

**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](http://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 3000
- 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.

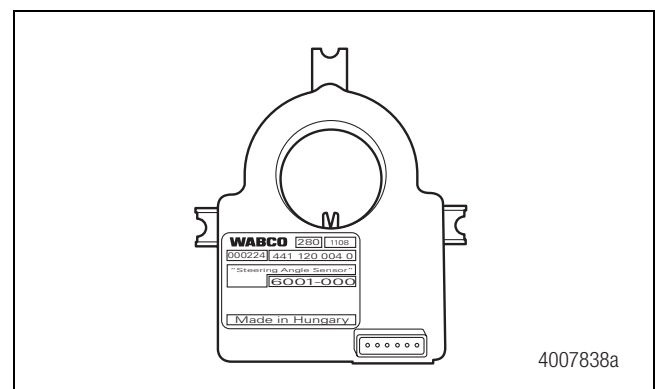


Figure 1

# 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.

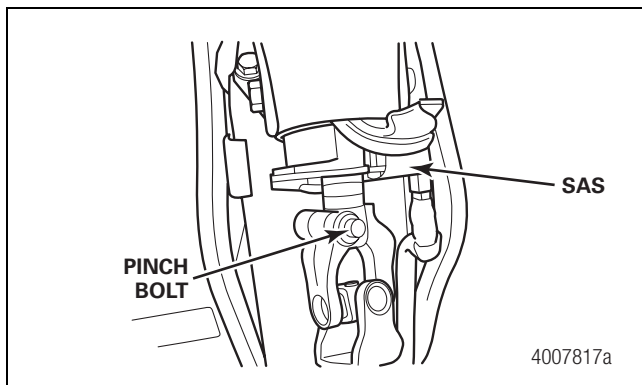


Figure 2

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".

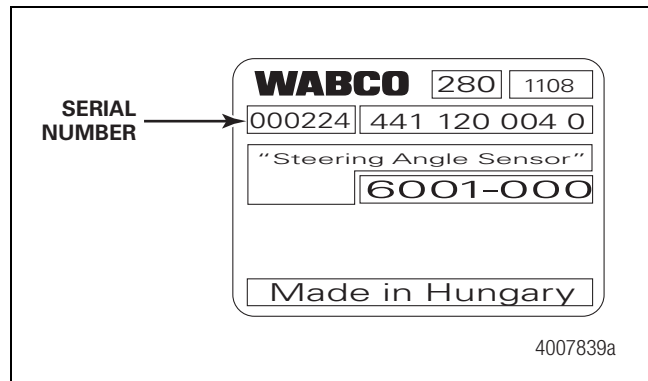


Figure 3

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.

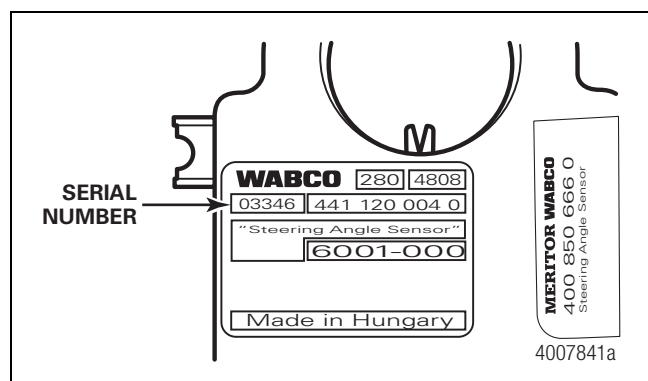


Figure 5

**NOTE:** Steering angle sensors with serial numbers less than 3000 must be replaced with an SAS with a serial number of 3000 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.

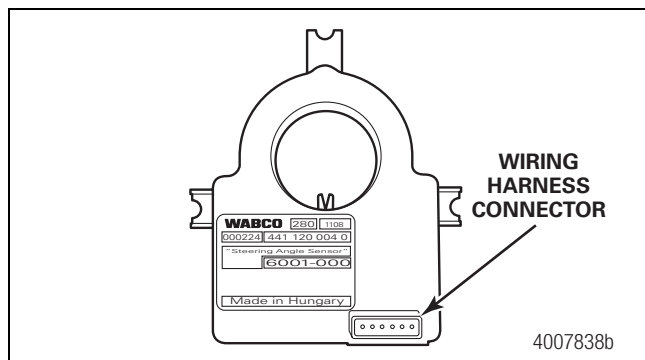


Figure 6

## 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.

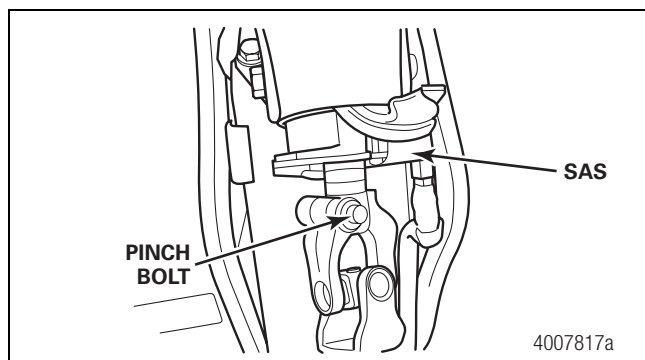


Figure 7

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 clamping 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.



Figure 8

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

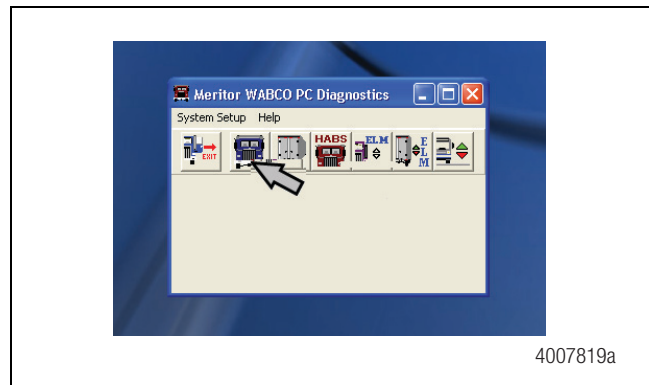


Figure 9

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

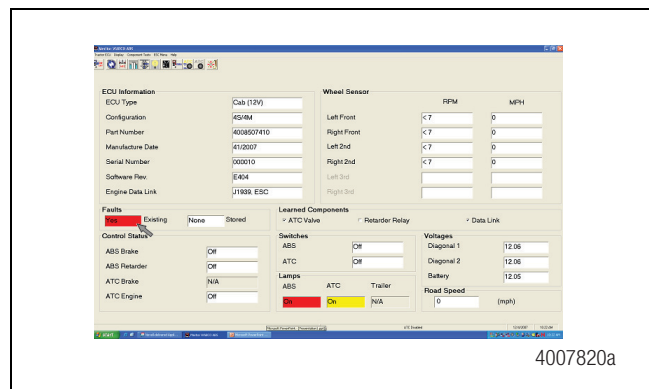
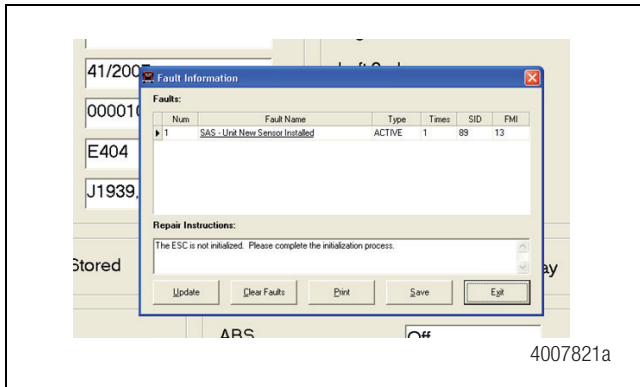


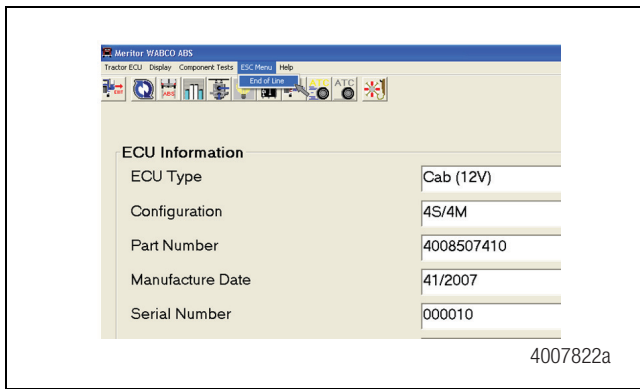
Figure 10

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.



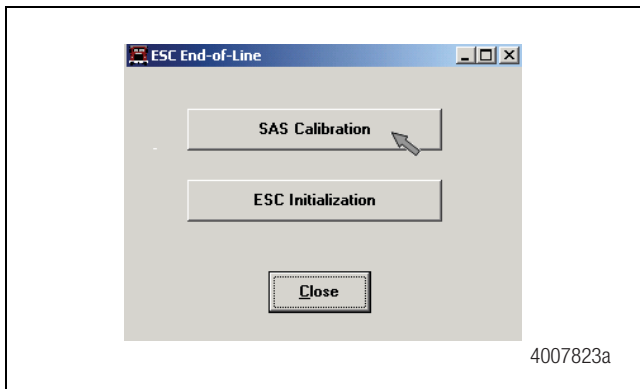
**Figure 11**

- 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.



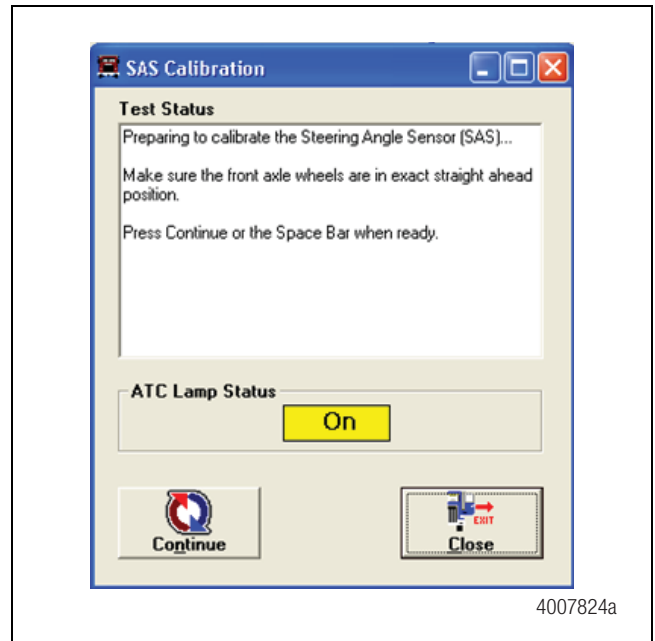
**Figure 12**

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



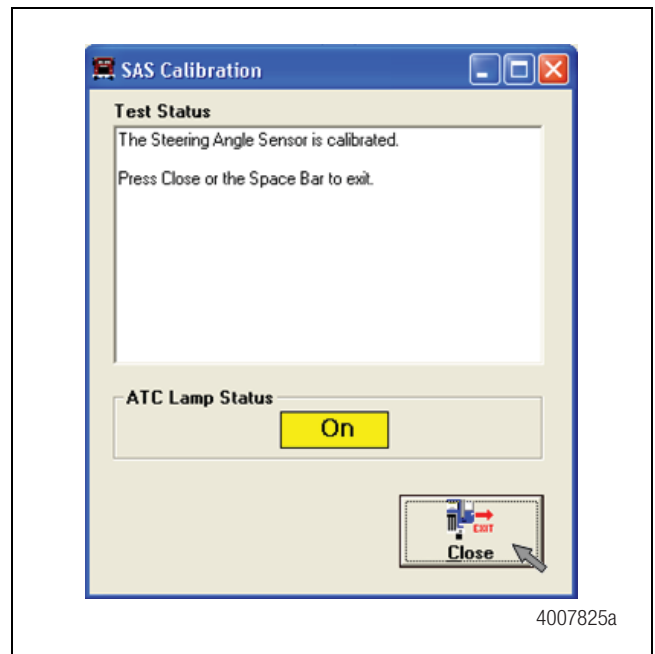
**Figure 13**

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



**Figure 14**

- 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.



**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.

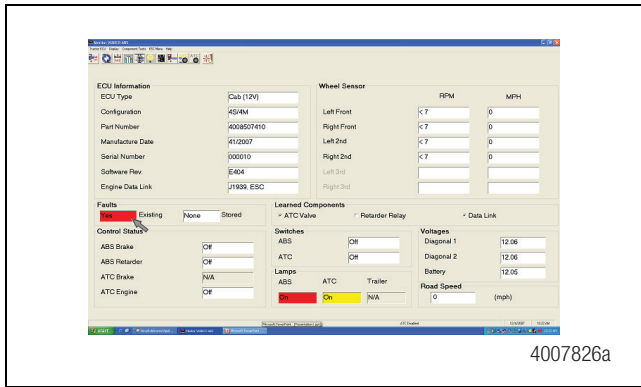


Figure 16

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

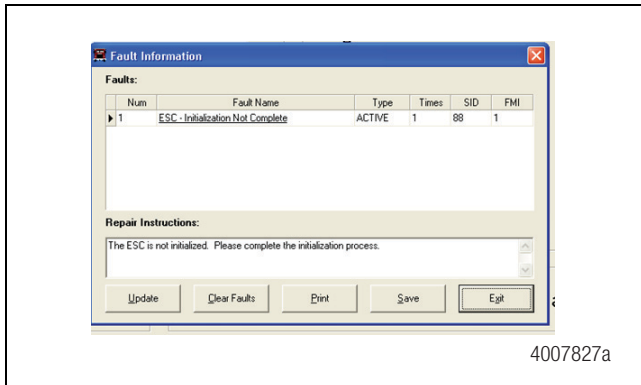


Figure 17

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

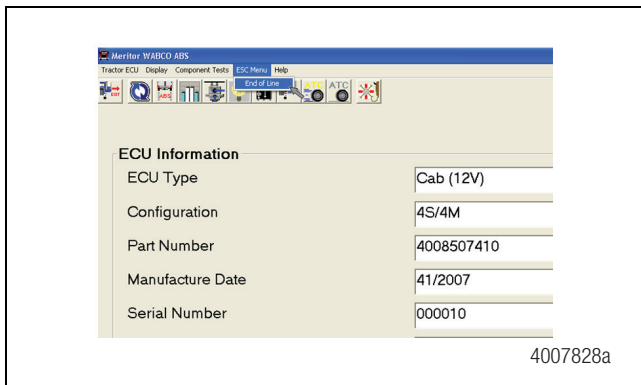


Figure 18

4. Click on ESC Initialization. Figure 19.

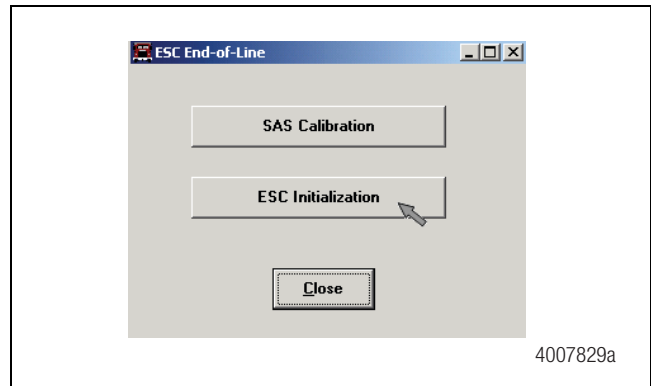


Figure 19

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.

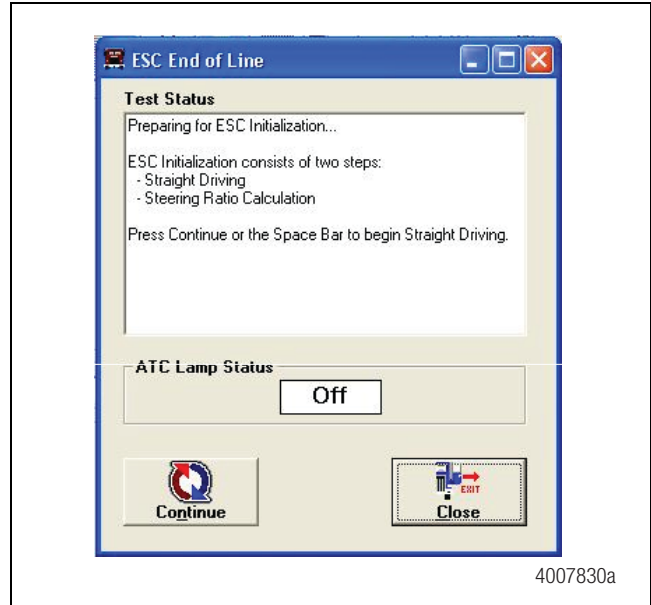


Figure 20

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.

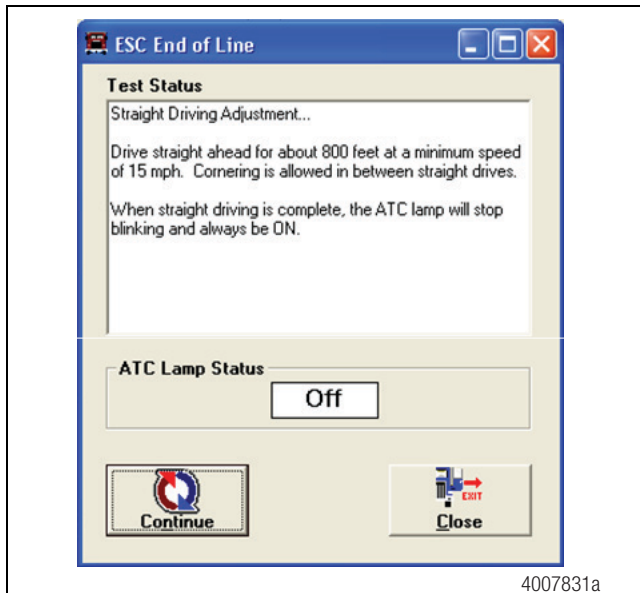


Figure 21

- 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.

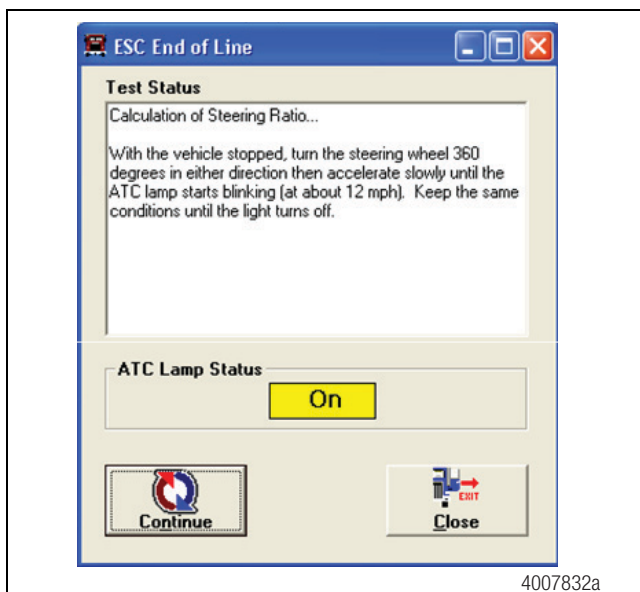


Figure 22

- 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.

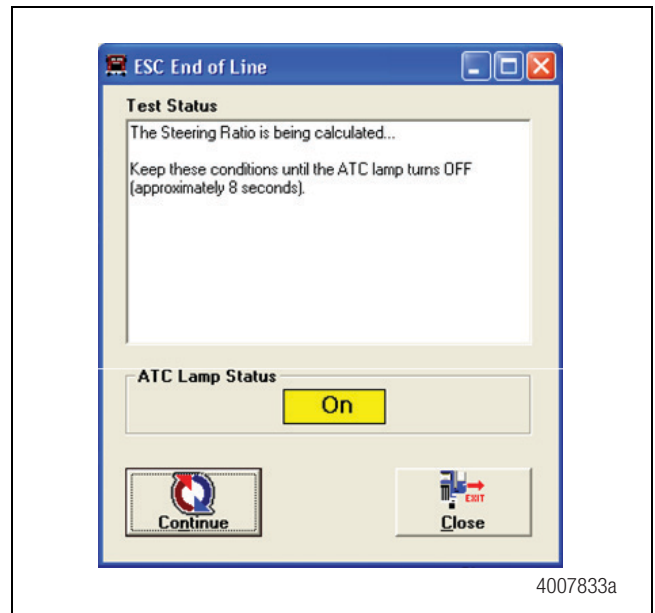


Figure 23

- 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.

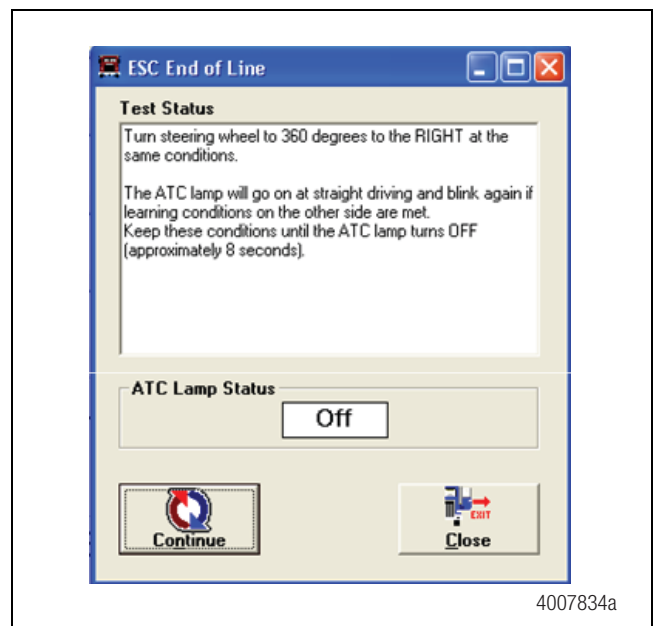


Figure 24

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

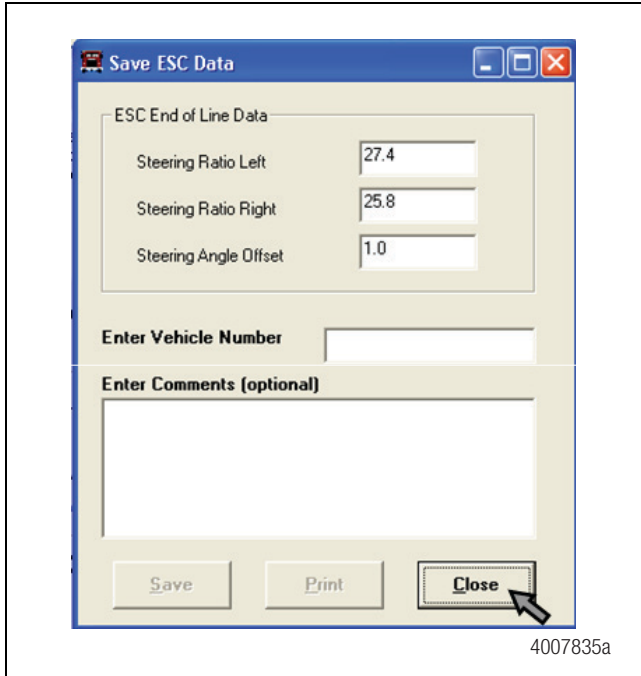


Figure 25

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.

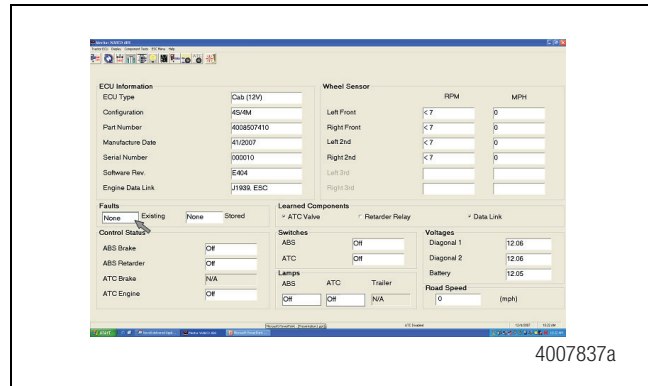


Figure 27

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.

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

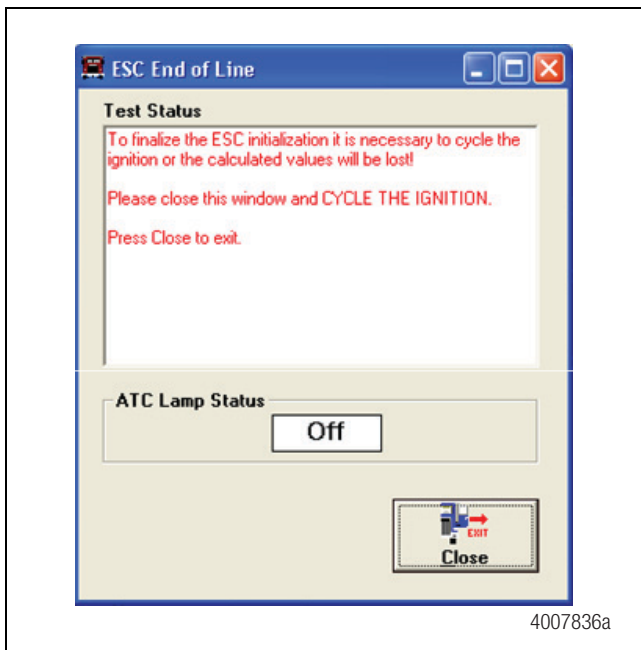


Figure 26

## MERITOR WABCO

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