

# **BENDIX® GSBC® (GLOBAL SCALABLE BRAKE CONTROL) SYSTEM OPERATOR'S MANUAL**



This booklet contains important operational and safety information.

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## TABLE OF CONTENTS

<b>Introduction</b> . . . . .	<b>3</b>
<b>Important Safety Information</b> . . . . .	<b>5</b>
<b>System Limitations</b> . . . . .	<b>6</b>
<b>Vehicle Inspection &amp; Pre-Trip Inspection</b> . . . . .	<b>7-8</b>
<b>Components</b> . . . . .	<b>8</b>
<b>System Operation</b> . . . . .	<b>9</b>
<b>System Display &amp; Behavior at Startup</b> . . . . .	<b>10-13</b>
<b>Dash Display Indicators and Operation</b> . . . . .	<b>14-15</b>
<b>GSBC System Features</b> . . . . .	<b>16-22</b>
<b>GSBC System - What to Expect</b> . . . . .	<b>23-25</b>
<b>System Maintenance</b> . . . . .	<b>26</b>
<b>Troubleshooting</b> . . . . .	<b>27-38</b>
<b>Acronyms and Definitions</b> . . . . .	<b>39</b>

## INTRODUCTION

This Operator's Manual provides an overview of the Bendix® Global Scalable Brake Control (hereafter known as GSBC®) system. This manual explains the components, features, functions, and known system limitations. There are also example descriptions and explanations of the driver alerts and system interventions that can be expected during operation.

Read this manual thoroughly before operating the system. Be familiar with the possible system actions, alerts, and its limitations.

Keep this manual in the vehicle as a reference at all times.

**NOTE:** All of these alerts and actions are part of the GSBC system's feature set released by Bendix. It is possible for this Operator's Manual to be moved from vehicle to vehicle. Always verify the features that are included on your vehicles with your dealer or OEM.

For additional information about Bendix® systems, visit [bendix.com](http://bendix.com), contact your local Bendix sales representative, or call 1-800-AIR-BRAKE (1-800-247-2725). Representatives are available to assist you Monday through Thursday, 8:00 a.m. to 6:00 p.m. and Friday, 8:00 a.m. to 5:00 p.m. ET.

Information about features, operation, and other aspects discussed in this manual are subject to change and updating and are posted on the document library located at [B2Bendix.com](http://B2Bendix.com).

## OVERVIEW

The Bendix® GSBC® is an Electronic Braking System (EBS) that controls the service brakes of the vehicle. The system is comprised of both hardware and software components that work together to control the service braking system of the vehicle. EBS utilizes electronic control systems but continues to use air to apply and release the parking and service brakes of the vehicle.

GSBC can provide additional functionality including Bendix® Electronic Stability Program (ESP).

For more descriptions of these features, *refer to the System Features section on page 16.*



**Bendix safety technologies complement safe driving practices. No commercial vehicle safety technology replaces a skilled, alert driver exercising safe driving techniques and proactive, comprehensive driver training.**



**Improper use of the GSBC system can result in a potential collision causing property damage, serious injuries, or death. Be sure to read, understand, and follow all these instructions carefully.**



**Bendix®-brand Electronic Control Units (ECUs) are not designed to store data for purposes of accident reconstruction, and Bendix® ACom® Diagnostic Software is not intended to retrieve data for purposes of accident reconstruction. Bendix makes no representations as to the accuracy of data retrieved and interpreted from ECUs for purposes of accident reconstruction. Bendix does not offer accident reconstruction services or interpretation of stored data. Bendix ECUs are not protected from fire, loss of power, impact damage, or other conditions that may be sustained in a crash situation and may cause data to be unavailable or irretrievable.**

## IMPORTANT SAFETY INFORMATION



When necessary, Bendix® GSBC® automatically intervenes to reduce the accelerator pedal input and/or apply the service brakes to help you maintain stability during potential loss-of-control or rollover events. The GSBC stability system does not replace the need for the driver to remain alert, react appropriately and in a timely manner, and use safe driving practices. Bendix safety technologies complement safe driving practices. Responsibility for the safe operation of the vehicle remains with you, the driver, at all times.



If you determine that a hazard or unsafe condition exists, you should take all necessary actions immediately. Never wait for the system to intervene.



To minimize unexpected deceleration and reduce the risk of a potential collision, the driver must:

- Avoid aggressive driving maneuvers, such as sharp turns or abrupt lane changes at high speeds, which might trigger the stability system; and
- Always operate the vehicle safely, drive defensively, anticipate obstacles and pay attention to road, weather and traffic conditions. Bendix brake control systems are no substitute for prudent, careful driving.



Bendix ESP is designed and optimized for trucks and for tractors that tow single trailers. If a tractor equipped with Bendix ESP is used to power multiple trailer combinations (known as “doubles” or “triples”), the effectiveness of Bendix ESP may be greatly reduced. Extremely careful driving is always required when towing doubles or triples. Excessive speed and aggressive maneuvers – such as sharp turns, sudden steering inputs, or abrupt lane changes – should be avoided. For more information about Bendix ESP, *refer to the System Features section on page 16.*

## SYSTEM LIMITATIONS

All systems have limitations, including the Bendix® GSBC® system. It is always the responsibility of the driver to operate the vehicle safely. There may be situations where the GSBC system unexpectedly issues warnings, applies brakes, or does not respond in a manner consistent with your expectations.

Cautious driving practices such as maintaining an adequate following distance with the forward vehicle, not speeding, anticipating obstacles and adjusting your vehicle's speed for traffic, weather and road conditions are essential for safe operation which is the responsibility of you, the driver, at all times.

## LIMITATIONS OF STABILITY SYSTEMS

The effectiveness of the Electronic Stability Program (ESP) functionality within the GSBC system may be greatly reduced if:

- The load shifts due to improper retention, accident damage, or the inherently mobile nature of some loads (for example, hanging meat, live animals or partially laden tankers);
- The vehicle has an unusually high – or off-set – center of gravity (CG);
- One side of the vehicle drops off the pavement at an angle that is too large to be counteracted by a reduction in speed;
- The vehicle is used to haul double or triple trailer combinations;
- If very rapid steering changes are attempted at high speeds;
- There are technical problems with suspension leveling of the tractor or trailer resulting in uneven loads;
- The vehicle is maneuvering on a high banked road creating either additional side forces due to the weight (mass) of the vehicle, or a deviation between expected & actual yaw rates;
- The vehicle experiences a significant mechanical problem or failure. ESP will not prevent serious problems (for example, tire failures) from impacting the driver's ability to control the vehicle;
- Gusty winds are strong enough to cause significant side forces on the vehicle and any towed vehicles.

To maximize the effectiveness of ESP functionality within the GSBC system, drivers need to exercise extreme caution at all times and should avoid sharp turns, sudden steering adjustments, or abrupt lane changes at high speeds, and any loads should be properly secured at all times.

## TRUCK CHASSIS MODIFICATIONS

If the vehicle's chassis components are altered, (for example, a wheel base extension or reduction; tag axle addition or removal; a major body change such as conversion of a tractor into a truck; or an axle, suspension, or steering system component modification) the GSBC® ECU must be updated to reflect these changes. Contact your OE vehicle manufacturer prior to making any modifications to your vehicle.



**If you modify your vehicle and do not update the GSBC ECU, the GSBC system may fail to function as intended. Serious vehicle braking and performance issues could result, including unnecessary ESP system interventions, exceeding regulated stopping distance, and/or system faults leading to loss of electronic functions. These types of failures can lead to a loss-of-control of the vehicle, potential collisions, property damage, serious injuries, or death.**



**If replacement tires are used that are a different diameter from the OEM-specified tire size, the brake control system must be updated with the new tire size using the appropriate diagnostic tool. Contact your OE for more information.**

## VEHICLE INSPECTION

For experienced drivers familiar with Bendix brake control systems, a pre- or post-trip inspection on a vehicle with GSBC is similar to the inspection procedure for previous Bendix systems. For a thorough inspection procedure for a Bendix air brake system, refer to the following documents. For new information specific to the Bendix GSBC system, *refer to the information on page 8.*

- BW2676 (for components located outside the cab)
- BW2677 (for components located inside the cab)

## PRE-TRIP INSPECTION INFORMATION

The Bendix® GSBC® system is an Electronic Braking System (EBS) which differs from previous generation Bendix brake systems. This results in some changes to your pre-trip inspection process:

**Indicator Lamps:** There is an additional lamp on the dashboard as compared to previous systems. This red “BRAKE” lamp should briefly illuminate (for approximately 3 seconds) when the vehicle is first powered on, but the lamp should not stay illuminated. If this lamp stays illuminated, it indicates a fault with the system or function described by the lamp. For more information about this, or, for more instructions on what to do if the lamp stays illuminated on the dashboard, refer to the *Display Indicators section on page 14*.

**Change in Components:** GSBC is comprised of fewer components than previous systems. As a result, valves that an experienced driver may be accustomed to seeing during pre-trip inspections will not be present on the vehicle.

When conducting a pre-trip inspection, use the following table to help locate the main components of a GSBC Service Braking System.

Main Components Generic Locations		
Name	Location	Function
FBM (Foot Brake Module)	Firewall, connected to the brake pedal	Turns foot motion into electronic request for service braking
1-Channel EPM (Electro-Pneumatic Module)	Above left frame rail in front of the cab, under hood; occasionally on accessory axles, like lift axles	Smart relay valve to control service pressure on the steer axle or lift axle
Modulators	Frame rail inside left and right steer wheels	Provide steer wheel specific modulation of air pressure to prevent wheel lockup and provide vehicle stability
2-Channel EPM (Electro-Pneumatic Module)	Frame rail or crossmember close to the controlled axle(s)	Smart relay valve to control service pressure on the steer axle(s) Note: Vehicles may have between one and three 2-Channel EPMS, depending on the axle configuration and layout
eTPCM (Electronic Trailer Pressure Control Module)	Back of cab, close to the trailer air lines	Smart relay valve to electronically control pressure to the trailer
Electronic Control Unit (ECU)	Rigidly mounted to the exterior of the vehicle; typically under the cab on the framerail	Controls the entire GSBC system and provides an interface between the vehicle and the braking system



## BENDIX GSBC SYSTEM OPERATION

Bendix® GSBC® will be controlled and operated in a similar manner to previous Bendix brake control systems. The driver will always be in control of the service brakes, which will be operated by the brake pedal under the driver's foot.

Experienced drivers may notice more solenoid noises during service brake operation. This is normal and is an audible confirmation that the system is operating as expected.

GSBC can operate in two modes: Electronic Primary Mode and Pneumatic Backup Mode. In **Electronic Primary Mode**, the driver's movement of the brake pedal is translated into an electronic request for air that is interpreted by the central Brake Control ECU (Electronic Control Unit) and sent to the Electro-Pneumatic Modules (EPMs) that have taken the place of the traditional relay valve. This electronic control allows the system to deliver the precise pressure required to each controlled foundation brake to ensure the desired brake response and provide improved brake balance and feel across different load conditions.

**NOTE:** In the event of a serious system malfunction, the GSBC ECU may be unable to maintain electronic control of the system. In the event of this unlikely occurrence, the system will revert to Pneumatic Backup Mode.

In **Pneumatic Backup Mode**, the system will rely on the pneumatic pressure sent by the foot brake module to the EPMs. This will ensure that the vehicle has all of the designed braking power available to bring the vehicle to a safe stop.

When the system is operating in this mode:

- A red warning lamp will appear on the dashboard accompanied by "a Truck brake failure" message.
- All of the electronic driver safety features (ABS, Stability Control, Traction Control, and so on) may be unavailable.
- The system will be unable to prevent wheel end lockup, or provide stability assistance.
- Brake pedal feel and response will likely be different as compared to operation in Electronic Primary Mode.

**As a result of these changes and limitations, drivers must immediately bring the vehicle to a safe stop if the red warning lamp appears on the dashboard and stays illuminated. The vehicle must be serviced as soon as possible by a qualified service facility, and the issue(s) that caused the system to enter Pneumatic Backup Mode should be identified, addressed, and corrected.**

Only after a repair has been completed, and the fault is verified to be cleared, can the vehicle be returned to service.

## BENDIX GSBC DISPLAY & BEHAVIOR AT STARTUP

When the Bendix® GSBC® system is first powered on at vehicle ignition, the brake control system does not require input or actions from the driver. For experienced drivers, there are a few things that are different relative to previous Bendix® brake control products:

### POWER ON SELF TEST (POST) SEQUENCE/CHUFF TEST

When GSBC is first powered on with the ignition key, the system will conduct a Power On Self Test (POST). This is a brief self-check that the system performs to check for basic operation of the system, components, internal software and communications functions.

**NOTE:** For experienced drivers familiar with the Bendix “Chuff” test, this POST test performs a similar function, but it will not make an audible noise. This means that the Chuff test sound of solenoids clicking during key on will not be present. The lack of clicking sound(s) during key on does not indicate a problem with the brake control system or its operation.

### FOOT BRAKE MODULE (FBM) WAKEUP

While powered, the GSBC system is always ready for the driver to press the foot brake to request the service brakes. This FBM function allows the driver to step on the service brake pedal while the vehicle is otherwise off, and still deliver the requested service brake pressure to the foundation brakes. This activity does not require the key to be in the ignition or the vehicle to be running – only that power has not been cut using a battery disconnect switch or similar device.

**NOTE:** If there is no air in the service reservoirs, the brake pedal activation will result in solenoids clicking, but no air being delivered to the foundation brakes.

### SOLENOID CONTROL

When in Electronic Primary Mode, the GSBC system will use solenoids to apply and release service brake pressure at the vehicle's foundation brakes. If the system encounters a fault significant enough to prevent the electronic system from operating, (*see the Pneumatic Backup Mode reference on page 9*) these solenoids will not activate and there will not be an audible clicking sound. Depending on how loud the environment surrounding the vehicle is when this occurs (engine noise, other vehicles, ambient noises, radio, etc.), the clicking may or may not be apparent to the driver in the cab. This solenoid noise is normal and indicative of the brake control system operating as intended. Once air pressure is restored to the reservoirs, the brake control system will once again deliver air to the foundation brakes as normal.

## BENDIX GSBC DISPLAY & BEHAVIOR AT STARTUP (CONT.)



**The driver should verify the proper operation of all installed indicator lamps when applying ignition power and during vehicle operation. Lamps that do not illuminate as expected when ignition power is applied, or red/yellow lamps that remain illuminated after startup, indicate the need for service and/or maintenance.**

**NOTE:** Refer to the *GSBC Dash Display Indicator Lamps and Operation* section starting on page 14 for more information about each lamp.

### **ELECTRONIC BRAKING SYSTEM (EBS) BRAKE INDICATOR LAMP (NEW)**

A red EBS brake critical malfunction indicator lamp is located in the vehicle display. This indicator lamp will illuminate for approximately three (3) seconds during the bulb check portion of the startup sequence when the vehicle key is turned from “off” to “ignition.” If this warning lamp appears during normal operation, it is indicative of a critical failure within the brake control system, and the vehicle should be brought to a safe stop as quickly as possible. Once safely stopped, the driver must have the vehicle serviced immediately by a qualified technician to restore full system functionality.

### **ELECTRONIC BRAKING SYSTEM (EBS) DASH DISPLAY WARNING (NEW)**

A yellow EBS dash display warning will display with the text “Contact Workshop Truck Brake Malfunction” when a fault occurs. This dashboard warning may be accompanied by other warning lamps indicating specific features or functions that may be inoperative. The vehicle should be serviced as soon as possible by a qualified technician to restore full system functionality.

### **ANTILOCK BRAKING SYSTEM (ABS) INDICATOR LAMP**

An yellow ABS indicator lamp is typically located in the vehicle display. At each ignition, the ABS Indicator Lamp should illuminate for approximately three (3) seconds and then turn off. If the ABS indicator lamp does not illuminate at ignition or if it remains on for more than three (3) seconds after ignition, or if it illuminates continuously while you are driving, the ABS system may not be fully functional or may be completely disabled. Have the vehicle serviced immediately by a qualified technician to restore full ABS functionality.

## BENDIX GSBC DISPLAY & BEHAVIOR AT STARTUP (CONT.)

**NOTE:** Refer to the *GSBC Dash Display Indicator Lamps and Operation* section starting on page 14 for more information about each lamp.

### TRAILER ABS INDICATOR LAMP

The yellow trailer ABS indicator lamp is typically located in the vehicle display of tractors or other towing vehicles. The trailer ABS indicator lamp functions similarly to the tractor ABS indicator lamp, as long as a trailer with a trailer ABS system is connected electrically to the towing vehicle. At each ignition, the trailer indicator lamp should illuminate for approximately three (3) seconds and then turn off. If the lamp does not turn off, one of the vehicle(s) connected to the power unit may have a faulty trailer ABS unit. If there is no trailer, the trailer does not have a trailer ABS unit, or if the trailer ABS unit is powered only by brake lamp power, the lamp will not remain illuminated.

All new trailers built after March 1, 2001 must support the dashboard mounted trailer ABS indicator lamp. Trailers built after March 1, 1998 (in the United States) or April 1, 2000 (in Canada) must be equipped with a trailer ABS unit, but are not required to support a dashboard mounted trailer ABS indicator lamp. The mode of operation of the trailer ABS indicator lamp (as equipped) will vary depending on how the ABS system is powered.

- **For full-time-powered ABS (usually obtaining power over the blue wire of the J560 connector):** The trailer ABS warning lamp will function just like the tractor ABS indicator lamp.
- **For brake-light-only powered ABS:** Each time the brakes are applied when the vehicle is stationary, the indicator lamp will come on for approximately three (3) seconds and then turn off. If the lamp remains on during braking, the trailer's ABS may not be operating. The trailer will retain normal service braking, although without the benefits of ABS. Have the trailer serviced as soon as possible to restore ABS operation.

In both cases where the warning lamp stays illuminated for longer than three (3) seconds, the trailer will retain normal service braking, although without the benefits of ABS. Have the trailer serviced as soon as possible to restore ABS operation.

## **BENDIX GSBC DISPLAY & BEHAVIOR AT STARTUP (CONT.)**

**NOTE:** Refer to the *GSBC Dash Display Indicator Lamps and Operation* section starting on page 14 for more information about each lamp.






### **AUTOMATIC TRACTION CONTROL (ATC) STATUS/INDICATOR LAMP**

If the vehicle is equipped with the Automatic Traction Control (ATC) feature, an indicator lamp may be located in the vehicle display. At each ignition, the ATC Indicator Lamp will illuminate for approximately three (3) seconds and then turn off. If the ATC indicator lamp does not illuminate at ignition – or if it remains on (not flashing) after ignition, or if it illuminates steadily (not flashing) while you are driving – the ATC system may not be fully functional or may be completely disabled. Have the vehicle serviced immediately by a qualified technician to restore full ATC system functionality.

### **BENDIX® ELECTRONIC STABILITY PROGRAM® (ESP) INDICATOR LAMP**







A yellow Electronic Stability Program (ESP) indicator lamp is located in the dashboard. At each vehicle ignition, the ESP indicator lamp should illuminate for approximately three (3) seconds and then turn off. If the lamp does not illuminate at ignition, or if the indicator lamp remains on for more than three (3) seconds after ignition, or if it illuminates while you are driving, the ESP system may not be fully functional or may be completely disabled. If the ESP is completely disabled or not functioning properly, have the vehicle serviced immediately by a qualified technician to restore full ESP functionality. During an ESP intervention, the lamp will flash rapidly.

# GSBC DISPLAY INDICATOR LAMPS AND OPERATION - NORMAL

								
Mode		EBS Lamp	ABS Lamp	ESP Lamp	ATC Lamp	TABS Lamp	Description	
At Vehicle Startup with Vehicle not Moving	Ignition on - startup	Trailer with ABS	On for approx. three (3) seconds*	On for approx. three (3) seconds*	On for approx. three (3) seconds*	On for approx. three (3) seconds*	On for approx. three (3) seconds*	*If any of the described lamp behaviors do not occur, or, if the lamp remains on continuously during operation, have the vehicle serviced by a qualified technician as soon as possible to restore full system functionality. Check with your OEM for variations on dash lamp timing and duration as compared to Bendix default lamp timings.  All lamp timings are approximate.
		No Trailer/Trailer without ABS	On for approx. three (3) seconds*	On for approx. three (3) seconds*	On for approx. three (3) seconds*	On for approx. three (3) seconds*	Lamp off*	
	Three (3) seconds after ignition (with no Diagnostic Trouble Codes)	Lamp off*	Lamp off*	Lamp off*	Lamp off*	Lamp off*	Lamp off*	
Vehicle in Normal Operation with Vehicle Moving	EBS Operation		Lamp off	Lamp off	Lamp off	Lamp off		EBS functions are active all the time - the EBS Warning Lamp will not illuminate except for system faults. (Refer to the EBS section on page 11.)
	ABS Activation		Lamp off	Lamp off	Lamp off	Lamp off		ABS activates when wheel slip is sensed during braking. (Refer to the ABS section on page 11.)
	ESP Activation		Lamp off	Lamp off	Lamp blinks rapidly	Lamp off		ESP activates when the system senses a possible loss of vehicle stability. (Refer to the ESP section on page 13.)
	ATC Activation		Lamp off	Lamp off	Lamp off	Lamp off		ATC activates when drive wheels are spinning at low speeds. (Refer to the ATC section on page 13.)
Vehicle in Special Operation	ATC Mode Switch Setting	ATC Disable	Lamp off	Lamp off	Lamp off	Lamp Solid		The Mud/Snow mode is an optional ATC feature operated by a dash-mounted switch. This function allows greater engine power and more wheel spin during ATC operation.
		Normal - During ATC event	Lamp off	Lamp off	Lamp off	Lamp off		
		Mud/Snow - During ATC Event	Lamp off	Lamp off	Lamp off	Lamp off		
<p><b>NOTE:</b> These dash indicator lamps and their operation are for representation purposes only. The OEM may have additional dash indicators for ATC and ABS activation. Check with the OEM for actual display indications and operation.</p>								

## GSBC DISPLAY INDICATOR LAMPS AND OPERATION - FAULTED

**NOTE:** These lamps show the operation of the individual functions and are not meant to represent the only possible combination of lamps to be shown. In certain scenarios, it is possible that multiple functions can be faulted at the same time.

	 BRAKE						
Fault	EBS Lamp*	EBS Indicator*	ABS Lamp	ESP Lamp	ATC Lamp	TABS Lamp	Description
<b>EBS Fault (Red)</b>	Lamp Solid (Red)	-	Lamp Solid	Lamp Solid	-	-	Pull over immediately in a safe location. (Refer to EBS section on page 11.)
<b>EBS Fault (Yellow) Dash Display</b>	-	Lamp Solid (Yellow)	-	-	-	-	"Contact workshop - Truck Brake Malfunction" Have the vehicle serviced by a qualified technician as soon as possible to restore full system functionality.
<b>ABS Fault</b>	-	-	Lamp Solid	Lamp Solid	-	-	Have the vehicle serviced by a qualified technician as soon as possible to restore full system functionality.
<b>ESP Fault</b>	-	-	-	Lamp Solid	-	-	Have the vehicle serviced by a qualified technician as soon as possible to restore full system functionality.
<b>ATC Fault</b>	-	-	-	-	Lamp Solid	-	Have the vehicle serviced by a qualified technician as soon as possible to restore full system functionality.
<b>Trailer ABS Fault</b>	-	-	-	-	-	Lamp Solid	Have the vehicle serviced by a qualified technician as soon as possible to restore full system functionality.
<p><b>NOTE:</b> These dash indicator lamps and their operation are for representation purposes only. Check with the OEM for actual display indications and operation.</p> <p><i>*The red and yellow EBS warning lamps are two lamps that may be associated with the Pressure Plausibility Tests. Refer to the Caution note below.</i></p>							



**If the red or yellow EBS warning lamps become illuminated, when safe to do so, power cycle the vehicle and monitor the dashboard for messages. If instructed to do so, the driver will need to perform Pressure Plausibility Tests (refer to Troubleshooting - Pressure Plausibility Tests section on page 28). These tests may clear faults related to pressure plausibility.**

## BENDIX GSBC SYSTEM FEATURES

### SERVICE BRAKING

The Bendix® GSBC® system provides service brake control for air braked vehicles. To control the service brakes, the driver's movement of the foot brake pedal is translated into an electronic signal that directly controls the air pressure sent to each controlled foundation brake.

### TRAILER BRAKING

The advantages also extend to braking control of trailers. The driver's movement of the foot brake pedal is translated into an electronic signal that directly controls the air pressure sent to the trailer. This pressure is automatically monitored to change the relative braking between the power unit and the trailer(s), reducing trailer "push" or "pull." This feature also reduces the risk of excessively wearing brake friction on either the power unit or the trailer due to vehicle incompatibility.

### ANTILOCK BRAKING SYSTEM (ABS)

Bendix® ABS is a feature for vehicles equipped with a Bendix® GSBC® system that is an electronic control that improves vehicle stability and steerability by preventing wheel lock during braking.

The ABS feature monitors wheel rotation, and if it detects any wheel locking up, the feature automatically reduces the brake pressure at that wheel. If necessary, ABS automatically modulates braking pressure at one (1) or more of the wheel ends. The feature may help to maintain lateral stability by preventing wheel lock during braking.

This simulates a driver pumping the brakes. However, ABS is able to pump the brakes on individual wheels (or pairs of wheels), independently, and with greater speed and accuracy than a driver.

During normal operation, do not pump your brakes. Use steady, even brake applications. Refer to the *Important Safety Information about Bendix ABS section on page 17* for more details.



**If you are towing a vehicle that is not equipped with ABS, you may need to modulate your braking applications in some instances. Refer to the *Towed Vehicles without ABS section on page 18* for more information.**



**If the Bendix® ABS feature has faulted which is indicated by the applicable warning lamp on the dash (see *Dash Indicator Lamp - Faulted section on page 15*), the feature will not be able to lock or unlock wheel ends without driver intervention. In this scenario, driver modulation (or pumping) of the brakes to prevent wheel end lockup may be necessary.**



## BENDIX GSBC SYSTEM FEATURES (CONT.)

### ANTILOCK BRAKING SYSTEM (ABS) (CONT.)

**Some towed vehicles, especially older trailers built before 2001, may not be equipped with their own ABS systems.** Use extra care when towing a vehicle that is not equipped with its own ABS system. During emergency braking or braking on slippery surfaces, a non-ABS equipped trailer could lose its lateral stability and swing out if its wheels lock up. Use your mirrors to watch carefully and adjust your brake applications as necessary to keep your tractor and the non-ABS-equipped towed vehicle in line with each other. Tractor ABS helps reduce the tendency to jackknife, but it cannot prevent a non-ABS equipped trailer from swinging out.

### IMPORTANT SAFETY INFORMATION ABOUT BENDIX® ANTILOCK BRAKING SYSTEMS (ABS)

#### Braking with the Bendix® Antilock Braking System (ABS)

- Use steady, even brake applications.
- Do not pump the brakes to attempt to prevent wheel lock. The system controls braking pressure automatically, and independently, at each wheel end to prevent wheel lockup.
- If you are towing a vehicle that is not equipped with ABS, you may need to adjust your braking applications in some instances.

#### Limitations of the Bendix ABS System

- The Bendix ABS system does not apply the brakes automatically. It is still up to you to apply the brakes at the right time and with the right amount of pedal force. A basic ABS system only starts to do its job after you apply the brake pedal.  
**NOTE:** The Bendix® Electronic Stability Program (ESP®) system (if equipped on your vehicle) can reduce the throttle and may apply some or all of the brakes selectively to maintain vehicle stability.
- The Bendix ABS system is not a substitute for safe driving. Even with the Bendix ABS system, you must remain alert, react appropriately and in a timely manner, and drive defensively. Do not take unnecessary risks. Cautious driving practices, such as maintaining an adequate distance away from the vehicle ahead, not speeding, anticipating obstacles, and adjusting your vehicle's speed for traffic, weather, and road conditions, are essential for safe operation.

## BENDIX GSBC SYSTEM FEATURES (CONT.)

### TOWED VEHICLES WITHOUT ABS

**Some towed vehicles, especially older trailers built before 2001, may not be equipped with their own ABS systems.** Use extra care when towing a vehicle that is not equipped with its own ABS system. During emergency braking or braking on slippery surfaces, a non-ABS equipped trailer could lose its lateral stability and swing out if its wheels lock up. Use your mirrors to watch carefully and adjust your brake applications as necessary to keep your tractor and the non-ABS-equipped towed vehicle in line with each other. Tractor ABS helps reduce the tendency to jackknife, but it cannot prevent a non-ABS equipped trailer from swinging out.

### AUTOMATIC TRACTION CONTROL (ATC)

Bendix® ATC is a feature for vehicles equipped with a Bendix® GSBC® system that controls wheel spin during vehicle acceleration to improve traction.

ATC may intervene automatically and apply braking pressure to a spinning wheel, thus transferring engine power to other drive wheels that have better traction. This feature is active only at low vehicle speeds.

If ATC is active and all of the drive wheels begin to spin, the Bendix ATC system may reduce engine throttle to improve traction at all of the drive wheels.

### Operating Vehicles with ATC

If the drive wheels begin to lose traction during acceleration, the ATC system may engage automatically to assist the driver in accelerating the vehicle.

**NOTE:** For vehicles equipped with an inter-axle differential lock switch, you should consult the vehicle Operator's Manual for additional information about that feature. Typically, the driver is advised to stop the wheels from spinning and engage the inter-axle differential lock switch, but you should always follow the specific instructions given in the vehicle's Operator's Manual for this feature and the vehicle's particular configuration.

## **BENDIX GSBC SYSTEM FEATURES (CONT.)**

### **AUTOMATIC TRACTION CONTROL (ATC) (CONT.)**

#### **ATC Disable Feature**

The optional ATC Disable feature is operated by a switch on the dash. When enabled, the dashboard ATC indicator lamp remains on to indicate that the ATC system has been turned off.

#### **Mud/Snow Mode**

The Mud/Snow mode is an optional ATC feature operated by a dash-mounted switch. This function allows greater engine power and more wheel spin during ATC operation. On vehicles equipped with this feature, depress the switch to the Mud/Snow position when operating on soft road surfaces. Always remember to turn the Mud/Snow feature off when driving on a firm road surface. A new ignition cycle, or a second depression of the Mud/Snow switch, will turn this function off.

### **ELECTRONIC STABILITY PROGRAM (ESP)**

Bendix® Electronic Stability Program (ESP®) is a feature offered by GSBC vehicles that reduces the risk of rollovers, jackknifing, and other loss-of-control situations. Bendix ESP features include roll stability control and yaw control.

## BENDIX GSBC SYSTEM FEATURES (CONT.)

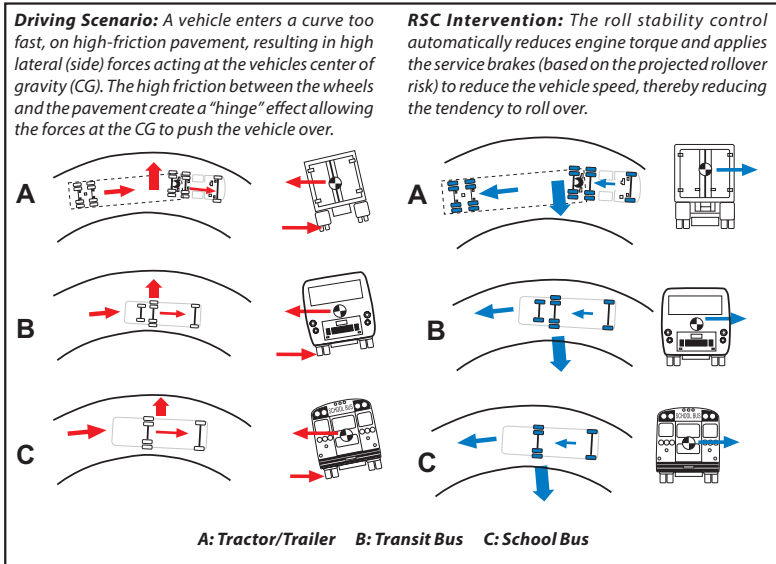
### ROLL STABILITY CONTROL (RSC)

Roll Stability Control (RSC) is a feature of Bendix® Electronic Stability Program (ESP®)-equipped vehicles that helps mitigate potential rollovers. RSC counteracts the tendency of a vehicle, or vehicle combination, to tip over while changing direction (typically, while turning). The lateral forces during a turn can push a vehicle horizontally and, if the friction between the tires and the road is sufficient, the vehicle may begin to tip and potentially could roll over. To reduce the risk of rollover, RSC may detect potential rollover conditions and may attempt to slow the vehicle both by reducing engine throttle (and hence, engine torque) and by applying the tractor and trailer service brakes as needed at the appropriate wheels.



**During an RSC intervention, the vehicle may automatically decelerate. The system may slow the vehicle with or without you applying the brake pedal, and even when you are applying the throttle. It is always the responsibility of the driver to operate the vehicle safely.**

During a Roll Stability Control (RSC) intervention, you can use your service brake pedal to increase the braking pressure. However, if you were to apply less braking pressure than needed – or even if you release the brake pedal entirely during an intervention – the system may continue to automatically apply the necessary amount of braking pressure to the appropriate wheels to potentially help mitigate a potential rollover.



## BENDIX GSBC SYSTEM FEATURES (CONT.)

### YAW CONTROL

Yaw control is a feature on vehicles equipped with Bendix® Electronic Stability Program (ESP®) that reduces the risk of jackknifing and other loss-of-control situations. If a vehicle's tires start to slide during a turn, yaw control counteracts the tendency of that vehicle to spin (or "yaw"), thereby mitigating a potential jackknife or other loss-of-control situation. Many factors – including road conditions, load distribution, and driving behavior – can contribute to the development of a vehicle spin.

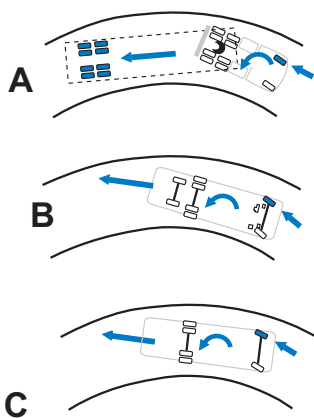
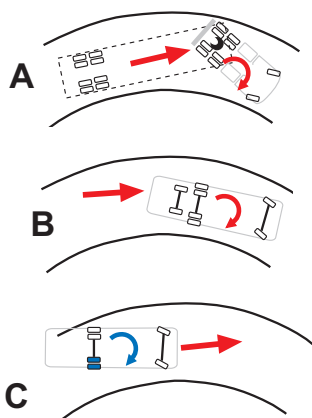
Vehicle spins typically occur where either: (a) the rear wheels begin to lose their grip on the road – which could lead to a jackknife when towing a trailer; or, (b) the front wheels begin to lose their grip, reducing a vehicle's ability to respond to the driver's steering inputs.

Yaw control continually monitors the direction in which you are steering the vehicle as well as the vehicle's response to those steering inputs. If the system detects that the vehicle is beginning to spin, yaw control reduces the engine throttle, uses selective braking at the four (4) corners of the vehicle – and may also use trailer braking – to help you keep the vehicle under control.

During a yaw control intervention, the vehicle automatically decelerates. Yaw control can slow the vehicle with or without you applying the brake, and even when you are applying the throttle.

**Driving Scenario:** Excessive speed exceeds the threshold, creating a situation where a vehicle is likely to spin and jackknife.

**Yaw Control Intervention:** The yaw control feature reduces engine throttle and selectively applies brakes to reduce the tendency to jackknife.



**A: Tractor/Trailer B: Transit Bus C: School Bus**

## BENDIX GSBC SYSTEM FEATURES (CONT.)

### AUTO-HOLD™ (OPTIONAL)

The Auto-Hold™ feature may automatically apply and hold the service brakes when the vehicle is stationary. Under certain circumstances, the feature will continue to hold the service brakes in the applied position until the driver takes action. If the driver does not take action, depending on the vehicle load and the grade, the system may also use the spring brakes to assist in holding the vehicle.



**Auto-Hold is not intended to hold the vehicle stationary when the vehicle is unattended. It is not a parking brake and should not be relied upon to hold a vehicle on a steep grade.**

Auto-Hold may potentially help the driver prevent the vehicle from rolling downhill when moving up a steep incline from a stationary position. **NOTE:** Auto-Hold has replaced Hill Start Aid/Assist (HSA) in this Bendix® GSBC® brake control system as opposed to previous versions.

While the Auto-Hold feature is active, if the driver presses the accelerator pedal, the system may release the service brakes (and spring brakes if applicable) once the driveline is engaged, with the goal of preventing the vehicle from rolling backwards.

The Auto-Hold feature is automatic and may become enabled whenever the vehicle is stationary. If the driver wants to disable Auto-Hold, there is a physical switch on the dashboard that disables the feature provided that Auto-Hold is not currently active.

**NOTE:** It may be important to disable the Auto-Hold feature during service or a roadside inspection, for example to check foundation brake stroke (*refer to the CVSA [Commerical Vehicle Safety Alliance] 2023-03 – Hill Start Aid/Brake Hold Modes on Power Units bulletin*).

## BENDIX GSBC SYSTEM - WHAT TO EXPECT

The following charts illustrate what to expect from the Bendix GSBC system in various driving situations you may encounter. Both the system indication, as well as action(s) to expect from the system, are illustrated on the pages that follow.

What to Expect		
Situation	Typical System Indications and Alerts	Typical System and/or Driver Actions
<b>ESP System Active</b>		
You steer abruptly to avoid a vehicle or obstacle in your lane of travel and the ESP feature activates.	During an ESP intervention, the lamp will flash rapidly. You may hear the system modulators cycling the service brakes and you may feel the vehicle slow down by automatic engine torque reduction and application of service brakes.	<b>You must respond as needed.</b> To respond to a potential oversteer, understeer, or loss-of-control situation, the GSBC system may potentially intervene by applying some or all of the service brakes and managing engine torque to maintain stability and the appropriate path of travel.
Your vehicle is traveling on an exit ramp and the ESP feature activates.	If the vehicle exceeds physical limitations, an ESP event will be initiated. The ESP lamp will flash rapidly. You may hear the system modulators applying the service brakes and you may feel the vehicle slow down by automatic engine torque reduction and application of service brakes.	<b>You must respond as needed.</b> The GSBC system may potentially intervene to apply the service brakes and manage the engine torque to help decelerate the vehicle and help mitigate a potential rollover.
You pass another vehicle on a wet or icy overpass and the ESP feature activates.	During an ESP intervention, the lamp will flash rapidly. You may hear the system modulators applying the service brakes and you may feel the automatic engine torque reduction and application of individual service brakes.	<b>You must respond as needed.</b> The GSBC system may potentially intervene to apply individual service brakes and manage engine torque to help mitigate a potential spin out or jackknife, helping maintain stability and the appropriate path of travel.

**NOTE:** The preceding sections show examples of situations and typical Bendix® GSBC system responses. However, the charts do not attempt to cover all possible situations.

## BENDIX GSBC SYSTEM - WHAT TO EXPECT (CONT.)

<b>What to Expect</b>		
<b>Situation</b>	<b>Typical System Indications and Alerts</b>	<b>Typical System and/or Driver Actions</b>
<b>ABS System Active</b>		
You perform a hard braking event that results in ABS function activation by stepping on the brake pedal aggressively.	During a hard braking event, you may hear the system modulators cycling the service brakes and you may feel the vehicle slow down.	<b>You must respond as needed.</b> To respond to the hard braking event, the GSBC system may manage the service brakes to help the vehicle maintain stability and in the appropriate path of travel.
<b>Operating on Soft Road Surfaces</b>		
Your vehicle is parked on a soft shoulder and you accelerate to enter traffic flow on a paved road results in an ATC function activation.	ATC will selectively apply brakes to spinning wheels. You may hear the service brake system applying and releasing pressure as the function cycles.	The ATC feature is active only at low vehicle speeds. If the drive wheels on one side begin to lose traction during acceleration, the ATC system may differential brake to transfer torque to the side that has traction and engine torque will be optimized to assist the driver in accelerating the vehicle.
Your vehicle is traveling in deep snow or mud. You have switched on the optional Mud/Snow Mode function.	When this function is in use, ATC will selectively apply brakes to spinning wheels. You may hear the service brake system applying and releasing pressure as the function cycles. ATC Mud/Snow mode allows for greater engine power and more wheel spin than normal ATC mode.	This function increases available traction on extra soft surfaces like snow, mud, or gravel, by slightly increasing the permissible wheel spin. Always remember to turn off the ATC Mud/Snow mode when driving on a firm road surface.

**NOTE:** The preceding sections show examples of situations and typical Bendix® GSBC system responses. However, the charts do not attempt to cover all possible situations.



## BENDIX GSBC SYSTEM - WHAT TO EXPECT (CONT.)

What to Expect		
Situation	Typical System Indications and Alerts	Typical System and/or Driver Actions
<b>Downhill or Uphill Grades</b>		
Your vehicle is traveling downhill on an icy slope and the powertrain downshifts which activates the ESP feature.	May feel increase engine torque briefly.	Drag Torque Control reduces wheel slip on a driven axle due to driveline inertia. If the driver lifts his foot from the accelerator, the system will reduce slippage of the drive wheels by increasing the torque of the engine to match the speed of the drive axle to the steer axle, increasing vehicle stability on low traction road surfaces during downshifting or retarder braking.
Your vehicle is stopped on a steeply inclined road. You take your foot off the brake and depress the accelerator to move forward.	The Auto-Hold feature applies pressure to the rear brakes then releases.	Auto-Hold interfaces between the transmission and the braking system to help the driver prevent the vehicle from rolling downhill when moving up a steep incline from a stationary position.

**NOTE:** The preceding sections show examples of situations and typical Bendix® GSBC system responses. However, the charts do not attempt to cover all possible situations.



**There may be situations where the GSBC system unexpectedly issues warnings, applies brakes, or does not respond in a manner consistent with your expectations. It is always the responsibility of the driver to operate the vehicle safely.**


## BENDIX GSBC SYSTEM MAINTENANCE


### PREVENTIVE SYSTEM CHECKS

If the Bendix® GSBC® system detects a problem, the system will illuminate a warning lamp on the dashboard, which will indicate which function(s) are impacted by the problem (*refer to the Dash Indicator Lamp section on page 14*). While any warning lamp is illuminated, system performance is likely affected, and the vehicle should be inspected by a qualified technician.

The system will also log a Diagnostic Troubleshooting Code (DTC) which can be read with a compatible vehicle diagnostic software by a properly trained technician.

### EQUIPMENT MAINTENANCE

 **Importance of GSBC system maintenance – Optimal GSBC system braking performance requires a properly maintained and inspected system, without any active warning lamps or Diagnostic Trouble Codes (DTCs). Have a vehicle with any active warning lamps diagnosed and repaired by a qualified technician.**

 **Importance of Brake Maintenance – Optimal braking requires properly maintained truck service brakes (drum, wide-drum, or air disc), which meet appropriate safety standards and regulations. Brake performance also requires the vehicle be equipped with properly sized and inflated tires with a safe tread depth.**

### TECHNICAL SUPPORT

For additional support, visit [bendix.com](http://bendix.com), contact your local Bendix Sales Representative, or contact the Bendix Tech team for direct telephone technical support at 1-800-AIR-BRAKE (1-800-247-2725), option 2, Monday through Thursday, 8:00 a.m. to 6:00 p.m., and Friday, 8:00 a.m. to 5:00 p.m. ET.

## BENDIX GSBC SYSTEM TROUBLESHOOTING

**Sensor Location Modifications:** The location and orientation of the Steering Angle Sensor and Central ECU must not be altered. When servicing, an identical component must be used and in the same orientation (using OEM brackets & torque requirements). During installation follow the OEM leveling guidelines.

**Steering Angle Sensor Recalibration:** Whenever maintenance or repair work is performed – on the steering mechanism, linkage, steering gear, adjustment of the wheel track, if the steering angle sensor is replaced, or if any other alignment service is performed – a recalibration of the steering angle sensor must be performed.



**If the steering angle sensor is not recalibrated, the yaw control system will not function properly, which could result in loss of control of your vehicle, resulting in a potential collision, property damage, serious injuries, or death.**



**When replacing a steering wheel, use only a vehicle manufacturer approved steering wheel and be sure that the steering angle sensor is not damaged during installation. Recalibrate the steering angle sensor.**



**If replacement tires are used that are a different diameter from the OEM-specified tire size, the brake control system must be updated with the new tire size using the appropriate diagnostic tool. Contact your OE for more information.**



**The location and orientation of the central Electronic Control Unit (ECU) must not be altered. When servicing, an identical component must be used in the same orientation using OEM mounting location, brackets, and torque requirements.**

## BENDIX GSBC SYSTEM TROUBLESHOOTING (CONT.)

### PRESSURE PLAUSIBILITY TESTS

In normal operation, the Bendix® GSBC® system uses electronic control signals to control the amount of brake pressure that is delivered to the foundation brakes. To ensure functionality in the event of an electrical failure, the brake system still sends and receives pneumatic signals using the foot brake valve, EPMs, and eTPCM.

To check and confirm the operation of this pneumatic backup control system, the GSBC system will occasionally disable the electronic control system and monitor the operation of the pneumatic valves and air lines by running the **Temporary Backup Mode Test** (refer to page 29) and the **Reverse (Validation) Test** (refer to page 34).

If the correct preconditions are met, **the tests will run automatically and without driver notification** to confirm the operation of the underlying pneumatic and mechanical parts of the system. These tests ensure that high-severity failures in air lines or control valves can be caught quickly so that the driver can be notified and the problem corrected.

The driver will be prompted by the dashboard display **ONLY IF** the system does **NOT** get the opportunity to run these tests automatically.

### Faults and Potential Causes

Pressure Plausibility Tests are safety monitoring functions to ensure that the mechanical components of the brake system are operating correctly. If the test is not run, a yellow warning lamp may be set on the dashboard, accompanied by a warning pop-up on the dashboard when the vehicle is started.

If a test runs and fails, it can result in a red or yellow EBS warning lamp on the dashboard. These failed tests are usually indicative of a problem that has been detected with the braking system like a significant air leak, or a blocked or kinked air line.



**If either the Temporary Backup Mode Test or the Reverse (Validation) Test fail, the vehicle should be inspected by a qualified technician. While the Reverse Test may clear some faults set within the system by these tests, it will not correct mechanical problems with the vehicle.**

## BENDIX GSBC SYSTEM TROUBLESHOOTING (CONT.)

### TEST 1: TEMPORARY BACKUP MODE TEST

The Temporary Backup Mode Test is designed to check and confirm operation of the pneumatic backup control system which includes the FBM, eTPCM, EPMs and the air lines that connect these components together. By intentionally disabling the electronic mode operation of these components, the underlying pneumatic and mechanical functions can be checked for correct operation.

The Bendix® GSBC® system will constantly monitor the vehicle for the correct set of preconditions and attempt to run the Temporary Backup Mode Test silently in the background without notifying the driver if the correct preconditions are met.

If this test does not run after 150 days, the driver will be reminded to run the test by a message on the dashboard. If the test is still not run, after an additional 10 days (for a total of 160 days since the last test), the system will set the yellow EBS warning lamp on the dashboard, which will not be cleared until the test is run.

#### Display Notifications for Driver



**When the dashboard displays the first pop-up message, the driver must take action. The driver cannot run the test unless a pop-up message first appears.**

Test Mode	Test State	Pop-Up Message	Warning Lamp Status
Silent	All Modes	None	None
Reminder	Before Test	"Fully Depress Brake Pedal and Release Parking Brake"	None
	Test Aborted	"Test Aborted, Vehicle Moving"	None
	Test Completed Successfully	"Test Completed, Vehicle Ready to Use"	None
	Test Failed	"Truck Brake Malfunction"	Red EBS Warning lamp set to ON if EPM (power unit) fails. Yellow Lamp set to ON if eTPCM (trailer control) fails.
Forced	Before Test	"Fully Depress Brake Pedal and Release Parking Brake"	Yellow Lamp is ON.
	Test Aborted	"Test Aborted, Vehicle Moving"	Yellow Lamp remains ON.
	Test Completed Successfully	"Test Completed, Vehicle Ready to Use"	Yellow Lamp is turned OFF.
	Test Failed	"Truck Brake Malfunction"	Red EBS Warning lamp set to ON if EPM (power unit) fails. Yellow Lamp set to ON if eTPCM (trailer control) fails.
<b>NOTE:</b> These dashboard displays and their operation are for representation purposes only. Check with the OEM for actual dashboard displays and operation.			

## BENDIX GSBC SYSTEM TROUBLESHOOTING (CONT.)

### TEST 1: TEMPORARY BACKUP MODE TEST (CONT.)

#### Test Frequency

The test will be run according to the following frequency:

Test Mode	Frequency
Silent	Every key cycle
Reminder	150 days since last test
Forced	160 days since last test

**NOTE:** If the test is running in any mode (silent, reminder, or forced) and the preconditions are no longer met (for example if the vehicle begins to move), the test will immediately exit and restore full electronic control. If the test exits prematurely, it will not count as a “passed” test.

#### Test Preconditions

For the Temporary Backup Mode Test to run, the following preconditions must be met on the vehicle:

1. The vehicle ignition is on.
2. The vehicle is stationary and on level ground.
3. Roller Test bench mode is not active.
4. The system is not in pneumatic backup mode due to other fault codes.
5. The air system is fully charged and must remain above 102 psi for the duration of the test.
6. All liftable axles (if present) are fully lowered and down.
7. The parking brake is released.

## BENDIX GSBC SYSTEM TROUBLESHOOTING (CONT.)

### TEST 1: TEMPORARY BACKUP MODE TEST (CONT.)

#### Test Procedure

This test requires the operator to unpark the vehicle and for the service brakes to be cycled in a specific sequence. If the vehicle moves or rolls during the test, the test will fail. To ensure that the vehicle remains stationary and that the test is completed correctly, chocking the wheels before the test will help ensure that the test can run successfully.

**NOTE:** To correct a test failure due to motion of the vehicle, refer to *Temporary Backup Mode Test Procedure Step 3.B on page 32*.



**Failure to chock the wheels could result in a potential collision, property damage, serious injuries, or death.**



**It is the operator's responsibility to prevent unintended vehicle movement. If the vehicle begins to move during the test, apply the service and/or parking brakes as necessary, regardless of test status. Once the vehicle is safely stopped, refer to *Temporary Backup Mode Test Procedure Step 3.B on page 31* on how to restart the test procedure.**

When prompted by the vehicle, to run the Temporary Backup Mode test, complete the following steps:

1. When the dashboard displays "Fully depress brake pedal and release the parking brake," complete the following:
  - Fully press and hold the service brakes.
  - Release the parking brakes on the power unit.
  - Release the parking brakes on the trailer (if a trailer is connected).

**NOTE:** The eTPCM will only be part of this test if a trailer is connected at startup. If the vehicle was built to tow other air brake vehicles but one is not connected, the test will skip the eTPCM but the counter will not be reset.

## BENDIX GSBC SYSTEM TROUBLESHOOTING (CONT.)

### TEST 1: TEMPORARY BACKUP MODE TEST (CONT.)

#### Test Procedure (cont.)

2. Hold the service brake application until the test is complete.

**NOTE:** It can take up to one (1) second for each EPM and eTPCM on the vehicle to be tested. Depending on the vehicle configuration, some GSBC vehicles may have between two and three EPMs and an eTPCM. Other vehicles may have up to four EPMs in addition to one eTPCM.

3. After all components have been tested, the test will complete automatically with three possible outcomes:
  - A. The test passed.
    - The dashboard will display “Test Completed, Vehicle Ready to Use.”
    - Any warning lamps related to the Temporary Backup Mode test will no longer be illuminated.
    - The vehicle can be driven normally.
  - B. The test fails due to preconditions not being met.

In order to reset the vehicle to repeat the test, make sure the preconditions are met and then complete the following steps:

1. Make sure the vehicle is parked.
2. Turn the vehicle ignition off.
3. Exit the vehicle, close all doors, and lock the vehicle.
4. Chock the wheels to prevent vehicle motion.
5. Remain outside the vehicle for at least 90 seconds to allow the brake controller to reset.

**NOTE:** Do not press the brake pedal during this time or the brake controller will not reset.
6. After 90 seconds have elapsed since the vehicle was locked, enter the vehicle.
7. Start the vehicle.
8. When the dashboard displays “Fully depress brake pedal and release the parking brake,” go back to *Step 1 of the Temporary Backup Mode Test Procedure on page 31* to attempt the test again.



## BENDIX GSBC SYSTEM TROUBLESHOOTING (CONT.)

### TEST 1: TEMPORARY BACKUP MODE TEST (CONT.)

#### Test Procedure (cont.)

- C. The test failed because an issue with the braking system was detected.
  - There will be a message on the dashboard that says “Truck Brake Malfunction.”
  - A red EBS Warning lamp will be set (if the EPM fails).
  - A yellow EBS Warning lamp will be set (if the eTPCM fails).
  - A DTC will be set.

#### Test Procedure (Pass/Fail Criteria)

**Passage of Test:** If the test passes, the vehicle can be driven as normal. The system will continue to attempt to conduct the Temporary Backup Mode test with every key cycle, but if preconditions are not met, the reminder to conduct the test will reappear on the dashboard after 150 days.

**Failure of Test:** If the test fails for the eTPCM, a yellow EBS warning lamp will be illuminated on the dashboard. If the test fails for an EPM, a red warning lamp will be illuminated on the dashboard. Both of these faults will be a persistent fault between key and power cycles, and require service to be corrected. Refer to the *GSBC Dash Display Indicator Lamps and Operation - Faulted* section on page 15 for more information about warning lamps.

If the fault was set in error, a Reverse (Validation) Test can either confirm the fault or clear it (see *Test 2: Reverse Validation Test* section on page 34).

If the Reverse (Validation) Test confirms the error, the vehicle must be immediately serviced by a qualified technician. Failure of the Temporary Backup Mode Test indicates a significant problem with the brake system, and the vehicle must not be operated until the problem is diagnosed and corrected.

# BENDIX GSBC SYSTEM TROUBLESHOOTING (CONT.)

## TEST 2: REVERSE (VALIDATION) TEST

If a pressure plausibility fault is set incorrectly, a Reverse (Validation) Test can check system operation and clear faults related to pressure plausibility. A Reverse (Validation) Test should be performed before scheduling service on a vehicle, or, if fault codes show any DTCs set to pressure plausibility.

**NOTE:** The Reverse (Validation) Test will only address faults set by pressure plausibility faults. It will not correct pneumatic or mechanical faults, or failures in the system. If the test does not clear a fault, the vehicle should not be driven, and should be inspected and diagnosed by a qualified technician.

### Display Notifications for Driver



**When the dashboard displays the first pop-up message, the driver must take action. The driver cannot run the test unless a pop-up message first appears.**

Pop-Up Message	Warning Lamp Status
"Test Not Started Fully Depress Brake Pedal And Release Parking Brake"	Release the parking brakes on the power unit. Release the parking brakes on the trailer (if equipped). Press the service brakes using the brake pedal.
"Test Active Fully Depress Brake Pedal"	Press the brake pedal so that more than 90 psi is delivered. Hold pressure steady until directed to do something else.
"Test Active Release The Brake Pedal"	Release the service brakes.
"Test Completed Vehicle Ready To Use"	Test was successfully passed, the fault was cleared, and the vehicle is ready for use.
"Test Failed Brake Pedal Operation Incorrect"	The service brake was not operated correctly. To begin the test again, power cycle the vehicle and restart the procedure. <b>NOTE:</b> This does not indicate a failure in the foot brake module.
"Test Aborted Vehicle Moving"	The test was canceled because vehicle movement was detected. Make sure the vehicle is parked on level ground and that the throttle is not applied during the test. To begin the test again, power cycle the vehicle and restart the procedure.
"Test Completed Error Remaining"	The test was conducted successfully, but the detected fault re-occurred. The vehicle must be serviced by a qualified technician.
<b>NOTE:</b> These dashboard displays and their operation are for representation purposes only. Check with the OEM for actual dashboard displays and operation.	

## BENDIX GSBC SYSTEM TROUBLESHOOTING (CONT.)

### TEST 2: REVERSE (VALIDATION) TEST (CONT.)

#### Test Frequency

The Reverse (Validation) Test can be performed by a driver but will not run automatically. The system will automatically prompt the driver to conduct the test if there is a pressure plausibility fault active and the test preconditions have been met.

**NOTE:** If the preconditions are no longer met (for example if the vehicle begins to move), the test will immediately exit and restore full electronic control. If the test exits prematurely, it will not clear any faults.

#### Test Preconditions

For the Reverse (Validation) Test to run, the following preconditions must be met on the vehicle.

1. The vehicle has an active pressure plausibility fault.
2. The vehicle ignition is on.
3. The air system is fully charged and must remain above 102 psi for the duration of the test.
4. The vehicle is stationary and on level ground.
5. The vehicle is not in roller test bench mode, or on a roller test bench.
6. Auto-Hold mode must be disabled using the dash switch.

#### Test Procedure

This test requires the operator to unpark the vehicle and for the service brakes to be cycled in a specific sequence. If the vehicle moves or rolls during the test, the test will fail. To ensure that the vehicle remains stationary and that the test is completed correctly, chocking the wheels before the test will help ensure that the test can run successfully.

**NOTE:** To correct a test failure due to motion of the vehicle, refer to *Reverse (Validation) Test Procedure Step 11.B on page 37*.



**Failure to chock the wheels could result in a potential collision, property damage, serious injuries, or death.**



**It is the operator's responsibility to prevent unintended vehicle movement. If the vehicle begins to move during the test, apply the service and/or parking brakes as necessary, regardless of test status. Once the vehicle is safely stopped, refer to *Reverse (Validation) Test Procedure Step 11.B on page 37* on how to restart the test procedure.**

## BENDIX GSBC SYSTEM TROUBLESHOOTING (CONT.)

### TEST 2: REVERSE (VALIDATION) TEST (CONT.)

#### Test Procedure (cont.)

When “Test Not Started Fully Depress Brake Pedal and Release Parking Brake” displays on the dashboard, to run the Reverse Test, complete the following steps:

1. Make sure the vehicle is parked.
2. Turn the vehicle ignition off for at least 90 seconds to reset the brake controller.

**NOTE:** Do not press the brake pedal during this time, or the brake controller will not reset.

3. Restart the vehicle.
4. Disable Auto-Hold using the dash switch.
5. When the dashboard displays “Test Not Started Fully Depress Brake Pedal and Release Parking Brake,” complete the following:

- Fully press the service brakes.
- Release the parking brakes on the power unit.
- Release the parking brakes on the trailer (if equipped).
- Release the service brakes.

6. The dashboard will display “Test Active Fully Depress Brake Pedal.”
7. Within 10 seconds, press and hold the brake pedal down fully until it stops.

**NOTE:** Air system pressure must remain above 102 psi for the test to operate.

8. Continue to hold the brake pedal steady at this application level until the “Test Active Fully Depress Brake Pedal” message no longer displays.
9. If the brake pedal is not pressed and held in place, or not pressed completely, the “Test Failed Brake Pedal Operation Incorrect” message may appear. The test will fail and this procedure must be restarted.

**NOTE:** This does not necessarily indicate a fault with the foot brake module, only that the test was not operated correctly. To restart the test, refer to *Reverse Test Procedure Step 11.B on page 37*.

## BENDIX GSBC SYSTEM TROUBLESHOOTING (CONT.)

### TEST 2: REVERSE (VALIDATION) TEST (CONT.)

#### Test Procedure (cont.)

10. When the dashboard displays “Test Active Release Brake Pedal,” fully release the service brakes and keep them released.



**At this point, there will be no brakes applied on the vehicle. It is the operator’s responsibility to ensure that the vehicle is parked on level ground and the wheels are chocked before the test begins to prevent unintended vehicle movement. If the vehicle begins to move, apply the service and/or parking brakes. Once the vehicle is safely stopped, chock the wheels, and restart the test. Failure to chock the wheels could result in a potential collision, property damage, serious injuries, or death.**

11. After all components have been tested, the test will complete automatically with three possible outcomes:

A. The test passed.

- If the test completed successfully, “Test Completed Vehicle Ready To Use” will be displayed. The fault has been cleared, and any warning lamps on the dashboard related to that fault will be turned off.

B. The test fails due to preconditions not being met.

- If the brake pedal is not pressed correctly, the “Test Failed Brake Pedal Operation Incorrect” message may appear.

**NOTE:** This does not necessarily indicate a fault with the foot brake module, only that the test was not operated correctly.

- If the vehicle begins to move during the test, “Test Aborted Vehicle Moving” will be displayed on the dashboard.

In order to reset the vehicle to repeat the test, make sure the preconditions are met and then complete the following steps:

1. Make sure the vehicle is parked.
2. Turn the vehicle ignition off.
3. Exit the vehicle, close all doors, and lock the vehicle.
4. Chock the wheels to prevent vehicle motion.
5. Remain outside the vehicle for at least 90 seconds to allow the brake controller to reset.

**NOTE:** Do not press the brake pedal during this time or the brake controller will not reset.

## BENDIX GSBC SYSTEM TROUBLESHOOTING (CONT.)

### TEST 2: REVERSE (VALIDATION) TEST (CONT.)

#### Test Procedure (cont.)

6. After 90 seconds since the vehicle was locked, enter the vehicle.
  7. Start the vehicle.
  8. When the dashboard displays “Test Not Started Fully Depress Brake Pedal and Release Parking Brake,” follow the instructions on the dashboard to complete the test.
- C. The test failed because an issue with the braking system was detected.
- If the fault is confirmed, “Test Completed Error Remaining” will be displayed. The test was conducted successfully, but the detected fault re-occurred. The vehicle must be serviced by a qualified technician.
  - No warning lamps will be cleared and the same warning lamps that were on prior to this test will remain illuminated.
  - No DTCs will be cleared.

#### Test Procedure (Pass/Fail Criteria)

**Passage of Test:** If the Reverse (Validation) Test completes successfully, the vehicle can be driven normally. The plausibility fault has been cleared, and any warning lamps related to that fault will be cleared.



**The Reverse (Validation) Test will not clear all the faults on the brake controller, only those faults related to pressure plausibility. If the Reverse (Validation) Test completes successfully but warning lamps remain illuminated on the dashboard, faults unrelated to pressure plausibility are present and must be diagnosed by a qualified technician.**

**Failure of Test:** If the test confirms the presence of a pressure plausibility fault, any plausibility faults that were previously active will remain active. This will be a persistent fault between key and power cycles and required service to be corrected. Refer to the *GSBC Dash Display Indicator Lamps and Operation - Faulted section on page 15* for more information about warning lamps.

If the Reverse (Validation) Test fails, the vehicle must be immediately serviced by a qualified technician. Failure of the Reverse (Validation) Test indicates a significant problem with the brake system, and the vehicle must not be operated until the problem is diagnosed and corrected.

## ACRONYMS AND DEFINITIONS

<b>ABS</b>	Antilock Braking System
<b>ABS Event</b>	Impending wheel lock situation that causes the ABS system to activate.
<b>ABS Indicator Lamp</b>	An yellow lamp which indicates the operating status of an antilock system.
<b>ATC</b>	Automatic Traction Control. An additional ABS feature in which engine torque is controlled and brakes are applied differentially to enhance vehicle traction.
<b>ATC/ESP Lamp</b>	A lamp that indicates when stability features, including traction control, roll stability program or yaw control are operating.
<b>Auto-Hold™</b>	This feature interfaces between the transmission and braking system to help the driver prevent the vehicle from rolling downhill when moving up a steep incline from a stationary position.
<b>Bendix® ACom®</b>	Bendix Diagnostic Software
<b>CAN</b>	Controller Area Network
<b>Center of Gravity (CG)</b>	A point where the total weight of a body is concentrated.
<b>Diagnostic Trouble Code (DTC)</b>	A condition that interferes with the generation or transmission of response or control signals in the vehicle's ABS system that could lead to the functionality of the ABS system becoming inoperable in whole or in part.
<b>Differential Braking</b>	Application of brake force to a spinning wheel so that torque can be applied to wheels which are not slipping.
<b>EBS</b>	Electronic Braking System
<b>ECU</b>	Electronic Control Unit
<b>ESP</b>	Electronic Stability Program. Full stability feature that includes Roll Stability Program & Yaw Control subfeatures.
<b>FMVSS-136</b>	Federal Motor Vehicle Safety Standard which requires the installation of an Electronic Stability Control (ESC) system on vehicles.
<b>Foundation Brakes</b>	The mechanical component that converts pneumatic air brake pressure to brake torque.
<b>Global Scalable Brake Control (GSBC)</b>	The next generation Electronic Braking System (EBS).
<b>Roll Stability Program (RSP)</b>	An all-axle ABS solution that helps reduce vehicle speed by applying all vehicle brakes as needed, reducing the tendency to roll over.
<b>SAS</b>	Steering Angle Sensor
<b>Wheel End</b>	The components between the vehicle and the road including tire, wheel, hub, foundation brake, and associated hardware.
<b>Yaw Control/Yaw Stability</b>	Helps stabilize rotational dynamics of vehicle.
<b>YRS</b>	Yaw Rate Sensor

## TECHNICAL SUPPORT

For additional support, visit [bendix.com](https://www.bendix.com) or contact the Bendix Tech team for direct telephone technical support at 1-800-AIR-BRAKE (1-800-247-2725), option 2, Monday through Thursday, 8:00 a.m. to 6:00 p.m., and Friday, 8:00 a.m. to 5:00 p.m. ET.



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