

# FEDERAL TRANSIT BUS TEST

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

## Altoona Bus Testing and Research Center Test Bus Procedure

### 5.2 STRUCTURAL STRENGTH AND DISTORTION TESTS – STRUCTURAL DISTORTION

Pass/Fail  
October 2016



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**LTI BUS RESEARCH  
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## ABBREVIATIONS

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

### **5.2-I. TEST OBJECTIVE**

The objective of this test is to observe the operation of various subsystems when the bus is placed in a longitudinal twist (simulating operation over an approximately 6-inch curb or through an approximately 6-inch pothole) and subjected to a water spray device (simulating rain and traffic spray).

### **5.2-II. TEST DESCRIPTION**

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

1. Body
2. Windows
3. Doors
4. Roof vents
5. Special seating
6. Wheelchair lift
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. TEST ARTICLE**

The test article is a transit bus with a minimum service life of 4, 5, 7, 10 or 12 years.

### **5.2-IV. TEST EQUIPMENT/FACILITIES/PERSONNEL**

The test will be performed on the structural strength test surface at the ABTC. The area contains a set of ramps, which will be used to alternately raise and lower each of the bus wheels by approximately 6 inches. The following test equipment is needed for this test:

1. The water spray mechanism that simulates rain and traffic spray.
2. Ballast to simulate passenger loading to GVW.
3. Four ramps, each approximately 6 inches in height.
4. Ten copies of the Distortion Test Data Form.
5. Calibrated thermometer

NOTE: All references herein to ramp heights of 6 inches are approximate.

Test personnel required for this test include:

1. Test personnel (TP)

## **5.2-V. TEST DATA**

The test data consists of the completed Distortion Test Inspection Form for the ten test orientations. All forms are to be completed using a pen. Upon completion of this test, data shall be forwarded to the ABTC manager.

## **5.2-VI. TEST PREPARATION AND PROCEDURES**

The detailed test preparation and procedures are listed in Procedure 5.2-1. This section also includes Distortion Test Data Form – 5.2.

| <b>DETAILED TEST PROCEDURES</b> |   | <b>TITLE: Structural Integrity</b>  |
|---------------------------------|---|---|
| <b>Procedure 5.2-1</b>          | <b>NOMENCLATURE: 5.2 Structural Strength and Distortion Tests – Structural Distortion</b> |   |
| <b>OPER STEP</b>                | <b>ACTION BY</b>  | <b>TEST PREPARATION AND PROCEDURE</b>   |
| 1                               | TP  | Record the bus number on the ten separate Structural Integrity Data Forms.  |
| 2                               | TP  | Maneuver the bus onto the structural strength test surface; i.e., all wheels level.   |
| 3                               | TP  | Verify the bus is loaded to gross vehicle weight using ballast. Gross vehicle weight is curb weight plus gross vehicle load.  |
| 4                               | TP  | Verify proper operation of the water spray device. Visually confirm that water flow is even through all nozzles.  |
| 5                               | TP  | Record environmental data on the Distortion Test Inspection Form.   |
| 6                               | TP  | Verify that all test prerequisites are satisfied and test preparation steps complete.   |
| 7                               | TP  | Using a ramp, position the bus so that the left front wheel is approximately 6 inches higher than the other three.  |
| 8                               | TP  | Check the appropriate position on a test form.  |
| 9                               | TP  | Slowly pass the water spray device over the entire length of the bus.   |
| 10                              | TP  | <p>Verify proper operation of the items listed below and record the findings.</p> <p><b>WINDOWS:</b></p> <ol style="list-style-type: none"> <li>1. Verify that all transom windows open and close properly.</li> <li>2. Verify that all emergency windows are closed, but will open and close properly.</li> <li>3. Verify that no windows are cracked or broken.</li> </ol> <p><b>FRONT DOORS:</b> Verify that the front doors open and close properly under both normal and emergency controls.</p> |

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|----|----|--|
|    |    | <p><b>REAR DOORS:</b> Verify that the rear doors open and close properly under both normal (McKay gate and operator control) and emergency control.</p> <p><b>ESCAPE MECHANISMS/ROOF VENTS:</b> Verify that the roof hatches open and close properly.</p> <p><b>ENGINE:</b> Operate the engine in neutral and verify normal operation. Verify belt and fan blades do not rub on surroundings.</p> <p><b>HANDICAPPED DEVICES/SPECIAL SEATING:</b> Place the special seating in the raised and lowered positions, operate all handicapped equipment and verify proper operation.</p> <p><b>UNDERCARRIAGE:</b> To the extent possible, inspect the undercarriage for cracks, gaps, loose hoses and other abnormalities.</p> <p><b>SERVICE DOORS:</b> Verify that all service doors open and close properly</p> <p><b>BODY:</b> Inspect the interior and exterior for leaks during the water spray.</p> <p><b>WINDOWS/BODY LEAKAGE:</b> Inspect the interior for leaks during the water spray test.</p> <p><b>STEERING MECHANISM:</b> Verify normal operation.</p> |
| 11 | TP | Repeat steps 7 through 10 with the right front wheel 6 inches higher than the other three.   |
| 12 | TP | Repeat steps 7 through 10 with the right rear wheel 6 inches higher than the other three.  |
| 13 | TP | Repeat steps 7 through 10 with the left rear wheel 6 inches higher than the other three.   |
| 14 | TP | Repeat steps 7 through 10 with the left front wheel 6 inches lower than the other three.   |
| 15 | TP | Repeat steps 7 through 10 with the right front wheel 6 inches lower than the other three.  |

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| 16 | TP | Repeat steps 7 through 10 with the right rear wheel 6 inches lower than the other three. |
| 17 | TP | Repeat steps 7 through 10 with the left rear wheel 6 inches lower than the other three.  |
| 18 | TP | Repeat steps 8 through 10 with all wheels level.   |
| 19 | TP | Upon completion of this test, data shall be forwarded to the ABTC manager.               |