

|                                                                                   |                                                               |           |          |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------|-----------|----------|
|  | <h1>TRIP REPORT</h1> <p>Matsonford Road, Conshohocken, PA</p> | Trip Date | 11/02/11 |
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Project. No./ Title: DCD 2183: 2003-2012 Thomas Built Bus CNG Tank Abrasion (ODI PE11-029)

Dates: Wed. 11/02/2011- Fri. 11/04/2011

Company: [REDACTED]

Location: [REDACTED], Ardmore, Pa [REDACTED]  
[REDACTED], Conshohocken, PA 1[REDACTED]

POC: [REDACTED]

[REDACTED]

Phone: [REDACTED]

[REDACTED]

Background/Purpose: Background: At the request of ODI and to support Investigation PE11-029, 2003 - 2012 Thomas Built Saf-T-Liner HDX CNG Bus VRTC has been asked to inspect CNG buses on the east coast.

Issue: The tank support frame has been reported to have contacted the top of the CNG tanks in at least on instance in California and had caused minor abrasion to the tank.

Objective: To evaluate clearance between the CNG tanks and the CNG tank support assembly on various busses in the school bus fleet.

Vehicle Metrics-Color: Yellow

MY: Multiple

Make: Thomas Built

Model; SAF-T-LINER HDX

VIN; Multiple

Engine: Cummins

WD: Two

Fuel: CNG

Bus Type: D

Operated By: Lower Merion School District

Maintained By: Lower Merion School District

| Instrumentation  | Channel          | Purpose                                                                                                                                                                                                           |
|------------------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Shim Test Gages  | na               | Evaluate clearances between CNG tank and bus frame.                                                                                                                                                               |
| Bore Scope       | na               | Document tank abrasion and evaluate damage to CNG tank.                                                                                                                                                           |
| High Speed Video | na               | na                                                                                                                                                                                                                |
| Digital Camera   | Pictures, video. | PHOTOGRAPHS:, Bus VIN Number, Bus Number, Bus Front, Bus Right Side, Bus Left Side, Bus Rear, CNG Id Signs, Underside/all tanks, Sample of inspection with shims , CNG Tank Stickers if available, other signage. |

## Results1

LMSD had inspected two busses, 26 and 112 per TBB inspection criteria. Both buses passed. NHTSA/TRC reinspected one bus, 112, and inspected six additional buses. Because of time constraints supporting school transportation needs, most buses were inspected with a single shim. All these buses passed at least a minimum of 0.124 inch shim.

|                                                                                   |                                                                                                             |  |                              |
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|  | <h1 style="margin: 0;">TRIP REPORT</h1>                                                                     |  | <b>Trip Date</b><br>11/02/11 |
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Results2

Two buses were inspected with multiple shims and or a borescope to determine actual clearances.

Bus 34 was as follows (tank 1 being in front and tank 5 being to the rear of the bus; + equals loose fit; units = inch):  
1L=0.203+, 2L=0.240, 3L=0.240+, 4L=0.171, 5L=0.203, 1R=0.203+, 2R=0.203, 3R=0.240, 4R=0.203+, 5R=0.240+.

Bus 31 was as follows:  
1L=0.240+, 2L=0.240+, 3L=0.240+, 4L=0.240, 5L=0.203, 1R=0.240, 2R=0.240+, 3R=0.203, 4R=0.240+, 5R=0.171.

| Results - Details |         |             |           |               |              |        |                              |
|-------------------|---------|-------------|-----------|---------------|--------------|--------|------------------------------|
| No.               | Bus No. | VIN         | Mileage   | Tank Pressure | Inspected by | Result | Remarks                      |
| 0                 | 26      | 1T7YR4F27A  | 26,937 mi | NR            | LMSD         | PASS   | Per TBB Inspection Criteria1 |
| 1                 | 34      | 1T7YR4F29A1 | 21,924 mi | 2500 psi      | VRTC         | PASS   | Bus at maintenance garage    |
| 2                 | 31      | 1T7YR4F20A1 | 36,374 mi | 2500 psi      | VRTC         | PASS   | Bus at maintenance garage    |
| 3                 | 17      | 1T7YR4F25A1 | 21,045 mi | 1760 psi      | VRTC         | PASS   | Bus at LM High School        |
| 4                 | 30      | 1T7YR4F24A1 | 21,728 mi | 2500 psi      | VRTC         | PASS   | Bus at LM High School        |
| 5                 | 21      | 1T7YR4F22A1 | 24,287 mi | 1700 psi      | VRTC         | PASS   | Bus at elementary school     |
| 6                 | 112     | 1T7YR4F20A1 | 21,913 mi | 1650 psi      | LMSD/VRTC    | PASS   | Bus at maintenance garage    |
| 7                 | 113     | nr          | 22,199 mi | na            | na           | nr     | Not inspected, not at LMSD   |

Notes/Remarks

- Tanks at LMSC were generally filled by the district to 2500 psi.
- Some tanks in the field at High Schools ready to take students home were at 1700 psi.
- Actual clearances exceeded any concern with tank expansion.
- Tanks cannot be removed from the bus without a complete re-inspection of the system.
- Tanks cannot be vented to atmosphere due to EPA restrictions, static electricity buildup.
- Notes on Inspections from various standards CGA C-6.4-2007, 3RD Edition *METHODS FOR EXTERNAL VISUAL INSPECTION OF NATURAL GAS VEHICLES (NGV) AND HYDROGEN VEHICLES (HV) FUEL CONTAINERS AND THEIR INSTALLATIONS*:
  - Appendix B – Sample Inspection for (Informative) yes/no query item 8, CGA C-6.4-2007 states:“Is there a minimum of 0.5 in (12.7 mm) clearance around the container when mounted? (A minimum standoff of 0.375 in [9.52 mm] is recommended for shields.)”
  - Section 6.2.5 Cylinder Inspection Form, from the Gas Technology Institute, Natural Gas Vehicle Coalition, in GTI-01/0119, Natural Gas Vehicle Cylinder Care and Maintenance Handbook, page 6-21 picks up the same inspection language:“Is there a minimum of ½ inch clearance around the container when mounted? (a minimum standoff of 3/8 inch is recommended for shields.)”
  - Section 2.1.3 Periodic In-Service Inspections, ANSI NGV 2-2007, American National Standard for Natural Gas Vehicle Containers, paragraph 3, states in part the following:“The inspection shall be performed by a qualified container inspector in accordance with (1) the manufacturer’s recommendations and (2) the inspection procedures provide in the Method for External Visual Inspection of Natural Gas Vehicle Fuel Containers and Their Installations, CGA C-6.4.”

<sup>1</sup> Per Thomas Built Busses, Inspection Instructions, Subject: Saf-T-Liner HDX CNG Tank Clearance Inspection, Date: 9/29/2011  
Draft Deliberative Document – For Internal Use Only  
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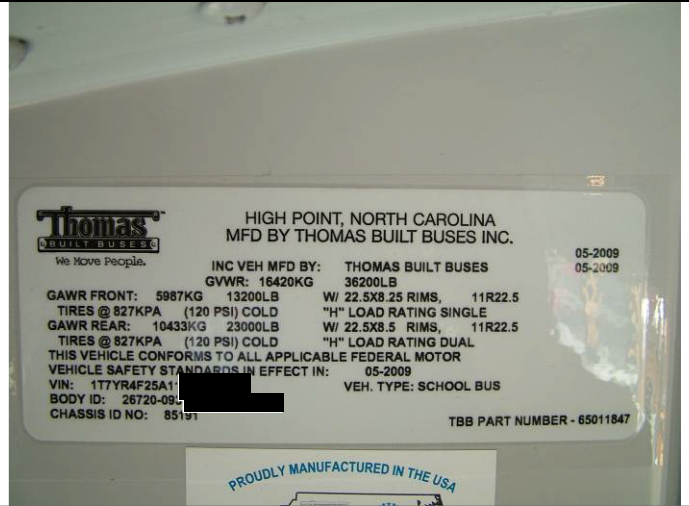
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19428



Bus 17 at



Bus 17 Vin Plate



Checking Tank on Bus 17 with Shim



Bus 17 CNG tank Pressure @ 1760 psi



Inspection of Tank Clearances on Bus 17



Typical Tank Clearance on Bus 17

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[REDACTED], Conshohocken, PA [REDACTED]



Inspection of Bus 34 At Maintenance Garage



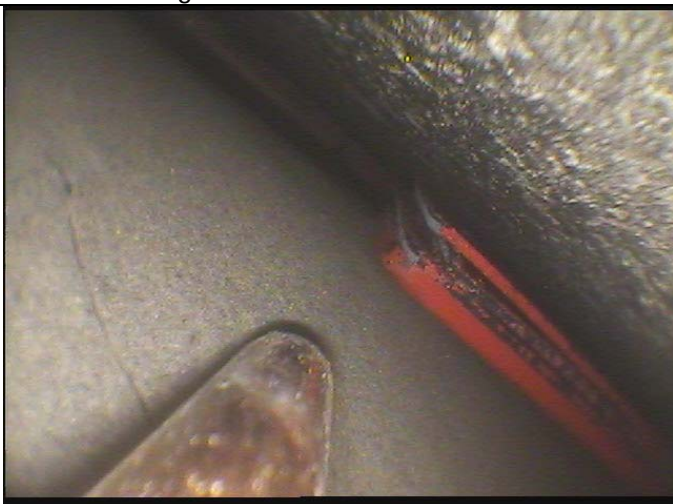
Bus 34 Showing Tank in Support Frame



Checking Clearances on Bus 34 with Shims



Checking Clearances on Bus 34 with Borescope



Detail of Borescope Inspections Showing Multiple Shims



Borescope Used in Inspection of Bus 34 in Garage

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Bus 21 at Elementary School



Bus 30 at High School