ISSUE DATE:	07/07/2023
REVISION DATE:	09/28/2023
SERVICE BULLETIN SUBJECT:	Duo Power Gearbox Single Turn Snap Ring Field Retrofit
VINs or MODELS AFFECTED:	Service Specified Buses
COMPLETE BY:	See Warranty Disclaimer
SERVICE BULLETIN #:	SC-23-085
LABOR OPERATION CODE:	PP59Z

Warranty Disclaimer: SC-23-085 is the solution to a systemic failure issue in the DuoPower gearbox. Repair labor reimbursement is available through Proterra's Warranty Portal. Oridinary Proterra Warranty policies applied. Failure to complete this repair within 180 days after retrofit kit shipment date may result future claims against the gearbox (Proterra PN: 050817) being rejected.
This document should be retained and referred to for future maintenance until the Proterra Parts and/or Maintenance Manual is updated to reflect work done as a result of this document. Please ensure that this document is available for parts and maintenance staff.

Labor Table

	Operation	Number of Technicians	Hours	Labor Time (T x H)
1	Step 1 – Step 14	1	1.5	1.5
2	Step 15 – Step 20	1	1	1
3	Step 21 – Step 33	1	3	3
4	Step 34 – Step 59	1	6	6
5	Step 60 – Step 79	1	3	3
6	Step 80 – Step 92	1	2	2
7	Step 93 – Step 97	1	1.5	1.5
9	Step 98 – Step 105 (FiF)	1	1	1 (FiF)
		Total Labor Time		18

Duo Power Gearbox Single Turn Snap Ring Field Retrofit

Description:

The procedure describes the process of updating the gearboxes from a dual turn to a single turn snap ring.

Note:

This campaign document must be printed in colored ink unless crucial information could be misunderstood.

PROTERRA
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DuoPower Gearbox Snap Ring Replacement Procedure

This procedure details the replacement of a snap ring in each gearbox.

Procedure Overview:

- Remove both traction motors.
- Separate each gearbox front housing cover from each gearbox.
- Remove and replace a snap ring on each gearbox front housing cover.
- Reinstall each gearbox front housing cover to its original gearbox.
- Reinstall both traction motors.

NOTE: This procedure does not require axle or gearbox removal.

NOTE: The traction motor pairing procedure is necessary if a motor is replaced or if the motor does not pair automatically when re-installed.

WARNING Electrocution hazards exist that could cause serious injury or death. Perform the Proterra High-Voltage Lockout/Tagout procedure as detailed in the vehicle's Maintenance Manual when instructed.

ATTENTION: Each gearbox front housing cover must be re-installed on the same gearbox it was removed from or gear damage may occur.

Table 9-1: Proterra Supplied Required Parts Kit

Proterra PN	Description	QTY	Use
065000	- Service Retrofit Kit, DuoPower, Single-Turn Snap Ring	1	Snap Ring Replacement
187-3024	Ring, Internal, 65.58 OD X 5.08 RAD. Wall X 1.93 Thick (Single Turn Snap Ring)	2	Snap Ring Replacement
050279	Bolt Gearbox Mount, Gearbox, Axle (Larger GB Front Housing Bolts)	20	Gearbox to Axle Cradle Mounting
129-5217	M8X1.25X45/22-10.9 HHCS (Smaller GB Front Housing Bolts)	26	Gearbox Front Hosing Cover Mounting

Table 9-2: Required Shop Supplies

Description	QTY	Use
Loctite®, 222, 243, 263	1 each	Multiple
Brake Cleaner (or equivalent)	1	Mounting Thread Preparation
Torque Stripe Marker	1	Torque Marking/Gearbox Procedure Completion Marking
Cable-Ties, Black	Multiple	Cable/Hose Securement
Coolant Fill Hose, 3/8” EPN	1	Coolant Fill
Coolant, 50/50 Ethylene Glycol/ Distilled Water Mixture	Varies	Coolant Fill
Transmission Fluid, Eaton	8-10 L	See Approved Gearbox Fluids Table for approved alternatives

Table 9-3: Tools

Description	QTY	Use
Tag, Plastic Lockout	1	Lock-out/Tag-out
Padlock, Orange Lockout	1	Lock-out/Tag-out
Lockout, Grip-cinching Cable	1	Lock-out/Tag-out
Wrench, Ratchet, 10 mm (Long)	1	Traction Motor Mounting
Wrench, Ratchet, 10 mm (Short)	1	Traction Motor Mounting
3/8” Drive Torque Adapter - 10 mm *Vendor: Matco Tools* *VPN: BTA10M*	1	Traction Motor Mounting
Tool, Wrench, 7/8”	1	Gearbox Outlet Oil Hose Fitting
Tool, Wrench, 1”	1	Oil and Coolant Hoses
Tool, CrowFoot, 30mm, 1/2” Drive *Vendor: MSC Industrial Supply* *VPN: 16679995* (if available)	1	Phase Cables Cord Grip Caps
Large Adjustable Wrench	1	Coolant Hose
Torque Wrench, In-lbs	1	Multiple/18-53 in-lbs
Torque Wrench, Ft-lbs	1	Multiple/8-80 ft-lbs
Ratchet, 1/4”	1	Multiple
Ratchet, 3/8”	1	Multiple
Breaker Bar/Long Handle Ratchet, 1/2” Drive	1	Oil Filter Caps
Impact Driver, 1/2, 3/8”	1 each	Multiple
Ratchet, Electric, Right-Angle, 1/4”	1	Multiple
Extension Variety, 1/4, 3/8, 1/2”	1 each	Multiple
Socket, 1 1/16”, 1/2” Drive	1	Oil Filter Caps
Socket, 10, 13, 15, 19mm	1 each	Multiple
Hex Bit, 3, 6, 8mm	1 each	Multiple
Oil Fill Pump	1	Gearbox Oil Refill
Pry Bar Variety: Small, Medium, Large	1 each	Multiple
Pick Variety	1 each	Multiple
Screwdriver, Flathead: Small, Large	1 each	Multiple
Screwdriver, Phillips #2	1	Multiple
Pliers, Needle-nose	1	Snap Ring Removal
Compressed Air w/Nozzle	1	Mounting Thread Preparation
Step-stool	1	Multiple
Snips, Flush-Cut	1	Abrasion Control

Table 9-4: Approved Gearbox Fluids

Manufacturer	Product
Allied Oil and Tire Co.	Allied Syntx MTF 7000 Synthetic Transmission Fluid
Bardahl de Mexico S.A. de C.V.	Bardhl Gear Oil MTF Fully SYN PS-386
BASF Corporation	EMGARD MTF 7000
BG Products, Inc.	SAE 40 Full Synthetic Transmission Oil
BP Lubricants USA Inc.	Transmax Manual E Longlife 40
Chevron Products	Delo® Syn-trans XE SAE 75W90
Chrysan Industries	Chrysan PS-386 MTF
CHS Incorporated	Maxtron MT 40
Citgo Petroleum Corp	Syndurance Synthetic MTF Mystik SX-7000 Synthetic MTF
Comercial Importadora S.A. de C.V.	Synquest CD 50
Comercial Roshfrans, S.A. de C.V.	Gear Plus CD-700 (Synthetic Transmission Fluid)
David Weber Oil Co	Gibraltar Syngear PS-386 SAE 40
Exxon Mobil Fuels and Lubricants	Mobil Delvac 1 Transmission Fluid 40
Federated Co-Operatives Ltd.	MTA EA Synthetic
Fuchs Petrolub	Fuchs Titan Cytrac ETN SAE 40
Industrial Villanueva, S.A. DE C.V.	Invisa Synthetic Oil Gear AC SAE 75W-90
Lubrication Engineers, Inc	Synolec Transmission Fluid SAE 40 (640)
Mercedes-Benz Australia/ Pacific Pty Ltd	Alliance Prime Trans Plus 40

Manufacturer	Product
Navistar	Fleetrite PS-386 Synthetic Manual Transmission Lubricant
Northland Products Co.	Northland Synergy Synthetic® ExP Transmission 50
Petro-Canada Lubricants Inc.	TRAXON E Synthetic MTF (Synthetic Transmission Fluid)
Phillips 66 Company	Triton® Synthetic MTF Kendall SHP® Synthetic MTF
Quick Smart Products P/L	Road Trans MTF PS-386
Raloy Lubricantes, S.A. C.V.	Raloy Transintex Plus SAE 40
Repsol Lubricantes Y Especialidades S.A.	Repsol Cartago LD 40
Royal Manufacturing Co	Monarch Syntran Plus SAE 40
Safety-Kleen Oil	Performance Plus Synthetic HD PS-386 Transmission Fluid
Shell	Spirax S6 GME 40
Texas Refinery	Syntex 2000 SAE40 Synthetic Manual Transmission Lubricant
The Valvoline Company	Syn Gard™ Transmission Fluid E386
Total Mexico S.A. DE C.V.	Transmission SYN 7000
TOTAL Specialties USA, Inc	TOTAL Transmission Gear 8 FE SAE 40
Warren Oil	America Max Full Synthetic SAE 40 Manual Transmission Fluid
Warren Oil	Lubriguard SAE 40 Synthetic Heavy Duty Transmission Fluid
Warren Oil	PURUS Synthetic SAE 40 Heavy Duty Transmission Fluid

Table 9-5: Additional Fix-if-Fail Supporting Documentation

Document	Description
Maintenance Manual	Gearbox Removal and Replacement Procedure
Maintenance Manual	Traction Motor Removal and Replacement Procedure

Table 9-6: Additional Fix-if-Fail Parts

Proterra PN	Description
040924	Motor, GVM, 310-125
140-3817	Lubricant, Spline, Chelsea
063900	Gearbox, DuoPower
125-6417	Washer, Lock
052501	Oil Filter, Replacement Kit, Oil Cooler, Gearbox, EMP
048430	Skid-Plate, Retainer, Ring, Locking
048427	Skid-Plate, Retainer, Plate, SS, Locking
048429	Skid-Plate, Bolt, M10-1.5, 20mm, 10.9, 100HSS, Locking
050190	Motor Stud, Gear Box, Axle
050259	12 Point Nut-Motor, Gear Box, Axle

Table 9-7: Additional Fix-if-Fail Tools

Description	QTY	Use
Laptop computer and Proterra Diagnostic Tool (current version) https://diag.proterra.com/	1	Pairing the Traction Motor and Power Inverter
Nexiq USB-Link 2	1	Pairing the Traction Motor and Power Inverter
Tool, Wheelend, Axial Nut, TMFS 5, 38mm *Vendor: Reliability Direct* *VPN: SKF-TMFS 5*	1	Gearbox Replacement
Kit, Broken Bolt Extraction	1	Broken Bolt

Procedure

Vehicle Preparation

1. Record the odometer reading on the vehicle's maintenance log.
2. Position the vehicle on an approved lifting device.
3. Perform the Proterra High-Voltage Lockout/Tagout procedure as specified in the vehicle's maintenance manual.
4. Lift the bus using the approved lifting device.
5. Remove and retain the large front cage dust cover (**1**) using a 10 mm socket/wrench.
6. Remove and retain the high voltage cable guard (**2**) using a 10 mm socket/wrench.
7. Place a coolant drain pan underneath the bulkhead coolant fitting (**3**).
8. Drain the coolant by slowly disconnecting the coolant hose from the bulkhead coolant fitting (**3**) using an adjustable wrench.
9. Reconnect the bulkhead coolant fitting (**3**).

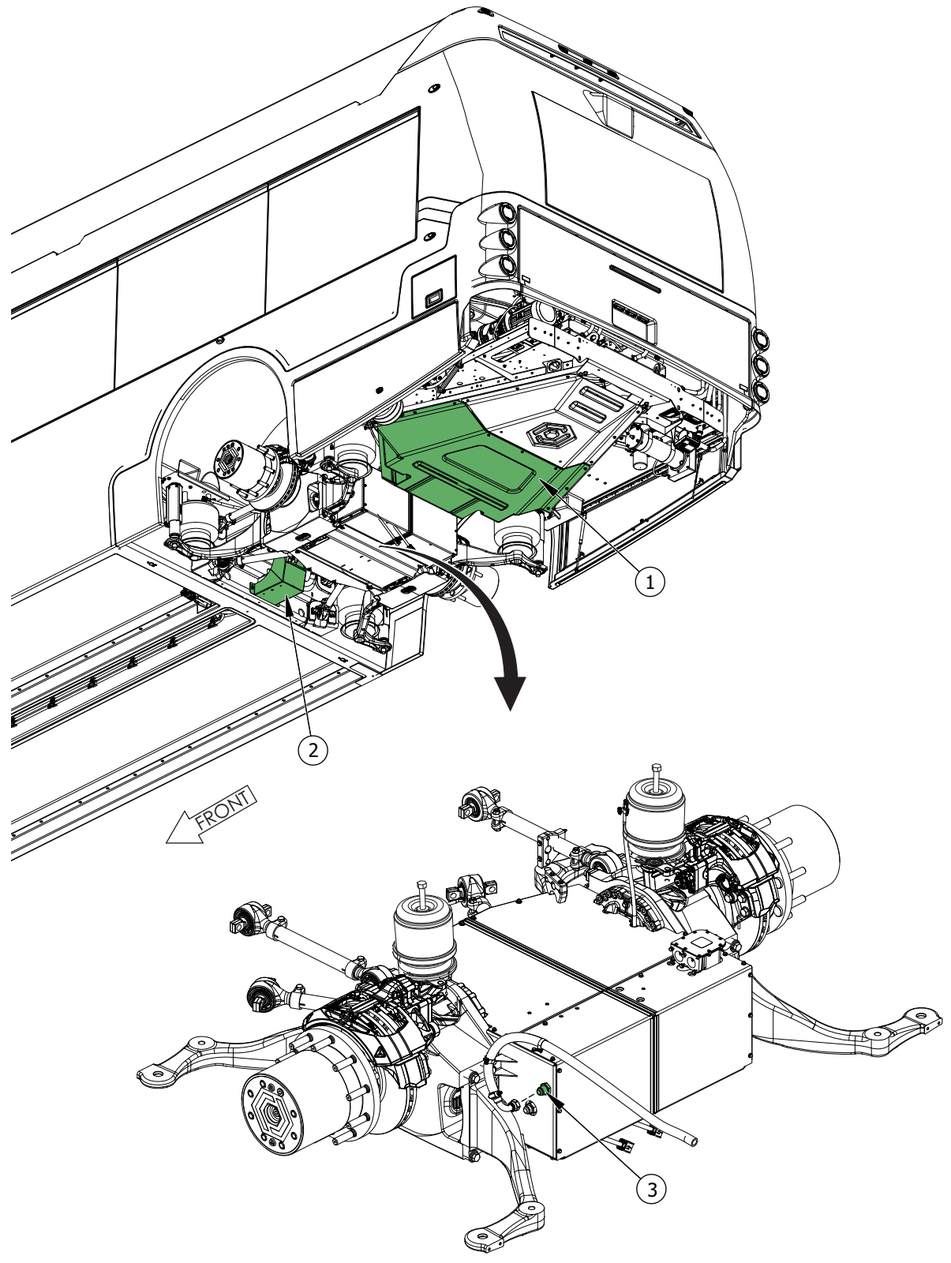


Figure 9-1. Axle Access and Coolant Draining

10. Remove and retain the skid-plate (**4**) and fasteners (**5**) using a 15 mm socket/wrench.

11. Remove and retain all six axle covers (**6**) and fasteners (**7**) using 10 and 13 mm sockets/wrenches.

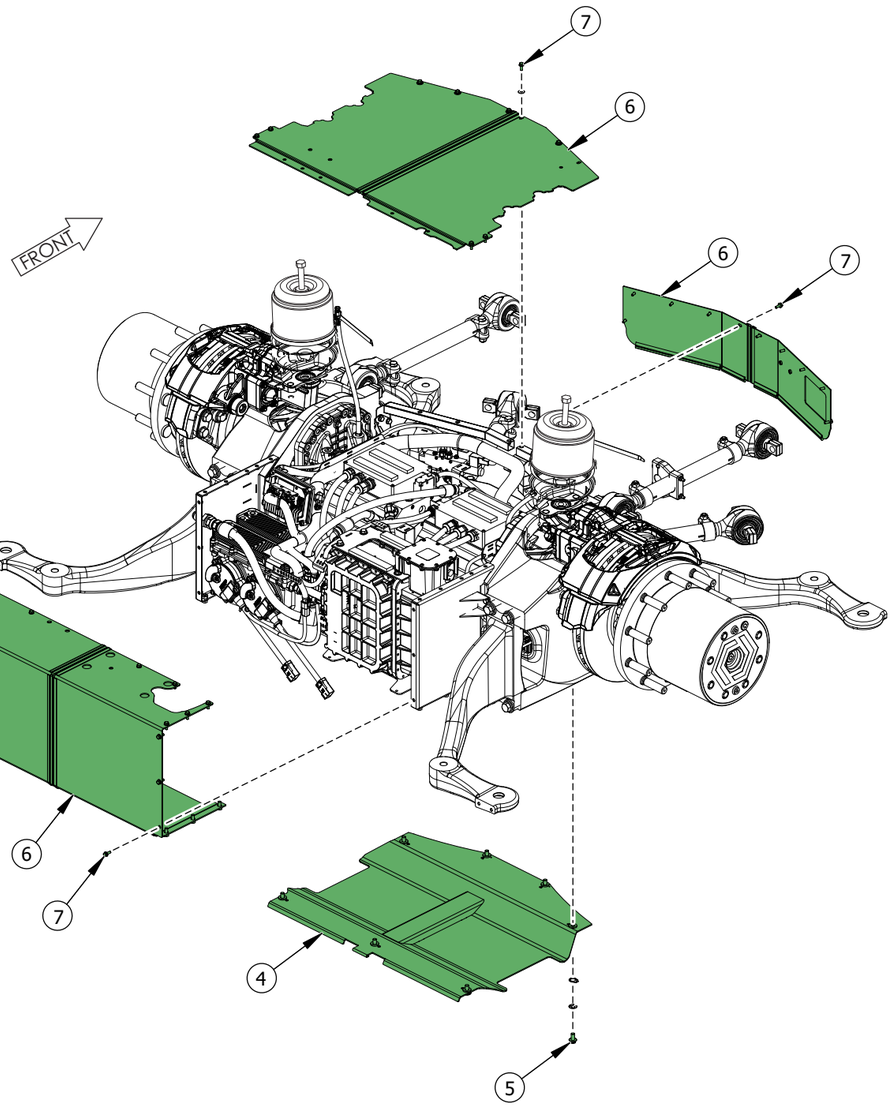


Figure 9-2. Skid-Plate and Axle Covers Removal

12. Remove and retain both motor bridge harness brackets/bolts (**8**) using a 13 mm socket/wrench.

13. Disconnect the ECU harness connector (**9**).

14. Remove and retain the ECU bracket/ECU (**10**) and fasteners (**11**) using a 10 mm socket/wrench.

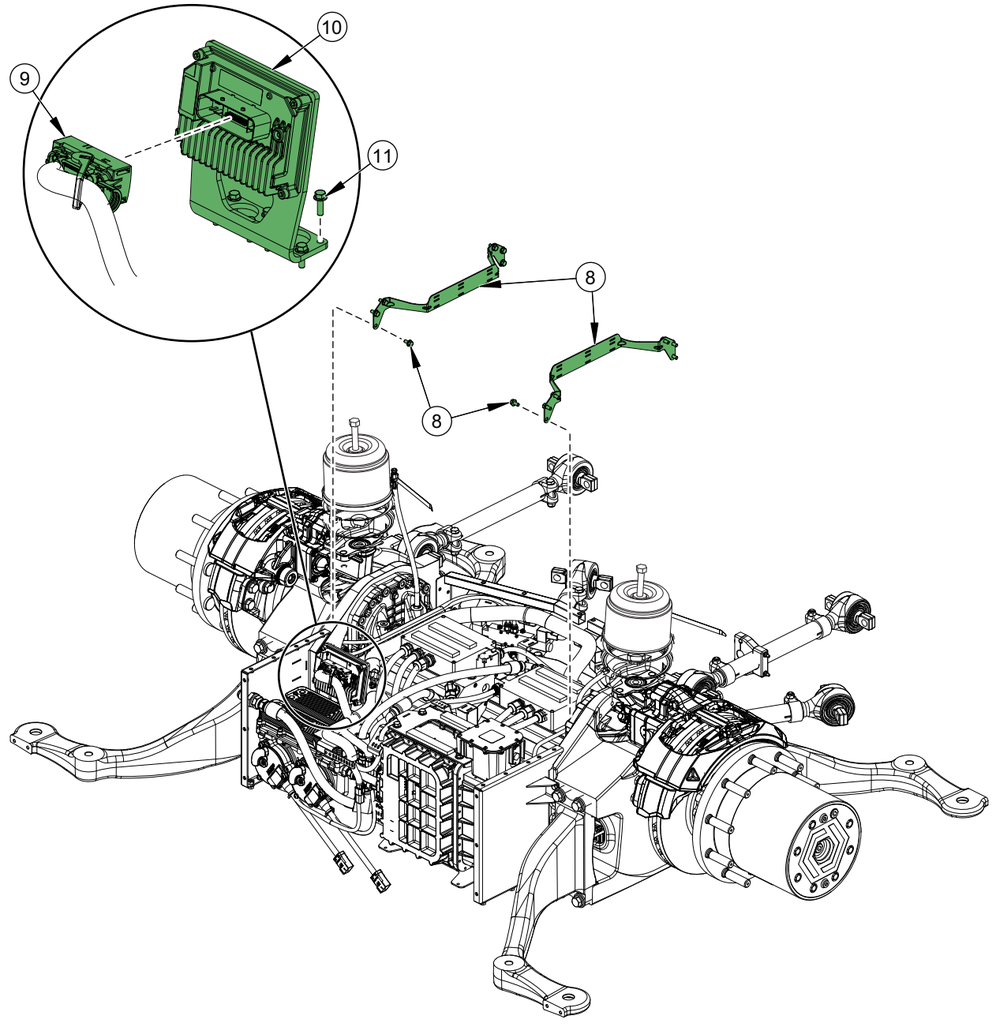


Figure 9-3. Harness Brackets & ECU bracket/ECU Removal

Gearbox Oil Draining and Filter Inspections

15. Drain both gearboxes into a suitable oil drain pan by removing the oil drain plugs (**12**) using a 21 mm socket/wrench.

16. Re-install the oil drain plugs (**12**) using a 21 mm socket/wrench and torque to 18 ft-lbs (24 Nm).

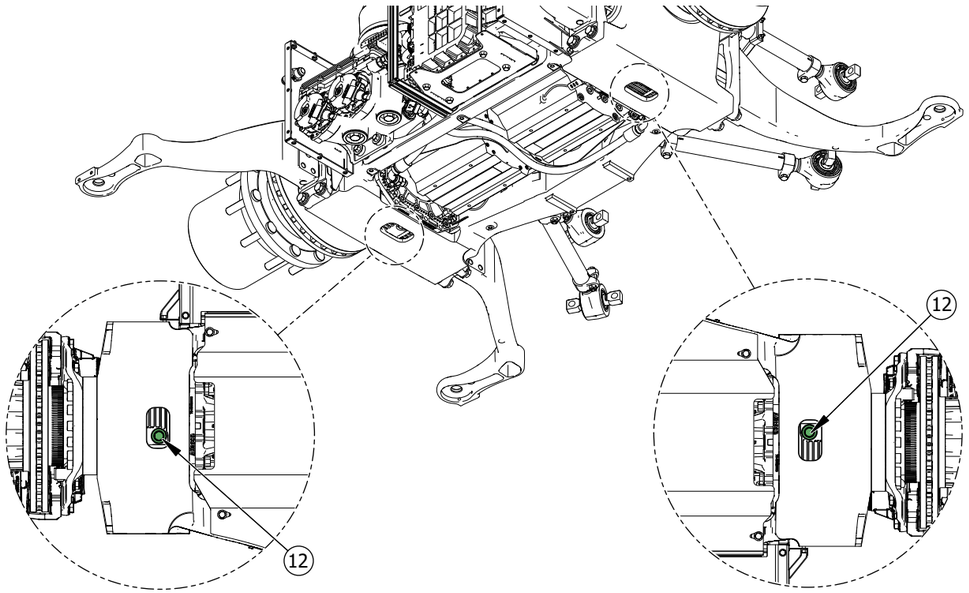


Figure 9-4. Gearbox Oil Draining

17. Verify the oil module torque stripes are present on the oil filter caps (**13**) and oil strainer caps (**14**). If no torque stripes are present, apply torque stripes before proceeding to the next step.

18. Remove and inspect both oil filter caps and oil filters (**13**). Replace the oil filters if swollen or disintegrating (see examples in figure).

19. Apply degreaser to a rag and clean the threads on both the oil filter caps and in the oil module. Reinstall both oil filters and oil filter caps (**13**) and realign the torque stripes.

20. If the oil filters were disintegrating, also remove and inspect both strainer caps and strainers (**14**). Clean the strainers as needed.
    Apply degreaser to a rag and clean the threads on both the strainer caps and in the oil module. Reinstall both oil strainer caps (**14**) and realign the torque stripes.

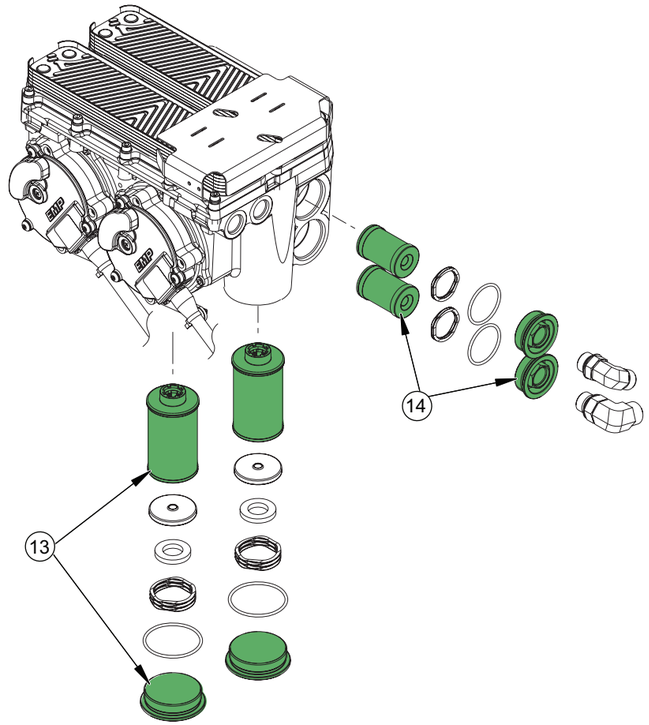


Figure 9-5. Oil Strainers and Oil Filters

Figure 9-6. Oil Strainer and Oil Filter Examples

Traction Motor Removals

21. Locate each gearbox serial number tag (X). No snap ring replacement is necessary on gearboxes where the “CUST:” line (**15**) includes “063900”.

    NOTE: *“CUST: PROTERRA - 063900”* indicates that the gearbox was manufactured with the new snap ring; no snap ring replacement is necessary on the gearbox.

22. Mark each traction motor for proper curb-side or street-side re-installation.

23. Mark each traction motor coolant hose (**16**) for proper re-installation and disconnect from each traction motor.

24. Disconnect the low-voltage connectors (**17**) from each traction motor.

25. Remove all brackets (**18**) from each traction motor using a 15 mm socket/wrench.

26. Remove and retain the traction motor ground cables and ground cable fasteners (**19**) using a 15 mm socket/wrench.

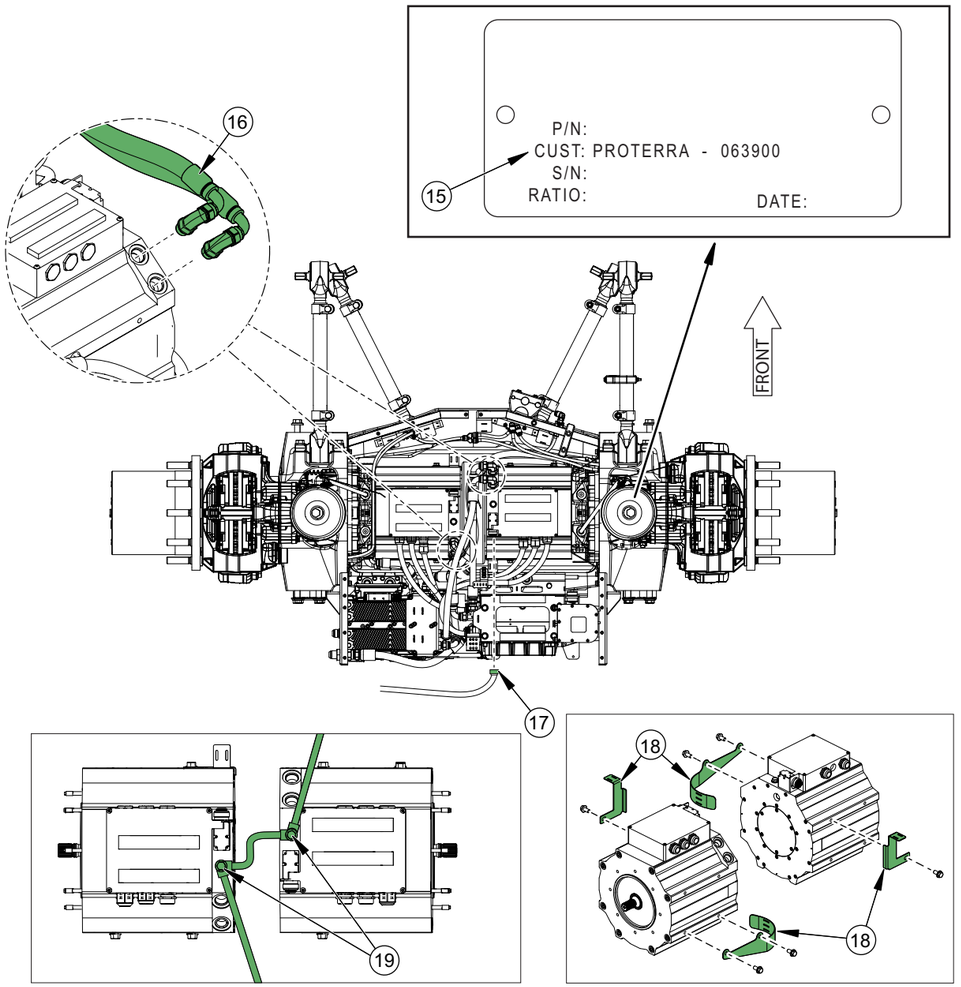


Figure 9-7. Traction Motor Removals (1 of 3)

27.Remove and retain the phase cable box guard (**20**) and the phase cable box cover (**21**) from each traction motor using a 3 mm hex-head wrench.

28. Mark each phase cable on each traction motor for proper re-installation. Remove and retain the phase cable fasteners (**22**) using a 13 mm socket on each traction motor.

29. Disconnect the cord grip caps (**23**) on each traction motor using the 30 mm Crow'sFoot tool (see the *Tools* table). Pull the phase cables (**24**) out of the phase cable junction boxes.
Remove and retain the three phase cable ground clips (**25**).

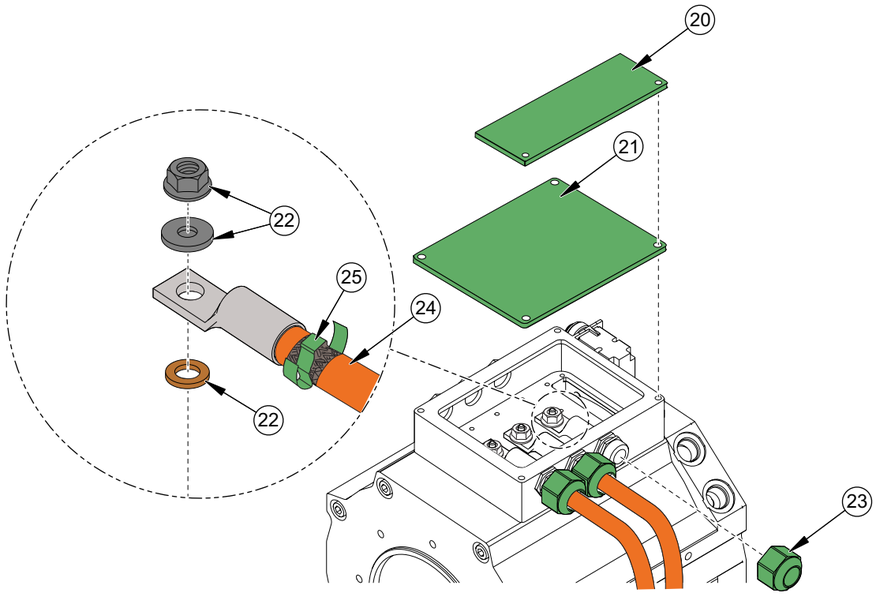


Figure 9-8. Traction Motor Removals (2 of 3)

30. Place a properly rated transmission jack or other suitable lifting device underneath the traction motor and secure with a ratchet strap.

31. Remove and retain the eight traction motor stud locknuts and spacers (**26**) using a 10 mm flexible ratchet wrench.

32. Carefully pry the traction motor (**27**) away from the gearbox and gently lower to a stable location.

33. Record both the gearbox and traction motor serial numbers on the vehicle's maintenance log.

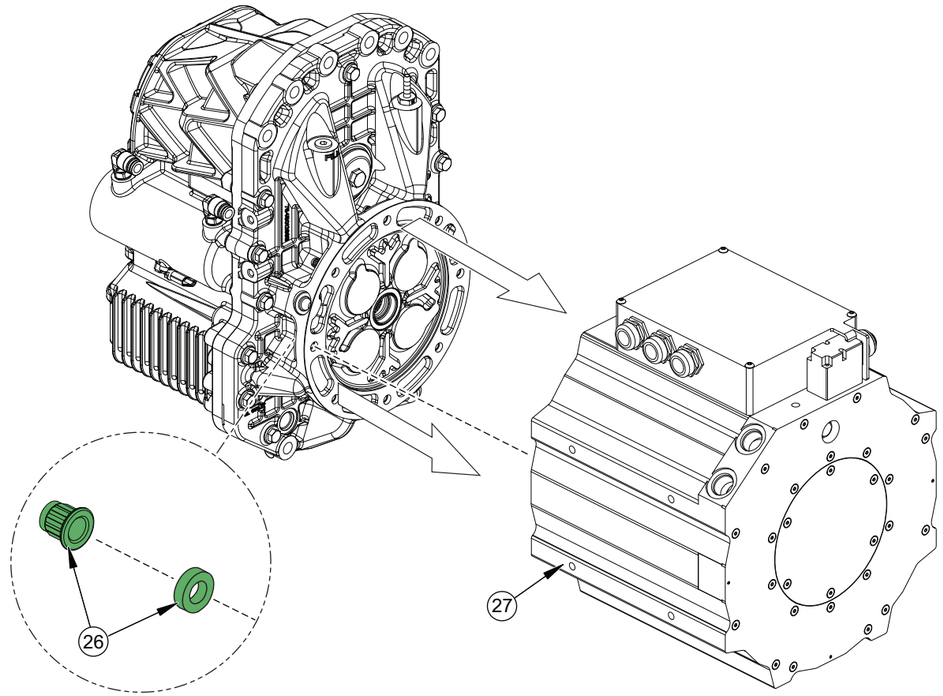


Figure 9-9. Traction Motor Removals (3 of 3)

Street-Side Gearbox Snap Ring Replacement

ATTENTION: Each gearbox front housing cover must be re-installed on the same gearbox it was removed from or gear damage may occur.

34. Mark each gearbox for proper curb-side or street-side re-installation.

35. Unplug the temperature sensor (**28**).

36. Mark both the inlet (**29**) and outlet (**30**) gearbox oil hoses for proper re-installation and disconnect from the gearbox front housing cover using a 7/8" wrench.

37. Cut the cable-tie securing the breather hose (**31**) to the brake cannister.

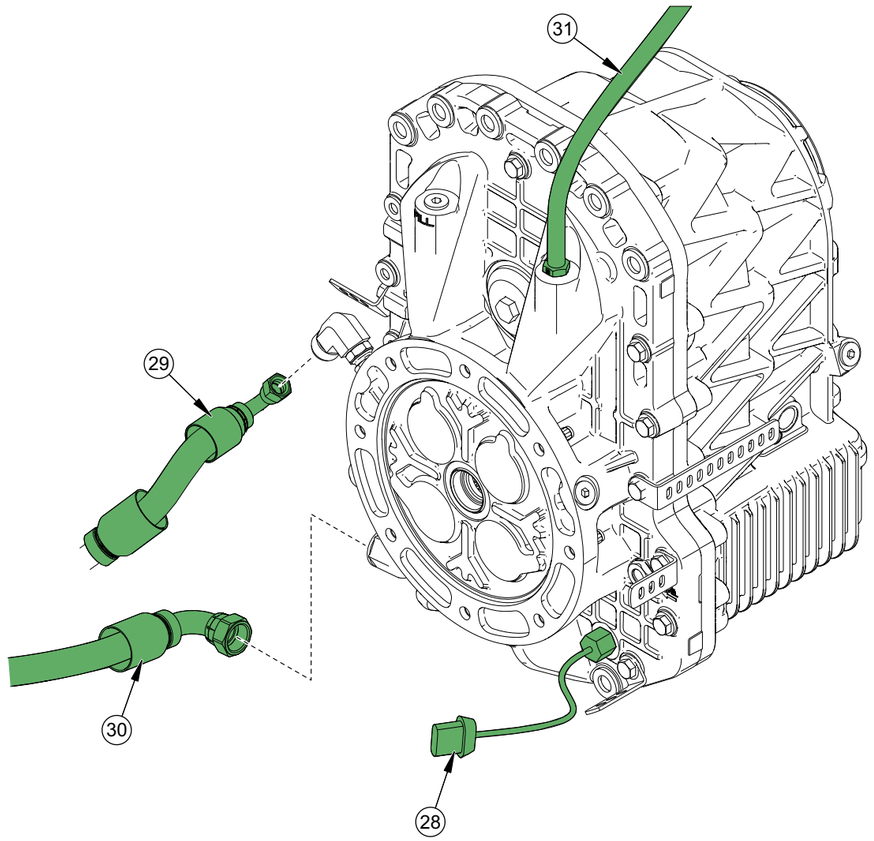


Figure 9-10. Gearbox Front Housing Cover Disconnection Preparation

38. Remove and discard the thirteen gearbox front housing cover mounting bolts (**32**) using a 13 mm socket/wrench. Retain the washers.

39. Remove and discard the ten gearbox mounting bolts (**33**) from the gearbox using a 19 mm socket/wrench. Retain the washers.

CAUTION: Do not pry the front housing cover side-to-side. Internal gearing damage can occur if the front housing cover is removed improperly at an angle.

CAUTION: Pry the gearbox front housing cover only at the three pry-bar locations shown.

40. Carefully pry the gearbox front housing cover (**34**) away from the gearbox with multiple pry-bars at the pry-bar locations shown, ensuring the housing cover comes horizontally straight out and place onto a workbench.

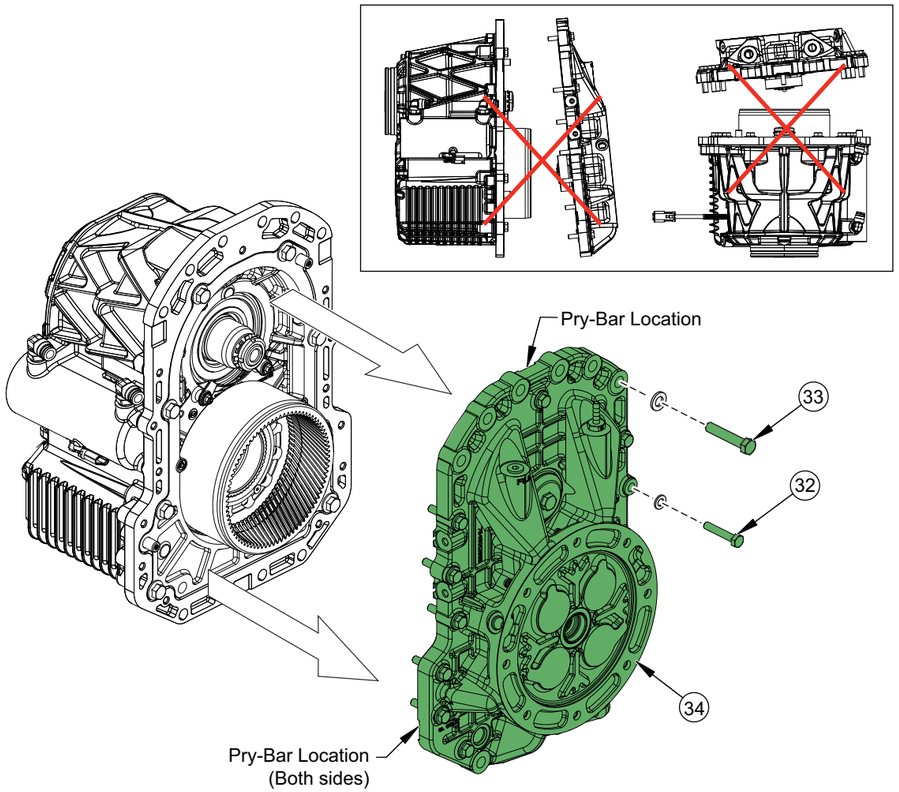


Figure 9-11. Gearbox Front Housing Cover Disconnection

41. Inspect the ring gear (**35**), planetary assembly (**36**), and the axle-shaft lock nut/lock washer assembly (**37**) for damage.
Record the inspection results on the vehicle's maintenance log.

IMPORTANT: If significant damage is present, a replacement gearbox is needed. Refer to the *Gearbox Removal and Replacement* procedure in the vehicle's maintenance manual.
Record the new gearbox serial number on the vehicle's maintenance log.

42. Ensure the oil passageway o-ring (**38**) is present and seated on both sides.

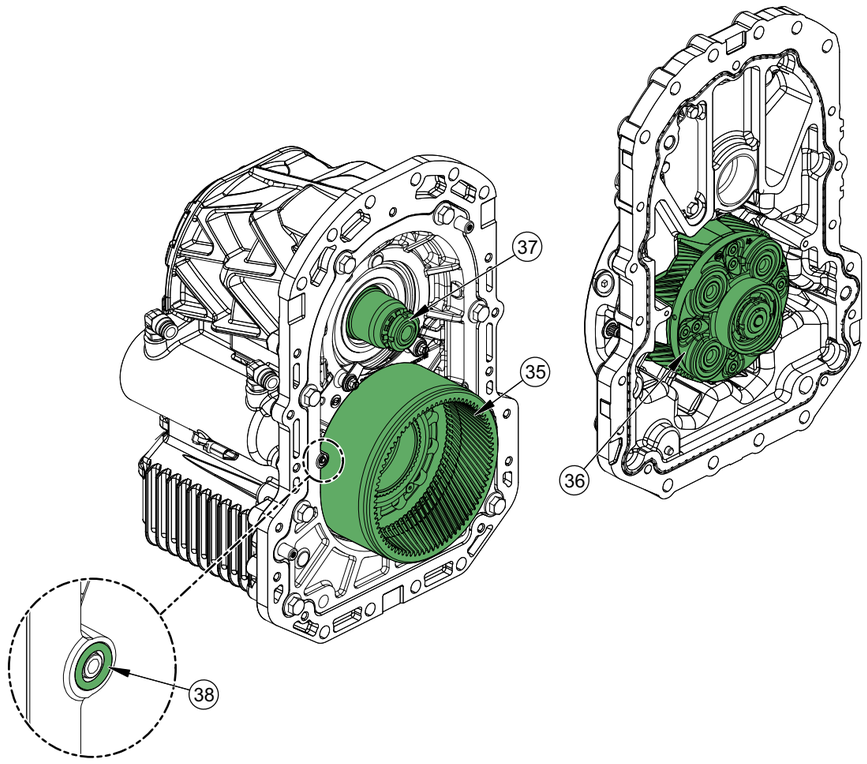


Figure 9-12. Gearbox Inspections

43. Clean debris that may have fallen into the gearbox and clean the mating surfaces between the gearbox front housing cover and the gearbox.

44. Cover the open gearbox housing with a plastic sheet to prevent internal gearbox contamination.

45. Remove and discard the snap ring by prying the tapered end inward and pulling upward using a screwdriver (or pick) and needle-nose pliers.

46. Coat the replacement snap ring with gearbox oil and install the replacement snap ring (**39**) onto the front housing cover, tapered end first.

IMPORTANT: The replacement snap ring is a different design.

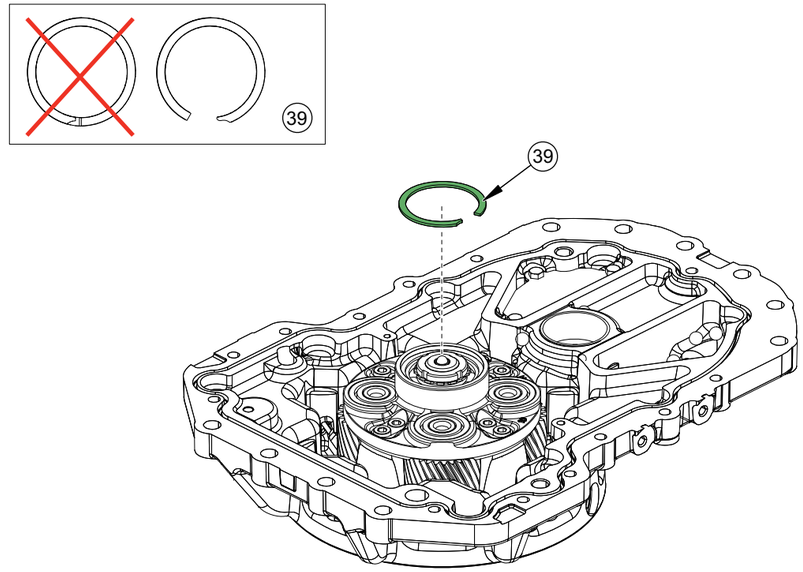


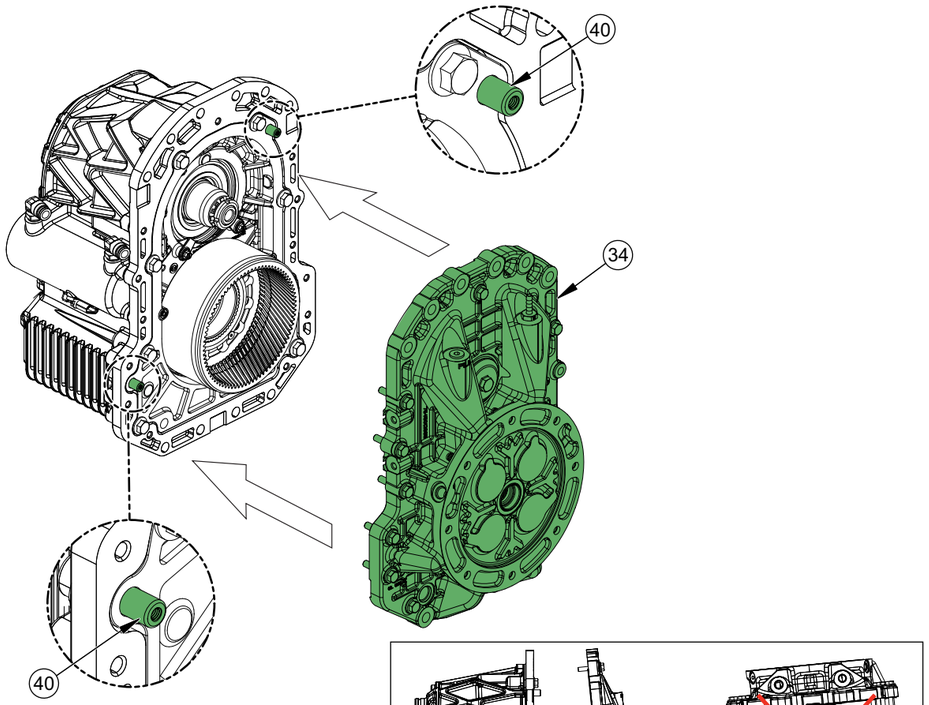
Figure 9-13. Snap Ring Removal and Replacement

47. Clean exposed gearbox opening and carefully position the gearbox front housing cover (**34**) onto the gearbox.

NOTE: It may be necessary to rotate the input spline by hand if internal gearing does not easily align. Do not insert tools into the input spline.

WARNING: Do not rock the front housing cover side-to-side or internal gearing damage may occur.

48. Carefully align the gearbox front housing cover (**34**) onto the two gearbox dowel pins (**40**).



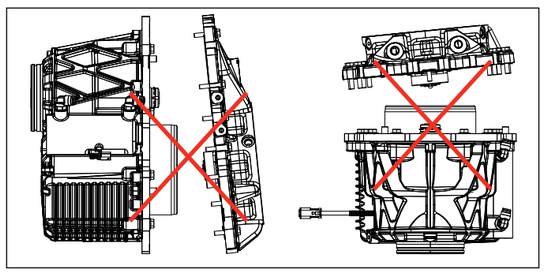


Figure 9-14. Gearbox Front Housing Cover Re-installation (1 of 2)

49. Temporarily install two 19 mm gearbox mounting bolts (**41**) into the #4 and #10 torque pattern positions, as shown.
Simultaneously tighten both bolts to fully seat the front housing cover onto the gearbox. Do not torque.

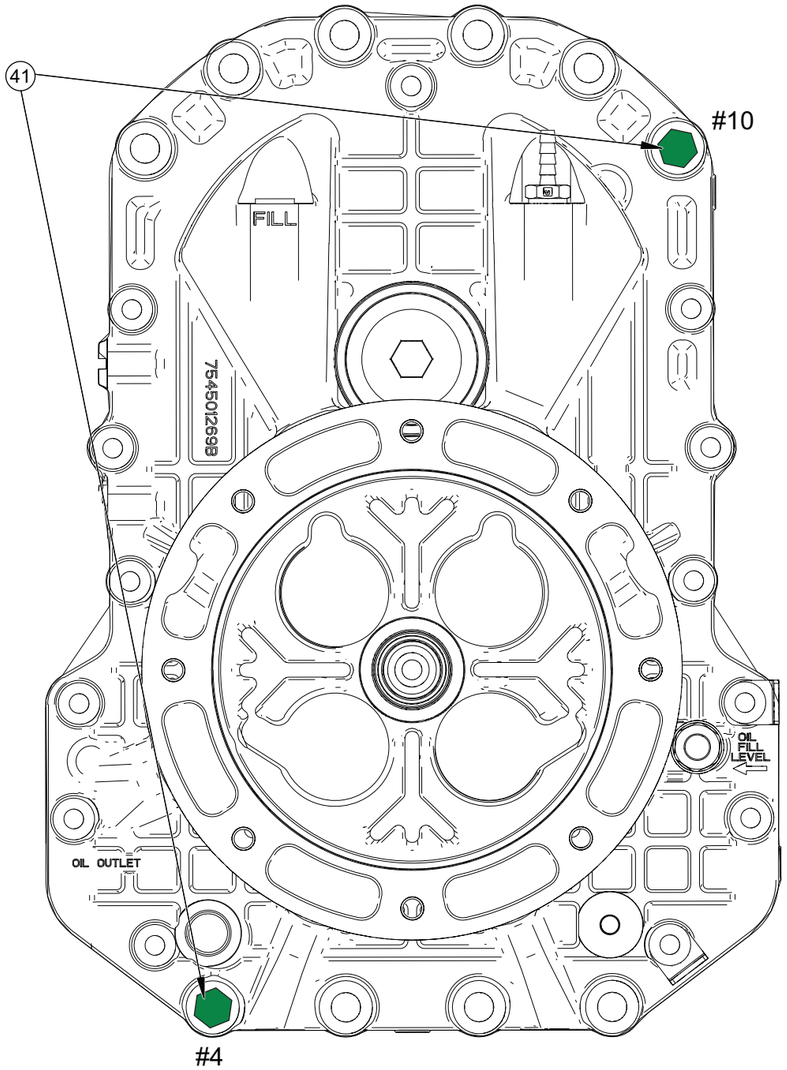


Figure 9-15. Gearbox Front Housing Cover Re-installation (2 of 2)

50. Apply Loctite™ 243 to each of the thirteen <u>new</u> gearbox front housing cover mounting bolts (**42**) and install with the retained washers. Torque to 26 ft-lbs (35 Nm) in the torque sequence shown using a 13 mm socket and apply torque stripes.

CAUTION: There is a risk of breaking mounting bolts due to over-rotation. **Stop** torquing if the mounting bolt “feels” at risk of breaking, and leave the mounting bolt in place as is.

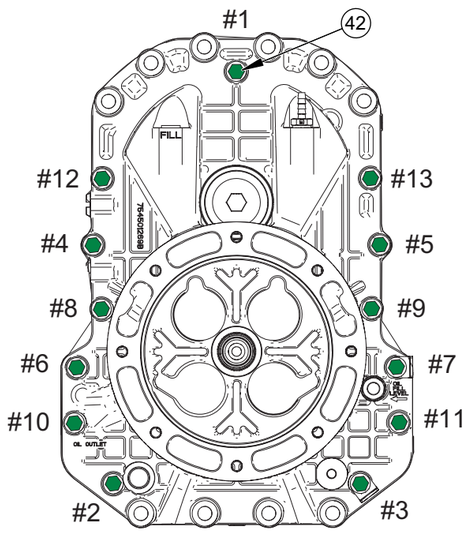


Figure 9-16. Gearbox Front Housing Cover Mounting Bolts Torque Sequence

51. Remove the two temporarily installed 19 mm gearbox mounting bolts (**41**).

52. Clean all ten gearbox mounting bolt holes/threads using brake cleaner (or equivalent). Clean out the brake cleaner using shop air.

53. Liberally apply Loctite™ 243 to each of the ten <u>new</u> gearbox mounting bolts (**43**) and install with the retained washers. Torque to 65 ft-lbs (88 Nm) in the torque sequence shown using a 19 mm socket.

54. Torque each of the 19 mm gearbox mounting bolts (**43**) a second time to 80 ft-lbs (108 Nm) in the torque sequence shown.

CAUTION: There is a risk of breaking mounting bolts due to over-rotation. **Stop** torquing if the mounting bolt “feels” at risk of breaking, and leave the mounting bolt in place as is.

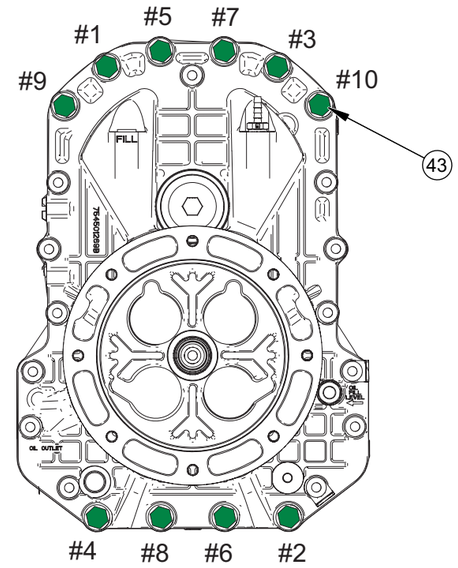


Figure 9-17. Gearbox Mounting Bolts Torque Sequence

55. Re-install the gearbox inlet (**29**) and outlet (**30**) oil hoses and fittings using a 7/8” wrench. Torque to 60 ft-lbs (81 Nm) and apply torque stripes.

NOTE: If challenges in torque tooling availability exist, tighten fittings to approximately 60 ft-lbs (81 Nm).

56. Plug-in the temperature sensor (**28**).

57. Secure the breather hose (**31**) to the brake cannister with a new cable-tie.

58. Apply a large “SR” with torque stripe paint on an open area of the SN plate to annotate the snap ring replacement. This step is <u>critical</u> to prevent costly duplicate work.

Curb-Side Gearbox Snap Ring Replacement

59. Repeat steps 35 thru 58 on the curb-side gearbox.

Traction Motors Re-Installation

60. Apply Loctite™ 243 onto each traction motor stud (**44**).

61. Carefully raise the traction motor (**27**), horizontally aligning the output shaft splines and traction motor studs (**44**) into the gearbox.

    NOTE: It may be necessary to shift the gearbox into gear by pressing and holding the manual shift button (**45**) on the shift solenoid (**46**). While the holding the manual shift button (**45**), rotate the tires slowly until the traction motor splines align with the gearbox input splines, allowing the traction motor to slide forward.

62. Firmly push the traction motor <u>fully flush</u> onto the gearbox.

63. Install retained 10 mm traction motor stud locknuts and spacers (**26**) onto each traction motor stud and hand-tighten.

64. Torque the eight locknuts (**26**) to 13 ft-lbs (18 Nm) in the torque sequence shown using a 12-point 10 mm torque wrench adapter.

    NOTE: Set the angle between the torque wrench and the torque wrench adapter to 90° to maintain accurate torque setting.

65. Final torque each locknut (**26**) to 27 ft-lbs (37 Nm) in the torque sequence shown and apply torque stripes with a paint pen (not torque paint/paste).

66. Carefully remove the lifting device from underneath the traction motor.

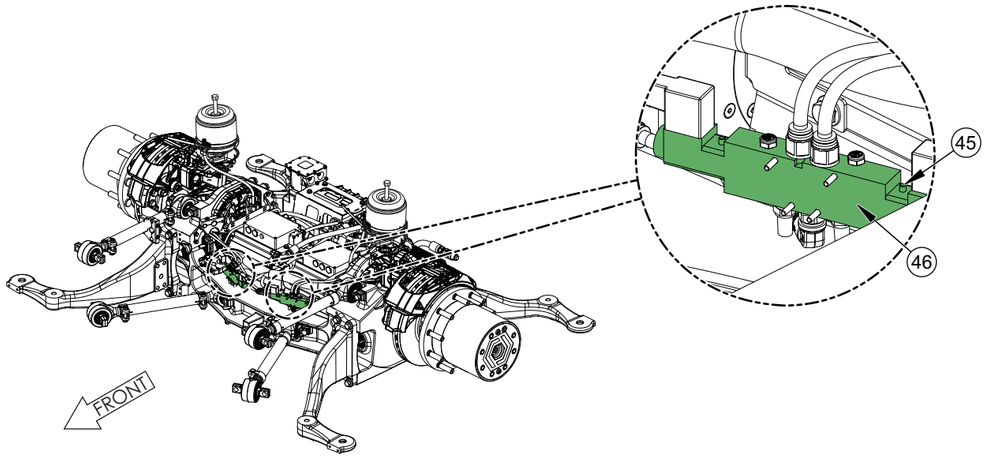


Figure 9-18. Traction Motors Re-Installation (1 of 2)

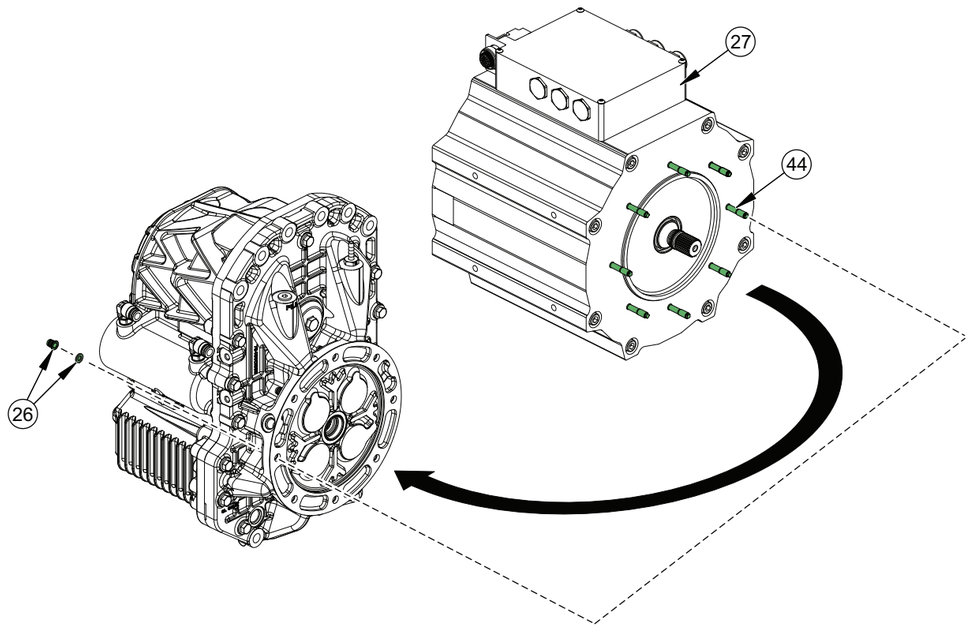


Figure 9-19. Traction Motors Re-Installation (2 of 2)

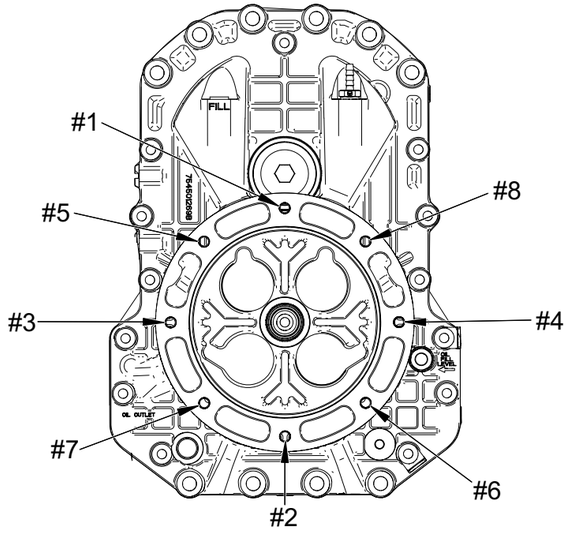


Figure 9-20. Traction Motor Mounting Locknuts Torque Sequence

67.Re-install each phase cable ground clip (**25**) and route each of the three phase cables through the cord grips on each traction motor.

68. Apply Loctite™ 222 to each phase cable stud (**47**).

69. Install the phase cables (**24**) with the retained fasteners in one of the two fastener sequences shown using a 13 mm socket. Torque to 15 ft-lbs (20 Nm). Do not apply torque stripes.

WARNING: The phase cable fasteners must be properly installed in one of the two fastener sequences shown, or serious damage to the traction motor will occur.

FASTENER NOTE: Each phase cable stud should have a copper spacer (**48**) below the phase cable lug (**49**), and a 13 mm nut (**50**) above the phase cable lug (**49**).
If present during disassembly, the conical washer (**51**) or serrated washer pair (**52**) should be re-installed between the phase cable lug (**49**) and the 13mm nut (**50**).

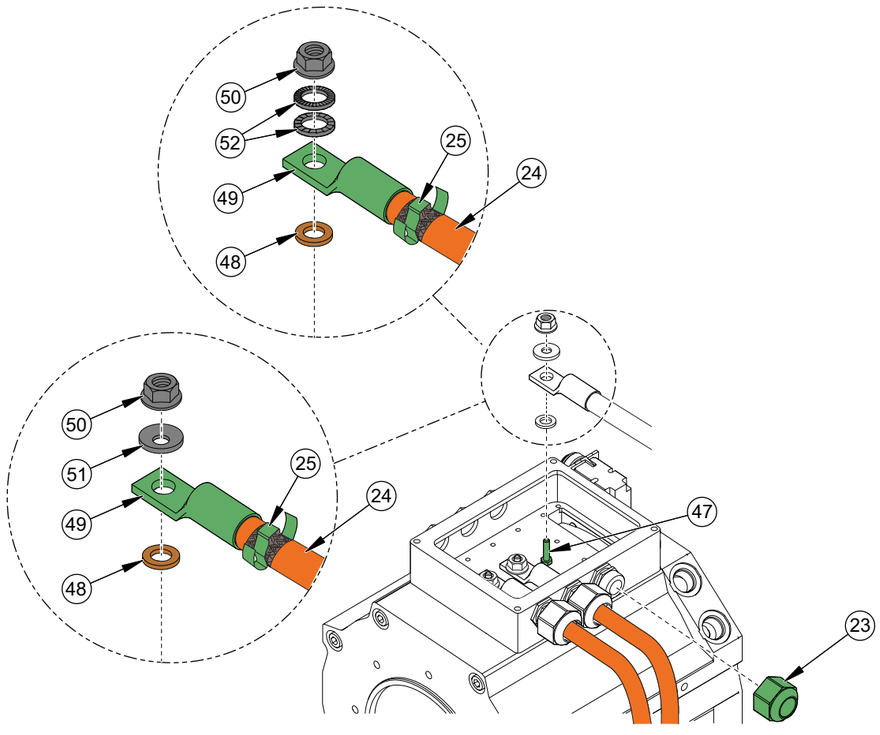


Figure 9-21. Phase Cables Connection

70. Inspect all phase cables for chaffing and ensure all phase cables are secured with the proper cable-ties and mounting blocks.

71. Tighten each cord grip cap (**23**) using the 30 mm Crow'sFoot tool (see *Tools* table). Torque each cord grip cap to 62 in-lbs (7 Nm) and apply torque stripes.

72. Re-install the phase cable box cover (**21**) and the phase cable box guard (**20**) on each traction motor using a 3 mm hex-head wrench. Torque to 18 in-lbs (2 Nm) and apply torque stripes.

73. Re-connect the traction motor coolant hoses (**16**) to the traction motors using a 1" wrench. Torque to 60 ft-lbs (81 Nm) and apply torque stripes.

NOTE: If challenges in torque tooling availability exist, tighten fittings to approximately 60 ft-lbs (81 Nm).

74. Re-install all brackets (**18**) to each traction motor using a 15 mm socket/wrench. Torque to 20 ft-lbs (27 Nm) and apply torque stripes.

75. Secure the curbside gearbox oil hoses (**29, 30**) to each lower motor bracket using cable ties.

76. Re-connect each low-voltage connector (**17**) to each traction motor.

77. Re-install the traction motor ground cables and ground cable fasteners (**19**) using a 15 mm socket. Torque to 25 ft-lbs (34 Nm) and apply torque stripes.

78. Re-install the ECU bracket/ECU (**10**) and fasteners (**11**) using a 10 mm socket/wrench and reconnect the ECU harness connector (**9**).

79. Remove lockout/tagout.

Gearboxes Fluid Fill

80. Verify each gearbox oil drain plug (**12**) is torqued to 18 ft-lbs (24 Nm).

81. Remove and retain the gearbox oil fill plug (**53**) on each gearbox using a 6 mm hex-head wrench.

82. Fill the gearboxes with fluid until full in the oil sight glasses (**54**) using a fluid fill pump. Let the oil settle for ten minutes, and refill until full in sight glass.

83. Temporarily install the oil fill plug (**53**) on each gearbox. Do not torque.

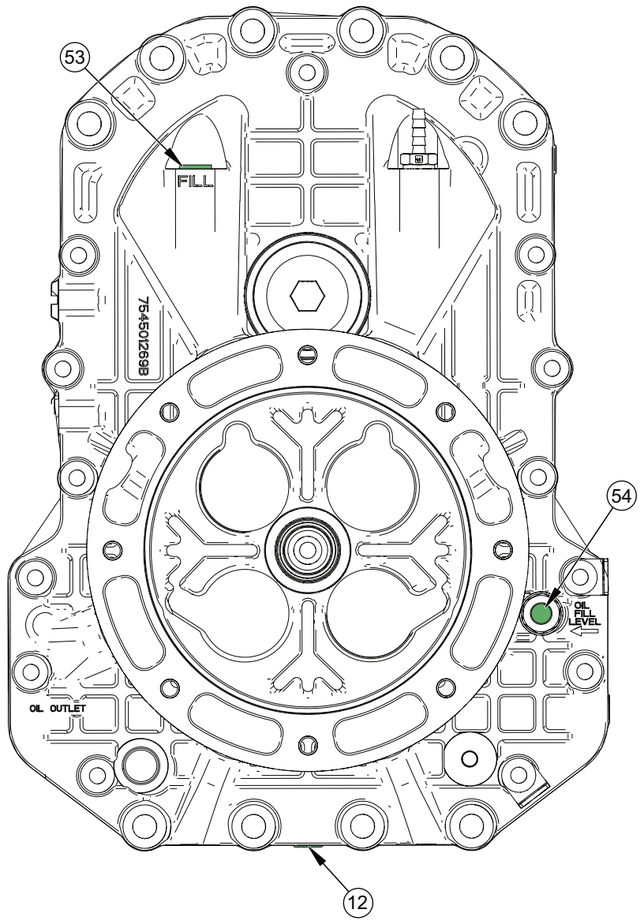


Figure 9-22. Gearboxes Fluid Fill
(traction motor shown removed for clarity)

84. Run the oil pumps for one minute to circulate oil through the oil module and gearboxes to remove potential air pockets from the system:

- Select *ON* at the Service Disconnect Switch (**55**).
- Select *ON* at the Master Disconnect Switch (**56**).
- Select *Day Run* at the Driver's Master Switch (**57**).

Wait one minute, then:

- Select *OFF* at the Driver's Master Switch (**57**).
- Select *OFF* at the Master Disconnect Switch (**56**).
- Select *OFF* at the Service Disconnect Switch (**55**).

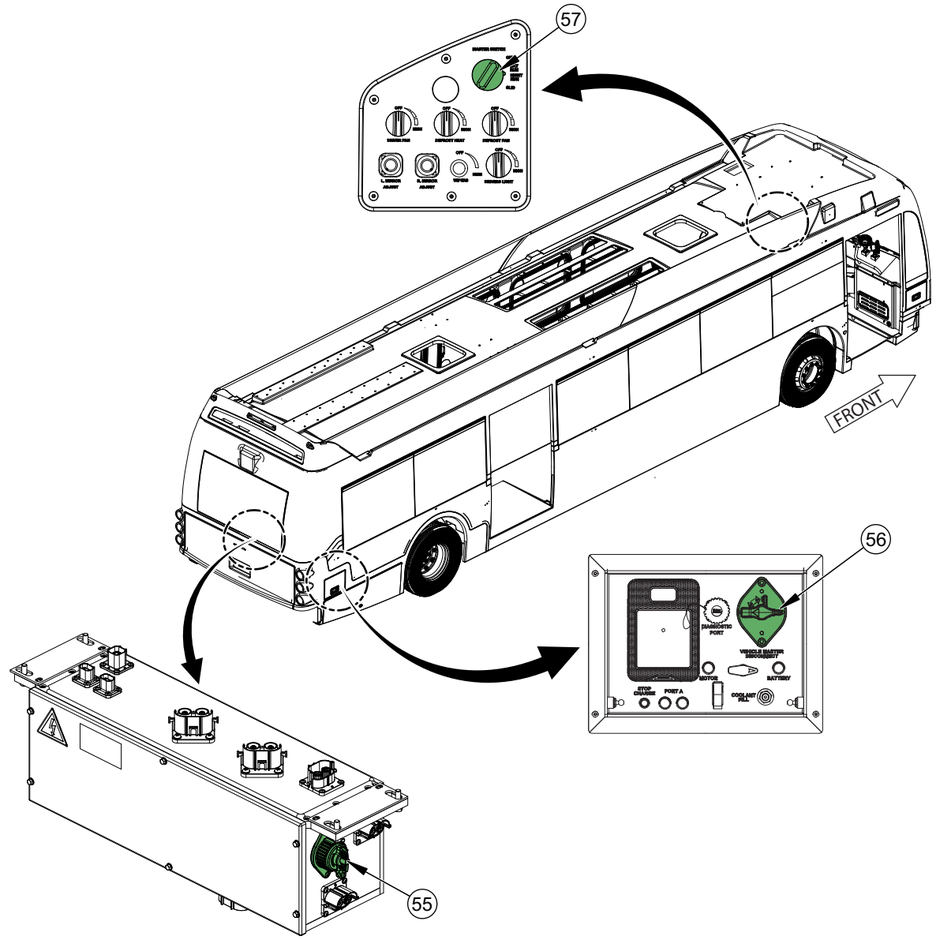


Figure 9-23. Switch Locations

85. Remove the temporarily installed oil fill plug (**53**) and fill the gearbox with fluid until full in the oil sight glass (**54**) using a fluid fill pump.

86. Apply a small amount of gearbox fluid to the oil fill plug (**53**) O-ring seal. Re-install and Torque to 13 ft-lbs (18 Nm).

87. Re-install both motor bridge harness brackets/bolts (**8**) using a 13 mm socket/wrench.

88. Re-install all six axle covers (**6**) and fasteners (**7**) using 10 and 13 mm sockets/wrenches. Torque to 8 ft-lbs (11 Nm).

89. Re-install the skid-plate (**4**) and fasteners (**5**) using a 15 mm socket/wrench.

90. Re-install the high voltage cable guard (**2**) using a 10 mm socket/wrench.

91. Re-install the large front cage dust cover (**1**) using a 10 mm socket/wrench.

92. Record both snap ring replacement procedures, the odometer reading, inspection results, and all gearbox/traction motor serial numbers on the vehicle's maintenance log.

Power Electronics Coolant Loop Fill

NOTE: Use only 50/50 ethylene glycol/distilled water mixture.

93. Lower the bus to the ground.

94. Attach a 3/8" EPN coolant fill hose onto the coolant fill port (**58**)

95. Insert the other end of the 3/8" EPN hose into the coolant supply container.

96. Select the motor coolant fill (Power Electronics) position on the coolant loop selector three way valve (**59**).

97. Toggle the coolant fill pump switch (**60**) to the "ON" position until the coolant level is full in the rooftop reservoir, ensuring that the coolant level is full in the translucent fill tube (**61**).

NOTE: Open the rooftop emergency escape hatch for translucent fill tube (**61**) visibility.

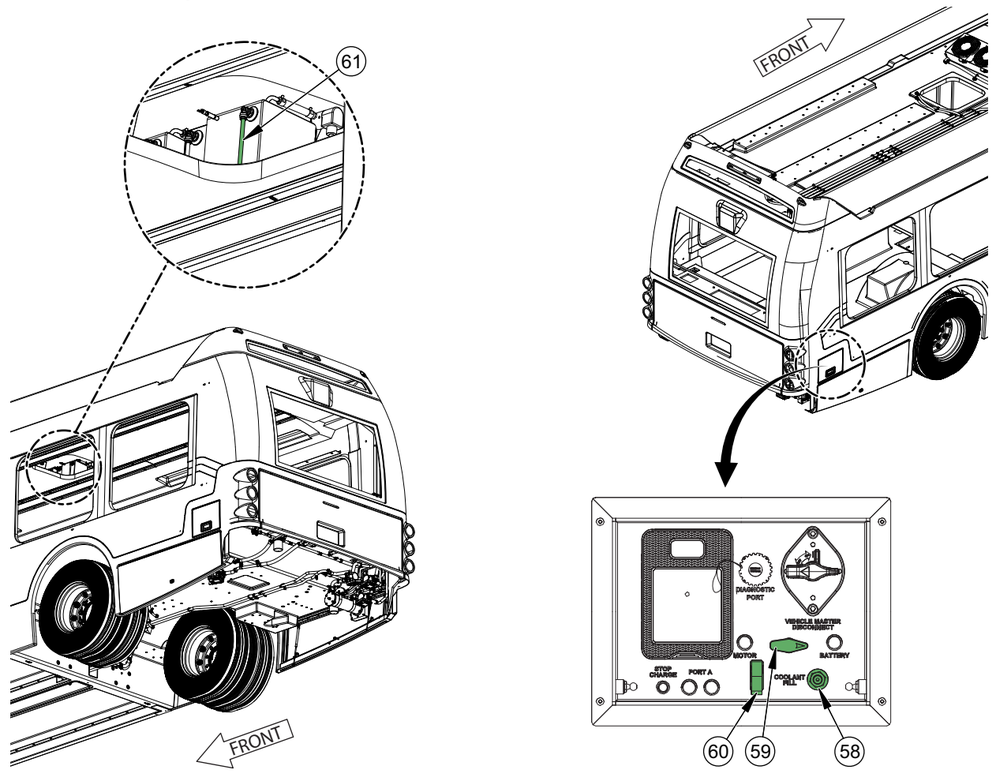


Figure 9-24. Power Electronics Coolant Loop Fill

Pairing the Traction Motor and Power Inverter

NOTE: The traction motor pairing procedure is only necessary if a traction motor is replaced or if a traction motor does not pair automatically when re-installed.

Additional information about the Proterra Diagnostic Tool can be found in the On-Board Diagnostics chapter of this maintenance manual.

Required Tools

- **Laptop computer** with the latest version of the Proterra Diagnostic Tool.
  https://diag.proterra.com/
- **Nexiq USB-Link 2**

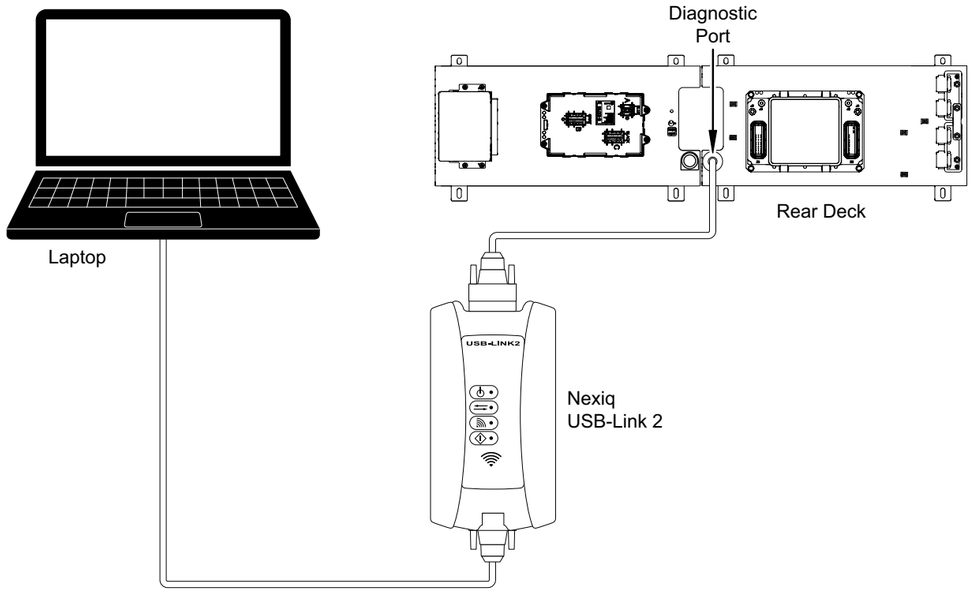


Figure 9-25. Required Tools for Pairing the Traction Motor & Power Inverter

NOTE: Vehicle Diagnostic Port locations vary by configuration. The above illustration shows a rear deck diagnostic port configuration.
If no diagnostic port is present on the rear deck, use the OBD II diagnostic port located in the street-side wheel-well ITS area.

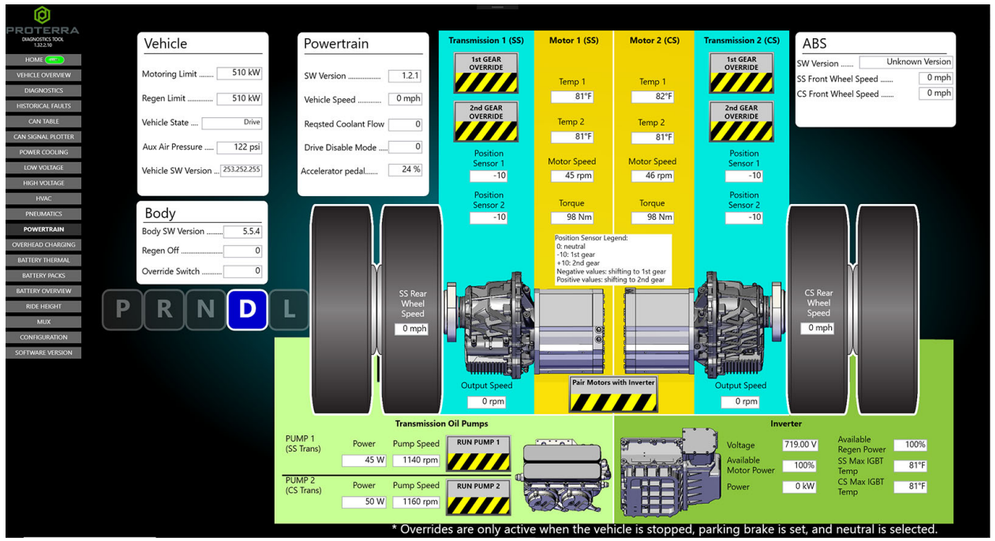


Figure 9-26. DuoPower Powertrain Screen

98. Power down the vehicle by:
    - Selecting *OFF* at the Driver's Master Switch (**57**).
    - Selecting *OFF* at the Master Disconnect Switch (**56**).
    - Selecting *OFF* at the Service Disconnect Switch (**55**).

99. Power up the vehicle by:
    - Selecting *ON* at the Service Disconnect Switch (**55**).
    - Selecting *ON* at the Master Disconnect Switch (**56**).
    - Selecting *Day Run* at the Driver's Master Switch (**57**).

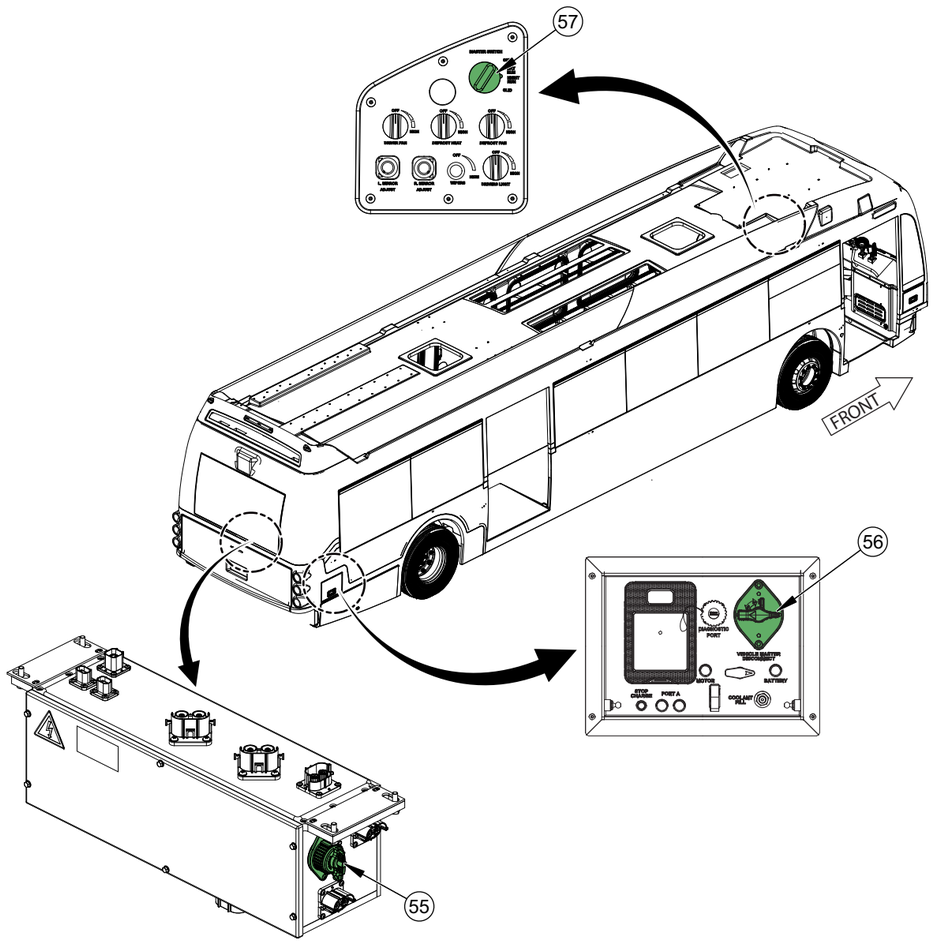


Figure 9-27. Switch Locations

100. Connect the laptop to the Nexiq USB-Link, and the Nexiq USB-Link to the vehicle diagnostic port.

101. From the laptop, launch the Proterra Diagnostic Tool, and select *Connect*.

102. Select *Powertrain*.

103. Select *Pair Motor with Inverter.*

104. When prompted, turn on high-voltage by pushing the green **Start** button on the driver's dash.

NOTE: A message confirming a successful traction motor/power inverter pairing will appear.

105. Turn the driver's master switch to the OFF position, and then back to the ON position and return the vehicle to service.