

Bendix® E-14™ Dual Brake Valve

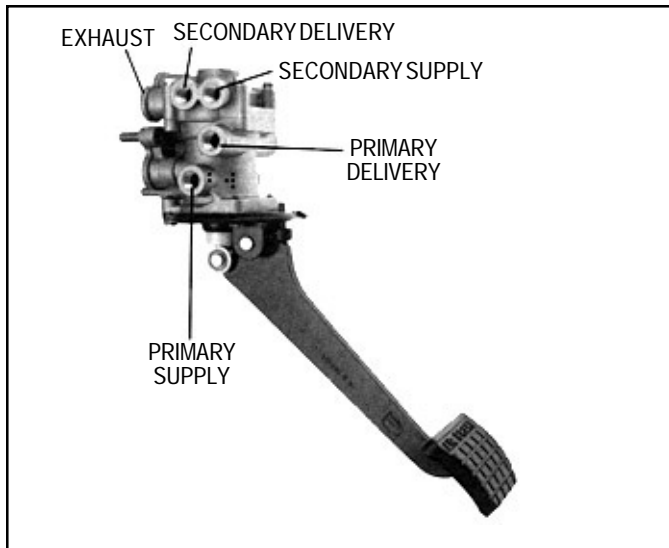


FIGURE 1 - E-14™ DUAL BRAKE VALVE

DESCRIPTION

The E-14™ dual brake valve is a suspended-pedal foot valve with two separate supply and delivery circuits. The valve provides the driver with graduated control for applying and releasing the vehicle brakes.

The circuits in the E-14™ dual brake valve are identified as follows: The number one (primary) circuit is the portion of the valve between the primary piston and the secondary piston. The number two (secondary) circuit consists of the area between the secondary piston and the exhaust cavity.

The supply, delivery, and exhaust ports of the E-14™ brake valve are identified by designations cast into the valve body next to the port. (See Figure 1). The primary supply and delivery ports are located in the valve's primary body, and the secondary supply and delivery ports are located in the secondary body.

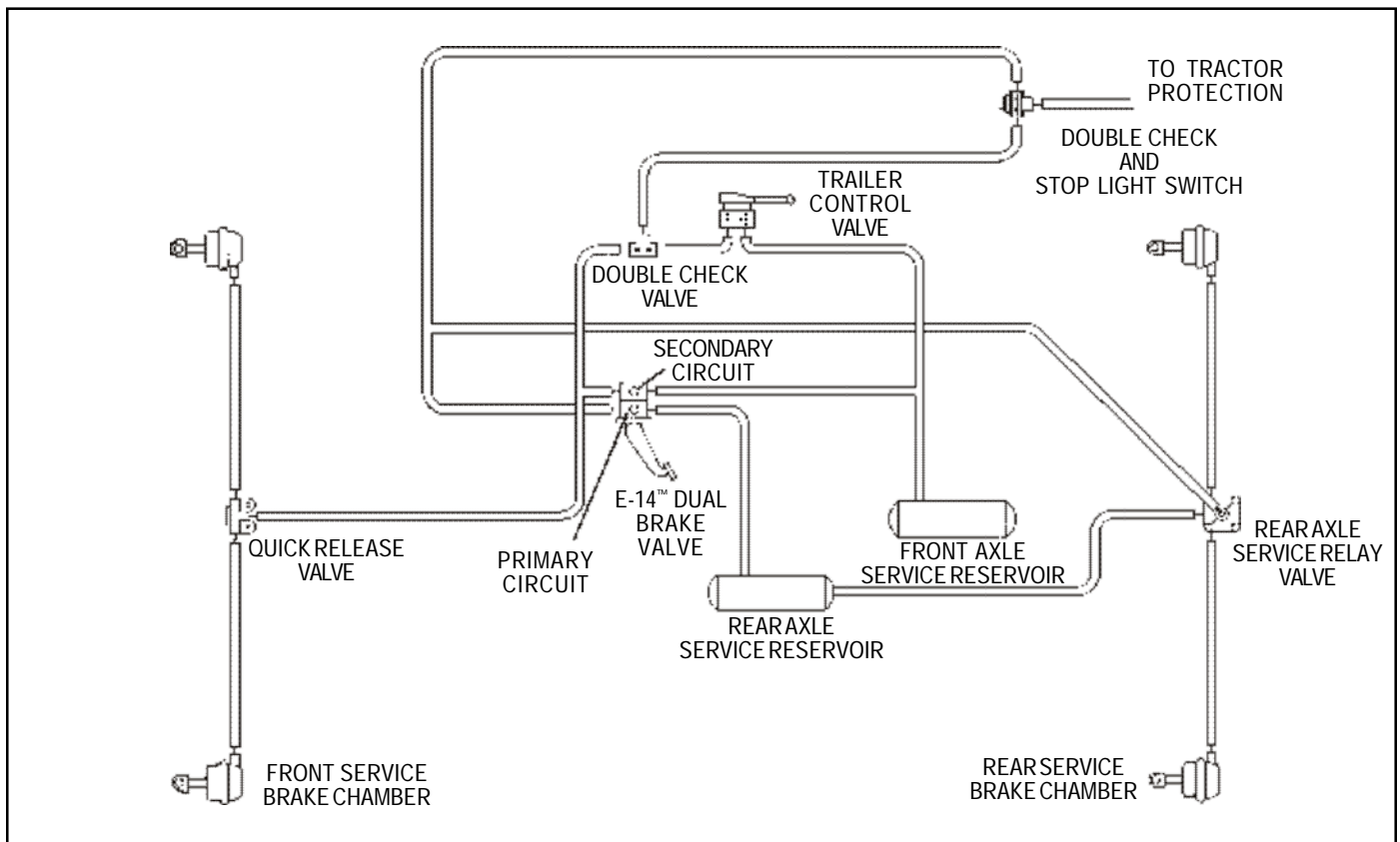


FIGURE 2 - TYPICAL PIPING SCHEMATIC

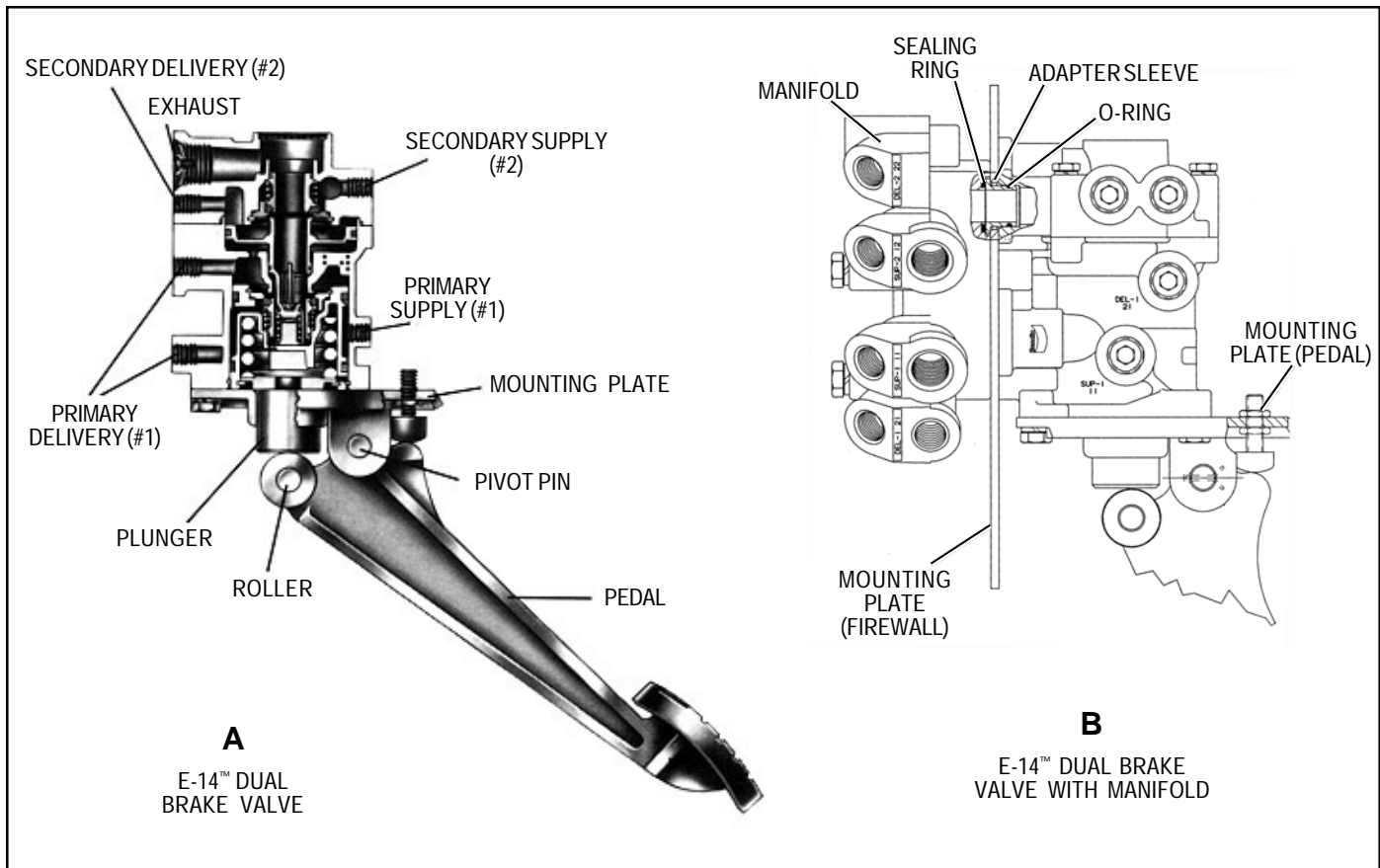


FIGURE 3 - E-14™ DUAL BRAKE VALVE CROSS SECTIONAL VIEW

The primary circuit operates similar to a standard single circuit air brake valve, and under normal operating conditions the secondary circuit operates similar to a relay valve.

Both the primary and secondary circuits use a common exhaust, protected by an exhaust diaphragm.

OPERATION

APPLYING: NORMAL OPERATION-PRIMARY CIRCUIT

When the brake pedal is depressed, the plunger exerts a force on the spring retainer(7), graduating spring(8), and primary piston(2). The primary piston, which contains the exhaust valve seat, closes the primary circuit exhaust valve. As the exhaust valve closes, the inlet valve for the primary circuit moves off its seat, allowing air from the primary circuit supply port to flow out the delivery port.

APPLYING: NORMAL OPERATION-SECONDARY CIRCUIT

The secondary piston(18) moves with the primary piston and closes the secondary circuit exhaust. When the inlet valve in the primary portion of the valve is moved off its

seat, air passes through the bleed passage in the secondary portion of the primary body and enters the secondary piston cavity. The air moves the secondary piston and opens the secondary inlet valve, allowing the air from the secondary supply to flow out the delivery port.

APPLYING: LOSS OF AIR IN THE PRIMARY CIRCUIT

If the brake pedal is depressed and no air pressure is present in the primary circuit, the primary piston will mechanically move the secondary piston, closing the secondary exhaust and opening the secondary inlet, allowing air flow from the secondary supply to its delivery port.

APPLYING: LOSS OF AIR IN THE SECONDARY CIRCUIT

If the air is lost in the secondary circuit, the primary circuit will function normally, as described in "Normal Operation: Primary Circuit."

BALANCED: PRIMARY CIRCUIT

When the primary delivery pressure acting upon the primary piston equals the mechanical force of the brake pedal application, the primary piston will close, preventing further

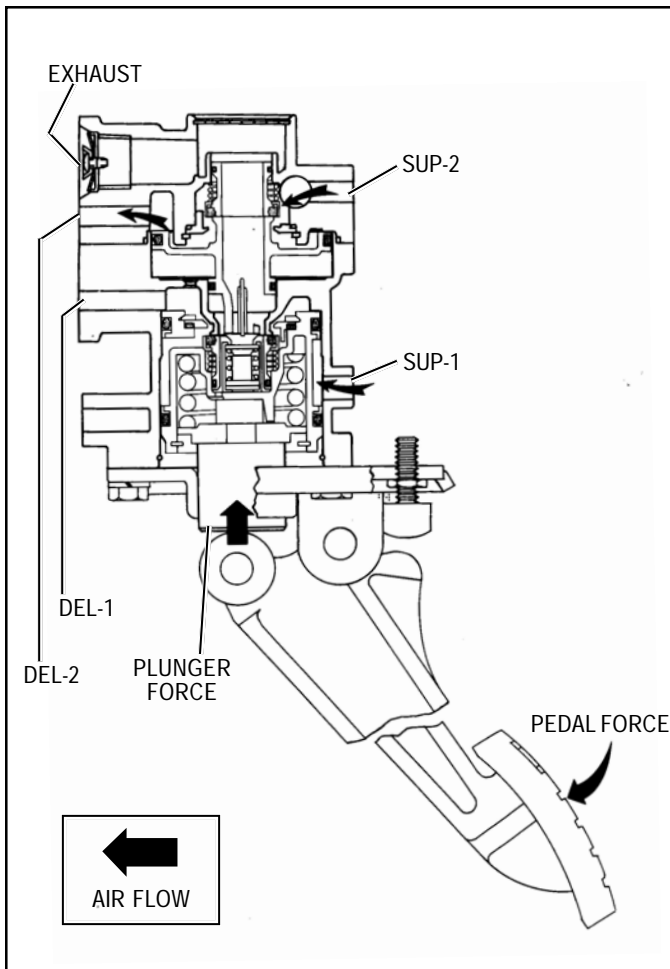


FIGURE 4 - APPLYING - NORMAL OPERATION

air flow from the supply port to the delivery port. The exhaust valve remains closed, preventing the escape of air through the exhaust port.

BALANCED: SECONDARY CIRCUIT

When air pressure on both sides of the secondary piston approach each other, the piston moves, closing the secondary inlet valve and preventing further air flow from the supply line through the valve. The exhaust remains closed as the secondary delivery pressure balances the primary delivery pressure.

RELEASING: PRIMARY CIRCUIT

When the force on the brake pedal is released, mechanical force is removed from the graduating spring and the primary piston. Air pressure in the delivery circuit moves the primary piston and opens the primary exhaust valve, allowing air pressure in the primary circuit to exit through the exhaust port.

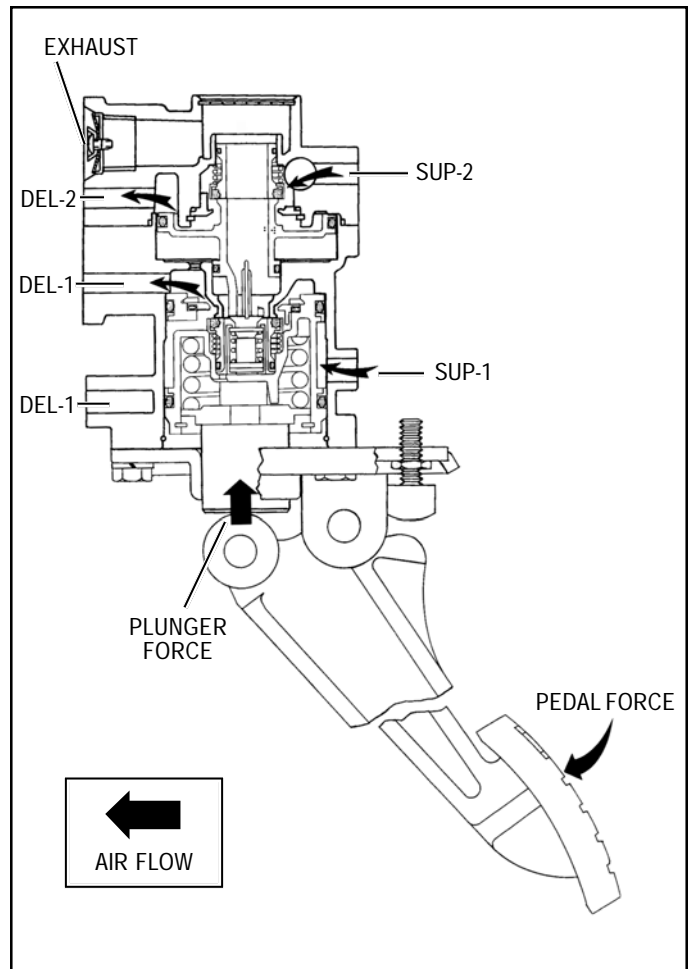


FIGURE 5 - APPLYING - FAILURE IN THE PRIMARY CIRCUIT

RELEASING: SECONDARY CIRCUIT

When the brake pedal is released, air is exhausted from the primary circuit side of the secondary piston through the bleed passage. Air pressure in the delivery side of the secondary circuit moves the piston and opens the secondary exhaust valve, allowing air pressure in the secondary delivery line to exit through the exhaust port.

PREVENTIVE MAINTENANCE

Important: Review the warranty policy before performing any intrusive maintenance procedures. An extended warranty may be voided if intrusive maintenance is performed during this period.

Because no two vehicles operate under identical conditions, maintenance and maintenance intervals will vary. Experience is a valuable guide in determining the best maintenance interval for any one particular operation.

Visually check for physical damage to the brake valve such as broken air lines and broken or missing parts.

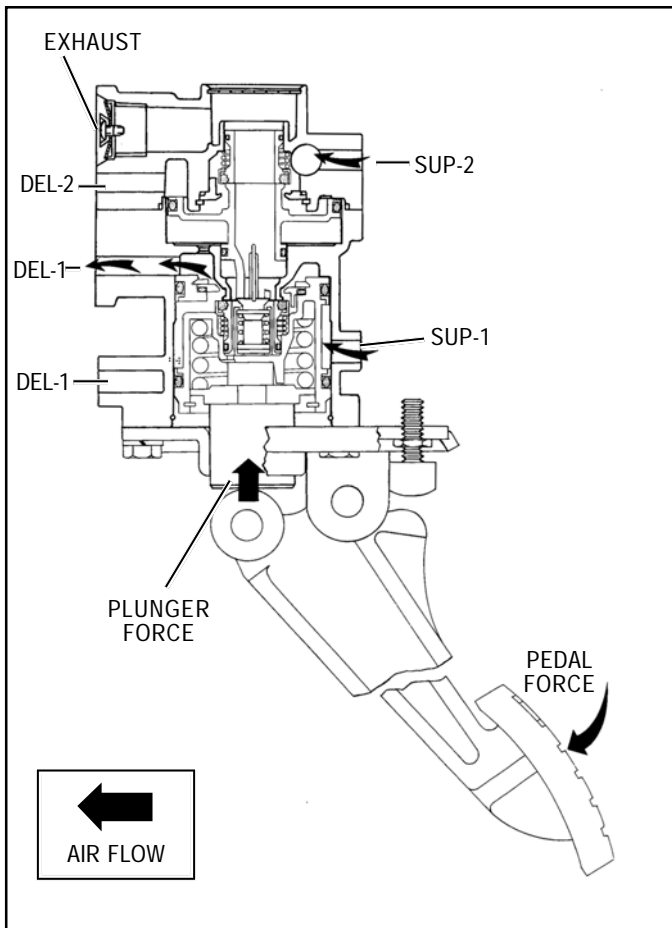


FIGURE 6 - APPLYING-FAILURE IN THE SECONDARY CIRCUIT

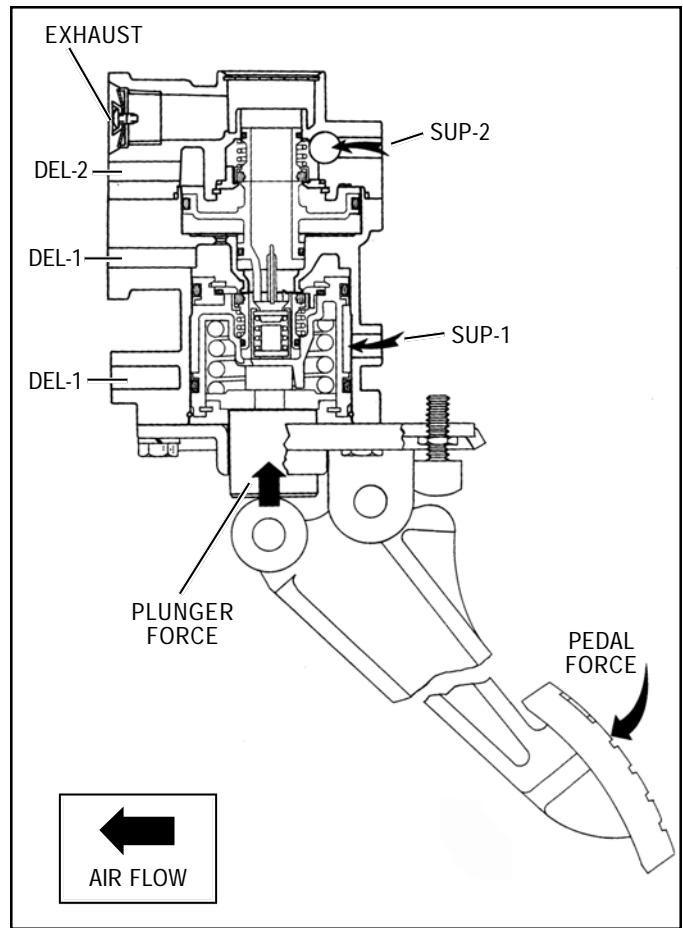


FIGURE 7 - BALANCED POSITION

EVERY 3 MONTHS, 25,000 MILES OR 900 OPERATING HOURS

1. Remove any accumulated contaminants such as dirt and gravel from the heel of the pedal, plunger, plunger boot, and mounting plate.
2. Using a light oil, lubricate the pedal roller, roller pin, and hinge pin.
3. Inspect the plunger boot for cracks, holes, or deterioration. Replace if necessary. Also check mounting plate and pedal for wear and corrosion. Repair or replace as necessary.
4. Apply 2 to 4 drops of oil between plunger and mounting plate - DO NOT OVER OIL!
5. Check for excessive leakage as described in the "OPERATIONAL & LEAKAGE TEST" section of this manual.

EVERY YEAR, 100,000 MILES, OR 3,600 OPERATING HOURS

1. Perform steps 1 through 4 above.
2. Perform the checks in the "OPERATION & LEAKAGE TEST" section of this manual.

OPERATIONAL & LEAKAGE TESTS

GENERAL

A change in vehicle braking characteristics or a low pressure warning may indicate a malfunction in one of the brake circuits. Although the air brake system may continue to function, the vehicle should not be operated until the necessary repairs have been made and both braking circuits, including the pneumatic and mechanical devices, are operating normally.

If the brake valve does not function as described above or if leakage is excessive, it is recommended that it be replaced with a new or remanufactured unit, available at Bendix outlets.

Always check the vehicle brake system for proper operation after performing brake work and before returning the vehicle to service.

OPERATIONAL TEST

Check the delivery pressure of both circuits, using test gauges known to be accurate. **Note:** The pedal will not be in a "normal" released position until the air brake system is pressurized. The pedal will rise to its normal release position as the brake system is pressurized from 0 psi. Depress the pedal to several positions between the fully released and fully applied positions and check the delivered pressure on the test gauges to see that it varies equally and proportionally with the movement of the brake pedal.

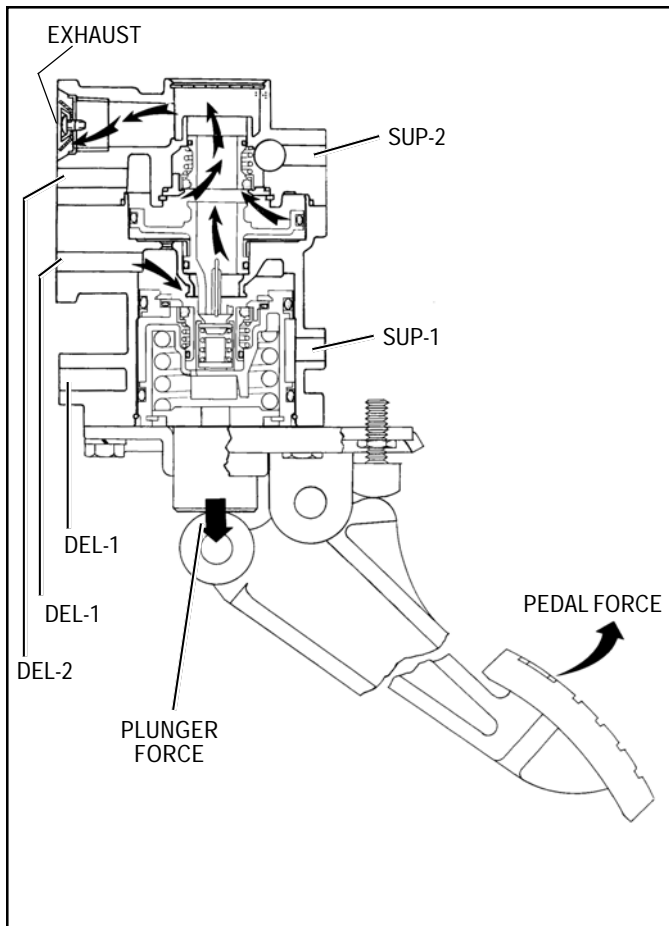


FIGURE 8- RELEASED MODE

After a full application is released, the reading on the test gauges should fall off to zero promptly. NOTE: the number one circuit delivery pressure will be about four psi greater than the number two circuit delivery pressure with both supply reservoirs at the same pressure. This is normal for the E-14™ brake valve.

LEAKAGE TEST

Make and hold a high pressure application (80 psi). Coat the exhaust port and body of the brake valve with a soap solution. Leakage permitted is a 1" bubble in 3 seconds in both the applied and released positions. No leakage is permitted anywhere else.

WARNING! PLEASE READ AND FOLLOW THESE INSTRUCTIONS TO AVOID PERSONAL INJURY OR DEATH:

When working on or around a vehicle, the following general precautions should be observed at all times.

1. Park the vehicle on a level surface, apply the parking brakes, and always block the wheels. Always wear safety glasses.
2. Stop the engine and remove ignition key when working under or around the vehicle. When working in the engine compartment, the engine should be shut off and the ignition key should be

removed. Where circumstances require that the engine be in operation, **EXTREME CAUTION** should be used to prevent personal injury resulting from contact with moving, rotating, leaking, heated or electrically charged components.

3. Do not attempt to install, remove, disassemble or assemble a component until you have read and thoroughly understand the recommended procedures. Use only the proper tools and observe all precautions pertaining to use of those tools.
4. If the work is being performed on the vehicle's air brake system, or any auxiliary pressurized air systems, make certain to drain the air pressure from all reservoirs before beginning **ANY** work on the vehicle. If the vehicle is equipped with an AD-IS™ air dryer system or a dryer reservoir module, be sure to drain the purge reservoir.
5. Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that safely removes all electrical power from the vehicle.
6. Never exceed manufacturer's recommended pressures.
7. Never connect or disconnect a hose or line containing pressure; it may whip. Never remove a component or plug unless you are certain all system pressure has been depleted.
8. Use only genuine Bendix® replacement parts, components and kits. Replacement hardware, tubing, hose, fittings, etc. must be of equivalent size, type and strength as original equipment and be designed specifically for such applications and systems.
9. Components with stripped threads or damaged parts should be replaced rather than repaired. Do not attempt repairs requiring machining or welding unless specifically stated and approved by the vehicle and component manufacturer.
10. Prior to returning the vehicle to service, make certain all components and systems are restored to their proper operating condition.

VALVE REMOVAL

1. Identify and mark or label all air lines and their respective connections on the brake valve to facilitate ease of installation. Disconnect all air lines.
2. Remove the valve from its mounting on the vehicle. For manifold-type valves, remove the brake valve and manifold, in tact, from the vehicle.

DISASSEMBLY (SEE FIGURE 9)

The following disassembly and assembly procedure is presented for reference purposes only. Always have the appropriate maintenance kit on hand, and use its instructions in lieu of those presented here. Refer to Figure nine throughout the procedure.

CAUTION: The brake valve may be light clamped in a bench vise, but overclamping may damage the valve and cause leakage and/or malfunction. If a vise is used, clamp on the supply and delivery ports on opposing sides of the valve's primary body.

1. Remove all air line fittings and plugs.
2. On valves that have a manifold on the engine compartment side, remove the bolts that secure the manifold to the valve. Separate the valve and manifold and remove the sealing rings and adapter sleeves. (See Figure 2.)
3. Remove the four cap screws(16) that secure the primary body to the secondary body. Separate the two body halves and remove and discard o-ring(17).
4. Pull secondary piston(18) out of the primary body and remove and discard o-rings(19 & 20).
5. Remove and discard snap ring(10) from the secondary body while manually holding and compressing valve seat(11) in place.
6. Slowly release valve seat(11), allowing it to rise out of the body. Remove the valve seat, then remove and discard o-ring(12).
7. Remove and discard valve assembly(13) along with its o-ring(15) from the secondary body. Remove the valve assembly return spring(14).
8. Carefully remove and discard exhaust diaphragm screw(24), diaphragm washer(25), diaphragm(26), and diaphragm retainer(27) from the secondary body. **NOTE:** Some **E-14™ brake** valves have a threaded exhaust port instead of items 24-27.
9. Using light force, push piston(2) into the primary body until piston retaining ring(1) is fully visible. Remove piston retaining ring(1), taking care not to damage the piston bore in the body.
10. Gently tap the primary body on a soft surface to remove piston(2). Remove and discard o-rings(3 & 5) and both wear rings(4) from piston(2).
11. Place the piston on a flat surface. Using finger force, depress and hold spring retainer(7), then remove and discard retaining ring(6) from piston(2).
12. Gently release spring retainer(7), allowing it to rise out of the piston. Remove spring retainer(7) and graduating spring(8) from piston(2).
13. Remove and discard rubber spring(9) from the interior of piston(2).
14. Remove and discard snap ring(10) from piston(2) while manually holding and compressing valve seat(11) in place.

15. Slowly release valve seat(11), allowing it to rise out of piston(2). Remove valve seat(11), then remove and discard o-ring(12).
16. Remove and discard valve assembly(13) along with its o-ring(15) from piston(2). Remove valve assembly return spring(14).

CLEANING & INSPECTION

1. Using mineral spirits or an equivalent solvent, clean and thoroughly dry all metal parts.
2. Inspect the interior and exterior of all metal parts that will be reused for severe corrosion, pitting, or cracks. Superficial corrosion and/or pitting on the exterior portion of the secondary and primary bodies is acceptable.
3. Inspect the bores of both bodies for deep scuffing or gouges.
4. If primary piston(2) is reused, make certain that vents "A & B" are open and free of obstructions. (See Figure 2.)
5. Make certain vent "C" is open in the primary body of the valve. (See Figure 2.)
6. Inspect the pipe threads in both bodies. Make certain they are clean and free of thread sealant.
7. Inspect pedal assembly and mounting plate. Make certain the pedal roller turns freely and is lightly lubricated. **Note:** Some pedal assemblies, not furnished by Bendix, do not employ a roller. In this case, make certain the mechanism in use moves across the plunger smoothly, without binding or sticking. Inspect plunger for excessive scuffing or wear. Check the plunger bore in the mounting plate for excessive wear, shown by "egg shaping" (bell mouthing). Inspect mounting plate for severe corrosion, paying particular attention to the area around the pivot pin bores.
8. If the brake valve uses a rubber boot between the plunger and mounting plate, inspect the boot for deterioration or cracking.
9. Inspect all air line fittings and plugs for corrosion. Clean all old thread sealant from the pipe threads.

Any valve or pedal assembly component that does not meet the inspection criteria listed above should be discarded and replaced before proceeding.

ASSEMBLY (SEE FIGURE 9)

1. Using silicone lubricant (650-M), lightly coat all o-rings, o-ring bores, and grooves, except for the secondary piston o-rings(19 and 20). Lightly lubricate primary piston(2) bore into which graduating spring(8) is installed. With the 328-M lubricant, lightly coat o-rings (19 and 20) and o-ring grooves on secondary piston(18).

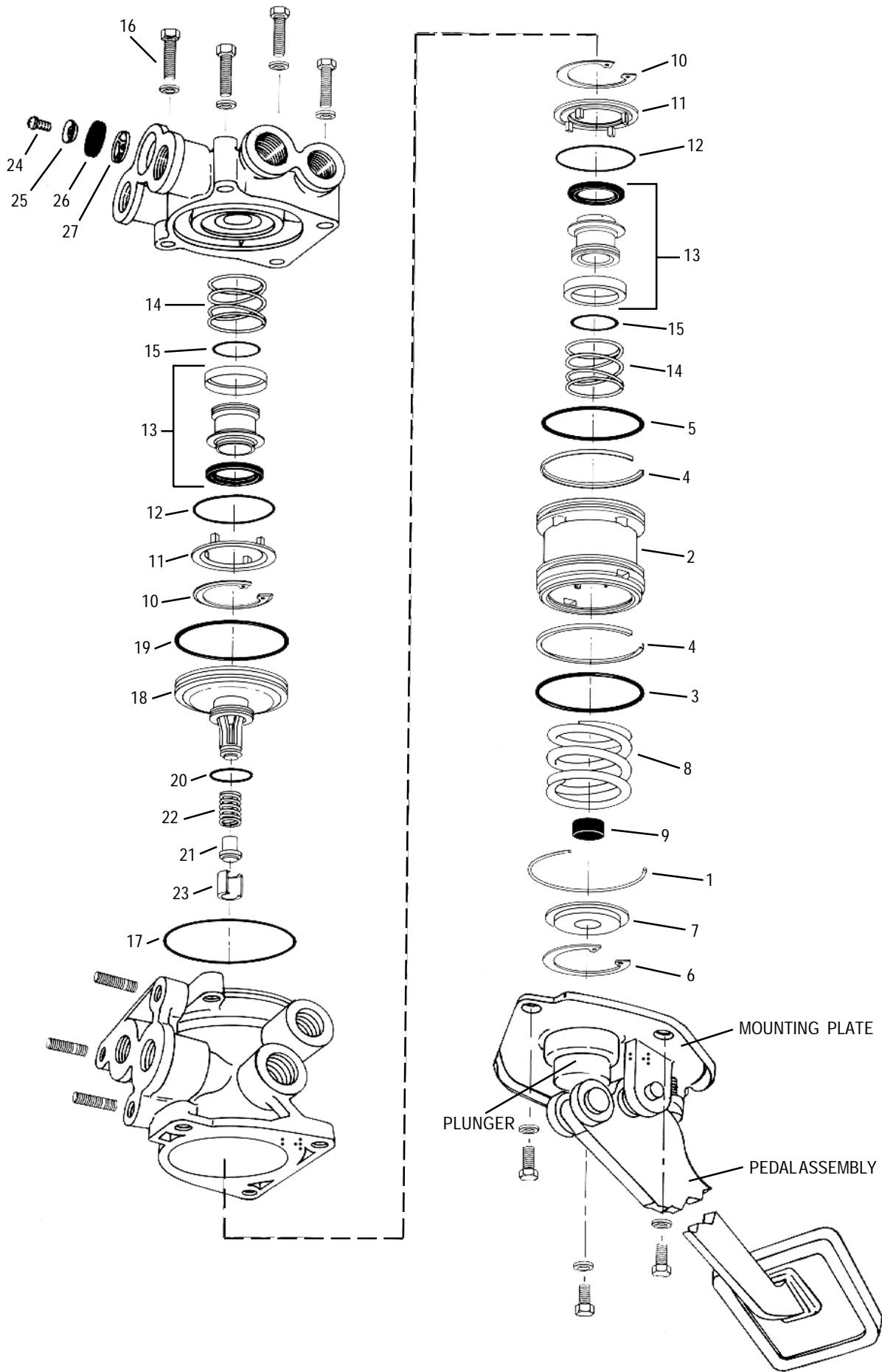


FIGURE 9 - EXPLODED VIEW

2. Place primary piston(2) on a flat surface and install rubber spring(9) and metal graduating spring(8).
3. Install graduating spring retainer(7) on top of graduating spring(8), making certain that the side with the high circular protrusion is away from the spring.
4. Manually depress and hold spring retainer(7) in piston(2), then install snap ring(6), making certain it is completely seated in its groove in piston(2).
5. Install o-rings(15) on both valve assemblies(13).
6. Install valve spring(14) in piston(2), then install valve assembly(13) in the spring.
7. Install o-ring(12) into the o-ring groove of piston(2), then install valve seat(11) on valve assembly(13). Gently depress and hold the valve seat in piston(2) while installing retaining ring(10).
8. Install o-rings(3 and 5) on primary piston(2), then install wear rings(4) in the o-ring grooves next to the o-rings. Make certain that one flange of the wear ring(4) is in the o-ring groove, while the opposite flange extends away from the end of piston(2) and toward the center. The wear ring flange **MUST NOT COVER OR OVERLAP EITHER O-RING.** (See Figure 10.)
9. Carefully insert the assembled primary piston(2), valve end first, into the primary valve body until the piston retaining ring groove in the body is visible. Make certain o-rings(3 and 5) and wear rings(4) are not damaged in the process. Do not force the piston. If substantial resistance is encountered, check for proper installation of the wear rings.
10. Install piston retaining ring(1) in its groove in the secondary body, making certain it is fully seated in the groove.
11. Install plunger(21) in its return spring(22). Install the spring and plunger on secondary piston(18). While manually depressing and holding the plunger and spring on the piston, slide plunger and spring retainer(23) into place so that it secures both the plunger and spring to the piston. Make certain the retainer flanges are securely around piston lip and plunger groove.
12. Install o-rings(19 and 20) on secondary piston(18).
13. Install diaphragm retainer(27), diaphragm(26), diaphragm washer(25), and screw(24) in the exhaust port. Torque screw to 15-25 in. lbs. NOTE: Some E-14™ brake valves have threaded exhaust ports instead of items 24-27.
14. Install valve spring(14) in the secondary body, then install valve assembly(13) in the spring.
15. Install o-ring(12) into the o-ring groove of piston(2), then install valve seat(11) on valve assembly(13). Gently depress and hold the valve seat in the secondary body while installing retaining ring(10).

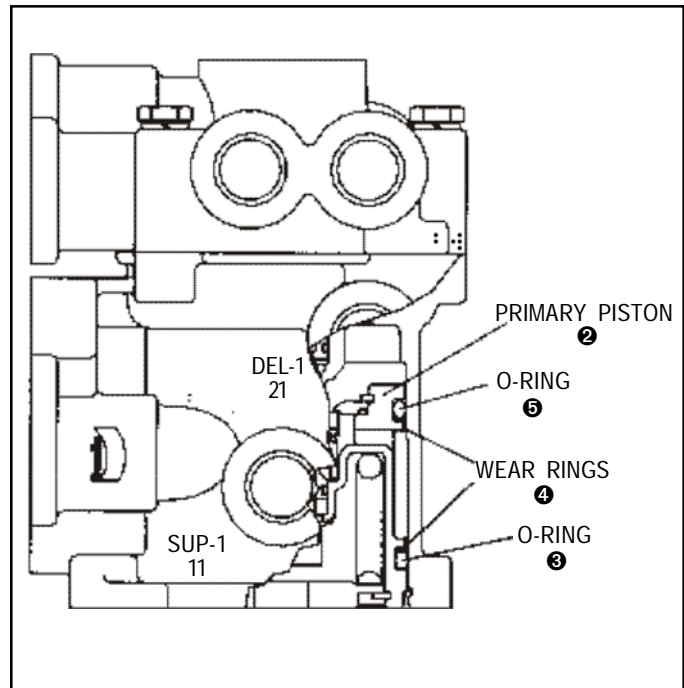


FIGURE 10

16. Install the assembled secondary piston(18) in the primary body, making certain that o-rings(19 and 20) are not damaged.
17. Install o-ring(17) on the secondary body. Join the assembled secondary and primary bodies. Secure the bodies using the four cap screws(16), and torque to 30 to 60 in. lbs.
18. Install the pedal mounting plate on the basic brake valve, noting the relationship marked during VALVE REMOVAL step 2. Secure the mounting plate to the valve using the three cap screws and torque to 80 to 120 in. lbs.
19. If using a manifold-type valve, install the sealing rings and adapter sleeves that connect the valve to the manifold. Install the manifold on the valve, and secure with its bolts. Torque to 80 to 120 in. lbs.
20. Install all air line fittings and plugs, making certain thread sealant material does not enter the valve.

VALVE INSTALLATION

1. Install the assembled brake valve on the vehicle.
2. Reconnect all air lines to the valve using the identification made during VALVE REMOVAL step 1.
3. After installing the brake valve assembly, perform the **"OPERATIONAL & LEAKAGE CHECKS"** before placing the vehicle in service.