

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

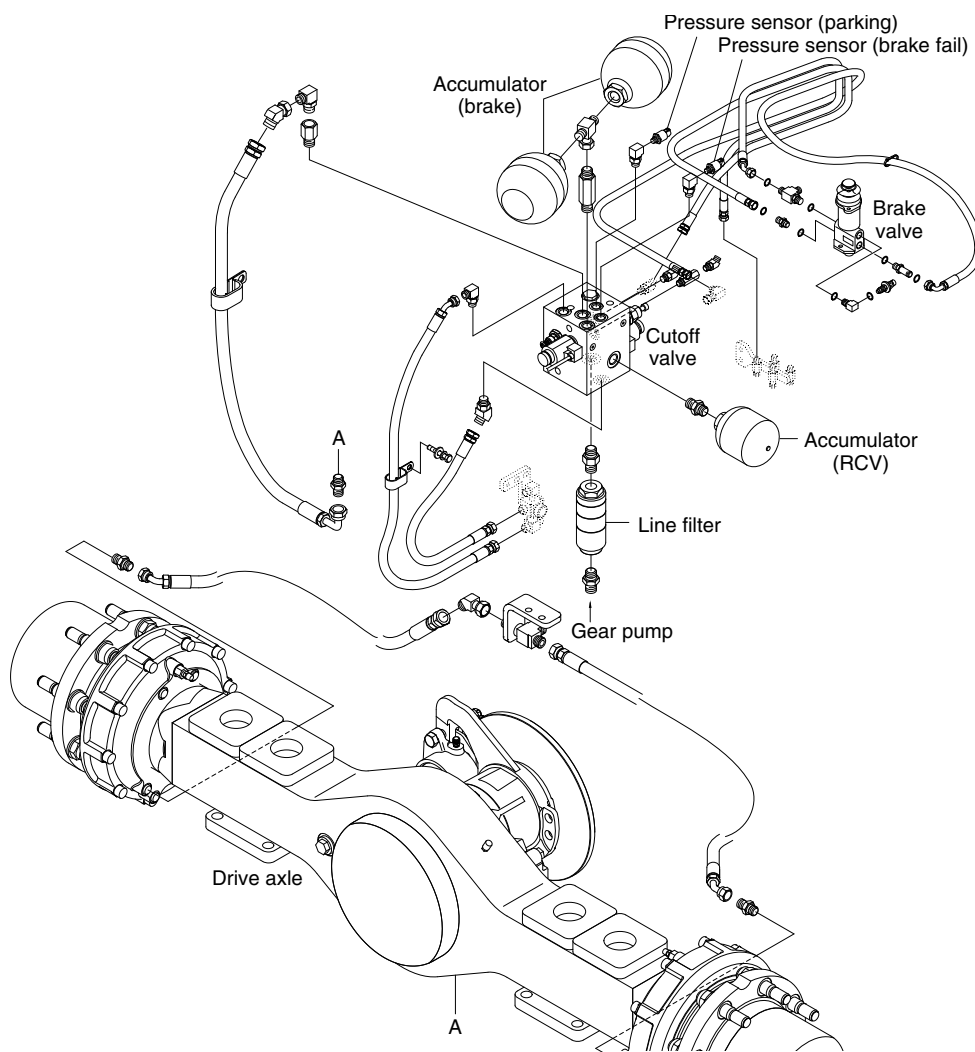
The fixed displacement brake pump supplies flow to the cut-off valve for service brake circuit. It flows to two accumulator. The accumulator has a gas precharge and an inlet check valve to maintain a pressurized volume of oil for reserve brake applications. Oil through the accumulator flows to the brake valves. The brake valve is a closed center design, single circuit operated by a pedal. The brake system contains the following components:

- Gear pump
- Cut-off valve, Line filter, Accumulators, Pressure sensor
- Brake valve, Pressure switch
- Line filter

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.

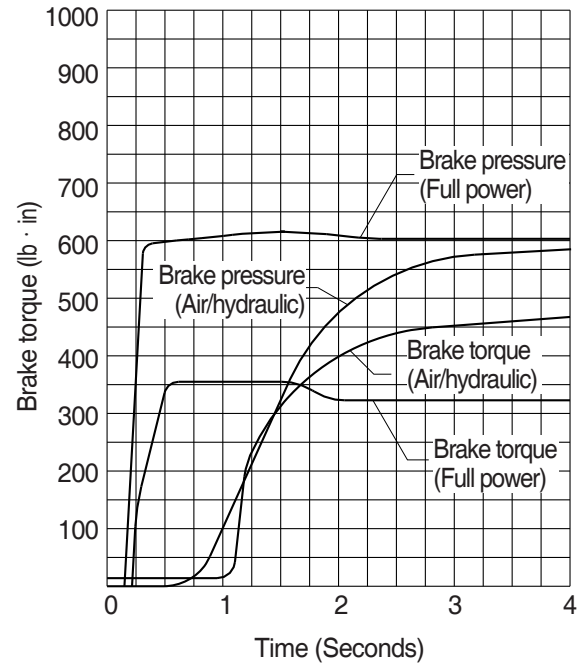
Full power systems can supply significantly higher brake pressures with relatively low reactive pedal forces. The reactive pedal force felt by the operator will be proportional to the brake line pressure being generated. This is referred to as brake pressure modulation.

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.

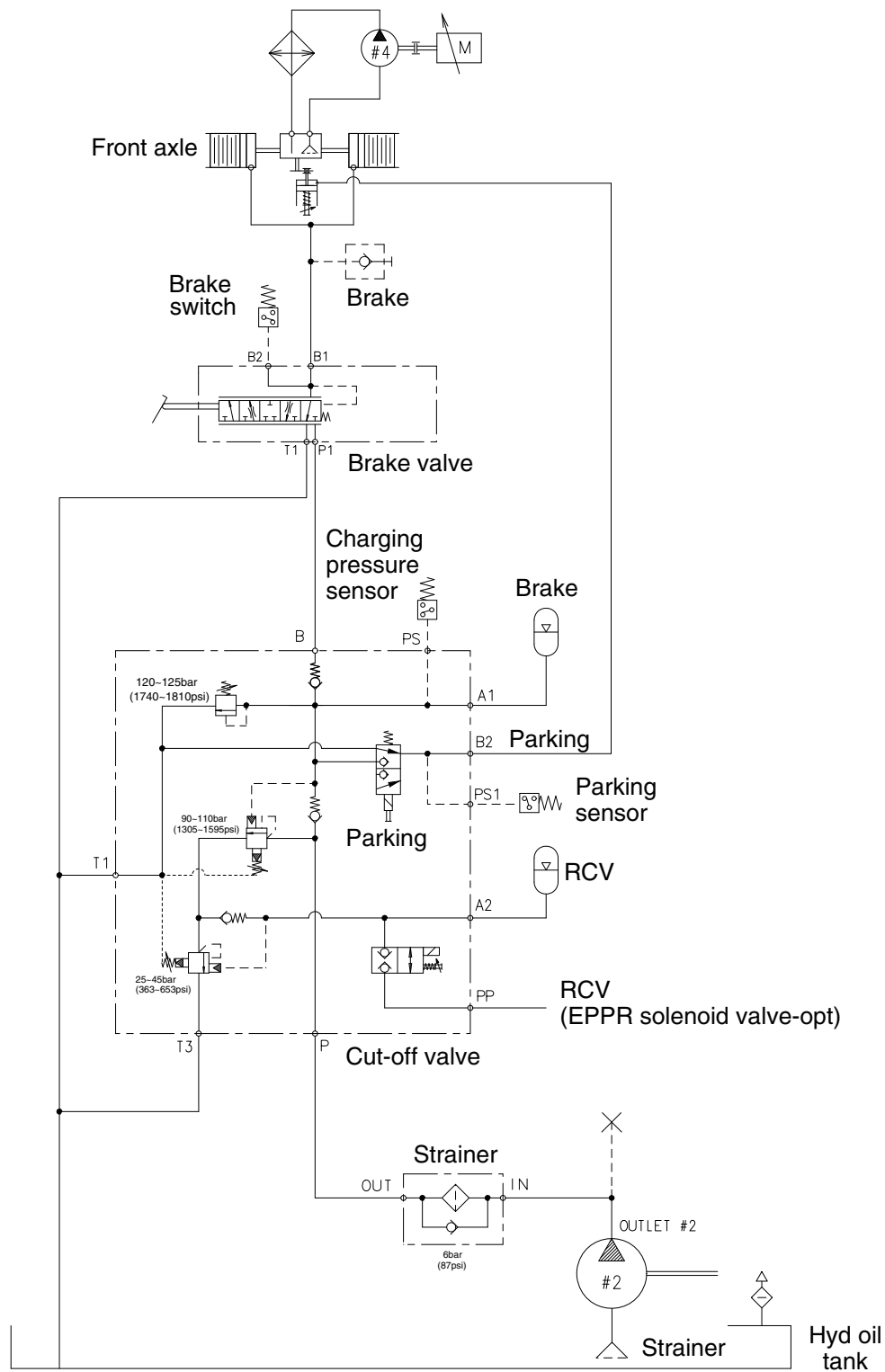
Because these systems are closed center, by using a properly sized accumulator, emergency power-off braking that is identical to power-on braking can be achieved. These systems can be either dedicated, where the brake system pump supplies only the demands of the brake system or non-dedicated, where the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

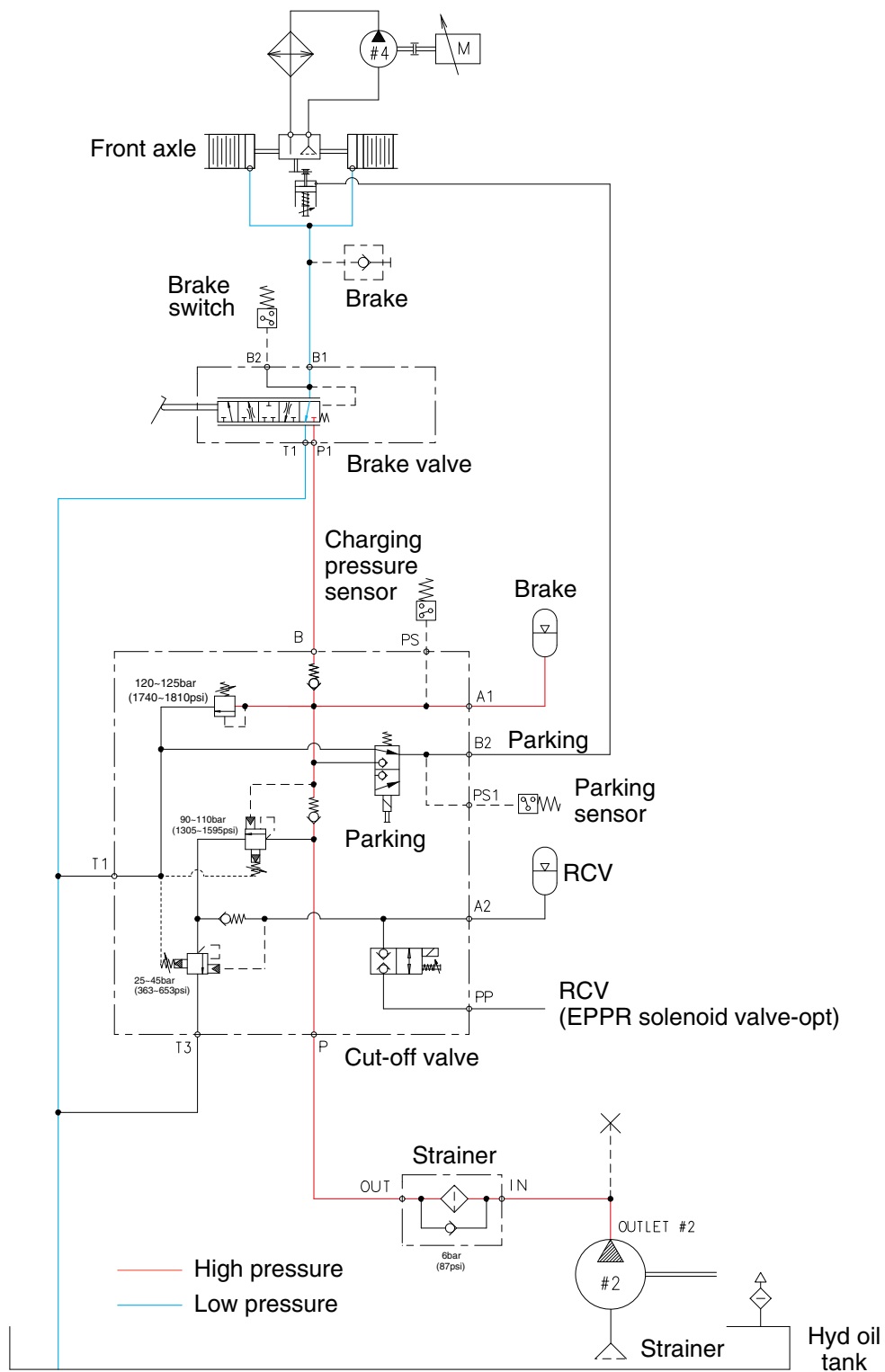


2. HYDRAULIC CIRCUIT



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1) SERVICE BRAKE RELEASED



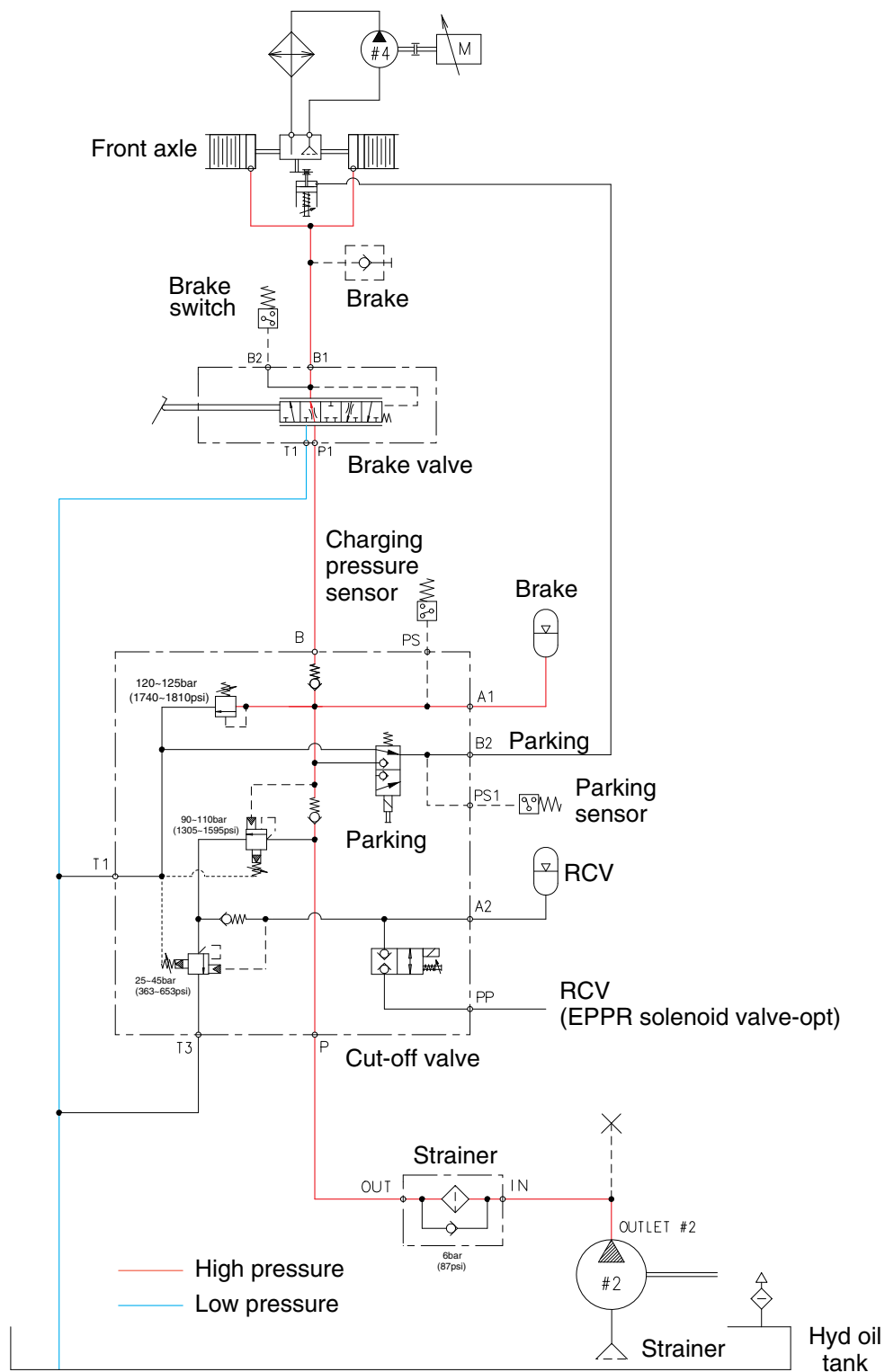
100D9V4BS11

When the pedal of brake valve 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 front axle return to the hydraulic oil tank.

Therefore, the service brake is kept released.

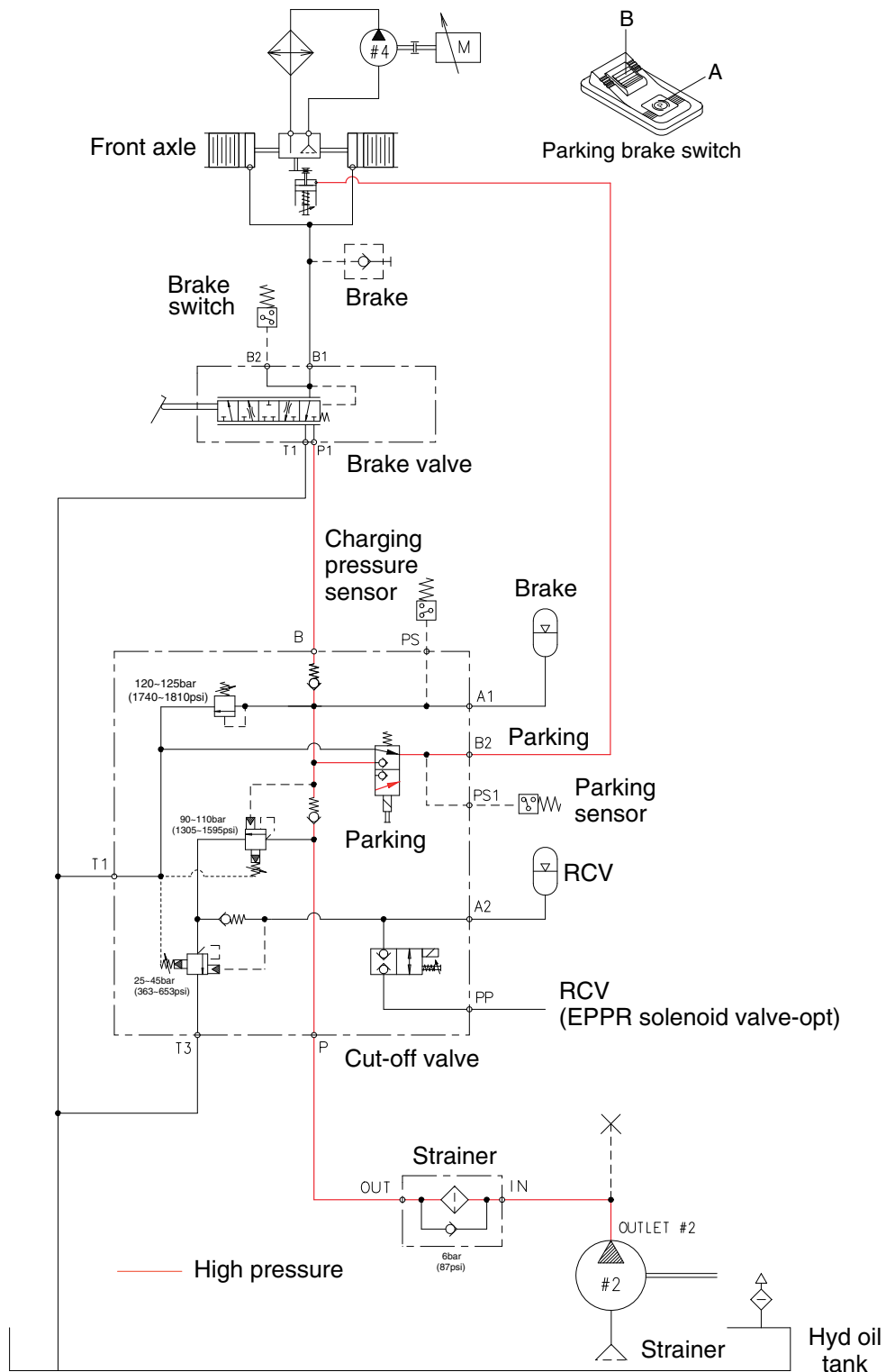
2) SERVICE BRAKE OPERATED



100D9V4BS12

When the pedal of brake valve is depressed, the operating force overcomes the force of the spring, and is transmitted to the spool. When the spool moves down, the inlet port is opened, and at the same time the hydraulic oil controlled the pressure level by the cut-off valve enters the piston in the front axle. Therefore, the service brake is applied.

3) PARKING BRAKE RELEASED

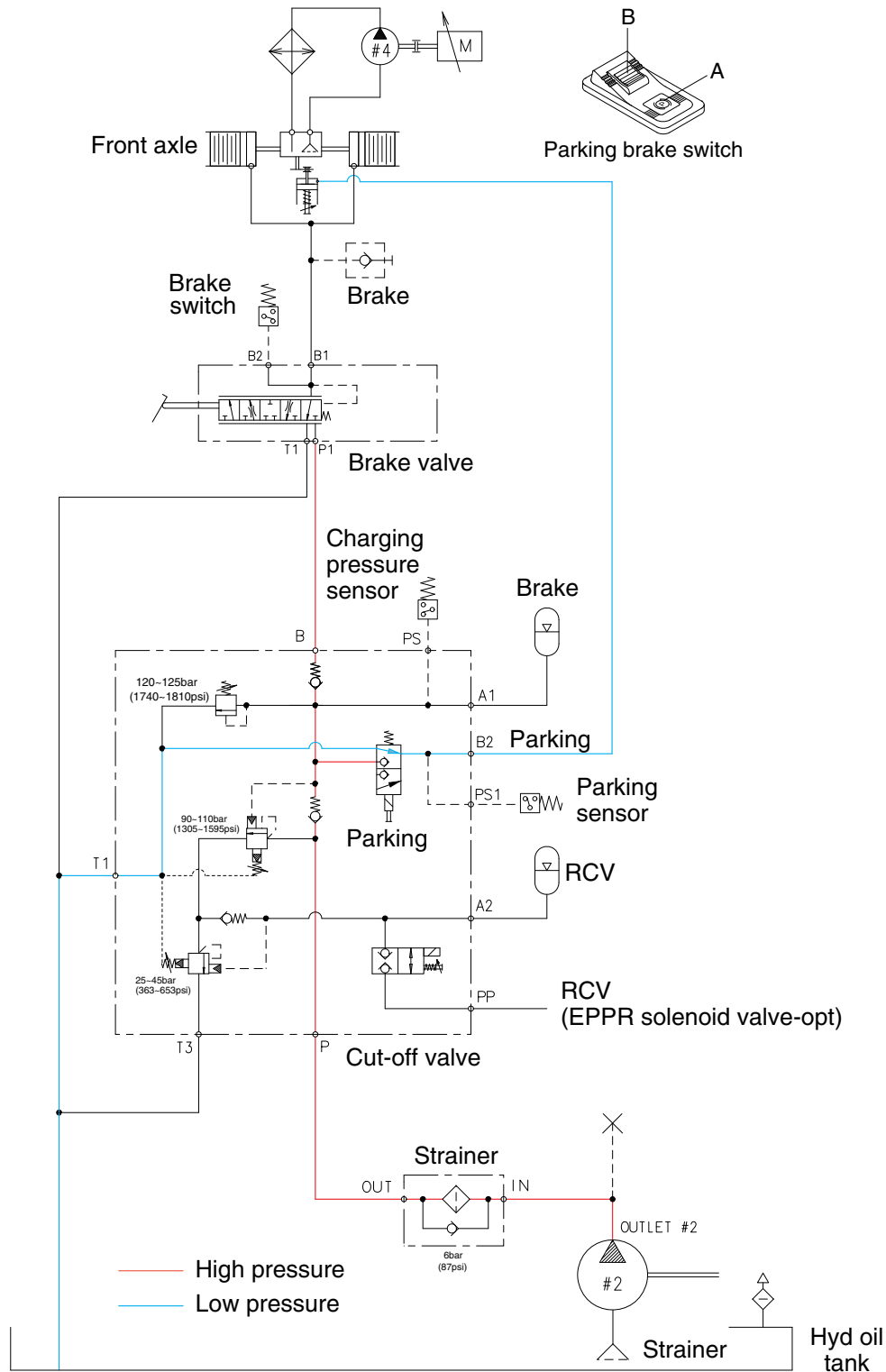


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When the parking brake switch is pressed B position, the parking brake solenoid valve is energized and the hydraulic oil controlled the pressure level by the cut-off valve enters the parking brake. It overcomes the force of the spring and pushes the 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 OPERATED



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

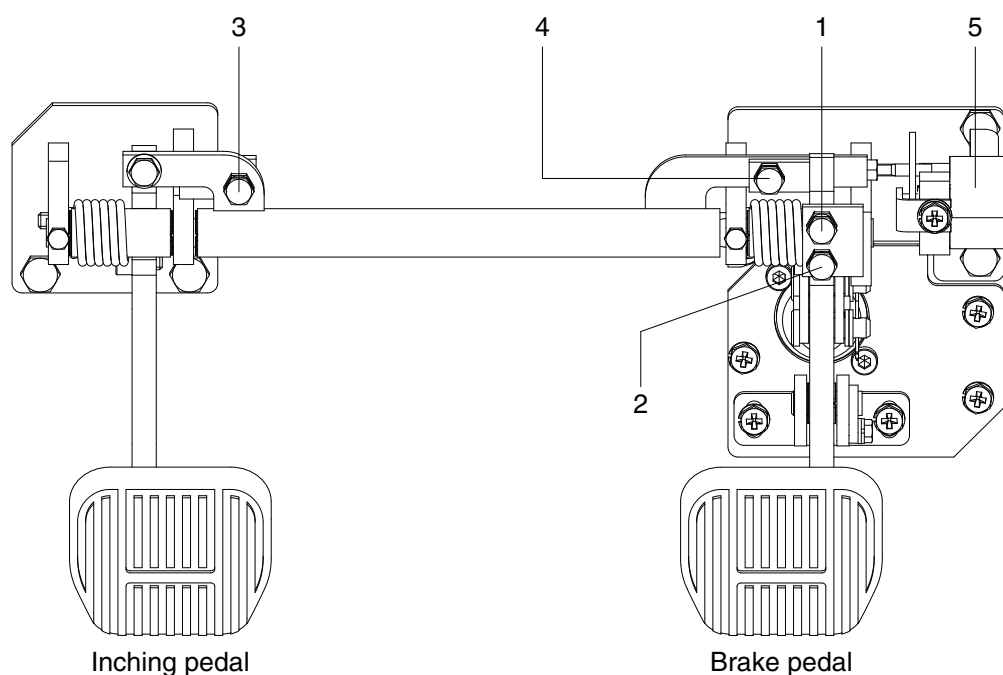
At the same time, the hydraulic oil in the parking brake return to the hydraulic oil tank through the solenoid valve. When the piston is returned by the force of the spring, the parking brake is applied.

5) DO AEB WORK

※ Please refer to page 7-91.

3. 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.



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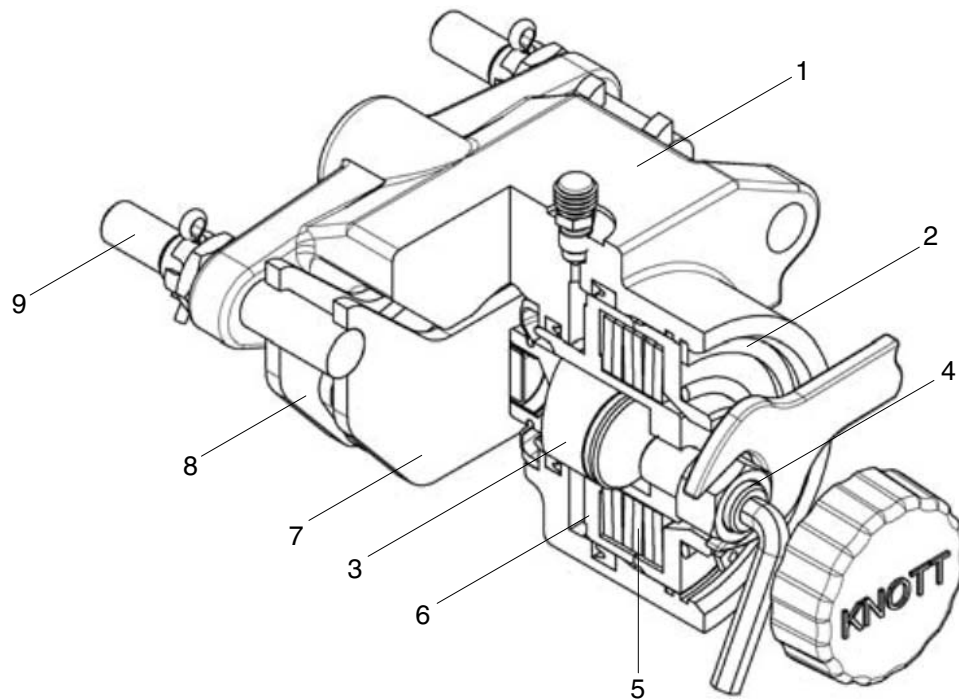
- | | | | | | |
|---|-------------------------|---|--------------------------------------|---|----------------|
| 1 | Brake stopper bolt | 3 | Inching stopper bolt | 5 | Inching sensor |
| 2 | Brake stroke limit bolt | 4 | Brake & inching pedal interlock bolt | | |

1) INITIALIZING THE INCHING SENSOR

Refer to the page of the cluster setting.

4. PARKING BRAKE SYSTEM (KESSLER)

1) STRUCTURE



100D7BS111

| | | | | | |
|---|---------------|---|---------------------|---|--------------|
| 1 | Housing | 4 | Adjust screw | 7 | Lining pad |
| 2 | Pressure ring | 5 | Bank of cup springs | 8 | Lining pad |
| 3 | Thrust bolt | 6 | Piston | 9 | Gliding bolt |

2) OPERATION

The two identical brake pads slide freely on the guide bolt, which is fastened in the housing. The guide bolts are guided in an additional brake anchor plate which in turn is screwed onto the vehicle, i.e. its axle.

On actuation, the brake generates a clamping force at the brake lining pads, which cause a tangential force/braking moment to be generated at the brake disk, the extent of which depends on the coefficients of friction generated by the linings.

The clamping force is generated by the bank of cup springs, during which the piston is moved together with the adjusting screw, the thrust bolt and the brake pad towards the brake disk.

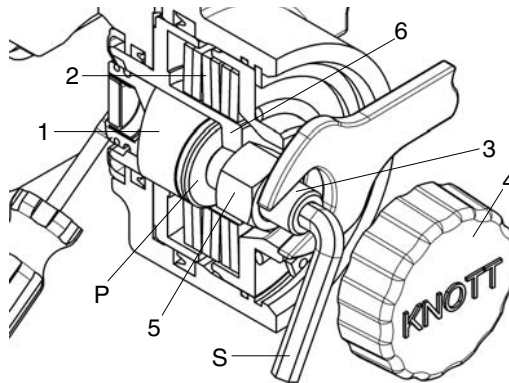
When the brake pad comes into contact with the brake disk, the reaction force shifts the housing onto the guide bolts until the brake pad is also pressed against the brake disk.

The brake is released by complete pre-tensioning of the bank of cup springs. During this process, through application of the necessary release pressure after overcoming the cup spring force, the piston must move back until it comes to rest against the pressure ring.

The clamping force diminishes with wear of the brake lining and brake disk. The brake must be adjusted at the latest at the times indicated by the adjusting specification followings.

3) MOUNTING AND BASIC SETTING REGULATIONS

Basic brake setting is required after mounting new brake lining plates or brake disks, as well as during all repair stages and in the event of insufficient braking performance.



100D7BS112

- | | | | | | |
|---|---------------------|---|-----------|---|---------------|
| 1 | Thrust bolt | 4 | Screw cap | P | Even surface |
| 2 | Bank of cup springs | 5 | Lock nut | S | Socket wrench |
| 3 | Adjusting screw | 6 | Piston | | |

※ All mounting and basic setting work must be carried out on the brake when cold.

(1) Mounting the brake

- ① Stand the vehicle on an even surface and secure against rolling away.
- ② Release the screw cap.
- ③ Release the lock nut (size 24 or 30) and turn the adjusting screw anticlockwise using a size 8 or 10 socket wrench until the pressure bolt comes to rest against the even surface of the piston. In this status, the brake can be mounted onto the brake disk and fastened.
- ④ Mount the pressure connection again.
Apply the necessary release pressure to the brake until the bank of cup springs is completely pre-tensioned. Following carry out the following page basic setting regulation.

(2) BASIC SETTING REGULATION

- ① Turn the adjusting screw manually clockwise until both brake pads make contact with the brake disk. Then it is not longer possible to turn the adjusting screw without exerting a major amount of force.
- ② Turn the adjusting screw anticlockwise in order to set the following rated clearances.

| Model | Adjusting screw | Clearance (mm) | | Turns |
|---------|------------------------|----------------|-----|-------|
| 100D-9V | FSG 90 | Min. | 0.5 | 1/4 |
| | | Clearance | 1.0 | 1/2 |
| | | Max. | 1.5 | 3/4 |
| | FSG 110 M20 (SW 10) | Min. | 1.0 | 2/5 |
| | | Clearance | 2.0 | 4/5 |
| | | Max. | 3.0 | 1 1/5 |

- ③ Hold the adjusting screw in position with a hexagonal socket wrench and lock with lock nut. (50+5 Mm)
 - ④ Mount the screw cap and tighten as far as possible manually.
 - ⑤ Mount the pressure connection in accordance with the instructions of the axle.
- ※ For bleeding the piston chamber use the socket spanner size 13 for the bleeding valve.

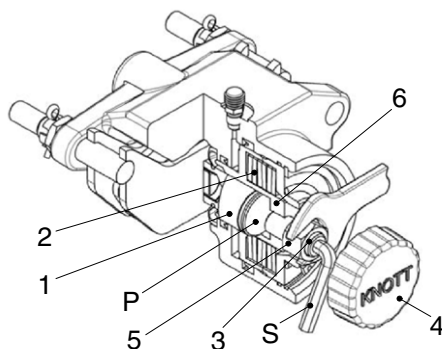
(3) ADJUSTING REGULATIONS

During this adjusting process, the parking brake must be released, i.e. the bank of cup springs must be completely pre-tensioned.

- ① Stand the vehicle on an even surface and secure against rolling away.
 - ② Release the parking brake by using the required release pressure.
 - ③ Release the screw cap and unscrew.
 - ④ Release the lock nut (size 24 or 30) and turn the adjusting screw with socket wrench size 8 or 10 manually clockwise until the two brake pads make contact with the brake disk.
 - ⑤ Turn the adjusting screw anti-clockwise and set the clearance specified in the above table.
 - ⑥ Hold the adjusting screw in position with the hexagonal socket wrench and lock with the lock nut. (50+5 Mm)
 - ⑦ Mount the screw cap and tighten as far as possible manually.
- ※ Actuate the brake valve several times and check the braking efficiency of the parking brake on a slope.

4) EMERGENCY RELEASE OF THE PARKING BRAKE

After the failure of the pressure release the parking brake by using following manual procedure.



100D7BS117

- | | | | | | |
|---|---------------------|---|-----------|---|---------------|
| 1 | Thrust bolt | 4 | Screw cap | P | Even surface |
| 2 | Bank of cup springs | 5 | Lock nut | S | Socket wrench |
| 3 | Adjusting screw | 6 | Piston | | |

- (1) The vehicle has to be secured against rolling away.
- (2) Release the screw cap and unscrew
- (3) Release the lock nut (size 24 or 30) and turn the adjusting screw with socket wrench size 8 or 10 manually counter-clockwise until the brake disc is free.

▲ For the emergency release is an actuation torque of 40 Nm respectively 70 Nm required.

- (4) Mount the lock nut and the screw cap and tighten both as far as possible manually. (protection against dirt)

▲ Now, the vehicle do not have any brake function. The vehicle must be secured against moving away with proper means. Before putting the vehicle into operation again, the brake has to be adjusted again. Refer to previous page. "Assembly and basic setting regulations".

5) MAINTENANCE AND REPAIR WORK

(1) Maintenance and exchange of brake pads

The brake pads themselves are maintenance free. All that is required here is a check for damaged parts, as well as inspection to ensure that the brake disk remains easy running.

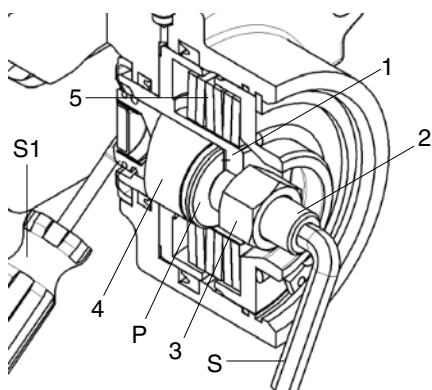
The thickness of the brake lining must be subjected to a visual inspection at regular intervals, which depend on vehicle usage, but every six months at the latest. In the event of a minimal residual lining thickness, these intervals must be reduced accordingly in order to avoid major damage to the brake or disk.

- FSG 90

Min. residual thickness 1.0 mm per lining pad (6 mm carrier plate thickness).

- FSG 100

Min. residual thickness 2.0 mm per lining pad (8 mm carrier plate thickness).



180D7EBS113

1 Piston

2 Adjusting screw

3 Lock nut

4 Thrust bolt

5 Bank of cup spring

S Socket wrench

S1 Screwdriver

P Inside of the piston

※ Only original spare lining plates may be used. If any other spare parts are used, no warranty claims will be accepted either for the brakes or their functional characteristics.

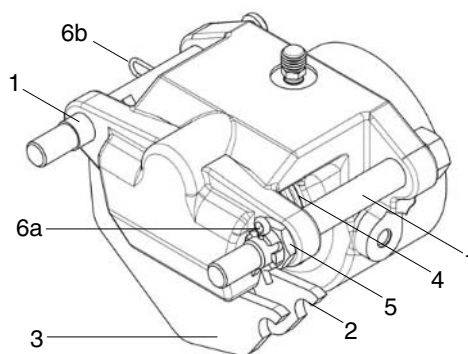
① Stand the vehicle on an even surface and secure against rolling away.

② Release the parking brake by applying the required release pressure.

③ Release the screw cap and unscrew.

④ Release the lock nut (size 24 or 30) and turn the adjusting screw with socket wrench size 8 or manually clockwise until it lies flush with the inside of the piston.

⑤ Press back the thrust bolt using a suitable screwdriver until it has contact with the piston.



100D7BS114

- | | | | |
|---|------------------|----|-----------------|
| 1 | Guide bolt | 5 | Castellated nut |
| 2 | Lining pad | 6a | Safety splint |
| 3 | Lining pad | 6b | Safety clip |
| 4 | Permanent magnet | | |

- ⑥ Depending on the free space available, release one of the two guide bolts, removing the safety splint, unscrewing the castellated nut and pulling the guide bolt out of the brake anchor plate. Now, the brake lining pads can be removed tangentially to the brake disk.

※ In the event of minimal clearance, i.e. it is not possible for space reasons to exchange the brake lining plate in accordance with these instructions, the brake must be removed completely. To do this, pull both guide bolts out of the brake anchor plate.

▲ Check the pressure hose. If the pressure hose is too short, it must be unscrewed to remove the brake. Before the pressure hose can be released the brake must be emergency released.

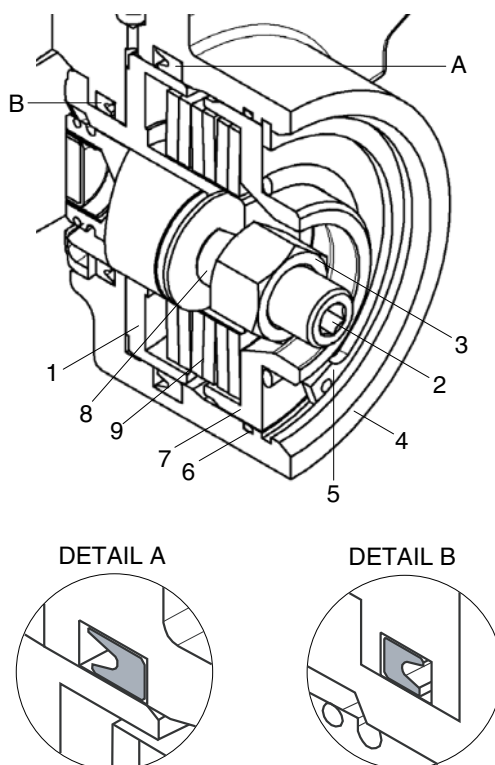
- ⑦ Exchange the brake pads and insert the guide bolts into the brake anchor plate. If you have removed the complete brake you have to amount the brake on both guide bolt again, now.

- ⑧ Check both permanent magnets if they still have sufficient magnetic force to hold the brake lining plates. Should this not be the case, the permanent magnets must also be changed by using a suitable screw driver.

- ⑨ Secure the guide bolt with the castellated nut and the safety splint respective safety clip.

▲ After mounting new brake lining plates or their repair, the brake must be correctly set in accordance with the instructions "Adjusting regulations".

(2) Changing the seal



100D7BS115

- | | | | | | |
|---|-----------------|---|-------------|---|--------------------|
| 1 | Piston | 5 | Circlip | 9 | Bank of cup spring |
| 2 | Adjusting screw | 6 | Seal | A | Detail of the seal |
| 3 | Lock nut | 7 | Guide bolt | B | Detail of the seal |
| 4 | Housing | 8 | Thrust bolt | | |

※ Faulty seals must be exchanged in accordance with the instructions below.

- ① Stand the vehicle on an even surface and secure against rolling away.
- ② Release the parking brake by applying the necessary release pressure.
- ③ Release the screw cap and unscrew.
- ④ Release the lock nut (size 24 or 30) and turn the adjusting screw with socket wrench size 8 or 10 manually counter clockwise until the adjuster screw is flush with the inner side of the piston.
- ⑤ Push back the thrust bolt until it has contact with the piston. Following actuate the hand brake valve (No pressure must be in the piston chamber). The bank of cup springs is now completely depressurized.
- ⑥ Unscrew the pressure hose and remove the brake.
- ⑦ Release the circlip and remove the pressure ring of the housing.
- ⑧ Release the bank of cup springs and the piston.

▲ Pay attention to the mounting direction of the seal rings, otherwise leaks can occur.

▲ Use for mounting the new seal rings a suitable mounting needle with rounded edge.
Be careful.

- ⑨ Change all seals and mount the parts of the brake in other way round order. By mounting the piston, the sliding and sealing surfaces must be greased lightly using lubricating grease to DIN 51825. The dust protection cap is fitted with a vulcanized-in steel ring which is used to press it through the locating hole. For exchanging, "lever out" the ring using a suitable tool. The new dust protection cap must be pressed in with the aid of a suitable mounting ring and screw clamps or a lever press.

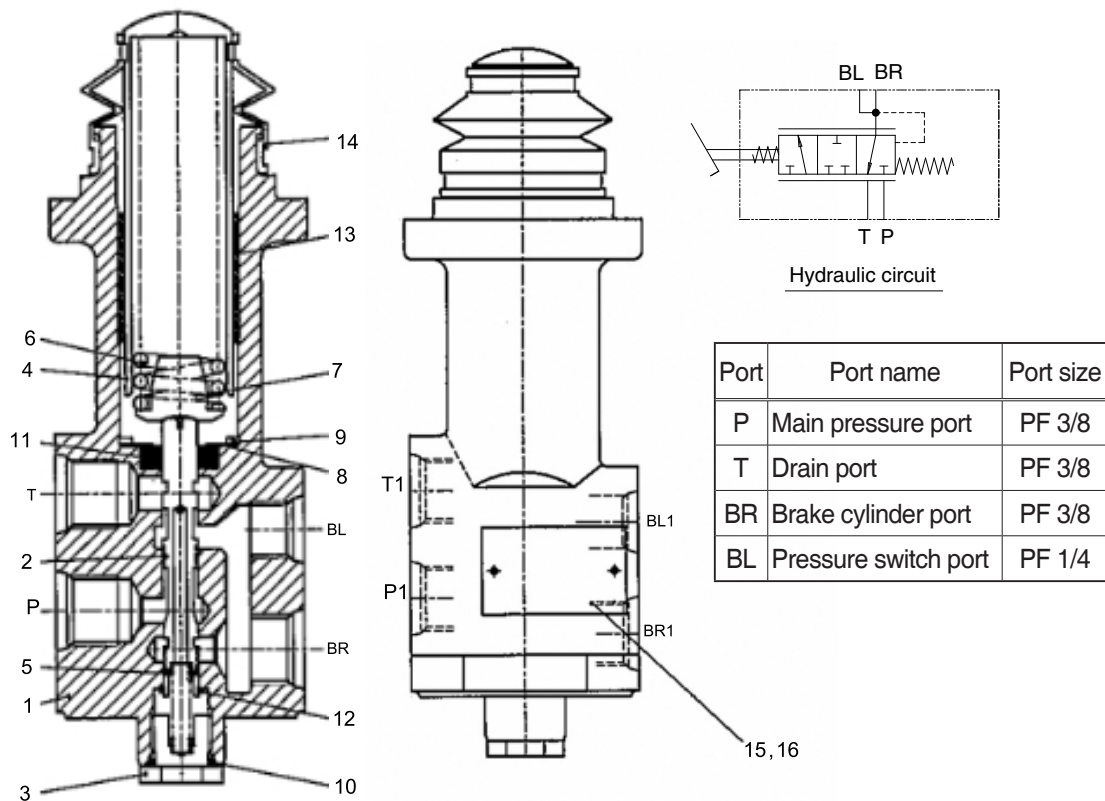
(2) General

Any discovered defects or damage to parts not listed here must naturally be repaired or replaced using original parts.

For any other information not contained in these instructions or for more detailed instructions, please contact Hyundai dealer.

5. BRAKE VALVE

1) STRUCTURE



160D9VBS07

- | | | |
|----------------|-------------------|-----------------|
| 1 Valve body | 7 Spring retainer | 13 DU bushing |
| 2 Spool | 8 Plain washer | 14 Rubber cover |
| 3 Plug | 9 Snap ring | 15 Name plate |
| 4 Brake holder | 10 O-ring | 16 Drive screw |
| 5 Lower spring | 11 Oil seal | |
| 6 Main spring | 12 Snap ring | |

(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) 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.

(6) 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.**

(7) Repair work

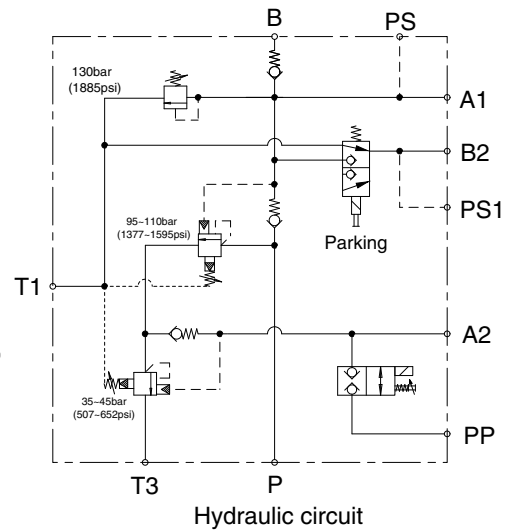
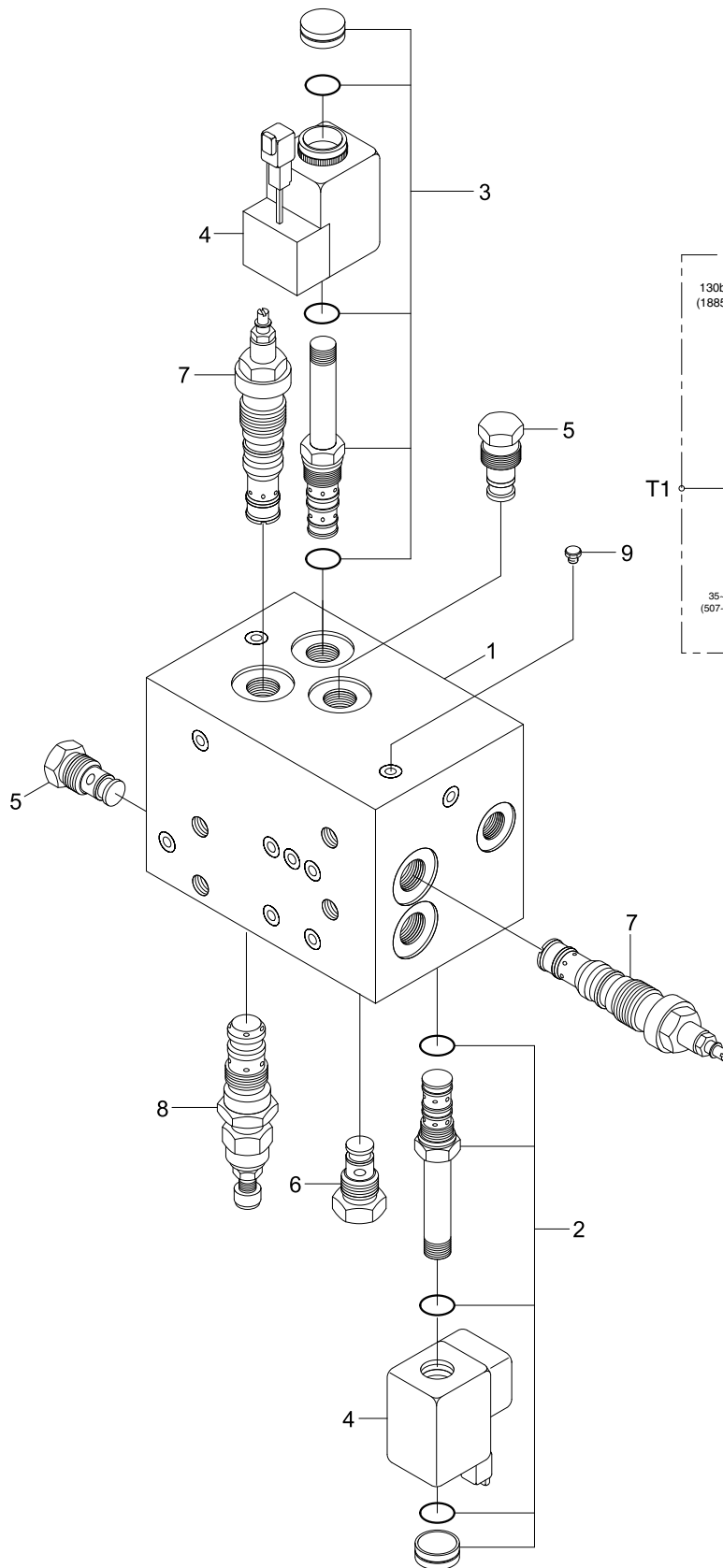
△ **When working on the braking system, always make sure that there is absolutely no pressure in the system. Even when the engine is switched off there will be some residual pressure in the system.**

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

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

6. CUT-OFF VALVE

1) STRUCTURE



- 1 Block
- 2 Solenoid valve
- 3 Solenoid valve
- 4 Coil
- 5 Check valve
- 6 Check valve
- 7 Cutoff valve
- 8 Relief valve
- 9 Plug

100D9V4CV01

2) TIGHTENING TORQUE

| Item | Name | Hex size | Tightening torque |
|------|----------------|----------|-------------------|
| 2 | Solenoid valve | 27 mm | 45 Nm |
| 3 | Solenoid valve | 27 mm | 45 Nm |
| 5 | Check valve | 22 mm | 40 Nm |
| 6 | Check valve | 22 mm | 40 Nm |
| 7 | Cutoff valve | 27 mm | 50 Nm |
| 8 | Relief valve | 27 mm | 50 Nm |

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.

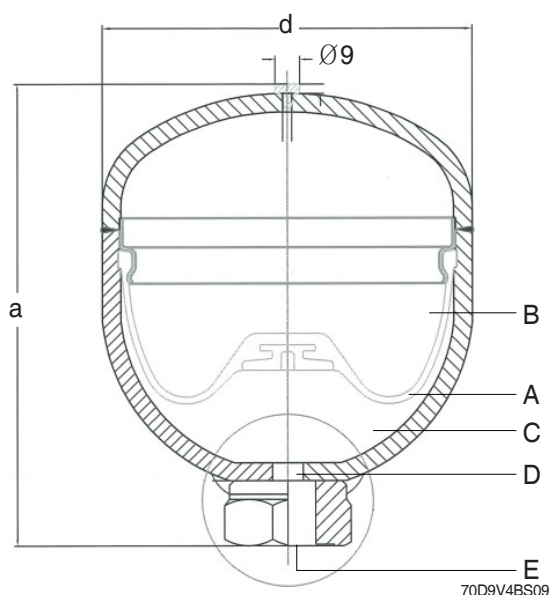
As the pressure on P line rises to 90 bar, the cut off valve (7) starts cut-offing and the oil in the P port is unloaded. The pressure on P line goes down 80 bar by the minute leakage from valve and other factors.

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

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

7. BRAKE ACCUMULATOR

1) STRUCTURE



| Item | Brake (2 EA) | RCV (1 EA) |
|---------------------|--------------|--------------|
| Diameter (d) | 122 mm | 90 mm |
| Mounting height (a) | 145 mm | 120 mm |
| Nominal volume | 0.75 ℓ | 0.35 ℓ |
| Priming pressure | 50 bar | 15 bar |
| Operating medium | Oil | Oil |
| Operating pressure | Max. 210 bar | Max. 170 bar |
| Thread | M18×1.5 | PF 1/2 |
| Priming gas | Nitrogen | Nitrogen |

A Fluid portion C Diaphragm E Flat port
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**.

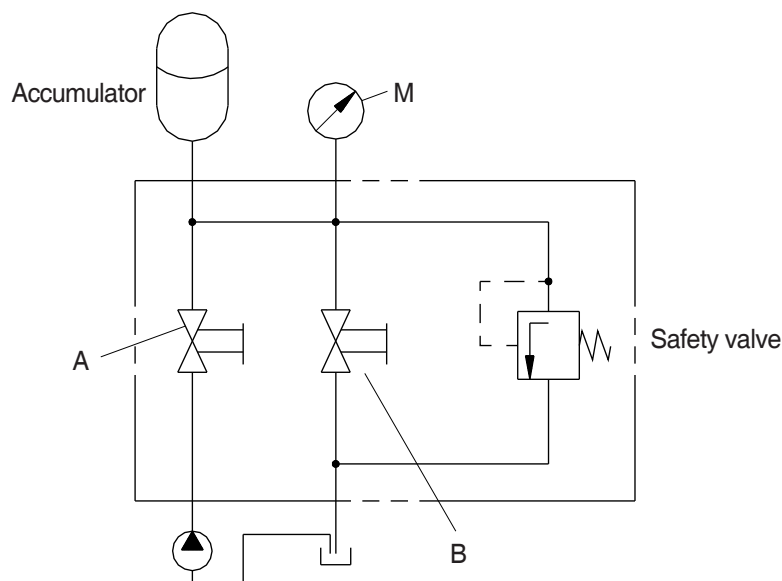
(7) Repair work

△ **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.**

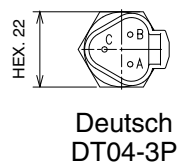
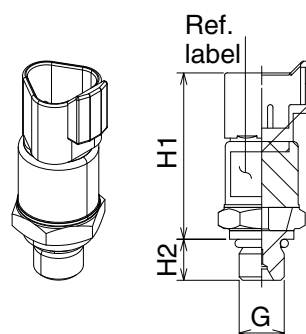


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8. PRESSURE SENSOR AND SWITCH

1) PRESSURE SENSOR

(1) Structure



· Tightening torque : 2.5 ~ 3.0 kgf·m
(18 ~ 21.7 lbf·ft)

| Pin map | Function |
|---------|----------|
| A | + Supply |
| B | - Supply |
| C | Output |

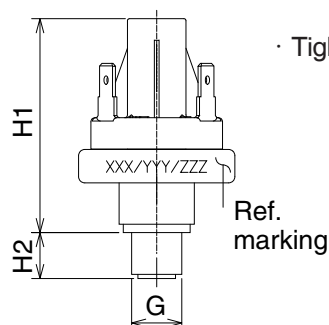
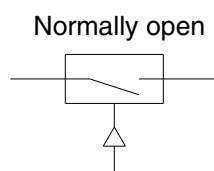
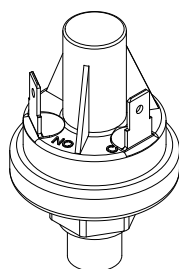
70D9V4BS10

| Item | Medium | Thread (G) | H1 (mm) | H2 (mm) | Measuring range (bar) | Cut-off actuating pressure | Voltage (V) | Electrical connections |
|--------------------------------------|--------|-------------|---------|---------|-----------------------|--------------------------------|-------------|------------------------|
| Charging pressure sensor (PS or PSS) | Oil | 9/16-18 UNF | 49 | 12 | 0 ~ 350 | 90 ~ 95 bar (1.52 ~ 1.58 V) | Max. 30 | CD-3 |
| Parking pressure sensor (PS1 or PSP) | Oil | 9/16-18 UNF | 49 | 12 | 0 ~ 350 | 90 ~ 95 bar (1.52 ~ 1.58 V) | Max. 30 | CD-26 |

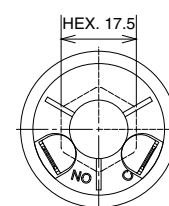
※ O-ring (S611-012001) : 11.89 × 1.98 (AS568-906, NBR Hs90)

2) PRESSURE SWITCH

(1) Structure



· Tightening torque : 2.5 ~ 3.0 kgf·m
(18 ~ 21.7 lbf·ft)



70D9V4BS11

| Item | Type | Medium | Thread (G) | H1 (mm) | H2 (mm) | Measuring range (bar) | Actuating pressure | Supply voltage | Electrical connections |
|---------------------------------------|---------------|--------|------------|---------|---------|-----------------------|-----------------------|----------------|------------------------|
| Brake lamp pressure switch (B2 or BL) | Normally open | Oil | 1/2-20 UNF | 49 | 11 | 1 ~ 10 | 5 ± 1 bar (0.56 V) | Max. 45 V | Slip on CD-4 |

※ O-ring (S611-011001) : 10.52 × 1.82 (AS568-905, NBR Hs90)

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.

GROUP 2 OPERATIONAL CHECKS AND TROUBLESHOOTING

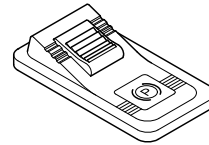
1. OPERATIONAL CHECKS

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.



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2. TROUBLESHOOTING

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

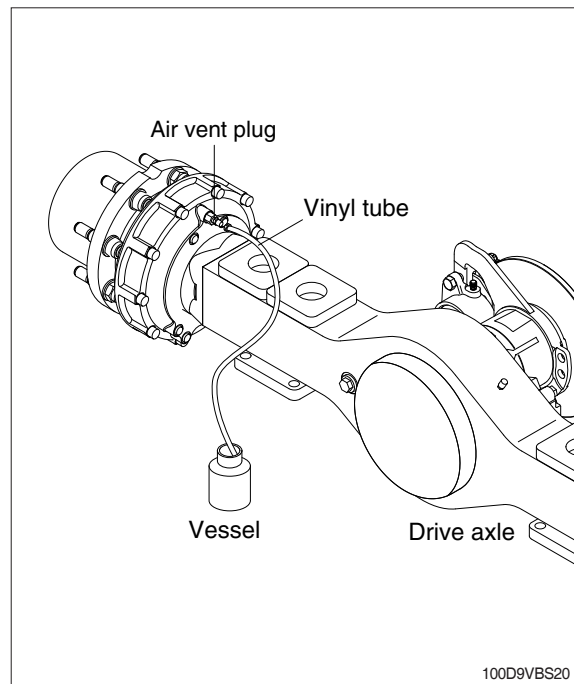
GROUP 3 TESTS AND ADJUSTMENTS

1. AIR BLEEDING OF BRAKE SYSTEM

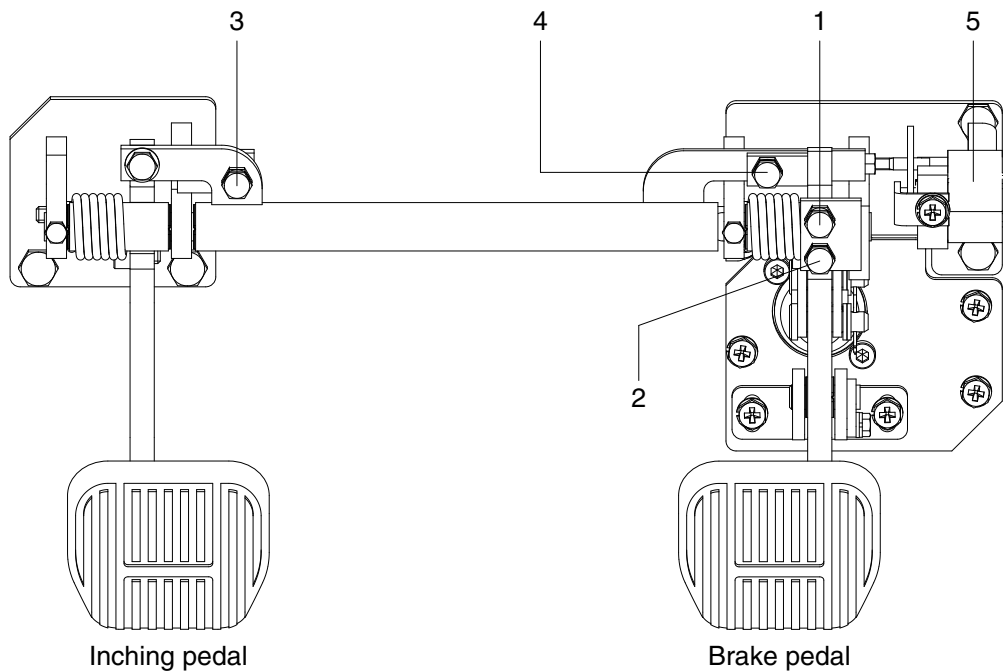
- 1) Air bleeding should be performed by two persons :

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.



2. ADJUSTMENT OF PEDALS



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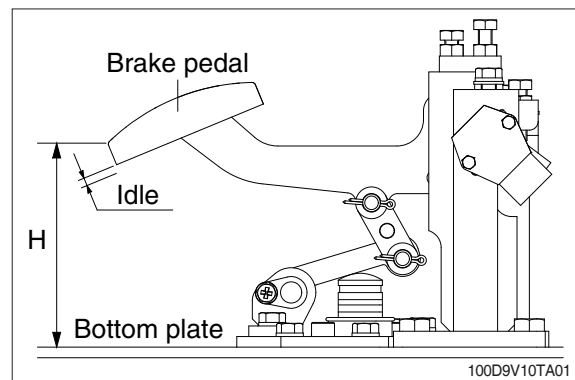
- | | | | | | |
|---|-------------------------|---|------------------------------------|---|----------------|
| 1 | Brake stopper bolt | 3 | Inching stopper bolt | 5 | Inching sensor |
| 2 | Brake stroke limit bolt | 4 | Brake&inching pedal interlock bolt | | |

1) Brake pedal

- Adjust the brake stopper bolt (1) so that pedal height is "H".

Unit : mm

| H | IDLE |
|-------------|------|
| 149 ± 1 | 0 |

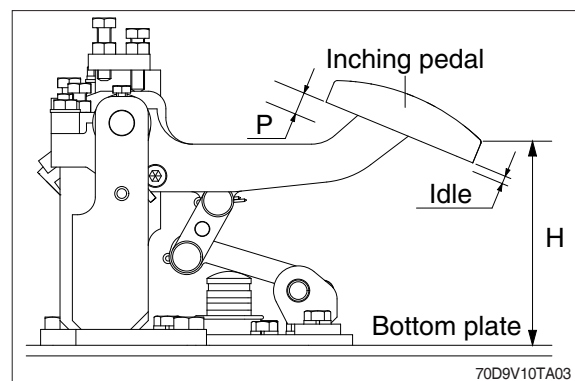


2) Inching pedal

- Adjust inching stopper bolt (3) so that pedal height is "H".
- Adjust rod of inching cable so that inching pedal play is idle stroke when pedal height is "H".
- Adjust the brake and inching pedal interlock bolt (4) so that brake pedal interconnects with inching pedal at inching pedal stroke "P".

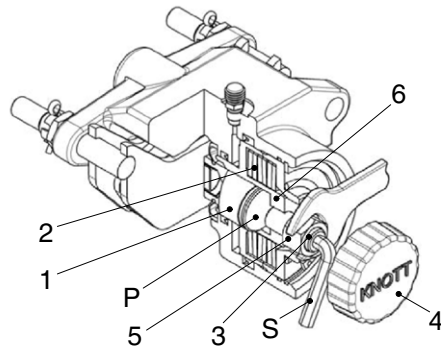
Unit : mm

| H | P | IDLE |
|-------------|----|------|
| 149 ± 1 | 10 | 3 |



3. EMERGENCY RELEASE OF THE PARKING BRAKE

After the failure of the pressure release the parking brake by using following manual procedure.



100D7BS117

| | | | | | |
|---|---------------------|---|-----------|---|---------------|
| 1 | Thrust bolt | 4 | Screw cap | P | Even surface |
| 2 | Bank of cup springs | 5 | Lock nut | S | Socket wrench |
| 3 | Adjusting screw | 6 | Piston | | |

- 1) The vehicle has to be secured against rolling away.
- 2) Release the screw cap and unscrew
- 3) Release the lock nut (size 24 or 30) and turn the adjusting screw with socket wrench size 8 or 10 manually counter-clockwise until the brake disc is free.

⚠ For the emergency release is an actuation torque of 40 Nm respectively 70 Nm required.

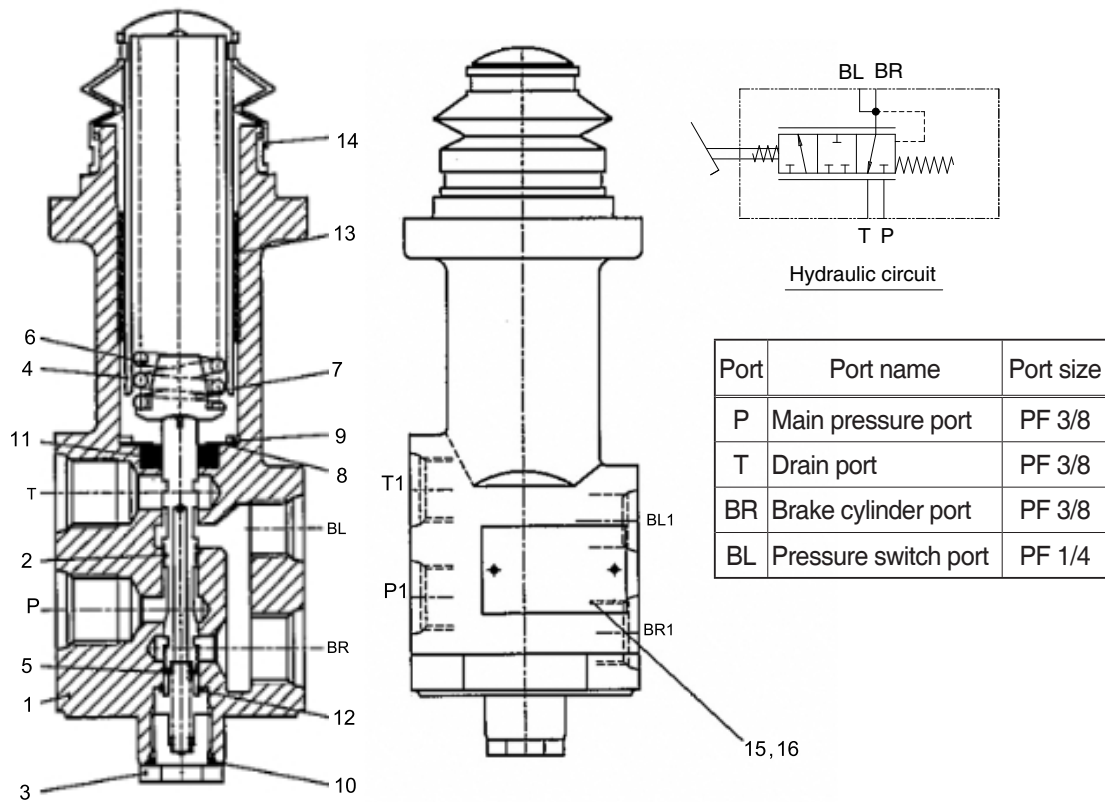
- 4) Mount the lock nut and the screw cap and tighten both as far as possible manually. (protection against dirt)

⚠ Now, the vehicle do not have any brake function. The vehicle must be secured against moving away with proper means. Before putting the vehicle into operation again, the brake has to be adjusted again. Refer to previous page. "Assembly and basic setting regulations".

GROUP 4 DISASSEMBLY AND ASSEMBLY

1. BRAKE VALVE

1) STRUCTURE



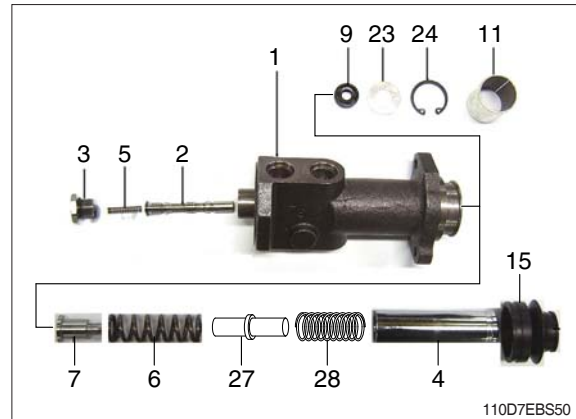
160D9VBS07

- | | | |
|----------------|-------------------|-----------------|
| 1 Valve body | 7 Spring retainer | 13 DU bushing |
| 2 Spool | 8 Plain washer | 14 Rubber cover |
| 3 Plug | 9 Snap ring | 15 Name plate |
| 4 Brake holder | 10 O-ring | 16 Drive screw |
| 5 Lower spring | 11 Oil seal | |
| 6 Main spring | 12 Snap ring | |

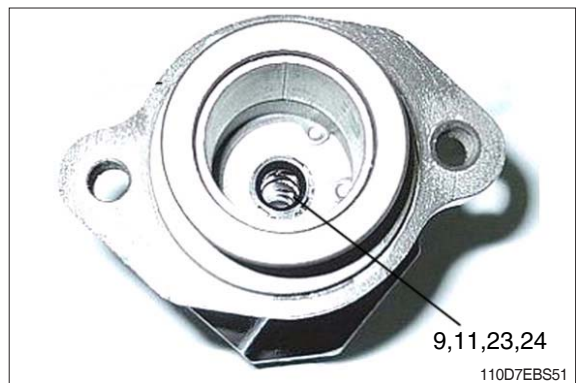
2) REASSEMBLY

(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 Snap ring
- 27 Spring retainer 2
- 28 Main spring 2



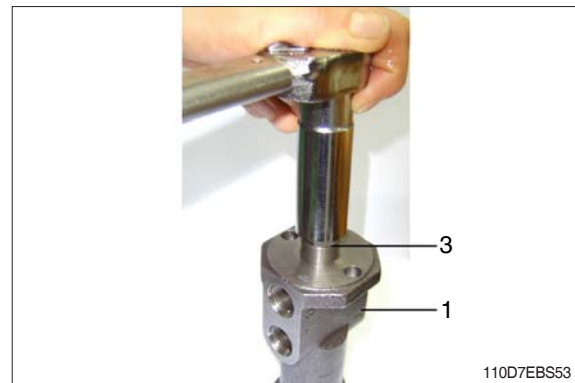
- ① Install oil seal (9), plain washer (23), snap ring (24), DU bushing (11).
- Tool : Jig for dry bearing, snap ring plier.



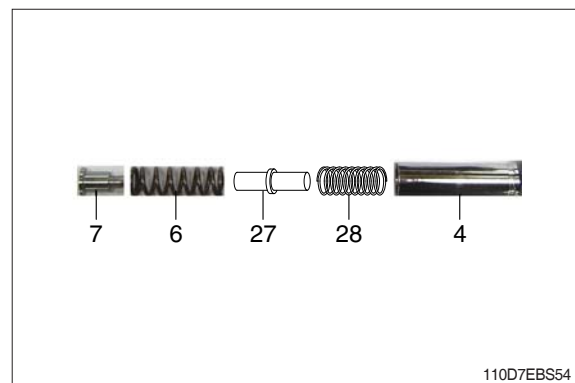
- ② Install spool (2) into body (1).



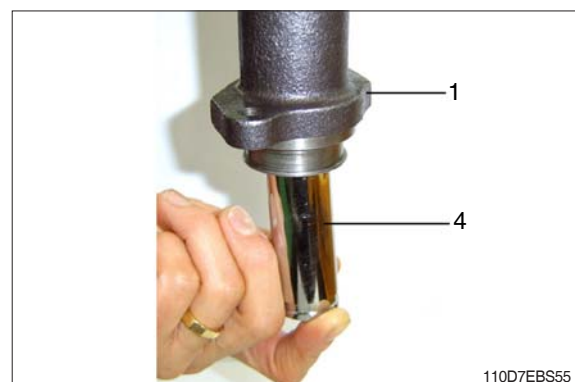
- ③ Tighten plug (3)
- Tool : 19 mm spanner
 - Tightening torque : 14.0~16.5 kgf · m
- ※ Press-in the DU bushing (11) with a exclusive jig.
- ※ Be careful of dust and scrap after washing the parts.



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



- ⑤ Holder (4) → Body (1)



- ⑥ Rubber cover (15)

