

Memorandum to File

attachment B

August 12, 2013

Updated 9/10/13, 1/10/14

Quality Control Failure Analysis

Subject matter:

- Broken tank brackets securing Passenger Side CNG fuel tank
- Part Number; N/A
- Manufactured by subcontractor (Mechanical Raisin Harvesting)
- Date of Manufacture; prior to April 2012
- Installation Date; 06/29/11
- Number of vehicles involved; one
- Number of vehicles with same design within fleet (* originally 6)
- Number of Vehicles affected; 18 at four locations

Synopsis of events:

We received a call on 8/7/13 from Victor Valley Transit Authority. They informed us that a CNG tank brackets on vehicle #2014 had broken on the passenger side outer rail tank. This caused the CNG tank to break away from the bus frame. The original report indicated that the tank had entirely dislodged from the bus. That same afternoon we arranged to send a technician to the agency. The following morning 8/8/13 we had our technician at the VVTA shop to inspect the vehicle. We started an evaluation of the vehicle, circumstances and of the failed components. We were also able to examine one other vehicle that was the same design for any signs of failure.

(* the agency had six vehicles originally delivered with this bracket design. However; four had been changed by another company in order to install larger CNG tanks and the remaining two were also scheduled for the upgrade). We determined that both brackets on the subject vehicle supporting the P/S CNG tank had broken. All the other tanks, mountings, and brackets were also inspected and determined to be in proper condition with no signs of fatigue. Only the subject brackets had failed. A second bus with this design was also inspected at the agency, with no signs of fatigue. The brackets were removed from the vehicle and brought back to our facility for a further analysis. During this return trip, our technician was able to inspect additional vehicles that may have had this same design stationed at other nearby agencies. The three agencies inspected were equipped with the later 2nd design.

History of Bracket:

This bracket in question was used during a period from mid-2011 to September 2012. The first brackets were installed with a BAF kit and used as a test vehicle for an Altoona crash evaluation. No signs of failure or fatigue of the bracket in question have been evident until this subject incident. This initial bracket was designed and recommended by a subcontractor that performed limited manufacturing work for us at the time. During and after the initial installations of the 1st design bracket, through comparisons and Quality Control evaluation, improvements to this bracket design were considered and made. We have determined that there are eighteen builds involved with this first bracket design.

Failure Analysis:

These Brackets were used on our original builds. Additionally all affected vehicles have been examined with no signs of failure or fatigue. The failure on the cantilevered frame support showed signs of the metal failure above the weld on the cantilevered section. Signs of stress on the specific tear would indicate that the plate may have had a crack for a long time. That the tearing of the metal was gradual and not sudden.

These failed brackets also received an informal visual evaluation by Technicon Engineering Services Inc. Their conclusion was similar to ours; that the metal failure started at the stress cracks and appeared to be gradual. They indicated that the design may not be strong enough under severe or rough duty cycles exercised by vehicles in a rough or heavy duty cycle environments. However, a complete test would need to be performed in order for them to issue a formal opinion.

Initial action plan:

- Critical Review of failure points, causes and options.
- Analysis of the actual failed bracket.
- Determine vehicles that could be equipped with the old 1st design bracket.
- Notification of all users with this design.

Corrective action:

- Send technicians to inspect affected vehicles. (replace old brackets as available during the inspection).
- Set up time frames and schedule work crews to locations to replace undesirable brackets.
- Continue to make plans to replace all of the first generation brackets with the new design.
- Continue use of the newer redesigned brackets.

Corrective action footnote:

After our further examination of the failed brackets, we believe that the metal used on the brackets in question may have been faulty. The second possibility is that the bracket was not strong enough, nor the cantlevered support properly positioned to bear the weight of the tanks over an extended period of time. Our earlier analysis and production of the 2nd design was supported by the recent evaluations.

As indicated our 2nd generation design used:

- heavier gauge metal plate.
- has a wider cantlevered stance.
- Cantlevered position is mounted higher on the bracket, higher above centerline position.
- has a greater surface bonding area.
- Cantlevered mounting plate is reinforced.

Conclusions:

Through our further evaluation of all affected vehicles with this design, we do not believe that the failure is inevitable in all brackets. This bracket is the same bracket design that was used on the Altoona crash test vehicle. The failure will be dependent on the actual material used, the duty cycle of the vehicle, environment of use, duration, and application. Design of bracket was taken from a previously constructed models and no inperical structural evaluation was conducted prior to bracket construction and use other than the Altoona bus. Profesional evaluation was conducted directly after this failure and the business decision was made to replace all brackets on eighteen vehicles that had the original design. This discision was based partially on design standardization.

9/10/13

Follow up on action plan

We determined that the total was 18 buses that had this first design bracket installed. (Six were VVTA buses and all six had been modified in order to install larger tanks). Notified all the other agencies with the subject buses. Traveled to agencies and inspected buses. Agencies involved were: Gateway Lines, Bauers Bus, City of Commerce, and VVTA. No failures or stress was evident on the remaining 12 buses inspected with this design. Removed original brackets on the Roadside outer tank and replaced with later 2nd design on six buses.

1/10/14

Follow up on action plan

All agencies have been notified and brackets have been inspected with no signs of fatigue stress. And buses have been equipped with the 2nd design bracket. Completed replacement of all brackets on remaining buses. All subject buses are equipped with new brackets.

VEHICLE ONE Effected Vehicle

Bus #2014

2012 Ford F550

Glaval Transit

VIN: 1FDGF5GYXCE [REDACTED]

MILEAGE: 65046

License# [REDACTED]

Date of manufacture: 1/3/12

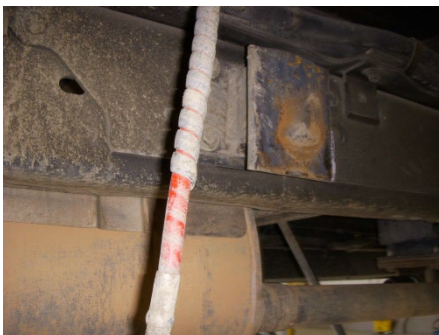
Date of Failure notification: 8 [REDACTED] 13

Inspection element:

Broken P/S forward CNG mounting bracket

BUS 2014 WITH FAILED BRACKETS





Broken bracket mount that remained bolted to the frame



Dislodged tank from bus #2014

VEHICLE TWO (not damaged)

Bus #2011

2012 Ford F550

Glaval Transit

VIN: 1FDGF5GY1BE [REDACTED]

MILEAGE: 61949

License# [REDACTED]

Date of manufacturer: 6/29/11

Second inspected bus with no damage



Bus #2011: INITIAL TANK INSPECTION; no visible damage on tank mountings



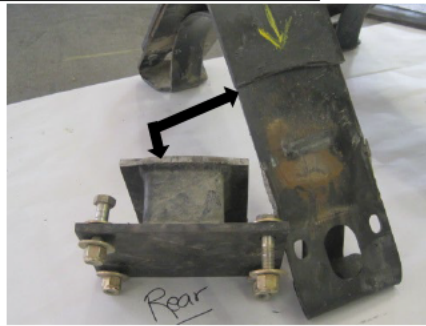
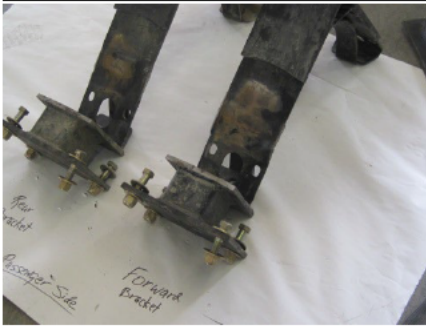
Bus #2011: INITIAL TANK INSPECTION; no visible damage on tank mountings



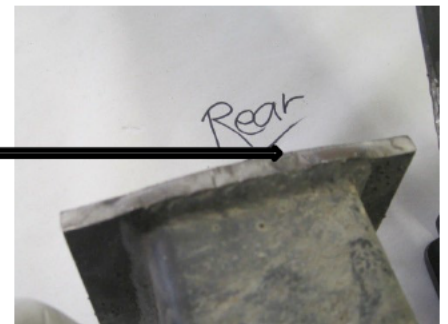
REMOVED BRACKET INSPECTION; no visible damage on tank mountings

FAILED BRACKET AND COMPAIRISON

Bus 2012: BROKEN BRACKETS AS REMOVED FROM THE BUS FRAME



frame mounting Cantilevered portion broken away from tank mounting base.



Tear approx. 1/4" above the weld

NEW 2ND DESIGN BRACKETS



The later designed bracket (year 2011) and comparison with old



Old Brackets with 2nd design



added strenght to Cantilevered extension. Mounted higher using heavier and larger material

Old bracket w/lower cantilevered frame mount