



Service Data

SD-13-4812

Bendix® ATR-2™ AntiLock Traction Relay Valve

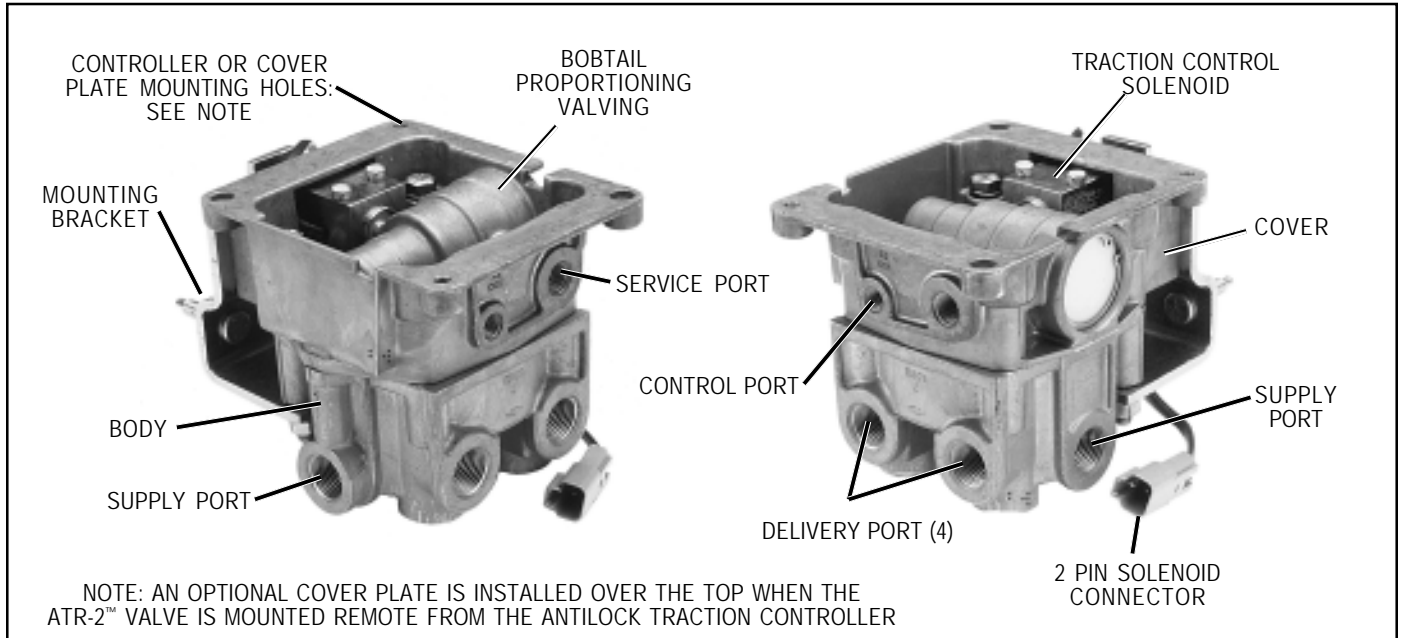


FIGURE 1 - ATR-2™ ANTILOCK TRACTION RELAY VALVE

DESCRIPTION

The ATR-2™ antilock traction relay valve is a specialized air brake valve developed for use on Bendix antilock/traction equipped tractors only.

It is essentially three separate valves working in combination in a single housing. An R-14™ style service relay valve is the base valve and is fitted with a modified cover containing a bobtail tractor brake proportioning valve (reference Bendix Service Data Sheet SD-03-1067) and a traction control solenoid. The ATR-2™ valve contains both air and electric components and provides both the service braking and traction control (differential braking) functions. A Bendix antilock traction controller can be mounted to the ATR-2™ valve or a cover plate can be installed and the antilock controller mounted elsewhere on the vehicle.

The ATR-2™ valve replaces the standard relay valve used to control the rear axle service brakes and performs the standard relay function during tractor-trailer operation. During tractor bobtail operation, the ATR-2™ valve reduces brake application pressure to the lighter rear axle(s) brakes to improve vehicle controllability and minimize rear axle(s) wheel skid before antilock is required. The ATR-2™ valve provides added vehicle braking control and reduces the number of times antilock is actually needed.

Like the standard relay valve it replaces, the ATR-2™ valve and its 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-2™ 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.

ATR-2™ VALVE

AIR CONNECTION	EMBOSSED IDENT.
Supply (to reservoir)	SUP
Delivery (to brake chamber)	DEL
Service (to brake valve rear delivery)	SER
Control (to delivery of trailer supply valve)	CON

The ATR-2™ valve is part of the R-12™ family of relay valves which includes the R-12™, R-14™, BP-R1™, AR-1™ valves. The internal components of the relay portion of all of these valves are interchangeable with the R-12™ valve and therefore the same basic components are used to service all of them.

The ATR-2™ valve is available with various crack pressures to accommodate specific applications, however the standard is 4 psi.

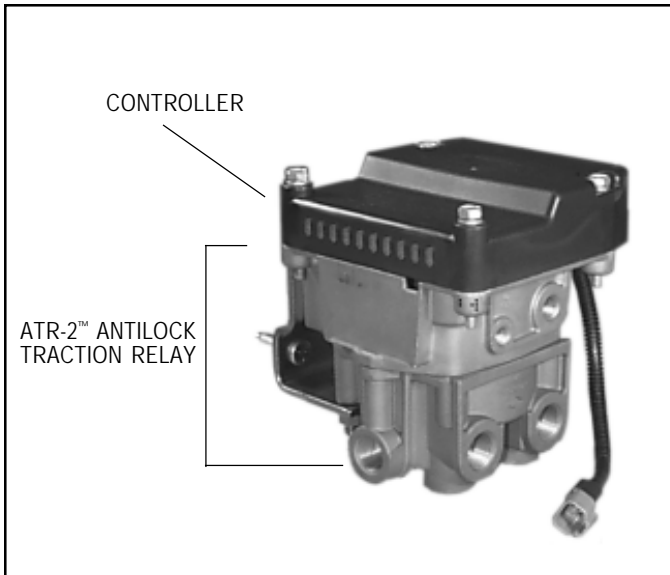


FIGURE 2 - ANTILOCK TRACTION ASSEMBLY

OPERATION GENERAL

Because the ATR-2™ valve is actually a relay valve, the following description of operation refers to its function in the vehicle's air brake system and does not address all of the separate antilock components and their operation. For a description of antilock operation refer to the appropriate Service Data Sheet covering the electronic controller used with the ATR-2™ valve.

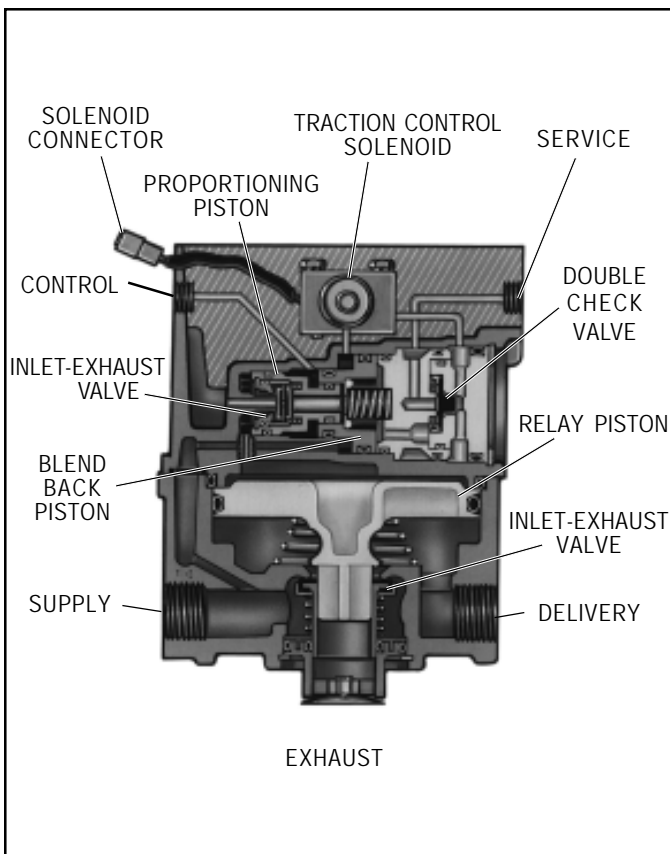


FIGURE 3 - SECTIONAL ATR-2™ ANTILOCK TRACTION ASSY.

INITIAL CHARGING

During the initial build up of tractor system air pressure, reservoir air flows into the supply port and through internal body and cover passages to the blend back piston and from there to the supply of the normally closed (NC) traction control solenoid. When sufficient air pressure is applied to the blend back piston, it moves against the resistance of its spring until it comes to rest against the service piston.

Activating the trailer supply valve (dash control with red octagonal button), simultaneously charges the trailer and the ATR-2™ valve's control port. Air entering the ATR-2™ valve's control causes the proportioning piston to move toward its stop in the cover. The integral inlet and exhaust valve is carried along with the piston until it seats and seals the exhaust passage. Continued movement of the proportioning piston opens the inlet seat. With the tractor and trailer air system fully charged the vehicle may be operated.

SERVICE BRAKES APPLYING - TRACTOR/ TRAILER COMBINATION (FIGURE 4)

Brake application air enters the ATR-2™ valve's service port and is conducted to the single check valve. The check valve diaphragm flexes in response to application pressure and seals the passage to the open exhaust of the traction solenoid. Air flows through the service piston then through the center of both the blend back and proportioning pistons to the inlet and exhaust valve. Flowing around the inlet valve, application air moves through a passage in the cover to the top of the service relay piston. In response to air pressure, 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-2™ valve's delivery ports to the brake chambers.

SERVICE BRAKES HOLDING - TRACTOR/ TRAILER COMBINATION (FIGURE 5)

The air pressure being delivered to the brake chambers is also present beneath the relay piston. When the air pressure above and below relay piston is equal, the piston moves 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 stable and neither increases nor decreases.

SERVICE BRAKES RELEASING - TRACTOR/ TRAILER COMBINATION (FIGURE 6)

When the brake application is released, air from above the relay piston, flows back through the proportioning, blend back and service pistons to the foot brake valve and is exhausted. As air pressure is reduced above the relay piston, pressure beneath it lifts the piston away from the exhaust valve and opens the exhaust passage. Air from the service brake chambers returns to the ATR-2™ valve and flows out the open exhaust.

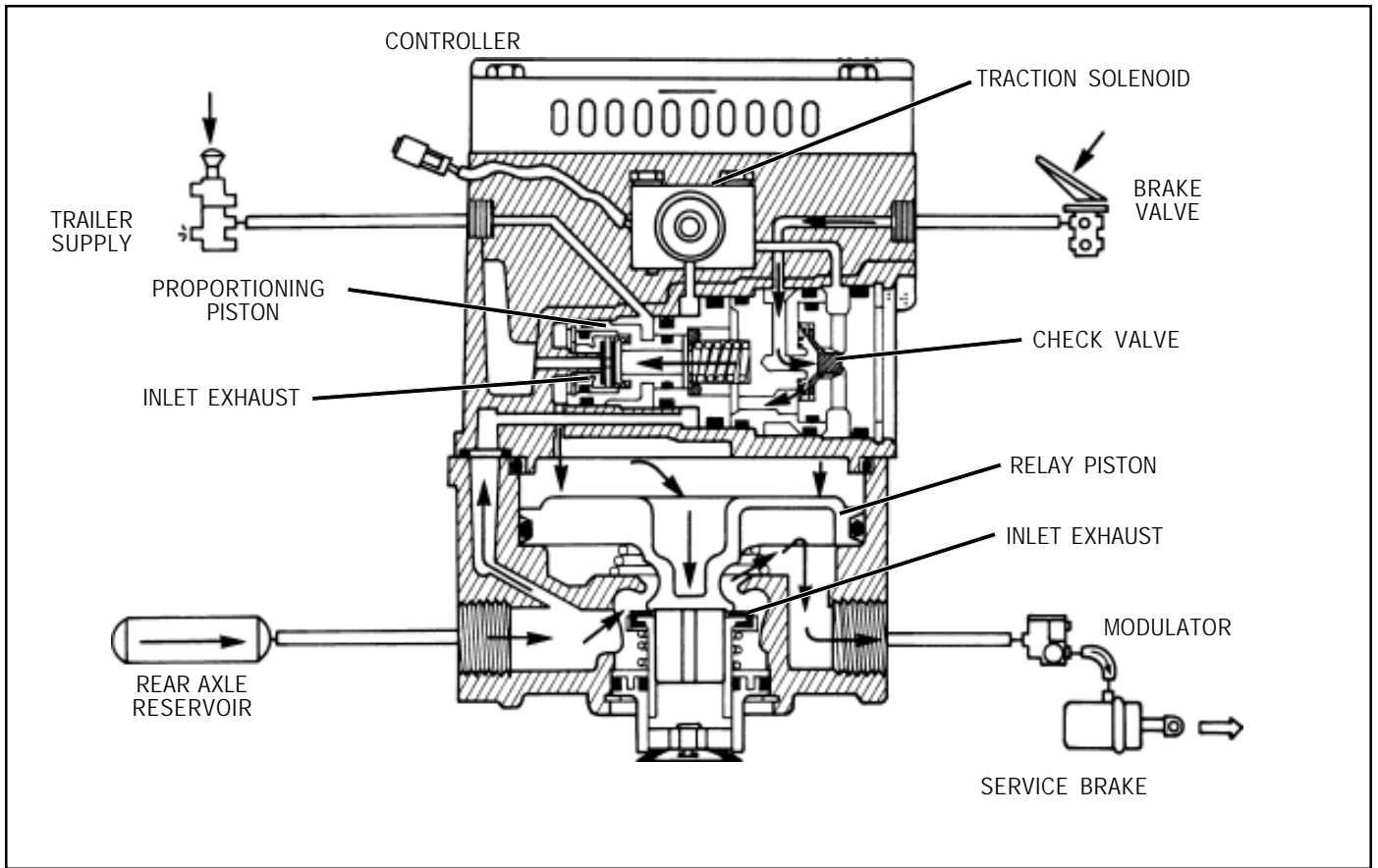


FIGURE 4 - SERVICE BRAKE APPLICATION

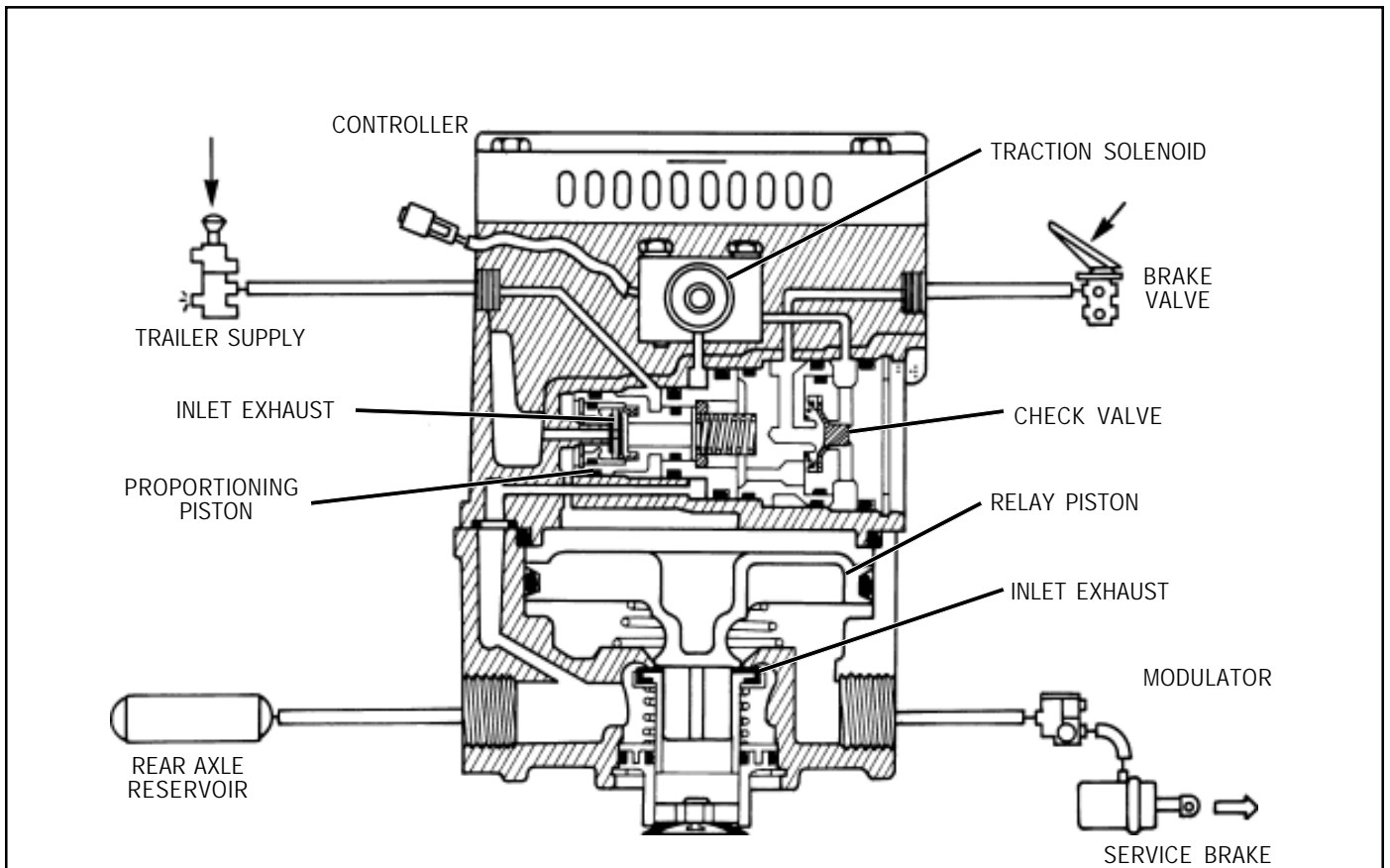


FIGURE 5 - SERVICE BRAKES HOLDING

SERVICE APPLICATION - BOBTAIL TRACTOR (FIGURE 7)

When the trailer supply valve (dash control with red octagonal button) is activated to disconnect the trailer, air in the ATR-2™ valve's control port and trailer supply line is exhausted to atmosphere. During bobtail tractor operation, service application air enters the ATR-2™ valve's service port and is conducted to the single check valve. The check valve diaphragm flexes in response to application pressure and seals the passage to the open exhaust of the traction solenoid. Application air passes through the blend back piston and exerts a force on the full effective diameter of the piston. The blend back piston remains stationary at application pressures below approximately 80 psi because of opposing reservoir air acting on the large diameter.

Application air flowing through the blend back piston also exerts a force on the small diameter of the proportioning piston while simultaneously flowing through the center of it on its way to the inlet and exhaust valve. Once past the inlet and exhaust valve, service air pressure exerts a force on the larger diameter end of the proportioning piston, which opposes the air pressure and spring force exerted on the other end. The proportioning piston inlet valve remains open until a preset, initial application pressure has reached the relay piston assuring that the foundation brake shoes are brought into contact with the drum. As service pressure begins to exceed the preset initial application, the proportioning piston will have moved sufficiently to close its inlet valve without opening the exhaust.

The inlet remains closed, preventing additional air delivery to the relay piston and a subsequent increase in brake

chamber pressure, until service application pressure exceeds approximately 30 psi. Service applications above this pressure will result in a proportioned increase of the preset initial brake application to the tractor's rear brakes. Proportioning occurs due to the difference in effective area on each end of the proportioning piston. Tractor rear axle brake proportioning will occur for all service applications between approximately 30 and 80 psi.

Service applications of more than 80 psi cause the blend back piston to begin to move. Service air pressure acting on the full diameter of the blend back piston over comes the resistance of reservoir pressure acting on the large diameter of the other side. Above 80 psi the ratio between control and delivered air pressure is reduced and "blends back" from a proportioned delivery to a full 1 to 1 delivery. Complete "blend back" to a 1 for 1 delivery is achieved when a full brake application is made.

SERVICE BRAKES RELEASING - BOBTAIL TRACTOR (FIGURE 8)

When the brake application is released, all air pressure from between the closed proportioning piston inlet valve and the ATR-2™ valve's service port returns to the brake valve and is exhausted. Air from above the relay piston, flows back to the proportioning piston causing it to move. As it moves, the proportioning piston unseats the exhaust valve allowing air from above the relay piston to escape to atmosphere. Reducing the air pressure above the relay piston, causes pressure beneath it to lift the piston away from the exhaust valve. Air from the service brake chambers returns to the ATR-2™ valve and flows out the open exhaust.

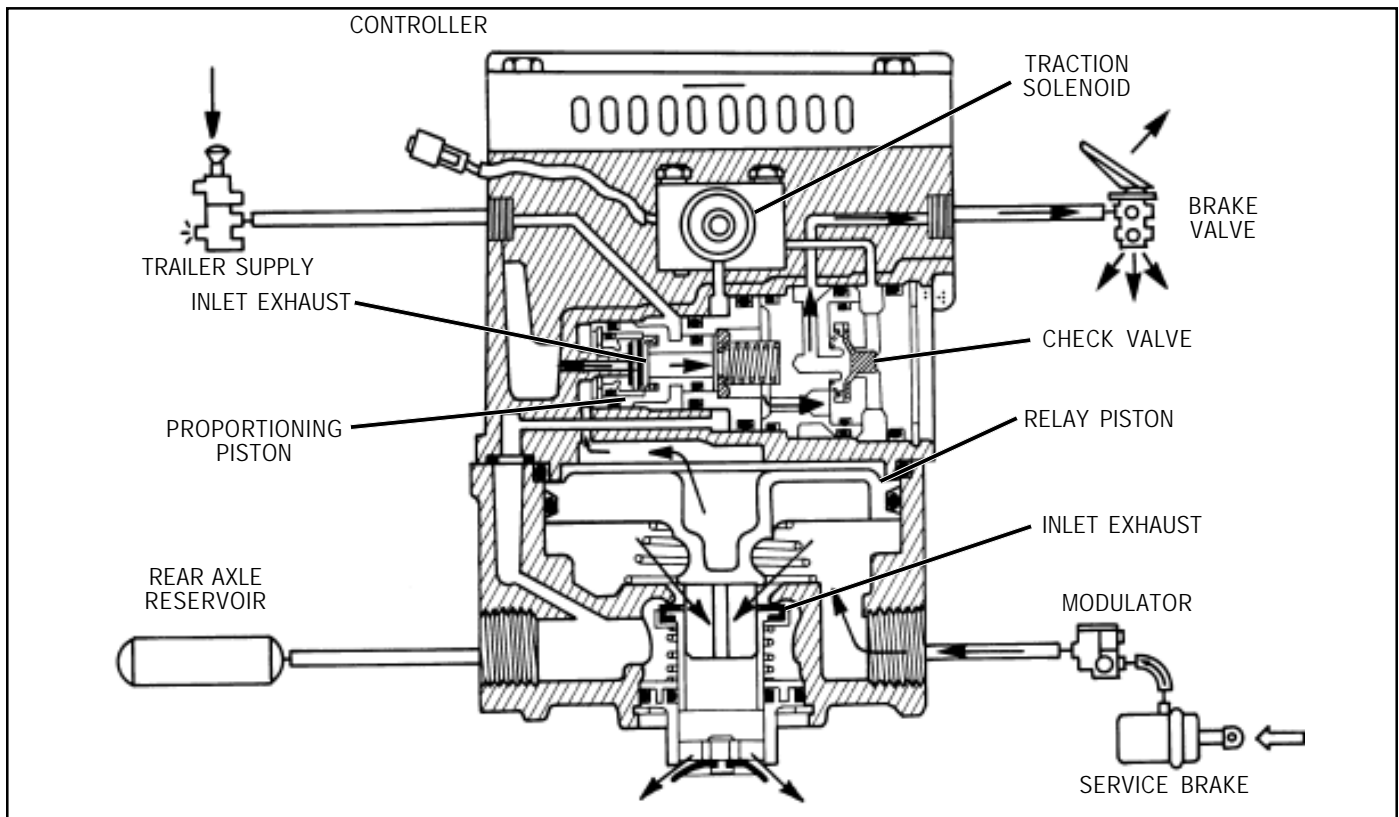


FIGURE 6 - TRACTOR - TRAILER SERVICE BRAKE RELEASING

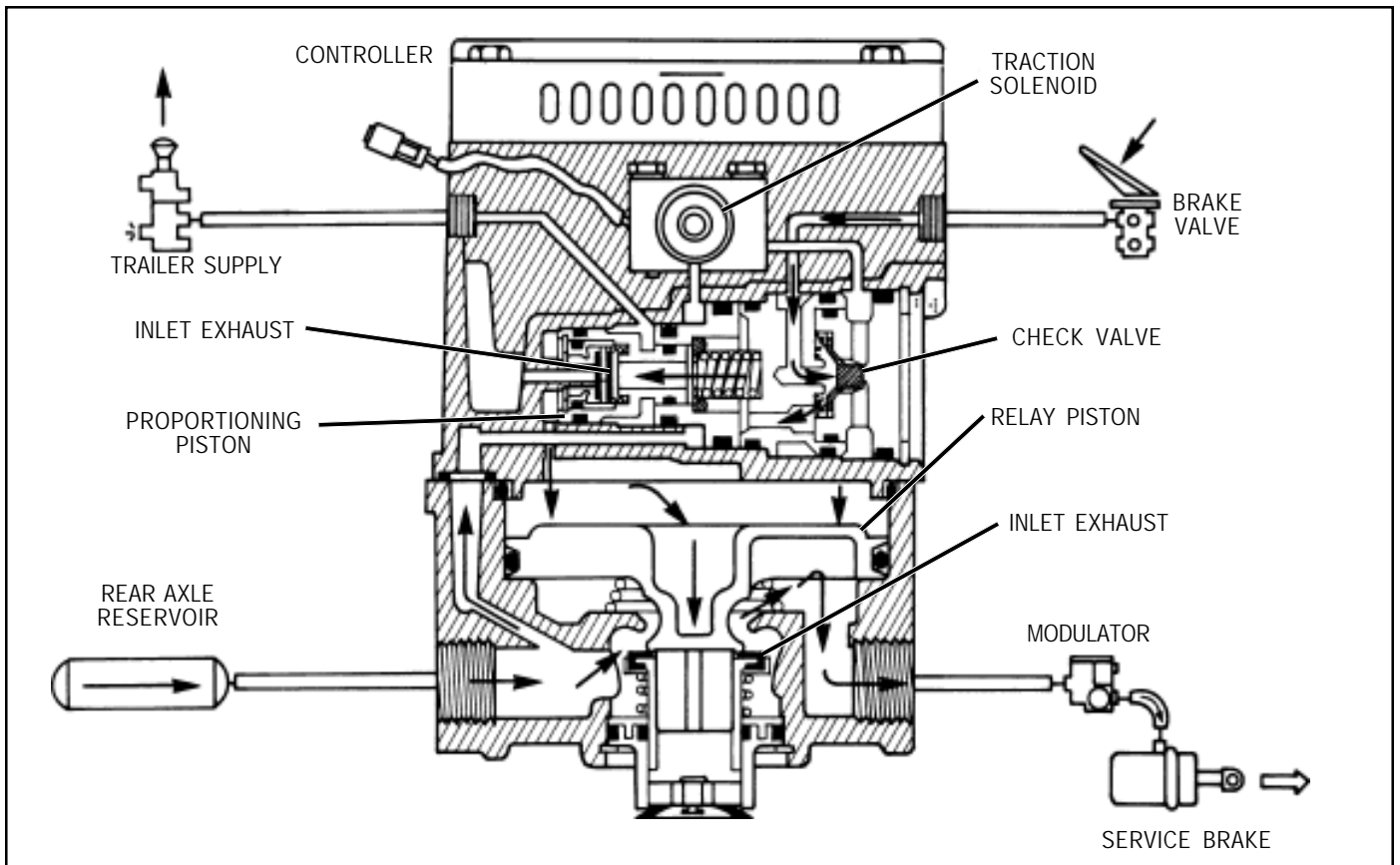


FIGURE 7 - BOBTAIL TRAILER SERVICE BRAKES APPLYING (LESS THAN 80 PSI)

TRACTION CONTROL - SERVICE APPLICATION
GENERAL

While under the control of an antilock traction controller, the ATR-2™ valve's solenoid is able to initiate a brake application that allows the traction system to control wheel

spin upon 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-2™ valve which then applies air to each of the rear axle modulators as shown in Figure 12. The modulators are equipped with solenoid valves

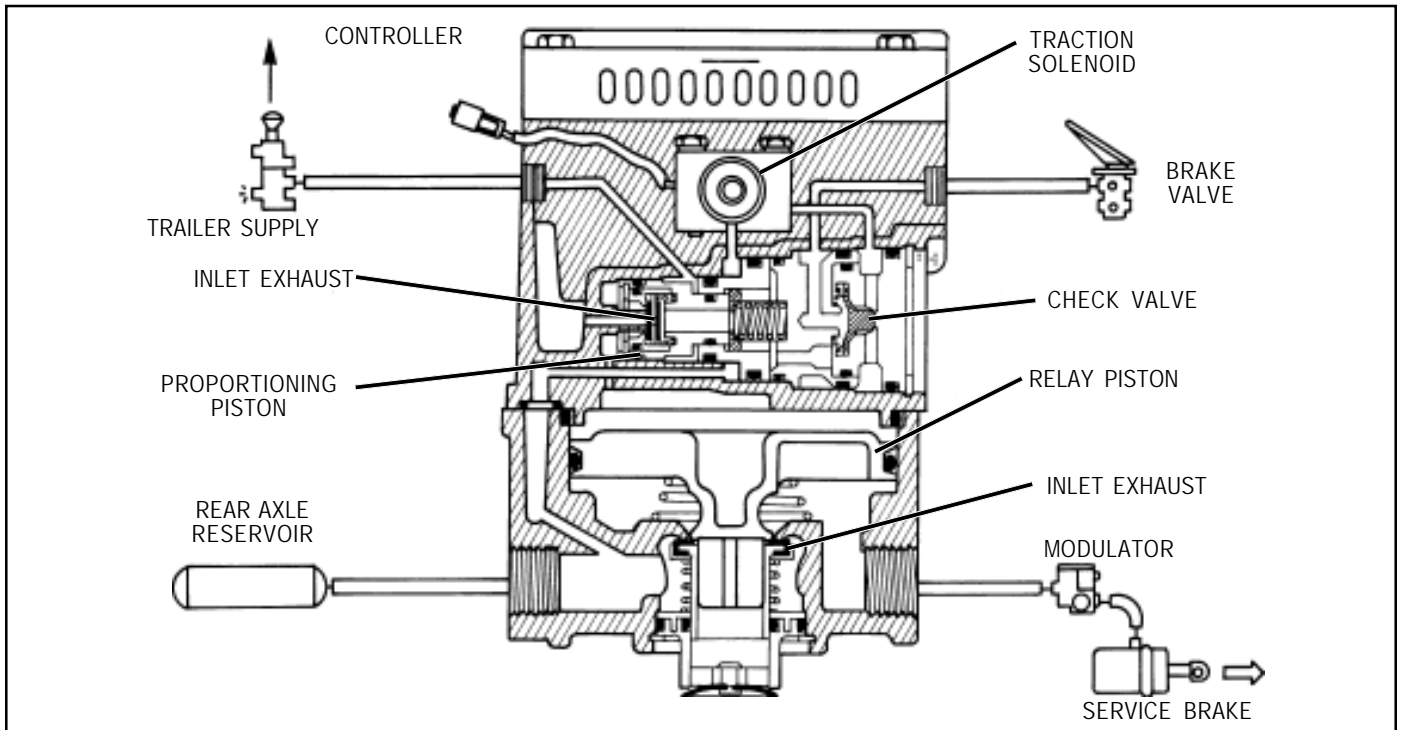


FIGURE 8 - BOBTAIL TRAILER SERVICE BRAKES HOLDING

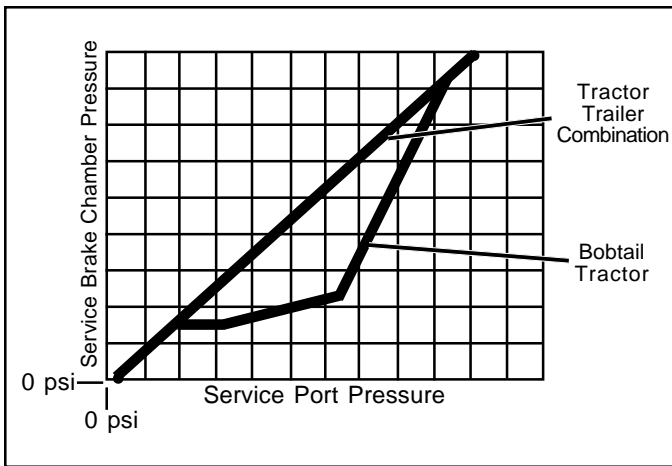


FIGURE 9 - ATR-2™ VALVE PRESSURE DELIVERY CURVE

also and because they are also controlled by the controller, the solenoid valves in the appropriate modulator are opened and closed to gently pump the brake on the spinning wheel only. This gentle brake application forces the differential to drive the stationary or slowly spinning wheel.

TYPICAL ANTILOCK - TRACTION SYSTEM (PARTIAL)

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 the double check valve. The check valve diaphragm flexes in response and seals the passage to the open exhaust of the brake valve. Once past the double check valve, air from the solenoid flows through the rest of the valve in the same manner as a normal service

brake application and air is delivered out the delivery ports of the ATR-2™ valve.

When the electronic controller de-energizes the solenoid, air between the solenoid and the double check valve returns to the solenoid and is exhausted. Air between the relay piston and double check valve is exhausted at the brake valve while delivery pressure is exhausted at the main ATR-2™ valve's exhaust port.

PREVENTIVE MAINTENANCE

GENERAL

Perform the tests and inspections presented at the prescribed intervals. If the ATR-2™ 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 contaminants and visually inspect the exterior for excessive corrosion and physical damage.
2. Inspect all air lines connected to the ATR-2™ 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.

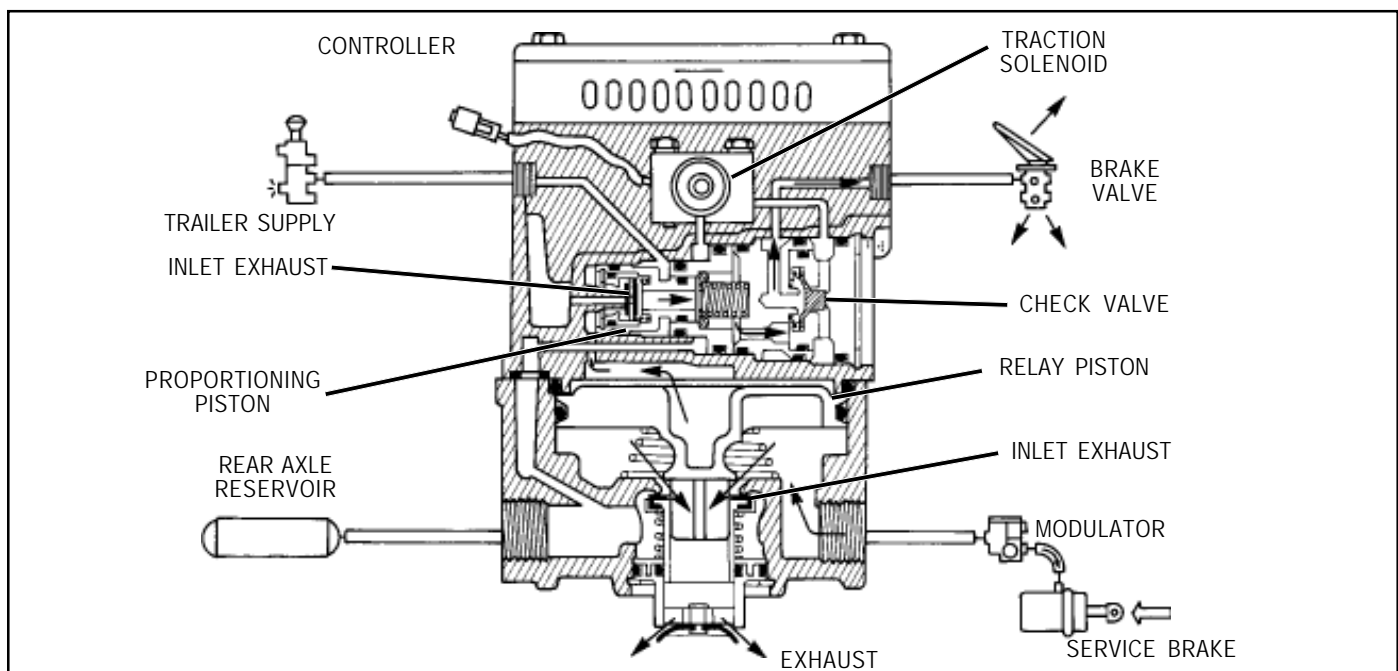


FIGURE 10 - BOBTAIL TRAILER SERVICE BRAKES RELEASING

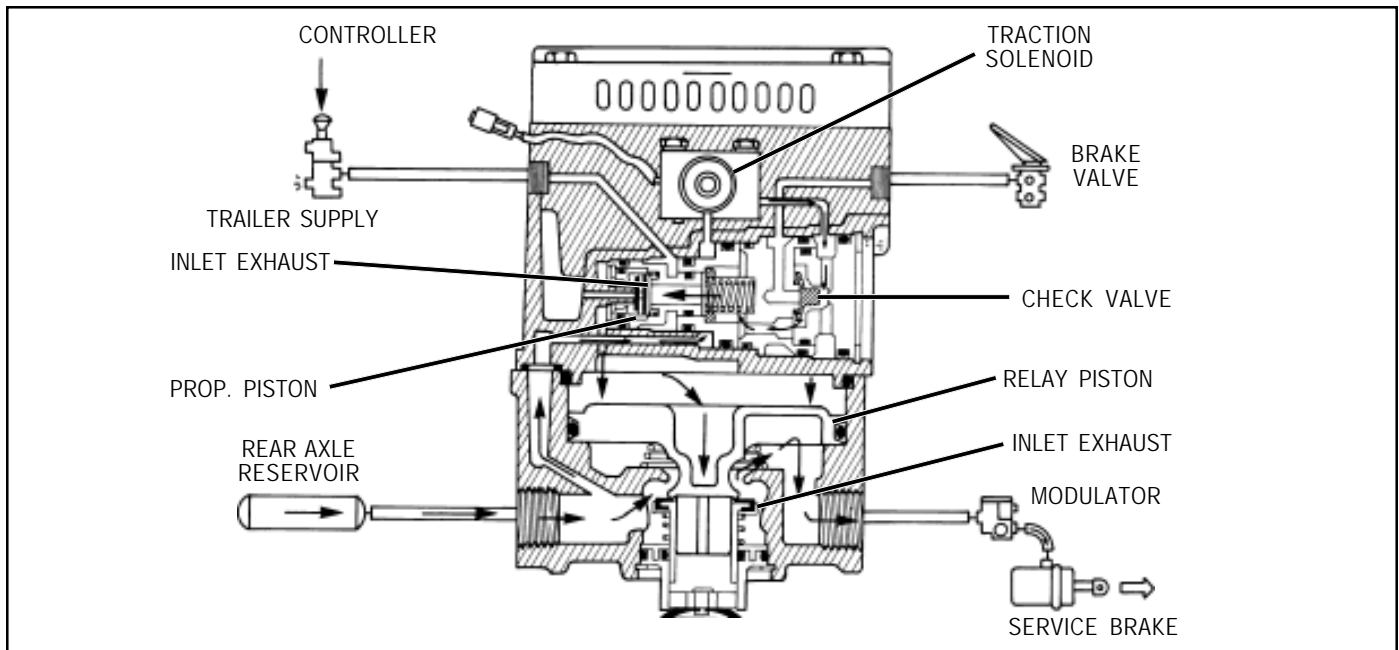


FIGURE 11 - TRACTION CONTROL BRAKE APPLICATION

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.
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.

To properly test the function of the ATR-2™ valve, a pair of test gauges or gauges of known accuracy must be used.

OPERATION TEST

1. Drain air pressure from all vehicle reservoirs.

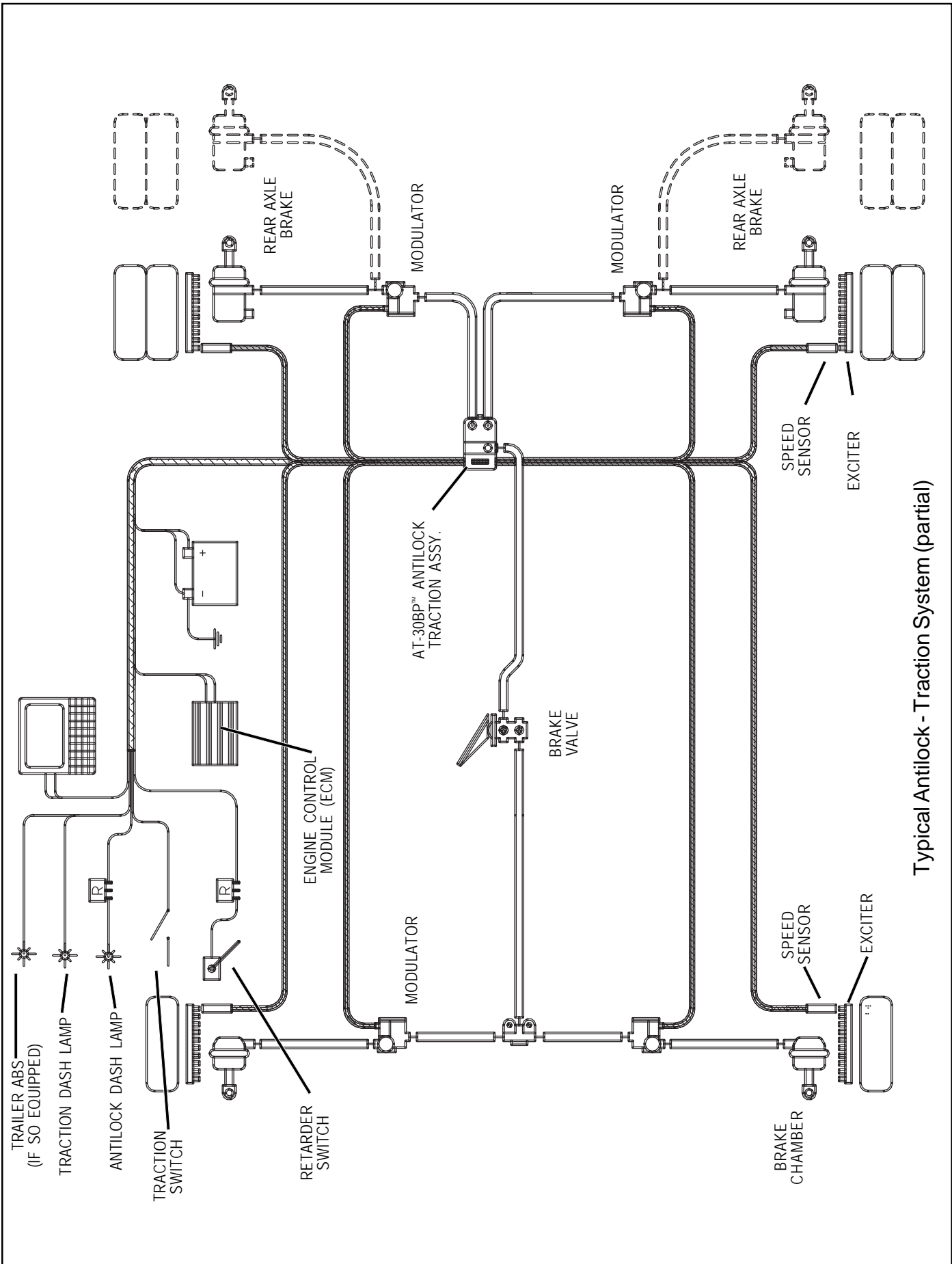


FIGURE 12 - PARTIAL ANTILOCK TRACTION SYSTEM SCHEMATIC

2. Install a gauge at the ATR-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 ATR-2™ valve for leakage. Tighten as needed.
4. With the trailer supply valve (dash control w/red octagonal button) and system park control (dash control w/yellow diamond button) activated for tractor/trailer operation, apply and release the brakes several times and check for prompt application and release at each wheel. If prompt reaction is noted at some, but not all wheels, test the antilock modulator between the ATR-2™ 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-2™ valve. If a complete release of the brakes is noted at some, but not all wheels, test the antilock modulator between the ATR-2™ 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-2™ valve.
5. Check the ATR-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 ATR-2™ valve part number (see the I.D. washer also for the differential). NOTE: For ATR-2™ valves not incorporating a relay piston return spring(14) 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 ATR-2™ valve’s 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 ATR-2™ valve’s 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. IMPORTANT: If during testing, the service port pressure is SLOWLY increased from approximately 70 psi to a full (100 psi or

greater) brake application, the ATR-2™ valve MAY begin to cycle between an apply and exhaust mode. This condition is normal while the ATR-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 service port pressure.

10. Disconnect the ATR-2™ valve’s two pin solenoid connector from the 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.
11. Apply and remove vehicle power (12 vdc) to the two pin connector half leading to the ATR-2™ valve (solenoid) while observing the brake chamber gauges. Note that a full brake application is made and held while power is applied to the ATR-2™ valve’s solenoid and that it is released when power is removed.
12. Remove the test gauges from the ATR-2™ valve.

LEAKAGE TESTS

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 all three exhaust ports (two in cover and one in body). The leakage noted should not exceed a 1” bubble in less than 3 seconds at any exhaust port.
2. Make and hold a full brake application and apply a soap solution to all three exhaust ports and around the cover where it joins the body. The leakage noted should not exceed a 1” bubble in less than 3 seconds at any exhaust port.

If the ATR-2™ valve fails to function as described, or leakage is excessive, it should be replaced with a new or genuine Bendix remanufactured unit or repair using maintenance kit piece number 109359, available at any Bendix 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 (ATR-2™ valve) from the vehicle.

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(2) to the body(1) and, if the valve is equipped with a mounting bracket(41), mark the relationship of the bracket to the cover and body(1).
3. Mark the relationship of the electronic controller(39) to the cover(2).

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. While holding the exhaust cover(4), remove the retaining ring(3) that secures it to the body(1).
2. Remove the exhaust cover(4) along with both o-rings(5 & 6).
3. Remove the valve spring(7), valve retainer(8), and the valve assembly(9) from the body(1).
4. Referring to Figure 2, remove and retain the four cap screws(38) that secure the electronic controller(39) to the cover(2), then separate and retain the controller(39), from the cover(2).
5. Remove and retain the two long cap screws(10), washers(45 and 46) and nuts(43) that secure the cover(2) to the body(1).
6. Remove and retain the two cap screws and lock washers(42) that secure the bracket(41) to the cover(2), then remove and retain the bracket.
7. Remove and retain the two short cap screws(40) that secure the cover(2) to the body(1).
8. Separate the cover(2) from the body(1), then remove the sealing ring(35) and o-ring(11).
9. Remove the relay piston(12) and relay piston spring(14) from the body(1). NOTE: The relay piston spring, item 14 is not used in all valves.
10. Remove the o-ring(13) from the relay piston(12).
11. Remove the retaining ring(15). Then remove check valve seat(16), with o-rings(20 & 21). Remove o-rings(20 & 21) from the check valve seat.
12. Remove the check valve(17), guide(18), and spring(19).
13. Remove the inlet seat(36) with o-rings(37 & 44), then remove and discard o-rings(37 & 44) from the inlet seat(36).

14. Remove the spring(22) then remove and retain the spring cage(23) from the valve cover(2).

15. Use shop air at the control port to extract the blend back piston(24) from the valve cover(2). Retain the piston(24) but remove and discard both o-rings(25 & 26).
16. Remove the entire, assembled proportioning piston(28) from the valve cover(2). Then remove and discard o-rings(27 & 29).
17. Remove retaining ring(30). Remove inlet seat(32) then remove and discard inlet valve(33) and spring(34). Remove and discard o-ring(31) from the inlet seat(32).

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 (Key Nos. 12, 23, 24) 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(1) and cover(2) 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(1) and cover(2) 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(2) 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(1) and valve cover(2). Make certain they are clean and free of thread sealant.
9. Inspect the relay piston spring(14) 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 o-ring(31) on the new inlet valve seat(32).
3. Install the small end of the new inlet/exhaust valve spring(34) over the rubber of the new valve(33) making sure the spring coils rest on the valve's four tabs.
4. Insert the spring and valve into the valve seat(32), making sure the four tabs are within the seat's bore.
5. Insert the valve, seat and spring assembly into the proportioning piston(28) and while holding the seat(32)

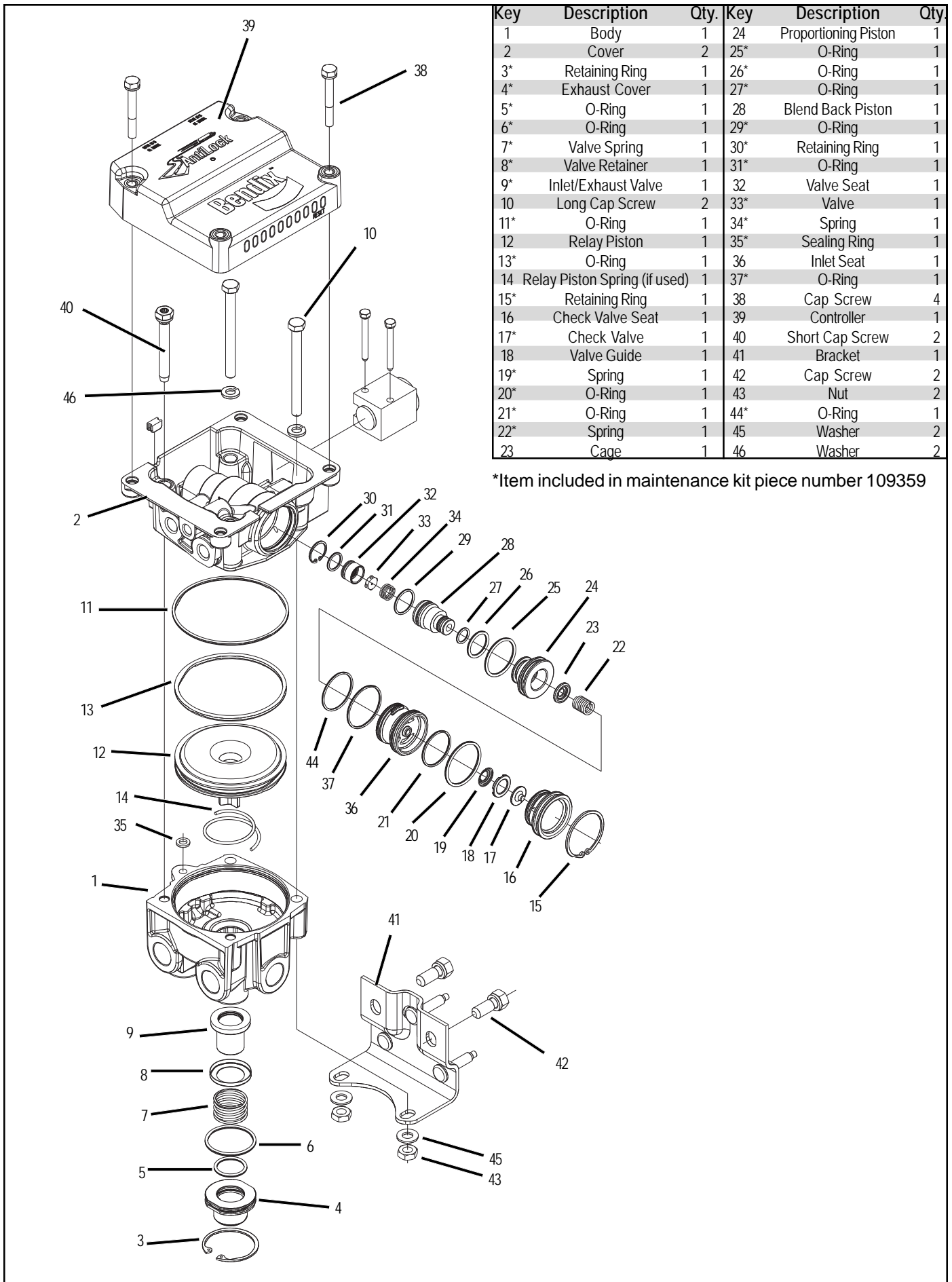


FIGURE 13 - AntiLock Traction Assembly Exploded View

in place, install retaining ring(30) to secure it in the piston(28). 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 the large and small diameter o-rings(27 & 29) on the proportioning piston(28).
7. Install both the large and small diameter o-rings(25 & 26) on the blend back piston(24), then insert the small diameter of the proportioning piston(28) into the small diameter end of the blend back piston(24).
8. Carefully insert the assembled proportioning and blend back pistons(24 & 28) 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 spring cage(23) in the blend back piston(24) so that its flat side rests against the blend back piston. The concave side of the spring cage should face toward the spring(22) which is installed next.
10. Install the spring(22) in the cage(23) so that its coils are within the I.D. of the cage.
11. Install the small and large diameter o-rings(44 & 37) on the inlet seat(36) then insert the inlet seat into the bore in the cover(2).
12. Install the small and large diameter o-rings(21 & 20) on the check valve seat(16).
13. Install the spring(19) on the inlet seat(36) so that the small diameter fits over and around the air passage through the center of the inlet seat.
14. Install the check valve(17) and valve guide(18) in the check valve seat(16). Note; The check valve must be installed so that the "top hat" portion fits into the valve seat(16). Install the valve guide(18) so that its flange contains (surrounds) the coils of the large end of the spring(19), when the valve seat(16) is installed in the cover(2). Use a small amount grease to hold these parts in the valve seat(16).
15. Install the assembled valve seat(16) with the check valve and valve guide(17 & 18) into the cover(2) bore and while holding it in place install the retaining ring(15). Make certain the retaining ring is fully seated in its groove.
16. Install the valve retainer(8) on the inlet and exhaust valve(9) so that the flange of the retainer(8) surrounds the rubber portion of the valve. Install the inlet and exhaust valve in the body(1).
17. Install the inlet and exhaust valve return spring(7) in the body(1).
18. Install the large and small diameter o-rings(5 & 6) in the exhaust cover(4), then install the exhaust cover in the body(1) taking care not to damage the o-rings. Hold the exhaust cover in place.
19. While depressing the exhaust cover(4), install the retaining ring(3) in the body(1). Make certain the retainer(3) is fully seated in its groove in the body.
20. If the valve was equipped with a relay piston return spring(14), install the spring in the body, large diameter first.

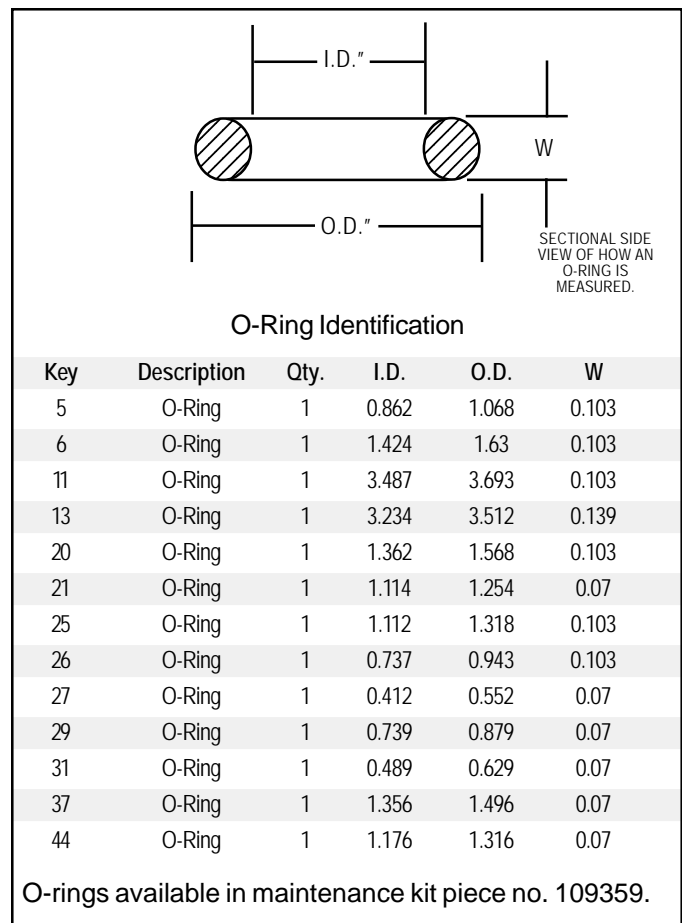


FIGURE 14 - O-RING IDENTIFICATION CHART

21. Using lubricant to hold them in place, install the large and small sealing rings(11 & 35) on the cover(2).
22. Install the o-ring(13) on the relay piston(12), then install the piston in the body(1).
23. Note the relationship marks made prior to disassembly, then install the cover(2) on the body(1). Secure the cover(2) on the body(1) using the two, short cap screws(40). Again, noting the relationship marks, secure the bracket(41) on the cover(2) and body(1) and using the two long cap screws(10), washers(45 and 46) and two nuts and washers(43). Torque the four cap screws to 120 to 150 lb. in.
24. Install the two cap screws(42) that secure the bracket(41) to the cover(2) and torque to 180 - 220 pound inches.
25. Noting the relationship marks made during disassembly, secure the controller(39) to the cover(2) using the four cap screws(38). Torque the four cap screws to 50-80 pound inches.
26. Install all air line fittings and plugs making certain thread sealing material does not enter the valve.
27. Install the rebuilt valve on the vehicle and perform the OPERATION AND LEAKAGE TESTS before placing the vehicle in service.