Technical Bulletin

Bulletin No: TCH-003-049 Effective Date: 10/24/2017 Cancels: Same dated 10/18/05 Page: 1 of 6

Subject: Flood Damage: Bendix Recommended Procedure for Power Vehicles that may have been Submerged

This Bulletin provides a recommended procedure for the inspection and (where possible) reconditioning of the air brake control system components on power vehicles (trucks, tractors, and buses) that have been submerged in flood waters. See Bulletin TCH-003-048 for trailer and dolly recommended inspections.

CAUTION: Take all appropriate safety measures when working in conditions where hazardous waste, etc. may be present, including appropriate eye protection, gloves, and masks. *See the General Precautions section at the end of this Bulletin for recommended standard maintenance safety practices for normal conditions.* Do not attempt to start the vehicle until a thorough inspection of the charging system is complete. Follow the vehicle manufacturers guidelines for submerged vehicles before performing any service on the air brake system.

SALT (SEA) WATER IMMERSION

Bendix Commercial Vehicle Systems LLC (Bendix) recommends immediate replacement of all power vehicle pneumatic air brake valves that have been submerged in salt (sea) water to avoid any immediate or future operational issues as a result of internal corrosion. Due to the extremely corrosive nature of salt water and the inherent removal of valve lubrication, sudden and premature valve malfunction can result. Vehicle components recommended to be replaced include air compressors, air dryers, reservoir(s), relay valves, spring brake valves, ABS relay-modulators, air disc brake calipers, brake pads, drum brake linings, cam tube and bushings, slack adjusters, and brake actuators. *If the air brake components are being replaced, there is no need to conduct the Air Brake System Inspections below; instead go to the sections for ABS System inspections and also the "General" heading for steps in restoring the vehicle to service.*

AIR BRAKE SYSTEM INSPECTION

In all other cases where the power vehicle or components have been submerged in fresh water, the recommended steps depend upon what is found during the following inspections. If the vehicle was in a coastal area and you are not certain whether the water submergence was by fresh water or salt (sea) water, our recommendation is to follow the guidelines for salt water submergence above. A separate section in this Bulletin covers inspections for the ABS system.

While it is not the scope of this Bulletin to address anything beyond the air brake control system of the power vehicle, as a useful first step, Bendix recommends that a thorough power-washing of the power vehicle, including the foundation brakes, will assist the technician in determining the condition of the vehicle components. Follow usual chassis re-lubrication measures (including re-greasing of slack adjusters) after power-washing.

To check for evidence of water or contamination, mark and remove the connectors at the first valve in the system from the front. Inspect the valve for water and contaminants. Carefully use air pressure to blow air through the hoses and watch for evidence of water or contamination. **CAUTION: Take all necessary precautions for the safety of the technician and others in the work area during this procedure, including use of appropriate eye protection.**

If evidence of water or contamination is found, *go to Section A.*

Continue to inspect all the valves in the air brake system, removing one control (or supply in the case of quick release valves) and delivery hose from each of the valves and inspect to determine if there is evidence of water or contamination. **If evidence of water or contamination is found, follow the instructions under Section A.**

If no evidence of water or contamination is found in any of the valves or hoses, follow the braking system inspections shown in Section B.

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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.**
- **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.**
- **You should consult the vehicle manufacturer's operating and service manuals, and any related literature, in conjunction with the Guidelines above.**

Section A. Power vehicle air brake systems with evidence of water or contamination

Once water or contamination has entered into any of the air brake components (for example through the exhaust valves, etc.), removal of all the water or contamination is not possible without total disassembly of the components. Therefore **Bendix recommends that all pneumatic air brake components be replaced** (including the air compressor, air dryer, reservoir(s), relay valves, spring brake valves, ABS relay-modulators, tractor protection valves, and brake actuators). This action is necessary to avoid any immediate or future operational issues as a result of internal corrosion and water migration.

If fresh water has entered the air compressor or air dryer through the system intakes, **Do Not** start the vehicle. Use dry compressed shop air to drain the service tanks of any residual water. Air dryers remove moisture from the compressed air, but won't remove moisture in the service tanks – downstream of the air dryer. Install a new or properly serviced air dryer.

See the "ABS Systems" section for ABS system checks and the "General" subheading for hose cleaning/replacement recommendations.

Section B. Power vehicle air brake system with no evidence of water/contaminants found

Power vehicles with only limited exterior exposure to fresh water can be returned to service after having their air brake system thoroughly tested. Following the thorough cleaning of the air dryer, it is recommended to service the unit by replacing the purge valve assembly, heater assembly, and desiccant cartridge – regardless of the level of contamination found – as long as the housing is not physically damaged. Include checks to verify that the parking and emergency brakes apply and release and that the reservoirs charge with minimal leakage (*See the General section at the end of this Bulletin for details of a leakage test*). Check that the application and release of the power vehicle service and parking brakes occur with no perceptible lag through the full range of normal service brake applications. Where applicable (for towing vehicles), make certain that the trailer supply and trailer service glad hands apply and release the trailer brakes fully with no perceptible lag.

With a parked vehicle (chocked wheels), test the tractor protection function by disconnecting the service glad hand. **Caution: Since it may whip, have a technician hold the tractor service glad hand to prevent damage as a result of the test.** With the red Trailer Air Supply button in, make a service brake application. The tractor protection function should detect that the glad hand is unattached, and pop the red button out, protecting the tractor from further air loss through the glad hand.

Replace any non-functioning valves.

Following the thorough cleaning of the air dryer it is recommended to service the unit by replacing the purge valve assembly and desiccant cartridge regardless of the level of contamination found, as long as the housing is not physically damaged.

For ABS system checks, see "ABS Systems" section below. Vehicles with normally-functioning air brake systems can be returned to service. Have all air dryers regularly serviced to aid in removing any residual moisture from the vehicle air brake system.

In addition, all reservoirs should be pressurized and then slowly drained using their drain valves to remove any contents. After 30 days retest the vehicle (*see the next section*).

30 DAY RETEST

Bendix recommends that power vehicles that do not show any internal evidence of water or contamination be retested 30 days after the vehicle has been returned to service. We also recommend that the vehicle be re-tested for operation, leakage, and contamination, and that a diagnostic check of the ABS system be carried out (*see below*). Use diagnostic software (e.g. Bendix® ACom® Diagnostic Software) to look for any present or intermittent trouble codes stored in the ABS Electronic Control Unit (ECU). Any air brake components found inoperative should be replaced.

WHEEL END

Inspect all wheel end components including chambers and slack adjusters for water and corrosion. Check for water in the chamber by removing the chamber from the vehicle and rotating it so that the drain hole points downward. If waste is present, drain the water and reinstall it on the vehicle. Follow the appropriate wheel end re-lubrication process including re-greasing the slack adjuster per manufacturer guidelines. For Bendix® slack adjusters refer to the appropriate Bendix Service Data sheet.

DRUM BRAKES

Examine the wheel ends for the presence of water which can lead to drum corrosion and rust-jacking – corrosion between the lining material and the shoe table on drum brakes.

Disassemble and clean all brake components, including the air chamber, slack adjuster, cam-tube, S-cam, hardware, and dust shield. Remove and replace shoe and lining assemblies that have been submerged.

Visually inspect all brake components for contamination, corrosion, and pitting; replace all damaged components. Note that the brake spider does not need to be disassembled from the vehicle; ensure the spider is free of corrosion and debris.

Inspect the cam tube and bushings, and replace as needed. Replace all cam tube seals and lubricate the cam tube assembly until fresh grease emerges from the shaft seal.

When re-assembly is complete, inspect the brake for proper operation per the Bendix® EB™ & ES™ air drum brakes service manual BW7258 – available for download on bendix.com.

AIR DISC BRAKES

If you suspect that the caliper has been submerged for a significant amount of time in salt water, replace the caliper. If you suspect that the Bendix® Air Disc Brake has been submerged in a flood, a thorough inspection of wheel end components is required. *Follow the inspection procedure below*.

Before analyzing the caliper, it may be helpful to refer to the hub manufacturer's guidelines on inspection after significant water submersion because hub replacement will usually necessitate caliper removal.

Inspect the hub and the condition of the brake rotor. Rust on the surface of the rotor is acceptable, while significant flaking or pitting on the rotor requires further investigation. Refer to Bendix Air Disc Brake Service Data sheet (SD-23-7541) for rotor thickness and maintenance acceptability criteria.

To inspect the functionality of the air disc brake caliper, remove the brake actuator from the air disc brake, and inspect the sealing area where the actuator pushrod enters the caliper. Look for signs of corrosion or standing water inside the caliper – a bore-scope or flashlight may be required to make this inspection. If water or corrosion is found inside the caliper, replace the caliper.

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Remove and discard the brake pads from the caliper – pads that have been subjected to floodwaters for a significant amount of time may not meet requirements for proper operation, depending on the contaminants present in the floodwaters.

Operate the lever arm with a screw driver or other object. The tappets should extend and retract with operation of the lever arm. If the tappets do not move, if the lever arm is frozen, or if the lever arm is extremely hard to move, replace the caliper.

Verify that the adjuster operates properly – the adjuster and tappets should smoothly advance when the adjuster is turned clockwise.

CAUTION! Be sure not to extend the tappets further than 1.75 inches!

If at any point the adjuster is frozen or does not advance, (usually evidenced by breaking multiple shear adapters) replace the caliper.

While the tappets are extended, inspect the tappet boots for rips or tears. If tappet boots are ripped or torn, replace the caliper.

If tappet boots are intact, turn the adjuster counter-clockwise. The adjuster should click as it is retracted, and the tappets should retract into the caliper. If the tappets do not retract, or if multiple shear adapters are broken while attempting to move the adjuster, replace the caliper.

ELECTRONIC/ ABS SYSTEMS

Electronic/ABS systems on power vehicles are comprised of components that include items such as wire harnesses, wheel speed sensors, cameras, radar sensors, visual displays, and an Electronic Control Unit (ECU) – in some cases with an attached relay/modulator valve assembly (*see earlier in this document for air brake valve inspections*).

System Physical Inspection. Inspect the wire harnesses for damage, cuts, chafing, etc. and replace as necessary (Bendix does not recommend repairing or splicing harnesses).

Since the action of floodwaters and power-washing may move the ABS wheel speed sensors from their normal position close to the exciter (tone) ring, push (by hand) each of the wheel speed sensors until they contact the exciter ring. Normal wheel bearing play will adjust the sensor position when the wheel turns. When replacing ABS wheel speed sensors – either because of damage, or as a result of electronic diagnostic checks (*see below*) – carefully follow the lubrication and re-installation instructions in the instruction sheet that is included with the replacement sensor (or, if available, you may use BW-120-A). Whenever a wheel speed sensor is removed from its mounting block, Bendix recommends that the sensor clip be replaced.

System Electronic Inspection. One of two types of Bendix® ECU styles may be used on the power vehicle: frame-mount or cab-mount. *See Figure 1*.

All cab-mounted ECUs that have been submerged must be replaced.

Unless damaged, frame-mounted ECUs are normally "weatherproof" and are not affected by water or most types of contamination. Attach the power vehicle to a towed vehicle and power up the system. Note any ABS indicator lamp diagnostic codes – verify PLC communication between the trailer and tractor. As necessary, use diagnostic software (e.g. Bendix® ACom® Diagnostic Software) to look for any present or intermittent trouble code history stored in the ECU. Inspect the seven-pin electrical connector interface between the tractor and the towed vehicle. Replace components as necessary.

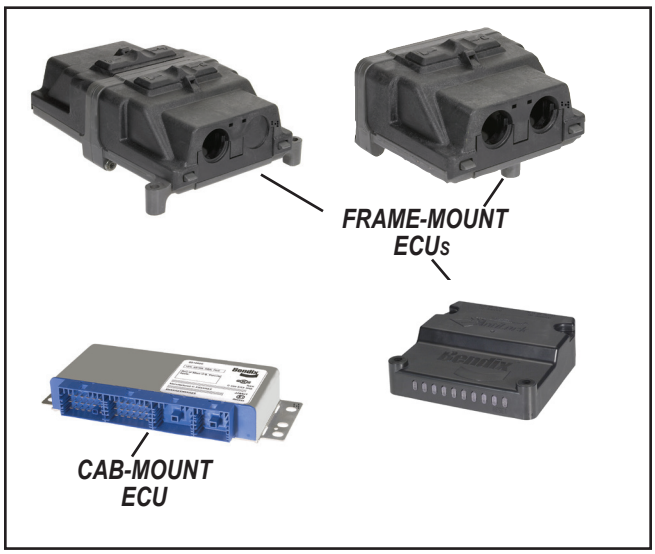


FIGURE 1 - EXAMPLES OF BENDIX® FRAME- AND CAB-MOUNT ECUs

GENERAL

To ensure proper air brake system operation, Bendix recommends that standard operator pre-trip inspections be rigorously performed for all vehicles potentially impacted by flood conditions.

When replacing pneumatic system components that have been subjected to flood conditions, Bendix recommends that all contaminated air hoses be disconnected and flushed with clean water plus blown out with air pressure to remove contaminants.

CAUTION: Take all necessary precautions for safety of the technician and others in the work area during this procedure, including eye protection.

If the contamination cannot be removed from an air line in this manner, replace the air line using SAE approved materials.

Air Brake System and Accessory Leakage Test

Park the vehicle on level ground and chock the wheels. Build system pressure to governor cut-out and allow the pressure to stabilize for one minute.

Step 1: Observe the dash gauges for two additional minutes without the service brakes applied.

Step 2: Release the parking brakes, and apply the service brakes. Allow the pressure to stabilize. Continue holding for two minutes (you may use a block of wood to hold the pedal in position.) Observe the dash gauges.

If you see any noticeable decrease of the dash air gauge readings (i.e. more than four (4) psi, plus two (2) psi for each additional trailer) during either two minute test, repair the leaks and repeat this test to confirm that they have been repaired.

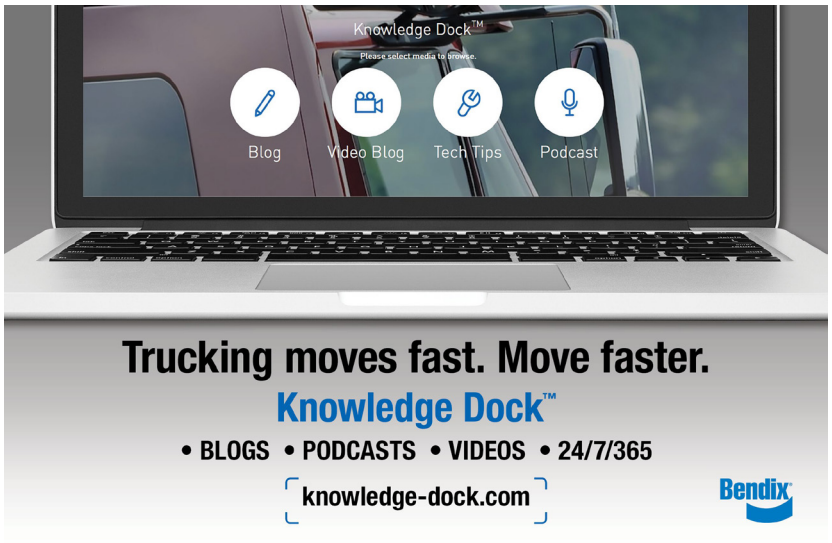
See BW1396 for further dual circuit brake system troubleshooting tests.

Bendix Technical Assistance Team

For direct telephone technical support, call the Bendix technical assistance team at:

1-800-AIR-BRAKE (1-800-247-2725, option 2) Monday through Friday, 8:00 a.m. to 6:00 p.m. ET, and follow the instructions in the recorded message.

Or, you may e-mail the Bendix technical assistance team at: techteam@bendix.com.



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