Purpose

Their purpose is to shorten the response and pressure build-up times within a braking process by more rapidly pressurizing the brake cylinders. At the same time, relay valves act as quick-release valves when the brakes are released. It is advisable to install relay valves if the total volume of the brake cylinders to be pressurized exceeds 4.5 litres.

Relay Valves **with Overload Protection** serve the purpose of preventing compounding of braking forces if the service and parking braking systems are actuated at the same time, thereby effectively protecting the mechanical transmission parts against excessive strain. For the area of the emergency and parking braking systems, this valve acts as a relay valve.

Design types

973 001 ...

a. Relay Valve for the service brake or the spring-loaded portion

973 006 ...

b. Relay Valve - plastic type. This valve **can only be used for controlling the spring-loaded portion of the Tristop spring brake actuator**.

973 011 ...

c. Relay Valve. Newly developed for the service brake or the spring-loaded portion. Replaces 973 001.

473 017 ...

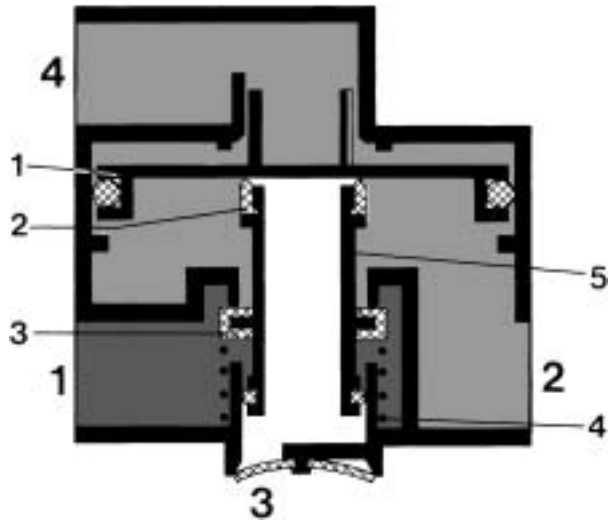
d. Relay Valve with Overload Protection for the Spring-Type Brake Actuator

973 011 2.. 0

e. Relay Valve with overload protection. Newly developed for the spring-loaded portion, **with integrated pressure reduction** from port **(42)** to **(2)**. Replaces 473 017.

Operation of the Relay Valve 973 001 (without Overload Protection)

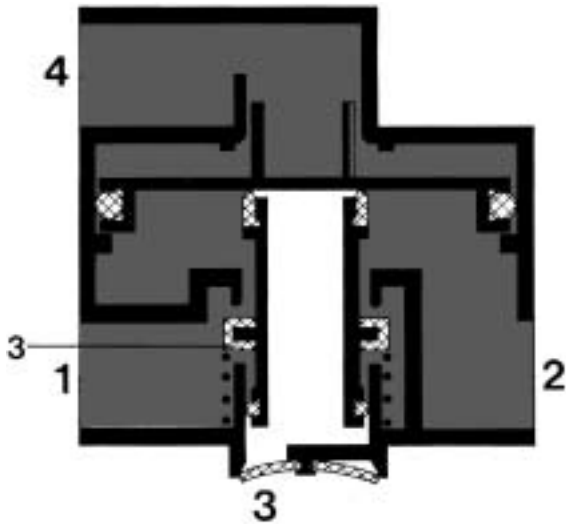
a. Partial Braking Position



When the pressure in chamber **(4)** is increased, the piston (1) is pushed downwards and the outlet valve (2) is closed. As piston (1) continues its downward motion, it takes along bell-shaped valve (5) whereby against the force of spring (4) inlet valve (3) opens. The compressed air in port (1) thus flows across the opened inlet valve (3) into port (2) and from there to the connected brake cylinders.

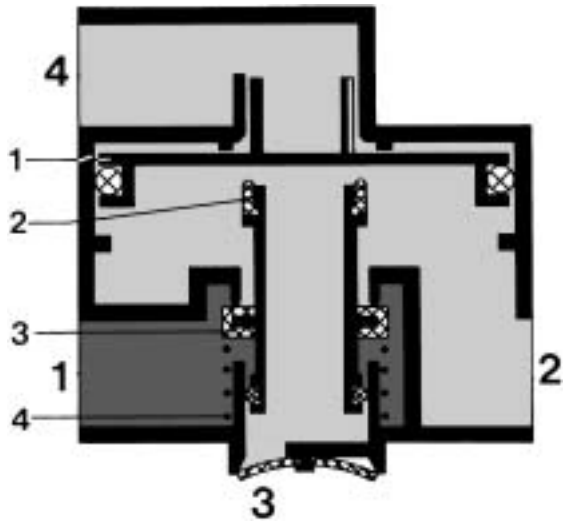
When the compressed air below the piston (1) in port **(2)** is stronger than the compressed air in port **(4)**, the piston (1) moves upwards until a balance of forces has been achieved. The bell-shaped valve (5) follows and closes the inlet valve (3). The relay valve thus has reached a final braking position.

b. Full Brake Application



When the control pressure in port **(4)** increases further the process described under “a” is repeated till the existing air reservoire pressure of port **(1)** is put through. The inlet valve (3) is fully open during this process.

c. Release Position



If port (4) is vented the relay valve moves to the release position. Thus the brake cylinder pressure in port **(2)** lifts up piston (1) till contact with the housing, so that the exhaust (3) is released by lifting piston (1) from oulet valve (2). Because of that the connected brake cylinders at port **(2)** are vented.

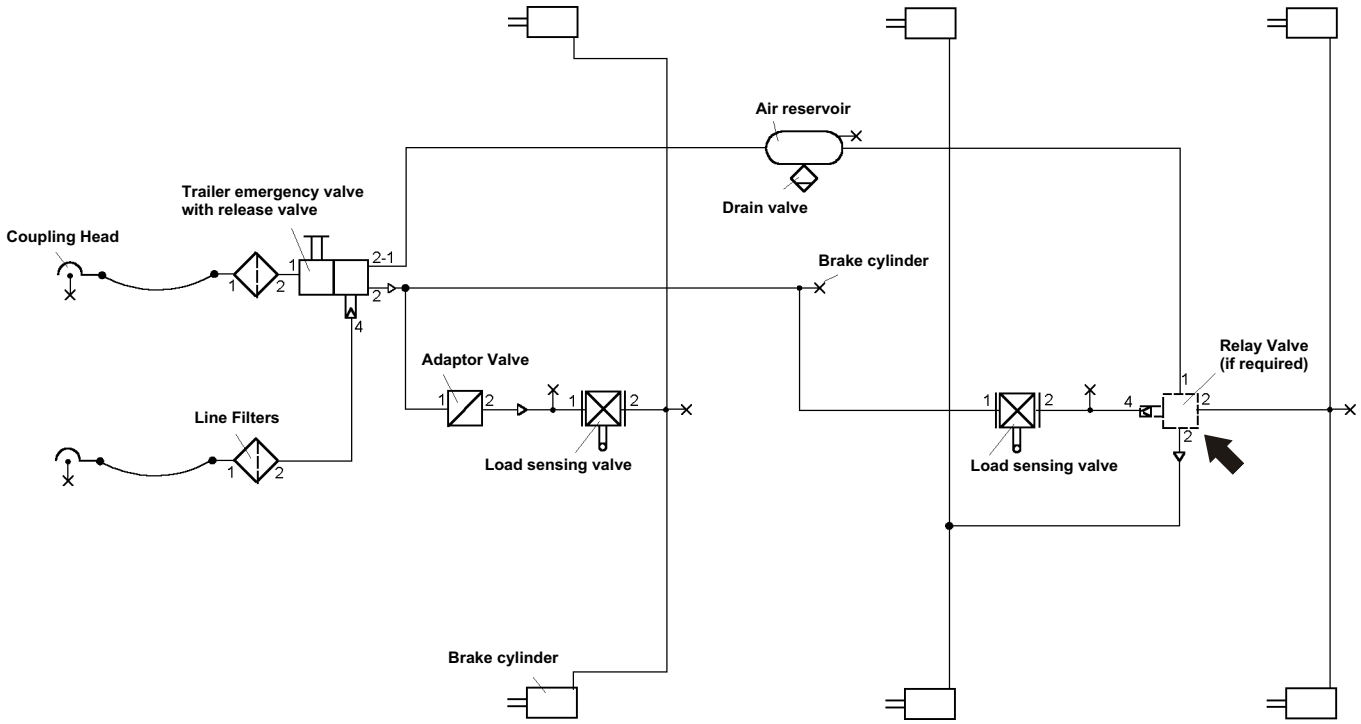
Maintenance

No maintenance is required beyond the checks required by law.

Testing

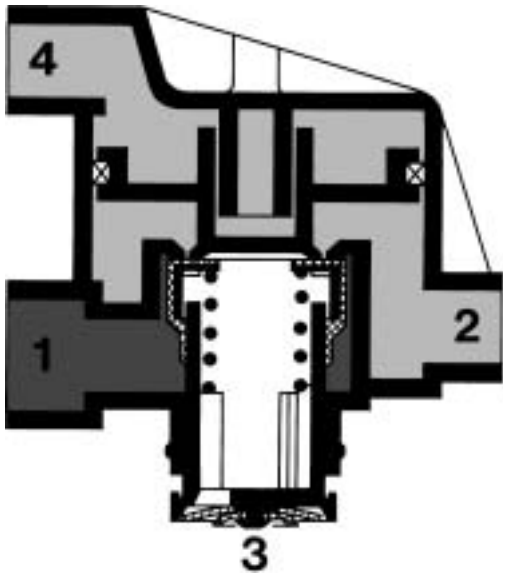
Response pressure:	max. 0.4 bar
Grading:	max. 0.3 bar
Full braking:	full reservoir pressure

Schematic for Testing and Installation



Relay Valve 973 006 (only for the Spring-Type Brake Actuator, without overload protection)

Function



The compressed air expelled from the upstream hand brake valve flows over port **(4)** in the room above the relay piston und moves him downwards.

This causes the oulet to be closed and the inlet valve to be fully opened. The supply pressure at port **(1)** flows now over the room under the relay valve and port **(2)** to the spring-loaded portion of the Tristop spring brake actuators.

When the hand brake valve is operated, the control pressure is partly or fully evacuated at port **4**. The relay piston is pushed upwards once again by the cylinder pressure below and the excess pressure from the spring-type brake actuators is evacuated to atmosphere through the opening outlet valve and exhaust **(3)**.

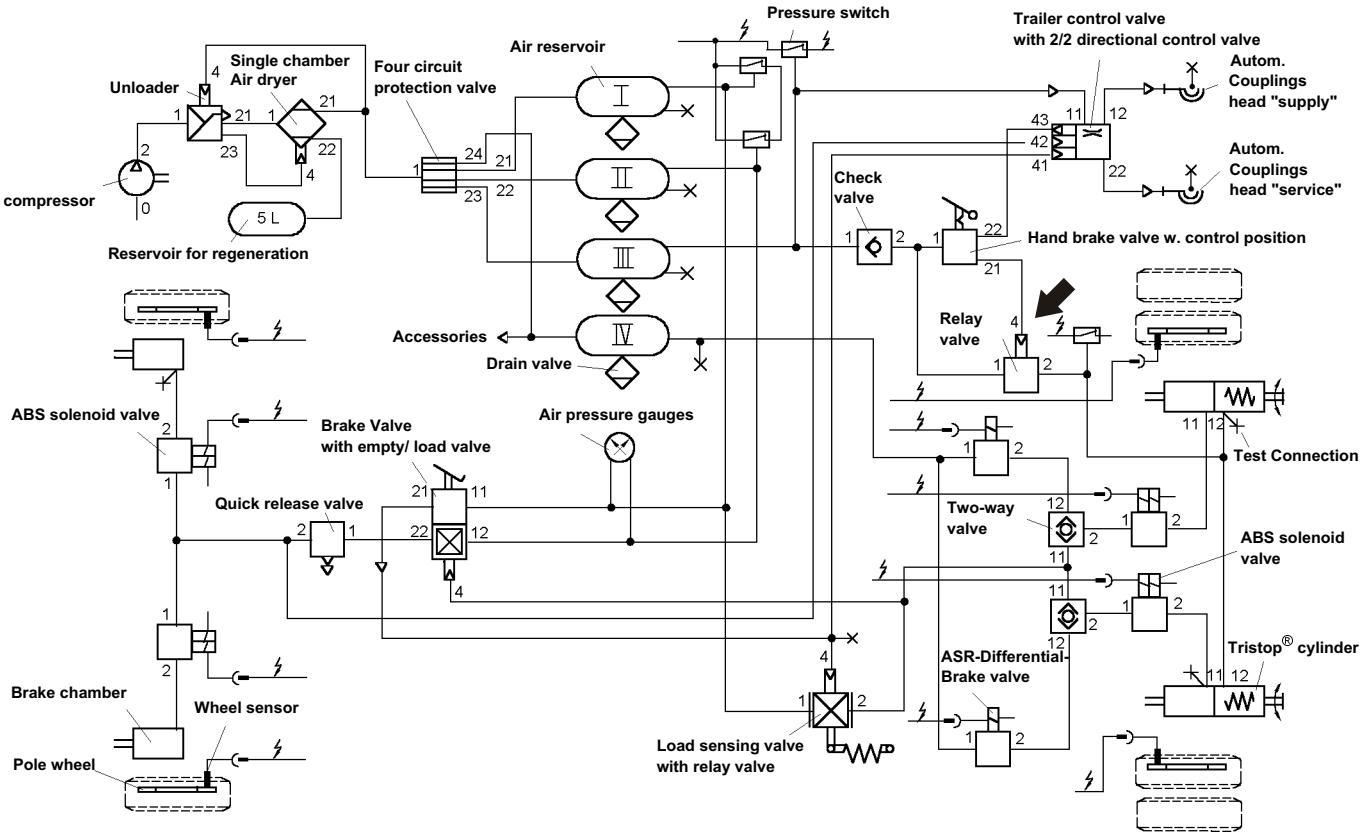
Maintenance

No maintenance is required beyond the checks required by law.

Testing

Release position= full reservoir pressure
Response level = 0.8 $^{\pm 0.2}$bar
Grading max. = 0.4 bar
Full braking = 0.0 bar

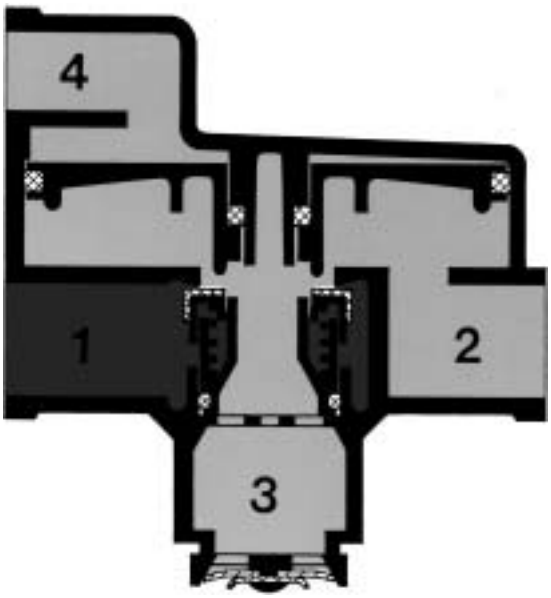
Schematic for Testing and Installation



Relay Valve 973 011
(for service or emergency braking systems without overload protection)

Function

It works exactly like the both valves described previously.



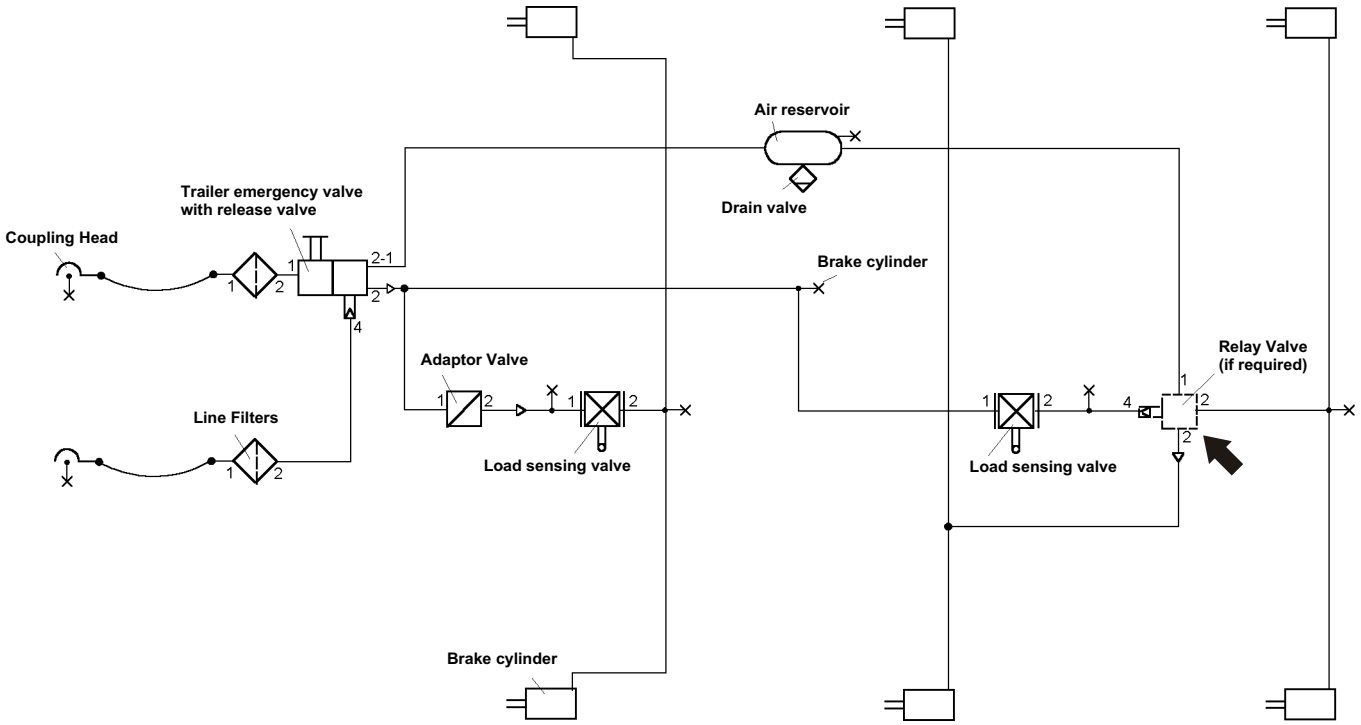
Maintenance

No maintenance is required beyond the checks required by law.

Testing

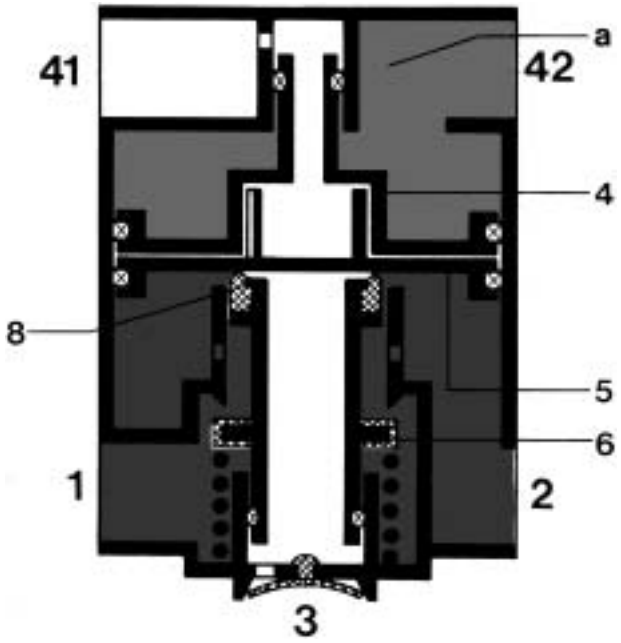
Release position	full reservoir pressure
Response pressure	max. 0.2 bar
Grading max.	0.4 bar
Full braking	0.0 bar

Schematic for Testing and Installation



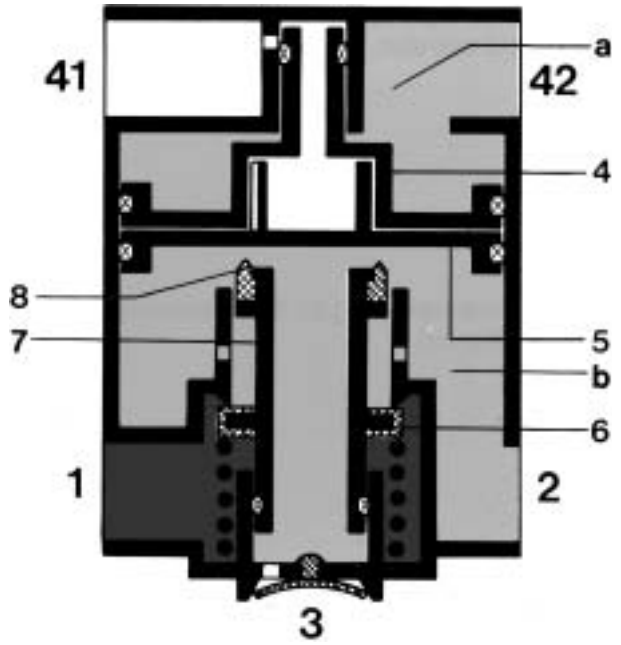
Operation of Relay Valve 473 017 with Overload Protection

a. Driving Position



In the driving position, the compressed air from the hand brake valve flows via port **(42)** into chamber (a). This applies pressure to the relay control piston (4) which now moves downwards, pulling along piston (5), thereby closing the outlet valve (8) and opening the inlet valve (6). The reservoir pressure at port **(1)** now flows via port **(2)** to the spring-loaded portion of the Tristop spring brake actuator. The parking braking system has thus been released.

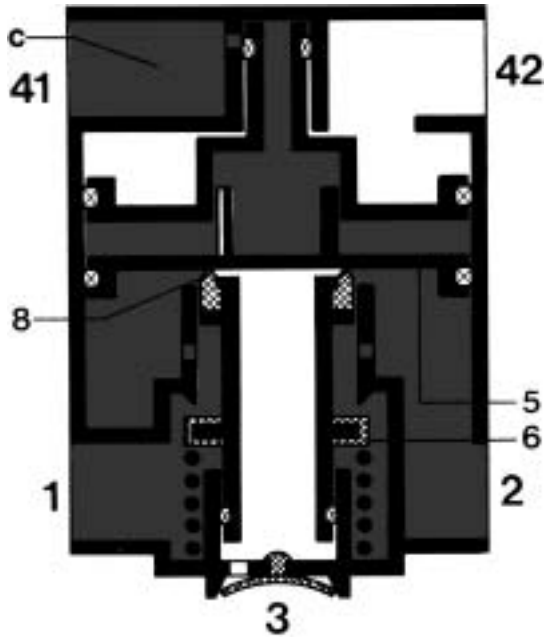
b. During Actuation of the Emergency and Parking Braking Systems (Relay Effect)



If the hand brake valve fully or partially vents port **(42)**, the pressure also falls in chamber (a). This allows the compressed air in chamber (b) to raise pistons (5) and (4). Since the bell-shaped valve (7) follows this upward motion, the inlet valve (6) is closed and the outlet valve (8) opened. The pressure of the spring-loaded portion at port **(2)** can thus be reduced via vent (3).

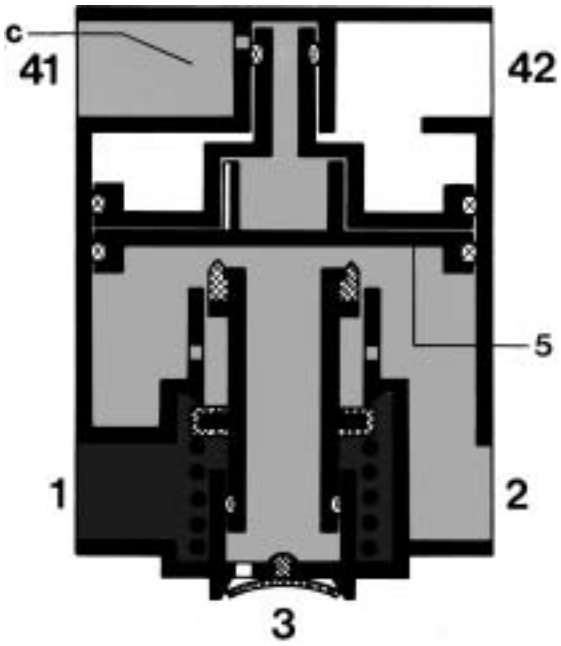
A final braking position is reached within the partial braking range when the pressures in chambers (a) and (b) are similar. In the full braking range, port **(2)** is pressureless.

b_1. When the Service Braking System is switched on



If the service braking system is switched on when the parking brake has been applied, the pressure builds up in chamber (c) via port **(41)**. If the resulting force is great enough to push piston (5) downwards, the outlet valve (8) is closed and the inlet valve (6) opened. The reservoir pressure at port **(1)** can thus pressurize the spring-loaded portion once again via port **(2)**. This partially or fully neutralizes the braking effect of the parking brake system depending on the addition of the service braking system.

b_2. When the Service Braking System is switched off

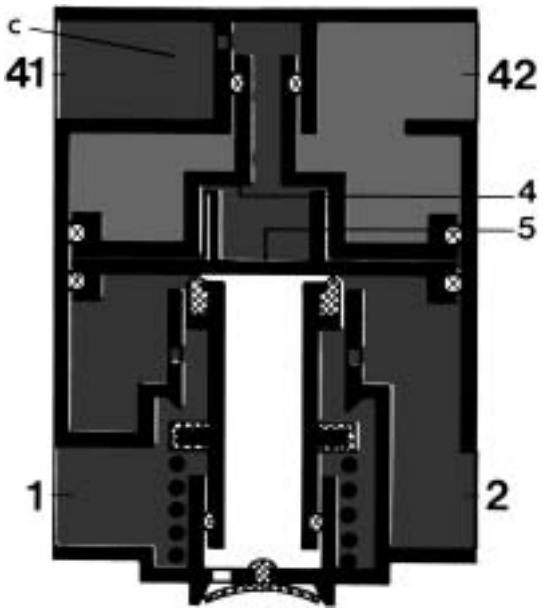


When the effect of the service brake has been neutralized, port **(41)** and chamber (c) are vented, causing the valve to reverse. The piston (5) is once again moved to its upper position. Since port **(2)** and vent **(3)** are connected, the parking brake system becomes effective once again, as described under **"b"** above.

Please note

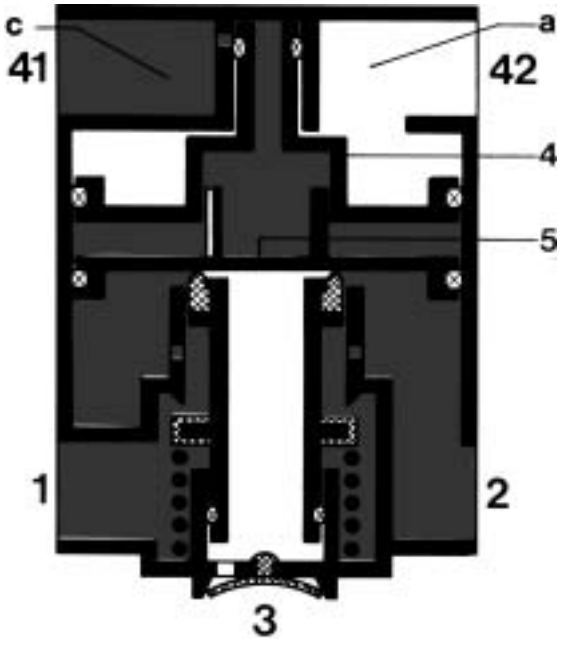
When the emergency and parking braking systems are released, port **(2)** is pressurized once again as described under **"a"** above.

c. When the Service Braking System is Actuated



By pressurizing port **(41)** and chamber (c), only the upper surface of piston (5) and the lower surface of piston (4) are pressurized. This does not cause the valve to reverse.

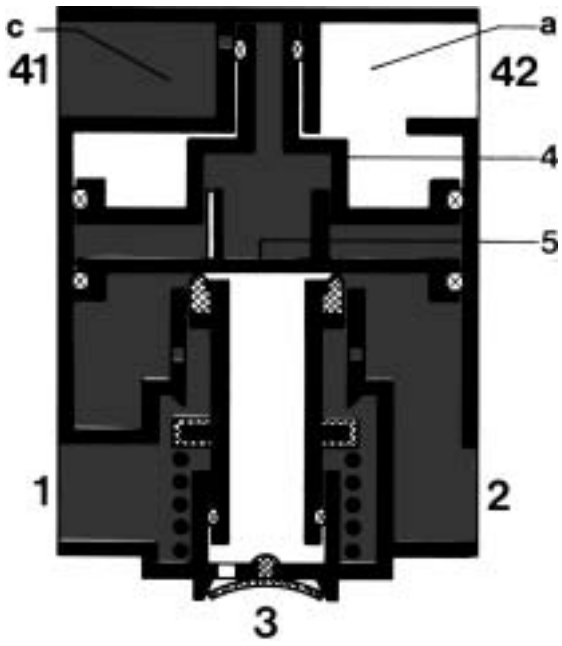
$c_{1.}$ When the Emergency and Parking Braking Systems are switched on



When the parking brake is switched on, port **(42)** and chamber (a) are vented via the hand brake valve. This allows the pressure in chamber (c) to raise piston (4) whilst holding piston (5) in its lower position. Since the reservoir pressure (port 1) continues to be connected with port (2), the parking braking system is not effective.

c_2. When the Emergency and Parking Braking Systems are Switched Off

When the effect of the emergency and parking braking systems has been neutralized, the process described under **"c"** above becomes effective once more.



Please note

When the service braking system is released, the valve automatically returns to the **driving position**.

Maintenance

No maintenance is required beyond the checks required by law.

Testing

a. Relay Valve

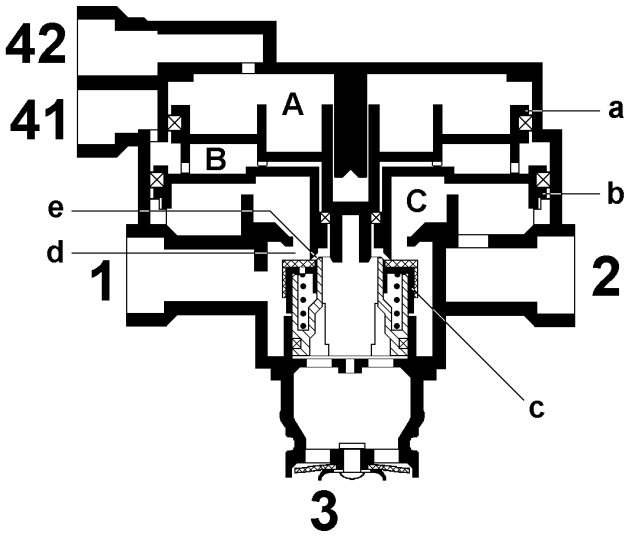
Response pressure:	max. 0.8 bar
Grading:	max. 0.3 bar
Full brake application:	0.0 bar at port **(2)**

b. Overload Protection

When the emergency and parking braking systems are fully actuated (pressure at port **"2"** = 0.0 bar), the pressure at port **(2)** must rise by the same amount when the service braking system is additionally switched on. Tolerance = ± 0.2 bar.

Relay valve 973 011 20. 0 (for FBA, with overload protection)

Function



It works like the valve described previously. At any rate, in the standard connection (brake valve to port **(41)** and hand brake valve to connection **(42)** in the valve's driving position, only a reduced pressure p2 = 6.5 bar at p_{42} = 8 bar) flows into the spring chamber of the tristop brake actuator (saving energy in normal driving operation).

This port type **should not be used** in vehicles **whose spring brake actuator has pneumatic emergency release function**! To avoid pressure difference in the switched two-way valve, the hand brake valve must be connected to port **(41)** and the brake valve to connection **(42)** of the relay valve.

Maintenance

No maintenance is required beyond the checks required by law.

Testing

Release Position:	=	reduced Reservoir pressure, (see above) if HBV connected to port (42)
Response pressure:	=	max. 0.8 bar
Grading:	=	max. 0.3 bar
Full braking	=	0.0 bar

Schematic for Testing and Installation