

## SECTION 6 WORK EQUIPMENT

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# SECTION 6 WORK EQUIPMENT

## GROUP 1 STRUCTURE AND FUNCTION

### 1. HYDRAULIC SYSTEM OUTLINE

The loader hydraulic system is a pilot operated, open center system which is supplied with flow from the fixed displacement main hydraulic pump.

The pilot control system is a low pressure, closed center hydraulic system which is supplied with flow from the first(Steering) pump.

The loader system components are :

- Main pump
- Main control valve
- Bucket cylinder
- Boom cylinders
- Pilot supply unit
- Remote control valve(Pilot control valve)
- Safety valve

The pilot supply unit consists of the pressure reducing valve, relief valve and accumulator.

Flow from the main hydraulic pump not used by the steering system leaves the steering valve(EHPS) EF port.

It flows to the inlet port plate of a mono block type main control valve.

The main control valve is a tandem version spool type, open center valve which routes flow to the boom, bucket or auxiliary cylinders(Not shown) when the respective spools are shifted.

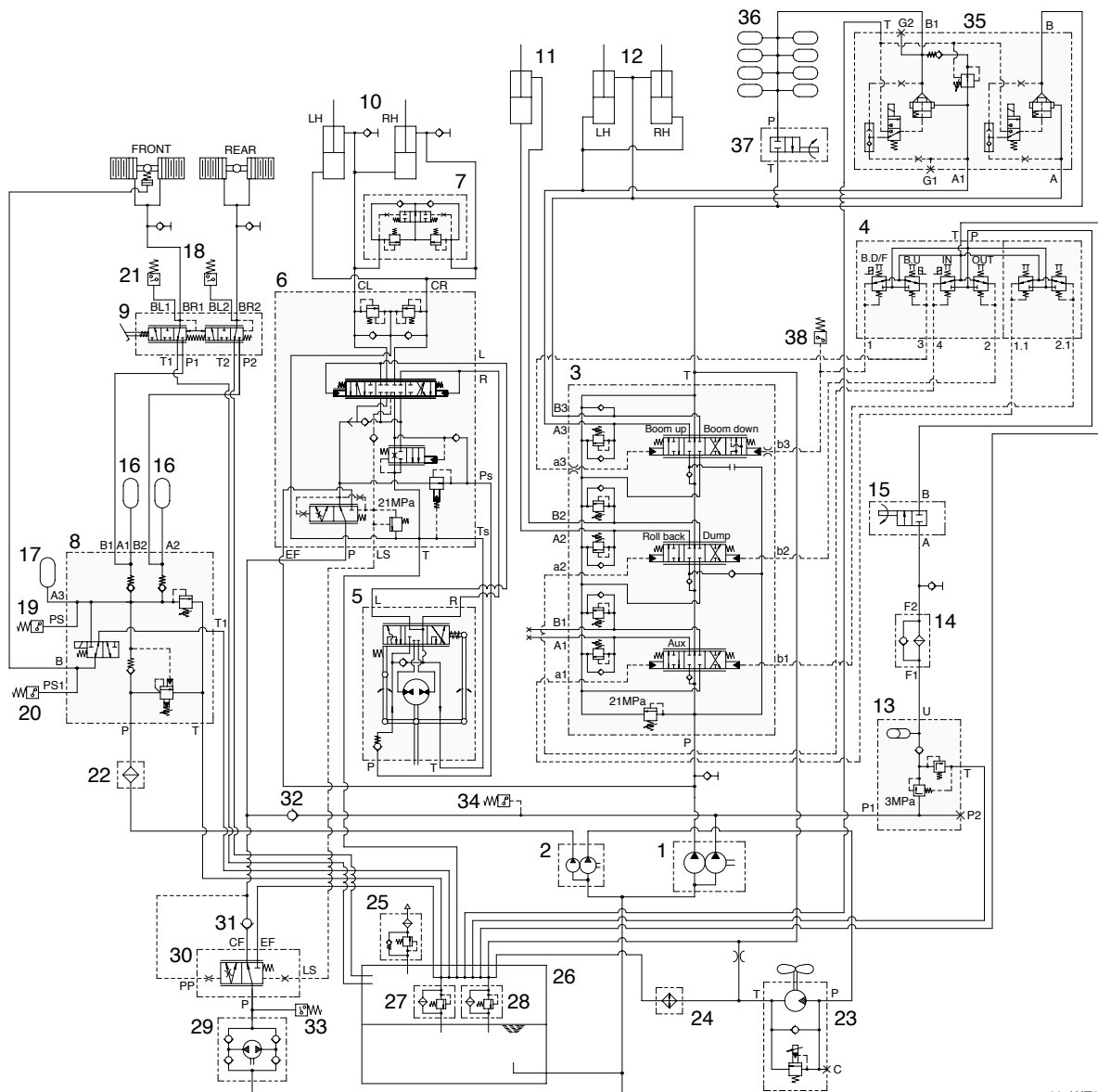
Flow from the steering pump is routed to the pilot supply unit where the steering pump outlet pressure is reduced to pilot circuit pressure. The pilot supply unit flow to the remote control valve.

The remote control valve routed flow to either end of each spool valve section in the main control valve to control spool stroke.

A accumulator mounted on pilot supply unit supplies a secondary pressure source to operated remote control valve so the boom can be lowered if the engine is off.

The return circuit for the main hydraulic system have return filter inside the hydraulic tank. The return filter uses a filter element and a bypass valve. The bypass valve is located in the upside of filter.

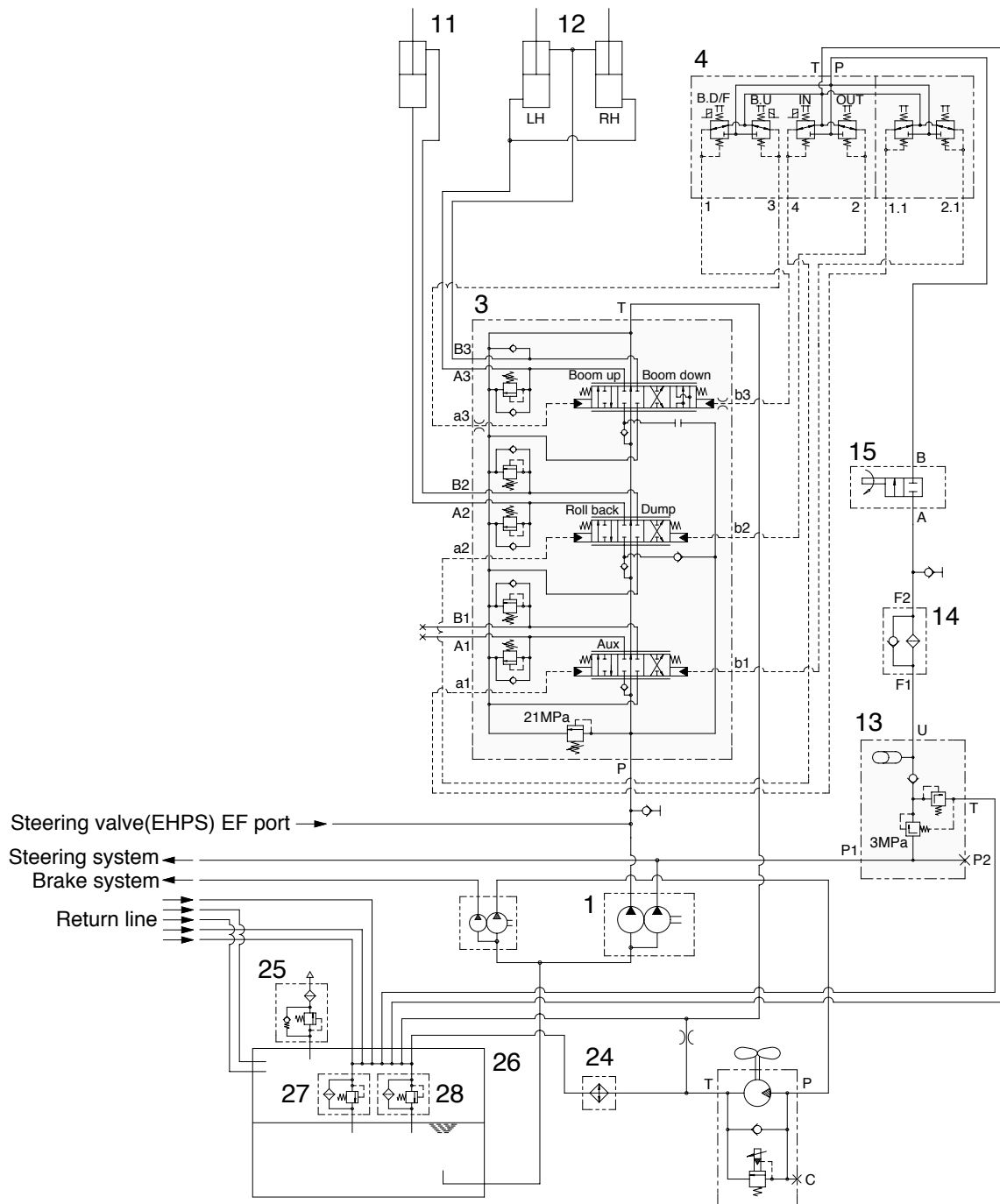
## 2. HYDRAULIC CIRCUIT



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- |    |                      |    |                 |    |                              |
|----|----------------------|----|-----------------|----|------------------------------|
| 1  | Main pump            | 14 | Line filter     | 27 | Return filter                |
| 2  | Brake & fan pump     | 15 | Safety valve    | 28 | Bypass valve                 |
| 3  | Main control valve   | 16 | Accumulator     | 29 | Emergency pump kit(Optional) |
| 4  | Remote control valve | 17 | Accumulator     | 30 | Priority valve(Optional)     |
| 5  | Steering unit        | 18 | Pressure switch | 31 | Check valve(Optional)        |
| 6  | Steering valve(EHPS) | 19 | Pressure switch | 32 | Check valve(Optional)        |
| 7  | Cushion valve        | 20 | Pressure switch | 33 | Pressure switch(Optional)    |
| 8  | Cut off valve        | 21 | Pressure switch | 34 | Pressure switch(Optional)    |
| 9  | Brake valve          | 22 | Line filter     | 35 | Ride control valve(Optional) |
| 10 | Steering cylinder    | 23 | Fan motor       | 36 | Accumulator(Optional)        |
| 11 | Bucket cylinder      | 24 | Oil cooler      | 37 | Safety valve(Optional)       |
| 12 | Boom cylinder        | 25 | Air breather    | 38 | Pressure switch(Optional)    |
| 13 | Pilot supply unit    | 26 | Hydraulic tank  |    |                              |

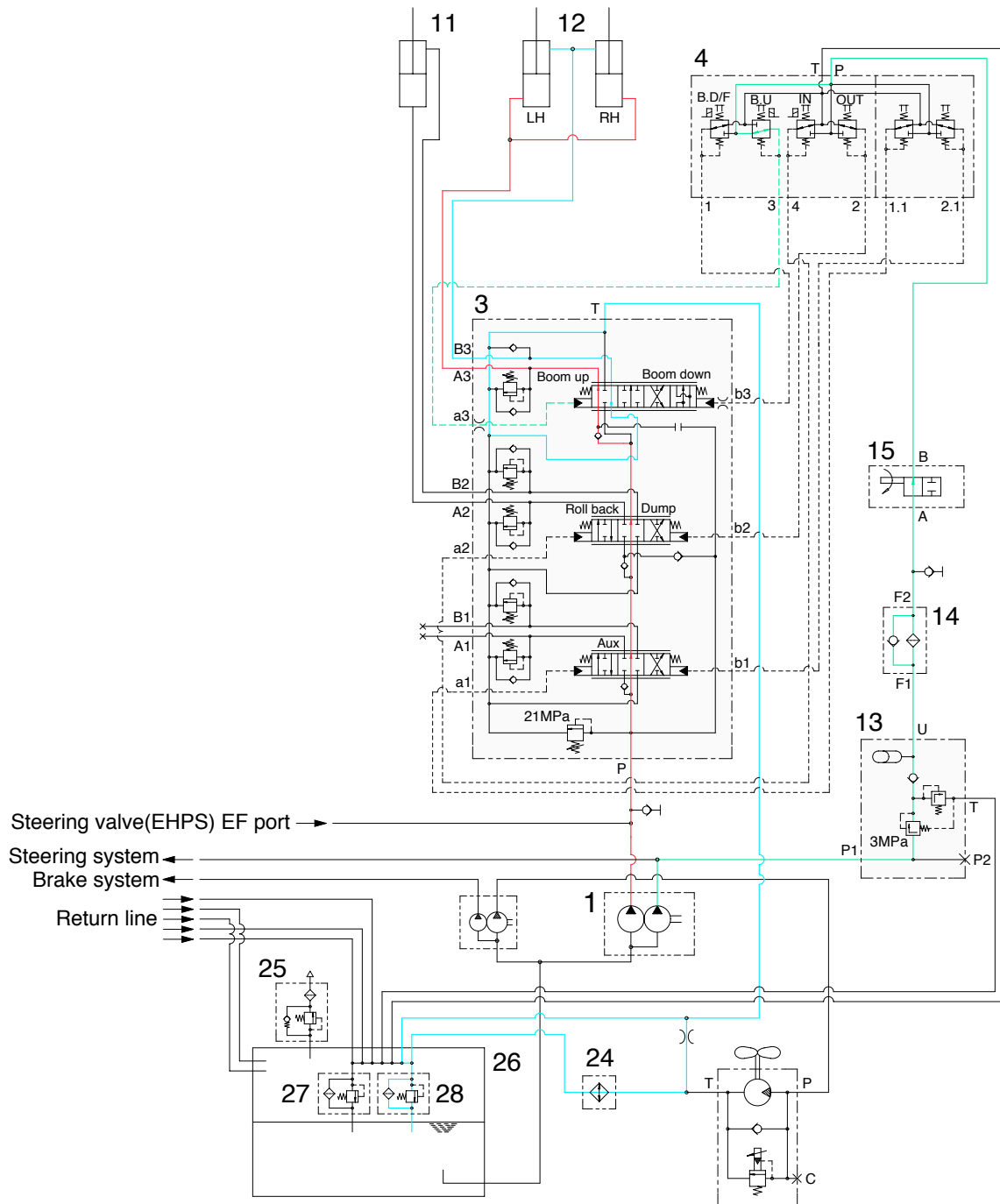
### 3. WORK EQUIPMENT HYDRAULIC CIRCUIT



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- |    |                      |    |                   |    |                |
|----|----------------------|----|-------------------|----|----------------|
| 1  | Main pump            | 13 | Pilot supply unit | 25 | Air breather   |
| 3  | Main control valve   | 14 | Line filter       | 26 | Hydraulic tank |
| 4  | Remote control valve | 15 | Safety valve      | 27 | Return filter  |
| 11 | Bucket cylinder      | 24 | Oil cooler        | 28 | Bypass valve   |
| 12 | Boom cylinder        |    |                   |    |                |

# 1) WHEN THE RCV LEVER IS IN THE RAISE POSITION

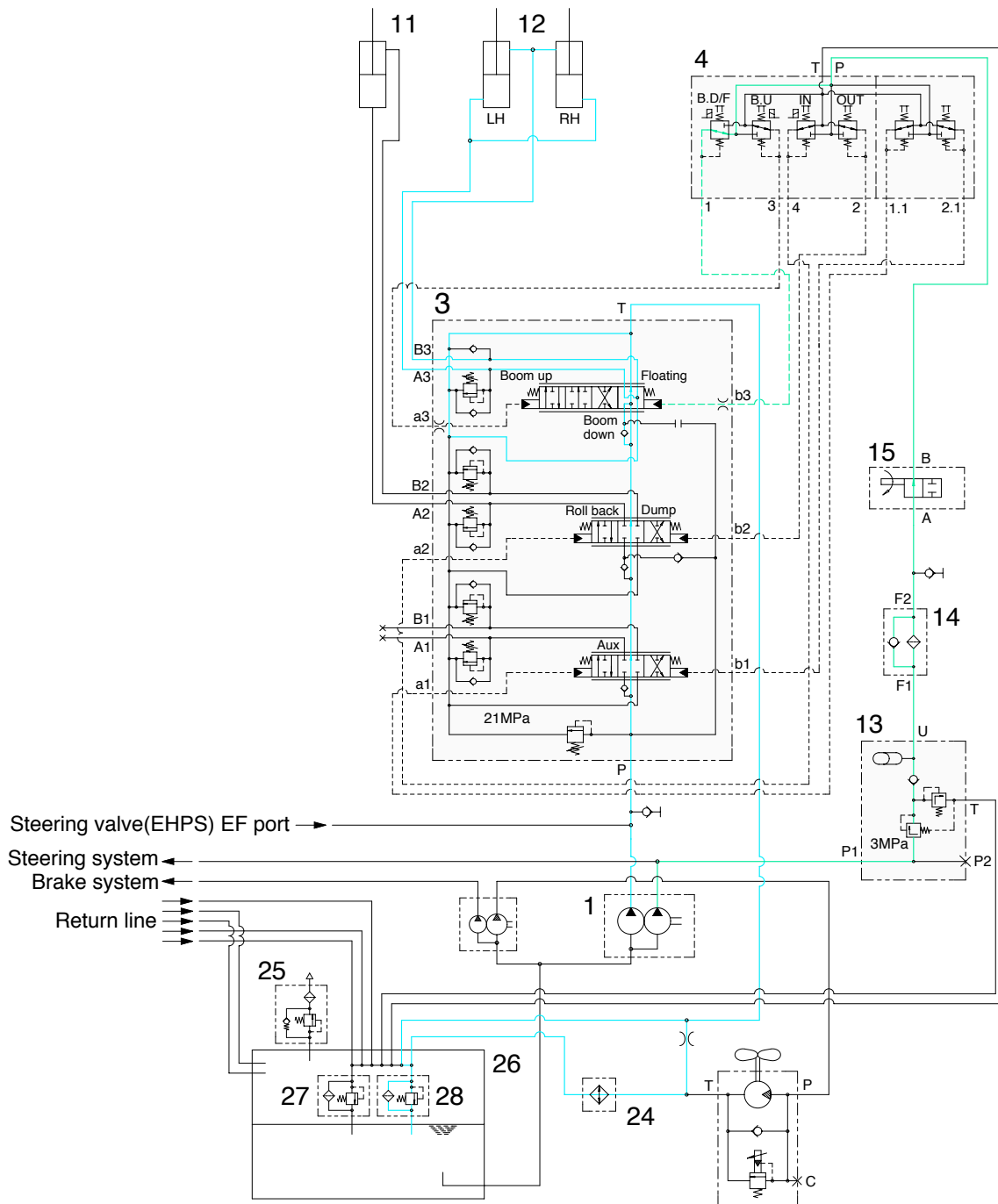


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- When the RCV lever(4) is pulled back, the boom spool on the second block is moved to raise position by pilot oil pressure from port 3 of RCV.
- The oil from main pump(1) flows into main control valve(3) and then goes to the large chamber of boom cylinder (12) by pushing the load check valve of the boom spool through center bypass circuit of the bucket spool.
- The oil from the small chamber of boom cylinder(12) returns to hydraulic oil tank(26) through the boom spool at the same time.
- When this happens, the boom goes up.



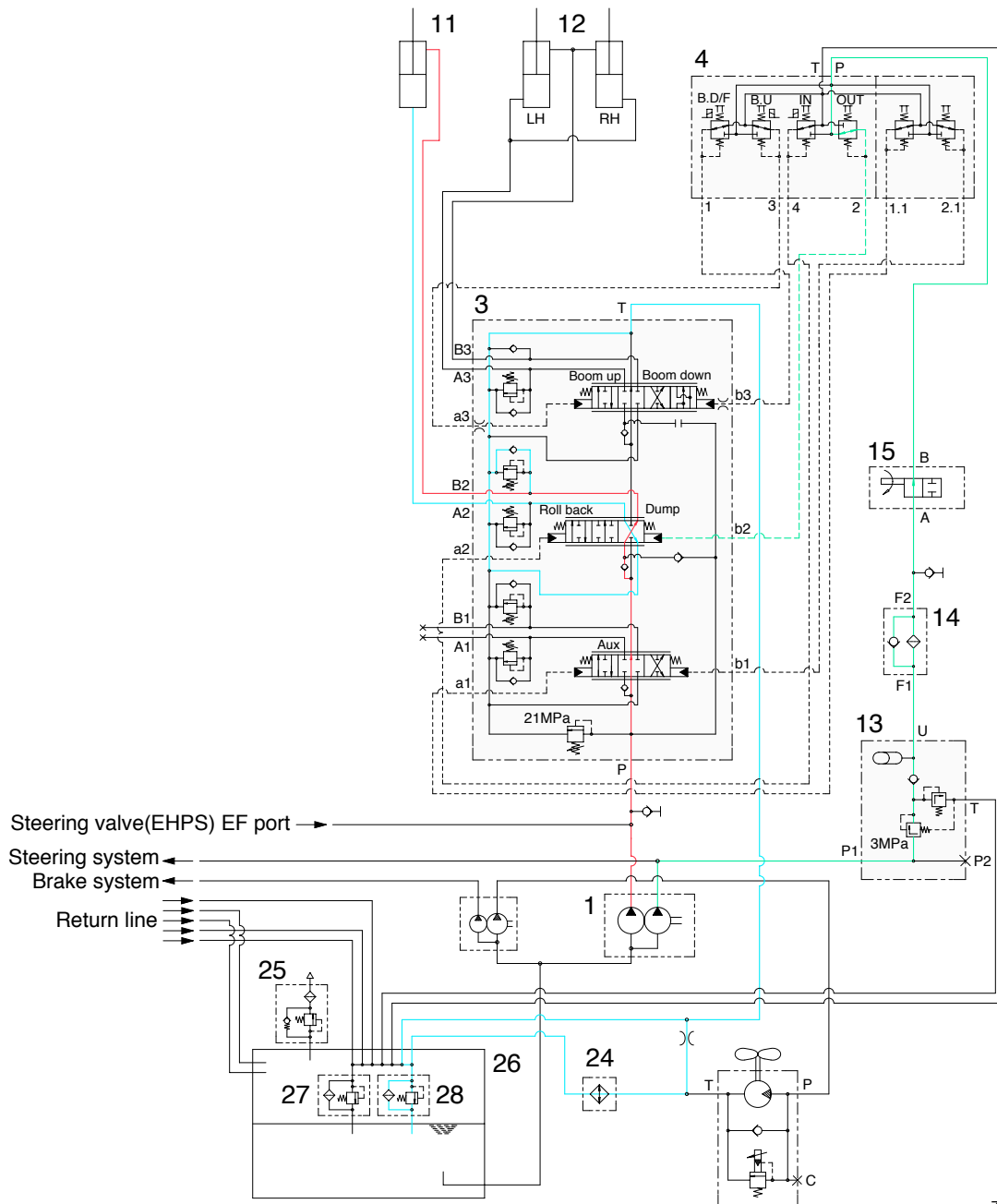
### 3) WHEN THE RCV LEVER IS IN THE FLOAT POSITION



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- When the RCV lever(4) is pushed further forward from the lower position, the pitot pressure reaches to 13~15bar, then the boom spool is moved to floating position.
- The work ports(A3), (B3) and the small chamber and the large chamber are connected to the return passage, so the boom will be lowered due to it's own weight.
- In this condition, when the bucket is in contact with the ground, it can be move up and down in accordance with the shape of the ground.

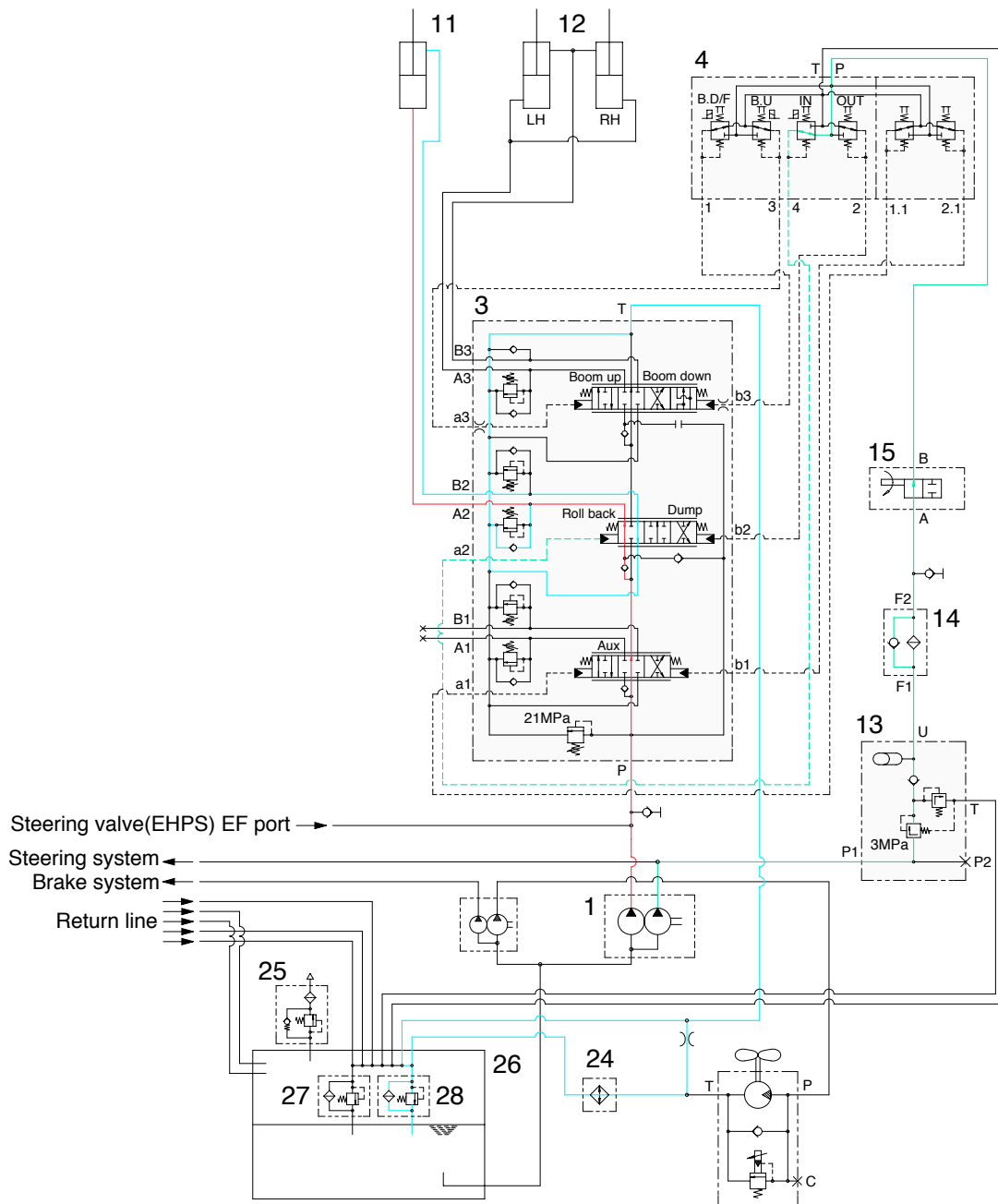
#### 4) WHEN THE RCV LEVER IS IN THE DUMP POSITION



7607WE06

- If the RCV lever(4) is pushed right, the bucket spool on the first block is moved to dump position by pilot oil pressure from port 2 of RCV.
- The oil from main pump(1) flows into main control valve(3) and then goes to the small chamber of bucket cylinder(11) by pushing the load check valve of the bucket spool.
- The oil at the large chamber of bucket cylinder(11) returns to hydraulic tank(26) through the bucket spool.
- When this happens, the bucket is dumped.
- When the dumping speed of bucket is faster, the oil returned from the large chamber of bucket cylinder combines with the oil from the pump, and flows into the small chamber of the cylinder. This prevents cylinder cavitation by the negative pressure when the pump flow cannot match the bucket dump speed.

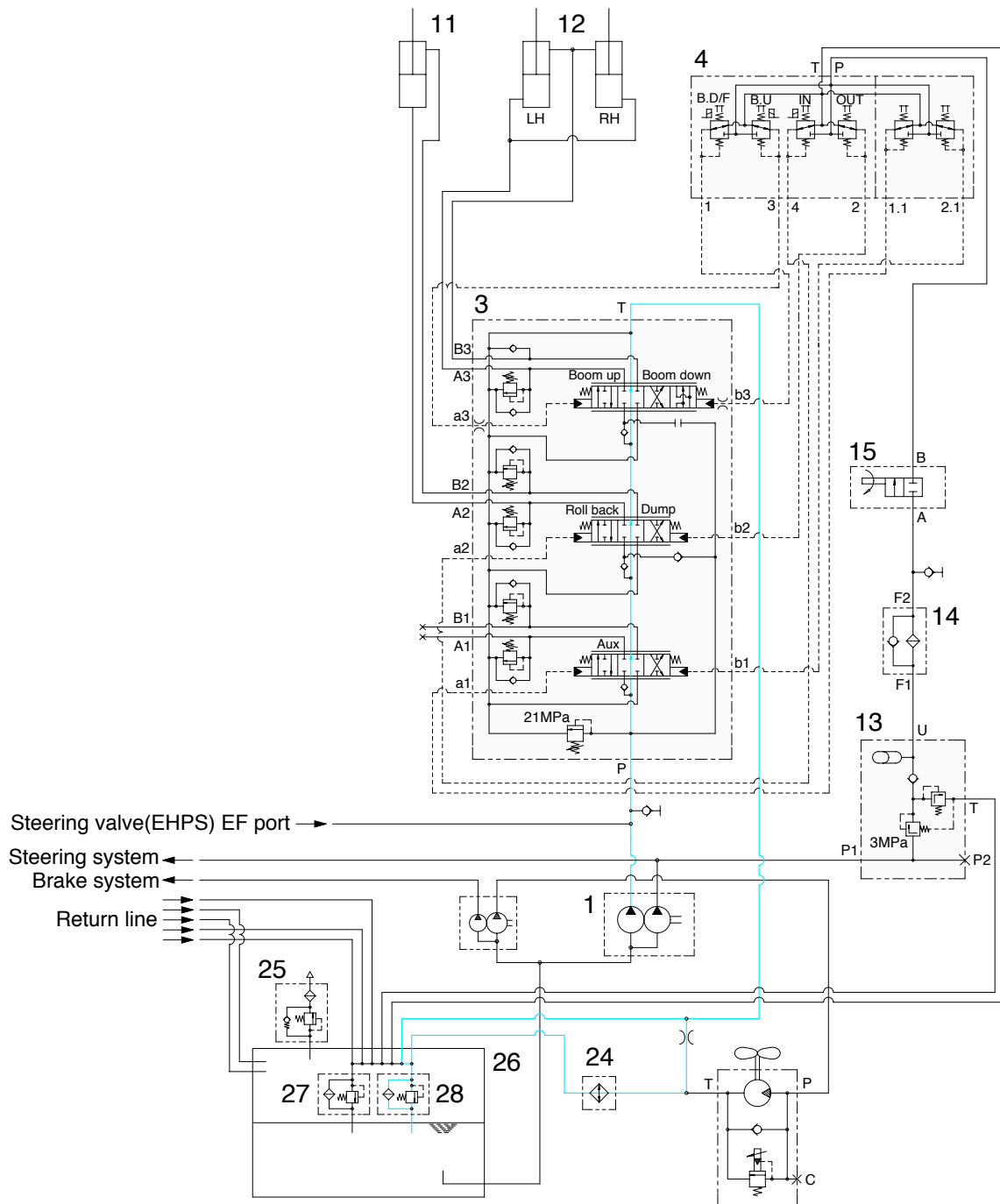
## 5) WHEN THE RCV LEVER IS IN THE ROLL BACK(retract) POSITION



7607WE07

- If the RCV lever(4) is pulled left, the bucket spool on the first block is moved to roll back position by pilot oil pressure from port 4 of RCV.
- The oil from main pump(1) flows into main control valve(3) and then goes to the large chamber of bucket cylinder by pushing the load check valve of the bucket spool.
- The oil at the chamber of bucket cylinder(11) returns to hydraulic tank(26) through the bucket spool.
- When this happens, the bucket roll back.
- When the rolling speed of bucket is faster, the return oil from the small chamber of bucket cylinder combines with the oil from the pump, and flows into the large chamber of the cylinder. This prevents cylinder cavitation by the negative pressure when the pump flow cannot match the bucket rolling speed.

## 6) WHEN THE RCV LEVER IS IN THE HOLD POSITION

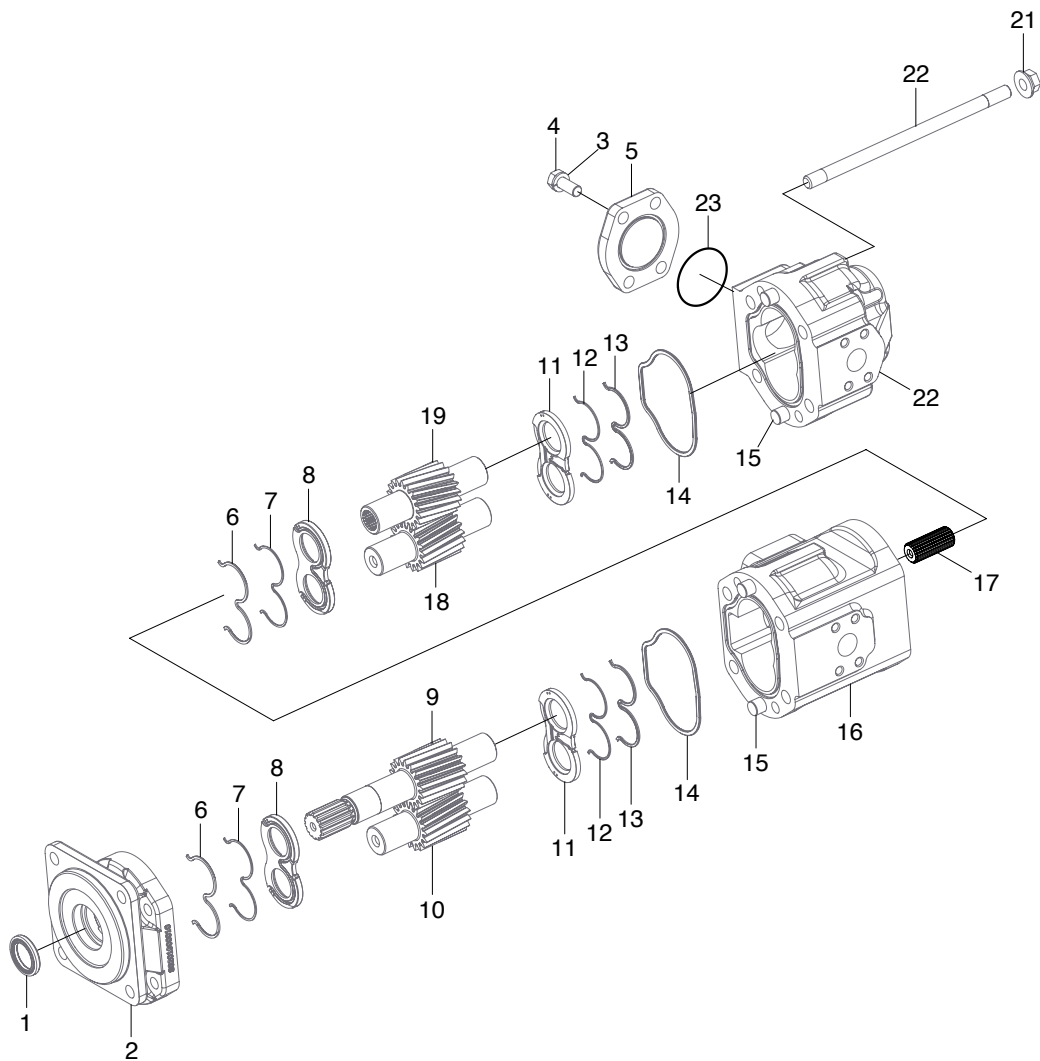


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- The oil from main pump(1) flows into main control valve(3).
- In this time, the bucket spool, the boom spool and the boom float spool are in neutral position, then the oil supplied to main control valve(3) returns into hydraulic tank(26) through center bypass circuit of each spool.
- In this condition, each cylinder keeps the neutral position, so the boom and the bucket is held.

## 4. MAIN PUMP

### 1) STRUCTURE



7607WE33

- |   |              |    |                   |    |                  |
|---|--------------|----|-------------------|----|------------------|
| 1 | Shaft seal   | 9  | Front drive gear  | 17 | Spline coupling  |
| 2 | Adapter      | 10 | Front driven gear | 18 | Rear driven gear |
| 3 | Washer       | 11 | Wearplate         | 19 | Rear drive gear  |
| 4 | Bolt         | 12 | O-ring seal       | 20 | Stud             |
| 5 | Flange       | 13 | Back up seal      | 21 | Flanged nut      |
| 6 | Back up seal | 14 | Interface seal    | 22 | Rear body        |
| 7 | O-ring seal  | 15 | Dowel             | 23 | O-ring           |
| 8 | Wearplate    | 16 | Front body        |    |                  |

## 2) OPERATION

The main hydraulic pump is a fixed displacement gear type pump. The pump is drive at engine speed by the transmission. The pump shafts are supported by shaft seal(1) adapter(2), front body(16) and rear body(22). The wearplate(8, 11) are located between the gear surface and adapter(1), rear body(22) and front body(16).

As the drive gear(9) and (19) turns the idler gears(10, 18), the gear teeth come out of mesh. Oil flows from the hydraulic tank through the inlet into the cavity between the gear teeth. As the gears continue to rotate, the oil becomes trapped between the gear teeth and front body(16).

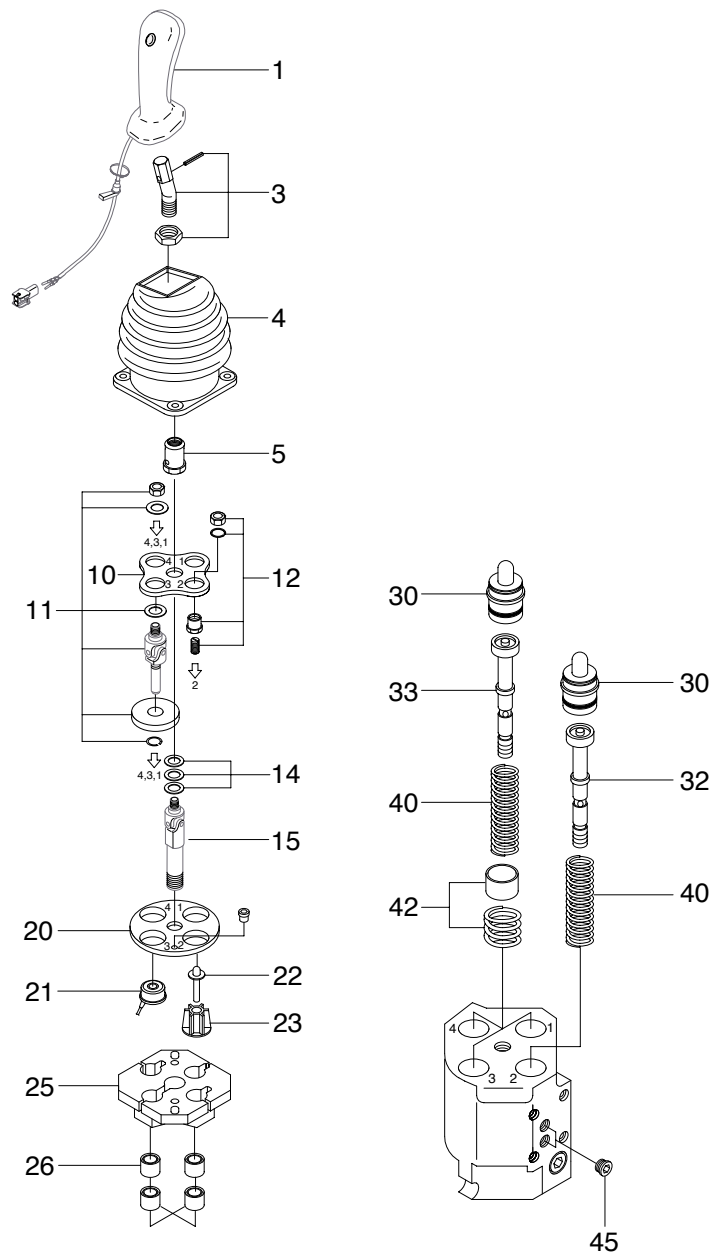
The trapped oil is then carried to the pump outlet. Oil is forced out the outlet to supply the hydraulic function. As the gears re-mesh, they form a seal to prevent oil from flowing between the gears and back to the inlet.

The pump uses outlet pressure oil to load the wearplate(8, 11) against the gear faces. This controls internal leakage to maintain pump displacement.

Outlet pressure fills the area bounded by the pressure balance moulded seals(6, 7) to force the wearplate against the high pressure area or the gear faces.

## 5. REMOTE CONTROL VALVE

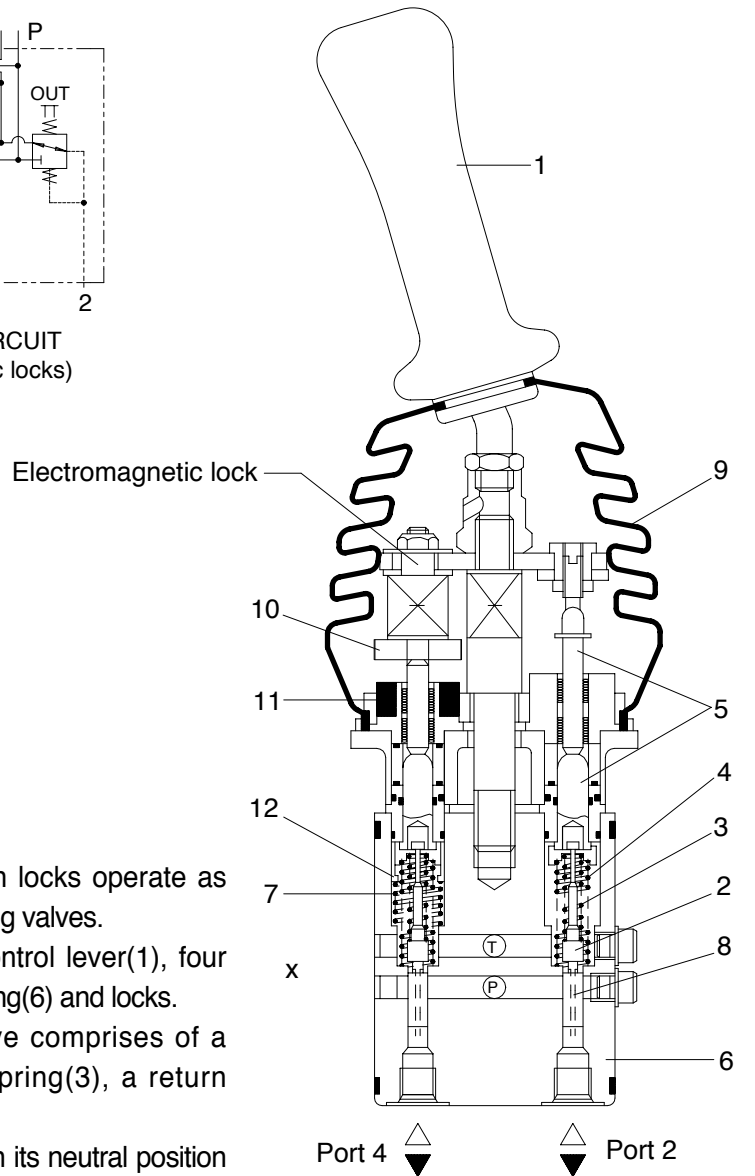
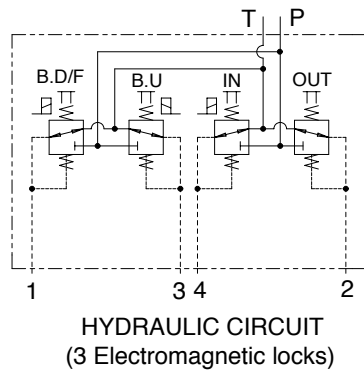
### 1) STRUCTURE



1	Handle	14	Shim set	26	Bushing kit
3	Lever kit	15	Joint	30	Plunger kit
4	Bellows	20	Flange	32	Regulating unit
5	Nut	21	Solenoid complete	33	Regulating unit
10	Bracket	22	Plunger kit	40	Spring set
11	Detent kit	23	Plunger guide	42	Prefeel point kit
12	Plunger kit	25	Electric bracket	45	Plug set

7707WE11

## 2) OPERATION



### (1) Hydraulic functional principle

Pilot devices with end position locks operate as direct operated pressure reducing valves.

They basically comprise of control lever(1), four pressure reducing valves, housing(6) and locks.

Each pressure reducing valve comprises of a control spool(2), a control spring(3), a return spring(4) a plunger(5).

At rest, control lever(1) is held in its neutral position by return springs(4). Ports(1, 2, 3, 4) are connected to tank port T via drilling(8).

When control lever(1) is deflected, plunger(5) is pressed against return spring(4) and control spring(3).

Control spring(3) initially moves control spool(2) downwards and closes the connection between the relevant port and tank port T. At the same time the relevant port is connected to port P via drilling(8). The control phase starts as soon as control spool(2) finds its balance between the force from control spring(3) and the force, which results from the hydraulic pressure in the relevant port(ports 1, 2, 3 or 4).

Due to the interaction between control spool(2) and control spring(3) the pressure in the relevant port is proportional to the stroke of plunger(5) and hence to the position of control lever(1).

This pressure control which is dependent on the position of the control lever and the characteristics of the control spring permits the proportional hydraulic control of the main directional valves and high response valves for hydraulic pumps.

A rubber bellows(9) protects the mechanical components in the housing from contamination.

## **(2) End position lock**

Only those control ports, for which it is necessary to hold the control lever in a deflected position are equipped with end position locks.

### **Electromagnetic lock**

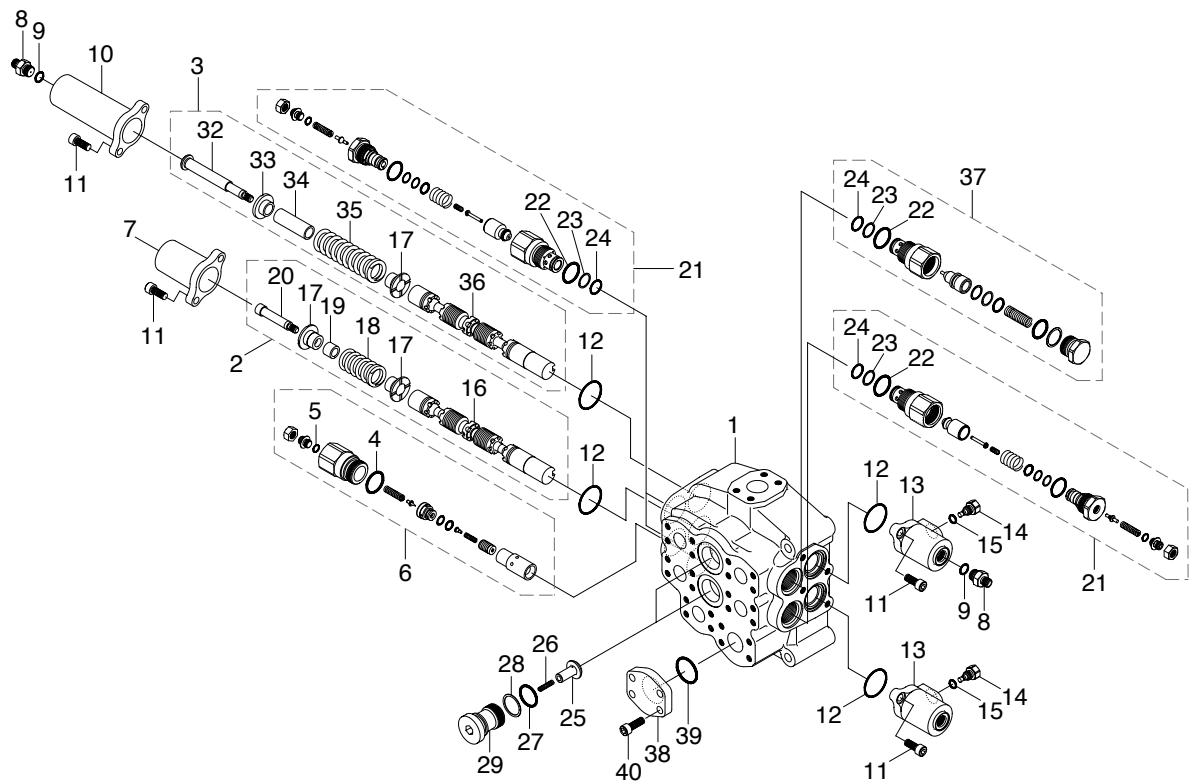
An additional spring(7), which is fitted below an additional plate(12) warns, by means of an increased force, which is required for compressing this spring, that the plunger(5) and the control lever(1) have almost reached their end position.

When this threshold is overcome, a ring(10) contacts the solenoid armature(11); if the solenoid is energized, then control lever(1) is held in its end position by magnetic force.

This lock is released automatically when the solenoid is deenergized.

## 6. MAIN CONTROL VALVE

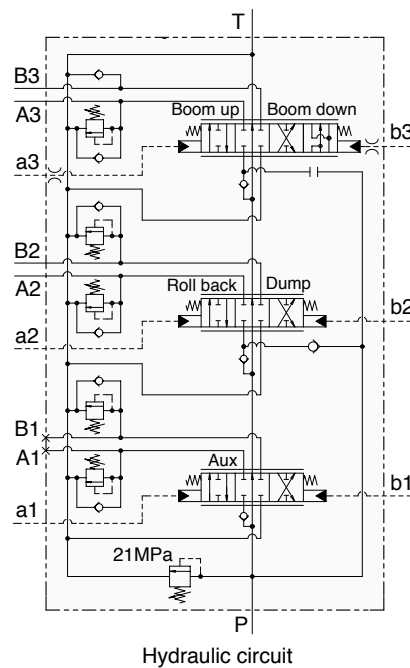
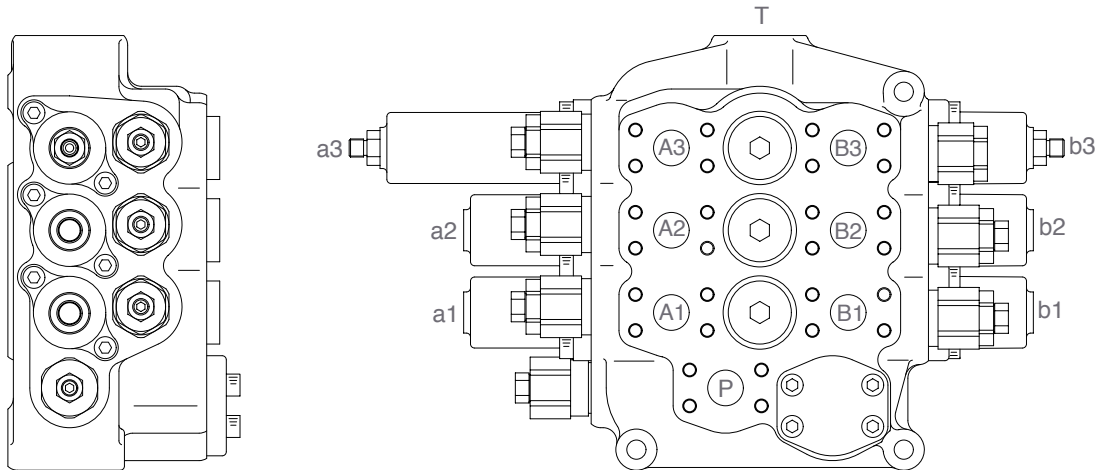
### 1) STRUCTURE



7607WE09

1	Housing assembly	14	Plug	27	O-ring
2	Plunger assembly	15	O-ring	28	Back up ring
3	Plunger assembly	16	Plunger	29	Cap
4	O-ring	17	Guide	32	Cap
5	O-ring	18	Spring	33	Guide
6	Main relief assembly	19	Spacer	34	Spacer
7	Cover	20	Nipple	35	Spring
8	Nipple	21	Port relief assembly	36	Plunger
9	O-ring	22	O-ring	37	Make up assembly
10	Cover	23	Back up ring	38	Cover
11	Socket bolt	24	O-ring	39	O-ring
12	O-ring	25	Check	40	Bolt
13	cover	26	Spring		

## STRUCTURE

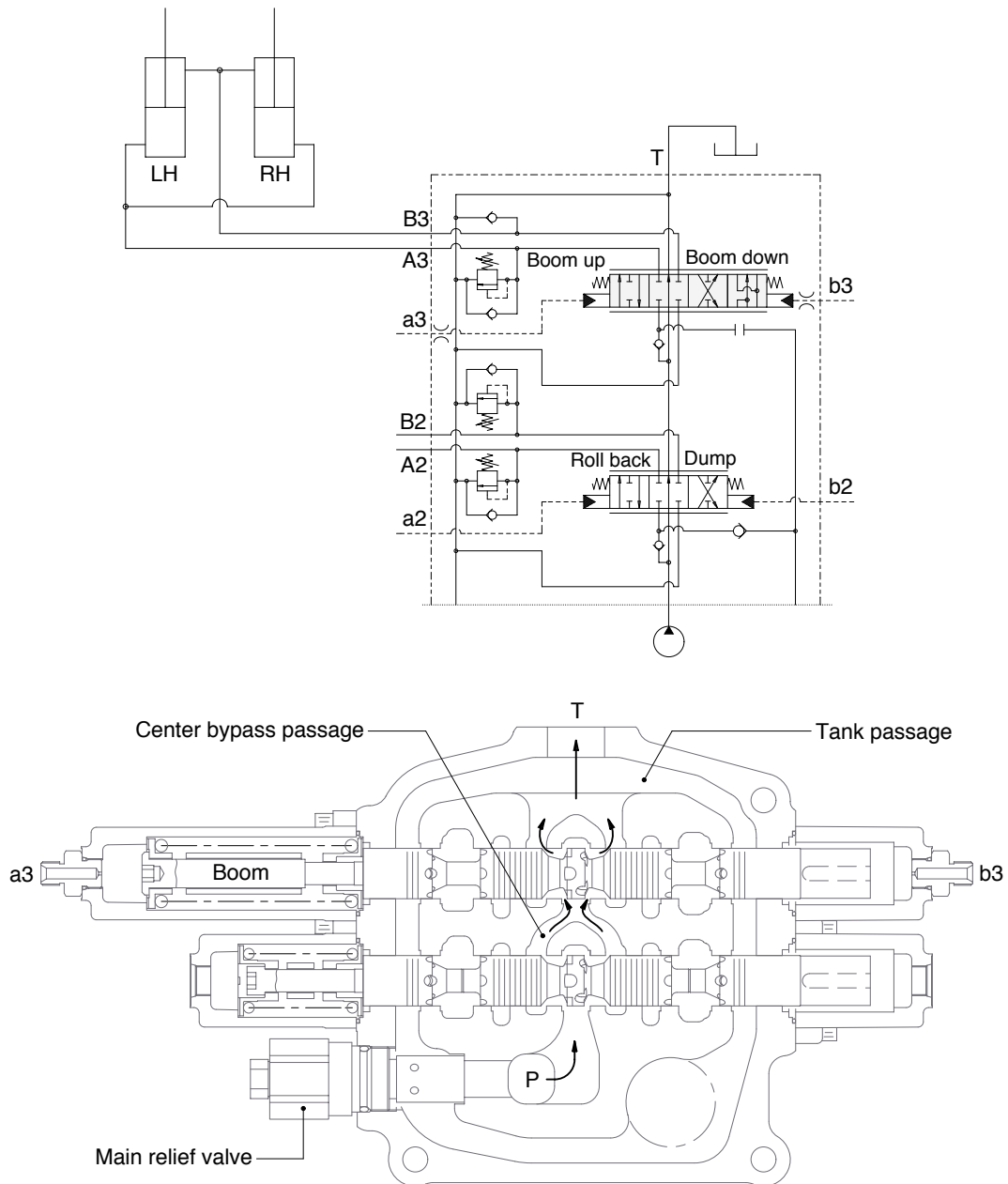


7607WE10

Port	Port name	Port size
P	From main pump	1 Split flange
T	To hydraulic tank	1-1/4 Split flange
A2, B2	To bucket cylinder port	1 Split flange
A3, B3	To boom cylinder port	1 Split flange
a3, b3	Boom pilot port	PF 3/8 Fitting
a2, b2	Bucket pilot port	PF 3/8 O-ring boss

## 2) BOOM SECTION OPERATION

### (1) Spool in neutral

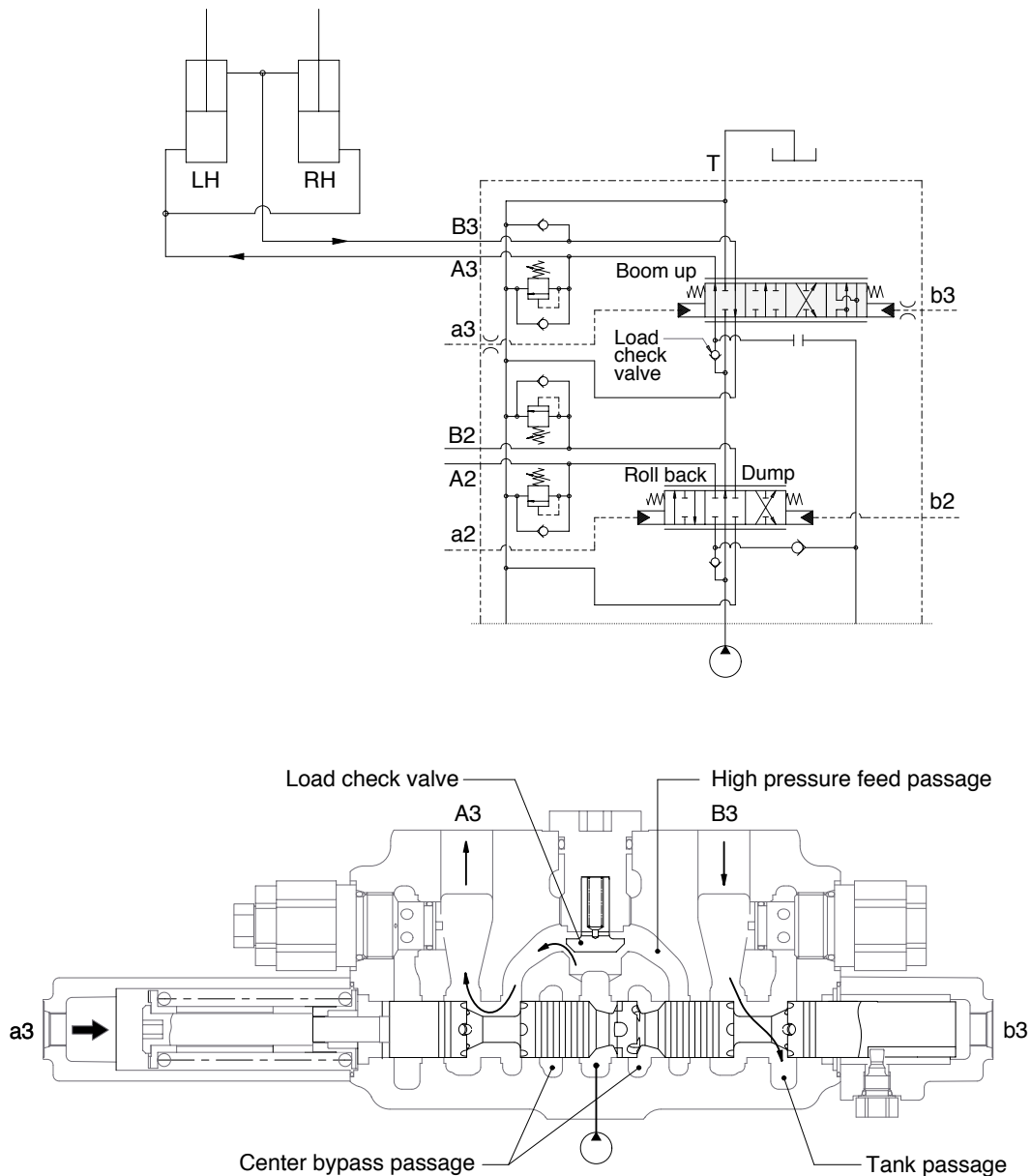


7607WE11

When the boom plunger is in neutral position, oil from the pump flows to the tank through the center bypass line.

The cylinder port(A3, B3) are shut off from the high pressure feed passage and tank passage by the boom plunger.

## (2) Boom raise position



7607WE12

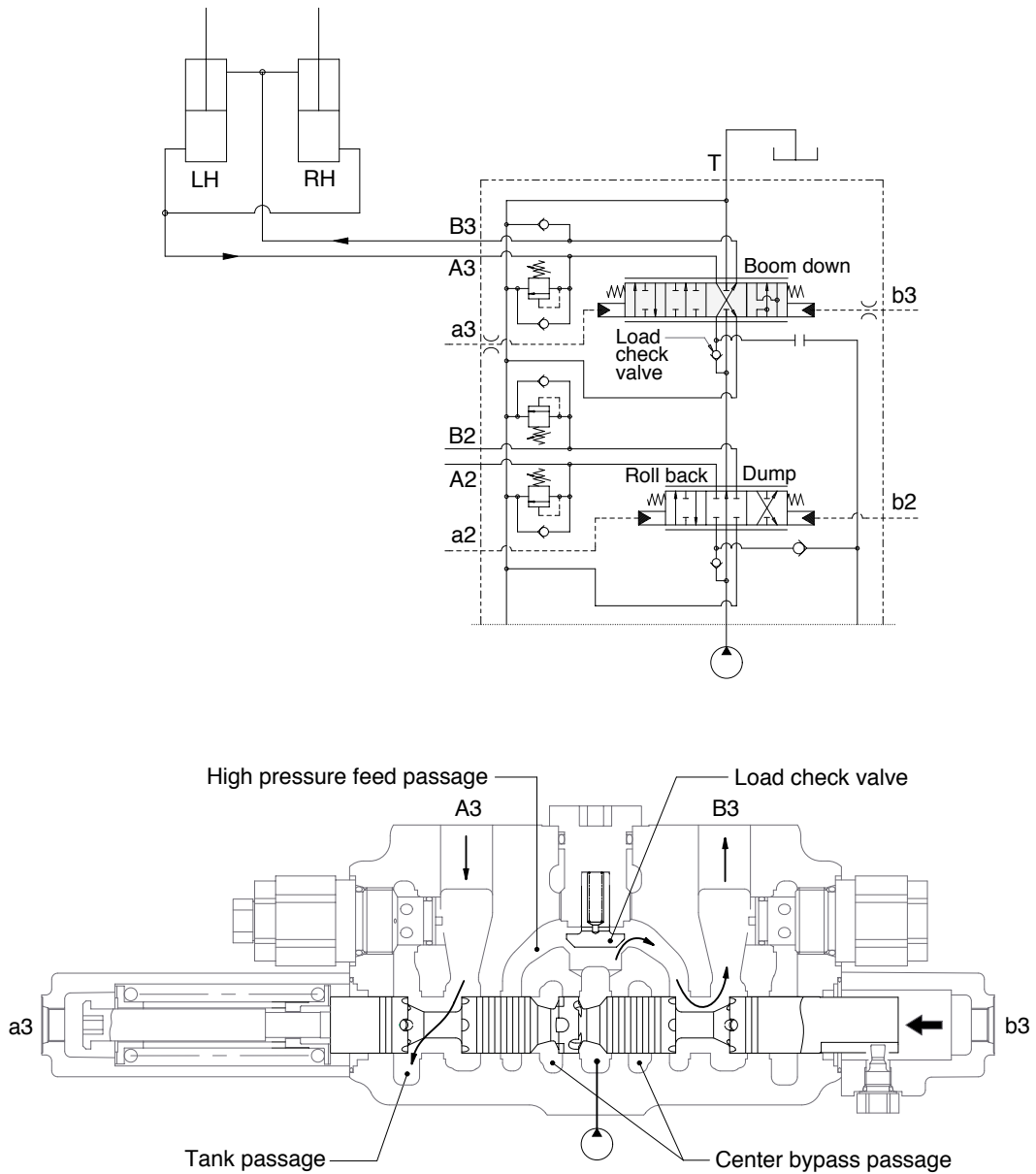
When the pilot pressure is led to the port(a3), the boom plunger is switched, and shut off center bypass passage.

Oil from the pump flows to the cylinder port(A3) through the load check valve and oil from the cylinder flows into the tank passage through the cylinder port(B3).

### Load check valve

When the load pressure is higher than the pump pressure, the load check shuts off the passage between the high pressure feed passage and the center bypass passage and prevents the reverse flow from the cylinder.

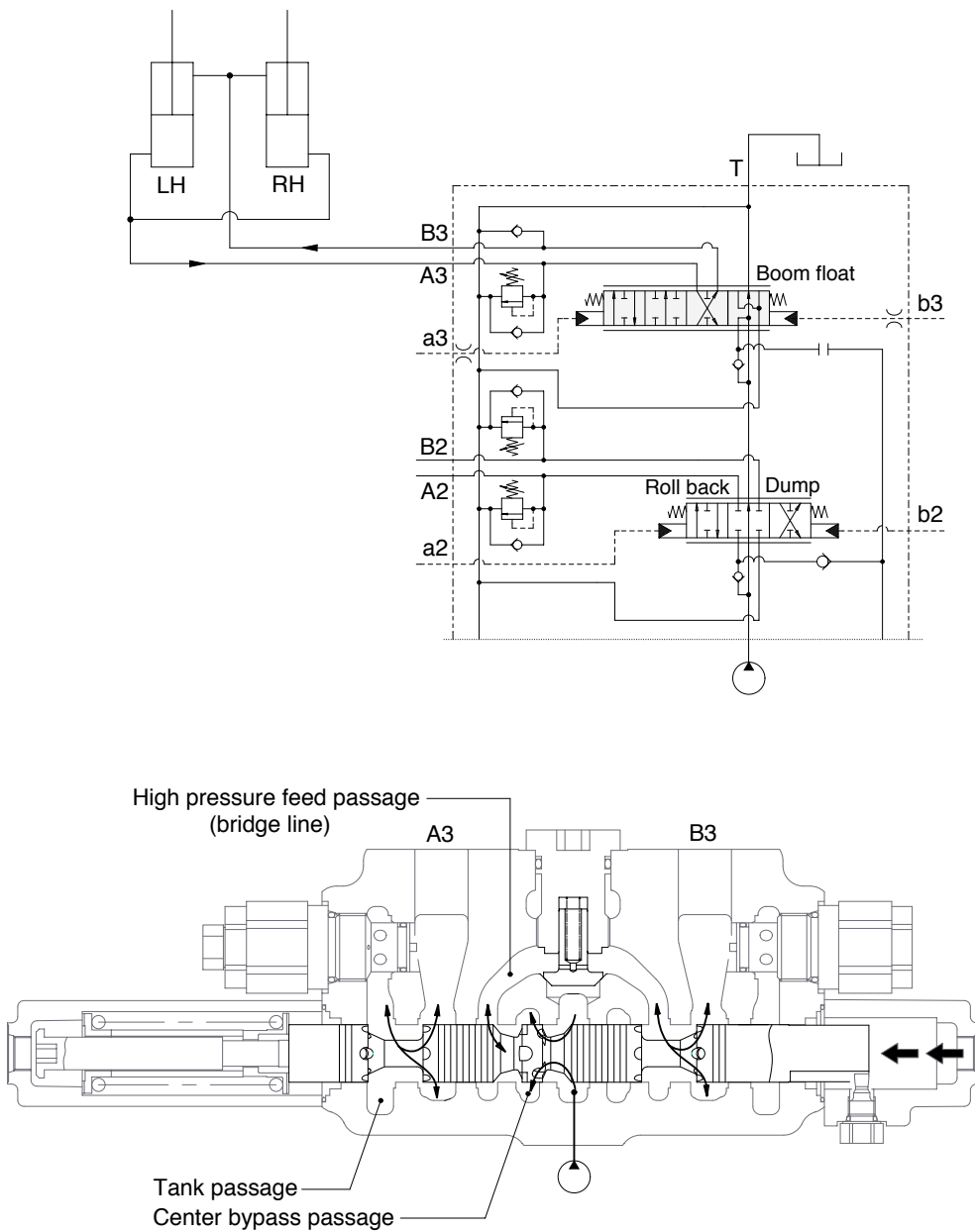
**(3) Boom lower position**



7607WE13

When the pilot pressure is led to the port(b3), the boom plunger is switched, and shut off center bypass passage. Oil from the pump flows to the cylinder port(B3), through the load check valve and oil from the cylinder flows into the tank passage through the cylinder port(A3).

#### (4) Boom float position



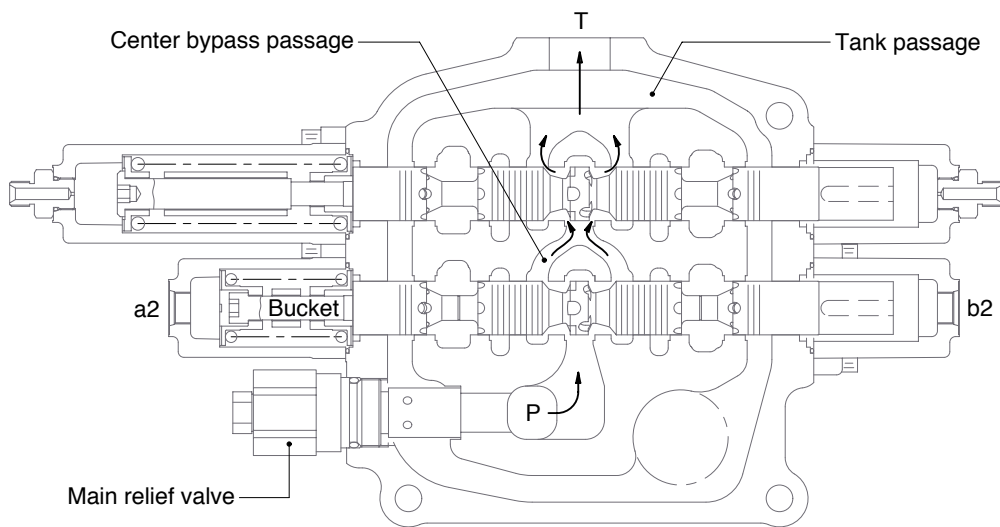
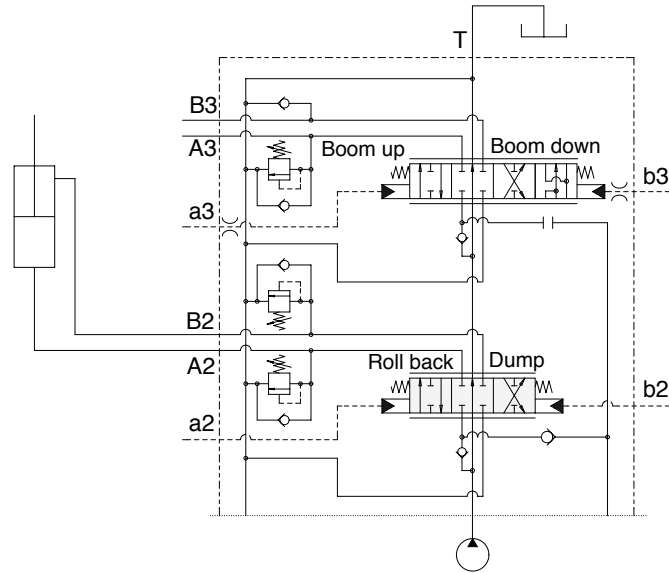
7607WE14

When the boom plunger is located in float position, the oil from the pump flows to the tank through the center bypass line.

The cylinder port(A3) is connected to the tank passage, and the cylinder port(B3) is connected to the tank passage, and the cylinder port(B3) is connected to the tank passage through the bridge line. And then the both cylinder port is in float condition.

### 3) BUCKET SECTION OPERATION

#### (1) Spool in neutral

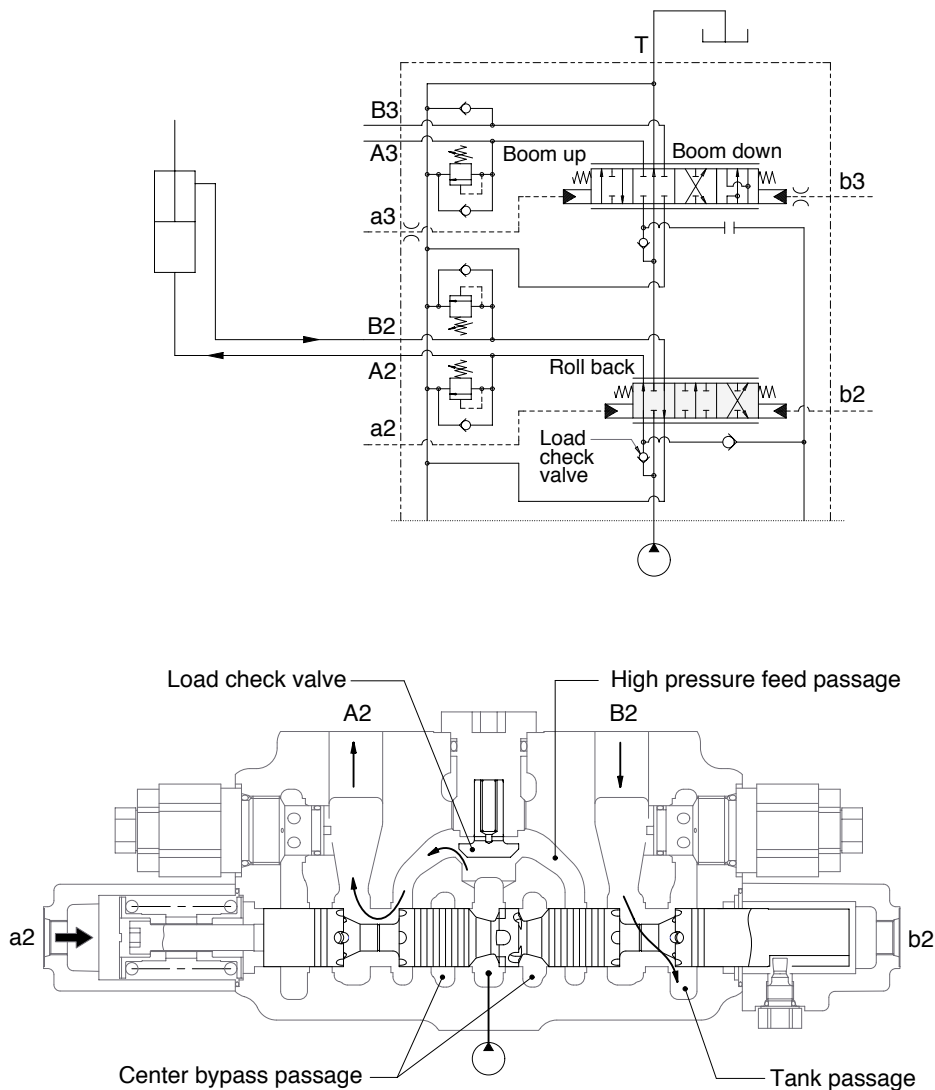


7607WE15

When the bucket plunger is in neutral position, oil from the pump flows to the tank through the center bypass line.

To cylinder port(A2, B2) are shut off from the high pressure feed passage and tank passage by the bucket plunger.

## (2) Bucket rollback position



7607WE16

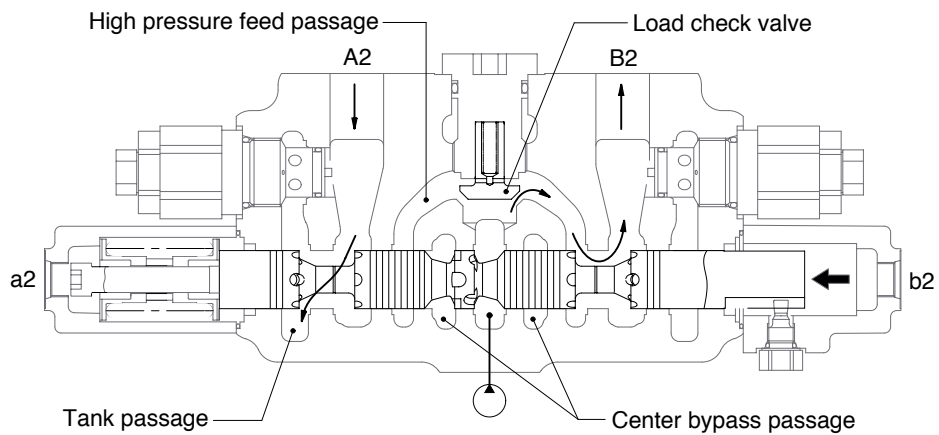
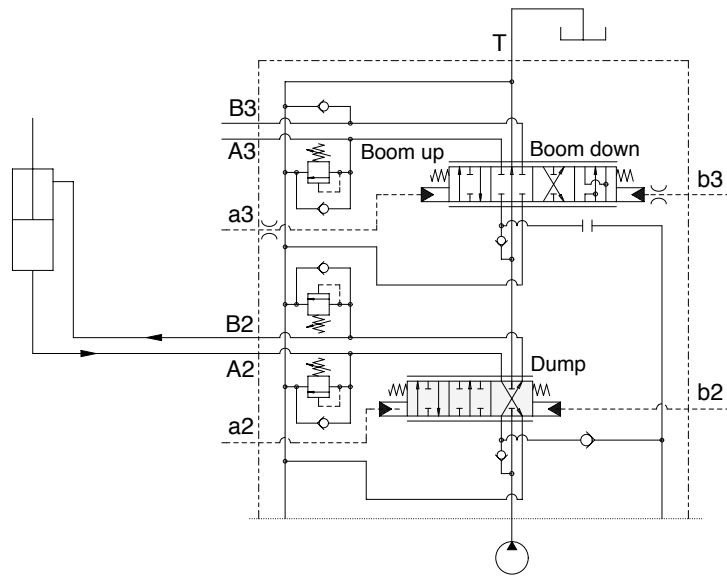
When the pilot pressure is led to the port(a2), the bucket plunger is switched, and shut off center bypass passage.

Oil from the pump flows to the cylinder port(A2) through the load check valve and oil from the cylinder flows into the tank passage through the cylinder port(B2).

### Load check valve

When the load pressure is higher than the pump pressure, the load check shuts off the passage between the high pressure feed passage and the center bypass passage and prevents the reverse flow from the cylinder.

### (3) Bucket dump position



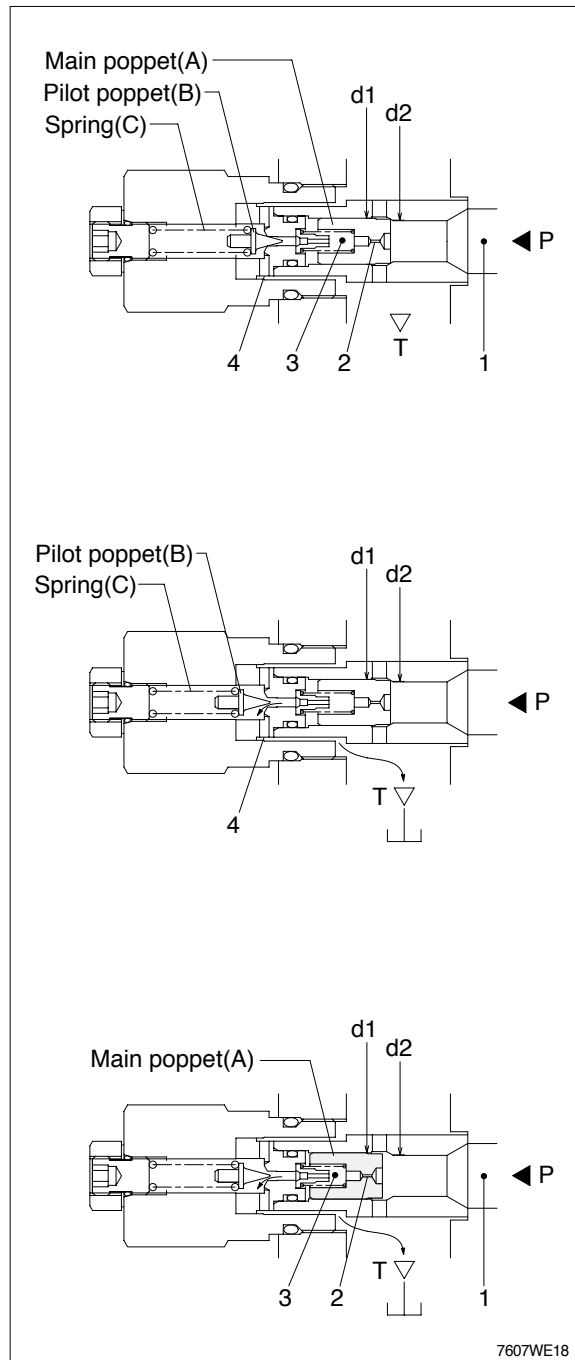
7607WE17

When the pilot pressure is led to the port(b2), the bucket plunger is switched, and shut off center bypass passage.

Oil from the pump flows to the cylinder port(B2) through the load check valve and oil from the cylinder flows into the tank passage through the cylinder port(A2).

#### 4) MAIN RELIEF VALVE

- The relief valve is installed between pump circuit and tank circuit in the main control valve housing and keeps system pressure to setting pressure.
- Oil from the pump port(P) enters into the chamber(3) through the orifice(2) of the main poppet(A).  
As  $d2 < d1$ , main poppet(A) is securely seated.
- When the pressure reaches the preset force of the spring(C), the pilot poppet(B) opens. Oil flow around pilot poppet(B) and flows into the tank passage(T) through the side hole(4).
- As oil flows from the pump port(P) to the tank passage(T) through the orifice(2) of the main poppet(A), the pressure of the chamber(3) comes to lower than that of the pump port.  
Then the main poppet(A) is lifted and pressured oil flows into the tank passage.

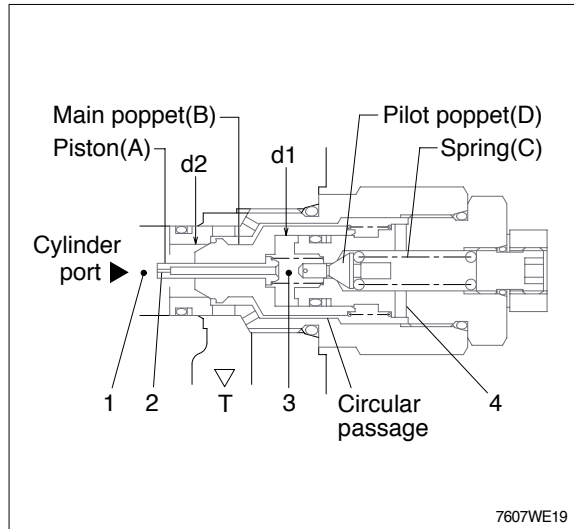


### 5) PORT RELIEF VALVE

The port relief valve is installed between cylinder port and tank passage.

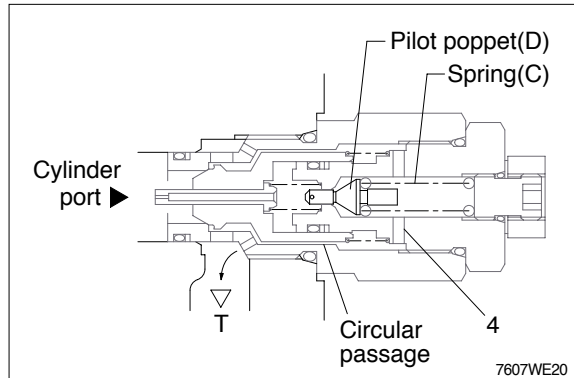
It protects the actuator from abnormal pressure, due to outer force or sudden block of cylinder pressure.

The port relief valve is the type of built-in make-up function.



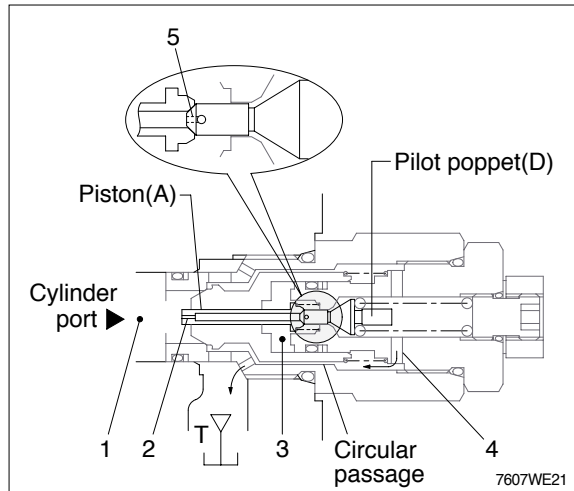
#### (1) Overload relief function

When the pressure reaches the preset force of the spring (C), the pilot poppet (D) is lifted and pressured oil flows into the tank passage.

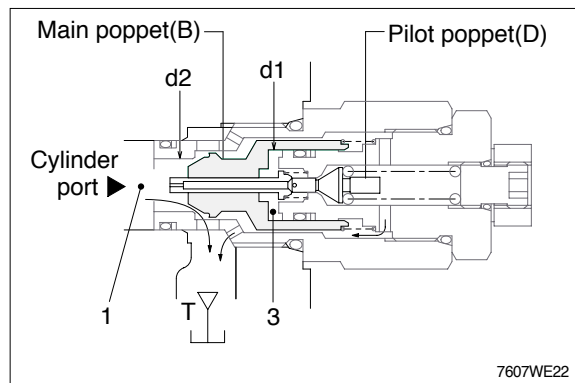


As oil flows from the cylinder port to the tank passage through the orifice (2) of the piston (A), the pressure of the chamber (3) comes to lower than that of the cylinder port. Then the piston (A) is lifted and seated to the pilot poppet (D).

Oil from the cylinder port flows to the tank passage through the orifice (5) of the pilot poppet (D), side hole (4) and the circular passage.

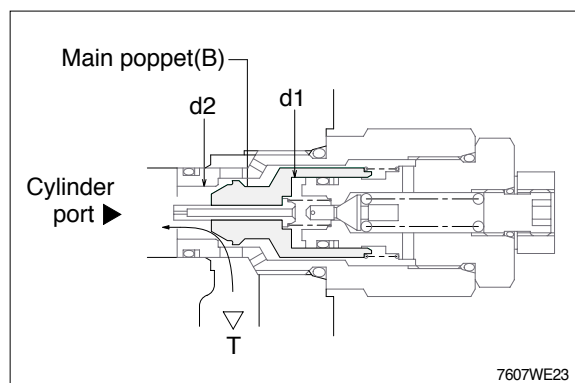


Oil from the cylinder port flows to the tank passage. As the pressure of the chamber(3) comes to lower still more, the main poppet(B) is lifted and pressured oil flows into the tank passage.



## (2) Make-up function

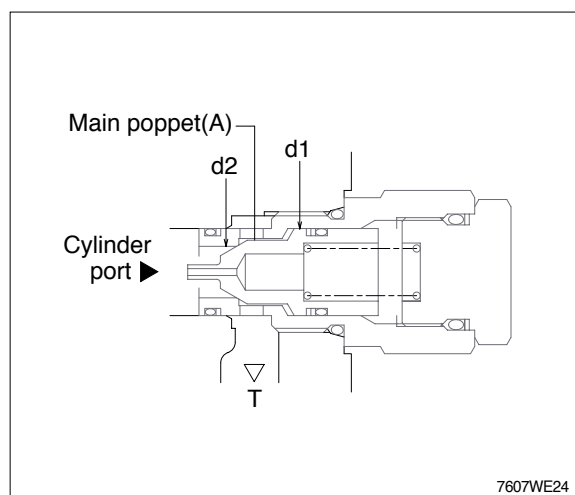
As the cylinder port pressure is normally higher than the tank passage pressure and  $d2 < d1$ , the poppet(B) is securely seated. When the cylinder port pressure comes to lower than the tank passage pressure (closer to negative pressure), the poppet(B) opens receiving the tank passage pressure for the difference in area between  $d2$  and  $d1$  oil from the tank passage flows to the cylinder port in order to prevent cavitation.



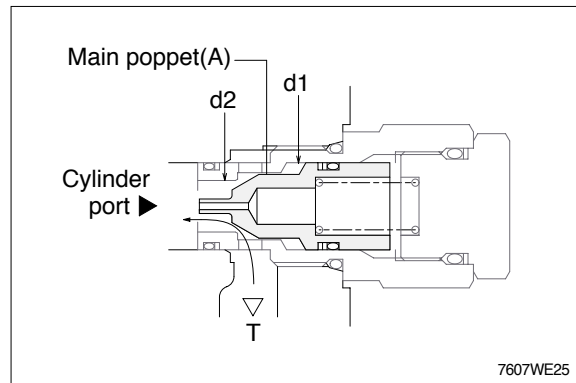
## 6) MAKE UP VALVE

The make-up valve is installed between the cylinder port and the tank passage. When the cylinder port pressure comes to lower than the tank passage pressure, then make-up valve supplies the oil to the cylinder port from the tank passage, and prevents cavitation.

- (1) As the cylinder port pressure is normally higher than the tank passage pressure and  $d2 < d1$ , the poppet(A) is securely seated.

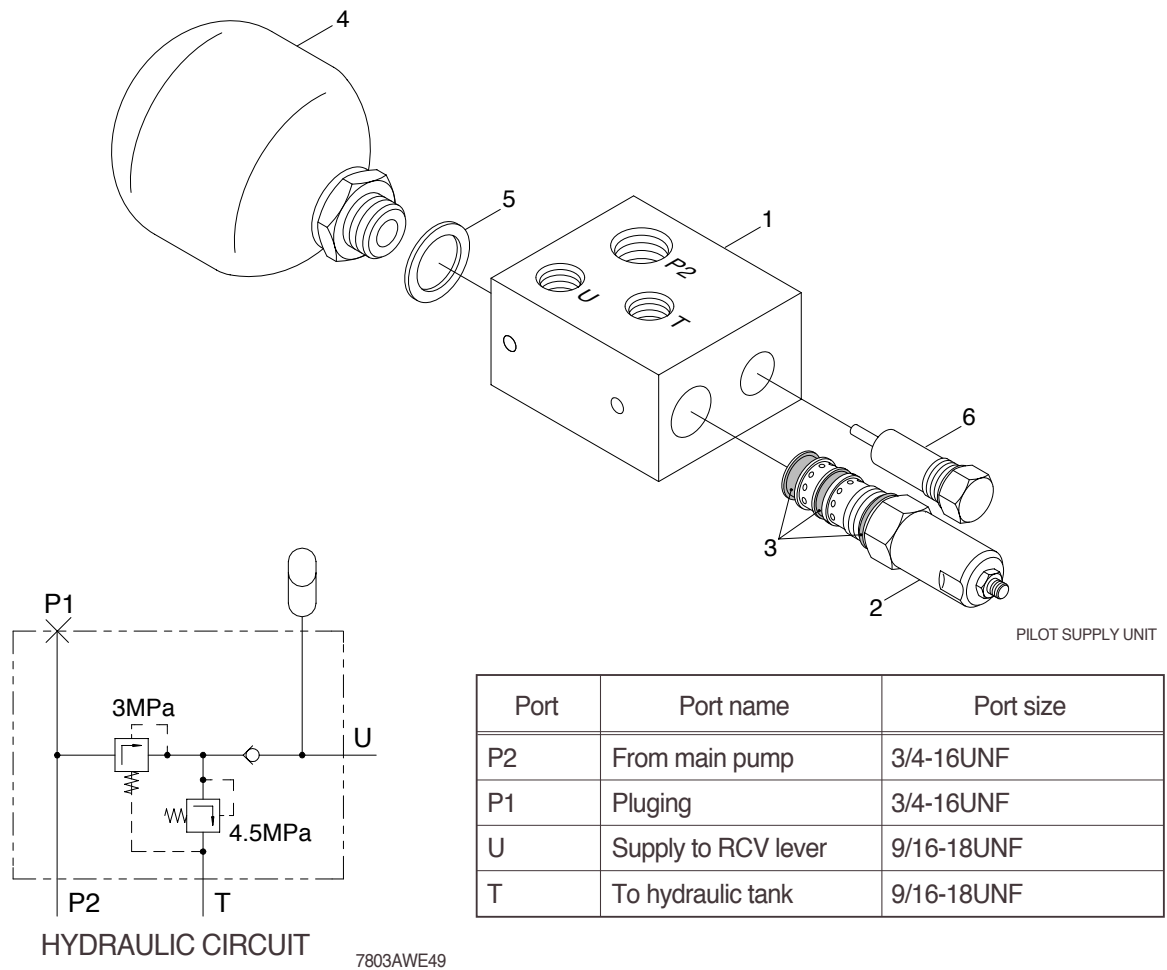


(2) When the cylinder port pressure comes to lower than the tank passage pressure (closer to negative pressure), the poppet (A) opens receiving the tank passage pressure for the difference in area between  $d2$  and  $d1$ . Oil from the tank passage flows to the cylinder port in order to prevent cavitation.



## 7. PILOT OIL SUPPLY UNIT

### 1) STRUCTURE



- |   |                   |   |              |
|---|-------------------|---|--------------|
| 1 | Manifold complete | 4 | Accumulator  |
| 2 | Reducing valve    | 5 | Gasket       |
| 3 | Seal kit          | 6 | Relief valve |

### (2) OPERATION

The pilot supply manifold reduces the pressure from the high pressure circuit to a low pressure circuit in order to supply the remote control valve.

The accumulator satisfies short term peak power demands and is a source of emergency power in case of main circuit pressure failures.

The unit consists of the housing, the accumulator(4), the relief valve(6), the check valve and the reducing valve(2).

The flow path is from the high pressure circuit through port P2 to the pressure reducing valve(2). The pressure is reduced in the reducing valve(2) and oil passes the check valve into the accumulator(4) and to the port U, which is connected with the remote control valve.

The pressure relief valve(6) protects the pilot circuit in case of the reducing valve(2) failures or external increase of pressure.

## 8. BOOM AND BUCKET CYLINDER

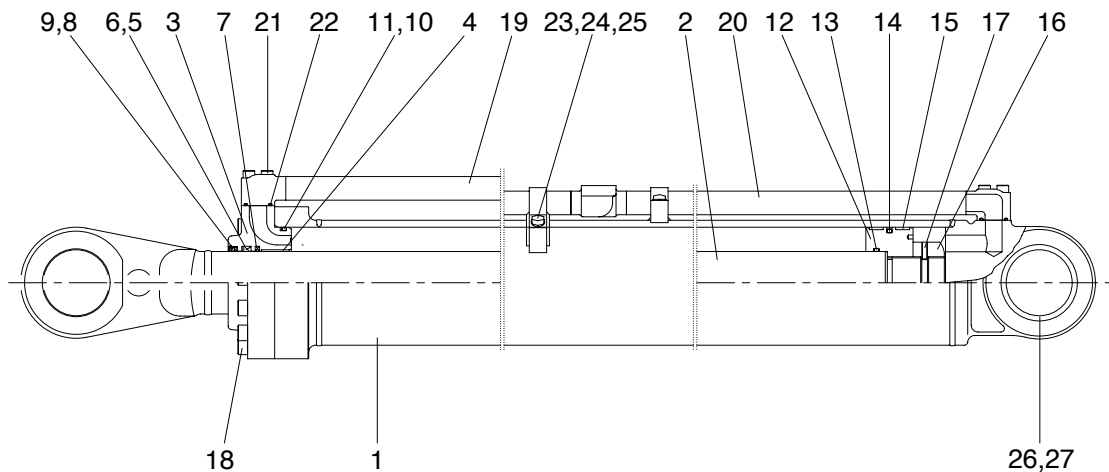
The boom cylinders are two unit and the bucket cylinder is one unit. They use a bolt on rod guide.

The piston(12) threads on to the rod(2) and is retained by a nut(16) and set screw(17).

The piston seals against the tube(1) with piston seal(14). Two wear rings(15) are located on each side of the piston seal.

The gland(3, the rod guide) seals against the tube with an O-ring(10). The cylinder thread seals against the rod with a lip type buffer ring(7) and a rod seal(5). A dust wiper(8) cleans the rod when it is retracted.

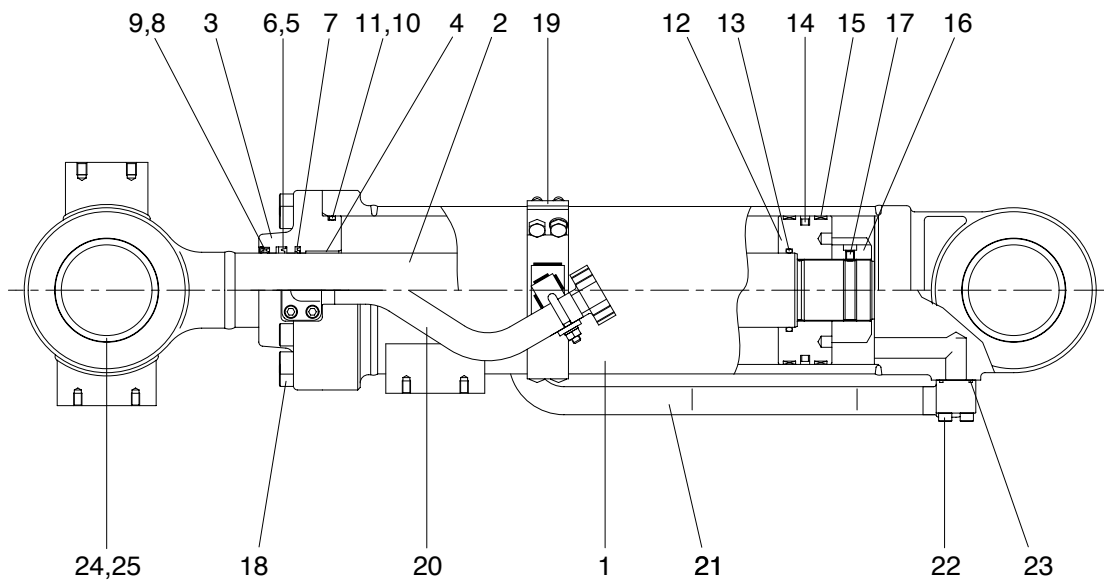
### 1) BOOM CYLINDER



7607WE26

1	Tube assembly	11	Back up ring	20	Pipe assembly
2	Rod assembly	12	Piston	21	Bolt
3	Gland	13	O-ring	22	O-ring
4	Bushing	14	Piston seal	23	Spring washer
5	Rod seal	15	Wear ring	24	Bolt
6	Back up ring	16	Piston nut	25	Pipe clamp
7	Buffer ring	17	Set screw	26	Bushing
8	Dust wiper	18	Bolt	27	Dust seal
9	Snap ring	19	Pipe assembly		
10	O-ring				

## 2) BUCKET CYLINDER



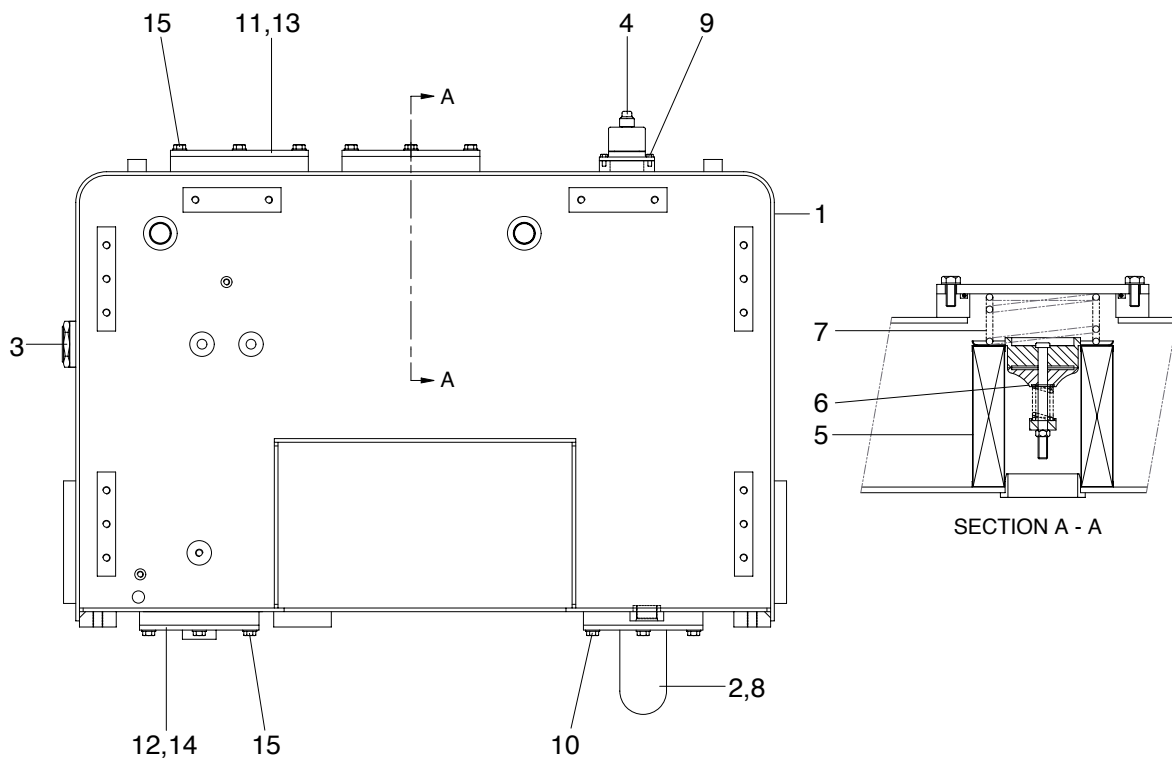
7607WE27

- |   |               |    |              |    |               |
|---|---------------|----|--------------|----|---------------|
| 1 | Tube assembly | 10 | O-ring       | 18 | Bolt          |
| 2 | Rod assembly  | 11 | Back up ring | 19 | Band assembly |
| 3 | Gland         | 12 | Piston       | 20 | Pipe assembly |
| 4 | Bushing       | 13 | O-ring       | 21 | Pipe assembly |
| 5 | Rod seal      | 14 | Piston seal  | 22 | Bolt          |
| 6 | Back up ring  | 15 | Wear ring    | 23 | O-ring        |
| 7 | Buffer ring   | 16 | Piston nut   | 24 | Bushing       |
| 8 | Dust wiper    | 17 | Set screw    | 25 | Dust seal     |
| 9 | Snap ring     |    |              |    |               |

## 9. HYDRAULIC OIL TANK

### 1) STRUCTURE

- The oil from the hydraulic tank is sent from the pump through main control valve to the cylinders. In the return circuit, the oil from various parts merges.
- A part of oil is cooled in the oil cooler, passes through the hydraulic filter and returns to the hydraulic tank(1).
- If the hydraulic return oil filter becomes clogged, return filter bypass valve(6) acts to allow the oil to return directly to the hydraulic tank(1). This prevents damage to the hydraulic filter(5). The bypass valve(6) is also actuated when negative pressure is generated in the circuit.



7607WE28

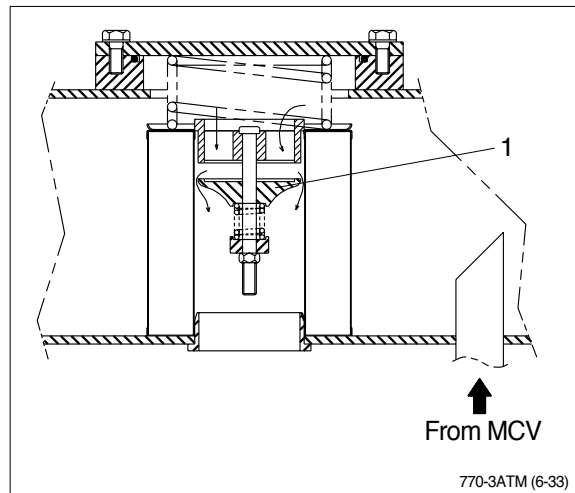
1	Hydraulic tank wa	9	Socket bolt
2	Pipe wa	10	Bolt
3	Sight gauge	11	Cover
4	Air breather	12	Cover
5	Element assembly	13	O-ring
6	Bypass valve	14	O-ring
7	Spring	15	Bolt
8	O-ring		

## 2) RETURN OIL FILTER BYPASS VALVE

### (1) When the filter is clogged

Bypass valve(1) is opened and the oil returns directly to the tank without passing through the filter.

- Bypass valve set pressure : 1.36kg/cm<sup>2</sup>  
(19.3psi)



### 3) AIR BREATHER

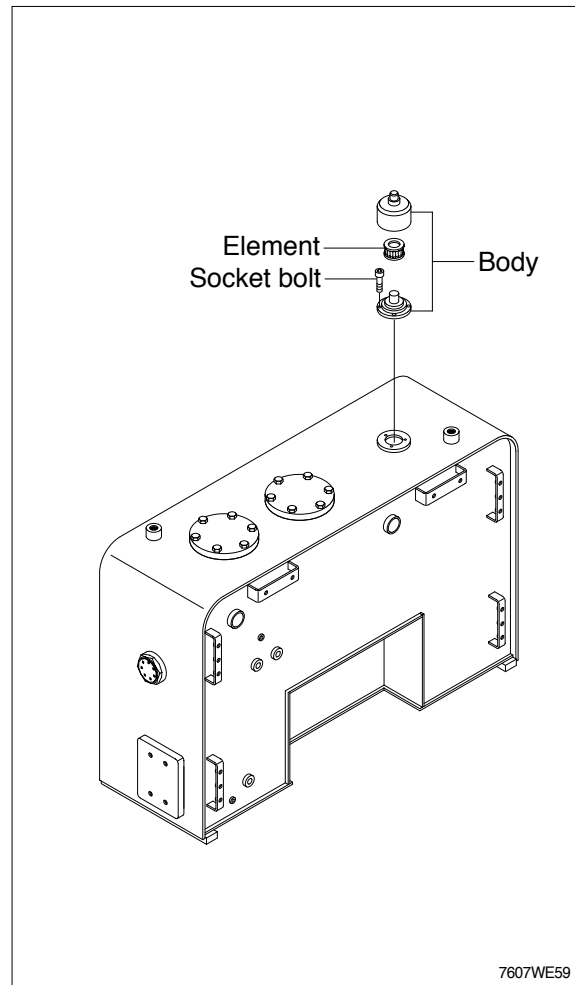
The air breather is equipped with the capacity to perform three functions simultaneously-as an air filter, breathing valve, and as a lubrication opening.

#### (1) Preventing negative pressure inside the tank

The tank is a pressurized sealed type, so negative pressure is formed inside the hydraulic tank when the oil level drops during operations. When this happens, the difference in pressure between the tank and the outside atmospheric pressure opens the poppet in the breather, and air from the outside is let into the tank or prevent negative pressure.

#### (2) Preventing excessive pressure inside the tank

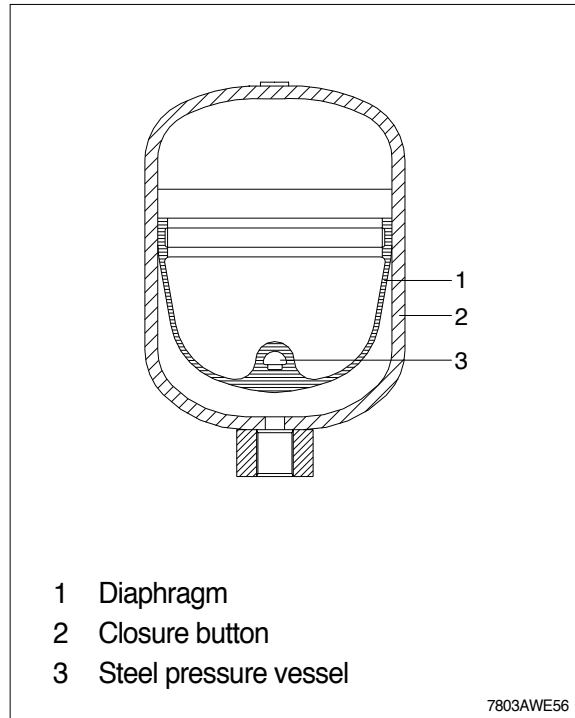
When the hydraulic cylinder is being used, the oil level in the hydraulic system increases and as temperature rises. If the hydraulic pressure rises above the set pressure, breather is actuated to release the hydraulic pressure inside the tank.



## 9. ACCUMULATOR

The accumulator is installed at the pilot oil supply unit. When the boom is left the raised position, and the control levers are operated with the engine stopped the pressure of the compressed nitrogen gas inside the accumulator sends pilot pressure to the control valve to actuate it and allow the boom and bucket to come down under their own weight.

Type of gas	Nitrogen gas(N <sub>2</sub> )
Volume of gas	0.75 (0.2 U.S.gal)
Charging pressure of gas	16kg/cm <sup>2</sup> (228psi)
Max actuating pressure	128kg/cm <sup>2</sup> (1820psi)



## GROUP 2 OPERATIONAL CHECKS AND TROUBLESHOOTING

### 1. OPERATIONAL CHECKS

This procedure is designed so the mechanic can make a quick check of the system using a minimum amount of diagnostic equipment. If you need additional information, read **structure and function**, Group 1.

A location will be required which is level and has adequate space to complete the checks.

The engine and all other major components must be at operating temperature for some checks.

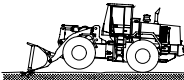
Locate system check in the left column and read completely, following the sequence from left to right. Read each check completely before performing.

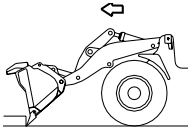
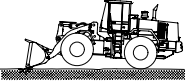
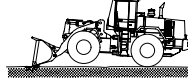

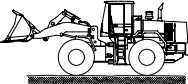
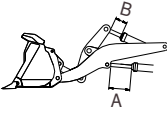
At the end of each check, if no problem is found(OK), that check is complete or an additional check is needed. If problem is indicated(NOT OK), you will be given repair required and group location.

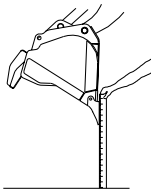
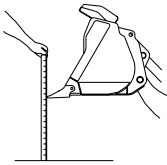
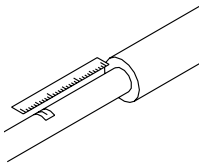
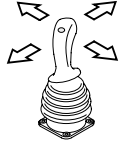
If verification is needed, you will be given next best source of information:

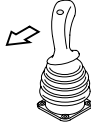
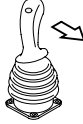
- Chapter 2 : Troubleshooting
- Group 3 : Tests and adjustments

**Hydraulic oil must be at operating temperature for these checks(Refer to page 6-50).**

Item	Description	Service action
<p><b>Hydraulic system warm-up procedure</b> Run engine at high idle. Refer to page 6-46.</p>	<p>Hold a hydraulic function over relief to heat oil.(Don't keep relief condition over 5 seconds at a time)</p> <p>Periodically cycle all hydraulic functions to distribute warm oil.</p> <p>Repeat procedure until oil is at operating temperature.</p> <p><b>FEEL</b> : Hydraulic reservoir must be uncomfortable to hold your hand against. (approximately 45 ~55, C)</p>	<p><b>OK</b> Check completed.</p>
<p><b>Hydraulic pump performance check</b> Heat hydraulic oil to operating temperature. Run engine at high idle.</p>	<p>With bucket flat on ground, actuate boom raise. Time how long it takes to raise boom to full height.</p> <p><b>LOOK</b> : Boom must raise to full height in less than 7 seconds.</p>	<p><b>OK</b> Check completed.</p> <p><b>NOT OK</b> Go to priority valve(in steering valve) high pressure check at page 5-28.</p> <p><b>IF OK</b> Do steering system leakage check at page 5-27.</p> <p><b>IF OK</b> Do main hydraulic pump flow test at page 6-51.</p>
<p><b>Control valve lift check</b> Run machine at low idle.</p>	 <p>With bucket partially dumped, lower boom to raise front of machine.</p> <p>Slowly move boom control lever(RCV lever) to boom lower position.</p> <p>Slowly move bucket control lever to bucket dump position.</p> <p><b>LOOK</b> : Boom must not raise before moving down.</p> <p>Bucket must not rollback before</p>	<p><b>OK</b> Check complete.</p> <p><b>NOT OK</b> Repair lift checks in main control valve.</p>

Item	Description	Service action
<p><b>Bucket rollback circuit relief valve check</b></p>	 <p>Position bucket at a 45° angle against an immovable object.</p> <p>Engage transmission in 3rd speed forward.</p> <p><b>LOOK</b> : Bucket angle must not change.</p>	<p><b>OK</b> Check complete.</p> <p><b>NOT OK</b> Replace rollback test check valve.</p>
<p><b>Bucket dump circuit relief valve low pressure check</b></p>	 <p>Raise front of machine which bucket at 45° angle.</p> <p>Backdrag with bucket while observing bucket angle.</p> <p><b>LOOK</b> : Bucket must not rollback</p>	<p><b>OK</b> Go to next check.</p> <p><b>NOT OK</b> Do loader system and circuit relief valve test at page 6-52.</p>
<p><b>Pilot control valve float check</b></p> <p>Run engine at low idle.</p>	  <p>With the bucket partially dumped, lower boom to raise front of machine.</p> <p>Push control lever to the float detent position and release lever.</p> <p><b>LOOK</b> : Front of machine lower to the ground and valve must remain in float position when lever is released.</p>	<p><b>OK</b> Check complete.</p> <p><b>NOT OK</b> Do pilot control valve pressure test in group 3.</p>
<p><b>Boom cylinder and bucket cylinder drift check</b></p> <p>Heat hydraulic oil to operating temperature.</p>	  <p>Set the boom and bucket horizontal, then stop the engine.</p> <p>Stop the engine, wait for 5 minutes, then start measuring.</p> <p>Measure the amount the lift and dump cylinder rods retract during 15 minutes.(Unloaded bucket)</p> <p>A : Retraction of boom cylinder rod</p> <p>B : Retraction of bucket cylinder rod</p> <p>Boom cylinder must drift less than 40mm</p> <p>Bucket cylinder must drift less than 50mm</p>	<p><b>OK</b> Check complete.</p> <p><b>NOT OK</b> Go to next check.</p>

Item	Description	Service action
<p><b>Boom cylinder leakage check</b></p> <p>Heat hydraulic oil to operating temperature.</p>	 <p>Dump bucket until teeth or cutting edge is perpendicular to the ground.</p> <p>Raise boom until cutting edge is about 1m(3ft) above ground.</p> <p>Stop engine. Measure drift from tooth or cutting edge to ground for 1 minute.</p> <p>Wait 10 minutes.</p> <p>Measure drift from tooth or cutting edge to ground for 1 minute.</p> <p><b>LOOK</b> : Compare the drift rate between the first measurement and the second measurement.</p>	<p><b>OK</b></p> <p>Drift is approximately the same between first and second measurement.</p> <p>Repair loader control valve or circuit relief valve.</p> <p><b>NOT OK</b></p> <p>If drift is considerably less on second measurement, repair cylinder.</p>
<p><b>Bucket cylinder leakage check</b></p> <p>Heat hydraulic oil to operating temperature.</p>	 <p>Raise bucket about 1m(3ft) off ground with bucket level.</p> <p>Stop engine. Place a support under boom.</p> <p>Measure drift from tooth or cutting edge to ground for 1 minute.</p> <p>Wait 10 minutes.</p> <p>Measure drift from tooth or cutting edge to ground for 1 minute.</p> <p><b>LOOK</b> : Compare the drift rates between the first measurement and the second measurement.</p>	<p><b>OK</b></p> <p>Drift is approximately the same between first and second measurement.</p> <p>Repair loader control valve or circuit relief valve at page 6-52.</p> <p><b>NOT OK</b></p> <p>Drift is considerably less on second measurement.</p> <p>Repair cylinder.</p>
<p><b>Check valve of safety valve leakage check</b></p> <p>Heat hydraulic oil to operating temperature.</p>	 <p>Put bucket level and position about 1.2m(4ft) above ground.</p> <p>Place a piece of tape on cylinder rod at least 51mm(2in) from rod guide.</p> <p>Run engine at low idle in safety-release position.</p> <p><b>LOOK</b> : Bucket must not drift up.</p>	<p><b>OK</b></p> <p>Check complete.</p> <p><b>NOT OK</b></p> <p>Check or replace safety valve.</p>
<p><b>Pilot control valve (RCV lever) check</b></p>	 <p>Stop engine. Turn key switch to OFF position.</p> <p>Move control lever to all positions and then release.</p> <p><b>LOOK</b> : Lever must return to neutral when released from all positions.</p>	<p><b>OK</b></p> <p>Check completed.</p> <p><b>NOT OK</b></p> <p>Repair pilot control valve.</p>

Item	Description	Service action												
<p><b>Bucket leveler (Positioner) check</b></p> <p>Run engine at low idle.</p>	 <p>Position bucket fully dumped just above ground level.</p> <p>Move control lever to bucket leveler detent position and release.</p> <p><b>LOOK</b> : Bucket must rollback to the level position and control lever must return to neutral.</p> <p>If bucket is in a rolled back position when key is turned ON, control lever must be returned to neutral manually if placed in the bucket leveler detent position.</p> <p>After bucket is dumped once, bucket leveler will work normally.</p>	<p><b>OK</b> Check complete.</p> <p><b>NOT OK</b> Do bucket leveler checks in group 3.</p>												
<p><b>Boom height kickout check</b></p> <p>Run engine at low idle.</p>	 <p>Position bucket flat on ground.</p> <p>Move control lever to boom raise detent position and release.</p> <p><b>LOOK</b> : Boom must raise to the set height and stop.</p> <p>Control lever must return to neutral.</p>	<p><b>OK</b> Check complete.</p> <p><b>NOT OK</b> Do boom height kickout check in group 3.</p>												
<p><b>Cycle time check</b></p> <p>Heat hydraulic oil to operating temperature. Run engine at high idle.</p>	<table border="0"> <tr> <td data-bbox="507 1090 699 1122">Function</td> <td data-bbox="715 1090 1088 1122">Operating condition.</td> </tr> <tr> <td data-bbox="507 1137 699 1169">Boom raise</td> <td data-bbox="715 1137 1088 1169">Bucket flat on ground to full height.</td> </tr> <tr> <td data-bbox="507 1184 699 1216">Boom lower(Float)</td> <td data-bbox="715 1184 1088 1216">Full height to level ground.</td> </tr> <tr> <td data-bbox="507 1232 699 1263">Bucket dump</td> <td data-bbox="715 1232 1088 1263">Boom at full height.</td> </tr> <tr> <td data-bbox="507 1279 699 1310">Bucket rollback</td> <td data-bbox="715 1279 1088 1310">Boom at full height.</td> </tr> <tr> <td data-bbox="507 1326 699 1391">Steering(No. of turns)</td> <td data-bbox="715 1326 1088 1357">Frame stop to frame stop.</td> </tr> </table>	Function	Operating condition.	Boom raise	Bucket flat on ground to full height.	Boom lower(Float)	Full height to level ground.	Bucket dump	Boom at full height.	Bucket rollback	Boom at full height.	Steering(No. of turns)	Frame stop to frame stop.	<p>Maximum cycle time</p> <p>6.7sec</p> <p>3.5sec</p> <p>1.7sec</p> <p>2.4sec</p> <p>2.7sec(4 turns)</p> <p><b>OK</b> Check complete.</p> <p><b>NOT OK</b> Go to slow hydraulic functions in group 3.</p>
Function	Operating condition.													
Boom raise	Bucket flat on ground to full height.													
Boom lower(Float)	Full height to level ground.													
Bucket dump	Boom at full height.													
Bucket rollback	Boom at full height.													
Steering(No. of turns)	Frame stop to frame stop.													

## MEASURING BOOM AND BUCKET CYCLE TIME

### 1. MEASUREMENT CONDITION

- Coolant temperature : Inside operating range
- Steering position : Neutral
- Hydraulic temperature : 40~50, C
- Bucket : Unloaded
- Engine speed : High idling

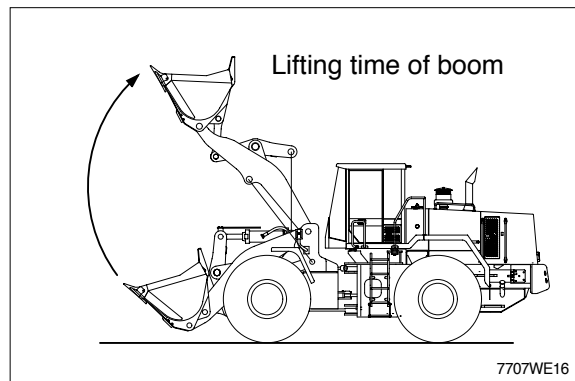
### 2. MEASURING TOOL

- Stop watch(1EA)

### 3. MEASURING PROCEDURE

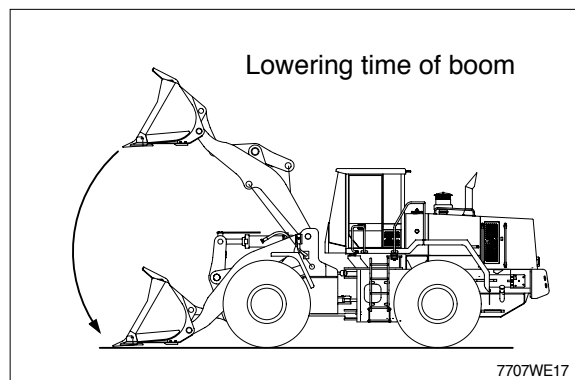
#### 1) LIFTING TIME OF BOOM

Set the bucket near the maximum tilt back position and at the lowest position on the ground. Raise the bucket and measure the time taken for bucket to reach the maximum height of the boom.



#### 2) LOWERING TIME OF BOOM

Set the bucket horizontal with the boom at the maximum height, lower the bucket and measure the taken for the bucket to reach the lowest position on the ground.

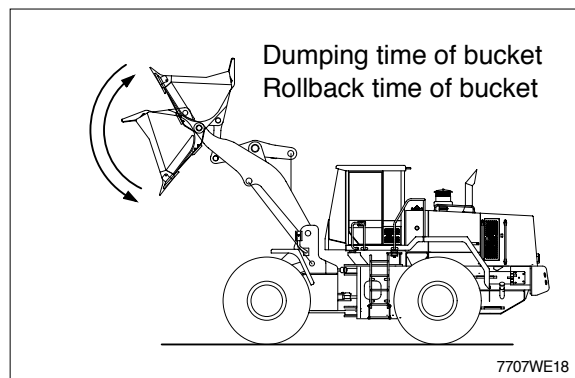


#### 3) DUMPING TIME OF BUCKET

Raise the boom to the maximum height and measure the time taken for the bucket to move from the maximum tilt back position to the maximum dump position

#### 4) ROLL BACK TIME OF BUCKET

Raise the boom to the maximum height and measure the time taken for the bucket to reach the maximum tilt back position.



## 2. TROUBLESHOOTING

Diagnose malfunction charts are arranged from most probable and simplest to verify, to least likely, more difficult to verify. Remember the following steps when troubleshooting a problem :

Step 1. Operational check out procedure (see section 1)

Step 2. Operational checks (see group 2)

Step 3. Troubleshooting

Step 4. Tests and adjustments (see group 3)

Problem	Cause	Remedy
<b>Noisy hydraulic pump</b>	Low oil supply or wrong viscosity Plugged or pinched suction line Air in oil  Plugged suction strainer Loose or missing hydraulic line clamps Hydraulic lines in contact with frame Worn or damaged pump	Fill reservoir with recommended oil. Clean or replace line. Check for foamy oil. Tighten connections. Replace O-rings and or lines. Inspect and clean strainer in reservoir. Tighten or replace clamps. Inspect and repair. Do hydraulic pump performance check in group 2. Do hydraulic pump flow test in group 3.
<b>No or Slow hydraulic functions</b>	Failed or worn hydraulic pump Cold oil Slow engine speed  Suction line air leak Low oil supply Wrong oil viscosity Oil leaking past cylinders or control valve Blocked or damaged line Faulty or misadjusted pilot oil supply unit Faulty pilot control valve(RCV)  Binding loader control valve(MCV) spool Faulty flow amplifier	Do performance check. Warm oil up. Adjust engine speed control linkage. Check high idle speed. Check for foamy oil. Add recommended oil. Use recommended oil. Check cylinder drift in group 2.  Inspect lines. Do pilot oil supply unit pressure test in group 3. Do pilot control valve(RCV) pressure test in group 3.  Inspect valve.  Check priority valve, orifice of flow amplifier specification

Problem	Cause	Remedy
<b>No steering or hydraulic function</b>	<p>Low oil level</p> <p>Failed hydraulic pump</p> <p>Failed main hydraulic pump drive</p>	<p>Add recommended oil.</p> <p>Remove and inspect return filter for metal pump particles.</p> <p>Remove main hydraulic pump and inspect drive gear.</p>
<b>No hydraulic functions steering normal</b>	<p>Failed hydraulic pump</p> <p>Failed line filter</p> <p>Faulty safety valve</p> <p>Stuck open port relief valve</p>	<p>Remove and inspect return filter for metal pump particles, or replace the pump.</p> <p>Remove and inspect line filter for RCV.</p> <p>Safety valve leakage test or ON, OFF function test.</p> <p>Replace relief valve.</p>
<b>Boom float function does not work</b>	<p>Low pilot control pressure</p> <p>Faulty pilot control valve(RCV)</p> <p>Loader control valve(MCV) spool binding in bore</p>	<p>Do pressure reducing valve pressure test in group 3.</p> <p>Replace relief valve.</p> <p>Do pressure reducing valve pressure test in group 3.</p>
<b>One hydraulic function does not work.</b>	<p>Faulty pilot control valve(RCV)</p> <p>Stuck open port relief valve</p> <p>Oil leaking past cylinder packings</p> <p>Blockage in oil lines or valve</p> <p>Loader control valve(MCV) spool stuck in bore</p>	<p>Do pilot control valve pressure test.</p> <p>Inspect and repair valve.</p> <p>Replace relief valve.</p> <p>Do boom and bucket cylinder leakage test in group 3.</p> <p>Inspect lines for damage.</p> <p>Disconnect and inspect lines for internal blockage.</p> <p>Inspect and repair valve.</p>
<b>Low hydraulic power</b>	<p>Leakage within work circuit</p> <p>Low system relief valve(main relief valve) setting</p> <p>Low port relief valve setting</p> <p>Faulty or misadjusted pilot oil supply unit</p> <p>Leaking system relief valve</p> <p>Worn hydraulic pump</p> <p>Faulty pilot control valve</p>	<p>Do cylinder drift check in group 2.</p> <p>Do loader system and port relief valve pressure test in group 3.</p> <p>Do loader system and port relief valve pressure test in group 3.</p> <p>Do pilot oil supply unit pressure test in group 3.</p> <p>Remove and inspect valve.</p> <p>Do hydraulic pump performance check in group 2.</p> <p>Do pilot control valve pressure test in group 3.</p>

Problem	Cause	Remedy
<b>Function drifts down</b>	Leaking cylinders Leaking seals in circuit relief valve(port relief valve) or valve stuck open Leaking loader control valve	Do cylinder leakage checks in group 2. Inspect seals. Replace relief valve. Repair or replace valve section.
<b>Boom drifts up</b>	Leakage in boom down spool	Remove and inspect boom down spool.
<b>Boom down does not work(Engine off)</b>	Safety valve not operated Stuck pilot control valve Faulty line filter Accumulation not operated. MCV spool stuck	Operate valve. Inspect. Remove and inspect filter. Inspect. Inspect and repair valve.
<b>Oil overheats</b>	Low oil viscosity in hot weather Excessive load Holding hydraulic system over relief Leakage in work circuit Plugged fins in oil cooler Internally plugged oil cooler Incorrect system or circuit relief valve setting Restriction in oil lines or loader valve(MCV) Pinched or restricted priority valve of steering valve "LS" line Malfunctioning steering valve Leaking system main relief valve Worn hydraulic pump(internal leakage)	Use recommended oil. Reduce load. Reduce load. Do boom and bucket cylinder leakage test in group 3. Inspect and clean oil cooler. Do hydraulic oil cooler restriction test in group 3. Do loader system and circuit relief valve pressure test in group 3. Inspect for dented or kinked lines. Do hydraulic system restriction test in group 3. Run engine at low idle. Steer machine back and forth. If engine load decreases while steering, a restricted "LS" line or priority valve of steering valve malfunction is indicated. Do priority valve of steering valve "LS" port flow test in group 3. Do hydraulic system restriction test in group 3. Remove and inspect valve and seals. Do hydraulic pump performance check in group 2.
<b>Function drops before raising when valve is activated</b>	Stuck open load check valve	Do control valve load check in group 2.

Problem	Cause	Remedy
<b>Hydraulic oil foams</b>	Low oil level Wrong oil Water in oil Loose or faulty suction lines (air leak in system)	Add recommended oil. Change to recommended oil. Change oil. Tighten or install new lines.
<b>Remote control valve (RCV) leaking</b>	Leaking plunger seals	Remove, inspect and replace plunger seals.

**Followings are general precautions for the hydraulic system and equipment.**

- 1) Every structure has its limit of strength and durability. The relief valve is installed to limit the pressure on the hydraulic equipment and protect various parts of the wheel loader from possible damage. Therefore, never change the preset pressure of the relief valve unless absolutely necessary.
- 2) Since the hydraulic equipment is built with precision, the presence of only the slightest amount of dust and / or other particles in the hydraulic circuit might cause wear and/or damage, resulting in unstable functions and/or damage, resulting in unstable functions and/or unexpected accidents. Therefore, always keep hydraulic oil clean. Periodically, check the filter in the return circuit and replace the element as necessary.
- 3) Extract about 200cc of hydraulic oil from the tank as a sample every 6 months. If possible, have it analyzed by a specialist to confirm that the oil can still be used. Never extract the oil for sampling until the oil temperature has become the normal operating temperature. Since the replacement period varies depending on operating conditions, refer to **Operator's Manual** and change oil.
- 4) Should the equipment get damaged due to the presence of metal particles and/or foreign matter in the circuit drain out the hydraulic oil and carry out flushing. Also, replace the filter element and clean the hydraulic tank. Change the hydraulic oil entirely.
- 5) When checking the filter, if found metal particles in the element, drain out the hydraulic oil entirely, flush the whole circuit, and then fill with new oil. The presence of metal particles may indicate internal damage to the equipment. In such a case, check carefully before flushing, and repair or replace as required.
- 6) To add and/or change the hydraulic oil, always use recommended oil.(Refer to the list of recommended oils and lubricants at page 1-21, **Recommended lubricants**.) Never mix oil of different makes of kinds.
- 7) To change the hydraulic oil, use a clean vessel and funnel for pouring it into the tank. Never use cloth because it might cause the presence of lint in the circuit.
- 8) When removing the hydraulic equipment, be sure to put plugs or caps on hoses, tube lines and ports. Also, enter mating marks for later identification.

- 9) Disassemble and/or assemble the hydraulic equipment only in a clean place free of dust. When disassembling, be careful about the interchangeability of parts, and clean the disassembled parts with pure and clean mineral cleansing oil. Clean the internal passages as well. After the parts have dried, wipe them off with a clean lint-free cloth.
- 10) When overhauling the hydraulic equipment replace all O-rings, backup rings, etc. with new ones. Assemble O-rings with grease or vaseline applied.
- 11) After installing the equipment, add more hydraulic oil to make up for that lost during disassembly.
- 12) Tighten joints correctly. Loose joints will cause the hydraulic oil to leak. If the oil leaks, the tank oil level drops and air gets sucked in, so the pump will break down. Also loose joints in suction lines will take air in and might cause abnormal noise, malfunction or damage to pumps.

## GROUP 3 TESTS AND ADJUSTMENTS

### 1. HYDRAULIC OIL CLEAN UP PROCEDURE USING PORTABLE FILTER CADDY

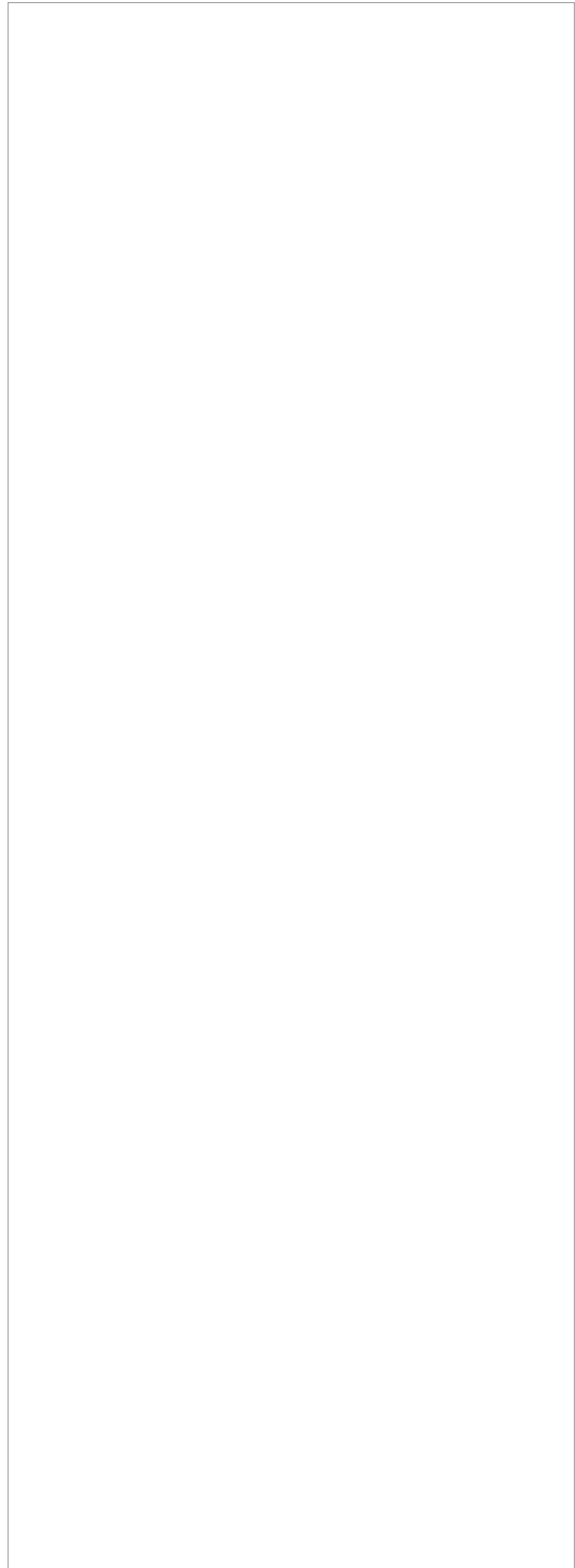
#### Service equipment and tool

- Portable filter caddy
- Two 4000mm × 1in 100R1 Hoses
- Quick disconnect fittings.
- Discharge wand
- Various size fittings.

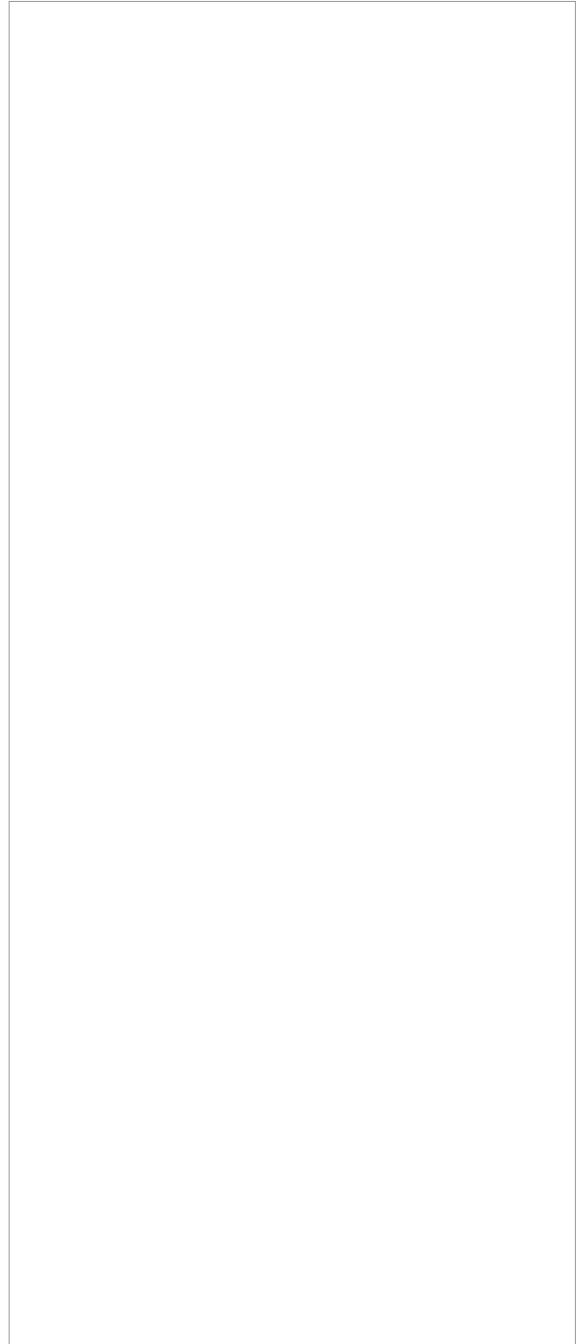
**Brake system uses oil from hydraulic oil tank. Flush all lines in the brake, pilot, steering system and cut off system. Disassemble and clean major components for brake and steering system. Remove and clean pilot caps from main control valve.**

**Brake and steering components may fail if brake and steering system is not cleaned after hydraulic oil tank contamination.**

- 1) If hydraulic system is contaminated due to a major component failure, remove and disassemble steering cylinders to clean debris from cylinders.
- 2) Install a new return filter element. Inspect filter housing before installing new element.  
**For a failure that creates a lot of debris, remove access cover from hydraulic oil tank. Drain and clean hydraulic oil tank of fill the specified oil to hydraulic oil tank through upper cover.**
- 3) To minimize oil loss, pull a vacuum in hydraulic oil tank using a vacuum pump. Connect filter caddy suction line to drain port at bottom of hydraulic oil tank using connector. Check to be sure debris has not closed drain port.
- 4) Put filter caddy discharge line into hydraulic oil tank filler hole so end is as far away from drain port as possible to obtain a thorough cleaning of oil.



- 5) Start the filter caddy. Check to be sure oil is flowing through the filters.  
Operate filter caddy approximately 10 minutes so oil in hydraulic oil tank is circulated through filter a minimum of four times.  
Hydraulic oil tank capacity : 115 (30.4U.S. gal)  
Leave filter caddy operation for the next steps.
- 6) Start the engine and run it at high idle.  
**For the most effective results, cleaning procedure must start with the smallest capacity circuit then proceed to the next largest capacity circuit.**
- 7) Operate all functions, one at a time, through a complete cycle in the following order: Clam, steering, bucket, and boom. Also include all auxiliary hydraulic functions.  
Repeat procedure until the total system capacity has circulated through filter caddy seven times, approximately 30 minutes.  
Each function must go through a minimum of three complete cycles for a through cleaning for oil.  
**Filtering time for machines with auxiliary hydraulic functions must be increased because system capacity is larger.**
- 8) Stop the engine. Remove the filter caddy.
- 9) Install a new return filter element.
- 10) Check oil level in reservoir; Add oil if necessary.

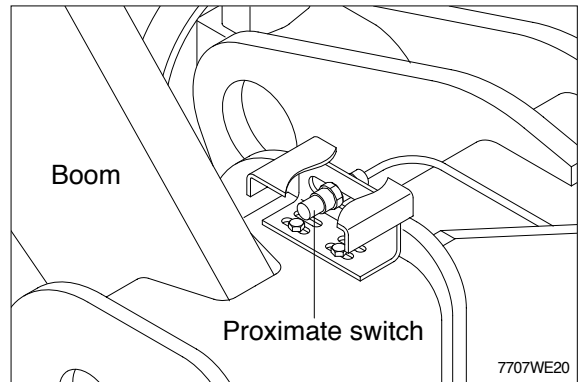


## 2. BOOM HEIGHT KICKOUT ADJUSTMENT

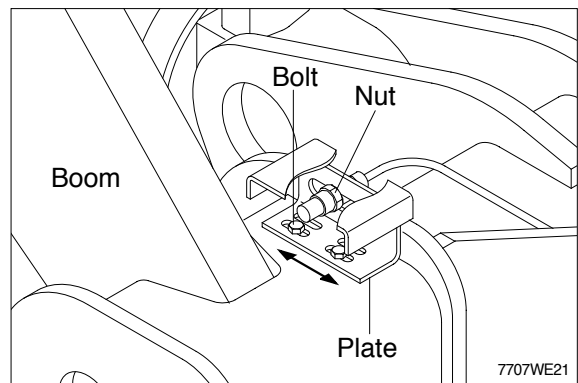
- 1) Lift the boom up to a desired height, set the boom control lever at hold, then stop the engine.

**▲ Be careful lest work equipment fall down.**

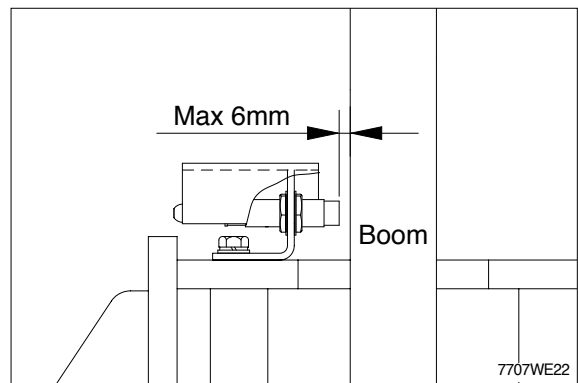
**Put the hydraulic safety lock lever in the LOCK position.**



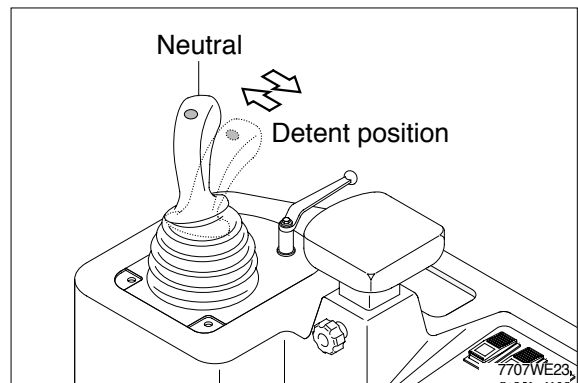
- 2) Loosen nuts and bolts then tighten them after adjusting the plate or proximate switch so that it comes in contact with the center of the probe of the proximate switch.



- 3) Loosen the nuts so that a clearance between the plate and the probe of the proximate switch are maximum 6mm.



- 4) Start the engine. Position the bucket on the ground. Then lift the bucket to a desired height by using the control lever and release the hand. Confirm the lever automatically returns to the neutral position and the boom(the bucket) stop at the adjusted position.



### 3. TEST TOOLS

#### 1) CLAMP-ON ELECTRONIC TACHOMETER INSTALLATION

- Service equipment and tools
- Tachometer

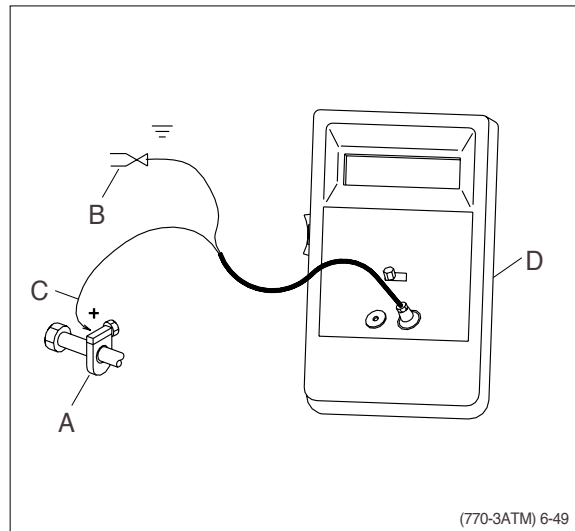
A : Clamp on tachometer.

Remove paint using emery cloth and connect to a straight section of injection line within 100mm(4in) of pump. Finger Tighten only-do not over tighten.

B : Black clip(-). Connect to main frame.

C : Red clip(+). Connect to transducer.

D : Tachometer readout. Install cable.



#### 2) DIGITAL THERMOMETER INSTALLATION

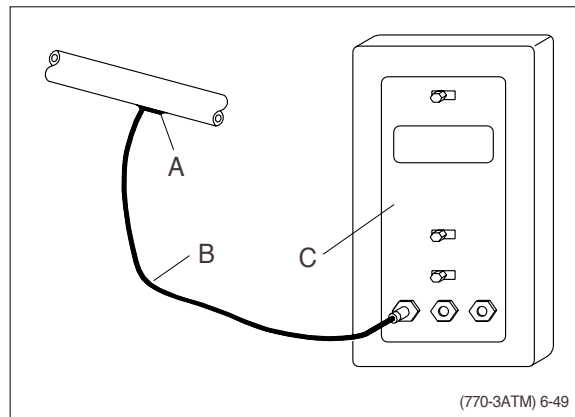
- Service equipment and tools
- Digital thermometer

A : Temperature probe.

Fasten to a bare metal line using a tie band. Wrap with shop towel.

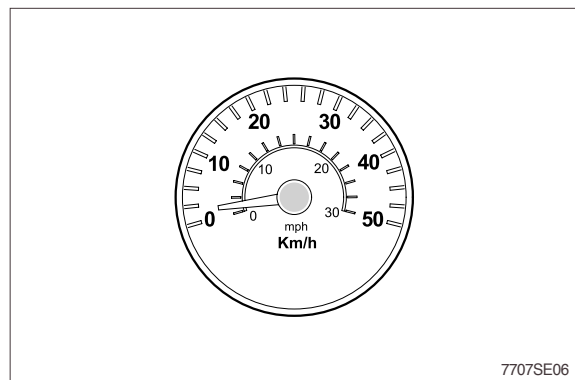
B : Cable.

C : Digital thermometer.



#### 3) DISPLAY MONITOR TACHOMETER

The display monitor tachometer is accurate enough for test work.



#### **4. HYDRAULIC OIL WARM UP PROCEDURE**

- 1) Install temperature reader(See temperature reader installation procedure in this group).
- 2) Run engine at high idle.
- 3) Hold a hydraulic function over relief to heat the oil.
- 4) Periodically cycle all hydraulic functions to distribute warm oil.
- 5) Heat oil to test specification(Approx. 50 °C).



## 5. MAIN HYDRAULIC PUMP FLOW TEST

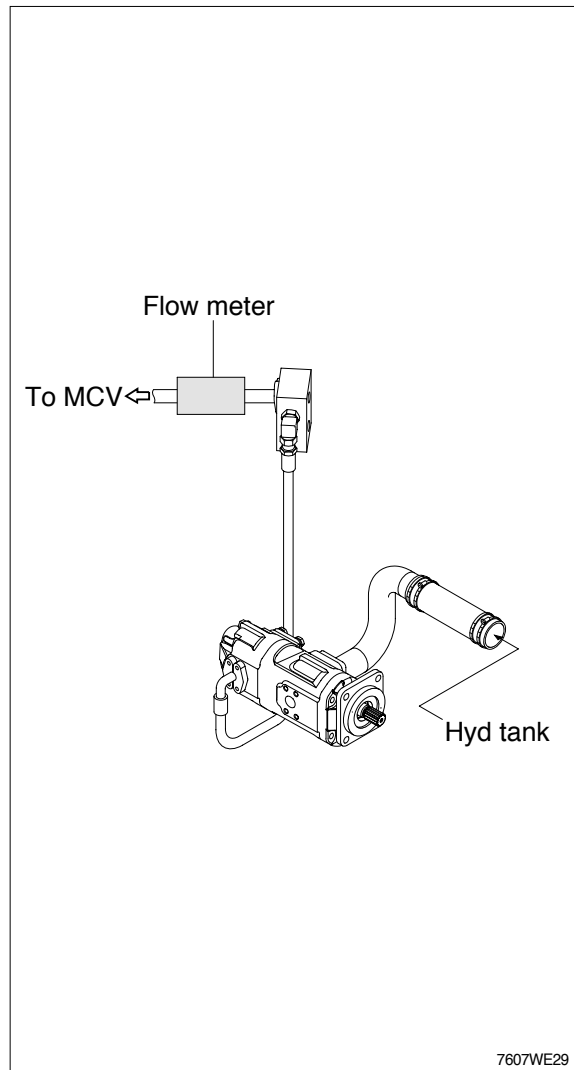
### · SPECIFICATION

Oil temperature	$45 \pm 5 \text{ }^{\circ}\text{C}$ ( $113 \pm 9 \text{ }^{\circ}\text{F}$ )
Engine speed	$2200 \pm 25 \text{ rpm}$
Test pressure	$210 \pm 5 \text{ bar}$ ( $2990 \text{ psi}$ )
Maximum pump flow	$282 \text{ l/min}$ ( $74.5 \text{ gpm}$ )

### · FLOW METER GAUGE AND TOOL

Gauge	$0 \sim 35 \text{ MPa}$ ( $0 \sim 350 \text{ bar}$ , $0 \sim 5000 \text{ psi}$ )
Temperature reader	

- 1) Make test connections.
- 2) Install temperature reader.  
(See temperature reader installation procedure in this group)
- 3) Heat hydraulic oil to specifications.  
(See hydraulic oil warm up procedure in this group)
- 4) Run engine at test specifications.
- 5) Close flow meter loading valve to increase pressure to test specifications.
- 6) Read flow meter.
- 7) If flow is below specifications, check suction line and suction pressure for abnormality before removing pump.



## 6. LOADER SYSTEM AND PORT RELIEF VALVE PRESSURE TEST

### · SPECIFICATION

Oil temperature (40~50 ℃)

Relief valve	Engine speed	Relief pressure
System(M)	High	210 ± 5kg/cm <sup>2</sup> (2987 ± 70psi)
Boom raise(U)	Low	240 ± 5kg/cm <sup>2</sup> (3414 ± 70psi)
Bucket rollback(R)	Low	240 ± 5kg/cm <sup>2</sup> (3414 ± 70psi)
Bucket dump(D)	Low	240 ± 5kg/cm <sup>2</sup> (3414 ± 70psi)

### · Gauge and tool

Gauge 0~35MPa(0~350bar, 0~5000psi)

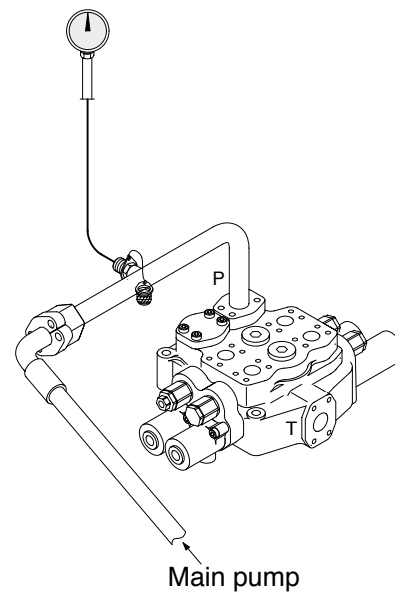
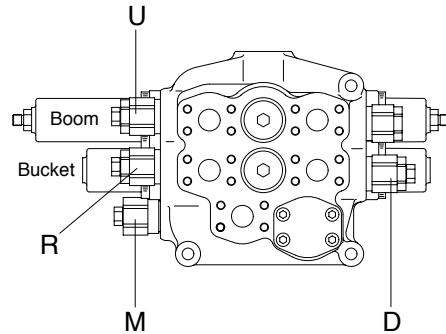
M : System(Main) relief valve

R : Bucket rollback relief

D : Bucket dump relief

U : Boom raise relief

- 1) Install fitting and pressure gauge to test port in pump delivery line.
- 2) Install temperature reader.  
(See temperature reader installation procedure in this group)
- 3) Heat hydraulic oil to specifications.  
(See hydraulic oil warm up procedure in this group)
- 4) To check the system relief(M), run engine at high idle. Lower boom to bottomed position.  
Slowly activate boom down function while watching pressure gauge. If pressure is not to specification, loosen lock nut on system relief valve(M) and adjust to specification.



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**Do not adjust the system relief valve above 250kg/cm<sup>2</sup>(3560psi). Damage to the pump will result from excessive pressure settings.**

- 5) To check the bucket dump, bucket rollback, and boom raise, adjust the system relief valve to 250kg/cm<sup>2</sup> (3560psi).

Run engine to maintain 800 ~ 850 rpm when hydraulic function is activated over relief.

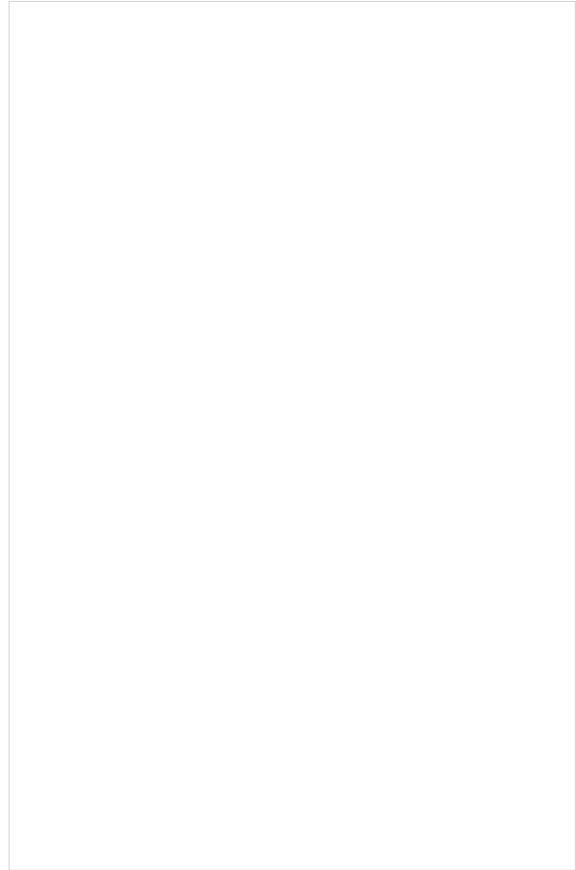
Activate the function to be checked with the cylinder bottomed. Read the pressure gauge.

If pressure is not to specification cycle relief valve over relief 10 times to flush.

Read pressure gauge again. Turn screw to adjust valve to specification.

**Do not work machine with system relief adjusted above specification or structural damage may occur.**

- 6) Adjust system relief valve to specification.



## 7. HYDRAULIC SYSTEM RESTRICTION TEST

### · SPECIFICATION

- Oil temperature  $45 \pm 5$  °C (113 ± 9 °F)  
Engine speed High idle  
Maximum pressure 2MPa(20bar, 285psi) at steering valve(EHPS).  
Maximum pressure at main control valve  
1MPa(10bar, 145psi)

### · GAUGE AND TOOL

Gauge 0~7MPa(0~70bar, 0~1000psi) 2EA  
This test will check for restrictions in the hydraulic system which can cause overheating of hydraulic oil.

- 1) Install temperature reader.  
(See temperature reader installation procedure in this group)
- 2) Heat hydraulic oil to specifications.  
(See hydraulic oil warm up procedure in this group)
- 3) Connect fitting and gauge to steering valve.
- 4) Connect fitting and gauge to main control valve.

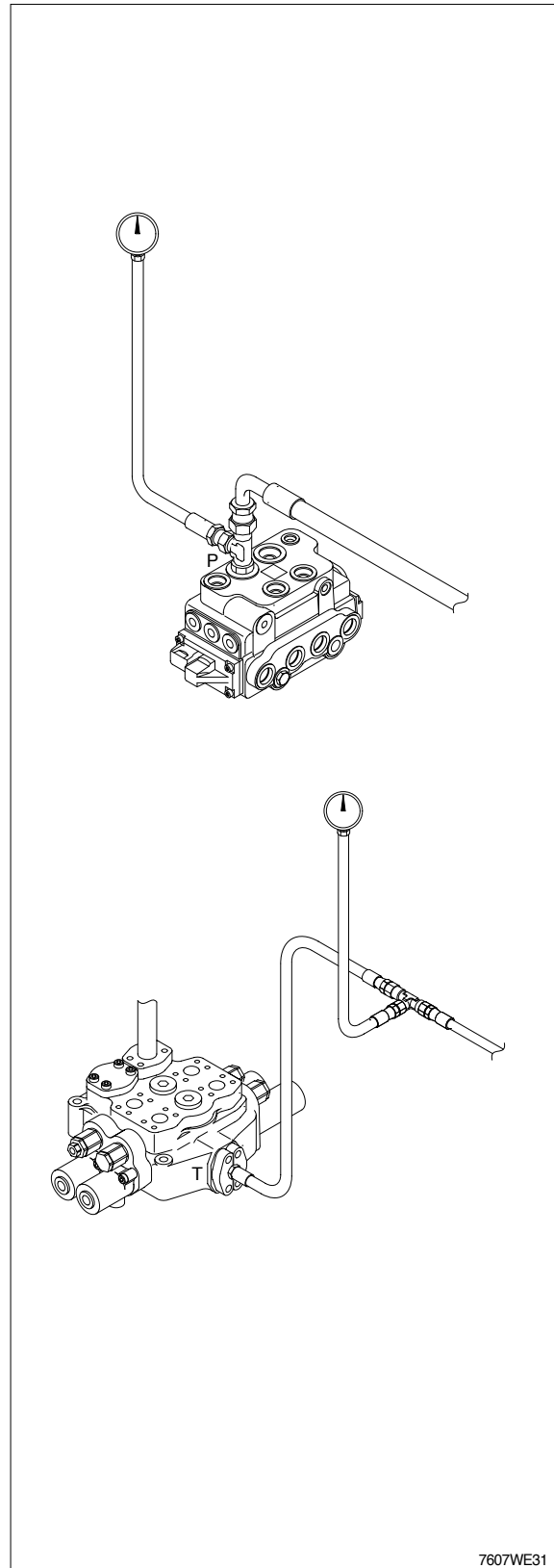
**▲ Do not operate steering or loader functions or test gauge may be damaged.**

- 5) Run engine at specification and read pressure gauges.

If pressure is more than specification at the loader control valve, check for a kinked, dented or obstructed hydraulic line. Check loader control valve for a binding spool.

If pressure is more than specification at the steering unit, inspect neutral condition of the steering unit and steering valve for a stuck spool. Make sure orifice plugs are installed in ends of priority valve spool.

Check for plugged orifice in priority valve "LS" port and dynamic signal orifice on steering valve body.



## 8. LOADER CYLINDER DRIFT TEST

### · SPECIFICATION

Oil temperature  $45 \pm 5$  C ( $113 \pm 9$  F)

Boom horizontal

Bucket horizontal

Bucket unloaded

Item	Standard value
Retraction of boom cylinder rod	40mm
Retraction of bucket cylinder rod	50mm

### · GAUGE AND TOOL

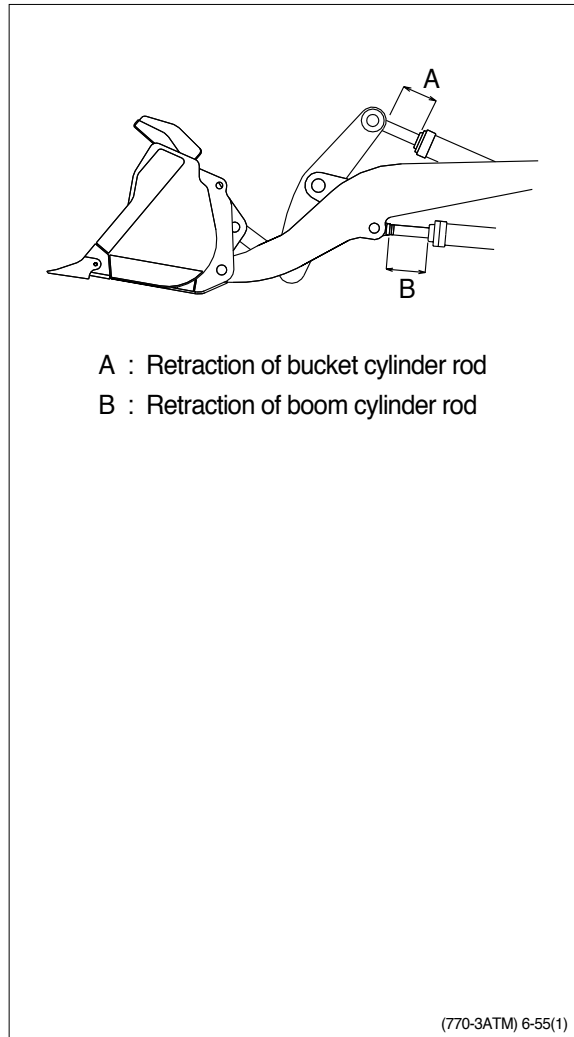
Stop watch

Temperature reader

**▲ Put the safety lock lever in the lock position.**

**▲ Do not go under the work equipment.**

- 1) Set the boom and bucket horizontal, then stop the engine.
- 2) Stop the engine, wait for 5 minutes, then start measuring.
- 3) Measure the amount the boom and bucket cylinder rods retract during 15 minutes.



## 9. BOOM AND BUCKET CYLINDER LEAKAGE TEST

### · SPECIFICATION

Oil temperature	45 ± 5 °C (113 ± 9 °F)
Engine speed	Low idle
Maximum leakage	15 ml /min (1/2 oz/min)

### · GAUGE AND TOOL

Temperature reader  
Stop watch  
Measuring container

- 1) Fasten temperature sensor to head end port of cylinder to be tested. Cover sensor with a shop towel.
- 2) Heat hydraulic oil to specifications (See hydraulic oil warm up procedure in this group).

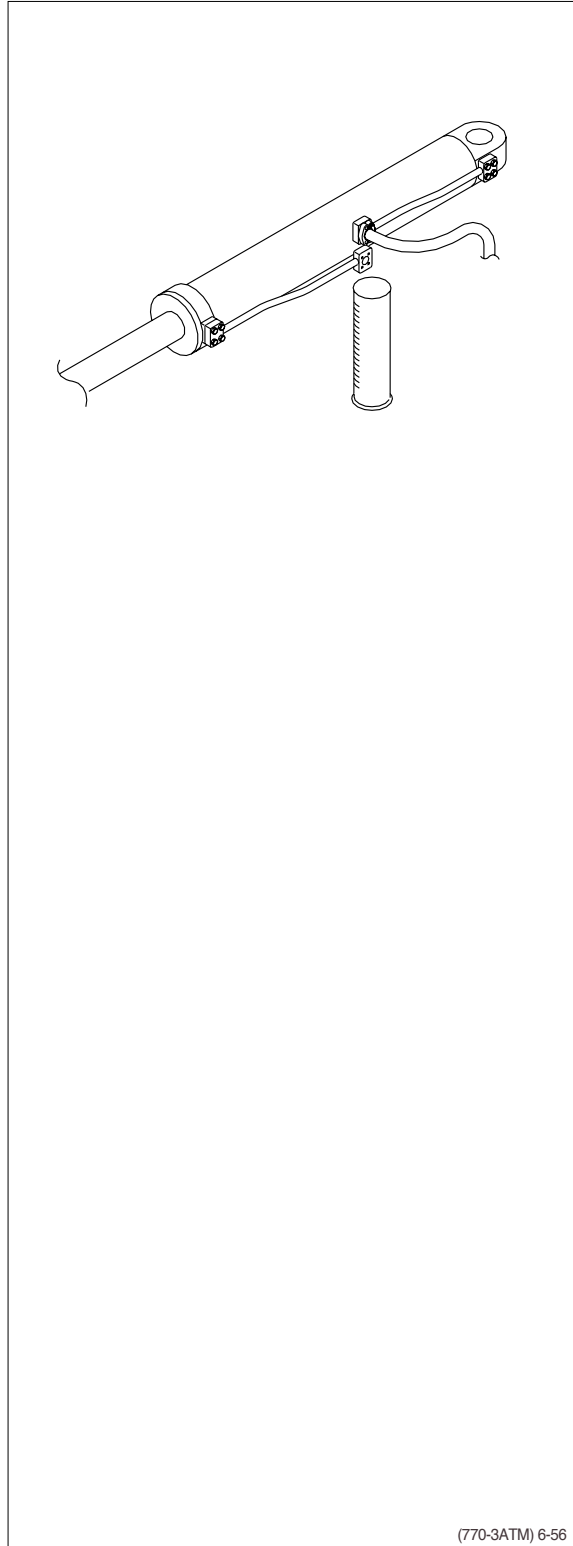
**▲ Never work under raised equipment unless it is supported with a hoist or support stands.**

- 3) Fully extend the cylinder to be tested. If testing the boom cylinders, restrain boom in the fully raised position using a hoist or a stand.

**Check cylinders for leakage in the fully extended position only. In the retracted position contacts the end of the cylinder and seals off piston seal leakage.**

- 4) Remove and plug cylinder rod end hose or line.
- 5) Run engine at slow idle. Activate control lever to extend cylinder for 1 minute over relief while measuring leakage for open port.

If leakage is within specification, excessive cylinder drift is caused by leakage in the loader control valve or circuit relief valve.



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## 10. PILOT CONTROL VALVE PRESSURE TEST

### · SPECIFICATION

Oil temperature  $45 \pm 5 \text{ }^{\circ}\text{C}$  ( $113 \pm 9 \text{ }^{\circ}\text{F}$ )

Engine speed Low idle

Begin metering  $1/4"$  of lever travel

Pressure in detent :

Boom float detent 1.9MPa( 19bar)

Pressure at feel position :

Boom power down 19~22bar

Boom raise 19~22bar

Bucket rollback 19~22bar

Bucket dump 19~22bar

### · GAUGE AND TOOL

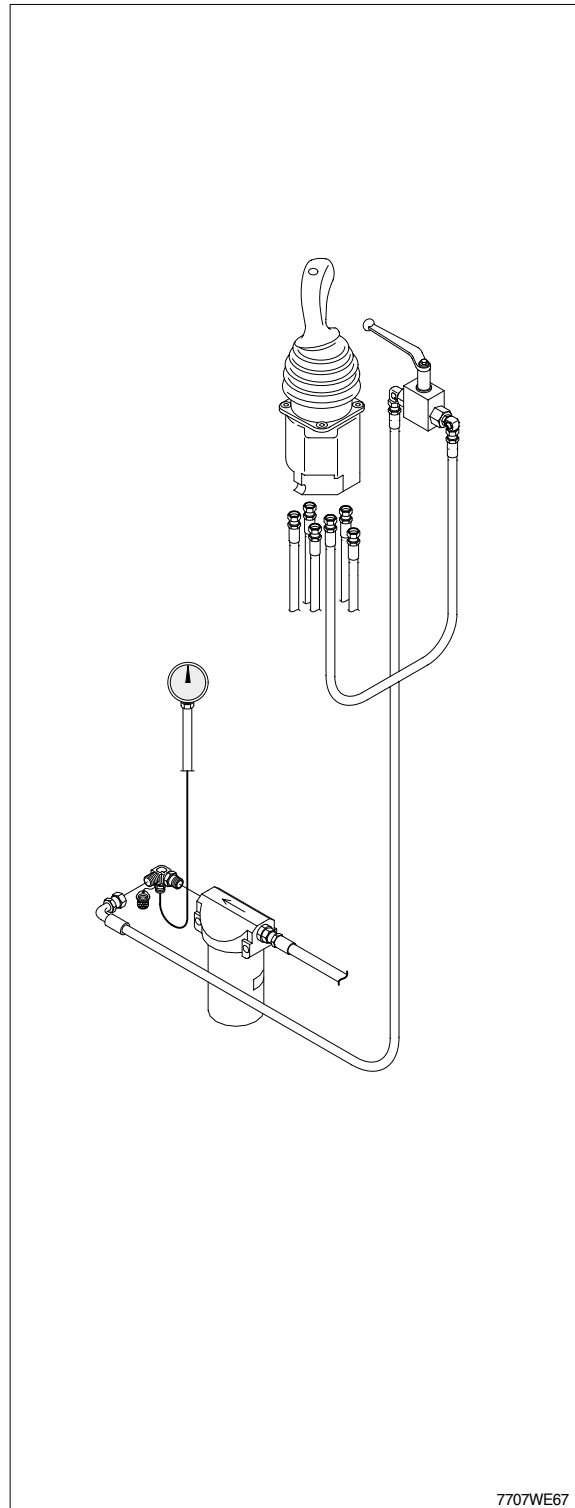
Gauge 0~7MPa(0~70bar, 0~1000psi)

As the control lever is moved from neutral, the pilot pressure will suddenly jump up to approximately 5.8bar at  $1/4$ in. travel. The pressure should then increase smoothly to the specification at the FEEL position(Or  $3/4$  lever travel), and then jump up about 430psi as the lever is moved into detent.

This test will determine if adequate pilot pressure is available to move the loader control valve spools.

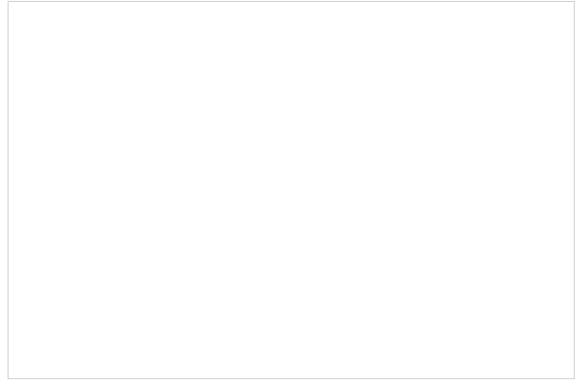
**The FEEL position is when lever is moved to feel the ramp of the detent before lever passes into detent position.**

- 1) Lower boom to ground.
- 2) Connect gauge to the pilot pressure port of function to be checked.
- 3) Install temperature reader(See temperature reader installation procedure in this group).
- 4) Heat hydraulic oil to specification(See hydraulic oil warm up procedure in this group).



5) Run engine at specification. Activate function to be checked and record pressure reading.

**If boom raise or bucket rollback FEEL positions are not operation due to boom or bucket position, plug boom float detent wires into bucket leveler solenoid or boom height kickout solenoid. This will provide a feel position on the control lever.**



## 11. PILOT OIL SUPPLY UNIT PRESSURE TEST

### · SPECIFICATION

Oil temperature  $45 \pm 5$  °C ( $113 \pm 9$  °F)

Engine speed Low idle and stop

Pilot pressure setting

30~35bar(430~500psi)

Relief valve setting pressure 45bar

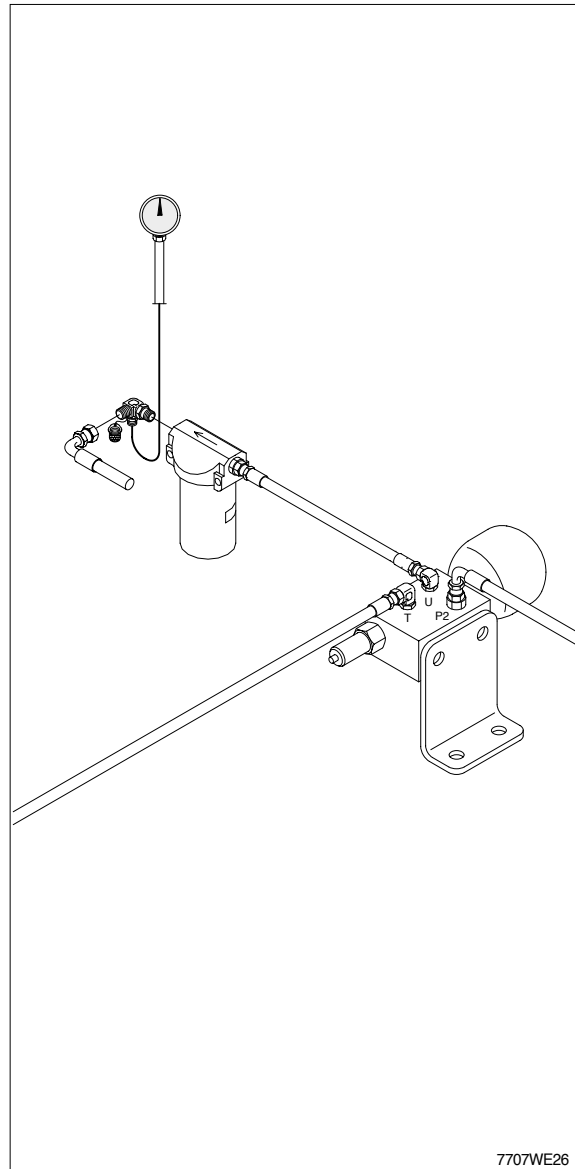
· Accumulator precharging pressure 16bar

### GAUGE AND TOOL

Gauge 0~7MPa(0~70bar, 0~1000psi)

The pilot supply unit consist of the pressure reducing valve, the relief valve and an accumulator. This regulates pressure to the pilot control circuit.

- 1) Connect gauge to test port on the screw coupling.
- 2) Install temperature reader(See temperature reader installation procedure in this group).
- 3) Heat hydraulic oil to specification(See hydraulic oil warm up procedure in this group).
- 4) Run engine at low idle for 1 minute and stop engine, wait for 5 minutes. Then start measuring.
- 5) If pressure in not within specifications, replace valve.



## 12. CYCLE TIME TEST

### · SPECIFICATION

Oil temperature -----  $45 \pm 5$  °C ( $113 \pm 9$  °F)

Engine speed ----- High idle

Function	Operating conditions	Maximum cycle time(seconds)
Boom raise	Bucket flat on ground to full height	6.7
Boom lower(float)	Full height to ground level	3.5
Bucket dump	Boom at full height	1.7
Bucket rollback	Boom at full height	2.4
Steering(Number of turns)	Frame stop to stop	2.7(4 turns)

Hydraulic pump performance cycle time.

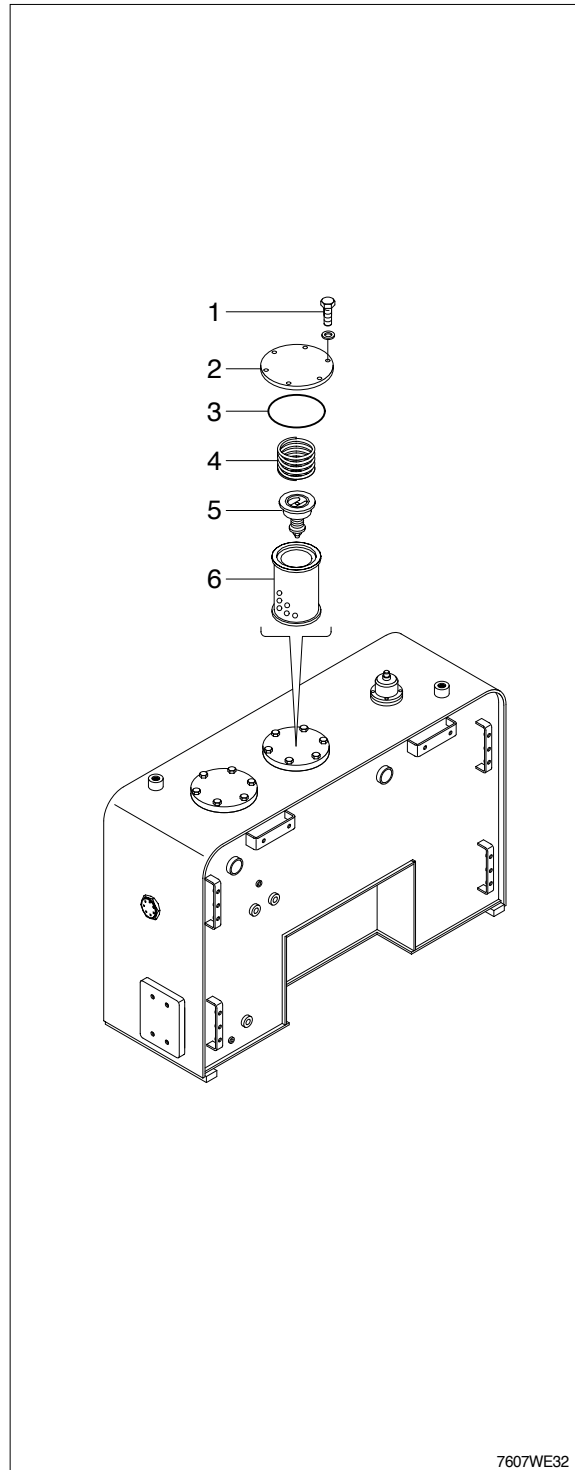
Function	Operating conditions	Maximum cycle time(seconds)
Boom raise	Bucket flat on ground to full height while holding steering over relief	8.0

### 13. HYDRAULIC OIL FILTER INSPECTION PROCEDURE

- 1) Lower the bucket to the ground, stop the engine, move the control lever back and forth several times, and clean all over the upper surface of the hydraulic oil tank.
- 2) Remove the bolts(1) and take out the filter case cover(2) and O-ring(3).
- 3) Remove the spring(4) and bypass valve(5).
- 4) Remove the filter element(6) from the tank.
- 5) Check the element and the filter case bottom for debris. Excessive amounts of brass and steel particles can indicate a failed hydraulic pump or a pump failure in process. A rubber type of material can indicated cylinder packing or other packing failure.

**The hydraulic oil filter in the filter case of the hydraulic oil tank should be replaced every 250 operating hours or more often. When the filter element is replaced, please keep as follows.**

- (1) Clean the inside of the filter case.
- (2) Place new element in the proper positions inside the filter case.
- (3) Install the bypass valve and spring. Make sure the element stand upright, and check for complete contact of the element bottom with the filter case bottom.
- (4) Install the O-ring and filter case covers. Tighten them with bolt. Replace the O-ring with new one if damaged.sa

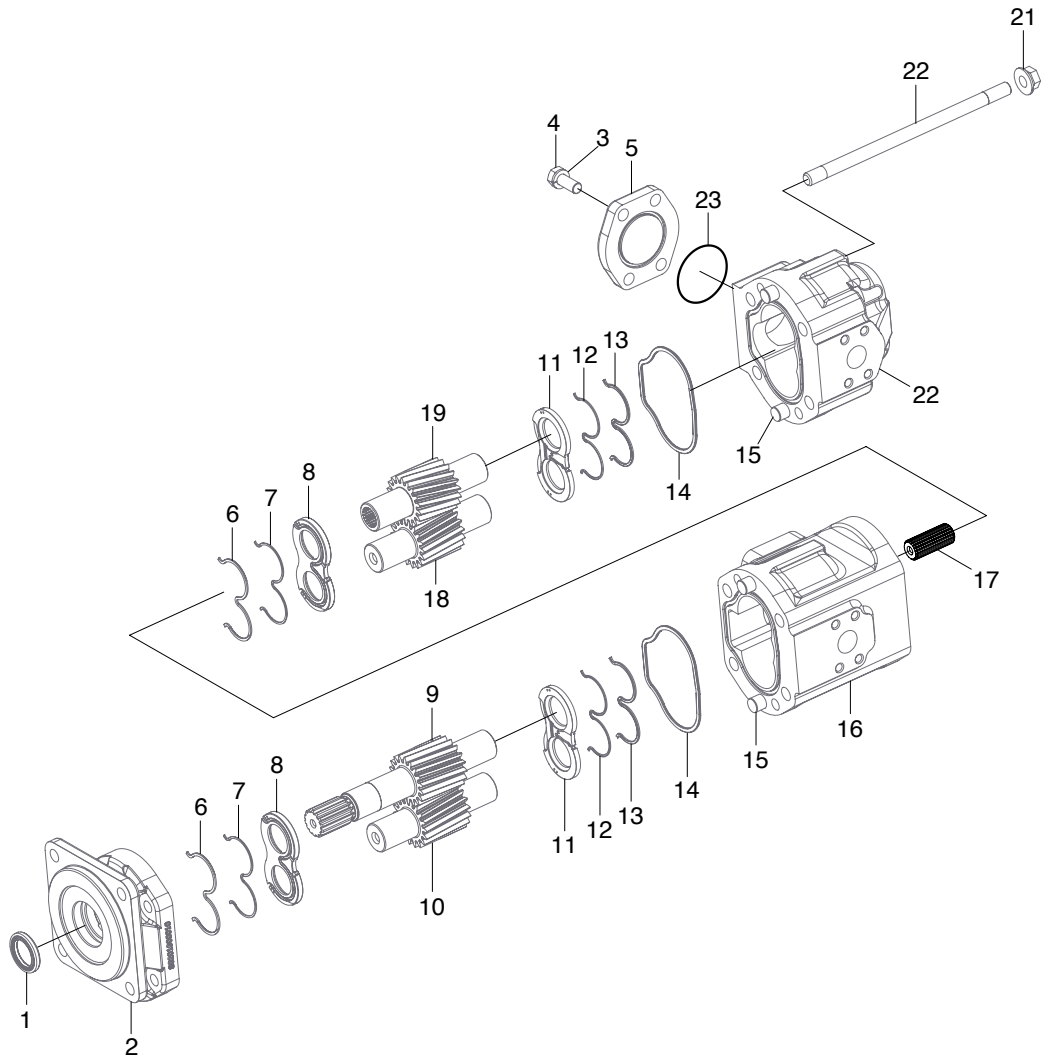


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## GROUP 4 DISASSEMBLY AND ASSEMBLY

### 1. MAIN PUMP

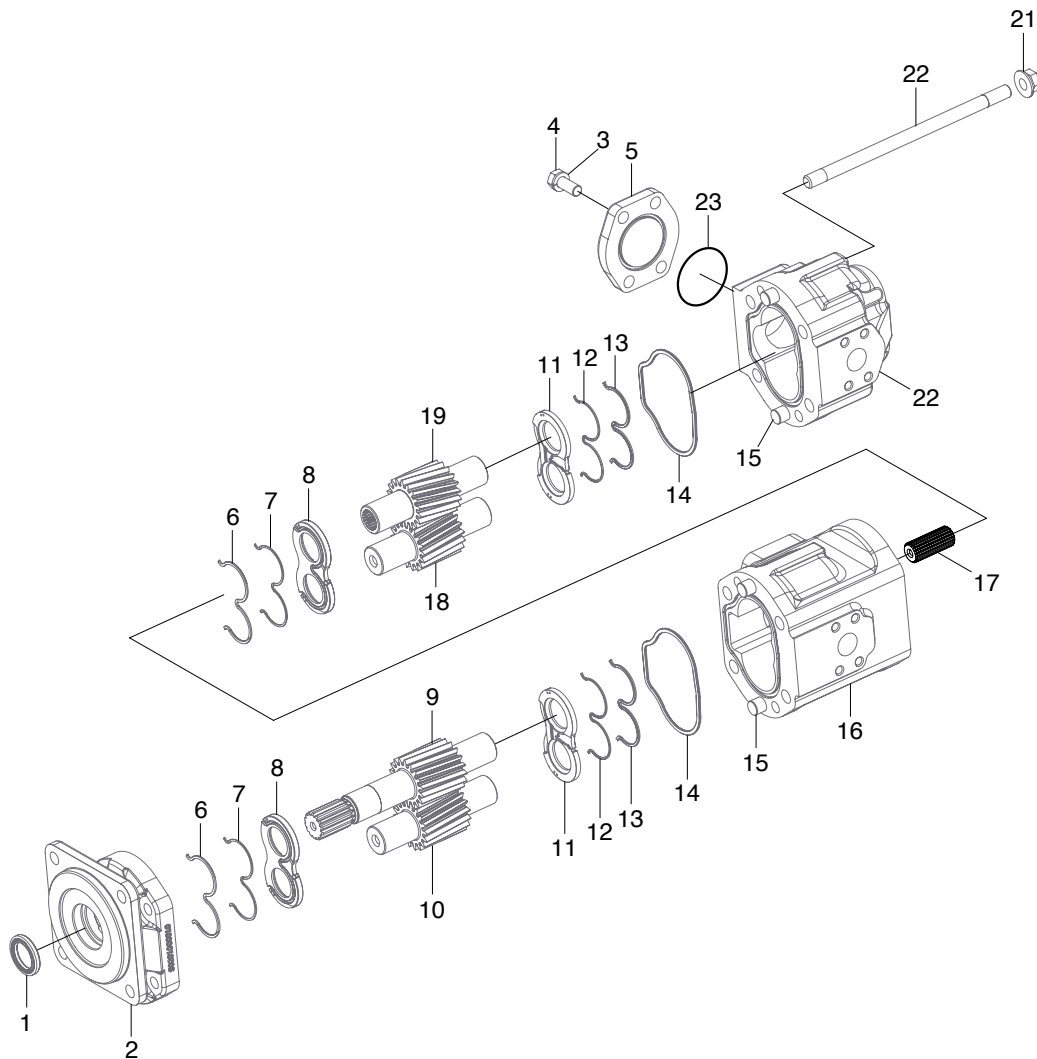
#### 1) STRUCTURE



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- |   |              |    |                   |    |                  |
|---|--------------|----|-------------------|----|------------------|
| 1 | Shaft seal   | 9  | Front drive gear  | 17 | Spline coupling  |
| 2 | Adapter      | 10 | Front driven gear | 18 | Rear driven gear |
| 3 | Washer       | 11 | Wearplate         | 19 | Rear drive gear  |
| 4 | Bolt         | 12 | O-ring seal       | 20 | Stud             |
| 5 | Flange       | 13 | Back up seal      | 21 | Flanged nut      |
| 6 | Back up seal | 14 | Interface seal    | 22 | Rear body        |
| 7 | O-ring seal  | 15 | Dowel             | 23 | O-ring           |
| 8 | Wearplate    | 16 | Front body        |    |                  |

## 2) DISASSEMBLY



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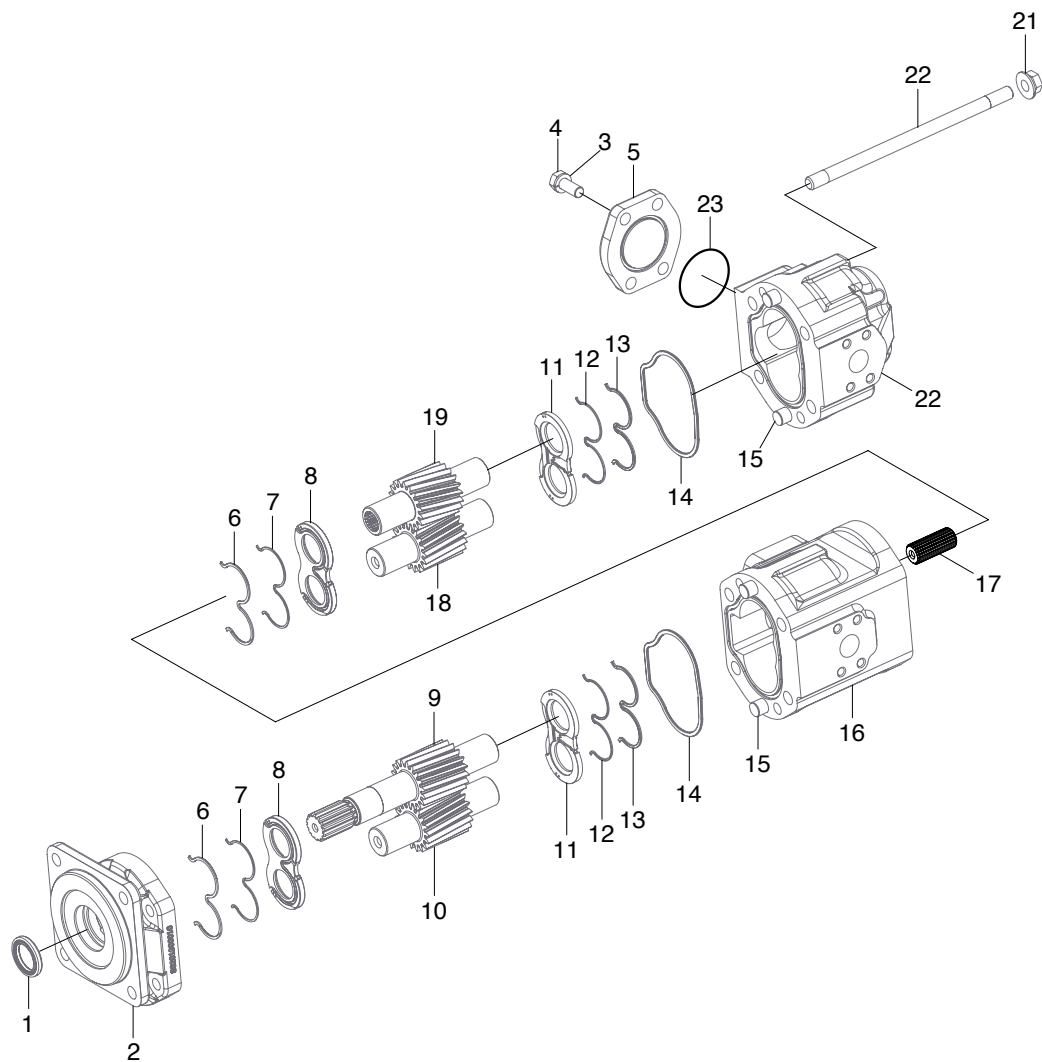
Plug all ports prior to cleaning and disassembling pump to prevent ingress of debris or contamination.

Clean the pump thoroughly with a solvent, ensuring no loose debris or contamination remains on the unit.

Mark each interface and then separate into individual pump sections.

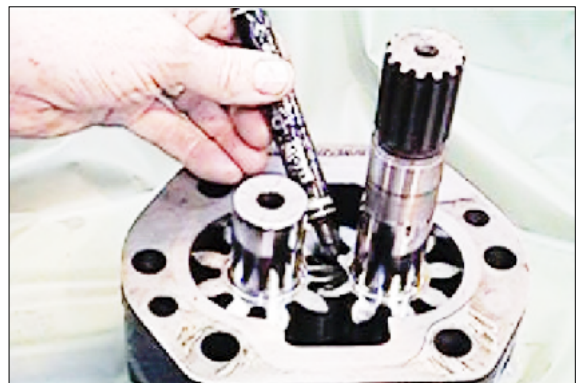
- (1) Securely clamp pump horizontally on one port face, ensuring that no damage is sustained to the port face and remove the stud(20) and nut(21).
- (2) Remove the front adaptor(2) from the body(16) using a pulling tool centred on the drive shaft(9).  
Under **NO** circumstances attempt to prise or chisel cover from body as such action could damage the machined sealing faces.
- (3) Remove and discard the shaft seal(1) from adaptor making sure that no damage is sustained to the surface of the seal bore.
- (4) Unclamp pump and place it vertically with drive shaft up.
- (5) Before removing wearplate from the body mark it using a soft pencil or a felt-tip pen to ensure correct reassembly. Remove wearplate(8) complete with O-ring seal(7) and back up seal(6).

## DISASSEMBLY



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- (6) Mark the gears using a soft pencil or felt-tip pen to ensure assembly in the same relative position, see figure on the right, then withdraw the drive shaft/gear(9) and driven gear(10) separately to prevent jamming.
- (7) Again, to ensure correct assembly, mark remaining wearplate(11) using a soft pencil or a felt-tip pen. Remove wearplate from body complete with O-ring seal(12) and back up seal(13).
- (8) Discard interface seal(14).
- (9) Having separated into individual pumps, proceed as per paragraph (1)~(7).



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### 3) MANDATORY REPLACEMENT PARTS

Discard all seals including interface seals, shaft seals, wear plate seals and back up seals. Fit new seals on reassembly. Wearplates should also be replaced with new items from seal kit.

### 4) HANDLING/STORAGE

While disassembling pump, ensure no surfaces are scored or marked in any way. A rubber surfaced table will be beneficial. All components must be placed in a clean, dry and safe area. Leakage will be created by scratches on components. If parts are to be left for any period ensure they are not exposed to dirt, dust and corrosion. Keep gears separate from each other in protective boxes.

### 5) INSPECTION OF PARTS

Wash all parts in a solvent and dry.

#### (1) Adaptor housing and cover

The pump must be replaced if the damage listed is present.

Feature	Damage
Surfaces	Corrosion, nicks or burrs(slight burrs can be removed using and india stone)
Machined sealing Interfaces	Scores, cracks or corrosion
Bearing	Loose

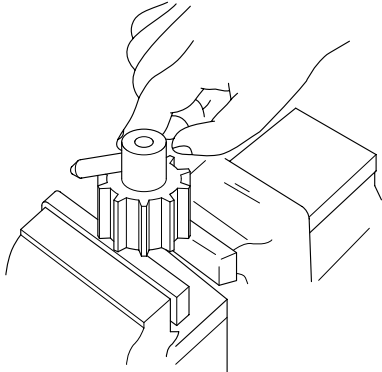
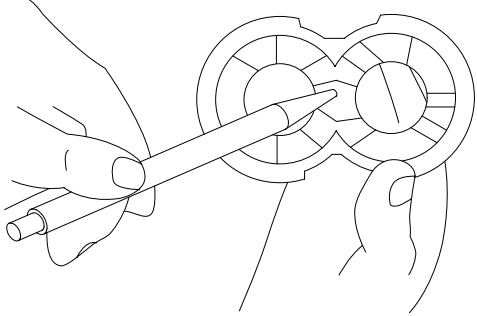
#### (2) Gears

The pump must be replaced if the damage listed is present.

Feature	Damage
Surfaces	Corrosion, nicks or burrs(slight burrs can be removed using an India stone). Wear due to seal(s)
Journals	Pitting, wear, sufficient wear to change outside diameter
Tooth	Cracks or heavy scoring or chipped
Splines/keyways	Distortion of wear
End faces	Wear, cracks

**(3) Floating wear plates**

The pump must be replaced if the damage listed is present.

Feature	Damage
Surfaces	Corrosion, nicks or burrs, amounts of scoring, erosion or any cracks, discoloration caused by overheating
 <p>Removing burrs or minor scoring from end faces and teeth of the gears.</p>	 <p>Scoring of wear plate.</p>

**(4) Bolts/Studs**

The pump should be replaced if the damage listed is present.

Feature	Damage
Surfaces	Corrosion, nicks or burrs (slight burrs can be removed using an India stone), cracks or scoring, distortion or damage to thread form

**(5) Plain bearings**

The pump must be replaced if the damage listed is present.

Feature	Damage
Surfaces	Cracks or scoring
PTEF Coating	Worn-bronze, sub-layer showing
Bearing	Loose in housing/cover

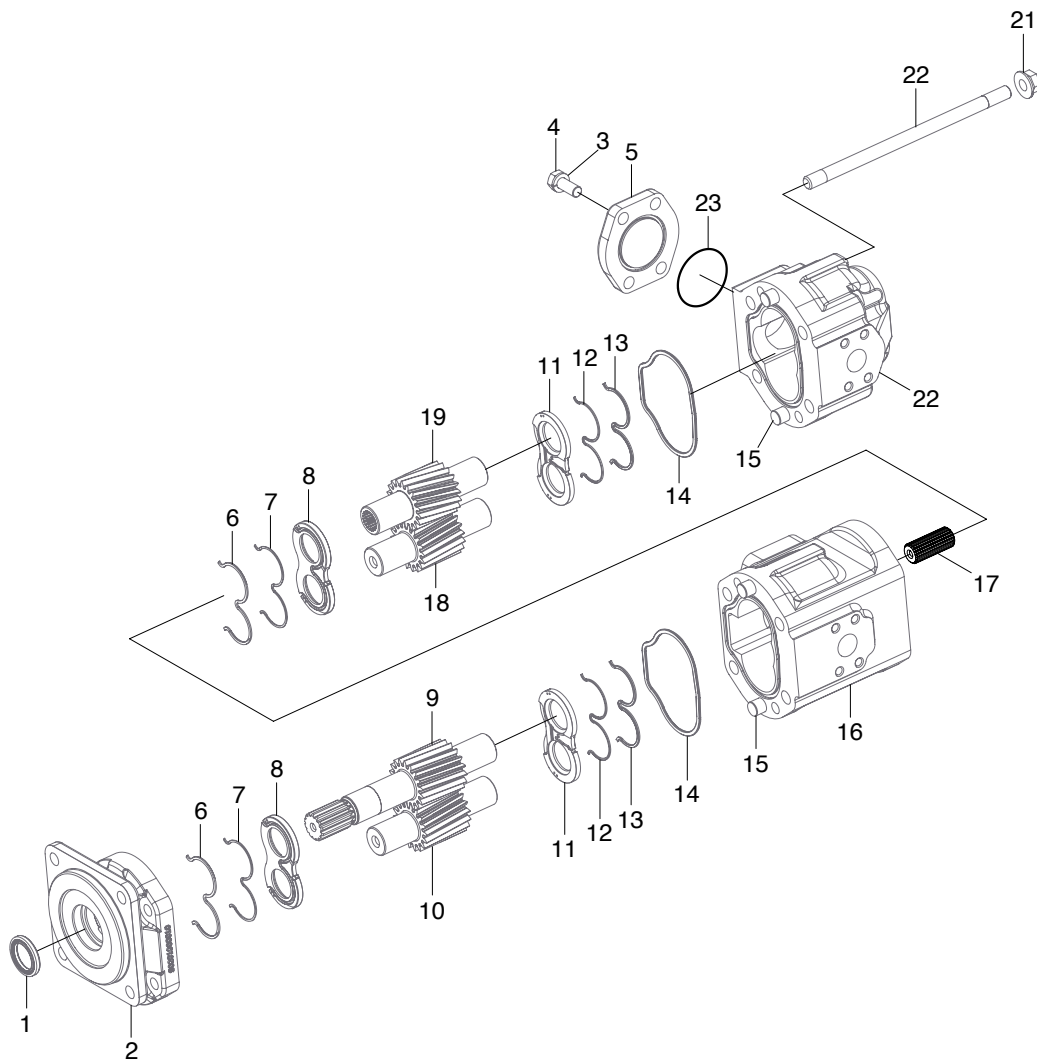
**(6) Coupling**

This must be replaced if damage listed is present.

Feature	Damage
Surfaces	Corrosion, nicks or burrs, erosion, cracks or pitting
Splines	Distorted or badly worn



## ASSEMBLY

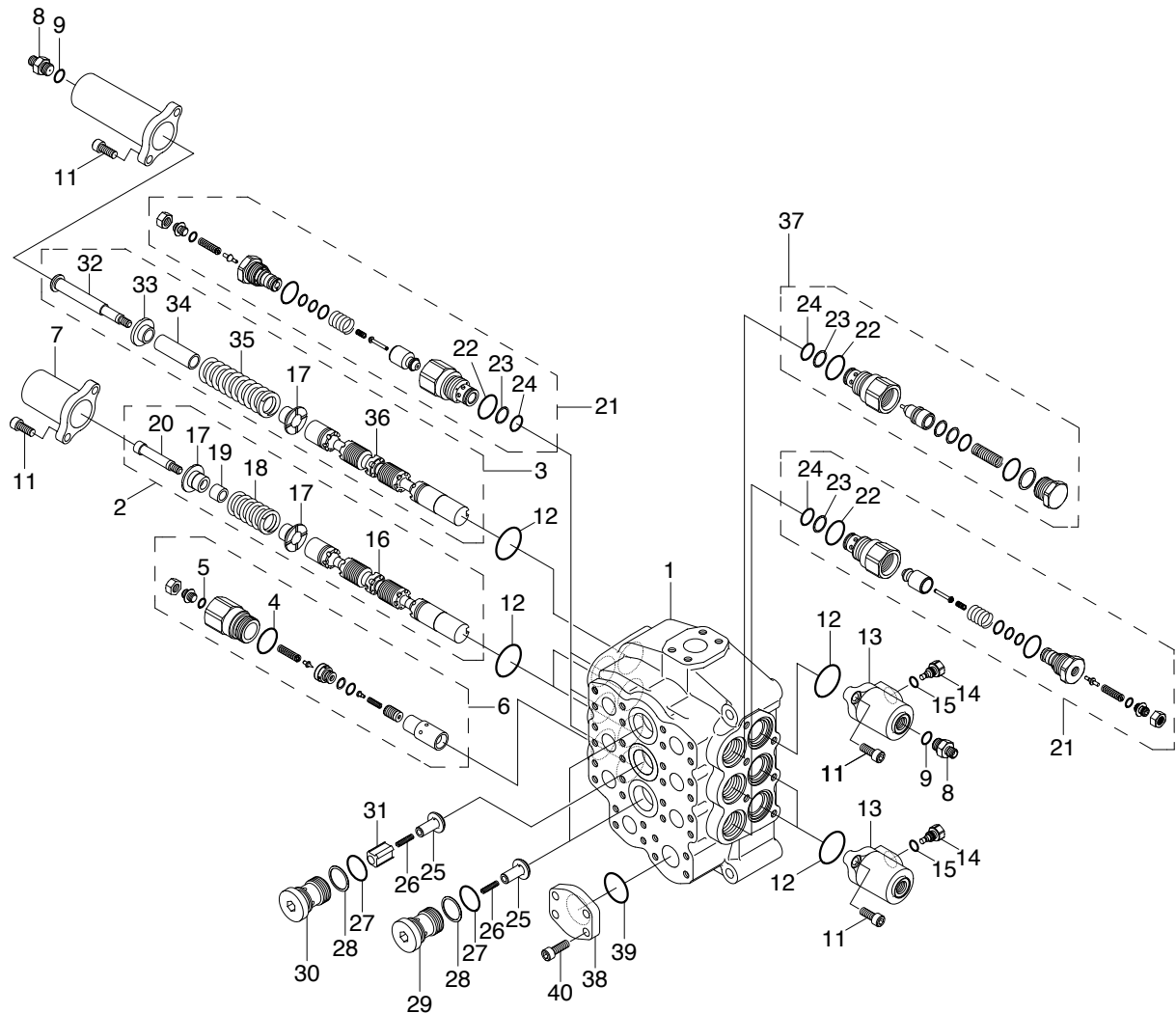


7607WE33

- (5) Fit new interface seal(14) into groove in body.
- (6) Proceed as per paragraph(1)~(5).
- (7) Fit adaptor(2) over the drive gear(9) and fit stud(22).
- (8) Securely clamp unit and tighten nut(21) to half torque and then full torque.
  - Tightening torque : 23.2kgf · m(168lbf · ft)
- (9) Fit shaft seal(1) using appropriate tooling, in correct position and orientation.
- (10) Pour a little clean hydraulic oil into the ports.

## 2. MAIN CONTROL VALVE

### 1) STRUCTURE



7607WE35

1	Housing assembly	15	O-ring	28	Back up ring
2	Plunger assembly	16	Plunger	29	Cap
3	Plunger assembly	17	Guide	30	Cap
4	O-ring	18	Spring	31	Check
5	O-ring	19	Spacer	32	Cap
6	Main relief assembly	20	Nipple	33	Guide
7	Cover	21	Port relief assembly	34	Spacer
8	Nipple	22	O-ring	35	Spring
9	O-ring	23	Back up ring	36	Plunger
10	Cover	24	O-ring	37	Make up assembly
11	Socket bolt	25	Check	38	Cover
12	O-ring	26	Spring	39	O-ring
13	Cover	27	O-ring	40	Bolt
14	Plug				

## 2) GENERAL PRECAUTIONS

- (1) Clean room with no dust is recommended for maintenance. Because hydraulic components are precision, and have minute clearance. Tool and wash-oil must be clean, too. Handle them carefully.
- (2) At removing control valve from the machine, wash around the piping port, and neither dust nor water should go into inside with plugging. It is same at attaching the machine.
- (3) Prepare the required parts by checking structure figure before assembly. There are parts which are supplied with only sub-assembly part, so check the parts list before assembly.

## 3) PRECAUTIONS FOR DISASSEMBLY

- (1) Handle the components carefully not to drop them or bump them with each other as they are made with precision.
- (2) Do not force the work by hitting or twisting as burred or damaged component may not be assembled or result in oil leakage or low performance.
- (3) When disassembled, tag the components for identification so that they can be reassembled correctly.
- (4) Once disassembled, O-ring and back-up rings are usually not to be used again.(Remove them using a wire with its end made like a shoe-horn. Be careful not to damage the slot)
- (5) If the components are left disassembled or half-disassembled, they may get rust from moisture or dust. If the work has to be interrupted, take care to prevent rust and dust.

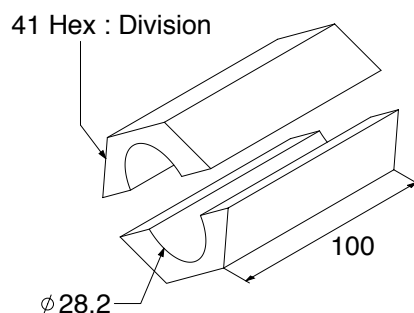
## 4) PRECAUTIONS FOR REASSEMBLY

- (1) Take the same precautions as for disassembly.
- (2) When assembling the components, remove any metal chips or foreign objects and check them for any burrs or dents. Remove burrs and dents with oil-stone, if any.
- (3) O-rings and back-up rings are to be replaced with new ones, as a rule.
- (4) When installing O-rings and back-up rings, be careful not to damage them. (Apply a little amount of grease for smoothness)
- (5) Tighten the bolts and caps with specified torque.

## 5) SPECIAL TOOL

### · HOLDER

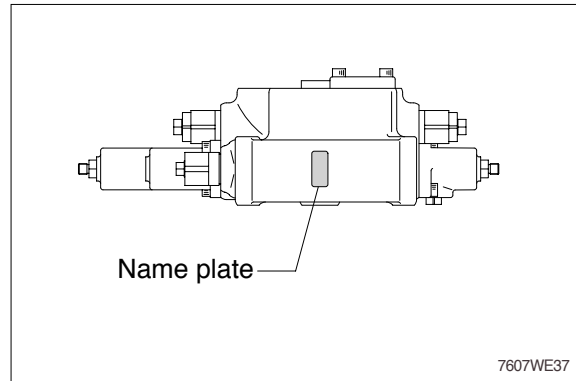
Material : copper



### Regarding to change the main plunger

We can not supply the main plunger, because the plunger is fit for valve housing.

So, do not change the plunger at the field. If changing plunger must be needed, then tell us model name of control valve and serial number written at its nameplate.



## 6) BUCKET PLUNGER AND ACCESSORY PLUNGER

Reassemble in the opposite order to disassemble.

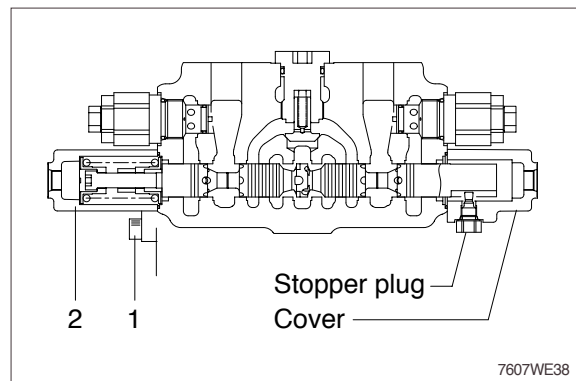
To reassemble correctly, attach an identification tag immediately after parts are removed.

- (1) Remove hexagon socket bolts(1) then remove cover(2).

- Hexagon socket bolt  
Width across flat : 8mm  
Tightening torque : 5.1kgf · m(36.8lbf · ft)

Reassembly

Install cover(2), after making sure that O-ring is placed on the edge of the housing hole.

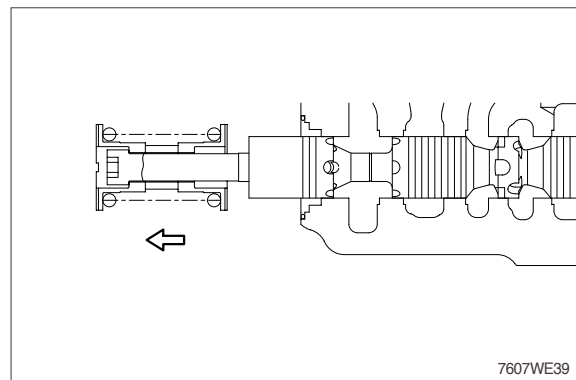


- (2) Pull out spool assembly from housing.

Do not pull out the spool all at once. Pull slowly while fitting in the housing hole.

Reassembly

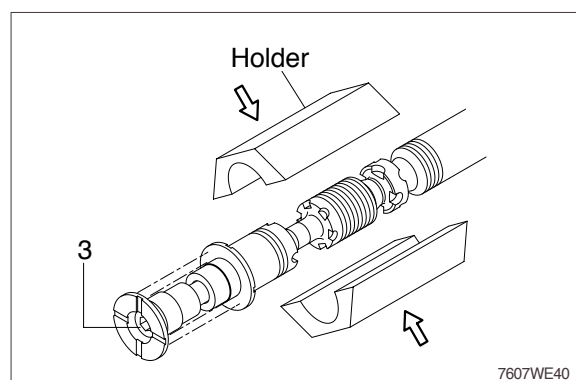
Set the key groove of the plunger with the stopper plug of the cover.



- (3) Set the spool between holders and loosen plunger cap(3) by using vise.

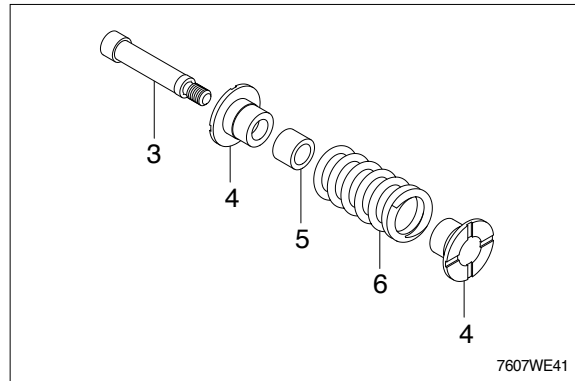
- Plunger cap  
Width across flat : 8mm  
Tightening torque : 6.1kgf · m(44.2lbf · ft)

Set the spool between holders and clamp them by a vise after degreasing the spool and holders as a special tool.



- (4) Remove the plunger cap(3), spring guide (4), spring(5) and sleeve(6).

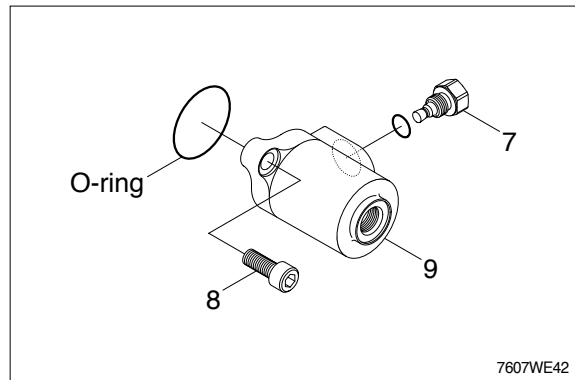
Spring is different from boom section spring.



- (5) Remove hexagon socket bolts(8) then remove cover(9) after remove plug(7).

- Plug(7)  
Width across flat : 19mm  
Tightening torque : 8.2kgf · m(59.0lbf · ft)
- Hexagon socket bolt(8)  
Width across flat : 8mm  
Tightening torque : 5.1kgf · m(36.8lbf · ft)

Make sure that O-ring is on the face of housing.



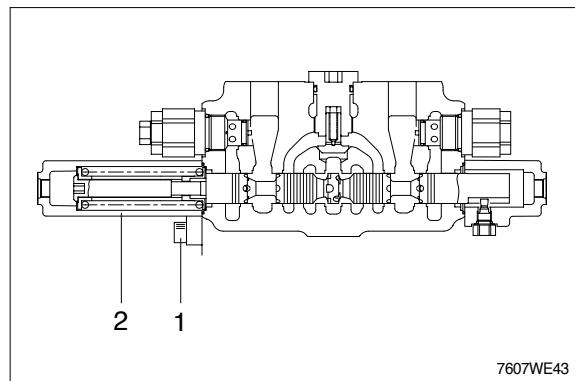
## 7) BOOM PLUNGER

- (1) Remove hexagon socket bolts(1) then remove cover(2).

- Hexagon socket bolt  
Width across flat : 8mm  
Tightening torque : 5.1kgf · m(36.8lbf · ft)

Reassembly

Install cover(2), after making sure that O-ring is placed on the edge of the housing hole.

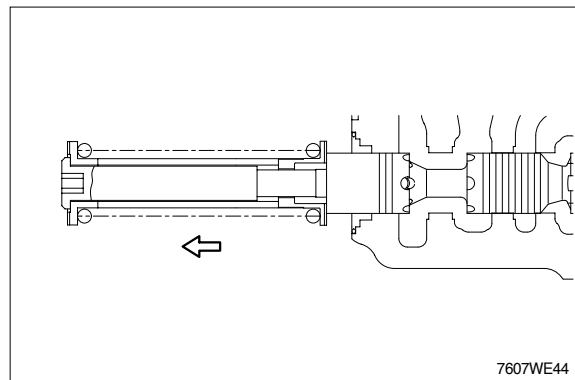


- (2) Pull out spool assembly from housing.

Do not pull out the spool all at once.  
Pull slowly while fitting in the housing hole.

Reassembly

Set the key way of the plunger to the stopper plug of the cover.



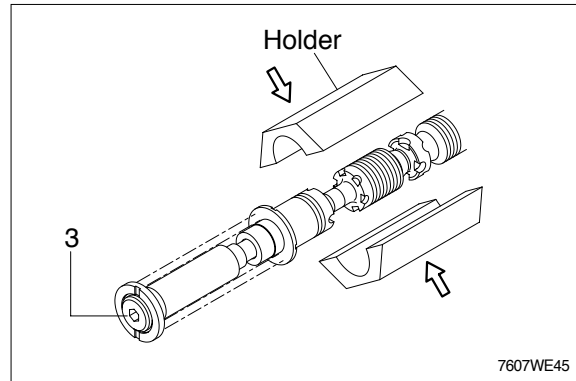
(3) Set the spool between holders and loosen plunger cap(3) by using vise.

- Plunger cap

Width across flat : 8mm

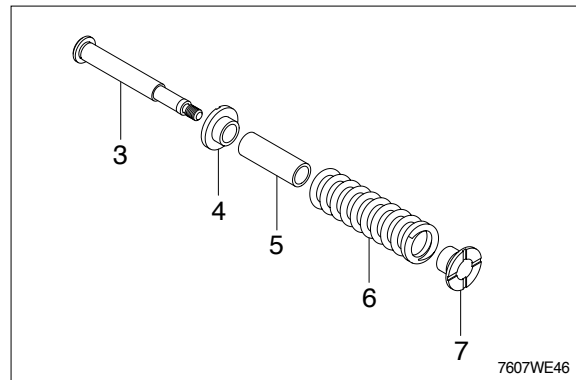
Tightening torque : 6.1kgf · m(44.2lbf · ft)

Set the spool between holders and clamp them by a vise after degreasing the spool and holders as a special tool.



(4) Remove the plunger cap(3), spring guide (4), spring(5), sleeve(6) and spring guide (7).

Spring is different from the other section spring.



(5) Remove hexagon socket bolts(8) then remove cover(9) after remove plug(7).

- Plug(7)

Width across flat : 19mm

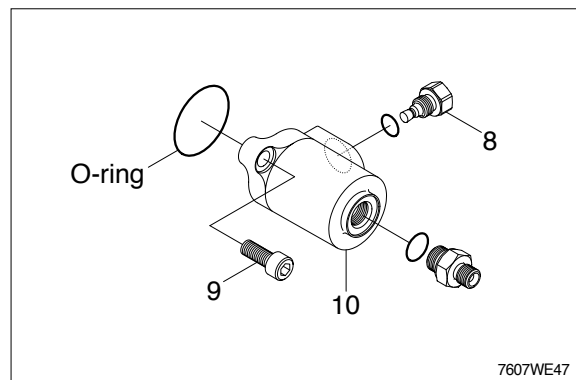
Tightening torque : 8.2kgf · m(59.0lbf · ft)

- Hexagon socket bolt(8)

Width across flat : 8mm

Tightening torque : 5.1kgf · m(36.8lbf · ft)

Confirm that O-ring is put to end face of housing.



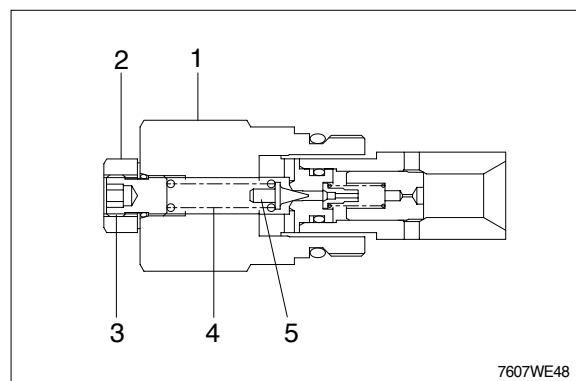
## 8) MAIN RELIEF VALVE

(1) Loosen cap(1) and remove the main relief cartridge from the body.

- Cap(1)

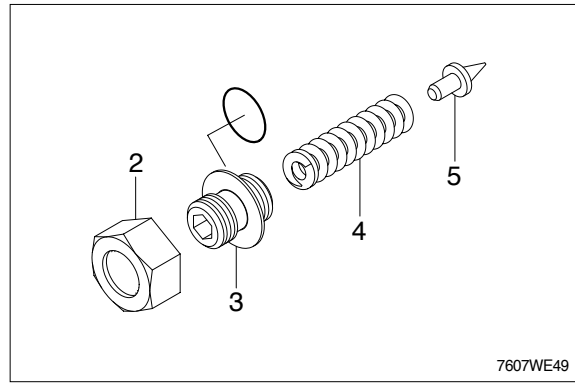
Width across flat : 41mm

Tightening torque : 10.2kgf · m(73.8lbf · ft)

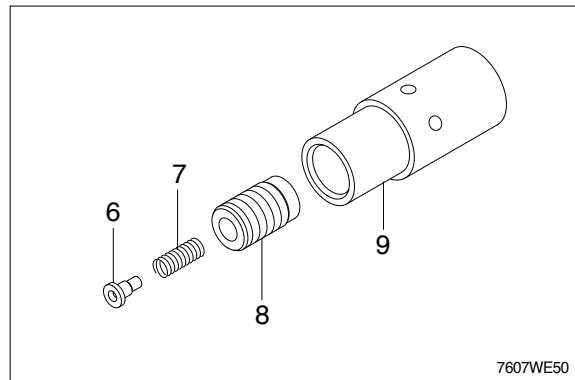


(2) Loosen hex nut(2), and remove adjust screw(3), spring(4) and pilot poppet(5).

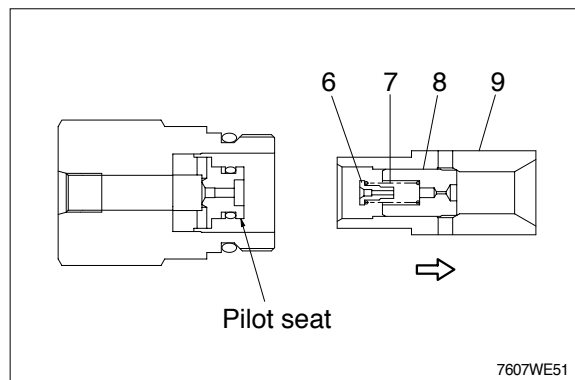
- Hex nut(2)  
Width across flat : 19mm  
Tightening torque : 3.3kgf · m(23.6lbf · ft)
- Adjust screw(3)  
Width across flat : 22mm



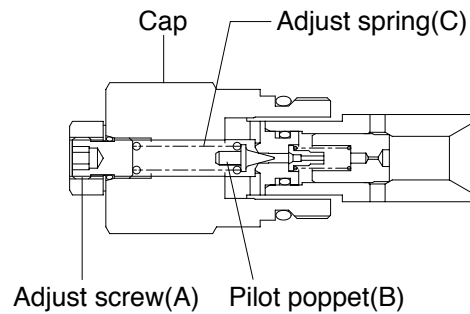
(3) Pull out sleeve(9), and remove orifice(6), spring(7) and main poppet(8).



Do not disassemble pilot seat, because the pilot seat is assembled with pressure.



## (5) RESETTING THE RELIEF PRESSURE



7607WE52

If setting pressure is mistaken, hydraulic unit may be destroyed and danger may be caused. Do not raise by any means more than the pressure decided for every model.

### Temporary assembly and setting

Check the position of setting pressure 0 MPa.

Set adjusting screw(A) temporarily in the position that pilot poppet(B) contacts to pilot seat.

Then pressure adjusting spring(C) begins to be effective.

Install the main relief valve which is set temporarily to main body.

Tighten cap with torque wrench.

- Tightning torque : 10.2kgf · m(73.8lbf · ft)

### To set pressure

Attach exact pressure gauge at exit of pump or gauge port of control valve.

Operate the pump with rated speed.

Operate plunger either boom or bucket at full stroke and check the pressure.

Turn adjusting screw(A) (right turn) and set pressure with checking pressure gauge.

- One quarter turn of adjusting screw(A) equals about 4 MPa.
- Setting pressure 20.6MPa(210kgf/cm<sup>2</sup>) at 220 /min.
- Relief is very sensitivity. So, do not turn adjusting screw(A) suddenly.

Tighten lock nut with torque wrench holding adjusting screw.

- Tightning torque : 3.3kgf · m(23.6lbf · ft)

Operate plunger and check the setting pressure, again.

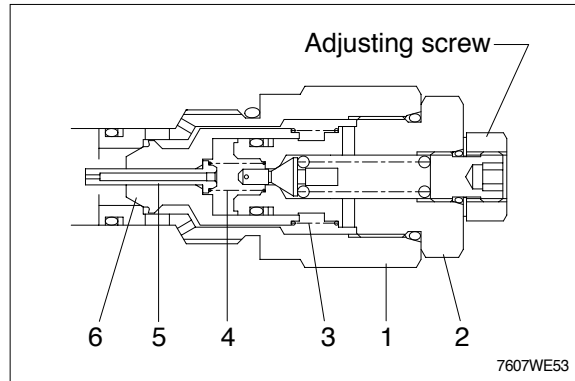
## 9) PORT RELIEF VALVE

Do not disassemble adjusting screw.  
It's impossible to readjust setting pressure exactly on the machine.

### (1) Loosen sleeve(1) and remove relief valve.

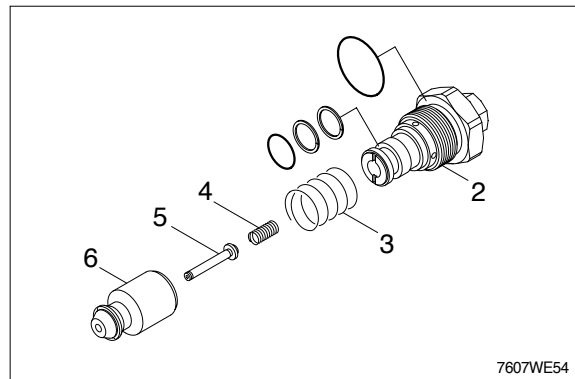
- Sleeve(1)  
Width across flat : 41mm  
Tightening torque : 10.2kgf · m(73.8lbf · ft)

Install to original position.



### (2) Loosen and remove relief seat sub-assembly(2). And remove spring(3),(4) piston(5), and main poppet(6).

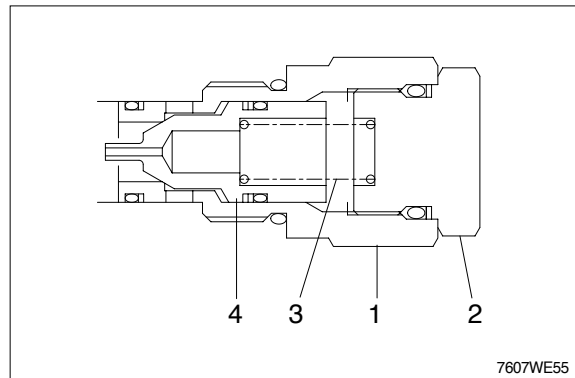
- Relief seat(2)  
Width across flat : 36mm  
Tightening torque : 10.2kgf · m(73.8lbf · ft)



## 10) MAKE UP VALVE

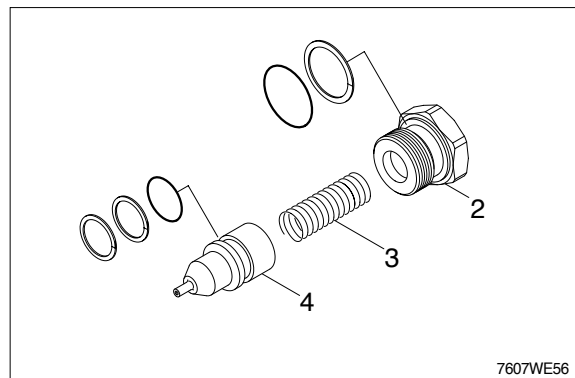
### (1) Loosen sleeve(1) and remove relief valve.

- Sleeve(1)  
Width across flat : 41mm  
Tightening torque : 10.2kgf · m(73.8lbf · ft)

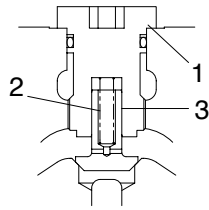


### (2) Remove cap(2) and pull out spring(3), poppet(4).

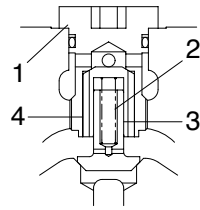
- Cap(2)  
Width across flat : 36mm  
Tightening torque : 10.2kgf · m(73.8lbf · ft)



## 11) LOAD CHECK VALVE



- Bucket for 2-spools valve
- Aux for 3-spools valve
- Boom for 2 & 3-spools valve



- Bucket for 3-spools valve

7607WE57

Example for explanation : Bucket section of 3-spools valve(double check)

(1) Remove cap(1) pull out spring(2), check (3) and (4)

· Cap(2)

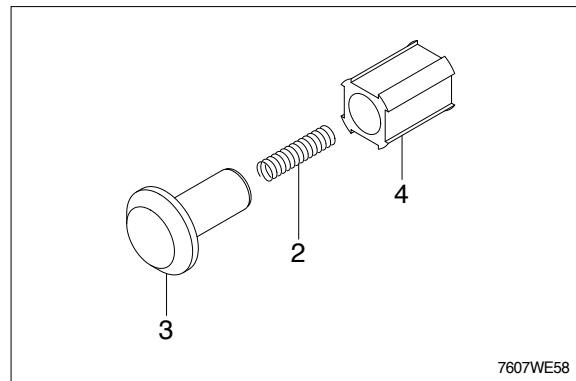
Width across flat : 36mm

Tightening torque : 25.5kgf · m(184lbf · ft)

When reassembly ;

Be careful for the back-up ring not to protrude.

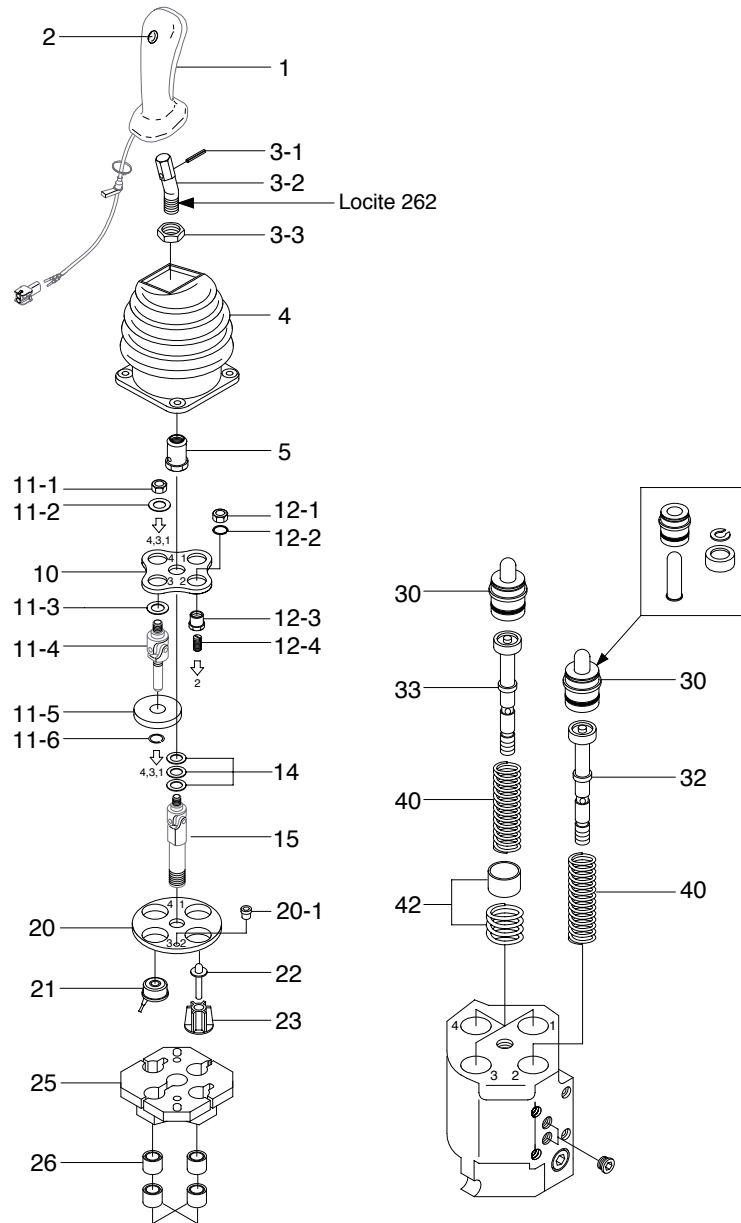
Only Bucket section has double check.



7607WE58

### 3. REMOTE CONTROL VALVE

#### 1) STRUCTURE



7707WE64

- |      |                  |      |                        |    |                            |
|------|------------------|------|------------------------|----|----------------------------|
| 1    | Handle           | 11-4 | Cardan                 | 21 | Solenoid                   |
| 2    | Push button      | 11-5 | Armature               | 22 | Intermediary plunger kit   |
| 3-1  | Locking pin      | 11-6 | Spring ring            | 23 | Intermediary plunger guide |
| 3-2  | Bent lever       | 12-1 | Counter nut            | 25 | Electric bracket           |
| 3-3  | Nut              | 12-2 | Spring ring            | 26 | Bushing                    |
| 4    | Rubber boot      | 12-3 | Switch plate screw     | 30 | Plunger kit                |
| 5    | Locking nut      | 12-4 | Press screw            | 32 | Regulation unit            |
| 10   | Cardan bracket   | 14   | Shims(0.1, 0.2, 0.5mm) | 33 | Regulation unit            |
| 11-1 | Self-locking nut | 15   | Cardan                 | 40 | Return spring              |
| 11-2 | Washer           | 20   | Flange                 | 42 | Prefeeling point kit       |
| 11-3 | Washer           |      |                        |    |                            |

## 2) DISASSEMBLY AND ASSEMBLY

### (1) PUSH BUTTEN

- ※ The remote control valve does not need to be removed from the machine to perform this operation.  
Remove worn pushbutton using a small screwdriver.  
The installation of new elements is performed without any special tools; the parts are simply pressed into place.

### (2) RUBBER BOOT

Remove the remote control valve from the machine or free the valve by unscrewing the 4 screws fixing the plate in order to release the electrical cable.

- Assembly

Torque : 1.02kgf · m(7.4lbf · ft)

Hold the remote control valve using a vice or a vice-grip wrench(clamp onto the body).

The pilot unit does not need to be removed from the machine to release the cable. However, it is recommended to lift the control unit by undoing the 4 fixing screws on the arm rest.

It is unnecessary to remove the units with no electrical functions.

Lift and turn the boot inside out.

Remove the grommet(7) from its emplacement to free the cable.

Loosen the handle mounting nut(3-3) using a 19mm open-end wrench.

- Assembly : torque 4.08kgf · m(29.5lbf · ft)

Unscrew and remove the handle(1).

- Assembly

- Add loctite 262 onto the lever thread

- Torque : 4.08kgf · m(29.5lbf · ft)

Replace the faulty rubber boot(4) with a new one.

Replace the handle(1) following the disassembly instructions in reverse order.

### (3) HANDLE

Clamp the threaded section of the lever(3-2) in a vice fitted with V-shaped vice clamp.

Remove the pin(3-1) using a 5mm pin driver.

Replace the lever(3-2) onto the new handle(1) and secure it with the pin(3-1) using a 5mm pin driver.

Respect the position of the curved lever to ensure that the handle is correctly oriented as indicated by the machine's technical specifications.

Replace the nut(3-3) on the threaded section and replace the boot(4).

#### (4) DETENT CARDAN BRACKET KIT

Remove the 2 grommets(20-1) from the flange (20).

Place centering sleeves V & W to avoid damaging the cardan knuckles while loosening the nuts.

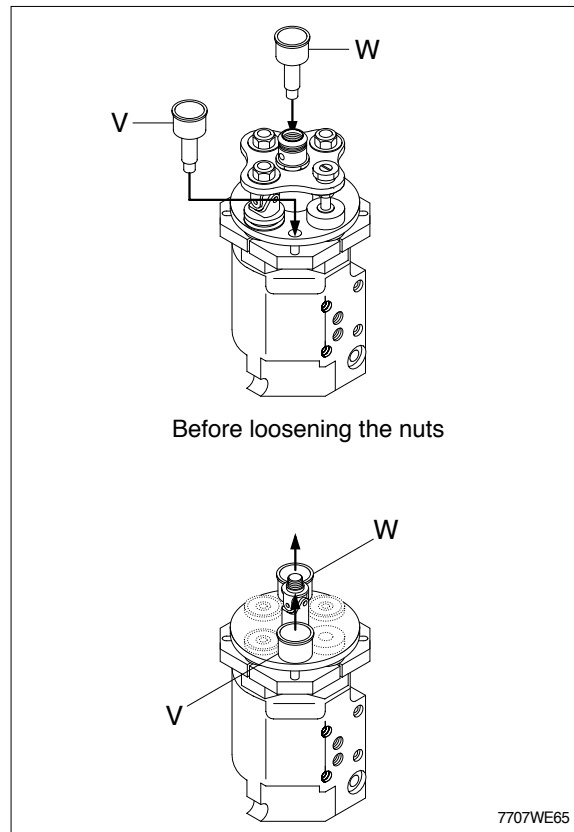
Unscrew the locking nut(5) using a 23mm open-end wrench.

- Assembly : Torque  $4.08 \pm 0.4\text{kgf} \cdot \text{m}$   
( $29.5 \pm 2.9\text{lb} \cdot \text{ft}$ )

Unscrew the self-locking nut(11-1) using a 13mm open-end wrench.

- Assembly
  - Torque  $1.02\text{kgf} \cdot \text{m}$ ( $7.4\text{lb} \cdot \text{ft}$ )
  - Place centering sleeves(V-W) to avoid damaging the cardan knuckles while screwing the nuts.

- Remove :
- Friction washer(11-2)
  - Friction washer(11-3)
  - Cardan/armature assembly (11-4 ~ 11-6)



#### (5) NON-DETENT PLUNGER KIT

Unscrew the self-locking nut(12-1) using a 13mm open-end wrench.

- Reassembly : - Torque  $1.02\text{kgf} \cdot \text{m}$ ( $7.4\text{lb} \cdot \text{ft}$ )
  - Place centering sleeves(V-W) to avoid damaging the cardan knuckles while screwing the nuts.

Undo the snap ring(12-2) using a flat-end screwdriver.

Remove the screw assembly(12-3, 12-4)

#### (6) CARDAN

Remove the centering sleeves **V** & **W**.

Remove the cardan bracket(10) and the shims(14).

Unscrew the cardan(15) using a 17mm open-end wrench.

- Reassembly : - Ungrease the cardan threads
  - Add loctite 262 onto the cardan threads(both end)
  - Torque  $4.08\text{kgf} \cdot \text{m}$ ( $29.5\text{lb} \cdot \text{ft}$ )

#### (7) SOLENOID AND CONNECTOR

It is advised to mount the connector onto the solenoid cable once the remote control valve is assembled.

Remove the flange(20) and the electrical bracket(25),

Remove the protecting bushes(26) from the electrical bracket(25).

Undo the solenoid(21) from the electric bracket(25).

Replace the solenoid.

Clean the polar face using a piece of cloth and pay attention not to hit them.

Assembly : Place the solenoid cable in its emplacement on the electric bracket before fitting the protection bushes.

### **(8) INTERMEDIARY PLUNGER KIT**

Undo the intermediary plunger guide(23).

Remove and replace the intermediary plunger kit assembly(22).

### **(9) GUIDE / PLUNGER AND REGULATION UNIT**

Beware of the plungers that might jump out due to the spring return.

Remove : - Guide/plunger assembly(30).

- Regulation unit(32/33).

- Return spring(40).

- Pre-feeling point kit(42).

The remote control valve is now totally disassembled.

Assemble in reverse order following the torque specification.