

Bendix® LQ-3™ & LQ-4™* Front Axle Ratio Valve

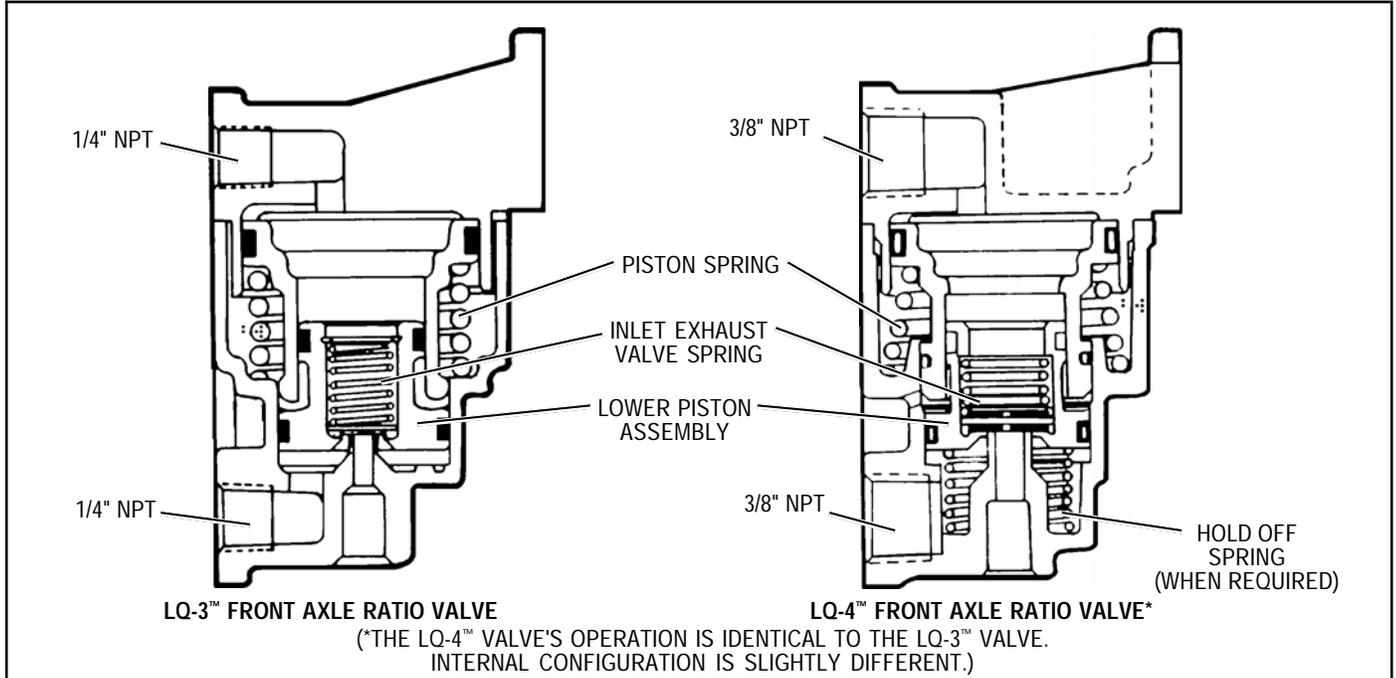


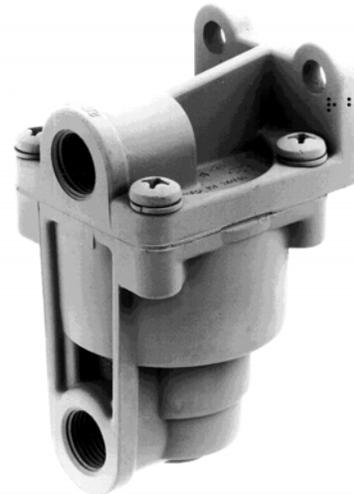
FIGURE 1 - LQ-3™ AND LQ-4™ FRONT AXLE RATIO VALVE FUNCTION AND DESCRIPTION

The LQ-3™ and LQ-4™ front axle ratio valve is used on the front or steering axle of a vehicle to limit the brake application pressure to the actuators during normal service braking. Limiting application pressure reduces the braking effort at the foundation brakes on the steering axle. The supply and delivery ports in both the LQ-3™ and LQ-4™ valves are identified with embossed lettering. The ports in the LQ-3™ valve are 1/4 inch N.P.T. and in the LQ-4™ valve, 3/8 inch N.P.T. The exhaust port is not threaded in either valve. Two mounting holes are provided for 5/16 inch mounting bolts. **Note:** When mounted on the vehicle the exhaust port should be pointed down.

GENERAL OPERATION

The supply port of the LQ-3™ or LQ-4™ valve is connected to the delivery port of the service brake valve. The delivery port of the LQ-3™ valve is connected to the service port of the front axle relay valve or the adaptive braking modulator. The LQ-4™ valve may be used to operate brake chambers up to Type 24 without relay or QRV.

Pressure delivered to the LQ supply port is reduced by 50% as it passes through the valve and out the delivery port. The 50% reduction occurs only when brake application pressure



LQ-3™ FRONT AXLE RATIO VALVE
 EXTERIOR

to the supply port of the LQ is between 0 psi and 40 psi. Brake applications between 40 psi and 60 psi to the LQ supply port are reduced by less than 50% and applications above 60 psi are not reduced at all. An example would be: 65 psi delivered to the supply port results in 65 psi out the LQ delivery port.

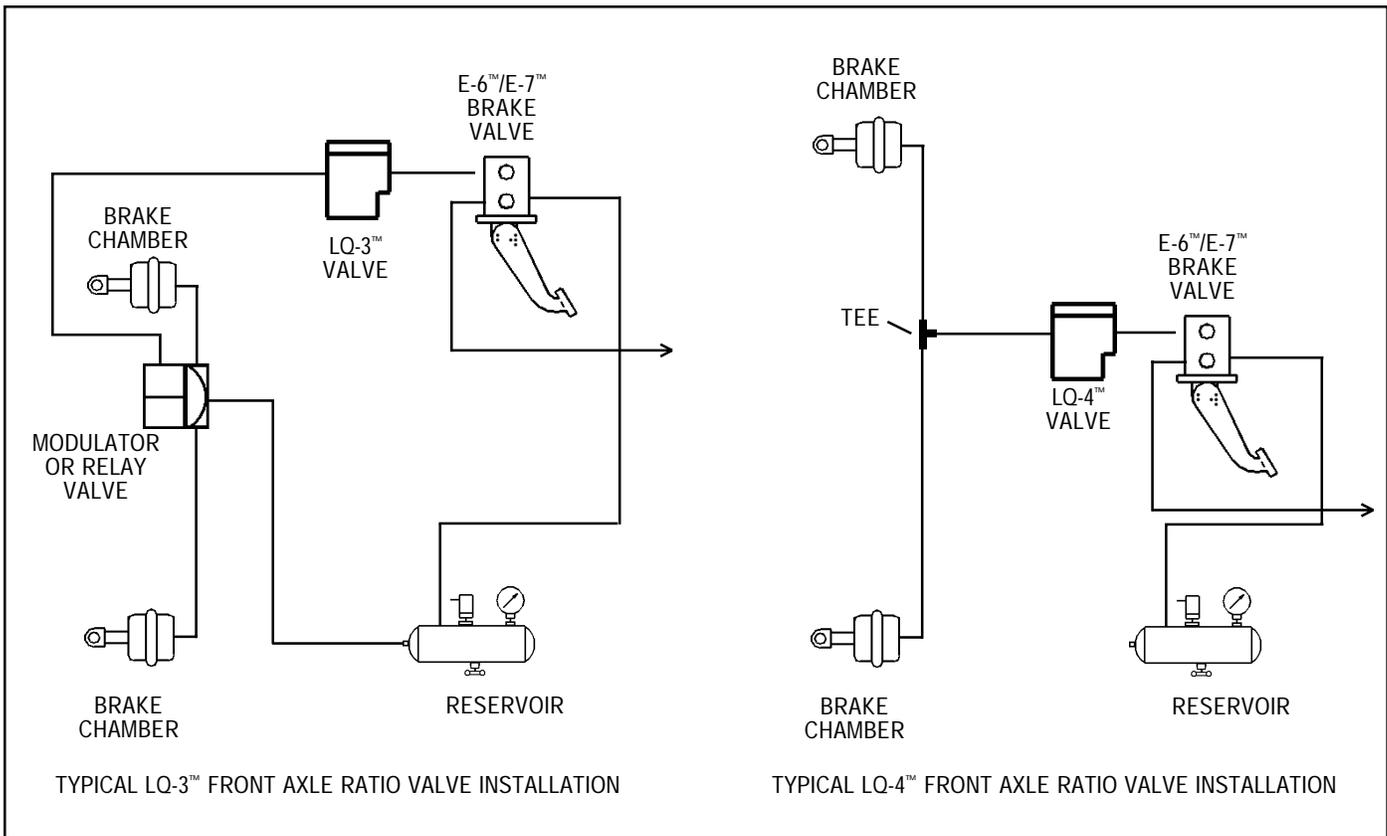


FIGURE 2 - TYPICAL INSTALLATIONS

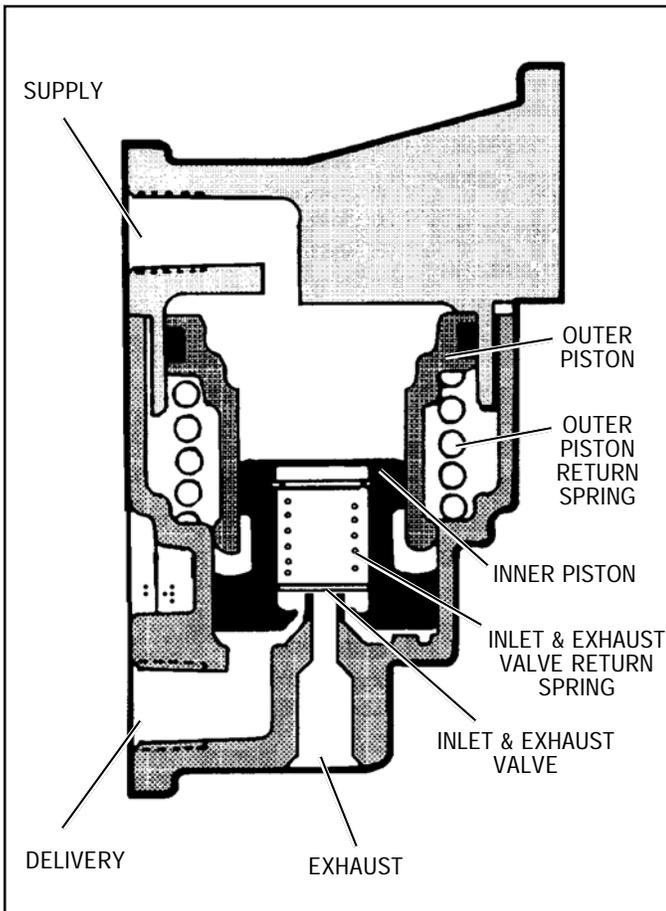


FIGURE 3 - LQ-3™* BRAKE VALVE APPLICATION: 0-40 PSI (*LQ-4™ VALVE OPERATION SAME AS LQ-3™ VALVE.)

Note: The pressures used here are examples only. Both the LQ-3™ and LQ-4™ valves may have been supplied with initial hold-off pressures of either 4 psi or 10 psi and equalization pressures of 60 or 65 psi respectively depending upon the vehicle installation and manufacturer's specification. The LQ-3™ valve hold-off pressure depends on the inlet-exhaust valve spring installed. The LQ-4™ valve by whether or not a hold-off spring is installed under the lower piston.

OPERATION — BRAKE APPLICATION OF 40 PSI OR LESS

When a service brake application of less than 40 psi is made, application air enters the LQ valve supply port and exerts a force over the surfaces of the outer and inner pistons. Because of the spring force beneath the outer piston, only the inner piston moves. The initial delivery of air from the brake valve forces the inner piston all the way down as shown in Figure 3. Delivery pressure builds up under the inner piston as shown in Figure 4 and as explained under *Operation — Balanced*.

OPERATION — BALANCED

Air pressure present at the delivery port of the LQ-3™ or LQ-4™ valve is also present beneath the inner piston. When the air pressure acting on the underside of the inner piston is approximately half of the brake valve delivered pressure, the piston lifts, closing the inlet. The exhaust remains closed. (See Figure 4.)

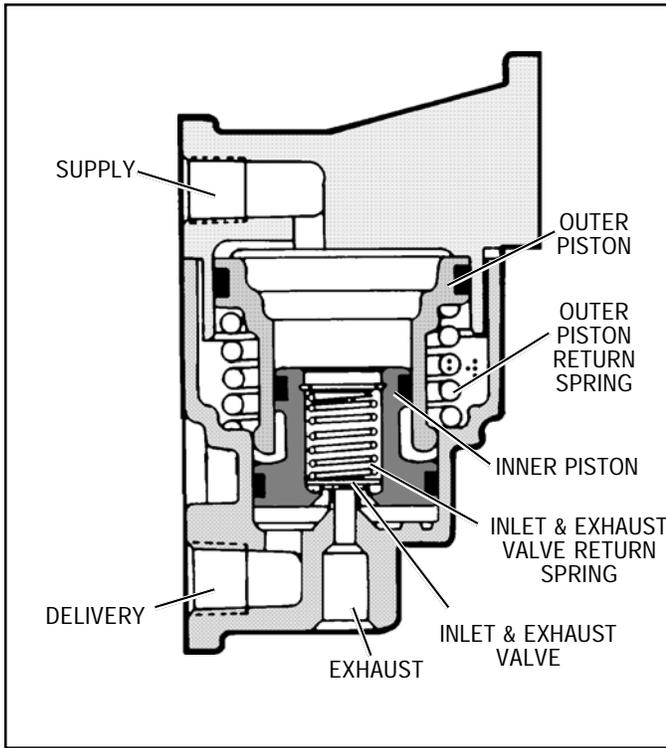


FIGURE 4 - LQ-3™ FRONT AXLE RATIO VALVE* BALANCED BRAKE VALVE APPLICATION AT 40 PSI OR LESS. (*LQ-4™ VALVE OPERATION SAME AS LQ-3™ VALVE.)

Note: The top surface of the inner piston has approximately one half of the area of the lower surface of the inner piston. Air pressure acting on the top surface of the inner piston exerts a force one half as great as the same air pressure acting on the lower surface. Therefore, to balance the piston, (both inlet and exhaust closed) the pressure beneath the inner piston may be 1/2 that above it. An example would be: 30 psi delivered to the supply port and acting on the top surface of the inner piston would result in approximately 15 psi at the delivery port and acting on the lower surface.

OPERATION — EXHAUST

When the service brake application is released, the air above the inner piston of the LQ valve returns to the brake valve and is exhausted. The air pressure at the delivery port of the LQ valve acts on the underside of the inner piston and lifts it, which unseats the exhaust valve. (See Figure 5.) The delivery volume air exhausts both through the brake valve and out the exhaust port.

OPERATION — SERVICE BRAKE APPLICATION 40 PSI OR GREATER

When a service brake application of greater than 40 psi is made, air entering the supply port forces the outer piston into contact with the inner piston against the resistance of the outer piston return spring. Both the outer and inner pistons now move as one. Because of the added surface area of the outer piston, delivery pressure from the LQ valve will

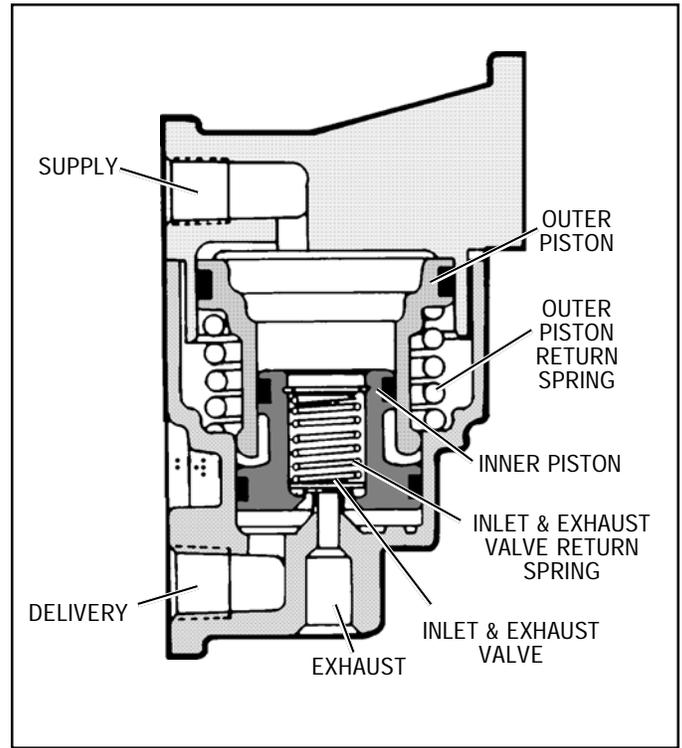


FIGURE 5 - LQ-3™ FRONT AXLE RATIO VALVE* EXHAUST. (*LQ-4™ VALVE OPERATION SAME AS LQ-3™ VALVE.)

“catch up” at the rate of 2:1 as supply pressure increases from 40-60 psi. An example would be: a brake application of 50 psi would result in delivery pressure of 40 psi. For service applications of 60 psi or greater the LQ valve does not reduce delivery pressure. (See Figure 6.)

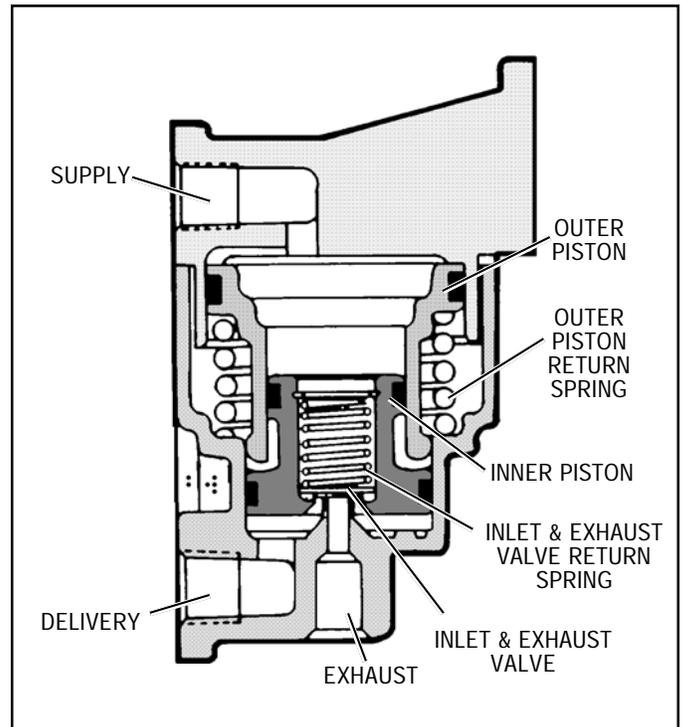


FIGURE 6 - LQ-3™ FRONT AXLE RATIO VALVE* BRAKE VALVE APPLICATION AT 60 PSI OR GREATER. (*LQ-4™ VALVE OPERATION SAME AS LQ-3™ VALVE.)

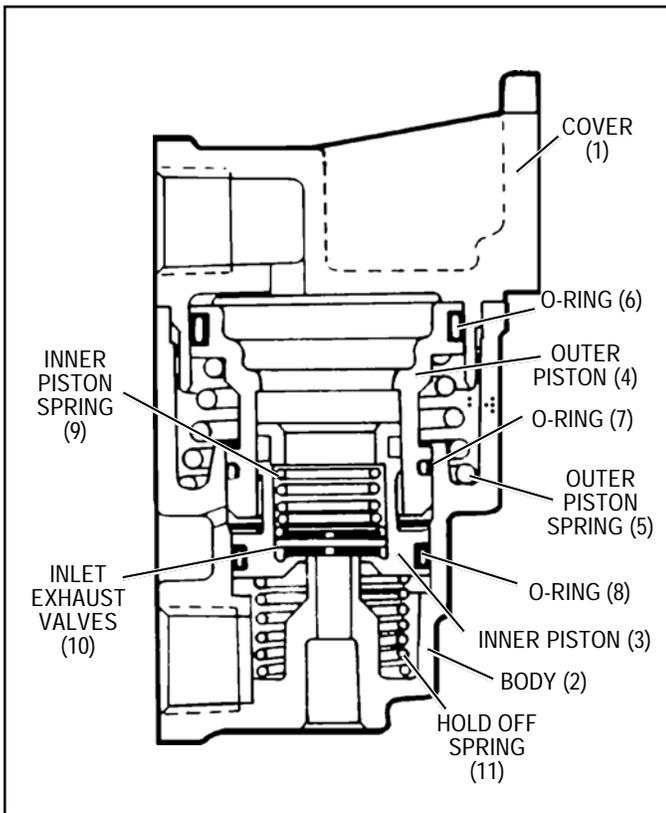


FIGURE 7 - LQ-4™ FRONT AXLE RATIO VALVE

PREVENTIVE MAINTENANCE

Important: Review the Bendix Warranty Policy before performing any intrusive maintenance procedures. A warranty may be voided if intrusive maintenance is performed during the warranty period.

No two vehicles operate under identical conditions, as a result, maintenance intervals may vary. Experience is a valuable guide in determining the best maintenance interval for air brake system components. At a minimum, the valve should be inspected every 6 months or 1500 operating hours, whichever comes first, for proper operation. Should the valve not meet the elements of the operational tests noted in this document, further investigation and service of the valve may be required.

SERVICE CHECKS

OPERATIONAL CHECKS

1. Install a test gauge or gauge of known accuracy in the supply and delivery lines of the LQ valve.
2. Build system air pressure to governor cut-out, turn off engine and apply parking brakes.
3. While making a slowly increasing service brake application, note that the pressure registered on the gauge installed in the delivery line from the LQ valve is approximately half the pressure registered on the gauge in the

supply line. The 50% reduction will occur while supply line pressure is between 0 and 40 psi.

4. When the supply line pressure exceeds 40 psi, but is below 60 psi, observe that the delivery line pressure is no longer one half and that the delivery line pressure is "catching up" to supply pressure.
5. When supply pressure exceeds 60 psi note that the delivery line pressure is approximately equal.

Note: The pressures stated here are examples only. Various piece numbers of the LQ valves may have different pressure settings. For information on a specific installation, consult the vehicle handbook.

LEAKAGE CHECKS

Make and hold a service brake application. Apply a soap solution to the exhaust port and around the seam between the cover and the body. Leakage equivalent to a 1" bubble in 5 seconds is permissible.

If the LQ valve does not function as described above or leakage is excessive, it is recommended that it be returned to the nearest Bendix authorized outlet for a factory remanufactured valve under the Exchange Plan. If this is not possible, the valve can be repaired with genuine Bendix parts, in which case the following should prove helpful.

Note: Maintenance kits for the LQ-3™ and LQ-4™ front axle ratio valves are available from any authorized Bendix outlet.

REMOVAL

Apply the vehicle parking brakes. Identify and disconnect the supply and delivery lines of the LQ valve. Remove the two mounting bolts securing the LQ valve to the vehicle.

DISASSEMBLY

1. Prior to removing the four Phillips head screws and their lockwashers which secure the cover to the body, mark the relationship between the cover and the body.
2. Carefully separate the cover (1) (Figure 7) from the body (2) and remove the inner (3) and outer pistons (4). (The cover is under approximately 30 pound load from the outer piston spring.)
3. Remove the outer piston spring (5).
4. Separate the inner and outer pistons.
5. Remove the o-ring (6) from the outer piston.
6. Remove the large (8) and small (7) diameter o-ring from the inner piston.
7. (LQ-4™ valve) Remove the inlet exhaust valve spring (9) and inlet exhaust valve (10) from the inner piston. Remove the hold-off spring (11) if present
8. (LQ-3™ valve — Figure 8) Remove the retaining ring (1), washer (2), inlet exhaust valve spring (3), and inlet exhaust valve (4).

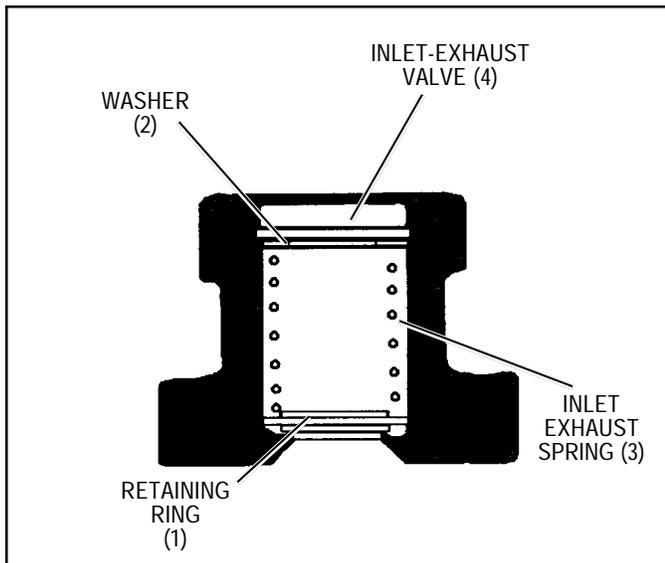


FIGURE 8 - LQ-3™ FRONT AXLE RATIO VALVE INNER PISTON ASSEMBLY

CLEANING AND INSPECTION

1. Wash all metal parts in mineral spirits and dry them.
2. Inspect all parts for excessive wear or deterioration.
3. Inspect the valve seat for nicks or burrs.
4. Check the spring for cracks or corrosion.
5. Replace all rubber parts and any part not found to be serviceable during inspection, using only genuine Bendix replacement parts.

ASSEMBLY

Prior to reassembling the LQ front axle ratio valve, lubricate all o-rings, o-ring grooves, piston bores and metal moving surfaces with Bendix silicone lubricant piece number 291126 (Dow Corning 650-M).

1. (LQ-3™ valve — Figure 8) Place the inlet and exhaust valve (4), valve spring (3), and washer (2) in the inner piston. Install the retaining ring (1) in the piston, making certain it is completely seated in its groove.
(LQ-4™ valve — Figure 7) Place the inlet and exhaust valve (10) and spring (9) in the inner piston (3). The spring must be carefully located under the shoulder in the inner piston.
2. Install the large (8) and small (7) diameter o-rings in their grooves on the inner piston.
3. Install the o-ring (6) on the outer piston.
4. Insert the inner piston into the bore of the outer piston.
Note: See Figure 7 for proper inner and outer piston configuration after assembly.
5. Place the outer piston spring (5) in the valve body and the hold-off spring (11) if used.
6. Install the inner and outer piston assembly in the body through the spring (see Figure 7).

7. Place the cover over the body in the proper position, as marked in Step 1 of the *Disassembly* procedure.
8. Using the four Phillips head screws and lockwashers, secure the cover to the body. Torque the screws to 50-80 inch pounds.

TESTING THE REBUILT LQ-3™ AND LQ-4™ FRONT AXLE RATIO VALVE

Test the rebuilt LQ-3™ or LQ-4™ front axle ratio valve by performing the operational and leakage tests outlined in the Service Checks section of this manual.

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.**

