EASY-STOP™ TRAILER ABS: 2S/1M (BASIC AND STANDARD), 2S/2M, 4S/2M AND 4S/3M SYSTEMS

MAINTENANCE MANUAL

MM33

WABCO

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You will find the current edition at: https://zf.com/cvliterature

1 General Information

1.1 Symbols Used in this Document

⚠ DANGER

Description of an immediate situation which will result in irreversible injury or death if the warning is ignored.

⚠ WARNING

Description of a possible situation which may result in irreversible injury or death if the warning is ignored.

⚠ CAUTION

Description of a possible situation which may result in irreversible injury if the warning is ignored.

NOTICE

Description of a possible situation which may result in material damage if the warning is ignored.

Important information, notices and/or tips

Reference to information on the Internet

Descriptive text

– Action step

1. Action step 1 (in ascending order)
2. Action step 2 (in ascending order)

⇨ Result of an action

• Listing

Indicating the use of a tool / WABCO tool

General Information

1.2 How to Obtain Additional Maintenance, Service and Product Information

If you have any questions about the material covered in this publication, or for more information about the WABCO product line, please contact WABCO Customer Care Center at 855-228-3203, by email at wabconacustomercare@zf.com, or visit our website: www.zf.com/cv.

Refer to the Society of Automotive Engineers (SAE) website to find all current SAE documents and standards applicable to WABCO products (such as SAE J447 and SAE J908 at www.sae.org).

Refer to the National Highway Traffic Safety Administration (NHTSA) website to find all current documents referenced in the manual at www.nhtsa.gov.

1.3 How to Obtain Parts and Kits

Contact the WABCO Customer Care Center at 855-228-3203 (United States and Canada); 800-953-0248 (Mexico). Email: wabconacustomercare@zf.com.

1.4 WABCO TOOLBOX PLUS™ Software

TOOLBOX PLUS™ Software provides PC diagnostic for WABCO products and can be purchased and downloaded from https://wabco.snapon.com.

The software User Guide, MM19047 can be obtained by visiting our Literature Center.



Purchase and Download TOOLBOX PLUS™
https://wabco.snapon.com



ZF Commercial Vehicle Literature Center
https://zf.com/cvliterature

1.5 WABCO Academy



www.wabco-academy.com

1.6 WABCO Online Product Catalog

www.wabco-customercenter.com

1.7 Your Direct Contact to ZF CVS

ZF CV Systems North America LLC

1220 Pacific Drive
Auburn Hills, MI 48326

Customer Care Center: (855) 228-3203

www.zf.com/cv

wabconacustomercare@zf.com

2 Safety Information

2.1 Provisions for a safe work environment

- Only experienced, trained and qualified automotive technicians may carry out work on the vehicle.
- Read this publication carefully.
- Follow all warnings, notices and instructions to avoid personal injury and property damage.
- Always abide by the vehicle's Original Equipment Manufacturer (OEM) specifications and instructions.
- Observe all accident regulations of the repair facility as well as regional and national regulations.
- The workplace should be dry, sufficiently lit and ventilated.
- Use personal protective equipment if required (safety shoes, protective goggles, respiratory protection and ear protectors).

Read and observe all Danger, Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.

⚠ WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

⚠ WARNING

Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip or fall over. Serious personal injury and damage to components can result.

⚠ WARNING

This product can expose you to chemicals including Nickel, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information, go to www.P65Warnings.ca.gov.

3 Introduction

3.1 Overview

This manual describes how WABCO's Easy-Stop™ Trailer Anti-Lock Braking System (ABS) works; answers some basic ABS questions; outlines procedures on how to adjust, test, remove and install ABS components, as well as how to test for faults in the system by using Blink Code Diagnostics; and illustrates ABS components and wiring and plumbing installation diagrams. This manual does not contain Original Equipment Manufacturer (OEM) installation instructions. New installations require the following documentation:

- Easy-Stop™ Basic (2S/1M without external diagnostics): TP97145
- Easy-Stop™ Standard (2S/1M, 2S/2M, 4S/2M with external diagnostics): TP97147
- Easy-Stop™ Standard (4S/3M with external diagnostics): TP97153

3.2 Scope of Blink Code Diagnostics in This Manual

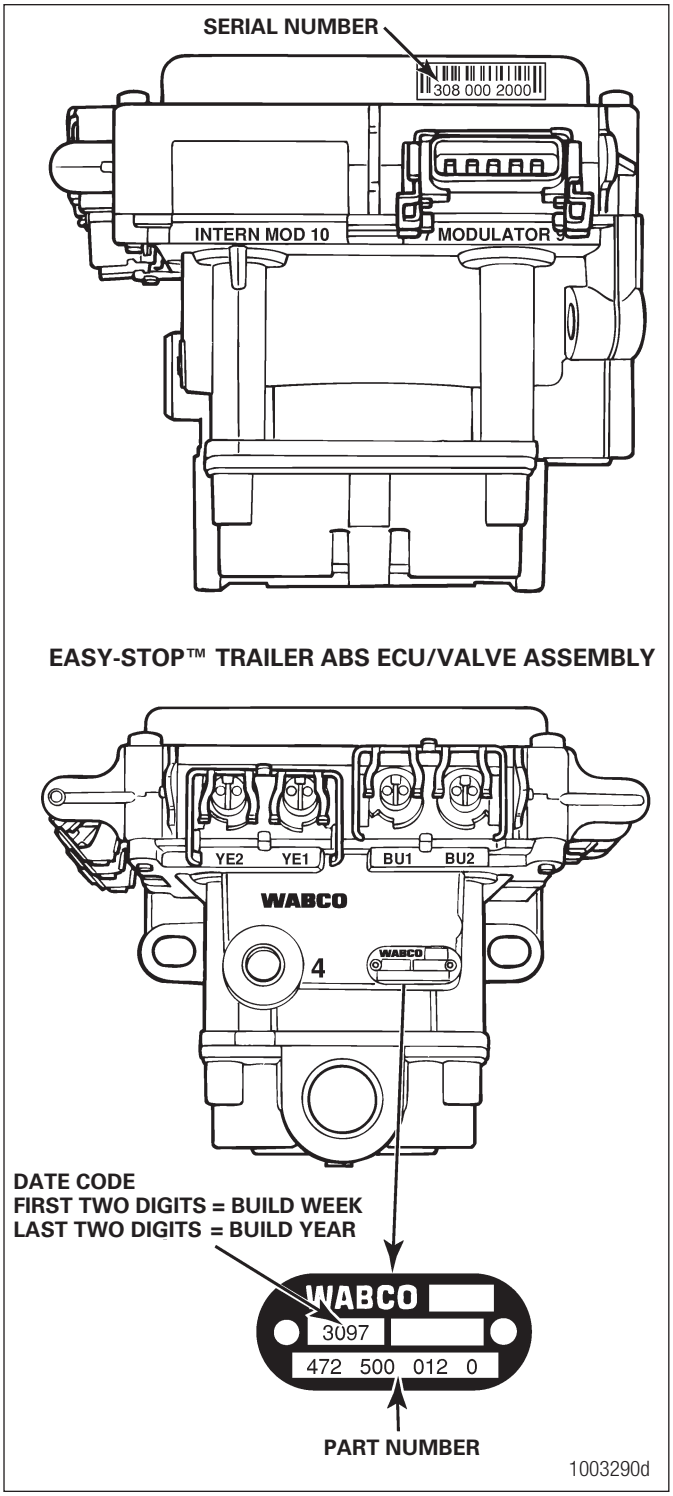
This manual contains blink code diagnostics information and instructions for most of the ECU/Valve Assemblies listed in Table A: Scope of Blink Code Diagnostics.

The serial and part numbers are located on the ECU/Valve Assembly.

Table A: Scope of Blink Code Diagnostics

ECU/Valve Assembly Part Number	Blink Code Diagnostics
472 500 001 0 (Serial Number 3080002745 and lower)	Contact WABCO for blink code diagnostics information.
472 500 001 0 (Serial Number 3080002746 and higher)	See Section 7 and Appendix A and B.
472 500 011 0 (Serial Number Not Applicable)	See Section 7 and Appendix C.
472 500 012 0 (Serial Number Not Applicable)	See Section 7 and Appendix A, B and C.
472 500 013 0 (Serial Number Not Applicable)	See Section 7 and Appendix A, B and C.

Introduction



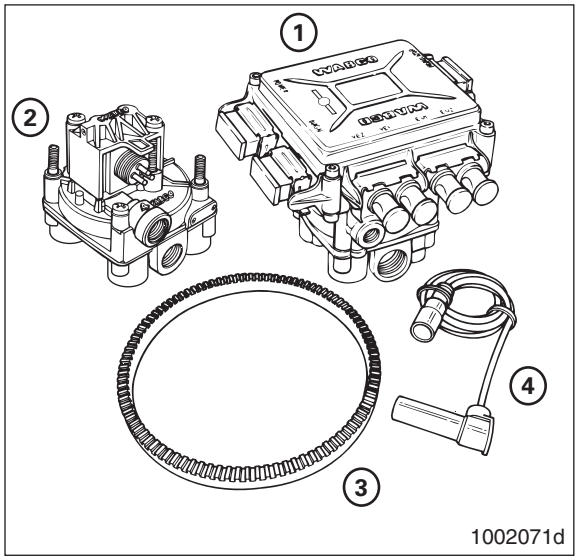
3.3 Easy-Stop™ Trailer ABS Parts

Parts book PB96133 lists WABCO Easy-Stop™ replacement parts. To obtain a copy, contact the WABCO Customer Care Center at 855-228-3203.

3.4 What Is WABCO's Easy-Stop™ Trailer ABS?

WABCO's Easy-Stop™ Trailer ABS is an electronic, self-monitoring system that works with standard air brakes. The major components of the system are the Electronic Control Unit (ECU)/Valve Assembly, ABS relay (modulator) valve, tooth wheel and wheel speed sensor.

ECU Part Numbers 472 500 001 0, 472 500 012 0 and 472 500 013 0 have an external diagnostics connector for use with a special diagnostic tool. These models are also compatible with an MPSI Pro-Link® 9000 diagnostic tool and WABCO cartridge. ECU/Valve Assembly 472 500 011 0 does not have a diagnostic connector port. Diagnostic procedures for all of these ECUs are detailed in Section 7, "Diagnostics" of this manual.



1 ECU/VALVE ASSEMBLY

2 EXTERNAL ABS RELAY VALVE (NOT USED IN 1M CONFIGURATIONS)

3 TOOTH WHEEL

4 WHEEL SPEED SENSOR

The ABS configuration defines the number of wheel speed sensors and ABS relay valves used in a system. For example, a 2S/1M configuration includes two wheel sensors and one ABS relay valve. A 2S/2M configuration includes two wheel sensors and two relay valves. A 4S/2M configuration includes four wheel sensors and two ABS relay valves.

3.5 How Trailer ABS Works

WABCO ABS is an electronic system that monitors and controls wheel speed during braking. The system works with standard air brake systems.

ABS monitors wheel speeds at all times and controls braking during wheel lock situations. The system improves vehicle stability and control by reducing wheel lock during braking.

The ECU receives and processes signals from the wheel speed sensors. When the ECU detects a wheel lockup, the unit activates the appropriate modulator valve, and air pressure is controlled.

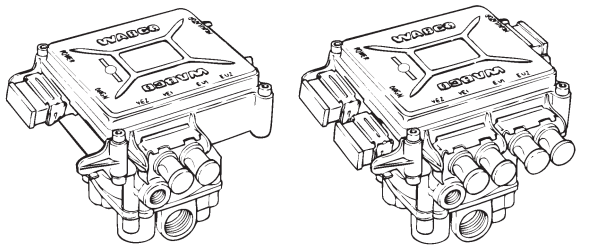
In the event of a malfunction in the system, the ABS in the affected wheel(s) is disabled; that wheel still has normal brakes. The other wheels keep the ABS function.

An ABS warning lamp lets drivers know the status of the system.

4 System Components

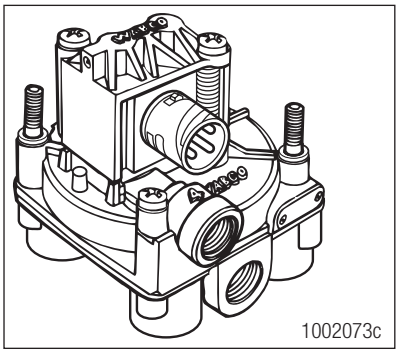
4.1 ECU/Valve Assembly

- 12 volt
- Integrated ECU and ABS relay valve
- The 2S/1M Basic ECU/Valve Assembly does not have an external diagnostics connector.



4.2 ABS External Valve

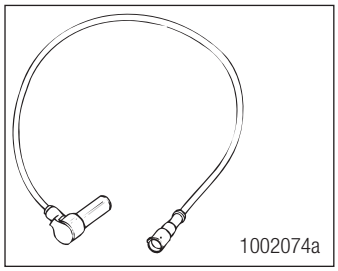
- Controls air pressure to the brake chambers where it is plumbed.
- During ABS operation, the valve adjusts air pressure to the brake chambers to control braking and prevent wheel lock.
- Used in conjunction with ECU/Valve Assembly for 2M or 3M systems.



System Components

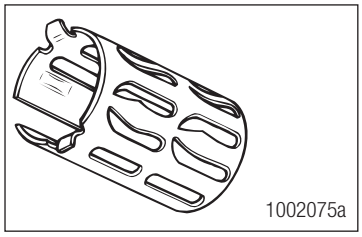
4.3 Sensor with Molded Socket

- Measures the speed of a tooth wheel rotating with the vehicle wheel.
- Produces an output voltage proportional to wheel speed.



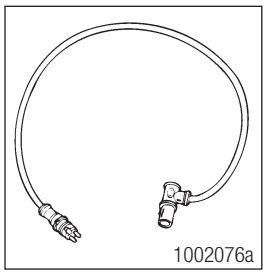
4.4 Sensor Spring Clip

- Holds the wheel speed sensor in close proximity to the tooth wheel.



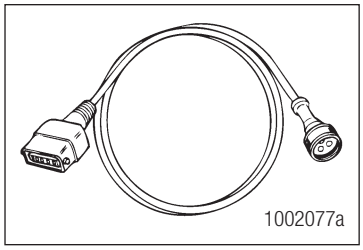
4.5 Sensor Extension Cable

- Two-wire cable with molded-on connector.
- Connects the wheel speed sensor to the ECU.



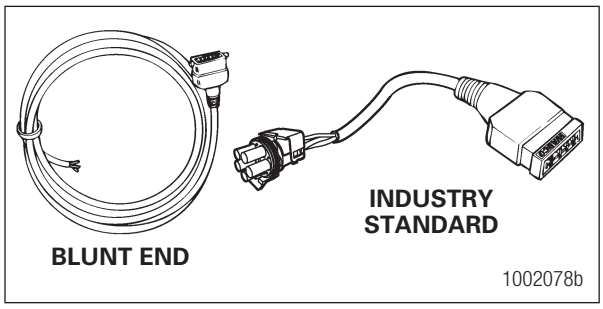
4.6 Connection Cable for ABS External Valves

- Three-wire cable with connector.
- Connects the ABS external valve to the ECU.
- “Y” cable for use with 4S/3M configurations also available.



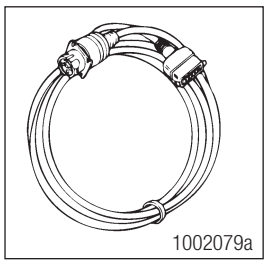
4.7 Power Cables

- Connects power to the ECU and provides a connection for the warning lamp.
- Available with blunt-end four- or five-wire cable or four- or five-wire industry standard harness connector at one end.
- Molded connector on opposite end used to attach cable to ECU.



4.8 Diagnostic Cable

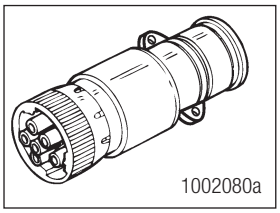
- Provides for blink code diagnostics and diagnostics using the MPSI Pro-Link® 9000 diagnostic tool.
- Five-wire cable with over-molded connector to ECU on one end and SAE J1587 diagnostic connector over-molded on the other end.



System Components

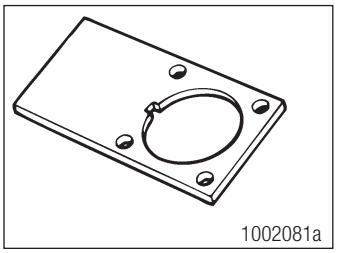
4.9 Diagnostic Tool

- Sealed switch and lamp that connects to the SAE J1587 diagnostic connector.
- Used to activate blink code diagnostics, reconfigure the ECU and test the ECU installation.
- Protective dust cap included.
- Designed to remain on the trailer at all times.



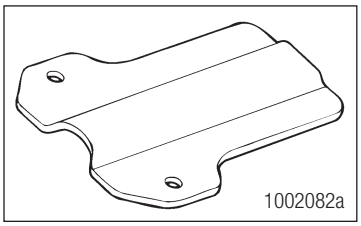
4.10 Diagnostic Cable Mounting Bracket

- Bracket used to mount the diagnostic cable assembly to the trailer.



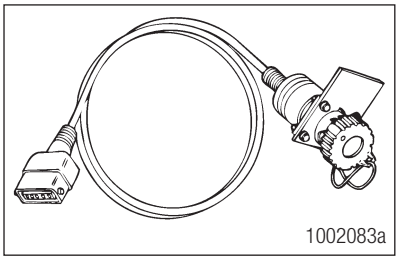
4.11 ECU/Valve Assembly Mounting Bracket

- Bracket used to remote mount the ECU/Valve Assembly to the trailer frame.



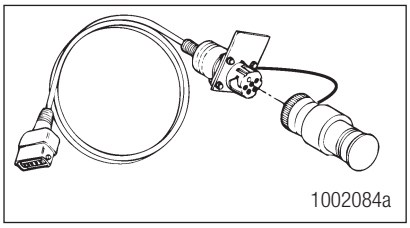
4.12 Diagnostic Cable Assembly with Protective Cap

- Diagnostic cable mounted to the bracket with a protective cap on the SAE J1587 diagnostic connector.



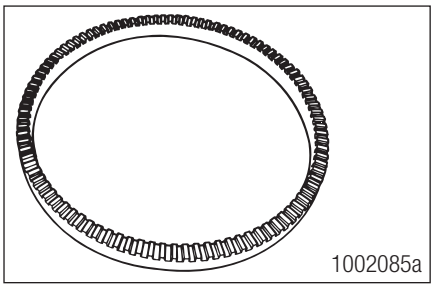
4.13 Diagnostic Cable Assembly with Diagnostic Tool

- Diagnostic cable mounted to the bracket with a diagnostic tool connected to the SAE J1587 diagnostic connector.
- Protective dust cap included.



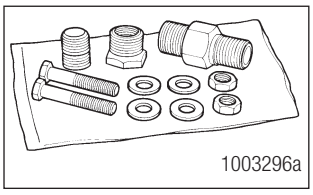
4.14 Tooth Wheel

- A machined ring mounted to the machined surface on the hub of each ABS-monitored wheel.



4.15 Installation Hardware Kit

- Contains Schedule 80 NPT pipe nipple fittings and Grade 8, 3/8-inch SAE bolts for proper mounting of ABS components to the trailer frame or reinforced air tanks.



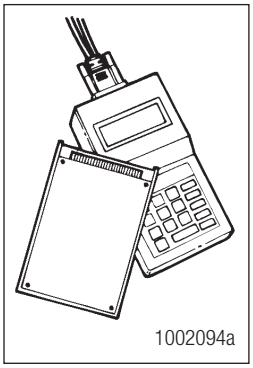
4.16 Easy-Stop™ Trailer ABS Warning Label

- Provides information about the operation of the ABS warning lamp and illustrates blink code fault locations.
- Label is self-adhesive and is mounted on the trailer near the ABS warning lamp.
- If there is no warning label on your trailer, let your supervisor know. Labels are available from WABCO. Ask for Part Number TP95172.

4.17 MPSI Pro-Link® 9000 Diagnostic Tool

- Provides diagnostic and testing capability for ABS components.
- Requires a cartridge (version 4.0 or higher) designed for use with WABCO ABS.

The Pro-Link® 9000 diagnostic tool is not available from WABCO. Contact Kent-Moore at 800-328-6657 to order.



5 ABS Questions and Answers

5.1 The Electronic Control Unit (ECU)

5.1.1 How do you activate the ECU?

In a constant-powered system, the ECU activates and then begins a self-diagnostic check of the system when you turn the ignition ON. In a stoplight-powered system, the ECU activates when you apply the brakes. All trailers manufactured on or after March 1, 1998 will be equipped with ABS that has constant power capability with stoplight power as back-up.

5.1.2 What if the ECU finds a fault in an ABS component during normal operation?

If the ECU senses a fault in the system (with an ABS valve, for example), the ECU turns the trailer ABS warning lamp on and returns the wheel controlled by that valve to standard braking. Or, if the ECU finds a fault with one wheel speed sensor in a system that has four sensors on a tandem axle, the ECU uses information from the other sensor on the same side of the tandem to ensure continuous ABS function. The ECU continues to provide full ABS function to the wheels unaffected by system faults. However, the ECU will turn the trailer ABS warning lamp on to tell the driver a fault has been detected in the system.

5.1.3 How does the ECU respond to a wheel approaching lock-up?

The ECU directs the ABS relay valve to function as a modulator valve and adjust air pressure to the chambers up to five times a second. This pressure adjustment allows a wheel (or wheels) to rotate without locking.

5.2 The ABS Warning Lamp

5.2.1 What is the function of the warning lamp?

The warning lamp enables a driver to monitor the ABS at all times. Refer to the OEM operating manual for the mounting location of the warning lamp.

5.2.2 How does the warning lamp operate?

How the warning lamp operates depends on whether the ABS is powered by stoplight or constant power:

- If the trailer was manufactured prior to February 28, 1998, or was manufactured outside of the United States, the ABS may be either stoplight or constant powered.
- If the trailer was manufactured March 1, 1998 or later — and was manufactured in the United States — it will have constant power capability. This is mandated by Federal Motor Vehicle Safety Standard (FMVSS) 121.

Check your vehicle specification sheet to determine the type of ABS power. Table B — Stoplight Power and Table C — Constant Power, in this section, illustrate warning lamp operation on stoplight and constant powered ABS systems.

ABS Questions and Answers

Table B: Stoplight Power

System Power Comes from Activating the Stoplight Circuit.			
Brakes	**Fault in System**	**Vehicle Speed**	**Warning Lamp**
Released	N.A.	N.A.	OFF
Applied	NO	Less than 4 mph	ON for 3 seconds, then goes OFF.
Applied	NO	Greater than 4 mph	Flashes once, then stays OFF for remainder of stop.
Applied	YES	N.A.	ON

Table C: Constant Power

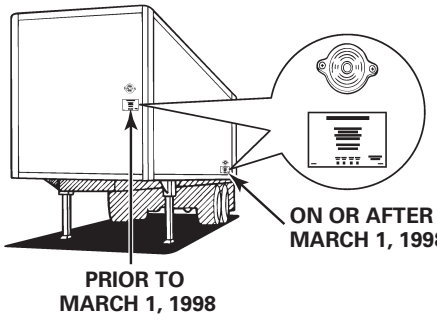
System Is Powered When Ignition Is Switched ON.				
Brakes	**Ignition**	**Fault in System**	**Vehicle Speed**	**Warning Lamps (Trailer and Dash)**
Released	OFF	N.A.	N.A.	OFF
Released	ON	NO	Less than 4 mph	ON for 3 seconds, then goes OFF.
Released	ON	NO	Greater than 4 mph	OFF
Released	ON	YES	N.A.	ON
Applied	OFF	NO	Less than 4 mph	ON for 3 seconds, then goes OFF.
Applied	OFF	NO	Greater than 4 mph	Flash once, then stay OFF for remainder of stop.
Applied	OFF	YES	N.A.	ON
Applied	ON	NO	Less than 4 mph	ON for 3 seconds, then goes OFF.
Applied	ON	NO	Greater than 4 mph	OFF
Applied	ON	N.A.	N.A.	ON

An ECU with part number 472 500 001 0 manufactured **prior to September 1997** requires all sensed wheels to detect a 4 mph signal to shut off the ABS warning lamp. Do not confuse this with a faulty ABS system. If the warning lamp stays on when the brakes are applied to a moving vehicle, service the ABS system.

Most trailers manufactured **prior to February 1998** require that the brakes be applied to operate the ABS warning lamp. If the warning lamp stays on when the brakes are applied to a moving vehicle, service the ABS system.

5.2.3 What does the trailer ABS warning lamp mean to service personnel?

The trailer ABS warning lamp indicates the status of the trailer ABS. If it comes **ON** and stays **ON** when you apply the brakes to a moving vehicle, there is an ABS malfunction. It is normal for the lamp to come **ON** and go **OFF** to perform a bulb check, but it should not stay **ON** when the vehicle is moving above 4 mph. As with any safety system, it is important not to ignore this warning. If the warning lamp indicates a malfunction, the vehicle can be operated to complete the trip, but it is important to have it serviced as soon as possible using the appropriate maintenance manual to ensure proper braking performance and that the benefits of ABS remain available to your drivers. Typical ABS warning lamp mounting locations are illustrated.



TYPICAL ABS WARNING LAMP MOUNTING LOCATIONS

1003294c

For more information, contact the WABCO Customer Care Center at 855-228-3203.

5.2.4 Can you continue to operate a vehicle when the warning lamp indicates a fault?

Yes. When a fault exists in the ABS, standard braking returns to the affected wheel, and the ABS still controls other monitored wheels. This lets you complete the trip. You should not ignore the warning lamp and should have the vehicle serviced as soon as possible after the lamp comes **ON** and stays **ON**.

5.3 Types of Faults

5.3.1 What is a “fault” in the system?

A fault in the system is a problem that can exist in the ABS or in the system’s components. Faults can be either existing faults or intermittent stored faults.

5.3.2 What is an existing fault?

An **existing** fault is a problem that exists currently in the system. For example, a damaged sensor cable is an existing fault that the ECU will detect and store into memory until you identify the cause, repair the cable and clear the fault from the ECU.

5.3.3 What is an intermittent fault?

An **intermittent** fault is a problem that usually occurs only under certain driving conditions. For example, the ECU may detect a loose cable or wire or receive an erratic signal from a wheel sensor. Since intermittent faults can be unpredictable and may only happen periodically, you can use information stored in ECU memory to find and correct the loose cable or wire.

5.3.4 Is an intermittent fault difficult to locate and repair?

It can be, because you may not be able to easily see the cause of the problem. WABCO recommends that you write down intermittent faults to help you isolate a fault that recurs over a period of time.

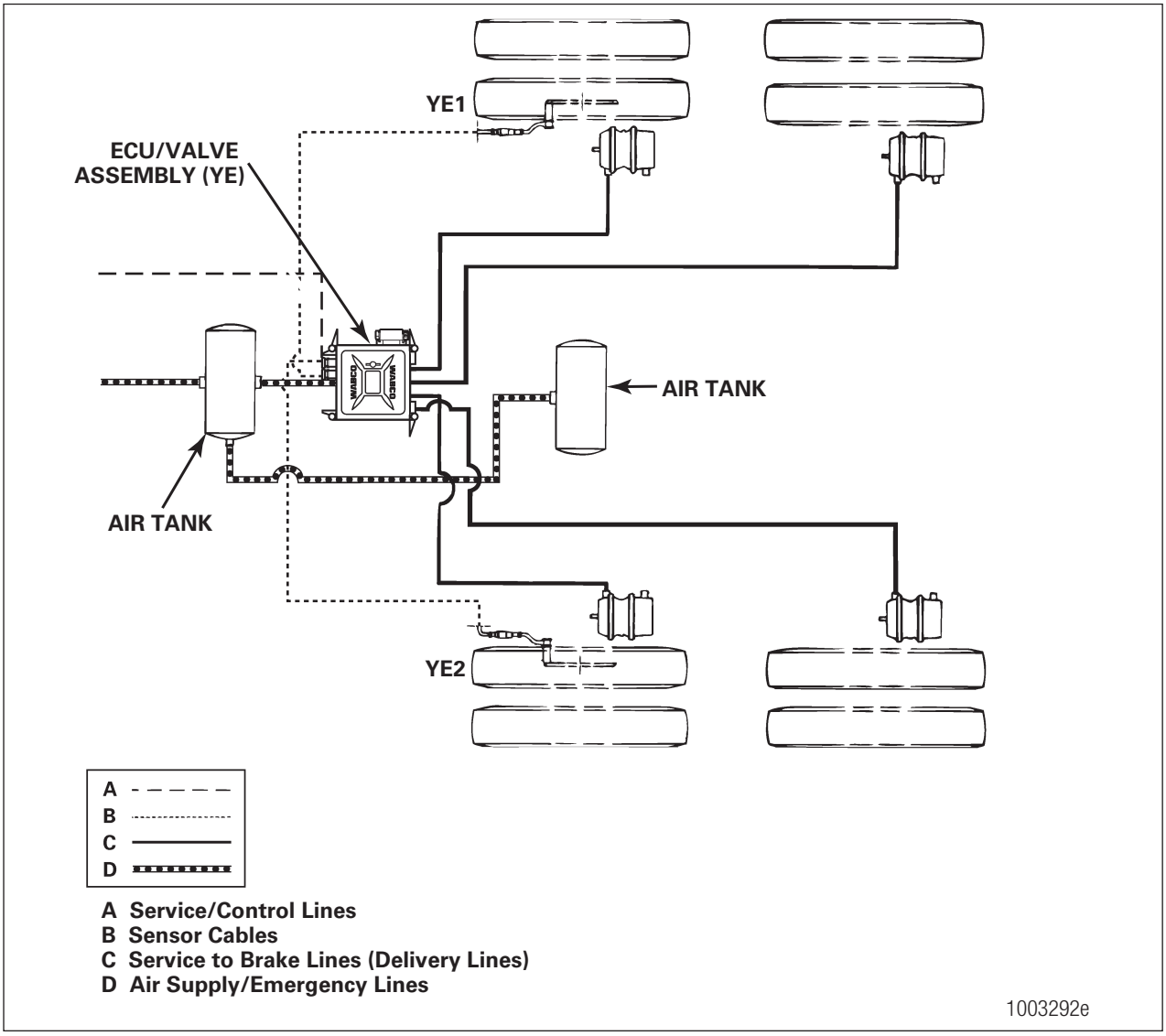
5.3.5 Can the ECU store more than one fault in memory?

Yes. And the ECU retains existing and intermittent faults in memory even when you turn OFF the power to the ECU.

> For part number information, refer to PB96133. Copies are available from the WABCO Customer Care Center at 855-228-3203.

6 System Configurations

6.1 2S/1M Trailer ABS Configuration Without External Diagnostics Capability Installation Diagram



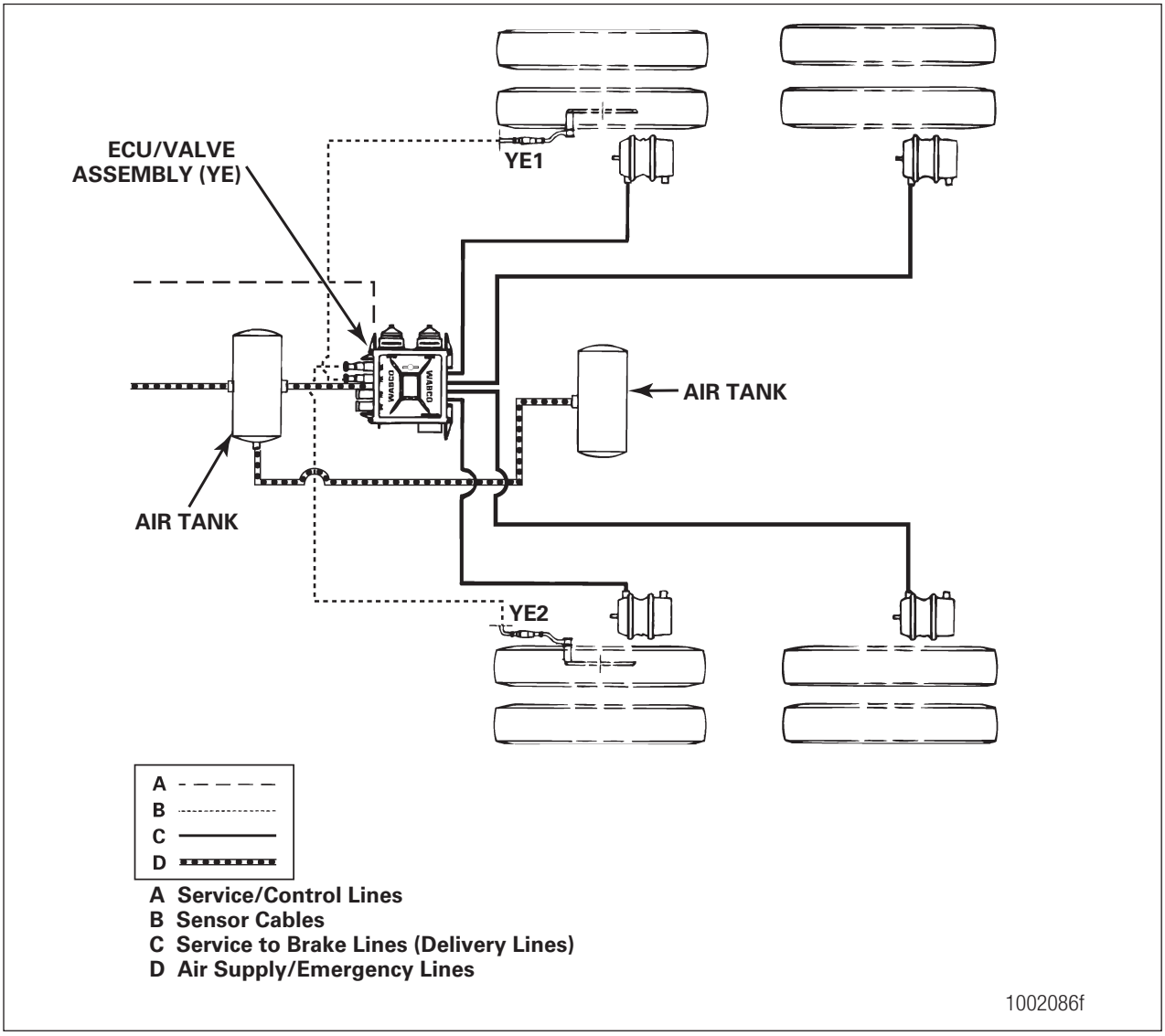
For direct tank-mounted installations, see “How to Install the ECU/Valve Assembly,” in Section 8, “Component Replacement”.

Typical Application:

- Single-Axle Dolly
- Single- and Tandem-Axle Semi-Trailer

Sensors may be installed on either axle, depending upon suspension and other vehicle characteristics.

6.2 2S/1M Trailer ABS Configuration with External Diagnostics Capability Installation Diagram



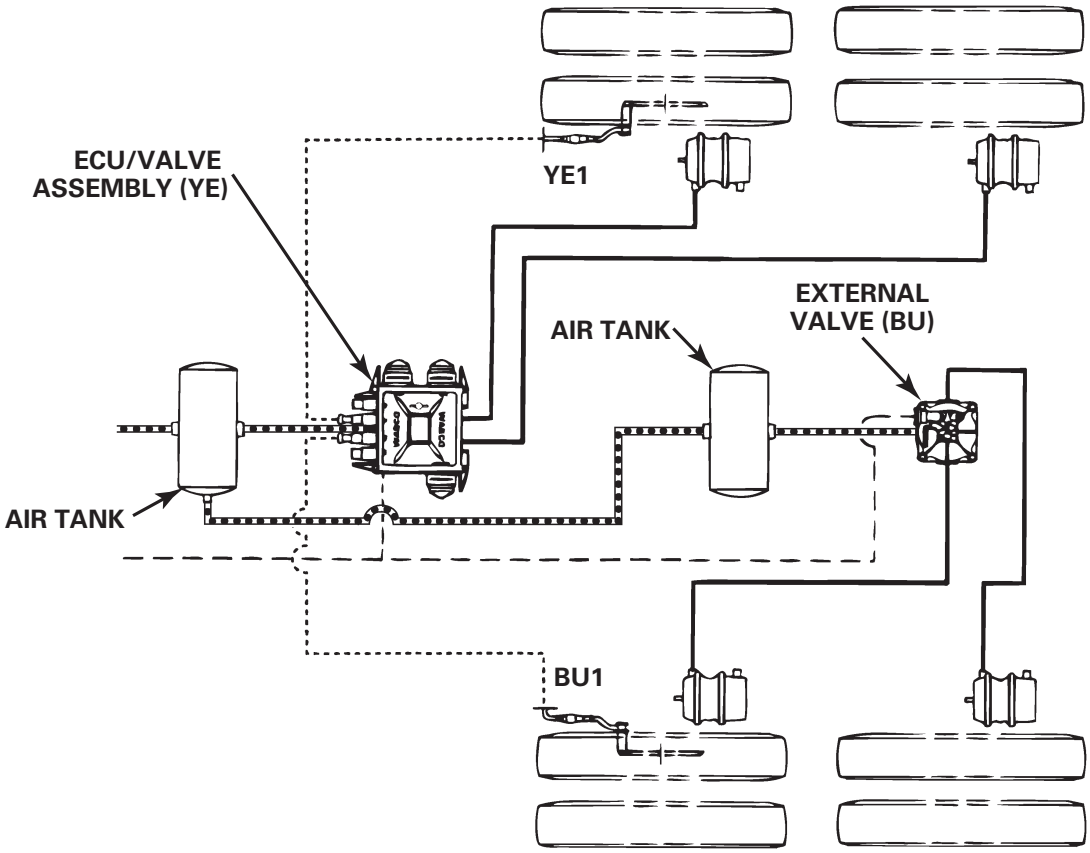
For direct tank-mounted installations, see “How to Install the ECU/Valve Assembly” in Section 8, “Component Replacement”.

Typical Application:

- Single-Axle Dolly
- Single- and Tandem-Axle Semi-Trailer

Sensors may be installed on either axle, depending upon suspension and other vehicle characteristics.

6.3 2S/2M Trailer ABS Configuration Installation Diagram



A Service/Control Lines
B Sensor Cables
C Service to Brake Lines (Delivery Lines)
D Air Supply/Emergency Lines

1002087e

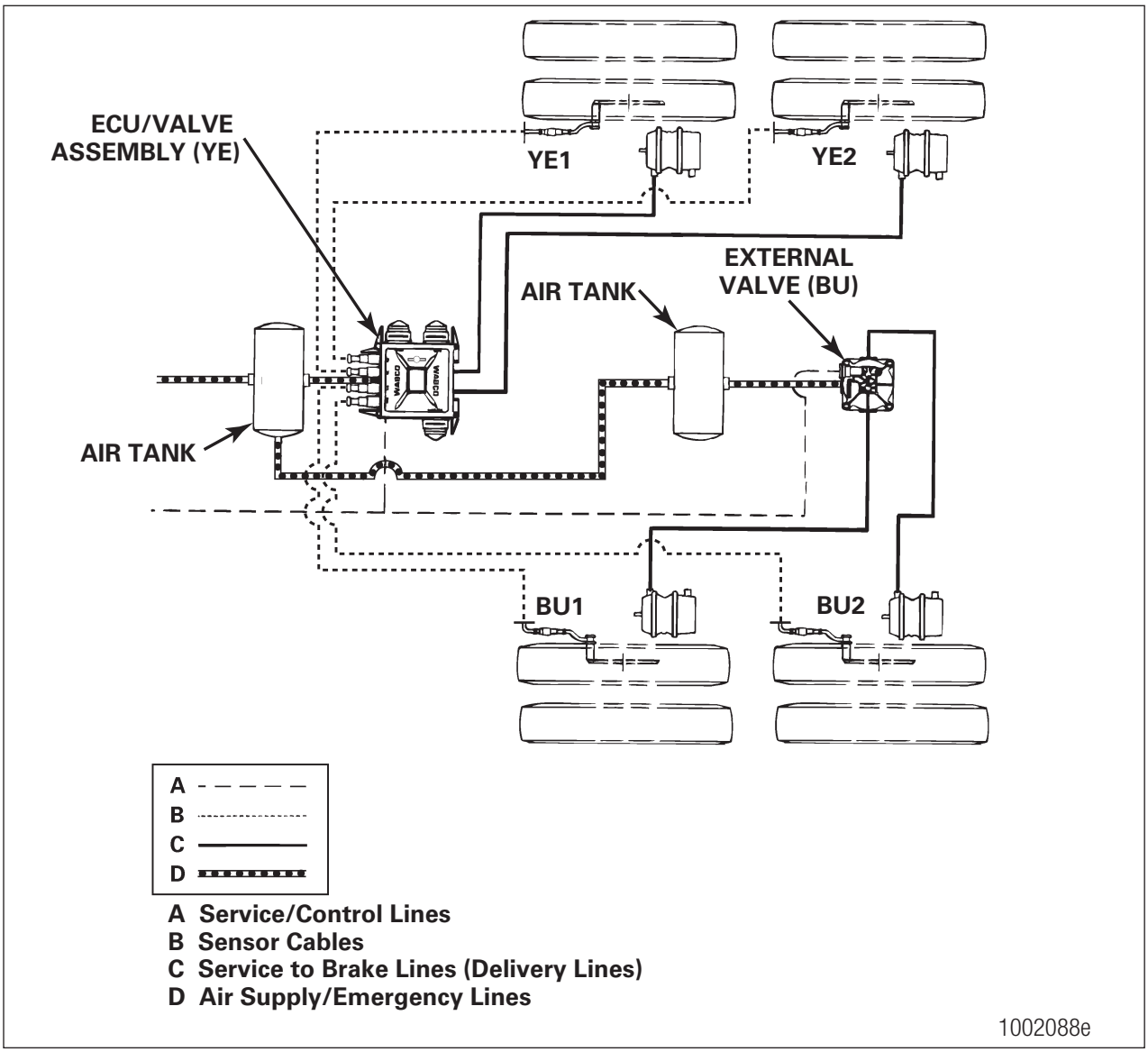
For direct tank-mounted installations, see “How to Install the ECU/Valve Assembly,” in Section 8, “Component Replacement”.

Typical Application:

- Single- and Tandem-Axle Semi-Trailer

Sensors may be installed on either axle, depending upon suspension and other vehicle characteristics.

6.4 4S/2M Trailer ABS Configuration Installation Diagram

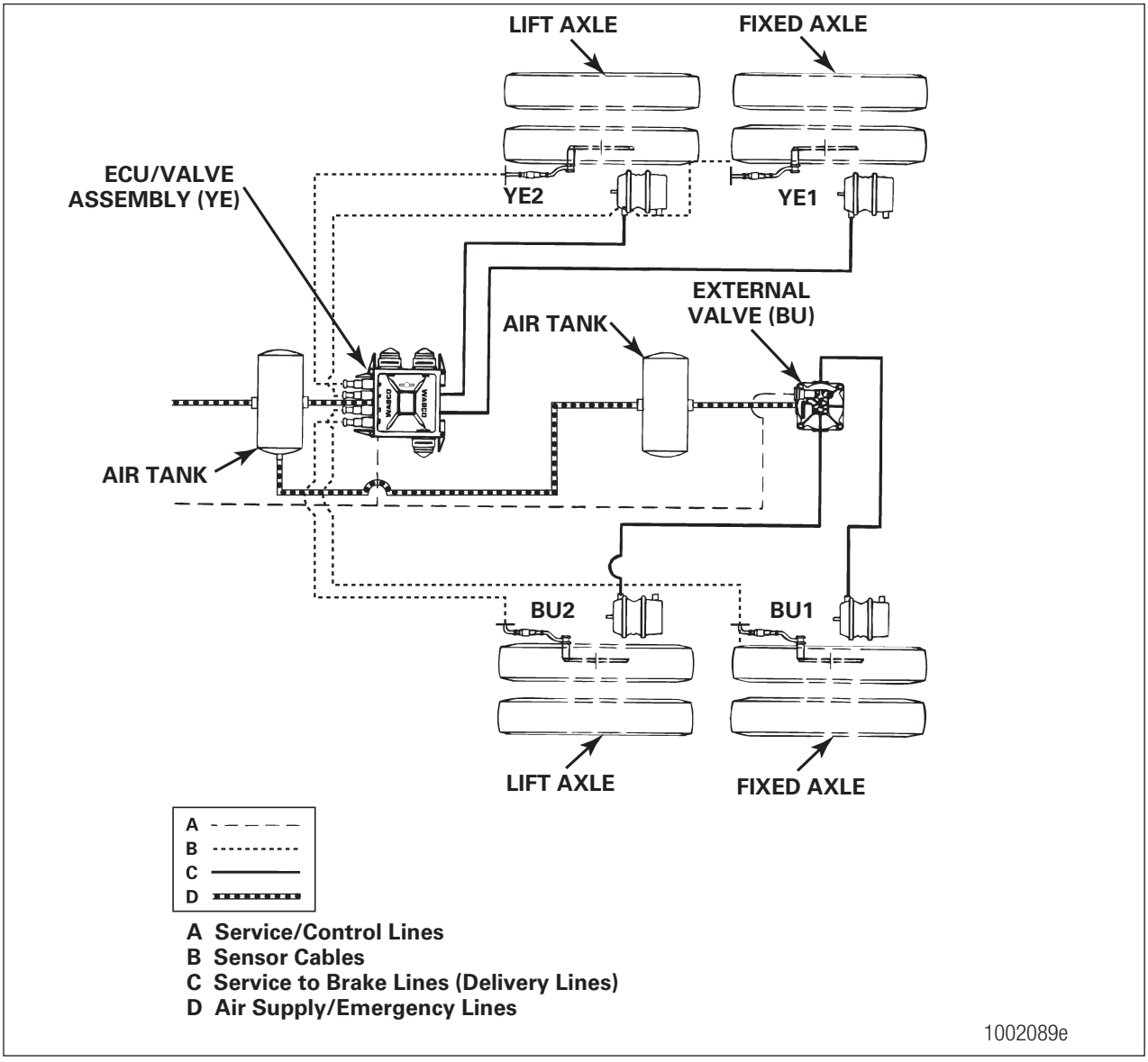


For direct tank-mounted installations, see “How to Install the ECU/Valve Assembly,” in Section 8, “Component Replacement”.

Typical Application:

- Tandem and Tri-Axle Semi-Trailer

6.5 4S/2M Trailer ABS Configuration Diagram for Lift Axle Applications (Forward Lift Axle Installation Diagram)

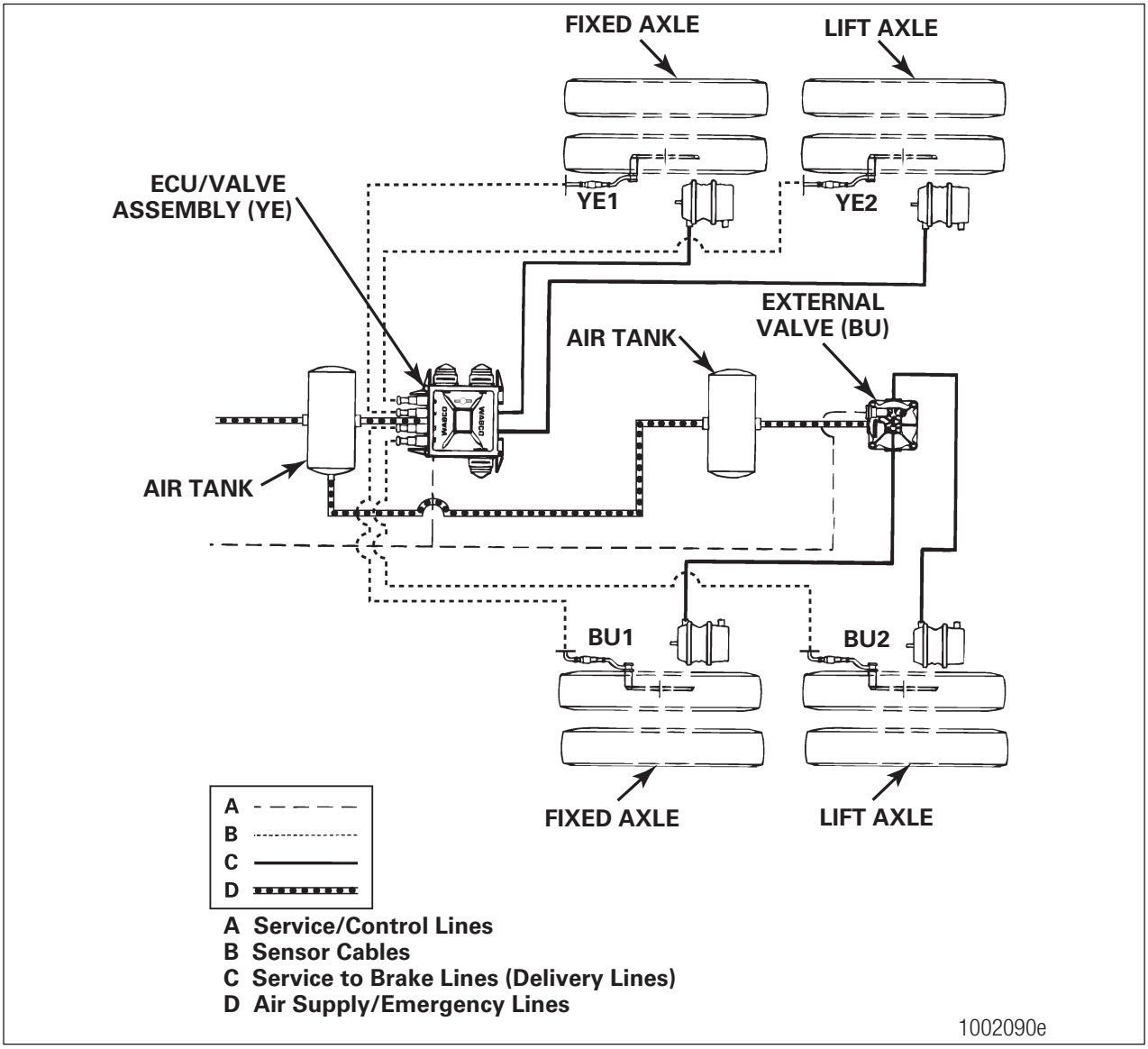


For direct tank-mounted installations, see “How to Install the ECU/Valve Assembly,” in Section 8, “Component Replacement”.

Typical Application:

- Tandem and Tri-Axle Semi-Trailer

6.6 4S/2M Trailer ABS Configuration Diagram for Lift Axle Applications (Rear Lift Axle Installation Diagram)

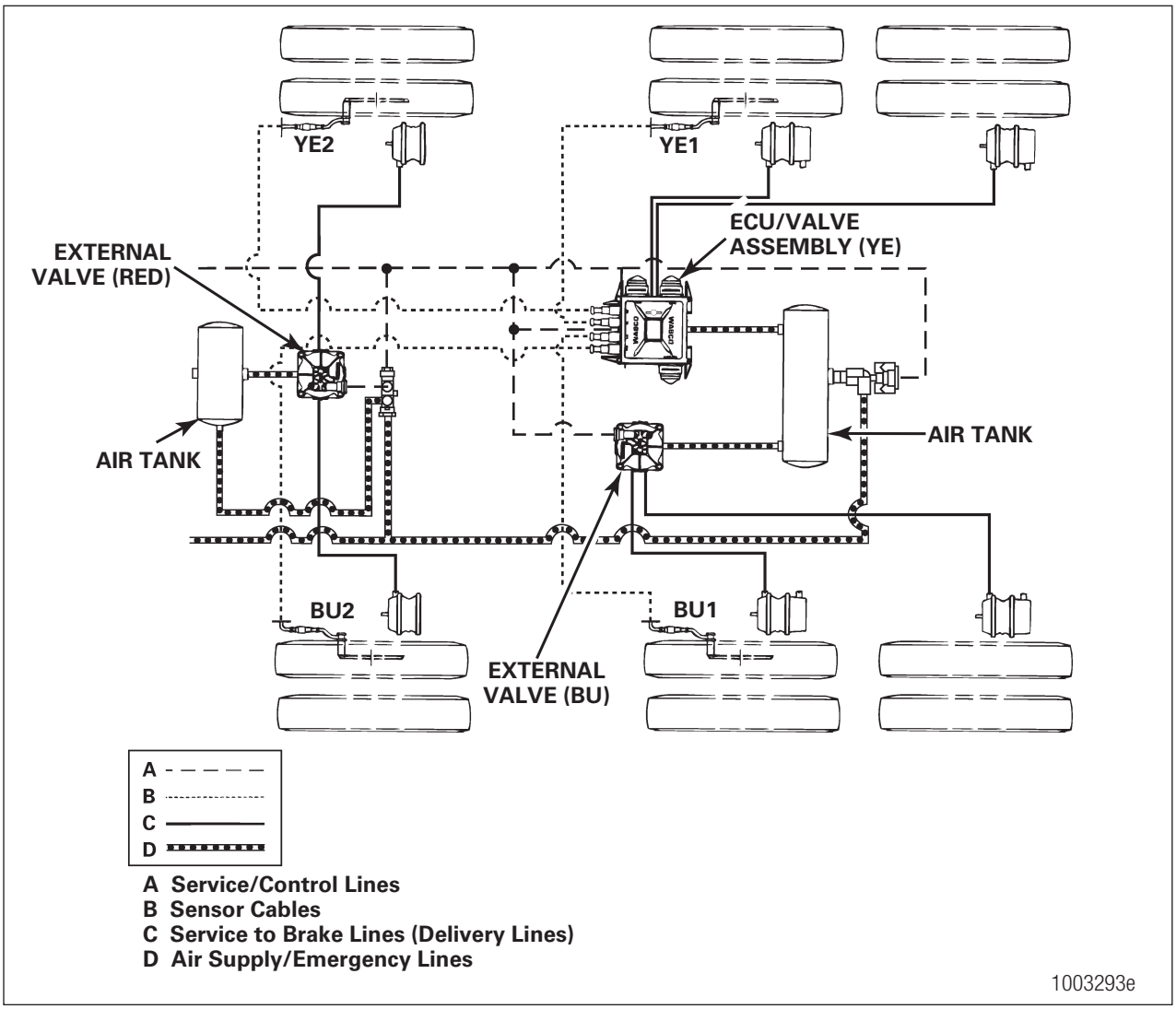


For direct tank-mounted installations, see “How to Install the ECU/Valve Assembly,” in Section 8, “Component Replacement”.

Typical Application:

- Tandem and Tri-Axle Semi-Trailer

6.7 4S/3M Trailer ABS Configuration Installation Diagram

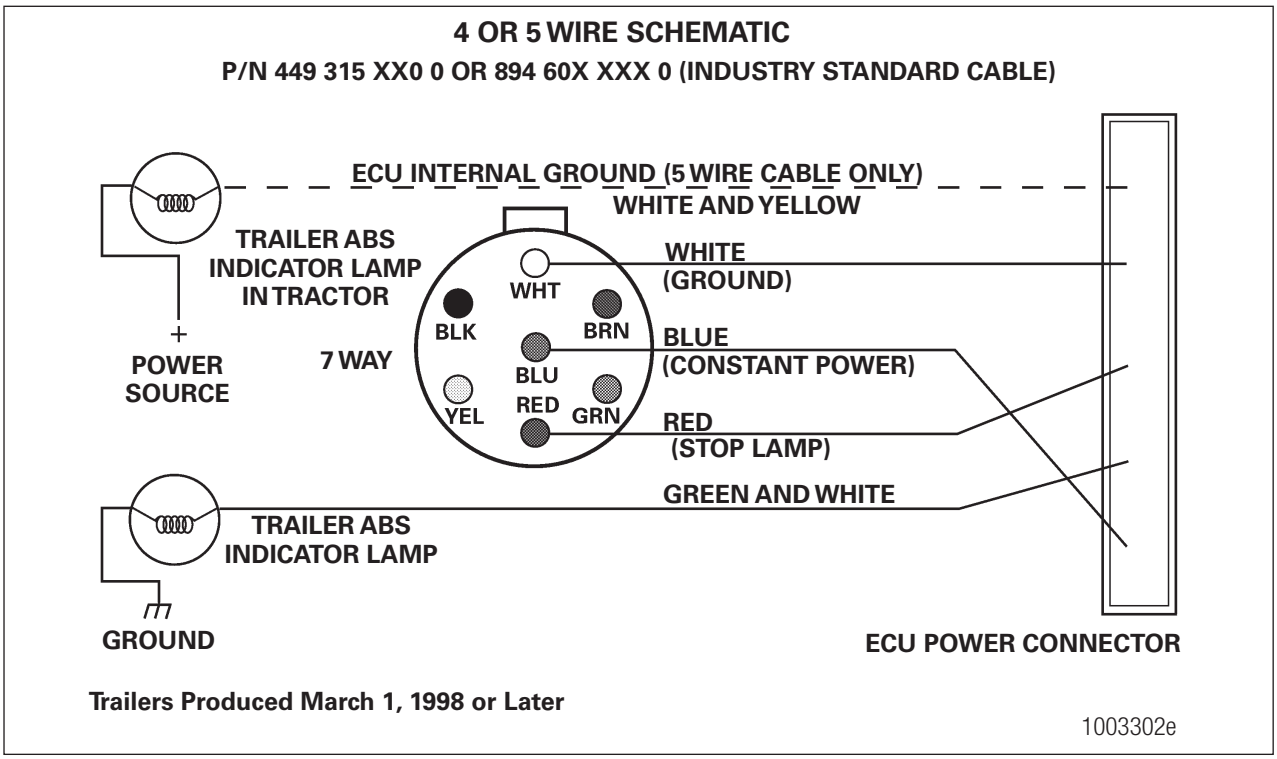


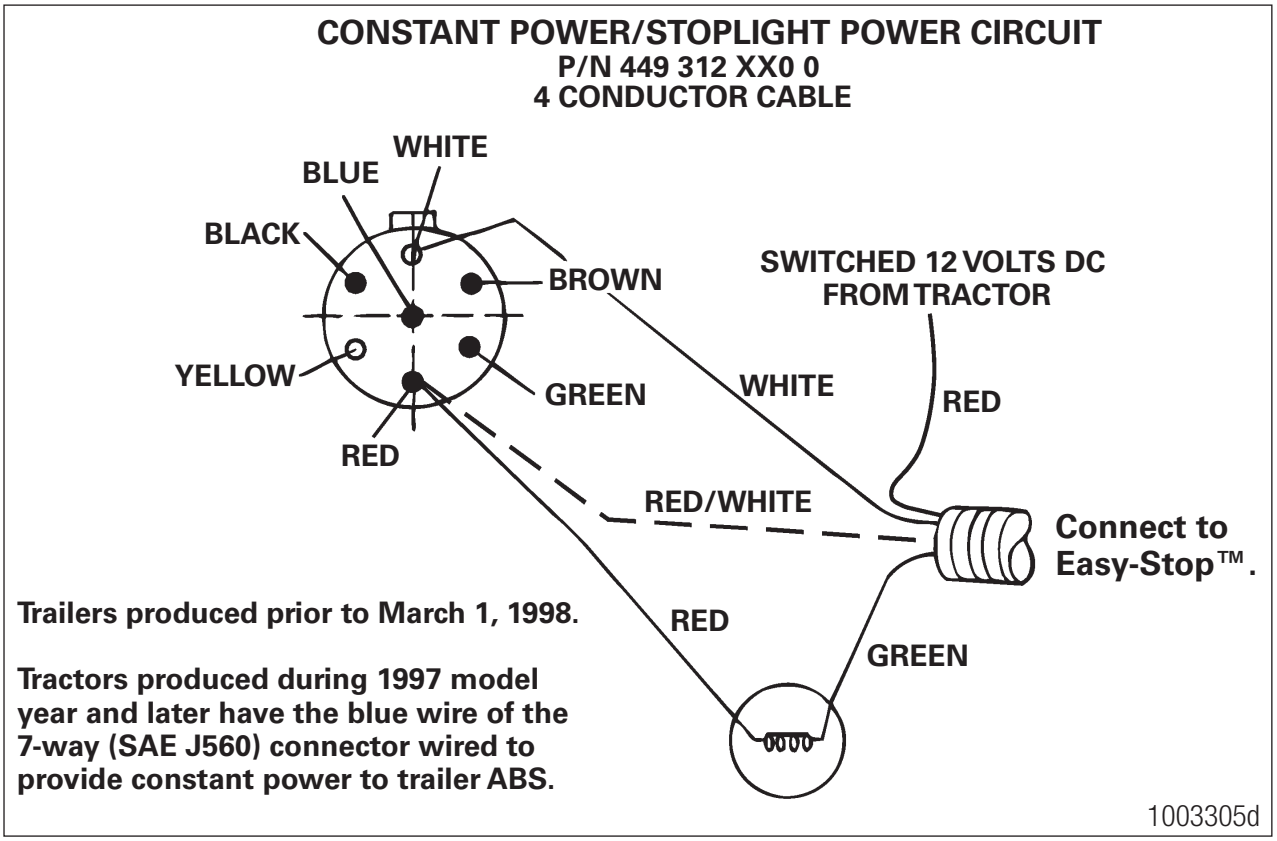
Typical Application:

- Tandem with Lift Axle
- Tri-Axle Semi-Trailer
- Semi-Trailer with Lift Axle
- Full Trailer (Drawbar Trailers)

Sensors may be installed on either axle, depending upon suspension and other vehicle characteristics.

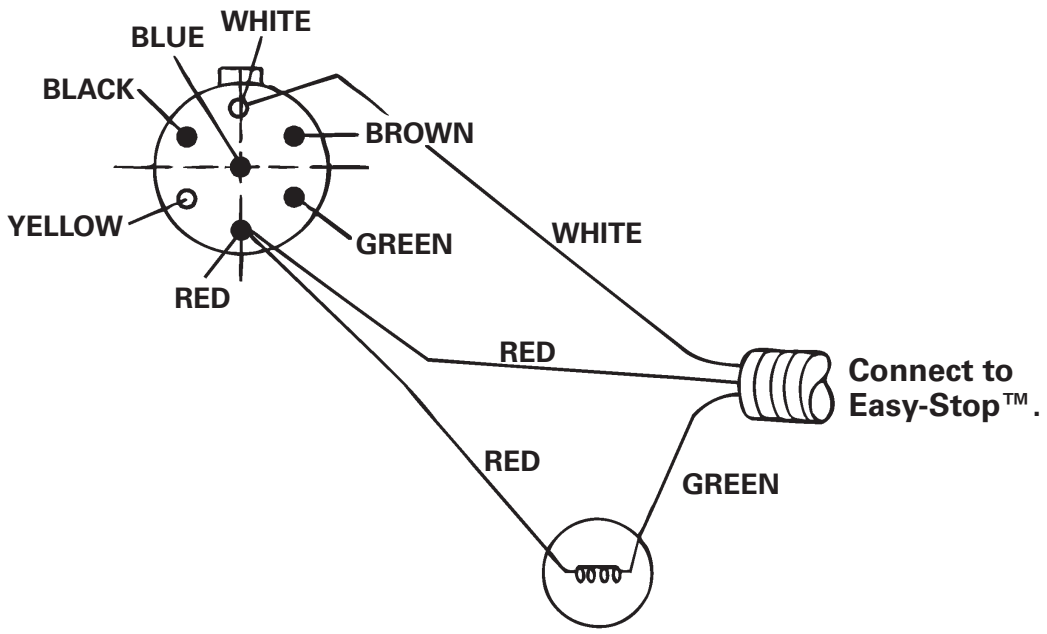
6.8 Power Cable Wiring Diagrams





System Configurations

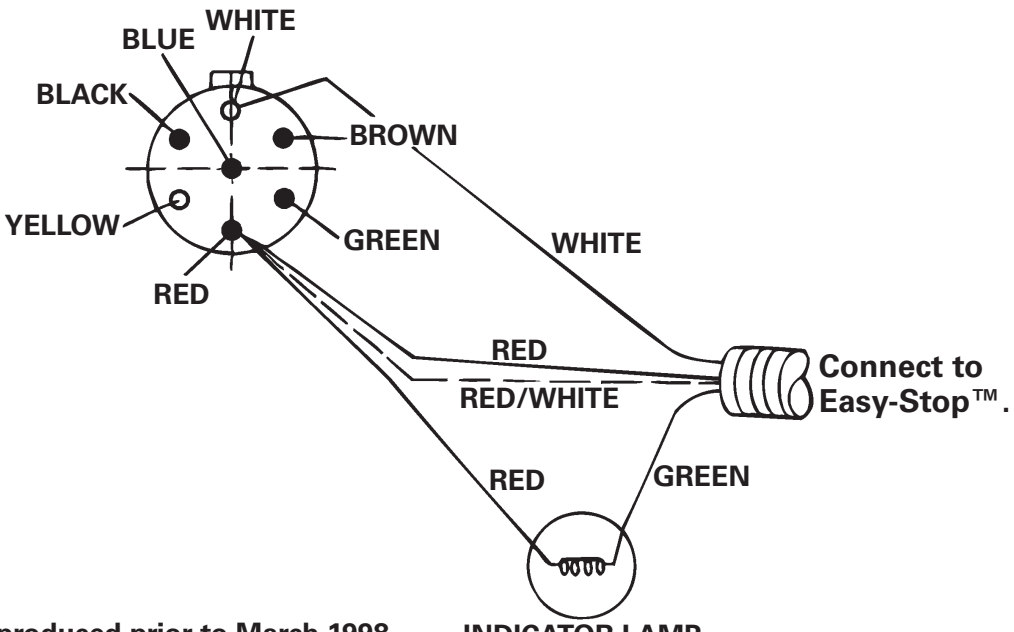
STOPLIGHT POWER CIRCUIT
P/N 894 604 19X 2
3 CONDUCTOR CABLE



Trailers produced prior to March 1998. **INDICATOR LAMP**

1003303c

STOPLIGHT POWER CIRCUIT
P/N 449 312 XX0 0
4 CONDUCTOR CABLE



Trailers produced prior to March 1998. **INDICATOR LAMP**

1003304c

7 Diagnostics

7.1 Hazard Alert Messages

⚠ WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

⚠ WARNING

The ABS is an electrical system. When you work on the ABS, take the same precautions that you must take with any electrical system to avoid serious personal injury. As with any electrical system, the danger of electrical shock or sparks exists that can ignite flammable substances. You must always disconnect the battery ground cable before working on the electrical system.

7.2 Introduction

Blink code diagnostic procedures in this section cover:

- ECU Part Number 472 500 011 0

WABCO Basic ECU without an external diagnostic connector

- ECU Part Number:
  - 472 500 001 0
  - 472 500 012 0
  - 472 500 013 0

WABCO ECUs with external diagnostic connectors

This section covers Normal Mode diagnostics (Codes for system faults that cause the ABS warning lamp to come on and stay on when the vehicle is in operation.)

For ECU Part Numbers 472 500 012 0 and 472 500 013 0 ONLY:
If you do not have a diagnostic blink code tool, follow the procedure given for ECU 472 500 011 0 (see “Using the Blink Code” in this section), but use Table E: Normal Mode Fault Code Table to identify the fault codes.

For additional diagnostic procedures, refer to:

- Appendix A Expert Mode Diagnostics (ECU P/Ns 472 500 001 0, 472 500 012 0, 472 500 013 0) This mode is used to identify **intermittent** faults, such as a loose connector.
- Appendix B Reconfigure Mode. Use only as indicated in the reconfiguration table in Appendix B.
- Appendix C Warning Lamp Diagnostics (ECU P/Ns 472 500 011 0, 472 500 012 0, 472 500 013 0)

7.3 Blink Code Diagnostics

To use blink code diagnostics you need to know whether or not the ECU has an external diagnostic connector. See Section 4, “System Components” in this manual for details. If you are unable to make this determination, contact the WABCO Customer Care Center at 855-228-3203 for assistance.

7.4 On-Site Assistance

WABCO has provided an ABS Trailer warning label that illustrates possible system fault locations. This label should be mounted on the trailer near the ABS warning lamp. If there is no ABS warning label on the trailer, let your supervisor know. Labels are available from WABCO. Ask for Part Number TP95172.

7.5 Using the Blink Code

7.5.1 For ECU Part Number 472 500 011 0 without diagnostic connector:

1. Make sure the vehicle is stationary:
   - Emergency brake ON
   - Wheels properly chocked
2. Provide 12 volts DC power (9.5 to 14 volts is acceptable range) to the ECU/Valve Assembly.
3. Check the ABS warning lamp on the trailer. If:
   - The warning lamp comes **ON** briefly, then goes **OFF**: There is no fault in system.
   - The warning lamp comes **ON** and stays **ON**: There is an existing fault. Go to Step 4.
4. Check the blink code lamp on the ECU.
   - If blink code lamp is **OFF**, there is no system fault.
   - If the blink code lamp is flashing, count the number of flashes to identify the fault. Check Table D: ECU Part Number 472 500 011 0 Blink Codes to determine the problem. Follow the suggested corrective action.

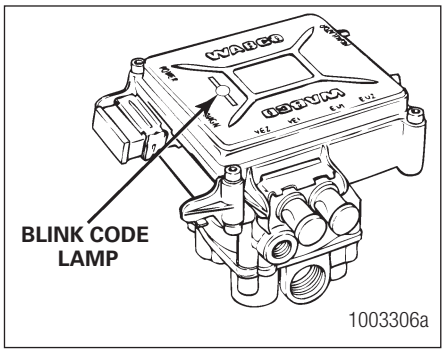


Table D: ECU Part Number 472 500 011 0 Blink Codes

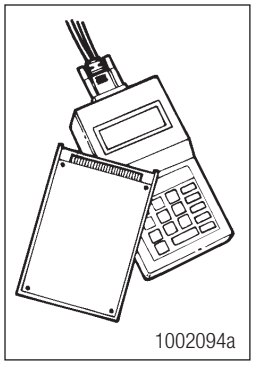
Blink Code	Problem Area	Action
4	Sensor YE1 (curbside sensor)	Check sensor installation and connections. Verify proper sensor resistance and air gap. Make necessary repairs.
6	Sensor YE2 (roadside sensor)	Check sensor installation and connections. Verify proper sensor resistance and air gap. Make necessary repairs.
10	ECU/Valve Assembly	Verify proper installation. Make sure all connections are secure. If code continues, contact WABCO for assistance.
14	Power Supply	Verify proper electrical installation and connections. Check power supply. Make necessary corrections.
15	ECU Failure	Verify proper installation. If code continues, contact WABCO for assistance.

7.6 Diagnostic Tools For ECUs with External Diagnostic Connectors

7.6.1 MPSI Pro-Link® 9000 Diagnostic Tool

7.6.1.1 (WABCO Cartridge Model J 38500-404)

The MPSI Pro-Link® 9000 diagnostic tool can test for existing and stored faults, read and clear fault codes, and test components, for WABCO tractor and trailer ABS.

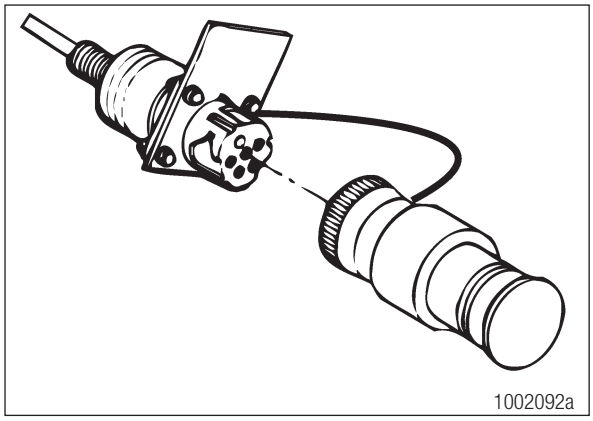


Kent-Moore offers Kit J 38500-404 that contains the WABCO ABS diagnostic cartridge, version 4.0 or higher, and the manual “WABCO ABS/ATC Systems,” which contains complete information and operating instructions for the MPSI Pro-Link® 9000 diagnostic tool. Order the kit from Kent- Moore, 28635 Mound Road, Warren, MI 48092-3499; phone 800-345-2233.

A J 38500-60A Deutsch cable is also required. It is available from Kent-Moore.

7.6.2 Diagnostic Activation Tool

7.6.2.1 For ECU Part Numbers 472 500 001 0, 472 500 012 0 and 472 500 013 0.



The blink code diagnostic tool inserts into the SAE J1587 diagnostic connector to activate the blink code diagnostics, reconfigure the ECU and test ECU installation. (See “How to Install the Blink Code Diagnostic Tool into the SAE J1587 Diagnostic Connector” in Section 8, “Component Replacement”.)

7.7 Normal Mode Diagnostics

If the blink code lamp displays a blink code for a fault that is not listed in the Normal Mode Fault Code Table or the Expert Mode Fault Code Table in Appendix A:

1. Visually inspect all connections and components.
2. Try to erase the fault from ECU memory. If you cannot erase the fault, a problem can exist within the ECU/Valve Assembly.
3. Contact the contact WABCO Customer Care Center at 855-228-3203.

7.7.1 How to Test for Existing Faults Using the Normal Mode

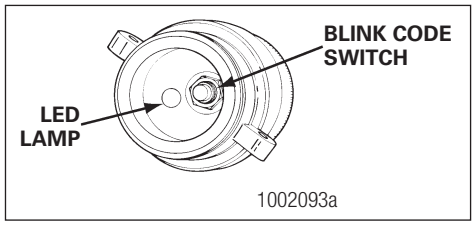
When you use **Normal Mode** diagnostics, the blink code lamp displays a numerical fault code sequence for each existing fault, one at a time. If the ECU stores more than one existing fault in memory, you must repair the first fault before Normal Mode diagnostics will display the second existing fault. In the **Normal Mode**, the lamp only identifies the **component** that needs repair; for example, **THREE FLASHES = SENSOR BU1**. To identify and display **intermittent** faults, use **Expert Mode** diagnostics. (See Appendix A.)

The ECU stores existing faults into memory in the order in which they occur, but the blink code lamp displays the most recent fault first. To identify and display intermittent stored faults (such as a loose cable or wire) from ECU memory, you must use Expert Mode diagnostics.

To activate Normal Mode diagnostics:

1. The vehicle must be stationary. Power the ECU with 12 volts DC (9.5–14 is an acceptable range). The warning lamp on the trailer will come **ON**.

2. Locate the diagnostic tool: Plug the diagnostic tool into the diagnostic cable socket located usually on the right side of the trailer sub-frame.

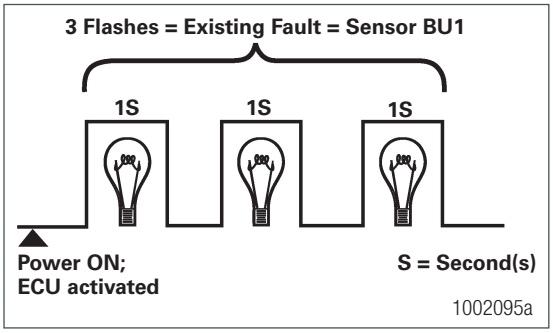


3. Press the blink code switch **once** for **one second** and release the switch.
4. **If there are no existing faults in the system:** When activated, the blink code lamp will:
   - Come **ON**
   - Go **OFF**
   - Remain **OFF**
5. **When there is an existing fault:** The blink code lamp will flash between **three** and **fifteen** times to identify the existing fault. Refer to Table E: Normal Mode Fault Code Table, for Normal Mode fault codes.
6. **When there are existing faults:** You must repair existing faults.
7. After you identify an existing fault, turn the power to the ECU **OFF**. Repair the fault. Turn the power to the ECU back **ON**.
8. **ECU Part Number 472 500 001 0**: Repeat Steps 3, 5, 6, and 7 until the blink code lamp goes **OFF**, comes back **ON** and remains **ON**. This sequence signals that there are no other existing faults.

   ECU Part Numbers 472 500 012 0 and 472 500 013 0: Repeat Step 3. If there are no other existing faults in the system, the blink code lamp will come **ON**, go **OFF** and remain **OFF**.
9. If you have just repaired a sensor fault, the ECU is “waiting” to see a 4-mph signal on sensed wheels. Until this 4 mph is sensed by the ECU, the ABS warning lamp on the trailer will remain **ON**.

Table E: Normal Mode Fault Code Table

Blink Code	Location
0	No Faults
3	Sensor BU1
4	Sensor YE1
5	Sensor BU2
6	Sensor YE2
7	Ext. Modulator (Red) 4S/3M Only
9	Ext. Modulator (BU)
10	ECU Modulator (YE)
14	System Configuration/Power Supply
15	ECU Failure



7.8 Repair Existing Faults

- With **Normal Mode** diagnostics, you must repair an existing fault before you can identify and repair the next existing fault stored in ECU memory. Follow these steps:
  - Turn off the power to the ECU.
  - Repair the fault.
  - Repeat Normal Mode diagnostics.
  - Clear stored faults (if necessary).

7.8.1 How to Clear Repaired Faults from the ECU

1. Power the ECU with 12 volts DC (9.5–14.0 is an acceptable range).
2. To clear repaired faults from ECU memory, press the blink code lamp switch **three times** for **one second** each time as follows:
   a. Depress the blink code lamp switch once for **one second**. The lamp will come **ON**.
   b. Release the switch for one second. The lamp will go **OFF**.
   c. Immediately depress the switch **once** for **one** second. The blink code lamp will come back **ON**.
   d. Immediately release the switch **once** for **one** second. The blink code lamp will go **OFF**.

e. Immediately depress the switch **once** for **one** second. The blink code lamp will come back **ON**.

f. Release the switch.

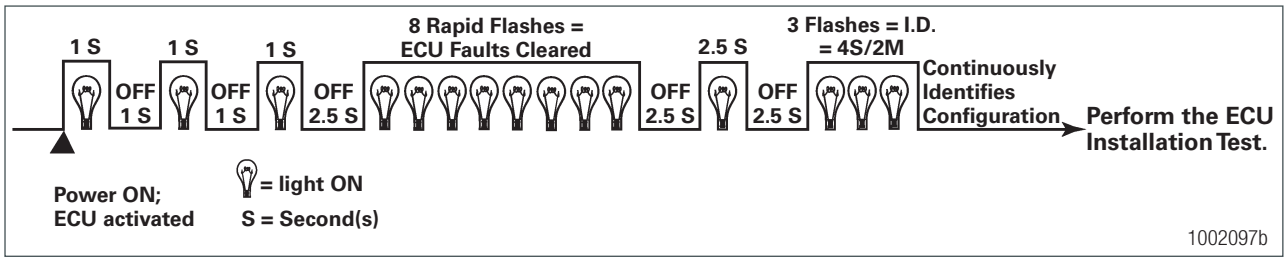
g. The blink code lamp will flash rapidly for **eight** times to indicate that the repaired faults have been erased from ECU memory.

h. The lamp will continue to flash the system configuration until you turn **OFF** the power to the ECU. System configuration codes are:

- 2 Flashes = 4S/3M
- 3 Flashes = 4S/2M
- 4 Flashes = 2S/2M
- 5 Flashes = 2S/1M

7.9 Blink Code Example (4S/2M Configuration)

7.9.1 Clear-All Mode



8 Component Replacement

8.1 Hazard Alert Messages

⚠ WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

⚠ WARNING

Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

⚠ WARNING

The ABS is an electrical system. When you work on the ABS, take the same precautions that you must take with any electrical system to avoid serious personal injury. As with any electrical system, the danger of electrical shock or sparks exists that can ignite flammable substances. You must always disconnect the battery ground cable before working on the electrical system.

Disconnect power from the ECU/Valve Assembly before you remove any components. Failure to disconnect power from the ECU can cause faults to be recorded and stored in ECU memory.

⚠ CAUTION

Use the following procedures to avoid damage to the electrical system and ABS components.

When welding on an ABS-equipped vehicle is necessary, disconnect the power connector from the ECU.

8.2 Wheel Speed Sensor

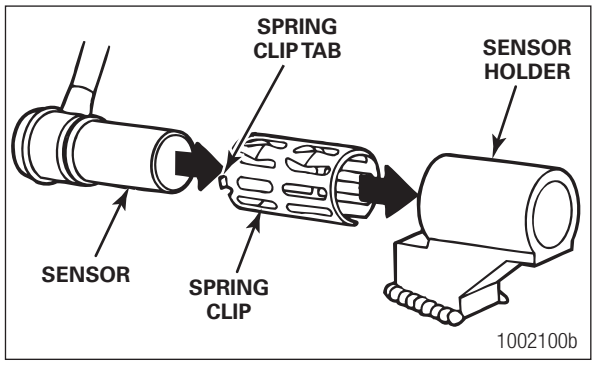
8.2.1 How to Remove a Sensor

1. Follow the vehicle manufacturer's instructions to back off the slack adjuster and remove the tire, wheel and drum.
2. Hold the sensor, not the cable, and use a twisting motion to pull the sensor out of its mounting block.
3. Remove the spring clip from the mounting block.
4. Remove any fasteners that hold the sensor cable to other components.
5. Disconnect the sensor cable from the extension cable.

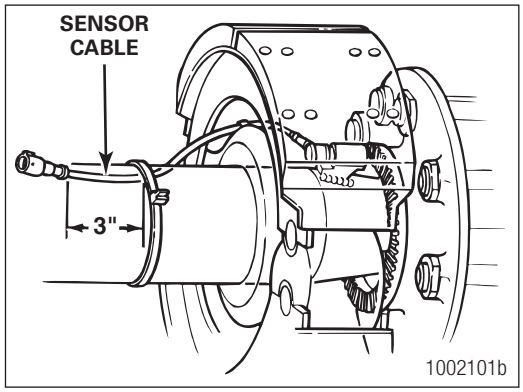
8.2.2 How to Install a Sensor

Sensor locations vary according to suspension types. Typically, a spring suspension has sensors on the forward axle, and an air suspension has sensors on the rear axle.

1. Apply a mineral oil-based grease that contains molydisulfide to the sensor spring clip and to the body of the sensor. The grease must be anti-corrosive and contain adhesive properties that will continuously endure temperatures from –40°F to 300°F (–40° to 150°C).
2. Push the spring clip into the sensor holder from the inboard side, until the spring clip tabs are against the sensor holder. Push the sensor into the spring clip as far as possible.

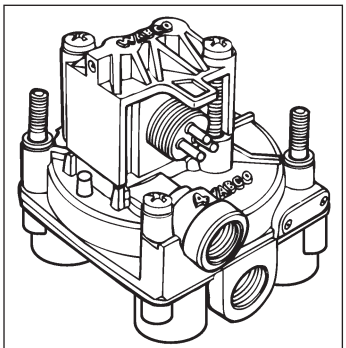


3. Route the sensor cable toward the brake chamber, over the brake spider, and behind the axle. Secure the cable to the axle between the brake spider and the suspension brackets. Continue to route the sensor cable behind the spring seats. Secure the cable to the axle one inch from the molded sensor plug.



4. Install the wheel hub carefully, so that the tooth wheel pushes against the sensor as you adjust the wheel bearings. After installation there should be no gap between the sensor and the tooth wheel. During normal operation a gap of 0.04-inch is allowable.
5. **Sensor Output Voltage Test:** Use a Volt/Ohm meter to check the AC output voltage of the sensors while rotating the wheel at approximately one-half revolution per second. Minimum output must be greater than 0.2 volts AC. If minimum output is less than 0.2 volts AC, push the sensor toward the tooth wheel. Recheck the sensor output.

8.3 ABS Relay Valve



⚠ WARNING

Release all pressure from the air system before you disconnect any components. Pressurized air can cause serious personal injury.

8.3.1 How to Remove a Standard ABS Relay Valve

1. Release all pressure from the air system.
2. Disconnect the cable from the valve.
3. Attach labels to identify all of the air lines.
4. Disconnect the air lines from the valve.
5. Remove the mounting fasteners if the valve is not nipple-mounted directly to the air tank.
6. Remove the valve.

8.3.2 How to Install a Standard ABS Relay Valve

⚠ CAUTION

You must use Schedule 80 pipe nipple (3/4-inch NPT) to nipple-mount the ABS relay valve securely to the reinforced air tank to avoid possible serious personal injury and damage to components.

1. Install the valve with two lock nuts and washers as required. Tighten the hex nuts to a torque of 18 lb-ft (24 Nm) or nipple-mount the valve directly to the air tank with Schedule 80 pipe nipple (3/4-inch NPT).
2. Connect the air lines to the ports according to the labels installed when the air lines were disconnected.
3. Connect the cable to the valve.
4. Pressurize the brake system. Apply the brakes and verify there are no air leaks.

8.4 The ECU/Valve Assembly

⚠ WARNING

Release all pressure from the air system before you disconnect any components. Pressurized air can cause serious personal injury.

⚠ CAUTION

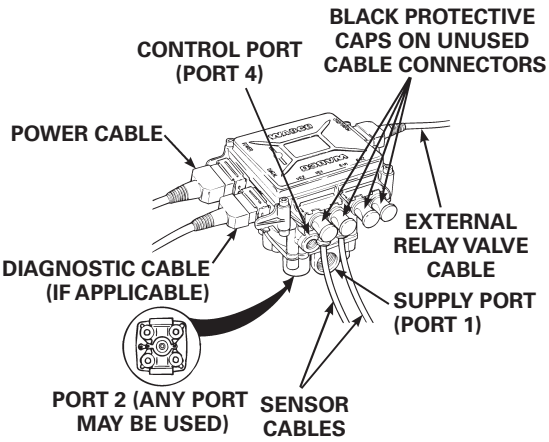
The ECU and valve assembly are sealed together as one unit. To ensure product integrity and avoid possible damage to the components, do not attempt to separate the ECU from the valve.

8.4.1 How to Remove the ECU/Valve Assembly

1. Release all pressure from the air system.
2. Attach labels to identify all air lines.
3. Disconnect the air lines from the ECU/Valve Assembly.
4. Disconnect the power cable, diagnostic cable, additional relay valve cable (if used), and all sensor cables from the ECU/Valve Assembly. Refer to the illustration on page 43.
5. Remove the ECU/Valve Assembly from its mounting location:
   a. **Bracket-mounted**: Loosen and remove the two mounting bolts and lock nuts that hold the assembly to the mounting bracket. Remove the assembly.
   b. **Nipple-mounted to Air Tank**: Unscrew the assembly from the air tank.
6. If the assembly being replaced is under warranty, please return it to the trailer OEM for replacement.

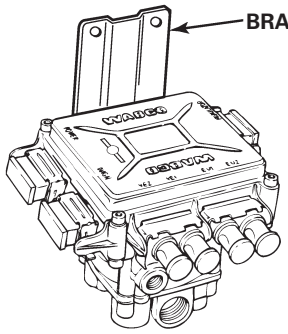
8.4.2 How to Install the ECU/Valve Assembly

The ECU/Valve Assembly is supplied with black protective caps on each sensor connector. When a sensor cable is not plugged into a sensor connector, the black cap must remain on the connector to protect it from dirt and contamination.



*** Plug unused port. Use front supply port for bracket-mounted. Use rear port for nipple mount.**

1002103c



Plug unused port.

1002104b

⚠ CAUTION

You must use a Schedule 80 pipe nipple (3/4-inch NPT) to nipple mount the ECU/Valve Assembly securely to the air tank to avoid possible serious personal injury and damage to components.

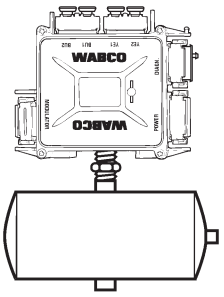
1. Attach the ECU/Valve Assembly to the vehicle:

   a. Bracket-mounted: Use two 3/8-inch Grade 8 bolts with prevailing torque nuts to attach the assembly to the mounting bracket. Tighten to 18 lb-ft (24 Nm).

   Plug unused supply port (Port 1). See above figure.

b. Nipple-mounted to air tank: Attach the ECU/Valve Assembly to the air tank, using a Schedule 80 pipe nipple (3/4-inch NPT). Tighten securely with exhaust port facing down. Do not overtighten.

Plug unused supply port (Port 1).



Plug unused port.
1002105c

2. Connect the air lines to the ports. Follow the label markers installed when the air lines were disconnected.
3. Connect the sensor cables, external relay valve cable (if used), diagnostic cable, and power cable to the ECU/Valve Assembly. Use the black protective connector caps included with the replacement assembly to cover unused cable connectors.
4. Test the installation using blink code diagnostics
5. Perform the “Final Test Before Returning A Trailer to Service” test in Section 9.

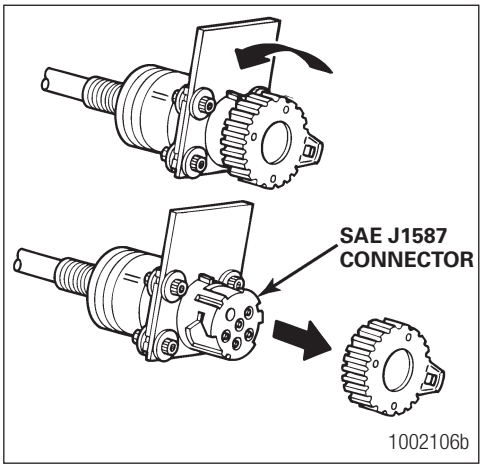
8.5 How to Install the Blink Code Diagnostic Tool into the SAE J1587 Diagnostic Connector

The blink code switch and LED lamp are sealed against dust and contaminants. The red dust cap protects the switch and lamp during use but is not an integral part of the diagnostic tool.

1. Remove the gray protective cap from the SAE J1587 diagnostic connector.

   a. Turn the cap counterclockwise.

   b. Pull off the cap.

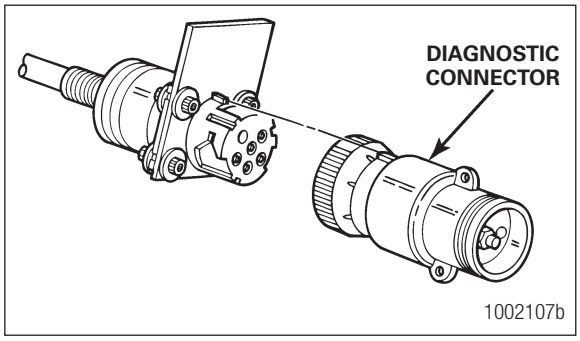


1002106b

2. Install the diagnostic tool into the diagnostic connector.

   a. Align the notch on the diagnostic tool with the notch on the diagnostic connector.

   b. Push the diagnostic tool firmly into the connector.



You must replace the gray protective cap if you remove the diagnostic tool from the diagnostic connector. Dirt and contaminants can damage the connector.

   c. Rotate the gray ring on the diagnostic tool to securely lock the diagnostic tool into the plug.

3. If the diagnostic tool will remain permanently installed into the connector:

   a. Remove the protective cap and guide wire that are attached to the mounting bracket.

   b. Attach the diagnostic tool and guide wire to the mounting bracket.

9 Sensor Adjustment and Component Testing

9.1 How to Test Wheel Speed Sensors

> At initial installation, no gap must exist between the sensor and the tooth wheel.

> After you install a hub, always check that the sensor is adjusted properly. Sensors may be installed on either axle, depending upon suspension and other vehicle characteristics.

Operating the trailer can cause a gap to develop between the sensor and the tooth wheel. If the gap exceeds 0.040-inch, the system may not function correctly.

To adjust the sensor, twist and push the sensor through the sensor bracket as far as possible or until the sensor touches the tooth wheel.

9.2 Sensor Test Procedure

1. Disconnect power to the ECU/Valve Assembly.
2. Disconnect the sensor electrical connector from the ECU/Valve Assembly.
3. Connect the Volt/Ohm meter leads to the two wire component terminals inside the disconnected connector.
4. When checking the resistance, the meter must read 500–2000 ohms.
5. Check and replace the sensor and cables as required.
6. Repeat Steps 1-5 for each sensor in the system.

9.3 Sensor Output Voltage Test

1. Disconnect power from the ECU/Valve Assembly.
2. Connect the AC Volt/Ohm meter leads to the sensor terminals inside the connector.
3. Rotate the corresponding wheel at a constant speed of one-half revolution per second.
4. The output voltage must be greater than 0.2 volts AC.
5. When there is no reading:
   a. Trace the cable to verify that the cable connects to the wheel you turned.
   b. Check that you turned the correct wheel.
   c. Check that the system is wired correctly.
   d. Check that the sensor touches the tooth wheel.
6. If the Volt/Ohm meter still indicates no reading or a low reading after following the above procedures, check and replace the component and cables as required.
7. Repeat Steps 1-5 for each sensor in the system.

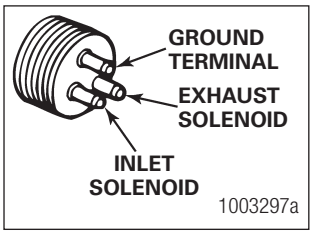
9.4 Check ABS Functions

WABCO recommends that you test a vehicle's ABS after a new installation and after you diagnose, repair and erase faults in the ABS.

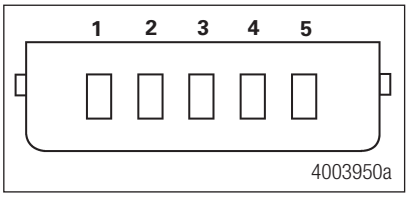
Perform installation tests and blink code diagnostics using the blink code diagnostic tool or the MPSI Pro-Link® 9000 (WABCO Cartridge Model J 38500-404, version 4.0 or higher).

9.5 ABS External Modulator Valve

Measure resistance across each valve solenoid coil terminal and ground on the ABS valve to ensure 4.0 to 8.0 ohms. Valve and cable pinouts are illustrated.



- To check the cable and the ABS valve as one unit, measure resistance across the pins on the ECU connector of the harness.
  - For 2S/1M, 2S/2M, and 2S/4M systems, measure the resistance across pins 1 and 3 and pins 2 and 3.
  - For 4S/3M systems ("Y" cable connectors), measure across pins 3 and 4 and pins 3 and 5.
  - Resistance should be between 4.0 and 8.0 ohms for each measurement.



1 EXHAUST SOLENOID
2 INLET SOLENOID
3 GROUND TERMINAL
4 EXHAUST SOLENOID (4S/3M ONLY)
5 INLET SOLENOID (4S/3M ONLY)

- If the resistance is greater than 8.0 ohms, clean the electrical contacts in the solenoid. Check the resistance again.

9.6 Final Test Before Returning a Trailer to Service

9.6.1 For ECU/Valve Assembly Part Number 472 500 011 0 (without external diagnostic connector)

If you are testing ECU 472 500 001 0, contact the WABCO Customer Care Center at 855-228-3203.

9.6.1.1 ABS Electrical/Hardware Installation Test

1. Provide 12 volts DC power (9.5–14 volts is an acceptable range) to the ECU/Valve Assembly.
   - Suggested power source: 12-volt battery.
2. Observe the ABS warning lamp and the blink code lamp on the ECU. Check the results in Table F.

Table F: ECU Part Number 472 500 011 0

If	Status	Action
Trailer ABS warning lamp does not come **ON**. OR Blink code lamp on ECU does not come **ON**.	Minimum power requirement not met or wiring problem exists.	Check electrical connections and power source. Make necessary repairs.
Trailer ABS warning lamp comes **ON**. AND Blink code lamp on ECU continues to flash.	Hardware fault code.	Identify fault location. Make necessary repairs to the installation: **# Blinks** **Location** 4 Sensor YE1 (curbside) 6 Sensor YE2 (roadside) 10 ECU/Valve Assembly 14 Power Supply 15 ECU Failure
Trailer ABS warning lamp comes **ON** and stays **ON**. AND ECU clicks twice. AND Blink code lamp on ECU comes **ON** briefly, then goes **OFF**.	Proper hardware installation.	Perform Sensor Installation Test.

If	Status	Action
Trailer ABS warning lamp comes **ON** for 3 seconds, then goes **OFF**. AND ECU clicks twice. AND Blink code lamp on ECU comes **ON** briefly, then goes **OFF**.	Proper hardware installation. Proper sensor installation.	None required.

9.6.2 ABS Sensor Installation Test (ECU Part Number 472 500 011 0)

1. Remove power.
2. Raise both sensed wheels off of the ground. Apply air to emergency line to fill air tanks and release parking brake.
3. Provide 12 volts DC power (9.5–14 volts is an acceptable range) to ECU/Valve Assembly. (Make sure trailer ABS warning lamp and ECU blink code lamp operate correctly, as described in “ABS Electrical/ Hardware Installation Test”.)
4. Rotate the sensed wheels — ONE AT A TIME — at a rate of 1/2 revolution per second.
5. Check Table G: Sensor Installation Test.

Table G: ECU Part Number 472 500 011 0

If	Status	Action
Trailer ABS warning lamp goes **OFF**.	ECU senses proper speed. Sensors properly installed.	No further testing required.
Trailer ABS warning lamp does not go **OFF**. AND There is no blink code flashing on the ECU.	There is a sensor gap problem.	Adjust sensor gap. Push sensor into its holder until it contacts the tooth wheel. Measure the AC voltage output. Value should be 0.2 volts AC when wheel is rotated at a rate of 1/2 revolution per second. Make necessary repairs.
Trailer ABS warning lamp does not go **OFF**. AND Blink code is on and flashing on ECU.	System fault exists.	Count the number of flashes. This is the blink code. Using Table H: Blink Code Table, identify the blink code. Make necessary repairs.

Table H: Blink Code Table

Blink Code	Problem Area	Action
4	Sensor YE1 (curbside sensor)	Check sensor installation. Make necessary repairs.
6	Sensor YE2 (roadside sensor)	Check sensor installation. Make necessary repairs.
10	ECU/Valve Assembly	Verify proper installation. If blink code continues, contact WABCO for assistance.
14	Power Supply	Verify proper electrical installation. Check power supply. Make necessary corrections.
15	ECU Failure	Verify proper installation. If code continues, contact WABCO for assistance.

After making the necessary corrections, repeat the sensor installation test to verify proper sensor installation.

9.7 For ECU/Valve Assembly Part Numbers 472 500 012 0 and S 472 500 013 0 (Units with External Diagnostic Connector)

If you are testing ECU Part Number 472 500 001 0, contact the WABCO Customer Care Center at 855-228-3203.

9.7.1 ABS Electrical/Hardware Installation Test

1. Provide 12 volts DC (9.5–14 volts is an acceptable range) to the ECU/Valve Assembly.
   - Suggested power source: 12-volt battery.
2. Observe the ABS warning lamp and the blink code lamp on the ECU. Check the results in Table I .

Table I: ECU Part Number 472 500 011 0

If	Status	Action
Trailer ABS warning lamp does not come **ON**. OR Blink code lamp on ECU does not come **ON**.	Minimum power requirement not met or wiring problem exists.	Check electrical connections and power source. Make necessary repairs.

If	Status	Action
Trailer ABS warning lamp comes **ON**. AND Blink code lamp on ECU continues to flash.	Hardware fault code.	Identify fault location. Make necessary repairs to the installation: **# Blinks** **Location** 3 Sensor BU1 4 Sensor YE1 5 Sensor BU2 6 Sensor YE2 7 External Modulator (Red) 4S/3M only 9 External Modulator (BU) 10 ECU Modulator (YE) 14 System Configuration or Power Supply 15 ECU (contact WABCO)
Trailer ABS warning lamp comes **ON** and stays **ON**. AND ECU clicks twice. AND Blink code lamp on ECU comes **ON** briefly then goes **OFF** or flashes 14 times, then goes out.	Proper hardware installation.	Perform Sensor Installation Test.
Trailer ABS warning lamp comes **ON** for 3 seconds, then goes **OFF**. AND ECU clicks twice. AND Blink code lamp on ECU comes **ON** briefly, then goes **OFF**.	Proper hardware installation. Proper sensor installation.	None required.

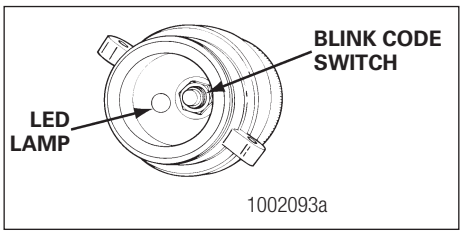
9.7.3 Sensor Installation Test (ECU Part Numbers 472 500 012 and 472 500 013 0)

Purpose of Test: To verify proper sensor gap, sensor hook-up to the ECU, ABS valve operation, and pneumatic plumbing connections of the WABCO Easy-Stop™ ABS on a new trailer.

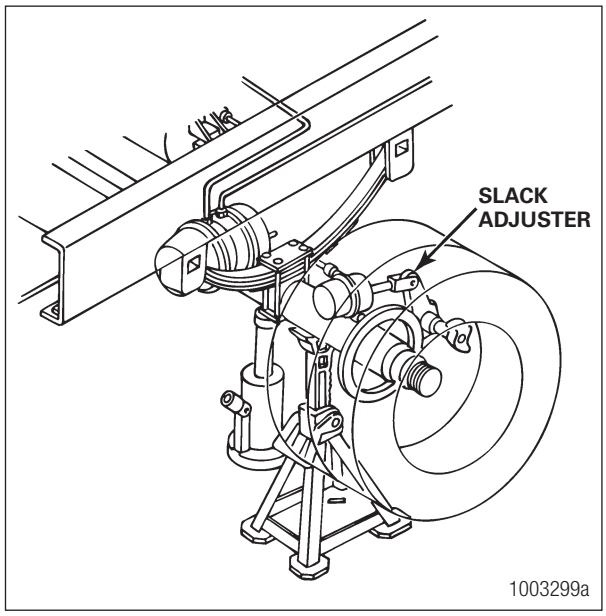
1. Remove power from the ABS.
2. Raise sensed wheels so that they may be rotated.
3. Go to the diagnostic tool. Reapply power to the ABS.
   - If there is no diagnostic tool on the trailer, temporarily install one for this test. You must use a diagnostic tool to complete the Sensor Installation Test.

Sensor Adjustment and Component Testing

4. Check the diagnostic tool to verify the status of the yellow LED.
   - If LED comes **ON** and stays **ON**, go to Step 5.
   - If LED does not light, verify adequate power is applied to the system. Make the necessary repairs.



5. Press and release the blink code switch three times for Sensor Installation Test Mode, one second each time, separated by a release time of one second.
   - The LED should display eight rapid flashes. This indicates the Sensor Installation Test Mode. Then, the LED will continuously display the system configuration code:
     - 2 Flashes = 4S/3M
     - 3 Flashes = 4S/2M
     - 4 Flashes = 2S/2M
     - 5 Flashes = 2S/1M
   - If this does not occur, repeat Step 4.
   - Attach the emergency and control air lines to the trailer. Fill air tanks to release the spring brakes.
6. Rotate each sensed wheel — ONE AT A TIME — at a rate of 1/2 revolution per second. Apply control pressure to activate the brakes.



7. Observe the automatic slack adjuster on the rotated wheel. It must move in and out as the ABS valve cycles. This indicates a proper installation.
   - If the slack adjuster on the rotated wheel does not move — but the slack adjuster on the opposite wheel does move — the sensor leads are reversed or the air line is plumbed wrong. Correct the installation.
   - If the slack adjuster on the rotated wheel does not move, there may be a sensor gap problem. Check the sensor gap and make the necessary repairs.
8. Repeat Steps 6 and 7 on the remaining sensed wheels.
9. If you installed a diagnostic blink code tool for this test, remove it. Replace the protective cap over the connector.

9.8 Trailer Identification

An Easy-Stop™ Trailer ABS warning label is generally affixed to the trailer near the ABS trailer warning lamp.

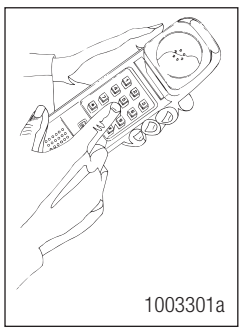
If this label is not on the trailer, let your supervisor know. Labels are available from WABCO. Ask for Part Number TP95172.

For additional assistance, contact the WABCO Customer Care Center at 855-228-3203.

Before calling the WABCO North America Customer Care, be prepared to provide the following information about the trailer you are working on:

1. Trailer make and model year.
2. What is the symptom/complaint? What is the component doing or not doing?
3. What is the ABS blink code or MPSI Pro-Link® 9000 reading?
4. Have any resistance and/or voltage measurements been taken?
5. What is the result of visual inspection of connectors, harness and components?
6. When does the symptom occur (vehicle moving, compressor unloading, etc.)?
7. Does the trailer have any unusual characteristics (for example, mismatched tires or larger than normal air consumption)?
8. Were maintenance manuals available? If so, which ones were used?
9. What is the part number of the ECU/Valve Assembly? What is the system configuration?

By having the above information ready when you call, your customer support technician will be better equipped to assist you.



10 Appendix A - Expert Mode Diagnostics

When you use Expert Mode diagnostics, the blink code lamp identifies and displays existing and intermittent faults consecutively in three-digit fault code sequences, with a short pause between each fault. Refer to Expert Mode Blink Code Example (4S/2M Configuration) and Table J: Expert Mode Fault Code, all in this section.

Expert Mode identifies:

- **System configuration**
- **Components** that need repair;
- **Cause** (or type) of fault, such as a cut sensor cable; and
- **Number of times** a fault has occurred.

The ECU stores **intermittent** and **existing faults** into memory in the order in which they occur. However, the blink code lamp displays the **most recent fault first**.

10.1 How to Test for Intermittent Stored Faults Using the Expert Mode

> Before you use Expert Mode diagnostics, be prepared to count and write down the blink code lamp flashes for each fault.

1. The vehicle must be stationary to activate the blink code. Power the ECU with a minimum of 12 volts DC (9.5–14 is an acceptable range). The warning lamp on the trailer will come **ON**.
2. **Identify the fault**. If not already attached, plug the diagnostic tool into the diagnostic cable socket usually located on the right side of the trailer.

> For an alternate blink code access procedure, see “Warning Lamp Diagnostics” in Appendix C.

> You can restart the Expert Mode fault sequence at any time by depressing the blink code lamp switch as described in Step 3 below.

3. Depress the blink code lamp switch located in the diagnostic tool **two times** for **one second** each time as follows:
   a. Depress the blink code lamp switch **once** for **one second**. The lamp will come **ON**.
   b. Release the switch. The blink code lamp will go **OFF**.
   c. Depress the blink code lamp switch **once** for **one second**. The blink code lamp will come **ON**.
   d. As soon as the blink code lamp comes **ON**, release the blink code button.

4. Determine whether or not there are Intermittent Stored faults in the system.

   If there are no Intermittent Stored faults, the blink code lamp will come back **ON** and identify the system configuration one time by displaying:

   - 2 Flashes = 4S/3M
   - 3 Flashes = 4S/2M
   - 4 Flashes = 2S/2M
   - 5 Flashes = 2S/1M

After the blink code lamp displays the system configuration once, the lamp will remain **OFF**.

10.1.1 If There Are Intermittent Stored Faults in the System

1. The blink code lamp will come back **ON** and identify the system configuration one time by displaying:
   - 2 Flashes = 4S/3M
   - 3 Flashes = 4S/2M
   - 4 Flashes = 2S/2M
   - 5 Flashes = 2S/1M
2. The blink code lamp will go **OFF** for 2.5 seconds, come back **ON** for 2.5 seconds, and go **OFF** for 2.5 seconds.
   - The blink code lamp will display the most recent fault in a three-digit fault code sequence. For example, a fault code sequence of **3-5-2** reads as follows:

First Digit	3 Flashes	= Sensor BU1
Second Digit	5 Flashes	= Cut Sensor Cable
Third Digit (X)	2 Flashes	= Number of Fault Occurrences

3. The blink code lamp will then go **OFF** for 2.5 seconds, then display each remaining fault code sequence.
4. When all fault code sequences have been displayed, the blink code lamp will come **ON** and go **OFF**, and remain **OFF**.

Appendix A - Expert Mode Diagnostics

10.1.2 Blink Code Example (4S/2M Configuration)

Expert Mode

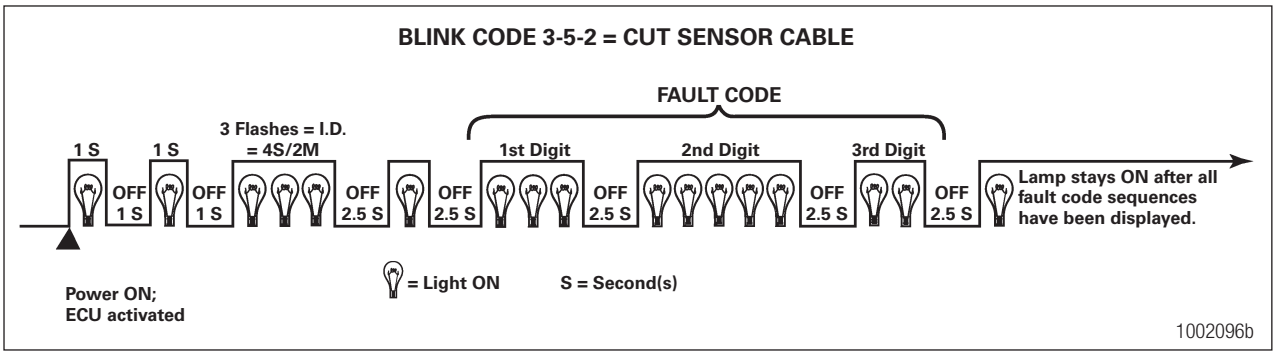


Table J: Expert Mode Fault Code

Blink Code			Component or Location	Cause or Type of Fault	Solution
1st Digit	2nd Digit	3rd Digit (X)			
0	0	0		No Faults	No action needed.
3	5	X	Sensor BU1	Cable Break, Short Circuit	Check sensor, sensor cable and cable connection.
3	7	X	Sensor BU1	Out of Adjustment	Adjust sensor.
3	10	X	Sensor BU1	Speed Erratic	Check for excessive hub runout, a sensor gap that is too wide or damage to the tooth wheels.
4	5	X	Sensor YE1	Cable Break, Short Circuit	Check sensor, sensor cable and cable connection.
4	7	X	Sensor YE1	Out of Adjustment	Adjust sensor.
4	10	X	Sensor YE1	Speed Erratic	Check for excessive hub runout, a sensor gap that is too wide or damage to the tooth wheels.
5	5	X	Sensor BU2	Cable Break, Short Circuit	Check sensor, sensor cable and cable connection.
5	7	X	Sensor BU2	Out of Adjustment	Adjust sensor.
5	10	X	Sensor BU2	Speed Erratic	Check for excessive hub runout, a sensor gap that is too wide or damage to the tooth wheels.
6	5	X	Sensor YE2	Cable Break, Short Circuit	Check sensor, sensor cable and cable connection.
6	7	X	Sensor YE2	Out of Adjustment	Adjust sensor.
6	10	X	Sensor YE2	Speed Erratic	Check for excessive hub runout, a sensor gap that is too wide or damage to the tooth wheels.

X = Number of Fault Occurrences

Appendix A - Expert Mode Diagnostics

Blink Code			Component or Location	Cause or Type of Fault	Solution
1st Digit	2nd Digit	3rd Digit (X)			
7	3	X	External Modulator (Red)	Short to Power	Check ABS valve and cable. Replace as required.
7	5	X	External Modulator (Red)	Cable Break or Open	Check ABS valve and cable. Replace as required.
7	6	X	External Modulator (Red)	Short to Ground or Cable Damaged	Check ABS valve and cable. Replace as required.
7	12	X	External Modulator (Red)	ECU/Valve Assembly Failure	Check ABS valve and cable. Replace as required.
9	3	X	External Modulator (BU)	Short to Power	Check ABS valve and cable. Replace as required.
9	5	X	External Modulator (BU)	Cable Break or Open	Check ABS valve and cable. Replace as required.
9	6	X	External Modulator (BU)	Short to Ground or Cable Damaged	Check ABS valve and cable. Replace as required.
9	12	X	External Modulator (BU)	ECU/Valve Assembly Failure	Check ABS valve and cable. Replace as required.
10	3	X	ECU/Valve Assembly Modulator (YE)	Short to Power	Check ABS valve and cable. Replace as required.
10	5	X	ECU/Valve Assembly Modulator (YE)	Cable Break or Open	Check ABS valve and cable. Replace as required.
10	6	X	ECU/Valve Assembly Modulator (YE)	Short to Ground or Cable Damaged	Check ABS valve and cable. Replace as required.
10	12	X	ECU/Valve Assembly Modulator (YE).	ECU/Valve Assembly Failure	Check ABS valve and cable. Replace as required
14	2	X	ECU	Data Erratic	Unexpected System.
14	3	X	Power Supply	Over Voltage	Repair vehicle power supply.
14	4	X	Power Supply	Under Voltage	Check vehicle voltage output and connector.
14	5	X	Power Supply	Current Low	Check for proper ground on power cable.
14	9	X	ECU/Valve Assembly	Internal Failure	Erase fault.

X = Number of Fault Occurrences

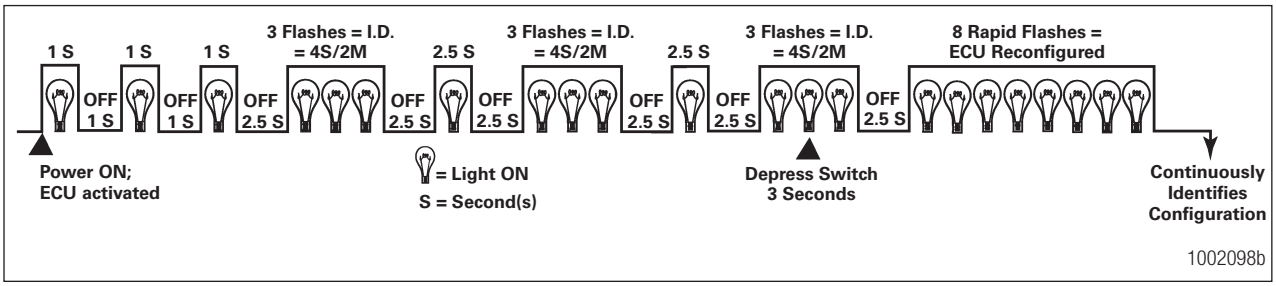
Appendix A - Expert Mode Diagnostics

Blink Code			Component or Location	Cause or Type of Fault	Solution
1st Digit	2nd Digit	3rd Digit (X)			
14	12	X	ECU/Valve Assembly	Internal Failure	Erase fault.
15	9	X	Electro-magnetic Interference	Various	Contact the WABCO Customer Care Center, 855-228-3203.
15	12	X	ECU/Valve Assembly	Internal Failure	Contact the WABCO Customer Care Center, 855-228-3203.
X = Number of Fault Occurrences					

11 Appendix B - Reconfigure Mode

11.1 Blink Code Example (4S/2M Configuration)

11.1.1 Reconfigure Mode



11.2 When to Use the Reconfigure Mode

Use the Reconfigure Mode to (1) reconfigure the ECU if necessary (see Table K: ECU Reconfiguration); or (2) to clear repaired faults from ECU memory.

Table K: ECU Reconfiguration

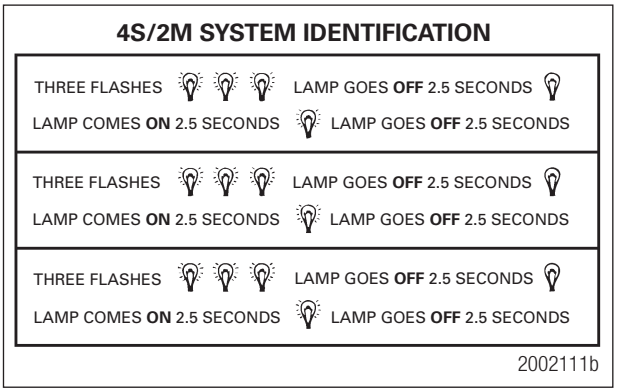
ECU Part Number	Reconfiguration Requirements
472 500 001 0	Manual reconfiguration required if ECU is installed on other than a 2S/2M configuration. See “How to Use the Reconfigure Mode”.
472 500 011 0	2S/1M only. No reconfiguration required.
471 500 012 0 and 472 500 013 0	Automatic reconfiguration for upward configurations (e.g., 2S/2M to 4S/2M). If downward, manual reconfiguration required. Do **NOT** reconfigure the ECU unless system usage has changed. Contact WABCO Customer Care Center at 855-228-3203 for assistance.

Appendix B - Reconfigure Mode

11.2.1 How to Use the Reconfigure Mode

> For an alternate blink code access procedure, see “Warning Lamp Diagnostics”, in Appendix C.

1. The vehicle must be stationary to activate and reconfigure the ECU. Power the ECU with 12 volts DC (9.5–14 is an acceptable range).
2. **If the diagnostic tool is not attached to the diagnostic cable:** Plug the diagnostic tool into the diagnostic cable socket usually located on the right side of the sub-frame.
3. **Activate the Reconfigure Mode**: Press the blink code lamp switch **three times** for **one second** each time as follows:
   a. Depress the blink code lamp switch **once** for **one second**.
   b. Release the switch for **one second**. The lamp will go **OFF**.
   c. Depress the switch **once** for **one second**. The blink code lamp will come back **ON**.
   d. Release the switch **once** for **one second**. The blink code lamp will go **OFF**.
   e. Depress the switch **once** for **one second**. The blink code lamp will come back **ON**.
   f. Release the switch. The blink code lamp will go **OFF**.
4. The blink code lamp will display the system’s identification **three times**. For example, **three** flashes identify a **4S/2M system**. (Refer to the system identification example shown below.)



> To accept the ECU reconfiguration, you must depress the blink code lamp switch for three seconds during the third display of the system’s identification.

5. During the **third** time the lamp displays the system’s identification, depress the blink code lamp switch for **three seconds** and release the switch to accept the system reconfiguration.
6. The blink code lamp will flash rapidly **eight times** to acknowledge that the ECU is reconfigured. The lamp will continue to flash the system’s identification until you turn **OFF** the power to the ECU.
7. If you repaired or replaced the ECU/Valve Assembly or ABS Modulator Valve, refer to “Final Test Before Returning a Trailer to Service” in Section 9, “Sensor Adjustment and Component Testing”.

12 Appendix C - Warning Lamp Diagnostics

12.1 ECU Part Numbers 472 500 011 0, 472 500 012 0, and 472 500 013 0

If you do not have easy access to either the diagnostic tool or blink code lamp on the ECU, the ABS warning lamp on the trailer may be used to display blink codes.

The lamp is capable of displaying faults in Normal, Expert, Clear-All, and Sensor Installation Test modes.

12.1.1 System Requirements

- Trailer with mandated ABS (with ECU/Valve Assembly part number listed above).
- Tractor/trailer hook-up with switched ignition power on tractor/trailer connector or a DC-powered tester.
- Technician and assistant recommended.

Read the description of each mode and use the blink code tables for Normal, Expert, and Reconfigure/ Clear-All modes that appear in this manual.

12.1.2 To display the blink codes on the ABS warning lamp:

1. Make sure the vehicle is stationary and that the trailer is hooked to a properly equipped tractor (see system requirements).
2. Remove power from the tractor and trailer (Turn off ignition).
3. Step on the brake pedal. Foot must remain on the brake for the entire procedure.
4. Provide Power. Turn on ignition for desired mode (Normal, Expert, or Clear-All). Once you enter the mode you plan to use, follow the instructions for that mode.

Reminder:

Brakes must be applied (foot on brake pedal) for the entire procedure.



To exit any mode, release foot brake pedal and turn ignition off for AT LEAST 10 SECONDS.

12.1.3 For Normal Mode

- Turn ignition **ON** ONCE for ONE SECOND.
- Turn ignition **OFF** for ONE SECOND.
- Turn ignition back **ON**.
  - Warning lamp will display the blink code one time. See Table E: Normal Mode Fault Code Table, in Section 7, “Diagnostics”, for blink code identification.

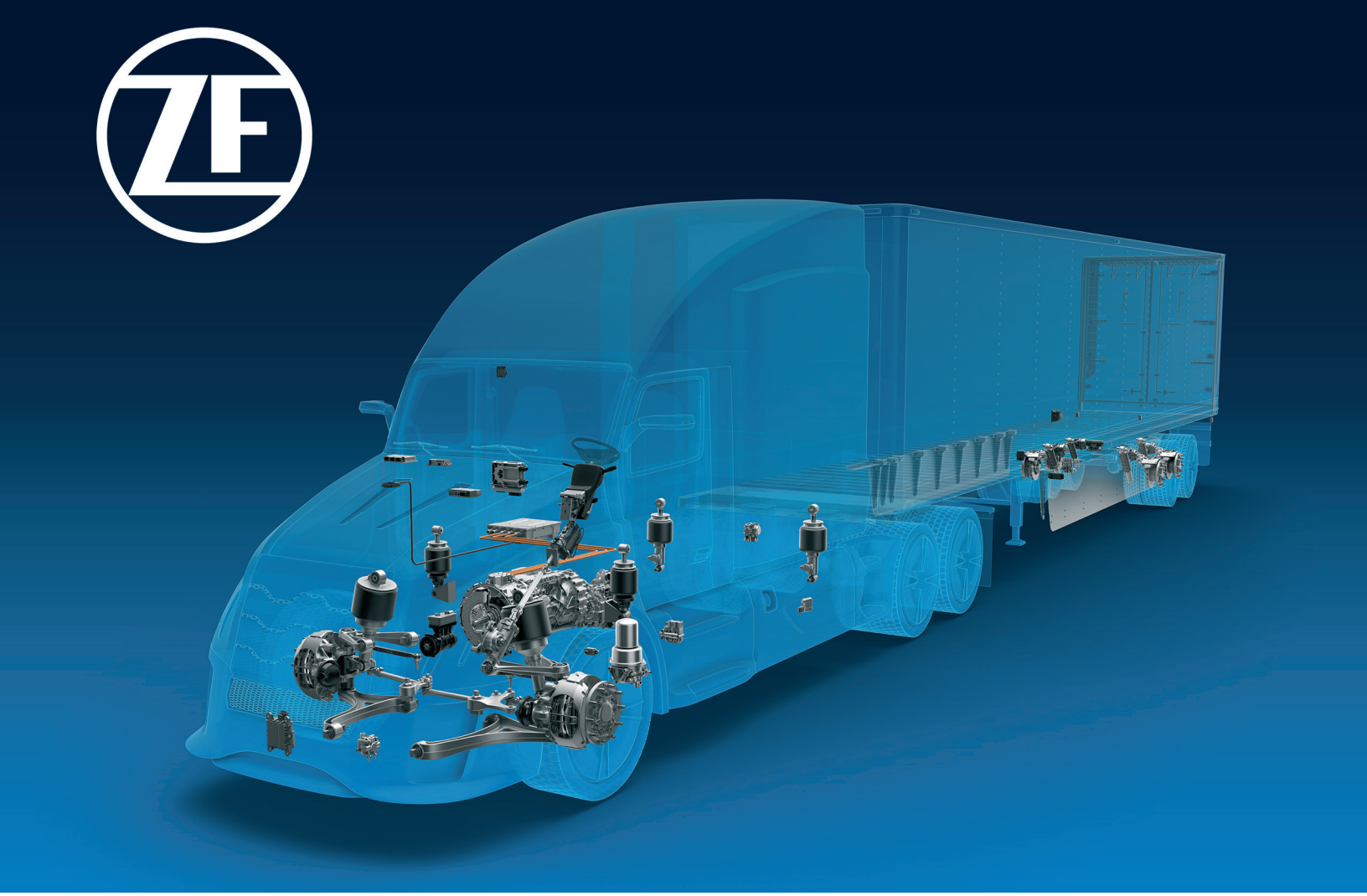
Appendix C - Warning Lamp Diagnostics

12.1.4 For Expert Mode

- Turn ignition **ON** ONCE for ONE SECOND.
- Turn ignition **OFF** for ONE SECOND.
- Turn ignition **ON** A SECOND TIME for ONE SECOND.
- Turn ignition **OFF** for ONE SECOND.
- Turn ignition back **ON**.
  - Warning lamp will display the blink code one time. See Table J: Expert Mode Fault Code, in “Appendixes”, for blink code identification.

12.1.5 For Clear-All or Sensor Installation Test Mode

- Turn ignition **ON** ONCE for ONE SECOND.
- Turn ignition **OFF** for ONE SECOND.
- Turn ignition **ON** A SECOND TIME for ONE SECOND.
- Turn ignition **OFF**.
- Turn ignition **ON** A THIRD TIME for ONE SECOND.
- Turn ignition **OFF** for ONE SECOND.
- Turn ignition back ON.
  - The blink code lamp will flash rapidly **eight times** to indicate that stored faults have been cleared from ECU memory.



For further details, contact the WABCO Customer Care Center at 855-228-3203.

About CVS Division

ZF's Commercial Vehicle Solutions (CVS) division is helping shape the future of commercial transportation ecosystems. Our mission is to be the preferred global technology partner to the commercial vehicle industry. Powerfully combining ZF's commercial vehicle systems expertise, extensive technology portfolio and global operations, the division serves the full commercial vehicle industry value chain. As the automotive industry progresses towards an increasingly autonomous, connected, and electrified (ACE) future, ZF's CVS division innovates, integrates and supplies components and advanced control systems that help make commercial vehicles and fleets operate more safely and sustainably. CVS unites ZF's former Commercial Vehicle Technology and Commercial Vehicle Control Systems divisions, the latter being formed following ZF's acquisition of WABCO in Spring 2020.

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