NABI -NJT: Radiator Support Crossmember Rework

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Approved by: Dan Allen
Chief Engineer of Manufacturing and Service Support

Property name and Top bus number: NJT 416.15 164200, 164400, 279000, 279500, 289000, 308000

Issue: Structural issues of the radiator support crossmember were reported.

Reason: Structural upgrades are required to enhance durability.

Solution: Remove old radiator support crossmember and install new crossbeam per this work instruction.

Effected buses: 1299 buses

Estimated repair hours/bus: 35 hours/bus.

Engineering documentation: V01-6055-901 (4 pages)

Necessary parts:

Cross Beam Kit, Fan Support,	Part #: **V01-6055-901**,	1 / bus,
Frame plug for cavity protection holes, 10 mm,	Part #: **NABI1874**,	5 / bus,
Foam Tape, double sided, 1/2" Wide,	Part #: **700-0001-200E**,	up to 2 feet / bus,
FOAM TAPE, 1/8x1-1/2, DBL, VHB,	Part #: **5021746**,	1 20’ roll / bus,
SCREW, #10-32x3/4, PH, SS, F410,	Part #: **270140**,	20 / bus,
#10 x 11/16 OD washer, flat,	Part #: **2603SS**,	20 / bus,
WASHER, LOCK, #10, SS,	Part #: **250010SS**,	10 / bus,
BOLT, 1/4-20x1, HEX, ZN, GR8,	Part #: **220420088**,	10 / bus,
NUT, 1/4-20, HEX, NYLOCK, ZP, GR 8,	Part #: **5015581**,	6 / bus,
WASHER, FLAT, 1/4, ZN, GR 8,	Part #: **2604**,	10 / bus,
WASHER, LOCK, 1/4, ZN,	Part #: **2504**,	6 / bus
BOLT, 5/16-18x1, HEX, ZN, GR8,	Part #: **220518088**,	2 / bus,
WASHER, FLAT, 5/16, ZN, GR 8, USS,	Part #: **2605**,	2 / bus,
WASHER, LOCK, 5/16 ZN,	Part #: **2505**,	2 / bus,
CLAMP, HOSE, SILICONE/SS, 7/8"ID,	Part #: **5002523**,	as required,
CLAMP, HOSE, SILICONE/SS, 1"ID,	Part #: **5002524**,	as required,
For radiator with CAT and Cummins engines:		
CLAMP, PWR GRIP SB, 2.5",	Part #: **101-1375-001**,	2/bus,
CLAMP, PWR GRIP, SB67, 2.50-2.75	Part #: **101-1375-275**,	2/bus,
HO$, SILICONE, RDCR, 2.5"ID-2.25",	Part #: **806-1310-004**,	1/bus
HOSE, SILICONE, 2.5"IDx8",	Part #: **500-1310-011**,	1/bus,
CENTER BONDED MOUNT,	Part #: **10A-1301-005**,	as required (4 / bus),
For CAC with CAT engine:		
HUMP HOSE, 90, 3.5", HI TEMP,	Part #: **511-1420-002**,	as required (1 / bus),
CLAMP, T-BOLT, 4.3125"-4.625",	Part #: **5013660**,	as required (1 / bus),
For CAC with Cummins engine:		
HUMP HOSE, 3.5"IDx6",	Part #: **416.00.1060.974**,	as required (1 / bus),
CLAMP, T-BOLT, 3.5"-3.812",	Part #: **416.06.1530.908**,	as required (2 / bus),
LOCTITE 246, 1.69 FL OZ/50mL,	Part #: **5033332**,	as required (1 / 40 buses),
LUBRICANT, ANTI-SEIZE, 16 FL OZ,	Part #: **5024582**,	as required (1 / 40 buses),
Welding wire, ER308LSi, dia. 0.035”,	Part #: **NPN**,	as required,
Acetone,	Part #: **NPN**,	as required,
Industrial primer,	Part #: **NPN**,	3 cans / bus,

Necessary tools:

Usual hand tools (wrenches, screwdrivers, hammer, chisel, etc.), angle grinder, GTAW (MIG) Welding machine, 1/8” and 5/16” diameter drill bits, drill, wire wheel, 36G and 60G abrasive discs, de-burr bits, partition/welding curtains, dust collector, chain and fork lift fork extension to remove radiator/CAC assembly, coolant pump, drain pan, 5/16-18 plusnut gun, 10/32, ¼-20 and 5/16-16 tread taps, fire proof blankets, Amerex fire suppression system probe.

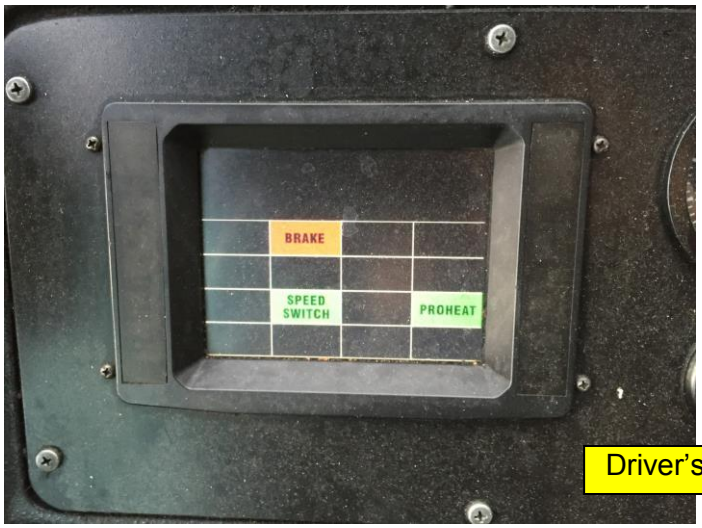
SAFETY PRECAUTIONS MUST BE FOLLOWED ACCORDING TO ACCEPTED INDUSTRY STANDARDS AND LOCAL/PROPERTY REQUIREMENTS.
Stop welding 45 minutes before planning to leave the bus.
Ensure that partitions/welding curtains are placed around the work area.

General Information:

- Read and understand this work instruction before starting the repair.
- Study and familiarize yourself with the work area before starting the repair.
- Before starting the work, make sure that all tools, protective equipment and parts are available.
- Any deviation from this work instruction should be discussed prior to performing any work that does not conform to this work instruction.
- Record bus number, mileage and date of completion and report weekly to Kalman Takacs.

General Preparation before Welding is Performed

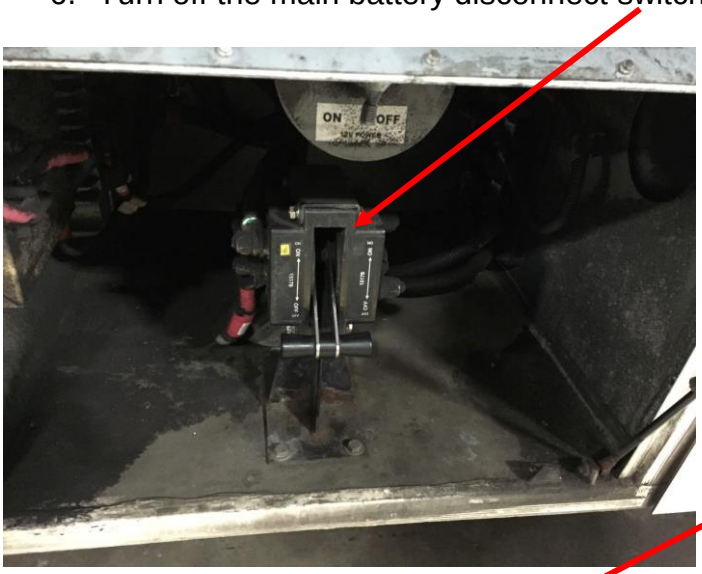
1. Start bus and check driver's dash for warning lights. Record and report any warning lights (for example check engine light) to the garage foreman.

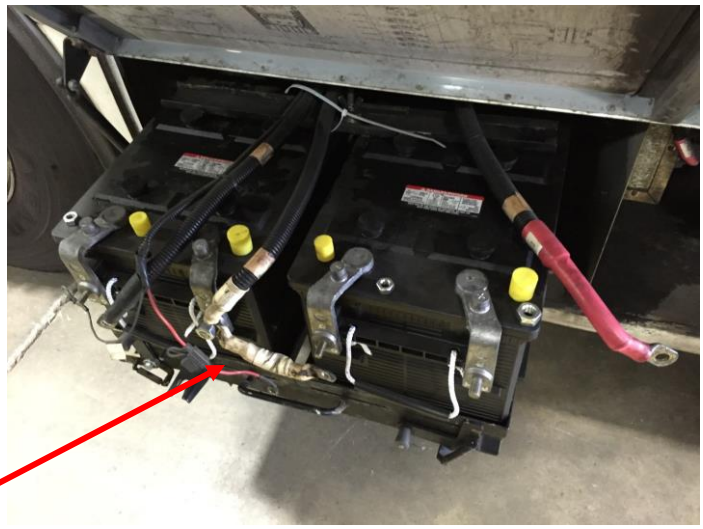


Driver's dash with no issue-lights

2. Inspect rear marker lights, engine compartment lights, back up alarm for proper operation. These components will be disconnected and they must work exactly as they were before. Report any issues to the garage foreman before you start disassembling the bus.
3. The charge air cooler (CAC) and coolant radiators will be disconnected and removed from the bus. Inspect them for any visible damage, leak, etc. and report findings (if any) to the garage foreman before start disassembling the bus.

4. Take photos of bus number and the issue (dash warning light, leaks, etc.) that was found during the inspection.
5. Turn off engine.
6. Turn off the main battery disconnect switch.





7. Tag and disconnect the battery cables.
8. Disconnect the ECU of engine, transmission and ABS. Disconnect the destination signs. Disconnect the Clever device. Open the light panels and disconnect all the IO modules. See some example pictures on the next page.

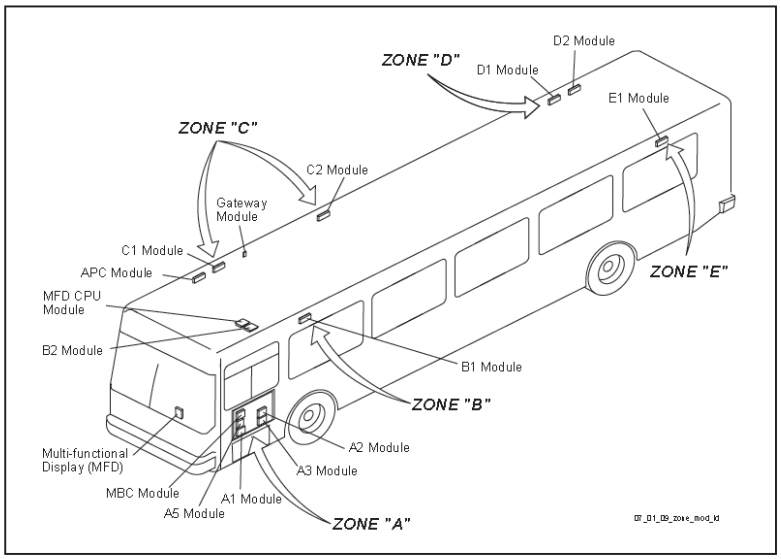
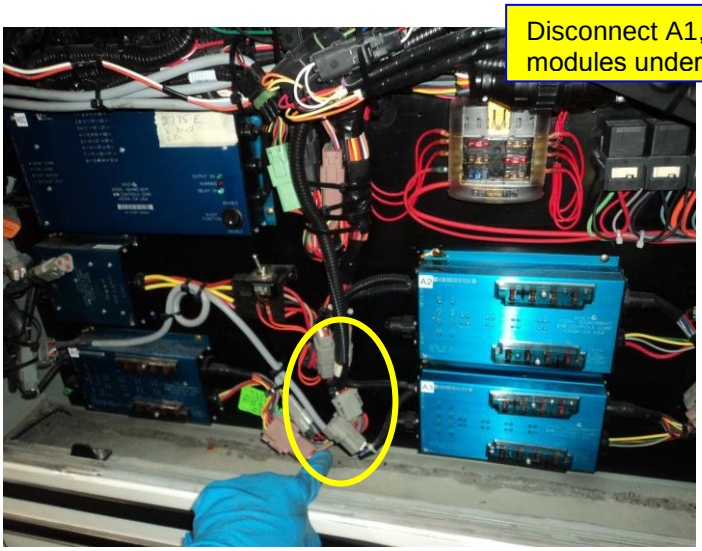
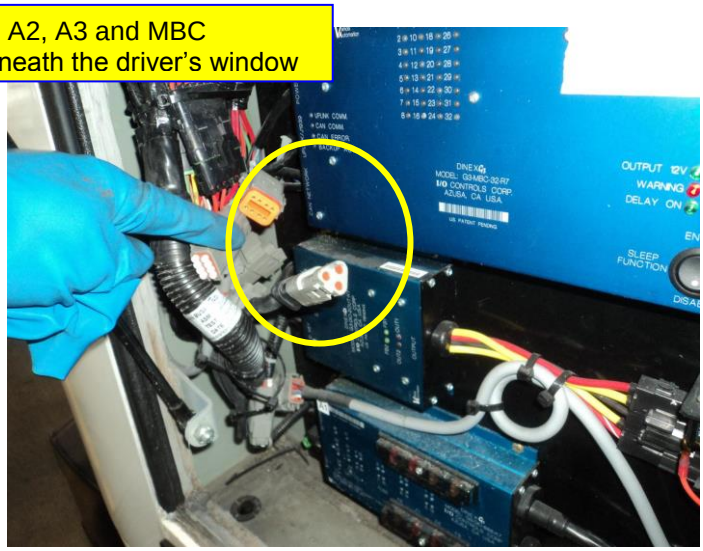
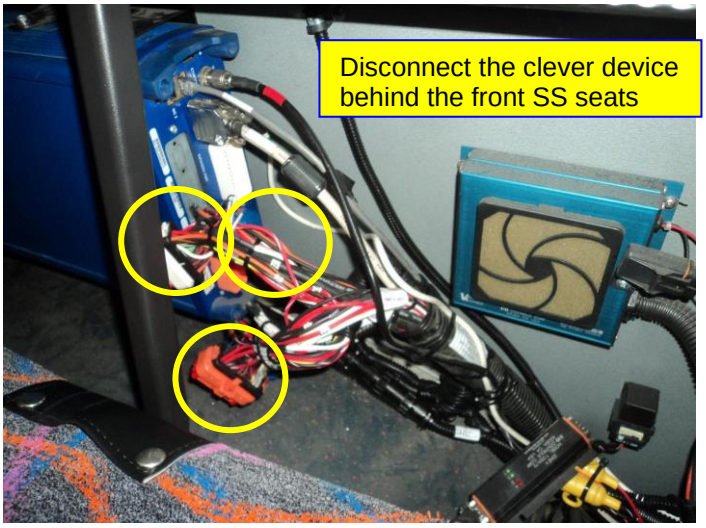


Figure 1- Zone and Module Identification



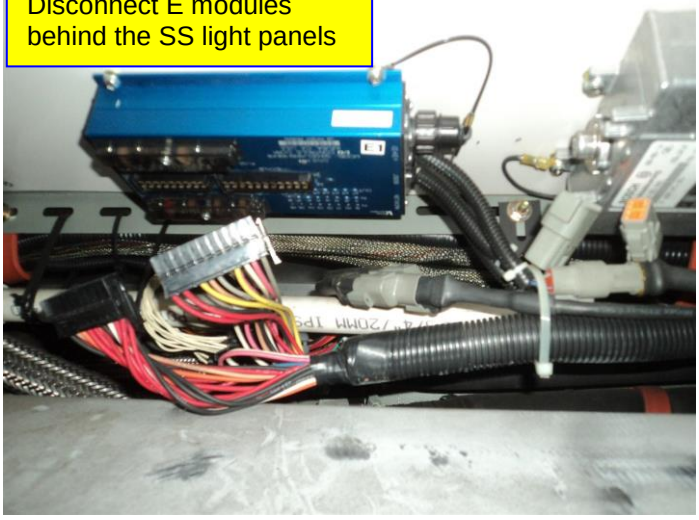
Disconnect A1, A2, A3 and MBC modules underneath the driver's window



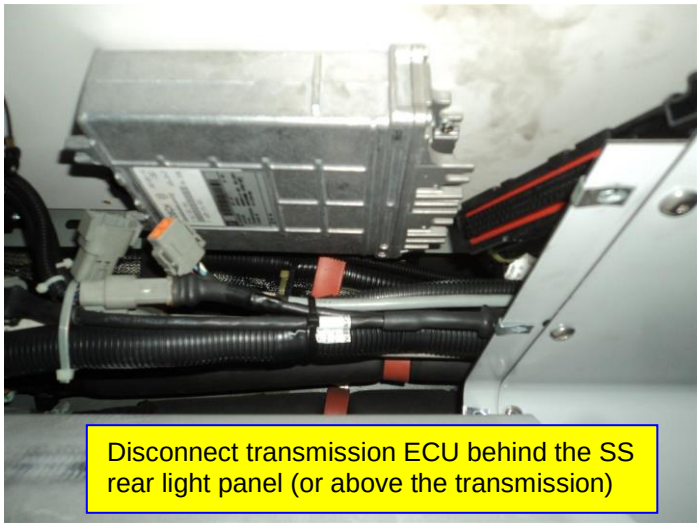


Disconnect the clever device behind the front SS seats

Disconnect C modules behind the CS light panels



Disconnect E modules behind the SS light panels



Disconnect transmission ECU behind the SS rear light panel (or above the transmission)

9. Disconnect the 2-way weather pack connector at the fire suppression bottle, located at the street side compartment in front of the rear axle.

10. Protect repaired area from damage, grinding spark and welding splatter by using fire proof blanket(s).

General Welding Instruction:

1. Remove coating material and primer from surfaces subject to be welded by using grinding tools and wire wheels. Primary condition of good quality weld is a perfectly clean metal surface.
2. Remove dust and degrease cleaned areas with acetone.
3. Weld only a completely clean surface! Grind surfaces with grinding disk suitable for stainless steel material.
4. To prevent gas defects of the weld joints welding should be performed only in closed production area protected from currents of air. Ensure adequate ventilation.
5. Welding parameters must be in accordance with attached Welding Procedure Specification (WPS) **NABI-2014-001 SS** sheets.
6. Weld joints should be 100% visually inspected.
7. Protect repaired area from damage during welding.

Make sure that no cracks are present at the side wall structure. If crack was found, then follow the steps below:

- Find the end of the crack (it is recommended to use magnifier or dye penetrate),
- Drill a 1/8” size hole at the end of the crack,

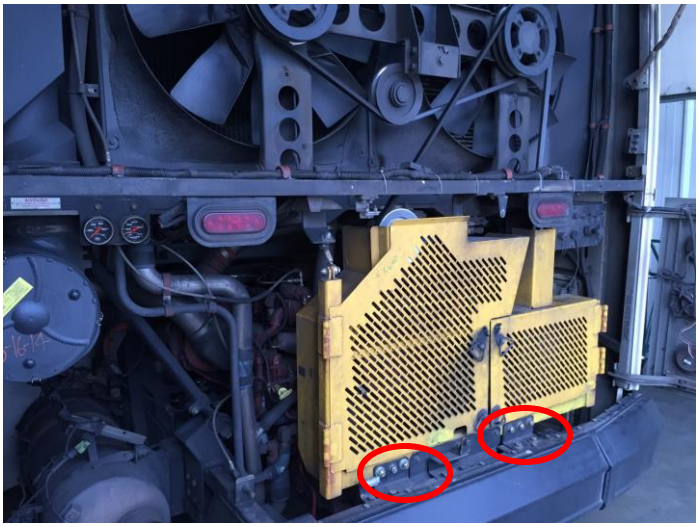
- Bevel the crack profile 2x30° for single “V” butt (groove) weld,
- Clean the surface at the welding area with abrasive disc and/or wire wheel.
- Degrease surface at the welding area by using acetone or denatured alcohol.
- Weld the cracked and bevelled line with continuous weld per WPS **NABI-2014-001 SS**.
- Grind the weld surface until the same height as the parent metal.
- Check the welds by Visual Test and/or Dye Penetrate Test.

Disassembly

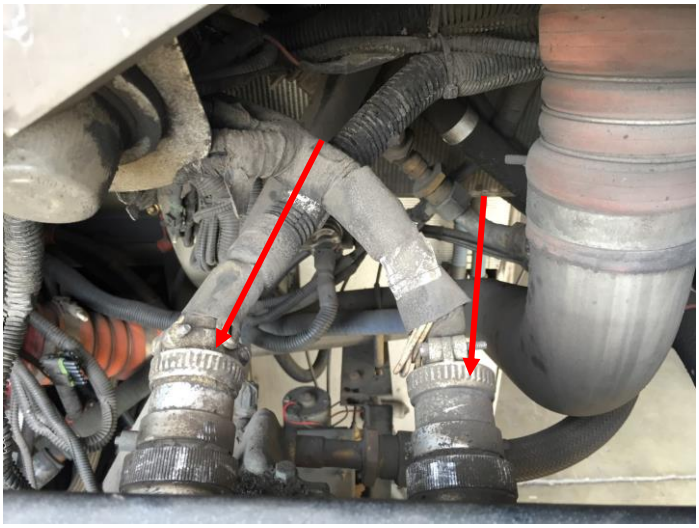
1. Disconnect electrical harnesses of the rear engine compartment doors then remove both doors from their hinges. Do not remove or disassemble hinges!

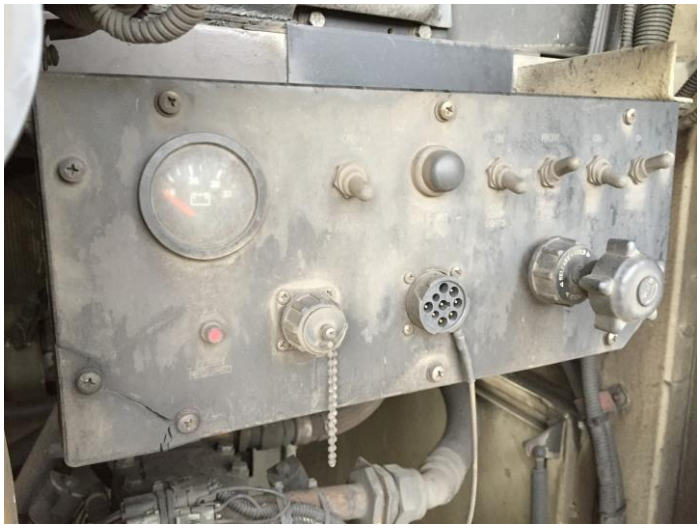
2. Open the attic compartment door and unhook the door limiter cables so the attic door can be opened all the way up.

3. Remove belt guard (see red circles below).

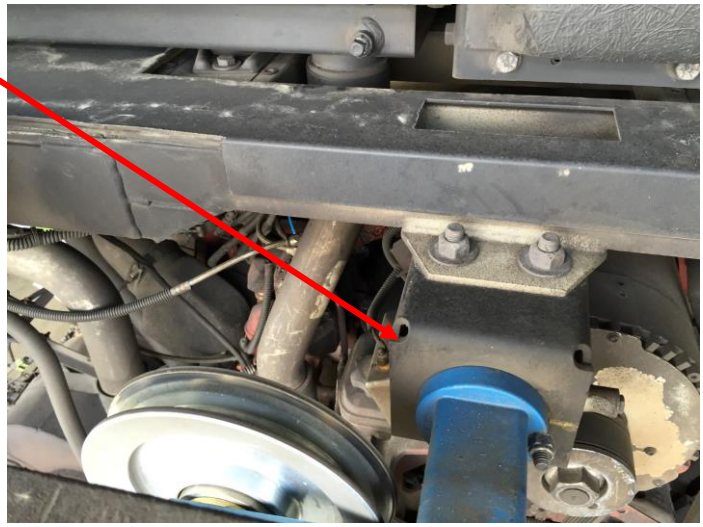


4. Disconnect electrical cables behind the rear engine control box then remove the control box. If connectors are seized up then leave them connected: place the control box to the top of the AC compressor and cover it with a fireproof blanket.





5. Remove fan belts and tensioners.



6. Remove cooling fan assembly and shrouds.

7. Remove fire suppression nozzles.

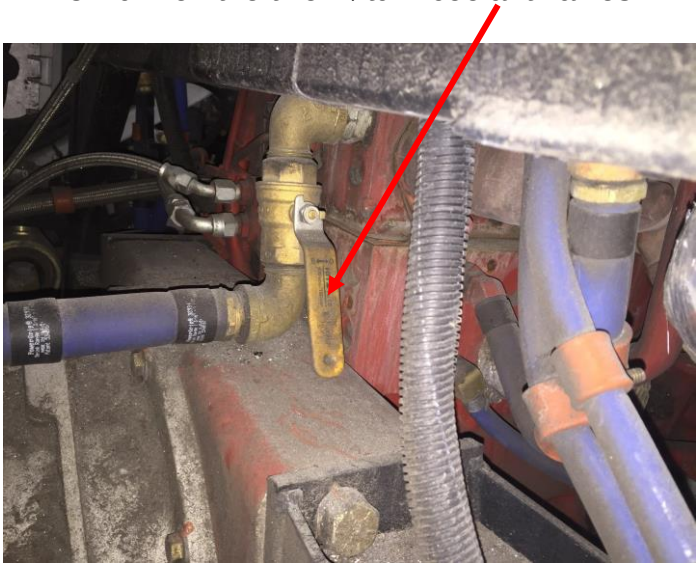
8. Remove gauges, harnesses, clamps, interior lights that attached to the radiator support crossmember.

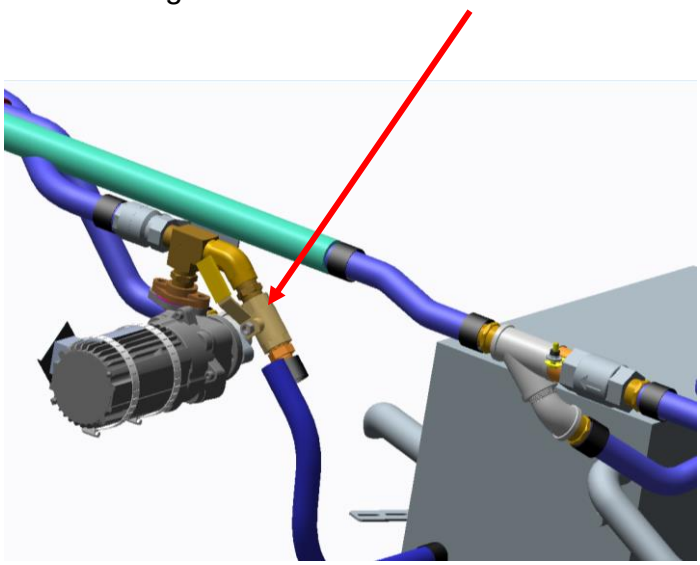
9. Remove side grills.

10. Remove closeout panels from the bottom and the sides of the radiator and CAC.
11. Remove air filter housing. Cover air intake hose to prevent contamination.

12. Remove brackets/clamps attached to the street side of the radiator.

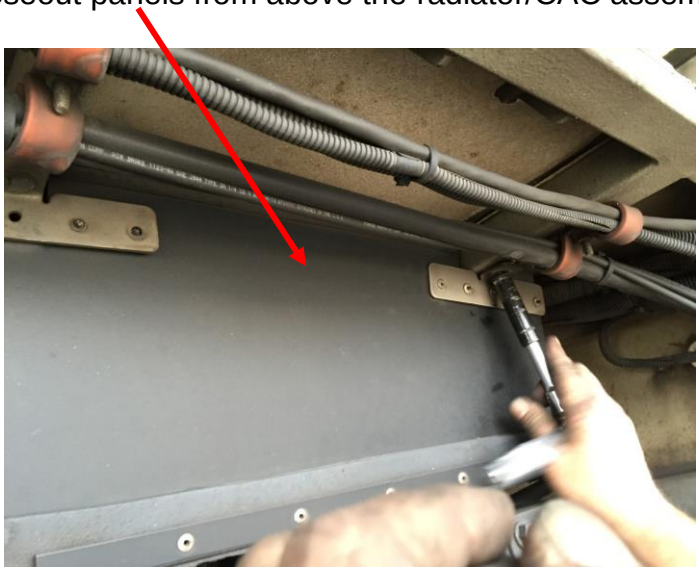
13. Turn off the two ¼-turn coolant valves in front of the engine and in front of the B-axle.





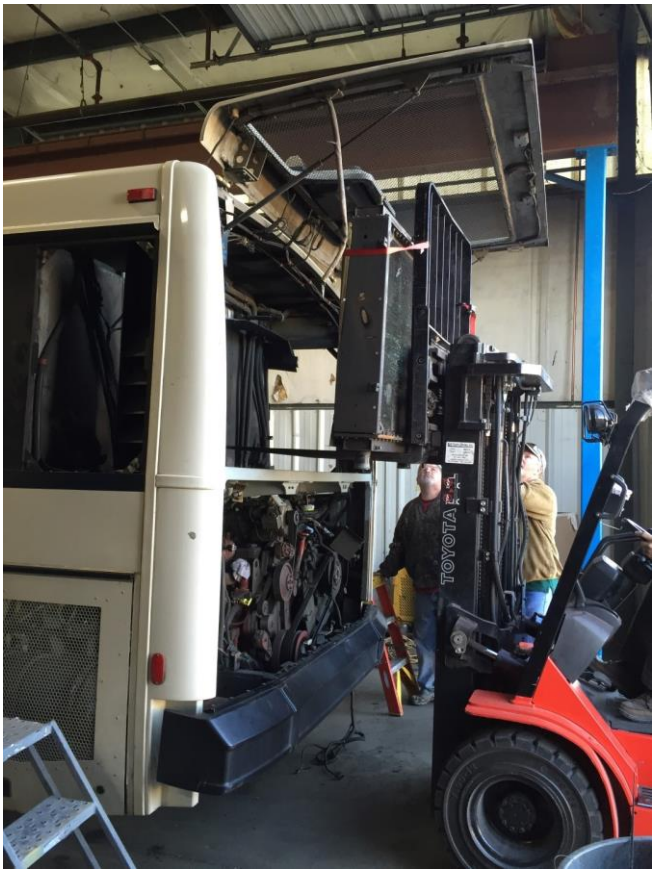
14. Drain coolant into a suitable coolant pan by removing hose at the top of the engine. Only the radiator needs to be drained. Stop draining coolant when it goes below the bottom of the radiator. *Follow safety instructions detailed in NABI Maintenance Manual when draining coolant.*
15. Disconnect hoses from radiator and CAC. **Use extra care not to damage coolant hoses when cutting the shrink-type plastic clamps off**. Cover all open pipes to prevent contamination.
16. Remove radiator and CAC mounting nuts at the bottom mounts.

17. Remove upper closeout panels from above the radiator/CAC assembly.

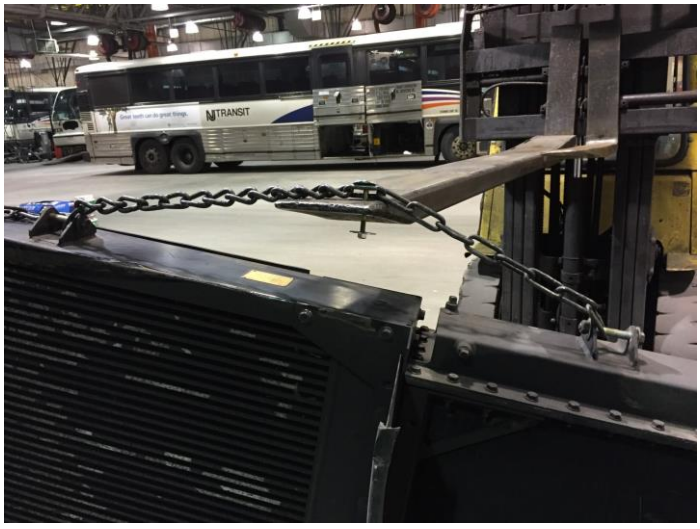


18. Place the forks of a forklift underneath the radiator/CAC assembly.
19. Disconnect the top mounts of the radiator/CAC assembly.

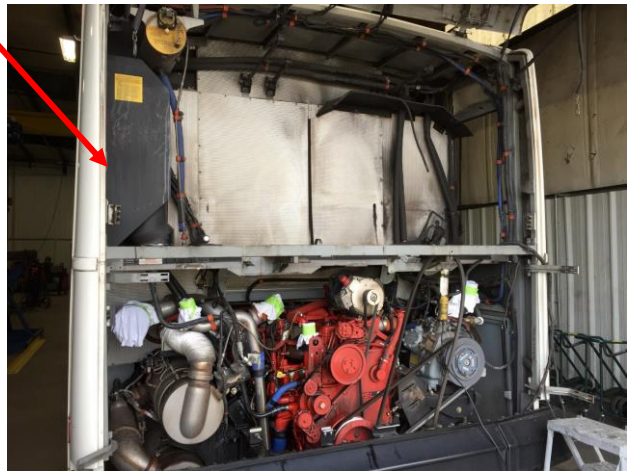
20. Carefully remove radiator/CAC assembly from the bus. Secure radiators to the fork lift with ratchet straps or similar. Place the radiator/CAC assembly on woodblocks and secure them so they don't fall.



Radiator/CAC assembly removal by using chain and fork extension:



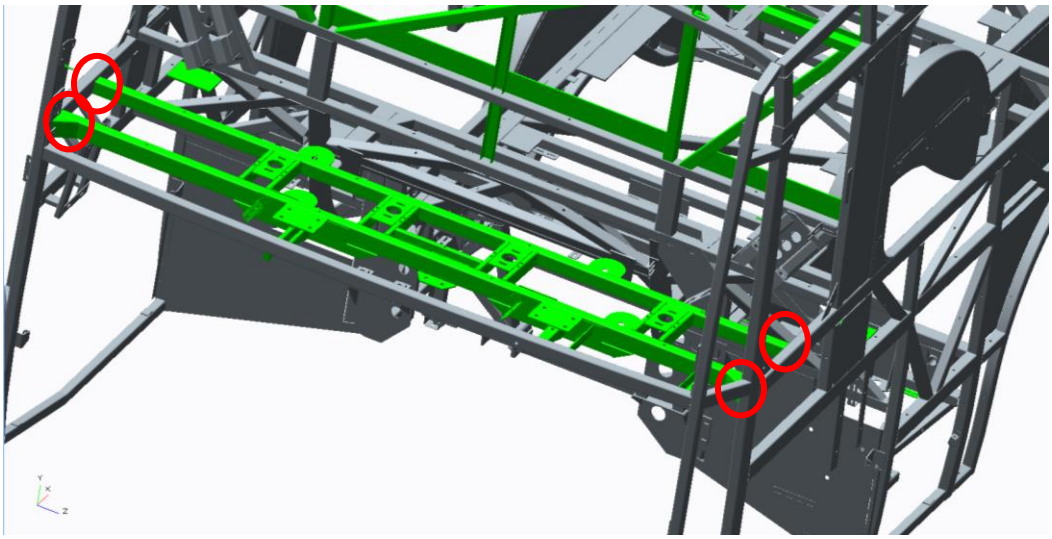
21. Cover all ports of the radiator/CAC assembly to prevent contamination.
22. Remove air intake box.



23. Remove closeout panel from the radiator support crossbeam.
24. Cover the engine and surrounding components with a fireproof blanket(s).

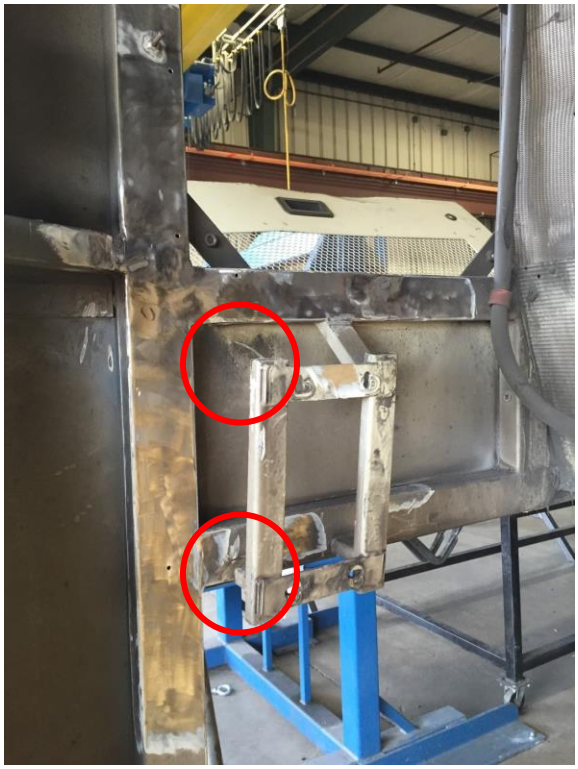
Radiator Support Crossmember Removal

1. Cut Radiator Support Crossmember through beside the side walls. Four beams need to be cut. If using plasma cutter keep ½" distance from the side wall structure.

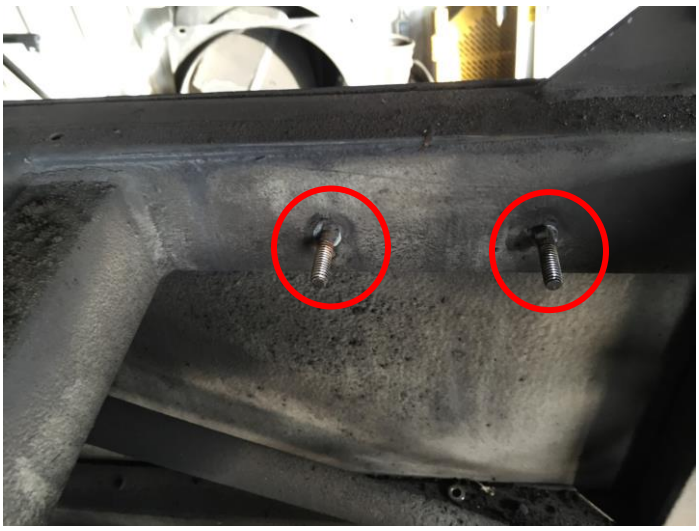


2. Remove original Radiator Support Crossmember and discard it.

3. Cut off the upper and lower aft legs of the air filter bracket and save them. These pieces will be reused later. See photos below.



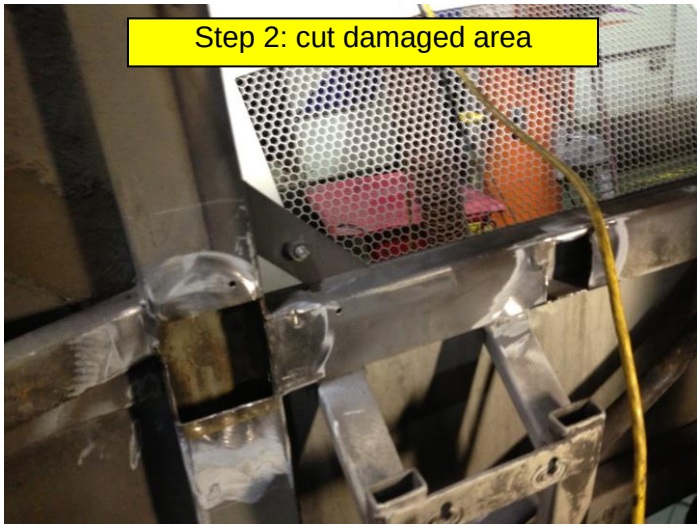
4. Grind remaining pieces off from the side wall structure. Cut mounting studs of the backup alarm from the curb side wall. Grind the side wall smooth.



5. Inspect the side wall structure. Repair cracks (if any) as described at the general welding instruction section. If side wall structure has missing piece then repair it as photos shown below.

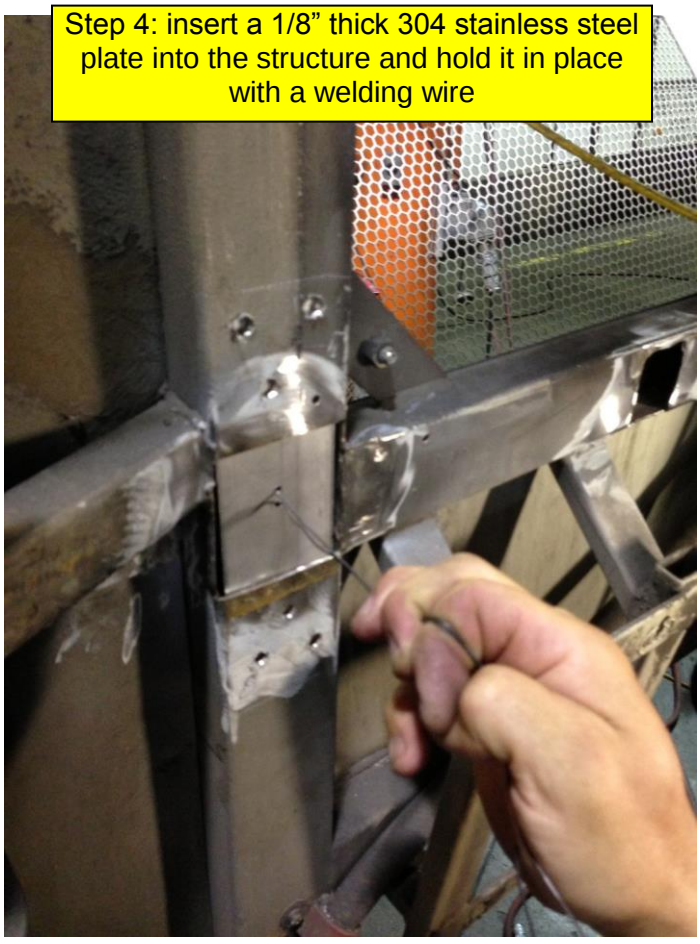
Step 1: grind damaged area with a 36G abrasive wheel

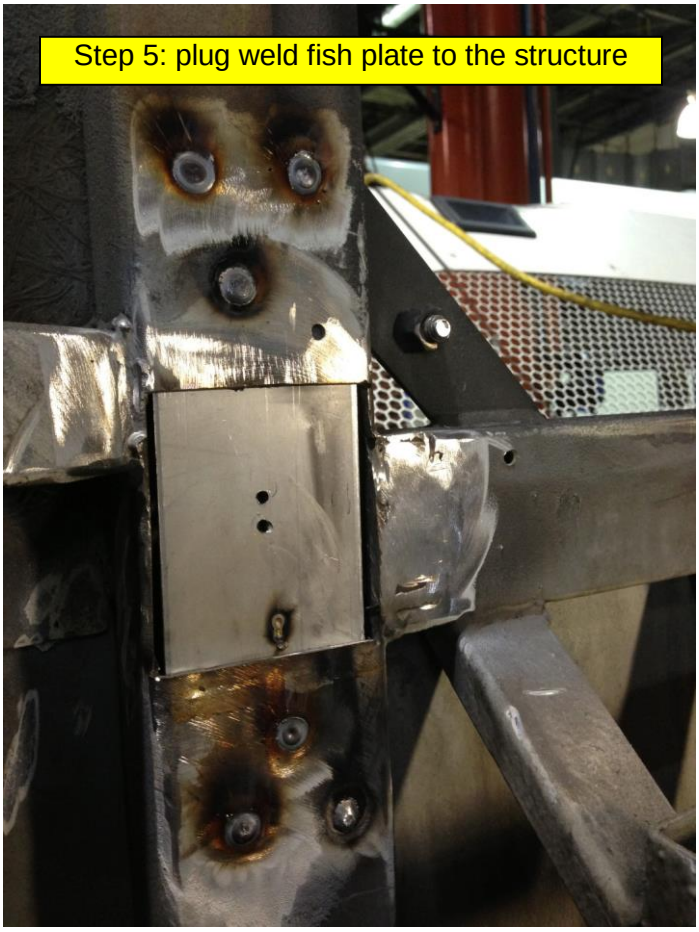
Step 2: cut damaged area



Step 3: drill ¼" holes for plug welds

Step 4: insert a 1/8" thick 304 stainless steel plate into the structure and hold it in place with a welding wire





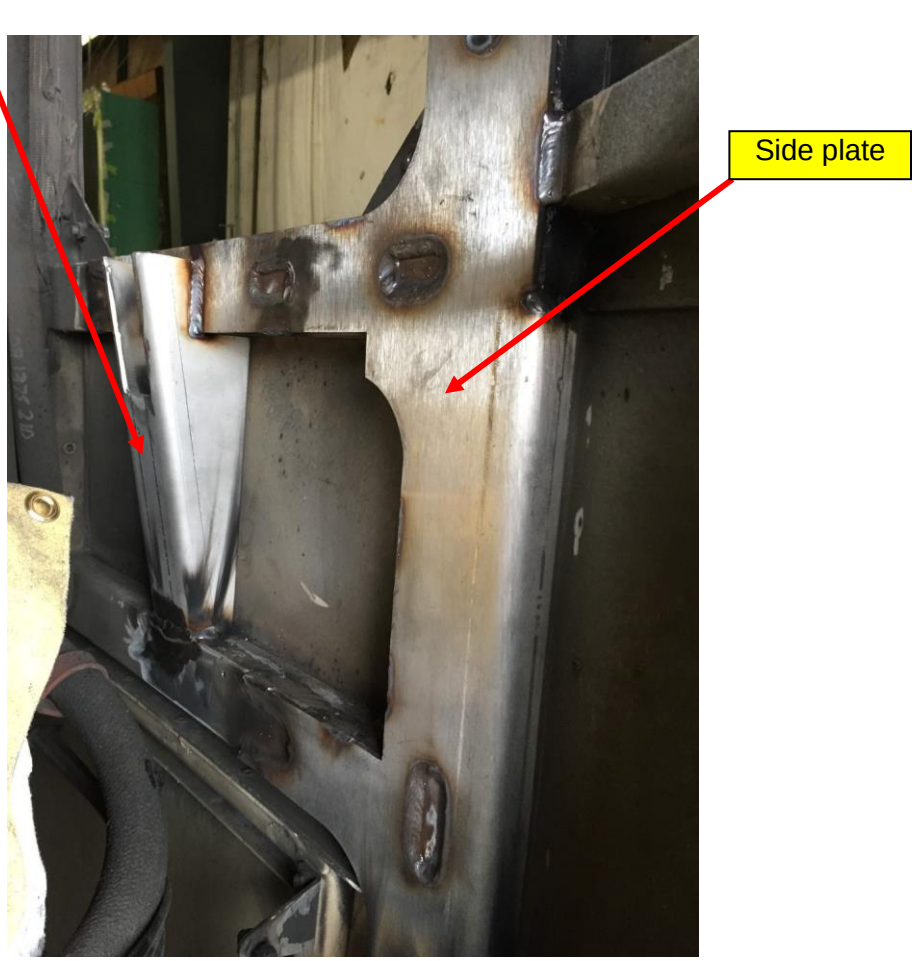
6. Grind side wall smooth after welding was performed.

New Support Crossmember Installation

1. Place the Side Plates (P/N **V01-6055-101** for street side and **-101T** for the curb side) to the side wall structure and align their horizontal legs with the horizontal tubes of the side wall structure. Use clamps to hold plates in place. **Caution:** use a piece of cardboard or similar underneath the clamps to protect the paint on the exterior panels!

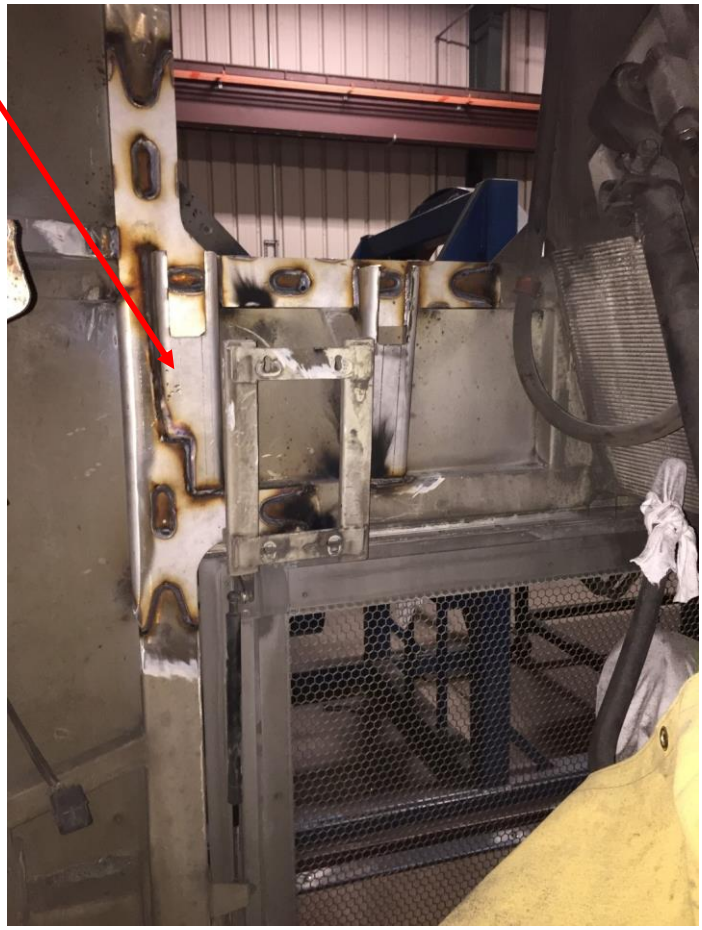
2. Tack weld Side Plate and double check their position. Ensure that the plate is pushed against the structure (no gaps are allowed between components).

3. Weld Side Plates to the side wall structure per page 2 of drawing # V01-6055-901.
4. Place forward Supports (P/N **V01-6055-102** for both sides - see item # 9 on drawing # V01-6055-901) and tack weld them to the side plates. Refer to page 3 of drawing # V01-6055-901.
5. Weld forward Supports to the side plates per page 3 of drawing # V01-6055-901.

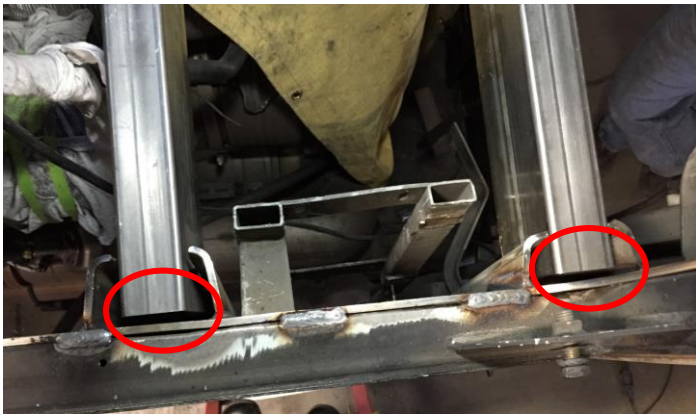


6. Place aft Supports (P/N **V01-6055-103** for the street side and **-103T** for the curb side - see item # 10 and 11 on drawing # V01-6055-901) and tack weld them to the side plates. Refer to page 3 of drawing # V01-6055-901.

7. Weld aft Supports to the side plates per page 3 of drawing # V01-6055-901.



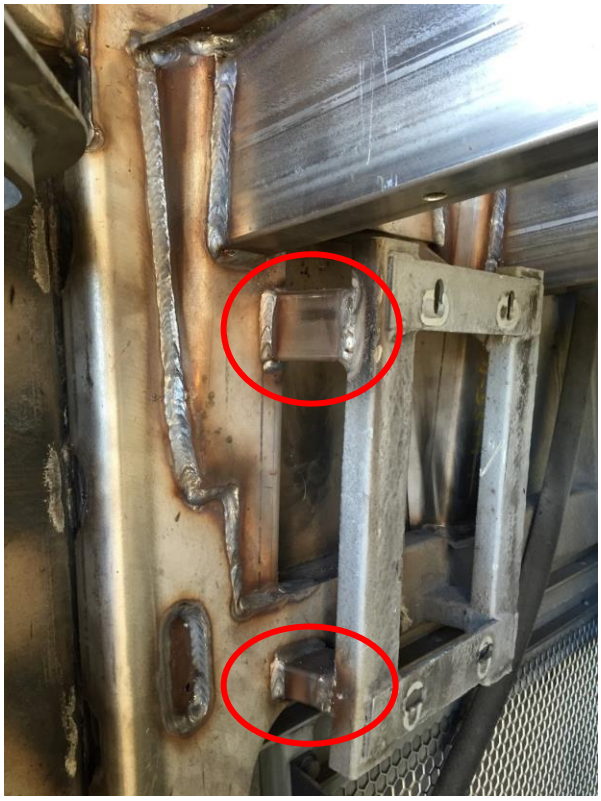
8. Place Radiator Support Frame assembly (P/N **V01-6055-300** – see item # 13 on drawing # V01-6055-901) into the Supports. Position the Radiator Support Frame assembly to the center of the bus (the gaps at the ends of the Radiator Support Frame assemble must be the same – see red circles below that show the street side gaps). Use clamps to secure the Radiator Support Frame assembly in place then tack weld it to the Supports at all four corners.



9. Weld Radiator Support Frame assembly to the Supports per page 4 of drawing # V01-6055-901.
10. Visually inspect welds. Repair/re-weld as required.
11. Place four Plates (P/N **V01-6055-308** – see item # 15 on drawing # V01-6055-901) to the top of the Supports and tack weld them.

12. Weld four Plates to the Supports and to the Radiator Support Frame assembly per page 4 of drawing # V01-6055-901.

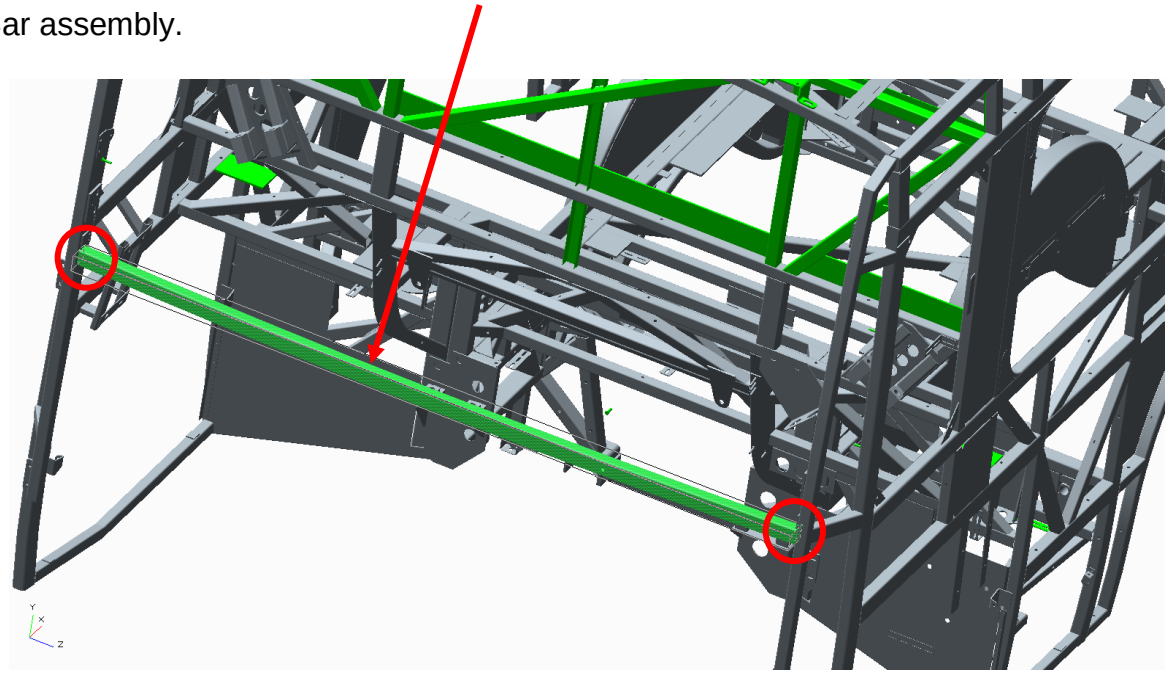
13. Cut the original legs of the air filter bracket to fit between the side plate and the air filter bracket. Weld them around with continuous fillet welds. See photo below.



14. Visually inspect welds. Repair/re-weld as required.

Cross Bar Removal

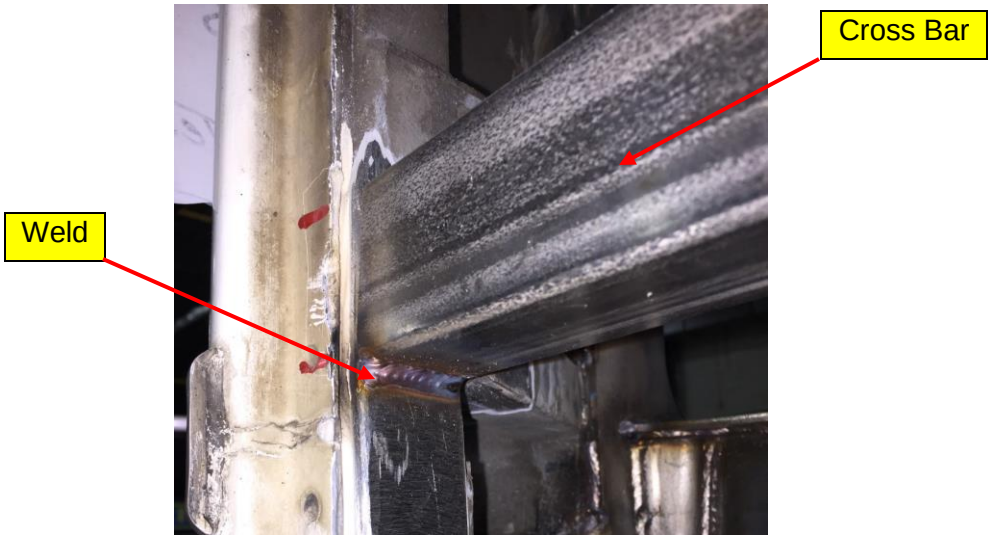
15. Cut both ends of the original Cross Bar beside the side wall structure. Discard original Cross Bar assembly.



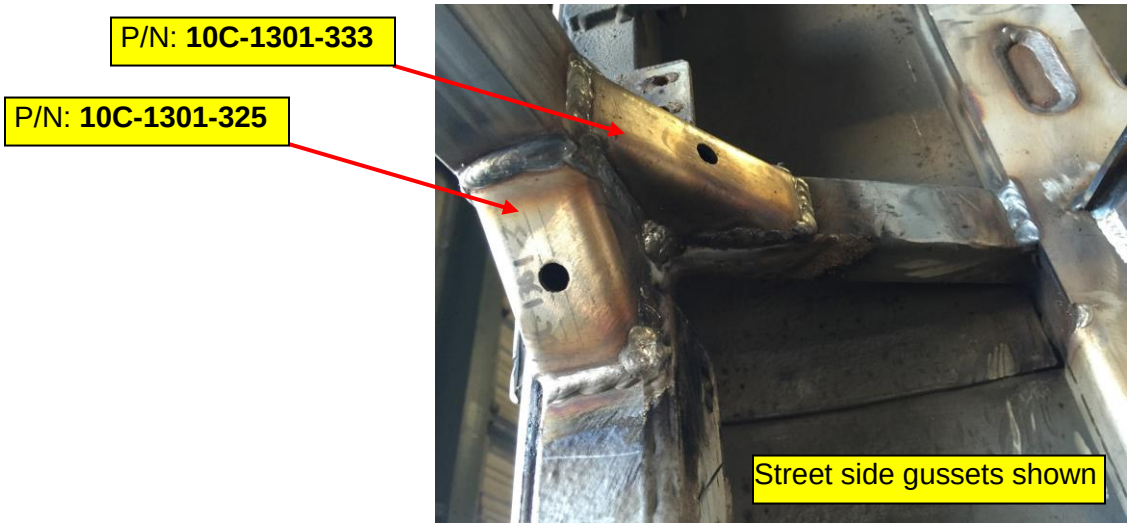
16. Grind side wall structure smooth.

New Cross Bar Assembly Installation

17. Install new Cross Bar assembly (P/N **V01-6055-120** – see item # 12 on drawing # V01-6055-901) per drawing # V01-6055-901.



18. Weld Cross Bar assembly per page 4 of drawing # V01-6055-901.
19. Install four Gussets (P/N **10C-1301-325** and **-333** – see item # 5 and 6 on drawing # V01-6055-901) to the ends of the Cross Bar assembly.
20. Weld Gussets to the Cross Bar assembly and to the side wall structure per page 4 of drawing # V01-6055-901.



21. Weld Brackets (P/N **V01-6055-307** – see item # 14 on drawing # V01-6055-901)to the Cross Bar assembly per page 4 of drawing # V01-6055-901.

22. Weld two ¼-20x1” studs (bolts) to the street side wall for the backup alarm. Use the alarm as a template to locate the studs.

23. Visually inspect welds. Repair/re-weld as required.
24. Prep and paint according to the General Surface Protection section.

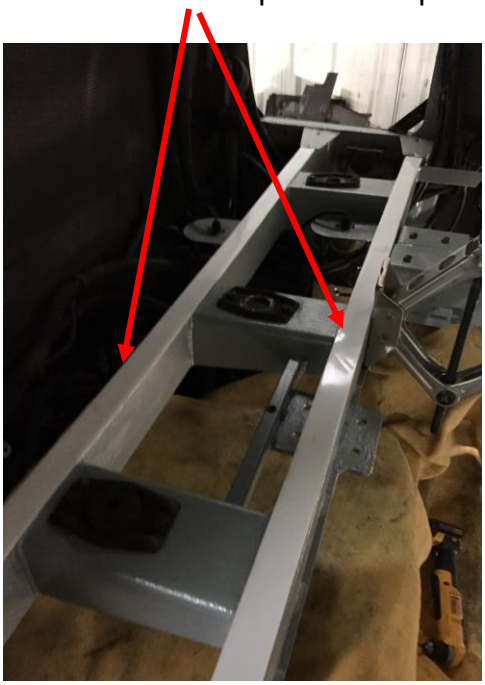
General Surface Protection

1. Clean welded area with wire wheels.
2. Scuff surfaces by using 120G abrasive disc and vibrating/rotating tool.

3. Degrease all grinded/sanded surfaces by using acetone and clean white color rags.
4. Protect surrounding components (threads of hardware, electric and air system components, etc.) against paint by using masking tape or cardboard-shields why spraying paint.
5. Apply industrial gray color primer to the degreased areas. Follow instructions written on the can.

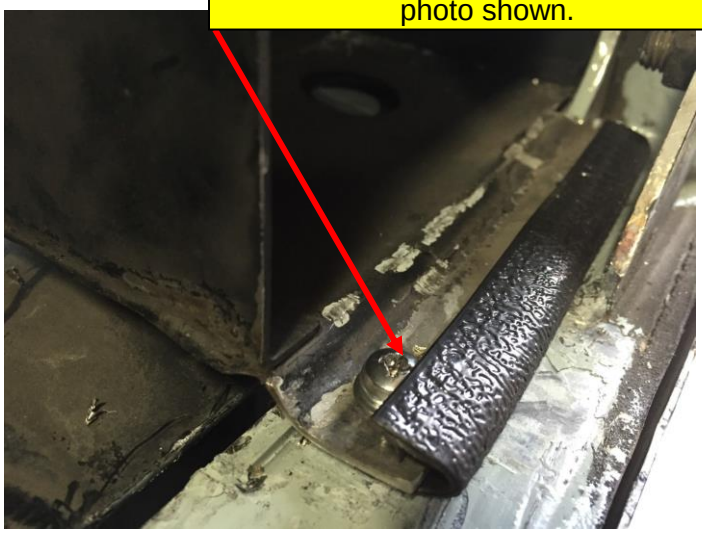
Reassembly

1. Place 2” wide tape to the top of the Radiator Support Crossmember.



2. Install closeout panel. Replace bulb seals on closeout panel as required.
3. Place a 1/8” thick foam tape to side wall structure where the air intake box will meet the side wall.

4. Bend the lower mounting tab of the air filter housing as photo shown below. Install air intake box to the structure. Enlarge the mounting holes on the air intake box if required so the original threaded holes of the side wall can be reused to secure the air intake box. Use 11/16” OD stainless steel flat washers with new #10-32x3/4” long stainless steel self-tapping screws to secure air intake box to the side wall. On buses equipped with square surge tank, the top of the air intake box maybe need to be cut to provide clearance between the surge tank and the air intake box. See details below.



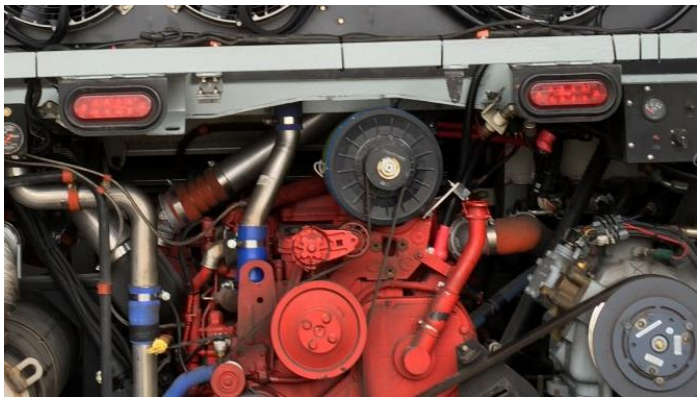
Modify the air intake box as photo shown.

5. Install air filter housing.
6. Reconnect hose to the air filter housing. Use new clamp if required.
7. Install compartment lights.
8. Install lower radiator and CAC mounts. Replace them if they are damaged. Do not tighten the mounting bolts of the mounts. They need to be loose so the mounts can be aligned with the radiator/CAC assembly during the installation.

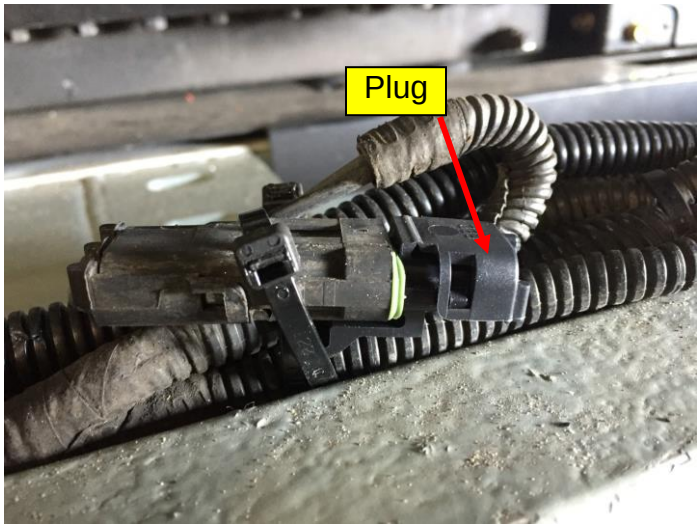
9. Install EMP or Modine electric fans per supplier instruction. If original belt driven fans will be reinstalled then reinstall components (after radiator/CAC assembly has been installed) the opposite way as they were removed.
10. Reinstall radiator/CAC assembly by lifting it in place using a forklift. Tighten the upper mounting bolts first so the radiator/CAC assembly is secured to the structure.
11. Install lower mounting bolts of the radiator/CAC assembly through the lower mounts. Tighten all bolts of the lower mounts.
12. Reinstall upper and side closeout panels. Replace bulb seals on closeout panels as required.
13. Install coolant hoses with new clamps to the radiator. Replace hoses as required.

14. Install hoses to the CAC. Replace hoses as required. Torque existing constant tension clamps to 110 in-lb. Install new clamp if required.

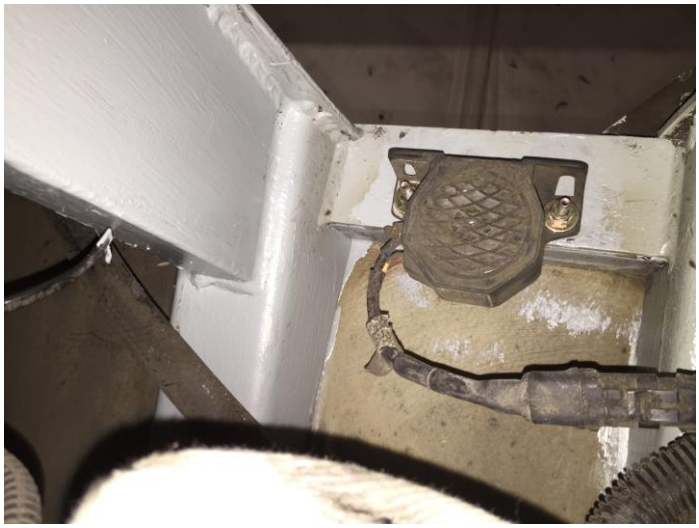
15. Install rear hazard lights as shown on photos below. Drill and tap ¼-20 threads for the mounting bolts. Use new ¼-20x1" hex head grade 8 Zn bolts with lock washer and flat washer. Apply anti-seize onto the threads.



16. Install harnesses with the original P-clamps to the Cross Bar assembly. Use new 10/32-3/4" long stainless steel screws. Ensure to plug original belt driven fan control harness if it is not used any more.



17. Install back up alarm to the curb side wall structure.



18. Reinstall belt guard.
19. Reinstall and adjust rear engine compartment doors.

Final Operation

1. Refill coolant system. Pump coolant into the surge tank. When the coolant level reaches the full hot level open the two ¼-turn coolant valves those were closed at the paragraph 13 of the Disassembly section.

Example of coolant pumps that can be used to fill the roof mounted surge tank up

2. Reconnect battery cables.
3. Turn battery disconnect switches on.
4. Connect Amerex fire suppression system test tool to the connector at the Amerex bottle.

5. Check the control panel of the Amerex fire suppression system and ensure that a green LED light is on that would indicate that the system is in good operating condition. In this case disconnect test tool and connect harness to the Amerex bottle. If yellow light is on or flashing on the Amerex control panel, then contact to the garage foreman and ask for help with troubleshooting. Check for loose connection or damaged cables of the fire suppression system especially at the engine compartment where the rework was done.

Amerex fire suppression system test tool

6. Start the bus and ensure that no warning lights (check engine, check transmission, etc.) are on.
7. De-aerate and refill cooling system per NABI work instruction # L3-FSV-026.
8. Clean bus inside and out. Ensure that the driver's area is clean, the driver's seat, front and side control panels are wiped off.
9. Double check for coolant leaks. Repair as needed.
10. Present the repaired bus for inspection to a delegated person.
11. Record bus number, mileage, date of completing and the name of the technician who completed the repair.