# Air Brake System Troubleshooting

## TEST 1

**Governor cut-out / Low pressure warning / Pressure build-up**
VEHICLE PARKED, WHEELS CHOCKED

| | | ☑ OK | ☑ Not OK |
|---|---|---|---|
| 1. | Drain all the reservoirs to 0 psi. | | |
| 2. | Start the engine and run at fast idle. The low pressure warning should be on. Note: on vehicles equipped with ABS, the warning lamp will also come on momentarily when the ignition is turned on. On some systems, such as the AD-IS® dryer system (illustrated), reservoirs may not fill simultaneously and one reservoir may fill to 110 psi before the other starts to fill. | ☐ | ☐ |
| 3. | Low pressure warning; dash warning lamp should go off above 60 psi. | ☐ | ☐ |
| 4. | Build up time; pressure should build from 85-100 psi within 40 seconds. | ☐ | ☐ |
| 5. | Governor cut-out; cuts out at the correct pressure, usually 125-135 psi. | ☐ | ☐ |
| 6. | Governor cut-in; reduce the service air pressure to governor cut-in. The difference between cut-in and cut-out pressure must not exceed 30 psi. | ☐ | ☐ |

MAKE ALL THE NECESSARY REPAIRS BEFORE PROCEEDING TO TEST 2;
SEE CHECKLIST 1 FOR COMMON CORRECTIONS.

## CHECKLIST 1

**If the low pressure warning lamp or buzzer doesn't come on:**
1. Check the warning lamp wiring.
2. Check the warning lamp bulb.
3. Repair or replace the buzzer, bulb or low pressure warning switch(es).

**If the governor cut-out is higher or lower than specified by the vehicle manual:**
1. Repair, replace or adjust the governor as necessary after ensuring the compressor unloader mechanism is operating correctly.

**If the low pressure warning occurs below 60 psi:**
1. Check the dash gauge with test gauge known to be accurate.
2. Repair or replace the faulty low pressure indicator switch.

**If the compressor build up time exceeds 40 seconds or is considerably greater than the permanent record figure:**
1. Examine the compressor air inlet filter and inlet line checking for restrictions, damage or wear. Clean or replace the filter or inlet line as necessary.
2. Check the compressor discharge port and line for excessive carbon. Clean or replace the discharge line as necessary. If there is carbon, find the cause of the excessive heat.
3. With the system fully charged and governor in the unloaded mode, listen at the compressor inlet for leakage. If leakage can be heard, remove the unloaders and repair or replace as necessary.

RETEST TO VERIFY PROPER OPERATION OF ALL ITEMS
REPAIRED OR REPLACED.

## TEST 2

**Leakage (reservoir air supply)**
For additional information refer to video Assessing Air Brake System Air Leakage (BW2327 - CD)
FULL PRESSURE, ENGINE STOPPED, PARKING BRAKES APPLIED

| | | ☑ OK | ☑ Not OK |
|---|---|---|---|
| 1. | Allow the air pressure to stabilize for at least 1 minute. | ☐ | ☐ |
| 2. | Observe the dash gauge pressures for 2 minutes and note any pressure drop. | | |
| | A. Pressure Drop: Single Vehicle (A 4 psi drop within 2 minutes is allowable for either service reservoir) | ☐ | ☐ |
| | B. Pressure Drop: Tractor/Trailer (A 6 psi drop within 2 minutes is allowable for either service reservoir) | ☐ | ☐ |
| | C. Pressure Drop: Tractor/2 Trailers (An 8 psi drop within 2 minutes is allowable for either service reservoir) | ☐ | ☐ |

MAKE ALL NECESSARY REPAIRS BEFORE PROCEEDING TO TEST 3;
SEE CHECKLIST 2 FOR COMMON CORRECTIONS.

## CHECKLIST 2

**If there is excessive leakage in the supply side of the pneumatic system, one or more of the following devices could be causing the problem:**
NOTE: A leak detector or soap solution will aid in locating the faulty component.
1. Supply lines and fittings
2. Low pressure indicator(s)
3. Service brake relay valve(s)
4. Spring brake relay valve (where applicable)
5. Dual brake valve
6. Trailer hand control valve
7. Parking control valve
8. System safety valve(s) in the supply reservoir and/or air dryer
9. Governor (may be mounted on the air dryer as illustrated, on the compressor, or remotely)
10. Compressor discharge line

RETEST TO VERIFY PROPER OPERATION OF ALL ITEMS
REPAIRED OR REPLACED.

## TEST 3

**Pressure Modulator Valve and Traction Control Valve Chuff Test**
FULL PRESSURE, ENGINE STOPPED, PARKING BRAKES RELEASED

| | | ☑ OK | ☑ Not OK |
|---|---|---|---|
| 1. | Make and hold brake application. When ignition power is applied, each modulator solenoid is briefly energized. If the air system is fully charged and the service brake pedal is depressed during ignition, the modulator creates a single, sharp audible "chuff" of air pressure. The modulators are energized in a certain pattern, as follows: right front, left front, right rear, left rear. This test is performed only when the vehicle is stationary (if the vehicle moves the chuff test will not be performed). | ☐ | ☐ |

NOTE: The EC-60™ controller will perform a PMV chuff test on all installed modulators in the following order:
1. Steer Axle Right PMV
2. Steer Axle Left PMV
3. Drive Axle Right PMV
4. Drive Axle Left PMV
5. Additional Axle Right PMV
6. Additional Axle Left PMV
7. Drive Axle TCV

The pattern will then repeat itself.
See appropriate Service Data Sheet for repairs.

MAKE ALL NECESSARY REPAIRS BEFORE PROCEEDING TO TEST 4.

## TEST 4

**Leakage service air delivery**
FULL PRESSURE, ENGINE STOPPED, PARKING BRAKES RELEASED

| | | ☑ OK | ☑ Not OK |
|---|---|---|---|
| 1. | Make and hold an 80-90 psi brake application. This can be accomplished by using the BVA-85™ brake valve actuator. If the vehicle is not equipped with a BVA-85™ brake valve actuator, an assistant should be used to maintain a constant application during these tests. | ☐ | ☐ |
| 2. | Allow pressure to stabilize for 1 minute; then begin timing for 2 minutes while watching the dash gauges for a pressure drop. | | |
| | A. Pressure Drop: **Single Vehicle** (A 4 psi drop within 2 minutes is allowable for either service reservoir) | ☐ | ☐ |
| | B. Pressure Drop: **Tractor/Trailer** (A 6 psi drop within 2 minutes is allowable for either service reservoir) | ☐ | ☐ |
| | C. Pressure Drop: **Tractor/2 Trailers** (An 8 psi drop within 2 minutes is allowable for either service reservoir) | ☐ | ☐ |
| 3. | Check brake chamber push rod travel (refer to chart for allowable tolerances). With the parking brakes released and service brakes applied with 80 to 90 psi of air pressure to the service chambers. | ☐ | ☐ |
| 4. | Check the angle formed between the brake chamber push rod and slack adjuster arm. It should be equal to or slightly less than 90° in the applied position (80-90 psi) and the same across the axle. | ☐ | ☐ |

| Brake Chamber Size | Maximum Allowable Stroke | Max Allowable Stroke - Long Stroke |
|---|---|---|
| 12 | 1-3/8" | 1-3/4" |
| 16 | 1-3/4" | 2" |
| 20 | 1-3/4" | 2" |
| 24 | 1-3/4" | 2" |
| 24 (Max Stroke) | - | 2-1/2" |
| 30 | 2" | 2-1/2" |

MAKE ALL NECESSARY REPAIRS BEFORE PROCEEDING TO TEST 5;
SEE CHECKLIST 4 FOR COMMON CORRECTIONS.

## CHECKLIST 4

**If there is excessive leakage in the service side of the pneumatic system, one or more of the following devices could be causing the problem:**
NOTE: A leak detector or soap solution will aid in locating the faulty component.
1. Loose service lines and fittings
2. Trailer control valve
3. Stoplight switch
4. Spring brake chamber, service chamber and/or brake chamber diaphragms
5. Tractor protection valve
6. Service brake relay valves
7. Dual brake valve
8. Inverting relay spring brake control valve (where applicable – usually found on the spring brake relay valve) straight trucks and buses
9. Double check valve

**If the automatic slack adjuster is not adjusting, repair or replace to obtain desired setting.**
CAUTION: If the brake chamber push rod travel exceeds the allowable stroke, identify and correct the root cause of the excess stroke. Do not make manual adjustments of an automatic slack adjuster once it can no longer automatically adjust the brakes. Manual adjustment DOES NOT fix the underlying wheel end adjustment. As soon as possible, have the vehicle inspected by a qualified technician or consult the manufacturer's troubleshooting guidelines to find and fix the problem.

RETEST TO VERIFY PROPER OPERATION OF ALL ITEMS
REPAIRED OR REPLACED.

## TEST 5

**Manual Parking Brake Operation**
FULL PRESSURE, ENGINE IDLING 600-900 RPM

| | | ☑ OK | ☑ Not OK |
|---|---|---|---|
| | **FOR STRAIGHT TRUCKS, BUSES AND BOBTAIL TRACTORS:** | | |
| 1. | Manually operate the park control, yellow button valve, and note that parking brakes apply and release promptly as the control valve button is pulled out and pushed in. | ☐ | ☐ |
| | **FOR TRACTOR/TRAILER COMBINATIONS:** | | |
| 1. | Manually operate the tractor protection control valve (trailer supply valve usually red octagonal button). Note that trailer brakes apply and release promptly as the control button is pulled out and pushed in. | ☐ | ☐ |
| 2. | Manually operate system park control (usually yellow diamond button) and note all parking brakes (tractor and trailer) apply promptly. | ☐ | ☐ |

MAKE ALL NECESSARY REPAIRS BEFORE PROCEEDING TO TEST 6;
SEE CHECKLIST 5 FOR COMMON CORRECTIONS.

## CHECKLIST 5

**If sluggish performance is noted in either test, check for:**
1. Dented or kinked lines
2. Improperly installed hose fitting
3. A faulty quick release valve or spring brake control valve
4. Damaged or improperly installed Spring Brake Chamber and/or Service Chambers
5. Foundation Brake component binding, improper installation and/or lack of lubrication.

**If the trailer brakes do not actuate and the trailer supply line remains charged, check the:**
1. Tractor protection control
2. Trailer spring brake valve
3. Damaged spring brake chamber and/or service chambers
4. Foundation brake component binding, improper installation and/or lack of lubrication

RETEST TO VERIFY PROPER OPERATION OF ALL ITEMS REPAIRED OR REPLACED.

## TEST 6

**Dual circuit system integrity check (emergency braking) and/or Automatic application of the parking brake and /or Tractor protection valve operation**
FULL PRESSURE, ENGINE STOPPED, PARKING BRAKES RELEASED

| | | ☑ OK | ☑ Not OK |
|---|---|---|---|
| 1. | Drain the front axle or secondary reservoir to 0 psi. | | |
| | A. The rear axle or primary reservoir should retain most of its pressure. | ☐ | ☐ |
| | B. On combination vehicles, the trailer air system should remain charged. | ☐ | ☐ |
| | C. Tractor and trailer brakes should not apply automatically. | ☐ | ☐ |
| 2. | With no air pressure in the front axle reservoir, make a brake application. | | |
| | A. Rear axle brakes should apply and release when application is released. | ☐ | ☐ |
| | B. On combination vehicles the trailer brakes should also apply and release when application is released. | ☐ | ☐ |
| | C. The stop lamps should light and go off when the application is released. | ☐ | ☐ |
| 3. | "Pop" Pressure Vehicle Test Procedure | | |
| | Note: Bendix is not aware of any federal legislation that specifies the pressure at which the YELLOW parking brake control valve must automatically "trip" to apply the vehicle parking brakes. This includes the Federal Motor Carrier Safety Regulations (FMCSR) for in-use vehicles, the CVSA out-of-service criteria, and the Federal Motor Vehicle Safety Standards (FMVSS) for newly manufactured vehicles. Although the "trip" pressure for the parking brake control valve is not stipulated for in-use or newly manufactured vehicles, a parking brake control valve "trip" pressure of 20-40 psi is currently (02/2009) specified as part of the Commercial Driver License in the CDL Manual. The CDL Manual is not consistent with the regulations cited above. See Bulletin TCH-003-051. continued . . . | | |

## TEST 6 Continued

| | | ☑ OK | ☑ Not OK |
|---|---|---|---|
| 3. | "Pop" Pressure Vehicle Test Procedure (Continued) | | |
| | A. Install an accurate "shop standard" pressure gauge in the secondary service reservoir. | ☐ | ☐ |
| | B. Build pressure in the service reservoirs until the compressor cut-out is reached, shut the engine off. | ☐ | ☐ |
| | C. Fully open the manual drain valve on the primary service reservoir allowing the reservoir to drain completely. | ☐ | ☐ |
| | D. Open the secondary reservoir's manual drain valve creating a bleed rate of approximately 20-50 psi/min. | ☐ | ☐ |
| | E. Monitor the pressure gauge noting the pressure at which the parking control automatically "pops". This is not a Federal requirement - See Note in previous column. | ☐ | ☐ |
| 4. | For Towing Vehicles Only - Test the tractor protection valve feature | | |
| | A. Charge the air system to governor cut-out. | ☐ | ☐ |
| | B. Disconnect the service or control (blue) line to the trailer. | ☐ | ☐ |
| | C. Take care to restrain the service coupling and direct flow safely away while making and holding a full service brake application via the foot valve. | ☐ | ☐ |
| | D. As the service application is vented through the open gladhand, the service system pressure drops until the tractor protection control (red) valve trips and shuts off the leak through the open coupling. This leak must be shut off. | ☐ | ☐ |
| | E. Record the pressure in the service reservoirs. Disconnect the trailer supply coupling to verify that the supply or emergency (red) coupling has been vented to atmosphere, thereby activating the trailer emergency feature. | ☐ | ☐ |
| 5. | Close the drain cocks, recharge the system and drain the rear axle primary reservoir to 0 psi. | | |
| | A. The front axle reservoir should retain most of its pressure. | ☐ | ☐ |
| | B. On combination vehicles the trailer air system should remain charged. | ☐ | ☐ |
| 6. | With no air pressure in the rear axle reservoir, make and release a brake application. | | |
| | A. Front axle brakes should apply and release. | ☐ | ☐ |
| | B. On combination vehicles the trailer brakes should also apply and release. | ☐ | ☐ |
| | C. If the vehicle is equipped with a spring brake modulating valve, typically found on trucks, towing trucks and buses, the rear axle brakes should also apply and release by exhausting spring brake air. | ☐ | ☐ |

MAKE ALL NECESSARY REPAIRS BEFORE PROCEEDING;
SEE CHECKLIST 6 FOR COMMON CORRECTIONS.

## CHECKLIST 6

**If the vehicle fails to pass the tests outlined, then check the following components for leakage and proper operation:**
1. Fittings
2. Kinked hose or tubing
3. Pressure protection valves
4. Double check valves
5. Tractor protection valve
6. Tractor protection control valve
7. Parking control valve
8. Relay valves (antilock modulators)
9. Trailer spring brake control valve
10. Inverting relay spring brake control valve (optional) straight trucks and buses

RETEST TO VERIFY PROPER OPERATION OF ALL ITEMS
REPAIRED OR REPLACED.

**Specify Genuine Bendix® Replacement Parts every time you service your Air Brake System.**

- All genuine Bendix replacement parts are manufactured to meet original OE specifications to guarantee quality, reliability and proper operating performance.
- Rely on genuine Bendix replacement parts to keep your Air Brake System operating efficiently.
- With thousands of Authorized Bendix parts outlets across North America, you're never far from quality genuine Bendix replacement parts.

**Visit www.bendix.com or www.foundationbrakes.com for**

**Service Data Sheets and other literature such as the following:**

**BW1114** Quick Reference Catalog
**BW1231** Air Brake System Troubleshooting Wallchart version of this piece.
**BW1555** Brake Balance Procedure
**BW2780** Troubleshooting Bendix® ESP® Stability System Wallchart
**BW2786** Troubleshooting Bendix® ESP® Stability System
**BW5057** Air Brake Handbook
**SD-13-4863** Service Data Sheet for EC-60™ ABS/ATC Standard & Premium Controllers

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Bendix Spicer Foundation Brake LLC
*A Bendix CVS and Dana Joint Venture*

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# Air Brake System Troubleshooting

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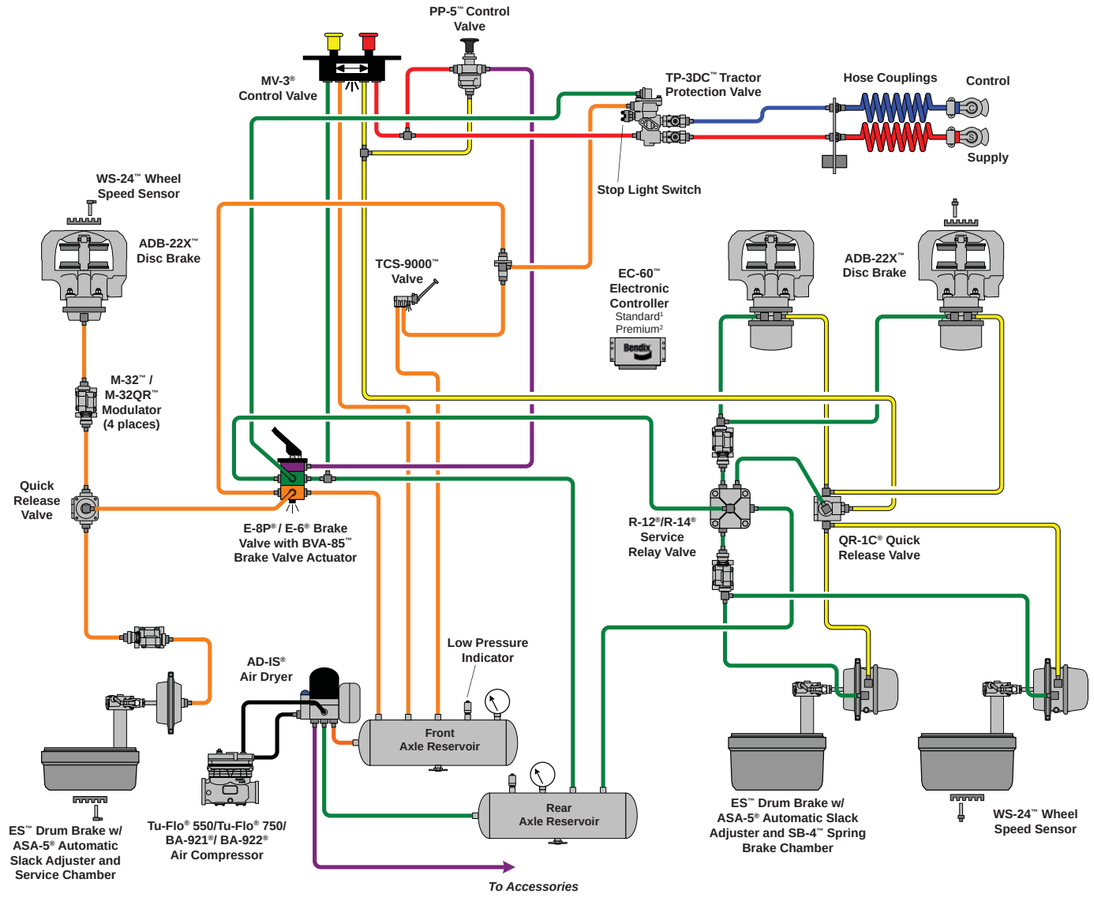
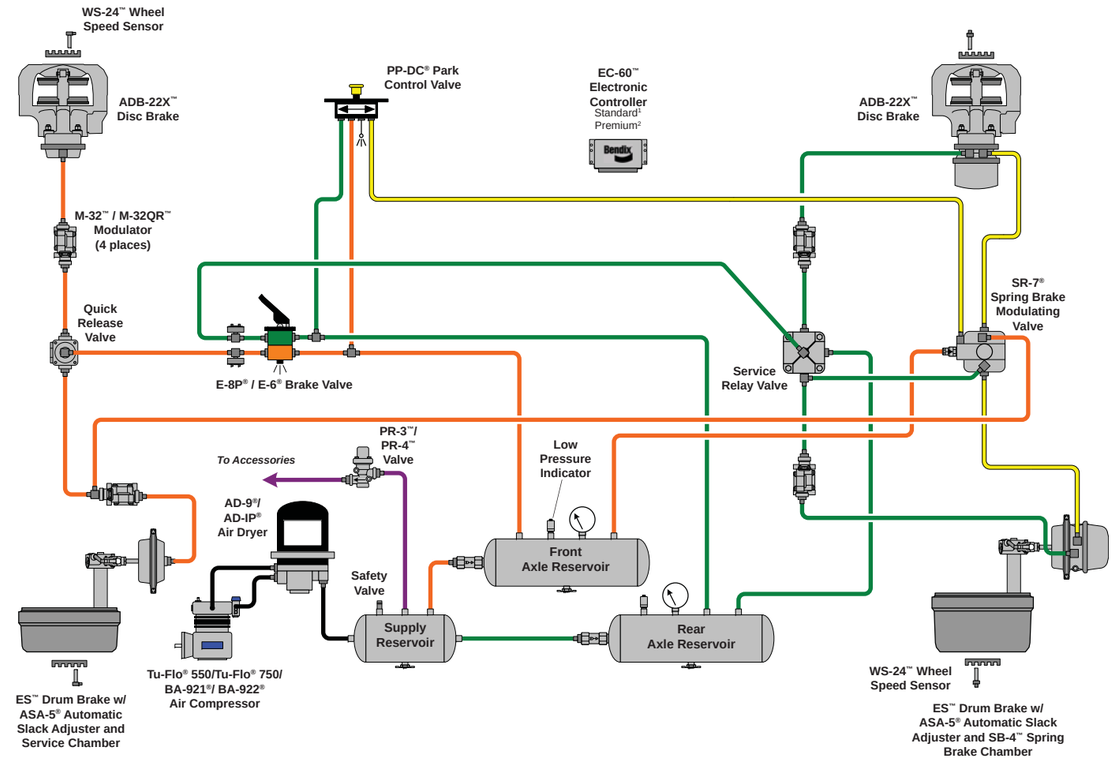
## Typical Tractor System Schematic




## Typical Truck System Schematic




### TRUCKS AND TRUCK TRACTORS:

| Charging | Primary | Secondary | Park (Supply) | Parking (Control) | Accessories |
|---|---|---|---|---|---|

*Notes:*
The color coding of the brake system schematic follows TMC Recommended Practice #423.
Air disc & drum brake actuation combined on a single axle are shown for pictorial purposes only.

[1] Equipped with standard Bendix® ABS Antilock Brake System
[2] Equipped with Bendix® ABS and Smart ATC™ Traction Control