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.

⚠️ 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.

How to Obtain Additional Maintenance and Service Information

Refer to Maintenance Manual MM-99106, 9- and 10-Speed Transmissions, Platform “G”. To obtain this publication, visit Literature on Demand at arvinmeritor.com.

How to Obtain Parts

To obtain the shift knob tester, part number J-44356, contact the SPX Kent-Moore service center at 800-345-2233.

How the Electric Over Air (EOA) Range Shift System Works

Meritor’s Electric Over Air (EOA) range shift system electronically controls the pneumatic actuation of the range shift through the use of an electronic shift lever, neutral switch and solenoids.

Components

<table>
<thead>
<tr>
<th>Component</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift Knob</td>
<td>Transmission in Neutral: Activates the preselected range shift solenoid. Requires 12 VDC switched power.</td>
</tr>
<tr>
<td></td>
<td>Preselected high range: Activates the high range solenoid and deactivates the low range solenoid.</td>
</tr>
<tr>
<td></td>
<td>Preselected low range: Activates the low range solenoid and deactivates the high range solenoid.</td>
</tr>
<tr>
<td>High and Low Range</td>
<td>Performs as electronic valves that enable air to pass through only when activated by the shift knob. Requires 12 VDC switched power.</td>
</tr>
<tr>
<td>Shift Solenoids</td>
<td></td>
</tr>
<tr>
<td>Neutral Switch</td>
<td>Selecting Neutral closes the switch, activates the preselected range shift solenoid, and deactivates the other one.</td>
</tr>
<tr>
<td>Wiring Harnesses</td>
<td>Connect components that operate the system.</td>
</tr>
</tbody>
</table>

Tools Required

- Volt-ohm Meter
- Pressure Gauge
- Kent-Moore Shift Knob Tester, Part Number J-44356
Diagnostics

Electric Over Air (EOA) components are not serviceable. Replace components that do not function correctly.

### Define the Problem

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ask the vehicle operator to describe the problem.</td>
<td>Test drive the vehicle to verify the vehicle operator's comments.</td>
</tr>
<tr>
<td>- When did you first notice the problem?</td>
<td></td>
</tr>
<tr>
<td>- Is the transmission making any noise? If so, when do you notice it most?</td>
<td></td>
</tr>
<tr>
<td>- What is the system air pressure?</td>
<td></td>
</tr>
<tr>
<td>- Have you noticed any other unusual gauge readings or electrical problems?</td>
<td></td>
</tr>
<tr>
<td>- Is the problem intermittent or constant?</td>
<td></td>
</tr>
</tbody>
</table>

### In-Cab Diagnostics

#### Vehicle Chassis Ground Test

1. Turn the key switch to the OFF position with the engine off.

2. Move the shift lever into Neutral.

3. Remove the screw on the shift knob and separate the skirt from the shift knob.
Vehicle Chassis Ground Test

4. Disconnect the four-pin connector at the shift knob.

5. Measure the resistance between Pin D of the four-pin connector and the vehicle negative battery terminal. Record the reading.

   Resistance Pin D to Battery Ground: _____________

   • If the resistance is greater than 0.5 ohm or is “OL”: Repair the vehicle ground system. Contact the vehicle manufacturer for diagnostic and repair assistance.

Vehicle Voltage Test

1. Turn the key switch to the ON position with the engine off.

2. Move the shift lever into Neutral.
Vehicle Voltage Test

3. Remove the screw on the shift knob and separate the skirt from the shift knob.

4. Disconnect the four-pin connector at the shift knob.

5. Measure the voltage across Pins A and D, and Pins B and D. Record the voltage readings.
   Voltage Pin A to Pin D: _____________
   Voltage Pin B to Pin D: _____________
   • If the voltage is less than 9 volts: Repair the vehicle electrical system. Contact the vehicle manufacturer to correct the voltage supply problem.

Neutral Switch Test

1. Move the shift lever into Neutral.
Neutral Switch Test

2. Remove the screw on the shift knob and separate the skirt from the shift knob.

3. Disconnect the four-pin connector at the shift knob.

4. Test One

   Measure the resistance (ohms) between Pins A and C of the four-pin connector. Place the red DVOM lead on Pin A and the black DVOM lead on Pin C. Record the reading.

   Neutral Switch Pin A to Pin C: ________

   - **If the resistance is 0.1-0.5 ohm:** The reading is within specification.
   - **If the resistance is “OL” or greater than 0.5 ohm:** Check the neutral switch assembly and repair as necessary. When the repair is complete, repeat the test to ensure the neutral switch assembly functions correctly.

5. Move the shift lever into gear.
Neutral Switch Test

6. Test Two

Measure the resistance (ohms) between Pins A and C. Place the red DVOM lead on Pin A and the black DVOM lead on Pin C. Record the reading.

Neutral Switch Pin A to Pin C: ________

- **If the reading is “OL”:** The neutral switch is functioning correctly.
- **If the volt-ohm meter shows any resistance:** Check the neutral switch assembly and repair as necessary. When the repair is complete, repeat the test to ensure the neutral switch assembly functions correctly.

Low Range Solenoid Test

1. Remove the screw on the shift knob and separate the skirt from the shift knob.

2. Disconnect the two-pin and four-pin connectors at the shift knob.

3. Measure the resistance (ohms) between Pin A of the two-pin connector and Pin D of the four-pin connector. Record the reading.

Resistance Pin A (two pin) to Pin D (four pin): ________

- **If the resistance is 11-21 ohms:** The low range solenoid is functioning correctly.
- **If the resistance is less than 11 ohms or more than 21 ohms:** Check the solenoid and wiring system and repair as necessary. When the repair is complete, repeat the test to ensure the solenoid is functioning correctly.
High Range Solenoid Test

1. Remove the screw on the shift knob and separate the skirt from the shift knob.

2. Disconnect the two-pin and four-pin connectors at the shift knob.

3. Measure the resistance (ohms) between Pin B of the two-pin connector and Pin D of the four-pin connector. Record the reading.
   Resistance Pin B (two pin) to Pin D (four pin): ________
   - If the resistance is 11-21 ohms: The high range solenoid is functioning correctly.
   - If the resistance is less than 11 ohms or more than 21 ohms: Check the solenoid and wiring system and repair as necessary. When the repair is complete, repeat the test to ensure the solenoid is functioning correctly.

Shift Knob Testing — Visual Connector Check

1. Remove the screw on the shift knob and separate the skirt from the shift knob.
2. Inspect the shift knob connectors. Verify that the connectors are seated correctly and the connector locks are engaged.

3. Disconnect the two-pin and four-pin connectors at the shift knob.

4. Inspect the pins on both sides of the connector for corrosion.
   - **If corrosion is found:** Replace the component.

5. Inspect the pins on the female connector ends to ensure they are straight. If the pins are bent apart, they will not make sufficient contact with the male connector pins.
   - **If damage is found:** Replace the component.
Shift Knob Testing — Visual Connector Check

6. Inspect the male connector pins for damage.
   - If damage is found: Replace the component.

Shift Knob Testing — Standard Shift Knob Test

1. Obtain the SPX Kent-Moore shift knob tester, part number J-44356.

2. Connect the tester to the shift knob connectors.

3. Follow the directions on the tester to verify that the shift knob is functioning correctly.
   - If the shift knob does not pass the test: Replace the shift knob.
Shift Knob Testing — Overtravel Test

1. Connect the tester to the shift knob connectors.

2. Set the tester to the In Neutral position.

3. Move the range selector to the Low position.

4. With the range selector in the Low position, push DOWN on the selector.
5. Watch the test lights on the shift knob tester. Verify that the only light illuminated is the Low light.
   • If the light flickers or the High light becomes illuminated:
     Replace the shift knob.

6. Lightly press UP 1/4-inch on the range selector, but do not change the range. Then press the selector back DOWN.

7. Watch the test lights on the shift knob tester. Verify that the only light illuminated is the Low light.
   • If the light flickers or the High light becomes illuminated:
     Replace the shift knob.

8. Move the range selector into the High position.
9. With the range selector in the High position, push UP on the selector.

10. Watch the test lights on the shift knob tester. Verify that the only light illuminated is the High light.
   - If the light flickers or the Low light becomes illuminated:
     Replace the shift knob.

11. Lightly press DOWN 1/4-inch on the range selector, but do not change the range. Then press the selector back UP.

12. Watch the test lights on the shift knob tester. Verify that the only light illuminated is the High light.
   - If the light flickers or the Low light becomes illuminated:
     Replace the shift knob.
1. Connect the tester to the shift knob connectors.

2. Set the tester to the In Neutral position.

3. Move the range selector to the Low position.

4. Grip the shift knob and rotate it in a twisting motion.
5. Watch the tester to see if the light flickers or changes status.
   - **If any light change occurs:** Replace the shift knob.

6. Grip the shift knob and push it forward and backward.

7. Watch the tester to see if the light flickers or changes status.
   - **If any light change occurs:** Replace the shift knob.

---

**Shift Knob Testing — Hair Trigger**

1. Connect the tester to the shift knob connectors.
2. Set the tester to the In Neutral position.

3. Slowly move the range selector from High to Low.

4. Watch the light status on the tester. The light should change status approximately at the center of the range selector's travel.
   - If the light changes status only near the beginning or end of the movement: Replace the shift knob.

5. Slowly move the range selector from Low to High.
### Shift Knob Testing — Hair Trigger

6. Watch the light status on the tester. The light should change status approximately at the center of the range selector’s travel.

- If the light changes status only near the beginning or end of the movement: Replace the shift knob.

![Shift Knob Tester Diagram](image1)

### Shift Knob Testing — Rattle Test

1. Connect the tester to the shift knob connectors.

![Shift Lever Position Diagram](image2)

2. Set the tester to the In Neutral position.

3. Move the shift lever into Neutral.

![Shift Lever Handle Diagram](image3)
4. While holding the tester, grab the shift lever below the shift knob.

5. Rapidly move the shift lever left and right to the full extent of travel.

6. Watch the shift knob tester for any light status changes. If the light flickers or the status changes: Replace the shift knob.

7. Rapidly move the shift lever forward and backward to the full extent of travel.
### Shift Knob Testing — Rattle Test

8. Watch the shift knob tester for any light status changes.
   - **If the light flickers or the status changes:** Replace the shift knob.

### Shift Knob Testing — Wire Pull Test

1. Connect the tester to the shift lever connectors.

2. Set the tester to the In Neutral position.

3. Gently pull on each wire. Use no more than 2 pounds (8.9 N) of force.

4. Verify the pin is seated correctly in the connector and is not loose.
   - **If the pin is loose:** Replace the shift knob.
Shift Knob Testing — Wire Pull Test

5. Watch the tester light for any status change.
   - If the light changes status: Replace the shift knob.

Intermittent System Test (Rapid)

1. Build vehicle air pressure to the standard operating pressure.

2. Check that the key is in the ON position and the engine is off.

3. Ensure that the vehicle air pressure stays above 90 psi (6.2 bar) for the entire test procedure.

   **NOTE:** If the pressure drops below 90 psi (6.2 bar), this test will not provide reliable results.
<table>
<thead>
<tr>
<th></th>
<th>Intermittent System Test (Rapid)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.</td>
<td>Move the shift lever into Neutral.</td>
</tr>
<tr>
<td>5.</td>
<td>Move the range selector to the Low position.</td>
</tr>
<tr>
<td>6.</td>
<td>Move the shift lever into gear.</td>
</tr>
<tr>
<td>7.</td>
<td>Preselect a range change by moving the range selector to the High position. You should not hear the synchronizer activate while in gear.</td>
</tr>
</tbody>
</table>
## Intermittent System Test (Rapid)

8. Move the shift lever out of gear into Neutral.

9. Listen for the synchronizer to immediately move. The sound indicates the completion of the range change.

10. Repeat the range change steps for 50 actuations.
    Move the shift lever out of gear into Neutral at a speed of approximately ONE SECOND per shift.

11. Record any occurrences where the range shift system did NOT activate when shifted from the gear to neutral.
    Any observed delays or no shifts? _____________
    - If all range shift actuations were observed immediately once the shift lever was moved to Neutral: The range shift system is operating correctly.
    - If a range shift did not occur immediately once the shift lever was moved to Neutral: The Electric Over Air system is not functioning correctly. Identify and correct the root cause of the problem before you replace the synchronizer.

## Intermittent System Test (Slow)

1. Build vehicle air pressure to the standard operating pressure.
2. Check that the key is in the ON position and the engine is off.

3. Ensure that the vehicle air pressure stays above 90 psi (6.2 bar) for the entire test procedure.
   
   **NOTE:** If the pressure drops below 90 psi (6.2 bar), this test will not provide reliable results.

4. Move the shift lever into Neutral.

5. Move the range selector to the Low position.
<table>
<thead>
<tr>
<th>Step</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.</td>
<td>Move the shift lever into gear.</td>
</tr>
<tr>
<td>7.</td>
<td>Preselect a range change by moving the range selector to the High position. You should not hear the synchronizer activate while in gear.</td>
</tr>
<tr>
<td>8.</td>
<td>Move the shift lever out of gear into Neutral.</td>
</tr>
<tr>
<td>9.</td>
<td>Listen for the synchronizer to immediately move. The sound indicates the completion of the range change.</td>
</tr>
<tr>
<td>10.</td>
<td>Repeat the range change steps for 50 actuations. Move the shift lever out of gear into Neutral at a speed of approximately THREE SECONDS per shift.</td>
</tr>
<tr>
<td>11.</td>
<td>Record any occurrences where the range shift system did NOT activate when shifted out of gear into Neutral. Any observed delays or no shifts? ______________</td>
</tr>
<tr>
<td></td>
<td>• If all range shift actuations were observed immediately once the shift lever was moved into Neutral: The range shift system is operating correctly.</td>
</tr>
<tr>
<td></td>
<td>• If a range shift did not occur immediately once the shift lever was moved into Neutral: The Electric Over Air system is not functioning correctly. Identify and correct the root cause of the problem before you replace the synchronizer.</td>
</tr>
</tbody>
</table>
Under-Cab Diagnostics

Vehicle Air Pressure Test

1. Build vehicle air pressure to the standard operating pressure.

2. Turn the engine and key switch off and listen for air leaks underneath the vehicle.
   - **If air leaks are detected:** Repair the leaks as necessary. When repairs are complete, repeat the test to ensure the system functions correctly.

3. Connect an air pressure gauge at the vehicle inlet air pressure port.

4. Build vehicle air pressure to the standard operating pressure.

5. Record the vehicle system air pressure.
   - **Vehicle Air Pressure:** ______________
   - Verify that the system pressure is within the acceptable range. Refer to the vehicle manufacturer guidelines for your specific vehicle.
   - **If system pressure is not within the acceptable range:** Repair the system. When repairs are complete, repeat the test to ensure the system functions correctly.
Regulated Air Pressure Test

1. Connect an air pressure gauge to the regulated air pressure port on the range piston housing.

2. Build vehicle air pressure to the standard operating pressure.

3. Record the regulated air pressure.
   Regulated Air Pressure: ________________
   Verify that the regulated air pressure is 55-75 psi (3.79-5.17 bar).
   • If the air pressure is not within this range: Check the air filter regulator for damage or contaminants. Replace the air filter regulator.

Low Diagnostic Air Pressure Test

1. Connect an air pressure gauge to the low diagnostic port on the range piston housing.
### Low Diagnostic Air Pressure Test

1. **Turn the key switch to the ON position and start the engine.**

2. **Move the shift lever into Neutral.**

3. **Move the range selector to the Low position.**

4. **Build vehicle air pressure to the standard operating pressure.**

5. **Record the pressure reading from the low diagnostic port.**

   **Low Air Pressure:** ________________

   Verify that the air pressure is 45-75 psi (3.1-5.17 bar).

   - **If the air pressure is low:** Check for damage to the range piston housing, contaminants in the range piston housing, or a tear in the range piston or range shaft seal.
# High Diagnostic Air Pressure Test

1. Connect an air pressure gauge to the high diagnostic port on the range piston housing.

2. Turn the key switch to the ON position and start the engine.

3. Move the shift lever into Neutral.

4. Move the range selector to the High position.
### High Diagnostic Air Pressure Test

5. Build vehicle air pressure to the standard operating pressure.

<table>
<thead>
<tr>
<th>4006790a</th>
</tr>
</thead>
</table>

6. Record the pressure reading from the high diagnostic port.

<table>
<thead>
<tr>
<th>High Air Pressure: ____________________</th>
</tr>
</thead>
</table>

Verify that the air pressure is 45-75 psi (3.1-5.17 bar).

- **If the pressure is low:** Check for damage to the range piston housing, contaminants in the range piston housing, or a tear in the range piston.
EOA Wiring Diagram

Platform G Range Shift System

OEM INTERFACE CONNECTOR

FUNCTION

NEUTRAL SWITCH

SOLENOID ASSEMBLY

REVERSE SWITCH

TRACTION CONTROL

OEM VEHICLE HARNESS

COMMAND HARNESS

OEM SUPPLIED CLUTCH PEDAL SWITCH, PEDAL UP/OUT POSITION

PAUSE

SET

RESUME

LOW ENABLE, ORANGE

HI G ENABLE, GREEN

LOW SOLENOID, BLUE

HI G SOLENOID, YELLOW

LOW SOLENOID, BLACK

Hi GROUND, WHITE

Neutral, GREEN

Low SOLENOID, BLUE

Hi SOLENOID, YELLOW

NEUTRAL SWITCH SHOWN IN DRAWING

COMMAND HARNESS WEITNESS WIRING HARNESS

OEM LEVER HARNESS

CRUISE HARNESS, OPTIONAL - SHIFT KNOB

PAUSE

NORMALLY CLOSED

SET

NORMALLY OPEN

RESUME

NORMALLY OPEN

LOW ENABLE, ORANGE

HI ENABLE, GREEN

LOW SOLENOID, BLUE

HI SOLENOID, YELLOW

LOW SOLENOID, BLACK

GROUND, WHITE

Neutral, GREEN

Low SOLENOID, BLUE

Hi SOLENOID, YELLOW

LOW SOLENOID, BLACK

GROUND, WHITE

Neutral, GREEN