



Volvo Trucks North America, Inc.

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Service Bulletin Trucks

This Service Bulletin replaces Service Bulletin 593-39, "Anti-Lock Brake System (ABS), Rockwell WABCO Troubleshooting" (11.2002), publication no. PV776-TSP175629.

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1.2004	593	39	1(12)

Anti-Lock Brake System (ABS),
Meritor WABCO
Troubleshooting
VN, VHD VERSION2
From build date 11.2002

Troubleshooting

This information contains details for Anti-Lock Brake System (ABS), Meritor WABCO applications in VN/VHD vehicles from build date 11.2002.

Note: All data provided is based on information that was current at time of release. However, **this information is subject to change without notice.**
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Anti-Lock Brake System Troubleshooting

You must read and understand the precautions and guidelines in Service Information, group 50, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

- 1 VCADS Pro. See "VCADS Pro" page 2.
- 2 Instrument cluster diagnostic display (see "Diagnosing Faults using the Instrument Cluster" page 3).
- 3 By removing a relay (see service procedures).

For additional troubleshooting information see:

- "Component Troubleshooting" page 5
- "Other Component Troubleshooting" page 8

All codes must be in a stored or inactive state before clearing.

Note: Tire size range — For proper ABS/ATC operation with the standard ECU, front and rear tire size must be within 14% of each other. Exceeding this size allowance without electronically resetting the ECU may cause the warning lamp to illuminate and the system to deactivate. If the difference between front and rear tire sizes will be greater than 14%, contact Meritor WABCO for instructions on how to reset the ECU. Calculate the tire size with the following equation:

$$\% \text{ Difference} = \left\{ \frac{RPM \text{ Steer}}{RPM \text{ Drive}} - 1 \right\} \times 100$$

RPM = tire revolutions per mile

VCADS Pro

VCADS Pro is a Windows based software tool used to perform tests and calibrations on ECUs on the vehicle.

A PC tool with VCADS Pro software is connected to the vehicle's diagnostic connector using adapters and a communication interface unit.

VCADS Pro Test and Calibration applications makes it possible to test and to calibrate the ECUs. The applications consist of standard graphical interfaces

displaying graph presentations and continuous reading of parameters. The Test and Calibration applications are organized according to function group.

Wabco ABS units installed on Volvo VN and VHD trucks are tested using the VCADS Pro tool. This tool conducts troubleshooting and diagnostics for the ABS unit.

Note: For further information on VCADS Pro, refer to the VCADS Pro User's Manual, in group 03.

Diagnosing Faults using the Instrument Cluster

The graphic display of the instrument cluster can be used to display diagnostic messages from the ABS. The system uses the SAE J1587/1708 data link and is installed in vehicles with electronically controlled engines.

To see diagnostic messages,

- 1 Stop the engine.
- 2 Turn the ignition ON.
- 3 Press the MODE button on the vehicle dash until the Diagnostics Menu is displayed. Use the UP and DOWN buttons to display DIAGNOSTIC MESSAGES.
- 4 Press the SET button to have the datalink retrieve data.
- 5 Press the DOWN button until the brake screen is displayed. The Set button can be pressed to toggle the display between the text description and the received data. If the display shows "UNKNOWN" in any line, press the Set button to display the MID, PID or SID and FMI.

Fault codes cannot be cleared using the instrument cluster graphic display.

- a. If the condition that caused the currently displayed fault still exists, the cluster will display "ACTIVE."
 - b. If the condition that caused the currently displayed fault is no longer occurring, the cluster will display "INACTIVE."
 - c. The number of times a fault has occurred will be displayed when available. In some cases, a short message may also be displayed.
- 6 Record all codes displayed.
 - 7 To display the next stored fault, press the Down button.

Diagnostic Messages

Diagnostic messages are provided as text descriptions or SAE J1587/J1708 fault codes (MID, SID and FMI). A list of these fault codes for ABS follows.

All ABS fault codes in the Instrument Cluster graphic display have the following for line 1:

Fault Description	MID (Message ID)
Brakes	136

The following is a list of the possible faulty component messages for the Instrument Cluster graphic display (Line 2), and the corresponding SAE J1587/J1708 code.

Fault Description	SID's (Subsystem ID's)
ABS Snsr axle 1 L	1
ABS Snsr axle 1 R	2
ABS Snsr axle 2 L	3
ABS Snsr axle 2 R	4
ABS Snsr axle 3 L	5
ABS Snsr axle 3 R	6
ABS valve axle 1 L	7
ABS valve axle 1 R	8
ABS valve axle 2 L	9
ABS valve axle 2 R	10
ABS valve axle 3 L	11
ABS valve axle 3 R	12
ABS rtrdr ctrl relay	13
ABS relay, diagonal 1	14
ABS relay, diagonal 2	15
ABS, dif 1 - ASR valve	18
ABS, dif 2 - ASR valve	19

The following is a list of the possible fault condition messages for the Instrument Cluster graphic display (Line 3), and the corresponding SAE J1587/J1708 code.

Fault Description	FMI's (Failure Modes)
Data valid, but high	0
Date valid, but low	1
Data erratic	2
Voltage shorted high	3
Voltage shorted low	4
Current low or open C	5
Current high or short C	6
Mech syst no respons	7
Abnormal freq or PW	8
Abnormal update rate	9
Abnormal change rate	10
Failure unknown	11
Bad device	12
Out of calibration	13
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Component Troubleshooting

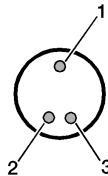
If diagnostics indicate that there is a problem with the ABS, the following component tests may be used to determine whether the problem is in the component or the wiring. Prior to performing any component tests, make a visual inspection of the cables, connectors and valves for loose connections, corrosion and breakage.

The ABS modulator valves and TCS valves can be checked by measuring the resistance of the coils. This measurement can be made at the valve or at the ECU connector.

ABS Modulator Valve

To check resistance, perform the following:

- 1 Verify that the vehicle ignition is OFF.
- 2 Disconnect the cable to the modulator valves at the ECU (connector for front or rear components as appropriate).
- 3 Measure the resistance across terminals listed on the table below. Acceptable reading is between 4.0 and 8.0 Ω .
- 4 If resistance in Step 3 was not within tolerance for any valve, perform Steps 5 through 6. Otherwise, go to Step 7.
- 5 Disconnect the connector on that valve.
- 6 Measure the resistance across terminals 1 and 2 and across terminals 1 and 3. If both resistance values are outside tolerance, the modulator valve must be replaced. If the resistance values are correct, the problem is in the cable.
- 7 Reconnect the connector.



- 2 Turn on the ignition.
- 3 Wait for the ABS indicator lamp to come on.
- 4 Listen to the valves cycle consecutively as follows:
 4 Channel Valve Cycle Order: 1-2-3-4.
 6 Channel Valve Cycle Order: 1-2-3-4-5-6.

Traction Control Valve

To check resistance, perform the following:

- 1 Verify that the vehicle ignition is OFF.
- 2 Disconnect the cable to the Traction Control valves at the ECU (connector for rear components).
- 3 Measure the resistance across terminals listed on the table below. Acceptable reading is between 8.0 and 14.0 Ω .
- 4 If resistance in Step 3 was not within tolerance for either valve, perform Steps 5 through 7. Otherwise, go to Step 8.
- 5 Disconnect the connector on that valve.
- 6 Measure the resistance across terminals 1 and 2.
- 7 If resistance value is not within tolerance, the Traction Control valve must be replaced. If the resistance value is correct, the problem is in the cable.
- 8 Reconnect the connector.

To check that the ABS valves are operating properly perform the following:

- 1 Apply the brakes.

ABS/Traction Valve Resistance				
Component	ABS ECU Connector	Terminals	Satisfactory Resistance	Possible Faults
ABS inlet, left front axle	Front (black) harness connector	11 to 2	4.0 to 8.0 Ω	Wiring between ECU and valve damaged
ABS exhaust, left front axle		11 to 10		
ABS inlet, right front axle		9 to 4		
ABS exhaust, right front axle		9 to 3		
ABS inlet, left rear axle	Rear (green) harness connector	11 to 12	4.0 to 8.0 Ω	Ground lead to valve disconnected
ABS exhaust, left rear axle		11 to 10		
ABS inlet, right rear axle		8 to 9		
ABS exhaust, right rear axle		8 to 7		
Traction Control valve		5 to 6	8.0 to 14.0 Ω	Solenoid valve shorted

Sensors

To check the resistance of a sensor, perform the following:

- 1 Verify that the vehicle ignition is OFF.
- 2 Disconnect the cable to the sensors at the ECU (connector for front or rear sensors as appropriate).
- 3 Use the Sensor Pin-out Cable (Tool J-42883) and the Digital Multimeter (Fluke 87) to check the Wheel Speed Sensor, Coil Resistance, Ground Resistance, and Output Voltage on Meritor Wabco ABS Brakes.
- 4 Measure the resistance across terminals listed on the table below. Acceptable reading is between 700 and 3000 ohms.
- 5 If resistance in Step 3 was not within tolerance for the sensor, perform Steps 5 through 7. Otherwise, go to Step 8.
- 6 Disconnect the connector for the sensor.
- 7 Measure the resistance across terminals 1 and 2.
- 8 If resistance value is not within tolerance shown in the table, the sensor must be replaced. If the resistance value is correct, the problem is in the cable.
- 9 Reconnect the connector.

ABS Sensor Resistance				
Sensor Location	ABS ECU Connector	Terminals	Satisfactory Resistance	Possible Faults
Left Front (Axle 1)	Front (black) harness connector	7 to 8	700 to 3000 Ω	Wiring between ECU and sensor damaged Damaged sensor connector Defective sensor
Right Front (Axle 1)		5 to 6		
Left Rear (Axle 2)	Rear (green) harness connector	1 to 2		
Right Rear (Axle 2)		3 to 4		
Left Rear (Axle 3)*	6-channel (brown) harness connector	3 to 4		
Right Rear (Axle 3)*		5 to 6		

* Only used in 6S/4M setup.

Sensor Adjustment Check

To check the proper adjustment of a sensor, perform the following:



If placing a vehicle with Traction Control System (ATC) on jacks when servicing, the ATC must be disabled. If the ATC is not disabled and one of the wheels starts to spin, the ATC will compensate and the vehicle may come off the jack and may cause serious personal injury or death.

- 4 Measure the AC voltage across terminals listed on the table below. Acceptable reading is greater than 0.200 VAC and steady.
- 5 If voltage in Step 4 was not acceptable, perform Step 5 through 7. Otherwise, go to Step 8.
- 6 Refer to the table below for possible causes.
- 7 Adjust or replace the sensor as required.
- 8 Recheck sensor adjustment.

- 1 Verify that the vehicle ignition is OFF.
- 2 Disconnect the cable to the sensors at the ECU (connector for front or rear sensors as appropriate).

3

Note: Before servicing the vehicle, disable the ATC by disconnecting the harness at the ATC control valve. Spin the wheel for the sensor to be checked, by using the Sensor pin-out tool (J-42883), at approximately 30 RPM.

ABS Sensor Adjustment Check				
Sensor Location	ABS ECU Connector	Terminals	Satisfactory Condition	Possible Faults
Left Front (Axle 1)	Front (black) harness connector	7 to 8	> 0.200 VAC	No voltage: <ul style="list-style-type: none"> ● sensor wire broken ● sensor wire shorted ● sensor gap too large Large variations: <ul style="list-style-type: none"> ● excessive tooth wheel runout ● tooth wheel damaged ● excessive wheel bearing end play
Right Front (Axle 1)		5 to 6		
Left Rear (Axle 2)	Rear (green) harness connector	1 to 2		
Right Rear (Axle 2)		3 to 4		
Left Rear (Axle 3)*	6-channel (brown) harness connector	3 to 4		
Right Rear (Axle 3)*		5 to 6		

* Only used in 6S/4M setup.

Sensor Bracket Corrosion

Due to field reporting efforts, there is a new procedure to prevent corrosion between the ABS aluminum sensor bracket and the copper clip by applying Glermo 805 Lubricating Paste. Grease will be added to steel brackets and the industry generic hub bore as well.

The product description literature of the lubricating paste states, "it is for paired surfaces which have a tendency to stick slip and seizure...suitable for lubrication of lathe chucks and clamping elements." Further attributes include the paste has a, "low coefficient of friction; adheres extremely well; protects against corrosion and is water resistant; avoids stick-slip effects and seizing."

The lubricating paste is to be, "applied 1ML (sometimes 2ML depending upon sensor bracket size) to the inside bore of each sensor bracket before inserting clamping sleeve."

When it is necessary to disassemble the ABS sensor components or to service them in the field, lubrication is recommended between the sensor bracket and the sensor copper clip. Currently the above grease is available only in bulk, production quantities. Efforts are being made to make available in service quantities.

Other Component Troubleshooting

Note: Refer to the system schematics for circuit information.

The following table provides additional possible faults within the ABS not previously covered within the Troubleshooting section.

Component Troubleshooting		
Symptom	Type of Failure	Check
Important: The following must be performed with the ignition ON.		
ABS light stays illuminated	Diagnostic faults present	See cluster diagnostic menu to check for stored fault codes. Refer to previous troubleshooting information
	No ECU power: Fuse blown	<ul style="list-style-type: none"> Check 15A fuses (F61/F62) in electrical center. Check 60A maxi fuse in power module of electrical center
	No ECU power: Open or short circuit in cab or chassis harness power/ground circuits	<ul style="list-style-type: none"> Check voltage at the gray ABS ECU (Cab) connector, terminals 1 to 11 and 2 to 12. Should read battery voltage with the ignition switch ON. (Note: terminals 1 (777A) & 2 (777B) are power; terminals 11 (ABS-A) & 12 (ABS-B) are ground). Check ECU and Cab connections for corrosion or loose terminals. Check relay PR3 ground wire, circuit OR-H, for continuity to the ground bus bar in the electrical center.
	No ECU power: ABS ECU power relay PR3 bad	<ul style="list-style-type: none"> Check power and ground at relay PR3 coil. Measure voltage from circuits 196 to OR-H (pins 86 to 85 of the relay holder). Try replacing relay PR3 with a known good relay.
	Short circuit in harness	<ul style="list-style-type: none"> Check circuit 779 for short to ground. Check circuit 778 from the ABS ECU for a short to ground.

Component Troubleshooting		
Symptom	Type of Failure	Check
Important: The following must be performed with the ignition ON.		
ABS warning lamp does not flash at key ON	ABS warning LED burned out	Perform an instrument cluster bulb test from the cluster diagnostic menu screen: CLUSTER SELF-TEST BULB TEST?
	Open circuit between ABS ECU and instrument cluster	<ul style="list-style-type: none"> • Check for a ground signal from ABS ECU to instrument cluster (Connector "C", pin 3, circuit 778 — 12V lamp Off, 0V lamp On) • Alternate check: Check circuit 778 for connection to ground (approximately $\emptyset\Omega$) • Check for open connections in the ABS harness.
	ABS ECU bad	Ground circuit 778 at the ABS ECU: Lamp On Circuit 778 OK (Replace ABS ECU); Lamp Off Circuit 778 Open (Check wire/connections for continuity)
TCS light flashing	TCS switch pressed once.	<ul style="list-style-type: none"> • Normal operation. Traction control in Mud/snow mode. • Press switch a second time to disengage mud/snow mode, or cycle ignition off and on.
TCS light stays illuminated	Short circuit in TCS switch.	Disconnect TCS switch and cycle ignition off and on.
	Short circuit in harness.	<ul style="list-style-type: none"> • Disconnect the instrument cluster connector for the TCS inlet circuit. Check circuits 774, 774-A and 774-B for short to ground.

ABS Indicator Light

Troubleshooting the ABS indicator lamp works as follows:


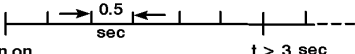
Ignition ON	Normal Operation	ABS lamp comes on at ignition momentarily for a bulb check, then goes out.	System is O.K.
	After servicing ABS	ABS lamp does not go out at ignition.	When vehicle is driven at speeds above 4 mph (6 km/h), lamp goes out. System is O.K.
	Existing Fault	ABS lamp does not go out at ignition.	Lamp does not go out at speeds above 4 mph (6 km/h) - a fault exists in the ABS system.

Trailer ABS Indicator Lamp

The trailer ABS indicator lamp on the vehicle dash applies to Trailer ABS only. The lamp is controlled by a signal to the tractor ECU, sent over the power line (PLC function). When a trailer ABS fault is detected, an ON message is sent, when no fault is detected, the ECU receives an OFF message. Table A illustrates trailer ABS lamp operation at power-up, or ignition on. Table B depicts lamp responses

that occur during operation. Lamp turn ON and OFF messages do not turn the lamp ON or OFF instantly. The delay between the receipt of the message and the lamp response time is intentional. It prevents erratic lamp activity. NOTE: For doubles or triples, the lamp does not distinguish between trailers. A system fault in any of the trailers will activate the trailer ABS indicator lamp.

Table A: Dash-mounted Trailer ABS Indicator Lamp Operation-Bulb Check (Information for Drivers)

Signal from trailer to tractor ECU	Status of Trailer ABS Lamp on vehicle dash	Explanation
<p>Single or Multiple Trailers</p> <p>message OFF OFF OFF OFF OFF OFF OFF OFF</p> <p>lamp on ...</p> <p>lamp off </p>	<p>Trailer ABS lamp comes on at ignition, OFF message is detected within three seconds of ignition, Trailer ABS lamp goes out.</p>	<p>Bulb Check performed and Trailer ABS system is OK. In this case, the lamp is ON for a Bulb Check only.</p>
<p>Single or Multiple Trailers</p> <p>message No ON or OFF messages</p> <p>lamp on</p> <p>lamp off </p> <p>ign on</p> <p>t > 3 sec</p>	<p>Trailer ABS lamp does not come on within three seconds of ignition.</p>	<p>No Bulb Check, trailer added after initial power-up, system OK. There was no trailer PLC message for at least three seconds following ignition ON.</p>

**Note: ON = Turn ON message to Trailer ABS lamp.
OFF = Turn OFF message to Trailer ABS lamp.
Removing a trailer with a fault causes the ABS lamp to turn off. Repair a trailer with a fault as soon as possible and before returning to use.**

Table B: Dash-mounted Trailer ABS Indicator Lamp Operation-Bulb Check (Information for Service Technicians)

Signal from trailer to tractor ECU	Status of Trailer ABS Lamp on Vehicle Dash	Explanation	Action
<p>Single or Multiple Trailers</p> <p>message</p> <p>lamp on</p> <p>lamp off</p>	Trailer ABS lamp does not come on within three seconds of ignition.	Not using the PLC system (no trailer connected) or trailer not equipped with PLC or fault in PLC system.	Use lamp on side of trailer to identify fault. Make necessary repairs.
<p>Single Trailer</p> <p>message OFF OFF OFF ON ON ON ON</p> <p>lamp on ...</p> <p>lamp off</p>	Trailer ABS lamp comes on.	Trailer ABS fault(s) occurred during operation and still exists.	
<p>Multiple Trailers/Dollies</p> <p>message OFF OFF OFF OFF OFF OFF OFF OFF</p> <p>lamp on ...</p> <p>lamp off</p>			
<p>Single Trailer</p> <p>message ON ON OFF OFF OFF OFF OFF OFF</p> <p>lamp on ...</p> <p>lamp off</p>	Trailer ABS lamp comes on but goes out 2.5 seconds after fault is detected.	Trailer ABS fault occurred during operation and the fault was corrected.	None
<p>Multiple Trailers/Dollies</p> <p>message OFF OFF OFF OFF OFF OFF OFF OFF</p> <p>lamp on ...</p> <p>lamp off</p>			

Signal from trailer to tractor ECU	Status of Trailer ABS Lamp on Vehicle Dash	Explanation	Action
<p>Single Trailer</p>	<p>ABS lamp is off, comes on, then goes off, 10 seconds after the loss of messages.</p>	<p>ABS fault existed, then signal was lost because trailer disconnected or PLC fault.</p>	<p>Use lamp on side of trailer to identify fault. Make necessary repairs.</p>
<p>Multiple Trailers/Dollies</p>		<p>ABS fault existed, then trailer with fault lost signal because trailer was disconnected or PLC fault.</p>	
<p>Single Trailer to Multiples</p>	<p>ABS lamp is on and stays on when a new trailer with no new fault is added.</p>	<p>There was a fault in existence before the new trailer was added and the ignition was not turned off before the trailer was added.</p>	
<p>Single Trailer to Multiples</p>	<p>ABS lamp is on and stays on when a new trailer with new fault is added.</p>	<p>ABS fault was in existence before the new trailer was added. The ignition was not turned off before the trailer was added and the new trailer has an ABS fault.</p>	

Note: ON = Turn ON message to Trailer ABS lamp.
OFF = Turn OFF message to Trailer ABS lamp.

Removing a trailer with a fault causes the ABS lamp to turn off. Repair a trailer with a fault as soon as possible and before returning to use.