DUAL BRAKE VALVE

Description

The foot control valve is bolted to a bracket and the complete assembly is mounted on the front of the engine bulkhead.

The dual brake valve controls the wheel brakes, using compressed air from separate sources simultaneously. This is achieved by having two valves, contained within the same composite body, each able to deliver compressed air according to the degree of brake application. Failure of an air supply to, or air delivery from, one half of the brake valve will not affect the satisfactory working of the other half. Suspended between the two halves of the body, is a piston, the upper and lower faces of which form exhaust seats. The relayed and reactive forces deployed during operation are sensed and transmitted by two diaphragms, carried on the centre flange of the piston. This permits a close relationship of the pressures delivered from the upper and lower halves of the valve and this relationship is retained throughout the extended service life of the valve. Also, as the valve has a low internal hysteresis, the valve is more sensitive to light brake applications.

Operation

In the brakes released position, the spring, under the lower diaphragm, holds the piston on the stop in the body and the lower exhaust seat is away from the inlet/exhaust valve. The valve carrier return spring holds the valve carrier, containing the upper inlet/exhaust valve away from the exhaust seat at the top of the piston. In this position the tandem actuator is inoperatived and the brakes are completely released.

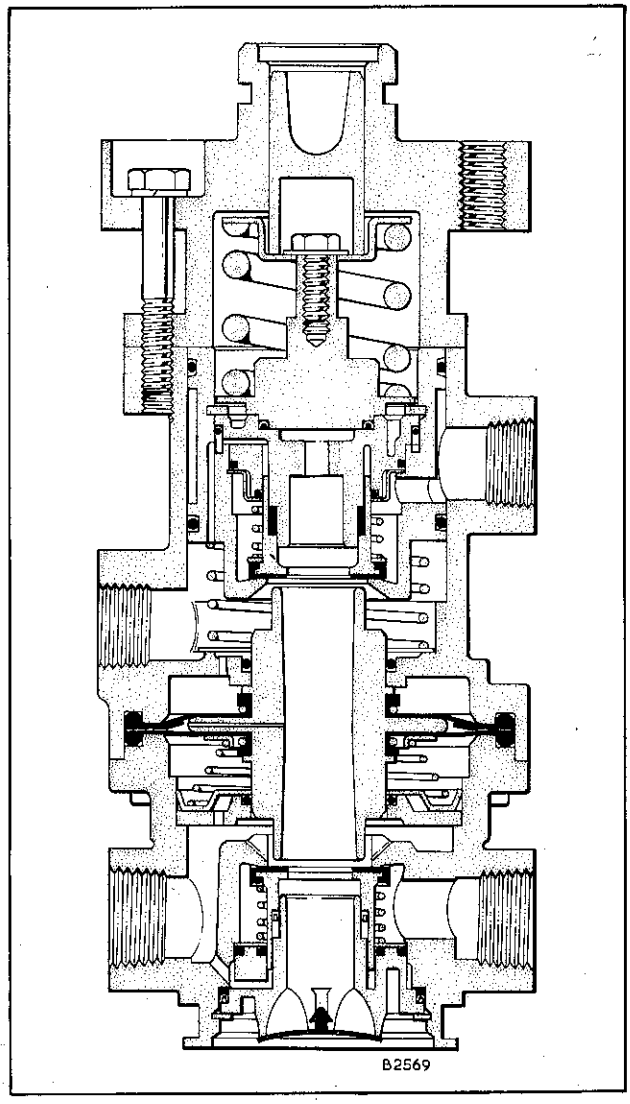
As the brake pedal is depressed the plunger, via the graduating spring, moves the valve carrier down the bore until the rubber head of the inlet/exhaust valve contacts the exhaust seat on the piston.

Further movement of the valve carrier draws the inlet seat in the carrier away from the inlet/exhaust valve allowing compressed air to pass out of the upper delivery port. At the same time the compressed air reacts on the face of the valve carrier and also on the upper diaphragm, through the small hole in the upper body. The spring seat rests across an annular groove in the body and is ventilated to permit air flow. The pressure on the diaphragm forces the piston down the body, followed up by the valve carrier and upper inlet/exhaust valve, until the lower exhaust seat contacts the rubber head of the lower inlet/exhaust valve. Continued movement of the piston forces the valve off its seat in the body and compressed air, from a separate source to the upper element, passes out of the lower delivery port. Smooth and balanced valve opening is achieved by the air pressure reaction on the valve stems; an air passageway is connected from the delivery side of the inlet/exhaust valves to each of the valve stems. Also, due to the very close balance of all the working parts of the valve, the top element may not necessarily open first. When the bottom element does open first, the operation is exactly as outlined, but the relay action is upwards.

The pressure of the delivered air at the lower port reacts on the lower diaphragm, via a small hole in the piston guide. The pressure delivered from the upper port reacting on the upper diaphragm signals the lower valve to deliver compressed air until the opposing forces above and below the diaphragms are approximately equal. As the delivered pressure from the upper element reacts on the valve carrier, the carrier moves up the bore until the plunger effort is balanced by air pressure. At the same time, as the valve carrier moves up the bore, the valve and piston return springs provide sufficient effort to move the piston upwards. This upward movement allows the inlet/exhaust valves to re-seat. shutting off the supply of compressed air. In this balanced condition, the valve has delivered compressed air in accordance with the driver's application of the pedal and will be held in this state until the driver applies more, or less, effort on the pedal. The reactive forces from the air pressure through the graduating spring give the driver a "feel" of the degree of brake application. If the driver increases the effort exerted on the pedal, the cycle is repeated until the valve balances at a higher pressure.

When the driver reduces the effort applied to the pedal, the force applied to the graduating spring is correspondingly less and the air pressure acting on the face of the valve carrier overcomes the graduating spring and moves slightly up the bore. This lifts the upper exhaust seat away from the inlet/exhaust valve slightly, and some compressed air passes from the upper delivery port, around the exhaust seat, down the piston and exhausts from the base of the valve. As the pressure on the upper diaphragm is reduced, the piston is moved

up the bore, by the slightly higher air pressure acting on the lower diaphragm. This upward movement draws the exhaust seat on the piston away from the lower inlet/exhaust valve, allowing some compressed air to pass from the lower delivery port and exhaust from the base of the unit. When the pressures above and below the diaphragms equalise, the exhaust seats close and balance is again established, but at a lower pressure. When all effort is removed from the pedal, the cycle is repeated very rapidly and all delivered compressed air exhausts from the base of the valve.



Fig, 1 *Dual brake valve – sectional view*

Maintenance

Check that the valve is securely mounted and pipes are free from chafing, kinking or corrosion.

Lubricate the push rod and check the condition of the rubber cover.

Check the pedal linkage for looseness, excessive play in the pivots or binding. Lubricate dry pivots with engine oil.

Renew all rubber parts at the period laid down in the Maintenance Schedule.

Operating Test

If the valve has just been re-assembled after overhaul, or a new valve fitted, operate and release the valve sharply several times to distribute the grease evenly over the internal surfaces.

Disconnect the two outlet pipes at the valve and connect two test gauges. Suspend the gauges from the driver's door mirror bracket to enable the operator to view both gauges.

Fully charge the air system and stop the engine.

Depress brake pedal just enough to register pressure on the gauges and check that they do not differ by more than 0.14 bar (2 lbf.in^2). A greater difference indicates a sticking piston or weak spring that must be rectified.

Continue to raise the delivered pressure in stages to the maximum pressure and check that each time the pedal is held stationary, the pressure differential does not exceed 0.14 bar (2 lbf.in^2).

Slowly release the brake pedal, pausing at intervals between the applied and released positons, and check that the gauges register promptly with a constant differential.

Apply and release the valve sharply several times, moving the pedal to its full application each time, to check for any lag in applying or releasing and that full reservoir pressure is delivered. Any lag indicates a fault in the valve that must be rectified.

Disconnect and remove the test gauges. Remake the air connections, recharge the system and test the disturbed connections for air leaks.

Leakage Test

Re-start the engine and run to governor cut-out pressure. Stop engine.

Remove rubber boot from valve and brush soap solution around the exhaust diaphragm. No leakage is permissible.

Fully depress the brake pedal and hold, brush soap solution on the exhaust diaphragm, valve body and pipe connections.

Leakage from the exhaust diaphragm should not exceed a 10 mm (3/8 in) soap bubble in three seconds.

No leakage is permissible from the body or pipe connections.

Refit rubber boot.

To Remove

Open and secure bonnet.

Remove heater air intake duct.

Thoroughly clean the valve and pipe connections.

Identify pipes/connections to assist in re-assembly.

Slacken the unions, allowing air to bleed away.

Remove clip and withdraw clevis pin, push rod to brake pedal.

Disconnect the brake pipes.

Remove four nuts and bolts securing the mounting plate to the engine bulkhead and withdraw valve.

Match mark the valve and mounting plate.

Remove the three setscrews securing the mounting plate to the valve, remove plate.

To Dismantle

Withdraw push-rod and remove rubber boot from each end of valve.

Match mark the three portions of the valve.

Remove three setscrews and spring washers securing graduating spring cover to upper body. Remove cover and withdraw push-rod plunger from cover.

Lift graduating spring assembly out of upper body. Unless damaged or worn, dismantling is not necessary.

Withdraw valve carrier assembly, spring and spring seat from upper body.

To Dismantle Valve Carrier Assembly

Remove two "O" rings from valve carrier.

Remove circlip from inside valve carrier and withdraw valve guide.

Remove four "O" rings from valve guide.

Remove spring seat and spring.

Remove inlet/exhaust valve and spring seat.

From the lower body carry out the following:

Remove circlip.

Remove valve guide.

Remove four "O" rings and exhaust diaphragm from valve guide.

Remove spring and seats.

Remove inlet/exhaust valve.

Remove four setscrews and spring washers securing upper and lower bodies, remove lower body.

Remove diaphragm spring and seat.

Remove "O" ring from piston guide.

The piston guide and spring seat fitted into the lower body should not be removed.

Remove piston assembly from upper body.

Remove the two snap rings securing diaphragms on piston.

Remove upper and lower diaphragms from piston.

Dual Brake Valve (Air/hyd Models)

Inspection and Overhaul

Thoroughly clean all parts.

Check all body parts for cracks, particularly around bosses, dents, corrosion or other damage.

Examine all internal bores and working surfaces for wear or scores.

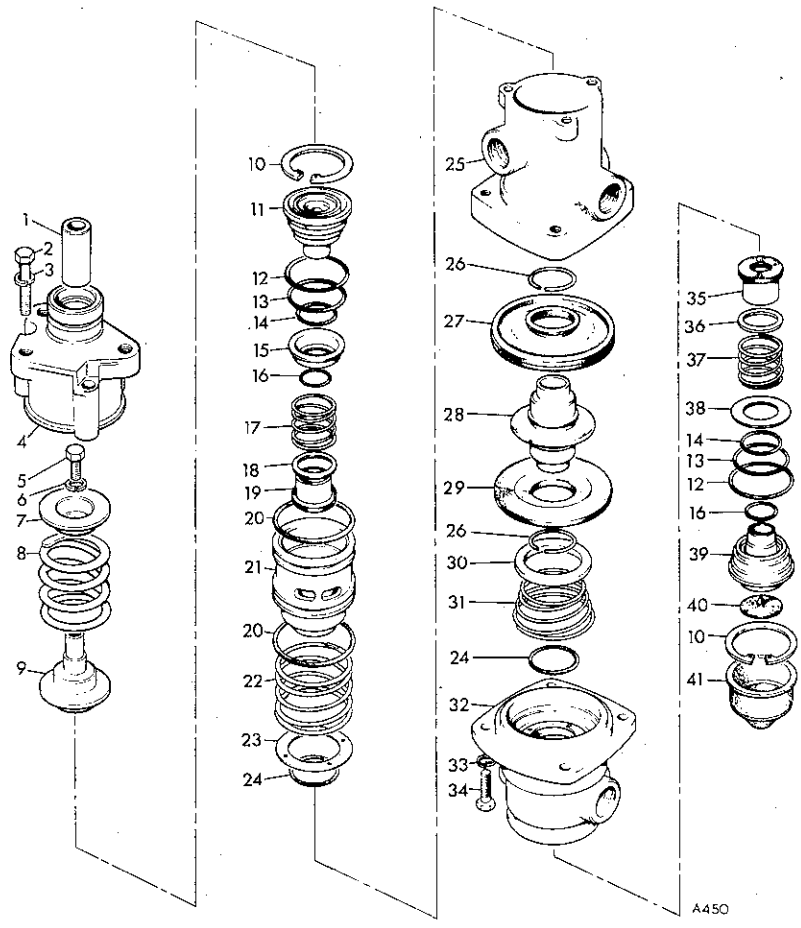
The exhaust seats, on each end of the piston, and the inlet seats in the body and valve carrier should be in perfect conditions, without nicks, burrs or pits.

Springs should be checked for corrosion or distortion.

Ensure that all drillways in the body, piston and piston guides are clean and clear.

Renew all rubber parts.

If unions are removed and replaced, clean off old sealing material and remake union joints with a suitable sealer.



1. PUSH-ROD PLUNGER
2. SETSCREW
3. SPRING WASHER
4. COVER
5. SETSCREW
6. SPRING WASHER
7. SPRING SEAT
8. SPRING
9. SPRING SEAT
10. CIRCLIP
11. SPRING SEAT AND VALVE GUIDE
12. "O" RING
13. "O" RING
14. "O" RING
15. SPRING SEAT
16. "O" RING
17. SPRING
18. WASHER
19. INLET/EXHAUST VALVE
20. "O" RING
21. VALVE CARRIER
22. SPRING
23. SPRING SEAT
24. "O" RING
25. UPPER BODY
26. SNAP RING
27. REINFORCED DIAPHRAGM
28. PISTON
29. DIAPHRAGM
30. SPRING SEAT
31. SPRING
32. LOWER BODY
33. SPRING WASHER
34. SETSCREW
35. INLET/EXHAUST VALVE
36. WASHER
37. VALVE SPRING
38. RETAINING WASHER
39. VALVE GUIDE
40. EXHAUST DIAPHRAGM
41. RUBBER BOOT

Fig. 2 *Exploded view of dual brake valve*

To Re-assemble

All sliding and load bearing surfaces, sealing rings and springs must be coated with the grease (CDS 156) supplied in the repair kit, or Rocal EIA.

Press the exhaust diaphragm into the small hole in the centre of the lower inlet/exhaust valve guide.

Install four new "O" rings in the appropriate positions on the outside of the valve guide.

Fit the "O" ring retaining washer over the centre portion of the guide.

Place the washer for the inlet/exhaust valve on the valve stem, and fit the spring onto the stem.

Carefully fit the assembly over the narrow end of the valve guide so that the inlet/exhaust valve stem fits into the recess in the guide without dislodging or nipping the "O" ring.

Hold the assembly and fit into the lower body and secure with circlip.

Install the two "O" rings in the grooves in the valve carrier.

Place the small washer over the inlet/exhaust valve stem and fit the valve spring on the valve stem.

Install four new "O" rings in the appropriate positions on the outside of the valve guide.

Place the stepped spring seat on the guide so that it fits over the second "O" ring.

Place the stem of the inlet/exhaust valve, complete with spring and washer over the narrow end of the valve guide and insert the valve stem into the recess in the guide, taking care not to dislodge or nip the "O" ring.

Hold the parts so that they can be fitted into the valve carrier, valve head first, compress the parts against the spring thrust and secure with the circlip.

Fit the diaphragms to the piston and secure with the snap rings. The lips of the diaphragms should face away from the piston centre flange so that the diaphragm lies flat against the flange.

Fit the "O" ring on the internal face in the upper body, which has an annular groove and drillway in it. Place the ventilated spring seat on the seal, ensuring that it fits correctly into its recess and lies flat.

Fit a sealing ring in the recess in the piston guide in the lower body.

Fit the tapered piston return spring in the lower body so that the widest coil sits on the spring seat.

Carefully position the spring seat on the top of the spring.

Press the exhaust seat (with the reinforced diaphragm adjacent) of the piston into the upper body, taking care not to dislodge the "O" ring and ventilated spring seat.

Hold the upper body and piston assembly over the lower body and align the marks made during dismantling. Insert the lower exhaust seat through the spring seats and piston guide taking care not to dislodge the "O" ring and ensuring that the spring seat at the narrow end of the piston return spring sits completely flat against the lower diaphragm.

Fit the four setscrews and spring washers to secure the upper and lower bodies.

Position the valve carrier return spring in the upper body.

Carefully slide the valve carrier assembly into the upper body, narrow end first, taking care not to damage or dislodge the "O" rings.

Position the graduating spring assembly in the valve carrier.

Locate the graduating spring cover on the upper body, align the marks made during dismantling, secure with three setscrews and spring washers.

Thoroughly grease push-rod plunger and insert into spring housing, conical end outwards.

Refit the rubber boot and push-rod.

Fit the rubber boot over the exhaust diaphragm after the operating and leakage tests.

To refit

Fit the mounting plate to the valve, align the match marks and secure with three setscrews.

Ensure the spacers are fitted on the back of the mounting plate. Position the assembly on the engine bulkhead, secure with four nuts and bolts.

Refit the clevis pin to the push-rod fork end and brake pedal and secure with clip.

Refit the pipes to the valve.

Carry out the operating and leakage tests.

Refit the heater air intake duct.