Bendix® ATR-1DC™ AntiLock Traction Relay Valve

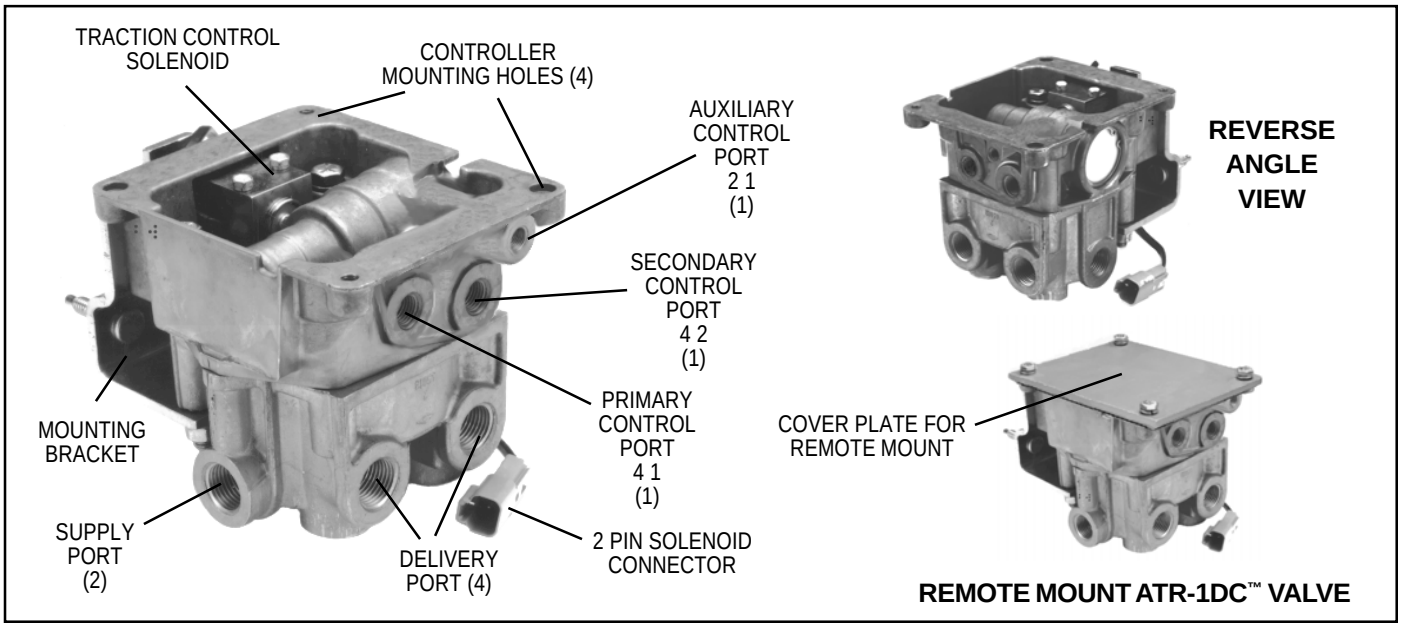


*FIGURE 1 - **ATR-1DC™ ANTILOCK TRACTION RELAY VALVE***

DESCRIPTION

The ATR-1DC™ antilock traction relay valve is a specialized air brake valve developed for use on Bendix antilock/traction equipped vehicles. The ATR-1DC™ valve can be used on straight trucks, buses and tractors. Although this valve, in combination with the appropriate controller, can be used in any Bendix antilock traction equipped brake system, it was developed for use in systems that were built to comply with Federal regulations effective 3/1/98.

It is a combination of four separate valves working in a single housing. A Bendix® R-14™ service relay is the base valve, fitted with a modified cover containing two double check valves and a traction control solenoid. In addition, the ATR-1DC™ valve also incorporates a relay piston drain, which continually allows system contamination to be drained from the relay exhaust port. (Refer to Service Data Sheet for more information.)

The ATR-1DC™ valve contains both air and electric components to provide the service braking and traction control (differential braking) functions. The traction function of the ATR-1DC™ valve is enhanced to allow coordination with the air suspension system of a 6x2 vehicle.

A Bendix antilock traction controller, such as the EC-16™ or EC-17™, can be mounted to the ATR-1DC™ valve or a cover plate can be installed and the antilock controller mounted elsewhere on the vehicle. When an ATR-1DC™ valve is combined with an antilock traction controller the resulting assembly is referred to as a antilock traction assembly or AT-1DC™.

The ATR-1DC™ valve replaces the standard relay valve used to control the rear axle service brakes and performs the standard relay function. Like the standard relay valve it replaces, the ATR-1DC™ valve (sometimes with attached antilock controller) is normally mounted near the service brakes it serves. A mounting bracket, furnished with the valve, permits either frame or cross member mounting. All air connections on the ATR-1DC™ valve are identified with cast, embossed letters for ease of identification and installation. The letter identification and air line connections are shown below for reference.

EMBOSSED ATR-1DC AIR CONNECTION	IDENT.
Supply (to reservoir)	SUP
Delivery (to brake Chamber)	DEL
Primary Control (to brake valve rear delivery)	4 1
Secondary Control (to brake valve front delivery)	4 2
Optional Auxiliary (connected to air suspension control)	2 1

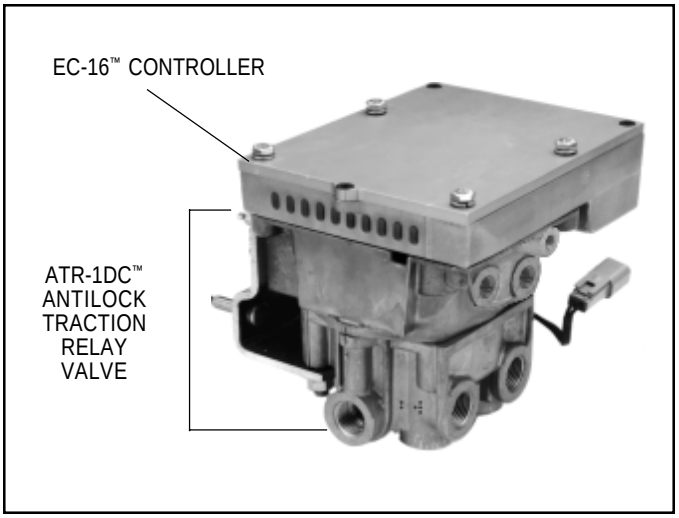


*FIGURE 2 - **TYPICAL AT-1DC™ ANTILOCK TRACTION ASSY.***

The ATR-1DC™ valve is part of the R-12™ family of relay valves which includes the R-12™, R-14™, BP-R1™, AR-1™ & ATR-1™ valves. The internal components of the relay portion of all of these valves are similar and in many cases interchangeable with the R-12™ valve and therefore the same basic components are used to service all of them. The ATR-1DC™ valve is available with various crack pressures to accommodate specific applications, however the standard is 4 psi, achieved without any added spring.

OPERATION

GENERAL

While the ATR-1DC™ valve is an antilock-traction relay valve its true function is that of an air brake relay valve. Because the ATR-1DC™ is essentially a relay valve, with a traction control function, the following description of operation describes its operation as a relay valve and its function in the traction control system. The full operation of the antilock system and separate antilock components and their operation is not addressed in this publication. For a description of antilock operation, refer to the appropriate Service Data Sheet covering the electronic controller used with the ATR-1DC™ valve (e.g. SD-13-4785 for the EC-16™ electronic controller, or SD-13-4788 for the EC-17™ electronic controller). Other useful information on antilock system components may be downloaded from www.bendix.com. For example: SD-13-4793 (M-21™ and M-22™ antilock modulators), SD-13-4870 (M-32™ and M-32QR™ antilock modulators), SD-13-4754 (WS-20™ wheel speed sensors), and SD-13-4860 (WS-24™ wheel speed sensors).

SERVICE BRAKES - APPLYING

Reservoir air pressure is present at the supply port (SUP) and at the relay inlet and exhaust valve. Reservoir air pressure also flows from the supply port through internal

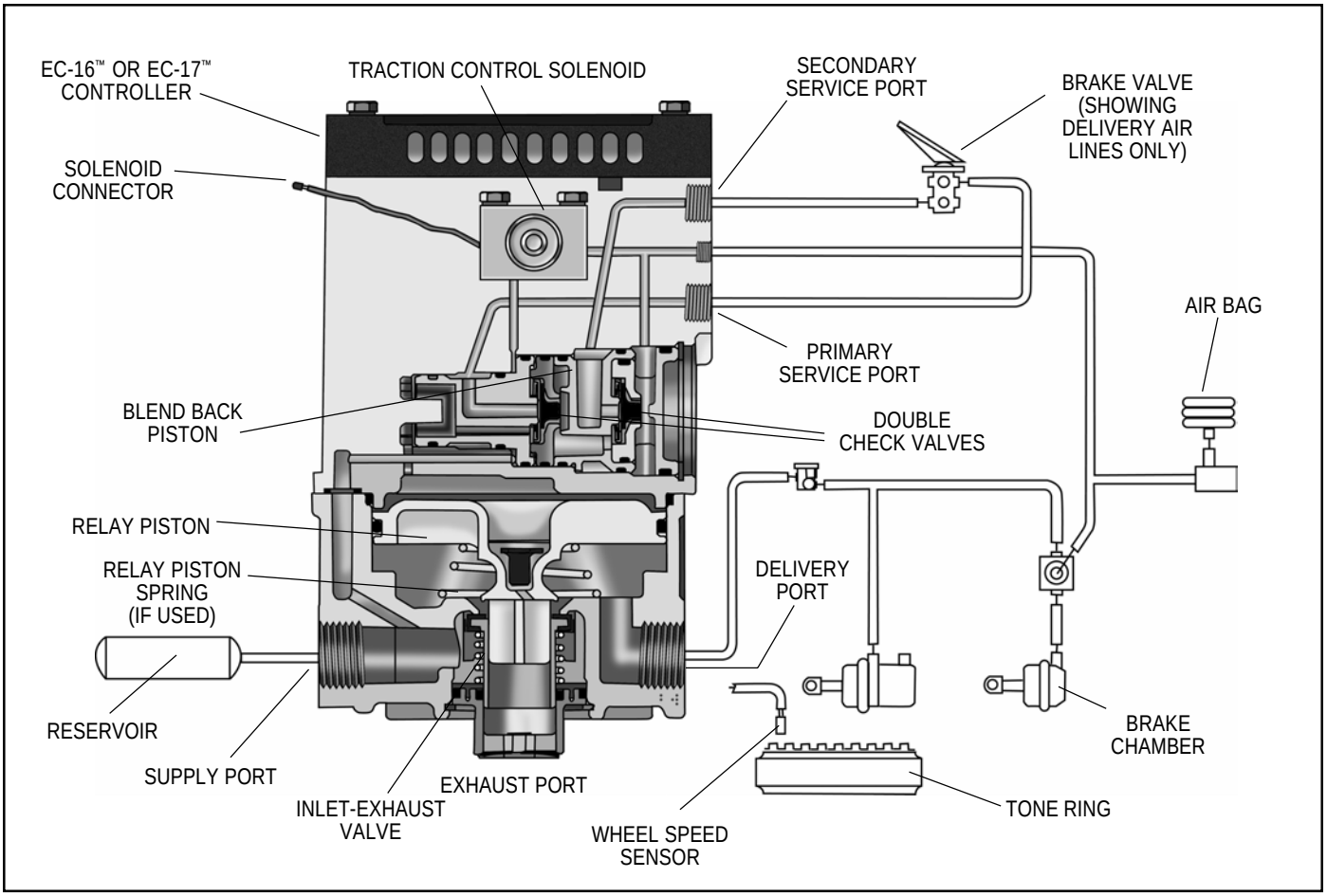


*FIGURE 3 - **SECTIONAL AT-1DC™ ANTILOCK TRACTION ASSEMBLY***

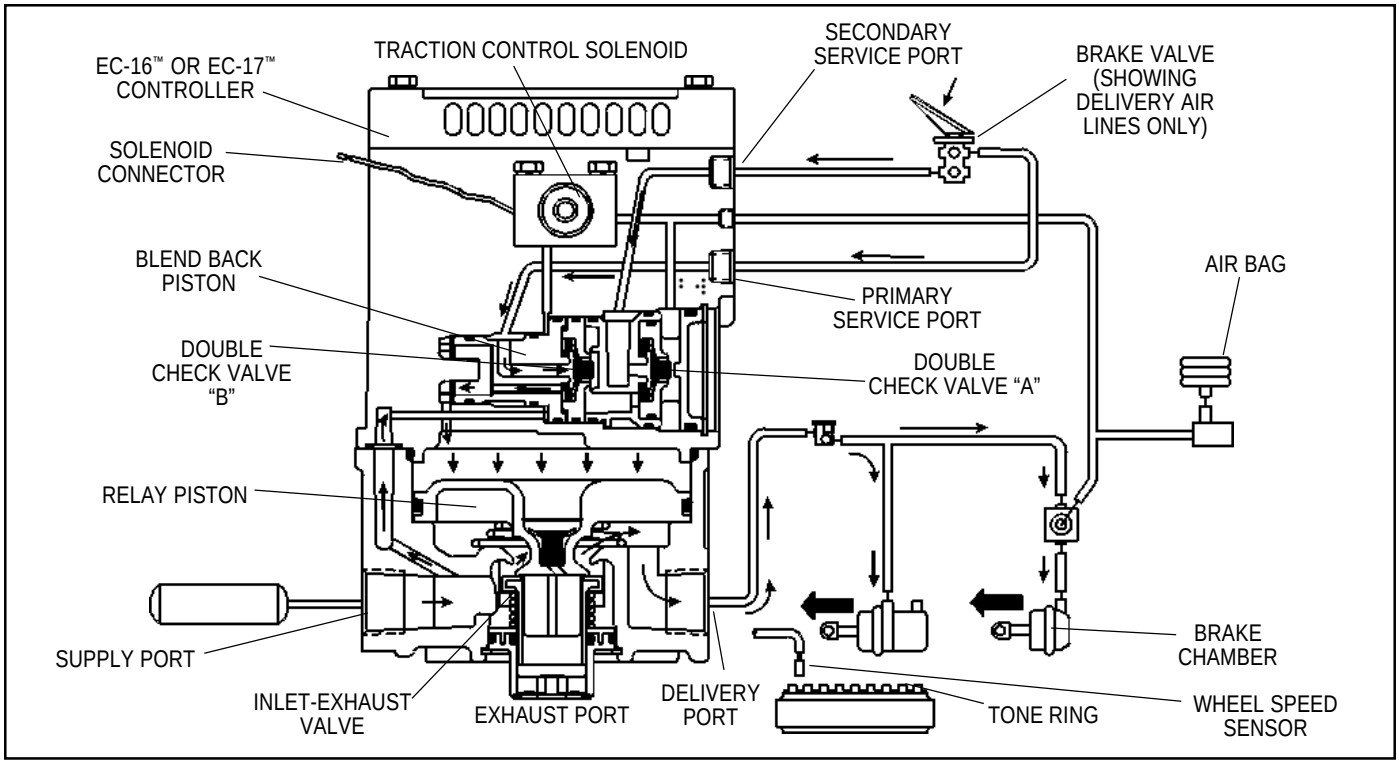


FIGURE 4 - ***SERVICE BRAKE APPLICATION***

body and cover passages to the supply of the normally closed (NC) traction control solenoid.

Brake application air from both the rear and front axle circuits of the brake valve enters the ATR-1DC™ valve's primary and secondary control ports. Secondary control pressure flexes double check valve diaphragm "A" causing it to seal the air passage leading to the solenoid and opening the passage leading to double check valve "B". Primary control air flows to double check valve diaphragm "B". Because primary control pressure, from the foot valve, is 2 to 4 psi greater than secondary control, double check valve diaphragm "B" flexes in response to primary control and seals the air passage leading to the secondary control. Air flows past double check valve diaphragm "B" and through a passage in the cover to the top of the service relay piston. In response

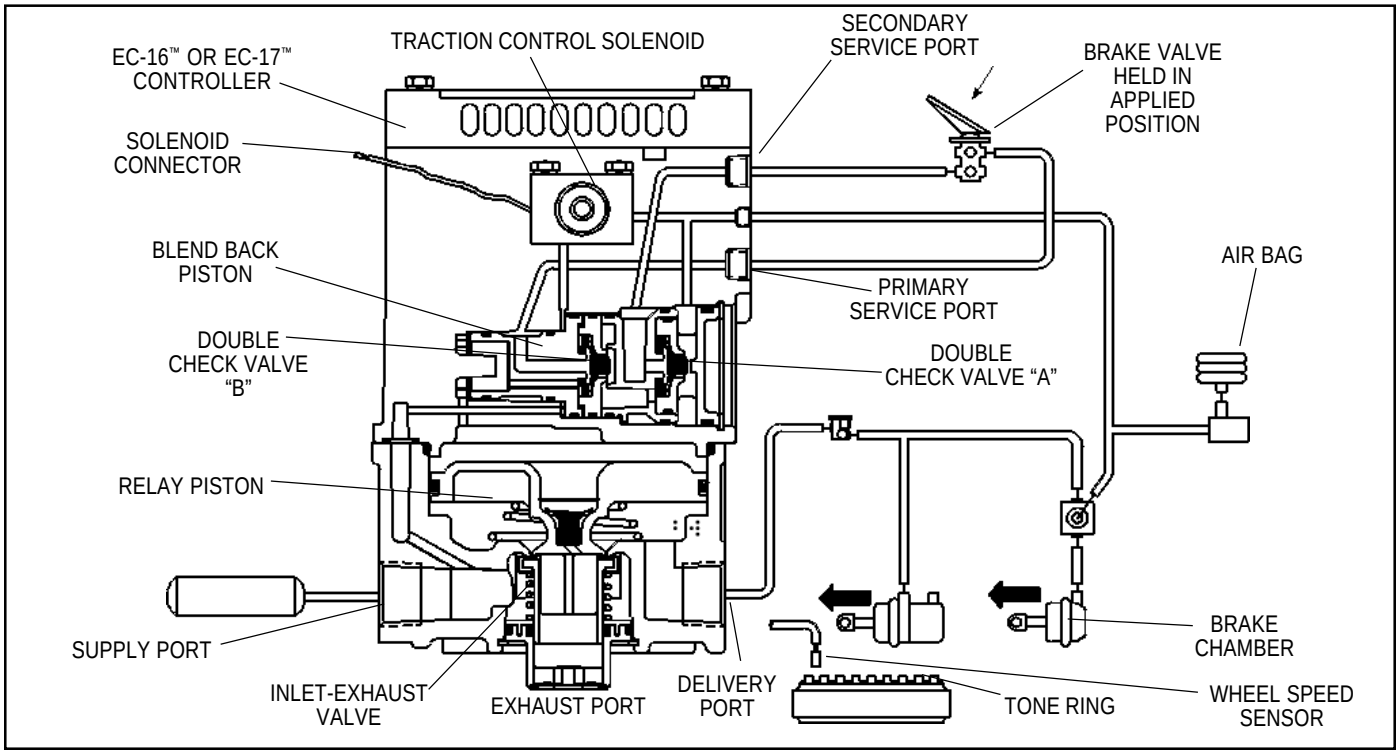


FIGURE 5 - ***SERVICE BRAKES HOLDING***

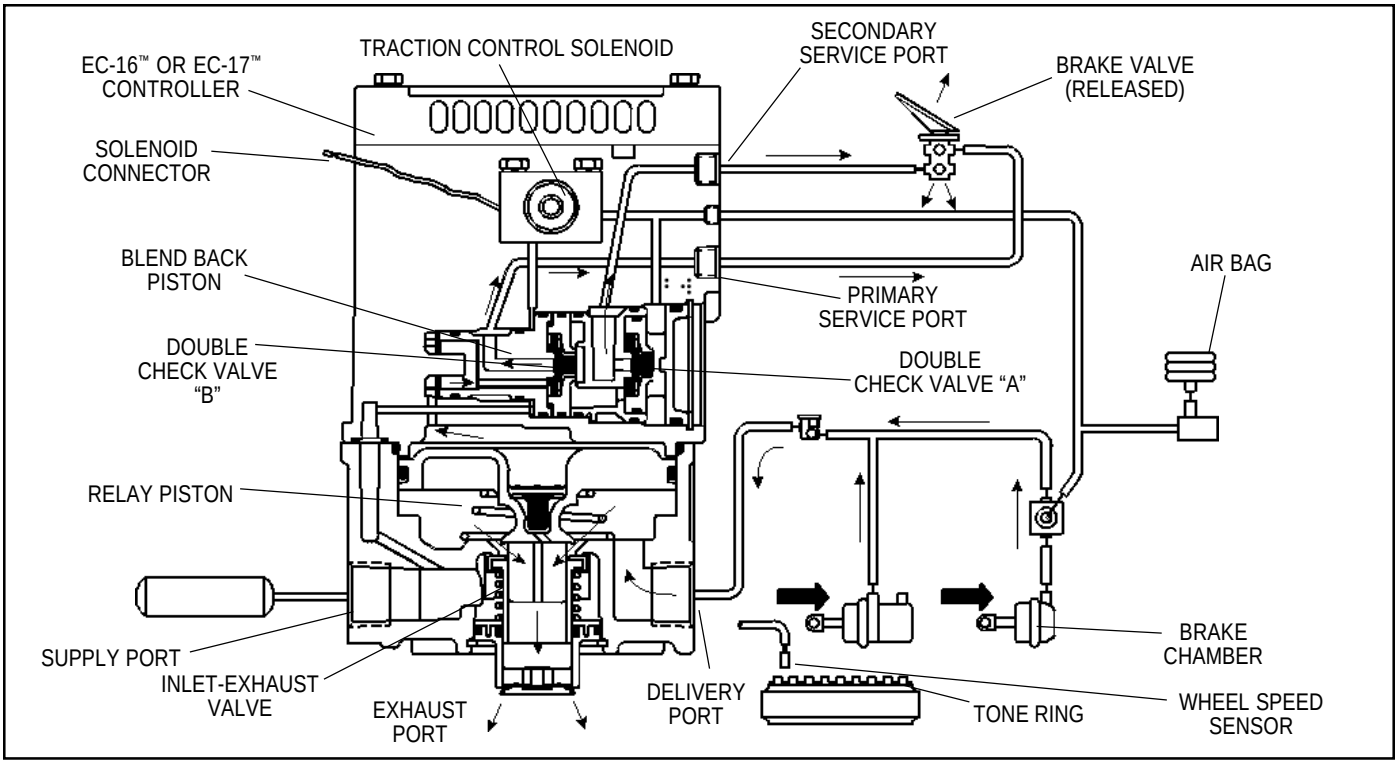


FIGURE 6 - ***SERVICE BRAKES RELEASING***

to air pressure, the relay piston drain valve flexes and seals the drain passage leading to the relay exhaust. Simultaneously the relay piston moves into contact with the exhaust portion of its inlet and exhaust valve. With the exhaust passage sealed, continued movement of the piston unseats the inlet portion of the inlet and exhaust valve, allowing supply air from the reservoir to flow out the ATR-1DC™ valve's delivery ports to the brake chambers.

SERVICE BRAKES - HOLDING

Air pressure being delivered to the brake chambers is also present beneath the relay piston. When air pressure above and below the relay piston is equal, the piston moves

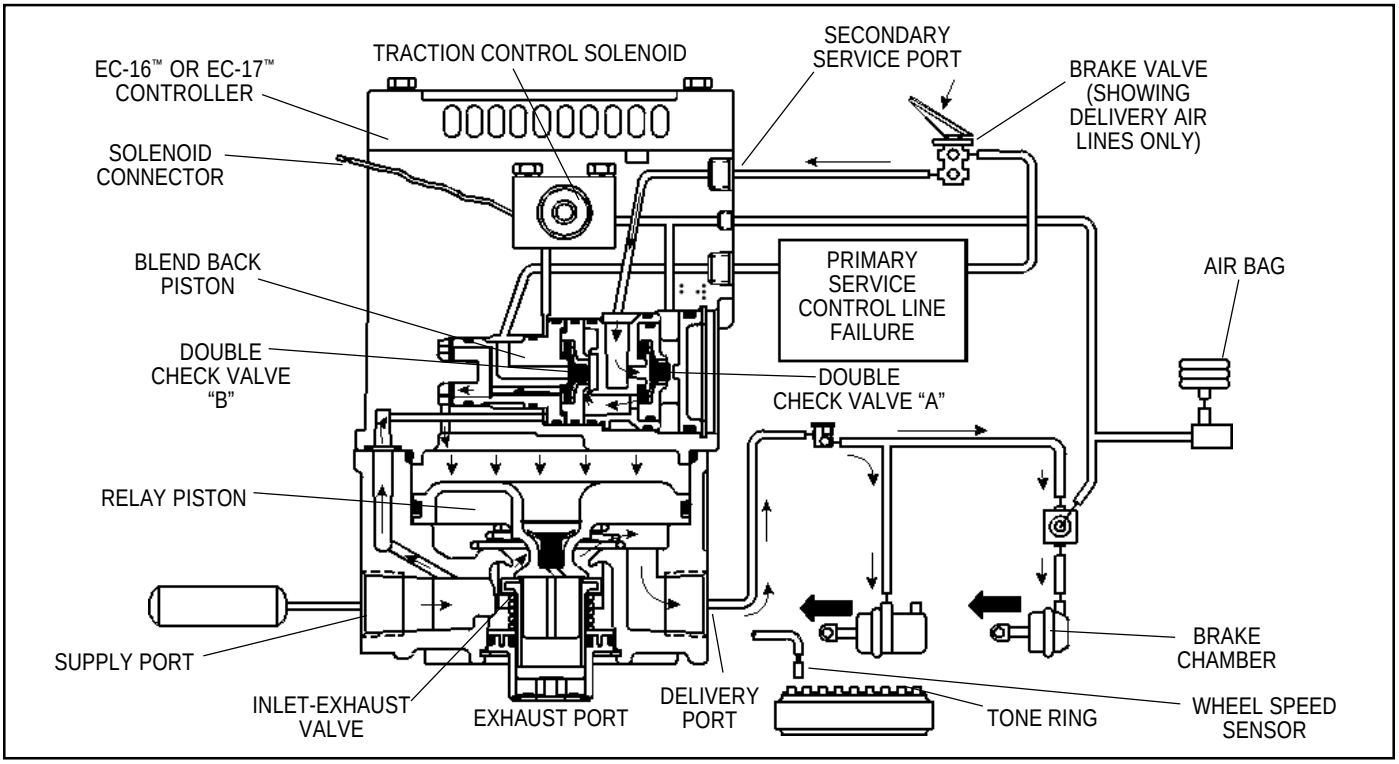


FIGURE 7 - ***SERVICE BRAKES - APPLYING (PRIMARY CIRCUIT DELIVERY FAILED)***

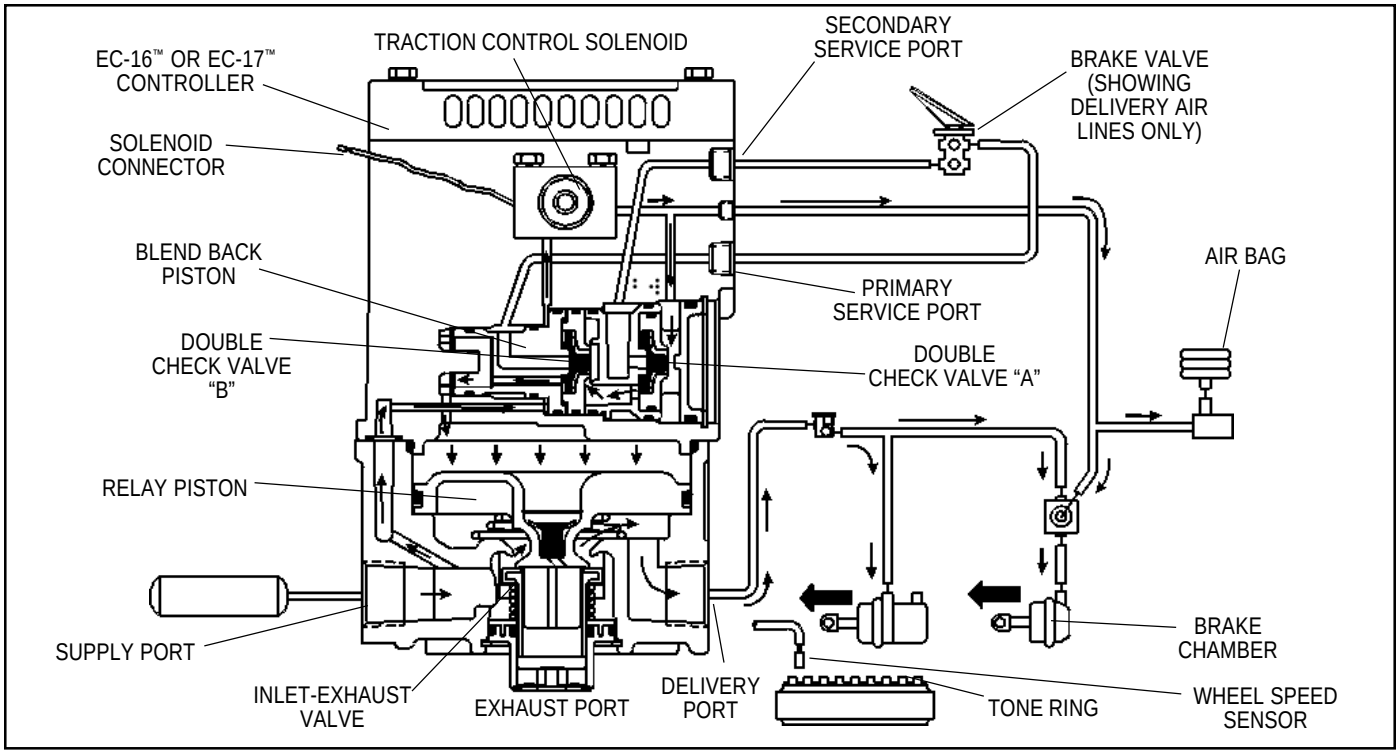


FIGURE 8 - ***TRACTION CONTROL BRAKE APPLICATION***

slightly allowing the inlet valve to return to its seat. The exhaust valve remains closed. With both the inlet and exhaust valves closed, air pressure in the brake chambers is held constant and neither increases nor decreases.

SERVICE BRAKES - RELEASING

When the brake application is released, air from above the relay piston, flows back to and past double check valve "B" and returns to the exhaust of the brake valve. Air on the other side of double check valve "B" and from double check valve "A" also returns to the exhaust of the brake valve. As air pressure above the relay piston is released the natural resilience of the relay piston drain valve causes it to return to its original position which opens the drain passage in the relay piston. With the piston drain open, gravity allows contamination to flow out the relay valve exhaust.

As air pressure is reduced above the relay piston, pressure beneath lifts the piston away from the exhaust valve and opens the exhaust passage. Air from the service brake chambers returns to the ATR-1DC™ valve and flows out the open exhaust.

SERVICE BRAKES – APPLYING (PRIMARY CIRCUIT FAILED)

In the event the rear axle delivery line from the brake valve is broken, air from the brake valve's front axle delivery circuit will enter the secondary control port. Secondary control pressure flexes double check valve diaphragm "A" causing it to seal the air passage leading to the solenoid and opening the passage leading to double check valve "B". Double check valve diaphragm "B" flexes in response to secondary control pressure and seals the air passage leading to the primary control port and primary delivery circuit of the brake valve. Air flows past double check valve diaphragm "B" and through a passage in the cover to the top of the service relay piston. In response to air pressure, the relay piston drain valve flexes and seals the drain passage leading to the relay exhaust. Simultaneously the relay piston moves into contact with the exhaust portion of its inlet and exhaust valve. With the exhaust passage sealed, continued movement of the piston unseats the inlet portion of the inlet and exhaust valve, allowing supply air from the reservoir to flow out the ATR-1DC™ valve's delivery ports to the brake chambers.

TRACTION CONTROL - SERVICE APPLICATION

GENERAL

While under the control of an antilock traction controller, the ATR-1DC™ valve's solenoid is able to initiate a brake application that allows the traction system to control wheel spin during acceleration under 25 mph. When wheel spin is detected and the vehicle is stopped, or moving at any speed up to 25 mph, the antilock traction controller instantly energizes the solenoid in the ATR-1DC™ valve which then applies air to each of the rear axle modulators as shown in Figure 8. The modulators are also equipped with solenoid valves and because the controller also controls them, the solenoid valves in the appropriate modulator are opened and closed to gently pump the brake on the spinning wheel only. This brake application, to the spinning wheel, forces the differential to drive the stationary or slowly spinning wheel.

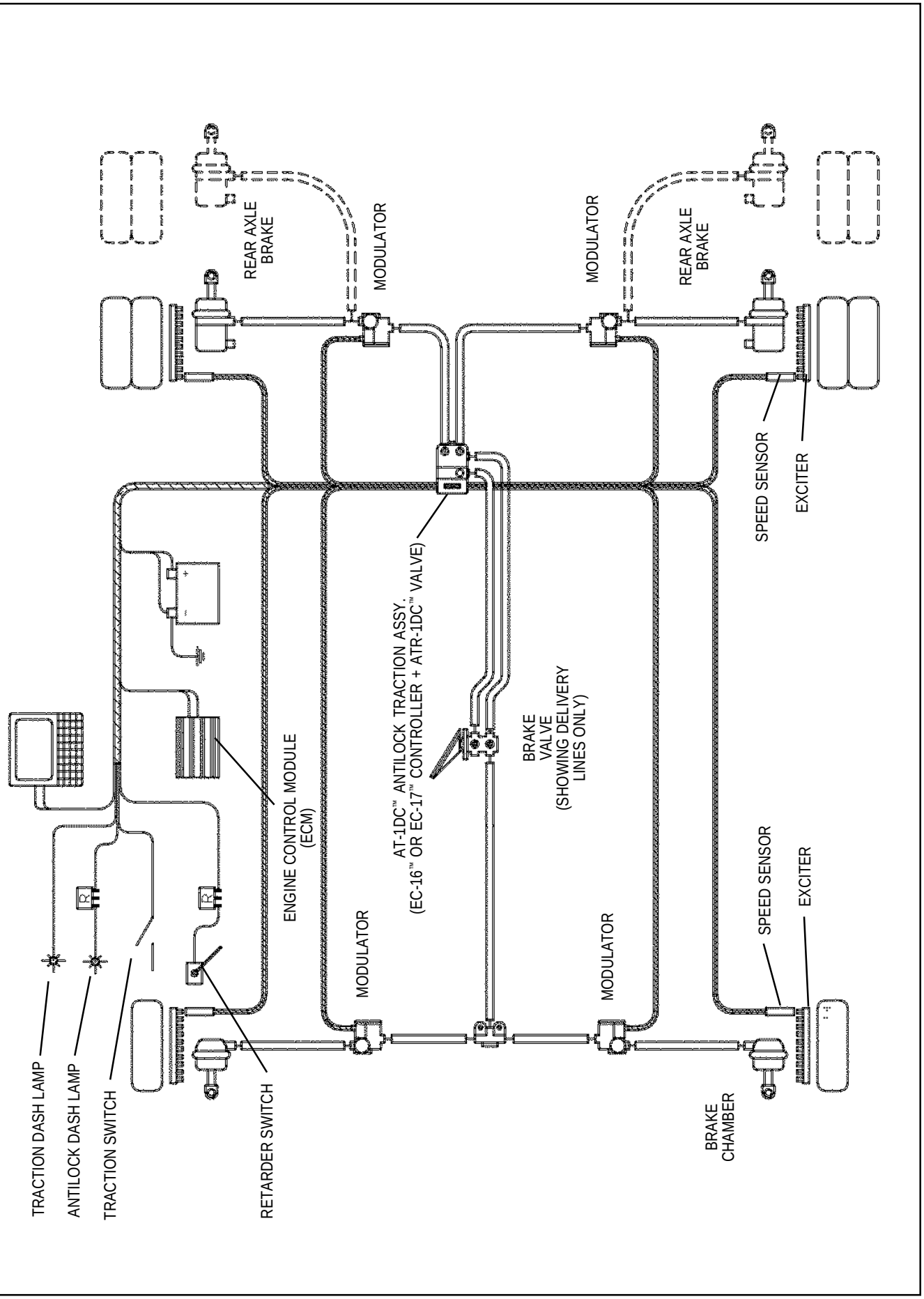


FIGURE 9 - ***PARTIAL ANTILOCK TRACTION SYSTEM SCHEMATIC***

The ATR-1DC™ valve also has an auxiliary control port that permits coordination of the traction function with an air suspended tag axle on a 6x2 vehicle. The auxiliary control port(21) connects to the air suspension control valve. If a traction event occurs and the tag axle is down and loaded the ATR-1DC™ valve is able to reduce air pressure in the tag axle air bags. Lowering pressure in the tag axle air bags increases the loading on the drive axle and further assists in eliminating wheel spin on acceleration.

OPERATION

Reservoir air pressure is constantly present at the traction solenoid. When the electronic controller detects wheel spin it energizes the solenoid and in response the solenoid opens momentarily. While the solenoid is open, air is delivered through internal passages to double check valve diaphragm "A".

Note: If the optional auxiliary port is in use, traction solenoid air pressure is also delivered to the air suspension system of the "tag" or non-drive axle. This signal pressure is used to exhaust some of the air pressure from the suspension bags on the tag axle. This causes some of the vehicle weight (carried by the tag axle) to shift to the drive axle further enhancing the traction control.

The check valve diaphragm flexes in response and seals the passage to the open exhaust of the secondary delivery of the brake valve. Once past double check valve "A", air from the solenoid flows to double check valve "B" which flexes and seals the passage to the open exhaust of the primary delivery of the brake valve. Air flowing around double check valve "B" moves through the rest of the valve in the same manner as a normal service brake application and is delivered out the delivery ports of the ATR-1DC™ valve to the antilock modulators near the rear wheels they serve.

When the electronic controller de-energizes the ATR-1DC™ valve's traction solenoid, air between the solenoid and the double check valve "A", including the air signal sent to the suspension system through the optional auxiliary port, returns to the solenoid and is exhausted. Air between double check valve "A" and "B" is exhausted from the secondary circuit of the brake valve. Air between the relay piston and double check valve "B" is exhausted from the primary circuit of the brake valve. Air in the service brakes is exhausted at the main ATR-1DC™ valve's exhaust port.

PREVENTIVE MAINTENANCE

GENERAL

Perform the tests and inspections presented at the prescribed intervals. If the ATR-1DC™ valve fails to function as described, or leakage is excessive, it should be repaired or replaced with a new or genuine Bendix remanufactured unit, available at any authorized parts outlet.

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

1. Remove any accumulated contaminates and visually inspect the exterior for excessive corrosion and physical damage.
2. Inspect all air lines connected to the ATR-1DC™ valve for signs of wear or physical damage. Replace as necessary.
3. Test air line fittings for excessive leakage and tighten or replace as necessary.
4. Perform the Leakage Test described in this manual.

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

1. Perform the Operation and Leakage Tests described in 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.**

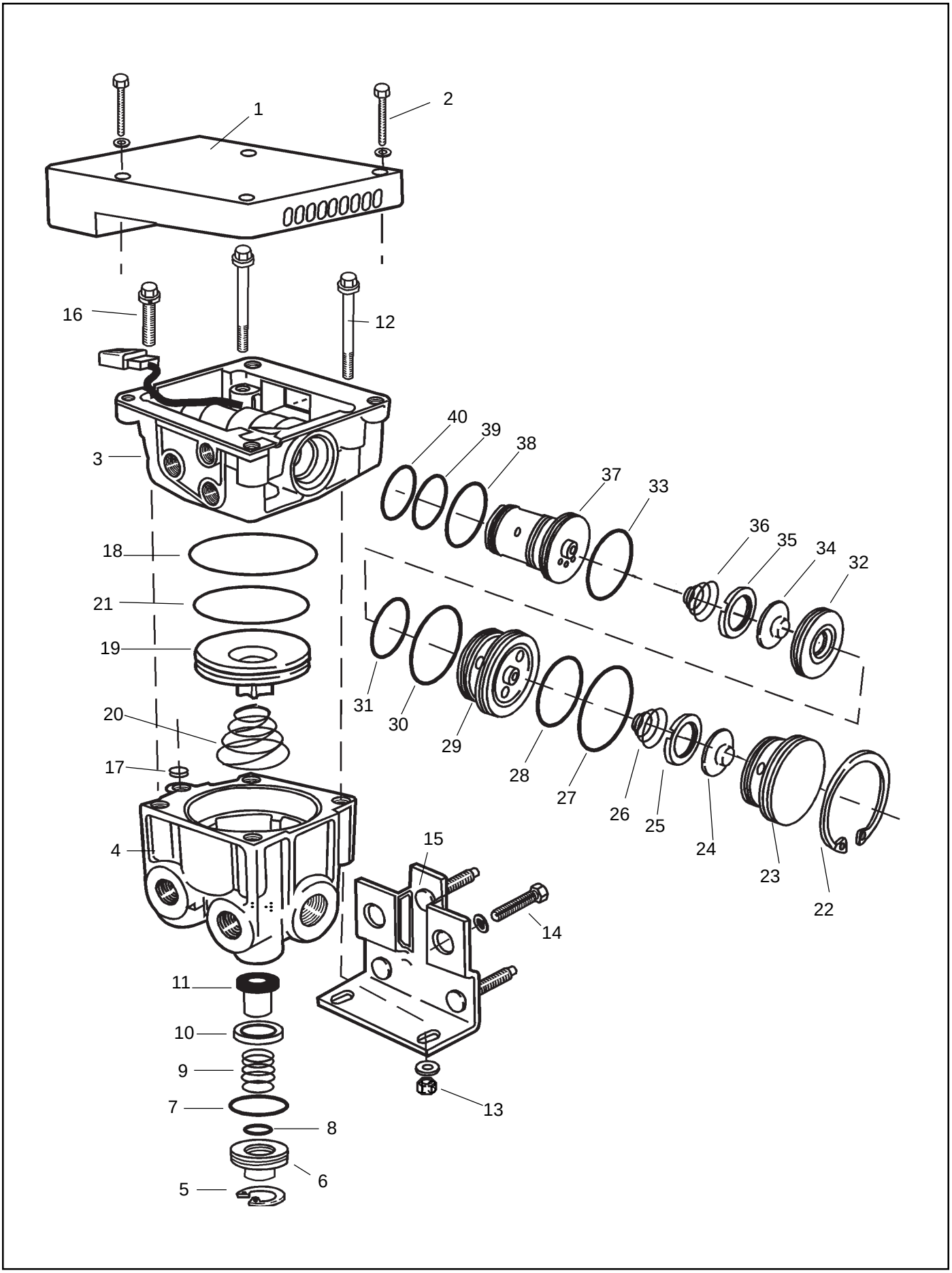


FIGURE 10 - ***ATR-1DC™ ANTILOCK TRACTION ASSEMBLY EXPLODED VIEW***

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.**
11. **For vehicles with Antilock 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.**

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, and 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.

OPERATION TEST

1. Apply and release the brakes several times and check for prompt application and release at each wheel. If a prompt reaction is noted at some, but not all wheels, test the antilock modulator (M-21™ or M-22™) between the ATR-1DC™ valve and the brake chamber for proper operation. If a sluggish response is noted at all wheels, inspect for a kinked or obstructed air line leading to or from the ATR-1DC™ valve. If a complete release of the brakes is noted at some, but not all wheels, test the antilock modulator (M-21™ or M-22™) between the ATR-1DC™ valve and the brake chamber for proper operation. If an incomplete release is noted at all wheels, inspect for a kinked or obstructed air line leading to or from the ATR-1DC™ valve.

   Note: The ATR-1DC™ valve differential pressure can be checked 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 ATR-1DC™ valve part number (see the I.D. washer also for the differential). NOTE: For ATR-1DC™ valves not incorporating a relay piston return spring (20) the measured differential should be approximately 4 psi. When a spring is in use, the differential will be higher.
2. Disconnect the ATR-1DC™ valve's two pin solenoid connector from the controller wire harness. Apply the probes of a volt-ohm meter to the connector leading to the solenoid and note the resistance of the solenoid is between 10 and 12 ohms. If resistance other than this is noted, replace the ATR-1DC™ valve.
3. Apply and remove vehicle power (12 vdc) to the two pin connector half leading to the ATR-1DC™ valve (solenoid) while observing the brake chambers. Note that a brake application is made and held while power is applied to the ATR-1DC™ valve's solenoid and that it is released when power is removed.

LEAKAGE TESTS

1. Build the air system pressure to governor cutout. Apply a soap solution to the exhaust port. The leakage noted should not exceed a 1" bubble in less than 3 seconds.
2. Make and hold a full brake application and apply a soap solution to the exhaust port and around the cover where it joins the body. The leakage noted should not exceed a 1" bubble in less than 3 seconds at the exhaust port.

   If the ATR-1DC™ valve fails to function as described, or leakage is excessive, it should be replaced with a new or genuine Bendix remanufactured unit or repaired using a genuine Bendix repair kit, available at any authorized parts outlet.

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.

REMOVAL

1. Identify and mark or label all electrical wiring harnesses and air lines and their respective connections on the assembly to facilitate ease of installation.
2. Disconnect the air lines and wire harnesses.
3. Remove the controller and valve assembly (AT-1DC™) from the vehicle. Note: The antilock controller may not be mounted to the ATR-1DC™ valve. Refer to Figure 1.

INSTALLATION

1. Install the assembled unit on the vehicle.
2. Reconnect all air lines and wire harnesses to the unit using the identification made during REMOVAL step 1.
3. After installing the unit, perform the OPERATION & LEAKAGE TESTS for the air valve before placing the vehicle in service.

DISASSEMBLY

PREPARATION FOR DISASSEMBLY

1. Remove all air fittings and plugs from the valve.
2. Mark the relationship of the valve cover (3) to the body (4) and, if the valve is equipped with a mounting bracket (15), mark the relationship of the bracket to the cover and body (4).
3. Mark the relationship of the electronic controller (1) to the cover (3).

DISASSEMBLY

The following disassembly and assembly procedure is presented for reference purposes only. Instructions packaged with repair and maintenance kits should always be followed instead of the instructions presented here.

CAUTION: 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. Remove and retain the four cap screws (2) that secure the electronic controller (1) to the cover (3), then separate and retain the controller (1), from the cover (3). Note: In some instances a controller, Item 1, will not be present and only a cover plate will be noted. Remove the cover plate in the same manner described for the controller.
2. While holding the exhaust cover (6), remove the retaining ring (5) that secures it to the body (4).
3. Remove the exhaust cover(6) along with both o-rings (7 & 8).
4. Remove the valve spring (9), valve retainer (10), and the valve assembly (11) from the body (4).
5. Remove and retain the two long cap screws (12) and nuts (13) that secure the cover (3) to the body (4).
6. Remove and retain the two cap screws and lock washers (14) that secure the bracket (15) to the cover (4), then remove and retain the bracket.
7. Remove and retain the two short cap screws (16) that secure the cover (3) to the body (4).
8. Separate the cover (3) from the body (4), then remove the sealing ring (17) and o-ring (18).
9. Remove the relay piston (19) and relay piston spring (20) from the body (4). NOTE: The relay piston spring, item 20 is not used in all valves.
10. Remove the o-ring (21) from the relay piston (19).
11. Remove the retaining ring (22). Then remove check valve seat (23), with o-rings (27 & 28). Remove o-rings (27 & 28) from the check valve seat.
12. Remove the check valve (24), guide (25), and spring (26).
13. Remove the inlet seat (29) with o-rings (30 & 31), then remove o-rings (30 & 31) from the inlet sea (29).
14. Remove the check valve seat (32) from the valve cover (3). Remove both o-ring (33).
15. Remove the check valve (34), guide (35), and spring (36).
16. Remove the primary inlet seat (37) with o-rings (38, 39 & 40), then remove o-rings (38, 39 & 40) from the primary inlet seat (37).
17. Do not disassemble the ATR-1DC™ valve any further than described here.

CLEANING & INSPECTION

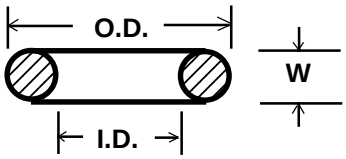
1. Using mineral spirits or an equivalent solvent, clean and thoroughly dry all metal parts. Do not damage bores with metal tools.
2. Wash all retained, nonmetallic components in a soap and water solution making certain to rinse and dry thoroughly.
3. Inspect the interior and exterior of all metal parts that will be reused for severe corrosion, pitting and cracks. Superficial corrosion and/or pitting on the exterior portion of the body (4) and cover (3) is acceptable. Replace the entire valve if the interior of the body or cover exhibit signs of corrosion or pitting.
4. Inspect each nonmetallic component for cracks, wear or distortion. Replace the entire valve if these conditions are found.
5. Inspect the bores of both the body (4) and cover (3) 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 (1) and its supply port is clear and free of obstruction.
7. Make certain all air channels and exhaust passages in the valve cover (3) are clear and free of obstruction.
8. Inspect the pipe threads in the body (4) and valve cover (3). Make certain they are clean and free of thread sealant.
9. Inspect the relay piston spring (20) 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, seals, and pistons, as well as body and cover bores, using silicone lubricant.
2. Install the large and small diameter o-rings (38, 39 & 40) on the primary inlet seat (37), then insert the small diameter of the seat (37) into the bore in the cover (3). Do not cut or pinch the o-rings.

3. Install the spring (36) on the inlet seat (37) so that the small diameter fits over and around the air passage through the center of the inlet seat.
4. Install o-ring (33) on the check valve seat (32).
5. Using a small amount of grease applied to the check valve (34) and guide (35) to secure both items to the check valve seat (32). Gently insert the assembled items into the valve cover (3). Install the valve guide (35) so that its flange contains (surrounds) the coils of the large end of the spring (36), when the valve seat (32) is installed in the cover (3). Make certain that the guide (35) is centered over the spring (36), which was installed in step 3. Note; The check valve must be installed so that the top hat portion fits into the valve seat (32).
6. Install the small and large diameter o-rings (27 & 28) on the check valve seat (23).
7. Install the spring (26) on the inlet seat (29) so that the small diameter fits over and around the air passage through the center of the inlet seat.
8. Install the check valve (24) and valve guide (25) in the check valve seat (23). Note: The check valve must be installed so that the top hat portion fits into the valve seat (23). Install the valve guide (25) so that its flange contains (surrounds) the coils of the large end of the spring (26), when the valve seat (23) is installed in the cover (3). Use a small amount grease to hold these parts in the valve seat (23).
9. Install the assembled valve seat (23) with the check valve and valve guide (24 & 25) into the cover (3) bore and while holding it in place install the retaining ring (22). Make certain the retaining ring is fully seated in its groove.
10. Install the valve retainer (10) on the inlet and exhaust valve (11) so that the flange of the retainer (10) surrounds the rubber portion of the valve. Install the inlet and exhaust valve in the body (4).
11. Install the inlet and exhaust valve return spring (9) in the body (4).
12. Install the large and small diameter o-rings (7 & 8) in the exhaust cover (6), then install the exhaust cover in the body (4) taking care not to damage the o-rings. Hold the exhaust cover in place.
13. While depressing the exhaust cover (6), install the retaining ring (5) in the body (4). Make certain the retainer (5) is fully seated in its groove in the body.
14. If the valve was equipped with a relay piston return spring (20), install the spring in the body, large diameter first.

O-RING IDENTIFICATION



Key	Description	Qty.	I.D.	O.D.	W
7	O-Ring	1	1.424	1.630	0.103
8	O-Ring	1	0.862	1.068	0.103
18	O-Ring	1	3.487	3.693	0.103
21	O-Ring	1	3.234	3.512	0.139
27	O-Ring	1	1.362	1.568	0.103
28	O-Ring	1	1.114	1.254	0.070
30	O-Ring	1	1.356	1.496	0.070
31	O-Ring	1	1.176	1.316	0.070
33	O-Ring	1	1.176	1.316	0.070
38	O-Ring	1	1.176	1.316	0.070
39	O-Ring	1	0.801	0.941	0.070
40	O-Ring	1	0.739	0.879	0.070

15. Using lubricant to hold them in place, install the large and small sealing rings (18 & 17) on the cover (3).
16. Install the o-ring (21) on the relay piston (19), then install the piston in the body (4).
17. Note the relationship marks made prior to disassembly, then install the cover (3) on the body (4). Secure the cover on the body using the two, short cap screws (16). Again, noting the relationship marks, secure the bracket (15) on the cover (3) and body (4) and using the two long cap screws (12) and two nuts and washers (13). Torque the four cap screws to 120 to 150 lb. in.
18. Install the two cap screws (14) that secure the bracket (15) to the cover (3) and torque to 180 - 220 pound inches.
19. Noting the relationship marks made during disassembly, secure the controller (1) or cover plate to the cover (3) using the four cap screws (2). Torque the four cap screws to 50-80 pound inches.
20. Install all air line fittings and plugs making certain thread sealing material does not enter the valve.

Install the rebuilt valve on the vehicle and perform the OPERATION AND LEAKAGE TESTS before placing the vehicle in service.