

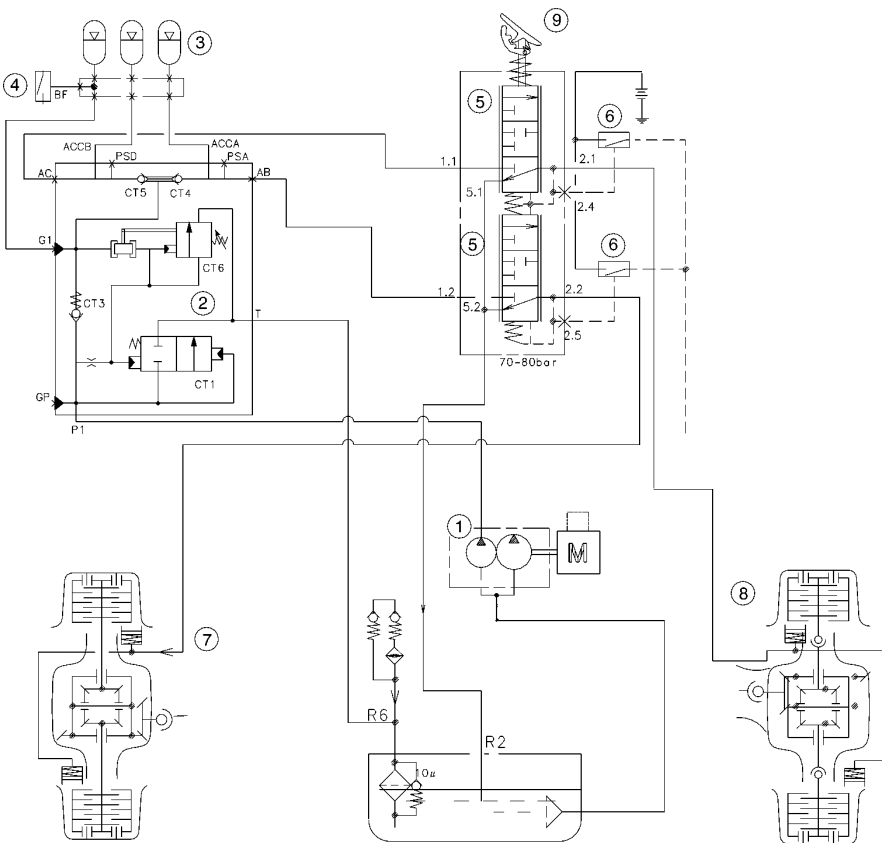
Document Title: Brake system diagram, description	Function Group: 520	Information Type: Service Information	Date: 2014/5/31
Profile:			

Brake system diagram, description

The machine is equipped with a fully hydraulic brake system utilizing separate circuits to simultaneously apply the front axle and rear axle multiple wet disc service brakes.

The principle of actuation is as follows:

- Hydraulic tank oil is sent by hydraulic pump (1) to brake supply valve (2) to accumulators (3).
 - When the accumulators reach the maximum set pressure of the cut-off valve the oil flow from pump (1) is returned to tank.
 - When the accumulators drop below the minimum set pressure of the cut-off valve the oil flow from the pump is directed to the accumulators.
 - Depressing service brake pedal (9) permits pressurized oil flow from both accumulators for the service brakes to flow through the brake valve, where the pressure is reduced, to the front and rear axle service brake assemblies.
- The pressurized oil pushes the axle brake pistons, applying the multiple wet disc brakes with a pressure proportional to the foot pedal stroke.



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Figure 1
Brake system diagram

1 Gear pump

4 Pressure switch (for brake failure)

7 Front axle

2 Brake supply valve

3 Accumulator

5 Service brake valve

6 Pressure switch (for brake failure)

8 Rear axle

9 Service brake pedal

Document Title: Brake system, maintenance	Function Group: 520	Information Type: Service Information	Date: 2014/5/31
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Brake system, maintenance

Specifications

Item	Testing condition	Measuring value	Unit	Standard value	Tolerance
Brake pedal	Engine speed: Low idle	Operating force	kg	19	less
		degree	°	20	-
Brake supply valve	Engine: Max. ~ Min. Oil temperature : 50 ± 5°C Normal brake system	Cut-in	bar	120	+ 5
Service brake		Cut-out		150	- 5
Accumulator		Operating pressure (Min.)	bar	75	± 5
		Operating pressure (Max.)		150	- 5
Brake pump		Displacement	cc/rev	7.6	-
Brake warning lamp		ON pressure	kgf/cm ²	96	less
	OFF pressure		100	more	
Brake oil pressure drop	Testing pressure: 75 bar	Pressure drop	bar	Max. 5	less
Wear of brake disc	Engine stop Activate brake Measure disc gap	Front axle	mm	Max. 4.5	less
		Rear axle			
Brake performance	Road: Level, straight, paved Speed: 32 km/h (20 mph) Pedal operating time: 0.5 sec. Pedal operating force: 19 kgf Tire pressure: Specification	Brake stopping distance	m (ft)	10 (33)	less

Measuring brake pressure

Measuring condition

- Coolant temperature: Within operating range

Brake supply valve

Specifications, unit : bar (psi)

Item	Standard value
Cut-in pressure	120 ~ 125 (1740 ~ 1812)
Cut-out pressure	145 ~ 150 (2103 ~ 2175)

Brake pressure switch

Specifications, unit : kgf/cm² (psi)

Item	Standard value
Brake stop light ON	100 (1422) or less
Brake stop light OFF	100 (1422) or more

Accumulator

Specifications, unit : bar (psi)

Item	Standard value
Maximum pressure	180 (2610)
Working pressure range	120 ~ 150 (1740 ~ 2175)

Special tools

- Oil pressure gauge: 0 ~ 300 kgf/cm² (0 ~ 4500 psi)
- Tee connector

NOTE!

When measuring, only use glycerine filled pressure gauges with a reading accuracy of $\pm 1\%$.

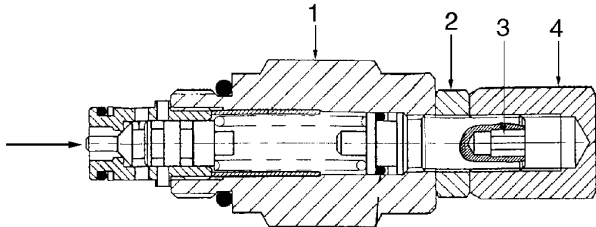
Measuring set pressure of brake supply valve

Measuring

- Measure the pressure at which, the brake supply valve is actuated and the pressure building cycle cuts out.
- With the engine at low idle, use the brake pedal to lower the brake system pressure.
Measure the pressure at which, the brake supply valve is actuated and the pressure building cycle cuts in.

Adjusting

- The cut-out pressure can be adjusted by turning adjusting screw (3) on the brake supply valve.
Turn the adjusting screw as follows:
 - To DECREASE set pressure, LOOSEN screw.
 - To INCREASE set pressure, TIGHTEN screw.



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Figure 1
Adjustment, brake supply valve

1. Body
2. Lock nut
3. Adjusting screw
4. Cap

Measuring warning lamp ON/OFF pressure

- Run the engine at low idle. Use the brake pedal to lower the accumulator pressure, and measure the pressure at which the lamp comes ON.
- Run the engine at high idle to build up the accumulator pressure and measure the pressure at which the lamp goes OFF.
- If the pressure is not standard value, check the switch.
If necessary, replace the switch.
 - After replacing the switch, measure the pressure again.

Measuring accumulator pressure

- Start the engine and run it until the cut-out pressure of the brake system is reached.
- Stop the engine and measure the maximum outlet pressure of both service brake accumulators.
- Actuate the service brake pedal 15 times, the accumulator pressure for both circuits should not drop below 60 bar.
- If brake is available less than 15 times, check brake disc wear and check each accumulator for defects.

Measuring pressure of axle service brake

- Start the engine and raise the accumulator pressure until the cut-off valve is actuated and the pressure building cycle cuts out.
- Depress the brake valve foot pedal completely and measure the brake circuit pressure between the brake valve and the axle brakes.

Adjusting

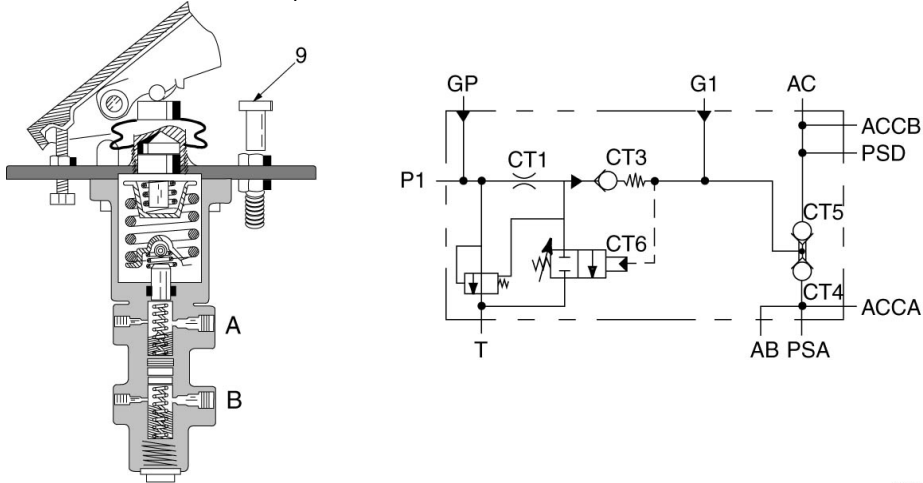
- The brake pressure can be adjusted by adjustment screw (9) on the service brake valve which limits pedal stroke. Turn the adjustment screw as follows :
 - To DECREASE set pressure, RAISE the screw.
 - To INCREASE set pressure, LOWER the screw.

Location of test point

- Test point A (PSD): Service brake/front axle.
- Test point B (PSA): Service brake/rear axle.
- Test point G1: Shift pressure on pressure switch.

To check the cut-in and cut-off pressure, the accumulator pressure on accumulators and the shifting pressure of the warning lamp pressure switch.

- Test points on front and rear axle.
To check the service brake pressure for each brake circuit.



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Figure 2
Position, brake pressure check

Air bleeding from brake system

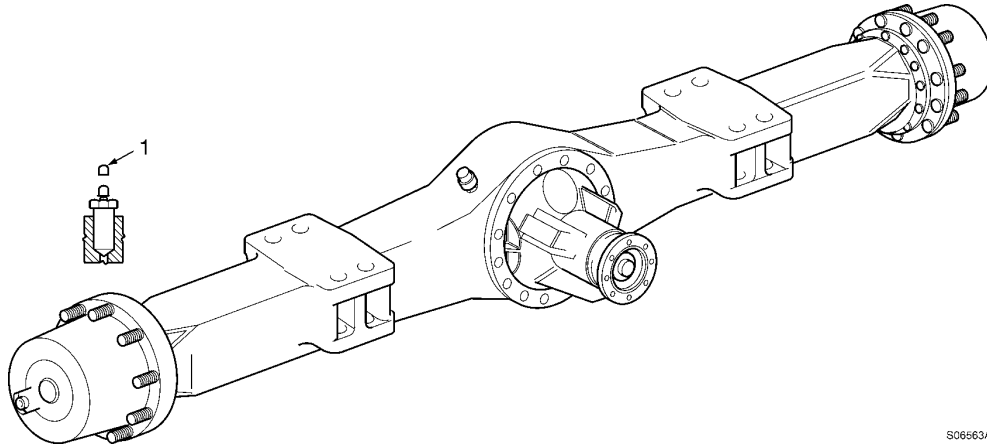


Block the tires securely. Set the travel mode switch at park position.

Order of operation

- Remove the bleeder screw cap, push a vinyl hose onto the screw and put the other end in a container.
- Start the engine and run on low idle.
- Depress the brake pedal, loosen the bleeder screw and bleed the air. Then tighten the bleeder screw and slowly release the brake pedal.

- Two workers are needed for this operation: one depresses the pedal and the other bleeds the air from the bleeder screw.
- Repeat this operation until the flow of brake oil is free of air bubbles. Then depress the pedal fully and tighten the bleeder screw while oil is flowing out.
 - Follow the same procedure to bleed the air from each wheel end brake assembly.
 - To bleed the air completely, bleed the air first from the brake assembly farthest from the brake valve.



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Figure 3
Bleeder screw, brake system air bleeding

Checking brake system leakage

Measuring condition

- Coolant temperature: Within operating range
- Test pressure: 75 bar (1087 psi)
- Hydraulic pressure: Within operating range

Item	Standard value, unit : bar (psi)
Drop in pressure	Max. 5.0 (72)
Accumulator outlet pressure	Max. 150 (2175)

Special tools

Part name	Quantity
Brake test kit	1



Block the tires securely.

Measuring procedure

- Remove bleeder screw, then install elbow and hydraulic pressure gauge in bleeder screw mount.
- Start the engine and bleed the air.
 - Bleed air from plug.
- Depress the brake pedal. When the gauge reading is 75 bar (1087 psi), leave for 5 minutes and check how much the pressure drops.
- After measuring, stop the engine, and loosen the bleeder screw.
 - After completing operation, bleed the air from the brake circuit again.
 - If the test results are not within specification, the axle brake assemblies, accumulators and the brake valves

should be isolated and tested individually to determine which component is causing the pressure drop.

Brake switch

The brake switches sense brake system pressure and turn on and off the brake warning lamp and stop light.

Brake stop light switch

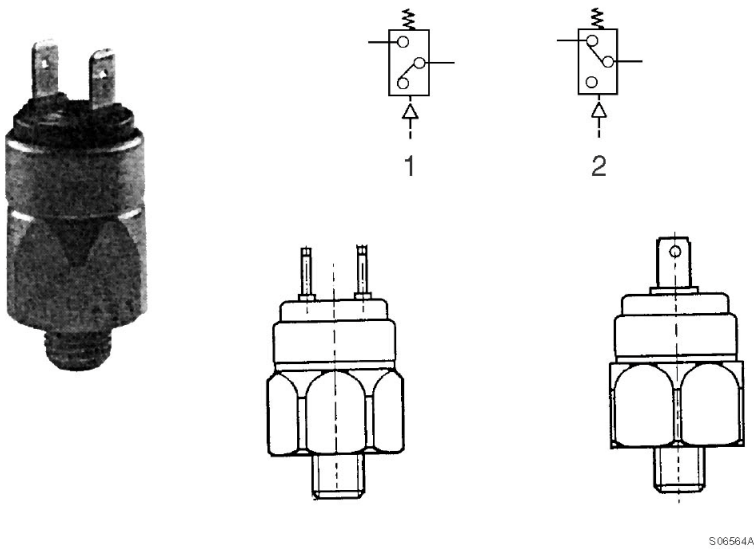


Figure 4

Brake stop light switch

1. Brake stop light switch, break contact (low pressure)
2. Brake stop light switch, make contact (high pressure)

Brake warning lamp switch

The brake warning lamp switch assembled in the accumulator block activates the indicator in the cluster when the brake system (accumulator) pressure is low.

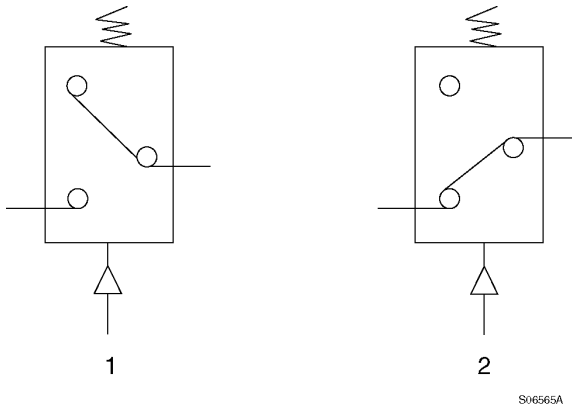


Figure 5

Brake warning lamp switch

1. Normal (high pressure) - No contact
2. Abnormal (low pressure) - Contact

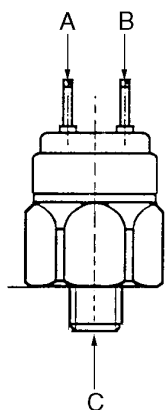
Testing

- High pressure 'C' → Check continuity between A and B.

Continuity → Abnormal
Open circuit → Normal

- Low pressure 'C' → Check continuity between A and B.

Continuity → Normal
Open → Abnormal



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Figure 6
Testing, brake stop light switch

Document Title: Brake system, troubleshooting	Function Group: 520	Information Type: Service Information	Date: 2014/5/31
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Brake system, troubleshooting

Brake system pressure does not rise to the specified range.

1. Ask the operator the following questions.

- Did the pressure suddenly cease to rise?
→ Damage in hydraulic circuit or components.
- Was the brake oil pressure difficult to raise for some time?
→ Brake oil leakage, performance drop in brake components.

2. Check before troubleshooting

- Damaged hose or piping, external damage to components associated with brake system.

3. Fault check

- Check the brake oil pressure by gauge.
- If the warning lamp on the instrument panel remains "ON" despite confirming that the accumulator is pressurized, the pressure switch is faulty.

The following symbols are used to indicate the action to be taken when a cause of failure is located.

- x : Replace
- D : Repair
- A : Adjust
- C : Clean

		Cause	Blockage on suction side of hydraulic pump / aeration of hydraulic oil.	Faulty hydraulic pump.	Faulty cut-off valve.	Incorrectly adjusted cut-off valve.	Faulty accumulator - axle brakes.	Faulty brake valve.	Incorrectly adjusted brake valve pedal stroke.	Faulty cut-off valve accumulator.
		a	b	c	d	e	f	g	h	
N o.	Problem	Remedy	D	D x	D x	A	x	x	A	x
1	No flow/low flow discharged from pump with engine running.		o	o						
2	Hydraulic pressure builds when cut-off valve is - disconnected from the circuit.				o	o				
3	Pressure does not rise when cut-off valve is disconnected from the circuit.			o						

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