

FEDERAL TRANSIT BUS TEST

Performed for the Federal Transit Administration U.S. DOT
In accordance with CFR 49, Volume 7, Part 665

Manufacturer:
Model:

Submitted for Testing in Service-Life Category
7 Year /200,000 Miles

Report Number: LTI-BT-R1314-P

PENNSSTATE



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Quality Authorization

Director, Bus Research
and Testing Center
Title

4/29/14
Date

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EXECUTIVE SUMMARY

submitted a model e, gasoline-powered 17 seat (including the driver) 26-foot bus, for a partial STURAA Test in the 7 yr. /200,000 mile category. The Federal Transit Administration determined that the following tests would be performed; 1.2 Servicing, Preventive Maintenance, and Repair and Maintenance during Testing, 2. Reliability and 5.7 Structural Durability. Testing started on September 19, 2013 and was completed on November 15, 2013. The Check-In section of the report provides a description of the bus and specifies its major components.

The primary part of this Partial Test is the Structural Durability Test, which also provides the information for the Maintainability and Reliability results. The Structural Durability Test was started on September 23, 2013 and was completed on November 12, 2013.

The interior of the bus is configured with seating for 17 passengers including the driver and 2 wheelchair positions. Note: this test bus is not designed to accommodate standing passengers. At 150 lbs. per person and 600 lbs. per wheelchair position, the load results in a measured gross vehicle weight of 13,130 lbs. The first segment of the Structural Durability Test was performed with the bus loaded to a GVW (Gross Vehicle Load) of 13,130 lbs. Note: due to no standees, GVW and SLW are the same at 13,130 lbs. The middle SLW (Seated Load Weight) segment was performed at 13,130 lbs. and the final segment was performed at a CW (Curb Weight) of 9,560 lbs. Durability driving resulted in unscheduled maintenance and failures that involved a variety of subsystems. A description of failures, and a complete and detailed listing of scheduled and unscheduled maintenance is provided in the Maintainability section of this report.

Effective January 1, 2010, the Federal Transit Administration determined that the total number of simulated passengers used for loading all test vehicles will be based on the full complement of seats and free-floor space available for standing passengers (150 lbs per passenger). The passenger loading used for dynamic testing will not be reduced in order to comply with Gross Axle Weight Ratings (GAWR's) or the Gross Vehicle Weight Ratings (GVWR's) declared by the manufacturer. Cases where the loading exceeds the GAWR and/or the GVWR will be noted accordingly. During the testing program, all test vehicles transported or operated over public roadways will be loaded to comply with the GAWR and GVWR specified by the manufacturer.

The Reliability section compiles failures that occurred during Structural Durability Testing. Breakdowns are classified according to subsystems. The data in this section are arranged so that those subsystems with more frequent problems are apparent. The problems are also listed by class as defined in Section 2. The test bus encountered no Class 1 or Class 2 failures. Of the three reported failures, two were Class 3 and one was a Class 4.

ABBREVIATIONS

| | |
|-------|---|
| ABTC | Altoona Bus Test Center |
| A/C | Air Conditioner |
| ADB | Advance design bus |
| CBD | Central business district |
| CI | Compression ignition |
| CNG | Compressed natural gas |
| CW | Curb weight (bus weight including maximum fuel, oil, and coolant; but without passengers or driver) |
| dB(A) | Decibels with reference to 0.0002 microbar as measured on the "A" scale |
| DIR | Test director |
| DR | Bus driver |
| EPA | Environmental Protection Agency |
| FFS | Free floor space (floor area available to standees, excluding ingress/egress areas, area under seats, area occupied by feet of seated passengers, and the vestibule area) |
| FTA | Federal Transit Administration |
| GAWR | Gross axle weight rating |
| GL | Gross load (150 lb. for every designed passenger seating position, for the driver, and for each 1.5 sq ft of free floor space) |
| GVW | Gross vehicle weight (curb weight plus gross vehicle load) |
| GVWR | Gross vehicle weight rating |
| hr | Hour |
| LNG | Liquefied natural gas |
| LTI | Larson Transportation Institute |
| mpg | Miles per gallon |
| mph | Miles per hour |
| NBM | New bus models |
| PSTT | Penn State Test Track |
| rpm | Revolutions per minute |
| SAE | Society of Automotive Engineers |
| SCF | Standard cubic feet |
| SCFM | Standard cubic feet per minute |
| SCH | Test scheduler |
| SA | Staff Assistant |
| SI | Spark ignition |
| SLW | Seated load weight (curb weight plus 150 lb for every designated passenger seating position and for the driver) |
| TD | Test driver |
| TM | Track manager |
| TP | Test personnel |

VEHICLE DATA FORM

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| | |
|------------------------|--------------------------------------|
| Bus Number: 1314-P | Arrival Date: 9-19-13 |
| Bus Manufacturer: | Vehicle Identification Number (VIN): |
| Model Number: | Date: 9-19-13 |
| Personnel: T.S. & E.D. | |

WEIGHT:

Individual Wheel Reactions:

| Weights (lb) | Front Axle | | Middle Axle | | Rear Axle | |
|--------------|------------|-------|-------------|------|-----------|-------|
| | Right | Left | Right | Left | Right | Left |
| CW | 1,670 | 1,820 | N/A | N/a | 2,740 | 3,330 |
| SLW | 1,620 | 1,980 | N/A | N/A | 4,640 | 4,890 |
| GVW | 1,620 | 1,980 | N/A | N/A | 4,640 | 4,890 |

Total Weight Details:

| Weight (lb) | CW | SLW | GVW | GAWR |
|-------------|-------|--------|--------|--------------|
| Front Axle | 3,490 | 3,600 | 3,600 | 5,000 |
| Middle Axle | N/A | N/A | N/A | N/A |
| Rear Axle | 6,070 | 9,530 | 9,530 | 9,600 |
| Total | 9,560 | 13,130 | 13,130 | GVWR: 14,500 |

Dimensions:

| | |
|---------------------|-------------|
| Length (ft/in) | 26 / 6.7 |
| Width (in) | 95.0 |
| Height (in) | 114.7 |
| Front Overhang (in) | 34.5 |
| Rear Overhang (in) | 97.2 |
| Wheel Base (in) | 187.0 |
| Wheel Track (in) | Front: 68.7 |
| | Rear: 78.1 |

VEHICLE DATA FORM

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| Bus Number: 1314-P | Date: 9-19-13 |
|--------------------|---------------|

CLEARANCES:

| | | |
|---|---------------------------------|---------------------|
| Lowest Point Outside Front Axle | Location: Bumper | Clearance(in): 13.1 |
| Lowest Point Outside Rear Axle | Location: Fuel tank heat shield | Clearance(in): 10.4 |
| Lowest Point between Axles | Location: Step well | Clearance(in): 10.3 |
| Ground Clearance at the center (in) | 12.2 | |
| Front Approach Angle (deg) | 20.8 | |
| Rear Approach Angle (deg) | 8.7 | |
| Ramp Clearance Angle (deg) | 7.4 | |
| Aisle Width (in) | 17.5 | |
| Inside Standing Height at Center Aisle (in) | 79.0 | |

BODY DETAILS:

| | | | |
|------------------------------------|--|---|---|
| Body Structural Type | Integral | | |
| Frame Material | Steel | | |
| Body Material | Fiberglass | | |
| Floor Material | Plywood | | |
| Roof Material | Fiberglass | | |
| Windows Type | <input checked="" type="checkbox"/> Fixed | <input type="checkbox"/> Movable | |
| Window Mfg./Model No. | Clear Vision / AS3 DOT 960 | | |
| Number of Doors | <u>2</u> Front | <u>2</u> Rear | |
| Mfr. / Model No. | Driver's – Ford / OEM Passenger – A & M Systems / FOD 290-L-002939 Handicap – Challenger / OEM Rear center –Challenger/OEM | | |
| Dimension of Each Door (in) | Driver's – 27.1 x 54.6 Passenger – 32.6 x 87.1 | Handicap – 44.6 x 69.5 Rear center – 35.3 x 60.7 | |
| Passenger Seat Type | <input type="checkbox"/> Cantilever | <input checked="" type="checkbox"/> Pedestal | <input type="checkbox"/> Other (explain) |
| Mfr. / Model No. | Freedman Seating Co. / OEM | | |
| Driver Seat Type | <input type="checkbox"/> Air | <input checked="" type="checkbox"/> Spring | <input type="checkbox"/> Other (explain) |
| Mfr. / Model No. | Freedman Seating Co. / OEM | | |
| Number of Seats (including Driver) | 17 + 2 wheelchair positions | | |

VEHICLE DATA FORM

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| Bus Number: 1314-P | Date: 9-19-13 |
|--------------------|---------------|

BODY DETAILS (Contd..)

| | |
|---|--|
| Free Floor Space (ft ²) | 16.5 |
| Height of Each Step at Normal Position (in) | Front 1. <u>12.3</u> 2. <u>9.0</u> 3. <u>9.0</u> 4. <u>N/A</u> |
| | Middle 1. <u>N/A</u> 2. <u>N/A</u> 3. <u>N/A</u> 4. <u>N/A</u> |
| | Rear 1. <u>N/A</u> 2. <u>N/A</u> 3. <u>N/A</u> 4. <u>N/A</u> |
| Step Elevation Change - Kneeling (in) | N/A |

ENGINE

| | | | |
|--|--|--|--|
| Type | <input type="checkbox"/> C.I. | <input type="checkbox"/> Alternate Fuel | |
| | <input checked="" type="checkbox"/> S.I. | <input type="checkbox"/> Other (explain) | |
| Mfr. / Model No. | Ford / 6.8 L | | |
| Location | <input checked="" type="checkbox"/> Front | <input type="checkbox"/> Rear | <input type="checkbox"/> Other (explain) |
| Fuel Type | <input checked="" type="checkbox"/> Gasoline | <input type="checkbox"/> CNG | <input type="checkbox"/> Methanol |
| | <input type="checkbox"/> Diesel | <input type="checkbox"/> LNG | <input type="checkbox"/> Other (explain) |
| Fuel Tank Capacity (indicate units) | 55 gals | | |
| Fuel Induction Type | <input checked="" type="checkbox"/> Injected | <input type="checkbox"/> Carburetion | |
| Fuel Injector Mfr. / Model No. | Ford / 6.8 L | | |
| Carburetor Mfr. / Model No. | N/A | | |
| Fuel Pump Mfr. / Model No. | Ford / 6.8 L | | |
| Alternator (Generator) Mfr. / Model No. | FoMoCo / TN104210-6630 | | |
| Maximum Rated Output (Volts / Amps) | Not available. OEM | | |
| Air Compressor Mfr. / Model No. | N/A | | |
| Maximum Capacity (ft ³ / min) | N/A | | |
| Starter Type | <input checked="" type="checkbox"/> Electrical | <input type="checkbox"/> Pneumatic | <input type="checkbox"/> Other (explain) |
| Starter Mfr. / Model No. | FoMoCo / TN348000-0410 | | |

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| Bus Number: 1314-P | Date: 9-19-13 |
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TRANSMISSION

| | | |
|------------------------------------|--|--|
| Transmission Type | <input checked="" type="checkbox"/> Manual | <input type="checkbox"/> Automatic |
| Mfr. / Model No. | FoMoCo / OEM | |
| Control Type | <input checked="" type="checkbox"/> Mechanical | <input type="checkbox"/> Electrical <input type="checkbox"/> Other |
| Torque Converter Mfr. / Model No. | FoMoCo / OEM | |
| Integral Retarder Mfr. / Model No. | N/A | |

SUSPENSION

| | | | |
|------------------------|---|---|--|
| Number of Axles | 2 | | |
| Front Axle Type | <input checked="" type="checkbox"/> Independent | <input type="checkbox"/> Beam Axle | |
| Mfr. / Model No. | FoMoCo / OEM | | |
| Axle Ratio (if driven) | N/A | | |
| Suspension Type | <input type="checkbox"/> Air | <input checked="" type="checkbox"/> Spring | <input type="checkbox"/> Other (explain) |
| No. of Shock Absorbers | 2 | | |
| Mfr. / Model No. | Motorcraft / H102G2 | | |
| Middle Axle Type | <input type="checkbox"/> Independent | <input type="checkbox"/> Beam Axle | |
| Mfr. / Model No. | N/A | | |
| Axle Ratio (if driven) | N/A | | |
| Suspension Type | <input type="checkbox"/> Air | <input type="checkbox"/> Spring | <input type="checkbox"/> Other (explain) |
| No. of Shock Absorbers | N/A | | |
| Mfr. / Model No. | N/A | | |
| Rear Axle Type | <input type="checkbox"/> Independent | <input checked="" type="checkbox"/> Beam Axle | |
| Mfr. / Model No. | Dana / M70HD | | |
| Axle Ratio (if driven) | 4.56 | | |
| Suspension Type | <input type="checkbox"/> Air | <input checked="" type="checkbox"/> Spring | <input type="checkbox"/> Other (explain) |
| No. of Shock Absorbers | 2 | | |
| Mfr. / Model No. | Motorcraft / H123G1 | | |

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| Bus Number: 1314-P | Date: 9-19-13 |
|--------------------|---------------|

WHEELS & TIRES

| | | |
|-------|-----------------------|----------------------|
| Front | Wheel Mfr./ Model No. | Ford / 16 x 6 |
| | Tire Mfr./ Model No. | Michelin LT225/75R16 |
| Rear | Wheel Mfr./ Model No. | Ford / 16 x 6 |
| | Tire Mfr./ Model No. | Michelin LT225/75R16 |

BRAKES

| | | | |
|-------------------------|------------------------------|--|--|
| Front Axle Brakes Type | <input type="checkbox"/> Cam | <input checked="" type="checkbox"/> Disc | <input type="checkbox"/> Other (explain) |
| Mfr. / Model No. | FoMoCo / OEM | | |
| Middle Axle Brakes Type | <input type="checkbox"/> Cam | <input type="checkbox"/> Disc | <input type="checkbox"/> Other (explain) |
| Mfr. / Model No. | N/A | | |
| Rear Axle Brakes Type | <input type="checkbox"/> Cam | <input checked="" type="checkbox"/> Disc | <input type="checkbox"/> Other (explain) |
| Mfr. / Model No. | FoMoCo / OEM | | |
| Retarder Type | N/A | | |
| Mfr. / Model No. | N/A | | |

HVAC

| | | | |
|---------------------------------|--|---|--------------------------------|
| Heating System Type | <input type="checkbox"/> Air | <input checked="" type="checkbox"/> Water | <input type="checkbox"/> Other |
| Capacity (Btu/hr) | 65,000 | | |
| Mfr. / Model No. | Pro-Air / OEM | | |
| Air Conditioner | <input checked="" type="checkbox"/> Yes | <input type="checkbox"/> No | |
| Location | Front dash & rear ceiling | | |
| Capacity (Btu/hr) | Front – OEM Rear 70,000 | | |
| A/C Compressor Mfr. / Model No. | Front – FoMoCo / 0464 Rear ceiling – Vale / 004875 | | |

STEERING

| | |
|--------------------------------|----------------|
| Steering Gear Box Type | Hydraulic gear |
| Mfr. / Model No. | FoMoCo / OEM |
| Steering Wheel Diameter | 15.4 |
| Number of turns (lock to lock) | 4.0 |

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| Bus Number: 1314-P | Date: 9-19-13 |
|--------------------|---------------|

OTHERS

| | | |
|-------------------|--|-----------------------------------|
| Wheel Chair Ramps | Location: N/A | Type: N/A |
| Wheel Chair Lifts | Location: Rear | Type: Hydraulic electric platform |
| Mfr. / Model No. | Braun / NCL919FIB-2 | |
| Emergency Exit | Location: Doors Windows Roof hatch | Number: 3 2 1 |

CAPACITIES

| | |
|--|--------------------|
| Fuel Tank Capacity (units) | 55.0 gals |
| Engine Crankcase Capacity (gallons) | 1.2 |
| Transmission Capacity (gallons) | Not available. OEM |
| Differential Capacity (gallons) | 1.1 |
| Cooling System Capacity (quarts) | 8.6 |
| Power Steering Fluid Capacity (quarts) | Not available. OEM |

COMPONENT/SUBSYSTEM INSPECTION FORM

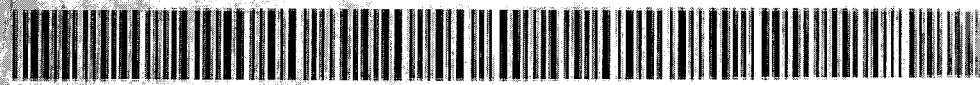
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| | |
|--------------------|---------------|
| Bus Number: 1314-P | Date: 9-19-13 |
|--------------------|---------------|

| Subsystem | Checked | Initials | Comments |
|--|---------|----------|----------|
| Air Conditioning Heating and Ventilation | ✓ | | |
| Body and Sheet Metal | ✓ | | |
| Frame | ✓ | | |
| Steering | ✓ | | |
| Suspension | ✓ | | |
| Interior/Seating | ✓ | | |
| Axles | ✓ | | |
| Brakes | ✓ | | |
| Tires/Wheels | ✓ | | |
| Exhaust | ✓ | | |
| Fuel System | ✓ | | |
| Power Plant | ✓ | | |
| Accessories | ✓ | | |
| Lift System | ✓ | | |
| Interior Fasteners | ✓ | | |
| Batteries | ✓ | | |

CHECK - IN CONT.

INCOMPLETE VEHICLE MFD. BY FORD MOTOR COMPANY

| | | | |
|---|-----------------------|--|---------------------------|
| <p>DATE: 05/13 FRONT GAWR: 2268 KG (5000 LB) WITH LT225/75R16E 115/112R 16x6.0K AT 515 kPa/ 75 PSI COLD VIN: </p> | <p>TIRES RIMS</p> | <p>GVWR: 6577 KG (14500 LB) REAR GAWR: 4355 KG (9600 LB) WITH LT225/75R16E 115/112R 16x6.0K AT 550 kPa/ 80 PSI COLD</p> | <p>TIF R11 DA</p> |
|---|-----------------------|--|---------------------------|

| | | | | | | | |
|-------------------|--------|--------|---|------|----|------|-------|
| EXT PNT: YZ | | RC: 86 | | DSO: | | | |
| WB | INT TR | TP/PS | R | AXLE | TR | SPR | DE418 |
| 158 | XE | | F | 83 | T | XXBB | NOS |
| MADE IN U.S.A. | | | | | | | ULN |
| ▽ 5U5A-3520472-AA | | | | | | | |

VIN TAG