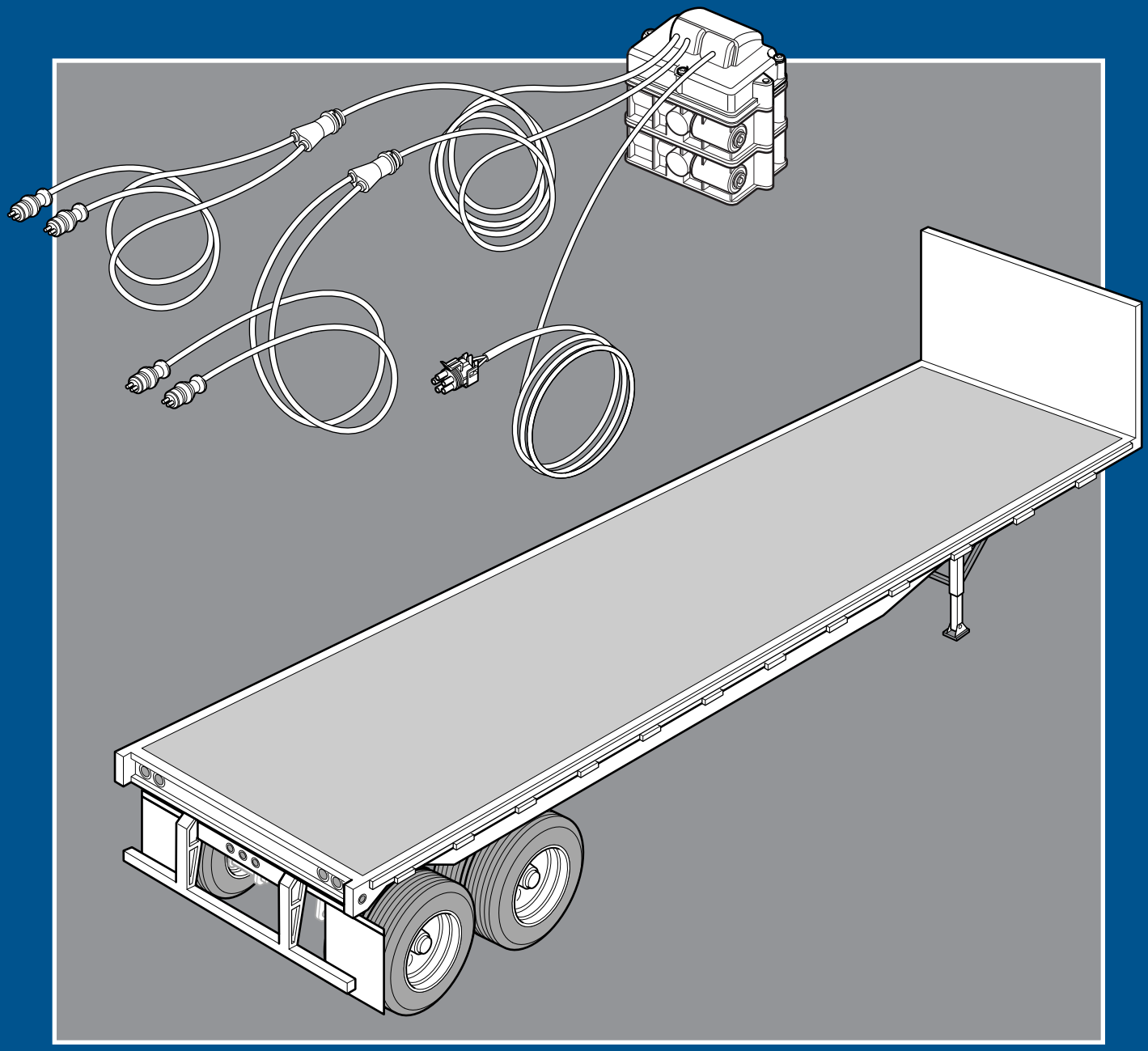
MBS-1P

Installation Guide

APRIL 2003



Heavy Duty Trailer ABS
by Wabash National

Notes, Cautions, and Warnings

This manual contains Notes, Cautions, and Warnings in addition to the assembly instructions.

Notes: Provide additional comments to help with installation and set up.

Cautions: Provide notification of situations that can cause damage to machinery and tools.

Warnings: Provide alerts to situations that can cause personal injury or death.

Please take the time to read and understand this manual before beginning assembly.

CAREFULLY FOLLOW THE SAFETY AND OPERATING INSTRUCTIONS IN THIS MANUAL.

Due to a policy of continuous product improvement, we reserve the right to make changes at any time, without notice, in prices, materials, colors, specifications, equipment, models, and availability. Some photos and drawings in this manual contain optional equipment. Since some information may have been updated since the time of printing, please check with your Wabash dealer for complete details.

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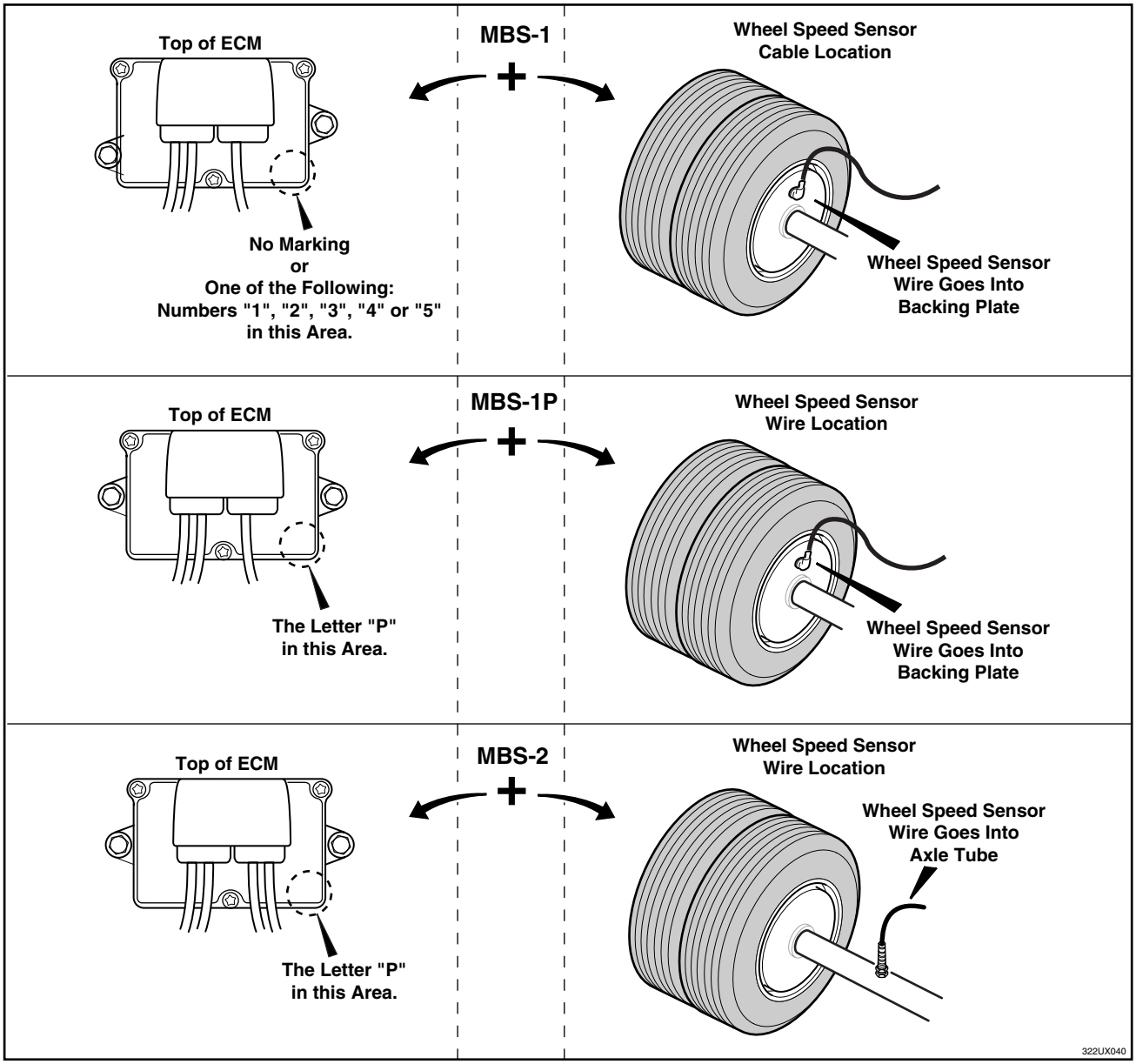
MBS Identification

Before service or diagnostics is performed on a Wabash MBS unit, the system design must be verified. Do not rely on labels or verbal descriptions to identify the MBS system. Refer to the illustration below and compare the marking in the lower right-hand corner of the ECM with the location(s) of the wheel speed sensor wire or cable on the trailer's axle(s). Make sure to properly identify the Wabash MBS; flash codes and system components are different for each system.



Contents

Wabash MBS-1P ABS Introduction

The Wabash MBS-1P ABS enhances the original MBS-1 system by adding Power Line Carrier (PLC) and expanding the number of configuration options. The system can be configured with either two or four sensors and either one or two pneumatic control modules. The Antilock Control Module (ACM) is separate from the service brake relay valve, eliminating costly repairs associated with relay valve failure. The choice of service brake relay can be separate from choice of ABS. This is also an advantage when troubleshooting the brake system.

MBS-1P System Components

Wabash's MBS-1P system includes unique ABS components as well as interfacing with standard trailer components (see Figure 1). Refer to Figures 2 and 3 for part number and description of Wabash parts.

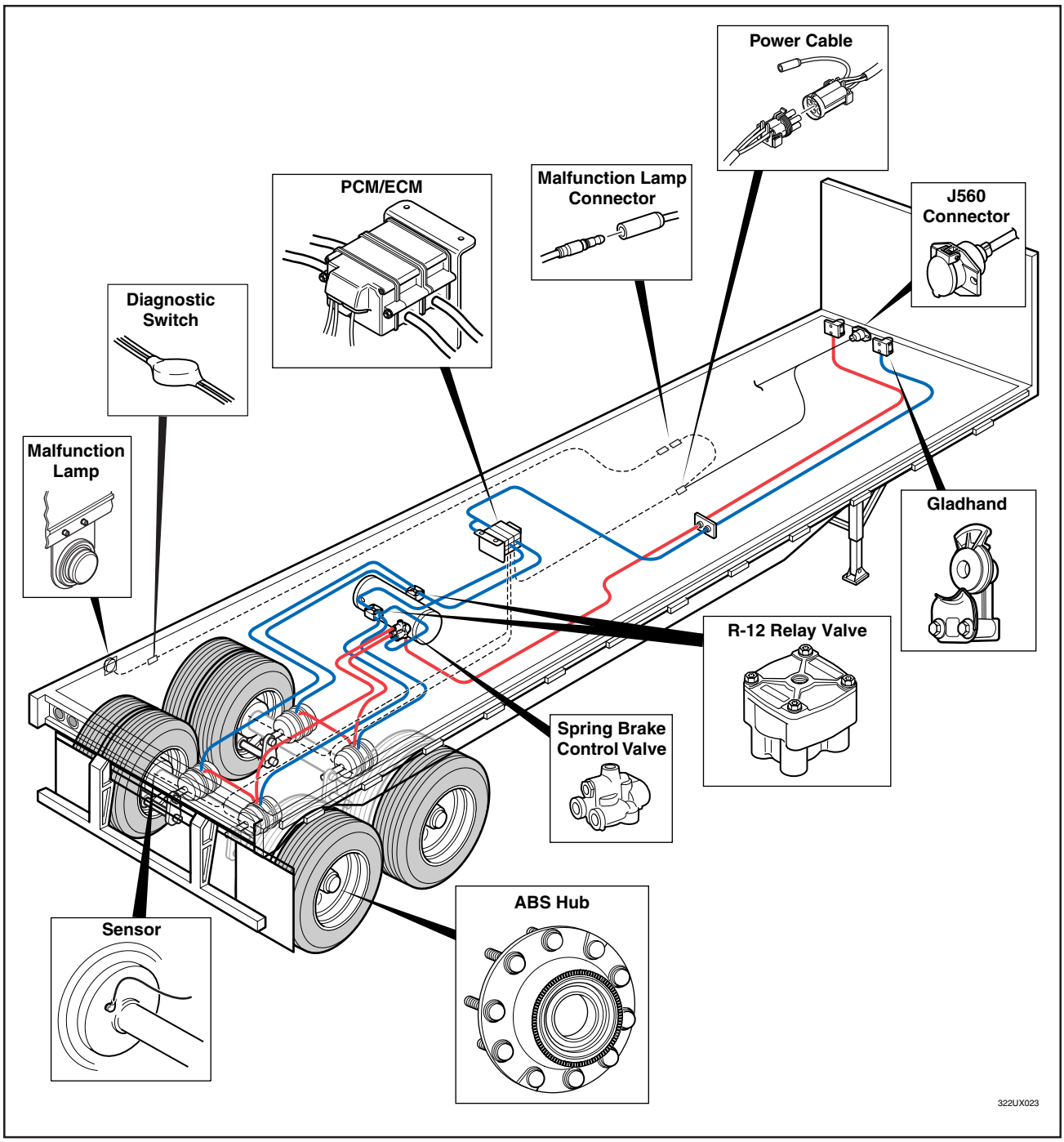


Figure 1, Wabash MBS-1P Antilock Brake System

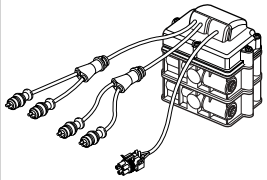
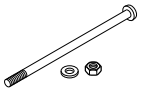
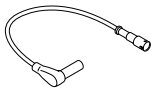
Component Item		Description	Qty. Req'd	Supplied in Kit
	10800313 10800314 10800358 10800357 10800353 10800362 10800349 10800361 10800360 10800359	2S-1M w/168" Power Cable 2S-1M w/30" Power Cable 2S-2M w/168" Power Cable 2S-2M w/30" Power Cable 4S-1M w/168" Power Cable 4S-1M w/30" Power Cable 4S-2M Side-by-Side w/168" Power Cable 4S-2M Side-by-Side w/30" Power Cable 4S-2M Axle-by-Axle w/168" Power Cable 4S-2M Axle-by-Axle w/30" Power Cable	1	yes
	12S00475	MBS-1P Mounting Bracket (optional)	1	yes
	BLT00650 BLT00732 NUT00007 WSH00010	Bolt 1/4-20 x 3-1/2" Grade 8 (1M Sys.) Bolt 1/4-20 x 5-1/2" Grade 8 (2M Sys.) Nut 1/4-20 Nylon Insert Locknut Washer 1/4" SAE Flat	2 2 2 2	yes yes
	10800225 10800126 10800068	Bosch ABS Sensor Wabco ABS Sensor Midland ABS Sensor	2	yes
	10800226 10800009 10800069	Bosch ABS Sensor Clip Wabco ABS Sensor Clip MidlandABS Sensor Clip	2	yes
	14401359	ABS Wiring Harness	1	yes
	14401744	ABS Malfunction Lamp Harness w/Diagnostic Switch	1	yes

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Figure 2, MBS-1P System Components

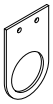
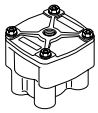
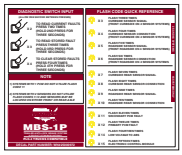
Component Item		Description	Quantity Required	Supplied in Kit
	14200428	Yellow ABS Malfunction Lamp	1	yes
	14200018	Closed Back MalfunctionLamp Grommet	1	yes
	14A00049	Straight Malfunction Lamp Mounting Bracket	—	no
	14A00050	90° Malfunction Lamp Mounting Bracket	—	no
	12900570	Relay Valve	1	yes
	25000972	MBS-1P Flash Code Decal	1	yes

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Figure 3, MBS-1P System Components

General Air Brake Requirements

FMVSS-121 identifies minimum requirements for air brake systems on commercial vehicles built in the U.S. (Requirements in Canada are covered under CMVSS-121 and are virtually identical.) These regulations cover requirements for new construction. Once put into operation, proper use and maintenance is covered under standards such as:

- FMCSR 393 – Covers required equipment
- FMCSR 396 – Covers inspection and repair.

The requirements for spring brake performance and operation, reservoir size and air timing have not been changed with the introduction of ABS. Because the addition of ABS components can have an affect on air brake timing, it is important to verify acceptable performance on new ABS installations. The maximum application and release times permitted under FMVSS-121 are shown in Figure 4.

	Apply Time (mSec)		Release Time (mSec)	
	From pedal movement to reach 60 PSIG	From pedal movement to reach 60 PSIG	From pedal movement to reach 5 PSIG	From pedal movement to reach 5 PSIG
Measured at	Brake Chamber	50 CI Reservoir	Brake Chamber	50 CI Reservoir
Initial Condition	0 PSIG	0 PSIG	95 PSIG	5 PSIG
Towing Trailer	500	500	1000	1000
Converter Dolly	550	550	1100	1000
Single Trailer	600	N/A	1200	N/A

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Figure 4, Air Timing Requirements

ABS

Key Dates

March 1, 1997	Tractors must be equipped to provide full time power to trailers.
March 1, 1998	Newly manufactured trailers must be equipped with ABS. Some special use cases are exempt. (Refer to FMVSS-121 for specific details.)
April 1, 2000	ABS required on newly manufactured Canadian Vehicles.
March 1, 2001	Trailer malfunction lamp is required in the tractor cab.
March 1, 2008	Trailer mounted malfunction lamp no longer required.

ABS Design Requirements

Under FMVSS-1221, an approved ABS must automatically control the degree of rotational wheel slip during braking by:

1. Sensing the rate of angular rotation of the wheels.
2. Transmitting signals regarding the rate of wheel angular rotation to one or more controlling devices which interpret those signals and generate responsive controlling output signals.
3. Transmitting those controlling signals to one or more modulators which adjust brake actuating forces in response to those signals.

Type of ABS Required for Trailers

ABS control is required on trailers as follows:

- Full Trailers – Direct ABS Control is required on at least one front and one rear axle.
- Semi Trailers and Dollies – Direct ABS Control is required on at least one axle.

Direct Control refers to an axle that is equipped with wheel speed sensors and is controlled by a modulator valve or valves in response to the wheel speed sensor signals. If this valve(s) also controls the brakes of another axle(s) that does not have sensors, the axle(s) is referred to as an indirectly controlled axle(s).

Power Requirements for ABS

For trailers built after March 1 of 1998, the trailer wiring system must provide two sources of power for the antilock system.

1. Full-time power (when ignition is on) must be provided by the tractor. This full-time power source may be shared with other trailer circuits. The SAE J560 Blue (AUX) circuit is commonly used as the full-time power source. In other cases, a separate ISO 3731 connector is provided.

2. Brake light power. This input provides a source of backup power for cases where an older tractor (without full-time power) is used to tow a trailer or in case of a failure of the permanent power source.

Industry standards (TMC RP-137 and SAE2247) require that the tractor provide at least 10 amps at 12 volts at the trailer end of the SAE J560 or ISO cable on all ABS power circuits. Suppliers of Trailer ABS have agreed to provide for proper antilock brake operation down to a minimum of 8.5 volts. The ABS malfunction lamp will light if voltages drop too low to maintain reliable solenoid operation.

Wabash National antilock systems operate at voltages down to 7.0 volts. Current requirements are approximately 330 milliamps per control unit and 1.25 amps per PCM.

ABS Malfunction Lamp

Rules for the location, color, labeling, intensity and photometrics for external ABS malfunction lamps have been established by the National Highway Transportation Safety Administration (NHTSA). These requirements are effective as of March 1, 1998.

Location

The lamp mounting location shall be near the left side rear of the trailer, no closer than 150 mm (5.9 inches) and not more than 600 mm (23.6 inches) from the rear red side marker indicator lamp. On a converter dolly, the lamp mounting location shall be on a permanent structure of the dolly at least 375 mm (14 inches) above the road surface. After March 1st, 2001 a second ABS malfunction lamp must be located in the cab.

Color and Labeling

The malfunction indicator lamp must be yellow in color and identified with the letters “ABS” to distinguish the lamp from other yellow side markers. The letters may be on the lens, on the lens housing, or on the trailer itself, near the lamp.

Intensity and Photometric Requirements

The external ABS malfunction indicator lamp must conform to SAE-J592 JUN92. Trailers shall use a combination clearance/side marker lamp marked with a “PC” or “P2”. These lamps offer a widely diffused beam pattern throughout a full 180-degree left and right range.

Power Line Carrier (PLC)

In order to meet the (March 2001) requirement to provide a tractor-mounted trailer ABS malfunction lamp, the industry has adopted power line carrier (PLC) technology. The use of a power-line-carrier permits transmission of data between tractors and trailers without adding wires or connectors. Data is transmitted as a series of high frequency chirps that appear on the ABS full-time power line (the blue wire). The chirps vary in frequency between 100K Hz and 400K Hz. The PLC signals are transmitted between trailer ABS control units and tractor ABS control units. The tractor ABS unit has an additional output signal that controls the cab-mounted trailer ABS malfunction lamp.

The cab-mounted trailer ABS malfunction lamp:

- Lights to indicate a bulb check at start-up
- Remains lit at start-up if a fault code is set
- Will turn OFF after two seconds if the trailer is disconnected
- Lights during vehicle operation to indicate a fault has occurred.

In order for PLC to function, tractors and trailers must both be equipped with PLC versions of ABS. All Wabash National MBS-1P systems manufactured after March 1, 2001 are PLC capable.

Applications

The performance of the Wabash MBS-1P ABS depends upon proper installation of all components. Trailer suspension, axle configuration, and other brake components will affect the level of ABS performance.

The “Sensed” and the “Controlled” axles must be considered prior to installation of the MBS-1P. Wabash recommends the following guideline for typical MBS-1P installations.

When locating the sensors on a 2S system, choose the axle that locks up first during hard braking. Typically, the front axle tends to lock up first on spring suspension trailer applications. On air suspension systems, the axles tend to lock up at the same time, so it is recommended that the rear axle be sensed because of the added stability.

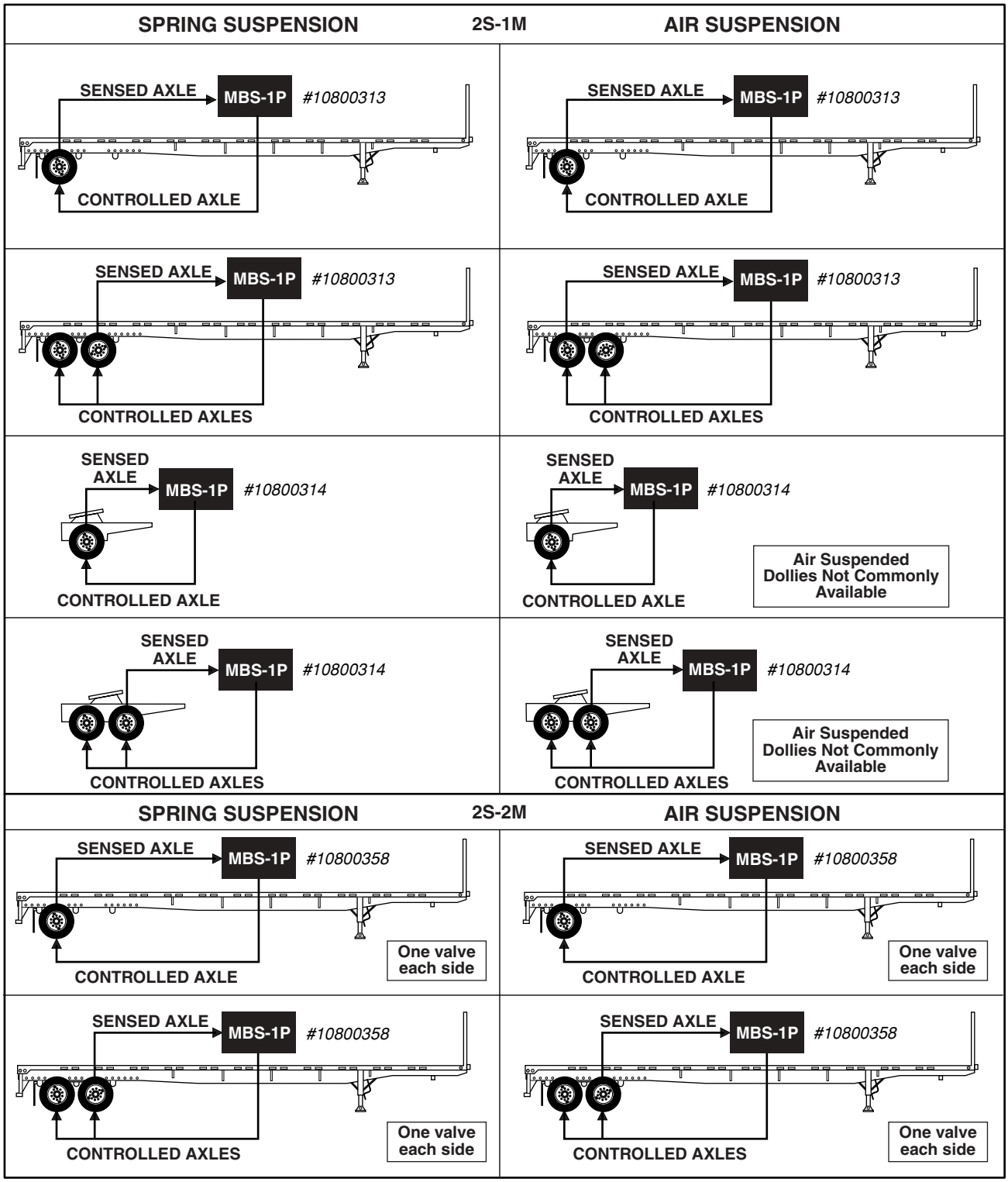

Figure 5, Wabash MBS-1P Application Chart

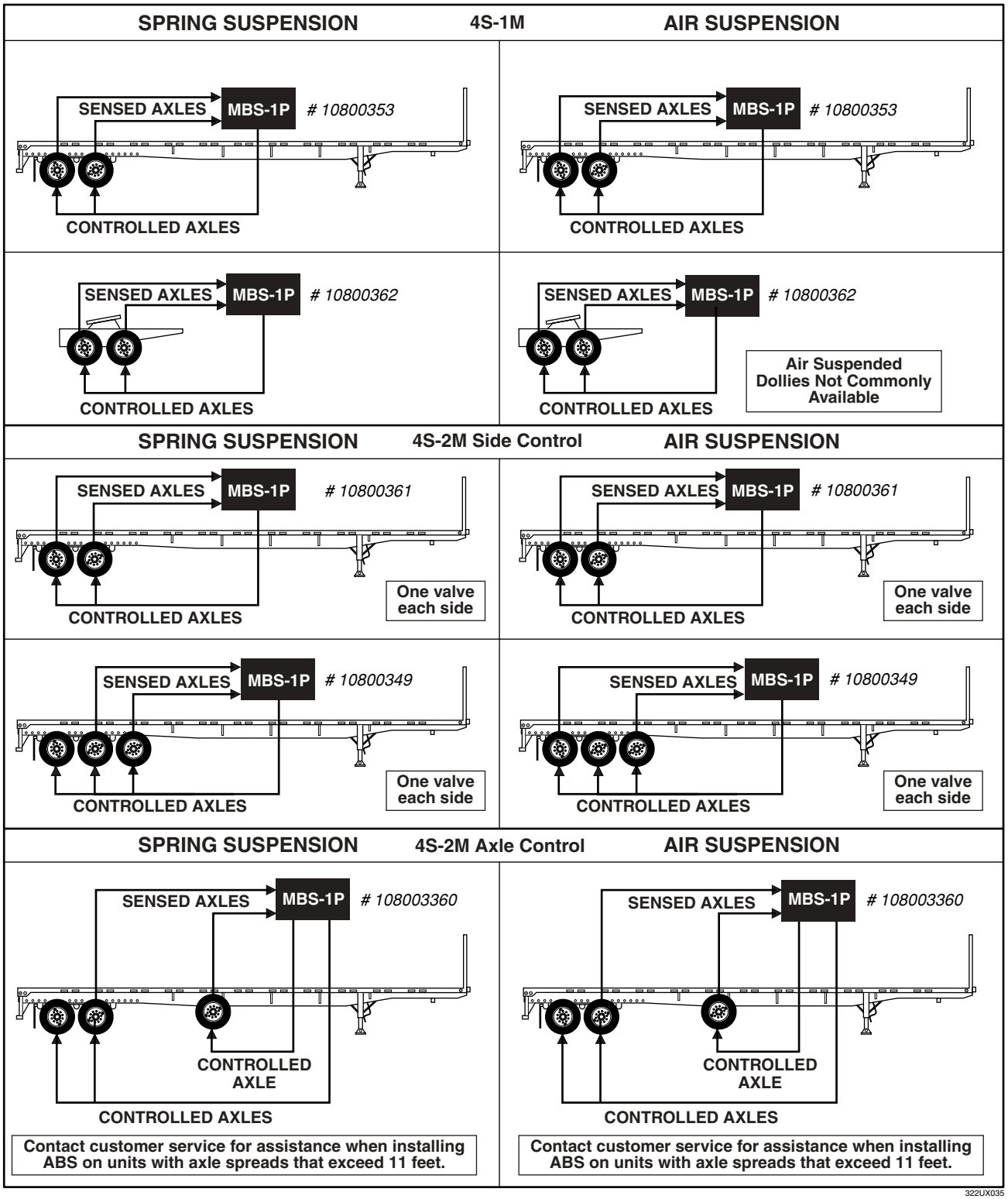

Figure 6, Wabash MBS-1P Application Chart

Electrical System

The Antilock Control Module (ACM) consists of an Electronic Control Module (ECM) and a Pneumatic Control Module (PCM) combined as one unit. However, they are individually field replaceable. The wheel sensor, malfunction lamp, and power harnesses are connected to the ECM.

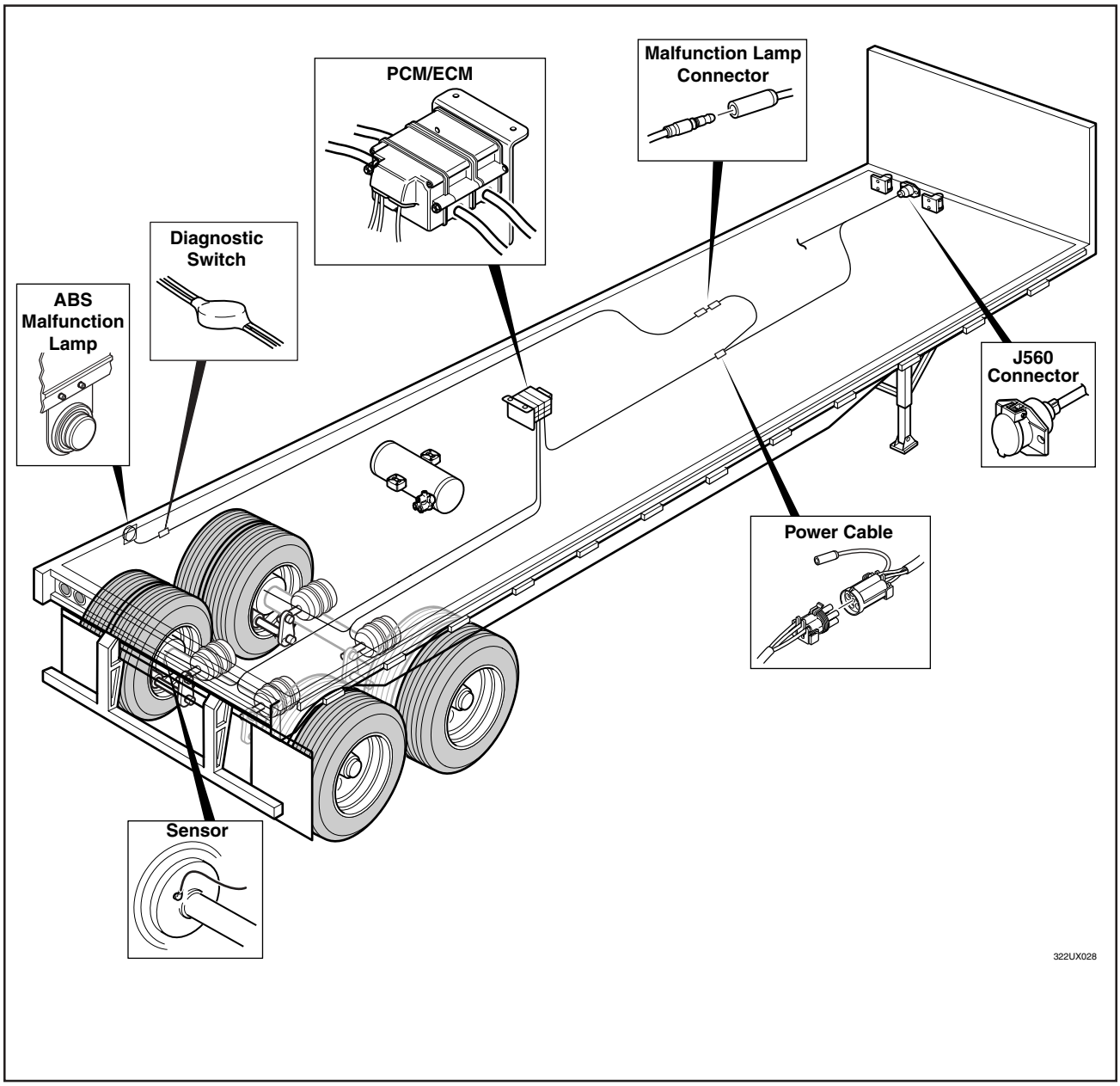

Figure 7, Typical Electrical System Layout

Pneumatic System

The PCM contains the pneumatic solenoids that physically control pressure in the service line to the relay valve. The 3/8" service line enters and exits the PCM through integrated quick connect fittings. The PCM also incorporates a quick exhaust valve that minimizes delays during brake release and helps purge contaminants that may enter the service control line.

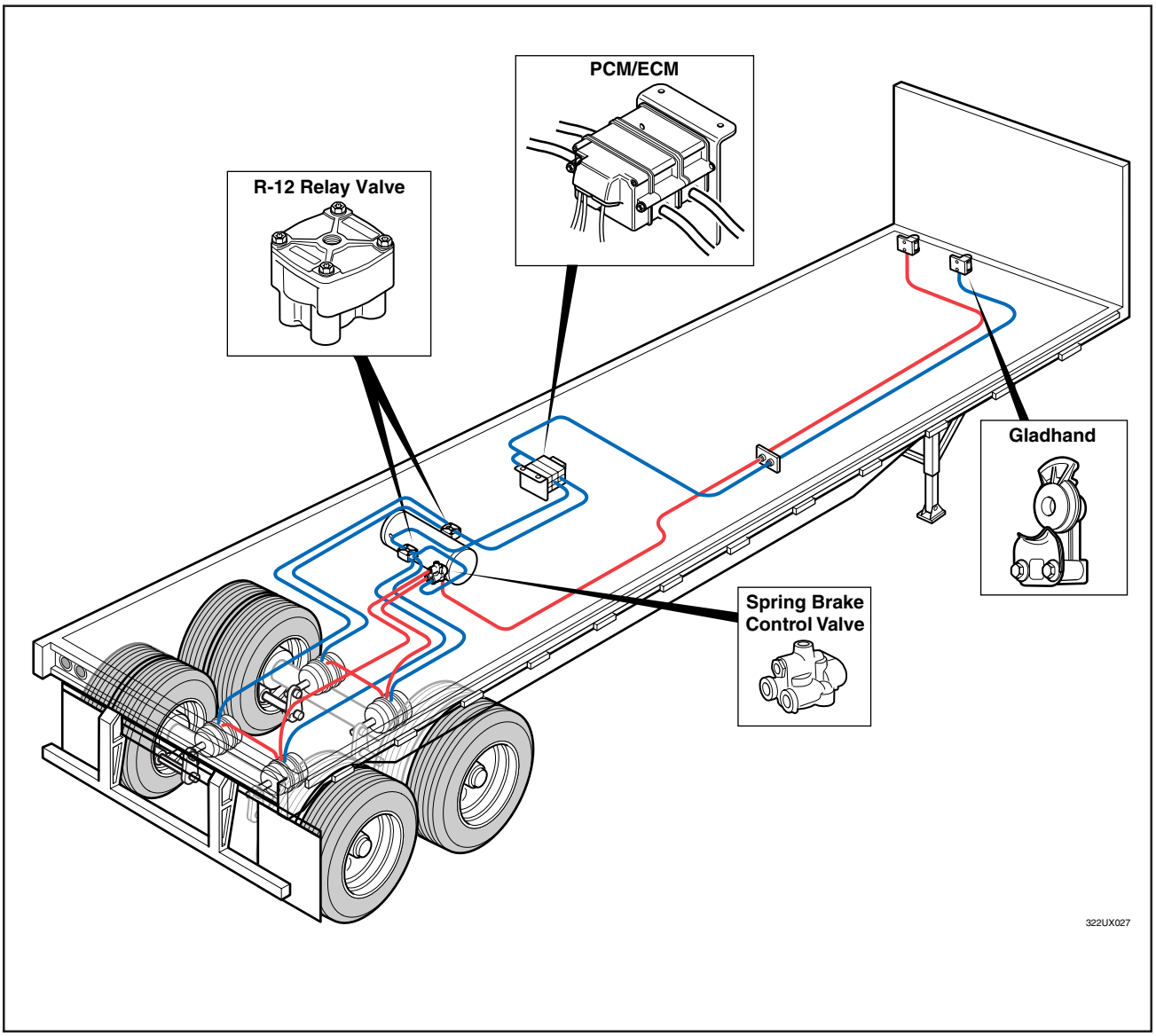

Figure 8, Typical Pneumatic Layout for a 2M System

Installation of Electrical System

Power and Sensor Cables

One power cable, and two or four sensor connector cables are integrated into the MBS-1P. The power cable runs to the Weather Pack 5-way connector on the trailer. The sensor cables terminate in molded two-pin (industry standard) connectors.

MBS-1P Cable Options

The MBS-1P can be configured with either a long or short power cable. Refer to the system component charts on page 3 and 4 for specific system and part number information.

The short power cable is typically used with fixed bogies.

The long power cable is typically used with sliding bogies. Route the power cable with the slider hoses to the trailer frame.

NOTE: The long cable can also be used on fixed bogies if required.

MBS-1P with short power cable (WNC part number 10800262).

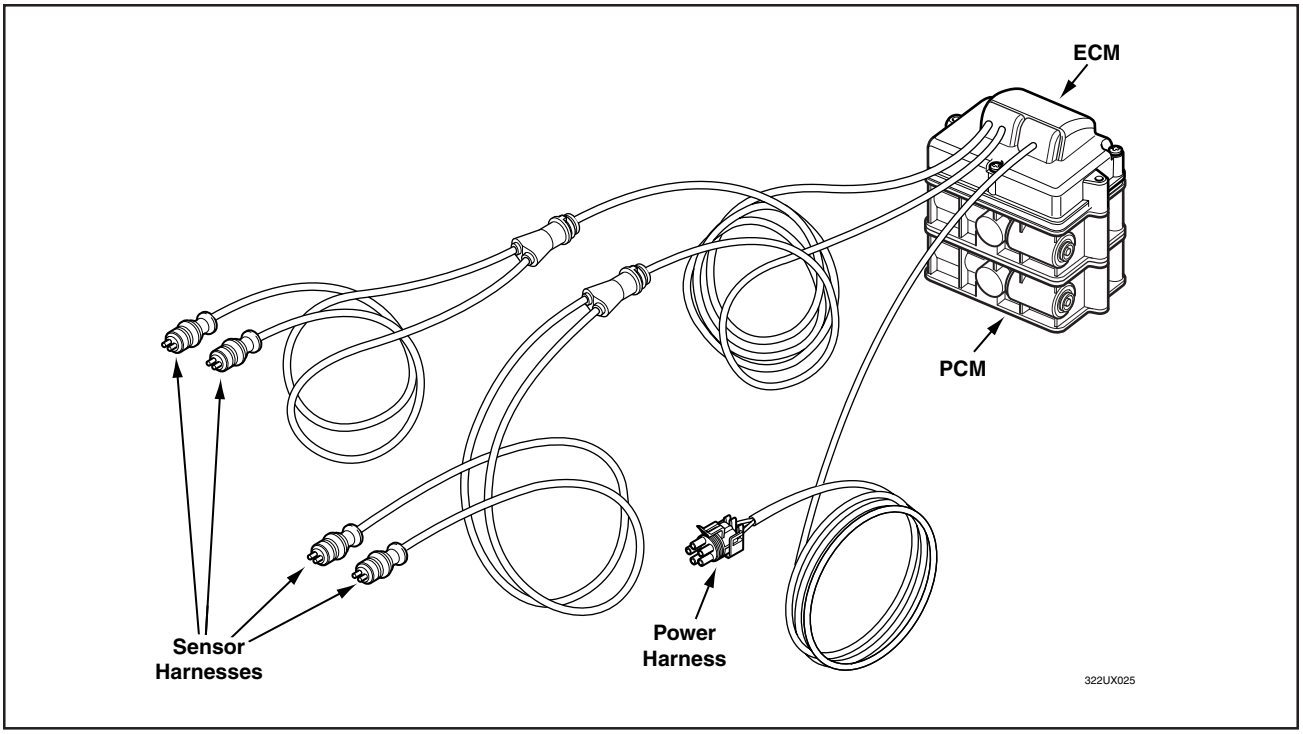

Figure 9, MBS-1P Components and Connectors

Circuit Requirements

The solenoid valves used in the Wabash MBS products allow higher airflow and require less voltage and current than most trailer ABS systems. For a nominal 12-volt supply, current consumption is about 1.25 amperes maximum during ABS activity. Satisfactory operation is available down to 7 volts. The MBS-1P minimizes trailer issues caused by inadequate voltage (typically found in 3-trailer units).

Malfunction Lamp Diagnostic Switch

NOTE: The malfunction lamp bulb must be incandescent. Always replace the bulb with another incandescent bulb of the same value.

A diagnostic switch is located near the ABS malfunction lamp. A malfunction lamp harness incorporating this switch is included in the MBS-1P kit.

NOTE: While this feature is desirable, it is not essential. Diagnostic flash codes can also be activated from the tractor cab via the ignition switch.

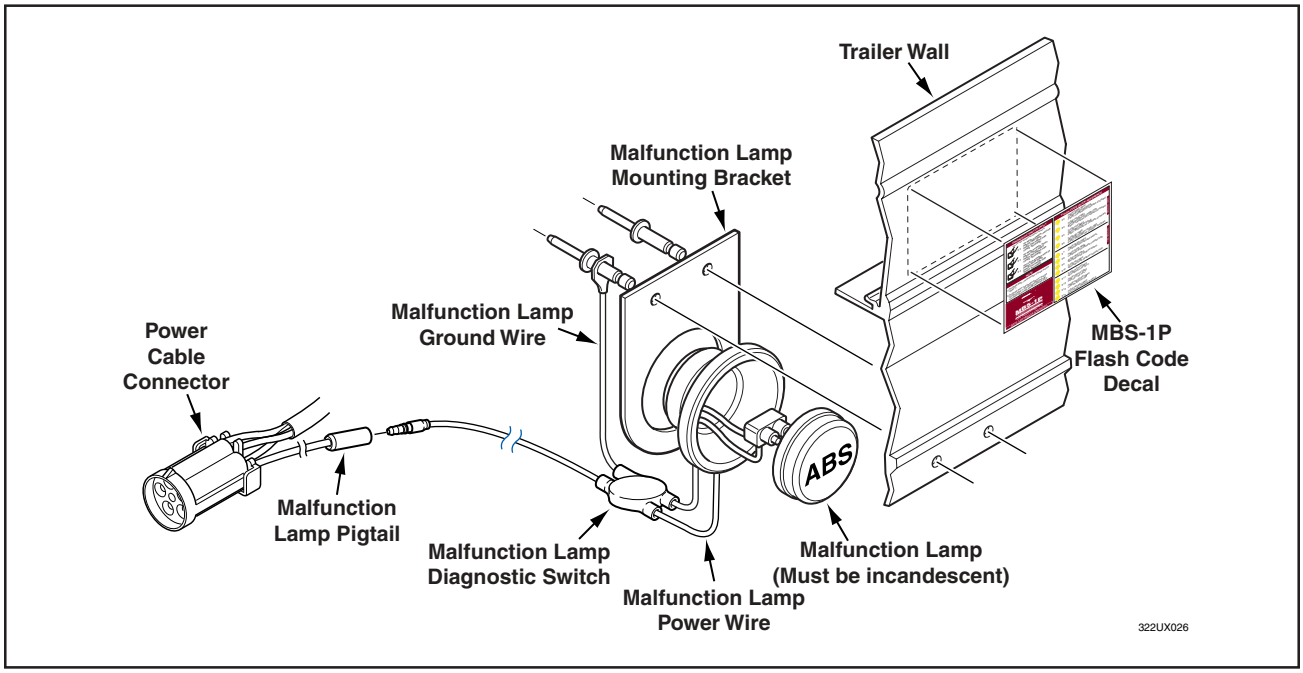

Figure 10, ABS Malfunction Lamp Installation

Pneumatic System

MBS-1P Location and Mounting

The MBS-1P can be located some distance from the relay valve. The air line connecting the PCM to the relay valve should be 3 to 5 feet in length. This allows some mounting flexibility, provides good ABS performance, and complies with brake application and release timing requirements.

Mount the MBS-1P using two grade 8 bolts WNC part number BLT 00650 (1/4-20 x 3-1/2") for 1M systems, BLT00732 (1/4-20 x 5-1/2") for 2M systems.

NOTE: Use the grade 8 bolts included with the MBS-1P installation kit. The bolts must be inserted from the bracket side when installing 2M systems.

An optional mounting bracket (WNC part number 12S00475) is available from Wabash.

The MBS-1P may also be mounted directly to a crossmember by drilling two mounting holes on 5-3/8" centers.

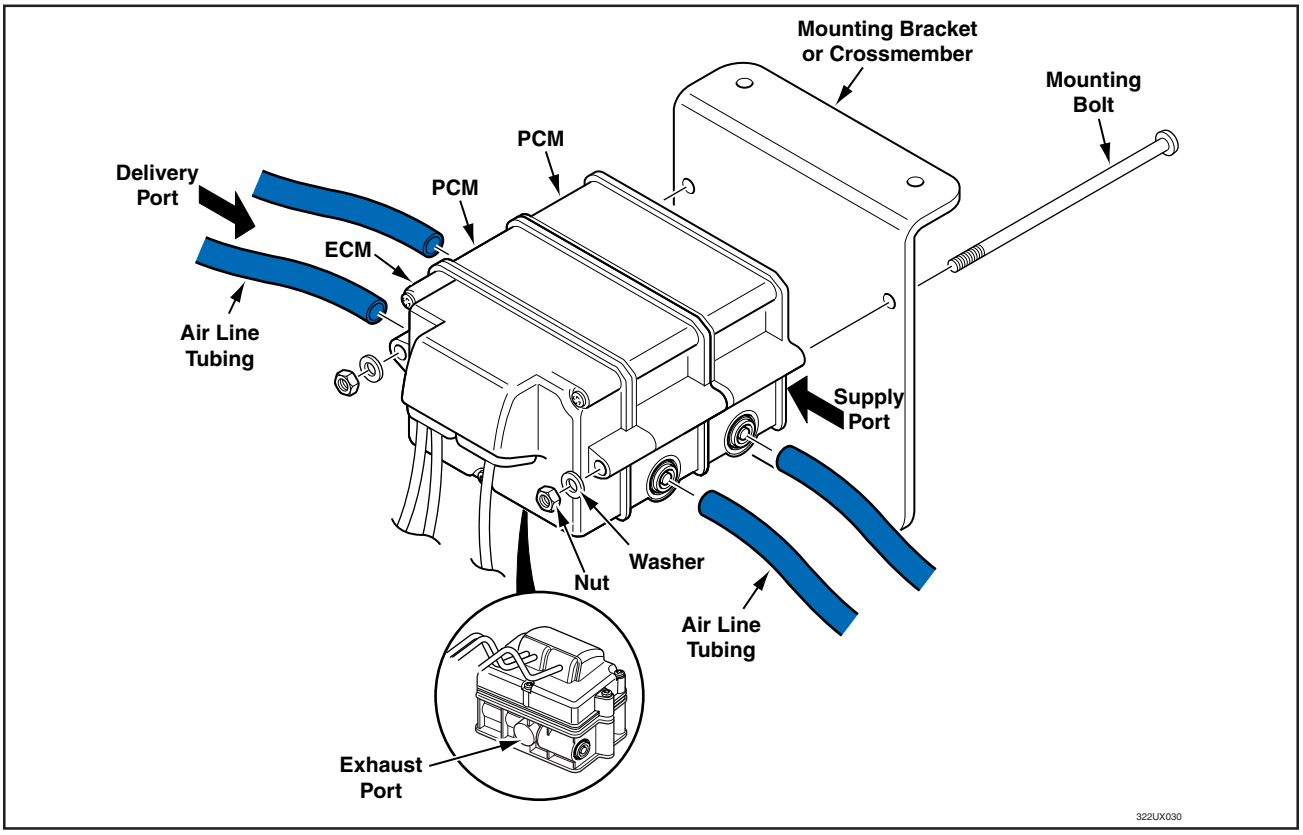

Figure 11, Typical MBS-1P Mounting

Plumbing Instructions

Install the MBS-1P as follows:

1. Select a suitable mounting location near the front of the bogie.
2. Install the MBS-1P in the blue service line (see Figure 12).
3. Connect the port marked “SUP” to the glad-hand side.
4. Connect the port marked “DEL” to the relay valve side.

NOTE: Because of volume considerations discussed later, the spring brake valve may be supplied from either the “upstream” (glad-hand side) or the “downstream” (relay side) of the MBS-1P. Wabash recommends that it be supplied from the downstream side to help purge contaminates from the anti-compounding supply line.

IMPORTANT: When the Trailer Emergency Valve (TEV) is supplied downstream of the MBS-1P, the line from the MBS-1P must be routed to the relay valve first, and from there, to the trailer emergency valve (TEV). Circumstances where the TEV is supplied downstream of the MBS-1P then 1/4" airline must be used from the R-12 to the TEV.

Wabash requires the following pneumatic plumbing:

1. From “DEL” of MBS-1P, route 3/8" tubing to a tee at the relay valve.
2. From the tee at the top of the relay valve, route 1/4" tubing to the spring brake valve anti-compounding port.

IMPORTANT: The line lengths are significant. The combined volume in the two lines mentioned in steps 1 and 2 above must equal the volume of between three and five feet of 3/8" tubing. The volume of 1/4" tubing is about 40% that of 3/8" tubing of equal length.

Calculate tubing equivalents using the following formula:

Leq = equivalent length of the combined 3/8" and 1/4" tubes

L3/8 = actual length of 3/8" tubing

L1/4 = actual length of 1/4" tubing

Then:

Leq = L3/8 + (0.4 x L1/4)

Example:
3 feet of 3/8"
2.5 feet of 1/4"
Leq= 3 + 0.4 (2.5)= 4.0

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The air volume in the tubing after the MBS-1P is a significant performance factor. Leq must be between three and five feet.

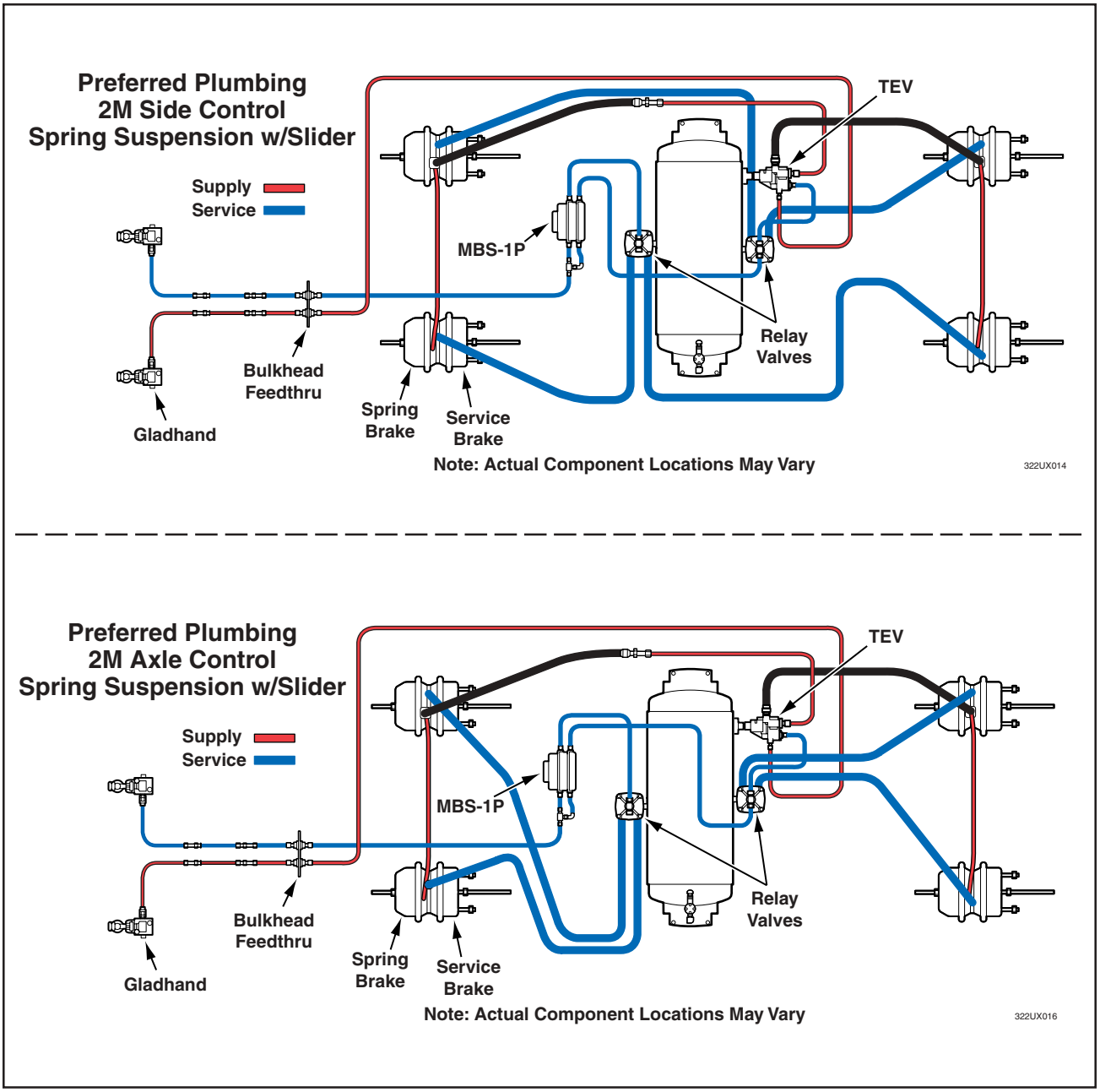

Figure 12, MBS-1P "Downstream" Air Supply Configurations (Preferred Plumbing)

NOTE: If the plumbing cannot be accomplished within the five foot maximum length, the relay valve can be fed directly with a 3/8" tube from the "DEL" port of the MBS-1P. The feed for the trailer spring brake valve can be taken from a tee connection upstream of the MBS-1P. Use a 3/8" line to the Trailer Emergency Valve (TEV).

For this configuration, the volume of the line to the spring brake valve is not included in the calculation.

Following these guidelines will usually result in an installation that complies with application and release brake timing requirements. However, always check application and release times for each configuration.

IMPORTANT: When the anti-compounding port of the Trailer Emergency Valve (TEV) is plumbed in before the PCM the straight through connection must be plumbed to the PCM and the branch connection to the TEV. All airline used in this case can be 3/8" tubing because the PCM does not exhaust this portion of the airline during an ABS event. For this plumbing configuration, omit this length of airline when calculating allowable tubing lengths.

Relay Valve

Provided that all brake application and release timing requirements are met, a Bendix relay valve (WNC part number 12900570) is approved for all applications. This valve is normally included with the MBS-1P installation kit.

IMPORTANT: Wabash National must approve all installations that use other relay valves.

Sensors

Bosch, Midland, or Wabco sensors are approved by Wabash National for all installations. However, the sensor and sleeve must be made by the same manufacturer. For example, Bosch sleeves cannot be used with Wabco sensors. Correct sensors and sleeves are included with the MBS-1P installation kit.

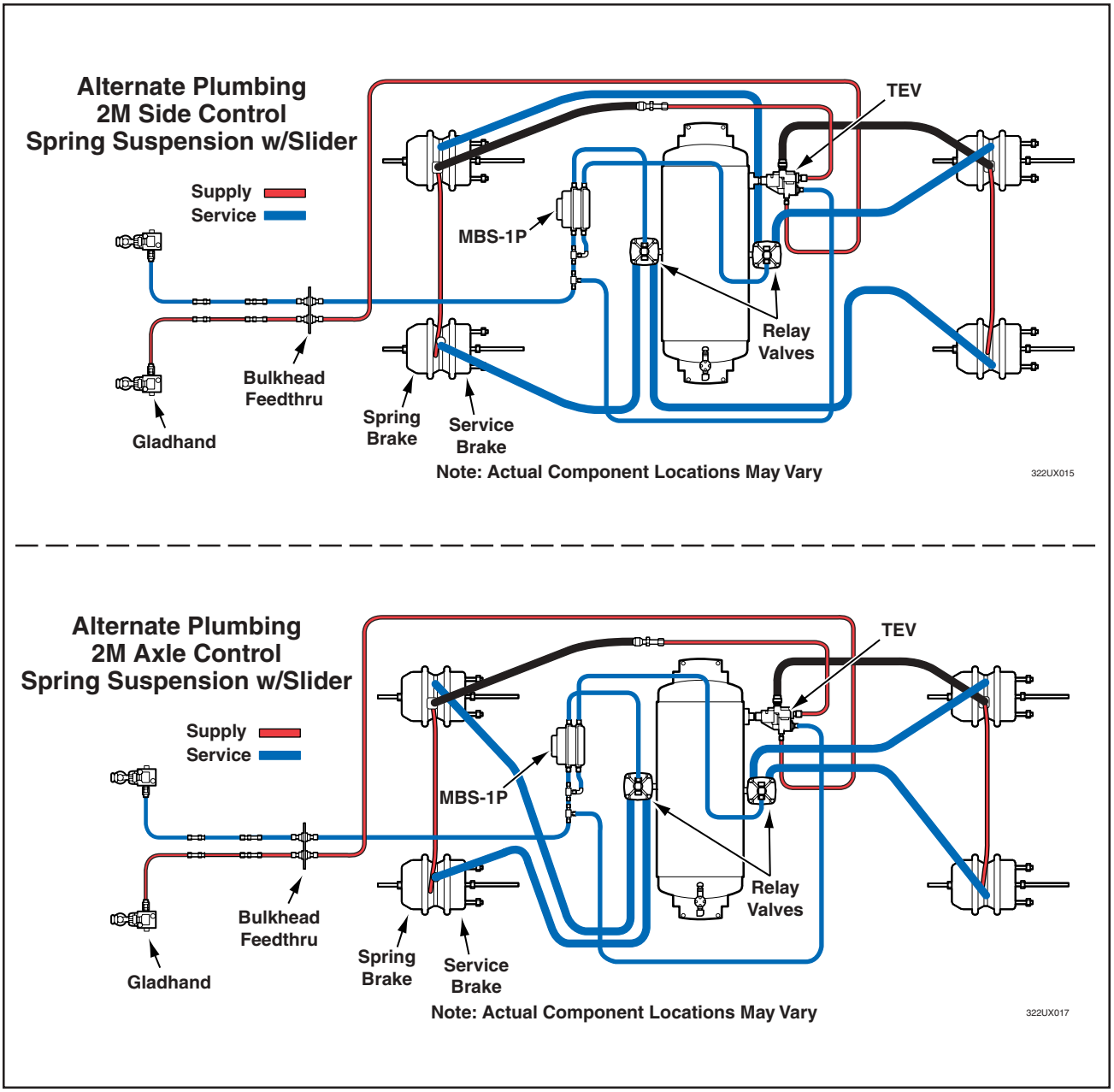

Figure 13, MBS-1P "Upstream" Air Supply Configurations (Alternate Plumbing)

Hub Installation

On retrofit applications, ABS wheel hubs must be installed (see Figure 14).

Purpose: to ensure hub installation is performed uniformly and consistently.

Recommended tools: 1-15/16", 4-13/16", 4-3/8", 3-1/4", and 3-3/16" sockets, vice grips, band cutters, allen wrench pack, 5 lb. rubber mallet, 1/2" impact wrench, standard screwdriver, utility knife, crowbar, 1/2" drive torque wrench, 3/4" drive torque wrench, 2 lb. hammer, 1" impact wrench.

This procedure must be followed unless otherwise specified by engineering, customer contracts, Wabash National policies or regulatory requirements.

1. Identify and prepare the type of spindle being used.
   - A. Identify whether the spindle is a TP type or a TN type with the tapered smaller end.
   - B. Remove the rubber spindle boot from the axle.
   - C. Clean the spindle completely with a rag and mineral spirits making sure to remove all lubrication and contaminants from the wheel end.
   - D. Inspect the seal shoulder and bearing races for nicks and/or burrs by rubbing the surface with your hand. Smooth any defects with an emery cloth, then reclean the spindle.
   - E. Visually inspect brake shoes for defects such as broken corners, missing rollers, and missing springs. Replace brake shoe components as necessary.
   - F. Refer to SOP 1800001 on ABS installation for installation of the sensor wires, if necessary.
   - G. Apply a thin layer of lubricant specified in the BOM/Work Order to the seal shoulder and bearing races.

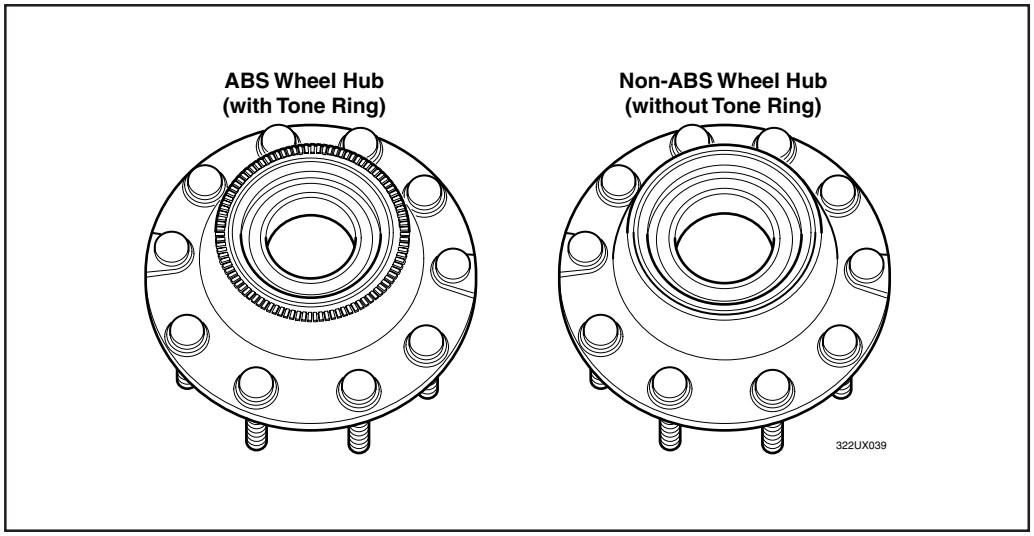

Figure 14, ABS Wheel Hub Identification

Initial System Checkout

Following initial installation or service of the MBS-1P system, perform the following checkout procedure to verify proper operation of the braking system.

1. Check each sensor for proper output.
    - Use a digital multimeter to read the sensor voltage. It should be in excess of 200 MV AC and should increase if the wheel is spun faster.
2. Check the service brakes for normal, non-ABS operation.
3. Check the malfunction lamp for proper operation as follows:
    - Power up the trailer – the malfunction lamp should turn OFF after two seconds.

NOTE: In some cases it may be necessary to spin the sensor equipped wheels to verify proper lamp operation.

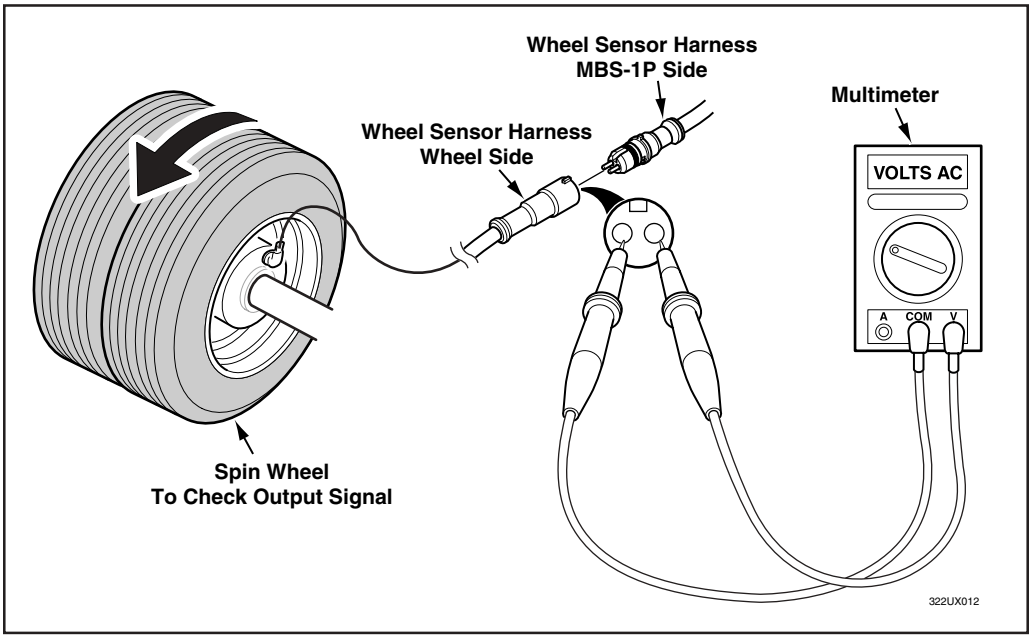

Figure 15, Wheel Speed Sensor Output Test

ABS System Diagnostics

Initial System Checkout

When the system is first powered up, the ABS malfunction lamp will come ON for two seconds then go OFF, indicating the system has passed all self-tests. All MBS-1P units must pass operation checks before the trailer is placed in service.

Pneumatic Diagnostics

The Wabash ABS system does not monitor the air system of the vehicle. For example, if there is an air leak, kink in the line, or faulty relay valve, the ABS malfunction lamp will not show a fault in the system. However, if a malfunction in the air system arises and it cannot be determined if the ABS valve is causing the problem, the ABS can simply be bypassed using a short length of airline and two push-in unions. For example, if an unknown kink exists in the control line and the brakes will not apply, simply remove the airlines from the quick connect fittings on the ABS valve and insert the short length of airline using the push-in unions. The system can then be reexamined without the ABS affecting the system. If the brakes still do not apply it can then be assumed that the ABS valve is not causing the problem.

Electrical Diagnostics

The malfunction lamp is an important tool when assessing the status of the ABS system. When the system is operating properly the malfunction lamp will illuminate briefly, then go OFF every time the system is powered up. If the vehicle is stationary at power up, the lamp will remain ON for two seconds and the PCM will perform a functional test causing an audible clicking or puffing. If the vehicle is mobile at power up, the lamp will remain ON for one second and the PCM self-test will be aborted. The PCM self-test is performed at each stationary power up to give the operator an audible sign that everything is performing normally.

The ABS system receives power from the stop lamp circuit (pin 4 of J560 connector – red) and the auxiliary circuit (pin 7 of J560 connector – blue). This means the system will operate on a tractor with or without the auxiliary circuit powered at tractor ignition. In a situation where the system only receives power from the stop circuit, the malfunction lamp will illuminate briefly each time the brakes are applied and the PCM self test will be performed at each stationary brake application.

Upon power up, if the system behaves differently than described above, such as the malfunction lamp remains illuminated or does not come ON at all, follow the instructions in the next section to determine the cause of the problem.

Troubleshooting The System

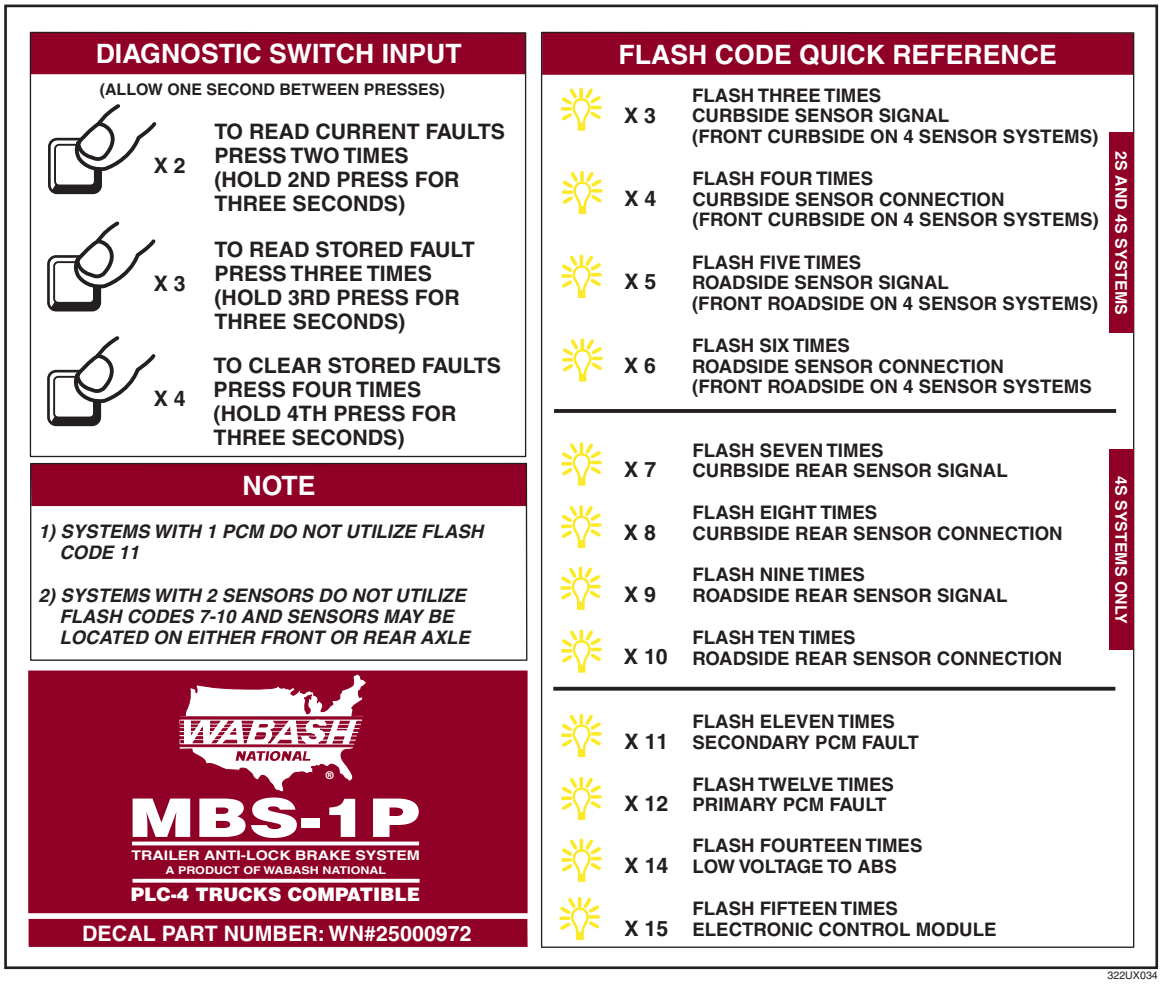

Figure 16, MBS-1P Flash Code Identification Decal

Entering the flash code diagnostic mode

Fault identification is provided via flashes of the ABS malfunction lamp. To enter the flash code diagnostic mode, it must be possible to power the auxiliary circuit. On March 1997 and newer tractors, this circuit is switched with the ignition. Alternately, a suitable light tester may be used.

Suitable Light Tester

When using a light tester to power any ABS system, supply power directly from a battery, not a charger. The charger may remain connected to the battery to keep the battery charged, but the charger can not be used as the power source. See Figure 17.

Faults are categorized in two types:

- Current Faults – Faults that are active when the system is powered up, causing the malfunction lamp to remain illuminated. All current faults become stored faults after they are repaired.
- Stored Faults – Faults that were current faults at one time, but are no longer active and allow the malfunction lamp to go OFF at power up. Typically they may be caused by intermittent problems that only occur when the vehicle is moving.

Both, stored faults and current faults can be identified using the ABS flash code system.

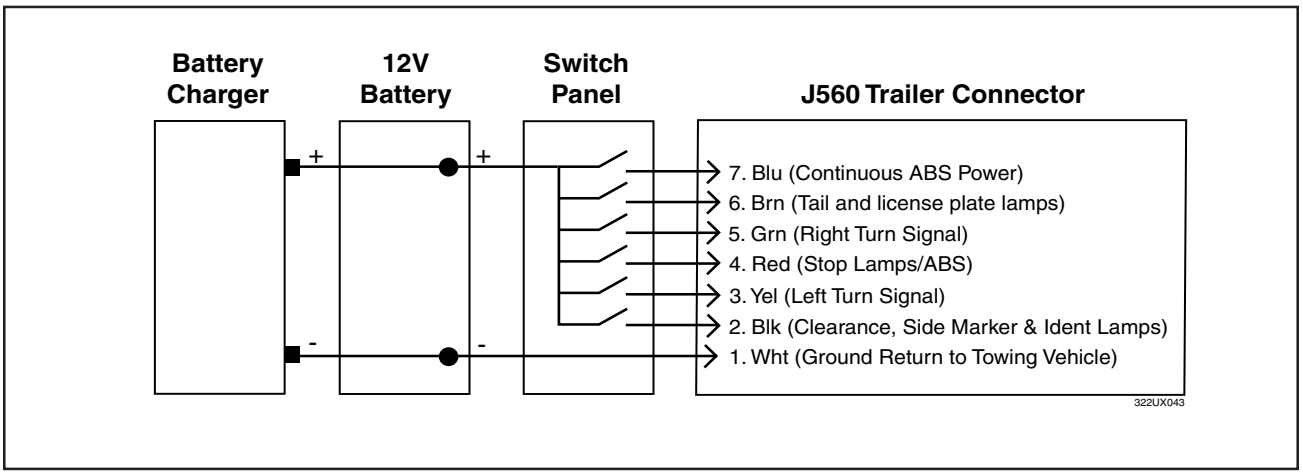

Figure 17, Typical Trailer Light Test Unit Suitable for Use with ABS

Current Faults

To access the flash code identification for a current fault, turn all power OFF to the ABS and perform the following steps.

1. Power the stop lamp circuit (red) and allow power to remain ON this circuit until the flash code has been identified (see step 3 below). The malfunction lamp will light with the stop lamps and remain ON (if the lamp goes out, there are no current faults).

NOTE: This circuit can be powered with a suitable light tester or by pulling down on the trailer brake lever in the cab.

2. Power the auxiliary circuit (blue) for one second, then power down for one second, then power back up and allow the power to remain ON until the flash code has been identified (power ON two times).

NOTE: This circuit can be powered with a suitable light tester or by turning the ignition ON and OFF on newer model tractors.

3. The malfunction lamp will begin flashing a code. The code is identified by the number of times the lamp illuminates.

NOTE: After the first flash sequence, the lamp will turn OFF briefly then repeat the flash sequence. This will continue for one minute allowing time to reach the trailer ABS light and record the number of flashes.

To identify the fault, the code will correspond to a specific fault found in the Flash Code Identification Table on page 35. Before any maintenance is performed, disconnect all power from the system.

In the unlikely event that more than one fault is present, the malfunction lamp will not turn OFF at power up after the original fault is repaired. Repeat the above steps to identify other faults. This allows repair personnel to focus on one fault at a time.

If a stored fault exists, it will be identified after the last stored fault is cleared (see Clearing Stored Faults). Current faults will always be displayed first and cannot be cleared.

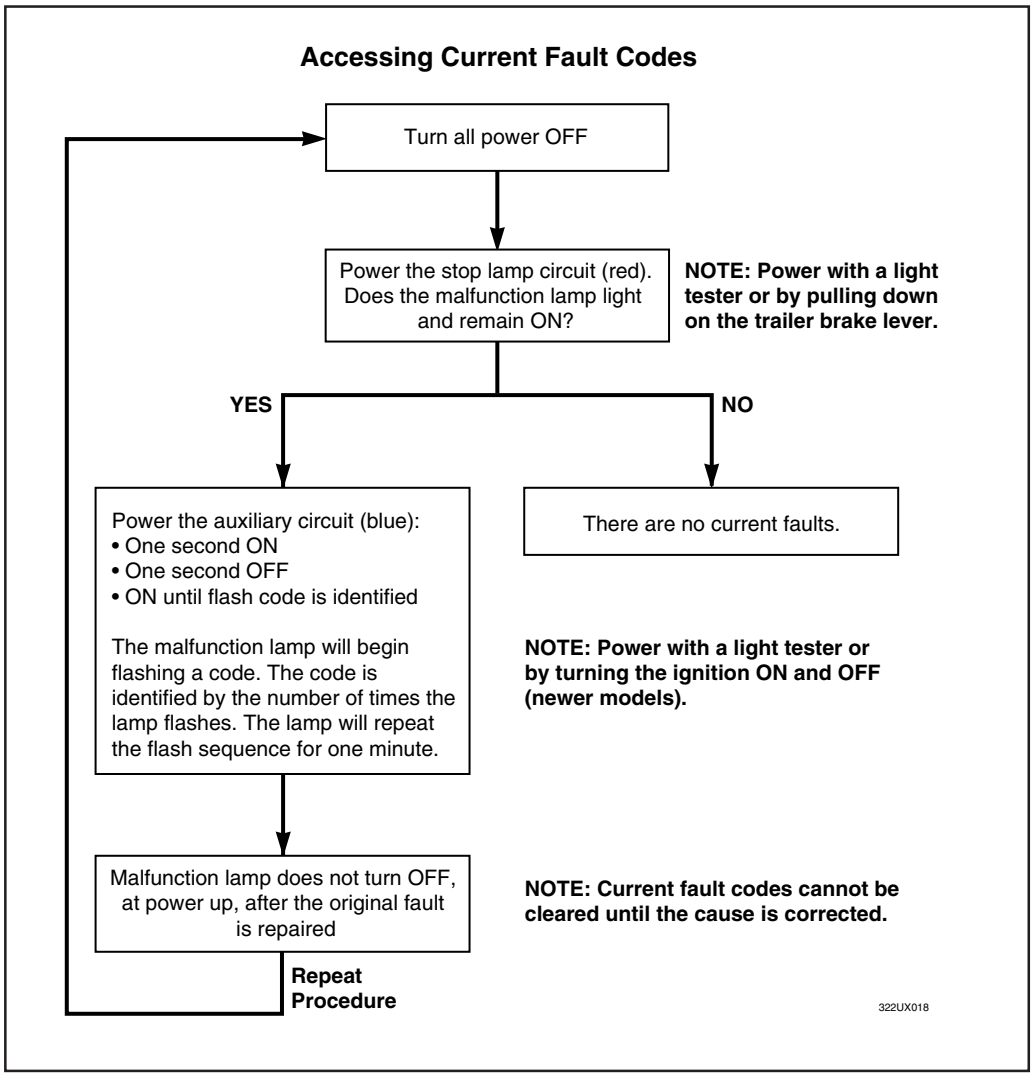

Figure 18, Accessing Current Fault Codes

Stored Faults

To access the flash code identification for a stored fault, turn all power OFF to the ABS and perform the following steps.

NOTE: This procedure should only be required during annual routine maintenance or when there is an intermittent problem that does not show up at stationary power up. For example, if a wheel locks up for an extended period of time because of a foundation brake malfunction.

1. Power the stop lamp circuit (red) and allow power to remain ON this circuit until the flash code has been identified (see step 3 below). The malfunction lamp will light with the stop lamps and then turn OFF.

NOTE: This circuit can be powered with a suitable light tester or by pulling down on the trailer brake lever in the cab.

2. Power the auxiliary circuit (blue) for one second, power down for one second, power back up for one second, power down for one second, then power back up and allow the power to remain ON until the flash code has been identified (power ON three times).

NOTE: This circuit can be powered with a suitable light tester or by turning the ignition ON and OFF on newer model tractors.

3. The malfunction lamp will begin flashing a code. The code is identified by the number of times the lamp illuminates.

NOTE: After the first flash sequence, the lamp will turn OFF briefly then repeat the flash sequence. This will continue for one minute allowing time to reach the trailer ABS light and record the number of flashes.

To identify the fault code, refer to the Flash Code Identification Table on page 35.

Before any maintenance is performed, all power must be disconnected from the system.

If more than one stored fault exists, it will be identified after you clear each fault.

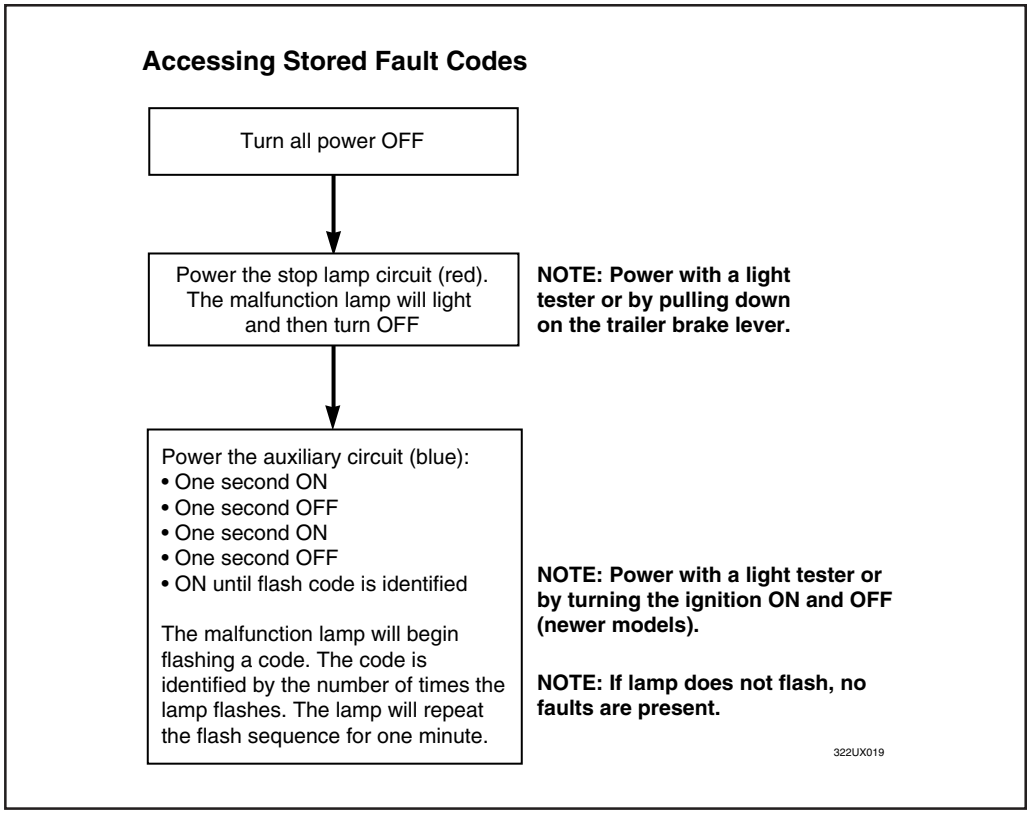

Figure 19, Accessing Stored Fault Codes

Clearing Stored Faults

To clear a stored fault, turn all power OFF to the ABS and perform the following steps:

1. Power the stop lamp circuit (red) and allow power to remain ON this circuit until the faults have been cleared (see step 3 below). The malfunction lamp will light with the stop lamps and turn OFF.

NOTE: This circuit can be powered with a suitable light tester or by pulling down on the trailer brake lever in the cab.

2. Power the auxiliary circuit (blue) for one second, power down for one second, power back up for one second, power down for one second, power up for one second, power down for one second, then power back up and allow the power to remain ON (power ON four times).

NOTE: This circuit can be powered with a suitable light tester or by turning the ignition ON and OFF on newer model tractors.

3. The malfunction lamp will begin flashing rapidly for ten seconds signaling the system is in the fault clear mode. The fault is actually cleared in the first fraction of a second but the delay is designed to allow time for the technician to confirm the fault clear mode was entered.

NOTE: This rapid flashing will occur even if no fault is present.

After the rapid flash sequence, the malfunction lamp will turn OFF and remain OFF unless another stored fault exists.

The malfunction lamp will flash a fault code shortly after the rapid flash sequence if more than one fault was stored in memory. After the appropriate number of flashes, the lamp will turn OFF briefly, then repeat the flash sequence. This will continue for one minute, giving personnel time to return from the tractor cab to check the count. To identify the code, refer to the Flash Code Identification Table.

NOTE: The ON and OFF periods for entering the above modes do not have to be exactly one second. However, one should use slow and deliberate motions when powering ON and OFF.

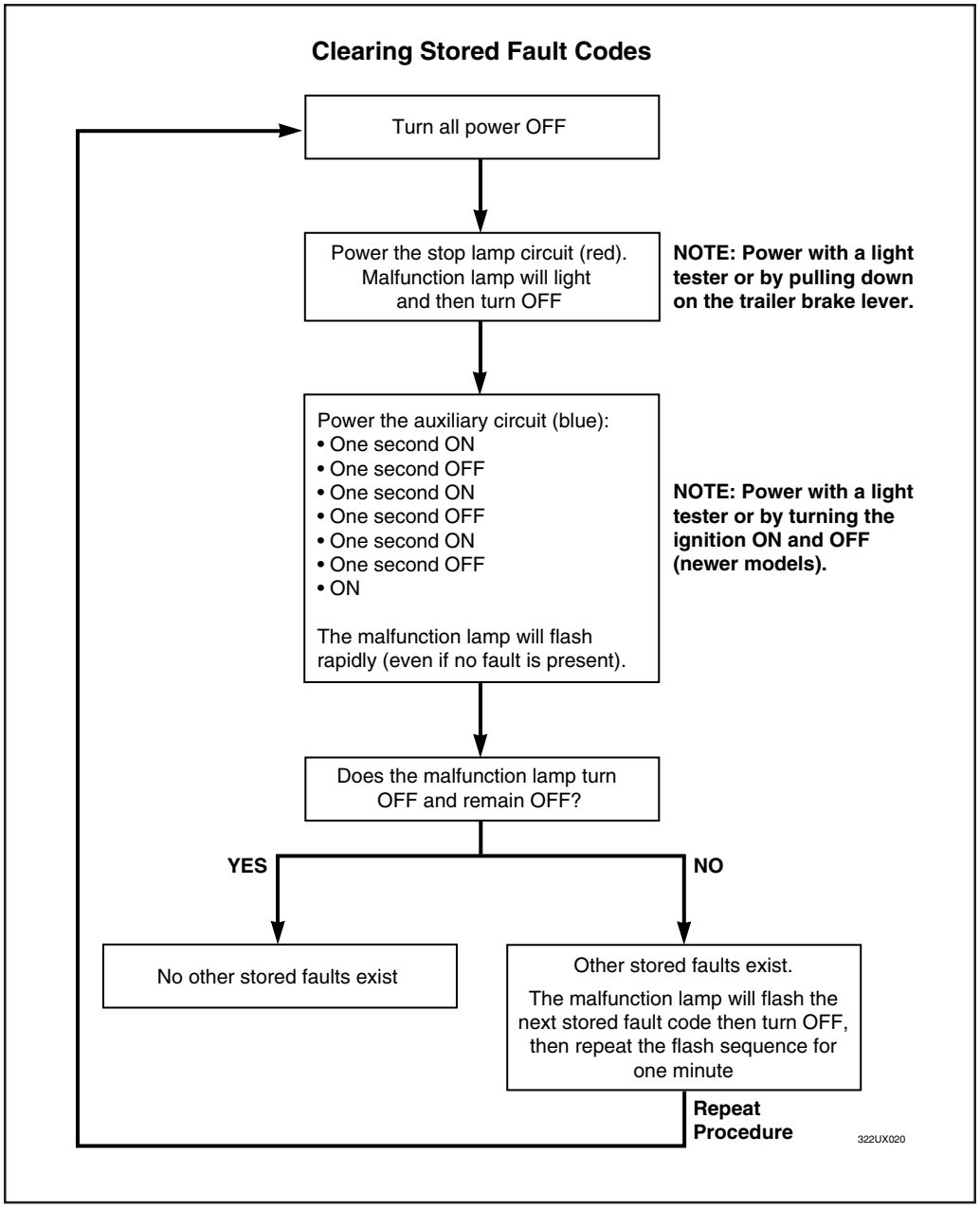

Figure 20, Clearing Stored Fault Codes

Malfunction Lamp Diagnostic Switch

All MBS-1P units have a malfunction lamp diagnostic switch. This diagnostic switch is located in the malfunction lamp wiring harness, behind the base rail where the malfunction lamp is mounted. The diagnostic switch works much like turning the auxiliary circuit ON and OFF on a newer model tractor. Pressing the button on the diagnostic switch two times will produce the same result as turning the auxiliary circuit ON and OFF two times to view a current fault.

There are subtle differences between using the diagnostic switch and the auxiliary circuit. When using the diagnostic switch, for instance, the warning lamp will not illuminate while the diagnostic switch is being pressed. Therefore, instead of holding the button down on the last desired cycle (equivalent to leaving the auxiliary circuit ON after the last desired cycle when using the auxiliary circuit method), the diagnostic switch must be released after three seconds to view the fault code. For example, to view a stored fault, perform the following steps:

1. Power the system using the stop lamp circuit (red) and/or the auxiliary circuit (blue), until the malfunction lamp goes OFF.

NOTE: This circuit can be powered with a suitable light tester or by turning the ignition ON for newer model tractors.

2. Press and hold the button for one second, release it for one second, press for one second, release for one second, then press and hold for three seconds and release.

3. The malfunction lamp will then flash a stored fault code if one is present.

NOTE: The malfunction lamp diagnostic switch will not operate once wheel speed is detected. Therefore, a stationary power up is required to activate the switch.

The malfunction lamp diagnostic switch is an exclusive Wabash National feature and has significant advantages. The technician is in close proximity to the malfunction lamp where all information from the ECM is received. A quick reference decal listing fault codes is located adjacent to the malfunction lamp for convenience. Another advantage is that it's not important which circuit is powered or if both are powered, thereby eliminating some confusion.

Flash Code	Fault	Comments
3	Curbside front sensor signal fault.	Check curbside front sensor gap.
4	Curbside front sensor connection fault.	Check curbside front sensor resistance and electrical connections.
5	Roadside front sensor signal fault.	Check roadside front sensor gap.
6	Roadside front sensor connection fault.	Check roadside front sensor resistance and electrical connections.
7	Curbside rear sensor signal fault.	Check curbside rear sensor gap.
8	Curbside rear sensor connection fault.	Check curbside rear sensor resistance and electrical connections.
9	Roadside rear sensor signal fault.	Check roadside rear sensor gap.
10	Roadside rear sensor connection fault.	Check roadside rear sensor resistance and electrical connections.
11	Secondary PCM fault.	Separate the ECM from the **secondary** PCM. Check that the connector and socket are secured together properly. If the fault persists, replace the secondary PCM.
12	Primary PCM fault.	Separate the ECM from the **primary** PCM. Check that the connector and socket are secured together properly. If the fault persists, replace the primary PCM.
14	Low voltage to ABS.	Check tractor and trailer wiring on auxiliary and stop lamp circuits. Check tractor battery and charging system.
15	Electronic Control Module failure.	Replace the ECM.
NOTE: A two-sensor system does not contain 7 through 10 blink codes and a one-PCM system does not include the 11 blink code. The primary PCM is the PCM closest to the Electronic Control Module (ECM) and the secondary PCM is the furthest from the ECM. 322UX044		

Figure 21, MBS-1P Flash Code Identification Table

Sensor Signal Faults (Trace)

While the trailer is moving, the MBS-1P continually compares the wheel speed signals from each sensor. If a wheel speed signal becomes inadequate, a sensor signal fault is detected. The malfunction lamp illuminates and the fault code is stored in memory. However, the fault detection mechanism is different from other faults because a bad signal fault is only detected when the trailer is moving. All other faults are electrical in nature and are detected at power up.

Because of this difference, sensor signal faults result in slightly different malfunction lamp behavior. The concept of a fault “trace” helps explain how the malfunction lamp functions. A fault trace is between a current fault and a stored fault.

- A current fault represents an existing fault condition. It causes the ABS malfunction lamp to be illuminated and disables trailer ABS.
- A stored fault is a record of a previous fault that no longer exists. It has no affect on normal malfunction lamp operation or ABS function.
- A fault trace is a temporary record of an earlier fault that slightly modifies malfunction lamp operation but does not affect ABS function. It normally clears itself within about two minutes of normal driving if the signal is okay.

NOTE: The concept of a fault trace only applies to sensor signal faults.

On the next stationary power up after a sensor signal fault is detected, the malfunction lamp remains ON due to the presence of a fault trace, providing an indication of a malfunction. A flash code read for current faults will indicate the appropriate sensor signal fault.

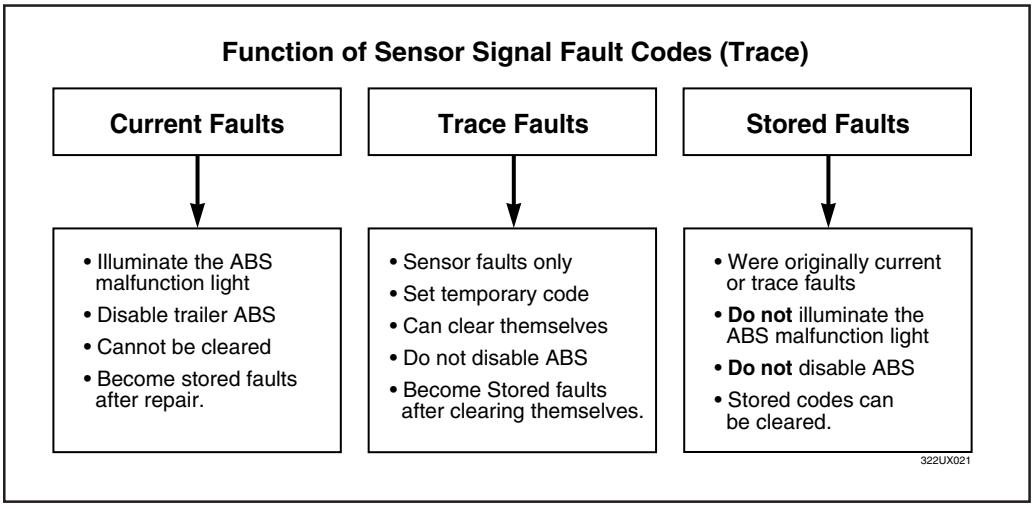

Figure 22, Trace Sensor Signal Codes

Unlike a regular fault, on the next stationary power up after the fault is repaired, the lamp will remain ON because the fault trace is still present. Once the trailer moves, and assuming both signals are now present, the malfunction lamp will go out and ABS function will be available. However, a trace of the fault still remains, even though the fault no longer exists as a current fault. If the trailer immediately stops and goes through a power OFF/ON cycle, the malfunction lamp will again remain illuminated until the trailer starts to move. The ECM still is not satisfied that the sensor signal fault is absolutely gone, taking about two minutes of normal driving above 5 mph before the trace of the fault is completely cleared with a restored signal. After the next power OFF/ON cycle, the malfunction lamp behaves as normal, illuminating for two seconds, then turning OFF. The fault trace is gone and will still be replaced by a stored fault in memory.

The fault trace can also be cleared in the shop by either of two methods:

- Jack up and spin only the wheel that had the faulty signal. The malfunction lamp will go OFF immediately and return to normal behavior. This approach does not clear the stored sensor signal fault. It is still available as a record, just like any other stored fault.

NOTE: All other wheels must remain stationary while spinning the wheel that introduced the fault.

- The second method of clearing the fault trace in the shop is to restore the sensor signal, then clear the signal fault. The fault trace will also be cleared. Proceed as usual to clear any stored fault.

The trace fault management philosophy provides an excellent compromise. It assures there is a fault indication on the next power up after sensor signal fault detection. After the signal has been restored, normal malfunction lamp behavior resumes within about two minutes of normal driving.

Malfunction Lamp Failure

If the malfunction lamp does not illuminate at power up but the solenoids perform the self-test (audible sound) or air brake sounds (chuffing sound) with treadle valve applied, check the following:

- The lamp power harness may be disconnected.
- The bulb may have a bad ground connection.
- The malfunction lamp may be faulty.

If the malfunction lamp does not illuminate on power up and the solenoids do not perform the self-test, check the following:

- The MBS-1P may not be receiving power. Check the Weather Pack 5-way power connector for a loose connection.
- The MBS-1P may have failed.

NOTE: When checking for proper operation, keep in mind the malfunction lamp circuit is only powered for two seconds at initial power up.

If a replacement part or other customer service is needed, please contact the Wabash National Corporation Customer Service Department at 765-771-5404.

MBS-1P Electrical Schematic

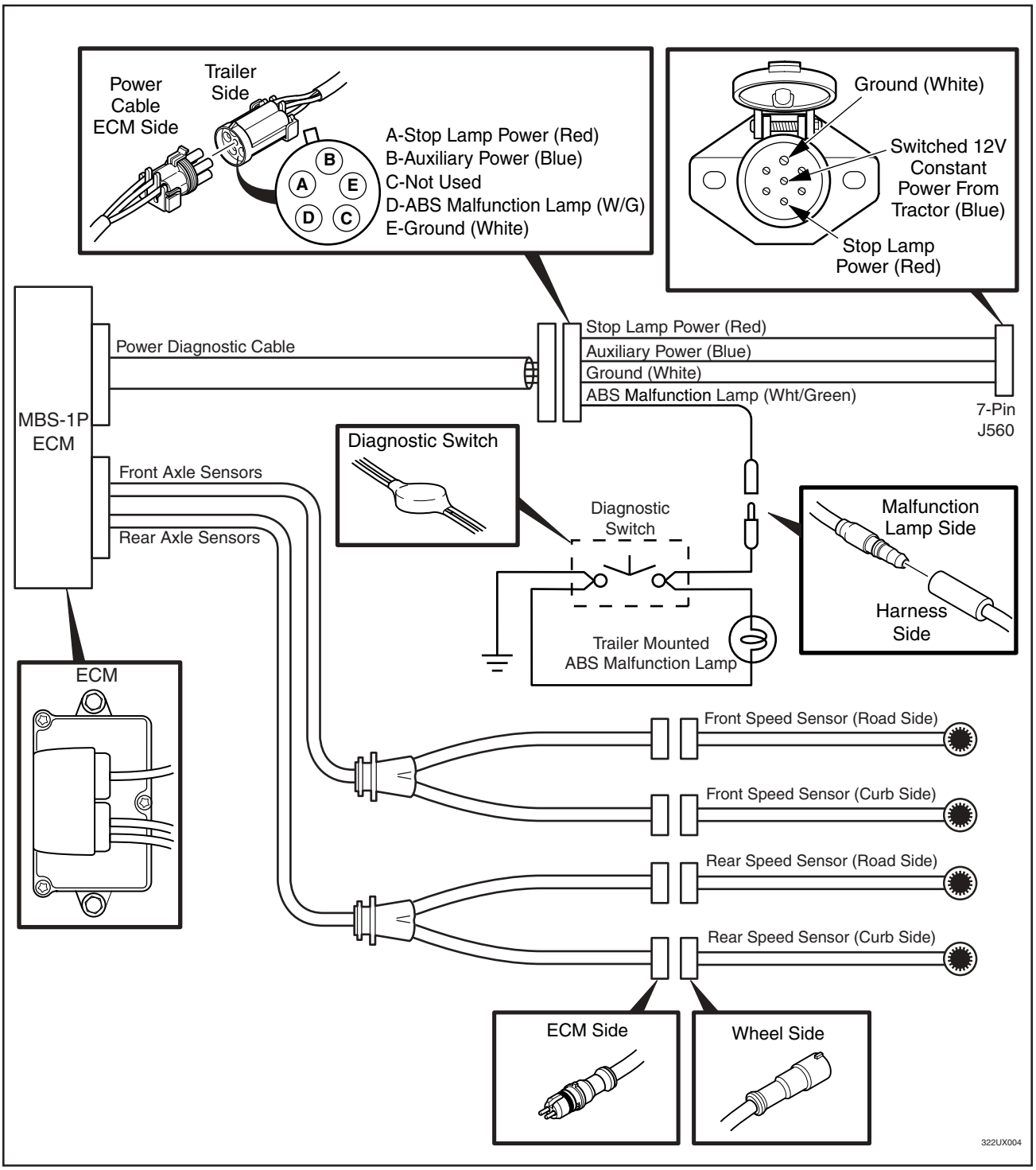

Figure 23, MBS-1P Electrical Schematic

Glossary

2S-1M	Two sensor, one modulator system.
2S-2M	Two sensor, two modulator system.
4S-1M	Four sensor, one modulator system.
4S-2M	Four sensor, two modulator system.
Axle-by-Axle Control	Axle-by-axle control is available only on 4S-2M system. Each sensed axle is controlled independently based on wheel speeds from both wheels on a single axle.
Side-by-Side Control	Side-by-side control is available only on 4S-2M system. Each side of the vehicle is controlled independently based on wheel speeds from sensed wheels on each side of the vehicle.
ACM	Antilock Control Module. Consists of ECM and PCM(s).
Current Faults	Faults that are active when the system is powered up which cause the malfunction lamp to remain illuminated.
ECM	Electronic Control Module.
Flash Code	A series of flashes of the malfunction lamp, providing fault code identification.
Malfunction Lamp	Located on the rear driver side corner of the vehicle just forward of the rear marker lamp, the malfunction lamp verifies the system is functioning properly or alerts the operator if a problem arises with the ABS.
MBS-1P	Wabash's ACM that upgraded the basic MBS-1 to add PLC and more ABS configuration options. Like the MBS-1, the MBS-1P uses the industry standard VR wheel speed sensor.
PCM	Pneumatic Control Module.
Stored Faults	Faults that were current faults at one time, but are no longer present and allow the malfunction lamp to go out at power up.

Trace Fault	A temporary record of a previous fault that slightly modifies malfunction lamp operation but does not affect ABS function.
Wheel Speed Sensors	Located either in the front and/or rear axle, depending on the geometry of each particular tandem, the wheel sensors receive wheel speed information.

Notes

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