INSTRUCTION TO SERVICE

ITS: 58550	
SECTION:	260 Battery Compartment
WRITTEN BY:	James Ashdown
SUBJECT:	Rooftop ESS Enclosure Sealing

ITS58550

THIS ITS DOCUMENT SHOULD BE RETAINED AND REFERED TO FOR FUTURE MAINTENANCE UNTIL THE NEW FLYER PARTS AND/OR SERVICE MANUAL IS UPDATED TO REFLECT WORK DONE AS A RESULT OF THIS DOCUMENT. ENSURE THAT THIS DOCUMENT IS AVAILABLE FOR PARTS AND MAINTENANCE STAFF GOING FORWARD.

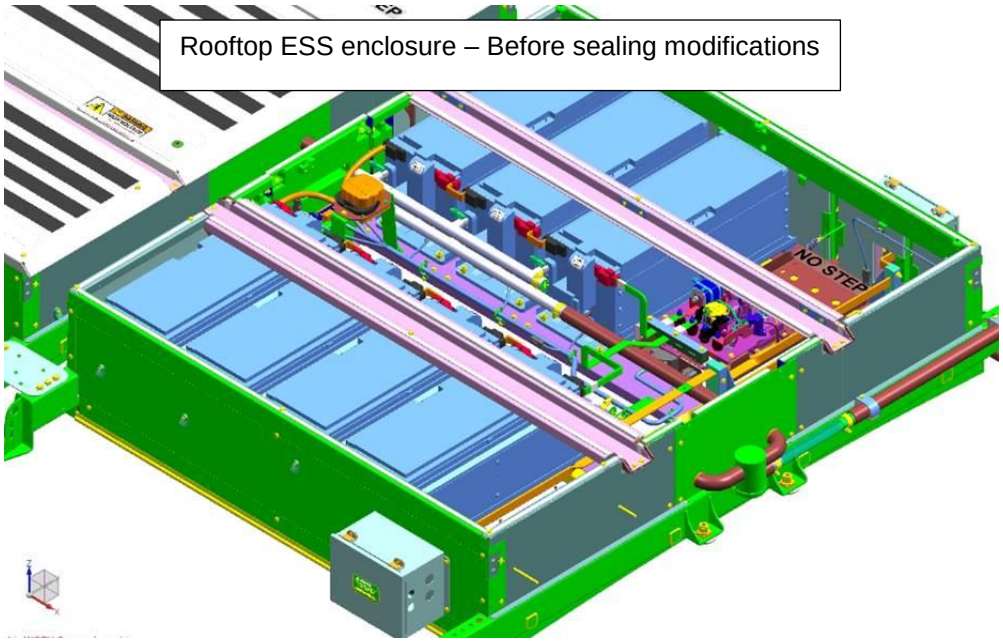
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PROBLEM DESCRIPTION:

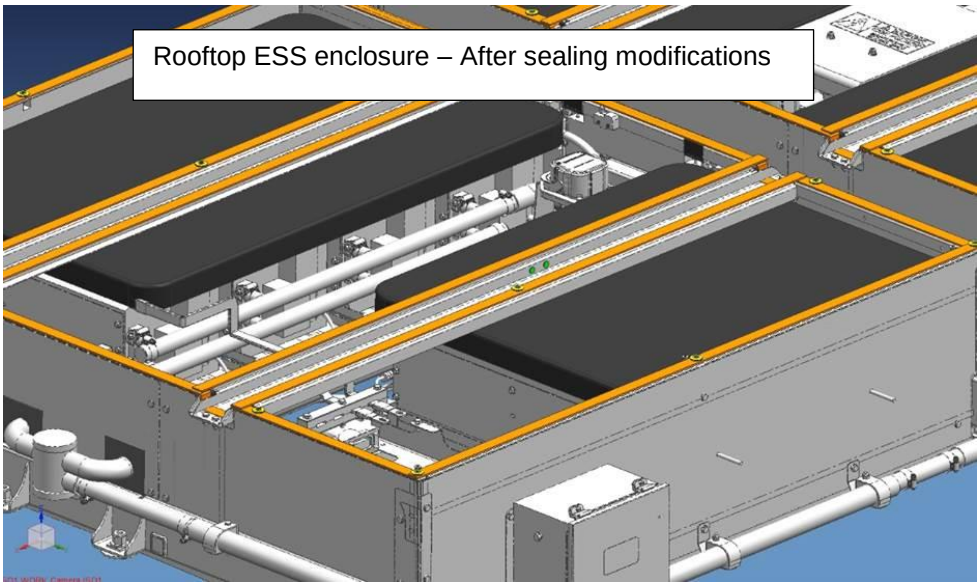
Water intrusion into the rooftop ESS compartment has been observed.

SOLUTION:

Update the rooftop ESS enclosure design to improve water sealing capabilities.



Rooftop ESS enclosure – Before sealing modifications



Rooftop ESS enclosure – After sealing modifications

DANGER

The Electric Drive System uses hazardous High Voltage (HV) electrical energy. There is a risk of electric shock. Only trained service personnel should access components of the electric drive system. Failure to observe all HV electrical safety precautions may result in personal injury and/or death.

The highest concerns are for the safety of service personnel working on the vehicle and others in the vicinity, and in minimizing the potential for damage to property.

Death, serious injury, and significant material damage will result if these safety rules are not followed.

DANGER

Even after the module has been de-energized, hazardous voltages can still be present for longer periods of time.

CAUTION

The following assembly sequence is only to be performed by personnel that have successfully completed New Flyer High Voltage High Voltage Safety Training and with the necessary personal protective equipment.

Only trained personnel shall supervise and perform High Voltage system testing, servicing and troubleshooting. Two personnel (one called the Checker and the other called Monitor/Recorder) shall perform service, troubleshooting and servicing procedures, together, to ensure safety of themselves, others nearby and for the protection of the vehicle and property.

Refer to New Flyer High Voltage Safety Guidelines and Procedures Document 532295 (Appendix A) when completing installation or service work on high voltage power cables.

Prior to proceeding with rework, ensure that:

- Master Run Switch (MRS) is in the “OFF” position
- High voltage interlock is in the “OFF” position and wait 10 minutes
- Switch 24V battery shut off to the “OFF” position
- Lock out/tag out high voltage system
- Bus is not charging at any time during retrofit
- The appropriate High Voltage PPE is available and used when required



Curbside Engine Compartment

PROCEDURE:

1. Enter bus and turn the master run switch to the “OFF” position.

⚠ WARNING

Disconnecting cables from the battery terminals exposes high voltage. Wear Personal Protection Equipment when working with the batteries. Use fall protection equipment if working on the vehicle's roof.

⚠ CAUTION

The batteries are static sensitive. Use caution when disconnecting the HV connections.

⚠ CAUTION

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

⚠CAUTION

NEVER remove the ESS Manual 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 that can cause burns, fire & electrical shock.

⚠CAUTION

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, dress in PPE and troubleshoot why the HV appeared and resolve.

2. Gain access to the roof of the bus and locate the ESS enclosure. Ensure that appropriate fall protection PPE is used and appropriate safety procedures are followed per the New Flyer Service Manual. Refer to Figure 1.

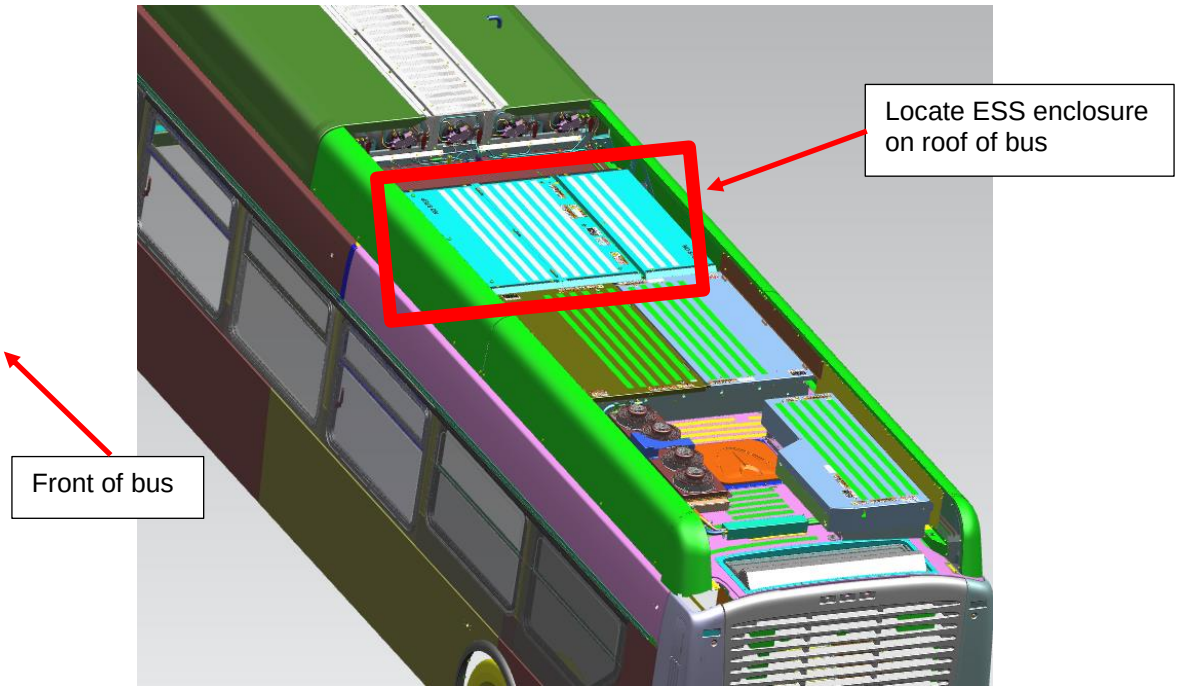


Figure 1 – Locate rooftop ESS enclosure

3. Open/remove side screens adjacent to the ESS enclosure and remove center rooftop cover on ESS by carefully sliding off hinge pins. Retain all hardware. Refer to Figure 2 as well as the New Flyer Service Manual.

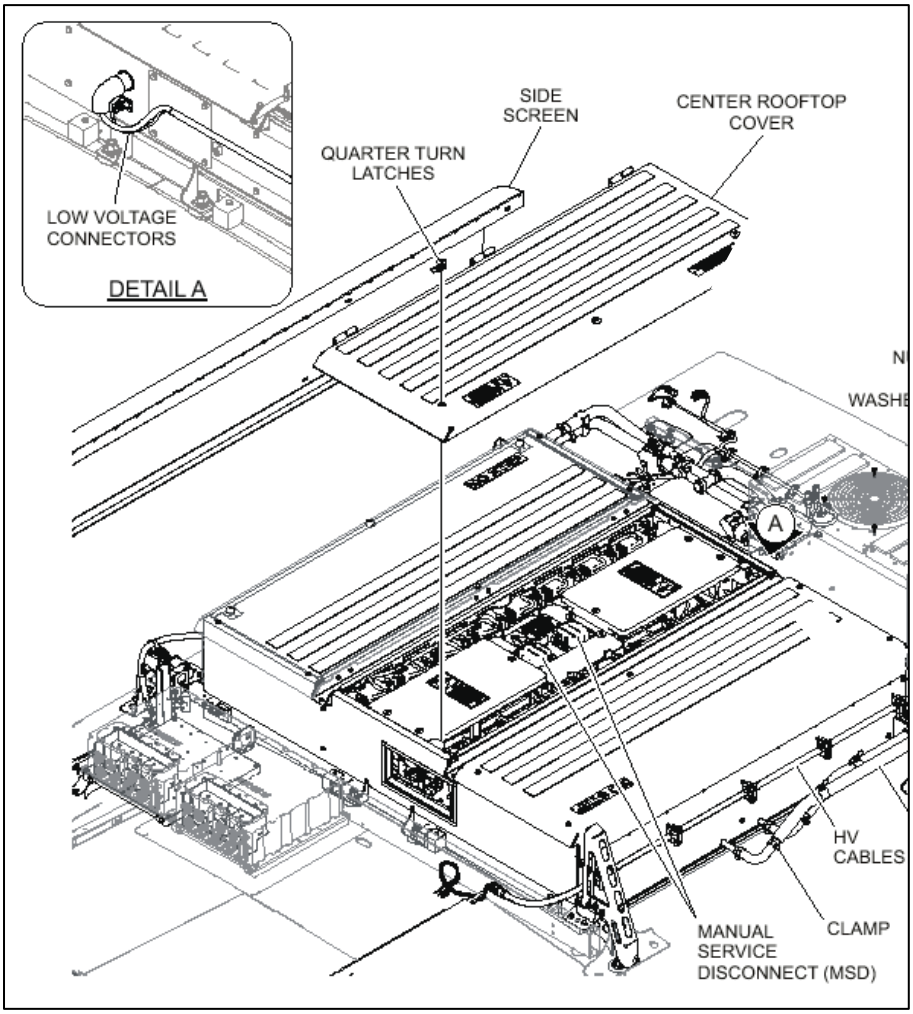
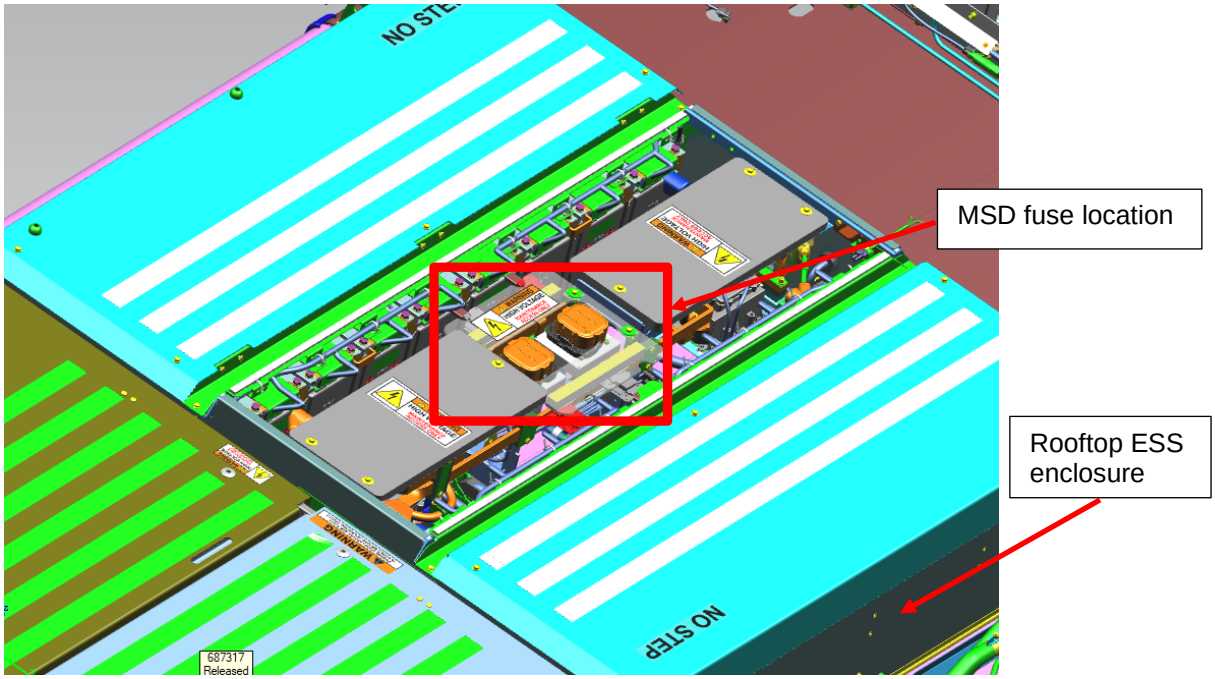


Figure 2 – Remove side screens, center rooftop cover and pull MSD fuses

4. Locate and remove rooftop ESS enclosure Manual Service Disconnect (MSD) fuses x2 locations by pressing on tabs and pulling upwards. Refer to Figures 2 and 3 as well as the applicable section of the New Flyer Service Manual.



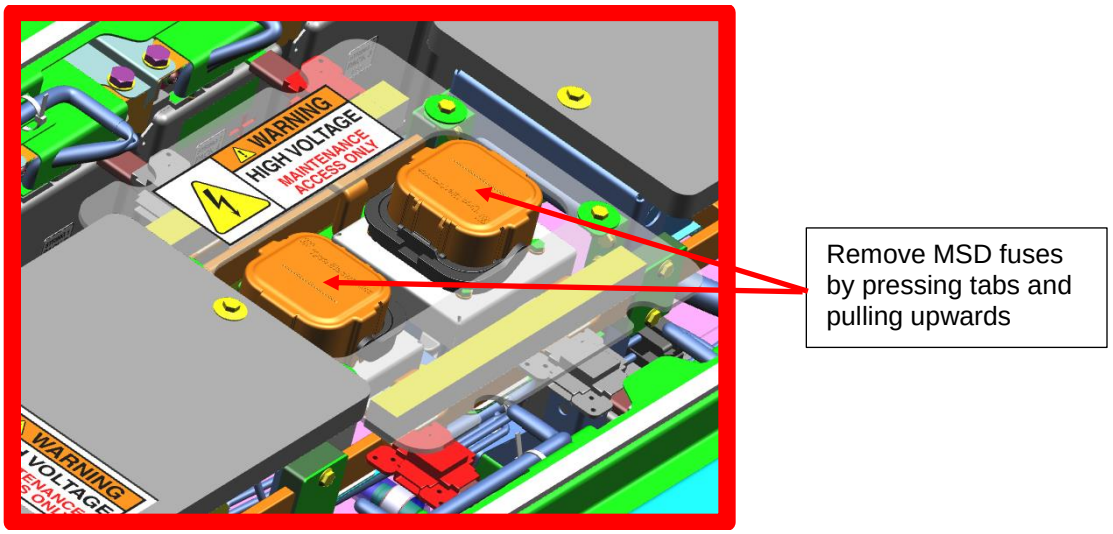


Figure 3 - Locate and remove Manual Service Disconnect (MSD) fuses x2

5. Remove Flange Bolts (P/N 10B04012) x10 and Washers (P/N 10W04000) x10 from CS/SS access panels and carefully remove panels (and insulation) from rooftop ESS enclosure. Retain all hardware.

⚠ CAUTION

DO NOT step onto the battery packs directly.

6. Cut Tyraps (P/N 5958112) x16 locations to disconnect LV Wire Harnesses from flanges on CS/SS Door Support Rails. Refer to Figure 4.

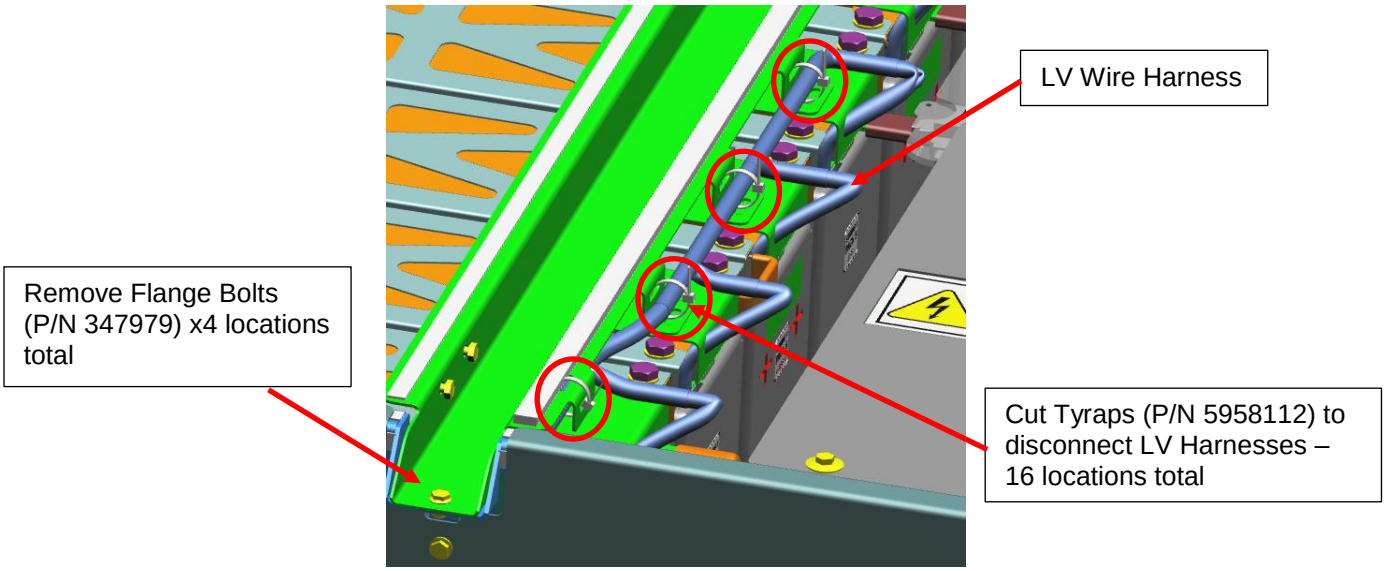


Figure 4 – Cut Tyraps to disconnect LV Harnesses from Door Support Rails (SS location shown)

7. Remove Flange Bolts (P/N 347979) x4 locations on rooftop ESS enclosure and remove CS/SS Door Support Rails. Retain all hardware. Refer to Figures 4 and 5.

   Note: If required, disconnect any electrical harnesses from Door Support Rails before removal.

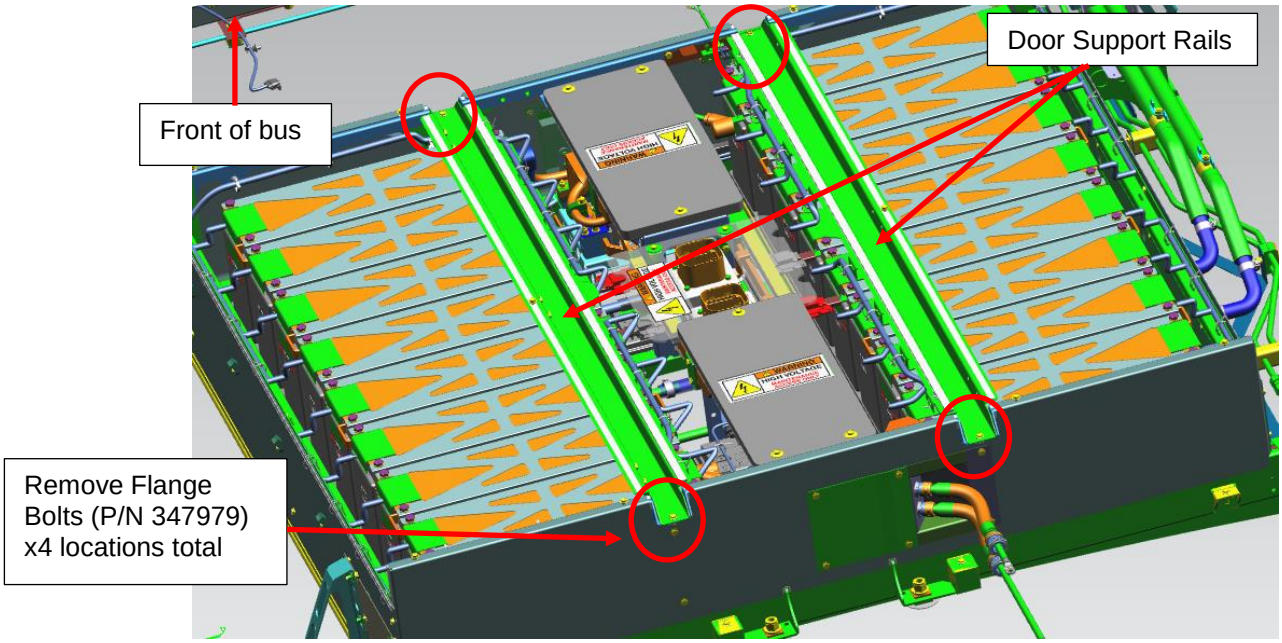


Figure 5 – Remove flange bolts and disconnect CS/SS Door Support Rails

8. In the ESS enclosure, visually inspect to ensure that all bus bar connection points have the correct boots/caps (red and grey) installed. If missing, reinstall/replace before performing rework. Refer to Figure 6.

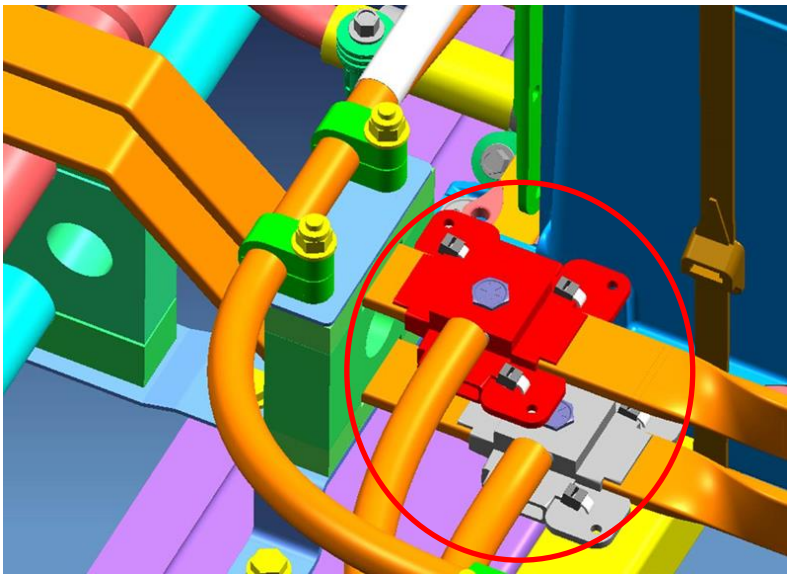


Figure 6 – Visually inspect all bus bar connection points for correct boots/caps

9. Use a lint free cloth to ensure that the top surfaces of all battery packs are free of dust and debris in preparation of adhering Velcro strip. Refer to Figure 7.

   Note: Do not use any chemicals or liquids to clean the top surfaces of battery packs.

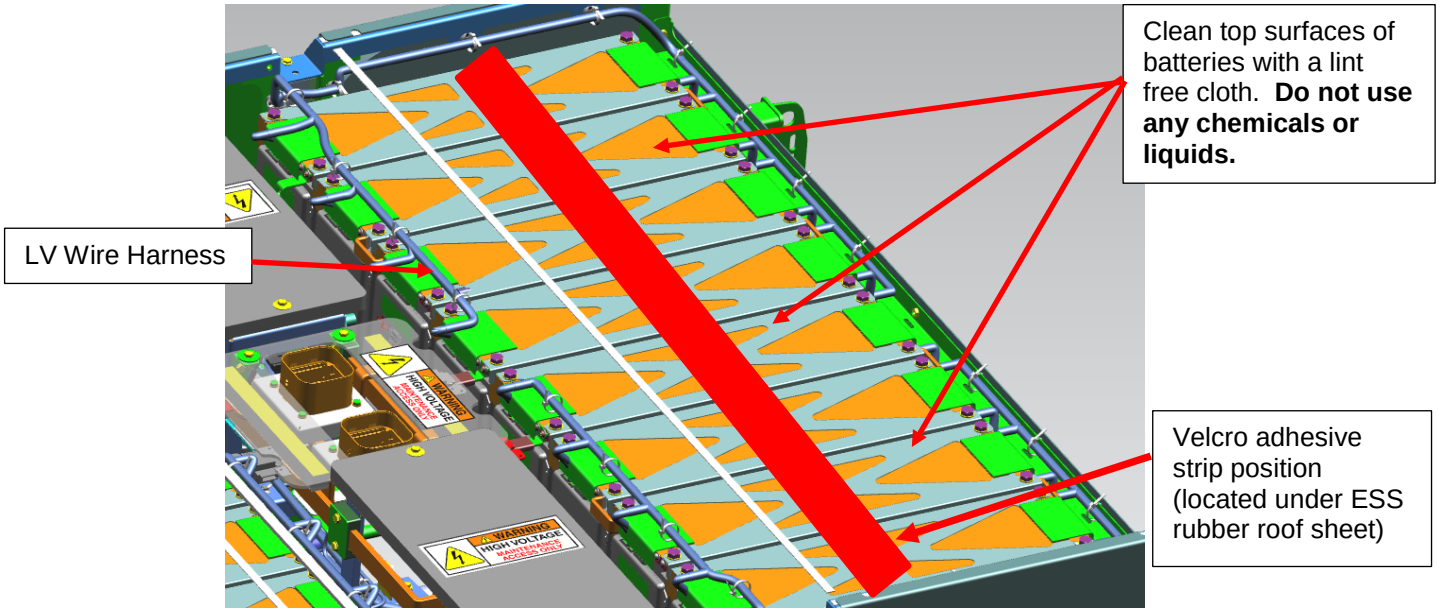


Figure 7 – Clean top surfaces of battery packs to prepare for Velcro strip application

10. Position ESS Rubber Roof Sheets (P/N 761574) x2 centered forward/aft on battery packs. Additionally, position sheets left to right to sufficiently cover the inboard low voltage harnesses. Following this, tuck sheets under low voltage harnesses and cut a 3” maximum slit at interfering powerbar locations. Refer to Figures 8 and 9.

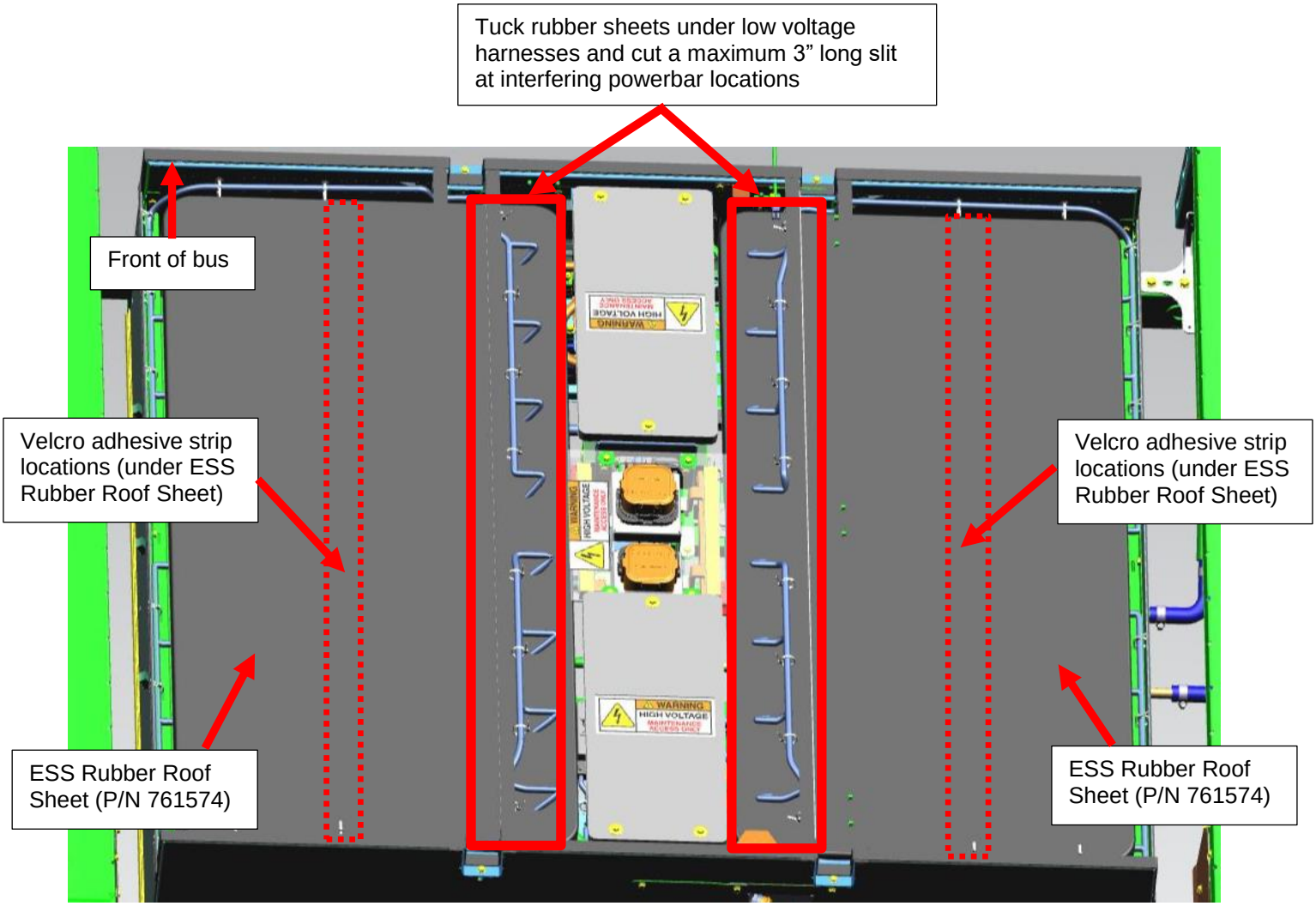


Figure 8 – Position ESS Rubber Roof Sheets and tuck under low voltage harnesses

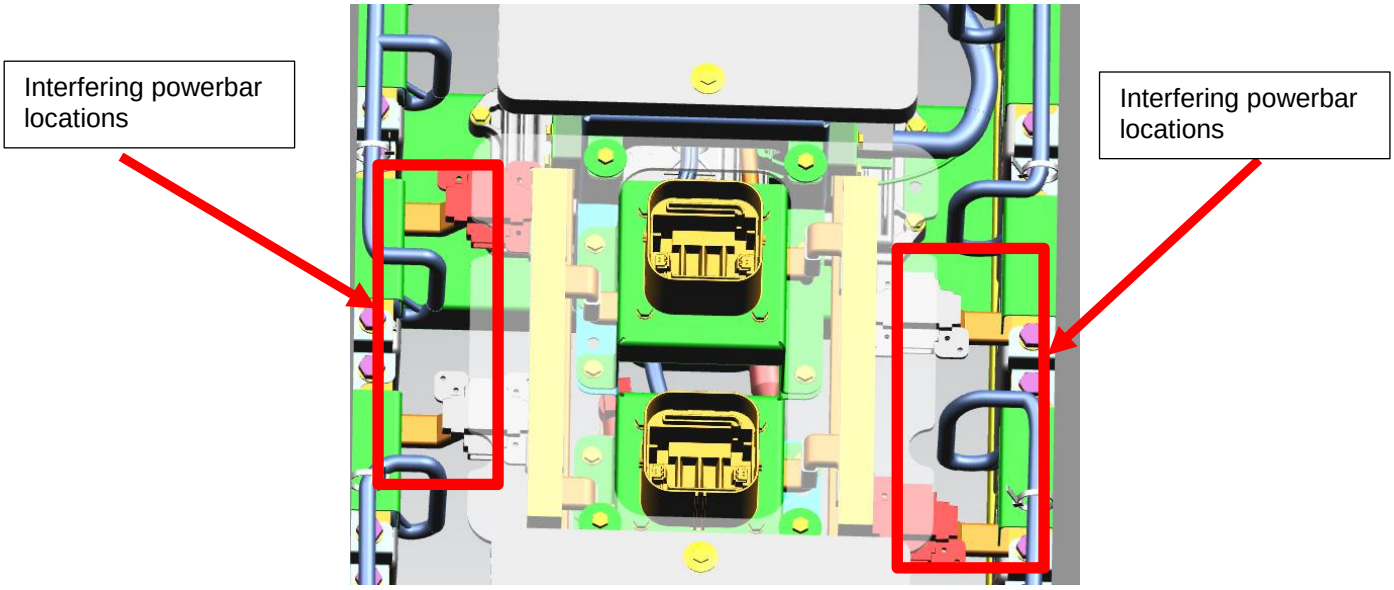


Figure 9 –Cut a 3" maximum slit in rubber sheets at interfering powerbar locations

11. Once properly positioned, flip back half of ESS Rubber Roof Sheets (P/N 761574) x2, expose adhesive side of Velcro strip (located under ESS sheet) and adhere in position on battery packs. Repeat for the second half of the rubber sheet. Refer to Figures 8, 9 and 10.



Figure 10 – ESS rubber roof sheet in final position on battery packs

12. Perform a visual inspection of existing black Rubatex Seal (P/N 5968183) on both ESS Enclosure Frame and top flanges of Door Support Rails. Replace if sections are observed missing/badly damaged. Refer to Figure 11.

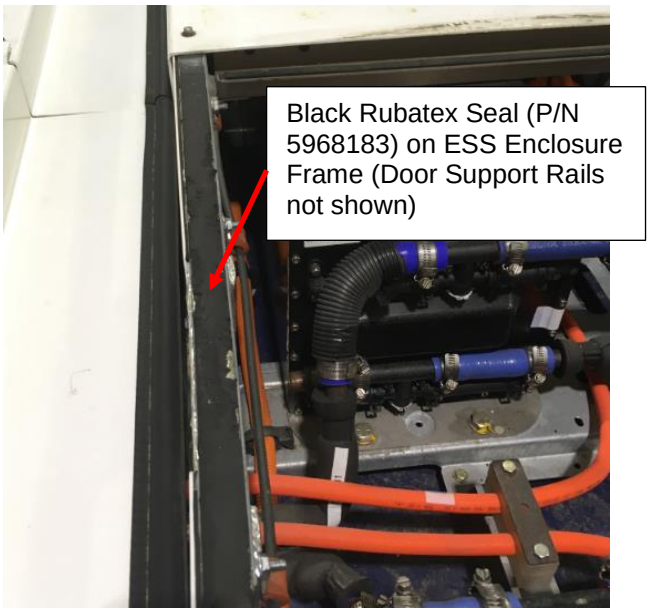


Figure 11 – Visually inspect existing Black Rubatex Seal (Door Support Rails not shown)

13. Cut continuous strips of Emseal Tape (P/N 761257) and adhere to existing black Rubatex Seal (P/N 5968183) along the outer perimeter of the ESS Enclosure Frame. Apply tape in full lengths with no seams (except at corners). Refer to Figures 12 and 13.

    Note: When applying Emseal Tape (P/N 761257), do not stretch tape around inside and outside corners of stiffening channel notches. Let tape relax naturally to prevent it from expanding/tearing. Refer to Figure 13.

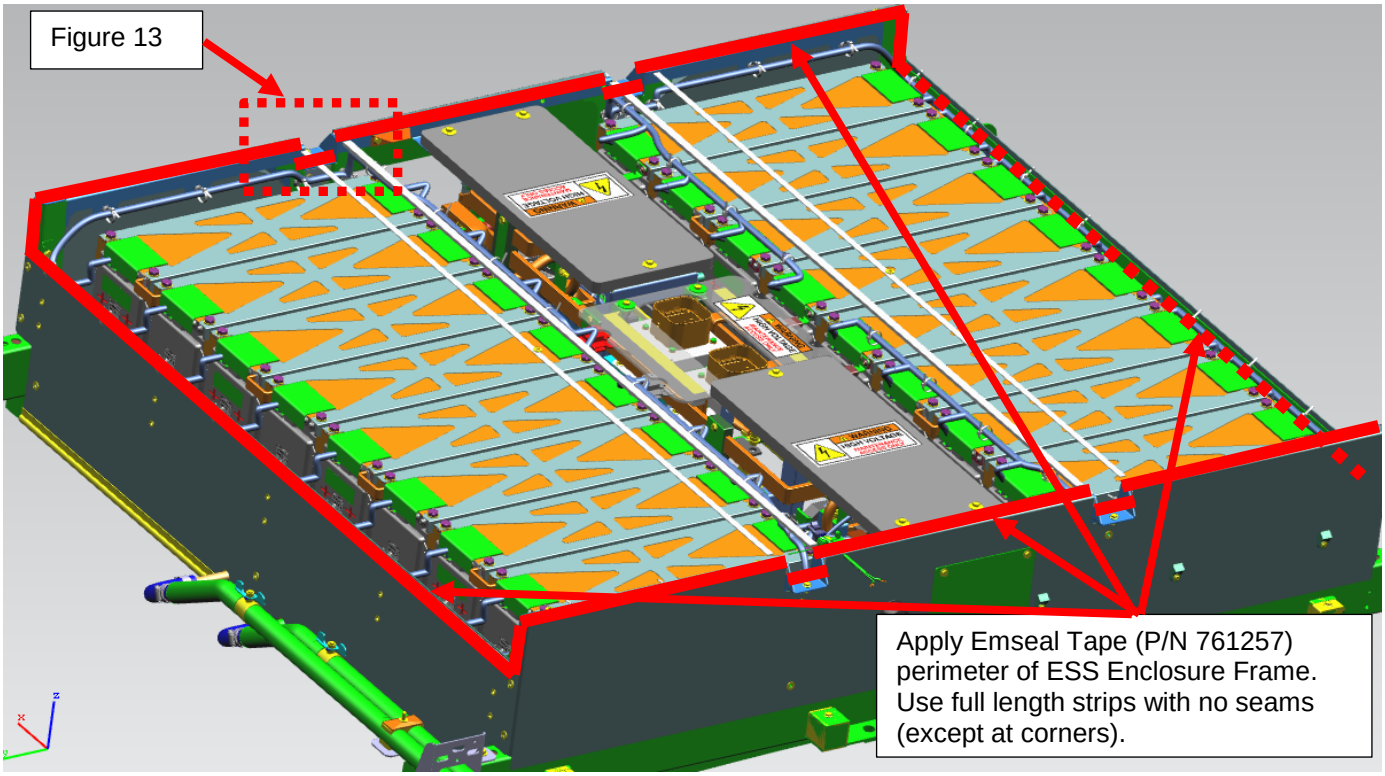


Figure 12 – Adhere Emseal Tape to existing black Rubatex Seal around perimeter of ESS Enclosure

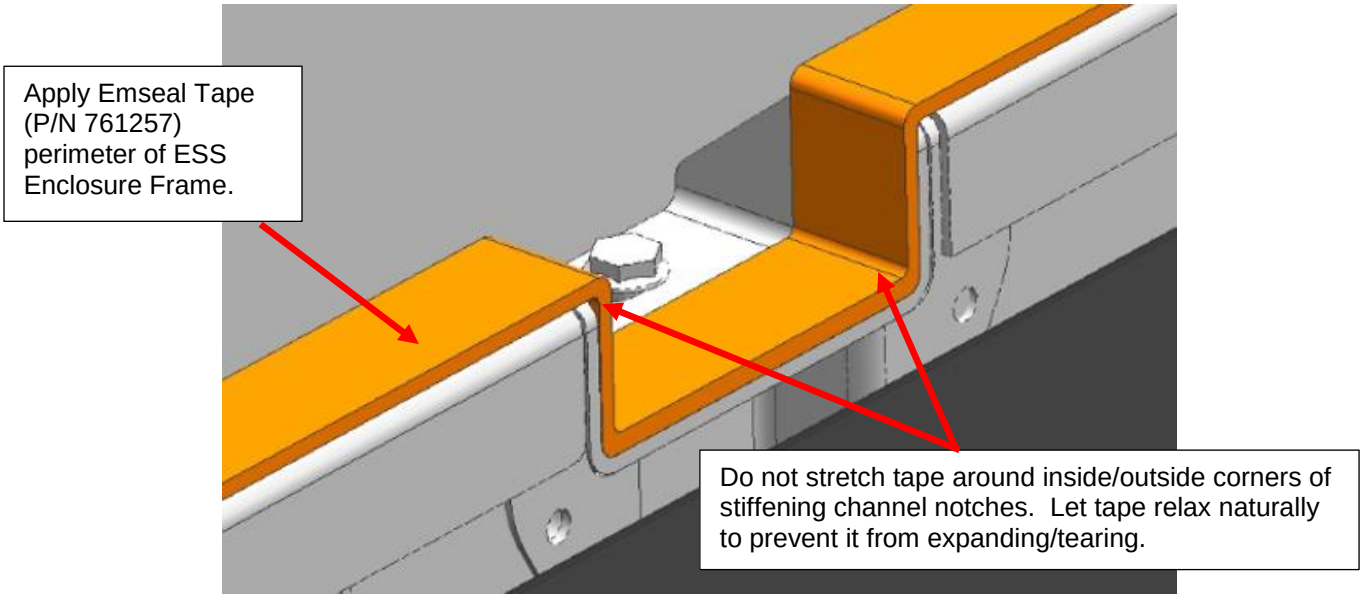


Figure 13 - Apply tape around inside/outside corners of stiffening channel notch

14. Using existing hardware, reinstall CS/SS Door Support Rails with Flange Bolts (P/N 347979) x4 locations on the rooftop ESS enclosure. Refer back Step 7, Figures 4 and 5.

15. Secure LV Wire Harnesses back to flanges on CS/SS Door Support Rails using Tyraps (P/N 5958112) x16 locations. Refer back to Step 6, to Figure 4.

16. Position Roof Seal Blocks (P/N 761202) x2 under Door Support Rail flanges, flush with the ESS Enclosure Frame to create a continuous contact surface for Emseal Tape (P/N 761257). Clean bonding surfaces with Isopropyl Alcohol (P/N 134336) and a lint free cloth. Perform at 8 locations total. Refer to Figure 14.

    Note: Trimming Roof Seal Blocks (P/N 761202) may be required to ensure a correct fit.

17. Apply Sika 221 White (P/N 055701) to bonding surfaces and secure blocks to Door Support Rail flanges/ESS Enclosure Frame. Perform at 8 locations total. Refer to Figure 14.

    Note: Apply enough Sika 221 White (P/N 055701) around block to create a water tight seal.

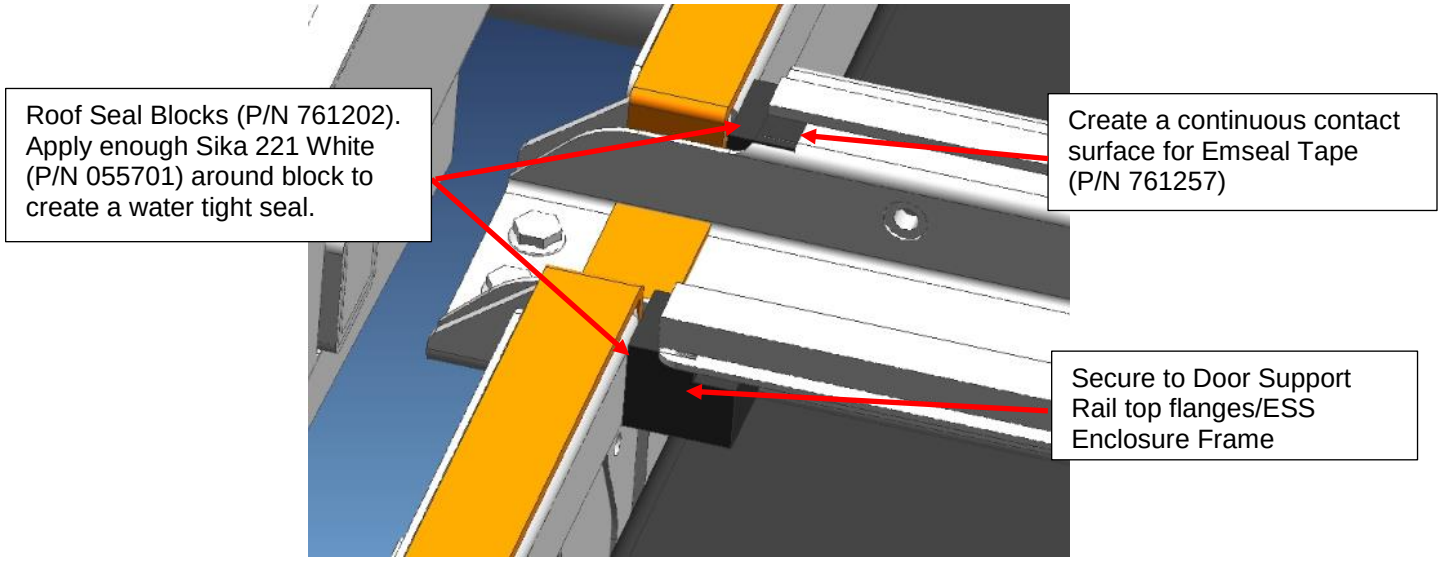


Figure 14 – Position roof seal blocks under flanges, flush with frame (8 locations total)

18. Cut continuous strips of Emseal Tape (P/N 761257) and adhere to existing black Rubatex Seal (P/N 5968183) along top flanges on Door Support Rails. Refer to Figure 15.

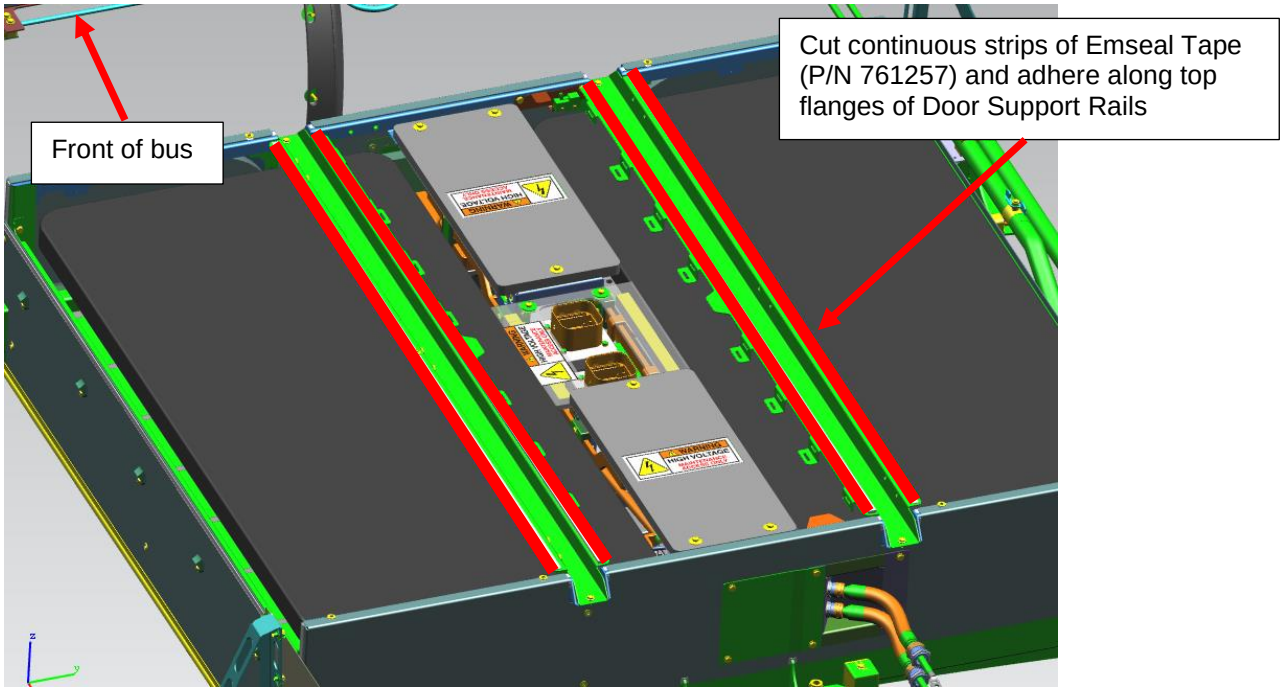


Figure 15- Adhere Emseal Tape along Door Support Rail top flanges

19. Insert Push Plugs (P/N 757560) x6 into existing holes in the CS Door Support Rail. Secure plugs with Sika 221 White (P/N 055701) to create a water tight seal. Refer to Figures 16 and 17.

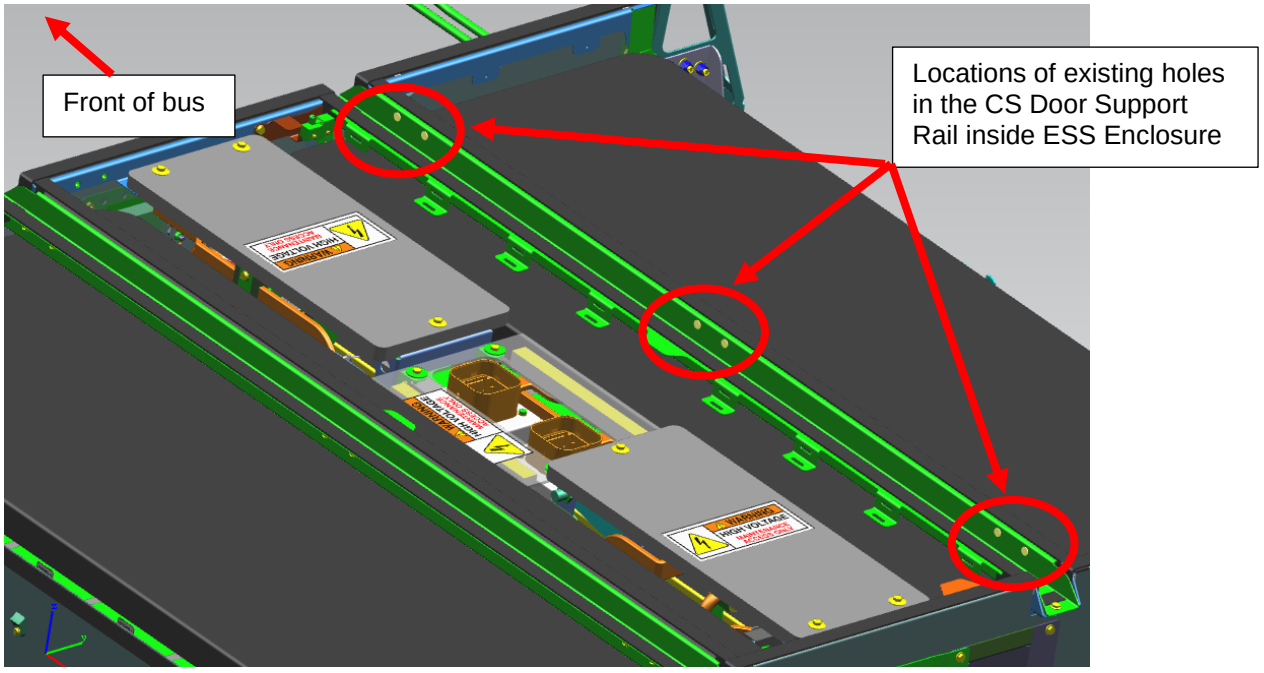


Figure 16 - CS Door Support Rail – Insert plugs into existing hole locations

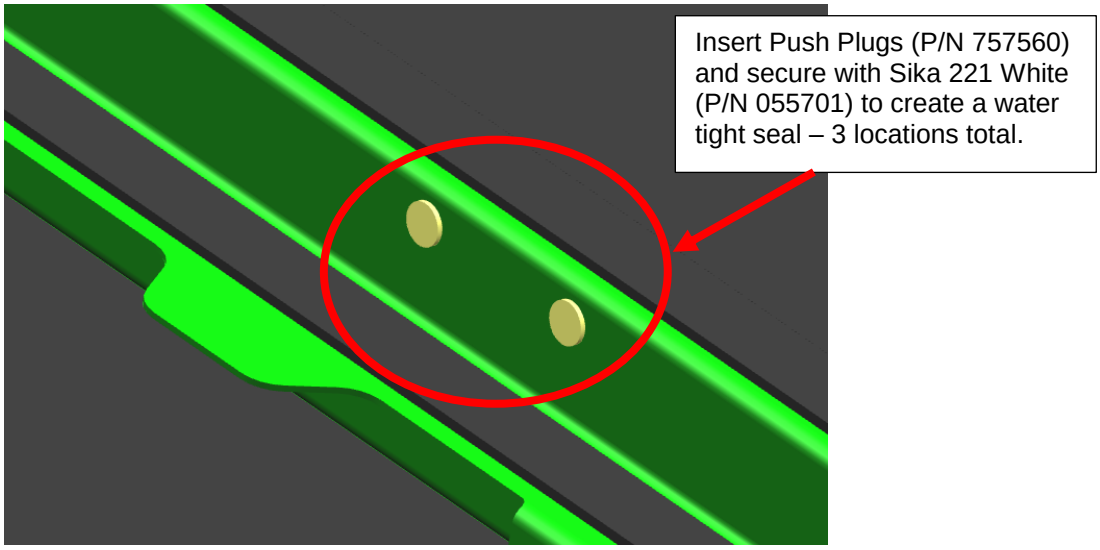


Figure 17 – Insert plugs into existing holes and secure with Sika 221 White (3 locations total)

20. Reinstall CS/SS access panels (and insulation) on ESS enclosures using existing hardware and new Sealing Washers (P/N 284236) x10 on tops of ESS panels. Torque hardware to 91 IN-LBS (7.58 FT-LBS) and apply torque marks. Refer to Figure 18.

    Note: Prior to reinstalling CS/SS access panels, puncture through Emseal Tape/Rubatex Seal to prevent tearing while fasteners are reinserted.

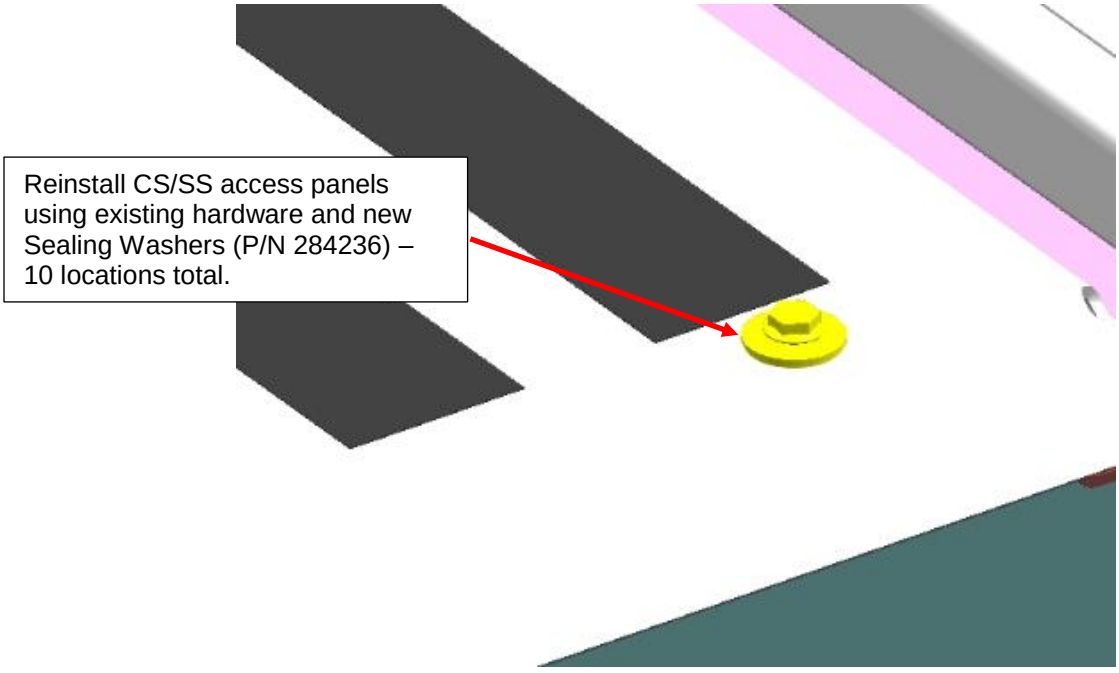


Figure 18 – Reinstall CS/SS access panels using existing hardware and sealing washers (10 locations)

21. Reinstall center access doors on rooftop ESS enclosure by carefully sliding back on hinge pins. Refer back to Step 3, Figure 2.

22. Perform a final visual inspection around exterior of ESS Enclosures for anything that would compromise a water tight seal. Ensure that there is no loose/missing hardware.

23. Reinstall/close side screens adjacent to rooftop ESS enclosure using existing hardware. Refer back to Step 3, Figure 2.

24. Reinstall Manual Service Disconnect (MSD) fuses x2 locations and close/secure center access door on rooftop ESS enclosure. Refer back to Step 4, Figures 2 and 3.

25. Remove all tools and debris and return the bus to service condition.

26. Turn the high voltage interlock to the “ON” position.

27. Turn the main battery disconnect switch to the “ON” position.

LABOUR ESTIMATE

	Operation	Men	Hours	Labor Time M X HR
1	Perform rooftop ESS enclosure sealing rework	1	8.0	8.0

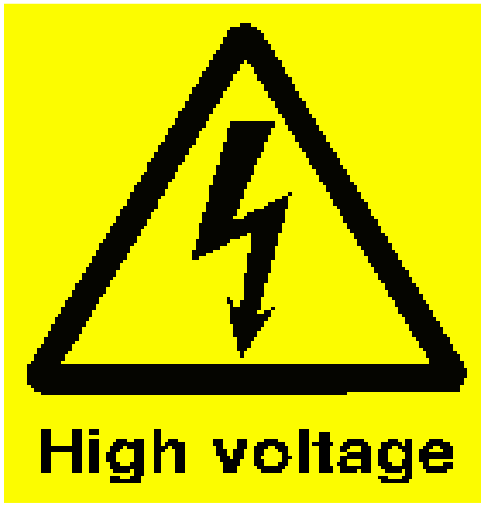
PARTS REQUIRED

Item	Part Number	Description	Qty. per Coach	Units	Notes
1	055701	SIKA ADHESIVE 221 WHITE	1.0	EA	
2	284236	WASHER-SEAL #14X1.0	20	EA	
3	757560	PLUG-PUSH IN .322 DIA.	6	EA	
4	761202	SEAL-ESS ROOF	8	EA	
5	761257	TAPE-EMSEAL ASH-12-25-10	50	FT	
6	761574	SHEET- ESS ROOF	2	EA	
7	5968183	SEAL-RUBATEX 0.62 WIDE X 3/8 THK	30	FT	As Required
8	10B04012	BOLT HEX 1/4" 20 UNC X 1" LG	20	EA	As Required
9	10W04000	WASHER-FLAT 1/4 NOM	20	EA	As Required
10	5958112	TYRAP- 7.0 BLACK	30	EA	As Required

Appendix A – NFIL Spec 532295 - High Voltage Safety Guidelines & Procedures for New Flyer Battery Bus

The following provides general guidelines in relation to safety and best practices when completing installation or servicing work on any New Flyer battery bus vehicle platform.

This document is not meant to supersede the actual released installation and assembly drawings and where conflicts arise, the released engineering drawings take precedence.



Introduction

The utmost concern, while working with High Voltage (HV) systems, is the safety of yourself, other personnel and the potential of damage to property. To minimize these risks, it is crucial to be properly trained and always maintain a very alert, questioning and disciplined attitude without fail. As soon as your guard is lowered, then the potential of an accident is probable that can hurt or kill yourself or someone else and possibly damage property.

What is High Voltage (HV)?

Any form of voltage that is greater than 50 volts if the person's skin at the electrical contact points is not compromised and not wet.

Equipment Required
The following equipment shall be required:

Digital Multimeter (DMM), 1000 volt Category III, 600 volt Category IV, 10Megohm impedance or greater with insulated case or rubber holster
Clamp-on current probe, 1000 volt Category III, 600 volt Category IV
High Pot Tester (Hi-Pot)
Phase rotation meter
Personal Protection Equipment (PPE) appropriate for 700volt DC & 230 volt AC with Class 00 or higher HV gloves with compatible leather over gloves. Appropriate safety glasses as well as the face shield. The PPE shall also meet the required Arc Flash & Arc Blast requirements. Before use, inspect the PPE in accordance with this guideline.
Adequate lighting
HV insulated mat
Two fused HV clip leads 10 inches long
Safety barricade with warning lights & "Danger High Voltage" signs
Belt tool pouch (use only to carry small components up/down a ladder)
Torque Screwdriver set
Imperial torque nut driver set
Metric torque nut driver set
Imperial 1/4" torque drive socket set
Imperial 3/8" torque drive socket set
Insulated rescue hook
ABC Fire extinguisher, 5 lb minimum, at the activity areas
Spare HV and low voltage fuses

Equipment Calibration
All test equipment must be within their calibration interval and recorded such with the respective serial numbers. These records must be available to the Checker.

Personnel Requirement
Only trained personnel shall supervise and perform High Voltage system testing, checkout and troubleshooting. Two personnel (one called the Checker & the other called Monitor/Recorder) shall perform Checkout Procedures, together, to ensure safety of themselves, others nearby & for the protection of vehicle & property. Refresher training shall be provided to these personnel on a regular basis and when new systems are to be checked by them. The training of the personnel shall consist of:

HV & low voltage basics, intermediate & advanced electricity
HV & low voltage electrical systems of the vehicle
Shop safety practices & procedures
First aide including CPR & the use of the shop defibrillator
How to release a victim that can't let go HV
Quickest method of shutting down HV
Fire fighting and emergency procedures
HV & arcflash safety
Organized & tidy placement of equipment & tools allowing for unrestricted movement
Operation of Hi-pot
Operation of Phase Rotation Meter

To ensure effectiveness of training, exams of the trained material shall be required with a high passing mark of at least 80% and a retraining of the missed 20 % on a one to one basis.

Checker Function

(Caution: The Checker must not have any health conditions that can be exacerbated when startled and must not have any electronic implants.)

Directed by the Monitor/Recorder
Performs all preparations & checks
Wears PPE as specified by the Checkout Procedure
Performs all restorations

Vehicle Inspection

It is necessary that the vehicle to be checked out, first be visually inspected of all systems, workmanship and with special attention to ensuring there is no HV cable or equipment damage or chafing.

High Voltage Checkout Preparation

(1) The scope of the work must be accurately defined such as a Checkout Procedure that requires systematic steps with sign offs. Before a Checkout is performed, the Supervisor, Checker and Monitor/Recorder must conduct a briefing of what shall transpire, identify potential hazards, resist pressures of "is it done yet?", anticipate problems and question possible events. If an unexpected electrical hazard or fault occurs, during any time of the Checkout, it must be immediately reported to the supervisor. After the Checkout is completed the same group should review the results and processes and make proposed modifications to the procedures if required.

(2) Install Safety barricade with warning lights & signs indicating "Danger High Voltage" around the vehicle perimeter and ensure no personnel are within the fenced perimeter during the checkout procedure.
(3) It shall always be the goal to check the systems as much as possible with all HV power OFF and Locked Out/Tagged Out and proven as de-energized by voltage measurement using the DMM. The functionality of the DMM must be proved before and after the verification of no HV present. Then, if possible, the HV systems should be challenged by trying to energize them while checking that no HV appears.
(4) When it is necessary to perform tests of HV systems with the power ON, then the Working Live procedure must be followed.
(5) The test personnel shall always rehearse the actions required in case of any possible accident scenarios.
(6) Before beginning the Checkout Procedure, the test personnel shall remove all their jewelry (including pierced ones), watches and any electrically conductive objects on them.

PPE Requirements
The PPE voltage class, Arc Flash and Arc Blast rating shall be compatible with the voltage and Arc Flash capability of the systems being tested. Appropriate leather glove protectors shall be worn over the HV rubber gloves.

PPE Care & Testing
Rubber insulated PPE shall be periodically cleaned and tested in accordance with 29 CFR 1910.137 and the appropriate ANSI/ASTM standards. HV gloves, sleeves and mats shall be tested every 6 months. PPE apparel shall be cleaned and maintained in accordance with the manufacturer's instructions. A record of the PPE testing shall be maintained and available to the users.

PPE Inspection
Inspect PPE equipment, before use, for any degradation or damage and ensure that the HV gloves have been tested every 6 months. Also perform an air pressure test on the HV gloves before and after each use. If during PPE use a potential damaging incident occurred to the PPE, stop further testing and inspect the PPE. If at any time the PPE is defective, reject it, and obtain an accepted one.

PPE Storage
PPE apparel should be stored lying flat, undistorted, right-side out and not folded in protective containers. The HV mats can be rolled with an inside diameter greater than 2 inches. Rubber HV gloves should be stored in cool, dark, dry, and free from damaging chemicals or vapors. The glove cuffs should face downwards, without folding, in the appropriate glove bag and hung vertically.

Insulated Tools

Insulated tools should be visually inspected for insulation damage before and after each session of use.

Lockout/Tagout Procedure
The Lockout/Tagout procedure should be followed that is specified in the respective Checkout procedure. When removing the lock and tag:

(1) The locks and tags shall be removed by the installer of them or 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 in 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

Stored Energy
Personnel must always remember the characteristics of stored energy devices such as capacitors and batteries and when energy is available from.

Working Live
To maximize safety, it is always important to perform the maximum amount of HV checkout in the de-energized state.
When it is necessary to work with HV equipment while energized or to verify whether HV is present, the utmost care and safety procedures must be utilized including:

(1) Wearing appropriate PPE with protector gloves over top of the HV rubber gloves
(2) Ensure all personnel, except the Checker and Monitor/Recorder, are clear of the vehicle
(3) Kneeling or standing on HV insulated mat

Energizing & De-energizing Procedure
It is critical that before any HV system is energized that a visual check be performed to ensure that all possible HV compartments are closed and there is no debris, tools or test equipment lying on HV terminations. If there is a certain sequence of energizing and de-energizing the HV system, then all personnel involved must be trained in this sequence. (**CAUTION:** Never try to connect or disconnect circuit components such as cables, fuses, connectors, etc while there is current flowing in the circuit.)

Electrical Injuries
Electrical injuries should be immediately reported to the first aide personnel and the supervisor. Other than electrostatic shocks, even non-injurious electrical shocks should be reported to the supervisor. These should be immediately investigated and documented to determine the cause and prevent the occurrence in the future.