

Bendix® eTrac™ Automated Air Pressure Transfer System

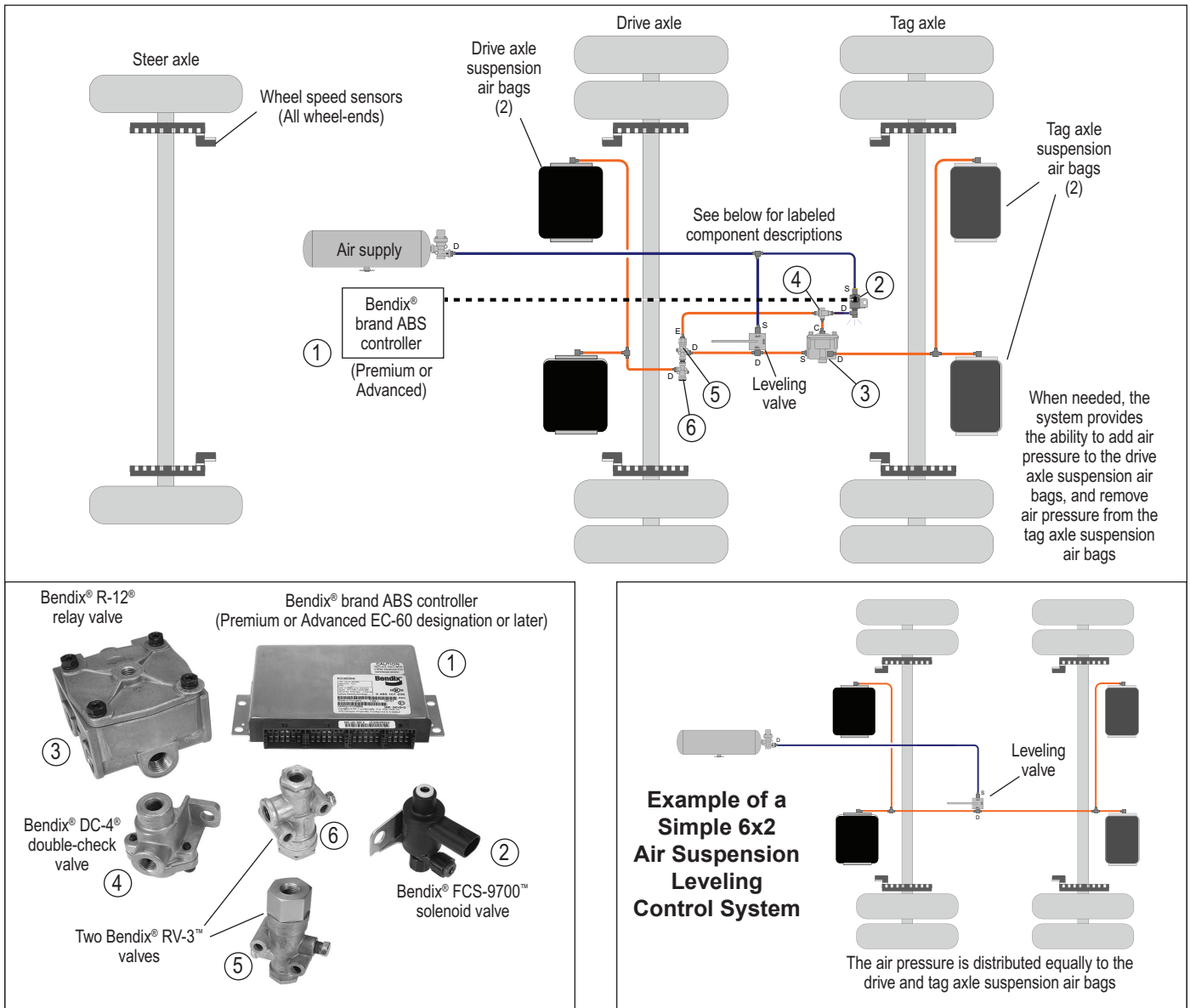



FIGURE 1 - BENDIX® eTrac™ SYSTEM WITH SYSTEM COMPONENTS AND A SIMPLE LEVELING SYSTEM SCHEMATIC

1. INTRODUCTION

The Bendix® eTrac™ automated air pressure transfer system is used on 6 x 2 semi-tractors that feature Bendix® premium and advanced Antilock Brake Systems (ABS). This system complements the Bendix® Smart ATC™ (Automatic Traction Control) feature of our ABS system to provide improved traction at low speeds (e.g. pulling away on an inclined ramp, or in slippery conditions such as mud or snow-covered surfaces, etc.)

When active, the Bendix eTrac system vents — or “dumps” — the air pressure of the tag axle suspension air bags, and increases the air pressure in the drive axle suspension air bags to a pre-determined maximum. This action helps the drive axle to gain more traction.

 **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. 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, 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 Bendix® Wingman® Advanced™-equipped vehicle.
- ▲ You should consult the vehicle manufacturer's operating and service manuals, and any related literature, in conjunction with the Guidelines above.

2. DESCRIPTION

The system features two states (with or without the Mud/Snow switch engaged) and three modes (Normal/inactive; System Active, and Pressure-Limiting Modes):

Mud/Snow Dash Switch Not Engaged

When the Mud/Snow dash switch is not engaged, the three modes of operation are:

- **Normal ("automatic") Mode** is ready whenever the vehicle is moving at less than 25 MPH. In this mode the system behaves just like a typical air suspension leveling system that adjusts for different loads by a mechanical leveling (height control) valve that adjusts all four rear suspension air bags as needed. *See Figure 3.*
- The **Active Mode** occurs when the vehicle encounters road conditions where automatic traction control (ATC) is activated. In addition to the actions of the Bendix® Smart ATC system, the Bendix® eTrac™ system automatically vents ("dumps") air pressure from the tag axle air bags. *See Figure 4.*

With the drop in air pressure in the tag axle, the leveling valve normal function adds air pressure to the drive axle suspension air bags. When the air pressure reaches a pre-determined maximum, the system enters the Pressure Limiting Mode.

- The **Pressure-Limiting Mode** prevents system air pressure delivery to the drive axle suspension air bags above a pre-determined maximum pressure. The system will then — using the backfeed valve — permit the leveling valve to add air back into the tag axle suspension air bags as needed. *See Figure 5.*

Automatic activations are terminated five (5) seconds after the end of an ATC event, and are not able to be initiated at vehicle speeds above 25 MPH.

Mud/Snow Dash Switch Engaged

This mode is sometimes called "semi-automatic" since the driver engages the Bendix eTrac system, however the system automatically terminates five (5) seconds after the vehicle reaches ten (10) MPH.

By activating the Mud/Snow dash switch, the driver can be proactive in anticipating slippery conditions. For example, a driver — moving at five (5) MPH approaching a section of road that is coated with mud — may anticipate this problem zone and press the Mud/Snow switch. The Bendix eTrac system will immediately enter the *Active Mode* described above. When the drive axle reaches the pre-determined maximum pressure, the *Pressure-Limiting Mode* (described above) will be entered.

[It is useful to note that other systems where the driver is responsible for remembering to disengage the air transfer (typically by using a dash button) can lead to significant damage to the driveline if left active.]

3. COMPONENTS *See Figure 1.*

The Bendix® eTrac™ system installation uses the following components:

- **Electronic Control Unit (ECU):** The specifically-configured Bendix® Premium, or Advanced, ABS ECU monitors the speed sensor signals at each wheel-end and during automatic traction control events under 25 MPH signals the Bendix® FCS-9700™ Solenoid Valve to close.

⚠ CAUTION: When replacing a Bendix eTrac-enabled ECU, it is important to replace it **ONLY** with another Bendix eTrac-enabled ECU as indicated by the **CAUTION** label located on the ECU. Installation of a non-eTrac-enabled ECU on an eTrac-equipped vehicle can result in erroneous eTrac system interventions, potentially causing vehicle damage and/or personal injury.



FIGURE 2 - EITHER BENDIX® eTrac™ SYSTEM CAUTION LABEL MAY BE LOCATED ON THE ECU

- **Dash-Mounted Mud/Snow Switch** (*Not shown.*)
- **Bendix FCS-9700 Solenoid Valve:** Energized by the ECU, this normally-open valve moves to the closed position when the Bendix eTrac system is active (and remains on five (5) seconds after the traction event ends). *See SD-03-10433 for more information about this valve.*
- **Bendix® R-12® Relay Valve:** This is the “dump” valve used for venting the Bendix eTrac system. During the *Normal Mode* this relay valve is used to provide an open channel for the inflation and deflation of the tag axle suspension air bags (to maintain equal pressure with the drive axle suspension air bags).

See Figure 3.

During the Bendix eTrac system *Active Mode*, the relay valve isolates the rest of the air suspension system from the tag axle suspension air bags and “dumps” the air pressure from them. The air is exhausted through the relay’s exhaust port. *See Figure 4.*

During the *Pressure-Limiting Mode*, the control port of the “dump” valve receives air pressure from the backfeed valve. This re-inflates the tag axle suspension air bags as required. *See Figure 5.*

See SD-03-1064 for more information about this valve.

- **Bendix® DC-4® Double-Check Valve:** This valve toggles based on the higher supply pressure.

When in *Normal Mode* the double-check valve allows the delivery from the solenoid valve to hold the tag axle suspension air bags open to the same pressure as the drive axle suspension air bags. *See Figure 3.*

In the *Active Mode*, the control air from the solenoid valve to the “dump” valve ends, and the air is vented back — through the double-check valve — and out of the solenoid valve exhaust. *See Figure 4.*

During the *Pressure-Limiting Mode*, the double-check valve allows air pressure from the backfeed valve to the control port of the “dump” valve. This re-inflates the tag axle suspension air bags as required.

See Figure 5.

See SD-03-2202 for more information about this valve.

- **Bendix® RV-3™ Valves:** Typically used for pressure reduction in air brake systems, this valve provides two special functions: It operates as a backfeed valve, and it also operates as a pressure-limiting valve. *See SD-03-3515 for general information about this valve.*

NOTE: When replacing the valves used in this system, it is important to replace **ONLY** like for like part numbers (or direct replacement parts as verified by Bendix.) In particular, the system upper pressure limit for the drive axle suspension air bags is pre-determined by the OEM, and this upper pressure limit determines the specific Bendix RV-3 valves that must be used to avoid damage to the drive train.

NOTE: In the case of the valve used to backfeed the Bendix eTrac system, it is necessary to install the valve as shown in the system diagrams, and not to follow the port designations (such as SUP for supply, etc.) cast into the valve housings.

4. OPERATION

4.1 Automatic Mode: Normal Mode.

Figure 3 shows the normal system position where the leveling valve controls the delivery of air to the rear axle air suspension bags.

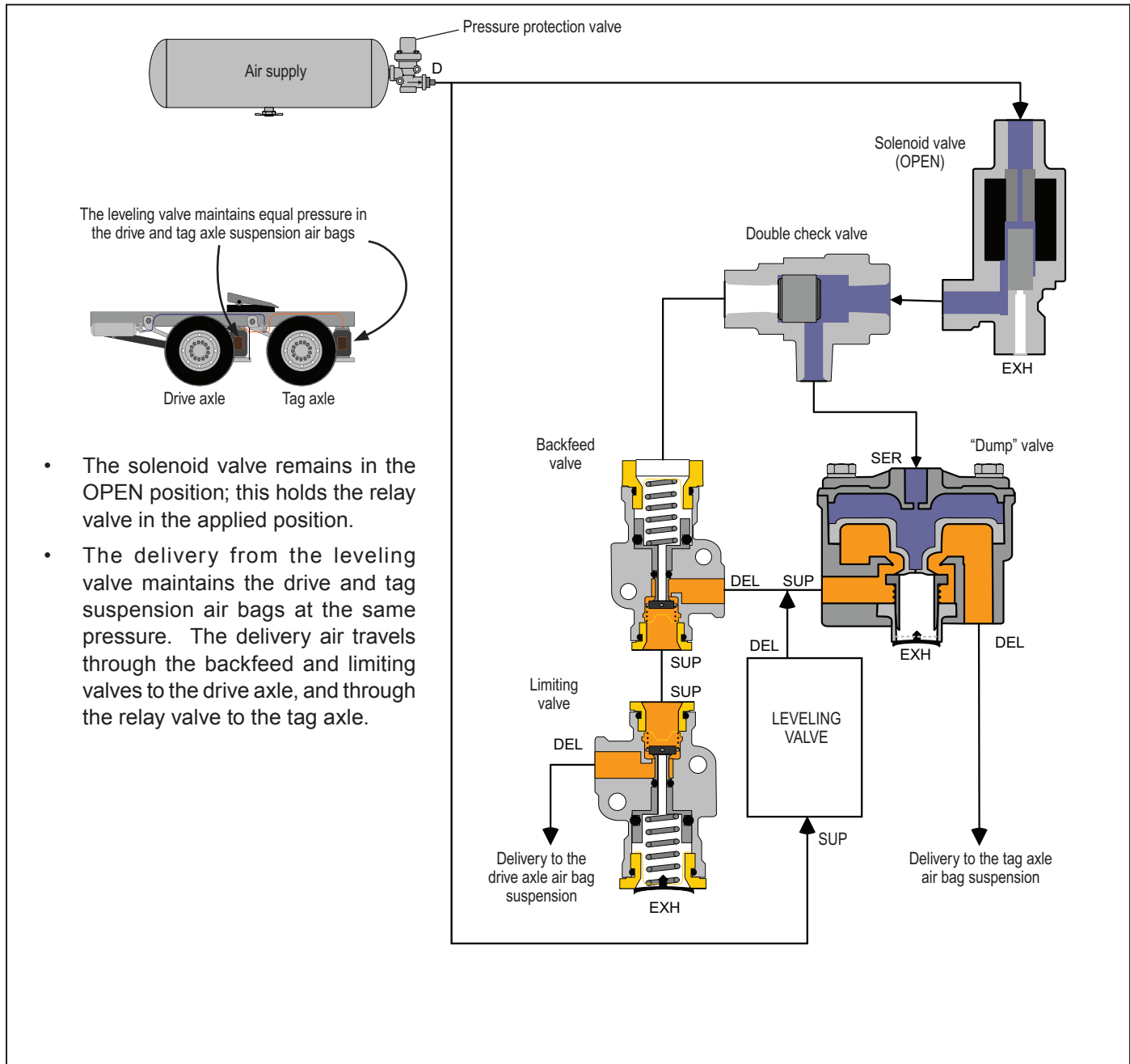


FIGURE 3 - BENDIX® eTrac™ SYSTEM NORMAL ("AUTOMATIC") MODE

4.2 Automatic Mode: Bendix® eTrac™ System Active Mode.

Figure 4 shows the Bendix eTrac system in its *Active Mode* where the “dump” valve controls the delivery of air to the rear axle suspension air bags. This diagram is for both automatic and semi-automatic applications.

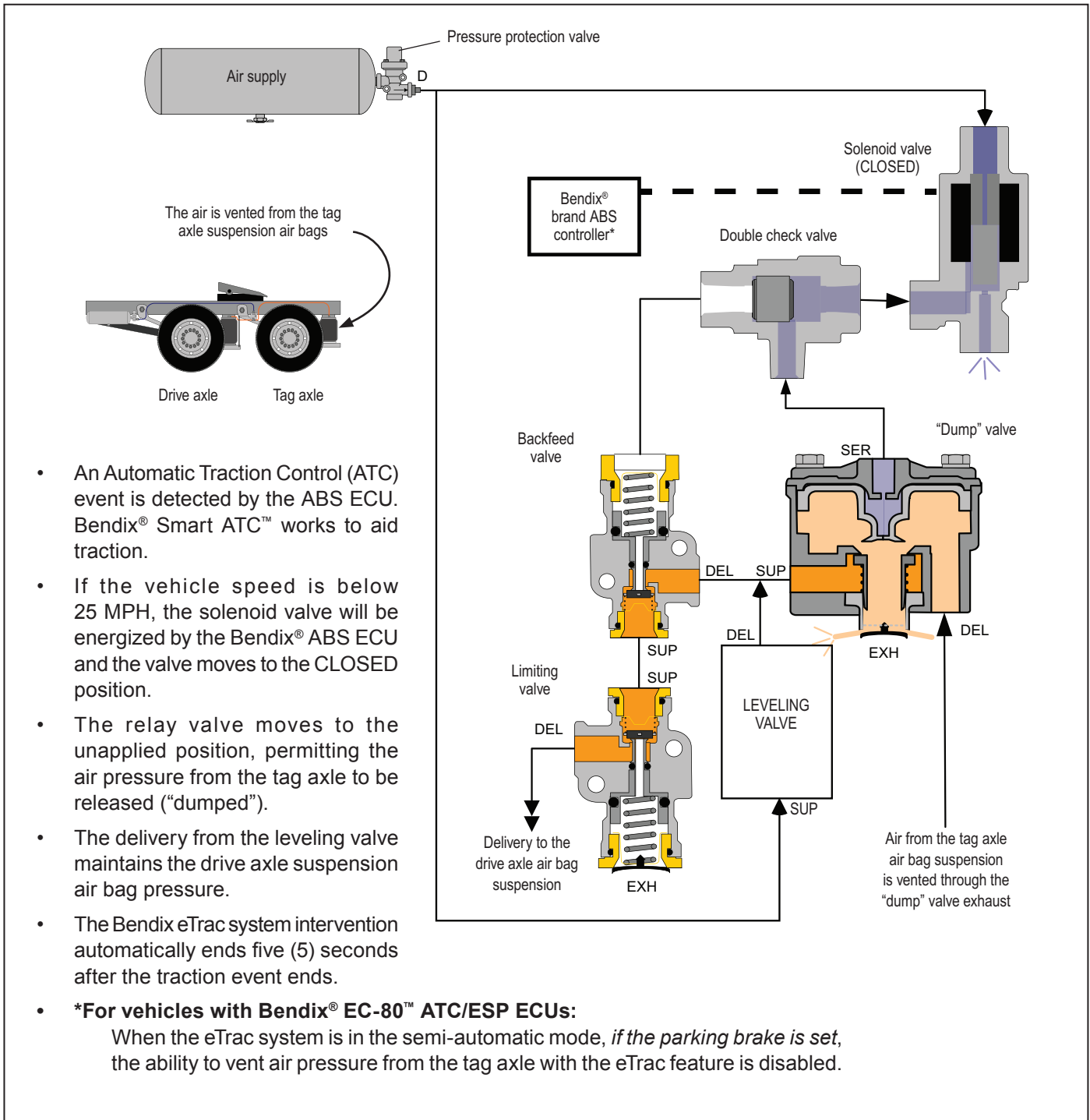


FIGURE 4 - BENDIX® eTrac™ SYSTEM ACTIVE MODE

4.3 Automatic Mode: Bendix® eTrac™ System Active Mode with Pressure-Limiting Mode.

Figure 5 shows the Bendix eTrac system in its *Pressure-Limiting Mode*.

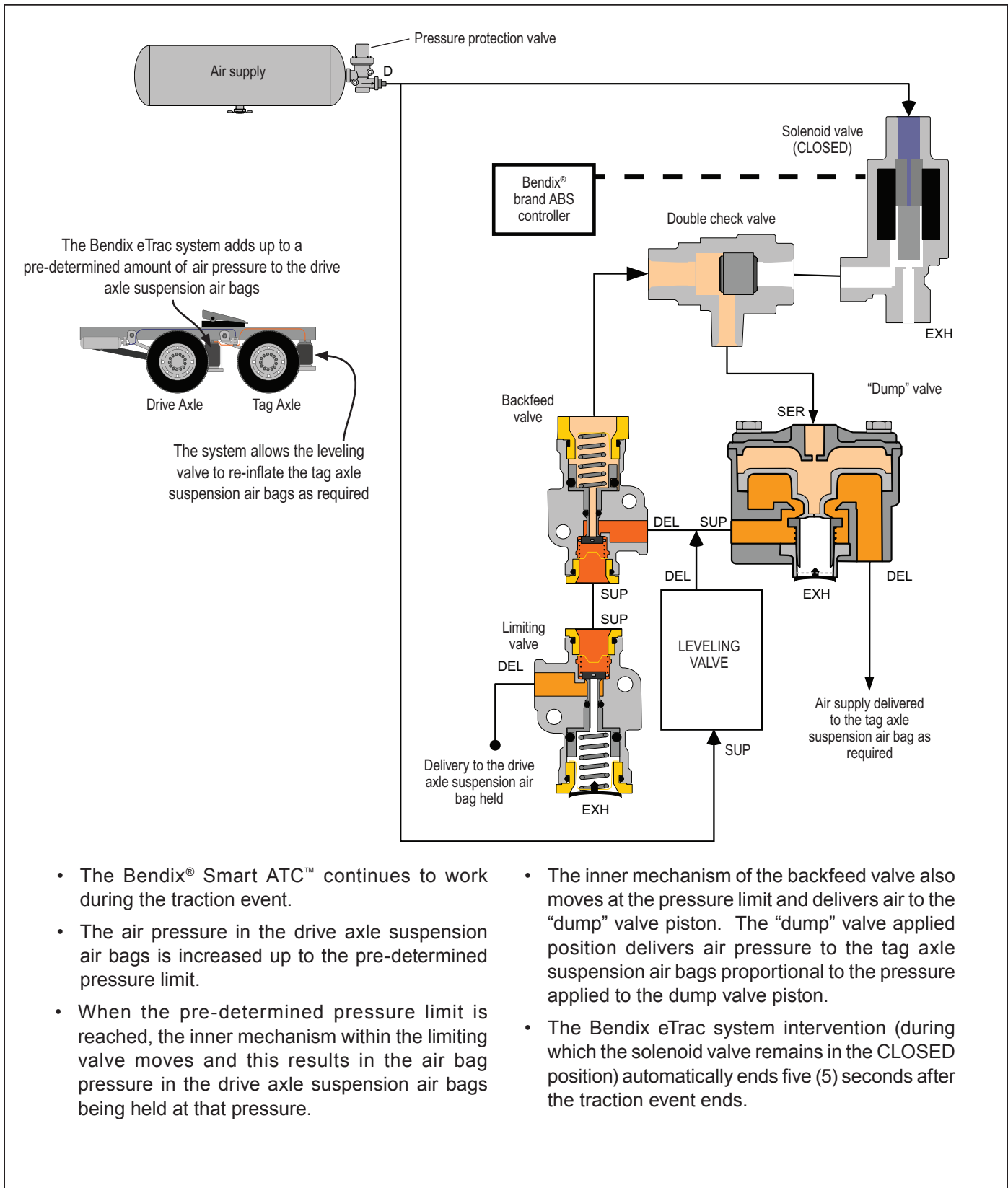


FIGURE 5 - BENDIX® eTrac™ SYSTEM PRESSURE-LIMITING MODE

5. TROUBLESHOOTING

Since this system uses some familiar valves for special purposes, the troubleshooting guide is presented in a frequently-asked-questions format:

- Q:** The Bendix® RV-3™ valve used for the backfeed function seems to be incorrectly plumbed on the vehicle (and in this document). Why?
- A:** To support special Bendix® eTrac™ system functions, it is correct that the backfeed valve has its delivery port connected to the leveling valve delivery port.
- Q:** What will happen if the backfeed valve's supply is connected to the leveling valve delivery?
- A:** An incorrectly installed backfeed valve will result in the pressure-limiting function not working. The technician may check if the backfeed function is working by depressing the Mud/Snow switch on a fully loaded vehicle; the vehicle's tag axle should not drop down to the suspension stops.
- Q:** How can I tell if the pressure-limiting function is working?
- A:** With a fully loaded vehicle, depress the Mud/Snow switch and verify that only a small amount of air is vented ("dumped") by the tag axle suspension air bags. The tag axle bags should remain firm and the suspension relatively level.
- In the case of a vehicle that is running "bobtail" (without a trailer), when the Mud/Snow switch is depressed, verify that the tag axle bags become completely vented ("dumped").
- Q:** Why is the Bendix eTrac system not venting ("dumping") air pressure from the tag axle?
- A:** Inspect the exhausts of all the valves used in the Bendix eTrac system to verify that they are free from debris. Exhaust ports can develop blockages from ice, snow, mud, or insects. Also check to see if the solenoid valve is operating by listening for a clicking noise (as the solenoid is energized) when the Mud/Snow switch is activated. **Note for vehicles with Bendix® EC-80™ ATC/ESP ECUs:** *If the parking brake is set*, the ability to vent air pressure from the tag axle with the eTrac feature is disabled.

SERVICING THE BENDIX® ETRAC™ SYSTEM COMPONENTS

⚠ CAUTION: When replacing a Bendix eTrac-enabled ECU, it is important to replace it **ONLY** with another Bendix eTrac-enabled ECU as indicated by the **CAUTION** label located on the ECU. Installation of a non-eTrac-enabled ECU on an eTrac-equipped vehicle can result in erroneous eTrac system interventions, potentially causing vehicle damage and/or personal injury.

NOTE: When replacing the valves used in this system, it is important to replace **ONLY** like for like part numbers (or direct replacement parts as verified by Bendix.) In particular, the system's upper pressure limit for the drive axle suspension air bags is pre-determined by the OEM, and this upper pressure limit determines the specific Bendix RV-3 valves that must be used to avoid damage to the drive train.

NOTE: In the case of the valve used to backfeed in this system, it is necessary to install the valve as shown in the system diagrams, and not to follow the port designations (such as SUP for supply, etc.) cast into the valve housings.

See the specific Bendix® Service Data Sheet for individual components for maintenance information, including leakage tests after re-installation.

ABS WIRING

When troubleshooting the ABS wiring used in this system, some general rules should be followed where applicable.

1. Check all wiring and connectors to ensure they are secure and free from visible damage (e.g. cuts, abrasions, etc.).
2. Check for evidence of wire chafing due to poor routing, or poor securing of wires.
3. Check connectors for proper insertion and locking.
4. Verify that the connector pins are properly greased with a non-conductive electrical grease compound.
5. Connector terminals must not show signs of corrosion or exposure to the environment.
6. Never pierce wire insulation when checking for continuity.
7. Do not deform individual pins or sockets during probing with a volt/ohm meter.
8. It is strongly recommended that all wiring harnesses and sensor leads are properly secured at least every 18 inches.
9. Apply a moderate amount of non-conductive electrical grease to each connector pin before reconnecting.

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For the latest information, and for free downloads of literature and the Bendix® ACom® diagnostics software, and its User Guide, visit the Bendix website at www.bendix.com.

Bendix Technical Assistance Team

For technical support, call the Bendix technical assistance team at **1-800-AIR-BRAKE** (1-800-247-2725), Monday through Friday, 8:00 a.m. to 6:00 p.m. ET.

Alternatively, you may e-mail the Bendix Tech Team at: techteam@bendix.com.

To better serve you, please record the following information before you call the Bendix Tech Team, or include this information in your e-mail:

- Bendix product model number, part number and configuration.
- Vehicle make and model.
- Vehicle configuration. (Number of axles, tire size, etc.)
- System performance symptoms: When do they occur?
- What DTCs have been identified using LEDs, blink codes or diagnostic tools?
- What troubleshooting/measurements have been performed?
- What Bendix service data literature do you have or need?

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