NOVA BUS **SERVICE BULLETIN** **BS3778E**

REFERENCE:	Nova Bus Manuals
SECTION:	01: Body
RS Nº:	MQR 7621-913
EFFECTIVE IN PROD.:	N/A

APPLICATION DEADLINE: 2017DE02
CLAIM REFERENCE NUMBER: WB-3778

SUBJECT:	Front shell cracking
JUSTIFICATION:	Water infiltration and structural weakness

LEVEL	DESCRIPTION	DIRECT CHARGES		TIME
		LABOUR	MATERIAL	
1	Repair front shell as per MERKUR structural rework procedures	Nova Bus	Nova Bus	64h
2	–	–	–	–

MATERIAL

QTY	PART Nº	REV.	DESCRIPTION	REPLACES PART N°
LEVEL 1				
—	–	–	–	–
LEVEL 2				
–	–	–	–	–

DISPOSAL OF PARTS

REMOVED PARTS ARE:	DISCARDED *	RETAINED	* Dispose of the unused parts and the defective parts in accordance with local environmental standards in effect.
	–Yes	—	

REVISION HISTORY

REV.	DATE	CHANGE DESCRIPTION	WRITTEN BY
NR	2016NO02	Initial release	Marc Rougeau

APPROVED BY: Daniel Theriault

Digitally signed by Daniel Theriault
DN: cn=Daniel Theriault, o=Nova Bus, ou, email=daniel.theriault@volvo.com, c=CA
Date: 2016.11.04 11:45:58 -04'00'

CLIENT	ORDER	ROAD NUMBER		VIN (2NVY/4RKY...)		QTY
		FROM	TO	FROM	TO	
SEPTA - Pennsylvania	L744	8614	8675	L82L5E4500583	L82LXE4500644	23
SEPTA - Pennsylvania	L742	7371	7386	S92L6E4500729	S92L5E4500771	16

WARNING

Follow your internal safety procedures.

PROCEDURE

1.1. Open the battery compartment access door, Ensure that the vehicle's power supply has been deactivated by turning off the battery cut-off switch (see Figure 1).

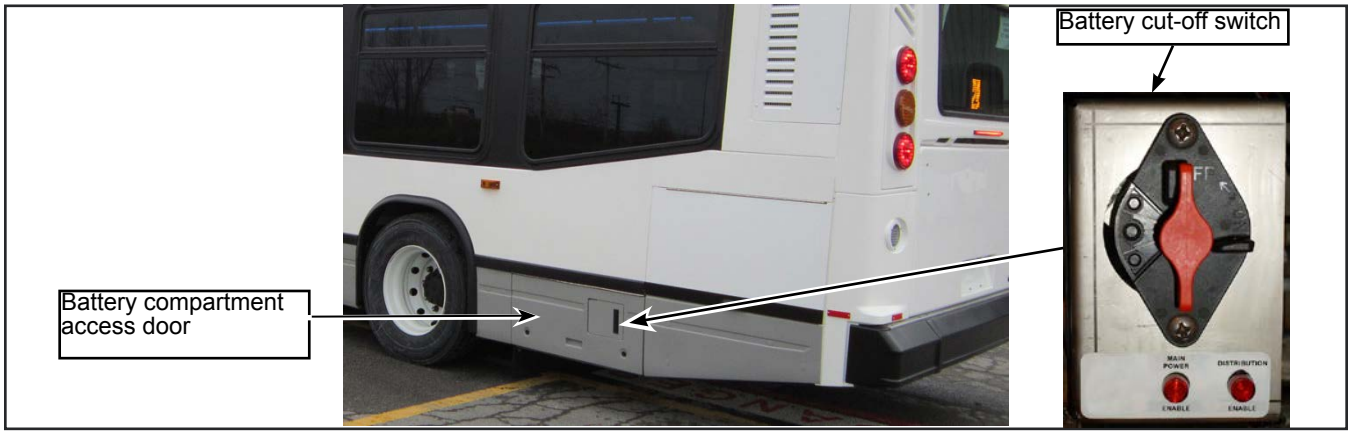


Figure 1 - Battery Compartment Access Door

1.2. Remove the headlight bezel by unscrewing the recessed retaining screw. This screw will unscrew but remains trapped in the bezel. The bezel can be removed by pulling the top out and then up. Retain the bezel for reinstallation once the repair is complete (see Figure 2).

Figure 2 - Remove Headlight Bezel

1.3. Remove the headlight bezel by unscrewing the recessed retaining screw. This screw will unscrew but remains trapped in the bezel. The bezel can be removed by pulling the top out and then up. Retain the bezel for reinstallation once the repair is complete (see Figure 3).

Figure 3 - Remove Headlight Bezel

1.4. Remove the windshield wiper hardware cover using a small flat-head screwdriver and prying the cover out using the slot in the wiper arm. Remove both sides and retain covers for reinstallation once repair is complete (see Figure 4).

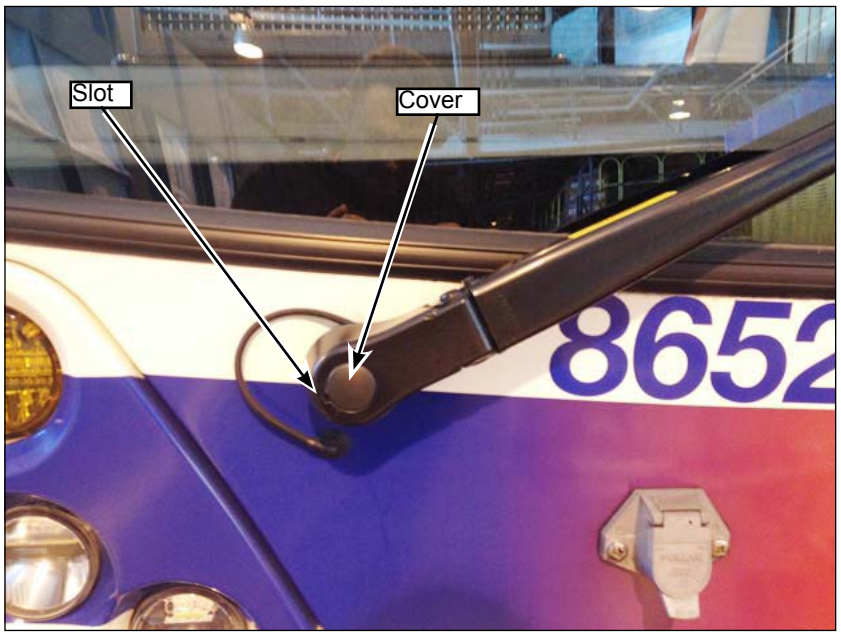


Figure 4 - Remove Windshield Wiper Hardware

1.5. Lower the bike rack to access the retaining screws (see Figure 5).

Figure 5 - Lower Bike Rack to Remove Retaining Screws

1.6. Remove the two safety pins on either side of the bike rack retaining screws. Unscrew the retaining screws. The keepers will prevent the bike rack from falling when the retaining screws are removed (see Figure 6).

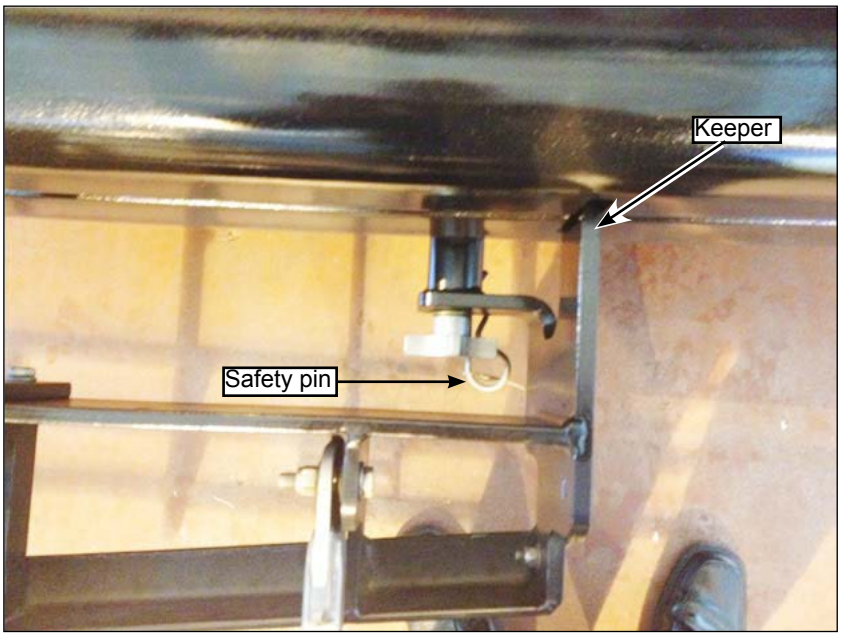


Figure 6 - Remove the Two Safety Pins

1.7. To remove the bike rack once the retaining screws have been unscrewed, lift it up on the mounting brackets closest to the bumper. The bike rack must be lifted parallel to the ground, which means you may need to press down on the front of the bike rack while lifting. The bike rack will then slide out of the bumper. Retain the bike rack for reinstallation (see Figure 7).

Figure 7 - Remove Bike Rack

1.8. Place a piece of masking tape above each wiper blade to aid in reinstallation (see Figure 8).

Figure 8 - Place Pieces of Masking Tape

1.9. Remove the windshield wiper arm nut and disconnect the windshield washer line (see Figure 9).

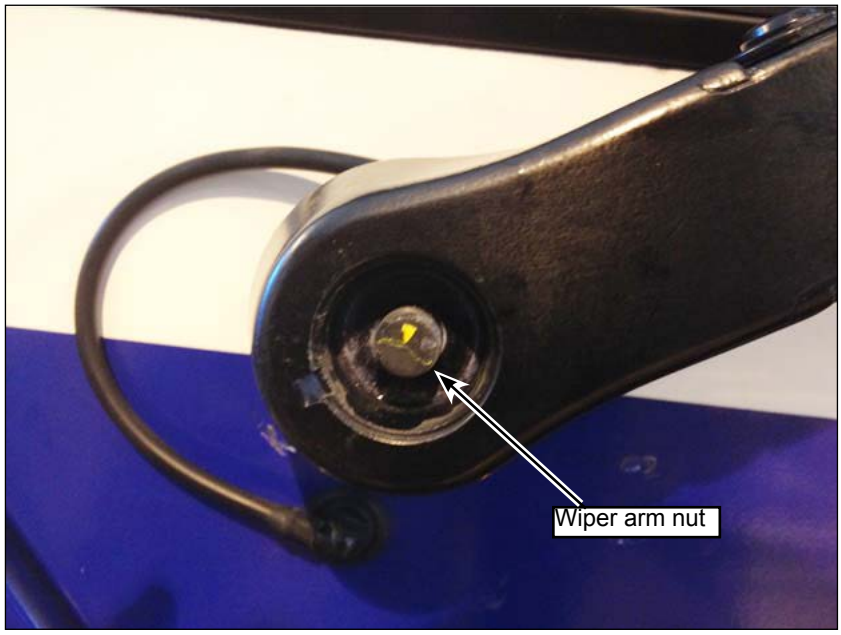


Figure 9 - Remove Wiper Arm Nut and Washer Line

1.10. Remove the windshield wiper arm by placing a block of wood against the front shell to protect against damage, and gently prying off the wiper using a pry bar. Remove both sides and retain wiper arms for reinstallation once the repair is complete (see Figure 10).

Figure 10 - Remove Wiper Arm

1.11. Remove the inner filler strip of the windshield gasket up to 4 inches above the destination sign glass, as well as the filler strip for the bottom of the destination sign glass. Note that the windshield will not fall out and the destination sign glass will still be secure. To remove the windshield, three people are needed, with two people outside the bus to push the gasket back as the person inside the bus pushes the windshield out (see Figure 11).

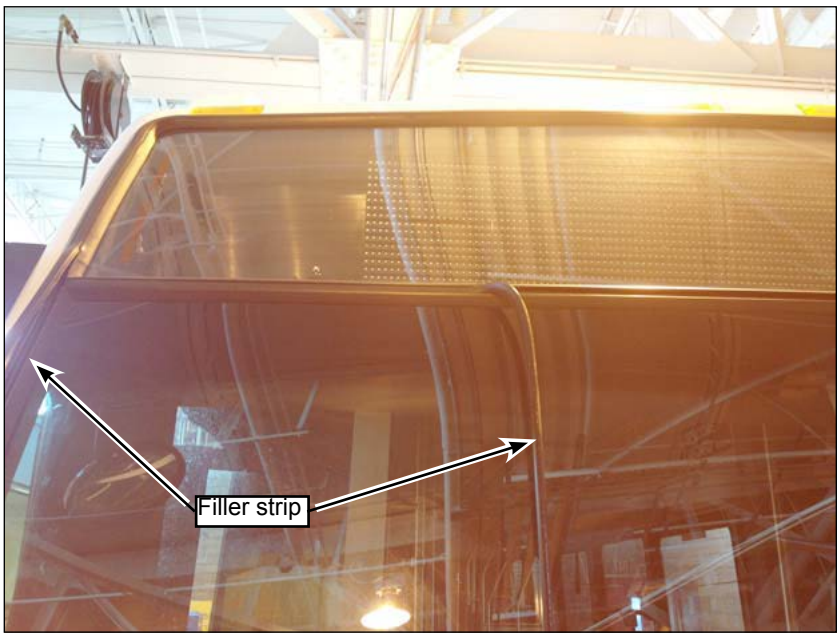


Figure 11 - Remove Inner Strip of Windshield Gasket and Windshield

1.12. Remove the three screws that secure the marker light and remove the marker light. Remove both sides and retain the screws for reinstallation once repair is complete (see Figure 12).

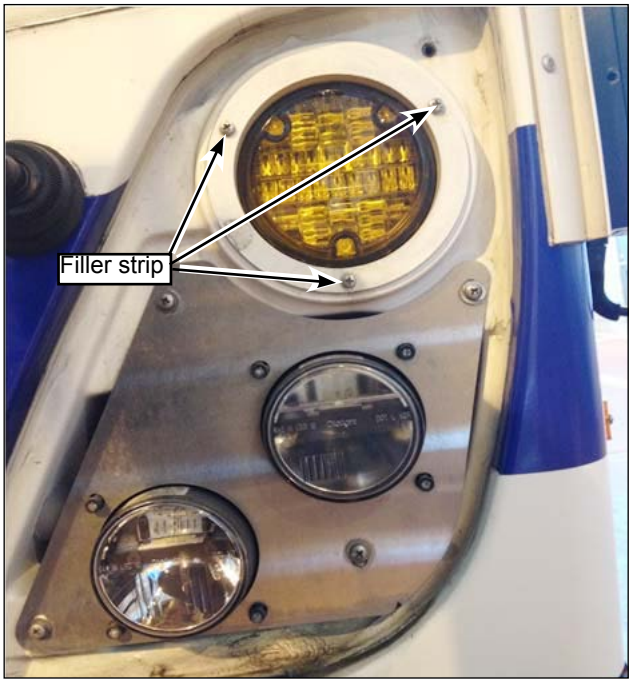


Figure 12 - Remove Marker Light Screws

1.13. Remove the two bottom dashboard panels and remove the four screws that secure the run number box. Retain all parts for reinstallation once the repair is complete (see Figure 13).

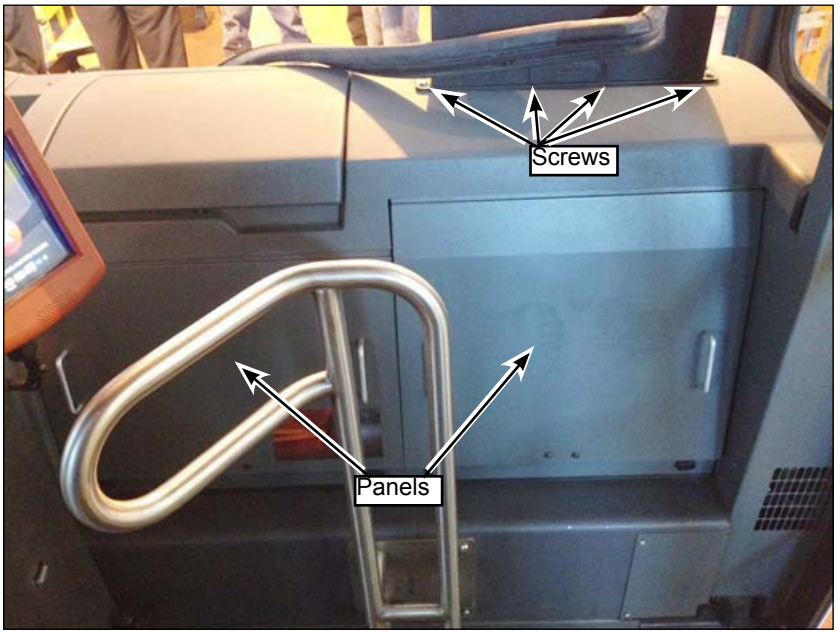


Figure 13 - Remove Panels and Screws

1.14. Remove the two run box electrical connectors and remove the run box, retaining the run box for reinstallation once the repair is complete.

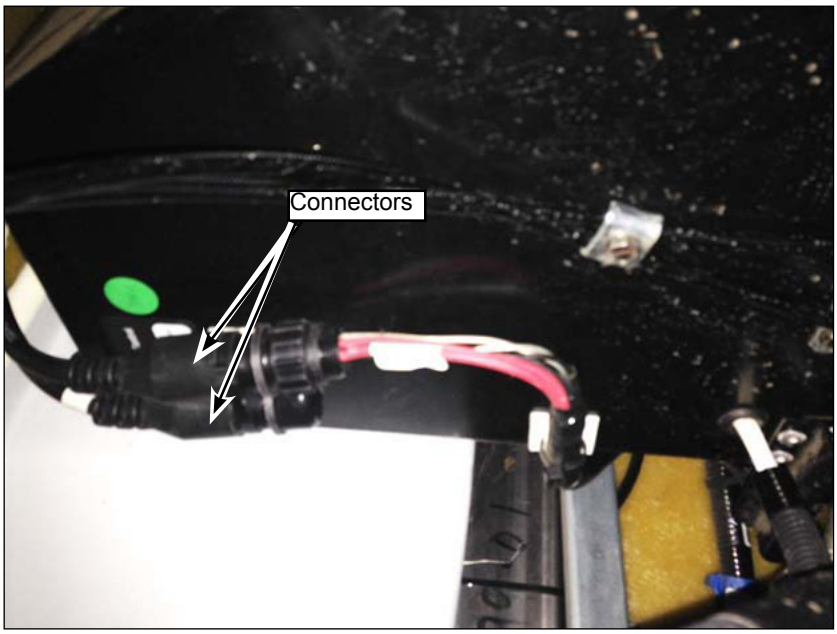


Figure 14 - Remove Connectors and Run Box

1.15. Remove the six nuts under the dash that secure the dash to the metal plate. Remove the glove box push rod by pushing it out of the opening. Retain all parts for reinstallation once the repair is complete (see Figure 15).

Figure 15 - Remove Nuts and Glove Box Push Rod

1.16. Remove the two bolts that hold down the transfer ticket holder and remove the holder. Retain for use during reassembly. Remove the NTP wiring if installed. Using a knife, cut the sealant between the left and right dash halves (see Figure 16).

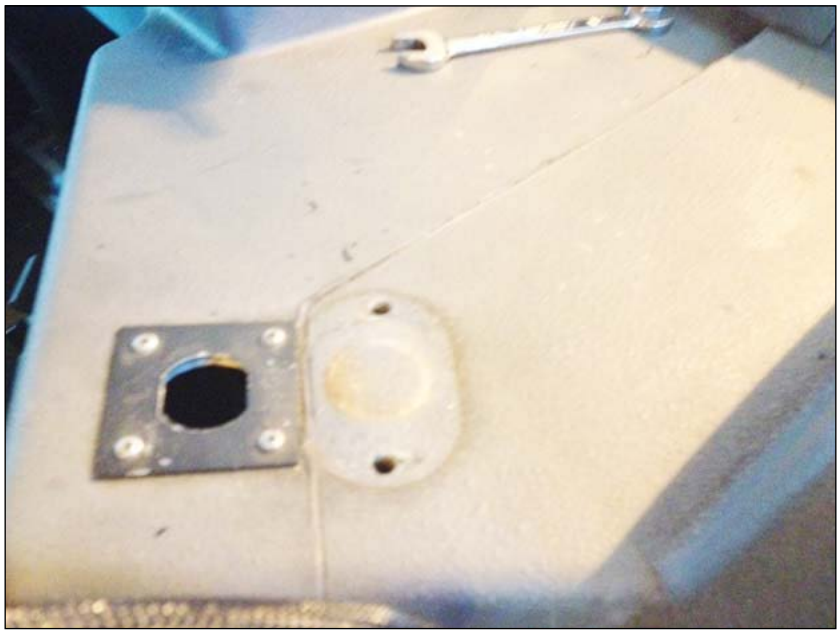


Figure 16 - Remove Transfer Ticket Holder and NTP Wiring

1.17. Remove all the screws around the perimeter of the dash and retain screws for reinstallation (se Figure 17).

Figure 17 - Remove Dash Screws

1.18. Remove the ten screws around the perimeter of the dash cluster and retain the screws for reinstallation. Pull the dash out slightly and remove the two main electrical connectors and the air lines from the Actia gauges. The cluster can be removed and retained for reinstallation. After the cluster is removed, cut the tiewraps that secure the main wiring harness to the dash (see Figure 18).

Figure 18 - Remove Dash Screws

1.19. There is no need to remove the shift selector from the dash, but the connector on the back of the selector must be removed. Remove the red locking tab, press down on the grey tab of the connector, and pull out the connector (see Figure 19).

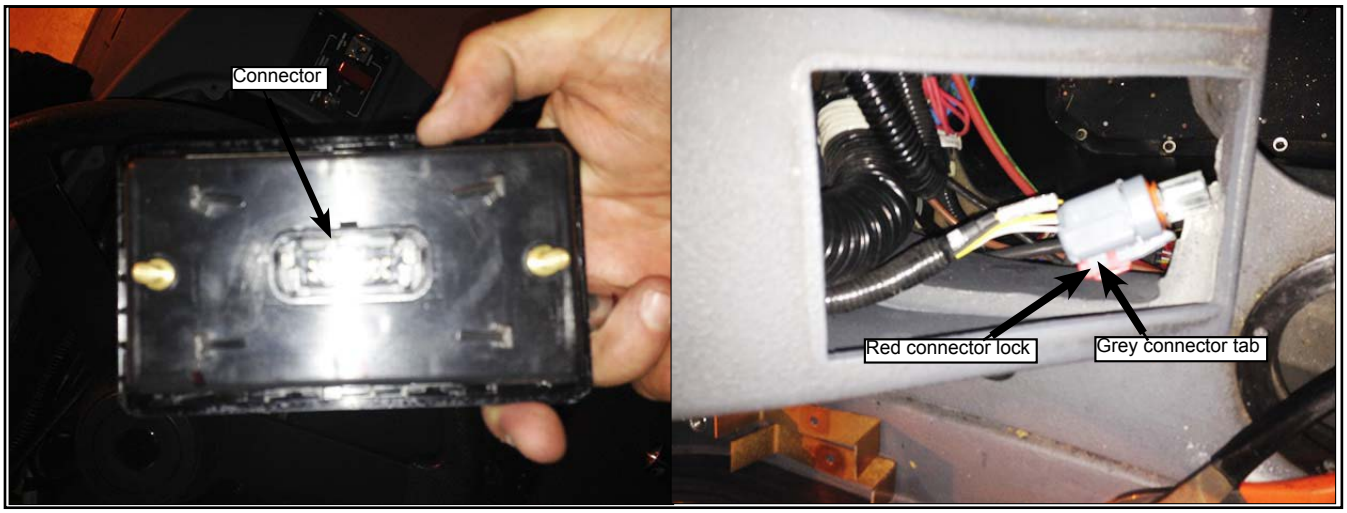


Figure 19 - Remove Connector at Rear of Shift Selector

1.20. Remove the dash defroster vent cable by removing the e clip that secures the pivot to the bracket, then removing the bolt that holds the cable to the dash. Retain all hardware for reinstallation (see Figure 20).

Figure 20 - Remove Dash Defroster Cable

1.21. Remove the dash diagnostic connector by removing the four nuts and screws that secure it to the bracket. Retain all hardware for reinstallation. The dash halves may now be removed, starting with the curb side (see Figure 21).

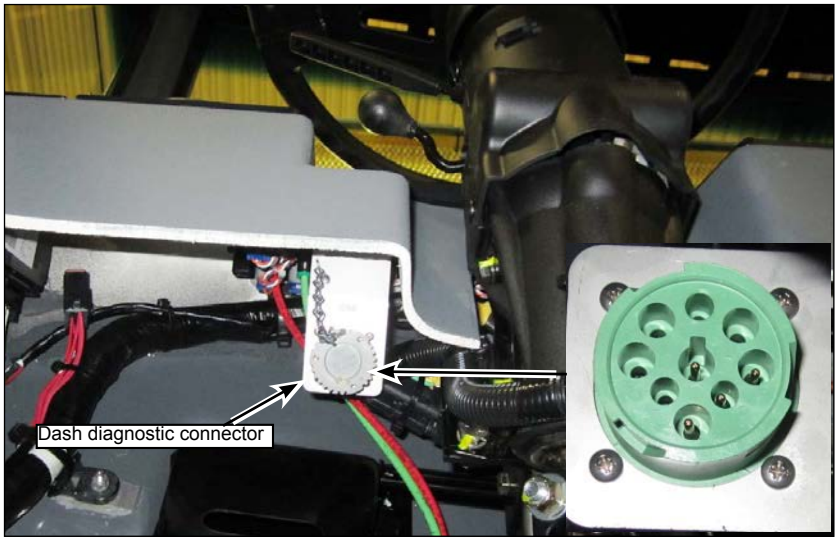


Figure 21 - Remove Dash Diagnostic Connector

1.22. Remove the rain gutter by drilling out the rivets. Retain the rain gutter for reinstallation (see Figure 22).

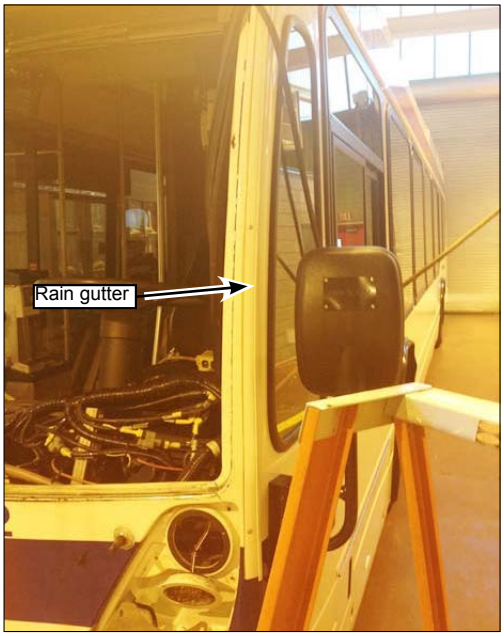


Figure 22 - Remove Gutter

1.23. Follow the instructions in Annex A for FRP Structural Rework. Read the instructions in their entirety before proceeding with the repair.

1.24. Reinstall the rain gutter using 1/8 inch rivets (see Figure 23).

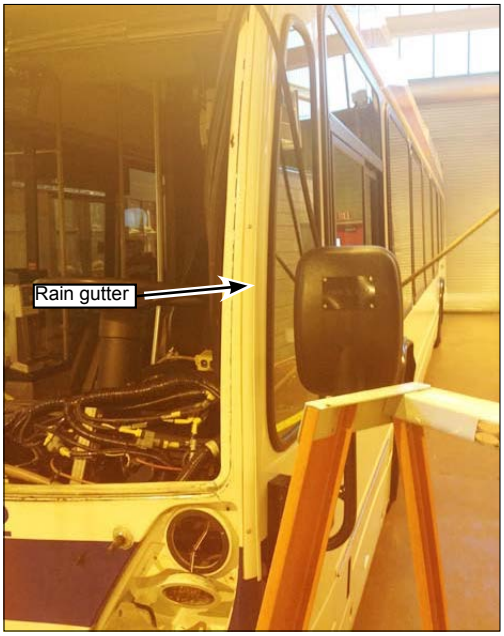


Figure 23 - Install Gutter

1.25. Reinstall the screws around the perimeter of the dash (see Figure 24).

Figure 24 - Install Dash Screws

1.26. Reinstall the six nuts under the dash that secure the dash to the metal plate. Reinstall the glove box push rod by pushing it though the opening and into the lock (see Figure 25).

Figure 25 - Install Nuts and Glove Box Push Rod

1.27. The shift selector can now be reconnected, ensuring that the red safety tab is installed on the connector (see Figure 26).

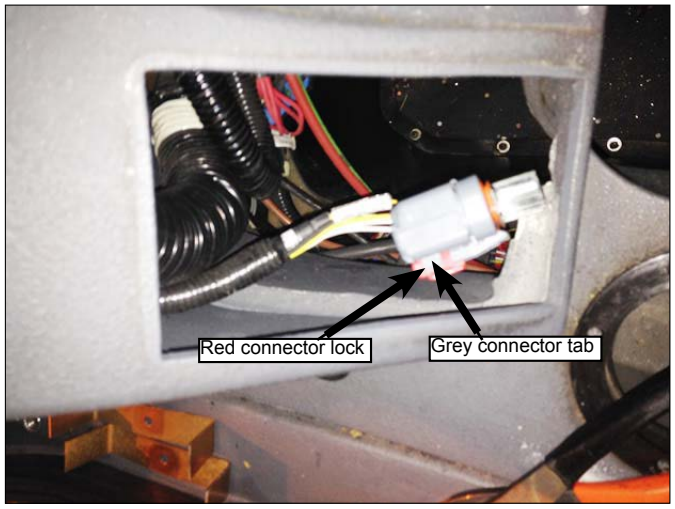


Figure 26 - Connect Shift Selector

1.28. Reinstall the dash diagnostic connector using the four nuts and screws that secure it to the bracket (see Figure 27).

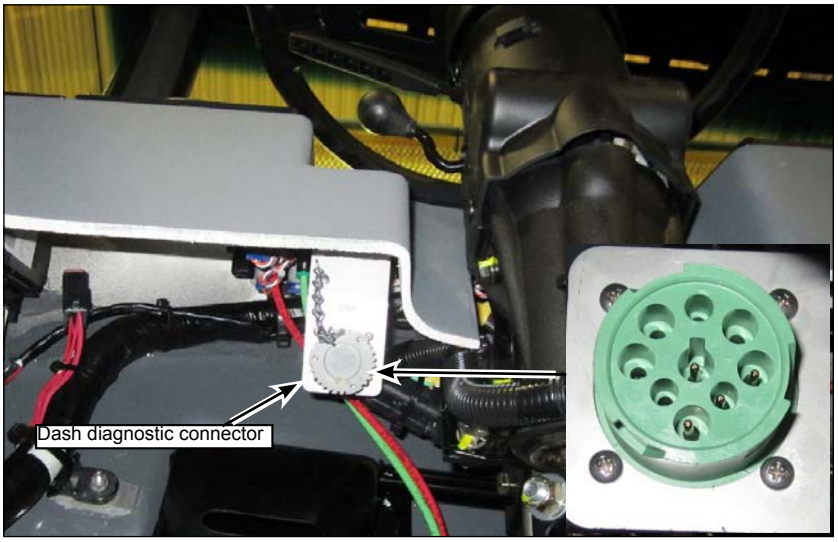


Figure 27 - Install Dash Diagnostic Connector

1.29. Reinstall the dash defroster vent cable starting with the e-clip that secures the pivot to the bracket, then the bolt that holds the cable to the dash (see Figure 28).

Figure 28 - Install Dash Defroster Cable

1.30. Reinstall the transfer ticket holder using the two bolts that hold down the transfer ticket holder. Install the NTP wiring if removed. Install new sealant between the left and right dash halves (see Figure 29) .

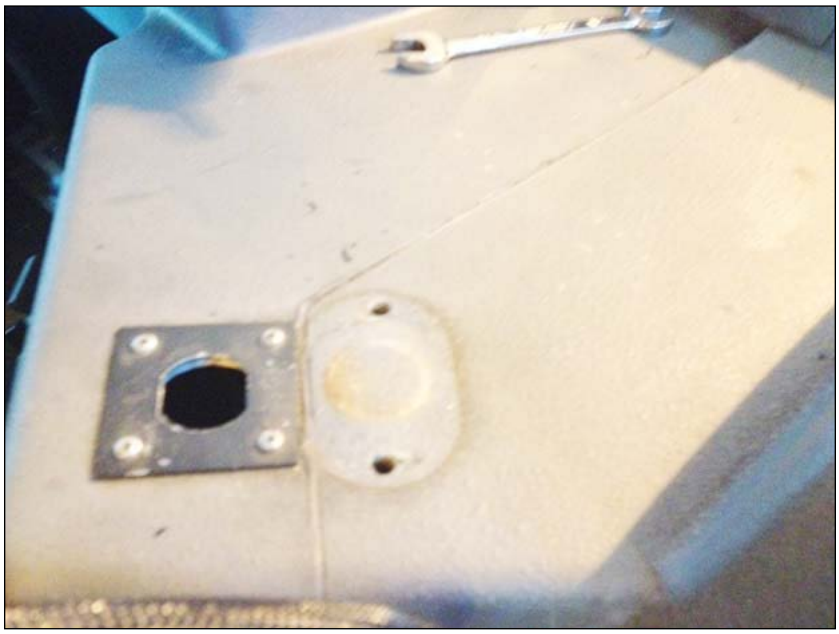


Figure 29 - Install Transfer Ticket Holder, NTP Wiring and Sealant

1.31. Before reinstalling the dash cluster, install the tiewraps that secure the main wire harness to the dash. The air lines and the electrical connectors can be plugged into the back of the dash cluster. Then reinstall the ten retaining screws (see Figure 30).

Figure 30 - Install main Wire Harness Tie Wraps, Air Lines, Electrical Connectors and Dash Cluster

1.32. Reinstall the run number box with the four retained screws and hook up the electrical connections under the dash (see Figure 31).

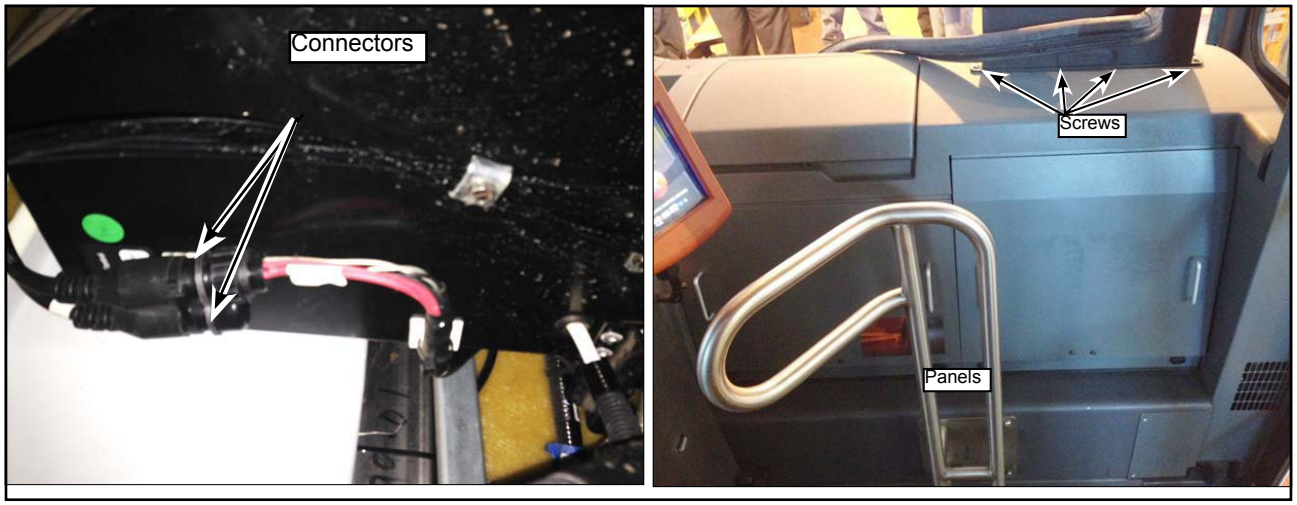


Figure 31 - Install Run Number Box and Connectors

1.33. Reinstall the two bottom dash panels (see Figure 32).

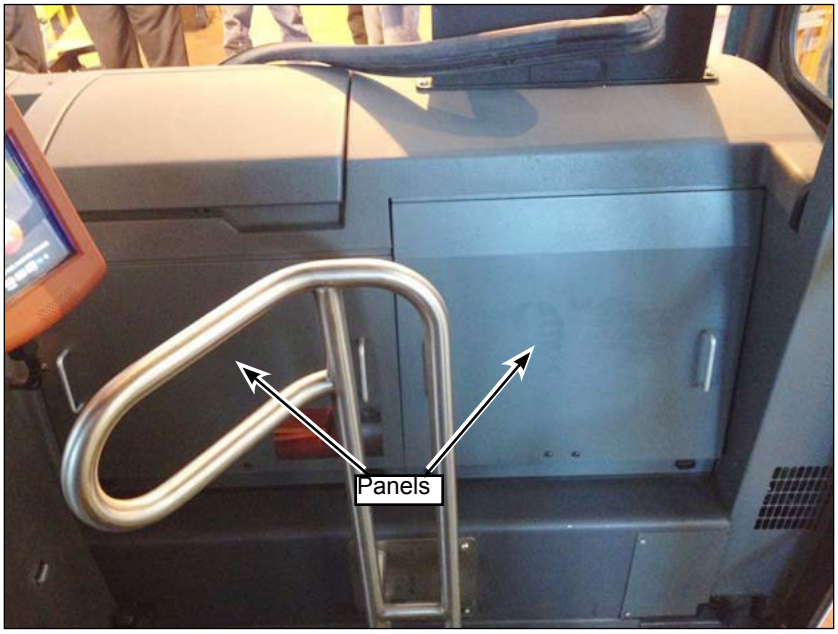


Figure 32 - Install Bottom Dash Pannels

1.34. Reinstall the marker light with the three screws that were removed, on both the street side and the curb side (see Figure 33).

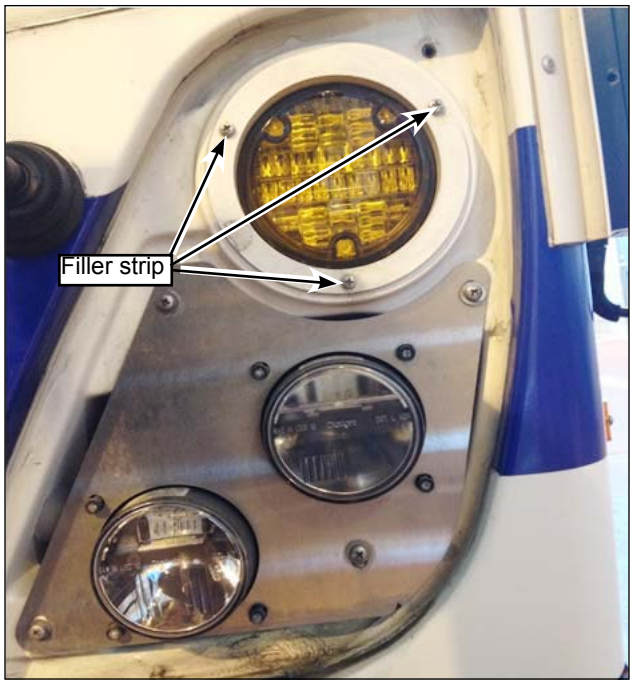


Figure 33 - Install Marker Lights

1.35. Reinstall the headlight bezels by screwing in the recessed retaining screws (see Figure 34).

Figure 34 - Install Headlight Bezels

1.36. To reinstall the windshield, have two people outside the bus pushing the glass back into the gasket as a third person works the gasket around the glass. Once the gasket is in place, install the filler strips (see Figure 35).

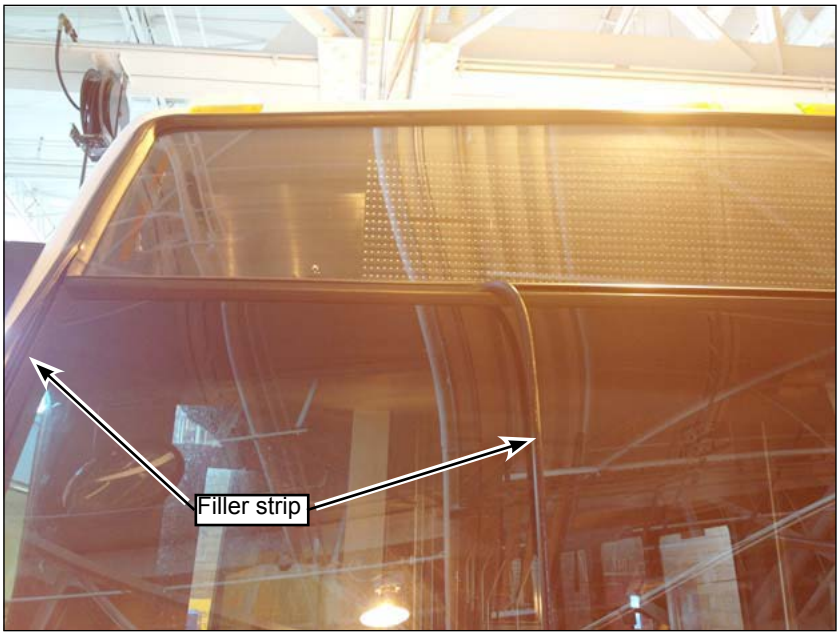


Figure 35 - Install Windshield

1.37. Reinstall the wiper arms using the tape on the windshield as reference to ensure that the wipers do not come into contact when in use. Push on the wiper arms and install the retaining nuts (see Figure 36).

Figure 36 - Install Wiper Arms

1.38. Reinstall the wiper hardware covers and washer lines (see Figure 37).

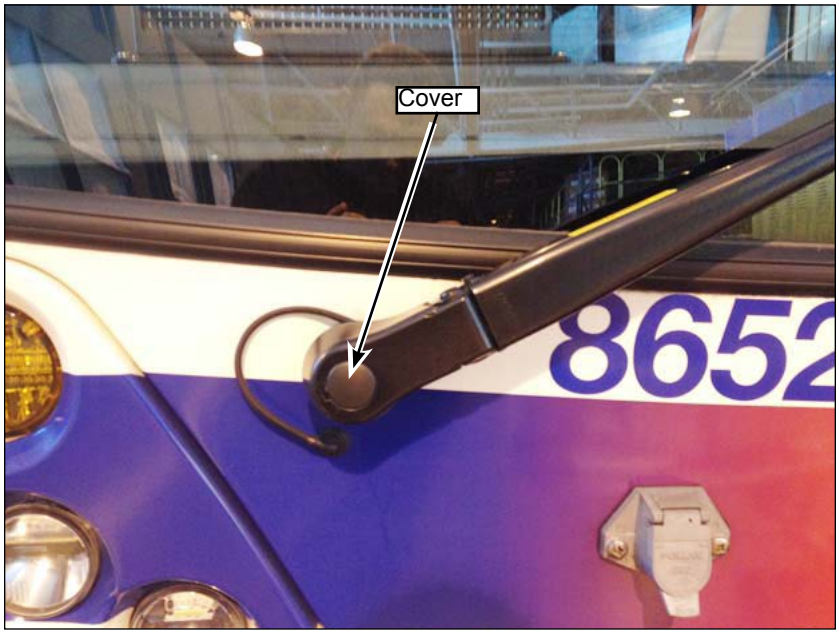


Figure 37 - Install Wiper Hardware and Washer Lines

1.39. Reinstall the bike rack by lifting it into position and letting the hooks fall into the slots (see Figure 38).

Figure 38 - Install Bike Rack

1.40. Secure the two mounting bolts and install the safety pins (see Figure 39).

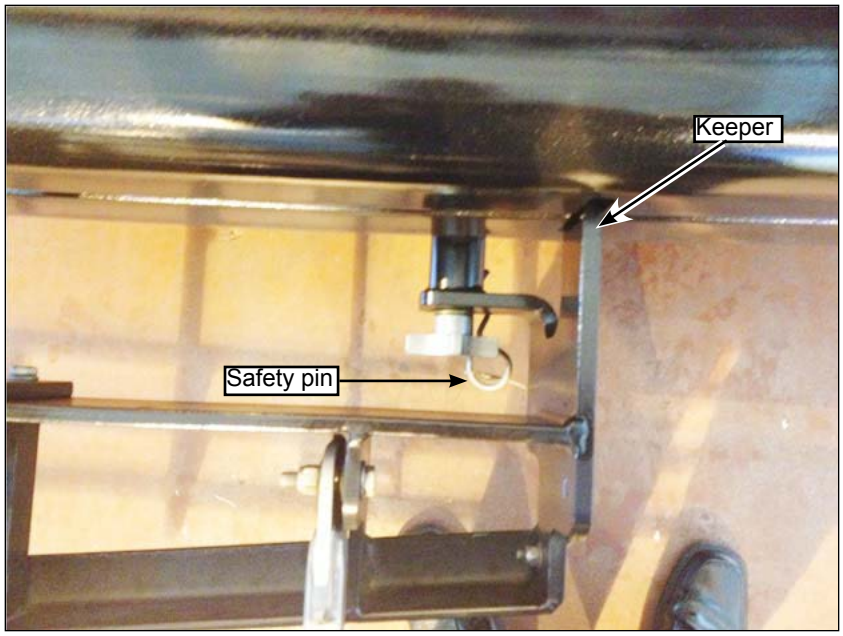
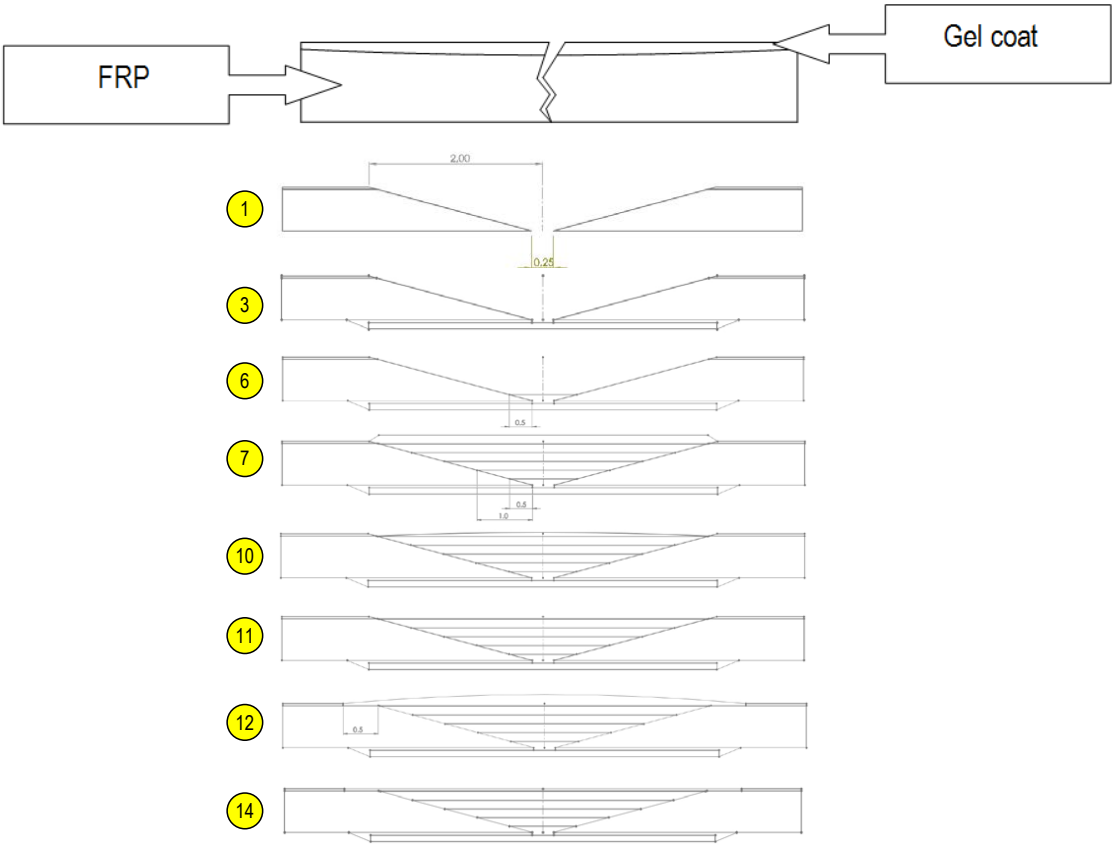


Figure 39 - Secure Mounting Bolts and Install Safety Pins

ANNEX A

MERKUR du génie à l'œuvre	Work method	
Dates :	Title :	Method no. :
Created : 01-12-2016 Revision : --	FRP STRUCTURAL REWORK	**M-06-02**

Schematic view of each step for a structural rework of a deep crack



Mandatory safety equipment		
		

MERKUR du génie à l'œuvre	Work method	
Dates :	Title :	Method no. :
Created : 01-12-2016 Revision : --	FRP STRUCTURAL REWORK	**M-06-02**

Material list:

- Grinder
- 80 grit sand paper
- 180 grit sand paper
- Clean acetone
- Woven rowing 9.4 oz/sq.yd (E-glass Bidirectional plain weave)
- Mat 1.5 oz/sq.ft
- Resin HETRON 92 FR with suitable MEKP catalyst.
- Lay-up rollers, including one of ¼ in diameter
- Brush
- Clean, lint-free cloth
- Stainless steel backing plate N84768
- Geometry templates for validation of surfaces (supplied by Nova Bus)
- Evercoat Rage Gold putty with its catalyst.
- Evercoat metalworks metal glaze polyester finish with its catalyst.
- Milled fibers
- Aerosil 200
- 3M FRP/SMC-90, two-component epoxy adhesive
- Suitable adhesive dispensing equipment

Mandatory safety equipment 		

MERKUR du génie à l'œuvre	Work method	
Dates :	Title :	Method no. :
Created : 01-12-2016 Revision : --	FRP STRUCTURAL REWORK	**M-06-02**

General considerations

Please read these instructions in their entirety before proceeding with any repair work.

Before starting any rework, a visual inspection of all cracks per M-06-01 must be performed to locate and evaluate the cracks. This work instruction explains all steps to make a structural rework, but depending of the depth of the crack, the rework will be different.

The extent of the repair area will vary from one occurrence to another. It should encompass the structural crack(s), the surrounding area needed to make the structural repair (at least 2 in each side of each structural crack), surrounding area where the thickness of the gelcoat exceeds 0.025 in, and surrounding areas where there are obvious defects, such as air entrapment, resin rich areas, etc. The first step of this work instruction may expose defects that will require adjusting the extent of the repair area.

Materials, such as laminating resin, catalyst, adhesive, etc., must be checked to ensure that the shelf life is not exceeded.

Mandatory safety equipment		
		

MERKUR du génie à l'œuvre	Work method	
Dates :	Title :	Method no. :
Created : 01-12-2016 Revision : --	FRP STRUCTURAL REWORK	**M-06-02**

STEP 1

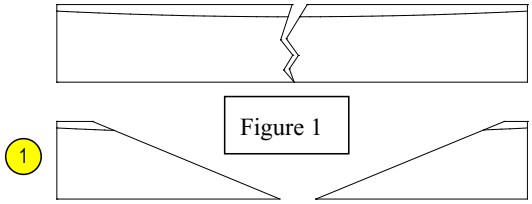
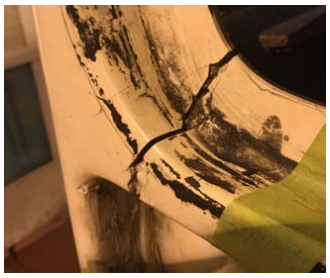


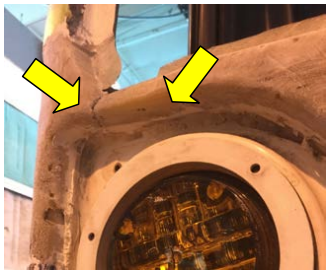
Figure 1

1-Using a grinder, grind each side of the crack (2 to 3 inches total width at the top of the V shape) to create an angle such as shown in figure 1 for FRP adherence with the front end. Use 80 grit sand papers as needed.

NOTE: At the bottom of the V shape grinded, ensure a minimum gap of ¼".



Before



After grinding

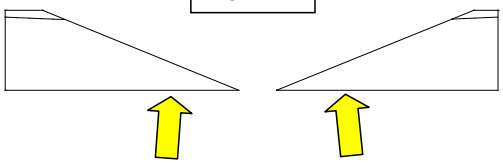
Mandatory safety equipment		
		

MERKUR du génie à l'œuvre	Work method	
Dates :	Title :	Method no. :
Created : 01-12-2016 Revision : --	FRP STRUCTURAL REWORK	**M-06-02**

STEP 2

Using clean cloth, clean the surface where the stainless steel plate will be bonded with acetone, to remove all dirt, dust and other contamination from FRP surface as shown in figure 2.
Allow acetone to evaporate.

Figure 2



STEP 3

Prepare surface of stainless steel backing plate N84768 to be bonded:

- Wipe the surface with a clean cloth soaked in acetone.
- Sand the surface with 80 grit sand paper.
- Wipe the surface with a clean cloth soaked in acetone.
- Allow acetone to evaporate.
  NOTE: don't use compress air to evaporate.

Mandatory safety equipment		
		

MERKUR du génie à l'œuvre	Work method	
Dates :	Title :	Method no. :
Created : 01-12-2016 Revision : --	FRP STRUCTURAL REWORK	**M-06-02**

STEP 4

Bond the stainless steel backing plate N84768 with adhesive 3M FRP/SMC-90 on the back side of the windshield gasket lip.

- Apply adhesive on the surface prepared at STEP 3, enough to obtain squeeze out all around plate and ensure a maximum thickness of 6mm.
- Use C-clamps and rigid bars to apply uniform pressure on the plate.
- Before adhesive cures, remove squeeze out around plate and on the inside bottom of the V shape to obtain a smooth transition, as shown in view figure 3 and at the bottom of the repair area.
- Maintain clamps in place for the specified adhesive clamping time, 4 hours as shown in view figure 4.

Figure 3

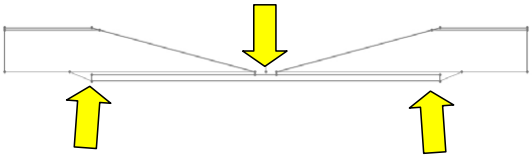
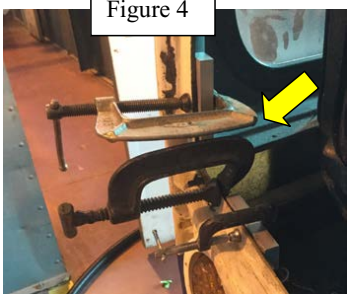


Figure 4

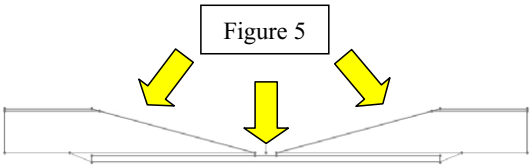


STEP 5

Using clean cloth, clean the entire repair surface with acetone, to remove all dirt, dust and other contamination as shown in figure 5.
Allow acetone to evaporate.

NOTE: Don't use compress air to evaporate.

Figure 5



Mandatory safety equipment		
		

MERKUR du génie à l'œuvre	Work method	
Dates :	Title :	Method no. :
Created : 01-12-2016 Revision : --	FRP STRUCTURAL REWORK	**M-06-02**

STEP 6

Lay up first layer of FRP:

- Cut 1 layer of 1.5 oz mat to cover min. of 0.5'' more on both side of the gap as shown figure 6.
- Prepare mixture of Hetron 92 FR resin, milled fiber and Aerosil, referred to as thick mix.
- Add MEKP (1% to 3%) to thick mix and apply on repair area to fill in imperfections and promote adhesion.
- Before thick mix cures, apply resin/catalyst mix on table and impregnated precut mat layer. Follow indications in chart below to prepare resin/catalyst mix.

HETRON® 92 FR Resin Series (Page 2 of 3) ASHLAND

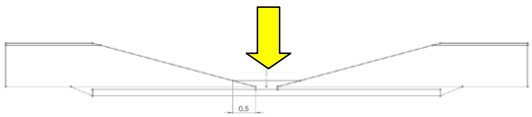
TYPICAL* PERFORMANCE PROPERTIES
(For Guidance Only)

TYPICAL CURING CHARACTERISTICS:

LUPERSOL® DDM-9 Catalyst	Temperature, °F	Gel Time, Minutes
1.00	60-70	39
	70-80	21
	80-90	14
1.25	60-70	34
	70-80	20
	80-90	12
1.50	60-70	32
	70-80	18
	80-90	11

- Laminate layer to remove all air with suitable tools (rollers, brushes, fingers, etc.), making sure the mat is touching and compress on the stainless steel insert and fills the entire ¼" gap in between the two surfaces.

Figure 6



STEP 7

When first layer of FRP is completely cured as fallowing this chart:

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MERKUR du génie à l'œuvre	Work method	
Dates :	Title :	Method no. :
Created : 01-12-2016 Revision : --	FRP STRUCTURAL REWORK	**M-06-02**

HETRON® 92 FR Resin Series (Page 2 of 3) ASHLAND

TYPICAL* PERFORMANCE PROPERTIES
(For Guidance Only)

TYPICAL CURING CHARACTERISTICS:

LUPERSOL® DDM-9 Catalyst	Temperature, °F	Gel Time, Minutes
1.00	60-70	39
	70-80	21
	80-90	14
1.25	60-70	34
	70-80	20
	80-90	12
1.50	60-70	32
	70-80	18
	80-90	11

Sand the surface with 80 grit sand paper.
Using clean cloth; clean the entire surface with acetone, to remove all dirt, dust and other contamination from the entire lay-up surface.
Allow acetone to evaporate.

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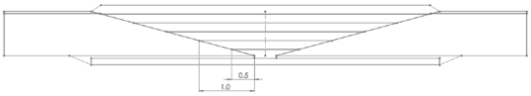
STEP 8

Lay up FRP layers:

- Cut layers of 1.5 oz mat and 9.4 oz fabric in alternating to cover area by step of min. 0.5"as shown on figure 7. First and last layer shall be mat. Layup alternative layers of 9.4 oz fabric and 1.5 oz. mat impregnated with HETRON 92 FR resin catalysed with MEKP (1%-3%). Repeat this sequence until the middle of the rework (bottom of the "V") is at the same height of the original part surface. It could take 2 or 3 layers of 1 x 1.5 oz. mat and 1 x 9.4 oz. roving.

Figure 7



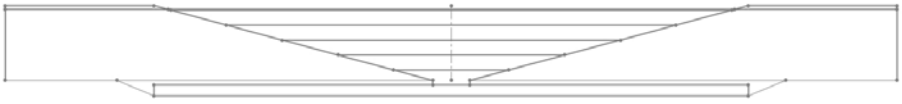
Note: This step must be performed before the resin cures.

CAUTION: If resin cures before the end, repeat step 6 and 7 and restart lay-up with 1.5 oz. mat.

STEP 9

Using a grinder with 80 grit minimum wheel, grind all the excess material as show on the schematic view Figure 9. Use the appropriate geometry templates LH & RH are provided by Nova to validate shape and adjust as necessary, to obtain surface geometry as close as possible to the original one.

Figure 9



Thickness location

- A) Windshield gasket lip and other controlled thickness areas: 5mm -1/+0
- B) Windshield gasket lip with bonded backing plate: 6mm -1/+0
- C) Some areas are 6mm -0/+3 (most of the front shell)
- D) Some areas are 14mm -0/+2

See next page for location:

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MERKUR du génie à l'œuvre	Work method	
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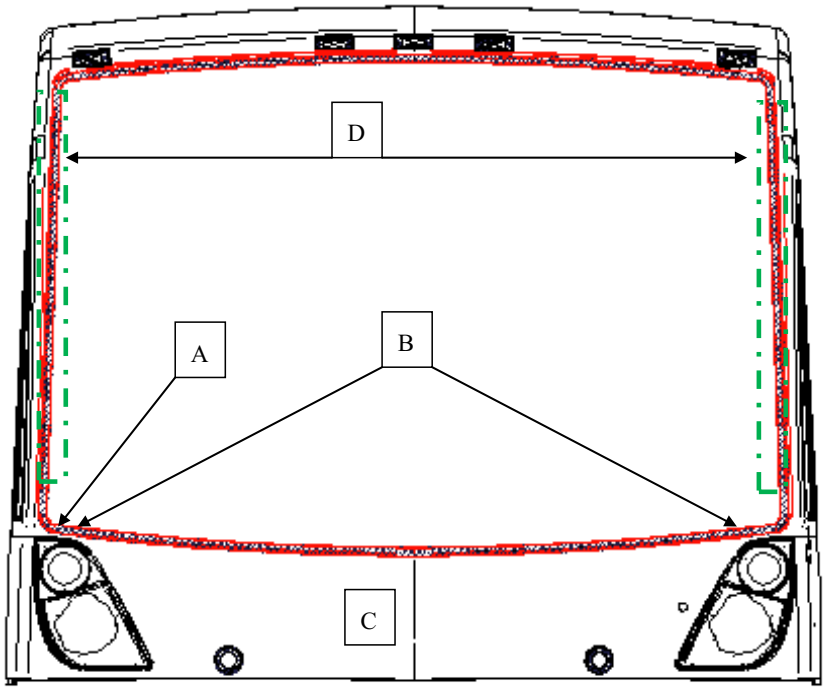

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MERKUR du génie à l'œuvre	Work method	
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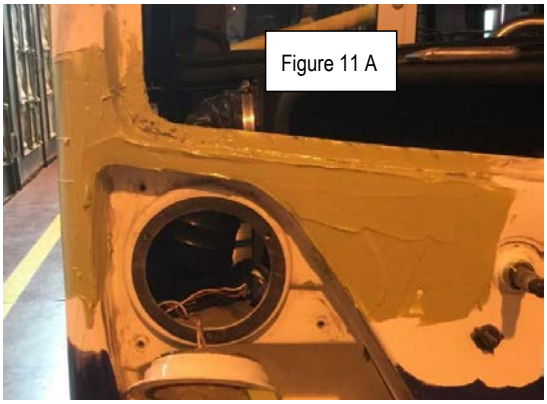
STEP 10

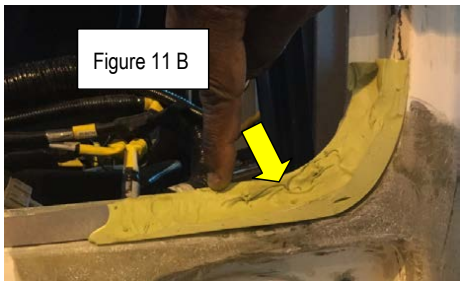
Using clean cloth, clean the entire surface with acetone, to remove all dirt, dust and other contamination from the entire grinding surface.
Allow acetone to evaporate.

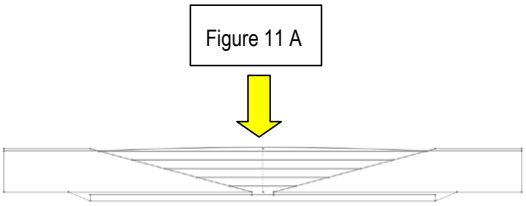
STEP 11

Apply base layer of putty:

- With catalysed Rage Gold putty, apply a thin layer all over the reworked surface with ½" exceeding all around shown on Figure 11 A.
- When putty has cured, sand surface while controlling and adjusting shape with appropriate geometry templates shown on Figure 11 B.







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MERKUR du génie à l'œuvre	Work method	
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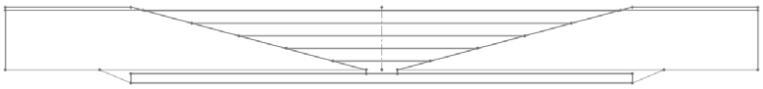
STEP 12

Apply a thin layer of catalysed Rage Gold putty around stainless steel plate to create a smooth transition between the stainless steel insert and FRP to ensure no water leak.

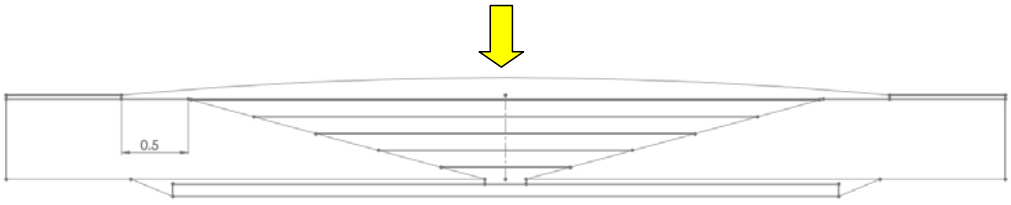
STEP 13

Using a 180 grit sand paper level the surface.
Then using clean cloth, clean the entire surface with acetone, to remove all dirt, dust and other contamination from the entire grinding surface.



STEP 14

With catalysed Metalwork metal glaze polyester putty, add a thin layer all over the reworked surface with ½" exceeding all around.
Apply catalysed putty on edge of part to seal away water and moisture.



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MERKUR du génie à l'œuvre	Work method	
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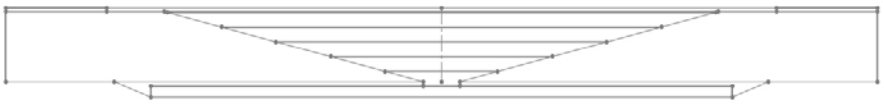
STEP 15

When putty has cured, sand the surface with 180 grit sand paper to give the exact same geometry as the original shape and to make it ready for paint.



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Return the vehicle in service. ❖