

**HEAVY-DUTY 500,000-MILE BUS  
WITH A MINIMUM SERVICE LIFE OF  
12 YEARS**

1. MAINTAINABILITY

**1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS**

APRIL 2006

## 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)<br>scale | - 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   |
| mpg            | - miles per gallon  |
| mph            | - miles per hour  |
| NBM            | - new bus models  |
| PSBRTF         | - Penn State Bus Research and Testing Facility  |
| PTI            | - Pennsylvania Transportation Institute   |
| rpm            | - revolutions per minute  |
| SAE            | - Society of Automotive Engineers   |
| SCF            | - standard cubic feet   |
| SCFM           | - standard cubic feet per minute  |
| SCH            | - test scheduler  |
| SEC            | - secretary   |
| SI             | - spark ignition  |
| SLW            | - seated load weight (curb weight plus 150 lb for every designed passenger seating position and for the driver)   |
| TD             | - test driver   |
| TM             | - track manager   |
| TP             | - test personnel  |

### 1.3-I. TEST OBJECTIVE

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

### 1.3-II. TEST DESCRIPTION

The test will address 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 test is included in the data. Components to be included are:

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

### 1.3-III. TEST ARTICLE

The test article is a heavy-duty transit bus with a minimum service life of 12 years or 500,000 mi.

### 1.3-IV. TEST EQUIPMENT/FACILITIES/PERSONNEL

All tests are conducted at the ABTC. Tests are performed by:

1. Test personnel (TP)
2. Driver (DR)

### 1.3-V. TEST DATA

The Maintainability Evaluation Form is filled out for the items listed in the reliability test procedure section and shall be forwarded to the ABTC manager. When the bus is returned for scheduled or unscheduled maintenance or repair, the form is to be updated for additional repairs and shall be forwarded to the ABTC manager.

### 1.3-VI. TEST PREPARATION AND PROCEDURES

The detailed test procedures are listed in procedure 1.3-1. This section also includes Maintainability Evaluation Form - 1.3.

**DETAILED TEST PROCEDURES****TITLE: 1. Maintainability****Procedure 1.3-1****NOMENCLATURE: 1.3 Replacement and/or Repair of Selected Subsystems**

| <b>OPER<br/>STEP</b> | <b>ACTION<br/>BY</b> | <b>TEST PREPARATION AND PROCEDURE</b>  |
|----------------------|----------------------|--|
| 1                    | DR                   | Position the bus into the requested mechanics stall.   |
| 2                    | TP                   | <p>Record the bus number, date, and test personnel on the Maintainability Evaluation Form.</p> <p>NOTE: Record date, mileage, diagnostic time, repair time, and special tools required, on the Work Order Form for each subsystem.</p> <p>NOTE: Some of the following procedures may need to be performed during the course of testing. If they have been previously evaluated, they do not need to be repeated here as long as all the appropriate information has been recorded on Work Order Forms and the Maintainability Evaluation Form.</p> |
| 3                    | TP                   | Remove and replace the transmission. Record the time required and any unusual difficulty.  |
| 4                    | TP                   | Remove and replace the alternator. Record the time required and any unusual difficulty.  |
| 5                    | TP                   | Remove and replace the starter. Record the time required and any unusual difficulty.   |
| 6                    | TP                   | Remove and replace the batteries. Record the time required and any unusual difficulty.   |
| 7                    | TP                   | Remove and replace the windshield wiper motor. Record the time required and any unusual difficulty.  |
| 8                    | TP                   | Fill out the Maintainability Evaluation and Work Order Forms.  |
| 9                    | TP                   | Any time the bus is returned for service or repair, add the components involved to the Maintainability Form.   |

## REVISIONS

All revisions to this test must be identified on this page. Briefly describe each revision in the space provided below.

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| Revision | Description | Date | Approval |
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## MAINTAINABILITY EVALUATION FORM

Bus Number: \_\_\_\_\_

| <b>SCHEDULED MAINTENANCE</b> |      |                        |                        |                    |                |               |
|------------------------------|------|------------------------|------------------------|--------------------|----------------|---------------|
| Description<br>of Task       | Date | Hubodometer<br>Reading | Special Tools<br>Req'd | Diagnostic<br>Time | Repair<br>Time | Total<br>Time |
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**MAINTAINABILITY EVALUATION FORM (continued)**

Bus Number:

| <b>UNSCHEDULED REPAIRS</b> |      |                     |                     |                 |             |            |
|----------------------------|------|---------------------|---------------------|-----------------|-------------|------------|
| Description of Task        | Date | Hubodometer Reading | Special Tools Req'd | Diagnostic Time | Repair Time | Total Time |
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