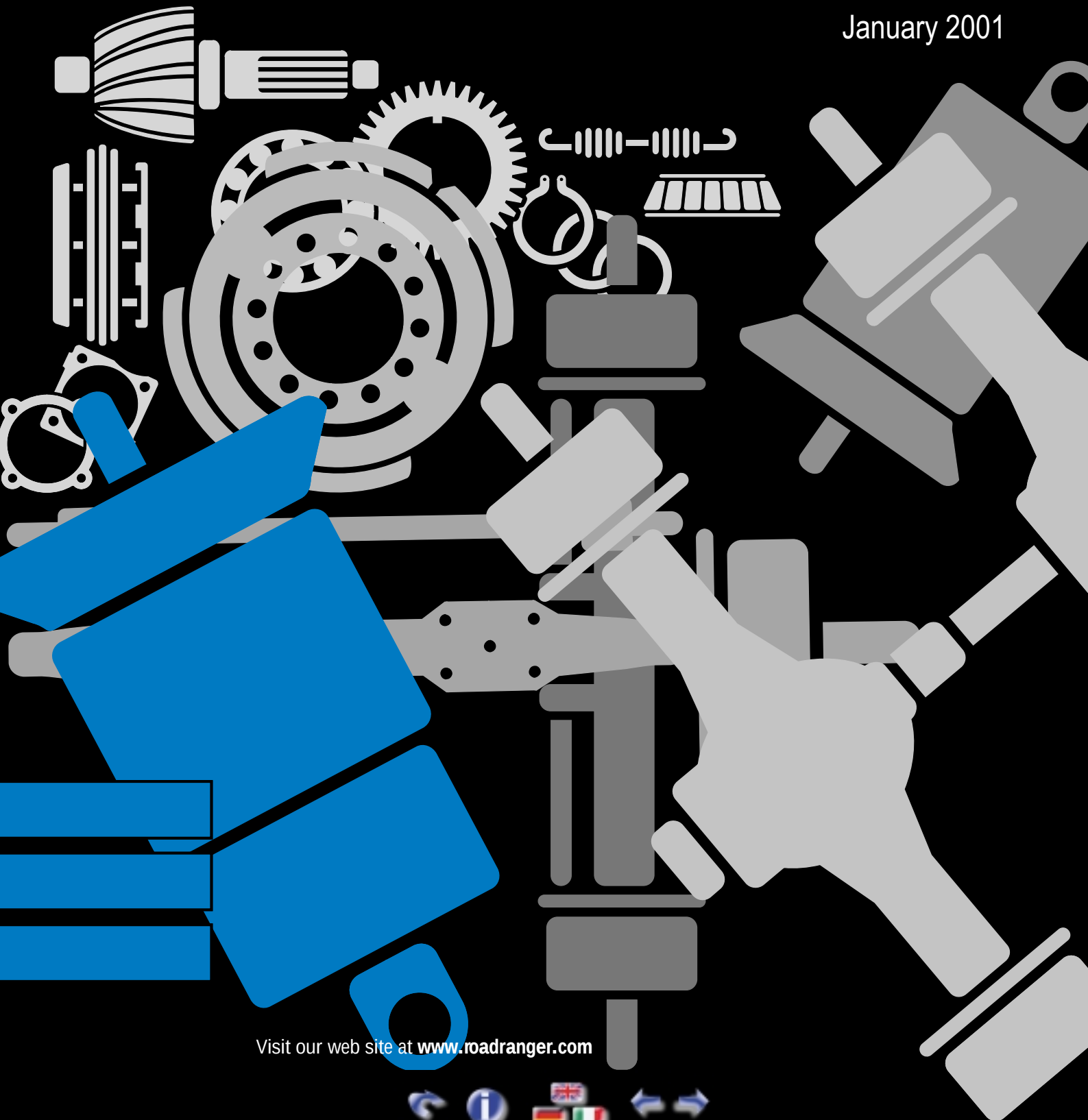


Eaton® Fuller®
Automated Transmissions

Service Manual

EATON

AutoShift 16
T20891
January 2001



Visit our web site at www.roadranger.com

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Notes, Cautions, and Warnings



WARNING: Follow the specified procedures in the indicated order to avoid personal injury.



CAUTION: Follow the specified procedures in the indicated order to avoid equipment malfunction or damage.

NOTE: Additional relevant information not covered in the service procedure.

Operational Warnings

Before starting a vehicle:

1. Sit in the driver's seat.
2. Place the transmission in neutral.
3. Set the parking brake.
4. Disengage the clutch.

Before working on a vehicle or leaving the cab with the engine running:

1. Place the transmission in neutral.
2. Set the parking brake.
3. Block the wheels.

Do not release the parking brake or attempt to select a gear until the air pressure is at the correct level.

When parking the vehicle or leaving the cab:

1. Place the transmission in neutral.
2. Set the parking brake.

To avoid damage to the transmission during towing:

1. Place the transmission in neutral.
2. Lift the drive wheels off the ground or disconnect the driveline.

Do not operate the vehicle if the alternator lamp is lit or if the gauges indicate low voltage.

Repair Warnings

When disassembling various assemblies, lay all parts on a clean bench in the same sequence as removed to simplify assembly and reduce the possibility of losing parts.

Provide a clean work area. Make sure no dirt or foreign materials enter the unit during repair and assembly.

Disconnect the vehicle's battery before removing or installing electronic parts.

Since the cost of a new part is generally a small fraction of the total cost of downtime and labor, avoid reusing a questionable part that could lead to additional repairs and expense.

Use of other than recommended tools, parts, and instructions listed in this manual may place the safety of the service technician or vehicle driver in jeopardy.

The location of some components may vary with each OEM. The removal and installation procedure described for each component may vary for your vehicle.

Always use genuine Eaton replacement parts.

Every effort has been made to ensure the accuracy of the information contained in this manual. However, Eaton Corporation makes no warranty, expressed or implied, based on the information provided. If you have comments or questions regarding this manual, write to:

Eaton B.V.
P.O. Box 75777
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The Netherlands



How to Use This Manual

This manual is designed to provide detailed information necessary to service and repair the automation portion of the Eaton® Fuller® AutoShift 16 transmission.

The service procedures in this manual are for transmission automation components only. To locate the information you need, simply locate the procedure in the table of contents, turn to the page specified, and follow the procedure.

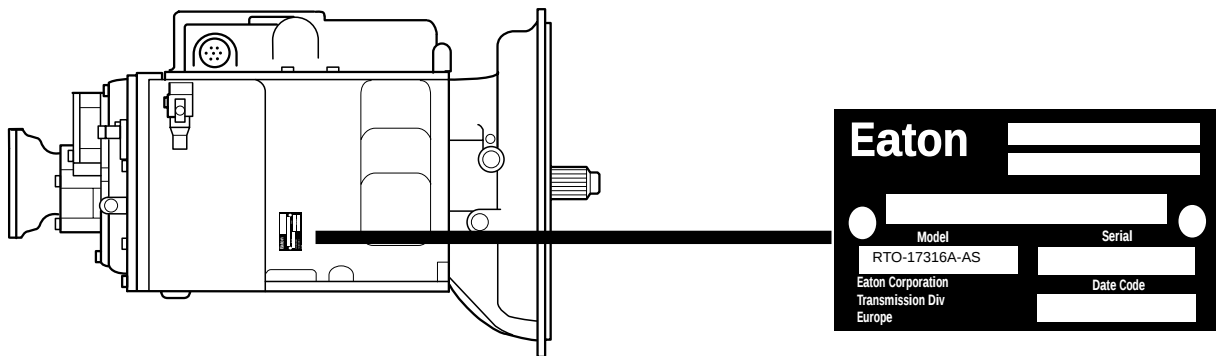
To service the mechanical portion of the transmission system, refer to the model specific transmission service manual.

Serial Tag Information and Model Nomenclature

Transmission model designation and other transmission identification information are stamped on the serial tag.

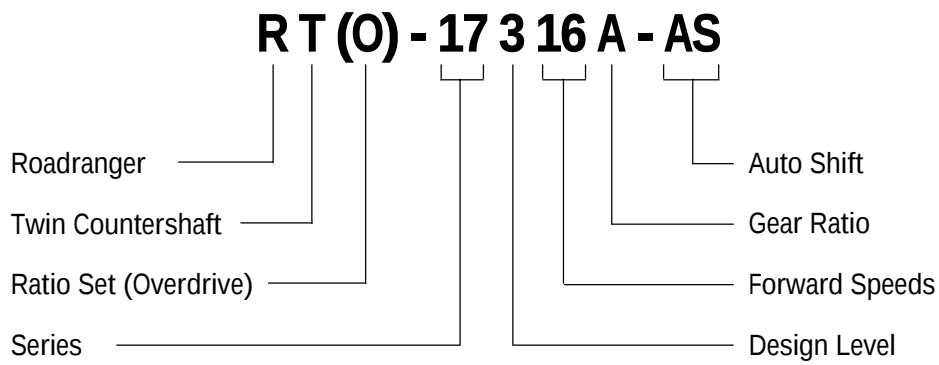
To identify the transmission model and serial number, locate the tag on the transmission and then locate the numbers as shown.

When calling for service assistance or parts, have the model and serial numbers readily available.



Model Number

The model number gives basic information about the transmission and is explained below. Use this number when calling for service assistance or replacement parts.



Serial Number

The serial number is the sequential identification number of the transmission. Have the serial number available when calling for service assistance.

Bill of Material or Customer Number

This number may be located above the model and serial numbers. It is a reference number used by Eaton® Fuller®.

Preventive Maintenance Overview

To keep a vehicle running properly, it is important to perform preventive maintenance on the vehicle components.

This ensures the vehicle and its subassemblies will operate properly throughout their useful life. To cover preventive maintenance completely, you must review the following subjects in detail.

- **Recommended Lubricants**
- **Maintenance/Lubricants Change Intervals**
- **Transmission Inspections**
- **Changing the Lubricant**
- **Vehicle System Effects**

1. Recommended Lubricants

Where transmissions are concerned, lubrication is possibly the most important part of keeping a vehicle operating.

Lubricants

Lubricant must be approved by Eaton Corporation to qualify for use in the AutoShift 16 transmission.

Recommended Lubricants		
Type	Grade (SAE)	Ambient Temperature
Heavy duty engine oil API - CD	40 30	Above -12° C Below -12° C
Mid EP gear oil API-GL-4	90 80W	-12° C to 38° C -26° C to 21° C
Synthetic/semi-synthetic oil	Consult vehicle manufacturer/Eaton regarding the use of synthetic/semi-synthetic oil	

- Multi-viscosity engine oils (such as 15W40) are not recommended without consulting Eaton.
- Do not mix engine oils and gear oils in the same transmission.
- Additives or friction modifiers should not be added.



2. Maintenance/Lubricant Change Intervals

Transmission inspections and lubricant changes depend on the type of lubricant used and whether the vehicle is used On- or Off-Highway.

On-Highway Lubricant – Vehicles operated on paved roads, interstate highways, and turnpikes are designated as on-highway vehicles. Lubricant change and inspection intervals are the most generous for on-highway vehicles using synthetic lubricants.

Off-Highway Lubricant – When operating vehicles with the AutoShift 16 transmission in off-highway applications such as coal trucks or mining vehicles, it is more important to use time rather than mileage to keep the transmission within its proper preventive maintenance schedule. Off-highway applications are divided into two categories, severe and normal. “Severe off-highway” is the designation used when there is excessive dust and dirt. “Normal off-highway” is for applications where dust and dirt are minimal.

Lubrication Change and Inspection	
Mineral Oil	
Highway Use (90 % on highway, 10 % off highway)	
First 5,000 to 10,000 km	Change transmission oil on new units.
Every 20,000 km	Inspection oil level. Check for leaks.
Every 100,000 km or one year	Change transmission oil.
Off Highway Use (90 % off highway, 10 % on highway)	
First 30 hours	Change transmission oil on new units.
Every 40 hours	Inspect oil level. Check for leaks.
Every 500 hours	Change transmission oil when severe dirt conditions exist.
Every 1,000 hours	Change transmission oil (normal off highway use).
Synthetic Oil	
Highway or Off Highway Use	
Every 300,000 km or three year	Change transmission oil.



3. Transmission Inspections

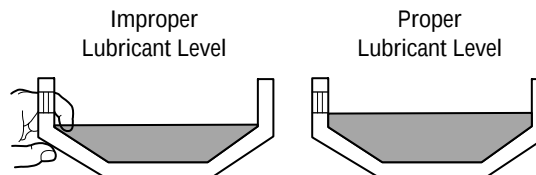
When performing preventive maintenance (PM) inspections, several items must be checked. It is important to perform every step to ensure the transmission will meet its life expectancy. Proper PM consists of the following steps:

- Check Lubricant Level
- Inspect for Loose/Missing Capscrews
- Check for Air Leaks
- Check for Lubricant Leaks.

Check Lubricant Level

When checking the transmission lubricant there are two important points to know: where to check the lubricant and what the proper lubricant level is. Always be cautious when checking the transmission lubricant as it may be hot.

- **Checking Location** – Check the lubricant at the lubricant fill plug located on the left side of the main transmission case.
- **Proper Lubricant Level** – The lubricant is at the proper level when it is even with the bottom of the fill hole. When you remove the plug to check the lubricant level, lubricant should actually seep out. Do not use your finger to feel for the lubricant. Even if you can touch the lubricant, it may not be at the proper level. In a transmission, one inch of lubricant level equals about one gallon of lubricant.



Inspect for Loose/Missing Capscrews

While you are under the vehicle checking the lubricant, make a quick check for loose or missing capscrews. Check all capscrews on the back box, PTO covers, shift bar housing, clutch housing, and Transmission ECU. Replace any missing or broken capscrews with the proper capscrews as called out in the illustrated parts listing. Follow the procedure defined in the manual transmission service manual when tightening any capscrews.

Check for Air Leaks

The two steps when checking for an air leak are inspection and repair.

- **Audible Inspection for Leaks** – To find air leaks, make sure the vehicle air system has at least 6.2 Bar (90 PSI) air pressure. Then, listen for leaks, making sure a vehicle leak is not mistaken for a transmission air leak.
- **Refer to Troubleshooting Procedures for Repair** – Once you find an air leak, use the troubleshooting guide to isolate the air leak to the faulty component.

Check for Lubricant Leaks

A lubricant leak could cause a catastrophic transmission failure. Check for leaks first at the gasket surfaces, input shaft, rear seal, and the transmission cooler.

- **Gaskets**

Visually check each gasket to ensure that no leak is present. Typically a moist spot is acceptable; however drips or larger wet areas are not. Check for leaks at the rear housing, PTO, shift bar housing, electric shifter, and clutch housing gasket surfaces. It is also important to ensure that the leak is indeed coming from the transmission. Make sure the oil is not being blown back from the engine or another vehicle component.

- **Input Shaft**

Check for leaks around the input shaft. Leaks in this area could be caused by a faulty gasket, the input shaft, or pressurization of the main transmission case by the air system. If you find a leak at the input shaft, make sure the air system is not leaking into the case before looking for leaking gaskets.

- **Rear Seal**

The rear seal is very important in maintaining lubricant in the transmission. If the seal is improperly installed or has failed, the transmission may experience a catastrophic failure. Check the rear seal by performing the following steps:

- **Visual Check for Leak** – Visually inspect the rear seal for a leak. If a rear seal leak is suspected, proper isolation is necessary.
- **Verify the Leak Path** – Other leaks may give the impression the rear seal is leaking. One possible cause is the vehicle speed sensor. Any lubricant leak above and in front of the rear seal could cause lubricant to collect around the seal. Wipe the seal with a clean rag, operate the vehicle, and recheck to verify the leak path.

- **Transmission Cooler Leaks**

If the vehicle is equipped with a transmission lubricant cooler, make sure there are no leaks at the lubricant cooler, hoses, and fittings of the cooler circuit.



4. Changing the Lubricant

When it is time to change the transmission lubricant, there are only a few steps to follow: draining and filling the transmission, draining and filling the cooler (if equipped), and changing the lubricant filter (if equipped). Remember to be careful when changing the transmission lubricant, as it may be hot.

Drain the Transmission

1. Locate the drain plug on the bottom of the transmission case.
2. Place a drain pan under the drain plug.
3. Remove the drain plug and allow the lubricant to drain completely.
4. Once drained, reinstall the drain plug and tighten to 61.0-74.6 Nm (45-55 lb-ft). Sealant is not required on the drain plug threads.

Drain the Cooler (If Equipped)

1. Remove both cooler lines at the transmission.
2. Pressurize one line with 2.1 Bar (30 PSI) of air pressure to force the lubricant out of the cooler.
3. Once drained, reconnect the coolant lines to the transmission. Make sure the lines are not crossed.

Fill the Transmission

1. Remove the transmission fill plug and fill the transmission with approved lubricant.
2. The transmission is full when the lubricant starts to flow out of the fill hole.
3. Replace the fill plug and tighten to 81.3-94.9 Nm (60-70 lb-ft).

Fill the Cooler (If Equipped)

1. Place the transmission in neutral and start the vehicle.
2. Release the clutch to rotate the input shaft of the transmission, allowing the pump to fill the cooler.
3. Run the vehicle for one minute.
4. Shut off the vehicle, recheck the transmission lubricant level and add lubricant as required.



5. Vehicle System Effects

Some vehicle systems can affect the transmission operation and possibly cause a failure. The air system is a major system that can affect the AutoShift components.

Air System

If the air system is not given recommended preventive maintenance, it can cause problems for the transmission system. Although the transmission has an Air Filter/Regulator, it can only protect the transmission from contaminants for so long. This is why it is important to follow OEM recommendations for air system preventive maintenance. It is important to regularly drain the air tanks and ensure that lubricant is not being pumped by the air compressor into the vehicle air system. If moisture is allowed to enter the transmission system, it can cause corrosion or, in cold climates, it could freeze and prevent the shift mechanisms from operating. If lubricant is allowed into the system, it could fill the air system components and cause them to lose valuable air volume, slowing or preventing movement.

6. Vehicle Components

The following components, although required for AutoShift operation, are OEM purchased and installed items. Refer to your OEM service information for removal and replacement procedures.

- Clutch Actuator
- Clutch Solenoid
- Clutch Switch
- Gear Display
- Gear Selector
- Kick Down Switch
- Power Connect Relay
- System Manager ECU
- Transmission Interface Harness.

Transmission Protective Covers – Removal

Special Instructions

None

Required Tools

Basic Hand Tools

Removal

1. Using a flat blade screwdriver, remove the Transmission Protective Covers by turning the attaching screws 180 degrees.

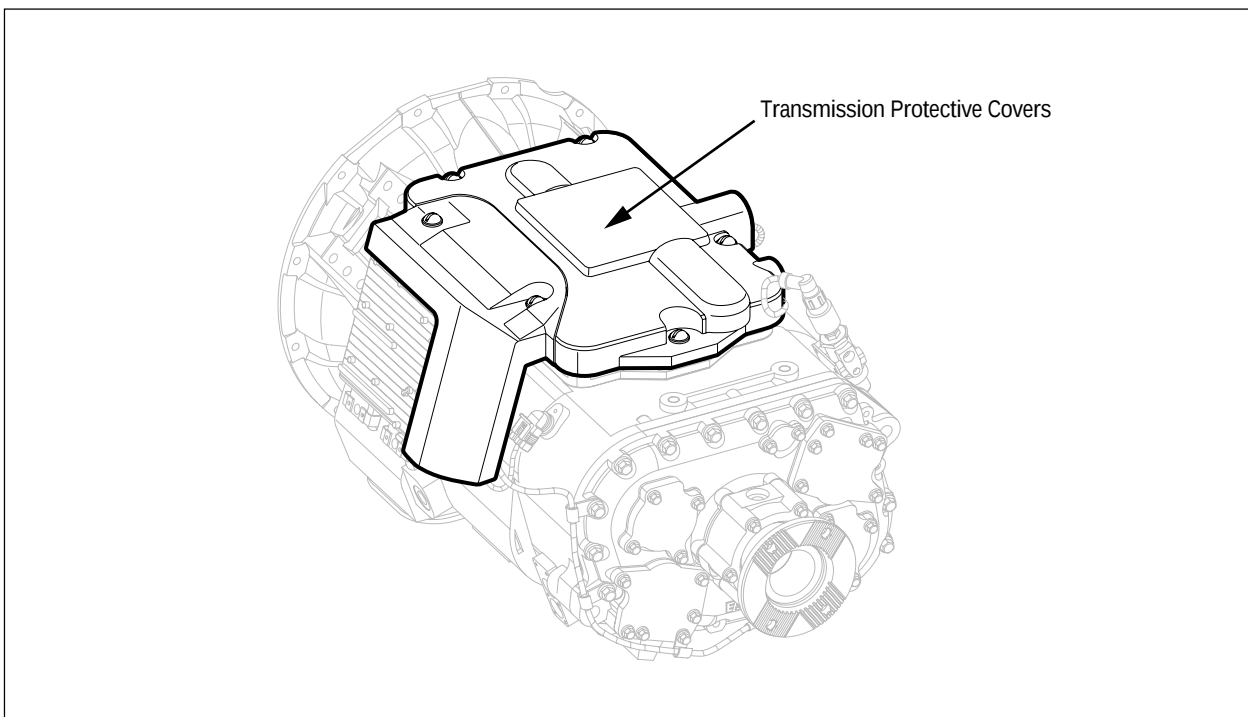


Figure 1. Transmission Protective Covers Location

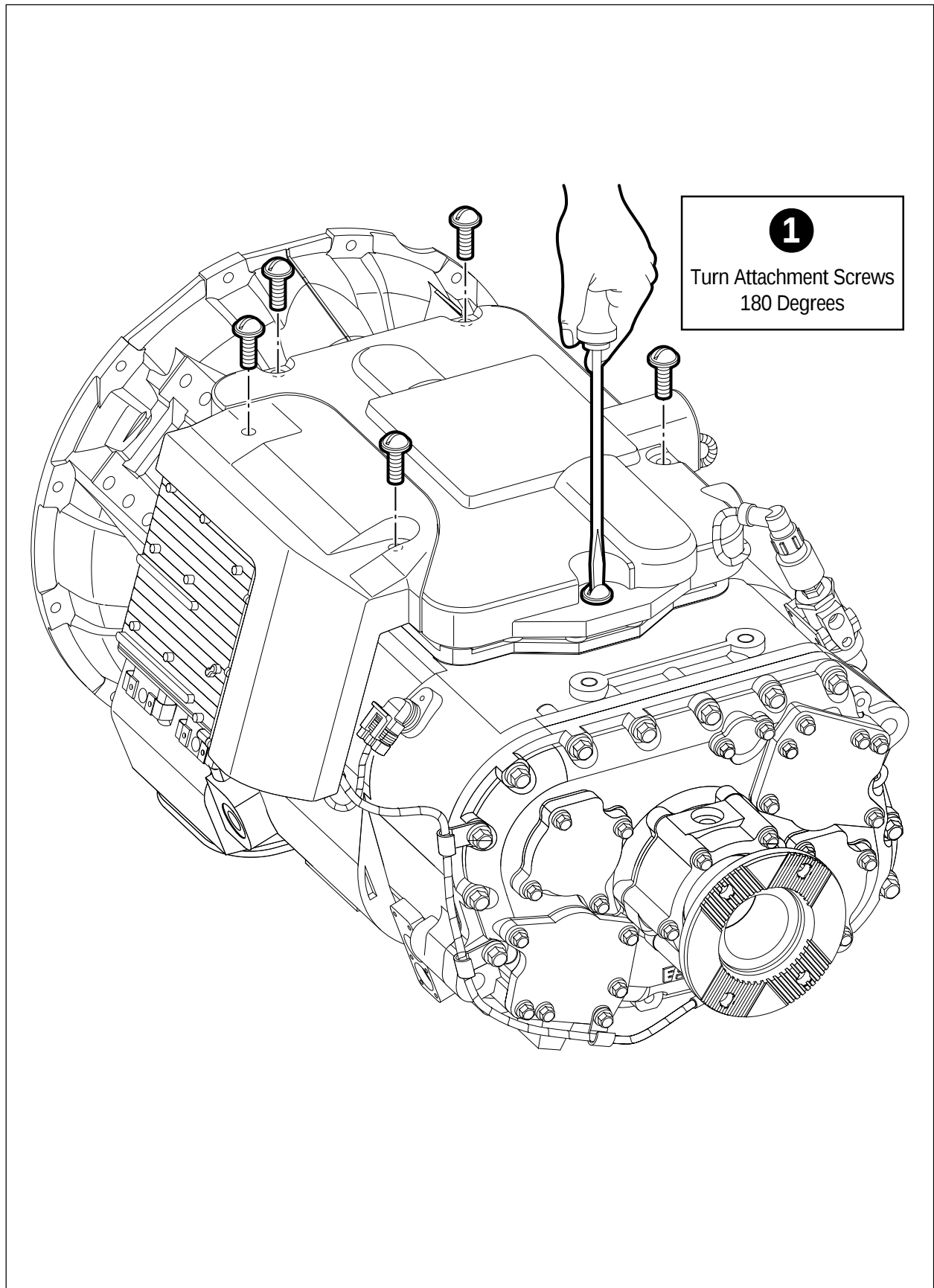


Figure 2. Transmission Protective Covers – Removal

Transmission Protective Covers – Installation

Special Instructions

None

Required Tools

Basic Hand Tools

Installation

1. Using a flat blade screwdriver, install the Transmission Protective Covers by turning the attaching screws 180 degrees.

Final Check

Make sure the mounting screws are locked in place.

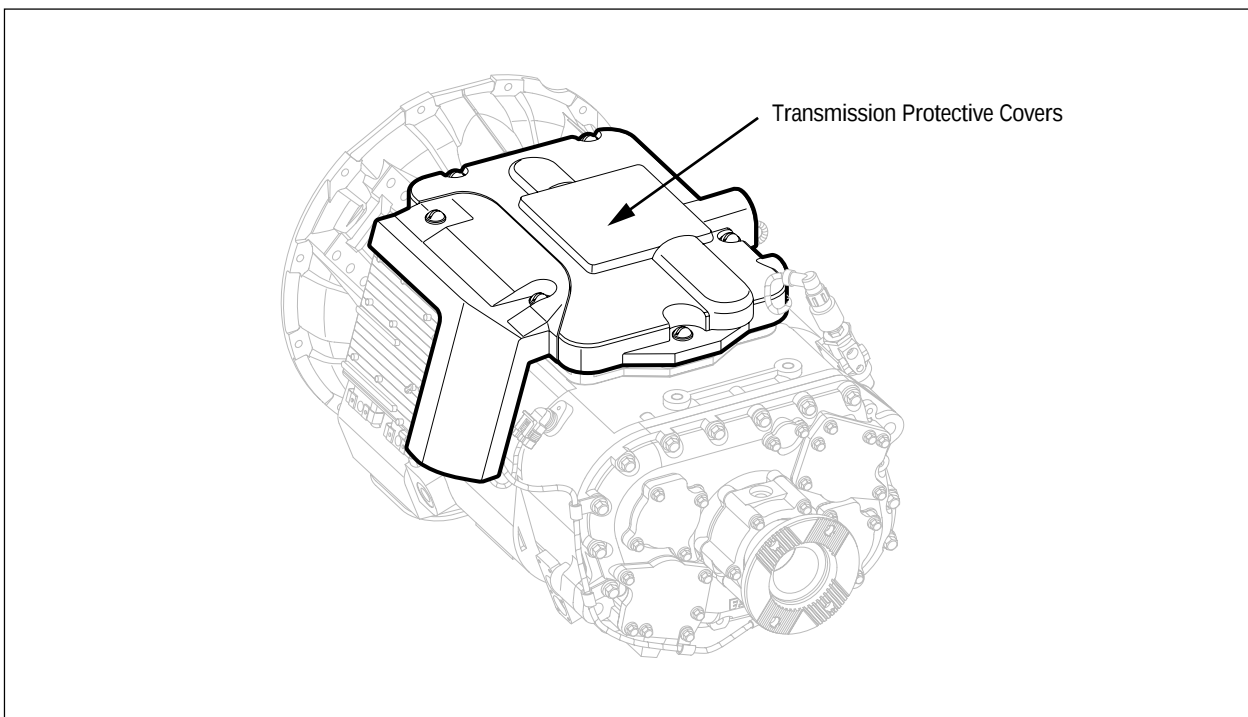


Figure 3. Transmission Protective Covers Location

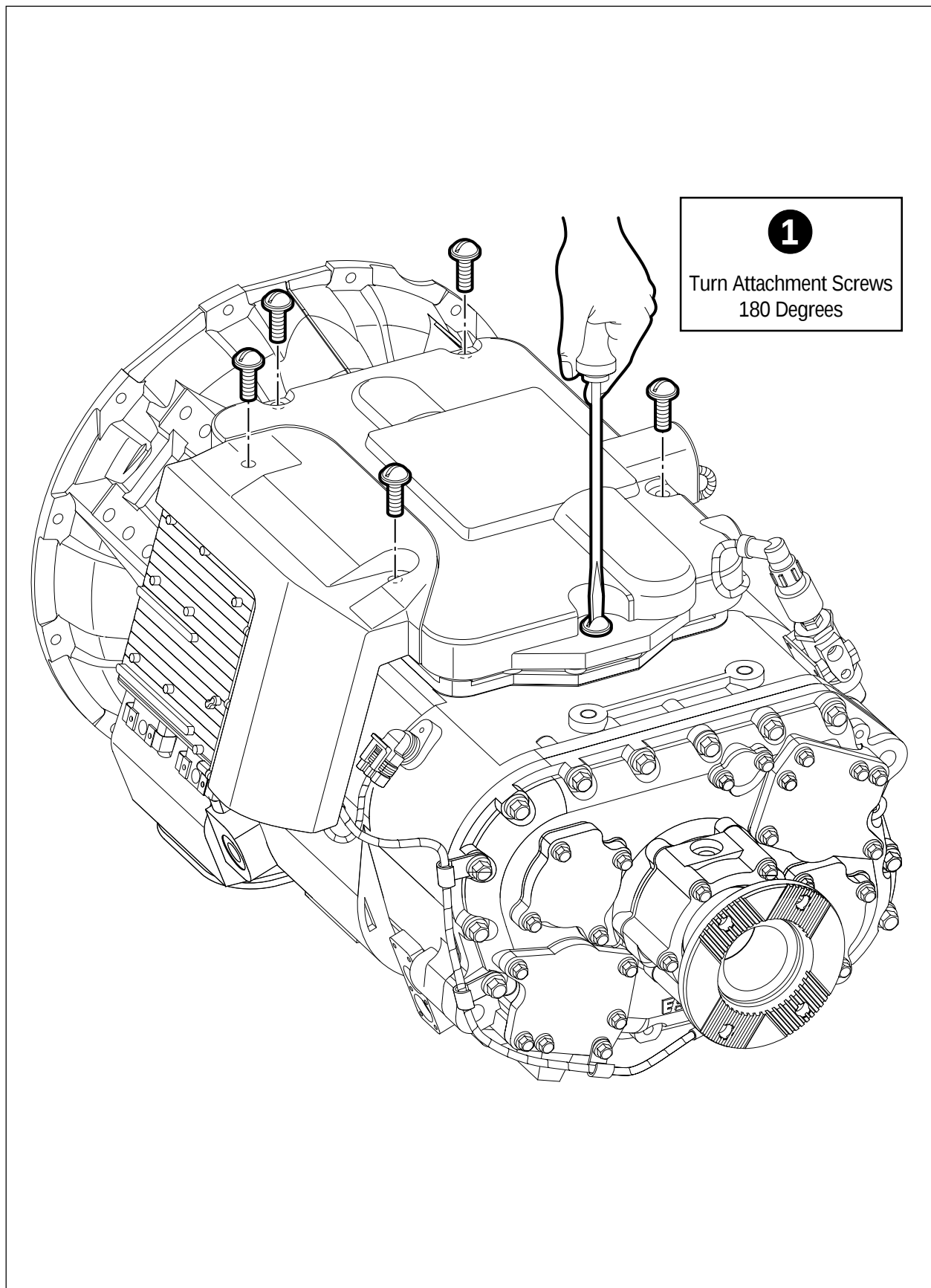


Figure 4. Transmission Protective Covers – Installation

Transmission ECU – Removal

Special Instructions

None

Required Tools

Basic Hand Tools

Removal

1. Using a flat blade screwdriver, remove the Transmission Protective Covers by turning the attaching screws 180 degrees.
2. Disconnect the following connectors:
 - a. Negative battery cable
 - b. Gear Select Motor
 - c. Cross Gate Motor
 - d. Power connector
 - e. 24-way connector
 - f. 32-way connector.
3. Using a 13 mm wrench, remove the two mounting capscrews at the bottom of the ECU.
4. Remove the Transmission ECU from the locating studs.

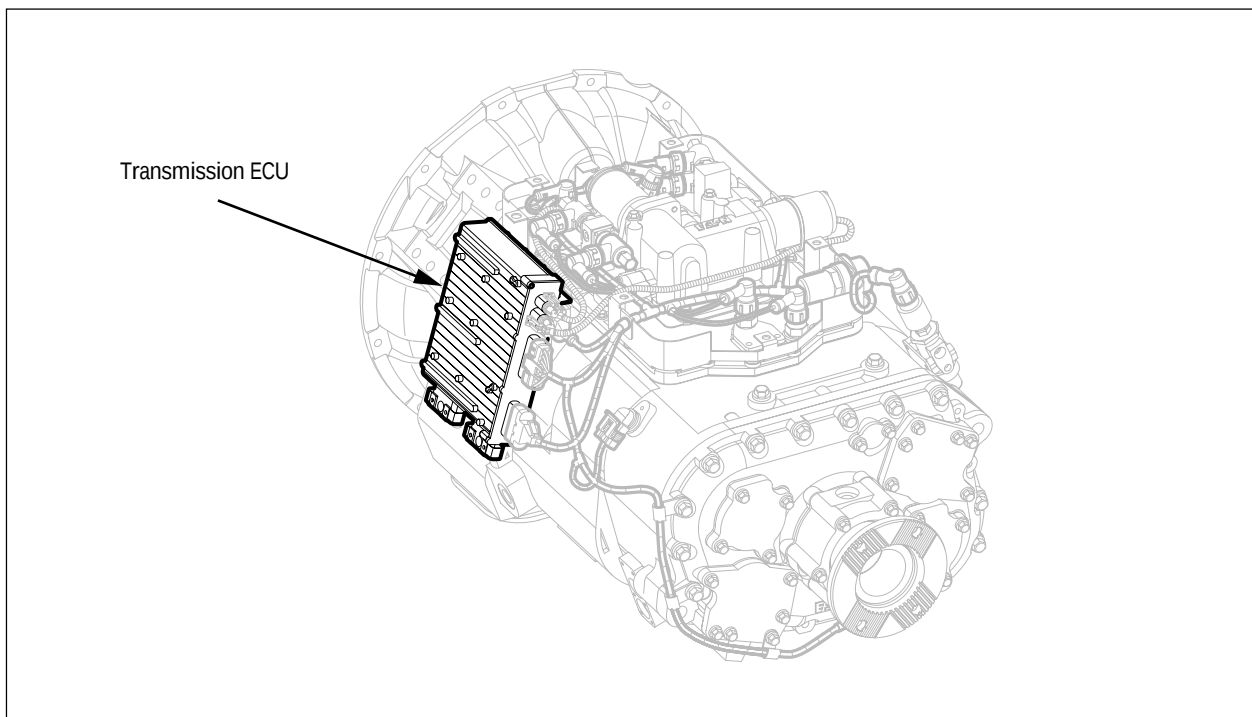


Figure 5. Transmission ECU Location

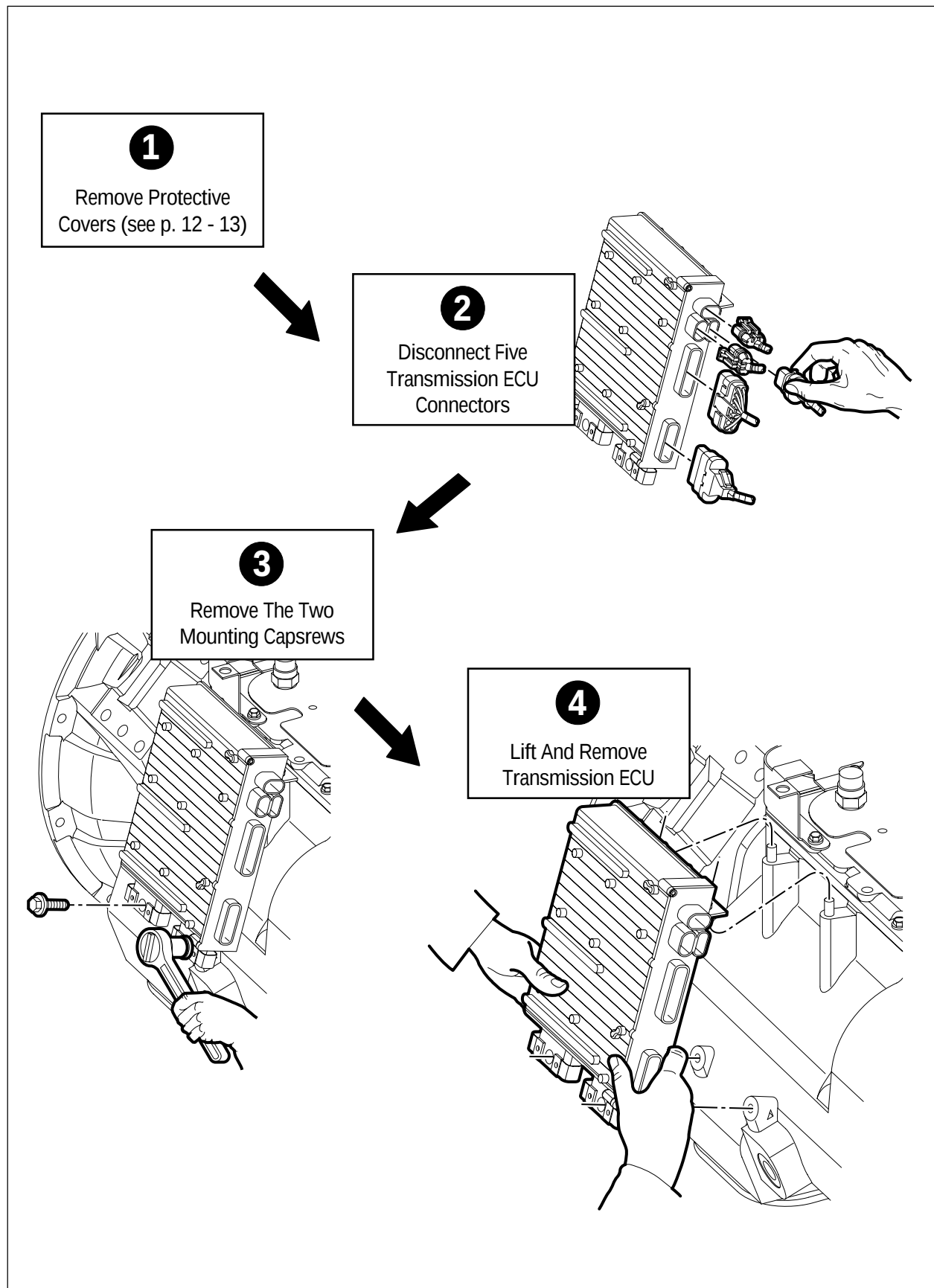


Figure 6. Transmission ECU – Removal

Transmission ECU – Installation

Special Instructions

None

Required Tools

Basic Hand Tools

Installation

1. Position Transmission ECU on the two locating studs.
2. Using a 13 mm wrench, install the Transmission ECU mounting capscrews.
Torque to 25-30 Nm (20-25 lb-ft).

3. Re-connect the following connectors:

- a. 32-way connector
- b. 24-way connector
- c. Power connector
- d. Cross Gate Motor
- e. Gear Select Motor
- f. Negative battery cable.

NOTE: These connectors cannot be interchanged.

4. Using a flat blade screwdriver, install the Transmission Protective Covers by turning the attaching screws 180 degrees.

Final Check

Make sure the mounting capscrews are properly torqued.

Make sure all the connectors are properly connected and locked.

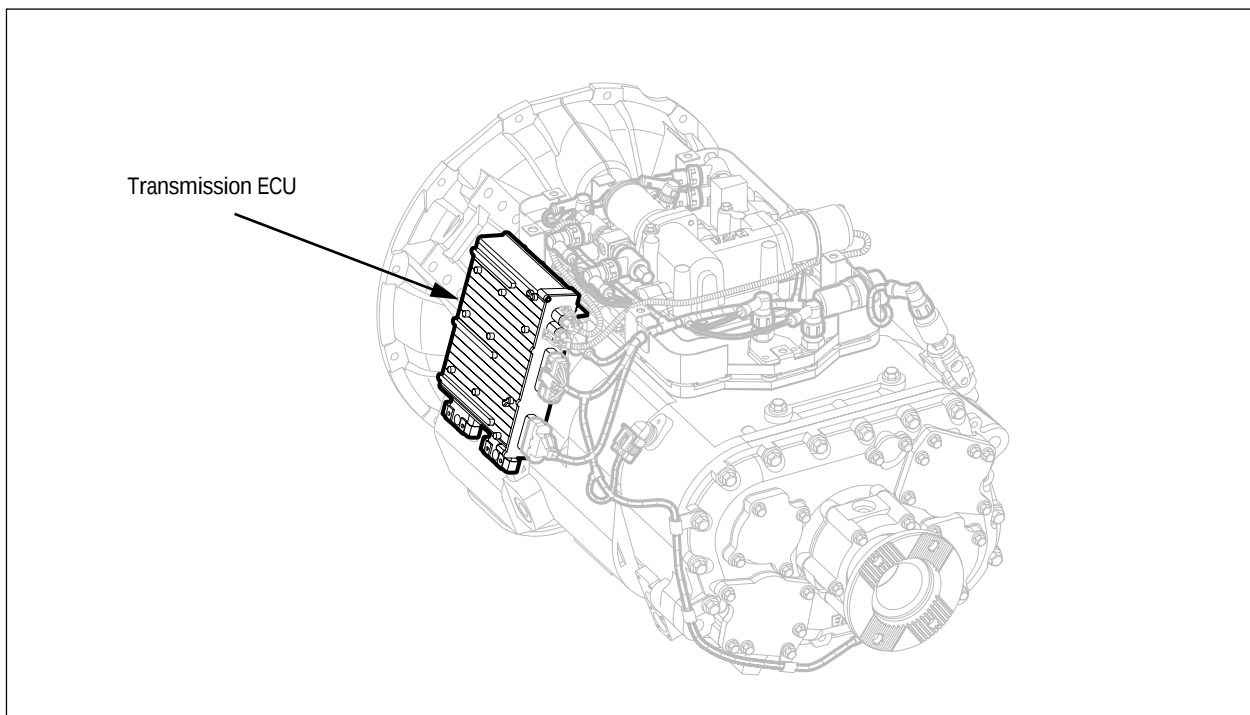


Figure 7. Transmission ECU Location

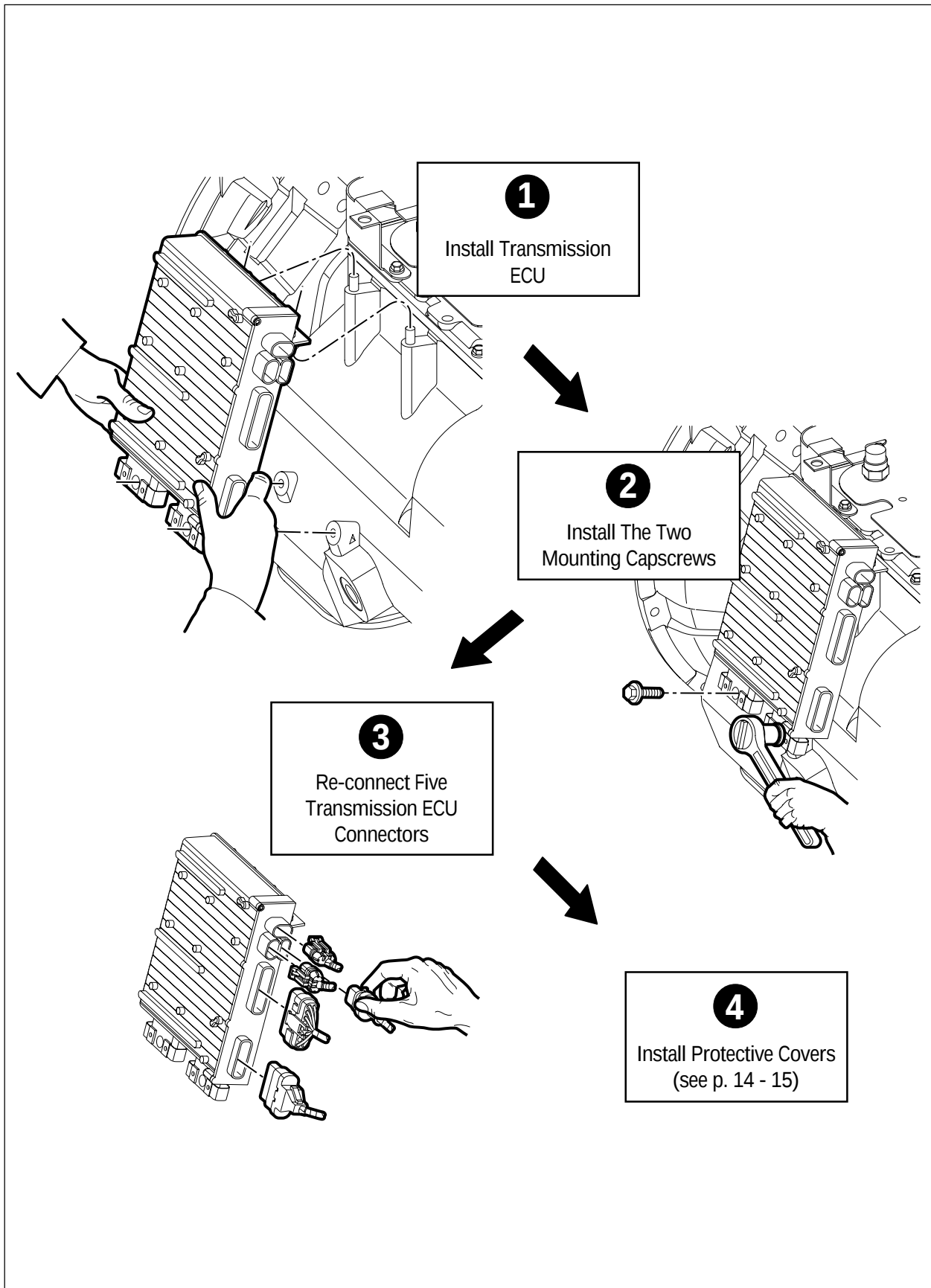


Figure 8. Transmission ECU – Installation

Transmission Harness – Removal

Special Instructions

None

Required Tools

Basic Hand Tools

Removal

1. Using a flat blade screwdriver, remove the Transmission Protective Covers by turning the attaching screws 180 degrees.
2. Disconnect the negative battery cable and the Transmission Interface Harness located on the right rear side of the Shift Bar Housing.
3. Disconnect the following connectors:
 - a. Power connector
 - b. 24-way connector
 - c. 32-way connector.
4. Disconnect the Transmission Harness from the following components:
 - a. Splitter Valve Assembly (S, D)
 - b. Range Valve Assembly (L, H)
 - c. Splitter Switch (M)
 - d. Neutral Switch (N)
 - e. Range Switch (R)
 - f. Reverse Switch (P)
 - g. Gear and Cross Gate Sensors (J, E)
 - h. Speed Sensors (T, U, V)
 - i. Low Air Switch (G)
 - j. Upshift Brake Solenoid (K).
5. Using a Philips screwdriver, remove the four Transmission Interface Harness connector mounting screws and any cable ties securing the harness to the transmission. Remove the harness from the transmission.

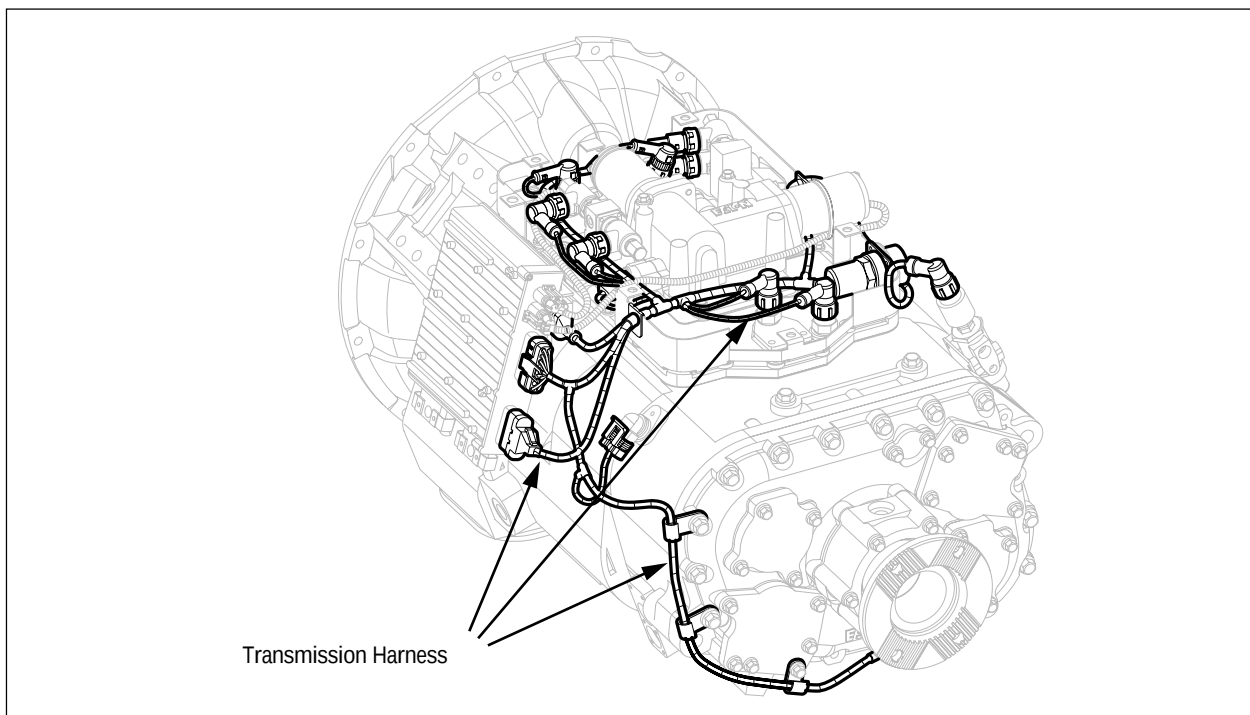


Figure 9. Transmission Harness Location

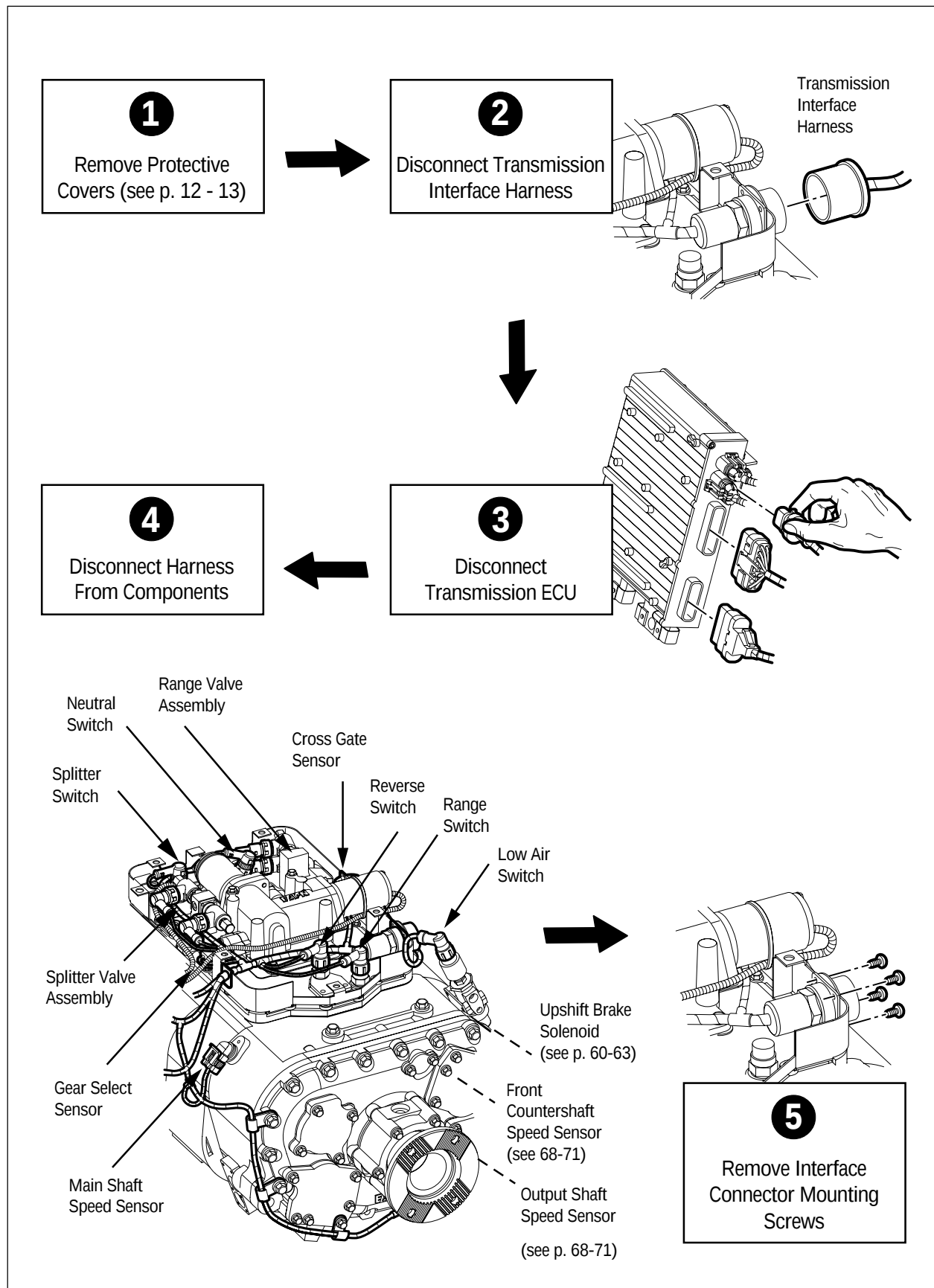


Figure 10. Transmission Harness – Removal

Transmission Harness – Installation

Special Instructions

Clean all connectors before installation.

Required Tools

Basic Hand Tools

Installation

1. Install the Transmission Harness on the transmission. Using a Philips screwdriver, install the four Transmission Interface Harness connector mounting screws and any cable ties securing the harness to the transmission.
2. Re-connect the Transmission Harness to the following components:
 - a. Splitter Valve Assembly (S, D)
 - b. Range Valve Assembly (L, H)
 - c. Splitter Switch (M)
 - d. Neutral Switch (N)
 - e. Range Switch (R)
 - f. Reverse Switch (P)
 - g. Gear and Cross Gate Sensors (J, E)
 - h. Speed Sensors (T, U, V)
 - i. Low Air Switch (G)
 - j. Upshift Brake Solenoid (K)
3. Re-connect the following connectors:
 - a. Power connector
 - b. 24-way connector
 - c. 32-way connector.

NOTE: These connectors cannot be interchanged.

4. Re-connect the Transmission Interface Harness located on the right rear side of the Shift Bar Housing, and the negative battery cable.
5. Using a flat blade screwdriver, install the Transmission Protective Covers by turning the attaching screws 180 degrees.

Final Check

Make sure all the connectors are properly connected and locked.

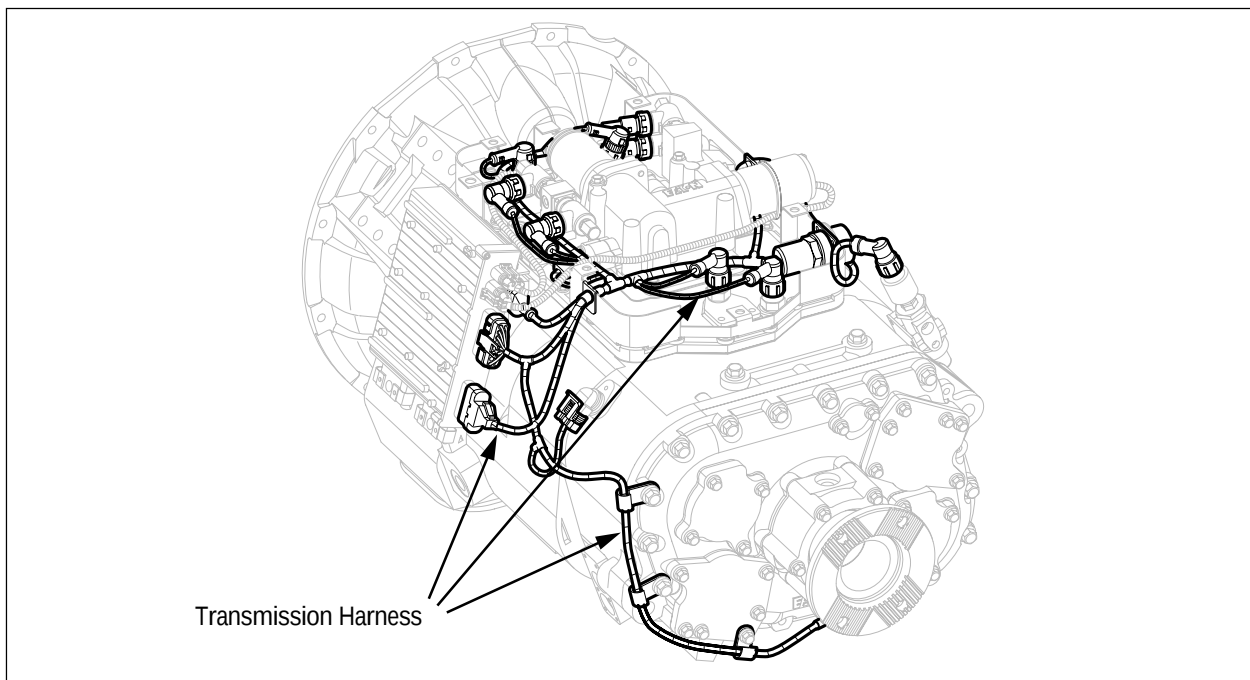


Figure 11. Transmission Harness Location

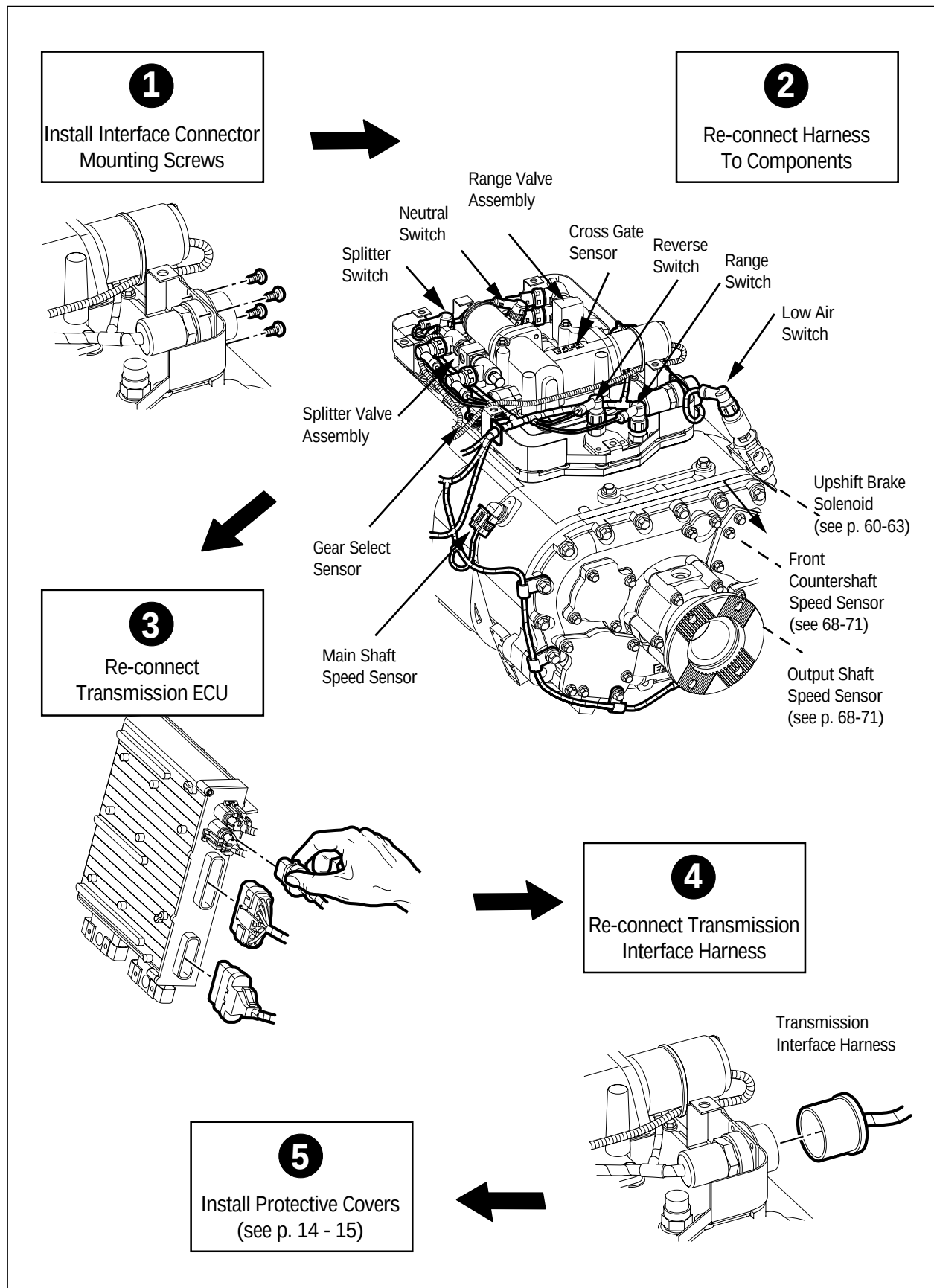


Figure 12. Transmission Harness – Installation

Electric Shifter – Removal

Special Instructions

None

Required Tools

Basic Hand Tools

Removal

1. Using a flat blade screwdriver, remove the Transmission Protective Covers by turning the attaching screws 180 degrees.
2. Remove the cable ties from the motor wires. Disconnect the Transmission Harness from the Gear Select Sensor (J) and Cross Gate Sensor (E).
3. Disconnect the Gear Motor and Cross Gate Motor connector from the Transmission ECU.
4. Using a 15 mm wrench, remove the four mounting capscrews from the Electric Shifter.
5. Remove the Electric Shifter and gasket.

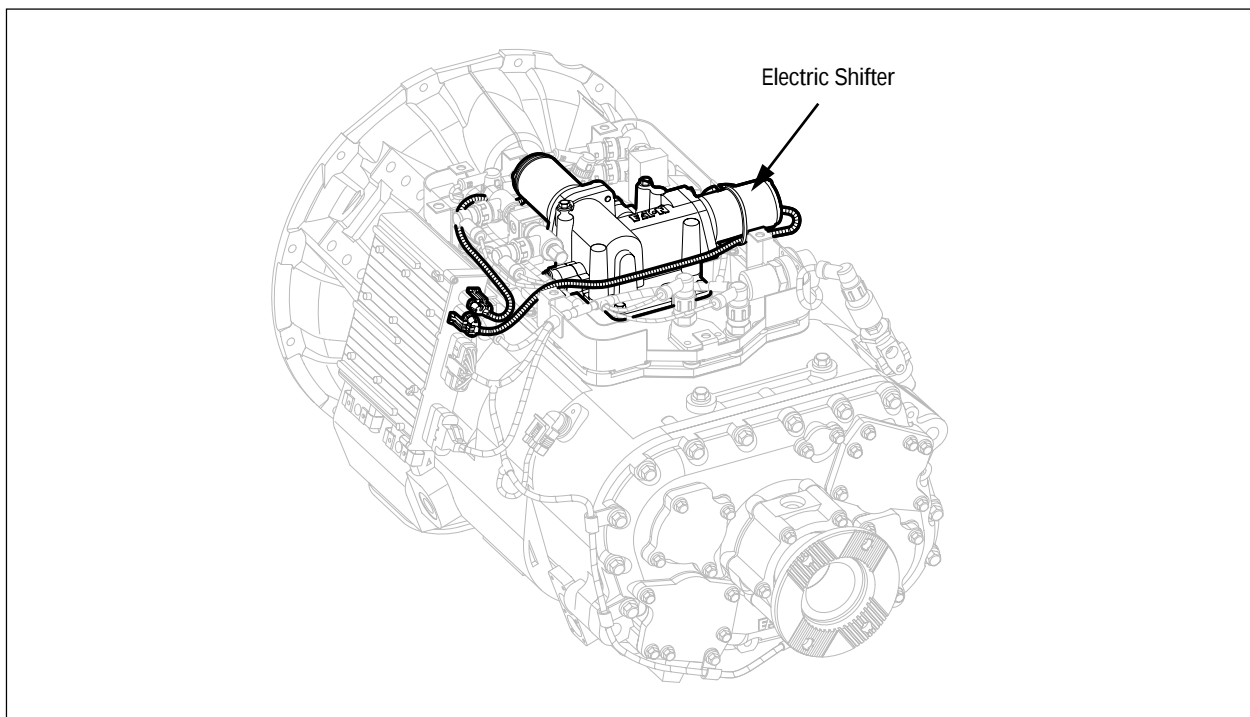


Figure 13. Electric Shifter Location

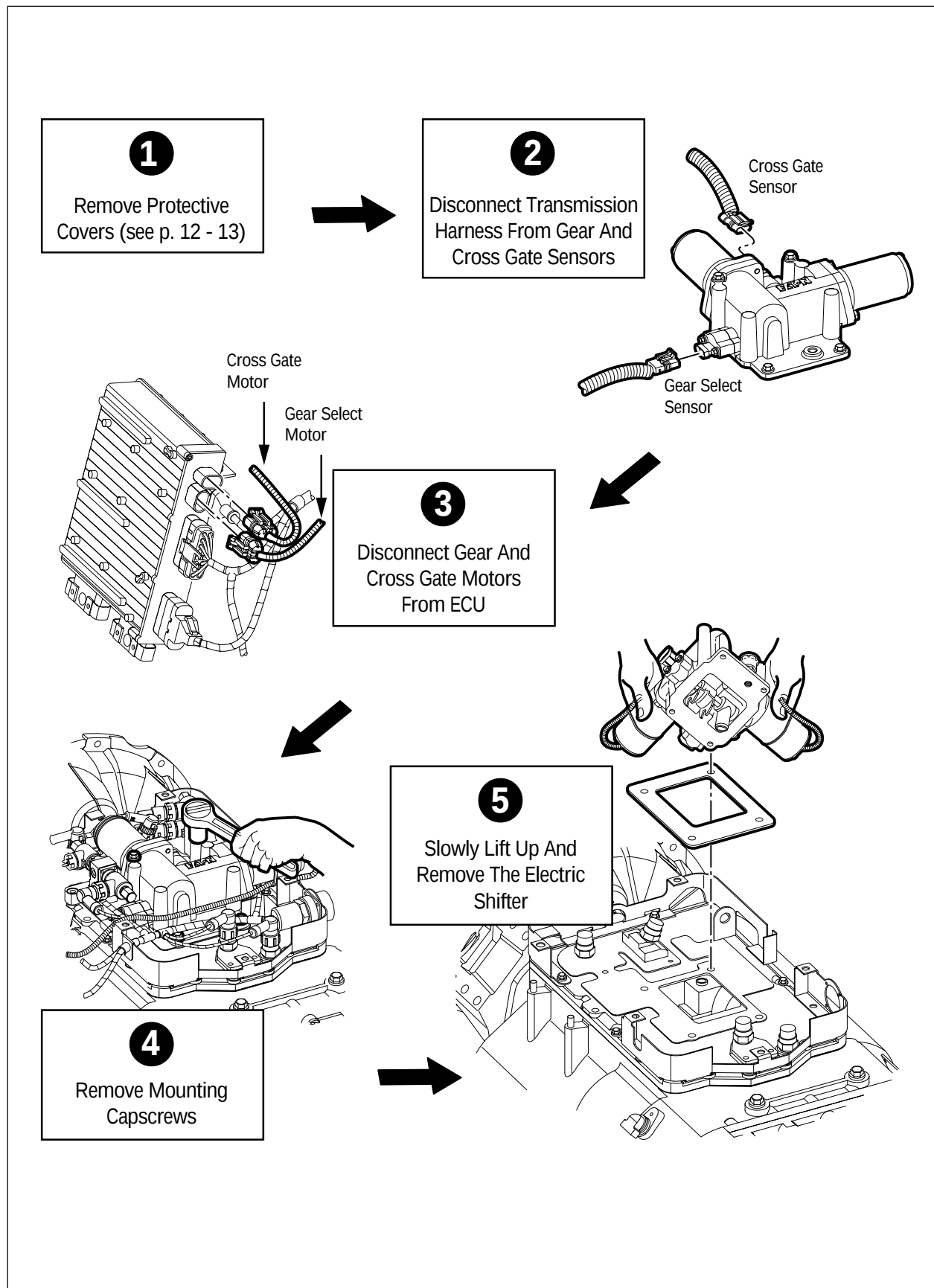


Figure 14. Electric Shifter – Removal

Electric Shifter – Installation

Special Instructions

Clean and remove old gasket material before installation.

Required Tools

Basic Hand Tools

Installation

1. Position a new gasket at the Electric Shifter mounting location. Check to ensure the transmission is in the neutral position, then move the Electric Shifter to the neutral position.

NOTE: If the Electric Shifter is not properly aligned, it will not fit properly.

2. Position the Electric Shifter on the Shift Bar Housing, then using 15mm wrench, install the four mounting capscrews. Torque to 60-70 Nm (40-50 lb-ft).
3. Re-connect the Gear Motor and Cross Gate Motor connectors to the Transmission ECU. Using cable ties, secure the motor wires to the transmission in their previous position.

4. Re-connect the Transmission Harness to the Gear Select Sensor (J) and Cross Gate Sensor (E). Install cable ties to the harness.
5. Using a flat blade screwdriver, install the Transmission Protective Covers by turning the attaching screws 180 degrees.

Calibration

To operate properly, the system must be calibrated as follows:

1. Turn the ignition switch ON, and allow the transmission to power up.
2. Turn the ignition switch OFF and wait two minutes.



CAUTION: The system must be calibrated before the vehicle is placed into operation.

Final Check

Make sure all the connectors are properly connected and locked.

Make sure that the mounting capscrews are properly torqued.

Be sure to perform the calibration procedure before operating the transmission.

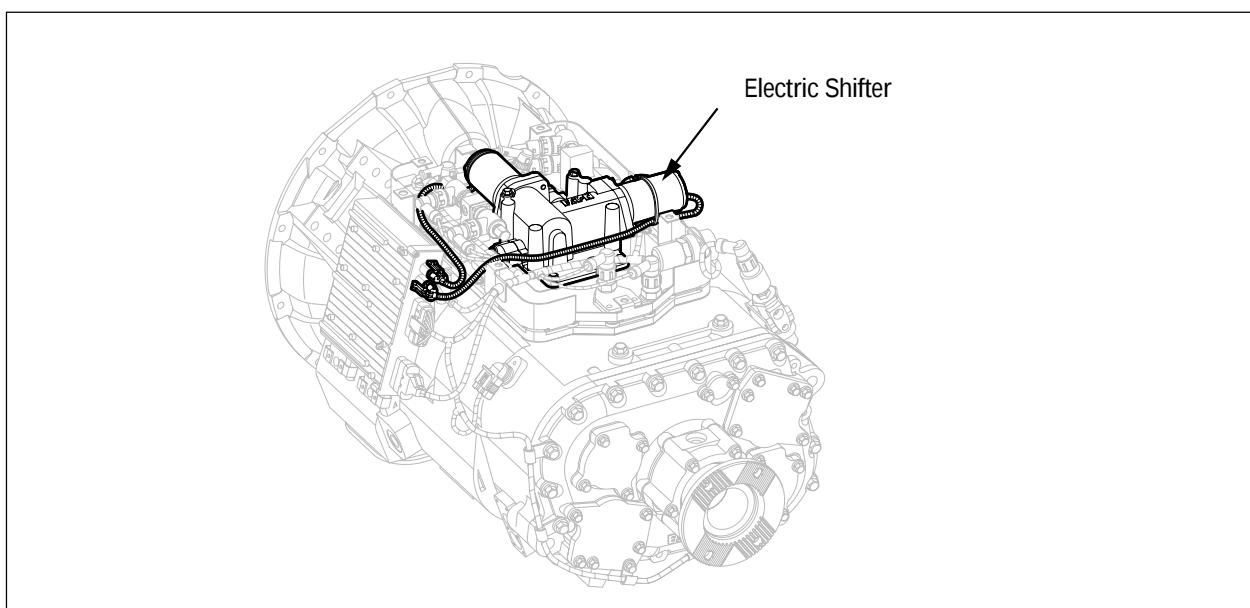


Figure 15. Electric Shifter Location

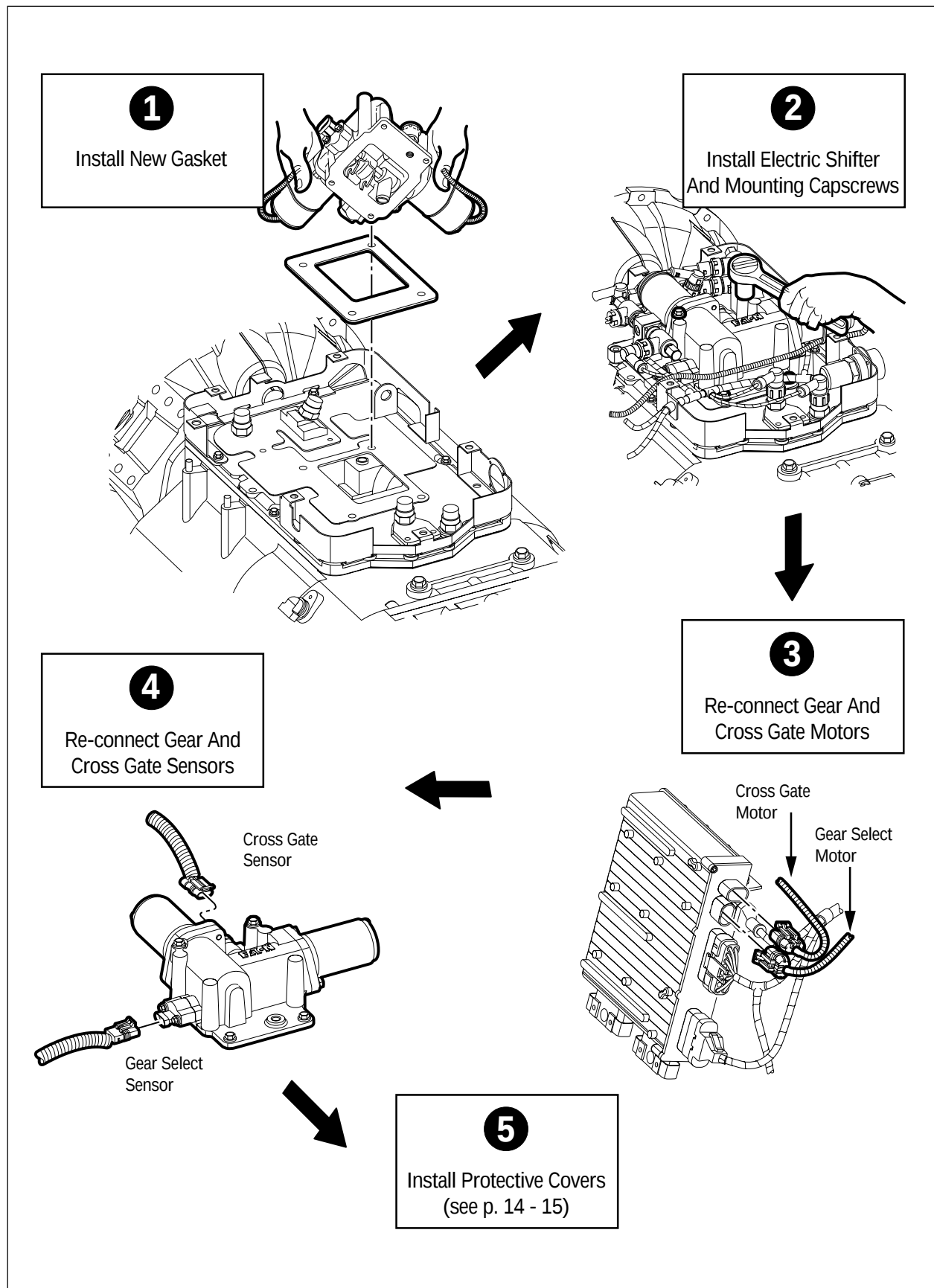


Figure 16. Electric Shifter – Installation

Cross Gate Sensor – Removal

Special Instructions

While removing the Cross Gate Sensor, hold the Cross Gate Sensor in place to prevent it from snapping out of position.

After removing the sensor, use your finger to push the sensor arm back in the sensor bore.

Required Tools

Basic Hand Tools

Removal

1. Using a flat blade screwdriver, remove the Transmission Protective Covers by turning the attaching screws 180 degrees.
 2. Disconnect the Transmission Harness from the Cross Gate Sensor (E).
 3. Using a 5/16" wrench, remove the Cross Gate Sensor mounting capscrews.
- CAUTION:** When removing the sensor carefully allow the sensor to rotate (not snap) to a relaxed position to prevent internal damage of the sensor.
4. Remove the Cross Gate Sensor, steel sleeves, and O-rings from the Electric Shifter.

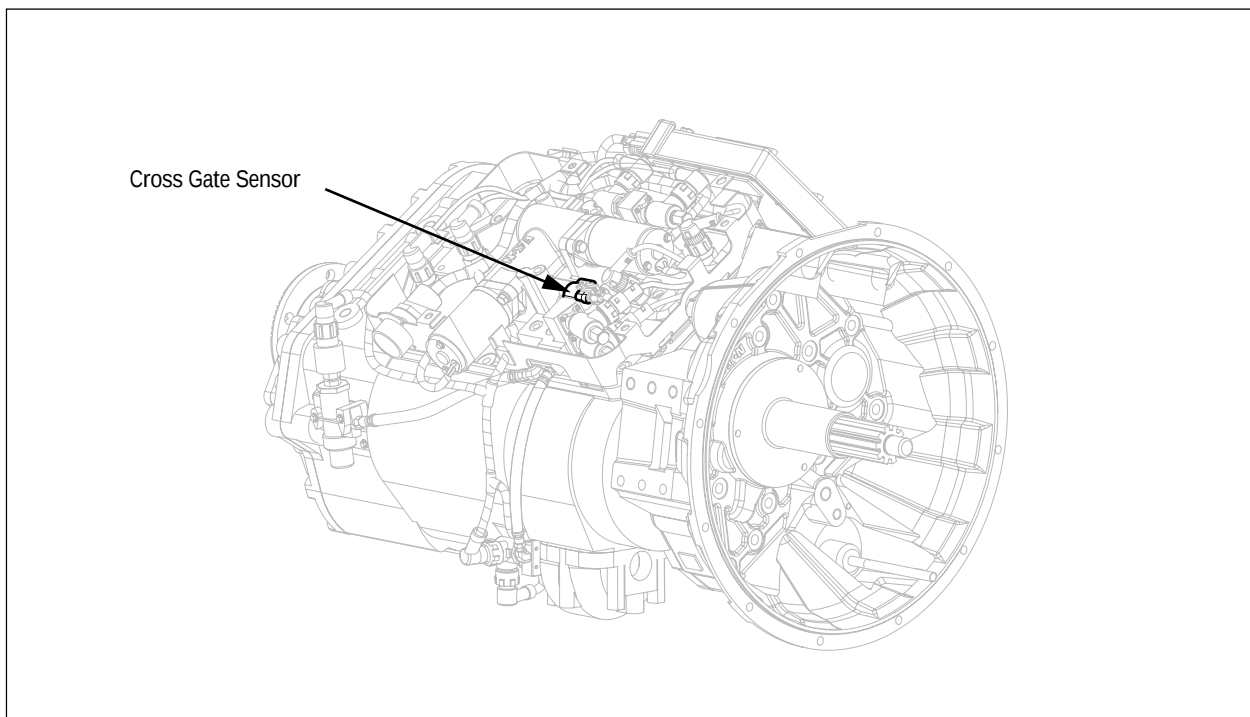


Figure 17. Cross Gate Sensor Location

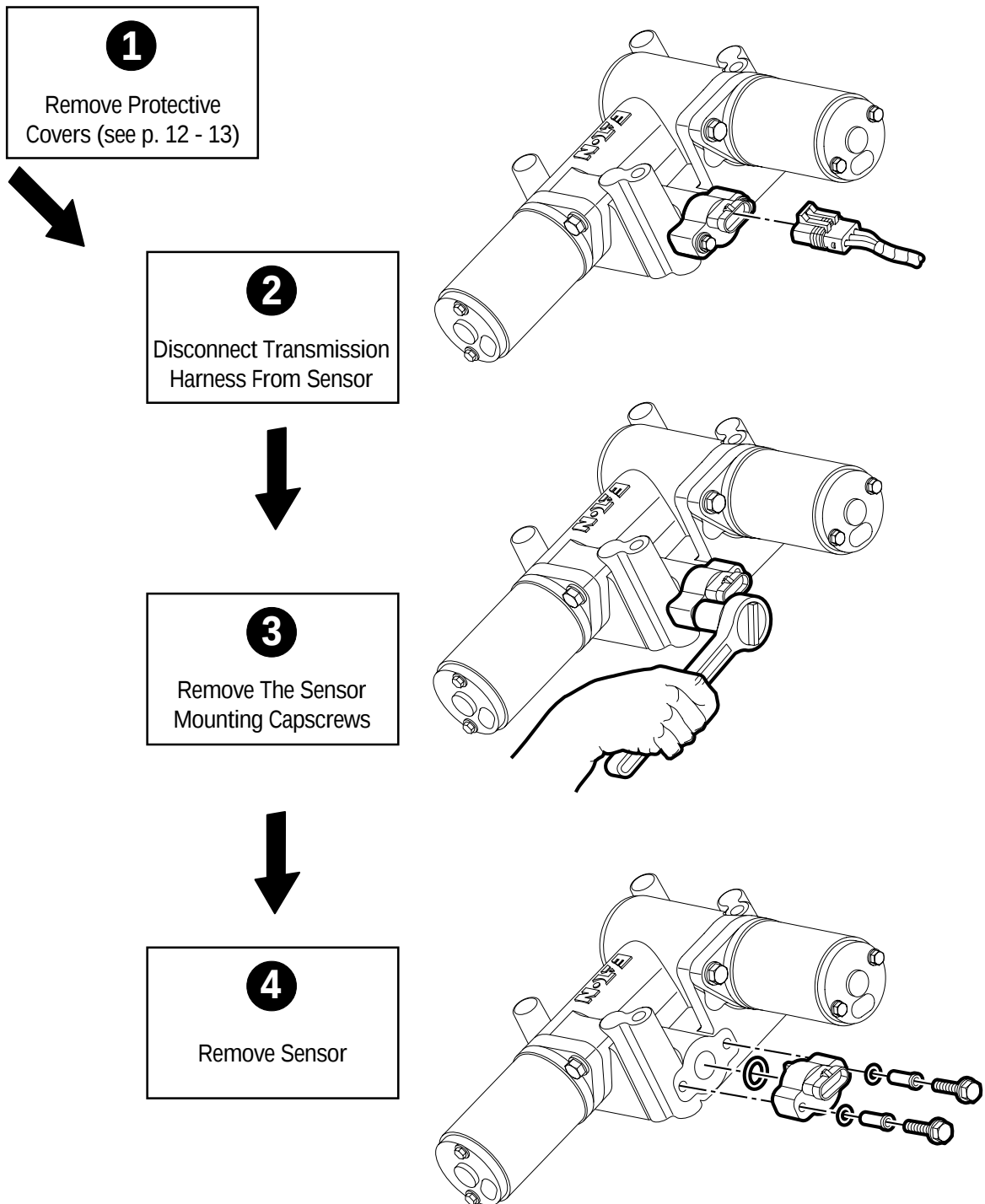


Figure 18. Cross Gate Sensor – Removal

Cross Gate Sensor – Installation

Special Instructions

While installing the Cross Gate Sensor, align the sensor tab with the groove and insert the Cross Gate Sensor.

Install the Cross Gate Sensor with the connector-locking tab at the top.

Required Tools

Basic Hand Tools

Calibration

To operate properly, the system must be calibrated as follows:

1. Turn the ignition switch ON and allow the transmission to power up.
2. Turn the ignition switch OFF and wait two minutes.



CAUTION: The system must be calibrated before the vehicle is placed into operation.

Installation

1. Align the Cross Gate Sensor tab with the slot in the Electric Shifter.
2. Using a 5/16" wrench, install the Cross Gate Sensor mounting capscrews. Torque to 2.4-3.1 Nm (21-27 lb-in).
3. Install the Transmission Harness on the Cross Gate Sensor (E).
4. Using a flat blade screwdriver, install the Transmission Protective covers by turning the attaching screws 180 degrees.

Final Check

Make sure that the capscrews are properly torqued.

Make sure that all of the connectors are properly connected and locked.

Be sure to perform the calibration procedure before operating the transmission.

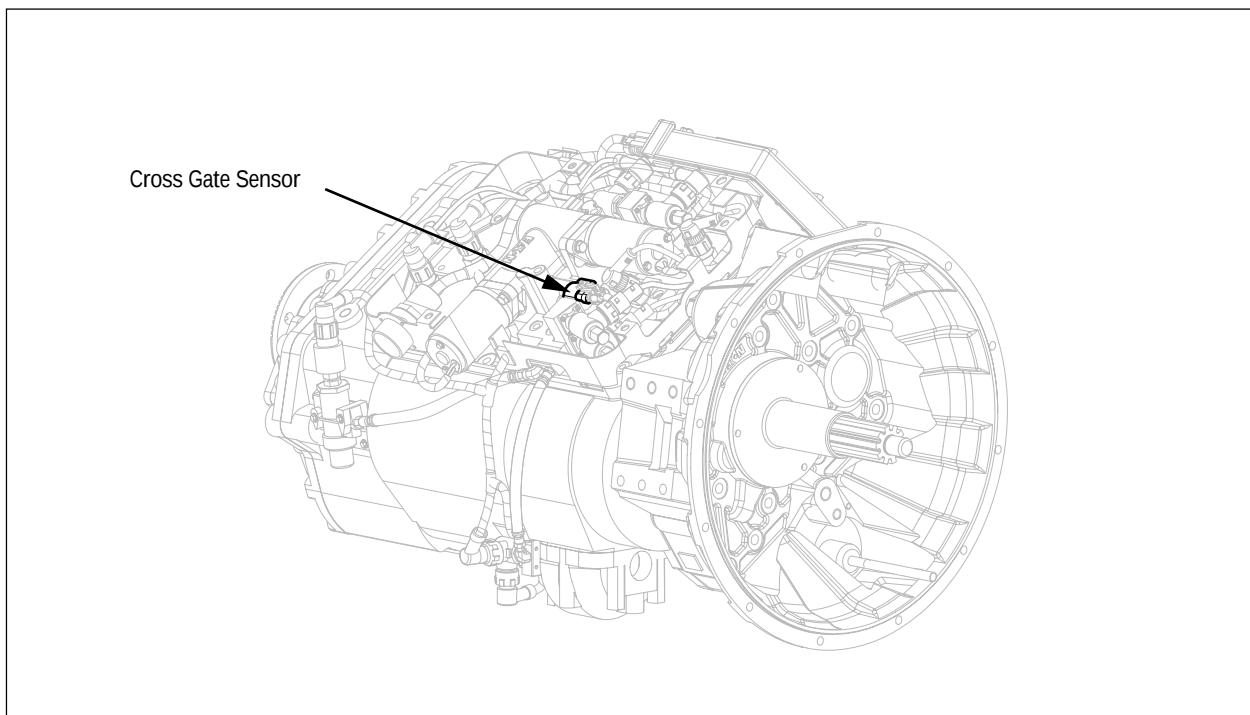


Figure 19. Cross Gate Sensor Location

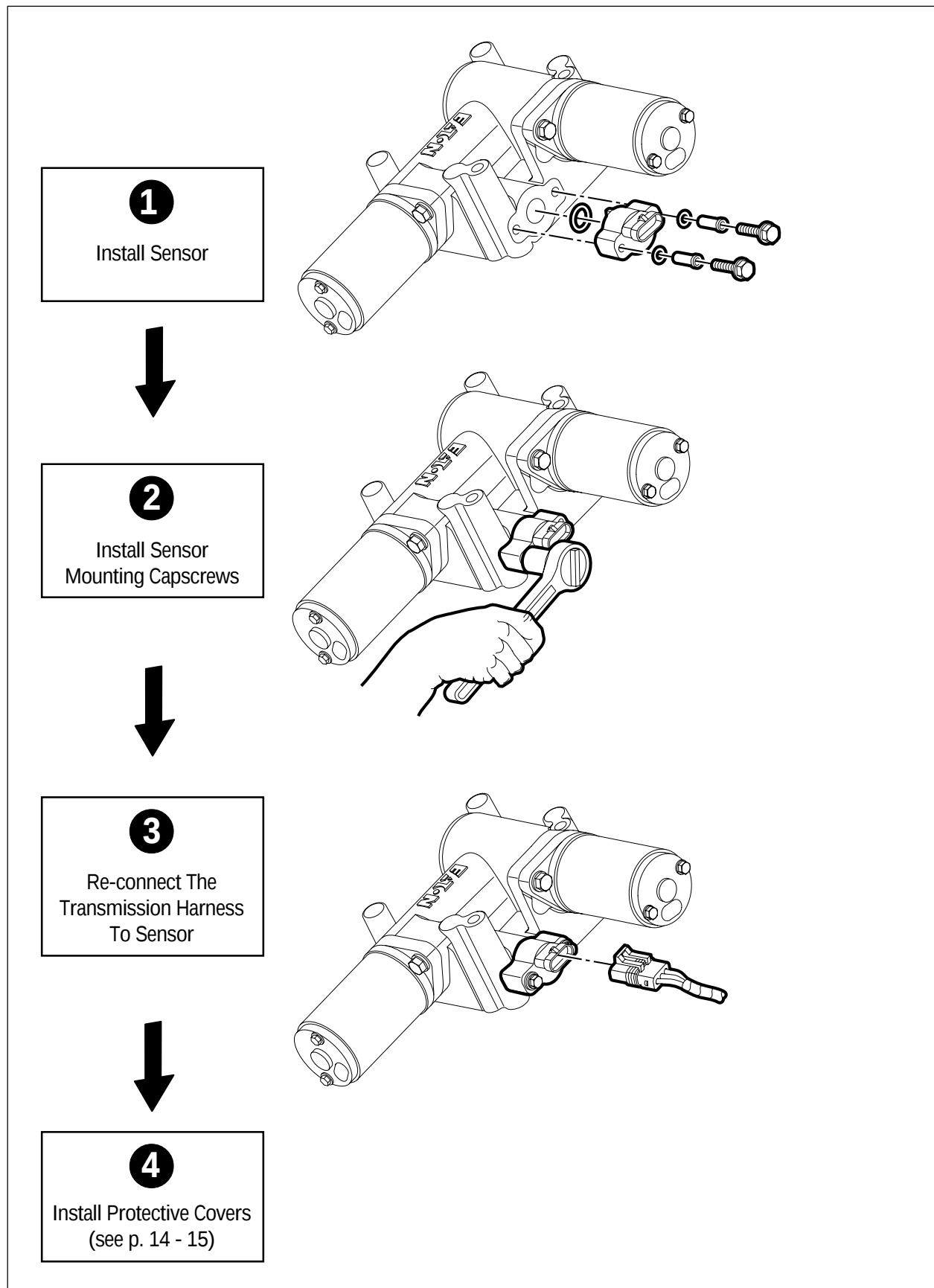


Figure 20. Cross Gate Sensor – Installation

Gear Select Sensor – Removal

Special Instructions

While removing the Gear Select Sensor, hold the Gear Select Sensor in place to prevent it from snapping out of position.

Required Tools

Basic Hand Tools

Removal

1. Using a flat blade screwdriver, remove the Transmission Protective Covers by turning the attaching screws 180 degrees.
2. Remove the cable ties from the motor wires. Disconnect the Transmission Harness from the Gear Select Sensor (J) and Cross Gate Sensor (E).
3. Disconnect the Gear Motor and Cross Gate Motor connectors from the Transmission ECU.
4. Using a 15 mm wrench, remove the four mounting capscrews from the Electric Shifter.
5. Remove Electric Shifter and gasket.
6. Using a 5/16" wrench, remove Gear Select Sensor mounting capscrews.
7. Remove the Gear Select Sensor, steel sleeves, and O-rings from the Electric Shifter.



CAUTION: When removing the sensor carefully allow the sensor to rotate (not snap) to a relaxed position to prevent internal damage of the sensor.

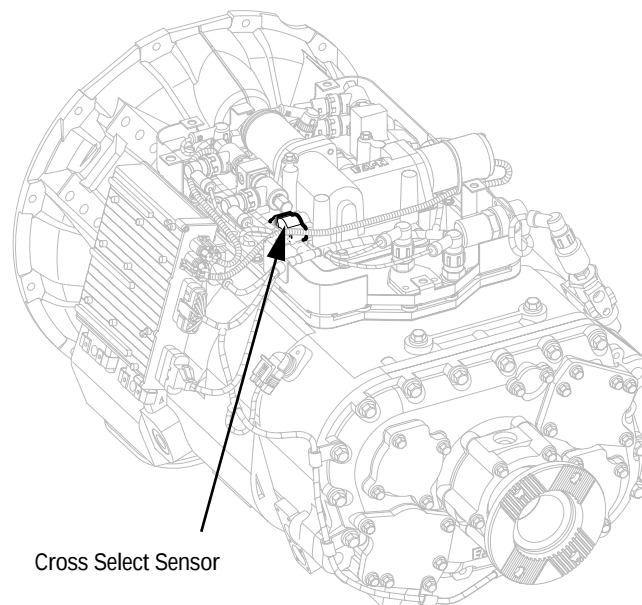


Figure 21. Gear Select Sensor Location

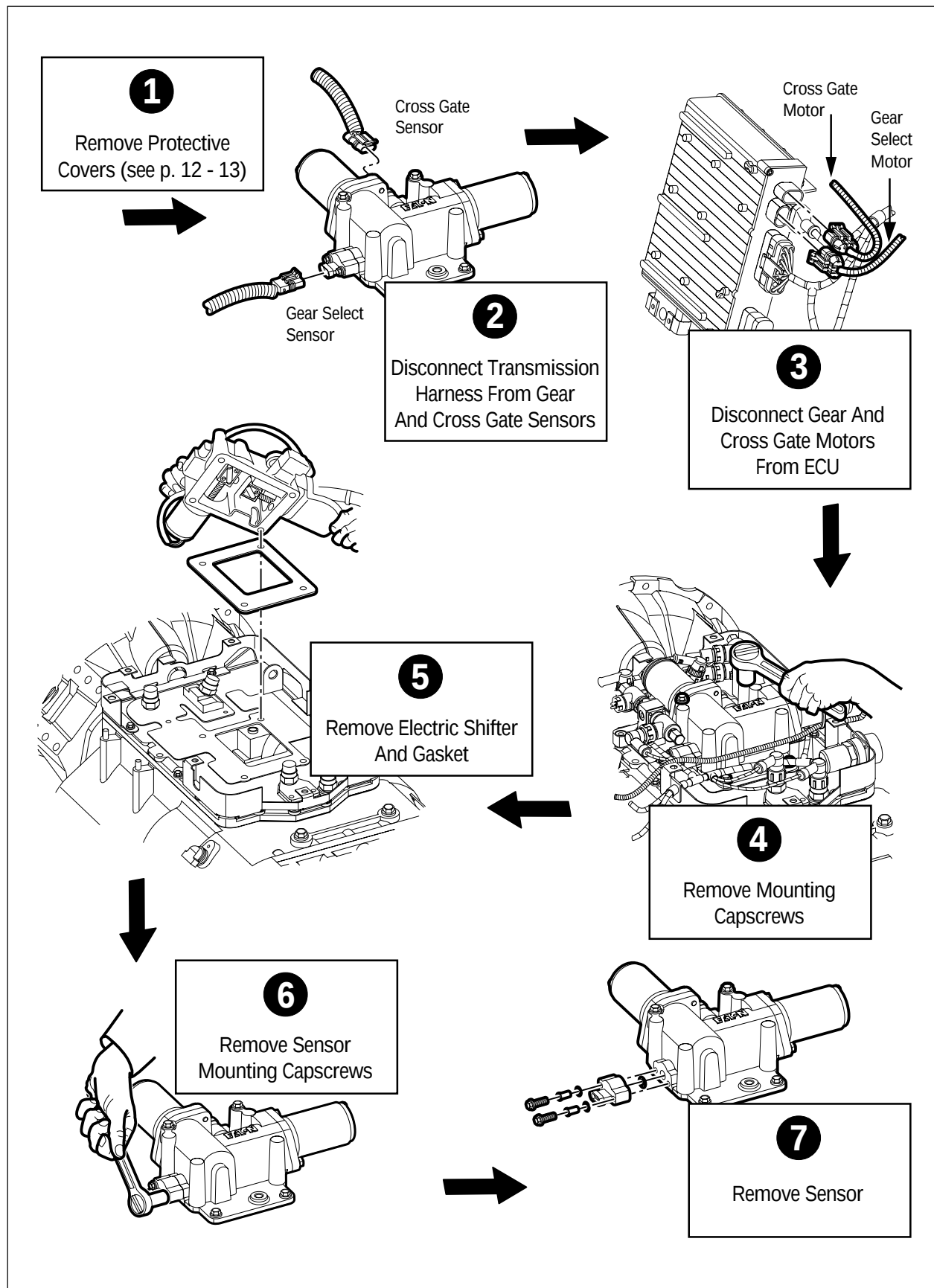


Figure 22. Gear Select Sensor – Removal

Gear Select Sensor – Installation

Special Instructions

Clean and remove old gasket material before installation.

While installing the Gear Select Sensor, align the sensor tab with the groove and insert the Gear Select Sensor.

Install the Gear Select Sensor with the connector-locking tab at the top.

Required Tools

Basic Hand Tools

Installation

1. Align the Gear Select Sensor tab with the slot in the Electric Shifter, then insert the sensor, steel sleeves, and O-rings on the Electric Shifter.
2. Using a 5/16" wrench, install Gear Select Sensor mounting capscrews. Torque to 2.4-3.1 Nm (21-27 lb-in).
3. Position a new gasket at the Electric Shifter mounting location. Check to ensure the transmission is in the neutral position, then move the Electric Shifter to the neutral position.

NOTE: If the Electric Shifter is not properly aligned, it will not fit properly.

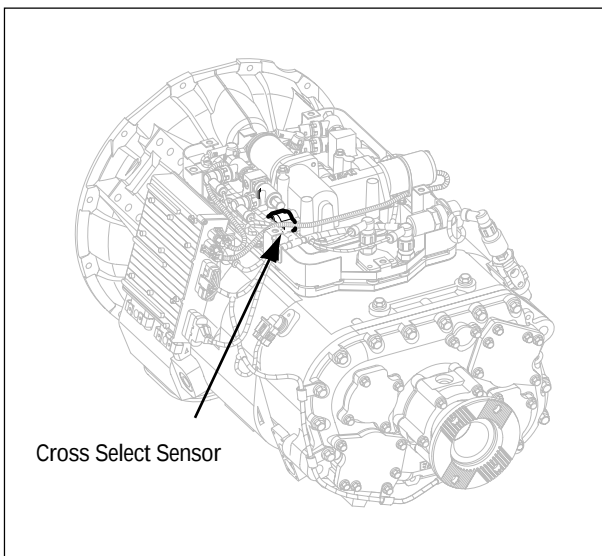


Figure 23. Gear Select Sensor Location

4. Position the Electric Shifter on the Shift Bar Housing, then using 15mm wrench, install the four mounting capscrews. Torque to 60-70 Nm (44-52 lb-ft).
5. Re-connect the Gear Motor and Cross Gate Motor connectors to the Transmission ECU. Using cable ties, secure the motor wires to the transmission in their previous position.
6. Re-connect the Transmission Harness to the Gear Select Sensor (J) and Cross Gate Sensor (E). Install cable ties to the harness.
7. Using a flat blade screwdriver, install the Transmission Protective covers by turning the attaching screws 180 degrees.

Calibration

To operate properly, the system must be calibrated as follows:

1. Turn the ignition switch ON and allow the transmission to power up.
2. Turn the ignition switch OFF and wait two minutes.



CAUTION: The system must be calibrated before the vehicle is placed into operation.

Final Check

Make sure all the connectors are properly connected and locked.

Make sure that the mounting capscrews are properly torqued.

Be sure to perform the calibration procedure before operating the transmission.

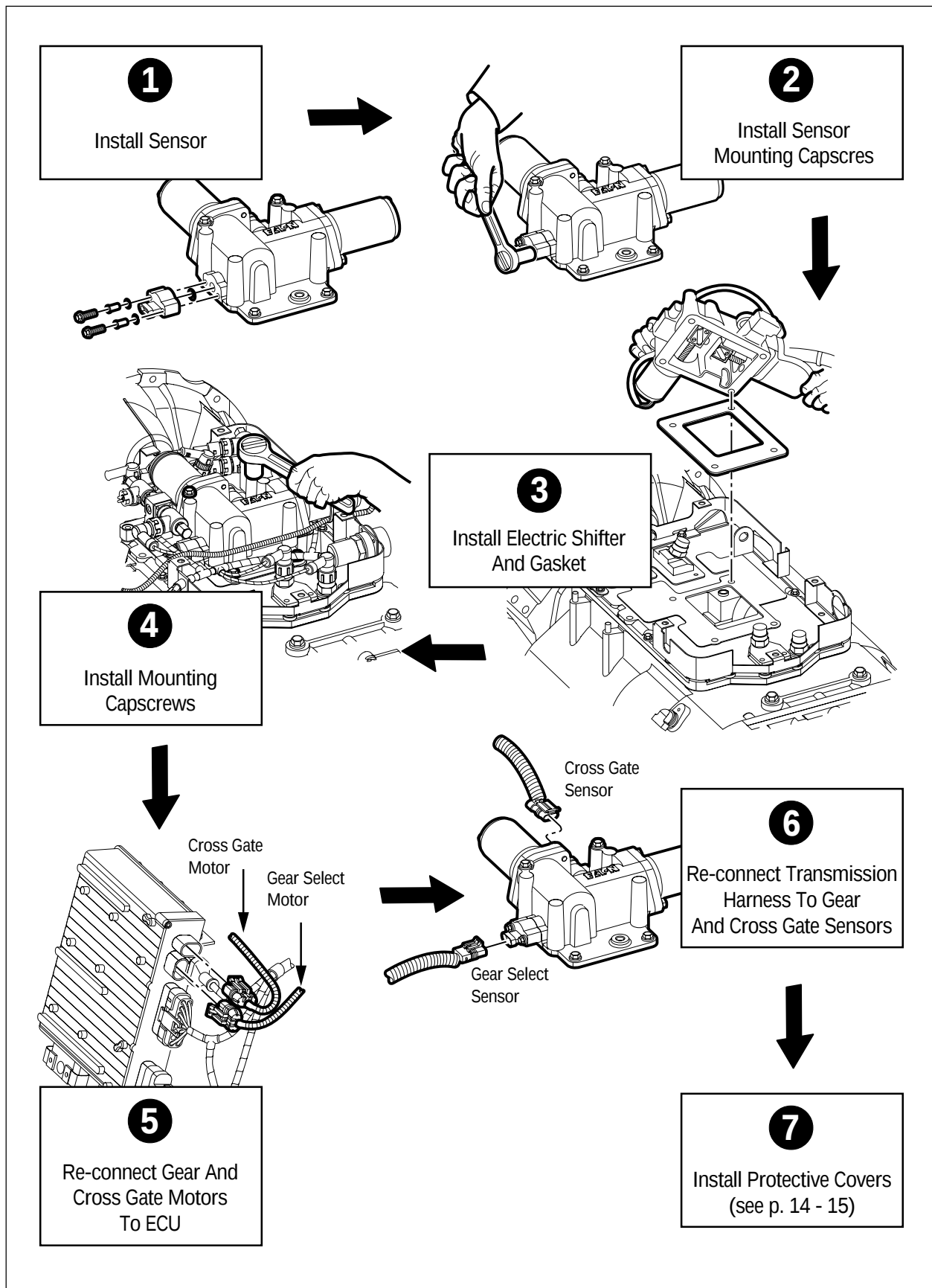


Figure 24. Gear Select Sensor – Installation

Range Switch – Removal

Special Instructions

None

Required Tools

Basic Hand Tools

Removal

1. Using a flat blade screwdriver, remove the Transmission Protective Covers by turning the attaching screws 180 degrees.
2. Disconnect the Transmission Harness from the Range Switch (R).
3. Using a 27 mm wrench, remove the Range Switch.

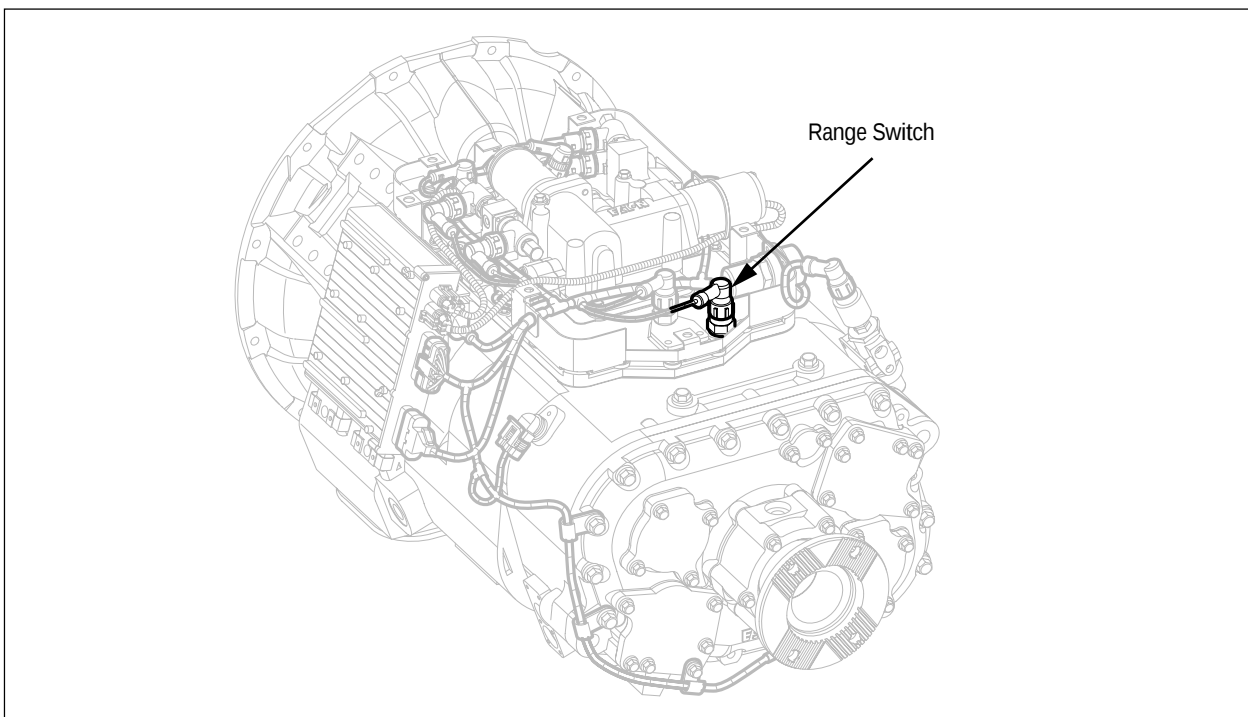


Figure 25. Range Switch Location

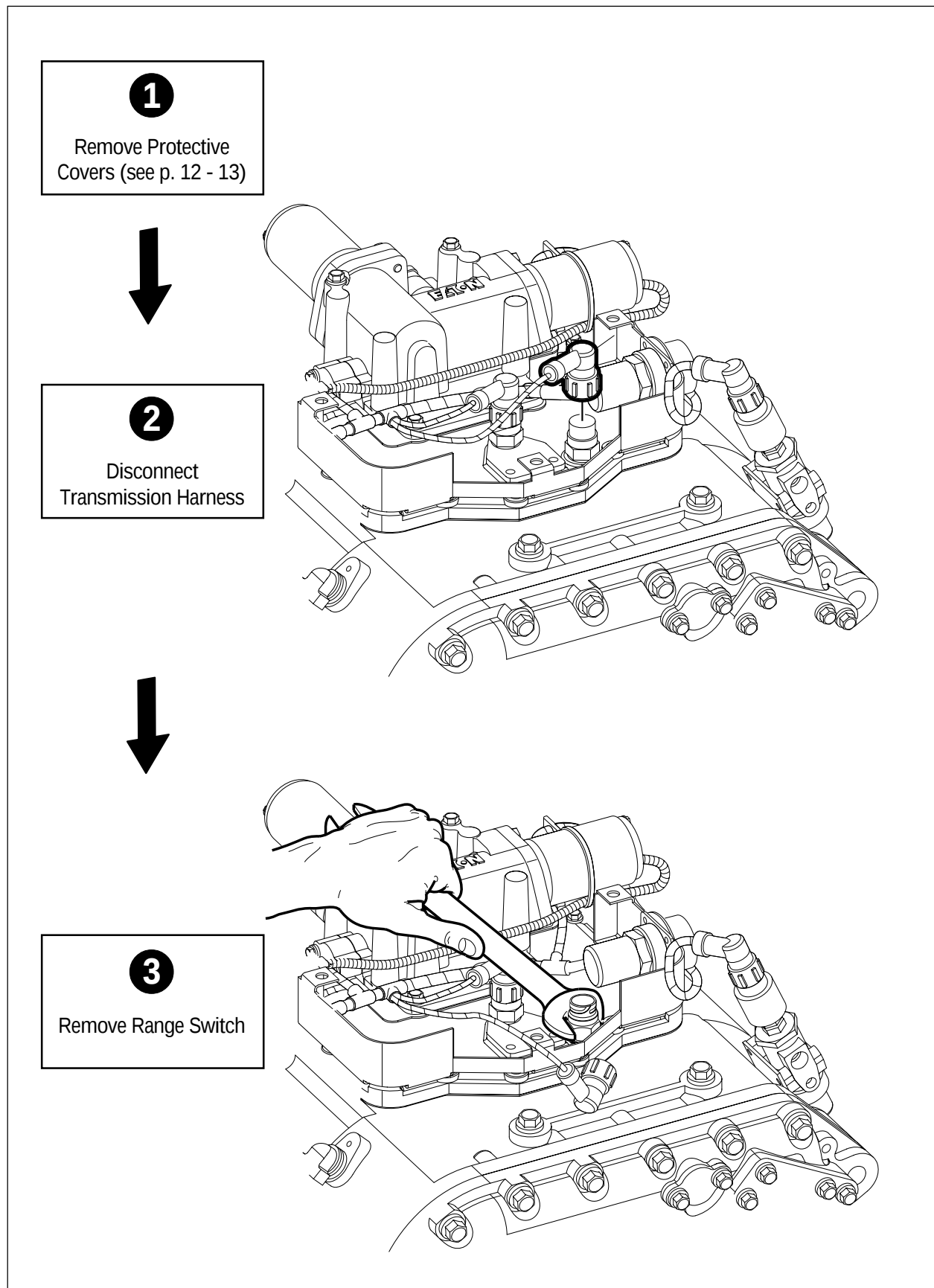


Figure 26. Range Switch – Removal

Range Switch – Installation

Special Instructions

None

Required Tools

Basic Hand Tools

Installation

1. Using a 27 mm wrench, install the Range Switch. Torque to 20-25 Nm (15-20 lb-ft).
2. Re-connect the Transmission Harness to the Range Switch (R).
3. Using a flat blade screwdriver, install the Transmission Protective Covers by turning the attaching screws 180 degrees.

Final Check

Make sure the Range Switch is properly torqued.

Make sure all of the connectors are properly connected and locked.

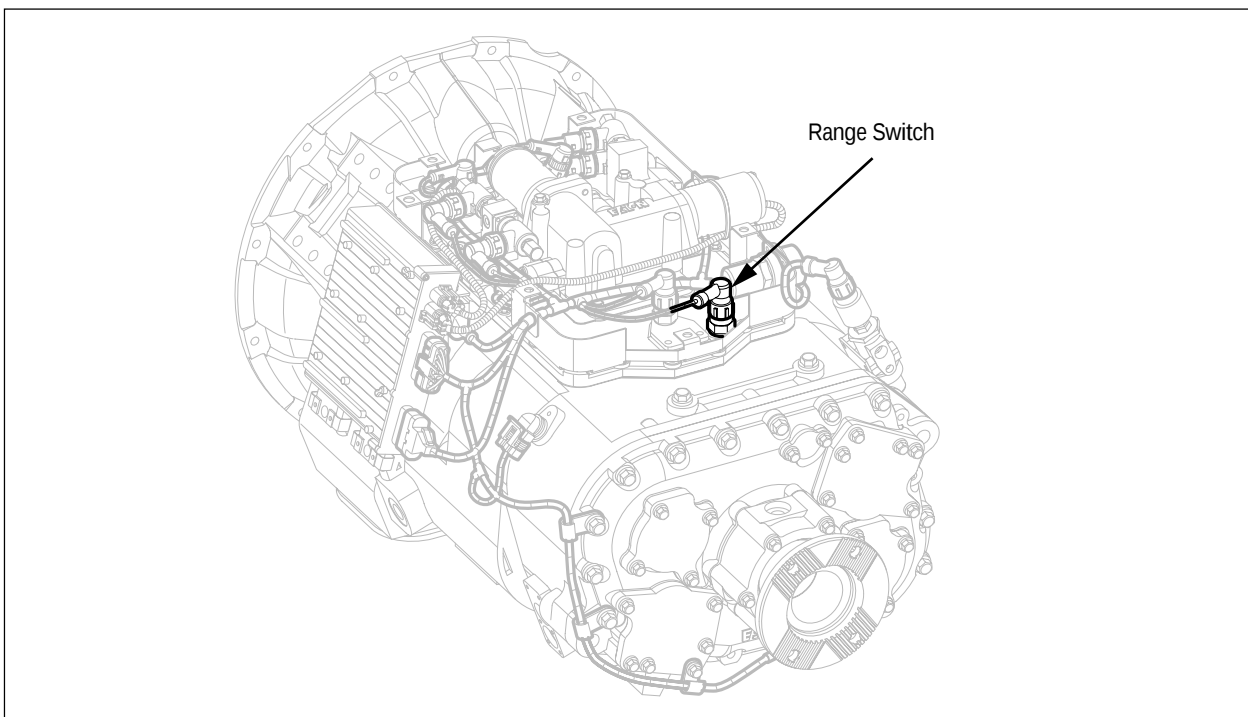


Figure 27. Range Switch Location

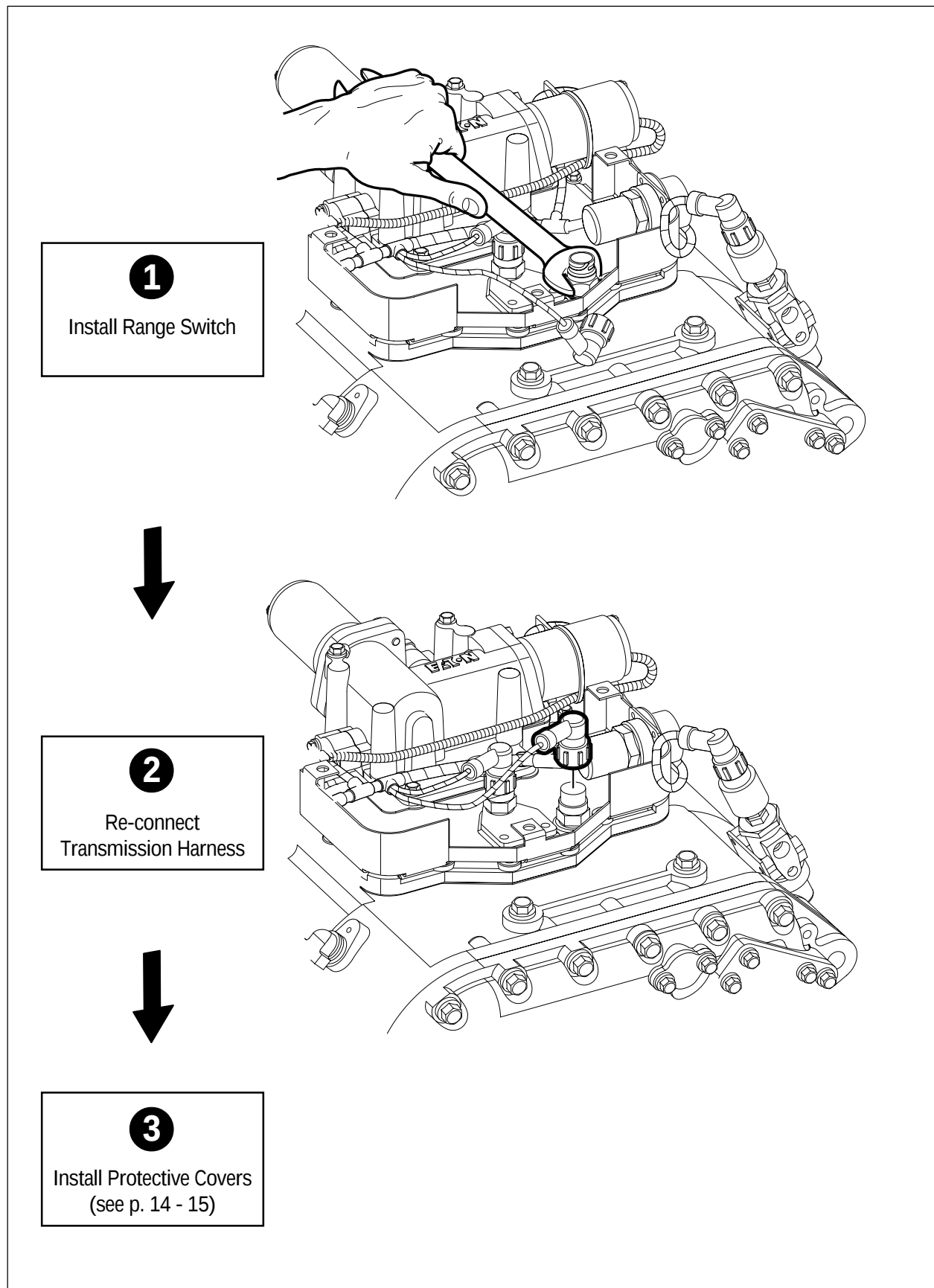


Figure 28. Range Switch – Installation

Range Solenoid Assembly – Removal

Special Instructions

None

Required Tools

Basic Hand Tools

Removal

1. Drain air system. Using a flat blade screwdriver, remove the Transmission Protective Covers by turning the attaching screws 180 degrees.
 2. Disconnect the Transmission Harness from the Range Solenoid Assemblies (L & H).
 3. Using an 11mm wrench, remove the air supply hose between the Air Filter Regulator and the Range Solenoid Assembly.
 4. Using an 11mm wrench, remove the Upshift Brake air supply line from the Range Solenoid Assembly.
 5. Using a 14 mm wrench, remove the air pipe between the Range Solenoid Assembly and the Splitter Solenoid Assembly.
- NOTE:** Take note of the copper washers at the ends of the air pipe.
6. Using a 13 mm wrench, remove the two mounting capscrews from the Range Solenoid Assembly.
 7. Lift the Range Solenoid Assembly from the Shift Bar Housing.
- NOTE:** Take note of the two O-rings at the air ports. Do not lose them.

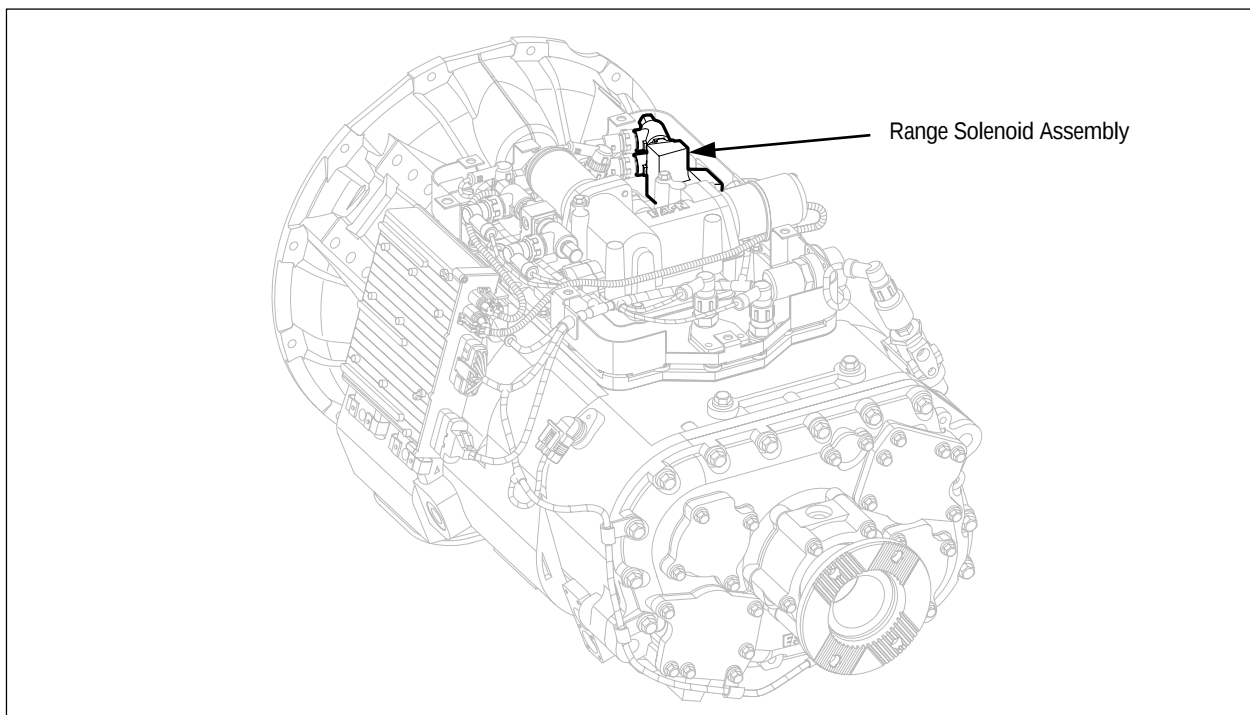


Figure 29. Range Solenoid Assembly Location

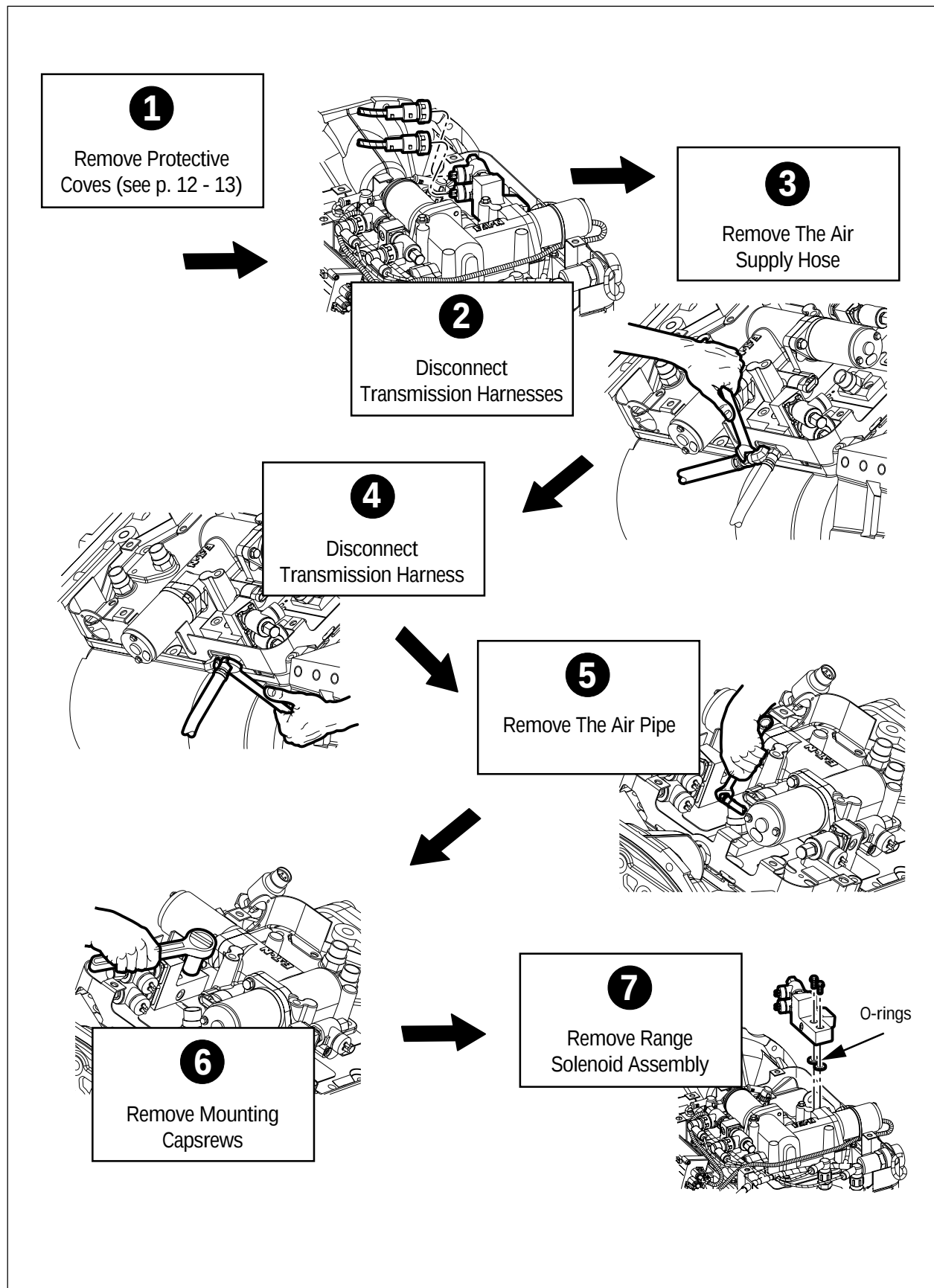


Figure 30. Range Solenoid Assembly Removal

Range Solenoid Assembly – Installation

Special Instructions

Use care when installing O-rings.

Lubricate O-rings with Eaton / Fuller silicone #71214 or equivalent.

Required Tools

Basic Hand Tools

Installation

NOTE: Make sure O-rings are in place on the Shift Bar Housing.

1. Install the Range Solenoid Assembly on the Shift Bar Housing.
2. Using a 13 mm wrench, install the two mounting capscrews. Torque to 40-45 Nm (30-33 lb-ft).
3. Using a 14 mm wrench, install the air pipe between the Splitter Solenoid Assembly and the Range Solenoid Assembly.

4. Using an 11 mm wrench, install the Upshift Brake air supply line to the Range Solenoid Assembly.
5. Using an 11 mm wrench, install the air supply hose between the Air Filter Regulator and the Range Solenoid Assembly.
6. Re-connect the Transmission Harness to the Range Solenoid Assembly (L & H).
7. Using a flat blade screwdriver, install the Transmission Protective Covers by turning the attaching screws 180 degrees.

Final Check

Make sure the mounting capscrews are properly torqued.

Make sure there are no air leaks.

Make sure that all of the connectors are properly connected and locked.

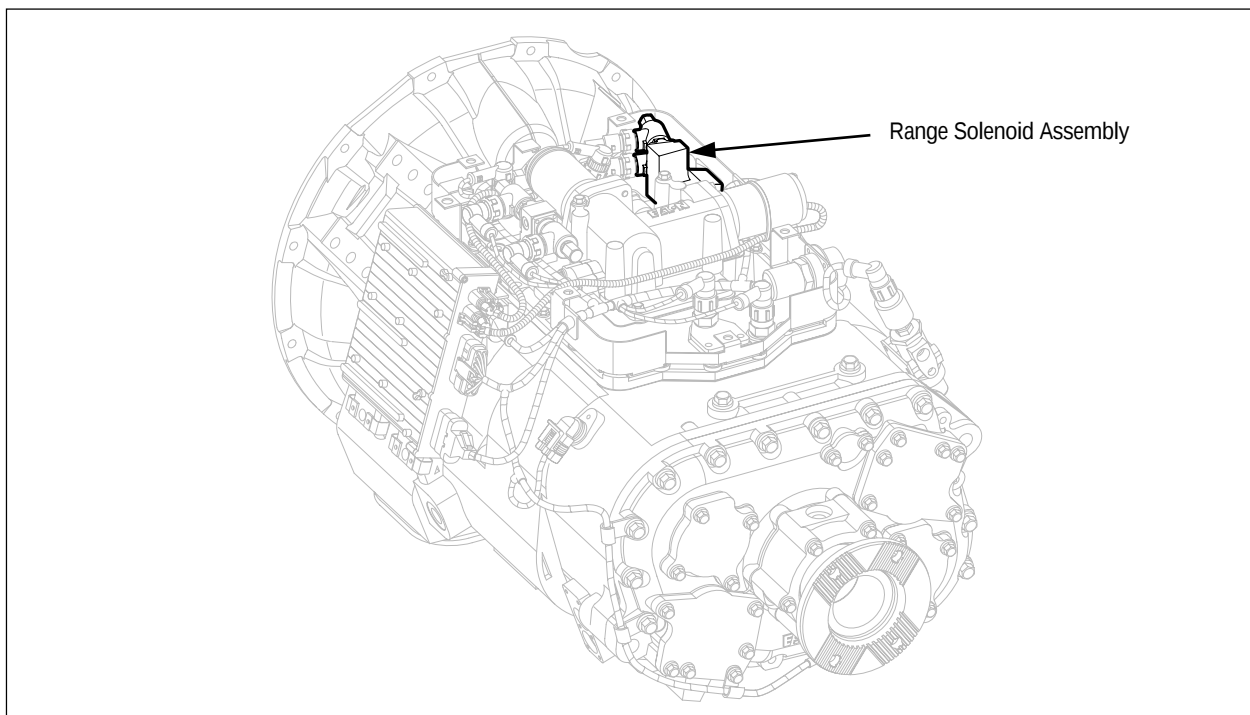


Figure 31. Range Solenoid Assembly Location

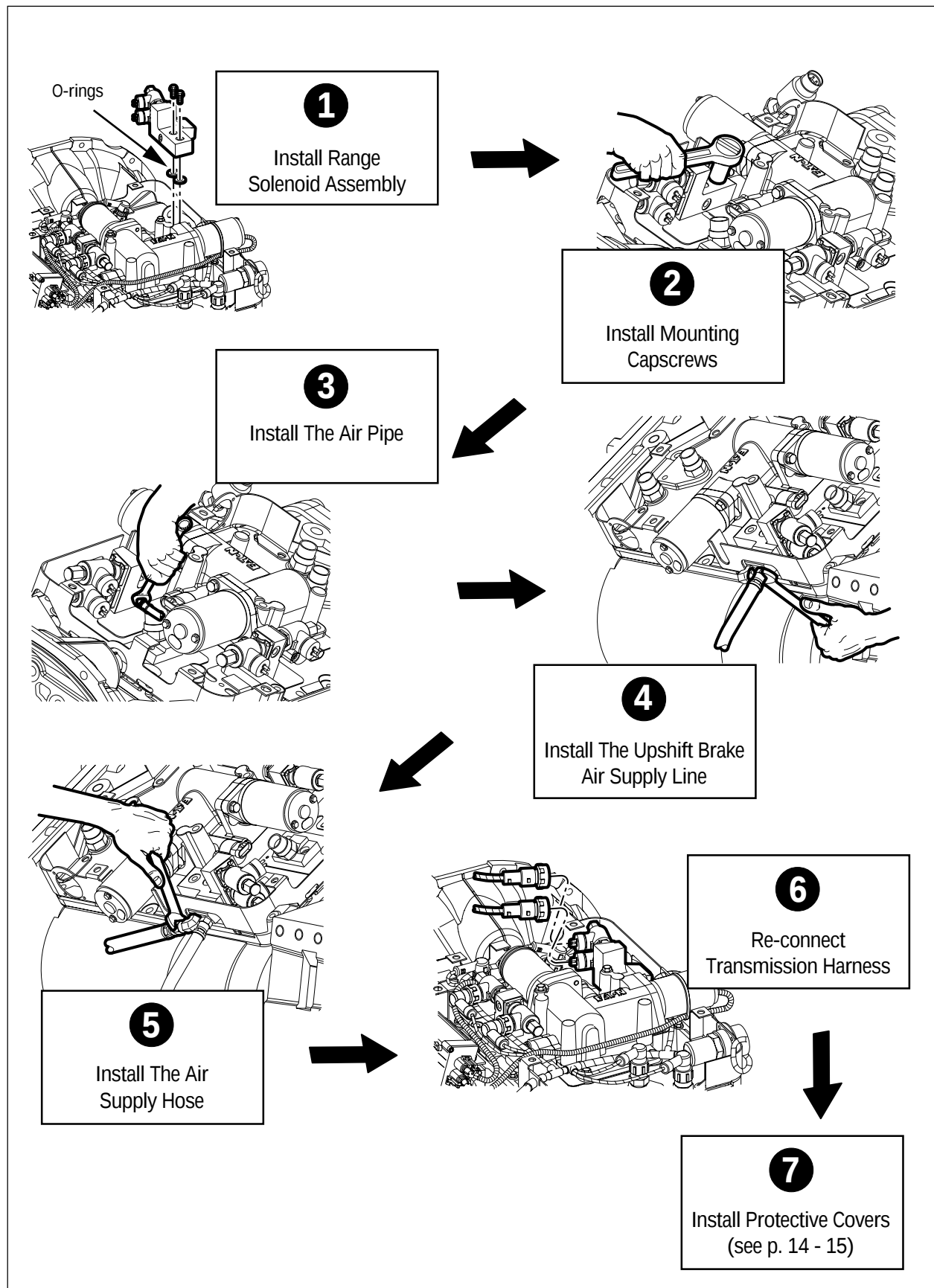


Figure 32. Range Solenoid Assembly – Installation

Neutral Switch – Removal

Special Instructions

None

Required Tools

Basic Hand Tools

Removal

1. Using a flat blade screwdriver, remove the Transmission Protective Covers by turning the attaching screws 180 degrees.
2. Disconnect the Transmission Harness from the Neutral Switch (N).
3. Using a 27 mm wrench, remove the Neutral Switch.

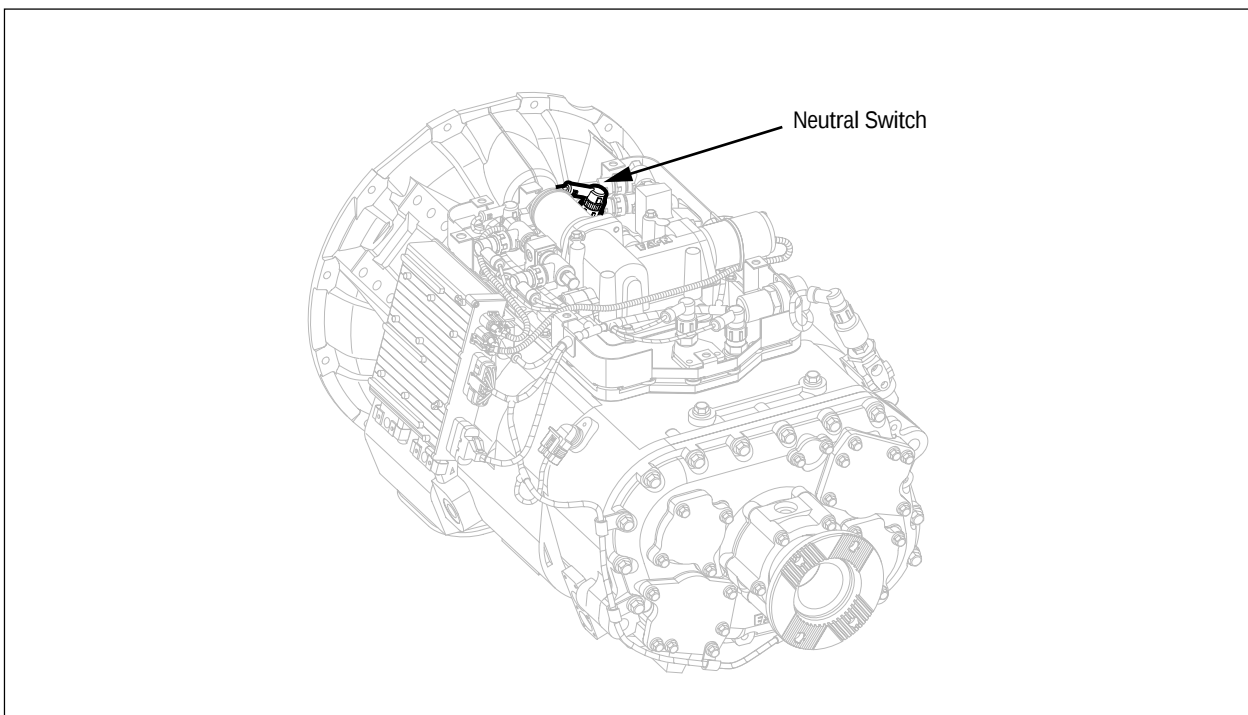


Figure 33. Neutral Switch Location

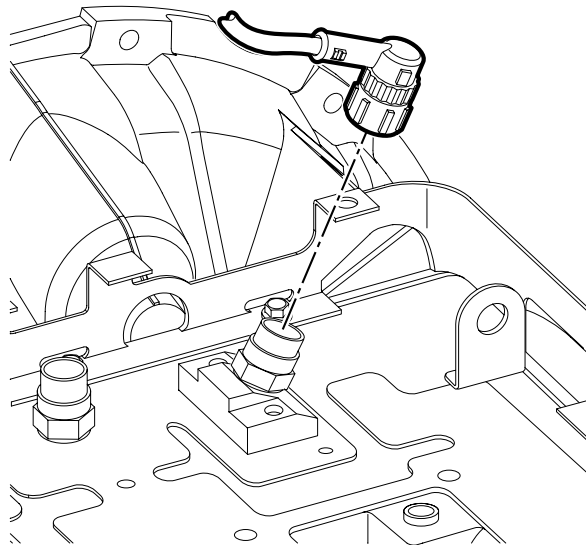
1

Remove Protective
Covers (see p. 12 - 13)



2

Disconnect
Transmission Harness



3

Remove Neutral Switch

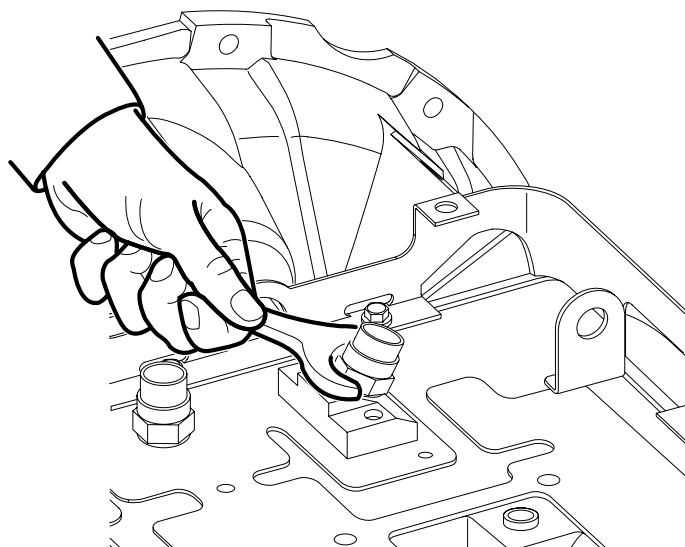


Figure 34. Neutral Switch – Removal

Neutral Switch – Installation

Special Instructions

None

Required Tools

Basic Hand Tools

Installation

1. Using a 27 mm wrench, install the Neutral Switch. Torque to 20-25 Nm (15-20 lb-ft).
2. Re-connect the Transmission Harness to the Neutral Switch (N).
3. Using a flat blade screwdriver, install the Transmission Protective Covers by turning the attaching screws 180 degrees.

Final Check

Make sure the Neutral Switch is properly torqued.

Make sure that all of the connectors are properly connected and locked.

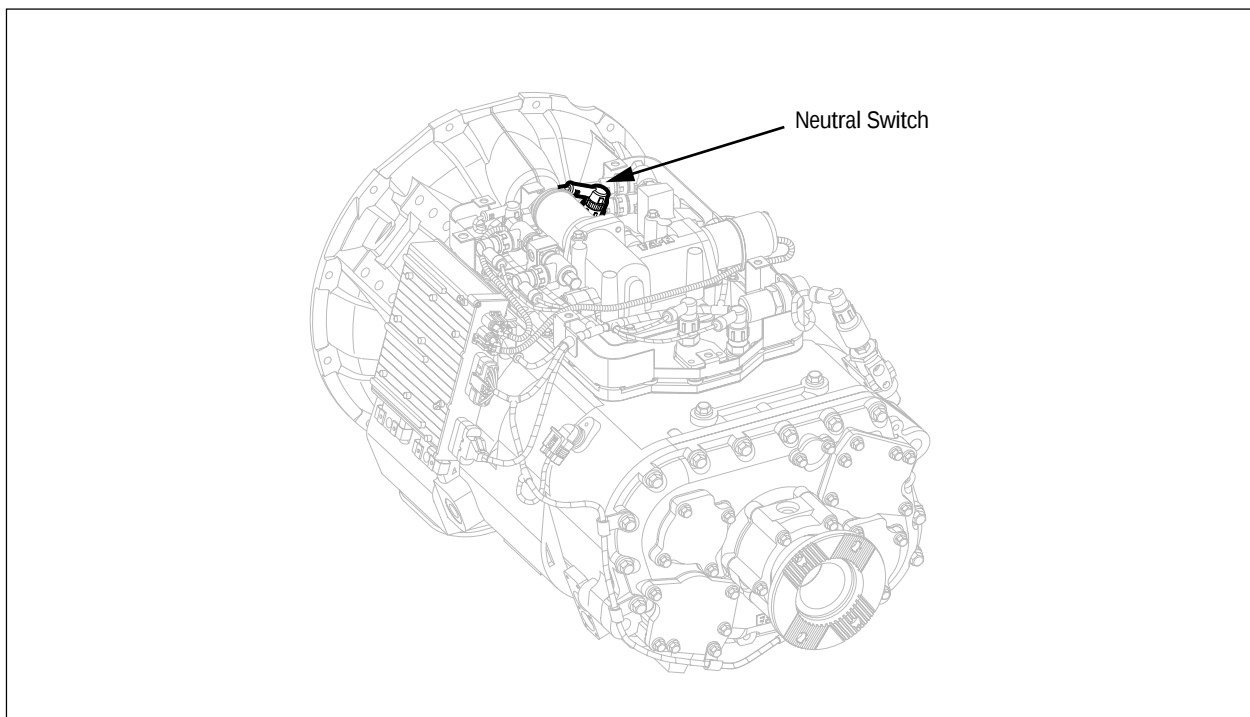
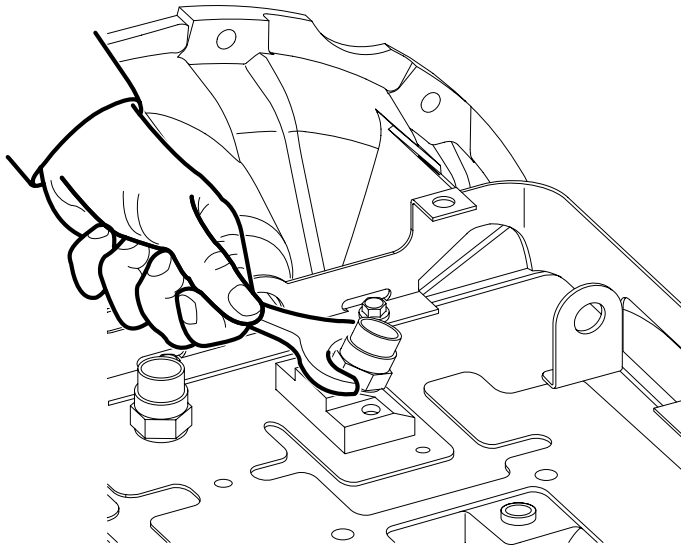
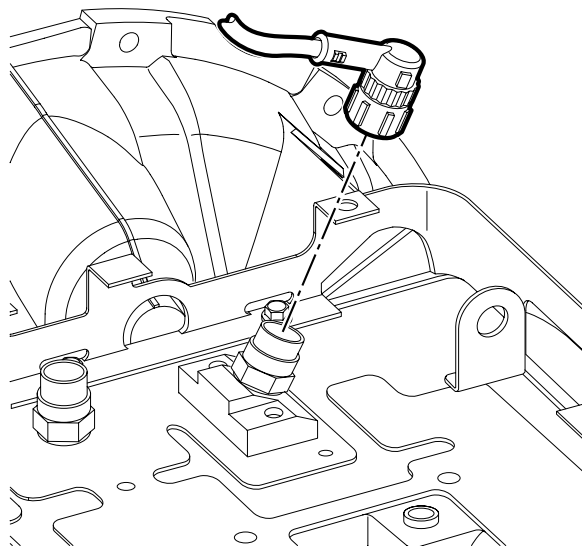


Figure 35. Neutral Switch Location

1
Install Neutral Switch



2
Re-connect
Transmission Harness



3
Install Protective Covers
(see p. 14 - 15)

Figure 36. Neutral Switch – Installation

Reverse Switch — Removal

Special Instructions

None

Required Tools

Basic Hand Tools

Removal

1. Using a flat blade screwdriver, remove the Transmission Protective Covers by turning the attaching screws 180 degrees.
2. Disconnect the Transmission Harness from the Reverse Switch (P).
3. Using a 27 mm wrench, remove the Reverse Switch.

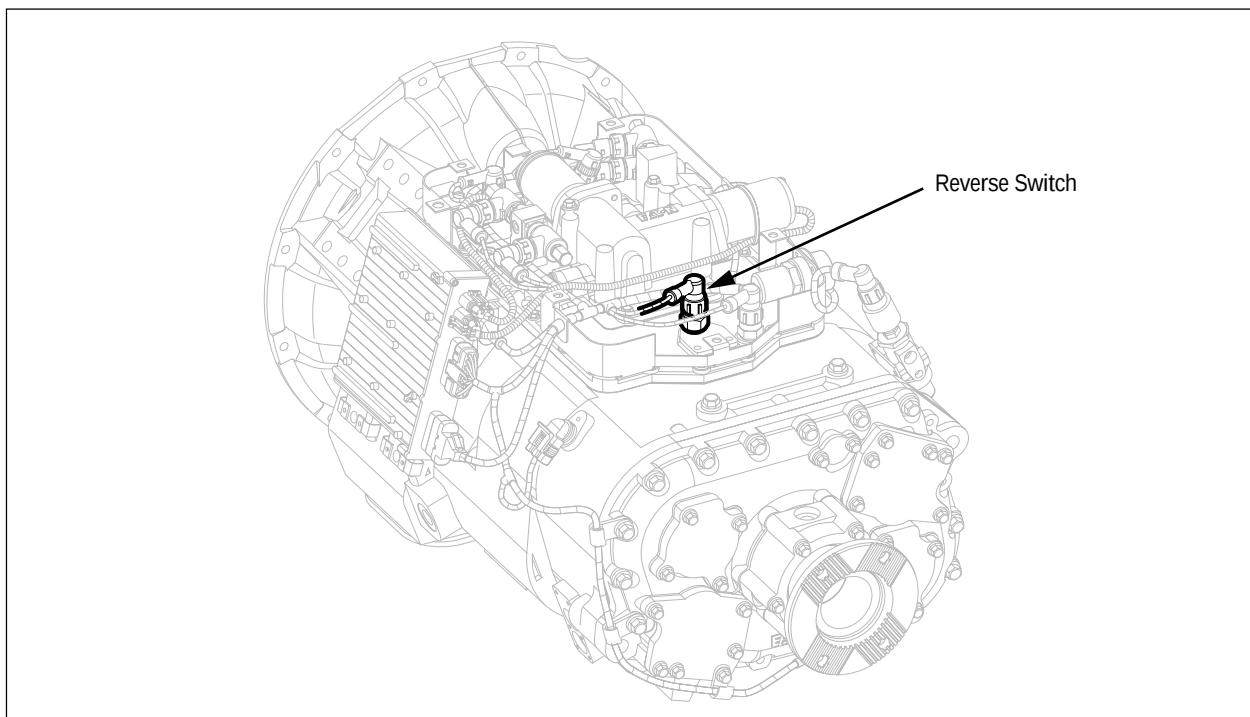


Figure 37. Reverse Switch Location

1
Remove Protective
Covers (see p. 12 - 13)



2
Disconnect
Transmission Harness



3
Remove Reverse Switch

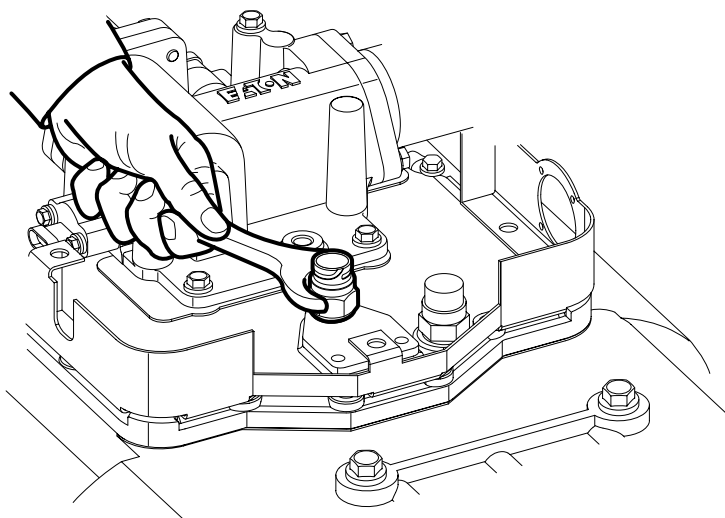
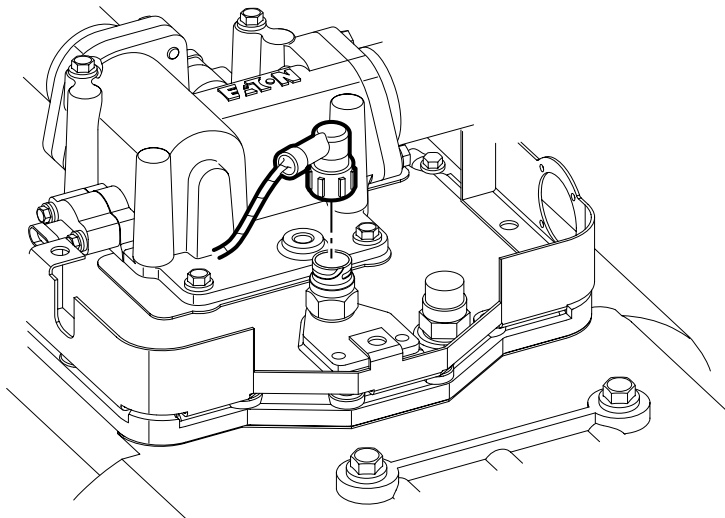


Figure 38. Reverse Switch – Removal

Reverse Switch – Installation

Special Instructions

None

Required Tools

Basic Hand Tools

Installation

1. Using a 27 mm wrench, install the Reverse Switch. Torque to 20-25 Nm (15-20 lb-ft).
2. Re-connect the Transmission Harness to the Reverse Switch (P).
3. Using a flat blade screwdriver, install the Transmission Protective Covers by turning the attaching screws 180 degrees.

Final Check

Make sure that all of the connectors are properly connected and locked.

Make sure that the Reverse Switch is properly torqued.

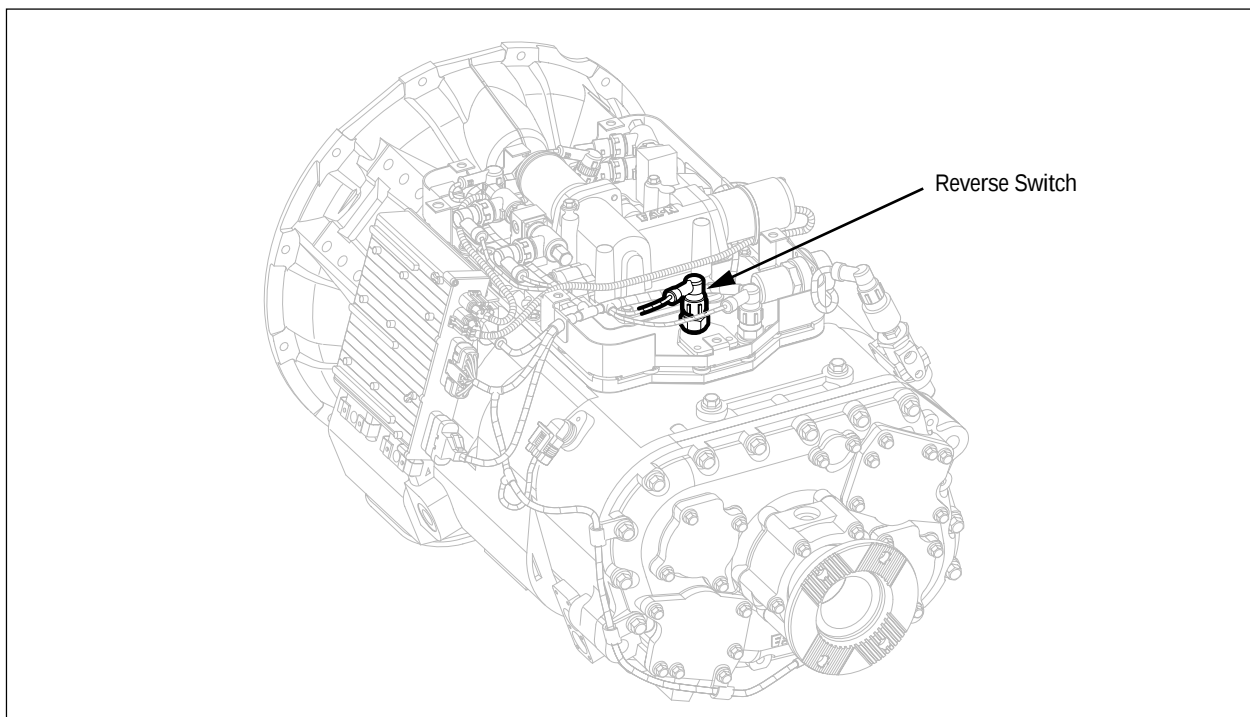
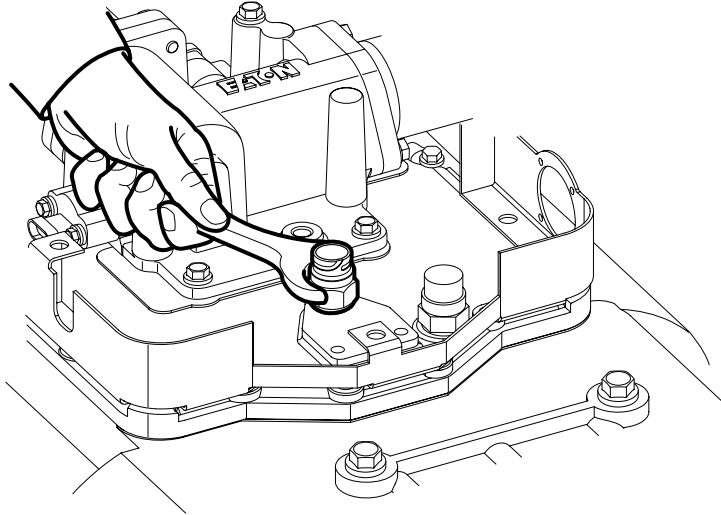


Figure 39. Reverse Switch Location

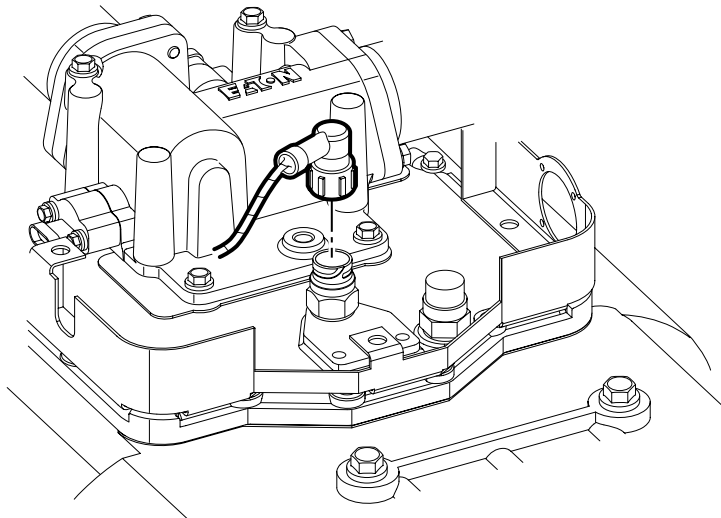
1

Install Reverse Switch



2

Re-connect
Transmission Harness



3

Install Protective Covers
(see p. 14 - 15)

Figure 40. Reverse Switch – Installation

Splitter Switch – Removal

Special Instructions

None

Required Tools

Basic Hand Tools

Removal

1. Using a flat blade screwdriver, remove the Transmission Protective Covers by turning the attaching screws 180 degrees.
2. Disconnect the Transmission Harness from the Splitter Switch (M).
3. Using a 27 mm wrench, remove the Splitter Switch.

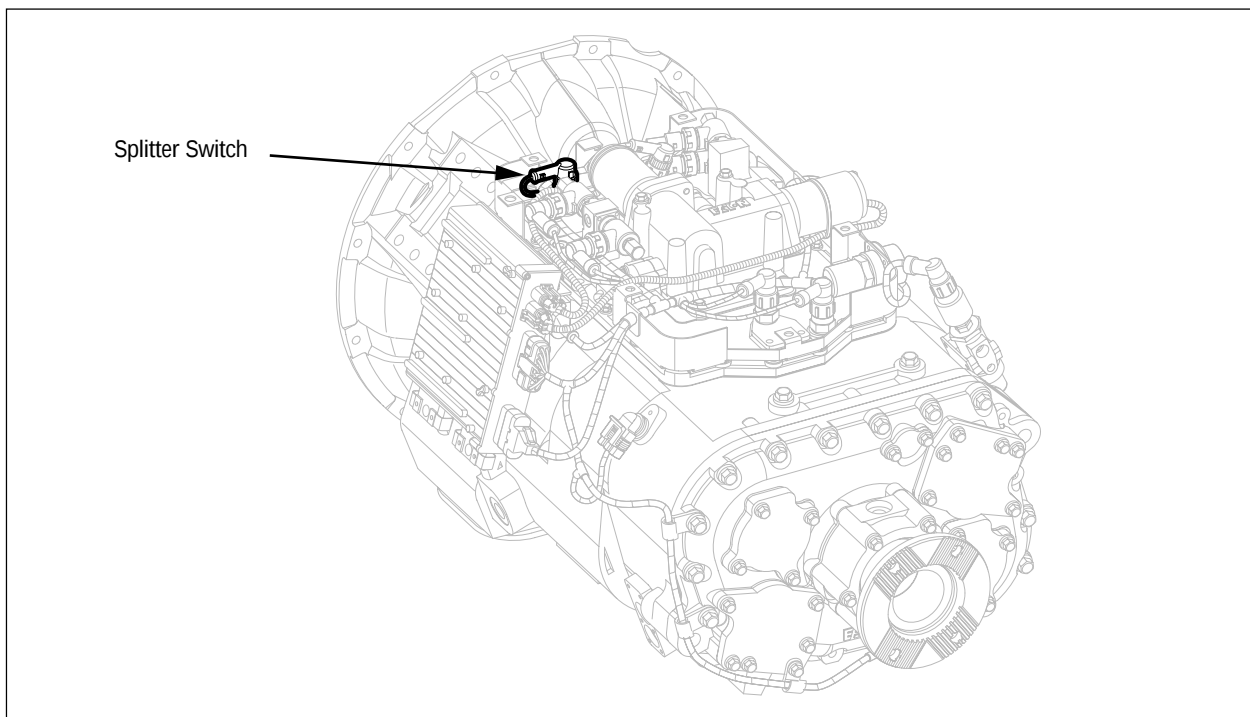


Figure 41. Splitter Switch Location

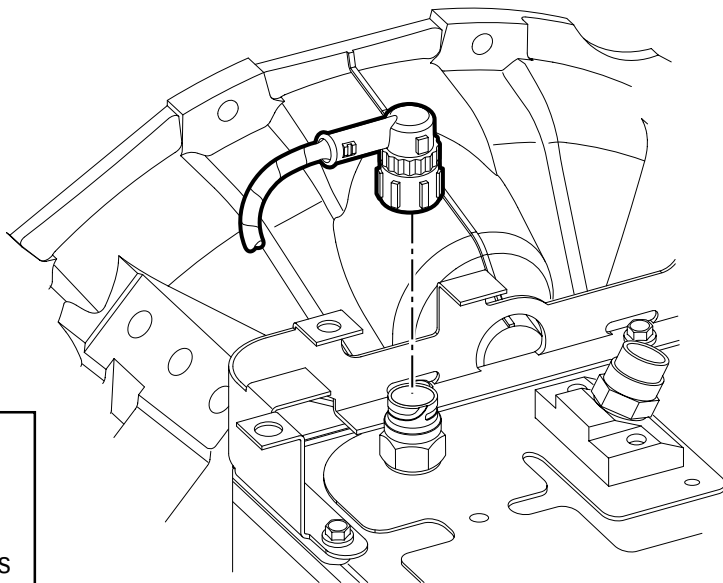
1

Remove Protective Covers
(see p. 12 - 13)



2

Disconnect
Transmission Harness



3

Remove Splitter Switches

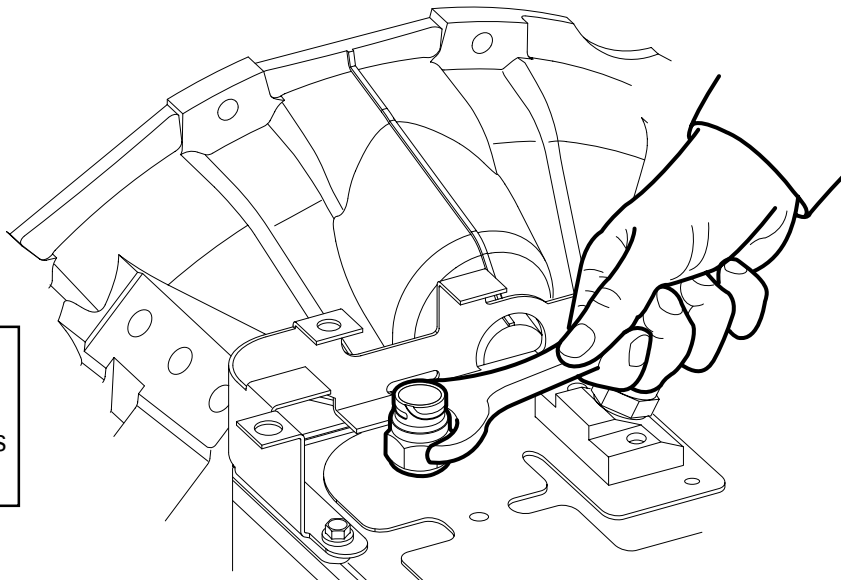


Figure 42. Splitter Switch – Removal

Splitter Switch – Installation

Special Instructions

None

Required Tools

Basic Hand Tools

Installation

1. Using a 27 mm wrench, install the Splitter Switch. Torque to 20-25 Nm (15-20 lb-ft).
2. Re-connect the Transmission Harness to the Splitter Switch (M).
3. Using a flat blade screwdriver, install the Transmission Protective Covers by turning the attaching screws 180 degrees.

Final Check

Make sure that all of the connectors are properly connected and locked.

Make sure that the Splitter Switch is properly torqued.

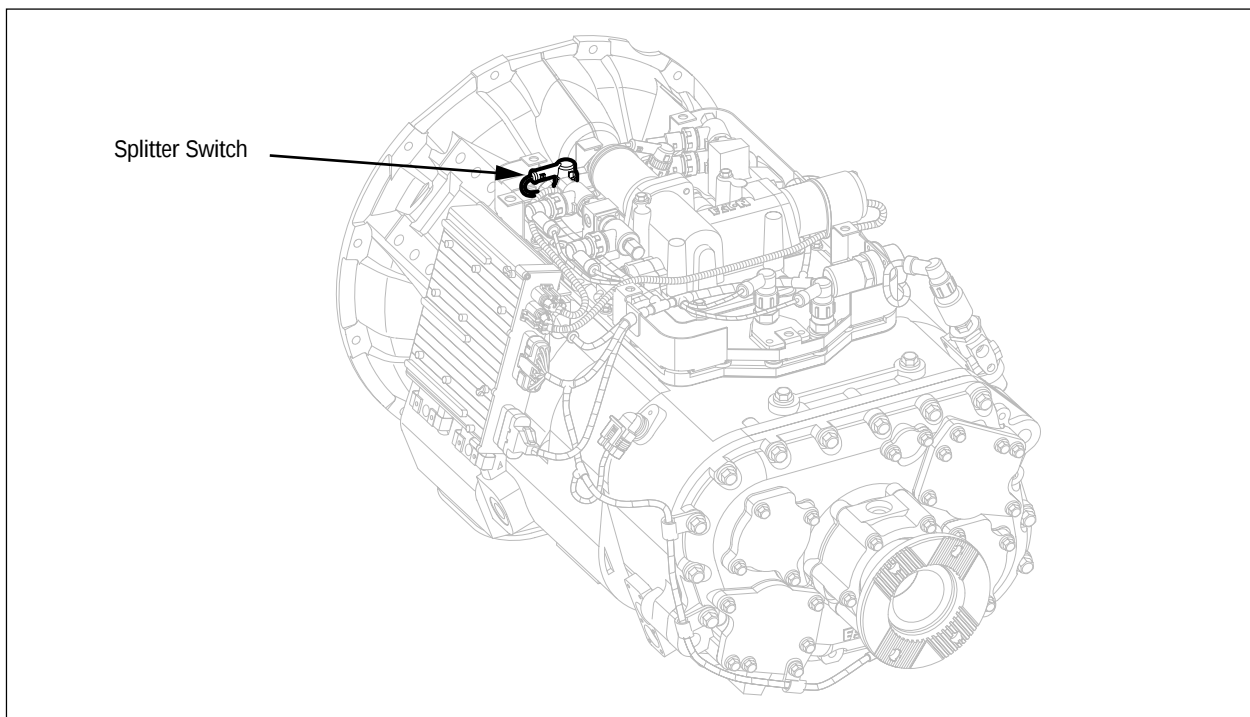


Figure 43. Splitter Switch Location

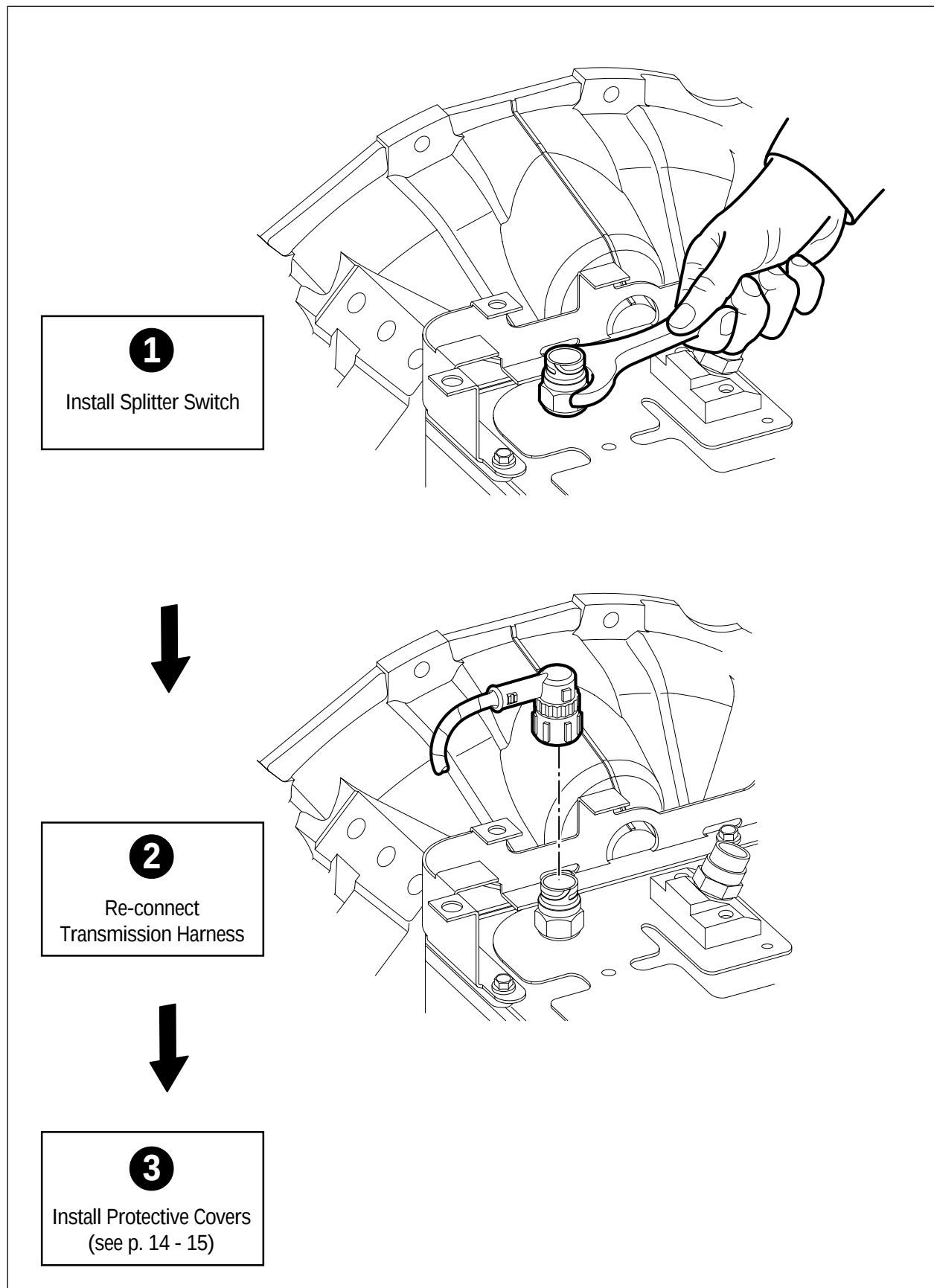


Figure 44. Splitter Switch – Installation

Splitter Solenoid Assembly – Removal

Special Instructions

None

Required Tools

Basic Hand Tools

Removal

1. Drain air system. Using a flat blade screwdriver, remove the Transmission Protective Covers by turning the attaching screws 180 degrees.
2. Remove Transmission Harness from the Splitter Solenoid Assembly (S and D).
3. Using a 14 mm wrench, remove the air pipe between the Splitter Solenoid Assembly and the Range Solenoid Assembly.
4. Using a 13 mm wrench, remove the two mounting capscrews from the Splitter Solenoid Assembly.
5. Remove Splitter Solenoid Assembly from the Shift Bar Housing.

NOTE: Take note of the two O-rings at the air ports. Do not lose them.

NOTE: Take note of the copper washers at the ends of the air pipe.

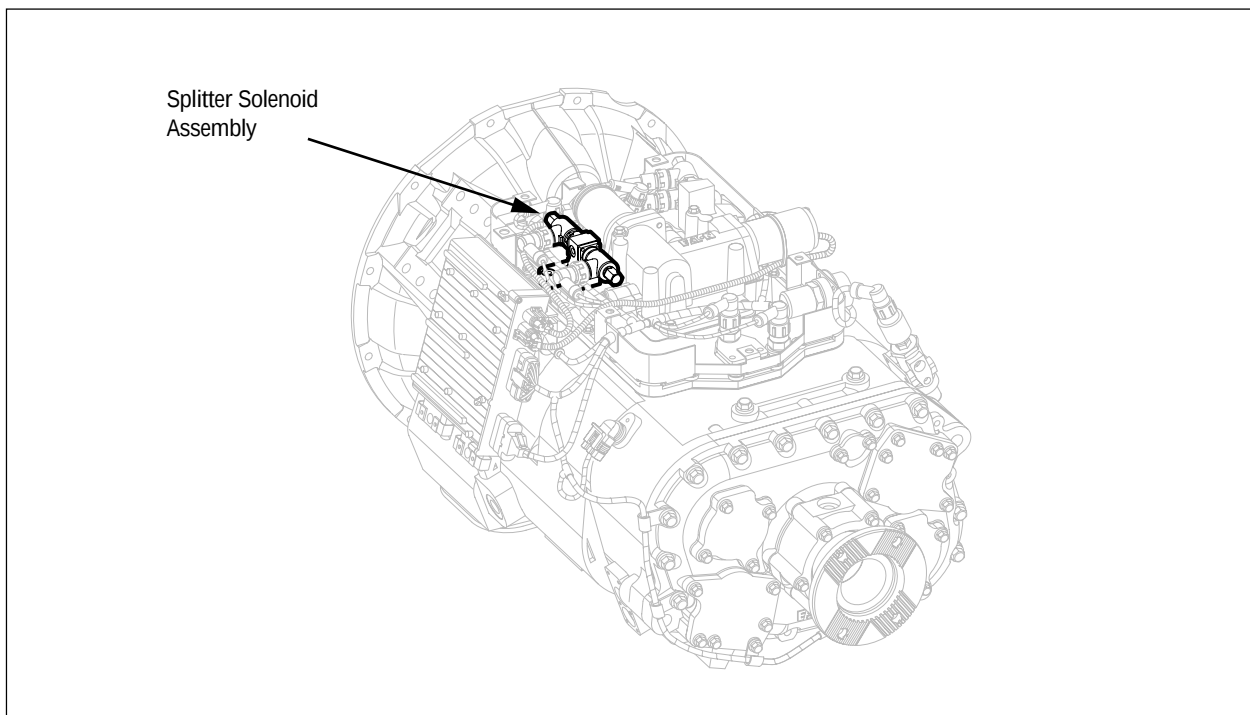


Figure 45. Splitter Solenoid Assembly Location

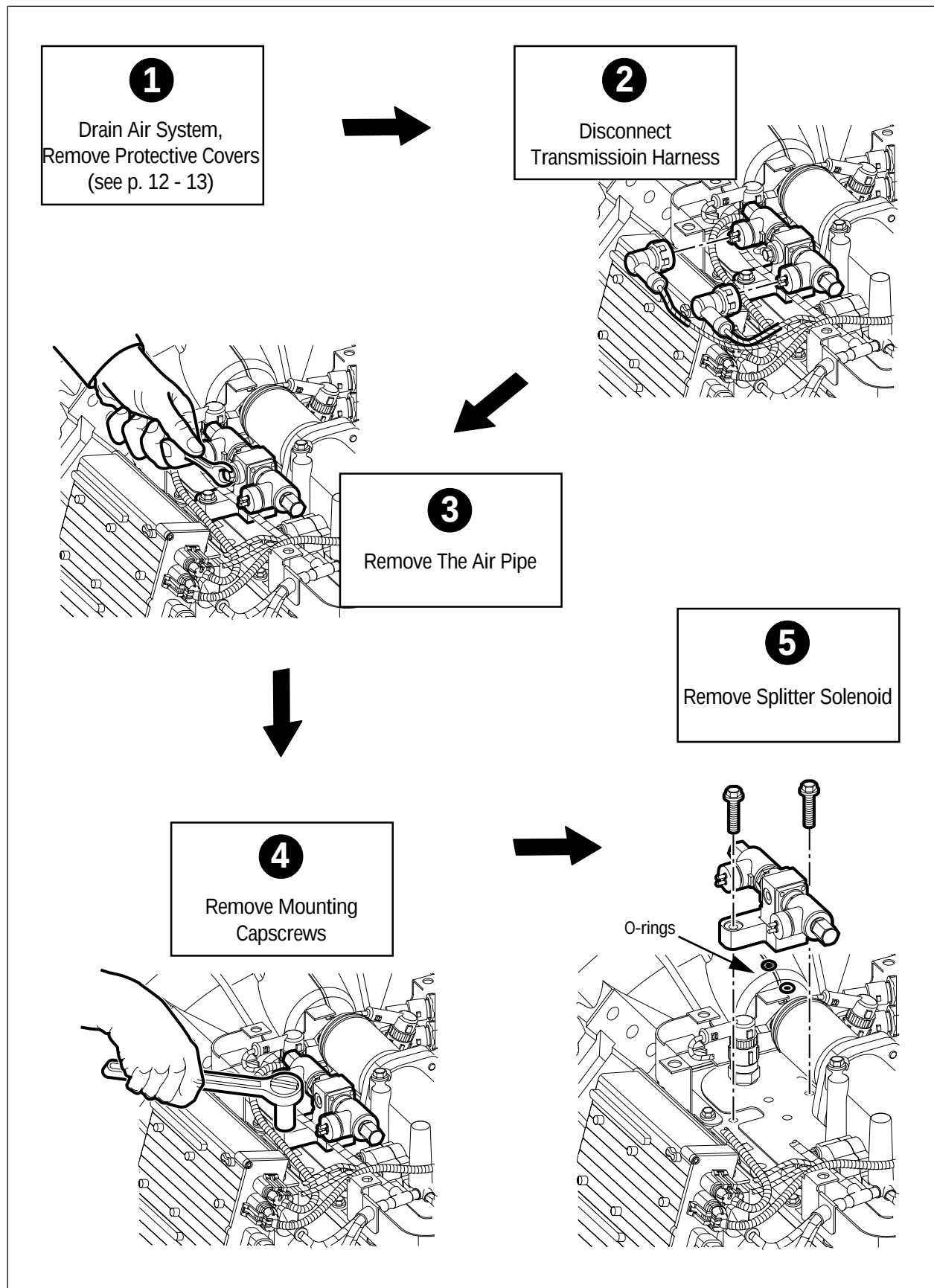


Figure 46. Splitter Solenoid Assembly – Removal

Splitter Solenoid Assembly – Installation

Special Instructions

Lubricate O-rings with Eaton/Fuller silicone #71214 or equivalent.

Use care when installing the O-rings.

Required Tools

Basic Hand Tools

3. Using a 14 mm wrench, install the air pipe between the Splitter Solenoid Assembly and the Range Solenoid Assembly.
4. Re-connect the Transmission Harness to the Splitter Solenoid Assembly (S and D).
5. Using a flat blade screwdriver, install the Transmission Protective Covers by turning the attaching screws 180 degrees.

Installation

NOTE: Make sure that the O-rings are in place on the Shift Bar Housing.

1. Install the Splitter Solenoid Assembly on the Shift Bar Housing.
2. Using a 13 mm wrench, install the two mounting capscrews. Torque to 40-45 Nm (30-33 lb-ft).

Final Check

Make sure the mounting capscrews are properly torqued.

Make sure there are no air leaks.

Make sure that all of the connectors are properly connected and locked.

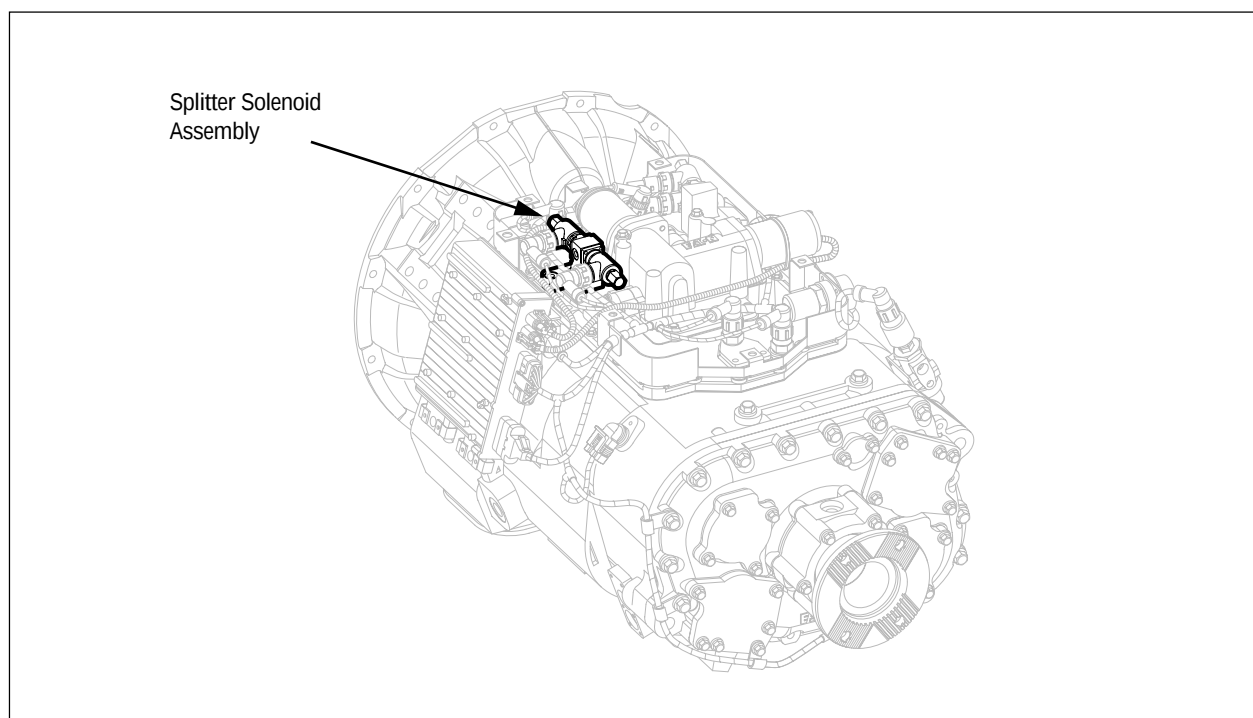


Figure 47. Splitter Solenoid Assembly Location

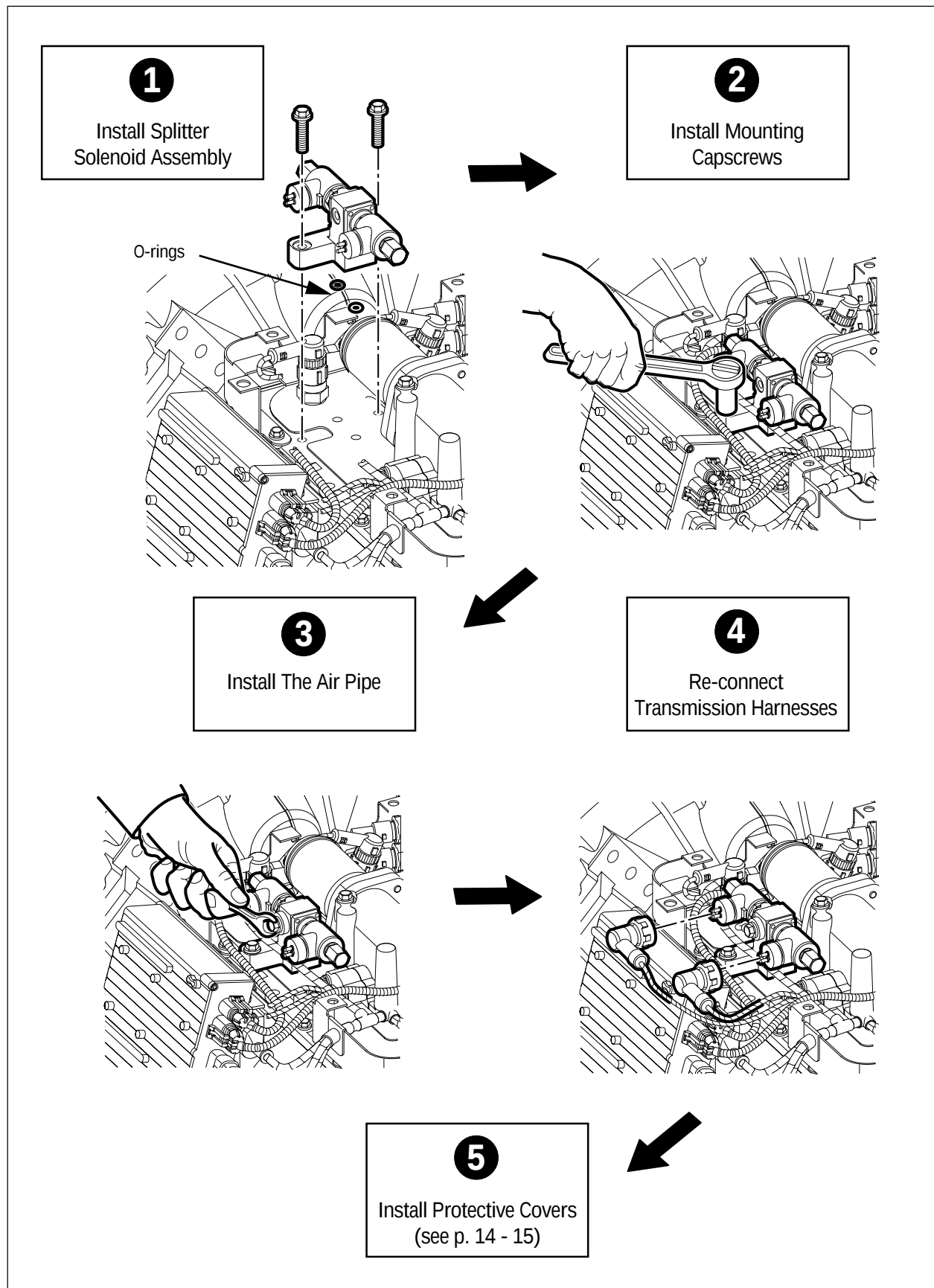


Figure 48. Splitter Solenoid Assembly – Installation

Upshift Brake Solenoid – Removal

Special Instructions

None

Required Tools

Basic Hand Tools

Removal

1. Drain the air system. Disconnect the Transmission Harness from the Front Counter Shaft Speed Sensor (T) and the Upshift Brake Solenoid (K).
 2. Using a 16 mm wrench, disconnect the air supply line from the Range Solenoid Assembly.
 3. Using a 14 mm wrench, remove the air pipe between the Upshift Brake and the Upshift Brake Solenoid.
- NOTE:** Take note of the brass washers on the air pipe capscrews.
4. Using a 13 mm wrench, remove the Upshift Brake Solenoid and bracket. Using a flat blade screwdriver, remove the bracket from the solenoid.

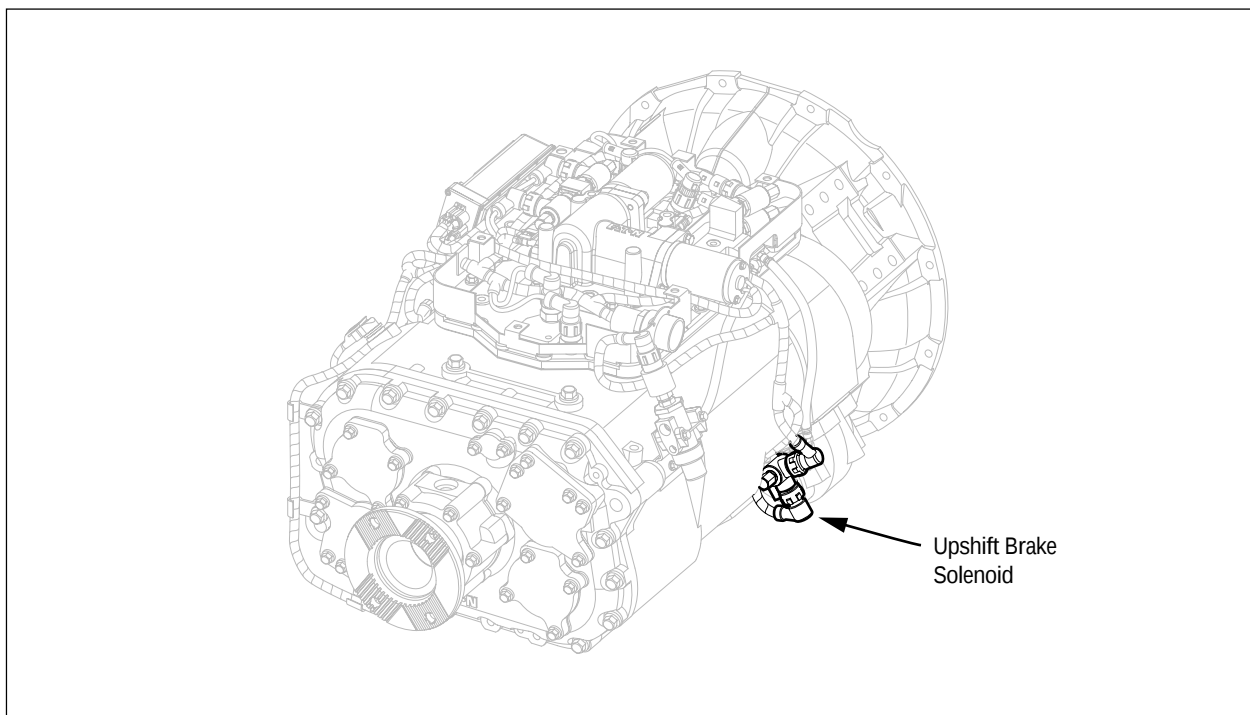


Figure 49. Upshift Brake Solenoid Location

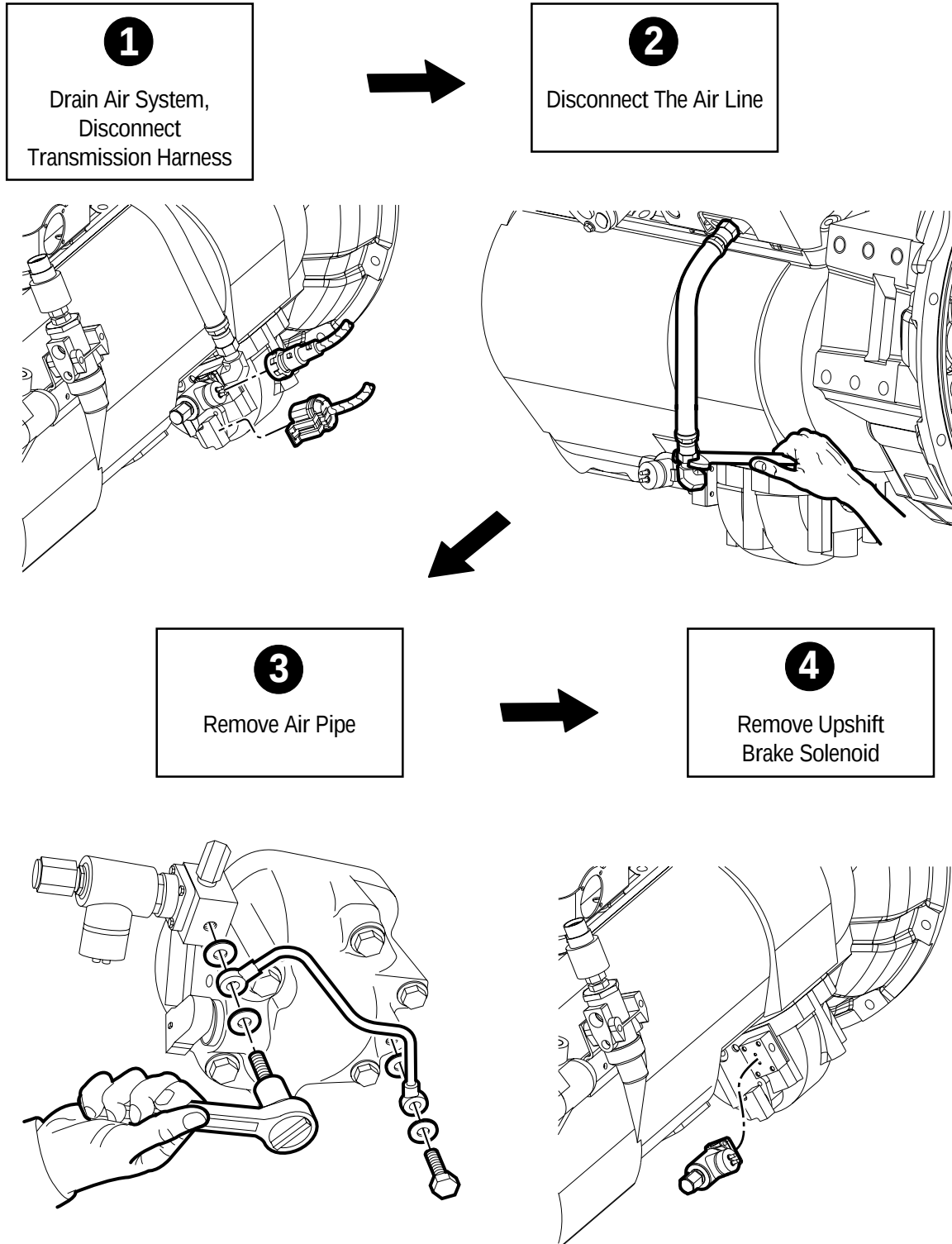


Figure 50. Upshift Brake Solenoid – Removal

Upshift Brake Solenoid – Installation

Special Instructions

None

Required Tools

Basic Hand Tools

Installation

1. Using a flat blade screwdriver, install the bracket onto the solenoid. Torque to 2-2.5 Nm (12-24 lb-in). Using a 13 mm wrench, install the Upshift Brake Solenoid and bracket to the Upshift Brake. Torque to 37-42 Nm (27-32 lb-ft).
2. Using a 16 mm wrench, connect the air line from the Range Solenoid Assembly to the Upshift Brake Solenoid.

3. Using a 14 mm wrench, install the air pipe between the Upshift Brake and the Upshift Brake Solenoid.

NOTE: Take note of the brass washers on the air pipe capscrews.

4. Re-connect the Transmission Harness to the Upshift Brake Solenoid (K) and the Front Counter Shaft Speed Sensor (T).

Final Check

Make sure that all of the connectors are properly connected and locked.

Make sure there are no air leaks.

Make sure that the mounting capscrews are properly torqued.

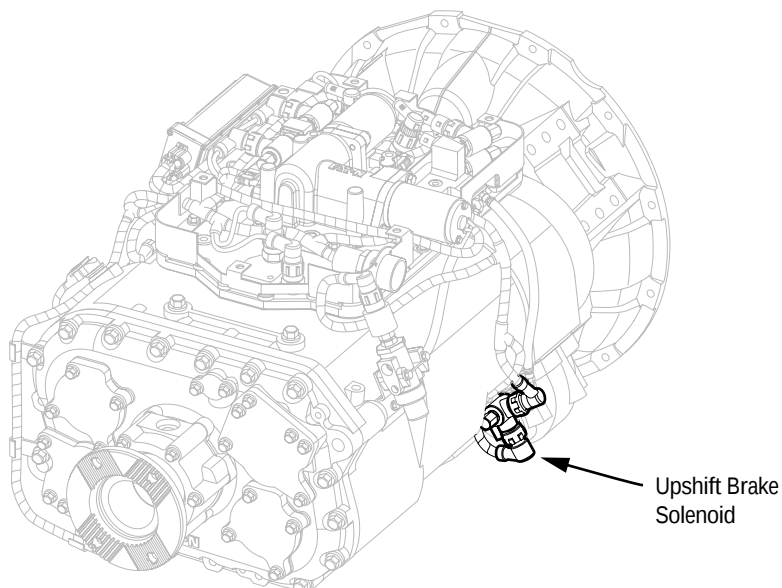


Figure 51. Upshift Brake Solenoid Location

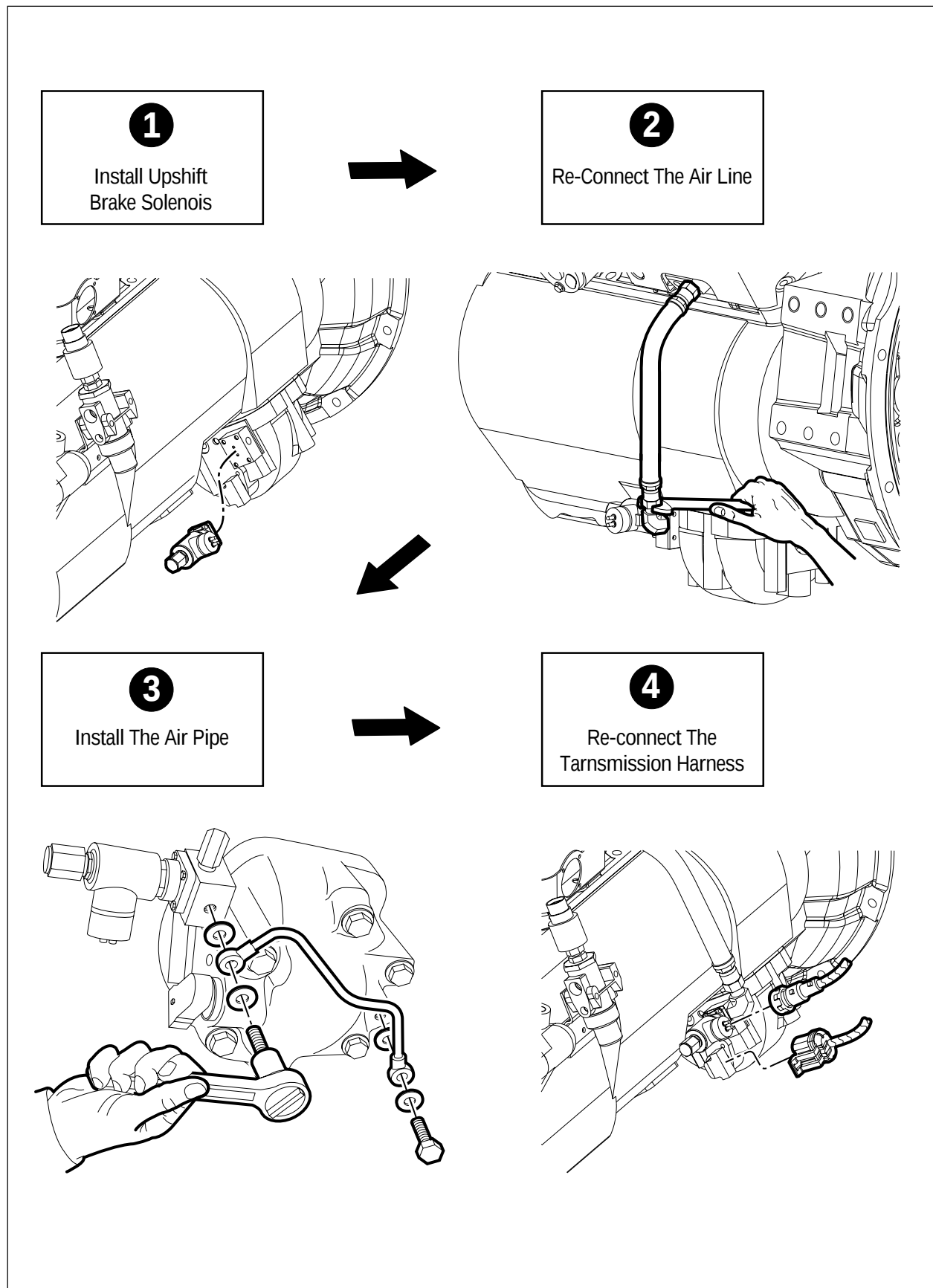


Figure 52. Upshift Brake Solenoid – Installation

Upshift Brake – Removal

Special Instructions



WARNING: Hot oil may be present when removing the Upshift Brake.

Required Tools

Basic Hand Tools

Removal

1. Prepare the Upshift Brake for removal as follows.
 - a. Drain transmission lubricant.
 - b. Disconnect the Transmission Harness from the Front Counter Shaft Speed Sensor (T) and Upshift Brake Solenoid (K).
2. Using a 14 mm wrench, remove the air pipe between the Upshift Brake Solenoid and the Upshift Brake.

NOTE: Take note of the brass washer on the air pipe capscsrews.

3. Using a 13 mm wrench, remove the Upshift Brake Solenoid Assembly and bracket.



WARNING: Upshift Brake is heavy.

4. Using a 15 mm wrench, remove the six mounting capscsrews from the Upshift Brake.
5. Remove the Upshift Brake and gasket from the transmission.



WARNING: Hot oil may be present in the Upshift Brake.

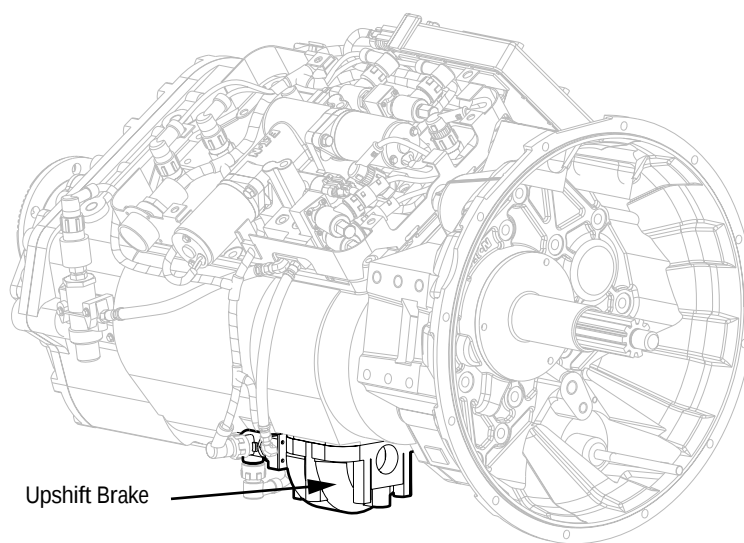


Figure 53. Upshift Brake Location

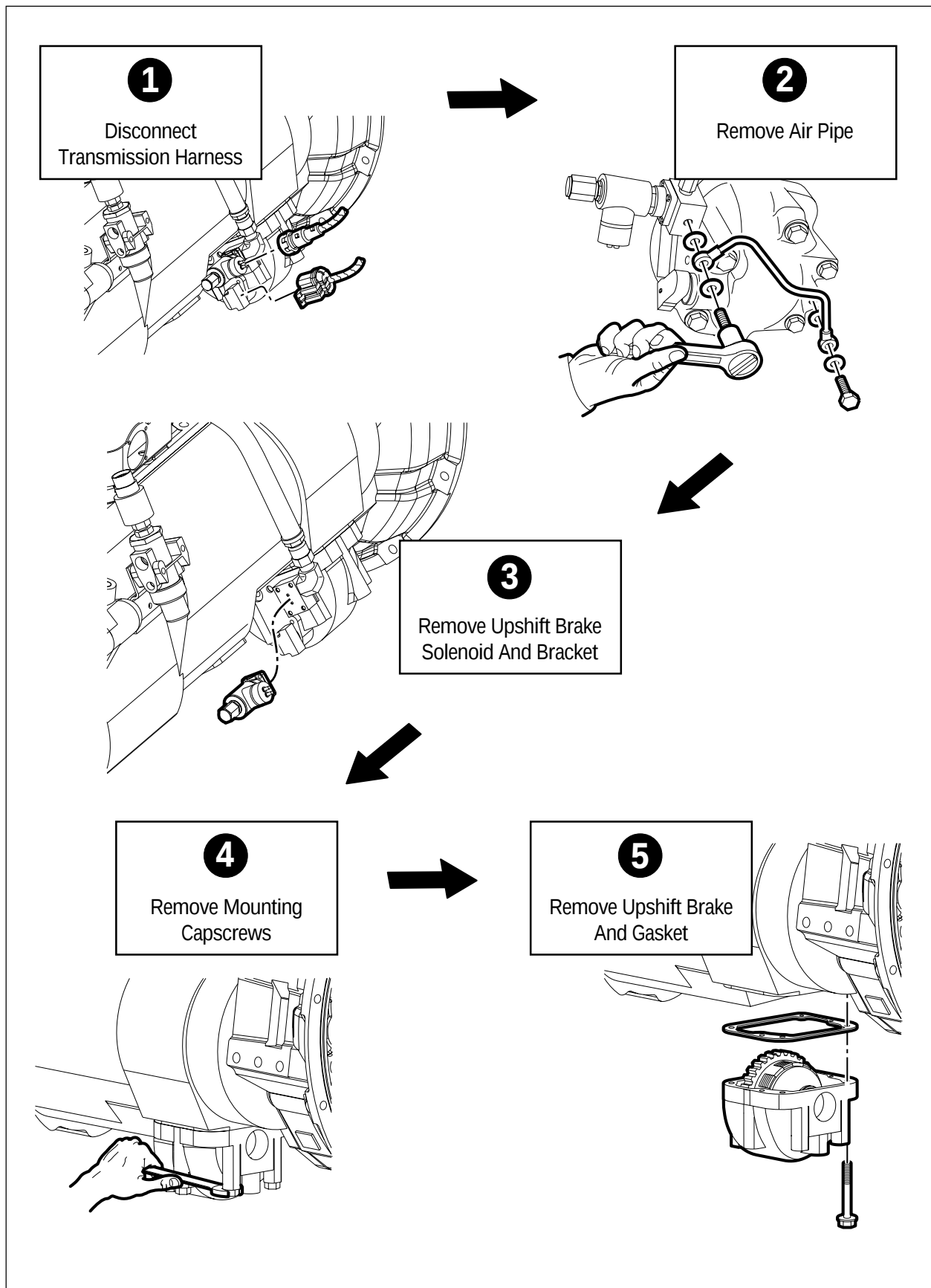


Figure 54. Upshift Brake – Removal

Upshift Brake – Installation

Special Instructions

Clean and remove old gasket material before installation.

Be sure to use sealing-type washers on the Upshift Brake mounting capscrews.

Required Tools

Basic Hand Tools

Installation



WARNING: Upshift Brake is heavy.

1. Install the Upshift Brake and new gasket to the transmission case by aligning the Upshift Brake Gear to the Transmission PTO Gear.
2. Using a 15 mm wrench, install the six mounting capscrews with new sealing washers. Torque to 45-70 Nm (33-52 lb-ft).
3. Using a 13 mm wrench, install the Upshift Brake Solenoid and bracket. Torque to 37-42 Nm (27-31 lb-ft).
4. Using a 14 mm wrench, install the air pipe between the Upshift Brake Solenoid and the Upshift Brake.

NOTE: Take note of the two brass washers.

5. Re-connect the Transmission Harness to the Upshift Brake Solenoid (K) and the Front Counter Shaft Speed Sensor (T).

Final Inspection

Make sure that mounting capscrews are properly torqued.

Refill and check the transmission lubricant level before driving the vehicle.

Make sure there are no air leaks.

Make sure that all of the connectors are properly connected and locked.

Check for lubricant leaks after operating the vehicle.

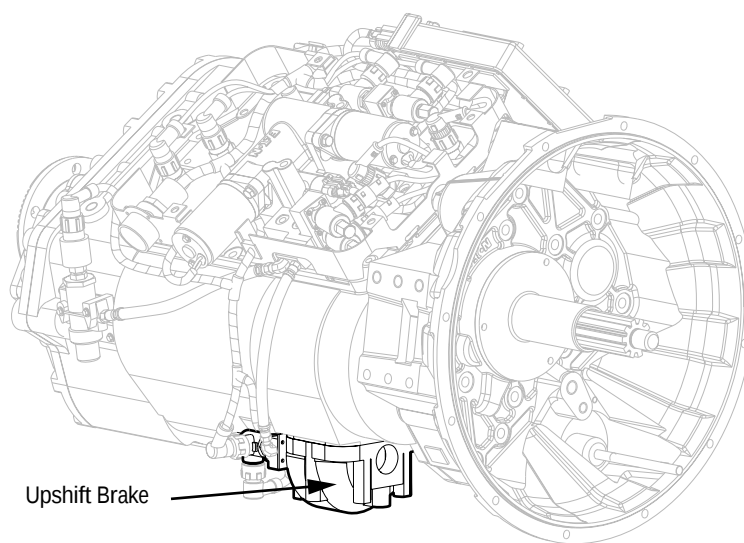


Figure 55. Upshift Brake Location

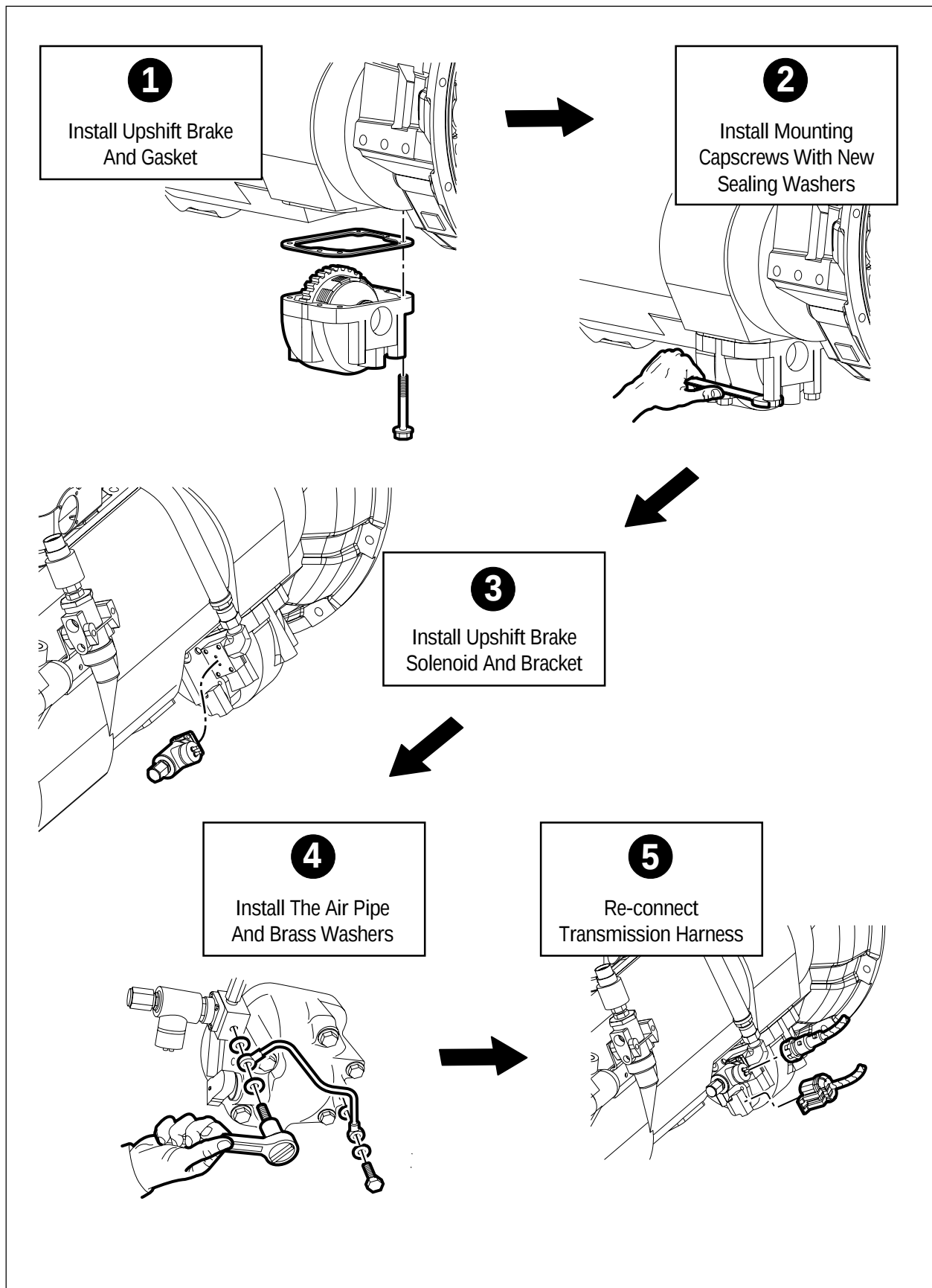


Figure 56. Upshift Brake – Installation

Front Counter Shaft / Main Shaft / Output Shaft Speed Sensor – Removal

Special Instructions

Drain the transmission lubricant before removing the Front Counter Shaft Speed Sensor.

Required Tools

Basic Hand Tools

2. Using a 10 mm wrench, remove the sensor retainer capscrews and lock plate.
3. Remove the sensor and O-ring from the transmission housing.



WARNING: Hot oil may be present when removing the Front Counter Shaft Speed Sensor.

Removal

1. Disconnect the Transmission Harness from the Speed Sensor.

NOTE: Before removing Front Counter Shaft Speed Sensor, drain the lubricant from transmission.

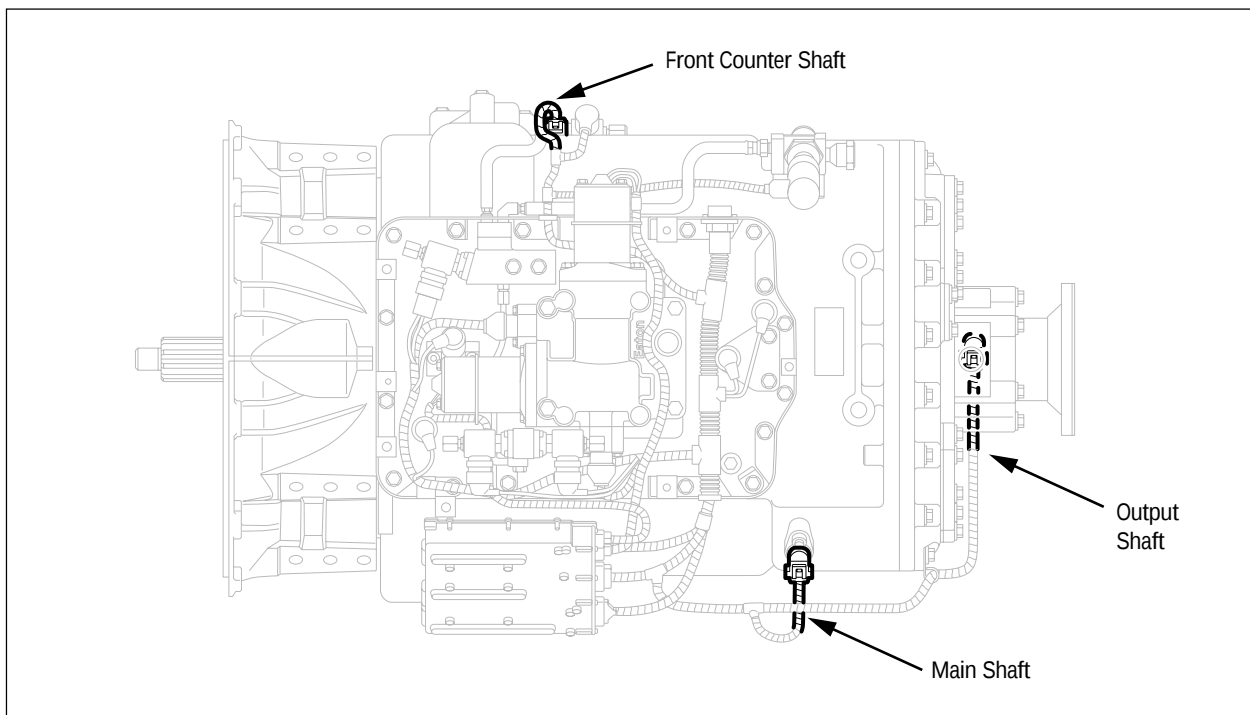


Figure 57. Front Counter Shaft / Main Shaft / Output Shaft Speed Sensor Location

1
Disconnect
Transmission Harness



2
Remove Mounting
Capscrews And Plate



3
Remove Sensor

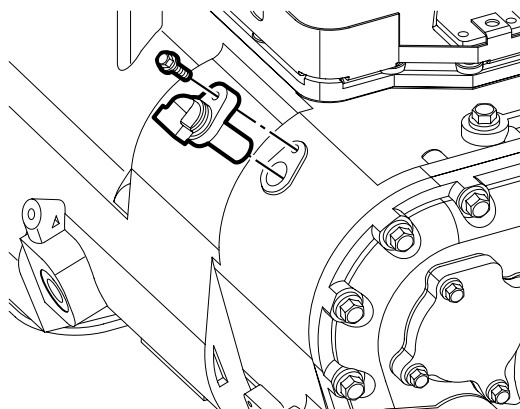
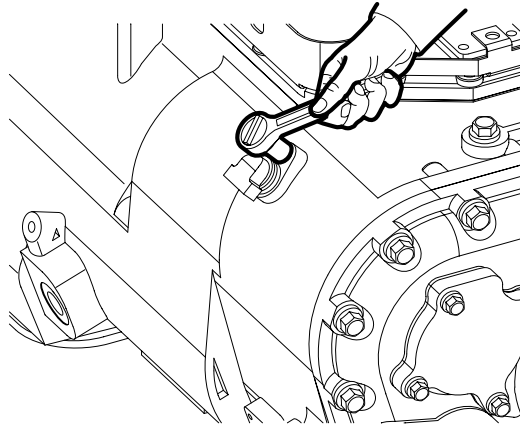
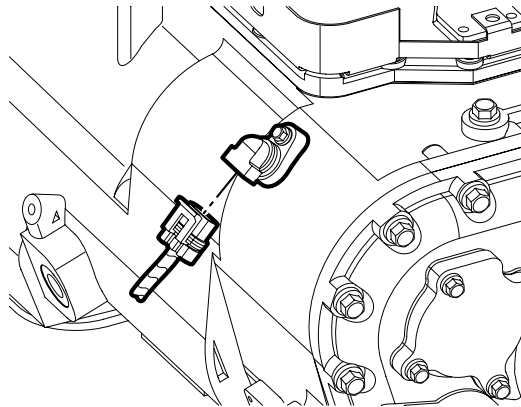


Figure 58. Front Counter Shaft / Main Shaft / Output Shaft Speed Sensor – Removal

Front Counter Shaft / Main Shaft / Output Shaft Speed Sensor – Installation

Special Instructions

Lubricate the O-ring with Eaton Fuller silicone # 71214 or equivalent.

Required Tools

Basic Hand Tools

Installation

1. Using a smooth, twisting motion, fully install sensor in the transmission housing opening.
2. Using a 10 mm wrench, install the sensor retainer capscrews and plate. Torque to 10-13 Nm (8-10 lb-ft).
3. Re-connect the Transmission Harness to the Speed Sensor.

Final Check

Refill and check transmission lubricant level before driving vehicle.

Make sure that the mounting capscrew is properly torqued.

Make sure that all of the connectors are properly connected and locked.

Check for lubricant leaks after operating the vehicle.

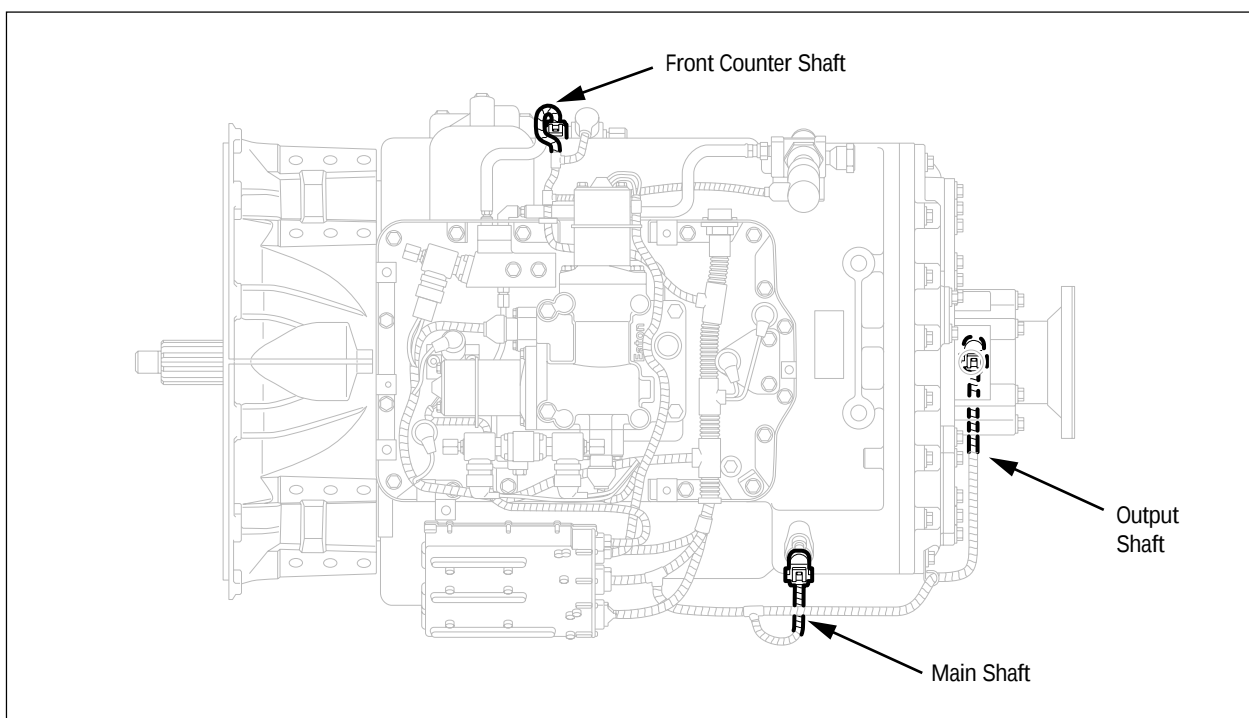
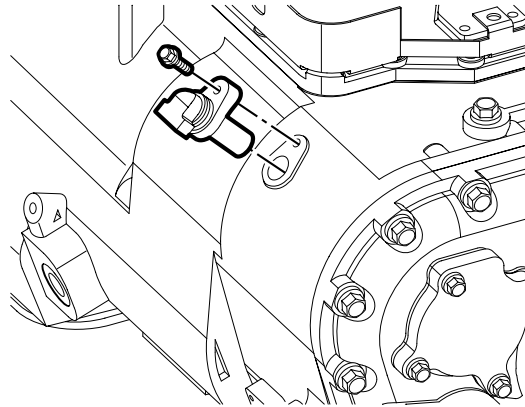
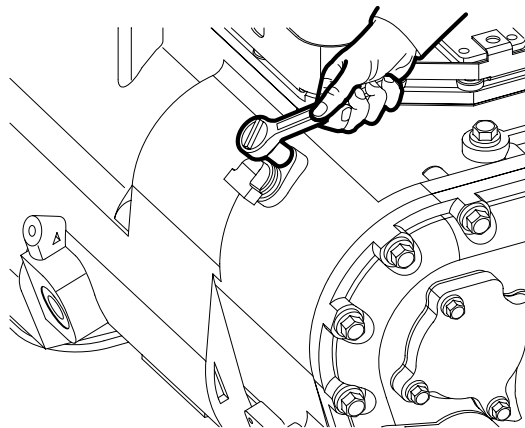


Figure 59. Front Counter Shaft / Main Shaft / Output Shaft Speed Sensor Location

1
Install Sensor



2
Install Mounting
Capscrews And Plate



3
Re-connect
Transmission Harness

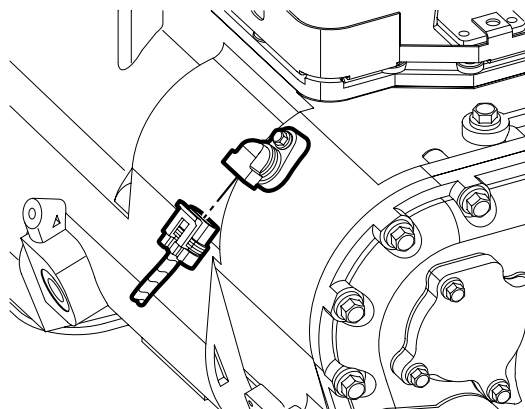


Figure 60. Front Counter Shaft / Main Shaft / Output Shaft Speed Sensor – Installation

Air Filter Regulator – Removal

Special Instructions

None

Required Tools

Basic Hand Tools

Removal

1. Drain air system. Disconnect the Transmission Harness from the Low Air Switch (G).
2. Using a 19 mm wrench, remove the Low Air Switch from the Air Filter Regulator.
3. Using a 16 mm wrench, remove the air lines from the Air Filter Regulator.
4. Using a 10 mm wrench, remove the two mounting capscrews and remove the Air Filter Regulator.

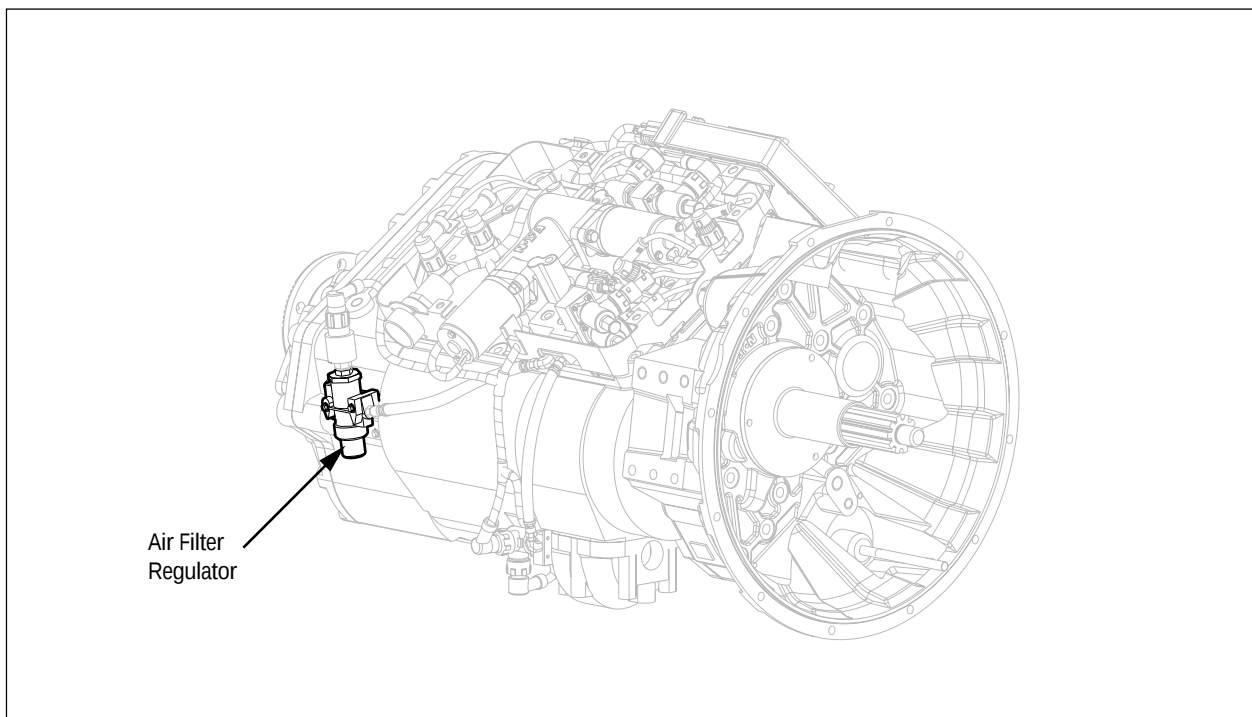


Figure 61. Air Filter Regulator Location

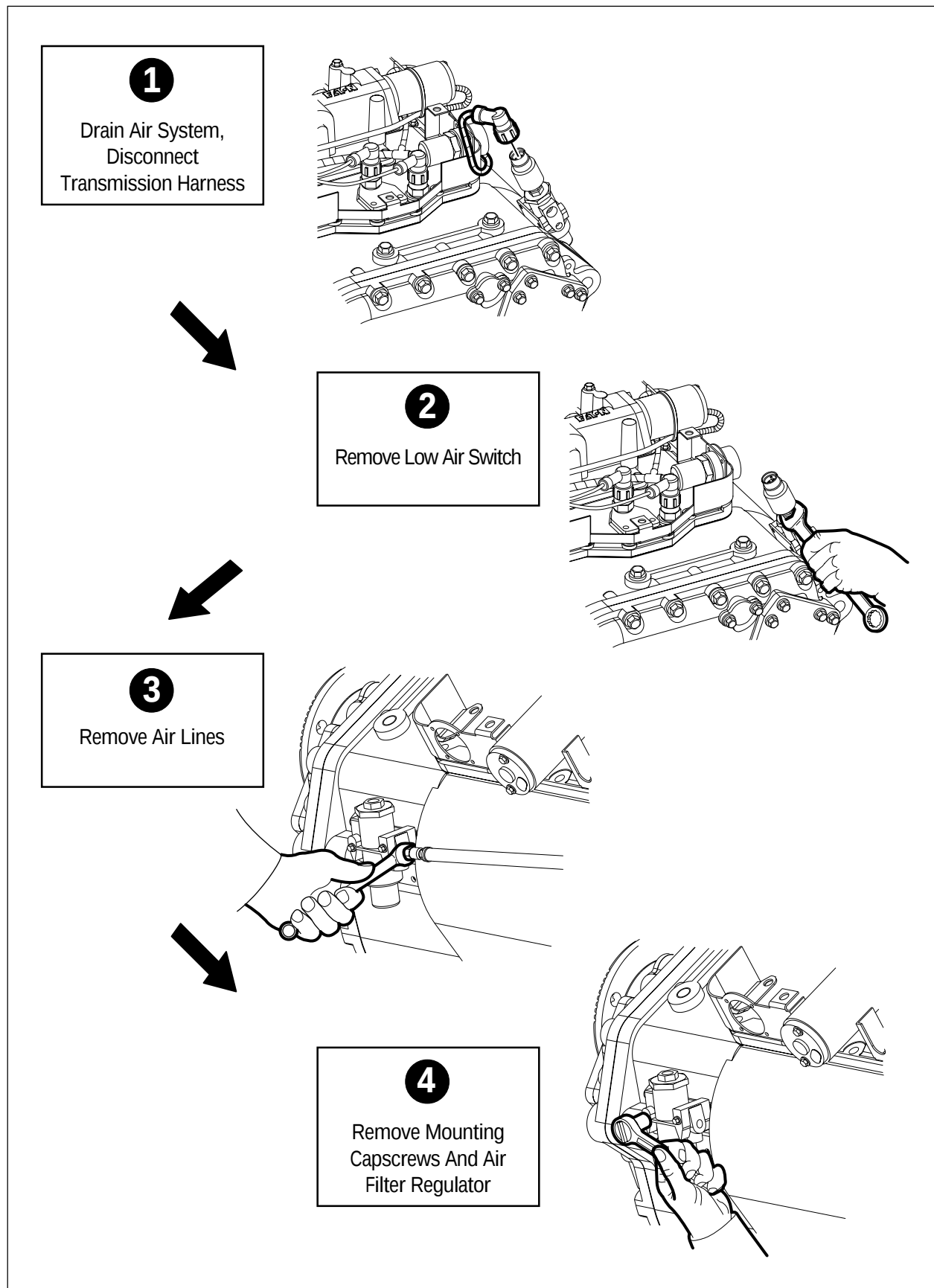


Figure 62. Air Filter Regulator – Removal

Air Filter Regulator – Installation

Special Instructions

None

Required Tools

Basic Hand Tools

Installation

1. Using a 10 mm wrench, install the Air Filter Regulator to the transmission. Torque to 10-13 Nm (8-10 lb-ft).
2. Using a 16 mm wrench, install the air lines to the Air Filter Regulator.
3. Using a 19 mm wrench, install the Low Air Switch to the Air Filter Regulator. Torque to 10-15 Nm (8-12 lb-ft).
4. Re-connect the Transmission Harness to the Low Air Switch (G).

Final Check

Make sure that all of the connectors are properly connected and locked.

Make sure there are no air leaks.

Make sure the mounting capscrews are properly torqued.

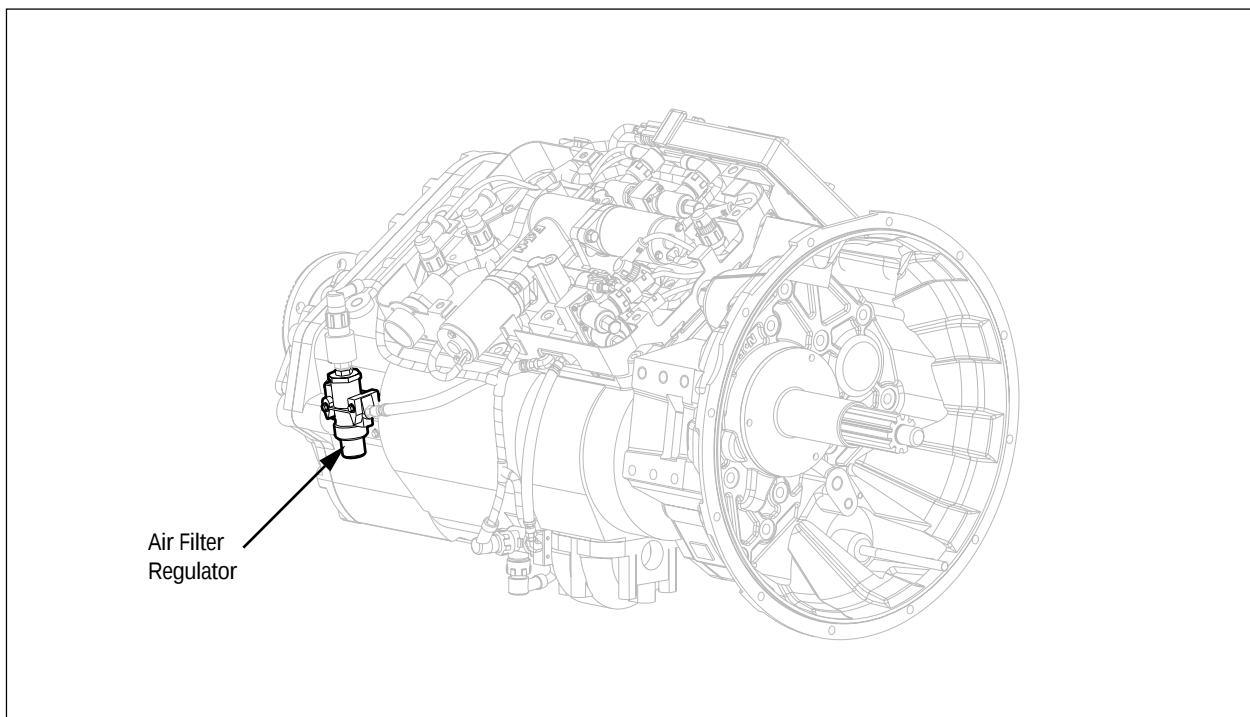


Figure 63. Air Filter Regulator Location

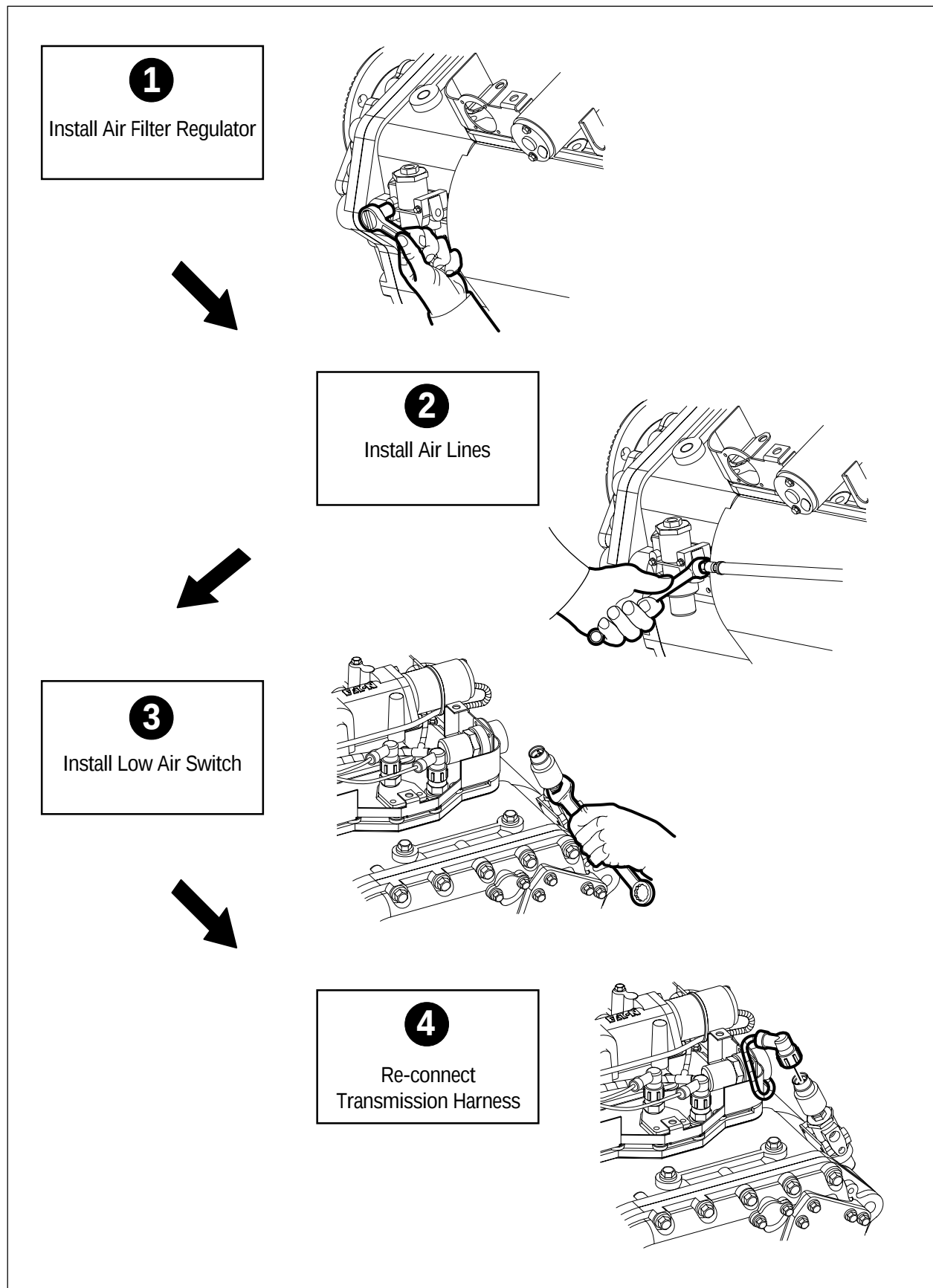


Figure 64. Air Filter Regulator – Installation

Low Air Switch – Removal

Special Instructions

None

Required Tools

Basic Hand Tools

Removal

1. Drain air system. Disconnect the Transmission Harness from the Low Air Switch (G).
2. Using a 19 mm wrench, remove the Low Air Switch from the Air Filter Regulator.

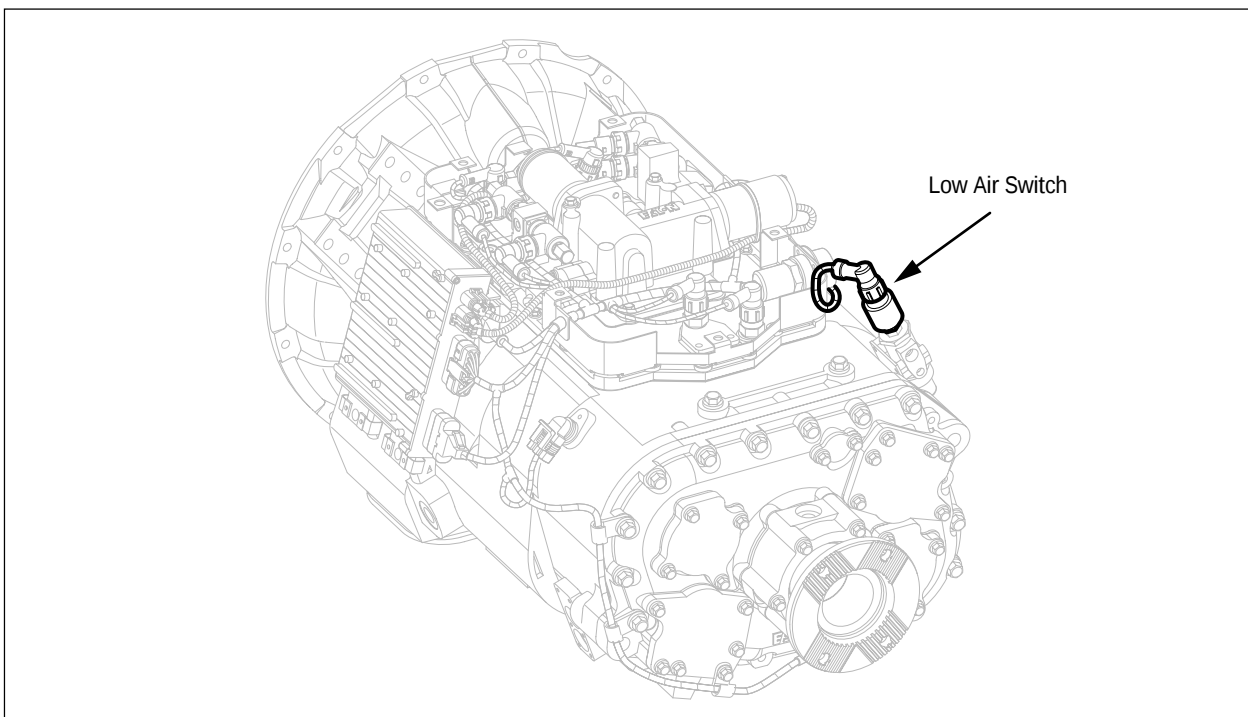
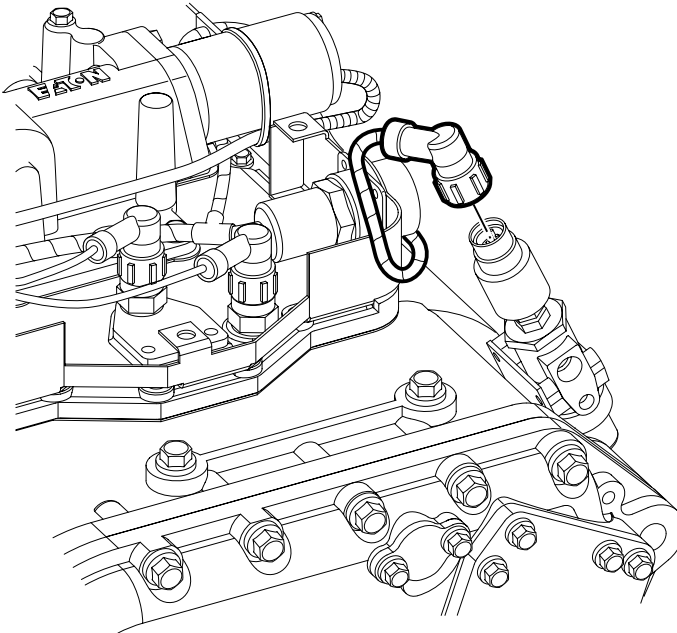


Figure 65. Low Air Switch Location

1

Drain Air System,
Disconnect
Transmission Harness



2

Remove Low Air Switch

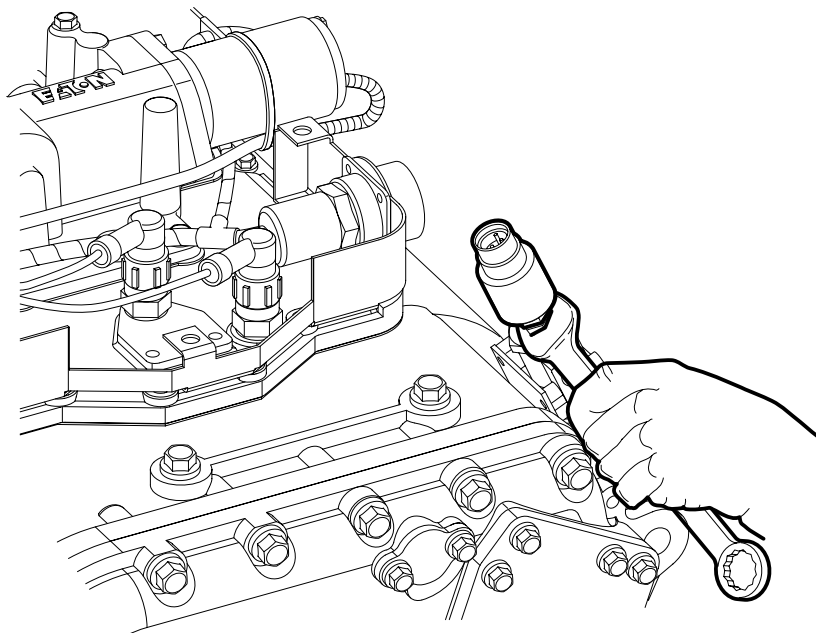


Figure 66. Low Air Switch – Removal

Low Air Switch — Installation

Special Instructions

None

Required Tools

Basic Hand Tools

Installation

1. Using a 19 mm wrench, install the Low Air Switch on the Air Filter Regulator.
Torque to 10-15 Nm (8-12 lb-ft).
2. Re-connect the Transmission Harness to the Low Air Switch (G).

Final Check

Make sure there are no air leaks.

Make sure that all of the connectors are properly connected and locked.

Make sure that the Low Air Switch is properly torqued.

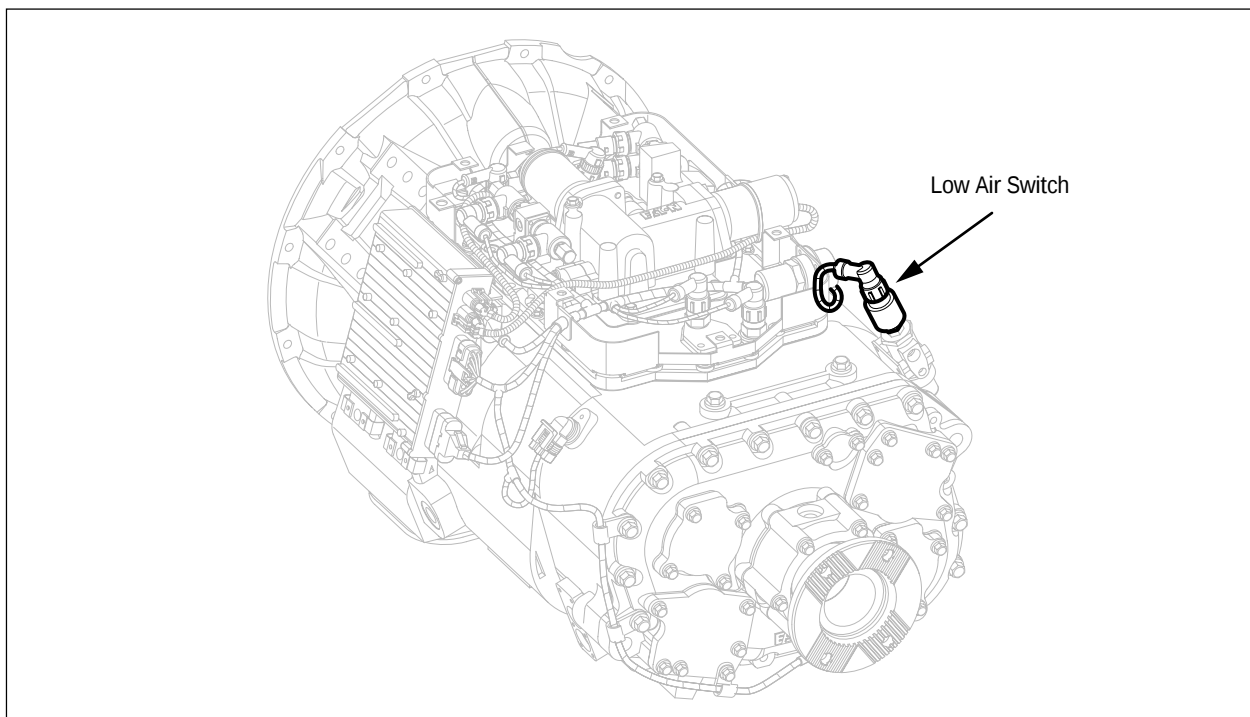
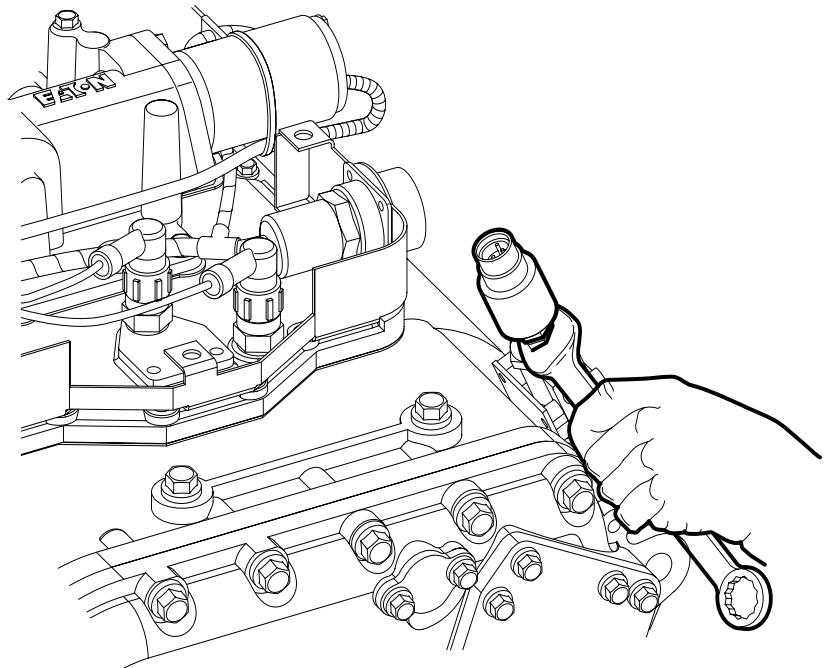


Figure 67. Low Air Switch Location

1

Install Air Filter Switch



2

Re-connect
Transmission Harness

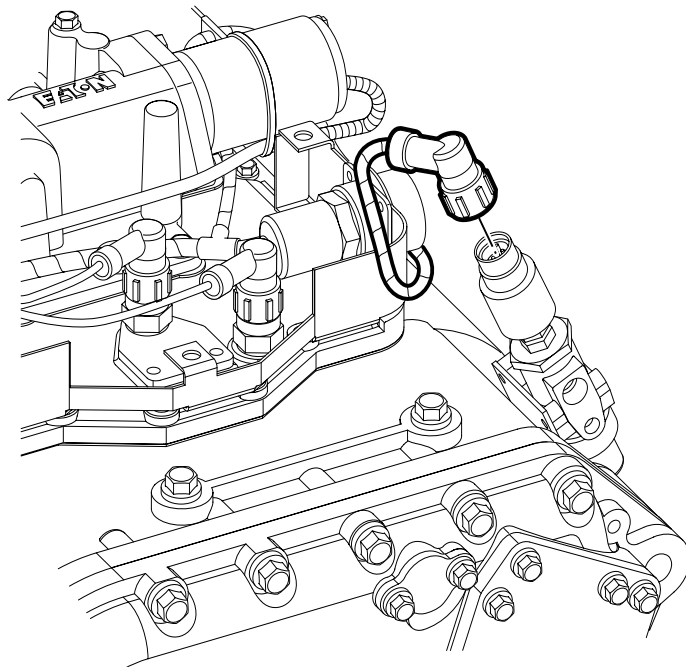
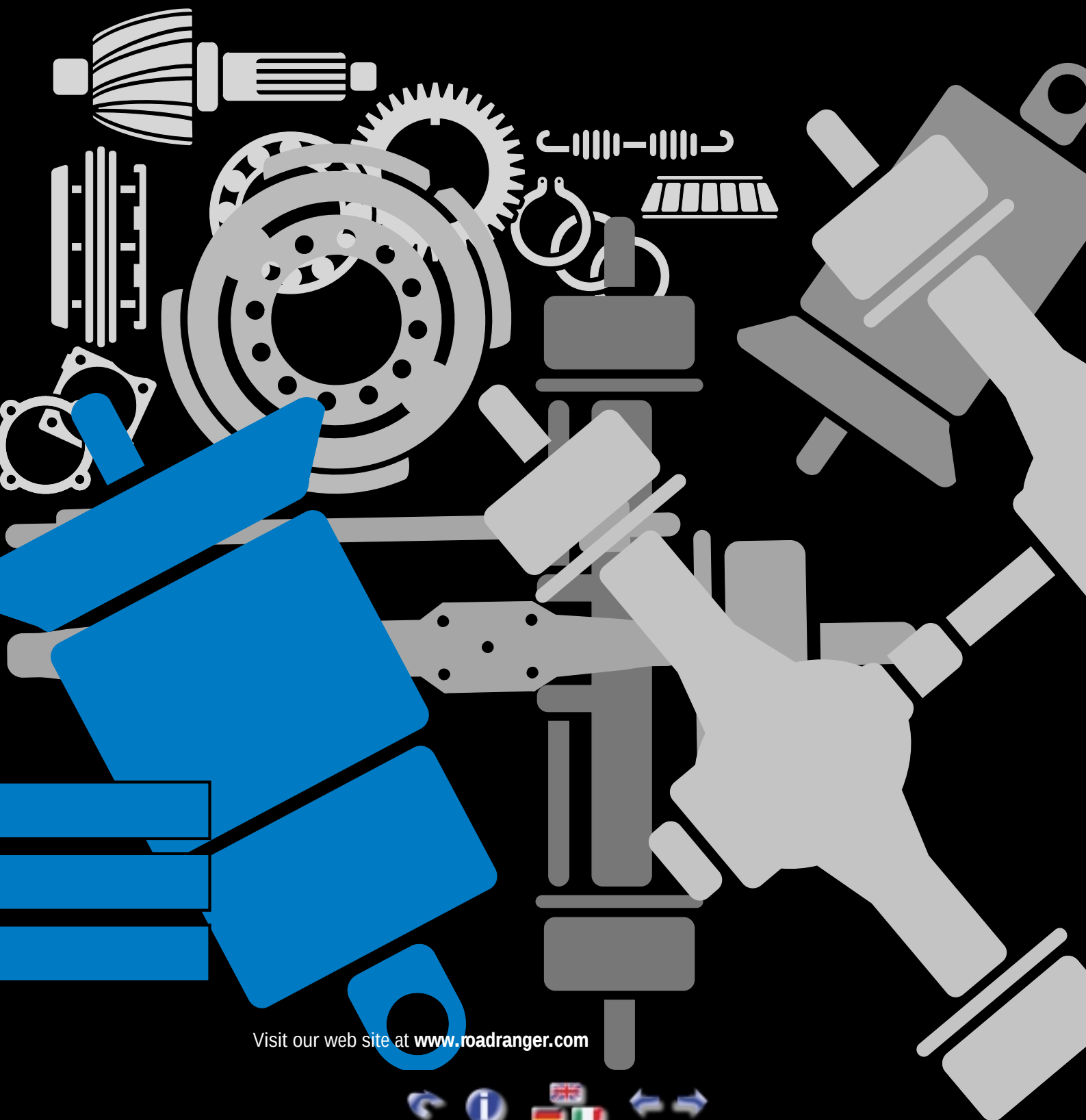


Figure 68. Low Air Switch – Installation



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