

Installation Instructions



BENDIX® BP-R1® & AR-2™ VALVE MAINTENANCE KIT

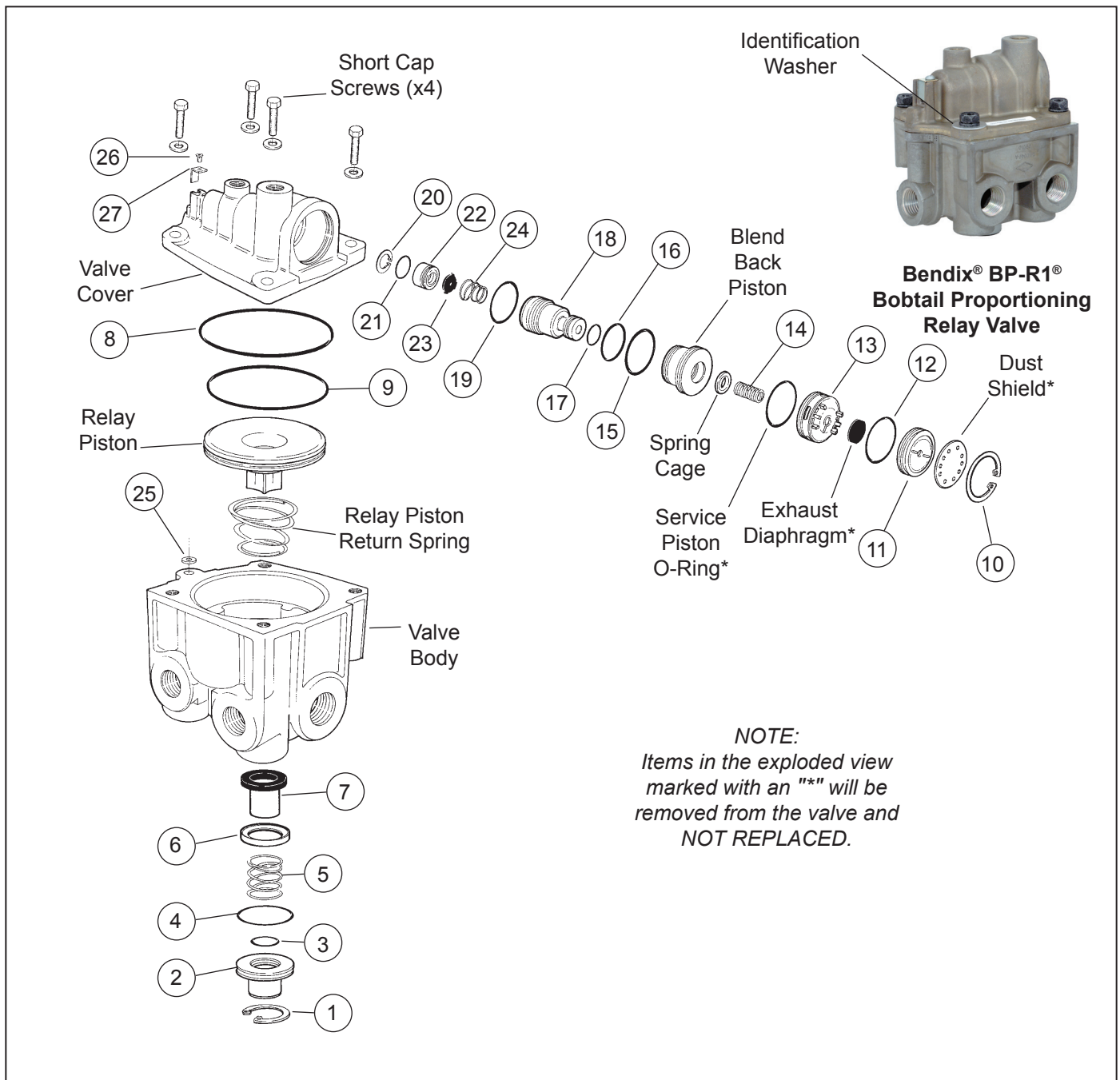


Figure 1 – Bendix® BP-R1® Bobtail Proportioning Relay Valve

IMPORTANT NOTICE ON USE OF THIS KIT:

This kit is intended to service both the Bendix® BP-R1® Bobtail Proportioning Relay valve (Figure 1) and the Bendix® AR-2™ Antilock Relay valve (Figure 2). The current production version of both valves contain redesigned components in the proportioning valve section. OLDER VERSIONS OF EITHER VALVE WILL BE UPGRADED TO THE CURRENT LEVEL BY INSTALLING THIS KIT. **ALL** OLD REVISION PARTS **MUST BE DISCARDED** AND REPLACED BY THE COMPONENTS CONTAINED IN THIS KIT. Components contained in the older version valves will not be replaced.

GENERAL SAFETY GUIDELINES



WARNING! PLEASE READ AND FOLLOW THESE INSTRUCTIONS



TO AVOID PERSONAL INJURY OR DEATH:

When working on or around a vehicle, the following guidelines should be observed **AT ALL TIMES**:

- ▲ Park the vehicle on a level surface, apply the parking brakes and always block the wheels. Always wear personal protection equipment.
- ▲ Stop the engine and remove the 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.
- ▲ 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.
- ▲ 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 a Bendix® AD-IS® air dryer system, a Bendix® DRM™ dryer reservoir module, or a Bendix® AD-9si® air dryer, be sure to drain the purge reservoir.
- ▲ Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that safely removes all electrical power from the vehicle.
- ▲ Never exceed manufacturer's recommended pressures.
- ▲ You should consult the vehicle manufacturer's operating and service manuals, and any related literature, in conjunction with the Guidelines above.
- ▲ Never connect or disconnect a hose or line containing pressure; it may whip and/or cause hazardous airborne dust and dirt particles. Wear eye protection. Slowly open connections with care, and verify that no pressure is present. Never remove a component or plug unless you are certain all system pressure has been depleted.
- ▲ Use only genuine Bendix® brand replacement parts, components and kits. Replacement hardware, tubing, hose, fittings, wiring, etc. must be of equivalent size, type and strength as original equipment and be designed specifically for such applications and systems.
- ▲ 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.
- ▲ Prior to returning the vehicle to service, make certain all components and systems are restored to their proper operating condition.
- ▲ For vehicles with Automatic Traction Control (ATC), the ATC function must be disabled (ATC indicator lamp should be ON) prior to performing any vehicle maintenance where one or more wheels on a drive axle are lifted off the ground and moving.
- ▲ The power **MUST** be temporarily disconnected from the radar sensor whenever any tests **USING A DYNAMOMETER** are conducted on a vehicle equipped with a Bendix® Wingman® system.

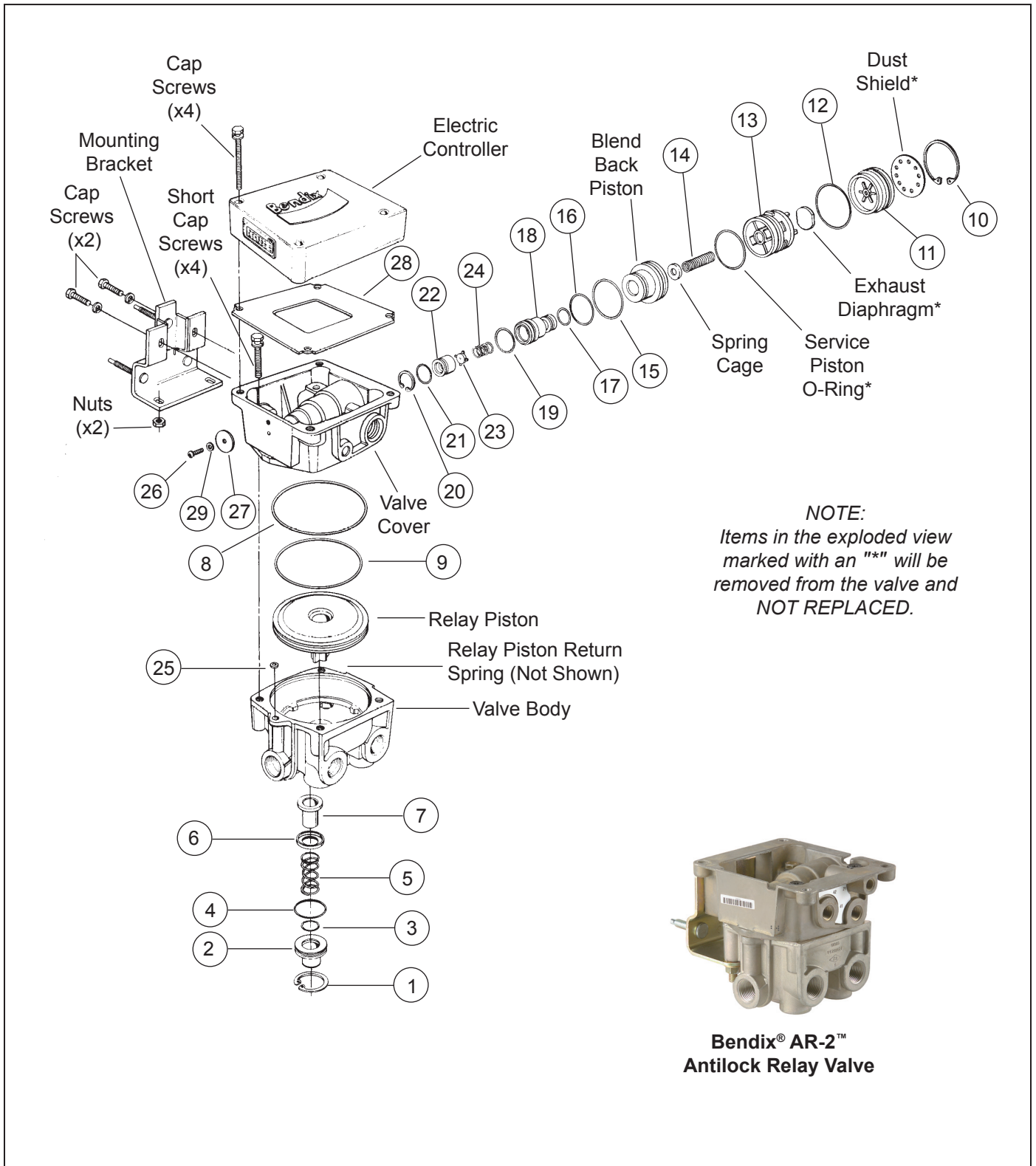


Figure 2 – Bendix® AR-2™ Antilock Relay Valve

IMPORTANT NOTICE ON USE OF THIS KIT:

This kit is intended to service both the Bendix® BP-R1® Bobtail Proportioning Relay valve (Figure 1) and the Bendix® AR-2™ Antilock Relay valve (Figure 2). The current production version of both valves contain redesigned components in the proportioning valve section. OLDER VERSIONS OF EITHER VALVE WILL BE UPGRADED TO THE CURRENT LEVEL BY INSTALLING THIS KIT. **ALL** OLD REVISION PARTS **MUST BE DISCARDED** AND REPLACED BY THE COMPONENTS CONTAINED IN THIS KIT. Components contained in the older version valves will not be replaced.

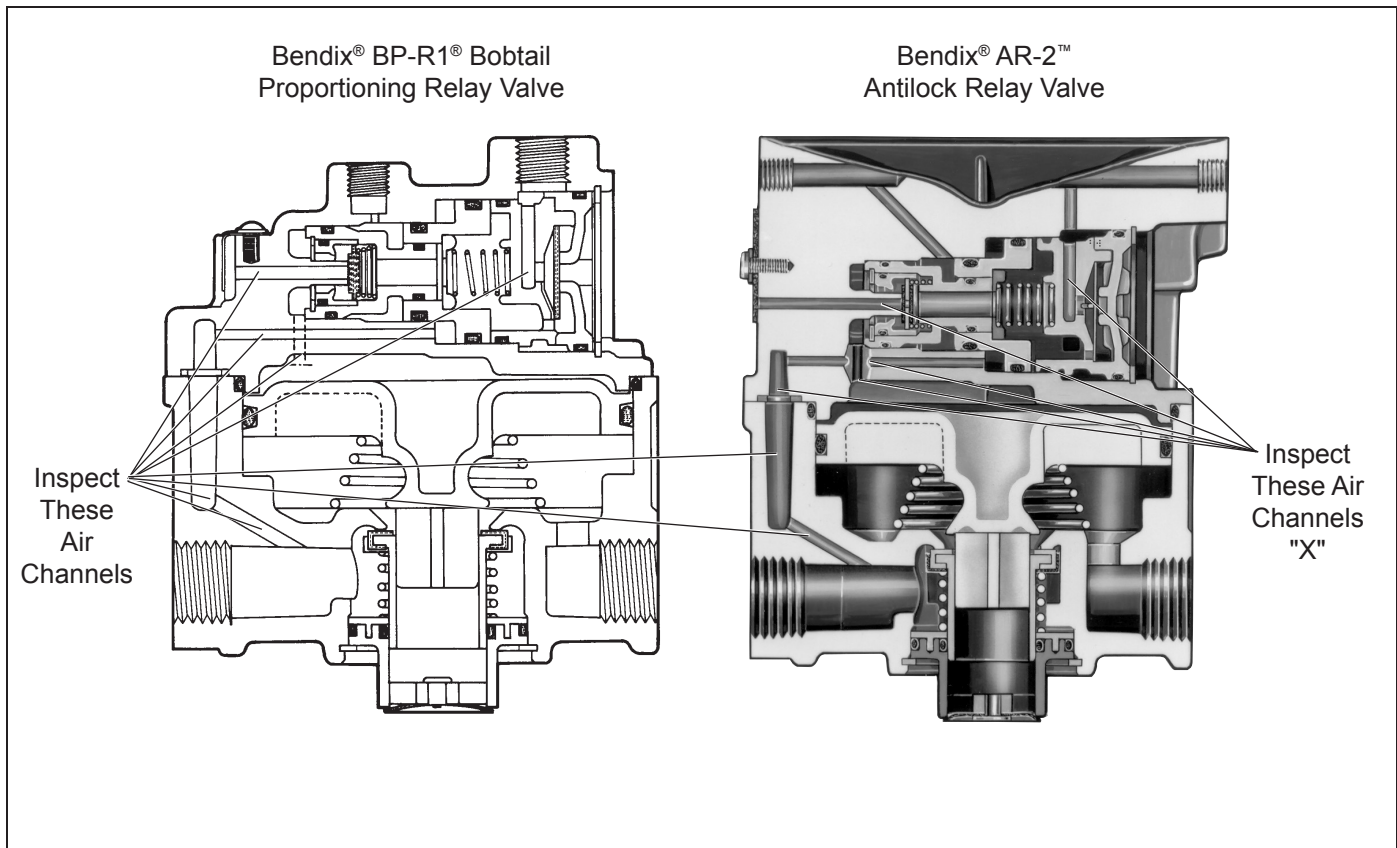


Figure 3 – Sectional View

Kit Contents		
Item No.	Description	Qty.
1	Retaining Ring	1
2	Exhaust Cover	1
3	O-Ring	1
4	O-Ring	1
5	Valve Spring	1
6	Valve Retainer	1
7	Inlet & Exhaust Valve	1
8	O-Ring	1
9	O-Ring	1
10	Retaining Ring	1
11	Exhaust Piston	1
12	O-Ring	1
13	Service Piston	1
14	Spring	1
15	O-Ring	1
16	O-Ring	1
17	O-Ring	1
18	Proportioning Piston	1
19	O-Ring	1
20	Retaining Ring	1
21	O-Ring	1

Kit Contents		
Item No.	Description	Qty.
22	Inlet Valve Seat	1
23	Valve	1
24	Spring	1
25	Sealing Ring	1
26	Exhaust Cover Screw	1
27	Exhaust Cover (BP-R1)	1
27	Exhaust Cover (AR-2)	1
28	Gasket	1
29	Plain Washer (AR-2)	1
—	Lubricant	2

VEHICLE PREPARATION

1. Park the vehicle on a level surface and block the wheels and/or hold the vehicle by means other than the air brakes.
2. Drain the air pressure from all vehicle reservoirs.

VALVE REMOVAL

1. Identify and mark or label all air lines and their respective connections on the valve to facilitate ease of installation. Where applicable, identify and mark or label all electrical wiring harnesses.
2. Disconnect the air lines and wire harnesses.
3. Remove the valve assembly from the vehicle.

PREPARATION FOR DISASSEMBLY

1. Remove all air fittings and plugs from the valve.
2. Mark the relationship of the valve cover to the body and, if the valve is equipped with a mounting bracket, mark the relationship of the bracket to the cover and body.
3. When working with the Bendix® AR-2™ valve (see *Figure 2*), mark the relationship of the electronic controller to the cover.

DISASSEMBLY



The valve may be lightly clamped in a bench vise during disassembly, however over clamping will result in damage to the valve and result in leakage and/or malfunction. If a vise is to be used, position the valve so that the jaws bear on the supply ports on opposing sides of the valve body.

1. While holding the exhaust cover (2), remove and discard the retaining ring (1) that secures it to the body.
2. Remove and discard the exhaust cover (2) along with both o-rings (3 & 4).
3. Remove and discard the valve spring (5), valve retainer (6), and the valve assembly (7) from the body.
4. If the valve being serviced is a Bendix® BP-R1® valve (see *Figure 1*) skip to step 6. Referring to *Figure 2*, remove and retain the two long cap screws and nuts and two short cap screws without nuts that secure the electronic controller to the cover, then separate and retain the controller, and gasket (28) from the cover.
5. Remove and retain the two cap screws and lock washers that secure the bracket to the cover, then remove and retain the bracket.
6. Remove and retain the four cap screws that secure the cover to the body.
7. Separate the cover from the body, then remove and discard the sealing ring (25) and o-ring (8).
8. Remove and retain the relay piston and relay piston spring from the body. *NOTE: The relay piston spring is not used in all valves.*
9. Remove and discard the o-ring (9) from the relay piston.
10. Remove and discard the retaining ring, dust shield, if fitted, exhaust piston (11) with o-ring (12) and the exhaust diaphragm, if fitted, from the valve cover.



All components removed and discarded in this step, with the exception of the retaining ring (10) are involved in the upgrade or maintenance procedure. It is extremely important that all components are discarded and replaced with the components contained in this kit. DUST SHIELD, AND EXHAUST DIAPHRAGM, IF PRESENT, WILL NOT BE REPLACED AND MUST NOT BE REUSED.

11. Remove and discard the service piston (13) and service piston o-ring from the valve cover.



The components removed and discarded in this step are involved in the upgrade. The service piston (13) contained in this kit has been redesigned and no longer requires an o-ring.

12. Remove and discard the spring (14) then remove and retain the spring cage from the valve cover.
13. Use shop air at the control port to extract the blend back piston from the valve cover. Retain the piston but remove and discard both o-rings (15 & 16).
14. **Remove and discard the entire, assembled proportioning piston (18) from the valve cover.** *NOTE: Removal of the proportioning piston is made easier if shop air is applied to the "inside air passage" of the cover as shown in *Figure 3* point "X".*
The assembled proportioning piston consists of o-rings (17) (19) (21), inlet valve and spring (23) (24), inlet seat (21) and retaining ring (20).
15. Remove and discard the exhaust cover screw (26) and the exhaust cover (27). *NOTE: If servicing the AR-2 valve (see *Figure 2*), remove and discard the plain washer (29).*

CLEANING & INSPECTION

1. Using mineral spirits or an equivalent solvent, clean and thoroughly dry all metal parts. Do not damage bores with metal tools.
2. Wash all **retained**, non-metallic components (relay piston, spring cage, blend back piston) in a soap and water solution making certain to rinse and dry thoroughly.
3. Inspect the interior and exterior of all metal parts that will be reused for severe corrosion, pitting, and cracks. Superficial corrosion and/or pitting, on the exterior portion of the body and cover is acceptable. Replace the entire valve if the interior of the body or cover exhibit signs of corrosion or pitting.
4. Inspect each non-metallic component for cracks, wear, or distortion. Replace the entire valve if these conditions are found.
5. Inspect the bores of both the body and cover for deep scuffing or gouges. Replace the entire valve if either are found.
6. Make certain the air channel running between the top surface of the body and its supply port is clear and free of obstruction.
7. Make certain all air channels and exhaust passages in the valve cover are clear and free of obstruction. Make sure the .060" hole in the control port is open.
8. Inspect the pipe threads in the body and valve cover. Make certain they are clean and free of thread sealant.
9. If the valve was equipped with a relay piston spring, inspect it for signs of corrosion, pitting, and cracks. Replace as necessary.

10. Inspect all air line fittings for corrosion and replace as necessary. Make certain to remove all old thread sealant before reuse.

ASSEMBLY

1. Prior to assembly, lubricate all o-rings (see *Figure 4*), seals, and pistons, as well as body and cover bores, using the lubricant provided with this kit. Use all of the lubricant and spread it evenly on the rubbing surfaces.
2. Install the new o-ring (21) on the new inlet valve seat (22).
3. Install the small end of the new inlet/exhaust valve spring (24) over the rubber of the new valve (23) making sure the spring coils rest on the valves four tabs.
4. Insert the spring and valve into the new valve seat (22), making sure the four tabs are within the seat's bore.
5. Insert the valve, seat, and spring assembly into the new proportioning piston (18) and while holding the seat (22) in place, install the new retaining ring (20) to secure it in the piston (18). Make certain the retaining ring is fully seated in its groove. Make sure the valve is straight, against the exhaust seat, and free to move.
6. Install both of the new, large and small diameter o-rings (17 & 19) on the proportioning piston (18).

O-Ring Identification

Item No.	I.D.	O.D.	W
3	.8620	1.068	.103
4	1.424	1.630	.103
8	3.487	3.693	.103
9	3.234	3.512	.139
12	1.356	1.496	.070
15	1.112	1.318	.103
16	.7370	.9430	.103
17	.4120	.5520	.070
19	.7390	.8790	.070
21	.4890	.6290	.070

Figure 4

7. Install both of the new, large and small diameter o-rings (16 & 17) on the old blend back piston, then insert the small diameter of the proportioning piston (18) into the small diameter end of the blend back piston.
8. Carefully insert the assembled proportioning and blend back (18) pistons into the bore in the cover (2). Do not cut or pinch the o-rings.
9. With the bore of the cover facing up, install the old spring cage in the blend back piston so that its flat

side rests against the blend back piston. The concave side of the spring cage should face toward the spring (14) which is installed next.

10. Install the new spring (14) in the cage so that its coils are within the I.D. of the cage.
11. Install the new o-ring (12) on the new exhaust piston (11) then place the exhaust piston on the new service piston, with its six-ribbed side facing the service piston. Install both pistons, while pushing the proportioning (18) and blend back pistons all the way into the cover at the same time.

! IMPORTANT

THE NEW SERVICE PISTON (13), CONTAINED IN THIS KIT DOES NOT REQUIRE AN O-RING AND NO EXHAUST DIAPHRAGM IS INSTALLED BETWEEN THE NEW SERVICE AND THE NEW EXHAUST PISTONS (13 & 11).

12. While holding the exhaust piston (11) in the cover, install the new retaining ring (10), making certain it is fully seated in its groove.

! IMPORTANT

THE OLD EXHAUST SHIELD IS NOT USED WITH THE NEW EXHAUST PISTON (11) CONTAINED IN THIS KIT.

13. Install the new exhaust cover (27) using the new screw (26) to retain it. Torque the screw to 8 to 15 in-lbs. If the valve being serviced is the Bendix® AR-2™ (see *Figure 2*), install the new plain washer (29) on the new screw (26), then insert both through the new exhaust cover and secure both to the cover. Torque the screw to 8 to 15 in-lbs. *NOTE: The exhaust cover (27) is an angular metal piece for the Bendix® BP-R1® valve (see Figure 1) and is a round rubber piece for the AR-2 valve (see Figure 2). Discard whichever unit is not used.*
14. Install the valve retainer (6) on the inlet and exhaust valve (7) so that the flange of the retainer (6) surrounds the rubber portion of the valve. Install the inlet and exhaust valve in the body.
15. Install the inlet and exhaust valve return spring (5) in the body.
16. Install the large and small diameter o-rings (3 & 4) in the exhaust cover (2), then install the exhaust cover in the body, taking care not to damage the o-rings. Hold the exhaust cover in place.
17. While depressing the exhaust cover (2), install the retaining ring (1) in the body. Make certain the retainer (6) is fully seated in its groove in the body.
18. If the valve (BP-R1 or AR-2) was equipped with a relay piston return spring, install the spring in the body, large diameter first.
19. Using lubricant to hold them in place, install the large and small sealing rings (8 & 25) on the cover.
20. Install the o-ring (9) on the relay piston, then install the piston in the body.

21. If the valve being serviced is a Bendix® BP-R1® valve, skip to step 24. Note the relationship marks made prior to disassembly, then install the cover on the body. Secure the cover on the body using the two, short cap screws. Again, noting the relationship marks, secure the bracket on the cover and body and using the two long cap screws and two nuts. Torque the four cap screws to 120-150 in-lbs.
 22. Install the two cap screws that secure the bracket to the cover and torque to 180-220 in-lbs.
 23. Install the new gasket (28) on the electronic controller, then noting the relationships marks made during disassembly, secure the controller to the cover using the four cap screws. Torque the four cap screws to 120-150 in-lbs. Proceed to step 25.
 24. After noting the relationship marks made prior to disassembly, install the mounting bracket on the cover then secure the cover and mounting bracket on the body using the four cap screws. Torque the cap screws to 120-150 in-lbs.
 25. Install all air line fittings and plugs making certain thread sealing material does not enter the valve.
4. With the trailer supply valve (dash control w/red octagon shaped button) and system park control (dash control with yellow diamond button) activated for tractor/trailer operation, apply, hold, then release the brakes several times varying the application pressures while watching the reaction of the gauges installed on the BP-R1 or AR-2 valve. Note that a prompt application occurs and that it can be held then promptly released.
 5. Check the BP-R1 or AR-2 valve differential pressure by applying 10 psi to the service port and noting the pressure registered at the delivery port. Subtract delivery port pressure from the 10 psi service pressure to obtain the differential. Compare the measured differential with the pressure specified for the valve part number (see the identification washer for the differential). NOTE: For BP-R1 or AR-2 valves not incorporating a relay piston return spring, the measured differential should be approximately 4 psi. When a spring is in use, the differential will be higher.
 6. Make and hold a full (100 psi or greater) brake application and note that full pressure is delivered to the chambers.
 7. Activate the dash mounted trailer supply valve for bobtail tractor operation. Then make a slow brake application, increasing the pressure at the valves' service port to 20 psi while watching the reaction at the delivery port gauge. Note that delivery pressure rises to approximately 5 to 10 psi and remains constant while service pressure continues to rise to 20 psi. Release the application.
 8. Make another brake application and slowly increase the pressure at the valves' service port to between 60 and 70 psi while observing the gauge installed at the delivery port. Note that when service port pressure rises to between 20 and 30 psi, delivery pressure begins to rise above the initial pressure noted in step 6. The rise of delivery pressure should be at a proportioned rate of approximately 3 to 1. At 70 psi service pressure, delivered pressure should be 15 to 25 psi.
 9. Make a full brake application and note that both test gauges register the same pressure.

VALVE INSTALLATION

1. Install the assembled 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 valve, perform the "OPERATION & LEAKAGE TESTS" before placing the vehicle in service.

OPERATION & LEAKAGE TESTS

GENERAL

A change in vehicle braking characteristics or a low pressure warning may indicate a malfunction in one or the other brake circuit. Although the vehicle 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. Always check the vehicle brake system for proper operation after performing brake work and before returning the vehicle to service.

To properly test the function of the BP-R1 or Bendix® AR-2™ valve, a pair of test gauges or gauges of known accuracy must be used.

OPERATION CHECK

1. Drain air pressure from all vehicle reservoirs.
2. Install a "tee" at the BP-R1 Valve or AR-2 Valve service port and at one of the delivery ports, then install a gauge in each.
3. Connect the tractor service and emergency "glad hands" (hose couplings) to hose couplings that have been plugged, or alternatively, to a trailer. Build the tractor system air pressure to governor cut-out and make 4 to 5 full brake applications. Check the air fittings at the BP-R1 or AR-2 valve for leakage. Tighten as needed.



- If during testing, the service port pressure is SLOWLY increased from approximately 70 psi to a full (100 psi or greater) brake application, the AR-2 valve MAY begin to cycle between an apply and exhaust mode. This condition is normal while the BP-R1 or AR-2 valve is transitioning from the proportioning mode to the full delivery mode and will only occur if the service application is SLOWLY increased as described. Cycling will not occur or can be stopped by increasing or decreasing the service port pressure.
10. Drain air pressure from all vehicle reservoirs and remove the test gauges from the BP-R1 or AR-2 valve.

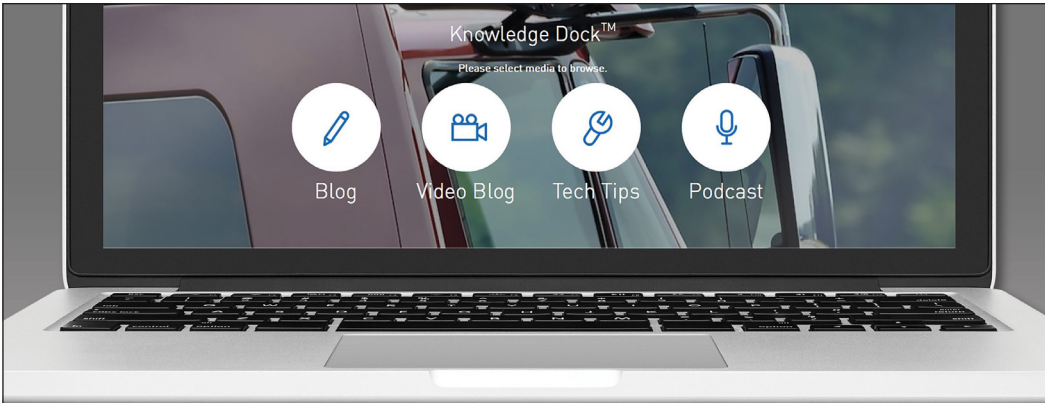
LEAKAGE CHECK

1. Build the air system pressure to governor cut-out. With the dash mounted trailer supply valve activated for tractor/trailer operation, apply a soap solution to both exhaust ports (one in cover and one in body). The leakage noted should not exceed a one inch bubble in less than three seconds at any exhaust port.
2. Make and hold a full brake application and apply a soap solution to both exhaust ports and around the cover where it joins the body. The leakage noted should not exceed a one inch bubble in less than three seconds at any exhaust port.

If the Bendix® BP-R1® or Bendix® AR-2™ valve fails to function as described, or leakage is excessive, it should be replaced with a new or genuine Bendix remanufactured unit, available at any authorized parts outlet.

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