

## SECTION 4 BRAKE SYSTEM

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## SECTION 4 BRAKE SYSTEM

### GROUP 1 STRUCTURE AND FUNCTION

#### 1. OUTLINE

- ※ The brakes are operated by a pressure compensated, closed center hydraulic system.  
Flow is supplied by a fixed displacement, gear type brake pump.

##### 1) SERVICE BRAKE SYSTEM

The fixed displacement brake pump supplies flow to the cut-off valve for service brake circuit.

It flows to two accumulator. The accumulator has a gas precharge and an inlet check valve to maintain a pressurized volume of oil for reserve brake applications.

Oil through the accumulator flows to the brake valves. The brake valve is a closed center design, dual circuit operated by a pedal.

The brake system contains the following components:

- Hyd pump
- Cut-off valve
- Brake valve
- Accumulators
- Pressure switches

##### 2) PARKING BRAKE SYSTEM

In the parking brake system, turn parking brake switch ON, the parking brake solenoid valve in the cut off solenoid valve is de-energized and the valve open the drain port.

At the same time, the hydraulic oil in the parking brake return to the tank through the solenoid valve. When the piston is returned by the force of the spring, the parking brake is applied.

### 3) FULL POWER HYDRAULIC BRAKE SYSTEM

**ADVANTAGES** - The full power hydraulic brake system has several advantages over traditional brake actuation systems. These systems are capable of supplying fluid to a range of very small and large volume service brakes with actuation that is faster than air brake systems. Figure represents a time comparison between a typical air/hydraulic and full power hydraulic brake actuation system.

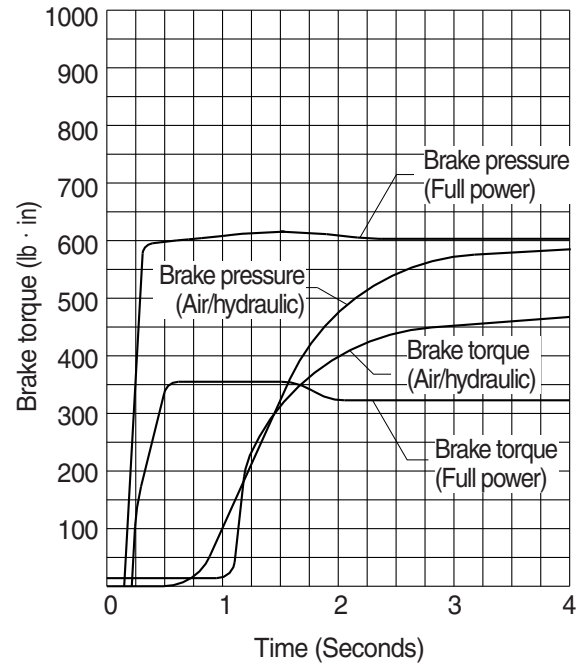
Full power systems can supply significantly higher brake pressures with relatively low reactive pedal forces. The reactive pedal force felt by the operator will be proportional to the brake line pressure being generated. This is referred to as brake pressure modulation.

Another key design feature of full power systems is the ability to control maximum brake line pressure. In addition, because these systems operate with hydraulic oil, filtration can be utilized to provide long component life and low maintenance operation.

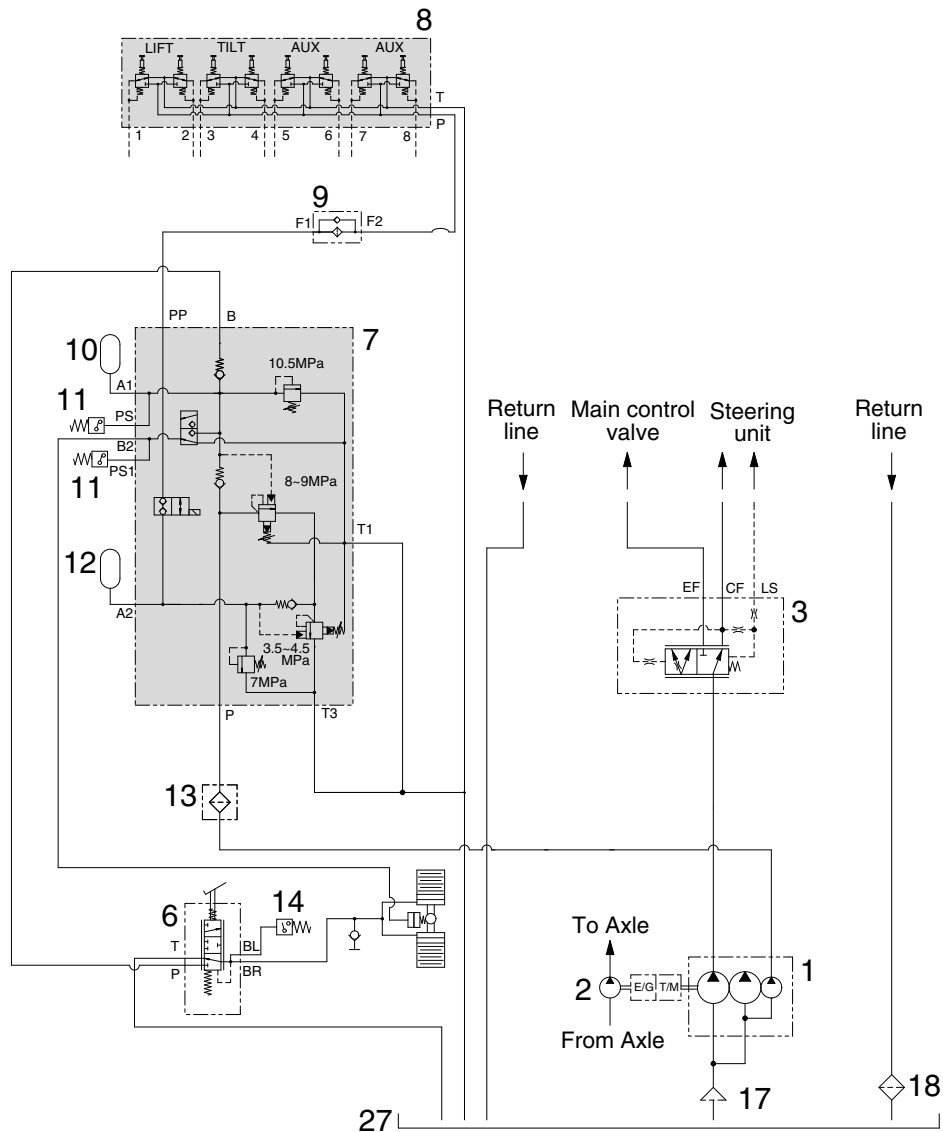
Because these systems are closed center, by using a properly sized accumulator, emergency power-off braking that is identical to power-on braking can be achieved. These systems can be either dedicated, where the brake system pump supplies only the demands of the brake system or non-dedicated, where the pump supplies the demands of the brake system as well as some secondary down stream hydraulic devise.

Another important note is that all seals within these system must be compatible with the fluid medium being used.

**Response time  
Full power brake actuation VS  
Air/Hydraulic brake actuation**



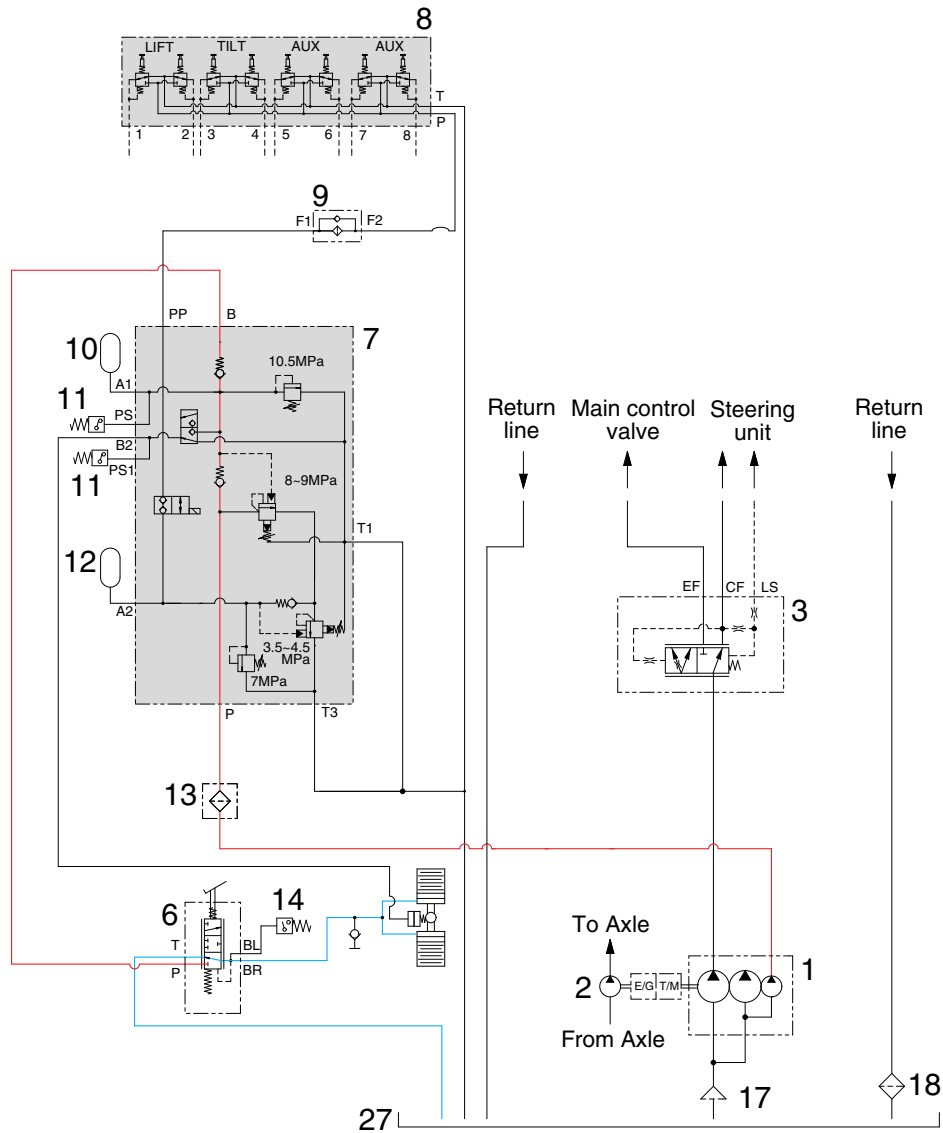
## 2. HYDRAULIC CIRCUIT



50D9BBS01

- |   |                |    |                 |    |                    |
|---|----------------|----|-----------------|----|--------------------|
| 1 | Main pump      | 8  | RCV             | 13 | Line filter        |
| 2 | Brake pump     | 9  | Line filter     | 14 | Pressure switch    |
| 3 | Priority valve | 10 | Accumulator     | 17 | Suction strainer   |
| 6 | Brake valve    | 11 | Pressure switch | 18 | Return filter      |
| 7 | Cut-off valve  | 12 | Accumulator     | 27 | Hydraulic oil tank |

## 1) SERVICE BRAKE RELEASED



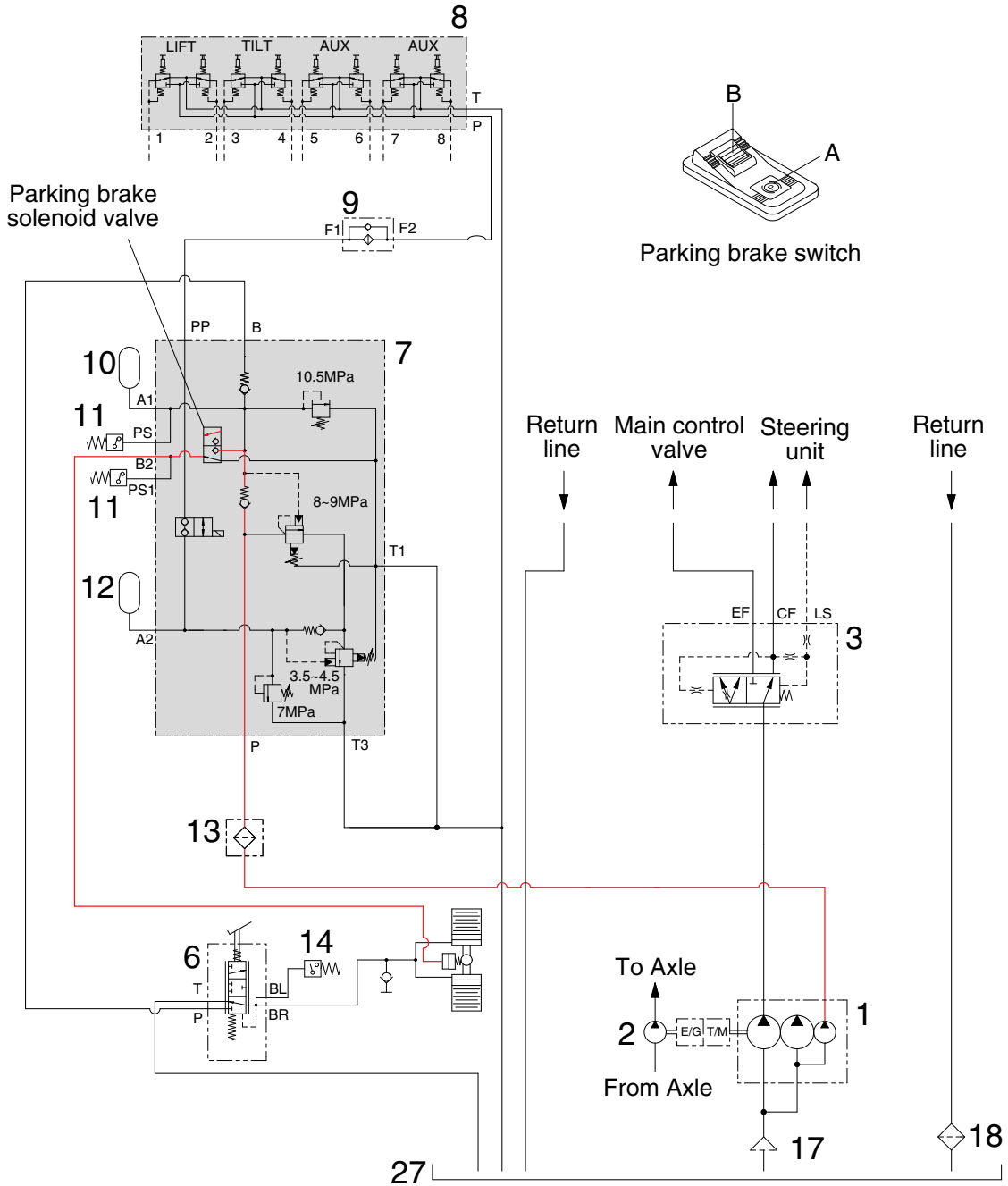
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When the pedal of brake valve (6) is released, the operating force is eliminated by the force of the spring, and the spool is returned.

When the spool removes up, the drain port is opened and the hydraulic oil in the piston of axles return to the tank. Therefore, the service brake is kept released.



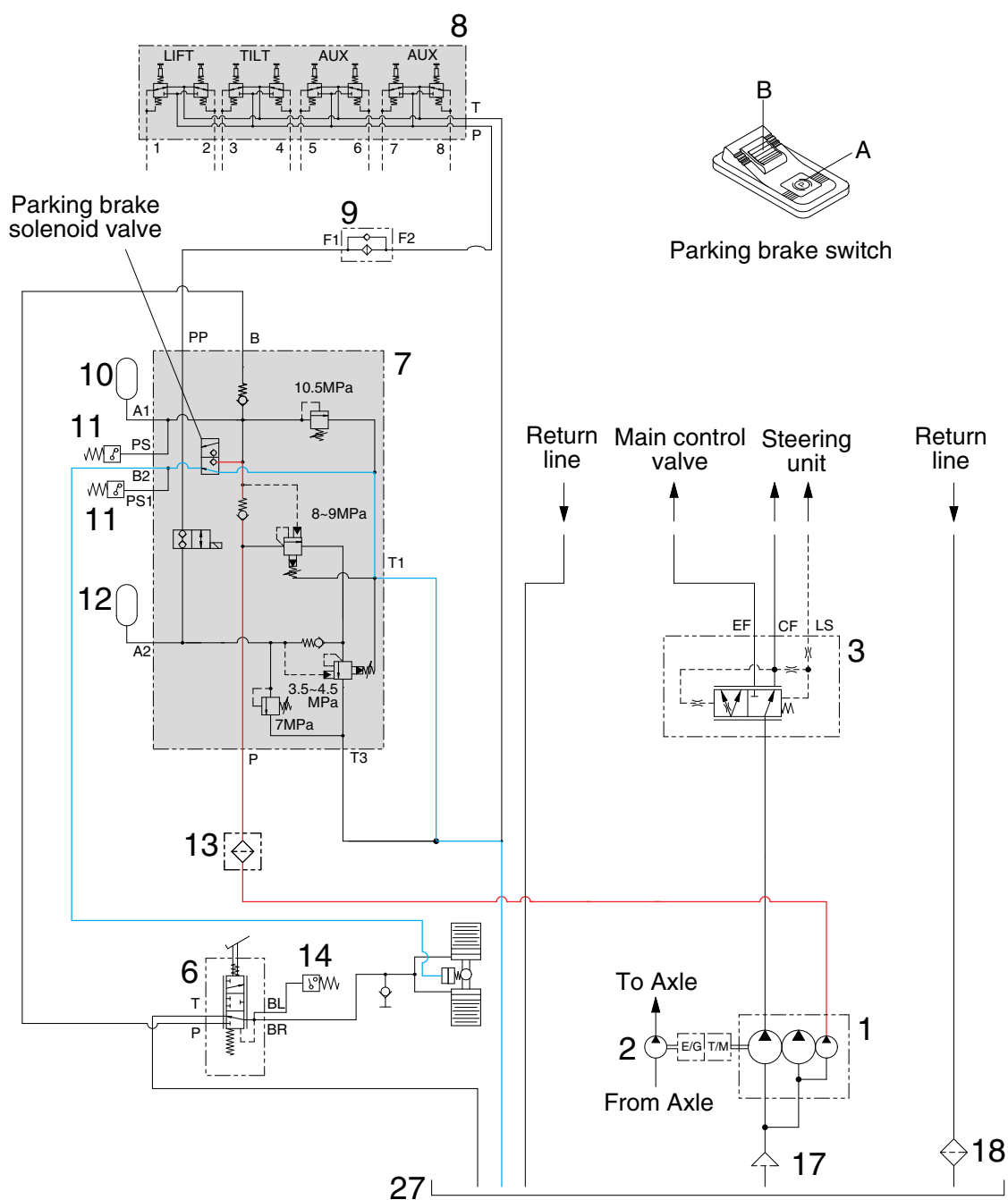
### 3) PARKING BRAKE RELEASED



50D9BBS04

When the parking brake switch is pressed B position, the solenoid valve is energized and the hydraulic oil controlled the pressure level by the cut-off valve enters the parking brake. It overcomes the force of the spring and pushes the parking brake piston. This releases the parking brake. Therefore, the hydraulic oil pressure is applied to the parking brake piston through the solenoid valve and the parking brake is kept released.

#### 4) PARKING BRAKE OPERATION



50D9BBS05

When the parking brake switch is pressed A position, the solenoid valve is de-energized and the valve open the drain port.

At the same time, the hydraulic oil in the parking brake return to the tank through the solenoid valve. When the piston is returned by the force of the spring, the parking brake is applied.

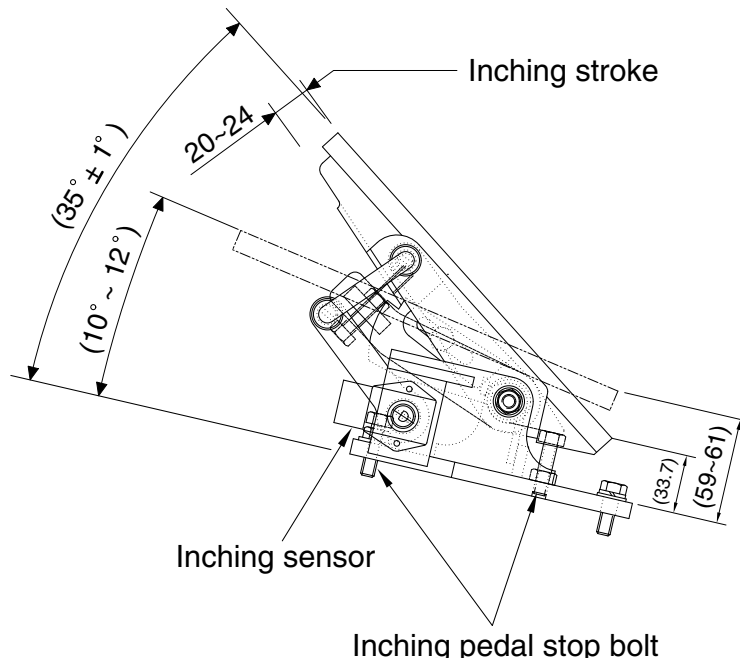


### 3. DO AEB WORK

- 1) Start engine after parking the machine on flat floor and blocking wheels.
  - 2) Release parking brake.
  - 3) With stepping on the service brake, operate T/M STALL (3 stage).  
(To avoid defect of clutch pack, repeat 10 sec of operation and 10 sec of placing neutral)
  - 4) When the T/M oil temperature reaches 75~80°C, lock the parking brake and then shift gear to neutral position to keep the machine at LOW RPM.
  - 5) Connect the AEB STARTER to T/M controller.
  - 6) Push AEB STARTER over 3 seconds.
  - 7) Confirm the status of AEB from the DISPLAY.
    - Normal operation shows "ST, KR, KV, KC, KD, KE" orderly for 3~5 minutes.
    - After the successful completion, it displays "OK".
    - With a new controller, it may display "F6" error code before AEB, but after AEB, it will disappear.
  - 8) In case of abnormal running, it may display "STOP" with the appropriate error code.
  - 9) After troubleshooting, start the machine again to repeat above.
- ※ As the STALL operation has to be done, the SERVICE BRAKE must be locked perfectly to avoid the fatal accident.

#### 4. INCHING PEDAL AND LINKAGE

The brake pedal serves to actuate the hydraulic brakes on the front axle. At the beginning of the pedal stroke, the inching spool of the transmission control valve is actuated to shift the hydraulic clutch to neutral and turn off the driving force. By treading the pedal further, the brake is applied.

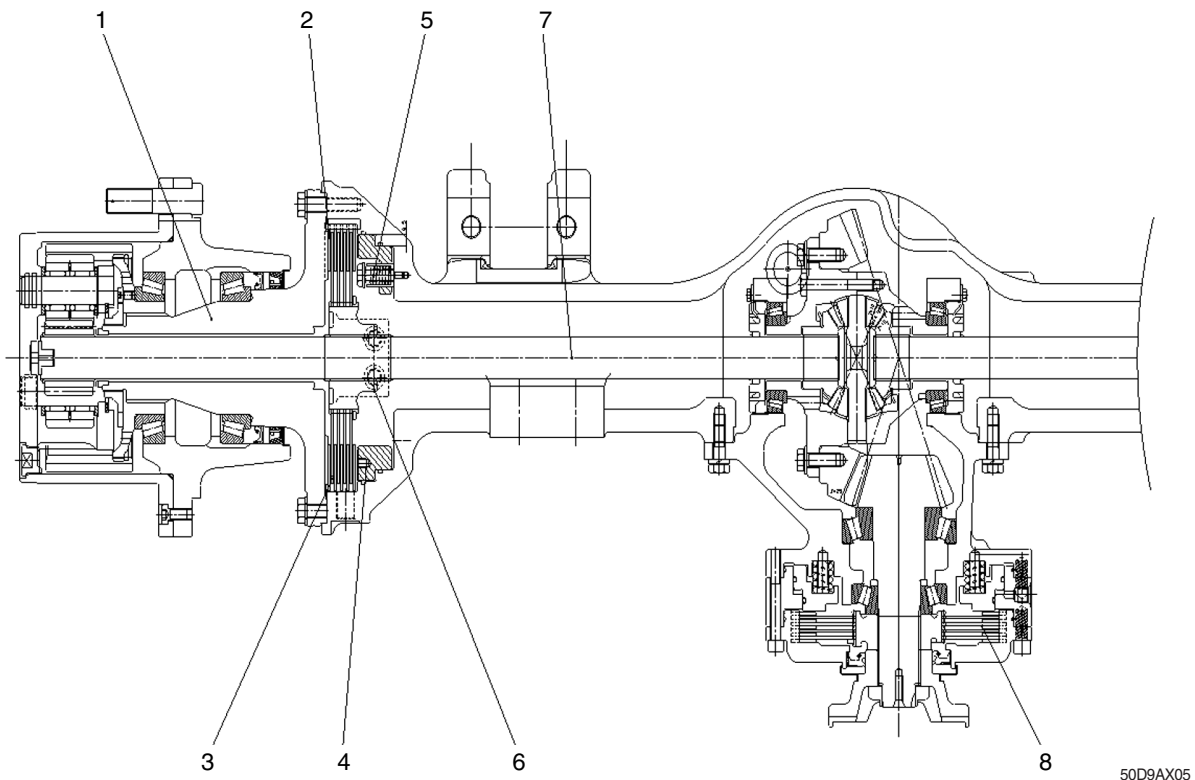


50D9HBS04

##### 1) INITIALIZING THE INCHING SENSOR

- (1) Start engine after parking the machine on flat floor and blocking wheels.
  - (2) Release parking brake and keep neutral gear shift.
  - (3) Adjust the inching sensor linkage so that the regular voltage is supplied to inching sensor when operating the pedal.  
(Regular voltage ; Before pedal operation ( $1 \pm 0.1V$ ),  
After pedal operation ( $3.5 \pm 0.1V$ ))
  - (4) Stop the engine and then just KEY ON. (Release parking brake, keep neutral gear)
  - (5) Connect the AEB STARTER to the T/M controller.
  - (6) Push AEB STARTER over 3 seconds.
  - (7) If display shows "▼IP", Step on the pedal fully.
  - (8) If display shows "▲IP", release "OK"
  - (9) After the successful completion, it displays "OK".
  - (10) In case of abnormal running, it may display "STOP" with the appropriate error code.
  - (11) After troubleshooting, start the machine again to repeat above.
- ※ Above works are to be done with the parking brake released, so machine's wheels must be blocked for safety.

## 5. DISK BRAKE



- |   |             |   |                            |   |               |
|---|-------------|---|----------------------------|---|---------------|
| 1 | Spindle     | 4 | Service piston             | 7 | Drive shaft   |
| 2 | Steel plate | 5 | Service piston adjust bolt | 8 | Parking brake |
| 3 | Disk plate  | 6 | Service collar             |   |               |

### OPERATION

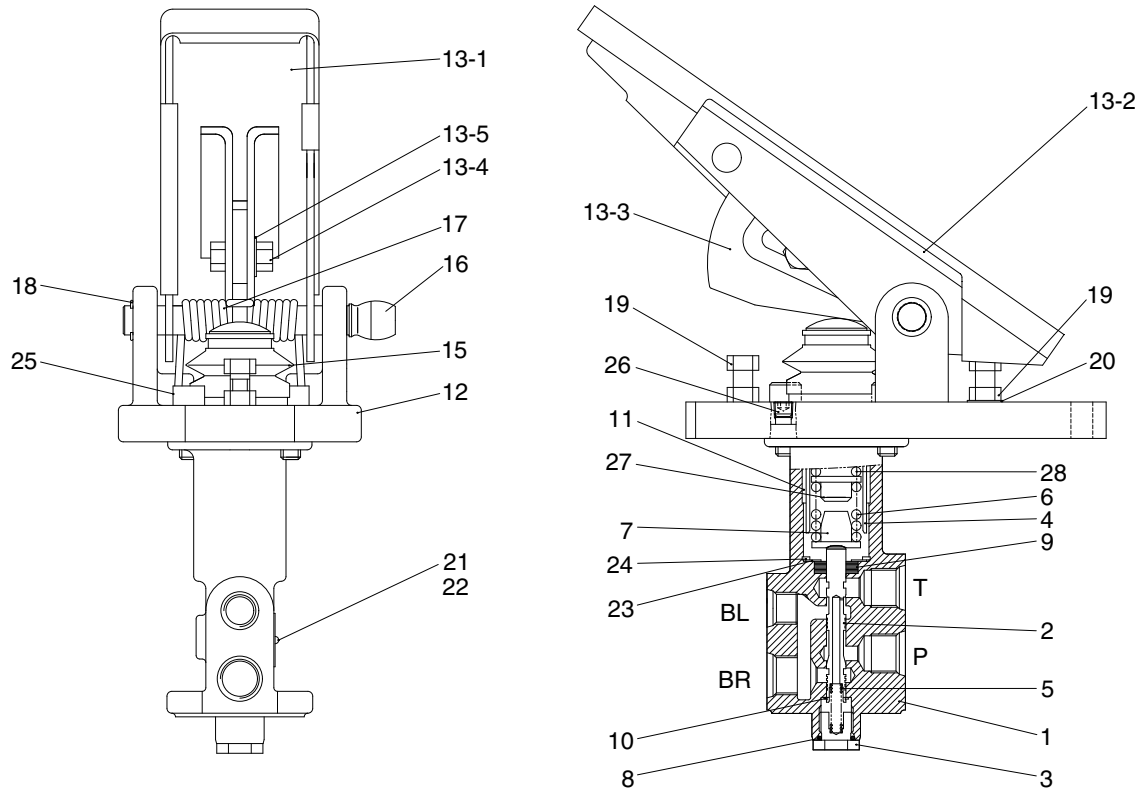
Sealed up structure of hydraulic multi-disk brake system secures good brake performance even in the high humid or dusty area.

Because it is possible to use the brake semi-permanently, there is no need to maintain its lining as drum type brake do. Also with self-adjust of friction plate clearance, it's easy to prevent the brake performance drop due to friction material wear.

Major components are 4 disk plates (3), 5 steel plates (2), service piston (4) and 4 piston adjust bolts (5). Braking take places when the discs and plates are pressed each other which make rotation resistance to the collar (6) and the drive shaft (7).

## 6. BRAKE VALVE

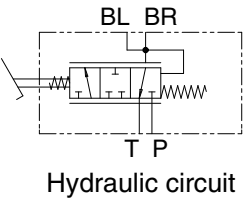
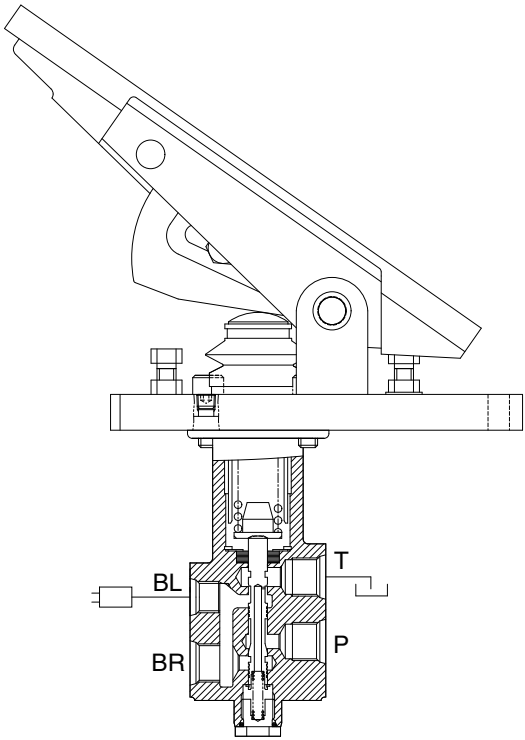
### 1) STRUCTURE



160D7ABS07

1	Body	11	Du bushing	17	Torsion spring
2	Spool	12	Pedal plate	18	Snap ring
3	Plug	13	Pedal assembly	19	Hexagon bolt
4	Holder (piston)	13-1	Pedal	20	Hexagon nut
5	Lower spring	13-2	Rubber	23	Plain washer
6	Main spring 1	13-3	Lock plate	24	Snap ring
7	Spring retainer 1	13-4	Hexagon bolt	25	Bolt
8	O-ring	13-5	Plate washer	26	Taper plug
9	Oil seal	15	Bellows	27	Spring retainer 2
10	Snap ring	16	Lock pin 1	28	Main spring 2

2) OPERATION



Port	Port name	Port size
P	Main pressure port	PF3/8
T	Drain port	PF3/8
BR	Brake cylinder port	PF3/8
BL	Pressure switch port	PF1/4

110D7EBS08

### **(1) Purpose**

The purpose of the brake valve is to sensitively increase and decrease the braking pressure when the brake pedal is actuated.

### **(2) Ready position**

A connection is established between ports (BR) and ports (T) so that the wheel brakes ports (BR) are pressureless via the returns ports (T).

### **(3) Partial braking**

When the brake valve is actuated, an amount of hydraulic pressure is output as a ratio of the foot force applied.

The main spring (6) beneath pedal plate (12) is designed in such a way that the braking pressure changes depending on the angle. In the lower braking pressure range, the machine can be slowed sensitively.

When the braking process is commenced, the spool (2) is mechanically actuated via main spring (6). As spool (2) move downward, they will first close returns (T) via the control edges, thus establishing a connection between accumulator ports (P) and ports (BR) for the wheel brake cylinders. The foot force applied now determines the output braking pressure. The control spool (2) is held in the control position by the force applied (Spring assembly above the spool).

After output of the braking pressure, spool (2) is in a partial braking position, causing ports (P) and ports (T) to close and holding the pressure in ports (BR).

### **(4) Full braking position**

When pedal is fully actuated, end position of the brakes is reached and a connection established between accumulator ports (P) and brake cylinder ports (BR). Returns (T) are closed at this point.

When the braking process is ended, a connection is once again established between brake cylinder ports (BR) and return ports (T), closing accumulator ports (P).

### **(5) Limiting the braking pressure**

Pedal restriction bolt (19) on base plate below pedal is used to limit the braking pressure.

### **(6) Installation requirements**

Return lines (T) must be connected directly to the tank.

The connecting lines must be installed in such a way as to permit proper bleeding.

### **(7) Maintenance of the brake valve**

No special maintenance beyond the legal requirements is necessary.

When using high-pressure cleaners on the machine, please make sure that the water jet is not aimed directly at the brake valve (To prevent damaging the bellows).

△ **For safety reasons the whole of the brake valve must be replaced if parts other than those listed above are damaged.**

**(8) Repair work**

- △ When working on the braking system, always make sure that there is absolutely no pressure in the system. Even when the engine is switched off there will be some residual pressure in the system.

When doing repair work, make sure your environment is very clean.

Immediately close all open ports on the components and on pipes using plugs.

**(9) Replacing the pedal cover**

Pedal cover (13-2) is simply pulled off by hand. The new pedal cover is pushed over pedal (13-1) and tightened manually. Fasten the bellows with the strap retainers.

**(10) Replacing the complete actuating mechanism**

Carefully clamp the unit vertically in a fixture. The actuating mechanism can be removed by taking out the four bolts. Make sure that main spring (6) does not fall out. When installing the new actuating mechanism, make sure that main spring (6) is fitted in the right order.

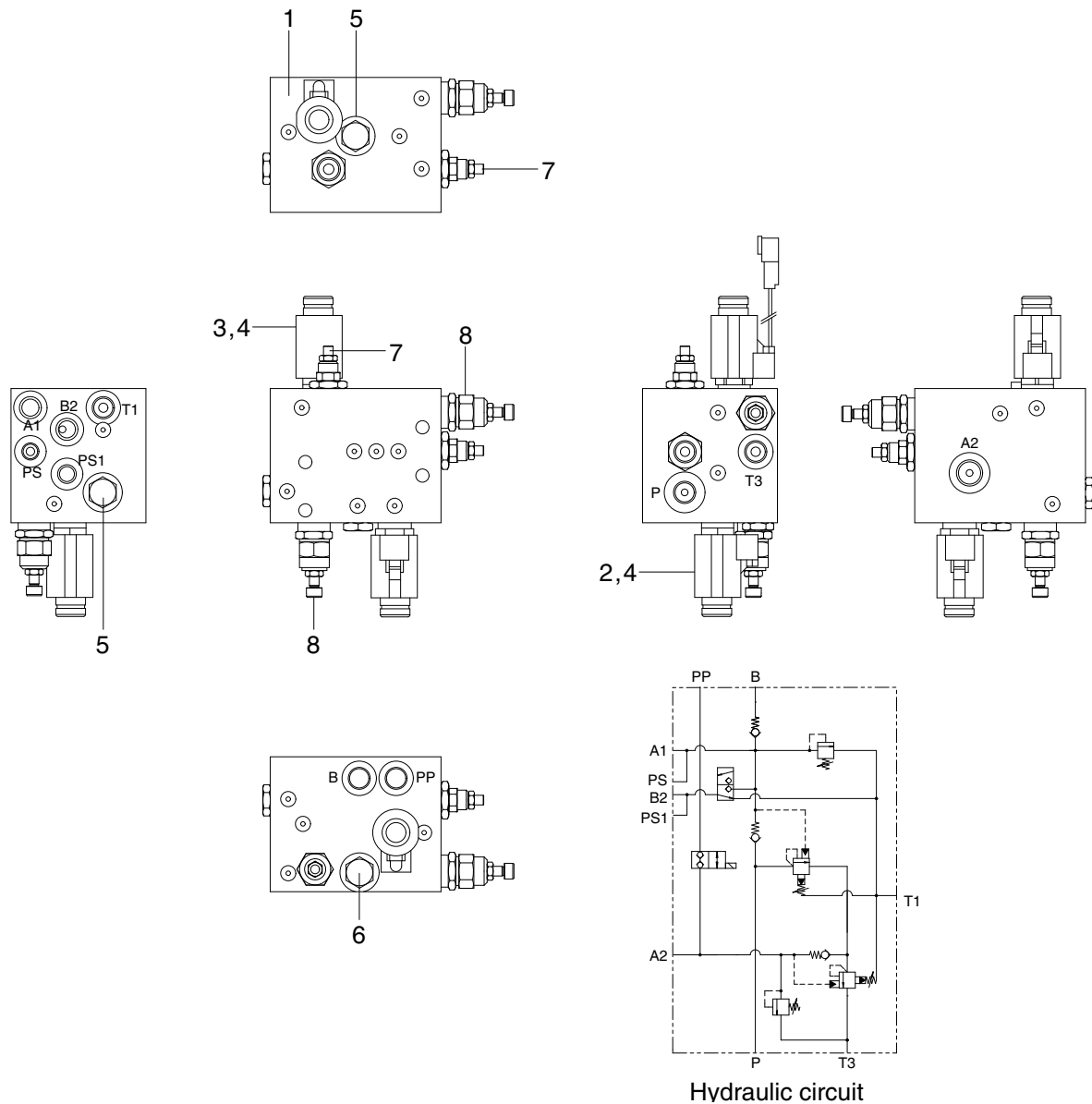
**(11) Replacing the bellows**

To change bellows (15) it is advisable to remove pedal (13). For this purpose, loosen retaining ring (18) and knock out pin 1 (16) using a mandrill. When knocking out the bolt, make sure that the mandrill is applied to the side of the bolt without a knurl. Remove pedal (13) and bellows (15).

Now fit the new bellows and proceed in reverse order as described above. The upper portion of bellows is fastened to piston (4), its lower portion to pedal plate (12) secure the bellows using clamps.

## 7. CUT-OFF VALVE (WITH OPSS)

### 1) STRUCTURE



50D9BS35

- |   |                |   |             |   |               |
|---|----------------|---|-------------|---|---------------|
| 1 | Manifold       | 4 | Coil        | 7 | Cut-off valve |
| 2 | Solenoid valve | 5 | Check valve | 8 | Relief valve  |
| 3 | Solenoid valve | 6 | Check valve |   |               |

### 2) OPERATION

When the pump works, the oil under the pressure flows into P port.

The oil in P port is stored in the accumulator on A1 port.

As the pressure on P line rises to 90 bar, the cut off valve (7) starts cut-offting and the oil in the P port is unloaded. The pressure on P line goes down 80 bar by the minute leakage from valve and other factors.

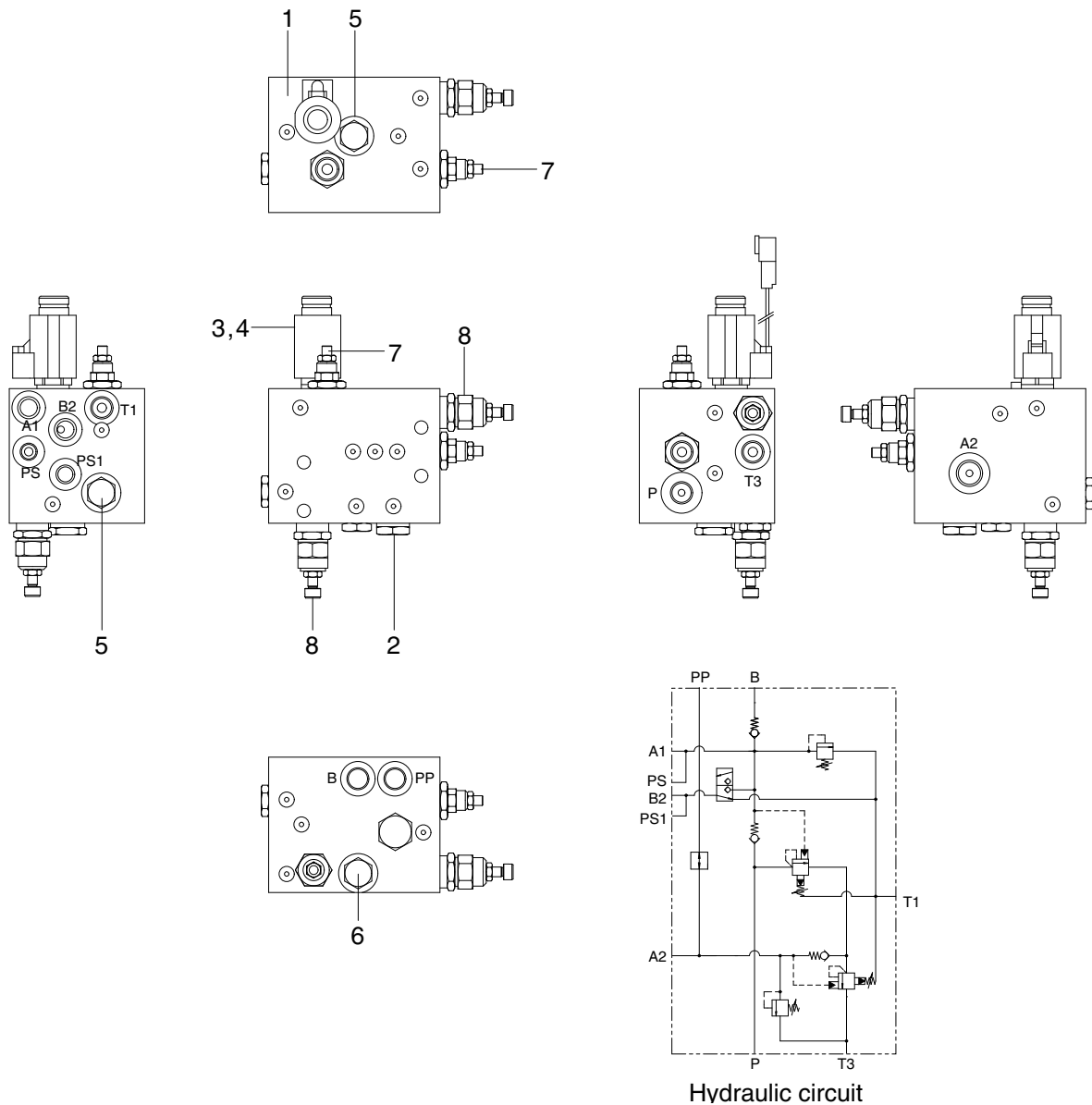
At this pressure, the cut-off valve starts cutting.

This process is repeated in the regular period of 30~40 seconds.



## CUT-OFF VALVE (NON-OPSS)

### 1) STRUCTURE



- |   |                |   |             |   |               |
|---|----------------|---|-------------|---|---------------|
| 1 | Manifold       | 4 | Coil        | 7 | Cut-off valve |
| 2 | Plug           | 5 | Check valve | 8 | Relief valve  |
| 3 | Solenoid valve | 6 | Check valve |   |               |

### 2) OPERATION

When the pump works, the oil under the pressure flows into P port.

The oil in P port is stored in the accumulator on A1 port.

As the pressure on P line rises to 90 bar, the cut off valve (7) starts cut-offting and the oil in the P port is unloaded. The pressure on P line goes down 80 bar by the minute leakage from valve and other factors.

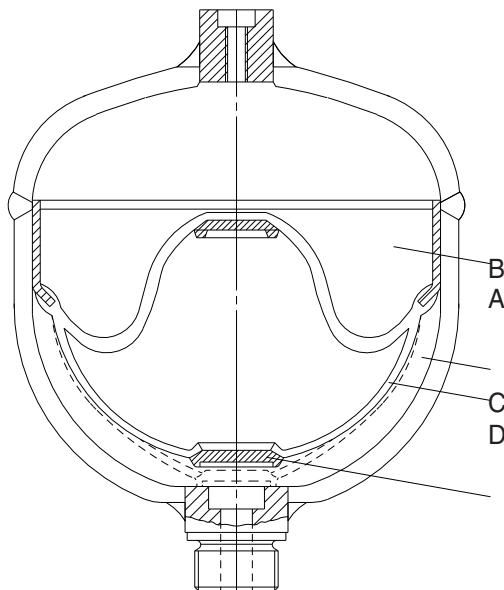
At this pressure, the cut-off valve starts cutting.

This process is repeated in the regular period of 30~40 seconds.

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## 8. BRAKE ACCUMULATOR

### 1) STRUCTURE



(770-3ATM) 4-22

Item	81L1-0004	31E3-3187
Diameter	110 mm	90 mm
Mounting height	164 mm	140 mm
Nominal volume	0.7 ℓ	0.35 ℓ
Priming pressure	50 kgf/cm <sup>2</sup>	15 kgf/cm <sup>2</sup>
Operating medium	Oil	Oil
Operating pressure	Max 150 kgf/cm <sup>2</sup>	170 kgf/cm <sup>2</sup>
Thread	M18×1.5	PF 1/2
Priming gas	Nitrogen	Nitrogen

A Fluid portion      C Diaphragm  
B Gas portion      D Valve disk

### 2) OPERATION

#### (1) Purpose

Fluids are practically incompressible and are thus incapable of accumulating pressure energy. In hydropneumatic accumulators, the compressibility of a gas is utilized to accumulate fluid. The compressible medium used in the accumulators is nitrogen.

In braking systems, the purpose of the accumulators is to store the energy supplied by the hydraulic pump. They are also used as an energy reserve when the pump is not working, as a compensator for any losses through leakage, and as oscillation dampers.

#### (2) Operation

The accumulator consists of a fluid portion (A) and a gas portion (B) with a diaphragm (C) as a gas-tight dividing element. The fluid portion (A) is connected to the hydraulic circuit, causing the diaphragm accumulator to be filled and the gas volume to be compressed as the pressure rises.

When the pressure falls, the compressed gas volume will expand, thus displacing the accumulated pressure fluid into the circuit.

The diaphragm bottom contains a valve disk (D) which, if the diaphragm accumulator is completely empty, closes the hydraulic outlet, thus preventing damage to the diaphragm.

#### (3) Installation requirements

The accumulators can be fitted in the hydraulic circuit, directly on a component or in blocks on suitable consoles.

They should be fitted in as cool a location as possible.

Installation can be in any position.

#### (4) Maintenance of the accumulator

No special maintenance beyond the legal requirements is necessary.

The accumulator should be checked annually. It should be replaced if the initial gas pressure has fallen by more than 30% (Please refer to Performance testing and checking of the accumulator).

#### (5) Disposal of the accumulator

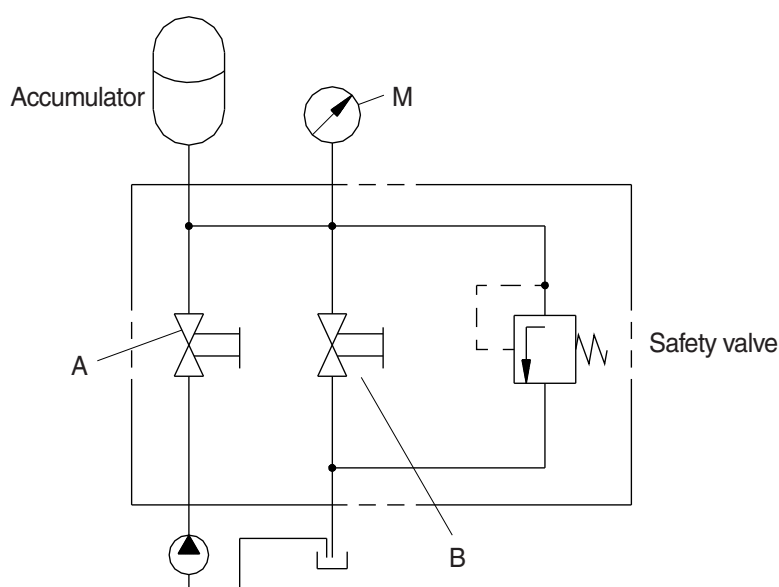
Before the accumulator is scrapped, its gas filling pressure must be reduced. For this purpose, drill a hole through gas chamber (B) using a drill approx. 3 mm in diameter. The gas chamber is located on the side opposite the threaded port above the welding seam around the center of the accumulator.

※ Wear safety goggles when doing this job.

#### (6) Performance testing and checking of the accumulator

The accumulator is gradually pressurized via the test pump; until the initial gas pressure is reached, the hydraulic pressure in the accumulator will rise abruptly. This is apparent from gauge M. If the initial gas pressure is more than 30% below the prescribed value, the accumulator needs to be replaced. If the measuring process needs to be repeated, wait for intervals of 3 minutes between the individual tests. Any accumulator whose initial gas pressure is insufficient must be scrapped following the instructions under Disposal of the accumulator.

The amount of initial gas pressure can also be checked from the vehicle. Start the vehicle's engine. The pump will now supply oil to the accumulators. Until the initial gas pressure is reached, the hydraulic pressure in the accumulator will rise abruptly. This is apparent from the gauge in the cab. If the initial gas pressure is more than 30% below the prescribed value, that initial pressure lies outside the permissible range for at least one of the accumulators fitted in the vehicle. This accumulator can be traced only by using the method described above, i.e. all accumulators have to be individually tested. The accumulator whose initial gas pressure is insufficient must be replaced and scrapped following the instruction under Disposal of the accumulator.

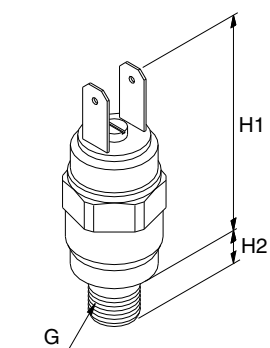


**(7) Repair work**

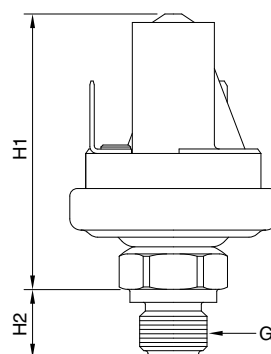
- △ **When working on the braking system, always make sure that there is absolutely no pressure in the system. Even when the engine is switched off there will be some residual pressure in the system.**
- ※ **When doing repair work, make sure your environment is very clean.  
Immediately close all open ports on the components and on pipes using plugs.**
- △ **For safety reasons the accumulators need to be replaced as a whole if damaged.**

## 9. PRESSURE SWITCHES

### 1) STRUCTURE



Parking and charging



Service brake

50D9BBS20

#### · Technical data

Item	Type	Medium	G	H1 mm	H2 mm	Adjusting range kgf/cm <sup>2</sup>	Adjusting pressure kgf/cm <sup>2</sup>	Voltage V
Parking	NC	Oil	M12×1.5	46	9	50 ~ 150	95 ± 5	Max 42
Charging	NC	Oil	M12×1.5	46	9	50 ~ 150	95 ± 5	Max 42
Brake stop	NO	Oil	PF 1/4	-	-	1~10	5 ± 1	Max 42

NC : Normally closed

NO : Normally open

## 2) OPERATION

### (1) Purpose

The pressure switches are used to visually or audibly warn the driver of the pressure within the system.

### (2) Make contact / circuit closer

The pressure switch can be fitted in the braking system or directly on one of its components.

The system pressure acts on an absorption area within the switch, making an electrical contact as the pressure on that area is increased. The resulting current is used to activate a warning facility, for instance.

### (3) Break contact / circuit breaker

The pressure switch can be fitted in the braking system or directly on one of its components.

The system pressure acts on a absorption area within the switch, breaking an electrical contact as the pressure on that area is increased. The current is now broken, e.g. to deactivate a warning facility.

### (4) Installation requirements

No special measures need to be taken.

### (5) Maintenance of the pressure switch

No special maintenance beyond the legal requirements is necessary.

When using high-pressure cleaners on the vehicle, please make sure that the water jet is not directed at the pressure switch (Corrosion of contacts).

### (6) Repair work

△ **When working on the braking system, always make sure that there is absolutely no pressure in the system. Even when the engine is switched off there will be some residual pressure in the system.**

※ When doing repair work, make sure your environment is very clean.

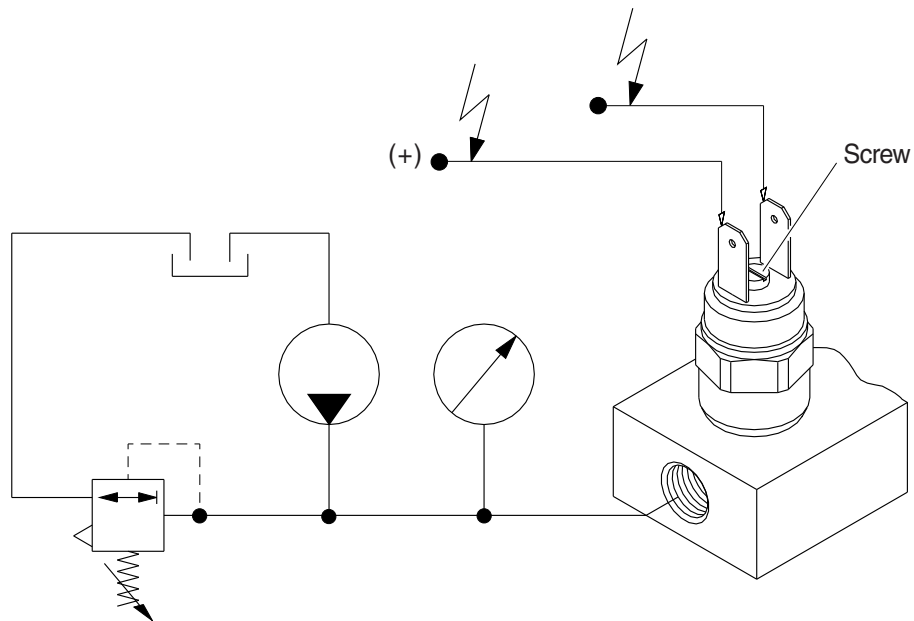
Immediately close all open ports on the components and on pipes using plugs.

※ For safety reasons the pressure switch needs to be replaced as a whole if damaged.

### (7) Adjusting and testing pressure switch

The adjusting screw located between the two contact plugs can be set to the desired value within a certain range. For adjusting range, please refer to the table Technical data on the previous page.

After making the adjustment, the adjusting screw should be secured using wax or a similar material.



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## GROUP 2 OPERATIONAL CHECKS AND TROUBLESHOOTING

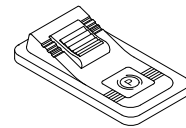
### 1. OPERATIONAL CHECKS

#### 1) BRAKE PIPING

- (1) Check pipes, hoses and joints for damage, oil leakage or interference.
- (2) Operate brake pedal and check operating force when pedal is depressed. Check also change in operating force, and change in position of pedal when pedal is kept depressed.

#### 2) PARKING BRAKE

- (1) Check that parking brake can hold machine in position when loaded on 20% slope. If there is no slope available, travel at low speed and check braking effect of parking brake.



Parking brake switch

50D9BCD44

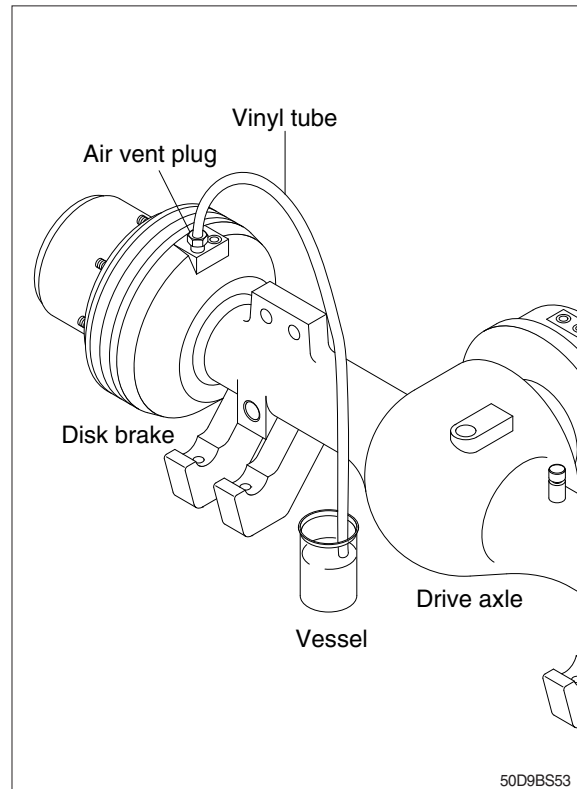


## 2. TROUBLESHOOTING

Problem	Cause	Remedy
Insufficient braking force	<ul style="list-style-type: none"> <li>· Hydraulic system leaks oil</li> <li>· Hydraulic system leaks air</li> <li>· Disk worn</li> <li>· Brake valve malfunctioning</li> <li>· Hydraulic system clogged</li> </ul>	<ul style="list-style-type: none"> <li>· Repair and add oil</li> <li>· Bleed air</li> <li>· Replace</li> <li>· Repair or replace</li> <li>· Clean</li> </ul>
Brake acting unevenly. (Machine is turned to one side during braking.)	<ul style="list-style-type: none"> <li>· Tires unequally inflated</li> <li>· Brake out of adjustment</li> <li>· Disk surface roughened</li> <li>· Wheel bearing out of adjustment</li> <li>· Hydraulic system clogged</li> </ul>	<ul style="list-style-type: none"> <li>· Adjust tire pressure</li> <li>· Adjust</li> <li>· Repair by polishing or replace</li> <li>· Adjust or replace</li> <li>· Clean</li> </ul>
Brake trailing	<ul style="list-style-type: none"> <li>· Pedal has no play</li> <li>· Piston cup faulty</li> <li>· Brake valve return port clogged</li> <li>· Hydraulic system clogged</li> <li>· Wheel bearing out of adjustment</li> </ul>	<ul style="list-style-type: none"> <li>· Adjust</li> <li>· Replace</li> <li>· Clean</li> <li>· Clean</li> <li>· Adjust or replace</li> </ul>
Brake chirps	<ul style="list-style-type: none"> <li>· Brake trailing</li> <li>· Piston fails to return</li> <li>· Disk worn</li> <li>· Disk surface roughened</li> </ul>	<ul style="list-style-type: none"> <li>· See above. Brake trailing</li> <li>· Replace</li> <li>· Replace</li> <li>· Repair by polishing or replace</li> </ul>
Brake squeaks	<ul style="list-style-type: none"> <li>· Disk surface roughened</li> <li>· Disk worn</li> <li>· Excessively large friction between disk plate</li> </ul>	<ul style="list-style-type: none"> <li>· Repair by polishing or replace</li> <li>· Replace</li> <li>· Clean and apply brake grease</li> </ul>
Large pedal stroke	<ul style="list-style-type: none"> <li>· Brake out of adjustment</li> <li>· Hydraulic line sucking air</li> <li>· Oil leaks from hydraulic line, or lack of oil</li> <li>· Disk worn</li> </ul>	<ul style="list-style-type: none"> <li>· Adjust</li> <li>· Bleed air</li> <li>· Check and repair or add oil</li> <li>· Replace</li> </ul>
Pedal dragging	<ul style="list-style-type: none"> <li>· Twisted push rod caused by improperly fitted brake valve</li> <li>· Brake valve seal faulty</li> </ul>	<ul style="list-style-type: none"> <li>· Adjust</li> <li>· Replace</li> </ul>

## GROUP 3 TESTS AND ADJUSTMENTS

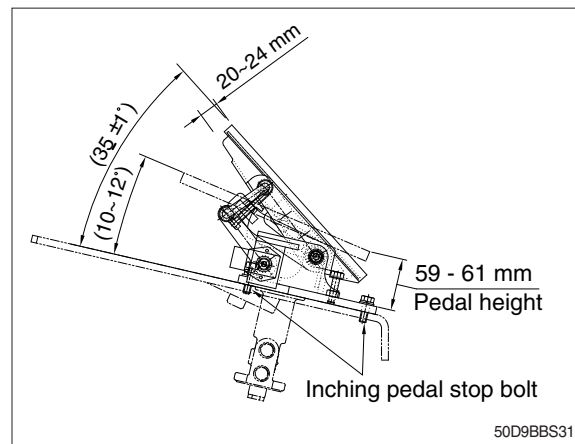
- 1) Air bleeding should be performed by two persons :  
One rides on truck for depressing and releasing brake pedal : the other person is on the ground and removes cap from air vent plug on wheel cylinder.
- 2) Block the front wheel securely and apply parking brake.
- 3) Start the engine.
- 4) Attach a vinyl tube to air vent plug and immerse other end of tube into a vessel filled with hydraulic oil.
- 5) Loosen air vent plug by turning it 3/4 with a wrench. Depress brake pedal to drain oil mixed with air bubbles from plug hole.
- 6) Depress brake pedal until no air bubbles come out of air vent plug hole.
- 7) After completion of air bleeding, securely tighten air vent plug. Install cap on plug.
- 8) Same way for the opposite side.



### 3. ADJUSTMENT OF PEDAL

#### 1) INCHING PEDAL

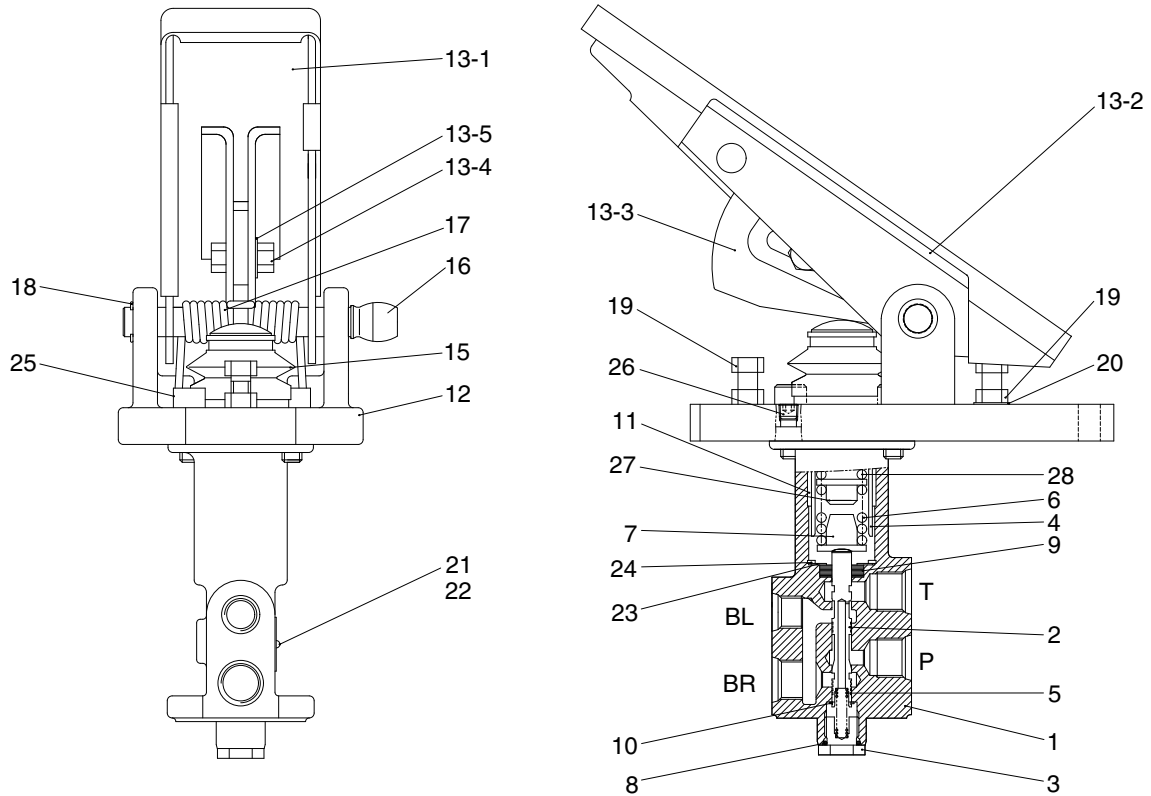
- (1) The angle stroke of the inching pedal :  
23~25 °
- (2) The adjusting dimension of the adjusting  
stopper bolt should be set with 12 mm.



## GROUP 4 DISASSEMBLY AND ASSEMBLY

### 1. BRAKE VALVE

#### 1) STRUCTURE



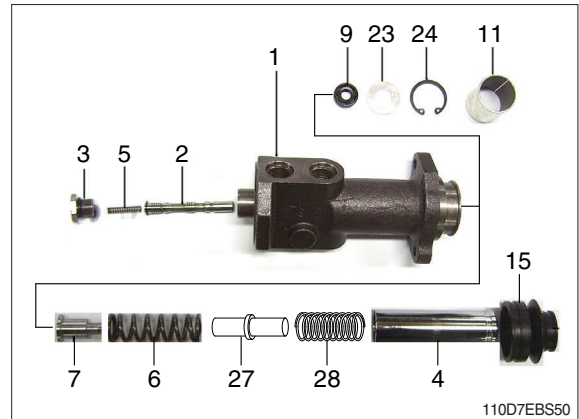
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- |                     |                   |                      |
|---------------------|-------------------|----------------------|
| 1 Body              | 11 Du bushing     | 17 Torsion spring    |
| 2 Spool             | 12 Pedal plate    | 18 Snap ring         |
| 3 Plug              | 13 Pedal assembly | 19 Hexagon bolt      |
| 4 Holder (piston)   | 13-1 Pedal        | 20 Hexagon nut       |
| 5 Lower spring      | 13-2 Rubber       | 23 Plain washer      |
| 6 Main spring 1     | 13-3 Lock plate   | 24 Snap ring         |
| 7 Spring retainer 1 | 13-4 Hexagon bolt | 25 Bolt              |
| 8 O-ring            | 13-5 Plate washer | 26 Taper plug        |
| 9 Oil seal          | 15 Bellows        | 27 Spring retainer 2 |
| 10 Snap ring        | 16 Lock pin 1     | 28 Main spring 2     |

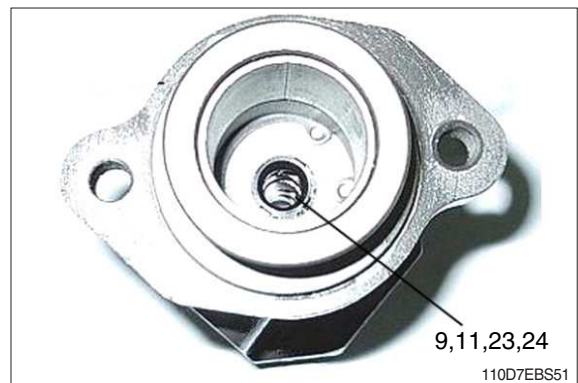
## 2) REASSEMBLY

### (1) Body assembly

- 1 Body
- 2 Spool
- 3 Plug
- 4 Holder
- 5 Spring
- 6 Main spring 1
- 7 Spring retainer 1
- 9 Oil seal
- 11 DU bushing
- 15 Rubber cover
- 23 Plain washer
- 24 Stop ring
- 27 Spring retainer 2
- 28 Main spring 2



- ① Install oil seal (9), plain washer (23), stop ring (24), DU bushing (11).
- Tool : Jig for dry bearing, snap ring plier.



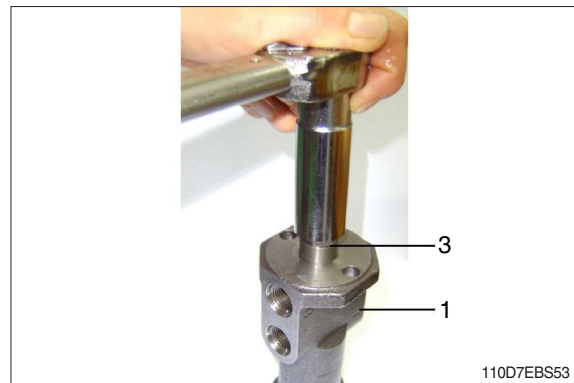
- ② Install spool (2) into body (1).



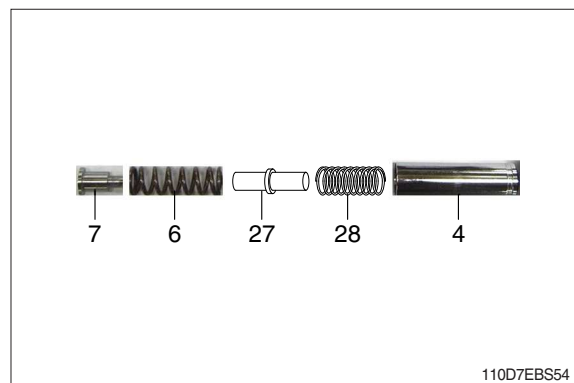
- ③ Tighten plug (3)
- Tool : 19 mm spanner
  - Tightening torque : 14.0~16.5 kgf · m

▲ Press-in the DU bushing (11) with a exclusive jig.

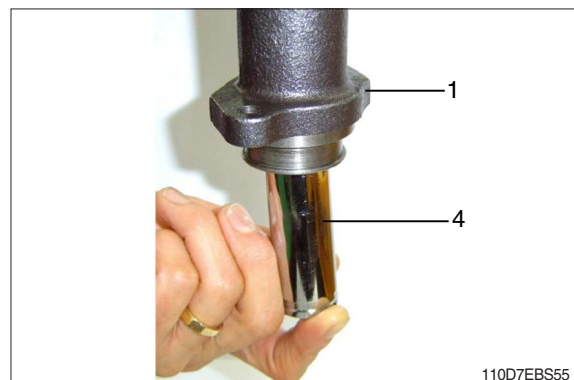
▲ Be careful of dust and scrap after washing the parts.



- ④ Spring retainer (7, 27), main spring (6, 28) and holder (4).



- ⑤ Holder (4) → Body (1)

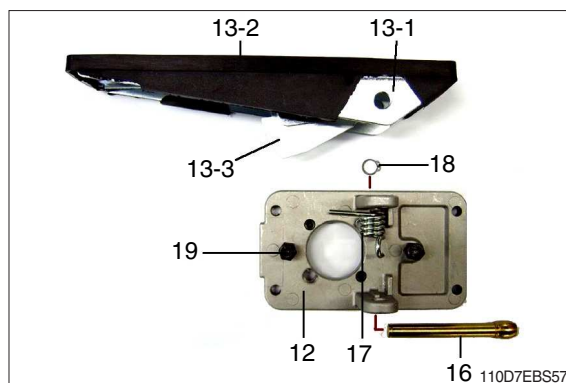


- ⑥ Rubber cover (15)



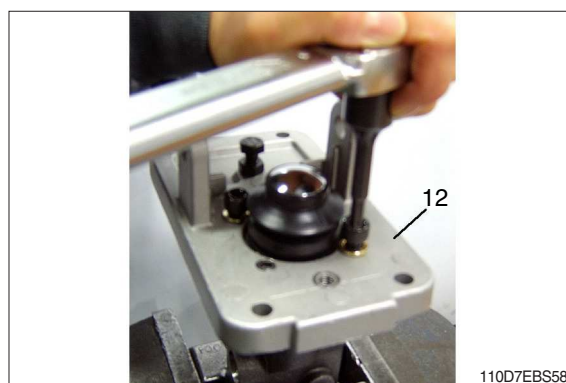
## (2) Pedal plate assembly

- 12 Pedal plate
- 13-1 Pedal
- 13-2 Pedal cover
- 13-3 Lock plate
- 16 Lock pin (pedal)
- 17 Torsion spring
- 18 Stop ring
- 19 Hexagon bolt

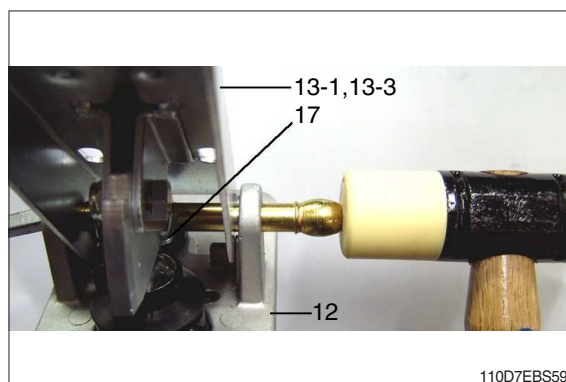


### ① Pedal plate (12) assembly

- Tool : 6 mm torque wrench
- Tightening torque : 2.5~3.0 kgf · m

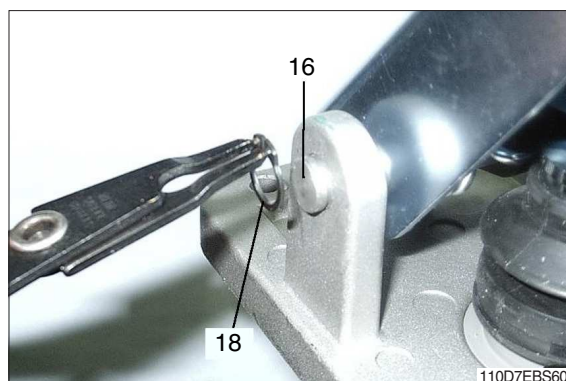


- ### ② Pre-assembly pedal assembly (13-1, 13-3) and torsion spring (17) on the pedal plate (12) with a bar of Ø12 and then push the bar with a plastic hammer.
- Tool : Ø12 bar, plastic hammer.

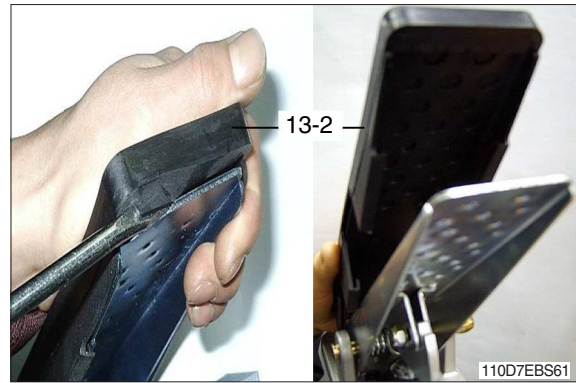


- ### ③ Lock pin (pedal) (16), stop ring (18).
- Tool : Snap ring plier for axis.

**▲ To prevent pedal plate from being damaged stop ring (18) must be removed before removing lock pin (16).**



④ Rubber cover (13-2)



⑤ Hexagon bolt (19)

- Tool : 13 mm spanner
- Tightening torque : 2.0 kgf · m



**▲ Never remove the hexagon bolt.**  
(Pressure setting valve deviation occurs)