SHIFT BY WIRE (SBW II)
RE-CALIBRATION PROCEDURE INSTRUCTIONS

AES-350

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<th>REV</th>
<th>REVISION RECORD</th>
<th>DATE</th>
<th>ENGINEER</th>
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<td>6/27/2019</td>
<td>A. GRENADER</td>
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1. RE-CALIBRATION PROCEDURE INFORMATION

- A Pre- Gen4 Transmission will contain an NSBU (Neutral-Start-Back-Up) Unit. See Figure #1-1. Gen 4 Transmissions moved the NSBU Connector to a different place on the Transmission and do not have an external NSBU Assembly.

- Figure #1-1 shows the NSBU Assembly (uninstalled).

- No adjustment to the NSBU unit is required.

- The procedure for re-calibration of a Horizontal/Vertical Actuator (Pre-Gen 4 Allison 1000/2000 Transmission) is exactly the same as the re-calibration procedure for a Gen 4 and up Allison 1000/2000 Transmission Horizontal/Vertical Actuator.
  
  - See Section 5.3 for Horizontal Actuator for Allison Pre-Gen 4 Transmission.
  - See Section 5.4 for Vertical Actuator for Allison Pre-Gen 4 Transmission.
2. SPECIAL TOOLING REQUIRED DURING RE-CALIBRATION PROCEDURE.

- Alignment tool (Curtiss-Wright Arens PN: TN4002) is required for the Re-Calibration procedure. See Figure #2-1.

- If you do not have the Alignment tool, it may be obtained from the OEM Manufacturer of the Vehicle.
### 3. HARDWARE USED DURING RE-CALIBRATION PROCEDURE FOR HORIZONTAL ACTUATOR.

<table>
<thead>
<tr>
<th>QTY</th>
<th>FASTNER NAME</th>
<th>FASTNER TYPE</th>
<th>TORQUE</th>
<th>TOLERANCE</th>
<th>REQUIRED TOOLS</th>
<th>IMAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FRONT MOUNTING</td>
<td>M8 X 55mm HEX BOLT</td>
<td>19.5 FT-LBS</td>
<td>±1.5 FT-LBS</td>
<td>13mm SOCKET WRENCH</td>
<td><img src="image1" alt="Bolt Image" /></td>
</tr>
<tr>
<td></td>
<td>BOLT</td>
<td></td>
<td>25 N·m</td>
<td>±1 N·m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>REAR MOUNTED</td>
<td>ALLISON REAR COVER BOLTS</td>
<td>41.5 FT-LBS</td>
<td>±3.5 FT-LBS</td>
<td>15mm SOCKET WRENCH</td>
<td><img src="image2" alt="Bolt Image" /></td>
</tr>
<tr>
<td>2</td>
<td>BOLTS</td>
<td></td>
<td>56 N·m</td>
<td>±5 N·m</td>
<td>NOT SUPPLIED</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>WASHER</td>
<td>M8 REGULAR WASHER</td>
<td></td>
<td></td>
<td>N/A</td>
<td><img src="image3" alt="Washer Image" /></td>
</tr>
<tr>
<td>1</td>
<td>CAP NUT</td>
<td>SPECIALTY FASTNER</td>
<td>40 IN-LBS</td>
<td>±4 IN-LBS</td>
<td>5/16&quot; HEX DRIVER (ALLEN WRENCH)</td>
<td><img src="image4" alt="Cap Nut Image" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5.2 N·m</td>
<td>±0.1 N·m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>COVER SCREWS</td>
<td>#10-32 X .38 PAN HEAD SCREW</td>
<td>20 IN-LBS</td>
<td>±4 IN-LBS</td>
<td>T25 TORX BIT</td>
<td><img src="image5" alt="Screw Image" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2.6 N·m</td>
<td>±0.1 N·m</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Tools Required:**
- 13mm SOCKET WRENCH
- 15mm SOCKET WRENCH
- 5/16" HEX DRIVER (ALLEN WRENCH)
- T25 TORX BIT
- T27 TORX BIT

**Notes:**
- QTY: Quantity
- FASTNER NAME: Name of the fastener
- FASTNER TYPE: Type of the fastener
- TORQUE: Required torque
- TOLERANCE: Torque tolerance
- REQUIRED TOOLS: Tools required for installation
- IMAGE: Image of the fastener

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### 4. HARDWARE USED DURING RE-CALIBRATION PROCEDURE FOR VERTICAL ACTUATOR.

<table>
<thead>
<tr>
<th>QTY</th>
<th>FASTNER NAME</th>
<th>FASTNER TYPE</th>
<th>TORQUE</th>
<th>TOLERANCE</th>
<th>REQUIRED TOOLS</th>
<th>IMAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FRONT MOUNTING BOLT</td>
<td>M8 X 55mm HEX BOLT</td>
<td>PER ALLISON SPEC AS64-431</td>
<td>19.5 FT-LBS ± 1.5 FT-LBS</td>
<td>25 N-m ± 1 N-m</td>
<td>13mm SOCKET WRENCH</td>
</tr>
<tr>
<td>1</td>
<td>UPPER MOUNTING BOLT</td>
<td>M8 X 60mm HEX THREAD FORMING BOLT</td>
<td>PER ALLISON SPEC AS64-431</td>
<td>19.5 FT-LBS ± 3.5 FT-LBS</td>
<td>25 N-m ± 5 N-m</td>
<td>15mm SOCKET WRENCH</td>
</tr>
<tr>
<td>2</td>
<td>REAR MOUNTED BOLTS</td>
<td>ALLISON REAR COVER BOLTS</td>
<td>PER ALLISON SPEC AS64-430</td>
<td>41.5 FT-LBS ± 3.5 FT-LBS</td>
<td>56 N-m ± 5 N-m</td>
<td>NOT SUPPLIED</td>
</tr>
<tr>
<td>1</td>
<td>WASHER</td>
<td>M8 REGULAR WASHER</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>SHIFT SHAFT ADAPTER SCREWS</td>
<td>#10-32 X .50 TORX HEAD CAP SCREW</td>
<td>20 IN-LBS</td>
<td>± 4 IN-LBS</td>
<td>T27 TORX BIT</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>CAP NUT</td>
<td>SPECIALTY FASTNER</td>
<td>20 IN-LBS</td>
<td>± 1 IN-LBS</td>
<td>5/16&quot; HEX DRIVER (ALLEN WRENCH)</td>
<td></td>
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<tr>
<td>3</td>
<td>COVER SCREWS</td>
<td>#10-32 X .38 PAN HEAD SCREW</td>
<td>20 IN-LBS</td>
<td>± 4 IN-LBS</td>
<td>T25 TORX BIT</td>
<td></td>
</tr>
</tbody>
</table>

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### 5. COMPONENTS USED DURING RECALIBRATION PROCEDURE.

#### 5.1. COMPONENTS FOR HORIZONTAL ACTUATOR.

<table>
<thead>
<tr>
<th>PART NO</th>
<th>PART NAME</th>
<th>MARKINGS</th>
<th>WHERE USED</th>
<th>IMAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT1317</td>
<td>BLUE ROUND SPACER</td>
<td>2 GROVES, BLUE</td>
<td>HORIZONTAL ACTUATOR ON ALLISON TRANSMISSIONS GEN. 4 AND UP.</td>
<td></td>
</tr>
<tr>
<td>FT1406</td>
<td>SHIFT SHAFT ADAPTER</td>
<td>FACE GROVES</td>
<td>ATTACHMENT OF ACTUATOR TO SHIFT SHAFT.</td>
<td></td>
</tr>
<tr>
<td>MT1237</td>
<td>ACTUATOR COVER</td>
<td>NONE</td>
<td>COVER</td>
<td></td>
</tr>
</tbody>
</table>

#### 5.2. COMPONENTS FOR VERTICAL ACTUATOR.

<table>
<thead>
<tr>
<th>PART NO</th>
<th>PART NAME</th>
<th>MARKINGS</th>
<th>WHERE USED</th>
<th>IMAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT1317</td>
<td>BLUE ROUND SPACER</td>
<td>2 GROVES, BLUE</td>
<td>VERTICAL ACTUATOR ON ALLISON TRANSMISSIONS GEN. 4 AND UP.</td>
<td></td>
</tr>
<tr>
<td>MT1291</td>
<td>RED HEXAGONAL SPACER</td>
<td>1 GROVE, RED</td>
<td>VERTICAL ACTUATOR ON ALLISON TRANSMISSIONS GEN. 4 AND UP.</td>
<td></td>
</tr>
<tr>
<td>FT1406</td>
<td>SHIFT SHAFT ADAPTER</td>
<td>FACE GROVES</td>
<td>ATTACHMENT OF ACTUATOR TO SHIFT SHAFT.</td>
<td></td>
</tr>
<tr>
<td>MT1237</td>
<td>ACTUATOR COVER</td>
<td>NONE</td>
<td>COVER</td>
<td></td>
</tr>
</tbody>
</table>

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### 5.3. COMPONENTS FOR HORIZONTAL ACTUATOR FOR ALLISON 1000/2000 PRE-GEN 4 TRANSMISSION.

<table>
<thead>
<tr>
<th>PART NO</th>
<th>PART NAME</th>
<th>MARKINGS</th>
<th>WHERE USED</th>
<th>IMAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT1246</td>
<td>SILVER ROUND SPACER</td>
<td>1 GROOVE, SILVER</td>
<td>HORIZONTAL ACTUATOR ON ALLISON TRANSMISSIONS PRE-GEN4.</td>
<td></td>
</tr>
<tr>
<td>FT1408</td>
<td>SHIFT SHAFT ADAPTER</td>
<td>FACE GROVES</td>
<td>ATTACHMENT OF ACTUATOR TO SHIFT SHAFT.</td>
<td></td>
</tr>
<tr>
<td>MT1237</td>
<td>ACTUATOR COVER.</td>
<td>NONE</td>
<td>COVER</td>
<td></td>
</tr>
</tbody>
</table>

### 5.4. COMPONENTS FOR VERTICAL ACTUATOR FOR ALLISON 1000/2000 PRE-GEN 4 TRANSMISSION.

<table>
<thead>
<tr>
<th>PART NO</th>
<th>PART NAME</th>
<th>MARKINGS</th>
<th>WHERE USED</th>
<th>IMAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT1246</td>
<td>SILVER ROUND SPACER</td>
<td>1 GROOVE, SILVER</td>
<td>VERTICAL ACTUATOR ON ALLISON TRANSMISSIONS PRE-GEN4.</td>
<td></td>
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<tr>
<td>MT1269</td>
<td>RED HEXAGONAL SPACER</td>
<td>NO GROVE, SILVER</td>
<td>VERTICAL ACTUATOR ON ALLISON TRANSMISSIONS PRE-GEN4.</td>
<td></td>
</tr>
<tr>
<td>FT1408</td>
<td>SHIFT SHAFT ADAPTER</td>
<td>FACE GROVES</td>
<td>ATTACHMENT OF ACTUATOR TO SHIFT SHAFT.</td>
<td></td>
</tr>
<tr>
<td>MT1237</td>
<td>ACTUATOR COVER.</td>
<td>NONE</td>
<td>COVER</td>
<td></td>
</tr>
</tbody>
</table>
6. COMPONENTS USED DURING RECALIBRATION PROCEDURE.
This is the Re-Calibration Procedure for a new Shift By Wire Actuator.
NOTE: If this is a “first time” installation or a replacement of a new actuator, please refer to Curtiss-Wright Arens Controls AES-349 Installation 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 MAY RESULT IN SERIOUS INJURY OR DEATH.

6.1. SET UP FOR RE-CALIBRATION PROCEDURE (DISASSEMBLY).

1. Remove the screws holding the Cover plate in place on the actuator as shown in Figure #6-1.

![Figure #6-1]

COVER SCREWS INSERT AND TORQUE TO 20 IN-LBS.
2. Unscrew and remove the cap nut as shown in Figure #6-2.

3. Unscrew and Remove the four socket head cap screws that hold the Shift Shaft Adapter in place, as shown in Figure #6-3.

If the Shift Shaft Adapter is stuck on the Transmission Selector Shaft, use two long #10-32 screws (not supplied) to help with removal. Insert the two long #10-32 screws into the threaded holes on the Shift Shaft Adapter (see Illustration #6-1). The screws will act as a “puller”, and help remove the Shift Shaft Adapter from the Transmission Selector Shaft. Remove these two screws after the Shift Shaft Adapter has been removed.
6.2. SETTING TRANSMISSION TO NEUTRAL POSITION.

**WARNING**

Before moving on to the next part of the Re-calibration Procedure, be sure that you have:

- Parked the vehicle on level ground.
- Set the emergency brake.
- Chock/block the tires to prevent the vehicle from moving unexpectedly.
- Turn off the engine.

**FAILURE TO FOLLOW THESE STEPS MAY RESULT IN SERIOUS INJURY OR DEATH.**

1. Move up into the cab of the vehicle and turn the ignition ON, but do not engage the starter, leaving the engine OFF. Select NEUTRAL, then REVERSE, then NEUTRAL again. This will ensure that the Actuator is in the Neutral position.

2. Check that the Transmission is in NEUTRAL by ‘bumping’ the starter with the ignition switch. If the transmission is in NEUTRAL the starter will engage. If the Transmission is not in NEUTRAL the starter will not engage.

3. If the transmission is not in NEUTRAL, perform the following steps:
   - **IMPORTANT** – The following steps are to confirm that the transmission is truly in NEUTRAL. Performing these steps incorrectly will result in calibrating the transmission in a position other than NEUTRAL.
   - Make sure that the four Socket Head Cap Screws that hold the Shift Shaft Adapter in place have been removed as described in step 6. Again, place the two long (1-3/4” to 2-1/2”) #10-32 screws (not supplied) in the two threaded holes (not the slot) of the Shift Shaft Adapter. And place the shift shaft Adapter back into the actuator engaging the Transmission’s Selector Shaft.
   - Using a long substantial screwdriver wedged between the 2 long screws, rotate the shift shaft adapter clockwise. 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.
   - **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 (the 2 detents) position. The transmission MUST be in NEUTRAL for proper calibration.
   - Next, slowly and carefully rotate the selector shaft back counterclockwise two detents. The transmission is now in NEUTRAL. Once NEUTRAL has been obtained on the transmission. **Remove the two #10-32 screws for the Shift Shaft Adapter and remove the Shift Shaft Adapter from the Actuator.**

4. Double check that the transmission is in NEUTRAL by repeating step #6.2.2.

5. Turn the Ignition OFF. The Push Button Shift Selector will react in different ways, depending on which Push Button Shift Selector is installed. See Illustration 6-2, and Illustration 6-3 for pushbutton examples.

**NOTE** – All Allison 1000 and 2000 series transmission have a PARK detent position regardless if they have a PARK pawl or not.
The engine should turn off when the ignition is turned off, though the Push Button Shift Selector will remain on. The Push Button Shift Selector will stay ON supplying power to the Actuator, holding it in NEUTRAL. This is the desired condition with this Push Button Shift Selector.

Both the engine and the Push Button Shift Selector should turn off when the key is turned off. This is the desired condition for this shift selector.
6.3. **ACTUATOR SET-UP FOR RE-CALIBRATION.**

1. **HORIZONTAL ACTUATOR**

Loosen (rotate counter-clockwise 1-3 turns) the 3 bolts for Horizontal Actuator as shown in Figure 6-4.

![Figure #6-4](image)

2. **VERTICAL ACTUATOR**

Loosen (rotate counter-clockwise 1-3 turns) the 4 bolts for the Vertical Actuator as shown in Figure 6-5.

![Figure #6-5](image)
6.4. USING SPECIAL TOOLING.

Insert the Alignment tool TN4002 into the Actuator until it is flush with the Actuator face. As shown in Figure #6-6

![Alignment Tool TN4002](image)

**ACTUATOR FACE**

**ALIGNMENT TOOL TN4002**

Figure #6-6

6.5. SECURING THE ACTUATOR IN CORRECTED POSITION.

While applying pressure to the Alignment Tool secure (tighten clockwise) the previously loosened bolts in the order described in Step 6.3.

- Bolt #1 (Front Mounted Bolt) – 19.5 ± 1.5 FT-LBS
- Bolt #2 (Rear Mounted Bolt) – 41.5 ± 3.5 FT-LBS
- Bolt #3 (Rear Mounted Bolt) – 41.5 ± 3.5 FT-LBS
- Bolt #4 (Upper Mounting Bolt)* – 19.5 ± 3.5 FT-LBS

*NOTE – Bolt # 4 (Upper Mounting Bolt) is only applicable for Vertical Actuator. If you have a Horizontal Actuator Assembly, skip this Bolt.

Once all the Bolts have been tightened you may now remove the Alignment Tool, as your Actuator has been Secured in a Re-Calibrated Position.
6.6. INSTALLATION OF THE SHIFT SHAFT ADAPTER TO THE TRANSMISSION.

1. HORIZONTAL ACTUATOR

1. Insert the Shift Shaft Adapter (FT1406) into the SBW Actuator (do NOT add grease/lube) to link up with the Shift Shaft that is coming off the Allison Transmission (Figure #6-7). Take care to align the SINGLE Witness Mark on the Shift Shaft Adapter, with the ARROW on the SBW Actuator Gear Housing (Illustration #6-4).

2. Insert and secure the Shift Shaft Adapter Screws (X 4) (Figure #6-8) through the slots in the Shift Shaft Adapter. Tighten the screws to 20 in-lbs. It is recommended that this is done in a “crisscross” pattern to avoid binding as per Figure #6-9.
2. VERTICAL ACTUATOR

1. Insert the Shift Shaft Adapter (FT1406) into the SBW Actuator (do NOT add grease/lube) to link up with the Shift Shaft that is coming off the Allison Transmission (Figure #6-10). Take care to align the DOUBLE Witness Mark on the Shift Shaft Adapter, with the ARROW on the SBW Actuator Gear Housing (Illustration #6-5).

2. Insert and secure the Shift Shaft Adapter Screws (X 4) (Figure #6-11) through the slots in the Shift Shaft Adapter. Tighten the screws to 20 lbs-in. It is recommended that this is done in a “crisscross” pattern to avoid binding as per Figure #6-12.
6.7. FINAL RE-ASSEMBLY OF ACTUATOR.

1. Insert CAP Nut Inside the Shift Shaft Adapter Opening (do NOT add grease/lube), and Secure in Place by applying a torque of 40 in-lbs, as shown in Figure #6-13.

2. Place the Cover (MT1237) over the opening as shown. Secure in place using Cover Screws (X 3), as shown in Figure #6-14. Torque the screws to 20 in-lbs.
7. SYSTEM CHECKS

**WARNING:**

*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 follow these steps may result in serious 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 Curtiss-Wright 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 re-calibration procedure was done correctly the engine should **not** start.

If any of these system checks fail to function as described above, please consult the Curtiss-Wright AES-286 Trouble Shooting Guide.

This completes the Re-calibration procedure of the Curtiss-Wright Arens Controls SBW Horizontal or Vertical Actuator for Allison 1000/2000 Transmission.