Steering system	Type		Articulated steering
	Structure		Hydraulic power steering
Hydraulic system	Delivery of hydraulic pump	Work equipment pump	144 (Gear pump: SAR (3)-80)
		Switch pump	181 (Gear pump: SAR (3)-100)
	Control valve	Steering pump	232 (Gear pump: SAR (4)-125)
PPC pump		59 (Gear pump: SAR (1)- 32)	
Transmission and PTO lubrication pump		234 (Gear pump: SAR (3)-125)	
Torque converter charging pump		234 (Gear pump: SAR (3)-125)	
Cylinder	Lift cylinder No. - bore x stroke	mm	Double acting piston type 1 – 160 x 870
			Steering cylinder No. - bore x stroke
Dozer system	Control valve	MPa {kg/cm ² }	2-spool type 20.6 {210}
			Orbit roll + spool valve type 20.6 {210}
	Blade width	mm	5,200
	Blade height	mm	2,250
	Max. lifting height	mm	1,560
	Max. digging depth	mm	555

TRANSMISSION



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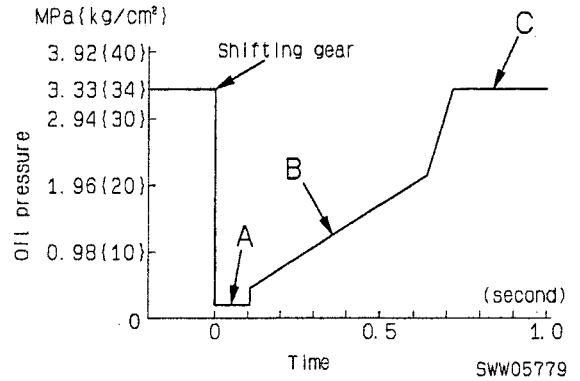
- 1. Coupling
- 2. Lubrication bypass valve
- 3. Transmission
- 4. Transfer
- 5. Coupling

- 6. Transmission control valve
- 7. Oil filter
- 8. Drain plug
- 9. Strainer

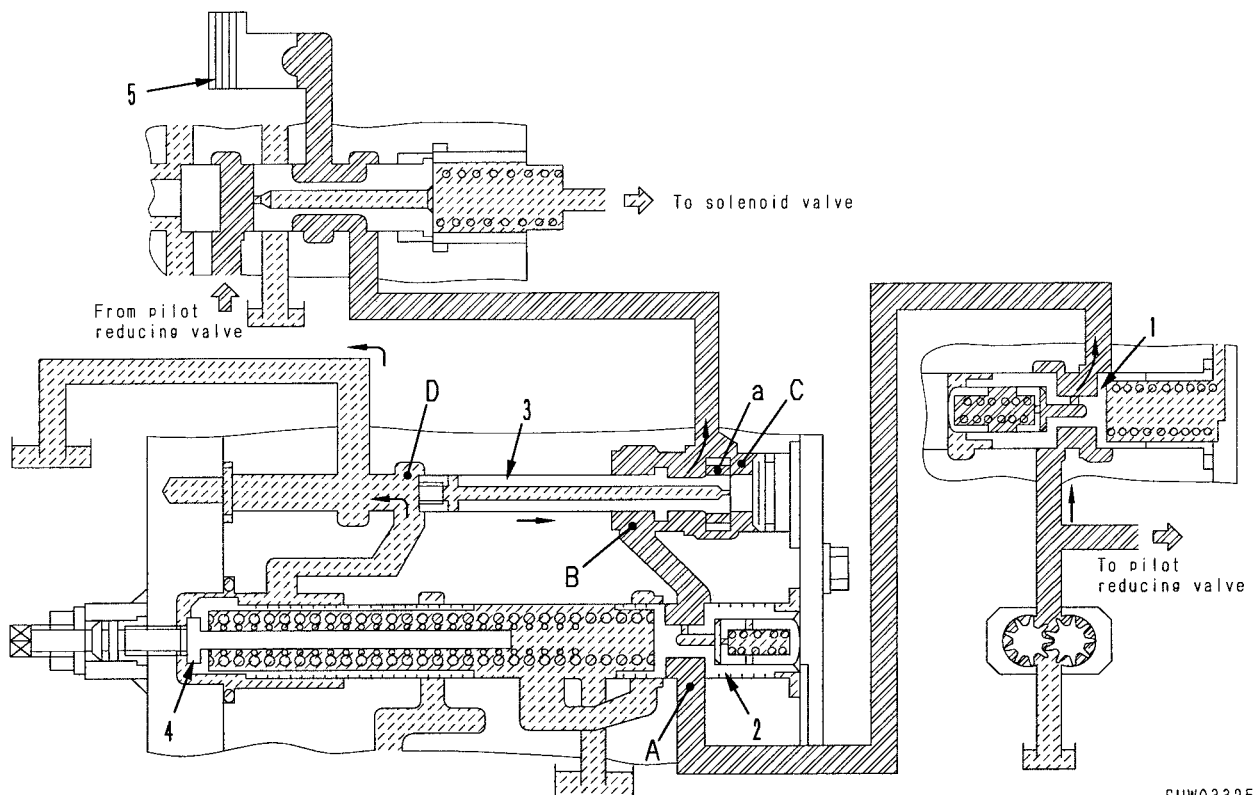
MODULATING VALVE AND QUICK RETURN VALVE

FUNCTION

- The modulating valve and quick return valve act together to raise the transmission clutch pressure slowly. In this way, they reduce the shock when shifting gear, and prevent the generation of peak torque in the power train. As a result, operator fatigue is reduced, and at the same time, operator comfort and the durability of the power train are increased.



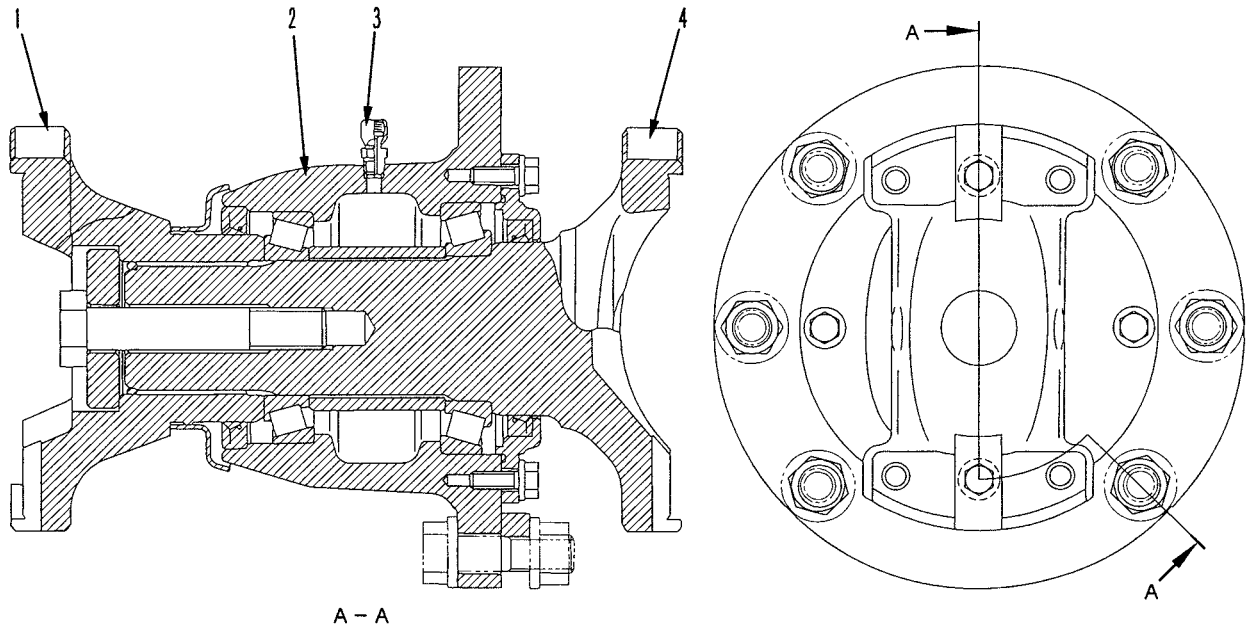
1) Immediately after shifting gear (Point A)



- The oil sent from the pump flows from priority valve (1) through port **A**, passes through modulating valve (2), and enters port **B** of quick return valve (3). The oil passes through orifice "a" of quick return valve (3) and flows to the clutch piston, which has been actuated. However when it passes through orifice "a" it

creates a difference in pressure between port **B** and port **C**. The quick return valve moves to the right and the oil flows to clutch (5). In addition, when quick return valve (3) moves to the right, drain port **D** is opened, and the pressurized oil at the rear of piston (4) flows to the drain circuit.

CENTER SUPPORT



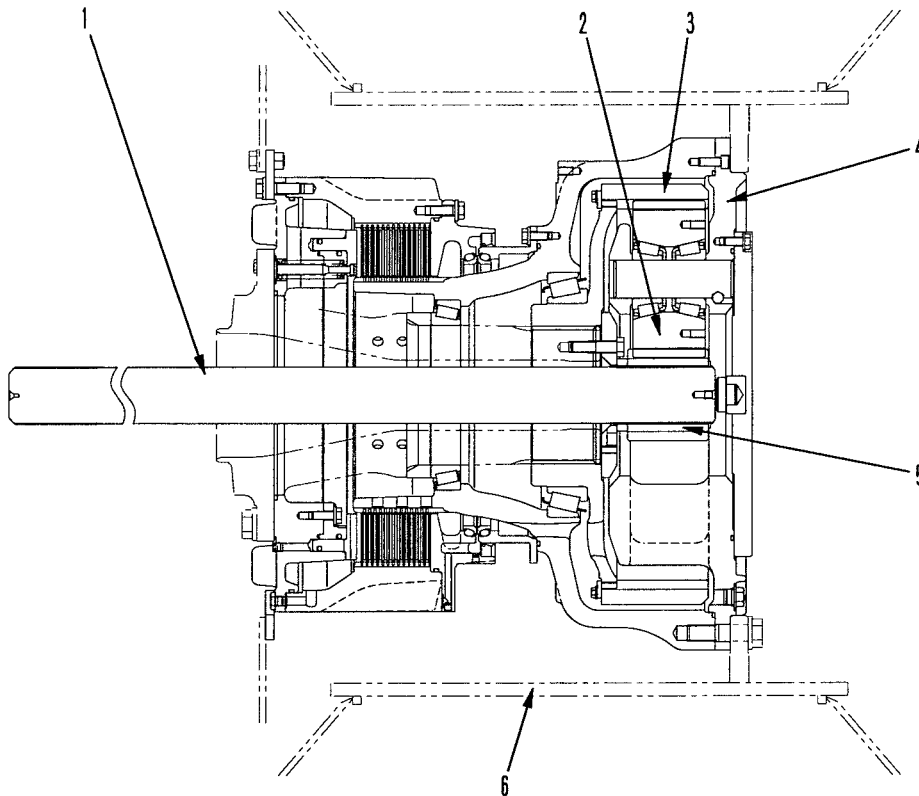
SUW03168

1. Front coupling
2. Case
3. Grease nipple
4. Rear coupling

OUTLINE

- The center support is mounted to the front frame, which is mounted between the center drive shaft and front drive shaft.
- In case of articulate frame, this part is always subject to repeated flexing and therefore, a large stress is easily applied. Adoption of the center support transmits the power smoothly and reduces the stress to the drive shaft, improving its durability.

FINAL DRIVE



SJW06033

1. Axle shaft
2. Planet gear (Number of teeth: 35)
3. Ring gear (Number of teeth: 92)
4. Planetary carrier
5. Sun gear (Number of teeth: 19)
6. Wheel (Steel wheel)

OUTLINE

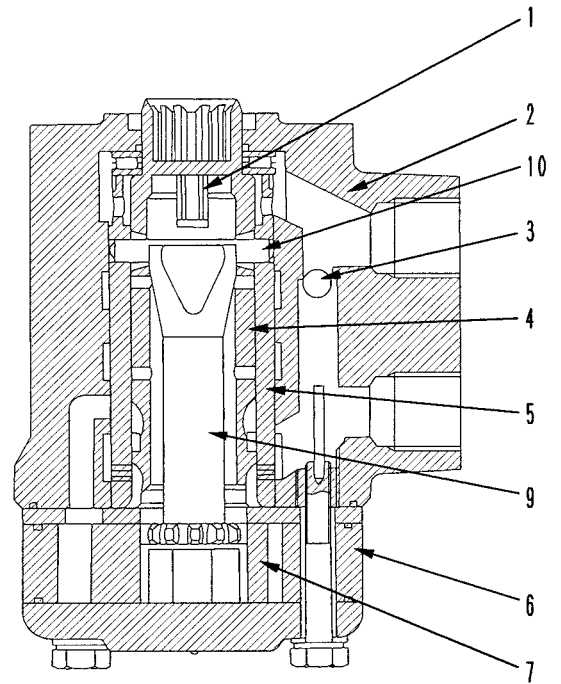
- The final drive obtains a large driving force by reducing the rpm with the planet gear mechanism to transmit it to the wheels.

OPERATION

- The power transmitted from the differential to the sun gear (5) through the axle shaft (1) is transmitted to the planet gear (2). The planet gear rotates inside the secured ring gear (3) to transmit the reduced rpm to the wheel (6) mounted to the planetary carrier (4).

OUTLINE

- The steering unit is directly connected to the shaft of the steering wheel. The oil from the PPC pump passes through the steering valve, and is switched to the left and right steering cylinders to determine the direction of travel of the machine.
- The steering unit can be broadly divided into the following: spool (4) and sleeve (5), which have a rotor type direction selection function, and the gear set (combination of gear (7) and gear rim (6)), which acts as a hydraulic motor when the steering is operated.

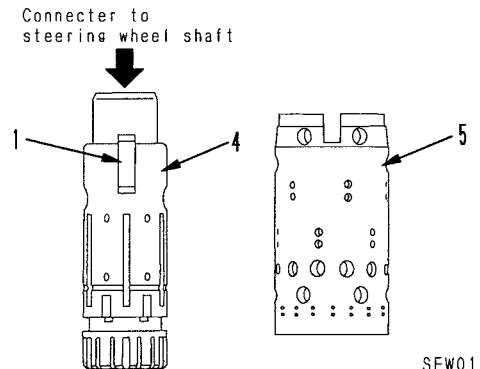


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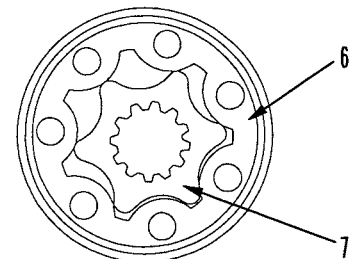
STRUCTURE

- Spool (4) is interconnected with the drive shaft of the steering wheel and is connected to sleeve (5) by neutral position spring (1) and center pin (10) (when the steering wheel is at neutral, it does not contact the spool).
- The top of drive shaft (9) is meshed with center pin (10) and forms one unit with sleeve (5). The bottom is meshed with the spline of gear (7) of the gear set.
- Valve body (2) has four ports. These are connected respectively to the pump circuit, tank circuit, and pilot circuit of the steering demand valve.

In addition, the port at the pump end and the port at the tank end are connected by check valve (3) inside the housing. If there is any failure in the PPC pump, oil is sucked in directly from the tank end by the check valve.



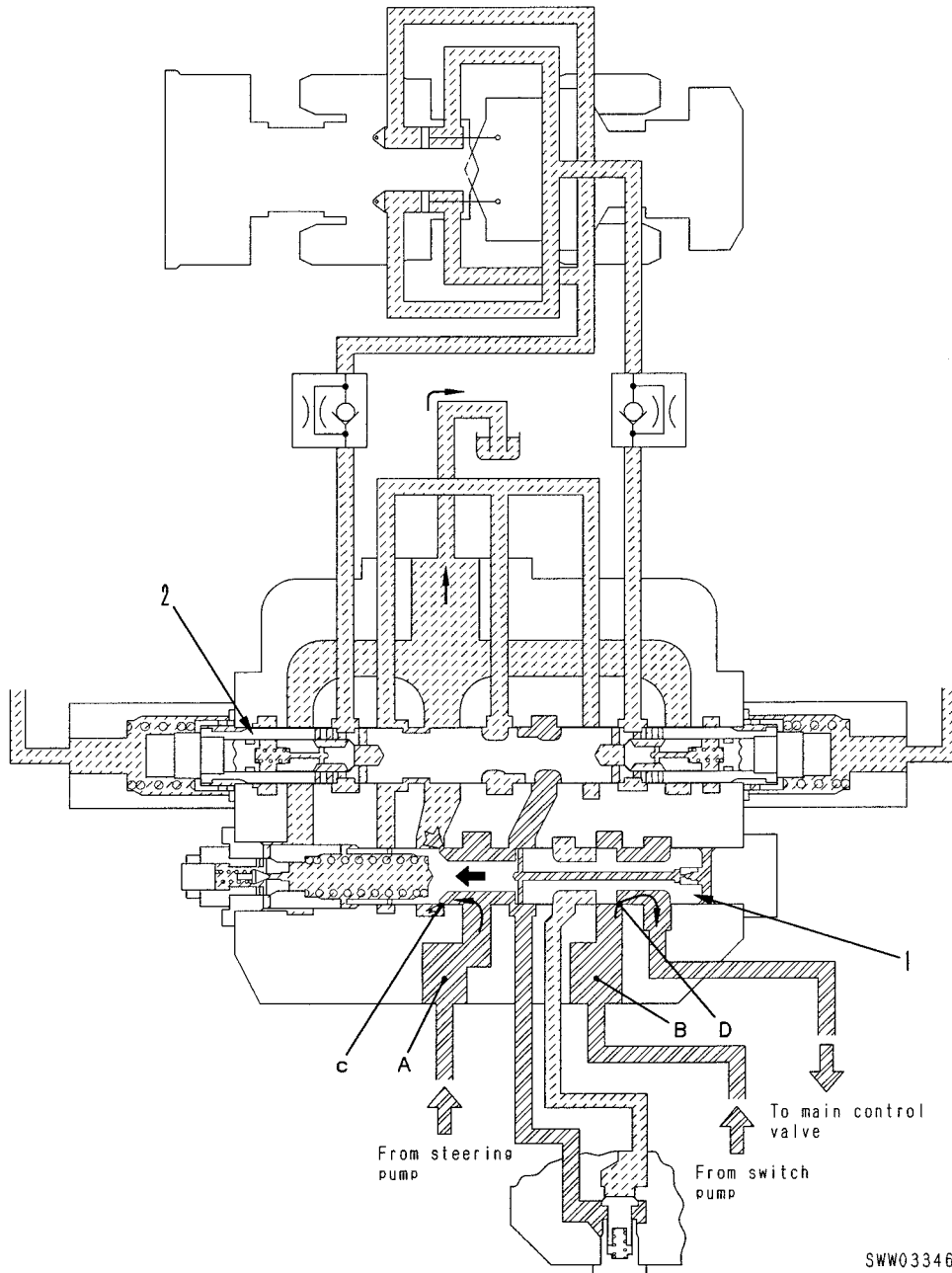
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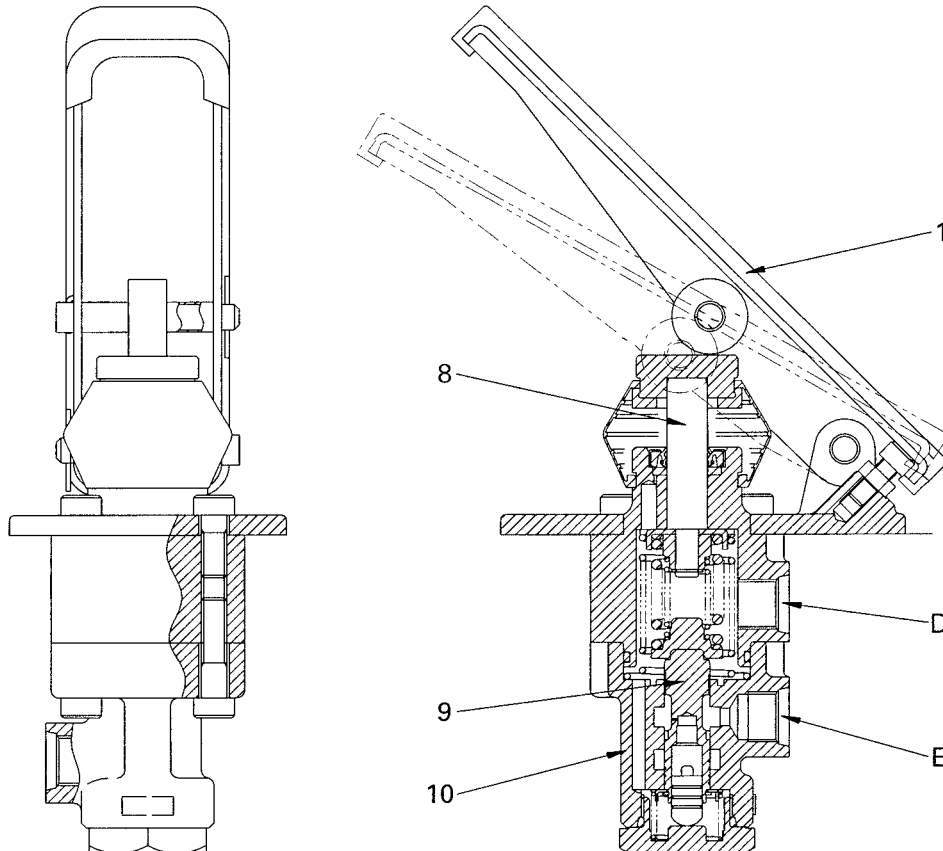
OPERATION OF STEERING VALVE

Neutral



- The steering wheel is not being operated, so steering spool (2) does not move.
- The oil from the steering pump enters port A. The oil from the switch pump enters port B.
- When the pressure at ports A and B rises, demand spool (1) moves to the left, so the oil from the steering pump passes through port C of the spool and is drained. The oil from the switch pump passes through port D and all flows to the main control valve.

BRAKE VALVE (LEFT)



SDW00108

OUTLINE

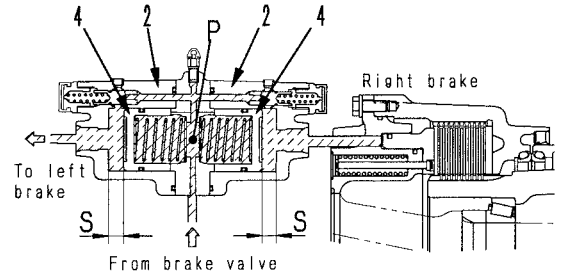
- There are two brake valves installed in parallel under the front of the operator's cab, and these are actuated by depressing the pedal.
- When the right pedal is depressed, oil is sent to the brake cylinder to apply the brakes.
- When the left pedal is depressed, oil is sent to the right pedal to apply the brakes in the same way as when the right pedal is depressed.

In addition, the left brake pedal operates the transmission cut-off switch to actuate the transmission solenoid valve electrically and set the transmission to neutral.

OPERATION

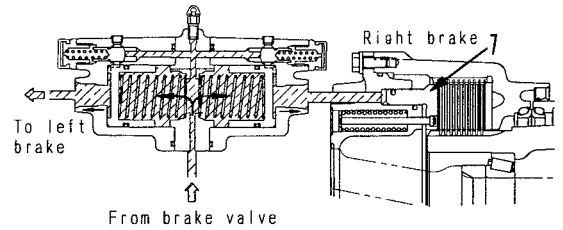
1. When brake pedal is depressed

- Before the brake is depressed, piston (4) is returned by the distance of stroke **S** (full stroke). When the brake pedal is depressed, the oil discharged from the brake valve flows from port **P** of the slack adjuster and is divided to left and right cylinders (2), where it moves piston (4) by stroke **S** to the left and right.



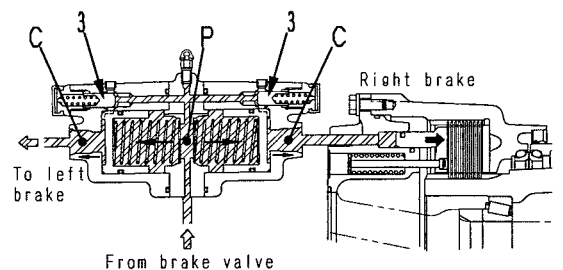
SUW03351

- When this is done, brake piston (7) moves by a distance of stroke **S**. In this condition, the closer the clearance between the brake piston (7) and disc is to 0, the greater the braking force becomes.

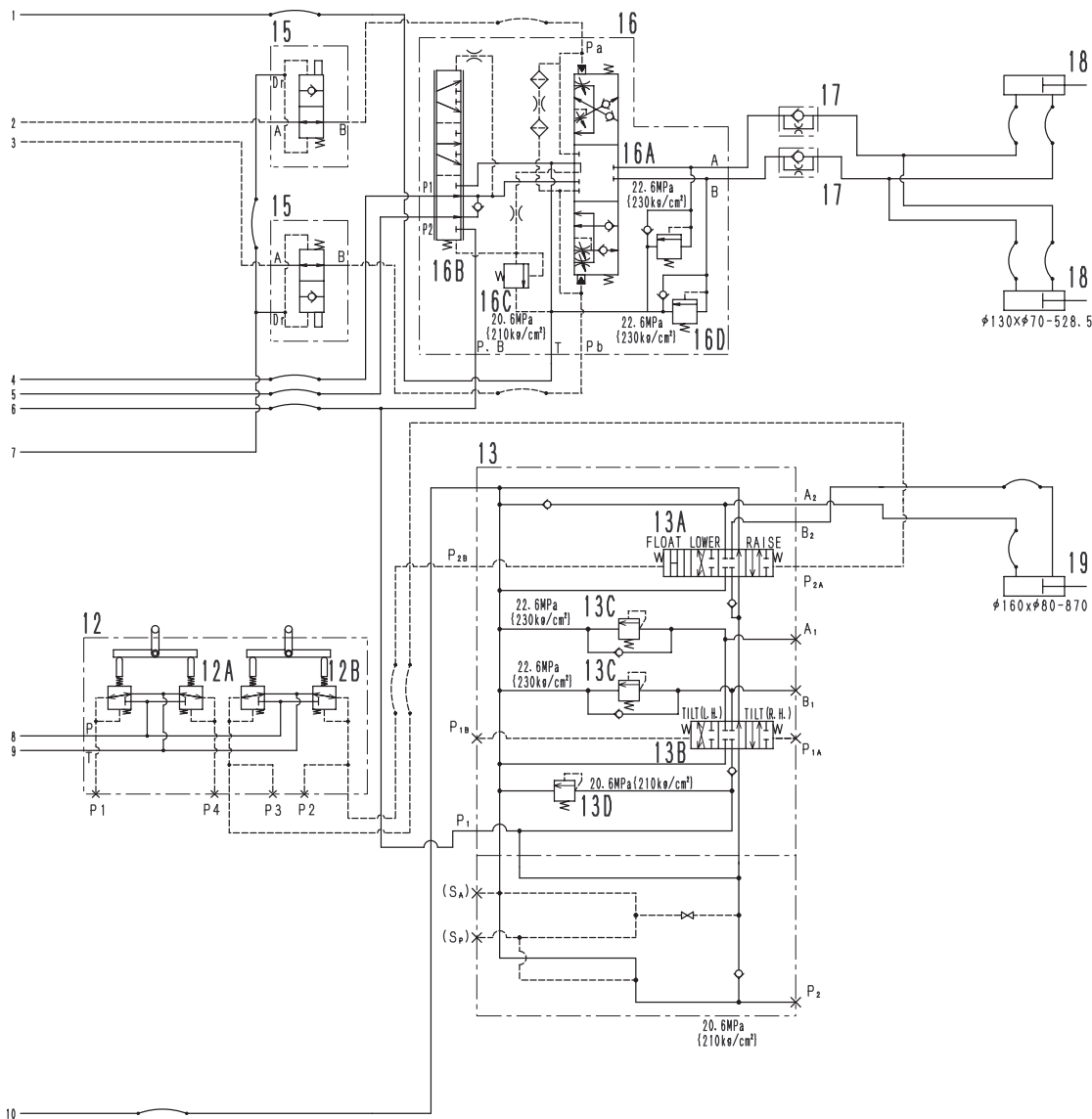


SUW03352

- If the brake pedal is depressed further, and the oil pressure discharged from the brake valve goes above the set pressure, check valve (3) opens and the pressure is applied to port **C** to act as the braking force. Therefore, when the brake is applied, the time lag is a fixed value.



SUW03353

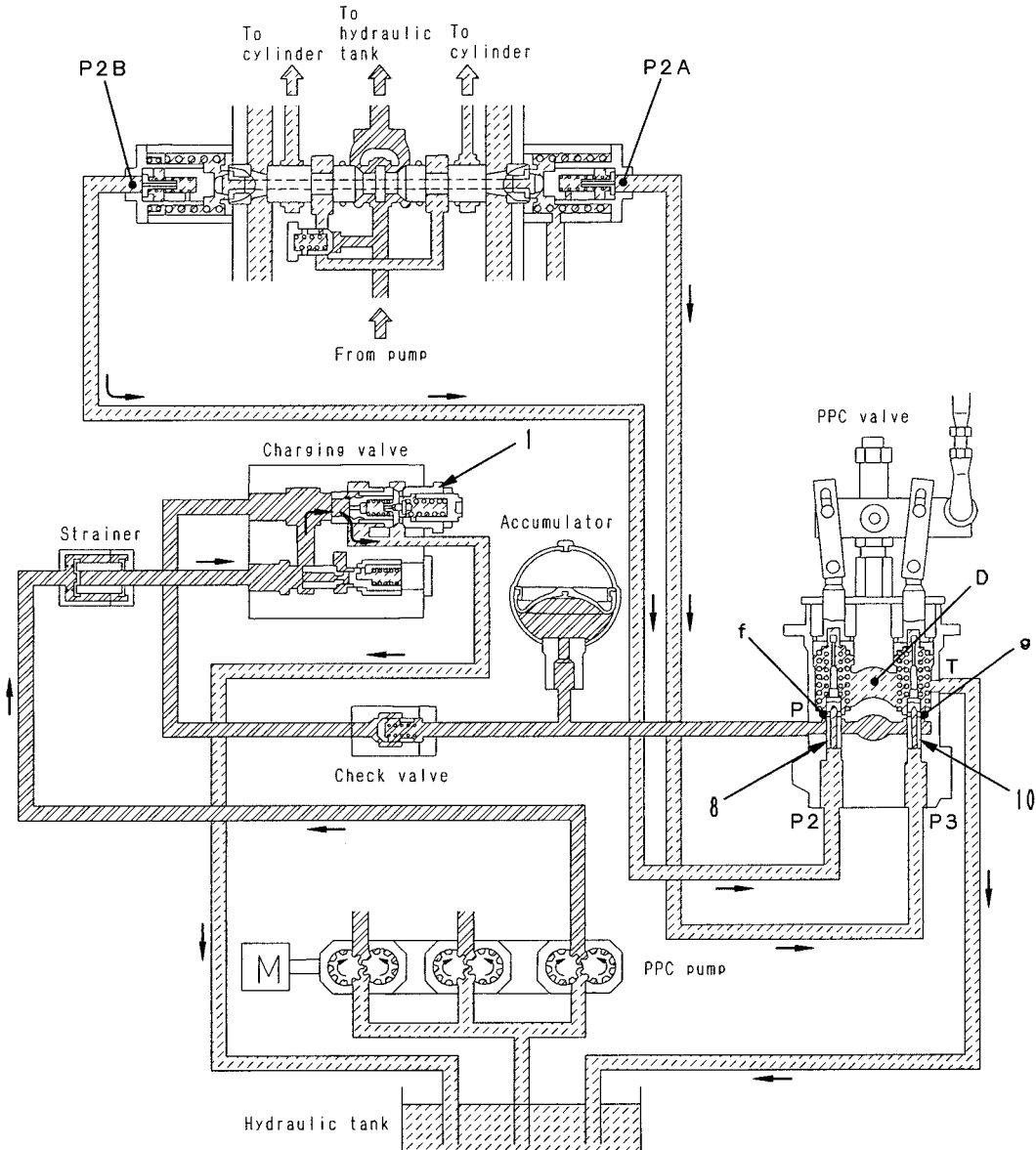


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- | | | |
|--|--|--|
| <ul style="list-style-type: none"> 1. Hydraulic tank 2. Oil filter 3. Breather 4. Switch pump (SAR (3)-100) 5. Steering pump (SAR (4)-125) 6. Work equipment pump (SAR (3)-80) 7. PPC pump (SAR (1)-32) 8. Strainer 9. Accumulator charge valve 10. Check valve 11. Accumulator | <ul style="list-style-type: none"> 12. PPC valve 12A. (Not used) 12B. PPC valve for lift 13. Work equipment valve 13A. Lift spool 13B. (Not used) 13C. Safety valve (with suction) 13D. Relief valve 14. Steering unit (Orbit-roll valve) 15. Stop valve | <ul style="list-style-type: none"> 16. Steering demand valve 16A. Steering spool 16B. Flow control spool 16C. Main relief valve 16D. Overload relief valve 17. Two-way restriction valve 18. Steering cylinder 19. Lift cylinder 20. Solenoid valve (For joystick) (If equipped) 21. Hydraulic oil cooler (Integrated in radiator) |
|--|--|--|

OPERATION OF PPC VALVE

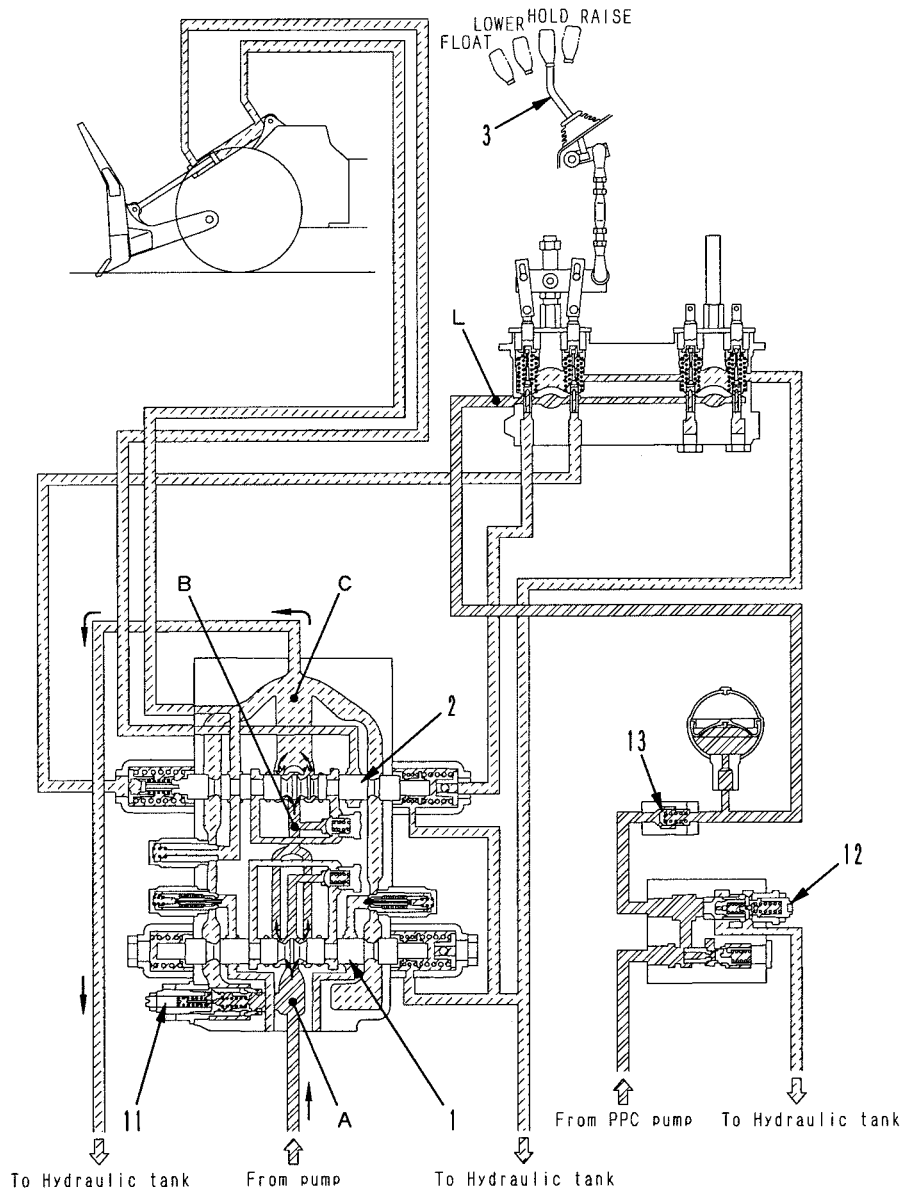
[AT NEUTRAL]



SJW06053

- Though the oil from the PPC pump enters the port **P** of the PPC valve, it is drained through the relief valve (1) due to the circuit closed by the spool (8).
The oil from the port **P2B** of the work equipment valve is drained through the port **f** of the spool (8).
The oil from the port **P2A** is drained through the port **g** of the spool (10).

LIFT SPOOL HOLD POSITION



SJW06059

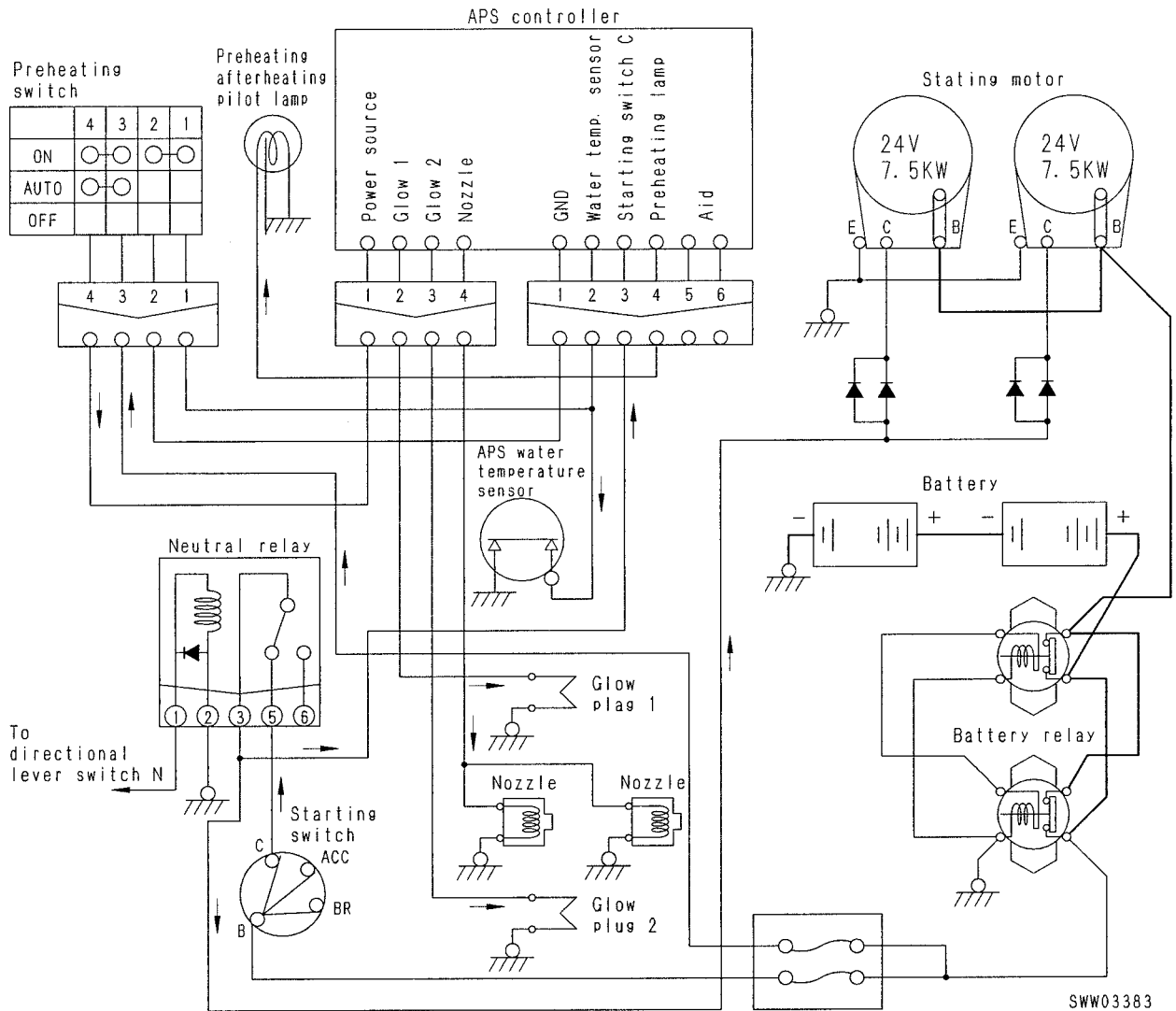
FUNCTION

- The oil flows from the pump to the port **A** and the relief valve (11) specifies its maximum pressure.
- Since the lift spool (2) is in the HOLD position, the bypass circuit is open. The oil at the port **B** goes around the spool to enter the port **C** in the drain circuit and further goes through the filter back to the tank.
- The oil from the PPC pump goes through the check valve (13) to enter the port **L** of the PPC valve. Since the work equipment control lever is in the HOLD position, however, the oil returns from the PPC relief valve (12) to the hydraulic tank.

MAIN MONITOR SWITCH FUNCTION

Item	Function	Display	Actuation
Working lamp (front)	Front working lamp lights up or goes out each time switch is pressed when side lamps are lighted up	Lights up	Front working lamp lights up
		Goes out	Front working lamp goes out
Working lamp (rear)	Rear working lamp lights up or goes out each time switch is pressed when side lamps are lighted up	Lights up	Rear working lamp lights up
		Goes out	Rear working lamp goes out
Transmission cut-off	Transmission cut-off function is actuated or stopped each time switch is pressed	Lights up	Cut-off function actuated
		Goes out	Cut-off function stopped

2. OPERATION OF AFTERHEATING



SWW03383

- If the starting switch is turned to the START position after the preheating pilot lamp goes out, electric current flows to neutral relay terminals 5 – 3, and the starting motor turns. At the same time, electric current flows to the circuit of APS controller terminal C and actuates the controller.

The APS fuel injection nozzle inside the intake manifold is switched ON/OFF to inject fuel intermittently (10 times/sec) to glow plugs 1 and 2. (When electric power is applied, the APS controller sends the start signal, or when the stop signal is input because the starting safety relay is actuated, the intermittent injection signal is output to the APS fuel injection nozzle.)

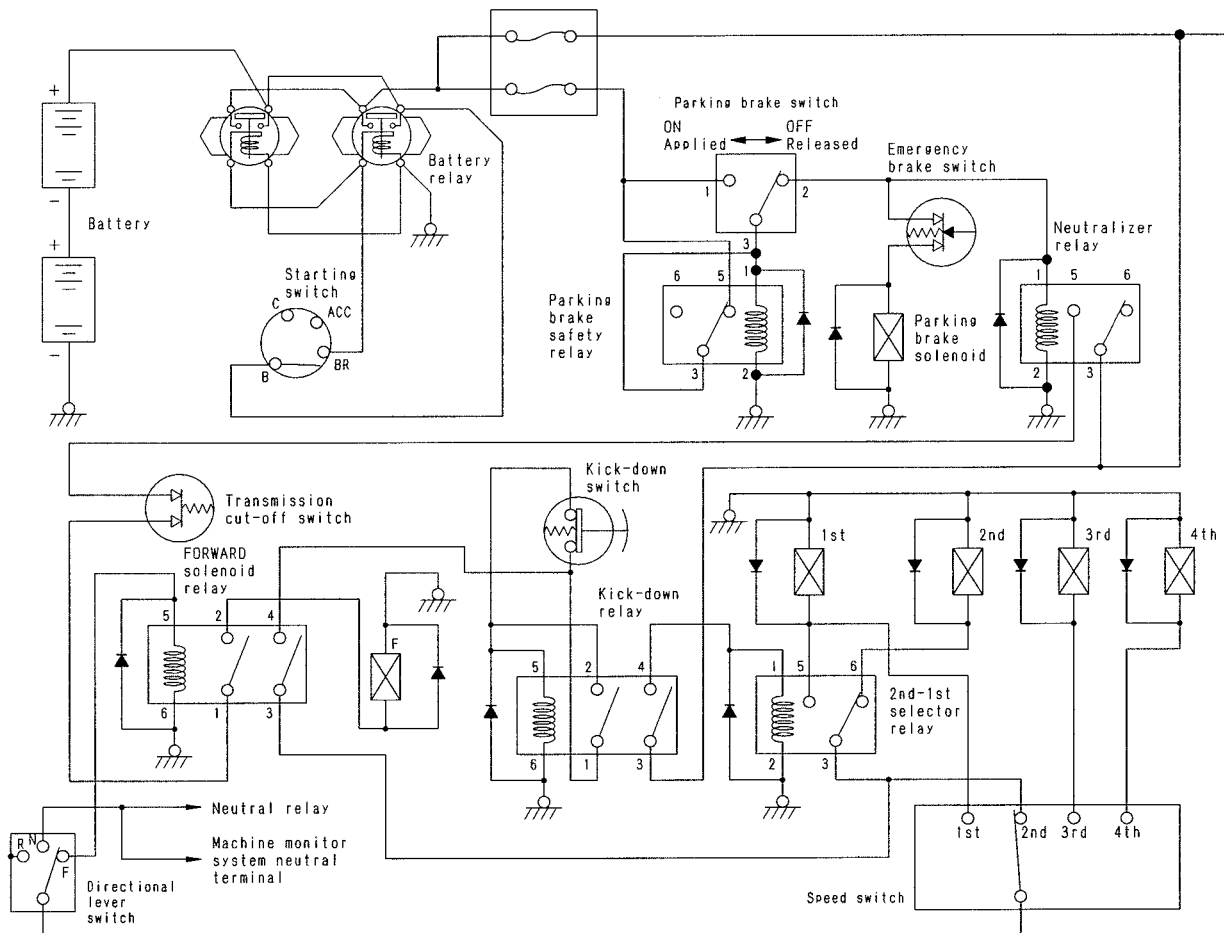
The fuel injected to glow plugs 1 and 2 is burned inside the intake manifold and heats the intake air.

After the engine starts, the signal from the preheating switch – APS water temperature sensor actuates the fuel injection nozzle and carries out afterheating.

After the engine starts and the warming-up operation raises the engine cooling water temperature to 20°C or above, the APS water temperature sensor opens (OFF). As a result, the water temperature sensor signal to the APS controller is turned OFF. The output signal to glow plugs 1 and 2 is cut off, and at the same time the afterheating pilot lamp flashes.

When starting work when the engine is running with the APS actuated and the engine water temperature above 20°C, if the preheating switch is turned OFF, the APS controller power circuit is cut off, and the operation of the APS is stopped. At the same time, the afterheating pilot lamp display goes out.

OPERATION FOR CANCELING KICK-DOWN IV
 (When starting switch is turned OFF)



SJW06072


- When the starting switch is turned OFF, the battery relay is opened, so electric current stops flowing to the transmission directional circuit and speed circuit, and the kick-down switch operation is canceled.
- If the starting switch is at OFF, even if the kick-down switch is turned ON (actuated), the kick-down switch will not work.


20 TESTING AND ADJUSTING


STANDARD VALUE TABLE	
Standard value table for engine	20- 2
Standard value table for chassis	20- 3
Standard value table for electrical parts	20- 8
TESTING AND ADJUSTING	20-101
TROUBLESHOOTING	20-201

★ Note the following when making judgements using the standard value tables for testing, adjusting, or troubleshooting.

1. The standard value for a new machine given in the table is the value used when shipping the machine from the factory and is given for reference. It is used as a guideline for judging the progress of wear after the machine has been operated, and as a reference value when carrying out repairs.
2. The service limit value given in the tables is the estimated value for the shipped machine based on the results of various tests. It is used for reference together with the state of repair and the history of operation to judge if there is a failure.
3. These standard values are not the standards used in dealing with claims.

 **When carrying out testing, adjusting, or troubleshooting, park the machine on level ground, inset the safety pins, and use blocks to prevent the machine from moving.**

 **When carrying out work together with other workers, always use signals and do not let unauthorized people near the machine.**

 **When checking the water level, always wait for the water to cool down. If the radiator cap is removed when the water is still hot, the water will spurt out and cause burns.**


 **Be careful not to get caught in the fan, fan belt or other rotating parts.**

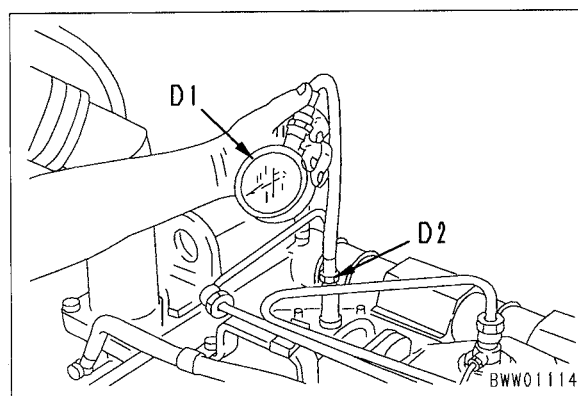
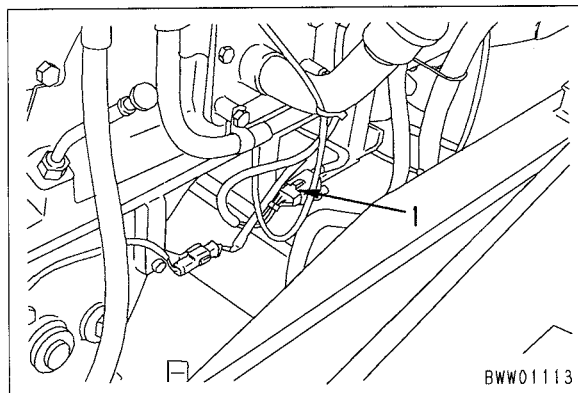
System	Name of component	Connector No.	Inspection method	Judgement table	Measurement conditions					
Maintenance monitor	Brake accumulator low pressure switch	C03 (male) C04 (male)	Measure resistance	<p>If the condition is as shown in the table below, it is normal</p> <table border="1"> <tr> <td>Accumulator pressure: Min 5.39 ± 0.49 MPa {5.39 ± 0.49 kg/cm²}</td> <td rowspan="2">Between (1) – (2)</td> <td>Max. 1 Ω</td> </tr> <tr> <td>Depress brake pedal and lower accumulator pressure to below 4.41 ± 0.49 MPa {45 ± 5 kg/cm²}</td> <td>Min. 1 MΩ</td> </tr> </table>	Accumulator pressure: Min 5.39 ± 0.49 MPa {5.39 ± 0.49 kg/cm ² }	Between (1) – (2)	Max. 1 Ω	Depress brake pedal and lower accumulator pressure to below 4.41 ± 0.49 MPa {45 ± 5 kg/cm ² }	Min. 1 MΩ	<ol style="list-style-type: none"> 1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.
	Accumulator pressure: Min 5.39 ± 0.49 MPa {5.39 ± 0.49 kg/cm ² }	Between (1) – (2)	Max. 1 Ω							
	Depress brake pedal and lower accumulator pressure to below 4.41 ± 0.49 MPa {45 ± 5 kg/cm ² }		Min. 1 MΩ							
	Engine water temperature sensor	E04 (male)	Measure resistance	<p>If the condition is as shown in the table below, it is normal</p> <table border="1"> <tr> <td>Normal temperature (25°C)</td> <td rowspan="2">Between (1) – (2)</td> <td>Approx. 40 kΩ</td> </tr> <tr> <td>100 °C</td> <td>Approx. 3.7 kΩ</td> </tr> </table>	Normal temperature (25°C)	Between (1) – (2)	Approx. 40 kΩ	100 °C	Approx. 3.7 kΩ	<ol style="list-style-type: none"> 1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter.
	Normal temperature (25°C)	Between (1) – (2)	Approx. 40 kΩ							
100 °C	Approx. 3.7 kΩ									
Torque converter oil temperature sensor	E07 (male)	Measure resistance	<p>If the condition is as shown in the table below, it is normal</p> <table border="1"> <tr> <td>Normal temperature (25°C)</td> <td rowspan="2">Between (1) – (2)</td> <td>Approx. 40 kΩ</td> </tr> <tr> <td>100 °C</td> <td>Approx. 3.7 kΩ</td> </tr> </table>	Normal temperature (25°C)	Between (1) – (2)	Approx. 40 kΩ	100 °C	Approx. 3.7 kΩ	<ol style="list-style-type: none"> 1) Turn starting switch OFF. 2) Disconnect connector. 3) Connect T-adapter. 	
Normal temperature (25°C)	Between (1) – (2)	Approx. 40 kΩ								
100 °C		Approx. 3.7 kΩ								
Engine oil lever switch	E10 (male)	Measure resistance	<p>If the condition is as shown in the table below, it is normal</p> <table border="1"> <tr> <td>Oil level normal</td> <td rowspan="2">Between (1) – Chassis</td> <td>Max. 1 Ω</td> </tr> <tr> <td>Oil level abnormal</td> <td>Min. 1 MΩ</td> </tr> </table>	Oil level normal	Between (1) – Chassis	Max. 1 Ω	Oil level abnormal	Min. 1 MΩ	<ol style="list-style-type: none"> 1) Turn starting switch OFF. 2) Disconnect terminal. 	
Oil level normal	Between (1) – Chassis	Max. 1 Ω								
Oil level abnormal		Min. 1 MΩ								
Dust indicator	E13 (male) E14 (male)	Measure continuity	<p>If the condition is as shown in the table below, it is normal</p> <table border="1"> <tr> <td>Air cleaner normal</td> <td rowspan="2">Between E13 (1) – E14 (1)</td> <td>Continuity</td> </tr> <tr> <td>Air cleaner clogged</td> <td>No Continuity</td> </tr> </table>	Air cleaner normal	Between E13 (1) – E14 (1)	Continuity	Air cleaner clogged	No Continuity	<ol style="list-style-type: none"> 1) Turn starting switch OFF. 2) Disconnect connector. 3) Start engine. 4) Measure continuity. 	
Air cleaner normal	Between E13 (1) – E14 (1)	Continuity								
Air cleaner clogged		No Continuity								

MEASURING COMPRESSION PRESSURE

⚠ When measuring the compression pressure, be careful not to touch the exhaust manifold, or to get your clothes caught in the fan, fan belt or other rotating parts.

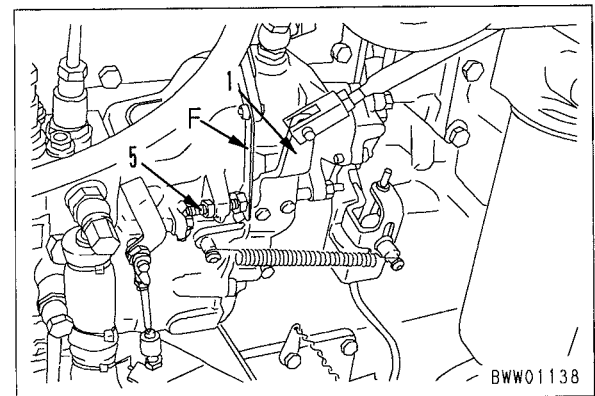
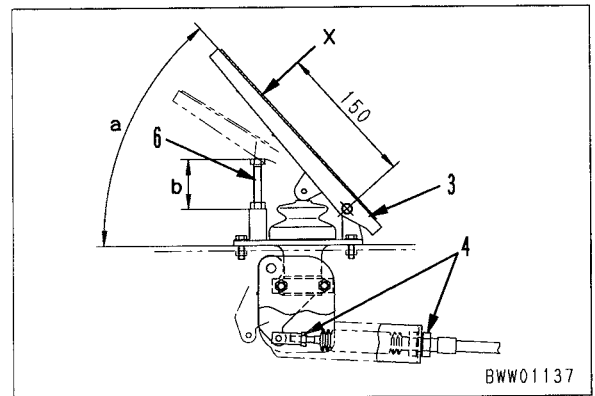
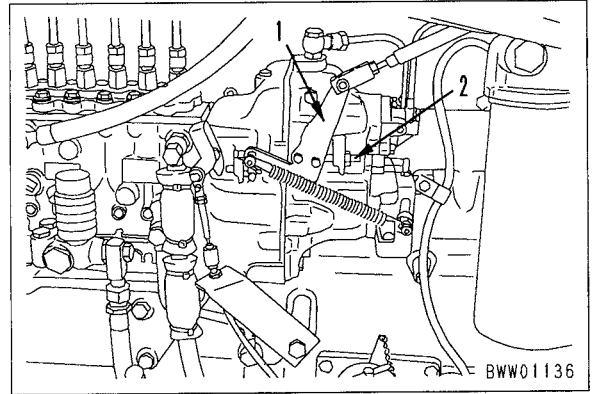
1. Adjust the valve clearance.
For details, see **ADJUSTING VALVE CLEARANCE**.
2. Warm up the engine to raise the oil temperature to 40°C – 60°C.
3. Disconnect wiring connector (E03) (1).
4. Remove the nozzle holder assembly of the cylinder to be measured.
For details, see **DISASSEMBLY AND ASSEMBLY, REMOVAL OF NOZZLE HOLDER ASSEMBLY**.
5. Install adapter **D2** in the mount of the nozzle holder assembly, then connect pressure gauge **D1**.

 Adapter mounting bolt:
24.5 – 29.4 Nm {2.5 – 3.0 kgm}
6. Set engine tachometer **A** in position.
 - ★ For details, see **MEASURING ENGINE SPEED**.
7. Crank the engine with the starting motor and measure the compression pressure.
 - ★ Measure the compression pressure at the point where the pressure gauge indicator remains steady.
 - ★ When measuring the compression pressure, measure the engine speed to confirm that it is within the specified range.
8. After measuring the compression pressure, install the nozzle holder assembly.
For details, see **DISASSEMBLY AND ASSEMBLY, INSTALLATION OF NOZZLE HOLDER ASSEMBLY**.



ADJUSTING FUEL CONTROL CABLE

1. Set so that fuel injection pump lever (1) is in contact with low idling stopper (2).
2. In the above condition, adjust the installed length of nut (4) so that the installed angle of accelerator pedal (3) is angle **a**.
 - ★ Installed angle **a**: 51°
3. Insert tool **F** (thickness: 0.2 mm) between high idling stopper (5) and fuel injection pump lever (1), and adjust length **b** of the stop bolt when a force of 29.4 – 49 Nm {3 – 5 kg} is applied at operating effort measurement point **X** of accelerator pedal (3).
 - If the high idling speed goes above the standard value ($2,150 \pm 100$ rpm), adjust the length of stop bolt (6) again.



TESTING AND ADJUSTING STEERING OIL PRESSURE

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

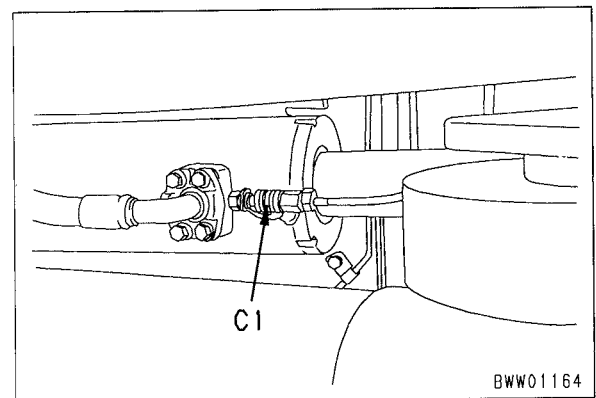
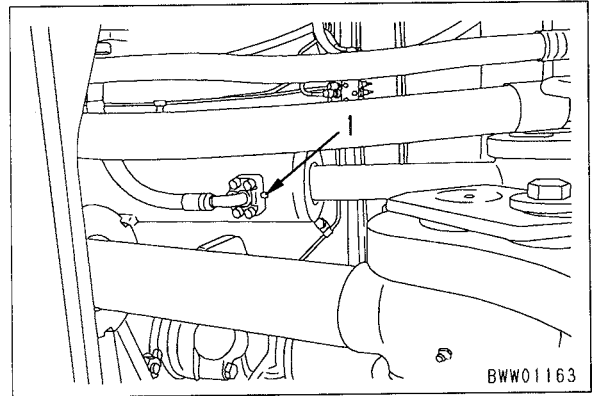
Measuring

1. Measuring steering relief pressure

⚠ Loosen the oil filler cap slowly to release the pressure inside the hydraulic tank. Then operate the steering wheel and control levers several times to release the remaining pressure in the hydraulic piping.

⚠ Install the safety bar to the frame.

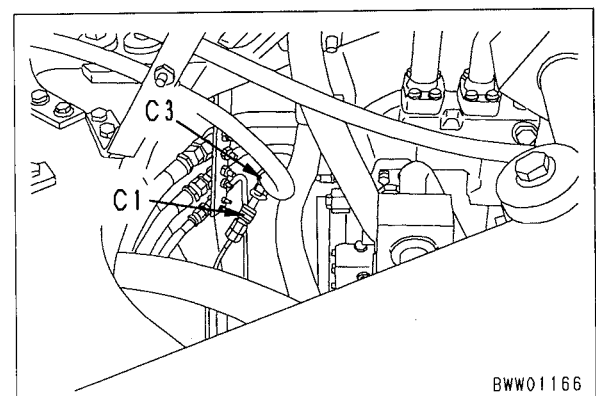
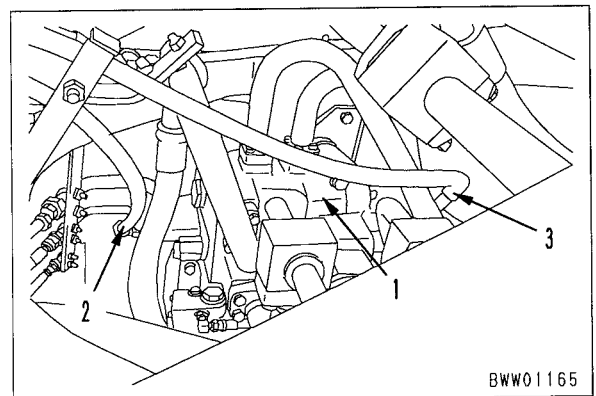
- 1) Remove oil pressure measurement plug (PT1/8) (1) from the elbow at the right steering cylinder head end, then install oil pressure gauge **C1** (39 MPa {400 kg/cm²}).
- 2) Start the engine, run the engine at high idling, then turn the steering wheel to the right and measure the pressure when the relief valve is actuated.
 - ★ When removing the oil pressure measurement plug on the left steering cylinder, turn the steering wheel to the left.



2. Measuring steering pilot pressure

⚠ Install the safety bar to the frame.


- 1) Disconnect pilot hose (2) or (3) from steering valve (1).
- 2) Install adapter **C3** (M18 x 1.5) to the elbow at the valve end, then assemble the hose again.
- 3) Install oil pressure gauge **C1** (5.9 MPa {60 kg/cm²}) to adapter **C3**.
- 4) Start the engine and measure the oil pressure when the steering wheel is turned with the engine running at high idling.
 - ★ Hose (2): **Turn steering to right**
 - ★ Hose (3): **Turn steering to left**



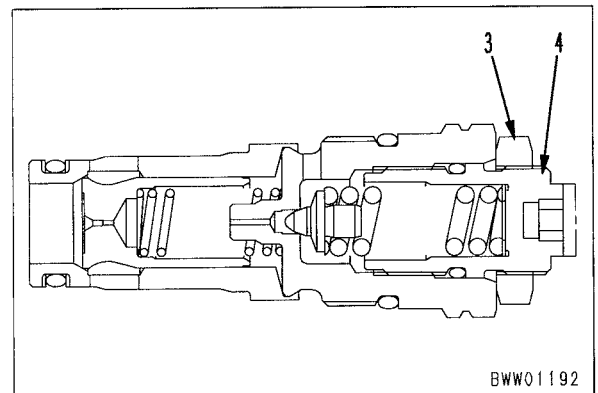
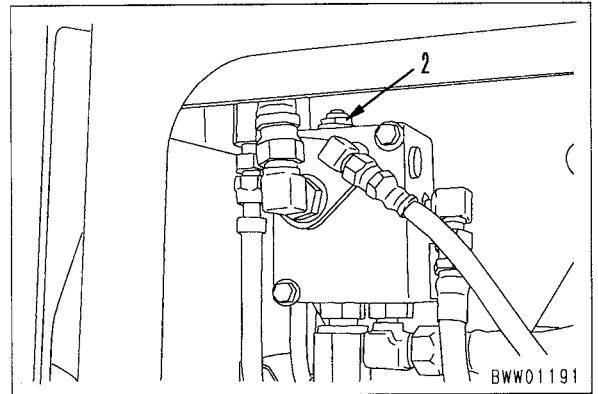
Adjusting**1. Adjusting PPC relief valve**

Loosen locknut (3) of PPC relief valve (2), then turn adjustment screw (4) to adjust.

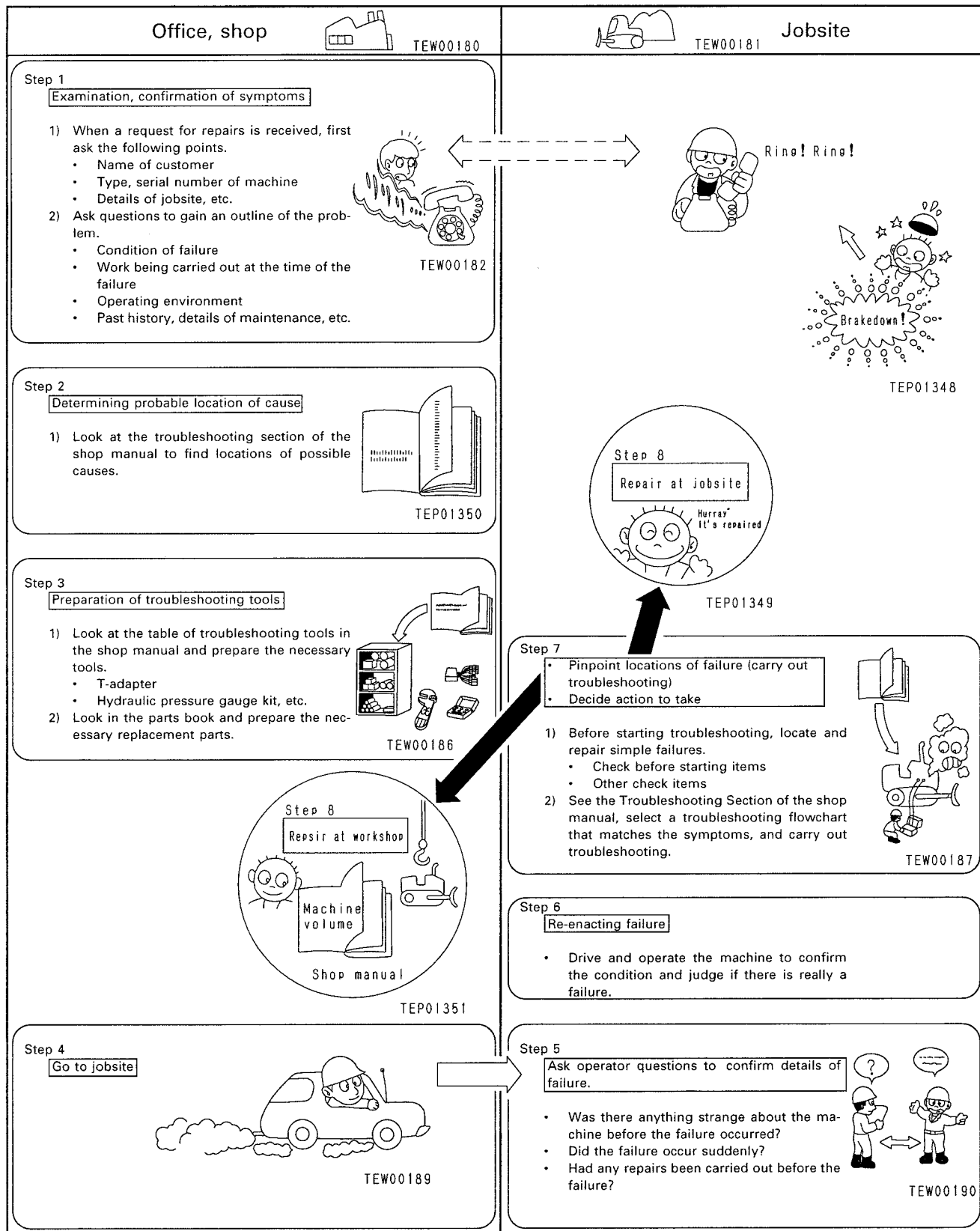
- ★ Turn the adjustment screw to adjust as follows.
 - To INCREASE the pressure, turn CLOCKWISE.
 - To DECREASE the pressure, turn COUNTERCLOCKWISE.
- ★ Amount of adjustment for one turn of adjustment screw: 1.79 MPa {18.3 kg/cm²}

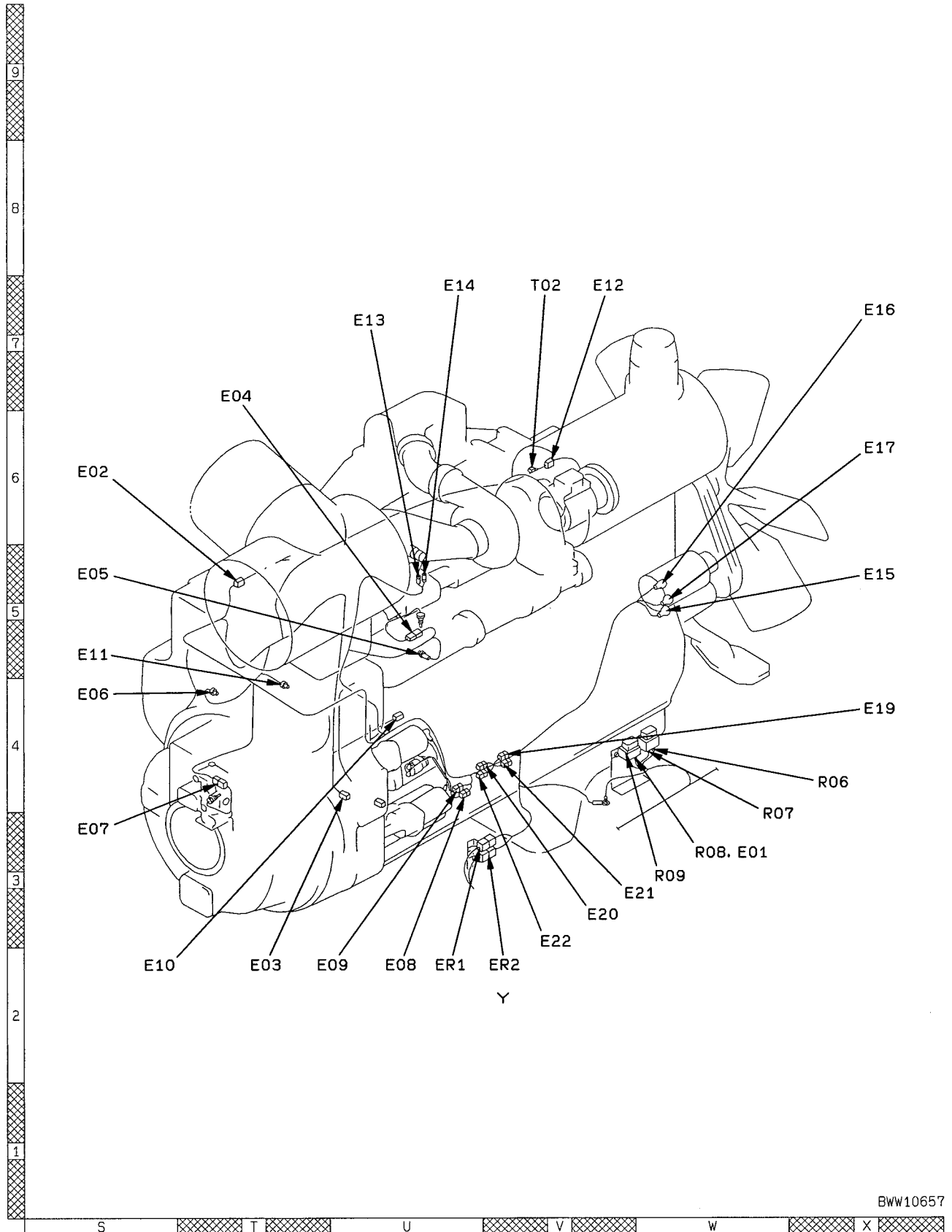
 Locknut : 78.5 – 88.3 Nm {8 – 9 kgm}

- ★ After completion of the adjustment, re-check the accumulator charge cut-in pressure and cut-out pressure again referring to the section "Testing and Adjusting Accumulator charge pressure".



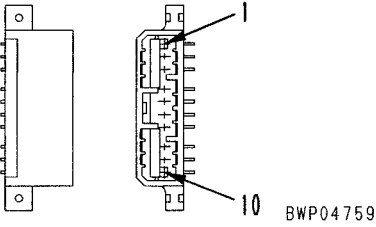
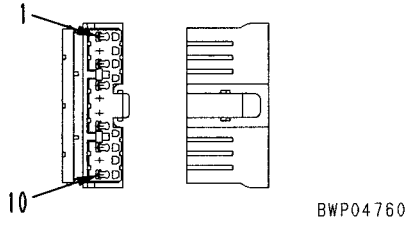
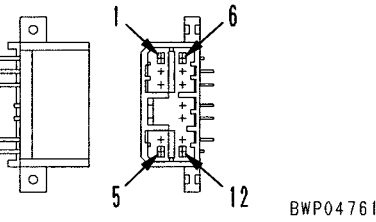
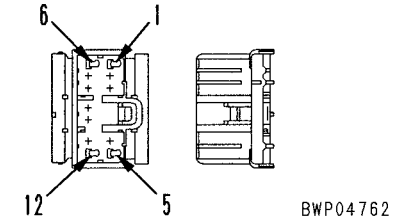
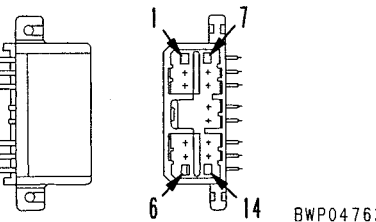
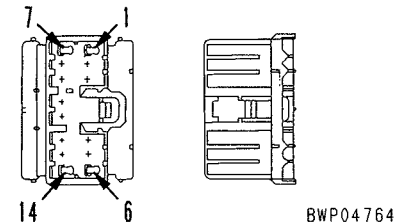
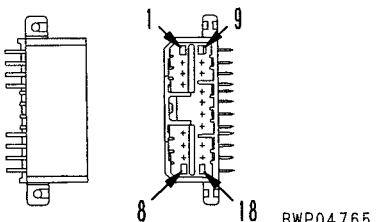
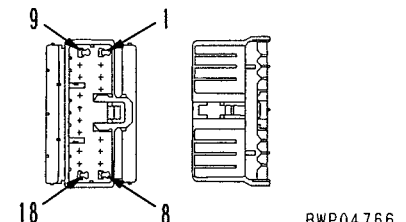
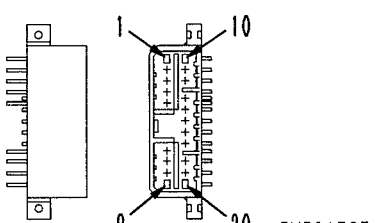
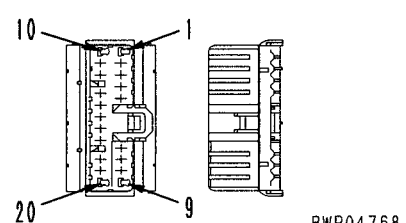
SEQUENCE OF EVENTS IN TROUBLESHOOTING





BWW10657

BOW10657

No. of pins	AMP070 type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
10	 <p>BWP04759</p>	 <p>BWP04760</p>	799-601-7510
	—		
12	 <p>BWP04761</p>	 <p>BWP04762</p>	799-601-7520
	—		
14	 <p>BWP04763</p>	 <p>BWP04764</p>	799-601-7530
	—		
18	 <p>BWP04765</p>	 <p>BWP04766</p>	799-601-7540
	—		
20	 <p>BWP04767</p>	 <p>BWP04768</p>	799-601-7550
	—		

3) Operate the machine and check the troubleshooting items other than those in 1). Operate the machine and check the items in the same way as in 1), and if the symptom appears, mark that item. (In the chart on the right, the symptom appears again for item 5).

4) Find the appropriate cause from the cause column. In the same way as in Step 2), if the symptom appears, the ○ marks on that line indicate the possible causes. (For item No. 5 in the table on the right, the possible causes are **b** or **e**.)

5) Narrow down the possible causes. There is one common cause among the causes located in Steps 2) and 4). (One cause marked ○ appears on the line for both items.) This cause is common to both the symptoms in troubleshooting Steps 1) and 3).

★ The causes which are not common to both troubleshooting items (items which are not marked ○ for both symptoms) are unlikely causes, so ignore them. (In the example given on the right, the causes for Troubleshooting Item 2 are **c** or **e**, and the cause for Troubleshooting Item 5 are **b** or **e**, so cause **e** is common to both.)

6) Repeat the operations in Steps 3), 4) and 5) until one cause (one common cause) remains.

★ If the causes cannot be narrowed down to one cause, narrow the causes down as far as possible.

7) Remedy
If the causes are narrowed down to one common cause, take the action given in the remedy column.

The symbols given in the remedy column indicate the following:

×: Replace, △: repair, A: Adjust, C: Clean

		Causes				
		a	b	c	d	e
Remedy		×	C	△	A	×
Problems						
1		○	○	○	○	
2				○		●
3			○		○	
4		○			○	
5			●			●

Applicable troubleshooting item located in Step 3).
Applicable troubleshooting item located in Step 1).

		Causes				
		a	b	c	d	e
Remedy		×	C	△	A	×
Problems						
1		○	○	○	○	
2	---			●		●
3			○		○	
4		○			○	
5	---		●			●

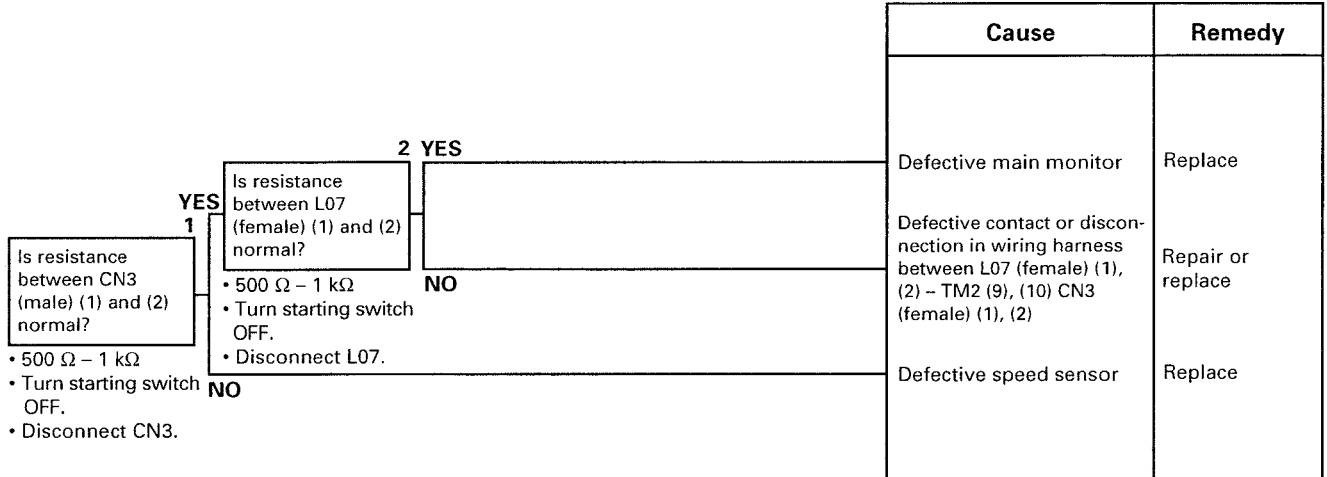
Ignore these causes
Common causes

		Causes				
		a	b	c	d	e
Remedy		×	C	△	A	×
Problems						
1		○	○	○	○	
2	---			○		●
3			○		○	
4		○			○	
5	---		○			●

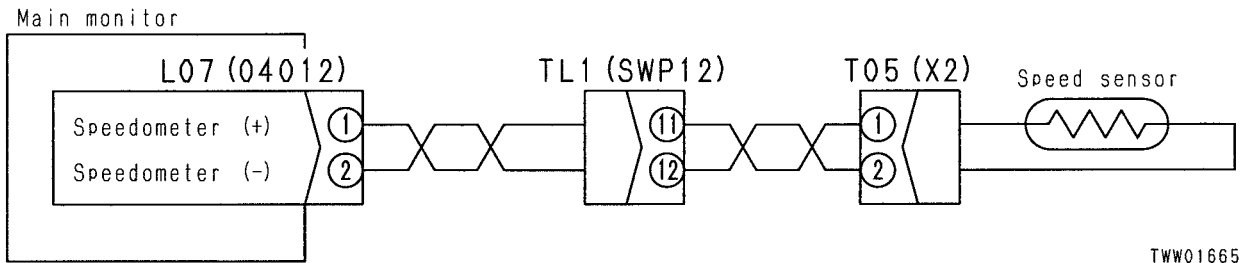
Action to take

M-3 Speedometer display does not work properly

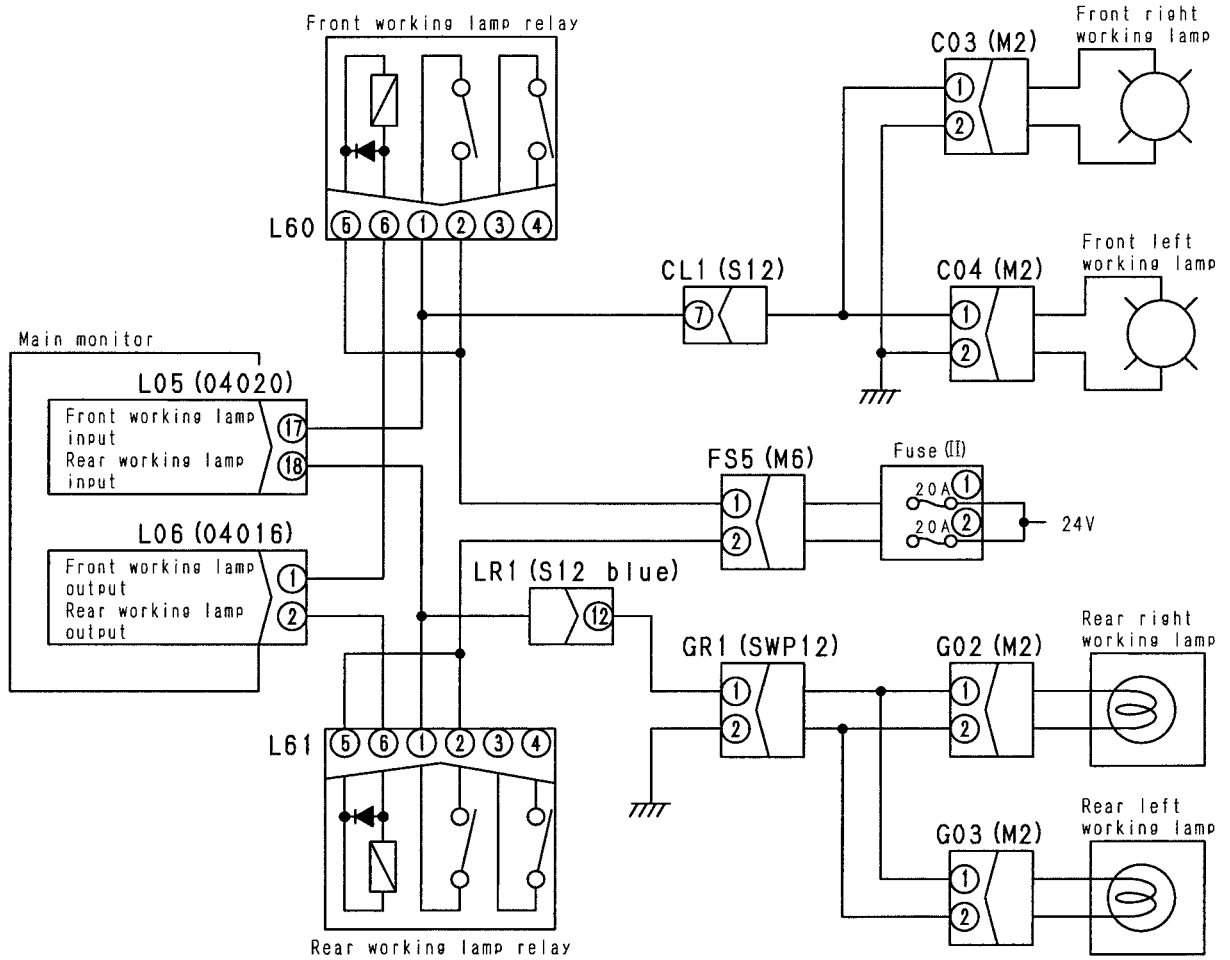
- ★ Before disconnecting or connecting connectors, always turn starting switch OFF.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.
- ★ Check that the gap between the speed sensor and gear is normal.



M-3 Related electrical circuit diagram



M-10 Related electrical circuit diagram



TWW01672

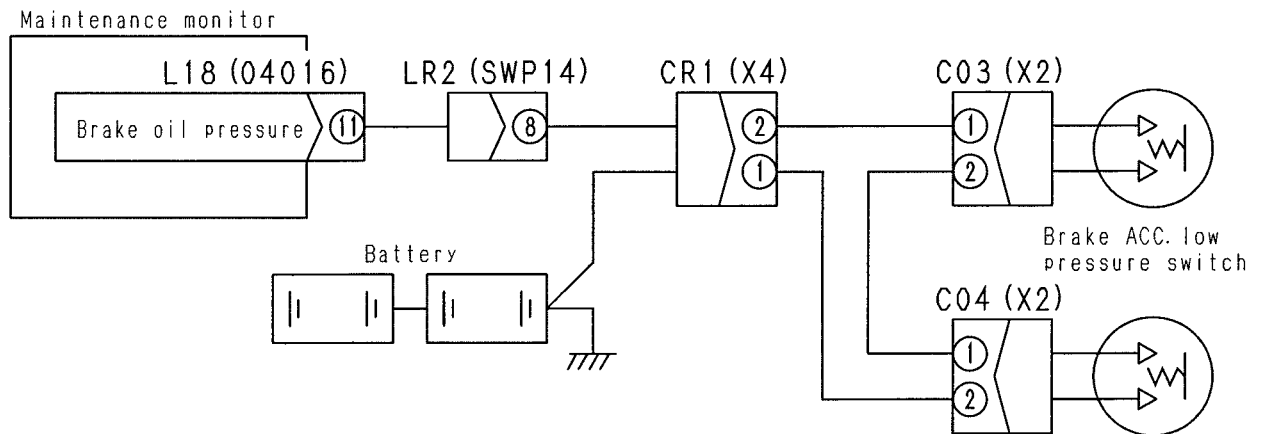
TROUBLESHOOTING OF MAINTENANCE MONITOR SYSTEM (K MODE)

Electrical circuit diagram for maintenance monitor	20-402
K- 1 When starting switch is turned ON, all display on maintenance monitor do not light up for 3 seconds	20-404
Maintenance monitor does not work	20-404
a) No lamps on maintenance monitor light up	20-404
b) Some lamps do not light up	20-404
K- 2 When starting switch is turned ON, all lamps on maintenance monitor light up but do not go out even after 3 seconds	20-405
K- 3 When engine is started immediately after starting switch is turned ON within 3 seconds, no lamps on maintenance monitor go out	20-406
K- 4 When engine is stopped and starting switch is turned ON, CHECK item display flashes	20-407
a) Engine oil level display flashes	20-407
b) Engine water level display flashes	20-408
K- 5 When engine is stopped and starting switch is turned ON, CAUTION item display flashes	20-409
a) Engine oil pressure display flashes	20-409
b) Battery charge level display flashes	20-410
c) Brake oil pressure display flashes	20-411
d) Air cleaner clogged display flashes	20-412
K- 6 CAUTION item display is flashing, but caution buzzer does not sound	20-413
K- 7 No monitor display lights up, but caution buzzer sounds	20-414
K- 8 CAUTION item display is flashing, but central CHECK lamp or central CAUTION lamp does not flash	20-415
a) CHECK lamp	20-415
b) CAUTION lamp	20-415
K- 9 No maintenance monitor display lights up, but central CHECK lamp or central CAUTION lamp lights up	20-416
a) CHECK lamp	20-416
b) CAUTION lamp	20-416
K-10 Only night lighting of monitor does not light up when lamp switch is turned ON	20-417
K-11 Night lighting of monitor lights up even when lamp switch is OFF	20-418
K-12 Service meter does not work	20-419
K-13 Service meter is running even when engine is stopped	20-419
K-14 Abnormality in gauges	20-420
a) Abnormality in fuel gauge	20-420
b) Abnormality in engine water temperature gauge	20-421
c) Abnormality in torque converter oil temperature gauge	20-422

c) Brake oil pressure display flashes
(Check that the brake oil pressure is correct.)

		Cause	Remedy
<p>1</p> <p>Is resistance between B08 (male) (1) and (2) normal?</p> <ul style="list-style-type: none"> • Max. 1 Ω • Start engine. • Disconnect B08. <p>YES</p> <p>2</p> <p>Is resistance between B13 (male) (1) and (2) normal?</p> <ul style="list-style-type: none"> • Max. 1 Ω • Start engine. • Disconnect B13. <p>YES</p> <p>3</p> <p>Is resistance between B08 (female) (2) and chassis ground normal?</p> <ul style="list-style-type: none"> • Max. 1 Ω • Turn starting switch OFF. • Disconnect B08. <p>YES</p> <p>4</p> <p>Is voltage between L18 (11) and chassis ground normal?</p> <ul style="list-style-type: none"> • Start engine. • Max. 3 V 	NO	Defective brake accumulator charge oil pressure switch (B08 end)	Replace
	NO	Defective brake accumulator charge oil pressure switch (B13 end)	Replace
	NO	Defective contact or disconnection in wiring harness between B08 (female) (2) – B13 (female) (1), or between B13 (female) (2) – BR1 (4) – chassis ground	Repair or replace
	NO	Defective contact or disconnection in wiring harness between L18 (female) (11) – LR2 (8) – BR1 (6) – B08 (female) (1)	Repair or replace
	NO	Defective monitor module of maintenance monitor	Replace

K-5 c) Related electrical circuit diagram



TWW01681

b) Abnormality in engine water temperature gauge

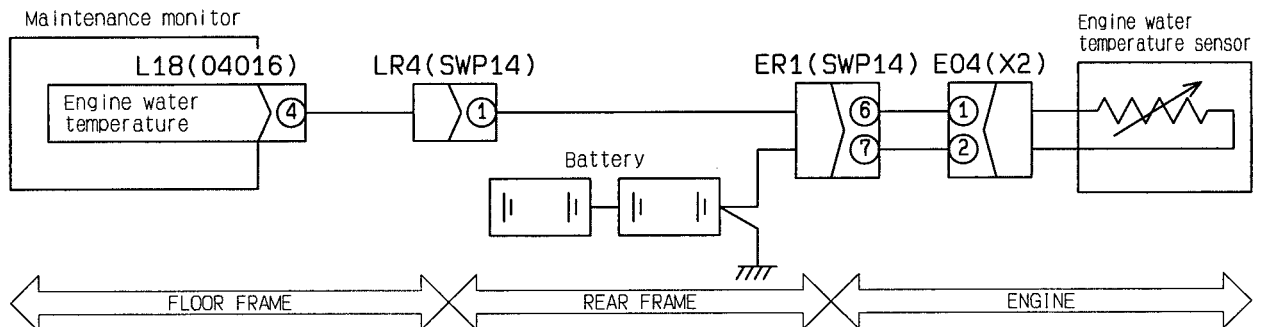
(1) Nothing is displayed

		Cause	Remedy		
<p>1</p> <p>Does engine water temperature gauge show minimum level when E04 is disconnected?</p> <p>• Disconnect E04. • Turn starting switch ON.</p>	YES	Defective engine water temperature sensor	Replace		
	NO	<p>2</p> <p>Is resistance between E04 (female) (1) and chassis ground normal?</p> <p>• Min. 1 MΩ • Turn starting switch OFF. • Disconnect L18 and E06.</p>	YES	Defective monitor module of maintenance monitor	Replace
	NO		NO	Short circuit with chassis ground in wiring harness between E04 (female) (1) – ER1 (6) – LR4 (1) – L18 (female) (4) (contact with chassis ground)	Repair or replace

(2) Display shows lowest level

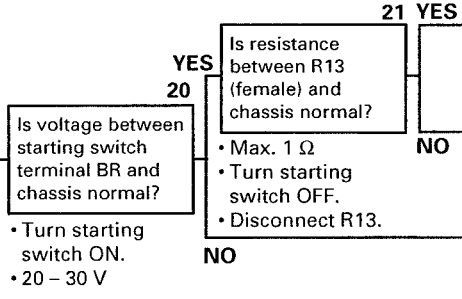
		Cause	Remedy		
<p>1</p> <p>When short connector is connected to E04 (female), does engine water temperature gauge display area rise one stage at a time, and finally do all lamps go out?</p> <p>• Disconnect E04. • Connect short connector to E04 (female). • Turn starting switch ON.</p>	YES	Defective engine water temperature sensor	Replace		
	NO	<p>2</p> <p>Is resistance between E04 (female) (2) and chassis ground normal?</p> <p>• Turn starting switch OFF. • Disconnect E04. • Max. 1 Ω</p>	YES	Defective monitor module of maintenance monitor	Replace
	NO		YES	Defective contact or disconnection in wiring harness between E04 (female) (1) – ER1 (6) – LR4 (1) – L18 (female) (4)	Repair or replace
	NO		NO	Defective contact or disconnection in wiring harness between E04 (female) (2) – ER1 (7) – chassis ground	Repair or replace

K-14 b) Related electrical circuit diagram



BWW10763

	Cause	Remedy
	Defective neutral relay	Replace
	Defective contact or disconnection in wiring harness between L57 (female) (3) – LR4 (8) – R01, R02 (diode) – ER1 (10) – E13 (female) (1)	Repair or replace
	Defective contact or disconnection in wiring harness between starting switch terminal C – L09 (3) – L57 (female) (5)	Repair or replace
	Defective starting switch	Replace
	Defective contact or disconnection in wiring harness between starting switch terminal B - L09 (1) – FS3 (4) – fuse I-12, FS3 (6) – LR5 (1) – R17 – slow blow fuse 30A – battery relay	Repair or replace
	Defective contact or disconnection in wiring harness between L04 (female) (3) and L57 (female) (1)	Repair or replace
	Defective directional lever switch	Replace
	Defective contact or disconnection in wiring harness between battery relay - slow blow fuse 80A – R15 – LR6 (1) – FS1 (2) fuse I-9 – FS2 (8) – L04 (female) (1)	Repair or replace
	<ul style="list-style-type: none"> • If answer is NO for both terminals: Defective contact or disconnection in wiring harness between battery and battery relay • If answer is NO for one terminal: Defective battery relay 	Repair or replace
	Defective battery relay	Replace
	Defective contact or disconnection in wiring harness between starting switch terminal BR – L09 (2) – LR4 (9) – R03 (diode) (2), (1) – R12 (female)	Repair or replace
	Defective contact or disconnection in wiring harness between R13 and chassis ground	Repair or replace
	Defective starting switch	Replace
	Defective contact or disconnection in wiring harness between L57 (female) (2) –	Repair or replace

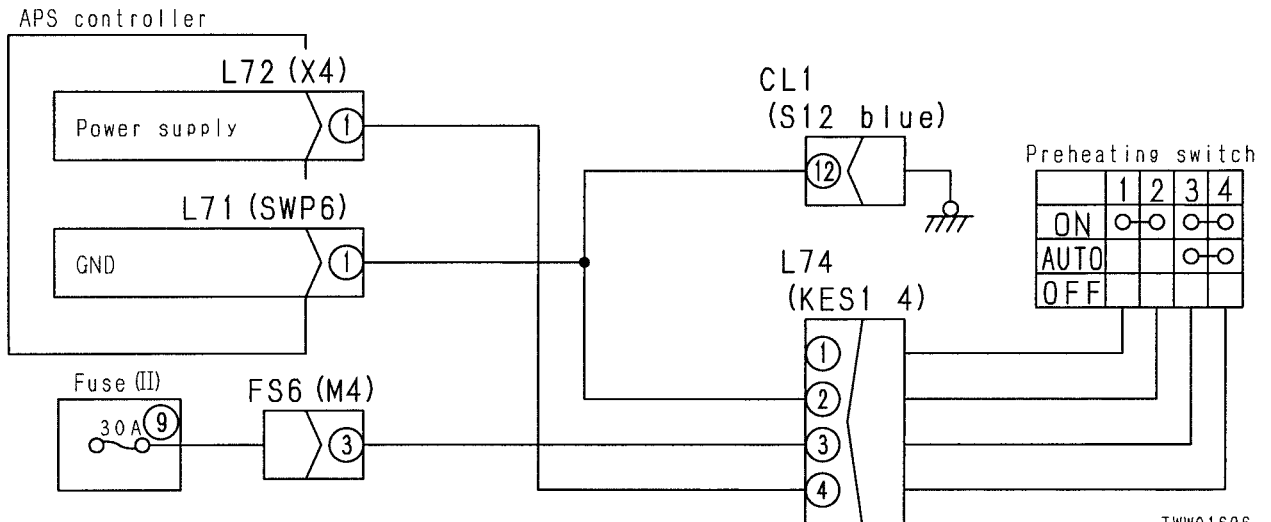


Abnormality in APS system

- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
 - ★ Always connect any disconnected connectors before going on to the next step.
- a) **When preheating switch is turned AUTO, preheating lamp does not light up, but no pilot LED on APS controller lights up.**
- ★ Check for power supply circuit.
 - ★ Check whether engine cranking is possible or not. In case cranking is impossible, check for E-1 then check for E-4.
 - ★ Check whether fuse 9 is blown or not. If fuse 9 is blown, check for short circuit to GND in fuse 9 related circuit.
 - ★ When carrying out troubleshooting, turn preheating switch AUTO.

		Cause	Remedy	
<p>1</p> <p>Is voltage between L72 (female) (1) and chassis ground normal?</p> <ul style="list-style-type: none"> • 20 – 30 V • Turn starting switch ON. • Disconnect L72. <p>YES</p> <p>2</p> <p>Is resistance between L71 (female) (1) and chassis ground normal?</p> <ul style="list-style-type: none"> • Max. 1Ω • Turn starting switch OFF. • Disconnect L71. <p>NO</p> <p>3</p> <p>Is voltage between L74 (female) (3) and chassis ground normal?</p> <ul style="list-style-type: none"> • 20 – 30 V • Turn starting switch ON. • Disconnect L74. <p>YES</p> <p>4</p> <p>Is resistance between L74 (male) (3) and (4) normal?</p> <ul style="list-style-type: none"> • Max. 1Ω • Turn starting switch OFF. • Disconnect L74. <p>NO</p>	<p>2 YES</p>	Defective APS controller	Replace	
		<p>NO</p>	Defective contact or disconnection in wiring harness between L71 (female) (1), CL1 (12) and chassis ground	Repair or replace
		<p>4 YES</p>	Defective contact or disconnection in wiring harness between L74 (female) (4) and L72 (female) (1)	Repair or replace
		<p>NO</p>	Defective preheater switch	Replace
		Defective contact or disconnection in wiring harness between L74 (female) (3), FS6 (3) and fuse II (9)	Repair or replace	

E-4 a) Related APS controller electrical circuit diagram



TWW01696

CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

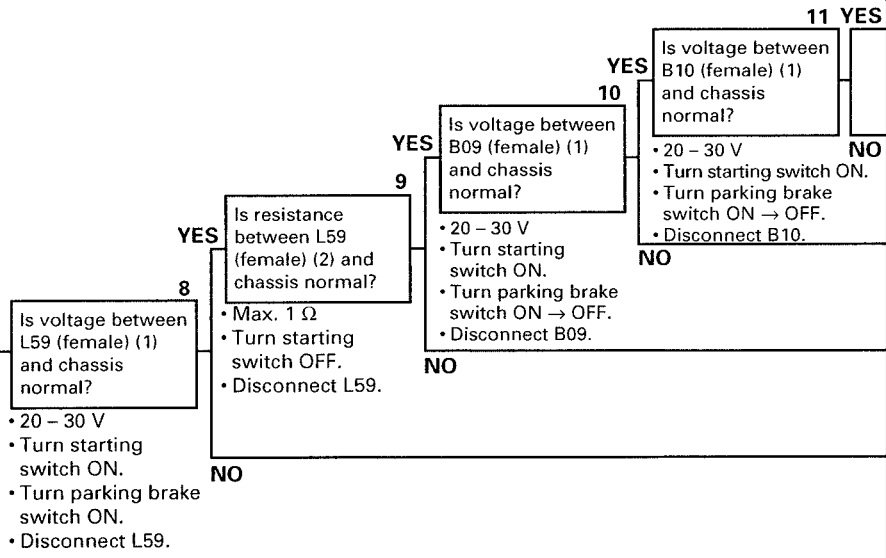
- Thank you very much for reading the preview of the manual.
- You can download the complete manual from: www.heydownloads.com by clicking the link below



- Please note: If there is no response to CLICKING the link, please download this PDF first and then click on it.

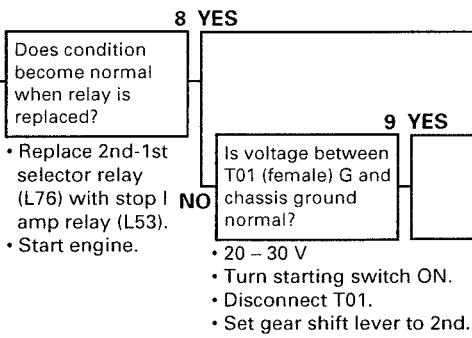
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Cause	Remedy
Defective parking brake solenoid	Replace
Defective contact or disconnection in wiring harness between CN10 (female) (2) and chassis	Repair or replace
Defective parking brake safety relay	Replace
Defective emergency brake switch	Replace
Defective contact or disconnection in wiring harness between B10 (female) (2) – BR1 (8) – LR4 (14) – TH2 (11) – CN10 (female)	Repair or replace
Defective contact or disconnection in wiring harness between B09 (female) (2) and B10 (female) (1)	Repair or replace
Defective contact or disconnection in wiring harness between B09 (female) (1) – BR1 (7) – LR4 (13) – L01 (female) (2)	Repair or replace
Defective contact or disconnection in wiring harness between L59 (female) (2) and chassis	Repair or replace
Defective contact or disconnection in wiring harness between L59 (female) (1) and L01 (female) (3), or between FS2 (female) (7) and L01 (female) (1)	Repair or replace
Defective contact or disconnection in wiring harness between L59 (female) (1) and L59 (female) (3)	Repair or replace
Defective contact or disconnection in wiring harness between L59 (female) (5) – FS2 (7) – fuse I-9	Repair or replace
Defective parking brake switch	Replace



	Cause	Remedy
_____	Defective forward solenoid	Replace
_____	Defective contact or disconnection in wiring harness between T01 (female) (A), TL1 (7), CL1 (12) and chassis ground	Repair or replace
_____	Defective forward relay	Replace
_____	See E-9-a).	—
_____	Defective directional lever, or defective contact or disconnection in wiring harness between L04 (female) (2) and L66 (female) (5)	Repair or replace
_____	Defective contact or disconnection in wiring harness between L04 (female) (1), FS2 (8) and fuse 1 (9)	Repair or replace
_____	Defective contact or disconnection in wiring harness between L66 (female) (6), CL1 (12) and chassis ground	Repair or replace

	Cause	Remedy
	Defective 1st gear solenoid	Replace
	Defective contact or disconnection in wiring harness between L04 (female) (5), TL1 (1) and T01 (female) (H)	Repair or replace
	Defective gear shift lever switch	Replace
	Defective 2nd-1st selector relay	Replace
	Defective 2nd gear solenoid	Replace
	Defective contact or disconnection in wiring harness between L76 (female) (6), TL1 (2) and T01 (female) (G)	Repair or replace
	Defective contact or disconnection in wiring harness between L04 (female) (6) and L76 (female) (3)	Repair or replace
	Defective gear shift lever switch	Replace
	Defective 3rd gear solenoid	Replace
	Defective contact or disconnection in wiring harness between L04 (female) (7), TL1 (3) and T01 (female) (F)	Repair or replace
	Defective gear shift lever switch	Replace
	Defective 4th gear solenoid	Replace
	Defective contact or disconnection in wiring harness between L04 (female) (8), TL1 (4) and T01 (female) (E)	Repair or replace
	Defective gear shift lever switch	Replace
	Defective contact or disconnection in wiring harness between T01 (female) (B), TL1 (7), CL1 (12) and chassis ground	Repair or replace
	Defective contact or disconnection in wiring harness between L04 (female) (1), FS2 (8) and fuse I (9)	Repair or replace
	Defective contact or disconnection in wiring harness between L04 (female) (10) LR5 (3) and chassis ground	Repair or replace

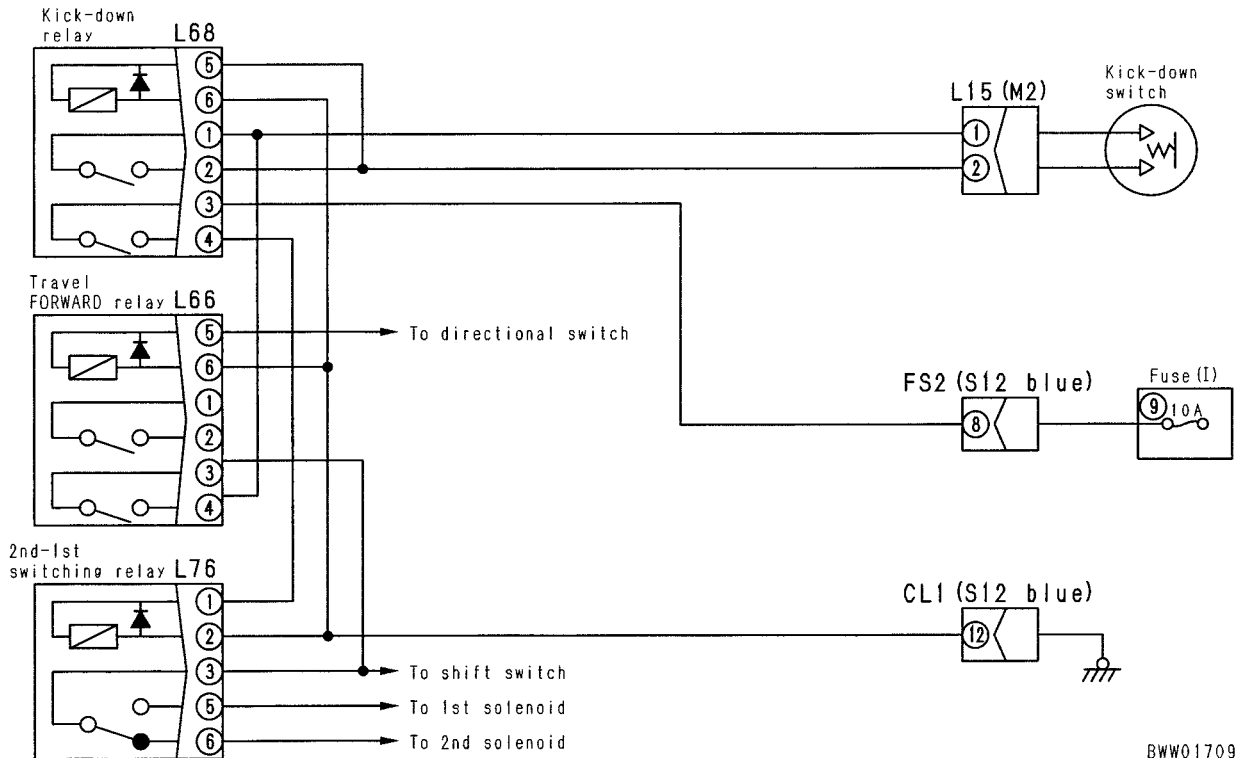


E-11 Kick-down works only when kick-down switch is being turned ON

- ★ Before disconnecting or connecting connectors, always turn starting switch OFF.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on to the next step.

	Cause	Remedy
<p>1</p> <p>Does condition become normal when kick-down relay is replaced?</p> <p>• Replace kick-down relay (L68) with reverse relay (L67).</p> <p>• Start engine.</p> <p>YES</p>	Defective kick-down relay	Replace
<p>2 YES</p> <p>Is resistance between L66 (female) (4) and L68 (female) (1) normal?</p> <p>• Max. 1 Ω</p> <p>• Turn starting switch OFF.</p> <p>• Disconnect L66 and L68.</p> <p>NO</p>	Defective contact or disconnection in wiring harness between L68 (female) (2) and (5)	Repair or replace
	Defective contact or disconnection in wiring harness between L66 (female) (4) and L68 (female) (1)	Repair or replace

E-11 Related electrical circuit diagram



BWW01709

TROUBLESHOOTING OF HYDRAULIC AND MECHANICAL SYSTEM (H MODE)

POWER TRAIN

H- 1	Machine does not start	20-602
H- 2	Travel speed is slow, or lacks power in all speed ranges	20-603
H- 3	Excessive time lag when starting machine or shifting gear	20-604
H- 4	Torque converter oil temperature is high	20-605
H- 5	Steering wheel does not turn	20-606
H- 6	Turning, response of steering is poor	20-607
H- 7	Steering is heavy	20-608
H- 8	Steering wheel shakes or jerks.....	20-609
H- 9	Turning radius is different between left and right at maximum steering.....	20-609

BRAKE SYSTEM

H-10	Wheel brakes do not work or braking effect is poor	20-610
H-11	Wheel brakes are not released or brakes drag	20-612
H-12	Parking brake does not work or braking effect is poor	20-613
H-13	Parking brake is not released or brake drags (including emergency release system)	20-614

WORK EQUIPMENT

H-14	Blade does not move	20-615
H-15	Blade is slow or blade lacks power	20-616
H-16	Blade cannot be set to FLOAT or cannot be released from FLOAT	20-617
H-17	Blade drops momentarily when control lever is operated from HOLD to RAISE	20-617
H-18	Excessive hydraulic drift of blade	20-618


METHOD OF USING MANUAL

1. When removing or installing unit assemblies


- ① When removing or installing a unit assembly, the order of work and techniques used are given for the removal operation; the order of work for the installation operation is not given.
- ② Any special techniques applying only to the installation procedure are marked ※ 1, and the same mark is placed after the relevant step in the removal procedure to indicate which step in the installation procedure it applies to.

(Example)

REMOVAL OF ○○○○ ASSEMBLY Title of operation

- Precautions related to safety when carrying out the operation
- 1. XXXX(1) Step in operation
 - ★ Technique or important point to remember when removing XXXX (1).
- 2. △△△△ (2): ※ 1 Indicates that a technique is listed for use during installation
- 3. □□□□ assembly (3)
 -  Quantity of oil or water drained

INSTALLATION OF ○○○○ ASSEMBLY Title of operation

- Carry out installation in the reverse order to removal.
- ※ 1 Technique used during installation
- ★ Technique or important point to remember when installing △△△△ (2).
- Adding water, oil Step in operation
 - ★ Point to remember when adding water or oil
 -  Quantity when filling with oil and water

2. General precautions when carrying out installation or removal (disassembly or assembly) of units are given together as PRECAUTIONS WHEN CARRYING OUT OPERATION, so be sure to follow these precautions when carrying out the operation.

3. Listing of special tools

- ① For details of the description, part number, and quantity of any tools (A1, etc.) that appear in the operation procedure, see the SPECIAL TOOLS LIST given in this manual.

Component	Symbol	Part No.	Part Name	Necessity	Qty	New/re-model	Sketch	Nature of work, remarks
Installation of center hinge bearing	K	2	790-438-1020	Guide	■	1		Installation of lower center hinge bearing
			790-438-1040	Screw	■	1		
			790-101-2102	Puller	■	1		
			790-101-1102	Pump	■	1		
Disassembly, assembly of steering cylinder	1	790-502-1003	Cylinder repair stand	■	1		Disassembly, assembly of cylinder	
		790-502-2000	Cylinder repair stand	■	1			
		790-101-1102	Hydraulic pump	■	1			
	2	790-102-3802	Wrench	■	1		Removal, installation of steering cylinder round head	
	3	790-302-1340	Socket (80mm)	■	1		Removal, installation of steering cylinder nylon nut	
	4	790-201-1500	Push tool kit	■	1		Press fitting of dust seal	
		• 790-201-1620	• Plate		1			
		• 790-101-5021	• Grip		1			
		• 01010-50816	• Bolt		1			
	5	790-201-1702	Push tool kit	■	1		Press fitting of roll bushing	
		• 790-201-1811	• Push tool		1			
		• 790-101-5021	• Grip		1			
		• 01010-50816	• Bolt		1			
	6	790-720-1000	Expander	●	1			
	7	796-720-1670	Ring	●	1			
		07281-01279	Clamp	●	1			
		X	1	799-703-1200	Service tool kit	■	1	
799-703-1110				Vacuum pump (220V)		1		
790-703-1120				Vacuum pump (240V)		1		
799-703-1400				Gas leak detector	■	1		

REMOVAL OF ENGINE OIL COOLER

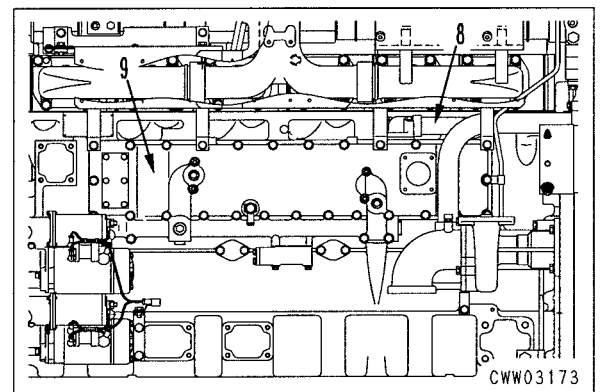
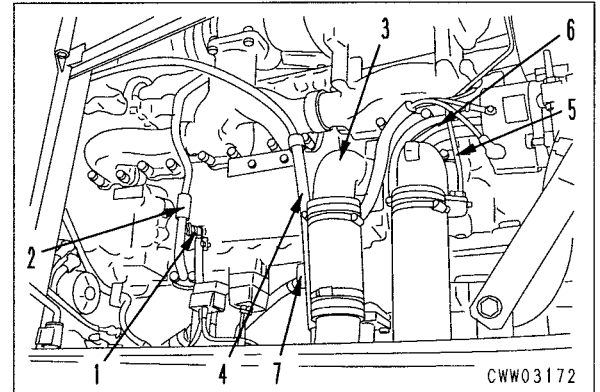
- ⚠ Stop the machine on level ground and lower the work equipment completely to the ground, then put blocks under the steel wheels to prevent the machine from moving.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Drain the engine cooling water.



Engine cooling water: **Approx. 150 ℓ**

2. Drain the engine cooling water in the engine oil cooler through drain plug (1).
3. Disconnect turbocharger drain tube (2).
4. Disconnect tube (3) between the engine oil cooler and transmission oil cooler.
5. Disconnect heater hose (4).
6. Disconnect muffler drain tube (5).
7. Disconnect tube (6) between the thermostat housing and water pump.
 - ★ Remove water pump. For details, see REMOVAL OF WATER PUMP.
8. Disconnect wire clamp (7).
9. Disconnect tube (8) between the engine oil cooler and cylinder block.
10. Remove the mounting bolts, then remove engine oil cooler (9).



INSTALLATION OF ENGINE OIL COOLER

- Carry out installation in the reverse order to removal.
- **Refilling with water**
Tighten radiator drain valve and add water through water filler to the specified level. Run the engine to circulate the water through the system. Then, check the water level again.

REMOVAL OF CYLINDER HEAD

⚠ Stop the machine on level ground and lower the work equipment completely to the ground, then put blocks under the steel wheels to prevent the machine from moving.

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

1. Drain the engine cooling water.



Engine cooling water: **Approx. 163 ℓ**

2. Open right and left side covers (1), then remove engine hood (2).



Engine hood: **99kg**

3. Disconnect turbocharger lubrication oil hose (3).

4. Remove lock plates (4) and (5).

5. Remove intake connector (6).

※ 1

★ Since a gasket sticks to the intake connector, hit the intake connector lightly with a plastic hammer to remove.

6. Remove partition (7).

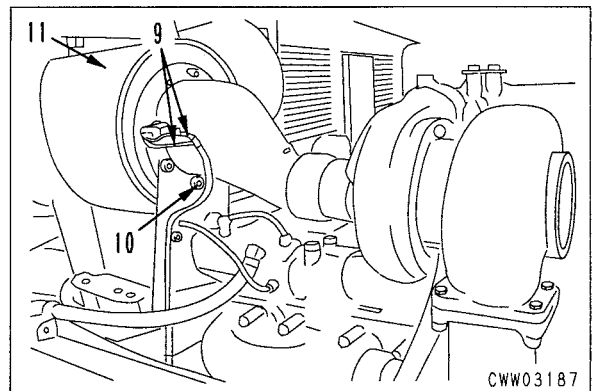
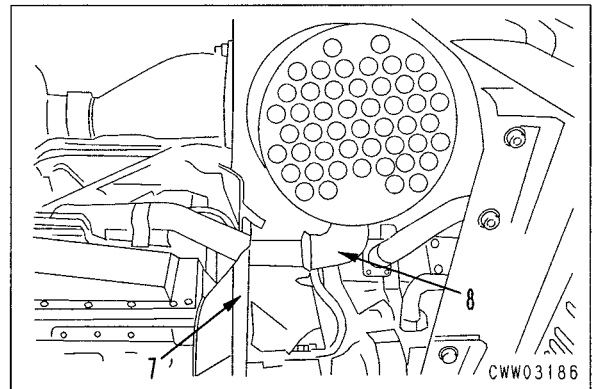
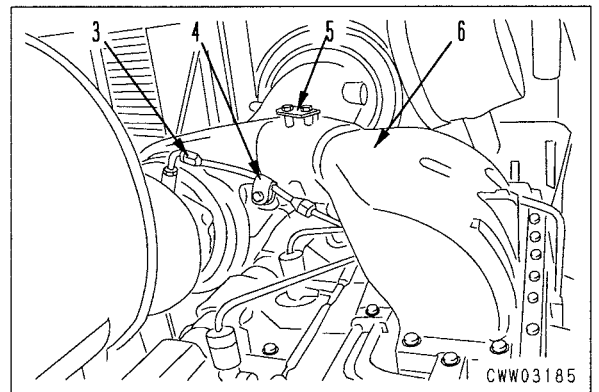
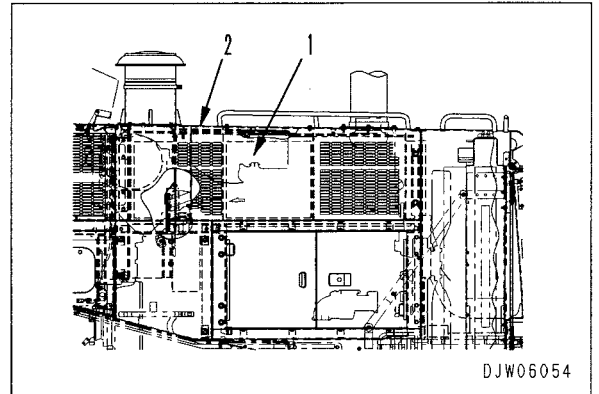
7. Disconnect Komaclone hose (8).

8. Disconnect dust indicator sensor connectors (9) (E13, E14).

9. Remove 3 mounting bolts (10), then remove air cleaner (11).



Air cleaner: **40kg**



REMOVAL OF RADIATOR

⚠ Stop the machine on level ground and lower the work equipment completely to the ground, then put blocks under the steel wheels to prevent the machine from moving.

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

1. Remove right and left side covers (1), then remove engine hood (2).

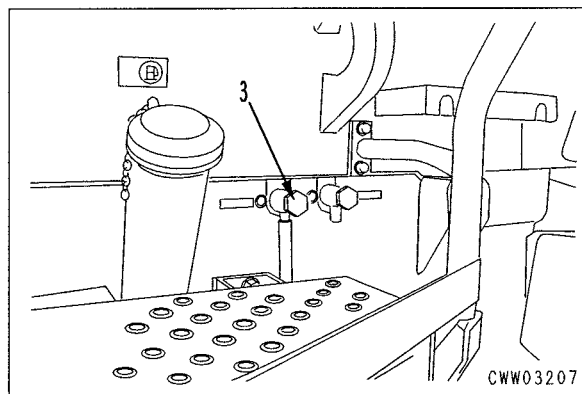
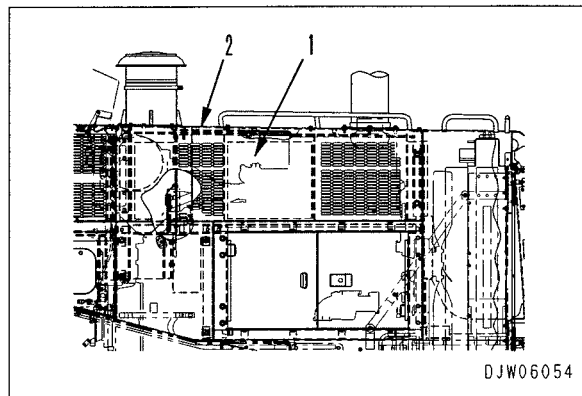


Engine hood assembly: **99kg**

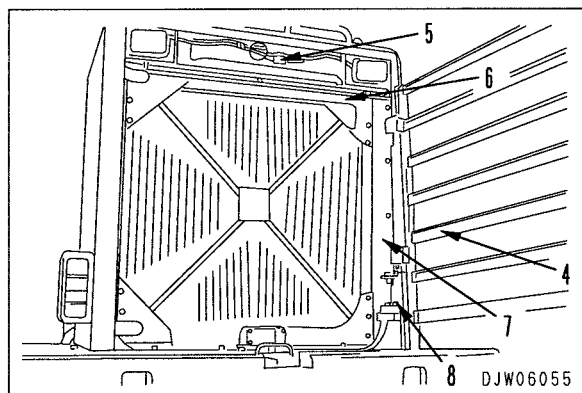
2. Loosen drain valve (3) and drain the engine cooling water.



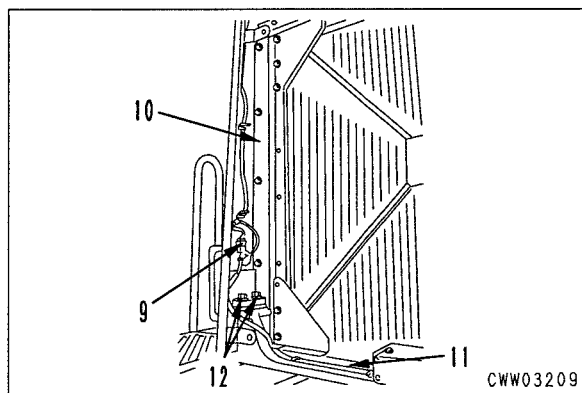
Engine cooling water: **Approx. 163 ℓ**



3. Open radiator grill (4) and remove it.
4. Disconnect radiator water level sensor connector (5) (G01).
5. Remove baffle plates (6) and (7).
6. Remove radiator guard mounting bolts (8).

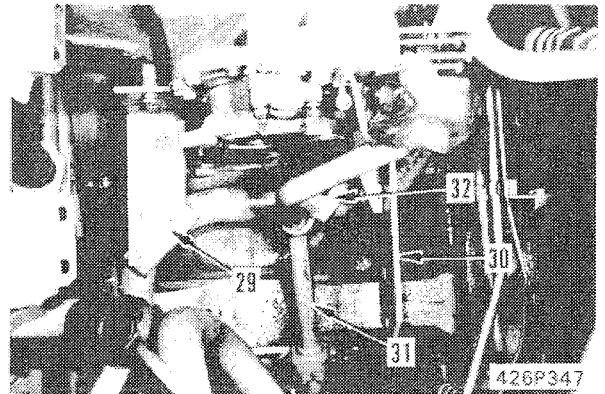


7. Disconnect tail lamp connector (9) (GR1).
8. Remove baffle plates (10) and (11).
9. Remove radiator guard mounting bolts (12).

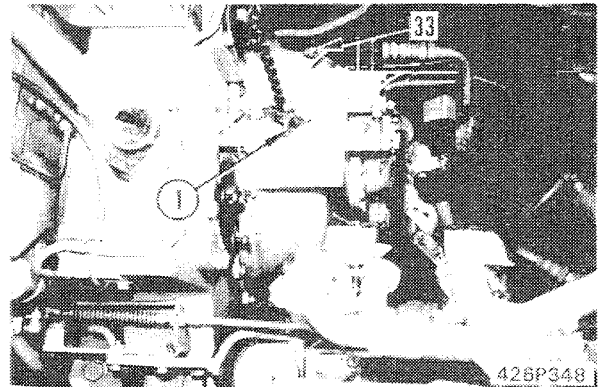


8. Torque converter

- 1) Remove brackets (29) and (30).
 - ★ Remove bracket (32) of tube (31).



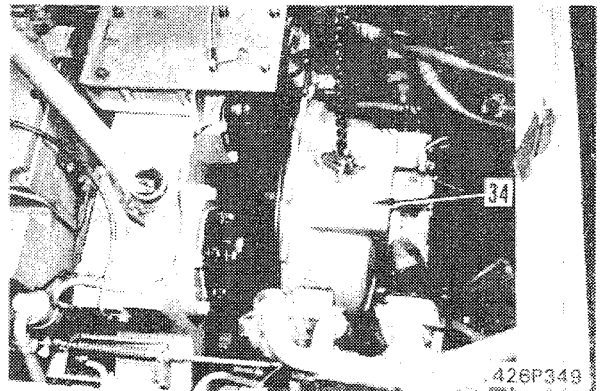
- 2) Sling torque converter, remove mounting bolts.
Using forcing screw ①, disconnect from case.
 - ★ Disconnect torque converter oil temperature sensor wiring (33) from connector.
 - ★ Be careful not to damage O-ring.



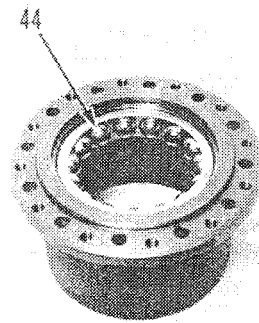
- 3) Lift off torque converter (34).
 - ★ Be careful not to interfere with pipings when lifting off torque converter.



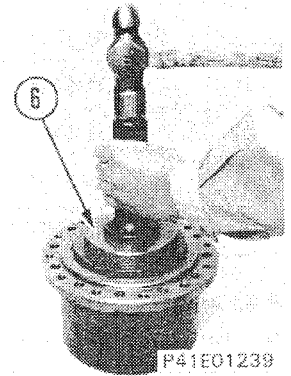
Torque converter: **155kg**



- iii) Using push tool ⑥ (outer dia. = 140 mm), remove bearing (44).



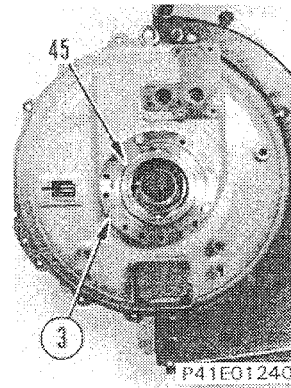
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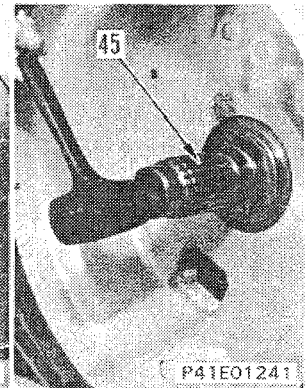
P41E01239

11. Stator shaft assembly

- 1) Remove 3 bolts ③, remove stator shaft assembly (45).

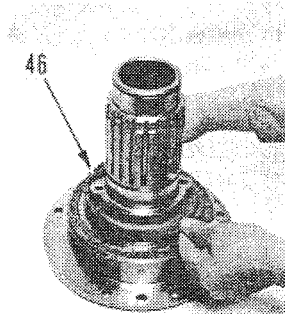


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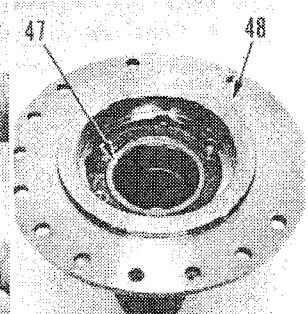


P41E01241

- 2) Disassemble stator shaft assembly as follows.
 i) Remove seal ring (46).
 ii) Remove sleeve (47) from stator shaft.

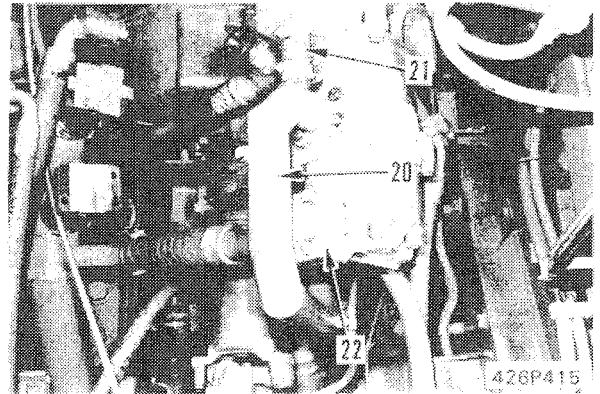


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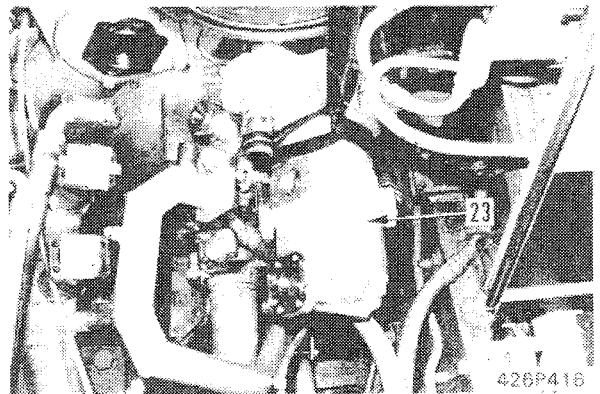
P41E01243

- Tube (20) between transmission and hydraulic pump.
 - ★ Loosen clamp of hose (21) at tube (20) end, then pull out to forward.
 - ★ Loosen clamp of tube (20).
 - ★ Be careful not to damage O-ring when removing.
- Tube (22) between hydraulic tank and hydraulic pump.



- 2) Sling hydraulic pump (23), remove mounting bolts, then lift off.
 - ★ Be careful not to damage O-ring when removing hydraulic pump.


 Hydraulic pump: **49.7kg**

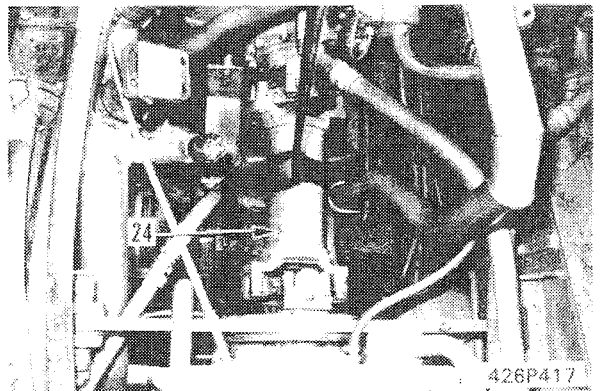


4. Upper drive shaft

Sling upper drive shaft (24), remove mounting bolts, then lift off.

- ★ Make match marks before disconnecting coupling.
- ★ Push in torque converter end coupling to torque converter. Then disconnect coupling.
- ★ Remove clamp of fuel control cable, move to frame end.

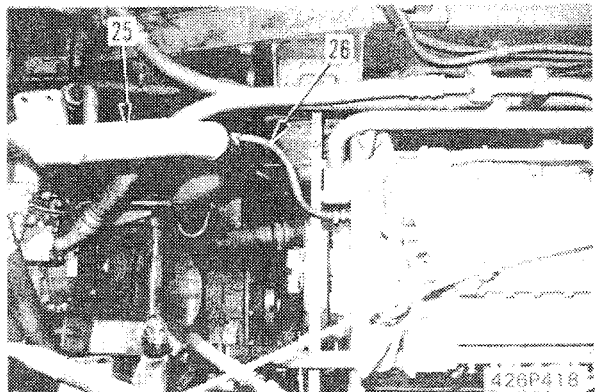
 Upper drive shaft: **30kg**



5. Torque converter piping

- 1) Loosen transmission end hose clamp, then remove tube (25) between transmission and hydraulic pump.

- ★ Remove clamp of tube.
- ★ Remove clamp of hose (26), then disconnect hose from transmission.



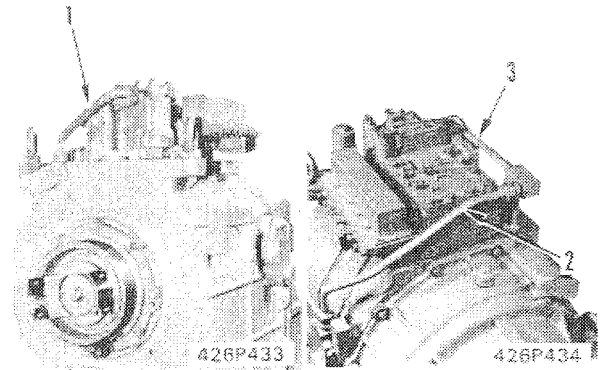
DISASSEMBLY OF TRANSMISSION

Special tool

	Part number	Part name	Q'ty
A	799-301-1500	Leak tester	1

1. Control valve assembly

1) Remove tubes (1), (2) and (3).



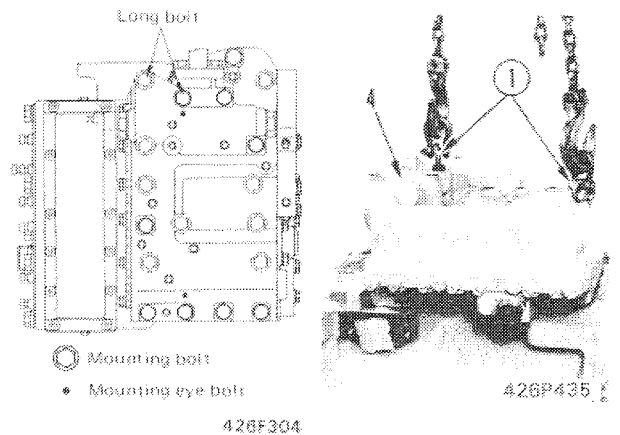
2) Remove 11 mounting bolts.

- ★ Different length of bolts are used. Check bolt length then remove.
- ★ Do not remove bolts which do not indicate in diagram.

3) Using eyebolts ① (thread dia. = 10mm, pitch = 1.5mm), lift off control valve assembly (4).

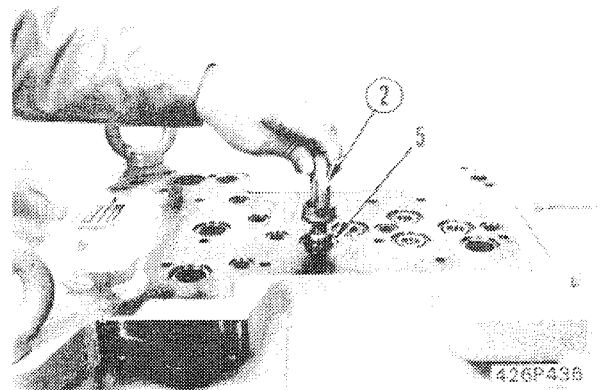


Control valve assembly: **70kg**



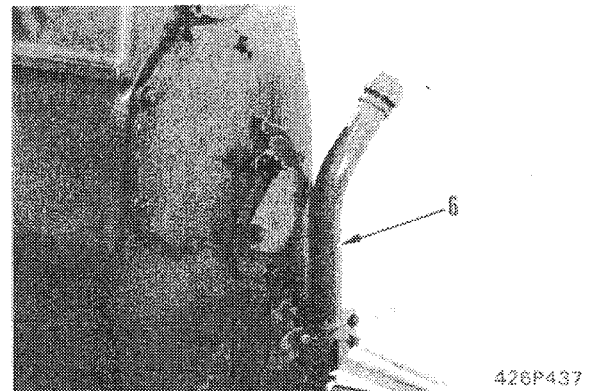
2. Sleeve

Using eyebolt ② (thread dia. = 16mm, pitch = 2.0mm), remove sleeve (5).



3. Lubricating pipe

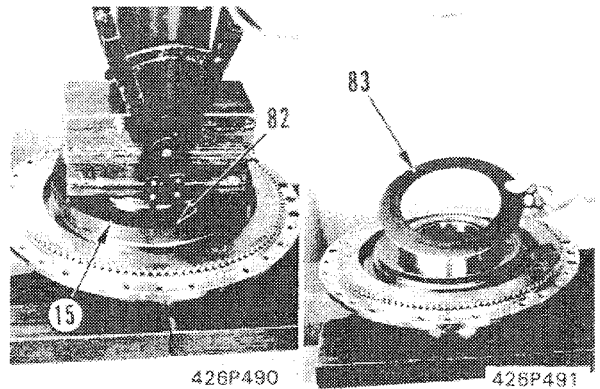
Remove 4 mounting bolts, remove lubricating pipe (6).



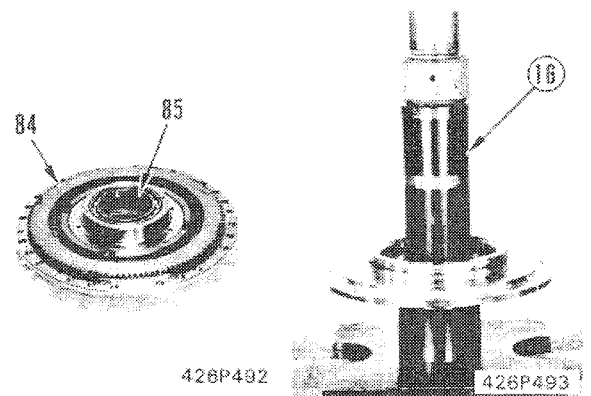


Be careful to remove spring, because spring is installed with 217kg tension.

- vi) Using push tool ⑮ (inner dia. = 180mm), compress belleville spring, and remove snap ring.
- vii) Release press slowly, then remove snap ring (82) and belleville spring (83).



- vii) Remove piston (84).
- ix) Using push tool ⑯ (outer dia. = 105mm), remove bearing (85).

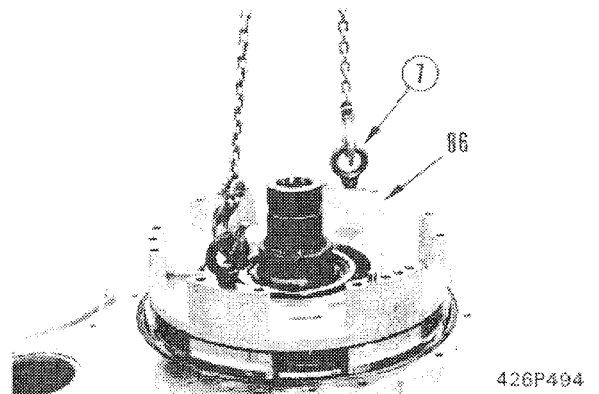


24. Housing, carrier assembly

- 1) Using eyebolts ⑦ (thread dia. = 14mm, pitch = 2.0mm), lift off housing, carrier assembly (86).

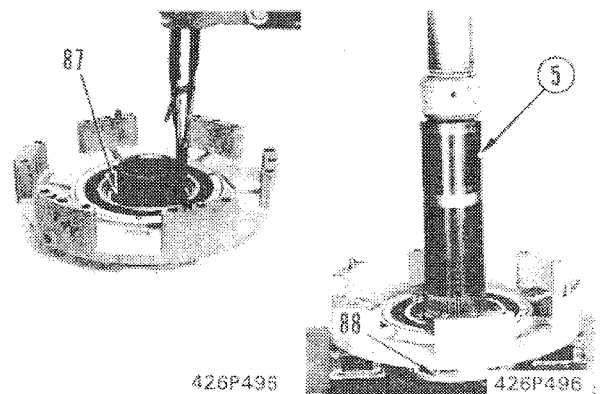


Housing, carrier assembly: **55kg**

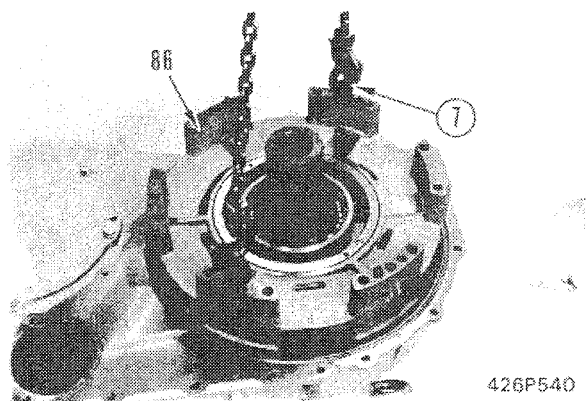


- 2) Disassemble housing, carrier assembly as follows.

- i) Remove snap ring (87).
- ii) Using push tool ⑤ (outer dia. = 120mm), remove carrier assembly (88).

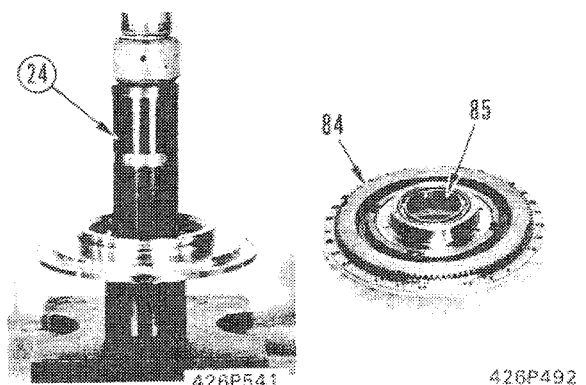


- 2) Using eyebolts ⑦ (thread dia. =14mm, pitch = 2.0mm), install housing, carrier assembly (86).

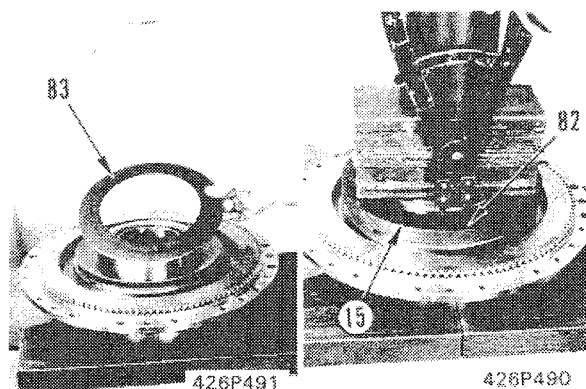


11. Rotating clutch assembly

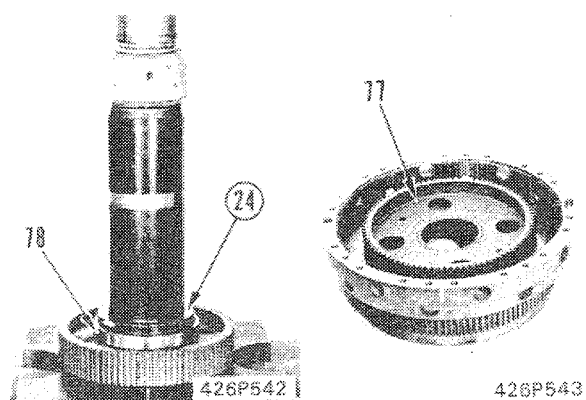
- 1) Assemble rotating clutch assembly as follows.
 - i) Fit seal ring, using push tool ⑳ (outer dia. = 125mm), press fit bearing (85).
 - ii) Fit seal ring, install piston (84).



- iii) Set belleville spring (83) and snap ring (82) in mounting position.
- iv) Using push tool ⑮ (inner dia. = 180mm), compress belleville spring with press, install snap ring (82).

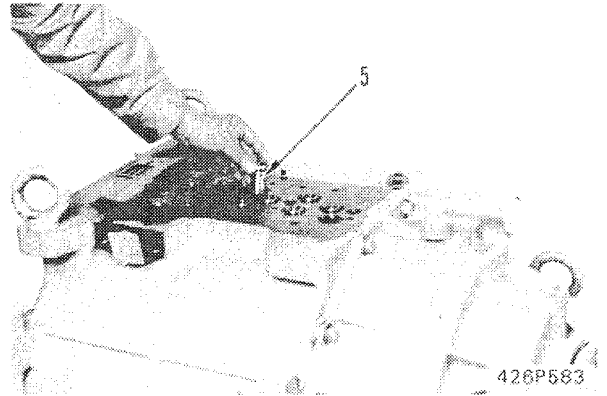


- v) Using push tool ⑳ (inner dia. = 125mm), press fit bearing (78).
- vi) Install hub (77).




36. Sleeve

Fit O-ring, install sleeve (5).

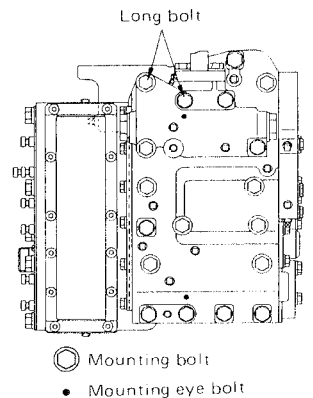
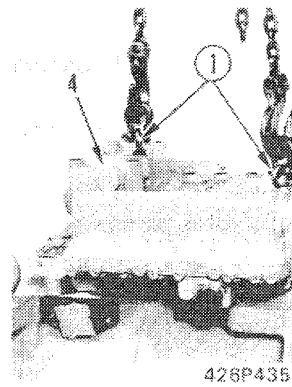


37. Control valve assembly

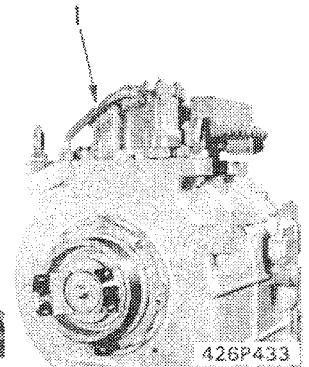
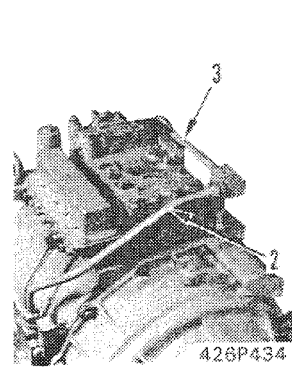
- 1) Fit O-ring, using eyebolts ① (thread dia. = 10mm, pitch = 1.5mm), install control valve assembly (4).
- 2) Install 11 mounting bolts.

 Mounting bolt: $5.0 \pm 0.5\text{kgm}$

★ Check bolt length, then install.



- 3) Install tubes (3), (2) and (1).



ASSEMBLY OF TRANSFER ASSEMBLY

Special tools required

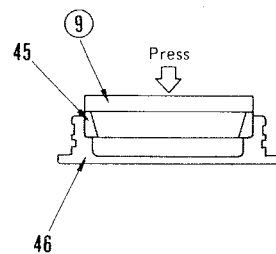
	Part number	Part name	Q'ty
A	799-301-1500	Leak tester	1
B	796-730-2140	Wrench	1

Preparatory work

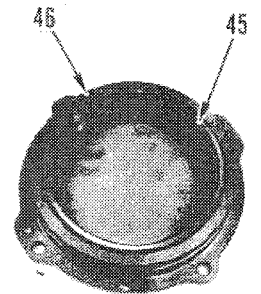
- Clean all parts, and check for dirt or damage before assembling.

1. Cage assembly

- 1) Using push tool ⑨ (outside diameter: 190mm), press fit outer race (45) in cage (46).



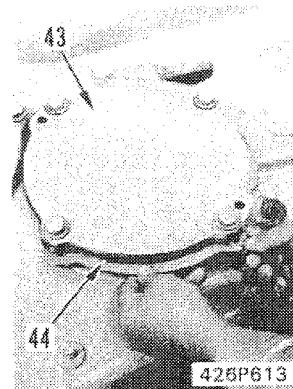
426F332



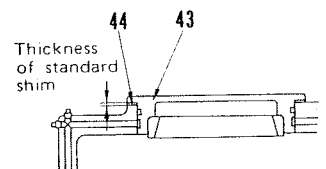
426P814

- 2) Fit O-ring and install cage assembly (43) and shim (44).

★ Standard shim thickness: 2mm



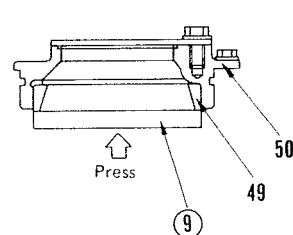
426P613



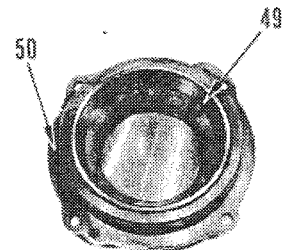
426F333

2. Cage assembly

- 1) Using push tool ⑨ (outside diameter: 190mm), press fit outer race (49) in cage (50).

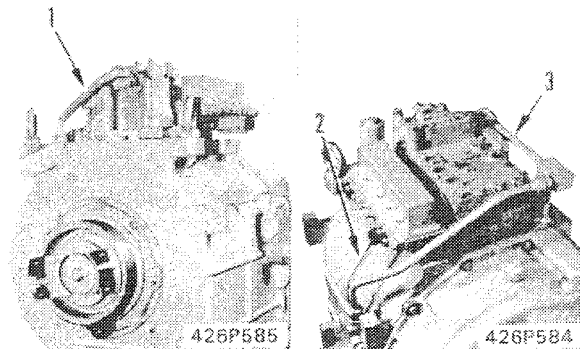


426F334

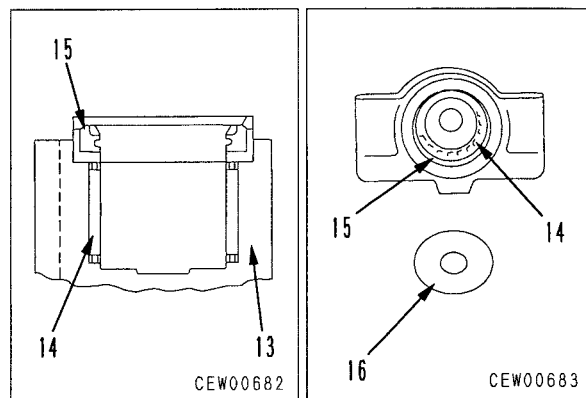


426P816

3) Install tubes (3), (2) and (1).



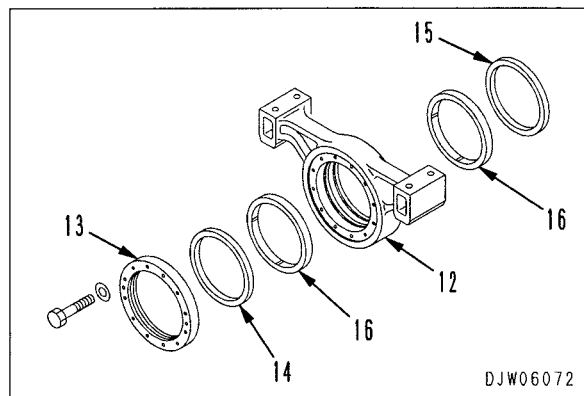
- 3) When replacing bearing (14), seal (15), and plastic washer (16) from bearing cap (13), replace whole cap assembly.



16. Remove the mounting bolt from front support (12), then remove retainer (13). ※ 5

17. Remove packings (14) and (15) from the front support.

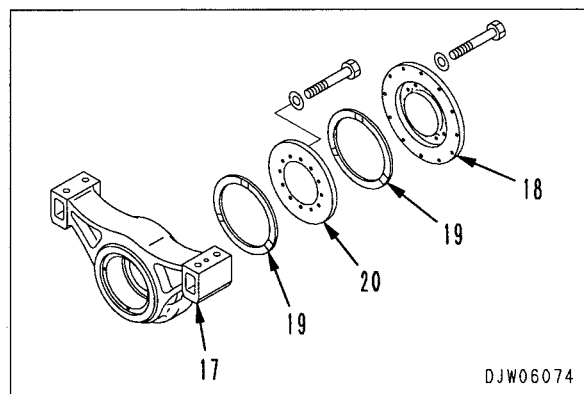
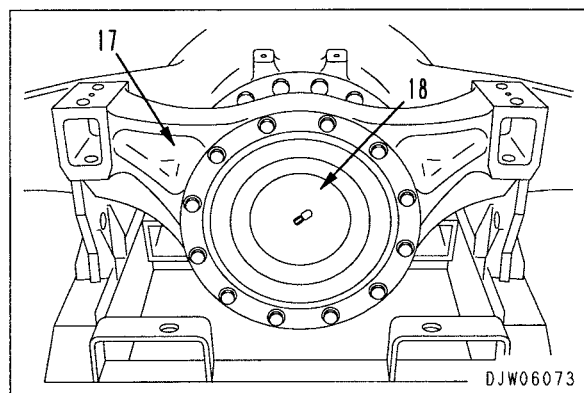
18. Remove 2 bushings (16) from the front support.
★ Remove all dirt and oil from the bushings and front support bushing fitting face. ※ 6



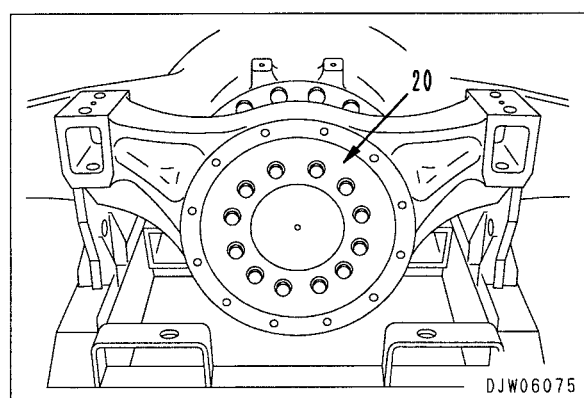
19. Remove thrust cover (18) and outer thrust washer (19) from rear support (17). ※ 7



Thrust cap: **38kg**



20. Remove thrust plate (20) from rear support (17), then remove inner thrust washer (19). ※ 8

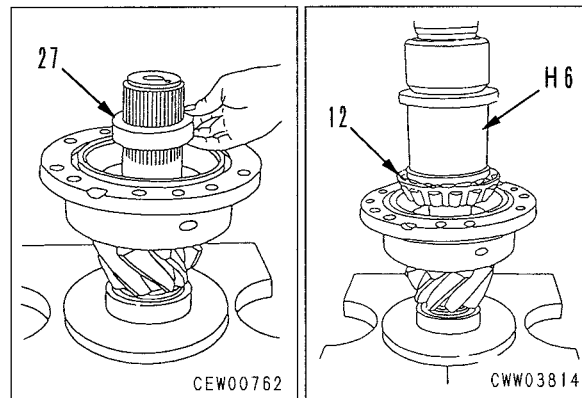


8. Collar

Install collar (27).

9. Bearing

Using press fit kit **H6** (Inner diameter: 76 mm), install bearing (12).

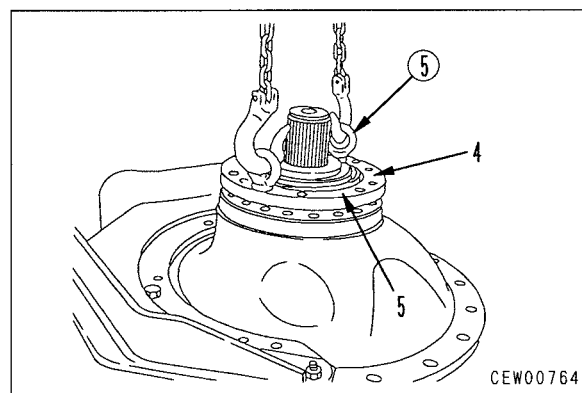


ASSEMBLY OF DIFFERENTIAL ASSEMBLY



★ Set differential case on special tool **H3**.

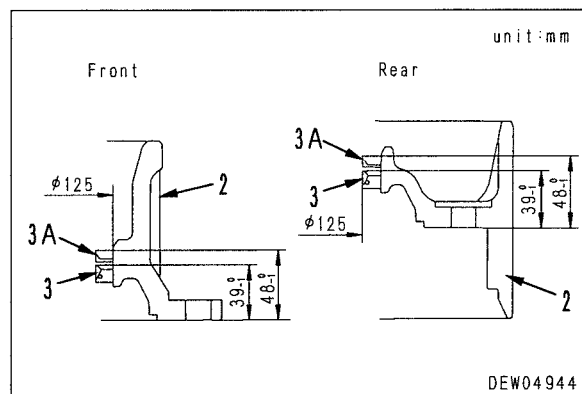
10. Pinion assembly

- 1) Assemble shims (5) removed when disassembled.
 - ★ Standard shims thickness : 2.1 mm.
- 2) Using eye-bolts ⑤ (Thread dia. = 12 mm, Pitch = 1.75 mm), install pinion assembly (4).





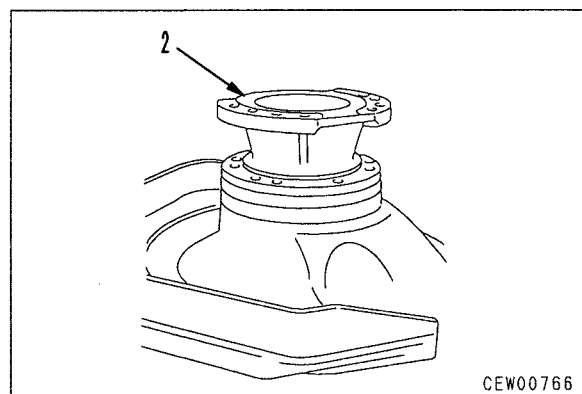
- 3) Install oil seal (3) and dust seal (3A) to case.

-  Lip of oil seal : **Grease (G2-LI)**
-  Lip of dust seal : **Grease (G2-LI)**



- 4) Fit O-ring to case, and install case (2).

-  **kgm** Mounting bolt : **279.3 ± 29.4 Nm {28.5 ± 3.0 kgm}**
-  Mounting bolt : **Tread tightener (LT-2)**

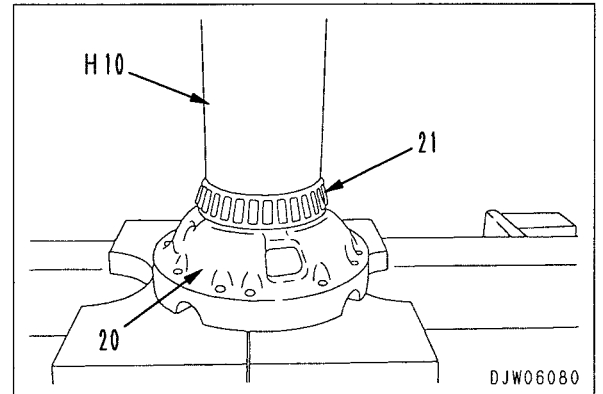


ASSEMBLY OF NON-SPIN DIFFERENTIAL GEAR

FINE ASSEMBLY OF DIFFERENTIAL GEAR CASE

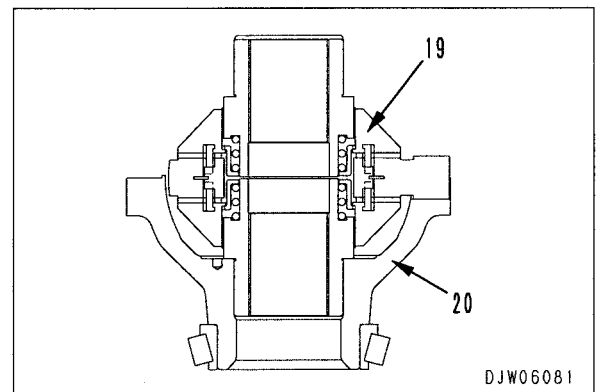
1. Bearing

Using press fit kit **H10** (Inner diameter: 120 mm), press fit bearing (21) to case (20).



2. Case

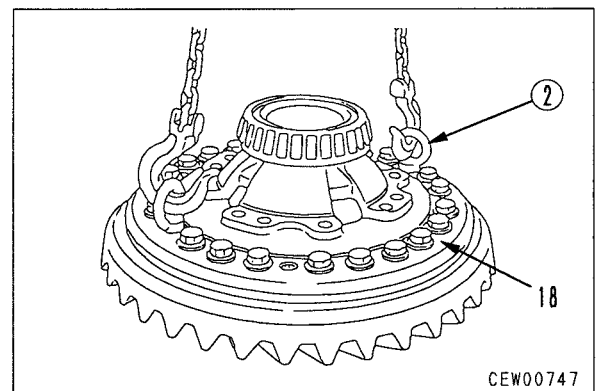
Install non-spin differential (19) to case (21).



3. Bevel gear (large)

Using eye-bolts ② (thread dia. = 16 mm, Pitch = 2.0 mm), lift and install bevel gear (18).


★ Align pin hole of thrust and dowel pin on case side and install.




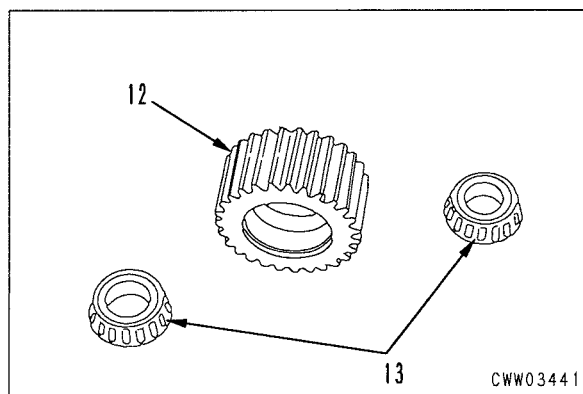
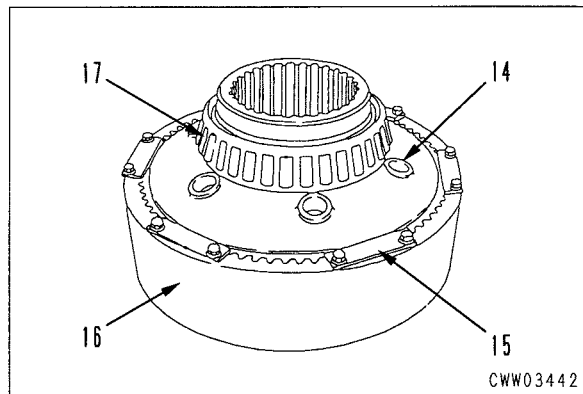
ASSEMBLY OF FINAL DRIVE

1. Assembly of ring gear

- 1) Press fit bearing (17) to ring gear hub (14).
 - ★ After press fitting the bearing, check that there is not any gap between bearing and hub.
- 2) Fit ring gear hub (14) to ring gear (16), then install lock plate (15).
 - ★ Install the lock plate with the wider side in.
 - ★ Degrease the screw holes sufficiently.

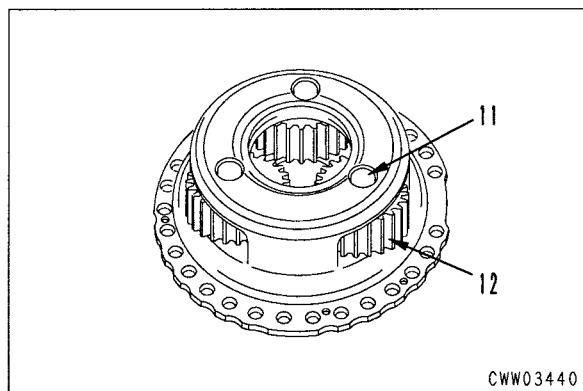
 Mounting bolt: **Adhesive (LT-2)**

 Mounting bolt:
27.0 – 34.0Nm {2.8 – 3.5kgm}




2. Assembly of planetary carrier

- 1) Install bearings (13) to pinion gear (12), then set them to the carrier case.
- 2) Matching the hole of the pinion to that of the carrier case, press fit shaft (11).
 - ★ Press fit the shaft with the lock ball hole outward. Stop before the hole, then adjust the holes to each other.

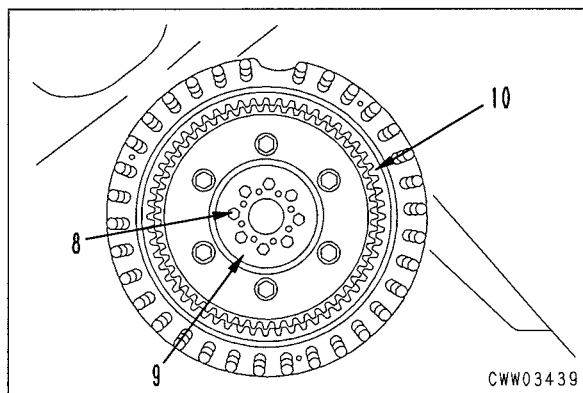


3. Adjustment procedure of wheel bearing

- 1) Insert ring gear (10) in the axle housing, then secure retainer (9) with mounting bolts (8) without inserting any shim.

 Mounting bolt:
57.9 – 67.7Nm {5.9 – 6.9kgm}

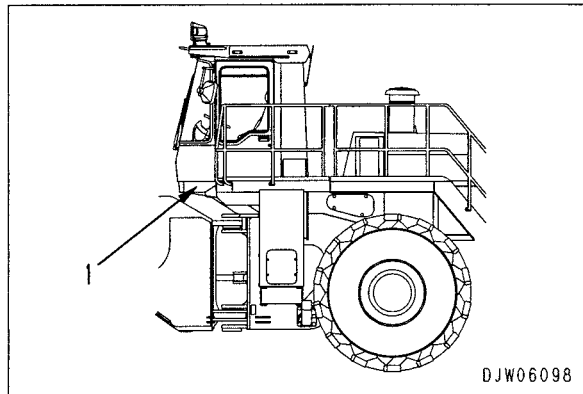
- ★ Turn the hub by 5 – 6 turns and tighten the bolts alternately and evenly.



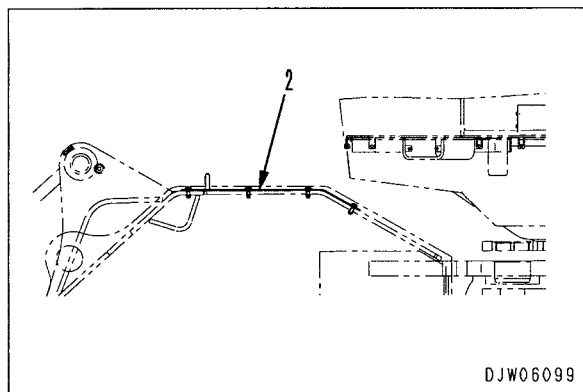
REMOVAL OF STEERING VALVE

- ⚠ Stop the machine on level ground and lower the work equipment completely to the ground, then put blocks under the steel wheels to prevent the machine from moving.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Remove the mounting bolt, then remove cover (1).



2. Remove inspection cover (2).

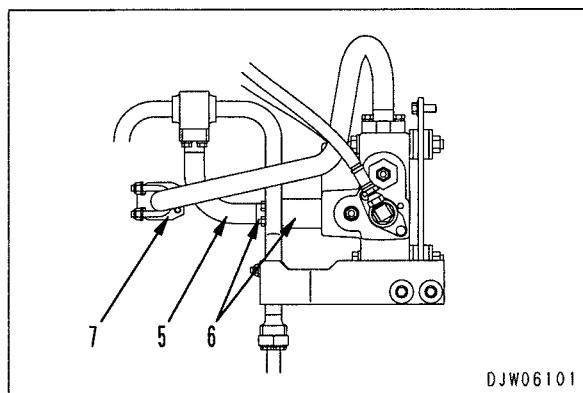
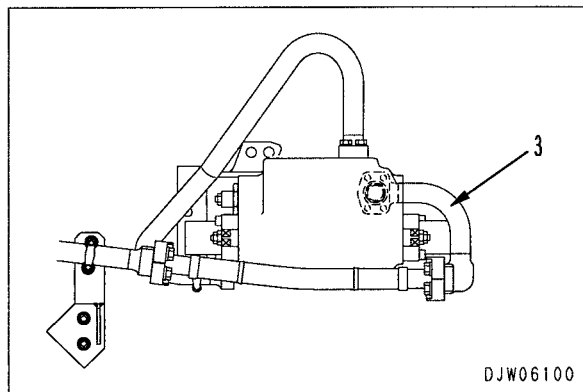


3. Remove tube (3) between main pump and steering valve.

4. Disconnect the hose between the left hand steering cylinder head and the right hand steering cylinder head, then remove tube (5).

- ★ Be careful not to drop the check valve and orifice (6).
- ★ Before removing the tubes, disconnect the parts fixed with bracket and U-bolt.

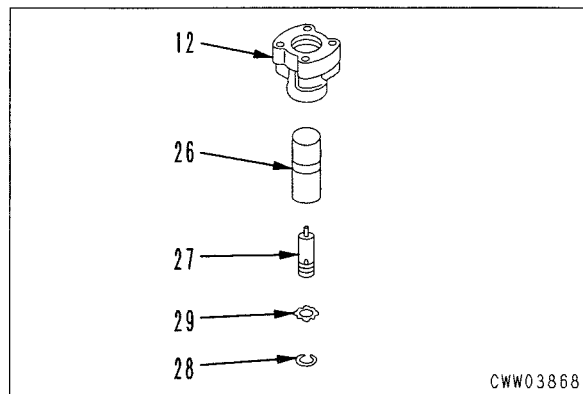
5. Remove the U-bolt, then remove brackets (7).




ASSEMBLY OF BRAKE VALVE (L.H.)

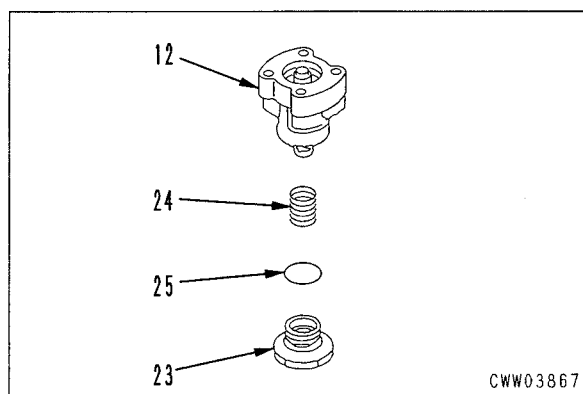
B. Single brake valve (Left)

1. Install retainer (29) to spool (26), then secure it with snap ring (28).
2. Insert piston (27) in spool (26).
 - ★ Apply engine oil.
3. Insert spool (26) in cylinder (12).

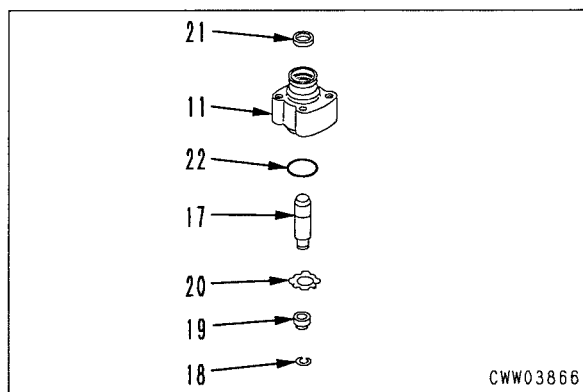


4. Install O-ring (25) to nut end (23).
5. Install spring (24) to nut end (23), then install them to cylinder (12).


 Nut end: $152.0 \pm 24.5\text{Nm}$ { $15.5 \pm 2.5\text{kgm}$ }

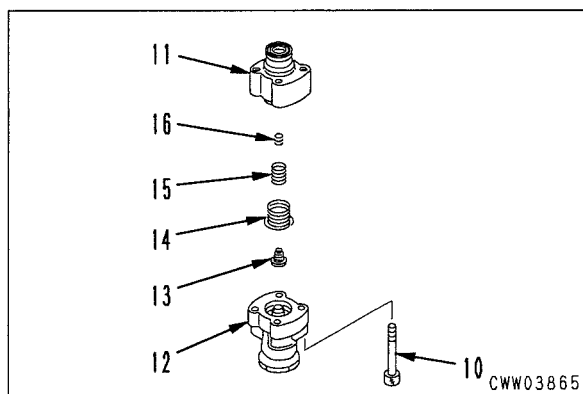


6. Install dust seal (21) and O-ring (22) to flange (11).
7. Install retainers (20) and (19) to rod (17), then install snap ring (18).
8. Insert rod (17) in flange (11).



9. Install holder (13) to cylinder (12), then set springs (16), (15) and (14).
10. Install flange (12) to flange (11), then secure them with mounting bolt (10).

 Mounting bolt:
 $66.2 \pm 7.3\text{Nm}$ { $6.75 \pm 0.75\text{kgm}$ }

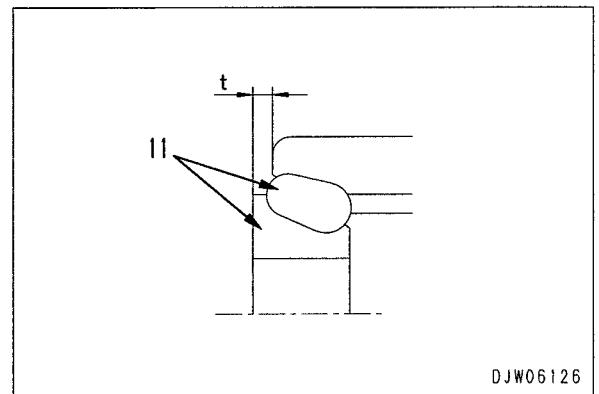
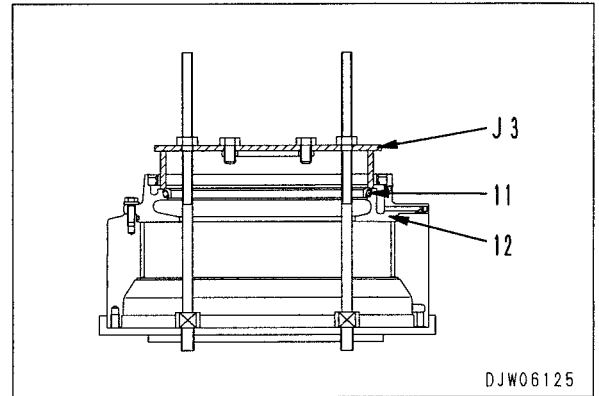


- 2) Using tool **J3**, install floating seal (11) to retainer (12).

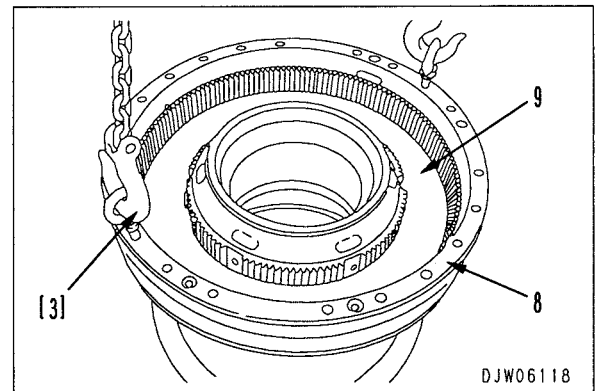
 Seal contact surface :

Engine oil (EO30-CD)

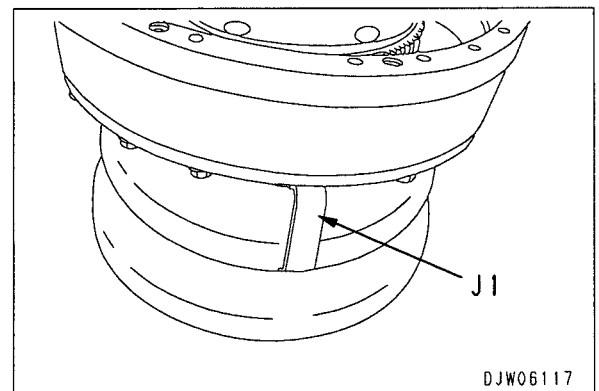
- ★ Assemble O-ring to floating seal (11).
- ★ Use alcohol to completely remove all the white blooming from the surface of the O-ring.
- ★ Remove all oil and grease from the floating seal and retainer O-ring contact surface.
- ★ Tighten tool **J3** uniformly to prevent twisting of the floating seal O-ring. After press fitting, measure height **t** at 4 places around the circumference and check that the difference in dimension **t** at all four places is within 1 mm.



3. Assemble plate (9), then using eyebolt [3] (Thread dia.=12mm, Pitch=1.75mm), raise gear (8) and install.

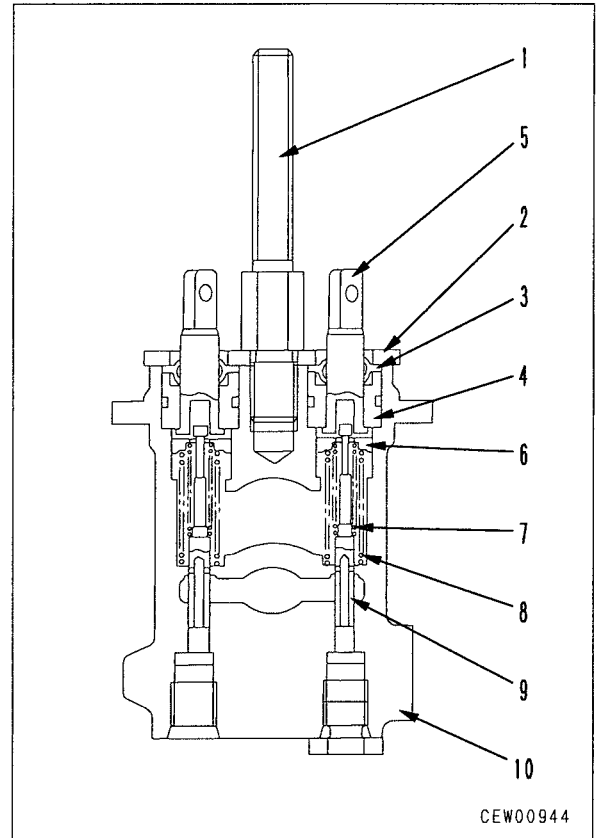


4. Install 3 tools **J1**.




DISASSEMBLY OF PPC VALVE

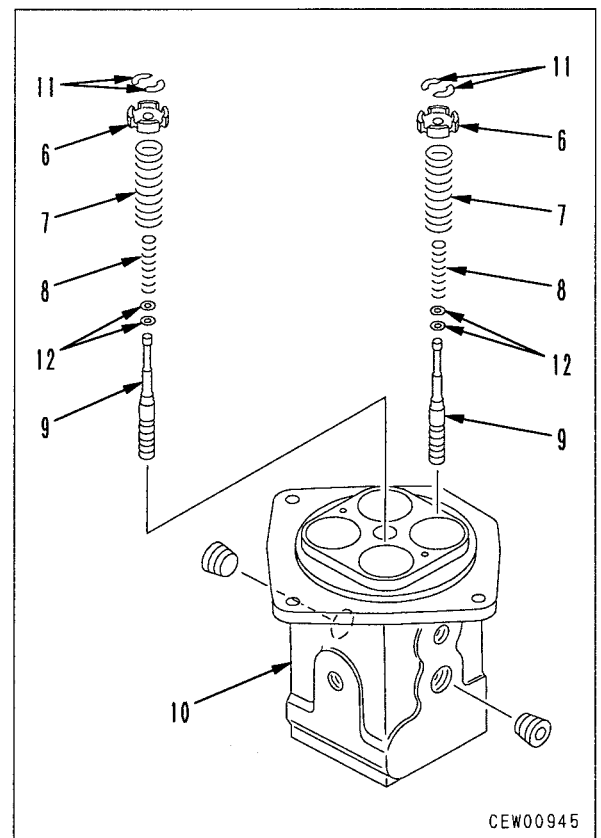
1. Remove bolt (1).
2. Remove plate (2).
3. Remove seal (3), then remove collar (4).
4. Remove valve assembly and center spring (7) from valve body (10).
5. Remove collar (11), then remove retainer (6), shim (12), and spring (8) from valve (9).



ASSEMBLY OF PPC VALVE

1. Push shim (12), spring (8), and retainer (6) into valve (9), and install collar (11).
2. Install center spring (7) and valve assembly to valve body (10).
3. Install spool (5).
4. Fit O-ring and install collar (4).
5. Install seal (3).
6. Fit plate (2) and install bolt (1).

 Bolt : $44.1 \pm 4.9 \text{ Nm}$ ($4.5 \pm 0.5 \text{ kgm}$)



INSTALLATION OF CENTER HINGE PIN

- Carry out installation in the reverse order to removal.

※ 1

- ★ Adjust the shims so that the clearance is in the specified range.
Clearance $a + b$ = Less than 0.5 mm

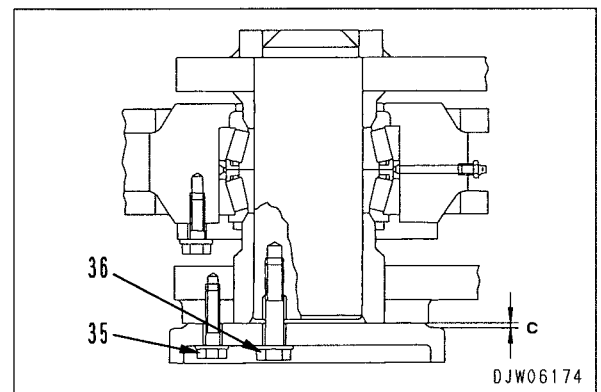
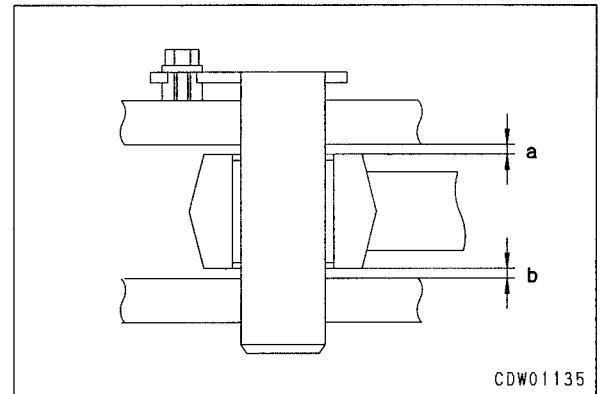
※ 2

- ⚙️ **kgm** Drive shaft mounting bolt :
157 – 196 Nm {16 – 20 kgm}

※ 3

- 🔧 Outer circumference of hinge pin :
Grease (G2-LI)
- ★ Measure clearance c between the retainer and frame at 4 places on the inside circumference, and select a shim thickness to make the value 0.08 – 0.18 mm less than the measured value.
- ★ When adjusting the shim, temporarily tighten the retainer mounting bolts to act as a stopper.
- ★ When tightening the mounting bolts, tighten the retainer mounting bolts first to the specified torque, then tighten the pin mounting bolts.
- ★ After selecting the shim, assemble the retainer to the specified torque.
- ★ Remove all oil and grease from the mounting bolts and mount holes.

- 🔧 Mounting bolt :
Thread tightener (Loctite 262)
- ⚙️ **kgm** Mounting bolt (35) when adjusting shims :
245 – 309 Nm {25.0 – 31.5 kgm}
- ⚙️ **kgm** Mounting bolt (36) :
490 – 608 Nm {50 – 62 kgm}




REMOVAL OF FUEL TANK

! Stop the machine on level ground and lower the work equipment completely to the ground, then put blocks under the steel wheels to prevent the machine from moving.

! Disconnect the cable from the negative (-) terminal of the battery.

1. Drain fuel through drain valve (1).
★ Before draining the fuel, check the remaining quantity.

 Fuel (When full): 890 ℓ

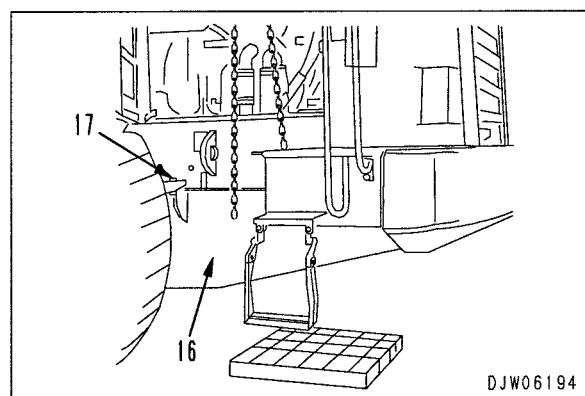
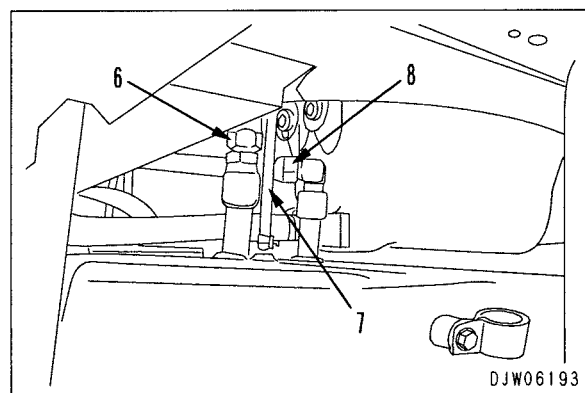
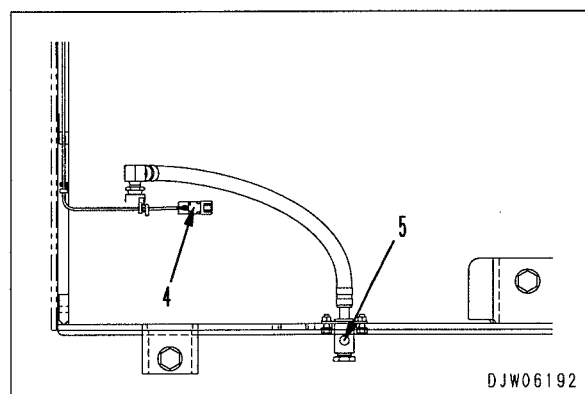
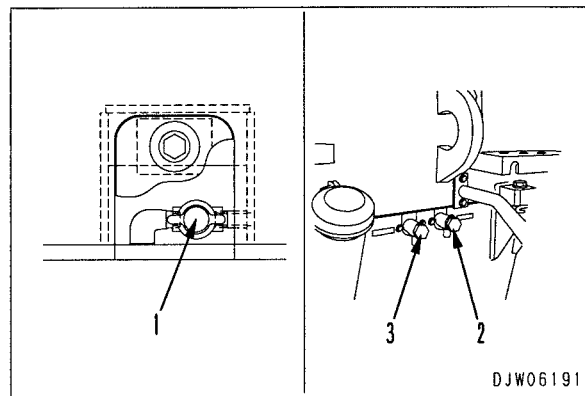
2. Disconnect engine oil drain valve (2).
3. Disconnect radiator drain valve (3).
★ Disconnect the clamp on the top of the fuel tank.
4. Disconnect fuel level sensor connector (4) (R05).
5. Disconnect torque converter oil cooler coolant drain valve (5) from the fuel tank.

6. Disconnect fuel return hose (6).
7. Disconnect spill hose (7).
8. Disconnect hose (8) of the fuel strainer.

9. Sling fuel tank (16) temporarily, then remove mounting bolt (17). ※ 1

★ Place a pallet under the fuel tank, then lower the tank slowly, balancing it.

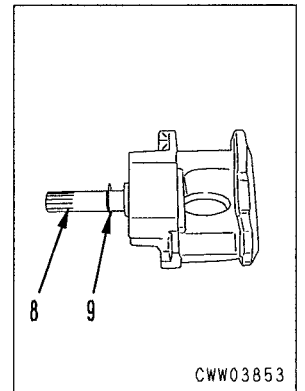
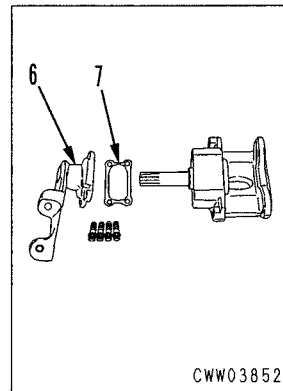
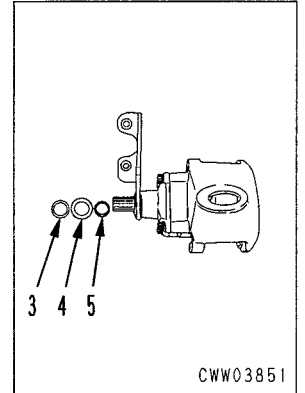
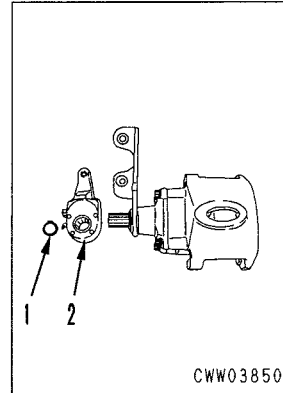
 Fuel tank: 650kg



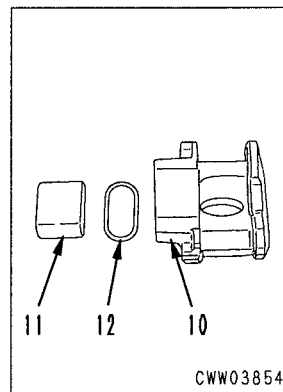
DISASSEMBLY OF PARKING BRAKE CALIPERS

Remove the parking brake calipers. For details, see REMOVAL OF PARKING BRAKE.

1. Remove snap ring (1), then pull out slack adjuster (2).
2. Remove washers (3) and (4), and seal (5).
3. Remove bolts, then remove cap (6) and gasket (7).
4. Remove piston shaft (8) and thrust bearing (9).



5. Remove piston (11) and piston seal (12) from calipers (10).



40 MAINTENANCE STANDARD

Engine mount	40- 2
Transmission mount	40- 3
Torque converter	40- 4
Torque converter regulator valve	40- 5
Transmission	40- 6
Transmission solenoid valve	40- 9
Transmission control valve	40-10
Transfer	40-14
Drive shaft	40-16
Center support	40-17
Differential	40-18
Final drive	40-24
Axle mount	40-27
Center hinge pin	40-28
Steering column	40-30
Steering valve	40-31
Steering cylinder mount	40-32
Brake valve	40-33
Slack adjuster	40-36
Brake	40-37
Parking brake	40-38
PPC Valve	40-39
Work equipment valve	40-40
Hydraulic cylinder	40-42
Work equipment linkage	40-44
Rops canopy	40-46

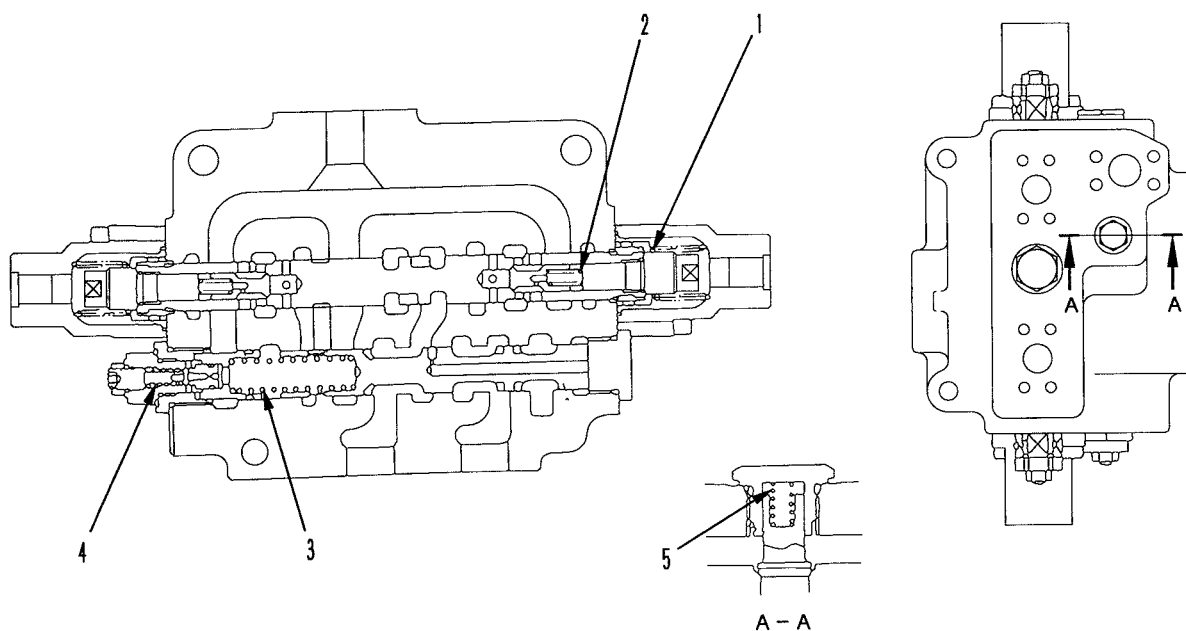
Unit: mm

No.	Check item	Criteria				Remedy	
		Standard size	Tolerance		Standard clearance		Clearance limit
	Shaft		Hole				
1	Clearance between reducing valve spool and body	25	-0.035 -0.045	+0.013 0	0.035 - 0.058	0.08	Replace
2	Clearance between torque converter relief valve spool and body	25	-0.035 -0.045	+0.013 0	0.035 - 0.058	0.08	
3	Clearance between priority valve spool and body	25	-0.035 -0.045	+0.013 0	0.035 - 0.058	0.08	
4	Clearance between quick return valve spool and body	12	-0.035 -0.045	+0.011 0	0.035 - 0.056	0.08	
5	Clearance between modulating valve spool and body	25	-0.035 -0.045	+0.013 0	0.035 - 0.058	0.08	
6	Clearance between main relief valve spool and body	28	-0.035 -0.045	+0.013 0	0.035 - 0.058	0.08	
7	Priority valve spring	Standard size			Repair limit		
		Free length	Installation length	Installation load	Free length	Installation load	
		62	37.7	217 N {22.1 kg}	60.1	206 N {21 kg}	
8	Torque converter relief valve spring	62	48	126 N {12.8 kg}	60.1	120 N {12.2 kg}	
9	Modulating valve spring (Inner)	118	110	91.6 N {9.34kg}	114.5	87.3 N {8.9 kg}	
10	Modulating valve spring (Outer)	145.7	144	16.6 N {1.69 kg}	141.3	15.8 N {1.61 kg}	
11	Reducing valve spring	70	57	293 N {29.9 kg}	67.9	279 N {28.4 kg}	
12	Main relief valve spring (Inner)	108	77.6	375 N {38.2 kg}	104.8	356 N {36.3 kg}	
13	Main relief valve spring (Outer)	128	77.6	485 N {49.5 kg}	124.1	461 N {47 kg}	
14	Thickness of shim for reducing valve	3.5 mm (pressure per 1 piece: 63.7 kPa {0.65 kg/cm ² })					Adjust
15	Thickness of shim for modulation valve	3.0 mm (pressure per 1 piece: 32.4 kPa {0.33 kg/cm ² })					
16	Thickness of shim for priority valve	2.0 mm (pressure per 1 pieces: 25.5 kPa {0.26 kg/cm ² })					
17	Thickness of shim for torque converter valve	2.0 mm (pressure per 1 piece: 25.5 kPa {0.26 kg/cm ² })					
18	Thickness of shim main relief valve	3.5 mm (pressure per 1 piece: 38.2 kPa {0.39 kg/cm ² })					
19	Tightening torque of modulation lock nut	34.3 - 49.0 Nm {3.5 - 5.0 kgm}					Retighten
20	Clearance between torque converter cold relief valve spool and body (Only cold area)	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		28	-0.035 -0.045	+0.021 0	0.035 - 0.066	0.08	
21	Torque converter cold relief valve spring (Only cold area)	Standard size			Repair limit		
		Free length	Installation length	Installation load	Free length	Installation load	
		92.8	64	201 N {20.5 kg}	90	191 N {19.5 kg}	

Unit: mm

No.	Check item	Criteria			Remedy
		Standard size	Tolerance	Repair limit	
1	Thickness of side gear washer	4.0	-	3.5	Replace
2	Wear of oil seal surface	110	0 -0.087	-	
3	Thickness of pinion gear washer	1.5	-	1.3	
4	Tightening torque of mounting bolt	1st step: 3.9±1.0 Nm {0.4±0.1 kgm} (when measuring clearance (no shim)) 2nd step: 113±10 Nm {11.5±1.0 kgm} (shim installed)			

STEERING VALVE



SVW03278

Unit: mm

No.	Check item	Criteria				Remedy
		Standard size		Repair limit		
		Free length	Installed length	Installed load	Free length	Load limit
1	Steering spool return spring	41.8	38	74.5 N {7.6 kg}	-	58.8 N {6 kg}
2	Load check valve spring	20.9	13.2	8.8 N {0.9 kg}	-	7.0 N {0.71 kg}
3	Demand spool return spring	90.8	83	409.9 N {41.8 kg}	-	327.5 N {33.4 kg}
4	Relief valve spring	24.0	22.19	182.4 N {18.6 kg}	-	145.1 N {14.8 kg}
5	Check valve return spring	20.9	13.2	8.8 N {0.9 kg}	-	7.0 N {0.71 kg}

Replace

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free length X O.D.	Installed length	Installed load	Free length	Load limit	
1	Spool return spring (For tilt)	54.8 × 34	53.5	125 N {12.7 kg}	-	-	Replace
2	Spool return spring (For tilt, lift)	54.8 × 33.7	52.2	235.5 N {24 kg}	-	-	
3	Spool return spring (For tilt, lift)	30.7 × 32.5	26.8	235.5 N {24 kg}	-	-	
4	Spool return spring (For lift)	55.3 × 16.9	40	233 N {23.8 kg}	-	-	
5	Spool return spring (For lift)	86.8 × 34.7	83.5	208 N {21.2 kg}	-	-	
6	Main valve spring of main relief valve	39.5 × 11.2	23.2	33 N {3.4 kg}	-	-	
7	Check valve spring	32.6 × 10.9	24.5	44 N {4.5 kg}	-	-	
8	Suction valve spring	27.9 × 13	19	7 N {0.7 kg}	-	-	
9	Poppet spring of relief valve	49.3 × 12.8	41.9	259 N {26.4 kg}	47.8	208 N {21.2 kg}	

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