Safety Defect and Noncompliance Report Guide for Vehicles

**PART 573 Defect and Noncompliance Report**

**On May 13, 2009, Motor Coach Industries, Inc. decided that a defect which relates to motor vehicle safety exists in the motor vehicles listed below, and is furnishing notification to the National Highway Traffic Safety Administration in accordance with 49 CFR Part 573 Defect and Noncompliance Reports.**

**Date this report was prepared:** May 26, 2009 **Amended September 3, 2009**

**Furnish the manufacturer's identification code for this recall (if applicable):**

MCI Service Bulletins 327**B** (D model series) and 328**B** (J **& E** model series)

**1. Identify the full corporate name of the fabricating manufacturer of the vehicle being recalled. If the recalled vehicle is imported, provide the name and mailing address of the designated agent as prescribed by 49 U.S.C. §30164.**

Motor Coach Industries, Inc.
1700 E. Golf Road
Suite 300
Schaumburg, IL 60173

**Identify the corporate official, by name and title, whom the agency should contact with respect to this recall.**

Bryan Couch, Vice President, Product Planning & Project Management

**Telephone Number:** (204) 287-4447 **Fax No.:** (204) 478-2867

**Name and Title of Person who prepared this report.**

Timothy J. Nalepka
Senior Vice President, General Counsel & Secretary

**Signed:** Timothy J. Nalepka

## I. Identify the Vehicle Models Involved in the Recall

**2. Identify the Vehicles Involved in the Recall,** ***for each make and model or applicable vehicle line (provide illustrations or photographs as necessary to describe the vehicle), provide*****:**

**Make(s):** MCI

**Model Years and Models Involved:**

1. 2009 D4000ISTV, **D4005,** D4500, D4505
2. **2010 D4500**
3. 2008 and 2009 J4500
4. **2009 E4500**
5. **2003 E4500 (one coach)**

**Production Dates:**

| | | | | |
|---|---|---|---|---|
| 1. 2009 D4000ISTV, **D4005,** D4500, D4505 | **Beginning:** | January 2009 | **Ending:** | **July** 2009 |
| **2. 2010 D4500** | **Beginning:** | **December 2008** | **Ending:** | **April 2009** |
| 3. 2008 and 2009 J4500 | **Beginning:** | October 2007 | **Ending:** | April 2009 |
| **4. 2009 E4500** | **Beginning:** | **January 2009** | **Ending:** | **April 2009** |
| **5. 2003 E4500 (one coach)** | **Beginning:** | **October 2002** | **Ending:** | **October 2002** |

**VIN Range:**

| | | | | |
|---|---|---|---|---|
| 1. 2009 D4000ISTV, **D4005,** D4500, D4505 | **Beginning:** | 58890 | **Ending:** | **59137** |
| **2. 2010 D4500** | **Beginning:** | **59139** | **Ending:** | **59155** |
| 3. 2008 and 2009 J4500 | **Beginning:** | 64618 | **Ending:** | **65374** |
| **4. 2009 E4500** | **Beginning:** | **65203** | **Ending:** | **65341** |
| **5. 2003 E4500 (one coach)** | **Beginning:** | **61996** | **Ending:** | **61996** |

| | | | | |
|---|---|---|---|---|
| 58890 | 58907 | 58980 – 58987 | **58988 – 58989** | 58990 |
| **58991** | 58992 – 59000 | **59001** | 59002 | **59003** |

| | | | | |
|---|---|---|---|---|
| 59004 – 59011 | 59012 | 59013 | 59014 | 59015 |
| 59016 – 59031 | 59038 – 59045 | 59047 – 59050 | 59053 | 59057 – 59058 |
| 59061 – 59062 | 59080 | 59092 – 59127 | 59130 – 59132 | 59137 |
| 59139 | 59142 | 59144 | 59146 | 59148 |
| 59150 | 59153 | 59155 | | |
| | | | | |
| 61996 | 64618 | 64918 | 64919 | 64948 – 64950 |
| 64953 – 64964 | 64966 | 64968 | 64970 | 64972 |
| 64974 | 64976 | 64978 – 64988 | 64990 – 65004 | 65006 |
| 65011 | 65013 – 65032 | 65035 – 65082 | 65086 – 65098 | 65106 |
| 65108 | 65110 | 65112 – 65118 | 65120 | 65122 |
| 65124 – 65147 | 65149 | 65151 – 65170 | 65172 | 65174 |
| 65176 | 65178 | 65180 | 65182 | 65184 |
| 65186 – 65188 | 65190 – 65194 | 65196 – 65202 | 65203 | 65204 – 65213 |
| 65215 – 65237 | 65238 | 65239 | 65240 | 65241 – 65242 |
| 65243 – 65255 | 65256 | 65257 | 65258 | 65259 – 65282 |
| 65284 | 65285 | 65286 | 65287 | 65288 |
| 65289 – 65303 | 65304 | 65305 – 65309 | 65310 | 65311 – 65319 |
| 65320 – 65322 | 65323 – 65326 | 65327 – 65336 | 65337 | 65338 – 65374 |

**Descriptive information which characterizes /distinguishes the recalled vehicles from those model vehicles not included in the recall:**

The vehicles that are the subject of the recall are the coaches manufactured with Meritor WABCO's Electronic Stability Control ("ESC") System, which has a Steer Angle Sensor ("SAS") as a component thereof, and bearing a Meritor WABCO serial number below 3404. Please see the attached Meritor WABCO Amended Part 573 Defect Information Report dated July 17, 2009. The subject Steer Angle Sensors were included in steering columns furnished to MCI by Douglas Autotech Corp. MCI is not able to correlate specific SAS serial numbers to specific MCI coaches.

**Identify the approximate percentage of the production of all the recalled models manufactured by your company between the inclusive dates of manufacture provided above, that the recalled model population represents. For example, if the recall involved Widgets equipped with certain items of equipment from January 1, 1996 through April 1, 1997, then what was the percentage of the recalled Widgets of all Widgets manufactured during that time period.**

The recalled 2009 D4000ISTV, D4005, D4500, and D4505 and 2010 D4500 model population represents approximately 45% of the total 2009 D4000ISTV, D4005, D4500, and D4505 and 2010 D4500 model coaches manufactured during the inclusive dates.

The recalled 2008 and 2009 J4500 model population represents approximately 53% of the total 2008 and 2009 J4500 model coaches manufactured during the inclusive dates.

**The recalled 2003 and 2009 E4500 model population represents approximately 10% of the total 2003 and 2009 E4500 model coaches manufactured during the inclusive dates.**

## II. Identify the Recall Population

**3. Furnish the total number of vehicles recalled potentially containing the defect or noncompliance.**

| MODELS | MODEL YEARS | NUMBER OF VEHICLES POTENTIALLY INVOLVED |
|---|---|---|
| D4500 | 2009 | 73 (previously 19) |
| D4500 | 2010 | 8 |
| D4505 | 2009 | 14 (previously 3) |
| D4000 ISTV | 2009 | 21 (previously 9) |
| D4005 | 2009 | 4 |
| J4500 | 2008 | 53 (previously 49) |
| J4500 | 2009 | 323 (previously 270) |
| E4500 | 2003 | 1 |
| E4500 | 2009 | 5 |

**Total Number Potentially Affected by the Recall:** 502 (previously 350)

**4. Furnish the approximate percentage of the total number of vehicles estimated to actually contain the defect or noncompliance:**

The percentage of coaches having SAS with serial numbers below 3404 is not currently known.

**Identify and describe how the recall population was determined--in particular how the recalled models were selected and the basis for the beginning and final dates of manufacture of the recalled vehicles:**

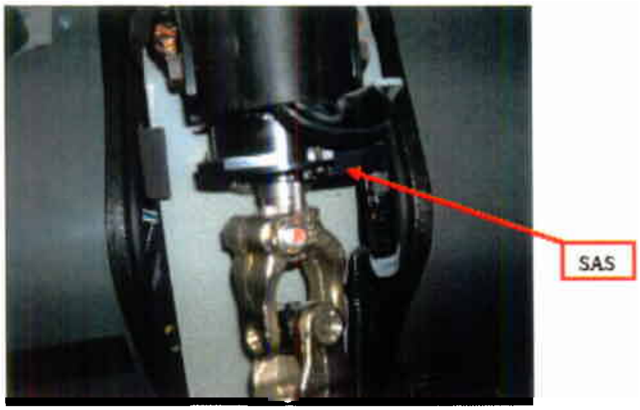
MCI determined the vehicle recall population by listing all coaches that were manufactured with the Electronic Stability Control feature, and then eliminating those coaches that have been checked and found to have a Meritor WABCO serial number of 3404 or above, as well as the coaches in which the SAS has been replaced with an SAS bearing a Meritor WABCO serial number of 3404 or above.

## III. Describe the Defect or Noncompliance

**5. Describe the defect or noncompliance. The description should address the nature and**

**physical location of the defect or noncompliance. Illustrations should be provided as appropriate.**

Please see the attached Meritor WABCO Amended Part 573 Defect Information Report dated July 17, 2009. The SAS is located at the lower end of the steering column, behind a steering column cover, as shown in the following photograph.




**Describe the cause(s) of the defect or noncompliance condition.**

Please see the attached Meritor WABCO Amended Part 573 Defect Information Report dated July 17, 2009.

**Describe the consequence(s) of the defect or noncompliance condition.**

Please see the attached Meritor WABCO Amended Part 573 Defect Information Report dated July 17, 2009.

**Identify any warning which can (a) precede or (b) occur.**

MCI is not aware of any warning expected to precede or occur when a failure is experienced.

**If the defect or noncompliance is in a component or assembly purchased from a supplier, identify the supplier by corporate name and address.**

Please see the attached Meritor WABCO Amended Part 573 Defect Information Report dated July 17, 2009. Meritor WABCO supplied the SAS to Douglas Autotech Corp., 300 Albers Rd, Bronson, MI, and MCI purchased the steering columns from Douglas Autotech.

**Identify the name and title of the chief executive officer or knowledgeable representative of the supplier:**

The knowledgeable representative of Meritor WABCO is Alan Korn, Director – Vehicle Dynamics & Control. Please see the attached Meritor WABCO Amended Part 573 Defect Information Report dated July 17, 2009.

## IV. Provide the Chronology in Determining the Defect/Noncompliance

***If the recall is for a defect, complete item 6, otherwise item 7.***

**6. With respect to a defect, furnish a chronological summary (including dates) of all the principal events that were the basis for the determination of the defect. The summary should include, but not be limited to, the number of reports, accidents, injuries, fatalities, and warranty claims.**

Please see the attached Meritor WABCO Amended Part 573 Defect Information Report dated July 17, 2009.

**7. With respect to a noncompliance, identify and provide the test results or other data (in chronological order and including dates) on which the noncompliance was determined.**

Not applicable.

## V. Identify the Remedy

**8. Furnish a description of the manufacturer's remedy for the defect or noncompliance. Clearly describe the differences between the recall condition and the remedy.**

Please see the attached Meritor WABCO Amended Part 573 Defect Information Report dated July 17, 2009.

**Clearly describe the distinguishing characteristics of the remedy component/assembly versus the recalled component/assembly.**

Please see the attached Meritor WABCO Amended Part 573 Defect Information Report dated July 17, 2009.

**Identify and describe how and when the recall condition was corrected in production. If the production remedy was identical to the recall remedy in the field, so state. If the product was discontinued, so state.**

Please see the attached Meritor WABCO Amended Part 573 Defect Information Report dated July 17, 2009.

## VI. Identify the Recall Schedule

**9. Furnish a schedule or agenda (with specific dates) for notification to other manufacturers, dealers/retailers, and purchasers. Please identify any foreseeable problems with implementing the recall.**

Please see the attached Meritor WABCO **Amended** Part 573 Defect Information Report dated **July 17, 2009**. MCI anticipates sending notifications to customers within one week after receiving approval by NHTSA of MCI's draft customer notification.

## VII. Furnish Recall Communications

**10. Furnish a final copy of all notices, bulletins, and other communications that relate directly to the defect or noncompliance and which are sent to more than one manufacturer, distributor, or purchaser. This includes all communications (including both original and follow-up) concerning this recall from the time your company determines the defect or noncompliance condition on, not just the initial notification.** ***A DRAFT copy of the notification documents should be submitted to this office by Fax (202-366-7882) for review prior to mailing.***

**Note that these documents are to be submitted separately from those provided in accordance with Part 573.8 requirements.**

**MCI has attached its proposed customer letter and bulletins.**

**MERITOR WABCO**

Meritor WABCO Vehicle Control Systems
2135 West Maple Road
Troy, MI 48084-7121
Telephone 248.435.8001
Facsimile 248.435.8002
meritorwabco.com

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May 11, 2009 Amended July 17, 2009

Daniel C. Smith, Esq.
Associate Administrator for Enforcement
National Highway Traffic Safety Administration
1200 New Jersey Avenue, SE
Washington, D.C. 20590

Fax: 202-366-7882

Re: Part 573 Defect Information Report relating to certain Electronic Stability Control Steering Angle Sensors shipped by Meritor WABCO Vehicle Control Systems between July 2007 and February 26, 2009.

Meritor WABCO File: C9AB NHTSA File: 09E-032

Dear Mr. Smith:

Meritor WABCO Vehicle Control Systems amends this Defect Information Report submitted May 11, 2009 in accordance with the requirements of the National Motor Vehicle Safety Act of 1966 as set forth in 49 CFR 573.5. This document corresponds to the sub paragraphs of section 573.5 (c).

**§573.6(c)(1) – This report is submitted by:**

Meritor WABCO Vehicle Control Systems
2135 West Maple Road
Troy, Michigan 48084-7186

**§573.6(c)(2) – Identification of vehicle or items of motor vehicle equipment:**

This report covers the following Steering Angle Sensor (SAS) part numbers supplied by Meritor WABCO Vehicle Control Systems:

| | |
|---|---|
| 441 120 004 0 | 400 850 666 0 |
| 400 850 647 0 | |

These potentially suspect Steering Angle Sensors with serial numbers below 3404 were mainly shipped by Meritor WABCO to the steering column supplier. This supplier installed the SAS in the column and then shipped the completed assembly to a number of North American coach and specialty OEMs.

The Steer Angle Sensor is a component of the Meritor WABCO Electronic Stability Control System. The SAS provides the Electronic Stability Control (ESC) system with the driver

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selected steering angle, a critical input necessary to help detect loss of directional vehicle stability. When a loss of control event occurs, the ESC automatically applies individual foundation brakes on the vehicle to generate a counteractive force to help regain stability and mitigate the risk of a crash.

**§573.6(c)(3) – Total number of vehicles or items of motor vehicle equipment affected:**

Meritor WABCO estimates 1023 Steering Angle Sensors were shipped between July 2007 and February 26, 2009 (serial numbers below 3404). A list of affected customer and quantities is contained in Appendix A of this notice.

**§573.6(c)(4) – Percentage of vehicles or items of motor vehicle equipment affected:**

Meritor WABCO has determined that 100% of the above mentioned population contains the original SAS design that potentially could perform as described in the following paragraph.

**§§573.6(c)(5) – Description of the defect:**

Meritor WABCO recently received reports from six motor coaches and two fire trucks equipped with Meritor WABCO Electronic Stability Control (ESC) alleging unexpected brake activations during low speed turning maneuvers. Meritor WABCO's investigation revealed the rotor driving tab of the Steer Angle Sensor used in the ESC system was sheared off on three of the coaches and two of the fire trucks. All of the affected Steer Angle Sensors had the original drive tab design with serial numbers below 3404. There have been no crashes or injuries relating to this sensor issue to date.

The Steer Angle Sensor driving tab fits in a groove in the steering column shaft, causing the sensor rotor to turn with the steering wheel. The SAS provides the Electronic Stability Control system with the driver selected steering angle, a critical input necessary to detect loss of directional stability. With a broken SAS driving tab, the ESC yaw rate sensor and lateral accelerometer will measure a difference in vehicle direction when the driver makes a turn without a corresponding change in steer angle. This could be interpreted by the ESC as a directional instability, requiring intervention by brake activation of a selected wheel.

Diagnostics that are integrated in the ESC software may or may not detect a broken SAS driving tab after a period of time during the ignition cycle once a failure has occurred. On subsequent ignition cycles, ESC power-up diagnostics will likely prevent the ESC from initializing with a broken SAS driving tab, eliminating the possibility of erroneous low speed brake activations.

Meritor WABCO's investigation indicates that internal SAS friction can develop between the sensor gears and sensor housing as a result of external forces experienced on the vehicle including vibration. If the developed friction is great enough, the driving tab can shear as the driver turns the steering wheel. Laboratory test data indicates incorporation of grease on SAS components during assembly significantly reduces the likelihood of internal frictional increases resulting in adequate SAS durability when properly installed in the steering column.

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§§573.6(c)(6) – **Chronology of principal events:**

- **November 3, 2008** – Last shipment of original sensor design from Meritor WABCO (serial numbers below 3000).
- **November 7, 2008** – First shipment of improved sensor design which included grease lubrication on internal components (serial number above 3000).
- February 26, 2009 – Last shipment of original sensor tab design from Meritor WABCO (serial numbers below 3404).
- **March 16, 2009** – Motor Coach Industries (MCI) reports to Meritor WABCO that a driver experienced unexpected stability control activations while performing tire testing at a test track in low speed figure eight maneuvers and while driving straight after completion of the maneuver. Upon cycling the ignition the behavior could not be reproduced.
- **March 16 - 25, 2009** – MCI receives several reports of similar behavior on other coaches and attempts to capture data during an event for Meritor WABCO review. All attempts to duplicate the event were unsuccessful.
- **March 27 – April 8, 2009** – MCI provides a suspect coach to Meritor WABCO for evaluation. Results indicated the Steer Angle Sensor (SAS) drive tab was completely sheared off and the subsequent lack of driver selected steer angle resulted in erroneous brake activation during the ignition cycle where the failure occurred.
- April 1, 2009 – First shipment of modified sensor drive tab design (serial number 3404 and above).
- **April 2, 2009** – Meritor WABCO checks inventory and determines zero stock of any affected SAS part numbers.
- **April 9, 2009** – Meritor WABCO call-in service center receives report of unexpected ESC activations on a Pierce fire truck. Call-in center advises technician to inspect condition of SAS and the driving tab is found to be sheared off.
- **April 20, 2009** – Measurements of a steering column installed with a SAS containing a sheared drive indicate critical dimensions are within specifications.
- **May 7, 2009** – Meritor WABCO management reviews the information and decides to campaign affected Steer Angle Sensors shipped prior to November 3, 2008.
- July 6, 2009 – WABCO recommends extending serial number range to include all SAS prior to design change to the external tab.

§573.6(c)(7) – **Test results or data supporting non-compliance:**

Not applicable.

§573.6(c)(8) – **Description of remedy:**

The identified defect will be remedied by notifying buyers of vehicles built with the affected product and requesting that they take the vehicles to certified dealers capable of inspecting the Steer Angle Sensors' serial numbers and replacing suspect Steer Angle Sensors, having a serial number below 3404, with the most recent SAS design level provided by Meritor

Meritor WABCO Vehicle Control Systems
2135 West Maple Road
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WABCO. On vehicles requiring Steer Angle Sensor replacement, an ESC calibration procedure will have to be conducted prior to the vehicle returning to service.

The following is an approximate revised time schedule for the program:

| | |
|---|---|
| By May 25, 2009: | Meritor WABCO notification to affected customers |
| By June 1, 2009: | Complete service instructions and procure inventory for replacement Steer Angle Sensors |
| By July 16, 2009: | Revise service instructions and procure additional inventory for replacement Steer Angle Sensors |
| By July 25, 2009: | Revise Meritor WABCO notification to affected customers |
| By Aug 15, 2009: | OEMs begin notifying customers and initiate the sensor replacement action where necessary |

**Information Requested under §573.6(c)(9)**

We trust that the information provided in this document is fully responsive to the requirements of 49 CFR §573.5. All additions or modifications to any of the information given will be reported promptly to NHTSA. Any questions with respect to the information provided should be directed to the undersigned.

Respectfully Submitted,

A. Balkcom

*Anne Balkcom*
Sr. Mgr. - Quality Assurance
**Meritor WABCO Vehicle Control Systems**
845 Lindbergh Court
Hebron, KY 41048
Ph 859.525.3676 Cell 859.380.7516
Anne.Balkcom@MeritorWabco.com

Enclosures:

Appendix A: Summary of Affected Customers and Quantities Shipped
Appendix B: Illustration of Steer Angle Sensor

Meritor WABCO Vehicle Control Systems
2135 West Maple Road
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Facsimile 248.435.8002
meritorwabco.com

## Appendix A:
## List of Affected Customers and Quantities Shipped by Meritor WABCO

| OEM | Quantity |
|---|---|
| BAE Systems TVS LP<br>5000 I-10 WEST<br>SEALY, Texas 77474 | 14 |
| Douglas Autotech Corp<br>300 Albers Rd<br>Bronson, Mich. 49028 | 939 |
| Emergency - One<br>3611 S.W. 20TH Street<br>Ocala, FL 34474 | 15 |
| Spartan Motors, Inc.<br>1165 Reynolds Road<br>Charlotte, Mich. 48813 | 6 |
| Pierce Manufacturing<br>2600 American Drive<br>P.O. Box 2017<br>Appleton, WI 54912 | 18 |
| Motor Coach Industries (MCI)<br>1475 Clarence Avenue;<br>Door 10, NPD<br>Winnipeg, Manitoba R3T 1T5, Canada | 24 +<br>3 service parts |
| Freightliner Custom Chassis Corp<br>Daimler Trucks North America LLC<br>4747 N Channel Avenue<br>Portland, OR 97217 | 2 |
| Kovatch Corporations<br>(via Star Steering Systems)<br>One Industrial Complex<br>Nesquehoning, Pa 18240 | 1 |
| H M E Inc (Hendrickson)<br>1950 Byron Center<br>Wyoming, Mi 49519 | 1 |

**MERITOR WABCO**

**Meritor WABCO Vehicle Control Systems**
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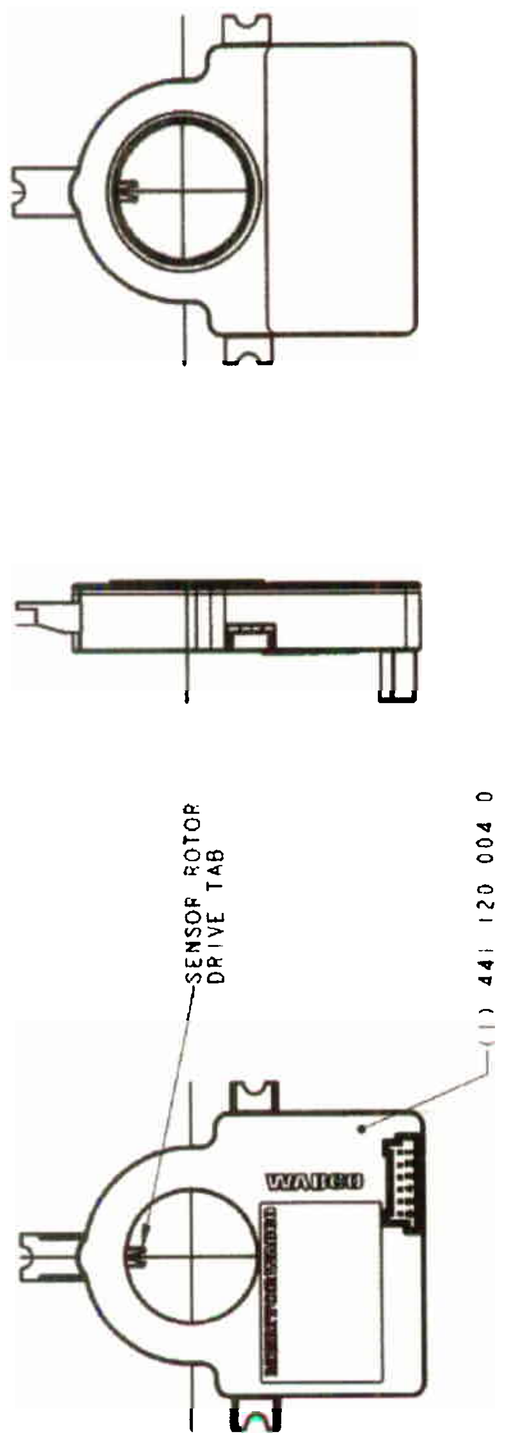
## Appendix B: Illustration of Steer Angle Sensor



MOTOR COACH
INDUSTRIES

September 3, 2009

«Customer_Name»
ATTENTION: TECH SERVICE DEPT/MAINT
«Address»
«Address_2»
«City», «State» «Zip»
«ctry»

**SUBJECT: SAFETY RECALL OF MERITOR WABCO STEERING ANGLE SENSORS**
Ref.: **NHTSA # 09E-032 (MERITOR WABCO)**
**NHTSA # 09V-196 (MCI)**
**TRANSPORT CANADA # 09-154**
**MCI Service Bulletins 327B and 328B**

Attention Owner:

This notice is sent to you in accordance with the National Traffic and Motor Vehicle Safety Act and the Canadian Motor Vehicle Safety Act.

Motor Coach Industries, Inc. ("MCI") has decided that a defect which relates to motor vehicle safety exists in certain steering angle sensors used in WABCO commercial vehicle Electronic Stability Control ("ESC") system applications. WABCO reports that the sensor rotor drive tab in certain Steering Angle Sensors ("SAS") can break while driving, resulting in unnecessary brake activation and thereby increasing the risk of a crash. **WABCO initially reported that the affected SAS's were those bearing a WABCO serial number below 3000. However, WABCO subsequently expanded the scope of the recall to include all SAS's bearing a WABCO serial number below 3404.** Please see the enclosed WABCO letter dated **July 20, 2009** for further information.

The vehicles that are subject to this notice are the following 2009 MCI D4000ISTV, **D4005,** D4500, and D4505 model coaches; **2010 D4500 model coaches;** 2008 and 2009 MCI J4500 model coaches; **and 2003 and 2009 E4500 model coaches** (last five VIN digits):

| | | | | |
|---|---|---|---|---|
| 58890 | 58907 | 58980 – 58987 | **58988 – 58989** | 58990 |
| **58991** | 58992 – 59000 | **59001** | 59002 | **59003** |
| 59004 – 59011 | **59012** | 59013 | **59014** | 59015 |
| **59016 – 59031** | **59038 – 59045** | **59047 – 59050** | **59053** | **59057 – 59058** |

1700 EAST GOLF ROAD, SUITE 300
SCHAUMBURG, ILLINOIS 60173
847-285-2000 PHONE
866-624-2622 TOLL FREE
WWW.MCICOACH.COM

| | | | | |
|---|---|---|---|---|
| 59061 – 59062 | 59080 | 59092 – 59127 | 59130 – 59132 | 59137 |
| 59139 | 59142 | 59144 | 59146 | 59148 |
| 59150 | 59153 | 59155 | | |
| | | | | |
| 61996 | 64618 | 64918 | 64919 | 64948 – 64950 |
| 64953 – 64964 | 64966 | 64968 | 64970 | 64972 |
| 64974 | 64976 | 64978 – 64988 | 64990 – 65004 | 65006 |
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| 65108 | 65110 | 65112 – 65118 | 65120 | 65122 |
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| 65176 | 65178 | 65180 | 65182 | 65184 |
| 65186 – 65188 | 65190 – 65194 | 65196 – 65202 | 65203 | 65204 – 65213 |
| 65215 – 65237 | 65238 | 65239 | 65240 | 65241 – 65242 |
| 65243 – 65255 | 65256 | 65257 | 65258 | 65259 – 65282 |
| 65284 | 65285 | 65286 | 65287 | 65288 |
| 65289 – 65303 | 65304 | 65305 – 65309 | 65310 | 65311 – 65319 |
| 65320 – 65322 | 65323 – 65326 | 65327 – 65336 | 65337 | 65338 – 65374 |

MCI is conducting a recall to inspect the affected coaches to determine whether they contain an SAS bearing a WABCO serial number below 3404, and to replace the affected SAS's. Please see the enclosed MCI Service Bulletin 327B (for D series coaches), and MCI Service Bulletin 328B (for J model and E model coaches), including the WABCO Installation Guide TP-09131 (Revised 07-09) appended thereto, which describe in further detail the inspection and replacement procedures that will be undertaken in connection with this recall. The inspection and any necessary replacement of the SAS will be done at no cost to you.

MCI records indicate that you are the owner or operator of the following vehicle(s) included in this recall:
**«Unit_Numbers»**

MCI strongly urges you to have the recall inspection and any necessary SAS replacement performed on your vehicle(s) as quickly as possible.

You may contact the MCI Customer Service Line at 1-800-241-2947 to make arrangements to have your vehicle(s) inspected and repaired as necessary at an authorized MCI service center. Please note that there are specialized tools and software needed (as described in the enclosed Service Bulletins 327B and 328B) if you decide to perform the recall work yourself and obtain reimbursement from MCI. Submittal of MCI Warranty Claim Forms may be completed on

MCI's website at http://fleetsupportiw.mcicoach.com/iwarranty/signon (click on Customer Care System), or a photocopy of the Warranty Claim Form found in the Warranty Manual can be mailed / faxed to the MCI Warranty Department. Please refer to Service Bulletins 327B and 328B, and your OWNER LIMITED WARRANTY MANUAL, for more detailed information.

If you have any questions about this recall campaign, you may contact the MCI Customer Service Line at 1-800-241-2947.

After contacting MCI Customer Service, if you are still unable to have the safety defect remedied without charge and within a reasonable time, you may submit a complaint:

For the U.S.:

The Administrator
National Highway Traffic Safety Administration
1200 New Jersey Avenue, SE.,
Washington, DC 20590;
or call the toll-free Vehicle Safety Hotline at 1-888-327-4236; (TTY: 1-800-424-9153); or go to http://www.safercar.gov.

For Canada:
Road Safety and Motor Vehicle
Regulation Directorate
Transport Canada
Tower C, Place de Ville
330 Sparks Street
Ottawa, Ontario
K1A 0N5
or call the Transport Canada's Information Centre at 1-800-333-0371.

If you are the lessor of the vehicle(s) identified above, Federal law requires that you forward this notice by first class mail to the most recent lessee(s) known to you, within ten days of your receipt of this notice.

If you have sold or otherwise transferred the vehicle(s) identified above, please contact the MCI Customer Service Line at 1-800-241-2947 with all of the information you have regarding the current owner/operator of the vehicle(s), so that we can ensure that the vehicles are inspected and repaired as necessary.

If you had your vehicle repaired or inspected for this condition prior to receipt of this notice and incurred any costs, you may be eligible for reimbursement. Please contact the MCI Customer Service Line at 1-800-241-2947 for further information in that regard.

We regret the inconvenience this may cause you, but urge you to have your vehicle(s) inspected and repaired as necessary as soon as possible for your added safety and satisfaction.

Sincerely,

*Motor Coach Industries*
Warranty Department

Enclosures: WABCO July 20, 2009 letter
MCI Service Bulletin 327B (including attachment)
MCI Service Bulletin 328B (including attachment)

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# MERITOR WABCO

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Facsimile 248.435.8002
meritorwabco.com

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July 20, 2009

Bryan Couch
VP - Product Planning & Project Management
Motor Coach Industries (MCI)
1475 Clarence Avenue; Door 10, NPD
Winnipeg, Manitoba R3T 1T5

Re: **Safety Defect Notice** - Certain WABCO Steering Angle Sensors distributed by Meritor WABCO between July 2007 and February 26, 2009; (NHTSA Recall No. 09E--032) Meritor WABCO Campaign ID Number C9AB

Dear Meritor WABCO Customer:

This notice is sent to you in accordance with the requirements of the National Traffic and Motor Vehicle Safety Act. Meritor WABCO has determined that a defect relating to motor vehicle safety exists in certain steering angle sensors used in Meritor WABCO commercial vehicle Electronic Stability Control (ESC) system applications. These parts were distributed by Meritor WABCO to OEM customers from July 2007 through February 26, 2009. Our records indicate that you may have received some of the suspect steering angle sensors. The purpose of this letter is to notify you of Meritor WABCO's plan for addressing this defect.

**What Products are Affected?**

The affected products were distributed by Meritor WABCO for installation as original equipment under the following part numbers:

| | |
|---|---|
| 441 120 004 0 | 400 850 666 0 |
| 400 850 647 0 | |

These potentially suspect Steering Angle Sensors (SAS) have serial numbers below 3404 and were mainly shipped by Meritor WABCO to the steering column assembly supplier. This supplier installed the SAS in the column and then shipped the completed assembly to a number of North American coach and specialty OEMs.

The Steering Angle Sensor is a component of the Meritor WABCO Electronic Stability Control System. The SAS provides the Electronic Stability Control (ESC) system with the driver selected steering angle, a critical input necessary to help detect loss of directional vehicle stability. When a loss of control event occurs, the ESC automatically applies individual foundation brakes on the vehicle to generate a counteractive force to help regain stability and mitigate the risk of a crash.

**What is the Problem?**

Meritor WABCO has determined that the original design of the Steering Angle Sensor (SAS) distributed in North America by Meritor WABCO exhibits a weakness in the sensor rotor drive tab that potentially can result in breakage during driving.

The SAS driving tab fits in a groove in the steering column shaft, causing the sensor rotor to turn with the steering wheel. The SAS provides the Electronic Stability Control system with the driver selected steering angle, a critical input necessary to detect loss of directional stability. With a broken SAS driving tab, the ESC yaw rate sensor and lateral accelerometer will measure a difference in vehicle direction when the driver makes a turn without a corresponding change in steer angle. This could be interpreted by the ESC as a directional instability, requiring intervention by brake activation of a selected wheel. Diagnostics that are integrated in the software may or may not detect a broken SAS driving tab after a period of time during the ignition cycle where the failure occurs. On subsequent ignition cycles, diagnostics will likely prevent the ESC from initializing with a broken SAS drive tab, eliminating the possibility of unnecessary low speed brake activations.

**What are the Risks to Motor Vehicle Safety?**

The broken SAS drive tab may result in unnecessary brake activation of a selected wheel during the ignition cycle in which the failure occurs and could pose a safety issue.

**What Should the Vehicle Manufacturer Do?**

If the subject products were installed as original equipment on vehicles you manufactured, and you agree that they contain a safety defect, you must notify the National Highway Traffic Safety Administration (NHTSA) in accordance with 49 C.F.R. Part 573. It is critical that the NHTSA guidelines are followed in a timely manner and that your customers are notified to conduct the remedy described below.

Meritor WABCO recommends that owners of vehicles equipped with the suspect steering angle sensors be instructed to inspect the production date code on the sensor and arrange to have any suspect sensors replaced at an authorized repair facility. The attached Meritor WABCO Service Bulletins describe the procedure for Date Code Identification and provide Replacement Instructions.

With respect to suspect products that remain in your inventory, Meritor WABCO will provide replacement parts prior to delivery to your customers, as described below.

**What will Meritor WABCO do?**

**Parts in Customers' Vehicles**. Meritor WABCO will reimburse you for standard labor costs to remove and replace defective steering angle sensors in the field in accordance with the instructions under the heading, "Labor Allowance" (see below). Replacement parts for these repairs should be obtained from Meritor WABCO as described under "Replacement Parts."

**Replacement Parts**

Replacement parts are available. Vehicle manufacturers' (OEMs') distribution facilities should obtain replacement steering angle sensor kit, part number 400 850 360 0, by contacting Meritor WABCO by any of the below methods:

**Liz Woodhull**
Key Customer Manager
**Meritor WABCO Vehicle Control Systems**
2135 W. Maple Road, Troy, MI 48084-7121
Phone: 248-435-3605 Fax: 248-435-8002
E-Mail: Elizabeth.Woodhull@MeritorWabco.com

Dealers should order replacement parts from the vehicle manufacturers parts distribution centers (PDC). Meritor WABCO will ship replacement service kits directly to the locations specified by the vehicle manufacturer.

**Removed Material Disposition**

Removed steering angle sensors must be returned to Meritor WABCO at the following address:

**Meritor WABCO Vehicle Control Systems**
Attention: SAS Recall
845 Lindbergh Court
Hebron, KY 41048

For questions relating to parts disposition, please contact Anne Balkcom at:

Anne.Balkcom@MeritorWABCO.com
Ph 859-525-3676 Fax 859-746-7875

**Labor Allowance**

The following are the details of labor allowances available to vehicle manufacturers (OEMs):

- Meritor WABCO will accept the previously agreed upon standard repair time (SRT) with the individual vehicle manufacturer (OEM).
- Vehicle manufacturers are requested to communicate their SRT for this program to Jim Nemeth via Phone: 1-248-435-1279 or Email: jim.nemeth@arvinmeritor.com, to ensure proper claim processing.

Dealers should follow their OEM procedures for warranty claims to obtain reimbursement for labor expenses associated with inspection and replacement of these sensors.

To facilitate this process, we request that you provide VIN information and Vehicle In-Service Dates for the corresponding steering angle sensor date codes for tracking field actions. Please forward this information to:

Anne Balkcom
Anne.Balkcom@MeritorWABCO.com
Senior Manager - Quality
Ph 859-525-3676 Fax 859-746-7875

Meritor WABCO will accept warranty claims for inspecting and replacing the suspect sensors associated with this notice directly from the vehicle manufacturers (OEMs). In order to receive proper credit, warranty claims must contain the following information at the time of submission:

- Reference to Meritor WABCO Campaign ID Number: C9AB
- Reference to NHTSA Campaign ID Number : **09E–032**
- Reference to the vehicle manufacturer's campaign number (optional)
- 17-digit vehicle identification number (VIN)
- Sensor date code
- Vehicle owner's name, address, and telephone number
- Vehicle in-service date
- Vehicle repair date

- Vehicle mileage at the time of repair
- Dealer work order number
- Repairing facility name, address, and telephone number
- Total labor hours required to perform the work, not to exceed agreed formula
- Repair facilities hourly rate
- Number of sensors replaced and shipped to Meritor WABCO in Hebron, Kentucky.
- Tracking number for shipment of returned suspect steering angle sensors.

Failure to provide complete information will delay processing of the warranty claim.

For questions relating to warranty claims, please contact Jim Nemeth via Phone: 1-248-435-1279 or Email: jim.nemeth@arvinmeritor.com.

**Communication**

If you conclude that Meritor WABCO has not enabled you to remedy this condition in a reasonable time, you may submit a written complaint to the:

Administrator
National Highway Traffic Safety Administration
400 Seventh Street, S.W.
Washington, D.C. 20590

- or -

Call the toll free Auto Safety Hotline: 1-888-327-4236

We apologize for any inconvenience that this situation may cause. Meritor WABCO wants to assure you that we are concerned for customer safety and endeavor to insure your continued satisfaction with our products.

Sincerely,

***Anne Balkcom***
Sr. Mgr. - Quality Assurance
**Meritor WABCO Vehicle Control Systems**
845 Lindbergh Court
Hebron, KY 41048
Ph 859.525.3676 Cell 859.380.7516
Anne.Balkcom@MeritorWabco.com

Attachments:

1. Customer Shipment Information
2. Meritor WABCO Service Bulletin (TP-09131) - Steering Angle Sensor (SAS) Replacement on Vehicles Equipped with Electronic Stability Control (ESC) - Revised 07-09

# Service Bulletin No. 327B

| MODEL | TYPE | SECTION/GROUP | DATE |
|---|---|---|---|
| D Series Coaches | Field Change Program | 11–Steering | |

| SUBJECT | STEERING ANGLE SENSOR (SAS) |
|---|---|
| CONDITIONS | |

***THIS BULLETIN SUPERSEDES SERVICE BULLETIN 327 IN ITS ENTIRETY.***

**Ref. NHTSA Meritor WABCO Recall No.: 09E–032**

**Ref. NHTSA MCI Recall No.: 09V–196**

**Ref. Transport Canada MCI Recall No.: 09–154**

## *NOTICE*

***Meritor WABCO ( WABCO ) previously notified Motor Coach Industries ( MCI ) that WABCO was recalling its steering angle sensors ( SAS ) with a serial number below 3000. WABCO has now notified MCI that WABCO is expanding its recall to include steering angle sensors below serial number 3404.***

**Customer Complaint:**

Meritor WABCO has reported to Motor Coach Industries ( MCI ) that a defect relating to motor vehicle safety exists in certain steering angle sensors used in Meritor WABCO commercial vehicle Electronic Stability Control ( ESC ) system applications. Meritor WABCO reports that the sensor rotor drive tab in certain Steering Angle Sensors ( SAS ) can break while driving, resulting in unnecessary brake activation that could pose a safety issue. Please see the attached Meritor WABCO letter dated July 20, 2009, and Meritor WABCO Installation Guide TP–09131 / Revised 07–09.

**Cause:**

Meritor WABCO reports that the potential malfunction is the result of the sensor rotor drive tab of the steering angle sensor shearing off due to internal friction developing between the sensor gears and the sensor housing. Meritor WABCO advises that the affected steering angle sensors were the original design with serial numbers below 3404.

**Corrective Action:**

MCI recommends that the steering angle sensor on affected coaches be inspected and replaced, if necessary, in order to eliminate any unexpected brake activations.

The MCI coach models that need to be inspected for this defect are the following:

-E4500 model with the following VIN's ( inclusive ): 61996, 65203, 65335, 65337, 65339 and 65341.

-D4000ISTV, D4500 and D4505 models with the following VIN's ( inclusive ): 58890, 58907, 58980 to 59031, 59038 to 59045, 59047 to 59050, 59053, 59057, 59058, 59061, 59062, 59080, 59092 to 59127, 59130 to 59132, 59137, 59139, 59142, 59144, 59146, 59148, 59150, 59153 and 59155.

-J4500 model with the following VIN's ( inclusive ): 64618, 64918, 64919, 64948 to 64950, 64953 to 64964, 64966, 64968, 64970, 64972, 64974, 64976, 64978 to 64988, 64990 to 65004, 65006, 65011, 65013 to 65032, 65035 to 65082, 65086 to 65098, 65106, 65108, 65110, 65112 to 65118, 65120, 65122, 65124 to 65147, 65149, 65151 to 65170, 65172, 65174, 65176, 65178, 65180, 65182, 65184, 65186 to 65188, 65190 to 65194, 65196 to 65202, 65204 to 65213, 65215 to 65282, 65284 to 65334, 65336, 65338, 65340 and 65342 to 65374.

Accordingly, MCI is instituting a field change program to inspect and replace, if necessary, the Meritor WABCO steering angle sensors in all of the coaches listed above. This bulletin describes the procedures for properly replacing the Meritor WABCO steering angle sensors in the D series coaches.

**MCI's Service Bulletin 328B describes the procedures for properly inspecting and, if necessary, replacing the Meritor WABCO steering angle sensor in E and J models.**

**Parts**

| Qty. | New P/N | Description |
|---|---|---|
| 1 | 11-02-1166 | Kit, Steering Angle Sensor Replacement |
| | | *Kit Contents Are:* |
| 1 | 11-02-1144 | Steering Angle Sensor |
| 3 | | Screw |
| 1 | | Lubricant, Packet |

## Service Procedure:

### General notes

Read this entire procedure before beginning work. Meritor WABCO Toolbox™ Software Version 8.12.2 is required to perform the outlined procedure steps in this service bulletin.

**Use Safe Shop Practices At All Times.**

1. Turn the main battery disconnect switch to the OFF position. Chock both sides of the tires.
2. Locate the steering column cover assembly below the steering wheel. Remove and retain the four screws on the top plate, and the eight screws on the steering column cover assembly ( refer to Figure 1 ).

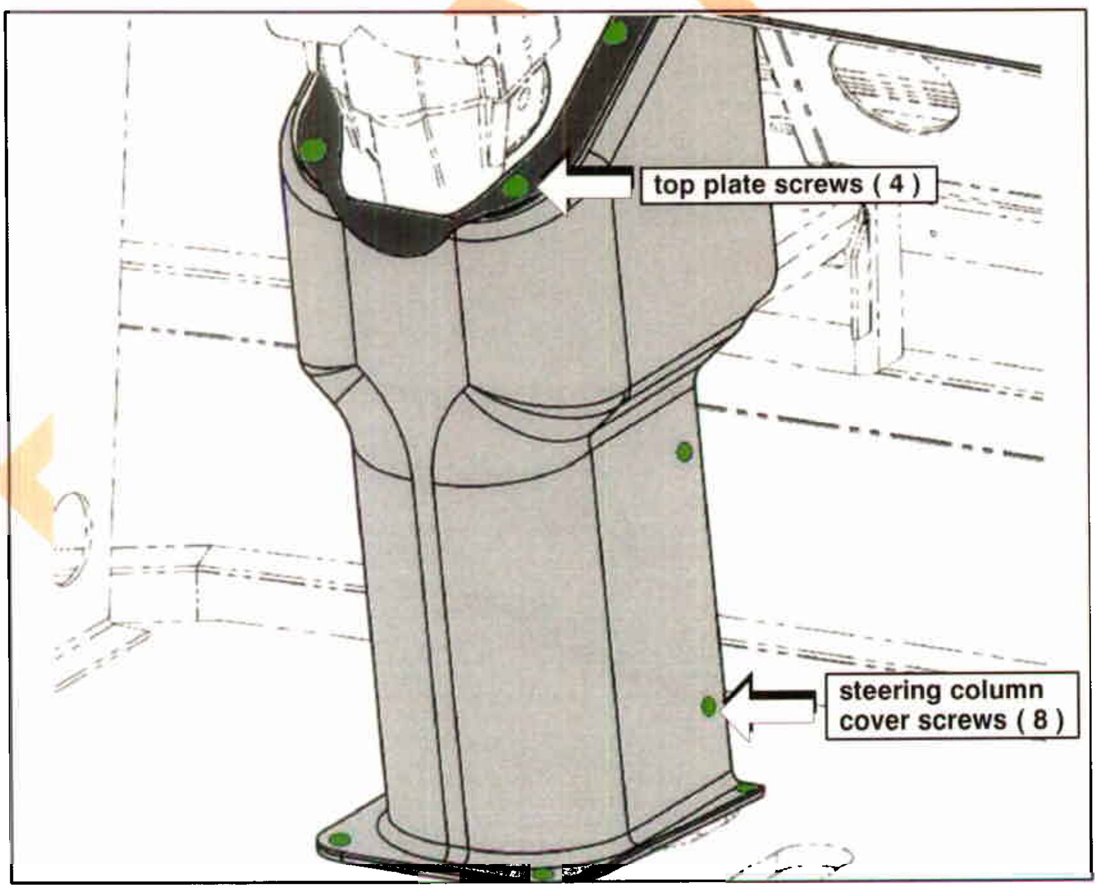



**Figure 1.**

3. Remove and retain the top plate and the steering column cover, to be re-installed at a later step in this procedure.

4. Locate the steering angle sensor serial number label ( refer to Figure 2 ).

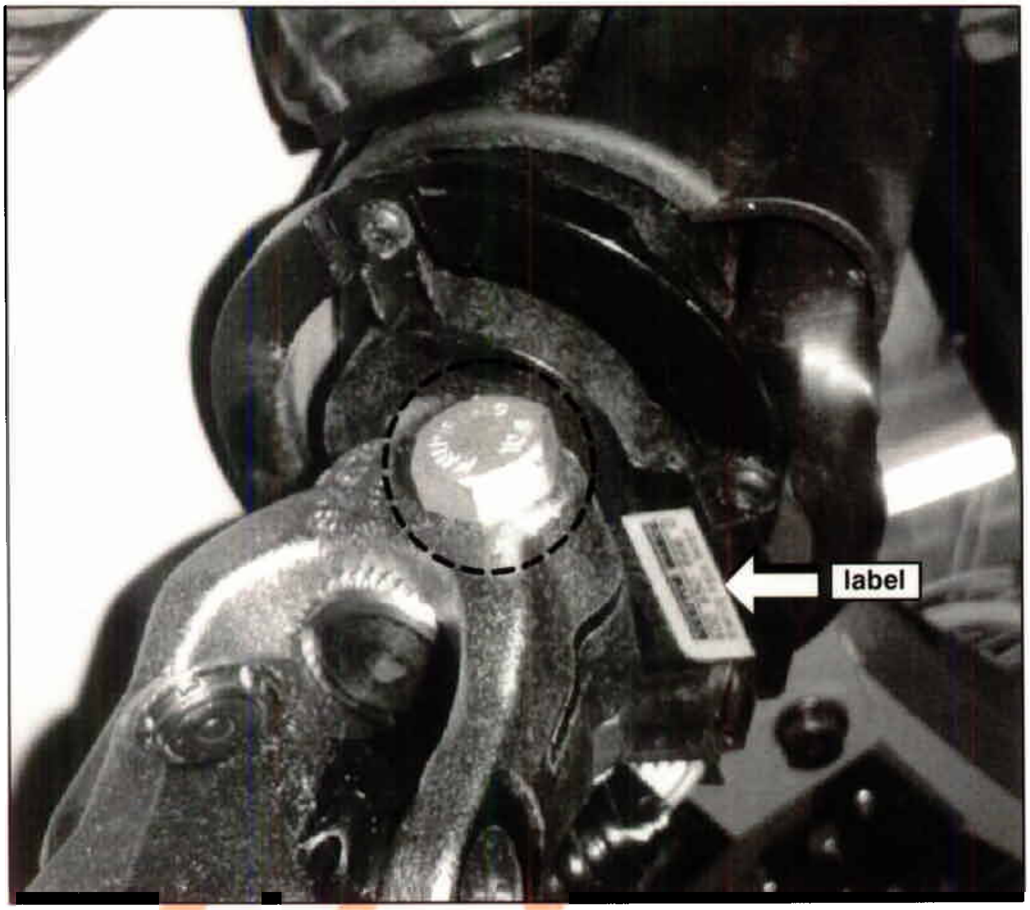



**Figure 2.**

5. Using a small mirror, view the steering angle sensor serial number label and record the serial number ( refer to Figures 3, 4 or 6 for the three { 3 } versions of label ).


**Figure 3. Meritor WABCO steering angle sensor requiring replacement.**


**Figure 4. Figure 5. Meritor WABCO steering angle sensor requiring replacement.**


**Figure 6. Meritor WABCO steering angle sensor NOT affected by campaign.**

## *NOTICE*

***If the steering angle sensor serial number is between 1 and 3403, ensure that a laptop computer with Meritor WABCO Toolbox ™ software version 8.12.2, or higher, is available . Proceed to Step 6.***

***If the steering angle sensor serial number is 3404 or above, record the steering angle sensor serial number and submit with paperwork to be returned to MCI. Re-install the steering column cover. No further action required.***
***Procedure complete.***

6. Locate and note the orientation of the steering angle sensor wiring harness connector ( refer to Figure 7 ). Carefully disconnect the steering angle sensor harness.
7. Locate and remove the clamp bolt and nut that secure the upper universal joint yoke to the steering column shaft ( refer to Figure 2 ).
8. Carefully mark the orientation of the upper universal joint yoke with respect to the steering column shaft so that correct alignment of the steering column shaft and universal joint yoke can be obtained during reassembly.
9. Mark the relative position of the steering column to the mounting bracket.
10. Loosen the four ( 4 ) 3/8 capscrews mounting the steering column to the mounting bracket allowing the column to be rotated upward and forward. This will allow the universal joint yoke to separate from the steering column shaft splines.
11. Locate the steering angle sensor ( refer to Figure 7 ).
12. Remove and discard the three ( 3 ) steering angle sensor mounting screws ( refer to Figure 7 ).
13. Remove and retain the existing steering angle sensor ( refer to Figure 7 ), to be returned to MCI.
14. Apply the supplied lubricant to the mating surface of the new steering angle sensor drive tab and the keyway of the shaft ( refer to Figure 7 ).

## *NOTICE*

***To avoid component damage, do not over–torque the steering angle sensor mounting screws.***

15. Align the new steering angle sensor drive tab and the keyway of the shaft. Carefully install the new steering angle sensor as per Figure 7 and secure using the three ( 3 ) screws in the Parts kit. Torque screws to 20–22 lb-in. Record the new steering angle sensor serial number and submit with paperwork to be returned to MCI.

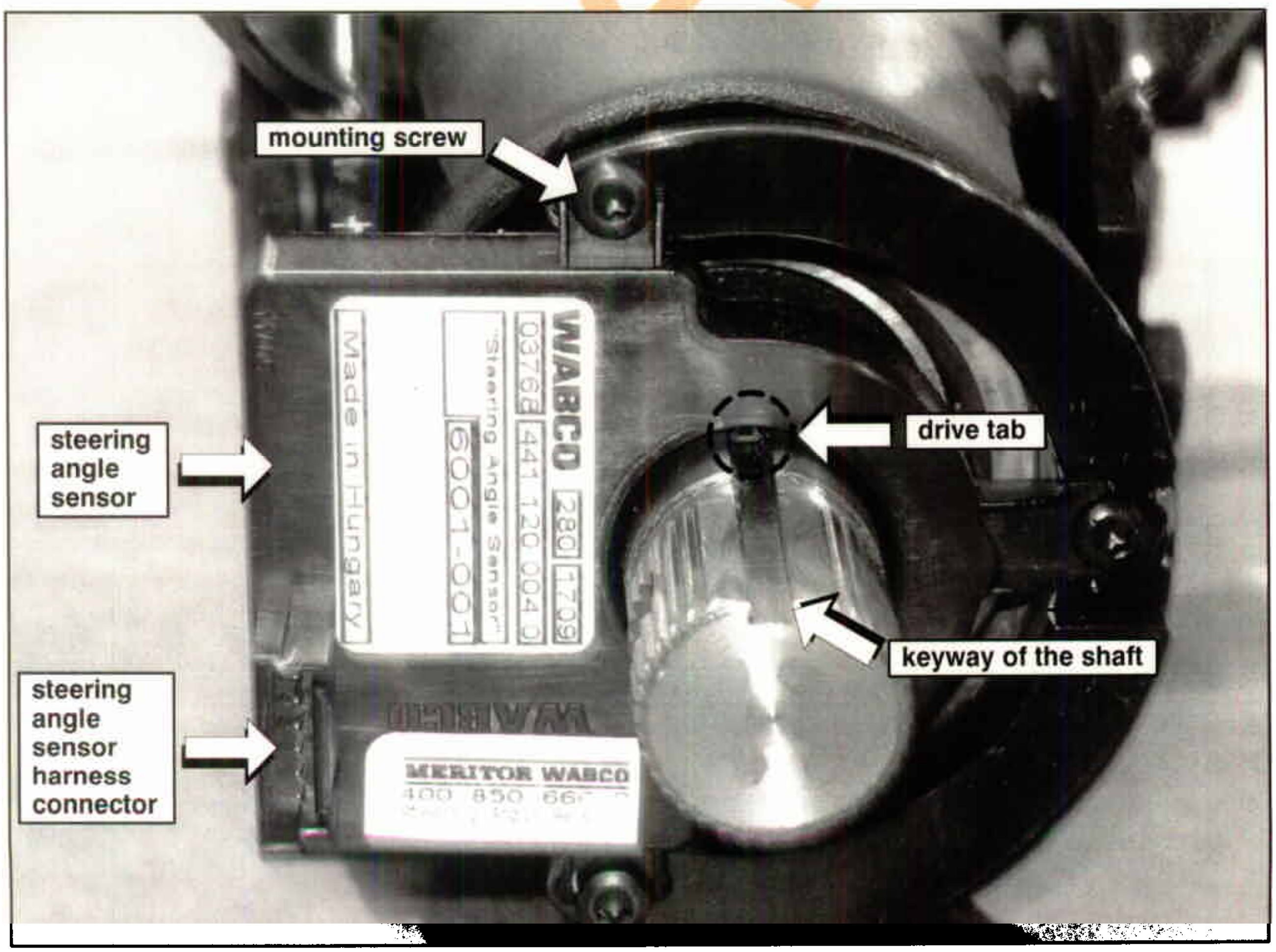



**Figure 7.**

## NOTICE

***Use caution to realign splines as marked in Step 8.***

16. Re-engage the universal joint yoke with the steering column shaft splines. Install the universal joint yoke clamp bolt and nut, finger tight only.

## NOTICE

***Ensure that the steering angle sensor harness is clear of any possible interference with the universal joint.***

17. Re-connect the steering angle sensor harness, ensuring that the small tab snaps into the connector groove.

## CAUTION

**If there is downward thrust on the steering box input shaft, the coach will pull to the right.**

18. Adjust the steering column final position using reference marks made previously during disassembly. Ensure there is no downward thrust being applied to the steering gearbox input shaft. This can be verified by moving the universal joint yoke clamp bolt and nut freely using only light finger pressure.
19. Verify that the universal joint clamp bolt and nut can move freely by hand. Torque the 3/8 column mounting bolts to 45–50 lb-ft. ( refer to Figure 8 ).

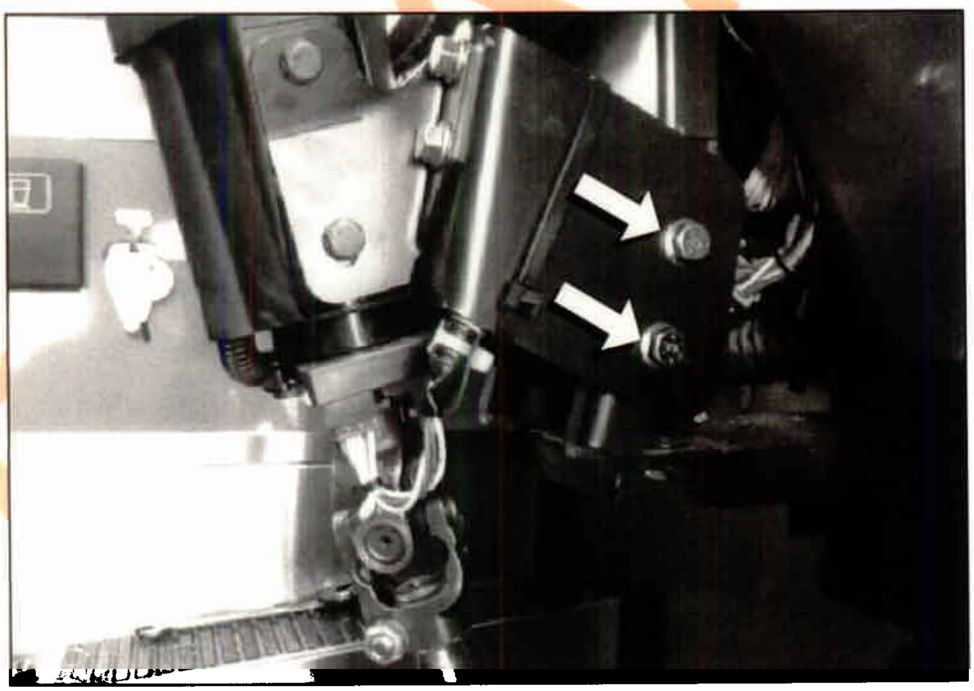


**Figure 8.**

20. Torque the universal joint clamp bolt and nut to 30–35 lb-ft.

21. Re-install the steering column cover and the top plate, removed in Step 3.
22. Using the attached Meritor WABCO Technical Bulletin TP–09127 titled Steering Angle Sensor Calibration and Electronic Stability Control Initialization and Meritor WABCO Toolbox™ Software Version 8.12.2, calibrate the new steering angle sensor.

## NOTICE

***It is important to the correct functioning of the ESC system that the entire SAS Calibration Procedure as well as Steps 1 to 6 and Steps 11 to 12 of the ESC Initialization Procedure occur exactly as outlined in the attached Meritor WABCO Technical Bulletin TP–09131.***

***Since MCI's coaches are configured with a preset steering ratio, Steps 7 to 10 of the attached ESC Initialization Procedure ( refer to Page 6 of attached TP–09131 ) do not apply and will not display on the laptop screen.***

***After completion of Step 6, proceed to Steps 11 and 12 to ensure procedure is completely performed.***

*Procedure complete.*

Mail or fax the completed warranty claim form to MCI's warranty department, or photocopy and mail it to:

MCI Fleet Support
Attn: Warranty Department
7001 Universal Coach Drive
Louisville, KY 40258
Fax Number 1-800–360–8886

to receive credit for the hours used to complete this task. Contact the MCI Fleet Support Technical Center at 1-800-241-2947 for any further information.

### *Field Change Program Conditions:*

The parts required for this change will be supplied without charge. Specialized equipment is required to perform the outlined procedure steps in this service bulletin.]

**ONLY ONE ( 1 ) CLAIM CAN BE FILED AGAINST THE COACH VIN, SB 327 OR SB 327B.**

A labor allowance of 0.4 hours will be granted against claim SB327B.1, for the procedure of inspecting the steering angle sensor serial number label only.

A labor allowance of 1.2 hours will be granted against claim SB327B.2, for the procedure of inspecting the steering angle sensor serial number label, replacing the steering angle sensor and re–calibrating the steering angle sensor.

**NO PAYMENT WILL BE ISSUED BY MOTOR COACH INDUSTRIES UNTIL THE COMPLETED WARRANTY CLAIM FORM, THE STEERING ANGLE SENSOR AND THE SERIAL NUMBER OF THE REPLACEMENT STEERING ANGLE SENSOR HAVE BEEN RECEIVED BY MCI.**

This labor allowance will be credited to your MCI Fleet Support Parts Account on receipt of a "Warranty Claim Form" as detailed in your Owner Warranty manual.

Motor Coach apologizes for any inconvenience resulting from this campaign, but urges you to implement this change as soon as possible.

Sincerely,

*Motor Coach Industries*
U.S. and Canadian Service Departments.

MERITOR WABCO

Installation Guide

# Steering Angle Sensor (SAS) Replacement on Vehicles Equipped with Electronic Stability Control (ESC)

## Hazard Alert Messages

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

## How to Obtain Additional Maintenance and Service Information

Refer to Maintenance Manual MM-0112, Anti-Lock Braking System (ABS) for Trucks, Tractors and Buses. Call ArvinMeritor's Customer Service Center at 800-535-5560 to obtain this publication. Meritor WABCO publications are also available on our website:

www.meritorwabco.com

## How to Obtain Kits

Contact the OnTrac Customer Service Center at 866-668-7221.

### Kit 400 850 360 0

The steering angle sensor field kit (part number 400 850 360 0) is required for completing the replacement procedure. The kit consists of the following parts.

- Steering angle sensor (SAS)
- Grease packet
- Three screws
- Field inspection, replacement and calibration instructions
- Return envelope for removed SAS with serial number less than 3404
- Tag to record Vehicle Identification Number (VIN) that will accompany SAS in the return envelope

## Tools

To complete this procedure, you will need screwdrivers appropriate for the type of screws used to attach the steering column lower shroud, and the steering angle sensor to the mounting bracket.

This installation guide provides steps for SAS replacement on vehicles equipped with ESC.

- Inspecting part number and serial number on SAS
- SAS replacement
- SAS calibration and ESC initialization

## Inspecting Part Number and Serial Number on the Steering Angle Sensor (SAS)

This section provides instructions on how to identify the part number and serial number of the Meritor WABCO Steering Angle Sensor, a component used in vehicles equipped with Electronic Stability Control (ESC). Figure 1.

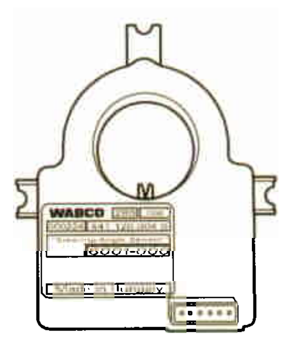



Figure 1

# Inspection Procedure

## ⚠ WARNING

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

**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 and fall over. Serious personal injury and damage to components can result.**

1. Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving.
2. Use a screwdriver to remove the screws on the shroud covering the lower portion of the steering column. Remove the shroud. This will expose the connection between the steering shaft and the I-shaft. The SAS is mounted just above this joint. Figure 2.

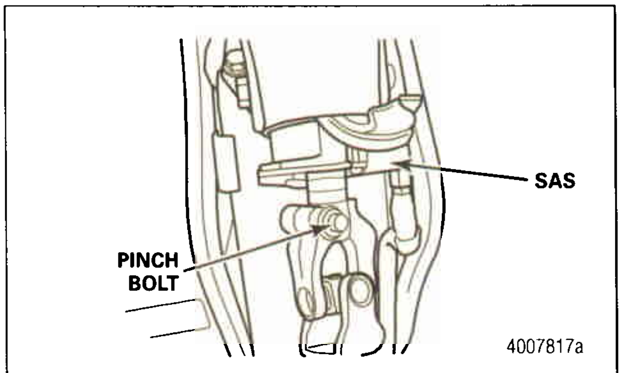



Figure 2

3. Locate the label on the exposed face of the SAS. It may be necessary to use a small mirror to view this while installed on the column. Record the part number and serial number of the SAS according to the type of label you find.

## Types of Labels

There are three types of labels you may find on the SAS.

For the label type in Figure 3, the part number is the 10-digit number starting with 441 in the second line of the text below "WABCO". The serial number is the 6-digit number directly below "WABCO".

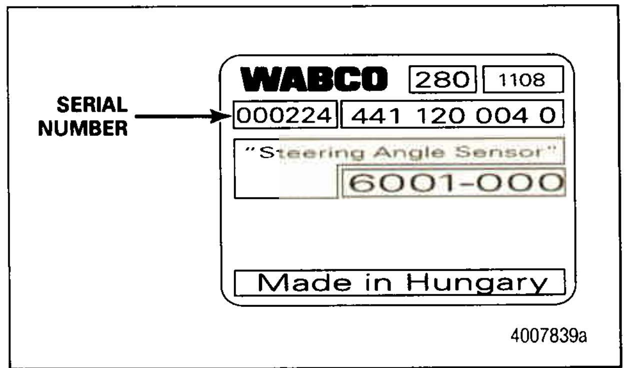



Figure 3

For the label type in Figure 4, the 10-digit part number which starts with 400 is directly below "MERITOR WABCO" and the 6-digit serial number is directly above the "Made in Hungary" text.

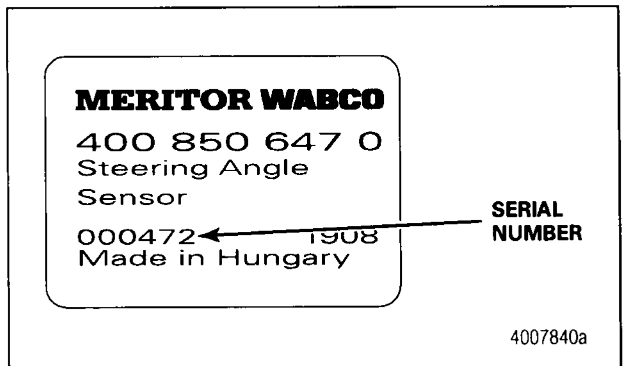



Figure 4

A third variation of the SAS shown in Figure 5 contains the label in Figure 3 as well as another label to the right containing the part number 400 850 666 0. The serial number should be read using the method described for the label in Figure 3.

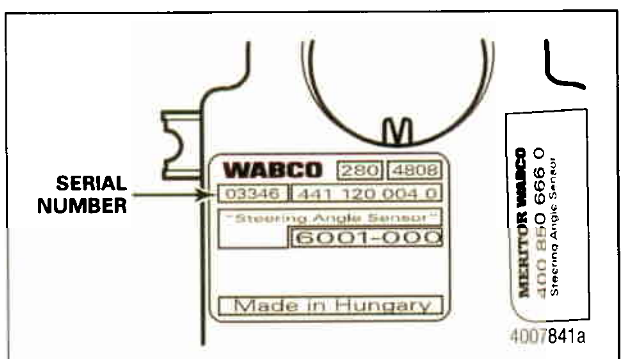



Figure 5

**NOTE:** Steering angle sensors with serial numbers less than 3404 must be replaced with an SAS with a serial number of 3404 or higher. Refer to the Steering Angle Sensor Replacement instructions in this guide; or to Maintenance Manual MM-0112.

# Steering Angle Sensor Replacement

This section provides procedures for replacing the Meritor WABCO Steering Angle Sensor on vehicles equipped with ESC. Figure 6.

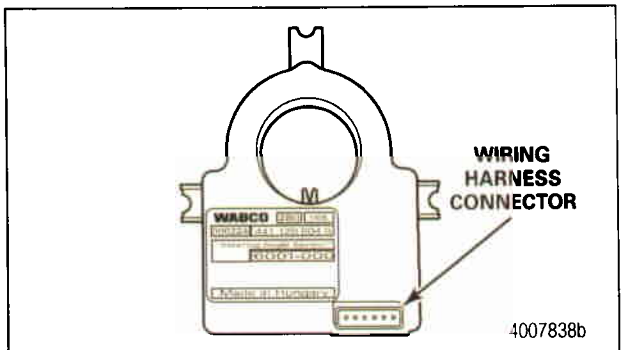



Figure 6

## Remove the Steering Angle Sensor

**⚠ WARNING**

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

**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 and fall over. Serious personal injury and damage to components can result.**

1. Park the vehicle on a level surface with the steering wheel centered and the front wheels positioned straight ahead.
2. Turn the ignition switch to the OFF position and apply the parking brake.
3. Block the wheels to prevent the vehicle from moving.
4. Remove the shroud that covers the lower portion of the steering column. This exposes the connection between the steering shaft and the I-shaft. The steering angle sensor is mounted just above this joint. Figure 7.

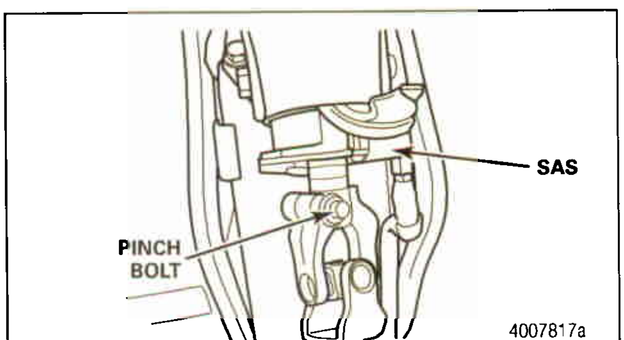



Figure 7

5. Remove the pinch bolt on the top portion of the universal steering joint. This will allow you to slide the joint down and off the steering column.
6. Note the position of the SAS wiring harness connector (Figure 7) — either facing UP or DOWN. The new SAS will need to be positioned the same way when installed. Disconnect the wiring harness connector from the SAS.
7. Remove the three screws that attach the SAS to the steering column and slide the SAS off the shaft. Note the tab in the center of the SAS fits into a groove machined into the steering shaft.

## Install the New Steering Angle Sensor

1. Apply a small amount of the supplied grease to the tab in the center of the SAS and to the machined groove on the steering shaft.

   **NOTE:** The SAS must be installed in the correct orientation or it will not function correctly.

2. Place the SAS over the shaft making sure that the connector is facing the same direction as the original one. Slide the SAS into place. Check to ensure the tab is in the machined groove on the column.
3. Install the three mounting screws provided in the kit and tighten to a maximum of 22 in-lb (2.5 N•m). Do not reinstall the original screws. ⓘ
4. Install the wiring harness connector. Push the connector together until the small tab snaps into the connector groove.
5. Replace the universal steering joint and tighten the pinch bolt to the vehicle manufacturer specification.
6. Install the steering column shroud.
7. Remove the wheel blocks.
8. Test the SAS installation using the test procedure in this installation guide.

## Testing the SAS Installation

The SAS must be calibrated and the ESC initialized in order to test the SAS installation.

1. Perform the SAS calibration and ESC initialization procedures. Refer to the procedures in this installation guide.
2. When the SAS calibration and ESC initialization procedures are complete, turn the ignition power on. The ABS and ATC/ESC lamps should come on and go out. The ATC/ESC lamp may also remain on briefly after the ABS lamp goes off.

3. Check to ensure there are no active faults displayed in the ABS ECU memory.

**NOTE:** If the SAS does not function as described above, contact the OnTrac Customer Service Center at 866-668-7221 for further information on how to correct any problems with the installation. The ESC may not function correctly if the SAS does not perform as described in this section.

## Filing Instructions and Return Parts Procedure

File the claim according to the vehicle manufacturer instructions. A return envelope and tag for recording any required information is included for the return.

# SAS Calibration and ESC Initialization Procedures

This section provides instructions for SAS calibration and ESC initialization. These procedures, sometimes referred to as the "ESC End-of-Line" procedure, must be performed as part of the final assembly of the vehicle at the vehicle manufacturer site. These procedures are also required when all or any component such as the SAS, the ESC Module or the ECU have been replaced or a major steering system repair or replacement has been completed including alignment of the front tires. Failure to do so may result in the ESC not functioning correctly.

The SAS calibration procedure must be performed before the ESC initialization.

The status of the procedures can be verified using one of the following faults.

SAS not calibrated — 89 13

ESC initialization required — 88 13

ESC initialization not completed — 88 01

**NOTE:** Additional faults must not be active when you begin these procedures. If any other faults are present, you must resolve those issues before the main calibration menu items will become available.

## SAS Calibration Procedure

**NOTE:** You must align the front tires before you perform the SAS calibration.

1. To access the Meritor WABCO TOOLBOX™ Software, double-click on the Meritor WABCO TOOLBOX™ icon from the desktop. Figure 8.


4007818a

Figure 8

2. From the message box, click on the Pneumatic ABS button. Figure 9.

4007819a

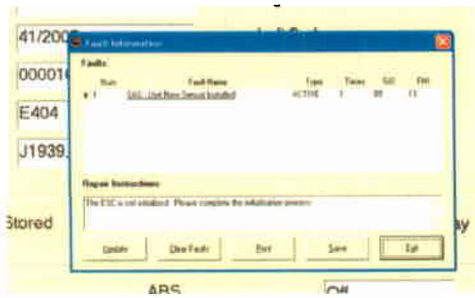
Figure 9

3. To verify status of the ESC initialization, double-click on the fault box from the initial screen. Figure 10.

4007820a

Figure 10

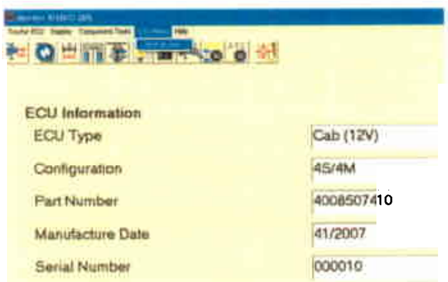
4. For new vehicles or vehicles where the SAS has been replaced, the message box should show the Steering Angle Sensor code 89-13. Check the code to ensure it is correct. Figure 11.




4007821a

Figure 11

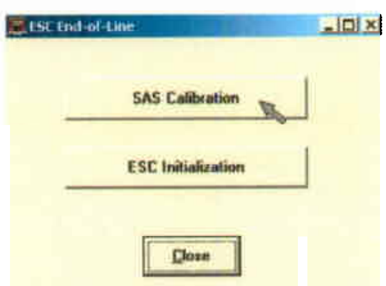
5. To access SAS Calibration, click on the ESC Menu from the bar menu at the initial screen. A drop box will illuminate. Select the "End of Line" option. Figure 12.




4007822a

Figure 12

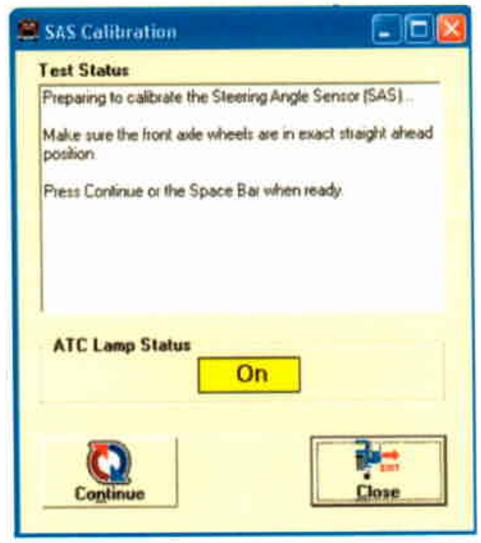
6. Click SAS Calibration in the message box. Figure 13.




4007823a

Figure 13

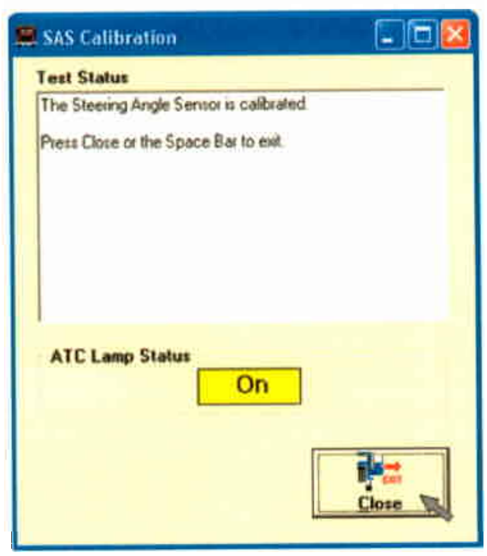
7. Follow the instruction in the message box. Figure 14.




4007824a

Figure 14

8. The message box will indicate when the SAS has been calibrated. Once the SAS is calibrated, press Close or the space bar to continue. The ESC initialization procedure can now be performed. Figure 15.




4007825a

Figure 15

## ESC Initialization Procedure

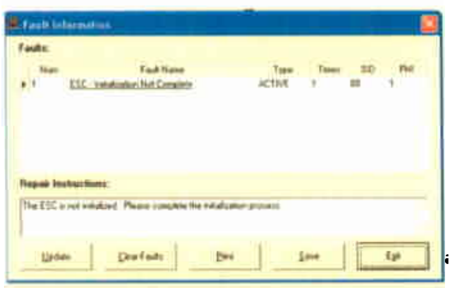
After the SAS calibration is completed, use the following procedure to initialize the ESC.

1. To verify the status of the ESC initialization, double-click on the fault box from the initial screen. Figure 16.

4007826a

Figure 16

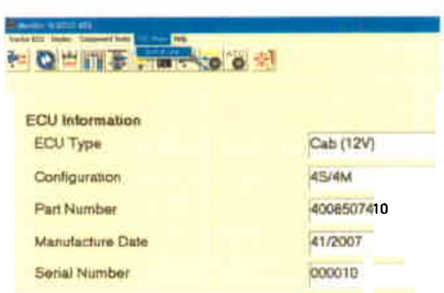
2. The message box should show the ESC Initialization Not Complete code 88-1. Verify the code is correct. Figure 17.



4007827a

Figure 17

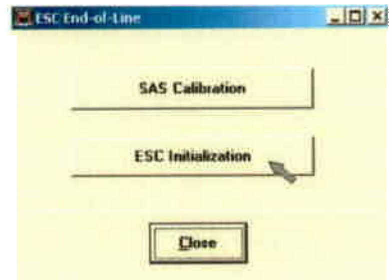
3. Again click on the ESC Menu from the bar menu at the initial screen. Select the "End of Line" option. Figure 18.




4007828a

Figure 18

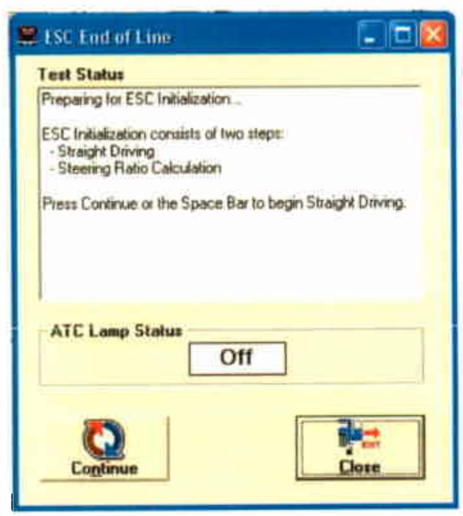
4. Click on ESC Initialization. Figure 19.




4007829a

Figure 19

5. Read the information in the message box. When you are ready to proceed, press the space bar or click Continue. Once the calibration process has started, it will continue until the calibration is complete. No further keyboard inputs are required. Once the calibration process has begun, instructions will appear in the message box and will continue until the calibration is complete. Figure 20.




4007830a

Figure 20

6. Carefully read and follow the instruction in the message box. The ATC/RSC/ESC lamp will start blinking when the 15 mph speed has been reached. When "straight driving" is completed after about 800 feet, the ATC/RSC/ESC lamp will stop blinking and will be on solid. Figure 21.

**NOTE:** The "straight driving" can be done in segments and the ECU will accumulate the information until the 800 feet are reached, but it must be done in the same ignition cycle.

**NOTE:** In some applications, you may have preset steering ratios and a message box will appear indicating the calibration procedure is complete. In this case, click Close and cycle the ignition. When the ignition is turned back on, check that no active faults are logged and the ABS and ATC/RSC/ESC warning lamps are off. The calibration is complete.

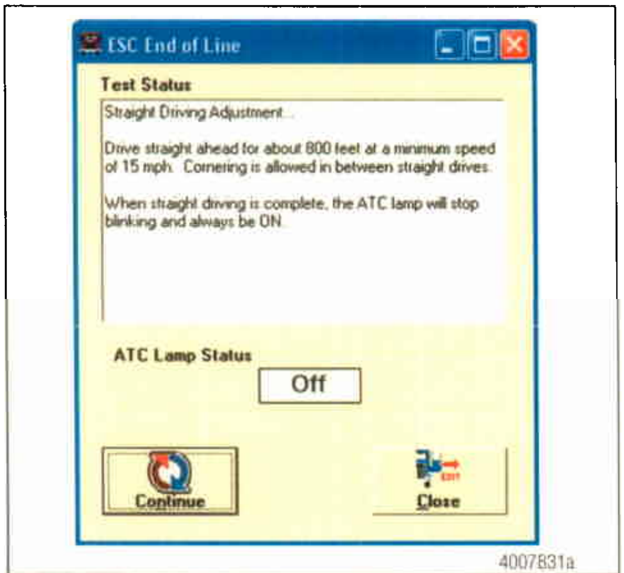



Figure 21

7. A message will appear after the "straight driving" is complete. Carefully read and follow the instructions in the message box. Start driving in a circle with the steering wheel rotated 360 degrees. No keyboard input is required. Figure 22.

   **NOTE:** The "circle driving" may also be done in segments and the ECU will accumulate the information until the required distance is reached, but it must be done in the same ignition cycle.

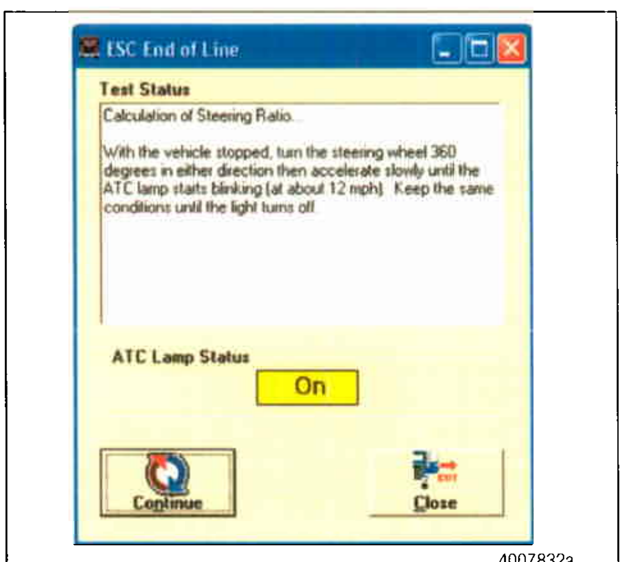



Figure 22

8. Read the message box carefully. The ATC/RSC/ESC lamp will start blinking when the required conditions are met. Keep driving until the lamp turns off. Figure 23.

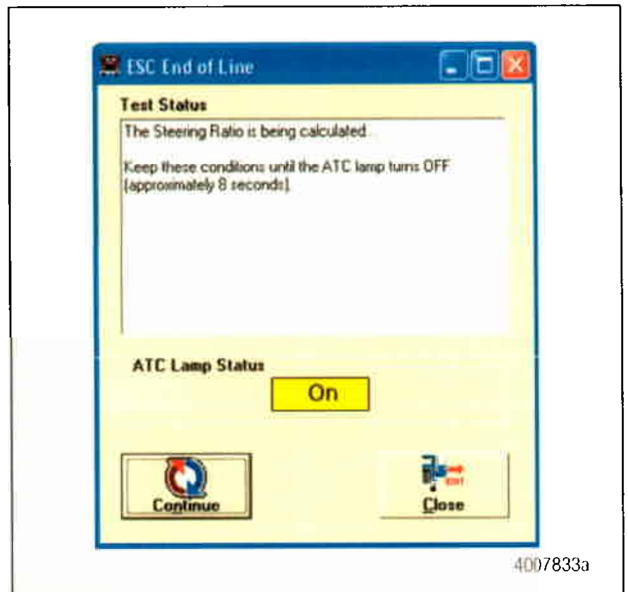



Figure 23

9. This message will appear after the steering ratio has been calculated. Figure 23. Stop the vehicle. Read the message box carefully and follow the instructions. Turn the steering wheel 360 degrees in the opposite direction from being centered. Repeat the driving conditions. Again, the ATC/RSC/ESC lamp will start blinking when the required conditions are met. Keep driving until the light turns off. Figure 24.

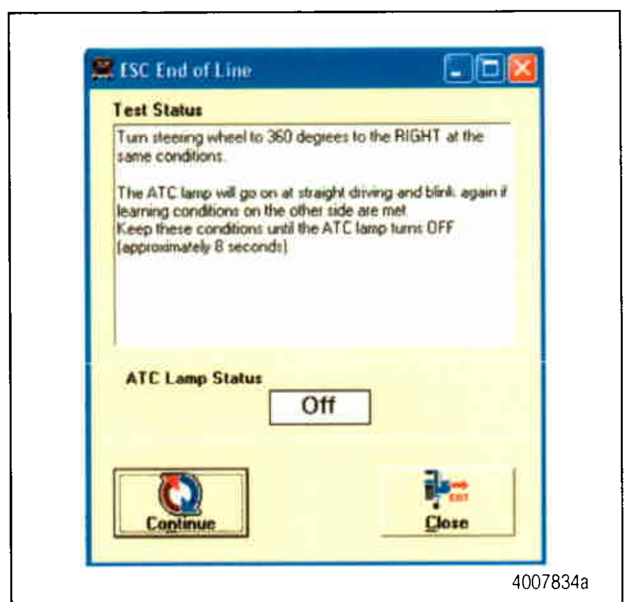
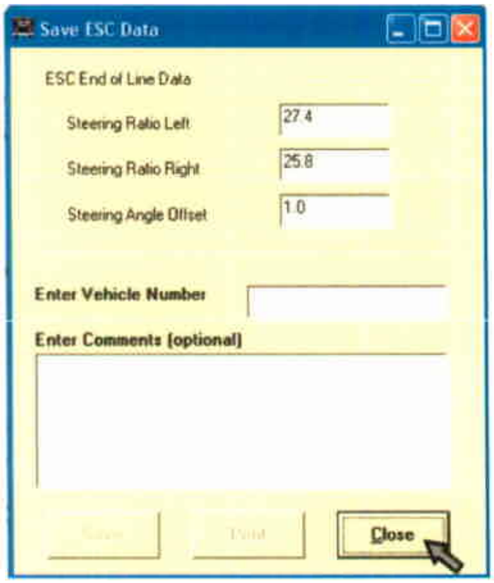



Figure 24

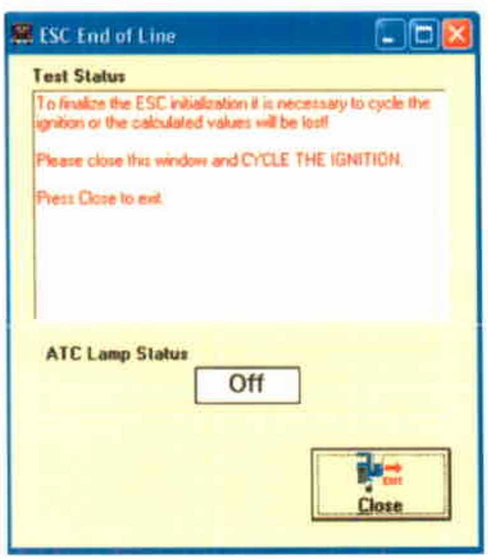
10. A message box will appear with the Steering Ratio and Steering Angle Offset values. Click Close. Figure 25.




4007835a

Figure 25

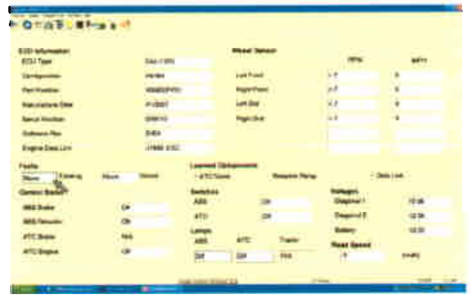
11. Read the message box and follow the instructions carefully. Click Close. Cycle the ignition. Figure 26.




4007836a

Figure 26

12. When the ignition is turned back on, check that no active or stored faults are logged in the ECU and the ABS and ATC/RSC/ESC warning lamps are off. Figure 27.



4007837a

Figure 27

It is important to the correct functioning of the ESC that the ESC/SAS calibration procedure occur exactly as outlined in this document. If the SAS or ESC calibration instructions and procedures do not occur as described above, refer to Maintenance Manual MM-0112, or contact the OnTrac Customer Service Center at 866-668-7221.


**MERITOR WABCO**

**Meritor WABCO Vehicle Control Systems**
2135 West Maple Road
Troy, MI 48084-7121 USA
800-535-5560
meritorwabco.com





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Revised 07-09
(16579/22882)

# Service Bulletin No. 328B

| MODEL | TYPE | SECTION/GROUP | DATE |
|---|---|---|---|
| E4500 / J4500 Series Coaches | Field Change Program | 11 – Steering | |

| SUBJECT | |
|---|---|
| | STEERING ANGLE SENSOR (SAS) |
| CONDITIONS | |

***THIS BULLETIN SUPERSEDES SERVICE BULLETIN 328 IN ITS ENTIRETY.***

**Ref. NHTSA Meritor WABCO Recall No.: 09E–032**

**Ref. NHTSA MCI Recall No.: 09V–196**

**Ref. Transport Canada MCI Recall No.: 09–154**



## *NOTICE*

***Meritor WABCO ( WABCO ) previously notified Motor Coach Industries ( MCI ) that WABCO was recalling its steering angle sensors ( SAS ) with a serial number below 3000. WABCO has now notified MCI that WABCO is expanding its recall to include steering angle sensors below serial number 3404.***

## Customer Complaint:

Meritor WABCO has reported to Motor Coach Industries ( MCI ) that a defect relating to motor vehicle safety exists in certain steering angle sensors used in Meritor WABCO commercial vehicle Electronic Stability Control ( ESC ) system applications. Meritor WABCO reports that the sensor rotor drive tab in certain Steering Angle Sensors ( SAS ) can break while driving, resulting in unnecessary brake activation that could pose a safety issue. Please see the attached Meritor WABCO letter dated July 20, 2009, and Meritor WABCO Installation Guide TP–09131 / Revised 07–09.

## Cause:

Meritor WABCO reports that the potential malfunction is the result of the sensor rotor drive tab of the steering angle sensor shearing off due to internal friction developing between the sensor gears and the sensor housing. Meritor WABCO advises that the affected steering angle sensors were the original design with serial numbers below 3404.

## Corrective Action:

MCI recommends that the steering angle sensor on affected coaches be inspected and replaced, if necessary, in order to eliminate any unexpected brake activations.

The MCI coach models that need to be inspected for by this defect are the following:

-E4500 model with the following VIN's ( inclusive ): 61996, 65203, 65335, 65337, 65339 and 65341.

-J4500 model with the following VIN's ( inclusive ): 64618, 64918, 64919, 64948 to 64950, 64953 to 64964, 64966, 64968, 64970, 64972, 64974, 64976, 64978 to 64988, 64990 to 65004, 65006, 65011, 65013 to 65032, 65035 to 65082, 65086 to 65098, 65106, 65108, 65110, 65112 to 65118, 65120, 65122, 65124 to 65147, 65149, 65151 to 65170, 65172, 65174, 65176, 65178, 65180, 65182, 65184, 65186 to 65188, 65190 to 65194, 65196 to 65202, 65204 to 65213, 65215 to 65282, 65284 to 65334, 65336, 65338, 65340 and 65342 to 65374.

-D4000ISTV, D4500 and D4505 models with the following VIN's ( inclusive ): 58890, 58907, 58980 to 59031, 59038 to 59045, 59047 to 59050, 59053, 59057, 59058, 59061, 59062, 59080, 59092 to 59127, 59130 to 59132, 59137, 59139, 59142, 59144, 59146, 59148, 59150, 59153 and 59155.

Accordingly, MCI is instituting a field change program to inspect and replace, if necessary, the Meritor WABCO steering angle sensors in all of the coaches listed above. This bulletin describes the procedures for properly replacing the Meritor WABCO steering angle sensors in the E and J series coaches.

**MCI's Service Bulletin 327B describes the procedures for properly inspecting and, if necessary, replacing the Meritor WABCO steering angle sensor in D models.**

**Parts**

| Qty. | New P/N | Description |
|---|---|---|
| 1 | 11-02-1166 | Kit, Steering Angle Sensor Replacement |
| | | *Kit Contents Are:* |
| 1 | 11-02-1144 | Steering Angle Sensor |
| 3 | | Screw |
| 1 | | Lubricant, Packet |

## Service Procedure:

### General notes

Read this entire procedure before beginning work. Meritor WABCO Toolbox™ Software Version 8.12.2 is required to perform the outlined procedure steps in this service bulletin.

**Use Safe Shop Practices At All Times.**

1. Turn the main battery disconnect switch to the OFF position. Chock both sides of the tires.
2. Locate the steering column cover assembly below the steering wheel. Remove and retain the four ( 4 ) screws from the bottom of the steering column cover assembly ( refer to Figure 1 ).


**Figure 1.**

3. Remove and retain the steering column cover, to be re-installed at a later step in this procedure.

4. Locate the steering angle sensor serial number label ( refer to Figure 2 ).

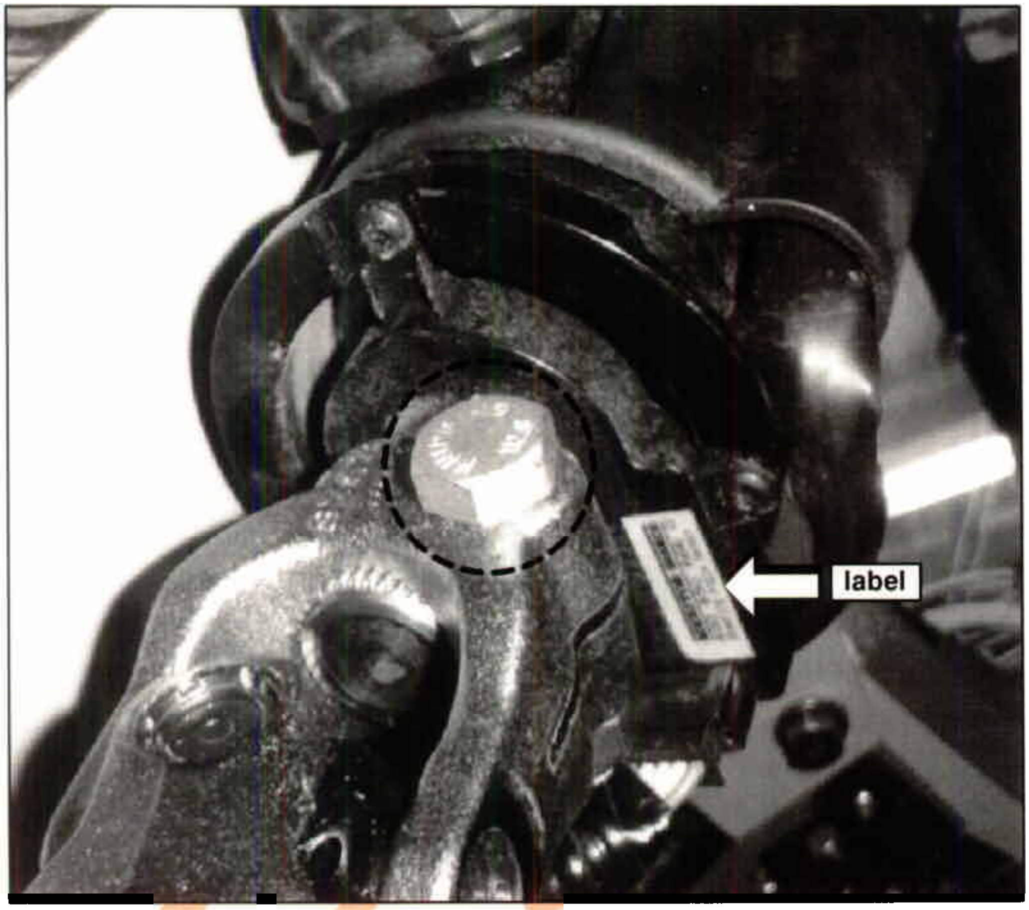



Figure 2.

5. Using a small mirror, view the steering angle sensor serial number label and record the serial number ( refer to Figures 3, 4 or 5 for the three { 3 } versions of labels ).


**Figure 3. Meritor WABCO steering angle sensor requiring replacement.**


**Figure 4. Meritor WABCO steering angle sensor requiring replacement.**


**Figure 5. Meritor WABCO steering angle sensor NOT affected by campaign.**

## *NOTICE*

***If the steering angle sensor serial number is between 1 and 3403, ensure that a laptop computer with Meritor WABCO Toolbox ™ software version 8.12.2, or higher, is available . Proceed to Step 6.***

***If the steering angle sensor serial number is 3404 or above, record the new steering angle sensor serial number and submit with paperwork to be returned to MCI. Re-install the steering column cover. No further action required.***
***Procedure complete.***

6. Locate and note the orientation of the steering angle sensor wiring harness connector ( refer to Figure 6 ). Carefully disconnect the steering angle sensor harness.
7. Locate and remove the clamp bolt and nut that secures the universal joint yoke to the steering column shaft ( refer to Figure 2 ).
8. Carefully mark the orientation of the universal joint yoke with respect to the steering column shaft so that correct alignment of the steering column shaft and universal joint yoke can be obtained during reassembly.
9. Slide the universal joint yoke downward, off of the steering column shaft splines to access to the steering angle sensor.
10. Remove and discard the three ( 3 ) steering angle sensor mounting screws ( refer to Figure 6 ).
11. Remove and retain the existing steering angle sensor ( refer to Figure 6 ), to be returned to MCI.
12. Apply the supplied lubricant to the mating surface of the new steering angle sensor drive tab and the keyway of the shaft ( refer to Figure 6 ).

## *NOTICE*

***To avoid component damage, do not over–torque the steering angle sensor screws.***

13. Align the new steering angle sensor drive tab and the keyway of the shaft. Carefully install the new steering angle sensor and secure using the three ( 3 ) screws in the Parts kit. Torque screws to 20–22 lb-in. Record the new steering angle sensor serial number and submit with paperwork to be returned to MCI.

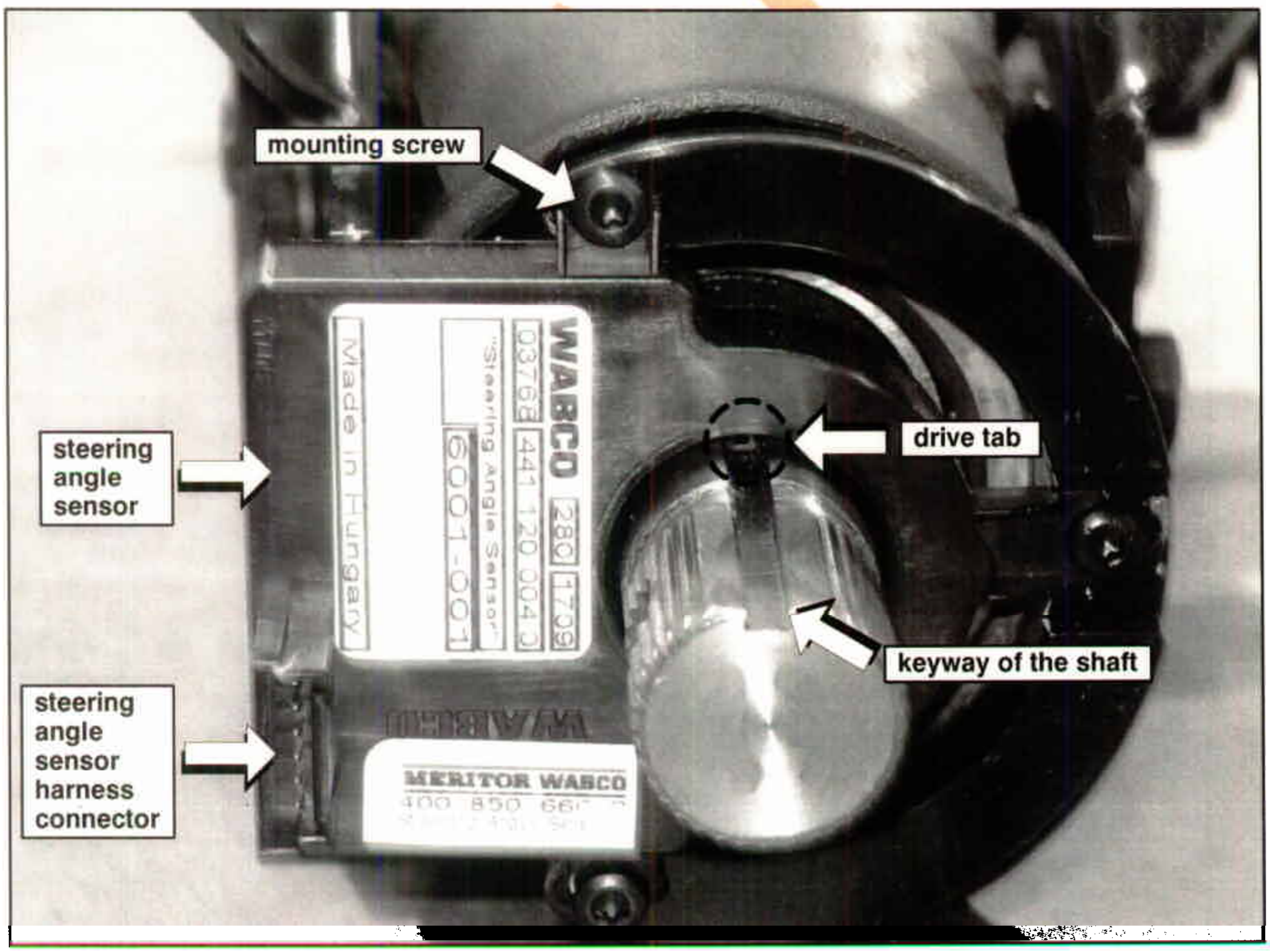



**Figure 6.**

14. Re-install the universal joint yoke onto the steering column shaft, using caution to re-align splines as marked in Step 8. Using the clamp bolt and nut removed in Step 7. , secure the universal joint yoke. Torque clamp bolt to 35–38 lb ft.

## NOTICE

***Ensure that the steering angle sensor harness is clear of any possible interference with the universal joint.***

15. Re-connect the steering angle sensor harness, ensuring that the small tab snaps into the connector groove.
16. Re-install the steering column cover, removed in Step 3.
17. Using the attached Meritor WABCO Technical Bulletin TP–09127 titled Steering Angle Sensor Calibration and Electronic Stability Control Initialization and Meritor WABCO Toolbox™ Software Version 8.12.2, calibrate the new steering angle sensor.

## NOTICE

***It is important to the correct functioning of the ESC that the entire SAS Calibration Procedure as well as Steps 1 to 6 and Steps 11 to 12 of the ESC Initialization Procedure occur exactly as outlined in the attached Meritor WABCO Technical Bulletin TP–09131.***

***Since MCI's coaches are configured with a preset steering ratio, Steps 7 to 10 of the attached ESC Initialization Procedure ( refer to Page 6 of attached TP–09131 ) do not apply and will not display on the laptop screen.***

***After completion of Step 6, proceed to Steps 11 and 12 to ensure procedure is completely performed.***

*Procedure complete.*

Mail or fax the completed warranty claim form to MCI's warranty department, or photocopy and mail it to:

MCI Fleet Support
Attn: Warranty Department
7001 Universal Coach Drive
Louisville, KY 40258
Fax Number 1-800–360–8886

to receive credit for the hours used to complete this task. Contact the MCI Fleet Support Technical Center at 1-800-241-2947 for any further information.

***Field Change Program Conditions:***

The parts required for this change will be supplied without charge.

**ONLY ONE ( 1 ) CLAIM CAN BE FILED AGAINST THE COACH VIN, SB 328 OR SB 328B.**

A labor allowance of 0.4 hours will be granted against claim SB328B.1, for the procedure of inspecting the steering angle sensor serial number label only.

A labor allowance of 1.2 hours will be granted against claim SB328B.2, for the procedure of inspecting the steering angle sensor serial number label, replacing the steering angle sensor and re–calibrating the steering angle sensor.

**NO PAYMENT WILL BE ISSUED BY MOTOR COACH INDUSTRIES UNTIL THE COMPLETED WARRANTY CLAIM FORM, THE STEERING ANGLE SENSOR AND THE SERIAL NUMBER OF THE REPLACEMENT STEERING ANGLE SENSOR HAVE BEEN RECEIVED BY MCI.**

This labor allowance will be credited to your MCI Fleet Support Parts Account on receipt of a "Warranty Claim Form" as detailed in your Owner Warranty manual.

Motor Coach apologizes for any inconvenience resulting from this campaign, but urges you to implement this change as soon as possible.

Sincerely,

*Motor Coach Industries*
U.S. and Canadian Service Departments.

TP-09131
Revised 07-09

MERITOR WABCO

Installation Guide

# Steering Angle Sensor (SAS) Replacement on Vehicles Equipped with Electronic Stability Control (ESC)

## Hazard Alert Messages

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

## How to Obtain Additional Maintenance and Service Information

Refer to Maintenance Manual MM-0112, Anti-Lock Braking System (ABS) for Trucks, Tractors and Buses. Call ArvinMeritor's Customer Service Center at 800-535-5560 to obtain this publication. Meritor WABCO publications are also available on our website:

www.meritorwabco.com

## How to Obtain Kits

Contact the OnTrac Customer Service Center at 866-668-7221.

### Kit 400 850 360 0

The steering angle sensor field kit (part number 400 850 360 0) is required for completing the replacement procedure. The kit consists of the following parts.

- Steering angle sensor (SAS)
- Grease packet
- Three screws
- Field inspection, replacement and calibration instructions
- Return envelope for removed SAS with serial number less than 3404
- Tag to record Vehicle Identification Number (VIN) that will accompany SAS in the return envelope

## Tools

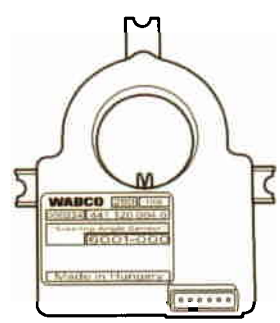
To complete this procedure, you will need screwdrivers appropriate for the type of screws used to attach the steering column lower shroud, and the steering angle sensor to the mounting bracket.

This installation guide provides steps for SAS replacement on vehicles equipped with ESC.

- Inspecting part number and serial number on SAS
- SAS replacement
- SAS calibration and ESC initialization

## Inspecting Part Number and Serial Number on the Steering Angle Sensor (SAS)

This section provides instructions on how to identify the part number and serial number of the Meritor WABCO Steering Angle Sensor, a component used in vehicles equipped with Electronic Stability Control (ESC). Figure 1.



4007838a

Figure 1

# Inspection Procedure

## ⚠ WARNING

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

**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 and fall over. Serious personal injury and damage to components can result.**

1. Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving.
2. Use a screwdriver to remove the screws on the shroud covering the lower portion of the steering column. Remove the shroud. This will expose the connection between the steering shaft and the I-shaft. The SAS is mounted just above this joint. Figure 2.

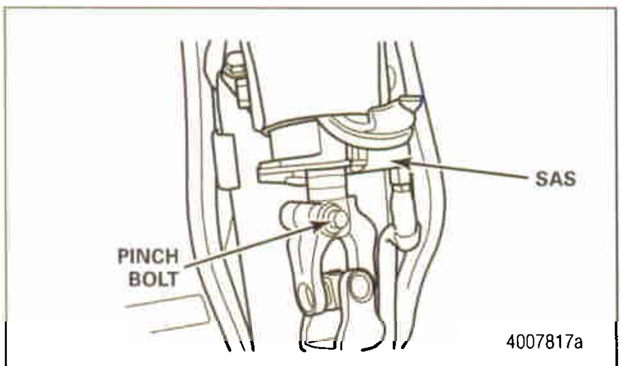



Figure 2

3. Locate the label on the exposed face of the SAS. It may be necessary to use a small mirror to view this while installed on the column. Record the part number and serial number of the SAS according to the type of label you find.

## Types of Labels

There are three types of labels you may find on the SAS.

For the label type in Figure 3, the part number is the 10-digit number starting with 441 in the second line of the text below "WABCO". The serial number is the 6-digit number directly below "WABCO".

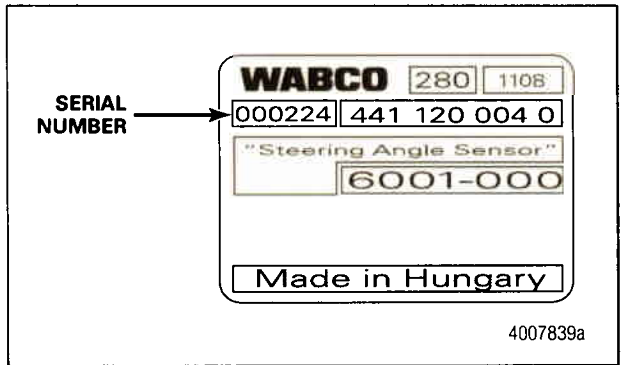



Figure 3

For the label type in Figure 4, the 10-digit part number which starts with 400 is directly below "MERITOR WABCO" and the 6-digit serial number is directly above the "Made in Hungary" text.


Figure 4

A third variation of the SAS shown in Figure 5 contains the label in Figure 3 as well as another label to the right containing the part number 400 850 666 0. The serial number should be read using the method described for the label in Figure 3.

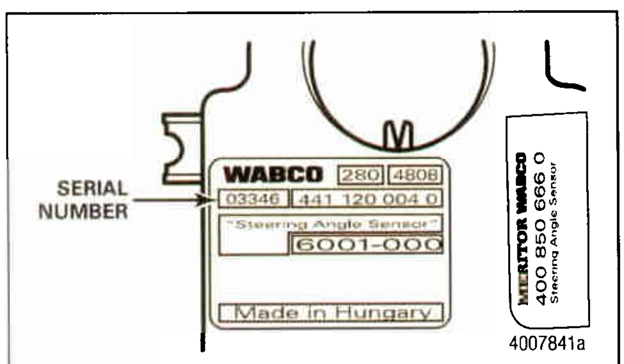



Figure 5

**NOTE:** Steering angle sensors with serial numbers less than 3404 must be replaced with an SAS with a serial number of 3404 or higher. Refer to the Steering Angle Sensor Replacement instructions in this guide, or to Maintenance Manual MM-0112.

## Steering Angle Sensor Replacement

This section provides procedures for replacing the Meritor WABCO Steering Angle Sensor on vehicles equipped with ESC. Figure 6.

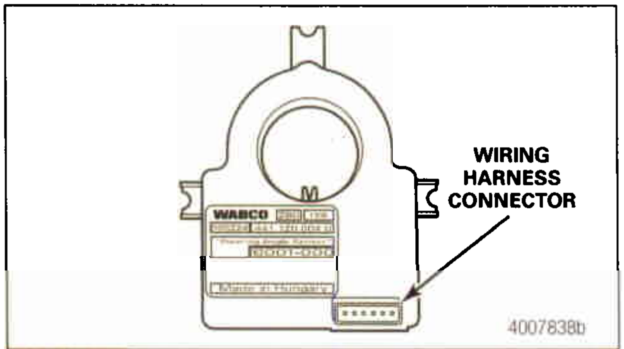



Figure 6

## Remove the Steering Angle Sensor

**WARNING**

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

**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 and fall over. Serious personal injury and damage to components can result.**

1. Park the vehicle on a level surface with the steering wheel centered and the front wheels positioned straight ahead.
2. Turn the ignition switch to the OFF position and apply the parking brake.
3. Block the wheels to prevent the vehicle from moving.
4. Remove the shroud that covers the lower portion of the steering column. This exposes the connection between the steering shaft and the I-shaft. The steering angle sensor is mounted just above this joint. Figure 7.

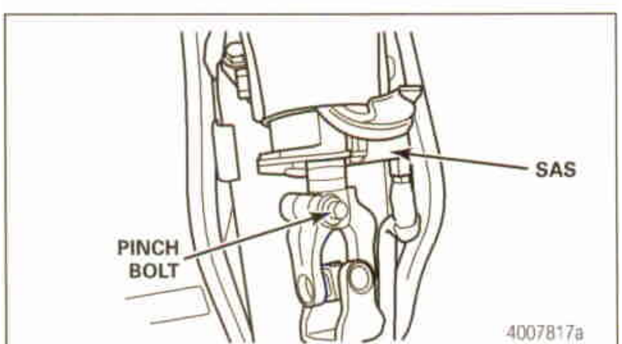



Figure 7

5. Remove the pinch bolt on the top portion of the universal steering joint. This will allow you to slide the joint down and off the steering column.
6. Note the position of the SAS wiring harness connector (Figure 7) — either facing UP or DOWN. The new SAS will need to be positioned the same way when installed. Disconnect the wiring harness connector from the SAS.
7. Remove the three screws that attach the SAS to the steering column and slide the SAS off the shaft. Note the tab in the center of the SAS fits into a groove machined into the steering shaft.

## Install the New Steering Angle Sensor

1. Apply a small amount of the supplied grease to the tab in the center of the SAS and to the machined groove on the steering shaft.

   **NOTE:** The SAS must be installed in the correct orientation or it will not function correctly.

2. Place the SAS over the shaft making sure that the connector is facing the same direction as the original one. Slide the SAS into place. Check to ensure the tab is in the machined groove on the column.
3. Install the three mounting screws provided in the kit and tighten to a maximum of 22 in-lb (2.5 N•m). Do not reinstall the original screws.
4. Install the wiring harness connector. Push the connector together until the small tab snaps into the connector groove.
5. Replace the universal steering joint and tighten the pinch bolt to the vehicle manufacturer specification.
6. Install the steering column shroud.
7. Remove the wheel blocks.
8. Test the SAS installation using the test procedure in this installation guide.

## Testing the SAS Installation

The SAS must be calibrated and the ESC initialized in order to test the SAS installation.

1. Perform the SAS calibration and ESC initialization procedures. Refer to the procedures in this installation guide.
2. When the SAS calibration and ESC initialization procedures are complete, turn the ignition power on. The ABS and ATC/ESC lamps should come on and go out. The ATC/ESC lamp may also remain on briefly after the ABS lamp goes off.

3 Check to ensure there are no active faults displayed in the ABS ECU memory.

**NOTE:** If the SAS does not function as described above, contact the OnTrac Customer Service Center at 866-668-7221 for further information on how to correct any problems with the installation. The ESC may not function correctly if the SAS does not perform as described in this section.

## Filing Instructions and Return Parts Procedure

File the claim according to the vehicle manufacturer instructions. A return envelope and tag for recording any required information is included for the return.

# SAS Calibration and ESC Initialization Procedures

This section provides instructions for SAS calibration and ESC initialization. These procedures, sometimes referred to as the "ESC End-of-Line" procedure, must be performed as part of the final assembly of the vehicle at the vehicle manufacturer site. These procedures are also required when all or any component such as the SAS, the ESC Module or the ECU have been replaced or a major steering system repair or replacement has been completed including alignment of the front tires. Failure to do so may result in the ESC not functioning correctly.

The SAS calibration procedure must be performed before the ESC initialization.

The status of the procedures can be verified using one of the following faults.

SAS not calibrated — 89 13

ESC initialization required — 88 13

ESC initialization not completed — 88 01

**NOTE:** Additional faults must not be active when you begin these procedures. If any other faults are present, you must resolve those issues before the main calibration menu items will become available.

## SAS Calibration Procedure

**NOTE:** You must align the front tires before you perform the SAS calibration.

1 To access the Meritor WABCO TOOLBOX™ Software, double-click on the Meritor WABCO TOOLBOX™ icon from the desktop. Figure 8.


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Figure 8

2. From the message box, click on the Pneumatic ABS button. Figure 9.

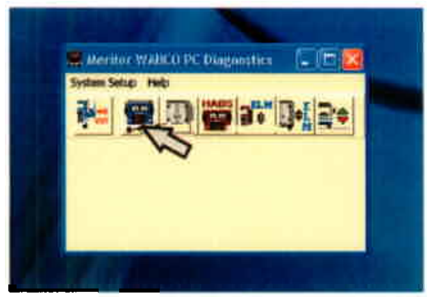


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Figure 9

3. To verify status of the ESC initialization, double-click on the fault box from the initial screen. Figure 10.

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Figure 10

4. For new vehicles or vehicles where the SAS has been replaced, the message box should show the Steering Angle Sensor code 89-13. Check the code to ensure it is correct. Figure 11.

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Figure 11

5. To access SAS Calibration, click on the ESC Menu from the bar menu at the initial screen. A drop box will illuminate. Select the "End of Line" option. Figure 12.

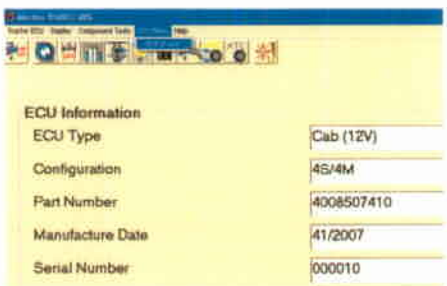


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Figure 12

6. Click SAS Calibration in the message box. Figure 13.

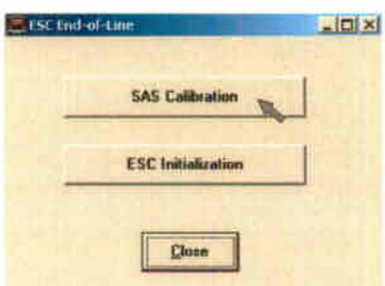


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Figure 13

7. Follow the instruction in the message box. Figure 14.

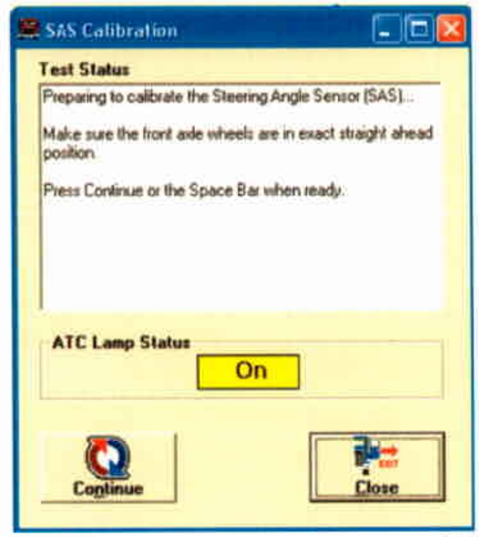


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Figure 14

8. The message box will indicate when the SAS has been calibrated. Once the SAS is calibrated, press Close or the space bar to continue. The ESC initialization procedure can now be performed. Figure 15.

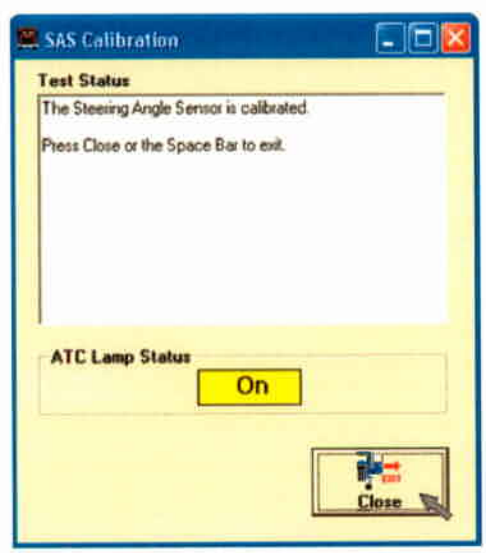


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Figure 15

## ESC Initialization Procedure

After the SAS calibration is completed, use the following procedure to initialize the ESC.

1. To verify the status of the ESC initialization, double-click on the fault box from the initial screen. Figure 16.

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Figure 16

2. The message box should show the ESC Initialization Not Complete code 88-1. Verify the code is correct. Figure 17.

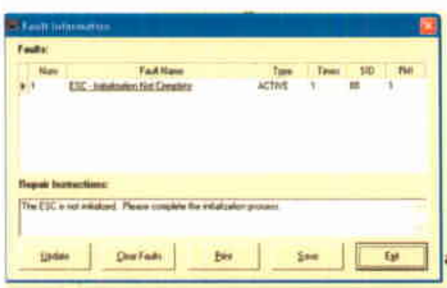

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Figure 17

3. Again click on the ESC Menu from the bar menu at the initial screen. Select the "End of Line" option. Figure 18.

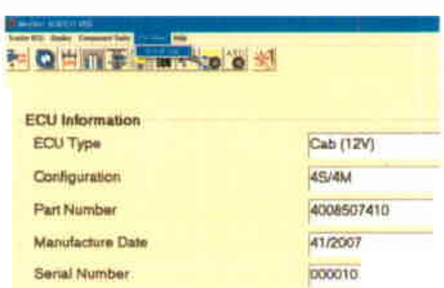


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Figure 18

4. Click on ESC Initialization. Figure 19.

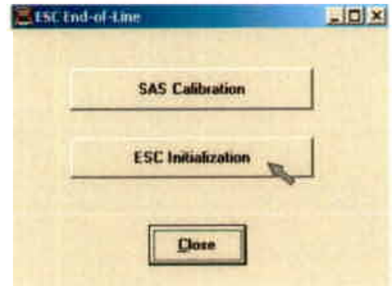


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Figure 19

5. Read the information in the message box. When you are ready to proceed, press the space bar or click Continue. Once the calibration process has started, it will continue until the calibration is complete. No further keyboard inputs are required. Once the calibration process has begun, instructions will appear in the message box and will continue until the calibration is complete. Figure 20.

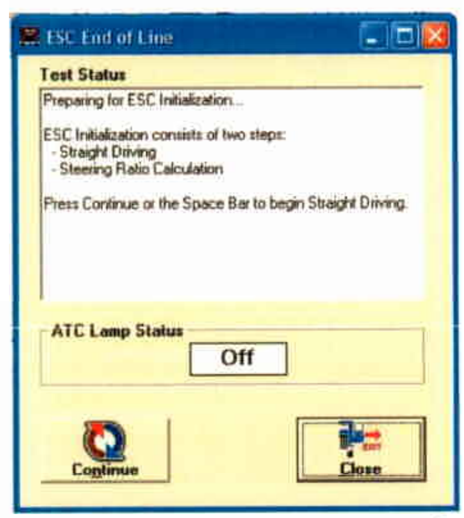


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Figure 20

6. Carefully read and follow the instruction in the message box. The ATC/RSC/ESC lamp will start blinking when the 15 mph speed has been reached. When "straight driving" is completed after about 800 feet, the ATC/RSC/ESC lamp will stop blinking and will be on solid. Figure 21.

   **NOTE:** The "straight driving" can be done in segments and the ECU will accumulate the information until the 800 feet are reached, but it must be done in the same ignition cycle.

**NOTE:** In some applications, you may have preset steering ratios and a message box will appear indicating the calibration procedure is complete. In this case, click Close and cycle the ignition. When the ignition is turned back on, check that no active faults are logged and the ABS and ATC/RSC/ESC warning lamps are off. The calibration is complete.

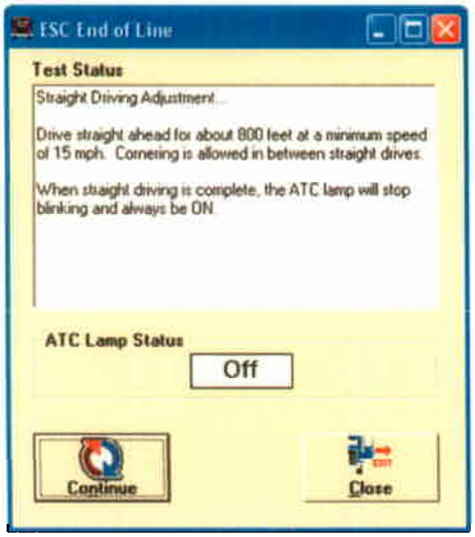


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Figure 21

7. A message will appear after the "straight driving" is complete. Carefully read and follow the instructions in the message box. Start driving in a circle with the steering wheel rotated 360 degrees. No keyboard input is required. Figure 22.

   **NOTE:** The "circle driving" may also be done in segments and the ECU will accumulate the information until the required distance is reached, but it must be done in the same ignition cycle.

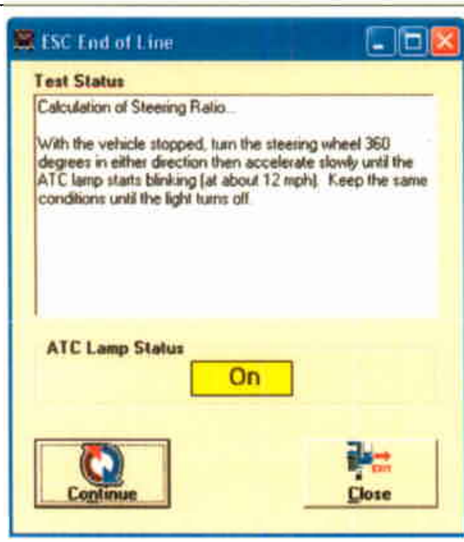


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Figure 22

8. Read the message box carefully. The ATC/RSC/ESC lamp will start blinking when the required conditions are met. Keep driving until the lamp turns off. Figure 23.

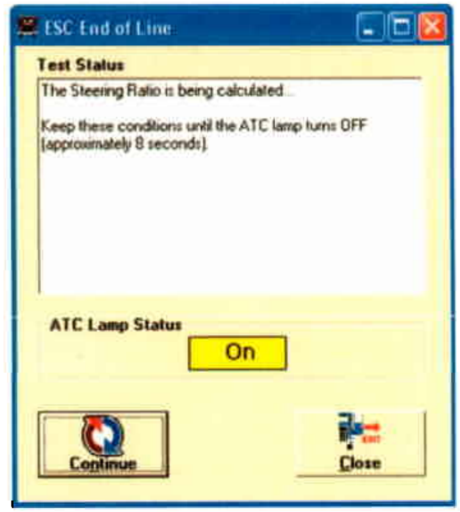


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Figure 23

9. This message will appear after the steering ratio has been calculated. Figure 23. Stop the vehicle. Read the message box carefully and follow the instructions. Turn the steering wheel 360 degrees in the opposite direction from being centered. Repeat the driving conditions. Again, the ATC/RSC/ESC lamp will start blinking when the required conditions are met. Keep driving until the light turns off. Figure 24.

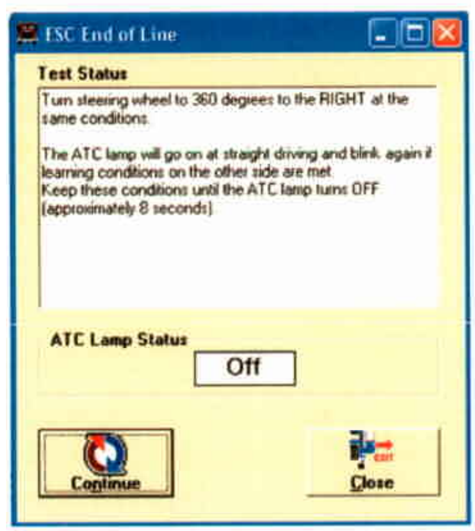


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Figure 24

10. A message box will appear with the Steering Ratio and Steering Angle Offset values. Click Close. Figure 25.

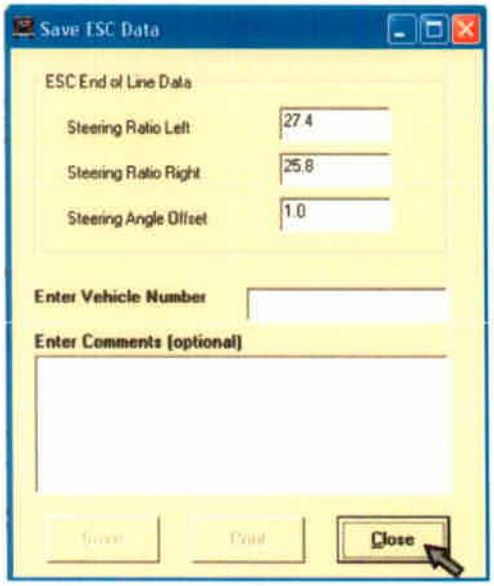


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Figure 25

11. Read the message box and follow the instructions carefully. Click Close. Cycle the ignition. Figure 26.

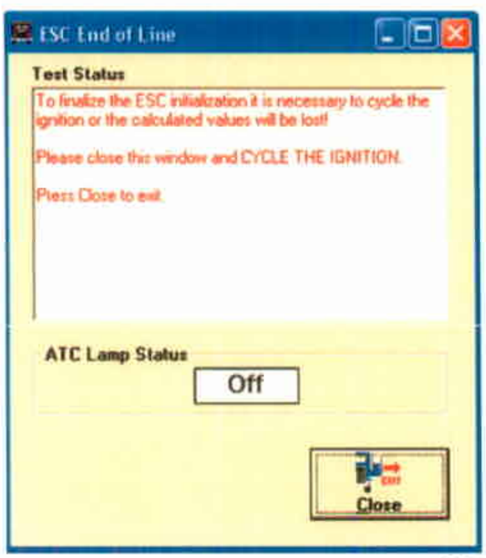


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Figure 26

12. When the ignition is turned back on, check that no active or stored faults are logged in the ECU and the ABS and ATC/RSC/ESC warning lamps are off. Figure 27.

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Figure 27

It is important to the correct functioning of the ESC that the ESC/SAS calibration procedure occur exactly as outlined in this document. If the SAS or ESC calibration instructions and procedures do not occur as described above, refer to Maintenance Manual MM-0112, or contact the OnTrac Customer Service Center at 866-668-7221.

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