



INSTRUCTION TO SERVICE

ITS: 60643D		4/21/2023
SECTION:	260-Battery Compartment	
WRITTEN BY:	██████████	
SUBJECT:	Install 4 drain ports into each ESS compartment – 6 String ESS	
ISSUE:	Should a leak occur, liquids can accumulate in the ESS compartment	
SUMMARY:	Install 4 drain ports into each corner of all 6 ESS compartments	

ITS60643

Ref. NHTSA Recall No.	Ref. Transport Canada Recall No.
23V083000	2023-073

THIS ITS DOCUMENT SHOULD BE RETAINED AND REFERRED 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.

PROCEDURE:

Section 1 – Initial Prep Work

1. Set the park brake and chock the wheels.
2. Turn the main battery disconnect and HV interlock switch to the “OFF” position.

⚠ WARNING: *The work detailed in this ITS involves working near exposed High Voltage (HV) compartments, even after the bus has been locked out and tagged out. It is recommended that the service personnel be trained in NFI HV safety practices, such as those included in Appendix A – NFIL Spec 532295 - High Voltage Safety Guidelines & Procedures for New Flyer Battery Bus.*

3. Perform the Lock Out Tag Out and De-Energizing procedures found in the Electrical System Section of the New Flyer Service Manual. Reference Figure 1 below.

⚠ WARNING: **ENSURE MSD DUMMY PLUGS ARE AVAILABLE PRIOR TO STARTING ANY HV DISASSEMBLY**

🔧 NOTE: *Use commercially available lock out equipment and tags being sure to follow any local laws or workplace procedures.*

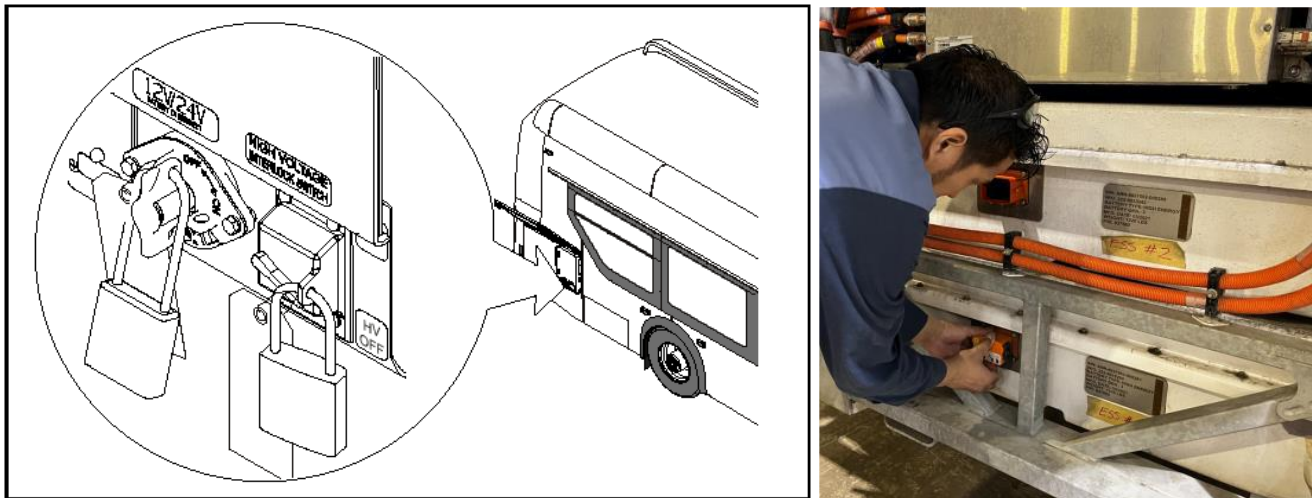


Figure 1: HV and LV Disconnect Switch Location Reference

Section 2 – Roof ESS Compartment Access

- Gain access to the rooftop ESS enclosures. Ensure that appropriate fall protection PPE is used and available for the duration of the work. Reference Figure 2 below for the upper ESS layout.

Ensure appropriate safety procedures are followed for the duration of the work.

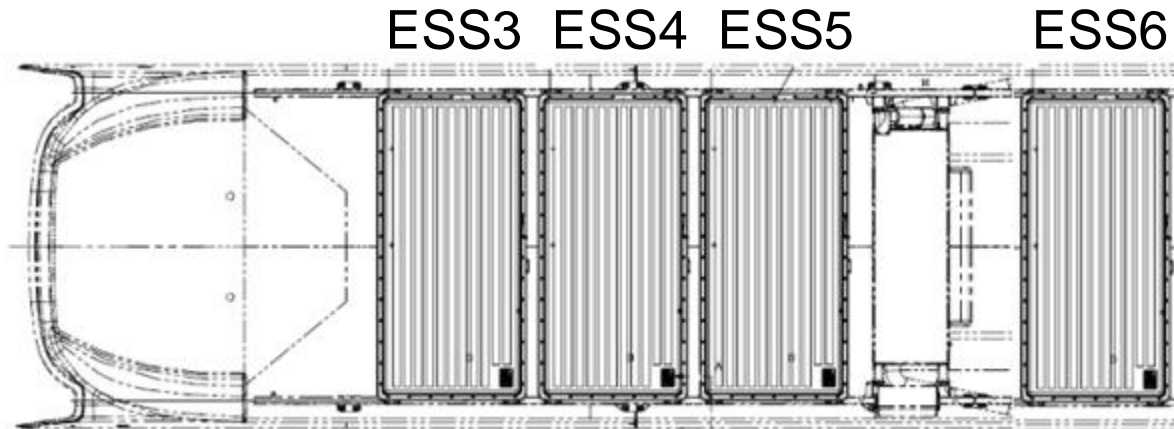


Figure 2: Upper ESS Layout

☞ NOTE: At this point access to the upper ESS compartments is available. Complete the rework in Appendix C on each upper ESS before proceeding to Step 5.

Section 3 – Rear ESS Compartment Access

- Gain access to the rear ESS area. Also support the rear frame members with jack stands as seen in Figure 3. Keep in mind that access will be needed underneath the bus later in this section.



Figure 3: Support Rear Frame Members with Jack Stands

- Drain the coolant from the ESS loop. Refer to the Cooling System Section of the New Flyer Service Manual for the full procedure.
☞ **NOTE: A coolant drain tool will be needed to ensure minimal mess.**
- Lay the rear access door flat on the forklift forks, loosen and remove hardware, and secure the hinges in the extended position.
☞ **NOTE: Remove door from hinges (leave hinges attached to bus frame).**
- Support the rear bumper with forklift, remove the four retaining bolts, and remove the rear bumper. Save all mounting hardware for reuse later.

9. Remove the lower corner pillars (including turn signals and brake lights) and brackets. Reference Figure 4 below. Save hardware for reuse.

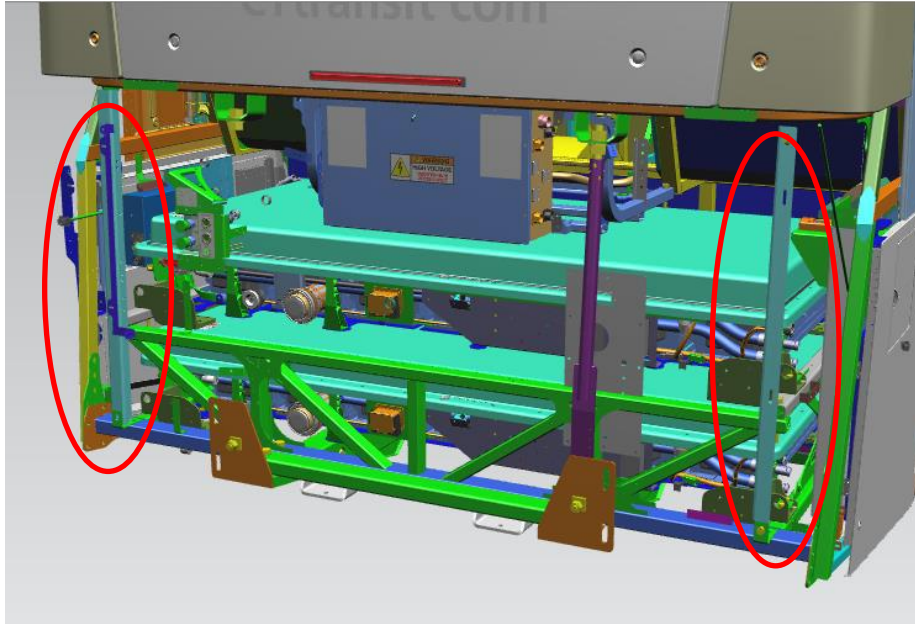


Figure 4: Lower Corner Pillars and Rear Door Removed

10. Disconnect and secure the high voltage cables, clamps, and grounding strap from both enclosures. Reference Figure 5.

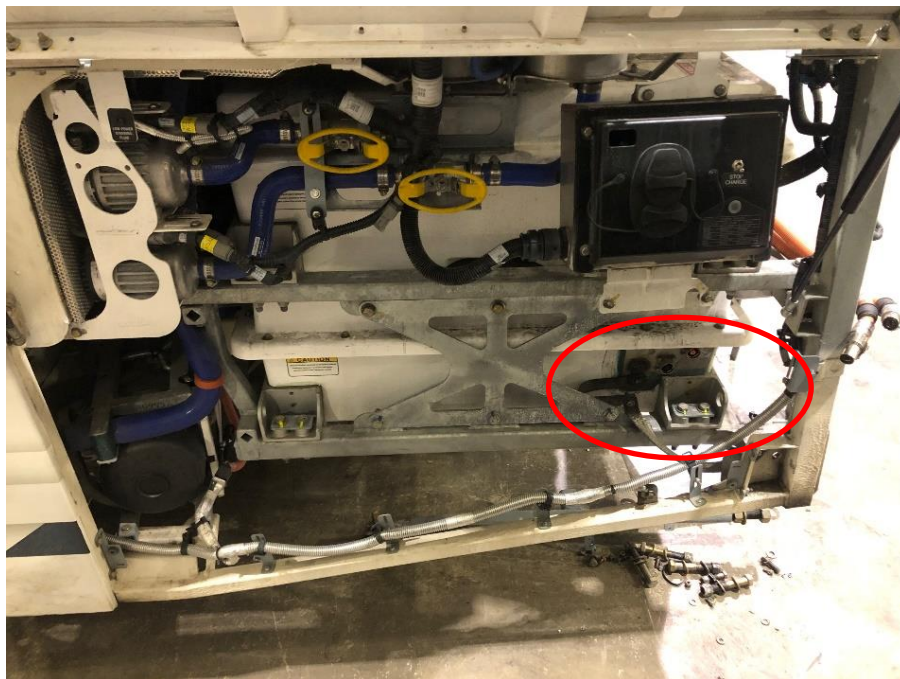


Figure 5: HV Connections and Ground Strap at Rear Street Side

11. Disconnect and secure the low voltage harness and coolant hoses on the opposite side of the ESS compartments. Reference Figure 6 below:

NOTE: *The clear BTMS vent line needs to be disconnected from the rear ESS frame.*

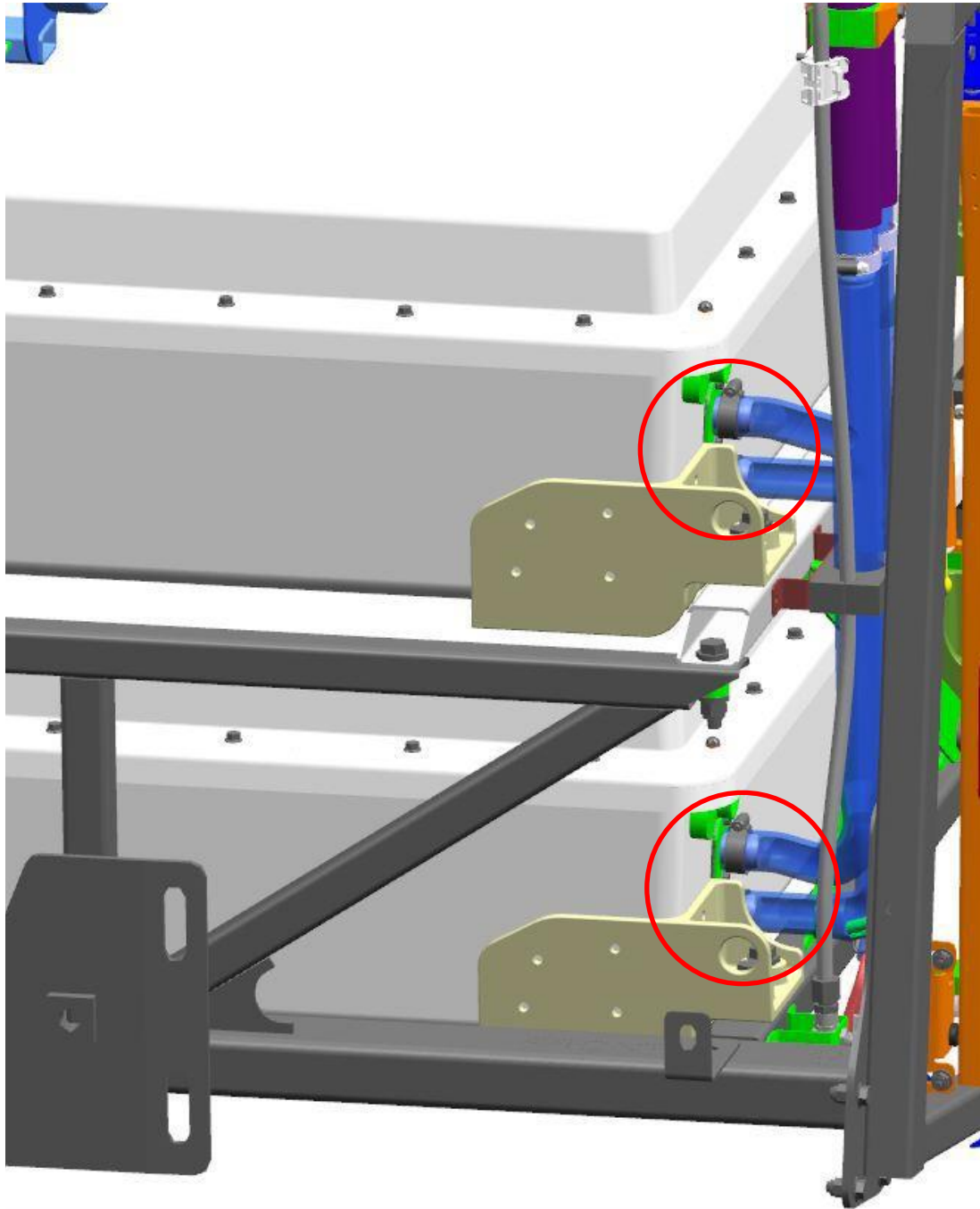
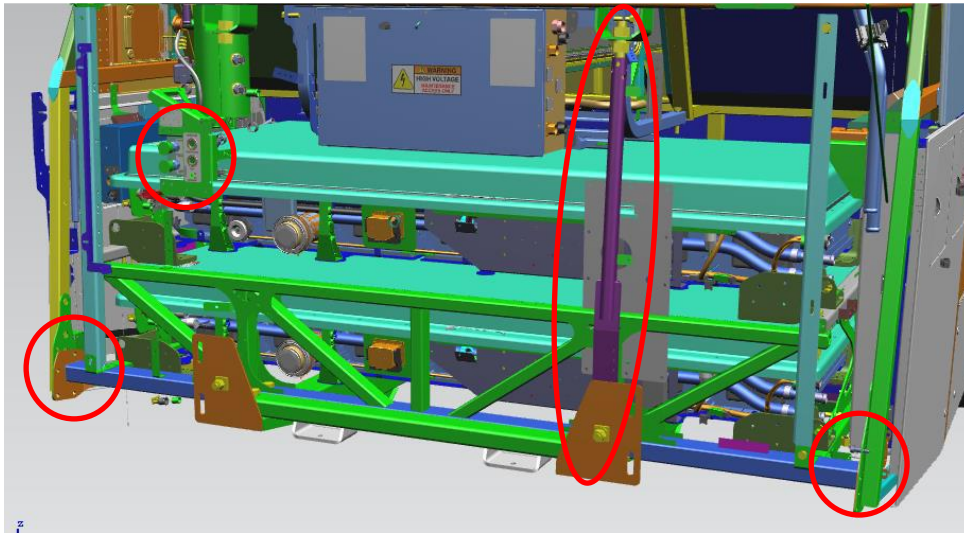


Figure 6: LV Harness and Coolant Hose

12. Remove mounting hardware and support the coolant fill panel. Ensure it clears the upper surface of the ESS enclosure. See Figure 7.
13. Remove the hardware between the bumper beam and side structure. See Figure 7.
14. Remove the street side and curbside struts as follows: See Figure 7.
 - a. Loosen the jam nut and remove the 1" upper nut on the strut.
 - b. Remove the 3/4" lock nut, bolt, and washers that attach the lower end of the strut to the main frame rail bracket.
 - c. Remove the strut itself.



15. Figure 7: Rear Struts and Side Structure Hardware Removal

16. Remove the hardware between the ESS rack and rear chassis end, with 2 sets on each side. Reference Figure 8 below for details:

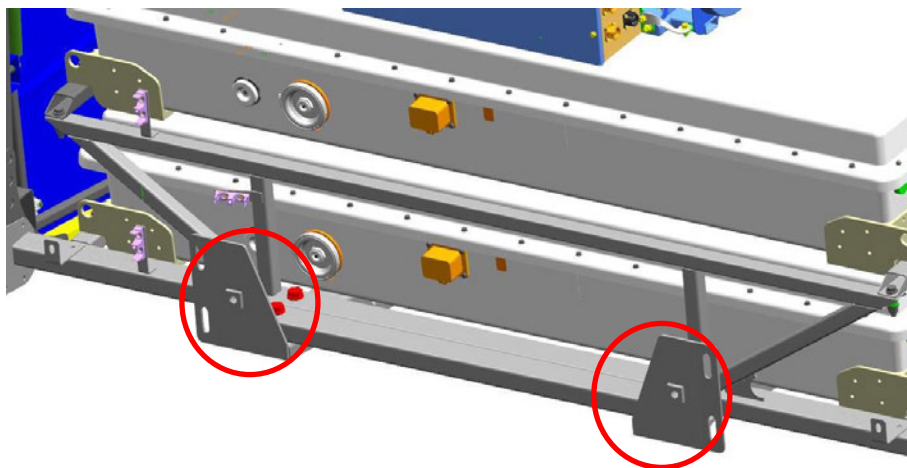


Figure 8: Hardware Between ESS Rack and Rear Chassis End

17. From under the bus, remove the hardware between the front of the rear ESS rack and chassis. Reference Figure 9 for details.

18. Support ESS rack with forklift. Remove both rear ESS compartments from the bus. Before removal of the ESS, ensure no harnesses, cables, ground straps, or coolant hoses are connected. Reference Figure 9.

NOTE: Use a spotter to ensure the forks are captured within the pockets on the ESS frame and not resting on the composite ESS enclosure. A c-clamp will ensure that the frame does not slide on the forks.

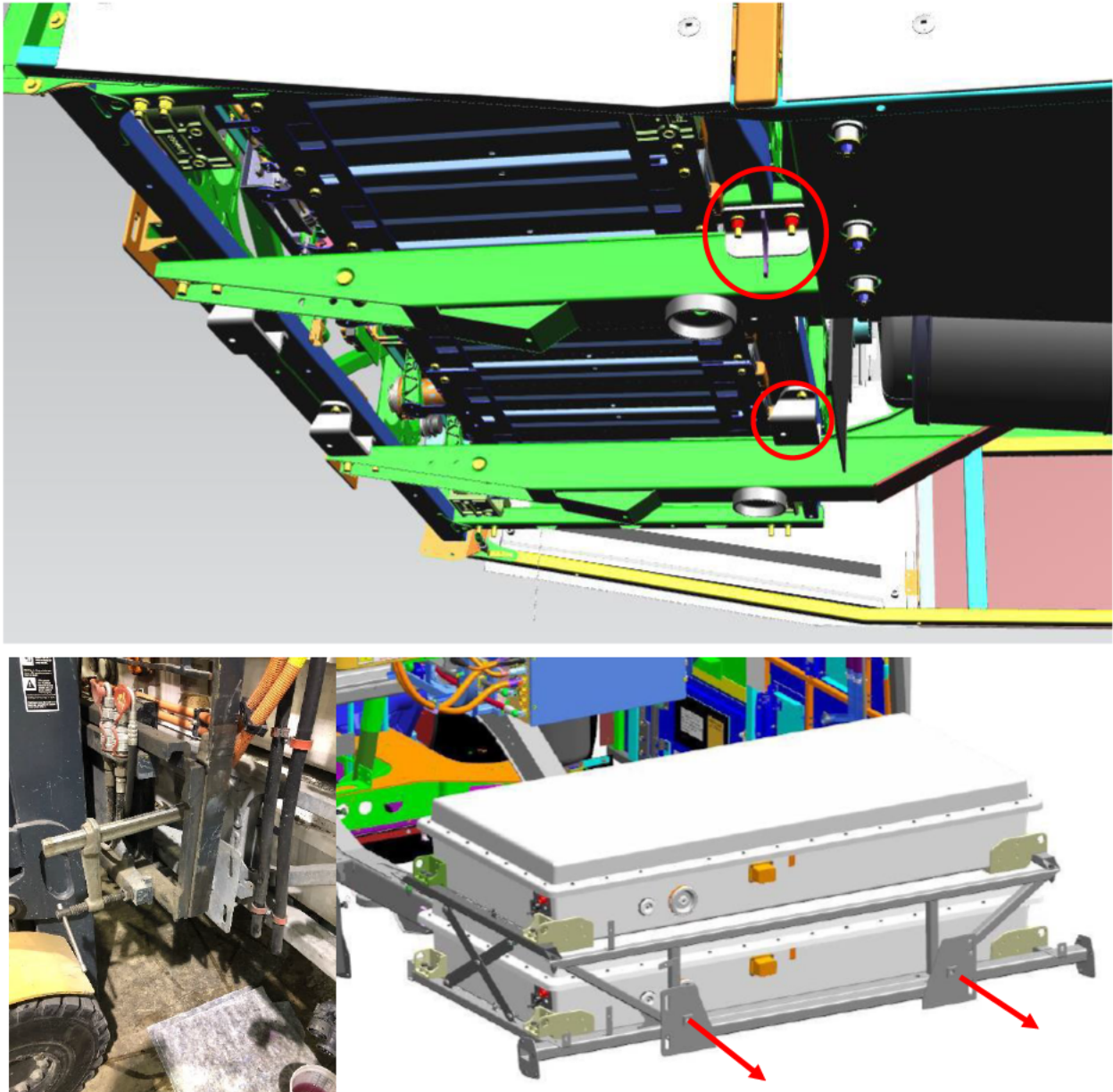


Figure 9: Rear ESS Compartments Removed from the Bus

19. Move the ESS enclosures into a clear and open workspace.

20. To separate the ESS Compartments and gain clearance to the compartments, refer to Appendix B for details.

NOTE: *At this point, suitable access to the ESS compartments should be available. Complete the rework in Appendix C before continuing to re-stack the rear ESS and then proceeding to Step 21.*

21. Using a forklift or dolly place the ESS rack inside the vehicle and align the holes to the vehicle structure.

Torque the 1/2" hardware to 69 ft-lbs. (94 Nm). Reference Figure 10.

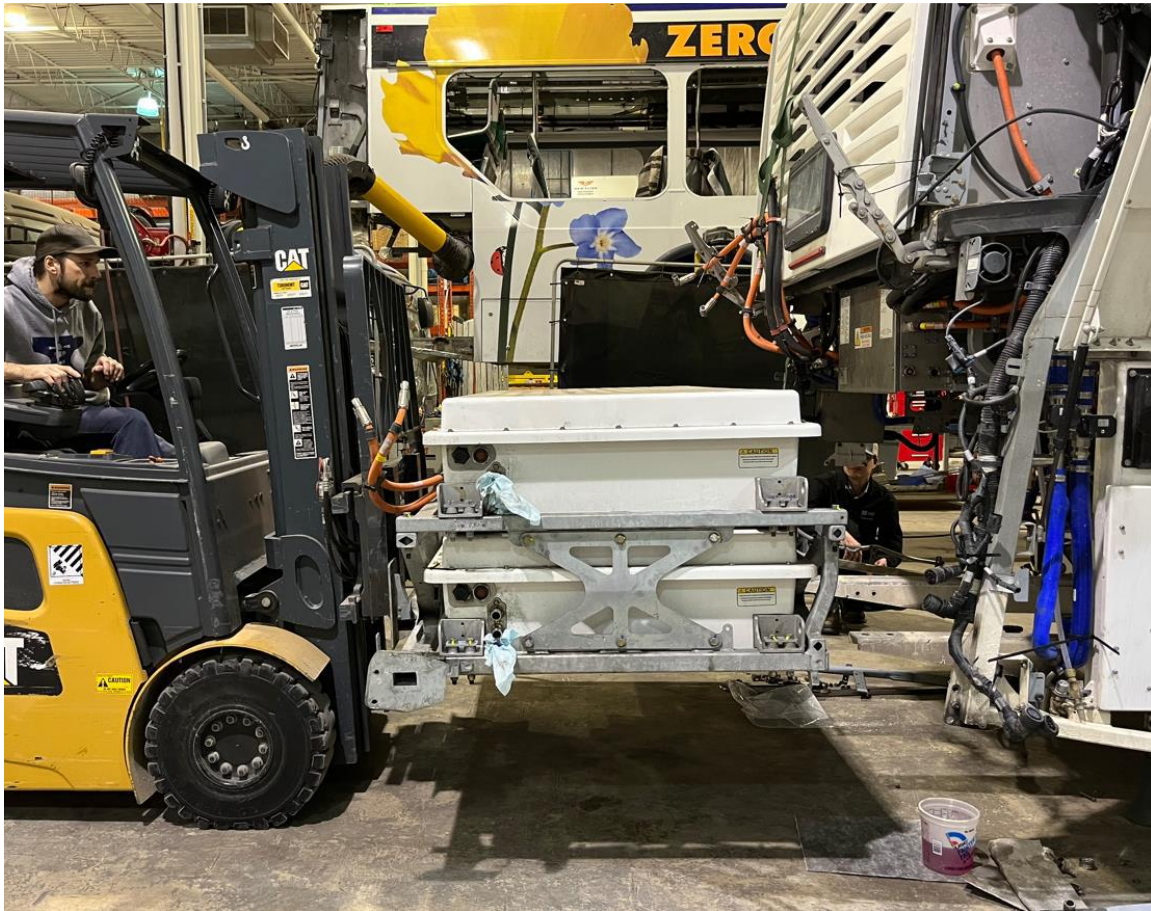


Figure 10: Installing ESS Enclosures

22. Place clamps over the upper and lower coolant line. Attach the coolant lines to the ESS and torque clamps to 80 in-lbs. (9 Nm) at 75 RPM or less.

23. After 30 minutes re-torque the clamps to 80 in-lbs. (9 Nm) at 75 RPM or less.

NOTE: *The orientation of clamps may vary to maximize clearance and access.*

24. Connect the low voltage harnesses.

25. Connect the high voltage cables, clamps, and grounding strap securely.

26. Connect the corner pillar brackets and pillars with washers on each side of bracket and torque 3/8" bolt to 8 ft-lbs. (38 Nm). Reference Figure 11 for details.

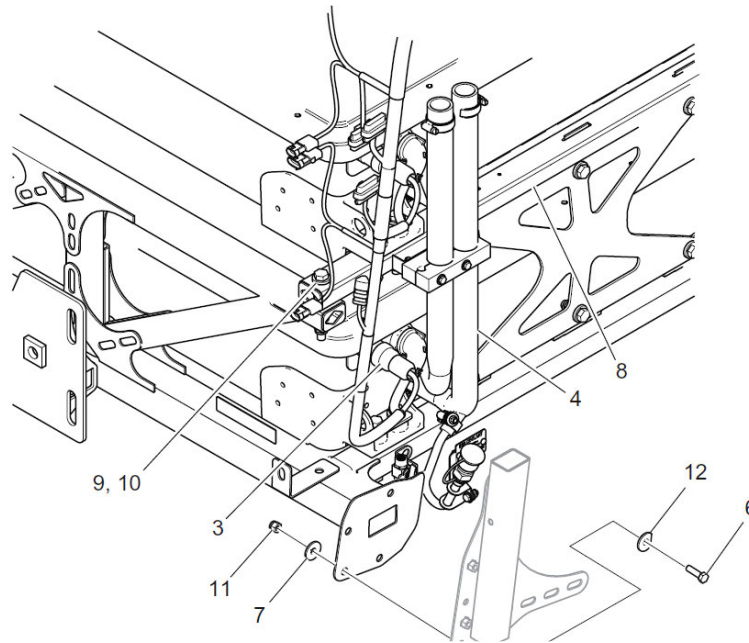


Figure 11: Rear ESS Compartment Rack Installation

27. Support strut Installation – Reference Figure 12:

- a. Thread a 1" nut on the upper end of the strut until it's nearly bottomed out.
- b. Install the threaded end of strut into upper mounting bracket and loosely install the upper nut
- c. Align hole in lower end of strut with hole in main frame rail mounting bracket and secure strut to frame rail bracket with 3/4" bolt, washers, and lock nut.
- d. Apply Never-Seez to bolt threads and torque lock nut to 250 ft-lb. (339 Nm).
- e. Ensure lower 1" nut is backed off, then tighten upper 1" nut until contact is made with upper mounting bracket.
- f. Measure the distance between the lower frame rail and upper vehicle structure. Refer figure 14.
- g. Continue to tighten upper nut until the 44.84" dimension is achieved, and then tighten an additional two turns.
- h. Apply Never-Seez to threaded area of strut and tighten lower 1" jam nut to 426 ft-lb. (578 Nm).

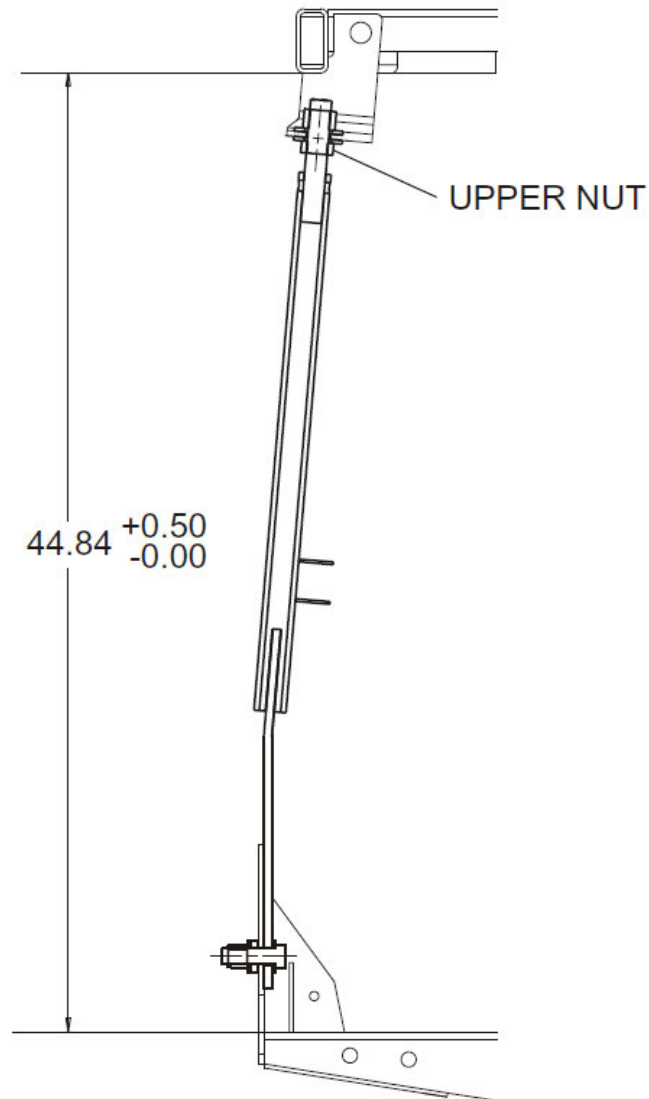


Figure 12: Strut Tensioning

28. Install rear access door and lower corner pillars. Use Loctite 243 on the rear access door hardware.
29. Install rear bumper – retorque rear bumper bolts 106 ft.-lbs. using Loctite 243. Additional instruction available within the Service Manual if panel gaps require adjustment.
30. Once rework on enclosures is complete, refill ESS coolant system according to the instructions within the NF Service Manual.
31. **Install revised PLC program – obtain SR specific programming from RPSM.**
32. Clean workspace and return coach to revenue service condition.



LABOUR – 6 STRINGS				
	Operation	Number of Technician(s)	Hours	Labor Time T X HR
1	INSTALL 24 ESS DRAIN PORTS 6-STRING	2	8.5	17
2	INSTALL PLC PROGRAM – OBTAIN FROM RPSM	1	0.25	0.25

PARTS KIT – 6 STRINGS					
Item	Part Number	Description	Qty. per Coach	Units	Notes
1	6492726	POUCH-DESICCANT SINGLE BAGGED	18	EA	ITS Parts
2	1017688	PORT-DRAIN P AL	24	EA	
3	1019455	PLUG-HEX -12 ORB	24	EA	

TOOL KIT					
Item	Part Number	Description	Qty.	Units	Notes
1	PS11-102	BOSCH 12V MAX 3/8IN ANGLE DRILL	1	EA	Part of Tool Kit
2	49-56-98	MILWAUKEE 1-1/4" HOLE SAW	2	EA	
3	XC-DJ-3073	PILOT HOLE FIXTURE	2	EA	
4	TG7.016+2K	BESSEY ADJUSTABLE CLAMP	1	EA	
5	VIKG 87830	1/4" STUB DRILL	4	EA	
6	VIKG 34631	CUSTOM 1/4" HEX SHANK DRILL	2	EA	
7		36" X 5" WOOD SUPPORTS	2	EA	
8		HOLE SAW CLEARING BLOCK	1	EA	

ADHESIVE KIT					
Item	Part Number	Description	Qty.	Units	Notes
1	DP2X-400	PLEXUS APPLICATOR	1	EA	
2	6470988	MIXING NOZZLE 490ML	3	AR	As Required
3	892007	MA420 – 490ML	1	EA	490mL/bus
4	067196	PRIMER-PLEXUS PC120-QRT	0.01	AR	As Required
5	6487253	ALCOHOL-CRC ISOPROPYL 99%-16OZ	0.01	AR	As Required
6		SCOTCHBRITE	0.01	AR	Source Locally
7		ADHESIVE DUCT TAPE	0.01	AR	Source Locally
8		SHOP TOWELS	0.01	AR	Source Locally



SPECIAL TOOLS					
Item	Part Number	Description	Qty.	Units	Notes
1		COOLANT RECOVERY AND FILL TOOL			Source Locally
2	2CDC6	MILWAUKEE PORTABLE SHOP VAC			Source Locally
3		3200LBS VERTICAL RATED STRAPS	6	EA	Source Locally
4	5928660	NEVER-SEEZ	0.01	AR	
5	081034	LOCTITE 243	0.01	AR	
6		PLASTIC PUTTY KNIFE	1	EA	Source Locally
7		HD NITRILE GROVES		AR	Source Locally

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

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
- Firefighting and emergency procedures
- HV & arc flash safety
- Organized & tidy placement of equipment & tools allowing for unrestricted movement
- Operation of Hi-pot

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 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 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

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.

Appendix B – Rear ESS Hoisting and Separating Instructions

DO NO USE METAL CLEVIS ON JB FEET

1. Stage ESS Enclosure on a flat and stable surface - Figure 13.



Figure 13: ESS Enclosures to be Reworked

2. Remove fasteners of the cross-brace and bolts that connect upper ESS enclosure to the lower frame (five fasteners on each side). Reference Figure 14.



Figure 14: Remove Upper Cross-Brace Hardware (5 Places Each Side)

- Use a forklift and appropriate straps (one in each corner) to lift the upper enclosure away from the frame. Reference Figure 15 below for proper rigging.



Figure 15: Rigging for lifting Upper ESS Enclosure

- Carefully move the upper ESS enclosure to a flat and stable surface. See Figure 16.

NOTE: Rest ESS enclosure on the metal corners, and not the composite of the 'tub'.



Figure 16: Lifting Upper ESS Enclosure

5. Remove the 8 bolts that secure the lower ESS enclosure to the frame (four bolts each side) per Figure 17.



Figure 17: Removing Hardware from ESS Enclosure Feet

6. Use forklift to lift the lower rack, then place the provided wood blocks under the metal corners of the ESS enclosure. Lower the rack so that the ESS enclosure is supported by the wood blocks as seen in Figure 18.



Figure 18: Lower ESS Resting on Wooden Blocks



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7. At this point, sufficient space to work has been obtained in order to rework the rear enclosures and the work outlined in Appendix C can commence.
8. Once rework is complete, reassemble the rear ESS frame by reversing steps outlined above. Retorque all ½" hardware to 69 ft. lbs. and apply a torque seal.

Appendix C – Installing Drain Ports into Each ESS

1. Each ESS enclosure (rooftop and rear) will have four drain ports installed in the approximate locations indicated below - two ports on the front side of each enclosure (not shown), and two ports on the rear side of each enclosure (as shown below in Figure 19).

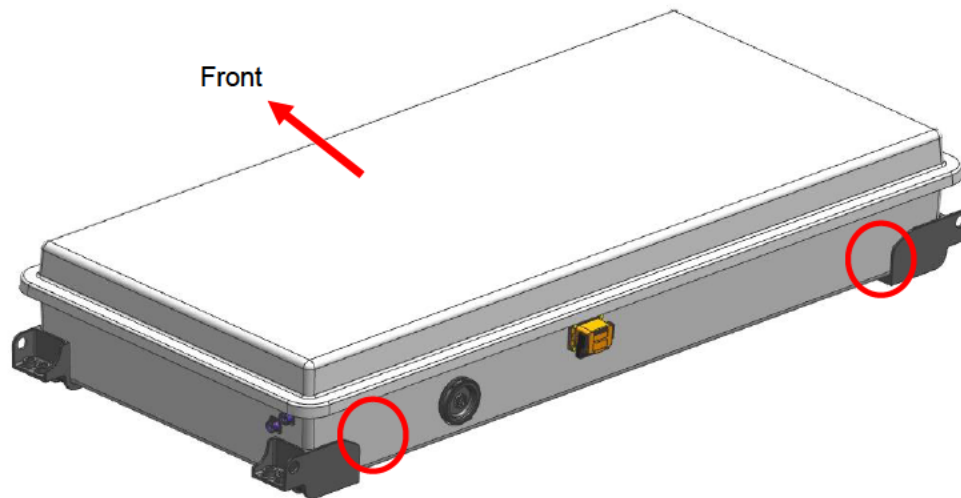


Figure 19: Location of Drain Ports

2. The location of each hole is defined by fixture XD-DJ-3073 as shown in Figure 20. It will butt against the cast feet, as well the lower surface of the enclosure.



Figure 20: Fixture XD-DJ-3073 (With and Without Clamp)

- Align fixture XD-DJ-3073 to one corner support bracket as shown in Figure 21 below.



Figure 21: Place Fixture Against Corner Bracket as Shown

- Using the SUPPLIED 1/4" STUB DRILL bit and BOSCH ANGLE DRILL attachment, drill a hole into the ESS compartment through the preset hole in the fixture. Reference Figure 22 for details on the pilot hole operation.

⚠ WARNING: USE THE PROVIDED TOOLING ONLY AS THE FIXTURE AND TOOL PREVENTS CUTTING TOO DEEP. DRILL THROUGH THE BUSHING IN THE FIXTURE.

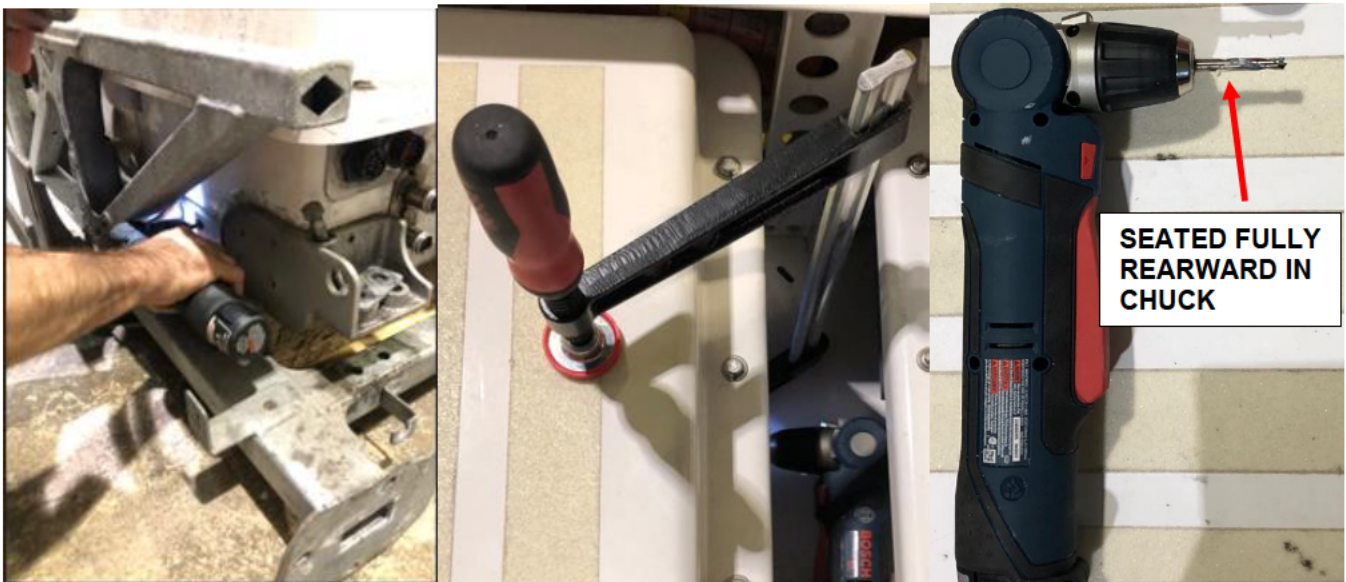


Figure 22: Pilot Hole Operation – PROVIDED 1/4" STUB DRILL MUST BE SEATED FULLY REARWARD IN CHUCK

- Once the pilot hole is completed, remove fixture and switch to the provided 1-1/4" HOLE SAW. Make sure hole is cut cleanly and no composite strands remain. Peck drill to clear cuttings. Reference Figure 23 below.

⚠ WARNING: USE THE PROVIDED TOOLING ONLY AS THE PROVIDED 1-1/4" HOLE SAW PREVENTS CUTTING TOO DEEP. ENSURE TOOL TEETH ARE INTACT.



Figure 23: Hole Saw Operation

6. Use a portable shop vac to clean out the cuttings per the right-most image in Figure 24. Clean bonding area around newly drilled hole using **Isopropyl PN 6487253**. Note if any Balsa-wood core is exposed and test fit each hole with a port.



Figure 24: Vacuum Out Cuttings

7. Scuff the **drain port insert PN 1017688** and the **bonding area around the newly drilled hole** in the enclosure with scotchbrite. Clean **scuffed insert** and **bonding area** of the ESS enclosure with **Isopropyl PN 6487253**. The anodized port shown in Figure 25 is extremely resilient so only a light scuff is required (may not show scuff marks).

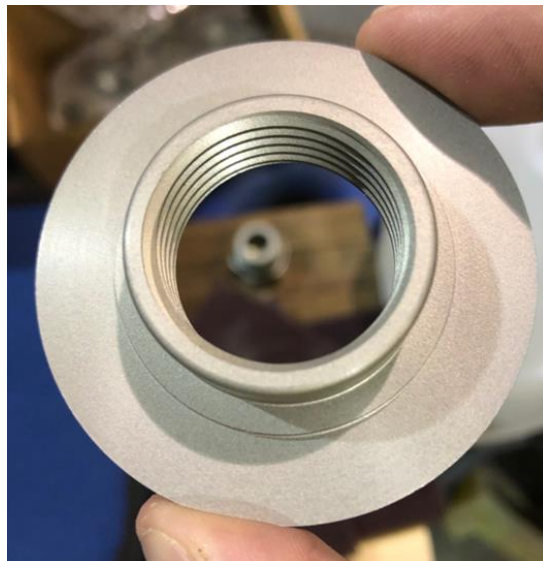
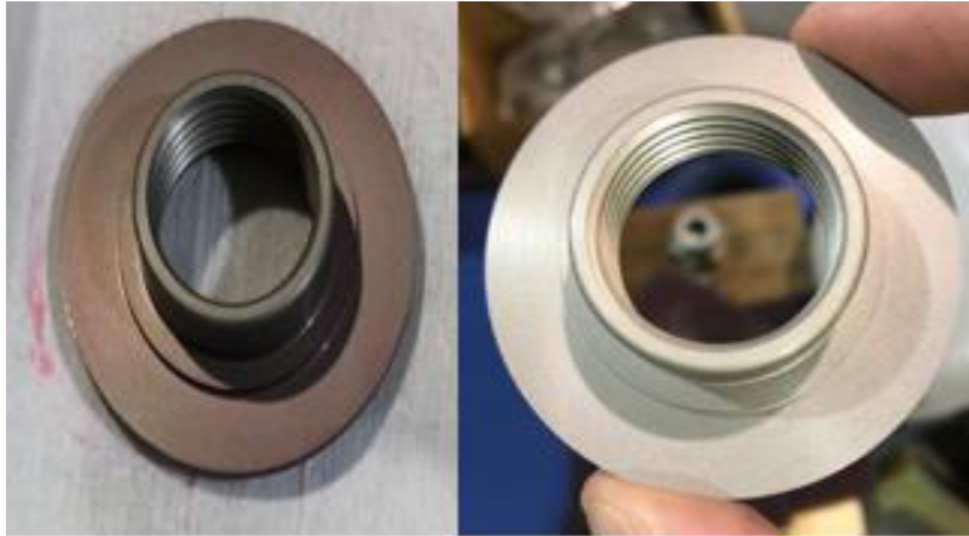


Figure 25: Anodized Port

8. Prime with **PC120 primer PN 067196**. Reference Figure 26 for details on the difference between primed and un-primed. **Allow a minimum of 3 min flash-off time.**



GOOD

REJECT

Figure 26: Primed (Right) Drain Port Insert Versus Un-primed (Left)

9. Apply **MA420 adhesive** to the primed port insert and install it into the newly drilled hole as shown in Figure 27. Ensure that the adhesive does not obstruct the threads of the insert.

NOTE: *Eject a small amount of adhesive thru new tips to ensure product is adequately mixed. If adhesive has sat in the tip for 4 minutes, eject fresh adhesive thru tip prior to continuing. Tool the bead of adhesive with a plastic putty knife. Working time is approximately 4 minutes as adhesive will turn from blue-to-green as it cures. If any Balsa-wood core is exposed, lightly coat exposed area with adhesive.*

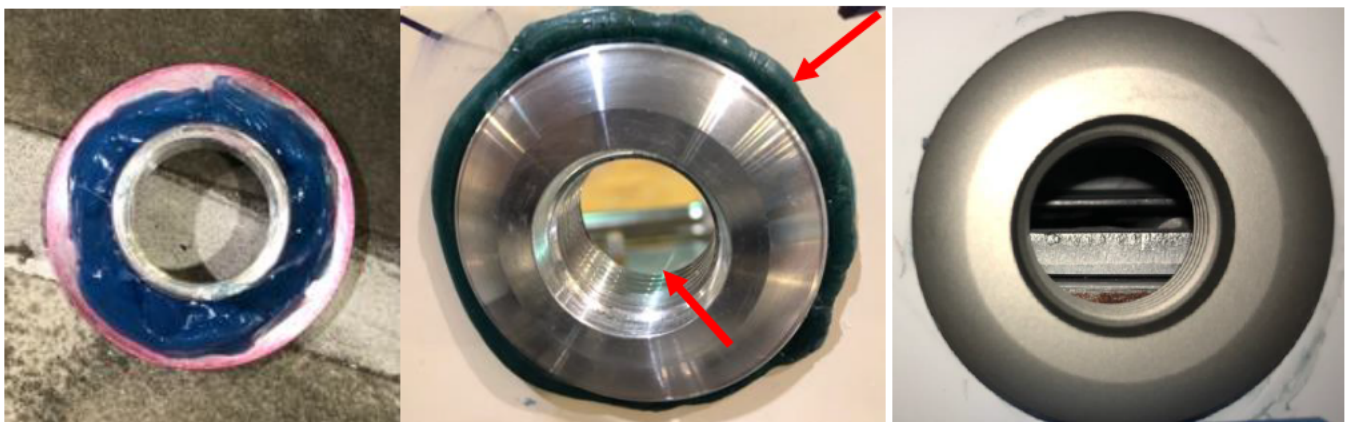


Figure 27: Adhesive Applied to Drain Port Insert and Installed –TOOL SQUEEZEOUT, ENSURE THREADS ARE CLEAR

10. Secure the installed port with tape while the adhesive dries for a minimum of 30 minutes per Figure 28.

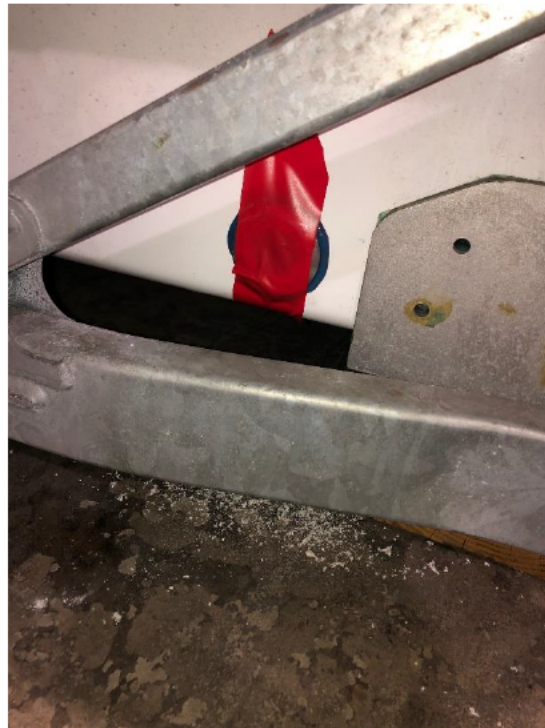


Figure 28: Secure Port with Tape for 30 minutes

11. After 30 mins elapsed, check again that there are no obstructions in the threads. Torque the supplied drain plug PN 1019455 to 40 ft. lbs. per Figure 29.. **DO NOT OVERTORQUE.**

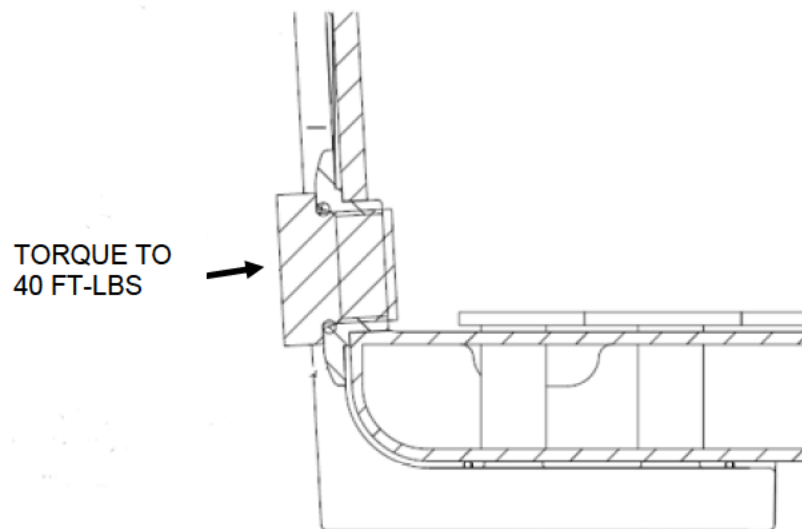


Figure 29: Cross-Section of Port and Plug Assembly

12. Add ports to the remaining corners of the ESS enclosure (four total in each ESS enclosure).

13. Add 3 supplied **desiccant bags (PN 6492726)** to the desiccant holder. The desiccant bags must not be left exposed to air longer than necessary. Reference Figure 30 for details.

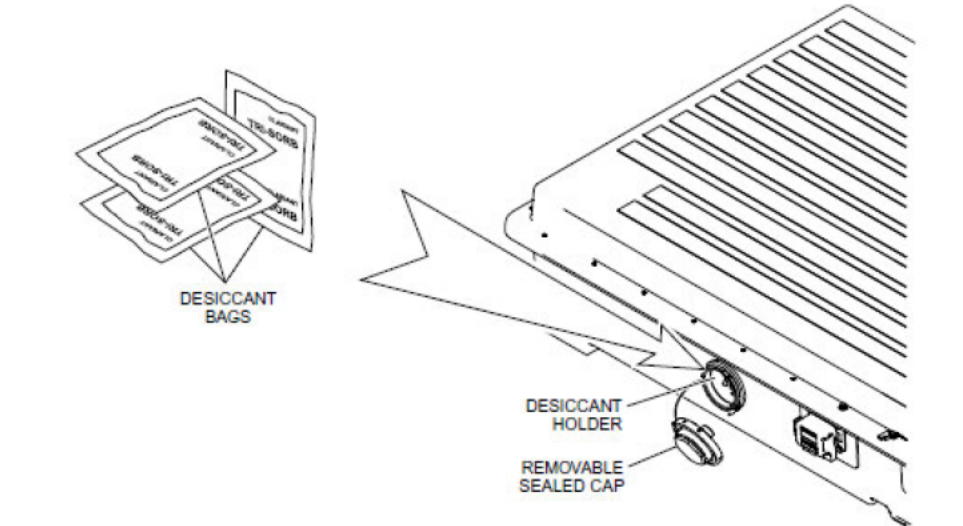


Figure 30: Desiccant Basket Location

14. A completed ESS enclosure will contain four ports and plugs, and new desiccant, as shown in Figure 31. Repeat for all strings on vehicle.

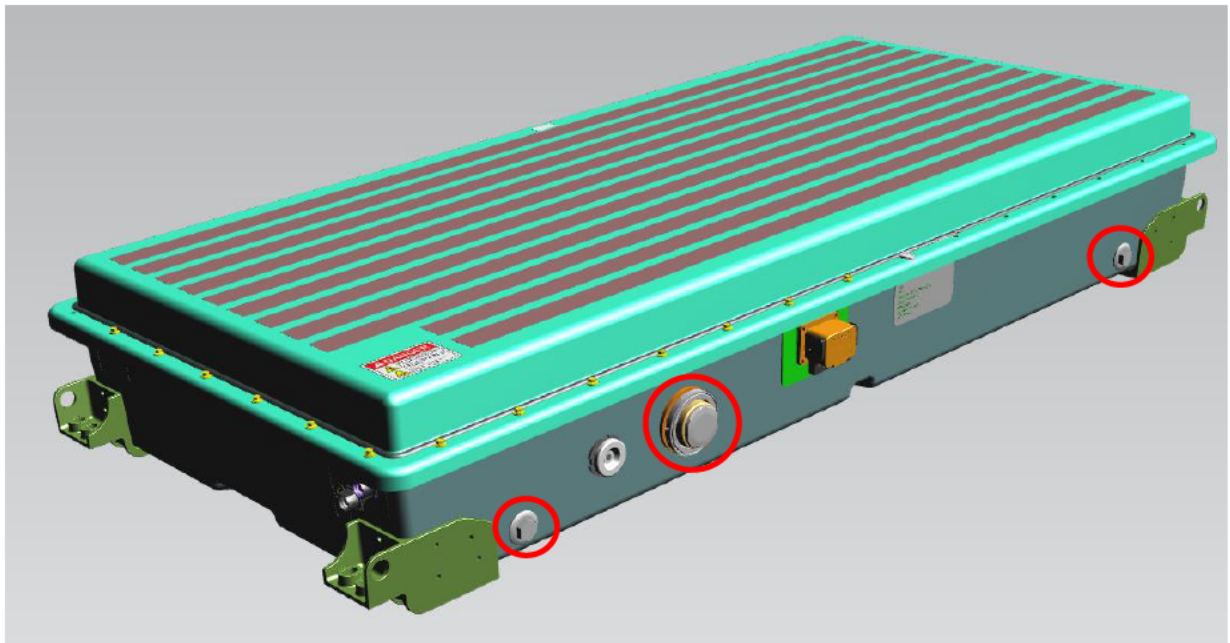


Figure 31: Completed ESS Enclosure