Bendix® GSBC® EPM-90™ (Global Scalable Brake Control Electro-Pneumatic Modulator)

INTRODUCTION

The Bendix® GSBC® EPM-90™ (Global Scalable Brake Control Electro-Pneumatic Modulator), hereafter known as “EPM,” is a pneumatic service brake control valve that can be controlled either electronically or pneumatically. The EPM is intended for installation on the chassis of commercial vehicles, and is an important part of the Bendix® GSBC® (Global Scalable Brake Control) system.

The EPM can control the service brakes on individual or multiple axle(s), depending on vehicle configuration and system features. The EPM is designed to function as part of the larger *GSBC* system and will not function properly in any stand-alone applications.

The EPM is available in a 1-Channel (1C) and a 2-Channel (2C). The 1C and 2C EPMs can be easily distinguished from each other by looking at the number of exhaust ports on the EPM, which correlate directly to the number of channels offered by a particular EPM. One exhaust port means the component is a 1C EPM (*see Figure 6*), and two exhaust ports means the component is a 2C EPM (*see Figure 7*).

The EPM is designed to receive both electronic and pneumatic control signals from the *GSBC* system, depending on the brake system’s mode of operation.

Both the 1C and 2C EPM operate at a nominal voltage of 24V. Both components are directly connected to the GSBC® EBS-90™ (Central Electronic Control Unit) known hereafter as “Central ECU,” which provides supply voltage to each EPM on the vehicle.

⚠ WARNING

Incorrect identification or plumbing of the primary or secondary circuit(s) at the GSBC® EPM-90™ could lead to serious vehicle braking, instability, and performance issues, and/or collisions causing property damage, serious injuries, and/or death. Contact your vehicle manufacturer for up-to-date pneumatic brake system schematics if work is being performed on the braking system of the vehicle, or if the EPM requires replacement.



Figure 1 – GSBC 1C EPM (1-Channel)



Figure 2 – GSBC 2C EPM (2-Channel)

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, a Bendix® AD-9si®, AD-HF®, or AD-HFi® 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.**

CAUTION

A change in vehicle braking characteristics or a dashboard warning lamp may indicate a malfunction in the braking system. Although the vehicle air brake system may continue to function, the vehicle should not be operated until the necessary repairs have been made by a qualified technician.

Always check the vehicle braking system for proper operation after performing service or maintenance and before returning the vehicle to service.

CAUTION

After removal and replacement of the EPM, special considerations need to be taken to ensure the EPM has been properly installed on the vehicle. These include:

- **Location and orientation of the EPM**
- **Correct plumbing of the EPM**
- **Installation test to verify proper installation, refer to the *Replacement Instructions* section.**

OPERATION

OPERATION OVERVIEW

The 1C and 2C EPMs are installed rigidly on the exterior of the vehicle, usually on the chassis or the frame. They are typically located close to the axle or axle(s) that they control, and can be located on a vehicle by following an air line up from the brake chamber.

The 1C and 2C EPMs primarily act as an electronically-controlled relay valve. Based on driver or system demand, they are capable of applying service brake pressure of any value between zero and system pressure to the wheel ends they are connected to.

ELECTRONIC MODE OPERATION

When the EPM is electrically powered and operating without errors, it will receive requests from the Central ECU, communicated over the digital connection between the Central ECU and the EPM. For an example of primary electronic mode operation, *see Figure 3*.

When operating in primary (electronic) mode, the 1C EPM can deliver a single pressure to connected wheel ends delivered by port 2, and is typically used to control the steer axle of a vehicle. It is also used to control liftable axles. For 1C EPM port identification, *see Figures 5 and 6*.

When operating in primary (electronic) mode, the 2C EPM can deliver two separate and independent pressures to connected wheel ends – one pressure delivered by port 21, and the other by port 22. 2C EPMs are typically used to control the drive axle(s) of a vehicle. For 2C EPM port identification, *see Figure 7*.

PNEUMATIC BACKUP MODE OPERATION

While in pneumatic backup mode, the pneumatic pressure delivered by the Bendix® GSBC® FBM-40™ (Global Scalable Brake Control Foot Brake Module), hereafter known as "FBM," will control the pressure to the brake chambers via the relay valve in the EPM. The EPM will function as a relay valve and deliver the pressure present at the control port through entirely mechanical means. For an example of pneumatic backup mode operation, *see Figure 4*.

For a full system schematic example, *refer to Figure 14* on page 9.

IMPORTANT

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 or video 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.

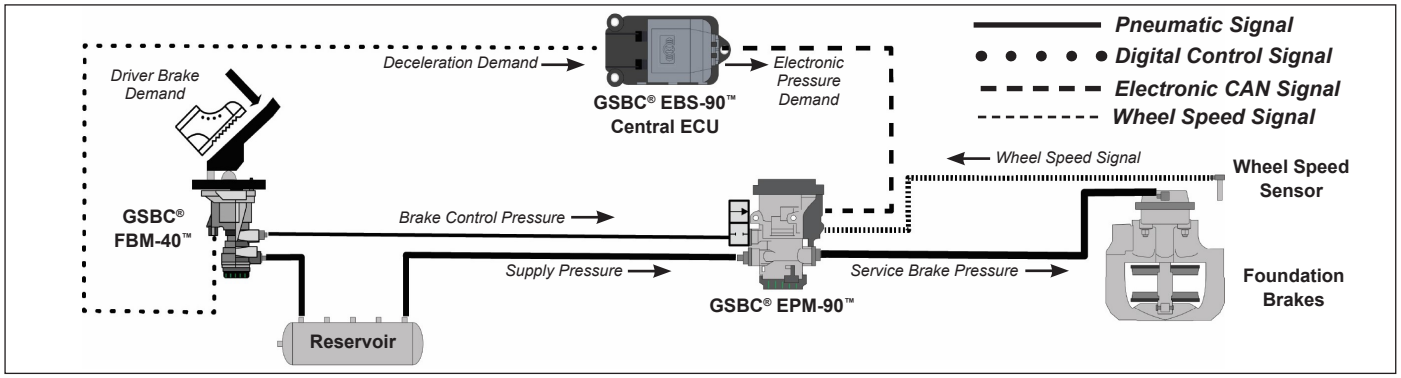


Figure 3 – GSBC Electronic Mode Example

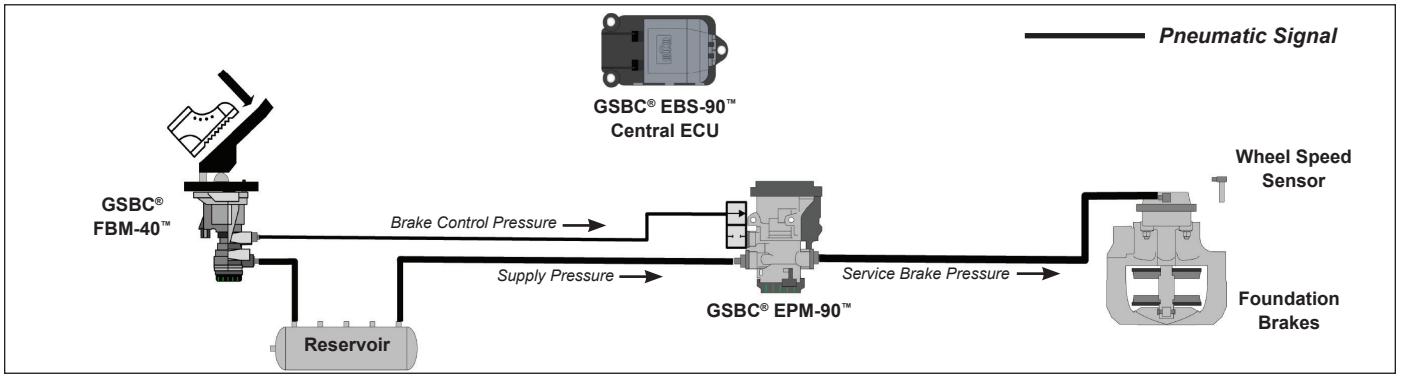


Figure 4 – GSBC Pneumatic Backup Mode Operation Example

EPM-90 PNEUMATIC AND ELECTRICAL INTERFACES

PNEUMATIC PORTS

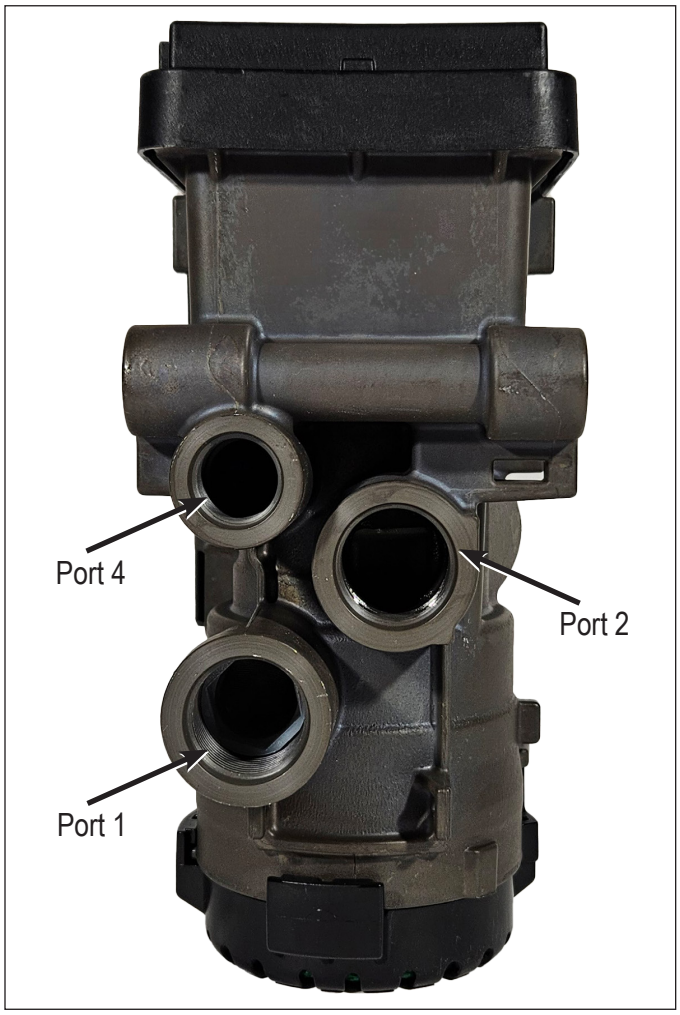


Figure 5 – 1C EPM Pneumatic Ports (Front)

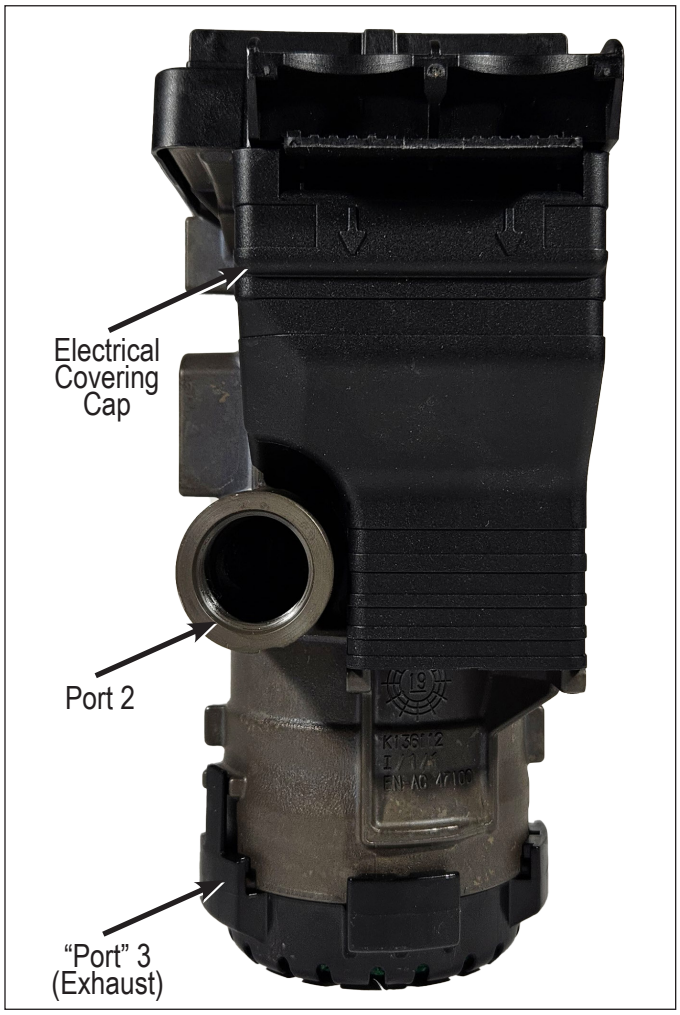


Figure 6 – 1C EPM Pneumatic Ports (Back)

PORT	FUNCTION	PORT THREADING	MAXIMUM FITTING TORQUE
1	Valve supply pressure	M22 x 1.5	Max 80 N•m (59 ft-lbs)
2 (1C EPM, common delivery)	Valve delivery pressure	M22 x 1.5	Max 80 N•m (59 ft-lbs)
3	Valve exhaust (to atmosphere)	N/A	*Refer to Silencer in Replacement Parts*
4	Control pressure (for pneumatic backup operation)	M16 x 1.5	Max 55 N•m (40.6 ft-lbs)

Table 1 – 1C EPM Pneumatic Port Information

IMPORTANT

All pneumatic fitting ports on both the 1C and 2C EPM are metric. ONLY USE metric straight thread O-ring fittings on this component. Failure to use the correct fittings may result in air leakage and permanent damage to the component.

EPM-90 PNEUMATIC AND ELECTRICAL INTERFACES (CONT.)

PNEUMATIC PORTS

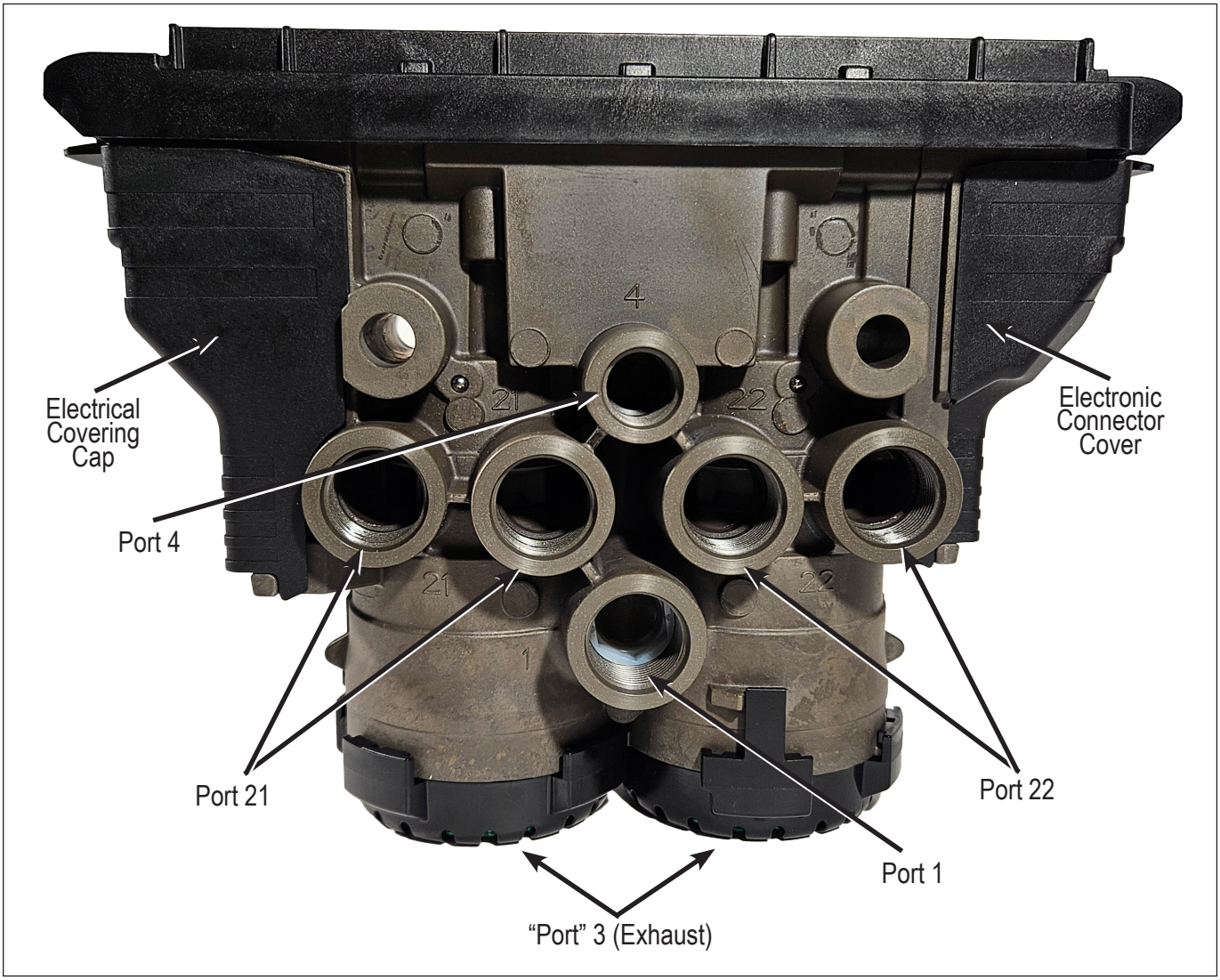


Figure 7 – 2C EPM Pneumatic Ports

PORT	FUNCTION	PORT THREADING	MAXIMUM FITTING TORQUE
1	Valve supply pressure	M22 x 1.5	Max 80 N•m (59 ft-lbs)
21, 22 (2C EPM, two separate delivery channels)	Valve delivery pressure	M22 x 1.5	Max 80 N•m (59 ft-lbs)
3	Valve exhaust (to atmosphere)	N/A	*Refer to Silencer in Replacement Parts*
4	Control pressure (for pneumatic backup operation)	M16 x 1.5	Max 55 N•m (40.6 ft-lbs)

Table 2 – 2C EPM Pneumatic Port Information

IMPORTANT

All pneumatic fitting ports on both the 1C and 2C EPM are metric. ONLY USE metric straight thread O-ring fittings on this component. Failure to use the correct fittings may result in air leakage and permanent damage to the component.

EPM-90 PNEUMATIC AND ELECTRICAL INTERFACES (CONT.)

ELECTRICAL CONNECTORS

The 1C EPM has two (2) electrical connectors, X1 and X2. The 2C EPM has three (3) electrical connectors, X1, X2, and X3, with X4 as an unused connector.

Regardless of EPM variant, the electrical connectors are protected from dirt and debris by a removable Electronic Covering Cap. The 1C EPM has one cover, and the 2C EPM has two. Refer to the *Replacement Parts* section of this document for the appropriate part number.

For pin descriptions, refer to:

- **Table 3: X1 Pin Description**
- **Table 4: X2 Pin Description**
- **Table 5: X3 Pin Description**

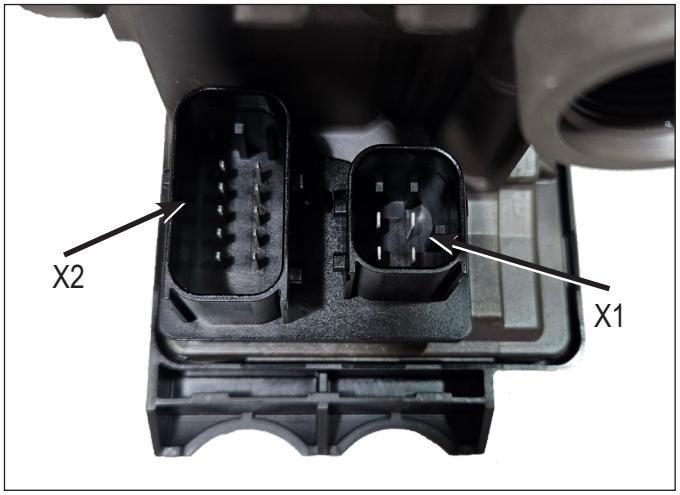


Figure 8 – 1C and 2C EPM Electronic Connectors X1 and X2

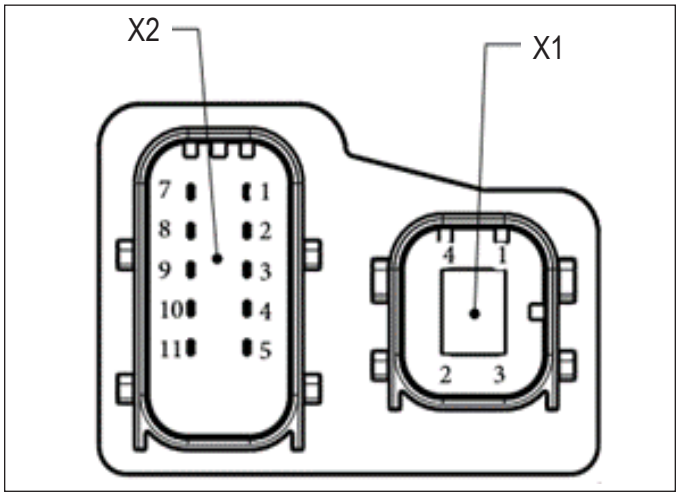


Figure 9 – X1 and X2 Electrical Pinout

CONNECTOR	PIN	SIGNAL	FUNCTION
X1 (1C & 2C EPM)	1	Ground	Supply ground from Central ECU
	2	Supply	Supply voltage from Central ECU
	3	CAN High	CAN Network Interface
	4	CAN Low	CAN Network Interface

Table 3 – 1C and 2C EPM X1 Pin Description

CONNECTOR		PIN	SIGNAL	FUNCTION
X2 (1C & 2C EPM)	Wheel Speed Sensor (WSS)	1	WSS A High	Speed Sensor Input
		2	WSS A Low	Speed Sensor Input
	Lining Wear Sensor (LWS)	3	LWS B Ground	Provides ground for Lining Wear Sensor
		4	LWS A Supply	Provides supply voltage for Lining Wear Sensor
		5	LWS B Supply	Provides supply voltage for Lining Wear Sensor
	N/A	6	Unused	Unused
	Wheel Speed Sensor (WSS)	7	WSS B High	Speed Sensor Input
		8	WSS B Low	Speed Sensor Input
	Lining Wear Sensor (LWS)	9	LWS B Signal	Output voltage of LWS B Sensor
		10	LWS A Signal	Output voltage of LWS A Sensor
		11	LWS A Ground	Provides ground for Lining Wear Sensor
	N/A	12	Unused	Unused

Table 4 – 1C and 2C EPM X2 Pin Description

ELECTRICAL CONNECTORS (CONT.)

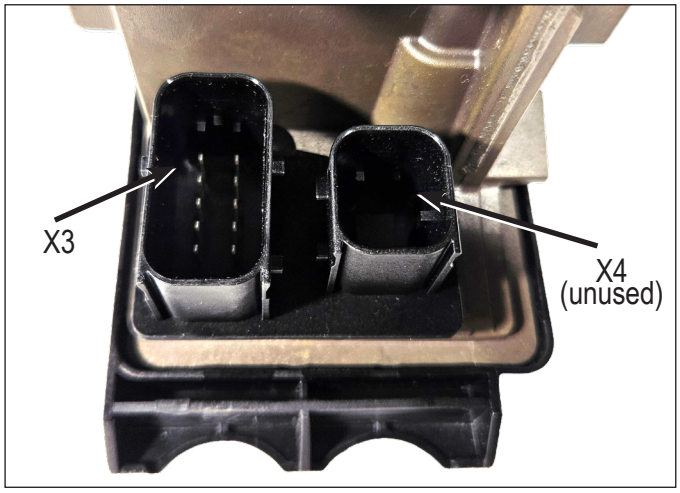


Figure 10 – 2C EPM Electronic Connectors X3 and X4

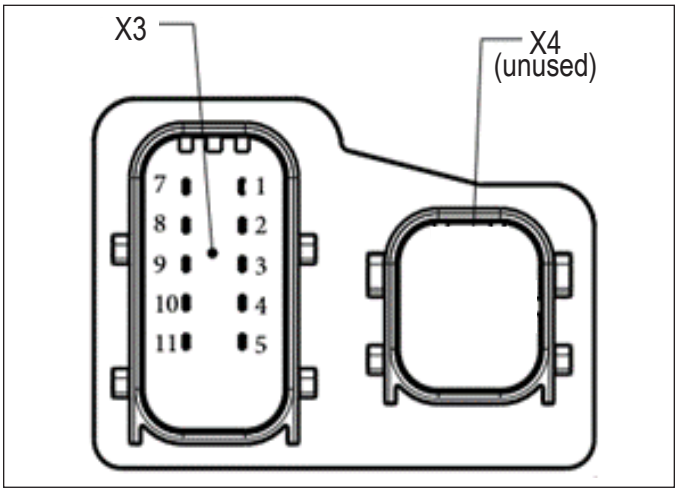


Figure 11 – X3 Electrical Pinout

CONNECTOR		PIN	SIGNAL	FUNCTION
X3 (2C EPM Only)	Wheel Speed Sensor (WSS)	1	WSS C High	Speed Sensor Input
		2	WSS C Low	Speed Sensor Input
	Lining Wear Sensor (LWS)	3	LWS D Ground	Provides ground for Lining Wear Sensor
		4	LWS C Supply	Provides supply voltage for Lining Wear Sensor
		5	LWS D Supply	Provides supply voltage for Lining Wear Sensor
	N/A	6	Unused	Unused
	Wheel Speed Sensor (WSS)	7	WSS D High	Speed Sensor Input
		8	WSS D Low	Speed Sensor Input
	Lining Wear Sensor (LWS)	9	LWS D Signal	Output voltage of LWS B Sensor
		10	LWS C Signal	Output voltage of LWS A Sensor
		11	LWS C Ground	Provides ground for Lining Wear Sensor
	N/A	12	Unused	Unused

Table 5 – 2C EPM X3 Pin Description

IMPORTANT

The X3 connector is not used on all vehicles. If not plugged into the vehicle harness, the X3 connector should be covered with a dust plug. Failure to do so may lead to corrosion of the pins which may cause issues and eventual EPM failure. Contact the OEM for dust plug ordering information.

The X4 connector does not require a dust cover as it is an unused connector without pins.

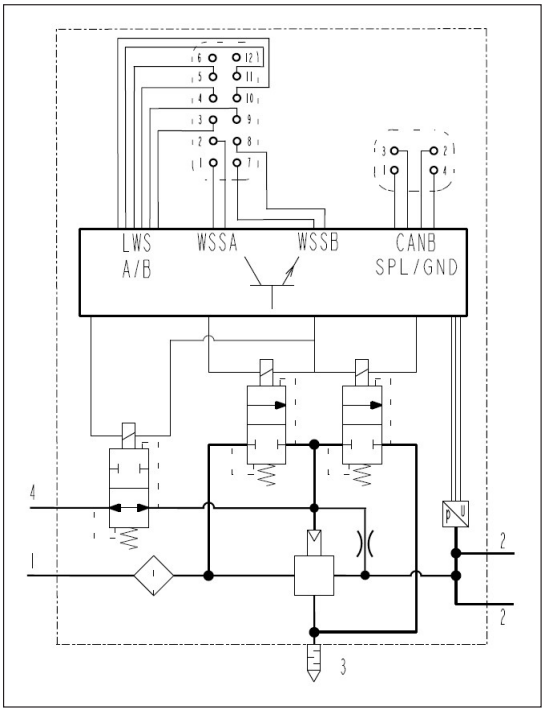


Figure 12 – 1C EPM Electrical and Pneumatic Schematic

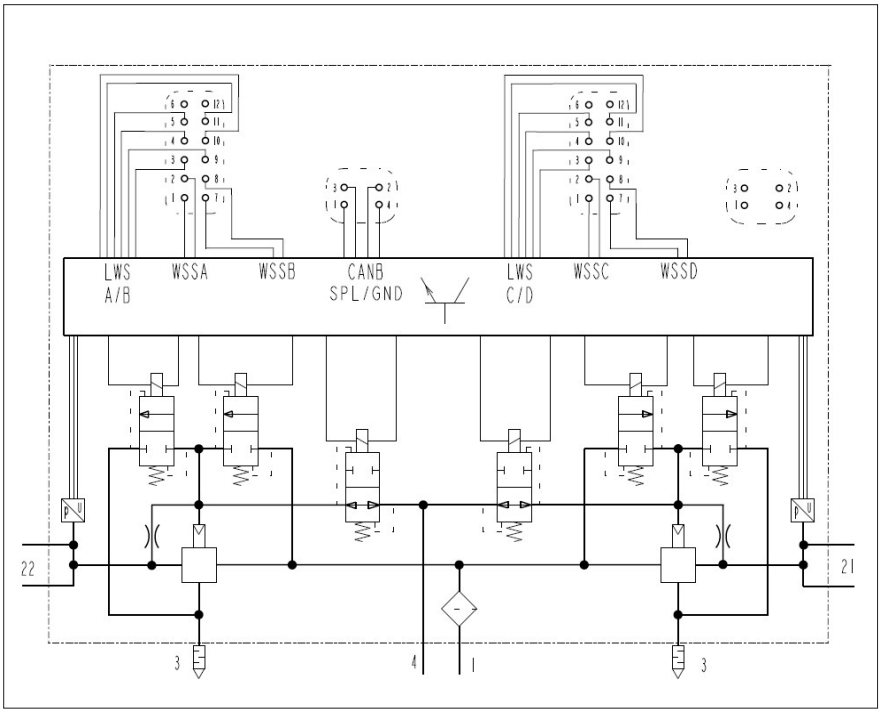


Figure 13 – 2C EPM Electrical and Pneumatic Schematic

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.

⚠ WARNING

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, and/or death.

GSBC SYSTEM PNEUMATIC SCHEMATIC EXAMPLE (WITH OPTIONAL GSAT)

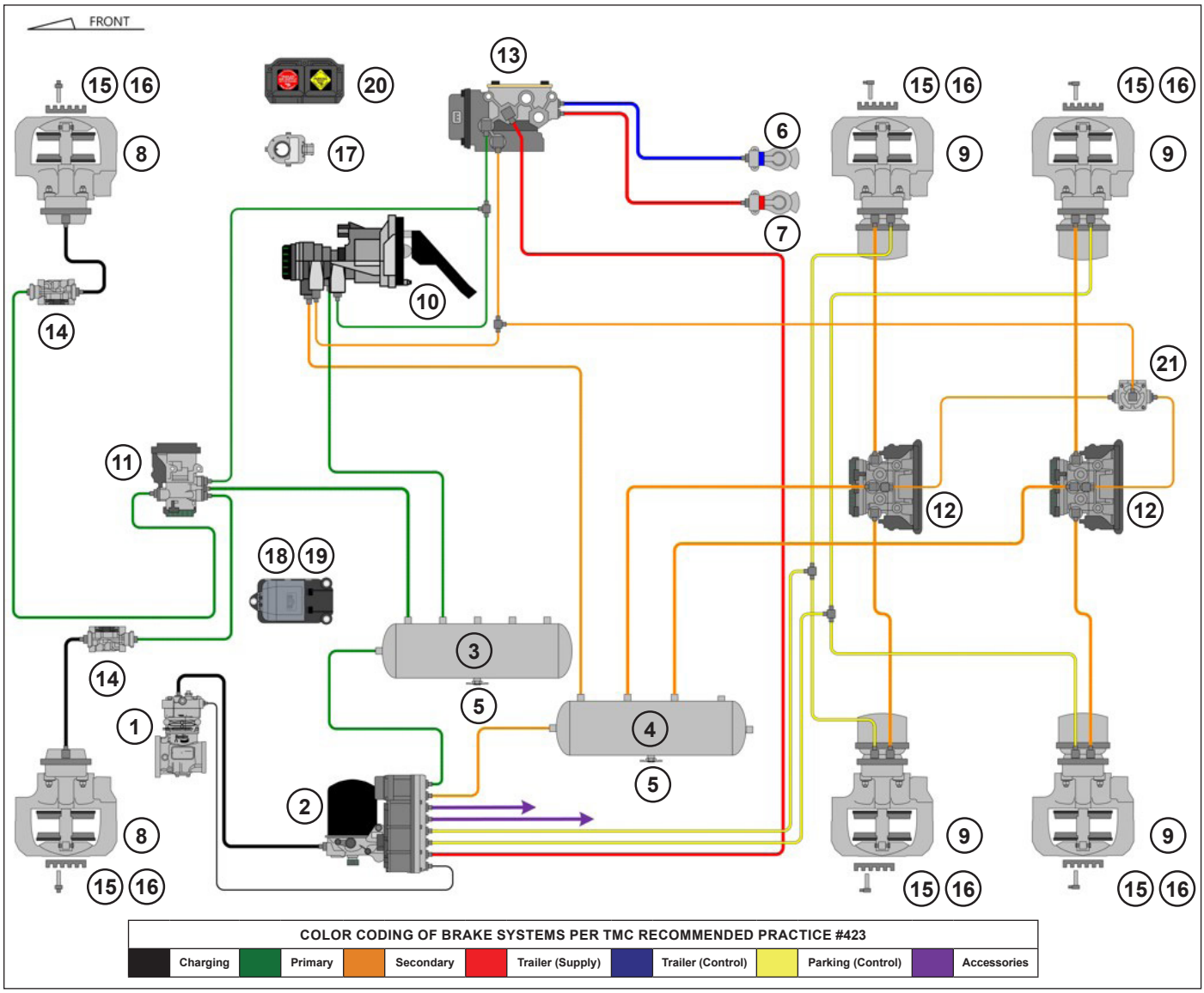


Figure 14 – GSBC System Pneumatic Schematic Example (With Optional GSAT)*

This schematic is representative only and may differ from your vehicle. Verify your vehicle schematic with your OEM. NOTE: In most applications of GSBC, the primary circuit is connected to the steer axle, and the secondary circuit is connected to the drive axle(s) unlike most conventional U.S. plumbing configurations.

ITEM	COMPONENT	ITEM	COMPONENT	ITEM	COMPONENT
1	AIR COMPRESSOR	8	FOUNDATION BRAKE WITH SERVICE CHAMBER	15	BENDIX® WS-24™ WSS
2	BENDIX® GSAT® AIR TREATMENT MODULE	9	FOUNDATION BRAKE WITH SPRING BRAKE CHAMBER	16	WSS CLAMPING SLEEVE
3	PRIMARY RESERVOIR	10	BENDIX® GSBC® FBM-40™ FOOT BRAKE MODULE	17	BENDIX® SAS-80™ STEER ANGLE SENSOR
4	SECONDARY RESERVOIR	11	BENDIX® GSBC® EPM-90™ ONE CHANNEL ELECTRO-PNEUMATIC MODULE (EPM-1C)	18	BENDIX® GSBC® EBS-90™ CENTRAL ECU
5	DRAIN VALVE	12	BENDIX® GSBC® EPM-90™ TWO CHANNEL ELECTRO-PNEUMATIC MODULE (EPM-2C)	19	BENDIX® GSBC® EBS-90™ CENTRAL ECU MUD COVER
6	TRAILER CONTROL GLADHAND	13	BENDIX® GSBC® ETPCM-90™ ELECTRONIC TRAILER PRESSURE CONTROL MODULE	20	ELECTRONIC PARKING BRAKE HAND CONTROL UNIT (HCU)
7	TRAILER SUPPLY GLADHAND	14	BENDIX® GSBC® M-50QR™ QUICK RELEASE ANTILOCK MODULATOR	21	QUICK RELEASE VALVE (OPTIONAL)

Table 6 – GSBC System Schematic Example Components

TROUBLESHOOTING

SOFTWARE TROUBLESHOOTING

The *GSBC* system will log DTCs when a fault is detected. Depending on the severity of the DTC and which features are impacted, one or more warning lamps may be displayed to the driver on the dashboard. Refer to *BW8207 GSBC Operator's Manual on B2Bendix.com* for more information.

To appropriately diagnose, troubleshoot, and repair faults, connect to the vehicle using Bendix® ACom® Diagnostic Software or an appropriate OEM diagnostic software. For more information regarding DTCs impacting EPMs, refer to the *Diagnostic Trouble Code (DTC) and Service Information* section on page 21.

TEST PREPARATION

Prior to conducting any troubleshooting testing, perform the following steps:

1. Ensure that the vehicle is in a location where it can be safely worked on.
2. Scan for any active faults in the *GSBC* System using the appropriate diagnostic tool and save the results.

⚠ CAUTION

For all troubleshooting tests and procedures, be sure to disable the vehicle's electrical supply and drain all reservoirs of air pressure before removing fittings. Failure to remove pressure from the pneumatic system could lead to serious injury.

NOTE: Before performing any troubleshooting procedures, check that the EPM is clean and clear of debris per the *Maintenance* section of this document.

PNEUMATIC FUNCTION TEST

This test procedure confirms that the EPM is receiving control pressure and supply pressure, and is responding appropriately to driver braking requests.

⚠ IMPORTANT

Before performing this test, ensure that the braking system is operating in electronic mode. This test can not be completed successfully if the braking system is not in electronic mode. Typically, a red "EBS" or "BRAKE" warning lamp on the dashboard is indicative of a braking system that is not operating in electronic mode.

Diagnose and repair any faults preventing the system from entering Electronic Mode prior to continuing this test.

NOTE: During all tests, listen for audible leaks. If audible leaks are observed, refer to the next section to troubleshoot leakage.

To perform the pneumatic test for the EPM, complete the following steps:

1. Chock the wheels on the vehicle to prevent unintended movement.
2. Turn the vehicle on and build the air system pressure to governor cut-out.
3. Release the parking brakes.
4. Confirm that the vehicle is in electronic mode. If the system faults, read the troubleshooting code using the appropriate diagnostic software. Troubleshoot the faulted component using the applicable service data sheet.
5. Turn the engine off in order to better hear the operation of the EPM solenoids. **NOTE:** An additional technician may be required to listen for EPM solenoid activation.
6. With the engine off, and ignition power on, make a series of light brake applications. The EPMs will activate and the internal solenoids will make audible 'clicking' noises as pressure is delivered.
7. Check for any system-generated faults using Bendix ACom Diagnostic Software or the appropriate OEM service tool.
8. Park the truck, turn off the ignition, and drain all reservoirs on the truck.

⚠ CAUTION

Be sure to remove all supply air from the system prior to installing any pressure gauge into the air system. Failure to do so can result in injury.

9. Install a pressure gauge in port 1 (supply) of the EPM and on one of the delivery ports of the same EPM (for a 1C EPM, Port 2 or for a 2C EPM, Port 21 or 22).
10. Unplug the electrical connector from the FBM to put the system into pneumatic backup mode. For more information on the FBM and how to unplug the electrical connector, *refer to SD-27-5028* on B2Bendix.com.
11. Release the parking brakes.
12. Restart the truck and build air system pressure to governor cut-out.

TROUBLESHOOTING (CONT.)

PNEUMATIC FUNCTION TEST (CONT.)

13. Measure the pressure in the supply port using the pressure gauge. If supply pressure is less than indicated on the dashboard, ensure that the measured supply pressure is being compared to the correct reservoir/circuit. If the circuit is correct and pressure is low, inspect the air line between port 1 on the EPM and the reservoir for kinks, blockages or damage. Repair the air line as necessary to ensure that supply pressure is reaching the EPM.
14. Make and hold a moderate service brake application using the foot brake pedal. Measure the pressure in the delivery port using the pressure gauge. Using the gauge, check for delivery pressure coming out of the EPM. Delivered pressure should be roughly proportional to the movement of the foot brake pedal.

    If pressure does not increase as expected, complete the following:

    - » If pressure does not increase at all, double check the plumbing and pressure gauges for proper operation. Ensure that the correct line is being measured.
    - » Inspect the EPM delivery port(s) and the attached fittings.
    - » Confirm that the FBM is delivering control pressure to the EPM. If pressure is being supplied by the FBM and no pressure is being delivered from the EPM, replace the EPM.
    - » If pressure is not being supplied by the FBM, *refer to SD-27-5028 on B2Bendix.com for FBM troubleshooting instructions*.
15. Release the service brake application using the foot brake pedal. Measure the pressure in the delivery port using the pressure gauge. Using the gauge, check that the delivery pressure coming out of the EPM has fallen to zero pressure on the gauge.

    If pressure does not respond as expected, complete the following:

    - » If pressure does not decrease at all or falls slowly, remove the silencer from the exhaust (port 3) to check for a blocked exhaust. If this corrects the issue, replace the silencer per instructions on page 18 of this document.
    - » If pressure is still trapped, remove the silencer from the FBM and perform the same check. If this corrects the issue, replace the FBM silencer per the instructions in the FBM SD sheet, *SD-27-5028 on B2Bendix.com*.
    - » If pressure is still trapped, inspect the air lines between the FBM and the EPM, looking for blockages, kinks, or other obstructions.
    - » If pressure is still trapped and no other blockages are found in the air lines, fittings, FBM, or exhaust port(s), replace the EPM.

    NOTE: Installing a gauge in the control port (port 4) of the EPM can help to diagnose this scenario. Pressure should not remain trapped on the control port of the EPM without a service brake application.
16. When diagnostic tests have been completed, reconnect the FBM electrical connector and remove any diagnostic pressure gauges from the air system.
17. Reapply the parking brakes and go to the *Installation Test* section on page 17 to validate any repairs that have been performed.

TROUBLESHOOTING (CONT.)

LEAKAGE TESTS

NOTE: This test typically requires two people to efficiently conduct the test.

NOTE: If the EPM needs replaced, *refer to the Replacement Instructions* section on page 15.

SUPPLY SIDE LEAKAGE TEST

To perform the leakage test for the EPM, complete the following steps:

1. Ensure that the test preparation procedure has been completed.
2. Turn the vehicle on, and build the air system pressure to governor cut-out.
3. Apply a soapy water solution to the body of the EPM.
    a. If bubbles accumulate near the supply fitting, check to see that the fitting is torqued to the correct value. *Refer to Table 1 for 1C EPM or Table 2 for 2C EPM torque information*. Bubble diameter(s) should not exceed a one-inch bubble in less than 3 seconds.
        » If the fitting is torqued to the correct value and the port continues to leak, replace the fitting.
        » If the EPM continues to leak after a replacement fitting has been installed and correctly torqued, the EPM is damaged and must be replaced.
    b. If bubbles accumulate anywhere on the body of the EPM, bubble diameter(s) should not exceed a one-inch bubble in less than 3 seconds.
        » If bubbles exceed this size/rate, the EPM is damaged and must be replaced.
    c. If bubbles accumulate on or near the silencer on the exhaust (port 3), bubble diameter(s) should not exceed a one-inch bubble in less than 3 seconds.
        » If bubbles exceed this size/rate, the EPM is damaged and must be replaced.

NOTE: If the EPM does not function as described above, or if the leakage is excessive, it is recommended that the EPM be replaced with new genuine Bendix parts, available at any authorized Bendix parts outlet.

TROUBLESHOOTING (CONT.)

DELIVERY SIDE LEAKAGE TEST

To perform the leakage test for the EPM, complete the following steps:

(ELECTRONIC MODE)

1. Ensure that the test preparation procedure has been completed.
2. Turn the vehicle on, and build the air system pressure to governor cut-out.
3. Make sure that the vehicle wheels are properly chocked to prevent unexpected movement.
4. Release the parking brakes.
5. Apply a soapy water solution to the body of the EPM, the pneumatic ports, exhaust port(s), and the silencer.
6. Make and hold a full service brake application using the foot brake pedal.
    a. If bubbles accumulate near any of the pneumatic fittings, check to see that the fitting is torqued to the correct value. *Refer to Table 1 for 1C EPM or Table 2 for 2C EPM torque information.* Bubble diameter(s) should not exceed a one-inch bubble in less than 3 seconds.
        » If the fitting is torqued to the correct value and the port continues to leak, replace the fitting.
        » If the EPM continues to leak after a replacement fitting has been installed and correctly torqued, the EPM is damaged and must be replaced.
    b. If bubbles accumulate anywhere on the body of the EPM, bubble diameter(s) should not exceed a one-inch bubble in less than 3 seconds.
        » If bubbles exceed this size/rate, the EPM is damaged and must be replaced.
    c. If bubbles accumulate on or near the silencer on the exhaust (port 3), bubble diameter(s) should not exceed a one-inch bubble in less than 3 seconds.
        » If bubbles exceed this size/rate, the EPM is damaged and must be replaced.

(PNEUMATIC BACKUP MODE)

7. Unplug the electrical connector from the FBM to put the system into pneumatic backup mode. For more information on the FBM and how to unplug the electrical connector, *refer to SD-27-5028* on B2Bendix.com.
8. Apply a soapy water solution to the body of the EPM on and around the pneumatic backup control port (port 4).
9. Make and hold a full service brake application using the foot brake pedal.
    a. If bubbles accumulate near any of the pneumatic fittings, check to see that the fitting is torqued to the correct value. *Refer to Table 1 for 1C EPM or Table 2 for 2C EPM torque information*. Bubble diameter(s) should not exceed a one-inch bubble in less than three (3) seconds.
    b. If the fitting is torqued to the correct value and the port continues to leak, replace the fitting.
        » If the EPM continues to leak after a replacement fitting has been installed and correctly torqued, the EPM is damaged and must be replaced.
    c. If bubbles accumulate anywhere on the body of the EPM, bubble diameter(s) should not exceed a one-inch bubble in less than 3 seconds.
        » If bubbles exceed this size/rate, the EPM is damaged and must be replaced.
    d. If bubbles accumulate on or near the silencer on the exhaust (port 3), bubble diameter(s) should not exceed a one-inch bubble in less than 3 seconds.
        » If bubbles exceed this size/rate, the EPM is damaged and must be replaced.
10. When diagnostic tests have been completed, turn off the vehicle, reconnect the FBM electrical connector, and remove any diagnostic pressure gauges from the air system.
11. Reapply the parking brakes and go to *Installation Test* section on page 17 to validate any repairs that have been performed.

NOTE: If the EPM does not function as described above, or if the leakage is excessive, it is recommended that the EPM be replaced with new genuine Bendix parts, available at any authorized Bendix parts outlet.

TROUBLESHOOTING (CONT.)

ELECTRICAL FUNCTION TESTS

The EPM functionality is electronically monitored by both the EPM and the central ECU. Electrical function testing is conducted automatically and any faults will be reported as DTCs. For more information regarding DTCs impacting EPMs, refer to the *Diagnostic Trouble Code (DTC) and Service Information* section on page 21.

HARNESS COMMUNICATION TEST

Perform this test to troubleshoot the CAN connection on the vehicle harness between the EPM and the Central ECU.

1. Turn off the vehicle.
2. Remove electrical power from the vehicle.
3. Disconnect the vehicle harness X1 connector from the EPM.
4. Measure the resistance between the exposed pin 3 and pin 4 on the vehicle harness X1 connector.

   The nominal resistance is 120 ohm. Resistance can vary depending on harness length. If the measured resistance is significantly different, for example, an open circuit or short to ground:

   » Inspect the vehicle wiring harness for open or shorted wiring per OEM instructions.

   » Check the electrical connections on the vehicle harness for damaged connectors or problems.

   » Inspect the electrical connector at the Central ECU for damage or other problems.

4. If the vehicle harness passes these checks, reconnect the harness to the EPM and restore vehicle power. Continue troubleshooting the problem using Bendix ACom Diagnostic Software or the appropriate OEM service tool.

EPM INTERNAL POWER CIRCUITRY TEST

Perform this test to check for physical damage to the EPM internal power circuitry.

1. Turn off the vehicle.
2. Remove electrical power from the vehicle.
3. Disconnect the vehicle harness X1 connector from the EPM.
4. Measure the resistance between the exposed pin 1 and pin 2 of the X1 connector on the EPM. Refer to *Figure 9 - X1 and X2 Electrical Pinout.*

   The nominal resistance measured should be between approximately 30 kohm and 36 kohm. If the measured resistance is significantly different, for example, an open circuit or short to ground, it may be indicative of a faulty EPM.

5. If the resistance falls outside these thresholds and/or there is damage to the EPM electrical connector, confirm there are faults using Bendix ACom Diagnostic Software or the appropriate OEM service tool. If so, replace the EPM.
6. If not, reconnect the X1 connector to the EPM, restore electrical power, and continue troubleshooting.

EPM COMMUNICATION RESISTANCE TEST

Perform this test to troubleshoot the physical CAN pins on the EPM that provide communication between the EPM and the Central ECU.

1. Prior to troubleshooting the EPM communication resistance, first confirm that the EPM harness is fully functional by running the *Harness Communication* test.
2. Turn off the vehicle.
3. Remove electrical power from the vehicle.
4. Disconnect the vehicle harness X1 connector from the EPM.
5. Measure the resistance between the exposed pin 3 and pin 4 on the X1 connector on the EPM. Refer to *Figure 9 - X1 and X2 Electrical Pinout.*

   The nominal resistance is 300 ohm. If the measured resistance is significantly different, for example, an open circuit or short to ground, it may be indicative of a faulty EPM.

6. If the resistance falls outside these thresholds and/or there is damage to the EPM electrical connector, confirm there are faults using Bendix ACom Diagnostic Software or the appropriate OEM service tool. If so, replace the EPM.
7. If not, reconnect the X1 connector to the EPM, restore electrical power, and continue troubleshooting.

REPLACEMENT INSTRUCTIONS

If replacing the EPM, use the same mounting location and, if necessary, the same bracketry as installed by the Original Equipment Manufacturer (OEM).

NOTE: The EPM does not need to be removed from the vehicle for maintenance of serviceable parts. Proper installation allows for sufficient clearance around the part. However, the part may be removed if necessary for service or replacement.

EPM REMOVAL

To remove the EPM from the vehicle, complete the following steps:

1. Chock the vehicle's wheels to prevent unintended movement.
2. Prior to disassembly, remove as much contamination as possible from the exterior of the device, taking care to keep all contamination from entering the open ports.
3. Drain air from primary and secondary reservoirs. Refer to OEM service manuals for detailed instructions.
4. Prior to removing the EPM from the vehicle, take a photo of the current EPM location and orientation, including air line connections and routing, for reference during the replacement steps. Additionally, mark or otherwise identify air hoses and electrical connectors to aid in the installation of the new EPM.
5. Clean and inspect all air hoses for damage and replace as necessary.
6. Disconnect the air hoses from the EPM. **NOTE:** Depending on the type of pneumatic fittings used, special tools may be required. Refer to the OEM service manual.

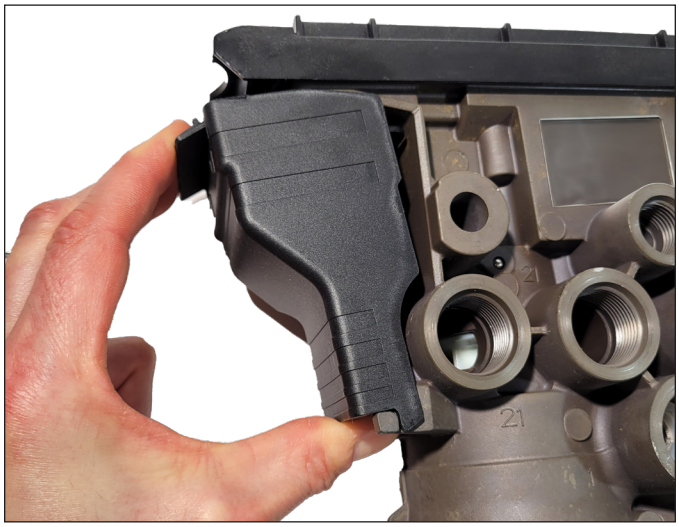


Figure 15 – Electrical Covering Cap Removal

7. Remove the Electrical Covering Cap(s) from the side of the unit. **NOTE:** The 2C EPM will have two covers.
8. Disconnect the electrical connections from the EPM. *See Figure 16*.

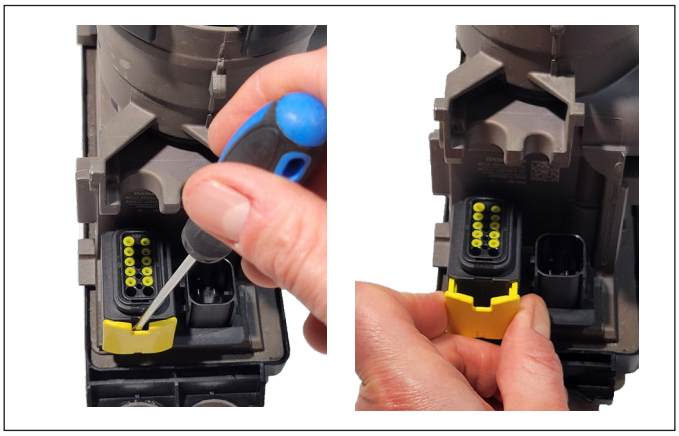


Figure 16 – Electrical Harness Connector Removal

9. Remove pneumatic fittings from the EPM and inspect them for damage or debris. Replace any damaged fittings as necessary.
10. Remove and retain mounting bolts for use in the installation. *See Figure 17*.

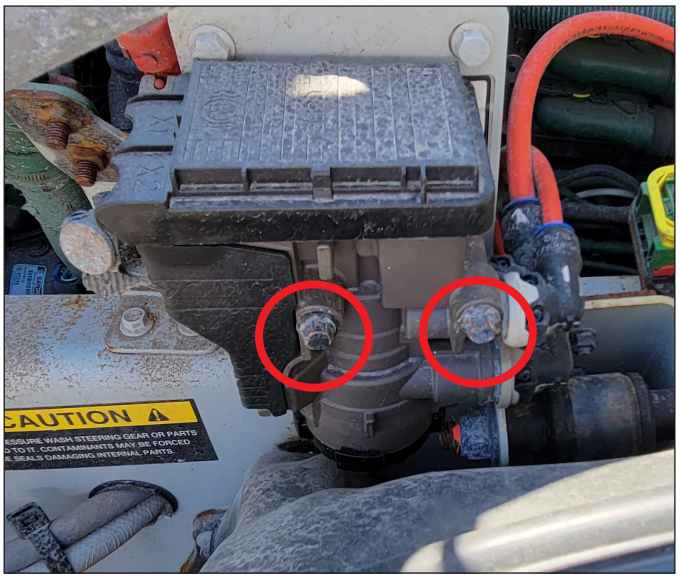


Figure 17 – 1C EPM Mounting Bolts Example

REPLACEMENT INSTRUCTIONS (CONT.)

COMPONENT MOUNTING

The 1C and 2C EPMs are mounted rigidly to the vehicle. Depending on the vehicle, the EPM may be mounted directly to the frame or to a bracket.

For fitting torque and replacement information for the mounting hardware, contact the vehicle OEM.

CAUTION

To prevent potential loss of functionality including loss of vehicle stability and loss of braking, all unused electrical and pneumatic connections must be sealed to protect the EPM from contamination.

Ensure that unused pneumatic ports are plugged with the appropriate plug fitting and that electrical connections are sealed using either the mating connector on the electrical harness or with a blank "dummy plug."

Contact the vehicle OEM for replacement parts if these plugs are missing or damaged.

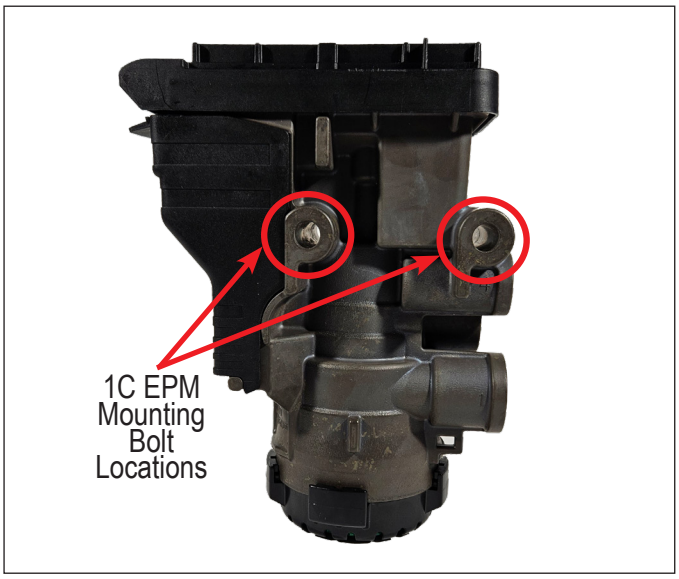


Figure 18A – 1C EPM Mounting Bolt Locations

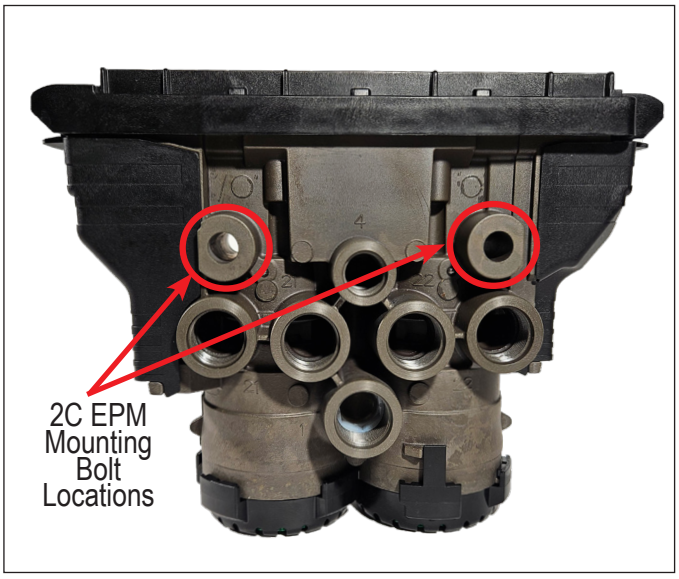


Figure 19A – 2C EPM Mounting Bolt Locations

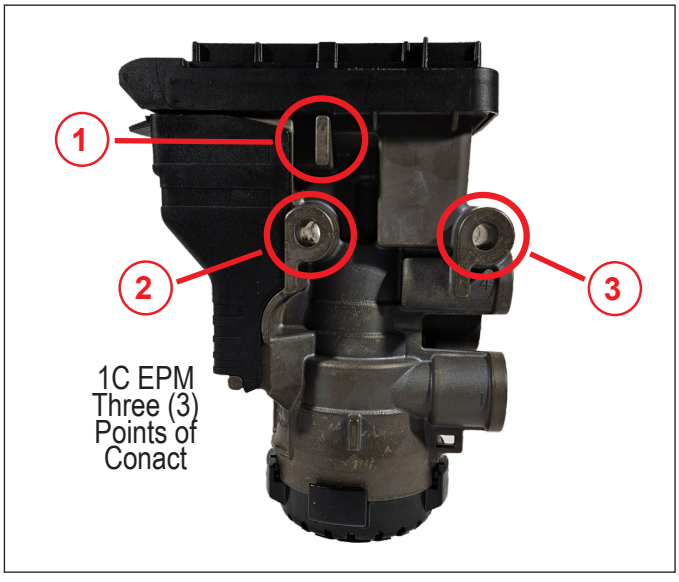


Figure 18B – 1C EPM Mounting Points of Contact

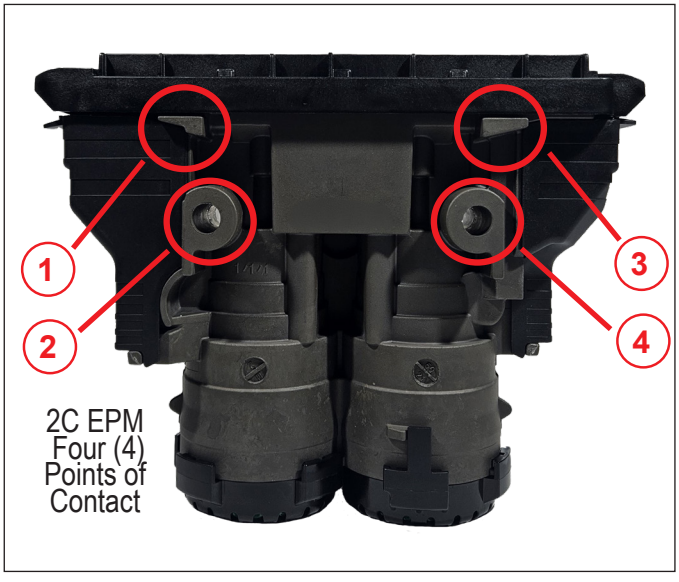


Figure 19B – 2C EPM Mounting Points of Contact

REPLACEMENT INSTRUCTIONS (CONT.)

EPM INSTALLATION

To install the EPM on the vehicle, complete the following steps:

1. Reference the EPM location and orientation image that was taken in Step 4 of EPM Removal prior to installing the EPM to the vehicle.
2. Clean and inspect all air hoses for damage and replace as necessary.
3. Install pneumatic fittings on new EPM and plug any unused ports. Do not exceed maximum torque on pneumatic fittings. *Refer to Table 1 for 1C EPM or Table 2 for 2C EPM torque information.*

   NOTE: All pneumatic fitting ports on both the 1C and 2C EPM are metric. Be sure to use only metric straight thread o-ring fittings on this component. Failure to use the correct fittings may result in air leakage and permanent damage to the component.

⚠ WARNING

Do not use thread sealant for EPM fittings. EPM threads do not use sealant. The seal is provided by an o-ring on the outside of the fitting.

4. Install the EPM and tighten mounting bolts. **NOTE:** Verify that mounting points make contact with the vehicle. For 1C EPM, *refer to Figure 18B*. For 2C EPM, *refer to Figure 19B*.

⚠ CAUTION

To prevent potential loss of EPM functionality, all unused EPM electrical connections must be sealed to receive the necessary protection from moisture and prevent corrosion. The sealing element is part of the connector plug and not the socket. Be careful when handling and installing the connector plugs so as to not damage the seal.

5. Replace the electrical plugs and connectors removed in Step 7 of the EPM removal process.
6. Replace the Electrical Covering Cap(s).
7. Connect airlines to the EPM by referencing the photo taken in *Step 4 of the EPM Removal process*.

⚠ WARNING

Failure to correctly plumb airlines can lead to limited functionality or loss of ABS, ESP, and other safety-critical functions. These failures may lead to serious vehicle braking, instability, and performance issues, and/or collisions causing property damage, serious injuries, and/or death.

8. Perform the *Installation Test*.

⚠ CAUTION

A change in vehicle braking characteristics or a dashboard warning lamp may indicate a malfunction in the braking system. Although the vehicle air brake system may continue to function, the vehicle should not be operated until the necessary repairs have been made by a qualified technician.

Always check the vehicle braking system for proper operation after performing service or maintenance and before returning the vehicle to service.

⚠ CAUTION

After removal and replacement of the EPM, special considerations need to be taken to ensure the EPM has been properly installed on the vehicle. These include:

- **Location and orientation of the EPM**
- **Correct plumbing of the EPM**
- **Installation Test to verify proper installation.**

INSTALLATION TEST

1. Chock the wheels on the vehicle to prevent unintended movement.
2. Turn the vehicle on and build the air system pressure to governor cut-out.
3. Check for and clear any system-generated faults using Bendix ACom Diagnostic Software or the appropriate OEM service tool. If there are any remaining active faults, following the relevant troubleshooting steps associated with the fault.
4. Confirm there are no active warning lamps associated with the *GSBC* system on the dash or display. *Refer to the GSBC Operator's Manual BW8207 on B2Bendix.com* for more information or contact your vehicle OEM.
5. With the engine off, and ignition power on, make a series of light brake application. The EPMs will activate and the internal solenoids will make audible 'clicking' noises as pressure is delivered.
6. If no new warning lamps are illuminated, *go to Step 7 of the Installation Test*. If new warning lamps become illuminated, *return to Step 3*.
7. Remove the wheel chocks. The EPM installation procedure is complete.

REPLACEMENT INSTRUCTIONS (CONT.)

REPLACEMENT PARTS

DESCRIPTION	PART NUMBER
Silencer	23144853
Electrical Covering Cap	24048059

Table 7 – EPM Replacement Parts Information

SILENCER REMOVAL AND REPLACEMENT

Silencers require regular inspection to ensure they do not become blocked by external contamination. Contamination slows down service brake release times, possibly leading to reduced braking performance and potential noncompliance to regulations.

⚠ WARNING

Accumulation of road debris on the EPM may cause blockage of the silencer. If the silencer is blocked, the EPM may be unable to reduce or release service brake pressure. This could lead to poor brake response, slow release of the brakes, and poor ABS or ESP performance.

Failure to perform inspection of the EPM could lead to serious vehicle braking, instability, and performance issues, and/or collisions causing property damage, serious injuries, and/or death. The EPM must be mounted to minimize the possibility of accumulated debris on the silencer which can potentially affect compliance. *Refer to the Cleaning and Inspection section on page 20.*

The silencer must not be covered or painted over.

⚠ IMPORTANT

If the silencer is found to be contaminated, it must be replaced. *Refer to Table 7 for silencer replacement information.*

SILENCER REMOVAL

NOTE: The EPM does not need to be removed from the vehicle for maintenance of serviceable parts. Proper installation allows for sufficient clearance around the part. However, the part may be removed if necessary for service or replacement.

To remove a silencer from the EPM, follow these steps:

1. Chock the wheels and drain the reservoirs to ambient pressure.
2. Lift the retention tab with a small screw driver using caution to not break the tab. Looking at exhaust port, rotate counter clockwise using gentle force to lift the retention tab so that it clears the locking point on the body casting. *See Figure 20.*

   NOTE: If the retention tab is broken, the silencer must be replaced.

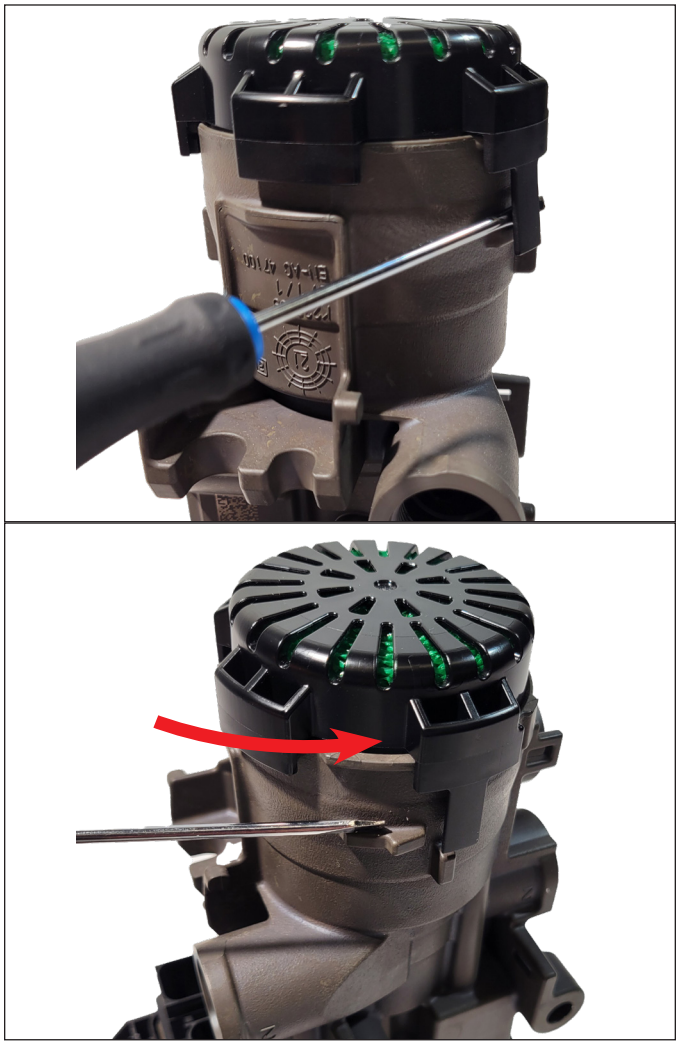


Figure 20 – Removing the EPM Silencer

3. Lift the cover and silencer element from the EPM.

REPLACEMENT INSTRUCTIONS (CONT.)

SILENCER INSTALLATION

To install a silencer on the EPM, follow these steps:

1. Place the new silencer on the EPM aligning the locking tabs between the slots on the body casting. **NOTE:** Be careful not to allow the mesh to fall out of the silencer housing during installation.

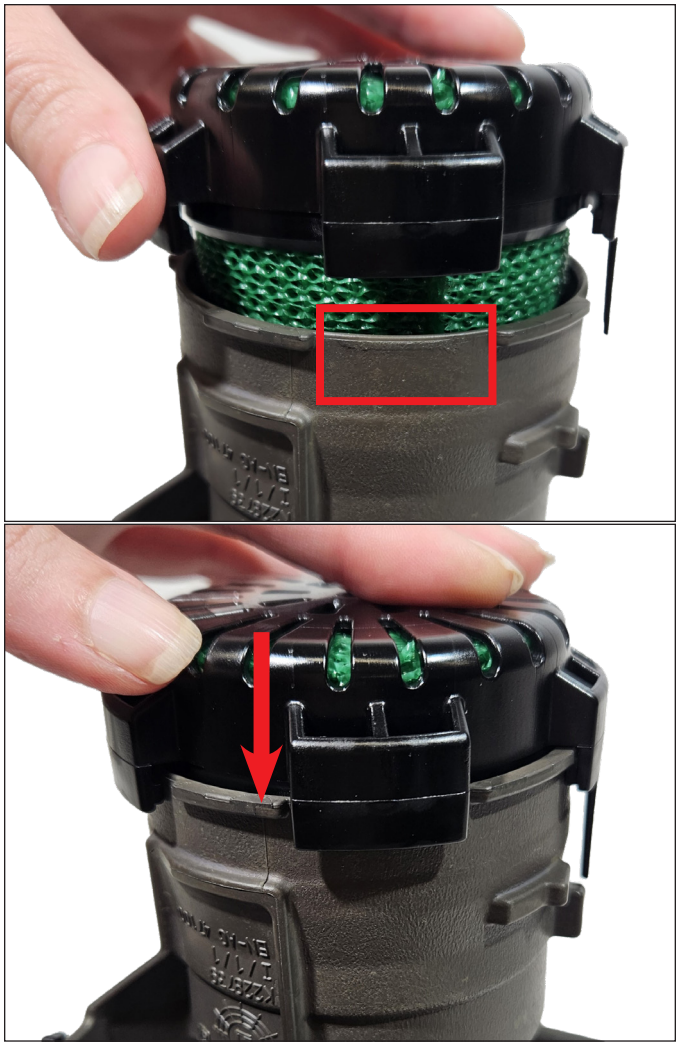


Figure 21 – Replacing the EPM Silencer

2. While keeping pressure on the silencer, looking at the exhaust port, rotate it clockwise to bring the retention tab over the locking point. *See Figure 22*.

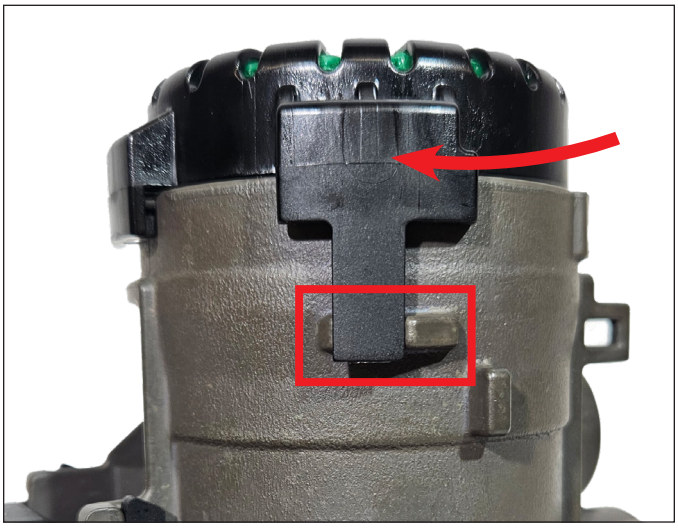


Figure 22 – Securing Silencer Retention Tab

MAINTENANCE

The EPM does not need to be removed from the vehicle for maintenance of serviceable parts. Proper installation allows for sufficient clearance around the part. However, the part may be removed if necessary for maintenance of serviceable parts.

IMPORTANT

Review the Bendix Warranty Policy before performing any intrusive maintenance procedures. A warranty may be voided if intrusive maintenance is performed during the warranty period. No two vehicles operate under identical conditions, as a result, maintenance intervals may vary. Experience is a valuable guide in determining the best maintenance interval for air brake system components. At a minimum, the EPM should be inspected every 6 months or 1500 operating hours, whichever comes first, for proper operation. Should the EPM not meet the standards of the operational tests noted in this document, further investigation may be required.

IMPORTANT

The EPM is designed not to require maintenance, and there are no user-serviceable components located inside the EPM. Disassembly of the device will void the component warranty, and Bendix will not provide technical support or replacement components for components internal to the EPM.

CLEANING AND INSPECTION

CLEANING

Clean the exterior of the EPM and remove debris and contamination.

The preferred method for cleaning the EPM of dirt, grit, salt, or other build-up is water with a gentle brush. It is permissible to use a gentle detergent, but strong acid or chemical cleaners should be avoided. It is also permissible to use a pressure washer, but the technician should be careful not to hold the pressure washer close to the EPM, use excessive pressure, or spray water directly at the exhaust port(s), electrical connectors, or Electrical Covering Cap(s).

CLEANING AND INSPECTION (CONT.)

CLEANING (CONT.)

WARNING

Be cautious while using a pressure washer to clean components. Appropriate Personal Protective Equipment (PPE) is recommended (e.g., eye protection) while using a pressure washer. Failure to use PPE could result in personal injury. Rubber parts, sealing interfaces, and electrical components or covers should not be directly sprayed with the high-pressure jet. Failure to follow maintenance procedures could lead to serious vehicle braking, instability, and performance issues, and/or collisions causing property damage, serious injuries, and/or death.

INSPECTION

To inspect an EPM, ensure that the following conditions are met:

1. Confirm that all harness connectors are properly plugged and secured.
2. If there is an unused X3 connector, confirm that the connector is covered with a dust plug.

IMPORTANT

The X3 connector is not used on all vehicles. If not plugged into the vehicle harness, the X3 connector should be covered with a dust plug. Failure to do so may lead to corrosion of the pins which may cause issues and eventual EPM failure. Contact the OEM for dust plug ordering information.

The X4 connector does not require a dust cover as it is an unused connector without pins.

3. Confirm that the electrical connector covers are properly plugged and secured.
4. Confirm that the silencer(s) on the exhaust port(s) (port 3) are clean and free of debris. *See Figures 6 and 7* starting on page 4.
5. Confirm that all the fittings are intact and there are no signs of excessive corrosion.
6. Confirm that all air lines are intact and not cracked, damaged, or worn.

DIAGNOSTIC TROUBLE CODE (DTC) AND SERVICE INFORMATION

The *GSBC* system and Bendix ACom Diagnostic Software retain a record of all DTCs. This record is commonly referred to as “event history.” When a DTC self-heals or is manually cleared, the DTC code remains in event history as an inactive DTC.

The *GSBC* system is supported by Bendix ACom Diagnostic Software. Visit B2Bendix.com for additional information or to purchase ACom Diagnostic Software.

IMPORTANT

For all repair steps, first complete the following:

1. **Generate an ACom Diagnostic Software report.**
2. **Clear DTCs.**
3. **Continue with repair information for each active DTC that will not clear.**

NOTE: After completing all repairs, drive the vehicle to ensure the repairs were sufficient.

4. **Once repairs have been made, clear the DTC again.**

DTC #	SPN (J1939)	FMI (J1939)	DTC NAME	DTC DESCRIPTION	GO TO SERVICE ACTION CODE LISTED IN TABLE 9
0x506712	20583	18	Wheel 1 EPM: Circuit Short To Battery	Internal WSS Analog signals are not in valid range. Short to Battery detected at high side or low side.	A
0x506714	20583	20	Wheel 1 EPM: Circuit Short To Ground or Open	Hardware fault detected inside EPM. Short to Gnd detected at high side or low side.	B
0x506718	20583	24	Wheel 1 EPM: Circuit Current Below Threshold	Hardware fault detected inside EPM. Sensor not connected or High side / Low side open.	C
0x506764	20583	100	Wheel 1 EPM: Signal Plausibility Failure	Sensor frequency is out of the specified ranges.	D
0x506812	20584	18	Wheel 2 EPM: Circuit Short To Battery	Internal WSS Analog signals are not in valid range. Short to Battery detected at high side or low side.	A
0x506814	20584	20	Wheel 2 EPM: Circuit Short To Ground or Open	Hardware fault detected inside EPM. Short to Gnd detected at high side or low side.	B
0x506818	20584	24	Wheel 2 EPM: Circuit Current Below Threshold	Hardware fault detected inside EPM. Sensor not connected or High side / Low side open.	C
0x506864	20584	100	Wheel 2 EPM: Signal Plausibility Failure	Sensor frequency is out of the specified ranges.	D
0x506912	20585	18	Wheel 3 EPM: Circuit Short To Battery	Internal WSS Analog signals are not in valid range. Short to Battery detected at high side or low side.	A
0x506914	20585	20	Wheel 3 EPM: Circuit Short To Ground or Open	Hardware fault detected inside EPM. Short to Gnd detected at high side or low side.	B
0x506918	20585	24	Wheel 3 EPM: Circuit Current Below Threshold	Hardware fault detected inside EPM. Sensor not connected or High side / Low side open.	C
0x506964	20585	100	Wheel 3 EPM: Signal Plausibility Failure	Sensor frequency is out of the specified ranges.	D
0x506A12	20586	18	Wheel 4 EPM: Circuit Short To Battery	Internal WSS Analog signals are not in valid range. Short to Battery detected at high side or low side.	A
0x506A14	20586	20	Wheel 4 EPM: Circuit Short To Ground or Open	Hardware fault detected inside EPM. Short to Gnd detected at high side or low side.	B
0x506A18	20586	24	Wheel 4 EPM: Circuit Current Below Threshold	Hardware fault detected inside EPM. Sensor not connected or High side / Low side open.	C
0x506A64	20586	100	Wheel 4 EPM: Signal Plausibility Failure	Sensor frequency is out of the specified ranges.	D

Table 8 - Diagnostic Trouble Codes (DTCs)

DTC #	SPN (J1939)	FMI (J1939)	DTC NAME	DTC DESCRIPTION	GO TO SERVICE ACTION CODE LISTED IN TABLE 9
0x506B12	20587	18	Wheel 5 EPM: Circuit Short To Battery	Internal WSS Analog signals are not in valid range. Short to Battery detected at high side or low side.	A
0x506B14	20587	20	Wheel 5 EPM: Circuit Short To Ground or Open	Hardware fault detected inside EPM. Short to Gnd detected at high side or low side.	B
0x506B18	20587	24	Wheel 5 EPM: Circuit Current Below Threshold	Hardware fault detected inside EPM. Sensor not connected or High side / Low side open.	C
0x506B64	20587	100	Wheel 5 EPM: Signal Plausibility Failure	Sensor frequency is out of the specified ranges.	D
0x506C12	20588	18	Wheel 6 EPM: Circuit Short To Battery	Internal WSS Analog signals are not in valid range. Short to Battery detected at high side or low side.	A
0x506C14	20588	20	Wheel 6 EPM: Circuit Short To Ground or Open	Hardware fault detected inside EPM. Short to Gnd detected at high side or low side.	B
0x506C18	20588	24	Wheel 6 EPM: Circuit Current Below Threshold	Hardware fault detected inside EPM. Sensor not connected or High side / Low side open.	C
0x506C64	20588	100	Wheel 6 EPM: Signal Plausibility Failure	Sensor frequency is out of the specified ranges.	D
0x506D12	20589	18	Wheel 7 EPM: Circuit Short To Battery	Internal WSS Analog signals are not in valid range. Short to Battery detected at high side or low side.	A
0x506D14	20589	20	Wheel 7 EPM: Circuit Short To Ground or Open	Hardware fault detected inside EPM. Short to Gnd detected at high side or low side.	B
0x506D18	20589	24	Wheel 7 EPM: Circuit Current Below Threshold	Hardware fault detected inside EPM. Sensor not connected or High side / Low side open.	C
0x506D64	20589	100	Wheel 7 EPM: Signal Plausibility Failure	Sensor frequency is out of the specified ranges.	D
0x506E12	20590	18	Wheel 8 EPM: Circuit Short To Battery	Internal WSS Analog signals are not in valid range. Short to Battery detected at high side or low side.	A
0x506E14	20590	20	Wheel 8 EPM: Circuit Short To Ground or Open	Hardware fault detected inside EPM. Short to Gnd detected at high side or low side.	B
0x506E18	20590	24	Wheel 8 EPM: Circuit Current Below Threshold	Hardware fault detected inside EPM. Sensor not connected or High side / Low side open.	C
0x506E64	20590	100	Wheel 8 EPM: Signal Plausibility Failure	Sensor frequency is out of the specified ranges.	D
0x506F12	20591	18	Wheel 9 EPM: Circuit Short To Battery	Internal WSS Analog signals are not in valid range. Short to Battery detected at high side or low side.	A
0x506F14	20591	20	Wheel 9 EPM: Circuit Short To Ground or Open	Hardware fault detected inside EPM. Short to Gnd detected at high side or low side.	B
0x506F18	20591	24	Wheel 9 EPM: Circuit Current Below Threshold	Hardware fault detected inside EPM. Sensor not connected or High side / Low side open.	C
0x506F64	20591	100	Wheel 9 EPM: Signal Plausibility Failure	Sensor frequency is out of the specified ranges.	D
0x507012	20592	18	Wheel 10 EPM: Circuit Short To Battery	Internal WSS Analog signals are not in valid range. Short to Battery detected at high side or low side.	A
0x507014	20592	20	Wheel 10 EPM: Circuit Short To Ground or Open	Hardware fault detected inside EPM. Short to Gnd detected at high side or low side.	B
0x507018	20592	24	Wheel 10 EPM: Circuit Current Below Threshold	Hardware fault detected inside EPM. Sensor not connected or High side / Low side open.	C
0x507064	20592	100	Wheel 10 EPM: Signal Plausibility Failure	Sensor frequency is out of the specified ranges.	D
0x509556	20629	86	Electro-Pneumatic Module: Invalid / Incompatible Configuration	Error is set if inconsistency is found between EEPROM dataset of the GSBC ECU and EEPROM dataset of the EPMs, or if any of the EPMs has incompatible software version.	E

Table 8 - Diagnostic Trouble Codes (DTCs)

DIAGNOSTIC TROUBLE CODE (DTC) AND SERVICE INFORMATION (CONT.)

DTC #	SPN (J1939)	FMI (J1939)	DTC NAME	DTC DESCRIPTION	GO TO SERVICE ACTION CODE LISTED IN TABLE 9
0x509562	20629	98	Electro-Pneumatic Module: Signal Compare Failure	EPM self-test comparing system supply pressure to maximum delivery pressure failed.	F
0x50B712	20663	18	EPM0, PCL0 Pressure Sensor: Circuit Short To Battery	EPM internal electrical failure.	G
0x50B716	20663	22	EPM0, PCL0 Pressure Sensor: Circuit Voltage Below Threshold	EPM internal electrical failure.	G
0x50B721	20663	33	EPM0, PCL0 Pressure Sensor: Signal Amplitude Less Than Minimum	EPM internal electrical failure.	G
0x50B722	20663	34	EPM0, PCL0 Pressure Sensor: Signal Amplitude Greater Than Maximum	EPM internal electrical failure.	G
0x50B728	20663	40	EPM0, PCL0 Pressure Sensor: Signal Bias Level Out of Range / Zero Adjustment Failure	The error is set if the internal EPM pressure sensor voltage signal is generally too low or too high (outside of valid signal range).	H
0x50B812	20664	18	EPM0, PCL1 Pressure Sensor: Circuit Short To Battery	EPM internal electrical failure.	G
0x50B816	20664	22	EPM0, PCL1 Pressure Sensor: Circuit Voltage Below Threshold	EPM internal electrical failure.	G
0x50B818	20664	24	EPM0, PCL1 Pressure Sensor: Circuit Current Below Threshold	EPM internal electrical failure.	G
0x50B821	20664	33	EPM0, PCL1 Pressure Sensor: Signal Amplitude Less Than Minimum	EPM internal electrical failure.	G
0x50B822	20664	34	EPM0, PCL1 Pressure Sensor: Signal Amplitude Greater Than Maximum	EPM internal electrical failure.	G
0x50B828	20664	40	EPM0, PCL1 Pressure Sensor: Signal Bias Level Out of Range / Zero Adjustment Failure	The error is set if the monitoring function detects too high pressure sensor offset while not braking.	H
0x50B912	20665	18	EPM1, PCL0 Pressure Sensor: Circuit Short To Battery	EPM internal electrical failure.	G
0x50B916	20665	22	EPM1, PCL0 Pressure Sensor: Circuit Voltage Below Threshold	EPM internal electrical failure.	G
0x50B918	20665	24	EPM1, PCL0 Pressure Sensor: Circuit Current Below Threshold	EPM internal electrical failure.	G
0x50B921	20665	33	EPM1, PCL0 Pressure Sensor: Signal Amplitude Less Than Minimum	EPM internal electrical failure.	G
0x50B922	20665	34	EPM1, PCL0 Pressure Sensor: Signal Amplitude Greater Than Maximum	EPM internal electrical failure.	G
0x50B928	20665	40	EPM1, PCL0 Pressure Sensor: Signal Bias Level Out of Range / Zero Adjustment Failure	The error is set if the internal EPM pressure sensor voltage signal is generally too low or too high (outside of valid signal range).	H
0x50BA12	20666	18	EPM1, PCL1 Pressure Sensor: Circuit Short To Battery	EPM internal electrical failure.	G

Table 8 - Diagnostic Trouble Codes (DTCs)

DTC #	SPN (J1939)	FMI (J1939)	DTC NAME	DTC DESCRIPTION	GO TO SERVICE ACTION CODE LISTED IN TABLE 9
0x50BA16	20666	22	EPM1, PCL1 Pressure Sensor: Circuit Voltage Below Threshold	EPM internal electrical failure.	G
0x50BA18	20666	24	EPM1, PCL1 Pressure Sensor: Circuit Current Below Threshold	EPM internal electrical failure.	G
0x50BA21	20666	33	EPM1, PCL1 Pressure Sensor: Signal Amplitude Less Than Minimum	EPM internal electrical failure.	G
0x50BA22	20666	34	EPM1, PCL1 Pressure Sensor: Signal Amplitude Greater Than Maximum	EPM internal electrical failure.	G
0x50BA28	20666	40	EPM1, PCL1 Pressure Sensor: Signal Bias Level Out of Range / Zero Adjustment Failure	The error is set if the monitoring function detects too high pressure sensor offset while not braking.	H
0x50BB12	20667	18	EPM2, PCL0 Pressure Sensor: Circuit Short To Battery	EPM internal electrical failure.	G
0x50BB16	20667	22	EPM2, PCL0 Pressure Sensor: Circuit Voltage Below Threshold	EPM internal electrical failure.	G
0x50BB18	20667	24	EPM2, PCL0 Pressure Sensor: Circuit Current Below Threshold	EPM internal electrical failure.	G
0x50BB21	20667	33	EPM2, PCL0 Pressure Sensor: Signal Amplitude Less Than Minimum	EPM internal electrical failure.	G
0x50BB22	20667	34	EPM2, PCL0 Pressure Sensor: Signal Amplitude Greater Than Maximum	EPM internal electrical failure.	G
0x50BB28	20667	40	EPM2, PCL0 Pressure Sensor: Signal Bias Level Out of Range / Zero Adjustment Failure	The error is set if the internal EPM pressure sensor voltage signal is generally too low or too high (outside of valid signal range).	H
0x50BC12	20668	18	EPM2, PCL1 Pressure Sensor: Circuit Short To Battery	EPM internal electrical failure.	G
0x50BC16	20668	22	EPM2, PCL1 Pressure Sensor: Circuit Voltage Below Threshold	EPM internal electrical failure.	G
0x50BC18	20668	24	EPM2, PCL1 Pressure Sensor: Circuit Current Below Threshold	EPM internal electrical failure.	G
0x50BC21	20668	33	EPM2, PCL1 Pressure Sensor: Signal Amplitude Less Than Minimum	EPM internal electrical failure.	G
0x50BC22	20668	34	EPM2, PCL1 Pressure Sensor: Signal Amplitude Greater Than Maximum	EPM internal electrical failure.	G
0x50BC28	20668	40	EPM2, PCL1 Pressure Sensor: Signal Bias Level Out of Range / Zero Adjustment Failure	The error is set if the monitoring function detects too high pressure sensor offset while not braking.	H
0x50BD12	20669	18	EPM3, PCL0 Pressure Sensor: Circuit Short To Battery	EPM internal electrical failure.	G
0x50BD16	20669	22	EPM3, PCL0 Pressure Sensor: Circuit Voltage Below Threshold	EPM internal electrical failure.	G

Table 8 - Diagnostic Trouble Codes (DTCs)

DIAGNOSTIC TROUBLE CODE (DTC) AND SERVICE INFORMATION (CONT.)

DTC #	SPN (J1939)	FMI (J1939)	DTC NAME	DTC DESCRIPTION	GO TO SERVICE ACTION CODE LISTED IN TABLE 9
0x50BD18	20669	24	EPM3, PCL0 Pressure Sensor: Circuit Current Below Threshold	EPM internal electrical failure.	G
0x50BD21	20669	33	EPM3, PCL0 Pressure Sensor: Signal Amplitude Less Than Minimum	EPM internal electrical failure.	G
0x50BD22	20669	34	EPM3, PCL0 Pressure Sensor: Signal Amplitude Greater Than Maximum	EPM internal electrical failure.	G
0x50BD28	20669	40	EPM3, PCL0 Pressure Sensor: Signal Bias Level Out of Range / Zero Adjustment Failure	The error is set if the internal EPM pressure sensor voltage signal is generally too low or too high (outside of valid signal range).	H
0x50BE12	20670	18	EPM3, PCL1 Pressure Sensor: Circuit Short To Battery	EPM internal electrical failure.	G
0x50BE16	20670	22	EPM3, PCL1 Pressure Sensor: Circuit Voltage Below Threshold	EPM internal electrical failure.	G
0x50BE18	20670	24	EPM3, PCL1 Pressure Sensor: Circuit Current Below Threshold	EPM internal electrical failure.	G
0x50BE21	20670	33	EPM3, PCL1 Pressure Sensor: Signal Amplitude Less Than Minimum	EPM internal electrical failure.	G
0x50BE22	20670	34	EPM3, PCL1 Pressure Sensor: Signal Amplitude Greater Than Maximum	EPM internal electrical failure.	G
0x50BE28	20670	40	EPM3, PCL1 Pressure Sensor: Signal Bias Level Out of Range / Zero Adjustment Failure	The error is set if the monitoring function detects too high pressure sensor offset while not braking.	H
0x50BF01	20671	1	Electro-Pneumatic Modulator 0: General Electrical Failure	This error is set if the supply voltage of a switched-off EPM is higher than 4V, while the EPM is switched off and another is switched on.	J
0x50BF02	20671	2	Electro-Pneumatic Modulator 0: General Signal Failure	The error is set if an EPM hardware fault is detected, or a special inactive DTC message is sent with wrong content, or if the reference voltage is out of range, or if the pressure demand value sent back by the EPM does not match any of the last 6 pressure demand values from the GSBC ECU.	K
0x50BF04	20671	4	Electro-Pneumatic Modulator 0: System Internal Failures	The failure is reported for a variety of EPM related internal faults.	L
0x50BF07	20671	7	Electro-Pneumatic Modulator 0: Mechanical Failures	The error is set if an EPM hardware fault is detected.	M
0x50BF09	20671	9	Electro-Pneumatic Modulator 0: Component Failures	EPM internal electrical failure.	G
0x50BF11	20671	17	Electro-Pneumatic Modulator 0: Circuit Short To Ground	The error is set if supply voltage of EPM becomes less than 4V or if EPM consumes more than 8A with supply of EPM switched on.	N
0x50BF12	20671	18	Electro-Pneumatic Modulator 0: Circuit Short To Battery	The error is set if supply voltage of EPM becomes higher than 4V with supply of EPM switched off.	P
0x50BF19	20671	25	Electro-Pneumatic Modulator 0: Circuit Current Above Threshold	The error is set if supply voltage of EPM becomes less than 4V or if EPM consumes more than 8A with supply of EPM switched on.	Q
0x50BF25	20671	37	Electro-Pneumatic Modulator 0: Signal Shape / Waveform Failure	The error is set if implausible voltage drop, during valve activation, is detected.	R

Table 8 - Diagnostic Trouble Codes (DTCs)

DIAGNOSTIC TROUBLE CODE (DTC) AND SERVICE INFORMATION (CONT.)

DTC #	SPN (J1939)	FMI (J1939)	DTC NAME	DTC DESCRIPTION	GO TO SERVICE ACTION CODE LISTED IN TABLE 9
0x50BF29	20671	41	Electro-Pneumatic Modulator 0: Signal invalid	EPM internal electrical failure.	G
0x50BF56	20671	86	Electro-Pneumatic Modulator 0: Invalid / Incompatible Configuration	The error is set if implausible voltage drop, during valve activation, is detected.	S
0x50BF96	20671	150	Electro-Pneumatic Modulator 0: Component Internal Failure	The error is set if test routines detect an internal hardware error of the EPM.	T
0x50BF98	20671	152	Electro-Pneumatic Modulator 0: Component or System Over Temperature	EPM PCB temperature exceeds the upper threshold temperature (248°F / 120°C).	U
0x50BF9D	20671	157	Electro-Pneumatic Modulator 0: Component or System Under Temperature	EPM PCB temperature exceeds the lower threshold temperature (-40 degrees F / C).	V
0x50C001	20672	1	Electro-Pneumatic Modulator 1: General Electrical Failure	This error is set if the supply voltage of a switched-off EPM is higher than 4V, while the EPM is switched off and another is switched on.	J
0x50C002	20672	2	Electro-Pneumatic Modulator 1: General Signal Failure	The error is set if an EPM hardware fault is detected, or a special inactive DTC message is sent with wrong content, or if the reference voltage is out of range, or if the pressure demand value sent back by the EPM does not match any of the last 6 pressure demand values from the GSBC ECU.	K
0x50C004	20672	4	Electro-Pneumatic Modulator 1 : System Internal Failures	The failure is reported for a variety of EPM related internal faults.	L
0x50C007	20672	7	Electro-Pneumatic Modulator 1: Mechanical Failures	The error is set if an EPM hardware fault is detected.	M
0x50C009	20672	9	Electro-Pneumatic Modulator 1: Component Failures	EPM internal electrical failure.	G
0x50C011	20672	17	Electro-Pneumatic Modulator 1: Circuit Short To Ground	The error is set if supply voltage of EPM becomes less than 4V or if EPM consumes more than 8A with supply of EPM switched on.	N
0x50C012	20672	18	Electro-Pneumatic Modulator 1: Circuit Short To Battery	The error is set if supply voltage of EPM becomes higher than 4V with supply of EPM switched off.	P
0x50C019	20672	25	Electro-Pneumatic Modulator 1: Circuit Current Above Threshold	The error is set if supply voltage of EPM becomes less than 4V or if EPM consumes more than 8A with supply of EPM switched on.	Q
0x50C025	20672	37	Electro-Pneumatic Modulator 1: Signal Shape / Waveform Failure	The error is set if implausible voltage drop, during valve activation, is detected.	R
0x50C029	20672	41	Electro-Pneumatic Modulator 1: Signal Invalid	EPM internal electrical failure.	G
0x50C056	20672	86	Electro-Pneumatic Modulator 1: Invalid / Incompatible Configuration	The error is set if implausible voltage drop, during valve activation, is detected.	S
0x50C096	20672	150	Electro-Pneumatic Modulator 1: Component Internal Failure	The error is set if test routines detect an internal hardware error of the EPM.	T
0x50C098	20672	152	Electro-Pneumatic Modulator 1: Component or System Over Temperature	EPM PCB temperature exceeds the upper threshold temperature (248°F / 120°C).	U
0x50C09D	20672	157	Electro-Pneumatic Modulator 1: Component or System Under Temperature	EPM PCB temperature exceeds the lower threshold temperature (-40 degrees F / C).	V
0x50C101	20673	1	Electro-Pneumatic Modulator 2: General Electrical Failure	This error is set if the supply voltage of a switched-off EPM is higher than 4V, while the EPM is switched off and another is switched on.	J

Table 8 - Diagnostic Trouble Codes (DTCs)

DTC #	SPN (J1939)	FMI (J1939)	DTC NAME	DTC DESCRIPTION	GO TO SERVICE ACTION CODE LISTED IN TABLE 9
0x50C102	20673	2	Electro-Pneumatic Modulator 2: General Signal Failure	The error is set if an EPM hardware fault is detected, or a special inactive DTC message is sent with wrong content, or if the reference voltage is out of range, or if the pressure demand value sent back by the EPM does not match any of the last 6 pressure demand values from the GSBC ECU.	K
0x50C104	20673	4	Electro-Pneumatic Modulator 2: System Internal Failures	The failure is reported for a variety of EPM related internal faults.	L
0x50C107	20673	7	Electro-Pneumatic Modulator 2: Mechanical Failures	The error is set if an EPM hardware fault is detected.	M
0x50C109	20673	9	Electro-Pneumatic Modulator 2: Component Failures	EPM internal electrical failure.	G
0x50C111	20673	17	Electro-Pneumatic Modulator 2: Circuit Short To Ground	The error is set if supply voltage of EPM becomes less than 4V or if EPM consumes more than 8A with supply of EPM switched on.	N
0x50C112	20673	18	Electro-Pneumatic Modulator 2: Circuit Short To Battery	The error is set if supply voltage of EPM becomes higher than 4V with supply of EPM switched off.	P
0x50C119	20673	25	Electro-Pneumatic Modulator 2: Circuit Current Above Threshold	The error is set if supply voltage of EPM becomes less than 4V or if EPM consumes more than 8A with supply of EPM switched on.	Q
0x50C125	20673	37	Electro-Pneumatic Modulator 2: Signal Shape / Waveform Failure	The error is set if implausible voltage drop, during valve activation, is detected.	R
0x50C129	20673	41	Electro-Pneumatic Modulator 2: Signal Invalid	EPM internal electrical failure.	G
0x50C156	20673	86	Electro-Pneumatic Modulator 2: Invalid / Incompatible Configuration	The error is set if implausible voltage drop, during valve activation, is detected.	S
0x50C196	20673	150	Electro-Pneumatic Modulator 2: Component Internal Failure	The error is set if test routines detect an internal hardware error of the EPM.	T
0x50C198	20673	152	Electro-Pneumatic Modulator 2: Component or System Over Temperature	EPM PCB temperature exceeds the upper threshold temperature (248°F / 120°C).	U
0x50C19D	20673	157	Electro-Pneumatic Modulator 2: Component or System Under Temperature	EPM PCB temperature exceeds the lower threshold temperature (-40 degrees°F / °C).	V
0x50C201	20674	1	Electro-Pneumatic Modulator 3: General Electrical Failure	This error is set if the supply voltage of a switched-off EPM is higher than 4V, while the EPM is switched off and another is switched on.	J
0x50C202	20674	2	Electro-Pneumatic Modulator 3: General Signal Failure	The error is set if an EPM hardware fault is detected, or a special inactive DTC message is sent with wrong content, or if the reference voltage is out of range, or if the pressure demand value sent back by the EPM does not match any of the last 6 pressure demand values from the GSBC ECU.	K
0x50C204	20674	4	Electro-Pneumatic Modulator 3: System Internal Failures	The failure is reported for a variety of EPM related internal faults.	L
0x50C207	20674	7	Electro-Pneumatic Modulator 3: Mechanical Failures	The error is set if an EPM hardware fault is detected.	M
0x50C209	20674	9	Electro-Pneumatic Modulator 3: Component Failures	EPM internal electrical failure.	G
0x50C211	20674	17	Electro-Pneumatic Modulator 3: Circuit Short To Ground	The error is set if supply voltage of EPM becomes less than 4V or if EPM consumes more than 8A with supply of EPM switched on.	N

Table 8 - Diagnostic Trouble Codes (DTCs)

DIAGNOSTIC TROUBLE CODE (DTC) AND SERVICE INFORMATION (CONT.)

DTC #	SPN (J1939)	FMI (J1939)	DTC NAME	DTC DESCRIPTION	GO TO SERVICE ACTION CODE LISTED IN TABLE 9
0x50C212	20674	18	Electro-Pneumatic Modulator 3: Circuit Short To Battery	The error is set if supply voltage of EPM becomes higher than 4V with supply of EPM switched off.	P
0x50C219	20674	25	Electro-Pneumatic Modulator 3: Circuit Current Above Threshold	The error is set if supply voltage of EPM becomes less than 4V or if EPM consumes more than 8A with supply of EPM switched on.	Q
0x50C225	20674	37	Electro-Pneumatic Modulator 3: Signal Shape / Waveform Failure	The error is set if implausible voltage drop, during valve activation, is detected.	R
0x50C229	20674	41	Electro-Pneumatic Modulator 3: Signal Invalid	EPM internal electrical failure.	G
0x50C256	20674	86	Electro-Pneumatic Modulator 3: Invalid / Incompatible Configuration	The error is set if implausible voltage drop, during valve activation, is detected.	S
0x50C296	20674	150	Electro-Pneumatic Modulator 3: Component Internal Failure	The error is set if test routines detect an internal hardware error of the EPM.	T
0x50C298	20674	152	Electro-Pneumatic Modulator 3: Component or System Over Temperature	EPM PCB temperature exceeds the upper threshold temperature (248°F / 120°C).	U
0x50C29D	20674	157	Electro-Pneumatic Modulator 3: Component or System Under Temperature	EPM PCB temperature exceeds the lower threshold temperature (-40 degrees °F / °C).	V
0x50C322	20675	34	EPM0, Pressure Control Loop0: Signal Amplitude Greater Than Maximum	This fault detects trapped pressure in the FBM and/or the EPM.	W
0x50C371	20675	113	EPM0, Pressure Control Loop0: Actuator Stuck	This error is set if the EPM detects trapped pressure.	X
0x50C377	20675	119	EPM0, Pressure Control Loop0: Commanded Position Not Reachable	This error is set if an EPM does not pass an automatic performance test, which could indicate trapped pressure.	Y
0x50C37E	20675	126	EPM0, Pressure Control Loop0: Actuator Stuck On	This fault detects trapped pressure in the FBM and/or the EPM.	Z
0x50C422	20676	34	EPM0, Pressure Control Loop1: Signal Amplitude Greater Than Maximum	This fault detects trapped pressure in the FBM and/or the EPM.	W
0x50C471	20676	113	EPM0, Pressure Control Loop1: Actuator Stuck	This error is set if the EPM detects trapped pressure.	X
0x50C477	20676	119	EPM0, Pressure Control Loop1: Commanded Position Not Reachable	This error is set if an EPM does not pass an automatic performance test, which could indicate trapped pressure.	Y
0x50C47E	20676	126	EPM0, Pressure Control Loop1: Actuator Stuck On	This fault detects trapped pressure in the FBM and/or the EPM.	Z
0x50C522	20677	34	EPM1, Pressure Control Loop0: Signal Amplitude Greater Than Maximum	This fault detects trapped pressure in the FBM and/or the EPM.	W
0x50C571	20677	113	EPM1, Pressure Control Loop0: Actuator Stuck	This error is set if the EPM detects trapped pressure.	X
0x50C577	20677	119	EPM1, Pressure Control Loop0: Commanded Position Not Reachable	This error is set if an EPM does not pass an automatic performance test, which could indicate trapped pressure.	Y
0x50C57E	20677	126	EPM1, Pressure Control Loop0: Actuator Stuck On	This fault detects trapped pressure in the FBM and/or the EPM.	Z
0x50C622	20678	34	EPM1, Pressure Control Loop1: Signal Amplitude Greater Than Maximum	This fault detects trapped pressure in the FBM and/or the EPM.	W

Table 8 - Diagnostic Trouble Codes (DTCs)

DIAGNOSTIC TROUBLE CODE (DTC) AND SERVICE INFORMATION (CONT.)

DTC #	SPN (J1939)	FMI (J1939)	DTC NAME	DTC DESCRIPTION	GO TO SERVICE ACTION CODE LISTED IN TABLE 9
0x50C671	20678	113	EPM1, Pressure Control Loop1: Actuator Stuck	This error is set if the EPM detects trapped pressure.	X
0x50C677	20678	119	EPM1, Pressure Control Loop1: Commanded Position Not Reachable	This error is set if an EPM does not pass an automatic performance test, which could indicate trapped pressure.	Y
0x50C67E	20678	126	EPM1, Pressure Control Loop1: Actuator Stuck On	This fault detects trapped pressure in the FBM and/or the EPM.	Z
0x50C722	20679	34	EPM2, Pressure Control Loop0: Signal Amplitude Greater Than Maximum	This fault detects trapped pressure in the FBM and/or the EPM.	W
0x50C771	20679	113	EPM2, Pressure Control Loop0: Actuator Stuck	This error is set if the EPM detects trapped pressure.	X
0x50C777	20679	119	EPM2, Pressure Control Loop0: Commanded Position Not Reachable	This error is set if an EPM does not pass an automatic performance test, which could indicate trapped pressure.	Y
0x50C77E	20679	126	EPM2, Pressure Control Loop0: Actuator Stuck On	This fault detects trapped pressure in the FBM and/or the EPM.	Z
0x50C822	20680	34	EPM2, Pressure Control Loop1: Signal Amplitude Greater Than Maximum	This fault detects trapped pressure in the FBM and/or the EPM.	W
0x50C871	20680	113	EPM2, Pressure Control Loop1: Actuator Stuck	This error is set if the EPM detects trapped pressure.	X
0x50C877	20680	119	EPM2, Pressure Control Loop1: Commanded Position Not Reachable	This error is set if an EPM does not pass an automatic performance test, which could indicate trapped pressure.	Y
0x50C87E	20680	126	EPM2, Pressure Control Loop1: Actuator Stuck On	This fault detects trapped pressure in the FBM and/or the EPM.	Z
0x50C922	20681	34	EPM3, Pressure Control Loop0: Signal Amplitude Greater Than Maximum	This fault detects trapped pressure in the FBM and/or the EPM.	W
0x50C971	20681	113	EPM3, Pressure Control Loop0: Actuator Stuck	This error is set if the EPM detects trapped pressure.	X
0x50C977	20681	119	EPM3, Pressure Control Loop0: Commanded Position Not Reachable	This error is set if an EPM does not pass an automatic performance test, which could indicate trapped pressure.	Y
0x50C97E	20681	126	EPM3, Pressure Control Loop0: Actuator Stuck On	This fault detects trapped pressure in the FBM and/or the EPM.	Z
0x50CA22	20682	34	EPM3, Pressure Control Loop1: Signal Amplitude Greater Than Maximum	This fault detects trapped pressure in the FBM and/or the EPM.	W
0x50CA71	20682	113	EPM3, Pressure Control Loop1: Actuator Stuck	This error is set if the EPM detects trapped pressure.	X
0x50CA77	20682	119	EPM3, Pressure Control Loop1: Commanded Position Not Reachable	This error is set if an EPM does not pass an automatic performance test, which could indicate trapped pressure.	Y
0x50CA7E	20682	126	EPM3, Pressure Control Loop1: Actuator Stuck On	This fault detects trapped pressure in the FBM and/or the EPM.	Z
0x50CB11	20683	17	EPM0, PCL0, Inlet Solenoid Valve: Circuit Short To Ground	EPM internal electrical failure.	G
0x50CB12	20683	18	EPM0, PCL0, Inlet Solenoid Valve: Circuit Short To Battery	EPM internal electrical failure.	G
0x50CB18	20683	24	EPM0, PCL0, Inlet Solenoid Valve: Circuit Current Below Threshold	EPM internal electrical failure.	G
0x50CB2B	20683	43	EPM0, PCL0, Inlet Solenoid Valve: Signal Cross Coupled	EPM internal electrical failure.	G

Table 8 - Diagnostic Trouble Codes (DTCs)

DTC #	SPN (J1939)	FMI (J1939)	DTC NAME	DTC DESCRIPTION	GO TO SERVICE ACTION CODE LISTED IN TABLE 9
0x50CB71	20683	113	EPM0, PCL0, Inlet Solenoid Valve: Actuator Stuck	Measured EPM pressure response not sufficient given the system reported reservoir pressure.	**AA**
0x50CC11	1292	17	EPM0, PCL1, Inlet Solenoid Valve: Circuit Short To Ground	EPM internal electrical failure.	**G**
0x50CC12	20684	18	EPM0, PCL1, Inlet Solenoid Valve: Circuit Short To Battery	EPM internal electrical failure.	**G**
0x50CC18	20684	24	EPM0, PCL1, Inlet Solenoid Valve: Circuit Current Below Threshold	EPM internal electrical failure.	**G**
0x50CC2B	20684	43	EPM0, PCL1, Inlet Solenoid Valve: Signal Cross Coupled	EPM internal electrical failure.	**G**
0x50CC71	20684	113	EPM0, PCL1, Inlet Solenoid Valve: Actuator Stuck	Measured EPM pressure response not sufficient given the system reported reservoir pressure.	**AA**
0x50CD11	20685	17	EPM1, PCL0, Inlet Solenoid Valve: Circuit Short To Ground	EPM internal electrical failure.	**G**
0x50CD12	20685	18	EPM1, PCL0, Inlet Solenoid Valve: Circuit Short To Battery	EPM internal electrical failure.	**G**
0x50CD18	20685	24	EPM1, PCL0, Inlet Solenoid Valve: Circuit Current Below Threshold	EPM internal electrical failure.	**G**
0x50CD2B	20685	43	EPM1, PCL0, Inlet Solenoid Valve: Signal Cross Coupled	EPM internal electrical failure.	**G**
0x50CD71	20685	113	EPM1, PCL0, Inlet Solenoid Valve: Actuator Stuck	Measured EPM pressure response not sufficient given the system reported reservoir pressure.	**AA**
0x50CE11	20686	17	EPM1, PCL1, Inlet Solenoid Valve: Circuit Short To Ground	EPM internal electrical failure.	**G**
0x50CE12	20686	18	EPM1, PCL1, Inlet Solenoid Valve: Circuit Short To Battery	EPM internal electrical failure.	**G**
0x50CE18	20686	24	EPM1, PCL1, Inlet Solenoid Valve: Circuit Current Below Threshold	EPM internal electrical failure.	**G**
0x50CE2B	20686	43	EPM1, PCL1, Inlet Solenoid Valve: Signal Cross Coupled	EPM internal electrical failure.	**G**
0x50CE71	20686	113	EPM1, PCL1, Inlet Solenoid Valve: Actuator Stuck	Measured EPM pressure response not sufficient given the system reported reservoir pressure.	**AA**
0x50CF11	20687	17	EPM2, PCL0, Inlet Solenoid Valve: Circuit Short To Ground	EPM internal electrical failure.	**G**
0x50CF12	20687	18	EPM2, PCL0, Inlet Solenoid Valve: Circuit Short To Battery	EPM internal electrical failure.	**G**
0x50CF18	20687	24	EPM2, PCL0, Inlet Solenoid Valve: Circuit Current Below Threshold	EPM internal electrical failure.	**G**
0x50CF2B	20687	43	EPM2, PCL0, Inlet Solenoid Valve: Signal Cross Coupled	EPM internal electrical failure.	**G**
0x50CF71	20687	113	EPM2, PCL0, Inlet Solenoid Valve: Actuator Stuck	Measured EPM pressure response not sufficient given the system reported reservoir pressure.	**AA**

Table 8 - Diagnostic Trouble Codes (DTCs)

DIAGNOSTIC TROUBLE CODE (DTC) AND SERVICE INFORMATION (CONT.)

DTC #	SPN (J1939)	FMI (J1939)	DTC NAME	DTC DESCRIPTION	GO TO SERVICE ACTION CODE LISTED IN TABLE 9
0x50D011	20688	17	EPM2, PCL1, Inlet Solenoid Valve: Circuit Short To Ground	EPM internal electrical failure.	**G**
0x50D012	20688	18	EPM2, PCL1, Inlet Solenoid Valve: Circuit Short To Battery	EPM internal electrical failure.	**G**
0x50D018	20688	24	EPM2, PCL1, Inlet Solenoid Valve: Circuit Current Below Threshold	EPM internal electrical failure.	**G**
0x50D02B	20688	43	EPM2, PCL1, Inlet Solenoid Valve: Signal Cross Coupled	EPM internal electrical failure.	**G**
0x50D071	20688	113	EPM2, PCL1, Inlet Solenoid Valve: Actuator Stuck	Measured EPM pressure response not sufficient given the system reported reservoir pressure.	**AA**
0x50D111	20689	17	EPM3, PCL0, Inlet Solenoid Valve: Circuit Short To Ground	EPM internal electrical failure.	**G**
0x50D112	20689	18	EPM3, PCL0, Inlet Solenoid Valve: Circuit Short To Battery	EPM internal electrical failure.	**G**
0x50D118	20689	24	EPM3, PCL0, Inlet Solenoid Valve: Circuit Current Below Threshold	EPM internal electrical failure.	**G**
0x50D12B	20689	43	EPM3, PCL0, Inlet Solenoid Valve: Signal Cross Coupled	EPM internal electrical failure.	**G**
0x50D171	20689	113	EPM3, PCL0, Inlet Solenoid Valve: Actuator Stuck	Measured EPM pressure response not sufficient given the system reported reservoir pressure.	**AA**
0x50D211	20690	17	EPM3, PCL1, Inlet Solenoid Valve: Circuit Short To Ground	EPM internal electrical failure.	**G**
0x50D212	20690	18	EPM3, PCL1, Inlet Solenoid Valve: Circuit Short To Battery	EPM internal electrical failure.	**G**
0x50D218	20690	24	EPM3, PCL1, Inlet Solenoid Valve: Circuit Current Below Threshold	EPM internal electrical failure.	**G**
0x50D22B	20690	43	EPM3, PCL1, Inlet Solenoid Valve: Signal Cross Coupled	EPM internal electrical failure.	**G**
0x50D271	20690	113	EPM3, PCL1, Inlet Solenoid Valve: Actuator Stuck	Measured EPM pressure response not sufficient given the system reported reservoir pressure.	**AA**
0x50D311	20691	17	EPM0, PCL0, Outlet Solenoid Valve : Circuit Short To Ground	EPM internal electrical failure.	**G**
0x50D312	20691	18	EPM0, PCL0, Outlet Solenoid Valve: Circuit Short To Battery	EPM internal electrical failure.	**G**
0x50D318	20691	24	EPM0, PCL0, Outlet Solenoid Valve: Circuit Current Below Threshold	EPM internal electrical failure.	**G**
0x50D32B	20691	43	EPM0, PCL0, Outlet Solenoid Valve: Signal Cross Coupled	EPM internal electrical failure.	**G**
0x50D371	20691	113	EPM0, PCL0, Outlet Solenoid Valve : Actuator Stuck	Fault set if EPM detects trapped pressure. Fault could be in FBM, EPM, or related plumbing.	**X**

Table 8 - Diagnostic Trouble Codes (DTCs)

DTC #	SPN (J1939)	FMI (J1939)	DTC NAME	DTC DESCRIPTION	GO TO SERVICE ACTION CODE LISTED IN TABLE 9
0x50D411	20692	17	EPM0, PCL1, Outlet Solenoid Valve: Circuit Short To Ground	EPM internal electrical failure.	G
0x50D412	20692	18	EPM0, PCL1, Outlet Solenoid Valve: Circuit Short To Battery	EPM internal electrical failure.	G
0x50D418	20692	24	EPM0, PCL1, Outlet Solenoid Valve: Circuit Current Below Threshold	EPM internal electrical failure.	G
0x50D42B	20692	43	EPM0, PCL1, Outlet Solenoid Valve: Signal Cross Coupled	EPM internal electrical failure.	G
0x50D471	20692	113	EPM0, PCL1, Outlet Solenoid Valve: Actuator Stuck	Fault set if EPM detects trapped pressure. Fault could be in FBM, EPM, or related plumbing.	X
0x50D511	20693	17	EPM1, PCL0, Outlet Solenoid Valve : Circuit Short To Ground	EPM internal electrical failure.	G
0x50D512	20693	18	EPM1, PCL0, Outlet Solenoid Valve: Circuit Short To Battery	EPM internal electrical failure.	G
0x50D518	20693	24	EPM1, PCL0, Outlet Solenoid Valve: Circuit Current Below Threshold	EPM internal electrical failure.	G
0x50D52B	20693	43	EPM1, PCL0, Outlet Solenoid Valve: Signal Cross Coupled	EPM internal electrical failure.	G
0x50D571	20693	113	EPM1, PCL0, Outlet Solenoid Valve : Actuator Stuck	Fault set if EPM detects trapped pressure. Fault could be in FBM, EPM, or related plumbing.	X
0x50D611	20694	17	EPM1, PCL1, Outlet Solenoid Valve: Circuit Short To Ground	EPM internal electrical failure.	G
0x50D612	20694	18	EPM1, PCL1, Outlet Solenoid Valve : Circuit Short To Battery	EPM internal electrical failure.	G
0x50D618	20694	24	EPM1, PCL1, Outlet Solenoid Valve: Circuit Current Below Threshold	EPM internal electrical failure.	G
0x50D62B	20694	43	EPM1, PCL1, Outlet Solenoid Valve: Signal Cross Coupled	EPM internal electrical failure.	G
0x50D671	20694	113	EPM1, PCL1, Outlet Solenoid Valve: Actuator Stuck	Fault set if EPM detects trapped pressure. Fault could be in FBM, EPM, or related plumbing.	X
0x50D711	20695	17	EPM2, PCL0, Outlet Solenoid Valve: Circuit Short To Ground	EPM internal electrical failure.	G
0x50D712	20695	18	EPM2, PCL0, Outlet Solenoid Valve: Circuit Short To Battery	EPM internal electrical failure.	G
0x50D718	20695	24	EPM2, PCL0, Outlet Solenoid Valve: Circuit Current Below Threshold	EPM internal electrical failure.	G
0x50D72B	20695	43	EPM2, PCL0, Outlet Solenoid Valve: Signal Cross Coupled	EPM internal electrical failure.	G
0x50D771	20695	113	EPM2, PCL0, Outlet Solenoid Valve: Actuator Stuck	Fault set if EPM detects trapped pressure. Fault could be in FBM, EPM, or related plumbing.	X

Table 8 - Diagnostic Trouble Codes (DTCs)

DIAGNOSTIC TROUBLE CODE (DTC) AND SERVICE INFORMATION (CONT.)

DTC #	SPN (J1939)	FMI (J1939)	DTC NAME	DTC DESCRIPTION	GO TO SERVICE ACTION CODE LISTED IN TABLE 9
0x50D811	20696	17	EPM2, PCL1, Outlet Solenoid Valve: Circuit Short To Ground	EPM internal electrical failure.	G
0x50D812	20696	18	EPM2, PCL1, Outlet Solenoid Valve: Circuit Short To Battery	EPM internal electrical failure.	G
0x50D818	20696	24	EPM2, PCL1, Outlet Solenoid Valve: Circuit Current Below Threshold	EPM internal electrical failure.	G
0x50D82B	20696	43	EPM2, PCL1, Outlet Solenoid Valve: Signal Cross Coupled	EPM internal electrical failure.	G
0x50D871	20696	113	EPM2, PCL1, Outlet Solenoid Valve: Actuator Stuck	Fault set if EPM detects trapped pressure. Fault could be in FBM, EPM, or related plumbing.	X
0x50D911	20697	17	EPM3, PCL0, Outlet Solenoid Valve: Circuit Short To Ground	EPM internal electrical failure.	G
0x50D912	20697	18	EPM3, PCL0, Outlet Solenoid Valve: Circuit Short To Battery	EPM internal electrical failure.	G
0x50D918	20697	24	EPM3, PCL0, Outlet Solenoid Valve: Circuit Current Below Threshold	EPM internal electrical failure.	G
0x50D92B	20697	43	EPM3, PCL0, Outlet Solenoid Valve: Signal Cross Coupled	EPM internal electrical failure.	G
0x50D971	20697	113	EPM3, PCL0, Outlet Solenoid Valve: Actuator Stuck	Fault set if EPM detects trapped pressure. Fault could be in FBM, EPM, or related plumbing.	X
0x50DA11	20698	17	EPM3, PCL1, Outlet Solenoid Valve: Circuit Short To Ground	EPM internal electrical failure.	G
0x50DA12	20698	18	EPM3, PCL1, Outlet Solenoid Valve: Circuit Short To Battery	EPM internal electrical failure.	G
0x50DA18	20698	24	EPM3, PCL1, Outlet Solenoid Valve: Circuit Current Below Threshold	EPM internal electrical failure.	G
0x50DA2B	20698	43	EPM3, PCL1, Outlet Solenoid Valve: Signal Cross Coupled	EPM internal electrical failure.	G
0x50DA71	20698	113	EPM3, PCL1, Outlet Solenoid Valve: Actuator Stuck	Fault set if EPM detects trapped pressure. Fault could be in FBM, EPM, or related plumbing.	X
0x50DB11	20699	17	EPM0, PCL0, Backup Solenoid Valve: Circuit Short To Ground	EPM internal electrical failure.	G
0x50DB12	20699	18	EPM0, PCL0, Backup Solenoid Valve: Circuit Short To Battery	EPM internal electrical failure.	G
0x50DB18	20699	24	EPM0, PCL0, Backup Solenoid Valve : Circuit Current Below Threshold	EPM internal electrical failure.	G
0x50DB2B	20699	43	EPM0, PCL0, Backup Solenoid Valve: Signal Cross Coupled	EPM internal electrical failure.	G
0x50DC11	20700	17	EPM0, PCL1, Backup Solenoid Valve: Circuit Short To Ground	EPM internal electrical failure.	G

Table 8 - Diagnostic Trouble Codes (DTCs)

DTC #	SPN (J1939)	FMI (J1939)	DTC NAME	DTC DESCRIPTION	GO TO SERVICE ACTION CODE LISTED IN TABLE 9
0x50DC12	20700	18	EPM0, PCL1, Backup Solenoid Valve: Circuit Short To Battery	EPM internal electrical failure.	G
0x50DC18	20700	24	EPM0, PCL1, Backup Solenoid Valve: Circuit Current Below Threshold	EPM internal electrical failure.	G
0x50DC2B	20700	43	EPM0, PCL1, Backup Solenoid Valve: Signal Cross Coupled	EPM internal electrical failure.	G
0x50DD11	20701	17	EPM1, PCL0, Backup Solenoid Valve: Circuit Short To Ground	EPM internal electrical failure.	G
0x50DD12	20701	18	EPM1, PCL0, Backup Solenoid Valve: Circuit Short To Battery	EPM internal electrical failure.	G
0x50DD18	20701	24	EPM1, PCL0, Backup Solenoid Valve: Circuit Current Below Threshold	EPM internal electrical failure.	G
0x50DD2B	20701	43	EPM1, PCL0, Backup Solenoid Valve: Signal Cross Coupled	EPM internal electrical failure.	G
0x50DE11	20702	17	EPM1, PCL1, Backup Solenoid Valve: Circuit Short To Ground	EPM internal electrical failure.	G
0x50DE12	20702	18	EPM1, PCL1, Backup Solenoid Valve: Circuit Short To Battery	EPM internal electrical failure.	G
0x50DE18	20702	24	EPM1, PCL1, Backup Solenoid Valve : Circuit Current Below Threshold	EPM internal electrical failure.	G
0x50DE2B	20702	43	EPM1, PCL1, Backup Solenoid Valve: Signal Cross Coupled	EPM internal electrical failure.	G
0x50DF11	20703	17	EPM2, PCL0, Backup Solenoid Valve: Circuit Short To Ground	EPM internal electrical failure.	G
0x50DF12	20703	18	EPM2, PCL0, Backup Solenoid Valve: Circuit Short To Battery	EPM internal electrical failure.	G
0x50DF18	20703	24	EPM2, PCL0, Backup Solenoid Valve: Circuit Current Below Threshold	EPM internal electrical failure.	G
0x50DF2B	20703	43	EPM2, PCL0, Backup Solenoid Valve: Signal Cross Coupled	EPM internal electrical failure.	G
0x50E011	20704	17	EPM2, PCL1, Backup Solenoid Valve: Circuit Short To Ground	EPM internal electrical failure.	G
0x50E012	20704	18	EPM2, PCL1, Backup Solenoid Valve: Circuit Short To Battery	EPM internal electrical failure.	G
0x50E018	20704	24	EPM2, PCL1, Backup Solenoid Valve: Circuit Current Below Threshold	EPM internal electrical failure.	G
0x50E02B	20704	43	EPM2, PCL1, Backup Solenoid Valve: Signal Cross Coupled	EPM internal electrical failure.	G
0x50E111	20705	17	EPM3, PCL0, Backup Solenoid Valve: Circuit Short To Ground	EPM internal electrical failure.	G

Table 8 - Diagnostic Trouble Codes (DTCs)

DIAGNOSTIC TROUBLE CODE (DTC) AND SERVICE INFORMATION (CONT.)

DTC #	SPN (J1939)	FMI (J1939)	DTC NAME	DTC DESCRIPTION	GO TO SERVICE ACTION CODE LISTED IN TABLE 9
0x50E112	20705	18	EPM3, PCL0, Backup Solenoid Valve: Circuit Short To Battery	EPM internal electrical failure.	**G**
0x50E118	20705	24	EPM3, PCL0, Backup Solenoid Valve: Circuit Current Below Threshold	EPM internal electrical failure.	**G**
0x50E12B	20705	43	EPM3, PCL0, Backup Solenoid Valve: Signal Cross Coupled	EPM internal electrical failure.	**G**
0x50E211	20706	17	EPM3, PCL1, Backup Solenoid Valve: Circuit Short To Ground	EPM internal electrical failure.	**G**
0x50E212	20706	18	EPM3, PCL1, Backup Solenoid Valve: Circuit Short To Battery	EPM internal electrical failure.	**G**
0x50E218	20706	24	EPM3, PCL1, Backup Solenoid Valve: Circuit Current Below Threshold	EPM internal electrical failure.	**G**
0x50E22B	20706	43	EPM3, PCL1, Backup Solenoid Valve: Signal Cross Coupled	EPM internal electrical failure.	**G**
0x50E367	20707	103	EPM, Pneumatic Backup Circuit: Signal Incorrect After Event	Temporary Brake Test Failure: EPM reports insufficient pressure delivered by FBM.	**BB**
0xD0011F	49153	31	Lost Communication With EPM0: Circuit Intermittent	EPM internal electrical failure.	**G**
0xD0018F	53249	143	Lost Communication With EPM0: Erratic	Inconsistent communications between EPM and GSBC ECU.	**CC**
0xD0021F	53250	31	Lost Communication With EPM1: Circuit Intermittent	EPM internal electrical failure.	**G**
0xD0028F	53250	143	Lost Communication With EPM1: Erratic	Inconsistent communications between EPM and GSBC ECU.	**CC**
0xD0031F	53251	31	Lost Communication With EPM2: Circuit Intermittent	EPM internal electrical failure.	**G**
0xD0038F	53251	143	Lost Communication With EPM2: Erratic	Inconsistent communications between EPM and GSBC ECU.	**CC**
0xD0041F	53252	31	Lost Communication With EPM3: Circuit Intermittent	EPM internal electrical failure.	**G**
0xD0048F	53252	143	Lost Communication With EPM3: Erratic	Inconsistent communications between EPM and GSBC ECU.	**CC**

Table 8 - Diagnostic Trouble Codes (DTCs)

DIAGNOSTIC TROUBLE CODE (DTC) AND SERVICE INFORMATION (CONT.)

SERVICE ACTION CODES

NOTE: Prior to servicing a vehicle, refer to the *General Safety Guidelines* on page 2.

SERVICE ACTION CODE	RECOMMENDED SERVICE
A	Turn off vehicle power. Check the cables and connectors between EPM and wheel-speed sensor for short circuit to battery power. If wiring harness is found to have a short, repair or replace wiring harness per OEM guidelines. Disconnect wheelspeed sensor electrical connector from EPM. Measure resistance between harness-side sensor pins and vehicle power. Resistance must be greater than 200 kohms. If resistance measurement is outside specified range, disconnect wheelspeed sensor from vehicle harness (if applicable) and re-check sensor pins. If test fails, replace sensor. Otherwise, investigate vehicle harness per OEM procedure for short circuit to battery voltage. If no fault is found in WSS or in vehicle harness, replace the EPM.
B	Turn off vehicle power. Check the cables and connectors between EPM and wheel-speed sensor for short circuit to vehicle ground. If wiring harness is found to have a short, repair or replace wiring harness per OEM guidelines. Disconnect wheelspeed sensor electrical connector from EPM. Measure resistance between harness-side sensor pins and vehicle ground. Resistance must be greater than 200 kohms. If resistance measurement is outside specified range, disconnect wheelspeed sensor from vehicle harness (if applicable) and re-check sensor pins. If test fails, replace sensor. Otherwise, investigate vehicle harness per OEM procedure for short circuit to battery voltage. If no fault is found in WSS or vehicle harness, replace the EPM.
C	Check wheel speed sensor for damage. Replace sensor if it is mechanically damaged. Check the cables and connectors between EPM and wheel-speed sensor for shorted or open circuits. Remove wheel speed sensor connector from EPM. At wheel speed sensor wiring harness connector, measure resistance across two pins of wheelspeed sensor harness. Resistance must be between 800 and 2000 ohms. Measure resistance of between sensor pins and vehicle GND. Resistance must be greater than 200 kohms. If either resistance measurement is outside measured range, disconnect wheelspeed sensor from vehicle harness (if applicable) and re-check sensor pins. If test fails, replace sensor. Otherwise, investigate vehicle harness per OEM procedure for short or open circuit. Measure voltage between EPM GND and either wheel speed sensor pin (with the wheelspeed sensor connected to the EPM electrical connector). Voltage must in range 0.5-4.3V. If voltage is not present and harness is known good, proceed to next step. Switch left and right WSS and repeat all tests above. If problem remains on the same side of the vehicle, replace EPM. Otherwise, switch sensors back and replace indicated WSS/harness.
D	Check for sources of electronic noise on vehicle, including aftermarket electronic components. Disable aftermarket components to see if fault returns. If fault returns, then check wheel speed sensor for damage. Replace sensor if it is mechanically damaged. Check the cables and connectors between EPM and wheel speed sensor for shorted or open circuits or mechanical damage to sensor wiring harness. If faults are found, repair harness according to OEM instructions. If no faults are found in the harness, replace the WSS. If fault returns, measure WSS pins for high-frequency noise using an oscilloscope. If found, find and eliminate source(s) of high-frequency noise. If fault still returns, replace the EPM.
E	Mismatch between EPM and GSBC ECU EEPROM Dataset. Contact OEM for assistance in updating software on GSBC ECU or EPMs.
F	Check pneumatic plumbing between EPM and supply pressure. Inspect EPM supply port (port 1) for blockage or restriction, and repair as necessary. On steer axles only, check pneumatic plumbing (air lines and fittings) between EPM and modulators. Inspect EPM delivery ports (both ports labeled 2) for blockage or restriction, and repair as necessary. Inspect modulator supply ports (port 1) for blockages or restrictions, and repair as necessary. Check modulator operation using diagnostic tool. If any operational problems are found, repair or replace as necessary. Check that dash gauges are appropriately reporting system pressures. If dash gauges are incorrect or missing information, diagnose and troubleshoot according to manufacturer instructions. If no fault is found in plumbing, modulators, system pressure signal or other checked items, replace the EPM.
G	Clear fault. If fault returns, replace the EPM.
H	Inspect EPM for correct plumbing at pneumatic ports - refer to OEM plumbing schematics for proper configuration. Inspect silencer by removing one or both (if equipped) from the EPM. Power cycle the vehicle. If the fault returns, replace the EPM. If fault does not return, replace the silencer.

Table 9 - Service Action Codes for Recommended Service

NOTE: Prior to servicing a vehicle, refer to the *General Safety Guidelines* on page 2.

SERVICE ACTION CODE	RECOMMENDED SERVICE
J	Check if other EPMs have the same fault. If so, check the cables and connectors from the GSBC ECU to both EPMs. Inspect wiring for chafing or shorts between both EPMs. Repair wiring or connector(s) found to be damaged according to OEM procedure. If other EPMs do not have the same fault, check for shorts between battery voltage and the indicated EPM. Inspect wiring and connectors for damage or wear, and replace anything found to be damaged according to the OEM procedure Once corrected, fault will clear with a power cycle of the GSBC system.
K	Check the cables and connectors from the GSBC ECU to the EPM. Inspect wiring for chafing or shorts to either ground or battery power. Repair any problem in the harness or electrical connector(s) found according to the OEM procedure. Check to see if a CAN Communication DTC is also active. If one is active, continue to troubleshoot wiring harness until harness faults are found and corrected. Otherwise, if no CAN Communication DTC(s) are active, and this DTC is still active, replace the EPM. If replacing the EPM does not correct the error, replace the GSBC ECU.
L	Check the wiring harness and connectors from the GSBC ECU to the EPM. Inspect wiring for chafing or shorts to either ground or battery power. Repair any problem in the harness or electrical connector(s) found according to the OEM procedure. Check that supply voltage at EPM is within 3V of GSBC ECU EPM Supply voltage. If the difference is more than 3V, inspect harness for shorts to ground or failed wiring. Replace components necessary to correct the condition according to OEM procedures. Clear fault. If fault returns, replace the EPM.
M	Check the wiring harness and connectors from the GSBC ECU to the EPM. Inspect wiring for chafing or shorts to either ground or battery power. Repair any problem in the harness or electrical connector(s) found according to the OEM procedure. Power cycle the vehicle. If there is no CAN Communication DTC active, and this DTC remains active, replace the EPM. Otherwise, continue to troubleshoot the wiring harness and electrical connectors until the source of the electrical fault is determined.
N	Check wiring between EPM and GSBC ECU. Check for shorts to battery voltage between EPM supply pin and sources of battery voltage. Inspect electrical connector at both ends (EPM and GSBC ECU) for damage, shorts, or missing insulation. Repair or replace wiring and/or electrical connectors as necessary per OEM instructions. Power cycle the vehicle. If the fault is still active, continue as follows: Turn vehicle off. At GSBC ECU, disconnect electrical connector with this EPM on it (refer to manufacturer wiring schematic). At disconnected electrical connector, on wiring harness side, measure resistance between EPM supply pin and EPM ground pin. Then, measure resistance between EPM supply pin and vehicle ground. Both measurements should be above 500 ohms. If this is not the case, disconnect electrical harness connector from EPM, and repeat previous measurement. If measurement is OK, then replace the EPM. Otherwise, repair wiring harness to eliminate the short. If isolation resistance with electrical harness connected to the EPM is above the limit of 500 ohms, reconnect everything and turn the truck back on. Check to see if the fault is still present. If the DTC is still active, replace the GSBC ECU.

Table 9 - Service Action Codes for Recommended Service

DIAGNOSTIC TROUBLE CODE (DTC) AND SERVICE INFORMATION (CONT.)

SERVICE ACTION CODES (CONT.)

NOTE: Prior to servicing a vehicle, refer to the *General Safety Guidelines* on page 2.

SERVICE ACTION CODE	RECOMMENDED SERVICE
P	Check the wiring between the EPM and the GSBC ECU. Check for shorts to battery voltage between EPM supply pin and sources of battery voltage. Inspect the electrical connector at both ends (EPM and GSBC ECU) for damage, shorts, or missing insulation. Repair or replace wiring and/or electrical connectors as necessary per OEM instructions. Power cycle the vehicle. If the fault is still active, continue as follows: Ensure that truck is parked and chocked. Electrical power truck. Unplug FBM electrical harness to put vehicle into backup mode. First, at the GSBC ECU, unplug the electrical connector that includes this EPM. Measure voltage at EPM supply pin on ECU. If voltage is more than 4V, replace the GSBC ECU. Next, if there is no voltage on the GSBC ECU EPM supply pin, measure for voltage on the corresponding EPM supply pin on the vehicle harness. If voltage is more than 4V on the vehicle harness pin, short is within the harness and coming from a component not located on the same GSBC ECU electrical connector. Finally, if there is no voltage on the vehicle harness EPM supply pin, re-connect the electrical connector to the GSBC ECU. At the EPM, remove the electrical connector and measure the voltage on the EPM supply pin. If voltage is more than 4V, the short is within the harness and stems from something else on the same GSBC ECU connector. Once the source of the short is located, repair or replace wiring and/or electrical connectors as necessary per OEM instructions. Power cycle the vehicle.
Q	Check wiring between the EPM and the GSBC ECU. Check for shorts between the EPM supply pin and other electrical wires. Inspect electrical connector at both ends (EPM and GSBC ECU) for damage, shorts, or missing insulation. Repair or replace wiring and/or the electrical connectors as necessary per OEM instructions. Power cycle the vehicle. If the fault is still active, continue as follows: Turn vehicle off. At the GSBC ECU, disconnect the electrical connector with this EPM on it (refer to manufacturer wiring schematic). At disconnected electrical connector, on wiring harness side, measure resistance between the EPM supply pin and the EPM ground pin. Then, measure the resistance between the EPM supply pin and the vehicle ground. Both measurements should be above 500 Ohms. If this is not the case, disconnect the electrical harness connector from the EPM, and repeat the previous measurement. If measurement is OK, then replace the EPM. Otherwise, repair wiring harness to eliminate the short. If isolation resistance with electrical harness connected to the EPM is above the limit of 500 ohms, reconnect everything and turn the truck back on. Check to see if the fault is still present. If the DTC is still active, replace the GSBC ECU.
R	Check the wiring between the EPM and the GSBC ECU for damage, shorts, missing insulation or corrosion damage. Inspect the electrical connector at both ends (EPM and GSBC ECU) for damage, shorts, missing insulation or corrosion damage. Repair or replace wiring and/or electrical connectors as necessary per OEM instructions. Power cycle the vehicle. If the fault is still active, continue as follows: Turn vehicle off. At GSBC ECU, disconnect the electrical connector with this EPM on it (refer to manufacturer wiring schematic). At EPM, disconnect the electrical connector. Measure resistance between each end of the harness for each of the 4 wires running to the EPM. Resistance of wires disconnected from both GSBC ECU and EPM should be below 3 ohms. If any wire exceeds a resistance of 3 ohms, repair or replace the wiring and/or connector as necessary per OEM instructions. Reassemble the vehicle and confirm that the fault clears. If fault does not clear, investigate components (EPM and GSBC ECU) for corrosion on electrical pins. If corrosion on electrical pins of components is discovered, replace the component and correct the condition that allowed corrosion to form in the first place.
S	Check the pinning of the power supply for the EPM at the GSBC ECU electrical connector, ensuring that the electrical connector is pinned properly, and the EPM is receiving power. Check the wiring harness at both the GSBC ECU and the EPM for incorrect pinning and correct if necessary. Contact the OEM to check/re-load the configuration of the GSBC ECU. If after updating the GSBC ECU configuration, if the DTC is only reported for some of the EPMs, replace those EPMs individually. If the DTC is reported for all EPMs, replace the GSBC ECU.

Table 9 - Service Action Codes for Recommended Service

NOTE: Prior to servicing a vehicle, refer to the *General Safety Guidelines* on page 2.

SERVICE ACTION CODE	RECOMMENDED SERVICE
T	Let the GSBC system shut down properly. Switch on the system again. If failure is no longer active, no further action is needed. If DTCs 0x504912..0x505212 (Lining Wear Supply Circuit) are active, check the lining wear sensor wiring/connection and repair as necessary. If failure is still active after correcting Lining Wear Sensing faults, replace the EPM.
U	The EPM is over temperature (248 degrees F/120 degrees C). Power off the vehicle, and wait for the vehicle to cool off (roughly 1 hour). Inspect the location of the EPM to ensure that heat shields (if applicable) have not been removed or rendered ineffective. If the DTC is still present after temperatures have returned to normal, then replace the EPM.
V	The EPM is under temperature (-40 degrees F/C). Safely warm up the vehicle. Once the vehicle is warm, if the failure is still present, then replace the EPM.
W	Check that the brake chamber air lines are connected to the correct ports in all GSBC devices. Note that connecting the parking brake line to the EPM can cause this fault. Check for leaks between the parking and service sides of all parking brake chambers. Carefully check the EPM, FBM, and all air lines between the two for debris, damage, kinks, or blockages. Check the silencers on both the EPM and the FBM for dirt, debris, or blockages. Repair or replace any faulty plumbing or silencers as needed. Continue with troubleshooting below if issue persists. Ensure that the reservoirs are fully charged (until cut-out pressure). Install a calibrated external pressure gauge in the service brake chamber to use as a reference. Apply 116 psi (~8 bar) of service brake pressure using the service brake pedal. Hold this application steady. Next, in one movement, reduce measured service brake pressure to approximately 16 psi (~1.1 bar) on the external gauge. After one second, if pressure on the gauge is greater than 22 psi (~1.5 bar), check the EPM silencer for blockage or debris. If the EPM silencer is OK, then the EPM should be replaced. Next, unplug the FBM electrical connector to force the system into pneumatic backup mode. Ensure that the reservoirs are fully charged (until cut-out pressure). Apply 30 psi (~2 bar) of service brake pressure using the service brake pedal. Hold this application steady. Next, in one movement, quickly and fully release the service brake pedal. After one second, if pressure on the gauge is greater than 5 psi, (~0.35 bar) then re-check the FBM silencer and the air lines between the FBM and the EPM. If the FBM silencer is OK and the air lines are undamaged, not blocked and in good condition, the the FBM should be replaced. Reconnect the FBM and clear faults. If the issue persists, replace the GSBC ECU.
X	Check that the brake chamber air lines are connected to the correct ports in all GSBC devices. Check for leaks between the parking and service sides of all parking brake chambers. Carefully check the EPM, FBM, and all air lines between the two for debris, damage, kinks, or blockages. Check the silencers on both the EPM and the FBM for dirt, debris, or blockages. Repair or replace any faulty plumbing or silencers as needed. Continue with troubleshooting below if issue persists. Ensure that the reservoirs are fully charged (until cut-out pressure). Install a calibrated external pressure gauge in the service brake chamber to use as a reference. Apply 116 psi (~8 bar) of service brake pressure using the service brake pedal. Hold this application steady. Next, in one movement, reduce measured service brake pressure to approximately 16 psi (~1.1 bar) on the external gauge. After one second, if pressure on the gauge is greater than 22 psi (~1.5 bar), check the EPM silencer for blockage or debris. If the EPM silencer is OK, then the EPM should be replaced. Next, unplug the FBM electrical connector to force the system into pneumatic backup mode. Ensure that the reservoirs are fully charged (until cut-out pressure). Apply 30 psi (~2 bar) of service brake pressure using the service brake pedal. Hold this application steady. Next, in one movement, quickly and fully release the service brake pedal. After one second, if pressure on the gauge is greater than 5 psi, (~0.35 bar) then re-check the FBM silencer and the air lines between the FBM and the EPM. If the FBM silencer is OK and the air lines are undamaged, not blocked and in good condition, the the FBM should be replaced. Reconnect the FBM and clear faults. If the issue persists, replace the GSBC ECU.
Y	Check that the brake chamber air lines are connected to the correct ports in all GSBC devices. Carefully check the EPM, FBM, and all air lines between the two for debris, damage, kinks, or blockages. Check the silencers on both the EPM and the FBM for dirt, debris, or blockages. Repair or replace any faulty plumbing or silencers as needed. Clear faults and test drive the vehicle. If the fault returns, replace the EPM. Clear faults and test drive the vehicle. If fault returns, replace the FBM. Clear faults and test drive the vehicle. If fault returns, replace the GSBC ECU.

Table 9 - Service Action Codes for Recommended Service

DIAGNOSTIC TROUBLE CODE (DTC) AND SERVICE INFORMATION (CONT.)

SERVICE ACTION CODES (CONT.)

NOTE: Prior to servicing a vehicle, refer to the *General Safety Guidelines* on page 2.

SERVICE ACTION CODE	RECOMMENDED SERVICE
Z	Carefully check the EPM, FBM, and all air lines between the two for debris, damage, kinks, or blockages. Check the silencers on both the EPM and the FBM for dirt, debris, or blockages. Repair or replace any faulty plumbing or silencers as needed. Clear faults. Install a pressure gauge at the control port of the EPM. Make and release a service brake application using the service brake pedal. If pressure is greater than 4.5 psi after releasing the pedal, inspect the air lines between the EPM and the FBM for blockages or kinks. Inspect the FBM silencer, and clean/replace either the silencer or the FBM as necessary. If pressure is less than 4.5 psi after releasing the pedal, move the gauge to each delivery of the EPM (if applicable). Make and release a service brake application using the service brake pedal. If pressure remains after the pedal is released, inspect the EPM silencer(s) and either clean or replace the silencer as necessary. Repeat the test. If pressure remains trapped, replace the EPM. If pressure does not remain trapped, test the other channel/delivery of the EPM (if applicable).
AA	Check for and correct any faults in the air supply system prior to troubleshooting this fault. If there are no faults in the air supply system, turn off the truck and drain both reservoirs to ambient pressure. Install an external pressure gauge in the supply port of the EPM that is faulted. Start the truck and charge both reservoirs to cut-out pressure. Turn the truck off and wait at least 90 seconds without pressing the brake pedal. Then, turn the ignition back to the “ON” position. Compare the pressure reported by the dashboard air gauge in the reservoir feeding the EPM to the external pressure gauge that was previously installed. If the pressure on the external gauge is not within +/-10% of the pressure reported on the dashboard, inspect air lines between the reservoir and the EPM for blockages, kinks, or other obstruction. Verify that both reservoirs are charged by the air treatment system. If the pressure measured on the external gauge is equal to that reported on the dashboard, replace the EPM.
BB	For each EPM channel, complete the troubleshooting steps below: Install an external pneumatic pressure gauge at the control port of the EPM. Using the external gauge, apply and release the service brakes. Confirm that pressure in the control port of the EPM rises and falls appropriately with the brake pedal application. If pressure does not rise or fall as expected, inspect the air line between the EPM and the FBM for kinks, blockage, or obstruction. Repair or replace air lines as necessary. If pressure rises but does not fall, remove the FBM silencer and the EPM silencer(s) and repeat the test. If this corrects the issue, clean or replace the suspect silencer(s) as necessary. If the air lines or silencers are not found to be damaged, install a pressure gauge in the delivery of the FBM and repeat the test. If indicated pressure does not rise or fall as expected, replace the FBM. If the pressure response is normal, inspect the air lines again to find the blockage preventing air from flowing. If all other possible problems have been eliminated, replace the EPM.
CC	If all EPMs report this fault, update the GSBC ECU software. Contact the OEM for assistance in updating the GSBC ECU. If only one EPM is reporting the fault, check all wiring between the GSBC ECU and the EPM (including checking for chafing damage, shorts, and opens). Check the electrical connector at the GSBC ECU and at the EPM. Check if DTC clears by disconnecting the EPM from the electrical connector. If all EPMs report the fault after checking the wiring and updating the GSBC ECU software, replace the GSBC ECU. If only one EPM continues to report this fault after checking the wiring, update the SW of that EPM. If the fault does not clear, replace that EPM.

Table 9 - Service Action Codes for Recommended Service







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