COMMONWEALTH of VIRGINIA

Jennifer B. DeBruhl
Director

DEPARTMENT OF RAIL AND PUBLIC TRANSPORTATION
600 EAST MAIN STREET, SUITE 2102
RICHMOND, VA 23219-2416

(804) 786-4440
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800-828-1120 (TDD)

PRE -AWARD PURCHASER'S REQUIREMENTS CERTIFICATION

As required by Title 49 of the CFR. Part 663 - Subpart B, Department of Rail and Public Transportation (the recipient) certifies that the buses to be purchased,
ADA Body-On-Chassis Cutaway (Ford Transit 11 Passenger BOC, Chevy G-Series Chassis 15 Passenger BOC, Chevy G-Series Chassis 19 Passenger BOC, Ford E-Series Chassis 14 Passenger BOC, Ford E-Series Chassis 15 Passenger BOC, Ford E-Series Chassis 19 Passenger BOC, and Ford F-Series Chassis 27 Passenger BOC (description of buses) from Forest River, Inc. (the manufacturer), are the same product described in the recipient's solicitation specification and that the proposed manufacturer is a responsible manufacturer with the capability to produce a bus that meets the specifications.

Avery Daugherty, Statewide Program Manager
Date: 8/16/2023

U.S. Department
of Transportation
**Federal Transit
Administration**

1200 New Jersey Avenue SE
Washington, D.C. 20590

March 21, 2016

Larry Hall
Director of Engineering
Starcraft Bus Division of Forest River, Inc.
2367 Century Drive
Goshen, IN 46528

Dear Mr. Hall,

This is in response to your email messages dated March 18, 2013 and March 21, 2016 in which you requested assistance from the Federal Transit Administration (FTA) concerning the applicability of the Bus Testing Regulation (49 CFR Part 665) to other chassis variations of the Starcraft Allstar bus model. In your message you indicated that:

- The Starcraft Allstar bus underwent structural integrity and durability testing in the 7 year service life category on a Ford E450 chassis two times. The results of these tests are reported in PTI-BT-R0518 and PTI-BT-R0909.

- Starcraft Bus would like to know if additional testing is required in order to offer the Allstar bus model on a GM 4500 diesel or gasoline chassis.

FTA has reviewed your request and has determined that the Allstar can be offered to FTA grantees on the GM 4500 diesel or gasoline chassis without additional testing. Please include the test report for the Elkhart Coach ECG bus, report number PTI-BT-R1111 with the Allstar test report PTI-BT-R0909 as evidence of satisfying FTA Bus Testing requirements for the diesel powered Allstar. For the gasoline powered chassis, please include the test report for the Arboc Mobility SOM, report number PTI-BT-R0812 as evidence of satisfying FTA Bus Testing requirements for the gasoline powered Allstar.

FTA allows the use of another manufacturer's test report to fill in gaps in test results from the use of another make of chassis as long as the bus body has undergone full structural integrity and durability testing on a similar weight class chassis and the body construction and mounting remains the same.

This determination is based on the changes mentioned above. Should you make any other changes to the vehicle, additional testing may be required. Feel free to contact me at the address above, or by e-mail (gregory.rymarz@dot.gov), fax (202-366-3765), or telephone (202-366-6410) with any other questions.

Sincerely,

Gregory Rymarz
Bus Testing Program Manager
Office of Mobility Innovation, TRI-12

STURAA TEST

7 YEAR

200,000 MILE BUS

from

ARBOC Mobility LLC.

MODEL SOM23G

JANUARY 2009

PTI-BT-R0812

PENNSTATE

The Thomas D. Larson
Pennsylvania Transportation Institute

201 Transportation Research Building
The Pennsylvania State University
University Park, PA 16802

(814) 865-1891

Bus Testing and Research Center

2237 Old Route 220 N.
Duncansville, PA 16635

(814) 695-3404

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EXECUTIVE SUMMARY

ARBOC Mobility LLC. submitted a model SOM23G, gasoline-powered 20 seat (including the driver) 23-foot bus, built on a GM G3500 chassis for a 7 yr/200,000 mile STURAA test. The odometer reading at the time of delivery was 471 miles. Testing started on July 30, 2008 and was completed on January 9, 2009. The Check-In section of the report provides a description of the bus and specifies its major components.

The primary part of the test program is the Structural Durability Test, which also provides the information for the Maintainability and Reliability results. The Structural Durability Test was started on September 10, 2008 and was completed on November 28, 2008.

The interior of the bus is configured with seating for 20 passengers including the driver. Free floor space will accommodate 9 standing passengers resulting in a potential load of 29 persons. At 150 lbs per person, this load results in a measured gross vehicle weight of 12,960 lbs. The first segment of the Structural Durability Test was performed with the bus loaded to a GVW of 12,960 lbs. The middle segment was performed at a seated load weight of 11,800 lbs and the final segment was performed at a curb weight of 8,870 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.

Accessibility, in general, was adequate, components covered in Section 1.3 (Repair and/or Replacement of Selected Subsystems) along with all other components encountered during testing, were found to be readily accessible and no restrictions were noted.

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 thirty-three reported failures, twenty-three were Class 3 and ten were Class 4.

The Safety Test, (a double-lane change, obstacle avoidance test) was safely performed in both right-hand and left-hand directions up to a maximum test speed of 45 mph. The performance of the bus is illustrated by a speed vs. time plot. Acceleration and gradeability test data are provided in Section 4, Performance. The average time to obtain 50 mph was 15.38 seconds.

The Shakedown Test produced a maximum final loaded deflection of 0.155 inches with a permanent set ranging between -0.006 to 0.006 inches under a distributed static load of 10,875 lbs. The Distortion Test was completed with all subsystems, doors and escape mechanisms operating properly. No water leakage was observed throughout the test. All subsystems operated properly.

The test bus submitted for testing was not equipped with any type of tow eyes or tow hooks, therefore, the Static Towing Test was not performed. The Dynamic Towing Test was performed by means of a front-lift tow. The towing interface was accomplished using a hydraulic under-lift wrecker. The bus was towed without incident and no damage resulted from the test. The manufacturer does not recommend towing the bus from the rear, therefore, a rear test was not performed. The Jacking and Hoisting Tests were also performed without incident. The bus was found to be stable on the jack stands, and the minimum jacking clearance observed with a tire deflated was 4.8 inches.

A Fuel Economy Test was run on simulated central business district, arterial, and commuter courses. The results were 4.35 mpg, 4.77 mpg, and 7.84 mpg respectively; with an overall average of 5.13 mpg.

A series of Interior and Exterior Noise Tests was performed. These data are listed in Section 7.1 and 7.2 respectively.

ABBREVIATIONS

ABTC - Altoona Bus Test Center
A/C - air conditioner
ADB - advance design bus
ATA-MC - The Maintenance Council of the American Trucking Association
CBD - central business district
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)
GVL - gross vehicle 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
MECH - bus mechanic
mpg - miles per gallon
mph - miles per hour
PM - Preventive maintenance
PSBRTF - Penn State Bus Research and Testing Facility
PTI - Pennsylvania Transportation Institute
rpm - revolutions per minute
SAE - Society of Automotive Engineers
SCH - test scheduler
SEC - secretary
SLW - seated load weight (curb weight plus 150 lb for every designed passenger seating position and for the driver)
STURAA - Surface Transportation and Uniform Relocation Assistance Act
TD - test driver
TECH - test technician
TM - track manager
TP - test personnel

TEST BUS CHECK-IN

I. OBJECTIVE

The objective of this task is to log in the test bus, assign a bus number, complete the vehicle data form, and perform a safety check.

II. TEST DESCRIPTION

The test consists of assigning a bus test number to the bus, cleaning the bus, completing the vehicle data form, obtaining any special information and tools from the manufacturer, determining a testing schedule, performing an initial safety check, and performing the manufacturer's recommended preventive maintenance. The bus manufacturer must certify that the bus meets all Federal regulations.

III. DISCUSSION

The check-in procedure is used to identify in detail the major components and configuration of the bus.

The test bus consists of a Spirit of Mobility, model SOM23G by ARBOC Mobility. The bus has an O.E.M. driver's door and a passenger entry door equipped with an ARBOC model 32 x 48 manual fold-out handicap ramp rear of the front axle. Power is provided by a gasoline-fueled, General Motors Co. model 6.0 L Vortec engine coupled to a General Motors Corp. model 4-SPD4L80-E transmission.

The measured curb weight is 3,380 lbs for the front axle and 5,490 lbs for the rear axle. These combined weights provide a total measured curb weight of 8,870 lbs. There are 20 seats including the driver and room for 9 standing passengers bringing the total passenger capacity to 29. Gross load is 150 lb x 29 = 4,350 lbs. At full capacity, the measured gross vehicle weight is 12,960 lbs.

VEHICLE DATA FORM

Bus Number: 0812	Arrival Date: 7-31-08
Bus Manufacturer: ARBOC Mobility LLC.	Vehicle Identification Number (VIN): 1GBKG31K781166323
Model Number: SOM 23C	Date: 7-31-08
Personnel: T.S. & S.C.	Chassis: Workhorse / Heavy Duty G 3500

WEIGHT:

Individual Wheel Reactions:

Weights (lb)	Front Axle		Middle Axle		Rear Axle	
	Right	Left	Right	Left	Right	Left
CW	1,750	1,630	N/A	N/A	2,620	2,870
SLW	1,690	1,650	N/A	N/A	3,980	4,480
GVW	1,700	1,730	N/A	N/A	4,580	4,950

Total Weight Details:

Weight (lb)	CW	SLW	GVW	GAWR
Front Axle	3,380	3,340	3,430	4,600
Middle Axle	N/A	N/A	N/A	N/A
Rear Axle	5,490	8,460	9,530	9,600
Total	8,870	11,800	12,960	GVWR: 14,200

Dimensions:

Length (ft/in)	23 / 6
Width (in)	96.0
Height (in)	111.0
Front Overhang (in)	39.0
Rear Overhang (in)	83.5
Wheel Base (in)	159.5
Wheel Track (in)	Front: 68.1
	Rear: 74.8

Bus Number: 0812	Date: 7-31-08

CLEARANCES:

Lowest Point Outside Front Axle	Location: Frame Clearance(in): 10.3
Lowest Point Outside Rear Axle	Location: Heat shield Clearance(in): 9.4
Lowest Point between Axles	Location: Exhaust pipe Clearance(in): 6.4
Ground Clearance at the center (in)	8.4
Front Approach Angle (deg)	22.9
Rear Approach Angle (deg)	9.4
Ramp Clearance Angle (deg)	6.0
Aisle Width (in)	21.0
Inside Standing Height at Center Aisle (in)	80.2

BODY DETAILS:

Body Structural Type	Integral		
Frame Material	Steel		
Body Material	Steel & fiberglass		
Floor Material	Composite		
Roof Material	Fiberglass		
Windows Type	■ Fixed	□ Movable	
Window Mfg./Model No.	Clear Vision / 36 x 36 egress & 36 x 45 fixed		
Number of Doors	2 Front	1 Rear	
Mfr. / Model No.	A&M Systems / 41"		
Dimension of Each Door (in)	Driver's – 56.0 x 34.3	Passenger – 77.4 x 38.8	
Passenger Seat Type	□ Cantilever	■ Pedestal	□ Other (explain)
Mfr. / Model No.	Freedman / Low Back		
Driver Seat Type	□ Air	□ Spring	■ Other (cushion)
Mfr. / Model No.	GM / High back /lumbar		
Number of Seats (including Driver)	20		

Bus Number: 0812	Date: 7-31-08

BODY DETAILS (Contd..)

Free Floor Space (ft^2)	14.3			
Height of Each Step at Normal Position (in)	Front 1. 16.5	2. N/A	3. N/A	4. N/A
	Middle 1. N/A	2. N/A	3. N/A	4. N/A
	Rear 1. N/A	2. N/A	3. N/A	4. N/A
Step Elevation Change - Kneeling (in)	4.2			

ENGINE

Type	□ C.I.	□ Alternate Fuel	
	■ S.I.	□ Other (explain)	
Mfr. / Model No.	General Motors Co. / 6.0 L Vortec		
Location	■ Front	□ Rear	□ Other (explain)
Fuel Type	■ Gasoline	□ CNG	□ Methanol
	□ Diesel	□ LNG	□ Other (explain)
Fuel Tank Capacity (indicate units)	57 gals.		
Fuel Induction Type	■ Injected	□ Carburetion	
Fuel Injector Mfr. / Model No.	General Motors Co. / 6.0 L Vortec		
Carburetor Mfr. / Model No.	N/A		
Fuel Pump Mfr. / Model No.	General Motors Co. / 6.0 L Vortec		
Alternator (Generator) Mfr. / Model No.	Delco / 145 amp		
Maximum Rated Output (Volts / Amps)	12 / 145		
Air Compressor Mfr. / Model No.	TCCI / SC 4779227		
Maximum Capacity (ft^3 / min)	5.0		
Starter Type	■ Electrical	□ Pneumatic	□ Other (explain)
Starter Mfr. / Model No.	Mean Green / MG 6492 HD		

Bus Number: 0812	Date: 7-31-08

TRANSMISSION

Transmission Type	□ Manual	■ Automatic	
Mfr. / Model No.	General Motors Corp. / 4-SPD4L80-E		
Control Type	■ Mechanical	□ Electrical	□ Other
Torque Converter Mfr. / Model No.	General Motors Corp. / 4-SPD4L80-E		
Integral Retarder Mfr. / Model No.	N/A		

SUSPENSION

Number of Axles	2		
Front Axle Type	■ Independent	□ Beam Axle	
Mfr. / Model No.	GM/ARBOC air suspension / 4,600 lbs		
Axle Ratio (if driven)	N/A		
Suspension Type	■ Air	□ Spring	□ Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Tenneco / 65mm (PN 1198729)		
Middle Axle Type	□ Independent	□ Beam Axle	
Mfr. / Model No.	N/A		
Axle Ratio (if driven)	N/A		
Suspension Type	□ Air	□ Spring	□ Other (explain)
No. of Shock Absorbers	N/A		
Mfr. / Model No.	N/A		
Rear Axle Type	□ Independent	■ Beam Axle	
Mfr. / Model No.	Dana Spicer / HD 70		
Axle Ratio (if driven)	4.10		
Suspension Type	■ Air	□ Spring	□ Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Tenneco / 65mm (1165741)		

Bus Number: 0812	Date: 7-31-08

WHEELS & TIRES

Front	Wheel Mfr./ Model No.	Accuride / 16 x 6.5
	Tire Mfr./ Model No.	Uniroyal Laredo LT225 / 75R 16
Rear	Wheel Mfr./ Model No.	Accuride / 16 x 6.5
	Tire Mfr./ Model No.	Uniroyal Laredo LT225 / 75R 16

BRAKES

Front Axle Brakes Type	□ Cam	■ Disc	□ Other (explain)
Mfr. / Model No.	GM / 12.8" x 1.5"		
Middle Axle Brakes Type	□ Cam	□ Disc	□ Other (explain)
Mfr. / Model No.	N/A		
Rear Axle Brakes Type	□ Cam	■ Disc	□ Other (explain)
Mfr. / Model No.	GM / 13.58" x 1.6"		
Retarder Type	N/A		
Mfr. / Model No.	N/A		

HVAC

Heating System Type	□ Air	■ Water	□ Other
Capacity (Btu/hr)	65,000		
Mfr. / Model No.	Pro Air/Trans Air / 65,000 btu		
Air Conditioner	■ Yes	□ No	
Location	Dash & front ceiling		
Capacity (Btu/hr)	70,000		
A/C Compressor Mfr. / Model No.	Trans Air / 21		

STEERING

Steering Gear Box Type	Hydraulic gear
Mfr. / Model No.	GM / Hydraulic recirc. gear
Steering Wheel Diameter	15.4
Number of turns (lock to lock)	3.25

Bus Number: 0812	Date: 7-31-08

OTHERS

Wheel Chair Ramps	Location: Right front	Type: Manual fold-out ramp
Wheel Chair Lifts	Location: N/a	Type: N/A
Mfr. / Model No.	ARBOC / 32 x 48	
Emergency Exit	Location: Window Door	Number: 3 2

CAPACITIES

Fuel Tank Capacity (units)	57 gals.
Engine Crankcase Capacity (gallons)	1.5
Transmission Capacity (gallons)	1.9
Differential Capacity (gallons)	1.0
Cooling System Capacity (gallons)	4.5
Power Steering Fluid Capacity (quarts)	1.0

HYBRID CONTROL SYSTEM

Hybrid Control System Mfr. / Model No.	Intermotive / ES1A

VEHICLE DATA FORM

Bus Number: 0812	Date: 7-31-08

List all spare parts, tools and manuals delivered with the bus.

Part Number	Description	Qty.
Uni Royal 225/75R 16	Mounted tire.	1
W01-358-5783	Air bag	1
W01-358-7339	Air bag	1
1167218	Shock	2
1165741	Shock	2
na	Leveling arms	2

COMPONENT/SUBSYSTEM INSPECTION FORM

Bus Number: 0812	Date: 7-31-08

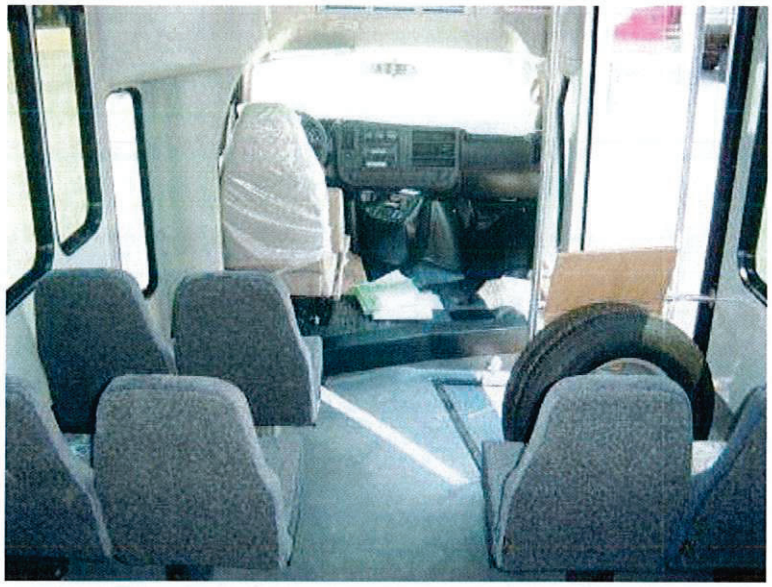
Subsystem	Checked	Comments
Air Conditioning Heating and Ventilation	✓	
Body and Sheet Metal	✓	
Frame	✓	
Steering	✓	
Suspension	✓	
Interior/Seating	✓	No wheelchair positions.
Axles	✓	
Brakes	✓	
Tires/Wheels	✓	
Exhaust	✓	
Fuel System	✓	Gasoline.
Power Plant	✓	
Accessories	✓	
Lift System	✓	Manual fold-out ramp.
Interior Fasteners	✓	
Batteries	✓	

CHECK - IN

ARBOC MOBILITY LLC
MODEL SOM23G

ARBOC MOBILITY LLC
MODEL SOM23G EQUIPPED WITH AN ARBOC
MODEL 32 X 48 HANDICAP RAMP

CHECK - IN CONT.

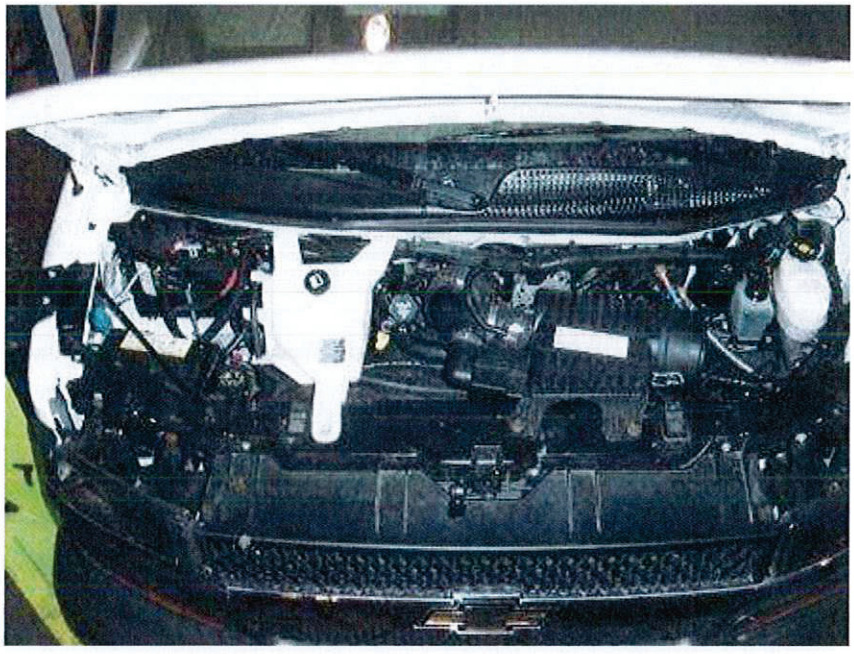


FRONT INTERIOR

REAR INTERIOR

CHECK - IN

DRIVER'S STATION



ENGINE COMPARTMENT

1. MAINTAINABILITY

1.1 ACCESSIBILITY OF COMPONENTS AND SUBSYSTEMS

1.1-I. TEST OBJECTIVE

The objective of this test is to check the accessibility of components and subsystems.

1.1-II. TEST DESCRIPTION

Accessibility of components and subsystems is checked, and where accessibility is restricted the subsystem is noted along with the reason for the restriction.

1.1-III. DISCUSSION

Accessibility, in general, was adequate. Components covered in Section 1.3 (repair and/or replacement of selected subsystems), along with all other components encountered during testing, were found to be readily accessible and no restrictions were noted.

ACCESSIBILITY DATA FORM

Bus Number: 0812	Date: 1-8-09

Component	Checked	Comments
ENGINE :		
Oil Dipstick	✓	
Oil Filler Hole	✓	
Oil Drain Plug	✓	
Oil Filter	✓	
Fuel Filter	✓	
Air Filter	✓	
Belts	✓	
Coolant Level	✓	
Coolant Filler Hole	✓	
Coolant Drain	✓	
Spark / Glow Plugs	✓	
Alternator	✓	
Diagnostic Interface Connector	✓	
TRANSMISSION :		
Fluid Dip-Stick	✓	
Filler Hole	✓	
Drain Plug	✓	
SUSPENSION :		
Bushings	✓	
Shock Absorbers	✓	
Air Springs	✓	
Leveling Valves	✓	
Grease Fittings	✓	

ACCESSIBILITY DATA FORM

Bus Number: 0812	Date: 1-8-09

Component	Checked	Comments
HVAC :		
A/C Compressor	✓	
Filters	✓	
Fans	✓	
ELECTRICAL SYSTEM :		
Fuses	✓	
Batteries	✓	
Voltage regulator	✓	
Voltage Converters	✓	
Lighting	✓	
MISCELLANEOUS :		
Brakes	✓	
Handicap Lifts/Ramps	✓	
Instruments	✓	
Axles	✓	
Exhaust	✓	
Fuel System	✓	
OTHERS :		

1.2 SERVICING, PREVENTIVE MAINTENANCE, AND REPAIR AND MAINTENANCE DURING TESTING

1.2-I. TEST OBJECTIVE

The objective of this test is to collect maintenance data about the servicing, preventive maintenance, and repair.

1.2.-II. TEST DESCRIPTION

The test will be conducted by operating the NBM and collecting the following data on work order forms and a driver log.

1. Unscheduled Maintenance
   a. Bus number
   b. Date
   c. Mileage
   d. Description of malfunction
   e. Location of malfunction (e.g., in service or undergoing inspection)
   f. Repair action and parts used
   g. Man-hours required

2. Scheduled Maintenance
   a. Bus number
   b. Date
   c. Mileage
   d. Engine running time (if available)
   e. Results of scheduled inspections
   f. Description of malfunction (if any)
   g. Repair action and parts used (if any)
   h. Man-hours required

The buses will be operated in accelerated durability service. While typical items are given below, the specific service schedule will be that specified by the manufacturer.

A. Service
   1. Fueling
   2. Consumable checks
   3. Interior cleaning

B. Preventive Maintenance
   4. Brake adjustments
   5. Lubrication
   6. 3,000 mi (or equivalent) inspection

7. Oil and filter change inspection
8. Major inspection
9. Tune-up

C. Periodic Repairs
1. Brake reline
2. Transmission change
3. Engine change
4. Windshield wiper motor change
5. Stoplight bulb change
6. Towing operations
7. Hoisting operations

1.2-III. DISCUSSION

Servicing and preventive maintenance were performed at manufacturer-specified intervals. The following Scheduled Maintenance Form lists the mileage, items serviced, the service interval, and amount of time required to perform the maintenance. Table 1 is a list of the lubricating products used in servicing. Finally, the Unscheduled Maintenance List along with Unscheduled Maintenance-related photographs is included in Section 5.7, Structural Durability. This list supplies information related to failures that occurred during the durability portion of testing. The Unscheduled Maintenance List includes the date and mileage at which the malfunction occurred, a description of the malfunction and repair, and the time required to perform the repair.

SCHEDULED MAINTENANCE

ARBOC #0812

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
10-03-08	1,214	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
10-15-08	2,146	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
11-05-08	3,409	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
11-11-08	4,936	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
11-19-08	5,997	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
11-25-08	6,739	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
12-09-08	7,500	P.M. / Inspection Fuel Economy Prep.	Linkage, tie rods, universals/u-joints all lubed. Oil changed. Oil, fuel, and air filters changed. Transmission oil and filter changed.	8.00	8.00

Table 1. STANDARD LUBRICANTS

The following is a list of Texaco lubricant products used in bus testing conducted by the Penn State University Altoona Bus Testing Center:

ITEM	PRODUCT CODE	TEXACO DESCRIPTION
Engine oil	#2112	URSA Super Plus SAE 30
Transmission oil	#1866	Automatic Trans Fluid Mercon/Dexron II Multipurpose
Gear oil	#2316	Multigear Lubricant EP SAE 80W90
Wheel bearing & Chassis grease	#1935	Starplex II

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS

1.3-I. TEST OBJECTIVE

The objective of this test is to establish the time required to replace and/or repair selected subsystems.

1.3-II. TEST DESCRIPTION

The test will involve components that may be expected to fail or require replacement during the service life of the bus. In addition, any component that fails during the NBM testing is added to this list. Components to be included are:

1. Transmission
2. Alternator
3. Starter
4. Batteries
5. Windshield wiper motor

1.3-III. DISCUSSION

During the test, several additional components were removed for repair or replacement. Following is a list of components and total repair/replacement time.

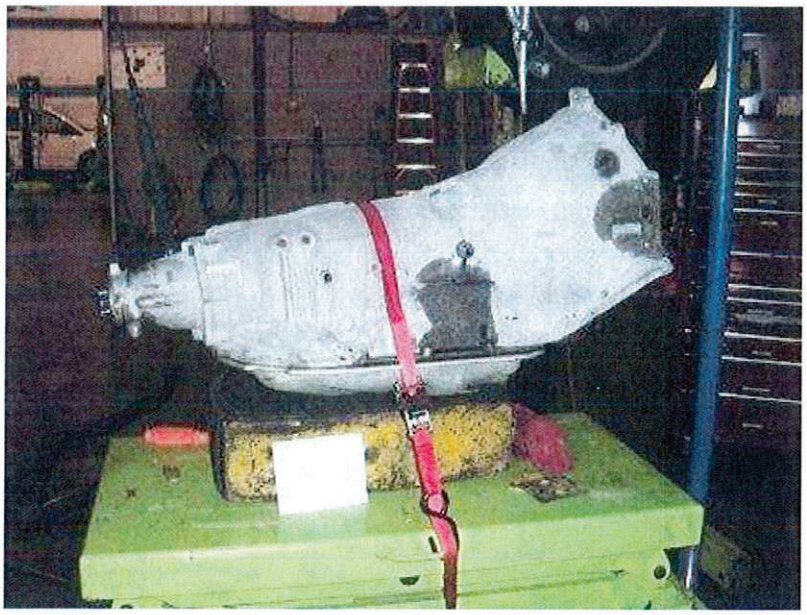
	MAN HOURS
Trailing arm bushings.	12.0
Left rear sway bar bracket.	1.5
Hadley unit.	8.0
Lower trailing arms.	4.0
Left rear sway bar link.	2.0
Right front sway bar link.	0.5
Left rear marker lamp.	0.25
Battery box.	1.75
Rear lateral bar mount.	2.00
Front sway bar link/bushing.	1.00
Left front sway bar link.	1.00

At the end of the test, the remaining items on the list were removed and replaced. The transmission assembly took 12.0 man-hours (two men 6.0 hrs) to remove and replace. The time required for repair/replacement of the four remaining components is given on the following Repair and/or Replacement Form.

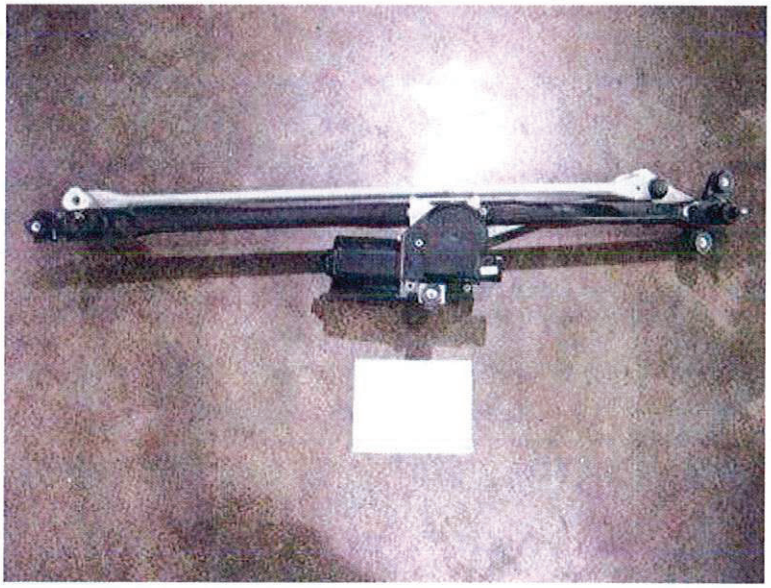
REPLACEMENT AND/OR REPAIR FORM

Subsystem	Replacement Time
Transmission	12.0 man hours
Wiper Motor	0.5 man hours
Starter	0.5 man hours
Alternator	1.0 man hours
Batteries	0.5 man hours

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS



TRANSMISSION REMOVAL AND REPLACEMENT (12.0 MAN HOURS)



WIPER MOTOR REMOVAL AND REPLACEMENT (0.5 MAN HOURS)

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS CONT.

STARTER REMOVAL AND REPLACEMENT (0.5 MAN HOURS)

ALTERNATOR REMOVAL AND REPLACEMENT (1.0 MAN HOURS)

2. RELIABILITY - DOCUMENTATION OF BREAKDOWN AND REPAIR TIMES DURING TESTING

2-I. TEST OBJECTIVE

The objective of this test is to document unscheduled breakdowns, repairs, down time, and repair time that occur during testing.

2-II. TEST DESCRIPTION

Using the driver log and unscheduled work order forms, all significant breakdowns, repairs, man-hours to repair, and hours out of service are recorded on the Reliability Data Form.

CLASS OF FAILURES

Classes of failures are described below:

(a) Class 1: Physical Safety. A failure that could lead directly to passenger or driver injury and represents a severe crash situation.

(b) Class 2: Road Call. A failure resulting in an en route interruption of revenue service. Service is discontinued until the bus is replaced or repaired at the point of failure.

(c) Class 3: Bus Change. A failure that requires removal of the bus from service during its assignments. The bus is operable to a rendezvous point with a replacement bus.

(d) Class 4: Bad Order. A failure that does not require removal of the bus from service during its assignments but does degrade coach operation. The failure shall be reported by driver, inspector, or hostler.

2-III. DISCUSSION

A listing of breakdowns and unscheduled repairs is accumulated during the Structural Durability Test. The following Reliability Data Form lists all unscheduled repairs under classes as defined above. These classifications are somewhat subjective as the test is performed on a test track with careful inspections every two hours. However, even on the road, there is considerable latitude on deciding how to handle many failures.

The Unscheduled Repair List is also attached to provide a reference for the repairs that are included in the Reliability Data Forms.

The classification of repairs according to subsystem is intended to emphasize those systems which had persistent minor or more serious problems. There were no Class 1 or 2 failures. Of the twenty-three Class 3 failures, seventeen involved the suspension system, two occurred with the engine/transmission, and one each to the frame, electrical, tire and air compressor. These and the remaining ten Class 4 failures are available for review in the Unscheduled Maintenance List, located in Section 5.7 Structural Durability.

Bus Number: 0812	Date: 11-28-08
Personnel: Bob Reifsteck	

	Failure Type					
Subsystems	Class 4 Bad Order Mileage	Class 3 Bus Change Mileage	Class 2 Road Call Mileage	Class 1 Physical Safety Mileage	Man Hours	Down Time
Suspension		482			2.00	1.00
	630				12.00	4.00
		630			1.50	47.00
	1,253				4.00	2.00
		1,771			2.00	4.00
		1,988			1.00	1.00
		2,202			5.00	70.00
		2,202			1.00	1.00
		2,384			2.00	2.00
		2,585			0.50	2.00
		2,659			4.00	2.00
		2,661			15.00	118.00
		3,008			1.00	0.50
		4,886			1.00	4.00
		5,071			2.00	3.00
		5,291			1.00	2.00
		6,402			2.00	4.00
		6,450			1.00	10.00
		6,450			1.00	0.50

RELIABILITY DATA FORMS

Bus Number: 0812	Date: 11-28-08
Personnel: Bob Reifsteck	

Failure Type			
Class 4 Bad Order	Class 3 Bus Change	Class 2 Road Call	Class 1 Physical Safety

Subsystems	Mileage	Mileage	Mileage	Mileage	Man Hours	Down Time
Body	2,786				1.00	1.00
	3,409				1.00	0.50
	3,409				2.00	2.00
	5,515				2.50	1.00
Engine/Transmission		1,059			2.00	3.00
		2,146			3.00	2.00
	2,786				1.75	4.00
	6,450				1.00	0.50
Electrical	2,786				0.25	0.25
		3,008			4.00	13.00
Frame	630				10.00	123.00
		5,515			2.00	8.00
Air Compressor		1,214			4.00	36.00
Wheels/Tires		2,384			2.00	2.00

3. SAFETY - A DOUBLE-LANE CHANGE (OBSTACLE AVOIDANCE)

3-I. TEST OBJECTIVE

The objective of this test is to determine handling and stability of the bus by measuring speed through a double lane change test.

3-II. TEST DESCRIPTION

The Safety Test is a vehicle handling and stability test. The bus will be operated at SLW on a smooth and level test track. The bus will be driven through a double lane change course at increasing speed until the test is considered unsafe or a speed of 45 mph is reached. The lane change course will be set up using pylons to mark off two 12 foot center to center lanes with two 100 foot lane change areas 100 feet apart. The bus will begin in one lane, change to the other lane in a 100 foot span, travel 100 feet, and return to the original lane in another 100 foot span. This procedure will be repeated, starting first in the right-hand and then in the left-hand lane.

3-III. DISCUSSION

The double-lane change was performed in both right-hand and left-hand directions. The bus was able to safely negotiate the test course in both the right-hand and left-hand directions up to the maximum test speed of 45 mph.

SAFETY DATA FORM

Bus Number: 0812	Date: 12-15-08
Personnel: T.S., E.D. & B.S.	

Temperature (°F): 49	Humidity (%): 81
Wind Direction: SSW	Wind Speed (mph): 11
Barometric Pressure (in.Hg): 30.17	

SAFETY TEST: DOUBLE LANE CHANGE	
Maximum safe speed tested for double-lane change to left	45 mph
Maximum safe speed tested for double-lane change to right	45 mph
Comments of the position of the bus during the lane change: A safe profile was maintained through all portions of testing.	
Comments of the tire/ground contact patch: Tire/ground contact was maintained through all portions of testing.	

RIGHT - HAND APPROACH

LEFT - HAND APPROACH

4. PERFORMANCE - AN ACCELERATION, GRADEABILITY, AND TOP SPEED TEST

4-I. TEST OBJECTIVE

The objective of this test is to determine the acceleration, gradeability, and top speed capabilities of the bus.

4-II. TEST DESCRIPTION

In this test, the bus will be operated at SLW on the skid pad at the PSBRTF. The bus will be accelerated at full throttle from a standstill to a maximum "geared" or "safe" speed as determined by the test driver. The vehicle speed is measured using a Correvit non-contacting speed sensor. The times to reach speed between ten mile per hour increments are measured and recorded using a stopwatch with a lap timer. The time to speed data will be recorded on the Performance Data Form and later used to generate a speed vs. time plot and gradeability calculations.

4-III. DISCUSSION

This test consists of three runs in both the clockwise and counterclockwise directions on the Test Track. Velocity versus time data is obtained for each run and results are averaged together to minimize any test variability which might be introduced by wind or other external factors. The test was performed up to a maximum speed of 50 mph. The fitted curve of velocity vs. time is attached, followed by the calculated gradeability results. The average time to obtain 50 mph was 15.38 seconds.

PERFORMANCE DATA FORM

Bus Number: 0812	Date: 12-15-08
Personnel: T.S., E.D. & B.S.	
Temperature (°F): 49	Humidity (%): 81
Wind Direction: SSW	Wind Speed (mph): 11
Barometric Pressure (in.Hg): 30.17	

Air Conditioning compressor-OFF	✓Checked
Ventilation fans-ON HIGH	✓Checked
Heater pump motor-Off	✓Checked
Defroster-OFF	✓ Checked
Exterior and interior lights-ON	✓ Checked
Windows and doors-CLOSED	✓ Checked

ACCELERATION, GRADEABILITY, TOP SPEED

Counter Clockwise Recorded Interval Times

Speed	Run 1	Run 2	Run 3
10 mph	2.76	2.82	2.79
20 mph	4.92	5.20	5.32
30 mph	8.11	8.32	8.38
40 mph	11.01	11.20	11.10
Top Test Speed(mph) 50	15.39	15.54	15.70

Clockwise Recorded Interval Times

Speed	Run 1	Run 2	Run 3
10 mph	2.79	2.66	2.64
20 mph	4.95	5.23	4.95
30 mph	7.88	7.91	7.83
40 mph	10.60	10.66	10.67
Top Test Speed(mph) 50	15.10	15.41	15.14

PERFORMANCE SUMMARY SHEET

BUS MANUFACTURER :ARBOC
BUS MODEL :SOM 23C

BUS NUMBER :0812
TEST DATE :12/15/08

TEST CONDITIONS :

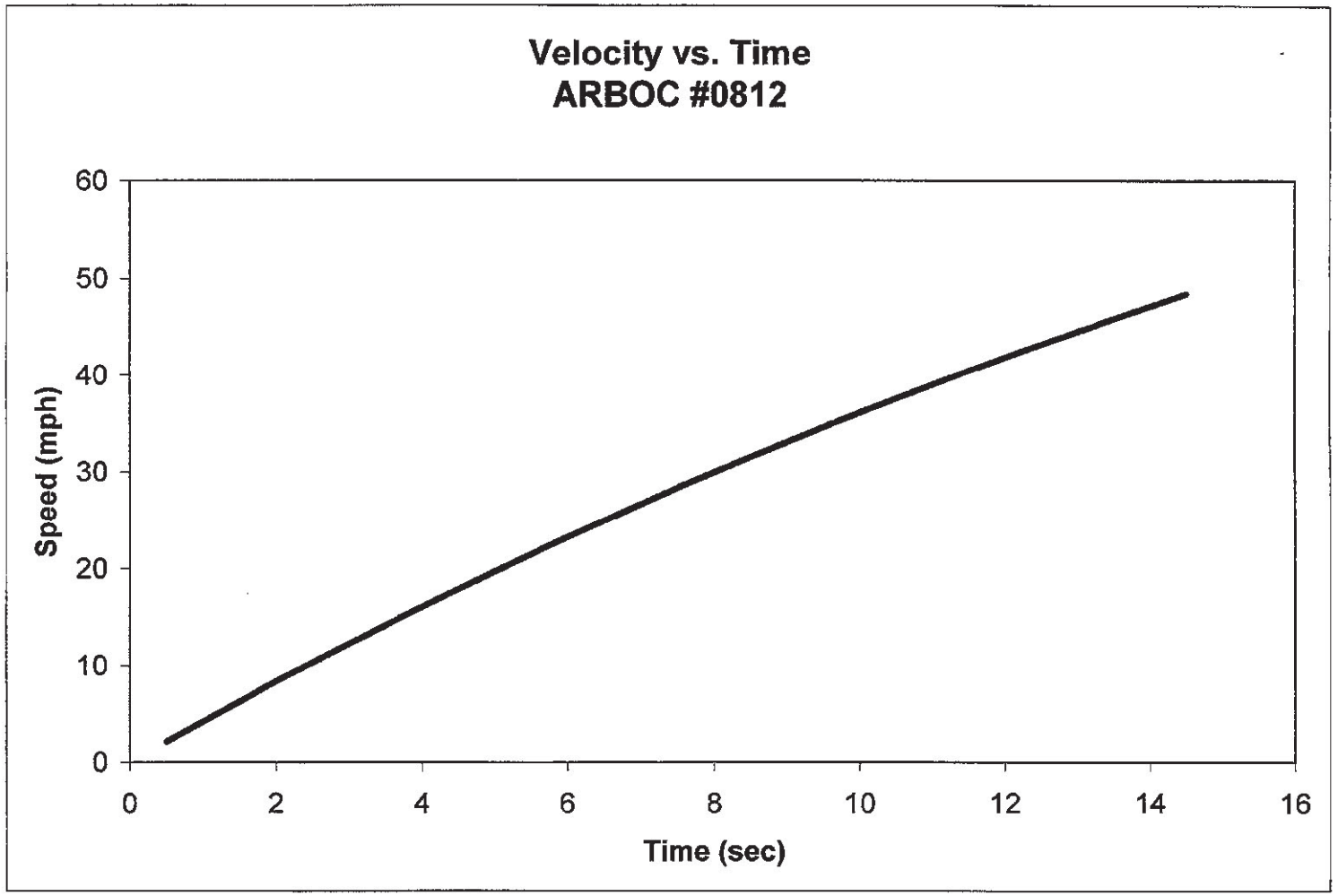
TEMPERATURE (DEG F) : 49.0
WIND DIRECTION : SSW
WIND SPEED (MPH) : 11.0
HUMIDITY (%) : 81
BAROMETRIC PRESSURE (IN. HG) : 30.2

VEHICLE SPEED	AVERAGE TIME (SEC)		
(MPH)	CCW DIRECTION	CW DIRECTION	TOTAL
10.0	2.79	2.70	2.74
20.0	5.15	5.04	5.10
30.0	8.27	7.87	8.07
40.0	11.10	10.64	10.87
50.0	15.54	15.22	15.38

TEST SUMMARY :

VEHICLE SPEED (MPH)	TIME (SEC)	ACCELERATION (FT/SEC^2)	MAX. GRADE (%)
1.0	.23	6.3	20.0
5.0	1.18	6.1	19.2
10.0	2.41	5.8	18.3
15.0	3.71	5.5	17.4
20.0	5.07	5.2	16.5
25.0	6.51	5.0	15.6
30.0	8.03	4.7	14.7
35.0	9.64	4.4	13.8
40.0	11.35	4.2	13.0
45.0	13.18	3.9	12.2
50.0	15.13	3.6	11.4

NOTE : Gradeability results were calculated from performance test data. Actual sustained gradeability performance for vehicles equipped with auto transmission may be lower than the values indicated here.


Velocity vs. Time
ARBOC #0812
Speed (mph)
60
50
40
30
20
10
0
0
2
4
6
8
10
12
14
16
Time (sec)

5. STRUCTURAL INTEGRITY

5.1 STRUCTURAL STRENGTH AND DISTORTION TESTS - STRUCTURAL SHAKEDOWN TEST

5.1-I. DISCUSSION

The objective of this test is to determine certain static characteristics (e.g., bus floor deflection, permanent structural deformation, etc.) under static loading conditions.

5.1-II. TEST DESCRIPTION

In this test, the bus will be isolated from the suspension by blocking the vehicle under the suspension points. The bus will then be loaded and unloaded up to a maximum of three times with a distributed load equal to 2.5 times gross load. Gross load is 150 lb for every designed passenger seating position, for the driver, and for each 1.5 sq ft of free floor space. For a distributed load equal to 2.5 times gross load, place a 375-lb load on each seat and on every 1.5 sq ft of free floor space. The first loading and unloading sequence will "settle" the structure. Bus deflection will be measured at several locations during the loading sequences.

5.1-III. DISCUSSION

This test was performed based on a maximum passenger capacity of 29 people including the driver. The resulting test load is (29 x 375 lb) = 10,875 lb. The load is distributed evenly over the passenger space. Deflection data before and after each loading and unloading sequence is provided on the Structural Shakedown Data Form.

The unloaded height after each test becomes the original height for the next test. Some initial settling is expected due to undercoat compression, etc. After each loading cycle, the deflection of each reference point is determined. The bus is then unloaded and the residual (permanent) deflection is recorded. On the final test, the maximum loaded deflection was 0.155 inches at reference point 2. The maximum permanent deflection after the final loading sequence ranged from -.006 inches at reference point 2 to 0.006 inches at reference point 7.

STRUCTURAL SHAKEDOWN DATA FORM

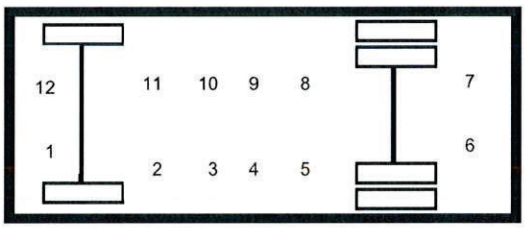
Bus Number: 0812	Date: 8-4-08
Personnel: T.S., E.D., E.L. & S.C.	Temperature (°F): 71
Loading Sequence: ■ 1 □ 2 □ 3 (check one) Test Load (lbs): 10,875	

Indicate Approximate Location of Each Reference Point

Right

Front of Bus

Left



Top View

Reference Point No.	A (in) Original Height	B (in) Loaded Height	B-A (in) Loaded Deflection	C (in) Unloaded Height	C-A (in) Permanent Deflection
1	0	-.068	-.068	-.002	-.002
2	0	.187	.187	.028	.028
3	0	.090	.090	.011	.011
4	0	.116	.116	.022	.022
5	0	.086	.086	.006	.006
6	0	.150	.150	.015	.015
7	0	.139	.139	.015	.015
8	0	.094	.094	.012	.012
9	0	.104	.104	.012	.012
10	0	.090	.090	.010	.010
11	0	.056	.056	.009	.009
12	0	-.080	-.080	-.003	-.003

STRUCTURAL SHAKEDOWN DATA FORM

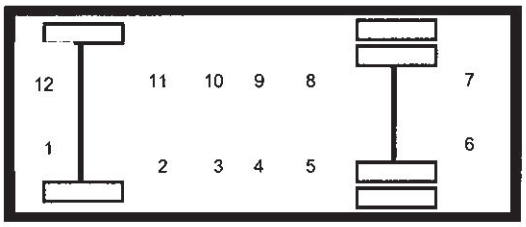
Bus Number: 0812	Date: 8-4-08
Personnel: T.S., E,.D., E.L. & S.C.	Temperature (°F): 76
Loading Sequence: □ 1 ■ 2 □ 3 (check one) Test Load (lbs): 10,875	

Indicate Approximate Location of Each Reference Point

Right

Front of Bus

Left



Top View

Reference Point No.	A (in) Original Height	B (in) Loaded Height	B-A (in) Loaded Deflection	C (in) Unloaded Height	C-A (in) Permanent Deflection
1	-.002	-.067	-.065	-.004	-.002
2	.028	.183	.155	.022	-.006
3	.011	.087	.076	.007	-.004
4	.022	.110	.088	.017	-.005
5	.006	.089	.083	.010	.004
6	.015	.167	.152	.020	.005
7	.015	.165	.150	.021	.006
8	.012	.091	.079	.011	-.001
9	.012	.100	.088	.011	-.001
10	.010	.087	.077	.010	.000
11	.009	.056	.047	.010	.001
12	-.003	-.080	-.077	.000	.003

5.1 STRUCTURAL SHAKEDOWN TEST

BUS LOADED TO 2.5 TIMES GVL
(10,875 LBS)

5.2 STRUCTURAL STRENGTH AND DISTORTION TESTS - STRUCTURAL DISTORTION

5.2-I. TEST OBJECTIVE

The objective of this test is to observe the operation of the bus subsystems when the bus is placed in a longitudinal twist simulating operation over a curb or through a pothole.

5.2-II. TEST DESCRIPTION

With the bus loaded to GVWR, each wheel of the bus will be raised (one at a time) to simulate operation over a curb and the following will be inspected:

1. Body
2. Windows
3. Doors
4. Roof vents
5. Special seating
6. Undercarriage
7. Engine
8. Service doors
9. Escape hatches
10. Steering mechanism

Each wheel will then be lowered (one at a time) to simulate operation through a pothole and the same items inspected.

5.2-III. DISCUSSION

The test sequence was repeated ten times. The first and last test is with all wheels level. The other eight tests are with each wheel 6 inches higher and 6 inches lower than the other three wheels.

All doors, windows, escape mechanisms, engine, steering and handicapped devices operated normally throughout the test. The undercarriage and body indicated no deficiencies. No water leakage was observed during the test. The results of this test are indicated on the following data forms.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0812	Date: 8-5-08
Personnel: T.S., E.L., E.D. & S.C.	Temperature(°F): 73

Wheel Position : (check one)		
All wheels level	■ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0812	Date: 8-5-08
Personnel: T.S., E.L., E.D. & S.C.	Temperature(°F): 73

Wheel Position : (check one)		
All wheels level	▫ before	▫ after
Left front	▪ 6 in higher	▫ 6 in lower
Right front	▫ 6 in higher	▫ 6 in lower
Right rear	▫ 6 in higher	▫ 6 in lower
Left rear	▫ 6 in higher	▫ 6 in lower
Right center	▫ 6 in higher	▫ 6 in lower
Left center	▫ 6 in higher	▫ 6 in lower

	Comments
▪ Windows	No deficiencies.
▪ Front Doors	No deficiencies.
▪ Rear Doors	No deficiencies.
▪ Escape Mechanisms/ Roof Vents	No deficiencies.
▪ Engine	No deficiencies.
▪ Handicapped Device/ Special Seating	No deficiencies.
▪ Undercarriage	No deficiencies.
▪ Service Doors	No deficiencies.
▪ Body	No deficiencies.
▪ Windows/ Body Leakage	No deficiencies.
▪ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0812	Date: 8-5-08
Personnel: T.S., E.L., E.D. & S.C.	Temperature(°F): 73

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	■ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0812	Date: 8-5-08
Personnel: T.S., E.L., E.D. & S.C.	Temperature(°F): 73

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	■ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0812	Date: 8-5-08
Personnel: T.S., E.L., E.D. & S.C.	Temperature(°F): 73

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	■ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0812	Date: 8-5-08
Personnel: T.S., E.L., E.D. & S.C.	Temperature(°F): 73

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	■ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0812	Date: 8-5-08
Personnel: T.S., E.L., E.D. & S.C.	Temperature(°F): 73

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	■ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0812	Date: 8-5-08
Personnel: T.S., E.L., E.D. & S.C.	Temperature(°F): 73

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	■ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0812	Date: 8-5-08
Personnel: T.S., E.L., E.D. & S.C.	Temperature(°F): 73

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	■ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0812	Date: 8-5-08
Personnel: T.S., E.L., E.D. & S.C.	Temperature(°F): 73

Wheel Position : (check one)		
All wheels level	□ before	■ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

5.2 STRUCTURAL DISTORTION TEST

RIGHT FRONT WHEEL SIX INCHES HIGHER

LEFT FRONT WHEEL SIX INCHES LOWER

5.3 STRUCTURAL STRENGTH AND DISTORTION TESTS - STATIC TOWING TEST

5.3-I. TEST OBJECTIVE

The objective of this test is to determine the characteristics of the bus towing mechanisms under static loading conditions.

5.3-II. TEST DESCRIPTION

Utilizing a load-distributing yoke, a hydraulic cylinder is used to apply a static tension load equal to 1.2 times the bus curb weight. The load will be applied to both the front and rear, if applicable, towing fixtures at an angle of 20 degrees with the longitudinal axis of the bus, first to one side then the other in the horizontal plane, and then upward and downward in the vertical plane. Any permanent deformation or damage to the tow eyes or adjoining structure will be recorded.

5.3-III. DISCUSSION

The test bus submitted for testing was not equipped with any type of tow eyes or tow hooks, therefore, the Static Towing Test was not performed.

5.4 STRUCTURAL STRENGTH AND DISTORTION TESTS - DYNAMIC TOWING TEST

5.4-I. TEST OBJECTIVE

The objective of this test is to verify the integrity of the towing fixtures and determine the feasibility of towing the bus under manufacturer specified procedures.

5.4-II. TEST DESCRIPTION

This test requires the bus be towed at curb weight using the specified equipment and instructions provided by the manufacturer and a heavy-duty wrecker. The bus will be towed for 5 miles at a speed of 20 mph for each recommended towing configuration. After releasing the bus from the wrecker, the bus will be visually inspected for any structural damage or permanent deformation. All doors, windows and passenger escape mechanisms will be inspected for proper operation.

5.4-III. DISCUSSION

The bus was towed using a heavy-duty wrecker. The towing interface was accomplished by incorporating a hydraulic under lift. A front lift tow was performed. Rear towing is not recommended. No problems, deformation, or damage was noted during testing.

DYNAMIC TOWING TEST DATA FORM

Bus Number: 0812	Date: 12-12-08
Personnel: S.C.	

Temperature (°F): 30	Humidity (%): 68
Wind Direction: W	Wind Speed (mph): 8
Barometric Pressure (in.Hg): 30.05	

Inspect tow equipment-bus interface.
Comments: A safe and adequate connection was made between the tow equipment and the bus.
Inspect tow equipment-wrecker interface.
Comments: A safe and adequate connection was made between the tow equipment and the wrecker.
Towing Comments: A front lift tow was performed incorporation a hydraulic under lift wrecker.
Description and location of any structural damage: None noted.
General Comments: No problems were encountered with the tow or towing interface.

5.4 DYNAMIC TOWING TEST

TOWING INTERFACE

TEST BUS IN TOW

5.5 STRUCTURAL STRENGTH AND DISTORTION TESTS – JACKING TEST

5.5-I. TEST OBJECTIVE

The objective of this test is to inspect for damage due to the deflated tire, and determine the feasibility of jacking the bus with a portable hydraulic jack to a height sufficient to replace a deflated tire.

5.5-II. TEST DESCRIPTION

With the bus at curb weight, the tire(s) at one corner of the bus are replaced with deflated tire(s) of the appropriate type. A portable hydraulic floor jack is then positioned in a manner and location specified by the manufacturer and used to raise the bus to a height sufficient to provide 3-in clearance between the floor and an inflated tire. The deflated tire(s) are replaced with the original tire(s) and the hack is lowered. Any structural damage or permanent deformation is recorded on the test data sheet. This procedure is repeated for each corner of the bus.

5.5-III. DISCUSSION

The jack used for this test has a minimum height of 8.75 inches. During the deflated portion of the test, the jacking point clearances ranged from 11.5 inches to 4.8 inches. No deformation or damage was observed during testing. A complete listing of jacking point clearances is provided in the Jacking Test Data Form.

JACKING CLEARANCE SUMMARY

Condition	Frame Point Clearance
Front axle – one tire flat	9.9"
Rear axle – one tire flat	11.0"
Rear axle – two tires flat	9.3"

JACKING TEST DATA FORM

Bus Number: 0812	Date: 8-1-08
Personnel: E.D.	Temperature (°F): 80

Record any permanent deformation or damage to bus as well as any difficulty encountered during jacking procedure.

Deflated Tire	Jacking Pad Clearance Body/Frame (in)	Jacking Pad Clearance Axle/Suspension (in)	Comments
Right front	11.6 " I 9.9 " D	9.1 " I 6.5 " D	
Left front	12.2 " I 10.6 " D	9.0 " I 6.5 " D	
Right rear—outside	11.5 " I 11.0 " D	6.7 " I 6.4 " D	
Right rear—both	11.5 " I 9.3 " D	6.7 " I 4.9 " D	
Left rear—outside	11.9 " I 11.5 " D	6.7 " I 6.4 " D	
Left rear—both	11.9 " I 9.6 " D	6.7 " I 4.8 " D	
Right middle or tag—outside	NA	NA	
Right middle or tag—both	NA	NA	
Left middle or tag—outside	NA	NA	
Left middle or tag—both	NA	NA	

Additional comments of any deformation or difficulty during jacking:
None noted.

5.6 STRUCTURAL STRENGTH AND DISTORTION TESTS - HOISTING TEST

5.6-I. TEST OBJECTIVE

The objective of this test is to determine possible damage or deformation caused by the jack/stands.

5.6-II. TEST DESCRIPTION

With the bus at curb weight, the front end of the bus is raised to a height sufficient to allow manufacturer-specified placement of jack stands under the axles or jacking pads independent of the hoist system. The bus will be checked for stability on the jack stands and for any damage to the jacking pads or bulkheads. The procedure is repeated for the rear end of the bus. The procedure is then repeated for the front and rear simultaneously.

5.6-III. DISCUSSION

The test was conducted using four posts of a six-post electric lift and standard 19 inch jack stands. The bus was hoisted from the front wheel, rear wheel, and then the front and rear wheels simultaneously and placed on jack stands.

The bus easily accommodated the placement of the vehicle lifts and jack stands and the procedure was performed without any instability noted.

HOISTING TEST DATA FORM

Bus Number: 0812	Date: 8-1-08
Personnel: S.C. & E.D.	Temperature (°F): 80

Comments of any structural damage to the jacking pads or axles while both the front wheels are supported by the jack stands:
None noted.
Comments of any structural damage to the jacking pads or axles while both the rear wheels are supported by the jack stands:
None noted.
Comments of any structural damage to the jacking pads or axles while both the front and rear wheels are supported by the jack stands:
None noted.

5.7 STRUCTURAL DURABILITY TEST

5.7-I. TEST OBJECTIVE

The objective of this test is to perform an accelerated durability test that approximates up to 25 percent of the service life of the vehicle.

5.7-II. TEST DESCRIPTION

The test vehicle is driven a total of 7,500 miles; approximately 5,000 miles on the PSBRTF Durability Test Track and approximately 2,500 miscellaneous other miles. The test will be conducted with the bus operated under three different loading conditions. The first segment will consist of approximately 3,000 miles with the bus operated at GVW. The second segment will consist of approximately 1,500 miles with the bus operated at SLW. The remainder of the test, approximately 3,000 miles, will be conducted with the bus loaded to CW. If GVW exceeds the axle design weights, then the load will be adjusted to the axle design weights and the change will be recorded. All subsystems are run during these tests in their normal operating modes. All recommended manufacturers servicing is to be followed and noted on the vehicle maintainability log. Servicing items accelerated by the durability tests will be compressed by 10:1; all others will be done on a 1:1 mi/mi basis. Unscheduled breakdowns and repairs are recorded on the same log as are any unusual occurrences as noted by the driver. Once a week the test vehicle shall be washed down and thoroughly inspected for any signs of failure.

5.7-III. DISCUSSION

The Structural Durability Test was started on September 10, 2008 and was conducted until November 28, 2008. The first 3,000 miles were performed at a GVW of 12,960 lbs. and completed on October 22, 2008. The next 1,500 mile SLW segment was performed at 11,800 lbs and completed on November 6, 2008 and the final 3,000 mile segment was performed at a CW of 8,870 lbs and completed on November 28, 2008.

The following mileage summary presents the accumulation of miles during the Structural Durability Test. The driving schedule is included, showing the operating duty cycle. A detailed plan view of the Test Track Facility and Durability Test Track are attached for reference. Also, a durability element profile detail shows all the measurements of the different conditions. Finally, photographs illustrating some of the failures that were encountered during the Structural Durability Test are included.

ARBOC - TEST BUS #0812

MILEAGE DRIVEN/RECORDED FROM DRIVER'S LOGS

DATE	TOTAL DURABILITY TRACK	TOTAL OTHER MILES	TOTAL
9/08/2008 TO 09/14/08	456.00	70.00	526.00
9/15/08 TO 09/21/08	52.00	52.00	104.00
9/22/08 TO 09/28/08	264.00	63.00	327.00
9/29/08 TO 10/05/08	282.00	14.00	296.00
10/06/08 TO 10/12/08	123.00	168.00	291.00
10/13/08 TO 10/19/08	416.00	242.00	658.00
10/20/08 TO 10/26/08	438.00	21.00	459.00
10/27/08 TO 11/02/08	333.00	14.00	347.00
11/03/08 TO 11/09/08	704.00	860.00	1564.00
11/10/08 TO 11/16/08	899.00	44.00	943.00
11/17/08 TO 11/23/08	801.00	134.00	935.00
11/24/08 TO 11/30/08	232.00	821.00	1053.00
TOTAL	5000.00	2503.00	7503.00

Table 4. Driving Schedule for Bus Operation on the Durability Test Track.

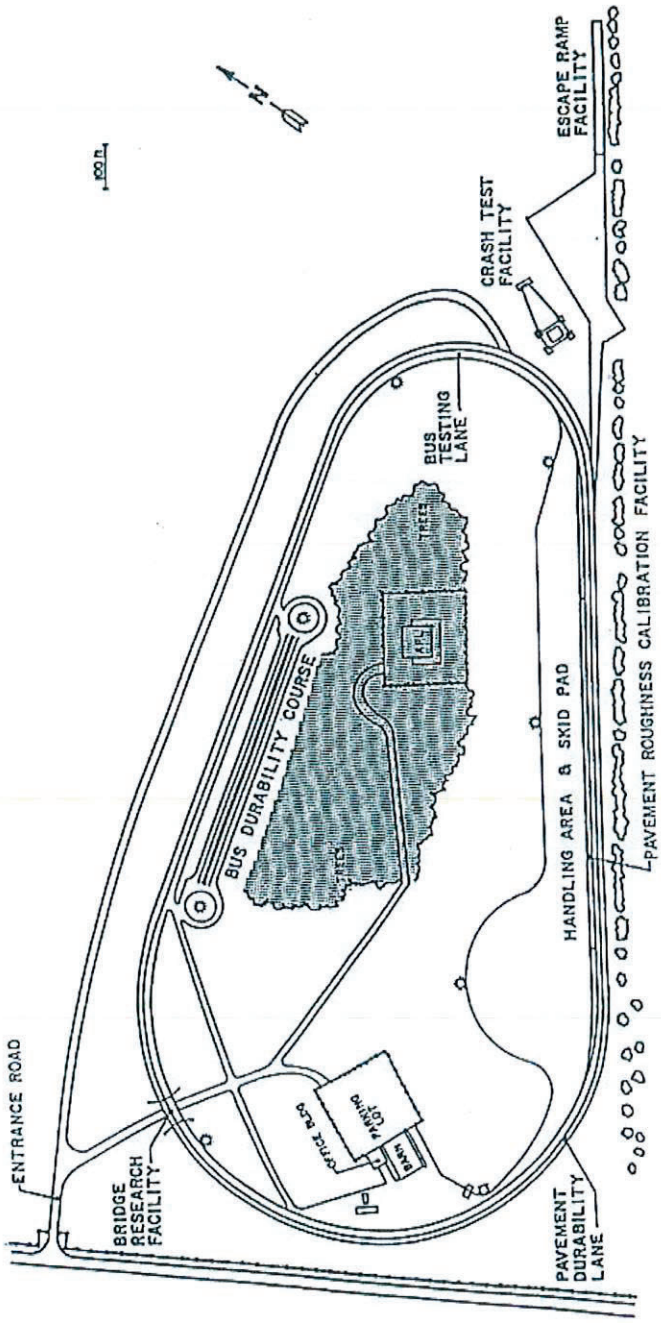
STANDARD OPERATING SCHEDULE

Monday through Friday

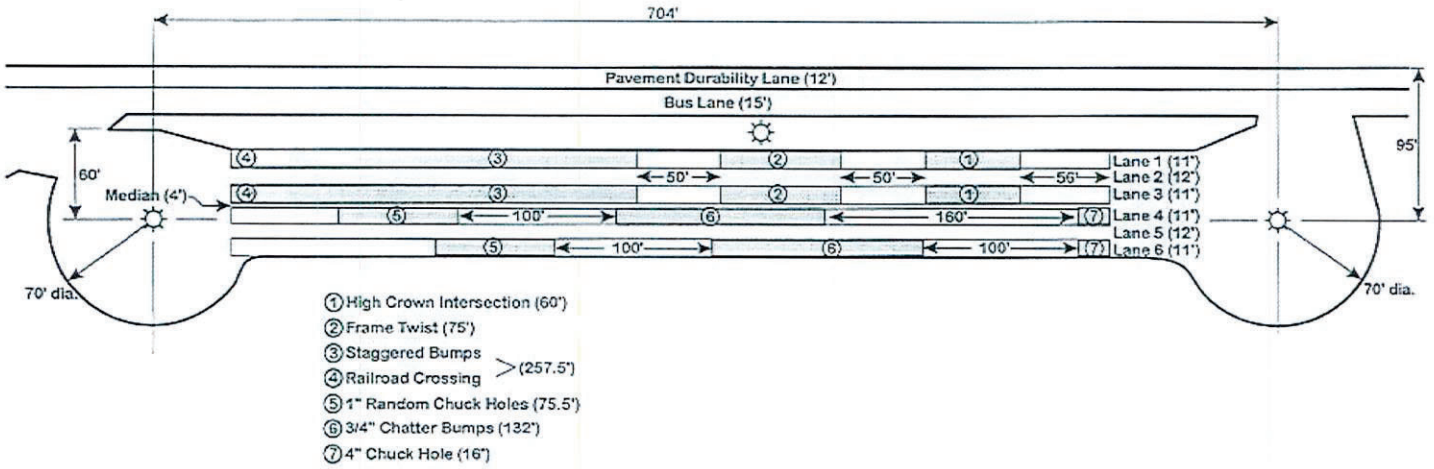
	HOUR	ACTION
Shift 1	midnight	D
	1:40 am	C
	1:50 am	B
	2:00 am	D
	3:35 am	C
	3:45 am	B
	4:05 am	D
	5:40 am	C
	5:50 am	B
	6:00 am	D
	7:40 am	C
	7:50 am	F
Shift 2	8:00 am	D
	9:40 am	C
	9:50 am	B
	10:00 am	D
	11:35 am	C
	11:45 am	B
	12:05 pm	D
	1:40 pm	C
	1:50 pm	B
	2:00 pm	D
	3:40 pm	C
	3:50 pm	F
Shift 3	4:00 pm	D
	5:40 pm	C
	5:50 pm	B
	6:00 pm	D
	7:40 pm	C
	7:50 pm	B
	8:05 pm	D
	9:40 pm	C
	9:50 pm	B
	10:00 pm	D
	11:40 pm	C
	11:50 pm	F

B—Break
C----Cycle all systems five times, visual inspection, driver's log entries
D—Drive bus as specified by procedure
F----Fuel bus, complete driver's log shift entries

"PLAN VIEW OF PENN STATE BUS TESTING AND RESEARCH FACILITY"



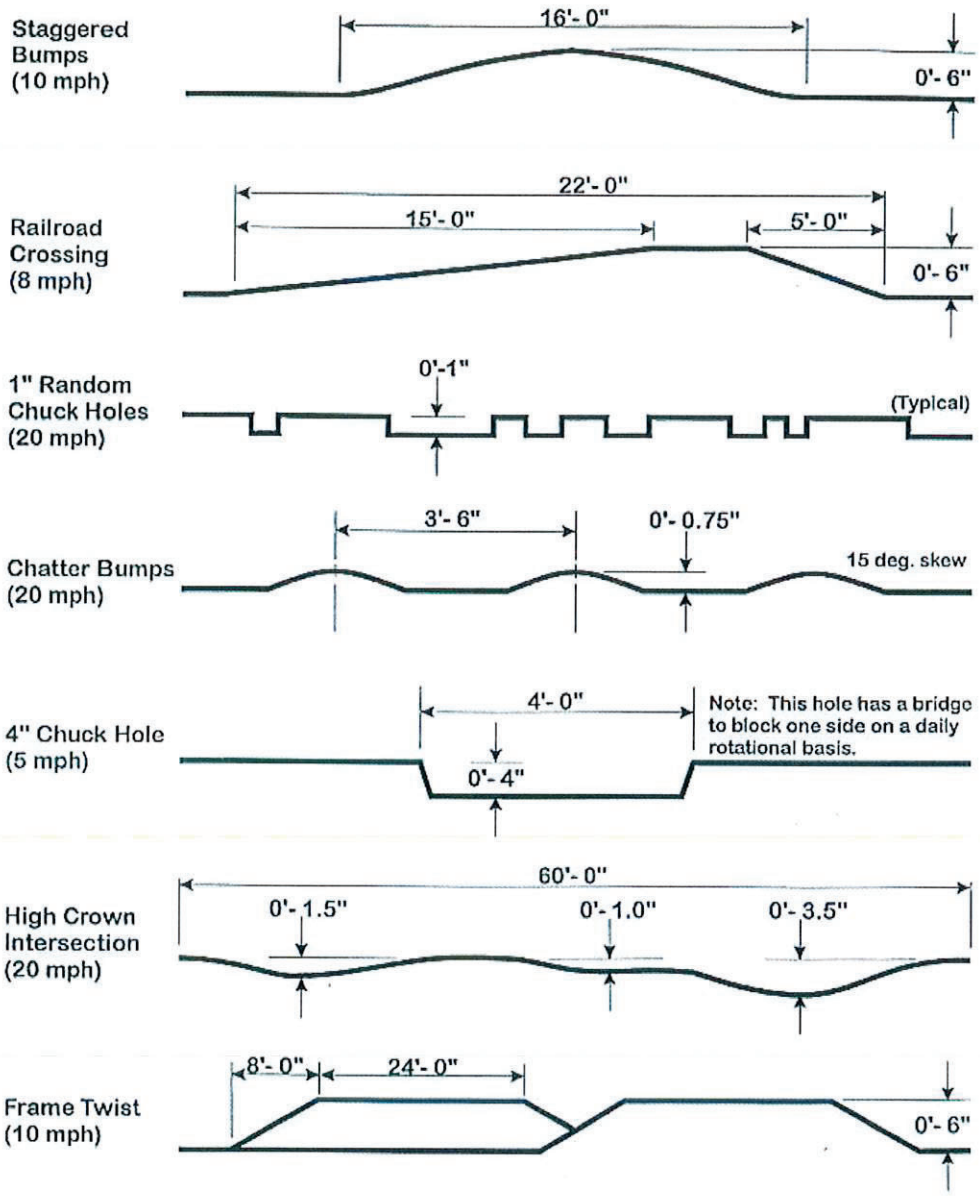
BUS TESTING AND RESEARCH TEST TRACK
UNIVERSITY PARK, PA



Plan View

Vehicle Durability Test Track

The Pennsylvania Transportation Institute
Penn State



Durability Element Profiles

The Pennsylvania Transportation Institute
Penn State

(Page 1 of 5)

UNSCHEDULED MAINTENANCE

ARBOC Bus #0812

DATE	TEST MILES	SERVICE	ACTIVITY	MAN HOURS	DOWN TIME
09-12-08	482	Both rear sway bar brackets are loose.	Replaced broken mounting bolts.	2.00	1.00
09-19-08	630	The trailing arm bushings are worn.	Replaced trailing arm bushings.	12.00	4.00
09-22-08	630	Both frame rails are cracked in the rear wheel well area. Twenty-two incomplete frame spot welds were found.	Welded/repaired both frame cracks. Rewelded 22 incomplete spot welds on the frame; 19 on the left side and 12 on the right side. Replaced both rear air bags with bases 2 5/8" higher. Repaired small crack at the forward, lower corner of the entrance door and added gusset.	10.00	123.00
09-26-08	630	The left rear sway bar bracket is broken.	Replaced left rear sway bar bracket.	1.50	47.00
09-29-08	1,059	Two bolts are missing from the right side engine mount.	Realigned engine mount and installed new bolts and nuts.	2.00	3.00
10-01-08	1,214	The air system will not build air. Air is exhausting out of the relief valve onto the air control board.	Manufacturer requests oil type be changed. Oil changed and control board replaced.	4.00	36.00
10-07-08	1,253	Air compressor is running, will not build air. Pressure relief valve is exhausting on the Hadley unit.	Replaced Hadley unit.	8.00	126.00

UNSCHEDULED MAINTENANCE

ARBOC Bus #0812

DATE	TEST MILES	SERVICE	ACTIVITY	MAN HOURS	DOWN TIME
10-07-08	1,253	The bushings are worn on the lower trailing arms.	Replaced lower trailing arms.	4.00	2.00
10-13-08	1,771	The welds are cracked on the trailing arm hangers at the rear axle.	Welded/repaired trailing arm hangers cracks.	2.00	4.00
10-14-08	1,988	The rear sway bar clamp bolt is broken at the right lower position.	Replaced bolt, nut and washer.	1.00	1.00
10-15-08	2,146	The battery and battery box are loose.	Installed new fasteners in battery box. Battery box is broken. Ordered new battery box.	3.00	2.00
10-20-08	2,202	The right rear air bag pedestal is broken in two at the sway bar clamp area. The air bag is gent and the way bar clamp is bent.	Replaced air bag pedestal, tie bar, sway bar bushing.	5.00	70.00
10-20-08	2,202	The weld is broken on the left rear suspension hanger.	Welded/repaired suspension hanger.	1.00	1.00
10-21-08	2,384	The left rear sway bar link is broken.	Replaced left rear sway bar link.	2.00	2.00
10-21-08	2,384	The left rear outside tire is flat.	Plugged/repaired left rear outside tire.	2.00	2.00
10-22-08	2,585	The right front sway bar link is broken.	Replaced right front sway bar link.	0.50	2.00

UNSCHEDULED MAINTENANCE

ARBOC Bus #0812

DATE	TEST MILES	SERVICE	ACTIVITY	MAN HOURS	DOWN TIME
10-23-08	2,659	Bus is leaning to the left rear. Rear leveling valve flipped 180 degrees and hung up on emergency brake cable.	Wrapped emergency brake cable tie out of interference with leveling valve and replaced broken bolt in leveling valve.	4.00	2.00
10-28-08 and 10-29-08	2,661	The right rear air bag pedestal is broken causing damage to the right rear sway bar bracket and the air bag tie bar.	Replaced right rear air bag pedestal and right rear sway bar bracket.	15.00	118.00
10-30-08	2,786	The grill fell out.	Repaired grill mounting points with angle brackets. Remounted grill.	1.00	1.00
10-30-08	2,786	The left front marker lamp is burned out.	Replaced left front marker lamp.	0.25	0.25
10-30-08	2,786	New battery box arrived (battery box repaired on 10/15/08).	Replaced damaged battery box.	1.75	4.00
11-03-08	3,008	The left rear sway bar clamp is bent and the lower mounting bolt is missing.	Replaced clamp, bushing and mounting bolts.	1.00	0.50
11-03-08	3,008	The air suspension will not rise after kneeling.	Troubleshooted. Repaired broken wire at the door function switch.	4.00	13.00
11-05-08	3,409	The grill fell off.	Repaired grill mounts and reinstalled grill.	1.00	0.50

UNSCHEDULED MAINTENANCE

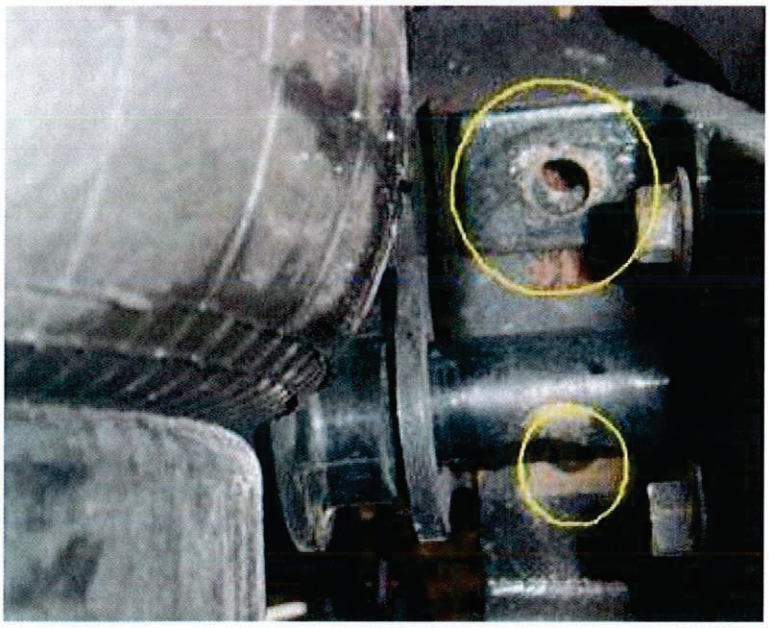
ARBOC Bus #0812

DATE	TEST MILES	SERVICE	ACTIVITY	MAN HOURS	DOWN TIME
11-05-08	3,409	The right side exterior rear view mirror is loose.	Disassembled mirror, drilled mounting holes out to 1/4" and larger bolts used for installation.	2.00	2.00
11-11-08	4,886	Front sway bar–left sway bar clamp is broken.	Replaced left sway bar clamp and bolts.	1.00	4.00
11-12-08	5,071	The rear lateral bar mount is cracked.	Replaced rear lateral bar mount.	2.00	3.00
11-13-08	5,291	Front sway bar; the left side bushing link is broken.	Replaced sway bar link/bushing.	1.00	2.00
11-17-08	5,515	The frame by the left rear wheel is cracked.	Welded/repaired crack and added plate.	2.50	8.00
11-17-08	5,515	The front bumper brackets are broken.	Welded/repaired front bumper brackets.	2.50	1.00
11-21-08	6,402	The left front sway bar link is broken.	Manufacturer requests temporary repair with all thread until replacement parts arrive.	2.00	4.00
11-24-08	6,450	The left front sway bar link is broken.	Replaced left front sway bar link.	1.00	10.00

UNSCHEDULED MAINTENANCE
ARBOC Bus #0812

DATE	TEST MILES	SERVICE	ACTIVITY	MAN HOURS	DOWN TIME
11-24-08	6,450	The left rear sway bar clamp is missing one mounting bolt.	Replaced missing bolt.	1.00	0.50
11-24-08	6,450	The battery tray is missing two mounting bolts.	Removed tray to install mounting bolts. Installed bolts and replaced tray.	1.00	0.50

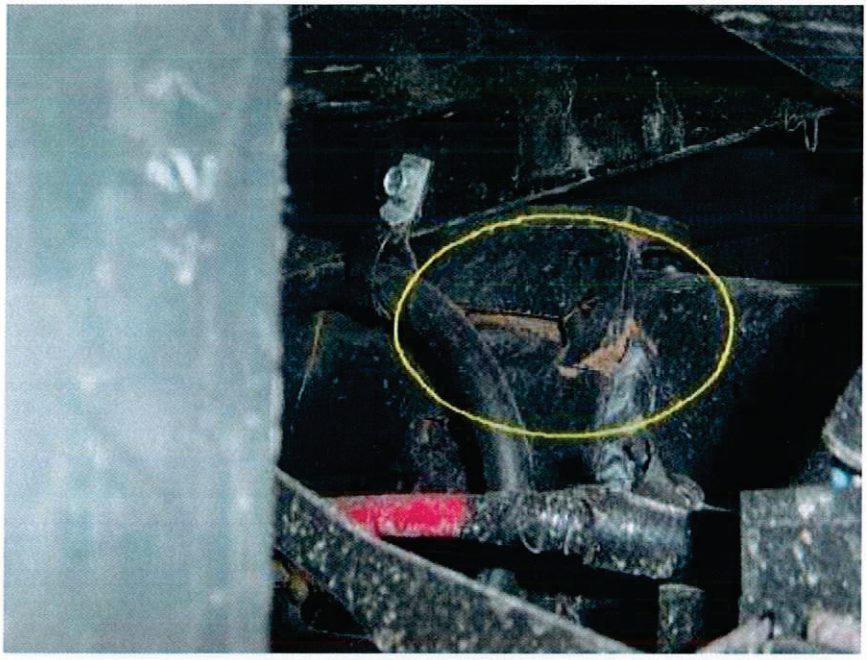
UNSCHEDULED MAINTENANCE



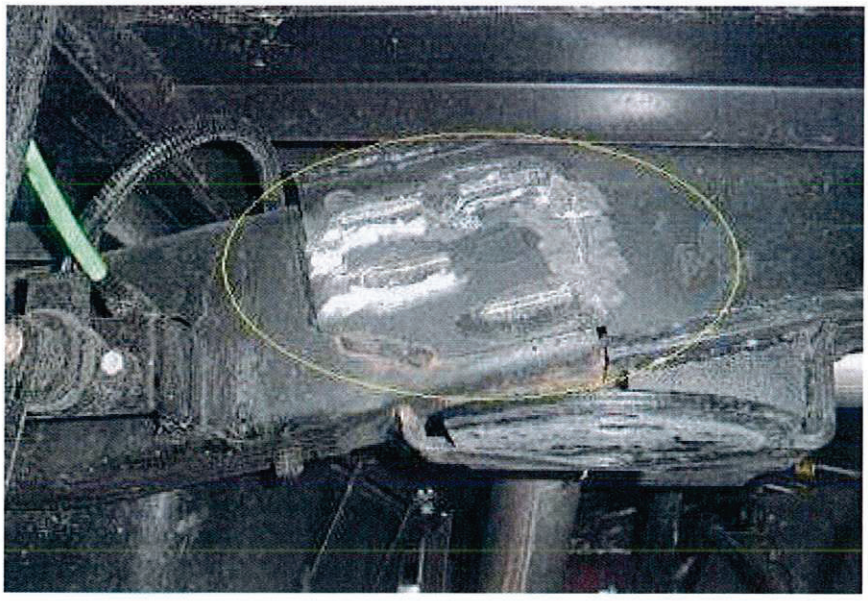
LOOSE REAR SWAY BAR BRACKET BOLTS REPLACED
(482 TEST MILES)

WORN TRAILING ARM BUSHING
(630 TEST MILES)

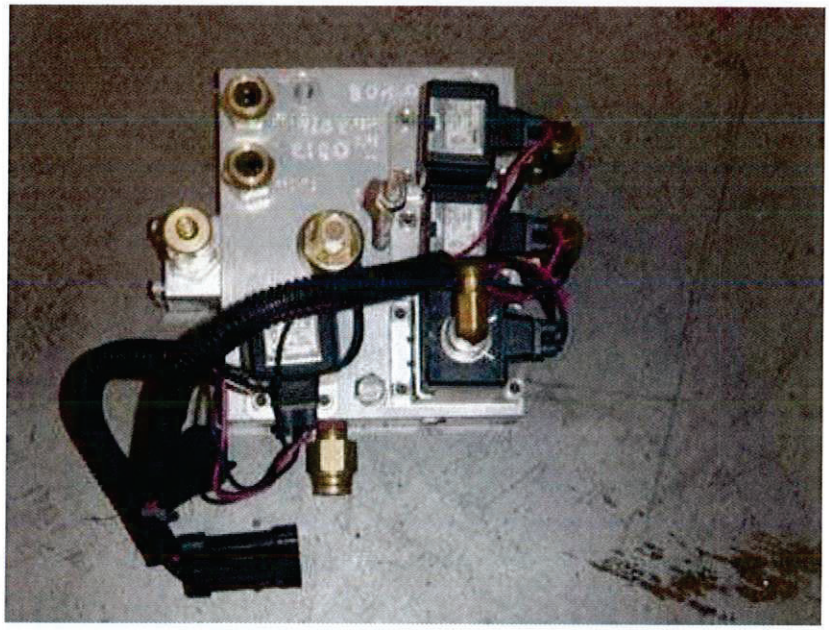
UNSCHEDULED MAINTENANCE CONT.



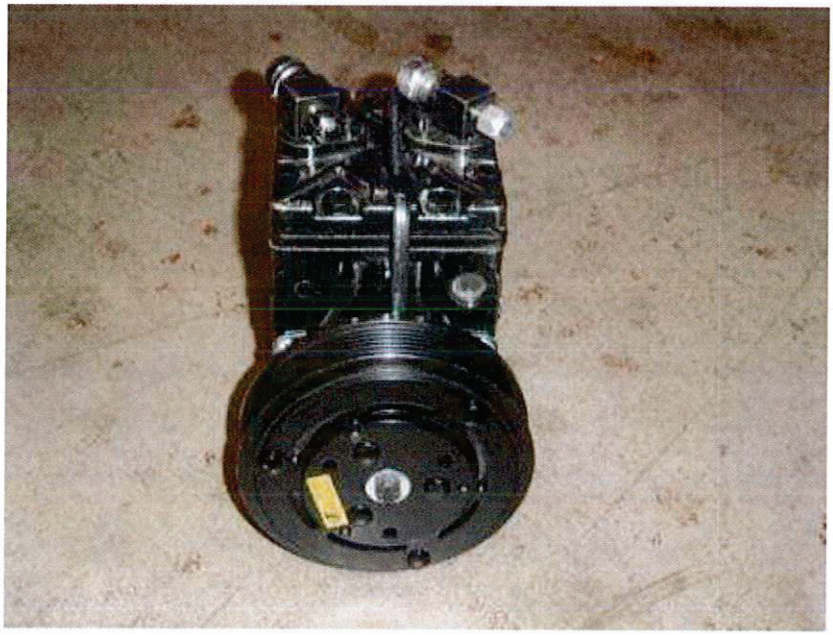
CRACKED FRAME RAIL
(630 TEST MILES)



UNSCHEDULED MAINTENANCE CONT.

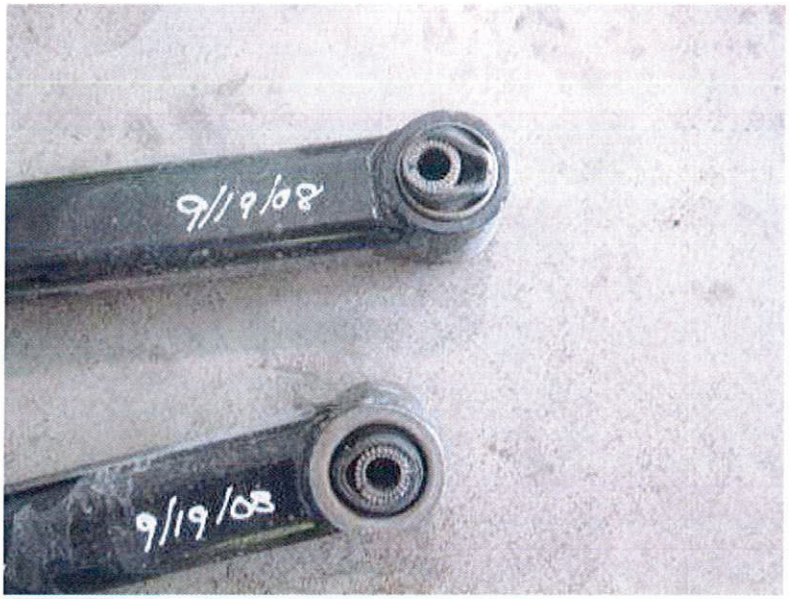


FAILED AIR CONTROL BOARD
(1,214 TEST MILES)

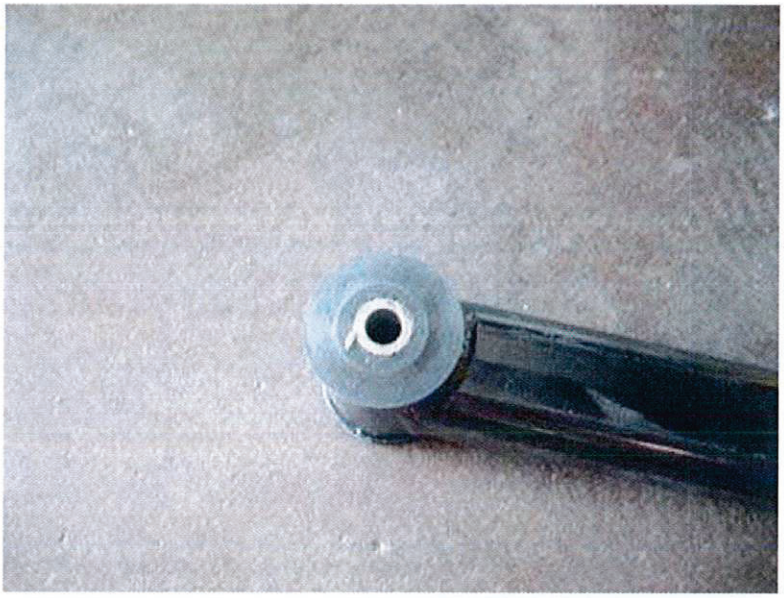


FAILED AIR COMPRESSOR
(1,253 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.

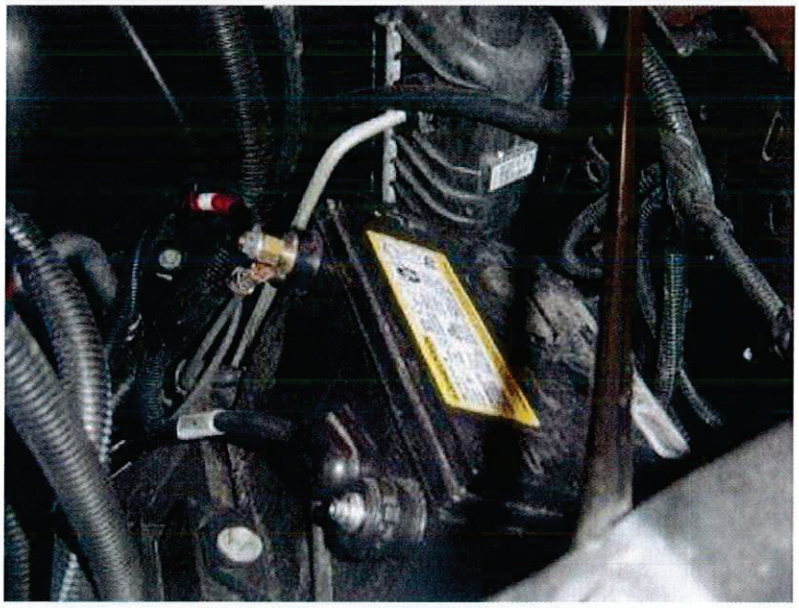


WORN BUSHINGS IN LOWER TRAILING ARMS
(1,253 TEST MILES)



TRAILING ARMS INSTALLED WITH NEW TYPE BUSHING
(1,253 TEST MILES)

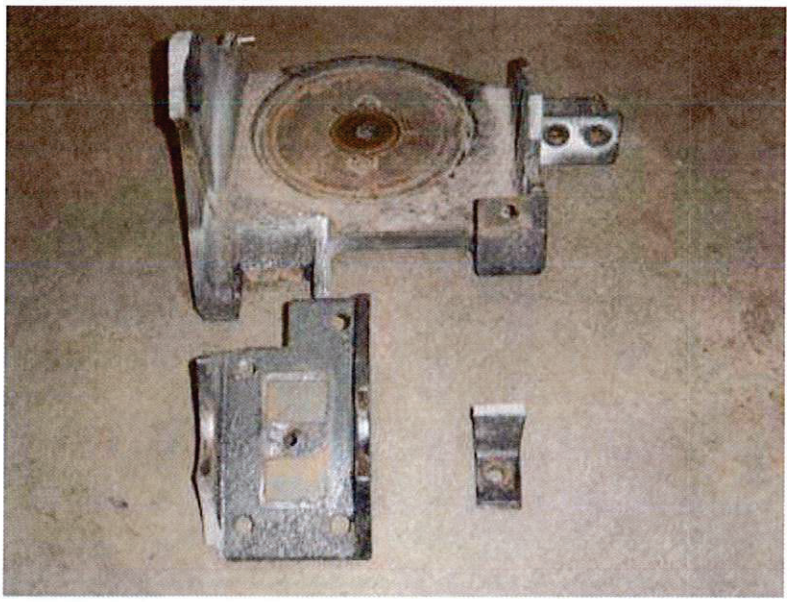
UNSCHEDULED MAINTENANCE CONT.



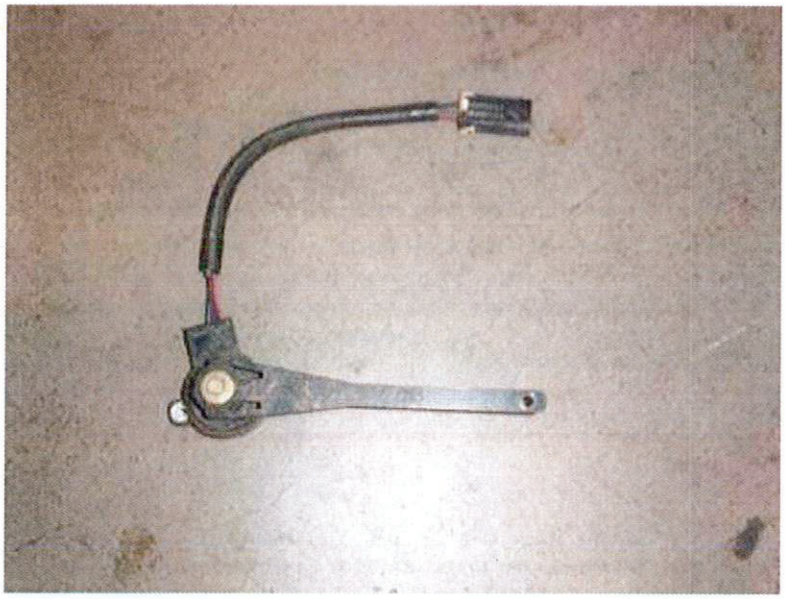
LOOSE BATTERY AND BATTERY BOX
(2,146 TEST MILES)

BROKEN RIGHT REAR AIR BAG PEDESTAL
(2,202 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.



BROKEN RIGHT REAR AIR BAG PEDESTAL
(2,202 TEST MILES)



FAILED LEVELING VALVE
(2,659 TEST MILES)

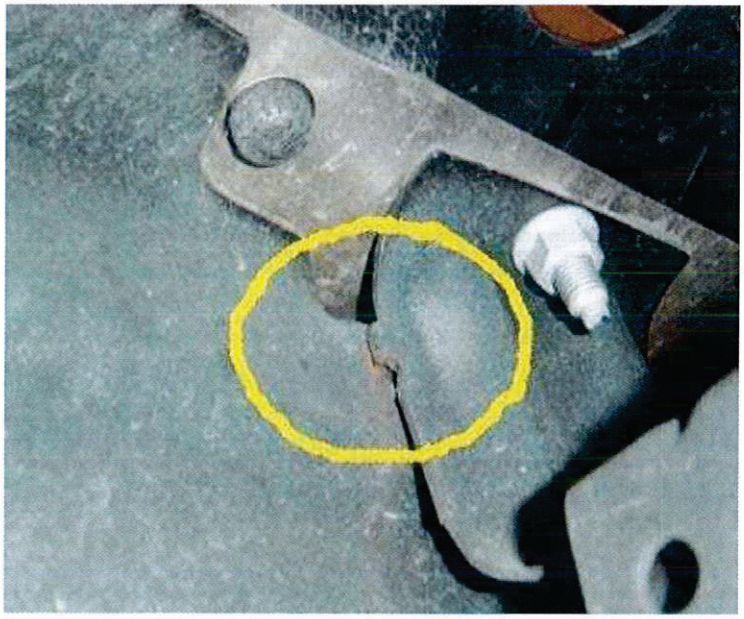
UNSCHEDULED MAINTENANCE CONT.

BROKEN RIGHT REAR AIR BAG PEDESTAL
(2,661 TEST MILES)

GRILL FELL OFF
(3,409 TEST MILES)

UNSCHEDULED MAINTENANCE

CRACKED REAR LATERAL BAR MOUNT
(5,071 TEST MILES)



BROKEN FRONT BUMPER BRACKET
(5,515 TEST MILES)

6. FUEL ECONOMY TEST - A FUEL CONSUMPTION TEST USING AN APPROPRIATE OPERATING CYCLE

6-I. TEST OBJECTIVE

The objective of this test is to provide accurate comparable fuel consumption data on transit buses produced by different manufacturers. This fuel economy test bears no relation to the calculations done by the Environmental Protection Agency (EPA) to determine levels for the Corporate Average Fuel Economy Program. EPA's calculations are based on tests conducted under laboratory conditions intended to simulate city and highway driving. This fuel economy test, as designated here, is a measurement of the fuel expended by a vehicle traveling a specified test loop under specified operating conditions. The results of this test will not represent actual mileage but will provide data that can be used by recipients to compare buses tested by this procedure.

6-II. TEST DESCRIPTION

This test requires operation of the bus over a course based on the Transit Coach Operating Duty Cycle (ADB Cycle) at seated load weight using a procedure based on the Fuel Economy Measurement Test (Engineering Type) For Trucks and Buses: SAE 1376 July 82. The procedure has been modified by elimination of the control vehicle and by modifications as described below. The inherent uncertainty and expense of utilizing a control vehicle over the operating life of the facility is impractical.

The fuel economy test will be performed as soon as possible (weather permitting) after the completion of the GVW portion of the structural durability test. It will be conducted on the bus test lane at the Penn State Test Facility. Signs are erected at carefully measured points which delineate the test course. A test run will comprise 3 CBD phases, 2 Arterial phases, and 1 Commuter phase. An electronic fuel measuring system will indicate the amount of fuel consumed during each phase of the test. The test runs will be repeated until there are at least two runs in both the clockwise and counterclockwise directions in which the fuel consumed for each run is within ± 4 percent of the average total fuel used over the 4 runs. A 20-minute idle consumption test is performed just prior to and immediately after the driven portion of the fuel economy test. The amount of fuel consumed while operating at normal/low idle is recorded on the Fuel Economy Data Form. This set of four valid runs along with idle consumption data comprise a valid test.

The test procedure is the ADB cycle with the following four modifications:

1. The ADB cycle is structured as a set number of miles in a fixed time in the following order: CBD, Arterial, CBD, Arterial, CBD, and Commuter. A separate idle fuel consumption measurement is performed at the beginning and end of the fuel economy test. This phase sequence permits the reporting of fuel consumption for each of these phases separately, making the data more useful to bus manufacturers and transit properties.

2. The operating profile for testing purposes shall consist of simulated transit type service at seated load weight. The three test phases (figure 6-1) are: a central business district (CBD) phase of 2 miles with 7 stops per mile and a top speed of 20 mph; an arterial phase of 2 miles with 2 stops per mile and a top speed of 40 mph; and a commuter phase of 4 miles with 1 stop and a maximum speed of 40 mph. At each designated stop the bus will remain stationary for seven seconds. During this time, the passenger doors shall be opened and closed.

3. The individual ADB phases remain unaltered with the exception that 1 mile has been changed to 1 lap on the Penn State Test Track. One lap is equal to 5,042 feet. This change is accommodated by adjusting the cruise distance and time.

4. The acceleration profile, for practical purposes and to achieve better repeatability, has been changed to "full throttle acceleration to cruise speed".

Several changes were made to the Fuel Economy Measurement Test (Engineering Type) For Trucks and Buses: SAE 1376 July 82:

1. Sections 1.1, and 1.2 only apply to diesel, gasoline, methanol, and any other fuel in the liquid state (excluding cryogenic fuels).

1.1 SAE 1376 July 82 requires the use of at least a 16-gal fuel tank. Such a fuel tank when full would weigh approximately 160 lb. It is judged that a 12-gal tank weighing approximately 120 lb will be sufficient for this test and much easier for the technician and test personnel to handle.

1.2 SAE 1376 July 82 mentions the use of a mechanical scale or a flowmeter system. This test procedure uses a load cell readout combination that provides an accuracy of 0.5 percent in weight and permits on-board weighing of the gravimetric tanks at the end of each phase. This modification permits the determination of a fuel economy value for each phase as well as the overall cycle.

2. Section 2.1 applies to compressed natural gas (CNG), liquefied natural gas (LNG), cryogenic fuels, and other fuels in the vapor state.

2.1 A laminar type flowmeter will be used to determine the fuel consumption. The pressure and temperature across the flow element will be monitored by the flow computer. The flow computer will use this data to calculate the gas flow rate. The flow computer will also display the flow rate (scfm) as well as the total fuel used (scf). The total fuel used (scf) for each phase will be recorded on the Fuel Economy Data Form.

3. Use both Sections 1 and 2 for dual fuel systems.

FUEL ECONOMY CALCULATION PROCEDURE

A. For diesel, gasoline, methanol and fuels in the liquid state.

The reported fuel economy is based on the following: measured test quantities--distance traveled (miles) and fuel consumed (pounds); standard reference values--density of water at 60EF (8.3373 lbs/gal) and volumetric heating value of standard fuel; and test fuel specific gravity (unitless) and volumetric heating value (BTU/gal). These combine to give a fuel economy in miles per gallon (mpg) which is corrected to a standard gallon of fuel referenced to water at 60EF. This eliminates fluctuations in fuel economy due to fluctuations in fuel quality. This calculation has been programmed into a computer and the data processing is performed automatically.

The fuel economy correction consists of three steps:

1.) Divide the number of miles of the phase by the number of pounds of fuel consumed

phase	miles per phase	total miles per run
CBD	1.9097	5.7291
ART	1.9097	3.8193
COM	3.8193	3.8193

$$\mathbf{FEo_{mi/lb}} = \text{Observed fuel economy} = \frac{\text{miles}}{\text{lb of fuel}}$$

2.) Convert the observed fuel economy to miles per gallon [mpg] by multiplying by the specific gravity of the test fuel Gs (referred to water) at 60°F and multiply by the density of water at 60°F

$$\mathbf{FEo_{mpg}} = \mathbf{FEc_{mi/lb}} \times Gs \times Gw$$

where **Gs** = Specific gravity of test fuel at 60°F (referred to water)
Gw = 8.3373 lb/gal

3.) Correct to a standard gallon of fuel by dividing by the volumetric heating value of the test fuel (H) and multiplying by the volumetric heating value of standard reference fuel (Q). Both heating values must have the same units.

$$\mathbf{FEc} = \mathbf{FEo_{mpg}} \times \frac{Q}{H}$$

where

H = Volumetric heating value of test fuel [BTU/gal]
Q = Volumetric heating value of standard reference fuel

Combining steps 1-3 yields

$$\Rightarrow FEc = \frac{miles}{lbs} \times (Gs \times Gw) \times \frac{Q}{H}$$

4.) Covert the fuel economy from mpg to an energy equivalent of miles per BTU. Since the number would be extremely small in magnitude, the energy equivalent will be represented as miles/BTUx10^6.

Eq = Energy equivalent of converting mpg to mile/BTUx10^6.

$Eq = ((mpg)/(H))x10^6$

B. CNG, LNG, cryogenic and other fuels in the vapor state.

The reported fuel economy is based on the following: measured test quantities--distance traveled (miles) and fuel consumed (scf); density of test fuel, and volumetric heating value (BTU/lb) of test fuel at standard conditions (P=14.73 psia and T=60°F). These combine to give a fuel economy in miles per lb. The energy equivalent

(mile/BTUx10^6) will also be provided so that the results can be compared to buses that use other fuels.

1.) Divide the number of miles of the phase by the number of standard cubic feet (scf) of fuel consumed.

phase	miles per phase	total miles per run
CBD	1.9097	5.7291
ART	1.9097	3.8193
COM	3.8193	3.8193

$$\mathbf{FEo_{mi/scf}} = \text{Observed fuel economy} = \frac{\text{miles}}{\text{scf of fuel}}$$

2.) Convert the observed fuel economy to miles per lb by dividing FEo by the density of the test fuel at standard conditions (Lb/ft^3).

Note: The density of test fuel must be determined at standard conditions as described above. If the density is not defined at the above standard conditions, then a correction will be needed before the fuel economy can be calculated.

$$\mathbf{FEo_{mi/lb}} = FEo / Gm$$

where Gm = Density of test fuel at standard conditions

3.) Convert the observed fuel economy (FEomi/lb) to an energy equivalent of (miles/BTUx10^6) by dividing the observed fuel economy (FEomi/lb) by the heating value of the test fuel at standard conditions.

$$Eq = ((FEomi/lb)/H)x10^6$$

where

Eq = Energy equivalent of miles/lb to mile/BTUx10^6
H = Volumetric heating value of test fuel at standard conditions

6-III. DISCUSSION

This is a comparative test of fuel economy using gasoline fuel with a heating value of 20,025.0 btu/lb. The driving cycle consists of Central Business District (CBD), Arterial (ART), and Commuter (COM) phases as described in 6-II. The fuel consumption for each driving cycle and for idle is measured separately. The results are corrected to a reference fuel with a volumetric heating value of 127,700.0 btu/gal.

An extensive pretest maintenance check is made including the replacement of all lubrication fluids. The details of the pretest maintenance are given in the first three Pretest Maintenance Forms. The fourth sheet shows the Pretest Inspection. The next sheet shows the correction calculation for the test fuel. The next four Fuel Economy Forms provide the data from the four test runs. Finally, the summary sheet provides the average fuel consumption. The overall average is based on total fuel and total mileage for each phase. The overall average fuel consumption values were; CBD – 4.35 mpg, ART – 4.77 mpg, and COM – 7.84 mpg. Average fuel consumption at idle was 1.59 gal/hr.

FUEL ECONOMY PRE-TEST MAINTENANCE FORM

Bus Number: 0812	Date: 12-4-08	SLW (lbs): 11,800
Personnel: S.C. & T.S.		

FUEL SYSTEM	OK	Date	Initials
Install fuel measurement system	✓	12/4/08	S.C.
Replace fuel filter	✓	12/4/08	T.S.
Check for fuel leaks	✓	12/4/08	S.C.
Specify fuel type (refer to fuel analysis)	Gasoline		
Remarks: None noted.			
BRAKES/TIRES	OK	Date	Initials
Inspect hoses	✓	12/4/08	S.C.
Inspect brakes	✓	12/4/08	S.C.
Relube wheel bearings	✓	12/4/08	T.S.
Check tire inflation pressures (mfg. specs.)	✓	12/4/08	T.S.
Remarks: None noted.			
COOLING SYSTEM	OK	Date	Initials
Check hoses and connections	✓	12/4/08	S.C.
Check system for coolant leaks	✓	12/4/08	S.C.
Remarks: None noted.			

FUEL ECONOMY PRE-TEST MAINTENANCE FORM (page 2)

Bus Number: 0812	Date: 12-4-80
Personnel: S.C. & T.S.	

ELECTRICAL SYSTEMS	OK	Date	Initials
Check battery	✓	12/4/08	S.C.
Inspect wiring	✓	12/4/08	S.C.
Inspect terminals	✓	12/4/08	S.C.
Check lighting	✓	12/4/08	S.C.
Remarks: None noted.			

DRIVE SYSTEM	OK	Date	Initials
Drain transmission fluid	✓	12/4/08	T.S.
Replace filter/gasket	✓	12/4/08	T.S.
Check hoses and connections	✓	12/4/08	T.S.
Replace transmission fluid	✓	12/4/08	T.S.
Check for fluid leaks	✓	12/4/08	T.S.
Remarks: None noted.			

LUBRICATION	OK	Date	Initials
Drain crankcase oil	✓	12/4/08	T.S.
Replace filters	✓	12/4/08	T.S.
Replace crankcase oil	✓	12/4/08	T.S.
Check for oil leaks	✓	12/4/08	T.S.
Check oil level	✓	12/4/08	T.S.
Lube all chassis grease fittings	✓	12/4/08	T.S.
Lube universal joints	✓	12/4/08	T.S.
Replace differential lube including axles	✓	12/4/08	T.S.
Remarks: None noted.			

FUEL ECONOMY PRE-TEST MAINTENANCE FORM (page 3)

Bus Number: 0812	Date: 12-4-08
Personnel: S.C. & T.S.	

EXHAUST/EMISSION SYSTEM	OK	Date	Initials
Check for exhaust leaks	✓	12/4/08	S.C.
Remarks: None noted.			

ENGINE	OK	Date	Initials
Replace air filter	✓	12/4/08	T.S.
Inspect air compressor and air system	✓	12/4/08	S.C.
Inspect vacuum system, if applicable	✓	12/4/08	S.C.
Check and adjust all drive belts	✓	12/4/08	T.S.
Check cold start assist, if applicable	✓	12/4/08	T.S.
Remarks: None noted.			

STEERING SYSTEM	OK	Date	Initials
Check power steering hoses and connectors	✓	12/4/08	S.C.
Service fluid level	✓	12/4/08	S.C.
Check power steering operation	✓	12/4/08	S.C.
Remarks: None noted.			

	OK	Date	Initials
Ballast bus to seated load weight	✓	12/4/08	S.C.

TEST DRIVE	OK	Date	Initials
Check brake operation	✓	12/4/08	S.C.
Check transmission operation	✓	12/4/08	S.C.
Remarks: None noted.			

FUEL ECONOMY PRE-TEST INSPECTION FORM

Bus Number: 0812	Date:
Personnel: S.C.	

PRE WARM-UP	If OK, Initial
Fuel Economy Pre-Test Maintenance Form is complete	S.C.
Cold tire pressure (psi): Front 80 Middle N/A Rear 80	S.C.
Tire wear:	S.C.
Engine oil level	S.C.
Engine coolant level	S.C.
Interior and exterior lights on, evaporator fan on	S.C.
Fuel economy instrumentation installed and working properly.	S.C.
Fuel line -- no leaks or kinks	S.C.
Speed measuring system installed on bus. Speed indicator installed in front of bus and accessible to TECH and Driver.	S.C.
Bus is loaded to SLW	S.C.
WARM-UP	**If OK, Initial**
Bus driven for at least one hour warm-up	S.C.
No extensive or black smoke from exhaust	S.C.
POST WARM-UP	**If OK, Initial**
Warm tire pressure (psi): Front 80 Middle N/A Rear 82	S.C.
Environmental conditions Average wind speed <12 mph and maximum gusts <15 mph Ambient temperature between 30°F(-1C°) and 90°F(32°C) Track surface is dry Track is free of extraneous material and clear of interfering traffic	S.C.

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 0812	Manufacturer: ARBOC	Date: 1-5-09
Run Number: 1	Personnel: M.R., T,.S. & S.C.	
Test Direction: ▫CW or ■CCW	Temperature (°F): 36	Humidity (%): 62
SLW (lbs): 11,800	Wind Speed (mph) & Direction: 10 / W	Barometric Pressure (in.Hg): 30.02

Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Load Cell Reading (lb)		Fuel Used (lbs)
	Start	Finish		Start	Start	Finish	
CBD #1	0	10:28	10:28	1.4	0	.455	.455
ART #1	0	4:21	4:21	1.4	0	.408	.408
CBD #2	0	10:36	10:36	1.6	0	.472	.472
ART #2	0	4:29	4:29	1.5	0	.415	.415
CBD #3	0	10:34	10:34	1.6	0	.445	.445
COMMUTER	0	5:51	5:51	1.6	0	.513	.513
						Total Fuel =	2.708 lbs

20 minute idle : Total Fuel Used = .572 lbs
Heating Value = 20,025.0 BTU/LB
Comments: 20 minute idle was performed with the passenger door closed so the engine would continue to run.
Engine shuts down with passenger door open.

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 0812	Manufacturer: ARBOC	Date: 1-5-09
Run Number: 2	Personnel: M.R., T.S. & S.C.	
Test Direction: ■CW or □CCW	Temperature (°F): 36	Humidity (%): 62
SLW (lbs): 11,800	Wind Speed (mph) & Direction: 7 / W	Barometric Pressure (in.Hg): 30.02

Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Load Cell Reading (lb)		Fuel Used (lbs)
	Start	Finish		Start	Start	Finish	
CBD #1	0	9:50	9:50	1.6	0	.450	.450
ART #1	0	4:18	4:18	1.8	0	.403	.403
CBD #2	0	9:30	9:30	1.8	0	.443	.443
ART #2	0	4:22	4:22	1.7	0	.411	.411
CBD #3	0	9:39	9:39	1.8	0	.452	.452
COMMUTER	0	5:53	5:53	1.8	0	.496	.496
							Total Fuel = 2.655 lbs

20 minute idle : Total Fuel Used = N/A lbs

Heating Value = 20,025.0 BTU/LB

Comments: None noted.

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 0812	Manufacturer: ARBOC	Date: 1-5-09
Run Number: 3	Personnel: M.R., T.S. & S.C.	
Test Direction: □CW or ■CCW	Temperature (°F): 38	Humidity (%): 62
SLW (lbs): 11,800	Wind Speed (mph) & Direction: 5 / W	Barometric Pressure (in.Hg): 30.02

Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Load Cell Reading (lb)		Fuel Used (lbs)
	Start	Finish		Start	Start	Finish	
CBD #1	0	10:24	10:24	2.1	0	.442	.442
ART #1	0	4:29	4:29	2.2	0	.412	.412
CBD #2	0	10:31	10:31	2.2	0	.452	.452
ART #2	0	4:31	4:31	2.4	0	.415	.415
CBD #3	0	10:20	10:20	2.4	0	.446	.446
COMMUTER	0	6:01	6:01	2.4	0	.491	.491
						Total Fuel = 2.658 lbs	

20 minute idle : Total Fuel Used = N/A lbs

Heating Value = 20,025.0 BTU/LB

Comments: None noted.

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 0812	Manufacturer: ARBOC	Date: 1-5-09
Run Number: 4	Personnel: M.R., T.S. & S.C.	
Test Direction: ■CW or □CCW	Temperature (°F): 38	Humidity (%): 62
SLW (lbs): 11,800	Wind Speed (mph) & Direction: 5 / W	Barometric Pressure (in.Hg): 30.02

Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Load Cell Reading (lb)		Fuel Used (lbs)
	Start	Finish		Start	Start	Finish	
CBD #1	0	9:54	9:54	2.4	0	.444	.444
ART #1	0	4:23	4:23	2.5	0	.407	.407
CBD #2	0	9:41	9:41	2.4	0	.455	.455
ART #2	0	4:19	4:19	2.5	0	.414	.414
CBD #3	0	9:44	9:44	2.5	0	.448	.448
COMMUTER	0	5:59	5:59	2.6	0	.498	.498
							Total Fuel = 2.666 lbs

20 minute idle : Total Fuel Used = .486 lbs

Heating Value = 20,025.0 BTU/LB

Comments: 20 minute idle was performed with the passenger door closed so the engine would continue to run.

Engine shuts down with passenger door open.

0812 .ful
FUEL ECONOMY SUMMARY SHEET

BUS MANUFACTURER :ARBOC BUS NUMBER :0812
BUS MODEL :Spirit of Mobility TEST DATE :01/05/09

FUEL TYPE : GASOLINE
SP. GRAVITY : .7400
HEATING VALUE : 20025.00 BTU/Lb
FUEL TEMPERATURE : 60.00 deg F
Standard Conditions : 60 deg F and 14.7 psi
Density of Water : 8.3373 lb/gallon at 60 deg F

CYCLE	TOTAL FUEL USED(GAL)	TOTAL MILES	FUEL ECONOMY MPG(Measured)	FUEL ECONOMY MPG (Corrected)
Run # :1, CCW				
CBD	1.372	5.73	4.176	4.28
ART	.823	3.82	4.642	4.76
COM	.513	3.82	7.446	7.64
TOTAL	2.708	13.37	4.937	5.06
Run # :2, CW				
CBD	1.345	5.73	4.260	4.37
ART	.814	3.82	4.693	4.81
COM	.496	3.82	7.702	7.90
TOTAL	2.655	13.37	5.036	5.16
Run # :3, CCW				
CBD	1.340	5.73	4.276	4.39
ART	.827	3.82	4.619	4.74
COM	.491	3.82	7.780	7.98
TOTAL	2.658	13.37	5.030	5.16
Run # :4, CW				
CBD	1.347	5.73	4.254	4.36
ART	.821	3.82	4.653	4.77
COM	.498	3.82	7.671	7.87
TOTAL	2.666	13.37	5.015	5.14

IDLE CONSUMPTION (MEASURED)

First 20 Minutes Data : .57GAL Last 20 Minutes Data : .49GAL
Average Idle Consumption : 1.59GAL/Hr

RUN CONSISTENCY: % Difference from overall average of total fuel used

Run 1 : -1.4 Run 2 : .6 Run 3 : .5 Run 4 : .2

SUMMARY (CORRECTED VALUES)

Average Idle Consumption : 1.55 G/Hr
Average CBD Phase Consumption : 4.35 MPG
Average Arterial Phase Consumption : 4.77 MPG
Average Commuter Phase Consumption : 7.84 MPG
Overall Average Fuel Consumption : 5.13 MPG
Overall Average Fuel Consumption : 41.54 Miles/ Million BTU

7. NOISE

7.1 INTERIOR NOISE AND VIBRATION TESTS

7.1-I. TEST OBJECTIVE

The objective of these tests is to measure and record interior noise levels and check for audible vibration under various operating conditions.

7.1-II. TEST DESCRIPTION

During this series of tests, the interior noise level will be measured at several locations with the bus operating under the following three conditions:

1. With the bus stationary, a white noise generating system shall provide a uniform sound pressure level equal to 80 dB(A) on the left, exterior side of the bus. The engine and all accessories will be switched off and all openings including doors and windows will be closed. This test will be performed at the ABTC.

2. The bus accelerating at full throttle from a standing start to 35 mph on a level pavement. All openings will be closed and all accessories will be operating during the test. This test will be performed on the track at the Test Track Facility.

3. The bus will be operated at various speeds from 0 to 55 mph with and without the air conditioning and accessories on. Any audible vibration or rattles will be noted. This test will be performed on the test segment between the Test Track and the Bus Testing Center.

All tests will be performed in an area free from extraneous sound-making sources or reflecting surfaces. The ambient sound level as well as the surrounding weather conditions will be recorded in the test data.

7.1-III. DISCUSSION

This test is performed in three parts. The first part exposes the exterior of the vehicle to 80.0 dB(A) on the left side of the bus and the noise transmitted to the interior is measured. The overall average of the six measurements was 52.0 dB(A); ranging from 50.2 dB(A) at the driver's seat to 54.1 dB(A) at the front passenger seats. The interior ambient noise level for this test was 34.1 dB(A).

The second test measures interior noise during acceleration from 0 to 35 mph. This noise level ranged from 68.0 dB(A) at the front passenger seats to 70.9 dB(A) at the driver's seat. The overall average was 69.7 dB(A). The interior ambient noise level for this test was 34.5 dB(A).

The third part of the test is to listen for resonant vibrations, rattles, and other noise sources while operating over the road. No vibrations or rattles were noted.

INTERIOR NOISE TEST DATA FORM
Test Condition 1: 80 dB(A) Stationary White Noise

Bus Number: 0812	Date: 7-30-08
Personnel: S.C. & E.D.	
Temperature (°F): 85	Humidity (%): 50
Wind Speed (mph): 5	Wind Direction: S
Barometric Pressure (in.Hg): 29.84	
Initial Sound Level Meter Calibration: ■ checked by: S.C.	
Interior Ambient Noise Level dB(A): 34.1	Exterior Ambient Noise Level dB(A): 51.1
Microphone Height During Testing (in): 48.0	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	50.2
Front Passenger Seats	54.1
In Line with Front Speaker	51.8
In Line with Middle Speaker	53.2
In Line with Rear Speaker	52.1
Rear Passenger Seats	50.6

Final Sound Level Meter Calibration: ■ checked by: S.C.

Comments: All readings taken in the center aisle.

INTERIOR NOISE TEST DATA FORM
Test Condition 2: 0 to 35 mph Acceleration Test

Bus Number: 0812	Date: 12-15-08
Personnel: T.S., E.D. & B.S.	
Temperature (°F): 49	Humidity (%): 81
Wind Speed (mph): 11	Wind Direction: SSW
Barometric Pressure (in.Hg): 30.17	
Initial Sound Level Meter Calibration: ▪ checked by: T.S.	
Interior Ambient Noise Level dB(A): 34.5	Exterior Ambient Noise Level dB(A): 46.6
Microphone Height During Testing (in): 48	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	70.9
Front Passenger Seats	68.0
Middle Passenger Seats	70.1
Rear Passenger Seats	69.8

Final Sound Level Meter Calibration: ▪ checked by: T.S.

Comments: All readings taken in the center aisle.

INTERIOR NOISE TEST DATA FORM
Test Condition 3: Audible Vibration Test

Bus Number: 0812	Date: 12-15-08
Personnel: T.S., E.D. & B.S.	
Temperature (°F): 49	Humidity (%): 81
Wind Speed (mph): 11	Wind Direction: SSW
Barometric Pressure (in.Hg): 30.17	

Describe the following possible sources of noise and give the relative location on the bus.

Source of Noise	Location
Engine and Accessories	None noted.
Windows and Doors	None noted.
Seats and Wheel Chair lifts	None noted.

Comment on any other vibration or noise source which may have occurred
that is not described above: None noted.

7.1 INTERIOR NOISE TEST

TEST BUS SET-UP FOR 80 dB(A)
INTERIOR NOISE TEST

7.2 EXTERIOR NOISE TESTS

7.2-I. TEST OBJECTIVE

The objective of this test is to record exterior noise levels when a bus is operated under various conditions.

7.2-II. TEST DESCRIPTION

In the exterior noise tests, the bus will be operated at a SLW in three different conditions using a smooth, straight and level roadway:

1. Accelerating at full throttle from a constant speed at or below 35 mph and just prior to transmission up shift.
2. Accelerating at full throttle from standstill.
3. Stationary, with the engine at low idle, high idle, and wide open throttle.

In addition, the buses will be tested with and without the air conditioning and all accessories operating. The exterior noise levels will be recorded.

The test site is at the PSBRTF and the test procedures will be in accordance with SAE Standards SAE J366b, Exterior Sound Level for Heavy Trucks and Buses. The test site is an open space free of large reflecting surfaces. A noise meter placed at a specified location outside the bus will measure the noise level.

During the test, special attention should be paid to:

1. The test site characteristics regarding parked vehicles, signboards, buildings, or other sound-reflecting surfaces
2. Proper usage of all test equipment including set-up and calibration
3. The ambient sound level

7.2-III. DISCUSSION

The Exterior Noise Test determines the noise level generated by the vehicle under different driving conditions and at stationary low and high idle, with and without air conditioning and accessories operating. The test site is a large, level, bituminous paved area with no reflecting surfaces nearby.

With an exterior ambient noise level of 46.8 dB(A), the average test result obtained while accelerating from a constant speed was 73.4 dB(A) on the right side and 74.6 dB(A) on the left side.

When accelerating from a standstill with an exterior ambient noise level of 46.4 dB(A), the average of the results obtained were 73.0 dB(A) on the right side and 74.0 dB(A) on the left side.

With the vehicle stationary and the engine, accessories, and air conditioning on, the measurements averaged 49.2 dB(A) at low idle, 53.6 dB(A) at high idle, and 69.5 dB(A) at wide open throttle. With the accessories and air conditioning off, the readings averaged 0.2 dB(A) higher at low idle, 0.7 dB(A) higher at high idle, and 0.2 dB(A) higher at wide open throttle. The exterior ambient noise level measured during this test was 46.9 dB(A).

EXTERIOR NOISE TEST DATA FORM
Accelerating from Constant Speed

Bus Number: 0812	Date: 12-15-08
Personnel: T.S., E.D. & B.S.	
Temperature (°F): 49	Humidity (%): 81
Wind Speed (mph): 11	Wind Direction: SSW
Barometric Pressure (in.Hg): 30.17	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ▪ checked by: S.C.	
Initial Sound Level Meter Calibration: ▪ checked by: S.C.	
Exterior Ambient Noise Level dB(A): 46.8	

Accelerating from Constant Speed Curb (Right) Side		Accelerating from Constant Speed Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	73.6	1	74.5
2	72.7	2	73.2
3	72.5	3	73.6
4	72.3	4	74.2
5	73.2	5	74.7
Average of two highest actual noise levels = 73.4 dB(A)		Average of two highest actual noise levels = 74.6 dB(A)	
Final Sound Level Meter Calibration Check: ▪ checked by: S.C.			
Comments: None noted.			

EXTERIOR NOISE TEST DATA FORM
Accelerating from Standstill

Bus Number: 0812	Date: 12-15-08
Personnel: T.S., E.D. & B.S.	
Temperature (°F): 49	Humidity (%): 81
Wind Speed (mph): 11	Wind Direction: SSW
Barometric Pressure (in.Hg): 30.17	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ▪ checked by: S.C.	
Initial Sound Level Meter Calibration: ▪ checked by: S.C.	
Exterior Ambient Noise Level dB(A): 46.4	

Accelerating from Standstill Curb (Right) Side		Accelerating from Standstill Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	73.0	1	73.7
2	72.2	2	73.7
3	71.8	3	73.5
4	71.9	4	73.5
5	73.0	5	74.2
Average of two highest actual noise levels = 73.0 dB(A)		Average of two highest actual noise levels = 74.0 dB(A)	

Final Sound Level Meter Calibration Check: ▪ checked by: S.C.
Comments: None noted.

EXTERIOR NOISE TEST DATA FORM
Stationary

Bus Number: 0812	Date: 12-15-08
Personnel: T.S., E.D. & B.S.	
Temperature (°F): 49	Humidity (%): 81
Wind Speed (mph): 11	Wind Direction: SSW
Barometric Pressure (in.Hg): 30.17	

Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■ checked by: S.C.

Initial Sound Level Meter Calibration: ■ checked by: S.C.

Exterior Ambient Noise Level dB(A): 46.9

Accessories and Air Conditioning ON

Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	500	49.1	49.2
High Idle	1,500	53.5	53.7
Wide Open Throttle	3,900	69.4	69.5

Accessories and Air Conditioning OFF

Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	500	49.5	49.2
High Idle	1,500	54.1	54.4
Wide Open Throttle	3,900	69.6	69.8

Final Sound Level Meter Calibration Check: ■ checked by: S.C.

Comments: None noted.

7.2 EXTERIOR NOISE TESTS

TEST BUS UNDERGOING EXTERIOR NOISE TESTS

HP LaserJet 400 color M451dn

HP Web Services

Enable HP Web Services

NOTE: HP Web Services requires the printer to be connected to a network.

1. Once the printer is connected to a network, enter the printer's network IP address into a Web browser. To find the printer's IP address, refer to the printer's user guide, or reprint this page after the printer is connected to the network.

2. On the Web page that appears, click on the HP Web Services tab.

3. Review and accept the terms of use, and then click the Enable button.

HP ePrint

Print from Anywhere

HP's free ePrint service provides an easy way to print from e-mail, anywhere and anytime. Simply attach a file to an e-mail, and send it to this printer's e-mail address. The attachment will print automatically on this printer. Supported attachment file types include .pdf, .jpg, .tif, and Microsoft Office(R) documents.

NOTE: Attachments may print differently than they appear in the software program which created them, depending on the original fonts and layout options used.

Your Printer is Protected

To help prevent unauthorized e-mail, HP assigns a random e-mail address to your printer, never publicizes this address, and by default does not respond to any sender. ePrint also provides industry-standard spam filtering and transforms e-mail and attachments to a print-only format to reduce the threat of a virus or other harmful content.

NOTE: The ePrint service does not filter e-mails based on content, so it cannot prevent objectionable or copyrighted material from being printed.

HP ePrintCenter

Use the HP ePrintCenter Web Site

Use HP's free ePrintCenter Web site to set up increased security for ePrint, specify the e-mail addresses that are allowed to send e-mail to your printer, get Print Apps (if available for your product), and access other free services.

- Go to the HP ePrintCenter Web site for more information and specific terms and conditions: www.hpePrintCenter.com

FOREST RIVER BUS

STARCRAFT | Allstar XL F550

Learn more at
forestriverbus.com/
Starcraft/Allstar-XL-F550

moving forward together.

Functionality + accessibility.

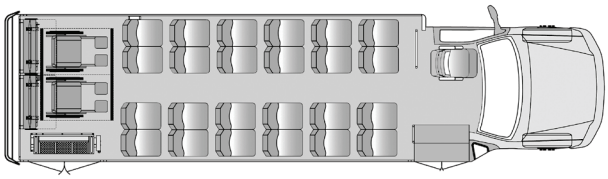
SAFETY. PERFORMANCE. DURABILITY.

The XL, one of Starcraft's largest shuttle buses, utilizes straight-side wall construction and features a wide aisle to maximize shoulder space, offering a spacious and comfortable experience for your passengers. The XL is engineered to accommodate a variety of seating arrangements, including wheelchair accessibility and numerous storage options for luggage. The roomy driver area allows easy maneuvering in and out of the driver's seat, and the transition window across from the driver provides increased visibility. Finally, with its rock-solid steel frame cage, the XL is designed for passenger comfort and safety.

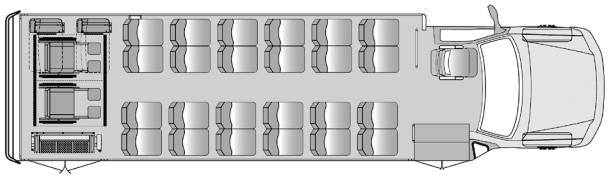
PASSENGERS	BUS LENGTH	BUS CHASSIS	WHEELCHAIR
Up to 33	28' - 32'	Ford 550	Side Access

Versatility + capacity options.

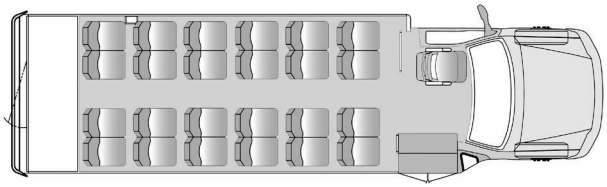
24 24 passenger + 2 wheelchair w/flip seats + driver



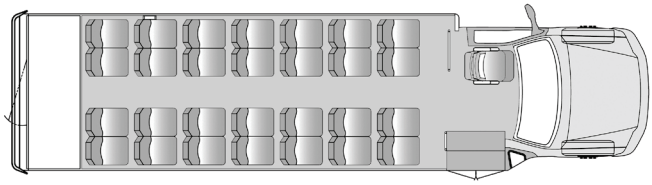
24 24 passenger + 2 wheelchair w/foldaway seats + driver



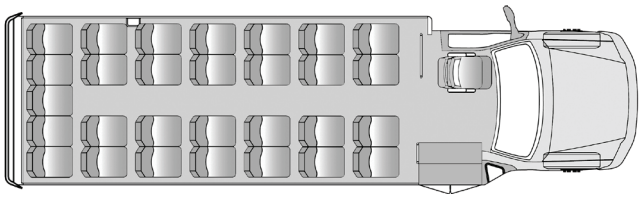
24 24 passenger w/rear luggage + driver



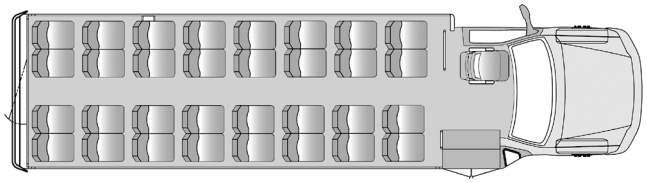
28 28 passenger w/rear luggage + driver



29 29 passenger + driver



32 32 passenger + driver



Specifications.

Length	28'	30'	32'
Wheelbase	205"	217"	238"
Chassis	Ford F550	Ford F550	Ford F550
Engine	7.3L Gas/6.7L Diesel	7.3L Gas/6.7L Diesel	7.3L Gas/6.7L Diesel
GVWR	19,500 lb.	19,500 lb.	19,500 lb.
Passenger Capacity*	25	29	33
Overall Width	96"	96"	96"
Overall Height	123"	123"	123"
Interior Width	93"	93"	93"
Interior Height	78"	78"	78"
Ground to Int. Floor	30.5"	30.5"	30.5"
Ground to 1st Step	10.5"	10.5"	10.5"
Step Riser	10"	10"	10"
Step Tread	11.5"	11.5"	11.5"
Step Width	35.75"	35.75"	35.75"
Entry Door Clear Opening w/One Grab Rail	31"	31"	31"
Entry Door Clear Opening w/Two Grab Rails	30"	30"	30"

*All passenger capacities are references and subject to final weight analysis

Features + options.

Standard Exterior Feature Highlights

- 96" wide exterior body
- Fully welded steel cage construction meeting all applicable FMVSS requirements
- "Starview" drivers visibility window in front of entry door
- Electric actuated passenger entry door with full length glass
- 36" wide x 36" high upper double T-Slider tempered safety glass windows with climate control tint
- Black powder coated steel rear bumper
- Rear mud flaps
- Pre-painted white aluminum side walls and skirts
- Fiberglass front and rear caps
- One-piece seamless FRP (fiberglass reinforced plastic) roof
- Breakaway rearview mirrors with convex
- Sealed LED stop, tail, and turn signal lights with LED reverse lights
- LED front and rear marker lights
- Exterior graphics package available in three colors (blue, green or burgundy)

Standard Interior Feature Highlights

- 93" interior width
- 80" interior floor to ceiling height with standard floor (raised floor is 75")
- Floor and wall seat track for flexible seating
- Black slip resistant floor covering
- 5/8" exterior grade plywood flooring
- Ceiling and rear wall fabric for sound abatement
- FRP (fiberglass reinforced plastic) sidewalls for ease of cleaning
- White step nosing
- 1.25" left hand vertical passenger assist rail at entry door
- Intermotive FlexTech Electrical System
- LED entry door step well lights
- LED driver and passenger area

Popular Option Highlights

- Stainless steel wheel inserts
- Luggage Storage areas (overhead luggage racks with reading lights, interior luggage racks, rear luggage area)
- Rear emergency door with window(s)
- Passenger area rear heat and air conditioning
- Complete rubber flooring
- Passenger grab rails
- Padded vinyl or cloth walls and ceiling
- Audio and video systems
- Mid back or high back seating
- ADA and FMVSS compliant wheel chair lifts and securement systems
- Fiberglass side walls and skirts

FOREST RIVER BUS

STARCRAFT | Allstar

Learn more at
forestriverbus.com/starcraft/allstar

moving forward together.

SAFETY. PERFORMANCE. DURABILITY.

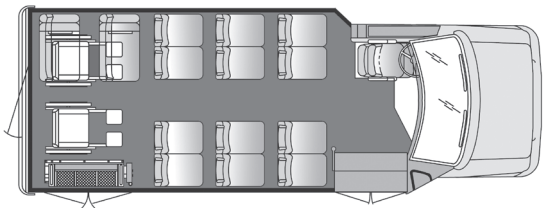
The Starcraft Allstar remains one of the best-selling shuttle buses in the market. Standard equipment includes a backup camera for safety and 4-inch low standard floor wheel wells for passenger seating comfort, making the Allstar a great addition to your fleet.

PASSENGERS	BUS LENGTH	BUS CHASSIS	WHEELCHAIR
17 - 25	21' - 25'	FORD E350/450	SIDE ACCESS

Versatility + capacity options.

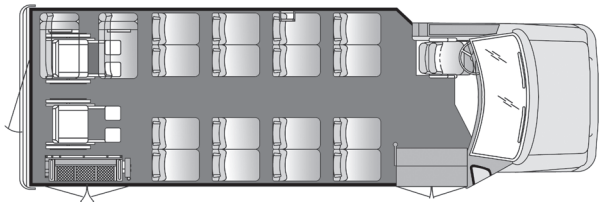
12

12 passenger + 2 wheelchair
w/foldaway seats + driver



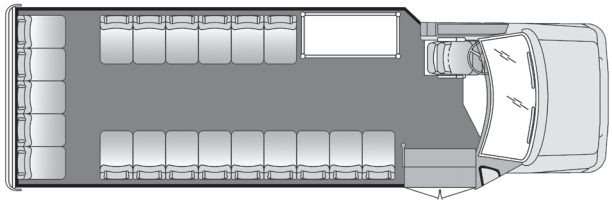
16

16 passenger + 2 wheelchair
w/foldaway seats + driver



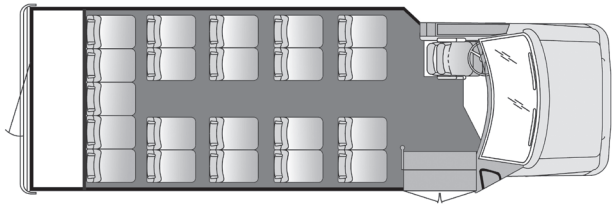
20

20 passenger
w/interior luggage + driver



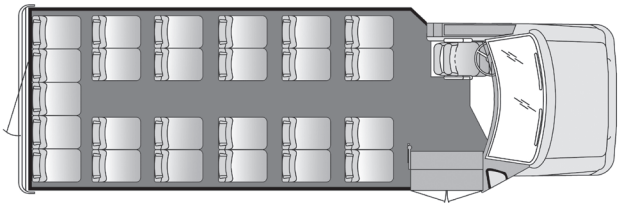
21

21 passenger
w/rear luggage + driver



25

25 passenger
+ driver

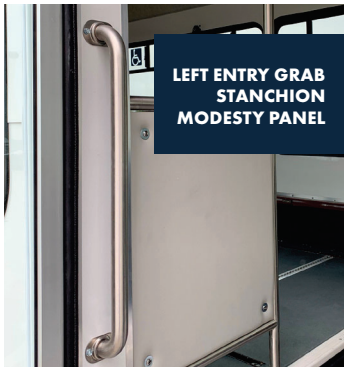


Specifications.

Length	20'	22'	24'	25'
Wheelbase	138"	158"	158"	190"
Chassis	E350	E450	E450	E450
Engine	7.3L Gas	7.3L Gas	7.3L Gas	7.3L Gas
GVWR	11,500 lb.	12,500 lb.	14,5000 lb.	14,500 lb.
Passenger Capacity*	17	21	21	25
Overall Width	96"	96"	96"	96"
Overall Height	115"	115"	116"	116"
Interior Width	93"	93"	93"	93"
Interior Height	80"	80"	80"	80"
Ground to Int. Floor	30"	30"	30"	30"
Ground to 1st Step	12"	12"	12"	12"
Step Riser	9"	9"	9"	9"
Step Tread	11.5"	11.5"	11.5"	11.5"
Step Width	35.75"	35.75"	35.75"	35.75"
Entry Door Clear Opening w/One Grab Rail	31"	31"	31"	31"
Entry Door Clear Opening w/Two Grab Rails	30"	30"	30"	30"

*All passenger capacities are references and subject to final weight analysis

Features + options.



Standard Exterior Feature Highlights

- Fully welded steel cage construction meeting all applicable FMVSS requirements
- "Starview" drivers visibility window in front of entry door
- Electric actuated passenger entry door with full length glass
- 36" wide x 36" high upper double T-Slider tempered safety glass windows with climate control tint
- Black powder coated steel rear bumper
- Rear mud flaps
- Pre-painted white aluminum sidewall and skirts
- Fiberglass front and rear caps
- One-piece seamless FRP (fiberglass reinforced plastic) roof
- Breakaway rearview mirrors with built-in convex
- Sealed LED stop, tail, and turn signal lights with LED back-up lights
- LED front and rear marker lights
- Exterior graphics package available in three colors (blue, green or burgundy)

Standard Interior Feature Highlights

- 93" interior width
- 80" interior floor to ceiling height with standard floor (raised floor is 75")
- Floor and wall seat track for flexible seating
- Black slip resistant floor covering
- 5/8" exterior grade plywood flooring
- Ceiling and rear wall fabric for sound abatement
- FRP (fiberglass reinforced plastic) sidewalls for ease of cleaning
- White step nosing
- 1.25" left hand vertical passenger assist rail at entry door
- Intermotive FlexTech Electrical System
- LED entry door step well lights
- LED driver and passenger area lighting
- Non-retractable seat belts

Popular Option Highlights

- Stainless steel wheel inserts
- Luggage Storage areas (overhead luggage racks with reading lights, interior luggage racks, rear luggage area)
- Rear emergency door with window(s)
- Passenger area rear heat and air conditioning
- Passenger grab rails
- Padded vinyl or cloth walls and ceiling
- Audio and video systems
- Mid back or high back seating
- ADA and FMVSS compliant wheel chair lifts and securement systems
- Fiberglass side walls and skirts

FOREST RIVER BUS

STARCRAFT | Starlite Transit

Learn more at
forestriverbus.com/
Starcraft/Starlite-Transit

moving forward together.

SAFETY. PERFORMANCE. DURABILITY.

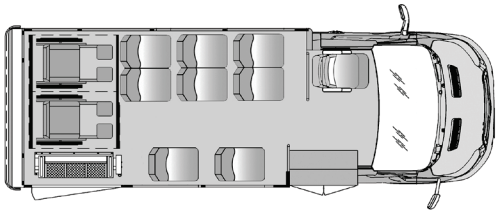
The Starlite's narrow body and small turning radius allow for easier handling, which your drivers will welcome. In addition, passengers will appreciate the wide entry door and deep steps when entering and exiting the vehicle. The Starlite is the perfect solution for those in the market for a smaller shuttle bus or an alternative to a raised-roof van.

PASSENGERS	BUS LENGTH	BUS CHASSIS	WHEELCHAIR
Up to 14	22' - 24'	Ford Transit	Side Access

Versatility + capacity options.

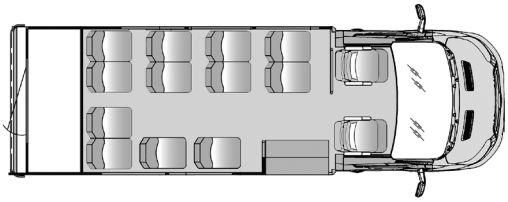
08

8 passenger
+ 2 wheelchair + driver



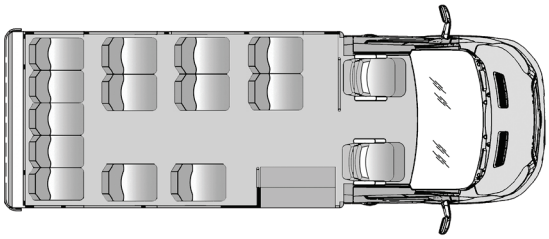
12

12 passenger w/rear luggage
+ driver & copilot



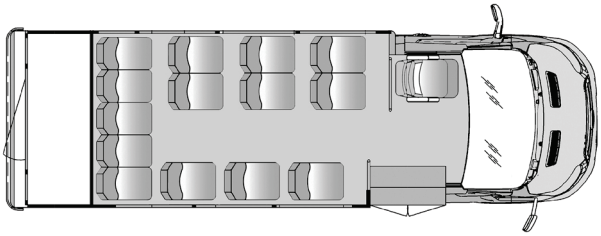
13

13 passenger
+ driver & copilot



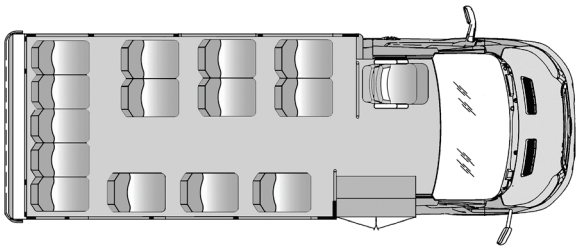
14

14 passenger w/rear luggage
+ driver



14

14 passenger + driver



Specifications.

Length	22'	24'
Wheelbase	138"	156"
Chassis	Ford Transit	Ford Transit
Engine	3.5L Gas	3.5L Gas
GVWR	10,360 lb.	10,360 lb.
Passenger Capacity*	14	14
Overall Width	84"	84"
Overall Height	110"	110"
Interior Width	81"	81"
Interior Height	76"	76"
Ground to Int. Floor	29"	29"
Ground to 1st Step	11"	11"
Step Riser	9"	9"
Step Tread	9.5"	9.7"
Step Width	35.75"	35.75"
Entry Door Clear Opening w/One Grab Rail	31"	31"
Entry Door Clear Opening w/Two Grab Rails	30"	30"

*All passenger capacities are references and subject to final weight analysis

Features + options.

Standard Exterior Feature Highlights

- Fully welded steel cage construction meeting all applicable FMVSS requirements
- 10" ground to first step at entry door
- 109" overall exterior height (depending on options)
- "Super Starview" drivers visibility window in front of entry door
- Electric actuated passenger entry door with full length glass
- 36" high x 36" wide high upper double T-Slider tempered safety glass windows with climate control tint
- Black powder coated steel rear bumper
- Rear mud flaps
- Pre-painted white aluminum side and skirts
- Fiberglass front and rear cap
- One-piece seamless FRP (fiberglass reinforced plastic) roof
- Breakaway rearview mirrors with built-in convex
- Drip rail over all windows and passenger door openings
- LED front and rear marker lights
- LED stop, tail, and turn signal lights including back-up lights
- Exterior graphics package available in three colors (blue, green, or burgundy)

Standard Interior Feature Highlights

- 81" interior width
- 76" interior floor to ceiling height
- Welded floor and wall seat track for flexible seating
- Black slip resistant floor covering
- 5/8" plywood flooring
- Ceiling and rear wall fabric for sound abatement
- FRP (fiberglass reinforced plastic) sidewalls for ease of cleaning
- White step nosing
- 1.25" left hand vertical passenger assist rail at entry door
- Intermotive FlexTech Electrical System

Popular Option Highlights

- Stainless steel wheel inserts
- Luggage Storage areas (overhead luggage racks with reading lights, interior luggage racks, rear luggage area)
- Rear emergency door with window(s)
- Passenger area rear heat and air conditioning
- Passenger grab rails
- Padded vinyl or cloth walls and ceiling
- Audio and video systems
- Bonded windows
- ADA and FMVSS compliant wheel chair lifts and securement systems

Related Links

- Transit Vehicle Manufacturers (TVMs)
- Transit Vehicle Award Reporting Form

Contact Us

Office of Civil Rights
Federal Transit Administration
1200 New Jersey Avenue, SE
Washington, DC 20590
United States

Phone: 888-446-4511
Business Hours:
8:30am-5:00pm ET, M-F

If you are deaf, hard of hearing, or have a speech disability, please dial 7-1-1 to access telecommunications relay services.

Eligible Transit Vehicle Manufacturers (FOREST RIVER ON Page three)

DBE regulations require FTA recipients to report transit vehicle procurement awards (49 CFR 26.49). Since November 2014, FTA grantees have been required to submit, within 30 days of making an award, the name of the successful bidder and the total dollar value of the contract. Only eligible TVMs may bid on FTA-assisted transit vehicle procurements. Transit vehicle manufacturers that have submitted a goal methodology to FTA that has been approved, or has not been disapproved, at the time of solicitation are eligible to bid (49 CFR 26.49(a)(1)). To remain eligible, TVMs must submit their DBE goal methodology to FTA by August 1 of each year. The following is a list of eligible TVMs:

Transit Vehicle Manufacturer	Address	FY2023 DBE Goal %	DBE Liaison Officer/ Email
A and J Vans, Inc.*	333 West Washington Street Valders, WI	2.06%	Travis Pfile

Transit Vehicle Manufacturer	Address	FY2023 DBE Goal %	DBE Liaison Officer/ Email
Advanced Wheels of Technology, Inc.*	33 Bradley Park Road P.O. Box 908 East Granby, CT	1.20%	Ed Basile
Alexander Dennis*	31566 Railroad Canyon Road, Suite 342 Canyon Lake, CA	2.50%	Judy Lovitt
Alstom Transportation, Inc.*	1 Transit Drive Hornell, NY	5.80%	James "JD" Daniel
ARBOC Specialty Vehicles, LLC*	51165 Greenfield Parkway Middlebury, IN	1.00%	Jessica Bordeau
Arrival Automotive USA, Inc.*	240 Twin Dolphin Drive, Suite A Redwood City, CA	1.86%	Clarence Tong
Blue Bird Body Company*	402 Blue Bird Boulevard, P.O. Box 937 Fort Valley, GA	1.16%	Linda Belflower
Braun Corporation d/b/a BraunAbility*	631 W. 11th Street Winamac, IN	0.51%	Ken Morgel
Brookville Equipment Corporation*	175 Evans Street Brookville, PA	3.31%	Haley Blazosky
BYD Coach & Bus, LLC*	1800 South Figueroa Street Los Angeles, CA	2.50%	Enid Santiago
CAD Railway Industries Ltd.*	155 Boulevard Montreal-Toronto, Lachine, Quebec City, Canada	8.66%	Mikael Levy
CAF USA, Inc.*	1401 K Street, NW Washington, DC	2.33%	Tonia Crosby
Coach & Equipment Manufacturing*	130 Horizon Park Drive Penn Yan, NY	2.26%	Calvin Livingston
Complete Coach Works*	1863 Service Court Riverside, CA	1.00%	Amber Lindsey
CRRC MA Corporation*	108 Myrtle Street, Quincy, MA	2.16%	Jing Jing
CRRC Sifang America, Inc.*	13535 S. Torrence Avenue Chicago, IL	2.99%	Haitao "Kevin" Qu

Transit Vehicle Manufacturer	Address	FY2023 DBE Goal %	DBE Liaison Officer/ Email
DCCCA1, Inc.*	70 Hegenberger Road Oakland, CA	1.79%	Dean C. Hurst
Diamond Acquisition, LLC d/b/a Diamond Coach*	2300 W. 4th Street Oswego, KS	1.12%	Kate Strickland
Driverge Vehicle Innovations (Formerly TransitWorks, LLC)*	1090 W. Wilbeth Road Akron, OH	0.68%	Ken Richards
ElDorado National California, Inc.*	9670 Galena Street Riverside, CA	2.72%	Jake Calvo
Endera Automotive, LLC*	804 N. Pratt Street Ottawa, OH	1.86%	Kevin Hernandez
Fenton Mobility Products, Inc.*	1209 E. Second Street Jamestown, NY	0.39%	Mary Gabalski
Forest River: - Champion Bus* - ElDorado* - Elkhart Coach* - Forest River Van; Glaval Bus; Starcraft/ StarTrans Bus*	2367 Century Drive Goshen, IN	2.00%	Donall Hasty
FR Conversions, Inc.*	1231 Tech Court Wesminster, MD	0.23%	Jeff Shay
Gillig, LLC*	451 Discovery Drive Livermore, CA	0.65%	Chris Turner
Gomaco Corporation*	P.O. Box 151 Ida Grove, IA	1.85%	Troy Kruse
Higher Power Industries*	940 Nepperhan Avenue Yonkers, NY	2.26%	Michael Liebler
Hitachi Rail STS USA Inc.*	11150 NW 122nd Street Miami, FL	4.00%	Gerhard Leitner
Hometown Manufacturing, Inc.*	701 North Rail Road Avenue Crandon, WI	3.00%	Jessica Donek
Hyundai Rotem USA*	1300 Virginia Drive, Suite 103 Philadelphia, PA	4.15%	Rocky Chong
Ilderton Conversion*	P.O. Box 350 High Point, NC	1.00%	Odell McBride

Transit Vehicle Manufacturer	Address	FY2023 DBE Goal %	DBE Liaison Officer/ Email
Kawasaki Rail Car, Inc.*	29 Wells Avenue, Building 4 Yonkers, NY	7.82%	Tadashi Doi
Kiepe Electric, Inc.*	359 Curie Drive Alpharetta, GA	2.89%	Noel D'Sa
KINKISHARYO International*	1960 E Grand Avenue, Suite 1210 El Segundo, CA	9.00%	Socorro Felix
Master's Specialty Vehicles, LLC*	800 Quick Trip Way Belton, MO	0.01%	Rita Luukkone
Matthews Specialty Vehicles*	211 American Avenue Greensboro, NC	1.00%	Maegan Demkowski
Midway Specialty Vehicles, LLC*	2940 Dexter Drive Elkhart, IN	8.88%	Mike R. Violi
Mitsubishi Heavy Industries America, Inc.*	630 Fifth Avenue, Suite 2650 New York, NY	2.00%	Michael Ang
Mobility TRANS*	12633 Inkster Road Livonia, MI	1.00%	Dave Brown
MotivePower, Inc.*	4600 Apple Street Boise, ID	3.00%	Thomas J. Salva
Motor Coach Industries*	200 E. Oakton Street Des Plaines, IL	3.52%	Darrin Smith
National Van Builders, Inc.*	80 Pine Street Attleboro, MA	1.50%	Glen Perlman
New England Wheels*	33 Manning Road Billerica, MA	0.30%	Judy Walcott
New Flyer of America*	711 Kernaghan Avenue Winnipeg, Manitoba	3.60%	Darrin Smith
Nova Bus*	260 Banker Road Plattsburgh, NY	4.40%	Julie Laplante
Prime-Time Specialty Vehicles, Inc.*	56616 Elk Park Drive Elkhart, IN	1.00%	Bradley Moore
Progress Rail Locomotive*	1600 Progress Drive Albertville, AL	1.62%	Guylando Moreno

Transit Vehicle Manufacturer	Address	FY2023 DBE Goal %	DBE Liaison Officer/ Email
Proterra*	1 Whitlee Court Greenville, SC	1.00%	Amy Cuny
RIDE Rolling Stock LLC*	919 North Markey Street, Suite 950 Wilmington, DE	2.50%	Joseph Hernandez
Siemens Mobility, Inc.*	7464 French Road Sacramento, CA	5.79%	Michelle Picard
Stadler US, Inc.*	900 North 500 West Salt Lake City, UT	1.51%	Justin Banks
Sumitomo Corporation of Americas*	9500 W. Bryn Mawr Avenue, Suite 400 Rosemont, IL	6.08%	Shunsuke Takaya
Sunset Vans, Inc.*	8851 Lakewood Boulevard Downey, CA	0.37%	Chris Perez
Talgo, Inc.*	3533 N 27th Street Milwaukee, WI	3.81%	Nicolas Lopez
TCI Mobility*	230 Bossardsville Road PO Box 252 Sciota, PA	0.18%	Katrina Licata
Thomas Built Buses, Inc.*	1408 Courtesy Road High Point, NC	3.00%	Daoud Chaaya
Turtle Top*	67819 State Road 15 New Paris, IN	0.85%	Matthew Gaff
Van Hool Company*	Bernard Van Hoolstraat 58 2500 Lier (Koningshooikt), Belgium	1.00%	Jeff Madura
Vicinity Motor Corp (Formerly Grande West Transportation International Ltd)*	3168 262nd Street Aldergrove BC, Canada	1.00%	Michelle Sahai
Wabtec Transportation System, LLC*	2901 East Lake Road, Bldg. 14-222 Erie, PA	3.00%	Thomas J. Salva

*Goal methodology has been submitted and is pending review by FTA. The TVM is eligible to bid on FTA-assisted procurements.

Last updated: Tuesday, January 24, 2023

U.S. DEPARTMENT OF TRANSPORTATION

Federal Transit Administration

1200 NEW JERSEY AVENUE, SE

WASHINGTON, DC 20590

202-366-4043

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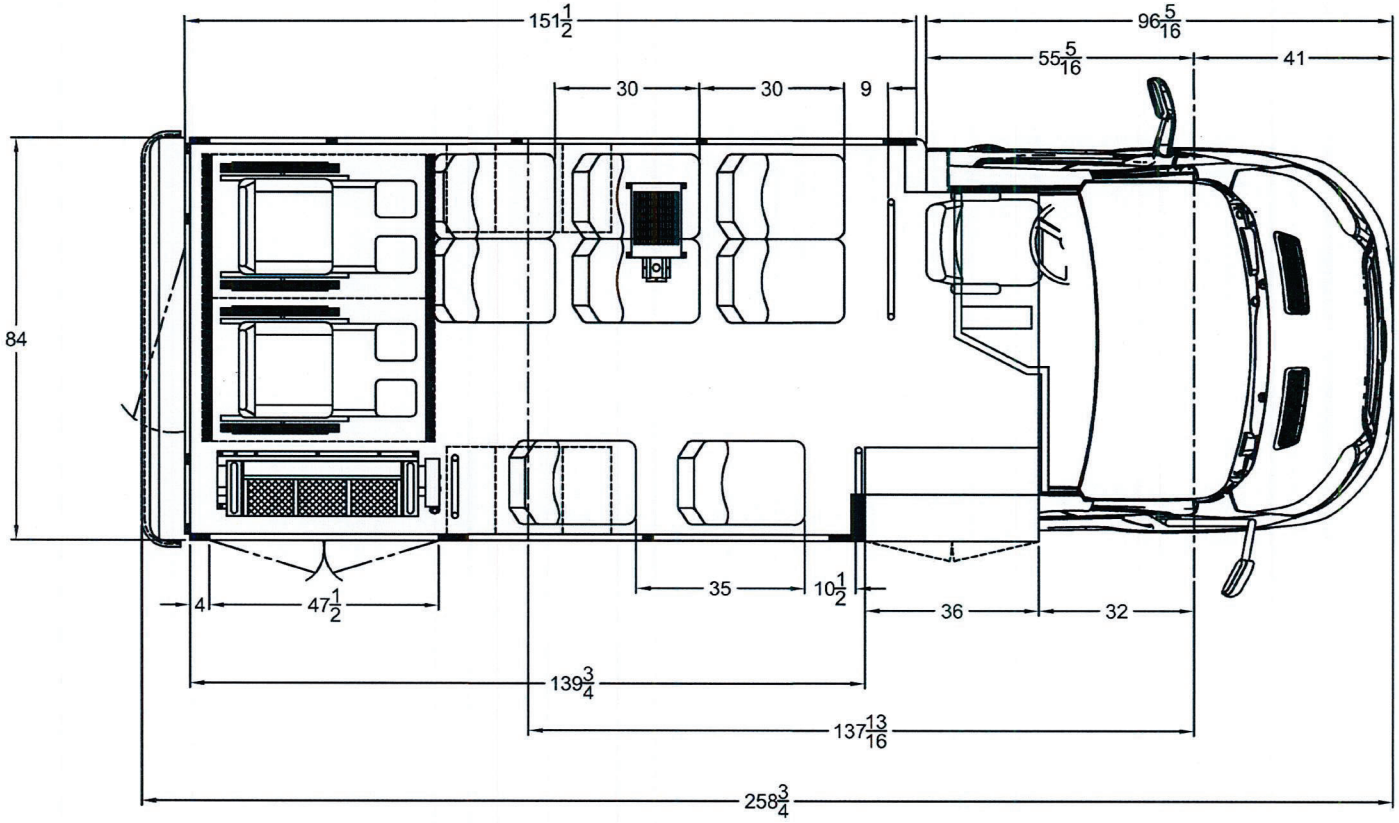
Ford 11 Passenger



NOTE: SHOWN WITH MID HI FREEDMAN SEATS
TRANSIT 10,360 GVWR
THIS FLOOR PLAN IS FOR ILLUSTRATION PURPOSES ONLY.
A WEIGHT ANALYSIS HAS NOT YET BEEN PERFORMED.
FINAL APPROVAL WITH A WEIGHT ANALYSIS IS REQUIRED UPON RECEIPT OF A COMPLETED ORDER WITH ALL OPTIONS SHOWN.
OPTIONAL EQUIPMENT MAY BE SHOWN.
THE SALES ORDER PLACED DICTATES ACTUAL OPTION CONTENT.

DEALER APPROVAL

☐ APPROVED

_____

CUSTOMER SIGNATURE

SCALE IN INCHES 0 12 24 36 48

REV. LET.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.

TOLERANCE UNLESS OTHERWISE SPECIFIED

WOOD	OTHER
± 1/8"	± 1/16"
± 1°	± 1/2°

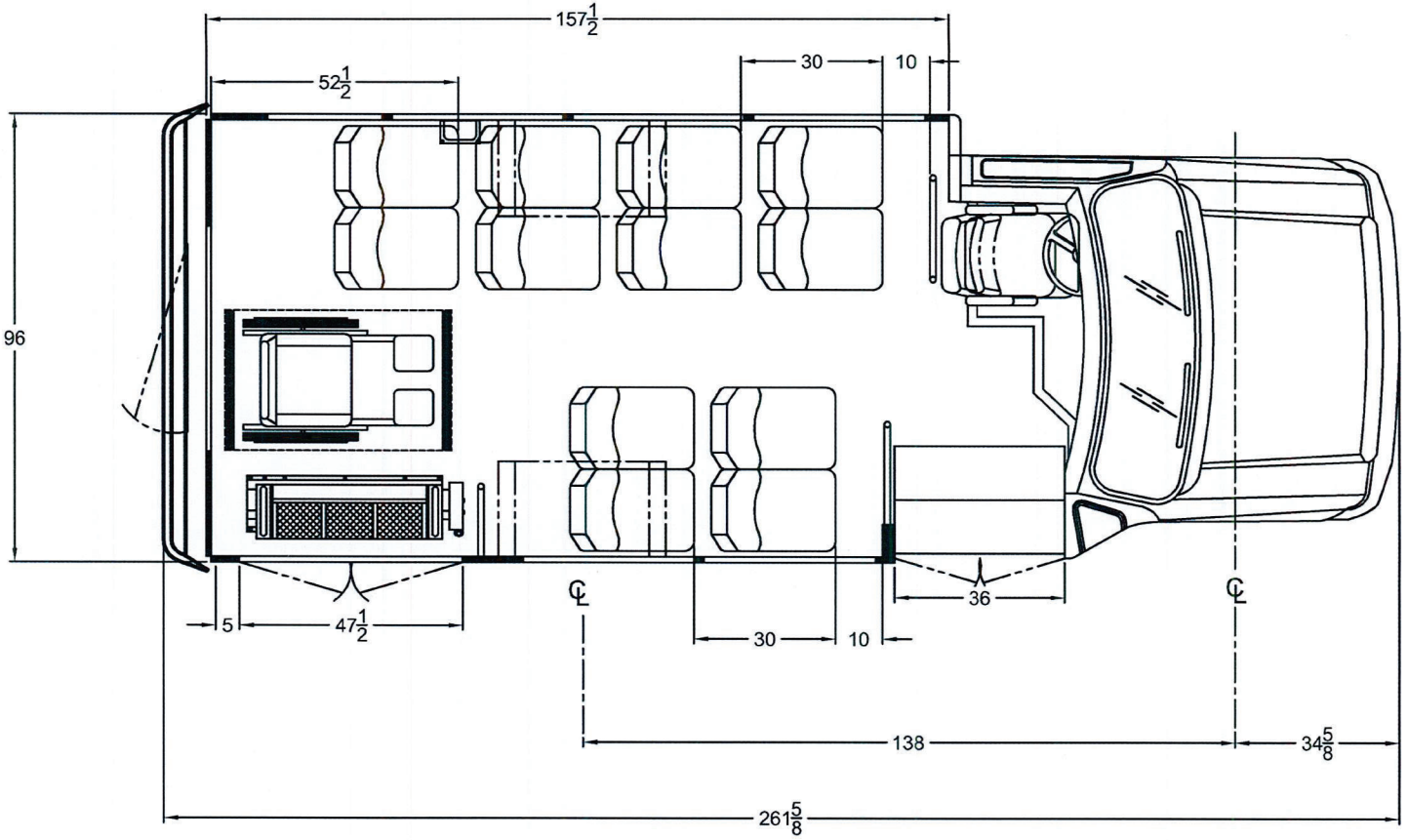
STARCRAFT BUS a division of Forest River, Inc.

DATE: 12/09/16 TITLE: 8 2 W/C 138" WB 150 BDY 22' TRANSIT

NAME: JPC

DWG. No. 8 2 WC 138 150-1 USA

Ford 14 Passenger



NOTE: SHOWN WITH MID HI FREEDMAN SEATS
ALLSTAR E-350 11,500 GVWR
THIS FLOOR PLAN IS FOR ILLUSTRATION PURPOSES ONLY.
A WEIGHT ANALYSIS HAS NOT YET BEEN PERFORMED.
FINAL APPROVAL WITH A WEIGHT ANALYSIS IS REQUIRED UPON RECEIPT OF A COMPLETED ORDER WITH ALL OPTIONS SHOWN.
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DEALER APPROVAL

☐ APPROVED

CUSTOMER SIGNATURE

SCALE IN INCHES 0 12 24 36 48

REV. LET.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.

TOLERANCE UNLESS OTHERWISE SPECIFIED

WOOD	OTHER
± 1/8"	± 1/16"
± 1°	± 1/2°

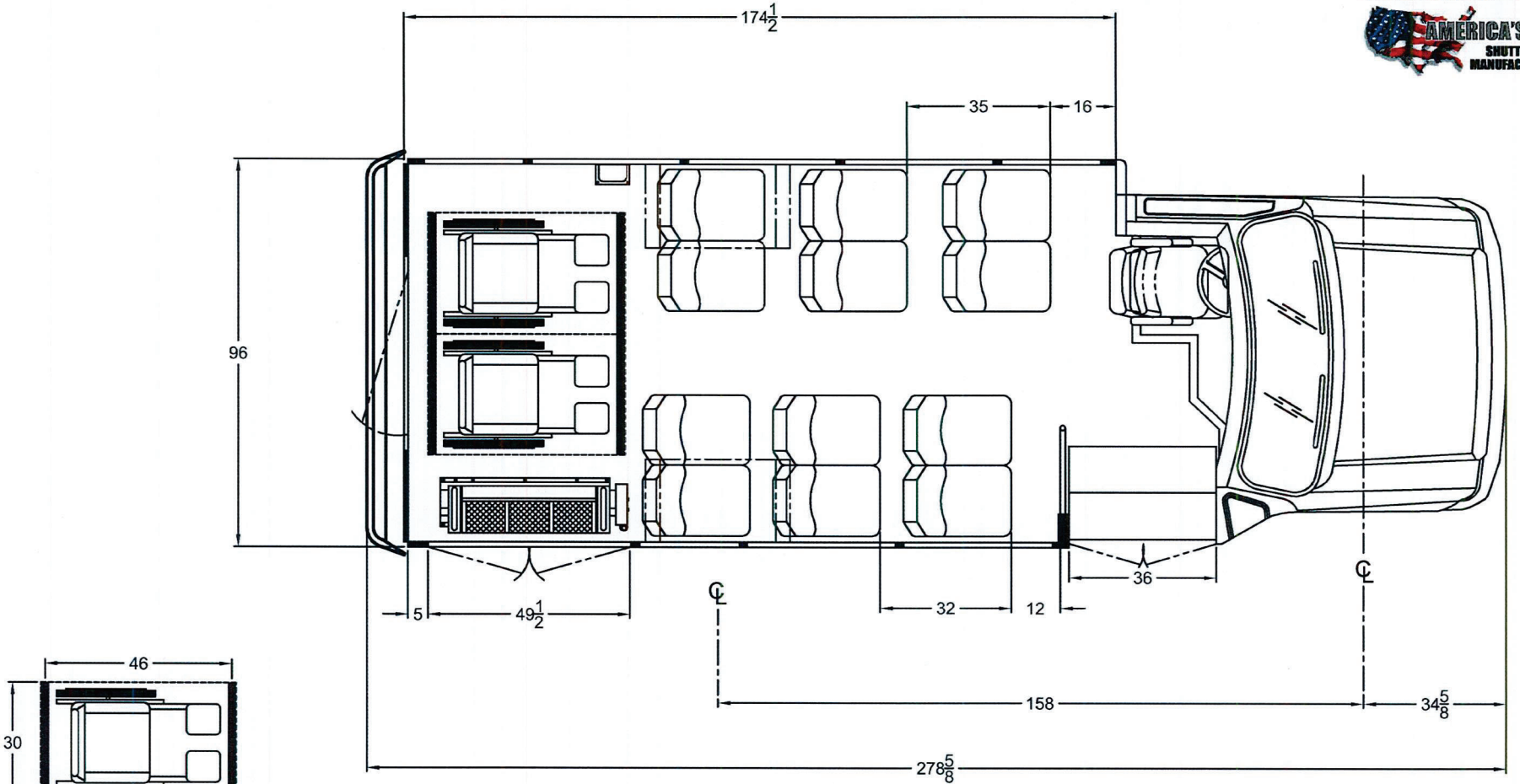
STARCRAFT BUS
a division of Forest River, Inc.

DATE: 01/07/16 TITLE: 12 1 WC 138" WB 20' ALLSTAR

NAME: JPC

DWG. No. 12 1 WC 138 146-1 USA

Ford 15 Passenger



NOTE: SHOWN WITH MID HI FREEDMAN SEATS
ALLSTAR E-350 14,500 GVWR
THIS FLOOR PLAN IS FOR ILLUSTRATION PURPOSES ONLY.
A WEIGHT ANALYSIS HAS NOT YET BEEN PERFORMED.
FINAL APPROVAL WITH A WEIGHT ANALYSIS IS REQUIRED UPON RECEIPT OF A COMPLETED ORDER WITH ALL OPTIONS SHOWN.
OPTIONAL EQUIPMENT MAY BE SHOWN.
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DEALER APPROVAL

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CUSTOMER SIGNATURE

SCALE IN INCHES 0 12 24 36 48

REV. LET.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.
		TAS		6/07/13	

TOLERANCE UNLESS OTHERWISE SPECIFIED

WOOD	OTHER
± 1/8"	± 1/16"
± 1°	± 1/2°

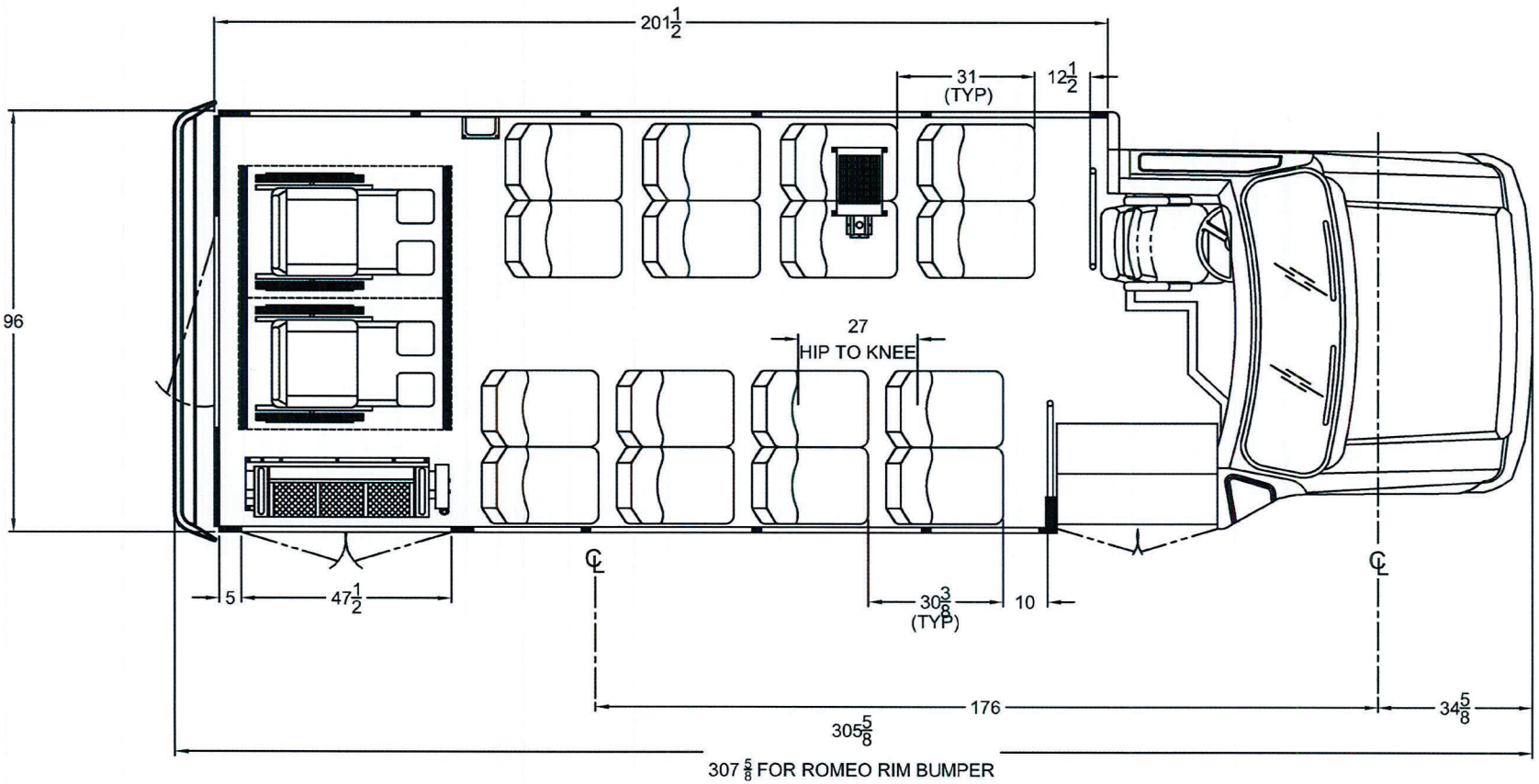
STARCRAFT BUS
a division of Forest River, Inc.

DATE: 06/07/13 TITLE: 12 2 WC 158" WB 163 BDY 22' 2011 ALLSTAR

NAME: TAS

DWG. No. 12 2 WC 1 DBL FOLD 158 163-2 USA

Ford 19 Passenger



DEALER APPROVAL
☐ APPROVED
_____
CUSTOMER SIGNATURE

NOTE: SHOWN WITH MID HI FREEDMAN SEATS
ALLSTAR E-450 14,500 GVWR
THIS FLOOR PLAN IS FOR ILLUSTRATION PURPOSES ONLY.
A WEIGHT ANALYSIS HAS NOT YET BEEN PERFORMED.
FINAL APPROVAL WITH A WEIGHT ANALYSIS IS REQUIRED UPON RECEIPT OF A COMPLETED ORDER WITH ALL OPTIONS SHOWN.
OPTIONAL EQUIPTMENT MAY BE SHOWN.
THE SALES ORDER PLACED DICTATES ACTUAL OPTION CONTENT.

SCALE IN INCHES 0 12 24 36 48

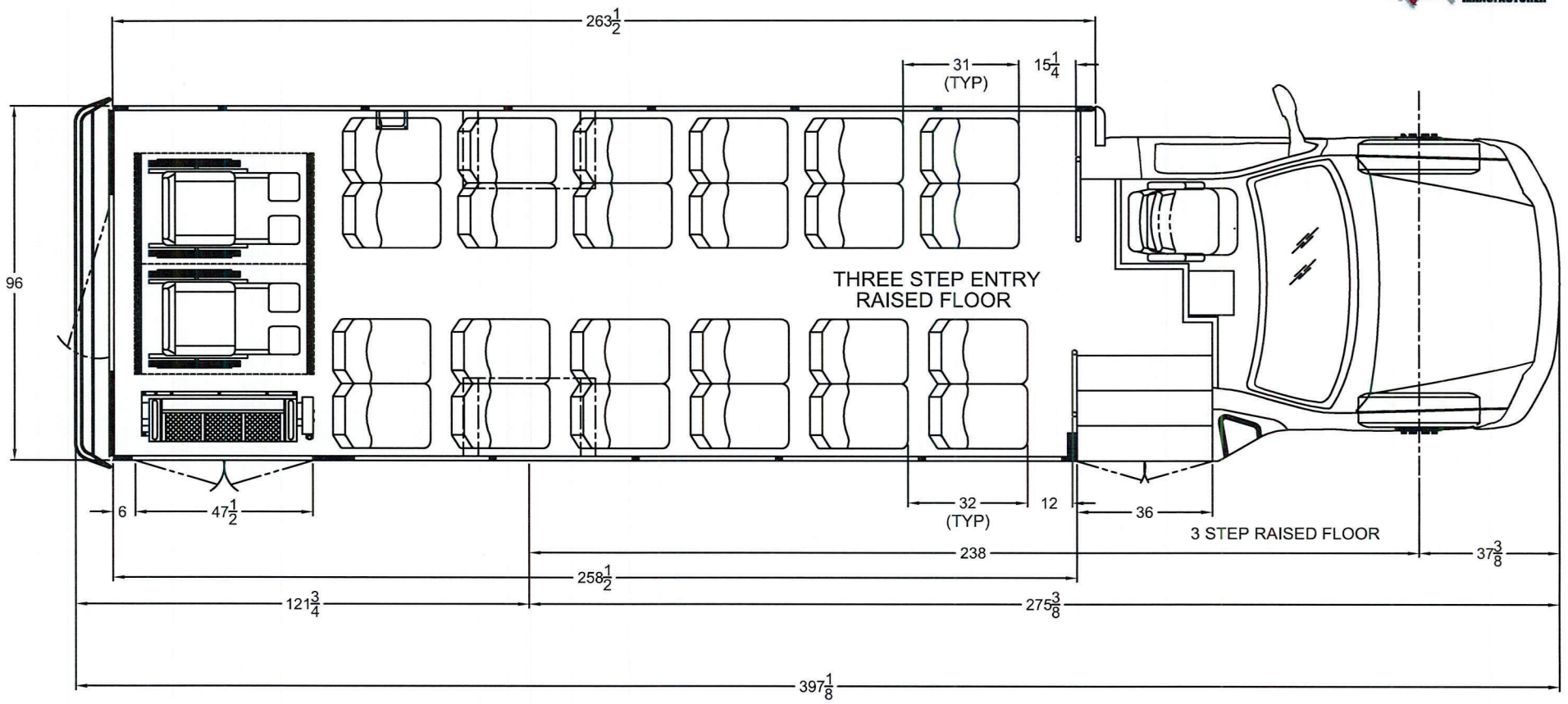
REV. LET.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.

TOLERANCE UNLESS OTHERWISE SPECIFIED	WOOD	OTHER
	± 1/8"	± 1/16"
	± 1°	± 1/2°

STARCRAFT BUS
a division of Forest River, Inc.

DATE: 04/26/17 TITLE: 16 2 WC PASSENGER 25' ALLSTAR
NAME: JPC
DWG. No. 16 2 WC 176 190-23 USA

Ford 27 Passenger



NOTE: SHOWN WITH MID HI FREEDMAN SEATS
ALLSTAR XL F-550 19,500 GVWR
THIS FLOOR PLAN IS FOR ILLUSTRATION PURPOSES ONLY.
A WEIGHT ANALYSIS HAS NOT YET BEEN PERFORMED.
FINAL APPROVAL WITH A WEIGHT ANALYSIS IS REQUIRED UPON RECEIPT OF A COMPLETED ORDER WITH ALL OPTIONS SHOWN.
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DEALER APPROVAL

☐ APPROVED

CUSTOMER SIGNATURE

SCALE IN INCHES 0 12 24 36 48

REV. LET.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.
A	PRELIM PACKET:	TAS		03/29/17	

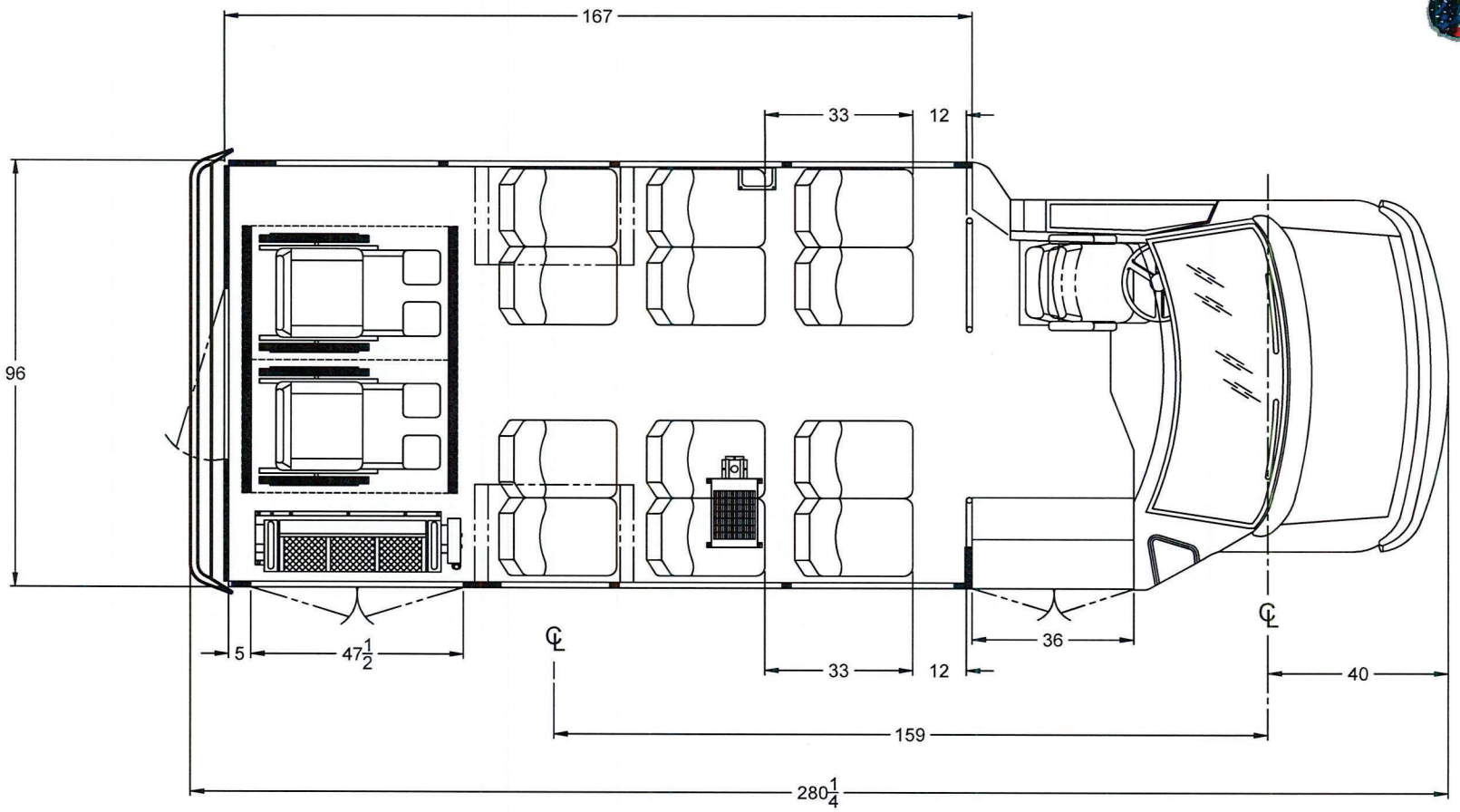
TOLERANCE UNLESS OTHERWISE SPECIFIED

WOOD	OTHER
± 1/8"	± 1/16"
± 1°	± 1/2°

STARCRAFT BUS
a division of Forest River, Inc.

DATE: 03/29/17
NAME: TAS
TITLE: 24 2 W/C 238" WB 364 BDY 33' ALLSTAR XL
DWG. No. 24 2 WC 238 WB 390 BDY USA

Chevy 15 Passenger



NOTE: SHOWN WITH MID HI FREEDMAN SEATS
ALLSTAR C-3500 12,300 GVWR
THIS FLOOR PLAN IS FOR ILLUSTRATION PURPOSES ONLY.
A WEIGHT ANALYSIS HAS NOT YET BEEN PERFORMED.
FINAL APPROVAL WITH A WEIGHT ANALYSIS IS REQUIRED UPON RECEIPT OF A COMPLETED ORDER WITH ALL OPTIONS SHOWN.
OPTIONAL EQUIPTMENT MAY BE SHOWN.
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DEALER APPROVAL

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CUSTOMER SIGNATURE

SCALE IN INCHES 0 12 24 36 48

REV. LET.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.

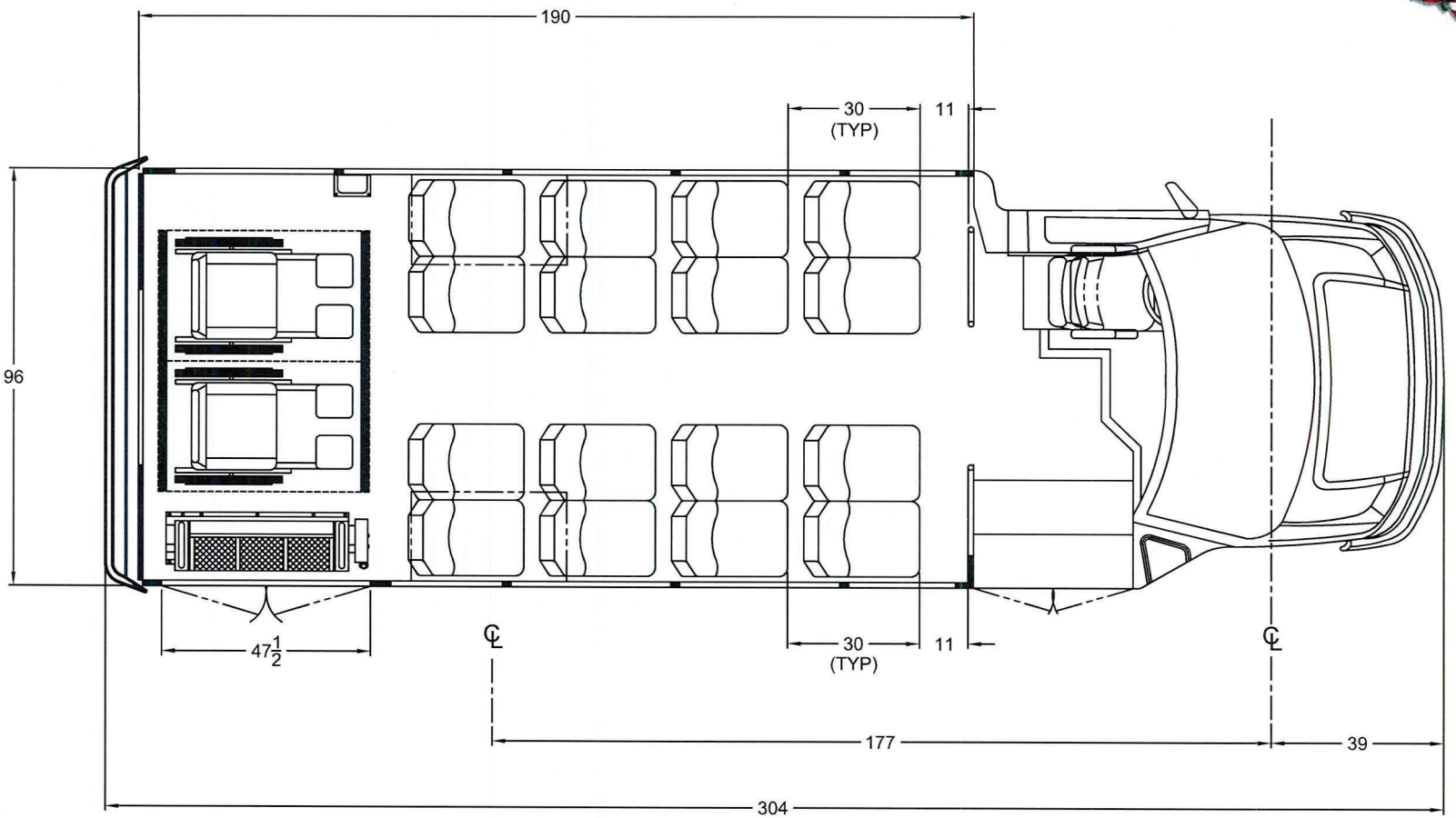
TOLERANCE UNLESS OTHERWISE SPECIFIED

WOOD	OTHER
± 1/8"	± 1/16"
± 1°	± 1/2°

STARCRAFT BUS
a division of Forest River, Inc.

DATE: 11/24/20
NAME: MK
TITLE: 12/2 WC PASS. 159" WB 167 BDY 22' ALLSTAR
DWG. No. 12 2 WC 159 167-17 USA

Chevy 19 Passenger



DEALER APPROVAL
☐ APPROVED
_____
CUSTOMER SIGNATURE

NOTE: SHOWN WITH MID HI FREEDMAN SEATS
ALLSTAR C-4500 14,200 GVWR
THIS FLOOR PLAN IS FOR ILLUSTRATION PURPOSES ONLY.
A WEIGHT ANALYSIS HAS NOT YET BEEN PERFORMED.
FINAL APPROVAL WITH A WEIGHT ANALYSIS IS REQUIRED UPON RECEIPT OF A COMPLETED ORDER WITH ALL OPTIONS SHOWN.
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SCALE IN INCHES 0 12 24 36 48

REV. LET.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.

TOLERANCE UNLESS OTHERWISE SPECIFIED		STARCRAFT BUS a division of Forest River, Inc.	
WOOD	OTHER	DATE: 10/30/14	TITLE: 16/2 W/C 177" WB 25' ALLSTAR
± 1/8"	± 1/16"	NAME: TAS	
± 1°	± 1/2°	DWG. No. 16 2 W/C 177 190 USA	

FOLD

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
2023 MODEL YEAR
CERTIFICATE OF CONFORMITY
WITH THE CLEAN AIR ACT

OFFICE OF TRANSPORTATION AND AIR QUALITY
ANN ARBOR, MICHIGAN 48105

Certificate Issued To: **Ford Motor Company**
(U.S. Manufacturer or Importer)

Certificate Number: **PFMXE07.3BW7-002**

Effective Date: 12/20/2022

Expiration Date: 12/31/2023

Byron J. Bunker, Division Director
Compliance Division

Issue Date: 12/20/2022

Revision Date: N/A

Model Year: 2023
Manufacturer Type: Original Engine Manufacturer
Engine Family: PFMXE07.3BW7
Intended Service Class: Light or Medium Heavy-Duty Otto Cycle engines for all vehicles (certified for vehicles between 14,001 lbs and 33,000 lbs GVWR inclusive)
Fuel Type: Gasoline
FELs (g/hp-hr):
NOx: 0.13

Intended Engine Application: Vocational
Primary Test Configuration Transient Duty Cycle:
CO2 FCL value (g/hp-hr): 627
CO2 FEL value (g/hp-hr): 646
N2O FEL value (g/hp-hr): 0.10
CH4 FEL value (g/hp-hr): 0.10

Pursuant to Section 206 of the Clean Air Act (42 U.S.C. section 7525), 40 CFR Parts 86 and 1036, and subject to the terms and conditions prescribed in those provisions, this certificate of conformity is hereby issued with respect to the test engines which represent the engine family, and is subject to the terms and conditions prescribed in those provisions.

This certificate of conformity covers only those new motor vehicle engines which conform in all material respects to the design specifications that applied to those engines described in the documentation required by 40 CFR Parts 86 and 1036 and which are produced during the model year stated on this certificate of the said manufacturer, as defined in 40 CFR Parts 86 and 1036.

This certificate of conformity is conditional upon compliance of said manufacturer with the averaging, banking and trading provisions of 40 CFR Parts 86 and 1036. Failure to comply with these provisions may render this certificate void *ab initio*.

It is a term of this certificate that the manufacturer shall consent to all inspections described in 40 CFR Parts 86 and 1068 and authorized in a warrant or court order. Failure to comply with the requirements of such a warrant or court order may lead to revocation or suspension of this certificate for reasons specified in 40 CFR Parts 86 and 1036. It is also a term of this certificate that this certificate may be revoked or suspended or rendered void *ab initio* for other reasons specified in 40 CFR Parts 86 and 1036.

This certificate does not cover engines sold, offered for sale, or introduced, or delivered for introduction into commerce in the U.S. prior to the effective date of the certificate.

This certificate is issued subject to the conditions specified in 40 CFR 80.24. Catalyst-equipped vehicles designed to be operated on gasoline or flexible fuel, otherwise covered by this certificate, which are driven outside the United States, Canada, Mexico, Japan, Australia, Taiwan and the Bahama Islands will be presumed to have been operated on leaded fuel resulting in deactivation of the catalysts. If these vehicles are imported or offered for importation without retrofit of the catalyst, they will be considered not to be within the coverage of this certificate unless included in a catalyst control program operated by manufacturer or a United States Government Agency and approved by the Administrator.

CW25V4

PART II

U.S. EPA, CALIFORNIA, AND CANADIAN EXHAUST & EVAPORATIVE EMISSION REQUIREMENTS AND EPA/NHTSA GREENHOUSE GAS EMISSIONS/FUEL ECONOMY REGULATIONS

Incomplete vehicles come in three major classifications: (1) Light Duty Vehicles, Light Duty Trucks, and Heavy Duty Vehicles (Including Medium Duty in California) are certified by the primary manufacturer and the vehicle is labeled as being in compliance with emission and fuel economy requirements. (2) Heavy Duty Vehicles are required to have an engine certified by the engine manufacturer and bear an engine emissions label, and if a gasoline vehicle, also bear an evaporative emissions label, (3) Light Duty Vehicles certified and labeled by the intermediate or final stage vehicle manufacturer as being in compliance with emission and fuel economy requirements.

Reference PART I CMVSS 301 and FMVSS 301 Table A and Table B, and PART II Table C. The completed vehicle Maximum Unloaded Vehicle (Curb) Weight, GVWR, and/or Maximum Frontal Area restrictions shown in Tables A, B and C should not be exceeded. If any of these restrictions are exceeded, re-certification by the final stage manufacturer will be required.

In addition, all gasoline/gasoline-ethanol blend powered Federal/California Light Duty, Medium Duty and Heavy Duty Vehicles are required to have an approved fuel evaporative emission control system. Vehicles certified to Heavy Duty gasoline emission standards also require special evaporative emission labeling. In order to assure that Environmental Protection Agency (EPA), National Highway Traffic Safety Administration (NHTSA), California and Canada Emission Certification and/or Greenhouse Gas/Fuel Economy regulations are met, this vehicle must be completed in strict accordance with all instructions contained in this manual, especially the following instructions which relate to:

EMISSION RELATED COMPONENTS

TYPE 1 The following statement is applicable to all types of incomplete vehicles contained in this document (unless otherwise noted on the cover).

A. This incomplete vehicle, when completed, will conform to U.S. EPA, CALIFORNIA, AND CANADIAN EXHAUST & EVAPORATIVE EMISSION REQUIREMENTS AND EPA/NHTSA GREEENHOUSE GAS EMISSIONS/FUEL ECONOMY REGULATIONS providing the vehicle is completed in strict accordance with all statements included in this document, especially those that relate to: "EMISSION RELATED COMPONENTS, and no alterations are made which affect the function, physical, chemical, or mechanical properties, environment, location or vital spatial clearances of the components, assemblies or systems, as manufactured by General Motors, including but not limited to those listed below (if equipped):

Air Injection Reaction (AIR) System
Axle
Brake System
Catalytic Converter
Components for All Wheel Drive (AWD) System: axle, Power Take-Off Unit (PTU), propshaft
Diesel Exhaust Emission Reduction Fluid (DEF) system, including, but not limited to: associated plumbing, fill neck assembly, heated delivery line, heater, injector, level sensor, pump, sensors, tank temperature sensor
Diesel Exhaust System, including, but not limited to: NOx Sensors, NOx Sensor Control Module, Diesel Exhaust (HCI) Direct Fuel Injector System, associated plumbing, injectors, injector controller and calibrations
Diesel/Bio-Diesel blend Particulate Filter (DPF) system, including, but not limited to: diesel/bio-diesel blend particulate filter assembly, diesel/bio-
Engine Assembly, including, but not limited to: cooling fan and drive system, crankcase emission control system, evaporative emission control system, Exhaust Gas Recirculation (EGR) system, fuel delivery and injection system, glow plugs, Glow Plug Control Module (GPCM), ignition system, Positive Crankcase Ventilation (PCV) system
Engine Electronics, including, but not limited to: coolant temperature sensor, ECM/GPCM/PCM/VCM, engine speed sensor, mass air flow sensor, calibrations/software, Exhaust oxygen sensors, Exhaust system
Intake System, including, but not limited to: air induction components/system, ducts, filter, mass air flow sensor, intake air heater
Onboard Diagnostics Emission System
Seating, the vehicle can remain with only two, or it must have 10 or more seats behind the

diesel blend oxidation catalyst assembly, exhaust system pressure differential assembly and/or plumbing, exhaust temperature sensor

driver (12 total with 2 in the front row), or it must have 13 or more total seats when completed.
Tires and Wheels
Transaxle/Transmission Assembly
Transaxle/Transmission Electronics, including, but not limited to: calibrations/software
Transmission Control Module (TCM)
Turbo Charging System, associated equipment and controls

NOTE: The Tailpipe Rear Cooler Assembly is non-emissions related. If equipped, to ensure adequate control of exhaust temperature, the intermediate or final stage manufacturer must complete tailpipe (loose kit) installations according to the instructions provided.

B. Cold tire pressure as listed for front and rear on the Incomplete Vehicle Label affixed to the front cover of this document must be maintained.

C. GVWR, GAWR front and rear weight ratings as listed on the Incomplete Vehicle Label affixed to the front cover of this document must not be exceeded.

TABLE C

Models	GVWR kg (lb) (RPO)	Engine (RPO)	Maximum Unloaded Vehicle Weight kg (lb)	Hi-Cube Van Body Type Maximum Frontal Area m^2 (ft^2)
G33503	4581 (10,100) (JFF)	6.6L Gasoline (L8T)	3894 (8585)	6.9 (74)
G33503	5579 (12,300) (C7N)	6.6L Gasoline (L8T)	4742 (10,455)	7.9 (85)
G33803	4581 (10,100) (JFF)	6.6L Gasoline (L8T)	3894 (8585)	6.9 (74)
G33803	5579 (12,300) (C7N)	6.6L Gasoline (L8T)	4742 (10,455)	7.9 (85)
G33803	6441 (14,200) (C7I)	6.6L Gasoline (L8T)	5474 (12,070)	7.9 (85)
G33903	5579 (12,300) (C7N)	6.6L Gasoline (L8T)	4742 (10,455)	7.9 (85)
G33903	6441 (14,200) (C7I)	6.6L Gasoline (L8T)	5474 (12,070)	7.9 (85)

Notes:

- **Table C above applies to ONLY incomplete vehicles (RPO: &VXT).**
- On page 2 within this document, before each vehicle illustration and after the word TYPE, is a list of types of vehicles into which the incomplete vehicle is designed to be manufactured.
- * The Maximum Frontal Area columns apply to: PART II, U.S. EPA, CALIFORNIA, AND CANADIAN EXHAUST & EVAPORATIVE EMISSION REQUIREMENTS AND EPA/NHTSA GREENHOUSE GAS/FUEL ECONOMY REGULATIONS.
- The completed vehicle Maximum Unloaded Vehicle (Curb) Weight, and/or GVWR, and/or frontal area should not be exceeded. If any of these restrictions are exceeded, re-certification by the final stage manufacturer will be required.
- Also see the Vehicle Emission Control Information Label in the vehicle engine compartment for maximum completed vehicle curb weight, GVWR, and frontal area restrictions, if applicable.
- GVWR refers to Gross Vehicle Weight Rating.

NOTES: All Federal/California gasoline/gasoline-ethanol blend powered heavy duty vehicles (except those equipped with option NJ2, Temporary Fuel Tank) will have an evaporative emission control system that is certified for a fuel tank capacity for the vehicle as built. Intermediate or Final Stage Manufacturers wishing to add fuel tank capacity beyond the original equipment

fuel tank capacity must recertify that the Modified Fuel System meets Evaporative Emission Regulations in effect at the time of original vehicle manufacture. Compliance with applicable exhaust and evaporative emission requirements is the responsibility of the final stage manufacturer.

Vehicles equipped with option NJ2 - Temporary Fuel Tank do not have an evaporative emission control system.

D. Further compliance with applicable fuel evaporative emission requirements will be maintained providing the intermediate or final stage manufacturer completes the fuel filler neck and fuel level sender installation(s) according to "Best Practices" or "Special Applications (if applicable)" sections found within the Body Builder Manuals on the **GM Upfitter Integration website located at www.gmupfitter.com**

Compliance with applicable fuel evaporative emission regulations will be maintained if no alterations are made to change material or increase the size or length or position of the following non-metallic fuel and evaporative emission hoses:

Fuel feed hoses front and rear
Fuel return hoses front and rear
Fuel tank filler hoses to filler neck
Fuel tank vent hoses to filler neck
Fuel vapor lines at canister
Fuel vapor lines from engine to chassis pipes
Fuel vapor lines from fuel tank sender to: chassis pipes

TYPE 2 The following statement is applicable to all types of incomplete vehicles contained in this document and having an auxiliary heat exchanger installed in the engine cooling system by a subsequent stage manufacturer (unless otherwise noted on the cover).

To prevent setting of Service Engine Diagnostic codes, installation of an auxiliary heat exchanger in the engine cooling system by a subsequent stage manufacturer must be completed following specific supplemental technical information contained within the **GM Upfitter Integration website located at www.gmupfitter.com**

SPECIFICATION FOR FILL PIPES AND OPENINGS OF 2016 AND SUBSEQUENT MODEL MOTOR VEHICLE FUEL TANKS (APPLICABLE ONLY TO CALIFORNIA GASOLINE/GASOLINE-ETHANOL BLEND POWERED VEHICLES)

TYPE 2 The following statement is applicable to all types of incomplete vehicles contained in this document (unless otherwise noted on the cover).

This incomplete vehicle, when completed, will conform to Title 13, California Code of Regulations Section 2235, and the "Specifications for Fill Pipes and Openings of 2015 and subsequent Model Year Motor Vehicle Fuel Tanks", dated March 22, 2012, providing no alterations are made which affect the function, physical, chemical, or mechanical properties, environment, location or vital spatial clearances of the fuel filler neck(s) and any intermediate or final stage manufacturer completes the fuel filler neck installation(s) according to the instructions which are furnished in the loose parts box.

LABELS

TYPE 2 The following statement is applicable to all types of incomplete vehicles contained in this document (unless otherwise noted on the cover).

This incomplete vehicle, when completed, will conform to U.S. EPA, CALIFORNIA, AND CANADIAN EXHAUST & EVAPORATIVE EMISSION REQUIREMENTS AND EPA/NHTSA GREENHOUSE GAS EMISSIONS/FUEL ECONOMY REGULATION labeling requirements providing no alterations are made which affect the function, physical, chemical, or mechanical properties, environment, location or vital spatial clearances of the Emission Control related Information Labels that are permanently affixed. The labels are required by government regulation and must not be obstructed from view or defaced so as to impair their visibility or legibility. In addition, an EPA/DOT Fuel

Economy and Environment Label may be affixed to the window glass of the incomplete vehicle as manufactured by General Motors. If equipped, the label must remain in place until this vehicle is received by the ultimate customer.

NOTE: G-VAN Cutaway vehicles built with Diesel Engines include a "Ultra Low Sulfur Diesel Fuel Only" label that is provided in the shipped loose container. The "Ultra Low Sulfur Diesel Fuel Only" label must be affixed, clearly visible, near the fuel fill opening.

SEATING

TYPE 2 The following statement is applicable to all types of incomplete vehicles contained in this document (unless otherwise noted on the cover).

This incomplete vehicle, when completed, will conform to U.S. EPA, CALIFORNIA, AND CANADIAN EXHAUST & EVAPORATIVE EMISSION REQUIREMENTS AND EPA/NHTSA GREENHOUSE GAS EMISSIONS/FUEL ECONOMY REGULATION applicable to a Medium Duty Vehicle (MDV) provided that the seating configuration added by the upfitter does not result in classification of the completed vehicle as a Medium Duty Passenger Vehicle (MDPV), As defined in 40 CFR 86.1803-01, an MDPV is a heavy duty vehicle with a gross vehicle weight rating less than 10,000 pounds that is designed primarily for the transportation of passengers. GM's emissions certification applies only to completed vehicles that are classified as a Medium Duty Vehicle (MDV). If your completed vehicle has a GVWR below 10,000 pounds and falls within the definition of an MDPV, it will not be covered by GM's MDV emissions certification. For example, a completed vehicle under 10,000 pounds with a seating capacity of less than 12 persons or designed to seat less than 9 persons behind the driver, would be an MDPV and not covered by GM's MDV emissions certification.

SARA REGISTRAR™

Certificate of Registration

This is to certify the Quality Management System of:

FOREST RIVER MANUFACTURING, LLC

Division 5

Location Addresses:

Starcraft Bus & Eldorado Bus
(Commercial Bus)
2367 Century Drive
Goshen, IN 46528

Forest River Van
2408 Century Drive
Goshen, IN 46528

StarTrans Bus and Glaval Bus
2412 Century Drive
Goshen, IN 46528

Part Sales and Customer Service
2372 Century Drive
Goshen, IN 46528

has been assessed and found to be in compliance with the requirements of

ISO 9001:2015

for the following scope:

Design, Manufacturing, Sales, and Administration of Commercial and Government Buses and Vans

Certificate Number: **SARA-2006-CA-0031-B**

Originally Registered:
January 26, 2009

Latest Issue:
July 1, 2021

Expiry Date:
January 25, 2024

President, SARA Registrar

Standards American Registrations Authority REGISTERED

MEMBER OF MULTILATERAL RECOGNITION ARRANGEMENT IAF

IAS ACCREDITED Management Systems Certification Body MSCB-194

This registration is subject to the company maintaining its system to the required standard which will be monitored annually by SARA Registrar. This certificate remains the property of Standards American Registrations Authority (SARA Registrar) and shall be returned immediately upon request.
SARA Registrar Headquarter Mailing: 1807H Santa Rita Road, #175, Pleasanton, CA 94566

FOREST RIVER BUS, LLC

2367 CENTURY DRIVE ▸ GOSHEN, INDIANA 46528 ▸ 1.800.348.7440

June 30, 2023

To Whom It May Concern:

This document confirms that Sonny Merryman is an authorized factory dealer for Starcraft Bus in the State of Virginia. As such, Sonny Merryman is also authorized to perform service on Starcraft Bus bodies and maintains an adequate supply of replacement parts for shipment to end users.

Please do not hesitate to contact me if you have any concerns or questions.

Regards,

Mark LeRoy

Mark LeRoy
Contract Administrator
Forest River Bus, LLC

Dealer Details

Dealer Details: SONNY MERRYMAN INC

Owner: MERRYMAN III,FLOYD,W, *

Dealer-Operator: FLOYD MERRYMAN III

Address: 5120 WARDS ROAD

Address:

City: EVINGTON

State: VA

Zip: 24550

Phone: 4348211000

Expiration: 11/30/2023

Dealer Type: Franchised Dealer

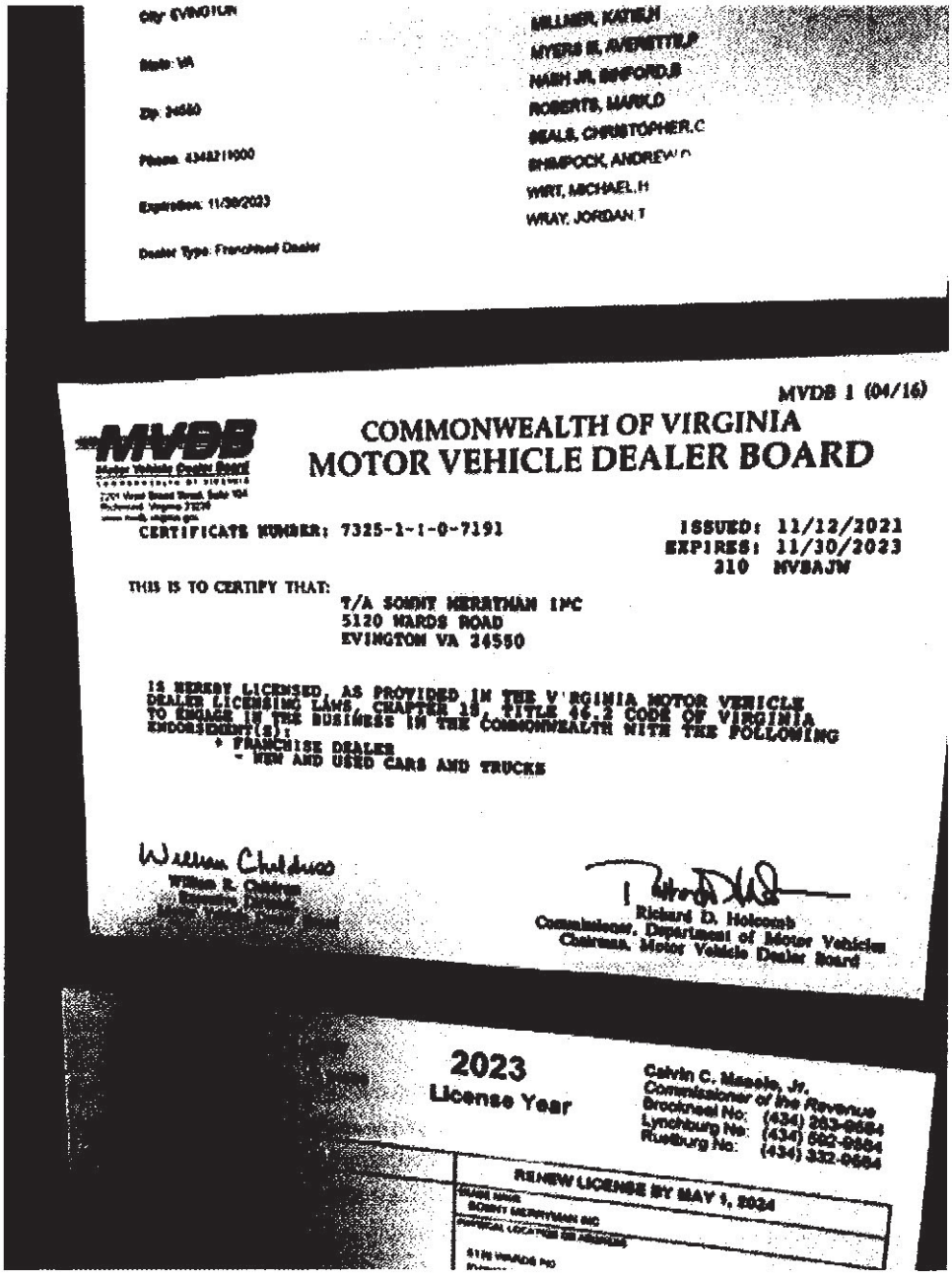
Sales Persons:

CHILDRESS, BRENT,L
COMPTON, CORY,F
EDGERLY, CALEY,R
FARMER, DEAN,G
HANKINS, JUDY,A
HELMS JR, JOSEPH,L
KOPANKO, WHITNEY,A
MARILLA, WENDY,M
MERRYMAN, MARSHALL,R
MERRYMAN III, FLOYD,W
MILLNER, KATIE,H
MYERS III, AVERETTE,P
NASH JR, BINFORD,B
ROBERTS, MARK,D
SEALS, CHRISTOPHER,C
SHIMPOCK, ANDREW,D
WIRT, MICHAEL,H
WRAY, JORDAN,T

Count of Salespersons: 18

Mark Roberts

From: Mark Roberts
Sent: Friday, July 14, 2023 10:49 AM
To: Mark Roberts



City: EVINGTON
State: VA
Zip: 24550
Phone: 4348219500
Expiration: 11/30/2023
Dealer Type: Franchised Dealer

MILLNER, KATHLYN
MYERS III, AVERETTE P
NASH JR, SHFORD B
ROBERTS, MARK D
SEALS, CHRISTOPHER C
SHIMPOCK, ANDREW D
WIRT, MICHAEL H
WRAY, JORDAN T

MVDB 1 (04/16)

MVDB
Motor Vehicle Dealer Board

COMMONWEALTH OF VIRGINIA
MOTOR VEHICLE DEALER BOARD

CERTIFICATE NUMBER: 7325-1-1-0-7191

ISSUED: 11/12/2021
EXPIRES: 11/30/2023
210 MVBAJW

THIS IS TO CERTIFY THAT:

T/A SONNY MERRYMAN INC
5120 WARDS ROAD
EVINGTON VA 24550

IS HEREBY LICENSED, AS PROVIDED IN THE VIRGINIA MOTOR VEHICLE DEALER LICENSING LAWS, CHAPTER 15, TITLE 46.2 CODE OF VIRGINIA TO ENGAGE IN THE BUSINESS IN THE COMMONWEALTH WITH THE FOLLOWING ENDORSEMENT(S):

- FRANCHISE DEALER
  - NEW AND USED CARS AND TRUCKS

William Childress
William R. Childress
Director

Richard D. Holcomb
Commissioner, Department of Motor Vehicles
Chairman, Motor Vehicle Dealer Board

2023
License Year

Calvin C. Massie, Jr.
Commissioner of the Revenue
Brookneal No: (434) 283-0684
Lynchburg No: (434) 582-0684
Rustburg No: (434) 332-0684

RENEW LICENSE BY MAY 1, 2024

SONNY MERRYMAN INC

5120 WARDS RD

Sent from my iPhone

STURAA TEST

7 YEAR

200,000 MILE BUS

from

STARCRAFT BUS,
A DIVISION of FOREST RIVER INC.

MODEL ALLSTAR -25

FEBRUARY 2006

PTI-BT-R0518

PENNSTATE

1855

The Pennsylvania Transportation Institute

201 Research Office Building
The Pennsylvania State University
University Park, PA 16802

(814) 865-1891

Bus Testing and Research Center

2237 Old Route 220 N.
Duncansville, PA 16635

(814) 695-3404

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Starcraft Bus, a Division of Forest River Inc. submitted a model Allstar-25, gasoline-powered 17 seat (including the driver) 25-foot bus, for a 7 yr/200,000 mile STURAA test. The odometer reading at the time of delivery was 529.0 miles. Testing started on December 6, 2005 and was completed on February 14, 2006. The Check-In section of the report provides a description of the bus and specifies its major components.

The primary part of the test program is the Structural Durability Test, which also provides the information for the Maintainability and Reliability results. The Structural Durability Test was started on December 14, 2005 and was completed on February 1, 2006.

The interior of the bus is configured with seating for 17 passengers including the driver + 1 wheelchair position. Free floor space will accommodate 10 standing passengers resulting in a potential capacity of 27 persons + 1 wheelchair position. At 150 lbs per person 600 lbs per wheelchair position, this load results in a measured gross vehicle weight of 13,950 lbs. The first segment of the Structural Durability Test was performed with the bus loaded to a GVW of 13,950 lbs. The middle segment was performed at a seated load weight of 12,500 lbs and the final segment was performed at a curb weight of 9,510 lbs. Durability driving resulted in no unscheduled maintenance and failures.

Accessibility, in general, was adequate, components covered in Section 1.3 (Repair and/or Replacement of Selected Subsystems) along with all other components encountered during testing, were found to be readily accessible and no restrictions were noted.

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 failures during the Structural Durability Test.

The Safety Test, (a double-lane change, obstacle avoidance test) was safely performed in both right-hand and left-hand directions up to a maximum test speed of 45 mph. The performance of the bus is illustrated by a speed vs. time plot. Acceleration and gradeability test data are provided in Section 4, Performance. The average time to obtain 50 mph was 13.75 seconds.

The Shakedown Test produced a maximum final loaded deflection of 0.224 inches with a permanent set ranging between -0.003 to 0.005 inches under a distributed static load of 10,725 lbs. The Distortion Test was completed with all subsystems, doors and escape mechanisms operating properly. Water leakage observed during the test at the top of the rear door between the door and the door frame.

The test bus was not equipped with any type of tow eyes or tow hooks, therefore, the Static Towing Test was not performed. The Dynamic Towing Test was performed by means of a front-lift tow. The towing interface was accomplished using a hydraulic under-lift wrecker. The bus was towed without incident and no damage resulted from the test. The manufacturer does not recommend towing the bus from the rear; therefore, a rear test was not performed. The Jacking and Hoisting Tests were also performed without incident. The bus was found to be stable on the jack stands, and the minimum jacking clearance observed with a tire deflated was 8.8 inches.

A Fuel Economy Test was run on simulated central business district, arterial, and commuter courses. The results were 6.39 mpg, 6.90 mpg, and 10.17 mpg respectively; with an overall average of 7.32 mpg.

A series of Interior and Exterior Noise Tests was performed. These data are listed in Section 7.1 and 7.2 respectively.

ABBREVIATIONS

ABTC - Altoona Bus Test Center
A/C - air conditioner
ADB - advance design bus
ATA-MC - The Maintenance Council of the American Trucking Association
CBD - central business district
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)
GVL - gross vehicle 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
MECH - bus mechanic
mpg - miles per gallon
mph - miles per hour
PM - Preventive maintenance
PSBRTF - Penn State Bus Research and Testing Facility
PTI - Pennsylvania Transportation Institute
rpm - revolutions per minute
SAE - Society of Automotive Engineers
SCH - test scheduler
SEC - secretary
SLW - seated load weight (curb weight plus 150 lb for every designed passenger seating position and for the driver)
STURAA - Surface Transportation and Uniform Relocation Assistance Act
TD - test driver
TECH - test technician
TM - track manager
TP - test personnel

TEST BUS CHECK-IN

I. OBJECTIVE

The objective of this task is to log in the test bus, assign a bus number, complete the vehicle data form, and perform a safety check.

II. TEST DESCRIPTION

The test consists of assigning a bus test number to the bus, cleaning the bus, completing the vehicle data form, obtaining any special information and tools from the manufacturer, determining a testing schedule, performing an initial safety check, and performing the manufacturer's recommended preventive maintenance. The bus manufacturer must certify that the bus meets all Federal regulations.

III. DISCUSSION

The check-in procedure is used to identify in detail the major components and configuration of the bus.

The test bus consists of a Starcraft Bus, model Allstar-25. The bus has a front door, rear of the front axle, and a dedicated handicap entrance rear of the rear axle. Note: the test bus was not equipped with a handicap device. Power is provided by a gasoline-fueled, Ford Motor Co. model 6.8 L EFI V10 engine coupled to a Ford Motor Co. model Elec 5-spd AOD transmission.

The measured curb weight is 3,810 lbs for the front axle and 5,700 lbs for the rear axle. These combined weights provide a total measured curb weight of 9,510 lbs. There are 17 seats including the driver, 1 wheelchair position and room for 10 standing passengers bringing the total passenger capacity to 27 + 1 wheelchair position. Gross load is 150 lb x 27 = 4,050 lbs + 600 lbs (wheelchair position) = 4,650 lbs. At full capacity, the measured gross vehicle weight is 13,950 lbs.

VEHICLE DATA FORM

Bus Number: 0518	Arrival Date: 12-6-05
Bus Manufacturer: Starcraft Bus	Vehicle Identification Number (VIN): 1FDXE45516HA98012
Model Number: Allstar-25	Date: 12-6-05
Personnel: S.C.	

WEIGHT:

Individual Wheel Reactions:

Weights (lb)	Front Axle		Middle Axle		Rear Axle	
	Right	Left	Right	Left	Right	Left
CW	1,970	1,840	N/A	N/A	2,930	2,770
SLW	2,180	2,080	N/A	N/A	4,170	4,070
GVW	2,370	2,250	N/A	N/A	4,750	4,580

Total Weight Details:

Weight (lb)	CW	SLW	GVW	GAWR
Front Axle	3,810	4,260	4,620	4,600
Middle Axle	N/A	N/A	N/A	N/A
Rear Axle	5,700	8,240	9,330	9,450
Total	9,510	12,500	13,950	GVWR: 14,050

Dimensions:

Length (ft/in)	25 / 11
Width (in)	98
Height (in)	112
Front Overhang (in)	33
Rear Overhang (in)	88
Wheel Base (in)	190
Wheel Track (in)	Front: 68.3
	Rear: 78.0

Bus Number: 0518	Date: 12-6-05

CLEARANCES:

Lowest Point Outside Front Axle	Location: Steering linkage	Clearance(in): 11.4
Lowest Point Outside Rear Axle	Location: Exhaust	Clearance(in): 11.2
Lowest Point between Axles	Location: Step	Clearance(in): 8.3
Ground Clearance at the center (in)	9.6	
Front Approach Angle (deg)	22.1	
Rear Approach Angle (deg)	9.5	
Ramp Clearance Angle (deg)	8.2	
Aisle Width (in)	17.1	
Inside Standing Height at Center Aisle (in)	92.2	

BODY DETAILS:

Body Structural Type	Integral		
Frame Material	Steel		
Body Material	Aluminum, fiberglass & steel		
Floor Material	Plywood		
Roof Material	Fiberglass		
Windows Type	□ Fixed	■ Movable	
Window Mfg./Model No.	Safety DOT 269 / ASE M180		
Number of Doors	_1_ Front	_1_ Rear	
Mfr. / Model No.	A & M Systems / 2133.1/213380		
Dimension of Each Door (in)	Front - 32.6 x 81.5	Rear – 45.6 x 70.0	
Passenger Seat Type	□ Cantilever	■ Pedestal	□ Other (explain)
Mfr. / Model No.	Freedman Seating Co. / Mid-Back Double		
Driver Seat Type	□ Air	□ Spring	■ Other (Cushion)
Mfr. / Model No.	Freedman Seating Co. / Hi-Back		
Number of Seats (including Driver)	17		

Bus Number: 0518	Date: 12-6-05

BODY DETAILS (Contd..)

Free Floor Space (ft^2)	16.4			
Height of Each Step at Normal Position (in)	Front	1. 10.0	2. 9.6	3. 10.1 4. N/A
	Middle	1. N/A	2. N/A	3. N/A 4. N/A
	Rear	1. N/A	2. N/A	3. N/A 4. N/A
Step Elevation Change - Kneeling (in)	N/A			

ENGINE

Type	□ C.I.	□ Alternate Fuel	
	■ S.I.	□ Other (explain)	
Mfr. / Model No.	Ford Motor Co. / 6.8 L EFI V10		
Location	■ Front	□ Rear	□ Other (explain)
Fuel Type	■ Gasoline	□ CNG	□ Methanol
	□ Diesel	□ LNG	□ Other (explain)
Fuel Tank Capacity (indicate units)	55 gals		
Fuel Induction Type	■ Injected	□ Carburetion	
Fuel Injector Mfr. / Model No.	Ford Motor Co. / 6.8 L EFI V10		
Carburetor Mfr. / Model No.	N/A		
Fuel Pump Mfr. / Model No.	Ford Motor Co. / 6.8 L EFI V10		
Alternator (Generator) Mfr. / Model No.	Motorcraft / 3GF		
Maximum Rated Output (Volts / Amps)	14.4 / 110		
Air Compressor Mfr. / Model No.	N/A		
Maximum Capacity (ft^3 / min)	N/A		
Starter Type	■ Electrical	□ Pneumatic	□ Other (explain)
Starter Mfr. / Model No.	Visteon / AY05J2		

Bus Number: 0518	Date: 12-6-05

TRANSMISSION

Transmission Type	□ Manual	■ Automatic	
Mfr. / Model No.	Ford Motor Co. / Elec 5-spd AOD		
Control Type	■ Mechanical	□ Electrical	□ Other
Torque Converter Mfr. / Model No.	Ford Motor Co. / Elec 5-spd AOD		
Integral Retarder Mfr. / Model No.	N/A		

SUSPENSION

Number of Axles	2		
Front Axle Type	■ Independent	□ Beam Axle	
Mfr. / Model No.	Ford Motor Co. / Twin I-Beam		
Axle Ratio (if driven)	N/A		
Suspension Type	■ Air	□ Spring	□ Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Motorcraft / C259Y2		
Middle Axle Type	□ Independent	□ Beam Axle	
Mfr. / Model No.	N/A		
Axle Ratio (if driven)	N/A		
Suspension Type	□ Air	□ Spring	□ Other (explain)
No. of Shock Absorbers	N/A		
Mfr. / Model No.	N/A		
Rear Axle Type	□ Independent	■ Beam Axle	
Mfr. / Model No.	Dana / Full Floating Dana 10.5H-D		
Axle Ratio (if driven)	4.56		
Suspension Type	□ Air	■ Spring	□ Other (explain)

No. of Shock Absorbers	2
Mfr. / Model No.	Motorcraft / C260Y1

Bus Number: 0518	Date: 12-6-05

WHEELS & TIRES

Front	Wheel Mfr./ Model No.	Ford / 8-Hole Disc, 16 x 6.0 Steel
	Tire Mfr./ Model No.	Michelin LTX / LT225/75R 16
Rear	Wheel Mfr./ Model No.	Ford / 8-Hole Disc, 16 x 6.0 Steel
	Tire Mfr./ Model No.	Michelin LTX / LT225/75R 16

BRAKES

Front Axle Brakes Type	□ Cam	■ Disc	□ Other (explain)
Mfr. / Model No.	TRW / na		
Middle Axle Brakes Type	□ Cam	□ Disc	□ Other (explain)
Mfr. / Model No.	N/A		
Rear Axle Brakes Type	□ Cam	■ Disc	□ Other (explain)
Mfr. / Model No.	Kelsey Hayes / na		
Retarder Type	N/A		
Mfr. / Model No.	N/A		

HVAC

Heating System Type	□ Air	■ Water	□ Other
Capacity (Btu/hr)	35,000		
Mfr. / Model No.	Ford Motor Co. / na		
Air Conditioner	■ Yes	□ No	
Location	Dash & Interior ceiling		
Capacity (Btu/hr)	55,000		
A/C Compressor Mfr. / Model No.	Ford / O.E.M.		

STEERING

Steering Gear Box Type	Hydraulic gear

Mfr. / Model No.	Ford / 6C22 3504 AA
Steering Wheel Diameter	15.0
Number of turns (lock to lock)	4.0

Bus Number: 0518	Date: 12-6-05

OTHERS

Wheel Chair Ramps	Location: N/A	Type: N/A
Wheel Chair Lifts	Location: N/A	Type: N/A
Mfr. / Model No.	N/A	
Emergency Exit	Location: Windows Doors	Number: 3 1

CAPACITIES

Fuel Tank Capacity (units)	55 gals
Engine Crankcase Capacity (gallons)	1.5
Transmission Capacity (gallons)	4.4
Differential Capacity (gallons)	2.1
Cooling System Capacity (quarts)	8.2
Power Steering Fluid Capacity (gallons)	Not available.

VEHICLE DATA FORM

Bus Number: 0518	Date: 12-6-05

List all spare parts, tools and manuals delivered with the bus.

Part Number	Description	Qty.
Michelin LTX M/S LT225/75R 16	Tires/wheels	6
XC2Z-2C026-BB	Brake rotors	2
FBUZ-1102-DA	Brake rotors	2
FA-1769	Air filter	1
FD-4606	Fuel water separator	1
FL-2016	Oil filter	1
AT-164-G F5UZ-18125-A	Shock absorber	2
AT-163-G F5UZ-18124-B	Shock absorber	2
FT-145	Transmission filter	1
FT-144	Screen assembly	1
BR1276 YU2Z-2V200-BA	Brake pads	1
1C3Z-2001-BA	Brake pads	1
2006 E-Series 6C2J19G219GA	Owner’s guide	1
NA	Allstar Owner Manual	1
NA	Trans/Air owner manual	1

COMPONENT/SUBSYSTEM INSPECTION FORM

Bus Number: 0518	Date: 12-6-05

Subsystem	Checked	Comments
Air Conditioning Heating and Ventilation		
Body and Sheet Metal		
Frame		
Steering		
Suspension		
Interior/Seating		
Axles		
Brakes		
Tires/Wheels		
Exhaust		
Fuel System		Gasoline.
Power Plant		
Accessories		
Lift System		Not equipped with a handicap device.
Interior Fasteners		
Batteries		

CHECK - IN

STARCRAFT BUS
MODEL ALLSTAR-25

1. MAINTAINABILITY

1.1 ACCESSIBILITY OF COMPONENTS AND SUBSYSTEMS

1.1-I. TEST OBJECTIVE

The objective of this test is to check the accessibility of components and subsystems.

1.1-II. TEST DESCRIPTION

Accessibility of components and subsystems is checked, and where accessibility is restricted the subsystem is noted along with the reason for the restriction.

1.1-III. DISCUSSION

Accessibility, in general, was adequate. Components covered in Section 1.3 (repair and/or replacement of selected subsystems), along with all other components encountered during testing, were found to be readily accessible and no restrictions were noted.

ACCESSIBILITY DATA FORM

Bus Number: 0518	Date: 2-9-06

Component	Checked	Comments
ENGINE :		
Oil Dipstick		
Oil Filler Hole		
Oil Drain Plug		
Oil Filter		
Fuel Filter		
Air Filter		
Belts		
Coolant Level		
Coolant Filler Hole		
Coolant Drain		
Spark / Glow Plugs		
Alternator		
Diagnostic Interface Connector		
TRANSMISSION :		
Fluid Dip-Stick		
Filler Hole		Fill through dip tube.
Drain Plug		
SUSPENSION :		
Bushings		
Shock Absorbers		
Air Springs	N/A	
Leveling Valves	N/A	
Grease Fittings		

ACCESSIBILITY DATA FORM

Bus Number: 0518	Date: 2-9-06

Component	Checked	Comments
HVAC :		
A/C Compressor		
Filters		
Fans		
ELECTRICAL SYSTEM :		
Fuses		
Batteries		
Voltage regulator		Internal.
Voltage Converters	N/A	
Lighting		
MISCELLANEOUS :		
Brakes		
Handicap Lifts/Ramps	N/A	
Instruments		
Axles		
Exhaust		
Fuel System		
OTHERS :		

1.2 SERVICING, PREVENTIVE MAINTENANCE, AND REPAIR AND MAINTENANCE DURING TESTING

1.2-I. TEST OBJECTIVE

The objective of this test is to collect maintenance data about the servicing, preventive maintenance, and repair.

1.2.-II. TEST DESCRIPTION

The test will be conducted by operating the NBM and collecting the following data on work order forms and a driver log.

1. Unscheduled Maintenance
    a. Bus number
    b. Date
    c. Mileage
    d. Description of malfunction
    e. Location of malfunction (e.g., in service or undergoing inspection)
    f. Repair action and parts used
    g. Man-hours required

2. Scheduled Maintenance
    a. Bus number
    b. Date
    c. Mileage
    d. Engine running time (if available)
    e. Results of scheduled inspections
    f. Description of malfunction (if any)
    g. Repair action and parts used (if any)
    h. Man-hours required

The buses will be operated in accelerated durability service. While typical items are given below, the specific service schedule will be that specified by the manufacturer.

A. Service
    1. Fueling
    2. Consumable checks
    3. Interior cleaning

B. Preventive Maintenance
    4. Brake adjustments
    5. Lubrication
    6. 3,000 mi (or equivalent) inspection

7. Oil and filter change inspection
8. Major inspection
9. Tune-up

C. Periodic Repairs
1. Brake reline
2. Transmission change
3. Engine change
4. Windshield wiper motor change
5. Stoplight bulb change
6. Towing operations
7. Hoisting operations

1.2-III. DISCUSSION

Servicing and preventive maintenance were performed at manufacturer-specified intervals. The following Scheduled Maintenance Form lists the mileage, items serviced, the service interval, and amount of time required to perform the maintenance. Table 1 is a list of the lubricating products used in servicing. Finally, the Unscheduled Maintenance List along with Unscheduled Maintenance-related photographs is included in Section 5.7, Structural Durability. This list supplies information related to failures that occurred during the durability portion of testing. The Unscheduled Maintenance List includes the date and mileage at which the malfunction occurred, a description of the malfunction and repair, and the time required to perform the repair.

SCHEDULED MAINTENANCE

Starcraft Bus 0518

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
12-21-05	1,185	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
01-06-06	2,375	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
01-13-06	4,131	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
01-18-06	5,137	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
01-24-06	6,407	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
01-31-06	7,404	P.M. / Inspection Fuel Economy Prep	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
02-01-06	7,500	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed. Oil changed. Oil, fuel, and air filters changed. Transmission oil and filter changed.	8.00	8.00

Table 1. STANDARD LUBRICANTS

The following is a list of Texaco lubricant products used in bus testing conducted by the Penn State University Altoona Bus Testing Center:

ITEM	PRODUCT CODE	TEXACO DESCRIPTION
Engine oil	#2112	URSA Super Plus SAE 30
Transmission oil	#1866	Automatic Trans Fluid Mercon/Dexron II Multipurpose
Gear oil	#2316	Multigear Lubricant EP SAE 80W90
Wheel bearing & Chassis grease	#1935	Starplex II

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS

1.3-I. TEST OBJECTIVE

The objective of this test is to establish the time required to replace and/or repair selected subsystems.

1.3-II. TEST DESCRIPTION

The test will involve components that may be expected to fail or require replacement during the service life of the bus. In addition, any component that fails during the NBM testing is added to this list. Components to be included are:

1. Transmission
2. Alternator
3. Starter
4. Batteries
5. Windshield wiper motor

1.3-III. DISCUSSION

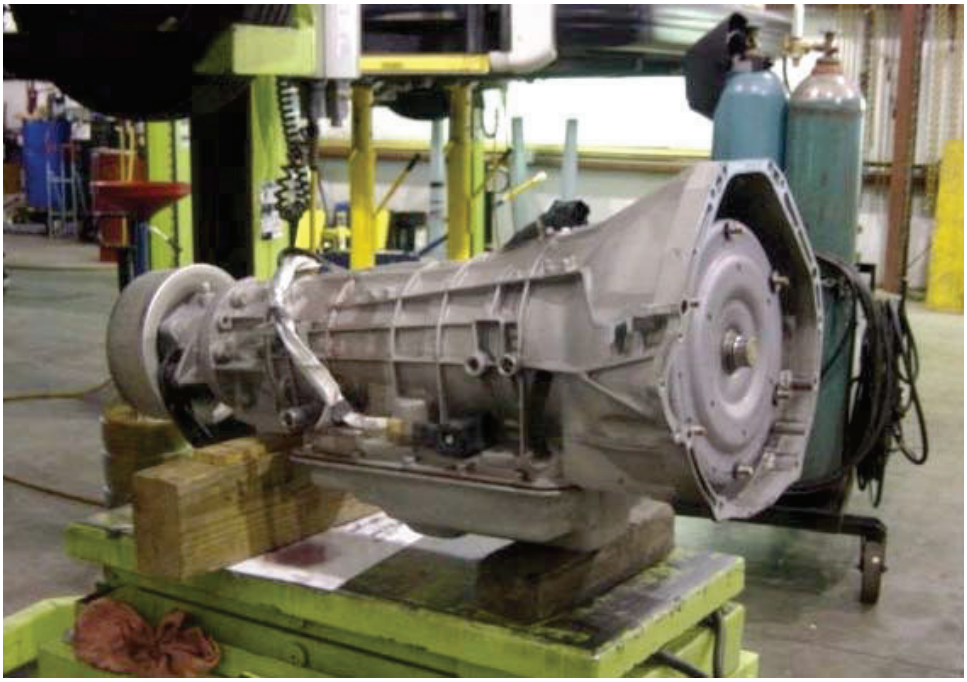
During the test, no additional components were removed for repair or replacement.

At the end of the test, the remaining items on the list were removed and replaced. The transmission assembly took 4.0 man-hours (two men 2.0 hrs) to remove and replace. The time required for repair/replacement of the four remaining components is given on the following Repair and/or Replacement Form.

REPLACEMENT AND/OR REPAIR FORM

Subsystem	Replacement Time
Transmission	4.00 man hours
Wiper Motor	0.50 man hours
Starter	0.50 man hours
Alternator	0.50 man hours
Batteries	1.00 man hours

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS



TRANSMISSION REMOVAL AND REPLACEMENT (4.00 MAN HOURS)

WIPER MOTOR REMOVAL AND REPLACEMENT (0.50 MAN HOURS)

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS CONT.

STARTER REMOVAL AND REPLACEMENT (0.50 MAN HOURS)

BATTERY REMOVAL AND REPLACEMENT (1.00 MAN HOURS)

2. RELIABILITY - DOCUMENTATION OF BREAKDOWN AND REPAIR TIMES DURING TESTING

2-I. TEST OBJECTIVE

The objective of this test is to document unscheduled breakdowns, repairs, down time, and repair time that occur during testing.

2-II. TEST DESCRIPTION

Using the driver log and unscheduled work order forms, all significant breakdowns, repairs, man-hours to repair, and hours out of service are recorded on the Reliability Data Form.

CLASS OF FAILURES

Classes of failures are described below:

(a) Class 1: Physical Safety. A failure that could lead directly to passenger or driver injury and represents a severe crash situation.

(b) Class 2: Road Call. A failure resulting in an en route interruption of revenue service. Service is discontinued until the bus is replaced or repaired at the point of failure.

(c) Class 3: Bus Change. A failure that requires removal of the bus from service during its assignments. The bus is operable to a rendezvous point with a replacement bus.

(d) Class 4: Bad Order. A failure that does not require removal of the bus from service during its assignments but does degrade coach operation. The failure shall be reported by driver, inspector, or hostler.

2-III. DISCUSSION

A listing of breakdowns and unscheduled repairs is accumulated during the Structural Durability Test. The following Reliability Data Form lists all unscheduled repairs under classes as defined above. These classifications are somewhat subjective as the test is performed on a test track with careful inspections every two hours. However, even on the road, there is considerable latitude on deciding how to handle many failures.

The classification of repairs according to subsystem is intended to emphasize those systems which had persistent minor or more serious problems. The bus submitted for testing encountered no failures during the Structural Durability Test.

3. SAFETY - A DOUBLE-LANE CHANGE (OBSTACLE AVOIDANCE)

3-I. TEST OBJECTIVE

The objective of this test is to determine handling and stability of the bus by measuring speed through a double lane change test.

3-II. TEST DESCRIPTION

The Safety Test is a vehicle handling and stability test. The bus will be operated at SLW on a smooth and level test track. The bus will be driven through a double lane change course at increasing speed until the test is considered unsafe or a speed of 45 mph is reached. The lane change course will be set up using pylons to mark off two 12 foot center to center lanes with two 100 foot lane change areas 100 feet apart. The bus will begin in one lane, change to the other lane in a 100 foot span, travel 100 feet, and return to the original lane in another 100 foot span. This procedure will be repeated, starting first in the right-hand and then in the left-hand lane.

3-III. DISCUSSION

The double-lane change was performed in both right-hand and left-hand directions. The bus was able to safely negotiate the test course in both the right-hand and left-hand directions up to the maximum test speed of 45 mph.

SAFETY DATA FORM

Bus Number: 0518	Date: 2-2-06
Personnel: B.S., S.C. & T.S.	

Temperature (°F): 35	Humidity (%): 93
Wind Direction: Calm	Wind Speed (mph): Calm
Barometric Pressure (in.Hg): 29.91	

SAFETY TEST: DOUBLE LANE CHANGE	
Maximum safe speed tested for double-lane change to left	45 mph
Maximum safe speed tested for double-lane change to right	45 mph
Comments of the position of the bus during the lane change: A safe profile was maintained through all portions of testing.	
Comments of the tire/ground contact patch: Tire/ground contact was maintained through all portions of testing.	

RIGHT - HAND APPROACH

LEFT - HAND APPROACH

4. PERFORMANCE - AN ACCELERATION, GRADEABILITY, AND TOP SPEED TEST

4-I. TEST OBJECTIVE

The objective of this test is to determine the acceleration, gradeability, and top speed capabilities of the bus.

4-II. TEST DESCRIPTION

In this test, the bus will be operated at SLW on the skid pad at the PSBRTF. The bus will be accelerated at full throttle from a standstill to a maximum "geared" or "safe" speed as determined by the test driver. The vehicle speed is measured using a Correvit non-contacting speed sensor. The times to reach speed between ten mile per hour increments are measured and recorded using a stopwatch with a lap timer. The time to speed data will be recorded on the Performance Data Form and later used to generate a speed vs. time plot and gradeability calculations.

4-III. DISCUSSION

This test consists of three runs in both the clockwise and counterclockwise directions on the Test Track. Velocity versus time data is obtained for each run and results are averaged together to minimize any test variability which might be introduced by wind or other external factors. The test was performed up to a maximum speed of 50 mph. The fitted curve of velocity vs. time is attached, followed by the calculated gradeability results. The average time to obtain 50 mph was 13.75 seconds.

PERFORMANCE DATA FORM

Bus Number: 0518	Date: 2-2-06
Personnel: B.S., S.C. & T.S.	

Temperature (°F): 37	Humidity (%): 93
Wind Direction: Calm	Wind Speed (mph): Calm
Barometric Pressure (in.Hg): 29.91	

Air Conditioning compressor-OFF	___ Checked
Ventilation fans-ON HIGH	___ Checked
Heater pump motor-Off	___ Checked
Defroster-OFF	___ Checked
Exterior and interior lights-ON	___ Checked
Windows and doors-CLOSED	___ Checked

ACCELERATION, GRADEABILITY, TOP SPEED

Counter Clockwise Recorded Interval Times

Speed	Run 1	Run 2	Run 3
10 mph	2.02	2.15	1.90
20 mph	3.77	4.24	3.84
30 mph	5.99	6.24	5.87
40 mph	9.68	9.84	9.43
Top Test Speed(mph) 50	14.09	14.40	14.20

Clockwise Recorded Interval Times

Speed	Run 1	Run 2	Run 3
10 mph	2.11	2.17	2.08
20 mph	3.88	4.14	3.86
30 mph	6.08	6.07	6.08
40 mph	9.36	9.28	9.30
Top Test Speed(mph) 50	13.42	13.08	13.33

0518.ACC

PERFORMANCE SUMMARY SHEET

BUS MANUFACTURER :Starcraft
BUS MODEL :Allstar-25
BUS NUMBER :0518
TEST DATE :2/2/06

TEST CONDITIONS :

TEMPERATURE (DEG F) : 37.0
WIND DIRECTION : calm
WIND SPEED (MPH) : .0
HUMIDITY (%) : 93
BAROMETRIC PRESSURE (IN. HG) : 29.9

VEHICLE SPEED	AVERAGE TIME (SEC)		
(MPH)	CCW DIRECTION	CW DIRECTION	TOTAL
10.0	2.02	2.12	2.07
20.0	3.95	3.96	3.96
30.0	6.03	6.08	6.06
40.0	9.65	9.31	9.48
50.0	14.23	13.28	13.75

TEST SUMMARY :

VEHICLE SPEED (MPH)	TIME (SEC)	ACCELERATION (FT/SEC^2)	MAX. GRADE (%)
1.0	.16	8.9	28.6
5.0	.85	8.3	26.8
10.0	1.76	7.7	24.6
15.0	2.76	7.1	22.4
20.0	3.85	6.4	20.3
25.0	5.05	5.8	18.3
30.0	6.38	5.2	16.4
35.0	7.87	4.7	14.6
40.0	9.54	4.1	12.9
45.0	11.45	3.6	11.2
50.0	13.64	3.1	9.7

NOTE : Gradeability results were calculated from performance test data. Actual sustained gradeability performance for vehicles equipped with auto transmission may be lower than the values indicated here.

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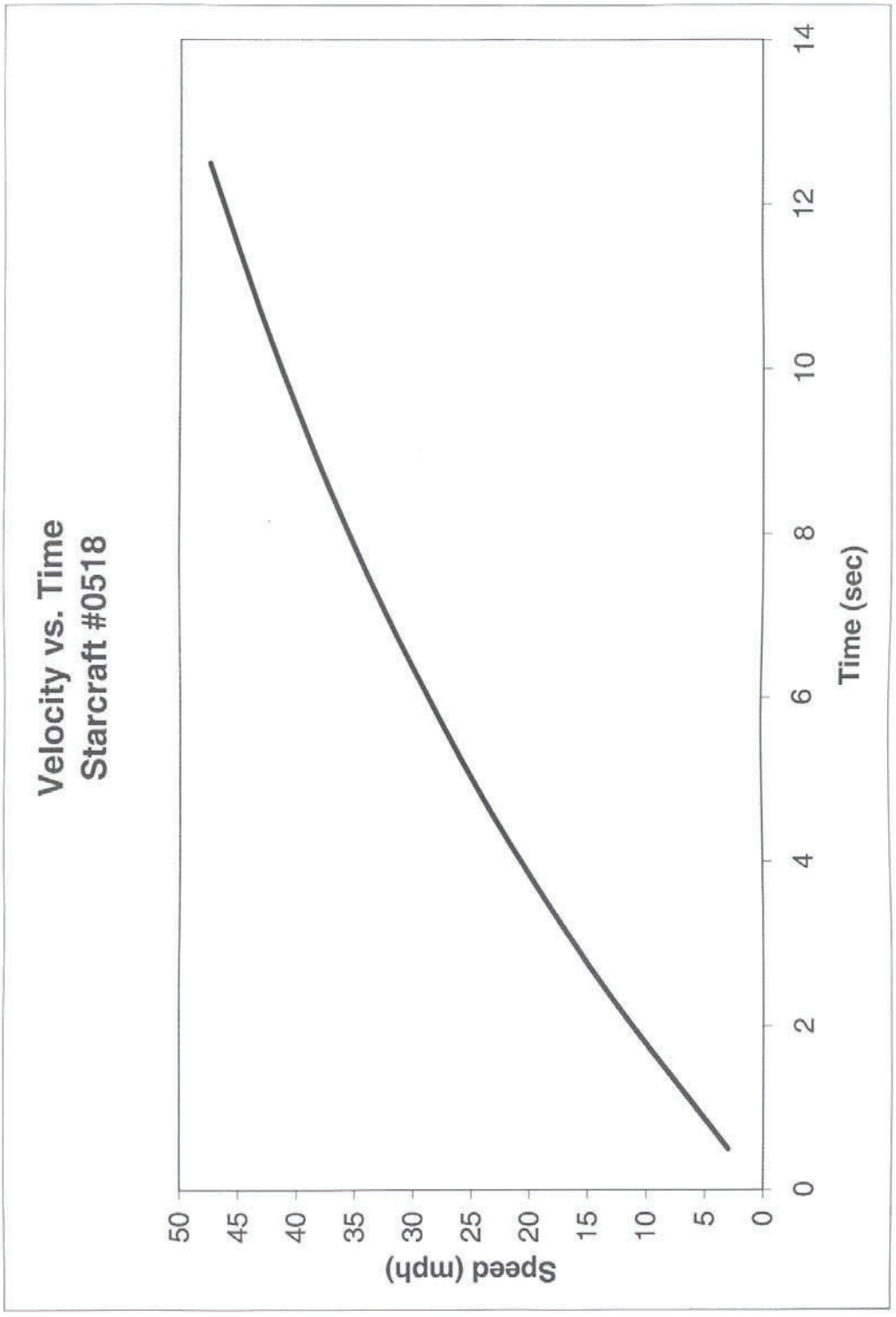

Velocity vs. Time
Starcraft #0518
Speed (mph)
0
5
10
15
20
25
30
35
40
45
50
Time (sec)
0
2
4
6
8
10
12
14

5. STRUCTURAL INTEGRITY

5.1 STRUCTURAL STRENGTH AND DISTORTION TESTS - STRUCTURAL SHAKEDOWN TEST

5.1-I. DISCUSSION

The objective of this test is to determine certain static characteristics (e.g., bus floor deflection, permanent structural deformation, etc.) under static loading conditions.

5.1-II. TEST DESCRIPTION

In this test, the bus will be isolated from the suspension by blocking the vehicle under the suspension points. The bus will then be loaded and unloaded up to a maximum of three times with a distributed load equal to 2.5 times gross load. Gross load is 150 lb for every designed passenger seating position, for the driver, and for each 1.5 sq ft of free floor space. For a distributed load equal to 2.5 times gross load, place a 375-lb load on each seat and on every 1.5 sq ft of free floor space. The first loading and unloading sequence will "settle" the structure. Bus deflection will be measured at several locations during the loading sequences.

5.1-III. DISCUSSION

This test was performed based on a maximum passenger capacity of 27 people including the driver and one wheelchair position. The resulting test load is (27 x 375 lb) = 10,125 lb + 600 lbs (wheelchair position) = 10,725 lbs. The load is distributed evenly over the passenger space. Deflection data before and after each loading and unloading sequence is provided on the Structural Shakedown Data Form.

The unloaded height after each test becomes the original height for the next test. Some initial settling is expected due to undercoat compression, etc. After each loading cycle, the deflection of each reference point is determined. The bus is then unloaded and the residual (permanent) deflection is recorded. On the final test, the maximum loaded deflection was 0.224 inches at reference point 9. The maximum permanent deflection after the final loading sequence ranged from -0.003 inches at reference point 6 to 0.005 inches at reference points 1, 4 and 12.

STRUCTURAL SHAKEDOWN DATA FORM

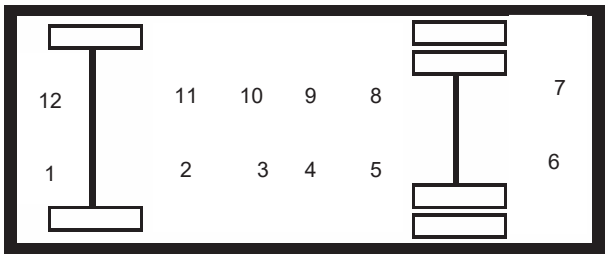
Bus Number: 0518	Date: 12-13-06
Personnel: D.L., E.L., K.D. & S.C.	Temperature (°F): 65
Loading Sequence: ■ 1 □ 2 □ 3 (check one) Test Load (lbs): 10,725	

Indicate Approximate Location of Each Reference Point

Right

Front of Bus

Left



Top View

Reference Point No.	A (in) Original Height	B (in) Loaded Height	B-A (in) Loaded Deflection	C (in) Unloaded Height	C-A (in) Permanent Deflection
1	0	-.085	-.085	-.015	-.015
2	0	.119	.119	.012	.012
3	0	.221	.221	.052	.052
4	0	.232	.232	.039	.039
5	0	.205	.205	.024	.024
6	0	-.066	-.066	-.011	-.011
7	0	-.015	-.015	-.021	-.021
8	0	.277	.277	.068	.068
9	0	.269	.269	.045	.045
10	0	.244	.244	.045	.045
11	0	.123	.123	.028	.028
12	0	-.009	-.009	-.011	-.011

STRUCTURAL SHAKEDOWN DATA FORM

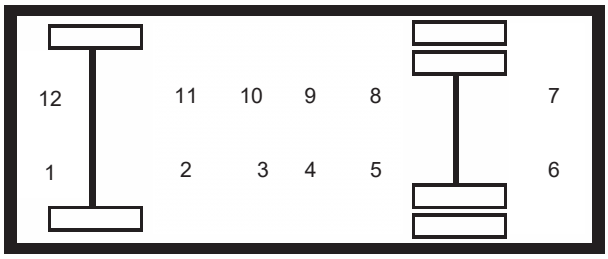
Bus Number: 0518	Date: 12-13-05
Personnel: D.L., E.L., T.S. & S.C.	Temperature (°F):
Loading Sequence: □ 1 ■ 2 □ 3 (check one) Test Load (lbs): 10,725	

Indicate Approximate Location of Each Reference Point

Right

Front of Bus

Left



Top View

Reference Point No.	A (in) Original Height	B (in) Loaded Height	B-A (in) Loaded Deflection	C (in) Unloaded Height	C-A (in) Permanent Deflection
1	-.015	-.086	-.071	-.020	.005
2	.012	.120	.108	.015	.003
3	.052	.228	.176	.056	.004
4	.039	.233	.194	.044	.005
5	.024	.205	.181	.027	.003
6	-.011	-.061	-.050	-.008	-.003
7	-.021	-.010	.011	-.023	.002
8	.068	.285	.217	.070	.002
9	.045	.269	.224	.047	.002
10	.045	.245	.200	.046	.001
11	.028	.124	.096	.032	.004
12	-.011	-.010	.001	-.016	.005

5.1 STRUCTURAL SHAKEDOWN TEST

DIAL INDICATORS IN POSITION
BUS LOADED TO 2.5 TIMES GVL
(10,725 LBS)

5.2 STRUCTURAL STRENGTH AND DISTORTION TESTS - STRUCTURAL DISTORTION

5.2-I. TEST OBJECTIVE

The objective of this test is to observe the operation of the bus subsystems when the bus is placed in a longitudinal twist simulating operation over a curb or through a pothole.

5.2-II. TEST DESCRIPTION

With the bus loaded to GVWR, each wheel of the bus will be raised (one at a time) to simulate operation over a curb and the following will be inspected:

1. Body
2. Windows
3. Doors
4. Roof vents
5. Special seating
6. Undercarriage
7. Engine
8. Service doors
9. Escape hatches
10. Steering mechanism

Each wheel will then be lowered (one at a time) to simulate operation through a pothole and the same items inspected.

5.2-III. DISCUSSION

The test sequence was repeated ten times. The first and last test is with all wheels level. The other eight tests are with each wheel 6 inches higher and 6 inches lower than the other three wheels.

All doors, windows, escape mechanisms, engine, steering and handicapped devices operated normally throughout the test. The undercarriage and body indicated no deficiencies. Water leakage was observed during the test at the top of the rear door between the door and the door frame. The results of this test are indicated on the following data forms.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0518	Date: 12-14-05
Personnel: T.S., E.L., D.L. & S.C.	Temperature(°F): 65

Wheel Position : (check one)		
All wheels level	■ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	Leak at top between door and door frame.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	Not equipped with a handicap device.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.

▪ Windows/ Body Leakage	No deficiencies.
▪ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0518	Date: 12-14-05
Personnel: T.S., E.L., D.L. & S.C.	Temperature(°F): 65

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	■ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	Leak at top between door and door frame.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	Not equipped with a handicap device.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.

▪ Windows/ Body Leakage	No deficiencies.
▪ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0518	Date: 12-14-05
Personnel: T.S., E.L., D.L. & S.C.	Temperature(°F): 65

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	■ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	Leak at top between door and door frame.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	Not equipped with a handicap device.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.

▪ Windows/ Body Leakage	No deficiencies.
▪ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0518	Date: 12-14-05
Personnel: T.S., E.L., D.L. & S.C.	Temperature(°F): 65

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	■ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	Leak at top between door and door frame.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	Not equipped with a handicap device.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.

▪ Windows/ Body Leakage	No deficiencies.
▪ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0518	Date: 12-14-05
Personnel: T.S., E.L., D.L. & S.C.	Temperature(°F): 65

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	■ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	Leak at top between door and door frame.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	Not equipped with a handicap device.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.

■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0518	Date: 12-14-05
Personnel: T.S., E.L., D.L. & S.C.	Temperature(°F): 65

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	■ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	Leak at top between door and door frame.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	Not equipped with a handicap device.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.

▪ Windows/ Body Leakage	No deficiencies.
▪ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0518	Date: 12-14-05
Personnel: T.S., E.L., D.L. & S.C.	Temperature(°F): 65

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	■ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	Leak at top between door and door frame.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	Not equipped with a handicap device.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.

▪ Windows/ Body Leakage	No deficiencies.
▪ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0518	Date: 12-14-05
Personnel: T.S., E.L., D.L. & S.C.	Temperature(°F): 65

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	■ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	Leak at top between door and door frame.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	Not equipped with a handicap device.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.

▪ Windows/ Body Leakage	No deficiencies.
▪ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0518	Date: 12-14-05
Personnel: T.S., E.L., D.L. & S.C.	Temperature(°F): 65

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	■ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	Leak at top between door and door frame.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	Not equipped with a handicap device.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.

■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0518	Date: 12-14-05
Personnel: T.S., E.L., D.L. & S.C.	Temperature(°F): 65

Wheel Position : (check one)		
All wheels level	□ before	■ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	Leak at top between door and door frame.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	Not equipped with a handicap device.
■ Undercarriage	No deficiencies
■ Service Doors	No deficiencies.
■ Body	No deficiencies.

■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

5.2 STRUCTURAL DISTORTION TEST

LEFT REAR WHEEL SIX INCHES LOWER

LEFT FRONT WHEEL SIX INCHES HIGHER

5.3 STRUCTURAL STRENGTH AND DISTORTION TESTS - STATIC TOWING TEST

5.3-I. TEST OBJECTIVE

The objective of this test is to determine the characteristics of the bus towing mechanisms under static loading conditions.

5.3-II. TEST DESCRIPTION

Utilizing a load-distributing yoke, a hydraulic cylinder is used to apply a static tension load equal to 1.2 times the bus curb weight. The load will be applied to both the front and rear, if applicable, towing fixtures at an angle of 20 degrees with the longitudinal axis of the bus, first to one side then the other in the horizontal plane, and then upward and downward in the vertical plane. Any permanent deformation or damage to the tow eyes or adjoining structure will be recorded.

5.3-III. DISCUSSION

The test bus submitted for testing was not equipped with any type of tow eyes or tow hooks, therefore, the Static Towing Test was not performed.

5.4 STRUCTURAL STRENGTH AND DISTORTION TESTS - DYNAMIC TOWING TEST

5.4-I. TEST OBJECTIVE

The objective of this test is to verify the integrity of the towing fixtures and determine the feasibility of towing the bus under manufacturer specified procedures.

5.4-II. TEST DESCRIPTION

This test requires the bus be towed at curb weight using the specified equipment and instructions provided by the manufacturer and a heavy-duty wrecker. The bus will be towed for 5 miles at a speed of 20 mph for each recommended towing configuration. After releasing the bus from the wrecker, the bus will be visually inspected for any structural damage or permanent deformation. All doors, windows and passenger escape mechanisms will be inspected for proper operation.

5.4-III. DISCUSSION

The bus was towed using a heavy-duty wrecker. The towing interface was accomplished by incorporating a hydraulic under lift. A front lift tow was performed. Rear towing is not recommended. No problems, deformation, or damage was noted during testing.

DYNAMIC TOWING TEST DATA FORM

Bus Number: 0518	Date: 2-13-06
Personnel: T.S. & S.C.	

Temperature (°F): 32	Humidity (%): 59
Wind Direction: NW	Wind Speed (mph): 8
Barometric Pressure (in.Hg): 30.05	

Inspect tow equipment-bus interface.
Comments: A safe and adequate connection was made between the tow equipment and the bus.
Inspect tow equipment-wrecker interface.
Comments: A safe and adequate connection was made between the tow equipment and the wrecker.
Towing Comments: A front lift tow was performed incorporating a hydraulic under lift wrecker.
Description and location of any structural damage: None noted.
General Comments: No problems were encountered with the tow or towing interface.

5.4 DYNAMIC TOWING TEST

TOWING INTERFACE

5.5 STRUCTURAL STRENGTH AND DISTORTION TESTS – JACKING TEST

5.5-I. TEST OBJECTIVE

The objective of this test is to inspect for damage due to the deflated tire, and determine the feasibility of jacking the bus with a portable hydraulic jack to a height sufficient to replace a deflated tire.

5.5-II. TEST DESCRIPTION

With the bus at curb weight, the tire(s) at one corner of the bus are replaced with deflated tire(s) of the appropriate type. A portable hydraulic floor jack is then positioned in a manner and location specified by the manufacturer and used to raise the bus to a height sufficient to provide 3-in clearance between the floor and an inflated tire. The deflated tire(s) are replaced with the original tire(s) and the hack is lowered. Any structural damage or permanent deformation is recorded on the test data sheet. This procedure is repeated for each corner of the bus.

5.5-III. DISCUSSION

The jack used for this test has a minimum height of 8.75 inches. During the deflated portion of the test, the jacking point clearances ranged from 8.8 inches to 20.1 inches. No deformation or damage was observed during testing. A complete listing of jacking point clearances is provided in the Jacking Test Data Form.

JACKING CLEARANCE SUMMARY

Condition	Frame Point Clearance
Front axle – one tire flat	15.3”
Rear axle – one tire flat	20.1”
Rear axle – two tires flat	17.7”

JACKING TEST DATA FORM

Bus Number: 0518	Date: 12-7-05
Personnel: E.L. & D.L.	Temperature (°F): 68

Record any permanent deformation or damage to bus as well as any difficulty encountered during jacking procedure.

Deflated Tire	Jacking Pad Clearance Body/Frame (in)	Jacking Pad Clearance Axle/Suspension (in)	Comments
Right front	17.3 “ I 15.3 “ D	11.2 “ I 9.3 “ D	None noted.
Left front	17.3 “ I 15.3 “ D	11.3 “ I 9.3 “ D	“
Right rear—outside	20.2 “ I 20.1 “ D	11.4 “ I 11.2 “ D	“
Right rear—both	20.2 “ I 17.7 “ D	11.4 “ I 8.9 “ D	“
Left rear—outside	20.3 “ I 20.1 “ D	11.4 “ I 11.1 “ D	“
Left rear—both	20.3 “ I 17.7 “ D	11.4 “ I 8.8 “ D	“
Right middle or tag—outside	NA	NA	
Right middle or tag—both	NA	NA	
Left middle or tag—outside	NA	NA	
Left middle or tag—both	NA	NA	

Additional comments of any deformation or difficulty during jacking:
None noted.

5.6 STRUCTURAL STRENGTH AND DISTORTION TESTS - HOISTING TEST

5.6-I. TEST OBJECTIVE

The objective of this test is to determine possible damage or deformation caused by the jack/stands.

5.6-II. TEST DESCRIPTION

With the bus at curb weight, the front end of the bus is raised to a height sufficient to allow manufacturer-specified placement of jack stands under the axles or jacking pads independent of the hoist system. The bus will be checked for stability on the jack stands and for any damage to the jacking pads or bulkheads. The procedure is repeated for the rear end of the bus. The procedure is then repeated for the front and rear simultaneously.

5.6-III. DISCUSSION

The test was conducted using four posts of a six-post electric lift and standard 19 inch jack stands. The bus was hoisted from the front wheel, rear wheel, and then the front and rear wheels simultaneously and placed on jack stands.

The bus easily accommodated the placement of the vehicle lifts and jack stands and the procedure was performed without any instability noted.

HOISTING TEST DATA FORM

Bus Number: 0518	Date: 12-12-05
Personnel: T.S. & S.C.	Temperature (°F): 66

Comments of any structural damage to the jacking pads or axles while both the front wheels are supported by the jack stands:
None noted.
Comments of any structural damage to the jacking pads or axles while both the rear wheels are supported by the jack stands:
None noted.
Comments of any structural damage to the jacking pads or axles while both the front and rear wheels are supported by the jack stands:
None noted.

5.7 STRUCTURAL DURABILITY TEST

5.7-I. TEST OBJECTIVE

The objective of this test is to perform an accelerated durability test that approximates up to 25 percent of the service life of the vehicle.

5.7-II. TEST DESCRIPTION

The test vehicle is driven a total of 7,500 miles; approximately 5,000 miles on the PSBRTF Durability Test Track and approximately 2,500 miscellaneous other miles. The test will be conducted with the bus operated under three different loading conditions. The first segment will consist of approximately 3,000 miles with the bus operated at GVW. The second segment will consist of approximately 1,500 miles with the bus operated at SLW. The remainder of the test, approximately 3,000 miles, will be conducted with the bus loaded to CW. If GVW exceeds the axle design weights, then the load will be adjusted to the axle design weights and the change will be recorded. All subsystems are run during these tests in their normal operating modes. All recommended manufacturers servicing is to be followed and noted on the vehicle maintainability log. Servicing items accelerated by the durability tests will be compressed by 10:1; all others will be done on a 1:1 mi/mi basis. Unscheduled breakdowns and repairs are recorded on the same log as are any unusual occurrences as noted by the driver. Once a week the test vehicle shall be washed down and thoroughly inspected for any signs of failure.

5.7-III. DISCUSSION

The Structural Durability Test was started on December 14, 2005 and was conducted until February 1, 2006. The first 3,000 miles were performed at a GVW of 13,950 lbs. and completed on January 6, 2006. The next 1,500 mile SLW segment was performed at 12,500 lbs and completed on January 16, 2006, and the final 3,000 mile segment was performed at a CW of 9,510 lbs and completed on February 1, 2006.

The following mileage summary presents the accumulation of miles during the Structural Durability Test. The driving schedule is included, showing the operating duty cycle. A detailed plan view of the Test Track Facility and Durability Test Track are attached for reference. Also, a durability element profile detail shows all the measurements of the different conditions. The test bus encountered no failures during the Structural Durability Test.

STARCRAFT - TEST BUS #0518

MILEAGE DRIVEN/RECORDED FROM DRIVERS= LOGS

DATE	TOTAL DURABILITY TRACK	TOTAL OTHER MILES	TOTAL
12/12/05 TO 12/18/05	496.00	74.00	570.00
12/19/05 TO 12/25/05	801.00	138.00	939.00
12/26/05 TO 01/01/06	0.00	0.00	0.00
01/02/06 TO 01/08/06	703.00	309.00	1012.00
01/09/06 TO 01/15/06	889.00	875.00	1764.00
01/16/06 TO 01/22/06	972.00	728.00	1700.00
01/23/06 TO 01/29/06	1139.00	180.00	1319.00
01/30/06 TO 02/05/06	0.00	196.00	196.00
TOTAL	5000.00	2500.00	7500.00

Table 4. Driving Schedule for Bus Operation on the Durability Test Track.

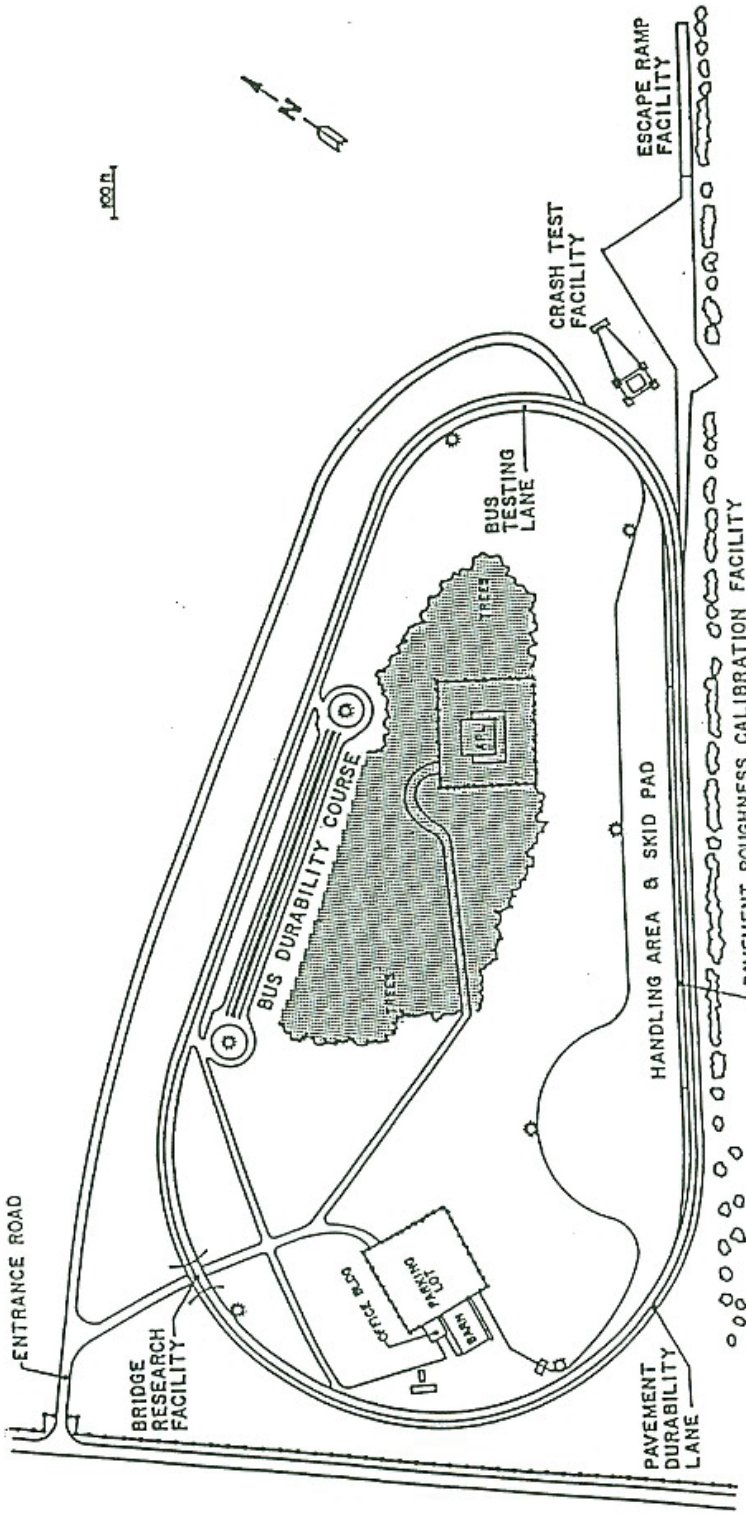
STANDARD OPERATING SCHEDULE

Monday through Friday

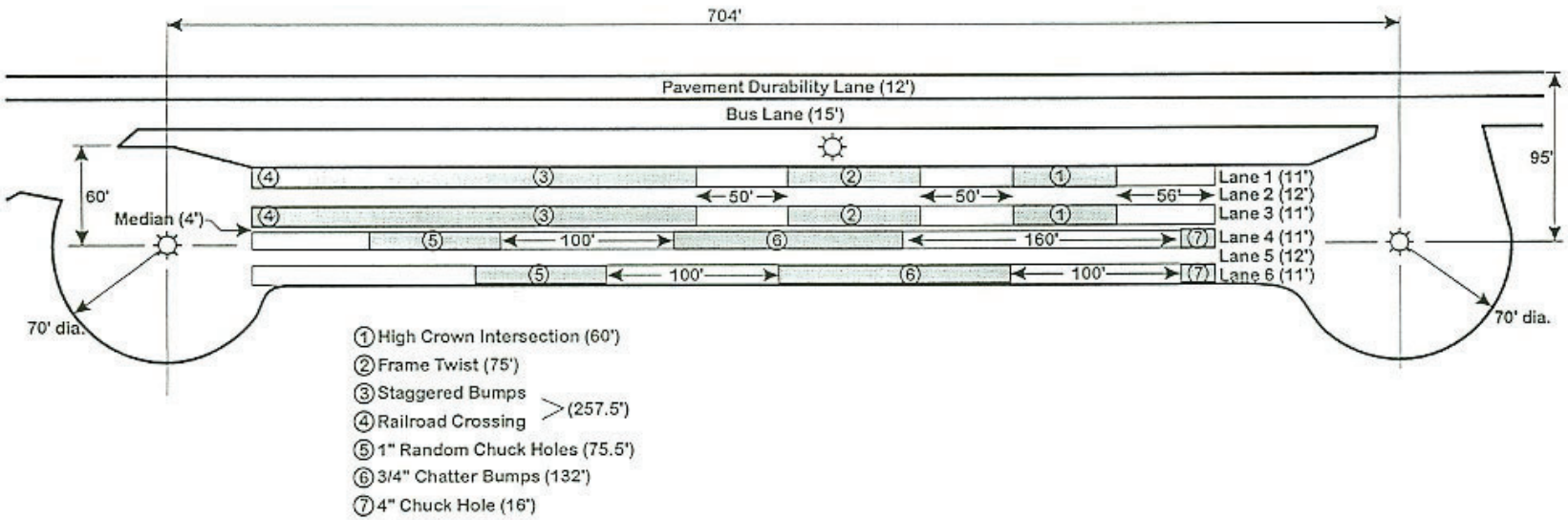
	HOUR	ACTION
Shift 1	midnight	D
	1:40 am	C
	1:50 am	B
	2:00 am	D
	3:35 am	C
	3:45 am	B
	4:05 am	D
	5:40 am	C
	5:50 am	B
	6:00 am	D
	7:40 am	C
	7:50 am	F
Shift 2	8:00 am	D
	9:40 am	C
	9:50 am	B
	10:00 am	D
	11:35 am	C
	11:45 am	B
	12:05 pm	D
	1:40 pm	C
	1:50 pm	B
	2:00 pm	D
	3:40 pm	C
	3:50 pm	F
Shift 3	4:00 pm	D
	5:40 pm	C
	5:50 pm	B
	6:00 pm	D
	7:40 pm	C
	7:50 pm	B
	8:05 pm	D
	9:40 pm	C
	9:50 pm	B
	10:00 pm	D
	11:40 pm	C
	11:50 pm	F

B---Break
C----Cycle all systems five times, visual inspection, driver's log entries
D----Drive bus as specified by procedure
F----Fuel bus, complete driver's log shift entries

"PLAN VIEW OF PENN STATE BUS TESTING AND RESEARCH FACILITY"



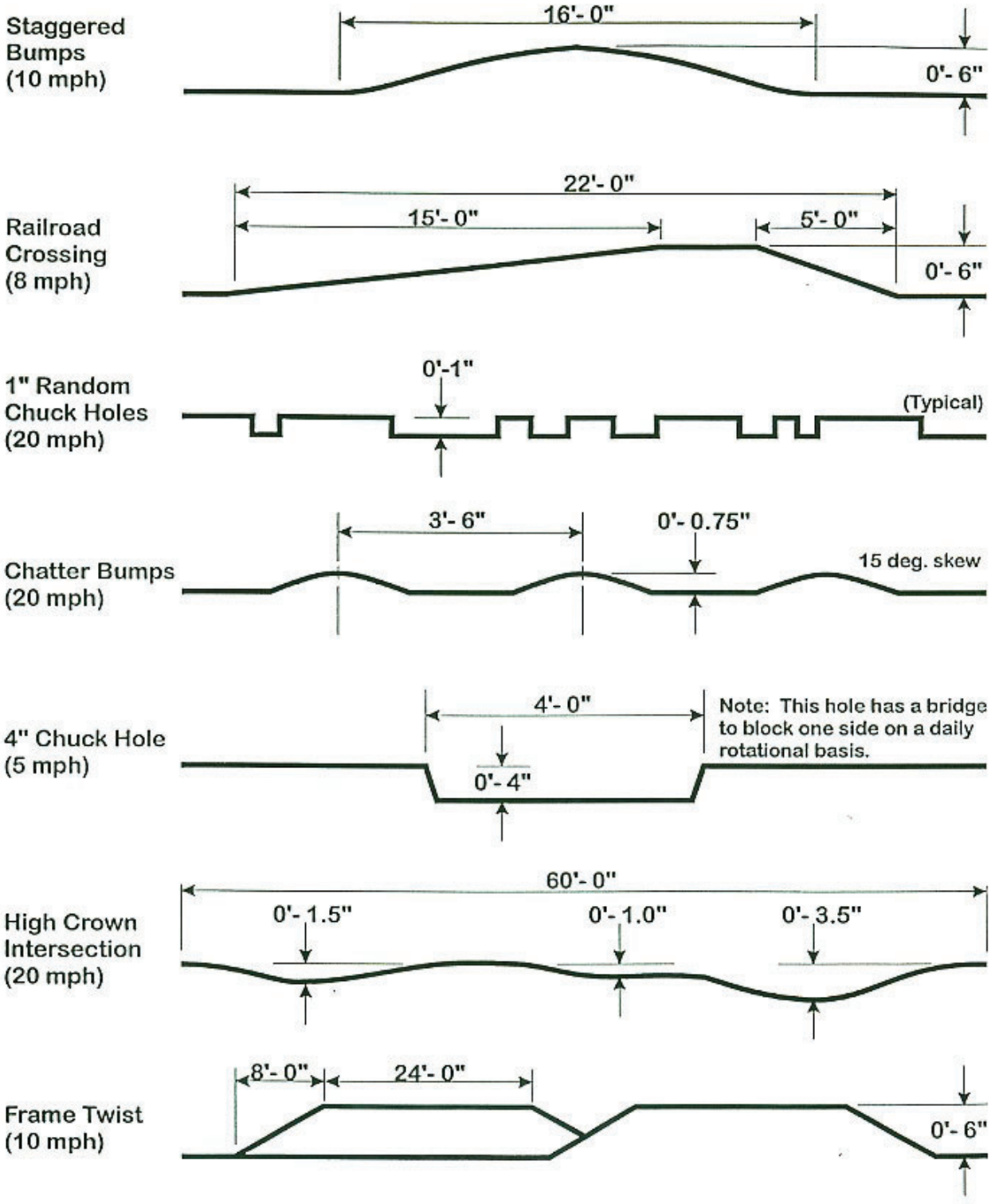
BUS TESTING AND RESEARCH TEST TRACK
UNIVERSITY PARK, PA



Plan View

Vehicle Durability Test Track

The Pennsylvania Transportation Institute
Penn State



Durability Element Profiles

The Pennsylvania Transportation Institute
Penn State

6. FUEL ECONOMY TEST - A FUEL CONSUMPTION TEST USING AN APPROPRIATE OPERATING CYCLE

6-I. TEST OBJECTIVE

The objective of this test is to provide accurate comparable fuel consumption data on transit buses produced by different manufacturers. This fuel economy test bears no relation to the calculations done by the Environmental Protection Agency (EPA) to determine levels for the Corporate Average Fuel Economy Program. EPA's calculations are based on tests conducted under laboratory conditions intended to simulate city and highway driving. This fuel economy test, as designated here, is a measurement of the fuel expended by a vehicle traveling a specified test loop under specified operating conditions. The results of this test will not represent actual mileage but will provide data that can be used by recipients to compare buses tested by this procedure.

6-II. TEST DESCRIPTION

This test requires operation of the bus over a course based on the Transit Coach Operating Duty Cycle (ADB Cycle) at seated load weight using a procedure based on the Fuel Economy Measurement Test (Engineering Type) For Trucks and Buses: SAE 1376 July 82. The procedure has been modified by elimination of the control vehicle and by modifications as described below. The inherent uncertainty and expense of utilizing a control vehicle over the operating life of the facility is impractical.

The fuel economy test will be performed as soon as possible (weather permitting) after the completion of the GVW portion of the structural durability test. It will be conducted on the bus test lane at the Penn State Test Facility. Signs are erected at carefully measured points which delineate the test course. A test run will comprise 3 CBD phases, 2 Arterial phases, and 1 Commuter phase. An electronic fuel measuring system will indicate the amount of fuel consumed during each phase of the test. The test runs will be repeated until there are at least two runs in both the clockwise and counterclockwise directions in which the fuel consumed for each run is within $\forall$ 4 percent of the average total fuel used over the 4 runs. A 20-minute idle consumption test is performed just prior to and immediately after the driven portion of the fuel economy test. The amount of fuel consumed while operating at normal/low idle is recorded on the Fuel Economy Data Form. This set of four valid runs along with idle consumption data comprise a valid test.

The test procedure is the ADB cycle with the following four modifications:

1. The ADB cycle is structured as a set number of miles in a fixed time in the following order: CBD, Arterial, CBD, Arterial, CBD, and Commuter. A separate idle fuel consumption measurement is performed at the beginning and end of the fuel economy test. This phase sequence permits the reporting of fuel consumption for each of these phases separately, making the data more useful to bus manufacturers and transit properties.

2. The operating profile for testing purposes shall consist of simulated transit type service at seated load weight. The three test phases (figure 6-1) are: a central business district (CBD) phase of 2 miles with 7 stops per mile and a top speed of 20 mph; an arterial phase of 2 miles with 2 stops per mile and a top speed of 40 mph; and a commuter phase of 4 miles with 1 stop and a maximum speed of 40 mph. At each designated stop the bus will remain stationary for seven seconds. During this time, the passenger doors shall be opened and closed.

3. The individual ADB phases remain unaltered with the exception that 1 mile has been changed to 1 lap on the Penn State Test Track. One lap is equal to 5,042 feet. This change is accommodated by adjusting the cruise distance and time.

4. The acceleration profile, for practical purposes and to achieve better repeatability, has been changed to "full throttle acceleration to cruise speed".

Several changes were made to the Fuel Economy Measurement Test (Engineering Type) For Trucks and Buses: SAE 1376 July 82:

1. Sections 1.1, and 1.2 only apply to diesel, gasoline, methanol, and any other fuel in the liquid state (excluding cryogenic fuels).

1.1 SAE 1376 July 82 requires the use of at least a 16-gal fuel tank. Such a fuel tank when full would weigh approximately 160 lb. It is judged that a 12-gal tank weighing approximately 120 lb will be sufficient for this test and much easier for the technician and test personnel to handle.

1.2 SAE 1376 July 82 mentions the use of a mechanical scale or a flowmeter system. This test procedure uses a load cell readout combination that provides an accuracy of 0.5 percent in weight and permits on-board weighing of the gravimetric tanks at the end of each phase. This modification permits the determination of a fuel economy value for each phase as well as the overall cycle.

2. Section 2.1 applies to compressed natural gas (CNG), liquefied natural gas (LNG), cryogenic fuels, and other fuels in the vapor state.

2.1 A laminar type flowmeter will be used to determine the fuel consumption. The pressure and temperature across the flow element will be monitored by the flow computer. The flow computer will use this data to calculate the gas flow rate. The flow computer will also display the flow rate (scfm) as well as the total fuel used (scf). The total fuel used (scf) for each phase will be recorded on the Fuel Economy Data Form.

3. Use both Sections 1 and 2 for dual fuel systems.

FUEL ECONOMY CALCULATION PROCEDURE

A. For diesel, gasoline, methanol and fuels in the liquid state.

The reported fuel economy is based on the following: measured test quantities--distance traveled (miles) and fuel consumed (pounds); standard reference values--density of water at 60EF (8.3373 lbs/gal) and volumetric heating value of standard fuel; and test fuel specific gravity (unitless) and volumetric heating value (BTU/gal). These combine to give a fuel economy in miles per gallon (mpg) which is corrected to a standard gallon of fuel referenced to water at 60EF. This eliminates fluctuations in fuel economy due to fluctuations in fuel quality. This calculation has been programmed into a computer and the data processing is performed automatically.

The fuel economy correction consists of three steps:

1.) Divide the number of miles of the phase by the number of pounds of fuel consumed

phase	miles per phase	total miles per run
CBD	1.9097	5.7291
ART	1.9097	3.8193
COM	3.8193	3.8193

$$\mathbf{FEo_{mi/lb}} = \text{Observed fuel economy} = \frac{\text{miles}}{\text{lb of fuel}}$$

2.) Convert the observed fuel economy to miles per gallon [mpg] by multiplying by the specific gravity of the test fuel Gs (referred to water) at 60EF and multiply by the density of water at 60EF

$$\mathbf{FEo_{mpg}} = \mathbf{FEc_{mi/lb}} \times Gs \times Gw$$

where **Gs** = Specific gravity of test fuel at 60EF (referred to water)
Gw = 8.3373 lb/gal

3.) Correct to a standard gallon of fuel by dividing by the volumetric heating value of the test fuel (H) and multiplying by the volumetric heating value of standard reference fuel (Q). Both heating values must have the same units.

$$\mathbf{FEc} = \mathbf{FEo_{mpg}} \times \frac{Q}{H}$$

where

H = Volumetric heating value of test fuel [BTU/gal]
Q = Volumetric heating value of standard reference fuel

Combining steps 1-3 yields

$$\Rightarrow \quad FEc = \frac{\text{miles}}{\text{lbs}} \times (Gs \times Gw) \times \frac{Q}{H}$$

4.) Covert the fuel economy from mpg to an energy equivalent of miles per BTU. Since the number would be extremely small in magnitude, the energy equivalent will be represented as miles/BTUx10^6.

Eq = Energy equivalent of converting mpg to mile/BTUx10^6.

$$Eq = ((mpg)/(H))x10^6$$

B. CNG, LNG, cryogenic and other fuels in the vapor state.

The reported fuel economy is based on the following: measured test quantities--distance traveled (miles) and fuel consumed (scf); density of test fuel, and volumetric heating value (BTU/lb) of test fuel at standard conditions (P=14.73 psia and T=60 EF).

These combine to give a fuel economy in miles per lb. The energy equivalent (mile/BTUx10^6) will also be provided so that the results can be compared to buses that use other fuels.

1.) Divide the number of miles of the phase by the number of standard cubic feet (scf) of fuel consumed.

phase	miles per phase	total miles per run
CBD	1.9097	5.7291
ART	1.9097	3.8193
COM	3.8193	3.8193

$FEo_{mi/scf}$ = Observed fuel economy = $\frac{\text{miles}}{\text{scf of fuel}}$

2.) Convert the observed fuel economy to miles per lb by dividing FEo by the density of the test fuel at standard conditions (Lb/ft^3).

Note: The density of test fuel must be determined at standard conditions as described above. If the density is not defined at the above standard conditions, then a correction will be needed before the fuel economy can be calculated.

$$FEo_{mi/lb} = FEo / Gm$$

where Gm = Density of test fuel at standard conditions

3.) Convert the observed fuel economy (FEomi/lb) to an energy equivalent of (miles/BTUx10^6) by dividing the observed fuel economy (FEomi/lb) by the heating value of the test fuel at standard conditions.

$$Eq = ((FEomi/lb)/H)x10^6$$

where

Eq = Energy equivalent of miles/lb to mile/BTUx10^6
H = Volumetric heating value of test fuel at standard conditions

6-III. DISCUSSION

This is a comparative test of fuel economy using unleaded gasoline fuel with a heating value of 20,025.0 btu/lb. The driving cycle consists of Central Business District (CBD), Arterial (ART), and Commuter (COM) phases as described in 6-II. The fuel consumption for each driving cycle and for idle is measured separately. The results are corrected to a reference fuel with a volumetric heating value of 127,700.0 btu/gal.

An extensive pretest maintenance check is made including the replacement of all lubrication fluids. The details of the pretest maintenance are given in the first three Pretest Maintenance Forms. The fourth sheet shows the Pretest Inspection. The next sheet shows the correction calculation for the test fuel. The next four Fuel Economy Forms provide the data from the four test runs. Finally, the summary sheet provides the average fuel consumption. The overall average is based on total fuel and total mileage for each phase. The overall average fuel consumption values were; CBD – 6.39 mpg, ART – 6.90 mpg, and COM – 10.17 mpg. Average fuel consumption at idle was 4.10 lb/hr (0.65 gph).

FUEL ECONOMY PRE-TEST MAINTENANCE FORM

Bus Number: 0518	Date: 1-30-06	SLW (lbs): 12,500
Personnel: T.S., E.L. & D.L.		

FUEL SYSTEM	OK	Date	Initials
Install fuel measurement system		1/30/06	T.S.
Replace fuel filter		1/30/06	T.S.
Check for fuel leaks		1/30/06	T.S.
Specify fuel type (refer to fuel analysis)	Gasoline		
Remarks: None noted.			
BRAKES/TIRES	OK	Date	Initials
Inspect hoses		1/30/06	T.S.
Inspect brakes		1/30/06	T.S.
Relube wheel bearings		1/30/06	T.S.
Check tire inflation pressures (mfg. specs.)		1/30/06	T.S.
Remarks: None noted.			
COOLING SYSTEM	OK	Date	Initials
Check hoses and connections		1/30/06	D.L.
Check system for coolant leaks		1/30/06	D.L.
Remarks: None noted.			

FUEL ECONOMY PRE-TEST MAINTENANCE FORM (page 2)

Bus Number: 0518	Date: 1-30-06
Personnel: T.S., E.L. & D.L.	

ELECTRICAL SYSTEMS	OK	Date	Initials
Check battery		1/30/06	T.S.
Inspect wiring		1/30/06	T.S.
Inspect terminals		1/30/06	T.S.
Check lighting		1/30/06	T.S.
Remarks: None noted.			
DRIVE SYSTEM	OK	Date	Initials
Drain transmission fluid		1/30/06	D.L.
Replace filter/gasket		1/30/06	E.L.
Check hoses and connections		1/30/06	D.L.
Replace transmission fluid		1/30/06	E.L.
Check for fluid leaks		1/30/06	E.L.
Remarks: None noted.			
LUBRICATION	OK	Date	Initials
Drain crankcase oil		1/30/06	E.L.
Replace filters		1/30/06	D.L.
Replace crankcase oil		1/30/06	T.S.
Check for oil leaks		1/30/06	E.L.
Check oil level		1/30/06	T.S.
Lube all chassis grease fittings		1/30/06	E.L.
Lube universal joints		1/30/06	E.L.
Replace differential lube including axles		1/30/06	D.L.
Remarks: None noted.			

FUEL ECONOMY PRE-TEST MAINTENANCE FORM (page 3)

Bus Number: 0518	Date: 1-30-06
Personnel: T.S., E.L. & D.L.	

EXHAUST/EMISSION SYSTEM	OK	Date	Initials
Check for exhaust leaks		1/30/06	T.S.
Remarks: None noted.			

ENGINE	OK	Date	Initials
Replace air filter		1/30/06	E.L.
Inspect air compressor and air system	N/A	1/30/06	E.L.
Inspect vacuum system, if applicable		1/30/06	D.L.
Check and adjust all drive belts		1/30/06	E.L.
Check cold start assist, if applicable	N/A	1/30/06	E.L.
Remarks: None noted.			

STEERING SYSTEM	OK	Date	Initials
Check power steering hoses and connectors		1/30/06	E.L.
Service fluid level		1/30/06	E.L.
Check power steering operation		1/30/06	E.L.
Remarks: None noted.			

	OK	Date	Initials
Ballast bus to seated load weight		1/30/06	T.S.

TEST DRIVE	OK	Date	Initials
Check brake operation		1/30/06	T.S.
Check transmission operation		1/30/06	T.S.
Remarks: None noted.			

FUEL ECONOMY PRE-TEST INSPECTION FORM

Bus Number: 0518	Date: 1-31-06
Personnel: T.S. & S.C.	

PRE WARM-UP	If OK, Initial
Fuel Economy Pre-Test Maintenance Form is complete	T.S.
Cold tire pressure (psi): Front 80 Middle N/A Rear 80	T.S.
Tire wear:	T.S.
Engine oil level	T.S.
Engine coolant level	T.S.
Interior and exterior lights on, evaporator fan on	T.S.
Fuel economy instrumentation installed and working properly.	T.S.
Fuel line -- no leaks or kinks	T.S.
Speed measuring system installed on bus. Speed indicator installed in front of bus and accessible to TECH and Driver.	S.C. & T.S.
Bus is loaded to SLW	T.S.
WARM-UP	**If OK, Initial**
Bus driven for at least one hour warm-up	S.C.
No extensive or black smoke from exhaust	S.C.
POST WARM-UP	**If OK, Initial**
Warm tire pressure (psi): Front 80 Middle N/A Rear 80	T.S.
Environmental conditions Average wind speed <12 mph and maximum gusts <15 mph Ambient temperature between 30°F(-1C°) and 90°F(32°C) Track surface is dry Track is free of extraneous material and clear of interfering traffic	T.S.

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 0518	Manufacturer: Starcraft	Date: 1-31-06
Run Number: 1	Personnel: B.S., T.S. & S.C.	
Test Direction: □CW or ■CCW	Temperature (°F): 38	Humidity (%): 61
SLW (lbs): 12,500	Wind Speed (mph) & Direction: 12/WNW	Barometric Pressure (in.Hg): 29.80

Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Load Cell Reading (lb)		Fuel Used (lbs)
	Start	Finish		Start	Start	Finish	
CBD #1	0	8:20	8:20	5.5	0	1.95	1.95
ART #1	0	3:54	3:54	4.5	0	1.74	1.74
CBD #2	0	8:25	8:25	4.5	0	1.82	1.82
ART #2	0	3:59	3:59	4.5	0	1.70	1.70
CBD #3	0	8:21	8:21	4.5	0	1.88	1.88
COMMUTER	0	5:51	5:51	4.0	0	2.37	2.37
							Total Fuel = 11.46 lbs

20 minute idle : Total Fuel Used = 1.36 lbs

Heating Value = 20,025.0 BTU/LB

Comments: None noted.

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 0518	Manufacturer: Starcraft	Date: 1-31-06
Run Number: 2	Personnel: B.S., T.S. & S.C.	
Test Direction: ■CW or □CCW	Temperature (°F): 38	Humidity (%): 61
SLW (lbs): 12,500	Wind Speed (mph) & Direction: 12/WNW	Barometric Pressure (in.Hg): 29.80

Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Load Cell Reading (lb)		Fuel Used (lbs)
	Start	Finish		Start	Start	Finish	
CBD #1	0	8:45	8:45	4.0	0	1.82	1.82
ART #1	0	3:57	3:57	4.0	0	1.68	1.68
CBD #2	0	8:25	8:25	3.5	0	1.88	1.88
ART #2	0	3:56	3:56	3.5	0	1.80	1.80
CBD #3	0	8:24	8:24	3.5	0	1.87	1.87
COMMUTER	0	6:06	6:06	3.5	0	2.40	2.40
							Total Fuel = 11.45 lbs

20 minute idle : Total Fuel Used = N/A lbs

Heating Value = 20,025.0 BTU/LB

Comments: None noted.

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 0518	Manufacturer: Starcraft	Date: 2/1/06
Run Number: 3	Personnel: B.S., T.S. & S.C.	
Test Direction: ▫CW or ▪CCW	Temperature (°F): 36	Humidity (%): 65
SLW (lbs): 12,500	Wind Speed (mph) & Direction: 5/SSW	Barometric Pressure (in.Hg): 29.96

Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Load Cell Reading (lb)		Fuel Used (lbs)
	Start	Finish		Start	Start	Finish	
CBD #1	0	8:51	8:51	4.0	0	1.87	1.87
ART #1	0	3:53	3:53	4.0	0	1.77	1.77
CBD #2	0	8:33	8:33	4.0	0	1.89	1.89
ART #2	0	3:55	3:55	4.0	0	1.76	1.76
CBD #3	0	8:36	8:36	4.5	0	1.93	1.93
COMMUTER	0	6:05	6:05	4.5	0	2.39	2.39
							Total Fuel = 11.61 lbs

20 minute idle : Total Fuel Used = N/A lbs

Heating Value = 20,025.0 BTU/LB

Comments: None noted.

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 0518	Manufacturer: Starcraft	Date: 2-1-06
Run Number: 4	Personnel: B.S., T.S. & S.C.	
Test Direction: ■CW or □CCW	Temperature (°F): 36	Humidity (%): 65
SLW (lbs): 12,500	Wind Speed (mph) & Direction: 5/SSW	Barometric Pressure (in.Hg): 29.96

Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Load Cell Reading (lb)		Fuel Used (lbs)
	Start	Finish		Start	Start	Finish	
CBD #1	0	8:38	8:38	3.5	0	1.94	1.94
ART #1	0	3:59	3:59	4.5	0	1.81	1.81
CBD #2	0	8:37	8:37	5.5	0	1.92	1.92
ART #2	0	3:55	3:55	5.5	0	1.76	1.76
CBD #3	0	8:36	8:36	4.5	0	1.93	1.93
COMMUTER	0	5:58	5:58	5.0	0	2.35	2.35
							Total Fuel = 11.71 lbs

20 minute idle : Total Fuel Used = 1.37 lbs

Heating Value = 20,025.0 BTU/LB

Comments: None noted.

0518.FUL
FUEL ECONOMY SUMMARY SHEET

BUS MANUFACTURER :Starcraft BUS NUMBER :0518
BUS MODEL :Allstar-25 TEST DATE :1/31/06

FUEL TYPE : GASOLINE
SP. GRAVITY : .7512
HEATING VALUE : 20025.00 BTU/Lb
Standard Conditions : 60 deg F and 14.7 psi
Density of Water : 8.3373 lb/gallon at 60 deg F

CYCLE	TOTAL FUEL USED (Lb)	TOTAL MILES	FUEL ECONOMY M/Lb(Measured)	FUEL ECONOMY MPG(Corrected)
Run # :1, CCW				
CBD	5.65	5.73	1.01	6.42
ART	3.44	3.82	1.11	7.03
COM	2.37	3.82	1.61	10.20
TOTAL	11.46	13.37	1.17	7.38
Run # :2, CW				
CBD	5.57	5.73	1.03	6.51
ART	3.48	3.82	1.10	6.95
COM	2.40	3.82	1.59	10.07
TOTAL	11.45	13.37	1.17	7.39
Run # :3, CCW				
CBD	5.69	5.73	1.01	6.37
ART	3.53	3.82	1.08	6.85
COM	2.39	3.82	1.60	10.11
TOTAL	11.61	13.37	1.15	7.29
Run # :4, CW				
CBD	5.79	5.73	.99	6.26
ART	3.57	3.82	1.07	6.77
COM	2.35	3.82	1.63	10.28
TOTAL	11.71	13.37	1.14	7.22

IDLE CONSUMPTION

First 20 Minutes Data : 1.36 Lb Last 20 Minutes Data : 1.37 Lb
Average Idle Consumption : 4.10 Lb/Hr

RUN CONSISTENCY: % Difference from overall average of total fuel used

Run 1 : .8 Run 2 : .9 Run 3 : -.5 Run 4 : -1.3

SUMMARY

Average Idle Consumption : .65 G/Hr
Average CBD Phase Consumption : 6.39 MPG
Average Arterial Phase Consumption : 6.90 MPG
Average Commuter Phase Consumption : 10.17 MPG
Overall Average Fuel Consumption : 7.32 MPG
Overall Average Fuel Consumption : 58.37 Miles/ Million BTU

7. NOISE

7.1 INTERIOR NOISE AND VIBRATION TESTS

7.1-I. TEST OBJECTIVE

The objective of these tests is to measure and record interior noise levels and check for audible vibration under various operating conditions.

7.1-II. TEST DESCRIPTION

During this series of tests, the interior noise level will be measured at several locations with the bus operating under the following three conditions:

1. With the bus stationary, a white noise generating system shall provide a uniform sound pressure level equal to 80 dB(A) on the left, exterior side of the bus. The engine and all accessories will be switched off and all openings including doors and windows will be closed. This test will be performed at the ABTC.

2. The bus accelerating at full throttle from a standing start to 35 mph on a level pavement. All openings will be closed and all accessories will be operating during the test. This test will be performed on the track at the Test Track Facility.

3. The bus will be operated at various speeds from 0 to 55 mph with and without the air conditioning and accessories on. Any audible vibration or rattles will be noted. This test will be performed on the test segment between the Test Track and the Bus Testing Center.

All tests will be performed in an area free from extraneous sound-making sources or reflecting surfaces. The ambient sound level as well as the surrounding weather conditions will be recorded in the test data.

7.1-III. DISCUSSION

This test is performed in three parts. The first part exposes the exterior of the vehicle to 80.0 dB(A) on the left side of the bus and the noise transmitted to the interior is measured. The overall average of the six measurements was 48..0 dB(A); ranging from 47.1 dB(A) at the rear passenger seats to 50.9 dB(A) at the driver's seat. The interior ambient noise level for this test was < 34.0 dB(A).

The second test measures interior noise during acceleration from 0 to 35 mph. This noise level ranged from 69.4 dB(A) at the front passenger seats to 71.7 dB(A) at the rear passenger seats. The overall average was 71.0 dB(A). The interior ambient noise level for this test was 38.6 dB(A).

The third part of the test is to listen for resonant vibrations, rattles, and other noise sources while operating over the road. No vibrations or rattles were noted.

INTERIOR NOISE TEST DATA FORM
Test Condition 1: 80 dB(A) Stationary White Noise

Bus Number: 0518	Date: 2/8/06
Personnel: T.S. & S.C.	
Temperature (°F): 33	Humidity (%): 67
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 30.10	
Initial Sound Level Meter Calibration: ■ checked by: S.C.	
Interior Ambient Noise Level dB(A): < 34.0	Exterior Ambient Noise Level dB(A): 45.1
Microphone Height During Testing (in): 48.0	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	50.9
Front Passenger Seats	47.6
In Line with Front Speaker	47.8
In Line with Middle Speaker	47.6
In Line with Rear Speaker	47.2
Rear Passenger Seats	47.1

Final Sound Level Meter Calibration: ■ checked by: S.C.

Comments: All readings taken in the center aisle.

INTERIOR NOISE TEST DATA FORM
Test Condition 2: 0 to 35 mph Acceleration Test

Bus Number: 0518	Date: 2-2-06
Personnel: B.S., S.C. & T.S.	
Temperature (°F): 37	Humidity (%): 93
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 29.91	
Initial Sound Level Meter Calibration: ■ checked by: S.C.	
Interior Ambient Noise Level dB(A): 38.6	Exterior Ambient Noise Level dB(A): 53.2
Microphone Height During Testing (in): 48.0	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	71.5
Front Passenger Seats	69.4
Middle Passenger Seats	71.5
Rear Passenger Seats	71.7

Final Sound Level Meter Calibration: ■ checked by: S.C.

Comments: All readings taken in the center aisle.

INTERIOR NOISE TEST DATA FORM
Test Condition 3: Audible Vibration Test

Bus Number: 0518	Date: 2-2-06
Personnel: B.S., S.C. & T.S.	
Temperature (°F): 37	Humidity (%): 93
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 29.91	

Describe the following possible sources of noise and give the relative location on the bus.

Source of Noise	Location
Engine and Accessories	None noted.
Windows and Doors	None noted.
Seats and Wheel Chair lifts	None noted.

Comment on any other vibration or noise source which may have occurred
that is not described above: None noted.

7.1 INTERIOR NOISE TEST

TEST BUS SET-UP FOR 80 dB(A)
INTERIOR NOISE TEST

7.2 EXTERIOR NOISE TESTS

7.2-I. TEST OBJECTIVE

The objective of this test is to record exterior noise levels when a bus is operated under various conditions.

7.2-II. TEST DESCRIPTION

In the exterior noise tests, the bus will be operated at a SLW in three different conditions using a smooth, straight and level roadway:

1. Accelerating at full throttle from a constant speed at or below 35 mph and just prior to transmission up shift.
2. Accelerating at full throttle from standstill.
3. Stationary, with the engine at low idle, high idle, and wide open throttle.

In addition, the buses will be tested with and without the air conditioning and all accessories operating. The exterior noise levels will be recorded.

The test site is at the PSBRTF and the test procedures will be in accordance with SAE Standards SAE J366b, Exterior Sound Level for Heavy Trucks and Buses. The test site is an open space free of large reflecting surfaces. A noise meter placed at a specified location outside the bus will measure the noise level.

During the test, special attention should be paid to:

1. The test site characteristics regarding parked vehicles, signboards, buildings, or other sound-reflecting surfaces
2. Proper usage of all test equipment including set-up and calibration
3. The ambient sound level

7.2-III. DISCUSSION

The Exterior Noise Test determines the noise level generated by the vehicle under different driving conditions and at stationary low and high idle, with and without air conditioning and accessories operating. The test site is a large, level, bituminous paved area with no reflecting surfaces nearby.

With an exterior ambient noise level of 51.6 dB(A), the average test result obtained while accelerating from a constant speed was 73.2 dB(A) on the right side and 73.0 dB(A) on the left side.

When accelerating from a standstill with an exterior ambient noise level of 53.7 dB(A), the average of the results obtained were 72.7 dB(A) on the right side and 71.4 dB(A) on the left side.

With the vehicle stationary and the engine, accessories, and air conditioning on, the measurements averaged 48.0 dB(A) at low idle, 56.2 dB(A) at high idle, and 67.1 dB(A) at wide open throttle. With the accessories and air conditioning off, the readings averaged 0.5 dB(A) higher at low idle, 0.8 dB(A) higher at high idle, and 0.3 dB(A) higher at wide open throttle. The exterior ambient noise level measured during this test was 50.9 dB(A).

EXTERIOR NOISE TEST DATA FORM
Accelerating from Constant Speed

Bus Number: 0518	Date: 2-2-06
Personnel: B.S., S.C. & T.S.	
Temperature (°F): 41	Humidity (%): 85
Wind Speed (mph): 5	Wind Direction: SW
Barometric Pressure (in.Hg): 29.91	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■ checked by: S.C.	
Initial Sound Level Meter Calibration: ■ checked by: S.C.	
Exterior Ambient Noise Level dB(A): 51.6	

Accelerating from Constant Speed Curb (Right) Side		Accelerating from Constant Speed Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	72.6	1	73.2
2	72.4	2	72.7
3	73.0	3	72.5
4	73.2	4	72.6
5	73.1	5	72.7
Average of two highest actual noise levels = 73.2 dB(A)		Average of two highest actual noise levels = 73.0 dB(A)	

Final Sound Level Meter Calibration Check: ■ checked by: S.C.

Comments: None noted.

EXTERIOR NOISE TEST DATA FORM
Accelerating from Standstill

Bus Number: 0518	Date: 2-2-06
Personnel: B.S., S.C. & T.S.	
Temperature (°F): 41	Humidity (%): 85
Wind Speed (mph): 5	Wind Direction: SW
Barometric Pressure (in.Hg): 29.91	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■ checked by: S.C.	
Initial Sound Level Meter Calibration: ■ checked by: S.C.	
Exterior Ambient Noise Level dB(A): 53.7	

Accelerating from Standstill Curb (Right) Side		Accelerating from Standstill Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	72.4	1	71.3
2	72.9	2	71.4
3	72.1	3	71.0
4	72.5	4	71.3
5	72.4	5	71.2
Average of two highest actual noise levels = 72.7 dB(A)		Average of two highest actual noise levels = 71.4 dB(A)	

Final Sound Level Meter Calibration Check: ■ checked by: S.C.

Comments: None noted.

EXTERIOR NOISE TEST DATA FORM
Stationary

Bus Number: 0518	Date: 2-2-06
Personnel: B.S., S.C. & T.S.	
Temperature (°F): 41	Humidity (%): 85
Wind Speed (mph): 5	Wind Direction: SW
Barometric Pressure (in.Hg): 29.91	

Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■ checked by: S.C.

Initial Sound Level Meter Calibration: ■ checked by: S.C.

Exterior Ambient Noise Level dB(A): 50.9

Accessories and Air Conditioning ON

Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	703	47.8	48.2
High Idle	2,050	54.3	58.1
Wide Open Throttle	3,602	67.0	67.2

Accessories and Air Conditioning OFF

Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	750	48.0	49.0
High Idle	2,153	54.7	59.3
Wide Open Throttle	3,651	66.9	67.8

Final Sound Level Meter Calibration Check: ■ checked by: S.C.

Comments: None noted.

7.2 EXTERIOR NOISE TESTS

TEST BUS UNDERGOING EXTERIOR NOISE TESTING

Filename: Report.0518.doc
Directory: E:
Template: C:\Documents and Settings\vnocek\Application Data\Microsoft\Templates\Normal.dot
Title: 5
Subject:
Author: Sondra Hoover
Keywords:
Comments:
Creation Date: 2/20/2006 10:52:00 AM
Change Number: 2
Last Saved On: 2/20/2006 10:52:00 AM
Last Saved By: PTI
Total Editing Time: 1 Minute
Last Printed On: 3/6/2007 10:41:00 AM
As of Last Complete Printing
Number of Pages: 102
Number of Words: 14,310 (approx.)
Number of Characters: 70,410 (approx.)

WARRANTY INFORMATION

SONNY MERRYMAN, INC. WILL SERVE AS THE FIRST POINT OF CONTACT FOR ALL WARRANTY RELATED CONCERNS AND SERVICE SCHEDULING. SONNY MERRYMAN, INC. OFFERS SERVICE LOCATIONS IN LYNCHBURG (SERVING CENTRAL AND SOUTHWEST VIRGINIA), MANASSAS (SERVING NORTHERN VIRGINIA AND WASHINGTON, DC) RICHMOND (SERVING THE GREATER RICHMOND AREA) AND CHESAPEAKE (SERVING TIDEWATER)

All chassis warranty work will be performed by a local Chassis dealer with prior approval from Sonny Merryman, Inc.

All body and aftermarket warranty work will be performed by Sonny Merryman, Inc., the vehicle recipient or a local dealer with prior approval by Sonny Merryman, Inc.

800-533-1006

STARCRAFT BUS
a division of Forest River, Inc.

STARCRAFT COMMERCIAL BUS WARRANTY

NOTICE

Please return the warranty registration card to register the warranty with STARCRAFT BUS so that Starcraft Bus may record your rights under this limited warranty and to assure prompt assistance. Your dealer will provide the warranty card for you to sign. If you do not remember signing a STARCRAFT BUS warranty card at the time of delivery, please contact your dealer.

1. Who Warrants the product

The product, as described and limited here, is warranted by the manufacturer and installer of the body: STARCRAFT BUS, Division of Forest River, Inc., hereinafter referred to as STARCRAFT BUS, 2367 Century Drive, Goshen, IN; an Indiana Corporation; and is administered by the STARCRAFT BUS Customer Service Dept., Goshen, Indiana 46528.

2. Who Is Covered

STARCRAFT BUS, the warrantor, extends this limited warranty to the original owner of the vehicle during the WARRANTY PERIOD.

3. What Is Covered

STARCRAFT BUS, your warrantor, extends the following limited warranty to you, which limited warranty covers your conversion only as to material defects in all materials and workmanship supplied by or performed by STARCRAFT BUS.

4. Warranty Period

The STARCRAFT BUS limited warranty is for a period of one (1) year from the date of first delivery or 12,000 miles for the Xpress; Starquest; Starlite; Allstar; Allstar XL; MVP; Ultrastar, and the XLT, whichever occurs first, except for other coverages listed under "Other Warranties that may Apply" and items listed under "Exclusions and Limitations" and "Limits of the Warranty."

5. Extended Warranty on Structural Items

Warrantor warrants to the original purchaser for a period of five (5) years from the date of first delivery or 100,000 miles, whichever comes first, that this produce shall be free of SUBSTANTIAL DEFECTS arising out of or relating to the structural portion of the product. THIS STRUCTURAL WARRANTY IS INTENDED TO COVER ONLY THE PERFORMANCE OF THE STEEL CAGE STRUCTURE OF THE BUS BODY for the Xpress; Starquest; Starlite; Allstar; Allstar XL; MVP; Ultrastar, and the XLT.

Custom paint and/or tape application, if performed by STARCRAFT BUS, is warranted to be free of substantial defects in workmanship and materials provided by STARCRAFT BUS for one (1) year (12 months) from date of original purchase.

6. Other Warranties That May Apply

STARCRAFT BUS does not warrant the base vehicle itself. The vehicle engine, chassis, drive train, suspension system, battery, and other chassis components are covered by a separate warranty offered by the manufacturer of the vehicle and administered by the manufacturer's authorized dealers. The tire manufacturer separately warrants tires. Examples of other manufacturer warranties, which may include the following, but not limited to:

- Electrical Components
- Air Conditioning and Heater(s)
- Wheelchair Restraints and Wheelchair Lifts

For a complete list of items and their respective warrantor, please contact Starcraft Bus Customer Service Department.

7. Owner's Responsibility

Proper maintenance and cleaning of the exterior and interior of the vehicle is the responsibility of the owner. See the owner's manual for proper care instructions. Defects or damage as a result of improper care or maintenance are not covered by the warranty.

8. Exclusions and Limitations

Damage caused by abuse, misuse, neglect, failure to observe reasonable and required maintenance practices, acid rain, accidents, natural disasters, acts of war and normal wear and tear and facing of fabrics, carpeting and/or fiberglass are not covered. Light bulbs and fuses are not covered.

Damage or deterioration to the physical appearance of the unit if such damage is the result of normal use, wear and tear, or exposure to the elements.

Damages that may occur to the chassis, frame, other parts or components that occur due to overloading will not be covered and may invalidate portions of the STARCRAFT BUS warranty.

Cosmetic or surface corrosion resulting from stone chips or scratches in paint are not covered.

STARCRAFT BUS does not cover accessories covered by their own manufacturer's warranties. Those items listed in paragraph 6 above are not covered or warranted by STARCRAFT BUS.

Replacement parts provided under terms of the warranty will whenever possible, match original equipment. When necessary, STARCRAFT BUS will substitute parts of comparable function and value. Defective items may be replaced with new, remanufactured, reconditioned or repaired components.

Modifications, alterations or repairs performed by unauthorized personnel may invalidate portions of the STARCRAFT BUS warranty. In addition, USING THIS VEHICLE TO TOW ANOTHER VEHICLE IS PROHIBITED AND MAY VOID WARRANTY. Contact STARCRAFT BUS Customer Service before you make any changes.

9. Recovery Limitations

NO PERSON SHALL BE ENTITLED TO RECOVER FROM WARRANTOR FOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES ARISING OUT OF OR RELATING TO ANY DEFECT IN THE PRODUCT. These limitations include, but are not limited to, loss of time; loss of use; loss of revenues, salaries or commissions; towing charges; bus fares; car rentals; gasoline expenses; telephone charges; inconvenience or other incidental damages.

10. How to get warranty service

To obtain warranty service, contact or visit the dealership where you originally purchased your vehicle or another warranty service facility designated by STARCRAFT BUS. Have the dealership contact Starcraft bus Customer Service Department for authorization to have a warranty claim submitted. If you or your dealer has moved, or if your dealer is no longer in business, contact STARCRAFT BUS Customer Service Department (see address and telephone numbers below) for the name of a STARCRAFT BUS dealer nearest you. Your claim must be made within 30 days of the discovery of the defect. Based on the determination of STARCRAFT BUS, and subject to the terms of the warranty, the warranty repair work will be authorized by STARCRAFT BUS.

All warranty claims must be reported within the warranty period. Warranty personnel must authorize all warranty service prior to performance. Warranty service may be reported directly to the warrantor or to one of their authorized dealers. If warranty personnel approve warranty service, you must leave the unit at the appropriate warranty service location for a sufficient time to perform service.

11. Who Performs Warranty Service

The best place to obtain warranty service is at the dealership where you originally purchased your bus. If the dealership cannot perform the service work, they should call STARCRAFT BUS Customer Service Department for assistance (see number below). If you are unable to visit your original dealer, contact STARCRAFT BUS Customer Service Department (address below) for the name and location of a STARCRAFT BUS dealer near you.

12. Dispute Resolution

Should you be unable to resolve a disagreement with your dealer regarding your right to pursue warranty coverage for a needed repair, contact the STARCRAFT BUS Customer Service Department (see address below). If a dispute about warranty service arises between STARCRAFT BUS and you, the owner, the disagreement will be resolved in accordance with the customary procedures of the American Arbitration Association relating to commercial transactions, or the dispute will be submitted to a panel of three (3) arbitrators for decision. The panel will be made up of one member appointed by STARCRAFT BUS, one member appointed by the complainant/owner, and one member from the arbitrators group mentioned above. Any and all legal remedies shall be available to the owner after pursuing this informal dispute resolution if a ruling is entered against STARCRAFT BUS and STARCRAFT BUS fails to abide by the ruling. The expenses of arbitration will be paid by the party against whom the arbitrator(s) rule.

13. Limits Of Warranty

This written statement of limited warranty represents the entire warranty authorized and offered by STARCRAFT BUS. There are no warranties or representations beyond those expressed in this written document. Any dealership, salesperson or agent cannot amend it. It expressly limits all warranties, including, but not limited to, by way of specification, both express and implied warranties, including warranties or merchantability and fitness for a particular purpose along with all other liabilities or obligations of STARCRAFT BUS.

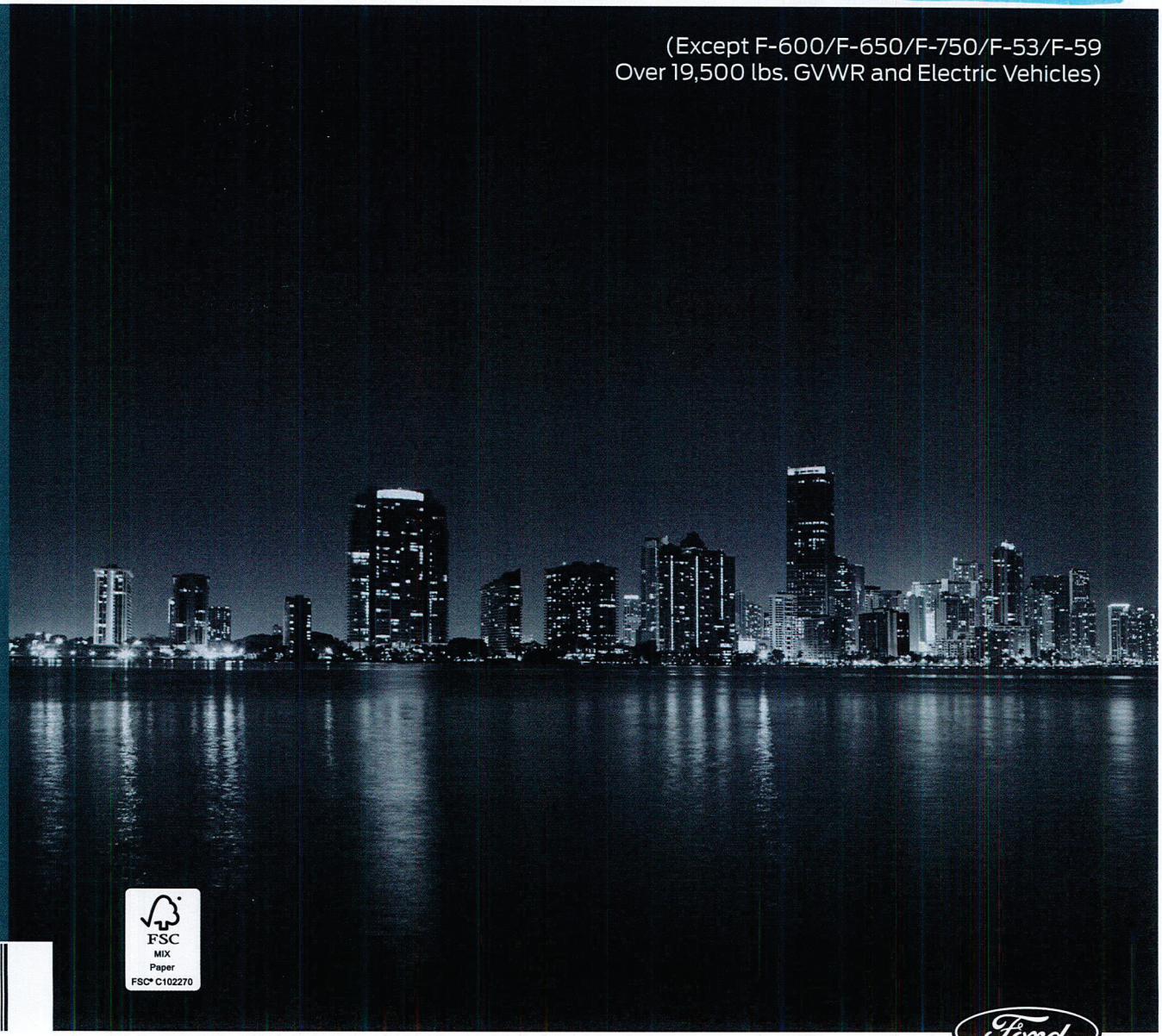
FEDERAL COMPLIANCE

THE TERMS OF THE WARRANTOR'S UNDERTAKING EXPRESSED IN THIS LIMITED WARRANTY ARE DRAFTED TO COMPLY WITH THE MAGNUSEN MOSS WARRANTY LEGISLATION, P.L. 93-637 OF 1974, AND OTHER APPLICABLE LAW. ANY WARRANTY PROVISIONS PROMULGATED BY THE FEDERAL TRADE COMMISSION PURSUANT TO RULES OR ANY OTHER LAW RELATIVE THERETO ARE EXPRESSLY INCORPORATED HEREIN. TO THE EXTENT ANY PROVISIONS OF THIS LIMITED WARRANTY ARE INCONSISTENT WITH STATE LAWS, ONLY THOSE PARTS INCONSISTENT ARE VOID.

STARCRAFT BUS
Division of Forest River, Inc.
CUSTOMER SERVICE DEPT.
2367 Century Drive
Goshen, IN 46528
Phone: 800.348.7440
Fax: 574.642.4853

2023 Model Year **Ford Warranty Guide**

(Except F-600/F-650/F-750/F-53/F-59
Over 19,500 lbs. GVWR and Electric Vehicles)



owner.ford.com

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November 2022
Fifth Printing
Litho in U.S.A.

FSC
MIX
Paper
FSC® C102270

PW7J 19T201 AE

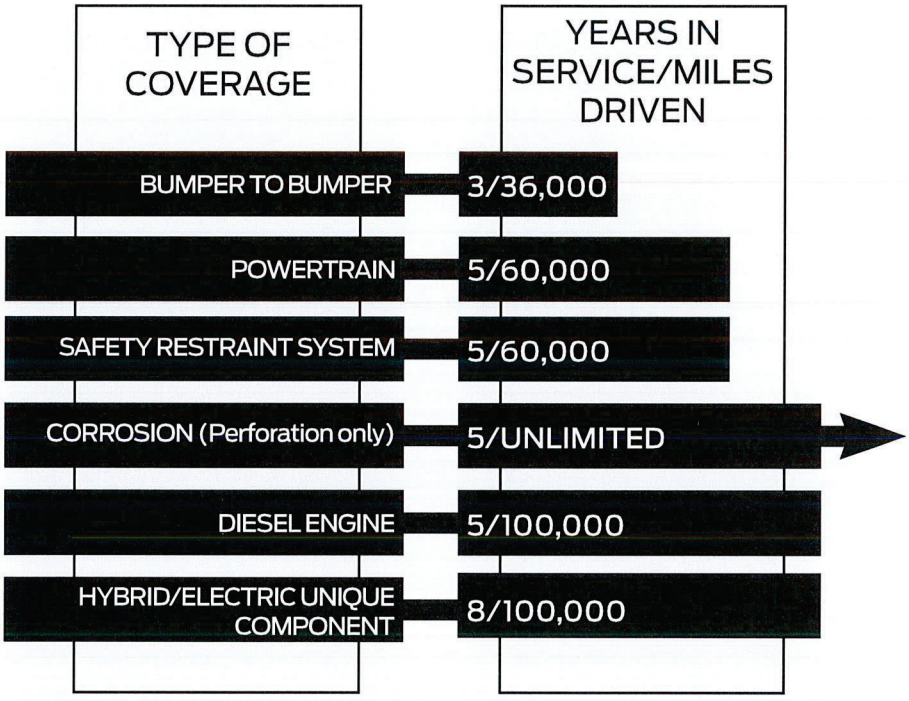
FORD

QUICK REFERENCE: WARRANTY COVERAGE

This chart gives a general summary of your warranty coverage provided by Ford Motor Company under the New Vehicle Limited Warranty. Please refer to the description of warranty coverage for more specific information.

For each type of coverage, the chart shows two measures:
- years in service
- miles driven

Your New Vehicle Limited Warranty



The measure that occurs first determines how long your coverage lasts. For example: Your Bumper to Bumper Coverage lasts for three years - unless you drive more than 36,000 miles before three years elapse. In that case, your coverage ends at 36,000 miles.

For more details on coverage, see:

→ What is Covered? (pages 9-15)
→ What is Not Covered? (pages 15-20)

CITEVY

McCormick Motors, Inc.
Sheryl Wineland | 574-773-3134

Vehicle: [Fleet] 2023 Chevrolet Express Commercial Cutaway (Complete)

WARRANTY

Warranty Note: <<< Preliminary 2023 Warranty >>>
Basic Years: 3
Basic Miles/km: 36,000
Drivetrain Years: 5
Drivetrain Miles/km: 60,000
Drivetrain Note: Qualified Fleet Purchases: 5 Years/100,000 Miles
Corrosion Years (Rust-Through): 6
Corrosion Years: 3
Corrosion Miles/km (Rust-Through): 100,000
Corrosion Miles/km: 36,000
Roadside Assistance Years: 5
Roadside Assistance Miles/km: 60,000
Roadside Assistance Note: Qualified Fleet Purchases: 5 Years/100,000 Miles
Maintenance Note: 1 Year/1 Visit

Trans/Air Manufacturing Corporation
Limited Warranty
36 Month (Unlimited Mileage)

Subject to the conditions and limitations set forth below, for a period of thirty six (36) months (with unlimited mileage) starting at the date of delivery to the End User and with proper registration documentation, Trans/Air Manufacturing Corporation (Trans/Air) warrants to the original owner, if still the user, that each manufactured system/component will be free from defects in factory workmanship and materials when used and maintained in accordance with the recommended procedures. Trans/Air will furnish new or remanufactured replacements parts and cover the cost of repair labor for thirty six (36) months following delivery in accordance with the current Trans/Air flat rate labor schedule when performed at an authorized Trans/Air Service Center. This is the End User's sole and exclusive remedy.

THIS IS TRANS/AIR'S SOLE WARRANTY AND IT IS FURNISHED IN LIEU OF ANY AND ALL OTHER WARRANTIES. TRANS/AIR MAKES NO OTHER EXPRESS OR IMPLIED WARRANTIES WHATSOEVER. NO WARRANTY OF MERCHANTIABILITY AND NO WARRANTY OF FITNESS FOR PARTICULAR PURPOSE IS MADE BY TRANS/AIR.

Conditions and Limitations

1) In order for a thirty six (36) month system warranty to apply, the customer must purchase the evaporator(s), condenser(s), compressor(s), piping kits, electrical kits, mount kits and refrigeration hose from Trans/Air. If the full system is not purchased from Trans/air, the thirty six (36) month warranty applies to Trans/Air supplied evaporators and condensers only. All compressors, piping kits, and electrical kits purchased outside of a full system, will be considered a service part and will carry a 180 day warranty. All mount kits purchased outside of a full system, and used on a Trans/Air system, will be considered a service part and will carry a 180 day warranty. All mount kits purchased outside of a full system, and used on a system other than Trans/Air, will carry no warranty. All other components supplied by Trans/Air are covered by standard parts warranty (see #4 below). Extended warranty coverage may be purchased from Trans/Air at the time of purchase of the unit or system. Correction of a failure under this warranty does not extend the warranty beyond the standard thirty six (36) month warranty period.

2) Service parts are warranted for a 180 day period from the date of sale or until the expiration of the original equipment warranty, whichever is later. (Compressors are warranted for 1 year) If required, parts covered by warranty must be returned to Trans/Air's factory in Dallastown, PA, by specified carrier freight prepaid, within standard Return Goods Authorization procedures, for evaluation, in order for Trans/Air to authorize any warranty claim.

3) Trans/Air will be responsible for the costs of repairs or replacement covered by warranty only if performed at an authorized Trans/Air Service Center. The Service Center is responsible for effecting repairs or replacement during the warranty period in accordance with current Trans/Air warranty procedures. A customer requesting service at a location other than an approved Service Center, or one requesting overtime, shall be responsible for all additional warranty repair expenses in excess of the flat rate allowed. Trans/Air is not responsible for towing charges.

4) If the customer has not properly registered the Trans/Air system, the Service Center is not authorized to render warranty services without charge. All information on the warranty registration from must be completed in its entirety and returned to Trans/air to activate the warranty.

5) Trans/Air does not warrant the installation of Trans/Air products unless installed by Trans/Air or an authorized Trans/Air Turnkey installation facility. In the cases of installation related failures, which are not covered by warranty Trans/Air specifically is not responsible for failures attributable to inadequate provision by the installer of structural support or inadequate provision of electrical requirements.

6) This warranty does not apply in cases of a failure of Trans/Air product which is attributable to improper evacuation procedures, or the introduction of non-approved refrigerant oil, additives, or other contaminants into the system.

7) This warranty does not apply in cases of failure of Trans/Air product, which is attributable to failure of the end user to perform or provide preventative maintenance in accordance with Trans/Air's guidelines. Examples include, but are not limited to, failure to properly maintain belt tension, clean condenser coils, replace evaporator filters, maintain electrical systems to provide proper voltage to components, or check and tighten hardware or fittings, which may have loosened due to vibration. (See Trans/Air Preventive Maintenance Schedule)

8) This warranty does not apply to loss of refrigerant or any damage caused by loss of refrigerant unless directly attributable to the failure of a Trans/Air product which, at the time of the failure, was under warranty.

9) Trans/Air reserves the right to make changes in design or improvements to its products or parts thereof, without obligation to make or install of such changes or improvements on existing units or upon products covered by this warranty.

10) If Trans/Air makes a product improvement program available to the End User, Trans/Air reserves the right to limit the duration of the programs unless it is safety related. Expenses incurred in completing said product improvements after the closing date of the program are the responsibility of the End User.

11) Trans/Air's warranty shall not apply in the case of damage incurred during shipment, accidental damage, abuse, misuse, act of nature, or if the serial number is missing, or to any product which, in the sole opinion of Trans/Air, has been installed, altered or repaired in a manner affecting the efficiency or performance of the unit or inconsistent with Trans/Air's written procedures.

12) This warranty applies only within the boundaries of the whole United States, its territories, and Canada. For other available coverage that may be purchased, contact Trans/Air.

TRANS/AIR'S LIABILITY TO THE PURCHASER FOR DAMAGES FROM ANY CAUSE WHATSOEVER AND REGARDLESS OF THE FORM (S) OF ACTION, WHETHER IN CONTACT OR TORT, INCLUDING NEGLIGENCE OR OTHERWISE, SHALL BE LIMITED TO THE VALUE OF REPAIRS TO OR REPLACEMENT OF THE DEFECTIVE COMPONENTS DURING THE WARRANTY PERIOD, AS THE EXCLUSIVE REMEDY, AND STRAIGHT TIME LABOR CHARGES AS OUTLINED IN ITS CURRENT WARRANTY PROCEDURE MANUAL AND FLATE RATE LABOR SCHEDULE. IN NO EVENT SHALL TRANS/AIR BE LIABLE WHATSOEVER FOR ANY PUNITIVE, INCIDENTAL OR CONSEQUENTIAL DAMAGES, OR FOR LOST PROFITS OR OTHER COMMERCIAL LOSSES FROM ANY CAUSE WHATSOEVER, WHETHER OR NOT TRANS/AIR HAS RECEIVED NOTICE OF THE POSSIBILITY OR CERTAINTY OF SUCH DAMAGES OR LOSSES. TRANS/AIR WILL NOT BE LIABLE FOR ANY LOSS OCCURING BECAUSE THE EQUIPMENT IS OUT OF SERVICE. NO ACTION OR PROCEEDING ARISING OUT OF, FOR BREACH OF, OR IN ANY MANNER RELATING TO THIS WARRANTY MAY BE BROUGHT BY ANYONE AFTER SIX (6) MONTHS FROM NOTIFICATION TO TRANS/AIR OF AN IN-WARRANTY FAILURE.

Passenger Seats Limited Warranty & Sales Terms

WARRANTY:
Freedman Seating Company warrants to the original buyer that its Passenger Seats are free from defects in material and workmanship for the following components:
Metal Components – Five (5) years
Plastic Components – Three (3) years
Moving Components – Three (3) years
Gas Shock Components – One (1) year
Upholstered Components (foam) – Three (3) years
Cover Warranty is for defects in the material or sewing and is limited to replacement covers.
- One (1) year for Level #1 in-stock FSC material and perforated vinyl
- Two (2) years for Level #3 in-stock FSC material and higher
- No warranty for COM (Customer Own/supplied Material)

For upholstered inserts
- Polyurethane foam and woven upholstery – Two (2) years
- FTA/Docket 90 foam and vinyl upholstery – One (1) year
- No warranty for COM (Customer Own/supplied Material)

The warranty period begins at time of the bus in-service date not to exceed 180 after the date of the shipment from Freedman Seating Company.

NON-PRORATED REPLACEMENT:
In the event that a warranty-covered failure should occur within the warranty period, Freedman Seating Company will repair or replace the seat without charge and without prorating, at Freedman Seating Company's option. This is the sole and exclusive remedy for breech of any warranty. Any replacement seat or part is only covered by this warranty for the remainder of warranty period applicable to the original seat.

EXCLUSIONS:
This warranty specifically excludes foam, upholstery material, seat belts, and items exposed to normal wear and tear such as metal finish and paint and does not apply to any seat that is damaged as result of accident, derailment, improper installation, structural defects, intentional damage, abuse, vandalism, negligence, misuse, improper operating conditions, lack of maintenance, or extreme natural phenomena. Seats exposed to toxic or corrosive materials are excluded from this warranty. Seats exposed to cleaning solutions that are not listed on the Freedman Seating Company Cleaning Guide are excluded from this warranty. This warranty is provided directly to the purchaser only and does not extend to any subsequent party and is solely for the Freedman Seating Company product as it is originally manufactured.

INCIDENTAL, CONSEQUENTIAL DAMAGES, & LIMITATIONS:
This warranty shall be in lieu of any other warranty or terms, expressed warranty or terms, expressed or implied, including but not limited to any implied warranty of merchantability or fitness for a particular purpose. The purchaser's sole and exclusive remedy against Freedman Seating Company shall be for the repair and replacement of the defective product as provided herein. No other remedy; including but not limited to
incidental or consequential damages for lost profits, lost sales, injury to person or property, shipping, freight, installation, removal, or any other incidental or consequential loss shall be available to the purchaser.

NOTIFICATION:
All reports, claims, or notices required by the warranty to be provided to Freedman Seating Company must be in writing and delivered to: Attention – Freedman Seating Company, Warranty Claim Department, 4545 W. Augusta Blvd., Chicago, IL 60630. Repairs being claimed for warranty must be sent to Freedman Seating Company for prior
approval and warranty acceptance before any warranty claims can be made. Parts being claimed for warranty must be sent to Freedman Seating Company for prior approval and warranty acceptance before any warranty claims can be made.

INSPECTION AND VERIFICATION:
The owner must provide access to the failed seat so that Freedman Seating Company's authorized representative can perform an on-site inspection. Alternatively, Freedman Seating Company may ask the owner to ship the failed seat to Freedman Seating Company's laboratory for inspection. Within 30 days of the inspection, either on-site or in the laboratory, Freedman Seating Company will render an opinion as to whether or not the claimed failure is covered by the warranty.

GENERAL MAINTENANCE:
Freedman Seating Company provides the proper maintenance and cleaning instructions on its web site www.freedmanseating.com. Warranty is contingent upon documented performance of recommended maintenance and service. All replacement parts should be recommended or authorized Freedman Seating Company components. Failure to purchase proper components will null and void the warranty.

DESIGN:
Freedman Seating Company reserves the right to modify parts and design specifications without notice as long as the seats meet general specifications, unless otherwise committed per contract. In case further non-conforming changes have to be incorporated, Freedman Seating Company will submit such changes to customer for prior approval.

OTHER:
The terms and warranty are contingent upon customers meeting agreed upon payment terms as specified in Freedman Seating Company proposals. Terms and warranty supersede any other terms including but not limited to customer terms printed on the back of Purchase Orders, listed on websites, or other sources from customers.

Braun® Limited Warranty

WARRANTY COVERAGE AND WARRANTY COVERAGE TIME PERIODS

The Braun Corporation ("Braun") warranty covers certain parts of this wheelchair lift for three (3) years or 10,000 cycles and the cost of labor to repair or replace those parts for one (1) year or 3,000 cycles. If The Braun Corporation receives the warranty registration card within 20 days after the lift is put into service, the warranty labor coverage will increase from one (1) year or 3,000 cycles to three (3) years or 10,000 cycles. In addition, providing the warranty registration card is returned as noted above, the following lift's power train parts are warrantied for five (5) years or 15,000 cycles: Cable, Cylinder, Flow Control, Gear Box, Motor, Pump, Hydraulic Hose and Fittings. This limited warranty covers substantial defects in materials and workmanship of the lift, provided that the lift is operated and maintained properly and in conformity with the owner's manual. The warranty period begins on the date that the product is delivered to the first retail purchaser by an independent, authorized dealer of Braun, or, if the dealer places the product into any type of service prior to retail sale, on the date the dealer first places the product in such service. This limited warranty applies only to the first purchaser. It may not be transferred.

WHAT BRAUN WILL DO TO CORRECT PROBLEMS

In the event that a substantial defect in material or workmanship, attributable to Braun, is found to exist during the first year of warranty coverage, it will be repaired or replaced, at Braun's option, without charge for parts or labor to the owner, in accordance with the terms, conditions and limitations of this limited warranty. If the substantial defect in material or workmanship, attributable to Braun, is found to exist during the second or third year of warranty coverage, it will be repaired or replaced, at Braun's option, without charge to the owner for parts, only, in accordance with the terms, conditions and limitations of this limited warranty. Providing the warranty card is returned within 20 days as outlined above, the labor warranty period will be extended by two years of coverage in accordance with the terms, conditions, and limitations of this limited warranty. In addition, if a substantial defect in material or workmanship, attributable to Braun, is found to exist during the fourth or fifth year of warranty coverage to the following lift's power train parts: Cable, Cylinder, Flow Control, Gear Box, Motor, Pump, Hydraulic Hose and Fittings, it will be repaired or replaced, at Braun's option, without charge to the owner for parts, only, in accordance with the terms, conditions and limitations of this limited warranty. The cost of labor for repair or replacement at any time after the warranty coverage detailed above is the sole responsibility of the owner.

Braun's obligation to repair or replace defective materials or workmanship is the sole obligation of Braun under this limited warranty. Braun reserves the right to use new or remanufactured parts of similar quality to complete any work, and to make parts and design changes from time to time without notice to anyone. Braun reserves the right to make changes in the design or material of its products without incurring any obligation to incorporate such changes in any previously manufactured product. Braun makes no warranty as to the future performance of this product, and this limited warranty is not intended to extend to the future performance of the product. In addition, the owner's obligation to notify Braun, or one of its authorized, independent dealers, of a claimed defect does not modify any obligation placed on the owner to contact Braun directly when attempting to pursue remedies under state or federal law.

LIMITATIONS, EXCLUSIONS AND DISCLAIMER OF IMPLIED WARRANTIES

ANY IMPLIED WARRANTY THAT IS FOUND TO ARISE BY WAY OF STATE OR FEDERAL LAW, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR ANY IMPLIED WARRANTY OF FITNESS, IS LIMITED IN DURATION TO THE TERMS OF THIS LIMITED WARRANTY AND IS LIMITED IN SCOPE OF COVERAGE TO THE SCOPE OF COVERAGE OF THIS LIMITED WARRANTY. Braun disclaims any express or implied warranty, including any implied warranty of fitness or merchantability, on items excluded from coverage as set forth in this limited warranty. Braun makes no warranty of any nature beyond that contained in this limited warranty. No one has authority to enlarge, amend or modify this limited warranty, and Braun does not authorize anyone to create any other obligation for it regarding this product. Braun is not responsible for any representation, promise or warranty made by any independent dealer or other person beyond what is expressly stated in this limited warranty. Any selling or servicing dealer is not Braun's agent, but an independent entity.

Braun® Limited Warranty

BRAUN SHALL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES THAT MAY RESULT FROM BREACH OF THIS LIMITED WARRANTY OR ANY IMPLIED WARRANTY. THIS EXCLUSION OF CONSEQUENTIAL AND INCIDENTAL DAMAGES SHALL BE INDEPENDENT OF ANY FAILURE OF THE ESSENTIAL PURPOSE OF ANY WARRANTY, AND THIS EXCLUSION SHALL SURVIVE ANY DETERMINATION THAT THIS LIMITED WARRANTY OR ANY IMPLIED WARRANTY HAS FAILED OF ITS ESSENTIAL PURPOSE. This warranty does not cover, and in no event shall Braun be liable for towing charges, travel, lodging, or any other expense incurred due to the loss of use of the product or other reason.

Some states do not allow limitations on how long an implied warranty lasts, or the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you.

HOW TO GET SERVICE

To obtain warranty service the owner must do all of the following:

1. Notify an authorized service center, of the claimed defect attributable to Braun, within the warranty coverage period designated above
2. Provide the notification mentioned in (1), above, within ten (10) days of when the owner discovered, or should have discovered, the claimed defect
3. Promptly schedule an appointment with and take the product to an authorized service center for service.
4. Pay any transportation costs and all expenses associated with obtaining warranty service.

Since Braun does not control the scheduling of service work at the independent dealerships you may encounter some delay in scheduling or completion of work. If you need assistance you may contact Braun, at 631 West 11th Street, Winamac, Indiana 46996; 1-800-THE-LIFT, (843-5438).

If two (2) or more service attempts have been made to correct any covered defect that you believe impairs the value, use or safety of the product, or if it has taken longer than thirty (30) days for repairs to be completed, you must, to the extent permitted by law, notify Braun directly, in writing, at the above address, of the unsuccessful repair(s) of the alleged defect(s) so that Braun can become directly involved in providing service pursuant to the terms of this limited warranty.

WHAT IS NOT COVERED

This Limited Warranty does not cover any of the following: defects in materials, components or parts of the product not attributable to Braun, any material, component or part of the product that is warranted by another entity (Note: the written warranty provided by the manufacturer of the material, component or part is the direct responsibility of that manufacturer); items that are added or changed after the product leaves Braun's possession; additional items installed at any dealership, or other place of business, or by any other party, other than Braun; normal wear, tear, usage, maintenance, service, periodic adjustments, the effects of condensation or moisture from condensation; mold or any damage caused by mold; imperfections that do not affect the product for its intended purpose; items that are working as designed but that you are unhappy with; problems related to mis-operation, misuse, mishandling, neglect or abuse, including failure to maintain the product in accordance with the owner's manual, or other routine maintenance such as inspections, lubricating, adjustments, tightening of screws, sealing, wheel alignments or rotating tires; damage due to accident or collision, including any acts of weather or damage or corrosion due to the environment; theft, vandalism, fire, or other intervening acts not attributable to Braun; damage resulting from tire wear or tire failure; defacing, scratches, dents or chips on any interior or exterior surface of the product, including those caused by rocks or other road hazards, damage caused by off road use, overloading or alteration of the product, or any of its components or parts.

Defects and/or damage to interior and exterior surfaces and other appearance items may occur at the factory or when the product is in transit. These items are usually detected and corrected at the factory or by

a dealer prior to delivery to the purchaser. You must inspect the product for this type of damage when you take delivery. If you find any such defect or damage you must notify the selling dealer, or Braun, at the time of delivery to have these items covered by this limited warranty and to have work performed on the items at no cost to you as provided by this limited warranty.

EVENTS DISCHARGING BRAUN FROM OBLIGATION UNDER WARRANTY

The following shall completely discharge Braun from any express or implied warranty obligation to repair or replace anything and void this warranty: misuse, neglect, collision, accidents, failure to provide routine maintenance (See Owner's Manual), unauthorized alteration, off road use, Acts of Nature, damage from weather or the environment, theft, vandalism, tampering, fire, explosions, overloading the product and odometer tampering.

LEGAL REMEDIES

Any action to enforce any portion of this limited warranty, or any implied warranty, must be commenced within six (6) months after expiration of the warranty coverage period designated above or the action will be barred because of the passage of time. Any performance of repairs shall not suspend this limitation period from expiring. Any performance of repairs after the warranty coverage period has expired, or performance of repairs regarding any thing excluded from coverage under this limited warranty shall be considered "good will" repairs, and they will not alter the terms of this limited warranty, or extend the warranty coverage period or the filing limitation period in this paragraph. In addition, since it is reasonable to expect that the product will need some service during the warranty period; this warranty does not extend to future performance. It only sets forth what Braun will do and does not guarantee anything about the product for any time period. Nothing in this warranty, or any action of Braun, or any agent of Braun, shall be interpreted as an extension of any warranty period or the filing limitation period in this paragraph. Some states do not allow a reduction in the statute of limitations, so this reduction may not apply to you.

WARRANTY REGISTRATION and MISCELLANEOUS

Your warranty registration records should be completed and delivered to the appropriate companies, including the Braun Delivery Checklist & Warranty form. That form must be returned to Braun within twenty (20) days of purchase. The Braun warranty will not be registered unless this warranty registration is completed and received by Braun. Failure to file this warranty registration with Braun will not affect your rights under this limited warranty as long as you can present proof of purchase, but it can cause delays in obtaining the benefits of this limited warranty, and it changes the start date of the warranty to the date of final assembly of the product by Braun.

Braun agrees to repair or replace any of its factory installed parts found to have substantial defects within the appropriate warranty period designated above, provided that the repair is authorized by Braun and carried out by an authorized service center (a Braun labor schedule determines the cost allowance for repairs). Braun will not honor any warranty claim for repairs or replacement of parts unless the claim is submitted with the appropriate paperwork, and the work is completed by an independent, factory authorized service center. The appropriate paperwork can be obtained by written or phone contact with Braun at the contact information in this warranty.

Braun reserves the right to designate where any warranty work can be performed. Braun also reserves the right to examine any defective workmanship or part prior to giving any authorization for warranty work. Braun's return authorization procedure must be adhered to in order to process any warranty claims.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS. YOU MAY ALSO HAVE OTHER RIGHTS THAT VARY FROM STATE TO STATE.

BETTER VALUE ▪ BETTER OPTIONS ▪ BETTER LIGHTING

OPTRONICS® LED LIFETIME LIMITED WARRANTY

LED LIFETIME WARRANTY
NO BULBS TO REPLACE EVER!

Optronics LED lighting products are warranted for the lifetime of original purchaser from defects in workmanship and/or materials only. Optronics will replace the product to the original purchaser or refund the purchase price if the product fails because of defect due to workmanship and/or materials. This limited lifetime warranty covers every and all diodes within each unit. Connector failure is covered by our three year limited warranty. The LED Lifetime Warranty does not apply to severe applications such as construction or off-road use and does not cover damage resulting from accident, misuse, or abuse. If warrantor is unable to provide replacement and repair is not commercially practicable or cannot be timely made, then warrantor will refund the purchase price. This offer does not constitute in any way a product guarantee and Optronics does not assume any obligations beyond replacement of the product. This warranty is not transferable and applies to the original installation of the product.

INCANDESCENT 3-YEAR LIMITED WARRANTY

Optronics' incandescent 12-volt lighting products are warranted for a period of three years from defects in workmanship and/or materials only. Optronics will replace the product to the original purchaser or refund the purchase price if the product fails because of defect due to workmanship and/or materials within the limited warranty period from the date or lot code printed on the product. If warrantor is unable to provide replacement and repair is not commercially practicable or cannot be timely made, then warrantor will refund the purchase price. This offer does not constitute in any way a product guarantee and Optronics does not assume any obligations beyond replacement of the product. This warranty is not transferable and applies to the original installation of the product.

CONSPICUITY TAPE LIMITED WARRANTY

Optronics' conspicuity tape products are warranted for a period of seven years from defects in workmanship and/or materials and adhesion failure only. Optronics will replace the product to the original purchaser or refund the purchase price if the product fails within the limited warranty period from the date or lot code printed on the product. If warrantor is unable to provide replacement and repair is not commercially practicable or cannot be timely made, then warrantor will refund the purchase price. This offer does not constitute in any way a product guarantee and Optronics does not assume any obligations beyond replacement of the product. This warranty is not transferable and applies to the original installation of the product.

PRODUCT REPLACEMENT PROCEDURES

To be eligible for Limited Warranty consideration, please contact your local authorized distributor/dealer or Optronics' customer service. Optronics' authorized distributor/dealer has full authority to issue an upfront warranty replacement/credit. If the product is found to be out of warranty at a later date, Optronics' customer service will rebill the customer for the replacement/credit. Customer service will determine if the failed product requires a return to Optronics. If return is required, a RETURN GOODS AUTHORIZATION NUMBER (RGA) will be issued.

THESE WARRANTIES DO NOT COVER DAMAGE RESULTING FROM ACCIDENT, MISUSE, OR ABUSE. CONSEQUENTIAL DAMAGES ARE EXCLUDED UNDER THIS WARRANTY AND ANY IMPLIED WARRANTY, EXCEPT FOR PERSONAL INJURY. THIS WARRANTY IS OFFERED IN LIEU OF ALL OTHER WARRANTIES. HOWEVER, MODIFICATION, LIMITATIONS OR EXCLUSIONS ON IMPLIED WARRANTIES MAY BE UNENFORCEABLE IN SOME STATES. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS AND YOU ALSO HAVE OTHER RIGHTS THAT VARY FROM STATE TO STATE. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO YOU.

OKLAHOMA
401 South 41st Street East
Muskogee OK 74403
Warranty Contact - Michelle Majors
Phone - 800-364-5483 ext. 349
Fax - 918-683-9517

INDIANA
3535 Corrie Drive
Goshen IN 46526
Warranty Contact - Keia Rolston
Phone - 800-826-5483 ext. 120
Fax - 574-389-0041

ROSCO®
VISION SYSTEMS

A CENTURY OF AUTOMOTIVE VISION SAFETY

Mirrors, Sunvisors, Cameras, and Video Recording

ROSCO COMMERCIAL WARRANTY

We warrant that all ROSCO mirror, camera, sun visor, and electronic vision products are free from defects in workmanship and materials for a period of ONE (1) YEAR from the date of receipt of the product. During the warranty period, we agree to provide a replacement for (or at our option repair) any ROSCO product and/or any one or more component parts of a ROSCO product, which malfunctions under normal use and service.

Upon discovering a defect, the customer must contact ROSCO for a return authorization and then must return the product, and/or component part, together with proof of date of receipt of the product, to ROSCO INC. 144-31 91 Ave. Jamaica, New York 11435. The customer and not ROSCO will be responsible for the payment of all removal, installation and transportation charges for return of defective products or components to ROSCO. Transportation charges for such return must be prepaid. The repaired or replaced equipment will be returned to the customer with transportation charges prepaid by ROSCO. Replacement (or repaired) products and/or component parts are warranted only for the unexpired term of the original warranty.

This warranty does not cover defects caused by neglect, misuse, incorrect application, incorrect installation, water damage, vehicle wash facilities, alteration or repair in any manner outside ROSCO's factory, or damage caused by the return shipment due to inadequate packaging or mishandling. If the alleged defect is due to any of these causes, the customer will be advised of the findings and asked what action is to be taken. If ROSCO is requested to repair the product, a repair charge estimate will be prepared and the customer's written permission (purchase order, repair, etc.) will be necessary to proceed with the repair of the product and/or component part. Transportation charges for such returns will be the responsibility of the customer.

This warranty may not be expanded by oral representation, written sales information, drawings or otherwise. Repair or replacement is the exclusive remedy for defective products under this warranty. This warranty is expressly in lieu of all other warranties, including any implied warranty of merchantability or any implied warranty of fitness for a particular purpose on any ROSCO product. ROSCO shall not be liable for any consequential or incidental damages for breach of any express or implied warranty on any ROSCO product.

90-21 144th Place, Jamaica, New York 11435 - 4397
Tel: (800) 227-2095 Fax: (718) 297-0323
Mirrors and Sunvisor Products: www.roscomirrors.com
Cameras & Electronic Products: www.roscovision.com

WARRANTY POLICY

Q'Straint belts/ retractor are inspected and tested thoroughly. The product is warranted to be free from defects in workmanship and materials for the periods from the date of purchase:

- **Q'POD – 5 years** (with warranty card submitted & proof of maintenance)
- **QRT-360 – 5 years** (with warranty card submitted)
- **QUBE – 3 years** (with warranty card submitted & proof of maintenance)
- **QRT Max – 3 years** (with warranty card submitted)
- **QRT Deluxe – 3 years** (with warranty card submitted)
- **QRT Standard – 2 years** (with warranty card submitted)
- **QLK-150 – 3 years** (with warranty card submitted & proof of maintenance)
- **QLK-110 – 2 years** (with warranty card submitted & proof of maintenance)
- **Q-5000 – 2 years**
- **M-Series – 2 years**
- **Anchorages** (track) **– 1 year**
- **Accessories – 1 year**

Should any of the belts fail to operate properly during the warranty period, return the COMPLETE belt/ retractor, freight prepaid, to Q'Straint or an authorized dealer. In some situations, we will determine to provide a replacement at a charge while we receive and inspect the item claimed. If inspection shows that improper operation is caused by defective workmanship or material, Q'Straint will repair or replace the belt/ retractor only, at no charge. Otherwise, invoice for replacement is due and payable within 45 days from ship date. Q'Straint does not warranty labor charges.

This warranty does not apply where:

- normal maintenance is required
- repairs shave been made or attempted by user
- the belts/ retractors have been abused, misused or improperly maintained
- alterations have been made to the Q'Straint belts/retractors by user or installer

A warranty card is enclosed with each Q'Straint kit.
Please register the product online at: **www.qstraint.com/registration**

Please contact us with any questions or concerns.

5553 Ravenswood Road . Bldg. 110 . Ft. Lauderdale, Florida 33312
Toll-Free: 1-800-987-9987 • Tel: 954-986-6665 • Fax: 954-986-0021 • **www.qstraint.com**