SERVICE MANUAL BULLETIN

This Service Manual Bulletin is prepared by the Publications Department of New Flyer Industries Canada ULC. Refer to details below.

SMB-189

ISSUE DATE: Dec 20 2019

APPLICABILITY					
VEHICLE LENGTH	☐ 30ft.	☐ 35ft.	☐ 40ft.	☐ 60ft.	■ ALL
VEHICLE TYPE	■ Xcelsior®	☐ MiDi®	☐ Invero®		☐ ALL
	☐ Low Floor	☐ High Floor			
FUEL TYPE	☐ Diesel	☐ Diesel/Electric	☐ CNG	☐ LNG	☐ ALL
	■ Fuel Cell	☐ Trolley/Electric	■ Battery/Electric		
SUBJECT	High Voltage Safety - Lockout / Tagout & De-Energizing & Energizing Procedure				
SECTION TITLE	Lockout / Tagout & De-Energizing & Energizing Procedure				
DETAILS	This bulletin provides revised lockout / tagout and de-energizing and energizing procedures on your New Flyer vehicles in Three Parts. Make this Service Bulletin available to service personnel to inform them of changed information.				

PART ONE

1. Lockout / Tagout Procedure for all Battery Electric Vehicles

The following Lock Out / Tag Out procedure should be followed when working on or near the High Voltage components.

NOTE:

Use commercially available lock out equipment and tags and be sure to follow any local laws or workplace procedures.

1.1. Locking / Tagging Out

1. Set the Master Run switch to the STOP-SYSTEM position.
2. Rotate the 12/24 volt Battery switch to the OFF position.
3. Lock and tag the switch and retain key. See “Fig. 1: Locking / Tagging Out” on page 2.
4. Switch the High Voltage Interlock switch to the HV OFF position.
5. Lock and tag the switch and retain key.
6. Verify the low voltage and high voltage systems are de-energized. Refer to De-Energizing & Energizing Procedures in this bulletin.

1.1.1. Locks / Tags Removal

1. The locks and tags shall be removed by the installer of the locks and tags or shall be removed under her / his supervision.
2. If the installer of the locks and tags is not available, then her/his supervisor:
   a. Ensures that the installer of the locks and tags is not in the facility.
   b. Contacts the installer to inform her/him that the locks and tags will be removed.
   c. Reminds the installer of the lock and tag removal when she/he resumes work.

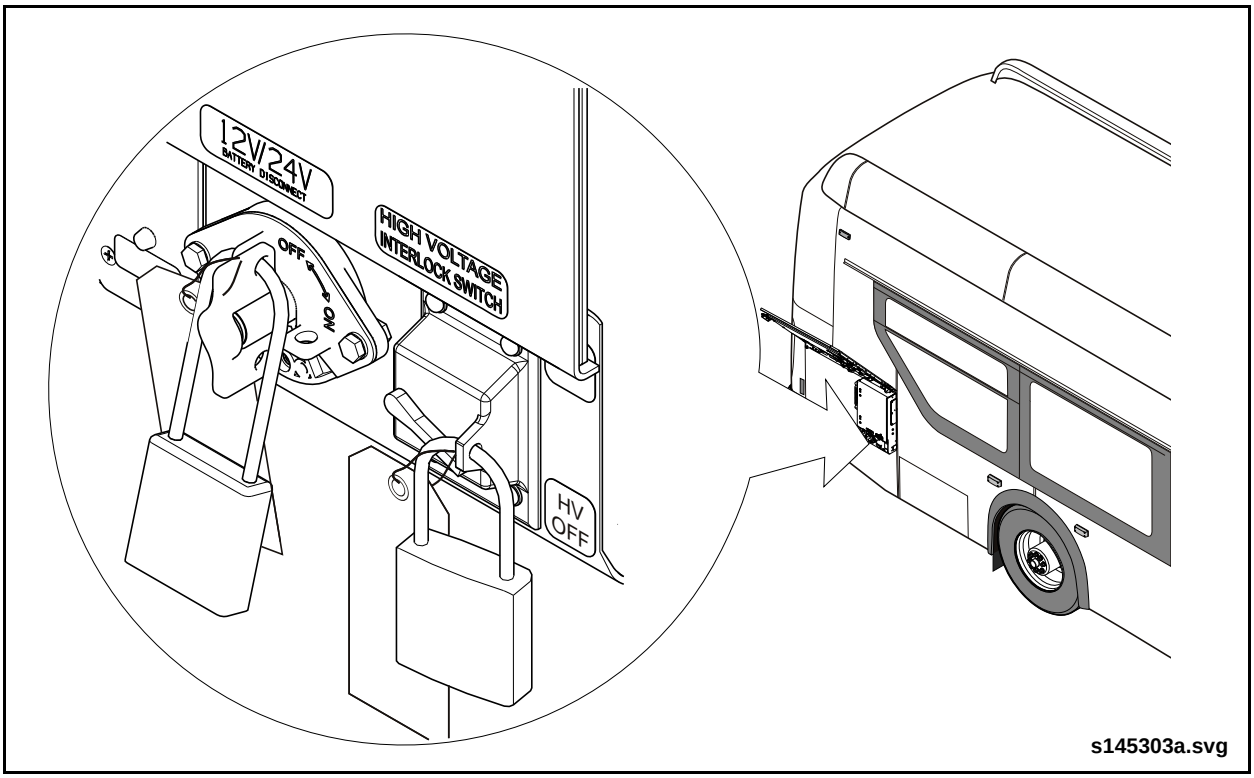

Fig. 1: Locking / Tagging Out

PART TWO

2. De-Energizing & Energizing Procedures for all Battery Electric Vehicles equipped with Manual Service Disconnects (MSD)

DANGER

NEVER try to connect or disconnect circuit components such as cables, fuses, or connectors while there is current flowing in the circuit.

2.1. De-Energizing Procedure

1. Prepare the work area. Refer to “Service Preparation” in your New Flyer Service Manual for information on how to safely prepare the work area.
2. Ensure the DC high voltage charging cables are disconnected from the vehicle.
3. Lock Out and Tag Out the Battery Disconnect and High Voltage Interlock switch. Refer to 1. “Lockout / Tagout Procedure for all Battery Electric Vehicles” on page 2 in this bulletin for procedure.
4. Wear High Voltage Personal Protection Equipment (PPE). Refer to “PPE Requirements” in your New Flyer Service Manual for guidelines.

☞NOTE:

Refer to “Equipment Requirements” in your New Flyer Service Manual for information on the type of multimeter required for the following test.

5. Ensure there is no voltage on the 12/24 VDC battery bus bars. Measure in the main fusebox between the 24V bus bar and the ground bar. See “Fig. 2: Low Voltage Verification” on page 3.

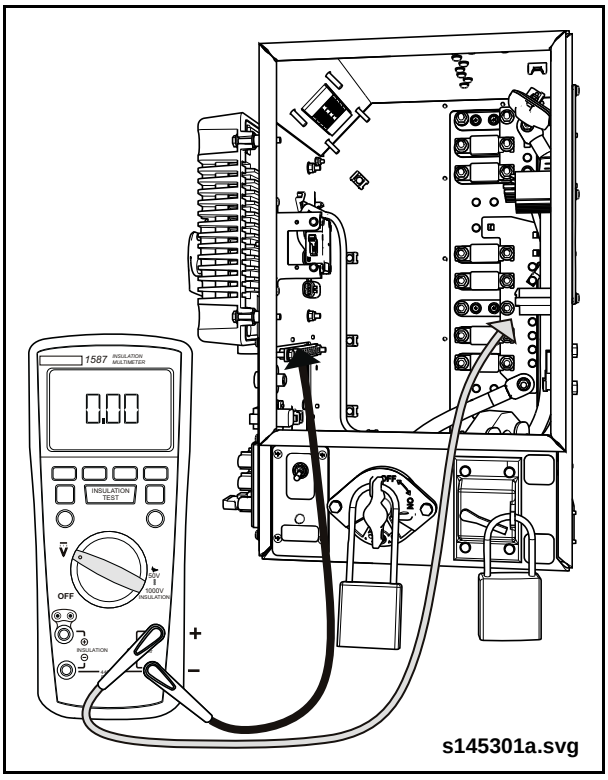

Fig. 2: Low Voltage Verification

6. Ensure there is no voltage on the High Voltage System. Measure in the roof-mounted high voltage fuse box as follows:
   a. Measure from the positive bus bar to the negative bus bar. See “Fig. 3: High Voltage Verification - 1” on page 4.
   b. Measure from the positive bus bar to the grounded enclosure or roof rack structure. See “Fig. 4: High Voltage Verification - 2” on page 5.
   c. Measure from the ground bar to the grounded enclosure or roof rack structure. See “Fig. 5: High Voltage Verification - 3” on page 5.

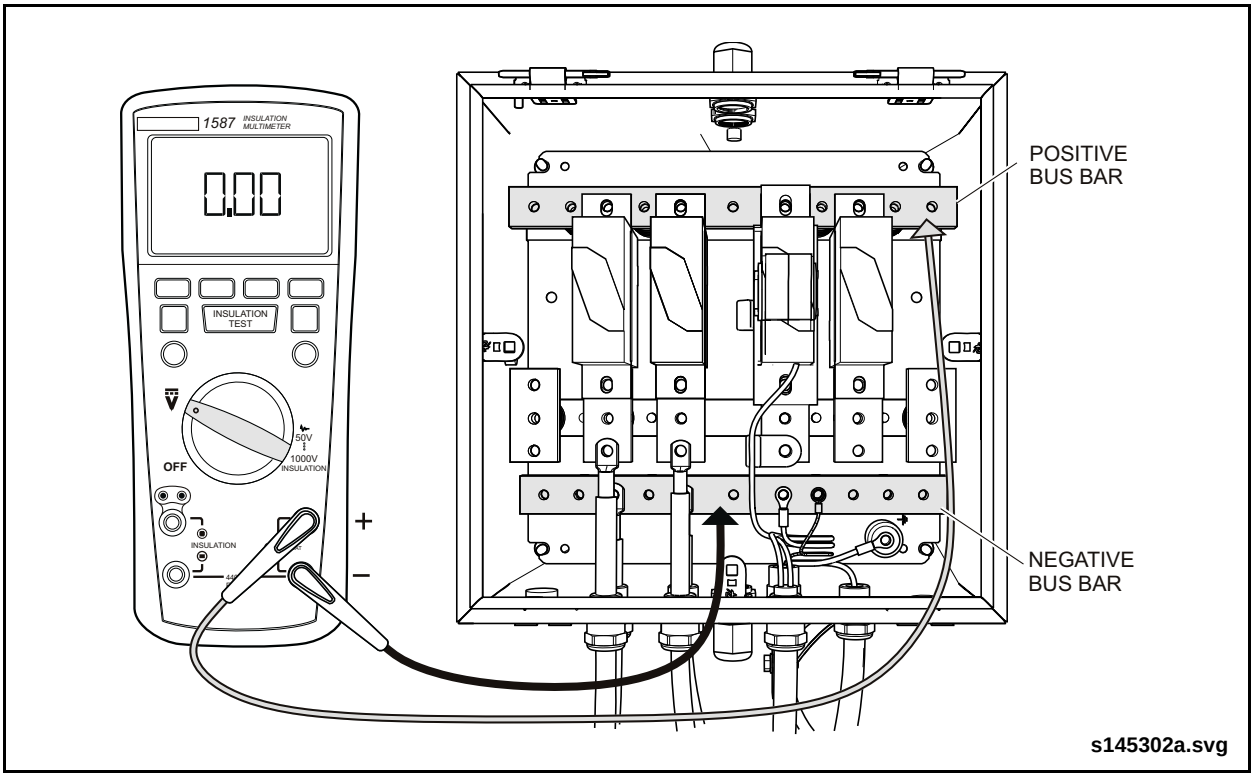

Fig. 3: High Voltage Verification - 1

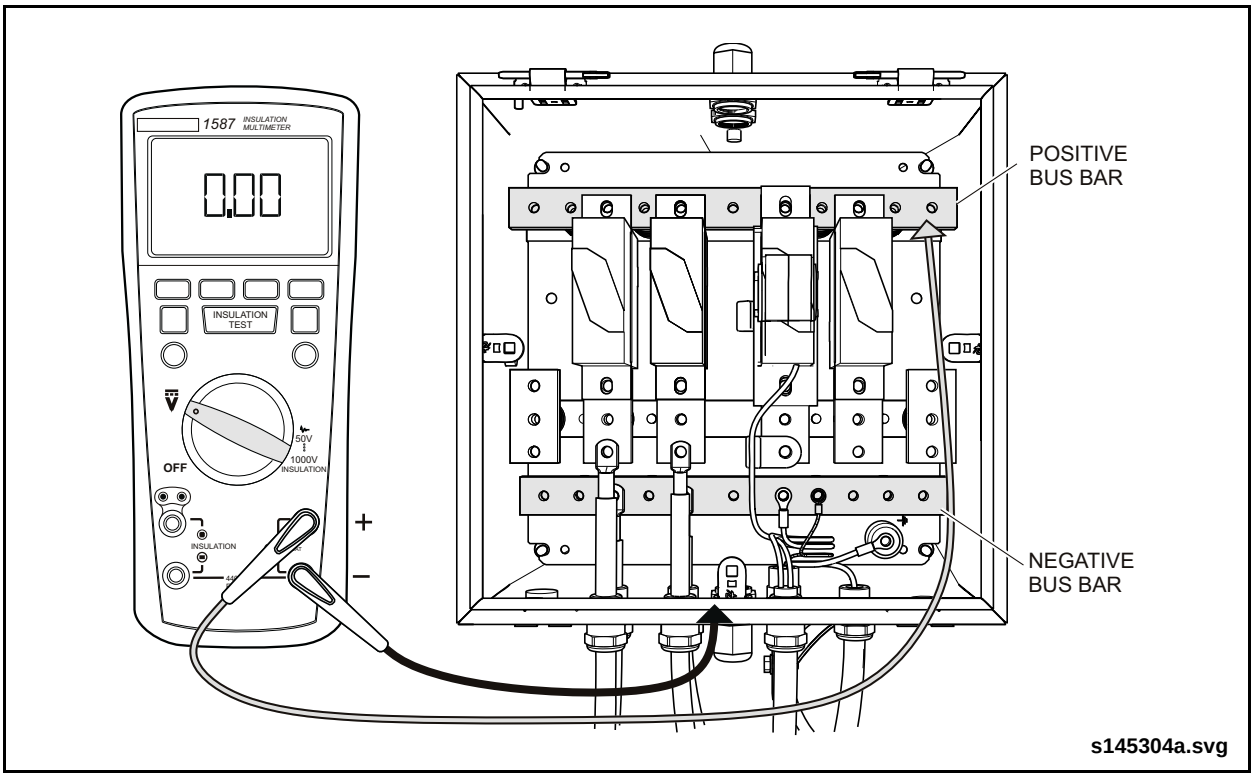

Fig. 4: High Voltage Verification - 2

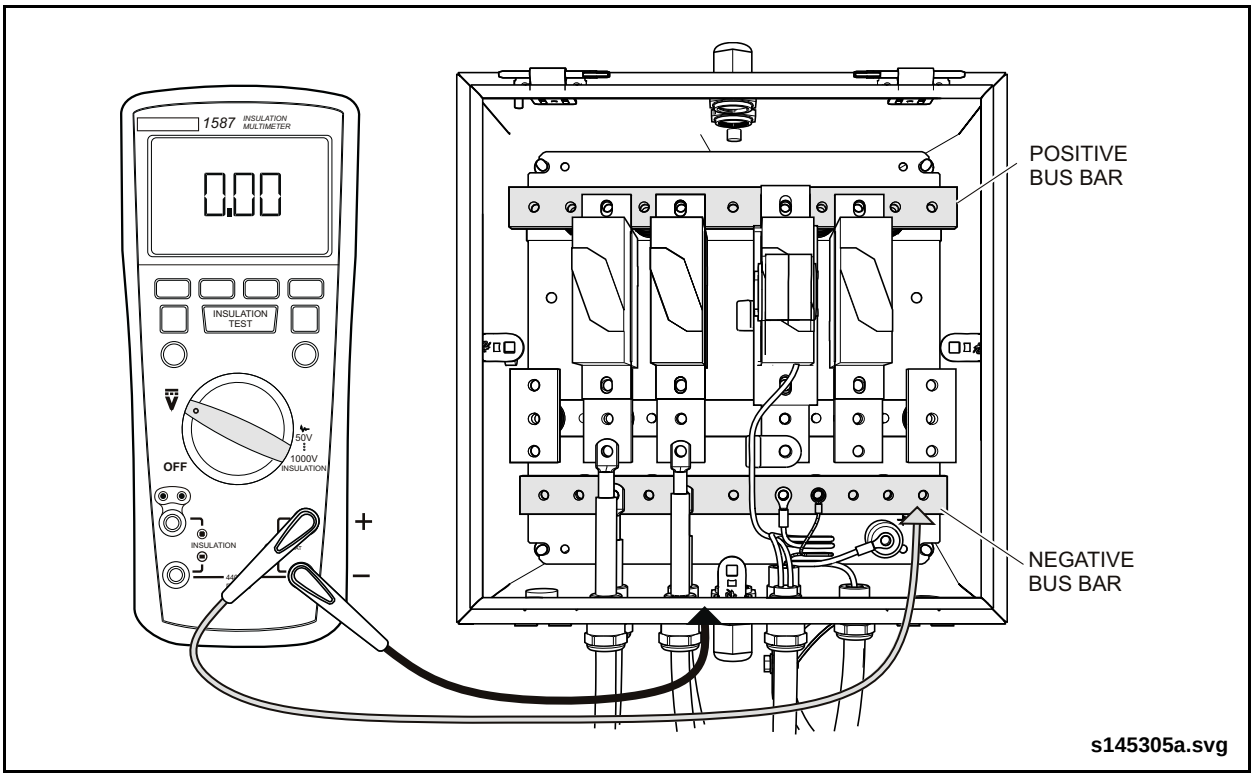

Fig. 5: High Voltage Verification - 3

DANGER

NEVER remove the ESS Manual Service Disconnect plug while current is flowing through it. The High Voltage may create a long enough ionized gas path, during circuit interruption, to bridge the contacts of the switch base and therefore continue the current flow. This ionized gas is very hot and can cause burns, fire and electrical shock.

Using a clamp-on current probe and DMM, ensure that there is no current flowing in the cables connecting to the ESS Manual Service Disconnect plug.

7. Remove all the ESS Manual Service Disconnect plugs as follows:
   a. Press the locking tab and rotate the MSD lever 45°. See “Fig. 6: Manual Service Disconnect - 1” on page 6.

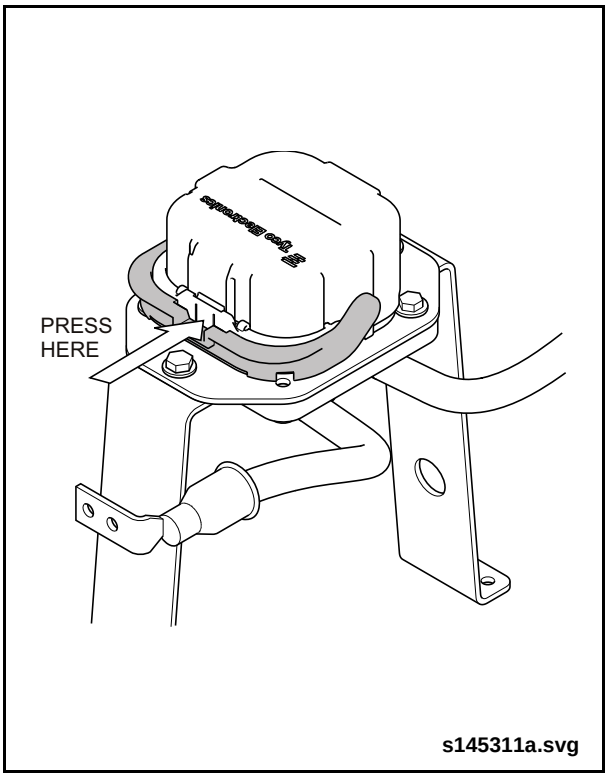

Fig. 6: Manual Service Disconnect - 1

   b. Press the locking tab and rotate the MSD lever to the 90° position. See “Fig. 7: Manual Service Disconnect - 2” on page 7.
   c. Remove the Manual Service Disconnects. See “Fig. 8: Manual Service Disconnect - 3” on page 7.
   d. Install a yellow insulating cover, that is open circuited in the Manual Service Disconnect receptacle and lock it in place.

NOTE:

Removing the Manual Service Disconnects reduces the ESS voltage but each battery within the ESS remains a high voltage hazard at 88 volts.

8. Ensure that insulating covers are installed in all ESS Manual Service Disconnect receptacle locations.
9. Stow the removed MSDs in a locked location to which only you have access.
10. Disconnect the high voltage cables at the HV Junction Box on the side of the ESS.

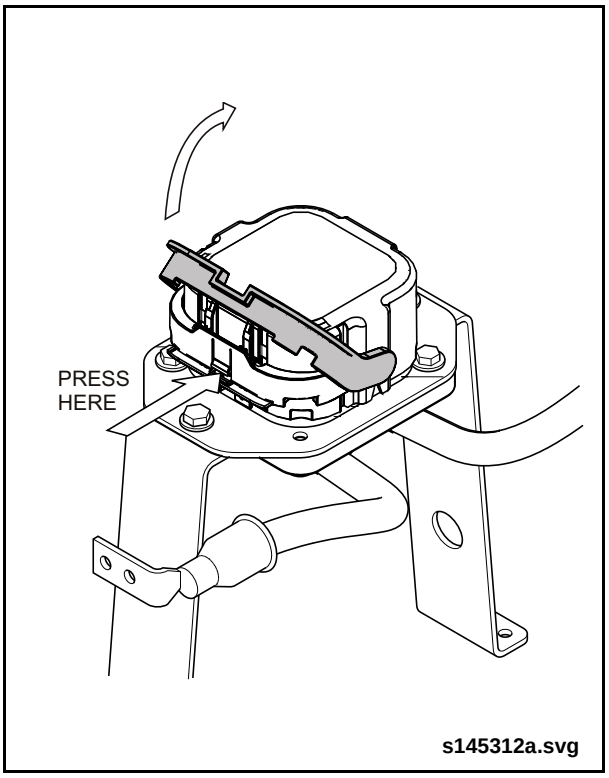

Fig. 7: Manual Service Disconnect - 2

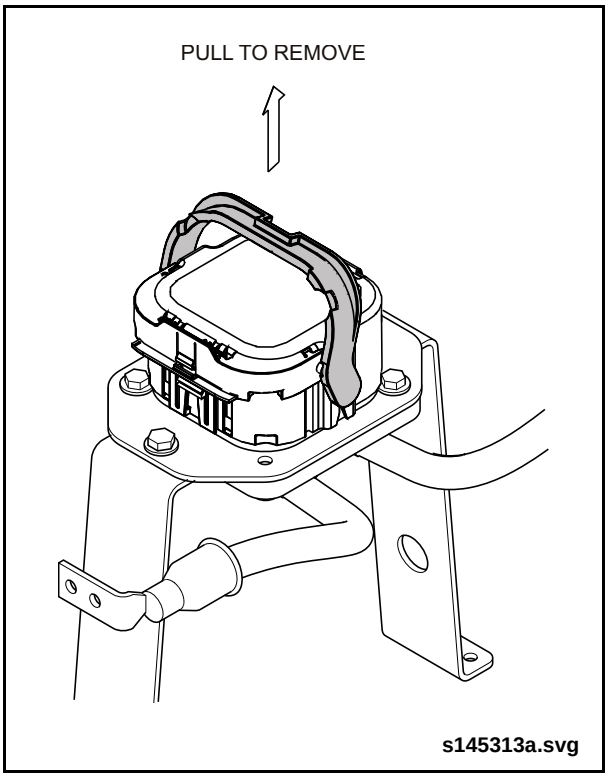

Fig. 8: Manual Service Disconnect - 3

2.2. Energizing Procedure

Perform a visual check to ensure that all possible HV compartments are closed and there is no debris, tools or test equipment lying on HV terminations before energizing the vehicle.

DANGER

DO NOT touch cable terminations until checking to ensure there is no voltage between any of these cables and with respect to vehicle chassis.

While connecting HV cables continuously monitor, with the DMM, for the inadvertent appearance of HV. If HV appears troubleshoot why the HV appeared and resolve before proceeding.

1. Using insulated tools, reconnect all high voltage cables.

NOTE:

For the following devices, use a phase rotation meter to ensure correct cable sequences:

- ❒ *Air Compressor*
- ❒ *ESS Heat Exchanger*
- ❒ *HVAC Unit*

2. Reinstall high voltage junction box covers.
3. Install the ESS Manual Service Disconnect plugs.
4. Close all HV access panels, doors, enclosures.
5. Remove the lockout / tagout from the 12/24 volt Battery Disconnect switch and turn the switch to the ON position.
6. Remove the lock/tag from the High Voltage Interlock switch and set the switch to the HV ON position.
7. Set the Master Run switch to the DAY-RUN or NIGHT-RUN position.
8. Remove “Safety Barricade” with warning lights and “Danger High Voltage” signs around the vehicle perimeter.

PART THREE

3. De-Energizing & Energizing Procedures for all Battery Electric Vehicles without Manual Service Disconnects (MSD)

DANGER

NEVER try to connect or disconnect circuit components such as cables, fuses, or connectors while there is current flowing in the circuit.

3.1. De-Energizing Procedure

1. Prepare the work area. Refer to “Service Preparation” in your New Flyer Service Manual for information information on how to safely prepare the work area.
2. Ensure the DC high voltage charging cables are disconnected from the vehicle.
3. Lock out and Tag Out the Battery Disconnect and High Voltage Interlock switch. Refer to 1. “Lockout / Tagout Procedure for all Battery Electric Vehicles” on page 2 in this bulletin for procedure.
4. Wear High Voltage Personal Protection Equipment (PPE). Refer to “PPE Requirements” in your New Flyer Service Manual for guidelines.

   NOTE:

   Refer to “Equipment Requirements” in your New Flyer Service Manual for information on the type of multimeter required for the following test.

5. Ensure there is no voltage on the 12/24 VDC battery bus bars. Measure in the main fusebox between the 24V bus bar and the ground bar. See “Fig. 9: Low Voltage Verification” on page 8.
6. Ensure there is no voltage on the High Voltage System. Measure in the roof-mounted high voltage fuse box.
   a. Measure from the positive bus bar to the negative bus bar. See “Fig. 10: High Voltage Verification - 1” on page 9.
   b. Measure from the positive bus bar to the grounded enclosure or roof rack structure. See “Fig. 11: High Voltage Verification - 2” on page 9.
   c. Measure from the ground bar to the grounded enclosure or roof rack structure. See “Fig. 12: High Voltage Verification - 3” on page 10.

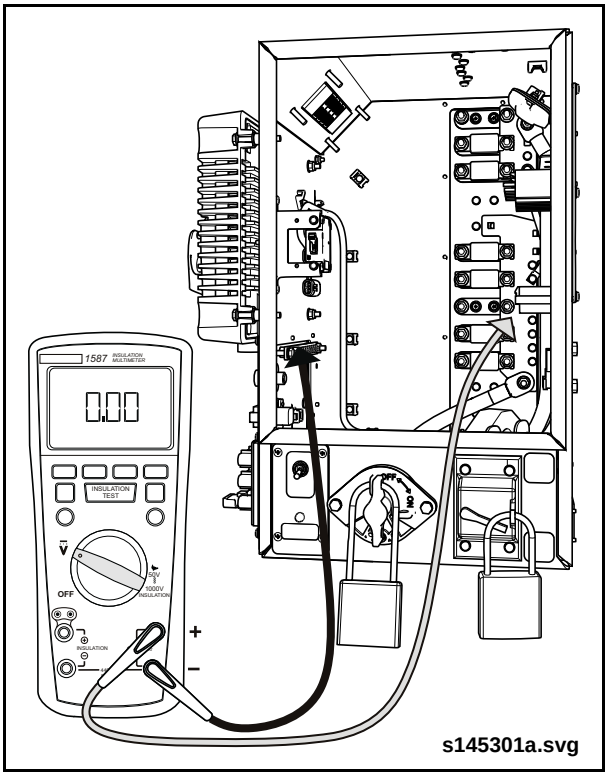

Fig. 9: Low Voltage Verification

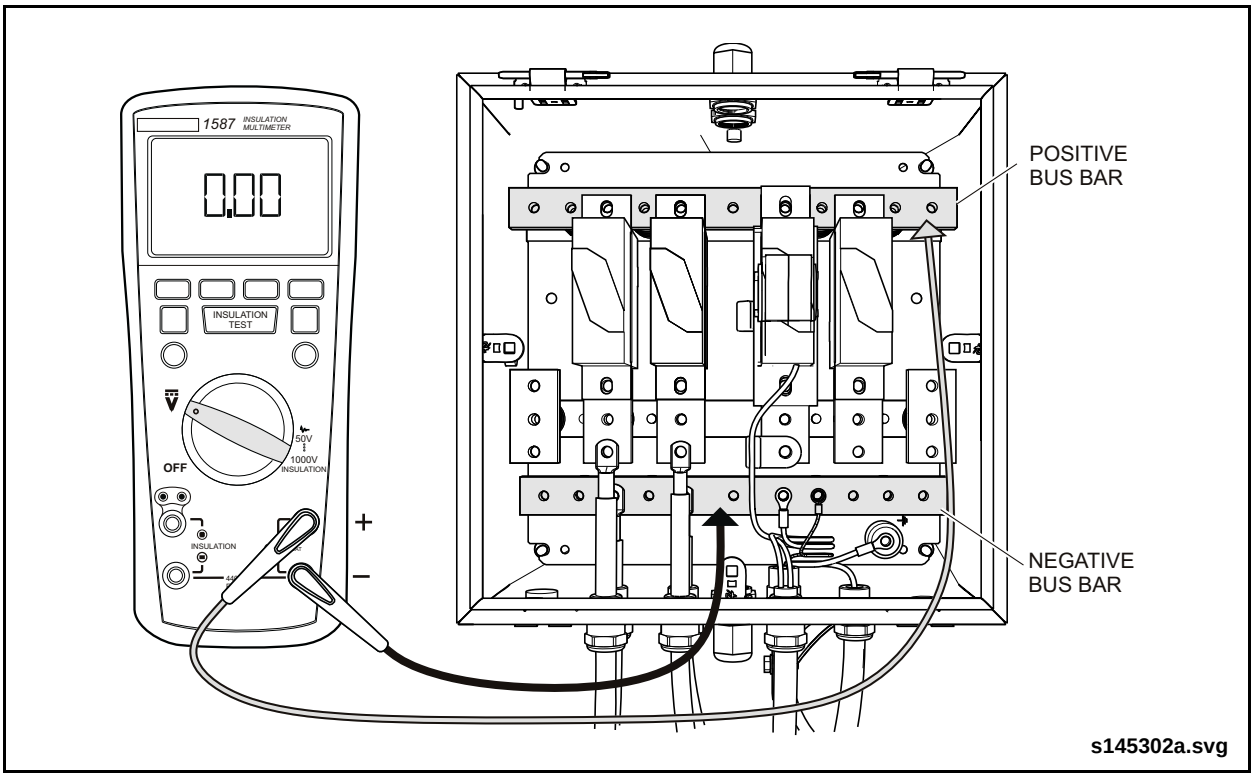

Fig. 10: High Voltage Verification - 1

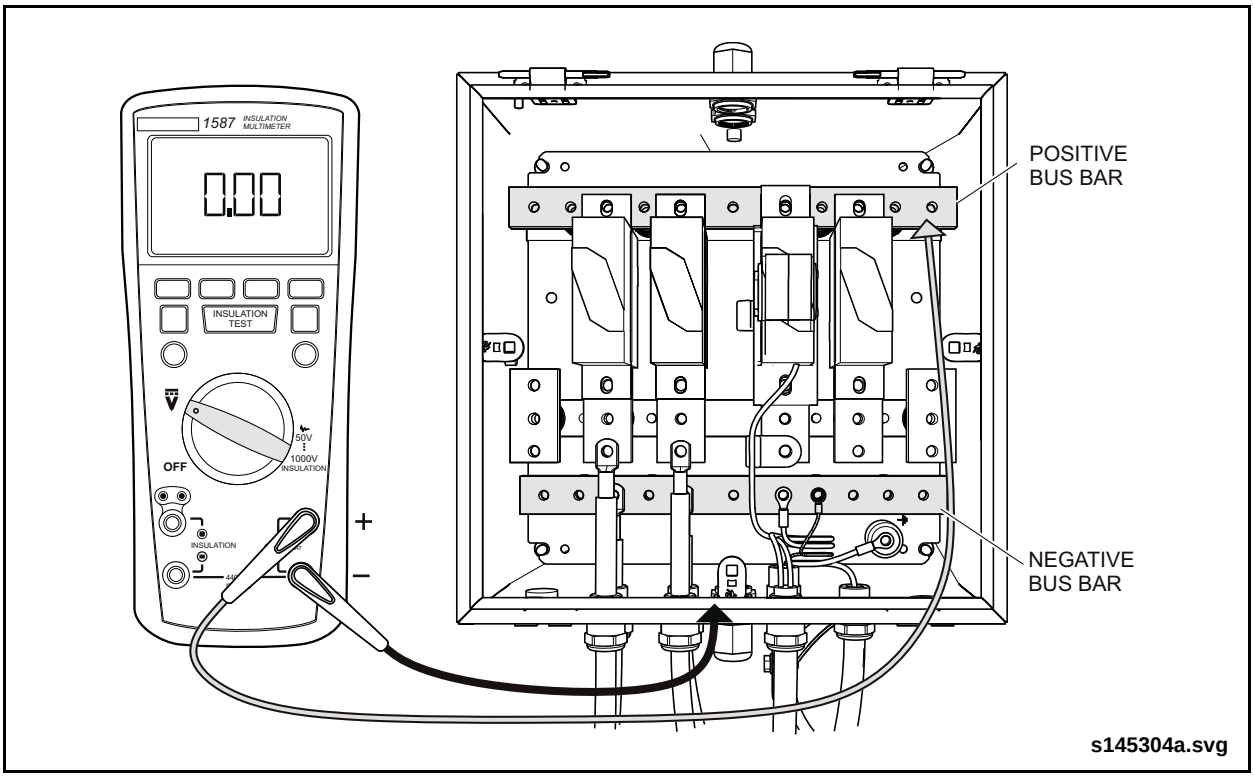

Fig. 11: High Voltage Verification - 2

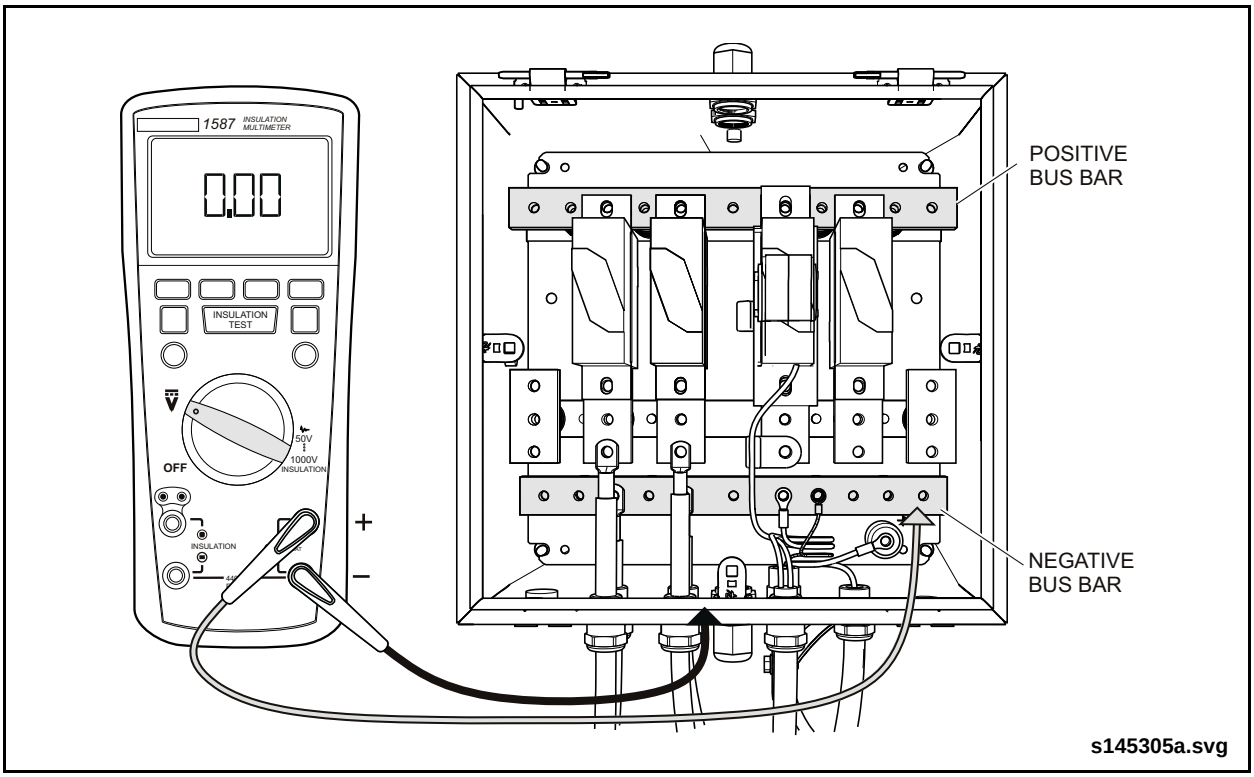

Fig. 12: High Voltage Verification - 3

7. Using a clamp-on current probe and DMM, ensure that there is no current flowing in the mid-string cable or cables inside the ESS enclosure.

NOTE:

The battery strings inside the ESS have a mid-string cable identified with a label. Removing this cable as a service disconnect will reduce the voltage approximately in half. Each battery remains at a high voltage of 88V so continued caution is required.

8. Disconnect the mid-string cable for all battery strings located inside the ESS compartment. See “Fig. 13: Mid-String Cable” on page 11.
9. Remove the cable connectors as follows:
   a. Pull tab #1 up. See “Fig. 14: Release Connector Tab #1” on page 11.
   b. Using an insulated flat-bladed screw driver, press on tab #2 and release tab. See “Fig. 15: Release Connector Tab #2” on page 11.
   c. Pull the high voltage connector off the battery pack.
10. Cover the connector on the cable with a locking cover to prevent it from being reinstalled until after the service work is complete. See “Fig. 16: Locking Cable Cover” on page 11.

DANGER

Removing the mid-string cable will reduce the high voltage risk but not eliminate it. Continue to use caution while disconnecting any other cables from the batteries or while working on any other components within the ESS.

11. Repeat this procedure to disconnect the most positive and most negative cable in the battery string (or strings) located in the ESS.

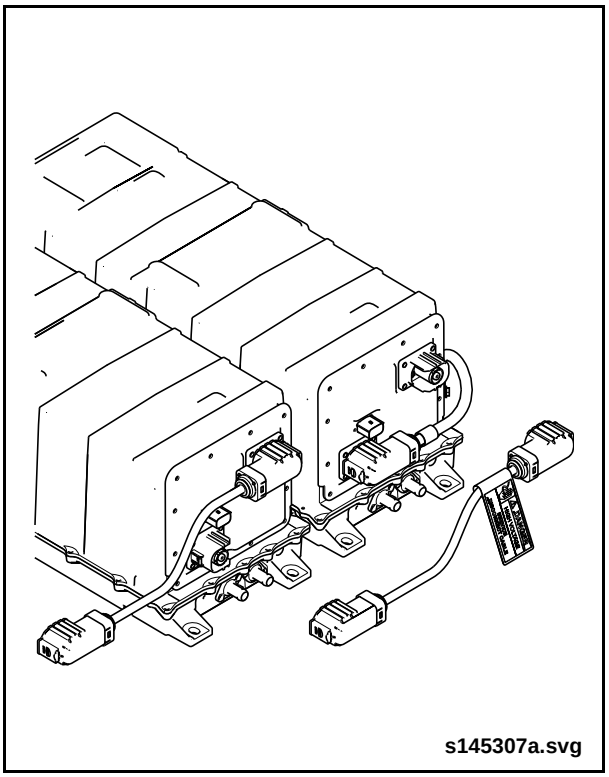

Fig. 13: Mid-String Cable

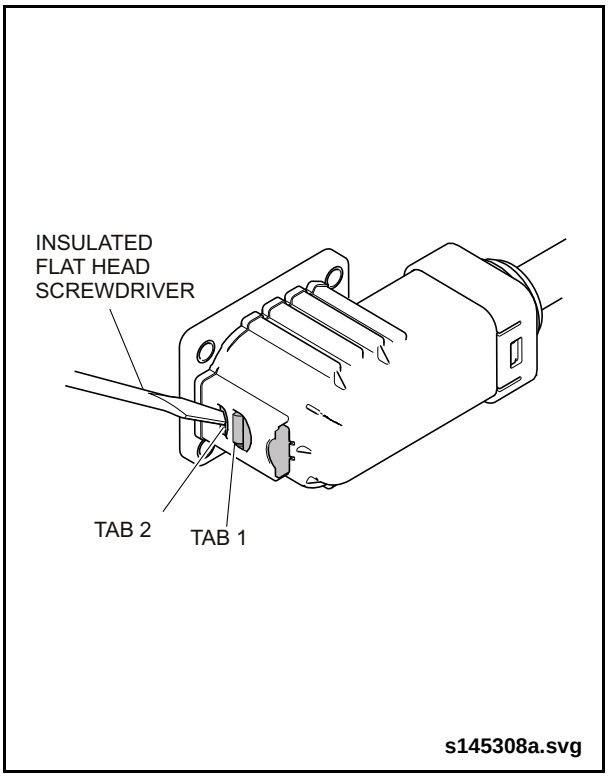

Fig. 15: Release Connector Tab #2

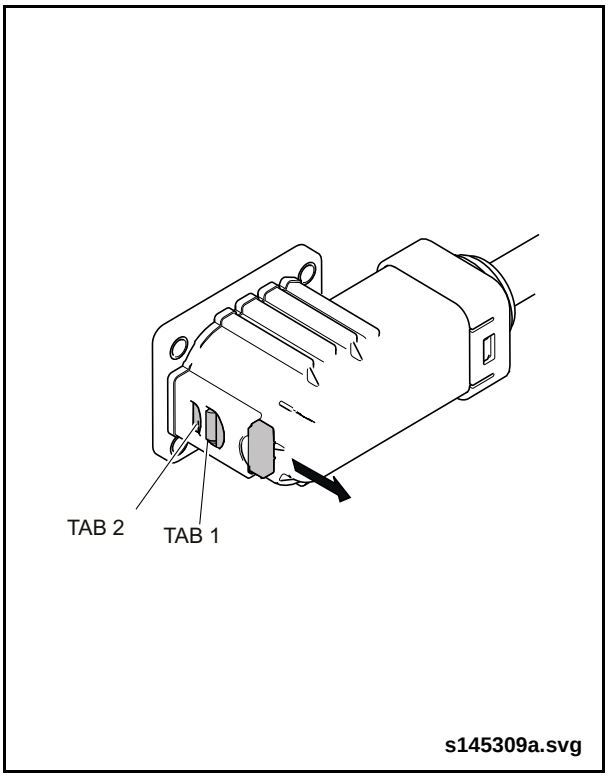

Fig. 14: Release Connector Tab #1

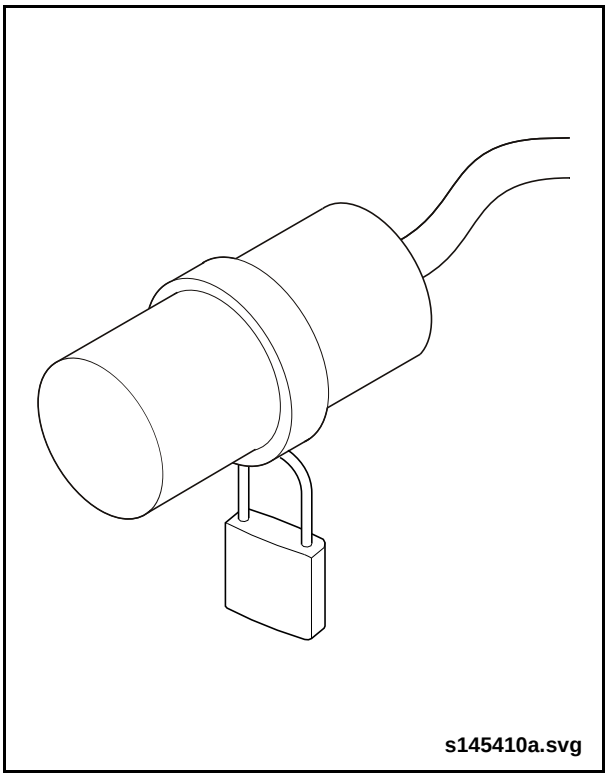

Fig. 16: Locking Cable Cover

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☞NOTE:

For the following devices, use a phase rotation meter to ensure correct cable sequences:

- ❒ *Air Compressor*
- ❒ *ESS Heat Exchanger*
- ❒ *HVAC Unit*

2. Reinstall high voltage junction box covers.
3. Close all HV access panels, doors, enclosures.
4. Remove the lockout/tagout from the 12/24 volt Battery Disconnect switch and turn the switch to the ON position.
5. Remove the lock/tag from the High Voltage Interlock switch and set the switch to the HV ON position.
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