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# APTA Webinar Series: Transit Bus Air Control System

Presented by APTA Bus Technical Maintenance Committee

July 9, 2020

# APTA Bus Technical Maintenance Committee Webinars

**2020 Webinar Series**

- 3/31/2020 Basic Electrical Troubleshooting
- 5/14/2020 Transit Bus Air Supply System
- Today Air Control System
- Next Foundation Brake System

Information and recordings found at https://www.apta.com/research-technical-resources/aptau/learning-and-development/webinars/committee-webinars/technical-services-and-innovation-webinars/

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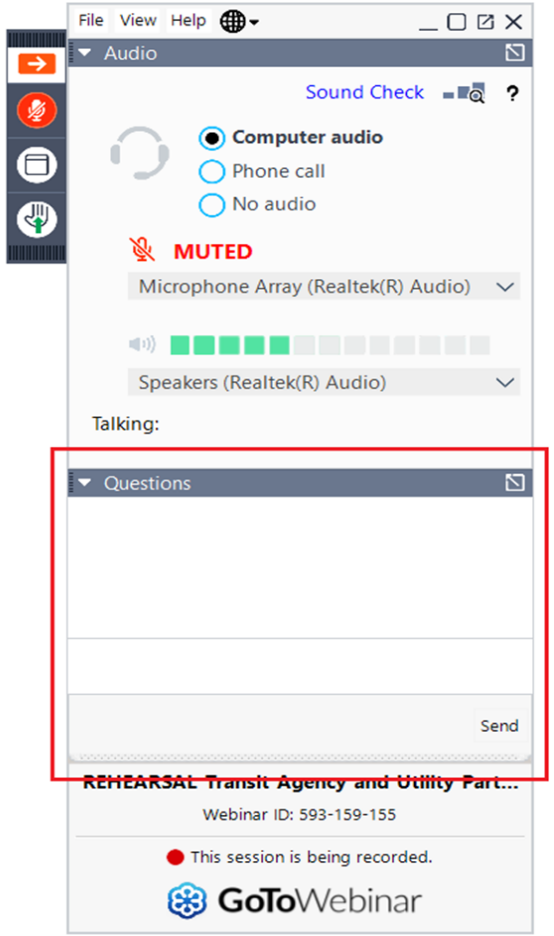
# Housekeeping

- All attendees are muted
- To submit a question or comment to the moderator during the webinar, please type it into the **Questions** box in the menu panel.

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# Moderator

## *Obed Mejia*

Senior Bus Equipment Maintenance Instructor
**Los Angeles Metropolitan Transportation Authority**
Los Angeles, CA

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# Presenter

## *Brian D. Markey*

Chief Executive Officer
**Custom Training Aids Inc.**
La Verne, CA

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# Panelists

## *Frank Forde*

Equipment Maintenance Instructor
**Los Angeles Metropolitan Transportation Authority**
Los Angeles, CA

## *John Brundage*

Transit & Rail Vehicle Specialist
**Jacobs**
Boston, MA

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# Objectives

**At the conclusion of this webinar, you will be able to:**

1. Understand the operation of the air control system
2. Demonstrate preventive maintenance practices
3. Demonstrate common diagnostic practices

- The information on this webinar is to be used in conjunction with the original equipment manufacturer (OEM) and air brake parts manufacturer service manuals.
- Proper tools and safety equipment must always be used when working on brake systems.

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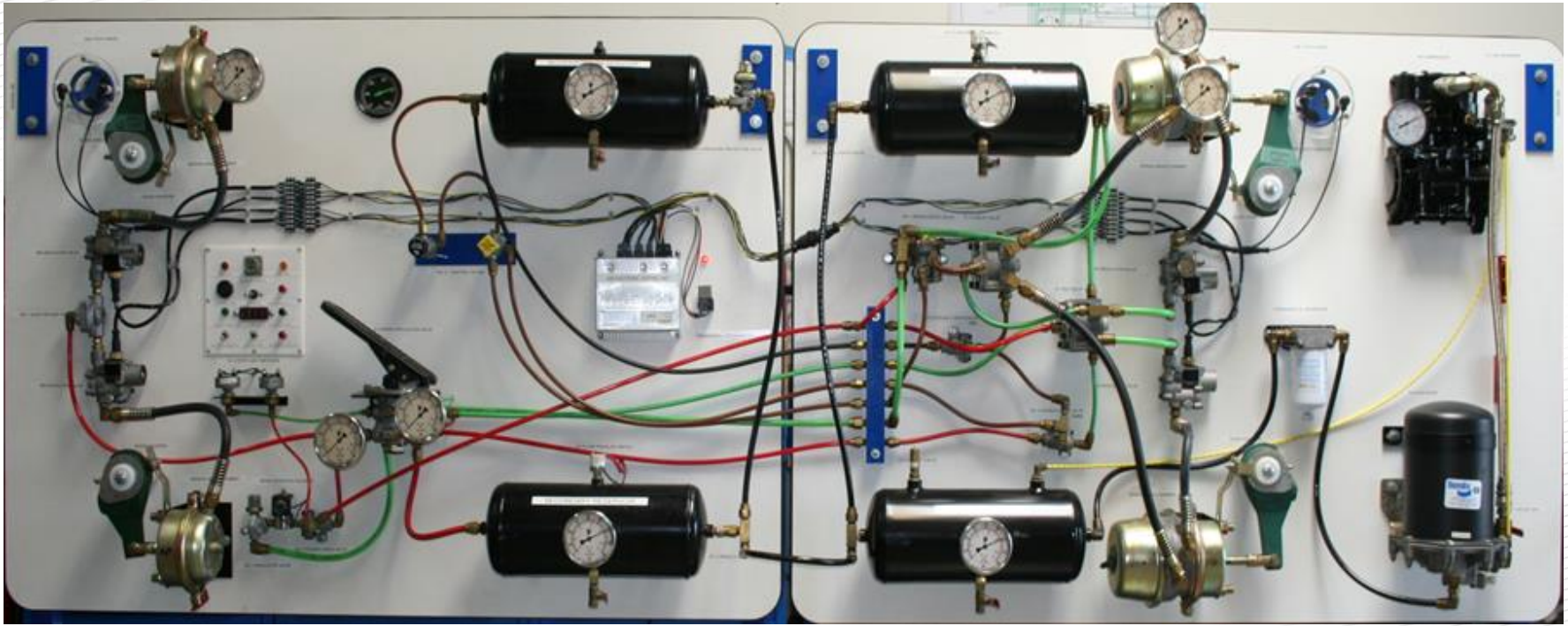
# Air Brake System

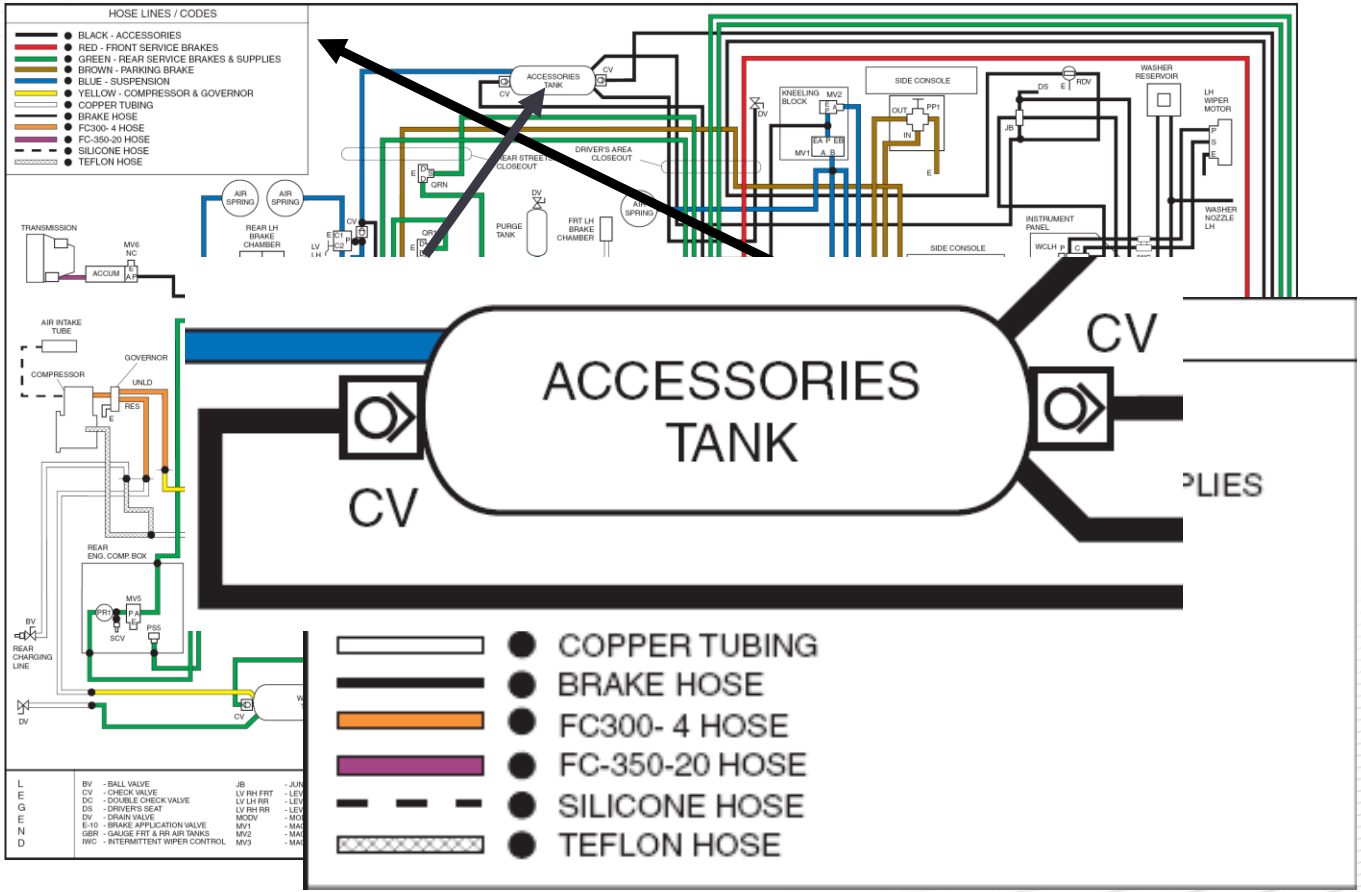


# System Layout

Air brake system is comprised of three sub systems:

- Air Supply System
- Air Control System
- Foundation Brake System

# Typical Air System Schematic

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# Air Tubing and Line Colors

- Green — Supply and primary brake system
- Red — Secondary brake system
- Brown — Parking, Emergency, Spring Brakes
- Yellow — Governor control circuit
- Black — Accessory system, suspension system on some buses
- Blue — Suspension system some buses

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# Air Control System

Control system regulates the pressure and flow of compressed air from the supply system and is comprised of:

- Application Valve
- Electric Pneumatic Valves
- Relay Valves
- Double Check Valves
- Quick Release Valves
- Push Pull Valves

# Air Control System Valves

## Control System:

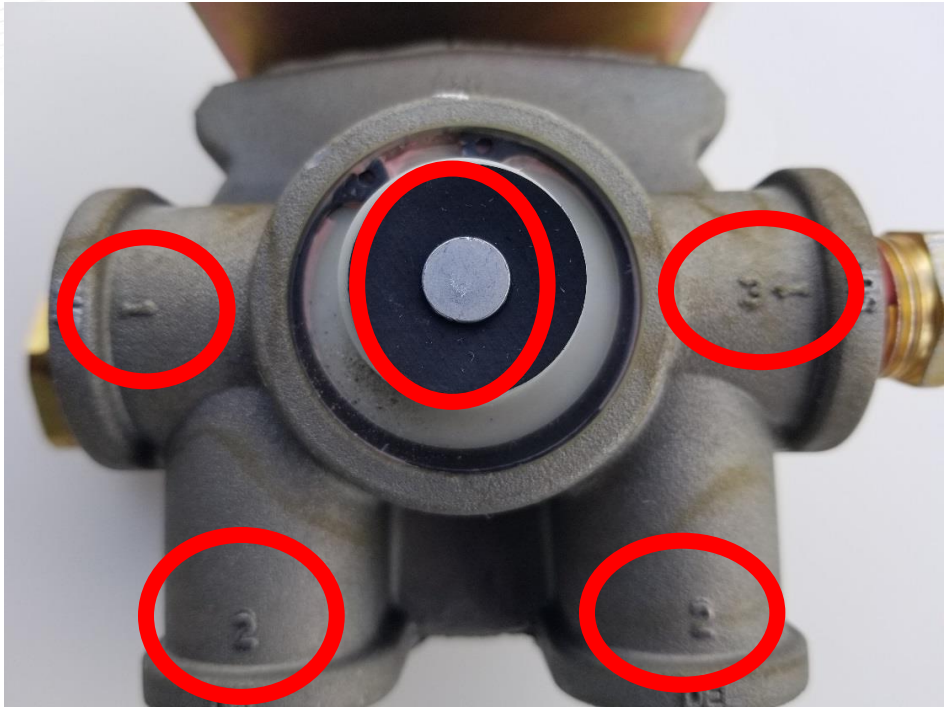
- Air valves are pressure regulators
- Air valves control the flow of air used to operate system components
- Industrial Standards Organization (ISO) identification of ports and controls
- Four or more ports or controls
- Ports or controls identified by numbers or wording

# Brake Relay Valve Ports

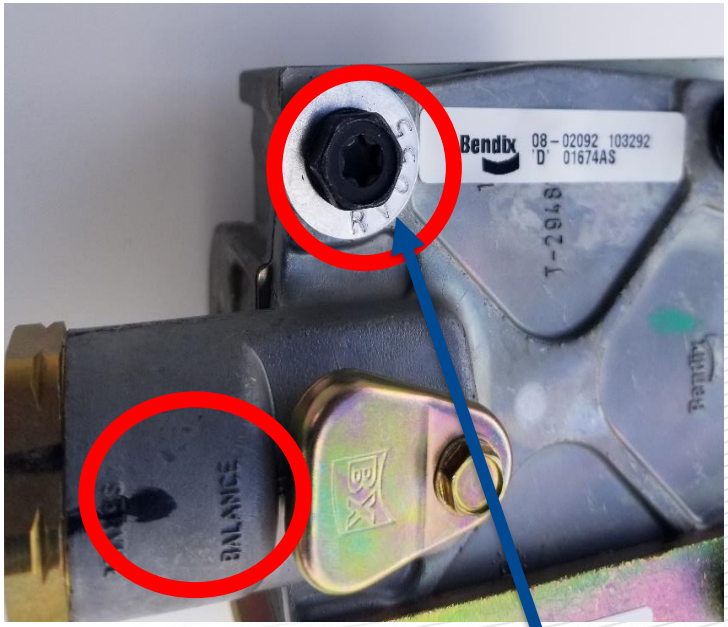
- #1 Supply port -- Air from system reservoir is supplied to this port
- #2 Delivery port -- Output which provides regulated supply pressure to operate a component or system
- #3 Exhaust port -- Delivery line air pressure exhaust
- #4 Service Port – Control or Signal pressure that operates the valve and regulates the delivery line pressure.

# Brake Relay Valves

**R14 Air Brake Valve Bottom View**



**R14 Air Brake Valve Bottom View**




Tag or washer contains valve type and crack pressure information

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# Control System

All air valves operate in 3 modes:

| MODE | EXHAUST VALVE | INLET VALVE |
|---|---|---|
| APPLIED | CLOSED | OPEN |
| HOLD / BALANCE | CLOSED | CLOSED |
| RELEASED | OPEN | CLOSED |

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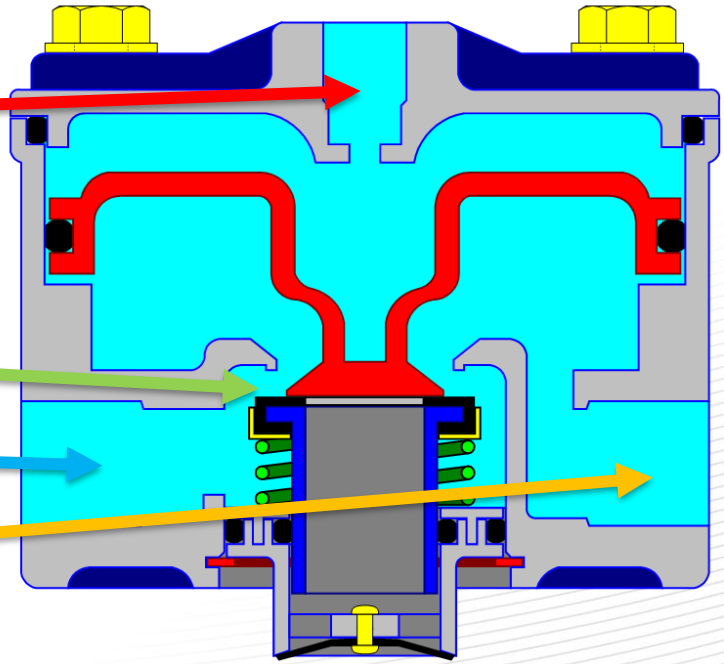
# Control System

Crack Pressure:

The control line pressure required for the exhaust valve to close and the inlet valve to open and air to begin to flow from the delivery port



# Control System
# Air Valve Diagnostics

When air is suspected of leaking from the valve exhaust port, perform the following simple diagnostic procedures:

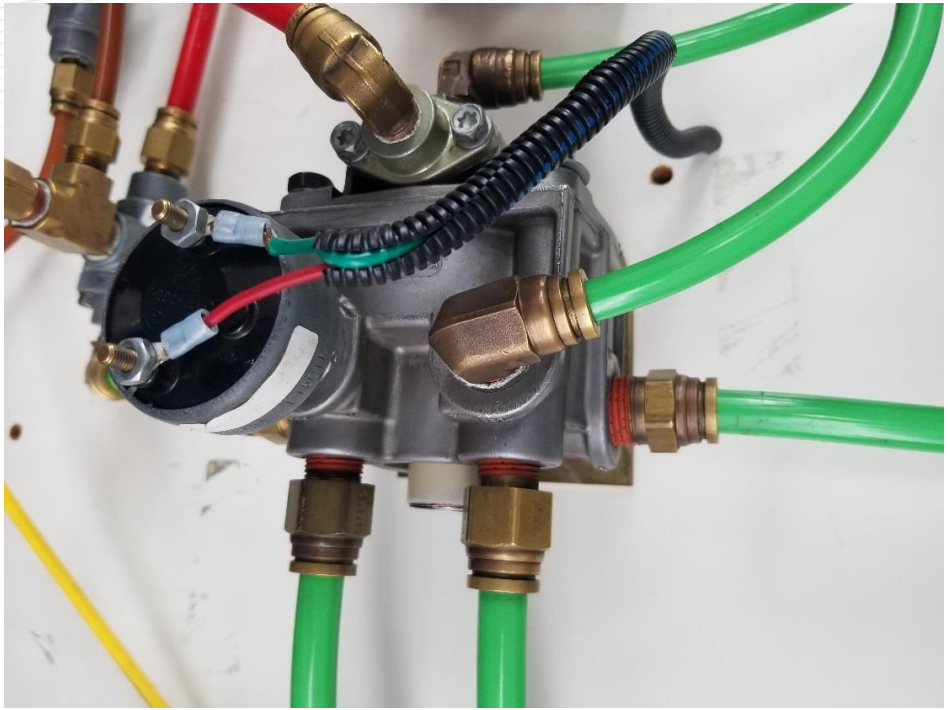
- Build air pressure to governor cut-out pressure
- Check to see if valve is leaking air from the exhaust port

# Control System
# Air Valve Diagnostics

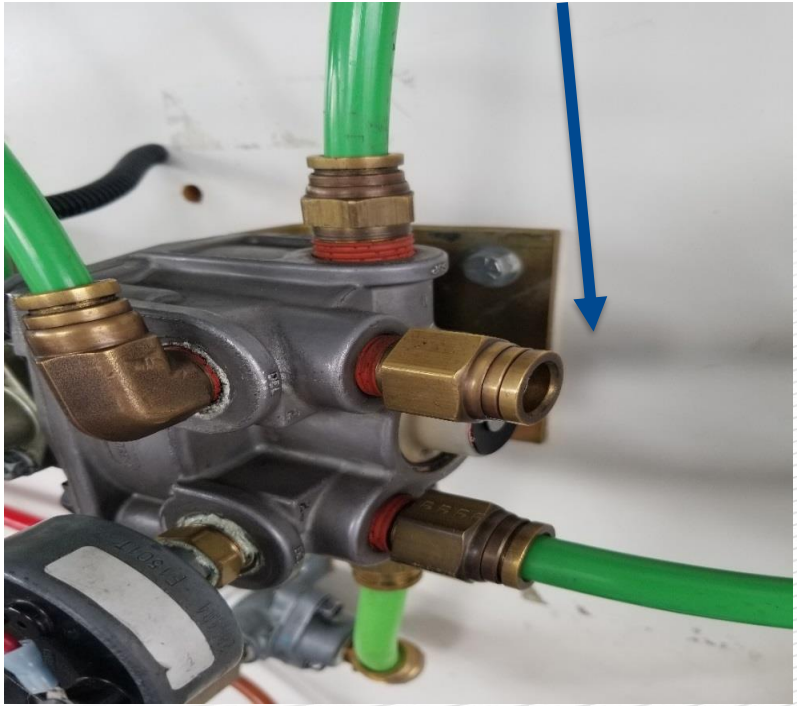
- If air is leaking from the exhaust port, remove the delivery line
- If valve stops leaking, check delivery line for air leakage

Remember, when the valve is in the released position, the delivery line is open to exhaust

# Control System Air Valve Diagnostics



**Delivery Line Removed**



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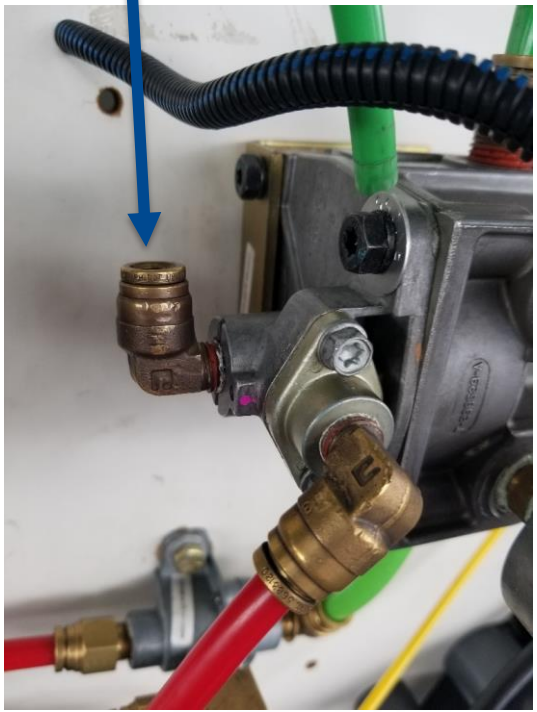
# Control System
# Air Valve Diagnostics

If valve continues to leak after delivery line is removed,

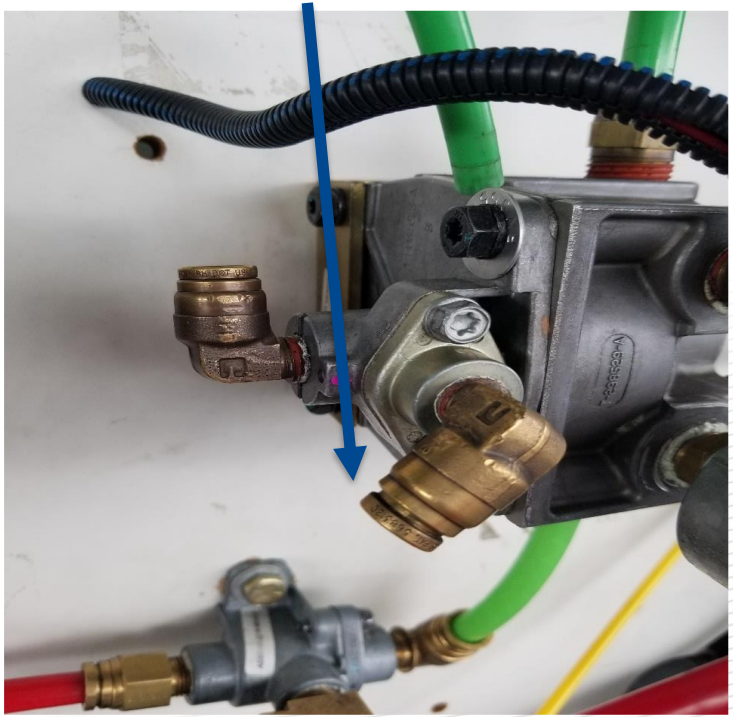
- Remove control line and see if leak stops
- If leak stops, check control line for air leakage

# Control System Air Valve Diagnostics

**Primary Control / Signal Line Removed**



**Secondary Control / Signal Line Removed**



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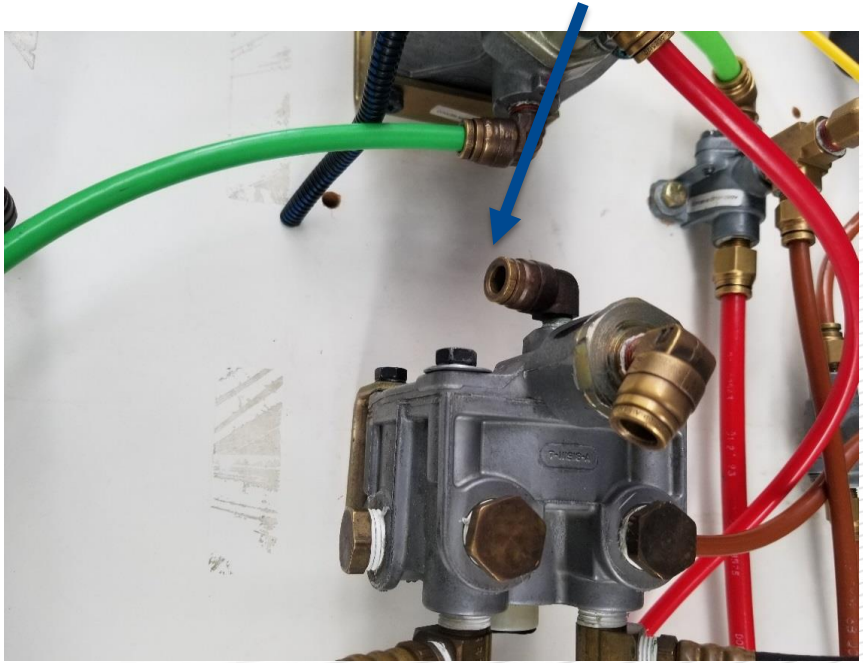
# Control System Air Valve Diagnostics

Parking Control / Signal Line

Anti- Compounding Line Removed



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# Air Valve Diagnostics Control System

If valve continues to leak with delivery and control lines removed,

- The problem is a bad valve
- The valve is only connected to supply line and isolated from the rest of the system
- Replace the valve

# Air Valve Replacement

- Never put a valve in a vise or clamp to install fittings

- Clamping the valve in a vise may cause the valve to become distorted and stick or bind

# Application Valve

Floor mounted dual brake valve with two separate supply and delivery circuits for primary and secondary brake circuits

- Primary circuit is operated mechanically by pressure on the pedal
- Secondary circuit is operated by air pressure from the primary circuit

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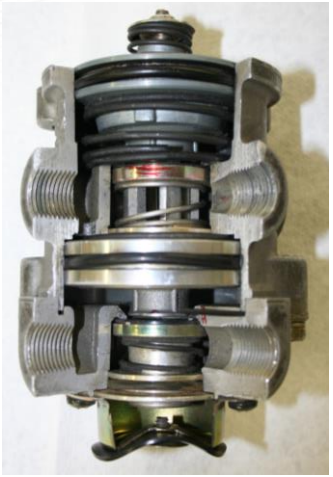
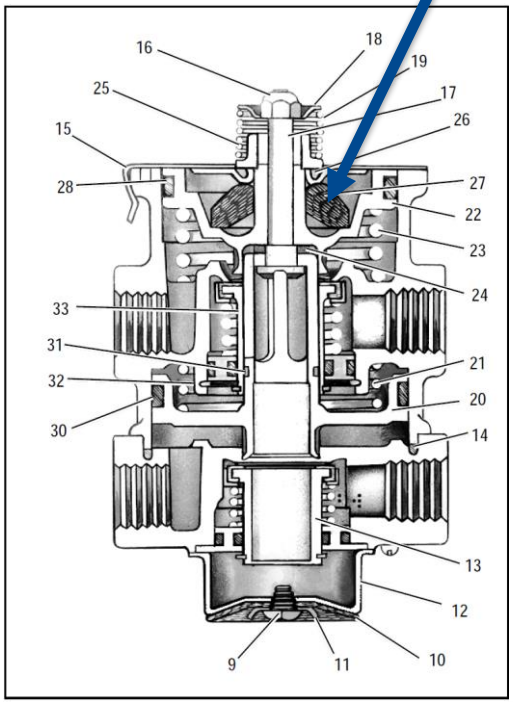
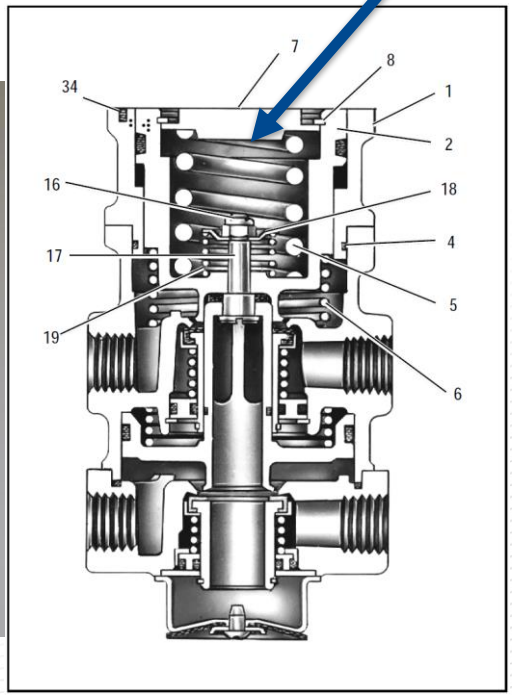
# Application Valve

E 6 valve has a rubber graduated spring at the top for greater sensitivity






E 10 valve has a steel coil graduated spring at the top for reduced sensitivity

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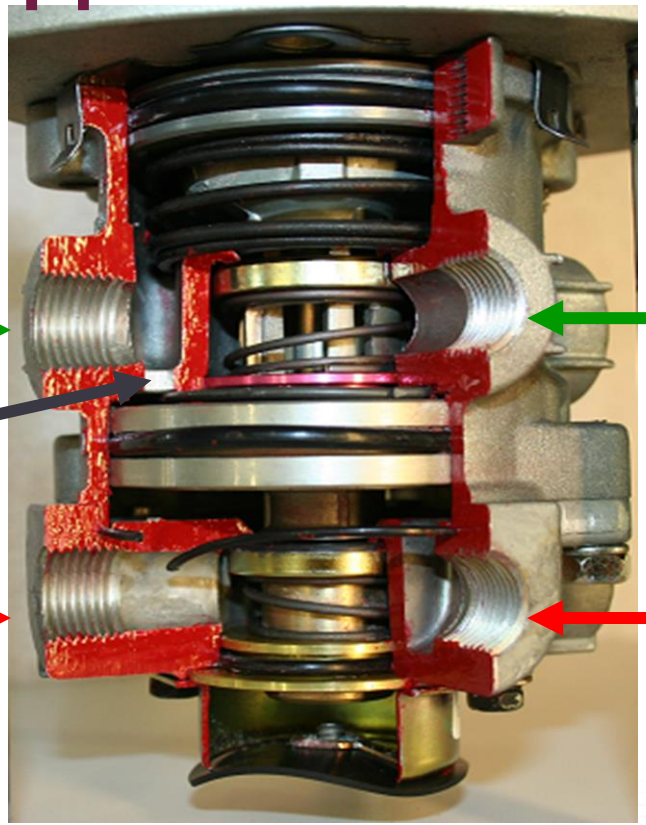
# Application Valve

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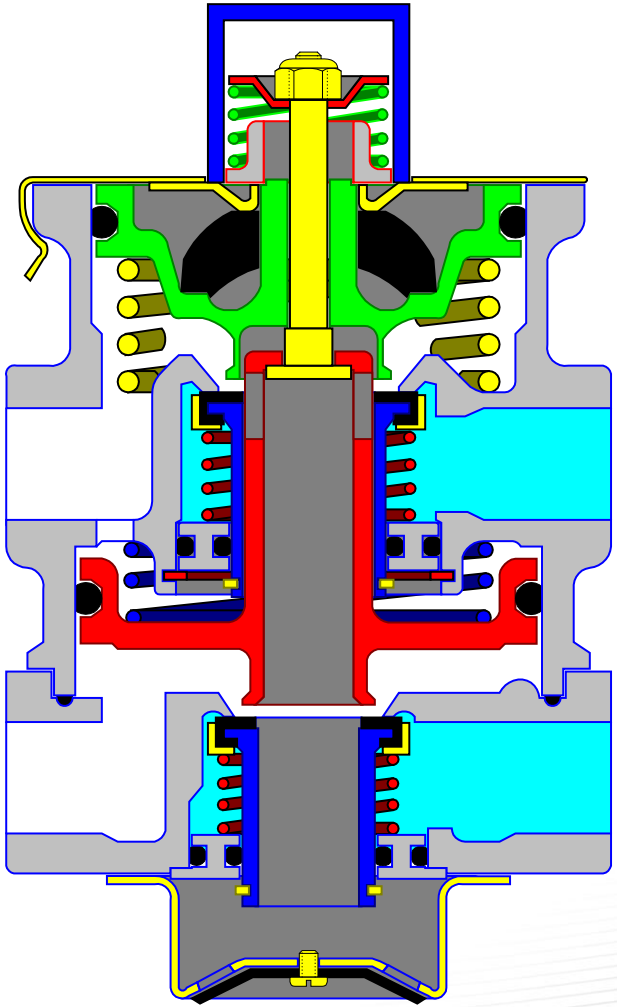
# E-6 Dual Brake Valve



Rear Delivery

Rear Supply

Front Delivery

Front Supply

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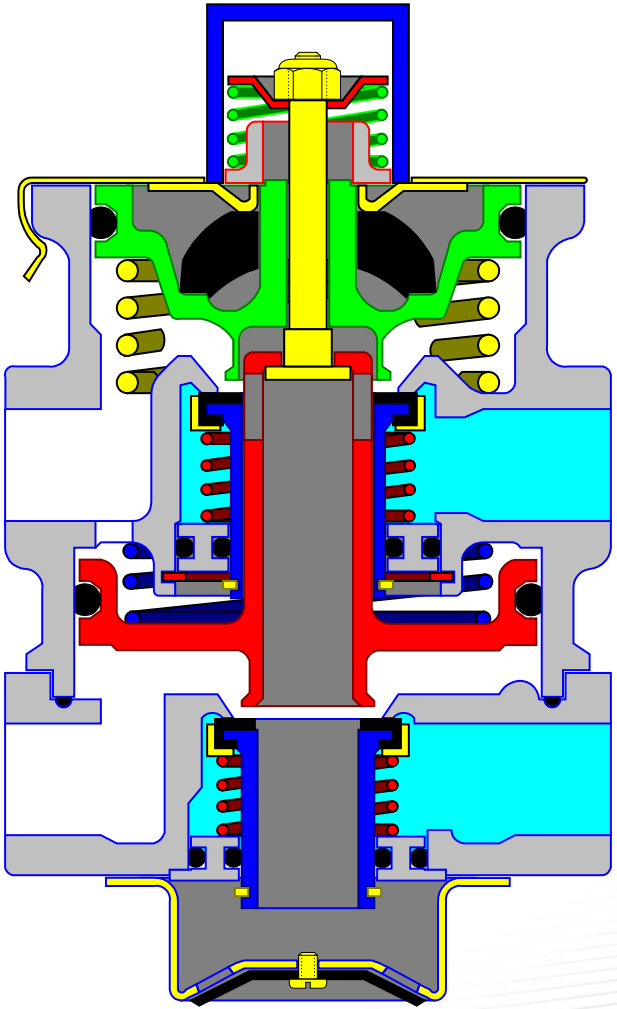
# Apply:

Primary piston moves down and closes exhaust valve.

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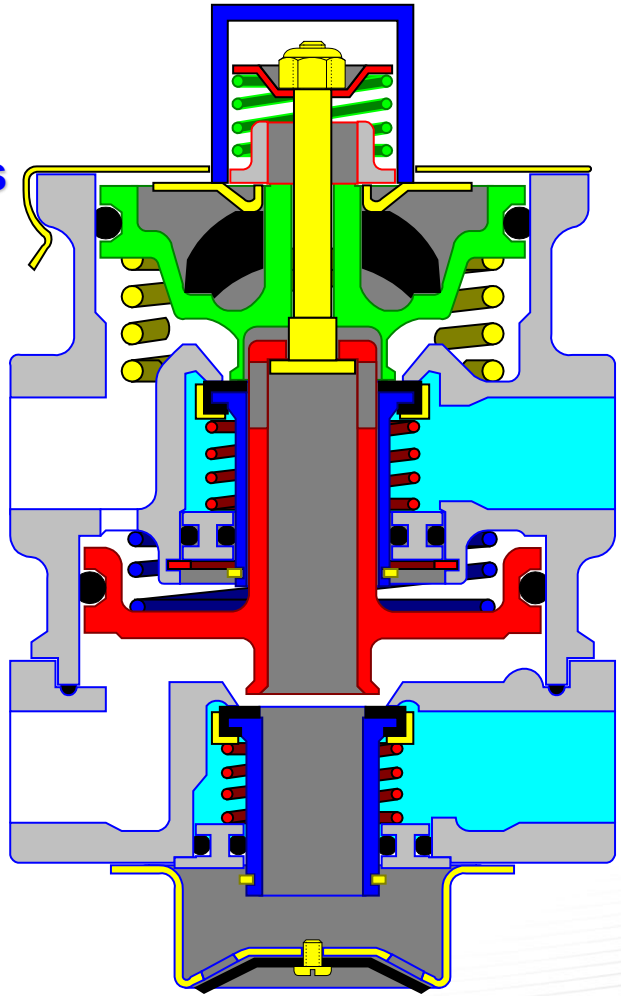


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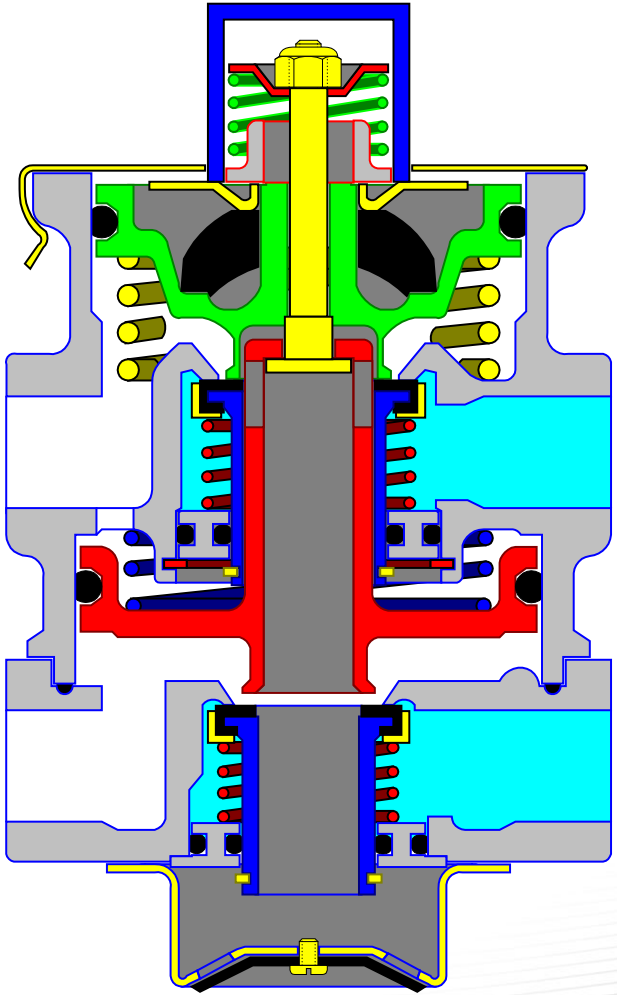
# Apply:

Primary piston continues down and opens the inlet valve.



Rear Delivery

Rear Supply

Front Delivery

Front Supply

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# Apply:

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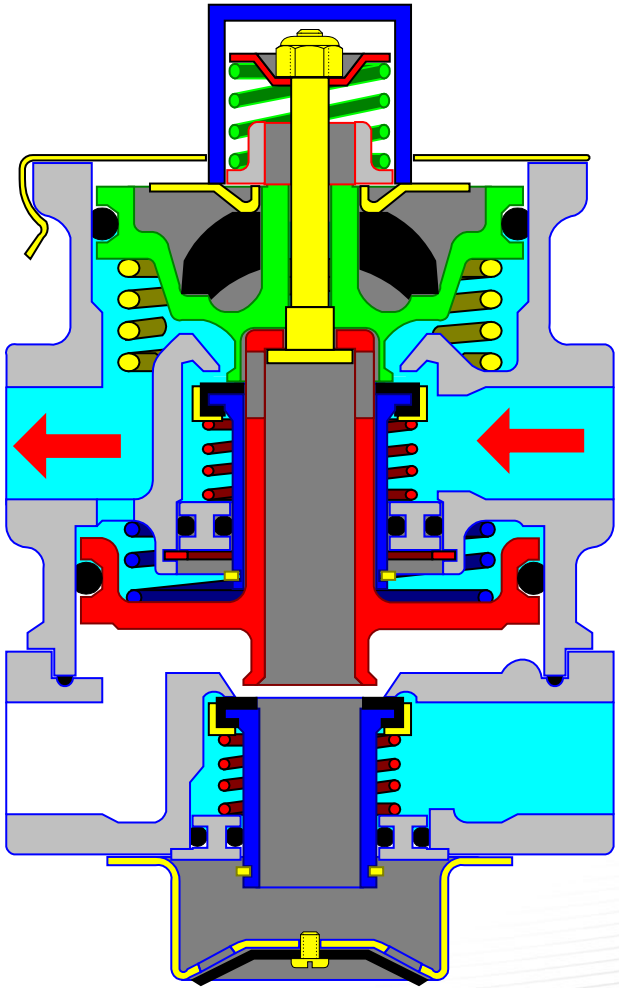
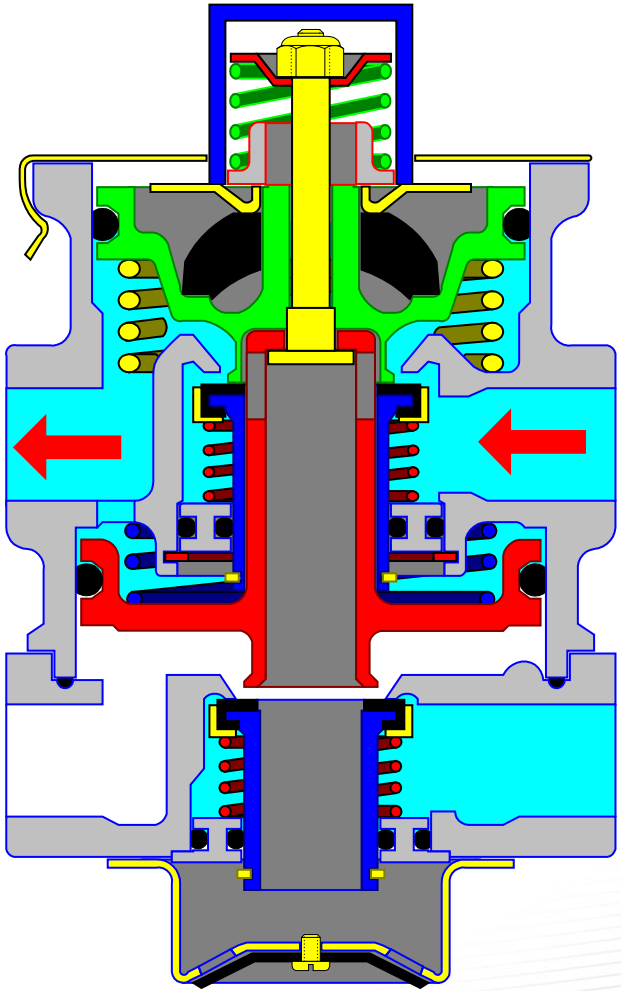


# Apply:

Air pressure from the primary delivery circuit causes the secondary piston to move down sealing the secondary exhaust valve.

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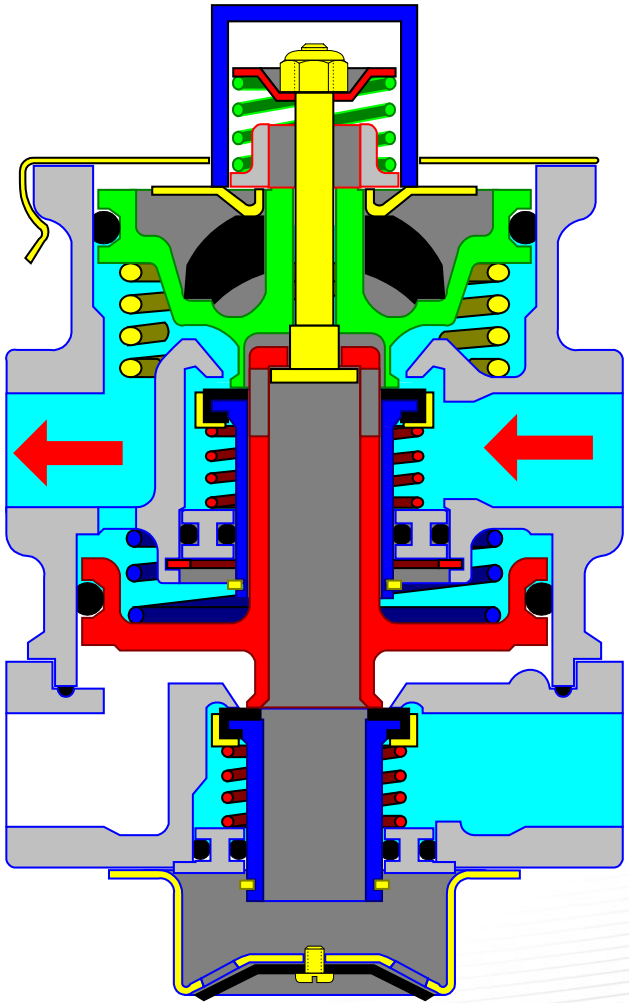


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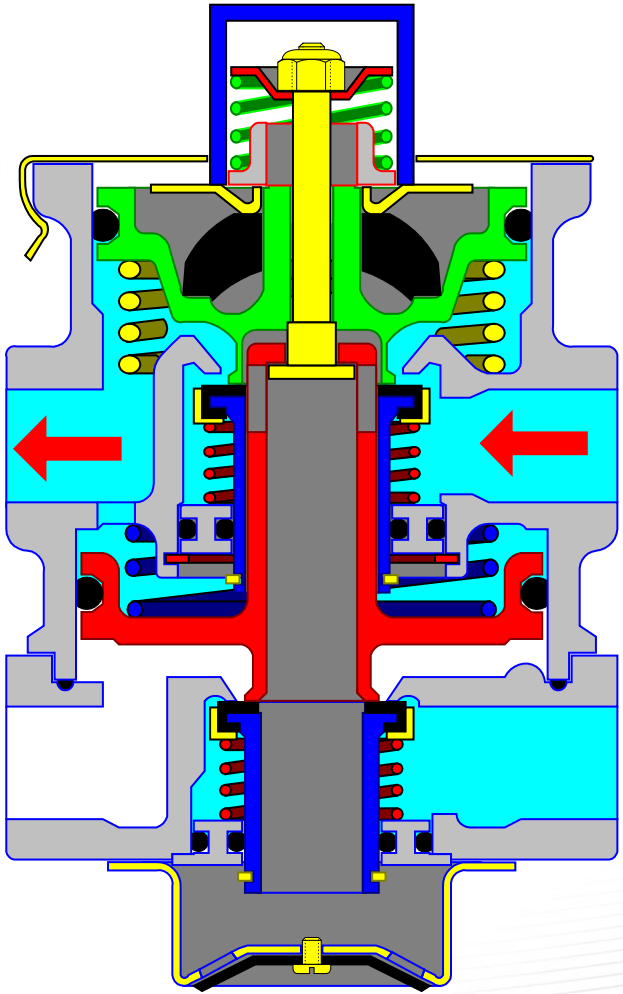
# Apply:

The secondary piston continues to move down opening the secondary inlet valve.



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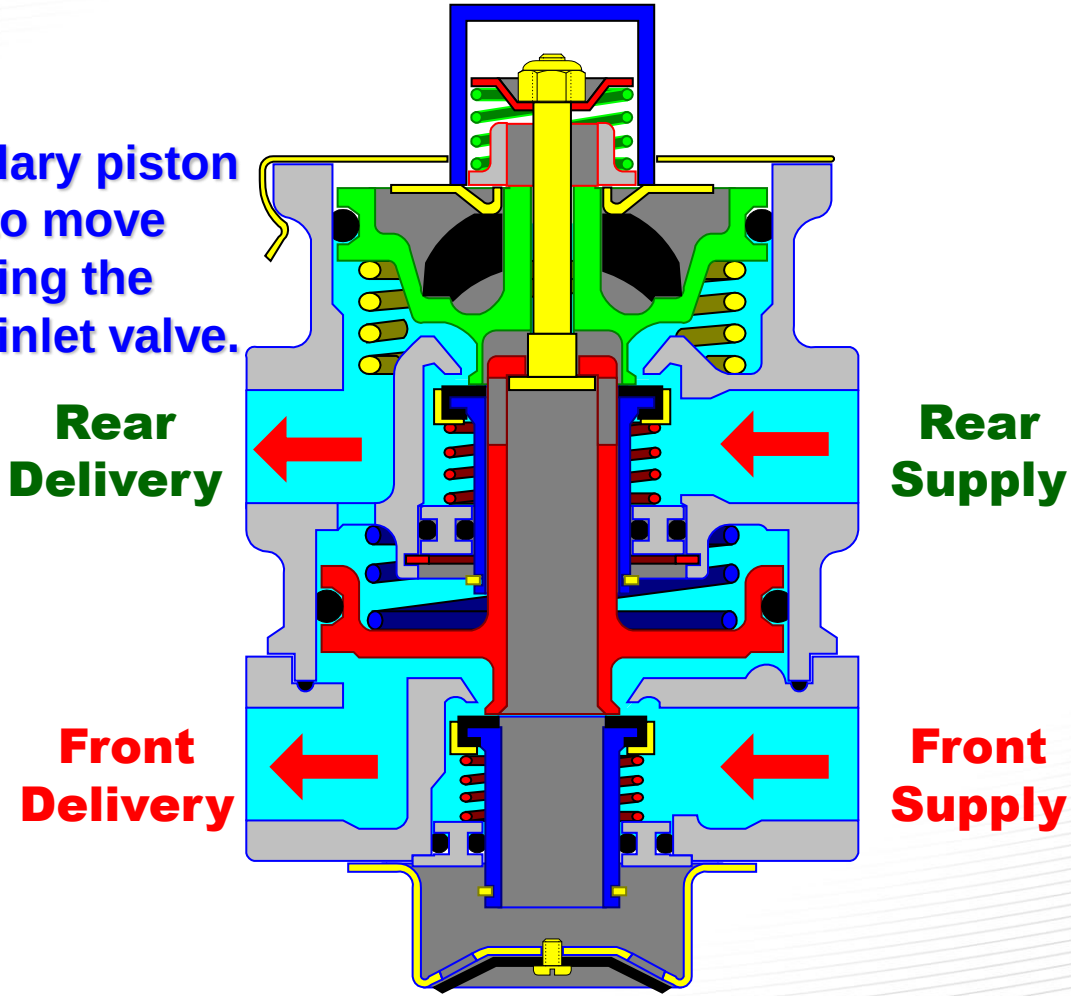
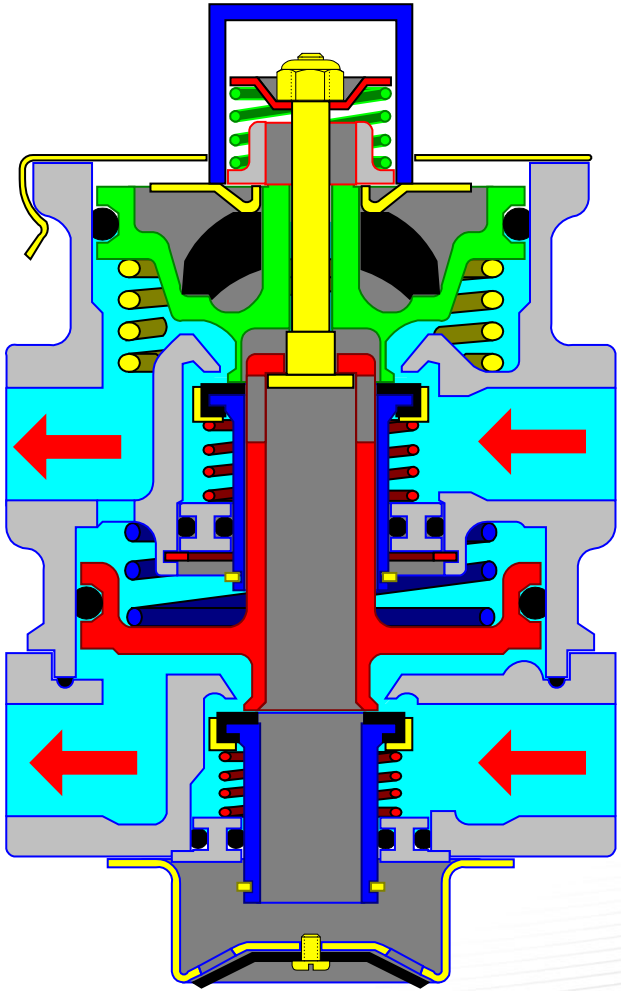


# Hold:

Pressure working on the bottom of the primary piston causes the piston to move upward against the graduating spring closing the inlet valve.



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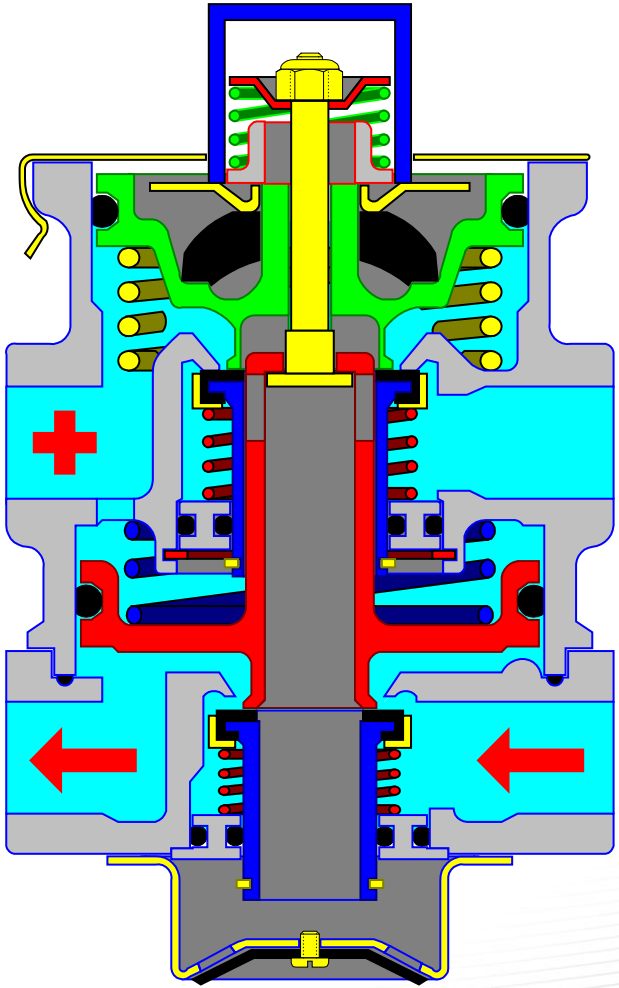


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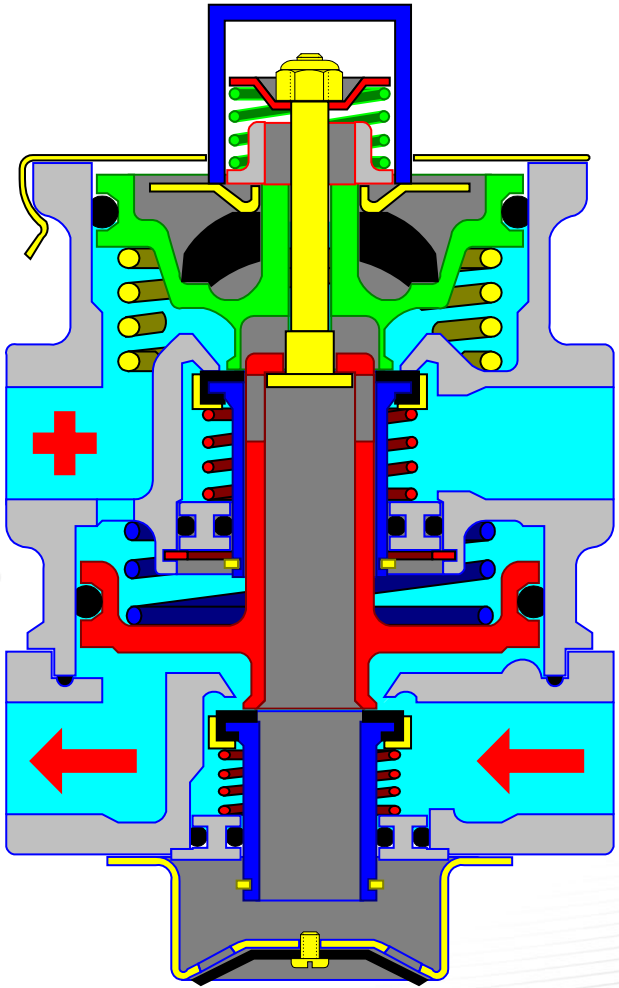
# Hold:

When the pressure equalizes above and below the secondary piston, the piston moves upward closing the secondary inlet valve.



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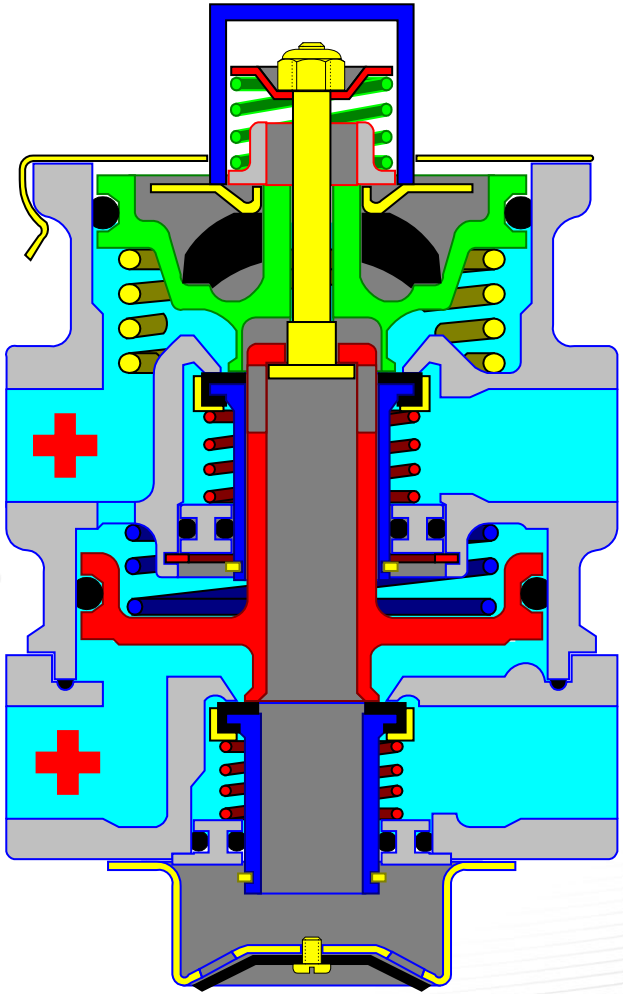


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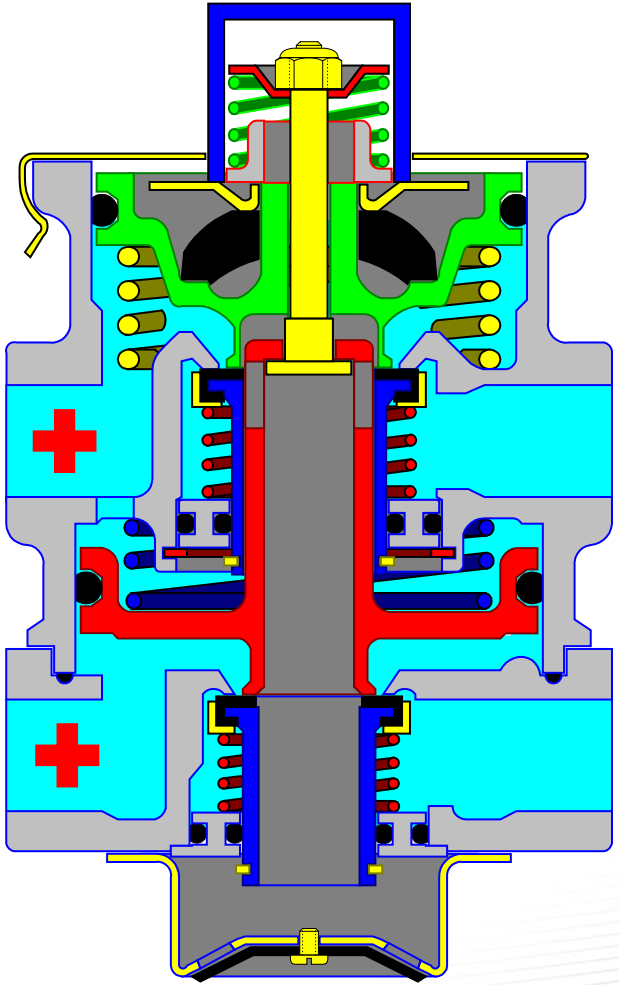
# Exhaust:

When the pedal is released the pistons move upward opening the exhaust valves.



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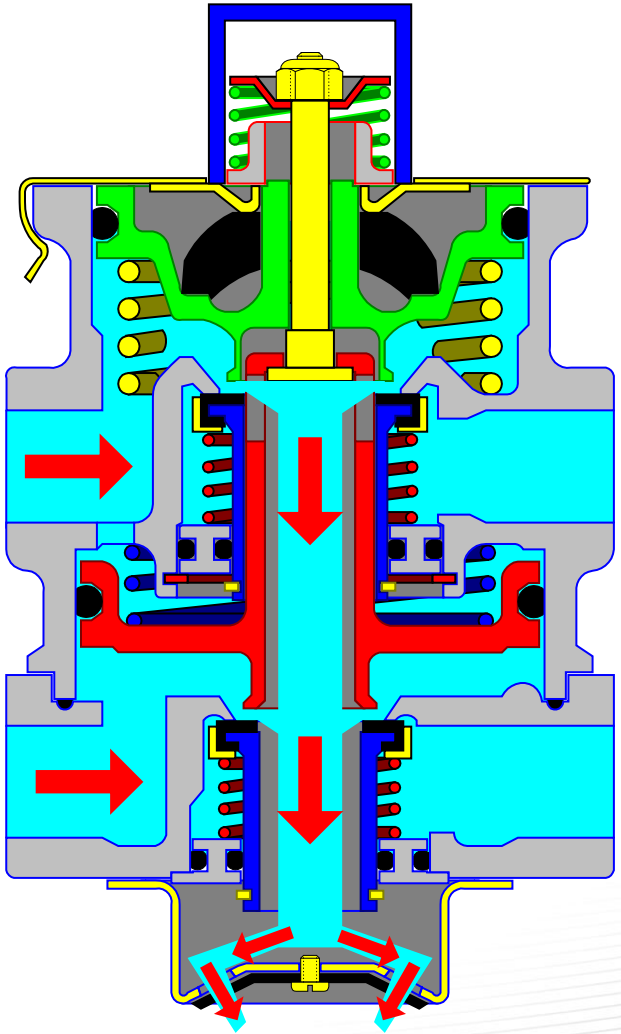
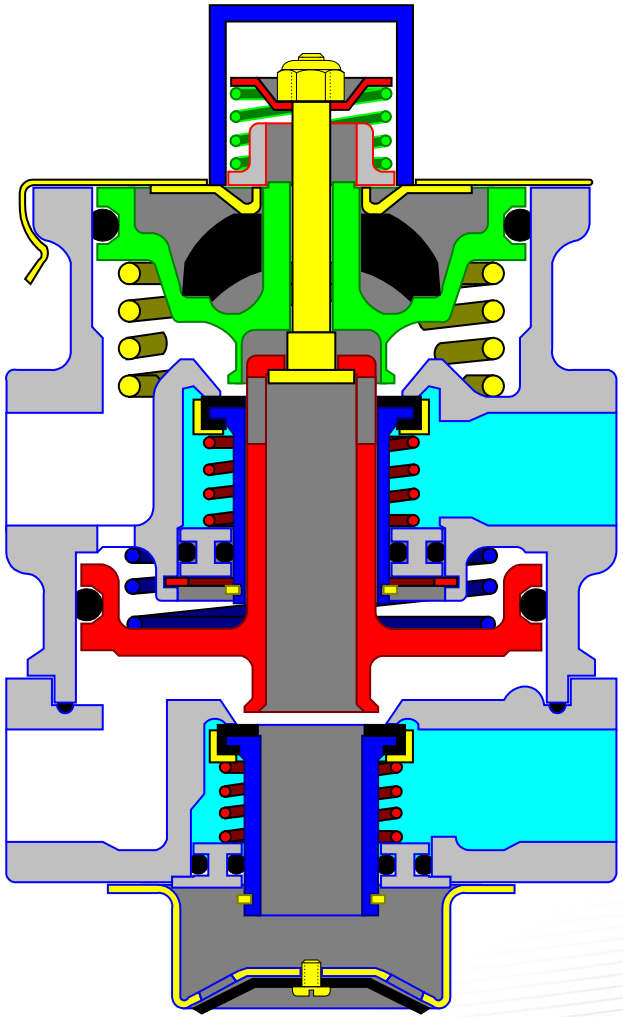


# Brakes Released

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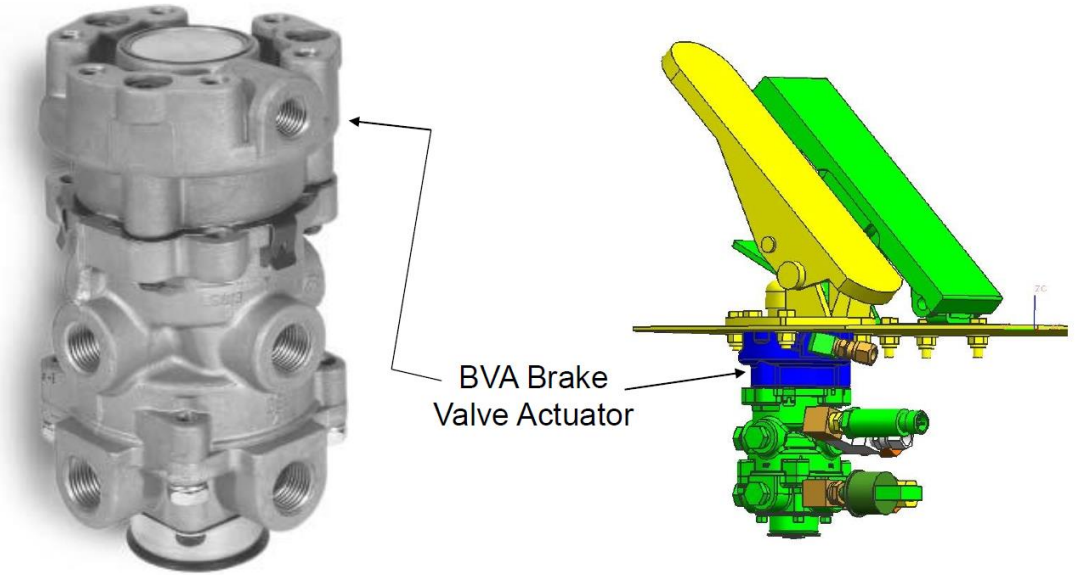
# Bendix BVA-85 Interlock

## Bendix BVA-85 Interlock

- Typically used with E-6 treadle valve
- Mounted between treadle valve plate and treadle valve
- Interlock is applied to all axles
- Eliminates need for downstream quick release and double check valves

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# Bendix BVA-85 Interlock

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# Brake Valve Actuator (BVA) Operation

The brake valve actuator on the E-6 brake valve receives air pressure from the pressure reducing valve and the brake interlock solenoid valve and applies the service brakes on all the axles. This action will mimic a foot application of the brake treadle and will apply front, rear, and center service brakes.

*Note:* The brake treadle will fall away from the operator's foot when the interlocks apply.

*Note:* Releasing the interlocks will require the vehicle operator to push through the interlock application. Applying sufficient pressure on the treadle to exceed interlock pressure by 10 PSI will release the interlocks and the treadle will return to its normal position.

*Note:* The BVA will apply 70-71% of the applied pressure to the BVA valve itself, due to internal piston design of the BVA.


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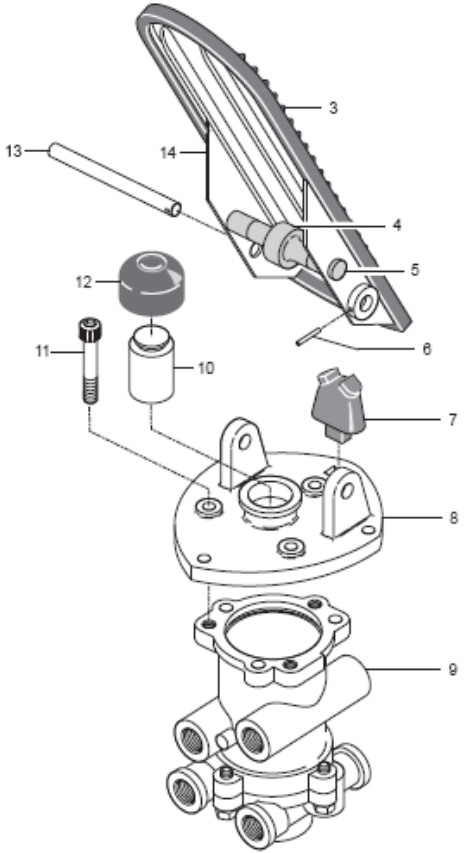
# Application Valve Maintenance

APTA recently published recommended *Transit Bus Brake Valve Treadle Assembly Maintenance*
BTS-BC-RP-008-20

- Inspect, clean, lube, and replace worn components
- Clean every three months, 25,000 miles, or 900 operating hours

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# Application Valve Maintenance

Inspect for worn, corroded and damaged Treadle Assembly components





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# Application Valve Maintenance

- Clean lubricate and assemble
- Test to make sure there are no air leaks, pedal moves freely and returns to normal position


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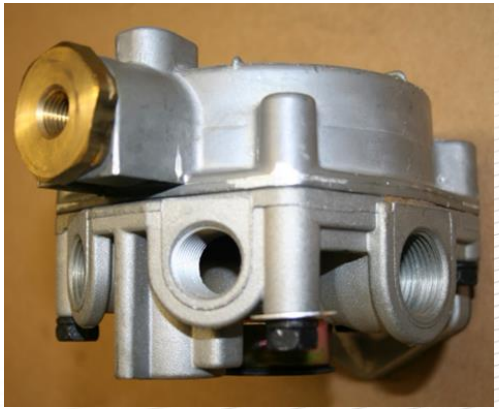
# Relay Valves

R-12DC

R-12

- Speeds up application and release of the brakes
- Remote controlled brake valve that delivers or releases air to the chambers in response to the control air delivered to it from the application valve
- Usually mounted in close proximity to the brake chambers it operates

R-14



R-8

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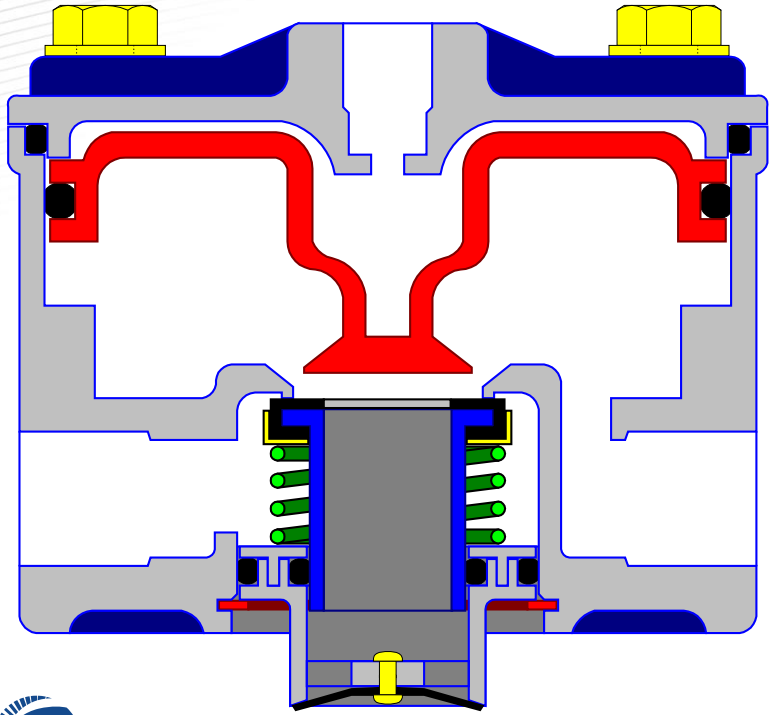
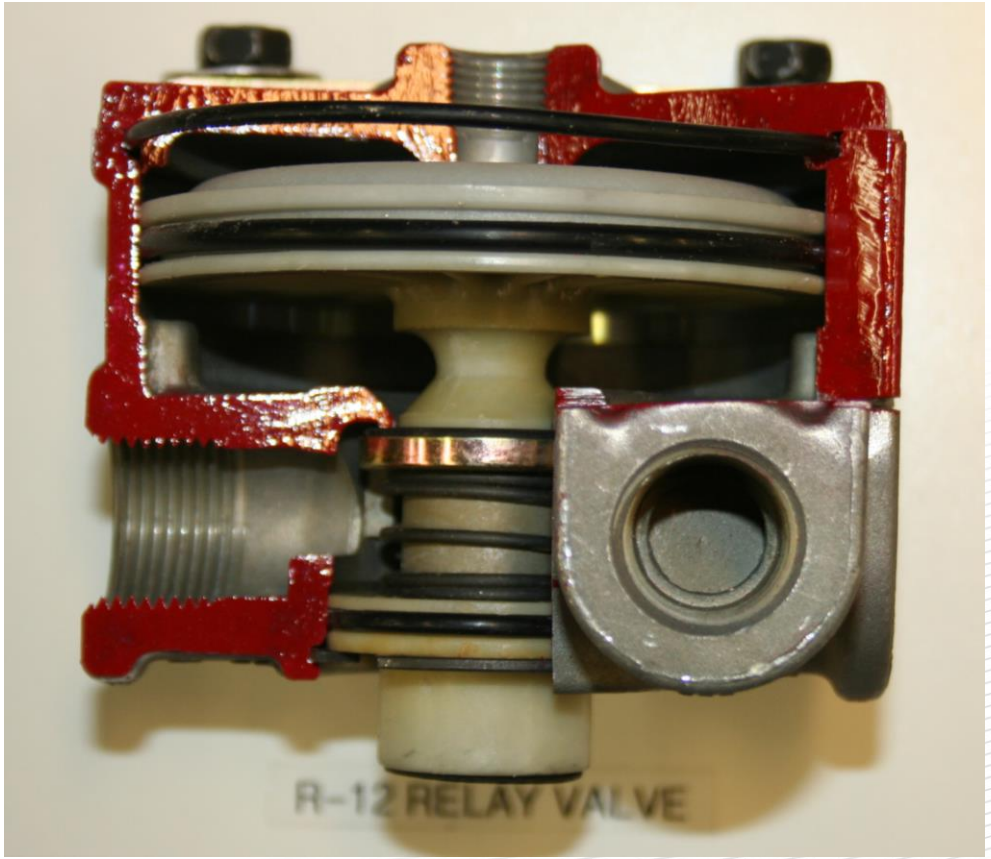
# R-12 Relay Valve



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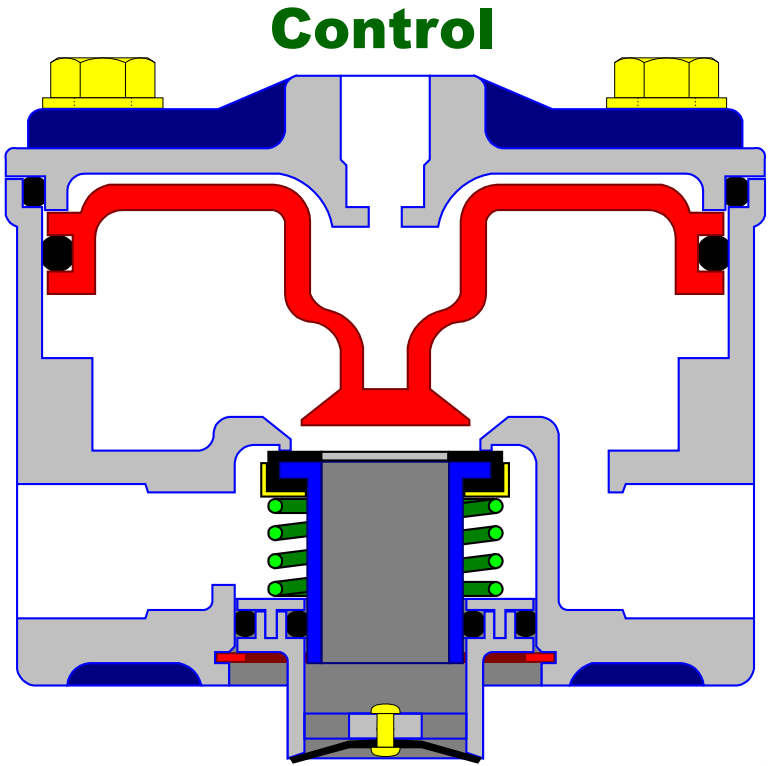
# R-12 Relay Valve

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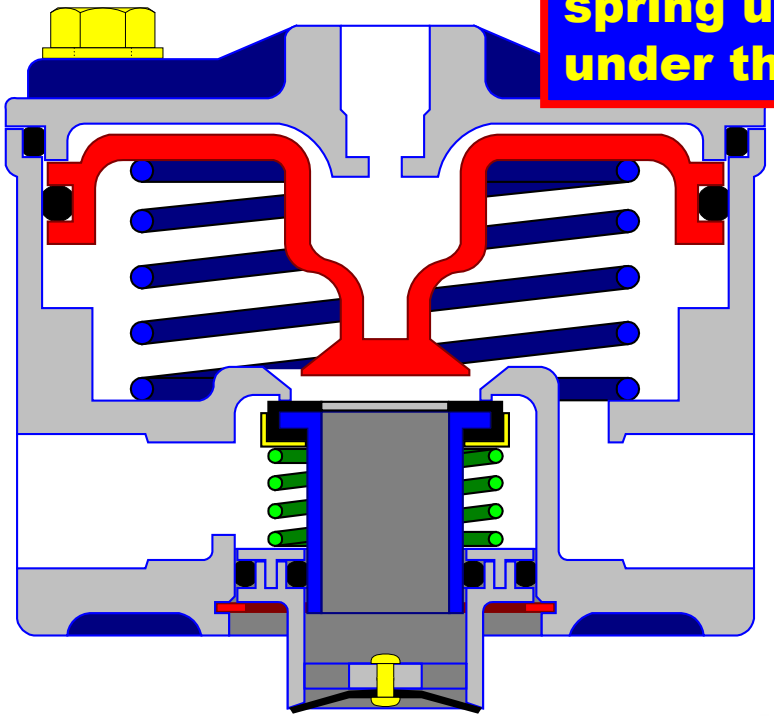
# R-12 Relay Valve

Control

Crack pressure is determined by spring used under the piston.



Supply

Delivery

**Crack Pressures Available:**
**4 PSI, 5.5 PSI, 7.5 PSI.**

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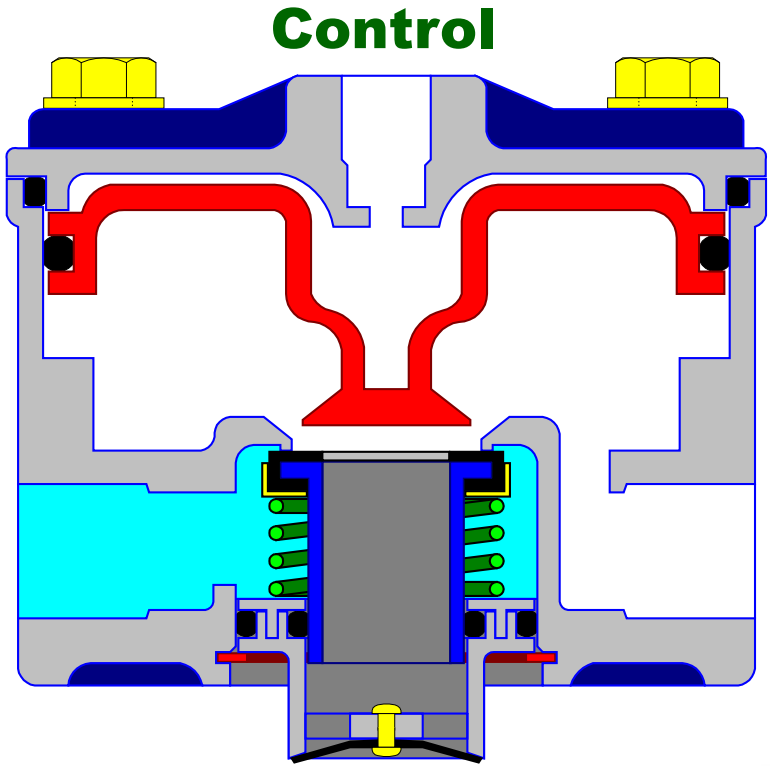
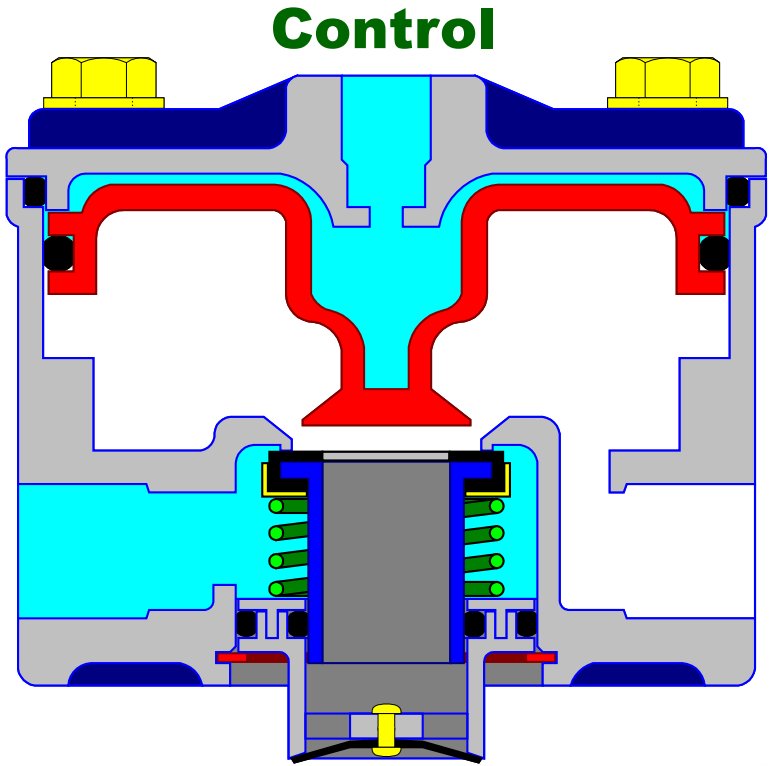
# R-12 Relay Valve



# R-12 Relay Valve

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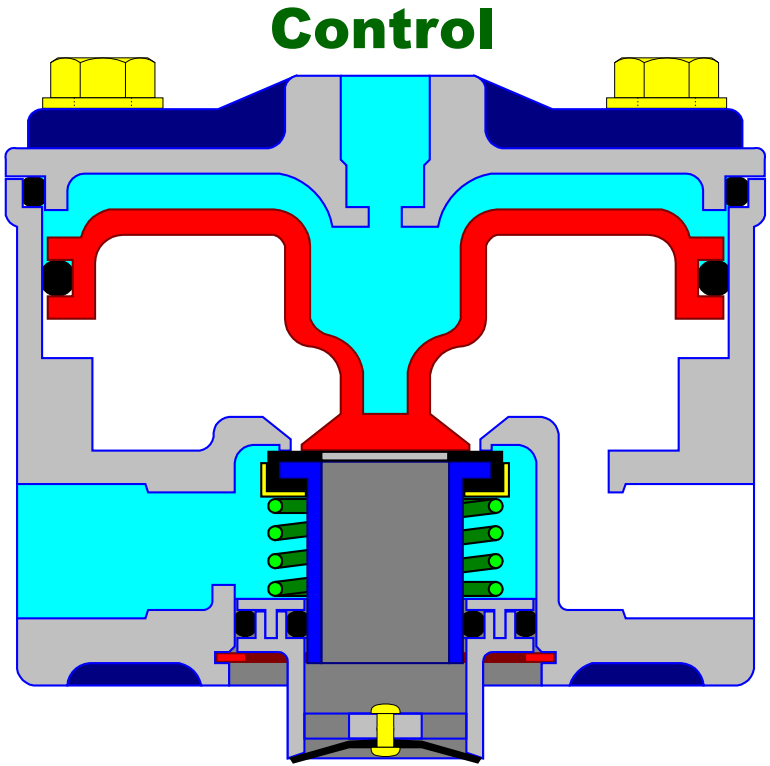
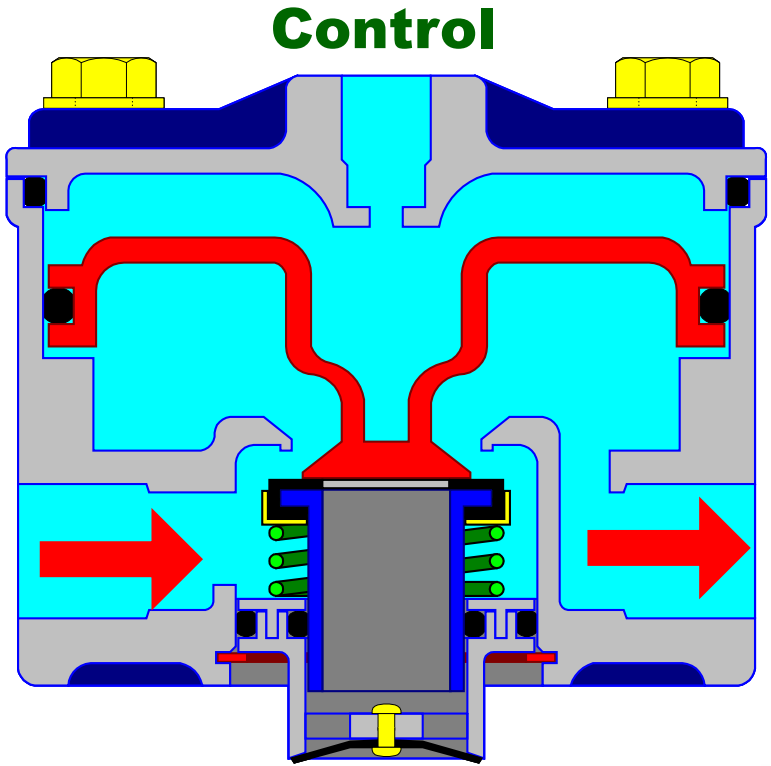
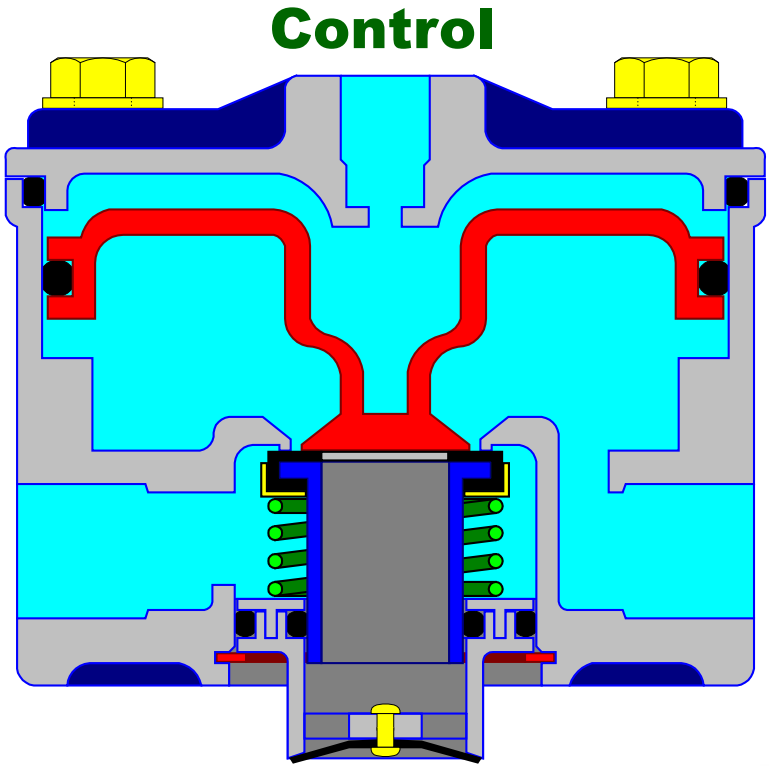
# R-12 Relay Valve



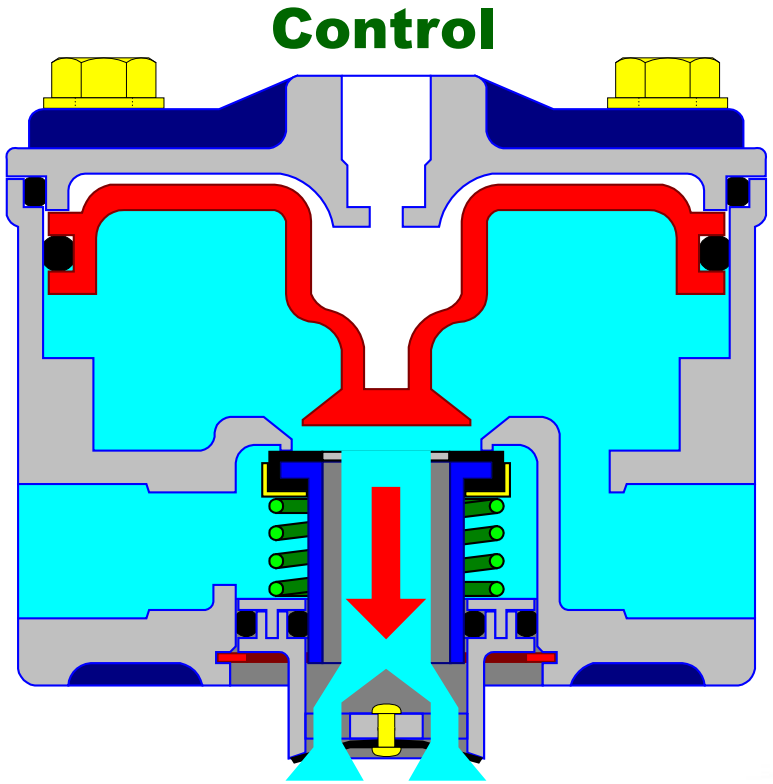
# R-12 Relay Valve



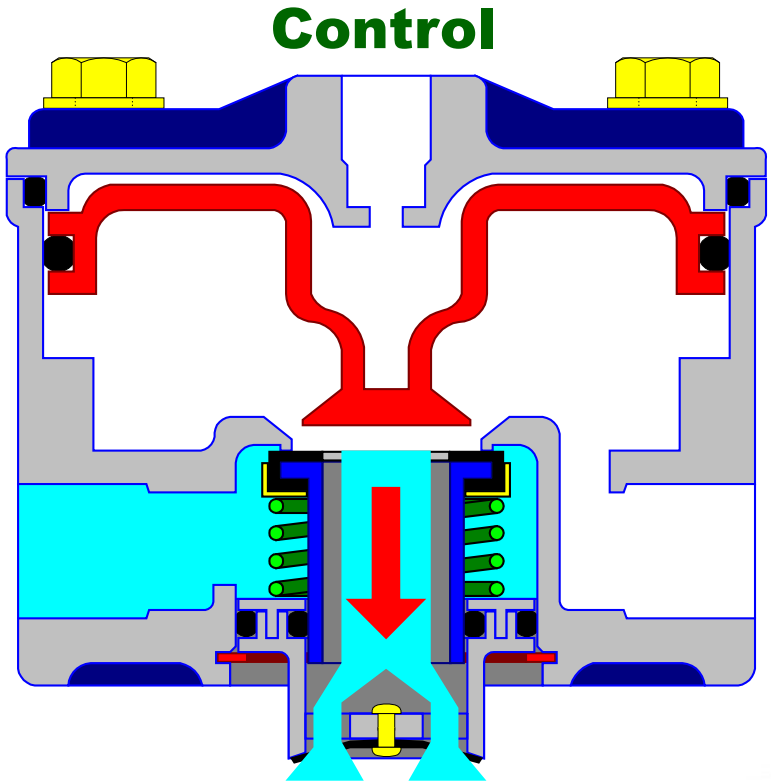
# R-12 Relay Valve



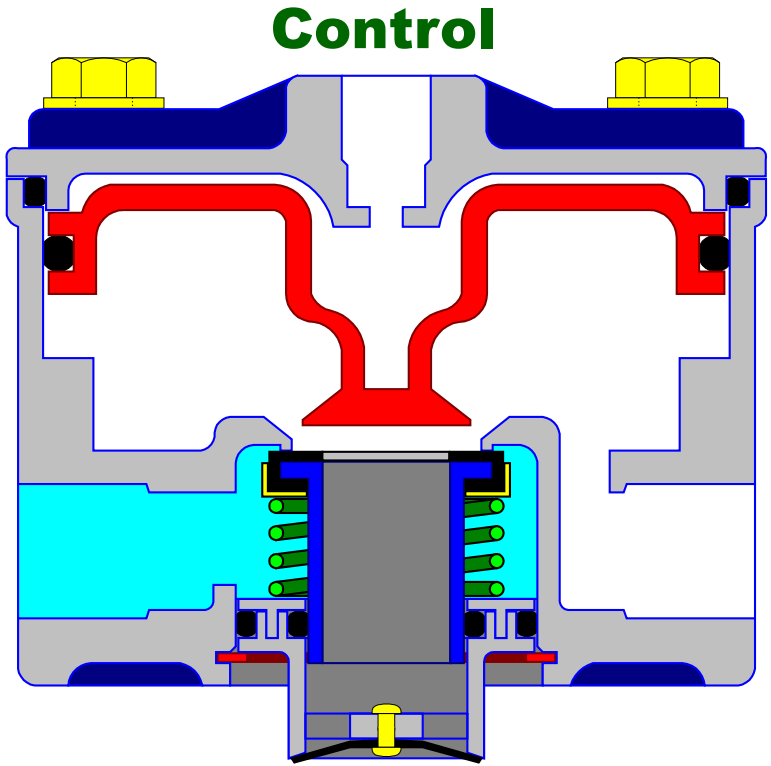
# R-12 Relay Valve



# R-12 Relay Valve

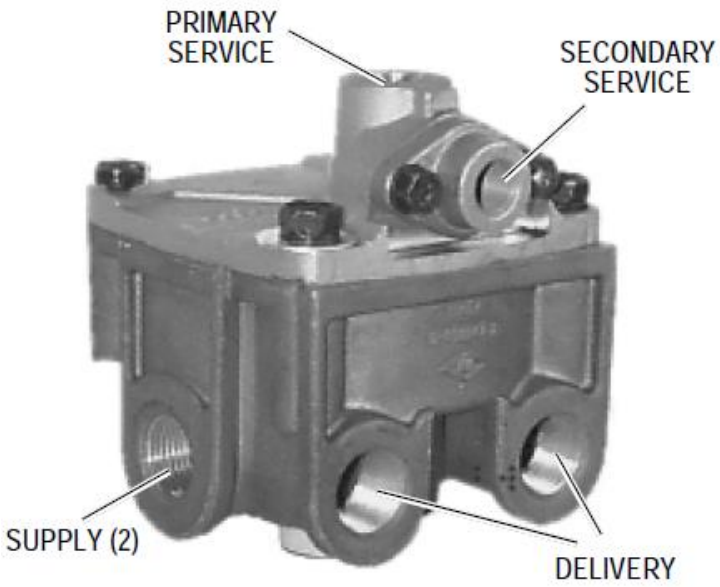


# R-12 Relay Valve

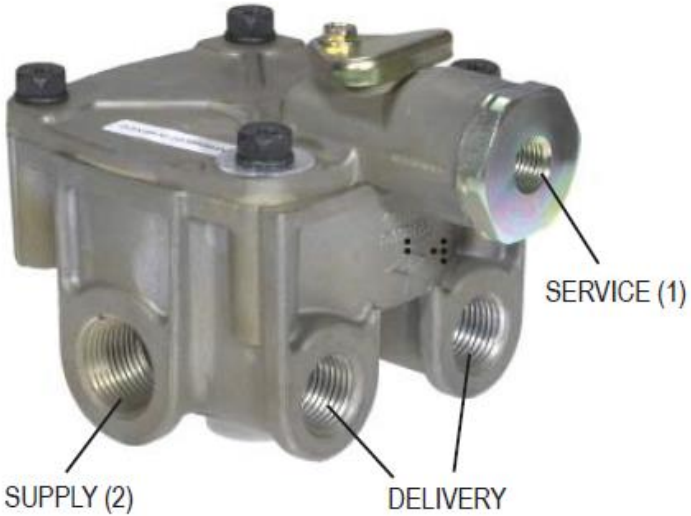


# Air Brake Relay Valves

## R12DC Air Brake Valve




## R14 Air Brake Valve



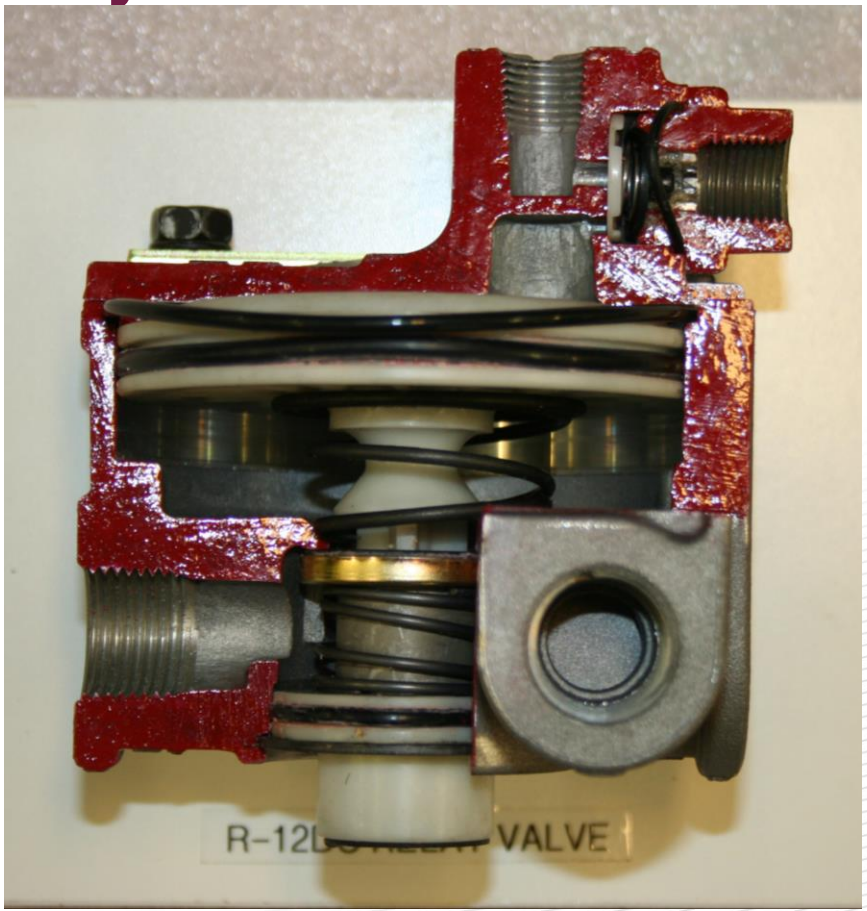
# R-12 R-12DC and R-14 Relay Valves

## Valve bodies are identical

- The R-14 valve differs from the R-12DC valve in that it incorporates a quick release and anti-compounding feature
- The R-14 valve's anti-compound feature allows it to be conveniently used as either a service or spring brake relay valve
- R-12DC biased double check valve ensures primary service signal pressure controls the valve

# R-12DC Relay Valve

- Allows either primary or secondary control pressure to operate the rear brakes
- Biased double check valve ensures primary service signal pressure controls the valve
- In the event of a loss of the primary control line, the secondary control line supplies the pressure to operates the valve

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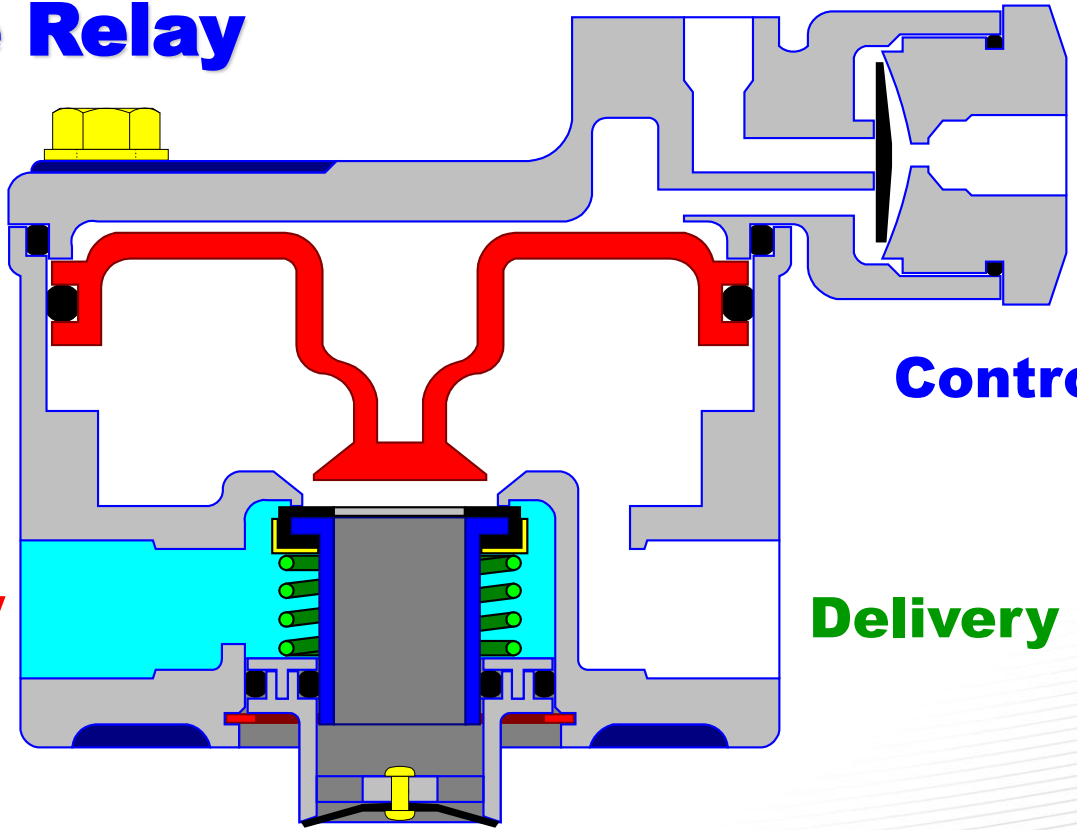
# R-14 Spring Brake Relay Valve

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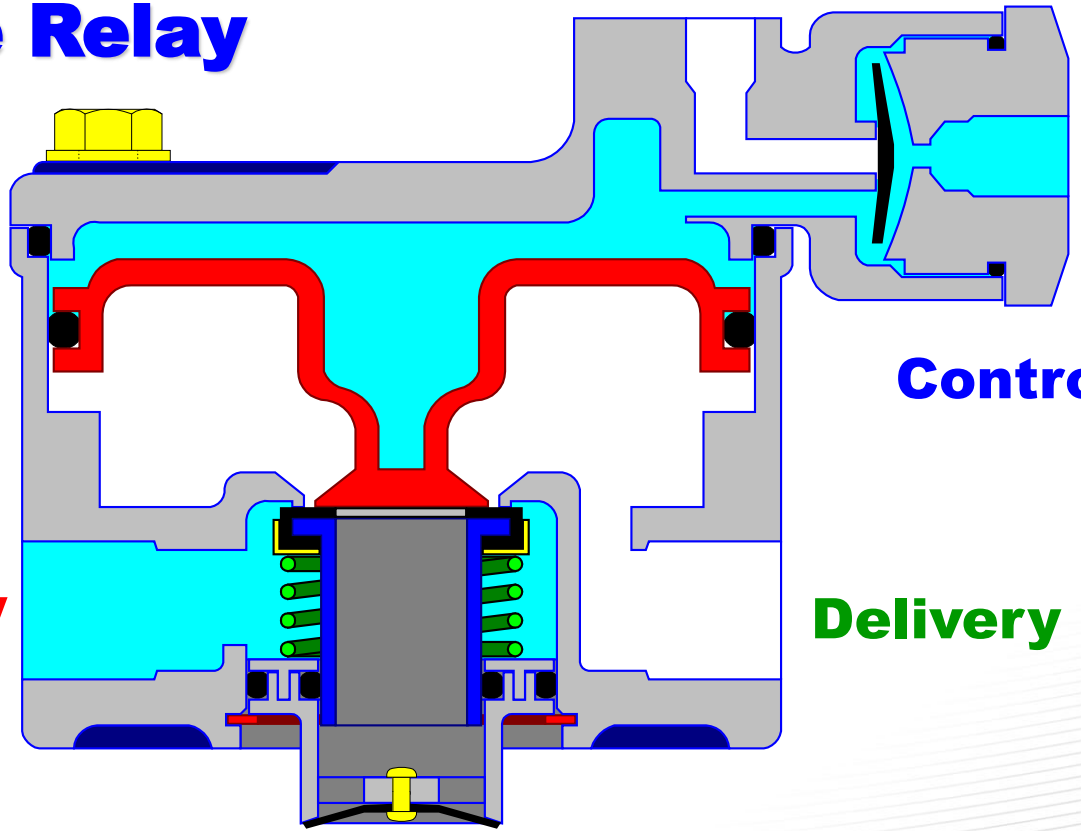
# R-14 Spring Brake Relay Valve

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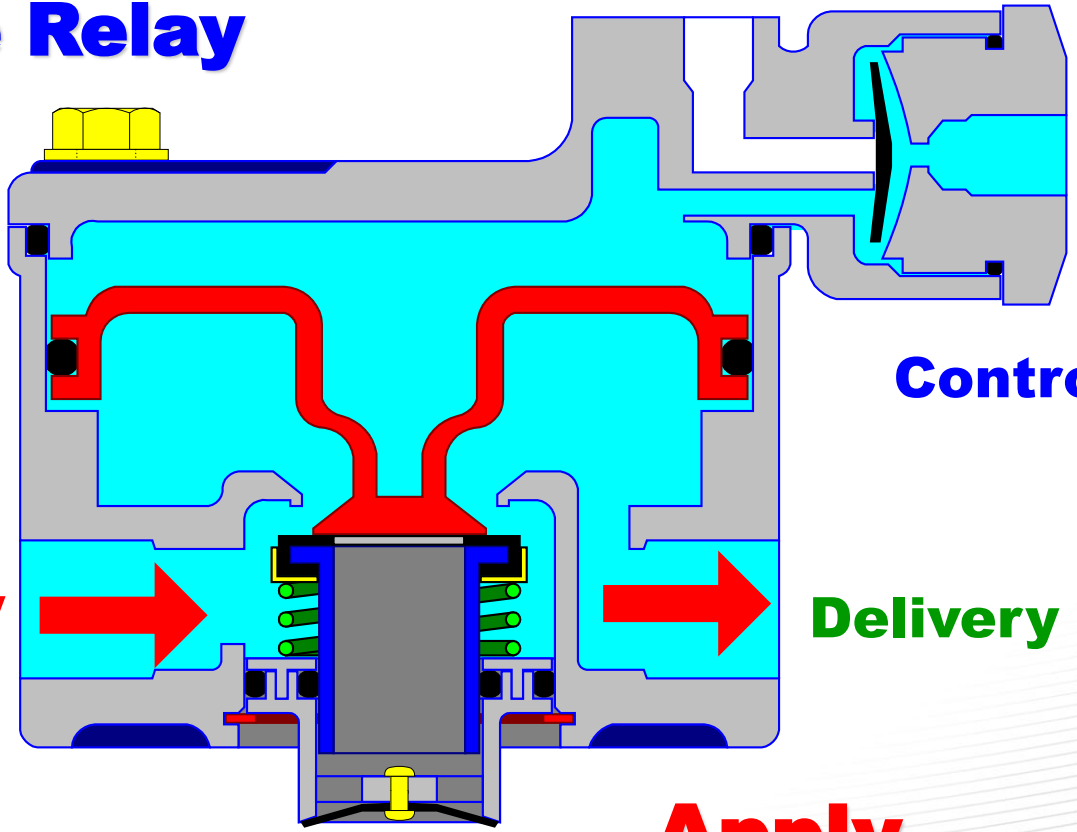
# R-14 Spring Brake Relay Valve

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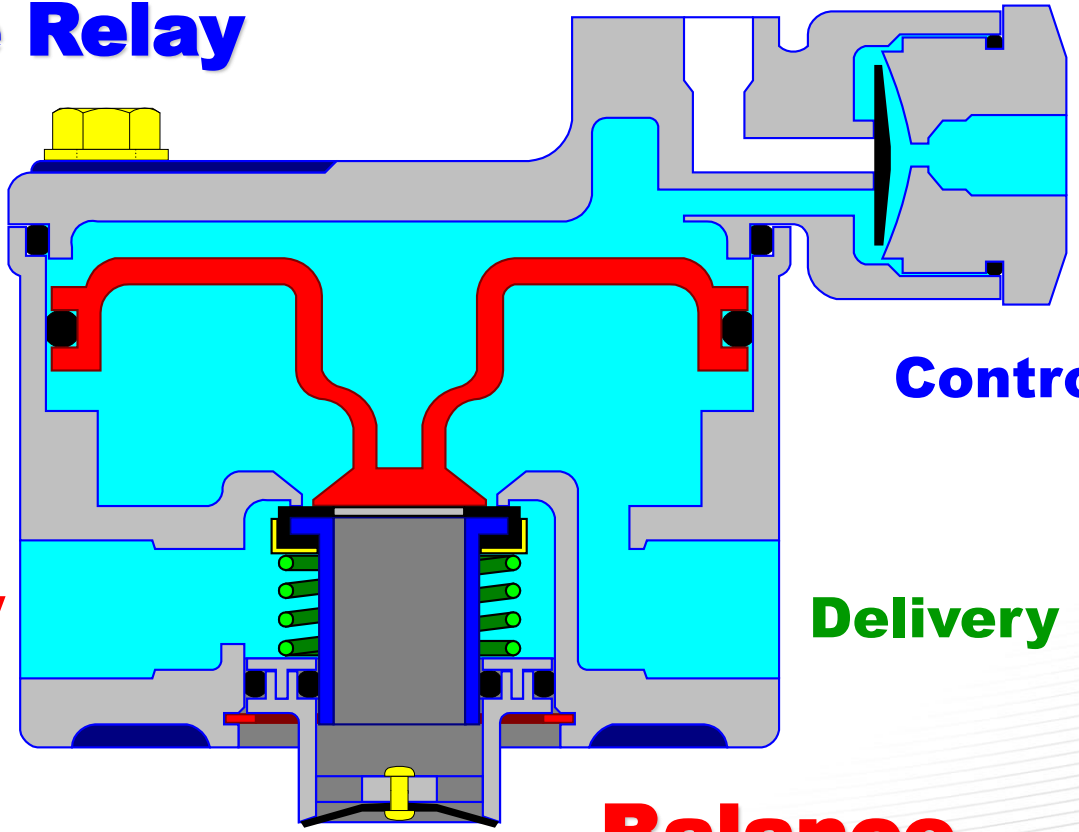
# R-14 Spring Brake Relay Valve

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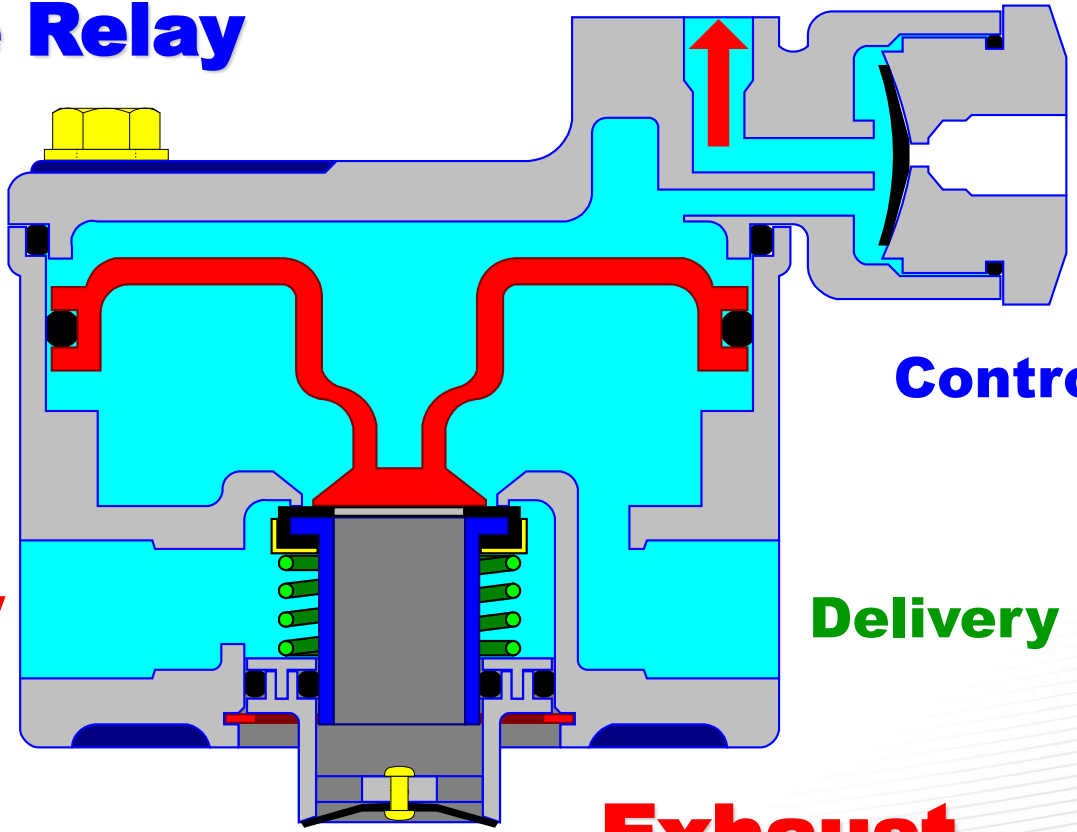
# R-14 Spring Brake Relay Valve

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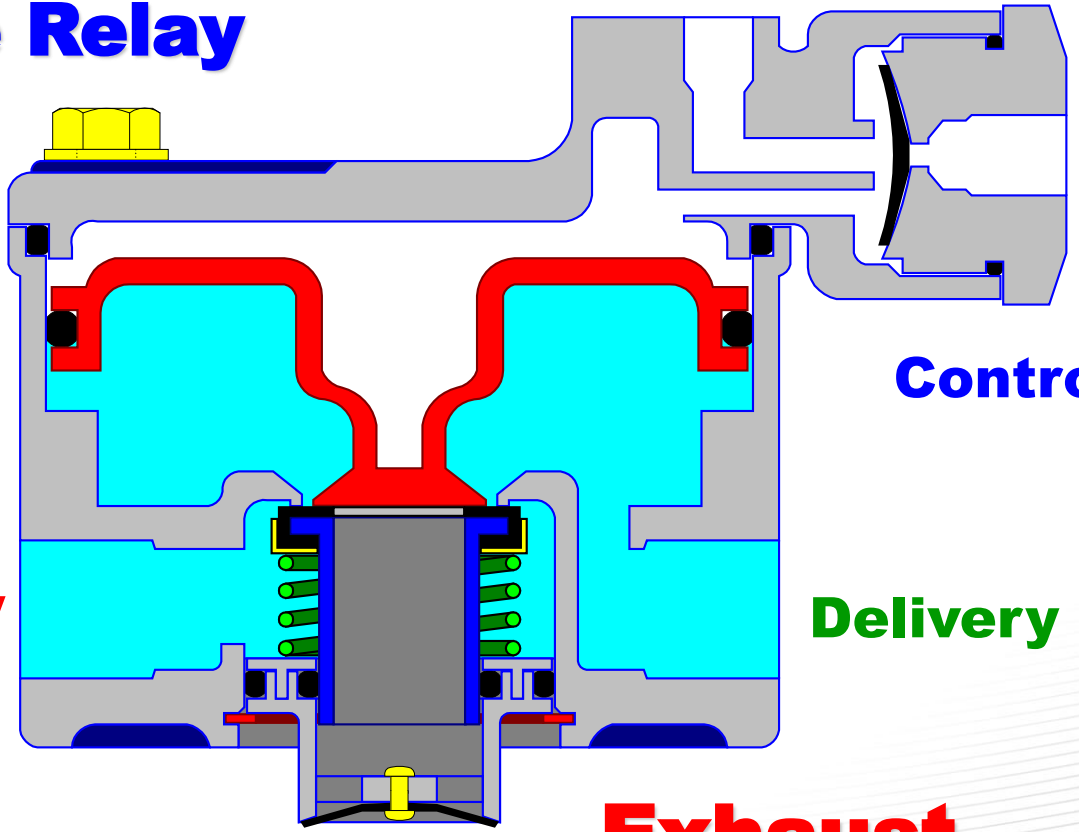
# R-14 Spring Brake Relay Valve

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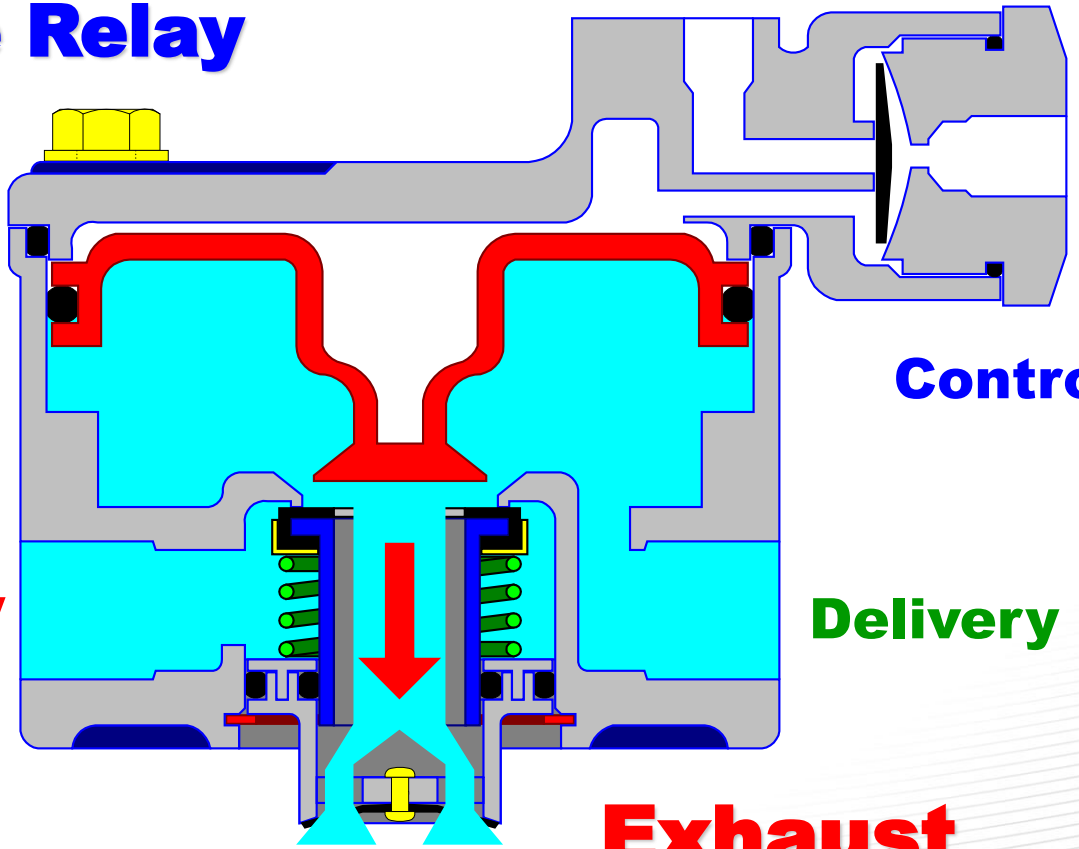
# R-14 Spring Brake Relay Valve

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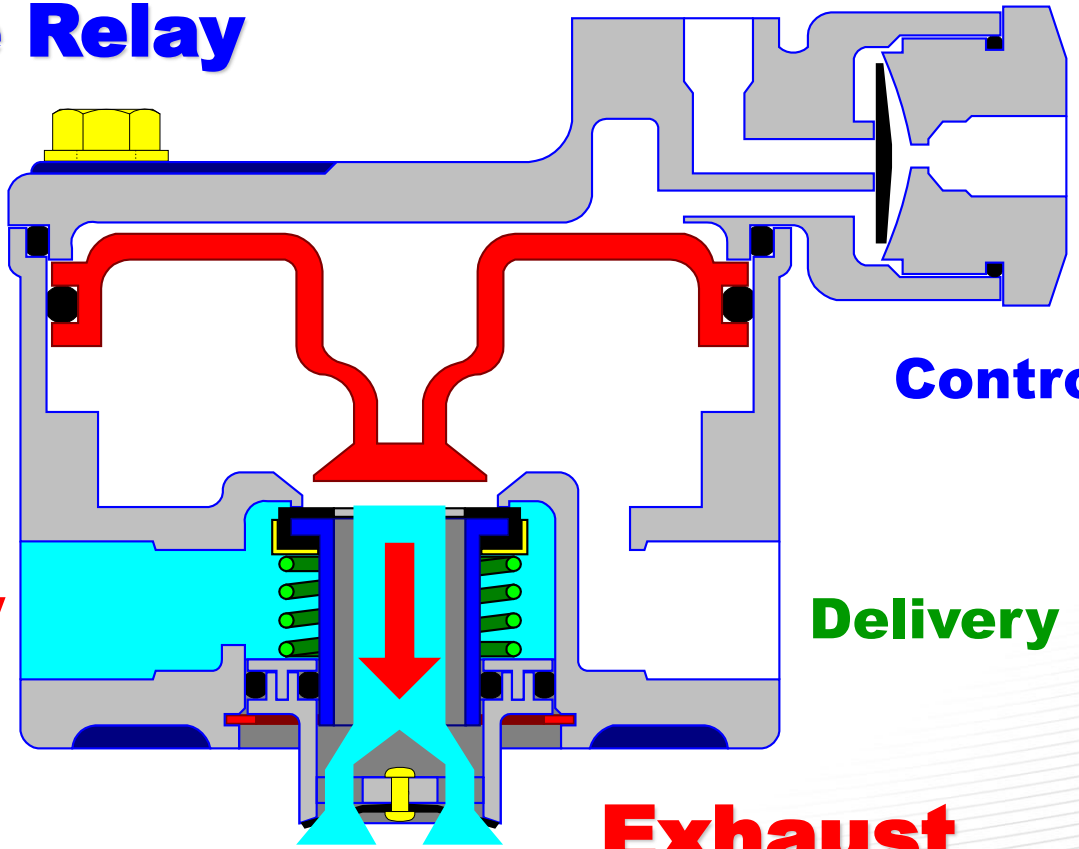
# R-14 Spring Brake Relay Valve

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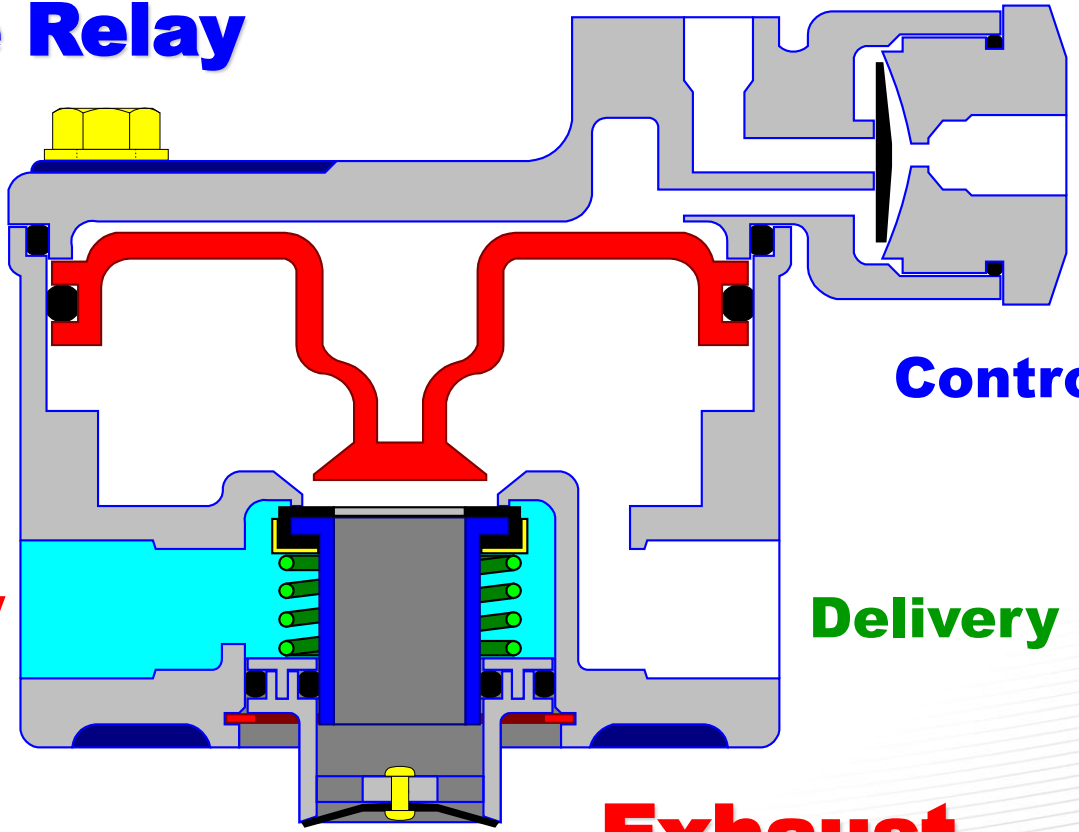
# R-14 Spring Brake Relay Valve

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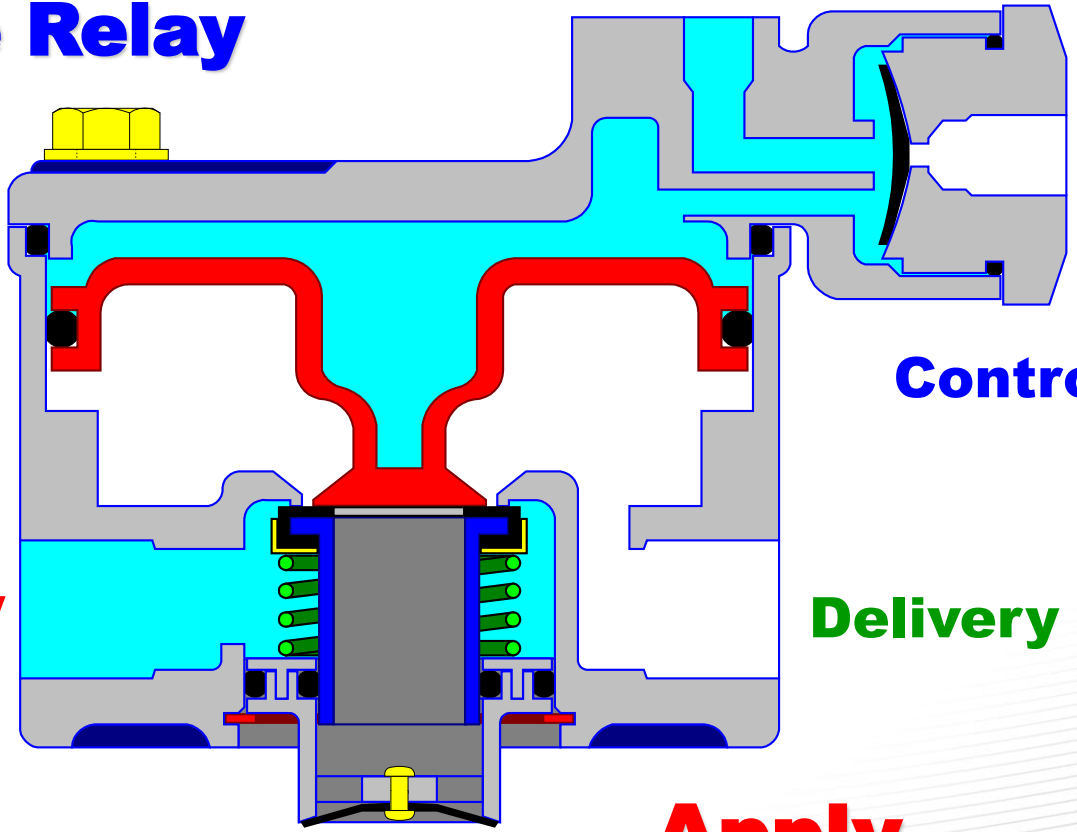
# R-14 Spring Brake Relay Valve

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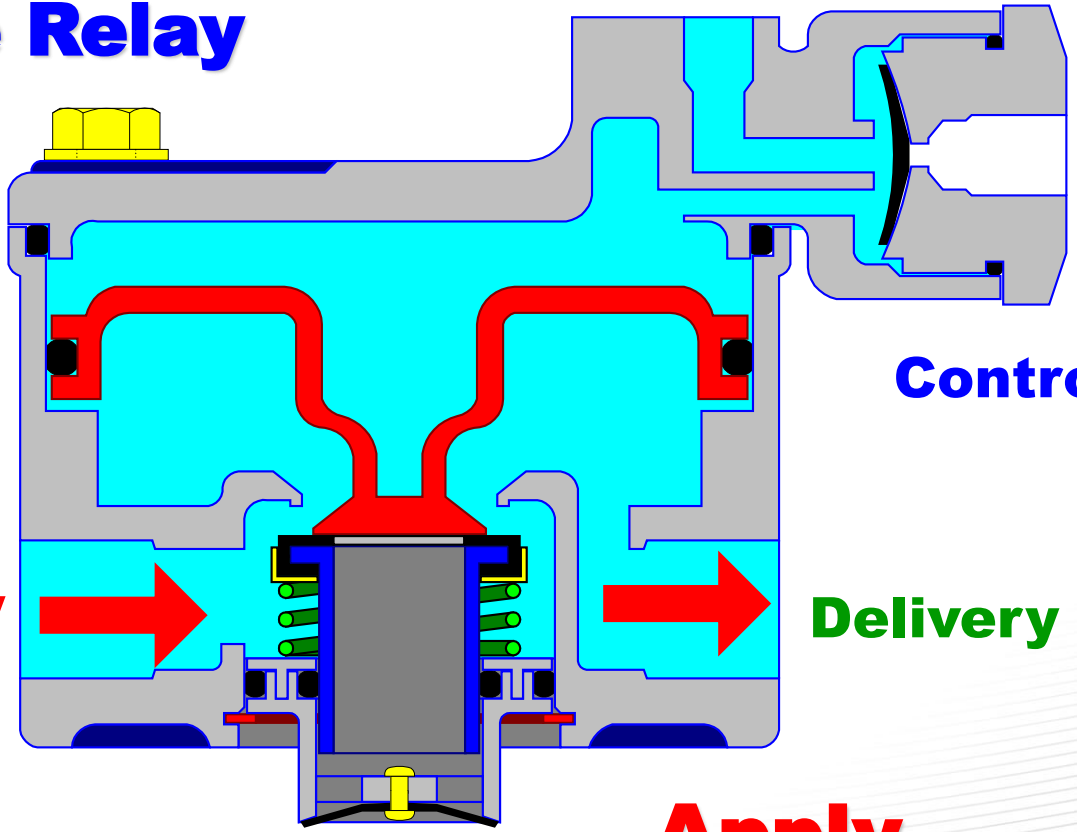
# R-14 Spring Brake Relay Valve

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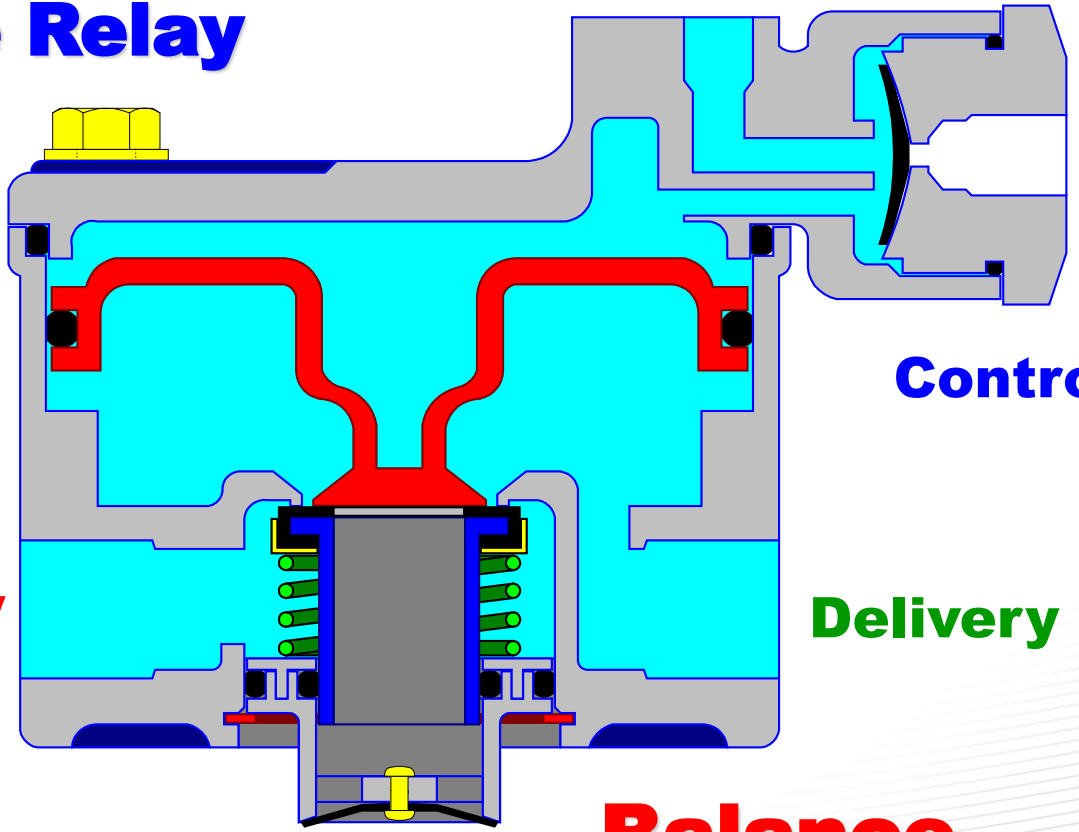
# R-14 Spring Brake Relay Valve

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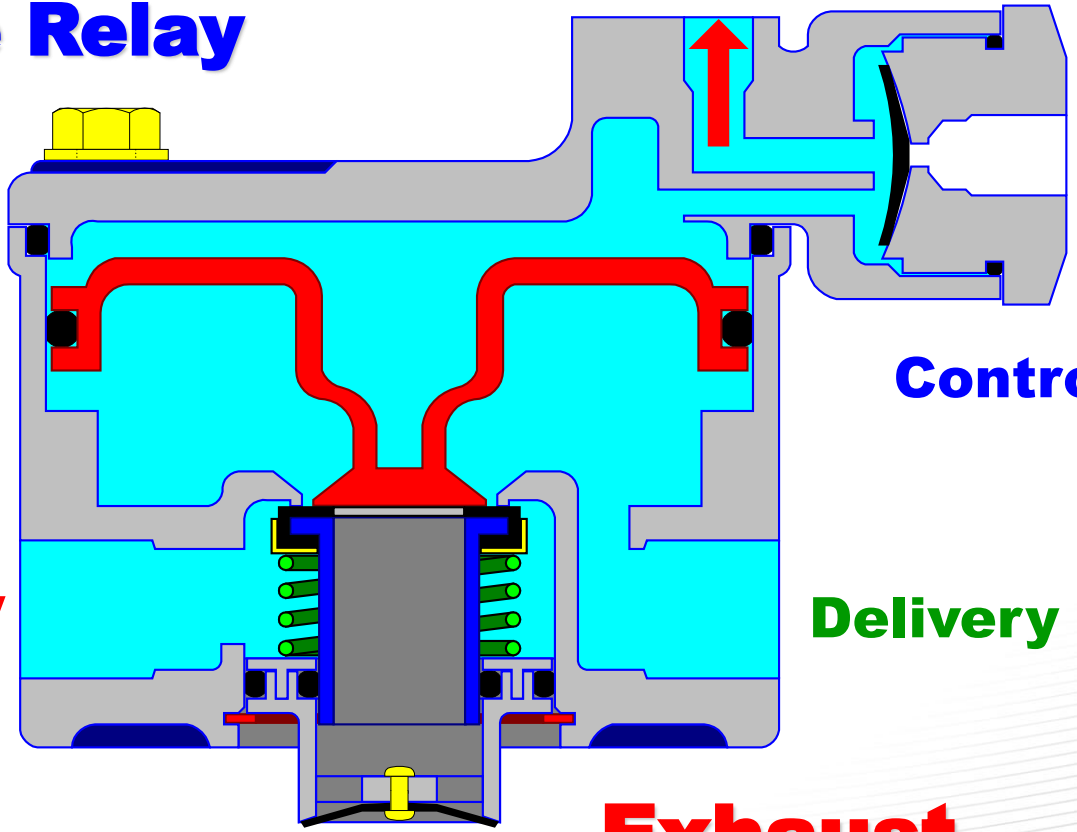
# R-14 Spring Brake Relay Valve

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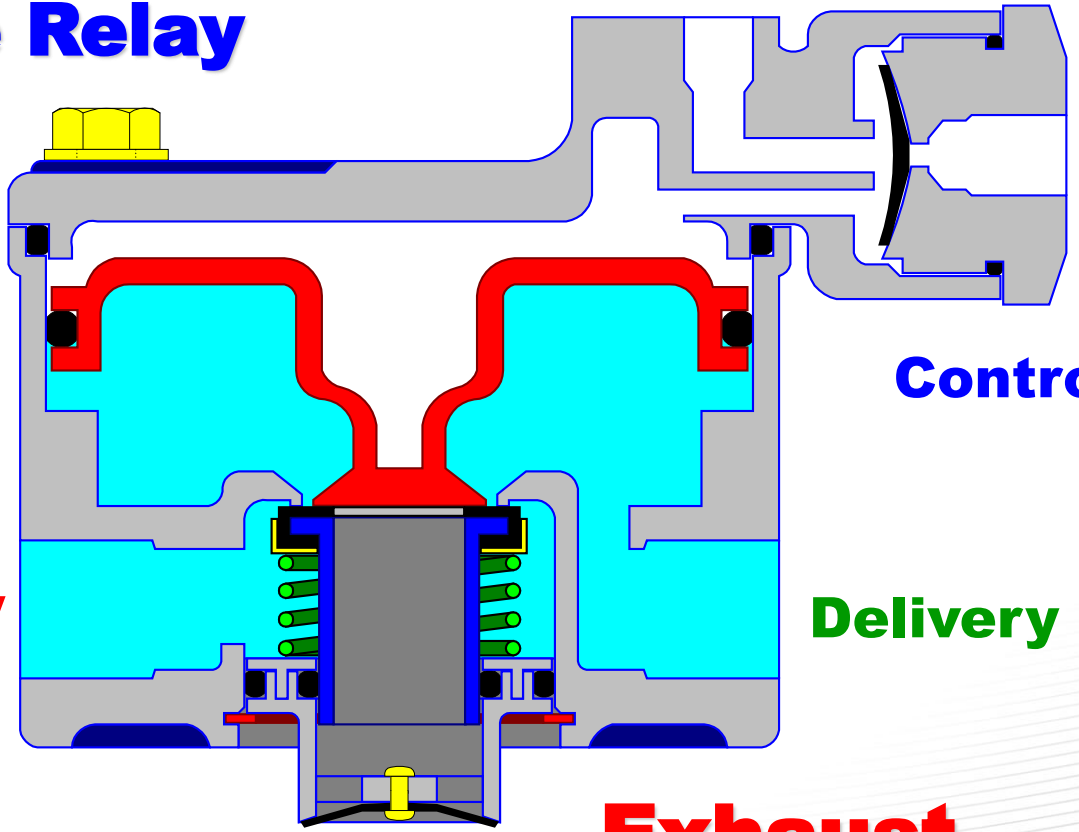
# R-14 Spring Brake Relay Valve

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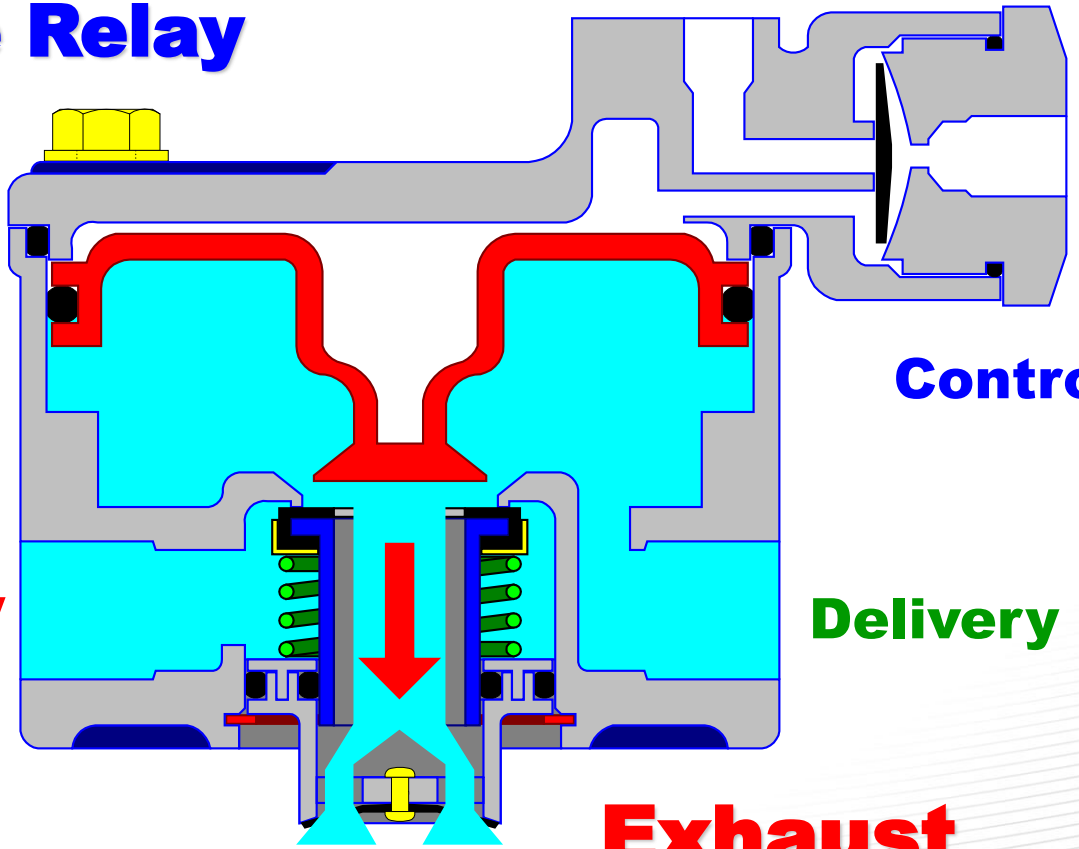
# R-14 Spring Brake Relay Valve

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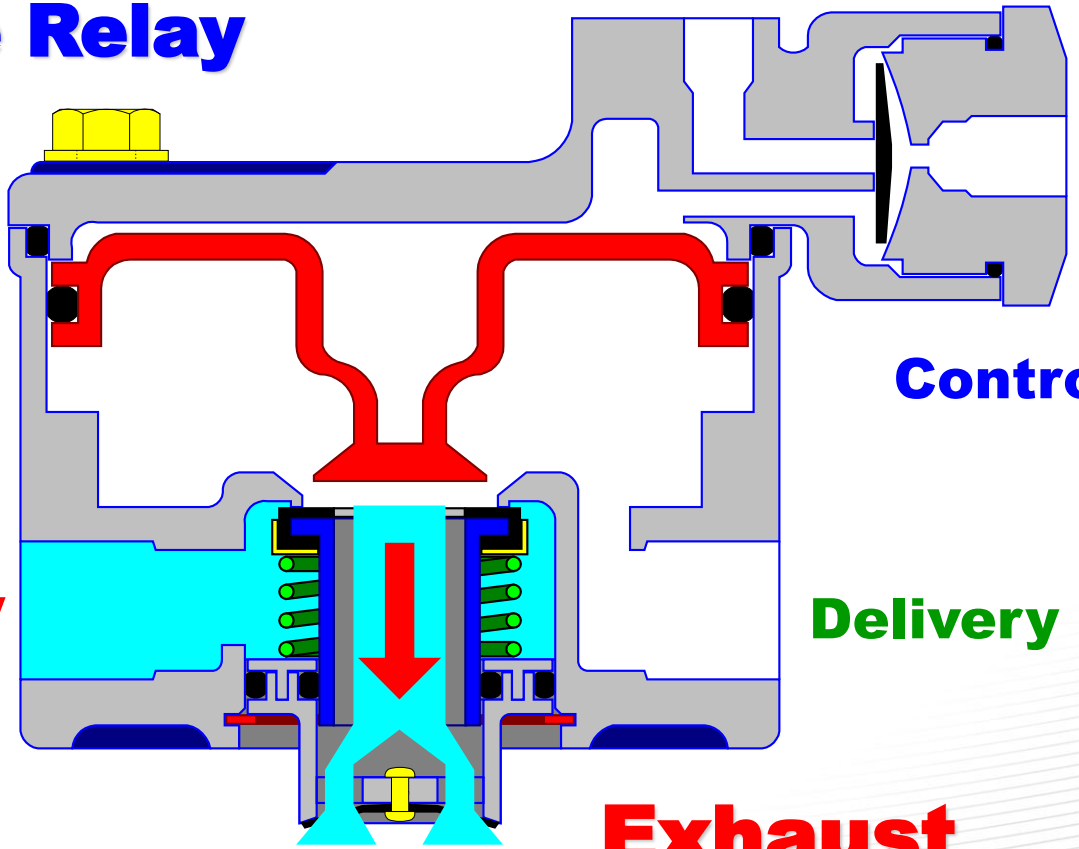
# R-14 Spring Brake Relay Valve

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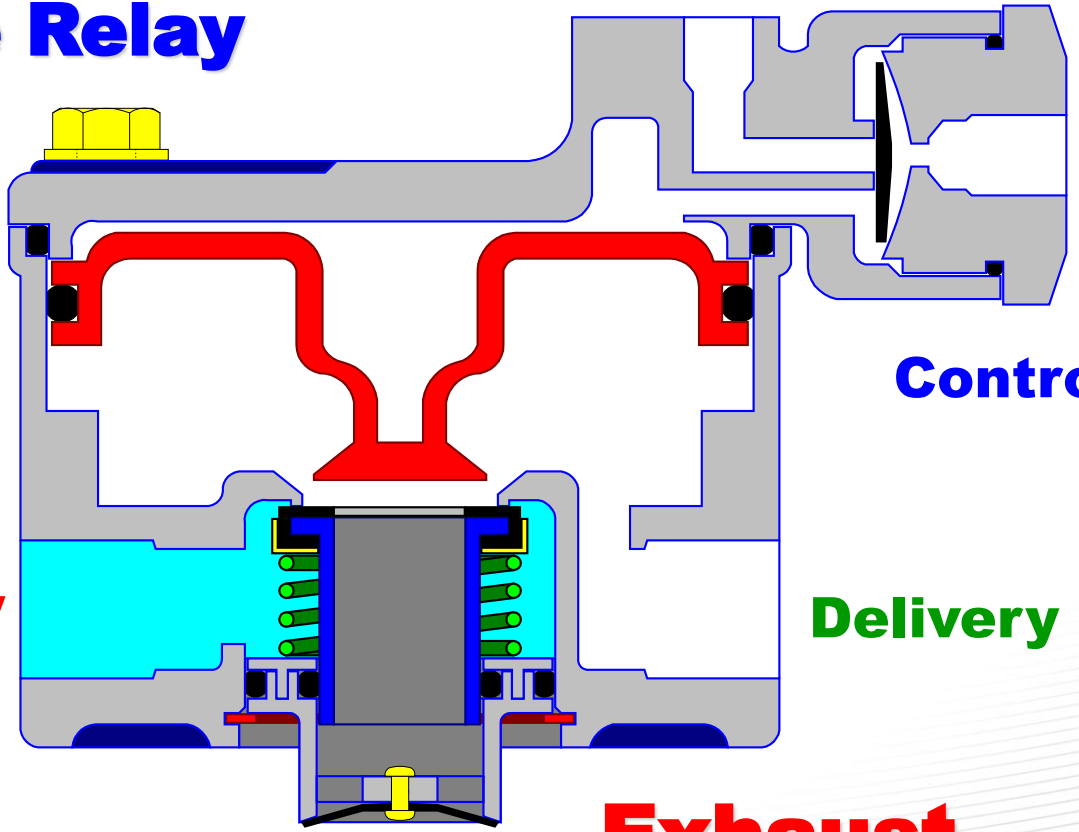
# R-14 Spring Brake Relay Valve

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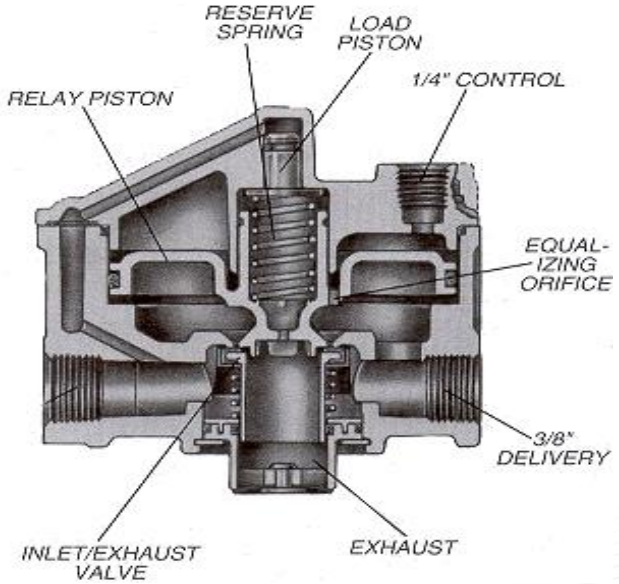
# R12P Relay Valve




R12P Relay Valves are typically used on 60 Ft. Articulated buses

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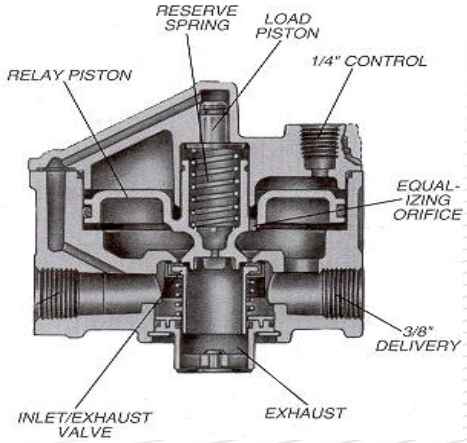
# R12P Relay Valve


R12P mounted on front coach body, LS rear 60Ft New Flyer bus

- Whenever control air must travel a long distance, a pilot relay valve is used.
- The R12P valve is used to control 2 relay valves simultaneously without incurring any additional crack pressure.

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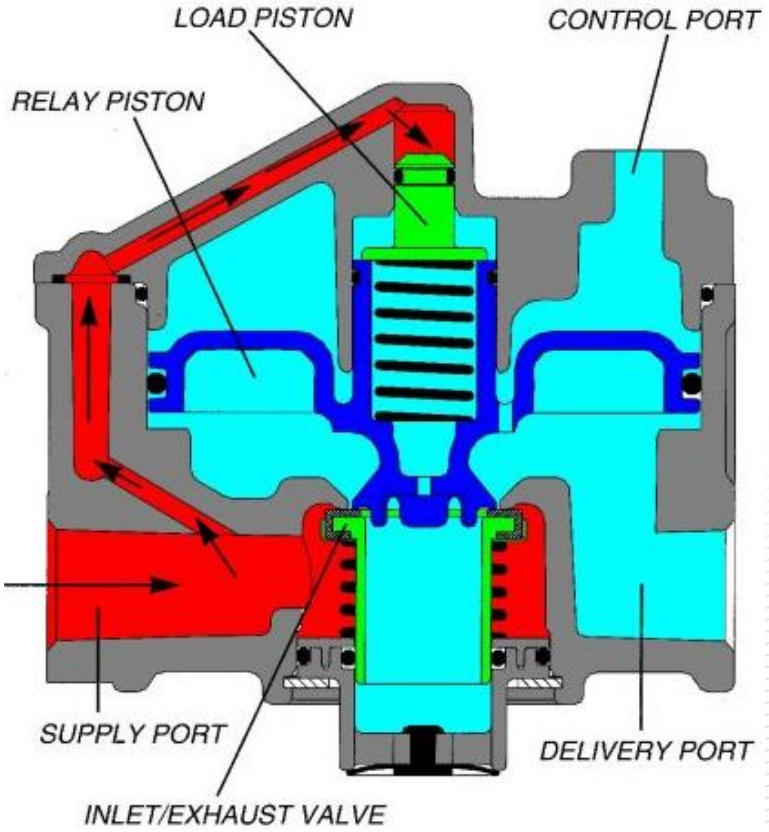
# R12P Relay Valve Operation (Charging)

- Reservoir air enters the R-12P supply port and becomes active upon the inlet/exhaust valve and at the same time, passes through the R-12P body channel to the load piston
- Supply air builds simultaneously and equally underneath the inlet/exhaust valve and above the load piston
- While supply pressure continues to hold the inlet/exhaust valve against its seat, it also moves the load piston into contact with the relay piston
- Supply air builds to governor cut-out and the inlet/exhaust valve remains closed

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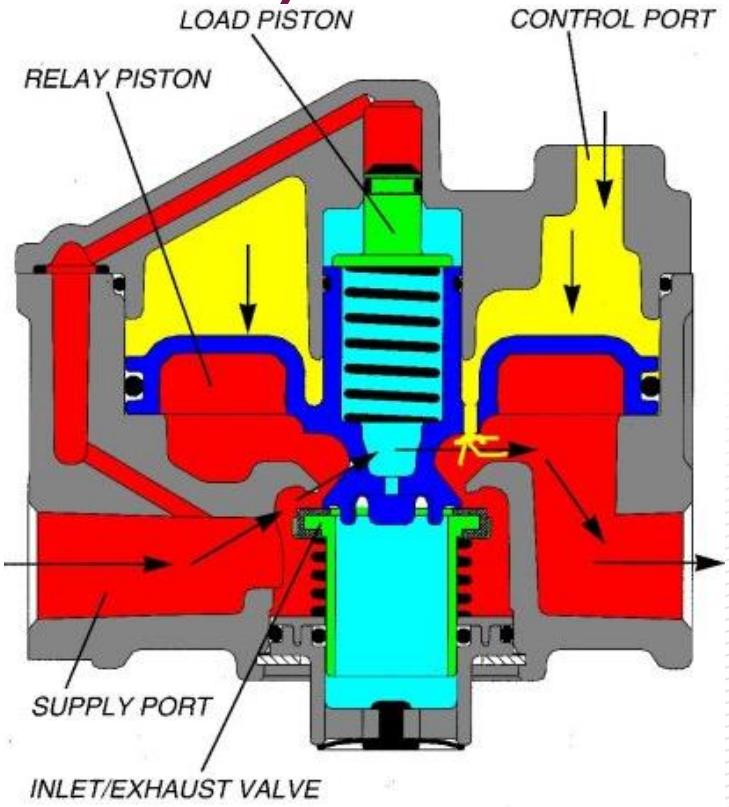
# R12P Relay Valve Operation (Normal Application)

- Normal" means the control signal is applied rapidly enough to build up pressure on the relay piston and "open" the inlet valve, causing the R-12P to react like a relay valve

- The relay piston opens the inlet, allowing supply air to flow out the delivery port to the next valve in the system

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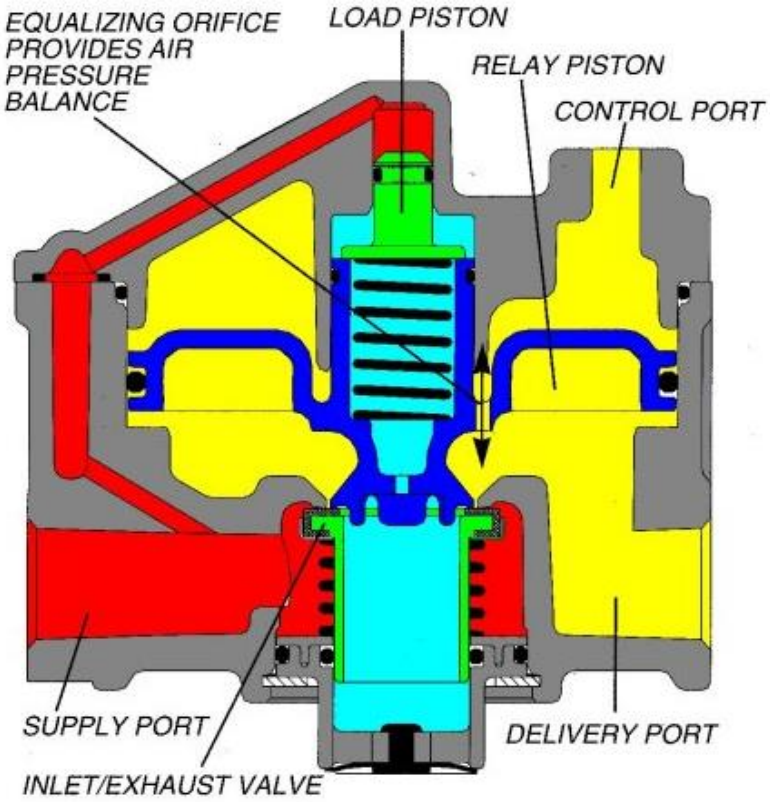
# R12P Relay Valve Operation (Balance)

- Air pressure being delivered by the open inlet valve is also effective underneath the R-12P relay piston
- When air pressure beneath the piston approaches control pressure on top of the piston, the piston and inlet valve lift together and close the inlet valve
- The exhaust remains closed, and the valve achieves “force balance”

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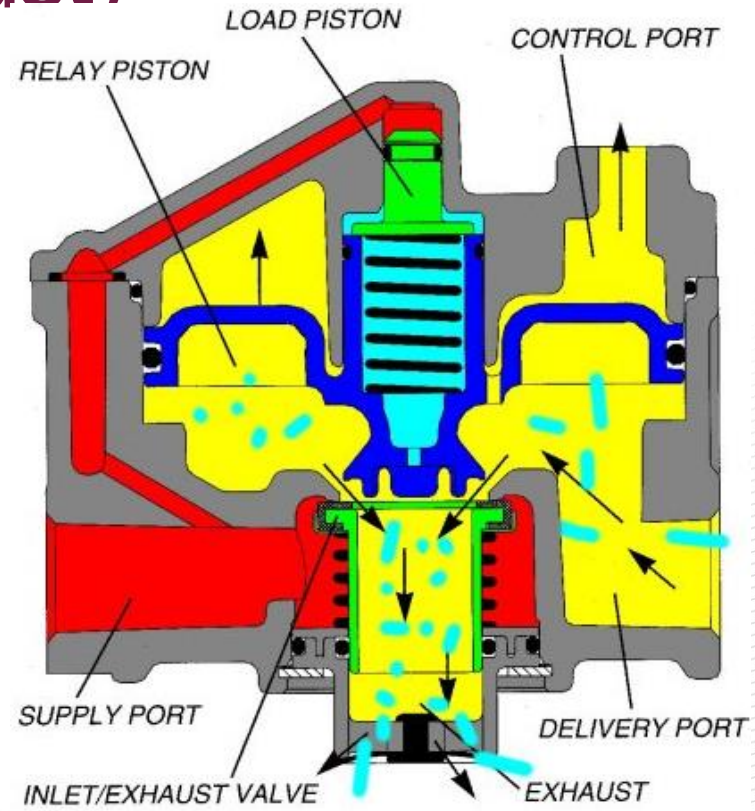
# R12P Relay Valve Operation (Rapid Exhaust)

- Air above  the relay piston travels back out the control port to be exhausted
- With the lack of air pressure above the piston, air pressure below lifts the piston, closing the inlet and opening the exhaust
- Delivery air then exhausts to atmosphere

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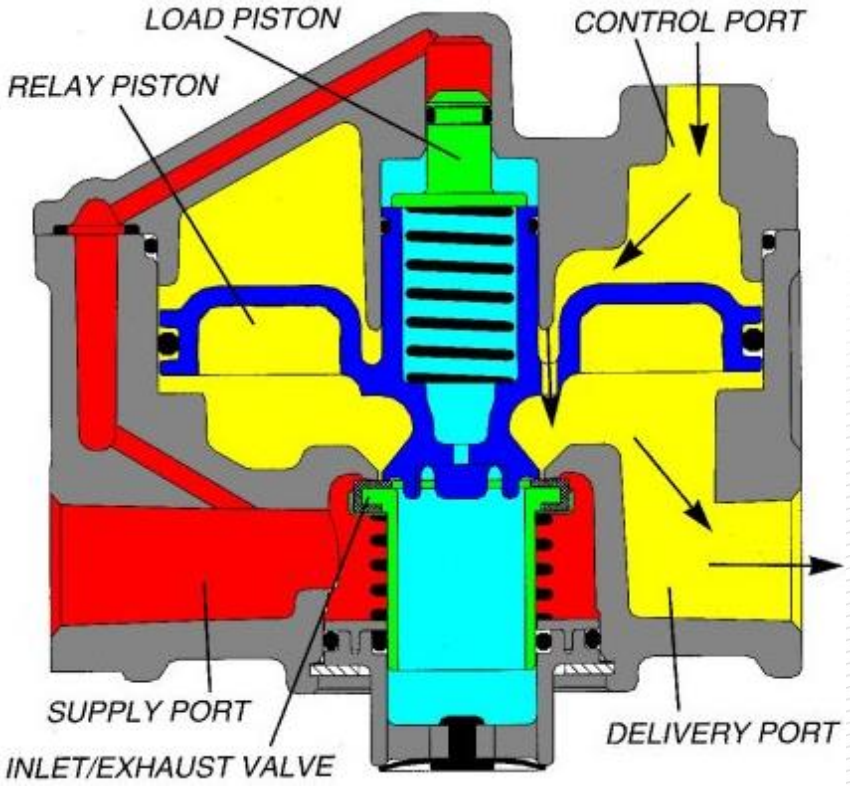
# R12P Relay Valve Operation (Slow Application)

- This figure shows the control signal passing through the valve without causing piston movement
- The air is passing through the relay piston's equalizing orifice, directly through the valve and out the delivery port to the next valve in the air system
- This situation occurs if air pressure build-up is slow and the pressure above the relay piston is not strong enough to open the valve
- This condition exists during very slow service brake applications

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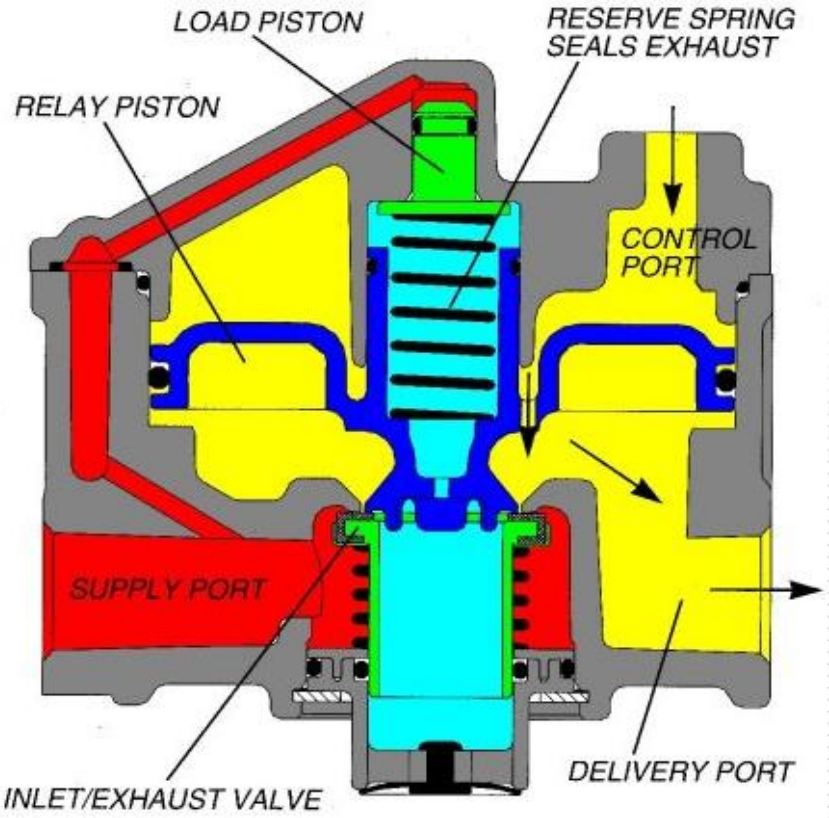
# R12P Relay Valve Operation (Loss of Supply Air)

- With no supply air, the reserve spring is strong enough to hold the relay piston on the exhaust seat, but is not strong enough to overcome the force of the inlet/exhaust valve spring
- So both inlet and exhaust valves are closed

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# Quick Release Valve

The function of the quick release valve is to speed up the exhaust of air from the air chambers

QR-1

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# Quick Release Valve

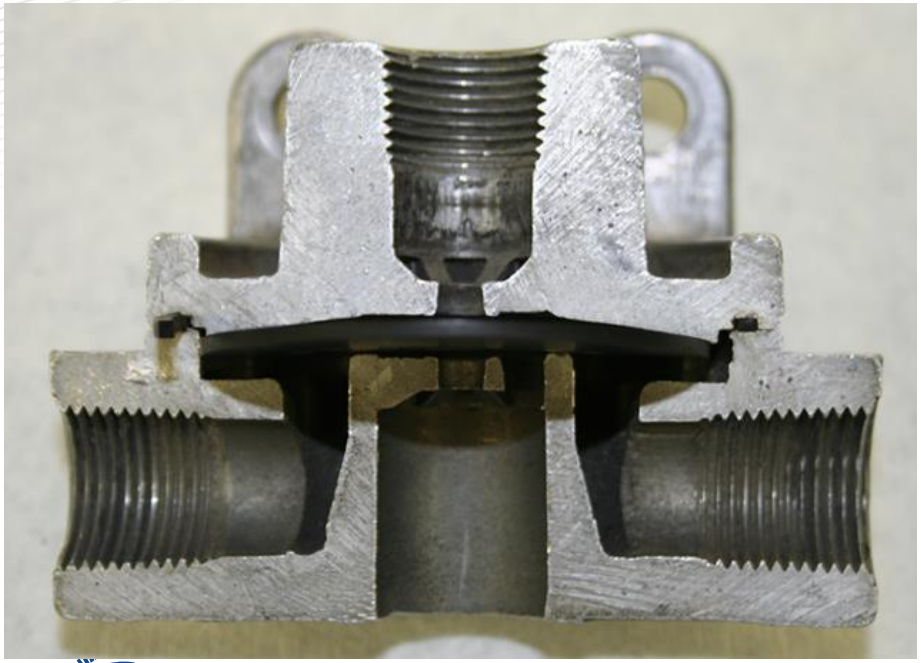
The function of the quick release valve is to speed up the exhaust of air from the air chambers

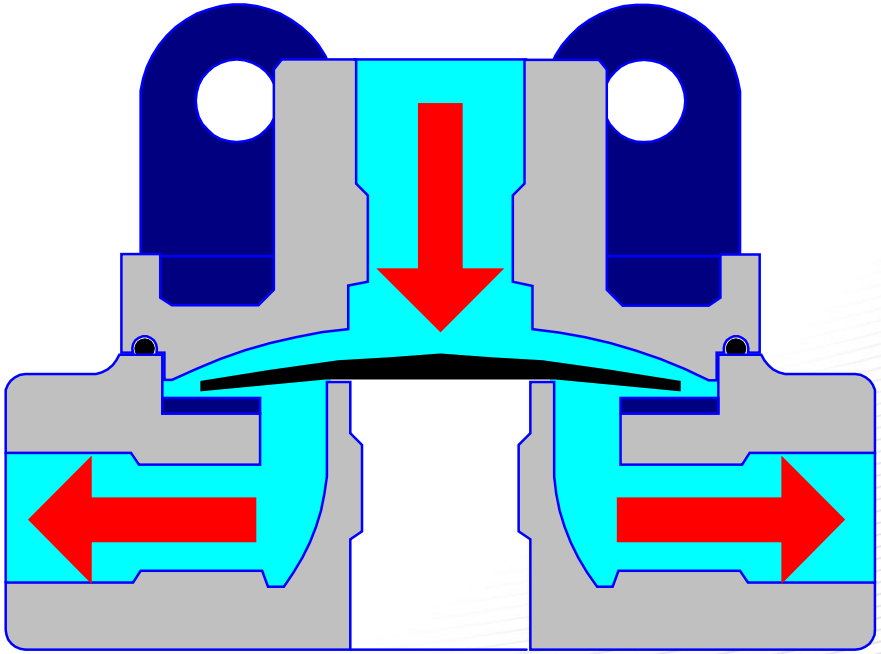
It is mounted close to the chambers or system it serves

In its standard configuration, the valve is designed to deliver within 1 psi of control pressure to the controlled device

# Quick Release Valve

## Apply



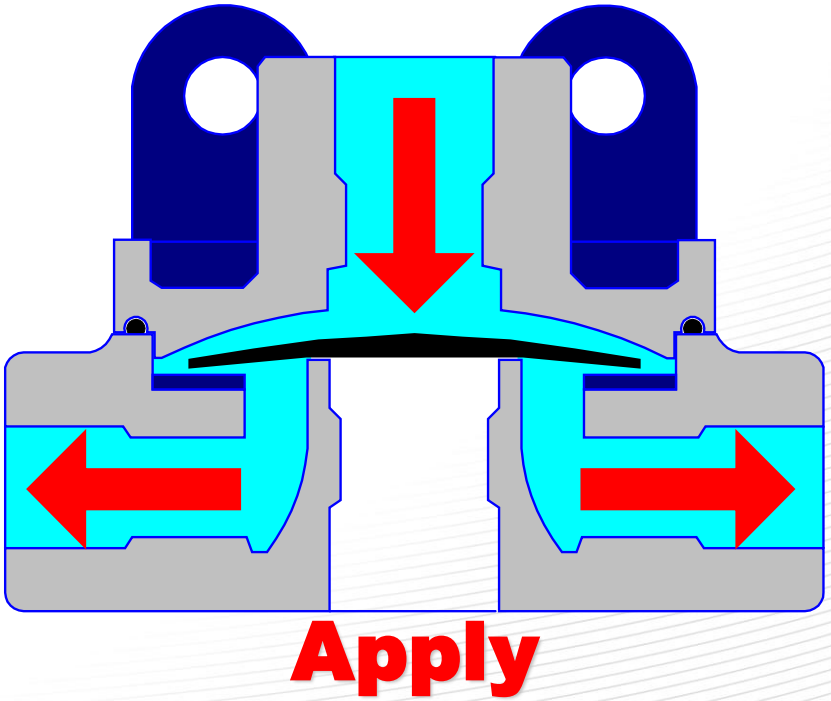


# QR-1 Quick Release Valve

Porting consists of one supply port, two delivery ports and one exhaust port

When a brake application is made, air pressure enters the supply port; the diaphragm moves down, sealing the exhaust

At the same time, air pressure forces the edges of the diaphragm down and air flows out the delivery ports

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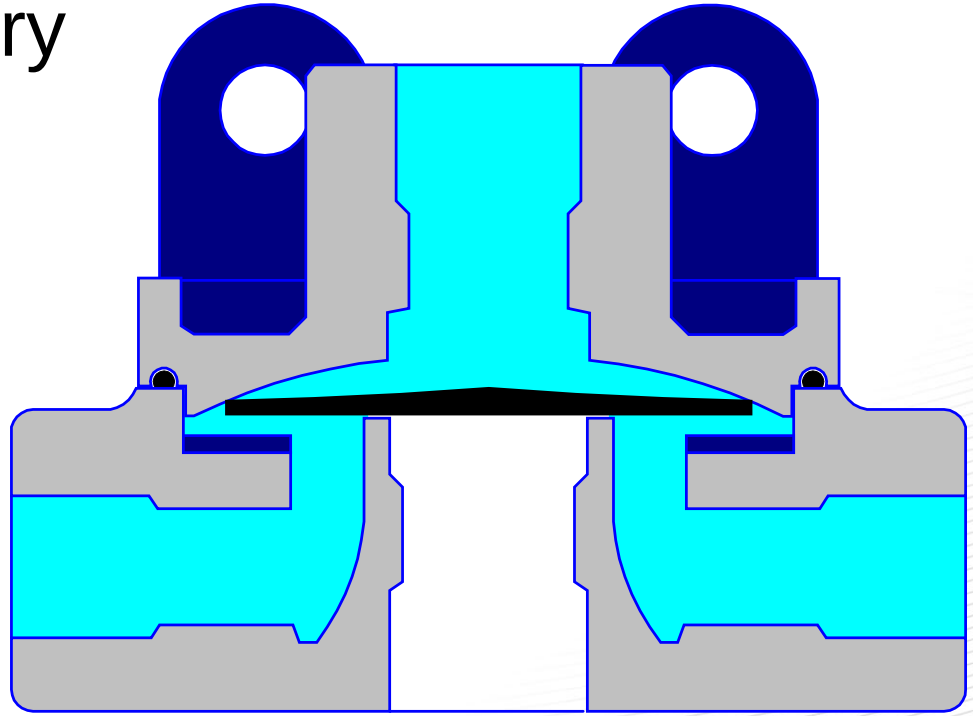
# QR-1 Quick Release Valve

When supply and delivery pressure are equal the valve is in the balanced position

In the balanced position the diaphragm remains down, sealing the exhaust port



Balanced

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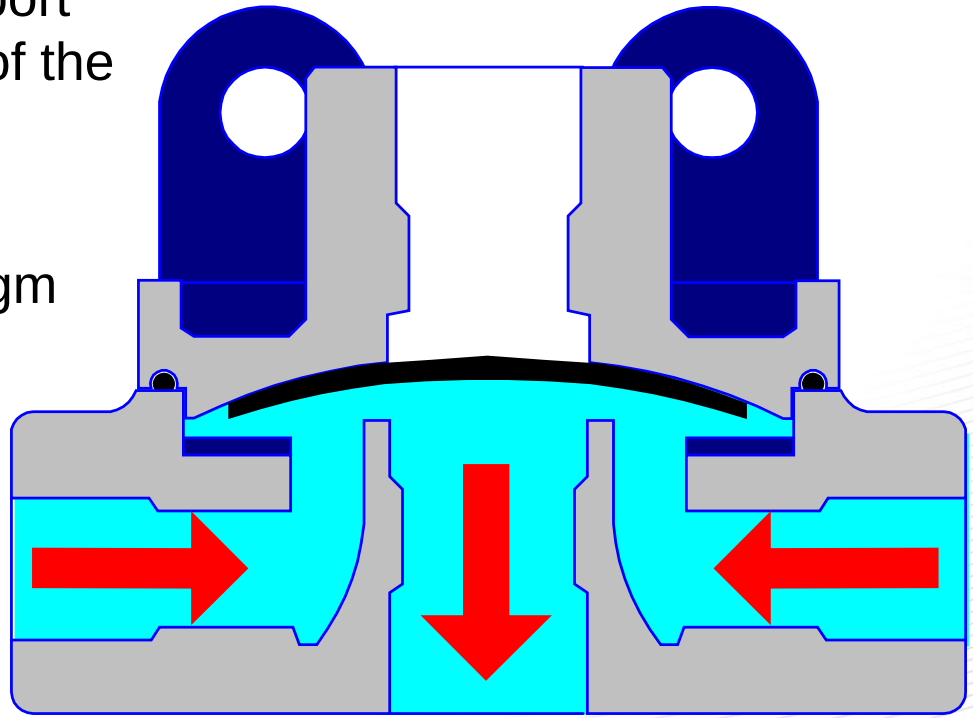
# QR-1 Quick Release Valve

During brake release, the exhaust port is still sealed by the center portion of the diaphragm when the supply air is released

The air pressure above the diaphragm is released back through the brake valve exhaust

Air pressure beneath the diaphragm forces the diaphragm to rise, opening the exhaust, allowing delivery air to exhaust



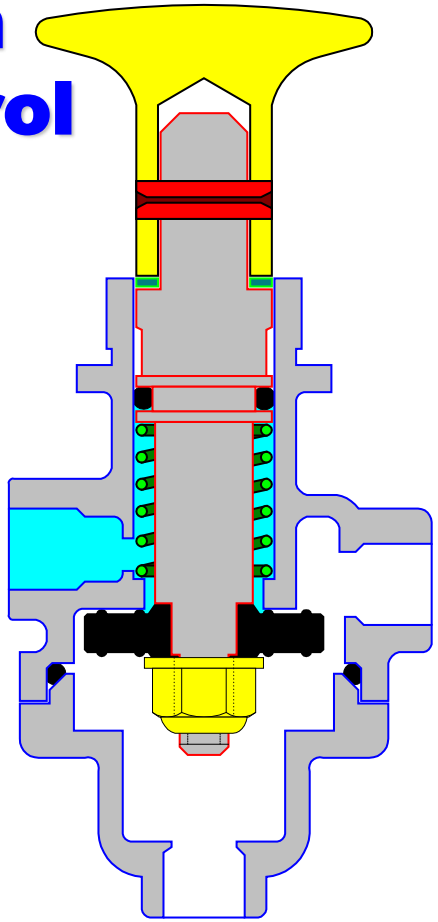
Release

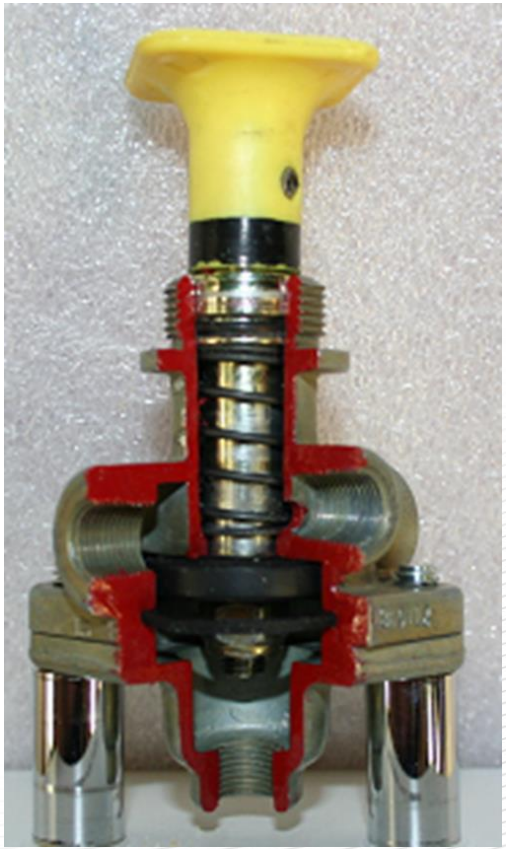
# PP-1 Push Pull Valve

The PP-1 valve is a push-pull manually operated on-off air control valve primarily used to supply air pressure for the release of the parking brake

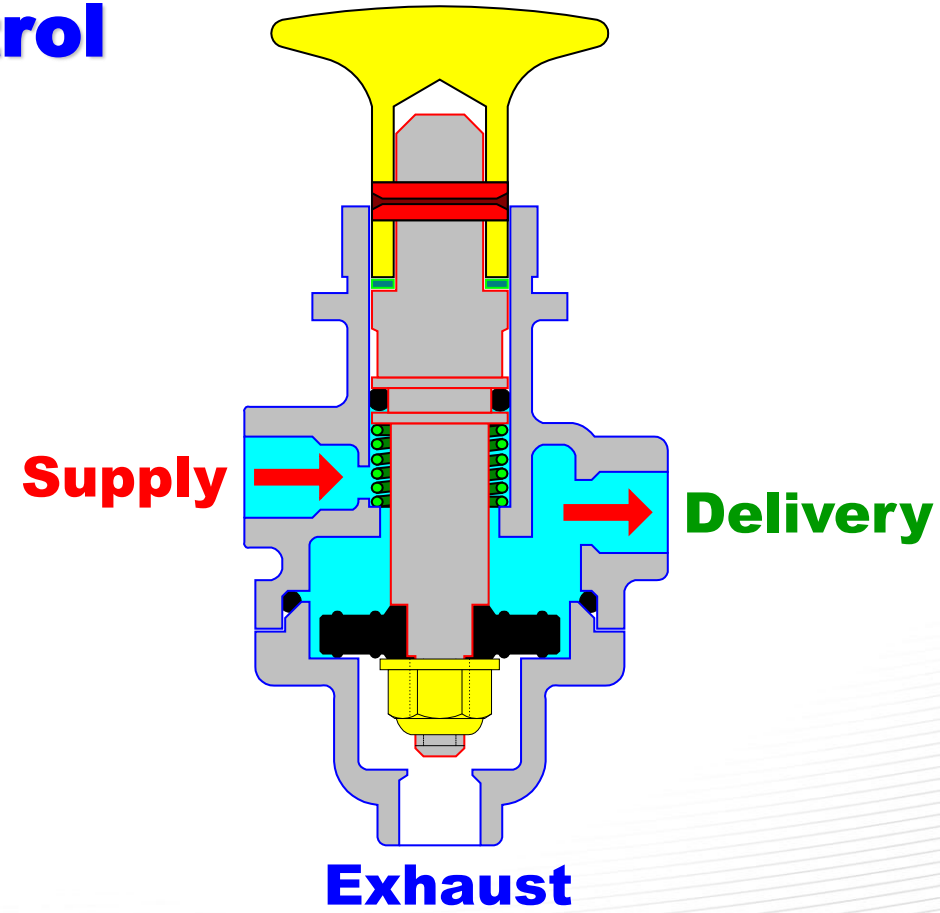
Most are pressure sensitive, so that they will automatically move from the applied to the exhaust position as supply pressure is reduced to a certain minimum, depending on the spring installed

# PP-1 Push Pull Control Valve

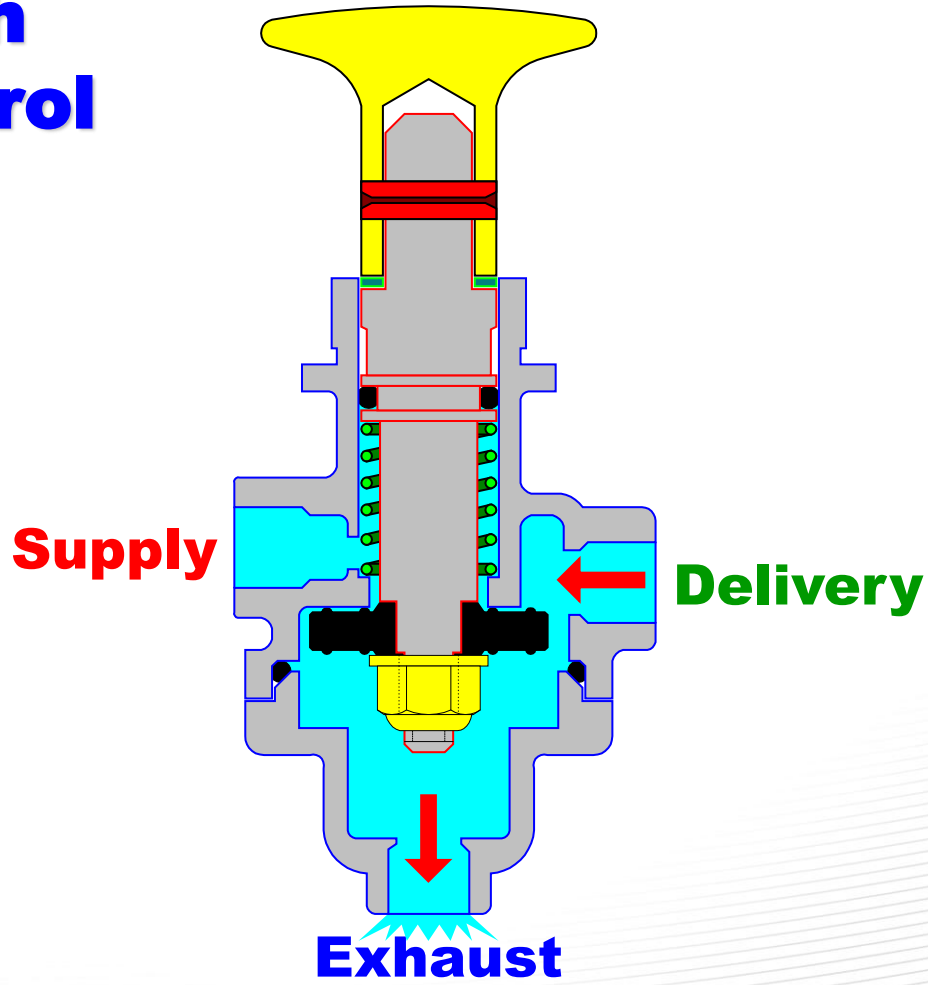


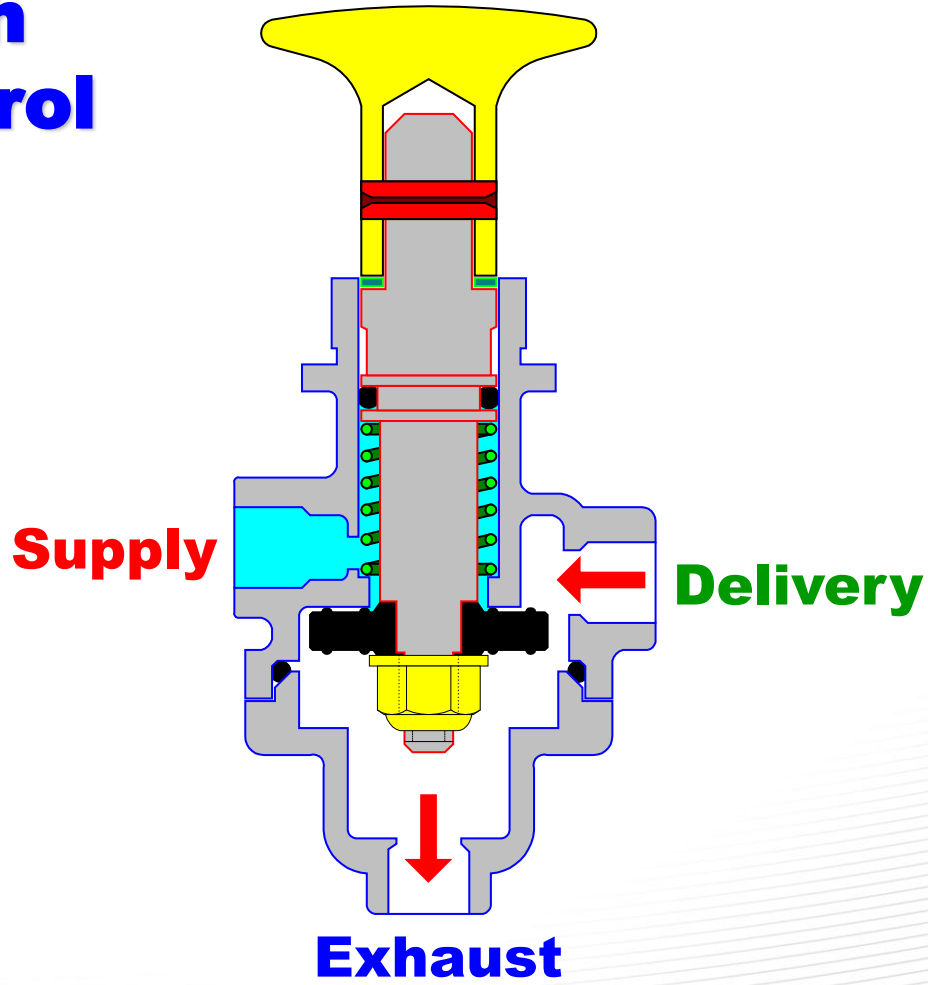
# PP-1 Push Pull Control Valve



# PP-1 Push Pull Control Valve



# PP-1 Push Pull Control Valve



# Emergency Release Valve

The RD-3 valve is commonly used as an emergency release valve, supplying air pressure to the spring brakes from an accessory or dedicated reservoir in the event the primary and secondary brake system reservoirs loose air pressure

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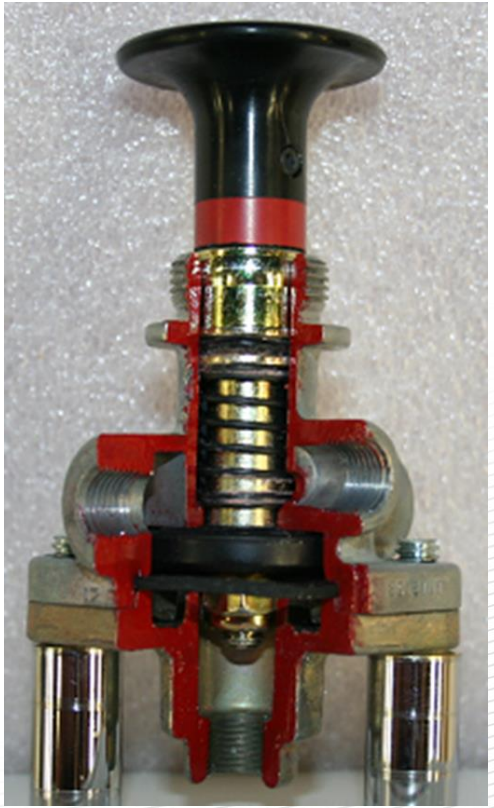
# Emergency Release Valve

PP-1

The RD-3 valve differs slightly from the PP-1 valve in that it normally remains in the exhaust position and requires a constant manual force to hold it in the applied position



RD-3

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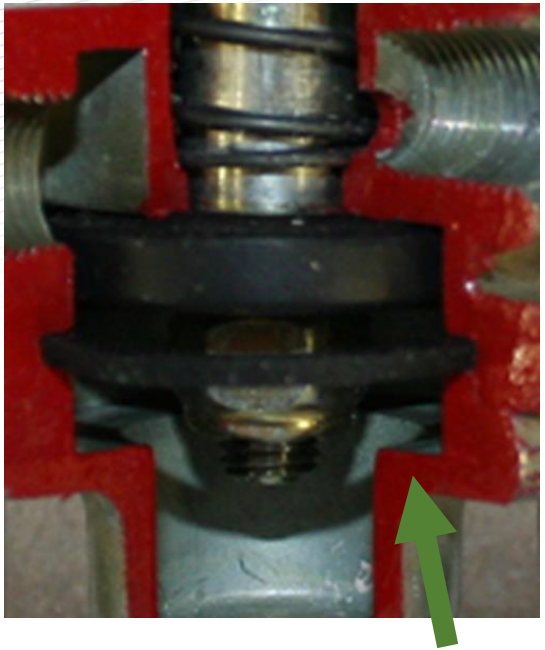
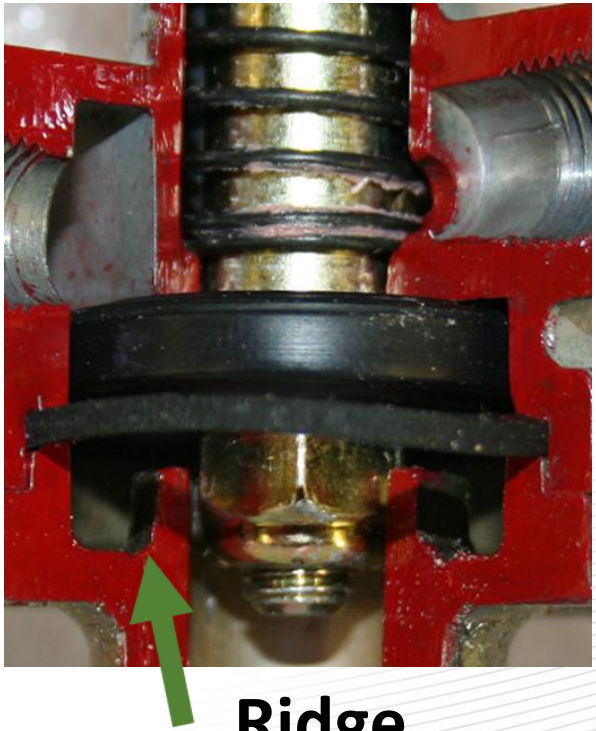
# Emergency Release Valve



**Missing Ridge**

**PP-1**

Although the RD-3 and the PP-1 valves look similar, the base of the valves are different and are not interchangeable. The RD-3 base has a raised seat to prevent it from remaining in the applied position



**Ridge**

**RD-3**

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# Double Check Valve

- Double check valves are used in an air brake system to direct a flow of air into a common line from either of two sources
- Test by individually draining each supply side pressure

# Double Check Valve

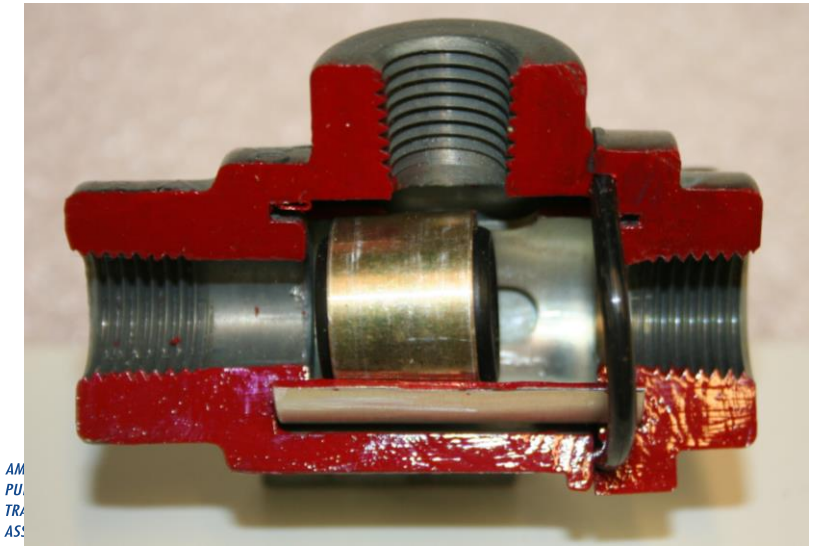
Double check valves are designed to never impede the flow or back flow of air either the apply or exhaust mode

Double check valves are commonly used in brake interlock, spring brake, and other air system operations

Operating performance is optimized when mounted in the horizontal position

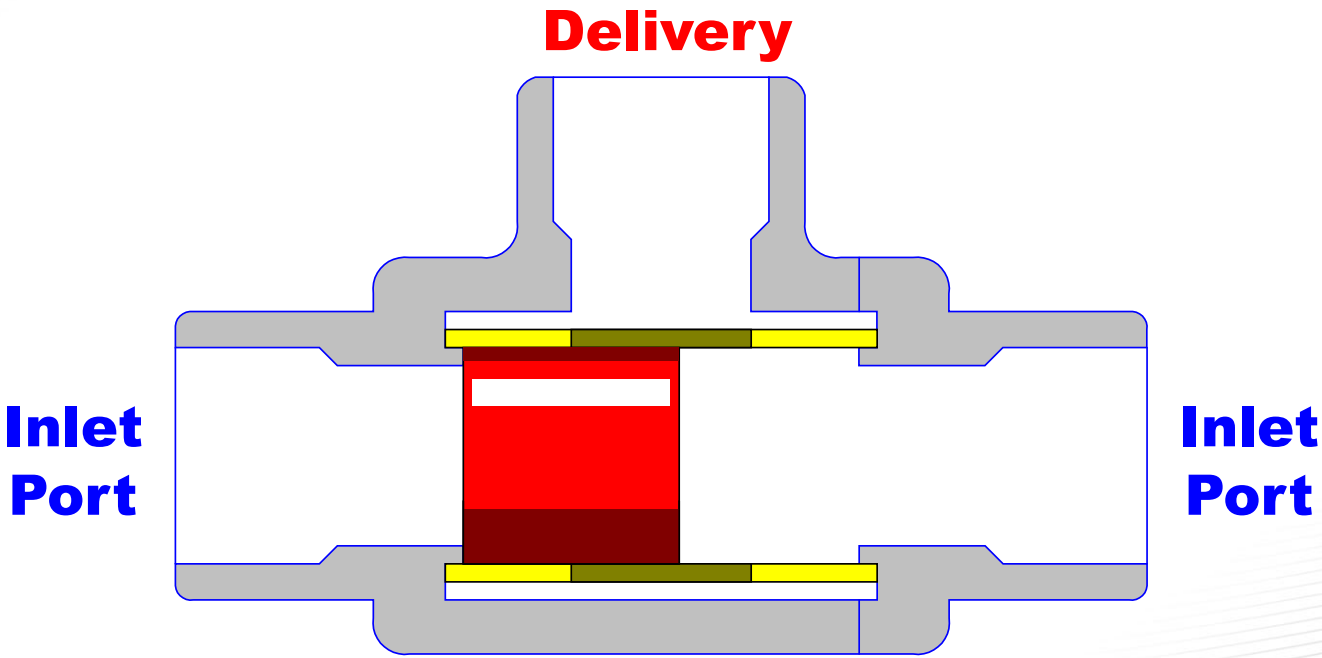
# Double Check Valve

As air pressure enters either end of the double check valve, the moving shuttle responds to the pressure and seals the opposite port assuming it is at a lower pressure level then the other and air flows out the delivery port

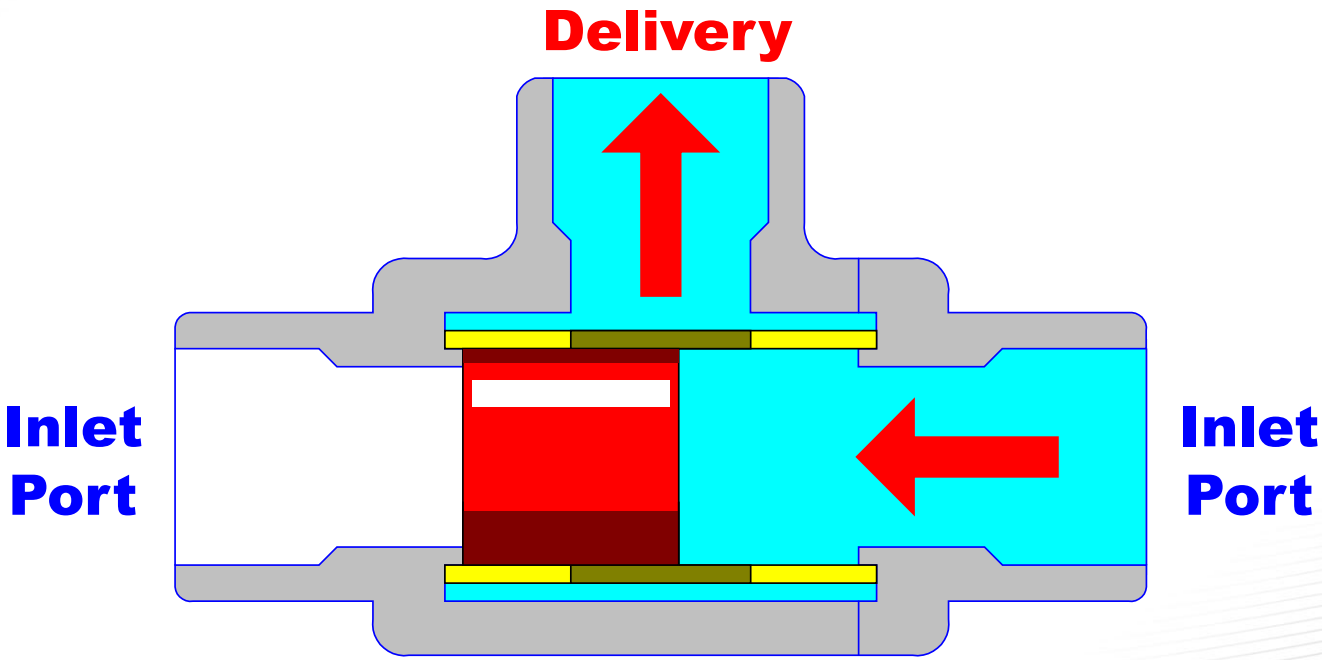


The position of the shuttle will reverse if pressure levels are reversed

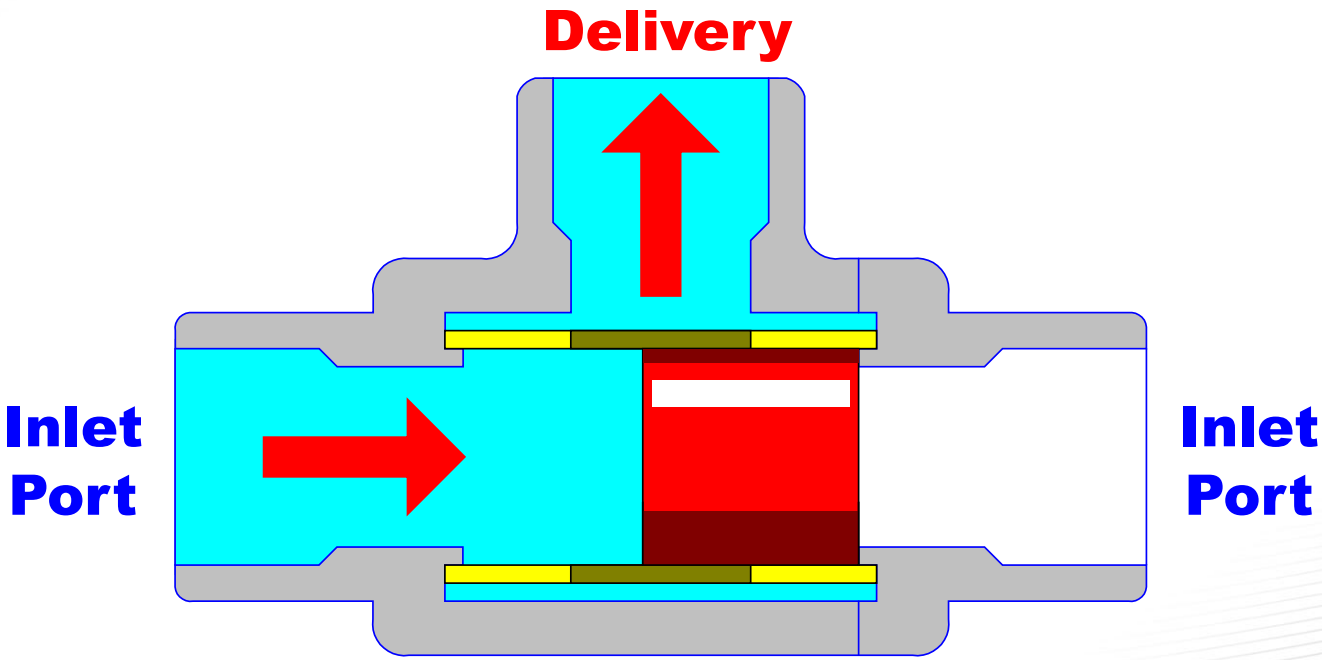
# DC-4 Double Check Valve



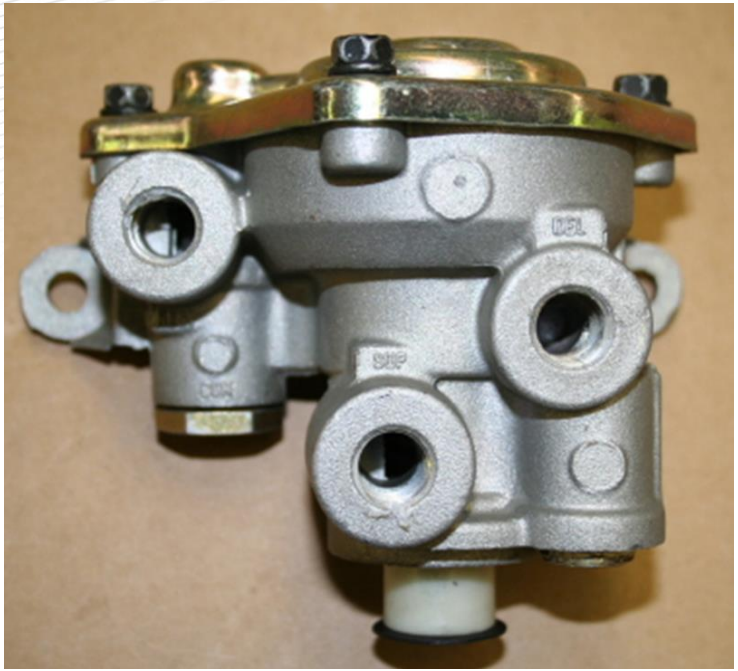
# DC-4 Double Check Valve



# DC-4 Double Check Valve



# Spring Brake Valve



The SR-1 spring brake valve is used in dual or “split” air brake systems equipped with spring brake actuators

The function of the SR-1 valve is to supply a specific, limited hold-off pressure to the spring brakes, and in the event of loss of No. 1 service air pressure, to modulate the spring brakes through the use of the service brake valve

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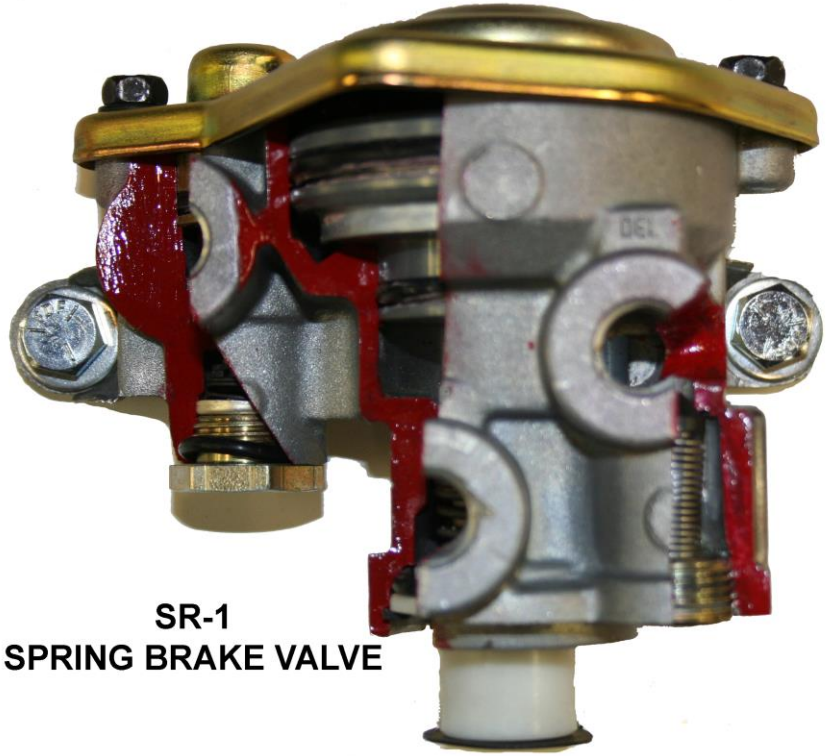
# Spring Brake Valve

The SR-1 spring brake valve regulates spring brake hold off pressure between 95 and 100 psi in normal operation

With the primary reservoir pressure above 55 psi, the SR-1 operates as a spring brake hold off pressure regulator to prevent excessive pressure from entering and damaging the spring brake chamber



SR-1
SPRING BRAKE VALVE

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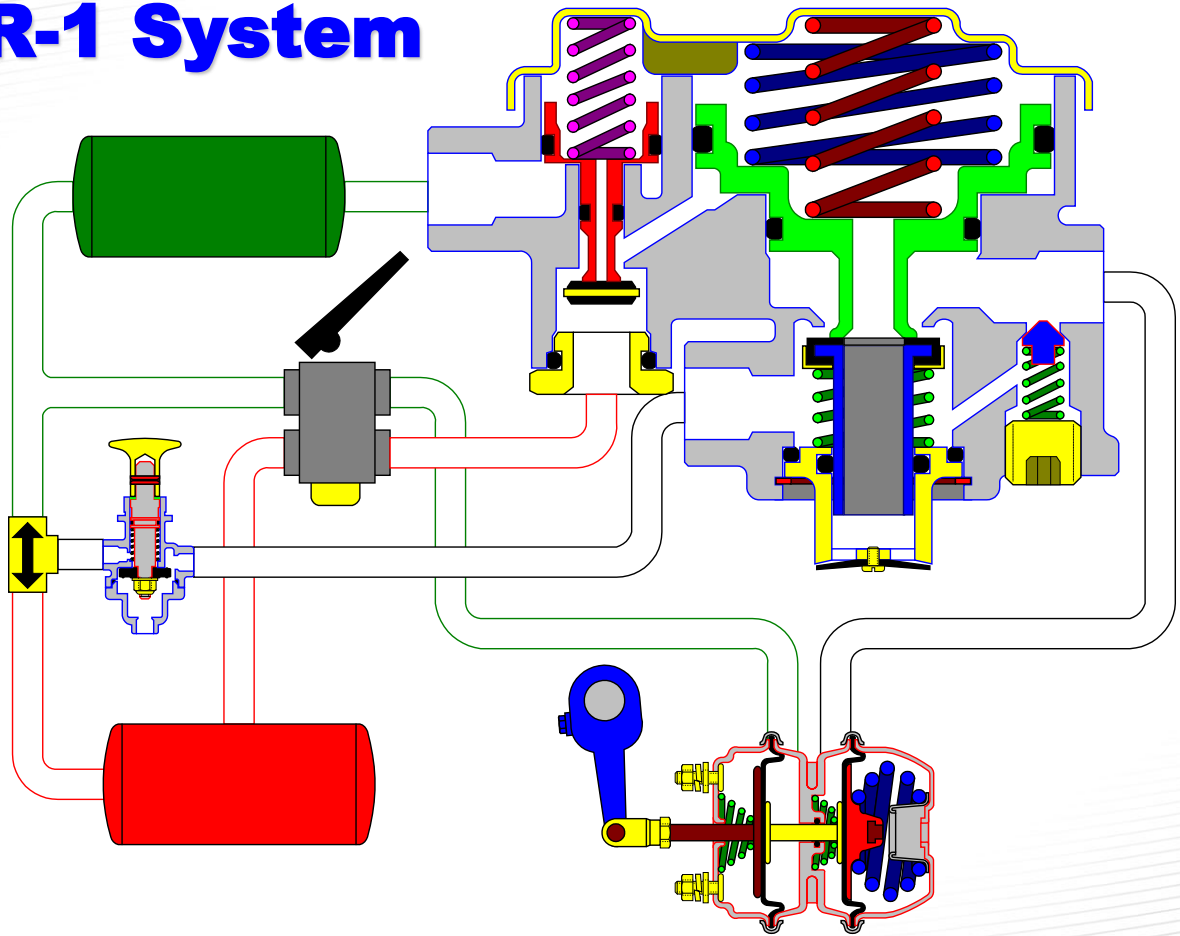
# SR-1 System



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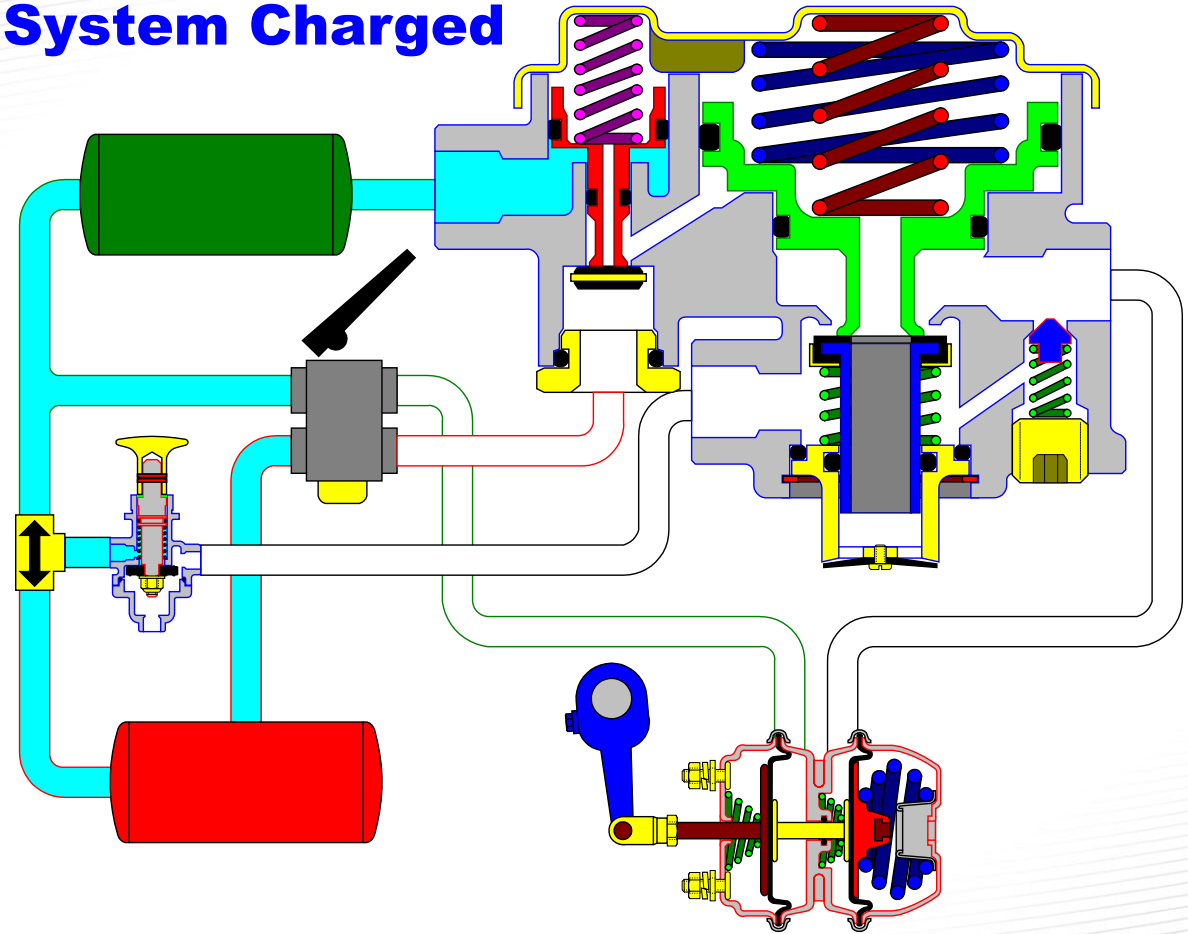
# Air System Charged



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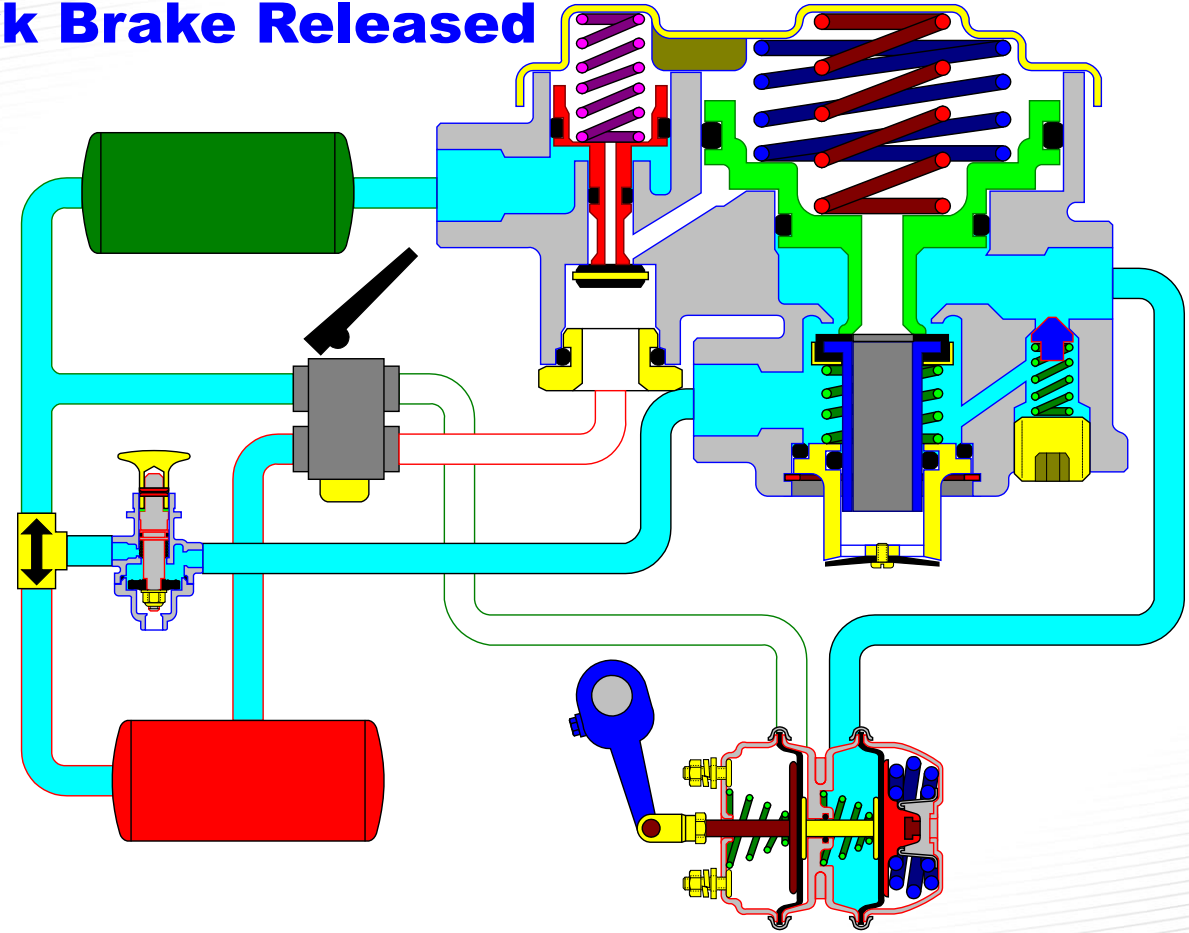
# Park Brake Released



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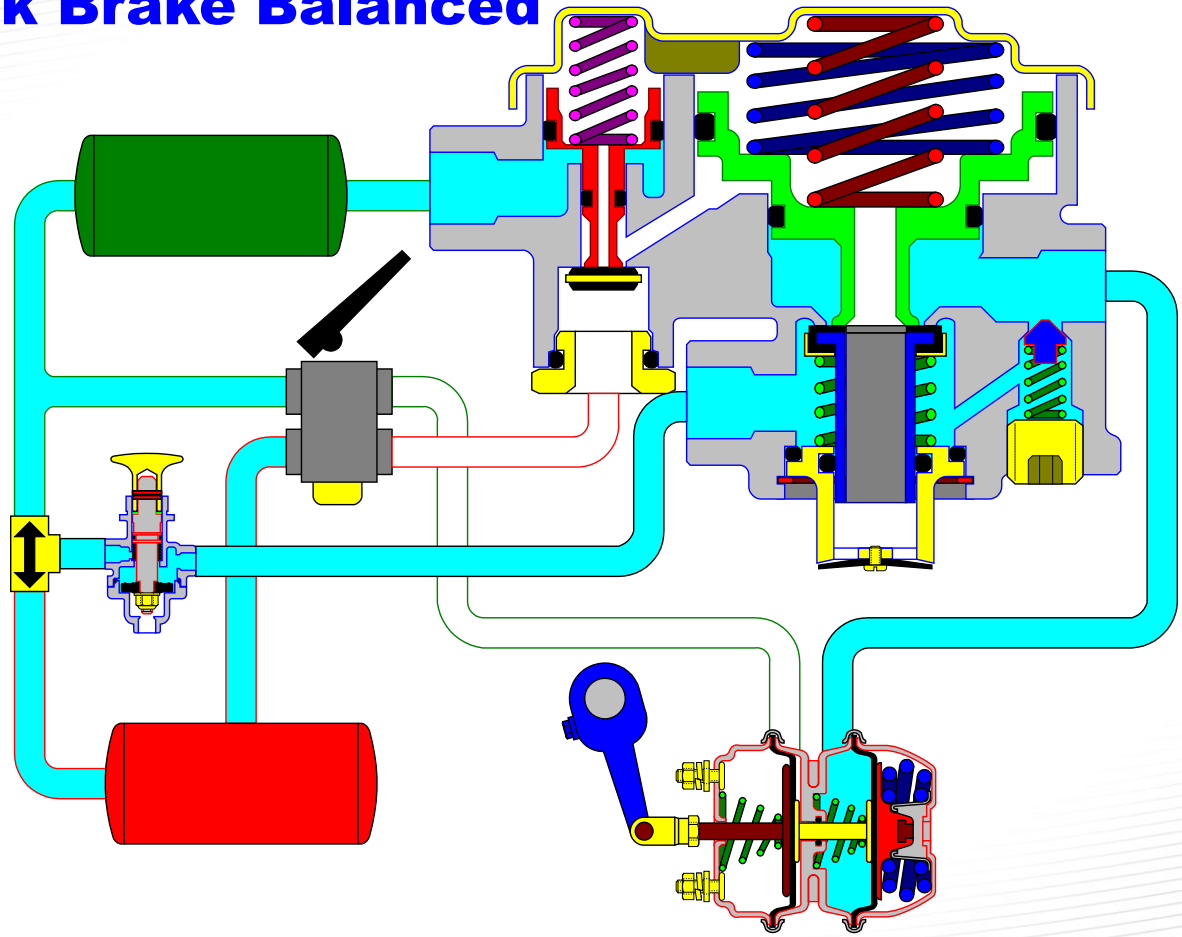
# Park Brake Balanced



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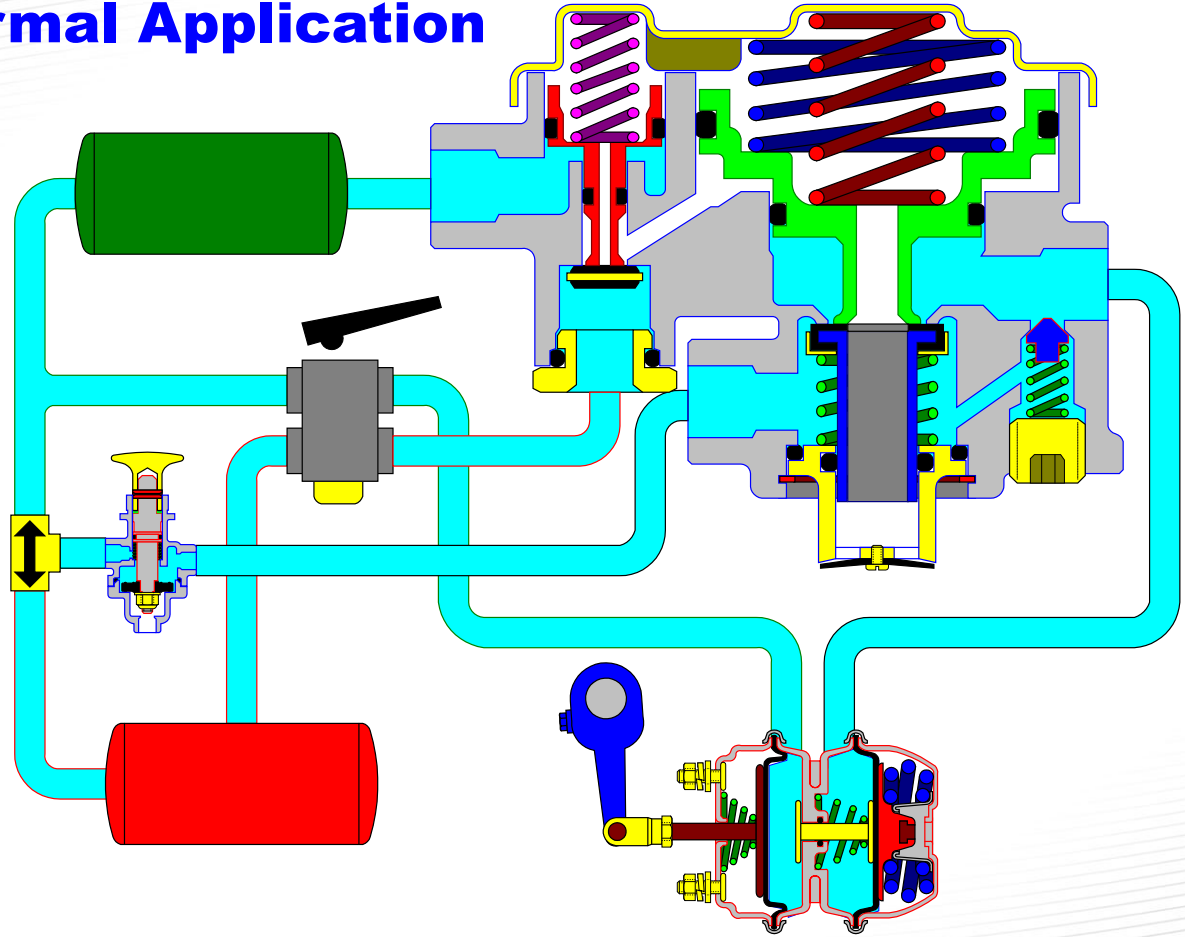
# Normal Application



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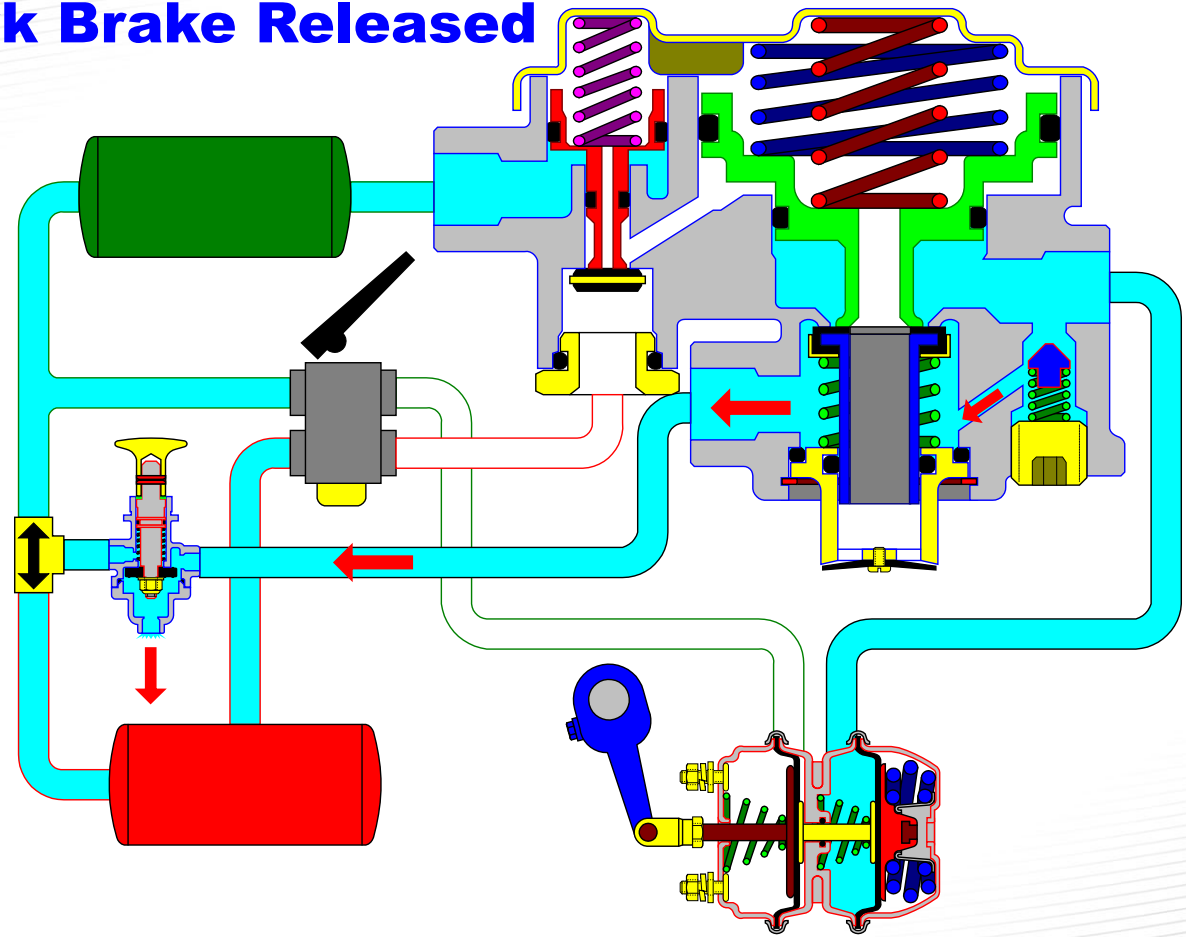
# Park Brake Released



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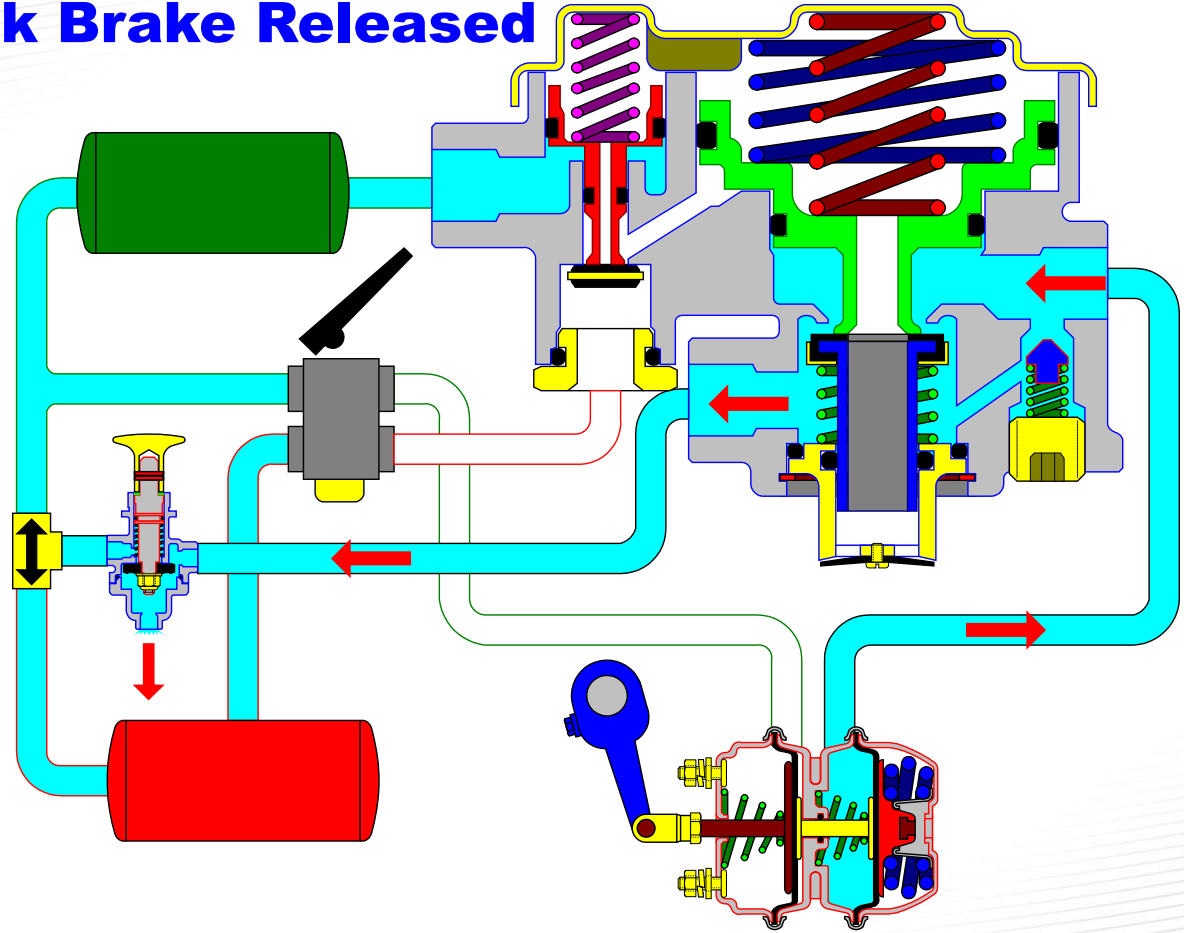
# Park Brake Released



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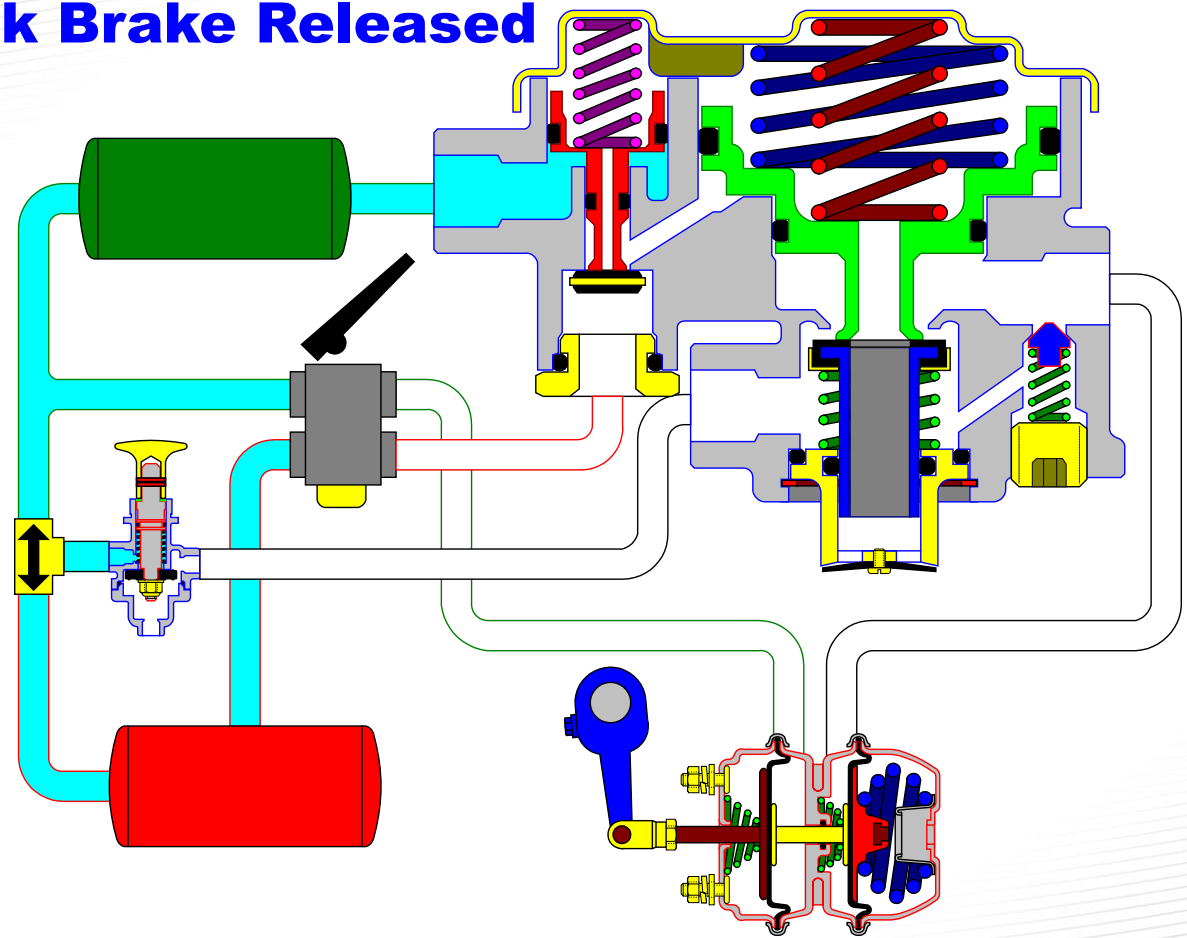
# Park Brake Released



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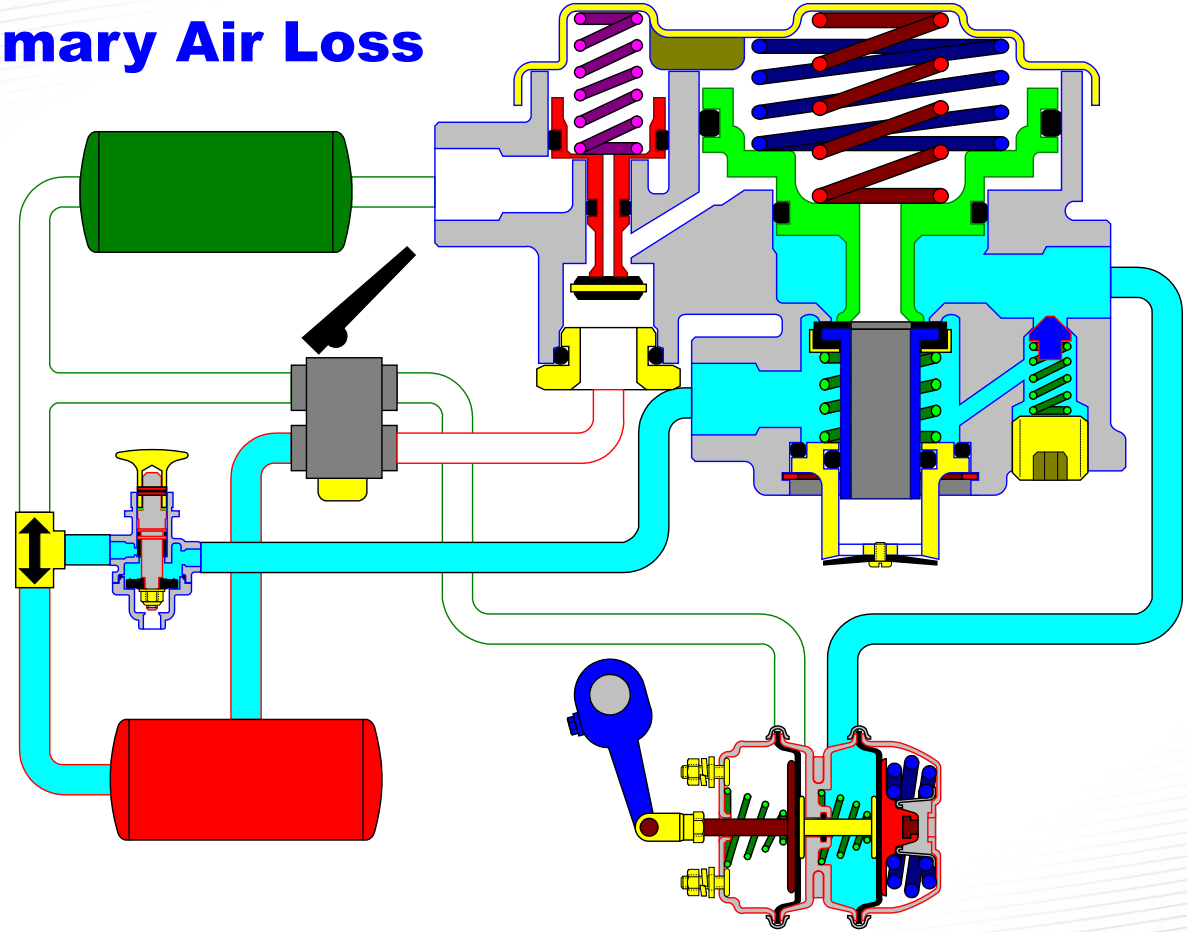
# Spring Brake Valve

With the loss of primary brake reservoir pressure, the SR-1 spring brake valve, acting on application pressure from the secondary brake system, will exhaust pressure from the spring brake chamber in direct proportion to application pressure and apply the rear brakes with spring force

Note: A 20 psi brake application will usually exhaust 40 psi hold off pressure

# Primary Air Loss



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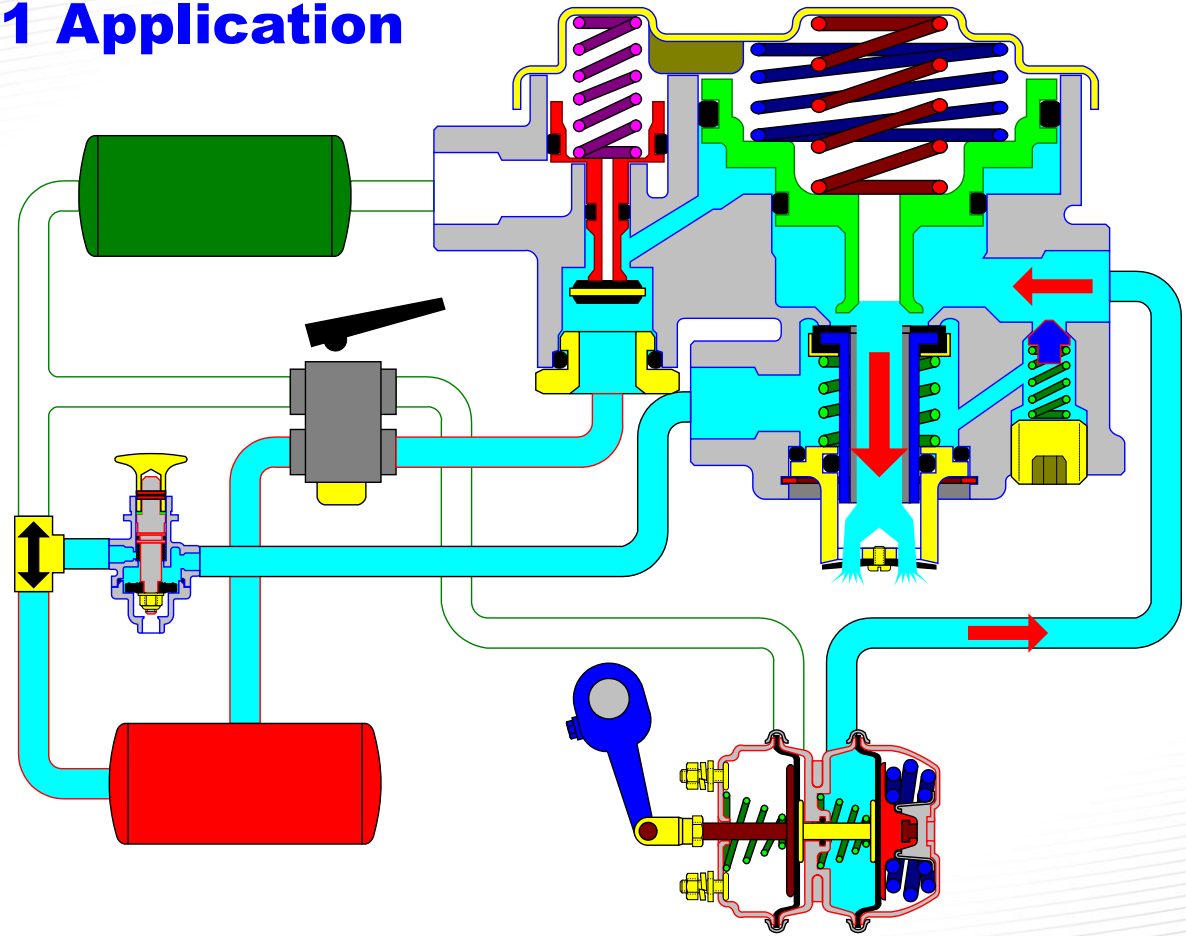
# SR-1 Application



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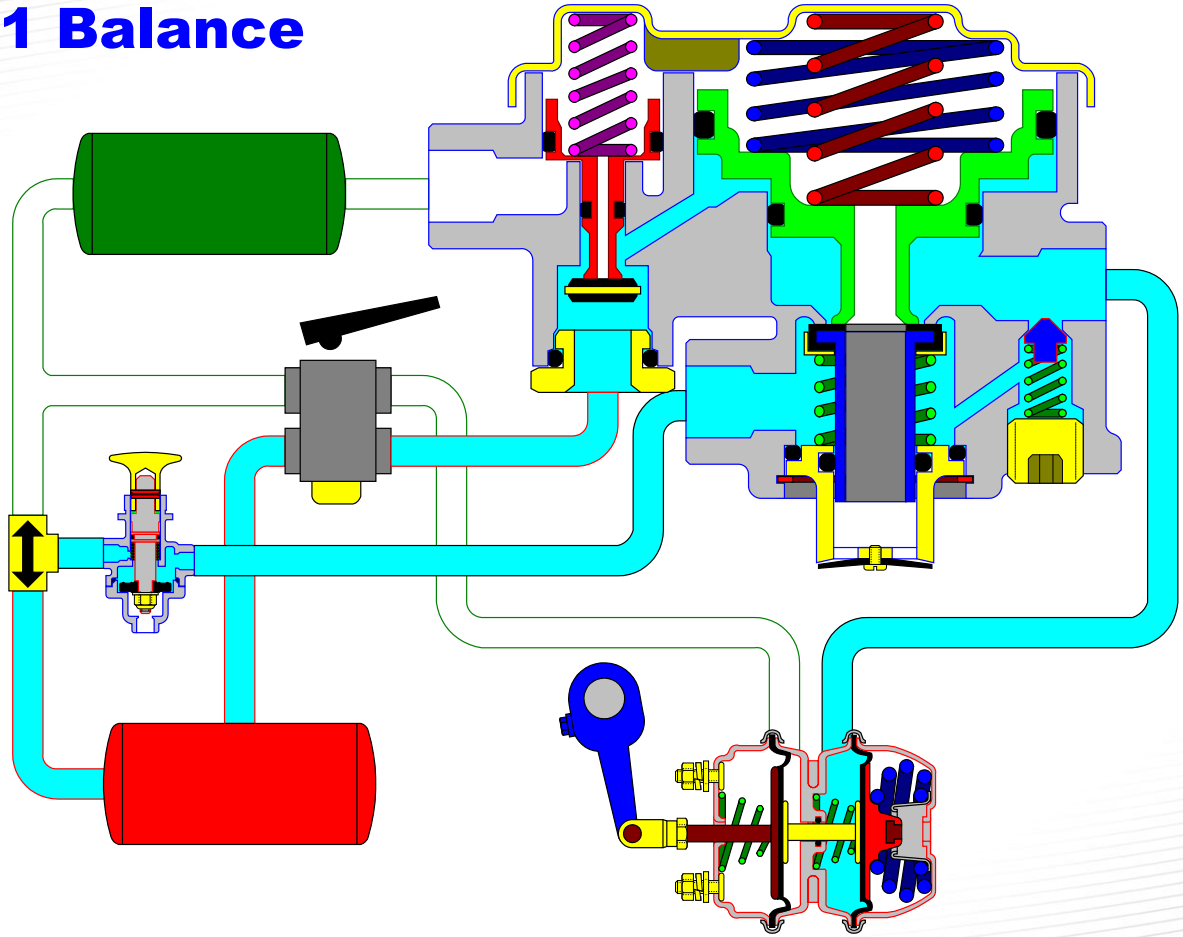
# SR-1 Balance



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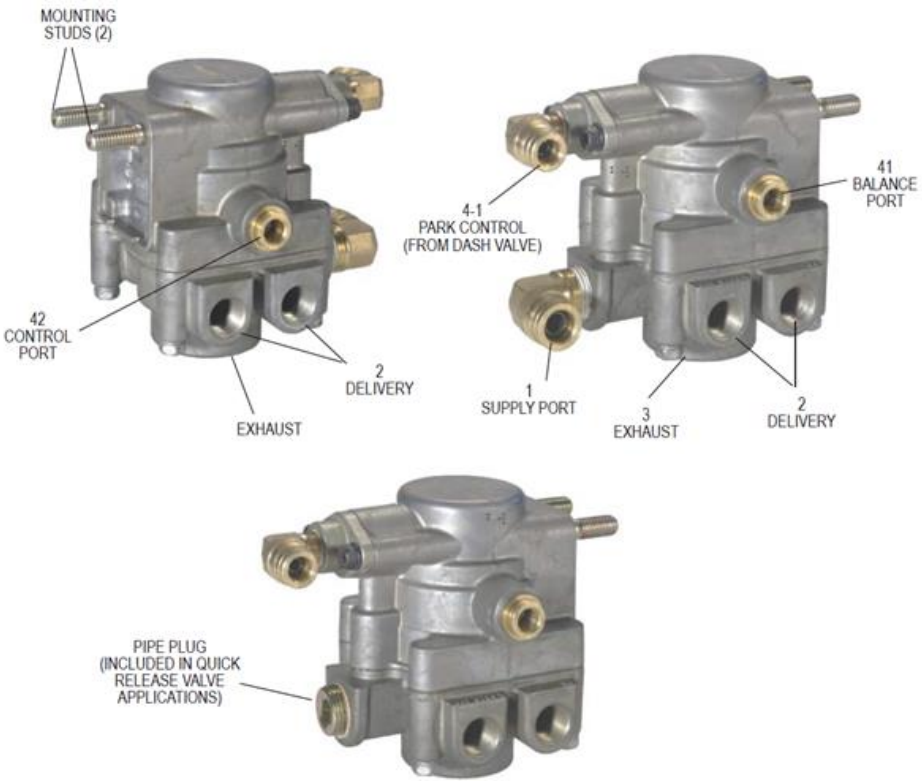
# Spring Brake Modulation Valve

The SR-7 spring brake modulating valve operates similar to the SR-1 but is used in place of the SR-1 and R-14 valve combination

The SR-7 spring brake modulating valve is used in conjunction with a dual air brake system and spring brake actuator and performs the following functions:

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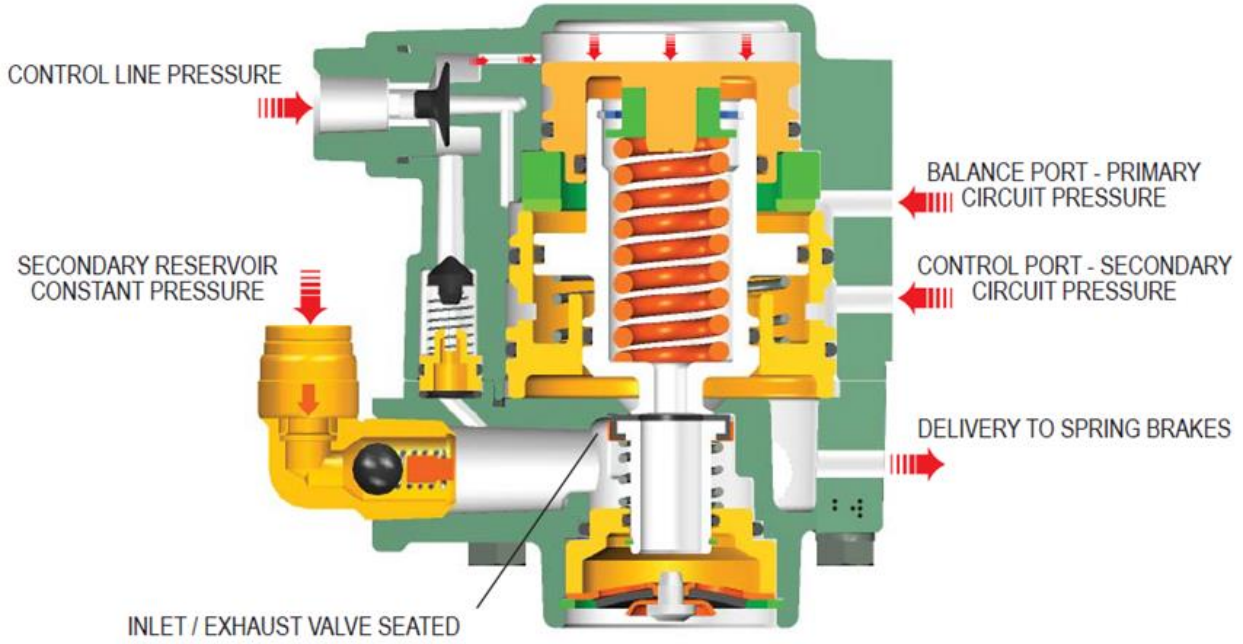
# Spring Brake Modulation Valve

Provides a rapid application of the spring brake actuator when parking

Modulates the spring brake actuator application using the dual brake valve should a primary failure occur in the service brake system

Prevents compounding of service and spring forces

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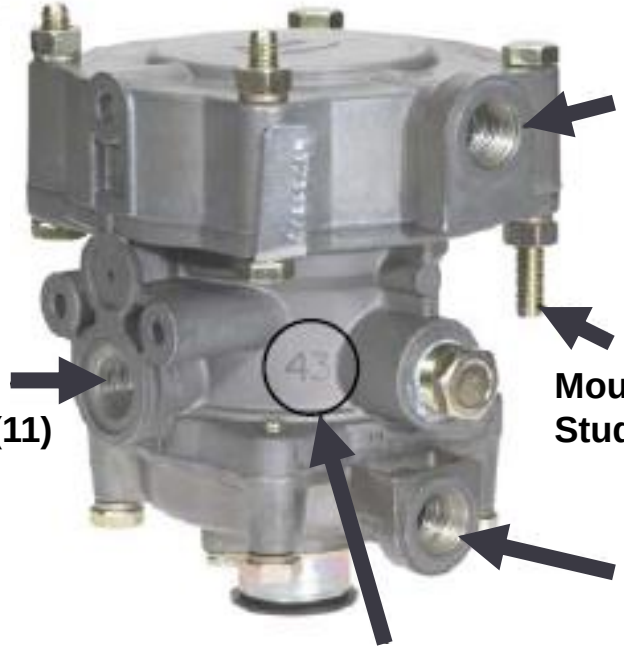
# Dual Relay Valve

- The Dual Relay Valve is a special purpose, multifunction relay valve typically used on articulated vehicles with three or more axles
- Normally mounted in close proximity to the valves and chambers served
- Its function is to speed the application and release of control air pressure to the service brake relay valve(s) on the rear most axles of the bus

# Dual Relay Valve



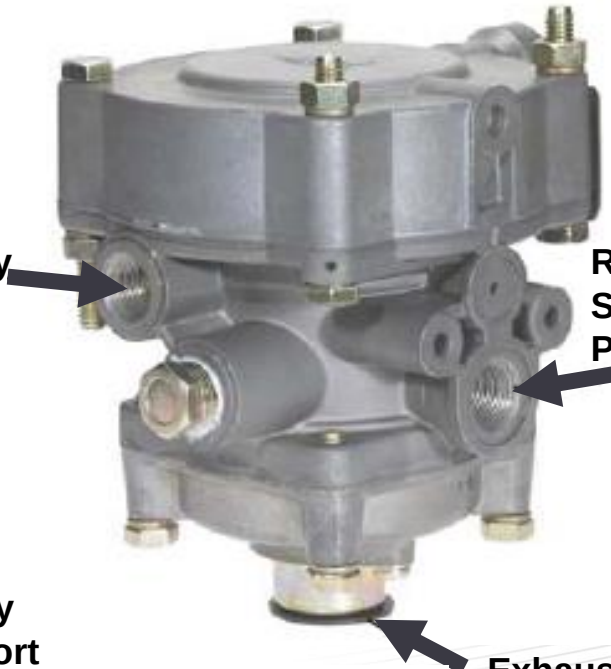
Primary Control Port (41)

Reservoir Supply Port (11)

Mounting Studs

Cast Port Identification

Secondary Control Port (42)



Delivery Port (22)

Reservoir Supply Port (11)

Exhaust Port

| Port ID | Size | Designation |
|---|---|---|
| 41 | 3/8 NPTF | Primary Control Port |
| 42 | 3/8 NPTF | Secondary Control Port |
| 12, 43 | Plugged | Not used |
| 22 | 3/8 NPTF | Delivery |
| 11 | 3/8 NPTF | Rear Service Reservoir |

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# Dual Relay Valve

The Dual Relay Valve is a pilot relay valve that responds to the control air delivered to it from both circuits of the foot brake valve.

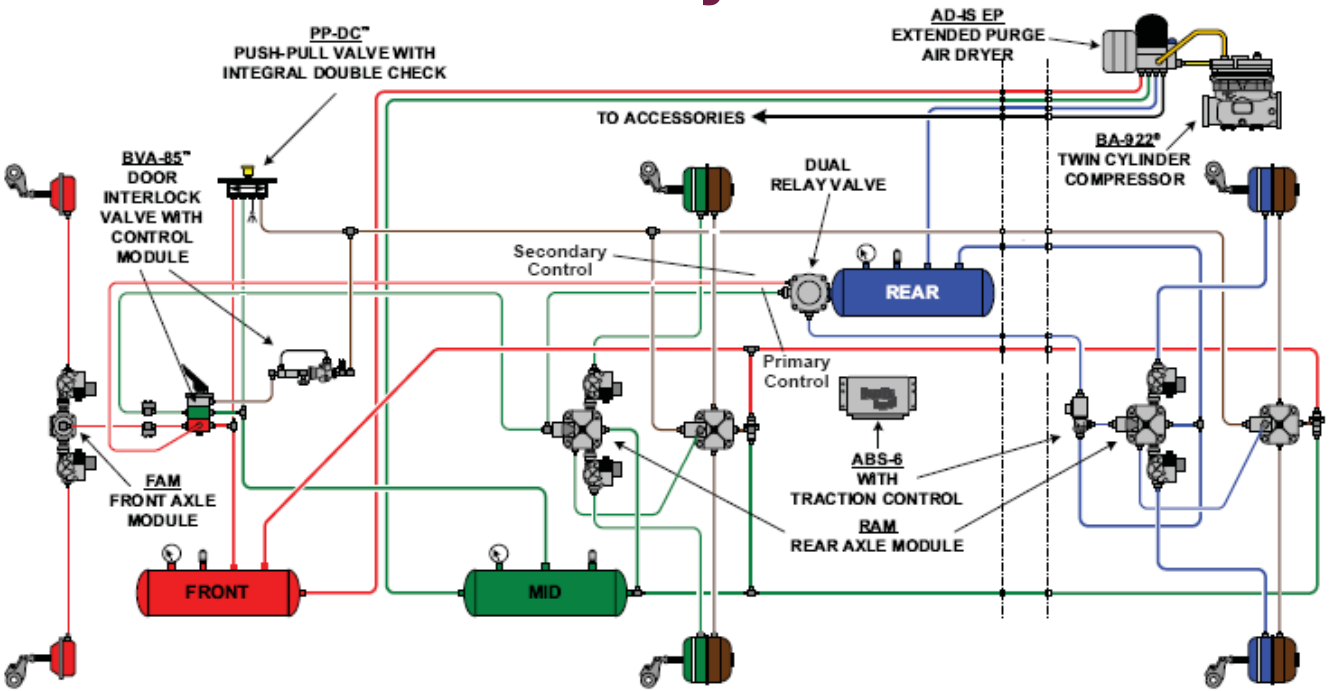
The Dual Relay Valve is controlled independently by the front (secondary) and mid (primary) delivery circuits of the dual circuit foot brake valve.

# Dual Relay Valve

The Dual Relay Valve is supplied air from the rear axles service reservoir that is isolated from the other service reservoirs forming a third service brake circuit on the vehicle.

With the addition of a third brake circuit the vehicle will maintain braking on at least two axles in the event of a single service system malfunction. In systems where this valve is used, the brake circuits are designated as Front (steering) Axle, Mid-Axle and Rear Axle.

# Dual Relay Valve




Air System Layout Schematic

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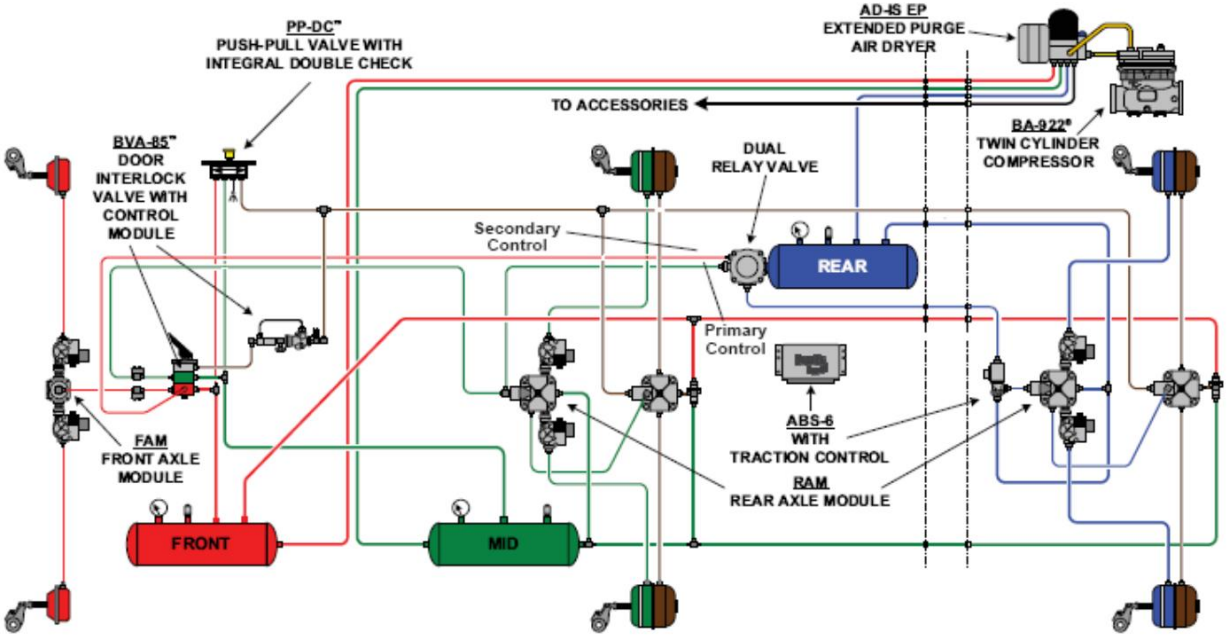
# Dual Relay Valve

Each service reservoir is isolated and is protected from loss of air in other service reservoirs. The front and mid-axle service reservoirs supply air directly to the secondary and primary circuits of the foot brake valve, as well as antilock and traction components for their respective circuits.




The rear axle service reservoir supplies air to the Dual Relay Valve, as well as the rear axle service antilock relay and traction components.

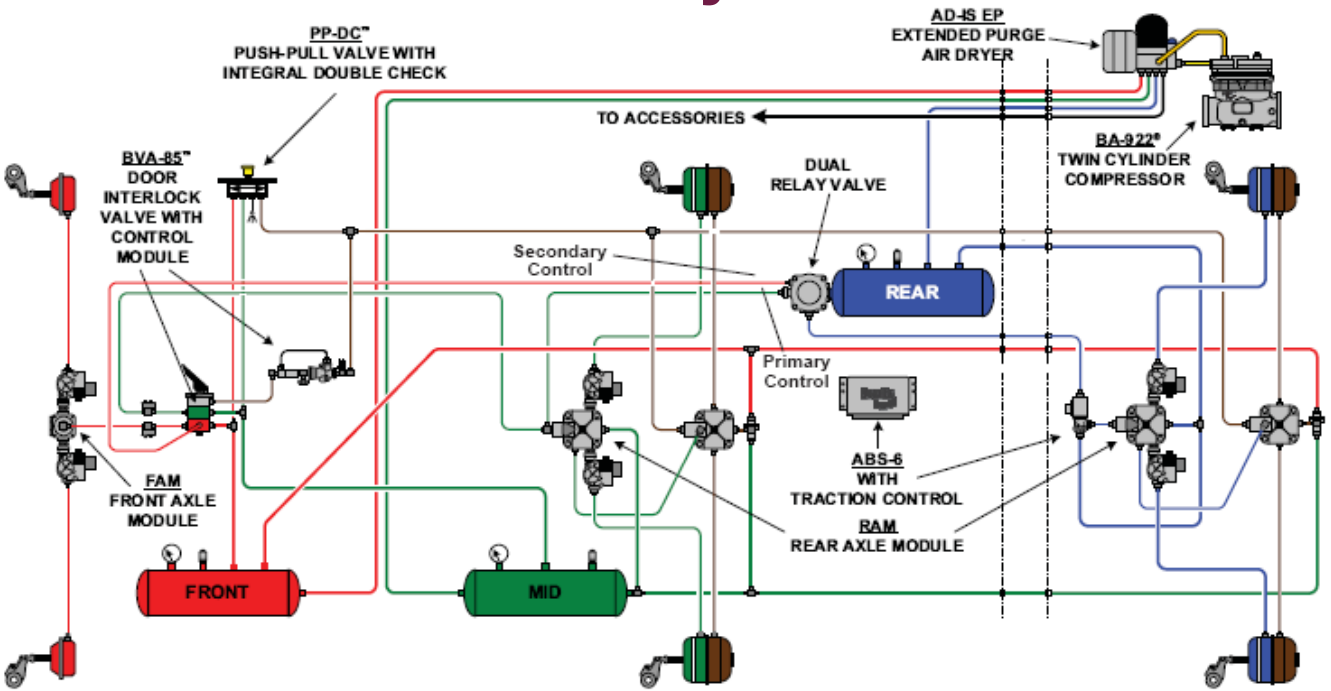
# Dual Relay Valve

**System Normal**

With the system normal and air pressure available in all service reservoirs, brake application pressure is transmitted from the primary and secondary circuits of the foot brake valve.

Application pressure is transmitted simultaneously to the front and mid-axle brakes and to the primary and secondary control ports of the Dual Relay Valve. The Dual Relay Valve applies or releases the rear axle brakes in direct proportion to the control signals received from the foot brake valve. The brake on each axle are applied using pressure from their dedicated respective reservoirs.

# Dual Relay Valve




Air System Layout Schematic

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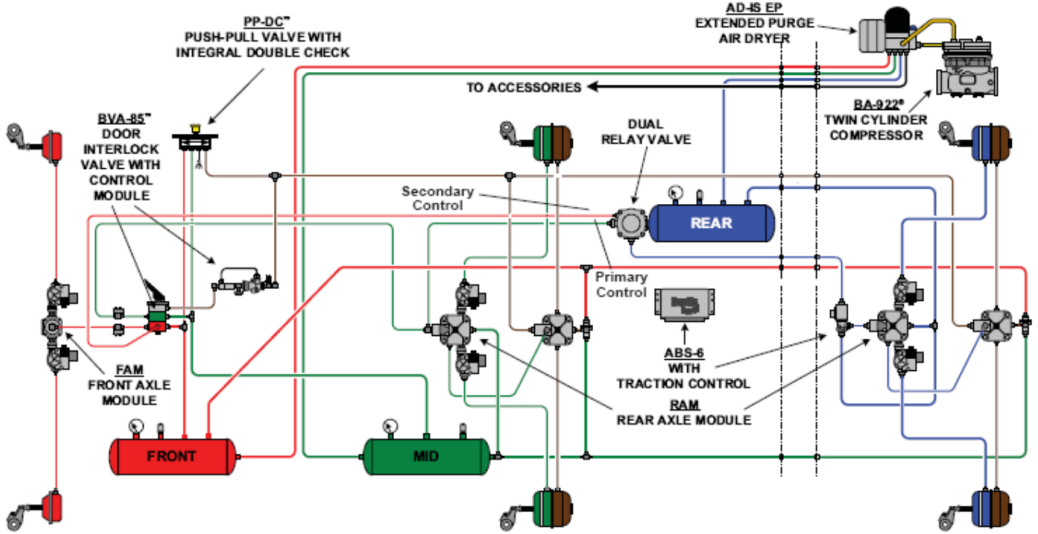
# Dual Relay Valve

**Loss of Front Axle Service Reservoir**

A service application made with a loss of air in the secondary circuit results in a no or low application of the front axle brakes.




*Air pressure from the primary circuit of the foot brake valve applies the mid-axle brakes and enters the primary control port of the Dual Relay Valve.*

*The Dual Relay Valve responds to primary control and applies the rear axle brakes. Brake release occurs when foot brake valve pressure is removed.*

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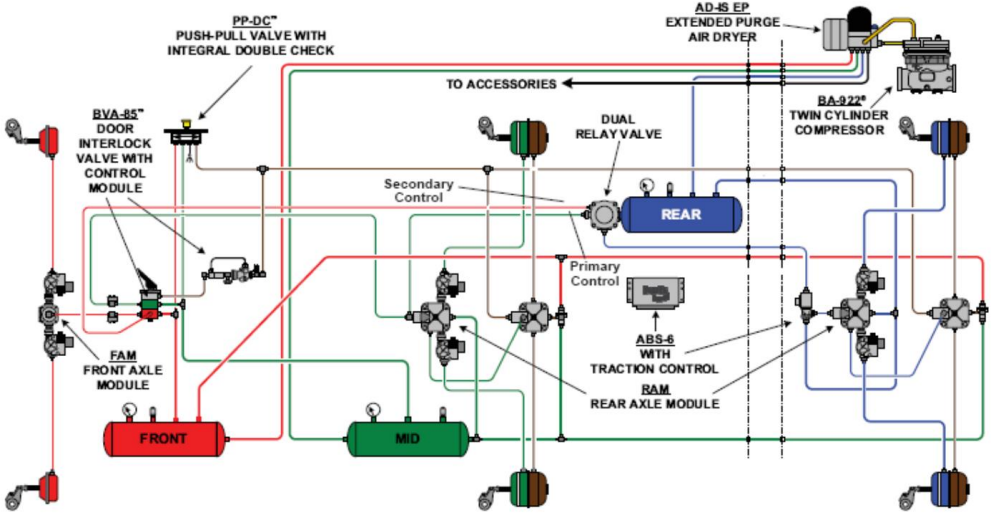
# Dual Relay Valve

**Loss of Mid-Axle Service Reservoir**

A service application made with a loss of air in the primary circuit results in a no or low application of the mid-axle brakes.




*Air pressure from the secondary circuit of the foot brake valve applies the front axle brakes and enters the secondary control port of the Dual Relay Valve.*

*The Dual Relay Valve responds to secondary control and applies the rear axle brakes.*

*Brake release occurs when foot brake valve pressure is removed.*

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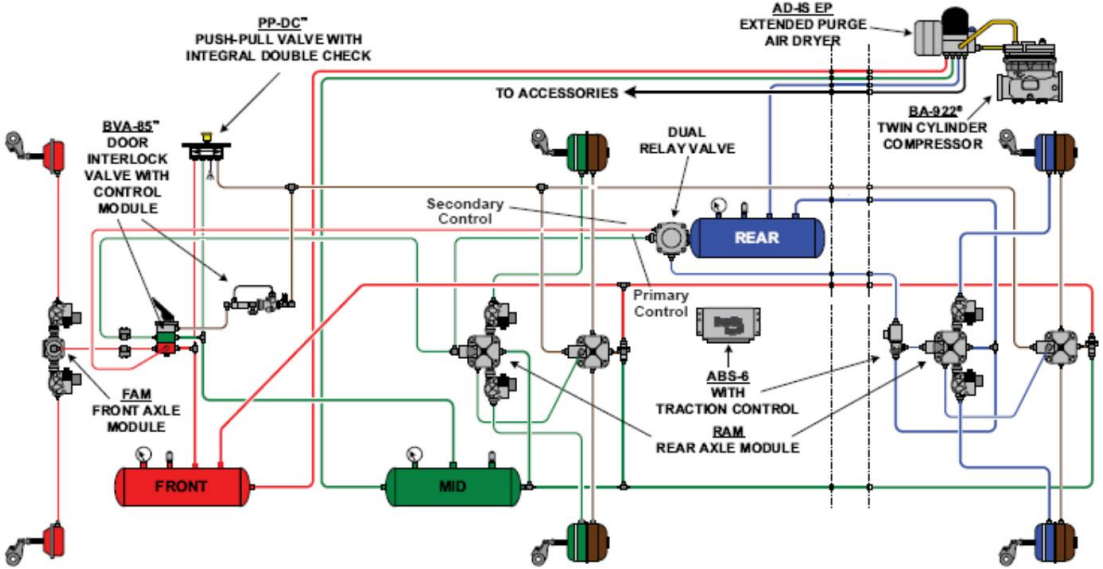
# Dual Relay Valve

**Loss of Rear Axle Service Reservoir**

With a loss of rear axle service pressure, the front and mid-axle brakes will be applied by the foot brake valve.



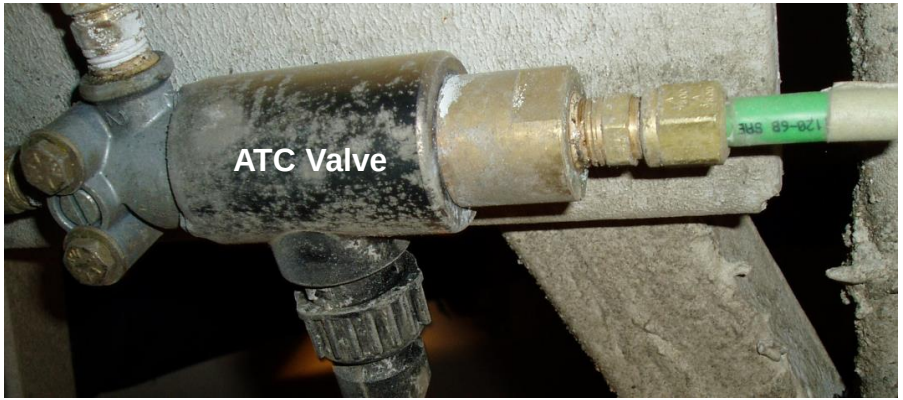

*Primary and secondary control pressure is received by the Dual Relay Valve. However, a no or low application of the rear brakes will occur due to a loss of pressure in the rear service reservoir. Front and mid-axle brakes will be applied by the treadle valve*

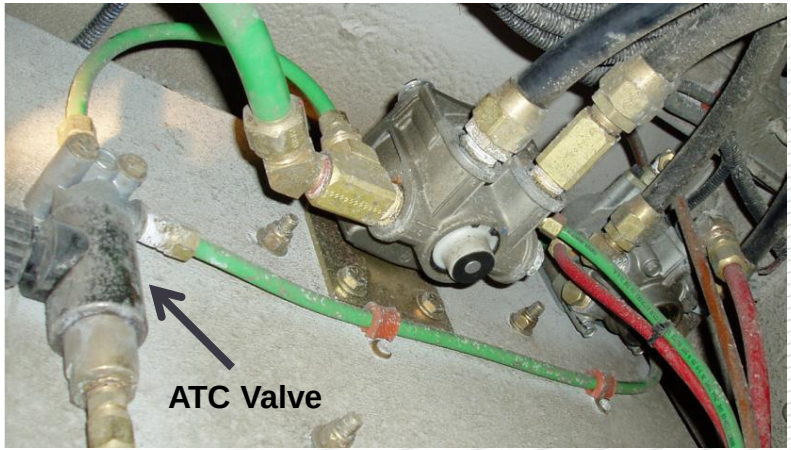
# Automatic Traction Control (ATC)

ATC (Automatic Traction Control) is an option to ABS that functions automatically to help the driver utilize the available traction for improved start-ability and vehicle stability on slippery surfaces.

If one drive wheel starts to spin, the ATC valve directs air pressure through the appropriate modulator valve, to apply the brakes on the spinning wheel. This transfers engine torque to the non-spinning drive wheel.

Engine control (torque reduction signal from ABS ECU to Engine ECU) will not occur unless both drive wheels are spinning or a single spinning drive wheel exceeds a threshold value.

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# Q & A

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# Related APTA Standards


- **APTA BTS-BC-RP-008-20:** Transit Bus Brake Valve Treadle Assembly Maintenance
- **APTA BTS-BC-RP-006-17:** Transit Bus Air Disc Brake Operation and Wheels On Inspection
- **APTA BTS-BC-RP-001-05 Rev. 1:** Transit Bus In-Service Brake System Performance Testing

For additional resources visit: https://www.apta.com/research-technical-resources/standards/bus-transit-systems-standards-program/

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***The APTA Bus Technical Maintenance Committee would like to thank you for joining our Webinar.***

***Please join us for the next Webinar in the series which will cover the Foundation Brake System.***

***Keep an eye out for a survey on today's webinar!***

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