Shift By Wire (SBW & SBW II) Actuator

Actuator Installation Instruction Procedure

For the Allison 1000 – 2000 Series Transmissions

AES-203
## Hardware used during this Installation Procedure.

<table>
<thead>
<tr>
<th>Fastener Name &amp; Number</th>
<th>Fastener Type</th>
<th>Torque</th>
<th>Tolerance</th>
<th>Required Tools</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front Bolt SC508</td>
<td>M8 x 55mm Hex Bolt</td>
<td>Per Allison Specification</td>
<td>13mm Socket Wrench</td>
<td><img src="image1.jpg" alt="Bolt Image" /></td>
<td></td>
</tr>
<tr>
<td>Rear Cover Bolts</td>
<td>Allison Rear Cover Bolts</td>
<td>Per Allison Specification</td>
<td>15mm Socket Wrench</td>
<td><img src="image2.jpg" alt="Bolt Image" /></td>
<td></td>
</tr>
<tr>
<td>Top Mounting Bracket Bolt (Vertical Mount installation only)</td>
<td>M8 x 60mm Flange Head Hex Bolt</td>
<td>24 lbs-ft ± 4 lbs-ft (30.5 N-m ± 5.5 N-m)</td>
<td>15mm Socket Wrench</td>
<td><img src="image3.jpg" alt="Bolt Image" /></td>
<td></td>
</tr>
<tr>
<td>Shift Shaft Adapter Screws (Qty 4)</td>
<td>#10-32 x ½&quot; Torx Screws</td>
<td>20 lbs-in ± 4 lbs-in (2.25 N-m ± 0.5 N-m)</td>
<td>T27 Torx Bit</td>
<td><img src="image4.jpg" alt="Screws Image" /></td>
<td></td>
</tr>
<tr>
<td>Shift Shaft Adapter</td>
<td>To Remove stuck Shift Shaft Adapters</td>
<td>N/A</td>
<td>N/A</td>
<td>#10-32 x 1 3/4&quot; to 2-1/2&quot; Screws</td>
<td>No Image Available</td>
</tr>
<tr>
<td>Cap Nut Locking Screw SC511</td>
<td>1/4&quot; - 28 x 2&quot; Hex Head Screw</td>
<td>18 lbs-in ± 4 lbs-in (2.0 N-m ± 0.5 N-m)</td>
<td>3/16&quot; Hex Wrench (Allen Wrench)</td>
<td><img src="image5.jpg" alt="Screw Image" /></td>
<td></td>
</tr>
<tr>
<td>Cap Nut</td>
<td>Specialty Fastener</td>
<td>5 lbs-ft ± 1 lbs-ft (6.75 N-m ± 1.3 N-m)</td>
<td>16mm Socket and Open End Wrench, or 5/8&quot; wrenches will work</td>
<td><img src="image6.jpg" alt="Screw Image" /></td>
<td></td>
</tr>
<tr>
<td>Cover Screws (Qty 3)</td>
<td>#10-32 x Torx Button Head Screws</td>
<td>20 lbs-in ± 4 lbs-in (2.25 N-m ± 0.5 N-m)</td>
<td>T25 Torx Bit</td>
<td><img src="image7.jpg" alt="Screw Image" /></td>
<td></td>
</tr>
</tbody>
</table>

### Hardware

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Marking</th>
<th>Number</th>
<th>When Used?</th>
<th>Images</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver Round Spacer</td>
<td>With 1 Groove</td>
<td>MT1246</td>
<td>On NSBU Equipped Transmission</td>
<td><img src="image8.jpg" alt="Spacer Image" /></td>
</tr>
<tr>
<td>Blue Round Spacer</td>
<td>With 2 Grooves</td>
<td>MT1317</td>
<td>On IMS Equipped Transmission</td>
<td><img src="image9.jpg" alt="Spacer Image" /></td>
</tr>
<tr>
<td>Silver Hex Spacer</td>
<td>No Grooves</td>
<td>MT1269</td>
<td>On Vertical Mount with 3mm thick OEM Brackets</td>
<td><img src="image10.jpg" alt="Spacer Image" /></td>
</tr>
<tr>
<td>Red Hex Spacer</td>
<td>With 1 Groove</td>
<td>MT1291</td>
<td>On Vertical Mount without OEM Brackets</td>
<td><img src="image11.jpg" alt="Spacer Image" /></td>
</tr>
<tr>
<td>Alignment Tool</td>
<td>None</td>
<td></td>
<td>On all Installations</td>
<td><img src="image12.jpg" alt="Tool Image" /></td>
</tr>
</tbody>
</table>
There are two important questions before you begin installation:

1) Horizontal or Vertical Installation?
Depending on the bracket, the Actuator is installed horizontally or vertically.

Horizontal Brackets are short and have 3 mounting points.

Vertical Brackets are tall and have 4 mounting points.

Where it is relevant these instructions will show the Installation Step as Horizontal or Vertical.

2) Is the Neutral-Start-Back-Up (NSBU) Connector part of your installation?
Pre Gen 4 Transmissions have an external NSBU Assembly behind the Actuator. Gen 4 Transmissions moved the NSBU Connector to a different place on the transmission, and do not have an external NSBU Assembly.

Where it is relevant these instructions will show the Installation Step with and without the NSBU Connector.

NSBU Connector shown with Horizontal Mounting.

NSBU Connector show with Vertical Mounting.
Installation Procedure:
This is the Initial Installation Procedure for a new Shift By Wire Actuator. Note: If this is not a “first time” installation or a replacement of a new actuator, please refer to Arens Controls AES-204 Re-Calibration Procedure.

**WARNING**

*If the transmission is installed in a chassis, do the following:*

a) Park the vehicle on level ground.
b) Set the emergency brake.
c) Chock/block the tires to prevent the vehicle from moving unexpectedly.
d) Turn off the engine.

**Failure to follow these steps could result in serious injury or death.**

1. Place the transmission manual shaft in the Neutral position. This can be done one of two ways:
   **Method A:** Line-up the flats on the Selector Shaft with the figure cast into the side of the transmission as shown in Figure #1 and Reference Illustration #1.
   **Method B:** Using an adjustable wrench turn the Selector Shaft clock-wise until it stops. Do not force the selector shaft when it reaches the end of its travel. This could damage the transmission. The transmission is now in *PARK detent position. Next, slowly and carefully rotate the selector shaft back counterclockwise two steps, or detents. The transmission is now in NEUTRAL.

   **NOTE** – All Allison 1000 and 2000 series transmission have a PARK detent position regardless if they have a PARK pawl or not.

   **IMPORTANT** - When moving the selector shaft in the counterclockwise direction from PARK, the tendency is to move it too fast. This may result in moving past the NEUTRAL position. The transmission MUST be in NEUTRAL for proper installation.

A simple check that the NEUTRAL position has been correctly obtained is to try and start the vehicle. If the vehicle is in NEUTRAL it will start, if it is not in NEUTRAL it will not start.

**CAUTION**

*When performing this check, make sure that the vehicle’s emergency brake is set, the wheels are chocked, and foot pressure is maintained on the service brake pedal. Failure to do so may result in injury or death.*
2. Remove the 2 bolts from the rear transmission cover. Remove the upper bolts for Vertical Mountings, or remove the lower bolts for Horizontal Mountings, shown in Figures #2 and #2a.

3. Place the Shift By Wire actuator and bracket assembly on the Allison transmission. Figure #3a shows the Horizontal Mounting; Figure #3b shows the Horizontal Mounting with the NSBU Connector; Figure #3c shows the Vertical Mounting (the mounting plate generally hides the NSBU Connector).

4. **Loosely** install the 2 rear cover bolts removed in step 2.

5. Insert the SBW Actuator Alignment Tool (TN4002) into the gear-head section of the actuator. Press the tool onto the Allison Shift Selector shaft, until it is flush with the actuator face.
Pre-Gen 4 systems (with the NSBU Assembly), Horizontal or Vertical Mount.

6. Place the **Round Silver Spacer with the single groove**, MT1246 (supplied with Actuator) between the actuator bracket and the transmission, shown in Figure #4a.

7. Place the Flat Washer, WA984 (M8 WASHER, 24 mm O.D.) on to the **M8 x 55mm hex bolt** SC508 (not the M8x60mm hex bolt), shown in Figure #5a.

8. Place the washer and hex bolt through the front hole in the actuator bracket, spacer and thread into the transmission. Tighten to 20 to 28 pound-feet (27Nm to 38 Nm).

Gen 4 Systems (Without the NSBU Assembly), Horizontal or Vertical Mount

6. Place the **Round Blue Spacer with the two grooves**, MT1317 (supplied with Actuator) between the actuator bracket and the transmission, shown in Figure #4b.

7. Place the Flat Washer, WA984 (M8 WASHER, 24 mm O.D.) on to the **M8 x 55mm hex bolt** SC508 (not the M8x60mm hex bolt), shown in Figure #5b.

8. Place the washer and hex bolt through the front hole in the actuator bracket, spacer and thread into the transmission. Tighten to 20 to 28 pound-feet (27Nm to 38 Nm).
9. Tighten rear cover bolts that were loosely installed in step 4, shown here in Figure #6. Consult the Allison manual for proper tightening torque specifications.

Figure #6a

**Horizontal Mount Rear Bolts,**
**with or without the NSBU Assembly**

9. Tighten rear cover bolts that were loosely installed in step 4, shown here in Figure #6b. Consult the Allison manual for proper tightening torque specifications.

Figure #6b

**Vertical Mount Rear Bolts,**
**with or without the NSBU Assembly**

10. If there is an OEM Bracket (typically used to retain wires) between the Actuator and transmission, install the **Silver Hex Spacer MT1246** utilizing the M8 x 60mm flanged head thread forming bolt and M8 washer as shown in Figure #7a and #7b. Be sure that the M8 x 60mm flanged head thread forming bolt is used here not the M8 x 55mm hex bolt; they are very similar. Tighten the top M8 thread forming bolt to 20 to 28 pound-feet (27Nm to 38 Nm).

Figure # 7a & Figure #7b

11. If there is **NOT** an OEM Bracket between the Actuator and the transmission, install the **Red Hex Spacer MT1291** utilizing the M8 x 60mm flanged head thread forming bolt and M8 washer as shown in Figure #8a and #8b. Be sure that the M8 x 60mm flanged head thread forming bolt is used here not the M8 x 55mm hex bolt; they are very similar. Tighten the top M8 thread forming bolt to 20 – 28 pound-feet (27Nm to 38 Nm).

Figure # 8a & Figure #8b

**Vertical Mount Only, Upper Left Mounting Bolt**
**(skip this step if you are installing a Horizontal Mount System)**
Horizontal Mount, Shift Shaft Adapter with or without the NSBU Assembly

12. Remove the SBW Actuator Alignment Tool and set aside.

13. Lube the O-Ring on the Shift Shaft Adapter. Align the witness marks on the Shift Shaft Adapter with the witness marks on the actuator housing. **Use the single groove witness mark** on the Shift Shaft Adapter as shown in Figure #9a. Place the shift shaft adapter into the center of the actuator, shown in Figure #9b. Be sure that the Shift Shaft Adapter properly engages the end of Selector Shaft of the transmission.

<table>
<thead>
<tr>
<th>Figure #9a</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.jpg" alt="Single Witness Mark" /></td>
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</table>

<table>
<thead>
<tr>
<th>Figure #9b</th>
</tr>
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<tbody>
<tr>
<td><img src="image2.jpg" alt="Double Witness Mark" /></td>
</tr>
</tbody>
</table>

Vertical Mount, Shift Shaft Adapter with or without the NSBU Assembly

12. Remove the SBW Actuator Alignment Tool and set aside.

13. Lube the O-Ring on the Shift Shaft Adapter. Align the witness marks on the Shift Shaft Adapter with the witness marks on the actuator housing. **Use the double witness mark** on the Shift Shaft Adapter as shown in Figure #9c. Place the shift shaft adapter into the center of the actuator, shown in Figure #9d. Be sure that the Shift Shaft Adapter properly engages the end of Selector Shaft of the transmission.

<table>
<thead>
<tr>
<th>Figure #9c</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3.jpg" alt="Double Witness Mark" /></td>
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</table>

<table>
<thead>
<tr>
<th>Figure #9d</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4.jpg" alt="Double Witness Mark" /></td>
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</tbody>
</table>
These final steps apply to both Horizontal and Vertical Mount Systems

14. Insert the (Qty 4) #10-32 x ½” long Socket Head Cap Screws into the Shift Shaft Adapter.

15. Place your thumb over the center of the Shift Shaft Adapter. Press the Shift Shaft Adapter inward while tightening all 4 screws that secure the shift shaft adapter to 20 lbs.-in, as shown in Figure #10.

16. **IMPORTANT** – Lube the O-Ring on the Cap Nut. Place the Cap Nut through the Shift Shaft Adapter and thread on to the end of the Transmission Selector Shaft. Tighten to 18 lbs.-in, and then loosen the Cap Nut 1/2 to 1 full turn. Holding the cap nut with a wrench, tighten the socket head cap screw that goes through the center of the cap nut to 5 lbs.-ft, shown in Figure #11. The Actuator will not work if you do not loosen the Cap Nut as described above.

17. Install the O-Ring, shown in Figure #12, then attach the Cover Plate with the 3 Cover Plate Screws, shown in Figure #13. Tighten the 3 screws to 20 lbs.-in.
System Checks:

**CAUTION:**

When performing the following system checks, make sure that the vehicle’s emergency brake is set, the wheels are chocked, and foot pressure is maintained on the service brake pedal.

*Failure to do so may result in injury or death.*

i. The installation of the SBW system was done with the transmission in NEUTRAL; as such, the transmission should still be in NEUTRAL. To confirm this, power-up the system with the ignition switch without starting the engine. The “Monitor” side (right hand side) of the display should indicate “N” for NEUTRAL. If it does not, select NEUTRAL by depressing the “N” button on the PBSS (Push Button Shift Selector). The display should now show “NN” for NEUTRAL. Attempt to start the engine. If the installation was done correctly the engine should start. Turn OFF the engine and proceed to the next system check.

ii. If chassis/vehicle is equipped with PARK, power-up the system with the ignition switch without starting the engine. Select “P” for PARK. The “Monitor” side (right hand side) of the display should indicate “P” for PARK. Attempt to start the engine. If the installation was done correctly the engine should start. Turn OFF the engine and proceed to the next system check.

iii. Power-up the system with the ignition switch without starting the engine. Select DRIVE, the SBW (Shift By Wire) system will place the transmission in the DRIVE position. The display should indicate “DN” for CAN equipped vehicles or “DD” for non-CAN equipped vehicles for DRIVE position. 

**NOTE:** With the ignition ON, and the engine not running, the CAN message from the Allison TCM (Transmission Control Module) to the Arens Controls PBSS (Push Button Shift Selector) will result in an “N” indication on the “Monitor” side of the display for any gear (e.g.: DRIVE, REVERSE, etc.). This is normal. Once the engine is running the Display for DRIVE will indicate “D1” through “D5”, depending on the vehicles speed, or “DD” if CAN is not utilized; for REVERSE the display will indicate “RR”.

iv. Attempt to start the engine. If the installation was done correctly the engine should not start.

If any of these system checks fail to function as described above, please consult the Arens Controls AES-125-C Trouble Shooting Guide.

This completes the Installation of the Arens Controls SBW Actuator.