



**MARYLAND TRANSIT ADMINISTRATION**

**MARYLAND DEPARTMENT OF TRANSPORTATION**

Martin O'Malley, Governor • Anthony G. Brown, Lt. Governor  
James T. Smith, Jr., Secretary • Robert L. Smith, Administrator

TO: All Planholders  
FROM: Maryland Transit Administration  
Procurement Division  
SUBJECT: **Addendum No. 3**  
**Contract No. T-8000-0451**  
**BUS PROCUREMENT – 41 Hybrid Buses**  
DATE: June 16, 2014

Enclosed and effective this date is Addendum No.3 to the subject Contract. This Addendum reflects changes made to the solicitation as mentioned on the attached list regarding approved equals.

The proposer shall acknowledge receipt of this Addendum by completing and returning this form with the proposal package.

All other terms and conditions remain unchanged.

Sincerely,  
  
Heidi J. Tarleton  
Procurement Officer

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Acknowledgement of receipt of ADDENDUM #3 to Solicitation #T-8000-0451

Vendor Name: \_\_\_\_\_

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Authorized Representative's Signature

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Date

**A list of the changes made to this solicitation follows – Addendum No 3:**

The following additions, deletions, and modifications are hereby made a part of the Contract Documents of BUS PROCURMENT– 41 Hybrid Buses, Contract No.: T-8000-0451.

<b>Contract Specifications</b>		
<b>Item No.</b>	<b>Page or Section</b>	<b>Modification</b>
One	<b>TS 39.1 Page 176</b>	<b>Electronic Cabinet approved equal accepted by MTA is a follows:</b>  Secure Diagnostics Station (SDS), Model – Xcelsior, Model Number 422-001, Lengths 35', 40' and 60', Propulsion – All.
Two	<b>TS 83.3 Item b) Page 272</b>	<b>On Board Video Surveillance System approved equal accepted by MTA is as follows:</b>  Safety Vision System DVR Road Recorder 7000



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Martin O'Malley, Governor • Anthony G. Brown, Lt. Governor  
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TO: All Planholders

FROM: Maryland Transit Administration  
Procurement Division

SUBJECT: **Addendum No. 2**  
**Contract No. T-8000-0451**  
**BUS PROCUREMENT – 41 Hybrid Buses**

DATE: June 9, 2014

Enclosed and effective this date is Addendum No.2 to the subject Contract. This Addendum reflects changes made to the solicitation as mentioned on the attached list and extends the following dates:

**Submission for approved equals due June 13, 2014 by Noon;**  
**Returned approved equals June 17, 2014 by Noon;**  
**Bid Due Date extended to June 24, 2014 at 12:30pm;**  
**Public Bid Opening extended to June 24, 2014 at 1:00pm.**

A conformed copy of the revised specification will be available on our website at [www.mta.maryland.gov/procurement](http://www.mta.maryland.gov/procurement).

The proposer shall acknowledge receipt of this Addendum by completing and returning this form with the proposal package.

All other terms and conditions remain unchanged.

Sincerely,

Heidi J. Tarleton  
Procurement Officer

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Acknowledgement of receipt of ADDENDUM #2 to Solicitation #T-8000-0451

Vendor Name: \_\_\_\_\_

---

Authorized Representative's Signature

Date

**A list of the changes made to this solicitation follows:**

The following additions, deletions, and modifications are hereby made a part of the Contract Documents of BUS PROCURMENT– 41 Hybrid Buses, Contract No.: T-8000-0451.

<b>Contract Specifications</b>		
<b>Item No.</b>	<b>Page or Section</b>	<b>Modification</b>
One	Page 9 Section 1.10	<p><b>Section 1.10 <u>Bids Due (Closing) Date and Time</u>, shall now read:</b></p> <p>Bids, in the number and form set forth in Section 4.4 “Required Bid Submissions,” must be received by the Procurement Officer at the address listed on the Key Information Summary Sheet, no later than <del>1:30 p.m.</del> Local Time on <del>June 12, 2014</del> in order to be considered.</p> <p>Bids, in the number and form set forth in Section 4.4 “Required Bid Submissions,” must be received by the Procurement Officer at the address listed on the Key Information Summary Sheet, no later than <b>12:30 p.m.</b> Local Time on <b>June 24, 2014</b> in order to be considered</p>
Two	Page 10 Section 1.12 Item 1.12.3	<p><b>Section 1.12 Item 3 <u>Bids Due (Closing) Date and Time</u>, shall now read:</b></p> <p>1.12.3 The Bid Opening shall be <del>2:00 p.m. on June 12, 2014</del> at the William Donald Schaefer Building, 6 St. Paul Street, 7th Floor, Baltimore, Maryland 21202.</p> <p><b>1.12.3</b> The Bid Opening shall be <b>1:00 p.m. on June 24, 2014</b> at the William Donald Schaefer Building, 6 St. Paul Street, 7th Floor, <b>Rooms 731-732</b>, Baltimore, Maryland 21202.</p>
Three	Page 55 Attachment F Bid Form	<p>Bid Opening Date Changed to <b>June 24, 2014.</b></p> <p>Bid Opening Time Changed to <b>1:00pm</b></p>

Four	Page 272 Section TS 83.3	<p><b>Section TS 83.3b <u>On Board Video Surveillance System (OBVSS)</u>, shall now read:</b></p> <p>b) The DVRU shall be <del>March Networks 5412 or approved equal (Apollo RR MRH12-2000 or Dedicated Micros AD/TV2/1612/A).</del></p> <p>b) The DVRU shall be Dedicated Micros AD/TV2/1612/A or approved equal.</p>
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**STATE OF MARYLAND**  
**MARYLAND DEPARTMENT OF TRANSPORTATION**  
**MARYLAND TRANSIT ADMINISTRATION**

**INVITATION FOR BIDS (IFB)**

**SOLICITATION NO. T-8000-0451**

**BUS PROCUREMENT – 41 HYBRID BUSES**

**Issue Date: June 9, 2014**  
**ADDENDUM NO. 2**

**NOTICE**

A Prospective Bidder that has received this document from the Maryland Transit Administration's (MTA) website or <https://emaryland.buyspeed.com/bsa/>, or that has received this document from a source other than the Procurement Officer, and that wishes to assure receipt of any changes or additional materials related to this IFB, should immediately contact the Procurement Officer and provide the Prospective Bidder's name and mailing address so that addenda to the IFB or other communications can be sent to the Prospective Bidder.

**Disadvantaged Business Enterprises Are Encouraged to Respond to this Solicitation**

**STATE OF MARYLAND  
NOTICE TO VENDORS**

In order to help us improve the quality of State solicitations, and to make our procurement process more responsive and business friendly, we ask that you take a few minutes and provide comments and suggestions regarding this solicitation. Please return your comments with your response. If you have chosen not to respond to this Contract, please email or fax this completed form to the attention of the Procurement Officer (see the Key Information Sheet below for contact information).

**Title: BUS PROCUREMENT – 41 HYBRID BUSES**  
**Solicitation No: T-8000-0451**

1. If you have chosen not to respond to this solicitation, please indicate the reason(s) below:

- Other commitments preclude our participation at this time.
- The subject of the solicitation is not something we ordinarily provide.
- We are inexperienced in the work/commodities required.
- Specifications are unclear, too restrictive, etc. (Explain in REMARKS section.)
- The scope of work is beyond our present capacity.
- Doing business with the State of Maryland is simply too complicated. (Explain in REMARKS section.)
- We cannot be competitive. (Explain in REMARKS section.)
- Time allotted for completion of the Bid/Proposal is insufficient.
- Start-up time is insufficient.
- Bonding/Insurance requirements are restrictive. (Explain in REMARKS section.)
- Bid/Proposal requirements (other than specifications) are unreasonable or too risky. (Explain in REMARKS section.)
- DBE requirements are not attainable or realistic. (Explain in REMARKS section.)
- Prior State of Maryland contract experience was unprofitable or otherwise unsatisfactory. (Explain in REMARKS section.)
- Payment schedule too slow.
- Other: \_\_\_\_\_

2. If you have submitted a response to this solicitation, but wish to offer suggestions or express concerns, please use the REMARKS section below. (Attach additional pages as needed.).

REMARKS: \_\_\_\_\_

\_\_\_\_\_

Vendor Name: \_\_\_\_\_ Date: \_\_\_\_\_

Contact Person: \_\_\_\_\_ Phone (\_\_\_\_) \_\_\_\_ - \_\_\_\_\_

Address: \_\_\_\_\_

E-mail Address: \_\_\_\_\_

**If you have chosen not to submit a bid on this procurement, please fax this completed form to:  
(410)-333-0126 (Attention: Heidi J. Tarleton).**

**Thank you**

**STATE OF MARYLAND  
MARYLAND TRANSIT ADMINISTRATION  
IFB KEY INFORMATION SUMMARY SHEET**

**Invitation for Bids:** **Bus Procurement – 41 Hybrid Buses**

**Solicitation Number:** **T-8000-0451**

**IFB Issue Date:** **May 19, 2014**

**IFB Issuing Office:** **MD Department of Transportation  
Maryland Transit Administration**

**Procurement Officer:** **Heidi J. Tarleton  
Contracts Administration Division  
6 St. Paul, 7th Floor  
Baltimore, MD 21202  
Phone: (410) 767-8374  
Fax: (410) 333-0126  
Email: htarleton@mta.maryland.gov**

**Bids are to be sent to:** **Maryland Transit Administration  
Contracts Administration Division  
6 St. Paul, 7th Floor  
Baltimore, MD 21202  
Attention: Heidi J. Tarleton**

**Pre-Bid Conference:** **May 28, 2014 at 10:00am Local Time  
Maryland Transit Administration  
Contracts Administration Division  
6 St. Paul, 7th Floor Conference Room  
Baltimore, MD 21202**

**Closing Date and Time:** **June 24, 2014 at 12:30pm Local Time**

**Public Bid Opening:** **June 24, 2014 at 1:00pm Local Time  
Maryland Transit Administration  
Contracts Administration Division  
6 St. Paul, 7th Floor Conference Room  
Baltimore, MD 21202**

**DBE Subcontracting Goal:** **See Section 1.32**

## Table of Contents

<b>SECTION 1 - GENERAL INFORMATION.....</b>	<b>6</b>
1.1 Summary Statement .....	6
1.2 Abbreviations and Definitions .....	6
1.3 Contract Type.....	7
1.4 Contract Duration.....	7
1.5 Procurement Officer.....	8
1.6 Pre-Bid Conference.....	8
1.7 eMaryland Marketplace .....	8
1.8 Questions.....	9
1.9 Procurement Method.....	9
1.10 Bids Due (Closing) Date and Time.....	9
1.11 Multiple or Alternate Bids .....	9
1.12 Receipt, Opening and Recording of Bids .....	10
1.13 Confidentiality of Bids.....	10
1.14 Award Basis .....	10
1.15 Tie Bids.....	10
1.16 Duration of Bid .....	10
1.17 Revisions to the IFB.....	10
1.18 Cancellations.....	11
1.19 Incurred Expenses .....	11
1.20 Protest/Disputes .....	11
1.21 Bidder Responsibilities .....	11
1.22 Substitution of Personnel .....	11
1.23 Mandatory Contractual Terms .....	11
1.24 Bid/Proposal Affidavit.....	12
1.25 Contract Affidavit .....	12
1.26 Compliance with Laws/Arrearages.....	12
1.27 Verification of Registration and Tax Payment .....	12
1.28 False Statements.....	12
1.29 Payments by Electronic Funds Transfer .....	13
1.30 Prompt Payment Policy.....	13
1.31 Electronic Procurements Authorized .....	13
1.32 Disadvantaged Business Enterprise Goal and Subgoals.....	14
1.33 Performance Guarantees .....	14
1.34 Bid Bond .....	16
1.35 Federal Funding Acknowledgement.....	16
1.36 Conflict of Interest Affidavit and Disclosure.....	16
1.37 Non-Disclosure Agreement .....	16
1.38 Non-visual Access .....	16
1.39 Mercury and Products that Contain Mercury.....	16
1.40 Location of the Performance of Services Disclosure.....	17
1.41 Department of Human Resources (DHR) Hiring Agreement.....	17
1.42 Buy America Requirements .....	17
<b>SECTION 2 – MINIMUM QUALIFICATIONS.....</b>	<b>18</b>
2.1 Bidder Minimum Qualifications .....	18

<b>SECTION 3 – SPECIFICATIONS</b> .....	<b>19</b>
3.1 Background and Purpose .....	19
3.2 Specification – Requirements .....	19
3.3 Security Requirements .....	21
3.4 Insurance Requirements.....	21
3.4 Problem Escalation Procedure .....	23
3.5 Invoicing .....	24
3.6 DBE Reports .....	25
<b>SECTION 4 – BID FORMAT</b> .....	<b>26</b>
4.1 One Part Submission.....	26
4.2 Labeling .....	26
4.3 Bid Price Form.....	26
4.4 Required Bid Submissions.....	26
4.5 Reciprocal Preference .....	28
4.6 Delivery.....	28
4.7 Documents Required upon Notice of Recommendation for Contract Award .....	29
<b>IFB ATTACHMENTS</b> .....	<b>30</b>
ATTACHMENT A – Contract .....	32
ATTACHMENT B – Bid/Proposal Affidavit.....	44
ATTACHMENT C – Contract Affidavit.....	49
ATTACHMENT D – .....	52
Transit Vehicle Manufacture (TVM)/Disadvantaged Business Enterprise (DBE) Certificate.	52
ATTACHMENT E – Pre-Bid Conference Response Form.....	53
ATTACHMENT F – Bid Pricing Instructions.....	54
ATTACHMENT F – Bid Form .....	55
ATTACHMENT G – Federal Funding Requirements.....	61
ATTACHMENT H – Conflict Of Interest Affidavit And Disclosure .....	68
ATTACHMENT I – Mercury Affidavit .....	69
ATTACHMENT J – Non-Disclousre Agreement .....	70
ATTACHMENT K – Performance Bond .....	74
ATTACHMENT L – Bid Bond .....	77
ATTACHMENT M – Location Of The Performance Of Services Disclosure .....	79
ATTACHMENT N – Buy America Certificate.....	80
ATTACHMENT O – Bus Testing Certification.....	81
<b>ADDITIONAL ATTACHMENTS:</b>	
BUY AMERICA REQUIREMENTS	
MANDATORY FEDERAL CLAUSES	
TECHNICAL SPECIFICATIONS	

## **SECTION 1 - GENERAL INFORMATION**

### **1.1 Summary Statement**

- 1.1.1 The Maryland Transit Administration (MTA or the Department) is issuing this Invitation for Bids (IFB) to Purchase forty-one (41) – 40 foot hybrid buses.
- 1.1.2 It is the State’s intention to obtain services, as specified in this IFB, from a Contract between the selected Bidder and the State. The anticipated duration of services to be provided under this Contract is for 12 months. See Section 1.4 for more information.
- 1.1.3 The Department intends to make a single award as a result of this IFB.
- 1.1.4 Bidders, either directly or through their subcontractor(s), must be able to provide all services and meet all of the requirements requested in this solicitation and the successful Bidder (the Contractor) shall remain responsible for Contract performance regardless of subcontractor participation in the work.

### **1.2 Abbreviations and Definitions**

For purposes of this IFB, the following abbreviations or terms have the meanings indicated below:

- a. **Bid** – A statement of price offered by a Bidder in response to an IFB.
- b. **Bidder** – An entity that submits a Bid in response to this IFB.
- c. **Business Day(s)** – The official Working Days of the week to include Monday through Friday. Official Working Days exclude State Holidays (see definition of “Normal State Business Hours” below).
- d. **COMAR** – Code of Maryland Regulations available on-line at [www.dsd.state.md.us](http://www.dsd.state.md.us).
- e. **Contract** – The Contract awarded to the successful Bidder pursuant to this IFB. The Contract will be in the form of **Attachment A**.
- f. **Contract Award Date** – The date the contract is signed by the Department following any required approvals of the Contract, including approval by the Board of Public Works, if such approval is required. See Section 1.4.
- g. **Contract Commencement Date** - The start date of performance.
- h. **Contract Monitor (CM)** – The State representative for this Contract who is primarily responsible for Contract administration functions, including issuing written direction, invoice approval, monitoring this Contract to ensure compliance with the terms and conditions of the Contract, monitoring MBE and VSBE compliance, and achieving completion of the Contract on budget, on time, and within scope.
- i. **Contractor** – The selected Bidder that is awarded a Contract by the State.
- j. **Department or MTA** – Maryland Transit Administration.
- k. **Disadvantaged Business Enterprise (DBE)** - Any legal entity certified as defined at COMAR 21.01.02.01B(54) which is certified by the Maryland Department of Transportation under COMAR 21.11.03

- l. **eMM** – eMaryland Marketplace (see IFB Section 1.8).
- m. **Invitation for Bids (IFB)** – This Invitation for Bids solicitation issued by the MTA, Solicitation Number T-8000-0451 dated May 19, 2014, including any addenda.
- n. **Local Time** – Time in the Eastern Time Zone as observed by the State of Maryland. Unless otherwise specified, all stated times shall be Local Time, even if not expressly designated as such.
- o. **Normal State Business Hours** - Normal State business hours are 8:00 a.m. – 5:00 p.m. Monday through Friday except State Holidays, which can be found at: [www.dbm.maryland.gov](http://www.dbm.maryland.gov) – keyword: State Holidays.
- p. **Notice to Proceed (NTP)** – A written notice from the Procurement Officer that, subject to the conditions of the Contract, work under the Contract is to begin as of a specified date. The start date listed in the NTP is the Contract Commencement Date, and is the official start date of the Contract for the actual delivery of services as described in this solicitation. After Contract Commencement, additional NTPs may be issued by either the Procurement Officer or the Department Contract Manager regarding the start date for any service included within this solicitation with a delayed or non-specified implementation date.
- q. **Procurement Officer** – The State representative for the resulting Contract. The Procurement Officer is responsible for the Contract and is the only State representative who can authorize changes to the Contract. The Department may change the Procurement Officer at any time by written notice to the Contractor.
- r. **State** – The State of Maryland.
- s. **Total Bid Price** - The Bidder’s total price for services in response to this solicitation, included in the Bid in Attachment F – Bid Form, and used in determining the recommended awardee (see IFB Section 1.15).
- t. **Working Day(s)** – Same as “Business Day(s).”

**1.3 Contract Type**

The Contract resulting from this solicitation shall be a fixed price contract as defined in COMAR 21.06.02.A(2).

**1.4 Contract Duration**

- 1.4.1 The Contract that results from this solicitation shall commence as of the date the Contract is signed by the Department following any required approvals of the Contract, including approval by the Board of Public Works, if such approval is required (“Contract Award Date”).
- 1.4.2 During the Start-up Period the Contractor shall perform start-up activities such as are necessary to enable the Contractor to begin the successful performance of Contract activities as of the Contract Commencement Date. No compensation will be paid to the Contractor for any activities it performs during the Start-up Period.
- 1.4.3 As of the Contract Commencement Date as contained in a Notice to Proceed (see Section 1.2 definition), the Contractor shall perform all activities required by the Contract, including the requirements of this solicitation, for the compensation described in its Bid.
- 1.4.4 The duration of the Contract will be for the period of time from Contract Commencement Date plus 12 months for the provision of all services required by the Contract and the requirements of this solicitation.

1.4.5 The Contractor's obligations to pay invoices to subcontractors that provided services during the Contract term, as well as the audit, confidentiality, document retention, and indemnification obligations of the Contract (see Attachment A) shall survive expiration or termination of the Contract and continue in effect until all such obligations are satisfied.

## **1.5 Procurement Officer**

The sole point of contact in the State for purposes of this solicitation prior to the award of any Contract is the Procurement Officer at the address listed below:

Heidi J. Tarleton  
Procurement Officer  
Contracts Administration Division  
6 St. Paul, 7<sup>th</sup> Floor  
Baltimore, MD 21202  
Phone Number: (410) 767-8374  
Fax Number: (410) 333-0126  
E-mail: htarleton@mta.maryland.gov

The Department may change the Procurement Officer at any time by written notice. No other MTA employees should be contacted referencing this IFB. The vendor is liable for any information received from other than the procurement officer.

## **1.6 Pre-Bid Conference**

A Pre-Bid Conference (the Conference) will be held on May 28, 2014, beginning at 10:00am Local Time, at the William Donald Schaefer Building, 6 St. Paul Street, 7<sup>th</sup> Floor, Baltimore, Maryland 21202. All prospective Bidders are encouraged to attend in order to facilitate better preparation of their Bids.

The Conference will be summarized. As promptly as is feasible subsequent to the Conference, a summary of the Conference and all questions and answers known at that time will be distributed to all prospective Bidders known to have received a copy of this IFB. This summary, as well as the questions and answers, will also be posted on eMaryland Marketplace. See IFB Section 1.8.

In order to assure adequate seating and other accommodations at the Conference, please e-mail, mail, or fax to (410) 333-4810 the Pre-Bid Conference Response Form to the attention of the Procurement Officer no later than 4:00 p.m. Local Time on May 23, 2014. The Pre-Bid Conference Response Form is included as **Attachment E** to this IFB. In addition, if there is a need for sign language interpretation and/or other special accommodations due to a disability, please notify the Procurement Officer no later than 4:00 p.m. Local Time on May 23, 2014. The Department will make a reasonable effort to provide such special accommodation.

## **1.7 eMaryland Marketplace**

Each Bidder is requested to indicate its eMaryland Marketplace (eMM) vendor number in the Transmittal Letter (cover letter) submitted at the time of its Bid submission to this IFB.

eMM is an electronic commerce system administered by the Maryland Department of General Services. In addition to using the MTA website <http://mta.maryland.gov/procurements> and possibly other means for transmitting the IFB

and associated materials, the solicitation and summary of the Pre-Bid Conference, Bidder questions and the Procurement Officer's responses, addenda, and other solicitation-related information will be provided via eMM.

In order to receive a contract award, a vendor must be registered on eMM. Registration is free. Go to <https://emaryland.buyspeed.com/bsc/login.jsp>, click on "Register" to begin the process, and then follow the prompts.

## 1.8 Questions

Written questions from prospective Bidders will be accepted by the Procurement Officer prior to the Conference. If possible and appropriate, such questions will be answered at the Conference. (No substantive question will be answered prior to the Conference.) Questions to the Procurement Officer shall be submitted via e-mail to the following e-mail address: [htarleton@mta.maryland.gov](mailto:htarleton@mta.maryland.gov). Please identify in the subject line the Solicitation Number and Title. Questions, both oral and written, will also be accepted from prospective Bidders attending the Conference. If possible and appropriate, these questions will be answered at the Conference.

Questions will also be accepted subsequent to the Conference and should be submitted to the Procurement Officer (**see above email address**) in a timely manner prior to the Bid due date. Questions are requested to be submitted by Noon on June 4, 2014. The Procurement Officer, based on the availability of time to research and communicate an answer, shall decide whether an answer can be given before the Bid due date. Time permitting, answers to all substantive questions that have not previously been answered, and are not clearly specific only to the requestor, will be distributed to all vendors that are known to have received a copy of the IFB in sufficient time for the answer to be taken into consideration in the Bid.

## 1.9 Procurement Method

This Contract will be awarded in accordance with the Competitive Sealed Bidding method under COMAR 21.05.02.

## 1.10 Bids Due (Closing) Date and Time

Bids, in the number and form set forth in Section 4.4 "Required Bid Submissions," must be received by the Procurement Officer at the address listed on the Key Information Summary Sheet, no later than **12:30 p.m.** Local Time on **June 24, 2014** in order to be considered.

Requests for extension of this time or date will not be granted. Bidders mailing Bids should allow sufficient mail delivery time to ensure timely receipt by the Procurement Officer. Except as provided in COMAR 21.05.02.10, Bids received after the due date and time listed in this section will not be considered.

Bids may be modified or withdrawn by written notice received by the Procurement Officer before the time and date set for the opening.

### **Bids may not be submitted by e-mail or facsimile.**

Vendors not responding to this solicitation are requested to submit the "Notice to Vendors" form, which includes company information and the reason for not responding (e.g., too busy, cannot meet mandatory requirements, etc.). This form is located in the IFB immediately following the Title Page (page ii).

## 1.11 Multiple or Alternate Bids

Multiple and/or alternate Bids will not be accepted.

## **1.12 Receipt, Opening and Recording of Bids**

- 1.12.1 Receipt. Upon receipt, each Bid and any timely modification(s) to a Bid shall be stored in a secure place until the time and date set for bid opening. Before Bid opening, the State may not disclose the identity of any Bidder.
- 1.12.2 Opening and Recording. Bids and timely modifications to Bids shall be opened publicly, at the time, date and place designated in the IFB. The name of each Bidder, the total Bid price, and such other information as is deemed appropriate shall be read aloud or otherwise made available.
- 1.12.3 The Bid Opening shall be 1:00 p.m. on June 24, 2014 at the William Donald Schaefer Building, 6 St. Paul Street, 7th Floor, Rooms 731-732, Baltimore, Maryland 21202.

## **1.13 Confidentiality of Bids**

The Bids shall be tabulated or a Bid abstract made. The opened Bids shall be available for public inspection at a reasonable time after Bid opening, but in any case before contract award, except to the extent the Bidder designates trade secrets or other proprietary data to be confidential as set forth in this solicitation. Material so designated as confidential shall accompany the Bid and shall be readily separable from the Bid in order to facilitate public inspection of the non-confidential portion of the Bid, including the Total Bid Price.

For requests for information made under the Public Information Act (PIA), the Procurement Officer shall examine the Bids to determine the validity of any requests for nondisclosure of trade secrets and other proprietary data identified in writing. Nondisclosure is permissible only if approved by the Office of the Attorney General.

## **1.14 Award Basis**

The Contract shall be awarded to the responsible Bidder submitting a responsive Bid with the most favorable Total Bid Price (as referenced in COMAR 21.05.02.13) for providing the goods and services as specified in this IFB. The most favorable Total Bid Price will be the lowest price total on **Attachment F** - Bid Form.

## **1.15 Tie Bids**

Tie Bids will be decided pursuant to COMAR 21.05.02.14.

## **1.16 Duration of Bid**

Bids submitted in response to this IFB are irrevocable for 120 days following the closing date of the Bids. This period may be extended at the Procurement Officer's request only with the Bidder's written agreement.

## **1.17 Revisions to the IFB**

If it becomes necessary to revise this IFB before the due date for Bids, the Department shall endeavor to provide addenda to all prospective Bidders that were sent this IFB or which are otherwise known by the Procurement Officer to have obtained this IFB. In addition, addenda to the IFB will be posted on the Department's procurement web page

and through eMM. It remains the responsibility of all prospective Bidders to check all applicable websites for any addenda issued prior to the submission of Bids.

Acknowledgment of the receipt of all addenda to this IFB issued before the Bid due date shall be included in the Transmittal Letter accompanying the Bidder's Bid. Failure to acknowledge receipt of an addendum does not relieve the Bidder from complying with the terms, additions, deletions, or corrections set forth in the addendum, and may cause the Bid to be rejected as being non-responsive to the requirements of the IFB.

### **1.18 Cancellations**

The State reserves the right to cancel this IFB, or accept or reject any and all Bids, in whole or in part, received in response to this IFB.

### **1.19 Incurred Expenses**

The State will not be responsible for any costs incurred by any Bidder in preparing and submitting a Bid or in performing any other activities related to this solicitation.

### **1.20 Protest/Disputes**

Any protest or dispute related, respectively, to this solicitation or the resulting Contract shall be subject to the provisions of COMAR 21.10 (Administrative and Civil Remedies).

### **1.21 Bidder Responsibilities**

The selected Bidder shall be responsible for rendering services for which it has been selected as required by this IFB. All subcontractors shall be identified and a complete description of their role relative to the Bid shall be included in the Bidder's Bid. If applicable, subcontractors utilized in meeting the established DBE participation goal(s) for this solicitation shall be identified as provided in the appropriate Attachment(s) of this IFB (see Section 1.32 "Disadvantaged Business Enterprise Goals").

If a Bidder that seeks to perform or provide the services required by this IFB is the subsidiary of another entity, all information submitted by the Bidder, such as but not limited to, references, financial reports, or experience and documentation (e.g. insurance policies, bonds, letters of credit) used to meet minimum qualifications, if any, shall pertain exclusively to the Bidder, unless the parent organization will guarantee the performance of the subsidiary.

### **1.22 Substitution of Personnel**

If the solicitation requires that a particular individual or personnel be designated by the Bidder to work on the Contract, any substitution of personnel after the Contract has commenced must be approved in writing by the Contract Monitor prior to the substitution. If the Contractor substitutes personnel without the prior written approval of the Contract Monitor, the Contract may be terminated for default which shall be in addition to, and not in lieu of, the State's remedies under the Contract or which otherwise may be available at law or in equity.

### **1.23 Mandatory Contractual Terms**

By submitting a Bid in response to this IFB, a Bidder, if selected for award, shall be deemed to have accepted the terms and conditions of this IFB and the Contract, attached herein as **Attachment A**. Any exceptions to this IFB or

the Contract must be raised prior to Bid submission. **Changes to the solicitation, including the Bid Form or Contract, made by the Bidder may result in Bid rejection.**

#### **1.24 Bid/Proposal Affidavit**

A Bid submitted by a Bidder must be accompanied by a completed Bid/Proposal Affidavit. A copy of this Affidavit is included as **Attachment B** of this IFB.

#### **1.25 Contract Affidavit**

All Bidders are advised that if a Contract is awarded as a result of this solicitation, the successful Bidder will be required to complete a Contract Affidavit. A copy of this Affidavit is included as **Attachment C** of this IFB. This Affidavit must be provided within ten (10) Business Days of notification of proposed Contract award. This Contract Affidavit will also be required to be completed by the Contractor prior to any Contract renewals, including the exercise of any options or modifications that may extend the Contract term.

#### **1.26 Compliance with Laws/Arrearages**

By submitting a Bid in response to this IFB, the Bidder, if selected for award, agrees that it will comply with all Federal, State, and local laws applicable to its activities and obligations under the Contract.

By submitting a response to this solicitation, each Bidder represents that it is not in arrears in the payment of any obligations due and owing the State, including the payment of taxes and employee benefits, and that it shall not become so in arrears during the term of the Contract if selected for Contract award.

#### **1.27 Verification of Registration and Tax Payment**

Before a business entity can do business in the State it must be registered with the State Department of Assessments and Taxation (SDAT). SDAT is located at State Office Building, Room 803, 301 West Preston Street, Baltimore, Maryland 21201. The SDAT website is <http://www.dat.state.md.us/sdatweb/services.html>.

It is strongly recommended that any potential Bidder complete registration prior to the due date for receipt of Bids. A Bidder's failure to complete registration with SDAT shall disqualify an otherwise successful Bidder from final consideration and recommendation for Contract award.

#### **1.28 False Statements**

Bidders are advised that Md. Code Ann., State Finance and Procurement Article, § 11-205.1 provides as follows:

1.29.1 In connection with a procurement contract a person may not willfully:

- (a) Falsify, conceal, or suppress a material fact by any scheme or device;
- (b) Make a false or fraudulent statement or representation of a material fact; or
- (c) Use a false writing or document that contains a false or fraudulent statement or entry of a material fact.

1.29.2 A person may not aid or conspire with another person to commit an act under subsection (1) of this section.

- 1.29.3 A person who violates any provision of this section is guilty of a felony and on conviction is subject to a fine not exceeding \$20,000 or imprisonment not exceeding five years or both.

### **1.29 Payments by Electronic Funds Transfer**

By submitting a response to this solicitation, the Bidder/Offeror agrees to accept payments by electronic funds transfer (EFT) unless the State Comptroller's Office grants an exemption. Payment by EFT is mandatory for contracts exceeding \$100,000. The selected Bidder/Offeror shall register using the COT/GAD X-10 Vendor Electronic Funds (EFT) Registration Request Form. Any request for exemption must be submitted to the State Comptroller's Office for approval at the address specified on the COT/GAD X-10 form, must include the business identification information as stated on the form, and must include the reason for the exemption. The COT/GAD X-10 form may be downloaded from the Comptroller's website at:

[http://comptroller.marylandtaxes.com/Government\\_Services/State\\_Accounting\\_Information/Static\\_Files/APM/gadx-10.pdf](http://comptroller.marylandtaxes.com/Government_Services/State_Accounting_Information/Static_Files/APM/gadx-10.pdf)

### **1.30 Prompt Payment Policy**

This procurement and the Contract(s) to be awarded pursuant to this solicitation are subject to the Prompt Payment Policy Directive issued by the Governor's Office of Minority Affairs (GOMA) and dated August 1, 2008. Promulgated pursuant to Md. Code Ann., State Finance and Procurement Article, §§ 11-201, 13-205(a), and Title 14, Subtitle 3, and COMAR 21.01.01.03 and 21.11.03.01, the Directive seeks to ensure the prompt payment of all subcontractors on non-construction procurement contracts. The Contractor must comply with the prompt payment requirements outlined in the Contract, Section 31 "Prompt Payment" (see **Attachment A**). Additional information is available on GOMA's website at:

[http://www.mdminoritybusiness.com/documents/PROMPTPAYMENTFAQs\\_000.pdf](http://www.mdminoritybusiness.com/documents/PROMPTPAYMENTFAQs_000.pdf)

### **1.31 Electronic Procurements Authorized**

- A. Under COMAR 21.03.05, unless otherwise prohibited by law, the Department may conduct procurement transactions by electronic means, including the solicitation, bidding, award, execution, and administration of a contract, as provided in Md. Code Ann., Maryland Uniform Electronic Transactions Act, Commercial Law Article, Title 21.
- B. Participation in the solicitation process on a procurement contract for which electronic means has been authorized shall constitute consent by the Bidder/Offeror to conduct by electronic means all elements of the procurement of that Contract which are specifically authorized under the solicitation or the Contract for protests.
- C. "Electronic means" refers to exchanges or communications using electronic, digital, magnetic, wireless, optical, electromagnetic, or other means of electronically conducting transactions. Electronic means includes facsimile, e-mail, internet-based communications, electronic funds transfer, specific electronic bidding platforms (e.g., <https://emaryland.buyspeed.com/bs/>), and electronic data interchange.
- D. In addition to specific electronic transactions specifically authorized in other sections of this solicitation (e.g., § 1.30 "Payments by Electronic Funds Transfer") and subject to the exclusions noted in section E of this subsection, the following transactions are authorized to be conducted by electronic means on the terms described:

1. The Procurement Officer may conduct the procurement using eMM, e-mail, or facsimile to issue:
  - (a) the solicitation (e.g., the IFB/RFP);
  - (b) any amendments;
  - (c) pre-Bid/Proposal conference documents;
  - (d) questions and responses;
  - (e) communications regarding the solicitation or Bid/Proposal to any Bidder/Offeror or potential Bidder/Offeror;
  - (f) notices of award selection or non-selection; and
  - (g) the Procurement Officer's decision on any Bid protest or Contract claim.
2. A Bidder/Offeror or potential Bidder/Offeror may use e-mail or facsimile to:
  - (a) ask questions regarding the solicitation;
  - (b) reply to any material received from the Procurement Officer by electronic means that includes a Procurement Officer's request or direction to reply by e-mail or facsimile, but only on the terms specifically approved and directed by the Procurement Officer;
  - (c) submit a "No Bid/Proposal Response" to the solicitation.
3. The Procurement Officer, the Contract Monitor, and the Contractor may conduct day-to-day Contract administration, except as outlined in Section E of this subsection utilizing e-mail, facsimile, or other electronic means if authorized by the Procurement Officer or Contract Monitor.

E. The following transactions related to this procurement and any Contract awarded pursuant to it are *not authorized* to be conducted by electronic means:

1. submission of initial Bids or Proposals;
2. filing of Bid Protests;
3. filing of Contract Claims;
4. submission of documents determined by the Department to require original signatures (e.g., Contract execution, Contract modifications, etc.); or
5. any transaction, submission, or communication where the Procurement Officer has specifically directed that a response from the Contractor or Bidder/Offeror be provided in writing or hard copy.

F. Any facsimile or e-mail transmission is only authorized to the facsimile numbers or e-mail addresses for the identified person as provided in the solicitation, the Contract, or in the direction from the Procurement Officer or Contract Monitor.

### **1.32 Disadvantaged Business Enterprise Goal and Subgoals**

The contract vendor must agree to abide by the requirements of 49 CFR 26 as amended, regarding minority (disadvantaged) business enterprises in USDOT programs. Specifically, and not by way of limitation, a copy of 49 CFR section 26.49, together with a Primary Transit Vehicle Manufacturer (TVM)/Disadvantage Business Enterprise (DBE) Compliance certificate (**Attachment D**) is included and is made a part of the Contract. Failure to carry out the requirements set forth in 49 CFR, section 26.49 shall constitute a breach of Contract and, after the notification of the US DOT, may result in termination of the contract by the State or such remedy as the State deems appropriate.

### **1.33 Performance Guarantees**

To ensure performance in accordance with the terms and conditions of the Contract and to protect the MTA and its patrons in the event of the Contractor's default on its contractual obligations, the Contractor shall be required

to submit a Performance Guarantee to the MTA prior to commencement of the contract. The Guarantee shall equal **five percent (5%)** of the total estimated contract price and be in *only* one of the forms specified below.

- a. A performance bond shall be in the format specified in **Attachment K**. The completed form shall be delivered to the MTA within ten (10) business days of receiving notification of recommendation for Contract award. The following surety bond qualifications shall apply:
  1. Bonds shall be written through surety insurers authorized to do business in the State of Maryland as surety, with a rating of at least “BV” as to management and financial strength according to the latest edition of Best’s Insurance Guide, published by A.M. Best Company.
  2. Surety insurers shall be listed in the latest Circular 570 of the U.S. Department of the Treasury entitled “Surety Companies Acceptable on Federal Bonds,” published annually. The bond amount shall not exceed the underwriting limitations as show in this circular.
  3. Surety Bonds guaranteed through the U.S. Government Small Business Administration or Contractors Training and Development, Inc. will also be acceptable.
  4. The attorney-in-fact or other officer who signs for a contract bond for a surety company must file with such bond a certified copy of their power of attorney authorizing him or her to do so. The contract bond must be countersigned by the surety’s resident Maryland Agent.
- b. A pledge of U.S. Government Securities or cash held in escrow by a Maryland bank in the amount of **5%** of the total, **one**-year estimated contract ceiling price to be held by a Maryland bank in escrow for the term of the contract and any extensions thereto. The form of the pledge must allow the MTA to direct the bank to liquidate the securities and withdraw funds from the escrow account upon presentation to the bank of a certification from the MTA Administrator that the Contractor has been issued a notice of termination for default in accordance with the terms of the contract. No countersignature or approval of the Contractor shall be required. The pledge must be signed and notarized by authorized officials of both the Contractor and the bank.
- c. An irrevocable Letter of Credit (LOC) issued by a Maryland financial institution in a form acceptable to the MTA in the amount of **5%** of the total, **one**-year estimated contract ceiling price. The form of the LOC must allow the MTA to draw upon the funds upon presentation to the bank of a certification from the MTA Administrator that the Contractor has been issued a notice of termination for default in accordance with the terms of the contract. No countersignature or approval of the Contractor shall be required. The LOC must be signed and notarized by authorized officials of both the Contractor and the bank.
- d. Retaining of a portion of the contractor’s gross billing amount until the termination of the contract or when the retainage equals **5%** of the total, **one**-year estimated contract ceiling price, whichever occurs first. The portion retained shall be **5%** of each monthly billings for all billings covering the first year of services. If the contract is terminated for default, the retainage shall be forfeited. Forfeiture shall not be construed as a waiver of any other remedies the MTA is entitled to exercise under the contract or at law.

### **1.34 Bid Bond**

Each bid exceeding \$100,000 must be accompanied by a Bid Bond (**Attachment L**) in the amount of five percent (5%) of the Bid Price. Bid, payment, and performance security may be in the form of: (1) a bond executed by a surety company authorized to do business in the State; (2) a bond executed by an individual surety that meets certain criteria; (3) another form of security required by State or federal law; or (4) another form of security satisfactory to the unit awarding the contract. Sections 13-207, 13-216, 17-104 of the State Finance and Procurement Article, Annotated Code of Maryland. Attachment L must be submitted with the Bid/Proposal.

### **1.35 Federal Funding Acknowledgement**

- 1.35.1 There are programmatic conditions that apply to this Contract due to Federal funding. (see **Attachment G**).
- 1.35.2 This Contract contains federal funds. The conditions that apply to all federal funds awarded by the Department are contained in Federal Funds **Attachment G**. Any additional conditions that apply to this particular federally-funded contract are contained as supplements to Federal Funds **Attachment G** and Bidders/Offerors are to complete and submit these Attachments with their Bid/Proposal as instructed in the Attachments. Acceptance of this agreement indicates the Bidder/Offeror's intent to comply with all conditions, which are part of this Contract.

### **1.36 Conflict of Interest Affidavit and Disclosure**

Bidders/Offerors shall complete and sign the Conflict of Interest Affidavit and Disclosure (**Attachment H**) and submit it with their Bid/Proposal. All Bidders/Offerors are advised that if a Contract is awarded as a result of this solicitation, the successful Contractor's personnel who perform or control work under this Contract and each of the participating subcontractor personnel who perform or control work under this Contract shall be required to complete agreements substantially similar to **Attachment H** Conflict of Interest Affidavit and Disclosure. For policies and procedures applying specifically to Conflict of Interests, the Contract is governed by COMAR 21.05.08.08.

### **1.37 Non-Disclosure Agreement**

All Bidders/Offerors are advised that this solicitation and any resultant Contract(s) are subject to the terms of the Non-Disclosure Agreement (NDA) contained in this solicitation as **Attachment J**. This Agreement must be provided within five (5) Business Days of notification of proposed Contract award; however, to expedite processing, it is suggested that this document be completed and submitted with the Bid/Proposal.

### **1.38 Non-visual Access**

This solicitation does not contain Information Technology (IT) provisions requiring Non-visual Access.

### **1.39 Mercury and Products that Contain Mercury**

All products or equipment provided pursuant to this solicitation shall be mercury-free products. The Bidder/Offeror must submit a Mercury Affidavit in the form of **Attachment I** with its Bid/Proposal.

#### **1.40 Location of the Performance of Services Disclosure**

The Bidder/Offeror is required to complete the Location of the Performance of Services Disclosure. A copy of this Disclosure is included as **Attachment M**. The Disclosure must be provided with the Bid/Proposal.

#### **1.41 Department of Human Resources (DHR) Hiring Agreement**

This solicitation does not require a DHR Hiring Agreement.

#### **1.42 Buy America Requirements**

This contract is subject to Section 165, “buy America”, of the Surface Transportation Assistant Act of 1982, U.S. Public Law 197-424, and regulations and/or guidance implementing this statutory provision issued by the Urban Mass Transportation Administration of the U.S. Department of Transportation. The contract is further subject to the Buy American Steel requirements of Chapter 02 of subtitle 11 of the Code of Maryland Regulations, Title 21, State Procurement Regulations.

The Buy America Certificate (**Attachment N**) must be signed and returned with the Bid.

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## **SECTION 2 – MINIMUM QUALIFICATIONS**

### **2.1 Bidder Minimum Qualifications**

There are no Bidder Minimum Qualifications for this procurement.

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## **SECTION 3 – SPECIFICATIONS**

### **3.1 Background and Purpose**

The Maryland Transit Administration's (MTA) Core Bus service operates 52 bus routes with 599 peak vehicles and a total fleet, including contingency vehicles, of 775 buses. Since 2006, the Core Bus service annual unlinked passenger trips have increased by 14.2 percent. On average unlinked passenger trips have been growing at 1.6 percent per year. With this ridership growth, the peak vehicle requirement is expected to increase to 667 vehicles by 2020.

The State is issuing this solicitation for the purposes of purchasing 41 hybrid buses to replacement older buses and ensure safe and reliable service.

### **3.2 Specification – Requirements**

#### 3.2.1 Scope of Work

- A. See Attachment R for detailed technical specifications and requirements.

#### 3.2.2 Delivery Schedule

- A. First bus to arrive six (6) months or less after Notice to Proceed.
- B. Last bus must be received one (1) year after Notice to Proceed.
- C. MTA will accept an accelerated production schedule.

#### 3.2.3 Liquidated Damages

- A. It is mutually understood and agreed by and between the parties to the Contract that time is of the essence with respect to completion of the Work and that in case of any failure on the part of the Contractor to complete the Work within the time specified in Section 3.2.2 or any extension thereof, MTA will be damaged thereby. The amount of said damages, being difficult if not impossible of definite ascertainment and proof, it is hereby agreed that the amount of such damages due MTA shall be fixed at \$150.00 per calendar day per bus not delivered in substantially as good condition as inspected by MTA at the time released for shipment.
- B. The Contractor hereby agrees to pay the aforesaid amounts as fixed, agreed and liquidated damages, and not by way of penalty, to MTA and further authorizes MTA to deduct the amount of the damages from money due the Contractor under the Contract, computed as aforesaid. If the monies due the Contractor are insufficient or no monies are due the Contractor, the Contractor shall pay MTA the difference or the entire amount, whichever may be the case, within thirty (30) calendar days after receipt of a written demand by the Contracting Officer.
- C. The payment of aforesaid fixed, agreed and liquidated damages shall be in lieu of any damages for any loss of profit, loss of revenue, loss of use, or for any other direct, indirect, special or consequential losses or damages of any kind whatsoever that may be suffered by MTA arising at any time from the failure of the Contractor to fulfill the obligations referenced in this clause in a timely manner.
- D. MTA specifically reserves the right, without limitation of any other rights, to terminate the Contract in accordance with "Termination of Contract".

### 3.2.4 Parts Availability Guarantee

- A. The Contractor hereby guarantees to provide, within reasonable periods of time, the spare parts, software and all equipment necessary to maintain and repair the buses supplied under this Contract for a period of at least fifteen (15) years after the date of award. Parts will be interchangeable with the original equipment and be manufactured in accordance with the quality assurance provisions of this Contract. Prices will not exceed the Contractor's then current published catalog prices.
- B. Where the parts ordered by MTA are not received within two (2) working days of the agreed upon time/date and a bus procured under this Contract is out-of-service due to the lack of said ordered parts, then the Contractor will provide MTA, within eight (8) hours of MTA's verbal or written request, the original suppliers' and/or manufacturers' parts numbers, company names, addresses, telephone numbers and contract persons' names for all of the specific parts not received by MTA.
- C. Where the Contractor fails to honor this parts guarantee or parts ordered by MTA are not received within thirty (30) days of the agreed upon delivery date, then the Contractor will provide to MTA, within seven (7) days of MTA's verbal or written request, the design and manufacturing documentation for those parts manufactured by the Contractor and the original suppliers' and/or manufacturers' parts numbers, company names, addresses, telephone numbers and contact persons' names for all of the specific parts not received by MTA. Contractor's design and manufacturing documentation provided to MTA will be for its sole use in regard to the buses procured under this Contract and for no other purpose.

### 3.2.5 Progress Payments

- A. All payments shall be made as provided herein, less any amount to be withheld as provided below and less any amounts for liquidated damages in accordance with "Liquidated Damages for Late Delivery of the Bus."
- B. The Administration shall make progress payments to the Contractor for buses in accordance with the performance milestones set forth below.
- C. Title to material included in any progress payment request shall pass to the Administration upon payment by the Administration. Said title shall be free of all encumbrances. However, such transfer of title shall not relieve the Contractor of its responsibility for the furnishing, installation, fabrication or inclusion of said materials as a deliverable element of buses procured in accordance with the requirements of the Contract.
- D. The performance milestones and payment limits shall be as follows:
  - 1. The Administration shall make payments for buses at Seventy-Five percent (75%) of the unit price(s) minus retention, for each bus itemized in the price schedule when the Administration's inspector has approved shipment of said bus(es) from the Contractor's plant.
  - 2. The Administration shall make payments for buses at Twenty-Five percent (25%) of the unit price(s) minus retention, for each bus itemized in the price schedule upon the delivery and acceptance of each bus.
  - 3. The Administration shall make payments for equipment at the unit prices, itemized in the price schedule upon the delivery and acceptance of said spare parts and/or equipment.

Title for equipment shall transfer to the Administration upon payment. Said title shall be free of all encumbrances.

4. The Administration shall make a final payment of the total Contract price plus any retention amount withheld, upon receipt of a proper invoice and the following:
    - Delivery and acceptance of all Contract deliverables, including manuals and other documentation required by the Contract.
    - Contractor provision of any certifications as required by law and/or regulations.
    - Completion of post-delivery audits required under the Contract.
- E. Progress payment requests shall be accompanied by a certification, or affidavit, signed by the Contractor's officer certifying that the Work covered by the progress payment requested has been completed. The Administration reserves the rights of inspection and audit to verify said progress as provided in "Maintenance of Records; Access by Administration; Right to Audit Records."

**3.3 Security Requirements**

**3.3.1 Employee Identification**

- (a) Each person who is an employee or agent of the Contractor or subcontractor shall display his or her company ID badge at all times while on State premises. Upon request of authorized State personnel, each such employee or agent shall provide additional photo identification.
- (b) At all times at any facility, the Contractor's personnel shall cooperate with State site requirements that include but are not limited to being prepared to be escorted at all times, providing information for badge issuance, and wearing the badge in a visual location at all times.

**3.3.2 Information Technology**

- (a) Contractors shall comply with and adhere to the State IT Security Policy and Standards. These policies may be revised from time to time and the Contractor shall comply with all such revisions. Updated and revised versions of the State IT Policy and Standards are available online at: [www.doit.maryland.gov](http://www.doit.maryland.gov) – keyword: Security Policy.
- (a) The Contractor shall not connect any of its own equipment to a State LAN/WAN without prior written approval by the State. The Contractor shall complete any necessary paperwork as directed and coordinated with the Contract Monitor to obtain approval by the State to connect Contractor-owned equipment to a State LAN/WAN.

**3.4 Insurance Requirements**

**3.4.1 Insurance Types**

[ X ] **Commercial General Liability Insurance** with minimum limits of \$5,000,000 per occurrence, written on an occurrence form. When the minimum contract amounts can only be met when applying the umbrella/excess policy, the umbrella/excess policy must follow form of the underlying policy and be extended to "drop down" to become primary in the event the primary limits are reduced or aggregate limits are exhausted. The coverage shall include:

- [X] Personal and Advertising Injury coverage,
- [X] Products and Completed Operations coverage,
- [ ] Independent Contractors coverage,
- [ ] Terrorism coverage,

- XCU coverage (explosion, collapse, and underground hazards)
  - Contractual liability exclusion (applicable to work to be performed within 50 feet of railroad tracks) must be removed.
  - Additional Insured Endorsement naming MTA.
- Workers' Compensation Insurance** meeting the statutory requirements of the jurisdiction where the work will be performed, including Employer's Liability coverage with minimum limits of \$1,000,000 each accident or disease.
- Longshore & Harbor Workers' Compensation Act Endorsement (work performed on or over navigable waterways) to cover contractor's employees for wages, transportation, maintenance and cure, in accordance with applicable laws.
  - Maritime Coverage Endorsement (Jones Act) for work upon navigable waterways and barges, tug boats, and all other vessels on the ocean and all intracoastal rivers and canals, covering drivers, divers, and underwater personnel, seamen, masters and members of a crew, providing remedy for damage or injury, in accordance with applicable laws.
- Business Automobile Liability Insurance** with minimum limits of \$1,000,000 per occurrence covering contractor against claims for bodily injury and property damage arising out of the ownership, maintenance or use of any owned, hired, or non-owned motor vehicle. MTA shall be added as an additional insured on the policy.
- MCS-90 Endorsement for work involving the transportation or disposal of any hazardous material or waste off of the jobsite. If the MCS-90 Endorsement is required, minimum auto liability limits of \$5,000,000 per occurrence are also required.**
- Railroad Protective Liability Insurance** (hereinafter "RRPL") issued to MTA as the Named Insured with minimum limits of \$2,000,000 per occurrence, \$6,000,000 in the aggregate and covering the liability of all Permitted Parties for the work to be performed within fifty (50) feet (on, above, adjacent to or underneath) of MTA's railroad property for any personal injuries or deaths or any damage to the property, equipment and facilities caused by the activities of any Permitted Party resulting from performance of the work which is the subject of this Permit. THE ORIGINAL POLICY SHALL BE FORWARDED TO MTA.
- Contractor's Pollution Liability Insurance** with minimum limits of \$5,000,000 per occurrence for work involving environmentally regulated substances or hazardous material exposures, including but not limited to handling, transporting or disposing of any hazardous substances and/or environmentally regulated materials and any sudden and/or non-sudden pollution or impairment of the environment, including cleanup costs and defense. This insurance may be supplied by the subcontractor performing the work if the Contractor is not performing any of the relevant work and providing that MTA and the Contractor are named as additional insureds on the subcontractor's policy. In the event that the Contractor or its subcontractor transports hazardous substances or any other environmentally regulated substance that requires a governmentally regulated manifest, the MCS-90 Endorsements shall be attached to the Contractor's (or subcontractor's) auto liability policy.
- Pollution Legal Liability Insurance** (Non-Owned Disposal Site Coverage) with minimum limits of \$5,000,000 per occurrence. Coverage may be maintained in one of the following ways:
- A standalone policy;
  - Non-Owned Disposal Site Endorsement on Contractor's Pollution Liability policy naming MTA as an additional insured; or

- Contractor may designate the disposal site and provide a COI from the disposal facility naming Contractor and MTA as additional insureds.

[ ] **Professional Liability Insurance (Errors and Omissions).** The Contractor shall provide minimum limits of \$3,000,000 to cover liability resulting from any error or omission in the performance of professional services under this Contract. .

### 3.4.2 Insurance Company Qualifications

3.4.2.1 The insurance required in this Article of this contract must be issued by companies that are:

- A. Acceptable to the MTA
- B. Licensed to do business in the State of Maryland.

### 3.4.3 Policy Requirements

3.4.3.1 The recommended Contractor awardee shall deliver to the MTA representative within 10 days of notification of proposed contract award an accurate and true Certificates of Insurance that show that:

3.4.3.2 The Contractor has procured coverage stated in this Article of this contract.

3.4.3.3 The Maryland Department of Transportation, the State of Maryland and the MTA has been named as an additional insured.

3.4.3.4 The policies will not be canceled, terminated or modified without 60 days prior written notice to the Administration. Certificates of Insurance are acceptable in lieu of true copies of the policies if the policy writer notes on the Certificate, or through attachment to the Certificate, all policy exclusions.

3.4.3.5 The Contractor shall require that any subcontractors providing services under this Contract obtain and maintain similar levels of insurance and shall provide the Contract Monitor with the same documentation as is required of the Contractor.

## 3.4 Problem Escalation Procedure

3.5.1 The Contractor must provide and maintain a Problem Escalation Procedure (PEP) for both routine and emergency situations. The PEP must state how the Contractor will address problem situations as they occur during the performance of the Contract, especially problems that are not resolved to the satisfaction of the State within appropriate timeframes.

The Contractor shall provide contact information to the Contract Monitor, as well as to other State personnel, as directed should the Contract Monitor not be available.

3.5.2 The Contractor must provide the PEP no later than ten (10) Business Days after notice of Contract award or after the date of the Notice to Proceed, whichever is earlier. The PEP, including any revisions thereto, must also be provided within ten (10) Business Days after the start of each Contract year and within ten (10) Business Days after any change in circumstance which changes the PEP. The PEP shall detail how problems with work under the Contract will be escalated in order to resolve any issues in a timely manner. The PEP shall include:

- The process for establishing the existence of a problem;

- The maximum duration that a problem may remain unresolved at each level in the Contractor's organization before automatically escalating the problem to a higher level for resolution;
- Circumstances in which the escalation will occur in less than the normal timeframe;
- The nature of feedback on resolution progress, including the frequency of feedback to be provided to the State;
- Identification of, and contact information for, progressively higher levels of personnel in the Contractor's organization who would become involved in resolving a problem;
- Contact information for persons responsible for resolving issues after normal business hours (e.g., evenings, weekends, holidays, etc.) and on an emergency basis; and
- A process for updating and notifying the Contract Monitor of any changes to the PEP.

Nothing in this section shall be construed to limit any rights of the Contract Monitor or the State which may be allowed by the Contract or applicable law.

## **3.5 Invoicing**

### **3.6.1 General**

- (a) All invoices for services shall be signed by the Contractor and submitted to the Contract Monitor. All invoices shall include the following information:

- Contractor name;
- Remittance address;
- Federal taxpayer identification number (or if sole proprietorship, the individual's social security number);
- Invoice period;
- Invoice date;
- Invoice number
- State assigned Contract number;
- State assigned (Blanket) Purchase Order number(s);
- Goods or services provided; and
- Amount due.

Invoices submitted without the required information cannot be processed for payment until the Contractor provides the required information.

- (b) The Department reserves the right to reduce or withhold Contract payment in the event the Contractor does not provide the Department with all required deliverables within the time frame specified in the Contract or in the event that the Contractor otherwise materially breaches the terms and conditions of the Contract until such time as the Contractor brings itself into full compliance with the Contract. Any action on the part of the Department, or dispute of action by the Contractor, shall be in accordance with the provisions of Md. Code Ann., State Finance and Procurement Article §§ 15-215 through 15-223 and with COMAR 21.10.02.

### **3.6.2 Invoice Submission Schedule**

The Contractor shall submit invoices by the 15<sup>th</sup> of the month following the month in which services were performed.

### **3.6 DBE Reports**

If this solicitation includes a DBE Goal (see Section 1.32), the awarded Contractor will be provided its DBE Monthly Reports and reporting requirements from an Office of Fair Practices representative within ten (10) days of notice to proceed.

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## **SECTION 4 – BID FORMAT**

### **4.1 One Part Submission**

Bidders shall submit with their Bid all Minimum Qualification documentation required (see Section 2), and all Required Bid Submissions (see Section 4.4) in a single sealed package/envelope.

### **4.2 Labeling**

Each Bidder is required to label the sealed Bid. The Bid shall bear the IFB title and number, name and address of the Bidder, and closing date and time for receipt of the Bids.

### **4.3 Bid Price Form**

The Bid shall contain all price information in the format specified on the Bid Form (**Attachment F**). Complete the Bid Form only as provided in the Bid Pricing Instructions. Do not amend, alter, or leave blank any items on the Bid Form or include additional clarifying or contingent language on or attached to the Bid Form. If option years are included, Bidders must submit Bids for each option year. Failure to adhere to any of these instructions may result in the Bid being determined to be non-responsive and rejected by the Department.

### **4.4 Required Bid Submissions**

Bidders shall include the following with their Bid:

#### **4.4.1 Transmittal Letter:**

A Transmittal Letter shall accompany the Bid. The purpose of this letter is to transmit the Bid and acknowledge the receipt of any addenda. The Transmittal Letter should be brief and signed by an individual who is authorized to commit the Bidder to the services and requirements as stated in this IFB. The Transmittal Letter should include the following:

- Name and address of the Bidder;
- Name, title, e-mail address, and telephone number of primary contact for the Bidder;
- Solicitation Title and Solicitation Number that the Bid is in response to;
- Signature, typed name, and title of an individual authorized to commit the Bidder to its Bid;
- Federal Employer Identification Number (FEIN) of the Bidder, or if a single individual, that individual's Social Security Number (SSN);
- Bidder's eMM number;
- Bidder's MBE certification number (if applicable);
- Acceptance of all State IFB and Contract terms and conditions (see Section 1.24); and
- Acknowledgement of all addenda to this IFB.

Any information which is claimed to be confidential is to be noted by reference and included after the Transmittal Letter. An explanation for each claim of confidentiality shall be included (see Section 1.14 "Confidentiality of Bids").

#### 4.4.2 **Minimum Qualifications Documentation:**

The Bidder shall submit any Minimum Qualifications documentation that may be required, as set forth in Section 2 “Bidder Minimum Qualifications.”

#### 4.4.3 **Completed Required Attachments:** Submit three (3) copies of each with original signatures:

- a. Completed Bid/Proposal Affidavit (**Attachment B**).
- b. Completed Certification of TVM/DBE Compliance (**Attachment D**).
- c. Completed Bid Form (**Attachment F**).
- d. Completed Federal Funding Requirements (**Attachment G**).
- e. Completed Conflict of Interest Affidavit and Disclosure (**Attachment H**).
- f. Completed Mercury Affidavit (**Attachment I**).
- g. Completed Non-Disclosure Agreement (**Attachment J**).
- h. Completed Bid Bond (**Attachment L**).
- i. Completed Location of Performance of Services Disclosure (**Attachment M**).
- j. Completed Buy America Certificate (**Attachment N**).
- k. Completed Bus Testing Certification (**Attachment O**).

#### 4.4.4 **References:**

At least three (3) references are requested from customers who are capable of documenting the Bidder’s ability to provide the services specified in this IFB. References used to meet any Bidder Minimum Qualifications (see Section 2) may be used to meet this request. Each reference shall be from a client for whom the Bidder has provided services within the past five (5) years and shall include the following information:

- a. Name of client organization;
- b. Name, title, telephone number, and e-mail address, if available, of point of contact for client organization; and
- c. Value, type, duration, and description of services provided.

The Department reserves the right to request additional references or utilize references not provided by a Bidder.

#### 4.4.5 **List of Current or Prior State Contracts:**

Provide a list of all contracts with any entity of the State of Maryland for which the Bidder is currently performing services or for which services have been completed within the last five (5) years. For each identified contract, the Bidder is to provide:

- a. The State contracting entity;
- b. A brief description of the services/goods provided;
- c. The dollar value of the contract;
- d. The term of the contract;
- e. The State employee contact person (name, title, telephone number, and, if possible, e-mail address); and
- f. Whether the contract was terminated before the end of the term specified in the original contract, including whether any available renewal option was not exercised.

Information obtained regarding the Bidder’s level of performance on State contracts will be considered as part of the responsibility determination by the Procurement Officer.

#### 4.4.6 **Financial Capabilities:**

The Bidder shall include Financial Statements, preferably a Profit and Loss (P&L) statement and a Balance Sheet, for the last two (2) years (independently audited preferred).

#### 4.4.7 **Certificate of Insurance:**

The Bidder shall provide a copy of the Bidder's current certificate of insurance. The recommended awardee must provide a certificate of insurance with the prescribed limits set forth in Section 3.4 "Insurance Requirements," naming the State as an additional insured if required, within five (5) Business Days from notification by the Procurement Officer that the Bidder has been determined to be the apparent awardee.

#### 4.4.8 **Subcontractors:**

The Bidder shall provide a complete list of all subcontractors that will work on the Contract if the Bidder receives an award, including those utilized in meeting the MBE and/or VSBE subcontracting goal, if applicable. This list shall include a full description of the duties each subcontractor will perform.

#### 4.4.9 **Legal Action Summary:**

This summary shall include:

- i. A statement as to whether there are any outstanding legal actions or potential claims against the Bidder and a brief description of any action;
- ii. A brief description of any settled or closed legal actions or claims against the Bidder over the past five (5) years;
- iii. A description of any judgments against the Bidder within the past five (5) years, including the case name, number court, and what the final ruling or determination was from the court; and
- iv. In instances where litigation is on-going and the Bidder has been directed not to disclose information by the court, provide the name of the judge and location of the court.

### **4.5 Reciprocal Preference**

Although Maryland law does not authorize procuring agencies to favor resident Bidders in awarding procurement contracts, many other states do grant their resident businesses preferences over Maryland contractors. Therefore, COMAR 21.05.01.04 requires that procuring units apply a reciprocal preference under the following conditions:

- The most advantageous offer is from a responsible Bidder whose headquarters, principal base of operations, or principal site (that will primarily provide the services required under this IFB) is in another state.
- The other state gives a preference to its resident businesses through law, policy, or practice; and
- The preference does not conflict with a Federal law or grant affecting the procurement Contract.

The preference given shall be identical to the preference that the other state, through law, policy, or practice gives to its resident businesses.

### **4.6 Delivery**

Bidders may either mail or hand-deliver Bids.

- 4.6.1 For U.S. Postal Service deliveries, any bid that has been received at the appropriate mail room, or typical place of mail receipt for the respective procuring unit by the time and date listed in the IFB will be deemed to be timely. If a Bidder chooses to use the U.S. Postal Service for delivery, the Department recommends that it use Express Mail, Priority Mail, or Certified Mail only as these are the only forms for which both the date and time of receipt can be verified by the Department. A Bidder using first class mail will not be able to prove a timely delivery at the mailroom and it could take several days for an item sent by first class mail to make its way by normal internal mail to the procuring unit.
- 4.6.2 Hand-delivery includes delivery by commercial carrier acting as agent for the Bidder. For any type of direct (non-mail) delivery, Bidders are advised to secure a dated, signed, and time-stamped (or otherwise indicated) receipt of delivery.

#### **4.7 Documents Required upon Notice of Recommendation for Contract Award**

Upon receipt of a Notification of Recommendation for Contract Award, the following documents shall be completed and submitted by the recommended awardee within ten (10) Business Days, unless noted otherwise. Submit three (3) copies of each with original signatures.

- a. signed Contract (**Attachment A**),
- b. completed Contract Affidavit (**Attachment C**),
- c. completed Performance Bond (**Attachment K**) \*see Section 1.33, and
- d. copy of a current Certificate of Insurance with the prescribed limits set forth in Section 3.4 “Insurance Requirements,” naming the State as an additional insured, if applicable; \*see Section 3.4.

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## **IFB ATTACHMENTS**

### **ATTACHMENT A – Contract**

This is the sample contract used by the Department. It is provided with the IFB for informational purposes and is not required to be submitted at Bid submission time. Upon notification of recommendation for award, a completed contract will be sent to the recommended awardee for signature. The recommended awardee must return to the Procurement Officer three (3) executed copies of the Contract within ten (10) Business days after receipt. Upon Contract award, a fully-executed copy will be sent to the Contractor.

### **ATTACHMENT B – Bid/Proposal Affidavit**

This Attachment must be completed and submitted with the Bid.

### **ATTACHMENT C – Contract Affidavit**

This Attachment must be completed and submitted by the recommended awardee to the Procurement Officer within ten (10) Business Days of receiving notification of recommendation for award.

### **ATTACHMENT D – Transit Vehicle Manufacturer (TVM)/Disadvantaged Business Enterprise (DBE) Certificate**

If required (see Section 1.32), this Attachment must be completed and submitted with the Bid.

### **ATTACHMENT E – Pre-Bid Conference Response Form**

It is requested that this form be completed and submitted as described in Section 1.6 by those potential Bidders that plan on attending the Pre-Bid Conference.

### **ATTACHMENT F – Bid Form Instructions and Bid Form**

The Bid Form must be completed and submitted with the Bid.

### **ATTACHMENT G – Federal Funding Requirements**

If required (see Section 1.35), this Attachment must be completed and submitted with the Bid.

### **ATTACHMENT H – Conflict of Interest Affidavit and Disclosure**

If required (see Section 1.36), this Attachment must be completed and submitted with the Bid.

### **ATTACHMENT I – Mercury Affidavit**

If required (see Section 1.39), this Attachment must be completed and submitted with the Bid.

### **ATTACHMENT J – Non-Disclosure Agreement**

If required (see Section 1.37), this Attachment must be completed and submitted with the Bid.

### **ATTACHMENT K – Performance Bond**

If required (see Section 1.33), this Attachment is to be completed and submitted within ten (10) Business days of receiving notification of recommendation for award.

### **ATTACHMENT L – Bid Bond**

If required (see Section 1.34), this Attachment must be completed and submitted the Bid.

### **ATTACHMENT M – Location of Performance of Services Disclosure**

If required (see Section 1.40), this Attachment must be completed and submitted the Bid.

### **ATTACHMENT N – Buy America Certificate**

If required (see Section 1.42), this Attachment must be completed and submitted the Bid.

**ATTACHMENT O – Bus Testing Certification**

This Attachment must be completed and submitted the Bid.

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## ATTACHMENT A – CONTRACT

### (CONTRACT TITLE)

THIS CONTRACT (the “Contract”) is made this (“X<sup>th</sup>”) day of (month), (year) by and between (Contractor’s name) and the STATE OF MARYLAND, acting through the Maryland Transit Administration.

In consideration of the promises and the covenants herein contained, the parties agree as follows:

#### 1. Definitions

In this Contract, the following words have the meanings indicated:

- 1.1 “Bid” means the Contractor’s Bid dated (Bid date).
- 1.2 “COMAR” means Code of Maryland Regulations.
- 1.3 “Contract Monitor” means the Department employee identified in Section 1.6 of the IFB as the Contract Monitor.
- 1.4 “Contractor” means (Contractor’s name) whose principal business address is (Contractor’s primary address) and whose principal office in Maryland is (Contractor’s local address).
- 1.5 “Department” means the Maryland Transit Administration.
- 1.6 “IFB” means the Invitation for Bids for (solicitation title) Solicitation # (solicitation number), and any addenda thereto issued in writing by the State.
- 1.7 “Procurement Officer” means the Department employee identified in Section 1.5 of the IFB as the Procurement Officer.
- 1.8 “State” means the State of Maryland.

#### 2. Scope of Contract

- 2.1 The Contractor shall provide deliverables, programs, goods, and services specific to the Contract awarded in accordance with Exhibits A-C listed in this section and incorporated as part of this Contract. If there is any conflict between this Contract and the Exhibits, the terms of the Contract shall govern. If there is any conflict among the Exhibits, the following order of precedence shall determine the prevailing provision:

Exhibit A - The Contract  
Exhibit B - The Invitation for Bid (IFB) with addenda(s)  
Exhibit C - The Bid

- 2.2 The Procurement Officer may, at any time, by written order, make changes in the work within the general scope of the Contract or the IFB. No other order, statement, or conduct of the Procurement Officer or any other person shall be treated as a change or entitle the Contractor to an equitable adjustment under this section. Except as otherwise provided in this Contract, if any change under this section causes an increase or decrease in the Contractor’s cost of, or the time required for, the performance of any part of the work, whether or not changed by the order, an equitable adjustment in the Contract price shall be made and the Contract modified in writing accordingly. The Contractor

must assert in writing its right to an adjustment under this section within thirty (30) days of receipt of written change order and shall include a written statement setting forth the nature and cost of such claim. No claim by the Contractor shall be allowed if asserted after final payment under this Contract. Failure to agree to an adjustment under this section shall be a dispute under the Disputes clause. Nothing in this section shall excuse the Contractor from proceeding with the Contract as changed.

- 2.3 While the Procurement Officer may, at any time, by written change order, make unilateral changes in the work within the general scope of the Contract as provided in Section 2.2 above, the Contract may be modified by mutual agreement of the parties, provided: (a) the modification is made in writing; (b) all parties sign the modification; and (c) all approvals by the required agencies as described in COMAR Title 21, are obtained.

### **3. Period of Performance.**

- 3.1 The term of this Contract begins on the date the Contract is signed by the Department following any required approvals of the Contract, including approval by the Board of Public Works, if such approval is required. The Contractor shall provide services under this Contract as of the Go-Live date contained in the written Notice to Proceed. From this Go-Live date, the Contract shall be for a period of approximately one year (**change to months if necessary**) beginning (**anticipated Contract start date**) and ending on (**anticipated end date of base term of Contract**).
- 3.2 Audit, confidentiality, document retention, and indemnification obligations under this Contract shall survive expiration or termination of the Contract.

### **4. Consideration and Payment**

- 4.1 In consideration of the satisfactory performance of the work set forth in this Contract, the Department shall pay the Contractor in accordance with the terms of this Contract and at the prices quoted on the Bid Form (Attachment F). Unless properly modified (see above Section 2.3), payment to the Contractor pursuant to this Contract shall not exceed \$ (**Not-to-Exceed amount**).
- 4.2 Payments to the Contractor shall be made no later than thirty (30) days after the Department's receipt of a proper invoice for services provided by the Contractor, acceptance by the Department of services provided by the Contractor, and pursuant to the conditions outlined in Section 4 of this Contract. Each invoice for services rendered must include the Contractor's Federal Tax Identification or Social Security Number for a Contractor who is an individual which is (**Contractor's FEIN or SSN**). Charges for late payment of invoices other than as prescribed at Md. Code Ann., State Finance and Procurement Article, §15-104 as from time-to-time amended, are prohibited. Invoices shall be submitted to the Contract Monitor. Electronic funds transfer shall be used by the State to pay Contractor pursuant to this Contract and any other State payments due Contractor unless the State Comptroller's Office grants Contractor an exemption.
- 4.3 In addition to any other available remedies, if, in the opinion of the Procurement Officer, the Contractor fails to perform in a satisfactory and timely manner, the Procurement Officer may refuse or limit approval of any invoice for payment, and may cause payments to the Contractor to be reduced or withheld until such time as the Contractor meets performance standards as established by the Procurement Officer.
- 4.4 Payment of an invoice by the Department is not evidence that services were rendered as required under this Contract.

4.5 Contractor's eMarylandMarketplace vendor ID number is (Contractor's eMM number).

## **5. Rights to Records**

- 5.1 The Contractor agrees that all documents and materials including, but not limited to, software, software-produced reports, drawings, studies, specifications, estimates, tests, maps, photographs, designs, graphics, mechanical, artwork, computations, and data prepared by the Contractor for purposes of this Contract shall be the sole property of the State and shall be available to the State at any time. The State shall have the right to use the same without restriction and without compensation to the Contractor other than that specifically provided by this Contract.
- 5.2 The Contractor agrees that at all times during the term of this Contract and thereafter, works created as a deliverable under this Contract, and services performed under this Contract shall be "works made for hire" as that term is interpreted under U.S. copyright law. To the extent that any products created as a deliverable under this Contract are not works made for hire for the State, the Contractor hereby relinquishes, transfers, and assigns to the State all of its rights, title, and interest (including all intellectual property rights) to all such products created under this Contract, and will cooperate reasonably with the State in effectuating and registering any necessary assignments.
- 5.3 The Contractor shall report to the Contract Monitor, promptly and in written detail, each notice or claim of copyright infringement received by the Contractor with respect to all data delivered under this Contract.
- 5.4 The Contractor shall not affix any restrictive markings upon any data, documentation, or other materials provided to the State hereunder and if such markings are affixed, the State shall have the right at any time to modify, remove, obliterate, or ignore such warnings.

## **6. Exclusive Use**

The State shall have the exclusive right to use, duplicate, and disclose any data, information, documents, records, or results, in whole or in part, in any manner for any purpose whatsoever, that may be created or generated by the Contractor in connection with this Contract. If any material, including software, is capable of being copyrighted, the State shall be the copyright owner and Contractor may copyright material connected with this project only with the express written approval of the State.

## **7. Patents, Copyrights, and Intellectual Property**

- 7.1 If the Contractor furnishes any design, device, material, process, or other item, which is covered by a patent, trademark or service mark, or copyright or which is proprietary to, or a trade secret of, another, the Contractor shall obtain the necessary permission or license to permit the State to use such item or items.
- 7.2 The Contractor will defend or settle, at its own expense, any claim or suit against the State alleging that any such item furnished by the Contractor infringes any patent, trademark, service mark, copyright, or trade secret. If a third party claims that a product infringes that party's patent, trademark, service mark, trade secret, or copyright, the Contractor will defend the State against that claim at Contractor's expense and will pay all damages, costs, and attorneys' fees that a court finally awards, provided the State: (a) promptly notifies the Contractor in writing of the claim; and (b) allows Contractor to control and cooperates with Contractor in, the defense and any related settlement negotiations. The obligations of this paragraph are in addition to those stated in Section 7.3 below.

- 7.3 If any products furnished by the Contractor become, or in the Contractor's opinion are likely to become, the subject of a claim of infringement, the Contractor will, at its option and expense: (a) procure for the State the right to continue using the applicable item; (b) replace the product with a non-infringing product substantially complying with the item's specifications; or (c) modify the item so that it becomes non-infringing and performs in a substantially similar manner to the original item.

## **8. Confidentiality**

- 8.1 Subject to the Maryland Public Information Act and any other applicable laws, including without limitation, HIPAA, the HI-TECH ACT, and the Maryland Medical Records Act, all confidential or proprietary information and documentation relating to either party (including without limitation, any information or data stored within the Contractor's computer systems) shall be held in absolute confidence by the other party. Each party shall, however, be permitted to disclose relevant confidential information to its officers, agents, and employees to the extent that such disclosure is necessary for the performance of their duties under this Contract, provided that the data may be collected, used, disclosed, stored, and disseminated only as provided by and consistent with the law. The provisions of this section shall not apply to information that: (a) is lawfully in the public domain; (b) has been independently developed by the other party without violation of this Contract; (c) was already in the possession of such party; (d) was supplied to such party by a third party lawfully in possession thereof and legally permitted to further disclose the information; or (e) which such party is required to disclose by law.

- 8.2 This Section 8 shall survive expiration or termination of this Contract.

## **9. Loss of Data**

In the event of loss of any State data or records where such loss is due to the intentional act or omission or negligence of the Contractor or any of its subcontractors or agents, the Contractor shall be responsible for recreating such lost data in the manner and on the schedule set by the Contract Monitor. The Contractor shall ensure that all data is backed up and recoverable by the Contractor. Contractor shall use its best efforts to assure that at no time shall any actions undertaken by the Contractor under this Contract (or any failures to act when Contractor has a duty to act) damage or create any vulnerabilities in data bases, systems, platforms, and/or applications with which the Contractor is working hereunder.

## **10. Indemnification**

- 10.1 The Contractor shall hold harmless and indemnify the State from and against any and all losses, damages, claims, suits, actions, liabilities, and/or expenses, including, without limitation, attorneys' fees and disbursements of any character that arise from, are in connection with or are attributable to the performance or nonperformance of the Contractor or its subcontractors under this Contract.
- 10.2 This indemnification clause shall not be construed to mean that the Contractor shall indemnify the State against liability for any losses, damages, claims, suits, actions, liabilities, and/or expenses that are attributable to the sole negligence of the State or the State's employees.
- 10.3 The State has no obligation to provide legal counsel or defense to the Contractor or its subcontractors in the event that a suit, claim, or action of any character is brought by any person not party to this Contract against the Contractor or its subcontractors as a result of or relating to the Contractor's performance under this Contract.
- 10.4 The State has no obligation for the payment of any judgments or the settlement of any claims against the Contractor or its subcontractors as a result of or relating to the Contractor's performance under this Contract.

10.5 The Contractor shall immediately notify the Procurement Officer of any claim or suit made or filed against the Contractor or its subcontractors regarding any matter resulting from, or relating to, the Contractor's obligations under the Contract, and will cooperate, assist, and consult with the State in the defense or investigation of any claim, suit, or action made or filed against the State as a result of, or relating to, the Contractor's performance under this Contract.

10.6 This Section 10 shall survive termination of this Contract.

## **11. Non-Hiring of Employees**

No official or employee of the State, as defined under Md. Code Ann., State Government Article, § 15-102, whose duties as such official or employee include matters relating to or affecting the subject matter of this Contract, shall, during the pendency and term of this Contract and while serving as an official or employee of the State, become or be an employee of the Contractor or any entity that is a subcontractor on this Contract.

## **12. Disputes**

This Contract shall be subject to the provisions of Md. Code Ann., State Finance and Procurement Article, Title 15, Subtitle 2, and COMAR 21.10 (Administrative and Civil Remedies). Pending resolution of a claim, the Contractor shall proceed diligently with the performance of the Contract in accordance with the Procurement Officer's decision. Unless a lesser period is provided by applicable statute, regulation, or the Contract, the Contractor must file a written notice of claim with the Procurement Officer within thirty (30) days after the basis for the claim is known or should have been known, whichever is earlier.

Contemporaneously with or within thirty (30) days of the filing of a notice of claim, but no later than the date of final payment under the Contract, the Contractor must submit to the Procurement Officer its written claim containing the information specified in COMAR 21.10.04.02.

## **13. Maryland Law**

13.1 This Contract shall be construed, interpreted, and enforced according to the laws of the State of Maryland.

13.2 The Md. Code Ann., Commercial Law Article, Title 22, Maryland Uniform Computer Information Transactions Act, does not apply to this Contract or to any purchase order or Notice to Proceed issued under this Contract.

13.3 Any and all references to the Maryland Code, Annotated contained in this Contract shall be construed to refer to such Code sections as are from time to time amended.

## **14. Nondiscrimination in Employment**

The Contractor agrees: (a) not to discriminate in any manner against an employee or applicant for employment because of race, color, religion, creed, age, sex, marital status, national origin, ancestry, or disability of a qualified individual with a disability; (b) to include a provision similar to that contained in subsection (a), above, in any underlying subcontract except a subcontract for standard commercial supplies or raw materials; and (c) to post and to cause subcontractors to post in conspicuous places available to employees and applicants for employment, notices setting forth the substance of this clause.

**15. Contingent Fee Prohibition**

The Contractor warrants that it has not employed or retained any person, partnership, corporation, or other entity, other than a bona fide employee, bona fide agent, bona fide salesperson, or commercial selling agency working for the business, to solicit or secure the Contract, and that the business has not paid or agreed to pay any person, partnership, corporation, or other entity, other than a bona fide employee, bona fide agent, bona fide salesperson, or commercial selling agency, any fee or any other consideration contingent on the making of this Contract.

**16. Non-availability of Funding**

If the General Assembly fails to appropriate funds or if funds are not otherwise made available for continued performance for any fiscal period of this Contract succeeding the first fiscal period, this Contract shall be canceled automatically as of the beginning of the fiscal year for which funds were not appropriated or otherwise made available; provided, however, that this will not affect either the State's rights or the Contractor's rights under any termination clause in this Contract. The effect of termination of the Contract hereunder will be to discharge both the Contractor and the State from future performance of the Contract, but not from their rights and obligations existing at the time of termination. The Contractor shall be reimbursed for the reasonable value of any nonrecurring costs incurred but not amortized in the price of the Contract. The State shall notify the Contractor as soon as it has knowledge that funds may not be available for the continuation of this Contract for each succeeding fiscal period beyond the first.

**17. Termination for Default**

If the Contractor fails to fulfill its obligations under this Contract properly and on time, or otherwise violates any provision of the Contract, the State may terminate the Contract by written notice to the Contractor. The notice shall specify the acts or omissions relied upon as cause for termination. All finished or unfinished work provided by the Contractor shall, at the State's option, become the State's property. The State shall pay the Contractor fair and equitable compensation for satisfactory performance prior to receipt of notice of termination, less the amount of damages caused by the Contractor's breach. If the damages are more than the compensation payable to the Contractor, the Contractor will remain liable after termination and the State can affirmatively collect damages. Termination hereunder, including the termination of the rights and obligations of the parties, shall be governed by the provisions of COMAR 21.07.01.11B.

**18. Termination for Convenience**

The performance of work under this Contract may be terminated by the State in accordance with this clause in whole, or from time to time in part, whenever the State shall determine that such termination is in the best interest of the State. The State will pay all reasonable costs associated with this Contract that the Contractor has incurred up to the date of termination, and all reasonable costs associated with termination of the Contract; provided, however, the Contractor shall not be reimbursed for any anticipatory profits that have not been earned up to the date of termination. Termination hereunder, including the determination of the rights and obligations of the parties, shall be governed by the provisions of COMAR 21.07.01.12A(2).

**19. Delays and Extensions of Time**

The Contractor agrees to prosecute the work continuously and diligently and no charges or claims for damages shall be made by it for any delays, interruptions, interferences, or hindrances from any cause whatsoever during the progress of any portion of the work specified in this Contract.

Time extensions will be granted only for excusable delays that arise from unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to, acts of God, acts of the public enemy, acts of the State in either its sovereign or contractual capacity, acts of another Contractor

in the performance of a contract with the State, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, or delays of subcontractors or suppliers arising from unforeseeable causes beyond the control and without the fault or negligence of either the Contractor or the subcontractors or suppliers.

**20. Suspension of Work**

The State unilaterally may order the Contractor in writing to suspend, delay, or interrupt all or any part of its performance for such period of time as the Procurement Officer may determine to be appropriate for the convenience of the State.

**21. Pre-Existing Regulations**

In accordance with the provisions of Md. Code Ann., State Finance and Procurement Article, § 11-206, the regulations set forth in Title 21 of the Code of Maryland Regulations (COMAR 21) in effect on the date of execution of this Contract are applicable to this Contract.

**22. Financial Disclosure**

The Contractor shall comply with the provisions of Md. Code Ann., State Finance and Procurement Article, § 13-221, which requires that every person that enters into contracts, leases, or other agreements with the State or its agencies during a calendar year under which the business is to receive in the aggregate, \$100,000 or more, shall within thirty (30) days of the time when the aggregate value of these contracts, leases or other agreements reaches \$100,000, file with the Secretary of the State certain specified information to include disclosure of beneficial ownership of the business.

**23. Political Contribution Disclosure**

The Contractor shall comply with Md. Code Ann., Election Law Article, §§ 14-101 through 14-108, which requires that every person that enters into contracts, leases, or other agreements with the State, a county, or an incorporated municipality, or their agencies, during a calendar year in which the person receives in the aggregate \$100,000 or more, shall, file with the State Board of Elections a statement disclosing contributions in excess of \$500 made during the reporting period to a candidate for elective office in any primary or general election. The statement shall be filed with the State Board of Elections: (a) before a purchase or execution of a lease or contract by the State, a county, an incorporated municipality, or their agencies, and shall cover the preceding two calendar years; and (b) if the contribution is made after the execution of a lease or contract, then twice a year, throughout the contract term, on: (i) February 5, to cover the six (6) month period ending January 31; and (ii) August 5, to cover the six (6) month period ending July 31.

**24. Documents Retention and Inspection Clause**

The Contractor and subcontractors shall retain and maintain all records and documents relating to this contract for a period of five (5) years after final payment by the State hereunder or any applicable statute of limitations, whichever is longer, and shall make them available for inspection and audit by authorized representatives of the State, including the Procurement Officer or designee, at all reasonable times. All records related in any way to the Contract are to be retained for the entire time provided under this section. This Section 24 shall survive expiration or termination of the Contract.

If the Contractor supplies services to a State residential health care facility under the Mental Hygiene Administration, the Family Health Administration, the Alcohol and Drug Abuse Administration, or the Developmental Disabilities Administration, the Contractor agrees, in addition to the requirements above,:

- 24.1 That pursuant to 42 Code of Federal Regulations (C.F.R.) Part 420, the Secretary of Health and Human Services, and the Comptroller General of the United States, or their duly-authorized representatives, shall be granted access to the Contractor's contract, books, documents, and records necessary to verify the cost of the services provided under this contract, until the expiration of four (4) years after the services are furnished under this contract; and
- 24.2 That similar access will be allowed to the books, documents, and records of any organization related to the Contractor or controlled by the Contractor (as those terms are defined in 42 C.F.R. (420.301) if that organization is subcontracting to provide services with a value of \$10,000 or more in a twelve (12) month period to be reimbursed through funds provided by this contract.

## **25. Compliance with Laws**

The Contractor hereby represents and warrants that:

- 25.1 It is qualified to do business in the State and that it will take such action as, from time to time hereafter, may be necessary to remain so qualified;
- 25.2 It is not in arrears with respect to the payment of any monies due and owing the State, or any department or unit thereof, including but not limited to the payment of taxes and employee benefits, and that it shall not become so in arrears during the term of this Contract;
- 25.3 It shall comply with all federal, State and local laws, regulations, and ordinances applicable to its activities and obligations under this Contract; and
- 25.4 It shall obtain, at its expense, all licenses, permits, insurance, and governmental approvals, if any, necessary to the performance of its obligations under this Contract.

## **26. Cost and Price Certification**

By submitting cost or price information, the Contractor certifies to the best of its knowledge that the information submitted is accurate, complete, and current as of the date of its Bid/Proposal.

The price under this Contract and any change order or modification hereunder, including profit or fee, shall be adjusted to exclude any significant price increases occurring because the Contractor furnished cost or price information which, as of the date of its Bid/Proposal, was inaccurate, incomplete, or not current.

## **27. Subcontracting; Assignment**

The Contractor may not subcontract any portion of the services provided under this Contract without obtaining the prior written approval of the Procurement Officer, nor may the Contractor assign this Contract or any of its rights or obligations hereunder, without the prior written approval of the Procurement Officer provided, however, that a contractor may assign monies receivable under a contract after due notice to the State. Any subcontracts shall include such language as may be required in various clauses contained within this Contract, exhibits, and attachments. The Contract shall not be assigned until all approvals, documents, and affidavits are completed and properly registered. The State shall not be responsible for fulfillment of the Contractor's obligations to its subcontractors.

## **28. Liability**

- 28.1 For breach of this Contract, negligence, misrepresentation, or any other contract or tort claim, Contractor shall be liable as follows:
- a. For infringement of patents, copyrights, trademarks, service marks, and/or trade secrets, as provided in Section 7 of this Contract;
  - b. Without limitation for damages for bodily injury (including death) and damage to real property and tangible personal property; and
  - c. For all other claims, damages, losses, costs, expenses, suits, or actions in any way related to this Contract, regardless of the form. Contractor's liability for third party claims arising under Section 10 of this Contract shall be unlimited if the State is not immune from liability for claims arising under Section 10.

## **29. Commercial Nondiscrimination**

- 29.1 As a condition of entering into this Contract, Contractor represents and warrants that it will comply with the State's Commercial Nondiscrimination Policy, as described at Md. Code Ann., State Finance and Procurement Article, Title 19. As part of such compliance, Contractor may not discriminate on the basis of race, color, religion, ancestry or national origin, sex, age, marital status, sexual orientation, or on the basis of disability or other unlawful forms of discrimination in the solicitation, selection, hiring, or commercial treatment of subcontractors, vendors, suppliers, or commercial customers, nor shall Contractor retaliate against any person for reporting instances of such discrimination. Contractor shall provide equal opportunity for subcontractors, vendors, and suppliers to participate in all of its public sector and private sector subcontracting and supply opportunities, provided that this clause does not prohibit or limit lawful efforts to remedy the effects of marketplace discrimination that have occurred or are occurring in the marketplace. Contractor understands that a material violation of this clause shall be considered a material breach of this Contract and may result in termination of this Contract, disqualification of Contractor from participating in State contracts, or other sanctions. This clause is not enforceable by or for the benefit of, and creates no obligation to, any third party.
- 29.2 The Contractor shall include the above Commercial Nondiscrimination clause, or similar clause approved by the Department, in all subcontracts.
- 29.3 As a condition of entering into this Contract, upon the request of the Commission on Civil Rights, and only after the filing of a complaint against Contractor under Md. Code Ann., State Finance and Procurement Article, Title 19, as amended from time to time, Contractor agrees to provide within sixty (60) days after the request a complete list of the names of all subcontractors, vendors, and suppliers that Contractor has used in the past four (4) years on any of its contracts that were undertaken within the State of Maryland, including the total dollar amount paid by Contractor on each subcontract or supply contract. Contractor further agrees to cooperate in any investigation conducted by the State pursuant to the State's Commercial Nondiscrimination Policy as set forth at Md. Code Ann., State Finance and Procurement Article, Title 19, and to provide any documents relevant to any investigation that are requested by the State. Contractor understands that violation of this clause is a material breach of this Contract and may result in contract termination, disqualification by the State from participating in State contracts, and other sanctions.

### 30. Prompt Pay Requirements

- 30.1 If the Contractor withholds payment of an undisputed amount to its subcontractor, the Department, at its option and in its sole discretion, may take one or more of the following actions:
- a. Not process further payments to the contractor until payment to the subcontractor is verified;
  - b. Suspend all or some of the contract work without affecting the completion date(s) for the contract work;
  - c. Pay or cause payment of the undisputed amount to the subcontractor from monies otherwise due or that may become due;
  - d. Place a payment for an undisputed amount in an interest-bearing escrow account; or
  - e. Take other or further actions as appropriate to resolve the withheld payment.
- 30.2 An “undisputed amount” means an amount owed by the Contractor to a subcontractor for which there is no good faith dispute. Such “undisputed amounts” include, without limitation:
- a. Retainage which had been withheld and is, by the terms of the agreement between the Contractor and subcontractor, due to be distributed to the subcontractor; and
  - b. An amount withheld because of issues arising out of an agreement or occurrence unrelated to the agreement under which the amount is withheld.
- 30.3 An act, failure to act, or decision of a Procurement Officer or a representative of the Department, concerning a withheld payment between the Contractor and a subcontractor under this provision, may not:
- a. Affect the rights of the contracting parties under any other provision of law;
  - b. Be used as evidence on the merits of a dispute between the Department and the contractor in any other proceeding; or
  - c. Result in liability against or prejudice the rights of the Department.
- 30.4 The remedies enumerated above are in addition to those provided under COMAR 21.11.03.13 with respect to subcontractors that have contracted pursuant to the Disadvantaged Business Enterprise (DBE) program.
- 30.5 To ensure compliance with certified DBE subcontract participation goals, the Department may, consistent with COMAR 21.11.03.13, take the following measures:
- a. Verify that the certified DBEs listed in the DBE participation schedule actually are performing work and receiving compensation as set forth in the DBE participation schedule.
  - b. This verification may include, as appropriate:
    - i. Inspecting any relevant records of the Contractor;
    - ii. Inspecting the jobsite; and
    - iii. Interviewing subcontractors and workers.
    - iv. Verification shall include a review of:
      - (a) The Contractor’s monthly report listing unpaid invoices over thirty (30) days old from certified DBE subcontractors and the reason for nonpayment; and
      - (b) The monthly report of each certified DBE subcontractor, which lists payments received from the Contractor in the preceding thirty (30) days and invoices for which the subcontractor has not been paid.
  - c. If the Department determines that the Contractor is not in compliance with certified DBE participation goals, then the Department will notify the Contractor in writing of its findings, and will require the Contractor to take appropriate corrective action. Corrective action may include,

- but is not limited to, requiring the Contractor to compensate the DBE for work performed as set forth in the DBE participation schedule.
- d. If the Department determines that the Contractor is in material noncompliance with DBE contract provisions and refuses or fails to take the corrective action that the Department requires, then the Department may:
    - i. Terminate the contract;
    - ii. Refer the matter to the Office of the Attorney General for appropriate action; or
    - iii. Initiate any other specific remedy identified by the contract, including the contractual remedies required by any applicable laws, regulations, and directives regarding the payment of undisputed amounts.
  - e. Upon completion of the Contract, but before final payment or release of retainage or both, the Contractor shall submit a final report, in affidavit form under the penalty of perjury, of all payments made to, or withheld from, DBE subcontractors.

**31. Contract Monitor and Procurement Officer**

The work to be accomplished under this Contract shall be performed under the direction of the Contract Monitor. All matters relating to the interpretation of this Contract shall be referred to the Procurement Officer for determination.

**32. Notices**

All notices hereunder shall be in writing and either delivered personally or sent by certified or registered mail, postage prepaid, as follows:

If to the State: Heidi J. Tarleton  
 Procurement Officer  
 6 St. Paul, 7th Floor  
 Baltimore, MD 21202

If to the Contractor: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**33. Miscellaneous**

- 33.1 Any provision of this Contract which contemplates performance or observance subsequent to any termination or expiration of this contract shall survive termination or expiration of this contract and continue in full force and effect.
- 33.2 If any term contained in this contract is held or finally determined to be invalid, illegal, or unenforceable in any respect, in whole or in part, such term shall be severed from this contract, and the remaining terms contained herein shall continue in full force and effect, and shall in no way be affected, prejudiced, or disturbed thereby.

**IN WITNESS THEREOF**, the parties have executed this Contract as of the date hereinabove set forth.

CONTRACTOR

STATE OF MARYLAND  
Maryland Transit Administration

\_\_\_\_\_  
By:

\_\_\_\_\_  
By: Anna Lansaw, Procurement Director

\_\_\_\_\_  
Date

Or designee:

\_\_\_\_\_

\_\_\_\_\_  
Date

Approved for form and legal sufficiency  
this \_\_\_\_ day of \_\_\_\_\_, 20\_\_.

\_\_\_\_\_  
Assistant Attorney General

APPROVED BY BPW: \_\_\_\_\_  
(Date)

\_\_\_\_\_  
(BPW Item #)

**ATTACHMENT B – BID/PROPOSAL AFFIDAVIT**

**A. AUTHORITY**

I hereby affirm that I, \_\_\_\_\_ (name of affiant) am the \_\_\_\_\_ (title) and duly authorized representative of \_\_\_\_\_ (name of business entity) and that I possess the legal authority to make this affidavit on behalf of the business for which I am acting.

**B. CERTIFICATION REGARDING COMMERCIAL NONDISCRIMINATION**

The undersigned Bidder/Offeror hereby certifies and agrees that the following information is correct: In preparing its Bid/Proposal on this project, the Bidder/Offeror has considered all Proposals submitted from qualified, potential subcontractors and suppliers, and has not engaged in “discrimination” as defined in § 19-103 of the State Finance and Procurement Article of the Annotated Code of Maryland. “Discrimination” means any disadvantage, difference, distinction, or preference in the solicitation, selection, hiring, or commercial treatment of a vendor, subcontractor, or commercial customer on the basis of race, color, religion, ancestry, or national origin, sex, age, marital status, sexual orientation, or on the basis of disability or any otherwise unlawful use of characteristics regarding the vendor’s, supplier’s, or commercial customer’s employees or owners. “Discrimination” also includes retaliating against any person or other entity for reporting any incident of “discrimination”. Without limiting any other provision of the solicitation on this project, it is understood that, if the certification is false, such false certification constitutes grounds for the State to reject the Bid/Proposal submitted by the Bidder/Offeror on this project, and terminate any contract awarded based on the Bid/Proposal. As part of its Bid/Proposal, the Bidder/Offeror herewith submits a list of all instances within the past 4 years where there has been a final adjudicated determination in a legal or administrative proceeding in the State of Maryland that the Bidder/Offeror discriminated against subcontractors, vendors, suppliers, or commercial customers, and a description of the status or resolution of that determination, including any remedial action taken. Bidder/Offeror agrees to comply in all respects with the State’s Commercial Nondiscrimination Policy as described under Title 19 of the State Finance and Procurement Article of the Annotated Code of Maryland.

**B-1. CERTIFICATION REGARDING DISADVANTAGED BUSINESS ENTERPRISES.**

The undersigned Bidder/Offeror hereby certifies and agrees that it has fully complied with the State Minority/Disadvantaged Business Enterprise Law, State Finance and Procurement Article, § 14-308(a)(2), Annotated Code of Maryland, which provides that, except as otherwise provided by law, a contractor may not identify a certified minority business enterprise in a Bid/Proposal and:

- (1) Fail to request, receive, or otherwise obtain authorization from the certified minority/disadvantaged business enterprise to identify the certified minority Proposal;
- (2) Fail to notify the certified minority/disadvantaged business enterprise before execution of the contract of its inclusion in the Bid/Proposal;
- (3) Fail to use the certified minority/disadvantaged business enterprise in the performance of the contract; or
- (4) Pay the certified minority/disadvantaged business enterprise solely for the use of its name in the Bid/Proposal.

Without limiting any other provision of the solicitation on this project, it is understood that if the certification is false, such false certification constitutes grounds for the State to reject the Bid/Proposal submitted by the Bidder/Offeror on this project, and terminate any contract awarded based on the Bid/Proposal.

**C. AFFIRMATION REGARDING BRIBERY CONVICTIONS**

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the above business (as is defined in Section 16-101(b) of the State Finance and Procurement Article of the Annotated Code of Maryland), or any of its officers, directors, partners, controlling stockholders, or any of its employees directly involved in the business’s contracting activities including obtaining or performing contracts with public bodies has been convicted of, or has had probation before judgment imposed pursuant to Criminal Procedure Article, § 6-220, Annotated Code of Maryland, or has pleaded nolo contendere to a charge of, bribery, attempted bribery, or conspiracy to bribe in violation of Maryland law, or of the law of any other state or federal law, except as follows (indicate the reasons why the affirmation cannot be given and list any conviction, plea, or imposition of probation before judgment with the date, court, official or administrative body, the sentence or disposition, the name(s) of person(s) involved, and their current positions and responsibilities with the business):

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**D. AFFIRMATION REGARDING OTHER CONVICTIONS**

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the above business, or any of its officers, directors, partners, controlling stockholders, or any of its employees directly involved in the business’s contracting activities including obtaining or performing contracts with public bodies, has:

- (1) Been convicted under state or federal statute of:
  - (a) A criminal offense incident to obtaining, attempting to obtain, or performing a public or private contract; or
  - (b) Fraud, embezzlement, theft, forgery, falsification or destruction of records or receiving stolen property;
- (2) Been convicted of any criminal violation of a state or federal antitrust statute;
- (3) Been convicted under the provisions of Title 18 of the United States Code for violation of the Racketeer Influenced and Corrupt Organization Act, 18 U.S.C. § 1961 et seq., or the Mail Fraud Act, 18 U.S.C. § 1341 et seq., for acts in connection with the submission of Bids/Proposals for a public or private contract;
- (4) Been convicted of a violation of the State Minority Business Enterprise Law, § 14-308 of the State Finance and Procurement Article of the Annotated Code of Maryland;
- (5) Been convicted of a violation of § 11-205.1 of the State Finance and Procurement Article of the Annotated Code of Maryland;
- (6) Been convicted of conspiracy to commit any act or omission that would constitute grounds for conviction or liability under any law or statute described in subsections (1)—(5) above;

(7) Been found civilly liable under a state or federal antitrust statute for acts or omissions in connection with the submission of Bids/Proposals for a public or private contract;

(8) Been found in a final adjudicated decision to have violated the Commercial Nondiscrimination Policy under Title 19 of the State Finance and Procurement Article of the Annotated Code of Maryland with regard to a public or private contract; or

(9) Admitted in writing or under oath, during the course of an official investigation or other proceedings, acts or omissions that would constitute grounds for conviction or liability under any law or statute described in §§ B and C and subsections D(1)—(8) above, except as follows (indicate reasons why the affirmations cannot be given, and list any conviction, plea, or imposition of probation before judgment with the date, court, official or administrative body, the sentence or disposition, the name(s) of the person(s) involved and their current positions and responsibilities with the business, and the status of any debarment):

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**E. AFFIRMATION REGARDING DEBARMENT**

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the above business, or any of its officers, directors, partners, controlling stockholders, or any of its employees directly involved in the business’s contracting activities, including obtaining or performing contracts with public bodies, has ever been suspended or debarred (including being issued a limited denial of participation) by any public entity, except as follows (list each debarment or suspension providing the dates of the suspension or debarment, the name of the public entity and the status of the proceedings, the name(s) of the person(s) involved and their current positions and responsibilities with the business, the grounds of the debarment or suspension, and the details of each person’s involvement in any activity that formed the grounds of the debarment or suspension).

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**F. AFFIRMATION REGARDING DEBARMENT OF RELATED ENTITIES**

I FURTHER AFFIRM THAT:

(1) The business was not established and it does not operate in a manner designed to evade the application of or defeat the purpose of debarment pursuant to Sections 16-101, et seq., of the State Finance and Procurement Article of the Annotated Code of Maryland; and

(2) The business is not a successor, assignee, subsidiary, or affiliate of a suspended or debarred business, except as follows (you must indicate the reasons why the affirmations cannot be given without qualification):

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**G. SUBCONTRACT AFFIRMATION**

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the above business, has knowingly entered into a contract with a public body under which a person debarred or suspended under Title 16 of the State Finance and Procurement Article of the Annotated Code of Maryland will provide, directly or indirectly, supplies, services, architectural services, construction related services, leases of real property, or construction.

**H. AFFIRMATION REGARDING COLLUSION**

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the above business has:

- (1) Agreed, conspired, connived, or colluded to produce a deceptive show of competition in the compilation of the accompanying Bid/Proposal that is being submitted;
- (2) In any manner, directly or indirectly, entered into any agreement of any kind to fix the Bid/Proposal price of the Bidder/Offeror or of any competitor, or otherwise taken any action in restraint of free competitive bidding in connection with the contract for which the accompanying Bid/Proposal is submitted.

**I. CERTIFICATION OF TAX PAYMENT**

I FURTHER AFFIRM THAT:

Except as validly contested, the business has paid, or has arranged for payment of, all taxes due the State of Maryland and has filed all required returns and reports with the Comptroller of the Treasury, the State Department of Assessments and Taxation, and the Department of Labor, Licensing, and Regulation, as applicable, and will have paid all withholding taxes due the State of Maryland prior to final settlement.

**J. CONTINGENT FEES**

I FURTHER AFFIRM THAT:

The business has not employed or retained any person, partnership, corporation, or other entity, other than a bona fide employee, bona fide agent, bona fide salesperson, or commercial selling agency working for the business, to solicit or secure the Contract, and that the business has not paid or agreed to pay any person, partnership, corporation, or other entity, other than a bona fide employee, bona fide agent, bona fide salesperson, or commercial selling agency, any fee or any other consideration contingent on the making of the Contract.

**K. CERTIFICATION REGARDING INVESTMENTS IN IRAN**

(1) The undersigned certifies that, in accordance with State Finance and Procurement Article, §17-705, Annotated Code of Maryland:

(a) It is not identified on the list created by the Board of Public Works as a person engaging in investment activities in Iran as described in State Finance and Procurement Article, §17-702, Annotated Code of Maryland; and

(b) It is not engaging in investment activities in Iran as described in State Finance and Procurement Article, §17-702, Annotated Code of Maryland.

2. The undersigned is unable to make the above certification regarding its investment activities in Iran due to the following activities: \_\_\_\_\_

**L. CONFLICT MINERALS ORIGINATED IN THE DEMOCRATIC REPUBLIC OF CONGO (FOR SUPPLIES AND SERVICES CONTRACTS)**

I FURTHER AFFIRM THAT:

The business has complied with the provisions of State Finance and Procurement Article, §14-413, Annotated Code of Maryland governing proper disclosure of certain information regarding conflict minerals originating in the Democratic Republic of Congo or its neighboring countries as required by federal law.

**M. ACKNOWLEDGEMENT**

I ACKNOWLEDGE THAT this Affidavit is to be furnished to the Procurement Officer and may be distributed to units of: (1) the State of Maryland; (2) counties or other subdivisions of the State of Maryland; (3) other states; and (4) the federal government. I further acknowledge that this Affidavit is subject to applicable laws of the United States and the State of Maryland, both criminal and civil, and that nothing in this Affidavit or any contract resulting from the submission of this Bid/Proposal shall be construed to supersede, amend, modify or waive, on behalf of the State of Maryland, or any unit of the State of Maryland having jurisdiction, the exercise of any statutory right or remedy conferred by the Constitution and the laws of Maryland with respect to any misrepresentation made or any violation of the obligations, terms and covenants undertaken by the above business with respect to (1) this Affidavit, (2) the contract, and (3) other Affidavits comprising part of the contract.

I DO SOLEMNLY DECLARE AND AFFIRM UNDER THE PENALTIES OF PERJURY THAT THE CONTENTS OF THIS AFFIDAVIT ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION, AND BELIEF.

Date: \_\_\_\_\_

By: \_\_\_\_\_ (print name of Authorized Representative and Affiant)

\_\_\_\_\_ (signature of Authorized Representative and Affiant)

**ATTACHMENT C – CONTRACT AFFIDAVIT**

**A. AUTHORITY**

I hereby affirm that I, \_\_\_\_\_ (name of affiant) am the \_\_\_\_\_ (title) and duly authorized representative of \_\_\_\_\_ (name of business entity) and that I possess the legal authority to make this affidavit on behalf of the business for which I am acting.

**B. CERTIFICATION OF REGISTRATION OR QUALIFICATION WITH THE STATE DEPARTMENT OF ASSESSMENTS AND TAXATION**

I FURTHER AFFIRM THAT:

The business named above is a (check applicable box):

- (1) Corporation —  domestic or  foreign;
- (2) Limited Liability Company —  domestic or  foreign;
- (3) Partnership —  domestic or  foreign;
- (4) Statutory Trust —  domestic or  foreign;
- (5)  Sole Proprietorship.

And is registered or qualified as required under Maryland Law. I further affirm that the above business is in good standing both in Maryland and (IF APPLICABLE) in the jurisdiction where it is presently organized, and has filed all of its annual reports, together with filing fees, with the Maryland State Department of Assessments and Taxation. The name and address of its resident agent (IF APPLICABLE) filed with the State Department of Assessments and Taxation is:

Name and Department ID  
Number: \_\_\_\_\_ Address: \_\_\_\_\_

and that if it does business under a trade name, it has filed a certificate with the State Department of Assessments and Taxation that correctly identifies that true name and address of the principal or owner as:

Name and Department ID  
Number: \_\_\_\_\_ Address: \_\_\_\_\_

**C. FINANCIAL DISCLOSURE AFFIRMATION**

I FURTHER AFFIRM THAT:

I am aware of, and the above business will comply with, the provisions of State Finance and Procurement Article, §13-221, Annotated Code of Maryland, which require that every business that enters into contracts, leases, or other agreements with the State of Maryland or its agencies during a calendar year under which the business is to receive in the aggregate \$100,000 or more shall, within 30 days of the time when the aggregate value of the contracts, leases, or other agreements reaches \$100,000, file with the Secretary of State of Maryland certain specified information to include disclosure of beneficial ownership of the business.

**D. POLITICAL CONTRIBUTION DISCLOSURE AFFIRMATION**

I FURTHER AFFIRM THAT:

I am aware of, and the above business will comply with, Election Law Article, §§14-101 — 14-108, Annotated Code of Maryland, which requires that every person that enters into contracts, leases, or other agreements with the State of

Maryland, including its agencies or a political subdivision of the State, during a calendar year in which the person receives in the aggregate \$100,000 or more shall file with the State Board of Elections a statement disclosing contributions in excess of \$500 made during the reporting period to a candidate for elective office in any primary or general election.

#### **E. DRUG AND ALCOHOL FREE WORKPLACE**

(Applicable to all contracts unless the contract is for a law enforcement agency and the agency head or the agency head's designee has determined that application of COMAR 21.11.08 and this certification would be inappropriate in connection with the law enforcement agency's undercover operations.)

I CERTIFY THAT:

(1) Terms defined in COMAR 21.11.08 shall have the same meanings when used in this certification.

(2) By submission of its Bid/Proposal, the business, if other than an individual, certifies and agrees that, with respect to its employees to be employed under a contract resulting from this solicitation, the business shall:

(a) Maintain a workplace free of drug and alcohol abuse during the term of the contract;

(b) Publish a statement notifying its employees that the unlawful manufacture, distribution, dispensing, possession, or use of drugs, and the abuse of drugs or alcohol is prohibited in the business' workplace and specifying the actions that will be taken against employees for violation of these prohibitions;

I Prohibit its employees from working under the influence of drugs or alcohol;

(d) Not hire or assign to work on the contract anyone who the business knows, or in the exercise of due diligence should know, currently abuses drugs or alcohol and is not actively engaged in a bona fide drug or alcohol abuse assistance or rehabilitation program;

(e) Promptly inform the appropriate law enforcement agency of every drug-related crime that occurs in its workplace if the business has observed the violation or otherwise has reliable information that a violation has occurred;

(f) Establish drug and alcohol abuse awareness programs to inform its employees about:

- (i) The dangers of drug and alcohol abuse in the workplace;
- (ii) The business's policy of maintaining a drug and alcohol free workplace;
- (iii) Any available drug and alcohol counseling, rehabilitation, and employee assistance programs; and
- (iv) The penalties that may be imposed upon employees who abuse drugs and alcohol in the workplace;

(g) Provide all employees engaged in the performance of the contract with a copy of the statement required by §E(2)(b), above;

(h) Notify its employees in the statement required by §E(2)(b), above, that as a condition of continued employment on the contract, the employee shall:

- (i) Abide by the terms of the statement; and
- (ii) Notify the employer of any criminal drug or alcohol abuse conviction for an offense occurring in the workplace not later than 5 days after a conviction;

(i) Notify the procurement officer within 10 days after receiving notice under §E(2)(h)(ii), above, or otherwise receiving actual notice of a conviction;

(j) Within 30 days after receiving notice under §E(2)(h)(ii), above, or otherwise receiving actual notice of a conviction, impose either of the following sanctions or remedial measures on any employee who is convicted of a drug or alcohol abuse offense occurring in the workplace:

- (i) Take appropriate personnel action against an employee, up to and including termination; or
- (ii) Require an employee to satisfactorily participate in a bona fide drug or alcohol abuse assistance or rehabilitation program; and

(k) Make a good faith effort to maintain a drug and alcohol free workplace through implementation of §E(2)(a)—(j), above.

(3) If the business is an individual, the individual shall certify and agree as set forth in §E(4), below, that the individual shall not engage in the unlawful manufacture, distribution, dispensing, possession, or use of drugs or the abuse of drugs or alcohol in the performance of the contract.

(4) I acknowledge and agree that:

(a) The award of the contract is conditional upon compliance with COMAR 21.11.08 and this certification;

(b) The violation of the provisions of COMAR 21.11.08 or this certification shall be cause to suspend payments under, or terminate the contract for default under COMAR 21.07.01.11 or 21.07.03.15, as applicable; and

I The violation of the provisions of COMAR 21.11.08 or this certification in connection with the contract may, in the exercise of the discretion of the Board of Public Works, result in suspension and debarment of the business under COMAR 21.08.03.

**F. CERTAIN AFFIRMATIONS VALID**

I FURTHER AFFIRM THAT:

To the best of my knowledge, information, and belief, each of the affirmations, certifications, or acknowledgements contained in that certain Bid/Proposal Affidavit dated \_\_\_\_\_, 201\_\_\_\_, and executed by me for the purpose of obtaining the contract to which this Exhibit is attached remains true and correct in all respects as if made as of the date of this Contract Affidavit and as if fully set forth herein.

I DO SOLEMNLY DECLARE AND AFFIRM UNDER THE PENALTIES OF PERJURY THAT THE CONTENTS OF THIS AFFIDAVIT ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION, AND BELIEF.

Date: \_\_\_\_\_

By: \_\_\_\_\_ (printed name of Authorized Representative and Affiant)

\_\_\_\_\_ (signature of Authorized Representative and Affiant)

**ATTACHMENT D –  
TRANSIT VEHICLE MANUFACTURE (TVM)/DISADVANTAGED BUSINESS ENTERPRISE  
(DBE) CERTIFICATE**

**(must be submitted with Bid)**

The Responder, a Primary Transit Vehicle Manufacturer (TVM), hereby certifies that it has complied with the requirements of 49 CFR section 26.49, as amended, and has submitted its annual Disadvantaged Business Enterprises (DBE) goal, as amended, to the Federal Transit Administration (FTA).

\_\_\_\_\_  
Authorized Signature

\_\_\_\_\_  
Typed or Printed Name

\_\_\_\_\_  
Title

\_\_\_\_\_  
Company

\_\_\_\_\_  
Date

**ATTACHMENT E – PRE-BID CONFERENCE RESPONSE FORM**

**Solicitation Number T-8000-0451  
BUS PROCUREMENT – 41 HYBRID BUSES**

A Pre-Bid Conference will be held at 10:00am, on May 28, 2014, at the William Donald Schaefer Building, 6 St. Paul Street, 7th Floor, Baltimore, Maryland 21202. Please return this form by May 23, 2014, advising whether or not you plan to attend.

Return via e-mail or fax this form to the Procurement Officer:

Heidi J. Tarleton  
Contracts Administration Division  
6 St. Paul Street, 7th Floor  
Baltimore, MD 21202  
Email: htarleton@mta.maryland.gov  
Fax #: (410) 333-0126

Please indicate:

\_\_\_\_\_ Yes, the following representatives will be in attendance:

- 1.
- 2.
- 3.

\_\_\_\_\_ No, we will not be in attendance.

Please specify whether any reasonable accommodations are requested (see IFB § 1.7 “Pre-Bid Conference”):

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Title

\_\_\_\_\_  
Name of Firm (please print)

## ATTACHMENT F – BID PRICING INSTRUCTIONS

In order to assist Bidders in the preparation of their Bid and to comply with the requirements of this solicitation, Bid Pricing Instructions and a Bid Form have been prepared. Bidders shall submit their Bid on the Bid Form in accordance with the instructions on the Bid Form and as specified herein. Do not alter the Bid Form or the Bid Form may be rejected. The Bid Form is to be signed and dated, where requested, by an individual who is authorized to bind the Bidder to the prices entered on the Bid Form.

The Bid Form is used to calculate the Bidder's TOTAL BID PRICE. Follow these instructions carefully when completing your Bid Form:

- A) All Unit and Extended Prices must be clearly entered in dollars and cents, e.g., \$24.15. Make your decimal points clear and distinct.
- B) All Unit Prices must be the actual price per unit the State will pay for the specific item or service identified in this IFB and may not be contingent on any other factor or condition in any manner.
- C) All calculations shall be rounded to the nearest cent, i.e., .344 shall be .34 and .345 shall be .35.
- D) Any goods or services required through this IFB and proposed by the vendor at **No Cost to the State** must be clearly entered in the Unit Price, if appropriate, and Extended Price with **\$0.00**.
- E) Every blank in every Bid Form shall be filled in. Any blanks may result in the Bid being regarded as non-responsive and thus rejected. Any changes or corrections made to the Bid Form by the Bidder prior to submission shall be initialed and dated.
- F) Except as instructed on the Bid Form, nothing shall be entered on or attached to the Bid Form that alters or proposes conditions or contingencies on the prices. Alterations and/or conditions usually render the Bid non-responsive, which means it will be rejected.
- G) It is imperative that the prices included on the Bid Form have been entered correctly and calculated accurately by the Bidder and that the respective total prices agree with the entries on the Bid Form. Any incorrect entries or inaccurate calculations by the Bidder will be treated as provided in COMAR 21.05.03.03E and 21.05.02.12, and may cause the Bid to be rejected.
- H) If option years are included, Bidders must submit pricing for each option year. Any option to renew will be exercised at the sole discretion of the State and will comply with all terms and conditions in force at the time the option is exercised. If exercised, the option period shall be for a period identified in the IFB at the prices entered in the Bid Form.
- I) All Bid prices entered below are to be fully loaded prices that include all costs/expenses associated with the provision of services as required by the IFB. The Bid price shall include, but is not limited to, all: labor, profit/overhead, general operating, administrative, and all other expenses and costs necessary to perform the work set forth in the solicitation. No other amounts will be paid to the Contractor. If labor rates are requested, those amounts shall be fully-loaded rates; no overtime amounts will be paid.
- J) Unless indicated elsewhere in the IFB, sample amounts used for calculations on the Bid Form are typically estimates for bidding purposes only. The Department does not guarantee a minimum or maximum number of units or usage in the performance of this Contract.
- K) Failure to adhere to any of these instructions may result in the Bid being determined non-responsive and rejected by the Department.

**ATTACHMENT F – BID FORM**

STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION  
MARYLAND TRANSIT ADMINISTRATION  
BID FORM  
FOR

CONTRACT NO.: \_\_\_\_\_

TO: Maryland Transit Administration  
ATTN: Procurement Division  
6 St. Paul Street, 7<sup>th</sup> Floor  
Baltimore, MD 21202-1614

BID OPENING DATE:  
June 24, 2014  
BID OPENING TIME:  
1:00 PM

BID OF: \_\_\_\_\_  
(Bidder's Name)

**PROJECT DESCRIPTION:**

The manufacture of forty-one (41) forty (40) foot Low Floor Diesel Electric Hybrid Transit Buses. The duration of this contract is for one (1) year with no renewal options.

1. This bid is hereby submitted to the Maryland Transit Administration (hereinafter sometimes called the "Administration") in response to NOTICE TO CONTRACTORS dated May 19, 2014.
2. The UNDERSIGNED has thoroughly examined, acknowledges receipt of, and is familiar with the Contract Documents as well as the various instructions, information, and requirements covering the same, all as mentioned herein and in said NOTICE TO CONTRACTORS.
3. In compliance with said NOTICE TO CONTRACTORS the UNDERSIGNED hereby proposes to furnish all labor, equipment, and materials and perform all work described and in strict accordance with the provisions of the Contract Documents for the consideration of the amounts, lump sum and unit prices listed in the attached Unit Price Schedule, and agrees that, upon Notice of Award, within one hundred eighty (180) calendar days after the date of opening of bids, unless mutually extended, he will within ten (10) calendar days after receipt of the prescribed forms, execute the Contract and furnish a performance bond and payment bond (if such bonds are required by the Contract Documents) on forms furnished by the Administration with good and sufficient surety or sureties.
4. The UNDERSIGNED agrees and understands that the time of completion is as specified in the Special Provisions, unless the completion dates are extended as provided for in the Contract Documents.
5. The UNDERSIGNED agrees to pay liquidated damages in the amount specified in the Special Provisions for each and every calendar day after the completion date that the work remains incomplete unless an extension is granted as provided for in the Contract Documents.
6. The UNDERSIGNED hereby certifies that the \_\_\_\_\_ (Bidder's Name) \_\_\_\_\_ is or \_\_\_\_\_ is not (check one) included on the GSA list of parties Excluded from Procurement.

AND

The UNDERSIGNED hereby certifies that the \_\_\_\_\_ (Bidder's Name) \_\_\_\_\_ is or \_\_\_\_\_ is not (check one) included on the List of Contractors suspended or debarred from contracting with the State of Maryland.

7. The UNDERSIGNED, as the Contractor, will perform on the Site, with its own organization, \_\_\_\_\_ percent (\_\_\_\_\_% ) of the total amount of work to be performed under this contract.

8. PARENT COMPANY

- a. The UNDERSIGNED represents that it \_\_\_\_ is or \_\_\_\_\_ is not, (check one) owned or controlled by a parent company. For this purpose a parent company is defined as one which either owns or controls the activities and basic business policies of the UNDERSIGNED. To own another company means the parent company must own at least a majority (more than 50 percent) of the voting rights in that company. To control another company such ownership is not required; if another company is able to formulate, determine or veto basic business policy decisions of the bidder, such other company is considered the parent of the bidder. This control may be exercised through the use of dominant minority voting rights, use of proxy voting, contractual arrangements, or otherwise.
- b. If UNDERSIGNED is owned or controlled by a parent company, insert in the space below the name and main office address of the parent company.

\_\_\_\_\_  
(Name)

\_\_\_\_\_  
(Address)

9. ARREARAGES

By submitting a response to this solicitation, the undersigned shall be deemed to represent that it is not in arrears in the payment of any obligations due and owing the State of Maryland, including the payment of taxes and employee benefits, and that it shall not become so arrears during the term of the contract if selected for contract award.

10. CERTIFICATION OF NON-MARYLAND CORPORATION (FOREIGN CORPORATION)

- a. A corporation not incorporated in the State of Maryland is considered to be a foreign corporation and, therefore, is required to be registered with the Maryland State Department of Assessment and Taxation if awarded this contract.
- b. Where a foreign corporation is currently registered with the Department of Assessments and Taxation, such a bidder shall submit with his bid a copy of the department's certification of his registration or qualification acknowledgment.
- c. If a foreign corporation is not currently registered, such a bidder shall submit with his bid his certification that, if notified of his apparent award of the contract, he will register with the Maryland State Department of Assessments and Taxation and provide a copy of the department's certification of his registration or qualification acknowledgment along with the executed contract.

11. The Contractor shall, prior to the time of execution of the contract, obtain all applicable licenses and comply with all applicable laws and regulations in the Annotated Code of Maryland.

CORPORATION BID: FEIN: \_\_\_\_\_

\_\_\_\_\_  
Name of Corporation

\_\_\_\_\_  
State in which Incorporated

\_\_\_\_\_  
Business Address

\_\_\_\_\_  
Telephone

ATTEST:

By:

\_\_\_\_\_  
Secretary

\_\_\_\_\_  
President or Vice President

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Print Name

B. PARTNERSHIP BID:

FEIN: \_\_\_\_\_

\_\_\_\_\_  
Name of Partnership

\_\_\_\_\_  
Business Address

\_\_\_\_\_  
Telephone

Names of each Partner:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Witness:

By:

\_\_\_\_\_

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Print Name

C. INDIVIDUAL BID:

S.S. No.: \_\_\_\_\_

\_\_\_\_\_  
Name

\_\_\_\_\_  
Business Address

\_\_\_\_\_  
Telephone

Witness:

\_\_\_\_\_  
Print Name

By:

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Print Name

D. JOINT VENTURE:

FEIN: \_\_\_\_\_

\_\_\_\_\_  
Name of Corporation

\_\_\_\_\_  
State in which Incorporated

\_\_\_\_\_  
Business Address

\_\_\_\_\_  
Telephone

ATTEST:

\_\_\_\_\_  
Secretary

\_\_\_\_\_  
Print Name

By:

\_\_\_\_\_  
President or Vice President

\_\_\_\_\_  
Print Name

FEIN: \_\_\_\_\_

\_\_\_\_\_  
Name of Corporation

\_\_\_\_\_  
State in which Incorporated

\_\_\_\_\_  
Business Address

\_\_\_\_\_  
Telephone

Attest:

By:

\_\_\_\_\_  
Secretary

\_\_\_\_\_  
President or Vice President

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Print Name

FEIN: \_\_\_\_\_

\_\_\_\_\_  
Name of Corporation

\_\_\_\_\_  
State in which Incorporated

\_\_\_\_\_  
Business Address

\_\_\_\_\_  
Telephone

Attest:

By:

\_\_\_\_\_  
Secretary

\_\_\_\_\_  
President or Vice President

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Print Name

A Joint Venture doing business as \_\_\_\_\_

\* Each member of the Joint Venture must execute the Bid Form. A Corporate Officer must sign for each member of the joint venture. In the event that a Corporate Officer (President or Vice President) does not sign the Bid Form, a Power of Execution or Power of Attorney, must be submitted with the Bid Forms.

# ATTACHMENT F - BID FORM

Maryland Transit Administration  
T-8000-0451  
40-Foot Low Floor Diesel Electric Hybrid Transit Buses

	All prices are to be in United States dollars		
	<b>Qty</b>	<b>Unit Price</b>	<b>Total Price</b>
40-foot Diesel Electric Hybrid Transit Buses	41		
Operator Manuals	250		
Final Parts Manual (hardcopy)	5		
Final Service Manual (hardcopy)	5		
Final Bus Systems Drawings Manual (11x17 3-hole regular paper)	5		
Final First Responder Guide (8.5x11 laminated card)	41		
Final Manuals in DVD ROM	5		
Maintenance and Operator Training	1500 hours	Lump Sum	
Extended Warranty [Allison - 5 year]	41		
Diagnostic Laptop (including all necessary software preinstalled)*	10		
Delivery charges	41		
<b>TOTAL PROPOSED PRICE</b>			

**This form is to be completed and included in the Bid Package.**

\* Shall include all special tools and pricing conducive to continuous operations and maintenance of these diagnostic laptops.

## ATTACHMENT G – FEDERAL FUNDING REQUIREMENTS

### A Summary of Certain Federal Fund Requirements and Restrictions

[Details of particular laws, which may levy a penalty for noncompliance, are available from the Department of Health and Mental Hygiene.]

1. Form and rule enclosed: 18 U.S.C. 1913 and Section 1352 of P.L. 101-121 require that all *prospective* and present sub-grantees (this includes all levels of funding) who receive more than \$100,000 in federal funds must submit the form “Certification Against Lobbying.” It assures, generally, that recipients will not lobby federal entities with federal funds, and that, as is required, they will disclose other lobbying on form SF- LLL.
2. Form and instructions enclosed: “Form LLL, Disclosure of Lobbying Activities” must be submitted by those receiving more than \$100,000 in federal funds, to disclose any lobbying of federal entities (a) with profits from federal contracts or (b) funded with nonfederal funds.
3. Form and summary of Act enclosed: Sub-recipients of federal funds on any level must complete a “Certification Regarding Environmental Tobacco Smoke,” required by Public Law 103-227, the Pro-Children Act of 1994. Such law prohibits smoking in any portion of any indoor facility owned or leased or contracted for regular provision of health, day care, early childhood development, education, or library services for children under the age of 18. Such language must be included in the conditions of award (they are included in the certification, which may be part of such conditions.) This does not apply to those solely receiving Medicaid or Medicare, or facilities where WIC coupons are redeemed.
4. In addition, federal law requires that:
  - A) OMB Circular A-133, Audits of States, Local Governments and Non-Profit Organizations requires that grantees (both recipients and sub-recipients) which expend a total of \$300,000 or more (*\$500,000 for fiscal years ending after December 31, 2003*) in federal assistance shall have a single or program-specific audit conducted for that year in accordance with the provisions of the Single Audit Act of 1984, P.L. 98-502, and the Single Audit Act Amendments of 1996, P.L. 104-156 and the Office of Management and Budget (OMB) Circular A-133. All sub-grantee audit reports, performed in compliance with the aforementioned Circular shall be forwarded within 30 days of report issuance to the Department Contract Monitor.
  - B) All sub-recipients of federal funds comply with Sections 503 and 504 of the Rehabilitation Act of 1973, the conditions of which are summarized in item (C).
  - C) Recipients of \$10,000 or more (on any level) must include in their contract language the requirements of Sections 503 (language specified) and 504 referenced in item (B).

Section 503 of the Rehabilitation Act of 1973, as amended, requires recipients to take affirmative action to employ and advance in employment qualified disabled people. An affirmative action program must be prepared and maintained by all contractors with 50 or more employees and one or more federal contracts of \$50,000 or more.

This clause must appear in subcontracts of \$10,000 or more:

- a) The contractor will not discriminate against any employee or applicant for employment because of physical or mental handicap in regard to any position for which the employee or applicant for

employment is qualified. The contractor agrees to take affirmative action to employ, advance in employment and otherwise treat qualified handicapped individuals without discrimination based upon their physical or mental handicap in all upgrading, demotion or transfer, recruitment, advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship.

- b) The contractor agrees to comply with the rules, regulations, and relevant orders of the secretary of labor issued pursuant to the act.
- c) In the event of the contractor's non-compliance with the requirements of this clause, actions for non-compliance may be taken in accordance with the rules, regulations and relevant orders of the secretary of labor issued pursuant to the act.
- d) The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices in a form to be prescribed by the director, provided by or through the contracting office. Such notices shall state the contractor's obligation under the law to take affirmative action to employ and advance in employment qualified handicapped employees and applicants for employment, and the rights of applicants and employees.
- e) The contractor will notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the contractor is bound by the terms of Section 503 of the Rehabilitation Act of 1973, and is committed to take affirmative action to employ and advance in employment physically and mentally handicapped individuals.
- f) The contractor will include the provisions of this clause in every subcontract or purchase order of \$10,000 or more unless exempted by rules, regulations, or orders of the [federal] secretary issued pursuant to Section 503 of the Act, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the director of the Office of Federal Contract Compliance Programs may direct to enforce such provisions, including action for non-compliance.

Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. Sec. 791 et seq.) prohibits discrimination on the basis of handicap in all federally assisted programs and activities. It requires the analysis and making of any changes needed in three general areas of operation-programs, activities, and facilities and employment. It states, among other things, that:

*Grantees that provide health ... services should undertake tasks such as ensuring emergency treatment for the hearing impaired and making certain that persons with impaired sensory or speaking skills are not denied effective notice with regard to benefits, services, and waivers of rights or consents to treatments.*

- D) All sub-recipients comply with Title VI of the Civil Rights Act of 1964 that they must not discriminate in participation by race, color, or national origin.
- E) All sub-recipients of federal funds from SAMHSA (Substance Abuse and Mental Health Services Administration) or NIH (National Institute of Health) are prohibited from paying any direct salary at a rate more than Executive Level 1 per year. (This includes, but is not limited to, sub-recipients of the Substance Abuse Prevention and Treatment and the Community Mental Health Block Grants and NIH research grants.)
- F) There may be no discrimination on the basis of age, according to the requirements of the Age Discrimination Act of 1975.

- G) For any education program, as required by Title IX of the Education Amendments of 1972, there may be no discrimination on the basis of sex.
- H) For research projects, a form for Protection of Human Subjects (Assurance/ Certification/ Declaration) should be completed by each level funded, assuring that either: (1) there are no human subjects involved, or that (2) an Institutional Review Board (IRB) has given its formal approval before human subjects are involved in research. [This is normally done during the application process rather than after the award is made, as with other assurances and certifications.]
- I) In addition, there are conditions, requirements, and restrictions which apply only to specific sources of federal funding. These should be included in your grant/contract documents when applicable.

U.S. Department of Health and Human Services

**CERTIFICATION REGARDING LOBBYING**  
**Certification for Contracts, Grants, Loans, and Cooperative Agreements**

The undersigned certifies, to the best of his or her knowledge and belief, that:

- (1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- (2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- (3) The undersigned shall require that the language of this certification be included in the award documents for all sub-awards at all tiers (including subcontracts, sub-grants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

Award No.	Organizational Entry
Name and Title of Official Signing for Organizational Entry	Telephone No. Of Signing Official
Signature of Above Official	Date Signed



## INSTRUCTIONS FOR COMPLETION OF SF-LLL, DISCLOSURE OF LOBBYING ACTIVITIES

This disclosure form shall be completed by the reporting entity, whether sub-awardee or prime Federal recipient, at the initiation or receipt of a covered Federal action, or a material change to a previous filing, pursuant to title 31 U.S.C. Section 1352. The filing of a form is required for each payment or agreement to make payment to any lobbying entity for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a covered Federal action. Complete all items that apply for both the initial filing and material change report. Refer to the implementing guidance published by the Office of Management and Budget for additional information.

1. Identify the type of covered Federal action for which lobbying activity is and/or has been secured to influence the outcome of a covered Federal action.
2. Identify the status of the covered Federal action.
3. Identify the appropriate classification of this report. If this is a follow-up report caused by a material change to the information previously reported, enter the year and quarter in which the change occurred. Enter the date of the last previously submitted report by this reporting entity for this covered Federal action.
4. Enter the full name, address, city, State and zip code of the reporting entity. Include Congressional District, if known. Check the appropriate classification of the reporting entity that designates if it is, or expects to be, a prime or sub-award recipient. Identify the tier of the sub-awardee, e.g., the first sub-awardee of the prime is the 1st tier. Sub-awards include but are not limited to subcontracts, sub-grants and contract awards under grants.
5. If the organization filing the report in item 4 checks "Sub-awardee," then enter the full name, address, city, State and zip code of the prime Federal recipient. Include Congressional District, if known.
6. Enter the name of the Federal agency making the award or loan commitment. Include at least one organizational level below agency name, if known. For example, Department of Transportation, United States Coast Guard.
7. Enter the Federal program name or description for the covered Federal action (item 1). If known, enter the full Catalog of Federal Domestic Assistance (CFDA) number for grants, cooperative agreements, loans, and loan commitments.
8. Enter the most appropriate Federal identifying number available for the Federal action identified in item 1 (e.g., Request for Proposal (RFP) number; Invitation for Bid (IFB) number; grant announcement number; the contract, grant, or loan award number; the application/proposal control number assigned by the Federal agency). Include prefixes, e.g., "RFP-DE-90-001."
9. For a covered Federal action where there has been an award or loan commitment by the Federal agency, enter the Federal amount of the award/loan commitment for the prime entity identified in item 4 or 5.
10. (a) Enter the full name, address, city, State and zip code of the lobbying registrant under the Lobbying Disclosure Act of 1995 engaged by the reporting entity identified in item 4 to influence the covered Federal action.
10. (b) Enter the full names of the individual(s) performing services, and include full address if different from 10 (a). Enter Last Name, First Name, and Middle Initial (MI).
11. The certifying official shall sign and date the form and print his/her name, title, and telephone number.

According to the Paperwork Reduction Act, as amended, no persons are required to respond to a collection of information unless it displays a valid OMB Control Number. The valid OMB control number for this information collection is OMB No. 0348-0046. Public reporting burden for this collection of information is estimated to average 10 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0046), Washington, DC 20503.

DEPARTMENT OF HEALTH AND HUMAN SERVICES

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Public Health Service  
Health Resources and  
Service Administration  
Rockville, MD 20857

**CERTIFICATION REGARDING ENVIRONMENTAL TOBACCO SMOKE**

Public Law 103-227, also known as the Pro Children Act of 1994, Part C Environmental Tobacco Smoke, requires that smoking not be permitted in any portion of any indoor facility owned, or leased or contracted for by an entity and used routinely or regularly for provision of health, day care, early childhood development services, education or library services to children under the age of 18, if the services are funded by Federal programs either directly or through State or local governments, by Federal grant, contract, loan, or loan guarantee. The law also applies to children's services that are provided in indoor facilities that are constructed, operated or maintained with such Federal funds. The law does not apply to children's services provided in private residences, portions of facilities used for inpatient drug or alcohol treatment, service providers whose sole sources of applicable Federal funds is Medicare or Medicaid, or facilities where WIC coupons are redeemed. Failure to comply with the provisions of the law may result in the imposition of a civil monetary penalty of up to \$1000 for each violation and/or the imposition of an administrative compliance order on the responsible entity.

By signing this certification, the offeror/contractor (for acquisitions) or applicant/grantee (for grants) certifies that the submitting organization will comply with the requirements of the Act and will not allow smoking within any portion of any indoor facility used for the provision of services for children as defined by the Act.

The submitting organization further agrees that it will require the language of this certification be included in any sub-awards which contain provisions for children's services and that all sub-recipients shall certify accordingly.

---

Signature of Authorized Certifying Individual

**ATTACHMENT H – CONFLICT OF INTEREST AFFIDAVIT AND DISCLOSURE**

**Reference COMAR 21.05.08.08**

**(submit with Bid/Proposal)**

A. “Conflict of interest” means that because of other activities or relationships with other persons, a person is unable or potentially unable to render impartial assistance or advice to the State, or the person’s objectivity in performing the contract work is or might be otherwise impaired, or a person has an unfair competitive advantage.

B. “Person” has the meaning stated in COMAR 21.01.02.01B(64) and includes a Bidder/Offeror, Contractor, consultant, or subcontractor or sub-consultant at any tier, and also includes an employee or agent of any of them if the employee or agent has or will have the authority to control or supervise all or a portion of the work for which a Bid/Proposal is made.

C. The Bidder/Offeror warrants that, except as disclosed in §D, below, there are no relevant facts or circumstances now giving rise or which could, in the future, give rise to a conflict of interest.

D. The following facts or circumstances give rise or could in the future give rise to a conflict of interest (explain in detail—attach additional sheets if necessary):

E. The Bidder/Offeror agrees that if an actual or potential conflict of interest arises after the date of this affidavit, the Bidder/Offeror shall immediately make a full disclosure in writing to the procurement officer of all relevant facts and circumstances. This disclosure shall include a description of actions which the Bidder/Offeror has taken and proposes to take to avoid, mitigate, or neutralize the actual or potential conflict of interest. If the contract has been awarded and performance of the contract has begun, the Contractor shall continue performance until notified by the procurement officer of any contrary action to be taken.

I DO SOLEMNLY DECLARE AND AFFIRM UNDER THE PENALTIES OF PERJURY THAT THE CONTENTS OF THIS AFFIDAVIT ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION, AND BELIEF.

Date: \_\_\_\_\_ By: \_\_\_\_\_  
(Authorized Representative and Affiant)

**ATTACHMENT I – MERCURY AFFIDAVIT**

**MERCURY AFFIDAVIT  
(Submit with Bid/Proposal)**

**AUTHORIZED REPRESENTATIVE THEREBY AFFIRM THAT:**

I, \_\_\_\_\_ (name of affiant) am the  
\_\_\_\_\_ (title) and the duly authorized representative of  
\_\_\_\_\_ (name of the business). I possess  
the legal authority to make this affidavit on behalf of myself and the business for which I am acting.

**MERCURY CONTENT INFORMATION:**

The product(s) offered do not contain mercury.

OR

The product(s) offered do contain mercury.

In an attachment to this Mercury Affidavit:

- (1) Describe the product or product component that contains mercury.
- (2) Provide the amount of mercury that is contained in the product or product component. Indicate the unit of measure being used.

**I ACKNOWLEDGE THAT** this affidavit is to be furnished to the procurement officer and may be distributed to units of (1) the State of Maryland; (2) counties or other subdivisions of the State of Maryland; (3) other states; and (4) the federal government. I further acknowledge that this Affidavit is subject to applicable laws of the United States and the State of Maryland, both criminal and civil, and that nothing in this affidavit or any contract resulting from the submission of this Bid/Proposal shall be construed to supersede, amend, modify, or waive, on behalf of the State of Maryland, or any unit of the State of Maryland having jurisdiction, the exercise of any statutory right or remedy conferred by the Constitution and the laws of Maryland with respect to any misrepresentation made or any violation of the obligations, terms and covenants undertaken by the above business with respect to (1) this affidavit, (2) the contract, and (3) other affidavits comprising part of the contract.

**I DO SOLEMNLY DECLARE AND AFFIRM UNDER THE PENALTIES OF PERJURY THAT THE CONTENTS OF THIS AFFIDAVIT ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION, AND BELIEF.**

\_\_\_\_\_ By: \_\_\_\_\_  
Date Signature

Print Name: \_\_\_\_\_  
Authorized Representative and Affiant

## ATTACHMENT J – NON-DISCLOSURE AGREEMENT

This Non-Disclosure Agreement (“Agreement”) is made by and between the State of Maryland (the “State”), acting by and through the Maryland Transit Administration (the “Department”), and \_\_\_\_\_ (the “Contractor”).

### RECITALS

**WHEREAS**, the Contractor has been awarded a contract (the “Contract”) following the solicitation for Bus Procurement – 41 Hybrid Buses, Solicitation # T-8000-0451; and

**WHEREAS**, in order for the Contractor to perform the work required under the Contract, it will be necessary for the State at times to provide the Contractor and the Contractor’s employees, agents, and subcontractors (collectively the “Contractor’s Personnel”) with access to certain information the State deems confidential information (the “Confidential Information”).

**NOW, THEREFORE**, in consideration of being given access to the Confidential Information in connection with the solicitation and the Contract, and for other good and valuable consideration, the receipt and sufficiency of which the parties acknowledge, the parties do hereby agree as follows:

1. Confidential Information means any and all information provided by or made available by the State to the Contractor in connection with the Contract, regardless of the form, format, or media on or in which the Confidential Information is provided and regardless of whether any such Confidential Information is marked as such. Confidential Information includes, by way of example only, information that the Contractor views, takes notes from, copies (if the State agrees in writing to permit copying), possesses or is otherwise provided access to and use of by the State in relation to the Contract.
2. Contractor shall not, without the State’s prior written consent, copy, disclose, publish, release, transfer, disseminate, use, or allow access for any purpose or in any form, any Confidential Information provided by the State except for the sole and exclusive purpose of performing under the Contract. Contractor shall limit access to the Confidential Information to the Contractor’s Personnel who have a demonstrable need to know such Confidential Information in order to perform under the Contract and who have agreed in writing to be bound by the disclosure and use limitations pertaining to the Confidential Information. The names of the Contractor’s Personnel are attached hereto and made a part hereof as **ATTACHMENT J-1**. Contractor shall update **ATTACHMENT J-1** by adding additional names (whether Contractor’s personnel or a subcontractor’s personnel) as needed, from time to time.
3. If the Contractor intends to disseminate any portion of the Confidential Information to non-employee agents who are assisting in the Contractor’s performance of the Contract or who will otherwise have a role in performing any aspect of the Contract, the Contractor shall first obtain the written consent of the State to any such dissemination. The State may grant, deny, or condition any such consent, as it may deem appropriate in its sole and absolute subjective discretion.
4. Contractor hereby agrees to hold the Confidential Information in trust and in strictest confidence, to adopt or establish operating procedures and physical security measures, and to take all other measures necessary to protect the Confidential Information from inadvertent release or disclosure to unauthorized third parties and to prevent all or any portion of the Confidential Information from falling into the public domain or into the possession of persons not bound to maintain the confidentiality of the Confidential Information.
5. Contractor shall promptly advise the State in writing if it learns of any unauthorized use, misappropriation, or disclosure of the Confidential Information by any of the Contractor’s Personnel or the Contractor’s former

Personnel. Contractor shall, at its own expense, cooperate with the State in seeking injunctive or other equitable relief against any such person(s).

6. Contractor shall, at its own expense, return to the Department all copies of the Confidential Information in its care, custody, control or possession upon request of the Department or on termination of the Contract.
7. A breach of this Agreement by the Contractor or by the Contractor's Personnel shall constitute a breach of the Contract between the Contractor and the State.
8. Contractor acknowledges that any failure by the Contractor or the Contractor's Personnel to abide by the terms and conditions of use of the Confidential Information may cause irreparable harm to the State and that monetary damages may be inadequate to compensate the State for such breach. Accordingly, the Contractor agrees that the State may obtain an injunction to prevent the disclosure, copying or improper use of the Confidential Information. The Contractor consents to personal jurisdiction in the Maryland State Courts. The State's rights and remedies hereunder are cumulative and the State expressly reserves any and all rights, remedies, claims and actions that it may have now or in the future to protect the Confidential Information and to seek damages from the Contractor and the Contractor's Personnel for a failure to comply with the requirements of this Agreement. In the event the State suffers any losses, damages, liabilities, expenses, or costs (including, by way of example only, attorneys' fees and disbursements) that are attributable, in whole or in part to any failure by the Contractor or any of the Contractor's Personnel to comply with the requirements of this Agreement, the Contractor shall hold harmless and indemnify the State from and against any such losses, damages, liabilities, expenses, and costs.
9. Contractor and each of the Contractor's Personnel who receive or have access to any Confidential Information shall execute a copy of an agreement substantially similar to this Agreement, in no event less restrictive than as set forth in this Agreement, and the Contractor shall provide originals of such executed Agreements to the State.
10. The parties further agree that:
  - a. This Agreement shall be governed by the laws of the State of Maryland;
  - b. The rights and obligations of the Contractor under this Agreement may not be assigned or delegated, by operation of law or otherwise, without the prior written consent of the State;
  - c. The State makes no representations or warranties as to the accuracy or completeness of any Confidential Information;
  - d. The invalidity or unenforceability of any provision of this Agreement shall not affect the validity or enforceability of any other provision of this Agreement;
  - e. Signatures exchanged by facsimile are effective for all purposes hereunder to the same extent as original signatures;
  - f. The Recitals are not merely prefatory but are an integral part hereof; and
  - g. The effective date of this Agreement shall be the same as the effective date of the Contract entered into by the parties.

**IN WITNESS WHEREOF**, the parties have, by their duly authorized representatives, executed this Agreement as of the day and year first above written.

Contractor: \_\_\_\_\_

Maryland Transit Administration:

By: \_\_\_\_\_ (SEAL)

By: \_\_\_\_\_

Printed Name: \_\_\_\_\_

Printed Name: \_\_\_\_\_

Title: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

Date: \_\_\_\_\_

**NON-DISCLOSURE AGREEMENT – ATTACHMENT J-1**

**LIST OF CONTRACTOR’S EMPLOYEES AND AGENTS WHO WILL BE GIVEN ACCESS TO THE CONFIDENTIAL INFORMATION**

<b>Printed Name and Address of Individual/Agent</b>	<b>Employee (E) or Agent (A)</b>	<b>Signature</b>	<b>Date</b>
_____	_____	_____	_____
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_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

**NON-DISCLOSURE AGREEMENT – ATTACHMENT J-2**

**CERTIFICATION TO ACCOMPANY RETURN OF CONFIDENTIAL INFORMATION**

I AFFIRM THAT:

To the best of my knowledge, information, and belief, and upon due inquiry, I hereby certify that: (i) all Confidential Information which is the subject matter of that certain Non-Disclosure Agreement by and between the State of Maryland and

\_\_\_\_\_ (“Contractor”) dated \_\_\_\_\_, 20\_\_\_\_ (“Agreement”) is attached hereto and is hereby returned to the State in accordance with the terms and conditions of the Agreement; and (ii) I am legally authorized to bind the Contractor to this affirmation.

**I DO SOLEMNLY DECLARE AND AFFIRM UNDER THE PENALTIES OF PERJURY THAT THE CONTENTS OF THIS AFFIDAVIT ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION, AND BELIEF, HAVING MADE DUE INQUIRY.**

\_\_\_\_\_  
Date

\_\_\_\_\_  
Contractor Name

\_\_\_\_\_  
Title of Authorized Representative and Affiant

\_\_\_\_\_  
Signature

**ATTACHMENT K – PERFORMANCE BOND**

STATE OF MARYLAND  
**MARYLAND DEPARTMENT OF TRANSPORTATION**  
 PERFORMANCE BOND

Principal		Business Address of Principal	
<u>Name of Surety:</u> A corporation of the State of _____ and authorized to do business in the State of Maryland.			
<b>PENAL SUM OF THIS PERFORMANCE BOND</b>		<b>DESCRIPTION OF CONTRACT</b>	
		Contract Number: T-8000-0451 Contract Name or Description: The purchase of forty-one (41) – forty (40) foot hybrid buses.	
<b>DATE OF BOND</b>		<b>DATE OF CONTRACT</b>	
(Shall be no later than Date on Contract)		(To be filled in by the Adm.)	
<b>OBLIGEE</b>			
State of Maryland by and through the following Administration acting for the Maryland Department of Transportation:  MARYLAND TRANSIT ADMINISTRATION			

KNOW ALL MEN BY THESE PRESENTS, That we, the principal named above and Surety named above, being authorized to do business in Maryland, and having business addresses as shown above are held and firmly bound unto the Obligee named above in the Penal Sum of this Performance Bond stated above, for the payment of which Penal Sum we bind ourselves, our heirs, executors, administrators, personal representatives, successors, and assigns, jointly and severally, firmly by these presents. However, where Surety is composed of corporations acting as co-sureties, bind ourselves, our successors and assigns, in such Penal Sum jointly and severally as well as severally only for the purpose of allowing a joint action or actions against any or all of us, and for all other purposes each co-surety binds itself, jointly and severally with the Principal, for the payment of such sum as appears above its name below, but if no limit of liability is indicated, the limit of such liability shall be the full amount of the Penal Sum.

WHEREAS, Principal has entered into or will enter into a contract with the State of Maryland, by and through the Administration named above acting for the State of Maryland, which contract is described and dated as shown above, and incorporated herein by reference. The contract and all items incorporated into the contract, together with any and all changes, extensions of time, alterations, modifications, or additions to the contract or to the work to be performed thereunder or to the Plans, Specifications, and Special Provisions, or any of them, or to any other items incorporated into the contract shall hereinafter be referred to as “the Contract”.

WHEREAS, it is one of the conditions precedent to the final award of the Contract that these presents be executed.

NOW, THEREFORE, during the original term of said Contract, during any extensions thereto that may be granted by the Administration, and during the guarantee and warranty period, if any, required under the Contract, unless otherwise stated therein, this Performance Bond shall remain in full force and effect unless and until the following terms and conditions are met:

1. Principal shall well and truly perform the Contract; and
2. Principal and Surety shall comply with the terms and conditions in this Performance Bond.

Whenever Principal shall be declared by the Administration to be in default under the Contract, the Surety may, within 15 days after notice of default from the Administration, notify the Administration of its election to either promptly proceed to remedy the default or promptly proceed to complete the contract in accordance with and subject to its terms and conditions. In the event the Surety does not elect to exercise either of the above stated options, then the Administration thereupon shall have the remaining contract work completed, Surety to remain liable hereunder for all expenses of completion up to but not exceeding the penal sum stated above.

The Surety hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the work to be performed thereunder or the Specifications accompanying the same shall in any way affect its obligations on this Performance Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the work or to the Specifications.

This Performance Bond shall be governed by and construed in accordance with the laws of the State of Maryland and any reference herein to Principal or Surety in the singular shall include all entities in the plural who or which are signatories under the Principal or Surety heading below.

IN WITNESS WHEREOF, Principal and Surety have set their hands and seals to this Performance Bond. If any individual is a signatory under the Principal heading below, then each such individual has signed below on his or her own behalf, has set forth below the name of the firm, if any, in whose name he or she is doing business, and has set forth below his or her title as a sole proprietor. If any partnership or joint venture is a signatory under the Principal heading below, then all members of each such partnership or joint venture, and each member has set forth below his or her title as a general partner, limited partner, or member of joint venture, whichever is applicable. If any corporation is a signatory under the Principal or Surety heading below, then each such corporation has caused the following: the corporation's name to be set forth below, a duly authorized representative of the corporation to affix below the corporation's seal and to attach hereto a notarized corporate resolution or power of attorney authorizing such action, and each such duly authorized representative to sign below and to set forth below his or her title as a representative of the corporation. If any individual acts as a witness to any signature below, then each such individual has signed below and has set forth below his or her title as a witness. All of the above has been done as of the Date of Bond shown above.

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In Presence of: \_\_\_\_\_  
Individual Principal

Witness: \_\_\_\_\_ as to \_\_\_\_\_ (SEAL)

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In Presence of: \_\_\_\_\_  
Co-Partnership Principal

Witness: \_\_\_\_\_ (SEAL)  
\_\_\_\_\_  
(Name of Co-Partnership)

\_\_\_\_\_ as to By: \_\_\_\_\_ (SEAL)  
\_\_\_\_\_ as to \_\_\_\_\_ (SEAL)  
\_\_\_\_\_ as to \_\_\_\_\_ (SEAL)

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Corporate Principal

Attest: \_\_\_\_\_  
(Name of Corporation)

\_\_\_\_\_ as to By: \_\_\_\_\_ AFFIX  
Corporate Secretary President CORPORATE  
SEAL

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(Surety)

Attest: \_\_\_\_\_ AFFIX  
(SEAL) By: \_\_\_\_\_ CORPORATE  
SEAL

\_\_\_\_\_ Title \_\_\_\_\_  
Signature  
Bonding Agent's Name: \_\_\_\_\_

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(Business Address of Surety)

Agent's Address \_\_\_\_\_

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Approved as to legal form and sufficiency this  
\_\_\_\_\_ day of \_\_\_\_\_ 20 \_\_\_\_

\_\_\_\_\_  
Assistant Attorney General

**ATTACHMENT L – BID BOND**

**(must be submitted with Bid)**

Bond No. \_\_\_\_\_

We, \_\_\_\_\_ as Principal, hereinafter called the Principal, and \_\_\_\_\_, a corporation duly organized under the laws of the State of \_\_\_\_\_, as Surety, hereinafter called the Surety, are held and firmly bound unto the State of Maryland, hereinafter called "State", for the sum of \_\_\_\_\_ for the payment of which sum, the Principal and the Surety bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a bid for \_\_\_\_\_  
(Identify project by number and brief description):

NOW, THEREFORE, if the Principal, upon acceptance by the State of its bid identified above, within the period specified therein for acceptance (ninety (90) days, if no period is specified), shall execute such further contractual documents, if any, and give such bond(s) as may be required by the terms of the bid as accepted within the time specified (ten (10) days if no period is specified) after receipt of the forms, or in the event of failure so to execute such further contractual documents and give such bonds, if the Principal shall pay the State the difference not to exceed the penalty hereof between the amount specified in Principal's bid and such larger amount for which the State may in good faith contract with another party to perform the work covered by said bid, then the above obligation shall be void and of no effect.

The Surety executing this instrument hereby agrees that its obligation shall not be impaired by any extension(s) of the time for acceptance of the bid that the Principal may grant to the State, notice of which extension(s) to the Surety being hereby waived; provided that such waiver of notice shall apply only with respect to extensions aggregating not more than ninety (90) calendar days in addition to the period originally allowed for acceptance of the bid.

In Presence of:  
Witness

Individual Principal

\_\_\_\_\_  
(Name) \_\_\_\_\_ (SEAL)

\_\_\_\_\_ as to

In Presence of:  
Witness:

Partnership Principal

\_\_\_\_\_  
(Name) \_\_\_\_\_ (SEAL)

\_\_\_\_\_ as to

(Partner) \_\_\_\_\_ (SEAL)

\_\_\_\_\_ as to

(Partner) \_\_\_\_\_ (SEAL)

\_\_\_\_\_ as to

(Partner) \_\_\_\_\_ (SEAL)

Attest:

Corporate Principal

\_\_\_\_\_  
(Name of Corporation)      AFFIX

\_\_\_\_\_  
Secretary

By: \_\_\_\_\_  
          President              SEAL

Attest:

\_\_\_\_\_  
(Surety)                      AFFIX

By: \_\_\_\_\_  
          Attorney-in-fact          SEAL

Bonding Agent's Name \_\_\_\_\_

Agent's Address \_\_\_\_\_

Approved as to form and legal sufficiency

This \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_

**ATTACHMENT M – LOCATION OF THE PERFORMANCE OF SERVICES DISCLOSURE**

**(submit with Bid/Proposal)**

Pursuant to Md. Ann. Code, State Finance and Procurement Article, § 12-111, and in conjunction with the Bid/Proposal submitted in response to Solicitation No. **T-8000-0451**, the following disclosures are hereby made:

- 1. At the time of Bid/Proposal submission, the Bidder/Offeror and/or its proposed subcontractors:
  - \_\_\_ have plans
  - \_\_\_ have **no** plans

to perform any services required under the resulting Contract outside of the United States.

2. If services required under the contract are anticipated to be performed outside the United States by either the Bidder/Offeror or its proposed subcontractors, the Bidder/Offeror shall answer the following (attach additional pages if necessary):

- a. Location(s) services will be performed:

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- b. Reasons why it is necessary or advantageous to perform services outside the United States:

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The undersigned, being an authorized representative of the Bidder/Offeror, hereby affirms that the contents of this disclosure are true to the best of my knowledge, information, and belief.

Date: \_\_\_\_\_

Bidder/Offeror Name: \_\_\_\_\_

By (Signature): \_\_\_\_\_

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Please be advised that the Department may contract for services provided outside of the United States if: the services are not available in the United States; the price of services in the United States exceeds by an unreasonable amount the price of services provided outside the United States; or the quality of services in the United States is substantially less than the quality of comparably priced services provided outside the United States.

**ATTACHMENT N – BUY AMERICA CERTIFICATE**

(submit with Bid/Proposal)

STATE OF MARYLAND  
DEPARTMENT OF TRANSPORTATION  
MARYLAND TRANSIT ADMINISTRATION

As a condition of responsiveness, the bidder or offeror must submit with his bid a completed Certificate of Compliance OR a Certificate of Non-Compliance.

**STEEL, IRON OR MANUFACTURED PRODUCTS**

CERTIFICATE OF COMPLIANCE WITH 49 U.S.C. 5323 (j)(1)

The bidder hereby certifies that it will comply with the requirements of 49 U.S.C. 5323(j)(1) and the applicable regulations in 49 C.F.R. Part 661.5.

DATE \_\_\_\_\_

SIGNATURE \_\_\_\_\_

COMPANY NAME \_\_\_\_\_

TITLE \_\_\_\_\_

-OR-

CERTIFICATE FOR NON-COMPLIANCE WITH 49 U.S.C. 5323 (j)(1)

The bidder hereby certifies that it cannot comply with the requirements of 49 U.S.C. 5323(j)(1) and 49 C.F.R. 661.5, but it may qualify for an exception pursuant to 49 U.S.C. 5323(j)(2)(A), 5323(j)(2)(B), or 5323(j)(2)(D), and 49 C.F.R. 661.7.4

DATE \_\_\_\_\_

SIGNATURE \_\_\_\_\_

COMPANY NAME \_\_\_\_\_

TITLE \_\_\_\_\_

**ATTACHMENT O – BUS TESTING CERTIFICATION**

(must be submitted with bid)

**Bus Testing**

**49 U.S.C. 5318(e)**

**49 CFR Part 665**

The Contractor [Manufacturer] agrees to comply with 49 U.S.C. A 5323(c) and FTA's implementing regulation at 49 CFR Part 665 and shall perform the following:

1. A manufacturer of a new bus model or a bus produced with a major change in components or configuration shall provide a copy of the final test report to the recipient at a point in the procurement process specified by the recipient which will be prior to the recipient's final acceptance of the first vehicle.
2. A manufacturer who releases a report under paragraph 1 above shall provide notice to the operator of the testing facility that the report is available to the public.
3. If the manufacturer represents that the vehicle was previously tested, the vehicle being sold should have the identical configuration and major components as the vehicle in the test report, which must be provided to the recipient prior to recipient's final acceptance of the first vehicle. If the configuration or components are not identical, the manufacturer shall provide a description of the change and the manufacturer's basis for concluding that it is not a major change requiring additional testing.
4. If the manufacturer represents that the vehicle is "grandfathered" (has been used in mass transit service in the United States before October 1, 1988, and is currently being produced without a major change in configuration or components), the manufacturer shall provide the name and address of the recipient of such a vehicle and the details of that vehicle's configuration and major components.

**CERTIFICATION OF COMPLIANCE WITH FTA'S BUS TESTING REQUIREMENTS**

The undersigned [Contractor/Manufacturer] certifies that the vehicle offered in this procurement complies with 49 U.S.C. A 5323(c) and FTA's implementing regulation at 49 CFR Part 665.

The undersigned understands that misrepresenting the testing status of a vehicle acquired with Federal financial assistance may subject the undersigned to civil penalties as outlined in the Department of Transportation's regulation on Program Fraud Civil Remedies, 49 CFR Part 31. In addition, the undersigned understands that FTA may suspend or debar a manufacturer under the procedures in 49 CFR Part 29.

Date: \_\_\_\_\_

Signature: \_\_\_\_\_

Company Name: \_\_\_\_\_

Title: \_\_\_\_\_

**BUY AMERICA**

**REQUIREMENTS**

**CONTRACT T-8000-0451**

## Title 49 - Transportation

### PART 661—BUY AMERICA REQUIREMENTS

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#### Section Contents

- § 661.1 Applicability.
  - § 661.3 Definitions.
  - § 661.5 General requirements.
  - § 661.6 Certification requirements for procurement of steel or manufactured products.
  - § 661.7 Waivers.
  - § 661.9 Application for waivers.
  - § 661.11 Rolling stock procurements.
  - § 661.12 Certification requirement for procurement of buses, other rolling stock and associated equipment.
  - § 661.13 Grantee responsibility.
  - § 661.15 Investigation procedures.
  - § 661.17 Failure to comply with certification.
  - § 661.18 Intentional violations.
  - § 661.19 Sanctions.
  - § 661.20 Rights of parties.
  - § 661.21 State Buy America provisions.
- 

**Authority:** 49 U.S.C. 5323(j) (formerly sec. 165 of the Surface Transportation Assistance Act of 1982 (Pub. L. 97-424); as amended by sec. 337, Pub. L. 100-17; sec. 1048, Pub. L. 102-240; sec. 3020(b), Pub. L. 105-178; and sec. 3023(i) and (k), Pub. L. 109-59); 49 CFR 1.51.

**Source:** 56 FR 932, Jan. 9, 1991, unless otherwise noted.

#### § 661.1 Applicability.

Unless otherwise noted, this part applies to all federally assisted procurements using funds authorized by 49 U.S.C. 5323(j); 23 U.S.C. 103(e)(4); and section 14 of the National Capital Transportation Act of 1969, as amended.

[56 FR 932, Jan. 9, 1991, as amended at 72 FR 53696, Sept. 20, 2007]

#### § 661.3 Definitions.

As used in this part:

*Act* means the Federal Public Transportation Law (49 U.S.C. Chapter 53).

*Administrator* means the Administrator of FTA, or designee.

*Component* means any article, material, or supply, whether manufactured or unmanufactured, that is directly incorporated into the end product at the final assembly location.

*Contractor* means a party to a third party contract other than the grantee.

*End product* means any vehicle, structure, product, article, material, supply, or system, which directly incorporates constituent components at the final assembly location, that is acquired for public use under a federally-funded third-party contract, and which is ready to provide its

intended end function or use without any further manufacturing or assembly change(s). A list of representative end products is included at Appendix A to this section.

*FTA* means the Federal Transit Administration.

*Grantee* means any entity that is a recipient of FTA funds.

*Manufactured product* means an item produced as a result of the manufacturing process.

*Manufacturing process* means the application of processes to alter the form or function of materials or of elements of the product in a manner adding value and transforming those materials or elements so that they represent a new end product functionally different from that which would result from mere assembly of the elements or materials.

*Negotiated procurement* means a contract awarded using other than sealed bidding procedures.

*Rolling stock* means transit vehicles such as buses, vans, cars, railcars, locomotives, trolley cars and buses, and ferry boats, as well as vehicles used for support services.

*System* means a machine, product, or device, or a combination of such equipment, consisting of individual components, whether separate or interconnected by piping, transmission devices, electrical cables or circuitry, or by other devices, which are intended to contribute together to a clearly defined function. Factors to consider in determining whether a system constitutes an end product include: Whether performance warranties apply to an integrated system (regardless of whether components are separately warranted); whether products perform on an integrated basis with other products in a system, or are operated independently of associated products in the system; or whether transit agencies routinely procure a product separately (other than as replacement or spare parts).

*United States* means the several States, the Commonwealth of Puerto Rico, the District of Columbia, Guam, American Samoa, the U.S. Virgin Islands, and the Commonwealth of the Northern Mariana Islands.

#### Appendix A to §661.3—End Products

The following is a list of representative end products that are subject to the requirements of Buy America. This list is representative, not exhaustive.

(1) *Rolling stock end products*: All individual items identified as rolling stock in §661.3 ( *e.g.*, buses, vans, cars, railcars, locomotives, trolley cars and buses, ferry boats, as well as vehicles used for support services); train control, communication, and traction power equipment that meets the definition of end product at §661.3 ( *e.g.*, a communication or traction power system, including manufactured bimetallic power rail).

(2) *Steel and iron end products*: Items made primarily of steel or iron such as structures, bridges, and track work, including running rail, contact rail, and turnouts.

(3) *Manufactured end products*: Infrastructure projects not made primarily of steel or iron, including structures (terminals, depots, garages, and bus shelters), ties and ballast; contact rail not made primarily of steel or iron; fare collection systems; computers; information systems; security systems; data processing systems; and mobile lifts, hoists, and elevators.

[72 FR 53696, Sept. 20, 2007, as amended at 74 FR 30239, June 25, 2009]

**§ 661.5 General requirements.**

(a) Except as provided in §661.7 and §661.11 of this part, no funds may be obligated by FTA for a grantee project unless all iron, steel, and manufactured products used in the project are produced in the United States.

(b) All steel and iron manufacturing processes must take place in the United States, except metallurgical processes involving refinement of steel additives.

(c) The steel and iron requirements apply to all construction materials made primarily of steel or iron and used in infrastructure projects such as transit or maintenance facilities, rail lines, and bridges. These items include, but are not limited to, structural steel or iron, steel or iron beams and columns, running rail and contact rail. These requirements do not apply to steel or iron used as components or subcomponents of other manufactured products or rolling stock, or to bimetallic power rail incorporating steel or iron components.

(d) For a manufactured product to be considered produced in the United States:

(1) All of the manufacturing processes for the product must take place in the United States; and

(2) All of the components of the product must be of U.S. origin. A component is considered of U.S. origin if it is manufactured in the United States, regardless of the origin of its subcomponents.

[61 FR 6302, Feb. 16, 1996, as amended at 74 FR 30239, June 25, 2009]

**§ 661.6 Certification requirements for procurement of steel or manufactured products.**

If steel, iron, or manufactured products (as defined in §§661.3 and 661.5 of this part) are being procured, the appropriate certificate as set forth below shall be completed and submitted by each bidder or offeror in accordance with the requirement contained in §661.13(b) of this part.

*Certificate of Compliance with Buy America Requirements*

The bidder or offeror hereby certifies that it will comply with the requirements of 49 U.S.C. 5323(j)(1), and the applicable regulations in 49 CFR part 661.

Date \_\_\_\_\_  
Signature \_\_\_\_\_  
Company \_\_\_\_\_  
Name \_\_\_\_\_  
Title \_\_\_\_\_

*Certificate of Non-Compliance with Buy America Requirements*

The bidder or offeror hereby certifies that it cannot comply with the requirements of 49 U.S.C. 5323(j), but it may qualify for an exception to the requirement pursuant to 49 U.S.C. 5323(j)(2), as amended, and the applicable regulations in 49 CFR 661.7.

Date \_\_\_\_\_  
Signature \_\_\_\_\_  
Company \_\_\_\_\_

Name \_\_\_\_\_  
Title \_\_\_\_\_

[71 FR 14117, Mar. 21, 2006, as amended at 72 FR 53696, Sept. 20, 2007]

**§ 661.7 Waivers.**

(a) Section 5323(j)(2) of Title 49 United States Code provides that the general requirements of 49 U.S.C. 5323(j)(1) shall not apply in four specific instances. This section sets out the conditions for the three statutory waivers based on public interest, non-availability, and price-differential. Section 661.11 of this part sets out the conditions for the fourth statutory waiver governing the procurement of rolling stock and associated equipment.

(b) Under the provision of 49 U.S.C. 5323(j)(2)(A), the Administrator may waive the general requirements of 49 U.S.C. 5323(j)(1) if the Administrator finds that their application would be inconsistent with the public interest. In determining whether the conditions exist to grant this public interest waiver, the Administrator will consider all appropriate factors on a case-by-case basis, unless a general exception is specifically set out in this part. When granting a public interest waiver, the Administrator shall issue a detailed written statement justifying why the waiver is in the public interest. The Administrator shall publish this justification in the Federal Register providing the public with a reasonable time for notice and comment of not more than seven calendar days.

(c) Under the provision of 49 U.S.C. 5323(j)(2), the Administrator may waive the general requirements of 49 U.S.C. 5323(j) if the Administrator finds that the materials for which a waiver is requested are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality.

(1) It will be presumed that the conditions exist to grant this non-availability waiver if no responsive and responsible bid is received offering an item produced in the United States.

(2) In the case of a sole source procurement, the Administrator will grant this non-availability waiver only if the grantee provides sufficient information which indicates that the item to be procured is only available from a single source or that the item to be procured is not produced in sufficient and reasonably available quantities of a satisfactory quality in the United States.

(3) After contract award, the Administrator may grant a non-availability waiver under this paragraph, in any case in which a bidder or Offeror originally certified compliance with the Buy America requirements in good faith, but can no longer comply with its certification. The Administrator will grant a non-availability waiver only if the grantee provides sufficient evidence that the original certification was made in good faith and that the item to be procured cannot now be obtained domestically due to commercial impossibility or impracticability. In determining whether the conditions exist to grant a post-award non-availability waiver, the Administrator will consider all appropriate factors on a case-by-case basis.

(d) Under the provision of section 165(b)(4) of the Act, the Administrator may waive the general requirements of section 165(a) if the Administrator finds that the inclusion of a domestic item or

domestic material will increase the cost of the contract between the grantee and its supplier of that item or material by more than 25 percent. The Administrator will grant this price-differential waiver if the amount of the lowest responsive and responsible bid offering the item or material that is not produced in the United States multiplied by 1.25 is less than the amount of the lowest responsive and responsible bid offering the item or material produced in the United States.

(e) The four statutory waivers of 49 U.S.C. 5323(j)(2) as set out in this part shall be treated as being separate and distinct from each other.

(f) The waivers described in paragraphs (b) and (c) of this section may be granted for a component or subcomponent in the case of the procurement of the items governed by 49 U.S.C. 5323(j)(2)(C) (requirements for rolling stock). If a waiver is granted for a component or a subcomponent, that component or subcomponent will be considered to be of domestic origin for the purposes of §661.11 of this part.

(g) The waivers described in paragraphs (b) and (c) of this section may be granted for a specific item or material that is used in the production of a manufactured product that is governed by the requirements of §661.5(d) of this part. If such a waiver is granted to such a specific item or material, that item or material will be treated as being of domestic origin.

(h) The provisions of this section shall not apply to products produced in a foreign country if the Secretary, in consultation with the United States Trade Representative, determines that:

(1) That foreign country is party to an agreement with the United States pursuant to which the head of an agency of the United States has waived the requirements of this section; and

(2) That foreign country has violated the terms of the agreement by discriminating against products covered by this section that are produced in the United States and are covered by the agreement.

#### Appendix A to §661.7—General Waivers

(a) All waivers published in 48 CFR 25.104 which establish excepted articles, materials, and supplies for the Buy American Act of 1933 (41 U.S.C. 10a–d), as the waivers may be amended from time to time, apply to this part under the provisions of §661.7 (b) and (c).

(b) Under the provisions of §661.7 (b) and (c) of this part, a general public interest waiver from the Buy America requirements applies to microprocessors, computers, microcomputers, or software, or other such devices, which are used solely for the purpose of processing or storing data. This general waiver does not extend to a product or device which merely contains a microprocessor or microcomputer and is not used solely for the purpose of processing or storing data.

(c) Under the provisions of §661.7(b) of this part, a general public interest waiver from the Buy America requirements for “small purchases” (as defined in the “common grant rule,” at 49 CFR 18.36(d)) made by FTA grantees with capital, planning, or operating assistance.

[56 FR 932, Jan. 9, 1991, as amended at 60 FR 37928, July 24, 1995, 61 FR 6302, Feb. 16, 1996; 71 FR 14117, Mar. 21, 2006; 72 FR 53697, Sept. 20, 2007; 74 FR 30239, June 25, 2009]

#### § 661.9 Application for waivers.

(a) This section sets out the application procedures for obtaining all waivers, except those general exceptions set forth in this part for which individual applications are unnecessary and

those covered by 49 U.S.C. 5323(j)(2)(C). The procedures for obtaining an exception covered by 49 U.S.C. 5323(j)(2)(C) are set forth in §661.11 of this part.

(b) A bidder or Offeror who seeks to establish grounds for an exception must seek the exception, in a timely manner, through the grantee.

(c) Except as provided in paragraph (d) of this section, only a grantee may request a waiver. The request must be in writing, include facts and justification to support the waiver, and be submitted to the Administrator through the appropriate Regional Office.

(d) FTA will consider a request for a waiver from a potential bidder, Offeror, or supplier only if the waiver is being sought under §661.7 (f) or (g) of this part.

(e) The Administrator will issue a written determination setting forth the reasons for granting or denying the exception request. Each request for an exception, and FTA's action on the request, are available for public inspection under the provisions of 49 CFR part 601, subpart C.

[56 FR 932, Jan. 9, 1991, as amended at 71 FR 14117, Mar. 21, 2006; 72 FR 53697, Sept. 20, 2007]

**§ 661.11 Rolling stock procurements.**

(a) The provisions of §661.5 do not apply to the procurement of buses and other rolling stock (including train control, communication, and traction power equipment), if the cost of components produced in the United States is more than 60 percent of the cost of all components and final assembly takes place in the United States.

(b) The domestic content requirements in paragraph (a) of this section also apply to the domestic content requirements for components set forth in paragraphs (i), (j), and (l) of this section.

(c) A component is any article, material, or supply, whether manufactured or unmanufactured, that is directly incorporated into an end product at the final assembly location.

(d) A component may be manufactured at the final assembly location if the manufacturing process to produce the component is an activity separate and distinct from the final assembly of the end product.

(e) A component is considered to be manufactured if there are sufficient activities taking place to advance the value or improve the condition of the subcomponents of that component; that is, if the subcomponents have been substantially transformed or merged into a new and functionally different article.

(f) Except as provided in paragraph (k) of this section, a subcomponent is any article, material, or supply, whether manufactured or unmanufactured, that is one step removed from a component (as defined in paragraph (c) of this section) in the manufacturing process and that is incorporated directly into a component.

(g) For a component to be of domestic origin, more than 60 percent of the subcomponents of that component, by cost, must be of domestic origin, and the manufacture of the component must take place in the United States. If, under the terms of this part, a component is determined to be

of domestic origin, its entire cost may be used in calculating the cost of domestic content of an end product.

(h) A subcomponent is of domestic origin if it is manufactured in the United States.

(i) If a subcomponent manufactured in the United States is exported for inclusion in a component that is manufactured outside the United States and it receives tariff exemptions under the procedures set forth in 19 CFR 10.11 through 10.24, the subcomponent retains its domestic identity and can be included in the calculation of the domestic content of an end product even if such a subcomponent represents less than 60 percent of the cost of a particular component.

(j) If a subcomponent manufactured in the United States is exported for inclusion in a component manufactured outside the United States and it does not receive tariff exemption under the procedures set forth in 19 CFR 10.11 through 10.24, the subcomponent loses its domestic identity and cannot be included in the calculation of the domestic content of an end product.

(k) Raw materials produced in the United States and then exported for incorporation into a component are not considered to be a subcomponent for the purpose of calculating domestic content. The value of such raw materials is to be included in the cost of the foreign component.

(l) If a component is manufactured in the United States, but contains less than 60 percent domestic subcomponents, by cost, the cost of the domestic subcomponents and the cost of manufacturing the component may be included in the calculation of the domestic content of the end product.

(m) For purposes of this section, except as provided in paragraph (o) of this section:

(1) The cost of a component or a subcomponent is the price that a bidder or Offeror must pay to a subcontractor or supplier for that component or subcomponent. Transportation costs to the final assembly location must be included in calculating the cost of foreign components and subcomponents.

(2) If a component or subcomponent is manufactured by the bidder or Offeror, the cost of the component is the cost of labor and materials incorporated into the component or subcomponent, an allowance for profit, and the administrative and overhead costs attributable to that component or subcomponent under normal accounting principles.

(n) The cost of a component of foreign origin is set using the foreign exchange rate at the time the bidder or Offeror executes the appropriate Buy America certificate.

(o) The cost of a subcomponent that retains its domestic identity consistent with paragraph (j) of this section shall be the cost of the subcomponent when last purchased, f.o.b. United States port of exportation or point of border crossing as set out in the invoice and entry papers or, if no purchase was made, the value of the subcomponent at the time of its shipment for exportation, f.o.b. United States port of exportation or point of border crossing as set out in the invoice and entry papers.

(p) In accordance with 49 U.S.C. 5323(j), labor costs involved in final assembly shall not be included in calculating component costs.

(q) The actual cost, not the bid price, of a component is to be considered in calculating domestic content.

(r) Final assembly is the creation of the end product from individual elements brought together for that purpose through application of manufacturing processes. If a system is being procured as the end product by the grantee, the installation of the system qualifies as final assembly.

(s) [Reserved]

(t) Train control equipment includes, but is not limited to, the following equipment:

- (1) Mimic board in central control
- (2) Dispatcher's console
- (3) Local control panels
- (4) Station (way side) block control relay cabinets
- (5) Terminal dispatcher machines
- (6) Cable/cable trays
- (7) Switch machines
- (8) Way side signals
- (9) Impedance bonds
- (10) Relay rack bungalows
- (11) Central computer control
- (12) Brake equipment
- (13) Brake systems
- (14) Cab Signaling;
- (15) ATO Equipment;
- (16) ATP Equipment;
- (17) Wayside Transponders;
- (18) Trip Stop Equipment;
- (19) Wayside Magnets;
- (20) Speed Measuring Devices;
- (21) Car Axle Counters;
- (22) Communication Based Train Control (CBTC).

(u) Communication equipment includes, but is not limited to, the following equipment:

- (1) Radios

- (2) Space station transmitter and receivers
- (3) Vehicular and hand-held radios
- (4) PABX telephone switching equipment
- (5) PABX telephone instruments
- (6) Public address amplifiers
- (7) Public address speakers
- (8) Cable transmission system cable
- (9) Cable transmission system multiplex equipment
- (10) Communication console at central control
- (11) Uninterruptible power supply inverters/rectifiers
- (12) Uninterruptible power supply batteries
- (13) Data transmission system central processors
- (14) Data transmission system remote terminals
- (15) Line printers for data transmission system
- (16) Communication system monitor test panel
- (17) Security console at central control
- (18) Antennas;
- (19) Wireless Telemetry Equipment;
- (20) Passenger Information Displays;
- (21) Communications Control Units;
- (22) Communication Control Heads;
- (23) Wireless Intercar Transceivers;
- (24) Multiplexers;
- (25) SCADA Systems;
- (26) LED Arrays;
- (27) Screen Displays such as LEDs and LCDs for communication systems;
- (28) Fiber-optic transmission equipment;
- (29) Fiber-optic transmission equipment;
- (30) Frame or cell based multiplexing equipment; 13) Communication system network elements.

(v) Traction power equipment includes, but is not limited to the following:

9 of 22

- (1) Primary AC switch gear
- (2) Primary AC transformer rectifiers
- (3) DC switch gear
- (4) Traction power console and CRT display system at central control
- (5) Bus ducts with buses (AC and DC)
- (6) Batteries
- (7) Traction power rectifier assemblies
- (8) Distribution panels (AC and DC)
- (9) Facility step-down transformers
- (10) Motor control centers (facility use only)
- (11) Battery chargers
- (12) Supervisory control panel
- (13) Annunciator panels
- (14) Low voltage facility distribution switch board
- (15) DC connect switches
- (16) Negative bus boxes
- (17) Power rail insulators
- (18) Power cables (AC and DC)
- (19) Cable trays
- (20) Instrumentation for traction power equipment
- (21) Connectors, tensioners, and insulators for overhead power wire systems
- (22) Negative drainage boards
- (23) Inverters
- (24) Traction motors
- (25) Propulsion gear boxes
- (26) Third rail pick-up equipment
- (27) Pantographs
- (28) Propulsion Control Systems;
- (29) Surge Arrestors;
- (30) Protective Relaying.

(31) Bimetallic power rail.

(w) The power or third rail is not considered traction power equipment and is thus subject to the requirements of 49 U.S.C. 5323(j) and the requirements of §661.5.

(x) A bidder on a contract for an item covered by 49 U.S.C. 5323(j) who will comply with section 165(b)(3) and regulations in this section is not required to follow the application for waiver procedures set out in §661.9. In lieu of these procedures, the bidder must submit the appropriate certificate required by §661.12.

Appendix A to §661.11—General Waivers

(a) The provisions of §661.11 of this part do not apply when foreign sourced spare parts for buses and other rolling stock (including train control, communication, and traction power equipment) whose total cost is 10 percent or less of the overall project contract cost are being procured as part of the same contract for the major capital item.

(b) [Reserved]

Appendix B to §661.11—Typical Components of Buses

The following is a list of items that typically would be considered components of a bus. This list is not all-inclusive.

Car body shells, engines, transmissions, front axle assemblies, rear axle assemblies, drive shaft assemblies, front suspension assemblies, rear suspension assemblies, air compressor and pneumatic systems, generator/alternator and electrical systems, steering system assemblies, front and rear air brake assemblies, air conditioning compressor assemblies, air conditioning evaporator/condenser assemblies, heating systems, passenger seats, driver's seat assemblies, window assemblies, entrance and exit door assemblies, door control systems, destination sign assemblies, interior lighting assemblies, front and rear end cap assemblies, front and rear bumper assemblies, specialty steel (structural steel tubing, etc.) aluminum extrusions, aluminum, steel or fiberglass exterior panels, and interior trim, flooring, and floor coverings.

Appendix C to §661.11—Typical Components of Rail Rolling Stock

The following is a list of items that typically would be considered components of rail rolling stock. This list is not all inclusive.

Car shells, engines, main transformer, pantographs, traction motors, propulsion gear boxes, interior linings, acceleration and braking resistors, propulsion controls, low voltage auxiliary power supplies, air conditioning equipment, air brake compressors, brake controls, foundation brake equipment, articulation assemblies, train control systems, window assemblies, communication equipment, lighting, seating, doors, door actuators and controls, wheelchair lifts and ramps to make the vehicle accessible to persons with disabilities, couplers and draft gear, trucks, journal bearings, axles, diagnostic equipment, and third rail pick-up equipment.

Appendix D to §661.11—Minimum Requirements for Final Assembly

(a) Rail Cars: In the case of the manufacture of a new rail car, final assembly would typically include, as a minimum, the following operations: installation and interconnection of propulsion control equipment, propulsion cooling equipment, brake equipment, energy sources for auxiliaries and controls, heating and air conditioning, communications equipment, motors, wheels and axles, suspensions and frames; the inspection and verification of all installation and interconnection work; and the in-plant testing of the stationary product to verify all functions.

(b) Buses: In the case of a new bus, final assembly would typically include, at a minimum, the installation and interconnection of the engine, transmission, axles, including the cooling and braking systems; the installation and interconnection of the heating and air conditioning equipment; the installation of pneumatic and electrical systems, door systems, passenger seats, passenger grab rails, destination signs, wheelchair lifts; and road testing, final inspection, repairs and preparation of the vehicles for delivery.

(c) If a manufacturer's final assembly processes do not include all the activities that are typically considered the minimum requirements, it can request a Federal Transit Administration (FTA) determination of compliance. FTA will review these requests on a case-by-case basis to determine compliance with Buy America.

[61 FR 6302, Feb. 16, 1996, as amended at 62 FR 40954, July 31, 1997; 72 FR 53697, Sept. 20, 2007; 72 FR 55103, Sept. 28, 2007; 74 FR 30239, June 25, 2009]

**§ 661.12 Certification requirement for procurement of buses, other rolling stock and associated equipment.**

If buses or other rolling stock (including train control, communication, and traction power equipment) are being procured, the appropriate certificate as set forth below shall be completed and submitted by each bidder in accordance with the requirement contained in §661.13(b) of this part.

*Certificate of Compliance with Buy America Rolling Stock Requirements*

The bidder or Offeror hereby certifies that it will comply with the requirements of 49 U.S.C. 5323(j), and the applicable regulations of 49 CFR 661.11.

Date \_\_\_\_\_  
Signature \_\_\_\_\_  
Company \_\_\_\_\_  
Name \_\_\_\_\_  
Title \_\_\_\_\_

*Certificate of Non-Compliance with Buy America Rolling Stock Requirements*

The bidder or Offeror hereby certifies that it cannot comply with the requirements of 49 U.S.C. 5323(j), but may qualify for an exception to the requirement consistent with 49 U.S.C. 5323(j)(2)(C), and the applicable regulations in 49 CFR 661.7.

Date \_\_\_\_\_  
Signature \_\_\_\_\_  
Company \_\_\_\_\_  
Name \_\_\_\_\_  
Title \_\_\_\_\_

[71 FR 14117, Mar. 21, 2006, as amended at 72 FR 53698, Sept. 20, 2007; 74 FR 30239, June 25, 2009]

**§ 661.13 Grantee responsibility.**

- (a) The grantee shall adhere to the Buy America clause set forth in its grant contract with FTA.
- (b) The grantee shall include in its bid or request for proposal (RFP) specification for procurement within the scope of this part an appropriate notice of the Buy America provision. Such specifications shall require, as a condition of responsiveness, that the bidder or Offeror submit with the bid or offer a completed Buy America certificate in accordance with §§661.6 or 661.12 of this part, as appropriate.

(1) A bidder or Offeror who has submitted an incomplete Buy America certificate or an incorrect certificate of noncompliance through inadvertent or clerical error (but not including failure to sign the certificate, submission of certificates of both compliance and non-compliance, or failure to submit any certification), may submit to the FTA Chief Counsel within ten (10) days of bid opening of submission or a final offer, a written explanation of the circumstances surrounding the submission of the incomplete or incorrect certification in

12 of 22

accordance with 28 U.S.C. 1746, sworn under penalty of perjury, stating that the submission resulted from inadvertent or clerical error. The bidder or Offeror will also submit evidence of intent, such as information about the origin of the product, invoices, or other working documents. The bidder or Offeror will simultaneously send a copy of this information to the FTA grantee.

(i) The FTA Chief Counsel may request additional information from the bidder or Offeror, if necessary. The grantee may not make a contract award until the FTA Chief Counsel issues his/her determination, except as provided in §661.15(m).

(ii) [Reserved]

(2) For negotiated procurements, compliance with the Buy America requirements shall be determined on the basis of the certification submitted with the final offer or final revised proposal. However, where a grantee awards on the basis of initial proposals without discussion, the certification submitted with the initial proposal shall control.

(3) Certification based on ignorance of the proper application of the Buy America requirements is not an inadvertent or clerical error.

(c) Whether or not a bidder or Offeror certifies that it will comply with the applicable requirement, such bidder or Offeror is bound by its original certification (in the case of a sealed bidding procurement) or its certification submitted with its final offer (in the case of a negotiated procurement) and is not permitted to change its certification after bid opening or submission of a final offer. Where a bidder or Offeror certifies that it will comply with the applicable Buy America requirements, the bidder, Offeror, or grantee is not eligible for a waiver of those requirements.

[56 FR 932, Jan. 9, 1991, as amended at 68 FR 9799, Feb. 28, 2003; 71 FR 14117, Mar. 21, 2006]

#### **§ 661.15 Investigation procedures.**

(a) It is presumed that a bidder or Offeror who has submitted the required Buy America certificate is complying with the Buy America provision. A false certification is a criminal act in violation of 18 U.S.C. 1001.

(b) Any party may petition FTA to investigate the compliance of a successful bidder or Offeror with the bidder's or Offeror's certification. That party ("the petitioner") must include in the petition a statement of the grounds of the petition and any supporting documentation. If FTA determines that the information presented in the petition indicates that the presumption in paragraph (a) of this section has been overcome, FTA will initiate an investigation.

(c) In appropriate circumstances, FTA may determine on its own to initiate an investigation without receiving a petition from a third party.

(d) When FTA determines under paragraph (b) or (c) of this section to conduct an investigation, it requests that the grantee require the successful bidder or Offeror to document its compliance with its Buy America certificate. The successful bidder or Offeror has the burden of proof to establish that it is in compliance. Documentation of compliance is based on the specific

circumstances of each investigation, and FTA will specify the documentation required in each case.

(e) The grantee shall reply to the request under paragraph (d) of this section within 15 working days of the request. The investigated party may correspond directly with FTA during the course of investigation, if it informs the grantee that it intends to do so, and if the grantee agrees to such action in writing. The grantee must inform FTA, in writing that the investigated party will respond directly to FTA. An investigated party may provide confidential or proprietary information (see paragraph (l) of this section) directly to FTA while providing other information required to be submitted as part of the investigation through the grantee.

(f) Any additional information requested or required by FTA must be submitted within 5 working days after the receipt of such request unless specifically exempted by FTA.

(g) The grantee's reply (or that of the bidder or Offeror) will be transmitted to the petitioner. The petitioner may submit comments on the reply to FTA within 10 working days after receipt of the reply. The grantee and the low bidder or Offeror will be furnished with a copy of the petitioner's comments, and their comments must be received by FTA within 5 working days after receipt of the petitioner's comments.

(h) The failure of a party to comply with the time limits stated in this section may result in resolution of the investigation without consideration of untimely filed comments.

(i) During the course of an investigation, with appropriate notification to affected parties, FTA may conduct site visits of manufacturing facilities and final assembly locations as it considers appropriate.

(j) FTA will, upon request, make available to any interested party information bearing on the substance of the investigation which has been submitted by the petitioner, interested parties or grantees, except to the extent that withholding of information is permitted or required by law or regulation.

(k) If a party submitting information considers that the information submitted contains proprietary material which should be withheld, a statement advising FTA of this fact may be included, and the alleged proprietary information must be identified wherever it appears. Any comments on the information provided shall be submitted within a maximum of ten days.

(l) For purposes of paragraph (j) of this section, confidential or proprietary material is any material or data whose disclosure could reasonably be expected to cause substantial competitive harm to the party claiming that the material is confidential or proprietary.

(m) When a petition for investigation has been filed before award, the grantee will not make an award before the resolution of the investigation, unless the grantee determines that:

- (1) The items to be procured are urgently required;
- (2) Delivery of performance will be unduly delayed by failure to make the award promptly;  
or
- (3) Failure to make prompt award will otherwise cause undue harm to the grantee or the Federal Government.

(n) In the event that the grantee determines that the award is to be made during the pendency of an investigation, the grantee will notify FTA before to making such award. FTA reserves the right not to participate in the funding of any contract awarded during the pendency of an investigation.

(o) Initial decisions by FTA will be in written form. Reconsideration of an initial decision of FTA may be requested by any party involved in an investigation. FTA will only reconsider a decision only if the party requesting reconsideration submits new matters of fact or points of law that were not known or available to the party during the investigation. A request for reconsideration of a decision of FTA shall be filed not later than ten (10) working days after the initial written decision. A request for reconsideration will be subject to the procedures in this section consistent with the need for prompt resolution of the matter.

[56 FR 932, Jan. 9, 1991, as amended at 71 FR 14118, Mar. 21, 2006]

**§ 661.17 Failure to comply with certification.**

If a successful bidder or Offeror fails to demonstrate that it is in compliance with its certification, it will be required to take the necessary steps in order to achieve compliance. If a bidder or Offeror takes these necessary steps, it will not be allowed to change its original bid price or the price of its final offer. If a bidder or Offeror does not take the necessary steps, it will not be awarded the contract if the contract has not yet been awarded, and it is in breach of contract if a contract has been awarded.

[71 FR 14118, Mar. 21, 2006]

**§ 661.18 Intentional violations.**

A person shall be ineligible to receive any contract or subcontract made with funds authorized under the Federal Public Transportation Act of 2005 pursuant to part 29 of this title if it has been determined by a court or Federal agency that the person intentionally—

(a) Affixed a label bearing a “Made in America” inscription, or an inscription with the same meaning, to a product not made in the United States, but sold in or shipped to the United States and used in projects to which this section applies, or

(b) Otherwise represented that any such product was produced in the United States.

[61 FR 6303, Feb. 16, 1996, as amended at 72 FR 53698, Sept. 20, 2007]

**§ 661.19 Sanctions.**

A willful refusal to comply with a certification by a successful bidder or Offeror may lead to the initiation of debarment or suspension proceedings under part 29 of this title.

[71 FR 14118, Mar. 21, 2006]

**§ 661.20 Rights of parties.**

(a) A party adversely affected by an FTA action under this subsection shall have the right to seek review under the Administrative Procedure Act (APA), 5 U.S.C. 702 *et seq.*

(b) Except as provided in paragraph (a) of this section, the sole right of any third party under the Buy America provision is to petition FTA under the provisions of §661.15 of this part. No third party has any additional right, at law or equity, for any remedy including, but not limited to, injunctions, damages, or cancellation of the Federal grant or contracts of the grantee.

[71 FR 14118, Mar. 21, 2006]

**§ 661.21 State Buy America provisions.**

(a) Except as provided in paragraph (b) of this section, any State may impose more stringent Buy America or buy national requirements than contained in section 165 of the Act and the regulations in this part.

(b) FTA will not participate in contracts governed by the following:

(1) State Buy America or Buy National preference provisions which are not as strict as the Federal requirements.

(2) State and local Buy National or Buy America preference provisions which are not explicitly set out under State law. For example, administrative interpretations of non-specific State legislation will not control.

(3) State and local Buy Local preference provisions.

## **PART 663—PRE-AWARD AND POST-DELIVERY AUDITS OF ROLLING STOCK PURCHASES**

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### **Section Contents**

#### **Subpart A—General**

- § 663.1 Purpose.
- § 663.3 Scope.
- § 663.5 Definitions.
- § 663.7 Certification of compliance to FTA.
- § 663.9 Audit limitations.
- § 663.11 Audit financing.
- § 663.13 Buy America requirements.
- § 663.15 Compliance.

#### **Subpart B—Pre-Award Audits**

- § 663.21 Pre-award audit requirements.
- § 663.23 Description of pre-award audit.
- § 663.25 Pre-award Buy America certification.
- § 663.27 Pre-award purchaser's requirements certification.

#### **Subpart C—Post-Delivery Audits**

- § 663.31 Post-delivery audit requirements.
- § 663.33 Description of post-delivery audit.
- § 663.35 Post-delivery Buy America certification.
- § 663.37 Post-delivery purchaser's requirements certification.
- § 663.39 Post-delivery audit review.

#### **Subpart D—Certification of Compliance With or Inapplicability of Federal Motor Vehicle Safety Standards**

- § 663.41 Certification of compliance with Federal motor vehicle safety standards.
- § 663.43 Certification that Federal motor vehicle standards do not apply.

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**Authority:** 49 U.S.C. 1608(j); 23 U.S.C. 103(e)(f); Pub. L. 96–184, 93 Stat. 1320; Pub. L. 101–551, 104 Stat. 2733; sec. 3023(m), Pub. L. 109–59; 49 CFR 1.51.

**Source:** 56 FR 48395, Sept. 24, 1991, unless otherwise noted.

#### **Subpart A—General**

##### **§ 663.1 Purpose.**

This part implements section 12(j) of the Federal Mass Transit Act of 1964, as amended, which was added by section 319 of the 1987 Surface Transportation and Uniform Relocation Assistance Act (Pub. L. 100–17). Section 12(j) requires the Federal Transit Administration, by delegation from the Secretary of Transportation, to issue regulations requiring pre-award and post-delivery audits when a recipient of Federal financial assistance purchases rolling stock with funds made available under the Federal Mass Transit Act, as amended.

##### **§ 663.3 Scope.**

This part applies to a recipient purchasing rolling stock to carry passengers in revenue service with funds made available under sections 3, 9, 18, and 16(b)(2) of the Federal Mass Transit Act, as amended; 23 U.S.C. 103(e)(4); and section 14 of the National Capital Transportation Act of 1969, as amended.

**§ 663.5 Definitions.**

As used in this part—

- (a) *Pre-award* means that period in the procurement process before the recipient enters into a formal contract with the supplier.
- (b) *Post-delivery* means the time period in the procurement process from when the rolling stock is delivered to the recipient until title to the rolling stock is transferred to the recipient or the rolling stock is put into revenue service, whichever is first.
- (c) *Recipient* means a recipient of Federal financial assistance from FTA.
- (d) *Revenue service* means operation of rolling stock for transportation of fare-paying passengers as anticipated by the recipient.
- (e) *Rolling stock* means buses, vans, cars, railcars, locomotives, trolley cars and buses, ferry boats, and vehicles used for guide ways and incline planes.
- (f) *Audit* means a review resulting in a report containing the necessary certifications of compliance with Buy America standards, purchaser's requirements specifications, and, where appropriate, a manufacturer's certification of compliance with or inapplicability of the Federal Motor Vehicle Safety Standards, required by section 319 of STURAA and this part.
- (g) *FTA* means the Federal Transit Administration.

**§ 663.7 Certification of compliance to FTA.**

A recipient purchasing revenue service rolling stock with funds obligated by FTA on or after October 24, 1991, must certify to FTA that it will conduct or cause to be conducted pre-award and post-delivery audits as prescribed in this part. In addition, such a recipient must maintain on file the certifications required under subparts B, C, and D of this part.

**§ 663.9 Audit limitations.**

- (a) An audit under this part is limited to verifying compliance with
  - (1) Applicable Buy America requirements [section 165 of the Surface Transportation Assistance Act of 1982, as amended,]; and
  - (2) Solicitation specification requirements of the recipient.
- (b) An audit under this part includes, where appropriate, a copy of a manufacturer's self certification information that the vehicle complies with Federal Motor Vehicle Safety Standards or a certification that such standards are inapplicable.
- (c) An audit conducted under this part is separate from the single annual audit requirement established by Office of Management and Budget Circular A-128, "Audits of State and Local Governments," dated May 16, 1985.

**§ 663.11 Audit financing.**

A recipient purchasing revenue rolling stock with FTA funds may charge the cost of activities required by this part to the grant which FTA made for such purchase.

**§ 663.13 Buy America requirements.**

A Buy America certification under this part shall be issued in addition to any certification which may be required by part 661 of this title. Nothing in this part precludes FTA from conducting a Buy America investigation under part 661 of this title.

**§ 663.15 Compliance.**

A recipient subject to this part shall comply with all applicable requirements of this part. Such compliance is a condition of receiving Federal financial assistance from FTA. A recipient determined not to be in compliance with this part will be subject to the immediate suspension, withholding, or repayment of Federal financial assistance from FTA or other appropriate actions unless and until it comes into compliance with this part.

**Subpart B—Pre-Award Audits**

**§ 663.21 Pre-award audit requirements.**

A recipient purchasing revenue service rolling stock with FTA funds must ensure that a pre-award audit under this part is complete before the recipient enters into a formal contract for the purchase of such rolling stock.

**§ 663.23 Description of pre-award audit.**

A pre-award audit under this part includes—

- (a) A Buy America certification as described in §663.25 of this part;
- (b) A purchaser's requirements certification as described in §663.27 of this part; and
- (c) Where appropriate, a manufacturer's Federal Motor Vehicle Safety certification information as described in §663.41 or §663.43 of this part.

**§ 663.25 Pre-award Buy America certification.**

For purposes of this part, a pre-award Buy America certification is a certification that the recipient keeps on file that—

- (a) There is a letter from FTA which grants a waiver to the rolling stock to be purchased from the Buy America requirements under section 165(b)(1), (b)(2), or (b)(4) of the Surface Transportation Assistance Act of 1982, as amended; or
- (b) The recipient is satisfied that the rolling stock to be purchased meets the requirements of section 165(a) or (b)(3) of the Surface Transportation Assistance Act of 1982, as amended, after having reviewed itself or through an audit prepared by someone other than the manufacturer or its agent documentation provided by the manufacturer which lists—
  - (1) Component and subcomponent parts of the rolling stock to be purchased identified by manufacturer of the parts, their country of origin and costs; and
  - (2) The location of the final assembly point for the rolling stock, including a description of the activities that will take place at the final assembly point and the cost of final assembly.

**§ 663.27 Pre-award purchaser's requirements certification.**

For purposes of this part, a pre-award purchaser's requirements certification is a certification a recipient keeps on file that—

- (a) The rolling stock the recipient is contracting for is the same product described in the purchaser's solicitation specification; and
- (b) The proposed manufacturer is a responsible manufacturer with the capability to produce a vehicle that meets the recipient's specification set forth in the recipient's solicitation.

**Subpart C—Post-Delivery Audits**

**§ 663.31 Post-delivery audit requirements.**

A recipient purchasing revenue service rolling stock with FTA funds must ensure that a post-delivery audit under this part is complete before title to the rolling stock is transferred to the recipient.

**§ 663.33 Description of post-delivery audit.**

A post-delivery audit under this part includes—

- (a) A post-delivery Buy America certification as described in §663.35 of this part;
- (b) A post-delivery purchaser's requirements certification as described in §663.37 of this part; and
- (c) When appropriate, a manufacturer's Federal Motor Vehicle Safety Standard self-certification information as described in §663.41 or §663.43 of this part.

**§ 663.35 Post-delivery Buy America certification.**

For purposes of this part, a post-delivery Buy America certification is a certification that the recipient keeps on file that—

- (a) There is a letter from FTA which grants a waiver to the rolling stock received from the Buy America requirements under sections 165 (b)(1), or (b)(4) of the Surface Transportation Assistance Act of 1982, as amended; or
- (b) The recipient is satisfied that the rolling stock received meets the requirements of section 165 (a) or (b)(3) of the Surface Transportation Assistance Act of 1982, as amended, after having reviewed itself or by means of an audit prepared by someone other than the manufacturer or its agent documentation provided by the manufacturer which lists—
  - (1) Components and subcomponent parts of the rolling stock identified by manufacturer of the parts, their country of origin and costs; and
  - (2) The actual location of the final assembly point for the rolling stock including a description of the activities which took place at the final assembly point and the cost of the final assembly.

**§ 663.37 Post-delivery purchaser's requirements certification.**

For purposes of this part, a post-delivery purchaser's requirements certification is a certification that the recipient keeps on file that—

(a) Except for procurements covered under paragraph (c) in this section, a resident inspector (other than an agent or employee of the manufacturer) was at the manufacturing site throughout the period of manufacture of the rolling stock to be purchased and monitored and completed a report on the manufacture of such rolling stock. Such a report, at a minimum, shall—

- (1) Provide accurate records of all vehicle construction activities; and
- (2) Address how the construction and operation of the vehicles fulfills the contract specifications.

(b) After reviewing the report required under paragraph (a) of this section, and visually inspecting and road testing the delivered vehicles, the vehicles meet the contract specifications.

(c) For procurements of:

- (1) Ten or fewer buses; or
- (2) Procurements of twenty vehicles or fewer serving rural (other than urbanized) areas, or urbanized areas of 200,000 people or fewer; or
- (3) Any number of primary manufacturer standard production and unmodified vans, after visually inspecting and road testing the vehicles, the vehicles meet the contract specifications.

[56 FR 48395, Sept. 24, 1991, as amended at 71 FR 14118, Mar. 21, 2006]

**§ 663.39 Post-delivery audit review.**

(a) If a recipient cannot complete a post-delivery audit because the recipient or its agent cannot certify Buy America compliance or that the rolling stock meets the purchaser's requirements specified in the contract, the rolling stock may be rejected and final acceptance by the recipient will not be required. The recipient may exercise any legal rights it has under the contract or at law.

(b) This provision does not preclude the recipient and manufacturer from agreeing to a conditional acceptance of rolling stock pending manufacturer's correction of deviations within a reasonable period of time.

**Subpart D—Certification of Compliance with or Inapplicability of Federal Motor Vehicle Safety Standards**

**§ 663.41 Certification of compliance with Federal motor vehicle safety standards.**

If a vehicle purchased under this part is subject to the Federal Motor Vehicle Safety Standards issued by the National Highway Traffic Safety Administration in part 571 of this title, a recipient shall keep on file its certification that it received, both at the pre-award and post-delivery stage, a copy of the manufacturer's self-certification information that the vehicle complies with relevant Federal Motor Vehicle Safety Standards.

**§ 663.43 Certification that Federal motor vehicle standards do not apply.**

(a) Except for rolling stock subject to paragraph (b) of this section, if a vehicle purchased under this part is not subject to the Federal Motor Vehicle Safety Standards issued by the National Highway Traffic Safety Administration in part 571 of this title, the recipient shall keep on file its certification that it received a statement to that effect from the manufacturer.

(b) This subpart shall not apply to rolling stock that is not a motor vehicle.

**MANDATORY**

**FEDERAL CLAUSES**

**CONTRACT T-8000-0451**

# MANDATORY FEDERAL CLAUSES FOR FEDERALLY FUNDED PROJECTS

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## Cargo Preference Requirements

**46 U.S.C. 1241**  
**46 CFR Part 381**

Use of United States-Flag Vessels - The contractor agrees: a. *to use* privately owned United States-Flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved, whenever shipping any equipment, material, or commodities pursuant to the underlying contract to the extent such vessels are available at fair and reasonable rates for United States-Flag commercial vessels; b. *to furnish within 20* working days following the date of loading for shipments originating within the United States or within 30 working days following the date of leading for shipments originating outside the United States, a legible copy of a rated, "on-board" commercial ocean bill-of-lading in English for each shipment of cargo *described in the preceding paragraph* to the Division of National Cargo, Office of Market Development, Maritime Administration, Washington, DC 20590 and to the FTA recipient (*through the contractor in the case of a subcontractor's bill-of-lading.*) c. *to include these requirements in all subcontracts issued pursuant to this contract when the subcontract may involve the transport of equipment, material, or commodities by ocean vessel.*

## Energy Conservation Requirements

**42 U.S.C. 6321 et seq.**  
**49 CFR Part 18**

The contractor agrees to comply with mandatory standards and policies relating to energy efficiency which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act.

## Clean Water Requirements

**33 U.S.C. 1251**

1. The Contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Federal Water Pollution Control Act, as amended, 33 U.S.C. 1251 et seq. . The Contractor agrees to report each violation to the Purchaser and understands and agrees that the Purchaser will, in turn, report each violation as required to assure notification to FTA and the appropriate EPA Regional Office.
2. The Contractor also agrees to include these requirements in each subcontract exceeding \$100,000 financed in whole or in part with Federal assistance provided by FTA.

## **Federal Changes**

### **49 CFR Part 18**

Contractor shall at all times comply with all applicable FTA regulations, policies, procedures and directives, including without limitation those listed directly or by reference in the Master Agreement between Purchaser and FTA, as they may be amended or promulgated from time to time during the term of this contract. Contractor's failure to so comply shall constitute a material breach of this contract.

## **CLEAN AIR**

### **42 U.S.C. 7401 et seq**

### **40 CFR 15.61**

### **49 CFR Part 18**

1. The Contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. §§ 7401 *et seq.* The Contractor agrees to report each violation to the Purchaser and understands and agrees that the Purchaser will, in turn, report each violation as required to assure notification to FTA and the appropriate EPA Regional Office.
2. The Contractor also agrees to include these requirements in each subcontract exceeding \$100,000 financed in whole or in part with Federal assistance provided by FTA.

## **Recycled Products**

### **42 U.S.C. 6962**

### **40 CFR Part 247**

### **Executive Order 12873**

The contractor agrees to comply with all the requirements of Section 6002 of the Resource Conservation and Recovery Act (RCRA), as amended (42 U.S.C. 6962), including but not limited to the regulatory provisions of 40 CFR Part 247, and Executive Order 12873, as they apply to the procurement of the items designated in Subpart B of 40 CFR Part 247.

## **Davis-Bacon and Copeland Anti-Kickback Acts**

(1) **Minimum wages** - (i) All laborers and mechanics employed or working upon the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and

made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR Part 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph (1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(ii)(A) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

1. Except with respect to helpers as defined as 29 CFR 5.2(n)(4), the work to be performed by the classification requested is not performed by a classification in the wage determination; and
2. The classification is utilized in the area by the construction industry; and
3. The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination; and
4. With respect to helpers as defined in 29 CFR 5.2(n)(4), such a classification prevails in the area in which the work is performed.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the

contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii) (B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(v)(A) The contracting officer shall require that any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefor only when the following criteria have been met:

1. The work to be performed by the classification requested is not performed by a classification in the wage determination; and
2. The classification is utilized in the area by the construction industry; and
3. The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The

Administrator, or an authorized representative, will issue a determination with 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(v) (B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(2) **Withholding** - The MTA shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), all or part of the wages required by the contract, the MTA may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) **Payrolls and basic records** - (i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the project). Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the MTA for transmission to the Federal Transit Administration. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under section 5.5(a)(3)(i) of Regulations, 29 CFR part

5. This information may be submitted in any form desired. Optional Form WH-347 is available for this purpose and may be purchased from the Superintendent of Documents (Federal Stock Number 029-005-00014-1), U.S. Government Printing Office, Washington, DC 20402. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors.

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

1. (1) That the payroll for the payroll period contains the information required to be maintained under section 5.5(a)(3)(i) of Regulations, 29 CFR part 5 and that such information is correct and complete;
2. (2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;
3. (3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the Federal Transit Administration or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) **Apprentices and trainees** - (i) *Apprentices* - Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The

allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator of the Wage and Hour Division of the U.S. Department of Labor determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) *Trainees* - Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) *Equal employment opportunity* - The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) **Compliance with Copeland Act requirements** - The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) **Subcontracts** - The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the Federal Transit Administration may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) **Contract termination: debarment** - A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) **Compliance with Davis-Bacon and Related Act requirements** - All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) **Disputes concerning labor standards** - Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

(10) **Certification of eligibility** - (i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

### **No Government Obligation to Third Parties**

1. The Purchaser and Contractor acknowledge and agree that, notwithstanding any concurrence by the Federal Government in or approval of the solicitation or award of the underlying contract, absent the express written consent by the Federal Government, the Federal Government is not a party to this contract and shall not be subject to any obligations or liabilities to the Purchaser, Contractor, or any other party (whether or not a party to that contract) pertaining to any matter resulting from the underlying contract.

2. The Contractor agrees to include the above clause in each subcontract financed in whole or in part with Federal assistance provided by FTA. It is further agreed that the clause shall not be modified, except to identify the subcontractor who will be subject to its provisions.

## **Program Fraud and False or Fraudulent Statements and Related Acts**

**31 U.S.C. 3801 et seq.  
49 CFR Part 31 18 U.S.C. 1001  
49 U.S.C. 5307**

1. The Contractor acknowledges that the provisions of the Program Fraud Civil Remedies Act of 1986, as amended, 31 U.S.C. § § 3801 et seq . and U.S. DOT regulations, "Program Fraud Civil Remedies," 49 C.F.R. Part 31, apply to its actions pertaining to this Project. Upon execution of the underlying contract, the Contractor certifies or affirms the truthfulness and accuracy of any statement it has made, it makes, it may make, or causes to be made, pertaining to the underlying contract or the FTA assisted project for which this contract work is being performed. In addition to other penalties that may be applicable, the Contractor further acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification, the Federal Government reserves the right to impose the penalties of the Program Fraud Civil Remedies Act of 1986 on the Contractor to the extent the Federal Government deems appropriate.
2. The Contractor also acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification to the Federal Government under a contract connected with a project that is financed in whole or in part with Federal assistance originally awarded by FTA under the authority of 49 U.S.C. § 5307, the Government reserves the right to impose the penalties of 18 U.S.C. § 1001 and 49 U.S.C. § 5307(n)(1) on the Contractor, to the extent the Federal Government deems appropriate.
3. The Contractor agrees to include the above two clauses in each subcontract financed in whole or in part with Federal assistance provided by FTA. It is further agreed that the clauses shall not be modified, except to identify the subcontractor who will be subject to the provisions.

## **Termination**

**49 U.S.C. Part 18  
FTA Circular 4220.1E**

- a. **Termination for Convenience (General Provision)** The (Recipient) may terminate this contract, in whole or in part, at any time by written notice to the Contractor when it is in the Government's best interest. The Contractor shall be paid its costs, including contract close-out costs, and profit on work performed up to the time of termination.

The Contractor shall promptly submit its termination claim to (Recipient) to be paid the Contractor. If the Contractor has any property in its possession belonging to the (Recipient), the Contractor will account for the same, and dispose of it in the manner the (Recipient) directs.

- b. **Termination for Default [Breach or Cause] (General Provision)** If the Contractor does not deliver supplies in accordance with the contract delivery schedule, or, if the contract is for services, the Contractor fails to perform in the manner called for in the contract, or if the Contractor fails to comply with any other provisions of the contract, the (Recipient) may terminate this contract for default. Termination shall be effected by serving a notice of termination on the contractor setting forth the manner in which the Contractor is in default. The contractor will only be paid the contract price for supplies delivered and accepted, or services performed in accordance with the manner of performance set forth in the contract.

If it is later determined by the (Recipient) that the Contractor had an excusable reason for not performing, such as a strike, fire, or flood, events which are not the fault of or are beyond the control of the Contractor, the (Recipient), after setting up a new delivery of performance schedule, may allow the Contractor to continue work, or treat the termination as a termination for convenience.

- c. **Opportunity to Cure (General Provision)** The (Recipient) in its sole discretion may, in the case of a termination for breach or default, allow the Contractor [an appropriately short period of time] in which to cure the defect. In such case, the notice of termination will state the time period in which cure is permitted and other appropriate conditions

If Contractor fails to remedy to (Recipient)'s satisfaction the breach or default of any of the terms, covenants, or conditions of this Contract within [ten (10) days] after receipt by Contractor of written notice from (Recipient) setting forth the nature of said breach or default, (Recipient) shall have the right to terminate the Contract without any further obligation to Contractor. Any such termination for default shall not in any way operate to preclude (Recipient) from also pursuing all available remedies against Contractor and its sureties for said breach or default.

- d. **Waiver of Remedies for any Breach** In the event that (Recipient) elects to waive its remedies for any breach by Contractor of any covenant, term or condition of this Contract, such waiver by (Recipient) shall not limit (Recipient)'s remedies for any succeeding breach of that or of any other term, covenant, or condition of this Contract.
- e. **Termination for Default (Supplies and Service)** If the Contractor fails to deliver supplies or to perform the services within the time specified in this contract or any extension or if the Contractor fails to comply with any other provisions of this contract, the (Recipient) may terminate this contract for default. The (Recipient) shall terminate by delivering to the Contractor a Notice of Termination specifying the nature of the default. The Contractor will only be paid the contract price for supplies delivered and accepted, or services performed in accordance with the manner or performance set forth in this contract.

If, after termination for failure to fulfill contract obligations, it is determined that the Contractor was not in default, the rights and obligations of the parties shall be the same as if the termination had been issued for the convenience of the Recipient.

## **Government-Wide Debarment and Suspension (Nonprocurement)**

### **49 CFR Part 29 Executive Order 12549**

This contract is a covered transaction for purposes of 49 CFR Part 29. As such, the contractor is required to verify that none of the contractor, its principals, as defined at 49 CFR 29.995, or affiliates, as defined at 49 CFR 29.905, are excluded or disqualified as defined at 49 CFR 29.940 and 29.945.

The contractor is required to comply with 49 CFR 29, Subpart C and must include the requirement to comply with 49 CFR 29, Subpart C in any lower tier covered transaction it enters into.

By signing and submitting its bid or proposal, the bidder or proposer certifies as follows:

The certification in this clause is a material representation of fact relied upon by MTA. If it is later determined that the bidder or proposer knowingly rendered an erroneous certification, in addition to remedies available to MTA, the Federal Government may pursue available remedies, including but not limited to suspension and/or debarment. The bidder or proposer agrees to comply with the requirements of 49 CFR 29, Subpart C while this offer is valid and throughout the period of any contract that may arise from this offer. The bidder or proposer further agrees to include a provision requiring such compliance in its lower tier covered transactions.

## **Privacy Act**

### **5 U.S.C. 552**

Contracts Involving Federal Privacy Act Requirements - The following requirements apply to the Contractor and its employees that administer any system of records on behalf of the Federal Government under any contract:

1. The Contractor agrees to comply with, and assures the compliance of its employees with, the information restrictions and other applicable requirements of the Privacy Act of 1974,

5 U.S.C. § 552a. Among other things, the Contractor agrees to obtain the express consent of the Federal Government before the Contractor or its employees operate a system of records on behalf of the Federal Government. The Contractor understands that the requirements of the Privacy Act, including the civil and criminal penalties for violation of that Act, apply to those individuals involved, and that failure to comply with the terms of the Privacy Act may result in termination of the underlying contract.

2. The Contractor also agrees to include these requirements in each subcontract to administer any system of records on behalf of the Federal Government financed in whole or in part with Federal assistance provided by FTA.

### **Civil Rights Requirements**

**29 U.S.C. § 623, 42 U.S.C. § 2000**  
**42 U.S.C. § 6102, 42 U.S.C. § 12112**  
**42 U.S.C. § 12132, 49 U.S.C. § 5332**  
**29 CFR Part 1630, 41 CFR Parts 60 et seq.**

1. *Nondiscrimination* - In accordance with Title VI of the Civil Rights Act, as amended, 42 U.S.C. § 2000d, section 303 of the Age Discrimination Act of 1975, as amended, 42 U.S.C. § 6102, section 202 of the Americans with Disabilities Act of 1990, 42 U.S.C. § 12132, and Federal transit law at 49 U.S.C. § 5332, the Contractor agrees that it will not discriminate against any employee or applicant for employment because of race, color, creed, national origin, sex, age, or disability. In addition, the Contractor agrees to comply with applicable Federal implementing regulations and other implementing requirements FTA may issue.
2. *Equal Employment Opportunity* - The following equal employment opportunity requirements apply to the underlying contract:
  - a. *Race, Color, Creed, National Origin, Sex* - In accordance with Title VII of the Civil Rights Act, as amended, 42 U.S.C. § 2000e, and Federal transit laws at 49 U.S.C. § 5332, the Contractor agrees to comply with all applicable equal employment opportunity requirements of U.S. Department of Labor (U.S. DOL) regulations, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor," 41 C.F.R. Parts 60 *et seq.* , (which implement Executive Order No. 11246, "Equal Employment Opportunity," as amended by Executive Order No. 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," 42 U.S.C. § 2000e note), and with any applicable Federal statutes, executive orders, regulations, and Federal policies that may in the future affect construction activities undertaken in the course of the Project. The Contractor agrees to take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, creed, national origin, sex, or age. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.
  - b. *Age* - In accordance with section 4 of the Age Discrimination in Employment Act of 1967, as amended, 29 U.S.C. § § 623 and Federal transit law at 49 U.S.C. § 5332, the Contractor agrees to refrain from discrimination against present and

prospective employees for reason of age. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

- c. *Disabilities* - In accordance with section 102 of the Americans with Disabilities Act, as amended, 42 U.S.C. § 12112, the Contractor agrees that it will comply with the requirements of U.S. Equal Employment Opportunity Commission, "Regulations to Implement the Equal Employment Provisions of the Americans with Disabilities Act," 29 C.F.R. Part 1630, pertaining to employment of persons with disabilities. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

3. The Contractor also agrees to include these requirements in each subcontract financed in whole or in part with Federal assistance provided by FTA, modified only if necessary to identify the affected parties.

## **Breaches and Dispute Resolution**

### **49 CFR Part 18**

#### **FTA Circular 4220.1E**

**Disputes** - Disputes arising in the performance of this Contract which are not resolved by agreement of the parties shall be decided in writing by the authorized representative of (Recipient)'s [title of employee]. This decision shall be final and conclusive unless within [ten (10)] days from the date of receipt of its copy, the Contractor mails or otherwise furnishes a written appeal to the [title of employee]. In connection with any such appeal, the Contractor shall be afforded an opportunity to be heard and to offer evidence in support of its position. The decision of the [title of employee] shall be binding upon the Contractor and the Contractor shall abide by the decision.

**Performance During Dispute** - Unless otherwise directed by (Recipient), Contractor shall continue performance under this Contract while matters in dispute are being resolved.

**Claims for Damages** - Should either party to the Contract suffer injury or damage to person or property because of any act or omission of the party or of any of his employees, agents or others for whose acts he is legally liable, a claim for damages therefor shall be made in writing to such other party within a reasonable time after the first observance of such injury of damage.

**Remedies** - Unless this contract provides otherwise, all claims, counterclaims, disputes and other matters in question between the (Recipient) and the Contractor arising out of or relating to this agreement or its breach will be decided by arbitration if the parties mutually agree, or in a court of competent jurisdiction within the State in which the (Recipient) is located.

**Rights and Remedies** - The duties and obligations imposed by the Contract Documents and the rights and remedies available thereunder shall be in addition to and not a limitation of any duties, obligations, rights and remedies otherwise imposed or available by law. No action or failure to act by the (Recipient), (Architect) or Contractor shall constitute a waiver of any right or duty afforded any of them under the Contract, nor shall any such action or failure to act constitute an approval of or acquiescence in any breach thereunder, except as may be specifically agreed in writing.

## **Incorporation of Federal Transit Administration (FTA) Terms**

### **FTA Circular 4220.1E**

Incorporation of Federal Transit Administration (FTA) Terms - The preceding provisions include, in part, certain Standard Terms and Conditions required by DOT, whether or not expressly set forth in the preceding contract provisions. All contractual provisions required by DOT, as set forth in FTA Circular 4220.1E are hereby incorporated by reference. Anything to the contrary herein notwithstanding, all FTA mandated terms shall be deemed to control in the event of a conflict with other provisions contained in this Agreement. The Contractor shall not perform any act, fail to perform any act, or refuse to comply with any (name of grantee) requests which would cause (name of grantee) to be in violation of the FTA terms and conditions.

# TECHNICAL SPECIFICATION – 40 FOOT BUS

## SECTION 6: TECHNICAL SPECIFICATIONS

### GENERAL

#### TS 1. Scope

Technical specifications define requirements for **heavy-duty low floor forty (40) foot diesel electric hybrid transit buses**, which, by the selection of specifically identified alternative configurations used in general transit service on urban arterial streets. Buses shall have a minimum expected life of twelve (12) years or 500,000 miles, whichever comes first, and are intended for the widest possible spectrum of passengers, including children, adults, the elderly and people with disabilities.

The MTA has determined in order to potentially reduce costs, it is preferred to continue operation with sub systems and components that are currently being used or that the MTA has tested and proven for use in their transit environment. Standardization of these components allows the MTA to limit risk by using a familiar proven product, one that is currently inventoried in the MTA system and limit training on new and unfamiliar systems / components.

This specification lists components the MTA approves for this procurement. Proposers are encouraged to submit their proposals based on these preferences. MTA approval will be required for substitutions after the proposer has submitted detailed operational and financial benefits of an alternative.

BUS USA: In order to have consistency within the framework of the Intelligent Transportation System (ITS) the MTA has chosen to integrate the systems. This effort is being done by a contractor for the MTA and provides the MTA an architecture for data exchange between the bus and division, control of various bus functions from the division, the ability to identify issues and provide the operator assistance in dealing with them and the ability to analyze the on street operation and service requirements. The MTA has designated this program BUS-USA. The manufacturer shall coordinate the MTA's contracts for integration installation, testing and BUS-USA system acceptance. Language in TS 83 of this specification may reference requirements for existing MTA fleet retrofits that are not a part of this contract.

This integration will affect the following sections that deal with the ITS component of the technical specification:

#### TS 83 Communications

- TS 83.1 Communications Systems Work
- TS 83.2 Radio AVL System
- TS 83.3 On Board Video Surveillance System (OBVSS)
- TS 83.4 Public Address System
- TS 83.5 Automatic Passenger Counter (APC)
- TS 83.6 Radio Handset and Control
- TS 83.7 Mobile Radio System
- TS 83.8 Automatic Voice Annunciation (AVA)
- TS 83.9 Automatic Vehicle Monitoring (AVM)
- TS 83.10 Pedestrian / Bus Warning System
- TS 83.11 Other Intelligent Onboard Electronics
  - TS 83.11.1 Electronic Cabinet
  - TS 83.11.2 Vehicle Area Networks
  - TS 83.11.3 Wireless Local Area Network (WLAN) Router

TS 83.11.4 Communications Antennas  
TS 83.11.5 Bus Mounted Data Recorders  
TS 83.11.6 Engine Auxiliary Heater Control

## TS 2. Definitions

**Absorbed Glass Mat (AGM).** Used in batteries AGM is a thin ultra-fine fiberglass mat sandwiched between the plates that are saturated with battery acid to about 95% of what they can hold. This mat is then packed in between the plates and slightly compressed, then welded/soldered in place.

**Alternative.** An alternative specification condition to the default bus configuration. The MTA may define alternatives to the default configuration to satisfy local operating requirements. Alternatives for the default configuration will be clearly identified.

**Ambient Temperature.** The temperature of the surrounding air. For testing purposes, ambient temperature must be between 16 °C (50 °F) and 38 °C (100 °F).

**Analog Signals.** A continuous variable signal that is solely dependent upon magnitude to express information content.

**NOTE:** Analog signals are used to represent the state of variable devices such as rheostats, potentiometers, temperature probes, etc.

**Anti-Locking Braking System (ABS).** Computerized wheel sensing system used to prevent brake lock up and wheel slide during heavy brake applications.

**American Standard Code for Information Interchange (ASCII).** A character-encoding scheme originally based on the English alphabet that encodes 128 specified characters - the numbers 0-9, the letters a-z and A-Z, some basic punctuation symbols, some control codes that originated with Teletype machines, and a blank space - into the 7-bit binary integers.

**ASHRAE (Formerly the American Society of Heating, Refrigerating and Air Conditioning Engineers).** The Society and its members focus on building systems, energy efficiency, indoor air quality, refrigeration and sustainability within the industry.

**Audible Discrete Frequency.** An audible discrete frequency is determined to exist if the sound power level in any 1/3-octave band exceeds the average of the sound power levels of the two adjacent 1/3-octave bands by 4 decibels (dB) or more.

**Automatic Locking Retractor (ALR).** The seat belt function that allows the user to lock the retractor at a set position.

**Automatic Traction Control System (ATC).** The wheel traction control system which automatically detects a maximum-traction wheel slippage and controls brake and drive systems so as to maintain this maximum-traction wheel slippage.

**Battery Compartment.** Low-voltage energy storage, i.e. 12/24 VDC batteries.

**Battery Management System (BMS).** Monitors energy, as well as temperature, cell or module voltages, and total pack voltage. The BMS adjusts the control strategy algorithms to maintain the batteries at uniform state of charge and optimal temperatures.

**Braking Resistor.** A device that converts electrical energy into heat, typically used as a retarder to supplement or replace the regenerative braking.

**BUS USA.** MTA's Integrated Intelligent Transportation System (ITS) architecture for data exchange that includes:

- Communications Systems Work
- Radio AVL System
- On Board Video Surveillance System (OBVSS)
- Public Address System
- Automatic Passenger Counter (APC)
- Radio Handset and Control
- Mobile Radio System
- Automatic Voice Annunciation (AVA)
- Automatic Vehicle Monitoring (AVM)
- Pedestrian / Bus Warning System
- Other Intelligent Onboard Electronics
  - Electronic Cabinet
  - Vehicle Area Networks
  - Wireless Local Area Network (WLAN) Router
  - Communications Antennas
  - Bus Mounted Data Recorders
  - Engine Auxiliary Heater Control

**Buy America.** No funds may be obligated by FTA for a grantee project unless the cost of components produced in the United States is more than 60 percent of the cost of all components and final assembly takes place in the United States.

**Capacity (fuel container).** The water volume of a container in gallons (liters).

**Central Business District (CBD).** Altoona test cycle for urban bus operation.

**Cells.** Individual components (i.e., battery or capacitor cells).

**Charge Air Cooling (CAC).** Cooler and associated piping to cool turbocharged intake air prior to induction to the engine.

**Clean Air Act Amendment (CAAA).** Code of Federal Regulations, Title 40 mandating controls on air pollution from mobile sources by regulating both the composition of fuels and emission-control components on motor vehicles and non-road engines.

**Climate Control System (CCS).** The system within the bus which provides passengers and the operator controlled temperature and humidity regardless of the outside ambient temperatures. The system includes the buses heating, ventilation, air conditioning, windshield defroster and all related compressors, pumps and valves.

**Code.** A legal requirement.

**Contractor.** Firm under contract with the MTA to provide bus manufacturing or component integration.

**Cubic Feet per Minute (CFM).** CFM is the measurement of air flow.

**Curb Weight.** Weight of vehicle, including maximum fuel, oil and coolant; and all equipment required for operation and required by this Specification, but without passengers or operator.

**dBA.** Decibels with reference to 0.0002 microbar as measured on the “A” scale.

**DC to DC Converter.** A module which converts a source of direct current (DC) from one voltage level to another.

**Diesel Exhaust Fluid (DEF).** Fluid injected into the exhaust stream at the catalytic converter resulting in a chemical reaction reducing NOx.

**Default Configuration Bus.** The bus described if no alternatives are selected. Signing, colors, the destination sign reading list and other information must be provided by the MTA.

**Department of Transportation (DOT).** Federal agency responsible for oversight of the various modes of transportation serving the United States by ensuring a fast, safe, efficient, accessible and convenient transportation system that meets the vital national interests and enhances the quality of life of the American people.

**Destroyed.** Physically made permanently unusable.

**Discrete Signal.** A signal that can take only pre-defined values, usually of a binary 0 or 1 nature where 0 is battery ground potential and 1 is a defined battery positive potential.

**Diesel Particulate Filter (DPF).** Engine exhaust stream filter trapping exhaust particulate matter and having a regeneration cycle for cleaning.

**Duty Cycle.** The MTA operates in the greater Baltimore area. The operation of buses is in the Central Business District (CBD) and the surrounding urban area. The service operates with approximately 16 stops per mile and provides transit service continually throughout the day and night 7 days per week. MTA buses operate from sea level to 469 feet experiencing up to 6% grades.

**Emergency Locking Retractor (ELR).** The seat belt retractor function that allows the occupant to have free movement while buckled up, but in an emergency situation or crash the retractor instantly locks securing the occupant.

**Electronic Control Unit (ECU).** Electronic unit used to control functions of components using inputs from sensors and the logic signaling actions of the components through the unit’s outputs.

**Electromagnetic Interference (EMI).** An outside electrical disturbance that may interrupt, obstruct, or otherwise degrade or limit the effective performance of the circuit.

**Engine Control Module (ECM).** Electronic module used to control the diesel engine functions using inputs from sensors for diagnostics, acceleration, fuel injection and exhaust aftertreatment with electronic input/output with the propulsion and bus control systems.

**Energy Density.** The relationship between the weight of an energy storage device and its power output in units of watt-hours per kilogram (Wh/kg).

**Energy Storage Medium (ESM).** A component or system of components that stores energy and for which its supply of energy is rechargeable by a PPU and/or an off-vehicle energy source.

**Environmental Protection Agency (EPA).** Federal agency responsible for protecting human health through establishment and enforcement of federal laws for the environment and air quality.

**Equalizer.** Low voltage devices to equalize 12-24 volt charging.

**Failure Mode, Effects and Criticality Analysis (FMECA).** Extends a Failure Modes and Effects Analysis by including a *criticality analysis*, which is used to chart the probability of failure modes against the severity of their consequences.

**Federal Motor Carrier Safety Regulations (FMCSR).** Federal commercial vehicle operational safety requirements.

**Federal Motor Vehicle Safety Standards (FMVSS).** Federal vehicle safety standards for manufacture of new vehicles.

**FMVSS Standard No. 302 - Flammability of Interior Materials - Passenger Cars, Multipurpose Passenger Vehicles, Trucks, and Buses (Effective 9-1-72)**

This standard specifies burn resistance requirements for materials used in the occupant compartments of motor vehicles. Its purpose is to reduce deaths and injuries to motor vehicle occupants caused by vehicle fires, especially those originating in the interior of the vehicle from sources such as matches or cigarettes.

**Fusible Material.** A metal, alloy or other material capable of being melted by heat.

**Finite Element Analysis (FEA).** A type of computer program that uses the finite element method to analyze a material or object and find how applied stresses will affect the material or design.

**Fire Resistant.** Materials that have a flame spread index less than 150 as measured in a radiant panel flame test per ASTM-E 162-90.

**Fireproof.** Materials that will not burn or melt at temperatures less than 2000 °F.

**Free Floor Space:** Floor area available to standees, excluding the area under seats, area occupied by feet of seated passengers, the vestibule area forward of the standee line, and any floor space indicated by manufacturer as non-standee areas such as, the floor space “swept” by passenger doors during operation. Floor area of 1.75 sq ft shall be allocated for the feet of each seated passenger that protrudes into the standee area.

**Fuel Management System.** The MTA uses the S&A Fleetwatch fuel management system.

**Global Positioning System (GPS).** A space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites.

**Gross Axle Weight Rating (GAWR).** The maximum total weight as determined by the axle manufacturer, at which the axle can be safely and reliably operated for its intended purpose.

**Gross Load.** 175 lbs for every designed passenger seating position, for the operator, and for each 1.75 square feet of free floor space.

**Gross Vehicle Weight (GVW).** Curb weight plus gross load.

**Gross Vehicle Weight Rating (GVWR).** The maximum total weight as determined by the vehicle manufacturer, at which the vehicle can be safely and reliably operated for its intended purpose.

**Head Injury Criterion (HIC).** A measurement of the likelihood of head injury arising from an impact.

**High Voltage (HV).** Greater than 50 volts (AC and DC).

**Human Machine Interface (HMI).** An interface which permits interaction between a human being and a machine.

**Hybrid.** A vehicle that uses two or more distinct power sources to propel the vehicle.

**Hybrid System Controller (HSC).** Regulates energy flow throughout hybrid system components in order to provide motive performance and accessory loads, as applicable, while maintaining critical system parameters (voltages, currents, temperatures, etc.) within specified operating ranges.

**Hybrid Drive System (HDS).** The mechanical and/or electromechanical components, including the PPU and energy storage system, which comprise the traction drive portion of the hybrid propulsion system.

**Hybrid Inverter.** A module that converts DC to and from AC.

**Input/Output (I/O).** Electronic communication of devices uses inputs which are the signals or data received by the system, and outputs which are the signals or data sent from it.

**Institute of Electrical and Electronics Engineers Standards Association (IEEE-SA).** An organization within IEEE that develops global standards in a broad range of industries, including: power and energy, biomedical and health care, information technology, telecommunication, transportation, nanotechnology, information assurance and more.

**International Organization for Standardization (ISO).** ISO is an international standard-setting body composed of representatives from various national standards organizations.

**JIC Fittings.** Defined by the SAE J514 and MIL-F-18866 standards, are a type of flare fitting machined with a 37-degree flare seating surface.

**Labeled.** Equipment or materials to which has been attached a label, symbol or other identifying mark of an organization, which is acceptable to the authority having jurisdiction and concerned with product evaluation, which maintains periodic inspection of production labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

**Leakage.** Release of contents through a defect or crack. See *Rupture*.

**Line.** Solid or flexible tubing or hose that carry fluids.

**Local Regulations.** Regulations below the state level.

**Low-Floor Bus.** A bus that, between at least the front (entrance) and rear (exit) doors, has a floor sufficiently low and level so as to remove the need for steps in the aisle between the doors and in the vicinity of these doors.

**Low Voltage (LV).** 50 volts or less (AC and DC).

**Metallic Hose.** A hose whose strength depends primarily on the strength of its metallic parts; it can have metallic liners or covers, or both.

**Mobile Data Terminal (MDT).** A computerized device to communicate with a central dispatch office.

**Module.** Assembly of individual components.

**Motor (Electric).** A device that converts electrical energy into mechanical energy.

**Motor (Traction).** An electric motor used to propel the bus. The context of this specification assumes the device consumes electrical energy for propulsion as well as providing retarding mechanical motion.

**National Electrical Manufacturer's Association (NEMA).** The association of electrical equipment and medical imaging manufacturers who produce standards that define a product, process, or procedure with reference to one or more of the following:

- Nomenclature
- Composition
- Construction
- Dimensions
- Tolerances
- Safety
- Operating characteristics
- Performance
- Ratings
- Testing
- The service for which it is designed

**Operator Control Console (OCC).** Control head for operator control of the destination sign.

**Operator Control Unit (OCU).** Control head for operator control and interface with the buses fare collection system.

**Operator's Eye Range.** The 95th-percentile ellipse defined in SAE Recommended Practice J941, except that the height of the ellipse shall be determined from the seat at its reference height.

**Physical Layer.** The first layer of the seven-layer International Standards Organization (ISO) Open Systems Interconnect (OSI) reference model. This provides the mechanical, electrical, functional and procedural characteristics required to gain access to the transmission medium (e.g., cable) and is responsible for transporting binary information between computerized systems.

**Pipe:** Nonflexible line.

**Portable Test Equipment:** Heavy duty laptops designed for shop programming and diagnostic operations supplied as part of the contract loaded with software capable of communicating with all of the buses electronically controlled and programmable components.

**Pounds per Square Inch (PSI).** It is the pressure resulting from a force of one pound-force applied to an area of one square inch. It is used to determine air, fluid and structural pressure.

**Power.** Work or energy divided by time

**Power Density.** Power divided by mass, volume or area.

**Pre-Production Meeting (PPM).** Meeting conducted to review and adjust the technical requirements to develop the final technical summary for production.

**Prime Power Unit (PPU).** Diesel engine which provides the mechanical energy to rotate the propulsion systems generator.

**Propulsion System.** System that provides propulsion for the vehicle proportional to operator commands. Includes, as applicable, the HDS, energy storage system and the hybrid system controller.

**Radio Frequency (RF).** A rate of oscillation in the range of about 3 kHz to 300 GHz, which corresponds to the frequency of radio waves, and the alternating currents which carry radio signals.

**Real-Time Clock (RTC).** Computer clock that keeps track of the current time.

**Regenerative Braking.** Deceleration of the bus by switching motors to act as generators, which return vehicle kinetic energy to the energy storage system.

**Radio Frequency Interference (RFI).** Electromagnetic radiation which is emitted by electrical circuits carrying rapidly changing signals, as a by-product of their normal operation, and which causes unwanted signals (interference or noise) to be induced in other circuits.

**Seated Load.** 175 lbs for every designed passenger seating position and for the operator.

**Selected Catalytic Reduction (SCR).** System for storing and injecting DEF for injection to the catalyst for reduction of NOx.

**Seated Load Weight (SLW).** Curb weight plus seated load.

**Serial Data Signals.** A current loop based representation of ASCII or alphanumeric data used for transferring information between devices by transmitting a sequence of individual bits in a prearranged order of significance.

**NOTE:** An example is the communication that takes place between two or more electronic components with the ability to process and store information.

**Sources of Ignition.** Devices or equipment that because of their modes of use or operation, are capable of providing sufficient thermal energy to ignite flammable air mixtures when introduced into such a mixture, or when such a mixture comes into contact with them.

**Special Tools.** Tools not normally stocked by the MTA.

**Specification.** A particular or detailed statement, account, or listing of the various elements, materials, dimensions, etc. involved in the manufacturing and construction of a product.

**Stainless Steel (SST).** A steel alloy with a minimum of 10.5% chromium content by mass.

**Standard.** A firm guideline from a consensus group.

**Standee Line.** A line marked across the bus aisle to designate the forward area that passengers may not occupy when the bus is moving.

**State of Charge (SOC).** Quantity of electric energy remaining in the battery relative to the maximum rated Amp hour (Ah) capacity of the battery expressed in percent. This is a dynamic measurement used for the energy storage system. A full SOC indicates that the energy storage system cannot accept further charging from the engine driven generator or the regenerative braking system.

**Stress Loops.** The “pig-tails” commonly used to absorb flexing in piping.

**Structural Analysis Report (SAR).** The SAR provides an engineering determination of the effects of loads on the bus structure and components.

**Structure.** The structure shall be defined as the basic body, including floor deck material and installation, load bearing external panels, structural components, axle mounting provisions and suspension beams and attachment points.

**Ultra Low Sulphur Diesel Fuel (ULSDF).** Diesel fuel meeting the CAAA and diesel engine manufacturers requirements for use with on-highway diesel engines.

**United Nations Economic Commission for Europe (UNECE).** Established to encourage economic cooperation among its member states. Its main area of work are innovation and competitiveness policies, intellectual property, financing innovative development, entrepreneurship and enterprise development, and public private partnerships.

**Ultraviolet (UV).** UV light is electromagnetic radiation with a wavelength shorter than that of visible light, but longer than X-rays

**Valve Regulated Lead Acid (VRLA) Battery.** A VRLA battery is more commonly known as a sealed battery or maintenance free battery and is a type of lead–acid rechargeable battery.

**Wheelchair.** A mobility aid belonging to any class of three- or four-wheeled devices, usable indoors, designed for and used by individuals with mobility impairments, whether operated manually or powered. A “common wheelchair” is such a device that does not exceed 30 inches in width and 48 inches in length measured 2 inches above the ground, and does not weigh more than 600 lbs when occupied.

**Wireless local Area Network (WLAN).** A WLAN links two or more devices using some wireless distribution method.

### TS 3. Referenced Publications

The documents or portions thereof referenced within this specification shall be considered part of the requirements of the specification. The edition indicated for each referenced document is the current edition, as of the date of the APTA issuance of this specification.

## **TS 4. Legal Requirements**

The Contractor shall comply with all applicable federal, state and local regulations. These shall include but not be limited to ADA, as well as state and local accessibility, safety and security requirements. Local regulations are defined as those below the state level.

Buses shall meet all applicable FMVSS, FMCSR, CAAA and Buy America Requirements in effect at location of the MTA and at the date of manufacture.

In the event of any conflict between the requirements of these specifications and any applicable legal requirement, the legal requirement shall prevail. Technical requirements that exceed the legal requirements are not considered to conflict.

## **TS 5. Overall Requirements**

The Contractor shall ensure that the application and installation of major bus subcomponents and systems are compliant with all such subcomponent vendors' requirements and recommendations. The MTA will identify subcomponent vendors that shall submit installation/application approval documents with the completion of a pilot or lead bus. Components used in the vehicle shall be of heavy-duty design and proven in transit service.

### **TS 5.1 Weight**

Each bus shall be designed and constructed in compliance with the design goal of being as lightweight as possible without degradation of safety, appearance, comfort, traction or performance.

Buses at a capacity load shall not exceed the tire, wheel or axle factor limits, brake test criteria or structural design criteria.

### **TS 5.2 Capacity**

The buses shall be designed to carry the gross vehicle weight, which shall not exceed the buses GVWR, tire, wheel, and axle ratings.

### **TS 5.3 Service Life**

The minimum useful design life of the bus in transit service shall be at least twelve (12) years or 500,000 miles. It shall be capable of operating at least 50,000 miles per year, including the 12th year.

### **TS 5.4 Maintenance and Inspection / Tools and Equipment**

Scheduled maintenance tasks shall be related and shall be in accordance with the manufacturer's recommended preventative maintenance schedule (along with routine daily service performed during the fueling operations).

Test ports, as required, shall be provided for commonly checked functions on the bus, such as air intake, exhaust, hydraulic, pneumatic, charge-air and engine cooling systems.

The bus manufacturer shall give prime consideration to the routine problems of maintaining the vehicle. All bus components and systems, both mechanical and electrical, which will require periodic physical work or inspection processes, shall be installed so that a minimum of time is consumed in gaining access to the critical repair areas. It shall not be necessary to disassemble portions of the bus structure and/or equipment such as seats and flooring under seats in order to gain access to these areas. Each bus shall be designed to facilitate the disassembly, reassembly, servicing or maintenance, using tools and equipment that are normally available as standard commercial items.

Requirements for the use of unique specialized tools shall be minimized. The body and structure of the bus shall be designed for ease of maintenance and repair. Individual panels or other equipment which may be damaged in normal service shall be repairable or replaceable. Ease of repair shall be related to the vulnerability of the item to damage in service.

Proposer shall provide a list of all special tools and pricing required (Form CER 9.5, Tools and Test Equipment) for maintaining this equipment. Said list shall be submitted as a supplement to the Pricing Schedule. Included in the Special Tools List shall be 10 Portable Test Equipment heavy duty laptops for every 40 buses purchased. These heavy duty laptops shall be designed for shop programming and diagnostic operations loaded with software capable of communicating with all of the buses electronically controlled and programmable components.

The Contractor shall provide ruggedized, Panasonic Toughbook 31, or approved equal, laptop-based PTE, which shall communicate with the systems through an easily-accessible Ethernet connection port.

The test equipment provided shall perform under the environmental conditions imposed by the activities of bus inspection and the repair shop. The test equipment shall be portable and suitable for industrial service for use on the shop floor, in pit locations, and in the shop environment.

The PTE shall also meet the following requirements:

- a) For each system there shall be system-specific software to be utilized by a common, portable test equipment laptop. The Contractor shall provide all software modules, master copy, and licenses for each portable test equipment program.
- b) The Contractor shall also provide a printer and cabling to permit receiving and printing of downloaded data from the PTE.
- c) The laptop-based test equipment Operating System shall operate under the Microsoft Windows environment. All user interaction with the software shall be consistent with established Windows conventions.
- d) The DTE shall record and display systems faults. The PTE shall display reported faults. The level of fault reporting shall be detailed enough to permit operation and maintenance personnel to identify the failed line replaceable component.
- e) The PTE shall have the capability to record when triggered by an event. Each snapshot shall include the identification of the recorded parameter, sample rates, and include the date and time of the fault.
- f) Terminology for the language shall be consistent, and shall be in plain English language, not logical status alone.
- g) The PTE units shall have the ability to generate automated test report printouts to satisfy regular inspection and testing documentation requirements.
- h) The Contractor shall provide complete parts lists and schematic diagrams of the test equipment, and instructions how to use the equipment.
- i) Other key requirements for the PTE include:
  1. Intel Core™ i7 vPro™
  2. Drop shock protection
  3. Docking stations
  4. Power supply
  5. Cables and connections
  6. Up to 11 hours of battery life

7. Comply with MIL-STD-810G
8. IP65 certification

Form CER 9.5 shall be submitted as a supplement to the Pricing Schedule.

**NOTE:** Tools such as compartment door keys, bellows gauges and other tools that are required for daily maintenance and inspections shall not be included in the special tool list and shall be furnished for each bus.

### **TS 5.5 Interchangeability**

Unless otherwise agreed, all units and components procured under this contract, whether provided by Suppliers or manufactured by the proposer, shall be duplicates in design, manufacture and installation to ensure interchangeability among buses in each order group in this procurement. This interchangeability shall extend to the individual components as well as to their locations in the buses. Components with non-identical functions shall not be, or appear to be, interchangeable.

Any one component or unit used in the construction of these buses shall be an exact duplicate in design, manufacture and assembly for each bus in each order group in this contract. Contractor shall identify and secure approval for any changes in components or unit construction provided within a contract.

MTA shall review proposed product changes on a case-by-case basis and shall have the right to require extended warranties to ensure that product changes perform at least as well as the originally supplied products.

### **TS 5.6 Training**

The Contractor shall have qualified instructor(s) who shall be available at the MTA's property providing training 30 calendar days prior to the delivery of the first bus of each annual purchase. Instructor(s) shall conduct training classes and advise the personnel of the MTA (mechanical, operator and supervisory staff) on the proper operation and maintenance of the buses and their systems. The training times shall be dependent on the MTA service requirements and personnel placement. The Contractor also shall provide visual and other teaching aids (such as manuals, slide presentations and literature) for use by the MTA's own training staff and which becomes the property of the MTA.

The MTA requires the following Training Aids be provided for the training classes which become the property of the MTA at the conclusion of the Contractor training. Items listed below that the MTA currently possess will be evaluated for need and may be negotiated out of the procurement.

Front and rear axle assemblies

I/O controls/Multiplex Training Board

Wheelchair ramp assembly

Engine, radiator, hybrid drive unit and hybrid control and energy storage system mock up

The following chart lists the training curriculum subjects, expected hours, number of classes and total number of training hours.

Subject	Hrs/Class	Number of Classes	Total Class Hours
ADA Ramp and Equipment	8	6	48
Axles and Brakes	16	8	128
Doors, Body and Glass	8	6	48
Engine Accessory	16	8	128
Engine Cooling System	40	4	160
Engine Emission Control System	8	10	80
Engine Familiarization	16	10	160
Engine Overhaul	40	3	120
HVAC	40	8	320
Hybrid Drive Unit	16	8	128
Hybrid Drive Unit Overhaul	40	3	120
Hybrid System Familiarization	24	10	240
I/O Controls/Multiplex System	24	8	192
Maintenance Orientation	2	16	32
Maintenance Orientation & Maint/R&R 60 ft	8	8	64
Operators Orientation 40 ft.	1	32	32
Operators Orientation 60 ft.	1	16	16
Pneumatic System	16	6	96
Preventative Maintenance	8	10	80
Steering and Suspension	8	6	48
System Monitors and Controls	8	8	64
Sub-Total		194	2304
Train the Trainer and Reliability		12	208
TOTALS		206	2512

#### Technical/Service Representatives

The Contractor shall, at its own expense, have one or more competent technical service representatives available on request to assist the MTA in the solution of engineering or design problems within the scope of the specifications that may arise during the warranty period. One service representative shall be designated as a “service manager” capable of coordinating service support, parts acquisition for warranty and fleet defect repairs and coordination of contractors service technicians. The Contractor’s service staff shall respond to MTA’s request for assistance within 24 hours. The service manager and supporting technicians shall be assigned to the MTA project for a period of two years following the acceptance of the last bus of each manufacturing lot. This does not relieve the Contractor of responsibilities under the provisions of “Section 7: Warranty Requirements.”

#### TS 5.7 Operating Environment

The bus shall achieve normal operation in ambient temperature ranges of 10 °F to 115 °F, at relative humidity between 5 percent and 100 percent, and at altitudes up to 3000 feet above sea level. Degradation of performance due to atmospheric conditions shall be minimized at temperatures below 10 °F, above 115 °F . Speed, gradability and acceleration performance requirements shall be met at, or corrected to, 77 °F, 29.31 in. Hg, dry air per SAE J1995.

## TS 5.8 Noise

### Interior Noise

The combination of inner and outer panels and any material used between them shall provide sufficient sound insulation so that a sound source with a level of 80 dBA measured at the outside skin of the bus shall have a sound level of 65 dBA or less at any point inside the bus. These conditions shall prevail with all openings, including doors and windows, closed and with the engine and accessories switched off.

The bus-generated noise level experienced by a passenger at any seat location in the bus shall not exceed 80 dBA. The operator area shall not experience a noise level of more than 75 dBA with the operators fan on high and the HVAC vents completely open.

### Exterior Noise

Airborne noise generated by the bus and measured from either side shall not exceed 80 dBA under full power acceleration when operated 0 to 35 mph at curb weight. The maximum noise level generated by the bus pulling away from a stop at full power shall not exceed 83 dBA. The bus-generated noise at curb idle shall not exceed 65 dBA. If the noise contains an audible discrete frequency, a penalty of 5 dBA shall be added to the sound level measured. The Contractor shall comply with the exterior noise requirements defined in local laws and ordinances identified by the MTA and SAE J366.

## TS 5.9 Fire Safety

The bus shall be designed and manufactured in accordance with all applicable fire safety and smoke emission regulations. These provisions shall include the use of fire-retardant/low-smoke materials, fire detection systems, bulkheads and facilitation of passenger evacuation.

Materials entirely enclosed from the passenger compartment, such as insulation within the sidewalls and sub-floor, need not comply. In addition, smaller components and items, such as seat grab rails, switch knobs and small light lenses, and shall be exempt from this requirement.

All materials used in the construction of the passenger compartment of the bus shall be in accordance with FMVSS 302 "Flammability of Interior Materials" and in accordance with the Recommended Fire Safety Practices defined in FTA Docket 90A, dated October 20, 1993.

**The MTA currently uses Amerex ABC dry chemical fire suppression system, model SafetyNet V-25 and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The bus shall be equipped with an ABC dry chemical pre-engineered fire suppression system. The system shall be approved and listed by Factory Mutual Research Corporation (FM) for use at -65°F to 150°F. The automatic actuation system shall provide 24-hour fire detection of the engine compartment, the particulate muffler and exhaust catalyst area, the bus battery box, and the supplemental diesel-fired heater.

The fire suppression system shall include the following features:

- a) A minimum of one (1) 25-pound capacity and one (1) 13-pound capacity ABC agent cylinders of the stored pressure design shall be furnished and be constructed of welded steel and shall conform to DOT specification 4BW; and be rated for 12-year minimum hydrostatic

retest. The cylinders shall be outfitted with a visual pressure gauge protected by a guard and forged brass valve assemblies.

- b) The fire suppression system shall be provided with an engineered amount of thermostats capable of signaling the activation of the system when temperatures reach engineered levels. Temperature-sensitive weather-proof miniature thermostat(s) shall be located in the bus engine compartment. Additional miniature thermostat(s) will be located in the bus battery compartment, supplemental heater, the particulate muffler and exhaust catalyst area. The Contractor shall include additional thermostats at any other area they deem necessary. Thermostats shall be approved by Factory Mutual (FM) as heat actuated fire detectors. The detectors shall be normally open and capable of carrying sufficient amperage for the purposes of firing the electric actuator(s). The electrical control head shall also be activated manually by depressing an electric switch (button with pull-pin labeled "fire") mounted in the operator's compartment area within practical view and in an overhead location within reach of the operator. The location of the system controls will be reviewed and approved by the MTA at the pre-production meeting.
- c) An engineered amount of suppression agent nozzles with dust caps shall be installed to provide adequate coverage to the engine compartment, the bus battery box, the supplemental heater, and the particulate muffler exhaust catalyst area. The Contractor shall include additional agent nozzles at any other area they deem necessary.
- d) An operator's display / control panel shall be provided. The operator's panel shall provide a simple means of indicating system status to the operator or maintenance personnel. Basic system status shall be indicated by easy to read LEDs and a buzzer indication. The operator's panel shall be capable of being easily accessed by maintenance personnel and include an Ethernet or USB, connection to allow for basic programming. The operator's panel shall provide the following features:
  - 1. Event recording
  - 2. Data logging
  - 3. Internal audible alarm with silencer
  - 4. Relay override
  - 5. Self-test function
  - 6. Keyboard programming capability
  - 7. Built-in battery back-up in the event of bus power failure
  - 8. Remote programming to a laptop computer via Ethernet or USB interface
  - 9. Environmentally sealed enclosure
  - 10. Red background or outline for easy identification
  - 11. LED indicator for system status
  - 12. Automatic bus shutdown feature with 15 second delay from thermal event recognition

The fire suppression system shall have the ability to operate and actuate separately, provide multiple zones of ABC agent, and have the ability to be expanded with additional agent cylinders. The MTA's zones are defined as the engine compartment, particulate filter muffler exhaust catalyst area, bus battery box and the supplemental heater.

The bus OEM shall provide a written sign off (Vendor Installation Certificate) from the fire suppression manufacturer that the system has been engineered to provide adequate fire suppression coverage all installation requirements have been met on the first bus.

An inspection door or window shall be provided by the OEM on the bus body or interior compartment allowing for visual site inspection of each ABC agent cylinder/gauge.

The Contractor shall provide proposed installation drawings after the systems manufacturers engineering review to MTA for review and approval at the pre-production meeting.

### **TS 5.10 Respect for the Environment**

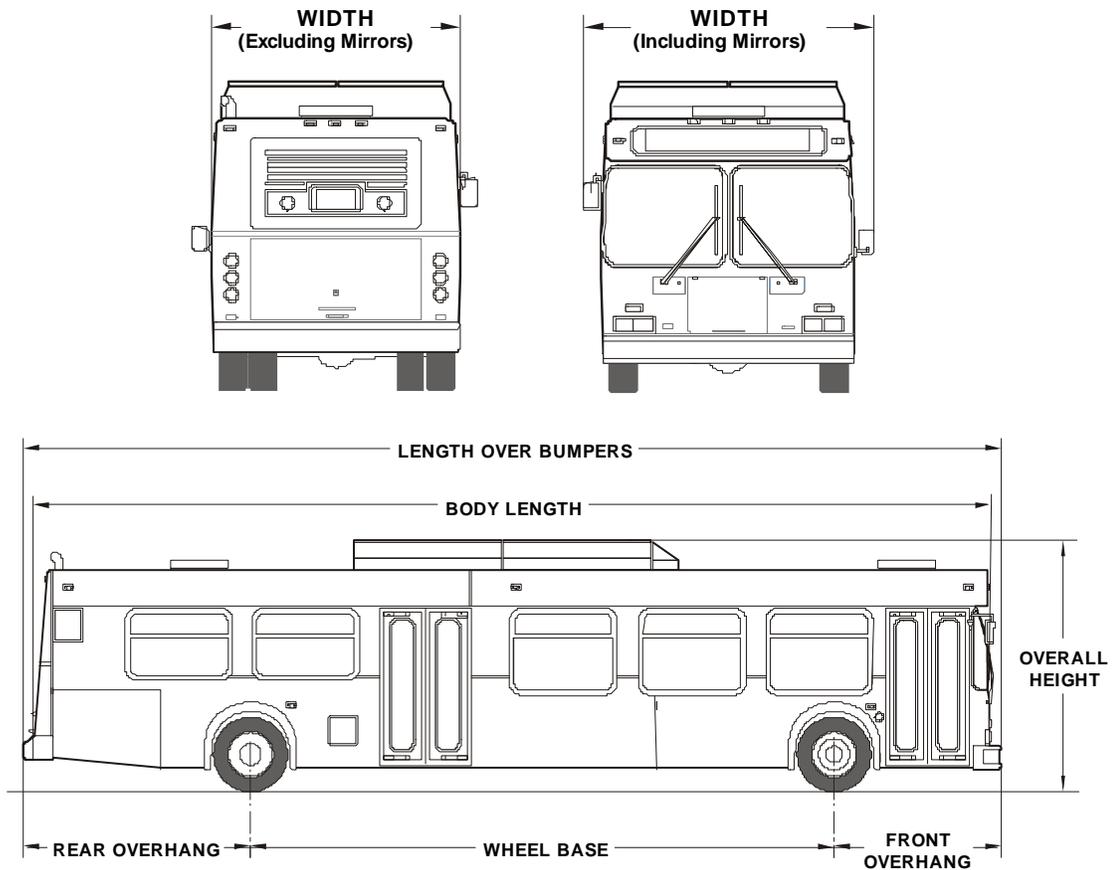
In the design and manufacture of the bus, the Contractor shall make every effort to reduce the amount of potentially hazardous waste. In accordance with Section 6002 of the Resource Conservation and Recovery Act, the Contractor shall use, whenever possible and allowed by the specifications, recycled materials in the manufacture of the bus.

## DIMENSIONS

### TS 6. Physical Size

With exceptions such as exterior mirrors, marker and signal lights, bumpers, fender skirts, washers, wipers, ad frames, cameras, object detection systems and bicycle racks the bus shall have the following overall dimensions as shown in Figure 1 at static conditions and design height.

**FIGURE 1**  
Transit Bus Exterior Dimensions



#### TS 6.1 Bus Length

For ease of use, the following tolerances will be allowable for each given bus length. Bus length is determined as the measurement from bumper to bumper and shall not exceed 41 feet.

- A. Front overhang: maximum of 117 inches
- B. Rear overhang: maximum of 127 inches

#### TS 6.2 Bus Width

The bus body width shall be 102 in. (+0, -1 inch).

### TS 6.3 Bus Height

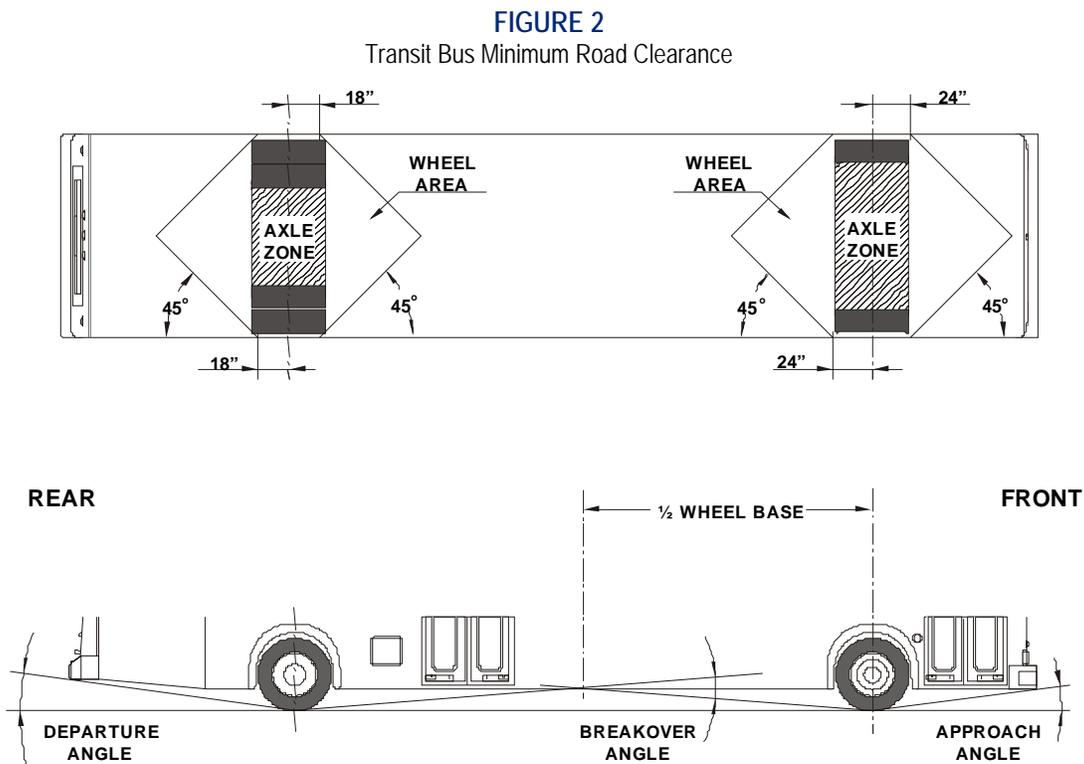
Maximum overall bus height shall be 132 inches, including all rigid, roof-mounted items such as A/C, exhaust, energy storage, controllers and cover, etc.

### TS 6.4 Step Height

The step height shall not exceed 15 inches at either doorway without kneeling. A maximum of two steps is allowed to accommodate a raised aisle floor in the rear of the bus. These steps shall be of equal height and shall not exceed 10 inches in height.

### TS 6.5 Underbody Clearance

The bus shall maintain the minimum underbody clearance dimensions as shown in Figure 2 and defined in SAE Standard J689, regardless of load up to the gross vehicle weight rating.



### TS 6.6 Clearance Angles

The approach angle is the angle measured between a line tangent to the front tire static loaded radius arc and the initial point of structural interference forward of the front tire to the ground.

The departure angle is the angle measured between a line tangent to the rear tire static loaded radius arc and the initial point of structural interference rearward of the rear tire to the ground.

The breakover angle is the angle measured between two lines tangent to the front and rear tire static loaded radius and intersecting at a point on the underside of the vehicle that defines the largest ramp over which the vehicle can roll.

Angle	40-ft Bus
Approach	9.0 degrees (min.)
Front breakover	8.5 degrees (min.)
Departure	9.0 degrees (min.)

### TS 6.7 Ground Clearance

Ground clearance shall be no less than 10 inches, (8 inches at jacking pad) except within the axle zone and wheel area.

Axle zone clearance, which is the projected area between tires and wheels on the same axial centerline, shall be no less than 5.5 inches.

Wheel area clearance shall be no less than 8 inches for parts fixed to the bus body and 6 inches for parts that move vertically with the axles.

### TS 6.8 Floor Height

Height of the step above the street shall be no more than 15 inches measured at the centerline of the front and rear doorway. The floor may be inclined along the longitudinal axis of the bus, and the incline shall not exceed 3.5 degrees off the horizontal except locally at the doors where 2 degree slope toward the door is allowed.

All floor measurements shall be with the bus at the design running height and on a level surface and with the standard installed tires.

A maximum of two steps is allowed to accommodate a raised aisle floor in the rear of the bus.

### TS 6.9 Interior Headroom

Headroom above the aisle and at the centerline of the aisle seats shall be no less than 78 inches in the forward half of the bus tapering to no less than 74 inches forward of the rear settee. At the centerline of the window seats, headroom shall be no lower than 65 inches. Headroom at the back of the rear bench seat may be reduced to a minimum of 72 inches, but it shall increase to the ceiling height at the front of the seat cushion. In any area of the bus directly over the head of a seated passenger and positioned where a passenger entering or leaving the seat is prone to strike his or her head, padding shall be provided on the overhead paneling.

### TS 6.10 Aisle Width

The minimum clear aisle width between pairs of transverse seats and modesty panels with all attached hardware shall be at least 22 inches.

The aisle width between the front wheelhouses shall be at least 44 inches, and the entire area between the front wheelhouses shall be available for passengers and mobility aid devices.

## VEHICLE PERFORMANCE

### TS 7. Power Requirements

The propulsion system shall be sized to provide sufficient power to enable the bus to meet the defined acceleration, top speed, and gradability requirements, and operate all propulsion-driven accessories using actual road test results and computerized vehicle performance data.

### TS 7.1 Top Speed

The bus shall be capable of achieving a top speed of 65 mph on a straight, level road at GVWR with all accessories operating. The bus shall be capable of safely maintaining the vehicle speed according to the recommendations by the tire manufacturer.

**NOTE:** Values are assumed to be sustained. Manufacturer shall supply MTA with data if there is a variance between peak performance and sustained vehicle performance.

### TS 7.2 Gradability

Gradability requirements shall be met on grades with a dry commercial asphalt or concrete pavement at GVWR with all accessories operating.

The propulsion system and drivetrain shall enable the bus to achieve and maintain a speed of 40 mph on a 2½ percent ascending grade and 15 mph on a 10 percent ascending grade continuous.

**NOTE:** Values are assumed to be sustained. Manufacturer shall supply MTA with data if there is a variance between peak performance and sustained vehicle performance.

### TS 7.3 Acceleration

The bus shall meet the acceleration requirements below and shall be sufficiently gradual and smooth to prevent throwing standing passengers off-balance. Acceleration measurement shall commence when the accelerator is depressed. Acceleration requirement times are based using the Allison hybrid mid range setting number 3.

**TABLE 3**

Maximum Start Acceleration Times on a Level Surface<sup>1</sup>

Speed (mph)	Maximum time (seconds)
10	4.0
20	8.5
30	15.0
40	28.0
50	50.0
Top speed	

1. Vehicle weight = GVWR

The hybrid propulsion and braking systems shall meet the performance requirements of the Duty Cycle.

Braking application and performance shall remain consistent regardless of hybrid system SOC or other variances related to regenerative braking.

The system shall be programmable to allow optimization of acceleration and deceleration rate. Performance may be affected when reprogramming. The manufacturer shall supply the new performance data.

## TS 7.4 Operating Range

The operating range of the bus shall be designed to meet the operating profile as stated in the “Operating Environment” section. The operating range of the bus when run on the “Design Operating Profile” shall be at least 500 miles on a full tank of fuel and DEF.

TS 7.4.1 INTENTIONALLY BLANK

TS 7.4.2 INTENTIONALLY BLANK

TS 7.4.3 INTENTIONALLY BLANK

## TS 8. Fuel Economy (Design Operating Profile)

Test results from the Altoona CBD fuel economy tests or other applicable test procedures shall be provided to the MTA. Results shall include vehicle configuration and test environment information. Fuel economy data shall be provided for each design operating profile. The design operating profile is defined as the Altoona CBD fuel duty cycle.

### TS 8.1 Hybrid

Energy storage system state of charge correction methods stated in SAE J2711 shall be utilized.

## POWERPLANT

### TS 9. Bus Propulsion

TS 9.1 INTENTIONALLY BLANK

### TS 9.2 Hybrid Propulsion System

**The MTA currently uses the Allison H 40 EP Hybrid System and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The hybrid drive system shall be a complete package capable of providing electrical power, storage of power, control of power, providing propulsion of the bus and regenerating electrical power through retardation. The system shall provide electrical power to drive the buses accessory loads including electric HVAC system, Beltless Alternator, electrically driven components and the low voltage system. The propulsion system shall be rated for the GVWR or greater of the bus.

#### TS 9.2.1 Propulsion System Description

The bus shall be powered by a hybrid propulsion system. Function and operation of the bus shall be transparent to the operator and passengers. The OEM shall assure that the bus structure can successfully accept the installation of the propulsion system and be operated in Baltimore for a period of 12 years without a structural failure. At a minimum, propulsion system shall comply with applicable Federal CAAA, State and Local emissions and useful life requirements. The systems energy storage, control and propulsion system shall be installed in accordance with the hybrid systems technical requirements. Cooling documentation and vehicle certification shall be provided to the MTA prior to the pilot bus being accepted.

#### TS 9.2.2 Propulsion System Service

The propulsion system shall be arranged so that accessibility for all routine maintenance is assured. No special tools, other than dollies and hoists, shall be required to remove the propulsion

system or any subsystems. However, the MTA shall recognize that properly rated test equipment and safe electrical work practices are essential when servicing high voltage hybrid components. The exhaust system, air cleaner, air compressor, starter (if used), alternator, radiator, all engine accessories, and any other component requiring service or replacement shall be easily removable. Contractor shall provide all specialty tools and diagnostic equipment required for maintaining the Propulsion System in accordance with Special Tools List.

### TS 9.2.3 Primary Propulsion Unit and Traction Motor

The PPU and traction motor may be configured in a variety of methods dependent upon type of drive system.

### TS 9.2.4 Energy Storage and Controller

Design and performance documentation shall be provided to the MTA. Energy storage shall be of a commercial design capable of operating in the MTA transit environment and have a minimum design life of six (6) years. The primary charging of the energy storage medium shall be accomplished by the on-board PPU and regenerative braking.

Thermal management shall be provided to ensure optimal life and performance of the ESM over the environmental operating range.

### TS 9.2.5 Hybrid System Controller

The HSC regulates energy flow throughout hybrid system components in order to provide energy for motive performance and accessory loads, as applicable, while maintaining critical system parameters (e.g., voltages, currents, temperatures, etc.) within specified operating ranges.

The controller shall monitor and process inputs and execute outputs as appropriate to control the operation of all propulsion system components.

### TS 9.2.6 Prime Power Unit

**The MTA currently uses the Cummins 280 horsepower ISL Diesel Engine for the Prime Power and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Contractor shall provide MTA with expected durability of the PPU and related emission systems.

The engine shall comply with applicable federal, state, and local emissions and useful life requirements. Components of the fuel management and/or control system shall have a design life of not less than 150,000 miles without replacement or major service. The lifetime estimate is based on the design operating profile.

The engine shall be equipped with an electronically controlled management system, compatible with either 12- or 24-volt power distribution. The engine control system shall be capable of transmitting and receiving electronic inputs and data from other drivetrain components and broadcasting that data to other vehicle systems. Communication between electronic drivetrain components and other vehicle systems shall be made using the communications networks. The engine's electronic management system shall monitor operating conditions and provide instantaneous adjustments to optimize both engine and bus performance. The system shall be programmable to allow optimization of programmable features.

The engine shall have on-board diagnostic capabilities, able to monitor vital functions, store out-of-parameter conditions in memory, and communicate faults and vital conditions to service personnel. Diagnostic reader device connector ports, suitably protected against dirt and moisture, shall be provided in operator's area and near or inside engine compartment. The on-board diagnostic system shall inform the operator via visual and/or audible alarms when out-of-parameter conditions exist for vital engine functions.

The engine starting system shall be protected by an interlock that prevents its engagement when the engine is running. Special equipment or procedures shall be employed to start the bus when exposed to temperatures less than 30 °F for a minimum of four hours without the engine in operation. All cold weather starting aids, engine heating devices and procedures shall be of the type recommended by the engine manufacturer and approved by the MTA. The integration of all systems on the vehicle relative to engine idle speed shall be the responsibility of the vehicle manufacturer to meet the requirements of the MTA.

The engine control system shall protect the engine against progressive damage. The system shall monitor conditions critical for safe operation and automatically derate power and/or speed and initiate engine shutdown as needed.

Provisions shall be made for installation of an engine starter to be used for diagnostics to start the engine in the event the hybrid drive system is incapable of starting the engine. The provisions at a minimum shall include a flywheel with ring gear, a starter mount on the flywheel with a bolted covering.

#### **TS 9.2.7 Automatic Engine Protection/Shutdown Override Feature**

A control shall be available to the operator that when constantly depressed and released will delay the engine shutdown or allow the bus to be moved. Override action shall be recorded. This data shall be retrievable by the MTA using a laptop.

The engine shall be equipped with an operator-controlled fast idle device. The fast idle control shall be a two-way switch mounted on the dash or side console and shall activate only with the hybrid drive in neutral and the parking brake applied. A second fast idle control switch shall be located in the engine compartment mounted in the engine rear run switch box.

#### **TS 9.2.8 Regenerative Braking**

The powertrain shall be equipped with regenerative braking to recharge the ESM and extend brake lining service life. The application of regenerative braking shall cause a smooth blending of both regenerative braking and service brake function and shall activate the brake lights.

Actuation of ABS and/or automatic traction control shall override the operation of the regenerative braking.

Regenerative braking, with a resulting deceleration of no greater than 0.077g when the throttle pedal is completely released. Maximum regenerative braking shall be achieved when brake pedal is depressed prior to engagement of service brakes, with a maximum resulting deceleration of approximately 0.20g in an empty bus. The resulting decelerations specified include the effects of engine braking, wind resistance and rolling resistance.

The regenerative braking disable switch shall be guarded and shall not be accessible to the seated operator. This switch shall be located in the overhead compartment (destination sign) near the operator.

Disabling regenerative braking shall be recorded for MTA data collection.

### TS 9.3 Auxiliary Heater

**The MTA currently uses ProHeat M80 series auxiliary heaters and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Auxiliary heaters (aka engine block heater) have two functions; pre-heat and supplemental heat. Pre-heat is used to heat the engine coolant before the engine starts. This is done by the dispatcher remotely (or by the driver using the dash switch).

The two operational modes of the auxiliary heater are as follows:

- Pre-Heat - The heater may be started in the Pre-Heat mode by one of two devices: (1) Momentary contact by the dash panel toggle switch to ON; or (2) RF wireless signal transmitted to the controlling unit (that includes the Bus Link Switch) that in turn sends a 24-volt pulse to the auxiliary heater. Repeated pulsing by either (1) or (2) shall have no effect on heater operation. Once started, the heater warms water in the engine block circuit only and maintains the water temperature between 160°F and 180°F, independent from the ambient air temperature. The heater shall be programmed to shut-off when the engine coolant temperature achieves 195°F. The unit's internal thermostat shall cause the heater to cycle on/off as required to maintain this temperature for a pre-programmed 30-minute time period.

The marine pump circulates water through the heater and engine for this time period. A magnetic water valve in the normally closed position precludes circulation of hot water to any other component or system. A start pulse from either (1) or (2) after 30 minutes will restart the Pre-Heat function for another 30-minute cycle.

- Supplemental Heat - The auxiliary heater operates in the Supplemental mode only when the engine is running and maintains the water temperature at the thermostatic settings for improved heater and defroster performance. No action is required to initiate supplemental heating when the engine is running. The heater shall not operate in the Supplemental mode when the auxiliary heater ON/OFF switch is in the "OFF" position.

A 24-volt auxiliary diesel fuel-fired heater (with a heat output not less than 80,000 BTU/hr) shall be provided to preheat the engine coolant and to supplement the heat supplied by the engine. When operating in the Pre-Heat mode, the auxiliary heater shall be capable of raising the engine coolant temperature from -10°F to 100°F within 30 minutes. The heating requirements, Interior Climate Control Capacity and Performance, may be attained with the auxiliary heater operating in the supplemental mode in conjunction with the engine. The heater shall be protected from loss of coolant or coolant flow, overheating, over fueling, and shall detect and cease operation when a low battery voltage condition exists. An air cleaner shall be fitted to the burner air inlet. Exhaust from the heater shall be directed rearward, routed under the bus, and exit at the rear.

The contractor shall install a device to remotely activate and verify operation of the auxiliary heaters on all buses during final plant inspection. Heaters are started manually by the MTA dispatcher remotely via the Wireless LAN.

One (1) waterproof toggle switch shall be mounted on the rear start-monitor box and permanently marked "AUXILIARY HEATER ON/OFF." This switch shall control all electric power to the auxiliary heater regardless of the operational mode.

A momentary toggle switch labeled “PRE HEAT ON/OFF” shall be installed on the operator’s dash panel. Momentarily moving the dash panel switch to the OFF position cancels the Pre-Heat function, regardless of how far the 30 minute pre-heat cycle has progressed and causes the heater to begin a cool down process before shutting down.

The auxiliary heater shall display fault codes by LEDs on the control panel located at the heater for troubleshooting and shall be capable of transmitting fault codes wirelessly. A green LED light (guarded) mounted on the streetside mid-bus, above the passenger window gutter on the exterior of the bus shall be illuminated whenever the heater is in operation and shall display blink fault codes as generated by the auxiliary heater. The control system connectivity shall be J1939 compatible. The heater shall have the capability of being remotely controlled through the Bus Link Switch. The configuration of the auxiliary heating system along with the location of the green light shall be approved by the MTA during the PPM.

**The MTA currently uses Ametek Rotron marine pump and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

A separate brushless, seal-less, marine pump shall be co-located with and completely controlled by the auxiliary heater, and shall circulate water through the auxiliary heater and the engine only.

The location of the heater and marine pump shall allow for ease of maintenance without removal of other components or their peripherals. Control wiring and fuel lines shall be shielded and not located within six (6) inches of the units exhaust.

## TS 10. Cooling Systems

**The MTA currently uses the EMP Mini Hybrid Thermal Management System package and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

### TS 10.1 Engine Cooling

The cooling systems shall be of sufficient size to maintain all engine and hybrid drive fluids and engine intake air at safe, continuous operating temperatures during the most severe operations possible and in accordance with engine and propulsion manufacturer’s cooling system requirements and passed their required testing.

The cooling system shall be a service proven cooling package that includes radiator, charge air cooling, electric fan(s), electronic control system with interface to the diesel engine control module and associated control valves. The cooling system shall include a de-aeration system approved by the engine manufacturer to mitigate cooling system cavitations.

The bus manufacturer shall be responsible for testing the cooling system to meet the cooling system, engine and hybrid drive manufacturers requirements for installation and performance.

#### TS 10.1.1 Cores

The radiator and charge air cooler shall be of durable, corrosion-resistant construction with non-removable tanks. A radiator skirt shall be provided to prevent air recirculation.

Radiator cores with a fin density greater than 12 fins per in. or a louvered slit design shall not be used. No heat-producing components or climate control system components shall be mounted

between the engine cooling air intake aperture and the radiator. The radiator and charge air cooler shall be designed to withstand thermal fatigue and vibration associated with the installed configuration. The radiator and charge air cooler cores shall be easily cleaned (to include engine side core surface) with standard pressure-washing equipment.

### TS 10.1.2 Radiator Plumbing

Radiator piping shall be stainless steel or brass tubing, and if practicable, hoses shall be eliminated. Coolant hoses and lines shall be impervious to all bus fluids, resist coolant loss from water permeation and be rated for high temperature applications. All slip-on coolant hoses shall have four ply construction, high temperature rating and shall be supported with stainless steel p-clamps having a silicon liner that provide a complete 360-degree seal. Coolant piping that uses slip-on hose shall have formed hose retaining barbs.

**The MTA currently uses Breeze constant torque clamps for slip on coolant hoses throughout the bus and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

All hoses shall be secured with stainless steel clamps that provide a complete 360-degree seal. Hose clamps shall be heavy duty and maintain a constant tension at all times, expanding and contracting with the hose in response to temperature changes and aging of the hose material.

The radiator system shall include a surge tank to prevent overflow of coolant condition. The surge tank shall be a proven design (material and size) as part of the coolant system requirements and the buses physical design. The surge tank shall be mounted in a manner to provide ease of daily service and maintenance requirements. The surge tank shall have a sight glass, a test port in the ullage space, and ports that contain low coolant sensors as part of the engine monitoring and diagnostics system. The low coolant warning system shall alert the operator of a low coolant situation and the “Check” and “Stop” engine lights controlled by the engines electronic control system illuminating the dash lights.

**The MTA currently uses Manuli coolant hoses throughout the bus and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Coolant hoses shall be four ply construction, high temperature rating and shall be supported with stainless steel p-clamps having a silicon cushion. Hoses shall be impervious to all bus fluids.

### TS 10.1.3 Fan Controls

The cooling system fan controls shall be electronically controlled and based on the engine ECM sensing and communicating the temperatures of the operating fluids and the intake air will control fan speed to maintain the specified operating temperatures. The fan control system shall be designed with a fail-safe mode of “fan on.” The cooling system shall meet the requirements stated in the operating environment.

### TS 10.1.4 Coolant Level

A visual means of determining satisfactory engine coolant level shall be provided. A spring-loaded, push-button type valve or lever shall be provided to safely release pressure or vacuum in the cooling system with both it and the water filler no more than +/- 60 in. above the ground. Both shall be accessible through the same access door.

Extended life (final charge) coolant shall be used with proper corrosion inhibitors meeting the engine manufacturer's requirement.

#### **TS 10.1.5 Standard Requirement for Coolant Filtration**

The engine cooling system shall be equipped with a properly sized Cummins approved Fleetguard coolant filter with a spin-on element and an automatic system for releasing supplemental coolant additives as needed to replenish and maintain protection properties. Quarter turn valves shall be installed on the inlet and outlet of the filter housing that may be closed when replacing the coolant filter so only the coolant in the filter will be lost.

#### **TS 10.1.6 Self-Cleaning**

Radiator and charge air cooler fan(s) shall be electrically driven and capable of manual and automated reverse operations for periodic self-cleaning of the radiator and charge air cooler.

#### **TS 10.1.7 Standard Mounting Design**

Mounting location of radiator and charge air cooler shall be the bus manufacturer's standard design located on the streetside of the bus in the engine compartment.

### **TS 10.2 Charge Air Cooling**

The charge air cooling system also referred to as after-coolers or inter-coolers shall provide maximum air intake temperature reduction with minimal pressure loss. The charge air cooler shall be sized and positioned to meet engine manufacturer's requirements for intake air temperature. The charge air cooler shall not be stacked ahead of or behind the engine radiator and shall be positioned as close to the engine as possible unless integrated with the radiator. CAC air plumbing and fittings shall be protected against heat sources and shall be configured to minimize restrictions and maintain sealing integrity.

Test ports with pipe threads shall be integrated into the metallic charge air piping for diagnostic purposes on both the inlet and outlet piping.

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### **TS 10.4 Hybrid Drive System Cooling**

The thermal management system shall maintain hybrid system electrical components within design operating temperature limits. The hybrid oil cooling system fan fault indication shall be provided at the operator's instrument panel LCD indicator. There shall also be an indication lamp at the rear engine run switch box.

The hybrid drive system cooling shall include components that maintain temperature ranges specified by the hybrid system manufacturer when operated in the varying temperatures of four seasons of the greater Baltimore service area.

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### TS 13. Power Plant Mounting

All powerplant mounting shall be mechanically isolated to minimize transfer of vibration to the body structure. Mounts shall control the movement of the powerplant so as not to affect performance of belt-driven accessories or cause strain in piping and wiring connections to the powerplant.

Access to belt driven accessories shall be protected by means of latching belt guard(s). The latches shall be rubber and the hinges shall allow for easy removal of the guard(s). The guard(s) shall be painted in safety yellow with warning signs attached that warn of moving engine pulleys and belts when the engine is running.

#### TS 13.1 Service

The propulsion system shall be arranged for ease of access and maintenance. The Contractor shall list all special tools, fixtures or facility requirements recommended for servicing. The exhaust system including DPF assembly and SCR systems, air cleaner, air compressor, radiator, all accessories and any other component requiring service or replacement shall be easily removable and independent of the engine and hybrid drive removal. An electronic module containing engine oil pressure and coolant temperature readouts shall be provided in the engine compartment. The module shall be mounted in the rear run switch box easily read during service and mounted where they shall not be damaged during minor or major repairs.

Engine oil and the radiator filler caps shall be hinged to the filler neck and closed with spring pressure or positive locks to prevent leakage. All fluid fill locations shall be properly labeled to help ensure that correct fluid is added. All fillers shall be easily accessible with standard funnels, pour spouts and automatic dispensing equipment. All lubricant sumps shall be fitted with magnetic-type drain plugs.

Scheduled maintenance fluids, filters and components shall be easily accessible for service. Frequent service items shall not require removal of other components for service.

Fluid sampling will be conducted for engine oil and hybrid drive fluid. Probalizer valves shall be installed in the engine compartment in convenient to use locations for engine oil and hybrid drive fluid extraction.

**The MTA currently uses Spinner II, model 576HE Oil Cleaning Centrifugal engine oil bypass filter and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

A heavy duty centrifugal, non-disposable lightweight engine bypass oil filter shall be installed. The bypass oil filter shall be installed and mounted for ease of service and shall not require removal of non related peripherals.

The centrifuge shall be powered by normal engine oil pressure. The bearing system shall enable the unit to generate centrifugal force 2,000 times greater than gravity.

The efficiency of the oil filter shall be effective at removing large particles, soot and other fine contaminants as small as one-tenth of a micron. The filter shall protect against premature wear and

maximize the service life of the engine and related components - even in the most demanding transit applications.

The single-use, disposable rotor is simply removed and replaced at each service interval. There shall be no special requirements for disposal.

### TS 13.2 Engine Compartment Gauges

An electronic diagnostic gauge shall be provided in the engine compartment mounted in the rear run switch box. The gauge shall be capable of displaying the hourmeter, engine oil pressure, coolant temperature, engine RPM, 24 volt battery status, hybrid drive temperature and active diagnostic codes as a minimum.

### TS 13.3 Engine Air Cleaner

**The MTA currently uses the Donaldson engine air intake cleaner part number D100226-016-002 and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

An air cleaner with a dry filter element shall be provided. The engine air cleaner and associated air inlet piping shall be sized to meet the air inlet requirements of the diesel engine manufacturer. The location of the air intake system shall be designed to minimize the entry of dust and debris and to maximize the life of the air filter and provide for ease of maintenance. The engine air duct shall be designed to minimize the entry of water into the air intake system. Drainage provisions shall be included to allow any water/moisture to drain prior to entry into air filter.

The air filter restriction gauge shall be mounted in a manner for ease of visibility and service adjacent to the engine gauge rear run switch box.

## TS 14. Hydraulic Systems

Hydraulic system service tasks shall be minimized and scheduled no more frequently than those of other major bus systems. All elements of the hydraulic system shall be easily accessible for service or unit replacement. Critical points in the hydraulic system shall be fitted with service ports so that portable diagnostic equipment may be connected or sensors for an off-board diagnostic system permanently attached to monitor system operation when applicable. A tamper-proof priority system shall prevent the loss of power steering during operation of the bus if other devices are also powered by the hydraulic system.

The hydraulic system shall operate within the allowable temperature range as specified by the lubricant manufacturer. The hydraulic reservoirs shall have sight glasses so the fluid level can be determined by visual inspection.

### TS 14.1 Fluid Lines

All lines shall be rigidly supported to prevent chafing damage, fatigue failures, degradation and tension strain. Lines shall be sufficiently flexible to minimize mechanical loads on the components. Lines passing through a panel, frame or bulkhead shall be protected and supported by heavy duty SST silicone cushioned p-clips and when necessary grommets (or similar devices) that fit snugly to both the line and the perimeter of the hole that the line passes through to prevent chafing and wear. Pipes and fluid hoses shall not be bundled with or used to support electrical wire harnesses.

**The MTA currently uses UMPCO 775 SST p-clips for supporting fluid lines and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

P-clips shall clamp the line, be a loop style with full box cushion. The p-clips shall be made of stainless steel with the cushion made of general purpose silicone.

Lines shall be as short as practicable and shall be routed or shielded so that failure of a line shall not allow the contents to spray or drain onto any component operable above the auto-ignition temperature of the fluid.

All hoses, pipes, lines and fittings shall be specified and installed per the manufacturer's recommendations.

### **TS 14.2 Fittings and Clamps**

All clamps shall maintain a constant tension at all times, expanding and contracting with the line in response to temperature changes and aging of the line material. The lines shall be designed for use in the environment where they are installed. For example, high-temperature resistant in the engine compartment, resistant to road salts near the road surface, and so on.

Compression fittings shall be standardized to prevent the intermixing of components. Compression fitting components from more than one manufacturer shall not be mixed, even if the components are known to be interchangeable.

### **TS 14.3 Charge Air Piping**

Charge air piping and fittings shall be designed to minimize air restrictions and leaks. Piping shall be as short as possible, and the number of bends shall be minimized. Bend radii shall be maximized to meet the pressure drop and temperature rise requirements of the engine manufacturer. The cross-section of all charge air piping shall not be less than the cross-section of the intake manifold inlet. Any changes in pipe diameter shall be gradual to ensure a smooth passage of air and to minimize restrictions. Piping shall be routed away from heat sources as practicable and shielded as required to meet the temperature rise requirements of the engine manufacturer.

Intake and charge air piping shall be constructed of stainless steel, aluminized steel or anodized aluminum. Connections between all charge air piping sections shall be sealed with a short section of reinforced hose and secured with stainless steel constant tension clamps that provide a complete 360-degree seal.

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### **TS 16. Oil and Hydraulic Lines**

Oil and hydraulic lines shall be compatible with the substances they carry. The lines shall be designed and intended for use in the environment where they are installed. For example, high-temperature resistant in the engine compartment, resistant to road salts near the road surface, and so on. Lines within the engine compartment shall be composed of steel tubing where practicable, except in locations where flexible lines are required.

Hydraulic lines of the same size and with the same fittings as those on other piping systems of the bus, but not interchangeable, shall be tagged or marked for use on the hydraulic system only.

## TS 17. Fuel

### TS 17.1 Fuel Lines

**The MTA currently uses Manuli Equator high temperature fuel hoses and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Fuel hoses shall be compatible with standard ULSD and fuels blended to be Biodiesel. Fuel hose and hose connections, where permitted, shall be made from materials resistant to corrosion and fuel and protected from fretting and high heat. Fuel hoses shall be rated as high temperature resistant and protected from heat of nearby engine components. Fuel hose routing and protection shall be submitted for MTA review.

Fuel hoses shall have an advertised working temperature range from -55C through 150 C and be capable of sustaining in continued temperatures of 135C . Hoses exposed to sustained high temperatures shall have resistance to aging. Hoses shall be shielded in areas where the sustained temperature is at or above the hoses rated temperature.

Fuel lines shall be securely mounted, braced and supported as designed by the bus manufacturer to minimize vibration and chafing and shall be protected against damage, corrosion or breakage due to strain or wear.

Fuel hoses shall be accessible for ease of serviceability. Fuel lines shall be supported to prevent sagging and contact with other lines, brackets and component by high quality insulated stainless steel silicone cushioned p-clamps and submitted for MTA review.

The fuel lines forward of the engine bulkhead shall be orange fuel grade nylon tubing in conformance to SAE Standards.

Fuel lines in the engine compartment shall be constructed of premium high temperature material, shielded and insulated as required from engine heat sources and supported to prevent contact with other lines, brackets or components.

### TS 17.2 Diesel Fuel Tanks

#### TS 17.2.1 Design and Construction

The fuel tank(s) shall be made of corrosion resistant ANSI 304 stainless steel, 16 gauge thickness meeting FMVSS and FMCSR requirements for passenger carrying vehicle diesel fuel tank construction and mounting.

The fuel tank(s) shall have the useable capacity to meet the range requirement of 500 miles as described in section TS 7.4 Operating Range.

#### TS 17.2.2 Installation

The fuel tank(s) shall be securely mounted to the bus to prevent movement during bus maneuvers.

The fuel tank(s) shall be equipped with an external, hex head, drain plug. It shall be at least a 3/8-inch size and shall be located at the lowest point of the tank(s). The fuel tank(s) shall have an inspection plate or easily removable filler neck to permit cleaning and inspection of the tank(s) without removal from the bus. The tank(s) shall be baffled internally to prevent fuel-sloshing noise regardless of fill level. The baffles or fuel pickup location shall assure continuous full

power operation on a 6 percent upgrade for 15 minutes starting with no more than 25 gallons of fuel over the unusable amount in the tank(s). The bus shall operate at idle on a 6 percent downgrade for 30 minutes starting with no more than 10 gallons of fuel over the unusable amount in the tank(s).

The materials used in mounting shall withstand the adverse effects of road salts, fuel oils, and accumulation of ice and snow for the life of the bus. Metallic fuel tank straps and support brackets shall have insulators of a material capable of meeting the adverse effects listed and lasting the expected life of the bus.

### TS 17.2.3 Labeling

The capacity, date of manufacture, manufacturer name, location of manufacture, and certification of compliance to Federal Motor Carrier Safety Regulation shall be permanently marked on the fuel tank(s). The markings shall be readily visible and shall not be covered with an undercoating material.

### TS 17.2.4 Fuel Filler

**The MTA currently uses Emco-Wheaton Posilock 105 dry brake fuel nozzle connections and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The fuel filler shall accommodate a nozzle that forms a locked and sealed connection during the refueling process to eliminate spills. Fuel shall not be allowed to flow into the tank unless the nozzle has been properly coupled, locked and sealed to the filler. With the nozzle open, fuel shall enter the tank at a fill rate of not less than 40 gallons per minute of foam-free fuel without causing the nozzle to shut off before the tank is full. The nozzle shall automatically shut off and provide an audible signal when the tank is 95% full. Once disconnected, fuel shall not be allowed to flow through the nozzle at any time. Any pressure over 3 psi shall be relieved from the fuel tank automatically. The fill neck shall be repairable in the field and contain provisions to meet the applicable rollover requirements. The dry break system shall be compatible with the MTA's existing diesel fueling system at all operating divisions.

The fuel filler cap shall be forward hinged and shall be located to the rear of the exit door and in front of the rear axle. The filler cap shall be a posi snap flip type and retained to prevent loss and shall be recessed into the body so that spilled fuel will not run onto the outside surface of the bus. The fuel door shall be hinged forward and have a quarter turn lock.

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## TS 18. Emissions and Exhaust

### TS 18.1 Exhaust Emissions

The engine and related systems shall meet all applicable emission and engine design guidelines and standards.

### TS 18.2 Exhaust System

Exhaust gases and waste heat shall be discharged from the roadside rear corner of the roof. The exhaust pipe shall be of sufficient height to prevent exhaust gases and waste heat from discoloring or causing heat deformation to the bus. The entire exhaust system shall be adequately shielded to

prevent heat damage to any bus component, including the exhaust after-treatment compartment area. The exhaust outlet shall be designed to minimize intrusion of rain, snow or water generated from high-pressure washing systems from entering into the exhaust pipe and causing damage to the after-treatment.

### **TS 18.3 Exhaust Aftertreatment**

An exhaust aftertreatment system shall be provided to ensure compliance to all applicable EPA regulations in effect at the time of manufacture. The following are current exhaust aftertreatment at the time of this writing.

#### **TS 18.3.1 Selected Catalytic Reduction**

An SCR system supplied by the engine manufacturer shall be provided. The system will minimally include a DEF tank, a dosing system, a pump, and a selective catalytic converter. The system shall be designed for operation in the Baltimore climate and environment.

The tanks shall be designed to store DEF in the operating environment described in the “Operating Environment” section. The DEF fluid lines shall be designed to prevent the DEF from freezing.

The DEF system shall be mounted and located to provide easy access for component diagnosis repair and replacement.

#### **TS 18.3.2 Diesel Particulate Filter**

A DPF system supplied by the engine manufacturer shall be provided. The particulate filter shall regenerate itself automatically if it senses pre set pressure differential levels in the exhaust stream. Regeneration cycles and conditions shall be defined by the engine manufacturer.

The DPF and associated components shall be mounted and located to provide easy access for component diagnosis, repair and replacement.

## **STRUCTURE**

### **TS 19. General**

#### **TS 19.1 Design**

The structure of the bus shall be designed to withstand the transit service conditions typical of an urban Central Business District duty cycle throughout its service life. The vehicle structural frame shall be designed to operate with minimal maintenance throughout the 12-year operation.

### **TS 20. Altoona Testing**

In order for a proposal to be considered compliant, the proposer shall supply an Altoona Test Report to the MTA for the model and power train being proposed. If the bus has not completed the testing or the report is not available, the proposer shall submit their plan to meet the requirements of providing a completed test with passing results and report as described below.

Prior to the start of any bus manufacturing or assembly processes, the structure of the proposed bus model shall have undergone appropriate structural testing and/or analysis, including the complete regimen of FTA required Altoona tests. Prior to assembly of the first bus, the contractor shall provide the MTA with a completed report with passing results of Altoona testing for the proposed bus model along with a plan of corrective action to address deficiencies, breakdowns and other issues identified during Altoona

testing. The bus model tested shall match the bus model proposed for procurement, including structure, axles and drive-train. Base model and partial Altoona test reports are acceptable when the combination of these tests adequately represents the proposed bus model.

## **TS 20.1 Structural Validation**

### **TS 20.1.1 Detailed Structural Analysis**

The structure of the proposed bus model shall have undergone structural testing, including Distortion and Crashworthiness, prior to assembly of the first bus. Part of the structural testing shall have been performed on the streets of Baltimore. The proposer shall provide the MTA with completed reports of all structural tests as specified by the MTA.

### **TS 20.1.2 Service-Proven Bus Structure**

To demonstrate that the bus structure shall survive in the MTA's operating environment, the proposer shall submit a test report from a reputable laboratory, accepted by the MTA, describing a shaker table fatigue test of the proposed bus structure, verifying the 12-year life, and strength and fatigue life requirements.

### **TS 20.1.3 Structural Analysis**

In lieu of a shaker table test, the proposer may submit a Structural Analysis Report (SAR) for the bus body structure proposed to be supplied under this Contract. The SAR shall use a Finite Element Analysis (FEA) model that has been verified for operational conditions similar to the MTA's operating environment. The SAR will demonstrate that the structure has sufficient strength to meet the 12-year life requirement.

The SAR shall address all structural elements and their attachments and joints in the bus body, the chassis frame, the suspension and undercarriage, and the structural elements that support equipment weighing more than 200 pounds.

Structural tests shall be conducted to confirm the validity of the analysis. These shall include, but not be limited to, full vehicle tests and tests of individual components. Data such as acceleration, strain, displacement, and load shall be included as well as a description of each test.

The SAR shall show the calculated stresses, allowable stresses, and design margins for all elements for all specified loading conditions. The structural analysis of the bus shall include a FEA using recognized computer programs acceptable to MTA. The structural analysis shall also include manual and computerized calculations of the stresses in structural elements such as joints, attachments, and other structural elements not included in the FEA.

The proposer shall submit to the MTA for review any planned modifications to the bus from that subjected to the shaker table test or as defined in the SAR, as design enhancements. A description of the modifications to the structure shall include justification for the changes, and a detailed analysis demonstrating that these changes will enhance and not adversely affect the structural strength, operability, and maintainability of the buses in the Baltimore environment.

The SAR will be independently verified by the MTA during the PPM and the proposer shall provide all support necessary.

For any portion of the proposed design that is based on a service-proven bus, the proposer may provide data from previous tests, historical data from operations, or structural analyses as required satisfying the corresponding portion of these requirements.

**TS 20.1.3.1 Finite Element Analysis**

The proposer shall submit and receive approval for the finite element models, including load cases and boundary conditions. A complete printed or computer file copy of the input and output of the FEA shall be included for review with the SAR. The proposer and the MTA shall mutually agree upon the computer file format.

### **TS 20.1.3.2 Structural Analysis Report**

The structural analysis report shall include, at a minimum:

- A. Table of Contents.
- B. References for all formulas, calculation procedures, buckling coefficients, material strengths, and like items cited where these items appear in the structural analysis.
- C. Each page numbered, dated, and initialed by the analyst and the reviewer. In the event of a revision, the revision letter shall be included with revision date and initials of the analyst and the reviewer.
- D. A description of each design load case or service condition that was considered, including combinations of these cases and conditions.
- E. Tables listing each material and product form with the relevant dimensions and mechanical properties (such as yield strength, ultimate strength, fatigue allowable, etc for isotropic and anisotropic materials) of these materials. If elastic-plastic analyses were conducted stress-strain diagrams should be included in the report.
- F. A set of diagrams and tables for each structure that was analyzed using an FEA model. These diagrams and tables shall show:
  1. Engineering drawings of the structure represented by the model.
  2. Tables referencing the material and product forms cited above to the property numbers used in the models.
  3. Elements, element types, element coordinate directions, element numbers, and element property identities corresponding to the material tables described above.
  4. For beam elements, cross sections and cross section properties of the beam elements showing beam coordinate directions and stress recovery points.
  5. Nodes and node numbers.
  6. Methods of representing attachments and joints.
  7. Diagrams for each load case showing external loads, internal loads that represent lumped and distributed masses or loading, and all support and boundary conditions.
  8. Overview color contour plots showing the stresses throughout the structure and close up views showing the stress distribution in all highly stressed areas.
  9. A summary showing compliance with each design load and service condition.
  10. A summary table and sample calculations of the design margins in the most highly loaded (stress critical, buckling critical, fatigue critical, etc.) structural member/material combinations. The table should show the location and the design load case or service condition for these combinations.

11. A tabulation or diagram of calculated deflections of the bus body under full vertical loading, and under combined vertical and compression of inertial and impact loadings resulting from street travel.
12. Analyses of the bus body structure under the torsional loading resulting from diagonal jacking, and under torsional loads resulting from anticipated normal operations.
13. Analysis of all critical and highly loaded connections showing the joint stronger than the weakest member being joined.
14. A tabulation of the proposer's selection of allowable fatigue stresses and assumed applied fatigue stress ranges and mean stresses for structural members that are fatigue sensitive.
15. If resistance welds are used, tables showing the minimum mechanical strength and fatigue strength of single and multiple spot welds. Values shall be given for each material, temper, weld size, and thickness.
16. The report shall summarize and present input parameters and results for each dynamic simulation conducted to define service loads and to demonstrate compliance with test requirements such as the PTI "Altoona" testing.
17. If tests are conducted to provide the necessary data, the entire test report shall be submitted. This report shall identify the test procedure, raw data, reduced data, and include a summary of results.
18. Weld strength assumptions and properties.

The proposer shall submit for MTA review a final complete FEA detailing all aspects of the MTA bus configuration, including any approved changes. The passing FEA shall be submitted in the proposer's submittals. The final FEA shall be signed by the Contractor's Lead Structural Engineer certifying that the body and structure meets all the requirements of this specification, is fit for service in the Baltimore service area and shall meet or exceed the 12-year required service life.

## **TS 21. Distortion**

The bus, loaded to GVWR and under static conditions, shall not exhibit deflection or deformation that impairs the operation of the steering mechanism, doors, windows, passenger escape mechanisms or service doors. Static conditions shall include the vehicle at rest with any one wheel or dual set of wheels on a 6 in. curb or in a 6 in. deep hole.

## **TS 22. Resonance and Vibration**

All structure, body and panel-bending mode frequencies, including vertical, lateral and torsional modes, shall be sufficiently removed from all primary excitation frequencies to minimize audible, visible or sensible resonant vibrations during normal service.

### **TS 22.1 Engine Compartment Bulkheads**

The passenger and engine compartment shall be separated by fire-resistant bulkheads. The engine compartment shall include areas where the engine and exhaust system are housed. This bulkhead shall

retard propagation of an engine compartment fire into the passenger compartment and shall be in accordance with the Recommended Fire Safety Practices defined in FTA Docket 90A, dated October 20, 1993. Only necessary openings shall be allowed in the bulkhead, and these shall be fire-resistant.

Any passageways for the climate control system air shall be separated from the engine compartment by fire-resistant material. Piping through the bulkhead shall have fire-resistant fittings sealed at the bulkhead. Wiring may pass through the bulkhead only if connectors or other means are provided to prevent or retard fire propagation through the bulkhead. Engine access panels in the bulkhead shall be fabricated of fire-resistant material and secured with fire-resistant fasteners. These panels, their fasteners and the bulkhead shall be constructed and reinforced to minimize warping of the panels during a fire that will compromise the integrity of the bulkhead.

Each bus structure shall undergo a “smoke” test as a quality assurance test to validate the sealing integrity of the bulkheads sealing the passenger area from the powertrain and attic area of the bus. Voids discovered during the test shall be corrected and the tests rerun until all voids are corrected. The smoke test documentation results shall become part of the bus documentation package.

## **TS 22.2 Roof**

All parts of the roof structure and skin shall have sufficient strength to withstand, without permanent deformation; the loads imposed by a mechanical bus washer and concentrated loads of 300 pounds spaced 30 inches apart. The roof shall be reinforced with supports integral to the roof structure to withstand the stresses imposed during normal operating and maintenance conditions. Mechanical fasteners that penetrate the roof skin shall be minimized and shall be properly shielded or sealed to prevent moisture intrusion. The area around the roof mounted equipment including antennas, HVAC, hybrid system components shall be sealed to prevent moisture intrusion. The roof exterior shall have anti-skid material installed to afford safety for maintenance personnel in performing maintenance on roof-mounted equipment with high voltage warning decals on the hybrid system components.

The roof shall be metallic, or composite, which shall be inherently corrosion-resistant, smooth, and without joints. The proposer’s method for sealing around the roof hatch and between the front and rear cap assemblies shall be submitted for MTA review in the submittal.

All roof mounted equipment shall be shielded from public view by means of full length roof fairings that will also serve as decal locations described elsewhere in these specifications.

The bus body and roof structure shall withstand a static load equal to 150 percent of the curb weight evenly distributed on the roof with no more than a 6 in. reduction in any interior dimension. Windows shall remain in place and shall not open under such a load. These requirements must be met with the roof-mounted equipment installed.

## **TS 22.3 Crashworthiness**

The bus shall withstand a 25 mph impact by a 4,000-pound automobile at any side, excluding doorways, along either side of the bus with no more than 3 inches of permanent structural deformation at seated passenger hip height. This impact shall not result in sharp edges or protrusions in the bus interior.

Exterior panels below 35 inches from ground level shall withstand a static load of 2,000 lbs applied perpendicular to the bus by a pad no larger than 5 square inches. This load shall not result in

deformation that prevents installation of new exterior panels to restore the original appearance of the bus.

## TS 23. Corrosion

The bus flooring, sides, roof, understructure and axle suspension components shall be designed to resist corrosion or deterioration from atmospheric conditions and de-icing materials (sodium and calcium chloride) for a period of twelve (12) years or 500,000 miles, whichever comes first. The bus shall maintain structural integrity and nearly maintain original appearance throughout its service life. Corrosion protection - grit blasted frame, moisture cure zinc-rich primer anti-chip undercoating, corrosion preventive coating sprayed inside frame tubes up to roof line. Stainless steel screws shall be used in all applications to mitigate corrosive activity.

All exposed surfaces and the interior surfaces of tubing and other enclosed members shall be corrosion resistant through application of a corrosion protection system. The corrosion protection system materials shall be temperature rated to provide protection coverage in the environment it is applied without adverse or detrimental effects to the protective material. All materials that are not inherently corrosion resistant shall be protected with a minimum 6 mil corrosion-resistant primer coating. All joints and connections of dissimilar metals shall be corrosion resistant and shall be protected from galvanic corrosion. Structural tubing after application of a corrosion resistant primer coating shall have the inside and outside undercoated with a minimum application of a 10 mil protective covering.

Representative samples of all materials and connections shall withstand a two-week (336-hour) salt spray test in accordance with ASTM Procedure B-117 with no structural detrimental effects to normally visible surfaces and no weight loss of over one (1) percent.

## TS 24. Towing

Each towing device shall withstand, without permanent deformation, tension loads up to 1.2 times the curb weight of the bus within 20 degrees of the longitudinal axis of the bus. If applicable, the rear towing device(s) shall not provide a toehold for unauthorized riders. The method of attaching the towing device shall not require the removal, or disconnection, of front suspension or steering components. The method of attaching the towing device shall not require the removal, or disconnection, of front suspension or steering components. The buses shall be designed to permit wheel lift towing from both the front and rear of the bus.

A plug connector permanently mounted at the front of the bus shall provide for bus tail lamp, marker, stop and turn signal lamp operation as controlled from the towing bus. The connector shall include a spring-loaded dust- and water-resistant cap. Shop air connectors (male ¼ inch NPT fittings) shall be provided at the front and rear of the bus and shall be capable of supplying all pneumatic systems of the bus with externally sourced compressed air. The shop air connectors shall be routed through the air dryer to prevent contaminants from entering the pneumatic system. The location of these shop air connectors shall facilitate towing operations. A connector to activate the service brakes shall also be provided at the front of the bus. The front connectors (45 degree fittings) shall be located under the bumper on the street side of the bus and protected by a covered, hinged box. A door will access the fittings inside the box with labels to identify the lines.

Two rear recovery devices/tie downs shall permit lifting and towing of the bus for a short distance, such as in cases of an emergency, to allow access to provisions for front towing of bus. The method of attaching the tow bar or adapter shall require the specific approval of the MTA. Any tow bar or adapter exceeding 50 lbs. should have means to maneuver or allow for ease of use and application. Each towing device shall accommodate a crane hook with a 1-inch throat.

The Proposer shall submit a complete description of towing devices and approved methods documenting compliance with these Specifications in its Technical Proposal.

It shall be the responsibility of the Contractor to evaluate MTA's towing equipment and propose appropriate towing devices during PPM.

## **TS 25. Jacking**

It shall be possible to safely jack up the bus, at curb weight, with a common 10-ton floor jack with or without special adapter, when a tire or dual set is completely flat and the bus is on a level, hard surface, without crawling under any portion of the bus. Jacking from a single point shall permit raising the bus sufficiently high to remove and reinstall a wheel and tire assembly. Jacking pads, 4 inch in diameter located on the axle or suspension near the wheels shall permit easy and safe jacking with the flat tire or dual set on a 6 in. high run-up block not wider than a single tire. The bus shall withstand such jacking at any one or any combination of wheel locations without permanent deformation or damage.

The jacking pads shall be painted safety yellow with decals applied to the body identifying the pad location.

## **TS 26. Hoisting**

The bus axles or jacking plates shall accommodate the lifting pads of a two-post hoist system. Jacking plates, if used as hoisting pads, shall be designed to prevent the bus from falling off the hoist. Other pads or the bus structure shall support the bus on jack stands independent of the hoist.

## **TS 27. Floor**

### **TS 27.1 Design**

The floor shall be essentially a continuous plane, except at the wheel housings and platforms. Where the floor meets the walls of the bus, as well as other vertical surfaces such as platform risers, the surface edges shall be blended with a circular section of radius not less than ¼ in. or installed in a fully sealed butt joint. Similarly, a molding or cover shall prevent debris accumulation between the floor and wheel housings. The bus floor in the area of the entrance and exit doors shall have a lateral slope not exceeding 2 degrees to allow for drainage.

The floor design shall consist of two levels (bi-level construction). Aft of the rear door extending to the rear settee riser, the floor height may be raised to a height no more than 20 inches above the lower level, with equally spaced steps. An increase slope shall be allowed on the upper level, not to exceed 3.5 degrees off the horizontal.

### **TS 27.2 Strength**

The floor deck may be integral with the basic structure or mounted on the structure securely to prevent chafing or horizontal movement and designed to last the life of the bus. Sheet metal screws shall not be used to retain the floor, and all floor fasteners shall be serviceable from one side only. Any adhesives, bolts or screws used to secure the floor to the structure shall last and remain effective throughout the life of the bus. Tapping plates, if used for the floor fasteners, shall be no less than the same thickness as a standard nut, and all floor fasteners shall be secured and protected from corrosion for the service life of the bus.

The floor deck shall be reinforced as needed to support passenger loads. At GVWR, the floor shall have an elastic deflection of no more than 0.60 inches from the normal plane. The floor shall

withstand the application of 2.5 times gross load weight without permanent detrimental deformation. The floor, with coverings applied, shall withstand a static load of at least 150 lbs applied through the flat end of a ½ inch diameter rod, with 1/32-inch radius, without permanent visible deformation.

### **TS 27.3 Construction**

The floor shall consist of the subfloor and the floor covering that will last the life of the bus. The floor as assembled, including the sealer, attachments and covering, shall be waterproof, non-hygroscopic and resistant to mold growth. The subfloor shall be resistant to the effects of moisture, including decay (dry rot). It shall be impervious to wood-destroying insects such as termites.

#### **TS 27.3.1 Pressure-Preserved Plywood Panel**

Plywood shall be certified at the time of manufacturing by an industry-approved third-party inspection such as APA – The Engineered Wood Association (formerly the American Plywood Association). Plywood shall be of a thickness adequate to support design loads, manufactured with exterior glue, satisfy the requirements of a Group I Western panel as defined in PS 1-95 (Voluntary Product Standard PS 1-95, “Construction and Industrial Plywood”) and be of a grade that is manufactured with a solid face and back and shall be provided with an edge sealing process to reduce moisture damage.

Plywood shall be installed with the highest-grade, veneer side up. Plywood shall be pressure-treated with a preservative chemical and process such as alkaline copper quaternary (ACQ) that prevents decay and damage by insects. Preservative treatments shall utilize no EPA-listed hazardous chemicals. The concentration of preservative chemicals shall be equal to or greater than required for an above ground level application. Treated plywood will be certified for preservative penetration and retention by a third party inspection MTA. Pressure-preservative treated plywood shall have moisture content at or below 15 percent.

Flooring shall be engineered with manufactured noise-reduction characteristics. Manufacturers shall submit their strategy to reduce noise transferred to the interior of the bus through the floor construction.

## **TS 28. Platforms**

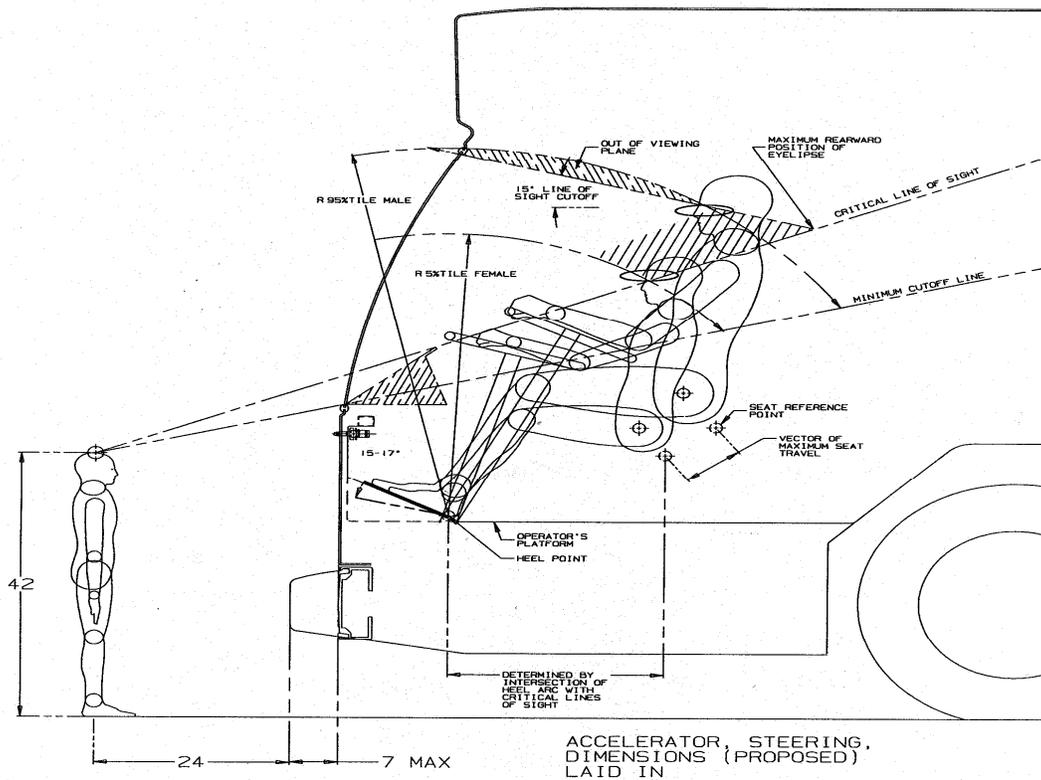
### **TS 28.1 Operator Area**

The covering of platform surfaces and risers except where otherwise indicated, shall be the same material as specified for floor covering. A heel wear plate shall be provided for pedals and foot switches protecting the covering. Trim shall be provided along top edges of platforms unless integral nosing is provided. The trim along the edges of the platform shall be slip resistant.

### **TS 28.2 Operator’s Platform**

The operator’s platform shall be of a height such that, in a seated position, the operator can see an object located at an elevation of 42 inches above the road surface, 24 inches from the leading edge of the bumper. Notwithstanding this requirement, the platform height shall not position the operator such that the operator’s vertical upward view is less than 15 degrees. A warning decal or sign shall be provided to alert the operator to the change in floor level. Figure 3 illustrates a means by which the platform height can be determined, using the critical line of sight.

**FIGURE 3**  
Determining Platform Height



### TS 28.3 Farebox

Farebox placement shall minimize impact to passenger access and minimize interference with the operator's line of sight.

If the operator's platform is higher than 12 inches, then the farebox is to be mounted on a platform of suitable height to provide accessibility for the operator without compromising passenger access.

Stanchions constructed with the yellow safety color shall be located around the farebox.

### TS 28.4 Rear Step Area to Rear Area

A lighted rear step area shall be provided along the center aisle of the bus to facilitate passenger traffic between the upper and lower floor levels. This step area shall be cut into the rear platform and shall be approximately the aisle width, a minimum 12 inches deep and approximately half the height of the upper level relative to the lower level. The horizontal surface of this platform shall be covered with skid-resistant material with a visually contrasting nosing and shall be sloped slightly for drainage. A warning sign shall be provided at the immediate platform area to alert passengers to the change in floor level.

## **TS 29. Wheel Housing**

### **TS 29.1 Design and Construction**

Sufficient clearance and air circulation shall be provided around the tires, wheels and brakes to preclude overheating when the bus is operating on the design operating profile. Wheel housings shall be constructed of corrosion-resistant and fire-resistant material.

Interference between the tires and any portion of the bus shall not be possible in maneuvers up to the limit of tire adhesion with weights from curb weight to GVWR. Wheel housings shall be adequately reinforced where seat pedestals are installed. Wheel housings shall have sufficient sound insulation to minimize tire and road noise and meet all noise requirements of this specification.

Design and construction of front wheel housings shall allow for the installation of a radio / electronic equipment storage compartment or utility box on the interior top surface.

The finish of the interior front wheel housings shall be scratch-resistant and complement interior finishes of the bus to minimize the visual impact of the wheel housing. If fiberglass wheel housings are provided, then they shall be color-impregnated to match interior finishes. The entire lower portion extending to approximately 10 to 12 inches above floor shall be equipped with scuff-resistant coating or stainless steel trim.

Wheel housings, as installed and trimmed, shall withstand impacts of a 2 inch steel ball with at least 200 ft-lbs of energy without penetration.

Wheel housings not equipped with seats or equipment enclosure shall have a horizontal assist mounted on the top portion of the housing no more than 4 inches higher than the wheel well housing. Wheel housings shall provide the clearance necessary for the installation snow chains or cables,

### **TS 29.2 INTENTIONALLY BLANK**

### **TS 29.3 INTENTIONALLY BLANK**

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### **TS 30. Suspension**

#### **TS 30.1 General Requirements**

The front and rear suspensions shall be pneumatic type. The basic suspension system shall last the service life of the bus without major overhaul or replacement. Adjustment points shall be minimized and shall not be subject to a loss of adjustment in service. Routine adjustments shall be easily accomplished by limiting the removal or disconnecting the components.

#### **TS 30.2 Alignment**

All axles shall be properly aligned so the vehicle tracks accurately within the size and geometry of the vehicle.

## TS 30.3 Springs and Shock Absorbers

### TS 30.3.1 Suspension Travel

The suspension system shall permit a minimum wheel travel of 3.00 inch jounce-upward travel of a wheel when the bus hits a bump (higher than street surface), and 3.00 inch rebound-downward travel when the bus comes off a bump and the wheels fall relative to the body. Elastomeric bumpers shall be provided at the limit of jounce travel. Rebound travel may be limited by elastomeric bumpers or hydraulically within the shock absorbers.

**The MTA currently uses Barksdale leveling valves and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Suspensions shall incorporate appropriate air suspension leveling devices for automatic height control so that regardless of load the bus height relative to the centerline of the wheels does not change more than ½ inch at any point from the height required. The operating pressure of the valve shall be a minimum of 150 PSI. Valve inlet and outlet piping and connections shall meet DOT approval for material and method. The valve material shall be impervious to road salts and be mounted in a location and manner for ease of service but safe from road debris damage. The safe operation of a bus shall not be impacted by ride height up to 1 in. from design normal ride height.

### TS 30.3.2 Damping

Vertical damping of the suspension system shall be accomplished by non-adjustable hydraulic shock absorbers mounted to the suspension arms or axles and attached to an appropriate location on the chassis. Damping shall be sufficient to control bus motion to three cycles or less after hitting road perturbations. The shock absorber bushing shall be made of elastomeric material that shall last the life of the shock absorber. The damper shall incorporate a secondary hydraulic rebound stop.

### TS 30.3.3 Lubrication

All elements of steering, suspension and drive systems requiring scheduled lubrication shall be provided with grease fittings conforming to SAE Standard J534. These fittings shall be located for ease of inspection and shall be accessible with a standard grease gun from a pit or with the bus on a hoist. Each element requiring lubrication shall have its own grease fitting with a relief path. The lubricant specified shall be standard for all elements on the bus serviced by standard fittings and shall be required no less than every 6,000 miles.

### TS 30.3.4 Kneeling

A kneeling system shall lower the entrance(s) of the bus a minimum of 3 inches during loading or unloading operations regardless of load up to GVWR, measured at the longitudinal centerline of the entrance door(s) by the operator. The kneeling control shall provide the following functions:

- A. Downward control shall be held to allow downward kneeling movement.
- B. Release of the control during downward movement shall completely stop the lowering motion and hold the height of the bus at that position.
- C. Upward control actuation shall allow the bus to return to normal floor height without the Bus operator having to hold the control.

The brake and throttle interlock shall prevent movement when the bus is kneeled. The kneeling control shall be disabled when the bus is in motion. The bus shall kneel at a maximum rate of 1

1/4 inch per second at essentially a constant rate. After kneeling, the bus shall rise within 3 seconds to a height permitting the bus to resume service and shall rise to the correct operating height within 7 seconds regardless of load up to GVWR. During the lowering and raising operation, the maximum vertical acceleration shall not exceed 0.2g, and the jerk shall not exceed 0.3g/second.

An indicator visible to the operator shall be illuminated until the bus is raised to a height adequate for safe street travel. An audible warning alarm shall sound simultaneously with the operation of the kneeler to alert passengers and bystanders. A warning light mounted near the curbside of the front door, a minimum 2.5 inches diameter amber lens, shall be provided that shall blink when the kneel feature is activated. Kneeling shall not be operational while the wheelchair ramp is deployed or in operation.

## TS 31. Wheels and Tires

### TS 31.1 Wheels

**The MTA currently uses Alcoa one piece Dura Flange aluminum wheels with Dura Bright surface treatment and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

These one piece forged aluminum wheels shall not require polishing while retaining their shine. The wheel surface shall not chip, crack or peel and will prevent corrosion. Wheels shall be installed using Freylube Supra or a similar product preventing corrosion between the aluminum wheel and its mounting surface.

All wheels shall be interchangeable and shall be removable without a puller. Wheels shall be compatible with tires in size and load-carrying capacity. Front wheels and tires shall be balanced as an assembly per SAE J1986. Wheels shall be installed with purple torque flags after the initial torque is completed.

Dual wheel configurations shall have valve stem extenders and hand-hole supports for the inside wheel positions to aid in checking tire pressure.

### TS 31.2 Tires

Tires shall be suitable for the conditions of transit service and sustained operation at the maximum speed capability of the bus. Load on any tire at GVWR shall not exceed the tire manufacturer's rating. Bus design shall determine the tire size to be used with the MTA specifying the tire size to be 305/70R22.5 and load range L with a speed rating of 68 mph. The tires shall be nitrogen filled by the bus manufacturer when assembled.

The tires shall be provided to the bus manufacturer under a lease agreement between the MTA and their tire Supplier, Goodyear. During the course of this contract the tire contractor may be changed.

### TS 31.3 Rear Wheel Safety Deflector

**The MTA currently uses S-1 GARD Dangerzone Deflector and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

A safety deflector device designed to deflect persons and objects away from the curbside rear wheels while the bus is in motion shall be incorporated into the bus design and installed on the bus. This deflector device shall be modular in design, designed to last the life of the bus and be easily replaced,

and made of a polyurethane material. Lifting the bus using conventional bus lifts shall be possible without removing the deflector. The unpainted deflector surfaces shall be black and not show any wear from scrapes or impacts. The deflector structure shall have a 10 inch clearance between it and the ground. No part of the bus, including the deflector, shall be damaged as a result of a 5 mph impact at any point parallel, and up to a 30-degree angle, to the longitudinal center line of the bus by the pendulum striker defined in FMVSS 581 loaded at 4,000 pounds.

The deflector device shall be modular in design and interchangeable between all buses built under the Contract. Deflector system shall be readily accessible for service and inspection. Maintenance requirements stated in mean time to replace shall be less than one hour by one, 'A' mechanic using standard hand tools.

The deflector system shall operate without degradation under all environmental conditions in the MTA's Operating Environment for a minimum of twelve (12) years.

## **TS 32. Steering**

Hydraulically assisted steering shall be provided. The steering gear shall be an integral type with the number and length of flexible lines minimized or eliminated. An engine driven hydraulic pump shall be provided for power steering.

### **TS 32.1 Steering Axle**

The front axle shall be non-driving with a load rating sufficient for the bus loaded to GVWR and shall be equipped with sealed, synthetic lubricated-type front wheel bearings. Front wheel bearings shall be capable of operating in transit service a minimum of 100,000 miles without requiring service or replacement.

All friction points on the front axle shall be equipped with replaceable bushings or inserts and, if needed, lubrication fittings easily accessible from a pit or hoist.

The steering geometry of the outside (frontlock) wheel shall be within 2 degrees of true Ackerman up to 50 percent lock measured at the inside (backlock) wheel. The steering geometry shall be within 3 degrees of true Ackerman for the remaining 100 percent lock measured at the inside (backlock) wheel.

### **TS 32.2 Steering Wheel**

#### **TS 32.2.1 Steering Wheel, General**

The steering wheel diameter shall be approximately 20 inches; the rim diameter shall be  $\frac{7}{8}$  inch to  $1\frac{1}{4}$  inch and shaped for firm grip with comfort for long periods of time. The center hub of the steering wheel shall include the horn button. The moveable components for horn actuation shall be accessible with removal of the horn button and shall only require simple hand tools for servicing.

The steering wheel shall have two (2) spokes and the wheel thickness shall ensure visibility of the dashboard so that vital instrumentation is clearly visible at center neutral position (within the range of a 95<sup>th</sup> percentile male or a 5<sup>th</sup> percentile female, as described in SAE 1050a, Sections 4.2.2 and 4.2.3). Placement of the steering column shall be as far forward as possible, but either in-line with or behind the instrument cluster.

### TS 32.2.2 Turning Effort

Steering effort shall be measured with the bus at GVWR, stopped with the brakes released and the engine at normal idling speed on clean, dry, level, commercial asphalt pavement and the tires inflated to recommended pressure.

Under these conditions, the torque required to turn the steering wheel ten (10) degrees shall be no less than 5 ft-lbs and no more than 10 ft-lbs. Steering torque may increase to 70 ft-lbs when the wheels are approaching the steering stops, as the relief valve activates.

Power steering failure shall not result in loss of steering control. With the bus in operation, the steering effort shall not exceed 55 lbs at the steering wheel rim, and perceived free play in the steering system shall not materially increase as a result of power assist failure. Gearing shall require no more than seven turns of the steering wheel lock-to-lock.

Caster angle shall be selected to provide a tendency for the return of the front wheels to the straight position with minimal assistance from the operator.

### TS 32.2.3 Steering Column

**The MTA currently uses Douglas Autotech 929 steering column, with tilt and telescopic features and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The steering column shall have full tilt and telescopic capabilities. A single lever mounted on the lower section of the steering column shall control both the tilt and telescopic features. The steering wheel will have the ability to be tilted a minimum of 21 degrees.

The steering column shall permit smooth un-obstructive turning of the steering wheel and control of the buses steering.

### TS 32.2.4 Steering Wheel Telescopic Adjustment

The steering wheel shall have full telescoping capability and have a minimum telescopic range of 2 inches and a minimum low-end adjustment of 29 inches, measured from the top of the steering wheel rim in the horizontal position to the cab floor at the heel point. Table 4 shows the steering wheel height relative to the angle of slope.

**TABLE 4**  
Steering Wheel Height<sup>1</sup> Relative to Angle of Slope

At Minimum Telescopic Height Adjustment (29 in.)		At Maximum Telescopic Height Adjustment (5 in.)	
Angle of Slope	Height	Angle of Slope	Height
0 degrees	29 in.	0 degrees	34 in.
15 degrees	26.2 in.	15 degrees	31.2 in.
25 degrees	24.6 in.	25 degrees	29.6 in.
35 degrees	22.5 in.	35 degrees	27.5 in.

1. Measured from bottom portion closest to operator.

## TS 33. Drive Axle

The bus shall be driven by a heavy-duty single reduction axle with a load rating sufficient for the bus loaded to GVWR and shall be equipped with sealed, oiled-type wheel bearings. The drive axle shall have a design life to operate for not less than 300,000 miles on the design operating profile without replacement or major repairs. The axle and wheel bearings shall be lubricated with synthetic oil approved by the axle manufacturer. The lubricant drain plug shall be magnetic type. The axle and driveshaft components shall be rated for both propulsion and regeneration modes with respect to duty cycle.

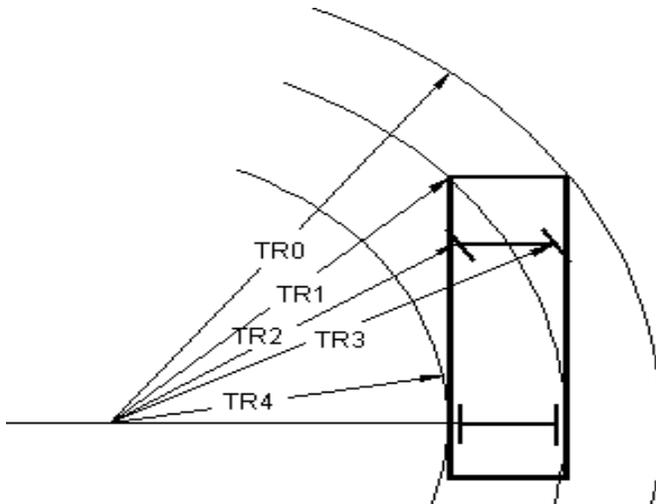
The drive shaft shall be guarded to prevent hitting any critical systems, including brake lines, bus floor or the ground, in the event of a tube or universal joint failure. Provisions shall be made in the bus floor for a sealed access to accommodate service of the drive axle and propeller shaft.

### TS 33.1 INTENTIONALLY BLANK

## TS 34. Turning Radius

The maximum turning radius (TR0) shall be 44 feet, as shown in **Figure 4**.

**FIGURE 4**  
Turning Radius



## TS 35. Brakes

### TS 35.1 Service Brake

The bus shall be equipped with disc brakes that meet FMVSS 121 requirements for stopping distance and efficiency. The brakes shall be self-adjusting and have the ability to check the pad thickness both visually.

Each bus shall be tested for FMVSS stopping distance and brake force during the final inspection before shipment to the MTA. A Vericom 4000 electronic brake computer shall be used for the testing each buses brake performance. The hard copy results shall be provided to the resident inspector and these become part of the vehicles manufacturing record. Buses shall not be accepted until satisfactory test results are achieved.

### TS 35.1.1 Air-Actuated Brakes

Service brakes shall be controlled and actuated by a compressed air system. Force to activate the brake pedal control shall be an essentially linear function of the bus deceleration rate and shall not exceed 70 lbs at a point 7 inches above the heel point of the pedal to achieve maximum braking. The heel point is the location of the operator's heel when his or her foot is rested flat on the pedal and the heel is touching the floor or heel pad of the pedal. The ECU for the ABS system shall be protected, yet in an accessible location to allow for ease of service.

The total braking effort of the foundation brakes shall be distributed between all wheels in such a ratio as to ensure equal friction material wear rate at all wheel locations. The contractor shall demonstrate compliance by providing a copy of the FMVSS 121 test results upon request.

### TS 35.2 Friction Material

The brake pads shall be made of non-asbestos material. In order to aid maintenance personnel in determining extent of wear, a provision such as a scribe line or chamfer indicating the thickness at which replacement becomes necessary shall be provided on each brake lining. The complete brake lining wear indicator shall be clearly visible from the hoist or pit without removing backing plates. Brake thickness shall be measured using an easy to use tool that indicates lining thickness and provides minimum thickness identification without removal of the tires for inspection.

The friction material shall be the material to which the buses braking system was tested with and approved meeting the FMVSS 121 certifications. The brake system material and design shall dissipate heat quickly so that the heat generated during braking operation does not glaze brake friction material.

### TS 35.3 Hubs and Rotors

Replaceable wheel bearing seals shall run on replaceable wear surfaces or be of an integral wear surface sealed design. Wheel bearing and hub seals shall be unitized hub assemblies that shall not leak or weep lubricant when operating on the design operating profile for the duration of the initial manufacturer's warranty.

All hubs shall be painted black.

### TS 35.4 Parking/Emergency Brake

The parking / emergency brake may be released when the buses air pressure meets the FMVSS 121 certification level. The release and apply valve shall be located to the street side of the operators seat convenient for the operator to reach and operate. The valve shall have a yellow diamond shaped button used to release and apply the parking/emergency brake. The button shall be labeled "**Pull To Apply**". Release of the parking/emergency brake shall require the operator to push down on the button and make a full application of the service brake pedal.

The parking brake shall be a spring-operated system, actuated by a valve that exhausts compressed air to apply the brakes in the event of depleting air pressure. The control valve at a minimum of 35 psi gauge pressure shall pop up and release while exhausting the air and activating the spring brakes. The Parking brake light at the operator's dash shall illuminate at this time.

The parking/emergency brake may be manually applied by the operator pulling upwards on the "**Pull to Apply**" button when the air pressure is at the operating level per FMVSS 121. In the event the operator does not apply the parking/emergency brake, has the seat belt released and turns the Master

Run switch to the OFF position, an audible alarm shall sound to alert the operator that the Parking / Emergency brake was not set.

The buses brake lights shall be illuminated when the parking brake is set.

### Emergency Brake Release

An emergency brake release shall be provided to release the brakes in the event of automatic emergency brake application. The emergency release valve shall be located besides the parking / emergency valve. The release valve shall have a round black button labeled “**Push To Release**”. The operator shall be able to manually depress and hold down the emergency brake release valve to release the brakes and maneuver the bus to safety. Once the operator releases the emergency brake release valve, the brakes shall engage to hold the bus in place.

### TS 35.5 Anti-Lock Braking System (ABS)

**The MTA currently uses Wabco ABS system and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

A microprocessor controlled anti-lock braking system (ABS) shall be provided. The system shall have diagnostic and data recording capabilities.

The buses shall be equipped with an ABS system meeting FMVSS 121 certification requirements. The ABS ECU shall be located inside the bus in an MTA approved accessible location, with diagnostic capabilities included. The system shall be capable of self diagnosis during start up of the power train and provide a visible fault signal to the operator.

The ABS system shall work in conjunction with the Automatic Traction Control System

### TS 35.6 Automatic Traction Control System (ATC)

**The MTA currently uses Wabco ATC system and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

A microprocessor controlled automatic traction control (ATC) shall be provided. The system shall have diagnostic and data recording capabilities.

The ATC system shall be able of controlling one wheel spin through automatic application of the brake on that wheel. In the event the ATC system detects both wheels spinning, it shall automatically reduce engine power allowing optimum tire-to-road traction. A ‘Wheel Spin’ light shall provide the operator early warning of slippery road conditions.

### TS 35.7 Hill Holder

A momentary contact guarded hill holder switch shall, upon deployment, disable the throttle and set the rear service brakes. The function shall be identical to the rear door interlock. Brake release and throttle shall be restored immediately upon release of the switch.

The hill holder switch as described shall be located on the operator’s control panel to the left of the operator’s seat in a position the operator can use while seated with his other hand on the steering wheel. The location and type of switch requires MTA input and approval.

## TS 36. Interlocks

### TS 36.1 Passenger Door Interlocks

To prevent opening the rear passenger doors while the bus is in motion, a speed sensor shall be integrated with the door controls to prevent the entrance / exit doors from being enabled or opened unless the bus speed is less than 2 mph.

To preclude movement of the bus, an accelerator interlock shall disable the accelerator, and a brake interlock shall engage the service brake system to stop movement of the bus when the operator's door control is moved to a front, front/rear door enable or open positions, or rear door panel is opened more than 3 inches from the fully closed position (as measured at the leading edge of the door panel). The interlock engagement shall bring the bus to a smooth stop and shall be capable of holding a fully loaded bus on a 6 percent grade, with the engine at idle and the hybrid drive in gear, until the interlocks are released by the operator placing their foot on the brake pedal and moving the door controller to the doors closed position.

These interlock functions shall be active whenever the bus Master Run Switch is in any "run" position.

All door systems employing brake and accelerator interlocks shall be supplied with supporting Failure Modes, Effects, and Criticality Analysis (FEMCA) documentation, which demonstrates that failure modes are of a failsafe type, thereby never allowing the possibility of release of interlock while an interlocked door is in an unsecured condition, unless the door master switch has been actuated to intentionally release the interlocks.

The brake interlock pressure shall be pre-set at the factory to a pressure which allows the interlock system to meet the requirements listed above. The valve shall have a diagnostic pressure port mounted on the application side of the valve to assist in diagnosis.

Engagement of the interlock system shall illuminate all of the rear brake lights.

### TS 36.2 Hybrid Drive Interlock

When neutral is selected by the hybrid drive control pad, the brake interlocks shall be applied. The throttle interlock shall not be activated when the hybrid drive is in neutral.

## TS 37. Pneumatic System

### TS 37.1 General

The bus air system shall operate the air-powered accessories and the braking system with reserve capacity. New buses shall not leak down more than 5 psi over a 12 hour period of time as indicated on the dash gauge.

Provision shall be made to apply shop air to the bus air systems. The air from the shop air fittings shall go through the air dryer. A quick disconnect fitting shall be easily accessible and located in the engine compartment and near the front bumper area for towing. Retained caps shall be installed to protect fitting against dirt and moisture when not in use. The front air connector arrangement located below the bumper, street side shall have the fittings inside a protective box with access door, square key lock and labels to identify lines.

Air for the compressor shall be filtered. The air system reservoirs shall meet all the requirements of FMVSS 121.

### TS 37.2 Air Compressor

**The MTA currently uses Wabco HD 30.4 two cylinder air compressor, rated for 30+ CFM and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The air compressor shall be approved by the Cummins Engine Company for use on the ISL diesel engine and shall have the capacity to supply sufficient and continuous volume and pressure compressed air for the buses braking, suspension, doors etc. The system shall meet all FMVSS requirements.

The engine-direct drive air compressor shall be sized to charge the air system from 40 psi to the governor cut-off pressure in less than 3 minutes while not exceeding the fast idle speed setting of the engine. The compressor shall have the air intake from the turbo charged side of the engine air intake system and capable of meeting all requirements operation of the buses air operated components and for air recovery.

The compressor shall be lubricated by the engine oil and drain to the engine sump. The compressor shall be cooled by the engine coolant system and through lowered temperatures shall minimize carbonization and contamination.

### TS 37.3 Air Governor

**The MTA currently uses Bendix D-2 part number 275491 standard version air governor and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The air governor shall have adjustable pressure settings capable of controlling air pressure cut in and cut out pressures. The air governor shall be remotely mounted near the air compressor in a location for ease of adjustment and replacement. Air pressure cut in /out adjustments shall be able to be made without removal of other components. The air pressure cut in and cut out pressures along with mounting and location are subject to MTA review.

### TS 37.4 Air Lines and Fittings

**The MTA currently uses Manuli high temperature air lines and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Flexible hoses used for the compressed air system shall be temperature resistant for the area in which they are utilized. The hose material shall be abrasion resistant and the cover has flame retardant properties. The hoses shall be used in areas where the ambient elements have little effect on their life expectancy. They shall be designed to meet the demanding applications in heavy duty transit working conditions.

Hose routing shall be in accordance with the hose manufacturers recommendations for radius bends and shall be supported to prevent sag or contact with other lines or components.

Air lines, except necessary flexible lines, shall conform to the installation and material requirements of SAE Standard J1149 for copper tubing with standard, brass, flared or ball sleeve fittings, or SAE Standard J844 for nylon tubing if not subject to temperatures over 200 °F. The air on the delivery side

of the compressor where it enters nylon housing shall not be above the maximum limits as stated in SAE J844. Nylon tubing shall be installed in accordance with the following color-coding standards:

- **Green:** Indicates primary brakes and supply.
- **Red:** Indicates secondary brakes.
- **Brown:** Indicates parking brake
- **Yellow:** Indicates compressor governor signal.
- **Black:** Indicates accessories.

**The MTA currently uses UMPCO 775 SST P-clamps to support air lines and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

P-clips shall secure lines to mitigate vibration and prevent chafing and constructed of stainless steel with the cushion made of general purpose silicone.

Line supports shall prevent movement, flexing, tension, strain and vibration. Copper lines shall be supported to prevent the lines from touching one another or any component of the bus. To the extent practicable and before installation, the lines shall be pre-bent on a fixture that prevents tube flattening or excessive local strain. Copper lines shall be bent only once at any point, including pre-bending and installation. Rigid lines shall be supported at no more than 5-ft intervals. Nylon lines may be grouped and shall be supported at 30 inch intervals or less.

The compressor discharge line between PPU and body-mounted equipment shall be Teflon 2807 SST hose with a braided stainless steel jacket. Other lines necessary to maintain system reliability shall be flexible Teflon hose with a braided stainless steel jacket. End fittings shall be standard SAE or JIC brass or steel, flanged, swivel-type fittings. Flexible hoses shall be as short as practicable and individually supported. They shall not touch one another or any part of the bus except for the supporting grommets. Flexible lines shall be supported at 2-foot intervals or less. All hoses shall be rated as high temperature. All air lines located within the engine compartment or any other high temperature area shall be supported by means of SST silicone box p-clips.

Air lines shall be clean before installation and shall be installed to minimize air leaks. All air lines shall be routed to prevent water traps to the extent possible. Grommets or insulated clamps shall protect the air lines at all points where they pass through understructure components.

### TS 37.5 Air Reservoirs

All air reservoirs shall meet the requirements of FMVSS 121 and SAE Standard J10 and shall be equipped with drain plugs and guarded or flush type drain valves. Major structural members shall protect these valves and any automatic moisture ejector valves from road hazards. Reservoirs shall be sloped toward the drain valve. All air reservoirs shall have drain valves that discharge below floor level with lines routed to eliminate the possibility of water traps and/or freezing in the drain line.

### TS 37.6 Air System Dryer

**The MTA currently uses the Bendix AD-IP 24 volt tandem air dryer and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

A twin tower air dryer shall prevent accumulation of moisture, oil and contaminants in the air system. The air dryer system shall include replaceable desiccant cartridges with internal oil separator. The air dryer system shall have a 24 volt heater. All replaceable assemblies shall be able to be serviced or

replaced without the removal of the air dryer from the vehicle. Services to the air dryer shall be able to be completed without removal of surrounding components.

The air dryer shall be located as far from the compressor as possible to allow air to cool prior to entering the air dryer. The air dryer shall also be located such that maintenance procedures (routine scheduled services and repair) can be performed without removing the entire assembly and shall not require removal of adjacent components or their peripherals.

The type of air system dryer and location shall be reviewed by the MTA at the Pre-Production meeting and validated for use with the Wabco twin cylinder air compressor.

## ELECTRICAL, ELECTRONIC AND DATA COMMUNICATION SYSTEMS

### TS 38. Overview

The electrical system shall consist of bus battery systems and components that generate, distribute and store power throughout the vehicle. (e.g., wiring, relays, and connectors).

Electronic devices are individual systems and components that process and store data, integrate electronic information or perform other specific functions.

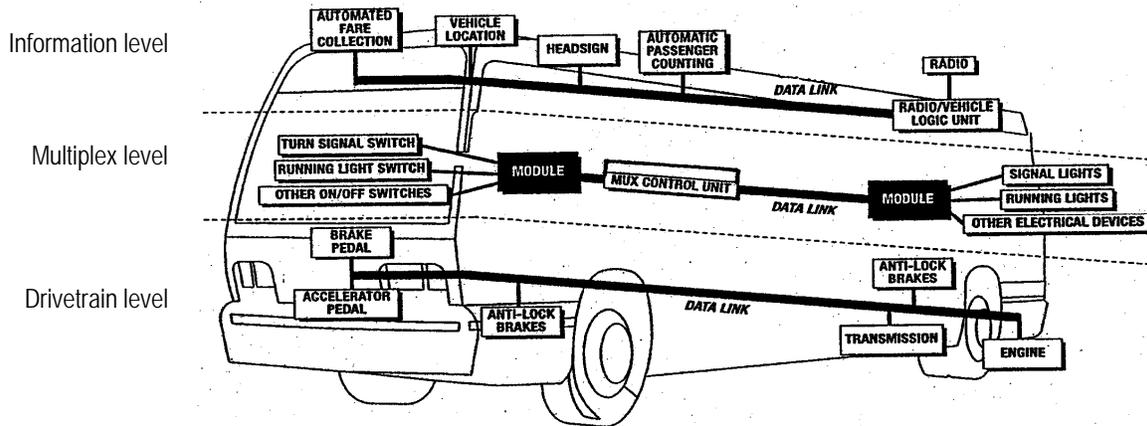
The data communication system consists of the bi-directional communications networks that electronic devices use to share data with other electronic devices and systems. Communication networks are essential to integrating electronic functions, both onboard the vehicle and off.

Information level systems that require bus information for their operations or provide information shall adhere to J1939 data standard.

Data communications systems are divided into three levels to reflect the use of multiple data networks:

- **Drivetrain level:** Components related to the drivetrain including the propulsion system components (engine, transmission and hybrid units), and anti-lock braking system (ABS), which may include traction control.
- **Information level:** Components whose primary function is the collection, control or display of data that is not necessary to the safe drivability of the vehicle (i.e., the vehicle will continue to operate when those functions are inoperable). These components typically consist of those required for automatic bus location (AVL) systems, destination signs, fare boxes, passenger counters, radio systems, automated voice and signage systems, video surveillance and similar components.
- **Multiplex level:** Electrical or electronic devices controlled through input/output signals such as discrete, analog and serial data information (i.e., on/off switch inputs, relay or relay control outputs). Multiplexing is used to control components not typically found on the drivetrain or information levels, such as lights; wheelchair lifts; doors; heating, ventilation and air conditioning (HVAC) systems; and gateway devices.

**FIGURE 5**  
Data Communications Systems Levels



### TS 38.1 Modular Design

Design of the electrical, electronic and data communication systems shall be modular so that each electronic device, apparatus panel, or wiring bundle is easily separable from its interconnect by means of connectors.

Powerplant wiring shall be an independent wiring harness. Replacement of the engine compartment wiring harness(es) shall not require pulling wires through any bulkhead or removing any terminals from the wires.

### TS 39. Environmental and Mounting Requirements

The electrical system and its electronic components shall be capable of operating in the area of the vehicle in which they will be installed, as recommended in SAE J1455.

Electrical and electronic equipment shall not be located in an environment that will reduce the performance or shorten the life of the component or electrical system when operating within the design operating profile. As a recommendation, no bus component shall generate, or be affected by, electromagnetic interference or radio frequency interference (EMI/RFI) that can disturb the performance of electrical/electronic equipment as defined in SAE J1113 and UNECE Council Directive 95/54 (R 10).

The MTA shall follow recommendations from bus manufacturers and subsystem suppliers regarding methods to prevent damage from voltage spikes generated from welding, jump starts, shorts, etc.

#### TS 39.1 Hardware Mounting

The mounting of the hardware shall not be used to provide the sole source ground, and all hardware shall be isolated from potential EMI/RFI, as referenced in SAE J1113. All electrical/electronic hardware and its mounting shall comply with the shock and vibration requirements of SAE J1455.

All electrical/electronic hardware mounted on the exterior of the bus that is not designed to be installed in an exposed environment shall be mounted in a sealed enclosure.

All electrical/electronic hardware mounted in the interior of the vehicle shall be inaccessible to passengers and hidden from view unless intended to be viewed. The hardware shall be mounted in such a manner as to protect it from splash or spray.

A full-sized electronics cabinet shall be securely mounted on top of the streetside front wheelhouse to accommodate the Intelligent Onboard Electronics, except the farebox, operator control units and bus multiplex electrical control system. At a minimum, the cabinet shall meet NEMA 1 standards, be designed built to last the life of the bus with minimal repair and without replacement. The cabinet design shall require MTA review.

The electronics cabinet shall be splash-proof when the service door(s) is secured and shall be made of a minimum of 18-gauge stainless steel or 12-gauge 5052 H32 aluminum construction, suitably reinforced. The cabinet shall be painted with black polyurethane enamel exterior and white interior. Access to the cabinet shall be from lockable-hinged doors opening into the passenger aisle area that includes a sturdy hold-open device. The cabinet door shall have a recessed paddle latches and General Motors key lock (key code to be provided) with four keys per vehicle. There shall be no sharp edges or corners on the enclosures. Inside of the cabinet shall be illuminated using two (2) 12" LED strip lights controlled by an inside the cabinet toggle switch. The electronics cabinet shall provide adequate ventilation for 1000 watts of equipment operating within the range of -20°F to +140°F.

The rear of the cabinet on the street side of the bus shall be open and accessible through the exterior glass. The glass shall be hinged at the top and open upwards with the assistance of gas struts with locks to support the access door in the open position. The window latching mechanism shall be only accessible through the inside of the cabinet.

The cabinet shall provide a minimum of 48 inches of free height that shall accommodate four heavy duty shelves of 19-inch electronic racks of 18-inch depth. These shelves shall consist of modular slide out trays that are removable and can be repositioned to accommodate changes in equipment position as needed. The slide out trays shall incorporate heavy-duty slide or roller mechanism to support a minimum of 150 lbs. of loading and shall be able to withstand the normal shock and vibration, (under full load) experienced in MTA revenue service, without damage to the slide or roller mechanisms. The trays shall lock in both the in and out positions and resilient material shall be used to prevent the trays from moving when the cabinet is closed.

Power provisions shall be made for the radio and electronics inside the cabinet. Circuits and wiring for each shelf shall be independent of one another at 30 amps 12VDC and 24VDC supplies and a chassis ground provided on four independent terminal strips with a minimum of six terminal mounting locations. Terminal strips shall be clearly identified. Terminal strips and associated wiring shall not interfere with shelf operation. All terminals shall be protected from accidental shorts. Wiring and cabling required between devices in the EC shall be protected by loom tubing to protect it from abrasion and must not interfere with the independent operation of the trays. The cabinet shall be provided with a terminal of the VAN system(s). A 3-inch inside diameter conduit, with a pull wire, shall connect the cabinet with the main bus wiring harnesses above the streetside lighting fixtures and the destination sign compartment. A 2-1/4-inch inside diameter metallic conduit, with a pull wire, shall connect the radio control head and control unit located within the electronics cabinet.

Additional requirements for the interior electronics cabinet are described in TS 83.11.1.

## TS 40. General Electrical Requirements

### TS 40.1 Batteries

#### TS 40.1.1 Low-Voltage Batteries (24V)

**The MTA currently uses Odyssey PC2150 Group 31 batteries, and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Four, Group 31 VRLA/AGM batteries, meeting the following requirements, shall be provided for the 12 VDC and 24 VDC requirements. Proposed batteries and layout shall be presented and reviewed at the PPM.

Batteries shall have a minimum rating of 1,000 CCA.

Batteries shall have a minimum of 200 minute reserve capacity at 25 AMPS and 80 degrees F.

Battery grid structure shall be Cast Only, stamped grids are unacceptable.

Grid structure shall be cast in Sunburst array only (radial grid design) to minimize internal resistance and maximize vibration resistance.

Battery plates shall not consist of Pure Virgin Lead due to voltage requirements.

Each battery shall have a manufacturing date no more than six months before the date of bus factory acceptance for shipment to the MTA.

Battery recharge voltage to be regulated at 28.8 – 29.0 VDC to protect other electrical circuits on the bus.

#### TS 40.1.2 Battery Equalizer

**The MTA currently uses Vanner 80-CAN Series and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The battery equalizer shall maintain a balanced and full charge on all batteries and shall be rated for the maximum current expected to be carried in either the 12 or 24 VDC circuits. The equalizer shall have an operating temperature range of -40 F to 167 F. The input voltage range shall be 18-32 VDC and 43 input amps.

The battery equalizer shall be located in the near vicinity of the batteries to minimize the cable runs between the two. The location shall be a sealed area that protects the component from moisture, battery acid / gassing, fluids and electrical grounding. The location shall be accessible for easy diagnosis and removal/replacement of the equalizer. Surrounding components shall not have to be removed for diagnosis or removal/replacement of the equalizer.

#### TS 40.1.3 Battery Cables

The battery terminal ends and cables shall be color-coded with red for the primary positive, black for negative and another color for any intermediate voltage cables. Battery cables shall be installed with heat shrink. Red heat shrink shall be used on the 24 VDC positive cable end and light blue shall be used on the 12 VDC positive cable end. Positive and negative battery cables shall not cross each other if at all possible, be flexible and sufficiently long to reach the batteries with the tray in the extended position without stretching or pulling on any connection and shall not lie directly on top of the batteries. Except as interrupted by the master battery switch, battery and starter wiring shall be continuous cables with connections secured by bolted terminals and shall conform to specification requirements of SAE Standard J1127 – Type SGT, SGX or GXL and SAE Recommended Practice J541.

#### TS 40.1.4 Jump Start

**The MTA currently uses Anderson Multi Pole Jump Start connector and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

A two pole jump-start connector shall be provided next to the Master Battery Switch equipped with dust cap and adequately protected from moisture, dirt and debris. This connector shall be accessible through a flip-open style door. The metal connector lugs shall have protectant applied to mitigate corrosion.

#### TS 40.1.5 Battery Compartment

The battery compartment shall prevent accumulation of snow, ice and debris on top of the batteries and shall be vented and self-draining. The battery compartment shall be accessible only from the outside of the bus located behind the curbside rear wheelhouse. All components within the battery compartment, and the compartment itself, shall be protected from damage or corrosion from the electrolyte. The inside surface of the battery compartment's access door shall be electrically insulated, as required, to prevent the battery terminals from shorting on the door if the door is damaged in an accident or if a battery comes loose. No sparking devices shall be located within the battery box. The battery compartment access door shall be hinged for easy opening and be equipped with square key locking device(s) to gain access.

The battery hold-down bracket shall be constructed of a non-metallic material (plastic or fiberglass).

The batteries shall be securely mounted on a stainless steel or equivalent tray that can accommodate the size and weight of the batteries. The battery tray shall pull out easily and properly support the batteries while they are being serviced. The tray shall allow each battery cell to be easily serviced and filled. A locking device shall retain the battery tray to the stowed position. The locking device shall be a tethered butterfly nut.

If not located in the engine compartment, the same fire-resistant properties shall apply to the battery compartment. No ignition sources shall be located within the battery box.

#### TS 40.1.6 INTENTIONALLY BLANK

#### TS 40.1.7 Master Battery Switch

A single rotary master battery switch shall be provided near the battery compartment for the disconnecting of all battery positives (12 and 24 VDC), except for safety devices such as the fire suppression system and other systems as specified. The rotary switch shall have a single On/Off switch. The location of the Master Battery Switch shall be clearly identified on the exterior access panel, be accessible in less than 10 seconds for deactivation, and prevent corrosion from fumes and battery acid when the batteries are washed off or are in normal service.

The access door shall require a square key locking device to gain access to the switch, and it shall be accessible without removing or lifting the panel. The door shall be flush-fitting and incorporate a spring tensioner to retain the door in a closed position when not in use.

The battery quick-disconnect access door shall be identified with a decal. The decal size shall not be less than 3.5 inches× 5 inches.

Turning the master switch off with the powerplant operating shall shut off the engine and shall not damage any component of the electrical system. The Master Battery Switch shall be capable of carrying and interrupting the total circuit load.

#### **TS 40.1.8 Low-Voltage Generation and Distribution**

The low-voltage generating system shall maintain the charge on fully charged batteries, except when the bus is at standard idle with a total low voltage generator load exceeding 70 percent of the low voltage generator nameplate rating.

Voltage monitoring and over-voltage output protection (recommended at 32 VDC) shall be provided.

Dedicated power and ground shall be provided as specified by the component or system manufacturer. Cabling to the equipment shall be sized to supply the current requirements with no greater than a 5 percent volt drop across the length of the cable.

**The MTA currently uses the Vanner Hybrid Beltless Alternator (HBA) and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

A beltless alternator shall be supplied capable of converting the buses hybrid system voltage to 24 VDC used for routine bus components. The nominal output of the HBA shall be 28 VDC +/- 2 percent and 250 amps at idle.

The HBA shall have been used in transit service a minimum of five years and shall be constructed for service in the transit environment of high and low ambient temperatures, weather and in-service vehicle shock. The area selected for mounting of the HBA shall provide for ease of diagnostic, service and replacement.

#### **TS 40.1.9 Circuit Protection**

All branch circuits shall be protected by current-limiting devices such as circuit breakers, fuses or solid state devices sized to the requirements of the circuit. The circuit breakers or fuses shall be easily accessible for authorized personnel. Fuses shall be used only where it can be demonstrated that circuit breakers are not practicable. Fuse holders shall be constructed to be rugged and waterproof.

All manual reset circuit breakers critical to the operation of the bus shall be mounted in a location convenient to the MTA mechanic with visible indication of open circuits. The MTA shall consider the application of automatic reset circuit breakers on a case-by-case basis. The Contractor shall show all in-line fuses in the final harness drawings. Manually resettable circuit breakers shall provide a visible indication of open circuits.

Circuit breakers or fuses shall be sized to a minimum of 15 percent larger than the total circuit load. The current rating for the wire used for each circuit must exceed the size of the circuit protection being used.

#### **TS 40.2 Grounds**

The batteries shall be grounded to the vehicle chassis/frame redundantly and as close to the batteries as possible. When using a chassis ground system, the chassis shall be grounded to the frame in multiple locations, evenly distributed throughout the vehicle to eliminate ground loops. No more than

four ground ring terminal connections shall be made per ground stud. Electronic equipment requiring an isolated ground to the battery (i.e., electronic ground) shall not be grounded through the chassis.

### **TS 40.3 Low Voltage/Low Current Wiring and Terminals**

All power and ground wiring shall conform to specification requirements of SAE Recommended Practice J1127, J1128 and J1292. Double insulation shall be maintained as close to the junction box, electrical compartment or terminals as possible. The requirement for double insulation shall be met by wrapping the harness with plastic electrical tape or by sheathing all wires and harnesses with non-conductive, rigid or flexible conduit.

Wiring shall be grouped, numbered and/or color-coded. Wiring harnesses shall not contain wires of different voltage classes unless all wires within the harness are insulated for the highest voltage present in the harness. Kinking, grounding at multiple points, stretching, and exceeding minimum bend radius shall be prevented.

Strain-relief fittings shall be provided at all points where wiring enters electrical compartments. Grommets or other protective material shall be installed at points where wiring penetrates metal structures outside of electrical enclosures. Wiring supports shall be protective and non-conductive at areas of wire contact and shall not be damaged by heat, water, solvents or chafing.

**The MTA currently uses UMPCO 775 SST P-clamps to support electrical harness's and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

P-clips shall clamp the line, be a loop style with full box cushion. The p-clips shall be made of stainless steel with the cushion made of general purpose silicone. Insulated SST p-clips shall be used for the securement of all harnesses. Screws used to attach P-clips shall be made of stainless steel.

To the extent practicable, wiring shall not be located in environmentally exposed locations under the bus. Wiring and electrical equipment necessarily located under the bus shall be insulated from water, heat, corrosion and mechanical damage. Where feasible, front to rear electrical harnesses shall be installed above the window line of the vehicle. Wiring decals shall be required at strategic points within the bus. Decals shall be laminated to protect the content and attached to the bus. The bus manufacturer shall propose where the decals are located with final approval determined by the MTA.

All wiring harnesses over 5 ft long and containing at least five wires shall include 10 percent (minimum one wire) excess wires for spares. This requirement for spare wires does not apply to data links and communication cables. Wiring harness length shall allow end terminals to be replaced twice without pulling, stretching or replacing the wire. Terminals shall be crimped to the wiring according to the connector manufacturer's recommendations for techniques and tools. All cable connectors shall be locking type, keyed and sealed, unless enclosed in watertight cabinets or the bus interior. Pins shall be removable, crimp contact type, of the correct size and rating for the wire being terminated. Unused pin positions shall be sealed with sealing plugs. Adjacent connectors shall either use different inserts or different insert orientations to prevent incorrect connections.

Terminals shall be crimped, corrosion-resistant and full ring type or interlocking lugs with insulating ferrules. When using pressure type screw terminal strips, only stranded wire shall be used. Insulation clearance shall ensure that wires have a minimum of "visible clearance" and a maximum of two times the conductor diameter or 1/16 in., whichever is less. When using shielded or coaxial cable, upon stripping of the insulation, the metallic braid shall be free from frayed strands that can penetrate the insulation of the inner wires.

Ultra-sonic and T-splices may be used with 7 AWG or smaller wire. When a T-splice is used, it shall meet these additional requirements:

- a) Splices shall include a mechanical clamp in addition to solder on the splice.
- b) The wire shall support no mechanical load in the area of the splice.
- c) The wire shall be supported to prevent flexing.

All splicing shall be staggered in the harness so that no two splices are positioned in the same location within the harness.

Wiring located in the engine compartment shall be routed away from high-heat sources or shielded and/or insulated from temperatures exceeding the wiring and connector operating requirements.

The instrument panel and wiring shall be easily accessible for service from the operator's seat or top of the panel. The instrument panel shall be separately removable and replaceable without damaging the instrument panel or gauges. Wiring shall have sufficient length and be routed to permit service without stretching or chafing the wires.

#### **TS 40.4 Electrical Components**

All electrical components, including switches, relays, flashers and circuit breakers, shall be heavy-duty designs with either a successful history of application in heavy-duty buses or design specifications for an equivalent environment.

All electric motors shall be heavy-duty brushless type where practical, and have a continuous duty rating of no less than 40,000 hours (except washer pumps and wiper motors). All electric motors shall be easily accessible for servicing.

#### **TS 40.5 Electrical Compartments**

All relays, controllers, flashers, circuit breakers and other electrical components shall be mounted in easily accessible electrical compartments. All compartments exposed to the outside environment shall be corrosion-resistant and sealed. The components and their functions in each electrical compartment shall be identified and their location permanently recorded on a drawing attached to the inside of the access panel or door. The drawing shall be protected from oil, grease, fuel and abrasion.

The front electrical compartment shall be completely serviceable from the operator's seat, vestibule or from the outside of the bus. "Rear start and run" controls shall be mounted in an accessible location in the engine compartment and shall be protected from the environment.

### **TS 41. General Electronic Requirements**

If an electronic component has an internal real-time clock, it shall provide its own battery backup to monitor time when battery power is disconnected, and/or it may be updated by a network component. If an electronic component has an hour meter, it shall record accumulated service time without relying on battery backup.

All electronic component Suppliers shall ensure that their equipment is self-protecting in the event of shorts in the cabling, and also in over-voltage (over 32V DC on a 24V DC nominal voltage rating with a maximum of 50V DC) and reverse polarity conditions. If an electronic component is required to interface with other components, it shall not require external pull-up and/or pull-down resistors. Where this is not possible, the use of a pull-up or pull-down resistor shall be limited as much as possible and easily accessible and labeled.

## TS 41.1 Wiring and Terminals

Kinking, grounding at multiple points, stretching and reducing the bend radius below the manufacturer's recommended minimum shall not be permitted.

### TS 41.1.1 Discrete I/O (Inputs/Outputs)

All wiring to I/O devices, either at the harness level or individual wires, shall be labeled, stamped or color-coded in a fashion that allows unique identification at a spacing not exceeding 4 in. Wiring for each I/O device shall be bundled together. If the I/O terminals are the same voltages, then jumpers may be used to connect the common nodes of each I/O terminal.

### TS 41.1.2 Shielding

All wiring that requires shielding shall meet the following minimum requirements. A shield shall be generated by connecting to a ground, which is sourced from a power distribution bus bar or chassis. A shield shall be connected at one location only, typically at one end of the cable. However certain standards or special requirements, such as SAE J1939 or RF applications, have separate shielding techniques that also shall be used as applicable.

When using shielded or coaxial cable, upon stripping of the insulation, the metallic braid shall be free from frayed strands, which can penetrate the insulation of the inner wires. To prevent the introduction of noise, the shield shall not be connected to the common side of a logic circuit.

### TS 41.1.3 Communications

The data network cabling shall be selected and installed according to the selected protocol requirements. The physical layer of all network communication systems shall not be used for any purpose other than communication between the system components, unless provided for in the network specifications.

Communications networks that use power line carriers (e.g., data modulated on a 24 VDC power line) shall meet the most stringent applicable wiring and terminal specifications.

### TS 41.1.4 Radio Frequency (RF)

RF components, such as radios, video devices, cameras, global positioning systems (GPS), etc., shall use coaxial cable, as applicable to carry the signal. All RF systems require special design consideration for losses along the cable. Connectors shall be minimized, since each connector and crimp has a loss that will attribute to attenuation of the signal. Cabling should allow for the removal of antennas or attached electronics without removing the installed cable between them. If this cannot be done, then a conduit of sufficient size shall be provided for ease of attachment of antenna and cable assembly.

### TS 41.1.5 Audio

Cabling used for microphone level and line level signals shall be 22 AWG minimum with shielded twisted pair. Cabling used for amplifier level signals shall be 18 AWG minimum.

## TS 42. Multiplexing

### TS 42.1 General

**The MTA currently uses the Vansco multiplex system and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The primary purpose of the multiplexing system is control of components necessary to operate the vehicle. This is accomplished by processing information from input devices and controlling output devices through the use of an internal logic program.

Versatility and future expansion shall be provided for by expandable system architecture. The multiplex system shall be capable of accepting new inputs and outputs through the addition of new modules and/or the utilization of existing spare (10% minimum) inputs and (10% minimum) outputs. All like components in the multiplex system shall be modular and interchangeable with self-diagnostic capabilities. The modules shall be easily accessible for troubleshooting electrical failures and performing system maintenance. Multiplex input/output modules shall use solid-state devices to provide extended service life and individual circuit protection.

Ten percent of the total number of inputs and outputs, or at least one each for each voltage type utilized (0V, 12 VDC, 24 VDC), at each module location shall be designated as spares.

## **TS 42.2 System Configuration**

Multiplexing shall be distributed or centralized. A distributed system shall process information on multiple control modules within the network. A centralized system shall process the information on a single control module. Either system shall consist of several modules connected to form a control network.

### **TS 42.2.1 I/O Signals**

The input/output for the multiplex system may contain three types of electrical signals: discrete, analog or serial data.

Discrete signals shall reflect the on/off status of switches, levers, limit switches, lights, etc. Analog signals shall reflect numerical data as represented by a voltage signal (0-12 VDC, 10-24 VDC, etc.) or current signal (4-20 mA). Both types of analog signals shall represent the status of variable devices such as rheostats, potentiometers, temperature probes, etc. Serial data signals shall reflect ASCII or alphanumeric data used in the communication between other on-board components.

## **TS 43. Data Communications**

### **TS 43.1 General**

All data communication networks shall be either in accordance with a nationally recognized interface standard, such as those published by SAE, IEEE or ISO, or shall be published to the MTA with the following minimum information:

- a) Protocol requirements for all timing issues (bit, byte, packet, inter-packet timing, idle line timing, etc.) packet sizes, error checking and transport (bulk transfer of data to/from the device).
- b) Data definition requirements that ensure access to diagnostic information and performance characteristics.
- c) The capability and procedures for uploading new application or configuration data.
- d) Access to revision levels of data, application software and firmware.
- e) The capability and procedures for uploading new firmware or application software.
- f) Evidence that applicable data shall be broadcast to the network in an efficient manner such that the overall network integrity is not compromised.

Any electronic bus components used on a network shall be conformance tested to the corresponding network standard.

## **TS 43.2 Drivetrain Level**

Drivetrain components, consisting of the engine, hybrid drive, retarder, ABS and all other related components, shall be integrated and communicate fully with respect to bus operation with data using SAE Recommended Communications Protocols such as J1939 and/or J1708/J1587 with forward and backward compatibilities or other open protocols.

### **TS 43.2.1 Diagnostics, Fault Detection and Data Access**

Drivetrain performance, maintenance and diagnostic data, and other electronic messages shall be formatted and transmitted on the communications networks.

The drivetrain level shall have the ability to record abnormal events in memory and provide diagnostic codes and other information to service personnel. At a minimum, this network level shall provide live/fail status, current hardware serial number, software/data revisions and uninterrupted timing functions.

### **TS 43.2.2 Programmability (Software)**

The drivetrain level components shall be programmable by the MTA with limitations as specified by the sub-system Supplier.

## **TS 43.3 Multiplex Level**

### **TS 43.3.1 Data Access**

At a minimum, information shall be made available via a communication port on the multiplex system. The location of the communication port shall be easily accessible. A hardware gateway and/or wireless communications system are options if requested by the MTA. The communication port(s) shall be mounted to the radio cabinet with velcro for ease of access.

### **TS 43.3.2 Diagnostics and Fault Detection**

The multiplex system shall have a proven method of determining its status (system health and input/output status) and detecting either active (online) or inactive (offline) faults through the use of on-board visual/audible indicators.

In addition to the indicators, the system shall employ an advanced diagnostic and fault detection system, which shall be accessible via either a personal computer or a handheld unit. Either unit shall have the ability to check logic function. The diagnostic data can be incorporated into the information level network or the central data access system.

### **TS 43.3.3 Programmability (Software)**

The multiplex system shall have security provisions to protect its software from unwanted changes. This shall be achieved through any or all of the following procedures:

- a) password protection
- b) limited distribution of the configuration software
- c) limited access to the programming tools required to change the software
- d) hardware protection that prevents undesired changes to the software

Provisions for programming the multiplex system shall be possible through a PC or laptop. The multiplex system shall have proper revision control to ensure that the hardware and software are identical on each vehicle equipped with the system. Revision control shall be provided by all of the following:

- a) hardware component identification where labels are included on all multiplex hardware to identify components
- b) hardware series identification where all multiplex hardware displays the current hardware serial number and firmware revision employed by the module
- c) software revision identification where all copies of the software in service displays the most recent revision number
- d) a method of determining which version of the software is currently in use in the multiplex system

Revision control labels shall be electronic.

### **TS 43.4 Electronic Noise Control**

Electrical and electronic sub-systems and components on all buses shall not emit electromagnetic radiation that will interfere with on-board systems, components or equipment, telephone service, radio or TV reception or violate regulations of the Federal Communications Commission.

Electrical and electronic sub-systems on the buses shall not be affected by external sources of RFI/EMI. This includes, but is not limited to, radio and TV transmission, portable electronic devices including computers in the vicinity of or onboard the buses, ac or dc power lines and RFI/EMI emissions from other vehicles.

## **OPERATOR CONTROLS AND INSTRUMENTATION**

### **TS 44. Operator Area Controls**

#### **TS 44.1 General**

In general when designing the operator's area, it is required that SAE J833, "Human Physical Dimensions," be used.

Switches and controls shall be divided into basic groups and assigned to specific areas, in conformance with SAE Recommended Practice J680, Revised 1988, "Location and Operation of Instruments and Controls in Motor Truck Cabs," and be essentially within the hand reach envelope described in SAE Recommended Practice J287, "Driver Hand Control Reach."

#### **TS 44.2 Glare**

The operator's work area shall be designed to minimize glare to the extent possible. Objects within and adjacent to this area shall be matte black or dark gray in color wherever possible to reduce the reflection of light onto the windshield. The use of polished metal and light-colored surfaces within and adjacent to the operator's area shall be avoided.

#### **TS 44.3 Visors/Sun Shades**

##### **TS 44.3.1 Operators Window Sunscreens**

An adjustable scissor type sunscreen shall be provided over the operator's windshield and the operator's side window. The sunscreen shall be capable of being lowered to the midpoint of the operator's window. When deployed, the screen shall be secure, stable and shall not rattle, not contact other appendages, sway or intrude into the operator's field of view due to the motion of the bus or as a result of air movement. Once lowered, the screen shall remain in the lowered position until returned to the stowed position by the operator. Sunscreen shall be shaped to minimize light leakage between the visor and windshield pillars to the extent possible.

#### **TS 44.4 Operator's Controls**

Frequently used controls shall be in easily accessible locations. These include the door control, kneel control, windshield wiper/washer controls, ramp, and lift and run switch. Any switches and controls necessary for the safe operation of the bus shall be conveniently located and shall provide for ease of operation. They shall be identifiable by shape, touch and permanent markings. Controls also shall be located so that passengers may not easily tamper with control settings.

All panel-mounted switches and controls shall be marked with easily read identifiers. Graphic symbols shall conform to SAE Recommended Practice J2402, "Road Vehicles – Symbols for Controls, Indicators, and Tell Tales," where available and applicable. Color of switches and controls shall be dark with contrasting typography or symbols.

Mechanical switches and controls shall be replaceable, and the wiring at these controls shall be serviceable from a convenient location. Switches, controls and instruments shall be dust- and water-resistant.

#### **TS 44.5 Normal Bus Operation Instrumentation and Controls**

The following list identifies bus controls used to operate the bus. These controls are either frequently used or critical to the operation of the bus. They shall be located within easy reach of the operator. The operator shall not be required to stand or turn to view to actuate these controls unless specified otherwise.

Systems or components monitored by onboard diagnostics system shall be displayed in clear view of the operator and provide visual and/or audible indicators. The intensity of indicators shall permit easy determination of on/off status in bright sunlight but shall not cause a distraction or visibility problem at night. All indicators shall be illuminated using backlighting.

The indicator panel shall be located within easy view of the operator instrument panel. All indicators shall have a method of momentarily testing their operation. The audible alarm shall be tamper-resistant and shall have an outlet level between 80 and 83 dBA when measured at the location of the operator's ear.

On-board displays visible to the operator shall be limited to indicating the status of those functions described herein that are necessary for the operation of the bus. All other indicators needed for diagnostics and their related interface hardware shall be concealed and protected from unauthorized access. Table 6 represents instruments and alarms. The intent of the overall physical layout of the indicators shall be in a logical grouping of systems and severity nature of the fault.

Consideration shall be provided for future additions of spare indicators as the capability of onboard diagnostic systems improves. Blank spaces shall contain LEDs.

**TABLE 6**  
Transit Bus Instruments, Controls and Alarms

Device	Description	Location	Function	Visual/ Audible
Master run switch	Rotary, four-position detent	Side console	Master control for bus, off, day run, night run and night park positions	
Engine start, front	Approved momentary switch	Side console	Activates engine starter motor	
Engine start, rear	Approved momentary switch	Engine compartment	Activates engine starter motor	
Engine run, rear	Three-position toggle switch	Engine compartment	Permits running engine from rear start, normal front run position and off	Amber light
Drive selector	Touch panel switch	Dash	Provides selection of propulsion: forward, reverse and neutral	Gear selection
Marker light strobe	Two position switch	Destination sign cavity	Three center markers strobe when switch is in normal position	
Climate Control	Switch or switches to control HVAC	Side console	Two position switch: full automatic system with on/off only	
Operator's fan	Three-position toggle switch	Side console or Dash left wing	Permits supplemental ventilation: fan off, low or high	
Defroster fan	Rotary switch	Side console or Dash left wing	Permits variable defroster fan speed	
Defroster temperature	Variable position	Side console or Dash left wing	Adjusts defroster water flow and temperature	
Windshield wiper control	One-variable rotary position operating both wipers	Dash left wing	Variable speed control for both windshield wipers	
Windshield washer	Incorporated into wiper control	Dash left wing	Activates windshield washers	
Dash panel lights	Rotary rheostat	Side Console or Dash left wing	Provides adjustment for dash light intensity in night run position	
Interior lights	Three-position switch	Side console	Selects mode of passenger compartment lighting: off, on, normal	
Fast idle	Two-position switch	Side console	Selects high idle speed of engine	
Pedal adjustment	Spring loaded 3 position toggle or rocker switch	Side console	Allows adjustment of throttle and brake pedals. Forward, rearward and hold.	
Ramp control	Two position guarded switch	Right side of steering wheel	Master on/off for ramp operation	Blue dash light
Front door ramp	Three-position momentary switch	Right side of steering wheel	Actuates the deployment and stowage of ramp	Red light

**TABLE 6**  
Transit Bus Instruments, Controls and Alarms

Device	Description	Location	Function	Visual/ Audible
Front kneel	Three-position guarded momentary switch	Front door remote	Permits kneeling activation and raise and normal at front door remote location	Amber or red dash indicator. Ext alarm and Amber light
Silent alarm	Recessed push button, NO and NC contacts momentary	Left foot panel in front of high beam switch	Activates emergency radio alarm at dispatch and permits covert microphone and/or enables destination sign emergency message	
Video system event switch	Momentary on/off momentary switch with plastic guard	Side console	Triggers event equipment, triggers event light on dash	Amber light
Left exterior rear view remote mirror	Control switch for upper and lower mirrors, streetside	Side console	Permits two-axis adjustment of street side exterior mirrors	
Right exterior rear view remote mirror	Control switch for upper and lower mirrors, curbside	Side console	Permits two-axis adjustment of curb side exterior mirror	
Passenger door control	Five-position handle type detent	Side console, forward	Permits open/close control of front and rear passenger doors	Red light
Rear door control	Guarded two-position switch in approved location	Side console,	Allows operator to switch rear door control between passenger (default) and operator control	
Engine shutdown override	Momentary switch with operation protection	Side console	Permits operator to override auto engine shutdown	
Hazard flashers	Two-position switch with long handle	Side console or Dash right wing	Activates emergency flashers	Dash turn signal indicators, exterior front, side and rear lights to flash for hazard warning
Fire suppression	Controller for auto fire suppression system	Dash left wing or dash center	System status and permits operator to override and manually discharge fire suppression system	Green light OK, red light to indicate shutdown with audible alarm
Mobile data terminal	Mobile data terminal bus operator interface panel	Above right dash wing	Facilitates operator interaction with communication system and master log-on	LCD display with visual status and text messages
Farebox interface	Farebox bus operator interface panel	Near farebox	Facilitates operator interaction with farebox system	LCD display
Destination sign interface	Destination sign interface panel	In front destination sign cavity	Facilitates operator interaction with destination sign system, manual entry	LCD display
Turn signals	Momentary push button (two required) raised from other switches	Left foot panel	Activates left and right turn signals	Two green lights and optional audible indicator

**TABLE 6**  
Transit Bus Instruments, Controls and Alarms

Device	Description	Location	Function	Visual/ Audible
PA manual	Momentary push button	Heel switch to street side of operators area floor	Permits operator to manually activate public address microphone	
High beam	Push button detent	Left of steering column between and in front of turn signal switches	Permits operator to toggle between low and high beam	Blue light on dash
Parking brake	Pneumatic PPV-Yellow diamond knob	Side console or Dash left wing	Permits operator to apply and release parking brake	Red light on dash
Hill holder	Two-position momentary switch	Side console	Applies brakes to prevent bus from rolling	Red light on dash
Master door/ interlock	Two position toggle switch	Right lower dash behind door	Permits operator to disable door and brake / throttle interlock	Red light on dash
Regen brake disable switch	Two position switch	Destination sign cavity	Permits operator to disable hybrid regen system	Red light
Indicator/ alarm test	Momentary switch	Dash center	Permits operator to activate test of sentry, indicators and audible alarms	All visual and audible alarms
Speedometer	Speedometer, odometer, and diagnostic capability, 5-mile increments	Dash center panel	Visual indication of speed and distance traveled, accumulated vehicle mileage, fault condition display	Visual
Air pressure gauge	Primary, secondary air system with gauges in 5 psi increments	Dash center panel	Visual indication of primary and secondary air systems.	Visual and audible alarms for low air pressure
Door obstruction	Sensing of door obstruction (sensitive edge)	Dash center	Indication of rear door sensitive edge activation	Red light and buzzer
Door ajar	Door not properly closed	Dash center panel	Indication of rear door not properly closed	Red light and buzzer
Low system air pressure	Sensing low primary and secondary air tank pressure	Dash center panel	Indication of low air system pressure	Visual and audible alarms for low air pressure
Engine coolant indicator	Low coolant indicator may be supplied as audible alert and visual and/or text message	Within operator's sight	Detects low coolant condition	Amber light

**TABLE 6**  
Transit Bus Instruments, Controls and Alarms

Device	Description	Location	Function	Visual/ Audible
Hot engine indicator	Coolant temperature indicator may be supplied as audible alert and visual and/or text message	Within operator's sight	Detects hot engine condition and initiates time delay shutdown	Red light
Low engine oil pressure indicator	Engine oil pressure indicator may be supplied as audible alert and visual and/or text message	Within operator's sight	Detects low engine oil pressure condition and initiates time-delayed shutdown	Red light
ABS indicator	Detects system status	Dash center panel	Displays system failure	Amber light
HVAC indicator	Detects system status	Dash center panel	Displays system failure	Amber or red light
Charging system indicator (12/24 VDC)	Detect charging system status	Dash center panel	Detects no charge condition and optionally detects battery high, low, imbalance, no charge condition, and initiates time-delayed shutdown	Red light flashing or solid based on condition
Bike rack deployed indicator	Detects bike rack position	Dash center	Text message indication of bike rack not being in fully stowed position	Amber light on dash
Fuel tank level	Gauge, graduated based on type	Dash center	Indication of diesel fuel tank level	Visual message
DEF gauge	Level Indicator	Center dash	Displays level of DEF tank and indicates with warning light when low	Red light
Active regeneration	Detects Status	Dash center	Indication of electric regeneration	Amber or red light
Passenger Signal	Passenger Requested Stop	Dash Center	Indication of Request	Amber/Audible Single Bell Tone
Passenger Signal	Mobility Position requested Stop	Dash Center	Indication of Request	Red/Audible Double Bell Tone

### TS 44.6 Operator Foot Controls

The operator's foot accelerator and brake pedals shall be designed for ankle motion. Foot surfaces of the pedals shall be faced with wear-resistant, nonskid, replaceable material.

### TS 44.6.1 Pedal Angle

The vertical angle of the accelerator and brake pedals shall have the same angle determined from a horizontal plane regardless of the slope of the cab floor. The accelerator and brake pedals shall be positioned at an angle of 37 to 50 degrees at the point of initiation of contact and extend downward to an angle of 10 to 18 degrees at full throttle.

The location of the brake and accelerator pedals shall be determined by the contractor, based on space needs, visibility and lower edge of windshield.

### TS 44.6.2 Pedal Dimensions and Position

The floor-mounted accelerator pedal shall be 10 to 12 inches long and 3 to 4 inches wide. Clearance around the pedal shall allow for no interference precluding operation.

The accelerator and brake pedals shall be positioned such that the spacing between them, measured at the heel of the pedals, is between 1 and 2 inches. Both pedals should be located approximately on the same plane coincident to the surface of the pedals. A floor mounted wear plate shall also be provided.

### TS 44.6.3 Adjustable Brake and Accelerator Pedals

**The MTA currently uses Teleflex adjustable brake and accelerator pedals and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The pedals shall conform to the requirements of SAE J1455 and FMVSS 124. Both pedals shall be adjustable forward and rearward a minimum of 3 inches. The adjustment shall be made by use of a side console mounted toggle or rocker switch. The switch shall be clearly labeled to identify it as pedal adjustment and shall be within easy reach of the operator. Pedal adjustment shall be enabled only when the bus is stationary and the parking brake engaged.

The adjustable system shall assist operator's of shorter stature to move the accelerator, brake, and clutch pedals closer while permitting them to maintain normal or desired seating position and optimum body positioning, without altering pedal deployment action or angle. This allows for safety restraint system effectiveness, and steering wheel and instrument panel control access, while enhancing the operator's comfort.

### TS 44.7 Operator Foot Switches

The angle of the turn signal platform shall be determined from a horizontal plane, regardless of the slope of the cab floor. The turn signal platform shall be angled at a minimum of 10 degrees and a maximum of 37 degrees. The platform shall be located no closer to the operator seat front than the heel point of the accelerator pedal.

The control switches for the turn signals, high beam and silent alarm shall be mounted on an inclined, floor-mounted stainless steel enclosure or metal plate mounted to an incline integrated into the operator's platform, located to the left of the steering column. The location and design of this enclosure shall be such that foot room for the operator is not impeded. The inclined mounting surface shall be skid-resistant and the underside sealed to the floor protecting the switch terminals and wiring from moisture and dirt. All proposed signal switches locations and mounting shall have MTA review..

The foot switches shall be UL-listed, heavy-duty type, of a rugged, corrosion-resistant metal construction. The foot switches for the turn signals and PA system shall be momentary type, while the switch for the high beam shall be latching type. The spacing of the switches shall be such that inadvertent simultaneous deflection of switches is prevented.

## TS 45. Operator Amenities

### TS 45.1 Coat Hanger

A hook and loop shall be provided to secure the operator's coat.

### TS 45.2 INTENTIONALLY BLANK

### TS 45.3 Storage Box

An enclosed operator storage area, with access from the aisle, shall be provided with a positive latching door and/or lock. The minimum size of the storage box shall be 2,750 cubic inches. The location will be reviewed by the MTA at PPM.

## TS 46. Windshield Wipers and Washers

### TS 46.1 Windshield Wipers

**The MTA currently Sprague windshield wiper system and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The bus shall be equipped with an electric windshield wiper system having two speeds and intermittent capability. The windshield wiper blades shall have a wet arm to allow washer fluid flow where the wiper sweeps.

The bus shall be equipped with a windshield wiper for each half of the windshield. At 60 mph, no more than 10 percent of the wiped area shall be lost due to windshield wiper lift. The wipers shall park along the center edges of the windshield glass. Windshield wiper motors and mechanisms shall be easily accessible for repairs or service. The fastener that secures the wiper arm to the drive mechanism shall be corrosion-resistant.

A single-control, electric two-speed intermittent wiper system shall be provided. A variable-speed feature shall be provided to allow adjustment of wiper speed for both sides of the windshield between approximately 5 and 25 cycles per minute.

### TS 46.2 Windshield Washers

The windshield washer system, when used with the wipers, shall deposit washing fluid evenly and completely wet the entire wiped area. A wet-arm-type system is acceptable. The wash operation shall be controlled by the wiper control knob.

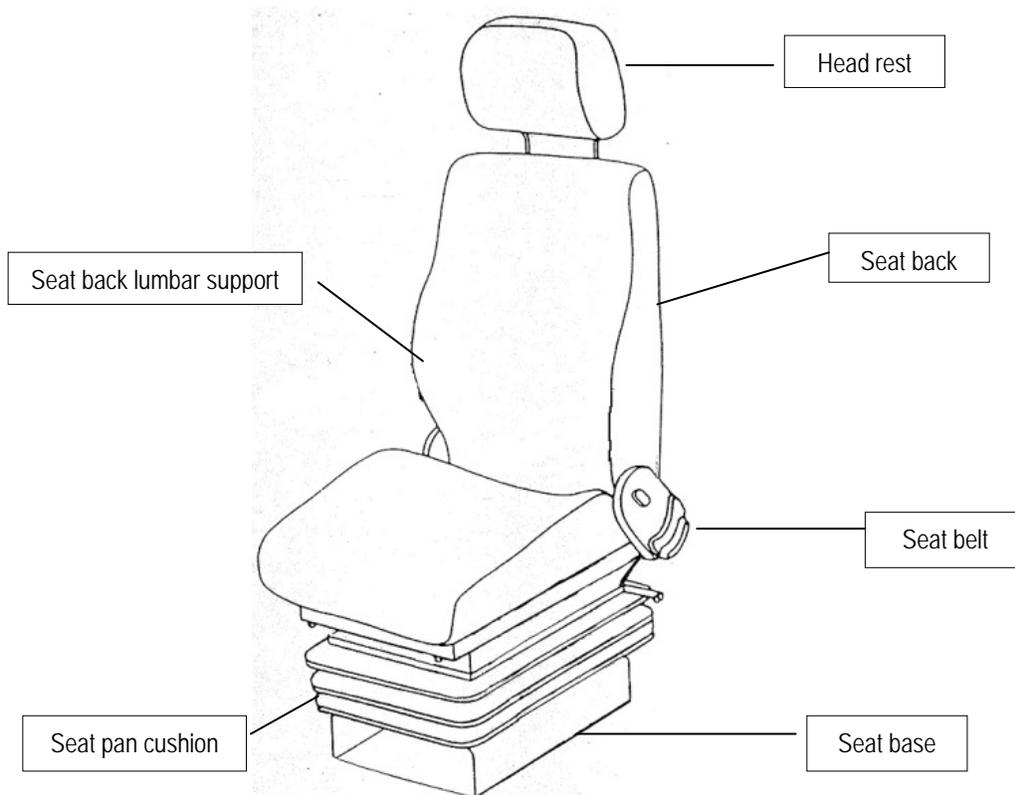
The windshield washer system shall have a minimum 5-gallon reservoir, located for easy refilling from outside of the bus. Reservoir pumps, lines and fittings shall be corrosion-resistant and must include a means to determine fluid level.

## TS 47. Operator's Seat and Security Door

**The MTA currently uses the Recaro Ergo Metro AM 80 operator's seat and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The operator's seat shall conform to the requirements of FMVSS 302, 207 and 210 and accordance with the Recommended Fire Safety Practices defined in FTA Docket 90A, dated October 20, 1993. The seat shall have an air suspension system with a 400 lb. lift capacity and 6.5 inches of height travel. The fore and aft travel shall be a minimum of 11.0 inches.

**FIGURE 6**  
Operator's Seat



### TS 47.1 Seat Dimensions

The operator's seat shall be comfortable and adjustable so that people ranging in size from a 95th-percentile male to a 5th-percentile female may operate the bus.

#### **TS 47.1.1 Seat Pan Cushion Length**

The seat pan cushion measurement shall be from the front edge of the seat pan to the rear at its intersection with the seat back. The adjustment of the seat pan length shall be no less than 16.5 inches at its minimum length and no more than 20.5 inches at its maximum length.

#### **TS 47.1.2 Seat Pan Cushion Height**

The seat pan cushion height measurement shall be from the cab floor to the top of the level seat at its center midpoint. The seat shall adjust in height from a minimum of 14 inches, with a minimum 6.5 inches vertical range of adjustment.

#### **TS 47.1.3 Seat Pan Cushion Width**

The seat pan cushion width measurement shall be the horizontal distance across the seat cushion. The seat pan cushion shall be 17 to 21 inches across at the front edge of the seat cushion and 20 to 23 inches across at the side bolsters.

#### **TS 47.1.4 Seat Pan Cushion Slope**

The seat pan cushion slope measurement shall be the slope of the plane created by connecting the two high points of the seat, one at the rear of the seat at its intersection with the seat back and the other at the front of the seat just before it waterfalls downward at the edge. The slope shall be measured using an inclinometer and shall be stated in degrees of incline relative to the horizontal plane (0 degrees). The seat pan shall adjust in its slope from no less than plus 12 degrees (rearward "bucket seat" incline), to no less than minus 5 degrees (forward slope).

#### **TS 47.1.5 Seat Base Fore/Aft Adjustment**

The seat base fore/aft adjustment measurement shall be the horizontal distance from the heel point to the front edge of the seat. The minimum and maximum distances shall be measured from the front edge of the seat when it is adjusted to its minimum seat pan depth (approximately 15 in.). The seat-base shall travel horizontally a minimum of 11 inches. It shall adjust no closer to the heel point than 6 in.

#### **TS 47.1.6 Seat Suspension**

The operator's seat shall be appropriately dampened to support a minimum weight of 400 lbs. The suspension shall be capable of dampening adjustment in both directions. The seat suspension shall incorporate an adjustable shock design allowing the operator to adjust the dampening.

Rubber bumpers shall be provided to prevent metal-to-metal contact.

#### **TS 47.1.7 Seat Back Width and Height**

The seat back width measurement shall be the distance between the outermost points of the front of the seat back, at or near its midpoint in height. The seat back width shall be no less than 19 in. The seat back will include dual recliner gears on both sides of the seat.

A standard height seat back shall be provided.

#### **TS 47.1.8 Headrests**

The operator's seat shall have an adjustable headrest.

### **TS 47.1.9 Seat Back Lumbar Support**

The seat back lumbar support measurement shall be from the bottom of the seat back at its intersection with the seat pan to the top of the lumbar cushioning. The seat back shall provide adjustable depth lumbar back support with at least three individual operating lumbar cells within a minimum range of 7 to 11 inches

### **TS 47.1.10 Seat Back Angle Adjustment**

The seat back angle shall be measured relative to a level seat pan, where 90 degrees is the upright position and 90 degrees-plus represents the amount of recline.

The seat back shall adjust in angle from a minimum of no more than 90 degrees (upright) to at least 105 degrees (reclined), with infinite adjustment in between.

### **TS 47.1.11 Seat Clearance**

In any position, the operator's seat shall not contact any part of the bus.

## **TS 47.2 Seat Belt**

The belt assembly should be an auto-locking retractor (ALR). All seat belts should be stored in automatic retractors on the left (street) side of the bus. The belts shall be mounted to the seat frame so that the operator may adjust the seat without resetting the seat belt.

The seat and seat belt assemblies as installed in the bus shall withstand static horizontal forces as required in FMVSS 207 and 210. The belt fabric shall be colored safety orange.

### **TS 47.2.1 Lap and Shoulder (Three-Point) Seat Belt**

Seat belts shall be provided across the operator's lap and diagonally across the operator's chest. The seat shall be equipped with a 2pt and a 3pt retractor with a single buckle on the right side of the seat cushion. The operator shall be able to use both belts by connecting a single buckle on the right side of the seat cushion. Three-point seatbelts shall be emergency locking retractor (ELR) in design. The seat shall have an integrated adjustable D ring that allows for 4 inch of horizontal / vertical adjustment to the shoulder belt. All seat belt assemblies shall come equipped with a warning switch device to remind operators to buckle up.

The lap and shoulder belt fabric shall be colored safety orange.

### **TS 47.2.2 Lap Belt Length**

The lap belt assembly shall be a minimum of 80 inches in length.

## **TS 47.3 Operator Seat Control Locations**

While seated, the operator shall be able to make seat adjustments by hand without complexity, excessive effort or being pinched. Adjustment mechanisms shall hold the adjustments and shall not be subject to inadvertent changes.

## **TS 47.4 Operator Seat Structure and Materials**

All foam and fabric cushions shall be in accordance with FMVSS Standard No. 302 and Recommended Fire Safety Practices defined in FTA Docket 90, dated October 20, 1993.

## TS 47.5 Operator Seat Options

The following seat options shall be provided:

- a) Seat belt alarm

## TS 47.6 Operator's Security Door

A two piece security door shall be provided that extends between the electrical cabinet at the rear of the operator's seat forward to an area beside the farebox. The structure of the door shall include black stanchions and grab rails and provide a buffer between the operator and passenger.

The bottom of the security door shall be solid metal and hinged towards the electrical cabinet. The upper part of the door shall be made of lexan, and sculptured to allow for the operator to converse with passengers entering the bus. A louvered opening in the glass shall be included at the operator's ear level designed so the operator can hear passengers but protecting the operator from assault. The two piece door when opened shall open to a 90 degree angle across the bus aisle way from the street to curb side wheelhouse. When closed the operator shall be able to latch the door sections preventing unwanted patrons from opening the security door.

Shown in the pictures below is the barrier type being specified.



## TS 47.7 Mirrors

### TS 47.7.1 Exterior Mirrors

**The MTA currently uses Hadley exterior mirrors and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The bus shall be equipped with corrosion-resistant, outside rearview mirrors mounted with stable supports to minimize vibration. Mirrors shall be firmly attached to the bus to minimize vibration and to prevent loss of adjustment with a breakaway mounting system. Mirrors shall permit the operator to view the roadway along the sides of the bus, including the rear wheels. Mirrors shall retract or fold sufficiently to allow bus washing operations and shall be designed to avoid contact with windshield. Mirror arms and heads shall be cast aluminum BRT style.

The bus shall be equipped with a combination of flat and convex mirrors referred to as transit-specific. The mirrors shall be located so as to provide the operator a view to the rear along both sides of the bus and shall be adjustable both in the horizontal and vertical directions to view the rearward scene. The roadside rearview mirror shall be positioned so that the operator's line of sight is not obstructed.

The mirrors shall incorporate turn signals on both the glass mirror and back of the mirror head. A red chevron signal arrow shall be incorporated in the mirror glass and on the back of the mirror head the turn signal shall be an LED strip light mounted to the mirror housing as shown in the photo below.



#### Curb and street side Mirrors

The curbside rearview mirror sized as 8" x 11" with a 2/1 split shall be mounted so that its lower edge is no less than 80 in. above the street surface.

The operator shall be able to adjust the curbside mirror remotely while seated in the driving position. The control for remote positioning of the mirror shall be a single switch or device.

#### Street-Side Mirrors

The street-side rearview mirror shall be sized as 8" x 11" with a 2/1 split.

The operator shall be able to adjust the street-side mirror remotely while seated in the driving position. The control for remote positioning of the mirror shall be a single switch or device.

#### TS 47.7.2 Interior Mirrors

**The MTA currently uses Hadley interior mirrors and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Interior mirrors shall be ball shaft mounted allowing for ease of adjustment. Standard safety glass shall be used for the mirrors. The mounting of mirrors shall be into steel structure, tapping plates or clamping to a stanchion. The interior mirrors shall not block the operator's exterior view or view of passengers in the bus.

Mirrors shall be provided for the operator to observe passengers throughout the bus without leaving the seat and without shoulder movement. The operator shall be able to observe passengers in the front/entrance and rear/exit areas, anywhere in the aisle, and in the rear seats. At a minimum, the interior mirrors to be provided shall include:

- a) Operator's rear view mirror – 8"x15"
- b) Spot mirror under destination sign – 6" round
- c) Convex mirror above front door to see first seat behind electronics box – 6" round
- d) Convex mirror mounted at ceiling above front doors to see doorway – 7"x10"
- e) Mirror at rear door area to see rear doorway – 12" round

## WINDOWS

### TS 48. General

There shall be a minimum of 10,000 sq. inches of window area, including operator and door windows, on each side of the bus.

### TS 49. Windshield

The windshield shall be two pieces and shall permit an operator's field of view as referenced in SAE Recommended Practice J1050. The vertically upward view shall be a minimum of 14 degrees, measured above the horizontal and excluding any shaded band. The vertically downward view shall permit detection of an object 3½ ft high no more than 2 ft in front of the bus. The horizontal view shall be a minimum of 90 degrees above the line of sight. Any binocular obscuration due to a center divider may be ignored when determining the 90-degree requirement, provided that the divider does not exceed a 3-degree angle in the operator's field of view. Windshield pillars shall not exceed 10 degrees of binocular obscuration. The windshield shall be designed and installed to minimize external glare as well as reflections from inside the bus.

The windshield shall be easily replaceable by removing zip-locks from the windshield retaining moldings. Bonded-in-place windshields shall not be used. Winglets may be bonded.

#### TS 49.1 Glazing

The windshield glazing material shall have a ¼ inch nominal thickness laminated safety glass conforming to the requirements of ANSI Z26.1 Test Grouping 1A and the Recommended Practices defined in SAE J673.

The upper portion of the windshield above the operator's field of view shall have a dark, shaded band with a minimum luminous transmittance of 5 percent when tested in accordance to ASTM D-1003.

## TS 50. Operator's Side Window

The operator's side window shall be the sliding type, requiring only the rear half of sash to latch upon closing, and shall open sufficiently to permit the seated operator to easily adjust the street-side outside rearview mirror. When in an open position, the window shall not rattle or close during braking. This window section shall slide in tracks or channels designed to last the service life of the bus. The operator's side window shall not be bonded in place and shall be easily replaceable. The glazing material shall have a single-density tint.

The operator's view, perpendicular through operator's side window glazing, shall extend a minimum of 33 inches to the rear of the heel point on the accelerator, and in any case shall accommodate a 5<sup>th</sup> percentile female and 95th percentile male operator. The view through the glazing at the front of the assembly should begin not more than 26 inches above the operator's floor to ensure visibility of an under-mounted convex mirror. The operator's window construction shall maximize ability for full opening of the window.

The operator's side window glazing material shall have a ¼ inch nominal thickness laminated safety glass conforming to the requirements of ANSI Z26.1-1996 Test Grouping 2 and the Recommended Practices defined in SAE J673.

The design shall prevent sections from freezing closed in the winter. Light transmittance shall be 75 percent on the glass area below 53 inches from the operator platform floor. On the top fixed over bottom slider configuration, the top fixed area above 53 inches may have a maximum 5 percent light transmittance.

## TS 51. Side Windows

**The MTA currently uses Arrow Global (Stormtite) flush mounted continuous passenger windows and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Bus windows shall be bonded to the frame appearing as a "continuous all glass" exterior. The bus windows shall be constructed and tested in accordance with FMVSS 217 and the materials conform to ANSI Z26.1 and recommended SAE J673 practices.

Windows shall have been designed and constructed with a water management system. The window seal and sash material shall be designed using UV stable material and of materials to prevent shrinkage, deterioration and water leakage. Window frame material shall be compatible with the bus structure and all fasteners shall be stainless steel.

Each glazing component including and window guards shall have the manufacturers DOT register identification "bug" applied according to DOT requirements and the "bug" shall include the date (month / year) of manufacturer applied.

### TS 51.1 Configuration

Side windows shall not be bonded in place, but shall be easily replaceable without disturbing adjacent windows and shall be mounted so that flexing or vibration from engine operation or normal road excitation is not apparent. All aluminum and steel material shall be treated to prevent corrosion.

Each side window shall incorporate an operable upper transom portion. The transom shall be between 25 and 35 percent of the total window area. The lower portion of the window shall be fixed. The transom portion shall be hinged along the lower edge, have a latch, support struts and designed to

open inward. The set screw for locking the transom window closed shall be removed, bagged along with the screws from the other windows and shipped in the curb side front utility box.

All passenger windows shall include clear window guards used to shield the window glass from graffiti and vandalism. The guards shall be able to be changed with minimal effort and not require the removal of the window assembly.

With the exception of the side destination sign window all windows shall be equipped with inward opening transom windows

### **TS 51.2 Emergency Exit (Egress) Configuration**

Emergency exit windows shall meet the requirements of 49 CFR 571.217 – FMVSS 217; Bus Emergency Exits and Window Retention and Release. All rectangle and square side windows shall be configured as emergency escape windows except the curbside window at the right front wheel house. Emergency escape windows shall be able to be opened with the use of durable release handles. Metal identification and instruction signs for opening the egress windows shall be installed by rivets on the inside of the window frame or between windows on the sidewall panel.

### **TS 51.3 INTENTIONALLY BLANK**

### **TS 51.4 Materials**

Side window glazing material shall have a minimum 1/4-inch nominal thickness. The material shall conform with the requirements of ANSI Z26.1-1996, “Standard for Type AS-5 Safety Glazing Materials,” except for Test Number 17, which shall subject the specimens to 100 cycles with less than 4 percent hazing and 500 cycles with less than 12 percent hazing. Windows shall be polycarbonate sheet with an abrasion resistant coating on both sides of the window.

Windows on the bus sides and in the rear door shall be tinted a neutral color, complementary to the bus exterior. The maximum solar energy transmittance shall not exceed 59 percent, as measured by ASTM E-424. Luminous transmittance shall be measured by ASTM D-1003. Windows over the destination signs shall not be tinted.

### **TS 51.5 INTENTIONALLY BLANK**

## **HEATING, VENTILATING AND AIR CONDITIONING**

### **TS 52. HVAC Capacity and Performance**

The MTA is specifying an all electric AC system powered from the Hybrid electrical system meeting the following requirements for the HVAC system:

The HVAC climate control system shall be capable of controlling the temperature and maintaining the humidity levels of the interior of the bus as defined in the following paragraphs. The system shall have programmable features to reduce the electrical load on the hybrid system.

The AC system shall use hermetically sealed variable speed compressor operating using 134a or R-407C refrigerant. The HVAC system shall utilize a microprocessor controller with a self diagnostic system. The system shall have maintenance free brushless motors with an expected bearing life of 36,000 hours.

With the bus running at the design operating profile with corresponding door opening cycle, and carrying a number of passengers equal to 150 percent of the seated load, the HVAC system shall control the

average passenger compartment temperature within a range between 65 and 80 °F, while maintaining the relative humidity to a value of 50 percent or less. The system shall maintain these conditions while subjected to any outside ambient temperatures within a range of 10 to 95 °F and at any ambient relative humidity levels between 5 and 50 percent.

When the bus is operated in outside ambient temperatures of 95 to 115 °F, the interior temperature of the bus shall be permitted to rise 0.5° for each degree of exterior temperature in excess of 95 °F.

When the bus is operated in outside ambient temperatures in the range of -10 to 10 °F, the interior temperature of the bus shall not fall below 55 °F while the bus is running on the design operating profile.

System capacity testing, including pull-down/warm-up, stabilization and profile, shall be conducted in accordance to the APTA's "Recommended Instrumentation and Performance Testing for Transit Bus Air Conditioning System." The recommended locations of temperature probes are only guidelines and may require slight modifications to address actual bus design. Care shall be taken to avoid placement of sensing devices in the immediate path of an air duct outlet. In general, the locations are intended to accurately represent the interior passenger area.

Additional testing shall be performed as necessary to ensure compliance to performance requirements stated herein.

### TS 52.1 Capacity and Performance Requirements

The air conditioning portion of the HVAC system shall be capable of reducing the passenger compartment temperature from 110 °F to 70 °F +/-3 °F in less than 30 minutes after system engagement. Engine temperature shall be within the normal operating range at the time of start-up of the cool-down test, and the engine speed shall be limited to fast idle at  $\frac{3}{4}$  max governed speed that may be activated by an operator-controlled device. During the cool-down period, the refrigerant pressure shall not exceed safe high-side pressures, and the condenser discharge air temperature, measured 6 in. from the surface of the coil, shall be less than 45 °F above the condenser inlet air temperature. No simulated solar load shall be used. There shall be no passengers on board, and the doors and windows shall be closed.

The pull-up requirements for the heating system shall be in accordance with Section 9 of APTA's "Recommended Instrumentation and Performance Testing for Transit Bus Air Conditioning." With ambient temperature at -20 °F, and vehicle cold soaked at that temperature, the bus heating system shall warm the interior passenger compartment to an average temperature of 70 °F  $\pm$ 2 °F within 70 minutes.

### TS 53. Controls and Temperature Uniformity

**The MTA currently uses the Thermo King Intelligaire III control / diagnostic controller and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The operator shall have a single toggle switch to turn the HVAC system on or off. The HVAC system excluding the operator's heater/defroster shall be centrally controlled with an advanced electronic/diagnostic control system with provisions for extracting/reading data. The system shall be compliant with J1939 Communication Protocol for receiving and broadcasting of data. Hot engine coolant water shall be delivered to the HVAC system operator's defroster/heater and other heater cores by means of an auxiliary coolant pump, sized for the required flow, which is brushless and seal less having a

minimum maintenance free service life for both the brushless motor and the pump of at least 40,000 hours at full power.

***The climate control system shall be fully automatic and control the interior average temperature to within  $\pm 2$  °F of 68 degrees Fahrenheit.***

Interior temperature distribution shall be uniform to the extent practicable to prevent hot and/or cold spots. After stabilization with doors closed, the temperatures between any two points in the passenger compartment in the same vertical plane, and 6 to 72 inches above the floor, shall not vary by more than 5 °F with doors closed. The interior temperatures, measured at the same height above the floor, shall not vary more than  $\pm 5$  °F from the front to the rear from the average temperature determined in accordance with APTA's "Recommended Instrumentation and Performance Testing for Transit Bus Air Conditioning System." Variations of greater than  $\pm 5$  °F will be allowed for limited, localized areas provided the majority of the measured temperatures fall within the specified requirement.

## **TS 54. Air Flow**

### **TS 54.1 Passenger Area**

The cooling mode of the interior climate control system shall introduce air into the bus at or near the ceiling height at a minimum rate of 25 cfm per passenger based on the standard configuration bus carrying a number of passengers equal to 150 percent of the seated load. Airflow shall be evenly distributed throughout the bus, with air velocity not exceeding 100 ft per minute on any passenger. The ventilating mode shall provide air at a minimum flow rate of 20 cfm per passenger.

Airflow may be reduced to 15 cfm per passenger (150 percent of seated load) when operating in the heating mode. The fans shall not activate until the heating element has warmed sufficiently to ensure at least 70 °F air outlet temperature. The heating air outlet temperature shall not exceed 120 °F under any normal operating conditions.

The climate control blower motors and fan shall be designed such that their operation complies with the interior noise level requirements.

### **TS 54.2 Operator Area**

The bus interior climate control system shall deliver at least 100 cfm of air to the operator's area when operating in the ventilating and cooling modes. Adjustable nozzles shall permit variable distribution or shutdown of the airflow. Airflow in the heating mode shall be reduced proportionally to the reduction of airflow into the passenger area. The windshield defroster unit shall meet the requirements of SAE Recommended Practice J382, "Windshield Defrosting Systems Performance Requirements," and shall have the capability of diverting heated air to the operator's feet and legs. The defroster or interior climate control system shall maintain visibility through the operator's side window.

### **TS 54.3 Controls for the Operator's Climate Control System (CCS)**

The controls for the operator's compartment for heating, ventilation and cooling systems shall be integrated and shall meet the following requirements:

- a) The operator's heat/defrost system fan shall be controlled by a separate switch that has an "off" position and a low and high position for speed control. All switches and controls shall preclude the possibility of clothing becoming entangled, and shields shall be provided, if required. An "on-off" switch shall be located to the right of or near the main defroster switch.

- b) A manually operated control valve shall control the coolant flow through the defrost/heater core.
- c) If a cable-operated manual control valve is used, the cable length shall be kept to a minimum to reduce cable seizing. Heater water control valves shall be “positive” type, closed or open. The method of operating remote valves shall require the concurrence of the MTA Project Manager.

## TS 54.4 Operator Compartment Requirements

A separate heating, ventilation and defroster system for the operator’s area shall be provided and shall be controlled by the operator. The system shall meet the following requirements:

- The heater and defroster system shall provide heating for the operator and heated air to completely defrost and defog the windshield, operator’s side window, and the front door glasses in all operating conditions. Fan(s) shall be able to draw air from the bus body interior and/or the exterior through a control device and pass it through the heater core to the defroster system and over the operator’s feet. A minimum capacity of 100 cfm shall be provided. The operator shall have complete control of the heat and fresh airflow for the operator’s area.
- The defroster supply outlets shall be located at the lower edge of the windshield. These outlets shall be durable and shall be free of sharp edges that can catch clothes during normal daily cleaning. The system shall be such that foreign objects such as coins or tickets cannot fall into the defroster air outlets. Adjustable ball vents or louvers shall be provided at the left of the operator’s position to allow direction of air onto the side windows.

A ventilation system shall be provided to ensure operator comfort and shall be capable of providing fresh air in both the foot and head areas. Vents shall be controllable by the operator from the normal driving position. Decals shall be provided, indicating “operating instructions” and “open” and “closed” positions. When closed, vents shall be sealed to prevent the migration of water or air into the bus.

## TS 54.5 Operators Ventilation

A 6-inch round, 2-speed, ceiling mounted fan that provides 100 cfm of air shall be provided. The fan shall be mounted on the ceiling above the operator’s seat in a location reviewed by the MTA.

## TS 55. Air Filtration

Air shall be filtered before discharge into the passenger compartment. The filter shall meet the ANSI/ASHRAE 52.1 requirement for 5 percent or better atmospheric dust spot efficiency, 50 percent weight arrestance, and a minimum dust holding capacity of 120 g per 1000 cfm cell.

Air filters shall be disposable and easily removable for inspection and service.

## TS 56. Roof Ventilators / Emergency Escape Hatches

**The MTA currently uses Spheros Glass Hatches and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Two glass roof ventilator / emergency escape hatches shall be provided in the roof of the bus, one approximately over or just forward of the front axle and the other approximately over the rear axle. Each shall have operational instruction decals in English.

Each hatch shall be easily opened and closed manually. When open with the bus in motion, the hatches may be used as a ventilator providing fresh air inside the bus. The hatches shall cover an opening area no less than 425 sq in. to be used as an emergency exit and shall be capable of being positioned as a scoop with either the leading or trailing edge open no less than 4 in., or with all four edges raised simultaneously to a height of no less than 3½ in. The hatches shall be sealed to prevent entry of water when closed.

## TS 57. Maintainability

Manually controlled shut-off valves in the refrigerant lines shall allow isolation of the compressor and dehydrator filter for service. To the extent practicable, self-sealing couplings utilizing O-ring seals shall be used to break and seal the refrigerant lines during removal of major components, such as the refrigerant compressor. Shut-off valves may be provided in lieu of self-sealing couplings. The condenser shall be located to efficiently transfer heat to the atmosphere and shall not ingest air warmed above the ambient temperature by the bus mechanical equipment, or to discharge air into any other system of the bus. The location of the condenser shall preclude its obstruction by wheel splash, road dirt or debris. HVAC components located within 6 in. of floor level shall be constructed to resist damage and corrosion.

Electronic high and low refrigerant pressure gauges shall be located in the return air area as part of systems controller.

## TS 58. Entrance/Exit Area Heating

Heat shall be supplied to the entrance and exit areas to maintain a tread surface temperature no less than 35 °F in an ambient of -10 °F to prevent accumulation of snow, ice or slush with the bus operating under design operating profile and corresponding door opening cycle.

A floor level heater shall be located adjacent to the entrance door platform with warm air directed to the ramp and surrounding floor area with capacity to meet the requirements listed above. Two floor level heaters shall be mounted to the floor adjacent to the rear exit door(s). One heater shall be underneath the seat to the front of the exit door and the other across the aisle from the rear exit door underneath the seat.

## TS 59. Floor-Level Heating

**The MTA currently uses Mobile Climate Control floor heaters and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

24 VDC floor level heaters shall be provided to evenly supply heated forced air through floor ducts across the area of the bus at the rear exit door. The heaters shall be provided with low noise centrifugal brushless motors. Floor ducts may be discontinued at the upper level, but additional provisions to prevent cold floors and ensure temperature uniformity shall be included. Variable speed control of the floor-level heating shall be through the main HVAC system controller.

The floor level heater cores and blower motors shall be mounted in stainless steel cabinets secured to the bus floor. The cabinets shall be constructed and mounted in a manner preventing the passenger from contacting the heater element.

## EXTERIOR PANELS, FINISHES AND EXTERIOR LIGHTING

### TS 60. Design

The bus shall have a clean, smooth, simple design, primarily derived from bus performance requirements and passenger service criteria. The exterior and body features, including grilles and louvers, shall be shaped to facilitate cleaning by automatic bus washers without snagging washer brushes. Water and dirt

shall not be retained in or on any body feature to freeze or bleed out onto the bus after leaving the washer. The body and windows shall be sealed to prevent leaking of air, dust or water under normal operating conditions and during cleaning in automatic bus washers for the service life of the bus. All fasteners used on the exterior of the bus shall be stainless steel.

Exterior panels shall be sufficiently stiff to minimize vibration, drumming or flexing while the bus is in service. When panels are lapped, the upper and forward panels shall act as a watershed. However, if entry of moisture into the interior of the vehicle is prevented by other means, then rear cap panels may be lapped otherwise. The windows, hatches and doors shall be able to be sealed. Accumulation of spray and splash generated by the bus's wheels shall be minimized on windows and mirrors.

### **TS 60.1 Materials**

Body materials shall be selected and the body fabricated to reduce maintenance, extend durability and provide consistency of appearance throughout the service life of the bus. Detailing shall be kept simple, and add-on devices and trim shall be minimized and integrated into the basic design.

### **TS 60.2 Roof-Mounted Equipment**

A non-skid, clearly marked walkway or steps shall be incorporated on the roof to provide access to equipment without damaging any system or bus paneling. Adhesive backed non-slip grip tape may be used to provide a safe walkway on the roof of the bus.

## **TS 61. Pedestrian Safety**

Exterior protrusions along the side and front of the bus greater than ½ in. and within 80 in. of the ground shall have a radius no less than the amount of the protrusion. The exterior rearview mirrors, cameras and required lights and reflectors are exempt from the protrusion requirement. Grilles, doors, bumpers and other features on the sides and rear of the bus shall be designed to minimize toeholds or handholds.

Exterior protrusions shall not cause a line-of-sight blockage for the operator through the windshield or in using the rear view mirrors.

## **TS 62. Repair and Replacement**

### **TS 62.1 Side Body Panels**

Structural elements supporting exterior body panels shall allow side body panels below the passenger windows to be repaired in lengths not greater than 12-1/2 feet. The body side panels shall be aluminum or fiberglass requiring MTA review and equal. Dissimilar metals are to be protected from each other where they contact each other.

## **TS 63. Rain Gutters**

Rain gutters shall be provided to prevent water flowing from the roof onto the passenger doors and operator's side window. When the bus is decelerated, the gutters shall not drain onto the windshield, operator's side window or door boarding area. Cross-sections of the gutters shall be adequate for proper operation.

## **TS 64. License Plate Provisions**

Provisions shall be made to mount standard-size U.S./Canada license plates per SAE J686 on the front and rear of the bus. These provisions shall direct-mount or recess the license plates so that they can be cleaned by automatic bus-washing equipment without being caught by the brushes.

The rear license plate provision shall be illuminated per SAE J587. Stainless steel hardware shall be used in mounting the license plates and the rear license plate LED lamp.

**The MTA currently uses Super Brite LED, model LPC-C-W2 rear license plate lamp and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The license plate light(s) shall be LED meeting the illumination requirements. The light beam pattern shall be 90 degrees. A waterproof metallic housing with a polycarbonate lens shall be painted the color of the bus at that location.

## **TS 64.1 INTENTIONALLY BLANK**

### **TS 65. Fender Skirts**

Features to minimize water spray from the bus in wet conditions shall be included in wheel housing design. Any fender skirts shall be easily replaceable and the fasteners shall be protected from road spray and salt. The fender skirts shall be flexible if they extend beyond the allowable body width. Wheels and tires shall be removable with the fender skirts in place.

### **TS 66. Splash Aprons**

Splash aprons, composed of ¼ in. minimum composition or rubberized fabric, shall be installed behind and/or in front of wheels as needed to reduce road splash and protect underfloor components. The splash aprons shall extend downward to within 2 inches off the road surface at static conditions. Apron widths shall be no less than tire widths. Splash aprons shall be bolted to the bus understructure. Splash aprons and their attachments shall be inherently weaker than the structure to which they are attached. The flexible portions of the splash aprons shall not be included in the road clearance measurements. Splash apron shall be installed as necessary to protect the wheelchair loading device from road splash. Other splash aprons shall be installed where necessary to protect bus equipment.

### **TS 67. Service Compartments and Access Doors**

#### **TS 67.1 Access Doors**

Conventional or pantograph hinged doors shall be used for the engine compartment and for all auxiliary equipment compartments including doors for checking the quantity and adding to the engine coolant, engine lubricant and hybrid drive fluid. Access openings shall be sized for easy performance of tasks within the compartment, including tool operating space. Access doors shall be of rugged construction and shall maintain mechanical integrity and function under normal operations throughout the service life of the bus. They shall close flush with the body surface. All doors shall be hinged at the top or on the forward edge and shall be prevented from coming loose or opening during transit service or in bus washing operations. All access doors shall be assisted opened and retained in the open position by gas-filled springs without support locks and shall be easily operable by one person. Springs and hinges shall be corrosion resistant. Latch handles shall be flush with, or recessed behind, the body contour and shall be sized to provide an adequate grip for opening. Access doors, when opened, shall not restrict access for servicing other components or systems.

All exterior access doors shall be equipped with corrosion-resistant flush-mounted locks. All such access doors shall require a standardized nominal 5/16 inch square male tool to open or lock.

If precluded by design, the contractor shall provide door design information specifying how the requirements are met.

## **TS 68. Bumpers**

**The MTA currently uses Romeo Rim “Help” Energy Absorbing Bumpers and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Bumper assemblies shall be energy absorbing allowing for 5 mph barrier impact at curb weight, 6.5 mph center strike and 5.5 mph corner strike impact of a 4,000 pound impact sled all without damage to the bumper after repeated impact.

The front bumper shall protect the bus from damage as a result of 6.5 mph impacts at any point by the common carriage with contoured impact surface defined in Figure 2 of FMVSS 301 loaded to 4000 lbs parallel to the longitudinal centerline of the bus. It shall protect the bus from damage as a result of 5.5 mph impacts into the corners at a 30-degree angle to the longitudinal centerline of the bus.

The rear bumper shall protect the bus, when impacted anywhere along its width by the common carriage with contoured impact surface defined in Figure 2 of FMVSS 301 loaded to 4000 lbs, at 4 mph parallel to or up to a 30-degree angle to, the longitudinal centerline of the bus.

Bumpers are considered as a part of the styling aesthetics of the bus. The bumpers while being functional as described in the specification shall blend into the overall styling aesthetics package

### **TS 68.1 Location**

Bumpers shall provide impact protection for the front and rear of the bus with the top of the bumper being 27 in.,  $\pm$  2 in., above the ground. Bumper height shall be such that when one bus is parked behind another, a portion of the bumper faces will contact each other.

### **TS 68.2 Front Bumper**

No part of the bus, including the bumper, shall be damaged as a result of a 5 mph impact of the bus at curb weight with a fixed, flat barrier perpendicular to the bus's longitudinal centerline. The bumper shall return to its pre-impact shape within 10 minutes of the impact. The energy absorption system of the bumper shall be independent of every power system of the bus and shall not require service or maintenance in normal operation during the service life of the bus. The bumper may increase the overall bus length specified by no more than 7 inches.

The front bumper shall be designed to include mounting provisions for an integrated bike rack.

### **TS 68.3 Rear Bumper**

No part of the bus, including the bumper, shall be damaged as a result of a 2 mph impact with a fixed, flat barrier perpendicular to the longitudinal centerline of the bus. The bumper shall return to its pre-impact shape within 10 minutes of the impact. When using a yard tug with a smooth, flat plate bumper 2 ft wide contacting the horizontal centerline of the rear bumper, the bumper shall provide protection at speeds up to 5 mph, over pavement discontinuities up to 1 in. high, and at accelerations up to 2 mph/sec. The rear bumper shall be shaped to preclude unauthorized riders standing on the bumper. The bumper shall not require service or maintenance in normal operation during the service life of the bus. The bumper may increase the overall bus length specified by no more than 7 in.

## TS 68.4 Bumper Material

Bumpers shall have lightweight aluminum construction backing and high energy level absorbing material. The black energy level molded material shall be easily replaceable by one technician in the event of damage.

Bumper material shall be corrosion-resistant and withstand repeated impacts of the specified loads without sustaining damage. The bumper material shall not discolor when exposed to sunshine, normal road grit, exhaust, cleaning agents, bus fluids and other material contacted during normal bus operation. Visible surfaces shall be black. These bumper qualities shall be sustained throughout the service life of the bus.

## TS 69. Finish and Color

### TS 69.1 Appearance

All exterior surfaces shall be smooth and free of wrinkles and dents. Exterior surfaces to be painted shall be properly prepared as required by the paint system supplier prior to application of paint to assure a proper bond between the basic surface and successive coats of original paint for the service life of the bus. Drilled holes and cutouts in exterior surfaces shall be made prior to cleaning, priming and painting, where possible, to prevent corrosion. The bus shall be completely painted prior to installation of exterior lights, windows, mirrors and other items that are applied to the exterior of the bus. Body filler materials may be used for surface dressing, but not for repair of damaged or improperly fitted panels.

**The MTA currently uses DuPont Imron Elite Express, 3.5 VOC and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The MTA color codes are:

**White: # 830728 EG**

**Black: # 830730 EG**

Paint shall be applied smoothly and evenly with the finished surface free of visible dirt and the following other imperfections:

- a) Blisters or bubbles appearing in the topcoat film
- b) Chips, scratches, or gouges of the surface finish
- c) Cracks in the paint film
- d) Craters where paint failed to cover due to surface contamination
- e) Overspray
- f) Peeling
- g) Runs or sags from excessive flow and failure to adhere uniformly to the surface
- h) Chemical stains and water spots
- i) Dry patch due to incorrect mixing of paint activators
- j) Buffing swirls

All exterior finished surfaces shall be impervious to diesel fuel, gasoline and commercial cleaning agents. Finished surfaces shall resist damage by controlled applications of commonly used graffiti-removing chemicals.

Proper adhesion between the basic surface and successive coats of the original paint shall be measured using an Elcometer adhesion tester as outlined in ASTM D4541-85. Adhesion shall be a minimum 300 ft-lbs. The bus manufacturer during the painting process shall be requested to supply random panel samples of for each step of the painting process that may be subject to adhesion testing per ASTM G4541-87 and ASTM D4145-85. ASTM D4541-93 may be used for inspection testing during assembly of the bus.

## TS 70. Decals, Numbering and Signing

**The MTA currently uses 3M Scotchlite Reflective Material for external decals and bus numbering and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The decal material shall be a durable, flexible, retro reflective film. The black film shall have a black daytime appearance but reflect white at night. It will have a position-able, pressure-activated adhesive and have a total thickness of .007 to .008 inches.

Monograms, numbers and other special signing shall be applied to the inside and outside of the bus as required. Signs shall be durable and fade-, chip- and peel-resistant. They may be painted signs, decals or pressure-sensitive appliques. All decals shall be a high quality material installed per the decal Supplier recommendations. Decals shall be installed in a manner that protects them from patrons intentionally peeling, degrading or removing them. Signs shall be provided in compliance with the ADA requirements defined in 49 CFR Part, Subpart B, 38.27.

Interior signs relating safety and ADA information shall be aluminum, and riveted in place and incorporated in the fabric of the passenger seat covering in the ADA securement area.

All signs (including samples of all interior plates and locations) shall be presented during the PPM and the MTA shall have final approval on all aspects of numbering and signing.

### **Bus exterior signage shall be as follows:**

- a) Exterior Bus Numbers shall be 5-digits in a sequence. The MTA numbering is derived from the first two digits being the year of build and the last three is the build sequence of 001 to 0YY. Numbers shall be 4-inch (minimum) 3M, Black Scotchlite Reflective Material, or approved equal. Exterior bus numbers shall be installed in these approximate locations and be visible to patrons:
  1. One at the right front of the bus.
  2. One each on the right and left sides above the drip rail.
  3. One at the top rear of the bus vertically.
- b) One on the roof of the bus (front) 18 inches high, reading street side to curbside from the rear.

- c) One ADA Wheelchair Accessible Logo shall be installed on the curbside corner of the bus. The logo shall be a black outline, 6-inch high minimum.

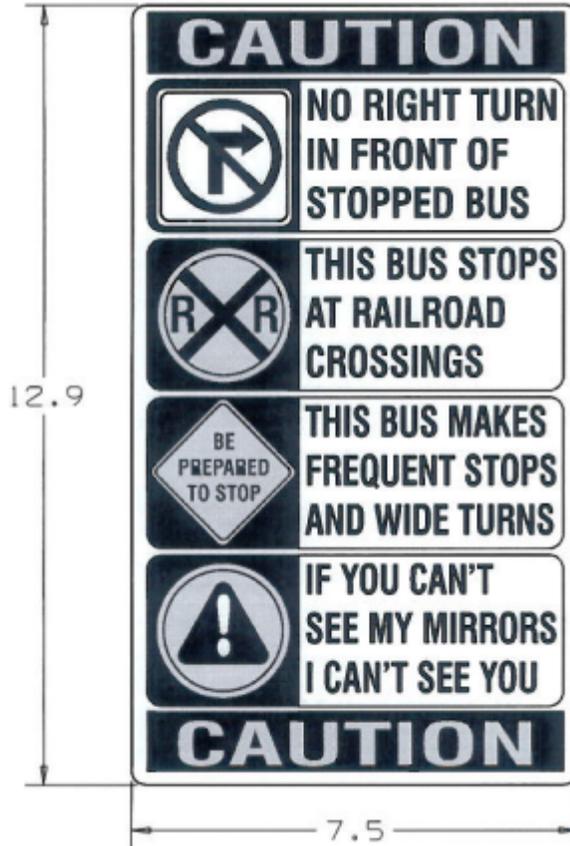


DESCRIPTION - DECAL HANDICAP SYMBOL  
 MATERIAL - 3M 180C-12 BLACK  
 - COATED WITH 3M 3650-114 CLEAR  
 - ADHESIVE BACKED AND KISS CUT  
 - APPLICATION PREMASK SCPM-44X  
 COLOR - BLACK

- d) One decal per bus, “This Bus Makes Wide Right Turns” shall be installed on the rear of the bus, in the lower right corner of the engine door. A second Caution decal shall be located on the panel above the engine door on the curb side indicating “No Right Turns in Front of the Bus”, “Bus Stops at Railroad Crossings”, “Bus Makes Frequent Stops and Wide Turns” and “If You Can’t See My Mirrors, I Can’t See You”.

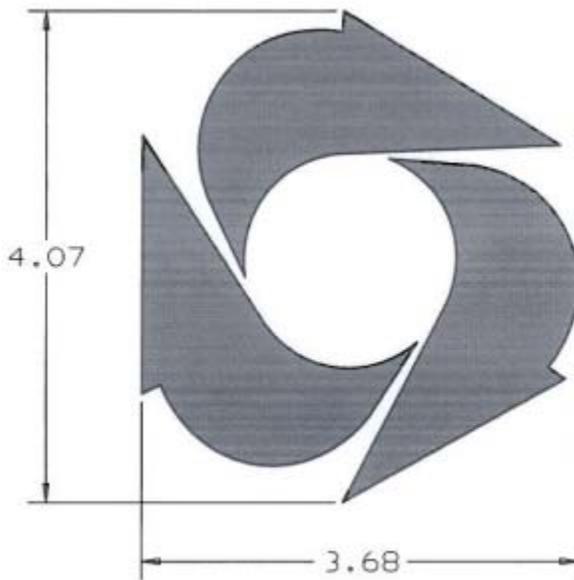


DESCRIPTION - DECAL WIDE RIGHTS  
 MATERIAL - 3M 680CR-10  
 - PREMASKED WITH SCPM-44X  
 COLOR - YELLOW/BLACK  
 AS PER SAMPLE



- DESCRIPTION - DECAL-CAUTION, ECT
- MATERIAL - 3M 680CR-10 WHITE
- COATED WITH 3M 3650-114 CLEAR
- COLOR - BLACK
- RED TO MATCH PMS 485
- YELLOW TO MATCH PMS PROCESS YELLOW
- FONT - AS SHOWN

- e) One decal per bus, “Maryland Department of Transportation” with MDOT logo shall be installed on the front of the bus, approximately in the center of the bus, under the windshield.



DESCRIPTION - DECAL MARYLAND DOT SYMBOL  
 MATERIAL - 3M 680CR-10 WHITE REFLECTIVE  
 - COATED WITH 3M 3650-114 CLEAR  
 - ADHESIVE BACKED AND KISS CUT  
 - PREMASKED WITH SCPM-44X  
 COLOR - ORANGE AS PER NFIL P/N 162607



DESCRIPTION - DECAL MARYLAND DOT  
 MATERIAL - 3M 680CR-85 BLACK REFLECTIVE  
 - PREMASKED WITH SCPM-44X  
 - ADHESIVE BACKED AND KISS CUT  
 COLOR - BLACK REFLECTIVE

f) Three “MTA Maryland” logo decals (see Drawing #1) per bus to be installed in the following locations:

1. One on the curb side above the drip rail, near the front of the bus
2. One on the street side above the drip rail, near the front of the bus
3. One on rear engine door in the lower left corner

**Drawing No. 1**



Colors:

PMS# 124 Gold

PMS# 193 Red



DESCRIPTION - DECAL MTA MARYLAND (REAR)  
MATERIAL - 3M 680CR-10  
- PREMASKED WITH SCPM-44X  
COLOR - WHITE/RED/BLACK/YELLOW  
- AS PER SAMPLE



DESCRIPTION - DECAL MTA MARYLAND (SIDE)  
MATERIAL - 3M 680CR-10 WHITE REFLECTIVE  
- PREMASKED WITH SCPM-44X  
COLOR - WHITE/RED/BLACK/YELLOW  
- AS PER SAMPLE

- g) One WWW.MTA.MARYLAND.GOV logo is to be installed on the rear of the bus, centered below the top rear marker lights.



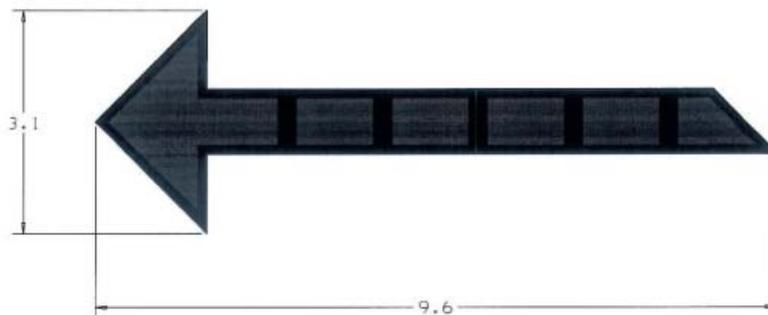
DESCRIPTION - DECAL-MTA WEBSITE  
 MATERIAL - 3M 680CR-85 BLACK REFLECTIVE  
 - PREMASKED WITH SCPM-44X  
 COLOR - BLACK REFLECTIVE

- h) Two “Kneeling Bus” decals to be installed, rear side of both the front and rear passenger doors, near the warning light.



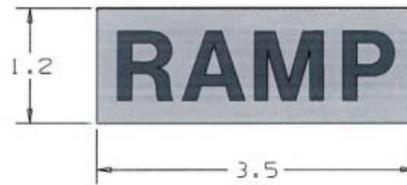
DESCRIPTION - DECAL KNEELING BUS  
 MATERIAL - 3M 3650-114 CLEAR  
 - LAMINATED WITH 3M 3650-114 CLEAR  
 - APPLICATION PREMASK  
 COLOR - RED TEXT ON CLEAR BACKGROUND  
 FONT - HELVETICA MEDIUM

- i) Two red and black ‘Arrows’ to be installed, rear side of both the front and rear passenger doors, near the warning light and ‘Kneeling Bus’ decals.



DESCRIPTION - DECAL ARROW  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH 3M 3650-114 CLEAR  
 - ADHESIVE BACKED  
 COLOR - PRINTED BLACK AND RED AS SHOWN

- j) One 'RAMP' decal to be installed, rear side of the front passenger doors, near the warning light.

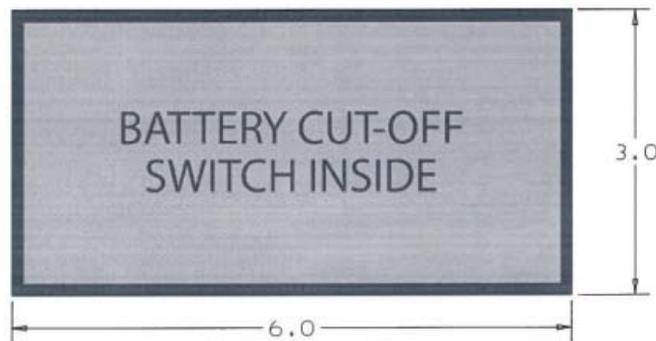


DESCRIPTION - DECAL RAMP  
 MATERIAL - 3M 3650-114 CLEAR  
 - LAMINATED WITH 3M 3650-114 CLEAR  
 - APPLICATION PREMASK  
 COLOR - RED TEXT ON CLEAR BACKGROUND  
 FONT - HELVETICA MEDIUM

- k) "Caution: Do Not Cross in Front of Standing Bus" decal to be installed on curbside front of bus adjacent to front headlights. Decal to be black lettering on yellow background, 4 inches by 6 inches.

- l) Two decals on the access door for the Battery Disconnect Switch as follows:

1. One decal 'BATTERY CUT OFF SWITCH INSIDE' with border

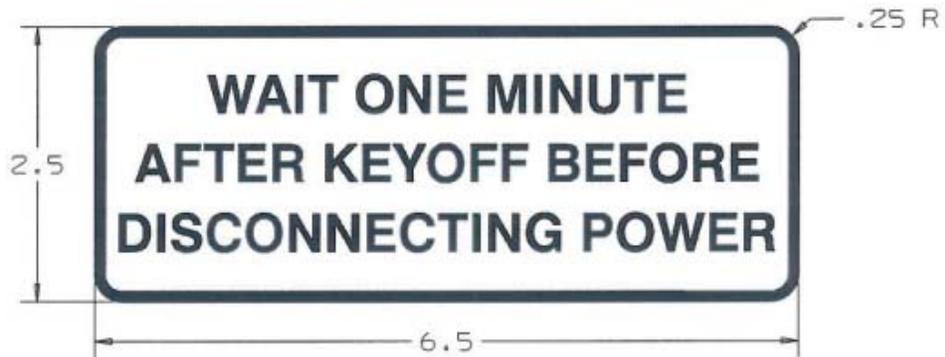


DESCRIPTION - DECAL-BATT CUTOFF SW INT  
 MATERIAL - 3M 3650-114 CLEAR  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED AND KISS CUT  
 COLOR - RED LETTERING AND .12 BORDER ON CLEAR  
 FONT - AS SHOWN

2. One decal 'KEY INSIDE FIRE EXTINGUISHER BOX' with border

Both decals shall be red die cut or red on clear background.

- m) One decal on inside of door for battery cut off switch with instructions “WAIT ONE MINUTE AFTER KEYOFF BEFORE DISCONNECTING POWER’.



DESCRIPTION - DECAL-WAIT 1 MINUTE  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED  
 FONT - HELVETICA MEDIUM  
 COLOR - RED TEXT ON WHITE BACKGROUND  
 - RED PMS 485

- n) Two decals, black lettering, shall be affixed to the roof mount battery compartment or roof shroud (one each streetside and curbside) that states: “Powered by CLEAN DIESEL ELECTRIC HYBRID TECHNOLOGY”.



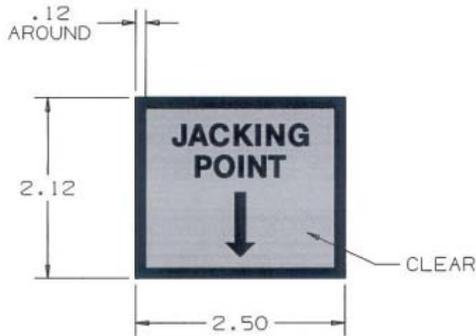
DESCRIPTION - DECAL-POWERED BY CLEAN  
 MATERIAL - 3M 680CR-85 BLACK REFL  
 - COATED WITH 3M 3650-114 CLEAR  
 - ADHESIVE BACKED AND KISS CUT  
 - APPLICATION PREMASK SCPM-44X  
 FONT - AS SHOWN  
 COLOR - BLACK

- o) Two decals, “Maryland – Smart, Green and Growing” to be installed above the drip rails on both sides of the bus.



DESCRIPTION - DECAL MARYLAND GREEN  
 MATERIAL - 3M 180C-10 WHITE W/CLEARCOAT  
 - ADHESIVE BACKED AND KISS CUT  
 - APPLICATION PREMASK SCPM-44X  
 COLORS - WHITE, LIGHT BLUE, DARK BLUE,  
 LIGHT GREEN, DARK GREEN, BLACK

- p) Four decals signifying the jacking points for the bus. The decal is labeled “JACKING POINT” with a downward arrow.



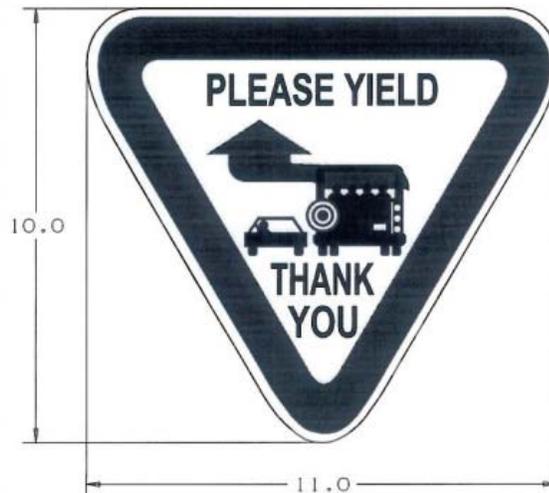
DESCRIPTION - DECAL JACKING POINTS  
 MATERIAL - 3M 3650-114 CLEAR  
 - ADHESIVE BACKED  
 - PREMASKED WITH SCPM 44X  
 - CLEARED WITH 3M 3650-114 CLEAR  
 - CLEAR WITH BLACK BORDER/ARROW  
 COLOR - CLEAR WITH BLACK BORDER/ARROW  
 FONT COLOR - BLACK  
 FONT - HELVETICA MEDIUM

- q) Warning decal for hybrid system high voltage areas. Locations to be reviewed and approved by the MTA.



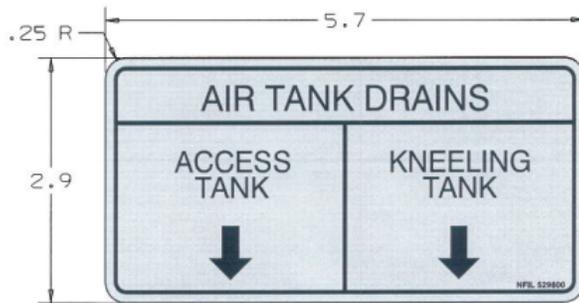
DESCRIPTION - DECAL WARNING HIGH VOLTAGE/DOOR LATCHES  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED  
 - APPLICATION PREMASK SCPM-44X  
 COLOR - RED/YELLOW/BLACK/ORANGE ON WHITE BACKGROUND AS SHOWN  
 - RED PANTONE 485C, YELLOW PANTONE 116C, ORANGE PANTONE 151C  
 FONT - HELVETICA MEDIUM

- r) Please yield triangle decal mounted on rear of bus street side near upper turn signal. Location to be reviewed and approved by the MTA.

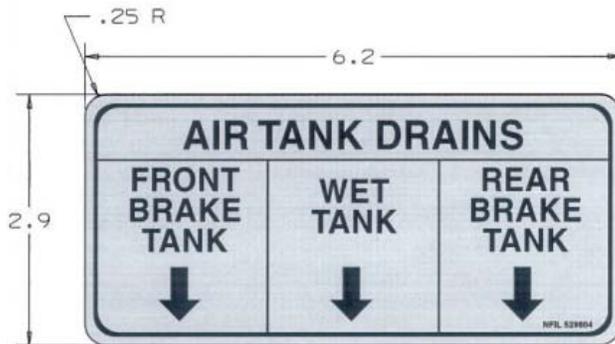


DESCRIPTION - DECAL-PLEASE YIELD, THANK YOU  
 MATERIAL - 3M 680CR-10 WHITE  
 - COATED WITH 3M 3650-114 CLEAR  
 COLOR - BLACK  
 - RED TO MATCH PMS 485  
 FONT - AS SHOWN/AS PER SAMPLE

- s) Decals indentifying air tank system drain locations. Decals will show the number of drains and the location of the quarter turn drain valves.

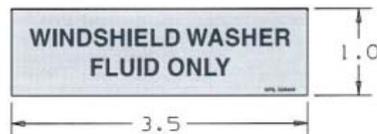


DESCRIPTION - DECAL-AIR TANK DRAIN X2  
 MATERIAL - 3M 3650-114 CLEAR  
 - COATED WITH 3M 3650-114 CLEAR  
 - ADHESIVE BACKED  
 COLOURS - BLACK ON CLEAR



DESCRIPTION - DECAL-AIR TANK DRAINS X3  
 MATERIAL - 3M 3650-114 CLEAR  
 - COATED WITH 3M 3650-114 CLEAR  
 - ADHESIVE BACKED  
 COLOURS - BLACK ON CLEAR

- t) Decal indentifying the windshield washer fill location.



DESCRIPTION - DECAL-WASHER FLUID ONLY (CLEAR)  
 MATERIAL - 3M 3650-114 CLEAR  
 - COATED WITH 3M 3650-114 CLEAR  
 - ADHESIVE BACKED  
 COLOURS - BLACK ON CLEAR

All logo materials, colors and installation locations are subject to MTA approval.

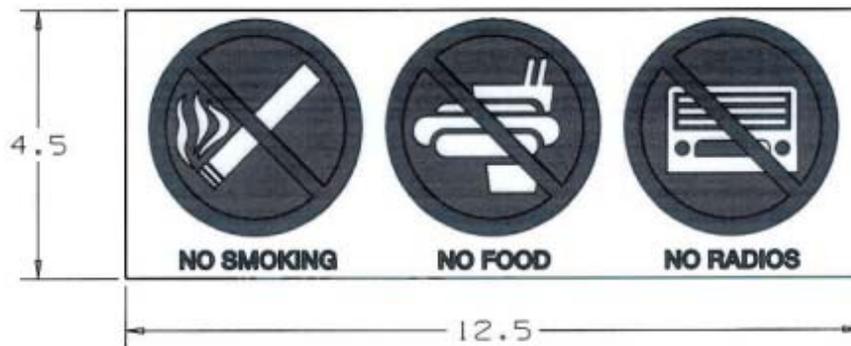
**Bus interior signage shall be as follows:**

- a) At least two signs shall be provided on each side of the bus interior at the forward most center-facing seats (curbside and street side) to indicate that seats at the front are priority seats for elderly and mobility-impaired passengers. The first forward facing seat on the street side of the bus shall also be designated as priority seating.



DESCRIPTION - DECAL-PRIORITY SEATING  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED

- b) An interior bus number shall be displayed at the front of the bus, to the right of the centerline on the face of the access door for the front destination sign. A second bus number shall be installed on the rear bulkhead. The interior bus numbers shall be 3-inches high and of white or black decal material, as appropriate.
- c) Two decals per bus, “No Smoking, Drinking or Radios” with symbols shall be installed in a location approved by the MTA.



DESCRIPTION - DECAL NO SMOKING ETC  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH 3M 3650-114 CLEAR  
 - ADHESIVE BACKED AND KISS CUT  
 COLOURS - WHITE  
 - RED PANTONE 032C  
 - BLUE PANTONE 287C  
 FONT - AS SHOWN

- d) Two decals per bus, “Wheelchair Priority” with logo shall be installed in a location approved by the MTA. Decal has blue background with white lettering.



DESCRIPTION - DECAL - WHEELCHAIR SECUREMENT  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED

- e) One sign in Braille, which includes the bus number and other information, shall be installed in a location approved by the MTA.



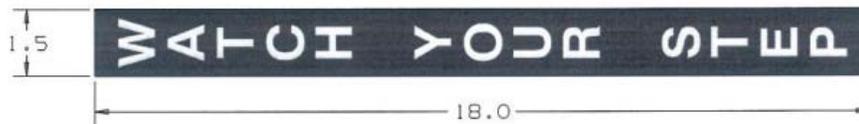
**Specification**

Size:	7.75 x 3.75 inches	
Cutout Area:	3.0 x 2.12 inches	
Material:	10 mil TransGrafix® PVF/PC	
	Sub-surface screen printed, not overlaminated	
Finish:	Velvet/Matte Low Glare	
Colors:	Background	White
	Text	Black
	Logo	MTA Black, Yellow & Red
Raised Letters:	5/8 inch, & 7/8 inch, ADA Compliant	
Braille:	Grade 2, ADA Compliant	
Bonded Adhesive:	3M™ #4920 VHB (Extreme Performance Acrylic Foam)	
Corner Radius:	.25 inches	
Application Tape:	To aid, protect, and identify during installation	
Design:	©2002 Globe Transportation Graphics	

- f) Two “Watch Your Step” (white lettering on red background) to be installed on the face of the step riser in the rear center aisle and on the side of the operator’s riser facing the front door.



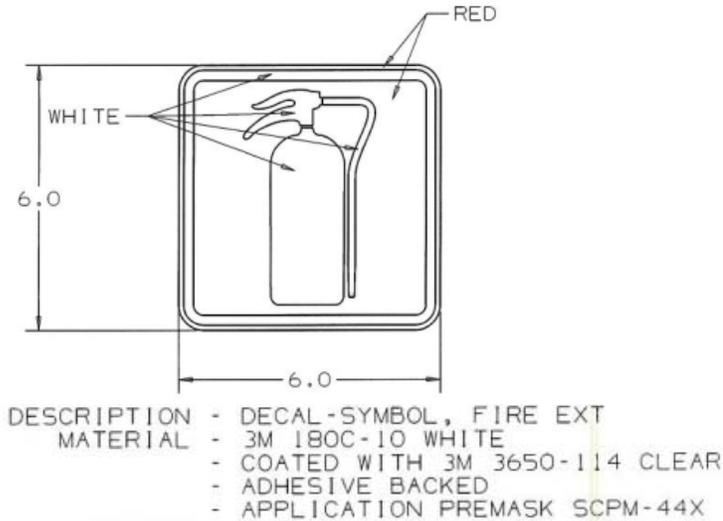
DESCRIPTION - DECAL WATCH YOUR STEP  
 MATERIAL - 3M 680CR-10 WHITE REFLECTIVE  
 - COATED WITH 3M 3650-114 CLEAR  
 - SPLIT BACKING PAPER  
 FONT - HELVETICA MEDIUM 2.75" HIGH  
 - CENTERED ON DECAL AS SHOWN  
 COLOR - WHITE TEXT ON RED BACKGROUND



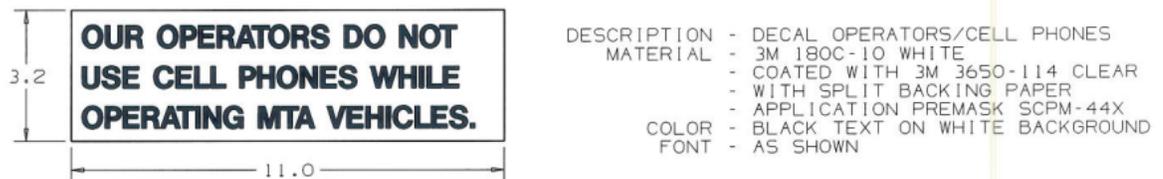
DESCRIPTION - DECAL WATCH YOUR STEP VERTICAL  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH 3M 3650-114 CLEAR  
 - ADHESIVE BACKED WITH SPLIT BACKING PAPER  
 - APPLICATION PREMASK SCPM-44X  
 COLOR - WHITE TEXT ON RED BACKGROUND  
 FONT - HELVETICA MEDIUM 0.85" HIGH

- g) Roof hatches to be labeled in black “Emergency Exit.” Unless provided with clear Plexiglas in which case this lettering shall be Red.

- h) Two decals with Fire Extinguisher Outline to be installed on emergency equipment box on top of lid and side facing the aisle.



- i) One decal located on the destination sign closure door labeled “Thank You For not: Smoking, Drinking, Eating or Playing Radio’s Without Earphones...It’s the Law.” Decal to be black letters on white background.
- j) One decal located on the destination sign closure door labeled: “**OUR OPERATORS DO NOT USE CELL PHONES WHILE OPERATING MTA VEHICLES**”. Decal to be black letters on white background.



- k) Two decals ‘For Your Safety, This Vehicle is Equipped With Video Surveillance’, with a camera logo and the MTA logo shall be installed in locations approved by the MTA.

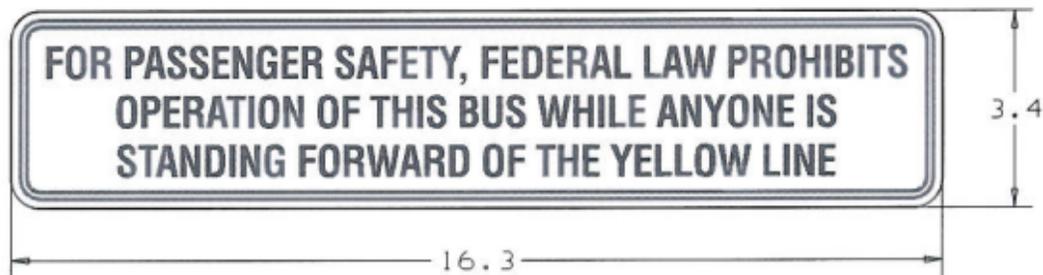


- l) Emergency exit signs and wheelchair securement signs to be provided as required.
- m) One bus height decal located over the front door, easily visible to the operator (in feet and inches, i.e. 10' 8"). Decal to be black letters on white background.



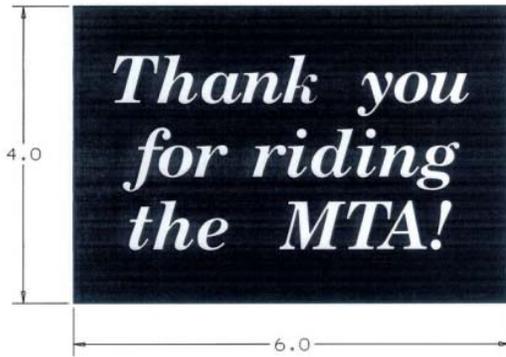
DESCRIPTION - DECAL-CAUTION, BUS HEIGHT  
 MATERIAL - 3M 680CR-10 WHITE REFLECTIVE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED

- n) One decal stating “FOR PASSENGER SAFETY, FEDERAL LAW PROHIBITS OPERATION OF THE BUS WHILE ANYONE IS STANDING FORWARD OF THE YELLOW LINE” applied to the destination sign cover door.



DESCRIPTION - DECAL-BEHIND YELW LINE  
 MATERIAL - 3M 180CR-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED

- o) One decal “*Thank you for riding the MTA!*” applied at the exit door.



DESCRIPTION - DECAL THANK YOU FOR RIDING  
 MATERIAL - 3M 180C-10 WHITE  
 - PREMASK WITH SCPM-44X  
 - WITH SPLIT BACKING PAPER  
 COLOR - BLUE WITH WHITE TEXT  
 AS PER SAMPLE

- p) One decal “WELCOME ABOARD” applied to the panel facing the front entrance door above the operator’s head.



DESCRIPTION - DECAL WELCOME ABOARD  
 MATERIAL - 3M 180C-10 WHITE  
 - PREMASK WITH SCPM-44X  
 - WITH SPLIT BACKING PAPER  
 COLOR - WHITE WITH RED TEXT

- q) One decal “Please Do Not Place Items On Top Of Box” applied to the emergency equipment box on top of lid and side facing the aisle.



DESCRIPTION - DECAL-DO NOT PLACE ITEMS ON BOX  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED

- r) Emergency window release instructions located in close proximity to the window release handle. Material, graphics and location are subject to MTA review and approval.



- DESCRIPTION - DECAL-WINDOW RELEASE  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH 3M 3650-114 CLEAR  
 - ADHESIVE BACKED AND PREMASKED  
 COLOR - WHITE TEXT AND BORDER/RED GRAPHICS ON  
 BLACK BACKGROUND  
 - RED TO MATCH PANTONE 186C  
 FONT - HELVETICA MEDIUM

- s) Caution decal for passengers when bus is in motion in English and Spanish. Decal states “**CAUTION PLEASE HOLD ON WHILE THE BUS IS IN MOTION. ALWAYS BE PREPARED FOR SUDDEN STOPS**”. Location and amount of decals subject to MTA review and approval

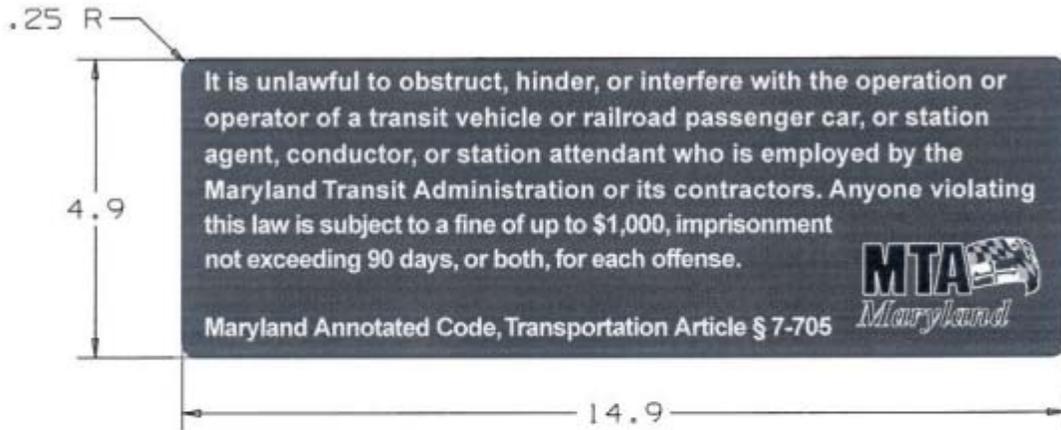


DESCRIPTION - DECAL-CAUTION, HOLD ON  
 MATERIAL - 3M 180C-15 BRIGHT YELLOW  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED  
 COLOURS - BLACK TEXT ON YELLOW

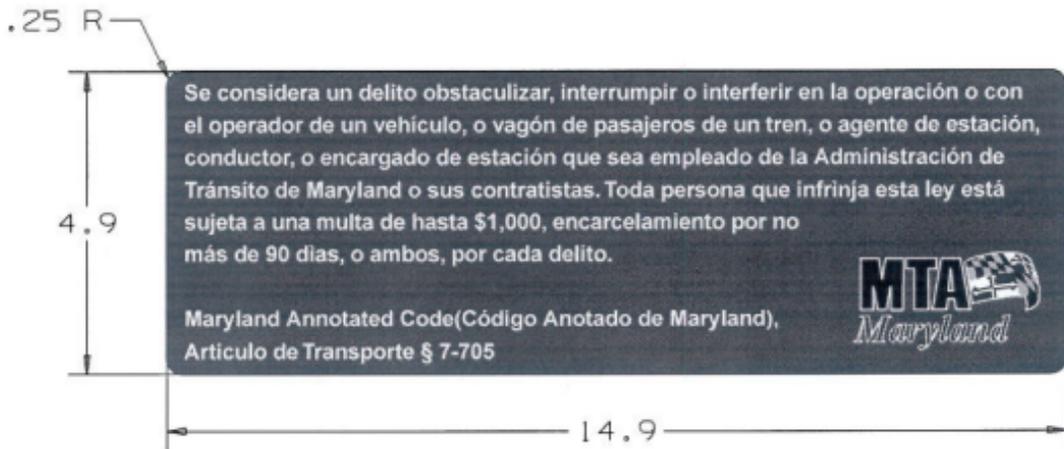


DESCRIPTION - DECAL-CAUTION, HOLD ON (SPN)  
 MATERIAL - 3M 180C-15 BRIGHT YELLOW  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED  
 FONT - AS SHOWN  
 COLOR - BLACK PRINT AND BORDER  
 - YELLOW BACKGROUND

- t) Decal with Maryland Transportation Code 7-705 in English and Spanish regarding obstruction of the operator. Location to be reviewed and approved by the MTA.

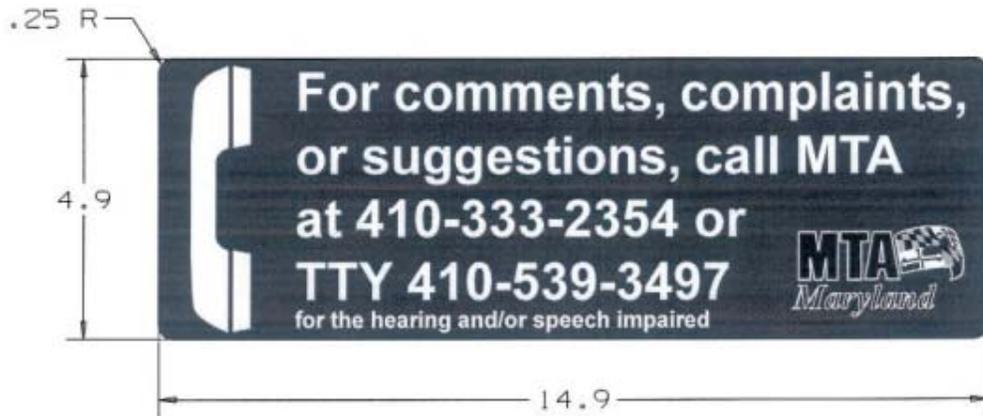


DESCRIPTION - DECAL - IT IS UNLAWFUL  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED

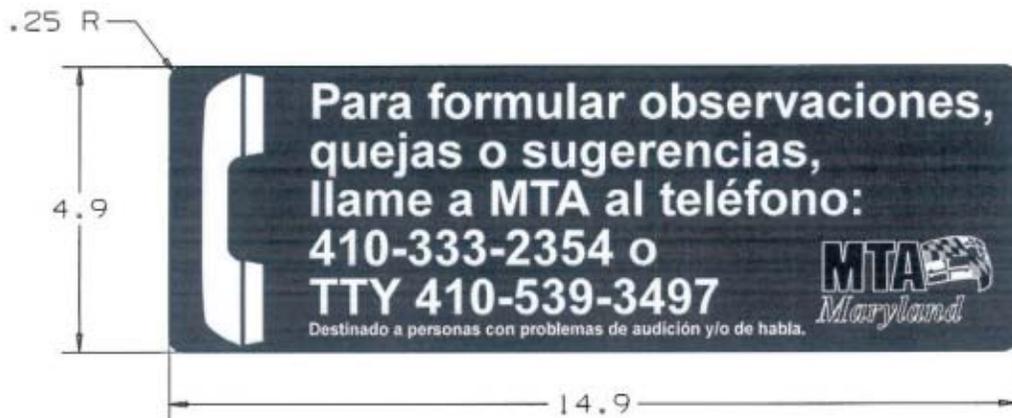


DESCRIPTION - DECAL - IT IS UNLAWFUL (SPN)  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED

- u) Decal for Comments, Complaints and Suggestions in English and Spanish advising where to contact the MTA. Location to be reviewed and approved by the MTA.

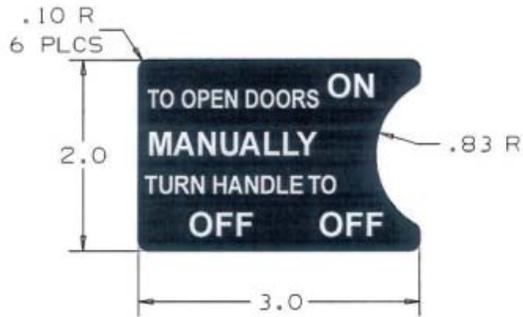


DESCRIPTION - DECAL-FOR COMMENTS  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED



DESCRIPTION - DECAL-FOR COMMENTS (SPN)  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED

- v) Decal providing instructions turn off power to the door valves to allow for manual open/close of the doors. Location to be reviewed and approved by the MTA. Example provided.



DESCRIPTION - DECAL - TO OPEN DOORS MANUALLY  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED  
 COLOURS - WHITE ON BLACK BACKGROUND

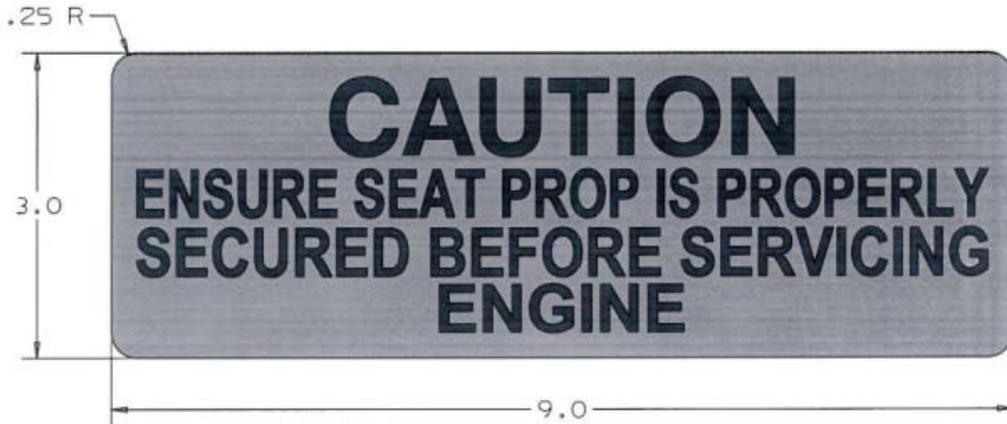
- w) Decal providing fare information applied to the exterior curbside of the bus adjacent to the front entrance door. Fares and phone numbers to be supplied by the MTA prior to bus production. Location to be reviewed by the MTA. Example provided.



All logo materials, colors and installation locations are subject to MTA approval.

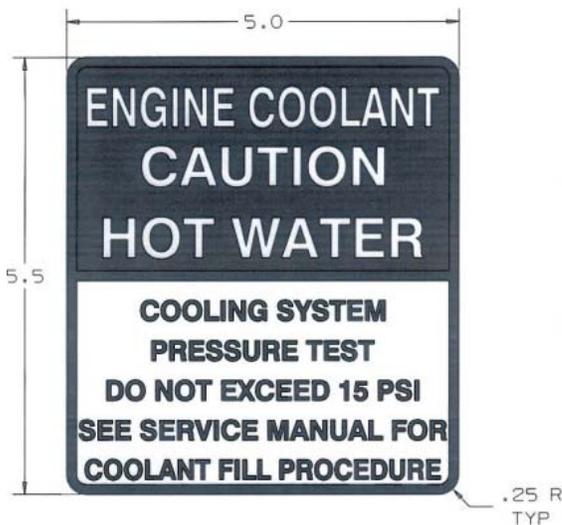
**Bus service and maintenance area signage shall be as follows:**

- a) Decal on underside of rear center seat stating **CAUTION ENSURE SEAT PROP IS PROPERLY SECURED BEFORE SERVICING ENGINE.**



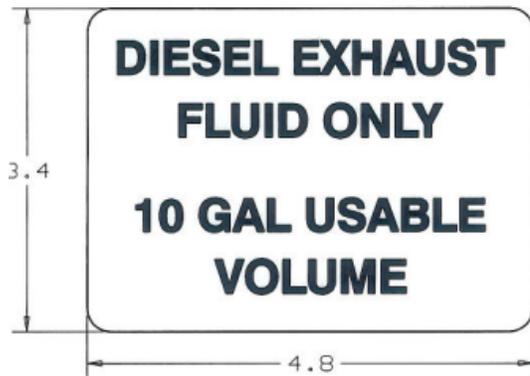
DESCRIPTION - DECAL-SEAT PROP  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED  
 COLOURS - RED (PMS 485) TEXT ON WHITE

- b) Decal on the inside of the door for the coolant fill that warns of coolant temperature and pressures testing system. Decal shall state: **ENGINE COOLANT CAUTION HOT WATER / COOLING SSYTEM PRESSURE TEST DO NOT EXCEED 15 PSI SEE SERVICIE MANUAL FO RCOOLANT FILL PROCEDURE.**



DESCRIPTION - DECAL-COOLING SYS TEST  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED  
 COLOURS - RED (PMS 485) TEXT ON WHITE  
 - WHITE TEXT ON RED (PMS 485)

- c) Decal on inside door for the Diesel Exhaust Fill port. The decal shall state: DIESEL EXHAUST FLUID ONLY / XX GAL USABLE VOLUME.



DESCRIPTION - DECAL-DIESEL EXHAUST FLUID  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED  
 COLOURS - BLACK TEXT ON WHITE

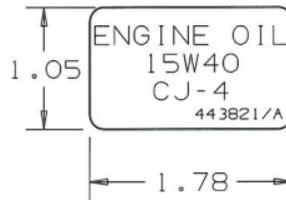
- d) Decals in critical locations throughout the bus to warn of where service personnel should not drill because of hidden electrical cables. Example decal provided.



DESCRIPTION - DECAL-DO NOT DRILL  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED  
 COLOURS - WHITE ON BLACK BACKGROUND

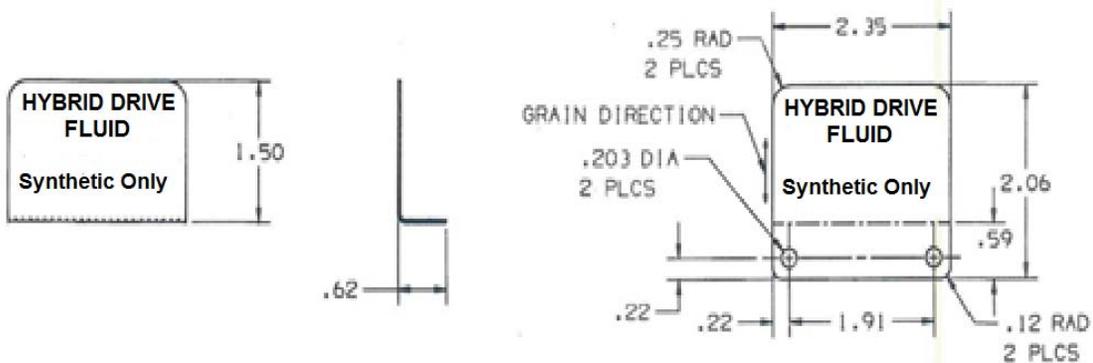
- e) Metallic instruction plate mounted near the engine coolant fill location providing instructions on the procedure for filling the coolant system.

- f) Metallic plate mounted to the engine oil fill location with decal identifying that the fill port is for engine oil and specifying the API category and weight required.



DESCRIPTION: DECAL-ENGINE OIL  
 MATERIAL: 3M 180-10 WHITE  
 COLOUR: BLACK LETTERS ON WHITE BACKGROUND  
 FONT: HELVETICA MEDIUM  
 ADHESIVE BACKING  
 COATED WITH 3M 3650-114 CLEAR

- g) Metallic plate mounted to the hybrid drive fluid fill location with decal identifying that the fill port is for hybrid drive fluid and specifying that synthetic fluid is required.



MATERIAL - ANODIZED ALUMINUM 14GA. 10641  
 LETTERING- RED ON METALLIC BACKGROUND

- h) Decal identifying the engine oil cleaning centrifuge at its location in the engine compartment is required.



### TS 70.1 Passenger Information

ADA priority seating signs as required and defined by 49 CFR, Part 38.27 shall be provided to identify the seats designated for passengers with disabilities.

Equipment for public announcements in compliance with 49 CFR, Part 38.35 shall be provided.

### TS 71. Exterior Lighting

**The MTA currently uses Dialight LED lamps for all exterior lighting and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Exterior LED lighting shall conform to all FMVSS requirements. The lamps shall have a lifetime warranty with a minimum 100,000 life. Lamps shall have potted construction and integral wiring. The lens shall be hard coated polycarbonate and the light assembly shall be mounted and sealed to the bus exterior using a foam gasket and the correct fasteners.

Exterior lighting and reflectors shall comply, as applicable, with Part 393, Subpart B of the FMCSA and FMVSS 108. All exterior lighting including headlamps shall be LED-type meeting the above requirements. All LED lamps shall be standard installation of the manufacturer. The entire assembly shall be specifically coated to protect the light from chemical and abrasion degradation.

All exterior lights shall be designed to prevent entry and accumulation of moisture or dust. Commercially available LED-type lamps shall be utilized at all exterior lamp locations except headlights. Lamps, lenses and fixtures shall be interchangeable to the extent practicable. Two hazard lamps at the rear of the bus shall be visible from behind when the engine service doors are opened. Light lenses shall be designed and located to prevent damage when running the vehicle through an automatic bus washer. Front marker (clearance) lights along with lights located on the roof and sides of the bus shall have protective shields or be of the flush mount type to protect the lens against minor impacts.

The bus shall be equipped with an exterior lamp test feature. Simultaneously depressing both floor mounted turn signal switches will enable this test feature. The exterior lamp test feature shall be active for five (5) minutes or until the parking brakes are released or the hybrid drive is taken out of the neutral position.

The front three center marker (clearance) lights shall be designed and configured to be used as strobe lights providing timed intermittent illumination. A two position toggle control switch shall be mounted in the front destination sign cavity to turn the lights from normal operation to the strobe feature.

### **TS 71.1 Backup Light/Alarm**

Visible and audible warnings shall inform following buses or pedestrians of reverse operation. Visible reverse operation warning shall conform to SAE Standard J593. Audible reverse operation warning shall conform to SAE Recommended Practice J994 Type C or D.

### **TS 71.2 Doorway Lighting**

LED strip lamps at the front and rear passenger doorways shall comply with ADA requirements and shall activate only when the doors open. These strip lamps shall illuminate the street surface to a level of no less than 1 foot-candle for a distance of 3 ft outward from the outboard edge of the door threshold. The lights may be positioned above or below the lower daylight opening of the windows and shall be shielded to protect passenger's and operator's eyes from glare.

### **TS 71.3 Turn Signals**

Turn-signal lights shall be provided on the front, rear, curb and street sides (2 per side, amber with guards) of the bus in accordance with FMVSS 108 and Part 393, Subpart B of the FMCSA as applicable. The front turn signals may be integrated with the buses headlamp assemblies. The rear lower amber LED turn signal lamps shall be 7-inch diameter. Two upper amber LED turn signal lamps shall be oval shaped and located on each rear corner of the bus approximately 12-18 inches below the roof line.

Two white curbside cornering lamps shall be provided that illuminate when the master switch is in night run and the right turn signal switch is activated and go out when the turn signal switch is released. One forward facing lamp shall be located on the lower side panel rearward of the front axle with the second forward facing lamp located on the lower side panel rearward of the rear drive axle providing a lighted area for the operator to view any obstructions through the mirror.

One white street side cornering lamp shall be provided that illuminates when the master switch is in night run and the left turn signal switch is activated and goes out when the turn signal switch is released. The forward facing lamp shall be located on the lower side panel rearward of the front axle providing a lighted area for the operator to view any obstructions through the mirror.

### **TS 71.4 Headlights**

The manufacturer's standard headlight installation using LED lamps for low and high beams shall be provided in accordance with FMVSS 108 and Part 393, Subpart B of the FMCSA as applicable. Headlamps shall incorporate a daytime running light feature.

### **TS 71.5 Tail / Brake Lights**

Tail and brake lights shall be provided in accordance with FMVSS 108 and Part 393, Subpart B of the FMCSA as applicable. The tail and brake lights shall be red and 7 inches in diameter.

The bus shall include red center mount brake lamp(s) along the rear of the bus above the engine door in addition to the 7 inch lower brake lamps required under FMVSS 108. The center mount brake lamps shall illuminate steady with brake application as well as when the regenerative braking is in effect. The center mount brake lamps shall be two 18-inch x1-inch LED strip lamps.

The rear red tail, brake and amber turn signal lights shall be 7-inches diameter, the white back-up light shall 4-inch diameter and be arranged in a vertical configuration from the top down (amber, red, white), located on the rear corner panel and not on the engine door. All exterior lights except the center mounted stop lights shall remain visible from the rear of the bus with the engine doors open.

### TS 71.6 Service Area Lighting (Interior and Exterior)

LED strip lamps shall be provided in the engine and all other compartments where service may be required to generally illuminate the area for night emergency repairs or adjustments. These service areas shall include, but not be limited to, the engine compartment, the communication box, junction/apparatus panels and passenger door operator compartments. Lighting shall be adequate to light the space of the service areas to levels needed to complete typical emergency repairs and adjustments. The service area lamps shall be suitable for the environment in which they are mounted.

There shall be a minimum of 4 strip lamps in the engine compartment controlled by a switch mounted near the rear start controls. All other service area lamps shall be controlled by switches mounted on or convenient to the lamp assemblies. Power to the service area lighting shall be programmable. Power shall latch on with activation of the switch and shall be automatically discontinued (timed out) when the bus multiplex system goes to sleep preventing damage caused by inadvertently leaving the service area lighting switch in the on position after repairs are made.

## INTERIOR PANELS AND FINISHES

### TS 72. General Requirements

Materials shall be selected on the basis of maintenance, durability, appearance, safety, and tactile qualities. Materials shall be strong enough to resist everyday abuse and be vandalism and corrosion resistant. Trim and attachment details shall be kept simple and unobtrusive. Interior trim shall be secured to avoid resonant vibrations under normal operational conditions.

Interior surfaces more than 10 in. below the lower edge of the side windows or windshield shall be shaped so that objects placed on them fall to the floor when the bus is parked on a level surface. Any components and other electrical components within close proximity to these surfaces shall also be resistant to this cleaning method.

### TS 73. Interior Panels

Panels shall be easily replaceable and tamper-resistant. They shall be reinforced, as necessary, to resist vandalism and other rigors of transit bus service. Individual trim panels and parts shall be interchangeable to the extent practicable.

Materials shall comply with the Recommended Fire Safety Practices defined in FTA Docket 90-A, dated October 20, 1993 and **FMVSS Standard No. 302** - Flammability of Interior Materials - Passenger Cars, Multipurpose Passenger Vehicles, Trucks, and Buses.

#### TS 73.1 Operator Area Barrier

A barrier or bulkhead between the operator's seat and the street-side front wheelhouse shall be provided. The barrier shall minimize glare and reflections in the windshield directly in front of the barrier from interior lighting during night operation. The barrier may be a part of the communications cabinet. Location and shape shall permit full seat travel and reclining possibilities that can accommodate the shoulders of a 5<sup>th</sup> percentile female and 95<sup>th</sup>-percentile male. The partition shall have a side return and stanchion to prevent passenger from reaching the operator by standing behind the operator's seat. The lower area between the seat and panel shall be accessible to the operator. The

partition must be strong enough in conjunction with entire partition assembly for mounting of such equipment as flare kits, 10 pound fire extinguishers, microcomputer, public address amplifier, etc. Dark or black panels are preferred behind the operator's head. The panel should be isolated for noise control and attached with rubber grommets. Provisions for the two piece operator's security barrier shall be integrated with this barrier.

The operator's barrier shall extend from the top of the wheel well to the ceiling the level of the seated operator and shall fit close to the bus side windows and wall to prevent passengers from reaching the operator or the operator's personal effects.

A chrome plated grab handle providing a handhold assist so the operator can pull themselves up and into the operator's seat shall be mounted to the ceiling above the operator's head.

### **TS 73.2 Safety Locker**

A sturdy locker located on top of the curbside front wheelhouse shall store the portable fire extinguisher, the safety triangles and unused wheelchair restraint belts. The locker shall have a top cover, hinged on the curbside, with a latch that secures the cover in the closed position. The top of the locker shall be designed to prevent items to be stored on the cover. The locker shall be splash proof when the cover is closed and made of a minimum of 14 gauge stainless steel or 12-gauge aluminum suitably reinforced to sustain a passenger sitting on the locker. The locker shall be painted with black polyurethane enamel.

A 10-pound dry chemical fire extinguisher shall be mounted inside the locker, with appropriate clamps to preclude rattles and the fill gauge visible when the cover is open. The fire extinguisher shall be engraved with MTA in letters not less than 1-inch high and shall include an inspection expiration date.

A safety kit containing three triangles shall be secured with Velcro straps inside the locker to preclude rattles.

Sufficient space shall be available inside the locker for storage of MTA safety equipment.

A square key for all interior and exterior access doors along with provisions for a retainer shall be included inside the safety locker.

### **TS 73.3 Modesty Panels**

Sturdy medium grey modesty panels constructed of durable, unpainted, corrosion-resistant material complementing the interior shall be provided to act as both a physical and visual barrier for seated passengers.

Design and installation of modesty panels located in front of forward-facing seats shall include a handhold or grab handle along its top edge. These panels shall be mounted on the sidewall and shall project toward the aisle no farther than passenger knee projection in longitudinal seats or the aisle side of the transverse seats. Modesty panels shall extend from at least the window opening of the side windows, and those forward of transverse seats shall extend downward to 1½ in. above the floor. Panels forward of longitudinal seats shall extend to below the level of the seat cushion. Dividers positioned at the doorways shall provide no less than a 2½ in. clearance between the modesty panel and a fully open, inward opening door, or the path of a deploying flip-out ramp to protect passengers from being pinched. Modesty panels installed at doorways shall be equipped with grab rails if passenger assists are not provided by other means.

The modesty panel and its mounting shall withstand a static force of 250 lbs applied to a 4 × 4 in. area in the center of the panel without permanent visible deformation.

A clear non-glass panel shall be provided from above the modesty panel to the top of the daylight opening of the passenger windows and attached to the stanchion.

#### **TS 73.4 Front End**

The entire front end of the bus shall be sealed to prevent debris accumulation behind the dash and to prevent the operator's feet from kicking or fouling wiring and other equipment. The front end shall be free of protrusions that are hazardous to passengers standing at the front of the standee line area of the bus during rapid decelerations. Paneling across the front of the bus and any trim around the operator's compartment shall be formed metal or composite material. Composite dash panels shall be reinforced as necessary, vandal-resistant and replaceable. All colored, painted and plated parts forward of the operator's barrier shall be finished with a black matte surface that reduces glare. Surfaces designated for mounted equipment shall have provisions to securely fasten and support the weight of equipment.

#### **TS 73.5 Rear Bulkhead**

The rear bulkhead and rear interior surfaces shall be covered with fabric to match the seats and trimmed with stainless steel, aluminum or composite.

The rear bulkhead shall be contoured to fit the ceiling, side walls and seat backs so that any litter or trash will tend to fall to the floor or seating surface when the bus is on a level surface. Any air vents in this area shall be louvered to reduce airflow noise and to eliminate the possibility of trash or litter being thrown or drawn through the grille. If it is necessary to remove the panel to service components located on the rear bulkhead, the panel shall be hinged or shall be able to be easily removed and replaced. Grilles where access to or adjustment of equipment is required shall be heavy-duty and designed to minimize damage and limit unauthorized access.

Tamper proof fasteners are to be used in retaining any service panels attached to the rear interior bulkhead. The rear settee is to be sealed to the rear bulkhead and if required a trash guard installed that insures no debris is able to get behind the settee.

#### **TS 73.6 Headlining**

Ceiling panels shall be made of durable, corrosion resistant, easily cleanable material. Headlining shall be supported to prevent buckling, drumming or flexing and shall be secured without loose edges. Headlining materials shall be treated or insulated to prevent marks due to condensation where panels are in contact with metal members. Moldings and trim strips, as required to make the edges tamperproof, shall be stainless steel, aluminum or plastic, colored to complement the ceiling material. Sealant or caulking used around moldings and trim strips shall be the same color as the molding or strip and applied evenly and professionally. Headlining panels covering operational equipment that is mounted above the ceiling shall be on hinges for ease of service but retained to prevent inadvertent opening.

#### **TS 73.7 Fastening**

Interior panels shall be attached so that there are no exposed unfinished or rough edges or rough surfaces. Fasteners shall be corrosion resistant. Panels and fasteners shall not be easily removable by passengers. Exposed interior fasteners should be minimized, and shall be tamper-proof.

## TS 73.8 Insulation

Any insulation material used between the inner and outer panels shall minimize the entry and/or retention of moisture. Insulation properties shall be unimpaired during the service life of the bus. Any insulation material used inside the engine compartment shall not absorb or retain oils or water and shall be designed to prevent casual damage that may occur during maintenance operations.

The combination of inner and outer panels on the sides, roof, wheel wells and ends of the bus, and any material used between these panels, shall provide a thermal insulation sufficient to meet the interior temperature requirements. The bus body shall be thoroughly sealed so that the operator or passengers cannot feel drafts during normal operations with the passenger doors closed.

All insulation materials shall comply with the Recommended Fire Safety Practices defined in FTA Docket 90-A, dated October 20, 1993. **FMVSS Standard No. 302** - Flammability of Interior Materials - Passenger Cars, Multipurpose Passenger Vehicles, Trucks, and Buses.

## TS 73.9 Floor Covering

**The MTA currently uses Altro Transflor Chroma 2.7 TFCR 2772 Phantom color and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The floor covering shall be slip resistant, durable and easy to clean. The floor cover shall be a minimum of 2.7 mm in thickness. and shall have an integrated bacteriostat to prevent the growth of bacteria. The flooring shall be resistant to impact indentation and have heat welded seams. The flooring shall be impervious to water and spillages and have a 15 year warranty.

The floor covering shall have a non-skid walking surface that remains effective in all weather conditions. The floor covering, as well as transitions of flooring material to the main floor and to the entrance and exit area, shall be smooth and present no tripping hazards. Seams shall be sealed/welded per manufacturer's specifications. The standee line shall be yellow and approximately 2 in. wide and shall extend across the bus aisle. The color and pattern shall be consistent throughout the floor covering. The floor shall be easily cleaned and shall be arranged to minimize debris accumulation.

Any areas on the floor that are not intended for standees, such as areas "swept" during passenger door operation, shall be clearly and permanently marked. The entire area by the rear door, back to the inboard edge of the modesty panel, shall be yellow with the words 'PLEASE NO STANDEES IN THIS AREA' inlaid in black lettering. Shown below is an example of the passenger message described previously.



A one-piece center strip shall extend from the vertical wall of the rear settee between the aisle sides of transverse seats to the standee line. The floor covering center strip shall be one piece at each level. The covering between the center strip and the wheel housings may be separate pieces. At the rear door, however, a separate strip as wide as the door shall extend from the center strip to the outboard edge of the rear/exit area.

Any area of the aisle with an elevation change, such as over the front axle, shall have diagonal yellow stripes in the floor covering in that area as shown below.



The floor under the seats shall be covered with smooth surface flooring material. The floor covering shall closely fit the sidewall in a fully sealed butt joint or extend to the top of the cove.

### TS 73.10 Interior Lighting

**The MTA currently uses Pretoria LED 24 volt lighting with concave profile and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The interior LED lighting system shall be cool white with the exception of the number 2 position as described below. The lighting fixture can be adjusted to extinguish or dim at 10%, 20%, 40%, 60% or 80% light output. The light output shall be equivalent to 400 lumens per foot. The system shall have individual power supplies per fixture, under/over voltage protection, have resettable circuit breakers

and be SAE J1455 compliant. The lenses, ductwork and peripherals shall meet FMVSS 302 flammability requirements. The system shall have a 12 year warranty on materials and workmanship.

The light source shall be located to minimize windshield glare, with distribution of the light focused primarily on the passengers' reading plane while casting sufficient light onto the advertising display. The lighting system may be designed to form part of or the entire air distribution duct. All interior passenger lighting shall be comprised of LED lights. All components mounted in the air distribution ducts shall be segregated from the main air flow by velcro sealed blankets to insure the air flow is not impeded by the components while protecting the components from air borne particles.

The lens material shall be translucent polycarbonate. Lenses shall be designed to effectively "mask" the light source. Street and curbside lenses in the number 2 position from the front of the bus shall be colored light blue. Lenses shall be sealed to inhibit incursion of dust and insects yet be easily removable for service. Access panels shall be provided to allow servicing of components located behind light panels. If necessary, the entire light fixture shall be hinged. Tamper proof screws shall be used for any passenger lighting joiner strips. Lenses shall be retained by retention brackets a maximum of every 4 feet to insure the lens cannot be pried away from its mounting base and fall on passengers.

### **TS 73.11 Passenger Area Lighting**

The first two banks of lights on the curbside and the first bank of lights on the streetside (behind the operator and the front door) are normally turned on only when the front door is opened, in "night run" and "night park." As soon as the door closes, these lights shall extinguish. These lights shall be turned on at any time if the toggle switch is in the "on" position.

All interior lighting shall be extinguished whenever the hybrid drive selector is in reverse and the engine run switch is in the "on" position.

All interior LED lights and included components (power supplies, controllers, etc.) shall have a 12-year warranty. The interior lighting shall have a concave profile and the design shall require the review of the MTA.

### **TS 73.12 Operator Area Lighting**

The operator area shall have an LED overhead light to provide general illumination, and shall illuminate the half of the steering wheel nearest the operator to a level of 5 to 10 foot-candles.

### **TS 73.13 Passenger Seating Area Lighting**

The interior lighting system shall provide a minimum 15 foot-candle illumination on a 1 sq ft plane at an angle of 45 degrees from horizontal, centered 33 in. above the floor and 24 in. in front of the seat back at each seat position. Allowable average light level for the rear bench seats shall be 7 foot-candles.

### **TS 73.14 Vestibules/Doors Lighting**

Floor surface in the aisles shall be a minimum of 10 foot-candles, and the vestibule area a minimum of 4 foot-candles with the front doors open and a minimum of 2 foot-candles with the front doors closed. The front entrance area and curb lights shall illuminate when the front door is open and master run switch is in the "Lights" positions. Rear exit area and curb lights shall illuminate when the rear door is unlocked.

### **TS 73.15 Step Lighting**

Step lighting for the intermediate steps between lower and upper floor levels shall be a minimum of 4 foot-candles and shall illuminate in all engine run positions. The step lighting shall be low-profile to minimize tripping and snagging hazards for passengers and shall be shielded as necessary to protect passengers' eyes from glare.

### **TS 73.16 Ramp Lighting**

Exterior and interior ramp lighting shall comply with CFR Part 49, Sections 19.29 and 19.31.

### **TS 73.17 INTENTIONALLY BLANK**

### **TS 73.18 Farebox Lighting**

An LED light fixture shall be mounted in the ceiling above the farebox location. The fixture shall be capable of projecting a concentrated beam of light on the farebox. This light will automatically come on whenever the front doors are opened and the run switch is in the "night run" or "night park" position.

## **TS 74. Fare Collection**

Provisions for MTA to install a GFI-Cubic Odyssey electronic farebox and OCU shall be provided in an area immediately adjacent to the operator as approved by MTA. Final location of the OCU shall insure a minimum of 3 inches of knuckle clearance from the steering wheel. Location of the fare collection device shall not restrict traffic in the vestibule, including mobility aid devices and shall allow the operator to reach the OCU and view the coin escrow. The farebox shall not restrict access to the operator's area and shall not restrict operation of operator controls. Farebox location shall permit accessibility to the cashbox door for easy manual removal of cashbox for extraction of revenue. Farebox communication requirements shall be included as part of the Bus –USA program.

No passenger stanchions or bus structure shall inhibit the opening of the farebox maintenance doors. The top of the farebox shall be illuminated from overhead with an LED light when the front doors are open and the master switch is in the NIGHT RUN or NIGHT PARK positions. A 10-amp, 24-VDC breaker, protected exclusive circuit shall power the farebox along with a wire grounded to the bus framing. This power service shall include the pair of wires enclosed in a flexible conduit with connections compatible to the farebox and control keypad and shall be wired independently of the master battery switch. A J-1708 and Ethernet cable shall be provided between the farebox and the EC.

The floor under the farebox shall be 1/4-inch stainless steel and shall be reinforced, as necessary, to provide a sturdy mounting platform and to prevent shaking of the farebox. The mounting provisions for the OCU to the farebox shall ensure a built-in appearance and shall not restrict the operator's visibility. Provisions shall be made to ensure that an MTA-installed wiring harness connecting the OCU to the farebox shall be concealed behind the dash and grommeted at the exit to the farebox.

The Contractor shall be responsible for installation of the following components associated with the fare collection system. With the exception of the farebox pedestal, all components are to be supplied by the Contractor.

- a) Farebox pedestal: GFI #D22581-0001. MTA will supply the farebox pedestals (only) to the Contractor for installation.

- b) Ground Strap Mounting Kit: CTS/GFI #B00756-002.
- c) Ground Strap: CTS/GFI #B22274-0001.
- d) External Power Cable: CTS/GFI #B22749-0001.
- e) All required miscellaneous hardware and fasteners.

The Contractor shall present farebox installation drawings, including space and mounting provisions for mounting of the OCU, for MTA review at the PPM to ensure an acceptable configuration and ADA compliance.

Upon request from the Contractor, the MTA may make a sample farebox and OCH available to the Contractor.

Fareboxes will be installed by MTA after delivery of the completed bus by the Contractor to MTA.

### TS 74.1 Farebox Communications

- a) The VCPU shall interface to the fare box and support common log-on hardware and software utilizing SAE J1708 or other available standard data interface.
- b) Upon normal bus start up, all on-board systems and components shall be initialized by turning the master run switch to one of the non-off positions and logging in. One and only one login shall be required to the GFI Fare box. Fare box logon information shall be transmitted from the VCPU after operator logon at the primary AVL interface unit (OIT). Logon information shall be transmitted to the fare box whether the operator logs on from the OIT or is remotely logged on from dispatch. The fare box control head unit shall be the backup logon location, should the OIT be unavailable.
- c) The common Farebox log-in shall allow the on-board systems to perform their respective functions for the duration of the assigned work without further operator intervention until the operator or work assignment changes.
- d) Upon receipt of fare box alarms during normal bus operation, the VCPU shall forward the Farebox alarm to the control center via the cellular data path or log the data for subsequent upload via the Wireless LAN networks located at the divisions. Critical alarms shall be immediately forwarded via the cellular data path for display and annunciation in the bus control center. Critical alarms are listed below. The numbers are PID number of the J1708 protocol for Fare Collection Unit alarms. When critical alarm information is forwarded, the message shall also include probe id, probe type and cashbox id, parameters that shall be gathered from the developed interface.
  - 1. Ticket Transport Jam (305)
  - 2. Trim Bypass (322)
  - 3. Bill Unit Jam (401)
  - 4. General Fault
  - 5. Cashbox Removed (378)
  - 6. Cashbox opened in service (378)

- 7. Fare box set in manual bypass (378)
- 8. Maintenance Access in service (378)
- e) The fare box interface shall also be used to pass GPS time from the VCPU unit to the Cubic fare box at least one time per day and during system startup. A single GPS time source shall be utilized to synchronize all on-board equipment to one common time point. The VCPU unit shall pass longitude and latitude information to the fare box at every stop during the work period. It shall also pass Bus Stop ID or similar unique ID at each stop so that passenger count information can be correlated with stop information.
- f) The Operator ID, Route, Trip, Run, Block and Fare Set information shall be transmitted to the fare box as part of the normal transfer of single-point logon information.
- g) The fareboxes will continue to utilize a separate WAN for offloading fare collection data independent of data collected and stored by the on-board VCPU.

## TS 75. Interior Access Panels and Doors

Access for maintenance and replacement of equipment shall be provided by panels and doors that appear to be an integral part of the interior. Access doors shall be hinged with gas props or over-center springs, where practical, to hold the doors out of the mechanic's way. Panels shall prevent entry of mechanism lubricant into the bus interior. All fasteners that retain access panels shall be captive in the cover.

Access doors shall be secured with locks that shall be standardized so that only one tool is required to open access doors in the bus.

### TS 75.1 Floor Hatches

Access openings in the floor shall be sealed to prevent entry of fumes and water into the bus interior. Flooring material at or around access hatches shall be flush with the floor and shall be edge-bound with stainless steel to prevent the edges from coming loose. Access openings shall be asymmetrical so that when the floor access hatches are reinstalled the hatch and flooring shall be properly aligned. Fasteners shall tighten flush with the floor.

One type of fastener shall be used for attachment of the floor panel and interior fasteners that require removal for routine maintenance and repair (i.e. Torx) so one tool may be used for all.

## PASSENGER ACCOMMODATIONS

### TS 76. Passenger Seating

**The MTA currently uses American Seating Insight passenger seating and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

#### TS 76.1 Arrangements and Seat Style

The passenger seating arrangement in the bus shall be such that seating capacity is maximized and in compliance to the following requirements. The seating layout shall be presented to the MTA in the proposal for consideration.

Passenger seats shall be arranged in a transverse, forward-facing configuration with due regard for passenger access and comfort. Other areas where aisle-facing seats may be provided are at wheelchair securement areas and platforms (such as for fuel tank storage space). All forward facing passenger

seats excepting any center rear seats above the engine access shall have either another set of seats in front of it or a securely mounted panel.

Seating materials shall meet Docket 90 requirements and **FMVSS Standard No. 302** - Flammability of Interior Materials - Passenger Cars, Multipurpose Passenger Vehicles, Trucks, and Buses.

### **TS 76.2 Rearward Facing Seats**

Rearward facing seats are not allowed.

### **TS 76.3 INTENTIONALLY BLANK**

### **TS 76.4 Padded Inserts/Cushioned Seats**

The passenger seats shall be equipped with vandal-resistant inserts throughout the bus. The seating shall have features to improve passenger comfort while being protected for service in an urban environment. The insert seat material shall be waterproof, stain resistant including anti bacterial and fungal protection while not supporting microbial growth. Materials shall have high resistance to tearing, flexing and wetting.

Seats, back cushions and other pads shall be securely attached and shall be detachable by means of a simple release mechanism so that they are easily removable by the maintenance staff but not by passengers. To the extent practicable, seat cushions and pads shall be interchangeable throughout the bus.

### **TS 76.5 Drain Hole in Seats**

There are no requirements for drain hole provision in seat inserts.

### **TS 76.6 Hip-to-Knee Room**

Hip-to-knee room measured from the center of the seating position, from the front of one seat back horizontally across the highest part of the seat to vertical surface immediately in front, shall be a minimum of 29 in.

### **TS 76.7 Foot Room**

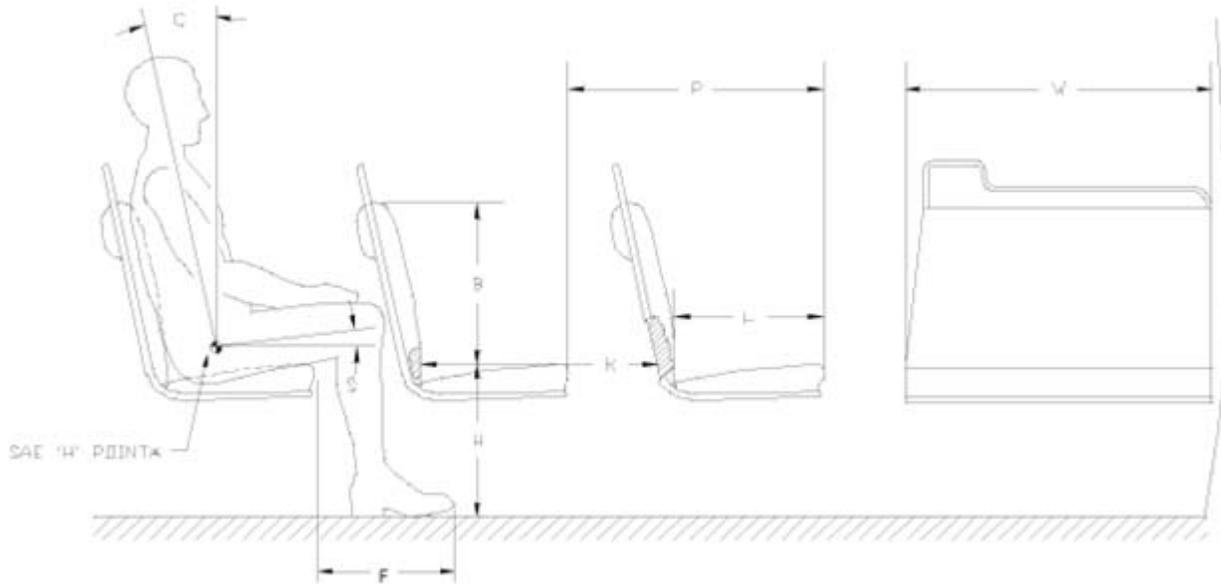
Foot room, measured at the floor forward from a point vertically below the front of the seat cushion, shall be no less than 14 in.

### **TS 76.8 Aisles**

The aisle between the seats shall be no less than 20 inches wide at seated passenger hip height. Seat backs shall be shaped to increase this dimension to no less than 24 in. at 32 in. above the floor (standing passenger hip height). The aisle between modesty panels that are located in front of forward facing seats shall be no less than 20 inches wide.

## TS 76.9 Dimensions

**FIGURE 7**  
Seating Dimensions and Standard Configuration



Seat dimensions for the various seating arrangements shall have the dimensions as follows (refer to Figure 7):

- a) The width, W, of the two-passenger transverse seat shall be a minimum 36 inches.
- b) The length, L, shall be 17 inches,  $\pm 1$ -inch.
- c) The seat back height, B, shall be a minimum of 15 inches.
- d) The seat height, H, shall be 17 inches,  $\pm 1$ -inch. For the rear lounge (or settee) and longitudinal seats, and seats located above raised areas for storage of under-floor components, a cushion height of up to 18 inches,  $\pm 2$ -inches, will be allowed. This shall also be allowed for limited transverse seats, but only with the expressed approval of the MTA.
- e) Foot room = F.
- f) The seat cushion slope, S, shall be between 5 and 11 degrees.
- g) The seat back slope, C, shall be between 8 and 17 degrees.
- h) Hip to knee room = K.
- i) The pitch, P, is shown as reference only.

## TS 76.10 Structure and Design

The T-pedestal passenger seat frame and its supporting structure shall be constructed and mounted so that space under the seat is maximized and is free of obstructions to facilitate cleaning.

Seats, structures and restraints around the securement area should not infringe into the mobility device envelope or maneuverability.

The transverse seat structure shall be 'T' Pedestal mounted with sufficient strength for the intended service. The lowest part of the seat assembly that is within 12 inches of the aisle shall be at least 10 inches above the floor.

All transverse objects — including seat backs, modesty panels, and longitudinal seats — in front of forward-facing seats shall not impart a compressive load in excess of 1000 lbs onto the femur of passengers ranging in size from a 5th-percentile female to a 95th-percentile male during a 10g deceleration of the bus. This deceleration shall peak at 0.05 to 0.015 seconds from initiation. Permanent deformation of the seat resulting from two 95th-percentile males striking the seat back during this 10g deceleration shall not exceed 2 inches, measured at the aisle side of the seat frame at height H. The seat back should not deflect more than 14 inches, measured at the top of the seat back, in a controlled manner to minimize passenger injury. Structural failure of any part of the seat or sidewall shall not introduce a laceration hazard.

The seat assembly shall withstand static vertical forces of 500 lbs applied to the top of the seat cushion in each seating position with less than 1/4-inch permanent deformation in the seat or its mountings. The seat assembly shall withstand static horizontal forces of 500 lbs evenly distributed along the top of the seat back with less than 1/4-inch permanent deformation in the seat or its mountings. The seat backs at the aisle position and at the window position shall withstand repeated impacts of two 40-lb sandbags without visible deterioration. One sandbag shall strike the front 40,000 times and the other sandbag shall strike the rear 40,000 times. Each sandbag shall be suspended on a 36-inch pendulum and shall strike the seat back 10,000 times each from distances of 6, 8, 10 and 12 inches. Seats at both seating positions shall withstand 4,000 vertical drops of a 40-lb sandbag without visible deterioration. The sandbag shall be dropped 1,000 times each from heights of 6, 8, 10 and 12 inches. Seat cushions shall withstand 100,000 randomly positioned 3-1/2-inch drops of a squirming, 150-lb, smooth-surfaced, buttocks-shaped striker with only minimal wear on the seat covering and no failures to seat structure or cushion suspension components.

The back of each transverse seat shall incorporate a yellow handhold no less than 7/8-inch in diameter for standees and seat access/egress; and shall have a diamond design stainless steel back panel. The handhold shall not be a safety hazard during severe decelerations. The handhold shall extend above the seat back near the aisle so that standees shall have a convenient vertical assist, no less than 4 inches long that may be grasped with the full hand. This handhold shall not cause a standee using this assist to interfere with a seated 50th-percentile male passenger. The handhold shall also be usable by a 5th-percentile female, as well as by larger passengers, to assist with seat access/egress for either transverse seating position. The upper rear portion of the seat back and the seat back handhold immediately forward of transverse seats shall be padded and/or constructed of energy absorbing materials. During a 10g deceleration of the bus, the HIC number (as defined by SAE Standard J211a) shall not exceed 400 for passengers ranging in size from a 5th percentile female through a 95th percentile male.

Seat back handholds shall be provided on all transverse seats and in appropriate locations connect with stanchions.

Longitudinal seats shall be the same general design as transverse seats but without seat back handholds. Clear space above the top of the longitudinal seat backs shall be a minimum of 28 inches to prevent passengers from head contact with fixed material. Armrests are not required on longitudinal seats located in the wheelchair parking area that fold up.

Seat back handholds shall withstand static horizontal and vertical forces of 250 lbs applied anywhere along their length with less than 1/4-inch permanent deformation. Seat back handhold and armrests shall withstand 25,000 impacts in each direction of a horizontal force of 125 lbs with less than 1/4-inch permanent deformation and without visible deterioration.

## TS 76.11 Seat Materials and Construction

**The MTA currently uses American Seating VR-50 seat inserts with Bus Tex 2273724 fabric and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The seating inserts shall be vandal resistant absorbing cuts, slashes and abuse to the material.

Selected materials shall minimize damage from vandalism and shall reduce cleaning time. The seats shall be attached to the frame with tamper-resistant fasteners. Coloring shall be consistent throughout the seat material, with no visually exposed portion painted. Any exposed metal touching the sides or the floor of the bus shall be stainless steel. The seat onset shall be contoured for individuality, lateral support and maximum comfort and shall fit the framework to reduce exposed edges.

The minimum radius of any part of the seat back, handhold or modesty panel in the head or chest impact zone shall be a nominal ¼-in. The seat back and seat back handhold immediately forward of transverse seats shall be constructed of energy-absorbing materials to provide passenger protection and, in a severe crash, allow the passenger to deform the seating materials in the impact areas. Complete seat assemblies shall be interchangeable to the extent practicable.

The insert for the flip-up seats in the Priority Seating Area shall have the wording ‘PRIORITY SEATING, For Persons With Disabilities & Seniors, YIELD THESE SEATS’ with an ADA wheelchair logo in the fabric as shown in the example below:



## TS 77. Passenger Assists

Passenger assists in the form of full grip, vertical stanchions or handholds shall be provided for the safety of standees and for ingress/egress. Passenger assists shall be convenient in location, shape, and size for both the 95th-percentile male and the 5th-percentile female standee. Starting from the entrance door and moving anywhere in the bus and out the exit door, a vertical assist shall be provided either as the vertical portion of seat back assist or as a separate item so that a 5th-percentile female passenger may easily move

from one assist to another using one hand and the other without losing support. All handholds and stanchions shall be powder-coated in a high-contrast yellow color.

### **TS 77.1 Assists**

Excluding those mounted on the seats and doors, the assists shall have a cross-sectional diameter between 1¼ and 1½ in. or shall provide an equivalent gripping surface with no corner radii less than ¼ in. All passenger assists shall permit a full hand grip with no less than 1½ in. of knuckle clearance around the assist. Passenger assists shall be designed to minimize catching or snagging of clothes or personal items.

Any joints in the assist structure shall be underneath supporting brackets and securely clamped to prevent passengers from moving or twisting the assists. Seat handholds shall be of the same construction and finish as the seat frame. Door mounted passenger assists shall be of powder-coated metal in high-contrast yellow color. Connecting tees and angles shall be high-contrast yellow color powder-coated metal castings with mechanical fasteners and shall not be bonded in place. Assists shall withstand a force of 300 lbs applied over a 12-in. lineal dimension in any direction normal to the assist without permanent visible deformation. All passenger assist components, including brackets, clamps, screw heads and other fasteners used on the passenger assists shall be designed to eliminate pinching, snagging and cutting hazards and shall be free from burrs or rough edges.

### **TS 77.2 Front Doorway**

Front doors, or the entry area, shall be fitted with ADA-compliant assists. Assists shall be as far outward as practicable, but shall be located no farther inboard than 6 in. from the outside edge of the entrance step and shall be easily grasped by a 5th-percentile female boarding from street level. Door assists shall be functionally continuous with the horizontal front passenger assist and the vertical assist and the assists on the wheel housing or on the front modesty panel. Assists shall be of powder-coated metal in high-contrast yellow color.

### **TS 77.3 Vestibule**

The aisle side of the operator's two piece security door between the EC and fare box, the wheel housings, and when applicable the modesty panels shall be fitted with vertical passenger assists that are functionally continuous with the overhead assist and that extend to within 36 in. of the floor. These assists shall have sufficient clearance from the barrier to prevent inadvertent wedging of a passenger's arm.

A horizontal passenger assist shall be located across the front of the bus and shall prevent passengers from sustaining injuries on the fare collection device or windshield in the event of a sudden deceleration. Without restricting the vestibule space, the assist shall provide support for a boarding passenger from the front door through the fare collection procedure. The assist shall be no less than 36 in. above the floor. The assists at the front of the bus shall be arranged to permit a 5th-percentile female passenger to easily reach from the door assist, to the front assist, to vertical assists on the operator's barrier, wheel housings or front modesty panel.

### **TS 77.4 Rear Doorway(s)**

Vertical assists that are functionally continuous with the overhead assist shall be provided at the aisle side of the transverse seat immediately forward of the rear door and on the aisle side of the rear door modesty panel(s). Passenger assists shall be provided on modesty panels that are functionally continuous with the rear door assists. Rear doors, or the exit area, shall be fitted with assists having a cross-sectional diameter between 1¼ and 1½ inch or providing an equivalent gripping surface with no

corner radii less than ¼ in., and shall provide at least 1½ inch of knuckle clearance between the assists and their mounting. The assists shall be designed to permit a 5th-percentile female to easily move from one assist to another during the entire exiting process. The assists shall be located no farther inboard than 6 inches from the outside edge of the rear doorway step.

### TS 77.5 Overhead

Except forward of the standee line and at the rear door, a continuous, full grip, overhead assist shall be provided. This assist shall be located over the center of the aisle seating position of the transverse seats. The assist shall be no less than 70 inches above the floor.

Grab straps or other extensions as necessary shall be provided for sections where vertical assists are not available and for the use by passengers that cannot reach to 70 inches. Fourteen (14) passenger grab straps made of yellow plastic are required to be mounted to the overhead assists.

Overhead assists shall simultaneously support 175 lbs on any 12-inch length. No more than 5 percent of the full grip feature shall be lost due to assist supports.

### TS 77.6 Longitudinal Seat Assists

Longitudinal seats shall have vertical assists located between every other designated seating position, except for seats that fold/flip up to accommodate wheelchair securement. Assists shall extend from near the leading edge of the seat and shall be functionally continuous with the overhead assist. Assists shall be staggered across the aisle from each other where practicable and shall be no more than 52 in. apart or functionally continuous for a 5th percentile female passenger.

### TS 77.7 Wheel Housing Barriers/Assists

Unless passenger seating is provided on top of wheel housing, passenger assists shall be mounted around the exposed sides of the wheel housings (and propulsion compartments if applicable), which shall also be designed to prevent passengers from sitting on wheel housings. Such passenger assists shall also effectively retain items, such as bags and luggage, placed on top of wheel housing.

## TS 78. Passenger Doors

**The MTA currently uses Vapor Bus International Door System with Pneumatic ActivAir Differential Engine and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The passenger door system shall use air operated motors for the opening and closing of doors. The systems shall use DOT approved material for air lines and fittings. The door engine shall be adjustable without service tools. The door motors shall require operating pressure between 90 and 120 psi. The closing and opening times of the doors shall be adjustable between 1.5 and 3.5 seconds. Sensors shall be solid state or proximity. The design life of the door system shall be 1,000,000 door cycles, 500,000 miles or 12 years.

Cabling shall be provided to allow monitoring of the Open/Close cycles and status by the VCPU.

Doorways will be provided in the locations and styles as follows. Passenger doors and doorways shall comply with ADA requirements.

Two doors shall be provided in the curbside of the bus for passenger ingress and egress. The front door shall be forward of the front wheels and located so that the operator is able to collect or monitor the

collection of fares of boarding passengers and shall incorporate the necessary accessibility equipment for mobility devices. The rear door centerline shall be rearward of the point midway between the front door centerline and the rearmost seat back. Passenger doors shall be air operated, Slide Glide in the front and Vapor Class controlled open/close in the rear. The rear door shall be an air open and air closed configuration.

Entrance doors shall be two leaf slide glide type driven by a single pneumatic air differential engine. This door engine shall be controlled by a single three-way "poppet type" solenoid valve. The use of four way valves, double solenoid valves or "spool type valves" shall not be allowed. Main door bearings shall be of the "maintenance free, sealed ball bearing type" and shall support the weight of the door system. Doors shall be provided with snag-proof yellow powder coated door handles.

Exit doors shall be wide style with two leaf slide glide type doors driven by a single pneumatic air differential engine. The door engine shall be controlled by a single three-way "poppet type" solenoid valve. The use of four way valves, double solenoid valves or "spool type valves" shall not be allowed. Main door bearings shall be of the "maintenance free, sealed ball bearing type" and shall support the weight of the door system.

### **TS 78.1 Door Materials and Construction**

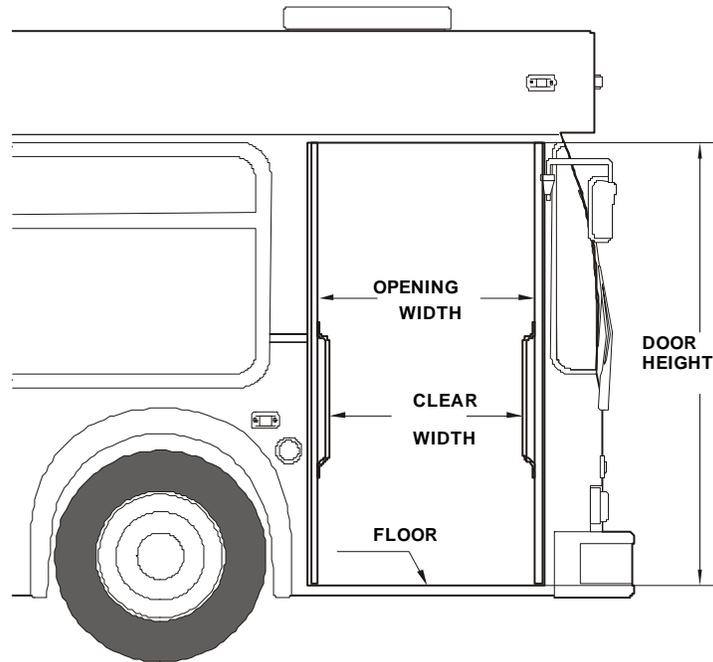
**The MTA currently uses Vapor Bus Ameriview type doors with full view quick change glazing and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Front entrance door shall have full length one piece glazing. Rear exit doors shall have one window at the top of door and aluminum panel on the lower portion. Door panels shall have full view quick change glazing and the panels shall be repairable with the use of common hand tools.

Door panels, associated trim and their attachment points shall be constructed of corrosion resistant materials. Doors when open shall provide a firm support for passengers entering or exiting the vehicle. Doors when closed shall be non-rattling and effectively sealed to preclude entry of water dirt and debris under normal operating conditions. When closed the doors shall provide a minimum of a four-inch gap between the hard edges of the doors. Door panel center seals shall be of resilient rubber of the overlapping type with the forward seal overlapping the aft seal. The combined weather seal and window glazing elements of the front door shall not exceed 10 degrees of binocular obstruction of the operator's view through the closed door.

## TS 78.2 Dimensions

**FIGURE 8**  
Transit Bus Minimum Door Opening



When open, the doors shall leave an opening no less than 75.3 inches in height.

The front door clear width shall be a minimum of 32 inches with the doors fully opened.

The rear door clear width shall be a minimum of 42 inches with the doors fully opened.

### TS 78.3 Door Glazing

The upper section of both front and rear doors shall be glazed for no less than 45 percent of the respective door opening area of each section. The lower section of the front door shall be glazed for no less than 25 percent of the door opening area of the section. The lower section of the rear door panels shall not have glazing and shall be constructed of corrosion resistant material and finished within the aesthetics of the overall bus paint design.

Door glazing shall be easily replaceable. Zip type glazing rubber shall be used.

The front door panel glazing material shall have a nominal 1/4-inch thick laminated safety glass conforming to the requirements of ANSI Z26.1 Test Grouping 2 and the Recommended Practices defined in SAE J673.

### TS 78.4 Door Projection

The exterior projection of the front doors beyond the side of the bus shall be minimized and shall not block the line of sight of the rear exit door via the curb side mirror when the doors are fully open. The exterior projection of both doors shall be minimized and shall not exceed 2 inches during the opening or closing cycles or when doors are fully opened

Projection inside the bus shall not cause an obstruction of the rear door mirror or cause a hazard for standees.

### **TS 78.5 Door Height Above Pavement**

It shall be possible to open and close either passenger door when the bus loaded to gross vehicle weight rating is not knelt and parked with the tires touching an 8-inch high curb on a street sloping toward the curb so that the street side wheels are 5 inches higher than the right side wheels.

### **TS 78.6 Closing Force**

Closing door edge speed shall not exceed 12 inches per second, and opening door speed shall not exceed 19 inches per second. The doors shall not slam closed under any circumstance, even if the door is obstructed during the closing cycle. If a door is obstructed during the closing cycle, the pressure exerted on the obstruction shall not increase once initial contact has been made.

The rear doors shall be equipped with an obstruction sensing system such that if an obstruction is within the path of the closing doors, the doors shall stop and reverse direction prior to imparting a 10-lb force on 1 sq in. of that obstruction and alert the operator if an obstruction is detected between the closing doors. The contactless obstruction sensing system shall be capable of discriminating between the normal doorway environment and passengers or other obstructions within the doorway, and of altering the zones of detection based upon the operating state of the door system.

Whether or not the obstruction sensing system is functional, it shall be possible to withdraw a 1½ inch diameter cylinder from between the center edges of a closed and locked door with an outward force not greater than 35 lbs.

### **TS 78.7 Actuators**

Doors shall open or close completely in not more than 3.5 seconds from the time of control actuation and shall be subject to the closing force requirements.

Door actuators shall be adjustable so that the door opening and closing speeds can be independently adjustable to satisfy the above requirements. Actuators and the complex door mechanism shall be concealed from passengers but shall be easily accessible for servicing. The door actuators shall be rebuildable. Exhaust from the door system shall be routed below the floor of the bus to prevent accumulation of any oil that may be present in the air system and to muffle sound.

Door actuators and associated linkages shall maximize door holding forces in the fully open and fully closed positions to provide firm, non-rattling, non-fluttering door panels while minimizing the force exerted by the doors on an obstruction midway between the fully open and closed positions.

The rear doors shall be Passenger or operator controlled. A two position toggle switch located within reach of the seated operator shall permit the operator to select either:

- a) The default is the rear doors shall be passenger controlled for rear door activation (contactless sensing device or manually pushing the doors open) or
- b) Operator full control over opening and closing of the rear door. The switch shall have a red spring loaded safety cover installed over the switch retaining the toggle in the passenger control position.

For passenger controlled opening of the rear door(s), the bus operator shall unlock and enable the opening mechanism using the operator door control handle. This shall be annunciated by illumination of a green light above the door. After enabling and unlocking the doors, the doors shall be opened by the contactless sensing system.

For operator controlled opening, the operator shall open the rear door using the operator door control handle, and this action shall be annunciated by illumination of a green light above the door with the opening of the doors.

Locked doors shall require a force of more than 300 lbs to open manually. When the locked doors are manually forced to open, damage shall be limited to the bending of minor door linkage with no resulting damage to the doors, actuators or complex mechanism.

### **TS 78.8 Rear Door Interlocks**

Rear door throttle and brake interlocks shall be provided.

### **TS 78.9 Emergency Operation**

In the event of an emergency, it shall be possible to manually open doors designated as emergency exits from inside the bus using a force of no more than 25 lbs to access the doors emergency release mechanism and actuating an unlocking device. The unlocking device shall be clearly marked as an emergency-only device and shall require two distinct actions to actuate. The respective door emergency unlocking device shall be accessible from the doorway area. The unlocking device shall be easily reset by the operator without special tools or opening the door mechanism enclosure. Doors that are required to be classified as "Emergency Exits" shall meet the requirements of FMVSS 217.

### **TS 78.10 Door Control**

The door control shall be located in the operator's area within the hand reach envelope described in SAE Recommended Practice J287, "Driver Hand Control Reach." The operator's door control shall provide tactile feedback to indicate commanded door position and resist inadvertent door actuation.

The front door shall remain in commanded state position even if power is removed or lost.

### **TS 78.11 Door Controller**

The control device shall be protected from moisture. Mounting and location of the door control device handle shall be designed so that it is within comfortable, easy arm's reach of the seated operator. The door control device handle shall be free from interference by other equipment and have adequate clearance so as not to create a pinching hazard.

Position of the door control handle shall result in the following operation of the front and rear doors:

- **Center position:** Front door closed, rear door closed or set to lock.
- **First position forward:** Front door open, rear door closed or set to lock.
- **Second position forward:** Front door open, rear door open or set to open.
- **First position back:** Front door closed, rear door open or set to open.
- **Second position back:** Front door open, rear door open or set to open.

### **TS 78.12 Door Open/Close**

Operation of, and power to, the front passenger doors shall be completely controlled by the operator. Power to open the rear doors shall be controlled by operator enabling the door system and the door

opening by the passenger using the acoustic sensing system. A two position toggle switch shall be provided to enable the operator to obtain full control of the rear doors.

A control or valve in the operator's compartment shall shut off the power to, and/or dump the power from, the front door mechanism to permit manual operation of the front door with the bus shut down. A master door switch, which is not within reach of the seated operator, when set in the "off" position shall close the rear doors, deactivate the door control system, release the interlocks, and permit only manual operation of the rear doors.

**The MTA currently uses Vapor CLASS Acoustic Sensing System for the passenger rear door control and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Closing of the rear door after being opened by the recognition of a passenger exiting via the contactless sensing system shall be automatically initiated once the door area is clear. When the rear door has been opened, the contactless system shall monitor the entire passenger door exit area. The rear exit doors shall remain open when passengers or other objects are in the exit area and the system will not allow closure until the area is cleared.

### **TS 78.13 Door and Interlock Master Switch**

A Door and Interlock Master Switch, which is not within reach of a seated operator when set in the "OFF" position, shall lock the rear doors, deactivate the rear door control system, release the interlocks, and permit continued operation of the bus without rear door service. This switch shall also release and disable the interlocks associated with the emergency opening of the front or rear door, wheelchair ramp, and kneeling system.

Location of this switch is recommended to be enclosed in the dash and accessible by a door. The location shall be reviewed by the MTA during the PPM.

### **TS 78.14 Door Voice Annunciator**

**The MTA currently uses Vapor Bus International Voice Annunciation System and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The rear door shall be equipped with a voice annunciation system. Message input shall be provided directly from the door controller system. The annunciator shall be packaged to fit in the header space or the doorway area using digitally recorded messages for clear announcements with a choice of languages. It shall be solid-state using low maintenance be controlled via the latest windows based diagnostics.

The appropriate message shall be played when the following door conditions are met:

<b>Rear Door Condition</b>	<b>Message</b>
Rear doors authorized ( door closed operator control to rear door open position green light on)	“Touch Yellow Tape to Open”
Doors begin to open (passenger has touched yellow tape while doors were authorized 5 degree switch de-actuates)	“Doors Opening”
Doors begin to close (Door full open sensor de-actuates after being actuated)	“Warning” “Doors Closing”
Doors reach full closed position while still authorized	“Touch Yellow Tape to Open”
Rear doors de-authorized, but does not begin to close in 5 seconds due to an obstruction	“Please Move Away From Rear Door”

## TS 79. Accessibility Provisions

Space and body structural provisions shall be provided at the front door of the bus to accommodate a wheelchair loading system.

### TS 79.1 Accessibility Loading System

**The MTA currently uses Ricon Wheelchair Ramp and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

An automatically-controlled, power-operated ramp system compliant to requirements defined in 49 CFR Part 38, Subpart B, §38.23c shall provide ingress and egress quickly, safely and comfortably, both in forward and rearward directions, for a passenger in a wheelchair from a level street or curb. The system shall be a full electric drive system with water resistant mechanism and controls. The ramp shall be a service proven product that has ease of service and operation.

The wheelchair loading system shall be located at the front door, with the ramp being of a simple hinged, flip-out type design being capable of deploying to the ground at a maximum 1:6 slope. The ramp shall be rated for 1,000 pound capacity. Whenever the loading system is operated, the Kneeling light located at the front door shall be illuminated and flashing.

Cabling shall be provided from the loading system sensors to allow wheelchair deployment cycles to be monitored and recorded by the VCPU.

### TS 79.2 INTENTIONALLY BLANK

### TS 79.3 INTENTIONALLY BLANK

### TS 79.4 Wheelchair Accommodations

**The MTA currently requires a fully integrated forward facing wheelchair securement station with the following specifications;**

The ADA restraint system shall include positive locking devices providing safe, easy and quick securement of passengers and their mobility aid device. The system shall be modular in design, with auto tensioning and auto locking retractors. The passenger restraint shall be a minimum 3 point system with occupant restraint lap and shoulder belt.

Two, forward-facing, ADA-compliant mobility-aid securement positions shall be provided, as close to the front door ramp system as practical. Passenger seats in these positions shall be visually similar to other seats in the bus, but operable to provide parking space and secure tie-downs for passengers with disabilities. The securement device shall be compatible with the passenger seating hardware and supplied by the passenger seating manufacturer. The front securement belts shall store under the aisle facing seat when not in use. Restraint belts shall be of sufficient length to accommodate electrically powered mobility aids. The system shall have a seatbelt able to secure around the mobility aid device and its occupant. The seatbelts shall include a retracting device positioned to keep belts off the floor and allow for maneuvering of the mobility aid device into position.

The rear securement belts shall be a remote system. The system shall be mechanically operated without the use of electrical wiring. No cables shall be allowed to operate the release of the rear belts. The system shall attach to the legs of the barrier or flip seats. The system shall employ a mechanical timer which when activated will release the belts and shall lock automatically.

A wheelchair-turning diagram should be included with the Proposer's interior seating diagrams as a submission in their proposal.

### TS 79.5 Interior Circulation

Maneuvering room inside the bus shall accommodate easy travel for a passenger in a wheelchair from the loading device and from the designated securement area. The travel area shall be designed so that no portion of the wheelchair protrudes into the aisle of the bus when parked in the designated parking space(s). When the positions are fully utilized, an aisle space of no less than 20 in. shall be maintained. As a guide, no width dimension should be less than 34 in. Areas requiring 90-degree turns of wheelchairs should have a clearance arc dimension no less than 45 in., and in the parking area where 180-degree turns are expected, space should be clear in a full 60-in.-diameter circle. A vertical clearance of 12 in. above the floor surface shall be provided on the outside of turning areas for wheelchair footrest.

## SIGNAGE AND COMMUNICATION

### TS 80. Destination Signs

**The MTA currently uses Twin Vision Smart Silver destination signs and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The destination sign system shall have control and processing ability to operate and monitor the electronic destination sign system. The signage fonts and graphics shall conform to all ADA requirements and have full readability for a total 130 degrees. Signs shall be readable for a distance up to 350 feet. Signs shall have the ability to display emergency messages. The destination sign system shall have a minimum operating life of 100,000 hours. The system shall have open architecture for J1708, J1939 and RS232. The control shall have the ability to integrate with the buses on-board IT systems.

A destination sign system shall be furnished on the front, on the curb side near the front door, as well as a route sign on the rear of the bus. Lettering shall appear as silver on a black background for all signs. The signs shall be lighted using high intensity LED lamps which shall have an automatic brightness adjustment.

The VCPU shall interface to the electronic destination sign system.

The interface shall include the ability to automatically initialize the destination sign system when single-point logon is initiated, to share route/trip/destination information and triggers, and to download updated

sign message content and related data from the fixed end, via the common secure router and the VCPU, without the need for manual and/or human interaction with the destination sign system. This will be accomplished via SAE J1708 interface from the VCPU to the destination sign system.

The destination sign compartments shall meet the following minimum requirements:

- a) Compartments shall be designed to prevent condensation and entry of moisture and dirt.
- b) Compartments shall be designed to prevent fogging of both compartment window and glazing on unit itself.
- c) Access shall be provided to allow cleaning of inside compartment window and unit glazing. Doors shall be locked via 5/16 inch square key locks.
- d) Front destination window shall have an exterior display area of no less than 8.5 inches high by 65 inches wide and shall have an electrical grid window defroster.

The system shall have the ability to sequentially display multi-line destination messages, with the route number portion remaining in a visible constant "ON" mode at all times, if so programmed. It shall provide the means of adjusting the length of time messages are displayed, from one-tenth (0.10) second to twenty-five (25) seconds duration.

The sign sets shall operate off a nominal 24-volt power source. The system shall operate at sustained voltages from 18 to 32 VDC. If voltage falls below the minimum, the system shall stop operating.

A "self-test" capability shall be provided to aid system troubleshooting shall indicate that each LED is functioning.

### **TS 80.1 Front Destination Sign**

The front destination sign shall have a minimum of 16 rows by 160 columns, in a display 63 inches wide by 8 inches high. The destination message shall be readable by a person with 20/20 vision from a distance of not less than 275 feet.

### **TS 80.2 Side Destination Sign**

The side destination sign shall be located at the top of the forward most curbside window and shall have a minimum of 16 rows by 160 columns, in a display 47 inches wide by 6 inches high. The side destination message shall be readable by a person with 20/20 vision from a distance of not less than 110 feet. The side sign shall use the same programming as the front sign.

The side destination sign shall be encased in a durable box designed for use in the transit environment.

### **TS 80.3 Rear Destination Sign**

The rear destination sign shall be located as high as practicable and to the curbside of center on the rear of the bus and shall have a minimum of 16 rows by 48 columns, in a display 17 inches wide by 6 inches high. The rear sign shall be capable of independently displaying alphanumeric characters. The rear destination sign message shall be readable by a person with 20/20 vision from a distance of not less than 225 feet.

## TS 80.4 Run Number Sign

Buses shall be equipped with a lightweight and serviceable front dash mounted run number sign box with white LED's and a glare guard. The box shall be mounted with a minimum amount of obstruction to defrosting the windshield and allow maximum operator's view of people crossing in close proximity to the front of the bus. The mounting area of the dash shall be reinforced to avoid dashboard cracking or damage. The penetration in the dashboard for the sign wiring shall be grommeted. Knife or sealed wiring connections for the sign shall be in an accessible area below the dashboard and sign.

## TS 80.5 Operator's Control Console

The Operator's Control Console (OCC) shall be inside in the front destination sign compartment and shall not be within reach of the seated operator. The OCC shall be easily viewed and operated with the destination sign compartment open. The OCC shall control all the destination and block number signs.

The OCC shall contain a display of at least two lines of 20-character capability to monitor the status of the destination sign system. The OCC shall incorporate an audio annunciator that beeps to indicate that a key is depressed. The OCC shall utilize a multi-key keyboard that is designed for transit use. The OCC shall continuously display the message that the front signs are displaying, except the emergency message, when initiated.

Buses shall be delivered with a pre-programmed list of destination sign messages supplied by the MTA. The various signs on a bus shall be programmable to display independent messages or the same messages. The destination sign system shall allow two destination messages and one public relations message to be pre-selected and the operator shall be able to change between the pre-selected destination messages without entering a new message code. Public relations messages shall be capable of being displayed alternately with the regular text and route messages or displayed separately.

## TS 80.6 Silent Alarm

A silent alarm switch located in the operator's compartment shall activate an emergency message on the destination signs and send an emergency message on the mobile radio. The switch shall be a momentary contact switch located forward and above the turn signal switches, which triggers both the destination sign and radio systems. The emergency message shall be displayed on signs facing outside the bus, while signs inside the bus (including the OCC display) shall remain unchanged or display a special message specified by the MTA.

The emergency message for the:

Front destination Sign: EMERGENCY CALL 911

Side Destination Sign: EMERGENCY CALL 911

Rear Destination Sign: CALL 911

In order to reset the destination signs to non-emergency status, the bus master switch shall have to be shut off for a maximum of 10 seconds and then the bus restarted. The signs shall return to the destination settings programmed prior to the emergency situation.

## **TS 80.7 Message Programming Capability**

The electronic destination sign system shall be capable of receiving wireless transmissions through the bus communications system to provide for reprogramming and shall be reprogrammable with the use of an industry-standard Flash PC card. The system shall be capable of accepting control and changes to the message lists via J-1708, J-1939, RS232, RS435 or Ethernet. A hardware/software package necessary for wireless message transfer shall be provided to generate message lists for the destination sign system. A software package to program the PC cards shall be provided and the Contractor shall supply six PC cards. The software package shall be installed on the Contractor-supplied laptop computers (inclusive of the quantity specified) and shall run on an MTA-approved version of Microsoft Windows.

The programming software shall be “user-friendly” in that the user interface is designed to have the following features:

- a) Rational prompts for user input
- b) A tree or menu structure
- c) Require minimal printed documentation
- d) Facilitate ease of training
- e) Incorporate context-sensitive help features

The programming software shall provide the capability for custom message writing by selecting pre-programmed standard variable-width fonts, and by creating custom fonts by varying spacing between characters, words, or other message elements. Graphic displays, with or without text, shall be capable of being created by selecting pre-programmed graphic sign images and by the use of multiple fonts within the same message (allowing graphic symbols to be placed anywhere within the display area.

## **TS 81. Passenger Information and Advertising**

### **TS 81.1 Interior Displays**

Provisions of 21 inches X 22 inches shall be made on the rear of the EC located on the wheel well for a frame to retain information such as routes and schedules.

Advertising media 11 in. high and 0.09 in. thick shall be retained near the juncture of the bus ceiling and sidewall. The retainers may be concave and shall support the media without adhesives. The media shall be illuminated by the interior light system.

A Next Stop display shall be provided.

### **TS 81.2 INTENTIONALLY BLANK**

## **TS 82. Passenger Stop Request/Exit Signal**

A passenger “Stop Requested” signal system that complies with applicable ADA requirements defined in 49 CFR, Part 38.37 shall be provided. The system shall consist of a series of passenger touch strips, chime and interior sign message. The touch strips shall be located vertically between each passenger window the full length of the bus on the sidewalls at the level where the transom is located and shall be easily accessible to all passengers, seated or standing. Touch strips shall activate an adjustable volume

chime located in the operator's station. At each wheelchair passenger position and at priority seating positions, additional provisions shall be included to allow a passenger in a mobility aid to easily activate the "stop request" signal. Touch strips shall not be located where passengers would inadvertently activate the passenger signal by their shoulder or head.

Two auxiliary passenger stop request signal switches shall be installed at the rear door to provide passengers standing in the rear door/exit area a convenient means of activating the stop request signal system. The switch shall be a heavy-duty push button type located in the rear door vicinity. The button shall be clearly identified with "STOP" cut in the button. A second heavy-duty "stop request" signal button shall be installed on the modesty panel stanchion immediately forward of the rear door and clearly identified with "STOP" cut in the button". The stanchion mounted switch shall be located 63 inches above the bus floor to avoid passengers inadvertently bumping the switch button. Both switches shall be constructed to mitigate the opportunity for passengers to inadvertently activate the switch by brushing past or laying their hand on it.

A single "Stop Requested" signal shall sound with a dash indicator light when the system is activated from the wall or stanchion mounted positions. A double "Stop Requested" signal shall sound with a mobility request dash indicator anytime the system is activated from wheelchair passenger areas.

Stop request Touch Strips located in the ADA wheelchair passenger area shall be no higher than 4 feet above the floor. Touch strips for patrons in the wheelchair passenger area shall also be located on the underside of the flip up seats as shown below:



Instructions printed on the touch strips shall clearly indicate function and operation of these signals as illustrated below:



Interior message signs shall be supplied that illuminate when the passenger signal is activated by one of the touch strips or stanchion mounted buttons. The red LED sign message shall read STOP REQUESTED. Once activated the passenger stop request sign shall stay illuminated with the stop requested message until the bus entrance or exit door has been cycled. Passengers shall not be able to activate the passenger signal again until the passenger door has been cycled and the system reset. An interior stop request message sign shall be installed facing the rear in front of the furthest front forward facing seat visible to all passengers. A similar sign shall be located on the rear bulkhead facing forward allowing those passengers either facing or walking towards the rear of the bus to view the passenger request status.

## TS 83. Communications Systems

### TS 83.1 Communications Systems Work

- a) The bus shall be equipped with a unified system as outlined in this section including furnishing all materials, tools, equipment, and testing and performing all labor and services to equip each bus in accordance with these Specifications.
- b) The Communications Systems shall comply with the intent of the National ITS architecture and shall support Transit Communication Interface Profiles (APTA TCIP-S-001 3.0.3) compliant data interface to share CAD/AVL data with other authorized and compliant business systems.
- c) The onboard communications system shall support single-point logon, where required, for the onboard subsystems, including but not limited to fare box, OIT and Destination Signs.

### TS 83.2 Radio / AVL System

- a) The automatic vehicle location subsystem shall provide real-time vehicle location updates for use by the onboard subsystem for vehicle location reporting, route and schedule adherence, automatic passenger counting, and automatic vehicle announcements.
- b) The system shall include a vehicle central processing unit (VCPU) and operator interface terminal (OIT).
- c) The VCPU shall be the central control and processing unit for all on-board equipment. The VCPU design shall be based on Commercial-Off-The-Shelf (COTS) industrial computer components.

- d) The VCPU shall mount in existing bus equipment racks, which vary in size and layout by model year.
- e) The OIT shall serve as the complete, single user interface to the CPU and all of its resident functions.
- f) The Contractor shall provide an equipment layout for each model. The OIT shall be mounted in the bus operator's area over head, or at another MTA-approved location in the operator's area that is accessible and does not significantly obstruct lines of sight.
- g) All radio voice communication controls shall be presented to the operator via the OIT. There shall be no need for the operator to control voice radio communications directly on the voice radio, or anywhere else other than the control head, except for picking up the handset for actually speaking and listening. This shall still be possible in the event of a CPU failure. In the event of a OIT failure, it shall be possible for the operator to use the handset and radio directly to make a radio call.
- h) Velocity, time, and direction of travel solutions shall also be provided. The AVL subsystem shall utilize GPS technology. The AVL subsystem shall utilize information from the odometer for vehicle location when the GPS signal is unavailable.
- i) The algorithm used for location shall take into account the expected GPS solution accuracy including number of satellites tracked and the distance traveled since the last known position to develop the position solution from the GPS and odometer data.
- j) The VCPU shall handle all on-board Computer Aided Dispatch/Automatic Vehicle Location (CAD/AVL) functions.
- k) The VCPU shall monitor route and schedule adherence for all vehicles operating on a defined route with a defined schedule. Route deviations that are beyond pre-defined, adjustable thresholds shall produce an off-route message that is sent to dispatch and shall produce a message that is displayed for the operator. Once the vehicle returns to its scheduled route, a back on route message shall be sent to dispatch and displayed for the operator.
- l) The system shall provide a means of preventing repeated off-route/back-on-route events when a vehicle is operating near the set thresholds.
- m) The VCPU shall accurately monitor the schedule adherence of vehicles operating on defined schedules, as obtained from the required Trapeze FX interface under this project.
- n) At a minimum, the schedule adherence shall be calculated at each time-point on the assigned route.
- o) Schedule deviations beyond a pre-defined maximum shall trigger messages to be sent to dispatch and display on the operator terminal.
- p) Early and Late messages shall also include the amount of deviation.
- q) The VCPU unit shall have enough non-volatile memory to store schedule data and vehicle logged operational data.
  - 1. The unit shall store the current schedule file.
  - 2. The on-board unit shall have the capability to store vehicle operational data including but not limited to schedule adherence status messages, time of time point encounters, pull-out/pull-in times, APC data, door open/close events and bus stop arrival/departure events and times.

3. The unit shall store up to one week of data before requiring an upload to the MTA fixed-end database. However, data will normally be uploaded whenever a vehicle enters a depot and has access to the WLAN.
  4. The on-board system shall be able to continue bus operations independent of communications status.
  5. Operator logon shall enable the on-board unit to perform all normal on-board functions including schedule and route adherence, AVA functions, APC functions and data logging for future data upload.
  6. The VCPU shall have 100% spare capacity for future upgrades in volatile memory, non-volatile memory, and processing capabilities.
- r) The VCPU shall have ports to communicate to on-bus systems as follows, with the quantity of ports of at least one (1) unused port or 100% spare above what is used:
1. SAE J1939 Networks
  2. SAE J1708 Information Networks
  3. SAE J1708 Drive Train Networks
  4. SAE J1587 Networks
  5. RS 232
  6. RS 485
  7. Ethernet
  8. USB (minimum 2)
  9. Serial interface(s) to be used to communicate with the existing Vansco on-board multiplex system (a spare multiplex interface is not required).
- s) The VCPU shall be integrated with all SAE J1708/J1939/J1587 compliant on-vehicle systems, providing a single, common source of any diagnostic information available. All necessary gateways and programming required to externalize data in a manner compatible with the VCPU shall be provided.
- t) Discrete wiring shall be provided from the instrument, diagnostic light, and main electrical panels, terminated in the electronic cabinet, and provided to the VCPU. 100% spare capacity for discrete signals shall be provided along their paths, in cables, on terminal strips, VCPU connectors, and elsewhere. The discrete signals shall be 12VDC, 24VDC, or ground.
- u) The VCPU shall have self diagnostic and monitoring capabilities for itself and all peripheral system equipment.
- v) The VCPU shall annunciate faults automatically to the bus operator and to the fixed end. Fault annunciation and response parameters shall be system administrator configurable.
- w) If a router fails, the OIT shall clearly indicate that data comms are down so that if there is an emergency, the operator knows that the EA data message is not being sent to dispatch. However, the voice fallback channels shall be used to send a EA to the Dispatcher console.
- x) The on-board unit shall support voice communications using the Motorola XTL5000 radio. Further radio details can be found in the "Voice and Data Communications" section of this RFP.

- y) The on-board unit shall support data communications using the cellular communication capability provided by the Contractor on this contract. Further cellular communication details can be found in the “Voice and Data Communications” section of this RFP.
1. The AVL unit shall support periodic reporting of location and status on a 30-second interval for normal operations and 15-second interval for buses operating under EA conditions.
  2. The location and status message shall include as a minimum, date/time, vehicle ID, Operator ID, Route and Block number, location, route and schedule adherence status, alarm status, current passenger load and other standard information as described throughout the RFP requirements for the various systems.
  3. The system shall also support real-time polling initiated by a Dispatcher and shall return the same information as described for periodic reporting. When polled, the vehicle unit shall respond immediately and not wait for next scheduled update.
  4. Incident and operator text messages shall be immediate and not wait for a scheduled update.
  5. The system shall poll for specific, system administrator configured information. An example would include polling for current passenger load without any other status information being transmitted.
- z) The system shall support WLAN data communications using the WLAN capability incorporated in the Contractor provided Mobile Router detailed elsewhere in the RFP.
- aa) The VCPU and all peripheral equipment shall accept software, firmware, configuration, schedule and route database, and other data updates via the WLAN and router without personnel physically having to visit the bus.
- bb) The WLAN shall be the primary means of receiving complete schedule and route database updates as bulk downloads or database change transactions wherever necessary.
- cc) As a backup, it shall also be possible to perform piecemeal updates of on-board schedule and route data via cellular communication or from a portable memory drive.
1. A wireless laptop with all programming software shall be provided that can be used to load software for the vehicles at remote locations or vehicle out of range of the WLAN.
  2. The laptop shall be provided with the latest compatible Windows operating system and shall meet the following minimum requirements:
    - a. Intel®Core™ i7 (2820QM, 2720QM, 2620M)
    - b. 16GB DDR3 SDRAM at 1600Mhz - 4 DIMMS
    - c. 17.3” Display
    - d. 750GB Hard Drive
    - e. DVD+/-RW; Blu-ray Disc™ writer
    - f. Integrated 10/100/1000 Gigabit Ethernet
    - g. Wireless LAN and WiMAX included
    - h. Bluetooth Capable
    - i. Ports to include – 2 USB 2.0, 1 IEEE 1394, 1 Microphone, 1 Headphone, 1 10-in-1 Media Card Reader, 1 Smart Card Reader, 1 54mm ExpressCard

Slot, 1 HDMI, 1 VGA, 1 RJ45, 2 USB 3.0, 1 Display Port, 1 Wireless Switch, 1 eSATA/USB 2.0.

- dd) The system shall interface multiple on-board sub-systems, utilizing a Contractor supplied and installed vehicle area network (VAN), and equipment as listed below and detailed in respective section of the RFP:
1. Voice and data communications management, interfaces, and user functions.
  2. Existing Cubic fareboxes
  3. AVA system, utilizing existing signs and speakers.
  4. The Contractor-provided APC system.
  5. Existing Destination Signs.
  6. Existing Block Heaters
  7. AVM System utilizing existing engine modules
- ee) The system shall provide a means to interface various hard-wired inputs, including but not limited to:
1. Wheel-chair lift status
  2. Left Turn Signal initiation
  3. Right Turn Signal initiation
  4. Door sensors (front and rear)
  5. Bike rack cycling
- ff) The system shall monitor the communications and status of other on-board sub-systems including but not limited to radio, farebox, AVA, AVM, APC, Destination Signs and router and provide indication of loss of communication or failure at both the VCPU unit and fixed-end CAD/AVL system.
- gg) The Contractor shall be responsible for surveying the MTA bus fleet to determine other interfaces required for each bus type. The interfacing capabilities of the system shall be detailed in the proposal.
- hh) The on-board system shall support fully automated single-point logon of other on-board systems.
1. Upon normal bus start up, all on-board systems and components shall be initialized by turning the master run switch to one of the non-off positions and logging into a single device, with interface to the VCPU.
  2. This single log-in shall allow the onboard systems to perform their respective functions for the duration of the assigned work without further operator intervention until the operator or work assignment changes.
  3. The CAD/AVL system shall receive operator ID, route and block information from Trapeze Ops and pass this information to the VCPU unit.
  4. This information shall be displayed on the OIT. Operator acknowledgement of the displayed information shall constitute logon to the VCPU and all connected subsystems.

5. Manual override of logon information shall be allowed if the displayed information is incorrect.
6. The operator shall be able to input Operator ID as well as assigned route and block information. If manual override is utilized, a notification shall be sent to dispatch.
7. The system shall also support remote logon from dispatch should a vehicle appear to the Dispatcher as not logged on.
8. Remote logon shall also logon the VCPU as well as all connected subsystems.
9. Vehicles that have been remotely logged on shall be uniquely displaced in the CAD/AVL System at dispatch.
10. The operator shall be allowed a limited number (system configurable) of failed logon attempts. If this number is reached, a notification shall be presented to dispatch in the fixed-end CAD/AVL system. The OIT shall specifically display what information being provided is Invalid.
11. Log-in validity checks shall be performed primarily on-board the bus by the VCPU so that the time required to perform the validity checking is minimized. Correct real-time log-in, operator ID, bus ID, and work assignment data shall be synchronized between the VCPU and the CAD/AVL fixed end. This would typically be done after the on-board log-in is complete, but in certain instances there may be a requirement for VCPU communications with the fixed end during the log-in and initialization process.
12. If the automatic synchronization fails and the operator does not correct the log-in, the CAD/AVL fixed end shall allow for Dispatcher manual intervention to achieve correct log-in and synchronization as quickly as possible.
13. It shall be possible for supervisors and maintainers to override log in validity checks. The system shall contain ancillary data to support this, with pre-defined override privileges for designated personnel IDs, with password protection. Similarly there shall be override codes for route, block, and any other data needed to allow for a valid log in indication, under special circumstances and with proper authorization, even if the entered log in data does not match pre-loaded operator and work assignment data.
14. The system shall allow for relief operator logon allowing the new operator to logon to the same route/block without having to input information other than Operator ID.
15. The Single Point Log-in shall include all systems on the bus that require a logon including: AVL, Fare box, Radio, AVA, AVM, APC, Destination Signs.
16. Log-in information shall be automatically checked for validity and shared among all systems as needed for proper functioning, so that it is not necessary for the operator to log in to multiple devices and that log in key stroke errors are mitigated.
17. Likewise, de-initialization of all on-board systems and components shall be accomplished by turning the master run switch to off and logging off of a single device.
18. Any other required operator interfaces to these systems, such as end-of-trip trigger, shall only need to be entered once on a single device.

19. In the event of one or more device failures, it shall be possible, as a backup, to log in separately to the individual devices such as the farebox, CAD/AVL OIT, and the Destination Sign System.
  20. It shall be required to log in to the CAD/AVL on-board system for any bus movement whether by operators, maintainers, or other authorized personnel. The system shall capture the unique personnel ID regardless of who is operating the bus.
  21. Blanket/dummy route and block codes are acceptable for maintainers and other non-revenue movements; the destination signs shall automatically display an out-of-service message. Bus movement without a valid log in shall be annunciated as an incident to the CAD/AVL fixed end.
  22. All logon alarms and indications shall be displayed simultaneously on the OIT for the Operator and at BOCC for the Controller.
  23. The Contractor shall develop, configure, and install the Single Point Logon function. The Contractor shall install any new or additional conduit or wiring required for Single Point Logon.
  24. The Contractor shall ensure that the on-board system properly interfaces with other on-board systems as indicated in this and other sections of this specification and that it communicates with the fixed-end system, where applicable, without degradation to any existing features or functions.
- ii) The VCPU unit shall support Dispatcher controlled communications requiring operators to request voice communications either as "Request to Talk" (RTT) or "Priority Request to Talk" (PRTT) data messages.
  - jj) Dispatcher response to either RTT or PRTT messages shall enable the transmit and receive audio paths of the voice radio system and shall remain enabled until terminated by Dispatcher, operator or a timeout.
  - kk) A message shall be displayed on the OIT once dispatch has established a call.
  - ll) The unit shall support two-way and one-way radio communications as initiated by dispatch to a single vehicle or group of vehicles. Voice calls shall be limited to 3 minutes.
    1. The VCPU unit shall provide dedicated RTT and PRTT keys that are always available to the operator for initiation of communications request messages to the fixed-end CAD/AVL system. The OIT shall display confirmation that the call is established and also provide an audible alert.
    2. The operator shall be able to terminate the call by hanging up the handset.
    3. Two-way voice calls shall be via the operator handset.
    4. One-way voice calls shall be initiated by dispatch and be supported by the VCPU for group and all calls.
    5. The OIT shall indicate whether a one-way call is a group call or all call. The audio shall be directed to the operator speaker but redirected if the operator picks up the handset. One-way calls shall be terminated by dispatch or timeout.
    6. The VCPU unit shall support a voice fallback mode on loss of data communications.
    7. In this event, the voice radio system shall allow microphone initiated calls on a default talk-group allowing the operator to make voice calls without the need for RTT or PRTT message response. The fallback conversation shall be allowed to

continue until completed whether data communications is re-established during the call or not.

mm) The OIT shall support multiple functions and displays.

1. The system shall support operator messaging with the ability to receive, view, store, clear and respond to messages from a Dispatcher and the ability to send messages to dispatch.
2. The OIT shall provide indications that the message queue is empty, a new message has been received or a message is stored and can be viewed.
3. The operator shall be able to view incoming messages and the unit shall provide a scroll feature for long messages.
4. The operator shall be able to store up to 20 messages for viewing at a later time, and the stored messages shall be easily retrievable from a queue. Operator shall be able to delete stored messages from this queue.
5. The VCPU unit and operator OIT shall allow the operator to easily respond to message from dispatch. The operator shall be able to respond with “Yes”, “No” or “Ack” as appropriate.
6. The VCPU system and operator OIT shall allow the operator to send “canned” messages to dispatch.
7. The system shall allow at least 128 pre-formatted messages to be selected and transmitted to the fixed end via the VCPU.
8. Canned messages shall be configurable. Entry shall be menu driven, covering mechanical, medical, and other urgent, notification, and log/documentation items for the operator. Menu screens shall be configurable and mutually agreed between MTA and the Contractor.
9. A set of menus and sub-menus shall clearly identify message types and allow messages to be selected and sent.
10. The operator shall be provided with feedback that the message has been sent and that it has been successfully received at the CAD/AVL fixed-end.
11. The on-board system shall support the receipt of detour messages.
12. The operator OIT shall receive and display the detour messages at each vehicle logon as long as the detour is active.

nn) The VCPU unit and operator OIT shall support a number of different types of messages including but not limited to the following.

oo) Messages shall be presented in a series of menus and sub-menus as required for operator ease of navigation to the appropriate message.

1. Emergency Alarm – EA message sent when the covert emergency button is activated.
2. PRTT – priority two-way request-to-talk
3. RTT – two-way request-to-talk
4. Wheel Chair Information – provides a sub-menu of available messages related to the wheel-chair lift
5. Accident Reporting – sub-menu of messages related to accidents.

6. Vehicle Change – sub-menu related to the need for a vehicle replacement (bus breakdown, breaks, etc.) The following information shall be included in the message: Line, Block, Operator, Location, Direction, Standing or Due, Load.
  7. On-Board Emergency – sub-menu related to emergency issues with need for EA (disturbance, passenger hurt, etc.)
  8. Incident Reporting – sub-menu for messages related to incidents
  9. Service Performance Issues –sub-menu for messages related to various service issues such as traffic, un-expected detours, water-main breaks, weather, etc.
  10. Operator Issues – sub-menu for messages related to operator issues (sick, break, etc.)
- pp) The VCPU CAD/AVL system shall perform real-time route and schedule adherence monitoring.
- qq) The on-board route and schedule information along with operator logon information shall be used to perform this monitoring.
- rr) The system shall support the following basic route and schedule adherence functions at a minimum.
1. The system shall accurately monitor the route adherence of vehicles operating on defined routes.
  2. Route deviations that are beyond pre-defined, adjustable thresholds shall produce an off-route condition and a message shall be sent to dispatch. Once the vehicle returns to its scheduled route, a back on route message shall be sent to dispatch.
  3. The system shall provide a means of preventing repeated off-route/back-on-route events when a vehicle is operating near the set thresholds.
  4. The system shall accurately monitor the schedule adherence of vehicles operating on defined schedules.
  5. The on-board schedule and operator logon information shall be used to monitor schedule adherence.
  6. At a minimum, the schedule adherence shall be calculated at each time-point on the assigned route. If the vehicle is early by more than the pre-defined “early” threshold, an EARLY message shall be displayed on the operator OIT and be transmitted to the fixed-end CAD/AVL system.
  7. If the vehicle is late by more than the pre-defined “late” threshold, a LATE message shall be displayed on the operator OIT and be transmitted to the fixed-end CAD/AVL system.
  8. Bus position shall be continuously calculated and logged on board at no more than one-second processing intervals.
  9. Bus position shall be reported to the fixed end and updated in the AVL display at least every 30 seconds for normal operations.
  10. Buses experiencing emergencies and selected events, as configured by MTA, shall automatically go into a fast report mode, where the fixed end AVL map display zooms to the bus and position is updated at least every 15 seconds.
  11. Fast report mode may be applied to any bus, whether logged on or not, by the Dispatcher selecting the vehicle and manually initiating the fast report mode.

12. The VCPU shall be the single master on-board source for bus AVL system navigation and positioning based on GPS, odometer, and any other positioning related inputs.
  13. The VCPU shall house a gyroscope and any other supplemental equipment needed to provide required location accuracy, beyond the inputs available from other existing bus equipment and the common GPS source from the router.
  14. RSA incidents shall be easily identified for on-time performance calculations and reporting.
- ss) The VCPU system shall support data logging of operational data including but not limited to logon/off events, bus stop and time-point encounters, message retrieve/send events, wheel chair lift cycles and incident message events. Logged data shall be maintained until uploaded to the CAD/AVL system via the WLAN or transmitted via cellular data communications after an outage. Operational data including on-time performance shall continue to be collected when the bus is in a communication failure mode.
  - tt) The VCPU system shall provide a layover countdown with display on the operator OIT. When the timer reaches zero (0), a pullout message shall be displayed and an optional audible alarm shall activate.
  - uu) The system shall allow creation of location-based trigger boxes for each bus division that are stored in the system. Based on the trigger box, the VCPU shall annunciate to the fixed end its pull-out/pull-in status for both its assigned division and other bus divisions and storage locations. The fixed end system shall display the status for the bus.
  - vv) Each bus shall be equipped with a covert emergency button that can be discreetly activated by the operator. The emergency button is a momentary contact switch.
  - ww) Upon activation, the system shall send an Emergency Alarm message to the fixed-end CAD/AVL system.
    1. When an Emergency Alarm situation is initiated as described above, the operator shall be provided with notification that the message has been sent and acted upon. Both states shall be indicated separately and shall be very subtle on-screen such that a layperson would not be aware.
    2. In addition, the destination signs shall display a message as defined by MTA such as "Call Police" or "Call 911".
    3. The on-board system shall allow for covert voice monitoring from dispatch when initiated by the Dispatcher.
    4. If EA is initiated while data communications are not active, the Dispatcher shall hear a beep through the voice communications path. The Dispatcher will use the Motorola commands to communicate with the vehicle. When data communication is restored, the VCPU will transmit the normal silent alarm message to the CAD. This redundancy ensures that the message is acknowledged by the CAD, and the silent alarm incident is properly recorded for reporting purposes.
  - xx) The OIT shall display system error messages any time a system error is detected. Messages shall remain on the display until cleared by the operator.
  - yy) The OIT shall have a color display and soft key graphical and text based user interface, supporting all required system functions with an on-board user interface.

- zz) The OIT shall provide a complete user interface for operators to complete paperless pre-trip inspection data entry.
- aaa) The VCPU shall perform processing of the paperless pre-trip inspection data including transmission to the fixed-end CAD/AVL systems. Inspection items shall be equivalent to the current paper carbon forms used by MTA; samples can be provided upon request. All automatically detected faults and inspection items available in the VCPU shall be auto-filled in the paperless pre-trip data. The system shall detect whether the wheelchair ramp was cycled as part of the pre-trip inspection and generate a pre-trip exception flag if it was not.
- bbb) The control head shall provide a pre-trip form display at any time requested and it shall comply with all legal and safety requirements for operating a heavy duty vehicle, in the event of a law enforcement stop.
- ccc) The OIT shall provide GPS based real-time turn-by-turn driving directions for the assigned route and for deadheading to and from revenue service. Directions shall be given visually on the control head and audibly.
- ddd) This is needed to assist operator's who may not be completely familiar with the assigned trip and route. The operator shall be able to disable the audible for turn-by-turn directions independent of other volume and audio settings.
- eee) The VCPU shall include configurable power management functions, including power-off delay timer keyed to the bus master run switch. Power management shall provide tools for managing data communications, controls, and other on-board functions that might need to be activated when the master run switch is off.
- fff) This shall be optimized against battery capacity and the need to avoid excessive battery discharge and damage due to deep cycling.
- ggg) The on-board system shall provide a diagnostics capability to check internal functions as well as status of interfaced systems. Maintenance personnel shall be able to access diagnostic information from separate, password-protected screens, menus and sub-menus.

### TS 83.3 On Board Video Surveillance System (OBVSS)

- a) The On-Board Video Surveillance System (OBVSS) shall be comprised of a Digital Video Recording System (DVRS) consisting of a Digital Video Recording Unit (DVRU), a System Status Display (SSD), 11 digital video cameras, and associated peripheral and communication equipment. The OBVSS shall monitor and digitally record video images.
- b) The DVRU shall be Dedicated Micros AD/TV2/1612/A or approved equal.
- c) All installations shall be consistent and uniform in quality, equipment, location, and wire routing.
- d) The OBVSS shall be compliant with the following standards:
  1. FCC CFR47 Part 15, EN55022, CISPR22 (radiated emissions)
  2. J1113-42, EN55022, CISPR22 (conducted emissions)
  3. J1113-21, J1113-26, EN50130-4 (radiated immunity)
  4. J1113-2, J1113-4, J1113-11, J1455, EN50130-4 (conducted immunity)
  5. J1113-12, EN50130-4 (electrical transient)
  6. EN50130-4: Surge (I/O signals)

7. J1113-13, EN50130-4 (electrostatic discharge)
  8. IEC 60529, IP65
  9. SAE J1455, 30g shock, test condition J. (MIL-STD202G, 213B)
  10. SAE J1455, 100g shock, test condition C. (MIL-STD202G)
  11. MIL-STD810D, random vibration
  12. SAE J2496 (cable, connectors, wiring, power, implementation)
  13. The OBVSS shall also be compliant, where applicable, to the SAE J1708 standard family.
- e) The following environmental performance requirements shall apply:
1. Operating temperature: -5°F to 115°F (-20°C to + 45°C)
  2. Storage temperature: -10°F to 150°F (-23°C to + 65°C).
- f) Power Requirements
1. The DVRS and system components shall have protective and filtering devices to protect the system and its memories from electrical fluctuations. The fluctuations may include, but not be limited to: over-voltage; under-voltage; transients; or power surges, dips or drop-outs.
  2. The DVRU shall have the capability of withstanding a momentary voltage drop to as low as 9 volts for less than 30 seconds. In addition, the DVRU shall withstand a momentary complete loss of input voltage for less than 2 seconds during events such as engine cold start or re-start. The DVRU shall not require re-initialization, re-log-ins, or lose internal data during such events. If internal batteries are used to accomplish these objectives, the batteries shall:
    - a. Be comprised of rugged non-spillable sealed-lead-acid (SLA) type cells and recognized components under UL 1989.
    - b. Support DVRU operation for up to 2 minutes.
    - c. Have a minimum 3-year life under normal operating conditions.
    - d. Be field replaceable.
  3. The DVRU shall have the capability of withstanding an over-voltage surge of 100 percent of the nominal applied voltage.
  4. The DVRU shall support standard vehicle 12-VDC and 24-VDC power input, in accordance with SAE J1455 specifications. The unit shall also supply current-limited and software-monitored DC power for each supported camera.
  5. The DVRU shall be connected directly to the vehicle “hot bus” through the protective device.
  6. Power source wiring shall be sized to meet specified requirements for unit start-up and normal operation and shall prevent unacceptable line voltage drop. The power supply shall be tested and the voltage levels at the DVRU input terminals shall be confirmed at the time of installation.
- g) Digital Video Recording System (DVRS)
1. The DVRS which shall consist of a DVRU, an SSD, and 11 digital video cameras, shall meet the following design criteria:

- a. Recording
  - 1) The system shall capture, digitize, authenticate, encrypt, compress, and record high-quality motion video images.
  - 2) The DVRS shall commence recording when the vehicle ignition is switched on (i.e., before engine start) and continue recording for a user configurable interval of one (1) to thirty (30) minutes after the vehicle ignition is switched off.
- b. Compression technique – the video compression protocol used by the DVRS unit shall be of a highly efficient and high quality design. The Contractor shall provide a written description to the MTA of the selected compression technique, together with sample video clips under various lighting conditions.
- c. Input/output ports – the following input/output ports shall be provided as a minimum:
  - 1) A minimum of twelve (12) ports for up to twelve (12) cameras (with appropriate camera power)
  - 2) One (1) port for possible use for an in-vehicle NTSC video monitor display
  - 3) Two (2) bi-directional half/duplex audio input/output ports with 12VDC/250mA device power included for possible use for internal microphones/loudspeakers.
  - 4) Six (6) two-state, dry contact current loop inputs
  - 5) One (1) port for reception of GPS signal from the on-board GPS unit (supplied by others)
  - 6) One (1) port for connection to a portable maintenance computer (laptop)
  - 7) One (1) port that shall provide a signal that appears on the System Status Display (SSD).
- d. GPS Capability:
  - 1) The DVRS shall receive reference Global Positioning Satellite (GPS) signals from the on-board GPS antenna/receiver (provided by others). The output of the GPS antenna/receiver is NMEA 0183.
  - 2) The DVRS shall provide means to integrate vehicle location, speed, direction and other telemetry data into the user interface, such that this data is synchronized with vehicle video image recorded in stored images, and has the capability to be used for displays of vehicle positioning.

- e. Accelerometer – the DVRS shall be provided with inputs from an accelerometer that shall be installed in a location approved by the Administration. The accelerometer shall meet the following minimum requirements:
  - 1) The same environmental specifications as the OBVSS
  - 2) The Impact Detection range shall be adjustable over the range of 2g to 15g
  - 3) Whenever the accelerometer detects and acceleration or deceleration beyond the selected level, the DVRU shall tag the activity as an “incident.”
  
- f. Wireless capabilities:
  - 1) The DVRS shall include a capability to connect to an on-board wireless router, which contains an integrated Wireless Access Point (WAP) based on the 802.11n specifications. The WAP provides upload and download capabilities to buses within the four MTA bus maintenance and storage yards using the existing 802.11n wireless systems installed at the yards. In turn, the yard 802-11n wireless system is connected to a Dedicated Virtual Private Network (DVPN) residing on the existing extensive fiber optic system used by the MTA. The DVPN connects to all MTA users of the DVRS.
  - 2) The DVRS shall include a capability to download video images using 802.11n wireless protocol. This capability, as a minimum, shall provide a capability of downloading 2 hours of stored video images in not more than 30 minutes.
  - 3) The manufacturer of the DRVS shall advise the MTA, in writing, of the maximum download speed, expressed in bits per second (bps), that the DVRS can provide in a configuration selected by the manufacturer.
  - 4) The DVRS shall include a capability to upload data messages by means of the established garage 802.11n wireless systems.
  - 5) The DVRS shall include a capability to download video images by means of this 802-11n wireless to a police vehicle equipped with a compatible WAP and associated laptop.
  - 6) In order to maintain system security integrity, the complete DVRS shall be certified by the MDOT as being acceptable for use with the state-wide communication system known as Network Maryland.
  
- g. Maintenance and performance monitoring:

- 1) The DVRS shall include the capability of monitoring, originating, and storing system maintenance and performance records.
- 2) The stored maintenance and performance records shall be available for transfer, by both end-of-day wireless transmissions or by a direct connection to a laptop computer. The Contractor shall provide MTA with the details of the scope and extent of this feature.

h. Other design criteria:

- 1) In the event of a component or function failure, the DVRS shall generate an alarm or similar signal that appears on the SSD.
- 2) The DVRS shall include a port to allow the connection and use of a portable computer (laptop), for maintenance purposes, or for transfer of stored images.
- 3) The DVRS shall allow remote maintenance monitoring, i.e., any failure of any component or function within the DVRS shall generate a message that is sent to a remote maintenance facility.

h) Digital Video Recording Unit (DVRU)

1. The DVRU shall have the following design criteria:

- a. The MTA prefers that the DVRU Operating System (OS) shall be UNIX based Linux or equivalent. In the event that some other form of OS is proposed, a full explanation of the advantages of the proposed system shall be provided to the MTA with the Technical Proposal. The OS shall include means to prevent system crashes and re-boots as a cause of power failures, and shall be permanently stored in a flash drive or equivalent device.
- b. The DVRU shall include a system clock with automatic winter and summer time adjustments, and yearly calendar adjustments. The clock battery shall have a minimum life of five (5) years.
- c. The DVRU chassis shall provide a field-removable hard-drive subsystem that supports one or more hard drives. The hard-drive subsystem shall have a self-contained shock and vibration isolation system, shall provide electro-mechanical protection to the mobile drive when the hard-drive subsystem is out of the DVRU, shall contain a temperature monitoring and control subsystem, shall contain a key-lock system for removal/insertion, and shall have a sealing mechanism to maintain IP65 ratings for the main DVRU chassis.
- d. The storage capacity of the removable hard-drive sub-system shall be sufficient to provide storage for ten cameras, with appropriate camera frame rates and image resolutions, in order to provide thirty (30) days of stored video images. The Contractor shall provide a calculation, based on a 20 hour day, 7 day/week, and the appropriate frame rates, resolution, and compression index required to achieve this goal.

- e. The DVRU shall have the capability of exchanging Self-Monitoring Analysis and Reporting Technology (SMART) messages with each internal hard drive, such that the recorder is able to detect and pre-emptively warn MTA personnel about an impending hard drive failure.
  - f. The DVRU shall include means to provide date and time stamps, indexing, and authentication of stored videos. The DVRU shall mark the recorded video during an external alarm or event activation. Unique marks shall be provided to provide searchable criteria for video viewing and verification of incidents.
  - g. The DVRU shall include a function to allow remote adjustment of all adjustable system operating parameters (such as camera frame rate).
  - h. The DVRU shall be mounted in each vehicle as determined by the vehicle design. The location shall be approved by the MTA.
  - i. DVRU shall accept 4-6 IP addressable cameras.
2. Recording capabilities:
- a. The DVRU shall have the capability of recording images from twelve (12) cameras. Eleven (11) cameras will be installed on the vehicle.
  - b. The DVRU shall have the capability to record frames up to the rate of 30 frames per second (fps) on each camera, with the capability to adjust each camera to between 1 fps to 30 fps. In normal operation, the rate shall be set at 8 fps for all cameras except the camera observing areas in front vehicle. This camera shall record at a rate of 15 fps.
  - c. The DVRU video images from each camera shall be recorded at rates between 1CIF to 4CIF resolution, with the resolution of each camera to be selected by the MTA.
3. Authenticity:
- a. Recorded video shall be provided with means to ensure that the authenticity of the recorded images is established and maintained throughout the entire process of obtaining the images, recording and duplicating the images, and displaying the images in accordance with established legal procedures.
  - b. The DVRU shall secure recorded video with a Secure Hash Technology and through the Viewing Software have the ability to check the authentication seal of the video to ensure it has not been tampered with.
  - c. It shall not be possible to change or modify the vehicle number and/or location data encoded on recorded video under any circumstances.
4. Obstructed or blocked images – the DVRU shall have the capability of recognizing an obstruction or a blocked or missing video image from any on-board camera, and shall have the capability of reporting such image errors to a remote maintenance facility by a data transmission instituted as soon as wireless connectivity has been established with the bus.

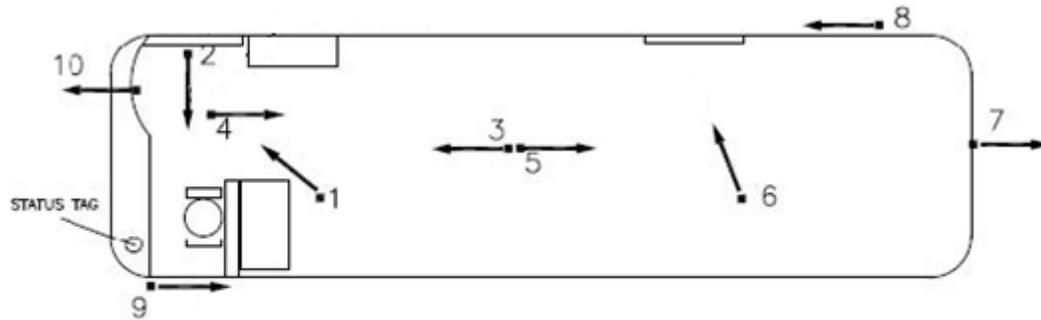
i) Video Cameras

The following video camera features are mandatory:

1. All video cameras shall be from the same manufacturer. Subject to MTA approval, different models or mounting styles may be used if appropriate justification is provided to the MTA. All video cameras shall be infra-red illuminated
2. The video cameras shall be supplied as the latest model available from the manufacturer selected by the Contractor, at the time of placing the order for the cameras.
3. The video cameras and housings and mountings shall be waterproof (IP65), shall withstand high impacts, be vandal-proof, and compact to allow unobtrusive mounting inside and outside the vehicle.
4. The external cameras shall withstand the water pressures encountered during high-velocity wash-down procedures, including water pressures up to 80 psi.
5. The external cameras shall be mounted on reinforced or protective shields to prevent camera damage from tree branches. This particularly applies to curb-side cameras.
6. The external cameras shall be fitted with tempered glass lenses, and shall be securely mounted by at least four (4) mounting screws to the vehicle structure.
7. Where practicable, each camera shall be sited such that the camera view shall overlap with one or more other camera views.
8. The camera frame rate may be set, by remote means, to any number of frames per second (fps) between 1 fps to 30 fps.
9. The camera image size may be set, by remote means, at any range between 1 CIF resolution to 4 CIF resolution.
10. The minimal acceptable light sensitivity shall be:
  - a. Color: 30 IRE 0.3 lux (F1.2)
  - b. B&W: 30 IRE 0.1 lux (F1.2)
  - c. Data stating the actual light sensitivities of the selected cameras shall be made available to the MTA for approval.
11. The minimal acceptable signal to noise ratio of the camera shall be 50 dB. The actual signal to noise level of the selected cameras shall be made available to the MTA for approval.
12. The cameras shall contain: automatic day/night Color/BW switching, automatic exposure control, automatic iris, built-in IR lights and other features such that the camera provides clear images under varying light and environmental conditions.
13. The cameras shall allow the MTA to adjust, by remote means, operating parameters such as camera resolution, compression ratio, fps, and similar camera operating features.
14. The MTA prefers that the cameras be IP addressable.
15. All camera installations shall be consistent and uniform in quality, equipment, location, and wire routing to the MTA's approved first installation.

All actual locations for the cameras shall be approved by the MTA:

**Figure 1  
Camera Locations**



PROVISIONAL CAMERA LAYOUT FOR REFERENCE ONLY  
FINAL LAYOUT SUBJECT TO MTA APPROVAL

Camera #	Location
1	– Ceiling mounted, with a view towards the front door.
– 2	– Mounted above the inside of the front door, with a view towards the fare box and driver.
– 3	– Ceiling mounted, at the centre of the bus, with a view towards the front seats.
– 4	– Ceiling mounted, operator’s compartment, with a view towards the rear seats.
– 5	– Ceiling mounted, center of bus, with a view towards the rear seats.
– 6	– Ceiling mounted, with a view towards the rear door.
– 7	– Horizontally mounted outside the rear of the bus, view to the rear.
– 8	– Mounted on the curb side, rear of the bus, view to the front
– 9	– Mounted on the street side, front of the bus, view to the rear
– 10	– Mounted inside the front window, with the view to the front
– 11	– Mounted above the operator’s seat, with view to entrance door

Camera mounting requirements shall include the following:

1. Hardware shall be tamper-proof and shall provide a firm and fixed attachment to the cameras. Each camera shall be attached to the vehicle with not less than three (3) attachment points.
2. Once each camera is aimed and set in position, the mounting shall permanently secure the camera in place with no requirement for any periodic or random readjustment of the mounting fasteners.
3. The Contractor shall provide a flat surface for mounting exterior cameras and a reinforced plate for securing the cameras.
4. The Contractor shall install the cameras with riv-nuts (not nuts and bolts) using tamper-proof screws, such that the cameras can be removed without moving headliner or bus panels.

5. Mounting hardware shall be of stainless steel fabrication, or as otherwise appropriate to the mounting surface. Electrolytic and rust corrosion shall be prevented.

j) System Status Display (SSD)

1. The SSD unit shall be located in an area adjacent to and in view of the vehicle operator. The location shall be approved by the MTA for each vehicle type or model.
2. The SSD shall have a continuous display showing that the DVRU is on-line.
3. The SSD shall display an alarm in the event that the removable hard drive has been removed, or the DVRU system is not working properly.
4. Associated with, or integral to the SSD display, shall be a button clearly marked "Record." Operation of this button shall illuminate the button, and automatically flag the recorded video as an "incident."
5. The button shall remain lit until operated again, when the button shall be unlit. SSD shall report individual camera obstructions.

k) Docking Station

The Contractor shall provide five (5) Hard Drive Docking Stations and an associated software program that will allow the MTA to insert removable hard drives, extract and copy video files from the hard drives, and prove the authenticity of recorded images. Each Hard Drive Docking Station shall be provided with Viewing Software to MTA enable operators to review stored images, and make appropriate copies.

l) Provided Software

The MTA shall be provided with all the software required to configure, operate, and maintain the OBVSS. The Contractor shall provide 5 copies (on CDs) of the required software in addition to any software loaded during the installation process. The following is a minimum list of the software functions that shall be provided:

1. Administrator software
2. DVR configuration software (IP address, serial numbers, etc.)
3. Maintenance monitoring software. (fault records, repairs, etc.)
4. Software Update tools
5. Data download/upload management
6. DVR recording software (construct video disks)
7. DVR viewer software (restrict playing of video disks) – the DVR view software shall prevent unauthorized users from viewing video disks)
8. DVR player software for external users – authorized users must configure the viewing PC with the DVR player software, provided by the MTA, prior to viewing video files.

m) System Reliability

1. The entire DVRS shall be of high reliability, expressed in terms of the minimum failures experienced over any one calendar year. The MTA has established that a failure rate of 2 percent per year for any single item of the DVRS is desirable, and a

failure rate of 5 percent is the maximum acceptable failure rate. For example, if 100 hard drives are used, then the failure rate shall not exceed five (5) per year.

2. The vendor shall certify the system presented for testing is exact in every detail to the system offered in their bid package.
3. The DVRS manufacturer shall supply the MTA with appropriate evidence that the maximum acceptable 5% failure rate is achievable with their product.
4. In order to ascertain the actual equipment failure rate, the MTA will require the selected vendor to provide and install one (1) DVRU unit with one (1) installed camera on an MTA bus, and the bus will then be placed into revenue service for one month within 60 days from NTP. This test period is called the "30- Day Operational Test" (30DOT).
5. In accordance with the statistical 5 percent maximum failure rate, there shall be no failures of the DVRU and camera during the 30DOT.
6. As appropriate, the MTA may ask selected vendors to meet a specified installation date and start date for the 30DOT.

n) Equipment Mounting

1. The DVRU shall be installed at or near the bottom of the bus equipment cabinet.
2. The DVRU shall be mounted on the slide-out tray provided as part of the bus equipment cabinet.
3. The DVRU shall be attached to the slide-out tray by stainless steel riv-nut fasteners (or equivalent) of a size and quantity sufficient to withstand bus movements. The RIV-NUT bolts shall be hex-head such that a standard nut-driver tool can be used. The Contractor shall specify the tightness (or torque) required to install the bolt securely.
4. The DVRU wiring harness shall be firmly attached to the equipment cabinet, with a maintenance loop allowing the DVR to be pulled forward for maintenance. The end of the maintenance loop shall be firmly attached to the DVRU chassis.
5. After the DVRU is installed on the tray, the tray shall be firmly and securely locked in place. If appropriate and feasible, closing the cabinet access door shall also press a non-rigid bumper onto the front end of the tray. By these actions, the tray, and also the DVRU shall be firmly locked in place.

o) Wiring

1. All wiring runs shall be continuous.
2. Wires and cables shall be color-coded and tagged at the entrance to the DVRS.
3. All wires and cables shall be secured and protected against movement, chafing, and contact with any conductive, sharp, or abrasive objects.
4. The Contractor shall provide a minimum of #10 AWG wire to supply power and ground leads, and #14 AWG wire for ignition lead.
5. Coaxial or Cat-5 cables shall be color-coded and identified at the plugs at each end.
6. Fuses or circuit breakers shall protect all power circuits. Circuit breakers shall be manually re-set.

7. The MTA prefers that all cables attached to DVRS cameras and the DVRU shall utilize plugs and sockets such that cable movements will not cause the internal wire connectors to work free. Coaxial cables shall be solid core and be terminated in plugs and sockets.
8. The main power circuit from the vehicle to the DVRS shall be protected by a circuit breaker provided by the vehicle manufacturer, and of the same type as used for similar equipment power connections.
9. All circuit breakers and fuses shall be permanently labeled to show their functions.

p) Installation

1. The DVRS installation shall be in accordance with all national, state, and local codes and regulations in effect.
2. Camera system shall be wired so that it has access to power after the bus has been turned off so that downloads can be completed.
3. The Contractor shall establish quality control standards, and provide an effective quality control procedure during the installation phase to ensure compliance with the quality standards.
4. All installations will be checked by the MTA Resident Inspector, and will be accepted only upon resolution of any problems found by the MTA Resident Inspector during or after each installation.
5. All DVRS equipment shall be mounted in such a way to allow easy maintenance and removal.
6. All DVRS equipment shall be rigidly mounted to prevent movement and rattle during vehicle operation.
7. Locations of the cameras and equipment enclosures shall be approved by the MTA.
8. The Contractor shall establish an installation and maintenance spreadsheet in an MS Excel format. The database shall include as a minimum but not be limited to: vehicle number, vehicle type, vehicle division, equipment models and serial numbers, camera locations, DVRU location, SSD location, tests performed, test results, date of testing, installation details, re-work details, MTA acceptance initials and dates, fields to track on-going activities and blank fields for MTA use. The installation and maintenance database shall be provided to the MTA in MS Excel format.
9. One set of final as-built drawings for each vehicle type shall be provided by the Contractor in MicroStation format.
10. One set of final as-built documentation for each vehicle type shall be provided by the Contractor in .pdf file format.

**DVRS Warranty**

The rights and remedies of the MTA under this Part are not intended to be exclusive and shall not preclude the exercise of any other rights or remedies provided for in this specification, or by any subsequent contract, or by law or otherwise.

The Contractor shall warrant that all goods supplied, systems, equipment, designs, and work covered by this Scope of Work and subsequent contract shall be satisfactory for its intended purpose, shall

conform to and perform as called for in the Contract requirements specifications and shall be free from all defects and faulty materials and workmanship. Any goods supplied, systems, equipment, designs, or work found to be defective within the time specified below shall be repaired, remedied, or replaced, hereinafter called “corrective work”, by the Contractor, free of all charges including transportation.

The warranty period for all Contractor-provided goods supplied, systems, and equipment except spare parts, shall extend to 24 months after Final Acceptance.

The warranty period for spare parts shall extend for 24 months from the placement of each spare part into regular service.

The Contractor shall provide the formal signed warranty(s) no later than 90 days after the placement into operation of the first DVRS unit.

Replacement parts and repairs provided, pursuant to corrective work hereunder, shall be subject to prior approval by the MTA and shall be tendered and performed in the same manner and extent as items originally delivered in accordance with this SOW.

#### **DVRS Technical Manuals**

Manuals shall be provided in accordance with the following:

- a) Manufacturer's standard manuals will be acceptable, subject to the approval of the MTA. Each manual must contain specific identification of products by model and part and number supplied under this contract. A detailed list of manuals to be provided shall be submitted.
- b) Documentation shall be provided for all system software, utilities, compilers, assemblers, linkers, editors, maintenance software, and other packages used to develop, debug and load software.
- c) Revisions to any manual shall be reflected in a revision index that is part of each handbook or manual and is revised according to a revision control method approved by the MTA. Revisions shall be made for all design changes, retrofits, and errors.
- d) Maintenance and Repair Manuals: These manuals shall provide sufficient information, including schematics, layout drawings, test and alignment procedures, inter-cabling diagrams, and parts lists, to permit quick and efficient maintenance and repair of the equipment by a qualified technician.
- e) Manual Types and Quantity: The Contractor shall supply complete documentation of the entire system provided. The Table 6 indicates the level and quantities required. In addition to hard copy versions of the manuals, provide five (5) CD-R copies in Microsoft Word 2007 format of every manual supplied.

Manuals shall be provided within 30 days of the delivery of the first DVRS

TABLE 6

Manual Types and Quantities

Item	Document Title or Description	Quantity Required
1	– Operator Manual (quick guide)	– 100
– 2	– Operations and Maintenance Manual	– 10
– 3	– Other Manuals (as appropriate)	– 10

**DVRS Training**

The Contractor shall provide a program to train MTA personnel in all aspects of the operation and maintenance (O&M) of the systems and equipment provided, as follows:

- a) Design the program such that the MTA may assume control and accomplishment of the training.
- b) Submit five (5) complete sets of printed training program materials on two CDs and five complete hard copies. In addition, provide copies required for implementation of the training program. For example, if there are eight (8) in the class, then supply thirteen (13) hard copies and two (2) CD-Rs in Microsoft Word 2000 format.
- c) All training course program materials, including training manuals and audio/video tapes or disks, shall become the property of the MTA and for use by the MTA for internal training purposes.

Table 7 lists the required training courses.

**TABLE 7**

<b>No.</b>	<b>Course Title</b>	<b>Description</b>	<b>Recipients, Class Size/ Sessions/Hours</b>
1	Management	High level system overview	MTA senior personnel: 5/1/4
2	Operator	Operations (train the trainer)	Operators, MTA training staff: 5/4/4 or as required (see Note 1).
3	System Administrator	Host administration, Statistics and data capabilities	System Administrator: 2/2/8
4	Maintenance	Technician training	Technicians: 4/2/8
5	Docking Station	Operation (train the trainer)	TIG Operators: 4/2/4

Note 1 The operator training should be based on a course assuming that the operators know nothing about the operation of the CCTV Surveillance system.

Training course delivery: All training shall be completed no later than thirty (30) days prior to the commencement of operation of the first equipped vehicle.

**DVRS Spare Components and Parts**

- a) Parts List: Provide a complete Parts Cross Reference List of all parts and components used in the equipment delivered in accordance with this contract. This list shall include as a minimum, equipment manufacturers part number and part name, and as appropriate the part number of the Original Equipment Manufacturer (OEM) part or component, in addition the part unit price. This information shall be furnished no later than ninety (90) days after the placement into operation of the first DVRS unit.
- b) Provide an Initial Spare Parts kit as follows with each bus delivery:
  - For each individual internal camera type (complete): five (5) units
  - For each individual external camera type (complete): five (5) units.
  - DVRU units (complete): five (5) units)
  - DVRU Hard Disk Drive Removable Cartridges: ten (10).
- c) Recommended Parts: In addition to the deliverable equipment and initial spare parts required to fully implement the system, the Contractor shall identify all recommended on-site spare

parts required to fully support the entire system over the long term, and after the warranty period. This information shall be furnished prior to Final Acceptance of the system. The MTA reserves the right to purchase any, all or none of the identified replacement parts at the published spare parts price list as current at the time of placing the spare parts order.

**DVRS Tools**

The contractor shall supply the MTA with a tool kit tailored specifically for the maintenance activities associated with the OBVSS. The following is an example of a satisfactory list of tools, and the contractor may add or amend this list according to the specific requirements of the OBVSS system that is being provided. Six maintenance tool kits shall be provided as shown in Table 8.

**TABLE 8**

<b>Item</b>	<b>Description</b>	<b>Remarks</b>
1	Coaxial cable Repair kit, containing tools to strip/prepare coaxial cables, assemble/crimp connectors.	For RG-179. If RG 179 is not used, provide details of suggested coaxial cable type Note: the use of BNC type connectors is discouraged
2	Riv-Nut inserts and bolts, Crimp tool and Mandrel. With appropriate hand ratchet tool and sockets.	
3	Power and other cable plug repair kit, containing tools to strip/prepare power and signal cables, assemble plugs/sockets.	
4	Torx or similar special tools for special screws	
5	Ethernet RJ-45 in-line coupler.	
6	Other recommended tools	

**TS 83.4 Public Address System**

An Americans With Disabilities Act (ADA)-compliant digital Public Address (PA) system shall be installed that enables the operator to address passengers either inside or outside the bus or both. The announcements shall be generated through a hands-free microphone system. The system shall be capable of recording announcements of up to 30 seconds in length. Announcements shall be initiated by depressing a foot switch in a MTA approved location near the turn signal switches. Playback shall be initiated immediately upon release of the foot switch. The system shall incorporate active noise cancellation to ensure minimum background noise and feedback.

Inside speakers shall broadcast, in a clear tone to enable announcements to be clearly perceived from all seat positions at approximately the same volume level. A speaker shall be provided so announcements can be clearly heard by passengers outside the bus near the front door. operator controls shall include an “Internal,” “External,” and “Both” speaker select switch; independent volume controls for internal and external speakers; and “External Record” and “Mute Functions.” Operator controls shall be located on the device to ensure ease of use and to maximize operator safety. LEDs shall be provided to indicate speaker selection, record, and mute status.

The PA system shall include the hands-free microphone, PA amplifiers(s), power filtering, noise filtering, and all required electronics for all external interfaces. The system shall be packaged in a single tamper-resistant, high-impact polymer housing that shall be mounted to the streetside A-pillar within easy reach of the operator. The PA system shall interface to the VCPU system to allow sharing

of the inside and outside speakers and shall be wired to act as a back up to the VCPU PA System in the event of a failure.

#### TS 83.4.1 Speakers

**The MTA currently uses TCB interior loudspeakers and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Six (6) interior loudspeakers shall be provided, semi-flush mounted, on alternate sides of the bus passenger compartment, and installed with proper phasing. Total impedance seen at the input connecting end shall be 8 Ohms. Mounting shall be accomplished with riv-nuts and machine screws. Speaker grilles shall be black and mounted using Torx screws.

**The MTA currently uses an REI exterior loudspeaker, part number 230058 and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

One (1) exterior loudspeaker shall be provided, semi-flush mounted, on top of the front door and installed with proper phasing. Total impedance seen at the input connecting end shall be 8 Ohms. Mounting shall be accomplished with riv-nuts and machine screws. Exterior speakers shall be insulated to minimize the sound leak to passenger compartment and the cover baffled to prevent water damage / intrusion.

#### TS 83.5 Automatic Passenger Counter (APC)

a) Integrated within the VCPU, the APC system shall collect raw and correlated on-board passenger count data. The APC system shall consist of APC sensors at each doorway and VCPU-resident application software and data storage. The system shall transmit APC data off-board via the router automatically as part of daily operations.

b) The APC system shall provide full state-of-the-art functionality and shall be integrated into the existing MTA operations and maintenance environment and network architecture. The system shall provide a comprehensive suite of APC data collection, management, analysis, and reporting capabilities.

c) APC Configuration

Passenger count sensors shall be installed at the front and rear doors and interface with the VCPU. The sensors shall sense and accurately count passenger boardings and alightings simultaneously. The mounting location and mounting provisions shall be optimized for passenger count accuracy, reliability, and maintainability, and shall be subject to MTA approval.

d) APC Minimum Performance and Accuracy Requirements

1. The accumulated count of both boarding and alighting passengers shall be within 5% for each 100 consecutive boarding and alighting passengers.
2. For 85% of all stops, the boarding and alighting counts shall be exact when compared to actual. For 90% of the stops, the counts shall be within 1 of actual. For 97% of the stops, the counts shall be within 2 of actual. This will include stops for which there was no observed boarding or alighting activity.
3. 95% of the time, the APC system shall correctly identify a bus stop. 97% of the time, APC shall correctly identify a bus stop or an adjacent bus stop for the bus run after correlation.

4. The system shall store and retain 14 days of recorded APC data.
  5. APC data shall be available for immediate transfer to the database as needed.
- e) Minimum Required APC Features and Functions
1. The APC system shall have the ability to effectively manage the large volume of data typically generated by such systems.
  2. The system shall include configurable validity checks, to eliminate, reduce, and mitigate erroneous data. Validity checks and filter shall be run automatically, semi-automatically, or manually.
  3. The system shall automatically correlate raw passenger count data against all available and relevant data such as route, trip, latitude and longitude, stop ID, stop name, wheelchair deployment, time of day, scheduled time, RSA status, day of week, fare class, fare collected, operator, and bus number. The system shall take into account the status of the bus operation such as in-service, out-of-service, on-route, off-route, detoured, and interlined. Data shall be correlated accordingly.
  4. Based on the raw passenger count data, the system shall calculate and record the number of passengers by stop-to-stop segment, trip, and route. Distance traveled for each segment shall also be calculated and recorded.
  5. The system shall record all door open/close cycles for each stop with a time stamp. The first door open shall be correlated as the arrival and the last door close as the departure. Based on this the dwell time at each stop shall be calculated and recorded. Counts of door open and close cycles at unscheduled locations or detours shall also be recorded.
  6. The system shall record the number of wheelchair ramp cycles and wheelchair passenger boarding and alighting at each stop the bus makes for each bus run and trip on a line.
  7. The system shall provide a comprehensive suite of APC data collection, management, analysis and reporting capabilities.
  8. The system shall include a wide range of standard tabular and graphical reports, both summary and detailed, including the ability to chart APC data on a map. The APC reporting shall be included in Management Reporting System section requirements detailed below.
  9. The APC shall produce reports that are integrated with Fare Box data by route, and/or block, and/or stop. The user shall be able to create reports on-demand of passenger counts by time period, and/or block, and/or route, and/or stop, and/or route segment. APC data shall be automatically exported and imported to Trapeze Plan on a user scheduled basis. Further reporting requirements are detailed in Section 3.014.
  10. The system shall export formatted APC data to the existing MTA Trapeze FX Plan module via the MTA network infrastructure.
  11. The system shall produce passenger related National Transit Database (NTD) data as required by the FTA, such as revenue passenger miles.

#### **TS 83.5.1 APC Sensors**

Sensors shall be mounted in the optimal locations, subject to MTA approval, to detect passenger boarding's and alightings at each doorway but shall not be mounted on the floor or steps. The

Contractor shall submit, for MTA approval, calculations showing expected accuracy of the APC in determining counts of passengers

## TS 83.6 Radio Handset and Control System

### TS 83.6.1 Operators Speaker

Each bus shall have a recessed speaker in the ceiling panel above the operator. This speaker shall be the same component used for the speakers in the passenger compartment. It shall have 8 Ohms of impedance.

### TS 83.6.2 Handset

The Contractor will install a handset for the operator's use.

### TS 83.6.3 Emergency Alarm

The Contractor shall install an emergency alarm that is accessible to the operator but hidden from view.

## TS 83.7 Mobile Radio System

Procure and install Motorola APX 7500 Multiband Radios.

Integrate the Motorola APX 7500 RF Radio for voice communications.

Program the radios to work with MTA's existing 490 MHz trunked radio system.

Include all design, engineering, wiring and cabling, antenna (if required), power, testing, and programming required for successful installation and operation in proposed system.

Provide manuals and training for maintenance and operation.

The voice and data radio system must be compatible with the MTA's current trunked radio system. The MRS shall consist of the following, as shown in Table 9.

**TABLE 9**

Item
Handset
– Handset cable
– Handset Mount
– Radio Equipment Tray (Including)
– Radio trunnion fixturing
– Fuses
– Power Filter
– Odometer Interface Unit

\*Part numbers and cable lengths may vary and will be determined during the pre-production meeting. The Contractor shall supply preliminary installation drawings prior to the pre-production meeting.

## TS 83.8 Automatic Voice Annunciation System (AVA)

- a) An Americans with Disabilities Act (ADA) compliant Automatic Voice and Visual Annunciation System shall be provided that automatically provides audible and visual passenger information inside the bus and audible passenger information outside the bus.

- b) The AVA provided shall be an integrated component of the on-board system, requiring no additional operator interface, and shall interface to the installed LED signs and speakers.
- c) The system shall record announcements of up to 30 seconds in length. The system shall incorporate active noise cancellation to ensure minimum background noise and feedback. The system shall provide the alternative of producing announcements via a computer generated, natural sounding human voice from text data supplied to the system. Operator controls shall include an “Internal,” “External,” and “Both” speaker select switch; independent volume controls for internal and external speakers; and “External Record” and “Mute” functions. Operator controls shall be located on the OIT to ensure ease of use and to maximize Operator safety. LEDs shall be provided to indicate speaker selection, record, and mute status.
- d) The system shall provide a customer service message window allowing the BOCC Dispatcher to send public service messages to bus operators for them to announce to passengers. Information to be sent shall include public service message description and purpose, effected routes, start and end locations, start and end dates/times, etc. The Dispatcher shall be able to specify the transit day and start and end date/time that the public service message will be stored and forwarded.
- e) The system shall provide the ability for dispatch to be able to make PA announcements from BOCC utilizing the radio or p data messages.
- f) Existing signs shall be J1708 compatible.
- g) The integrated AVA sub-system shall support but not be limited to the following standard feature and functions:
  1. Automated interior next-stop audible and visual announcements for all stops based upon vehicle location along a stored schedule and route to aid the transit authority in complying with ADA requirements found in 49CFR Parts 37.167 and 38.35
  2. Automated interior audible and visual transfer announcements.
  3. Interior audible and visual “Stop Requested” announcement.
  4. Automated audio and visual public service announcements, at programmable intervals, to riders on-board and audio to those waiting curbside. Public service announcement shall not over-ride automated stop announcements, which shall be accomplished by prioritization control of P/A announcement and automated AVA announcements.
  5. Prioritization and sequencing control of PA announcements and AVA announcements.
- h) The system shall use a human-sounding voice for announcing route and stop information. Robotic sounding voices shall not be used.
- i) The system shall provide for a microphone input for driver initiated announcements both inside and outside the vehicle.
- j) For automatic announcements, the system shall automatically adjust the audio output level for ambient noise levels both inside and outside the vehicle.
- k) The system shall support automatic volume control of both interior and exterior speakers.
- l) The integrated AVA sub-system shall support remote updates of destination and announcement information via the WLAN.

- m) The Contractor shall supply all equipment, wiring, necessary appurtenances, installation, configuration and interfacing to provide a complete and integrated AVA sub-system.
- n) The amount and rate of automatic volume change shall be programmable by the system administrator via parameters accessible via on-board system.

### TS 83.9 Automatic Vehicle Monitoring (AVM)

Integrated within the VCPU, the AVM system shall collect a comprehensive set of on-board data related to vehicle health, maintenance, and alarms (critical and non-critical, as defined by the system administrator). The AVM system shall consist of VCPU interfaces to the existing Vansco multiplex system, SAE J1939 network interfaces, SAE J1708 information and drive train network interfaces, and discrete and other interfaces. MTA Buses requiring interface under this contract all have Cummings Engines. The system shall transmit AVM data off-board via the router automatically as part of daily operations and shall transmit critical alarms in real-time.

AVM data shall be continuously acquired and stored on-board. The VCPU shall utilize compression algorithms to minimize stored data while still capturing real changes of state and data change thresholds. Data shall be stored for download via existing WLAN to the Contractor-provided storage database for further analysis and processing. The table below indicates minimum data items to be acquired and stored. The AVM system shall collect at a minimum 500 separate raw data elements; the "Approx. No. of Data Elements" column indicates the approximate number to actually be populated in the bus implementation. To fulfill this, the Contractor shall propose a listing of data elements to be populated for MTA's approval. Data collection parameters shall include collection of the count, minimum, maximum, and average of values observed during configurable capture time periods.

On-Board System/Component	Approx. No. of Data Elements	Example Data Elements
Engine	- 170	- Performance Data, Ambient Air Temperature, Warning Indicator Lamp Status, Battery Voltage, Engine Coolant Temperature, Engine Oil Pressure, Total Engine Hours, Total Fuel Used, Total Mileage, Trip Fuel, Trip Miles
- Transmission	- 10	- Performance Data, Warning Indicator Lamps Status, Hydraulic Retarder Oil Temperature, Retarder Status, Transmission Oil Level High/Low, Transmission Oil Temperature
- ABS/Other Brake Signal	- 175	- Brake Stroke - Axle 1 Left - Over-Stroke, 10% Brake Lining Remaining - Axle 1 Left, Brake Stroke - Axle 1 Right - Dragging Brake, Brake Monitor Pressure Transducer Fault, Change Of Wheel Circumference Detected, Data Communication Faults
- Destination Sign System	- 4	- Destination Sign Fault
- Fare Box	- 10	- Fare Box Fault, Alarm Status
- On-Board Video Surveillance System	- 4	- Accelerometer Triggered, Record Incident Triggered

<ul style="list-style-type: none"> <li>- Multiplex/Warning Light/Discrete/Other Signals</li> </ul>	<ul style="list-style-type: none"> <li>- 30</li> </ul>	<ul style="list-style-type: none"> <li>- Air Conditioning Failed, Fire, Fire Suppression Activated/Fault, Wheelchair Ramp Deployed/Stowed, Wheelchair Ramp Fault, Emissions System Fault/Temp., External/Interior Light Faults, Engine Coolant Low, Alternator Charging Fault, Odometer, Fuel Leak, Check Engine, Hot Engine, Low Oil, Hydraulic Fault, HVAC Fault, Low Air, Wiper Motor Fault, Safety/Restraint Fault, J1708 and Other Comms Faults, Other Multiplex Alarms</li> </ul>
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The VCPU AVM features shall include but not be limited to:

- a) The VCPU shall capture information for all faults by the on-board systems and components and stamp each fault with date and time.
- b) The VCPU shall capture aggregated operational performance data from the on-board systems. The fixed end AVM system shall provide state-of-the-art display, analysis, and reporting capabilities for all of the AVM data.
- c) It shall be possible to create unique faults triggered by operational performance data points crossing user-defined high/low thresholds.
- d) A self-diagnostic “Roll-Call” feature shall be included to verify active communication between all monitored sub-systems and components and the VCPU.
- e) The AVM system shall interrogate the discrete signals for all diagnostic lights, which shall indicate the operational status of the bus including: fire, check engine, hot engine, low coolant, low oil, generator stop, hydraulic, air conditioning, low air pressure, anti-skid braking, brake fault, and fire suppression system fault.
- f) The AVM system shall perform automatic communication of vehicle ID, delta mileage, delta engine hours, all fault codes, and any other collected operational performance data to the fixed end AVM system. It shall also be possible for a fixed end CAD/AVL user to interrogate selected bus(es) at any time for available data.
- g) The fixed end AVM system shall automatically generate alert notifications based on configurable parameters. Configurable alert destinations shall include email addresses, mobile phones, and pagers.
- h) The AVM system shall automatically distribute periodic daily/weekly/monthly reports via email in a configurable manner. All AVM reports shall be available to users of the AVM system and their delegates. Reports shall be made available on a pre-determined, schedulable, and repeatable basis.
- i) The AVM system shall be integrated with the paperless pre-trip inspection function required under this contract. All automatically detected faults and inspection items available in the VCPU, such as tail light fault, shall be auto-filled in the paperless pre-trip data.

A subset of alarms shall be designated as critical by the system administrator, and these critical alarms shall be annunciated as an event to the CAD/AVL fixed end in real time, regardless of the bus’ location within or outside of the bus division facility. Critical alarms shall also be annunciated to the AVL fixed end in real time. Critical alarm annunciations shall contain bus number, location, and other information that may be useful to street supervisors and on-street maintenance and other

responders. The system shall allow for at least 30 configurable critical alarms, from the available data, including but not limited to the following:

- Engine Battery Voltage
- Engine Coolant Temperature High
- Engine Oil Pressure High/Low
- Transmission Level Low
- Transmission Temperature High
- Brakes Dragging
- Faulty Brakes
- Fire Indication
- DVR Accelerometer/Record Trigger
- Low Fuel
- Windshield Wiper Motor Problem
- Farebox Fault
- Excessive Passenger Count
- Safety Feature Fault
- Engine Coolant Low
- Fuel Leak
- AC Failed
- Radiator Fan Failure
- Hybrid System Warning Status

Critical alarms may also include alarms from other on-board systems. The system shall allow the MTA's System Administrator or their delegate to specify which Alarms are critical and which are not critical. A method of displaying and managing alarms based on their critical or not critical nature shall be provided. A filter for displaying and managing alarms based on their critical or not critical nature shall be provided. Likewise, the user shall be able to create alarm groups for the purpose of display on the user console.

The CAD/AVL system shall be able to display alarms filtered by severity level determined by each user or by a group of users (ex. Dispatchers, Supervisors, Police). This applies to alarms not just those listed in this section.

## **TS 83.10 Pedestrian / Bus Warning System**

The bus shall be equipped with a warning system that provides an audible message warning pedestrians that the bus is turning. The system shall sense when the steering of the bus is being turned to a preset angle indicating the bus is making a turn. When reaching the adjustable steering angle the system shall announce an external voice message and illuminate guide way lighting.

Speakers shall be located on both the curb and street side of the bus. Speaker shall be replaceable and external louvers provided that protect the speakers from the elements. The system shall sense the ambient noise level and adjust the audible warning to a level 5 decibels above. The system shall also enact the external guide way lighting for the direction the bus is turning.

The system shall not require operator intervention to activate and shall shut off automatically once the steering is returned past the preset point. The preset point shall be adjustable by qualified and trained technicians.

The system shall interface with the GPS, AVM and On board video surveillance system

## **TS 83.11 Other Intelligent Onboard Electronics**

The Contractor must work with the selected suppliers to ensure that the equipment, cabling and software supplied meets the MTA's requirements. The Contractor shall assure that all supplied buses are equipped with the same revision software for all components. During the course of this contract, should improved versions of any software or operating systems become available, a listing and description of the changes must be submitted to the MTA for approval complete with a procedure for updating any previously provided. A listing of all software part number and revision shall be identified for each component that is software controlled.

### **TS 83.11.1 Electronics Cabinet (EC)**

A full-sized electronics cabinet (EC) shall be securely mounted on top of the streetside front wheelhouse to accommodate the Intelligent Onboard Electronics, except the farebox, operator control units and bus multiplex electrical control system. At a minimum, the cabinet shall meet NEMA 1 standards, be designed built to last the life of the bus with minimal repair and without replacement. The cabinet design shall require MTA review and approval.

The electronics cabinet shall be splash-proof when the service door(s) is secured and shall be made of a minimum of 18-gauge stainless steel or 12-gauge 5052 H32 aluminum construction, suitably reinforced. The cabinet shall be painted with black polyurethane enamel exterior and white interior. Access to the cabinet shall be from lockable-hinged doors opening into the passenger aisle area that includes a sturdy hold-open device. The cabinet door shall have a recessed paddle latches and GM key lock with four keys per vehicle. There shall be no sharp edges or corners on the enclosures. Inside of the cabinet shall be illuminated using two (2) 12" LED strip lights controlled by an inside the cabinet toggle switch. The electronics cabinet shall provide adequate ventilation for 1000 watts of equipment operating within the range of -20°F to +140°F.

The cabinet shall provide a minimum of 48 inches of free height that shall accommodate four heavy duty shelves of 19-inch electronic racks of 18-inch depth. These shelves shall consist of modular slide out trays that are removable and can be repositioned to accommodate changes in equipment position as needed. The slide out trays shall incorporate heavy-duty slide or roller mechanism to support a minimum of 150 lbs. of loading and shall be able to withstand the normal shock and vibration, (under full load) experienced in MTA revenue service, without damage to

the slide or roller mechanisms. The trays shall lock in both the in and out positions and resilient material shall be used to prevent the trays from moving when the cabinet is closed.

Power provisions shall be made for the radio and electronics inside the cabinet. Circuits and wiring for each shelf shall be independent of one another at 30 amps 12VDC and 24VDC supplies and a chassis ground provided on four independent terminal strips with a minimum of six terminal mounting locations. Terminal strips shall be clearly identified. Terminal strips and associated wiring shall not interfere with shelf operation. All terminals shall be protected from accidental shorts. Wiring and cabling required between devices in the EC shall be protected by loom tubing to protect it from abrasion and must not interfere with the independent operation of the trays. The cabinet shall be provided with a terminal of the VAN system(s). A 3-inch inside diameter conduit, with a pull wire, shall connect the cabinet with the main bus wiring harnesses above the streetside lighting fixtures and the destination sign compartment. A 2-1/4-inch inside diameter metallic conduit, with a pull wire, shall connect the radio control head and control unit located within the electronics cabinet.

To support the Automated Vehicle Monitoring (AVM) system, provisions shall be made to allow the VCPU access to the bus multiplex system status through a serial communications interface. Discrete wiring shall be provided from the instrument and diagnostic light panels into the electronic cabinet to support the Automated Vehicle Monitoring (AVM) system. The AVM system shall interrogate the discrete signals for all diagnostic lights, which shall indicate the operational status of the bus including, but not limited to; fire, check engine, hot engine, low coolant, low oil, generator stop, hydraulic, air conditioning, low air pressure, anti-skid braking, brake fault, and fire suppression system fault. In addition the odometer and "wheelchair ramp deployed" signals shall be wired to the VCPU in the electronics cabinet. The discrete signals shall be 12VDC, 24VDC, or ground and shall be terminated on a terminal strip and continue to the VCPU. All wires and cables shall be clearly labeled and identified on the schematic decal attached to the electronics cabinet door. During the bus build, cable conduits shall be routed at the discretion of the MTA to ease in cable replacement on a case-by-case basis. These conduits should be 3/4-inch ID or larger as noted and be routed in a continuous fashion. The conduits shall have bend radiuses that will permit the ease of replacing and adding cables or wires (no sharp or right angles). In general, conduits exposed to the interior of the bus shall be watertight and shall be terminated at the EC enclosure using suitable reusable watertight fittings. Conduit installation shall follow best commercial practices with regard to drip loops and routing to avoid moisture problems.

Table 11 lists the minimum conduit runs required.

**TABLE 11  
Conduit Runs**

<b>From</b>	<b>Termination</b>
IVN, GPS Receiver	EC Enclosure
ACS Antenna, GPS Receiver	EC Enclosure
ACS Antenna, Radio Transceiver (2)	EC Enclosure
GFI Odyssey Farebox	EC Enclosure
Automatic Passenger Counter controller	EC Enclosure
IVN Transit Control Head	EC Enclosure
Front Dash	EC Enclosure
Display Control Monitor.	EC Enclosure, 2 ¼-inch ID
Destination Sign Controller Operator's Control Console (OCC) defined in section 79.4	EC Enclosure
Cameras	EC Enclosure

Proposed conduit runs shall be submitted to the MTA for approval prior to the PDMR.

### **TS 83.11.2 Vehicle Area Networks**

The Contractor shall install and verify the operability of a Vehicle Area Network (VAN) in accordance with SAE Recommended Practice J1939, Serial Data Communications between Microcomputer Systems in Heavy-Duty Applications and SAE Recommended Practice J2496, Transport Area Network Cabling. Not all devices on the vehicle may support the J1939 standard so a second VAN to support older J1708 devices may be required. In some cases, specific J1708 cabling is required to or within the EC.

The VAN shall provide connectivity between the Electronics Cabinet and Device Access Boxes in strategic locations throughout the bus including the engine compartment, front electrical junction box, front destination sign compartment and over both passenger doors.

The VAN shall provide the inter connectivity of all elements of the Communication System, and other equipment on the bus with microprocessor controls. Functionally, the VAN shall support an environment where all components, modules, and systems installed on the bus shall have built-in diagnostics capability. The diagnostic system shall be capable of checking the communications between all components of the installed systems. In some cases direct cabling between components may be required.

In preparation for future Transit Communication Interface Profiles (TCIP) compatible components, A Cat 5e cable shall be installed between the Electronics Cabinet and major systems components detailed throughout this section.

### **TS 83.11.3 Wireless Local Area Network (WLAN) Router**

MTA buses shall be outfitted with a secure mobile router for interconnecting the various networks on the bus and providing a common means of interconnection to the MTA network via a wireless interface that complies with the IEEE 802.11 g/n specifications. This device shall also support all data communications via a commercial cellular telephone network.

- a) The router shall integrate and optimize the data communications on-board the bus and to off-board wireless infrastructure. The Mobile Router shall be the InMotion on-board mobile gateway (oMG) model # IMTOMG2040101MT or approved equivalent and shall

be compliant with the 802.11 a/b/g/n standards. Table 1 in Appendix A indicates those buses requiring a new fully-equipped router and those requiring upgrade to 802.11n and cellular communications.

- b) The DVR and the VCPU (including all on-board applications) shall use the router for data uploads and downloads to and from the bus. Existing, dedicated farebox infrared and short-range Wireless Local Area Network (WLAN) paths shall be left in place.
- c) Bulk data transfers shall be required for AVM data uploads, APC data uploads, DVR data uploads, and software updates. This shall be accomplished via WLAN at the assigned bus division. This shall be via the existing MTA Aruba secure wireless infrastructure at each division. In the event that not all data is uploaded while the bus is in the range of the WLAN, the VCPU shall continue uploading data from where the previous uploaded data stopped when the vehicle is again in the range of the WLAN.
- d) The Router shall provide an interface to a cellular provider for long-distance real-time data communications.
- e) As purchased and installed, the router shall include the following:
  - 1. embedded mobile access point
  - 2. embedded wide area 802.11n radio module with 2x2 MIMO
  - 3. integrated 4-port Ethernet switch
  - 4. embedded GPS receiver
  - 5. DC power cable
  - 6. incremental license fee for on-Board Mobility Manager server
  - 7. one year of premium support service
- f) The router shall provide IP routing in support of all on-board electronics.
- g) The router shall provide state-of-the-art wireless service management and optimization functions for all communications services mentioned throughout the contract documents.
- h) The router shall support wireless streaming video to authorized devices such as laptops in close proximity to the bus and longer distance via VPN authentication.
- i) The router shall be manageable and all functions and parameters shall be configurable through the existing InMotion mobile gateway server located in the Washington Boulevard Radio Shop.
- j) The router shall include state-of-the-art self diagnostic capabilities that can be accessed and used locally and remotely at the mobile gateway server.
- k) The router shall support the following protocols:
  - l) Wireless Area Network (WAN) backhaul communications of the router shall be compliant with the IEEE 802.11a/b/g/n standard (latest version), with Multiple Input Multiple Output (MIMO) high bandwidth communications implemented on at least two WLAN antennae.
  - m) Local Area Network (LAN) Access Point (AP) communications of the router shall be compliant with the IEEE 802.11g/n standard.
  - n) The router security protocols shall be WPA2 and WPA2-PSK with 128-bit encryption.
  - o) The router shall include the following ports at minimum. It is expected that some but not all will be used in this bus implementation:

- p) Four (4) 10/100MB Ethernet CAT5 ports.
- q) Two (2) Wide Area Network (WAN) coaxial ports.
- r) Two (2) Local Area Network (LAN) coaxial ports.
- s) Three (3) additional antenna coaxial ports.
- t) Two (2) USB ports.
- u) One (1) RS 232 port for local configuration, data exchange, and diagnostics.
- v) One (1) power plug.
- w) All modems in the router shall be of the highest power available and permissible by the FCC.
- x) The router shall have a minimum of six (6) internal expansion slots, including at least two (2) Express, two (2) miniPCI and two (2) miniExpress. It is expected that some but not all will be used in the bus implementation.
- y) The wireless router power shall be connected to the vehicle's 24V Ignition power (24 VDC continuous power) through a protective device.
- z) The router shall include a GPS receiver which will be used to provide a common GPS source suitable for all on-board applications requiring positioning and/or time synchronization.
- aa) The GPS receiver shall be the time source for on-vehicle time used for operator display, to time-tag all recorded events and for all on-board subsystems.
- bb) It is preferred that the GPS information be shared on board using standard GPS data words per the NMEA 2000 standard via UDP packet over Ethernet and via RS 232 serial link. Splitting of the GPS antenna signal upstream of the receiver is not preferred.
- cc) The Contractor shall minimize the number of antennae and roof penetrations, while still maintaining the manufacturers' recommendations for antenna spacing, ground plane, and other installation details.
- dd) Transmission EIRP and reception strength shall be the maximum possible and allowable within applicable FCC regulations.
- ee) The GPS receiver housing shall be an integrated receiver/antenna module, in a non-metallic housing and mounted on the roof of the vehicle.
- ff) The antenna shall be a surface-mounted multiband antenna supporting LTE MIMO 700 MHz, AWS, WiFi and GPS. Existing antenna shall be new installation, replacement or upgrade as required.
- gg) Antenna shall be supplied and installed with all pigtail leads, RF extension cables and connectors.
- hh) An antenna grounding plane shall also be provided.

#### **TS 83.11.4 Communications Antennas**

The Contractor shall install GPS, WLAN and Radio Antenna reinforcing plates in the roof sections as required. These plates shall be at least 3 feet apart and shall be located such that:

- a) The cable distance to radio box shall be kept to a minimum and less than 25 feet.

- b) The underside of the reinforcement plate area is accessible for service of the antenna connector. The Contractor shall install interior ceiling cover plates in a design approved by the MTA at the pre-production meeting.
- c) The location of the reinforcement plate for the antennas shall not be more than 10 degrees from horizontal.
- d) The GPS antenna/receivers shall be located at least 1 meter from other radiating elements.

**TS 83.11.5 Bus Mounted Data Recorders**

**The MTA currently uses FLEETWATCH (S&A Systems) Model JX55 Data Logger and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The Contractor shall provide Data Loggers for each bus. Each data logger shall be suitable for mounting on a transit bus and connecting directly to a J1708 connector on the bus. The mounting of the data recorder shall be presented for review and requires MTA approval during the PPM.

Bus-mounted data recorders shall be programmable by the MTA with vehicle number and codes for defining the set of data to be recorded and reported. Programming software and hardware shall be provided to allow the MTA to program or re-program the bus-mounted data recorder units at any time.

Bus-mounted data recorders provided shall include a minimum 1-year warranty on all parts, including batteries, if applicable.

Bus-mounted data recorders shall be programmed to respond to a beacon signal sent from a Receiver Unit and upon receipt of such beacon signal shall transmit via radio frequency the bus number and other defined data to the Receiver Unit. Bus-mounted data recorders shall as a minimum provide the following capabilities:

- a) Collect and report Vehicle Number, Vehicle Total Mileage, and Vehicle Total Engine Hours
- b) Capture and report fault indicators. Fault Codes reported shall include Subsystem ID and Failure Mode Identifier as defined in SAEJ1587 documentation. The last 10 unique Active Fault Codes shall be recorded and reported with the Date and Time of the beginning and ending of the last occurrence observed.
- c) Last value observed. The Bus-mounted data recorder shall report the last value observed for 10 items. The user shall be able to define these 10 items using M.I.D. and P.I. D. codes as defined in SAEJ1587 documentation.

Examples:	M.I.D.	P.I.D.
Engine Idle Hours	128	235
Idle Fuel Used	128	346

- d) Maximum and minimum value observed in 24 hours. The bus-mounted data recorder shall report the maximum and minimum values observed during the

previous 24 hour time period for 10 items defined using M.I.D. and P.I.D. codes. The date and time of the minimum and maximum occurrences shall also be reported. The user shall be able to define the codes for the items to be reported.

Examples:	M.I.D.	P.I.D.
Engine Coolant Temperature	128	110
Engine Oil Pressure	128	100
Engine Oil Temperature	128	175
Hybrid drive Oil Temperature	130	177
Ambient Air Temperature	128	171

#### TS 83.11.6 Engine Auxiliary Heater Control

The engine auxiliary heater specified in TS 9.3 shall be controlled via the integrated WLAN. These heaters shall be started by the MTA dispatcher as described in the specification.

#### TS 84. Bicycle Racks

**The MTA currently uses Sportworks Velo Porter 2 position Bicycle Rack and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Each bus shall be equipped with a bicycle rack capable of accommodating two bicycles. The bicycle rack shall be located at the buses front bumper and shall not obstruct or require removal to access the exterior defroster box. The operation of the bicycle rack shall be performed by passengers and shall not require operator's assistance or tools.

The mounting of the bicycle racks shall not interfere with the FMVSS lighting requirements for the bus or the vision of the operator.

The racks, located on the front of the bus above the bumper, shall be constructed of durable material and fold up when not in use. The rack shall be capable of being raised and lowered with one hand and both racks shall load or unload independently of the other. The rack shall only contact the bicycle tires and will by design prevent contact between the two bicycles.

A "bike rack deployed" message shall be on the center dash message center and a red warning light within the operator's sight when the bicycle rack is not stowed.



**MARYLAND TRANSIT ADMINISTRATION**

**MARYLAND DEPARTMENT OF TRANSPORTATION**

Martin O'Malley, Governor • Anthony G. Brown, Lt. Governor  
James T. Smith, Jr., Secretary • Robert L. Smith, Administrator

TO: All Planholders

FROM: Maryland Transit Administration  
Procurement Division, 7<sup>th</sup> Floor  
6 Saint Paul Street  
Baltimore, Maryland 21202-1614

SUBJECT: **Addendum No. 1**  
**Contract No. T-8000-0451**  
BUS PROCUREMENT – 41 Hybrid Buses

DATE: June 6, 2014

Enclosed and effective this date is Addendum No.1 to the subject Contract. This Addendum reflects changes made to the solicitation as mentioned on the attached list and includes responses to Planholder's written questions in Addendum No. 1 - Attachment A and an Approved Equal Request Form.

A conformed copy of the revised specification will be available on our website at [www.mta.maryland.gov/procurement](http://www.mta.maryland.gov/procurement) .

The proposer shall acknowledge receipt of this Addendum by completing and returning this form with the proposal package.

All other terms and conditions remain unchanged.

Sincerely,

Heidi J. Tarleton  
Procurement Officer

---

Acknowledgement of receipt of ADDENDUM #1 to Solicitation #T-8000-0451

Vendor Name: \_\_\_\_\_

---

Authorized Representative's Signature

Date

**A list of the changes made to this solicitation follows:**

The following additions, deletions, and modifications are hereby made a part of the Contract Documents of BUS PROCURMENT– 41 Hybrid Buses, Contract No.: T-8000-0451.

<b>Contract Specifications</b>		
<b>Item No.</b>	<b>Page or Section</b>	<b>Modification</b>
One	Throughout IFB	Approved equals are permitted for name brand references throughout the specification for T-8000-0451 using the Attached Approved Equal Request Form and must be submitted by June 10, 2014 by 2:00 pm for consideration.
Two	Section 1.33 Page 15	<p><b>Section 1.33 <u>Performance Guarantees</u>, shall now read:</b></p> <p>“...to submit a Performance Guarantee to the MTA prior to commencement of the contract. The Guarantee shall equal <del>10%</del> of the total estimated contract price and be in <i>only</i> one of the forms specified below.</p> <p>“...to submit a Performance Guarantee to the MTA prior to commencement of the contract. The Guarantee shall equal <b>five percent (5%)</b> of the total estimated contract price and be in <i>only</i> one of the forms specified below.</p>
Three	Section 1.33b Page 15 Performance Guarantees	<p><b>Section 1.33b <u>Performance Guarantees</u>, shall now read:</b></p> <p>b. A pledge of U.S. Government Security or cash held in escrow by a Maryland bank in the amount of <del>100%</del> of the total, <del>five</del>-year estimated contract ceiling price to be held by a Maryland bank in escrow for the term of the contract any any extensions thereto.</p> <p>b. A pledge of U.S. Government Securities or cash held in escrow by a Maryland bank in the amount of <b>5%</b> of the total, <del>one</del>-year estimated contract ceiling price to be held by a Maryland bank in escrow for the term of the contract and any extensions thereto.</p>

<p>Four</p>	<p><b>Section 1.33c Page 15 Performance Guarantees</b></p>	<p><b>Section 1.33c <u>Performance Guarantees</u>, shall now read:</b></p> <ul style="list-style-type: none"> <li>c. An irrevocable Letter of Credit (LOC) issued by a Maryland financial institution in a form acceptable to the MTA in the amount of 100% of the total, five-year estimated contract ceiling price.</li> <li>c. An irrevocable Letter of Credit (LOC) issued by a Maryland financial institution in a form acceptable to the MTA in the amount of 5% of the total, one-year estimated contract ceiling price.</li> </ul>
<p>Five</p>	<p><b>Section 1.33d Page 15 Performance Guarantees</b></p>	<p><b>Section 1.33d <u>Performance Guarantees</u>, shall now read:</b></p> <ul style="list-style-type: none"> <li>d. Retaining of a portion of the contractor's gross billing amount until the termination of the contract or when the retainage equals 100% of the total, five-year estimated contract ceiling price, whichever occurs first. The portion retained shall be 100% of each monthly billings for all billings covering the first year of services and <del>five percent (5%) thereafter until the 10% ceiling is reached.</del></li> <li>d. Retaining of a portion of the contractor's gross billing amount until the termination of the contract or when the retainage equals 5% of the total, one-year estimated contract ceiling price, whichever occurs first. The portion retained shall be 5% of each monthly billings for all billings covering the first year of services.</li> </ul>
<p>Six</p>	<p><b>Item 33 Page 42 Attachment A Contract Agreement</b></p>	<p><b>Attachment A, Item 33 <u>Hiring Agreement</u>, shall now read:</b></p> <p><b>33. — Hiring Agreement</b></p> <p><del>The Contractor agrees to execute and comply with the enclosed Maryland Department of Human Resources (DHR) Hiring Agreement (Attachment P). The Hiring Agreement is to be executed by the Bidder/Offeror and delivered to the</del></p>

~~Procurement Officer within ten (10) Working Days following receipt of notice by the Bidder/Offeror that it is being recommended for contract award. The Hiring Agreement will become effective concurrently with the award of the contract.~~

~~The Hiring Agreement provides that the Contractor and DHR will work cooperatively to promote hiring by the Contractor of qualified individuals for job openings resulting from this procurement, in accordance with Md. Code Ann., State Finance and Procurement Article §13-224.~~

**34. Miscellaneous**

34.1 Any provision of this Contract which contemplates performance or observance subsequent to any termination or expiration of this contract shall survive termination or expiration of this contract and continue in full force and effect.

34.2 If any term contained in this contract is held or finally determined to be invalid, illegal, or unenforceable in any respect, in whole or in part, such term shall be severed from this contract, and the remaining terms contained herein shall continue in full force and effect, and shall in no way be affected, prejudiced, or disturbed thereby.

**33. Miscellaneous**

33.1 Any provision of this Contract which contemplates performance or observance subsequent to any termination or expiration of this contract shall survive termination or expiration of this contract and continue in full force and effect.

33.2 If any term contained in this contract is held or finally determined to be invalid, illegal, or unenforceable in any respect, in whole or in part, such term shall be severed from this contract, and the remaining terms contained herein shall continue in full force and effect, and shall in no way be affected, prejudiced, or

		disturbed thereby.
<b>Seven</b>	<b>Attachment F Bid Form Page 60</b>	Maintenance and Operator Training hours have been revised from 60 hours to 1500 hours.

## **Addendum No. 1**

**Attachment A - Responses to Planholder's Written Questions**



**CONTRACT NO: T-8000-0451  
BUS PROCUREMENT - 41 Hybrid  
Buses**

**Attachment A**

No.	Spec. Section & Para # for Dwg #	Questions from Proposers	Response to Questions
1	Page 15, Section 1.33 Performance Guarantee	Bidder requests to submit a Performance Guarantee to the MTA prior to commencement of the contract. The Guarantee shall equal 10% of the total estimated contract price and be in only one of the forms specified below.	The performance guarantee has been changed to the following: "The Guarantee shall equal 5% of the total estimated contract price and be in only one of the forms specified below."
2	Page 15, Section 1.33b Performance Guarantee	Since this procurement appears to be for one year, the Contractor respectfully requests that the five year requirement be removed from Sections 1.44.b, c, d.	All references to five years have been changed to one year on Page 15 regarding Performance Guarantees.
3	Page 16, Section 1.34 Bid Bond	Bidder requests that the Bid Bond be changed to 1%.	The Bid Bond shall remain at 5% of the Bid Price as noted on page 16, Section 1.34.
4	Page 22, Section 3.4.1 Insurance Types	Bidder requests clarification that the types of insurance not marked with an "X" such as this one will not be required.	MTA is clarifying that the items that do not have an "X" to the left of the insurance item do not apply and are not required for T-8000-0451.
5	Page 34, Section 7.1 Patents, Copyrights and Intellectual Property	Bidder wishes to advise the MTA that the Contractor will not act in any way that infringes on any copyrights. The Contractor cannot obtain copyright permission for the MTA.	The MTA understands that the Bidder cannot obtain copyright permission on the behalf of the MTA.
6	Page 42, Item 33, Hiring Agreement	Bidder requests clarification that DHR Hiring Agreement is not applicable to the resultant Contract.	MTA is confirming that a DHR Hiring Agreement is not applicable to contract T-8000-0451 and item 33 on Page 42 of the IFB has been removed.
7	Page 60, Attachment F	Bidder requests definition of the term "Final First Responder"	First responder guide is a laminated document, that highlights high voltage systems on the hybrid bus, battery disconnect switch location, location of the batteries, and details emergency shutdown, isolation and evacuation procedures. This document is provided to local police and fire authorities.
8	Page 131, TS 5.4 Maintenance and Inspection/Tools and Equipment	Proposer shall provide a list of all special tools and pricing required (Form CER 9.5, Tools and Test Equipment) for maintaining this equipment. Said list shall be submitted as a supplement to the Pricing Schedule. Included in Contractor requests clarification that other than the laptops, none of these tools will be included in the total contract price for determination of lowest bidder.	Shall be included in line item 10 of the Bid Form Attachment F as part of the bid price. IFB Attachment F has been updated.
9	Page 132, TS 5.6 Training	Bidder requests clarification if the MTA desires a fully functional mock-up with reporting capability to the multiplex system.	The MTA does not require the mock-up to be multiplexed.
10	Page 132, TS 5.6 Training	Bidder requests clarification if the MTA actually requires this training aids package which we conservatively estimate will cost \$200,000 for a lot of about 40 buses built with industry standard components.	As a revised requirement under this procurement, MTA requests 1500 hours of training. Details to be discussed at the Pre Production Meeting (PPM).
11	Page 132, TS 5.6 Training	Bidder requests the MTA to change the requirement from "30 calendar days prior to the delivery .." to "not later than two weeks after receipt on delivery of the first bus of each annual lot". It is beneficial to the MTA as more information will be accurate later in the build and the MTA must license and insure each vehicle after receipt on delivery.	The MTA advises that the requirement is modified to read: "not later than two weeks after delivery of first bus". The reference to an annual lot is deleted as well.
12	Page 132, TS 5.6 Training	Bidder requests clarification if the MTA wants the I/O Multiplex Training Board to be constructed such as to hang on a wall (which is I/O Control's normal practice) or to have the Training Board portable via movable racks or similar means	The MTA wishes to clarify that the multiplex training board is to be mobile and capable of being moved around on wheels, and not tied to a wall.
13	Page 132, TS 5.6 Training	Bidder requests clarification of what the MTA considers "System Monitors and Controls".	MTA wishes to clarify that these are dashboard indicator lights and operator controls (door controls, camera monitors, fire suppression system etc.)
14	Page 132, TS 5.6 Training	Bidder requests clarification if the MTA desires HVAC training only by the OEM or will the MTA consider the Contractor to conduct the training?	MTA requires that all training is to be conducted by the subcomponent manufacturer.

15	Page 132, TS 5.6 Training	Bidder requests clarification for the requirement of a course for "Operator's Orientation 60 ft" as the solicitation is for a 40 ft vehicle.	MTA advises that bidders are to disregard and delete all 60-foot references. This procurement is only for 40-foot buses.
16	Page 132, TS 5.6 Training	Bidder requests clarification if the Transit desires Engine training only by the OEM or can other sources outside of the Contractor conduct these sources	MTA requires that all training is to be conducted by the subcomponent manufacturer.
17	Page 132, TS 5.6 Training	Bidder requests clarification about the requirement for Maintenance Orientation & Maint/R&R 60 ft: Does the Transit desire this course as the solicitation is for 40 ft vehicles?	MTA advises that bidders are to disregard and delete all 60-foot references. This procurement is only for 40-foot buses.
18	Page 132, TS 5.6 Training	Bidder requests clarification if the Transit desires Hybrid Drive training only by the OEM or can other sources outside of the Contractor and OEM conduct the training	MTA requires that all training is to be conducted by the subcomponent manufacturer.
19	Page 284 TS 83.3, On Board Video Surveillance System (OBVSS)	Bidder requests clarification if Microsoft Word 2013 is this acceptable to the Transit	MTA can only accept Microsoft Word 2000 and 2007 formats.
20	Page 284 TS 83.3, On Board Video Surveillance System (OBVSS)	Bidder requests clarification of where the cost for this training program should be captured as it's not part of the defined training requirements	The MTA requires that the OBVSS training shall be captured under Item Maintenance and Operations Training on the Bid Form - Attachment F.
21	Page 289, TS 83.7, Mobile Radio System	Provide manuals and training for maintenance and operation. advise the MTA that the Contractor cannot print OEM manuals, and as such, must be ordered.	Accepted
22	Page 20, Section 3.2.5 Progress Payment	Request approval to include the definition of acceptance as follows: "Within fifteen (15) calendar days after delivery of the bus to the State, the State shall conduct acceptance tests on the bus. The acceptance tests to be conducted by the State and the criteria and standards in respect of such tests shall be agreed upon between the State and the Contractor prior to the Contractor building buses for the State. If a bus passes these tests or if the State does not notify the Contractor of non-acceptance within 15 calendar days after delivery of the bus, then acceptance of the bus by the State shall be deemed to have occurred on the 15th day after delivery of the bus. Acceptance shall occur earlier if the State notifies the Contractor of early acceptance of the bus or places the bus into revenue service."	The MTA denies this request, the MTA has no control over the speed at which the Contractor's on site team will effect corrective action to a delivered bus with identified defects upon delivery. The requested definition for acceptance is rejected.
23	Page 34 Section 5, Rights to Records	Bidder requests approval for the data prepared by the Contractor regarding this contract shall remain the property of the Contractor; provided however, the State shall have a royalty fee, non-exclusive, non-transferable and irrevocable license to use drawings, specifications and other documents for the purposes of operating and maintaining the buses.	Any exceptions to conditions set forth in the IFB must be submitted formally in writing on company letterhead before the bid due date. By submitting a bid in accordance with the IFB, you are accepting the Terms and Conditions outlined in the IFB.
24	Page 37 Section 18, Termination for Convenience	Bidder requests approval to include profit on all worked performed up to the time of termination.	Section 18, Termination for Convenience has been approved by the Attorney General and has been incorporated in COMAR and cannot be changed.
25	Pages 60./133 Attachment F and TS 5.6 Training Hours	Bidder requests clarification as to which quantity of training hours should be used in the proposal, 60 hours per the bid form or 2432 hours per the Training section.	As a revised requirement under this procurement, MTA requests 1500 hours of training. Details to be discussed at the Pre Production Meeting (PPM).
26	Page 70, Attachment J Non-disclosure Agreement	Bidder requests approval to revise the non-disclosure agreement as a Mutual agreement of non-disclosure where the confidential information provided from the contractor to the State is also protected.	
27	Page 133, TS 5.6 Training	Bidder requests approval to delete the requirement of a full-time service manager and replace with a Regional Product Support Manager to work with the MTA on warranty related issues as needed and will be available via phone or e-mail and perform regular on-site visits to the MTA.	The MTA rejects this request, the MTA requires full time service manager representation.

28	Page 134 TS 5.8, Interior Noise	Bidder requests for approval to provide 75 dBA with A/C off and 78 dBA with A/C On at the driver's area and 80 dBA at all passenger seat location following test guidelines specified in the White Book as following: "The bus shall accelerate at full throttle from a standstill to 35 mph on level commercial asphalt or concrete pavement in an area free of large reflecting surfaces within 50 feet of the bus path."	The MTA accepts a noise level of 75dBA with AC and heat fans off and 78 dBA with AC and heat fans on in the Operators area and 80dBA at all passenger seats.
29	Page 139 TS 6.9, Interior Headroom	Bidder requests approval for the distance between the rear seats to the PLC panel to be 56" and not 72". The area outside the PLC panel meets the specification requirements.	The MTA accepts the design configuration where a junction box is located over the rear setee which reduces the vertical clearance to 56 inches between the junction box and the rear seats of the bus provided the junction box is secured with theft proof screws to prevent customers from entering the junction box.
30	Page 139 TS6.10 Aisle Width	Bidder requests approval to provide a distance between the wheelwells of 36" and not 44"	The MTA accepts a 36 inch clear, uninterrupted distance between the front wheelwells of 36 inches provided all interior components and dimensions remain in compliance with ADA requirements.
31	Page 149 TS 14.1, Fluid Lines	Bidder requests approval to provide Hellerman Titan clamps.	This request is approved provided the proposed P-clips are stainless steel construction with rubber insulation.
32	Page 151 TS 17.2.1, Design and Construction	Bidder requests approval to provide 100 gallons on the XDE40 bus. The tank is constructed of cross-linked polyethylene which still contains the necessary baffles required to control the moving of the liquid inside the tank instead of the corrosion resistant ANSI 304 Stainless steel, 16 gauge thickness meeting FMVSS and FMCSR requirements for passenger carrying vehicle diesel fuel tank construction and mounting.	Accepted.
33	Page 159 TS 24, Towing	Bidder requests approval to provide a crane hook with a 1.25 in. Throat instead of a 1-inch throat.	Accepted.
34	Page 172 TS 37.4, Air Lines and Fittings	Bidder requests to provide an additional colour for air lines; Blue = suspension.	Accepted.
35	Page 175 T 39.1, Hardware Mounting	Bidder requests approval to provide its standard Secure Diagnostic Station.	Approved Equal Request form must be filled out and submitted for review and/or approval by June 10, 2014.
36	Page 178 TS 40.1.5, Battery Compartment	Bidder requests approval to provide a heavy duty 3/16" polyethylene plastic enclosure with a battery tray constructed of polyethylene plastic mounted on a stainless steel sub-frame for support. The tray easily slides out on stainless steel rollers.	Accepted.
37	Page 180 TS 40.3, Low Voltage/Low Current Wiring and Terminals	Bidder requests approval to provide Hellerman Titan clamps instead of UMPCO 775 SST P-clamps .	This request is approved provided the proposed P-clips are stainless steel construction with rubber insulation
38	Page 199 TS 50, Operator's Side Window	Please clarify that the Driver's Window is to match the polycarbonate requirements as the passenger windows.	The operator's side window glazing material shall have a ¼ inch nominal thickness laminated safety glass conforming to the requirements of ANSI Z26.1-1996 Test Grouping 2 and the Recommended Practices defined in SAE J673.
39	Page 200 TS 52, HVAC Capacity and Performance	Bidder requests approval to delete the requirement of an electrical HVAC system as this system has not yet been developed or tested with the Allison EV40 system.	Accepted.
40	Page 201 TS 52.1, Capacity and Performance Requirements	Bidder requests approval to provide a performance of 110 °F to 70 °F +/-3 °F in less than 45 minutes after system engagement instead of less than 30 minutes after system engagement.	Accepted.
41	Page 239 TS 73.9, Floor Covering	Bidder requests approval to provide a 15 year parts only warranty on the floor covering. This is max warranties passed on to New Flyer from the supplier.	Accepted.
42	Page 240 TS 73.10, Interior Lighting	Bidder requests approval to provide New Flyer (TCB) interior lights.	Accepted.
43	Page 241 TS 73.10, Interior Lighting	Bidder requests approval to provide a 12 year parts only warranty on materials and a 1 year/50,000 (whichever occurs first) warranty on workmanship	Accepted.

44	Page 244 TS 75.1, Floor Hatches	Bidder requests approval to provide the hatch with Stainless Steel hardware; however the edge of the hatch is framed with Polycarbonate material and it prevents the edges coming loose.	Accepted.
45	Page 256 TS 79.1, Accessibility Loading system	Bidder requests approval to provide New Flyer's patented self contained, modular Flip Type ramp that is stored in a stainless steel box mounted into the floor of the bus. The non-skid, 3/16 inch thick aluminum ramp platform has a clear width of 32.25 inches, a length of 47.6 inches and is rated at 660 lbs. with a deployment angle ratio of 1:7. The ramp exceeds ADA requirements	Both Ricon and New Flyer ramps are acceptable.
46	Page 272 TS 83.3, On Board Video Surveillance system (OBVSS)	Bidder requests approval to provide the Safety Vision System DVR Road Recorder 7000.	Approved Equal Request form must be filled out and submitted for review and/or approval by June 10, 2014.
47	Page 283 TS 83.3 DVRs Technical Manuals	Manuals shall be provided with first bus delivery or soon after the Contractor receives the documents from the DVRS supplier instead of within 30 days of the delivery of the first DVRS.	Accepted.
48	Page 294 TS 83.11.1, Electronic Cabinet (EC)	Bidder requests approval to provide its standard Secure Diagnostic Station instead of a splash-proof when the service door(s) is secured and shall be made of a minimum of 18-gauge stainless steel or 12-gauge 5052 H32 aluminum construction, suitably reinforced The cabinet shall be painted with black polyurethane enamel exterior and white interior	Approved Equal Request form must be filled out and submitted for review and/or approval by June 10, 2014.
49	N/A - Confidentiality Agreements	Bidder requests approval for "The Administration and its representatives and agents agree to enter into a confidentiality agreement with the Contractor prior to commencing an audit, review or analysis in order to protect and maintain the confidentiality of the Contractor's information."	Any information provided by a contractor/bidder must be marked "confidential" and/or "proprietary" and will remain confidential for the duration of the contract.

**MARYLAND TRANSIT ADMINISTRATION**

**APPROVED EQUAL REQUEST**

VENDOR:  DATE:

Bidder may propose an approved equal for any brand name part that is listed in the specification and must identify the IFB Section Number, manufacturer part number and a description of the proposed part that supports the similar functionality of the name brand item. ONE FORM PER ITEM.

IFB Section Number	Brand Name Listed	Description	Proposed Approved Equal Name	Part Number	Justification

Vendor Representative:  Title:

Vendor Representative: \_\_\_\_\_ Date: \_\_\_\_\_  
Signature

**MTA Office Use Only**

Received By:  Date:

Approved By: \_\_\_\_\_ Date: \_\_\_\_\_

Disapproved By: \_\_\_\_\_ Date: \_\_\_\_\_



**STATE OF MARYLAND**  
**MARYLAND DEPARTMENT OF TRANSPORTATION**  
**MARYLAND TRANSIT ADMINISTRATION**

**INVITATION FOR BIDS (IFB)**

**SOLICITATION NO. T-8000-0451**

**BUS PROCUREMENT – 41 HYBRID BUSES**

**Issue Date: June 6, 2014**  
**ADDENDUM NO. 1**

**NOTICE**

A Prospective Bidder that has received this document from the Maryland Transit Administration's (MTA) website or <https://emaryland.buyspeed.com/bsa/>, or that has received this document from a source other than the Procurement Officer, and that wishes to assure receipt of any changes or additional materials related to this IFB, should immediately contact the Procurement Officer and provide the Prospective Bidder's name and mailing address so that addenda to the IFB or other communications can be sent to the Prospective Bidder.

**Disadvantaged Business Enterprises Are Encouraged to Respond to this Solicitation**

**STATE OF MARYLAND  
NOTICE TO VENDORS**

In order to help us improve the quality of State solicitations, and to make our procurement process more responsive and business friendly, we ask that you take a few minutes and provide comments and suggestions regarding this solicitation. Please return your comments with your response. If you have chosen not to respond to this Contract, please email or fax this completed form to the attention of the Procurement Officer (see the Key Information Sheet below for contact information).

**Title: BUS PROCUREMENT – 41 HYBRID BUSES**  
**Solicitation No: T-8000-0451**

1. If you have chosen not to respond to this solicitation, please indicate the reason(s) below:

- Other commitments preclude our participation at this time.
- The subject of the solicitation is not something we ordinarily provide.
- We are inexperienced in the work/commodities required.
- Specifications are unclear, too restrictive, etc. (Explain in REMARKS section.)
- The scope of work is beyond our present capacity.
- Doing business with the State of Maryland is simply too complicated. (Explain in REMARKS section.)
- We cannot be competitive. (Explain in REMARKS section.)
- Time allotted for completion of the Bid/Proposal is insufficient.
- Start-up time is insufficient.
- Bonding/Insurance requirements are restrictive. (Explain in REMARKS section.)
- Bid/Proposal requirements (other than specifications) are unreasonable or too risky. (Explain in REMARKS section.)
- DBE requirements are not attainable or realistic. (Explain in REMARKS section.)
- Prior State of Maryland contract experience was unprofitable or otherwise unsatisfactory. (Explain in REMARKS section.)
- Payment schedule too slow.
- Other: \_\_\_\_\_

2. If you have submitted a response to this solicitation, but wish to offer suggestions or express concerns, please use the REMARKS section below. (Attach additional pages as needed.).

REMARKS: \_\_\_\_\_  
\_\_\_\_\_

Vendor Name: \_\_\_\_\_ Date: \_\_\_\_\_

Contact Person: \_\_\_\_\_ Phone (\_\_\_\_) \_\_\_\_ - \_\_\_\_\_

Address: \_\_\_\_\_

E-mail Address: \_\_\_\_\_

If you have chosen not to submit a bid on this procurement, please fax this completed form to:  
(410)-333-0126 (Attention: Heidi J. Tarleton).

Thank you

**STATE OF MARYLAND  
MARYLAND TRANSIT ADMINISTRATION  
IFB KEY INFORMATION SUMMARY SHEET**

**Invitation for Bids:** **Bus Procurement – 41 Hybrid Buses**

**Solicitation Number:** **T-8000-0451**

**IFB Issue Date:** **May 19, 2014**

**IFB Issuing Office:** **MD Department of Transportation  
Maryland Transit Administration**

**Procurement Officer:** **Heidi J. Tarleton  
Contracts Administration Division  
6 St. Paul, 7th Floor  
Baltimore, MD 21202  
Phone: (410) 767-8374  
Fax: (410) 333-0126  
Email: htarleton@mta.maryland.gov**

**Bids are to be sent to:** **Maryland Transit Administration  
Contracts Administration Division  
6 St. Paul, 7th Floor  
Baltimore, MD 21202  
Attention: Heidi J. Tarleton**

**Pre-Bid Conference:** **May 28, 2014 at 10:00am Local Time  
Maryland Transit Administration  
Contracts Administration Division  
6 St. Paul, 7th Floor Conference Room  
Baltimore, MD 21202**

**Closing Date and Time:** **June 12, 2014 at 1:30pm Local Time**

**Public Bid Opening:** **June 12, 2014 at 2:00pm Local Time  
Maryland Transit Administration  
Contracts Administration Division  
6 St. Paul, 7th Floor Conference Room  
Baltimore, MD 21202**

**DBE Subcontracting Goal:** **2.0%**

## Table of Contents

<b>SECTION 1 - GENERAL INFORMATION.....</b>	<b>6</b>
1.1 Summary Statement .....	6
1.2 Abbreviations and Definitions .....	6
1.3 Contract Type.....	7
1.4 Contract Duration.....	7
1.5 Procurement Officer.....	8
1.6 Pre-Bid Conference.....	8
1.7 eMaryland Marketplace .....	8
1.8 Questions.....	9
1.9 Procurement Method.....	9
1.10 Bids Due (Closing) Date and Time.....	9
1.11 Multiple or Alternate Bids .....	9
1.12 Receipt, Opening and Recording of Bids .....	10
1.13 Confidentiality of Bids.....	10
1.14 Award Basis .....	10
1.15 Tie Bids.....	10
1.16 Duration of Bid .....	10
1.17 Revisions to the IFB.....	10
1.18 Cancellations.....	11
1.19 Incurred Expenses .....	11
1.20 Protest/Disputes .....	11
1.21 Bidder Responsibilities .....	11
1.22 Substitution of Personnel .....	11
1.23 Mandatory Contractual Terms .....	11
1.24 Bid/Proposal Affidavit.....	12
1.25 Contract Affidavit .....	12
1.26 Compliance with Laws/Arrearages.....	12
1.27 Verification of Registration and Tax Payment .....	12
1.28 False Statements.....	12
1.29 Payments by Electronic Funds Transfer .....	13
1.30 Prompt Payment Policy.....	13
1.31 Electronic Procurements Authorized .....	13
1.32 Disadvantaged Business Enterprise Goal and Subgoals.....	14
1.33 Performance Guarantees .....	14
1.34 Bid Bond .....	16
1.35 Federal Funding Acknowledgement.....	16
1.36 Conflict of Interest Affidavit and Disclosure.....	16
1.37 Non-Disclosure Agreement .....	16
1.38 Non-visual Access .....	16
1.39 Mercury and Products that Contain Mercury.....	16
1.40 Location of the Performance of Services Disclosure.....	17
1.41 Department of Human Resources (DHR) Hiring Agreement.....	17
1.42 Buy America Requirements .....	17
<b>SECTION 2 – MINIMUM QUALIFICATIONS.....</b>	<b>18</b>
2.1 Bidder Minimum Qualifications .....	18

<b>SECTION 3 – SPECIFICATIONS</b> .....	<b>19</b>
3.1 Background and Purpose .....	19
3.2 Specification – Requirements .....	19
3.3 Security Requirements .....	21
3.4 Insurance Requirements.....	21
3.4 Problem Escalation Procedure .....	23
3.5 Invoicing .....	24
3.6 DBE Reports .....	25
<b>SECTION 4 – BID FORMAT</b> .....	<b>26</b>
4.1 One Part Submission.....	26
4.2 Labeling .....	26
4.3 Bid Price Form.....	26
4.4 Required Bid Submissions.....	26
4.5 Reciprocal Preference .....	28
4.6 Delivery.....	28
4.7 Documents Required upon Notice of Recommendation for Contract Award .....	29
<b>IFB ATTACHMENTS</b> .....	<b>30</b>
ATTACHMENT A – Contract .....	32
ATTACHMENT B – Bid/Proposal Affidavit.....	44
ATTACHMENT C – Contract Affidavit.....	49
ATTACHMENT D – .....	52
Transit Vehicle Manufacture (TVM)/Disadvantaged Business Enterprise (DBE) Certificate.....	52
ATTACHMENT E – Pre-Bid Conference Response Form.....	53
ATTACHMENT F – Bid Pricing Instructions.....	54
ATTACHMENT F – Bid Form .....	55
ATTACHMENT G – Federal Funding Requirements.....	61
ATTACHMENT H – Conflict Of Interest Affidavit And Disclosure .....	68
ATTACHMENT I – Mercury Affidavit .....	69
ATTACHMENT J – Non-Disclousre Agreement .....	70
ATTACHMENT K – Performance Bond .....	74
ATTACHMENT L – Bid Bond .....	77
ATTACHMENT M – Location Of The Performance Of Services Disclosure .....	79
ATTACHMENT N – Buy America Certificate.....	80
ATTACHMENT O – Bus Testing Certification.....	81
<b>ADDITIONAL ATTACHMENTS:</b>	
BUY AMERICA REQUIREMENTS	
MANDATORY FEDERAL CLAUSES	
TECHNICAL SPECIFICATIONS	

## **SECTION 1 - GENERAL INFORMATION**

### **1.1 Summary Statement**

- 1.1.1 The Maryland Transit Administration (MTA or the Department) is issuing this Invitation for Bids (IFB) to Purchase forty-one (41) – 40 foot hybrid buses.
- 1.1.2 It is the State’s intention to obtain services, as specified in this IFB, from a Contract between the selected Bidder and the State. The anticipated duration of services to be provided under this Contract is for 12 months. See Section 1.4 for more information.
- 1.1.3 The Department intends to make a single award as a result of this IFB.
- 1.1.4 Bidders, either directly or through their subcontractor(s), must be able to provide all services and meet all of the requirements requested in this solicitation and the successful Bidder (the Contractor) shall remain responsible for Contract performance regardless of subcontractor participation in the work.

### **1.2 Abbreviations and Definitions**

For purposes of this IFB, the following abbreviations or terms have the meanings indicated below:

- a. **Bid** – A statement of price offered by a Bidder in response to an IFB.
- b. **Bidder** – An entity that submits a Bid in response to this IFB.
- c. **Business Day(s)** – The official Working Days of the week to include Monday through Friday. Official Working Days exclude State Holidays (see definition of “Normal State Business Hours” below).
- d. **COMAR** – Code of Maryland Regulations available on-line at [www.dsd.state.md.us](http://www.dsd.state.md.us).
- e. **Contract** – The Contract awarded to the successful Bidder pursuant to this IFB. The Contract will be in the form of **Attachment A**.
- f. **Contract Award Date** – The date the contract is signed by the Department following any required approvals of the Contract, including approval by the Board of Public Works, if such approval is required. See Section 1.4.
- g. **Contract Commencement Date** - The start date of performance.
- h. **Contract Monitor (CM)** – The State representative for this Contract who is primarily responsible for Contract administration functions, including issuing written direction, invoice approval, monitoring this Contract to ensure compliance with the terms and conditions of the Contract, monitoring MBE and VSBE compliance, and achieving completion of the Contract on budget, on time, and within scope.
- i. **Contractor** – The selected Bidder that is awarded a Contract by the State.
- j. **Department or MTA** – Maryland Transit Administration.
- k. **Disadvantaged Business Enterprise (DBE)** - Any legal entity certified as defined at COMAR 21.01.02.01B(54) which is certified by the Maryland Department of Transportation under COMAR 21.11.03

- l. **eMM** – eMaryland Marketplace (see IFB Section 1.8).
- m. **Invitation for Bids (IFB)** – This Invitation for Bids solicitation issued by the MTA, Solicitation Number T-8000-0451 dated May 19, 2014, including any addenda.
- n. **Local Time** – Time in the Eastern Time Zone as observed by the State of Maryland. Unless otherwise specified, all stated times shall be Local Time, even if not expressly designated as such.
- o. **Normal State Business Hours** - Normal State business hours are 8:00 a.m. – 5:00 p.m. Monday through Friday except State Holidays, which can be found at: [www.dbm.maryland.gov](http://www.dbm.maryland.gov) – keyword: State Holidays.
- p. **Notice to Proceed (NTP)** – A written notice from the Procurement Officer that, subject to the conditions of the Contract, work under the Contract is to begin as of a specified date. The start date listed in the NTP is the Contract Commencement Date, and is the official start date of the Contract for the actual delivery of services as described in this solicitation. After Contract Commencement, additional NTPs may be issued by either the Procurement Officer or the Department Contract Manager regarding the start date for any service included within this solicitation with a delayed or non-specified implementation date.
- q. **Procurement Officer** – The State representative for the resulting Contract. The Procurement Officer is responsible for the Contract and is the only State representative who can authorize changes to the Contract. The Department may change the Procurement Officer at any time by written notice to the Contractor.
- r. **State** – The State of Maryland.
- s. **Total Bid Price** - The Bidder’s total price for services in response to this solicitation, included in the Bid in Attachment F – Bid Form, and used in determining the recommended awardee (see IFB Section 1.15).
- t. **Working Day(s)** – Same as “Business Day(s).”

**1.3 Contract Type**

The Contract resulting from this solicitation shall be a fixed price contract as defined in COMAR 21.06.02.A(2).

**1.4 Contract Duration**

- 1.4.1 The Contract that results from this solicitation shall commence as of the date the Contract is signed by the Department following any required approvals of the Contract, including approval by the Board of Public Works, if such approval is required (“Contract Award Date”).
- 1.4.2 During the Start-up Period the Contractor shall perform start-up activities such as are necessary to enable the Contractor to begin the successful performance of Contract activities as of the Contract Commencement Date. No compensation will be paid to the Contractor for any activities it performs during the Start-up Period.
- 1.4.3 As of the Contract Commencement Date as contained in a Notice to Proceed (see Section 1.2 definition), the Contractor shall perform all activities required by the Contract, including the requirements of this solicitation, for the compensation described in its Bid.
- 1.4.4 The duration of the Contract will be for the period of time from Contract Commencement Date plus 12 months for the provision of all services required by the Contract and the requirements of this solicitation.

1.4.5 The Contractor's obligations to pay invoices to subcontractors that provided services during the Contract term, as well as the audit, confidentiality, document retention, and indemnification obligations of the Contract (see Attachment A) shall survive expiration or termination of the Contract and continue in effect until all such obligations are satisfied.

## **1.5 Procurement Officer**

The sole point of contact in the State for purposes of this solicitation prior to the award of any Contract is the Procurement Officer at the address listed below:

Heidi J. Tarleton  
Procurement Officer  
Contracts Administration Division  
6 St. Paul, 7<sup>th</sup> Floor  
Baltimore, MD 21202  
Phone Number: (410) 767-8374  
Fax Number: (410) 333-0126  
E-mail: htarleton@mta.maryland.gov

The Department may change the Procurement Officer at any time by written notice. No other MTA employees should be contacted referencing this IFB. The vendor is liable for any information received from other than the procurement officer.

## **1.6 Pre-Bid Conference**

A Pre-Bid Conference (the Conference) will be held on May 28, 2014, beginning at 10:00am Local Time, at the William Donald Schaefer Building, 6 St. Paul Street, 7<sup>th</sup> Floor, Baltimore, Maryland 21202. All prospective Bidders are encouraged to attend in order to facilitate better preparation of their Bids.

The Conference will be summarized. As promptly as is feasible subsequent to the Conference, a summary of the Conference and all questions and answers known at that time will be distributed to all prospective Bidders known to have received a copy of this IFB. This summary, as well as the questions and answers, will also be posted on eMaryland Marketplace. See IFB Section 1.8.

In order to assure adequate seating and other accommodations at the Conference, please e-mail, mail, or fax to (410) 333-4810 the Pre-Bid Conference Response Form to the attention of the Procurement Officer no later than 4:00 p.m. Local Time on May 23, 2014. The Pre-Bid Conference Response Form is included as **Attachment E** to this IFB. In addition, if there is a need for sign language interpretation and/or other special accommodations due to a disability, please notify the Procurement Officer no later than 4:00 p.m. Local Time on May 23, 2014. The Department will make a reasonable effort to provide such special accommodation.

## **1.7 eMaryland Marketplace**

Each Bidder is requested to indicate its eMaryland Marketplace (eMM) vendor number in the Transmittal Letter (cover letter) submitted at the time of its Bid submission to this IFB.

eMM is an electronic commerce system administered by the Maryland Department of General Services. In addition to using the MTA website <http://mta.maryland.gov/procurements> and possibly other means for transmitting the IFB

and associated materials, the solicitation and summary of the Pre-Bid Conference, Bidder questions and the Procurement Officer's responses, addenda, and other solicitation-related information will be provided via eMM.

In order to receive a contract award, a vendor must be registered on eMM. Registration is free. Go to <https://emaryland.buyspeed.com/bsc/login.jsp>, click on "Register" to begin the process, and then follow the prompts.

## **1.8 Questions**

Written questions from prospective Bidders will be accepted by the Procurement Officer prior to the Conference. If possible and appropriate, such questions will be answered at the Conference. (No substantive question will be answered prior to the Conference.) Questions to the Procurement Officer shall be submitted via e-mail to the following e-mail address: [htarleton@mta.maryland.gov](mailto:htarleton@mta.maryland.gov). Please identify in the subject line the Solicitation Number and Title. Questions, both oral and written, will also be accepted from prospective Bidders attending the Conference. If possible and appropriate, these questions will be answered at the Conference.

Questions will also be accepted subsequent to the Conference and should be submitted to the Procurement Officer (**see above email address**) in a timely manner prior to the Bid due date. Questions are requested to be submitted by Noon on June 4, 2014. The Procurement Officer, based on the availability of time to research and communicate an answer, shall decide whether an answer can be given before the Bid due date. Time permitting, answers to all substantive questions that have not previously been answered, and are not clearly specific only to the requestor, will be distributed to all vendors that are known to have received a copy of the IFB in sufficient time for the answer to be taken into consideration in the Bid.

## **1.9 Procurement Method**

This Contract will be awarded in accordance with the Competitive Sealed Bidding method under COMAR 21.05.02.

## **1.10 Bids Due (Closing) Date and Time**

Bids, in the number and form set forth in Section 4.4 "Required Bid Submissions," must be received by the Procurement Officer at the address listed on the Key Information Summary Sheet, no later than 1:30 p.m. Local Time on June 12, 2014 in order to be considered.

Requests for extension of this time or date will not be granted. Bidders mailing Bids should allow sufficient mail delivery time to ensure timely receipt by the Procurement Officer. Except as provided in COMAR 21.05.02.10, Bids received after the due date and time listed in this section will not be considered.

Bids may be modified or withdrawn by written notice received by the Procurement Officer before the time and date set for the opening.

**Bids may not be submitted by e-mail or facsimile.**

Vendors not responding to this solicitation are requested to submit the "Notice to Vendors" form, which includes company information and the reason for not responding (e.g., too busy, cannot meet mandatory requirements, etc.). This form is located in the IFB immediately following the Title Page (page ii).

## **1.11 Multiple or Alternate Bids**

Multiple and/or alternate Bids will not be accepted.

## **1.12 Receipt, Opening and Recording of Bids**

- 1.12.1 Receipt. Upon receipt, each Bid and any timely modification(s) to a Bid shall be stored in a secure place until the time and date set for bid opening. Before Bid opening, the State may not disclose the identity of any Bidder.
- 1.12.2 Opening and Recording. Bids and timely modifications to Bids shall be opened publicly, at the time, date and place designated in the IFB. The name of each Bidder, the total Bid price, and such other information as is deemed appropriate shall be read aloud or otherwise made available.
- 1.12.3 The Bid Opening shall be 2:00 p.m. on June 12, 2014 at the William Donald Schaefer Building, 6 St. Paul Street, 7th Floor, Baltimore, Maryland 21202.

## **1.13 Confidentiality of Bids**

The Bids shall be tabulated or a Bid abstract made. The opened Bids shall be available for public inspection at a reasonable time after Bid opening, but in any case before contract award, except to the extent the Bidder designates trade secrets or other proprietary data to be confidential as set forth in this solicitation. Material so designated as confidential shall accompany the Bid and shall be readily separable from the Bid in order to facilitate public inspection of the non-confidential portion of the Bid, including the Total Bid Price.

For requests for information made under the Public Information Act (PIA), the Procurement Officer shall examine the Bids to determine the validity of any requests for nondisclosure of trade secrets and other proprietary data identified in writing. Nondisclosure is permissible only if approved by the Office of the Attorney General.

## **1.14 Award Basis**

The Contract shall be awarded to the responsible Bidder submitting a responsive Bid with the most favorable Total Bid Price (as referenced in COMAR 21.05.02.13) for providing the goods and services as specified in this IFB. The most favorable Total Bid Price will be the lowest price total on **Attachment F** - Bid Form.

## **1.15 Tie Bids**

Tie Bids will be decided pursuant to COMAR 21.05.02.14.

## **1.16 Duration of Bid**

Bids submitted in response to this IFB are irrevocable for 120 days following the closing date of the Bids. This period may be extended at the Procurement Officer's request only with the Bidder's written agreement.

## **1.17 Revisions to the IFB**

If it becomes necessary to revise this IFB before the due date for Bids, the Department shall endeavor to provide addenda to all prospective Bidders that were sent this IFB or which are otherwise known by the Procurement Officer to have obtained this IFB. In addition, addenda to the IFB will be posted on the Department's procurement web page

and through eMM. It remains the responsibility of all prospective Bidders to check all applicable websites for any addenda issued prior to the submission of Bids.

Acknowledgment of the receipt of all addenda to this IFB issued before the Bid due date shall be included in the Transmittal Letter accompanying the Bidder's Bid. Failure to acknowledge receipt of an addendum does not relieve the Bidder from complying with the terms, additions, deletions, or corrections set forth in the addendum, and may cause the Bid to be rejected as being non-responsive to the requirements of the IFB.

### **1.18 Cancellations**

The State reserves the right to cancel this IFB, or accept or reject any and all Bids, in whole or in part, received in response to this IFB.

### **1.19 Incurred Expenses**

The State will not be responsible for any costs incurred by any Bidder in preparing and submitting a Bid or in performing any other activities related to this solicitation.

### **1.20 Protest/Disputes**

Any protest or dispute related, respectively, to this solicitation or the resulting Contract shall be subject to the provisions of COMAR 21.10 (Administrative and Civil Remedies).

### **1.21 Bidder Responsibilities**

The selected Bidder shall be responsible for rendering services for which it has been selected as required by this IFB. All subcontractors shall be identified and a complete description of their role relative to the Bid shall be included in the Bidder's Bid. If applicable, subcontractors utilized in meeting the established DBE participation goal(s) for this solicitation shall be identified as provided in the appropriate Attachment(s) of this IFB (see Section 1.32 "Disadvantaged Business Enterprise Goals").

If a Bidder that seeks to perform or provide the services required by this IFB is the subsidiary of another entity, all information submitted by the Bidder, such as but not limited to, references, financial reports, or experience and documentation (e.g. insurance policies, bonds, letters of credit) used to meet minimum qualifications, if any, shall pertain exclusively to the Bidder, unless the parent organization will guarantee the performance of the subsidiary.

### **1.22 Substitution of Personnel**

If the solicitation requires that a particular individual or personnel be designated by the Bidder to work on the Contract, any substitution of personnel after the Contract has commenced must be approved in writing by the Contract Monitor prior to the substitution. If the Contractor substitutes personnel without the prior written approval of the Contract Monitor, the Contract may be terminated for default which shall be in addition to, and not in lieu of, the State's remedies under the Contract or which otherwise may be available at law or in equity.

### **1.23 Mandatory Contractual Terms**

By submitting a Bid in response to this IFB, a Bidder, if selected for award, shall be deemed to have accepted the terms and conditions of this IFB and the Contract, attached herein as **Attachment A**. Any exceptions to this IFB or

the Contract must be raised prior to Bid submission. **Changes to the solicitation, including the Bid Form or Contract, made by the Bidder may result in Bid rejection.**

#### **1.24 Bid/Proposal Affidavit**

A Bid submitted by a Bidder must be accompanied by a completed Bid/Proposal Affidavit. A copy of this Affidavit is included as **Attachment B** of this IFB.

#### **1.25 Contract Affidavit**

All Bidders are advised that if a Contract is awarded as a result of this solicitation, the successful Bidder will be required to complete a Contract Affidavit. A copy of this Affidavit is included as **Attachment C** of this IFB. This Affidavit must be provided within ten (10) Business Days of notification of proposed Contract award. This Contract Affidavit will also be required to be completed by the Contractor prior to any Contract renewals, including the exercise of any options or modifications that may extend the Contract term.

#### **1.26 Compliance with Laws/Arrearages**

By submitting a Bid in response to this IFB, the Bidder, if selected for award, agrees that it will comply with all Federal, State, and local laws applicable to its activities and obligations under the Contract.

By submitting a response to this solicitation, each Bidder represents that it is not in arrears in the payment of any obligations due and owing the State, including the payment of taxes and employee benefits, and that it shall not become so in arrears during the term of the Contract if selected for Contract award.

#### **1.27 Verification of Registration and Tax Payment**

Before a business entity can do business in the State it must be registered with the State Department of Assessments and Taxation (SDAT). SDAT is located at State Office Building, Room 803, 301 West Preston Street, Baltimore, Maryland 21201. The SDAT website is <http://www.dat.state.md.us/sdatweb/services.html>.

It is strongly recommended that any potential Bidder complete registration prior to the due date for receipt of Bids. A Bidder's failure to complete registration with SDAT shall disqualify an otherwise successful Bidder from final consideration and recommendation for Contract award.

#### **1.28 False Statements**

Bidders are advised that Md. Code Ann., State Finance and Procurement Article, § 11-205.1 provides as follows:

1.29.1 In connection with a procurement contract a person may not willfully:

- (a) Falsify, conceal, or suppress a material fact by any scheme or device;
- (b) Make a false or fraudulent statement or representation of a material fact; or
- (c) Use a false writing or document that contains a false or fraudulent statement or entry of a material fact.

1.29.2 A person may not aid or conspire with another person to commit an act under subsection (1) of this section.

- 1.29.3 A person who violates any provision of this section is guilty of a felony and on conviction is subject to a fine not exceeding \$20,000 or imprisonment not exceeding five years or both.

### **1.29 Payments by Electronic Funds Transfer**

By submitting a response to this solicitation, the Bidder/Offeror agrees to accept payments by electronic funds transfer (EFT) unless the State Comptroller's Office grants an exemption. Payment by EFT is mandatory for contracts exceeding \$100,000. The selected Bidder/Offeror shall register using the COT/GAD X-10 Vendor Electronic Funds (EFT) Registration Request Form. Any request for exemption must be submitted to the State Comptroller's Office for approval at the address specified on the COT/GAD X-10 form, must include the business identification information as stated on the form, and must include the reason for the exemption. The COT/GAD X-10 form may be downloaded from the Comptroller's website at:

[http://comptroller.marylandtaxes.com/Government\\_Services/State\\_Accounting\\_Information/Static\\_Files/APM/gadx-10.pdf](http://comptroller.marylandtaxes.com/Government_Services/State_Accounting_Information/Static_Files/APM/gadx-10.pdf)

### **1.30 Prompt Payment Policy**

This procurement and the Contract(s) to be awarded pursuant to this solicitation are subject to the Prompt Payment Policy Directive issued by the Governor's Office of Minority Affairs (GOMA) and dated August 1, 2008. Promulgated pursuant to Md. Code Ann., State Finance and Procurement Article, §§ 11-201, 13-205(a), and Title 14, Subtitle 3, and COMAR 21.01.01.03 and 21.11.03.01, the Directive seeks to ensure the prompt payment of all subcontractors on non-construction procurement contracts. The Contractor must comply with the prompt payment requirements outlined in the Contract, Section 31 "Prompt Payment" (see **Attachment A**). Additional information is available on GOMA's website at:

[http://www.mdminoritybusiness.com/documents/PROMPTPAYMENTFAQs\\_000.pdf](http://www.mdminoritybusiness.com/documents/PROMPTPAYMENTFAQs_000.pdf)

### **1.31 Electronic Procurements Authorized**

- A. Under COMAR 21.03.05, unless otherwise prohibited by law, the Department may conduct procurement transactions by electronic means, including the solicitation, bidding, award, execution, and administration of a contract, as provided in Md. Code Ann., Maryland Uniform Electronic Transactions Act, Commercial Law Article, Title 21.
- B. Participation in the solicitation process on a procurement contract for which electronic means has been authorized shall constitute consent by the Bidder/Offeror to conduct by electronic means all elements of the procurement of that Contract which are specifically authorized under the solicitation or the Contract for protests.
- C. "Electronic means" refers to exchanges or communications using electronic, digital, magnetic, wireless, optical, electromagnetic, or other means of electronically conducting transactions. Electronic means includes facsimile, e-mail, internet-based communications, electronic funds transfer, specific electronic bidding platforms (e.g., <https://emaryland.buyspeed.com/bs/>), and electronic data interchange.
- D. In addition to specific electronic transactions specifically authorized in other sections of this solicitation (e.g., § 1.30 "Payments by Electronic Funds Transfer") and subject to the exclusions noted in section E of this subsection, the following transactions are authorized to be conducted by electronic means on the terms described:

1. The Procurement Officer may conduct the procurement using eMM, e-mail, or facsimile to issue:
  - (a) the solicitation (e.g., the IFB/RFP);
  - (b) any amendments;
  - (c) pre-Bid/Proposal conference documents;
  - (d) questions and responses;
  - (e) communications regarding the solicitation or Bid/Proposal to any Bidder/Offeror or potential Bidder/Offeror;
  - (f) notices of award selection or non-selection; and
  - (g) the Procurement Officer's decision on any Bid protest or Contract claim.
2. A Bidder/Offeror or potential Bidder/Offeror may use e-mail or facsimile to:
  - (a) ask questions regarding the solicitation;
  - (b) reply to any material received from the Procurement Officer by electronic means that includes a Procurement Officer's request or direction to reply by e-mail or facsimile, but only on the terms specifically approved and directed by the Procurement Officer;
  - (c) submit a "No Bid/Proposal Response" to the solicitation.
3. The Procurement Officer, the Contract Monitor, and the Contractor may conduct day-to-day Contract administration, except as outlined in Section E of this subsection utilizing e-mail, facsimile, or other electronic means if authorized by the Procurement Officer or Contract Monitor.

E. The following transactions related to this procurement and any Contract awarded pursuant to it are *not authorized* to be conducted by electronic means:

1. submission of initial Bids or Proposals;
2. filing of Bid Protests;
3. filing of Contract Claims;
4. submission of documents determined by the Department to require original signatures (e.g., Contract execution, Contract modifications, etc.); or
5. any transaction, submission, or communication where the Procurement Officer has specifically directed that a response from the Contractor or Bidder/Offeror be provided in writing or hard copy.

F. Any facsimile or e-mail transmission is only authorized to the facsimile numbers or e-mail addresses for the identified person as provided in the solicitation, the Contract, or in the direction from the Procurement Officer or Contract Monitor.

### **1.32 Disadvantaged Business Enterprise Goal and Subgoals**

The contract vendor must agree to abide by the requirements of 49 CFR 26 as amended, regarding minority (disadvantaged) business enterprises in USDOT programs. Specifically, and not by way of limitation, a copy of 49 CFR section 26.49, together with a Primary Transit Vehicle Manufacturer (TVM)/Disadvantage Business Enterprise (DBE) Compliance certificate (**Attachment D**) is included and is made a part of the Contract. Failure to carry out the requirements set forth in 49 CFR, section 26.49 shall constitute a breach of Contract and, after the notification of the US DOT, may result in termination of the contract by the State or such remedy as the State deems appropriate.

### **1.33 Performance Guarantees**

To ensure performance in accordance with the terms and conditions of the Contract and to protect the MTA and its patrons in the event of the Contractor's default on its contractual obligations, the Contractor shall be required

to submit a Performance Guarantee to the MTA prior to commencement of the contract. The Guarantee shall equal **five percent (5%)** of the total estimated contract price and be in **only** one of the forms specified below.

- a. A performance bond shall be in the format specified in **Attachment K**. The completed form shall be delivered to the MTA within ten (10) business days of receiving notification of recommendation for Contract award. The following surety bond qualifications shall apply:
  1. Bonds shall be written through surety insurers authorized to do business in the State of Maryland as surety, with a rating of at least “BV” as to management and financial strength according to the latest edition of Best’s Insurance Guide, published by A.M. Best Company.
  2. Surety insurers shall be listed in the latest Circular 570 of the U.S. Department of the Treasury entitled “Surety Companies Acceptable on Federal Bonds,” published annually. The bond amount shall not exceed the underwriting limitations as show in this circular.
  3. Surety Bonds guaranteed through the U.S. Government Small Business Administration or Contractors Training and Development, Inc. will also be acceptable.
  4. The attorney-in-fact or other officer who signs for a contract bond for a surety company must file with such bond a certified copy of their power of attorney authorizing him or her to do so. The contract bond must be countersigned by the surety’s resident Maryland Agent.
- b. A pledge of U.S. Government Securities or cash held in escrow by a Maryland bank in the amount of **5%** of the total, **one**-year estimated contract ceiling price to be held by a Maryland bank in escrow for the term of the contract and any extensions thereto. The form of the pledge must allow the MTA to direct the bank to liquidate the securities and withdraw funds from the escrow account upon presentation to the bank of a certification from the MTA Administrator that the Contractor has been issued a notice of termination for default in accordance with the terms of the contract. No countersignature or approval of the Contractor shall be required. The pledge must be signed and notarized by authorized officials of both the Contractor and the bank.
- c. An irrevocable Letter of Credit (LOC) issued by a Maryland financial institution in a form acceptable to the MTA in the amount of **5%** of the total, **one**-year estimated contract ceiling price. The form of the LOC must allow the MTA to draw upon the funds upon presentation to the bank of a certification from the MTA Administrator that the Contractor has been issued a notice of termination for default in accordance with the terms of the contract. No countersignature or approval of the Contractor shall be required. The LOC must be signed and notarized by authorized officials of both the Contractor and the bank.
- d. Retaining of a portion of the contractor’s gross billing amount until the termination of the contract or when the retainage equals **5%** of the total, **one**-year estimated contract ceiling price, whichever occurs first. The portion retained shall be **5%** of each monthly billings for all billings covering the first year of services. If the contract is terminated for default, the retainage shall be forfeited. Forfeiture shall not be construed as a waiver of any other remedies the MTA is entitled to exercise under the contract or at law.

### **1.34 Bid Bond**

Each bid exceeding \$100,000 must be accompanied by a Bid Bond (**Attachment L**) in the amount of five percent (5%) of the Bid Price. Bid, payment, and performance security may be in the form of: (1) a bond executed by a surety company authorized to do business in the State; (2) a bond executed by an individual surety that meets certain criteria; (3) another form of security required by State or federal law; or (4) another form of security satisfactory to the unit awarding the contract. Sections 13-207, 13-216, 17-104 of the State Finance and Procurement Article, Annotated Code of Maryland. Attachment L must be submitted with the Bid/Proposal.

### **1.35 Federal Funding Acknowledgement**

- 1.35.1 There are programmatic conditions that apply to this Contract due to Federal funding. (see **Attachment G**).
- 1.35.2 This Contract contains federal funds. The conditions that apply to all federal funds awarded by the Department are contained in Federal Funds **Attachment G**. Any additional conditions that apply to this particular federally-funded contract are contained as supplements to Federal Funds **Attachment G** and Bidders/Offerors are to complete and submit these Attachments with their Bid/Proposal as instructed in the Attachments. Acceptance of this agreement indicates the Bidder/Offeror's intent to comply with all conditions, which are part of this Contract.

### **1.36 Conflict of Interest Affidavit and Disclosure**

Bidders/Offerors shall complete and sign the Conflict of Interest Affidavit and Disclosure (**Attachment H**) and submit it with their Bid/Proposal. All Bidders/Offerors are advised that if a Contract is awarded as a result of this solicitation, the successful Contractor's personnel who perform or control work under this Contract and each of the participating subcontractor personnel who perform or control work under this Contract shall be required to complete agreements substantially similar to **Attachment H** Conflict of Interest Affidavit and Disclosure. For policies and procedures applying specifically to Conflict of Interests, the Contract is governed by COMAR 21.05.08.08.

### **1.37 Non-Disclosure Agreement**

All Bidders/Offerors are advised that this solicitation and any resultant Contract(s) are subject to the terms of the Non-Disclosure Agreement (NDA) contained in this solicitation as **Attachment J**. This Agreement must be provided within five (5) Business Days of notification of proposed Contract award; however, to expedite processing, it is suggested that this document be completed and submitted with the Bid/Proposal.

### **1.38 Non-visual Access**

This solicitation does not contain Information Technology (IT) provisions requiring Non-visual Access.

### **1.39 Mercury and Products that Contain Mercury**

All products or equipment provided pursuant to this solicitation shall be mercury-free products. The Bidder/Offeror must submit a Mercury Affidavit in the form of **Attachment I** with its Bid/Proposal.

#### **1.40 Location of the Performance of Services Disclosure**

The Bidder/Offeror is required to complete the Location of the Performance of Services Disclosure. A copy of this Disclosure is included as **Attachment M**. The Disclosure must be provided with the Bid/Proposal.

#### **1.41 Department of Human Resources (DHR) Hiring Agreement**

This solicitation does not require a DHR Hiring Agreement.

#### **1.42 Buy America Requirements**

This contract is subject to Section 165, “buy America”, of the Surface Transportation Assistant Act of 1982, U.S. Public Law 197-424, and regulations and/or guidance implementing this statutory provision issued by the Urban Mass Transportation Administration of the U.S. Department of Transportation. The contract is further subject to the Buy American Steel requirements of Chapter 02 of subtitle 11 of the Code of Maryland Regulations, Title 21, State Procurement Regulations.

The Buy America Certificate (**Attachment N**) must be signed and returned with the Bid.

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## **SECTION 2 – MINIMUM QUALIFICATIONS**

### **2.1 Bidder Minimum Qualifications**

There are no Bidder Minimum Qualifications for this procurement.

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## **SECTION 3 – SPECIFICATIONS**

### **3.1 Background and Purpose**

The Maryland Transit Administration's (MTA) Core Bus service operates 52 bus routes with 599 peak vehicles and a total fleet, including contingency vehicles, of 775 buses. Since 2006, the Core Bus service annual unlinked passenger trips have increased by 14.2 percent. On average unlinked passenger trips have been growing at 1.6 percent per year. With this ridership growth, the peak vehicle requirement is expected to increase to 667 vehicles by 2020.

The State is issuing this solicitation for the purposes of purchasing 41 hybrid buses to replacement older buses and ensure safe and reliable service.

### **3.2 Specification – Requirements**

#### 3.2.1 Scope of Work

- A. See Attachment R for detailed technical specifications and requirements.

#### 3.2.2 Delivery Schedule

- A. First bus to arrive six (6) months or less after Notice to Proceed.
- B. Last bus must be received one (1) year after Notice to Proceed.
- C. MTA will accept an accelerated production schedule.

#### 3.2.3 Liquidated Damages

- A. It is mutually understood and agreed by and between the parties to the Contract that time is of the essence with respect to completion of the Work and that in case of any failure on the part of the Contractor to complete the Work within the time specified in Section 3.2.2 or any extension thereof, MTA will be damaged thereby. The amount of said damages, being difficult if not impossible of definite ascertainment and proof, it is hereby agreed that the amount of such damages due MTA shall be fixed at \$150.00 per calendar day per bus not delivered in substantially as good condition as inspected by MTA at the time released for shipment.
- B. The Contractor hereby agrees to pay the aforesaid amounts as fixed, agreed and liquidated damages, and not by way of penalty, to MTA and further authorizes MTA to deduct the amount of the damages from money due the Contractor under the Contract, computed as aforesaid. If the monies due the Contractor are insufficient or no monies are due the Contractor, the Contractor shall pay MTA the difference or the entire amount, whichever may be the case, within thirty (30) calendar days after receipt of a written demand by the Contracting Officer.
- C. The payment of aforesaid fixed, agreed and liquidated damages shall be in lieu of any damages for any loss of profit, loss of revenue, loss of use, or for any other direct, indirect, special or consequential losses or damages of any kind whatsoever that may be suffered by MTA arising at any time from the failure of the Contractor to fulfill the obligations referenced in this clause in a timely manner.
- D. MTA specifically reserves the right, without limitation of any other rights, to terminate the Contract in accordance with "Termination of Contract".

### 3.2.4 Parts Availability Guarantee

- A. The Contractor hereby guarantees to provide, within reasonable periods of time, the spare parts, software and all equipment necessary to maintain and repair the buses supplied under this Contract for a period of at least fifteen (15) years after the date of award. Parts will be interchangeable with the original equipment and be manufactured in accordance with the quality assurance provisions of this Contract. Prices will not exceed the Contractor's then current published catalog prices.
- B. Where the parts ordered by MTA are not received within two (2) working days of the agreed upon time/date and a bus procured under this Contract is out-of-service due to the lack of said ordered parts, then the Contractor will provide MTA, within eight (8) hours of MTA's verbal or written request, the original suppliers' and/or manufacturers' parts numbers, company names, addresses, telephone numbers and contract persons' names for all of the specific parts not received by MTA.
- C. Where the Contractor fails to honor this parts guarantee or parts ordered by MTA are not received within thirty (30) days of the agreed upon delivery date, then the Contractor will provide to MTA, within seven (7) days of MTA's verbal or written request, the design and manufacturing documentation for those parts manufactured by the Contractor and the original suppliers' and/or manufacturers' parts numbers, company names, addresses, telephone numbers and contact persons' names for all of the specific parts not received by MTA. Contractor's design and manufacturing documentation provided to MTA will be for its sole use in regard to the buses procured under this Contract and for no other purpose.

### 3.2.5 Progress Payments

- A. All payments shall be made as provided herein, less any amount to be withheld as provided below and less any amounts for liquidated damages in accordance with "Liquidated Damages for Late Delivery of the Bus."
- B. The Administration shall make progress payments to the Contractor for buses in accordance with the performance milestones set forth below.
- C. Title to material included in any progress payment request shall pass to the Administration upon payment by the Administration. Said title shall be free of all encumbrances. However, such transfer of title shall not relieve the Contractor of its responsibility for the furnishing, installation, fabrication or inclusion of said materials as a deliverable element of buses procured in accordance with the requirements of the Contract.
- D. The performance milestones and payment limits shall be as follows:
  - 1. The Administration shall make payments for buses at Seventy-Five percent (75%) of the unit price(s) minus retention, for each bus itemized in the price schedule when the Administration's inspector has approved shipment of said bus(es) from the Contractor's plant.
  - 2. The Administration shall make payments for buses at Twenty-Five percent (25%) of the unit price(s) minus retention, for each bus itemized in the price schedule upon the delivery and acceptance of each bus.
  - 3. The Administration shall make payments for equipment at the unit prices, itemized in the price schedule upon the delivery and acceptance of said spare parts and/or equipment.

Title for equipment shall transfer to the Administration upon payment. Said title shall be free of all encumbrances.

4. The Administration shall make a final payment of the total Contract price plus any retention amount withheld, upon receipt of a proper invoice and the following:
    - Delivery and acceptance of all Contract deliverables, including manuals and other documentation required by the Contract.
    - Contractor provision of any certifications as required by law and/or regulations.
    - Completion of post-delivery audits required under the Contract.
- E. Progress payment requests shall be accompanied by a certification, or affidavit, signed by the Contractor's officer certifying that the Work covered by the progress payment requested has been completed. The Administration reserves the rights of inspection and audit to verify said progress as provided in "Maintenance of Records; Access by Administration; Right to Audit Records."

**3.3 Security Requirements**

**3.3.1 Employee Identification**

- (a) Each person who is an employee or agent of the Contractor or subcontractor shall display his or her company ID badge at all times while on State premises. Upon request of authorized State personnel, each such employee or agent shall provide additional photo identification.
- (b) At all times at any facility, the Contractor's personnel shall cooperate with State site requirements that include but are not limited to being prepared to be escorted at all times, providing information for badge issuance, and wearing the badge in a visual location at all times.

**3.3.2 Information Technology**

- (a) Contractors shall comply with and adhere to the State IT Security Policy and Standards. These policies may be revised from time to time and the Contractor shall comply with all such revisions. Updated and revised versions of the State IT Policy and Standards are available online at: [www.doit.maryland.gov](http://www.doit.maryland.gov) – keyword: Security Policy.
- (a) The Contractor shall not connect any of its own equipment to a State LAN/WAN without prior written approval by the State. The Contractor shall complete any necessary paperwork as directed and coordinated with the Contract Monitor to obtain approval by the State to connect Contractor-owned equipment to a State LAN/WAN.

**3.4 Insurance Requirements**

**3.4.1 Insurance Types**

[ X ] **Commercial General Liability Insurance** with minimum limits of \$5,000,000 per occurrence, written on an occurrence form. When the minimum contract amounts can only be met when applying the umbrella/excess policy, the umbrella/excess policy must follow form of the underlying policy and be extended to "drop down" to become primary in the event the primary limits are reduced or aggregate limits are exhausted. The coverage shall include:

- [X] Personal and Advertising Injury coverage,
- [X] Products and Completed Operations coverage,
- [ ] Independent Contractors coverage,
- [ ] Terrorism coverage,

- XCU coverage (explosion, collapse, and underground hazards)
- Contractual liability exclusion (applicable to work to be performed within 50 feet of railroad tracks) must be removed.
- Additional Insured Endorsement naming MTA.
- Workers' Compensation Insurance** meeting the statutory requirements of the jurisdiction where the work will be performed, including Employer's Liability coverage with minimum limits of \$1,000,000 each accident or disease.
- Longshore & Harbor Workers' Compensation Act Endorsement (work performed on or over navigable waterways) to cover contractor's employees for wages, transportation, maintenance and cure, in accordance with applicable laws.
- Maritime Coverage Endorsement (Jones Act) for work upon navigable waterways and barges, tug boats, and all other vessels on the ocean and all intracoastal rivers and canals, covering drivers, divers, and underwater personnel, seamen, masters and members of a crew, providing remedy for damage or injury, in accordance with applicable laws.
- Business Automobile Liability Insurance** with minimum limits of \$1,000,000 per occurrence covering contractor against claims for bodily injury and property damage arising out of the ownership, maintenance or use of any owned, hired, or non-owned motor vehicle. MTA shall be added as an additional insured on the policy.
- MCS-90 Endorsement for work involving the transportation or disposal of any hazardous material or waste off of the jobsite. If the MCS-90 Endorsement is required, minimum auto liability limits of \$5,000,000 per occurrence are also required.**
- Railroad Protective Liability Insurance** (hereinafter "RRPL") issued to MTA as the Named Insured with minimum limits of \$2,000,000 per occurrence, \$6,000,000 in the aggregate and covering the liability of all Permitted Parties for the work to be performed within fifty (50) feet (on, above, adjacent to or underneath) of MTA's railroad property for any personal injuries or deaths or any damage to the property, equipment and facilities caused by the activities of any Permitted Party resulting from performance of the work which is the subject of this Permit. THE ORIGINAL POLICY SHALL BE FORWARDED TO MTA.
- Contractor's Pollution Liability Insurance** with minimum limits of \$5,000,000 per occurrence for work involving environmentally regulated substances or hazardous material exposures, including but not limited to handling, transporting or disposing of any hazardous substances and/or environmentally regulated materials and any sudden and/or non-sudden pollution or impairment of the environment, including cleanup costs and defense. This insurance may be supplied by the subcontractor performing the work if the Contractor is not performing any of the relevant work and providing that MTA and the Contractor are named as additional insureds on the subcontractor's policy. In the event that the Contractor or its subcontractor transports hazardous substances or any other environmentally regulated substance that requires a governmentally regulated manifest, the MCS-90 Endorsements shall be attached to the Contractor's (or subcontractor's) auto liability policy.
- Pollution Legal Liability Insurance** (Non-Owned Disposal Site Coverage) with minimum limits of \$5,000,000 per occurrence. Coverage may be maintained in one of the following ways:
- A standalone policy;
  - Non-Owned Disposal Site Endorsement on Contractor's Pollution Liability policy naming MTA as an additional insured; or

- Contractor may designate the disposal site and provide a COI from the disposal facility naming Contractor and MTA as additional insureds.

[ ] **Professional Liability Insurance (Errors and Omissions).** The Contractor shall provide minimum limits of \$3,000,000 to cover liability resulting from any error or omission in the performance of professional services under this Contract. .

### 3.4.2 Insurance Company Qualifications

3.4.2.1 The insurance required in this Article of this contract must be issued by companies that are:

- A. Acceptable to the MTA
- B. Licensed to do business in the State of Maryland.

### 3.4.3 Policy Requirements

3.4.3.1 The recommended Contractor awardee shall deliver to the MTA representative within 10 days of notification of proposed contract award an accurate and true Certificates of Insurance that show that:

3.4.3.2 The Contractor has procured coverage stated in this Article of this contract.

3.4.3.3 The Maryland Department of Transportation, the State of Maryland and the MTA has been named as an additional insured.

3.4.3.4 The policies will not be canceled, terminated or modified without 60 days prior written notice to the Administration. Certificates of Insurance are acceptable in lieu of true copies of the policies if the policy writer notes on the Certificate, or through attachment to the Certificate, all policy exclusions.

3.4.3.5 The Contractor shall require that any subcontractors providing services under this Contract obtain and maintain similar levels of insurance and shall provide the Contract Monitor with the same documentation as is required of the Contractor.

## 3.4 Problem Escalation Procedure

3.5.1 The Contractor must provide and maintain a Problem Escalation Procedure (PEP) for both routine and emergency situations. The PEP must state how the Contractor will address problem situations as they occur during the performance of the Contract, especially problems that are not resolved to the satisfaction of the State within appropriate timeframes.

The Contractor shall provide contact information to the Contract Monitor, as well as to other State personnel, as directed should the Contract Monitor not be available.

3.5.2 The Contractor must provide the PEP no later than ten (10) Business Days after notice of Contract award or after the date of the Notice to Proceed, whichever is earlier. The PEP, including any revisions thereto, must also be provided within ten (10) Business Days after the start of each Contract year and within ten (10) Business Days after any change in circumstance which changes the PEP. The PEP shall detail how problems with work under the Contract will be escalated in order to resolve any issues in a timely manner. The PEP shall include:

- The process for establishing the existence of a problem;

- The maximum duration that a problem may remain unresolved at each level in the Contractor's organization before automatically escalating the problem to a higher level for resolution;
- Circumstances in which the escalation will occur in less than the normal timeframe;
- The nature of feedback on resolution progress, including the frequency of feedback to be provided to the State;
- Identification of, and contact information for, progressively higher levels of personnel in the Contractor's organization who would become involved in resolving a problem;
- Contact information for persons responsible for resolving issues after normal business hours (e.g., evenings, weekends, holidays, etc.) and on an emergency basis; and
- A process for updating and notifying the Contract Monitor of any changes to the PEP.

Nothing in this section shall be construed to limit any rights of the Contract Monitor or the State which may be allowed by the Contract or applicable law.

## **3.5 Invoicing**

### **3.6.1 General**

- (a) All invoices for services shall be signed by the Contractor and submitted to the Contract Monitor. All invoices shall include the following information:

- Contractor name;
- Remittance address;
- Federal taxpayer identification number (or if sole proprietorship, the individual's social security number);
- Invoice period;
- Invoice date;
- Invoice number
- State assigned Contract number;
- State assigned (Blanket) Purchase Order number(s);
- Goods or services provided; and
- Amount due.

Invoices submitted without the required information cannot be processed for payment until the Contractor provides the required information.

- (b) The Department reserves the right to reduce or withhold Contract payment in the event the Contractor does not provide the Department with all required deliverables within the time frame specified in the Contract or in the event that the Contractor otherwise materially breaches the terms and conditions of the Contract until such time as the Contractor brings itself into full compliance with the Contract. Any action on the part of the Department, or dispute of action by the Contractor, shall be in accordance with the provisions of Md. Code Ann., State Finance and Procurement Article §§ 15-215 through 15-223 and with COMAR 21.10.02.

### **3.6.2 Invoice Submission Schedule**

The Contractor shall submit invoices by the 15<sup>th</sup> of the month following the month in which services were performed.

### **3.6 DBE Reports**

If this solicitation includes a DBE Goal (see Section 1.32), the awarded Contractor will be provided its DBE Monthly Reports and reporting requirements from an Office of Fair Practices representative within ten (10) days of notice to proceed.

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## **SECTION 4 – BID FORMAT**

### **4.1 One Part Submission**

Bidders shall submit with their Bid all Minimum Qualification documentation required (see Section 2), and all Required Bid Submissions (see Section 4.4) in a single sealed package/envelope.

### **4.2 Labeling**

Each Bidder is required to label the sealed Bid. The Bid shall bear the IFB title and number, name and address of the Bidder, and closing date and time for receipt of the Bids.

### **4.3 Bid Price Form**

The Bid shall contain all price information in the format specified on the Bid Form (**Attachment F**). Complete the Bid Form only as provided in the Bid Pricing Instructions. Do not amend, alter, or leave blank any items on the Bid Form or include additional clarifying or contingent language on or attached to the Bid Form. If option years are included, Bidders must submit Bids for each option year. Failure to adhere to any of these instructions may result in the Bid being determined to be non-responsive and rejected by the Department.

### **4.4 Required Bid Submissions**

Bidders shall include the following with their Bid:

#### **4.4.1 Transmittal Letter:**

A Transmittal Letter shall accompany the Bid. The purpose of this letter is to transmit the Bid and acknowledge the receipt of any addenda. The Transmittal Letter should be brief and signed by an individual who is authorized to commit the Bidder to the services and requirements as stated in this IFB. The Transmittal Letter should include the following:

- Name and address of the Bidder;
- Name, title, e-mail address, and telephone number of primary contact for the Bidder;
- Solicitation Title and Solicitation Number that the Bid is in response to;
- Signature, typed name, and title of an individual authorized to commit the Bidder to its Bid;
- Federal Employer Identification Number (FEIN) of the Bidder, or if a single individual, that individual's Social Security Number (SSN);
- Bidder's eMM number;
- Bidder's MBE certification number (if applicable);
- Acceptance of all State IFB and Contract terms and conditions (see Section 1.24); and
- Acknowledgement of all addenda to this IFB.

Any information which is claimed to be confidential is to be noted by reference and included after the Transmittal Letter. An explanation for each claim of confidentiality shall be included (see Section 1.14 "Confidentiality of Bids").

#### 4.4.2 **Minimum Qualifications Documentation:**

The Bidder shall submit any Minimum Qualifications documentation that may be required, as set forth in Section 2 “Bidder Minimum Qualifications.”

#### 4.4.3 **Completed Required Attachments:** Submit three (3) copies of each with original signatures:

- a. Completed Bid/Proposal Affidavit (**Attachment B**).
- b. Completed Certification of TVM/DBE Compliance (**Attachment D**).
- c. Completed Bid Form (**Attachment F**).
- d. Completed Federal Funding Requirements (**Attachment G**).
- e. Completed Conflict of Interest Affidavit and Disclosure (**Attachment H**).
- f. Completed Mercury Affidavit (**Attachment I**).
- g. Completed Non-Disclosure Agreement (**Attachment J**).
- h. Completed Bid Bond (**Attachment L**).
- i. Completed Location of Performance of Services Disclosure (**Attachment M**).
- j. Completed Buy America Certificate (**Attachment N**).
- k. Completed Bus Testing Certification (**Attachment O**).

#### 4.4.4 **References:**

At least three (3) references are requested from customers who are capable of documenting the Bidder’s ability to provide the services specified in this IFB. References used to meet any Bidder Minimum Qualifications (see Section 2) may be used to meet this request. Each reference shall be from a client for whom the Bidder has provided services within the past five (5) years and shall include the following information:

- a. Name of client organization;
- b. Name, title, telephone number, and e-mail address, if available, of point of contact for client organization; and
- c. Value, type, duration, and description of services provided.

The Department reserves the right to request additional references or utilize references not provided by a Bidder.

#### 4.4.5 **List of Current or Prior State Contracts:**

Provide a list of all contracts with any entity of the State of Maryland for which the Bidder is currently performing services or for which services have been completed within the last five (5) years. For each identified contract, the Bidder is to provide:

- a. The State contracting entity;
- b. A brief description of the services/goods provided;
- c. The dollar value of the contract;
- d. The term of the contract;
- e. The State employee contact person (name, title, telephone number, and, if possible, e-mail address); and
- f. Whether the contract was terminated before the end of the term specified in the original contract, including whether any available renewal option was not exercised.

Information obtained regarding the Bidder’s level of performance on State contracts will be considered as part of the responsibility determination by the Procurement Officer.

#### 4.4.6 **Financial Capabilities:**

The Bidder shall include Financial Statements, preferably a Profit and Loss (P&L) statement and a Balance Sheet, for the last two (2) years (independently audited preferred).

#### 4.4.7 **Certificate of Insurance:**

The Bidder shall provide a copy of the Bidder's current certificate of insurance. The recommended awardee must provide a certificate of insurance with the prescribed limits set forth in Section 3.4 "Insurance Requirements," naming the State as an additional insured if required, within five (5) Business Days from notification by the Procurement Officer that the Bidder has been determined to be the apparent awardee.

#### 4.4.8 **Subcontractors:**

The Bidder shall provide a complete list of all subcontractors that will work on the Contract if the Bidder receives an award, including those utilized in meeting the MBE and/or VSBE subcontracting goal, if applicable. This list shall include a full description of the duties each subcontractor will perform.

#### 4.4.9 **Legal Action Summary:**

This summary shall include:

- i. A statement as to whether there are any outstanding legal actions or potential claims against the Bidder and a brief description of any action;
- ii. A brief description of any settled or closed legal actions or claims against the Bidder over the past five (5) years;
- iii. A description of any judgments against the Bidder within the past five (5) years, including the case name, number court, and what the final ruling or determination was from the court; and
- iv. In instances where litigation is on-going and the Bidder has been directed not to disclose information by the court, provide the name of the judge and location of the court.

### **4.5 Reciprocal Preference**

Although Maryland law does not authorize procuring agencies to favor resident Bidders in awarding procurement contracts, many other states do grant their resident businesses preferences over Maryland contractors. Therefore, COMAR 21.05.01.04 requires that procuring units apply a reciprocal preference under the following conditions:

- The most advantageous offer is from a responsible Bidder whose headquarters, principal base of operations, or principal site (that will primarily provide the services required under this IFB) is in another state.
- The other state gives a preference to its resident businesses through law, policy, or practice; and
- The preference does not conflict with a Federal law or grant affecting the procurement Contract.

The preference given shall be identical to the preference that the other state, through law, policy, or practice gives to its resident businesses.

### **4.6 Delivery**

Bidders may either mail or hand-deliver Bids.

- 4.6.1 For U.S. Postal Service deliveries, any bid that has been received at the appropriate mail room, or typical place of mail receipt for the respective procuring unit by the time and date listed in the IFB will be deemed to be timely. If a Bidder chooses to use the U.S. Postal Service for delivery, the Department recommends that it use Express Mail, Priority Mail, or Certified Mail only as these are the only forms for which both the date and time of receipt can be verified by the Department. A Bidder using first class mail will not be able to prove a timely delivery at the mailroom and it could take several days for an item sent by first class mail to make its way by normal internal mail to the procuring unit.
- 4.6.2 Hand-delivery includes delivery by commercial carrier acting as agent for the Bidder. For any type of direct (non-mail) delivery, Bidders are advised to secure a dated, signed, and time-stamped (or otherwise indicated) receipt of delivery.

#### **4.7 Documents Required upon Notice of Recommendation for Contract Award**

Upon receipt of a Notification of Recommendation for Contract Award, the following documents shall be completed and submitted by the recommended awardee within ten (10) Business Days, unless noted otherwise. Submit three (3) copies of each with original signatures.

- a. signed Contract (**Attachment A**),
- b. completed Contract Affidavit (**Attachment C**),
- c. completed Performance Bond (**Attachment K**) \*see Section 1.33, and
- d. copy of a current Certificate of Insurance with the prescribed limits set forth in Section 3.4 “Insurance Requirements,” naming the State as an additional insured, if applicable; \*see Section 3.4.

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## **IFB ATTACHMENTS**

### **ATTACHMENT A – Contract**

This is the sample contract used by the Department. It is provided with the IFB for informational purposes and is not required to be submitted at Bid submission time. Upon notification of recommendation for award, a completed contract will be sent to the recommended awardee for signature. The recommended awardee must return to the Procurement Officer three (3) executed copies of the Contract within ten (10) Business days after receipt. Upon Contract award, a fully-executed copy will be sent to the Contractor.

### **ATTACHMENT B – Bid/Proposal Affidavit**

This Attachment must be completed and submitted with the Bid.

### **ATTACHMENT C – Contract Affidavit**

This Attachment must be completed and submitted by the recommended awardee to the Procurement Officer within ten (10) Business Days of receiving notification of recommendation for award.

### **ATTACHMENT D – Transit Vehicle Manufacturer (TVM)/Disadvantaged Business Enterprise (DBE) Certificate**

If required (see Section 1.32), this Attachment must be completed and submitted with the Bid.

### **ATTACHMENT E – Pre-Bid Conference Response Form**

It is requested that this form be completed and submitted as described in Section 1.6 by those potential Bidders that plan on attending the Pre-Bid Conference.

### **ATTACHMENT F – Bid Form Instructions and Bid Form**

The Bid Form must be completed and submitted with the Bid.

### **ATTACHMENT G – Federal Funding Requirements**

If required (see Section 1.35), this Attachment must be completed and submitted with the Bid.

### **ATTACHMENT H – Conflict of Interest Affidavit and Disclosure**

If required (see Section 1.36), this Attachment must be completed and submitted with the Bid.

### **ATTACHMENT I – Mercury Affidavit**

If required (see Section 1.39), this Attachment must be completed and submitted with the Bid.

### **ATTACHMENT J – Non-Disclosure Agreement**

If required (see Section 1.37), this Attachment must be completed and submitted with the Bid.

### **ATTACHMENT K – Performance Bond**

If required (see Section 1.33), this Attachment is to be completed and submitted within ten (10) Business days of receiving notification of recommendation for award.

### **ATTACHMENT L – Bid Bond**

If required (see Section 1.34), this Attachment must be completed and submitted the Bid.

### **ATTACHMENT M – Location of Performance of Services Disclosure**

If required (see Section 1.40), this Attachment must be completed and submitted the Bid.

### **ATTACHMENT N – Buy America Certificate**

If required (see Section 1.42), this Attachment must be completed and submitted the Bid.

**ATTACHMENT O – Bus Testing Certification**

This Attachment must be completed and submitted the Bid.

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## ATTACHMENT A – CONTRACT

### (CONTRACT TITLE)

THIS CONTRACT (the “Contract”) is made this (“X<sup>th</sup>”) day of (month), (year) by and between (Contractor’s name) and the STATE OF MARYLAND, acting through the Maryland Transit Administration.

In consideration of the promises and the covenants herein contained, the parties agree as follows:

#### 1. Definitions

In this Contract, the following words have the meanings indicated:

- 1.1 “Bid” means the Contractor’s Bid dated (Bid date).
- 1.2 “COMAR” means Code of Maryland Regulations.
- 1.3 “Contract Monitor” means the Department employee identified in Section 1.6 of the IFB as the Contract Monitor.
- 1.4 “Contractor” means (Contractor’s name) whose principal business address is (Contractor’s primary address) and whose principal office in Maryland is (Contractor’s local address).
- 1.5 “Department” means the Maryland Transit Administration.
- 1.6 “IFB” means the Invitation for Bids for (solicitation title) Solicitation # (solicitation number), and any addenda thereto issued in writing by the State.
- 1.7 “Procurement Officer” means the Department employee identified in Section 1.5 of the IFB as the Procurement Officer.
- 1.8 “State” means the State of Maryland.

#### 2. Scope of Contract

- 2.1 The Contractor shall provide deliverables, programs, goods, and services specific to the Contract awarded in accordance with Exhibits A-C listed in this section and incorporated as part of this Contract. If there is any conflict between this Contract and the Exhibits, the terms of the Contract shall govern. If there is any conflict among the Exhibits, the following order of precedence shall determine the prevailing provision:
  - Exhibit A - The Contract
  - Exhibit B - The Invitation for Bid (IFB) with addenda(s)
  - Exhibit C - The Bid
- 2.2 The Procurement Officer may, at any time, by written order, make changes in the work within the general scope of the Contract or the IFB. No other order, statement, or conduct of the Procurement Officer or any other person shall be treated as a change or entitle the Contractor to an equitable adjustment under this section. Except as otherwise provided in this Contract, if any change under this section causes an increase or decrease in the Contractor’s cost of, or the time required for, the performance of any part of the work, whether or not changed by the order, an equitable adjustment in the Contract price shall be made and the Contract modified in writing accordingly. The Contractor

must assert in writing its right to an adjustment under this section within thirty (30) days of receipt of written change order and shall include a written statement setting forth the nature and cost of such claim. No claim by the Contractor shall be allowed if asserted after final payment under this Contract. Failure to agree to an adjustment under this section shall be a dispute under the Disputes clause. Nothing in this section shall excuse the Contractor from proceeding with the Contract as changed.

- 2.3 While the Procurement Officer may, at any time, by written change order, make unilateral changes in the work within the general scope of the Contract as provided in Section 2.2 above, the Contract may be modified by mutual agreement of the parties, provided: (a) the modification is made in writing; (b) all parties sign the modification; and (c) all approvals by the required agencies as described in COMAR Title 21, are obtained.

### **3. Period of Performance.**

- 3.1 The term of this Contract begins on the date the Contract is signed by the Department following any required approvals of the Contract, including approval by the Board of Public Works, if such approval is required. The Contractor shall provide services under this Contract as of the Go-Live date contained in the written Notice to Proceed. From this Go-Live date, the Contract shall be for a period of approximately one year (**change to months if necessary**) beginning (**anticipated Contract start date**) and ending on (**anticipated end date of base term of Contract**).
- 3.2 Audit, confidentiality, document retention, and indemnification obligations under this Contract shall survive expiration or termination of the Contract.

### **4. Consideration and Payment**

- 4.1 In consideration of the satisfactory performance of the work set forth in this Contract, the Department shall pay the Contractor in accordance with the terms of this Contract and at the prices quoted on the Bid Form (Attachment F). Unless properly modified (see above Section 2.3), payment to the Contractor pursuant to this Contract shall not exceed \$ (**Not-to-Exceed amount**).
- 4.2 Payments to the Contractor shall be made no later than thirty (30) days after the Department's receipt of a proper invoice for services provided by the Contractor, acceptance by the Department of services provided by the Contractor, and pursuant to the conditions outlined in Section 4 of this Contract. Each invoice for services rendered must include the Contractor's Federal Tax Identification or Social Security Number for a Contractor who is an individual which is (**Contractor's FEIN or SSN**). Charges for late payment of invoices other than as prescribed at Md. Code Ann., State Finance and Procurement Article, §15-104 as from time-to-time amended, are prohibited. Invoices shall be submitted to the Contract Monitor. Electronic funds transfer shall be used by the State to pay Contractor pursuant to this Contract and any other State payments due Contractor unless the State Comptroller's Office grants Contractor an exemption.
- 4.3 In addition to any other available remedies, if, in the opinion of the Procurement Officer, the Contractor fails to perform in a satisfactory and timely manner, the Procurement Officer may refuse or limit approval of any invoice for payment, and may cause payments to the Contractor to be reduced or withheld until such time as the Contractor meets performance standards as established by the Procurement Officer.
- 4.4 Payment of an invoice by the Department is not evidence that services were rendered as required under this Contract.

4.5 Contractor's eMarylandMarketplace vendor ID number is (Contractor's eMM number).

## **5. Rights to Records**

- 5.1 The Contractor agrees that all documents and materials including, but not limited to, software, software-produced reports, drawings, studies, specifications, estimates, tests, maps, photographs, designs, graphics, mechanical, artwork, computations, and data prepared by the Contractor for purposes of this Contract shall be the sole property of the State and shall be available to the State at any time. The State shall have the right to use the same without restriction and without compensation to the Contractor other than that specifically provided by this Contract.
- 5.2 The Contractor agrees that at all times during the term of this Contract and thereafter, works created as a deliverable under this Contract, and services performed under this Contract shall be "works made for hire" as that term is interpreted under U.S. copyright law. To the extent that any products created as a deliverable under this Contract are not works made for hire for the State, the Contractor hereby relinquishes, transfers, and assigns to the State all of its rights, title, and interest (including all intellectual property rights) to all such products created under this Contract, and will cooperate reasonably with the State in effectuating and registering any necessary assignments.
- 5.3 The Contractor shall report to the Contract Monitor, promptly and in written detail, each notice or claim of copyright infringement received by the Contractor with respect to all data delivered under this Contract.
- 5.4 The Contractor shall not affix any restrictive markings upon any data, documentation, or other materials provided to the State hereunder and if such markings are affixed, the State shall have the right at any time to modify, remove, obliterate, or ignore such warnings.

## **6. Exclusive Use**

The State shall have the exclusive right to use, duplicate, and disclose any data, information, documents, records, or results, in whole or in part, in any manner for any purpose whatsoever, that may be created or generated by the Contractor in connection with this Contract. If any material, including software, is capable of being copyrighted, the State shall be the copyright owner and Contractor may copyright material connected with this project only with the express written approval of the State.

## **7. Patents, Copyrights, and Intellectual Property**

- 7.1 If the Contractor furnishes any design, device, material, process, or other item, which is covered by a patent, trademark or service mark, or copyright or which is proprietary to, or a trade secret of, another, the Contractor shall obtain the necessary permission or license to permit the State to use such item or items.
- 7.2 The Contractor will defend or settle, at its own expense, any claim or suit against the State alleging that any such item furnished by the Contractor infringes any patent, trademark, service mark, copyright, or trade secret. If a third party claims that a product infringes that party's patent, trademark, service mark, trade secret, or copyright, the Contractor will defend the State against that claim at Contractor's expense and will pay all damages, costs, and attorneys' fees that a court finally awards, provided the State: (a) promptly notifies the Contractor in writing of the claim; and (b) allows Contractor to control and cooperates with Contractor in, the defense and any related settlement negotiations. The obligations of this paragraph are in addition to those stated in Section 7.3 below.

- 7.3 If any products furnished by the Contractor become, or in the Contractor's opinion are likely to become, the subject of a claim of infringement, the Contractor will, at its option and expense: (a) procure for the State the right to continue using the applicable item; (b) replace the product with a non-infringing product substantially complying with the item's specifications; or (c) modify the item so that it becomes non-infringing and performs in a substantially similar manner to the original item.

## **8. Confidentiality**

- 8.1 Subject to the Maryland Public Information Act and any other applicable laws, including without limitation, HIPAA, the HI-TECH ACT, and the Maryland Medical Records Act, all confidential or proprietary information and documentation relating to either party (including without limitation, any information or data stored within the Contractor's computer systems) shall be held in absolute confidence by the other party. Each party shall, however, be permitted to disclose relevant confidential information to its officers, agents, and employees to the extent that such disclosure is necessary for the performance of their duties under this Contract, provided that the data may be collected, used, disclosed, stored, and disseminated only as provided by and consistent with the law. The provisions of this section shall not apply to information that: (a) is lawfully in the public domain; (b) has been independently developed by the other party without violation of this Contract; (c) was already in the possession of such party; (d) was supplied to such party by a third party lawfully in possession thereof and legally permitted to further disclose the information; or (e) which such party is required to disclose by law.

- 8.2 This Section 8 shall survive expiration or termination of this Contract.

## **9. Loss of Data**

In the event of loss of any State data or records where such loss is due to the intentional act or omission or negligence of the Contractor or any of its subcontractors or agents, the Contractor shall be responsible for recreating such lost data in the manner and on the schedule set by the Contract Monitor. The Contractor shall ensure that all data is backed up and recoverable by the Contractor. Contractor shall use its best efforts to assure that at no time shall any actions undertaken by the Contractor under this Contract (or any failures to act when Contractor has a duty to act) damage or create any vulnerabilities in data bases, systems, platforms, and/or applications with which the Contractor is working hereunder.

## **10. Indemnification**

- 10.1 The Contractor shall hold harmless and indemnify the State from and against any and all losses, damages, claims, suits, actions, liabilities, and/or expenses, including, without limitation, attorneys' fees and disbursements of any character that arise from, are in connection with or are attributable to the performance or nonperformance of the Contractor or its subcontractors under this Contract.
- 10.2 This indemnification clause shall not be construed to mean that the Contractor shall indemnify the State against liability for any losses, damages, claims, suits, actions, liabilities, and/or expenses that are attributable to the sole negligence of the State or the State's employees.
- 10.3 The State has no obligation to provide legal counsel or defense to the Contractor or its subcontractors in the event that a suit, claim, or action of any character is brought by any person not party to this Contract against the Contractor or its subcontractors as a result of or relating to the Contractor's performance under this Contract.
- 10.4 The State has no obligation for the payment of any judgments or the settlement of any claims against the Contractor or its subcontractors as a result of or relating to the Contractor's performance under this Contract.

10.5 The Contractor shall immediately notify the Procurement Officer of any claim or suit made or filed against the Contractor or its subcontractors regarding any matter resulting from, or relating to, the Contractor's obligations under the Contract, and will cooperate, assist, and consult with the State in the defense or investigation of any claim, suit, or action made or filed against the State as a result of, or relating to, the Contractor's performance under this Contract.

10.6 This Section 10 shall survive termination of this Contract.

## **11. Non-Hiring of Employees**

No official or employee of the State, as defined under Md. Code Ann., State Government Article, § 15-102, whose duties as such official or employee include matters relating to or affecting the subject matter of this Contract, shall, during the pendency and term of this Contract and while serving as an official or employee of the State, become or be an employee of the Contractor or any entity that is a subcontractor on this Contract.

## **12. Disputes**

This Contract shall be subject to the provisions of Md. Code Ann., State Finance and Procurement Article, Title 15, Subtitle 2, and COMAR 21.10 (Administrative and Civil Remedies). Pending resolution of a claim, the Contractor shall proceed diligently with the performance of the Contract in accordance with the Procurement Officer's decision. Unless a lesser period is provided by applicable statute, regulation, or the Contract, the Contractor must file a written notice of claim with the Procurement Officer within thirty (30) days after the basis for the claim is known or should have been known, whichever is earlier.

Contemporaneously with or within thirty (30) days of the filing of a notice of claim, but no later than the date of final payment under the Contract, the Contractor must submit to the Procurement Officer its written claim containing the information specified in COMAR 21.10.04.02.

## **13. Maryland Law**

13.1 This Contract shall be construed, interpreted, and enforced according to the laws of the State of Maryland.

13.2 The Md. Code Ann., Commercial Law Article, Title 22, Maryland Uniform Computer Information Transactions Act, does not apply to this Contract or to any purchase order or Notice to Proceed issued under this Contract.

13.3 Any and all references to the Maryland Code, Annotated contained in this Contract shall be construed to refer to such Code sections as are from time to time amended.

## **14. Nondiscrimination in Employment**

The Contractor agrees: (a) not to discriminate in any manner against an employee or applicant for employment because of race, color, religion, creed, age, sex, marital status, national origin, ancestry, or disability of a qualified individual with a disability; (b) to include a provision similar to that contained in subsection (a), above, in any underlying subcontract except a subcontract for standard commercial supplies or raw materials; and (c) to post and to cause subcontractors to post in conspicuous places available to employees and applicants for employment, notices setting forth the substance of this clause.

**15. Contingent Fee Prohibition**

The Contractor warrants that it has not employed or retained any person, partnership, corporation, or other entity, other than a bona fide employee, bona fide agent, bona fide salesperson, or commercial selling agency working for the business, to solicit or secure the Contract, and that the business has not paid or agreed to pay any person, partnership, corporation, or other entity, other than a bona fide employee, bona fide agent, bona fide salesperson, or commercial selling agency, any fee or any other consideration contingent on the making of this Contract.

**16. Non-availability of Funding**

If the General Assembly fails to appropriate funds or if funds are not otherwise made available for continued performance for any fiscal period of this Contract succeeding the first fiscal period, this Contract shall be canceled automatically as of the beginning of the fiscal year for which funds were not appropriated or otherwise made available; provided, however, that this will not affect either the State's rights or the Contractor's rights under any termination clause in this Contract. The effect of termination of the Contract hereunder will be to discharge both the Contractor and the State from future performance of the Contract, but not from their rights and obligations existing at the time of termination. The Contractor shall be reimbursed for the reasonable value of any nonrecurring costs incurred but not amortized in the price of the Contract. The State shall notify the Contractor as soon as it has knowledge that funds may not be available for the continuation of this Contract for each succeeding fiscal period beyond the first.

**17. Termination for Default**

If the Contractor fails to fulfill its obligations under this Contract properly and on time, or otherwise violates any provision of the Contract, the State may terminate the Contract by written notice to the Contractor. The notice shall specify the acts or omissions relied upon as cause for termination. All finished or unfinished work provided by the Contractor shall, at the State's option, become the State's property. The State shall pay the Contractor fair and equitable compensation for satisfactory performance prior to receipt of notice of termination, less the amount of damages caused by the Contractor's breach. If the damages are more than the compensation payable to the Contractor, the Contractor will remain liable after termination and the State can affirmatively collect damages. Termination hereunder, including the termination of the rights and obligations of the parties, shall be governed by the provisions of COMAR 21.07.01.11B.

**18. Termination for Convenience**

The performance of work under this Contract may be terminated by the State in accordance with this clause in whole, or from time to time in part, whenever the State shall determine that such termination is in the best interest of the State. The State will pay all reasonable costs associated with this Contract that the Contractor has incurred up to the date of termination, and all reasonable costs associated with termination of the Contract; provided, however, the Contractor shall not be reimbursed for any anticipatory profits that have not been earned up to the date of termination. Termination hereunder, including the determination of the rights and obligations of the parties, shall be governed by the provisions of COMAR 21.07.01.12A(2).

**19. Delays and Extensions of Time**

The Contractor agrees to prosecute the work continuously and diligently and no charges or claims for damages shall be made by it for any delays, interruptions, interferences, or hindrances from any cause whatsoever during the progress of any portion of the work specified in this Contract.

Time extensions will be granted only for excusable delays that arise from unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to, acts of God, acts of the public enemy, acts of the State in either its sovereign or contractual capacity, acts of another Contractor

in the performance of a contract with the State, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, or delays of subcontractors or suppliers arising from unforeseeable causes beyond the control and without the fault or negligence of either the Contractor or the subcontractors or suppliers.

**20. Suspension of Work**

The State unilaterally may order the Contractor in writing to suspend, delay, or interrupt all or any part of its performance for such period of time as the Procurement Officer may determine to be appropriate for the convenience of the State.

**21. Pre-Existing Regulations**

In accordance with the provisions of Md. Code Ann., State Finance and Procurement Article, § 11-206, the regulations set forth in Title 21 of the Code of Maryland Regulations (COMAR 21) in effect on the date of execution of this Contract are applicable to this Contract.

**22. Financial Disclosure**

The Contractor shall comply with the provisions of Md. Code Ann., State Finance and Procurement Article, § 13-221, which requires that every person that enters into contracts, leases, or other agreements with the State or its agencies during a calendar year under which the business is to receive in the aggregate, \$100,000 or more, shall within thirty (30) days of the time when the aggregate value of these contracts, leases or other agreements reaches \$100,000, file with the Secretary of the State certain specified information to include disclosure of beneficial ownership of the business.

**23. Political Contribution Disclosure**

The Contractor shall comply with Md. Code Ann., Election Law Article, §§ 14-101 through 14-108, which requires that every person that enters into contracts, leases, or other agreements with the State, a county, or an incorporated municipality, or their agencies, during a calendar year in which the person receives in the aggregate \$100,000 or more, shall, file with the State Board of Elections a statement disclosing contributions in excess of \$500 made during the reporting period to a candidate for elective office in any primary or general election. The statement shall be filed with the State Board of Elections: (a) before a purchase or execution of a lease or contract by the State, a county, an incorporated municipality, or their agencies, and shall cover the preceding two calendar years; and (b) if the contribution is made after the execution of a lease or contract, then twice a year, throughout the contract term, on: (i) February 5, to cover the six (6) month period ending January 31; and (ii) August 5, to cover the six (6) month period ending July 31.

**24. Documents Retention and Inspection Clause**

The Contractor and subcontractors shall retain and maintain all records and documents relating to this contract for a period of five (5) years after final payment by the State hereunder or any applicable statute of limitations, whichever is longer, and shall make them available for inspection and audit by authorized representatives of the State, including the Procurement Officer or designee, at all reasonable times. All records related in any way to the Contract are to be retained for the entire time provided under this section. This Section 24 shall survive expiration or termination of the Contract.

If the Contractor supplies services to a State residential health care facility under the Mental Hygiene Administration, the Family Health Administration, the Alcohol and Drug Abuse Administration, or the Developmental Disabilities Administration, the Contractor agrees, in addition to the requirements above,:

- 24.1 That pursuant to 42 Code of Federal Regulations (C.F.R.) Part 420, the Secretary of Health and Human Services, and the Comptroller General of the United States, or their duly-authorized representatives, shall be granted access to the Contractor's contract, books, documents, and records necessary to verify the cost of the services provided under this contract, until the expiration of four (4) years after the services are furnished under this contract; and
- 24.2 That similar access will be allowed to the books, documents, and records of any organization related to the Contractor or controlled by the Contractor (as those terms are defined in 42 C.F.R. (420.301) if that organization is subcontracting to provide services with a value of \$10,000 or more in a twelve (12) month period to be reimbursed through funds provided by this contract.

## **25. Compliance with Laws**

The Contractor hereby represents and warrants that:

- 25.1 It is qualified to do business in the State and that it will take such action as, from time to time hereafter, may be necessary to remain so qualified;
- 25.2 It is not in arrears with respect to the payment of any monies due and owing the State, or any department or unit thereof, including but not limited to the payment of taxes and employee benefits, and that it shall not become so in arrears during the term of this Contract;
- 25.3 It shall comply with all federal, State and local laws, regulations, and ordinances applicable to its activities and obligations under this Contract; and
- 25.4 It shall obtain, at its expense, all licenses, permits, insurance, and governmental approvals, if any, necessary to the performance of its obligations under this Contract.

## **26. Cost and Price Certification**

By submitting cost or price information, the Contractor certifies to the best of its knowledge that the information submitted is accurate, complete, and current as of the date of its Bid/Proposal.

The price under this Contract and any change order or modification hereunder, including profit or fee, shall be adjusted to exclude any significant price increases occurring because the Contractor furnished cost or price information which, as of the date of its Bid/Proposal, was inaccurate, incomplete, or not current.

## **27. Subcontracting; Assignment**

The Contractor may not subcontract any portion of the services provided under this Contract without obtaining the prior written approval of the Procurement Officer, nor may the Contractor assign this Contract or any of its rights or obligations hereunder, without the prior written approval of the Procurement Officer provided, however, that a contractor may assign monies receivable under a contract after due notice to the State. Any subcontracts shall include such language as may be required in various clauses contained within this Contract, exhibits, and attachments. The Contract shall not be assigned until all approvals, documents, and affidavits are completed and properly registered. The State shall not be responsible for fulfillment of the Contractor's obligations to its subcontractors.

## **28. Liability**

- 28.1 For breach of this Contract, negligence, misrepresentation, or any other contract or tort claim, Contractor shall be liable as follows:
- a. For infringement of patents, copyrights, trademarks, service marks, and/or trade secrets, as provided in Section 7 of this Contract;
  - b. Without limitation for damages for bodily injury (including death) and damage to real property and tangible personal property; and
  - c. For all other claims, damages, losses, costs, expenses, suits, or actions in any way related to this Contract, regardless of the form. Contractor's liability for third party claims arising under Section 10 of this Contract shall be unlimited if the State is not immune from liability for claims arising under Section 10.

## **29. Commercial Nondiscrimination**

- 29.1 As a condition of entering into this Contract, Contractor represents and warrants that it will comply with the State's Commercial Nondiscrimination Policy, as described at Md. Code Ann., State Finance and Procurement Article, Title 19. As part of such compliance, Contractor may not discriminate on the basis of race, color, religion, ancestry or national origin, sex, age, marital status, sexual orientation, or on the basis of disability or other unlawful forms of discrimination in the solicitation, selection, hiring, or commercial treatment of subcontractors, vendors, suppliers, or commercial customers, nor shall Contractor retaliate against any person for reporting instances of such discrimination. Contractor shall provide equal opportunity for subcontractors, vendors, and suppliers to participate in all of its public sector and private sector subcontracting and supply opportunities, provided that this clause does not prohibit or limit lawful efforts to remedy the effects of marketplace discrimination that have occurred or are occurring in the marketplace. Contractor understands that a material violation of this clause shall be considered a material breach of this Contract and may result in termination of this Contract, disqualification of Contractor from participating in State contracts, or other sanctions. This clause is not enforceable by or for the benefit of, and creates no obligation to, any third party.
- 29.2 The Contractor shall include the above Commercial Nondiscrimination clause, or similar clause approved by the Department, in all subcontracts.
- 29.3 As a condition of entering into this Contract, upon the request of the Commission on Civil Rights, and only after the filing of a complaint against Contractor under Md. Code Ann., State Finance and Procurement Article, Title 19, as amended from time to time, Contractor agrees to provide within sixty (60) days after the request a complete list of the names of all subcontractors, vendors, and suppliers that Contractor has used in the past four (4) years on any of its contracts that were undertaken within the State of Maryland, including the total dollar amount paid by Contractor on each subcontract or supply contract. Contractor further agrees to cooperate in any investigation conducted by the State pursuant to the State's Commercial Nondiscrimination Policy as set forth at Md. Code Ann., State Finance and Procurement Article, Title 19, and to provide any documents relevant to any investigation that are requested by the State. Contractor understands that violation of this clause is a material breach of this Contract and may result in contract termination, disqualification by the State from participating in State contracts, and other sanctions.

### 30. Prompt Pay Requirements

- 30.1 If the Contractor withholds payment of an undisputed amount to its subcontractor, the Department, at its option and in its sole discretion, may take one or more of the following actions:
- a. Not process further payments to the contractor until payment to the subcontractor is verified;
  - b. Suspend all or some of the contract work without affecting the completion date(s) for the contract work;
  - c. Pay or cause payment of the undisputed amount to the subcontractor from monies otherwise due or that may become due;
  - d. Place a payment for an undisputed amount in an interest-bearing escrow account; or
  - e. Take other or further actions as appropriate to resolve the withheld payment.
- 30.2 An “undisputed amount” means an amount owed by the Contractor to a subcontractor for which there is no good faith dispute. Such “undisputed amounts” include, without limitation:
- a. Retainage which had been withheld and is, by the terms of the agreement between the Contractor and subcontractor, due to be distributed to the subcontractor; and
  - b. An amount withheld because of issues arising out of an agreement or occurrence unrelated to the agreement under which the amount is withheld.
- 30.3 An act, failure to act, or decision of a Procurement Officer or a representative of the Department, concerning a withheld payment between the Contractor and a subcontractor under this provision, may not:
- a. Affect the rights of the contracting parties under any other provision of law;
  - b. Be used as evidence on the merits of a dispute between the Department and the contractor in any other proceeding; or
  - c. Result in liability against or prejudice the rights of the Department.
- 30.4 The remedies enumerated above are in addition to those provided under COMAR 21.11.03.13 with respect to subcontractors that have contracted pursuant to the Disadvantaged Business Enterprise (DBE) program.
- 30.5 To ensure compliance with certified DBE subcontract participation goals, the Department may, consistent with COMAR 21.11.03.13, take the following measures:
- a. Verify that the certified DBEs listed in the DBE participation schedule actually are performing work and receiving compensation as set forth in the DBE participation schedule.
  - b. This verification may include, as appropriate:
    - i. Inspecting any relevant records of the Contractor;
    - ii. Inspecting the jobsite; and
    - iii. Interviewing subcontractors and workers.
    - iv. Verification shall include a review of:
      - (a) The Contractor’s monthly report listing unpaid invoices over thirty (30) days old from certified DBE subcontractors and the reason for nonpayment; and
      - (b) The monthly report of each certified DBE subcontractor, which lists payments received from the Contractor in the preceding thirty (30) days and invoices for which the subcontractor has not been paid.
  - c. If the Department determines that the Contractor is not in compliance with certified DBE participation goals, then the Department will notify the Contractor in writing of its findings, and will require the Contractor to take appropriate corrective action. Corrective action may include,

- but is not limited to, requiring the Contractor to compensate the DBE for work performed as set forth in the DBE participation schedule.
- d. If the Department determines that the Contractor is in material noncompliance with DBE contract provisions and refuses or fails to take the corrective action that the Department requires, then the Department may:
    - i. Terminate the contract;
    - ii. Refer the matter to the Office of the Attorney General for appropriate action; or
    - iii. Initiate any other specific remedy identified by the contract, including the contractual remedies required by any applicable laws, regulations, and directives regarding the payment of undisputed amounts.
  - e. Upon completion of the Contract, but before final payment or release of retainage or both, the Contractor shall submit a final report, in affidavit form under the penalty of perjury, of all payments made to, or withheld from, DBE subcontractors.

**31. Contract Monitor and Procurement Officer**

The work to be accomplished under this Contract shall be performed under the direction of the Contract Monitor. All matters relating to the interpretation of this Contract shall be referred to the Procurement Officer for determination.

**32. Notices**

All notices hereunder shall be in writing and either delivered personally or sent by certified or registered mail, postage prepaid, as follows:

If to the State: Heidi J. Tarleton  
 Procurement Officer  
 6 St. Paul, 7th Floor  
 Baltimore, MD 21202

If to the Contractor: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**33. Miscellaneous**

- 33.1 Any provision of this Contract which contemplates performance or observance subsequent to any termination or expiration of this contract shall survive termination or expiration of this contract and continue in full force and effect.
- 33.2 If any term contained in this contract is held or finally determined to be invalid, illegal, or unenforceable in any respect, in whole or in part, such term shall be severed from this contract, and the remaining terms contained herein shall continue in full force and effect, and shall in no way be affected, prejudiced, or disturbed thereby.

**IN WITNESS THEREOF**, the parties have executed this Contract as of the date hereinabove set forth.

CONTRACTOR

STATE OF MARYLAND  
Maryland Transit Administration

\_\_\_\_\_  
By:

\_\_\_\_\_  
By: Anna Lansaw, Procurement Director

\_\_\_\_\_  
Date

Or designee:

\_\_\_\_\_  
Date

Approved for form and legal sufficiency  
this \_\_\_\_ day of \_\_\_\_\_, 20\_\_.

\_\_\_\_\_  
Assistant Attorney General

APPROVED BY BPW: \_\_\_\_\_  
(Date) (BPW Item #)

**ATTACHMENT B – BID/PROPOSAL AFFIDAVIT**

**A. AUTHORITY**

I hereby affirm that I, \_\_\_\_\_ (name of affiant) am the \_\_\_\_\_ (title) and duly authorized representative of \_\_\_\_\_ (name of business entity) and that I possess the legal authority to make this affidavit on behalf of the business for which I am acting.

**B. CERTIFICATION REGARDING COMMERCIAL NONDISCRIMINATION**

The undersigned Bidder/Offeror hereby certifies and agrees that the following information is correct: In preparing its Bid/Proposal on this project, the Bidder/Offeror has considered all Proposals submitted from qualified, potential subcontractors and suppliers, and has not engaged in “discrimination” as defined in § 19-103 of the State Finance and Procurement Article of the Annotated Code of Maryland. “Discrimination” means any disadvantage, difference, distinction, or preference in the solicitation, selection, hiring, or commercial treatment of a vendor, subcontractor, or commercial customer on the basis of race, color, religion, ancestry, or national origin, sex, age, marital status, sexual orientation, or on the basis of disability or any otherwise unlawful use of characteristics regarding the vendor’s, supplier’s, or commercial customer’s employees or owners. “Discrimination” also includes retaliating against any person or other entity for reporting any incident of “discrimination”. Without limiting any other provision of the solicitation on this project, it is understood that, if the certification is false, such false certification constitutes grounds for the State to reject the Bid/Proposal submitted by the Bidder/Offeror on this project, and terminate any contract awarded based on the Bid/Proposal. As part of its Bid/Proposal, the Bidder/Offeror herewith submits a list of all instances within the past 4 years where there has been a final adjudicated determination in a legal or administrative proceeding in the State of Maryland that the Bidder/Offeror discriminated against subcontractors, vendors, suppliers, or commercial customers, and a description of the status or resolution of that determination, including any remedial action taken. Bidder/Offeror agrees to comply in all respects with the State’s Commercial Nondiscrimination Policy as described under Title 19 of the State Finance and Procurement Article of the Annotated Code of Maryland.

**B-1. CERTIFICATION REGARDING DISADVANTAGED BUSINESS ENTERPRISES.**

The undersigned Bidder/Offeror hereby certifies and agrees that it has fully complied with the State Minority/Disadvantaged Business Enterprise Law, State Finance and Procurement Article, § 14-308(a)(2), Annotated Code of Maryland, which provides that, except as otherwise provided by law, a contractor may not identify a certified minority business enterprise in a Bid/Proposal and:

- (1) Fail to request, receive, or otherwise obtain authorization from the certified minority/disadvantaged business enterprise to identify the certified minority Proposal;
- (2) Fail to notify the certified minority/disadvantaged business enterprise before execution of the contract of its inclusion in the Bid/Proposal;
- (3) Fail to use the certified minority/disadvantaged business enterprise in the performance of the contract; or
- (4) Pay the certified minority/disadvantaged business enterprise solely for the use of its name in the Bid/Proposal.

Without limiting any other provision of the solicitation on this project, it is understood that if the certification is false, such false certification constitutes grounds for the State to reject the Bid/Proposal submitted by the Bidder/Offeror on this project, and terminate any contract awarded based on the Bid/Proposal.

**C. AFFIRMATION REGARDING BRIBERY CONVICTIONS**

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the above business (as is defined in Section 16-101(b) of the State Finance and Procurement Article of the Annotated Code of Maryland), or any of its officers, directors, partners, controlling stockholders, or any of its employees directly involved in the business’s contracting activities including obtaining or performing contracts with public bodies has been convicted of, or has had probation before judgment imposed pursuant to Criminal Procedure Article, § 6-220, Annotated Code of Maryland, or has pleaded nolo contendere to a charge of, bribery, attempted bribery, or conspiracy to bribe in violation of Maryland law, or of the law of any other state or federal law, except as follows (indicate the reasons why the affirmation cannot be given and list any conviction, plea, or imposition of probation before judgment with the date, court, official or administrative body, the sentence or disposition, the name(s) of person(s) involved, and their current positions and responsibilities with the business):

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**D. AFFIRMATION REGARDING OTHER CONVICTIONS**

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the above business, or any of its officers, directors, partners, controlling stockholders, or any of its employees directly involved in the business’s contracting activities including obtaining or performing contracts with public bodies, has:

- (1) Been convicted under state or federal statute of:
  - (a) A criminal offense incident to obtaining, attempting to obtain, or performing a public or private contract; or
  - (b) Fraud, embezzlement, theft, forgery, falsification or destruction of records or receiving stolen property;
- (2) Been convicted of any criminal violation of a state or federal antitrust statute;
- (3) Been convicted under the provisions of Title 18 of the United States Code for violation of the Racketeer Influenced and Corrupt Organization Act, 18 U.S.C. § 1961 et seq., or the Mail Fraud Act, 18 U.S.C. § 1341 et seq., for acts in connection with the submission of Bids/Proposals for a public or private contract;
- (4) Been convicted of a violation of the State Minority Business Enterprise Law, § 14-308 of the State Finance and Procurement Article of the Annotated Code of Maryland;
- (5) Been convicted of a violation of § 11-205.1 of the State Finance and Procurement Article of the Annotated Code of Maryland;
- (6) Been convicted of conspiracy to commit any act or omission that would constitute grounds for conviction or liability under any law or statute described in subsections (1)—(5) above;

(7) Been found civilly liable under a state or federal antitrust statute for acts or omissions in connection with the submission of Bids/Proposals for a public or private contract;

(8) Been found in a final adjudicated decision to have violated the Commercial Nondiscrimination Policy under Title 19 of the State Finance and Procurement Article of the Annotated Code of Maryland with regard to a public or private contract; or

(9) Admitted in writing or under oath, during the course of an official investigation or other proceedings, acts or omissions that would constitute grounds for conviction or liability under any law or statute described in §§ B and C and subsections D(1)—(8) above, except as follows (indicate reasons why the affirmations cannot be given, and list any conviction, plea, or imposition of probation before judgment with the date, court, official or administrative body, the sentence or disposition, the name(s) of the person(s) involved and their current positions and responsibilities with the business, and the status of any debarment):

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**E. AFFIRMATION REGARDING DEBARMENT**

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the above business, or any of its officers, directors, partners, controlling stockholders, or any of its employees directly involved in the business’s contracting activities, including obtaining or performing contracts with public bodies, has ever been suspended or debarred (including being issued a limited denial of participation) by any public entity, except as follows (list each debarment or suspension providing the dates of the suspension or debarment, the name of the public entity and the status of the proceedings, the name(s) of the person(s) involved and their current positions and responsibilities with the business, the grounds of the debarment or suspension, and the details of each person’s involvement in any activity that formed the grounds of the debarment or suspension).

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**F. AFFIRMATION REGARDING DEBARMENT OF RELATED ENTITIES**

I FURTHER AFFIRM THAT:

(1) The business was not established and it does not operate in a manner designed to evade the application of or defeat the purpose of debarment pursuant to Sections 16-101, et seq., of the State Finance and Procurement Article of the Annotated Code of Maryland; and

(2) The business is not a successor, assignee, subsidiary, or affiliate of a suspended or debarred business, except as follows (you must indicate the reasons why the affirmations cannot be given without qualification):

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**G. SUBCONTRACT AFFIRMATION**

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the above business, has knowingly entered into a contract with a public body under which a person debarred or suspended under Title 16 of the State Finance and Procurement Article of the Annotated Code of Maryland will provide, directly or indirectly, supplies, services, architectural services, construction related services, leases of real property, or construction.

**H. AFFIRMATION REGARDING COLLUSION**

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the above business has:

- (1) Agreed, conspired, connived, or colluded to produce a deceptive show of competition in the compilation of the accompanying Bid/Proposal that is being submitted;
- (2) In any manner, directly or indirectly, entered into any agreement of any kind to fix the Bid/Proposal price of the Bidder/Offeror or of any competitor, or otherwise taken any action in restraint of free competitive bidding in connection with the contract for which the accompanying Bid/Proposal is submitted.

**I. CERTIFICATION OF TAX PAYMENT**

I FURTHER AFFIRM THAT:

Except as validly contested, the business has paid, or has arranged for payment of, all taxes due the State of Maryland and has filed all required returns and reports with the Comptroller of the Treasury, the State Department of Assessments and Taxation, and the Department of Labor, Licensing, and Regulation, as applicable, and will have paid all withholding taxes due the State of Maryland prior to final settlement.

**J. CONTINGENT FEES**

I FURTHER AFFIRM THAT:

The business has not employed or retained any person, partnership, corporation, or other entity, other than a bona fide employee, bona fide agent, bona fide salesperson, or commercial selling agency working for the business, to solicit or secure the Contract, and that the business has not paid or agreed to pay any person, partnership, corporation, or other entity, other than a bona fide employee, bona fide agent, bona fide salesperson, or commercial selling agency, any fee or any other consideration contingent on the making of the Contract.

**K. CERTIFICATION REGARDING INVESTMENTS IN IRAN**

(1) The undersigned certifies that, in accordance with State Finance and Procurement Article, §17-705, Annotated Code of Maryland:

(a) It is not identified on the list created by the Board of Public Works as a person engaging in investment activities in Iran as described in State Finance and Procurement Article, §17-702, Annotated Code of Maryland; and

(b) It is not engaging in investment activities in Iran as described in State Finance and Procurement Article, §17-702, Annotated Code of Maryland.

2. The undersigned is unable to make the above certification regarding its investment activities in Iran due to the following activities: \_\_\_\_\_

**L. CONFLICT MINERALS ORIGINATED IN THE DEMOCRATIC REPUBLIC OF CONGO (FOR SUPPLIES AND SERVICES CONTRACTS)**

I FURTHER AFFIRM THAT:

The business has complied with the provisions of State Finance and Procurement Article, §14-413, Annotated Code of Maryland governing proper disclosure of certain information regarding conflict minerals originating in the Democratic Republic of Congo or its neighboring countries as required by federal law.

**M. ACKNOWLEDGEMENT**

I ACKNOWLEDGE THAT this Affidavit is to be furnished to the Procurement Officer and may be distributed to units of: (1) the State of Maryland; (2) counties or other subdivisions of the State of Maryland; (3) other states; and (4) the federal government. I further acknowledge that this Affidavit is subject to applicable laws of the United States and the State of Maryland, both criminal and civil, and that nothing in this Affidavit or any contract resulting from the submission of this Bid/Proposal shall be construed to supersede, amend, modify or waive, on behalf of the State of Maryland, or any unit of the State of Maryland having jurisdiction, the exercise of any statutory right or remedy conferred by the Constitution and the laws of Maryland with respect to any misrepresentation made or any violation of the obligations, terms and covenants undertaken by the above business with respect to (1) this Affidavit, (2) the contract, and (3) other Affidavits comprising part of the contract.

I DO SOLEMNLY DECLARE AND AFFIRM UNDER THE PENALTIES OF PERJURY THAT THE CONTENTS OF THIS AFFIDAVIT ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION, AND BELIEF.

Date: \_\_\_\_\_

By: \_\_\_\_\_ (print name of Authorized Representative and Affiant)

\_\_\_\_\_ (signature of Authorized Representative and Affiant)

**ATTACHMENT C – CONTRACT AFFIDAVIT**

**A. AUTHORITY**

I hereby affirm that I, \_\_\_\_\_ (name of affiant) am the \_\_\_\_\_ (title) and duly authorized representative of \_\_\_\_\_ (name of business entity) and that I possess the legal authority to make this affidavit on behalf of the business for which I am acting.

**B. CERTIFICATION OF REGISTRATION OR QUALIFICATION WITH THE STATE DEPARTMENT OF ASSESSMENTS AND TAXATION**

I FURTHER AFFIRM THAT:

The business named above is a (check applicable box):

- (1) Corporation —  domestic or  foreign;
- (2) Limited Liability Company —  domestic or  foreign;
- (3) Partnership —  domestic or  foreign;
- (4) Statutory Trust —  domestic or  foreign;
- (5)  Sole Proprietorship.

And is registered or qualified as required under Maryland Law. I further affirm that the above business is in good standing both in Maryland and (IF APPLICABLE) in the jurisdiction where it is presently organized, and has filed all of its annual reports, together with filing fees, with the Maryland State Department of Assessments and Taxation. The name and address of its resident agent (IF APPLICABLE) filed with the State Department of Assessments and Taxation is:

Name and Department ID  
Number: \_\_\_\_\_ Address: \_\_\_\_\_

and that if it does business under a trade name, it has filed a certificate with the State Department of Assessments and Taxation that correctly identifies that true name and address of the principal or owner as:

Name and Department ID  
Number: \_\_\_\_\_ Address: \_\_\_\_\_

**C. FINANCIAL DISCLOSURE AFFIRMATION**

I FURTHER AFFIRM THAT:

I am aware of, and the above business will comply with, the provisions of State Finance and Procurement Article, §13-221, Annotated Code of Maryland, which require that every business that enters into contracts, leases, or other agreements with the State of Maryland or its agencies during a calendar year under which the business is to receive in the aggregate \$100,000 or more shall, within 30 days of the time when the aggregate value of the contracts, leases, or other agreements reaches \$100,000, file with the Secretary of State of Maryland certain specified information to include disclosure of beneficial ownership of the business.

**D. POLITICAL CONTRIBUTION DISCLOSURE AFFIRMATION**

I FURTHER AFFIRM THAT:

I am aware of, and the above business will comply with, Election Law Article, §§14-101 — 14-108, Annotated Code of Maryland, which requires that every person that enters into contracts, leases, or other agreements with the State of

Maryland, including its agencies or a political subdivision of the State, during a calendar year in which the person receives in the aggregate \$100,000 or more shall file with the State Board of Elections a statement disclosing contributions in excess of \$500 made during the reporting period to a candidate for elective office in any primary or general election.

#### **E. DRUG AND ALCOHOL FREE WORKPLACE**

(Applicable to all contracts unless the contract is for a law enforcement agency and the agency head or the agency head's designee has determined that application of COMAR 21.11.08 and this certification would be inappropriate in connection with the law enforcement agency's undercover operations.)

I CERTIFY THAT:

(1) Terms defined in COMAR 21.11.08 shall have the same meanings when used in this certification.

(2) By submission of its Bid/Proposal, the business, if other than an individual, certifies and agrees that, with respect to its employees to be employed under a contract resulting from this solicitation, the business shall:

(a) Maintain a workplace free of drug and alcohol abuse during the term of the contract;

(b) Publish a statement notifying its employees that the unlawful manufacture, distribution, dispensing, possession, or use of drugs, and the abuse of drugs or alcohol is prohibited in the business' workplace and specifying the actions that will be taken against employees for violation of these prohibitions;

I Prohibit its employees from working under the influence of drugs or alcohol;

(d) Not hire or assign to work on the contract anyone who the business knows, or in the exercise of due diligence should know, currently abuses drugs or alcohol and is not actively engaged in a bona fide drug or alcohol abuse assistance or rehabilitation program;

(e) Promptly inform the appropriate law enforcement agency of every drug-related crime that occurs in its workplace if the business has observed the violation or otherwise has reliable information that a violation has occurred;

(f) Establish drug and alcohol abuse awareness programs to inform its employees about:

- (i) The dangers of drug and alcohol abuse in the workplace;
- (ii) The business's policy of maintaining a drug and alcohol free workplace;
- (iii) Any available drug and alcohol counseling, rehabilitation, and employee assistance programs; and
- (iv) The penalties that may be imposed upon employees who abuse drugs and alcohol in the workplace;

(g) Provide all employees engaged in the performance of the contract with a copy of the statement required by §E(2)(b), above;

(h) Notify its employees in the statement required by §E(2)(b), above, that as a condition of continued employment on the contract, the employee shall:

- (i) Abide by the terms of the statement; and
- (ii) Notify the employer of any criminal drug or alcohol abuse conviction for an offense occurring in the workplace not later than 5 days after a conviction;

(i) Notify the procurement officer within 10 days after receiving notice under §E(2)(h)(ii), above, or otherwise receiving actual notice of a conviction;

(j) Within 30 days after receiving notice under §E(2)(h)(ii), above, or otherwise receiving actual notice of a conviction, impose either of the following sanctions or remedial measures on any employee who is convicted of a drug or alcohol abuse offense occurring in the workplace:

- (i) Take appropriate personnel action against an employee, up to and including termination; or
- (ii) Require an employee to satisfactorily participate in a bona fide drug or alcohol abuse assistance or rehabilitation program; and

(k) Make a good faith effort to maintain a drug and alcohol free workplace through implementation of §E(2)(a)—(j), above.

(3) If the business is an individual, the individual shall certify and agree as set forth in §E(4), below, that the individual shall not engage in the unlawful manufacture, distribution, dispensing, possession, or use of drugs or the abuse of drugs or alcohol in the performance of the contract.

(4) I acknowledge and agree that:

(a) The award of the contract is conditional upon compliance with COMAR 21.11.08 and this certification;

(b) The violation of the provisions of COMAR 21.11.08 or this certification shall be cause to suspend payments under, or terminate the contract for default under COMAR 21.07.01.11 or 21.07.03.15, as applicable; and

I The violation of the provisions of COMAR 21.11.08 or this certification in connection with the contract may, in the exercise of the discretion of the Board of Public Works, result in suspension and debarment of the business under COMAR 21.08.03.

**F. CERTAIN AFFIRMATIONS VALID**

I FURTHER AFFIRM THAT:

To the best of my knowledge, information, and belief, each of the affirmations, certifications, or acknowledgements contained in that certain Bid/Proposal Affidavit dated \_\_\_\_\_, 201\_\_\_\_, and executed by me for the purpose of obtaining the contract to which this Exhibit is attached remains true and correct in all respects as if made as of the date of this Contract Affidavit and as if fully set forth herein.

I DO SOLEMNLY DECLARE AND AFFIRM UNDER THE PENALTIES OF PERJURY THAT THE CONTENTS OF THIS AFFIDAVIT ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION, AND BELIEF.

Date: \_\_\_\_\_

By: \_\_\_\_\_ (printed name of Authorized Representative and Affiant)

\_\_\_\_\_ (signature of Authorized Representative and Affiant)

**ATTACHMENT D –  
TRANSIT VEHICLE MANUFACTURE (TVM)/DISADVANTAGED BUSINESS ENTERPRISE  
(DBE) CERTIFICATE**

**(must be submitted with Bid)**

The Responder, a Primary Transit Vehicle Manufacturer (TVM), hereby certifies that it has complied with the requirements of 49 CFR section 26.49, as amended, and has submitted its annual Disadvantaged Business Enterprises (DBE) goal, as amended, to the Federal Transit Administration (FTA).

\_\_\_\_\_  
Authorized Signature

\_\_\_\_\_  
Typed or Printed Name

\_\_\_\_\_  
Title

\_\_\_\_\_  
Company

\_\_\_\_\_  
Date

**ATTACHMENT E – PRE-BID CONFERENCE RESPONSE FORM**

**Solicitation Number T-8000-0451  
BUS PROCUREMENT – 41 HYBRID BUSES**

A Pre-Bid Conference will be held at 10:00am, on May 28, 2014, at the William Donald Schaefer Building, 6 St. Paul Street, 7th Floor, Baltimore, Maryland 21202. Please return this form by May 23, 2014, advising whether or not you plan to attend.

Return via e-mail or fax this form to the Procurement Officer:

Heidi J. Tarleton  
Contracts Administration Division  
6 St. Paul Street, 7th Floor  
Baltimore, MD 21202  
Email: htarleton@mta.maryland.gov  
Fax #: (410) 333-0126

Please indicate:

\_\_\_\_\_ Yes, the following representatives will be in attendance:

- 1.
- 2.
- 3.

\_\_\_\_\_ No, we will not be in attendance.

Please specify whether any reasonable accommodations are requested (see IFB § 1.7 “Pre-Bid Conference”):

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Title

\_\_\_\_\_  
Name of Firm (please print)

## ATTACHMENT F – BID PRICING INSTRUCTIONS

In order to assist Bidders in the preparation of their Bid and to comply with the requirements of this solicitation, Bid Pricing Instructions and a Bid Form have been prepared. Bidders shall submit their Bid on the Bid Form in accordance with the instructions on the Bid Form and as specified herein. Do not alter the Bid Form or the Bid Form may be rejected. The Bid Form is to be signed and dated, where requested, by an individual who is authorized to bind the Bidder to the prices entered on the Bid Form.

The Bid Form is used to calculate the Bidder's TOTAL BID PRICE. Follow these instructions carefully when completing your Bid Form:

- A) All Unit and Extended Prices must be clearly entered in dollars and cents, e.g., \$24.15. Make your decimal points clear and distinct.
- B) All Unit Prices must be the actual price per unit the State will pay for the specific item or service identified in this IFB and may not be contingent on any other factor or condition in any manner.
- C) All calculations shall be rounded to the nearest cent, i.e., .344 shall be .34 and .345 shall be .35.
- D) Any goods or services required through this IFB and proposed by the vendor at **No Cost to the State** must be clearly entered in the Unit Price, if appropriate, and Extended Price with **\$0.00**.
- E) Every blank in every Bid Form shall be filled in. Any blanks may result in the Bid being regarded as non-responsive and thus rejected. Any changes or corrections made to the Bid Form by the Bidder prior to submission shall be initialed and dated.
- F) Except as instructed on the Bid Form, nothing shall be entered on or attached to the Bid Form that alters or proposes conditions or contingencies on the prices. Alterations and/or conditions usually render the Bid non-responsive, which means it will be rejected.
- G) It is imperative that the prices included on the Bid Form have been entered correctly and calculated accurately by the Bidder and that the respective total prices agree with the entries on the Bid Form. Any incorrect entries or inaccurate calculations by the Bidder will be treated as provided in COMAR 21.05.03.03E and 21.05.02.12, and may cause the Bid to be rejected.
- H) If option years are included, Bidders must submit pricing for each option year. Any option to renew will be exercised at the sole discretion of the State and will comply with all terms and conditions in force at the time the option is exercised. If exercised, the option period shall be for a period identified in the IFB at the prices entered in the Bid Form.
- I) All Bid prices entered below are to be fully loaded prices that include all costs/expenses associated with the provision of services as required by the IFB. The Bid price shall include, but is not limited to, all: labor, profit/overhead, general operating, administrative, and all other expenses and costs necessary to perform the work set forth in the solicitation. No other amounts will be paid to the Contractor. If labor rates are requested, those amounts shall be fully-loaded rates; no overtime amounts will be paid.
- J) Unless indicated elsewhere in the IFB, sample amounts used for calculations on the Bid Form are typically estimates for bidding purposes only. The Department does not guarantee a minimum or maximum number of units or usage in the performance of this Contract.
- K) Failure to adhere to any of these instructions may result in the Bid being determined non-responsive and rejected by the Department.

**ATTACHMENT F – BID FORM**

STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION  
MARYLAND TRANSIT ADMINISTRATION  
BID FORM  
FOR

CONTRACT NO.: \_\_\_\_\_

TO: Maryland Transit Administration  
ATTN: Procurement Division  
6 St. Paul Street, 7<sup>th</sup> Floor  
Baltimore, MD 21202-1614

BID OPENING DATE:  
June 12, 2014  
BID OPENING TIME:  
2:00 PM

BID OF: \_\_\_\_\_  
(Bidder's Name)

**PROJECT DESCRIPTION:**

The manufacture of forty-one (41) forty (40) foot Low Floor Diesel Electric Hybrid Transit Buses. The duration of this contract is for one (1) year with no renewal options.

1. This bid is hereby submitted to the Maryland Transit Administration (hereinafter sometimes called the "Administration") in response to NOTICE TO CONTRACTORS dated May 19, 2014.
2. The UNDERSIGNED has thoroughly examined, acknowledges receipt of, and is familiar with the Contract Documents as well as the various instructions, information, and requirements covering the same, all as mentioned herein and in said NOTICE TO CONTRACTORS.
3. In compliance with said NOTICE TO CONTRACTORS the UNDERSIGNED hereby proposes to furnish all labor, equipment, and materials and perform all work described and in strict accordance with the provisions of the Contract Documents for the consideration of the amounts, lump sum and unit prices listed in the attached Unit Price Schedule, and agrees that, upon Notice of Award, within one hundred eighty (180) calendar days after the date of opening of bids, unless mutually extended, he will within ten (10) calendar days after receipt of the prescribed forms, execute the Contract and furnish a performance bond and payment bond (if such bonds are required by the Contract Documents) on forms furnished by the Administration with good and sufficient surety or sureties.
4. The UNDERSIGNED agrees and understands that the time of completion is as specified in the Special Provisions, unless the completion dates are extended as provided for in the Contract Documents.
5. The UNDERSIGNED agrees to pay liquidated damages in the amount specified in the Special Provisions for each and every calendar day after the completion date that the work remains incomplete unless an extension is granted as provided for in the Contract Documents.
6. The UNDERSIGNED hereby certifies that the \_\_\_\_\_ (Bidder's Name) \_\_\_\_\_ is or \_\_\_\_\_ is not (check one) included on the GSA list of parties Excluded from Procurement.

AND

The UNDERSIGNED hereby certifies that the \_\_\_\_\_ (Bidder's Name) \_\_\_\_\_ is or \_\_\_\_\_ is not (check one) included on the List of Contractors suspended or debarred from contracting with the State of Maryland.

7. The UNDERSIGNED, as the Contractor, will perform on the Site, with its own organization, \_\_\_\_\_ percent (\_\_\_\_\_% ) of the total amount of work to be performed under this contract.

8. PARENT COMPANY

- a. The UNDERSIGNED represents that it \_\_\_\_ is or \_\_\_\_\_ is not, (check one) owned or controlled by a parent company. For this purpose a parent company is defined as one which either owns or controls the activities and basic business policies of the UNDERSIGNED. To own another company means the parent company must own at least a majority (more than 50 percent) of the voting rights in that company. To control another company such ownership is not required; if another company is able to formulate, determine or veto basic business policy decisions of the bidder, such other company is considered the parent of the bidder. This control may be exercised through the use of dominant minority voting rights, use of proxy voting, contractual arrangements, or otherwise.
- b. If UNDERSIGNED is owned or controlled by a parent company, insert in the space below the name and main office address of the parent company.

\_\_\_\_\_  
(Name)

\_\_\_\_\_  
(Address)

9. ARREARAGES

By submitting a response to this solicitation, the undersigned shall be deemed to represent that it is not in arrears in the payment of any obligations due and owing the State of Maryland, including the payment of taxes and employee benefits, and that it shall not become so arrears during the term of the contract if selected for contract award.

10. CERTIFICATION OF NON-MARYLAND CORPORATION (FOREIGN CORPORATION)

- a. A corporation not incorporated in the State of Maryland is considered to be a foreign corporation and, therefore, is required to be registered with the Maryland State Department of Assessment and Taxation if awarded this contract.
- b. Where a foreign corporation is currently registered with the Department of Assessments and Taxation, such a bidder shall submit with his bid a copy of the department's certification of his registration or qualification acknowledgment.
- c. If a foreign corporation is not currently registered, such a bidder shall submit with his bid his certification that, if notified of his apparent award of the contract, he will register with the Maryland State Department of Assessments and Taxation and provide a copy of the department's certification of his registration or qualification acknowledgment along with the executed contract.

11. The Contractor shall, prior to the time of execution of the contract, obtain all applicable licenses and comply with all applicable laws and regulations in the Annotated Code of Maryland.

CORPORATION BID: FEIN: \_\_\_\_\_

\_\_\_\_\_  
Name of Corporation

\_\_\_\_\_  
State in which Incorporated

\_\_\_\_\_  
Business Address

\_\_\_\_\_  
Telephone

ATTEST:

By:

\_\_\_\_\_  
Secretary

\_\_\_\_\_  
President or Vice President

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Print Name

B. PARTNERSHIP BID:

FEIN: \_\_\_\_\_

\_\_\_\_\_  
Name of Partnership

\_\_\_\_\_  
Business Address

\_\_\_\_\_  
Telephone

Names of each Partner:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Witness:

By:

\_\_\_\_\_

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Print Name

C. INDIVIDUAL BID:

S.S. No.: \_\_\_\_\_

\_\_\_\_\_  
Name

\_\_\_\_\_  
Business Address

\_\_\_\_\_  
Telephone

Witness:

\_\_\_\_\_  
Print Name

By:

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Print Name

D. JOINT VENTURE:

FEIN: \_\_\_\_\_

\_\_\_\_\_  
Name of Corporation

\_\_\_\_\_  
State in which Incorporated

\_\_\_\_\_  
Business Address

\_\_\_\_\_  
Telephone

ATTEST:

\_\_\_\_\_  
Secretary

\_\_\_\_\_  
Print Name

By:

\_\_\_\_\_  
President or Vice President

\_\_\_\_\_  
Print Name

FEIN: \_\_\_\_\_

\_\_\_\_\_  
Name of Corporation

\_\_\_\_\_  
State in which Incorporated

\_\_\_\_\_  
Business Address

\_\_\_\_\_  
Telephone

Attest:

By:

\_\_\_\_\_  
Secretary

\_\_\_\_\_  
President or Vice President

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Print Name

FEIN: \_\_\_\_\_

\_\_\_\_\_  
Name of Corporation

\_\_\_\_\_  
State in which Incorporated

\_\_\_\_\_  
Business Address

\_\_\_\_\_  
Telephone

Attest:

By:

\_\_\_\_\_  
Secretary

\_\_\_\_\_  
President or Vice President

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Print Name

A Joint Venture doing business as \_\_\_\_\_

\* Each member of the Joint Venture must execute the Bid Form. A Corporate Officer must sign for each member of the joint venture. In the event that a Corporate Officer (President or Vice President) does not sign the Bid Form, a Power of Execution or Power of Attorney, must be submitted with the Bid Forms.

# ATTACHMENT F - BID FORM

Maryland Transit Administration  
T-8000-0451  
40-Foot Low Floor Diesel Electric Hybrid Transit Buses

	All prices are to be in United States dollars		
	<b>Qty</b>	<b>Unit Price</b>	<b>Total Price</b>
40-foot Diesel Electric Hybrid Transit Buses	41		
Operator Manuals	250		
Final Parts Manual (hardcopy)	5		
Final Service Manual (hardcopy)	5		
Final Bus Systems Drawings Manual (11x17 3-hole regular paper)	5		
Final First Responder Guide (8.5x11 laminated card)	41		
Final Manuals in DVD ROM	5		
Maintenance and Operator Training	1500 hours	Lump Sum	
Extended Warranty [Allison - 5 year]	41		
Diagnostic Laptop (including all necessary software preinstalled)*	10		
Delivery charges	41		
<b>TOTAL PROPOSED PRICE</b>			

**This form is to be completed and included in the Bid Package.**

\* Shall include all special tools and pricing conducive to continuous operations and maintenance of these diagnostic laptops.

## ATTACHMENT G – FEDERAL FUNDING REQUIREMENTS

### A Summary of Certain Federal Fund Requirements and Restrictions

[Details of particular laws, which may levy a penalty for noncompliance, are available from the Department of Health and Mental Hygiene.]

1. Form and rule enclosed: 18 U.S.C. 1913 and Section 1352 of P.L. 101-121 require that all *prospective* and present sub-grantees (this includes all levels of funding) who receive more than \$100,000 in federal funds must submit the form “Certification Against Lobbying.” It assures, generally, that recipients will not lobby federal entities with federal funds, and that, as is required, they will disclose other lobbying on form SF- LLL.
2. Form and instructions enclosed: “Form LLL, Disclosure of Lobbying Activities” must be submitted by those receiving more than \$100,000 in federal funds, to disclose any lobbying of federal entities (a) with profits from federal contracts or (b) funded with nonfederal funds.
3. Form and summary of Act enclosed: Sub-recipients of federal funds on any level must complete a “Certification Regarding Environmental Tobacco Smoke,” required by Public Law 103-227, the Pro-Children Act of 1994. Such law prohibits smoking in any portion of any indoor facility owned or leased or contracted for regular provision of health, day care, early childhood development, education, or library services for children under the age of 18. Such language must be included in the conditions of award (they are included in the certification, which may be part of such conditions.) This does not apply to those solely receiving Medicaid or Medicare, or facilities where WIC coupons are redeemed.
4. In addition, federal law requires that:
  - A) OMB Circular A-133, Audits of States, Local Governments and Non-Profit Organizations requires that grantees (both recipients and sub-recipients) which expend a total of \$300,000 or more (*\$500,000 for fiscal years ending after December 31, 2003*) in federal assistance shall have a single or program-specific audit conducted for that year in accordance with the provisions of the Single Audit Act of 1984, P.L. 98-502, and the Single Audit Act Amendments of 1996, P.L. 104-156 and the Office of Management and Budget (OMB) Circular A-133. All sub-grantee audit reports, performed in compliance with the aforementioned Circular shall be forwarded within 30 days of report issuance to the Department Contract Monitor.
  - B) All sub-recipients of federal funds comply with Sections 503 and 504 of the Rehabilitation Act of 1973, the conditions of which are summarized in item (C).
  - C) Recipients of \$10,000 or more (on any level) must include in their contract language the requirements of Sections 503 (language specified) and 504 referenced in item (B).

Section 503 of the Rehabilitation Act of 1973, as amended, requires recipients to take affirmative action to employ and advance in employment qualified disabled people. An affirmative action program must be prepared and maintained by all contractors with 50 or more employees and one or more federal contracts of \$50,000 or more.

This clause must appear in subcontracts of \$10,000 or more:

- a) The contractor will not discriminate against any employee or applicant for employment because of physical or mental handicap in regard to any position for which the employee or applicant for

employment is qualified. The contractor agrees to take affirmative action to employ, advance in employment and otherwise treat qualified handicapped individuals without discrimination based upon their physical or mental handicap in all upgrading, demotion or transfer, recruitment, advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship.

- b) The contractor agrees to comply with the rules, regulations, and relevant orders of the secretary of labor issued pursuant to the act.
- c) In the event of the contractor's non-compliance with the requirements of this clause, actions for non-compliance may be taken in accordance with the rules, regulations and relevant orders of the secretary of labor issued pursuant to the act.
- d) The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices in a form to be prescribed by the director, provided by or through the contracting office. Such notices shall state the contractor's obligation under the law to take affirmative action to employ and advance in employment qualified handicapped employees and applicants for employment, and the rights of applicants and employees.
- e) The contractor will notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the contractor is bound by the terms of Section 503 of the Rehabilitation Act of 1973, and is committed to take affirmative action to employ and advance in employment physically and mentally handicapped individuals.
- f) The contractor will include the provisions of this clause in every subcontract or purchase order of \$10,000 or more unless exempted by rules, regulations, or orders of the [federal] secretary issued pursuant to Section 503 of the Act, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the director of the Office of Federal Contract Compliance Programs may direct to enforce such provisions, including action for non-compliance.

Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. Sec. 791 et seq.) prohibits discrimination on the basis of handicap in all federally assisted programs and activities. It requires the analysis and making of any changes needed in three general areas of operation-programs, activities, and facilities and employment. It states, among other things, that:

*Grantees that provide health ... services should undertake tasks such as ensuring emergency treatment for the hearing impaired and making certain that persons with impaired sensory or speaking skills are not denied effective notice with regard to benefits, services, and waivers of rights or consents to treatments.*

- D) All sub-recipients comply with Title VI of the Civil Rights Act of 1964 that they must not discriminate in participation by race, color, or national origin.
- E) All sub-recipients of federal funds from SAMHSA (Substance Abuse and Mental Health Services Administration) or NIH (National Institute of Health) are prohibited from paying any direct salary at a rate more than Executive Level 1 per year. (This includes, but is not limited to, sub-recipients of the Substance Abuse Prevention and Treatment and the Community Mental Health Block Grants and NIH research grants.)
- F) There may be no discrimination on the basis of age, according to the requirements of the Age Discrimination Act of 1975.

- G) For any education program, as required by Title IX of the Education Amendments of 1972, there may be no discrimination on the basis of sex.
- H) For research projects, a form for Protection of Human Subjects (Assurance/ Certification/ Declaration) should be completed by each level funded, assuring that either: (1) there are no human subjects involved, or that (2) an Institutional Review Board (IRB) has given its formal approval before human subjects are involved in research. [This is normally done during the application process rather than after the award is made, as with other assurances and certifications.]
- I) In addition, there are conditions, requirements, and restrictions which apply only to specific sources of federal funding. These should be included in your grant/contract documents when applicable.

U.S. Department of Health and Human Services

**CERTIFICATION REGARDING LOBBYING**  
**Certification for Contracts, Grants, Loans, and Cooperative Agreements**

The undersigned certifies, to the best of his or her knowledge and belief, that:

- (1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- (2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- (3) The undersigned shall require that the language of this certification be included in the award documents for all sub-awards at all tiers (including subcontracts, sub-grants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

Award No.	Organizational Entry
Name and Title of Official Signing for Organizational Entry	Telephone No. Of Signing Official
Signature of Above Official	Date Signed



## INSTRUCTIONS FOR COMPLETION OF SF-LLL, DISCLOSURE OF LOBBYING ACTIVITIES

This disclosure form shall be completed by the reporting entity, whether sub-awardee or prime Federal recipient, at the initiation or receipt of a covered Federal action, or a material change to a previous filing, pursuant to title 31 U.S.C. Section 1352. The filing of a form is required for each payment or agreement to make payment to any lobbying entity for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a covered Federal action. Complete all items that apply for both the initial filing and material change report. Refer to the implementing guidance published by the Office of Management and Budget for additional information.

1. Identify the type of covered Federal action for which lobbying activity is and/or has been secured to influence the outcome of a covered Federal action.
2. Identify the status of the covered Federal action.
3. Identify the appropriate classification of this report. If this is a follow-up report caused by a material change to the information previously reported, enter the year and quarter in which the change occurred. Enter the date of the last previously submitted report by this reporting entity for this covered Federal action.
4. Enter the full name, address, city, State and zip code of the reporting entity. Include Congressional District, if known. Check the appropriate classification of the reporting entity that designates if it is, or expects to be, a prime or sub-award recipient. Identify the tier of the sub-awardee, e.g., the first sub-awardee of the prime is the 1st tier. Sub-awards include but are not limited to subcontracts, sub-grants and contract awards under grants.
5. If the organization filing the report in item 4 checks "Sub-awardee," then enter the full name, address, city, State and zip code of the prime Federal recipient. Include Congressional District, if known.
6. Enter the name of the Federal agency making the award or loan commitment. Include at least one organizational level below agency name, if known. For example, Department of Transportation, United States Coast Guard.
7. Enter the Federal program name or description for the covered Federal action (item 1). If known, enter the full Catalog of Federal Domestic Assistance (CFDA) number for grants, cooperative agreements, loans, and loan commitments.
8. Enter the most appropriate Federal identifying number available for the Federal action identified in item 1 (e.g., Request for Proposal (RFP) number; Invitation for Bid (IFB) number; grant announcement number; the contract, grant, or loan award number; the application/proposal control number assigned by the Federal agency). Include prefixes, e.g., "RFP-DE-90-001."
9. For a covered Federal action where there has been an award or loan commitment by the Federal agency, enter the Federal amount of the award/loan commitment for the prime entity identified in item 4 or 5.
10. (a) Enter the full name, address, city, State and zip code of the lobbying registrant under the Lobbying Disclosure Act of 1995 engaged by the reporting entity identified in item 4 to influence the covered Federal action.
10. (b) Enter the full names of the individual(s) performing services, and include full address if different from 10 (a). Enter Last Name, First Name, and Middle Initial (MI).
11. The certifying official shall sign and date the form and print his/her name, title, and telephone number.

According to the Paperwork Reduction Act, as amended, no persons are required to respond to a collection of information unless it displays a valid OMB Control Number. The valid OMB control number for this information collection is OMB No. 0348-0046. Public reporting burden for this collection of information is estimated to average 10 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0046), Washington, DC 20503.

DEPARTMENT OF HEALTH AND HUMAN SERVICES

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Public Health Service  
Health Resources and  
Service Administration  
Rockville, MD 20857

**CERTIFICATION REGARDING ENVIRONMENTAL TOBACCO SMOKE**

Public Law 103-227, also known as the Pro Children Act of 1994, Part C Environmental Tobacco Smoke, requires that smoking not be permitted in any portion of any indoor facility owned, or leased or contracted for by an entity and used routinely or regularly for provision of health, day care, early childhood development services, education or library services to children under the age of 18, if the services are funded by Federal programs either directly or through State or local governments, by Federal grant, contract, loan, or loan guarantee. The law also applies to children's services that are provided in indoor facilities that are constructed, operated or maintained with such Federal funds. The law does not apply to children's services provided in private residences, portions of facilities used for inpatient drug or alcohol treatment, service providers whose sole sources of applicable Federal funds is Medicare or Medicaid, or facilities where WIC coupons are redeemed. Failure to comply with the provisions of the law may result in the imposition of a civil monetary penalty of up to \$1000 for each violation and/or the imposition of an administrative compliance order on the responsible entity.

By signing this certification, the offeror/contractor (for acquisitions) or applicant/grantee (for grants) certifies that the submitting organization will comply with the requirements of the Act and will not allow smoking within any portion of any indoor facility used for the provision of services for children as defined by the Act.

The submitting organization further agrees that it will require the language of this certification be included in any sub-awards which contain provisions for children's services and that all sub-recipients shall certify accordingly.

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Signature of Authorized Certifying Individual

**ATTACHMENT H – CONFLICT OF INTEREST AFFIDAVIT AND DISCLOSURE**

**Reference COMAR 21.05.08.08**

**(submit with Bid/Proposal)**

A. “Conflict of interest” means that because of other activities or relationships with other persons, a person is unable or potentially unable to render impartial assistance or advice to the State, or the person’s objectivity in performing the contract work is or might be otherwise impaired, or a person has an unfair competitive advantage.

B. “Person” has the meaning stated in COMAR 21.01.02.01B(64) and includes a Bidder/Offeror, Contractor, consultant, or subcontractor or sub-consultant at any tier, and also includes an employee or agent of any of them if the employee or agent has or will have the authority to control or supervise all or a portion of the work for which a Bid/Proposal is made.

C. The Bidder/Offeror warrants that, except as disclosed in §D, below, there are no relevant facts or circumstances now giving rise or which could, in the future, give rise to a conflict of interest.

D. The following facts or circumstances give rise or could in the future give rise to a conflict of interest (explain in detail—attach additional sheets if necessary):

E. The Bidder/Offeror agrees that if an actual or potential conflict of interest arises after the date of this affidavit, the Bidder/Offeror shall immediately make a full disclosure in writing to the procurement officer of all relevant facts and circumstances. This disclosure shall include a description of actions which the Bidder/Offeror has taken and proposes to take to avoid, mitigate, or neutralize the actual or potential conflict of interest. If the contract has been awarded and performance of the contract has begun, the Contractor shall continue performance until notified by the procurement officer of any contrary action to be taken.

I DO SOLEMNLY DECLARE AND AFFIRM UNDER THE PENALTIES OF PERJURY THAT THE CONTENTS OF THIS AFFIDAVIT ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION, AND BELIEF.

Date: \_\_\_\_\_ By: \_\_\_\_\_  
(Authorized Representative and Affiant)

**ATTACHMENT I – MERCURY AFFIDAVIT**

**MERCURY AFFIDAVIT  
(Submit with Bid/Proposal)**

**AUTHORIZED REPRESENTATIVE THEREBY AFFIRM THAT:**

I, \_\_\_\_\_ (name of affiant) am the  
\_\_\_\_\_ (title) and the duly authorized representative of  
\_\_\_\_\_ (name of the business). I possess  
the legal authority to make this affidavit on behalf of myself and the business for which I am acting.

**MERCURY CONTENT INFORMATION:**

The product(s) offered do not contain mercury.

OR

The product(s) offered do contain mercury.

In an attachment to this Mercury Affidavit:

- (1) Describe the product or product component that contains mercury.
- (2) Provide the amount of mercury that is contained in the product or product component. Indicate the unit of measure being used.

**I ACKNOWLEDGE THAT** this affidavit is to be furnished to the procurement officer and may be distributed to units of (1) the State of Maryland; (2) counties or other subdivisions of the State of Maryland; (3) other states; and (4) the federal government. I further acknowledge that this Affidavit is subject to applicable laws of the United States and the State of Maryland, both criminal and civil, and that nothing in this affidavit or any contract resulting from the submission of this Bid/Proposal shall be construed to supersede, amend, modify, or waive, on behalf of the State of Maryland, or any unit of the State of Maryland having jurisdiction, the exercise of any statutory right or remedy conferred by the Constitution and the laws of Maryland with respect to any misrepresentation made or any violation of the obligations, terms and covenants undertaken by the above business with respect to (1) this affidavit, (2) the contract, and (3) other affidavits comprising part of the contract.

**I DO SOLEMNLY DECLARE AND AFFIRM UNDER THE PENALTIES OF PERJURY THAT THE CONTENTS OF THIS AFFIDAVIT ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION, AND BELIEF.**

\_\_\_\_\_ By: \_\_\_\_\_  
Date Signature

Print Name: \_\_\_\_\_  
Authorized Representative and Affiant

## ATTACHMENT J – NON-DISCLOSURE AGREEMENT

This Non-Disclosure Agreement (“Agreement”) is made by and between the State of Maryland (the “State”), acting by and through the Maryland Transit Administration (the “Department”), and \_\_\_\_\_ (the “Contractor”).

### RECITALS

**WHEREAS**, the Contractor has been awarded a contract (the “Contract”) following the solicitation for Bus Procurement – 41 Hybrid Buses, Solicitation # T-8000-0451; and

**WHEREAS**, in order for the Contractor to perform the work required under the Contract, it will be necessary for the State at times to provide the Contractor and the Contractor’s employees, agents, and subcontractors (collectively the “Contractor’s Personnel”) with access to certain information the State deems confidential information (the “Confidential Information”).

**NOW, THEREFORE**, in consideration of being given access to the Confidential Information in connection with the solicitation and the Contract, and for other good and valuable consideration, the receipt and sufficiency of which the parties acknowledge, the parties do hereby agree as follows:

1. Confidential Information means any and all information provided by or made available by the State to the Contractor in connection with the Contract, regardless of the form, format, or media on or in which the Confidential Information is provided and regardless of whether any such Confidential Information is marked as such. Confidential Information includes, by way of example only, information that the Contractor views, takes notes from, copies (if the State agrees in writing to permit copying), possesses or is otherwise provided access to and use of by the State in relation to the Contract.
2. Contractor shall not, without the State’s prior written consent, copy, disclose, publish, release, transfer, disseminate, use, or allow access for any purpose or in any form, any Confidential Information provided by the State except for the sole and exclusive purpose of performing under the Contract. Contractor shall limit access to the Confidential Information to the Contractor’s Personnel who have a demonstrable need to know such Confidential Information in order to perform under the Contract and who have agreed in writing to be bound by the disclosure and use limitations pertaining to the Confidential Information. The names of the Contractor’s Personnel are attached hereto and made a part hereof as **ATTACHMENT J-1**. Contractor shall update **ATTACHMENT J-1** by adding additional names (whether Contractor’s personnel or a subcontractor’s personnel) as needed, from time to time.
3. If the Contractor intends to disseminate any portion of the Confidential Information to non-employee agents who are assisting in the Contractor’s performance of the Contract or who will otherwise have a role in performing any aspect of the Contract, the Contractor shall first obtain the written consent of the State to any such dissemination. The State may grant, deny, or condition any such consent, as it may deem appropriate in its sole and absolute subjective discretion.
4. Contractor hereby agrees to hold the Confidential Information in trust and in strictest confidence, to adopt or establish operating procedures and physical security measures, and to take all other measures necessary to protect the Confidential Information from inadvertent release or disclosure to unauthorized third parties and to prevent all or any portion of the Confidential Information from falling into the public domain or into the possession of persons not bound to maintain the confidentiality of the Confidential Information.
5. Contractor shall promptly advise the State in writing if it learns of any unauthorized use, misappropriation, or disclosure of the Confidential Information by any of the Contractor’s Personnel or the Contractor’s former

Personnel. Contractor shall, at its own expense, cooperate with the State in seeking injunctive or other equitable relief against any such person(s).

- 6. Contractor shall, at its own expense, return to the Department all copies of the Confidential Information in its care, custody, control or possession upon request of the Department or on termination of the Contract.
- 7. A breach of this Agreement by the Contractor or by the Contractor’s Personnel shall constitute a breach of the Contract between the Contractor and the State.
- 8. Contractor acknowledges that any failure by the Contractor or the Contractor’s Personnel to abide by the terms and conditions of use of the Confidential Information may cause irreparable harm to the State and that monetary damages may be inadequate to compensate the State for such breach. Accordingly, the Contractor agrees that the State may obtain an injunction to prevent the disclosure, copying or improper use of the Confidential Information. The Contractor consents to personal jurisdiction in the Maryland State Courts. The State’s rights and remedies hereunder are cumulative and the State expressly reserves any and all rights, remedies, claims and actions that it may have now or in the future to protect the Confidential Information and to seek damages from the Contractor and the Contractor’s Personnel for a failure to comply with the requirements of this Agreement. In the event the State suffers any losses, damages, liabilities, expenses, or costs (including, by way of example only, attorneys’ fees and disbursements) that are attributable, in whole or in part to any failure by the Contractor or any of the Contractor’s Personnel to comply with the requirements of this Agreement, the Contractor shall hold harmless and indemnify the State from and against any such losses, damages, liabilities, expenses, and costs.
- 9. Contractor and each of the Contractor’s Personnel who receive or have access to any Confidential Information shall execute a copy of an agreement substantially similar to this Agreement, in no event less restrictive than as set forth in this Agreement, and the Contractor shall provide originals of such executed Agreements to the State.
- 10. The parties further agree that:
  - a. This Agreement shall be governed by the laws of the State of Maryland;
  - b. The rights and obligations of the Contractor under this Agreement may not be assigned or delegated, by operation of law or otherwise, without the prior written consent of the State;
  - c. The State makes no representations or warranties as to the accuracy or completeness of any Confidential Information;
  - d. The invalidity or unenforceability of any provision of this Agreement shall not affect the validity or enforceability of any other provision of this Agreement;
  - e. Signatures exchanged by facsimile are effective for all purposes hereunder to the same extent as original signatures;
  - f. The Recitals are not merely prefatory but are an integral part hereof; and
  - g. The effective date of this Agreement shall be the same as the effective date of the Contract entered into by the parties.

**IN WITNESS WHEREOF**, the parties have, by their duly authorized representatives, executed this Agreement as of the day and year first above written.

Contractor: \_\_\_\_\_

Maryland Transit Administration:

By: \_\_\_\_\_(SEAL)

By: \_\_\_\_\_

Printed Name: \_\_\_\_\_

Printed Name: \_\_\_\_\_

Title: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

Date: \_\_\_\_\_

**NON-DISCLOSURE AGREEMENT – ATTACHMENT J-1**

**LIST OF CONTRACTOR’S EMPLOYEES AND AGENTS WHO WILL BE GIVEN ACCESS TO  
THE CONFIDENTIAL INFORMATION**

<b>Printed Name and Address of Individual/Agent</b>	<b>Employee (E) or Agent (A)</b>	<b>Signature</b>	<b>Date</b>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

**NON-DISCLOSURE AGREEMENT – ATTACHMENT J-2**

**CERTIFICATION TO ACCOMPANY RETURN OF CONFIDENTIAL INFORMATION**

I AFFIRM THAT:

To the best of my knowledge, information, and belief, and upon due inquiry, I hereby certify that: (i) all Confidential Information which is the subject matter of that certain Non-Disclosure Agreement by and between the State of Maryland and

\_\_\_\_\_ (“Contractor”) dated \_\_\_\_\_, 20\_\_\_\_ (“Agreement”) is attached hereto and is hereby returned to the State in accordance with the terms and conditions of the Agreement; and (ii) I am legally authorized to bind the Contractor to this affirmation.

**I DO SOLEMNLY DECLARE AND AFFIRM UNDER THE PENALTIES OF PERJURY THAT THE CONTENTS OF THIS AFFIDAVIT ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION, AND BELIEF, HAVING MADE DUE INQUIRY.**

\_\_\_\_\_  
Date

\_\_\_\_\_  
Contractor Name

\_\_\_\_\_  
Title of Authorized Representative and Affiant

\_\_\_\_\_  
Signature

**ATTACHMENT K – PERFORMANCE BOND**

STATE OF MARYLAND  
**MARYLAND DEPARTMENT OF TRANSPORTATION**  
 PERFORMANCE BOND

Principal		Business Address of Principal	
<u>Name of Surety:</u> A corporation of the State of _____ and authorized to do business in the State of Maryland.			
<b>PENAL SUM OF THIS PERFORMANCE BOND</b>		<b>DESCRIPTION OF CONTRACT</b>	
		Contract Number: T-8000-0451 Contract Name or Description: The purchase of forty-one (41) – forty (40) foot hybrid buses.	
<b>DATE OF BOND</b>		<b>DATE OF CONTRACT</b>	
(Shall be no later than Date on Contract)		(To be filled in by the Adm.)	
<b>OBLIGEE</b>			
State of Maryland by and through the following Administration acting for the Maryland Department of Transportation:  MARYLAND TRANSIT ADMINISTRATION			

KNOW ALL MEN BY THESE PRESENTS, That we, the principal named above and Surety named above, being authorized to do business in Maryland, and having business addresses as shown above are held and firmly bound unto the Obligee named above in the Penal Sum of this Performance Bond stated above, for the payment of which Penal Sum we bind ourselves, our heirs, executors, administrators, personal representatives, successors, and assigns, jointly and severally, firmly by these presents. However, where Surety is composed of corporations acting as co-sureties, bind ourselves, our successors and assigns, in such Penal Sum jointly and severally as well as severally only for the purpose of allowing a joint action or actions against any or all of us, and for all other purposes each co-surety binds itself, jointly and severally with the Principal, for the payment of such sum as appears above its name below, but if no limit of liability is indicated, the limit of such liability shall be the full amount of the Penal Sum.

WHEREAS, Principal has entered into or will enter into a contract with the State of Maryland, by and through the Administration named above acting for the State of Maryland, which contract is described and dated as shown above, and incorporated herein by reference. The contract and all items incorporated into the contract, together with any and all changes, extensions of time, alterations, modifications, or additions to the contract or to the work to be performed thereunder or to the Plans, Specifications, and Special Provisions, or any of them, or to any other items incorporated into the contract shall hereinafter be referred to as “the Contract”.

WHEREAS, it is one of the conditions precedent to the final award of the Contract that these presents be executed.

NOW, THEREFORE, during the original term of said Contract, during any extensions thereto that may be granted by the Administration, and during the guarantee and warranty period, if any, required under the Contract, unless otherwise stated therein, this Performance Bond shall remain in full force and effect unless and until the following terms and conditions are met:

1. Principal shall well and truly perform the Contract; and
2. Principal and Surety shall comply with the terms and conditions in this Performance Bond.

Whenever Principal shall be declared by the Administration to be in default under the Contract, the Surety may, within 15 days after notice of default from the Administration, notify the Administration of its election to either promptly proceed to remedy the default or promptly proceed to complete the contract in accordance with and subject to its terms and conditions. In the event the Surety does not elect to exercise either of the above stated options, then the Administration thereupon shall have the remaining contract work completed, Surety to remain liable hereunder for all expenses of completion up to but not exceeding the penal sum stated above.

The Surety hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the work to be performed thereunder or the Specifications accompanying the same shall in any way affect its obligations on this Performance Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the work or to the Specifications.

This Performance Bond shall be governed by and construed in accordance with the laws of the State of Maryland and any reference herein to Principal or Surety in the singular shall include all entities in the plural who or which are signatories under the Principal or Surety heading below.

IN WITNESS WHEREOF, Principal and Surety have set their hands and seals to this Performance Bond. If any individual is a signatory under the Principal heading below, then each such individual has signed below on his or her own behalf, has set forth below the name of the firm, if any, in whose name he or she is doing business, and has set forth below his or her title as a sole proprietor. If any partnership or joint venture is a signatory under the Principal heading below, then all members of each such partnership or joint venture, and each member has set forth below his or her title as a general partner, limited partner, or member of joint venture, whichever is applicable. If any corporation is a signatory under the Principal or Surety heading below, then each such corporation has caused the following: the corporation's name to be set forth below, a duly authorized representative of the corporation to affix below the corporation's seal and to attach hereto a notarized corporate resolution or power of attorney authorizing such action, and each such duly authorized representative to sign below and to set forth below his or her title as a representative of the corporation. If any individual acts as a witness to any signature below, then each such individual has signed below and has set forth below his or her title as a witness. All of the above has been done as of the Date of Bond shown above.

---

In Presence of: \_\_\_\_\_  
Individual Principal

Witness: \_\_\_\_\_ as to \_\_\_\_\_ (SEAL)

---

In Presence of: \_\_\_\_\_  
Co-Partnership Principal

Witness: \_\_\_\_\_ (SEAL)  
\_\_\_\_\_  
(Name of Co-Partnership)

\_\_\_\_\_ as to By: \_\_\_\_\_ (SEAL)  
\_\_\_\_\_ as to \_\_\_\_\_ (SEAL)  
\_\_\_\_\_ as to \_\_\_\_\_ (SEAL)

---

Corporate Principal

Attest: \_\_\_\_\_  
(Name of Corporation)

\_\_\_\_\_ as to By: \_\_\_\_\_ AFFIX  
Corporate Secretary President CORPORATE  
SEAL

---

(Surety)

Attest: \_\_\_\_\_ AFFIX  
(SEAL) By: \_\_\_\_\_ CORPORATE  
SEAL

\_\_\_\_\_ Title \_\_\_\_\_  
Signature  
Bonding Agent's Name: \_\_\_\_\_

---

(Business Address of Surety)

Agent's Address \_\_\_\_\_

---

Approved as to legal form and sufficiency this  
\_\_\_\_\_ day of \_\_\_\_\_ 20 \_\_\_\_

\_\_\_\_\_  
Assistant Attorney General

**ATTACHMENT L – BID BOND**

**(must be submitted with Bid)**

Bond No. \_\_\_\_\_

We, \_\_\_\_\_ as Principal, hereinafter called the Principal, and \_\_\_\_\_, a corporation duly organized under the laws of the State of \_\_\_\_\_, as Surety, hereinafter called the Surety, are held and firmly bound unto the State of Maryland, hereinafter called "State", for the sum of \_\_\_\_\_ for the payment of which sum, the Principal and the Surety bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a bid for \_\_\_\_\_  
(Identify project by number and brief description):

NOW, THEREFORE, if the Principal, upon acceptance by the State of its bid identified above, within the period specified therein for acceptance (ninety (90) days, if no period is specified), shall execute such further contractual documents, if any, and give such bond(s) as may be required by the terms of the bid as accepted within the time specified (ten (10) days if no period is specified) after receipt of the forms, or in the event of failure so to execute such further contractual documents and give such bonds, if the Principal shall pay the State the difference not to exceed the penalty hereof between the amount specified in Principal's bid and such larger amount for which the State may in good faith contract with another party to perform the work covered by said bid, then the above obligation shall be void and of no effect.

The Surety executing this instrument hereby agrees that its obligation shall not be impaired by any extension(s) of the time for acceptance of the bid that the Principal may grant to the State, notice of which extension(s) to the Surety being hereby waived; provided that such waiver of notice shall apply only with respect to extensions aggregating not more than ninety (90) calendar days in addition to the period originally allowed for acceptance of the bid.

In Presence of:  
Witness

Individual Principal

\_\_\_\_\_  
(Name) \_\_\_\_\_ (SEAL)

\_\_\_\_\_ as to

In Presence of:  
Witness:

Partnership Principal

\_\_\_\_\_  
(Name) \_\_\_\_\_ (SEAL)

\_\_\_\_\_ as to

(Partner) \_\_\_\_\_ (SEAL)

Attest:

Corporate Principal

\_\_\_\_\_  
(Name of Corporation)      AFFIX

\_\_\_\_\_  
Secretary

By: \_\_\_\_\_  
          President            SEAL

Attest:

\_\_\_\_\_  
(Surety)                    AFFIX

\_\_\_\_\_

By: \_\_\_\_\_  
          Attorney-in-fact      SEAL

Bonding Agent's Name \_\_\_\_\_

Agent's Address \_\_\_\_\_

Approved as to form and legal sufficiency

This \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_

**ATTACHMENT M – LOCATION OF THE PERFORMANCE OF SERVICES DISCLOSURE**

**(submit with Bid/Proposal)**

Pursuant to Md. Ann. Code, State Finance and Procurement Article, § 12-111, and in conjunction with the Bid/Proposal submitted in response to Solicitation No. **T-8000-0451**, the following disclosures are hereby made:

- 1. At the time of Bid/Proposal submission, the Bidder/Offeror and/or its proposed subcontractors:
  - \_\_\_ have plans
  - \_\_\_ have **no** plans

to perform any services required under the resulting Contract outside of the United States.

2. If services required under the contract are anticipated to be performed outside the United States by either the Bidder/Offeror or its proposed subcontractors, the Bidder/Offeror shall answer the following (attach additional pages if necessary):

a. Location(s) services will be performed:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

b. Reasons why it is necessary or advantageous to perform services outside the United States:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

The undersigned, being an authorized representative of the Bidder/Offeror, hereby affirms that the contents of this disclosure are true to the best of my knowledge, information, and belief.

Date: \_\_\_\_\_

Bidder/Offeror Name: \_\_\_\_\_

By (Signature): \_\_\_\_\_

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Please be advised that the Department may contract for services provided outside of the United States if: the services are not available in the United States; the price of services in the United States exceeds by an unreasonable amount the price of services provided outside the United States; or the quality of services in the United States is substantially less than the quality of comparably priced services provided outside the United States.

**ATTACHMENT N – BUY AMERICA CERTIFICATE**

**(submit with Bid/Proposal)**

STATE OF MARYLAND  
DEPARTMENT OF TRANSPORTATION  
MARYLAND TRANSIT ADMINISTRATION

As a condition of responsiveness, the bidder or offeror must submit with his bid a completed Certificate of Compliance OR a Certificate of Non-Compliance.

**STEEL, IRON OR MANUFACTURED PRODUCTS**

CERTIFICATE OF COMPLIANCE WITH 49 U.S.C. 5323 (j)(1)

The bidder hereby certifies that it will comply with the requirements of 49 U.S.C. 5323(j)(1) and the applicable regulations in 49 C.F.R. Part 661.5.

DATE \_\_\_\_\_

SIGNATURE \_\_\_\_\_

COMPANY NAME \_\_\_\_\_

TITLE \_\_\_\_\_

-OR-

CERTIFICATE FOR NON-COMPLIANCE WITH 49 U.S.C. 5323 (j)(1)

The bidder hereby certifies that it cannot comply with the requirements of 49 U.S.C. 5323(j)(1) and 49 C.F.R. 661.5, but it may qualify for an exception pursuant to 49 U.S.C. 5323(j)(2)(A), 5323(j)(2)(B), or 5323(j)(2)(D), and 49 C.F.R. 661.7.4

DATE \_\_\_\_\_

SIGNATURE \_\_\_\_\_

COMPANY NAME \_\_\_\_\_

TITLE \_\_\_\_\_

**ATTACHMENT O – BUS TESTING CERTIFICATION**

(must be submitted with bid)

**Bus Testing**

**49 U.S.C. 5318(e)**

**49 CFR Part 665**

The Contractor [Manufacturer] agrees to comply with 49 U.S.C. A 5323(c) and FTA's implementing regulation at 49 CFR Part 665 and shall perform the following:

1. A manufacturer of a new bus model or a bus produced with a major change in components or configuration shall provide a copy of the final test report to the recipient at a point in the procurement process specified by the recipient which will be prior to the recipient's final acceptance of the first vehicle.
2. A manufacturer who releases a report under paragraph 1 above shall provide notice to the operator of the testing facility that the report is available to the public.
3. If the manufacturer represents that the vehicle was previously tested, the vehicle being sold should have the identical configuration and major components as the vehicle in the test report, which must be provided to the recipient prior to recipient's final acceptance of the first vehicle. If the configuration or components are not identical, the manufacturer shall provide a description of the change and the manufacturer's basis for concluding that it is not a major change requiring additional testing.
4. If the manufacturer represents that the vehicle is "grandfathered" (has been used in mass transit service in the United States before October 1, 1988, and is currently being produced without a major change in configuration or components), the manufacturer shall provide the name and address of the recipient of such a vehicle and the details of that vehicle's configuration and major components.

**CERTIFICATION OF COMPLIANCE WITH FTA'S BUS TESTING REQUIREMENTS**

The undersigned [Contractor/Manufacturer] certifies that the vehicle offered in this procurement complies with 49 U.S.C. A 5323(c) and FTA's implementing regulation at 49 CFR Part 665.

The undersigned understands that misrepresenting the testing status of a vehicle acquired with Federal financial assistance may subject the undersigned to civil penalties as outlined in the Department of Transportation's regulation on Program Fraud Civil Remedies, 49 CFR Part 31. In addition, the undersigned understands that FTA may suspend or debar a manufacturer under the procedures in 49 CFR Part 29.

Date: \_\_\_\_\_

Signature: \_\_\_\_\_

Company Name: \_\_\_\_\_

Title: \_\_\_\_\_

**BUY AMERICA**

**REQUIREMENTS**

**CONTRACT T-8000-0451**

## Title 49 - Transportation

### PART 661—BUY AMERICA REQUIREMENTS

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#### Section Contents

- § 661.1 Applicability.
  - § 661.3 Definitions.
  - § 661.5 General requirements.
  - § 661.6 Certification requirements for procurement of steel or manufactured products.
  - § 661.7 Waivers.
  - § 661.9 Application for waivers.
  - § 661.11 Rolling stock procurements.
  - § 661.12 Certification requirement for procurement of buses, other rolling stock and associated equipment.
  - § 661.13 Grantee responsibility.
  - § 661.15 Investigation procedures.
  - § 661.17 Failure to comply with certification.
  - § 661.18 Intentional violations.
  - § 661.19 Sanctions.
  - § 661.20 Rights of parties.
  - § 661.21 State Buy America provisions.
- 

**Authority:** 49 U.S.C. 5323(j) (formerly sec. 165 of the Surface Transportation Assistance Act of 1982 (Pub. L. 97-424); as amended by sec. 337, Pub. L. 100-17; sec. 1048, Pub. L. 102-240; sec. 3020(b), Pub. L. 105-178; and sec. 3023(i) and (k), Pub. L. 109-59); 49 CFR 1.51.

**Source:** 56 FR 932, Jan. 9, 1991, unless otherwise noted.

#### § 661.1 Applicability.

Unless otherwise noted, this part applies to all federally assisted procurements using funds authorized by 49 U.S.C. 5323(j); 23 U.S.C. 103(e)(4); and section 14 of the National Capital Transportation Act of 1969, as amended.

[56 FR 932, Jan. 9, 1991, as amended at 72 FR 53696, Sept. 20, 2007]

#### § 661.3 Definitions.

As used in this part:

*Act* means the Federal Public Transportation Law (49 U.S.C. Chapter 53).

*Administrator* means the Administrator of FTA, or designee.

*Component* means any article, material, or supply, whether manufactured or unmanufactured, that is directly incorporated into the end product at the final assembly location.

*Contractor* means a party to a third party contract other than the grantee.

*End product* means any vehicle, structure, product, article, material, supply, or system, which directly incorporates constituent components at the final assembly location, that is acquired for public use under a federally-funded third-party contract, and which is ready to provide its

intended end function or use without any further manufacturing or assembly change(s). A list of representative end products is included at Appendix A to this section.

*FTA* means the Federal Transit Administration.

*Grantee* means any entity that is a recipient of FTA funds.

*Manufactured product* means an item produced as a result of the manufacturing process.

*Manufacturing process* means the application of processes to alter the form or function of materials or of elements of the product in a manner adding value and transforming those materials or elements so that they represent a new end product functionally different from that which would result from mere assembly of the elements or materials.

*Negotiated procurement* means a contract awarded using other than sealed bidding procedures.

*Rolling stock* means transit vehicles such as buses, vans, cars, railcars, locomotives, trolley cars and buses, and ferry boats, as well as vehicles used for support services.

*System* means a machine, product, or device, or a combination of such equipment, consisting of individual components, whether separate or interconnected by piping, transmission devices, electrical cables or circuitry, or by other devices, which are intended to contribute together to a clearly defined function. Factors to consider in determining whether a system constitutes an end product include: Whether performance warranties apply to an integrated system (regardless of whether components are separately warranted); whether products perform on an integrated basis with other products in a system, or are operated independently of associated products in the system; or whether transit agencies routinely procure a product separately (other than as replacement or spare parts).

*United States* means the several States, the Commonwealth of Puerto Rico, the District of Columbia, Guam, American Samoa, the U.S. Virgin Islands, and the Commonwealth of the Northern Mariana Islands.

#### Appendix A to §661.3—End Products

The following is a list of representative end products that are subject to the requirements of Buy America. This list is representative, not exhaustive.

(1) *Rolling stock end products*: All individual items identified as rolling stock in §661.3 ( *e.g.*, buses, vans, cars, railcars, locomotives, trolley cars and buses, ferry boats, as well as vehicles used for support services); train control, communication, and traction power equipment that meets the definition of end product at §661.3 ( *e.g.*, a communication or traction power system, including manufactured bimetallic power rail).

(2) *Steel and iron end products*: Items made primarily of steel or iron such as structures, bridges, and track work, including running rail, contact rail, and turnouts.

(3) *Manufactured end products*: Infrastructure projects not made primarily of steel or iron, including structures (terminals, depots, garages, and bus shelters), ties and ballast; contact rail not made primarily of steel or iron; fare collection systems; computers; information systems; security systems; data processing systems; and mobile lifts, hoists, and elevators.

[72 FR 53696, Sept. 20, 2007, as amended at 74 FR 30239, June 25, 2009]

**§ 661.5 General requirements.**

(a) Except as provided in §661.7 and §661.11 of this part, no funds may be obligated by FTA for a grantee project unless all iron, steel, and manufactured products used in the project are produced in the United States.

(b) All steel and iron manufacturing processes must take place in the United States, except metallurgical processes involving refinement of steel additives.

(c) The steel and iron requirements apply to all construction materials made primarily of steel or iron and used in infrastructure projects such as transit or maintenance facilities, rail lines, and bridges. These items include, but are not limited to, structural steel or iron, steel or iron beams and columns, running rail and contact rail. These requirements do not apply to steel or iron used as components or subcomponents of other manufactured products or rolling stock, or to bimetallic power rail incorporating steel or iron components.

(d) For a manufactured product to be considered produced in the United States:

(1) All of the manufacturing processes for the product must take place in the United States; and

(2) All of the components of the product must be of U.S. origin. A component is considered of U.S. origin if it is manufactured in the United States, regardless of the origin of its subcomponents.

[61 FR 6302, Feb. 16, 1996, as amended at 74 FR 30239, June 25, 2009]

**§ 661.6 Certification requirements for procurement of steel or manufactured products.**

If steel, iron, or manufactured products (as defined in §§661.3 and 661.5 of this part) are being procured, the appropriate certificate as set forth below shall be completed and submitted by each bidder or offeror in accordance with the requirement contained in §661.13(b) of this part.

*Certificate of Compliance with Buy America Requirements*

The bidder or offeror hereby certifies that it will comply with the requirements of 49 U.S.C. 5323(j)(1), and the applicable regulations in 49 CFR part 661.

Date \_\_\_\_\_  
Signature \_\_\_\_\_  
Company \_\_\_\_\_  
Name \_\_\_\_\_  
Title \_\_\_\_\_

*Certificate of Non-Compliance with Buy America Requirements*

The bidder or offeror hereby certifies that it cannot comply with the requirements of 49 U.S.C. 5323(j), but it may qualify for an exception to the requirement pursuant to 49 U.S.C. 5323(j)(2), as amended, and the applicable regulations in 49 CFR 661.7.

Date \_\_\_\_\_  
Signature \_\_\_\_\_  
Company \_\_\_\_\_

Name \_\_\_\_\_  
Title \_\_\_\_\_

[71 FR 14117, Mar. 21, 2006, as amended at 72 FR 53696, Sept. 20, 2007]

**§ 661.7 Waivers.**

(a) Section 5323(j)(2) of Title 49 United States Code provides that the general requirements of 49 U.S.C. 5323(j)(1) shall not apply in four specific instances. This section sets out the conditions for the three statutory waivers based on public interest, non-availability, and price-differential. Section 661.11 of this part sets out the conditions for the fourth statutory waiver governing the procurement of rolling stock and associated equipment.

(b) Under the provision of 49 U.S.C. 5323(j)(2)(A), the Administrator may waive the general requirements of 49 U.S.C. 5323(j)(1) if the Administrator finds that their application would be inconsistent with the public interest. In determining whether the conditions exist to grant this public interest waiver, the Administrator will consider all appropriate factors on a case-by-case basis, unless a general exception is specifically set out in this part. When granting a public interest waiver, the Administrator shall issue a detailed written statement justifying why the waiver is in the public interest. The Administrator shall publish this justification in the Federal Register providing the public with a reasonable time for notice and comment of not more than seven calendar days.

(c) Under the provision of 49 U.S.C. 5323(j)(2), the Administrator may waive the general requirements of 49 U.S.C. 5323(j) if the Administrator finds that the materials for which a waiver is requested are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality.

(1) It will be presumed that the conditions exist to grant this non-availability waiver if no responsive and responsible bid is received offering an item produced in the United States.

(2) In the case of a sole source procurement, the Administrator will grant this non-availability waiver only if the grantee provides sufficient information which indicates that the item to be procured is only available from a single source or that the item to be procured is not produced in sufficient and reasonably available quantities of a satisfactory quality in the United States.

(3) After contract award, the Administrator may grant a non-availability waiver under this paragraph, in any case in which a bidder or Offeror originally certified compliance with the Buy America requirements in good faith, but can no longer comply with its certification. The Administrator will grant a non-availability waiver only if the grantee provides sufficient evidence that the original certification was made in good faith and that the item to be procured cannot now be obtained domestically due to commercial impossibility or impracticability. In determining whether the conditions exist to grant a post-award non-availability waiver, the Administrator will consider all appropriate factors on a case-by-case basis.

(d) Under the provision of section 165(b)(4) of the Act, the Administrator may waive the general requirements of section 165(a) if the Administrator finds that the inclusion of a domestic item or

domestic material will increase the cost of the contract between the grantee and its supplier of that item or material by more than 25 percent. The Administrator will grant this price-differential waiver if the amount of the lowest responsive and responsible bid offering the item or material that is not produced in the United States multiplied by 1.25 is less than the amount of the lowest responsive and responsible bid offering the item or material produced in the United States.

(e) The four statutory waivers of 49 U.S.C. 5323(j)(2) as set out in this part shall be treated as being separate and distinct from each other.

(f) The waivers described in paragraphs (b) and (c) of this section may be granted for a component or subcomponent in the case of the procurement of the items governed by 49 U.S.C. 5323(j)(2)(C) (requirements for rolling stock). If a waiver is granted for a component or a subcomponent, that component or subcomponent will be considered to be of domestic origin for the purposes of §661.11 of this part.

(g) The waivers described in paragraphs (b) and (c) of this section may be granted for a specific item or material that is used in the production of a manufactured product that is governed by the requirements of §661.5(d) of this part. If such a waiver is granted to such a specific item or material, that item or material will be treated as being of domestic origin.

(h) The provisions of this section shall not apply to products produced in a foreign country if the Secretary, in consultation with the United States Trade Representative, determines that:

(1) That foreign country is party to an agreement with the United States pursuant to which the head of an agency of the United States has waived the requirements of this section; and

(2) That foreign country has violated the terms of the agreement by discriminating against products covered by this section that are produced in the United States and are covered by the agreement.

#### Appendix A to §661.7—General Waivers

(a) All waivers published in 48 CFR 25.104 which establish excepted articles, materials, and supplies for the Buy American Act of 1933 (41 U.S.C. 10a–d), as the waivers may be amended from time to time, apply to this part under the provisions of §661.7 (b) and (c).

(b) Under the provisions of §661.7 (b) and (c) of this part, a general public interest waiver from the Buy America requirements applies to microprocessors, computers, microcomputers, or software, or other such devices, which are used solely for the purpose of processing or storing data. This general waiver does not extend to a product or device which merely contains a microprocessor or microcomputer and is not used solely for the purpose of processing or storing data.

(c) Under the provisions of §661.7(b) of this part, a general public interest waiver from the Buy America requirements for “small purchases” (as defined in the “common grant rule,” at 49 CFR 18.36(d)) made by FTA grantees with capital, planning, or operating assistance.

[56 FR 932, Jan. 9, 1991, as amended at 60 FR 37928, July 24, 1995, 61 FR 6302, Feb. 16, 1996; 71 FR 14117, Mar. 21, 2006; 72 FR 53697, Sept. 20, 2007; 74 FR 30239, June 25, 2009]

#### § 661.9 Application for waivers.

(a) This section sets out the application procedures for obtaining all waivers, except those general exceptions set forth in this part for which individual applications are unnecessary and

those covered by 49 U.S.C. 5323(j)(2)(C). The procedures for obtaining an exception covered by 49 U.S.C. 5323(j)(2)(C) are set forth in §661.11 of this part.

(b) A bidder or Offeror who seeks to establish grounds for an exception must seek the exception, in a timely manner, through the grantee.

(c) Except as provided in paragraph (d) of this section, only a grantee may request a waiver. The request must be in writing, include facts and justification to support the waiver, and be submitted to the Administrator through the appropriate Regional Office.

(d) FTA will consider a request for a waiver from a potential bidder, Offeror, or supplier only if the waiver is being sought under §661.7 (f) or (g) of this part.

(e) The Administrator will issue a written determination setting forth the reasons for granting or denying the exception request. Each request for an exception, and FTA's action on the request, are available for public inspection under the provisions of 49 CFR part 601, subpart C.

[56 FR 932, Jan. 9, 1991, as amended at 71 FR 14117, Mar. 21, 2006; 72 FR 53697, Sept. 20, 2007]

**§ 661.11 Rolling stock procurements.**

(a) The provisions of §661.5 do not apply to the procurement of buses and other rolling stock (including train control, communication, and traction power equipment), if the cost of components produced in the United States is more than 60 percent of the cost of all components and final assembly takes place in the United States.

(b) The domestic content requirements in paragraph (a) of this section also apply to the domestic content requirements for components set forth in paragraphs (i), (j), and (l) of this section.

(c) A component is any article, material, or supply, whether manufactured or unmanufactured, that is directly incorporated into an end product at the final assembly location.

(d) A component may be manufactured at the final assembly location if the manufacturing process to produce the component is an activity separate and distinct from the final assembly of the end product.

(e) A component is considered to be manufactured if there are sufficient activities taking place to advance the value or improve the condition of the subcomponents of that component; that is, if the subcomponents have been substantially transformed or merged into a new and functionally different article.

(f) Except as provided in paragraph (k) of this section, a subcomponent is any article, material, or supply, whether manufactured or unmanufactured, that is one step removed from a component (as defined in paragraph (c) of this section) in the manufacturing process and that is incorporated directly into a component.

(g) For a component to be of domestic origin, more than 60 percent of the subcomponents of that component, by cost, must be of domestic origin, and the manufacture of the component must take place in the United States. If, under the terms of this part, a component is determined to be

of domestic origin, its entire cost may be used in calculating the cost of domestic content of an end product.

(h) A subcomponent is of domestic origin if it is manufactured in the United States.

(i) If a subcomponent manufactured in the United States is exported for inclusion in a component that is manufactured outside the United States and it receives tariff exemptions under the procedures set forth in 19 CFR 10.11 through 10.24, the subcomponent retains its domestic identity and can be included in the calculation of the domestic content of an end product even if such a subcomponent represents less than 60 percent of the cost of a particular component.

(j) If a subcomponent manufactured in the United States is exported for inclusion in a component manufactured outside the United States and it does not receive tariff exemption under the procedures set forth in 19 CFR 10.11 through 10.24, the subcomponent loses its domestic identity and cannot be included in the calculation of the domestic content of an end product.

(k) Raw materials produced in the United States and then exported for incorporation into a component are not considered to be a subcomponent for the purpose of calculating domestic content. The value of such raw materials is to be included in the cost of the foreign component.

(l) If a component is manufactured in the United States, but contains less than 60 percent domestic subcomponents, by cost, the cost of the domestic subcomponents and the cost of manufacturing the component may be included in the calculation of the domestic content of the end product.

(m) For purposes of this section, except as provided in paragraph (o) of this section:

(1) The cost of a component or a subcomponent is the price that a bidder or Offeror must pay to a subcontractor or supplier for that component or subcomponent. Transportation costs to the final assembly location must be included in calculating the cost of foreign components and subcomponents.

(2) If a component or subcomponent is manufactured by the bidder or Offeror, the cost of the component is the cost of labor and materials incorporated into the component or subcomponent, an allowance for profit, and the administrative and overhead costs attributable to that component or subcomponent under normal accounting principles.

(n) The cost of a component of foreign origin is set using the foreign exchange rate at the time the bidder or Offeror executes the appropriate Buy America certificate.

(o) The cost of a subcomponent that retains its domestic identity consistent with paragraph (j) of this section shall be the cost of the subcomponent when last purchased, f.o.b. United States port of exportation or point of border crossing as set out in the invoice and entry papers or, if no purchase was made, the value of the subcomponent at the time of its shipment for exportation, f.o.b. United States port of exportation or point of border crossing as set out in the invoice and entry papers.

(p) In accordance with 49 U.S.C. 5323(j), labor costs involved in final assembly shall not be included in calculating component costs.

(q) The actual cost, not the bid price, of a component is to be considered in calculating domestic content.

(r) Final assembly is the creation of the end product from individual elements brought together for that purpose through application of manufacturing processes. If a system is being procured as the end product by the grantee, the installation of the system qualifies as final assembly.

(s) [Reserved]

(t) Train control equipment includes, but is not limited to, the following equipment:

- (1) Mimic board in central control
- (2) Dispatcher's console
- (3) Local control panels
- (4) Station (way side) block control relay cabinets
- (5) Terminal dispatcher machines
- (6) Cable/cable trays
- (7) Switch machines
- (8) Way side signals
- (9) Impedance bonds
- (10) Relay rack bungalows
- (11) Central computer control
- (12) Brake equipment
- (13) Brake systems
- (14) Cab Signaling;
- (15) ATO Equipment;
- (16) ATP Equipment;
- (17) Wayside Transponders;
- (18) Trip Stop Equipment;
- (19) Wayside Magnets;
- (20) Speed Measuring Devices;
- (21) Car Axle Counters;
- (22) Communication Based Train Control (CBTC).

(u) Communication equipment includes, but is not limited to, the following equipment:

- (1) Radios

- (2) Space station transmitter and receivers
- (3) Vehicular and hand-held radios
- (4) PABX telephone switching equipment
- (5) PABX telephone instruments
- (6) Public address amplifiers
- (7) Public address speakers
- (8) Cable transmission system cable
- (9) Cable transmission system multiplex equipment
- (10) Communication console at central control
- (11) Uninterruptible power supply inverters/rectifiers
- (12) Uninterruptible power supply batteries
- (13) Data transmission system central processors
- (14) Data transmission system remote terminals
- (15) Line printers for data transmission system
- (16) Communication system monitor test panel
- (17) Security console at central control
- (18) Antennas;
- (19) Wireless Telemetry Equipment;
- (20) Passenger Information Displays;
- (21) Communications Control Units;
- (22) Communication Control Heads;
- (23) Wireless Intercar Transceivers;
- (24) Multiplexers;
- (25) SCADA Systems;
- (26) LED Arrays;
- (27) Screen Displays such as LEDs and LCDs for communication systems;
- (28) Fiber-optic transmission equipment;
- (29) Fiber-optic transmission equipment;
- (30) Frame or cell based multiplexing equipment; 13) Communication system network elements.

(v) Traction power equipment includes, but is not limited to the following:

- (1) Primary AC switch gear
- (2) Primary AC transformer rectifiers
- (3) DC switch gear
- (4) Traction power console and CRT display system at central control
- (5) Bus ducts with buses (AC and DC)
- (6) Batteries
- (7) Traction power rectifier assemblies
- (8) Distribution panels (AC and DC)
- (9) Facility step-down transformers
- (10) Motor control centers (facility use only)
- (11) Battery chargers
- (12) Supervisory control panel
- (13) Annunciator panels
- (14) Low voltage facility distribution switch board
- (15) DC connect switches
- (16) Negative bus boxes
- (17) Power rail insulators
- (18) Power cables (AC and DC)
- (19) Cable trays
- (20) Instrumentation for traction power equipment
- (21) Connectors, tensioners, and insulators for overhead power wire systems
- (22) Negative drainage boards
- (23) Inverters
- (24) Traction motors
- (25) Propulsion gear boxes
- (26) Third rail pick-up equipment
- (27) Pantographs
- (28) Propulsion Control Systems;
- (29) Surge Arrestors;
- (30) Protective Relaying.

(31) Bimetallic power rail.

(w) The power or third rail is not considered traction power equipment and is thus subject to the requirements of 49 U.S.C. 5323(j) and the requirements of §661.5.

(x) A bidder on a contract for an item covered by 49 U.S.C. 5323(j) who will comply with section 165(b)(3) and regulations in this section is not required to follow the application for waiver procedures set out in §661.9. In lieu of these procedures, the bidder must submit the appropriate certificate required by §661.12.

Appendix A to §661.11—General Waivers

(a) The provisions of §661.11 of this part do not apply when foreign sourced spare parts for buses and other rolling stock (including train control, communication, and traction power equipment) whose total cost is 10 percent or less of the overall project contract cost are being procured as part of the same contract for the major capital item.

(b) [Reserved]

Appendix B to §661.11—Typical Components of Buses

The following is a list of items that typically would be considered components of a bus. This list is not all-inclusive.

Car body shells, engines, transmissions, front axle assemblies, rear axle assemblies, drive shaft assemblies, front suspension assemblies, rear suspension assemblies, air compressor and pneumatic systems, generator/alternator and electrical systems, steering system assemblies, front and rear air brake assemblies, air conditioning compressor assemblies, air conditioning evaporator/condenser assemblies, heating systems, passenger seats, driver's seat assemblies, window assemblies, entrance and exit door assemblies, door control systems, destination sign assemblies, interior lighting assemblies, front and rear end cap assemblies, front and rear bumper assemblies, specialty steel (structural steel tubing, etc.) aluminum extrusions, aluminum, steel or fiberglass exterior panels, and interior trim, flooring, and floor coverings.

Appendix C to §661.11—Typical Components of Rail Rolling Stock

The following is a list of items that typically would be considered components of rail rolling stock. This list is not all inclusive.

Car shells, engines, main transformer, pantographs, traction motors, propulsion gear boxes, interior linings, acceleration and braking resistors, propulsion controls, low voltage auxiliary power supplies, air conditioning equipment, air brake compressors, brake controls, foundation brake equipment, articulation assemblies, train control systems, window assemblies, communication equipment, lighting, seating, doors, door actuators and controls, wheelchair lifts and ramps to make the vehicle accessible to persons with disabilities, couplers and draft gear, trucks, journal bearings, axles, diagnostic equipment, and third rail pick-up equipment.

Appendix D to §661.11—Minimum Requirements for Final Assembly

(a) Rail Cars: In the case of the manufacture of a new rail car, final assembly would typically include, as a minimum, the following operations: installation and interconnection of propulsion control equipment, propulsion cooling equipment, brake equipment, energy sources for auxiliaries and controls, heating and air conditioning, communications equipment, motors, wheels and axles, suspensions and frames; the inspection and verification of all installation and interconnection work; and the in-plant testing of the stationary product to verify all functions.

(b) Buses: In the case of a new bus, final assembly would typically include, at a minimum, the installation and interconnection of the engine, transmission, axles, including the cooling and braking systems; the installation and interconnection of the heating and air conditioning equipment; the installation of pneumatic and electrical systems, door systems, passenger seats, passenger grab rails, destination signs, wheelchair lifts; and road testing, final inspection, repairs and preparation of the vehicles for delivery.

(c) If a manufacturer's final assembly processes do not include all the activities that are typically considered the minimum requirements, it can request a Federal Transit Administration (FTA) determination of compliance. FTA will review these requests on a case-by-case basis to determine compliance with Buy America.

[61 FR 6302, Feb. 16, 1996, as amended at 62 FR 40954, July 31, 1997; 72 FR 53697, Sept. 20, 2007; 72 FR 55103, Sept. 28, 2007; 74 FR 30239, June 25, 2009]

**§ 661.12 Certification requirement for procurement of buses, other rolling stock and associated equipment.**

If buses or other rolling stock (including train control, communication, and traction power equipment) are being procured, the appropriate certificate as set forth below shall be completed and submitted by each bidder in accordance with the requirement contained in §661.13(b) of this part.

*Certificate of Compliance with Buy America Rolling Stock Requirements*

The bidder or Offeror hereby certifies that it will comply with the requirements of 49 U.S.C. 5323(j), and the applicable regulations of 49 CFR 661.11.

Date \_\_\_\_\_  
Signature \_\_\_\_\_  
Company \_\_\_\_\_  
Name \_\_\_\_\_  
Title \_\_\_\_\_

*Certificate of Non-Compliance with Buy America Rolling Stock Requirements*

The bidder or Offeror hereby certifies that it cannot comply with the requirements of 49 U.S.C. 5323(j), but may qualify for an exception to the requirement consistent with 49 U.S.C. 5323(j)(2)(C), and the applicable regulations in 49 CFR 661.7.

Date \_\_\_\_\_  
Signature \_\_\_\_\_  
Company \_\_\_\_\_  
Name \_\_\_\_\_  
Title \_\_\_\_\_

[71 FR 14117, Mar. 21, 2006, as amended at 72 FR 53698, Sept. 20, 2007; 74 FR 30239, June 25, 2009]

**§ 661.13 Grantee responsibility.**

- (a) The grantee shall adhere to the Buy America clause set forth in its grant contract with FTA.
- (b) The grantee shall include in its bid or request for proposal (RFP) specification for procurement within the scope of this part an appropriate notice of the Buy America provision. Such specifications shall require, as a condition of responsiveness, that the bidder or Offeror submit with the bid or offer a completed Buy America certificate in accordance with §§661.6 or 661.12 of this part, as appropriate.

(1) A bidder or Offeror who has submitted an incomplete Buy America certificate or an incorrect certificate of noncompliance through inadvertent or clerical error (but not including failure to sign the certificate, submission of certificates of both compliance and non-compliance, or failure to submit any certification), may submit to the FTA Chief Counsel within ten (10) days of bid opening of submission or a final offer, a written explanation of the circumstances surrounding the submission of the incomplete or incorrect certification in

12 of 22

accordance with 28 U.S.C. 1746, sworn under penalty of perjury, stating that the submission resulted from inadvertent or clerical error. The bidder or Offeror will also submit evidence of intent, such as information about the origin of the product, invoices, or other working documents. The bidder or Offeror will simultaneously send a copy of this information to the FTA grantee.

(i) The FTA Chief Counsel may request additional information from the bidder or Offeror, if necessary. The grantee may not make a contract award until the FTA Chief Counsel issues his/her determination, except as provided in §661.15(m).

(ii) [Reserved]

(2) For negotiated procurements, compliance with the Buy America requirements shall be determined on the basis of the certification submitted with the final offer or final revised proposal. However, where a grantee awards on the basis of initial proposals without discussion, the certification submitted with the initial proposal shall control.

(3) Certification based on ignorance of the proper application of the Buy America requirements is not an inadvertent or clerical error.

(c) Whether or not a bidder or Offeror certifies that it will comply with the applicable requirement, such bidder or Offeror is bound by its original certification (in the case of a sealed bidding procurement) or its certification submitted with its final offer (in the case of a negotiated procurement) and is not permitted to change its certification after bid opening or submission of a final offer. Where a bidder or Offeror certifies that it will comply with the applicable Buy America requirements, the bidder, Offeror, or grantee is not eligible for a waiver of those requirements.

[56 FR 932, Jan. 9, 1991, as amended at 68 FR 9799, Feb. 28, 2003; 71 FR 14117, Mar. 21, 2006]

#### **§ 661.15 Investigation procedures.**

(a) It is presumed that a bidder or Offeror who has submitted the required Buy America certificate is complying with the Buy America provision. A false certification is a criminal act in violation of 18 U.S.C. 1001.

(b) Any party may petition FTA to investigate the compliance of a successful bidder or Offeror with the bidder's or Offeror's certification. That party ("the petitioner") must include in the petition a statement of the grounds of the petition and any supporting documentation. If FTA determines that the information presented in the petition indicates that the presumption in paragraph (a) of this section has been overcome, FTA will initiate an investigation.

(c) In appropriate circumstances, FTA may determine on its own to initiate an investigation without receiving a petition from a third party.

(d) When FTA determines under paragraph (b) or (c) of this section to conduct an investigation, it requests that the grantee require the successful bidder or Offeror to document its compliance with its Buy America certificate. The successful bidder or Offeror has the burden of proof to establish that it is in compliance. Documentation of compliance is based on the specific

circumstances of each investigation, and FTA will specify the documentation required in each case.

(e) The grantee shall reply to the request under paragraph (d) of this section within 15 working days of the request. The investigated party may correspond directly with FTA during the course of investigation, if it informs the grantee that it intends to do so, and if the grantee agrees to such action in writing. The grantee must inform FTA, in writing that the investigated party will respond directly to FTA. An investigated party may provide confidential or proprietary information (see paragraph (l) of this section) directly to FTA while providing other information required to be submitted as part of the investigation through the grantee.

(f) Any additional information requested or required by FTA must be submitted within 5 working days after the receipt of such request unless specifically exempted by FTA.

(g) The grantee's reply (or that of the bidder or Offeror) will be transmitted to the petitioner. The petitioner may submit comments on the reply to FTA within 10 working days after receipt of the reply. The grantee and the low bidder or Offeror will be furnished with a copy of the petitioner's comments, and their comments must be received by FTA within 5 working days after receipt of the petitioner's comments.

(h) The failure of a party to comply with the time limits stated in this section may result in resolution of the investigation without consideration of untimely filed comments.

(i) During the course of an investigation, with appropriate notification to affected parties, FTA may conduct site visits of manufacturing facilities and final assembly locations as it considers appropriate.

(j) FTA will, upon request, make available to any interested party information bearing on the substance of the investigation which has been submitted by the petitioner, interested parties or grantees, except to the extent that withholding of information is permitted or required by law or regulation.

(k) If a party submitting information considers that the information submitted contains proprietary material which should be withheld, a statement advising FTA of this fact may be included, and the alleged proprietary information must be identified wherever it appears. Any comments on the information provided shall be submitted within a maximum of ten days.

(l) For purposes of paragraph (j) of this section, confidential or proprietary material is any material or data whose disclosure could reasonably be expected to cause substantial competitive harm to the party claiming that the material is confidential or proprietary.

(m) When a petition for investigation has been filed before award, the grantee will not make an award before the resolution of the investigation, unless the grantee determines that:

- (1) The items to be procured are urgently required;
- (2) Delivery of performance will be unduly delayed by failure to make the award promptly;  
or
- (3) Failure to make prompt award will otherwise cause undue harm to the grantee or the Federal Government.

(n) In the event that the grantee determines that the award is to be made during the pendency of an investigation, the grantee will notify FTA before to making such award. FTA reserves the right not to participate in the funding of any contract awarded during the pendency of an investigation.

(o) Initial decisions by FTA will be in written form. Reconsideration of an initial decision of FTA may be requested by any party involved in an investigation. FTA will only reconsider a decision only if the party requesting reconsideration submits new matters of fact or points of law that were not known or available to the party during the investigation. A request for reconsideration of a decision of FTA shall be filed not later than ten (10) working days after the initial written decision. A request for reconsideration will be subject to the procedures in this section consistent with the need for prompt resolution of the matter.

[56 FR 932, Jan. 9, 1991, as amended at 71 FR 14118, Mar. 21, 2006]

**§ 661.17 Failure to comply with certification.**

If a successful bidder or Offeror fails to demonstrate that it is in compliance with its certification, it will be required to take the necessary steps in order to achieve compliance. If a bidder or Offeror takes these necessary steps, it will not be allowed to change its original bid price or the price of its final offer. If a bidder or Offeror does not take the necessary steps, it will not be awarded the contract if the contract has not yet been awarded, and it is in breach of contract if a contract has been awarded.

[71 FR 14118, Mar. 21, 2006]

**§ 661.18 Intentional violations.**

A person shall be ineligible to receive any contract or subcontract made with funds authorized under the Federal Public Transportation Act of 2005 pursuant to part 29 of this title if it has been determined by a court or Federal agency that the person intentionally—

(a) Affixed a label bearing a “Made in America” inscription, or an inscription with the same meaning, to a product not made in the United States, but sold in or shipped to the United States and used in projects to which this section applies, or

(b) Otherwise represented that any such product was produced in the United States.

[61 FR 6303, Feb. 16, 1996, as amended at 72 FR 53698, Sept. 20, 2007]

**§ 661.19 Sanctions.**

A willful refusal to comply with a certification by a successful bidder or Offeror may lead to the initiation of debarment or suspension proceedings under part 29 of this title.

[71 FR 14118, Mar. 21, 2006]

**§ 661.20 Rights of parties.**

(a) A party adversely affected by an FTA action under this subsection shall have the right to seek review under the Administrative Procedure Act (APA), 5 U.S.C. 702 *et seq.*

(b) Except as provided in paragraph (a) of this section, the sole right of any third party under the Buy America provision is to petition FTA under the provisions of §661.15 of this part. No third party has any additional right, at law or equity, for any remedy including, but not limited to, injunctions, damages, or cancellation of the Federal grant or contracts of the grantee.

[71 FR 14118, Mar. 21, 2006]

**§ 661.21 State Buy America provisions.**

(a) Except as provided in paragraph (b) of this section, any State may impose more stringent Buy America or buy national requirements than contained in section 165 of the Act and the regulations in this part.

(b) FTA will not participate in contracts governed by the following:

(1) State Buy America or Buy National preference provisions which are not as strict as the Federal requirements.

(2) State and local Buy National or Buy America preference provisions which are not explicitly set out under State law. For example, administrative interpretations of non-specific State legislation will not control.

(3) State and local Buy Local preference provisions.

## PART 663—PRE-AWARD AND POST-DELIVERY AUDITS OF ROLLING STOCK PURCHASES

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### Section Contents

#### Subpart A—General

- § 663.1 Purpose.
- § 663.3 Scope.
- § 663.5 Definitions.
- § 663.7 Certification of compliance to FTA.
- § 663.9 Audit limitations.
- § 663.11 Audit financing.
- § 663.13 Buy America requirements.
- § 663.15 Compliance.

#### Subpart B—Pre-Award Audits

- § 663.21 Pre-award audit requirements.
- § 663.23 Description of pre-award audit.
- § 663.25 Pre-award Buy America certification.
- § 663.27 Pre-award purchaser's requirements certification.

#### Subpart C—Post-Delivery Audits

- § 663.31 Post-delivery audit requirements.
- § 663.33 Description of post-delivery audit.
- § 663.35 Post-delivery Buy America certification.
- § 663.37 Post-delivery purchaser's requirements certification.
- § 663.39 Post-delivery audit review.

#### Subpart D—Certification of Compliance With or Inapplicability of Federal Motor Vehicle Safety Standards

- § 663.41 Certification of compliance with Federal motor vehicle safety standards.
- § 663.43 Certification that Federal motor vehicle standards do not apply.

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**Authority:** 49 U.S.C. 1608(j); 23 U.S.C. 103(e)(f); Pub. L. 96–184, 93 Stat. 1320; Pub. L. 101–551, 104 Stat. 2733; sec. 3023(m), Pub. L. 109–59; 49 CFR 1.51.

**Source:** 56 FR 48395, Sept. 24, 1991, unless otherwise noted.

#### Subpart A—General

##### § 663.1 Purpose.

This part implements section 12(j) of the Federal Mass Transit Act of 1964, as amended, which was added by section 319 of the 1987 Surface Transportation and Uniform Relocation Assistance Act (Pub. L. 100–17). Section 12(j) requires the Federal Transit Administration, by delegation from the Secretary of Transportation, to issue regulations requiring pre-award and post-delivery audits when a recipient of Federal financial assistance purchases rolling stock with funds made available under the Federal Mass Transit Act, as amended.

##### § 663.3 Scope.

This part applies to a recipient purchasing rolling stock to carry passengers in revenue service with funds made available under sections 3, 9, 18, and 16(b)(2) of the Federal Mass Transit Act, as amended; 23 U.S.C. 103(e)(4); and section 14 of the National Capital Transportation Act of 1969, as amended.

**§ 663.5 Definitions.**

As used in this part—

- (a) *Pre-award* means that period in the procurement process before the recipient enters into a formal contract with the supplier.
- (b) *Post-delivery* means the time period in the procurement process from when the rolling stock is delivered to the recipient until title to the rolling stock is transferred to the recipient or the rolling stock is put into revenue service, whichever is first.
- (c) *Recipient* means a recipient of Federal financial assistance from FTA.
- (d) *Revenue service* means operation of rolling stock for transportation of fare-paying passengers as anticipated by the recipient.
- (e) *Rolling stock* means buses, vans, cars, railcars, locomotives, trolley cars and buses, ferry boats, and vehicles used for guide ways and incline planes.
- (f) *Audit* means a review resulting in a report containing the necessary certifications of compliance with Buy America standards, purchaser's requirements specifications, and, where appropriate, a manufacturer's certification of compliance with or inapplicability of the Federal Motor Vehicle Safety Standards, required by section 319 of STURAA and this part.
- (g) *FTA* means the Federal Transit Administration.

**§ 663.7 Certification of compliance to FTA.**

A recipient purchasing revenue service rolling stock with funds obligated by FTA on or after October 24, 1991, must certify to FTA that it will conduct or cause to be conducted pre-award and post-delivery audits as prescribed in this part. In addition, such a recipient must maintain on file the certifications required under subparts B, C, and D of this part.

**§ 663.9 Audit limitations.**

- (a) An audit under this part is limited to verifying compliance with
  - (1) Applicable Buy America requirements [section 165 of the Surface Transportation Assistance Act of 1982, as amended,]; and
  - (2) Solicitation specification requirements of the recipient.
- (b) An audit under this part includes, where appropriate, a copy of a manufacturer's self certification information that the vehicle complies with Federal Motor Vehicle Safety Standards or a certification that such standards are inapplicable.
- (c) An audit conducted under this part is separate from the single annual audit requirement established by Office of Management and Budget Circular A-128, "Audits of State and Local Governments," dated May 16, 1985.

**§ 663.11 Audit financing.**

A recipient purchasing revenue rolling stock with FTA funds may charge the cost of activities required by this part to the grant which FTA made for such purchase.

**§ 663.13 Buy America requirements.**

A Buy America certification under this part shall be issued in addition to any certification which may be required by part 661 of this title. Nothing in this part precludes FTA from conducting a Buy America investigation under part 661 of this title.

**§ 663.15 Compliance.**

A recipient subject to this part shall comply with all applicable requirements of this part. Such compliance is a condition of receiving Federal financial assistance from FTA. A recipient determined not to be in compliance with this part will be subject to the immediate suspension, withholding, or repayment of Federal financial assistance from FTA or other appropriate actions unless and until it comes into compliance with this part.

**Subpart B—Pre-Award Audits**

**§ 663.21 Pre-award audit requirements.**

A recipient purchasing revenue service rolling stock with FTA funds must ensure that a pre-award audit under this part is complete before the recipient enters into a formal contract for the purchase of such rolling stock.

**§ 663.23 Description of pre-award audit.**

A pre-award audit under this part includes—

- (a) A Buy America certification as described in §663.25 of this part;
- (b) A purchaser's requirements certification as described in §663.27 of this part; and
- (c) Where appropriate, a manufacturer's Federal Motor Vehicle Safety certification information as described in §663.41 or §663.43 of this part.

**§ 663.25 Pre-award Buy America certification.**

For purposes of this part, a pre-award Buy America certification is a certification that the recipient keeps on file that—

- (a) There is a letter from FTA which grants a waiver to the rolling stock to be purchased from the Buy America requirements under section 165(b)(1), (b)(2), or (b)(4) of the Surface Transportation Assistance Act of 1982, as amended; or
- (b) The recipient is satisfied that the rolling stock to be purchased meets the requirements of section 165(a) or (b)(3) of the Surface Transportation Assistance Act of 1982, as amended, after having reviewed itself or through an audit prepared by someone other than the manufacturer or its agent documentation provided by the manufacturer which lists—
  - (1) Component and subcomponent parts of the rolling stock to be purchased identified by manufacturer of the parts, their country of origin and costs; and
  - (2) The location of the final assembly point for the rolling stock, including a description of the activities that will take place at the final assembly point and the cost of final assembly.

**§ 663.27 Pre-award purchaser's requirements certification.**

For purposes of this part, a pre-award purchaser's requirements certification is a certification a recipient keeps on file that—

- (a) The rolling stock the recipient is contracting for is the same product described in the purchaser's solicitation specification; and
- (b) The proposed manufacturer is a responsible manufacturer with the capability to produce a vehicle that meets the recipient's specification set forth in the recipient's solicitation.

**Subpart C—Post-Delivery Audits**

**§ 663.31 Post-delivery audit requirements.**

A recipient purchasing revenue service rolling stock with FTA funds must ensure that a post-delivery audit under this part is complete before title to the rolling stock is transferred to the recipient.

**§ 663.33 Description of post-delivery audit.**

A post-delivery audit under this part includes—

- (a) A post-delivery Buy America certification as described in §663.35 of this part;
- (b) A post-delivery purchaser's requirements certification as described in §663.37 of this part; and
- (c) When appropriate, a manufacturer's Federal Motor Vehicle Safety Standard self-certification information as described in §663.41 or §663.43 of this part.

**§ 663.35 Post-delivery Buy America certification.**

For purposes of this part, a post-delivery Buy America certification is a certification that the recipient keeps on file that—

- (a) There is a letter from FTA which grants a waiver to the rolling stock received from the Buy America requirements under sections 165 (b)(1), or (b)(4) of the Surface Transportation Assistance Act of 1982, as amended; or
- (b) The recipient is satisfied that the rolling stock received meets the requirements of section 165 (a) or (b)(3) of the Surface Transportation Assistance Act of 1982, as amended, after having reviewed itself or by means of an audit prepared by someone other than the manufacturer or its agent documentation provided by the manufacturer which lists—
  - (1) Components and subcomponent parts of the rolling stock identified by manufacturer of the parts, their country of origin and costs; and
  - (2) The actual location of the final assembly point for the rolling stock including a description of the activities which took place at the final assembly point and the cost of the final assembly.

**§ 663.37 Post-delivery purchaser's requirements certification.**

For purposes of this part, a post-delivery purchaser's requirements certification is a certification that the recipient keeps on file that—

(a) Except for procurements covered under paragraph (c) in this section, a resident inspector (other than an agent or employee of the manufacturer) was at the manufacturing site throughout the period of manufacture of the rolling stock to be purchased and monitored and completed a report on the manufacture of such rolling stock. Such a report, at a minimum, shall—

- (1) Provide accurate records of all vehicle construction activities; and
- (2) Address how the construction and operation of the vehicles fulfills the contract specifications.

(b) After reviewing the report required under paragraph (a) of this section, and visually inspecting and road testing the delivered vehicles, the vehicles meet the contract specifications.

(c) For procurements of:

- (1) Ten or fewer buses; or
- (2) Procurements of twenty vehicles or fewer serving rural (other than urbanized) areas, or urbanized areas of 200,000 people or fewer; or
- (3) Any number of primary manufacturer standard production and unmodified vans, after visually inspecting and road testing the vehicles, the vehicles meet the contract specifications.

[56 FR 48395, Sept. 24, 1991, as amended at 71 FR 14118, Mar. 21, 2006]

**§ 663.39 Post-delivery audit review.**

(a) If a recipient cannot complete a post-delivery audit because the recipient or its agent cannot certify Buy America compliance or that the rolling stock meets the purchaser's requirements specified in the contract, the rolling stock may be rejected and final acceptance by the recipient will not be required. The recipient may exercise any legal rights it has under the contract or at law.

(b) This provision does not preclude the recipient and manufacturer from agreeing to a conditional acceptance of rolling stock pending manufacturer's correction of deviations within a reasonable period of time.

**Subpart D—Certification of Compliance with or Inapplicability of Federal Motor Vehicle Safety Standards**

**§ 663.41 Certification of compliance with Federal motor vehicle safety standards.**

If a vehicle purchased under this part is subject to the Federal Motor Vehicle Safety Standards issued by the National Highway Traffic Safety Administration in part 571 of this title, a recipient shall keep on file its certification that it received, both at the pre-award and post-delivery stage, a copy of the manufacturer's self-certification information that the vehicle complies with relevant Federal Motor Vehicle Safety Standards.

**§ 663.43 Certification that Federal motor vehicle standards do not apply.**

(a) Except for rolling stock subject to paragraph (b) of this section, if a vehicle purchased under this part is not subject to the Federal Motor Vehicle Safety Standards issued by the National Highway Traffic Safety Administration in part 571 of this title, the recipient shall keep on file its certification that it received a statement to that effect from the manufacturer.

(b) This subpart shall not apply to rolling stock that is not a motor vehicle.

**MANDATORY**

**FEDERAL CLAUSES**

**CONTRACT T-8000-0451**

# MANDATORY FEDERAL CLAUSES FOR FEDERALLY FUNDED PROJECTS

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## Cargo Preference Requirements

**46 U.S.C. 1241**  
**46 CFR Part 381**

Use of United States-Flag Vessels - The contractor agrees: a. *to use* privately owned United States-Flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved, whenever shipping any equipment, material, or commodities pursuant to the underlying contract to the extent such vessels are available at fair and reasonable rates for United States-Flag commercial vessels; b. *to furnish within 20* working days following the date of loading for shipments originating within the United States or within 30 working days following the date of leading for shipments originating outside the United States, a legible copy of a rated, "on-board" commercial ocean bill-of-lading in English for each shipment of cargo *described in the preceding paragraph* to the Division of National Cargo, Office of Market Development, Maritime Administration, Washington, DC 20590 and to the FTA recipient (*through the contractor in the case of a subcontractor's bill-of-lading.*) c. *to include these requirements in all subcontracts issued pursuant to this contract when the subcontract may involve the transport of equipment, material, or commodities by ocean vessel.*

## Energy Conservation Requirements

**42 U.S.C. 6321 et seq.**  
**49 CFR Part 18**

The contractor agrees to comply with mandatory standards and policies relating to energy efficiency which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act.

## Clean Water Requirements

**33 U.S.C. 1251**

1. The Contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Federal Water Pollution Control Act, as amended, 33 U.S.C. 1251 et seq . The Contractor agrees to report each violation to the Purchaser and understands and agrees that the Purchaser will, in turn, report each violation as required to assure notification to FTA and the appropriate EPA Regional Office.
2. The Contractor also agrees to include these requirements in each subcontract exceeding \$100,000 financed in whole or in part with Federal assistance provided by FTA.

## **Federal Changes**

### **49 CFR Part 18**

Contractor shall at all times comply with all applicable FTA regulations, policies, procedures and directives, including without limitation those listed directly or by reference in the Master Agreement between Purchaser and FTA, as they may be amended or promulgated from time to time during the term of this contract. Contractor's failure to so comply shall constitute a material breach of this contract.

## **CLEAN AIR**

### **42 U.S.C. 7401 et seq**

### **40 CFR 15.61**

### **49 CFR Part 18**

1. The Contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. §§ 7401 *et seq.* The Contractor agrees to report each violation to the Purchaser and understands and agrees that the Purchaser will, in turn, report each violation as required to assure notification to FTA and the appropriate EPA Regional Office.
2. The Contractor also agrees to include these requirements in each subcontract exceeding \$100,000 financed in whole or in part with Federal assistance provided by FTA.

## **Recycled Products**

### **42 U.S.C. 6962**

### **40 CFR Part 247**

### **Executive Order 12873**

The contractor agrees to comply with all the requirements of Section 6002 of the Resource Conservation and Recovery Act (RCRA), as amended (42 U.S.C. 6962), including but not limited to the regulatory provisions of 40 CFR Part 247, and Executive Order 12873, as they apply to the procurement of the items designated in Subpart B of 40 CFR Part 247.

## **Davis-Bacon and Copeland Anti-Kickback Acts**

(1) **Minimum wages** - (i) All laborers and mechanics employed or working upon the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and

made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR Part 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph (1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(ii)(A) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

1. Except with respect to helpers as defined as 29 CFR 5.2(n)(4), the work to be performed by the classification requested is not performed by a classification in the wage determination; and
2. The classification is utilized in the area by the construction industry; and
3. The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination; and
4. With respect to helpers as defined in 29 CFR 5.2(n)(4), such a classification prevails in the area in which the work is performed.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the

contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii) (B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(v)(A) The contracting officer shall require that any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefor only when the following criteria have been met:

1. The work to be performed by the classification requested is not performed by a classification in the wage determination; and
2. The classification is utilized in the area by the construction industry; and
3. The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The

Administrator, or an authorized representative, will issue a determination with 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(v) (B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(2) **Withholding** - The MTA shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), all or part of the wages required by the contract, the MTA may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) **Payrolls and basic records** - (i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the project). Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the MTA for transmission to the Federal Transit Administration. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under section 5.5(a)(3)(i) of Regulations, 29 CFR part

5. This information may be submitted in any form desired. Optional Form WH-347 is available for this purpose and may be purchased from the Superintendent of Documents (Federal Stock Number 029-005-00014-1), U.S. Government Printing Office, Washington, DC 20402. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors.

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

1. (1) That the payroll for the payroll period contains the information required to be maintained under section 5.5(a)(3)(i) of Regulations, 29 CFR part 5 and that such information is correct and complete;
2. (2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;
3. (3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the Federal Transit Administration or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) **Apprentices and trainees** - (i) *Apprentices* - Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The

allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator of the Wage and Hour Division of the U.S. Department of Labor determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) *Trainees* - Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) *Equal employment opportunity* - The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) **Compliance with Copeland Act requirements** - The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) **Subcontracts** - The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the Federal Transit Administration may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) **Contract termination: debarment** - A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) **Compliance with Davis-Bacon and Related Act requirements** - All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) **Disputes concerning labor standards** - Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

(10) **Certification of eligibility** - (i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

### **No Government Obligation to Third Parties**

1. The Purchaser and Contractor acknowledge and agree that, notwithstanding any concurrence by the Federal Government in or approval of the solicitation or award of the underlying contract, absent the express written consent by the Federal Government, the Federal Government is not a party to this contract and shall not be subject to any obligations or liabilities to the Purchaser, Contractor, or any other party (whether or not a party to that contract) pertaining to any matter resulting from the underlying contract.

2. The Contractor agrees to include the above clause in each subcontract financed in whole or in part with Federal assistance provided by FTA. It is further agreed that the clause shall not be modified, except to identify the subcontractor who will be subject to its provisions.

## **Program Fraud and False or Fraudulent Statements and Related Acts**

**31 U.S.C. 3801 et seq.  
49 CFR Part 31 18 U.S.C. 1001  
49 U.S.C. 5307**

1. The Contractor acknowledges that the provisions of the Program Fraud Civil Remedies Act of 1986, as amended, 31 U.S.C. § § 3801 et seq . and U.S. DOT regulations, "Program Fraud Civil Remedies," 49 C.F.R. Part 31, apply to its actions pertaining to this Project. Upon execution of the underlying contract, the Contractor certifies or affirms the truthfulness and accuracy of any statement it has made, it makes, it may make, or causes to be made, pertaining to the underlying contract or the FTA assisted project for which this contract work is being performed. In addition to other penalties that may be applicable, the Contractor further acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification, the Federal Government reserves the right to impose the penalties of the Program Fraud Civil Remedies Act of 1986 on the Contractor to the extent the Federal Government deems appropriate.
2. The Contractor also acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification to the Federal Government under a contract connected with a project that is financed in whole or in part with Federal assistance originally awarded by FTA under the authority of 49 U.S.C. § 5307, the Government reserves the right to impose the penalties of 18 U.S.C. § 1001 and 49 U.S.C. § 5307(n)(1) on the Contractor, to the extent the Federal Government deems appropriate.
3. The Contractor agrees to include the above two clauses in each subcontract financed in whole or in part with Federal assistance provided by FTA. It is further agreed that the clauses shall not be modified, except to identify the subcontractor who will be subject to the provisions.

## **Termination**

**49 U.S.C. Part 18  
FTA Circular 4220.1E**

- a. **Termination for Convenience (General Provision)** The (Recipient) may terminate this contract, in whole or in part, at any time by written notice to the Contractor when it is in the Government's best interest. The Contractor shall be paid its costs, including contract close-out costs, and profit on work performed up to the time of termination.

The Contractor shall promptly submit its termination claim to (Recipient) to be paid the Contractor. If the Contractor has any property in its possession belonging to the (Recipient), the Contractor will account for the same, and dispose of it in the manner the (Recipient) directs.

- b. **Termination for Default [Breach or Cause] (General Provision)** If the Contractor does not deliver supplies in accordance with the contract delivery schedule, or, if the contract is for services, the Contractor fails to perform in the manner called for in the contract, or if the Contractor fails to comply with any other provisions of the contract, the (Recipient) may terminate this contract for default. Termination shall be effected by serving a notice of termination on the contractor setting forth the manner in which the Contractor is in default. The contractor will only be paid the contract price for supplies delivered and accepted, or services performed in accordance with the manner of performance set forth in the contract.

If it is later determined by the (Recipient) that the Contractor had an excusable reason for not performing, such as a strike, fire, or flood, events which are not the fault of or are beyond the control of the Contractor, the (Recipient), after setting up a new delivery of performance schedule, may allow the Contractor to continue work, or treat the termination as a termination for convenience.

- c. **Opportunity to Cure (General Provision)** The (Recipient) in its sole discretion may, in the case of a termination for breach or default, allow the Contractor [an appropriately short period of time] in which to cure the defect. In such case, the notice of termination will state the time period in which cure is permitted and other appropriate conditions

If Contractor fails to remedy to (Recipient)'s satisfaction the breach or default of any of the terms, covenants, or conditions of this Contract within [ten (10) days] after receipt by Contractor of written notice from (Recipient) setting forth the nature of said breach or default, (Recipient) shall have the right to terminate the Contract without any further obligation to Contractor. Any such termination for default shall not in any way operate to preclude (Recipient) from also pursuing all available remedies against Contractor and its sureties for said breach or default.

- d. **Waiver of Remedies for any Breach** In the event that (Recipient) elects to waive its remedies for any breach by Contractor of any covenant, term or condition of this Contract, such waiver by (Recipient) shall not limit (Recipient)'s remedies for any succeeding breach of that or of any other term, covenant, or condition of this Contract.
- e. **Termination for Default (Supplies and Service)** If the Contractor fails to deliver supplies or to perform the services within the time specified in this contract or any extension or if the Contractor fails to comply with any other provisions of this contract, the (Recipient) may terminate this contract for default. The (Recipient) shall terminate by delivering to the Contractor a Notice of Termination specifying the nature of the default. The Contractor will only be paid the contract price for supplies delivered and accepted, or services performed in accordance with the manner or performance set forth in this contract.

If, after termination for failure to fulfill contract obligations, it is determined that the Contractor was not in default, the rights and obligations of the parties shall be the same as if the termination had been issued for the convenience of the Recipient.

## **Government-Wide Debarment and Suspension (Nonprocurement)**

### **49 CFR Part 29 Executive Order 12549**

This contract is a covered transaction for purposes of 49 CFR Part 29. As such, the contractor is required to verify that none of the contractor, its principals, as defined at 49 CFR 29.995, or affiliates, as defined at 49 CFR 29.905, are excluded or disqualified as defined at 49 CFR 29.940 and 29.945.

The contractor is required to comply with 49 CFR 29, Subpart C and must include the requirement to comply with 49 CFR 29, Subpart C in any lower tier covered transaction it enters into.

By signing and submitting its bid or proposal, the bidder or proposer certifies as follows:

The certification in this clause is a material representation of fact relied upon by MTA. If it is later determined that the bidder or proposer knowingly rendered an erroneous certification, in addition to remedies available to MTA, the Federal Government may pursue available remedies, including but not limited to suspension and/or debarment. The bidder or proposer agrees to comply with the requirements of 49 CFR 29, Subpart C while this offer is valid and throughout the period of any contract that may arise from this offer. The bidder or proposer further agrees to include a provision requiring such compliance in its lower tier covered transactions.

## **Privacy Act**

### **5 U.S.C. 552**

Contracts Involving Federal Privacy Act Requirements - The following requirements apply to the Contractor and its employees that administer any system of records on behalf of the Federal Government under any contract:

1. The Contractor agrees to comply with, and assures the compliance of its employees with, the information restrictions and other applicable requirements of the Privacy Act of 1974,

5 U.S.C. § 552a. Among other things, the Contractor agrees to obtain the express consent of the Federal Government before the Contractor or its employees operate a system of records on behalf of the Federal Government. The Contractor understands that the requirements of the Privacy Act, including the civil and criminal penalties for violation of that Act, apply to those individuals involved, and that failure to comply with the terms of the Privacy Act may result in termination of the underlying contract.

2. The Contractor also agrees to include these requirements in each subcontract to administer any system of records on behalf of the Federal Government financed in whole or in part with Federal assistance provided by FTA.

### **Civil Rights Requirements**

**29 U.S.C. § 623, 42 U.S.C. § 2000**  
**42 U.S.C. § 6102, 42 U.S.C. § 12112**  
**42 U.S.C. § 12132, 49 U.S.C. § 5332**  
**29 CFR Part 1630, 41 CFR Parts 60 et seq.**

1. *Nondiscrimination* - In accordance with Title VI of the Civil Rights Act, as amended, 42 U.S.C. § 2000d, section 303 of the Age Discrimination Act of 1975, as amended, 42 U.S.C. § 6102, section 202 of the Americans with Disabilities Act of 1990, 42 U.S.C. § 12132, and Federal transit law at 49 U.S.C. § 5332, the Contractor agrees that it will not discriminate against any employee or applicant for employment because of race, color, creed, national origin, sex, age, or disability. In addition, the Contractor agrees to comply with applicable Federal implementing regulations and other implementing requirements FTA may issue.
2. *Equal Employment Opportunity* - The following equal employment opportunity requirements apply to the underlying contract:
  - a. *Race, Color, Creed, National Origin, Sex* - In accordance with Title VII of the Civil Rights Act, as amended, 42 U.S.C. § 2000e, and Federal transit laws at 49 U.S.C. § 5332, the Contractor agrees to comply with all applicable equal employment opportunity requirements of U.S. Department of Labor (U.S. DOL) regulations, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor," 41 C.F.R. Parts 60 *et seq.* , (which implement Executive Order No. 11246, "Equal Employment Opportunity," as amended by Executive Order No. 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," 42 U.S.C. § 2000e note), and with any applicable Federal statutes, executive orders, regulations, and Federal policies that may in the future affect construction activities undertaken in the course of the Project. The Contractor agrees to take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, creed, national origin, sex, or age. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.
  - b. *Age* - In accordance with section 4 of the Age Discrimination in Employment Act of 1967, as amended, 29 U.S.C. § § 623 and Federal transit law at 49 U.S.C. § 5332, the Contractor agrees to refrain from discrimination against present and

prospective employees for reason of age. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

- c. *Disabilities* - In accordance with section 102 of the Americans with Disabilities Act, as amended, 42 U.S.C. § 12112, the Contractor agrees that it will comply with the requirements of U.S. Equal Employment Opportunity Commission, "Regulations to Implement the Equal Employment Provisions of the Americans with Disabilities Act," 29 C.F.R. Part 1630, pertaining to employment of persons with disabilities. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

3. The Contractor also agrees to include these requirements in each subcontract financed in whole or in part with Federal assistance provided by FTA, modified only if necessary to identify the affected parties.

## **Breaches and Dispute Resolution**

### **49 CFR Part 18**

#### **FTA Circular 4220.1E**

**Disputes** - Disputes arising in the performance of this Contract which are not resolved by agreement of the parties shall be decided in writing by the authorized representative of (Recipient)'s [title of employee]. This decision shall be final and conclusive unless within [ten (10)] days from the date of receipt of its copy, the Contractor mails or otherwise furnishes a written appeal to the [title of employee]. In connection with any such appeal, the Contractor shall be afforded an opportunity to be heard and to offer evidence in support of its position. The decision of the [title of employee] shall be binding upon the Contractor and the Contractor shall abide by the decision.

**Performance During Dispute** - Unless otherwise directed by (Recipient), Contractor shall continue performance under this Contract while matters in dispute are being resolved.

**Claims for Damages** - Should either party to the Contract suffer injury or damage to person or property because of any act or omission of the party or of any of his employees, agents or others for whose acts he is legally liable, a claim for damages therefor shall be made in writing to such other party within a reasonable time after the first observance of such injury of damage.

**Remedies** - Unless this contract provides otherwise, all claims, counterclaims, disputes and other matters in question between the (Recipient) and the Contractor arising out of or relating to this agreement or its breach will be decided by arbitration if the parties mutually agree, or in a court of competent jurisdiction within the State in which the (Recipient) is located.

**Rights and Remedies** - The duties and obligations imposed by the Contract Documents and the rights and remedies available thereunder shall be in addition to and not a limitation of any duties, obligations, rights and remedies otherwise imposed or available by law. No action or failure to act by the (Recipient), (Architect) or Contractor shall constitute a waiver of any right or duty afforded any of them under the Contract, nor shall any such action or failure to act constitute an approval of or acquiescence in any breach thereunder, except as may be specifically agreed in writing.

## **Incorporation of Federal Transit Administration (FTA) Terms**

### **FTA Circular 4220.1E**

Incorporation of Federal Transit Administration (FTA) Terms - The preceding provisions include, in part, certain Standard Terms and Conditions required by DOT, whether or not expressly set forth in the preceding contract provisions. All contractual provisions required by DOT, as set forth in FTA Circular 4220.1E are hereby incorporated by reference. Anything to the contrary herein notwithstanding, all FTA mandated terms shall be deemed to control in the event of a conflict with other provisions contained in this Agreement. The Contractor shall not perform any act, fail to perform any act, or refuse to comply with any (name of grantee) requests which would cause (name of grantee) to be in violation of the FTA terms and conditions.

# TECHNICAL SPECIFICATION – 40 FOOT BUS

## SECTION 6: TECHNICAL SPECIFICATIONS

### GENERAL

#### TS 1. Scope

Technical specifications define requirements for **heavy-duty low floor forty (40) foot diesel electric hybrid transit buses**, which, by the selection of specifically identified alternative configurations used in general transit service on urban arterial streets. Buses shall have a minimum expected life of twelve (12) years or 500,000 miles, whichever comes first, and are intended for the widest possible spectrum of passengers, including children, adults, the elderly and people with disabilities.

The MTA has determined in order to potentially reduce costs, it is preferred to continue operation with sub systems and components that are currently being used or that the MTA has tested and proven for use in their transit environment. Standardization of these components allows the MTA to limit risk by using a familiar proven product, one that is currently inventoried in the MTA system and limit training on new and unfamiliar systems / components.

This specification lists components the MTA approves for this procurement. Proposers are encouraged to submit their proposals based on these preferences. MTA approval will be required for substitutions after the proposer has submitted detailed operational and financial benefits of an alternative.

BUS USA: In order to have consistency within the framework of the Intelligent Transportation System (ITS) the MTA has chosen to integrate the systems. This effort is being done by a contractor for the MTA and provides the MTA an architecture for data exchange between the bus and division, control of various bus functions from the division, the ability to identify issues and provide the operator assistance in dealing with them and the ability to analyze the on street operation and service requirements. The MTA has designated this program BUS-USA. The manufacturer shall coordinate the MTA's contracts for integration installation, testing and BUS-USA system acceptance. Language in TS 83 of this specification may reference requirements for existing MTA fleet retrofits that are not a part of this contract.

This integration will affect the following sections that deal with the ITS component of the technical specification:

#### TS 83 Communications

- TS 83.1 Communications Systems Work
- TS 83.2 Radio AVL System
- TS 83.3 On Board Video Surveillance System (OBVSS)
- TS 83.4 Public Address System
- TS 83.5 Automatic Passenger Counter (APC)
- TS 83.6 Radio Handset and Control
- TS 83.7 Mobile Radio System
- TS 83.8 Automatic Voice Annunciation (AVA)
- TS 83.9 Automatic Vehicle Monitoring (AVM)
- TS 83.10 Pedestrian / Bus Warning System
- TS 83.11 Other Intelligent Onboard Electronics
  - TS 83.11.1 Electronic Cabinet
  - TS 83.11.2 Vehicle Area Networks
  - TS 83.11.3 Wireless Local Area Network (WLAN) Router

TS 83.11.4 Communications Antennas  
TS 83.11.5 Bus Mounted Data Recorders  
TS 83.11.6 Engine Auxiliary Heater Control

## TS 2. Definitions

**Absorbed Glass Mat (AGM).** Used in batteries AGM is a thin ultra-fine fiberglass mat sandwiched between the plates that are saturated with battery acid to about 95% of what they can hold. This mat is then packed in between the plates and slightly compressed, then welded/soldered in place.

**Alternative.** An alternative specification condition to the default bus configuration. The MTA may define alternatives to the default configuration to satisfy local operating requirements. Alternatives for the default configuration will be clearly identified.

**Ambient Temperature.** The temperature of the surrounding air. For testing purposes, ambient temperature must be between 16 °C (50 °F) and 38 °C (100 °F).

**Analog Signals.** A continuous variable signal that is solely dependent upon magnitude to express information content.

**NOTE:** Analog signals are used to represent the state of variable devices such as rheostats, potentiometers, temperature probes, etc.

**Anti-Locking Braking System (ABS).** Computerized wheel sensing system used to prevent brake lock up and wheel slide during heavy brake applications.

**American Standard Code for Information Interchange (ASCII).** A character-encoding scheme originally based on the English alphabet that encodes 128 specified characters - the numbers 0-9, the letters a-z and A-Z, some basic punctuation symbols, some control codes that originated with Teletype machines, and a blank space - into the 7-bit binary integers.

**ASHRAE (Formerly the American Society of Heating, Refrigerating and Air Conditioning Engineers).** The Society and its members focus on building systems, energy efficiency, indoor air quality, refrigeration and sustainability within the industry.

**Audible Discrete Frequency.** An audible discrete frequency is determined to exist if the sound power level in any 1/3-octave band exceeds the average of the sound power levels of the two adjacent 1/3-octave bands by 4 decibels (dB) or more.

**Automatic Locking Retractor (ALR).** The seat belt function that allows the user to lock the retractor at a set position.

**Automatic Traction Control System (ATC).** The wheel traction control system which automatically detects a maximum-traction wheel slippage and controls brake and drive systems so as to maintain this maximum-traction wheel slippage.

**Battery Compartment.** Low-voltage energy storage, i.e. 12/24 VDC batteries.

**Battery Management System (BMS).** Monitors energy, as well as temperature, cell or module voltages, and total pack voltage. The BMS adjusts the control strategy algorithms to maintain the batteries at uniform state of charge and optimal temperatures.

**Braking Resistor.** A device that converts electrical energy into heat, typically used as a retarder to supplement or replace the regenerative braking.

**BUS USA.** MTA's Integrated Intelligent Transportation System (ITS) architecture for data exchange that includes:

- Communications Systems Work
- Radio AVL System
- On Board Video Surveillance System (OBVSS)
- Public Address System
- Automatic Passenger Counter (APC)
- Radio Handset and Control
- Mobile Radio System
- Automatic Voice Annunciation (AVA)
- Automatic Vehicle Monitoring (AVM)
- Pedestrian / Bus Warning System
- Other Intelligent Onboard Electronics
  - Electronic Cabinet
  - Vehicle Area Networks
  - Wireless Local Area Network (WLAN) Router
  - Communications Antennas
  - Bus Mounted Data Recorders
  - Engine Auxiliary Heater Control

**Buy America.** No funds may be obligated by FTA for a grantee project unless the cost of components produced in the United States is more than 60 percent of the cost of all components and final assembly takes place in the United States.

**Capacity (fuel container).** The water volume of a container in gallons (liters).

**Central Business District (CBD).** Altoona test cycle for urban bus operation.

**Cells.** Individual components (i.e., battery or capacitor cells).

**Charge Air Cooling (CAC).** Cooler and associated piping to cool turbocharged intake air prior to induction to the engine.

**Clean Air Act Amendment (CAAA).** Code of Federal Regulations, Title 40 mandating controls on air pollution from mobile sources by regulating both the composition of fuels and emission-control components on motor vehicles and non-road engines.

**Climate Control System (CCS).** The system within the bus which provides passengers and the operator controlled temperature and humidity regardless of the outside ambient temperatures. The system includes the buses heating, ventilation, air conditioning, windshield defroster and all related compressors, pumps and valves.

**Code.** A legal requirement.

**Contractor.** Firm under contract with the MTA to provide bus manufacturing or component integration.

**Cubic Feet per Minute (CFM).** CFM is the measurement of air flow.

**Curb Weight.** Weight of vehicle, including maximum fuel, oil and coolant; and all equipment required for operation and required by this Specification, but without passengers or operator.

**dBA.** Decibels with reference to 0.0002 microbar as measured on the “A” scale.

**DC to DC Converter.** A module which converts a source of direct current (DC) from one voltage level to another.

**Diesel Exhaust Fluid (DEF).** Fluid injected into the exhaust stream at the catalytic converter resulting in a chemical reaction reducing NOx.

**Default Configuration Bus.** The bus described if no alternatives are selected. Signing, colors, the destination sign reading list and other information must be provided by the MTA.

**Department of Transportation (DOT).** Federal agency responsible for oversight of the various modes of transportation serving the United States by ensuring a fast, safe, efficient, accessible and convenient transportation system that meets the vital national interests and enhances the quality of life of the American people.

**Destroyed.** Physically made permanently unusable.

**Discrete Signal.** A signal that can take only pre-defined values, usually of a binary 0 or 1 nature where 0 is battery ground potential and 1 is a defined battery positive potential.

**Diesel Particulate Filter (DPF).** Engine exhaust stream filter trapping exhaust particulate matter and having a regeneration cycle for cleaning.

**Duty Cycle.** The MTA operates in the greater Baltimore area. The operation of buses is in the Central Business District (CBD) and the surrounding urban area. The service operates with approximately 16 stops per mile and provides transit service continually throughout the day and night 7 days per week. MTA buses operate from sea level to 469 feet experiencing up to 6% grades.

**Emergency Locking Retractor (ELR).** The seat belt retractor function that allows the occupant to have free movement while buckled up, but in an emergency situation or crash the retractor instantly locks securing the occupant.

**Electronic Control Unit (ECU).** Electronic unit used to control functions of components using inputs from sensors and the logic signaling actions of the components through the unit’s outputs.

**Electromagnetic Interference (EMI).** An outside electrical disturbance that may interrupt, obstruct, or otherwise degrade or limit the effective performance of the circuit.

**Engine Control Module (ECM).** Electronic module used to control the diesel engine functions using inputs from sensors for diagnostics, acceleration, fuel injection and exhaust aftertreatment with electronic input/output with the propulsion and bus control systems.

**Energy Density.** The relationship between the weight of an energy storage device and its power output in units of watt-hours per kilogram (Wh/kg).

**Energy Storage Medium (ESM).** A component or system of components that stores energy and for which its supply of energy is rechargeable by a PPU and/or an off-vehicle energy source.

**Environmental Protection Agency (EPA).** Federal agency responsible for protecting human health through establishment and enforcement of federal laws for the environment and air quality.

**Equalizer.** Low voltage devices to equalize 12-24 volt charging.

**Failure Mode, Effects and Criticality Analysis (FMECA).** Extends a Failure Modes and Effects Analysis by including a *criticality analysis*, which is used to chart the probability of failure modes against the severity of their consequences.

**Federal Motor Carrier Safety Regulations (FMCSR).** Federal commercial vehicle operational safety requirements.

**Federal Motor Vehicle Safety Standards (FMVSS).** Federal vehicle safety standards for manufacture of new vehicles.

**FMVSS Standard No. 302 - Flammability of Interior Materials - Passenger Cars, Multipurpose Passenger Vehicles, Trucks, and Buses (Effective 9-1-72)**

This standard specifies burn resistance requirements for materials used in the occupant compartments of motor vehicles. Its purpose is to reduce deaths and injuries to motor vehicle occupants caused by vehicle fires, especially those originating in the interior of the vehicle from sources such as matches or cigarettes.

**Fusible Material.** A metal, alloy or other material capable of being melted by heat.

**Finite Element Analysis (FEA).** A type of computer program that uses the finite element method to analyze a material or object and find how applied stresses will affect the material or design.

**Fire Resistant.** Materials that have a flame spread index less than 150 as measured in a radiant panel flame test per ASTM-E 162-90.

**Fireproof.** Materials that will not burn or melt at temperatures less than 2000 °F.

**Free Floor Space:** Floor area available to standees, excluding the area under seats, area occupied by feet of seated passengers, the vestibule area forward of the standee line, and any floor space indicated by manufacturer as non-standee areas such as, the floor space “swept” by passenger doors during operation. Floor area of 1.75 sq ft shall be allocated for the feet of each seated passenger that protrudes into the standee area.

**Fuel Management System.** The MTA uses the S&A Fleetwatch fuel management system.

**Global Positioning System (GPS).** A space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites.

**Gross Axle Weight Rating (GAWR).** The maximum total weight as determined by the axle manufacturer, at which the axle can be safely and reliably operated for its intended purpose.

**Gross Load.** 175 lbs for every designed passenger seating position, for the operator, and for each 1.75 square feet of free floor space.

**Gross Vehicle Weight (GVW).** Curb weight plus gross load.

**Gross Vehicle Weight Rating (GVWR).** The maximum total weight as determined by the vehicle manufacturer, at which the vehicle can be safely and reliably operated for its intended purpose.

**Head Injury Criterion (HIC).** A measurement of the likelihood of head injury arising from an impact.

**High Voltage (HV).** Greater than 50 volts (AC and DC).

**Human Machine Interface (HMI).** An interface which permits interaction between a human being and a machine.

**Hybrid.** A vehicle that uses two or more distinct power sources to propel the vehicle.

**Hybrid System Controller (HSC).** Regulates energy flow throughout hybrid system components in order to provide motive performance and accessory loads, as applicable, while maintaining critical system parameters (voltages, currents, temperatures, etc.) within specified operating ranges.

**Hybrid Drive System (HDS).** The mechanical and/or electromechanical components, including the PPU and energy storage system, which comprise the traction drive portion of the hybrid propulsion system.

**Hybrid Inverter.** A module that converts DC to and from AC.

**Input/Output (I/O).** Electronic communication of devices uses inputs which are the signals or data received by the system, and outputs which are the signals or data sent from it.

**Institute of Electrical and Electronics Engineers Standards Association (IEEE-SA).** An organization within IEEE that develops global standards in a broad range of industries, including: power and energy, biomedical and health care, information technology, telecommunication, transportation, nanotechnology, information assurance and more.

**International Organization for Standardization (ISO).** ISO is an international standard-setting body composed of representatives from various national standards organizations.

**JIC Fittings.** Defined by the SAE J514 and MIL-F-18866 standards, are a type of flare fitting machined with a 37-degree flare seating surface.

**Labeled.** Equipment or materials to which has been attached a label, symbol or other identifying mark of an organization, which is acceptable to the authority having jurisdiction and concerned with product evaluation, which maintains periodic inspection of production labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

**Leakage.** Release of contents through a defect or crack. See *Rupture*.

**Line.** Solid or flexible tubing or hose that carry fluids.

**Local Regulations.** Regulations below the state level.

**Low-Floor Bus.** A bus that, between at least the front (entrance) and rear (exit) doors, has a floor sufficiently low and level so as to remove the need for steps in the aisle between the doors and in the vicinity of these doors.

**Low Voltage (LV).** 50 volts or less (AC and DC).

**Metallic Hose.** A hose whose strength depends primarily on the strength of its metallic parts; it can have metallic liners or covers, or both.

**Mobile Data Terminal (MDT).** A computerized device to communicate with a central dispatch office.

**Module.** Assembly of individual components.

**Motor (Electric).** A device that converts electrical energy into mechanical energy.

**Motor (Traction).** An electric motor used to propel the bus. The context of this specification assumes the device consumes electrical energy for propulsion as well as providing retarding mechanical motion.

**National Electrical Manufacturer's Association (NEMA).** The association of electrical equipment and medical imaging manufacturers who produce standards that define a product, process, or procedure with reference to one or more of the following:

- Nomenclature
- Composition
- Construction
- Dimensions
- Tolerances
- Safety
- Operating characteristics
- Performance
- Ratings
- Testing
- The service for which it is designed

**Operator Control Console (OCC).** Control head for operator control of the destination sign.

**Operator Control Unit (OCU).** Control head for operator control and interface with the buses fare collection system.

**Operator's Eye Range.** The 95th-percentile ellipse defined in SAE Recommended Practice J941, except that the height of the ellipse shall be determined from the seat at its reference height.

**Physical Layer.** The first layer of the seven-layer International Standards Organization (ISO) Open Systems Interconnect (OSI) reference model. This provides the mechanical, electrical, functional and procedural characteristics required to gain access to the transmission medium (e.g., cable) and is responsible for transporting binary information between computerized systems.

**Pipe:** Nonflexible line.

**Portable Test Equipment:** Heavy duty laptops designed for shop programming and diagnostic operations supplied as part of the contract loaded with software capable of communicating with all of the buses electronically controlled and programmable components.

**Pounds per Square Inch (PSI).** It is the pressure resulting from a force of one pound-force applied to an area of one square inch. It is used to determine air, fluid and structural pressure.

**Power.** Work or energy divided by time

**Power Density.** Power divided by mass, volume or area.

**Pre-Production Meeting (PPM).** Meeting conducted to review and adjust the technical requirements to develop the final technical summary for production.

**Prime Power Unit (PPU).** Diesel engine which provides the mechanical energy to rotate the propulsion systems generator.

**Propulsion System.** System that provides propulsion for the vehicle proportional to operator commands. Includes, as applicable, the HDS, energy storage system and the hybrid system controller.

**Radio Frequency (RF).** A rate of oscillation in the range of about 3 kHz to 300 GHz, which corresponds to the frequency of radio waves, and the alternating currents which carry radio signals.

**Real-Time Clock (RTC).** Computer clock that keeps track of the current time.

**Regenerative Braking.** Deceleration of the bus by switching motors to act as generators, which return vehicle kinetic energy to the energy storage system.

**Radio Frequency Interference (RFI).** Electromagnetic radiation which is emitted by electrical circuits carrying rapidly changing signals, as a by-product of their normal operation, and which causes unwanted signals (interference or noise) to be induced in other circuits.

**Seated Load.** 175 lbs for every designed passenger seating position and for the operator.

**Selected Catalytic Reduction (SCR).** System for storing and injecting DEF for injection to the catalyst for reduction of NOx.

**Seated Load Weight (SLW).** Curb weight plus seated load.

**Serial Data Signals.** A current loop based representation of ASCII or alphanumeric data used for transferring information between devices by transmitting a sequence of individual bits in a prearranged order of significance.

**NOTE:** An example is the communication that takes place between two or more electronic components with the ability to process and store information.

**Sources of Ignition.** Devices or equipment that because of their modes of use or operation, are capable of providing sufficient thermal energy to ignite flammable air mixtures when introduced into such a mixture, or when such a mixture comes into contact with them.

**Special Tools.** Tools not normally stocked by the MTA.

**Specification.** A particular or detailed statement, account, or listing of the various elements, materials, dimensions, etc. involved in the manufacturing and construction of a product.

**Stainless Steel (SST).** A steel alloy with a minimum of 10.5% chromium content by mass.

**Standard.** A firm guideline from a consensus group.

**Standee Line.** A line marked across the bus aisle to designate the forward area that passengers may not occupy when the bus is moving.

**State of Charge (SOC).** Quantity of electric energy remaining in the battery relative to the maximum rated Amp hour (Ah) capacity of the battery expressed in percent. This is a dynamic measurement used for the energy storage system. A full SOC indicates that the energy storage system cannot accept further charging from the engine driven generator or the regenerative braking system.

**Stress Loops.** The “pig-tails” commonly used to absorb flexing in piping.

**Structural Analysis Report (SAR).** The SAR provides an engineering determination of the effects of loads on the bus structure and components.

**Structure.** The structure shall be defined as the basic body, including floor deck material and installation, load bearing external panels, structural components, axle mounting provisions and suspension beams and attachment points.

**Ultra Low Sulphur Diesel Fuel (ULSDF).** Diesel fuel meeting the CAAA and diesel engine manufacturers requirements for use with on-highway diesel engines.

**United Nations Economic Commission for Europe (UNECE).** Established to encourage economic cooperation among its member states. Its main area of work are innovation and competitiveness policies, intellectual property, financing innovative development, entrepreneurship and enterprise development, and public private partnerships.

**Ultraviolet (UV).** UV light is electromagnetic radiation with a wavelength shorter than that of visible light, but longer than X-rays

**Valve Regulated Lead Acid (VRLA) Battery.** A VRLA battery is more commonly known as a sealed battery or maintenance free battery and is a type of lead–acid rechargeable battery.

**Wheelchair.** A mobility aid belonging to any class of three- or four-wheeled devices, usable indoors, designed for and used by individuals with mobility impairments, whether operated manually or powered. A “common wheelchair” is such a device that does not exceed 30 inches in width and 48 inches in length measured 2 inches above the ground, and does not weigh more than 600 lbs when occupied.

**Wireless local Area Network (WLAN).** A WLAN links two or more devices using some wireless distribution method.

### TS 3. Referenced Publications

The documents or portions thereof referenced within this specification shall be considered part of the requirements of the specification. The edition indicated for each referenced document is the current edition, as of the date of the APTA issuance of this specification.

## **TS 4. Legal Requirements**

The Contractor shall comply with all applicable federal, state and local regulations. These shall include but not be limited to ADA, as well as state and local accessibility, safety and security requirements. Local regulations are defined as those below the state level.

Buses shall meet all applicable FMVSS, FMCSR, CAAA and Buy America Requirements in effect at location of the MTA and at the date of manufacture.

In the event of any conflict between the requirements of these specifications and any applicable legal requirement, the legal requirement shall prevail. Technical requirements that exceed the legal requirements are not considered to conflict.

## **TS 5. Overall Requirements**

The Contractor shall ensure that the application and installation of major bus subcomponents and systems are compliant with all such subcomponent vendors' requirements and recommendations. The MTA will identify subcomponent vendors that shall submit installation/application approval documents with the completion of a pilot or lead bus. Components used in the vehicle shall be of heavy-duty design and proven in transit service.

### **TS 5.1 Weight**

Each bus shall be designed and constructed in compliance with the design goal of being as lightweight as possible without degradation of safety, appearance, comfort, traction or performance.

Buses at a capacity load shall not exceed the tire, wheel or axle factor limits, brake test criteria or structural design criteria.

### **TS 5.2 Capacity**

The buses shall be designed to carry the gross vehicle weight, which shall not exceed the buses GVWR, tire, wheel, and axle ratings.

### **TS 5.3 Service Life**

The minimum useful design life of the bus in transit service shall be at least twelve (12) years or 500,000 miles. It shall be capable of operating at least 50,000 miles per year, including the 12th year.

### **TS 5.4 Maintenance and Inspection / Tools and Equipment**

Scheduled maintenance tasks shall be related and shall be in accordance with the manufacturer's recommended preventative maintenance schedule (along with routine daily service performed during the fueling operations).

Test ports, as required, shall be provided for commonly checked functions on the bus, such as air intake, exhaust, hydraulic, pneumatic, charge-air and engine cooling systems.

The bus manufacturer shall give prime consideration to the routine problems of maintaining the vehicle. All bus components and systems, both mechanical and electrical, which will require periodic physical work or inspection processes, shall be installed so that a minimum of time is consumed in gaining access to the critical repair areas. It shall not be necessary to disassemble portions of the bus structure and/or equipment such as seats and flooring under seats in order to gain access to these areas. Each bus shall be designed to facilitate the disassembly, reassembly, servicing or maintenance, using tools and equipment that are normally available as standard commercial items.

Requirements for the use of unique specialized tools shall be minimized. The body and structure of the bus shall be designed for ease of maintenance and repair. Individual panels or other equipment which may be damaged in normal service shall be repairable or replaceable. Ease of repair shall be related to the vulnerability of the item to damage in service.

Proposer shall provide a list of all special tools and pricing required (Form CER 9.5, Tools and Test Equipment) for maintaining this equipment. Said list shall be submitted as a supplement to the Pricing Schedule. Included in the Special Tools List shall be 10 Portable Test Equipment heavy duty laptops for every 40 buses purchased. These heavy duty laptops shall be designed for shop programming and diagnostic operations loaded with software capable of communicating with all of the buses electronically controlled and programmable components.

The Contractor shall provide ruggedized, Panasonic Toughbook 31, or approved equal, laptop-based PTE, which shall communicate with the systems through an easily-accessible Ethernet connection port.

The test equipment provided shall perform under the environmental conditions imposed by the activities of bus inspection and the repair shop. The test equipment shall be portable and suitable for industrial service for use on the shop floor, in pit locations, and in the shop environment.

The PTE shall also meet the following requirements:

- a) For each system there shall be system-specific software to be utilized by a common, portable test equipment laptop. The Contractor shall provide all software modules, master copy, and licenses for each portable test equipment program.
- b) The Contractor shall also provide a printer and cabling to permit receiving and printing of downloaded data from the PTE.
- c) The laptop-based test equipment Operating System shall operate under the Microsoft Windows environment. All user interaction with the software shall be consistent with established Windows conventions.
- d) The DTE shall record and display systems faults. The PTE shall display reported faults. The level of fault reporting shall be detailed enough to permit operation and maintenance personnel to identify the failed line replaceable component.
- e) The PTE shall have the capability to record when triggered by an event. Each snapshot shall include the identification of the recorded parameter, sample rates, and include the date and time of the fault.
- f) Terminology for the language shall be consistent, and shall be in plain English language, not logical status alone.
- g) The PTE units shall have the ability to generate automated test report printouts to satisfy regular inspection and testing documentation requirements.
- h) The Contractor shall provide complete parts lists and schematic diagrams of the test equipment, and instructions how to use the equipment.
- i) Other key requirements for the PTE include:
  1. Intel Core™ i7 vPro™
  2. Drop shock protection
  3. Docking stations
  4. Power supply
  5. Cables and connections
  6. Up to 11 hours of battery life

7. Comply with MIL-STD-810G
8. IP65 certification

Form CER 9.5 shall be submitted as a supplement to the Pricing Schedule.

**NOTE:** Tools such as compartment door keys, bellows gauges and other tools that are required for daily maintenance and inspections shall not be included in the special tool list and shall be furnished for each bus.

### **TS 5.5 Interchangeability**

Unless otherwise agreed, all units and components procured under this contract, whether provided by Suppliers or manufactured by the proposer, shall be duplicates in design, manufacture and installation to ensure interchangeability among buses in each order group in this procurement. This interchangeability shall extend to the individual components as well as to their locations in the buses. Components with non-identical functions shall not be, or appear to be, interchangeable.

Any one component or unit used in the construction of these buses shall be an exact duplicate in design, manufacture and assembly for each bus in each order group in this contract. Contractor shall identify and secure approval for any changes in components or unit construction provided within a contract.

MTA shall review proposed product changes on a case-by-case basis and shall have the right to require extended warranties to ensure that product changes perform at least as well as the originally supplied products.

### **TS 5.6 Training**

The Contractor shall have qualified instructor(s) who shall be available at the MTA's property providing training 30 calendar days prior to the delivery of the first bus of each annual purchase. Instructor(s) shall conduct training classes and advise the personnel of the MTA (mechanical, operator and supervisory staff) on the proper operation and maintenance of the buses and their systems. The training times shall be dependent on the MTA service requirements and personnel placement. The Contractor also shall provide visual and other teaching aids (such as manuals, slide presentations and literature) for use by the MTA's own training staff and which becomes the property of the MTA.

The MTA requires the following Training Aids be provided for the training classes which become the property of the MTA at the conclusion of the Contractor training. Items listed below that the MTA currently possess will be evaluated for need and may be negotiated out of the procurement.

Front and rear axle assemblies

I/O controls/Multiplex Training Board

Wheelchair ramp assembly

Engine, radiator, hybrid drive unit and hybrid control and energy storage system mock up

The following chart lists the training curriculum subjects, expected hours, number of classes and total number of training hours.

Subject	Hrs/Class	Number of Classes	Total Class Hours
ADA Ramp and Equipment	8	6	48
Axles and Brakes	16	8	128
Doors, Body and Glass	8	6	48
Engine Accessory	16	8	128
Engine Cooling System	40	4	160
Engine Emission Control System	8	10	80
Engine Familiarization	16	10	160
Engine Overhaul	40	3	120
HVAC	40	8	320
Hybrid Drive Unit	16	8	128
Hybrid Drive Unit Overhaul	40	3	120
Hybrid System Familiarization	24	10	240
I/O Controls/Multiplex System	24	8	192
Maintenance Orientation	2	16	32
Maintenance Orientation & Maint/R&R 60 ft	8	8	64
Operators Orientation 40 ft.	1	32	32
Operators Orientation 60 ft.	1	16	16
Pneumatic System	16	6	96
Preventative Maintenance	8	10	80
Steering and Suspension	8	6	48
System Monitors and Controls	8	8	64
Sub-Total		194	2304
Train the Trainer and Reliability		12	208
TOTALS		206	2512

#### Technical/Service Representatives

The Contractor shall, at its own expense, have one or more competent technical service representatives available on request to assist the MTA in the solution of engineering or design problems within the scope of the specifications that may arise during the warranty period. One service representative shall be designated as a “service manager” capable of coordinating service support, parts acquisition for warranty and fleet defect repairs and coordination of contractors service technicians. The Contractor’s service staff shall respond to MTA’s request for assistance within 24 hours. The service manager and supporting technicians shall be assigned to the MTA project for a period of two years following the acceptance of the last bus of each manufacturing lot. This does not relieve the Contractor of responsibilities under the provisions of “Section 7: Warranty Requirements.”

#### TS 5.7 Operating Environment

The bus shall achieve normal operation in ambient temperature ranges of 10 °F to 115 °F, at relative humidity between 5 percent and 100 percent, and at altitudes up to 3000 feet above sea level. Degradation of performance due to atmospheric conditions shall be minimized at temperatures below 10 °F, above 115 °F . Speed, gradability and acceleration performance requirements shall be met at, or corrected to, 77 °F, 29.31 in. Hg, dry air per SAE J1995.

## TS 5.8 Noise

### Interior Noise

The combination of inner and outer panels and any material used between them shall provide sufficient sound insulation so that a sound source with a level of 80 dBA measured at the outside skin of the bus shall have a sound level of 65 dBA or less at any point inside the bus. These conditions shall prevail with all openings, including doors and windows, closed and with the engine and accessories switched off.

The bus-generated noise level experienced by a passenger at any seat location in the bus shall not exceed 80 dBA. The operator area shall not experience a noise level of more than 75 dBA with the operators fan on high and the HVAC vents completely open.

### Exterior Noise

Airborne noise generated by the bus and measured from either side shall not exceed 80 dBA under full power acceleration when operated 0 to 35 mph at curb weight. The maximum noise level generated by the bus pulling away from a stop at full power shall not exceed 83 dBA. The bus-generated noise at curb idle shall not exceed 65 dBA. If the noise contains an audible discrete frequency, a penalty of 5 dBA shall be added to the sound level measured. The Contractor shall comply with the exterior noise requirements defined in local laws and ordinances identified by the MTA and SAE J366.

## TS 5.9 Fire Safety

The bus shall be designed and manufactured in accordance with all applicable fire safety and smoke emission regulations. These provisions shall include the use of fire-retardant/low-smoke materials, fire detection systems, bulkheads and facilitation of passenger evacuation.

Materials entirely enclosed from the passenger compartment, such as insulation within the sidewalls and sub-floor, need not comply. In addition, smaller components and items, such as seat grab rails, switch knobs and small light lenses, and shall be exempt from this requirement.

All materials used in the construction of the passenger compartment of the bus shall be in accordance with FMVSS 302 "Flammability of Interior Materials" and in accordance with the Recommended Fire Safety Practices defined in FTA Docket 90A, dated October 20, 1993.

**The MTA currently uses Amerex ABC dry chemical fire suppression system, model SafetyNet V-25 and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The bus shall be equipped with an ABC dry chemical pre-engineered fire suppression system. The system shall be approved and listed by Factory Mutual Research Corporation (FM) for use at -65°F to 150°F. The automatic actuation system shall provide 24-hour fire detection of the engine compartment, the particulate muffler and exhaust catalyst area, the bus battery box, and the supplemental diesel-fired heater.

The fire suppression system shall include the following features:

- a) A minimum of one (1) 25-pound capacity and one (1) 13-pound capacity ABC agent cylinders of the stored pressure design shall be furnished and be constructed of welded steel and shall conform to DOT specification 4BW; and be rated for 12-year minimum hydrostatic

retest. The cylinders shall be outfitted with a visual pressure gauge protected by a guard and forged brass valve assemblies.

- b) The fire suppression system shall be provided with an engineered amount of thermostats capable of signaling the activation of the system when temperatures reach engineered levels. Temperature-sensitive weather-proof miniature thermostat(s) shall be located in the bus engine compartment. Additional miniature thermostat(s) will be located in the bus battery compartment, supplemental heater, the particulate muffler and exhaust catalyst area. The Contractor shall include additional thermostats at any other area they deem necessary. Thermostats shall be approved by Factory Mutual (FM) as heat actuated fire detectors. The detectors shall be normally open and capable of carrying sufficient amperage for the purposes of firing the electric actuator(s). The electrical control head shall also be activated manually by depressing an electric switch (button with pull-pin labeled "fire") mounted in the operator's compartment area within practical view and in an overhead location within reach of the operator. The location of the system controls will be reviewed and approved by the MTA at the pre-production meeting.
- c) An engineered amount of suppression agent nozzles with dust caps shall be installed to provide adequate coverage to the engine compartment, the bus battery box, the supplemental heater, and the particulate muffler exhaust catalyst area. The Contractor shall include additional agent nozzles at any other area they deem necessary.
- d) An operator's display / control panel shall be provided. The operator's panel shall provide a simple means of indicating system status to the operator or maintenance personnel. Basic system status shall be indicated by easy to read LEDs and a buzzer indication. The operator's panel shall be capable of being easily accessed by maintenance personnel and include an Ethernet or USB, connection to allow for basic programming. The operator's panel shall provide the following features:
  - 1. Event recording
  - 2. Data logging
  - 3. Internal audible alarm with silencer
  - 4. Relay override
  - 5. Self-test function
  - 6. Keyboard programming capability
  - 7. Built-in battery back-up in the event of bus power failure
  - 8. Remote programming to a laptop computer via Ethernet or USB interface
  - 9. Environmentally sealed enclosure
  - 10. Red background or outline for easy identification
  - 11. LED indicator for system status
  - 12. Automatic bus shutdown feature with 15 second delay from thermal event recognition

The fire suppression system shall have the ability to operate and actuate separately, provide multiple zones of ABC agent, and have the ability to be expanded with additional agent cylinders. The MTA's zones are defined as the engine compartment, particulate filter muffler exhaust catalyst area, bus battery box and the supplemental heater.

The bus OEM shall provide a written sign off (Vendor Installation Certificate) from the fire suppression manufacturer that the system has been engineered to provide adequate fire suppression coverage all installation requirements have been met on the first bus.

An inspection door or window shall be provided by the OEM on the bus body or interior compartment allowing for visual site inspection of each ABC agent cylinder/gauge.

The Contractor shall provide proposed installation drawings after the systems manufacturers engineering review to MTA for review and approval at the pre-production meeting.

### **TS 5.10 Respect for the Environment**

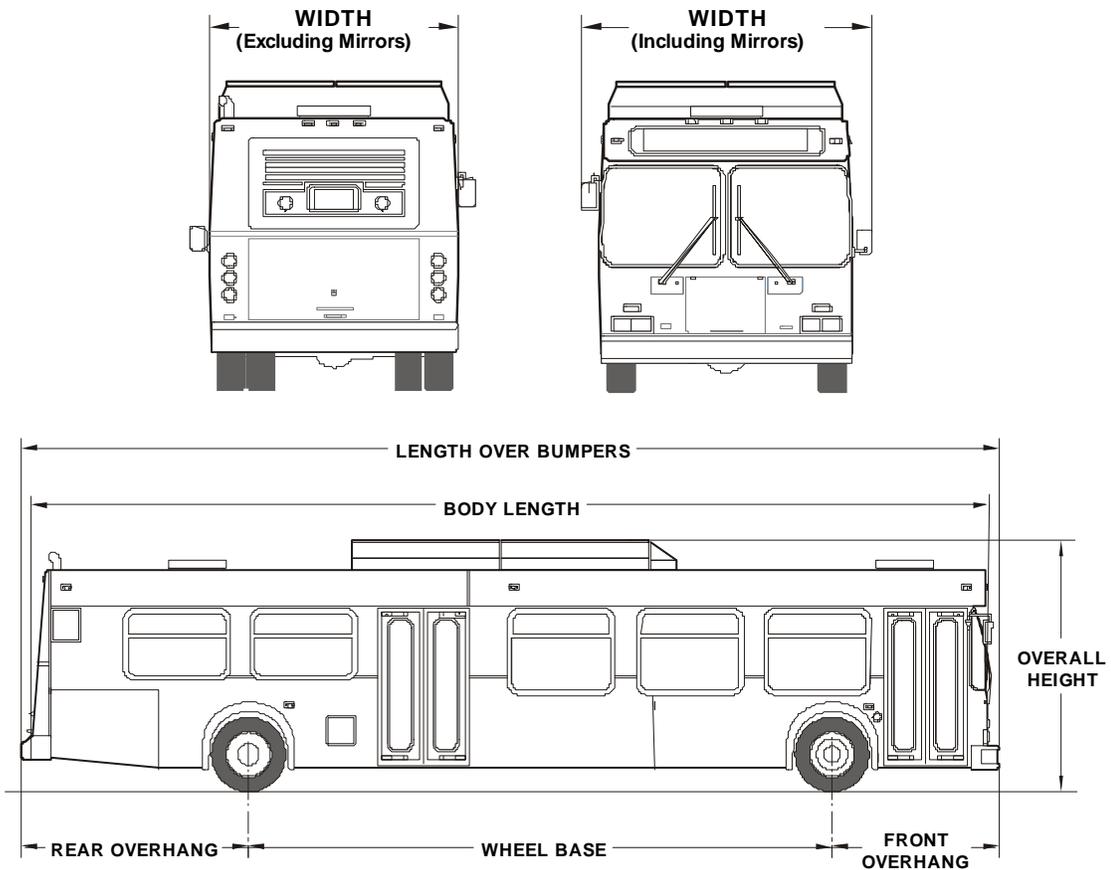
In the design and manufacture of the bus, the Contractor shall make every effort to reduce the amount of potentially hazardous waste. In accordance with Section 6002 of the Resource Conservation and Recovery Act, the Contractor shall use, whenever possible and allowed by the specifications, recycled materials in the manufacture of the bus.

## DIMENSIONS

### TS 6. Physical Size

With exceptions such as exterior mirrors, marker and signal lights, bumpers, fender skirts, washers, wipers, ad frames, cameras, object detection systems and bicycle racks the bus shall have the following overall dimensions as shown in Figure 1 at static conditions and design height.

**FIGURE 1**  
Transit Bus Exterior Dimensions



#### TS 6.1 Bus Length

For ease of use, the following tolerances will be allowable for each given bus length. Bus length is determined as the measurement from bumper to bumper and shall not exceed 41 feet.

- A. Front overhang: maximum of 117 inches
- B. Rear overhang: maximum of 127 inches

#### TS 6.2 Bus Width

The bus body width shall be 102 in. (+0, -1 inch).

### TS 6.3 Bus Height

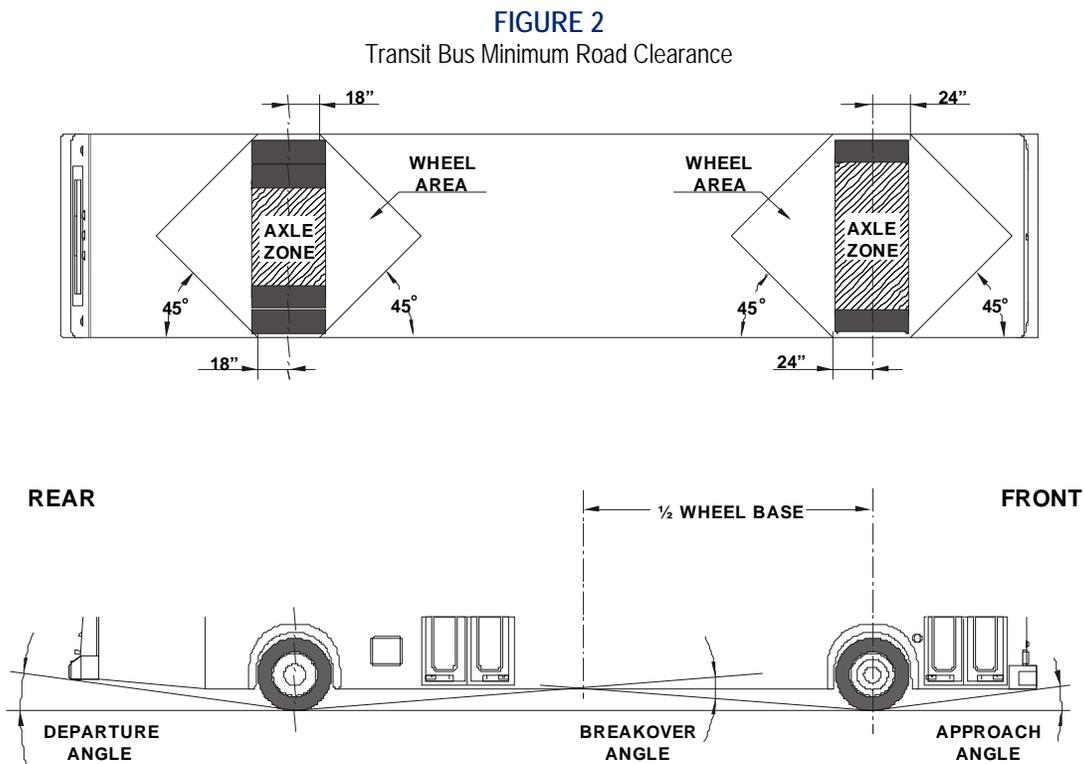
Maximum overall bus height shall be 132 inches, including all rigid, roof-mounted items such as A/C, exhaust, energy storage, controllers and cover, etc.

### TS 6.4 Step Height

The step height shall not exceed 15 inches at either doorway without kneeling. A maximum of two steps is allowed to accommodate a raised aisle floor in the rear of the bus. These steps shall be of equal height and shall not exceed 10 inches in height.

### TS 6.5 Underbody Clearance

The bus shall maintain the minimum underbody clearance dimensions as shown in Figure 2 and defined in SAE Standard J689, regardless of load up to the gross vehicle weight rating.



### TS 6.6 Clearance Angles

The approach angle is the angle measured between a line tangent to the front tire static loaded radius arc and the initial point of structural interference forward of the front tire to the ground.

The departure angle is the angle measured between a line tangent to the rear tire static loaded radius arc and the initial point of structural interference rearward of the rear tire to the ground.

The breakover angle is the angle measured between two lines tangent to the front and rear tire static loaded radius and intersecting at a point on the underside of the vehicle that defines the largest ramp over which the vehicle can roll.

Angle	40-ft Bus
Approach	9.0 degrees (min.)
Front breakover	8.5 degrees (min.)
Departure	9.0 degrees (min.)

### TS 6.7 Ground Clearance

Ground clearance shall be no less than 10 inches, (8 inches at jacking pad) except within the axle zone and wheel area.

Axle zone clearance, which is the projected area between tires and wheels on the same axial centerline, shall be no less than 5.5 inches.

Wheel area clearance shall be no less than 8 inches for parts fixed to the bus body and 6 inches for parts that move vertically with the axles.

### TS 6.8 Floor Height

Height of the step above the street shall be no more than 15 inches measured at the centerline of the front and rear doorway. The floor may be inclined along the longitudinal axis of the bus, and the incline shall not exceed 3.5 degrees off the horizontal except locally at the doors where 2 degree slope toward the door is allowed.

All floor measurements shall be with the bus at the design running height and on a level surface and with the standard installed tires.

A maximum of two steps is allowed to accommodate a raised aisle floor in the rear of the bus.

### TS 6.9 Interior Headroom

Headroom above the aisle and at the centerline of the aisle seats shall be no less than 78 inches in the forward half of the bus tapering to no less than 74 inches forward of the rear settee. At the centerline of the window seats, headroom shall be no lower than 65 inches. Headroom at the back of the rear bench seat may be reduced to a minimum of 72 inches, but it shall increase to the ceiling height at the front of the seat cushion. In any area of the bus directly over the head of a seated passenger and positioned where a passenger entering or leaving the seat is prone to strike his or her head, padding shall be provided on the overhead paneling.

### TS 6.10 Aisle Width

The minimum clear aisle width between pairs of transverse seats and modesty panels with all attached hardware shall be at least 22 inches.

The aisle width between the front wheelhouses shall be at least 44 inches, and the entire area between the front wheelhouses shall be available for passengers and mobility aid devices.

## VEHICLE PERFORMANCE

### TS 7. Power Requirements

The propulsion system shall be sized to provide sufficient power to enable the bus to meet the defined acceleration, top speed, and gradability requirements, and operate all propulsion-driven accessories using actual road test results and computerized vehicle performance data.

### TS 7.1 Top Speed

The bus shall be capable of achieving a top speed of 65 mph on a straight, level road at GVWR with all accessories operating. The bus shall be capable of safely maintaining the vehicle speed according to the recommendations by the tire manufacturer.

**NOTE:** Values are assumed to be sustained. Manufacturer shall supply MTA with data if there is a variance between peak performance and sustained vehicle performance.

### TS 7.2 Gradability

Gradability requirements shall be met on grades with a dry commercial asphalt or concrete pavement at GVWR with all accessories operating.

The propulsion system and drivetrain shall enable the bus to achieve and maintain a speed of 40 mph on a 2½ percent ascending grade and 15 mph on a 10 percent ascending grade continuous.

**NOTE:** Values are assumed to be sustained. Manufacturer shall supply MTA with data if there is a variance between peak performance and sustained vehicle performance.

### TS 7.3 Acceleration

The bus shall meet the acceleration requirements below and shall be sufficiently gradual and smooth to prevent throwing standing passengers off-balance. Acceleration measurement shall commence when the accelerator is depressed. Acceleration requirement times are based using the Allison hybrid mid range setting number 3.

**TABLE 3**

Maximum Start Acceleration Times on a Level Surface<sup>1</sup>

Speed (mph)	Maximum time (seconds)
10	4.0
20	8.5
30	15.0
40	28.0
50	50.0
Top speed	

1. Vehicle weight = GVWR

The hybrid propulsion and braking systems shall meet the performance requirements of the Duty Cycle.

Braking application and performance shall remain consistent regardless of hybrid system SOC or other variances related to regenerative braking.

The system shall be programmable to allow optimization of acceleration and deceleration rate. Performance may be affected when reprogramming. The manufacturer shall supply the new performance data.

## TS 7.4 Operating Range

The operating range of the bus shall be designed to meet the operating profile as stated in the “Operating Environment” section. The operating range of the bus when run on the “Design Operating Profile” shall be at least 500 miles on a full tank of fuel and DEF.

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TS 7.4.2 INTENTIONALLY BLANK

TS 7.4.3 INTENTIONALLY BLANK

## TS 8. Fuel Economy (Design Operating Profile)

Test results from the Altoona CBD fuel economy tests or other applicable test procedures shall be provided to the MTA. Results shall include vehicle configuration and test environment information. Fuel economy data shall be provided for each design operating profile. The design operating profile is defined as the Altoona CBD fuel duty cycle.

### TS 8.1 Hybrid

Energy storage system state of charge correction methods stated in SAE J2711 shall be utilized.

## POWERPLANT

### TS 9. Bus Propulsion

TS 9.1 INTENTIONALLY BLANK

#### TS 9.2 Hybrid Propulsion System

**The MTA currently uses the Allison H 40 EP Hybrid System and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The hybrid drive system shall be a complete package capable of providing electrical power, storage of power, control of power, providing propulsion of the bus and regenerating electrical power through retardation. The system shall provide electrical power to drive the buses accessory loads including electric HVAC system, Beltless Alternator, electrically driven components and the low voltage system. The propulsion system shall be rated for the GVWR or greater of the bus.

##### TS 9.2.1 Propulsion System Description

The bus shall be powered by a hybrid propulsion system. Function and operation of the bus shall be transparent to the operator and passengers. The OEM shall assure that the bus structure can successfully accept the installation of the propulsion system and be operated in Baltimore for a period of 12 years without a structural failure. At a minimum, propulsion system shall comply with applicable Federal CAAA, State and Local emissions and useful life requirements. The systems energy storage, control and propulsion system shall be installed in accordance with the hybrid systems technical requirements. Cooling documentation and vehicle certification shall be provided to the MTA prior to the pilot bus being accepted.

##### TS 9.2.2 Propulsion System Service

The propulsion system shall be arranged so that accessibility for all routine maintenance is assured. No special tools, other than dollies and hoists, shall be required to remove the propulsion

system or any subsystems. However, the MTA shall recognize that properly rated test equipment and safe electrical work practices are essential when servicing high voltage hybrid components. The exhaust system, air cleaner, air compressor, starter (if used), alternator, radiator, all engine accessories, and any other component requiring service or replacement shall be easily removable. Contractor shall provide all specialty tools and diagnostic equipment required for maintaining the Propulsion System in accordance with Special Tools List.

### TS 9.2.3 Primary Propulsion Unit and Traction Motor

The PPU and traction motor may be configured in a variety of methods dependent upon type of drive system.

### TS 9.2.4 Energy Storage and Controller

Design and performance documentation shall be provided to the MTA. Energy storage shall be of a commercial design capable of operating in the MTA transit environment and have a minimum design life of six (6) years. The primary charging of the energy storage medium shall be accomplished by the on-board PPU and regenerative braking.

Thermal management shall be provided to ensure optimal life and performance of the ESM over the environmental operating range.

### TS 9.2.5 Hybrid System Controller

The HSC regulates energy flow throughout hybrid system components in order to provide energy for motive performance and accessory loads, as applicable, while maintaining critical system parameters (e.g., voltages, currents, temperatures, etc.) within specified operating ranges.

The controller shall monitor and process inputs and execute outputs as appropriate to control the operation of all propulsion system components.

### TS 9.2.6 Prime Power Unit

**The MTA currently uses the Cummins 280 horsepower ISL Diesel Engine for the Prime Power and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Contractor shall provide MTA with expected durability of the PPU and related emission systems.

The engine shall comply with applicable federal, state, and local emissions and useful life requirements. Components of the fuel management and/or control system shall have a design life of not less than 150,000 miles without replacement or major service. The lifetime estimate is based on the design operating profile.

The engine shall be equipped with an electronically controlled management system, compatible with either 12- or 24-volt power distribution. The engine control system shall be capable of transmitting and receiving electronic inputs and data from other drivetrain components and broadcasting that data to other vehicle systems. Communication between electronic drivetrain components and other vehicle systems shall be made using the communications networks. The engine's electronic management system shall monitor operating conditions and provide instantaneous adjustments to optimize both engine and bus performance. The system shall be programmable to allow optimization of programmable features.

The engine shall have on-board diagnostic capabilities, able to monitor vital functions, store out-of-parameter conditions in memory, and communicate faults and vital conditions to service personnel. Diagnostic reader device connector ports, suitably protected against dirt and moisture, shall be provided in operator's area and near or inside engine compartment. The on-board diagnostic system shall inform the operator via visual and/or audible alarms when out-of-parameter conditions exist for vital engine functions.

The engine starting system shall be protected by an interlock that prevents its engagement when the engine is running. Special equipment or procedures shall be employed to start the bus when exposed to temperatures less than 30 °F for a minimum of four hours without the engine in operation. All cold weather starting aids, engine heating devices and procedures shall be of the type recommended by the engine manufacturer and approved by the MTA. The integration of all systems on the vehicle relative to engine idle speed shall be the responsibility of the vehicle manufacturer to meet the requirements of the MTA.

The engine control system shall protect the engine against progressive damage. The system shall monitor conditions critical for safe operation and automatically derate power and/or speed and initiate engine shutdown as needed.

Provisions shall be made for installation of an engine starter to be used for diagnostics to start the engine in the event the hybrid drive system is incapable of starting the engine. The provisions at a minimum shall include a flywheel with ring gear, a starter mount on the flywheel with a bolted covering.

#### **TS 9.2.7 Automatic Engine Protection/Shutdown Override Feature**

A control shall be available to the operator that when constantly depressed and released will delay the engine shutdown or allow the bus to be moved. Override action shall be recorded. This data shall be retrievable by the MTA using a laptop.

The engine shall be equipped with an operator-controlled fast idle device. The fast idle control shall be a two-way switch mounted on the dash or side console and shall activate only with the hybrid drive in neutral and the parking brake applied. A second fast idle control switch shall be located in the engine compartment mounted in the engine rear run switch box.

#### **TS 9.2.8 Regenerative Braking**

The powertrain shall be equipped with regenerative braking to recharge the ESM and extend brake lining service life. The application of regenerative braking shall cause a smooth blending of both regenerative braking and service brake function and shall activate the brake lights.

Actuation of ABS and/or automatic traction control shall override the operation of the regenerative braking.

Regenerative braking, with a resulting deceleration of no greater than 0.077g when the throttle pedal is completely released. Maximum regenerative braking shall be achieved when brake pedal is depressed prior to engagement of service brakes, with a maximum resulting deceleration of approximately 0.20g in an empty bus. The resulting decelerations specified include the effects of engine braking, wind resistance and rolling resistance.

The regenerative braking disable switch shall be guarded and shall not be accessible to the seated operator. This switch shall be located in the overhead compartment (destination sign) near the operator.

Disabling regenerative braking shall be recorded for MTA data collection.

### TS 9.3 Auxiliary Heater

**The MTA currently uses ProHeat M80 series auxiliary heaters and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Auxiliary heaters (aka engine block heater) have two functions; pre-heat and supplemental heat. Pre-heat is used to heat the engine coolant before the engine starts. This is done by the dispatcher remotely (or by the driver using the dash switch).

The two operational modes of the auxiliary heater are as follows:

- Pre-Heat - The heater may be started in the Pre-Heat mode by one of two devices: (1) Momentary contact by the dash panel toggle switch to ON; or (2) RF wireless signal transmitted to the controlling unit (that includes the Bus Link Switch) that in turn sends a 24-volt pulse to the auxiliary heater. Repeated pulsing by either (1) or (2) shall have no effect on heater operation. Once started, the heater warms water in the engine block circuit only and maintains the water temperature between 160°F and 180°F, independent from the ambient air temperature. The heater shall be programmed to shut-off when the engine coolant temperature achieves 195°F. The unit's internal thermostat shall cause the heater to cycle on/off as required to maintain this temperature for a pre-programmed 30-minute time period.

The marine pump circulates water through the heater and engine for this time period. A magnetic water valve in the normally closed position precludes circulation of hot water to any other component or system. A start pulse from either (1) or (2) after 30 minutes will restart the Pre-Heat function for another 30-minute cycle.

- Supplemental Heat - The auxiliary heater operates in the Supplemental mode only when the engine is running and maintains the water temperature at the thermostatic settings for improved heater and defroster performance. No action is required to initiate supplemental heating when the engine is running. The heater shall not operate in the Supplemental mode when the auxiliary heater ON/OFF switch is in the "OFF" position.

A 24-volt auxiliary diesel fuel-fired heater (with a heat output not less than 80,000 BTU/hr) shall be provided to preheat the engine coolant and to supplement the heat supplied by the engine. When operating in the Pre-Heat mode, the auxiliary heater shall be capable of raising the engine coolant temperature from -10°F to 100°F within 30 minutes. The heating requirements, Interior Climate Control Capacity and Performance, may be attained with the auxiliary heater operating in the supplemental mode in conjunction with the engine. The heater shall be protected from loss of coolant or coolant flow, overheating, over fueling, and shall detect and cease operation when a low battery voltage condition exists. An air cleaner shall be fitted to the burner air inlet. Exhaust from the heater shall be directed rearward, routed under the bus, and exit at the rear.

The contractor shall install a device to remotely activate and verify operation of the auxiliary heaters on all buses during final plant inspection. Heaters are started manually by the MTA dispatcher remotely via the Wireless LAN.

One (1) waterproof toggle switch shall be mounted on the rear start-monitor box and permanently marked "AUXILIARY HEATER ON/OFF." This switch shall control all electric power to the auxiliary heater regardless of the operational mode.

A momentary toggle switch labeled “PRE HEAT ON/OFF” shall be installed on the operator’s dash panel. Momentarily moving the dash panel switch to the OFF position cancels the Pre-Heat function, regardless of how far the 30 minute pre-heat cycle has progressed and causes the heater to begin a cool down process before shutting down.

The auxiliary heater shall display fault codes by LEDs on the control panel located at the heater for troubleshooting and shall be capable of transmitting fault codes wirelessly. A green LED light (guarded) mounted on the streetside mid-bus, above the passenger window gutter on the exterior of the bus shall be illuminated whenever the heater is in operation and shall display blink fault codes as generated by the auxiliary heater. The control system connectivity shall be J1939 compatible. The heater shall have the capability of being remotely controlled through the Bus Link Switch. The configuration of the auxiliary heating system along with the location of the green light shall be approved by the MTA during the PPM.

**The MTA currently uses Ametek Rotron marine pump and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

A separate brushless, seal-less, marine pump shall be co-located with and completely controlled by the auxiliary heater, and shall circulate water through the auxiliary heater and the engine only.

The location of the heater and marine pump shall allow for ease of maintenance without removal of other components or their peripherals. Control wiring and fuel lines shall be shielded and not located within six (6) inches of the units exhaust.

## TS 10. Cooling Systems

**The MTA currently uses the EMP Mini Hybrid Thermal Management System package and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

### TS 10.1 Engine Cooling

The cooling systems shall be of sufficient size to maintain all engine and hybrid drive fluids and engine intake air at safe, continuous operating temperatures during the most severe operations possible and in accordance with engine and propulsion manufacturer’s cooling system requirements and passed their required testing.

The cooling system shall be a service proven cooling package that includes radiator, charge air cooling, electric fan(s), electronic control system with interface to the diesel engine control module and associated control valves. The cooling system shall include a de-aeration system approved by the engine manufacturer to mitigate cooling system cavitations.

The bus manufacturer shall be responsible for testing the cooling system to meet the cooling system, engine and hybrid drive manufacturers requirements for installation and performance.

#### TS 10.1.1 Cores

The radiator and charge air cooler shall be of durable, corrosion-resistant construction with non-removable tanks. A radiator skirt shall be provided to prevent air recirculation.

Radiator cores with a fin density greater than 12 fins per in. or a louvered slit design shall not be used. No heat-producing components or climate control system components shall be mounted

between the engine cooling air intake aperture and the radiator. The radiator and charge air cooler shall be designed to withstand thermal fatigue and vibration associated with the installed configuration. The radiator and charge air cooler cores shall be easily cleaned (to include engine side core surface) with standard pressure-washing equipment.

### TS 10.1.2 Radiator Plumbing

Radiator piping shall be stainless steel or brass tubing, and if practicable, hoses shall be eliminated. Coolant hoses and lines shall be impervious to all bus fluids, resist coolant loss from water permeation and be rated for high temperature applications. All slip-on coolant hoses shall have four ply construction, high temperature rating and shall be supported with stainless steel p-clamps having a silicon liner that provide a complete 360-degree seal. Coolant piping that uses slip-on hose shall have formed hose retaining barbs.

**The MTA currently uses Breeze constant torque clamps for slip on coolant hoses throughout the bus and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

All hoses shall be secured with stainless steel clamps that provide a complete 360-degree seal. Hose clamps shall be heavy duty and maintain a constant tension at all times, expanding and contracting with the hose in response to temperature changes and aging of the hose material.

The radiator system shall include a surge tank to prevent overflow of coolant condition. The surge tank shall be a proven design (material and size) as part of the coolant system requirements and the buses physical design. The surge tank shall be mounted in a manner to provide ease of daily service and maintenance requirements. The surge tank shall have a sight glass, a test port in the ullage space, and ports that contain low coolant sensors as part of the engine monitoring and diagnostics system. The low coolant warning system shall alert the operator of a low coolant situation and the “Check” and “Stop” engine lights controlled by the engines electronic control system illuminating the dash lights.

**The MTA currently uses Manuli coolant hoses throughout the bus and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Coolant hoses shall be four ply construction, high temperature rating and shall be supported with stainless steel p-clamps having a silicon cushion. Hoses shall be impervious to all bus fluids.

### TS 10.1.3 Fan Controls

The cooling system fan controls shall be electronically controlled and based on the engine ECM sensing and communicating the temperatures of the operating fluids and the intake air will control fan speed to maintain the specified operating temperatures. The fan control system shall be designed with a fail-safe mode of “fan on.” The cooling system shall meet the requirements stated in the operating environment.

### TS 10.1.4 Coolant Level

A visual means of determining satisfactory engine coolant level shall be provided. A spring-loaded, push-button type valve or lever shall be provided to safely release pressure or vacuum in the cooling system with both it and the water filler no more than +/- 60 in. above the ground. Both shall be accessible through the same access door.

Extended life (final charge) coolant shall be used with proper corrosion inhibitors meeting the engine manufacturer's requirement.

#### **TS 10.1.5 Standard Requirement for Coolant Filtration**

The engine cooling system shall be equipped with a properly sized Cummins approved Fleetguard coolant filter with a spin-on element and an automatic system for releasing supplemental coolant additives as needed to replenish and maintain protection properties. Quarter turn valves shall be installed on the inlet and outlet of the filter housing that may be closed when replacing the coolant filter so only the coolant in the filter will be lost.

#### **TS 10.1.6 Self-Cleaning**

Radiator and charge air cooler fan(s) shall be electrically driven and capable of manual and automated reverse operations for periodic self-cleaning of the radiator and charge air cooler.

#### **TS 10.1.7 Standard Mounting Design**

Mounting location of radiator and charge air cooler shall be the bus manufacturer's standard design located on the streetside of the bus in the engine compartment.

### **TS 10.2 Charge Air Cooling**

The charge air cooling system also referred to as after-coolers or inter-coolers shall provide maximum air intake temperature reduction with minimal pressure loss. The charge air cooler shall be sized and positioned to meet engine manufacturer's requirements for intake air temperature. The charge air cooler shall not be stacked ahead of or behind the engine radiator and shall be positioned as close to the engine as possible unless integrated with the radiator. CAC air plumbing and fittings shall be protected against heat sources and shall be configured to minimize restrictions and maintain sealing integrity.

Test ports with pipe threads shall be integrated into the metallic charge air piping for diagnostic purposes on both the inlet and outlet piping.

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### **TS 10.4 Hybrid Drive System Cooling**

The thermal management system shall maintain hybrid system electrical components within design operating temperature limits. The hybrid oil cooling system fan fault indication shall be provided at the operator's instrument panel LCD indicator. There shall also be an indication lamp at the rear engine run switch box.

The hybrid drive system cooling shall include components that maintain temperature ranges specified by the hybrid system manufacturer when operated in the varying temperatures of four seasons of the greater Baltimore service area.

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### TS 13. Power Plant Mounting

All powerplant mounting shall be mechanically isolated to minimize transfer of vibration to the body structure. Mounts shall control the movement of the powerplant so as not to affect performance of belt-driven accessories or cause strain in piping and wiring connections to the powerplant.

Access to belt driven accessories shall be protected by means of latching belt guard(s). The latches shall be rubber and the hinges shall allow for easy removal of the guard(s). The guard(s) shall be painted in safety yellow with warning signs attached that warn of moving engine pulleys and belts when the engine is running.

#### TS 13.1 Service

The propulsion system shall be arranged for ease of access and maintenance. The Contractor shall list all special tools, fixtures or facility requirements recommended for servicing. The exhaust system including DPF assembly and SCR systems, air cleaner, air compressor, radiator, all accessories and any other component requiring service or replacement shall be easily removable and independent of the engine and hybrid drive removal. An electronic module containing engine oil pressure and coolant temperature readouts shall be provided in the engine compartment. The module shall be mounted in the rear run switch box easily read during service and mounted where they shall not be damaged during minor or major repairs.

Engine oil and the radiator filler caps shall be hinged to the filler neck and closed with spring pressure or positive locks to prevent leakage. All fluid fill locations shall be properly labeled to help ensure that correct fluid is added. All fillers shall be easily accessible with standard funnels, pour spouts and automatic dispensing equipment. All lubricant sumps shall be fitted with magnetic-type drain plugs.

Scheduled maintenance fluids, filters and components shall be easily accessible for service. Frequent service items shall not require removal of other components for service.

Fluid sampling will be conducted for engine oil and hybrid drive fluid. Probalizer valves shall be installed in the engine compartment in convenient to use locations for engine oil and hybrid drive fluid extraction.

**The MTA currently uses Spinner II, model 576HE Oil Cleaning Centrifugal engine oil bypass filter and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

A heavy duty centrifugal, non-disposable lightweight engine bypass oil filter shall be installed. The bypass oil filter shall be installed and mounted for ease of service and shall not require removal of non related peripherals.

The centrifuge shall be powered by normal engine oil pressure. The bearing system shall enable the unit to generate centrifugal force 2,000 times greater than gravity.

The efficiency of the oil filter shall be effective at removing large particles, soot and other fine contaminants as small as one-tenth of a micron. The filter shall protect against premature wear and

maximize the service life of the engine and related components - even in the most demanding transit applications.

The single-use, disposable rotor is simply removed and replaced at each service interval. There shall be no special requirements for disposal.

### TS 13.2 Engine Compartment Gauges

An electronic diagnostic gauge shall be provided in the engine compartment mounted in the rear run switch box. The gauge shall be capable of displaying the hourmeter, engine oil pressure, coolant temperature, engine RPM, 24 volt battery status, hybrid drive temperature and active diagnostic codes as a minimum.

### TS 13.3 Engine Air Cleaner

**The MTA currently uses the Donaldson engine air intake cleaner part number D100226-016-002 and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

An air cleaner with a dry filter element shall be provided. The engine air cleaner and associated air inlet piping shall be sized to meet the air inlet requirements of the diesel engine manufacturer. The location of the air intake system shall be designed to minimize the entry of dust and debris and to maximize the life of the air filter and provide for ease of maintenance. The engine air duct shall be designed to minimize the entry of water into the air intake system. Drainage provisions shall be included to allow any water/moisture to drain prior to entry into air filter.

The air filter restriction gauge shall be mounted in a manner for ease of visibility and service adjacent to the engine gauge rear run switch box.

## TS 14. Hydraulic Systems

Hydraulic system service tasks shall be minimized and scheduled no more frequently than those of other major bus systems. All elements of the hydraulic system shall be easily accessible for service or unit replacement. Critical points in the hydraulic system shall be fitted with service ports so that portable diagnostic equipment may be connected or sensors for an off-board diagnostic system permanently attached to monitor system operation when applicable. A tamper-proof priority system shall prevent the loss of power steering during operation of the bus if other devices are also powered by the hydraulic system.

The hydraulic system shall operate within the allowable temperature range as specified by the lubricant manufacturer. The hydraulic reservoirs shall have sight glasses so the fluid level can be determined by visual inspection.

### TS 14.1 Fluid Lines

All lines shall be rigidly supported to prevent chafing damage, fatigue failures, degradation and tension strain. Lines shall be sufficiently flexible to minimize mechanical loads on the components. Lines passing through a panel, frame or bulkhead shall be protected and supported by heavy duty SST silicone cushioned p-clips and when necessary grommets (or similar devices) that fit snugly to both the line and the perimeter of the hole that the line passes through to prevent chafing and wear. Pipes and fluid hoses shall not be bundled with or used to support electrical wire harnesses.

**The MTA currently uses UMPCO 775 SST p-clips for supporting fluid lines and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

P-clips shall clamp the line, be a loop style with full box cushion. The p-clips shall be made of stainless steel with the cushion made of general purpose silicone.

Lines shall be as short as practicable and shall be routed or shielded so that failure of a line shall not allow the contents to spray or drain onto any component operable above the auto-ignition temperature of the fluid.

All hoses, pipes, lines and fittings shall be specified and installed per the manufacturer's recommendations.

### **TS 14.2 Fittings and Clamps**

All clamps shall maintain a constant tension at all times, expanding and contracting with the line in response to temperature changes and aging of the line material. The lines shall be designed for use in the environment where they are installed. For example, high-temperature resistant in the engine compartment, resistant to road salts near the road surface, and so on.

Compression fittings shall be standardized to prevent the intermixing of components. Compression fitting components from more than one manufacturer shall not be mixed, even if the components are known to be interchangeable.

### **TS 14.3 Charge Air Piping**

Charge air piping and fittings shall be designed to minimize air restrictions and leaks. Piping shall be as short as possible, and the number of bends shall be minimized. Bend radii shall be maximized to meet the pressure drop and temperature rise requirements of the engine manufacturer. The cross-section of all charge air piping shall not be less than the cross-section of the intake manifold inlet. Any changes in pipe diameter shall be gradual to ensure a smooth passage of air and to minimize restrictions. Piping shall be routed away from heat sources as practicable and shielded as required to meet the temperature rise requirements of the engine manufacturer.

Intake and charge air piping shall be constructed of stainless steel, aluminized steel or anodized aluminum. Connections between all charge air piping sections shall be sealed with a short section of reinforced hose and secured with stainless steel constant tension clamps that provide a complete 360-degree seal.

## **TS 15. INTENTIONALLY BLANK**

### **TS 16. Oil and Hydraulic Lines**

Oil and hydraulic lines shall be compatible with the substances they carry. The lines shall be designed and intended for use in the environment where they are installed. For example, high-temperature resistant in the engine compartment, resistant to road salts near the road surface, and so on. Lines within the engine compartment shall be composed of steel tubing where practicable, except in locations where flexible lines are required.

Hydraulic lines of the same size and with the same fittings as those on other piping systems of the bus, but not interchangeable, shall be tagged or marked for use on the hydraulic system only.

## TS 17. Fuel

### TS 17.1 Fuel Lines

**The MTA currently uses Manuli Equator high temperature fuel hoses and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Fuel hoses shall be compatible with standard ULSD and fuels blended to be Biodiesel. Fuel hose and hose connections, where permitted, shall be made from materials resistant to corrosion and fuel and protected from fretting and high heat. Fuel hoses shall be rated as high temperature resistant and protected from heat of nearby engine components. Fuel hose routing and protection shall be submitted for MTA review.

Fuel hoses shall have an advertised working temperature range from -55C through 150 C and be capable of sustaining in continued temperatures of 135C . Hoses exposed to sustained high temperatures shall have resistance to aging. Hoses shall be shielded in areas where the sustained temperature is at or above the hoses rated temperature.

Fuel lines shall be securely mounted, braced and supported as designed by the bus manufacturer to minimize vibration and chafing and shall be protected against damage, corrosion or breakage due to strain or wear.

Fuel hoses shall be accessible for ease of serviceability. Fuel lines shall be supported to prevent sagging and contact with other lines, brackets and component by high quality insulated stainless steel silicone cushioned p-clamps and submitted for MTA review.

The fuel lines forward of the engine bulkhead shall be orange fuel grade nylon tubing in conformance to SAE Standards.

Fuel lines in the engine compartment shall be constructed of premium high temperature material, shielded and insulated as required from engine heat sources and supported to prevent contact with other lines, brackets or components.

### TS 17.2 Diesel Fuel Tanks

#### TS 17.2.1 Design and Construction

The fuel tank(s) shall be made of corrosion resistant ANSI 304 stainless steel, 16 gauge thickness meeting FMVSS and FMCSR requirements for passenger carrying vehicle diesel fuel tank construction and mounting.

The fuel tank(s) shall have the useable capacity to meet the range requirement of 500 miles as described in section TS 7.4 Operating Range.

#### TS 17.2.2 Installation

The fuel tank(s) shall be securely mounted to the bus to prevent movement during bus maneuvers.

The fuel tank(s) shall be equipped with an external, hex head, drain plug. It shall be at least a  $\frac{3}{8}$ -inch size and shall be located at the lowest point of the tank(s). The fuel tank(s) shall have an inspection plate or easily removable filler neck to permit cleaning and inspection of the tank(s) without removal from the bus. The tank(s) shall be baffled internally to prevent fuel-sloshing noise regardless of fill level. The baffles or fuel pickup location shall assure continuous full

power operation on a 6 percent upgrade for 15 minutes starting with no more than 25 gallons of fuel over the unusable amount in the tank(s). The bus shall operate at idle on a 6 percent downgrade for 30 minutes starting with no more than 10 gallons of fuel over the unusable amount in the tank(s).

The materials used in mounting shall withstand the adverse effects of road salts, fuel oils, and accumulation of ice and snow for the life of the bus. Metallic fuel tank straps and support brackets shall have insulators of a material capable of meeting the adverse effects listed and lasting the expected life of the bus.

### TS 17.2.3 Labeling

The capacity, date of manufacture, manufacturer name, location of manufacture, and certification of compliance to Federal Motor Carrier Safety Regulation shall be permanently marked on the fuel tank(s). The markings shall be readily visible and shall not be covered with an undercoating material.

### TS 17.2.4 Fuel Filler

**The MTA currently uses Emco-Wheaton Posilock 105 dry brake fuel nozzle connections and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The fuel filler shall accommodate a nozzle that forms a locked and sealed connection during the refueling process to eliminate spills. Fuel shall not be allowed to flow into the tank unless the nozzle has been properly coupled, locked and sealed to the filler. With the nozzle open, fuel shall enter the tank at a fill rate of not less than 40 gallons per minute of foam-free fuel without causing the nozzle to shut off before the tank is full. The nozzle shall automatically shut off and provide an audible signal when the tank is 95% full. Once disconnected, fuel shall not be allowed to flow through the nozzle at any time. Any pressure over 3 psi shall be relieved from the fuel tank automatically. The fill neck shall be repairable in the field and contain provisions to meet the applicable rollover requirements. The dry break system shall be compatible with the MTA's existing diesel fueling system at all operating divisions.

The fuel filler cap shall be forward hinged and shall be located to the rear of the exit door and in front of the rear axle. The filler cap shall be a posi snap flip type and retained to prevent loss and shall be recessed into the body so that spilled fuel will not run onto the outside surface of the bus. The fuel door shall be hinged forward and have a quarter turn lock.

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## TS 18. Emissions and Exhaust

### TS 18.1 Exhaust Emissions

The engine and related systems shall meet all applicable emission and engine design guidelines and standards.

### TS 18.2 Exhaust System

Exhaust gases and waste heat shall be discharged from the roadside rear corner of the roof. The exhaust pipe shall be of sufficient height to prevent exhaust gases and waste heat from discoloring or causing heat deformation to the bus. The entire exhaust system shall be adequately shielded to

prevent heat damage to any bus component, including the exhaust after-treatment compartment area. The exhaust outlet shall be designed to minimize intrusion of rain, snow or water generated from high-pressure washing systems from entering into the exhaust pipe and causing damage to the after-treatment.

### **TS 18.3 Exhaust Aftertreatment**

An exhaust aftertreatment system shall be provided to ensure compliance to all applicable EPA regulations in effect at the time of manufacture. The following are current exhaust aftertreatment at the time of this writing.

#### **TS 18.3.1 Selected Catalytic Reduction**

An SCR system supplied by the engine manufacturer shall be provided. The system will minimally include a DEF tank, a dosing system, a pump, and a selective catalytic converter. The system shall be designed for operation in the Baltimore climate and environment.

The tanks shall be designed to store DEF in the operating environment described in the “Operating Environment” section. The DEF fluid lines shall be designed to prevent the DEF from freezing.

The DEF system shall be mounted and located to provide easy access for component diagnosis repair and replacement.

#### **TS 18.3.2 Diesel Particulate Filter**

A DPF system supplied by the engine manufacturer shall be provided. The particulate filter shall regenerate itself automatically if it senses pre set pressure differential levels in the exhaust stream. Regeneration cycles and conditions shall be defined by the engine manufacturer.

The DPF and associated components shall be mounted and located to provide easy access for component diagnosis, repair and replacement.

## **STRUCTURE**

### **TS 19. General**

#### **TS 19.1 Design**

The structure of the bus shall be designed to withstand the transit service conditions typical of an urban Central Business District duty cycle throughout its service life. The vehicle structural frame shall be designed to operate with minimal maintenance throughout the 12-year operation.

### **TS 20. Altoona Testing**

In order for a proposal to be considered compliant, the proposer shall supply an Altoona Test Report to the MTA for the model and power train being proposed. If the bus has not completed the testing or the report is not available, the proposer shall submit their plan to meet the requirements of providing a completed test with passing results and report as described below.

Prior to the start of any bus manufacturing or assembly processes, the structure of the proposed bus model shall have undergone appropriate structural testing and/or analysis, including the complete regimen of FTA required Altoona tests. Prior to assembly of the first bus, the contractor shall provide the MTA with a completed report with passing results of Altoona testing for the proposed bus model along with a plan of corrective action to address deficiencies, breakdowns and other issues identified during Altoona

testing. The bus model tested shall match the bus model proposed for procurement, including structure, axles and drive-train. Base model and partial Altoona test reports are acceptable when the combination of these tests adequately represents the proposed bus model.

## **TS 20.1 Structural Validation**

### **TS 20.1.1 Detailed Structural Analysis**

The structure of the proposed bus model shall have undergone structural testing, including Distortion and Crashworthiness, prior to assembly of the first bus. Part of the structural testing shall have been performed on the streets of Baltimore. The proposer shall provide the MTA with completed reports of all structural tests as specified by the MTA.

### **TS 20.1.2 Service-Proven Bus Structure**

To demonstrate that the bus structure shall survive in the MTA's operating environment, the proposer shall submit a test report from a reputable laboratory, accepted by the MTA, describing a shaker table fatigue test of the proposed bus structure, verifying the 12-year life, and strength and fatigue life requirements.

### **TS 20.1.3 Structural Analysis**

In lieu of a shaker table test, the proposer may submit a Structural Analysis Report (SAR) for the bus body structure proposed to be supplied under this Contract. The SAR shall use a Finite Element Analysis (FEA) model that has been verified for operational conditions similar to the MTA's operating environment. The SAR will demonstrate that the structure has sufficient strength to meet the 12-year life requirement.

The SAR shall address all structural elements and their attachments and joints in the bus body, the chassis frame, the suspension and undercarriage, and the structural elements that support equipment weighing more than 200 pounds.

Structural tests shall be conducted to confirm the validity of the analysis. These shall include, but not be limited to, full vehicle tests and tests of individual components. Data such as acceleration, strain, displacement, and load shall be included as well as a description of each test.

The SAR shall show the calculated stresses, allowable stresses, and design margins for all elements for all specified loading conditions. The structural analysis of the bus shall include a FEA using recognized computer programs acceptable to MTA. The structural analysis shall also include manual and computerized calculations of the stresses in structural elements such as joints, attachments, and other structural elements not included in the FEA.

The proposer shall submit to the MTA for review any planned modifications to the bus from that subjected to the shaker table test or as defined in the SAR, as design enhancements. A description of the modifications to the structure shall include justification for the changes, and a detailed analysis demonstrating that these changes will enhance and not adversely affect the structural strength, operability, and maintainability of the buses in the Baltimore environment.

The SAR will be independently verified by the MTA during the PPM and the proposer shall provide all support necessary.

For any portion of the proposed design that is based on a service-proven bus, the proposer may provide data from previous tests, historical data from operations, or structural analyses as required satisfying the corresponding portion of these requirements.

**TS 20.1.3.1 Finite Element Analysis**

The proposer shall submit and receive approval for the finite element models, including load cases and boundary conditions. A complete printed or computer file copy of the input and output of the FEA shall be included for review with the SAR. The proposer and the MTA shall mutually agree upon the computer file format.

### **TS 20.1.3.2 Structural Analysis Report**

The structural analysis report shall include, at a minimum:

- A. Table of Contents.
- B. References for all formulas, calculation procedures, buckling coefficients, material strengths, and like items cited where these items appear in the structural analysis.
- C. Each page numbered, dated, and initialed by the analyst and the reviewer. In the event of a revision, the revision letter shall be included with revision date and initials of the analyst and the reviewer.
- D. A description of each design load case or service condition that was considered, including combinations of these cases and conditions.
- E. Tables listing each material and product form with the relevant dimensions and mechanical properties (such as yield strength, ultimate strength, fatigue allowable, etc for isotropic and anisotropic materials) of these materials. If elastic-plastic analyses were conducted stress-strain diagrams should be included in the report.
- F. A set of diagrams and tables for each structure that was analyzed using an FEA model. These diagrams and tables shall show:
  1. Engineering drawings of the structure represented by the model.
  2. Tables referencing the material and product forms cited above to the property numbers used in the models.
  3. Elements, element types, element coordinate directions, element numbers, and element property identities corresponding to the material tables described above.
  4. For beam elements, cross sections and cross section properties of the beam elements showing beam coordinate directions and stress recovery points.
  5. Nodes and node numbers.
  6. Methods of representing attachments and joints.
  7. Diagrams for each load case showing external loads, internal loads that represent lumped and distributed masses or loading, and all support and boundary conditions.
  8. Overview color contour plots showing the stresses throughout the structure and close up views showing the stress distribution in all highly stressed areas.
  9. A summary showing compliance with each design load and service condition.
  10. A summary table and sample calculations of the design margins in the most highly loaded (stress critical, buckling critical, fatigue critical, etc.) structural member/material combinations. The table should show the location and the design load case or service condition for these combinations.

11. A tabulation or diagram of calculated deflections of the bus body under full vertical loading, and under combined vertical and compression of inertial and impact loadings resulting from street travel.
12. Analyses of the bus body structure under the torsional loading resulting from diagonal jacking, and under torsional loads resulting from anticipated normal operations.
13. Analysis of all critical and highly loaded connections showing the joint stronger than the weakest member being joined.
14. A tabulation of the proposer's selection of allowable fatigue stresses and assumed applied fatigue stress ranges and mean stresses for structural members that are fatigue sensitive.
15. If resistance welds are used, tables showing the minimum mechanical strength and fatigue strength of single and multiple spot welds. Values shall be given for each material, temper, weld size, and thickness.
16. The report shall summarize and present input parameters and results for each dynamic simulation conducted to define service loads and to demonstrate compliance with test requirements such as the PTI "Altoona" testing.
17. If tests are conducted to provide the necessary data, the entire test report shall be submitted. This report shall identify the test procedure, raw data, reduced data, and include a summary of results.
18. Weld strength assumptions and properties.

The proposer shall submit for MTA review a final complete FEA detailing all aspects of the MTA bus configuration, including any approved changes. The passing FEA shall be submitted in the proposer's submittals. The final FEA shall be signed by the Contractor's Lead Structural Engineer certifying that the body and structure meets all the requirements of this specification, is fit for service in the Baltimore service area and shall meet or exceed the 12-year required service life.

## **TS 21. Distortion**

The bus, loaded to GVWR and under static conditions, shall not exhibit deflection or deformation that impairs the operation of the steering mechanism, doors, windows, passenger escape mechanisms or service doors. Static conditions shall include the vehicle at rest with any one wheel or dual set of wheels on a 6 in. curb or in a 6 in. deep hole.

## **TS 22. Resonance and Vibration**

All structure, body and panel-bending mode frequencies, including vertical, lateral and torsional modes, shall be sufficiently removed from all primary excitation frequencies to minimize audible, visible or sensible resonant vibrations during normal service.

### **TS 22.1 Engine Compartment Bulkheads**

The passenger and engine compartment shall be separated by fire-resistant bulkheads. The engine compartment shall include areas where the engine and exhaust system are housed. This bulkhead shall

retard propagation of an engine compartment fire into the passenger compartment and shall be in accordance with the Recommended Fire Safety Practices defined in FTA Docket 90A, dated October 20, 1993. Only necessary openings shall be allowed in the bulkhead, and these shall be fire-resistant.

Any passageways for the climate control system air shall be separated from the engine compartment by fire-resistant material. Piping through the bulkhead shall have fire-resistant fittings sealed at the bulkhead. Wiring may pass through the bulkhead only if connectors or other means are provided to prevent or retard fire propagation through the bulkhead. Engine access panels in the bulkhead shall be fabricated of fire-resistant material and secured with fire-resistant fasteners. These panels, their fasteners and the bulkhead shall be constructed and reinforced to minimize warping of the panels during a fire that will compromise the integrity of the bulkhead.

Each bus structure shall undergo a “smoke” test as a quality assurance test to validate the sealing integrity of the bulkheads sealing the passenger area from the powertrain and attic area of the bus. Voids discovered during the test shall be corrected and the tests rerun until all voids are corrected. The smoke test documentation results shall become part of the bus documentation package.

## **TS 22.2 Roof**

All parts of the roof structure and skin shall have sufficient strength to withstand, without permanent deformation; the loads imposed by a mechanical bus washer and concentrated loads of 300 pounds spaced 30 inches apart. The roof shall be reinforced with supports integral to the roof structure to withstand the stresses imposed during normal operating and maintenance conditions. Mechanical fasteners that penetrate the roof skin shall be minimized and shall be properly shielded or sealed to prevent moisture intrusion. The area around the roof mounted equipment including antennas, HVAC, hybrid system components shall be sealed to prevent moisture intrusion. The roof exterior shall have anti-skid material installed to afford safety for maintenance personnel in performing maintenance on roof-mounted equipment with high voltage warning decals on the hybrid system components.

The roof shall be metallic, or composite, which shall be inherently corrosion-resistant, smooth, and without joints. The proposer’s method for sealing around the roof hatch and between the front and rear cap assemblies shall be submitted for MTA review in the submittal.

All roof mounted equipment shall be shielded from public view by means of full length roof fairings that will also serve as decal locations described elsewhere in these specifications.

The bus body and roof structure shall withstand a static load equal to 150 percent of the curb weight evenly distributed on the roof with no more than a 6 in. reduction in any interior dimension. Windows shall remain in place and shall not open under such a load. These requirements must be met with the roof-mounted equipment installed.

## **TS 22.3 Crashworthiness**

The bus shall withstand a 25 mph impact by a 4,000-pound automobile at any side, excluding doorways, along either side of the bus with no more than 3 inches of permanent structural deformation at seated passenger hip height. This impact shall not result in sharp edges or protrusions in the bus interior.

Exterior panels below 35 inches from ground level shall withstand a static load of 2,000 lbs applied perpendicular to the bus by a pad no larger than 5 square inches. This load shall not result in

deformation that prevents installation of new exterior panels to restore the original appearance of the bus.

## TS 23. Corrosion

The bus flooring, sides, roof, understructure and axle suspension components shall be designed to resist corrosion or deterioration from atmospheric conditions and de-icing materials (sodium and calcium chloride) for a period of twelve (12) years or 500,000 miles, whichever comes first. The bus shall maintain structural integrity and nearly maintain original appearance throughout its service life. Corrosion protection - grit blasted frame, moisture cure zinc-rich primer anti-chip undercoating, corrosion preventive coating sprayed inside frame tubes up to roof line. Stainless steel screws shall be used in all applications to mitigate corrosive activity.

All exposed surfaces and the interior surfaces of tubing and other enclosed members shall be corrosion resistant through application of a corrosion protection system. The corrosion protection system materials shall be temperature rated to provide protection coverage in the environment it is applied without adverse or detrimental effects to the protective material. All materials that are not inherently corrosion resistant shall be protected with a minimum 6 mil corrosion-resistant primer coating. All joints and connections of dissimilar metals shall be corrosion resistant and shall be protected from galvanic corrosion. Structural tubing after application of a corrosion resistant primer coating shall have the inside and outside undercoated with a minimum application of a 10 mil protective covering.

Representative samples of all materials and connections shall withstand a two-week (336-hour) salt spray test in accordance with ASTM Procedure B-117 with no structural detrimental effects to normally visible surfaces and no weight loss of over one (1) percent.

## TS 24. Towing

Each towing device shall withstand, without permanent deformation, tension loads up to 1.2 times the curb weight of the bus within 20 degrees of the longitudinal axis of the bus. If applicable, the rear towing device(s) shall not provide a toehold for unauthorized riders. The method of attaching the towing device shall not require the removal, or disconnection, of front suspension or steering components. The method of attaching the towing device shall not require the removal, or disconnection, of front suspension or steering components. The buses shall be designed to permit wheel lift towing from both the front and rear of the bus.

A plug connector permanently mounted at the front of the bus shall provide for bus tail lamp, marker, stop and turn signal lamp operation as controlled from the towing bus. The connector shall include a spring-loaded dust- and water-resistant cap. Shop air connectors (male ¼ inch NPT fittings) shall be provided at the front and rear of the bus and shall be capable of supplying all pneumatic systems of the bus with externally sourced compressed air. The shop air connectors shall be routed through the air dryer to prevent contaminants from entering the pneumatic system. The location of these shop air connectors shall facilitate towing operations. A connector to activate the service brakes shall also be provided at the front of the bus. The front connectors (45 degree fittings) shall be located under the bumper on the street side of the bus and protected by a covered, hinged box. A door will access the fittings inside the box with labels to identify the lines.

Two rear recovery devices/tie downs shall permit lifting and towing of the bus for a short distance, such as in cases of an emergency, to allow access to provisions for front towing of bus. The method of attaching the tow bar or adapter shall require the specific approval of the MTA. Any tow bar or adapter exceeding 50 lbs. should have means to maneuver or allow for ease of use and application. Each towing device shall accommodate a crane hook with a 1-inch throat.

The Proposer shall submit a complete description of towing devices and approved methods documenting compliance with these Specifications in its Technical Proposal.

It shall be the responsibility of the Contractor to evaluate MTA's towing equipment and propose appropriate towing devices during PPM.

## **TS 25. Jacking**

It shall be possible to safely jack up the bus, at curb weight, with a common 10-ton floor jack with or without special adapter, when a tire or dual set is completely flat and the bus is on a level, hard surface, without crawling under any portion of the bus. Jacking from a single point shall permit raising the bus sufficiently high to remove and reinstall a wheel and tire assembly. Jacking pads, 4 inch in diameter located on the axle or suspension near the wheels shall permit easy and safe jacking with the flat tire or dual set on a 6 in. high run-up block not wider than a single tire. The bus shall withstand such jacking at any one or any combination of wheel locations without permanent deformation or damage.

The jacking pads shall be painted safety yellow with decals applied to the body identifying the pad location.

## **TS 26. Hoisting**

The bus axles or jacking plates shall accommodate the lifting pads of a two-post hoist system. Jacking plates, if used as hoisting pads, shall be designed to prevent the bus from falling off the hoist. Other pads or the bus structure shall support the bus on jack stands independent of the hoist.

## **TS 27. Floor**

### **TS 27.1 Design**

The floor shall be essentially a continuous plane, except at the wheel housings and platforms. Where the floor meets the walls of the bus, as well as other vertical surfaces such as platform risers, the surface edges shall be blended with a circular section of radius not less than  $\frac{1}{4}$  in. or installed in a fully sealed butt joint. Similarly, a molding or cover shall prevent debris accumulation between the floor and wheel housings. The bus floor in the area of the entrance and exit doors shall have a lateral slope not exceeding 2 degrees to allow for drainage.

The floor design shall consist of two levels (bi-level construction). Aft of the rear door extending to the rear settee riser, the floor height may be raised to a height no more than 20 inches above the lower level, with equally spaced steps. An increase slope shall be allowed on the upper level, not to exceed 3.5 degrees off the horizontal.

### **TS 27.2 Strength**

The floor deck may be integral with the basic structure or mounted on the structure securely to prevent chafing or horizontal movement and designed to last the life of the bus. Sheet metal screws shall not be used to retain the floor, and all floor fasteners shall be serviceable from one side only. Any adhesives, bolts or screws used to secure the floor to the structure shall last and remain effective throughout the life of the bus. Tapping plates, if used for the floor fasteners, shall be no less than the same thickness as a standard nut, and all floor fasteners shall be secured and protected from corrosion for the service life of the bus.

The floor deck shall be reinforced as needed to support passenger loads. At GVWR, the floor shall have an elastic deflection of no more than 0.60 inches from the normal plane. The floor shall

withstand the application of 2.5 times gross load weight without permanent detrimental deformation. The floor, with coverings applied, shall withstand a static load of at least 150 lbs applied through the flat end of a ½ inch diameter rod, with 1/32-inch radius, without permanent visible deformation.

### **TS 27.3 Construction**

The floor shall consist of the subfloor and the floor covering that will last the life of the bus. The floor as assembled, including the sealer, attachments and covering, shall be waterproof, non-hygroscopic and resistant to mold growth. The subfloor shall be resistant to the effects of moisture, including decay (dry rot). It shall be impervious to wood-destroying insects such as termites.

#### **TS 27.3.1 Pressure-Preserved Plywood Panel**

Plywood shall be certified at the time of manufacturing by an industry-approved third-party inspection such as APA – The Engineered Wood Association (formerly the American Plywood Association). Plywood shall be of a thickness adequate to support design loads, manufactured with exterior glue, satisfy the requirements of a Group I Western panel as defined in PS 1-95 (Voluntary Product Standard PS 1-95, “Construction and Industrial Plywood”) and be of a grade that is manufactured with a solid face and back and shall be provided with an edge sealing process to reduce moisture damage.

Plywood shall be installed with the highest-grade, veneer side up. Plywood shall be pressure-treated with a preservative chemical and process such as alkaline copper quaternary (ACQ) that prevents decay and damage by insects. Preservative treatments shall utilize no EPA-listed hazardous chemicals. The concentration of preservative chemicals shall be equal to or greater than required for an above ground level application. Treated plywood will be certified for preservative penetration and retention by a third party inspection MTA. Pressure-preservative treated plywood shall have moisture content at or below 15 percent.

Flooring shall be engineered with manufactured noise-reduction characteristics. Manufacturers shall submit their strategy to reduce noise transferred to the interior of the bus through the floor construction.

## **TS 28. Platforms**

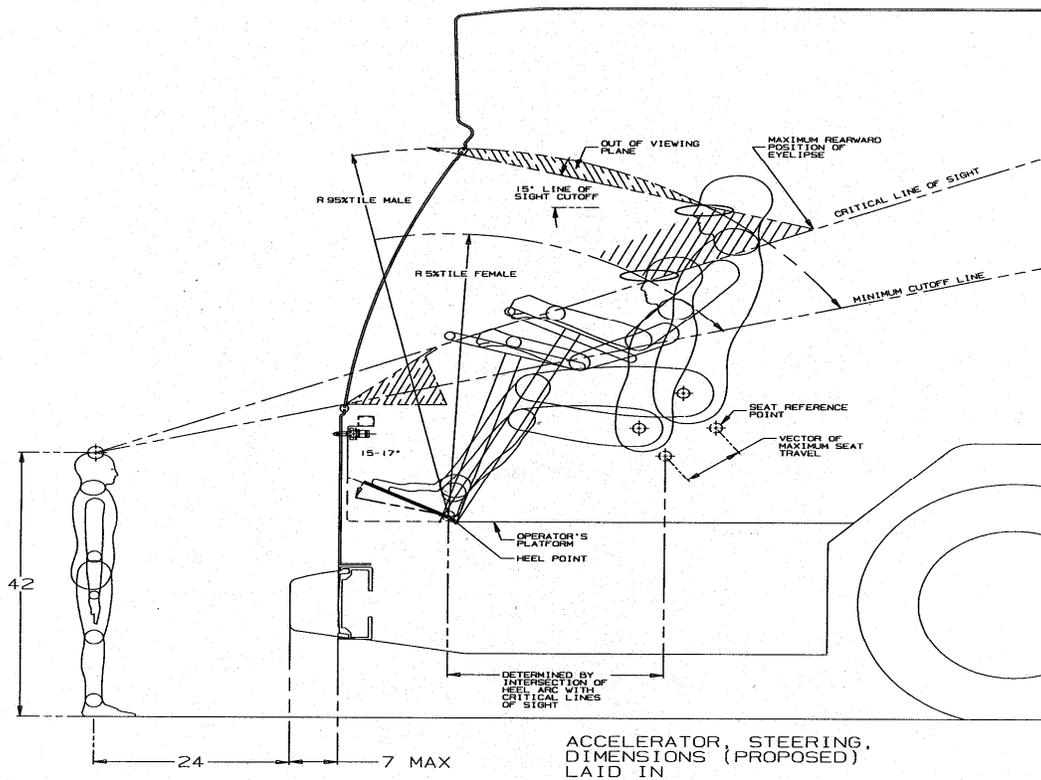
### **TS 28.1 Operator Area**

The covering of platform surfaces and risers except where otherwise indicated, shall be the same material as specified for floor covering. A heel wear plate shall be provided for pedals and foot switches protecting the covering. Trim shall be provided along top edges of platforms unless integral nosing is provided. The trim along the edges of the platform shall be slip resistant.

### **TS 28.2 Operator’s Platform**

The operator’s platform shall be of a height such that, in a seated position, the operator can see an object located at an elevation of 42 inches above the road surface, 24 inches from the leading edge of the bumper. Notwithstanding this requirement, the platform height shall not position the operator such that the operator’s vertical upward view is less than 15 degrees. A warning decal or sign shall be provided to alert the operator to the change in floor level. Figure 3 illustrates a means by which the platform height can be determined, using the critical line of sight.

**FIGURE 3**  
Determining Platform Height



### TS 28.3 Farebox

Farebox placement shall minimize impact to passenger access and minimize interference with the operator's line of sight.

If the operator's platform is higher than 12 inches, then the farebox is to be mounted on a platform of suitable height to provide accessibility for the operator without compromising passenger access.

Stanchions constructed with the yellow safety color shall be located around the farebox.

### TS 28.4 Rear Step Area to Rear Area

A lighted rear step area shall be provided along the center aisle of the bus to facilitate passenger traffic between the upper and lower floor levels. This step area shall be cut into the rear platform and shall be approximately the aisle width, a minimum 12 inches deep and approximately half the height of the upper level relative to the lower level. The horizontal surface of this platform shall be covered with skid-resistant material with a visually contrasting nosing and shall be sloped slightly for drainage. A warning sign shall be provided at the immediate platform area to alert passengers to the change in floor level.

## **TS 29. Wheel Housing**

### **TS 29.1 Design and Construction**

Sufficient clearance and air circulation shall be provided around the tires, wheels and brakes to preclude overheating when the bus is operating on the design operating profile. Wheel housings shall be constructed of corrosion-resistant and fire-resistant material.

Interference between the tires and any portion of the bus shall not be possible in maneuvers up to the limit of tire adhesion with weights from curb weight to GVWR. Wheel housings shall be adequately reinforced where seat pedestals are installed. Wheel housings shall have sufficient sound insulation to minimize tire and road noise and meet all noise requirements of this specification.

Design and construction of front wheel housings shall allow for the installation of a radio / electronic equipment storage compartment or utility box on the interior top surface.

The finish of the interior front wheel housings shall be scratch-resistant and complement interior finishes of the bus to minimize the visual impact of the wheel housing. If fiberglass wheel housings are provided, then they shall be color-impregnated to match interior finishes. The entire lower portion extending to approximately 10 to 12 inches above floor shall be equipped with scuff-resistant coating or stainless steel trim.

Wheel housings, as installed and trimmed, shall withstand impacts of a 2 inch steel ball with at least 200 ft-lbs of energy without penetration.

Wheel housings not equipped with seats or equipment enclosure shall have a horizontal assist mounted on the top portion of the housing no more than 4 inches higher than the wheel well housing. Wheel housings shall provide the clearance necessary for the installation snow chains or cables,

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### **TS 30. Suspension**

#### **TS 30.1 General Requirements**

The front and rear suspensions shall be pneumatic type. The basic suspension system shall last the service life of the bus without major overhaul or replacement. Adjustment points shall be minimized and shall not be subject to a loss of adjustment in service. Routine adjustments shall be easily accomplished by limiting the removal or disconnecting the components.

#### **TS 30.2 Alignment**

All axles shall be properly aligned so the vehicle tracks accurately within the size and geometry of the vehicle.

## TS 30.3 Springs and Shock Absorbers

### TS 30.3.1 Suspension Travel

The suspension system shall permit a minimum wheel travel of 3.00 inch jounce-upward travel of a wheel when the bus hits a bump (higher than street surface), and 3.00 inch rebound-downward travel when the bus comes off a bump and the wheels fall relative to the body. Elastomeric bumpers shall be provided at the limit of jounce travel. Rebound travel may be limited by elastomeric bumpers or hydraulically within the shock absorbers.

**The MTA currently uses Barksdale leveling valves and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Suspensions shall incorporate appropriate air suspension leveling devices for automatic height control so that regardless of load the bus height relative to the centerline of the wheels does not change more than ½ inch at any point from the height required. The operating pressure of the valve shall be a minimum of 150 PSI. Valve inlet and outlet piping and connections shall meet DOT approval for material and method. The valve material shall be impervious to road salts and be mounted in a location and manner for ease of service but safe from road debris damage. The safe operation of a bus shall not be impacted by ride height up to 1 in. from design normal ride height.

### TS 30.3.2 Damping

Vertical damping of the suspension system shall be accomplished by non-adjustable hydraulic shock absorbers mounted to the suspension arms or axles and attached to an appropriate location on the chassis. Damping shall be sufficient to control bus motion to three cycles or less after hitting road perturbations. The shock absorber bushing shall be made of elastomeric material that shall last the life of the shock absorber. The damper shall incorporate a secondary hydraulic rebound stop.

### TS 30.3.3 Lubrication

All elements of steering, suspension and drive systems requiring scheduled lubrication shall be provided with grease fittings conforming to SAE Standard J534. These fittings shall be located for ease of inspection and shall be accessible with a standard grease gun from a pit or with the bus on a hoist. Each element requiring lubrication shall have its own grease fitting with a relief path. The lubricant specified shall be standard for all elements on the bus serviced by standard fittings and shall be required no less than every 6,000 miles.

### TS 30.3.4 Kneeling

A kneeling system shall lower the entrance(s) of the bus a minimum of 3 inches during loading or unloading operations regardless of load up to GVWR, measured at the longitudinal centerline of the entrance door(s) by the operator. The kneeling control shall provide the following functions:

- A. Downward control shall be held to allow downward kneeling movement.
- B. Release of the control during downward movement shall completely stop the lowering motion and hold the height of the bus at that position.
- C. Upward control actuation shall allow the bus to return to normal floor height without the Bus operator having to hold the control.

The brake and throttle interlock shall prevent movement when the bus is kneeled. The kneeling control shall be disabled when the bus is in motion. The bus shall kneel at a maximum rate of 1

1/4 inch per second at essentially a constant rate. After kneeling, the bus shall rise within 3 seconds to a height permitting the bus to resume service and shall rise to the correct operating height within 7 seconds regardless of load up to GVWR. During the lowering and raising operation, the maximum vertical acceleration shall not exceed 0.2g, and the jerk shall not exceed 0.3g/second.

An indicator visible to the operator shall be illuminated until the bus is raised to a height adequate for safe street travel. An audible warning alarm shall sound simultaneously with the operation of the kneeler to alert passengers and bystanders. A warning light mounted near the curbside of the front door, a minimum 2.5 inches diameter amber lens, shall be provided that shall blink when the kneel feature is activated. Kneeling shall not be operational while the wheelchair ramp is deployed or in operation.

## TS 31. Wheels and Tires

### TS 31.1 Wheels

**The MTA currently uses Alcoa one piece Dura Flange aluminum wheels with Dura Bright surface treatment and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

These one piece forged aluminum wheels shall not require polishing while retaining their shine. The wheel surface shall not chip, crack or peel and will prevent corrosion. Wheels shall be installed using Freylube Supra or a similar product preventing corrosion between the aluminum wheel and its mounting surface.

All wheels shall be interchangeable and shall be removable without a puller. Wheels shall be compatible with tires in size and load-carrying capacity. Front wheels and tires shall be balanced as an assembly per SAE J1986. Wheels shall be installed with purple torque flags after the initial torque is completed.

Dual wheel configurations shall have valve stem extenders and hand-hole supports for the inside wheel positions to aid in checking tire pressure.

### TS 31.2 Tires

Tires shall be suitable for the conditions of transit service and sustained operation at the maximum speed capability of the bus. Load on any tire at GVWR shall not exceed the tire manufacturer's rating. Bus design shall determine the tire size to be used with the MTA specifying the tire size to be 305/70R22.5 and load range L with a speed rating of 68 mph. The tires shall be nitrogen filled by the bus manufacturer when assembled.

The tires shall be provided to the bus manufacturer under a lease agreement between the MTA and their tire Supplier, Goodyear. During the course of this contract the tire contractor may be changed.

### TS 31.3 Rear Wheel Safety Deflector

**The MTA currently uses S-1 GARD Dangerzone Deflector and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

A safety deflector device designed to deflect persons and objects away from the curbside rear wheels while the bus is in motion shall be incorporated into the bus design and installed on the bus. This deflector device shall be modular in design, designed to last the life of the bus and be easily replaced,

and made of a polyurethane material. Lifting the bus using conventional bus lifts shall be possible without removing the deflector. The unpainted deflector surfaces shall be black and not show any wear from scrapes or impacts. The deflector structure shall have a 10 inch clearance between it and the ground. No part of the bus, including the deflector, shall be damaged as a result of a 5 mph impact at any point parallel, and up to a 30-degree angle, to the longitudinal center line of the bus by the pendulum striker defined in FMVSS 581 loaded at 4,000 pounds.

The deflector device shall be modular in design and interchangeable between all buses built under the Contract. Deflector system shall be readily accessible for service and inspection. Maintenance requirements stated in mean time to replace shall be less than one hour by one, 'A' mechanic using standard hand tools.

The deflector system shall operate without degradation under all environmental conditions in the MTA's Operating Environment for a minimum of twelve (12) years.

## **TS 32. Steering**

Hydraulically assisted steering shall be provided. The steering gear shall be an integral type with the number and length of flexible lines minimized or eliminated. An engine driven hydraulic pump shall be provided for power steering.

### **TS 32.1 Steering Axle**

The front axle shall be non-driving with a load rating sufficient for the bus loaded to GVWR and shall be equipped with sealed, synthetic lubricated-type front wheel bearings. Front wheel bearings shall be capable of operating in transit service a minimum of 100,000 miles without requiring service or replacement.

All friction points on the front axle shall be equipped with replaceable bushings or inserts and, if needed, lubrication fittings easily accessible from a pit or hoist.

The steering geometry of the outside (frontlock) wheel shall be within 2 degrees of true Ackerman up to 50 percent lock measured at the inside (backlock) wheel. The steering geometry shall be within 3 degrees of true Ackerman for the remaining 100 percent lock measured at the inside (backlock) wheel.

### **TS 32.2 Steering Wheel**

#### **TS 32.2.1 Steering Wheel, General**

The steering wheel diameter shall be approximately 20 inches; the rim diameter shall be  $\frac{7}{8}$  inch to  $1\frac{1}{4}$  inch and shaped for firm grip with comfort for long periods of time. The center hub of the steering wheel shall include the horn button. The moveable components for horn actuation shall be accessible with removal of the horn button and shall only require simple hand tools for servicing.

The steering wheel shall have two (2) spokes and the wheel thickness shall ensure visibility of the dashboard so that vital instrumentation is clearly visible at center neutral position (within the range of a 95<sup>th</sup> percentile male or a 5<sup>th</sup> percentile female, as described in SAE 1050a, Sections 4.2.2 and 4.2.3). Placement of the steering column shall be as far forward as possible, but either in-line with or behind the instrument cluster.

### TS 32.2.2 Turning Effort

Steering effort shall be measured with the bus at GVWR, stopped with the brakes released and the engine at normal idling speed on clean, dry, level, commercial asphalt pavement and the tires inflated to recommended pressure.

Under these conditions, the torque required to turn the steering wheel ten (10) degrees shall be no less than 5 ft-lbs and no more than 10 ft-lbs. Steering torque may increase to 70 ft-lbs when the wheels are approaching the steering stops, as the relief valve activates.

Power steering failure shall not result in loss of steering control. With the bus in operation, the steering effort shall not exceed 55 lbs at the steering wheel rim, and perceived free play in the steering system shall not materially increase as a result of power assist failure. Gearing shall require no more than seven turns of the steering wheel lock-to-lock.

Caster angle shall be selected to provide a tendency for the return of the front wheels to the straight position with minimal assistance from the operator.

### TS 32.2.3 Steering Column

**The MTA currently uses Douglas Autotech 929 steering column, with tilt and telescopic features and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The steering column shall have full tilt and telescopic capabilities. A single lever mounted on the lower section of the steering column shall control both the tilt and telescopic features. The steering wheel will have the ability to be tilted a minimum of 21 degrees.

The steering column shall permit smooth un-obstructive turning of the steering wheel and control of the buses steering.

### TS 32.2.4 Steering Wheel Telescopic Adjustment

The steering wheel shall have full telescoping capability and have a minimum telescopic range of 2 inches and a minimum low-end adjustment of 29 inches, measured from the top of the steering wheel rim in the horizontal position to the cab floor at the heel point. Table 4 shows the steering wheel height relative to the angle of slope.

**TABLE 4**  
Steering Wheel Height<sup>1</sup> Relative to Angle of Slope

At Minimum Telescopic Height Adjustment (29 in.)		At Maximum Telescopic Height Adjustment (5 in.)	
Angle of Slope	Height	Angle of Slope	Height
0 degrees	29 in.	0 degrees	34 in.
15 degrees	26.2 in.	15 degrees	31.2 in.
25 degrees	24.6 in.	25 degrees	29.6 in.
35 degrees	22.5 in.	35 degrees	27.5 in.

1. Measured from bottom portion closest to operator.

## TS 33. Drive Axle

The bus shall be driven by a heavy-duty single reduction axle with a load rating sufficient for the bus loaded to GVWR and shall be equipped with sealed, oiled-type wheel bearings. The drive axle shall have a design life to operate for not less than 300,000 miles on the design operating profile without replacement or major repairs. The axle and wheel bearings shall be lubricated with synthetic oil approved by the axle manufacturer. The lubricant drain plug shall be magnetic type. The axle and driveshaft components shall be rated for both propulsion and regeneration modes with respect to duty cycle.

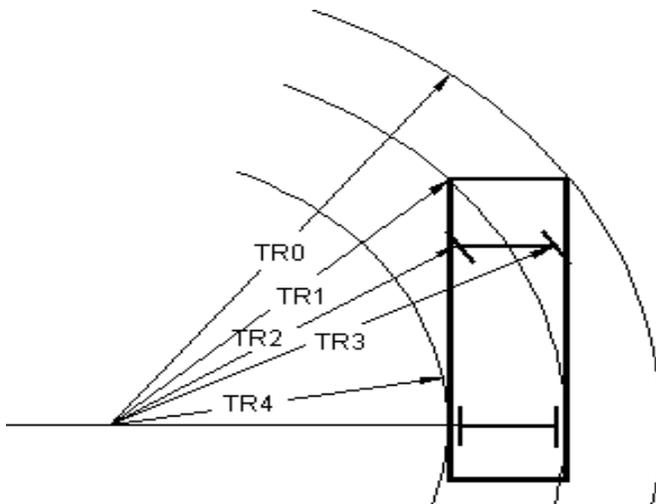
The drive shaft shall be guarded to prevent hitting any critical systems, including brake lines, bus floor or the ground, in the event of a tube or universal joint failure. Provisions shall be made in the bus floor for a sealed access to accommodate service of the drive axle and propeller shaft.

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## TS 34. Turning Radius

The maximum turning radius (TR0) shall be 44 feet, as shown in **Figure 4**.

**FIGURE 4**  
Turning Radius



## TS 35. Brakes

### TS 35.1 Service Brake

The bus shall be equipped with disc brakes that meet FMVSS 121 requirements for stopping distance and efficiency. The brakes shall be self-adjusting and have the ability to check the pad thickness both visually.

Each bus shall be tested for FMVSS stopping distance and brake force during the final inspection before shipment to the MTA. A Vericom 4000 electronic brake computer shall be used for the testing each buses brake performance. The hard copy results shall be provided to the resident inspector and these become part of the vehicles manufacturing record. Buses shall not be accepted until satisfactory test results are achieved.

### TS 35.1.1 Air-Actuated Brakes

Service brakes shall be controlled and actuated by a compressed air system. Force to activate the brake pedal control shall be an essentially linear function of the bus deceleration rate and shall not exceed 70 lbs at a point 7 inches above the heel point of the pedal to achieve maximum braking. The heel point is the location of the operator's heel when his or her foot is rested flat on the pedal and the heel is touching the floor or heel pad of the pedal. The ECU for the ABS system shall be protected, yet in an accessible location to allow for ease of service.

The total braking effort of the foundation brakes shall be distributed between all wheels in such a ratio as to ensure equal friction material wear rate at all wheel locations. The contractor shall demonstrate compliance by providing a copy of the FMVSS 121 test results upon request.

### TS 35.2 Friction Material

The brake pads shall be made of non-asbestos material. In order to aid maintenance personnel in determining extent of wear, a provision such as a scribe line or chamfer indicating the thickness at which replacement becomes necessary shall be provided on each brake lining. The complete brake lining wear indicator shall be clearly visible from the hoist or pit without removing backing plates. Brake thickness shall be measured using an easy to use tool that indicates lining thickness and provides minimum thickness identification without removal of the tires for inspection.

The friction material shall be the material to which the buses braking system was tested with and approved meeting the FMVSS 121 certifications. The brake system material and design shall dissipate heat quickly so that the heat generated during braking operation does not glaze brake friction material.

### TS 35.3 Hubs and Rotors

Replaceable wheel bearing seals shall run on replaceable wear surfaces or be of an integral wear surface sealed design. Wheel bearing and hub seals shall be unitized hub assemblies that shall not leak or weep lubricant when operating on the design operating profile for the duration of the initial manufacturer's warranty.

All hubs shall be painted black.

### TS 35.4 Parking/Emergency Brake

The parking / emergency brake may be released when the buses air pressure meets the FMVSS 121 certification level. The release and apply valve shall be located to the street side of the operators seat convenient for the operator to reach and operate. The valve shall have a yellow diamond shaped button used to release and apply the parking/emergency brake. The button shall be labeled "**Pull To Apply**". Release of the parking/emergency brake shall require the operator to push down on the button and make a full application of the service brake pedal.

The parking brake shall be a spring-operated system, actuated by a valve that exhausts compressed air to apply the brakes in the event of depleting air pressure. The control valve at a minimum of 35 psi gauge pressure shall pop up and release while exhausting the air and activating the spring brakes. The Parking brake light at the operator's dash shall illuminate at this time.

The parking/emergency brake may be manually applied by the operator pulling upwards on the "**Pull to Apply**" button when the air pressure is at the operating level per FMVSS 121. In the event the operator does not apply the parking/emergency brake, has the seat belt released and turns the Master

Run switch to the OFF position, an audible alarm shall sound to alert the operator that the Parking / Emergency brake was not set.

The buses brake lights shall be illuminated when the parking brake is set.

### Emergency Brake Release

An emergency brake release shall be provided to release the brakes in the event of automatic emergency brake application. The emergency release valve shall be located besides the parking / emergency valve. The release valve shall have a round black button labeled “**Push To Release**”. The operator shall be able to manually depress and hold down the emergency brake release valve to release the brakes and maneuver the bus to safety. Once the operator releases the emergency brake release valve, the brakes shall engage to hold the bus in place.

### TS 35.5 Anti-Lock Braking System (ABS)

**The MTA currently uses Wabco ABS system and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

A microprocessor controlled anti-lock braking system (ABS) shall be provided. The system shall have diagnostic and data recording capabilities.

The buses shall be equipped with an ABS system meeting FMVSS 121 certification requirements. The ABS ECU shall be located inside the bus in an MTA approved accessible location, with diagnostic capabilities included. The system shall be capable of self diagnosis during start up of the power train and provide a visible fault signal to the operator.

The ABS system shall work in conjunction with the Automatic Traction Control System

### TS 35.6 Automatic Traction Control System (ATC)

**The MTA currently uses Wabco ATC system and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

A microprocessor controlled automatic traction control (ATC) shall be provided. The system shall have diagnostic and data recording capabilities.

The ATC system shall be able of controlling one wheel spin through automatic application of the brake on that wheel. In the event the ATC system detects both wheels spinning, it shall automatically reduce engine power allowing optimum tire-to-road traction. A ‘Wheel Spin’ light shall provide the operator early warning of slippery road conditions.

### TS 35.7 Hill Holder

A momentary contact guarded hill holder switch shall, upon deployment, disable the throttle and set the rear service brakes. The function shall be identical to the rear door interlock. Brake release and throttle shall be restored immediately upon release of the switch.

The hill holder switch as described shall be located on the operator’s control panel to the left of the operator’s seat in a position the operator can use while seated with his other hand on the steering wheel. The location and type of switch requires MTA input and approval.

## TS 36. Interlocks

### TS 36.1 Passenger Door Interlocks

To prevent opening the rear passenger doors while the bus is in motion, a speed sensor shall be integrated with the door controls to prevent the entrance / exit doors from being enabled or opened unless the bus speed is less than 2 mph.

To preclude movement of the bus, an accelerator interlock shall disable the accelerator, and a brake interlock shall engage the service brake system to stop movement of the bus when the operator's door control is moved to a front, front/rear door enable or open positions, or rear door panel is opened more than 3 inches from the fully closed position (as measured at the leading edge of the door panel). The interlock engagement shall bring the bus to a smooth stop and shall be capable of holding a fully loaded bus on a 6 percent grade, with the engine at idle and the hybrid drive in gear, until the interlocks are released by the operator placing their foot on the brake pedal and moving the door controller to the doors closed position.

These interlock functions shall be active whenever the bus Master Run Switch is in any "run" position.

All door systems employing brake and accelerator interlocks shall be supplied with supporting Failure Modes, Effects, and Criticality Analysis (FEMCA) documentation, which demonstrates that failure modes are of a failsafe type, thereby never allowing the possibility of release of interlock while an interlocked door is in an unsecured condition, unless the door master switch has been actuated to intentionally release the interlocks.

The brake interlock pressure shall be pre-set at the factory to a pressure which allows the interlock system to meet the requirements listed above. The valve shall have a diagnostic pressure port mounted on the application side of the valve to assist in diagnosis.

Engagement of the interlock system shall illuminate all of the rear brake lights.

### TS 36.2 Hybrid Drive Interlock

When neutral is selected by the hybrid drive control pad, the brake interlocks shall be applied. The throttle interlock shall not be activated when the hybrid drive is in neutral.

## TS 37. Pneumatic System

### TS 37.1 General

The bus air system shall operate the air-powered accessories and the braking system with reserve capacity. New buses shall not leak down more than 5 psi over a 12 hour period of time as indicated on the dash gauge.

Provision shall be made to apply shop air to the bus air systems. The air from the shop air fittings shall go through the air dryer. A quick disconnect fitting shall be easily accessible and located in the engine compartment and near the front bumper area for towing. Retained caps shall be installed to protect fitting against dirt and moisture when not in use. The front air connector arrangement located below the bumper, street side shall have the fittings inside a protective box with access door, square key lock and labels to identify lines.

Air for the compressor shall be filtered. The air system reservoirs shall meet all the requirements of FMVSS 121.

### TS 37.2 Air Compressor

**The MTA currently uses Wabco HD 30.4 two cylinder air compressor, rated for 30+ CFM and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The air compressor shall be approved by the Cummins Engine Company for use on the ISL diesel engine and shall have the capacity to supply sufficient and continuous volume and pressure compressed air for the buses braking, suspension, doors etc. The system shall meet all FMVSS requirements.

The engine-direct drive air compressor shall be sized to charge the air system from 40 psi to the governor cut-off pressure in less than 3 minutes while not exceeding the fast idle speed setting of the engine. The compressor shall have the air intake from the turbo charged side of the engine air intake system and capable of meeting all requirements operation of the buses air operated components and for air recovery.

The compressor shall be lubricated by the engine oil and drain to the engine sump. The compressor shall be cooled by the engine coolant system and through lowered temperatures shall minimize carbonization and contamination.

### TS 37.3 Air Governor

**The MTA currently uses Bendix D-2 part number 275491 standard version air governor and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The air governor shall have adjustable pressure settings capable of controlling air pressure cut in and cut out pressures. The air governor shall be remotely mounted near the air compressor in a location for ease of adjustment and replacement. Air pressure cut in /out adjustments shall be able to be made without removal of other components. The air pressure cut in and cut out pressures along with mounting and location are subject to MTA review.

### TS 37.4 Air Lines and Fittings

**The MTA currently uses Manuli high temperature air lines and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Flexible hoses used for the compressed air system shall be temperature resistant for the area in which they are utilized. The hose material shall be abrasion resistant and the cover has flame retardant properties. The hoses shall be used in areas where the ambient elements have little effect on their life expectancy. They shall be designed to meet the demanding applications in heavy duty transit working conditions.

Hose routing shall be in accordance with the hose manufacturers recommendations for radius bends and shall be supported to prevent sag or contact with other lines or components.

Air lines, except necessary flexible lines, shall conform to the installation and material requirements of SAE Standard J1149 for copper tubing with standard, brass, flared or ball sleeve fittings, or SAE Standard J844 for nylon tubing if not subject to temperatures over 200 °F. The air on the delivery side

of the compressor where it enters nylon housing shall not be above the maximum limits as stated in SAE J844. Nylon tubing shall be installed in accordance with the following color-coding standards:

- **Green:** Indicates primary brakes and supply.
- **Red:** Indicates secondary brakes.
- **Brown:** Indicates parking brake
- **Yellow:** Indicates compressor governor signal.
- **Black:** Indicates accessories.

**The MTA currently uses UMPCO 775 SST P-clamps to support air lines and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

P-clips shall secure lines to mitigate vibration and prevent chafing and constructed of stainless steel with the cushion made of general purpose silicone.

Line supports shall prevent movement, flexing, tension, strain and vibration. Copper lines shall be supported to prevent the lines from touching one another or any component of the bus. To the extent practicable and before installation, the lines shall be pre-bent on a fixture that prevents tube flattening or excessive local strain. Copper lines shall be bent only once at any point, including pre-bending and installation. Rigid lines shall be supported at no more than 5-ft intervals. Nylon lines may be grouped and shall be supported at 30 inch intervals or less.

The compressor discharge line between PPU and body-mounted equipment shall be Teflon 2807 SST hose with a braided stainless steel jacket. Other lines necessary to maintain system reliability shall be flexible Teflon hose with a braided stainless steel jacket. End fittings shall be standard SAE or JIC brass or steel, flanged, swivel-type fittings. Flexible hoses shall be as short as practicable and individually supported. They shall not touch one another or any part of the bus except for the supporting grommets. Flexible lines shall be supported at 2-foot intervals or less. All hoses shall be rated as high temperature. All air lines located within the engine compartment or any other high temperature area shall be supported by means of SST silicone box p-clips.

Air lines shall be clean before installation and shall be installed to minimize air leaks. All air lines shall be routed to prevent water traps to the extent possible. Grommets or insulated clamps shall protect the air lines at all points where they pass through understructure components.

### TS 37.5 Air Reservoirs

All air reservoirs shall meet the requirements of FMVSS 121 and SAE Standard J10 and shall be equipped with drain plugs and guarded or flush type drain valves. Major structural members shall protect these valves and any automatic moisture ejector valves from road hazards. Reservoirs shall be sloped toward the drain valve. All air reservoirs shall have drain valves that discharge below floor level with lines routed to eliminate the possibility of water traps and/or freezing in the drain line.

### TS 37.6 Air System Dryer

**The MTA currently uses the Bendix AD-IP 24 volt tandem air dryer and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

A twin tower air dryer shall prevent accumulation of moisture, oil and contaminants in the air system. The air dryer system shall include replaceable desiccant cartridges with internal oil separator. The air dryer system shall have a 24 volt heater. All replaceable assemblies shall be able to be serviced or

replaced without the removal of the air dryer from the vehicle. Services to the air dryer shall be able to be completed without removal of surrounding components.

The air dryer shall be located as far from the compressor as possible to allow air to cool prior to entering the air dryer. The air dryer shall also be located such that maintenance procedures (routine scheduled services and repair) can be performed without removing the entire assembly and shall not require removal of adjacent components or their peripherals.

The type of air system dryer and location shall be reviewed by the MTA at the Pre-Production meeting and validated for use with the Wabco twin cylinder air compressor.

## ELECTRICAL, ELECTRONIC AND DATA COMMUNICATION SYSTEMS

### TS 38. Overview

The electrical system shall consist of bus battery systems and components that generate, distribute and store power throughout the vehicle. (e.g., wiring, relays, and connectors).

Electronic devices are individual systems and components that process and store data, integrate electronic information or perform other specific functions.

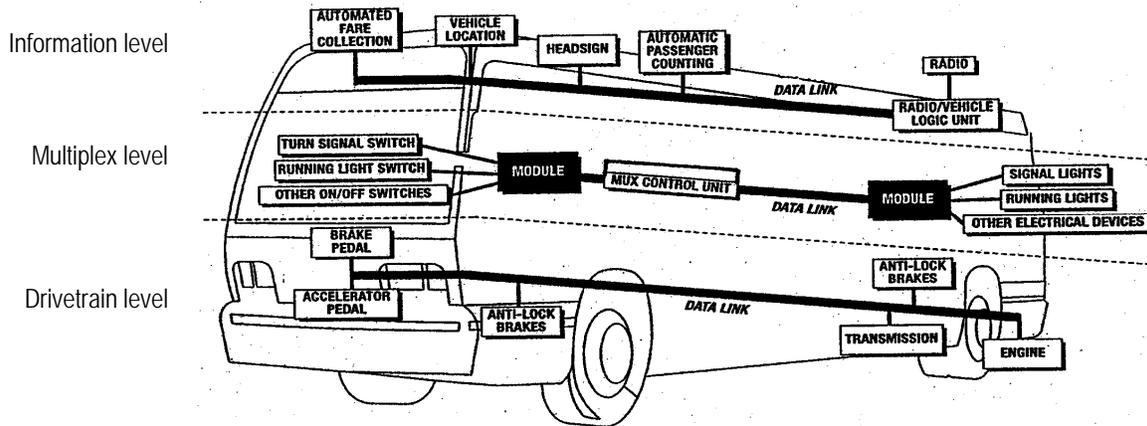
The data communication system consists of the bi-directional communications networks that electronic devices use to share data with other electronic devices and systems. Communication networks are essential to integrating electronic functions, both onboard the vehicle and off.

Information level systems that require bus information for their operations or provide information shall adhere to J1939 data standard.

Data communications systems are divided into three levels to reflect the use of multiple data networks:

- **Drivetrain level:** Components related to the drivetrain including the propulsion system components (engine, transmission and hybrid units), and anti-lock braking system (ABS), which may include traction control.
- **Information level:** Components whose primary function is the collection, control or display of data that is not necessary to the safe drivability of the vehicle (i.e., the vehicle will continue to operate when those functions are inoperable). These components typically consist of those required for automatic bus location (AVL) systems, destination signs, fare boxes, passenger counters, radio systems, automated voice and signage systems, video surveillance and similar components.
- **Multiplex level:** Electrical or electronic devices controlled through input/output signals such as discrete, analog and serial data information (i.e., on/off switch inputs, relay or relay control outputs). Multiplexing is used to control components not typically found on the drivetrain or information levels, such as lights; wheelchair lifts; doors; heating, ventilation and air conditioning (HVAC) systems; and gateway devices.

**FIGURE 5**  
Data Communications Systems Levels



### TS 38.1 Modular Design

Design of the electrical, electronic and data communication systems shall be modular so that each electronic device, apparatus panel, or wiring bundle is easily separable from its interconnect by means of connectors.

Powerplant wiring shall be an independent wiring harness. Replacement of the engine compartment wiring harness(es) shall not require pulling wires through any bulkhead or removing any terminals from the wires.

### TS 39. Environmental and Mounting Requirements

The electrical system and its electronic components shall be capable of operating in the area of the vehicle in which they will be installed, as recommended in SAE J1455.

Electrical and electronic equipment shall not be located in an environment that will reduce the performance or shorten the life of the component or electrical system when operating within the design operating profile. As a recommendation, no bus component shall generate, or be affected by, electromagnetic interference or radio frequency interference (EMI/RFI) that can disturb the performance of electrical/electronic equipment as defined in SAE J1113 and UNECE Council Directive 95/54 (R 10).

The MTA shall follow recommendations from bus manufacturers and subsystem suppliers regarding methods to prevent damage from voltage spikes generated from welding, jump starts, shorts, etc.

#### TS 39.1 Hardware Mounting

The mounting of the hardware shall not be used to provide the sole source ground, and all hardware shall be isolated from potential EMI/RFI, as referenced in SAE J1113. All electrical/electronic hardware and its mounting shall comply with the shock and vibration requirements of SAE J1455.

All electrical/electronic hardware mounted on the exterior of the bus that is not designed to be installed in an exposed environment shall be mounted in a sealed enclosure.

All electrical/electronic hardware mounted in the interior of the vehicle shall be inaccessible to passengers and hidden from view unless intended to be viewed. The hardware shall be mounted in such a manner as to protect it from splash or spray.

A full-sized electronics cabinet shall be securely mounted on top of the streetside front wheelhouse to accommodate the Intelligent Onboard Electronics, except the farebox, operator control units and bus multiplex electrical control system. At a minimum, the cabinet shall meet NEMA 1 standards, be designed built to last the life of the bus with minimal repair and without replacement. The cabinet design shall require MTA review.

The electronics cabinet shall be splash-proof when the service door(s) is secured and shall be made of a minimum of 18-gauge stainless steel or 12-gauge 5052 H32 aluminum construction, suitably reinforced. The cabinet shall be painted with black polyurethane enamel exterior and white interior. Access to the cabinet shall be from lockable-hinged doors opening into the passenger aisle area that includes a sturdy hold-open device. The cabinet door shall have a recessed paddle latches and General Motors key lock (key code to be provided) with four keys per vehicle. There shall be no sharp edges or corners on the enclosures. Inside of the cabinet shall be illuminated using two (2) 12" LED strip lights controlled by an inside the cabinet toggle switch. The electronics cabinet shall provide adequate ventilation for 1000 watts of equipment operating within the range of -20°F to +140°F.

The rear of the cabinet on the street side of the bus shall be open and accessible through the exterior glass. The glass shall be hinged at the top and open upwards with the assistance of gas struts with locks to support the access door in the open position. The window latching mechanism shall be only accessible through the inside of the cabinet.

The cabinet shall provide a minimum of 48 inches of free height that shall accommodate four heavy duty shelves of 19-inch electronic racks of 18-inch depth. These shelves shall consist of modular slide out trays that are removable and can be repositioned to accommodate changes in equipment position as needed. The slide out trays shall incorporate heavy-duty slide or roller mechanism to support a minimum of 150 lbs. of loading and shall be able to withstand the normal shock and vibration, (under full load) experienced in MTA revenue service, without damage to the slide or roller mechanisms. The trays shall lock in both the in and out positions and resilient material shall be used to prevent the trays from moving when the cabinet is closed.

Power provisions shall be made for the radio and electronics inside the cabinet. Circuits and wiring for each shelf shall be independent of one another at 30 amps 12VDC and 24VDC supplies and a chassis ground provided on four independent terminal strips with a minimum of six terminal mounting locations. Terminal strips shall be clearly identified. Terminal strips and associated wiring shall not interfere with shelf operation. All terminals shall be protected from accidental shorts. Wiring and cabling required between devices in the EC shall be protected by loom tubing to protect it from abrasion and must not interfere with the independent operation of the trays. The cabinet shall be provided with a terminal of the VAN system(s). A 3-inch inside diameter conduit, with a pull wire, shall connect the cabinet with the main bus wiring harnesses above the streetside lighting fixtures and the destination sign compartment. A 2-1/4-inch inside diameter metallic conduit, with a pull wire, shall connect the radio control head and control unit located within the electronics cabinet.

Additional requirements for the interior electronics cabinet are described in TS 83.11.1.

## TS 40. General Electrical Requirements

### TS 40.1 Batteries

#### TS 40.1.1 Low-Voltage Batteries (24V)

**The MTA currently uses Odyssey PC2150 Group 31 batteries, and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Four, Group 31 VRLA/AGM batteries, meeting the following requirements, shall be provided for the 12 VDC and 24 VDC requirements. Proposed batteries and layout shall be presented and reviewed at the PPM.

Batteries shall have a minimum rating of 1,000 CCA.

Batteries shall have a minimum of 200 minute reserve capacity at 25 AMPS and 80 degrees F.

Battery grid structure shall be Cast Only, stamped grids are unacceptable.

Grid structure shall be cast in Sunburst array only (radial grid design) to minimize internal resistance and maximize vibration resistance.

Battery plates shall not consist of Pure Virgin Lead due to voltage requirements.

Each battery shall have a manufacturing date no more than six months before the date of bus factory acceptance for shipment to the MTA.

Battery recharge voltage to be regulated at 28.8 – 29.0 VDC to protect other electrical circuits on the bus.

#### TS 40.1.2 Battery Equalizer

**The MTA currently uses Vanner 80-CAN Series and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The battery equalizer shall maintain a balanced and full charge on all batteries and shall be rated for the maximum current expected to be carried in either the 12 or 24 VDC circuits. The equalizer shall have an operating temperature range of -40 F to 167 F. The input voltage range shall be 18-32 VDC and 43 input amps.

The battery equalizer shall be located in the near vicinity of the batteries to minimize the cable runs between the two. The location shall be a sealed area that protects the component from moisture, battery acid / gassing, fluids and electrical grounding. The location shall be accessible for easy diagnosis and removal/replacement of the equalizer. Surrounding components shall not have to be removed for diagnosis or removal/replacement of the equalizer.

#### TS 40.1.3 Battery Cables

The battery terminal ends and cables shall be color-coded with red for the primary positive, black for negative and another color for any intermediate voltage cables. Battery cables shall be installed with heat shrink. Red heat shrink shall be used on the 24 VDC positive cable end and light blue shall be used on the 12 VDC positive cable end. Positive and negative battery cables shall not cross each other if at all possible, be flexible and sufficiently long to reach the batteries with the tray in the extended position without stretching or pulling on any connection and shall not lie directly on top of the batteries. Except as interrupted by the master battery switch, battery and starter wiring shall be continuous cables with connections secured by bolted terminals and shall conform to specification requirements of SAE Standard J1127 – Type SGT, SGX or GXL and SAE Recommended Practice J541.

#### TS 40.1.4 Jump Start

**The MTA currently uses Anderson Multi Pole Jump Start connector and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

A two pole jump-start connector shall be provided next to the Master Battery Switch equipped with dust cap and adequately protected from moisture, dirt and debris. This connector shall be accessible through a flip-open style door. The metal connector lugs shall have protectant applied to mitigate corrosion.

#### TS 40.1.5 Battery Compartment

The battery compartment shall prevent accumulation of snow, ice and debris on top of the batteries and shall be vented and self-draining. The battery compartment shall be accessible only from the outside of the bus located behind the curbside rear wheelhouse. All components within the battery compartment, and the compartment itself, shall be protected from damage or corrosion from the electrolyte. The inside surface of the battery compartment's access door shall be electrically insulated, as required, to prevent the battery terminals from shorting on the door if the door is damaged in an accident or if a battery comes loose. No sparking devices shall be located within the battery box. The battery compartment access door shall be hinged for easy opening and be equipped with square key locking device(s) to gain access.

The battery hold-down bracket shall be constructed of a non-metallic material (plastic or fiberglass).

The batteries shall be securely mounted on a stainless steel or equivalent tray that can accommodate the size and weight of the batteries. The battery tray shall pull out easily and properly support the batteries while they are being serviced. The tray shall allow each battery cell to be easily serviced and filled. A locking device shall retain the battery tray to the stowed position. The locking device shall be a tethered butterfly nut.

If not located in the engine compartment, the same fire-resistant properties shall apply to the battery compartment. No ignition sources shall be located within the battery box.

#### TS 40.1.6 INTENTIONALLY BLANK

#### TS 40.1.7 Master Battery Switch

A single rotary master battery switch shall be provided near the battery compartment for the disconnecting of all battery positives (12 and 24 VDC), except for safety devices such as the fire suppression system and other systems as specified. The rotary switch shall have a single On/Off switch. The location of the Master Battery Switch shall be clearly identified on the exterior access panel, be accessible in less than 10 seconds for deactivation, and prevent corrosion from fumes and battery acid when the batteries are washed off or are in normal service.

The access door shall require a square key locking device to gain access to the switch, and it shall be accessible without removing or lifting the panel. The door shall be flush-fitting and incorporate a spring tensioner to retain the door in a closed position when not in use.

The battery quick-disconnect access door shall be identified with a decal. The decal size shall not be less than 3.5 inches× 5 inches.

Turning the master switch off with the powerplant operating shall shut off the engine and shall not damage any component of the electrical system. The Master Battery Switch shall be capable of carrying and interrupting the total circuit load.

#### **TS 40.1.8 Low-Voltage Generation and Distribution**

The low-voltage generating system shall maintain the charge on fully charged batteries, except when the bus is at standard idle with a total low voltage generator load exceeding 70 percent of the low voltage generator nameplate rating.

Voltage monitoring and over-voltage output protection (recommended at 32 VDC) shall be provided.

Dedicated power and ground shall be provided as specified by the component or system manufacturer. Cabling to the equipment shall be sized to supply the current requirements with no greater than a 5 percent volt drop across the length of the cable.

**The MTA currently uses the Vanner Hybrid Beltless Alternator (HBA) and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

A beltless alternator shall be supplied capable of converting the buses hybrid system voltage to 24 VDC used for routine bus components. The nominal output of the HBA shall be 28 VDC +/- 2 percent and 250 amps at idle.

The HBA shall have been used in transit service a minimum of five years and shall be constructed for service in the transit environment of high and low ambient temperatures, weather and in-service vehicle shock. The area selected for mounting of the HBA shall provide for ease of diagnostic, service and replacement.

#### **TS 40.1.9 Circuit Protection**

All branch circuits shall be protected by current-limiting devices such as circuit breakers, fuses or solid state devices sized to the requirements of the circuit. The circuit breakers or fuses shall be easily accessible for authorized personnel. Fuses shall be used only where it can be demonstrated that circuit breakers are not practicable. Fuse holders shall be constructed to be rugged and waterproof.

All manual reset circuit breakers critical to the operation of the bus shall be mounted in a location convenient to the MTA mechanic with visible indication of open circuits. The MTA shall consider the application of automatic reset circuit breakers on a case-by-case basis. The Contractor shall show all in-line fuses in the final harness drawings. Manually resettable circuit breakers shall provide a visible indication of open circuits.

Circuit breakers or fuses shall be sized to a minimum of 15 percent larger than the total circuit load. The current rating for the wire used for each circuit must exceed the size of the circuit protection being used.

#### **TS 40.2 Grounds**

The batteries shall be grounded to the vehicle chassis/frame redundantly and as close to the batteries as possible. When using a chassis ground system, the chassis shall be grounded to the frame in multiple locations, evenly distributed throughout the vehicle to eliminate ground loops. No more than

four ground ring terminal connections shall be made per ground stud. Electronic equipment requiring an isolated ground to the battery (i.e., electronic ground) shall not be grounded through the chassis.

### **TS 40.3 Low Voltage/Low Current Wiring and Terminals**

All power and ground wiring shall conform to specification requirements of SAE Recommended Practice J1127, J1128 and J1292. Double insulation shall be maintained as close to the junction box, electrical compartment or terminals as possible. The requirement for double insulation shall be met by wrapping the harness with plastic electrical tape or by sheathing all wires and harnesses with non-conductive, rigid or flexible conduit.

Wiring shall be grouped, numbered and/or color-coded. Wiring harnesses shall not contain wires of different voltage classes unless all wires within the harness are insulated for the highest voltage present in the harness. Kinking, grounding at multiple points, stretching, and exceeding minimum bend radius shall be prevented.

Strain-relief fittings shall be provided at all points where wiring enters electrical compartments. Grommets or other protective material shall be installed at points where wiring penetrates metal structures outside of electrical enclosures. Wiring supports shall be protective and non-conductive at areas of wire contact and shall not be damaged by heat, water, solvents or chafing.

**The MTA currently uses UMPCO 775 SST P-clamps to support electrical harness's and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

P-clips shall clamp the line, be a loop style with full box cushion. The p-clips shall be made of stainless steel with the cushion made of general purpose silicone. Insulated SST p-clips shall be used for the securement of all harnesses. Screws used to attach P-clips shall be made of stainless steel.

To the extent practicable, wiring shall not be located in environmentally exposed locations under the bus. Wiring and electrical equipment necessarily located under the bus shall be insulated from water, heat, corrosion and mechanical damage. Where feasible, front to rear electrical harnesses shall be installed above the window line of the vehicle. Wiring decals shall be required at strategic points within the bus. Decals shall be laminated to protect the content and attached to the bus. The bus manufacturer shall propose where the decals are located with final approval determined by the MTA.

All wiring harnesses over 5 ft long and containing at least five wires shall include 10 percent (minimum one wire) excess wires for spares. This requirement for spare wires does not apply to data links and communication cables. Wiring harness length shall allow end terminals to be replaced twice without pulling, stretching or replacing the wire. Terminals shall be crimped to the wiring according to the connector manufacturer's recommendations for techniques and tools. All cable connectors shall be locking type, keyed and sealed, unless enclosed in watertight cabinets or the bus interior. Pins shall be removable, crimp contact type, of the correct size and rating for the wire being terminated. Unused pin positions shall be sealed with sealing plugs. Adjacent connectors shall either use different inserts or different insert orientations to prevent incorrect connections.

Terminals shall be crimped, corrosion-resistant and full ring type or interlocking lugs with insulating ferrules. When using pressure type screw terminal strips, only stranded wire shall be used. Insulation clearance shall ensure that wires have a minimum of "visible clearance" and a maximum of two times the conductor diameter or 1/16 in., whichever is less. When using shielded or coaxial cable, upon stripping of the insulation, the metallic braid shall be free from frayed strands that can penetrate the insulation of the inner wires.

Ultra-sonic and T-splices may be used with 7 AWG or smaller wire. When a T-splice is used, it shall meet these additional requirements:

- a) Splices shall include a mechanical clamp in addition to solder on the splice.
- b) The wire shall support no mechanical load in the area of the splice.
- c) The wire shall be supported to prevent flexing.

All splicing shall be staggered in the harness so that no two splices are positioned in the same location within the harness.

Wiring located in the engine compartment shall be routed away from high-heat sources or shielded and/or insulated from temperatures exceeding the wiring and connector operating requirements.

The instrument panel and wiring shall be easily accessible for service from the operator's seat or top of the panel. The instrument panel shall be separately removable and replaceable without damaging the instrument panel or gauges. Wiring shall have sufficient length and be routed to permit service without stretching or chafing the wires.

#### **TS 40.4 Electrical Components**

All electrical components, including switches, relays, flashers and circuit breakers, shall be heavy-duty designs with either a successful history of application in heavy-duty buses or design specifications for an equivalent environment.

All electric motors shall be heavy-duty brushless type where practical, and have a continuous duty rating of no less than 40,000 hours (except washer pumps and wiper motors). All electric motors shall be easily accessible for servicing.

#### **TS 40.5 Electrical Compartments**

All relays, controllers, flashers, circuit breakers and other electrical components shall be mounted in easily accessible electrical compartments. All compartments exposed to the outside environment shall be corrosion-resistant and sealed. The components and their functions in each electrical compartment shall be identified and their location permanently recorded on a drawing attached to the inside of the access panel or door. The drawing shall be protected from oil, grease, fuel and abrasion.

The front electrical compartment shall be completely serviceable from the operator's seat, vestibule or from the outside of the bus. "Rear start and run" controls shall be mounted in an accessible location in the engine compartment and shall be protected from the environment.

### **TS 41. General Electronic Requirements**

If an electronic component has an internal real-time clock, it shall provide its own battery backup to monitor time when battery power is disconnected, and/or it may be updated by a network component. If an electronic component has an hour meter, it shall record accumulated service time without relying on battery backup.

All electronic component Suppliers shall ensure that their equipment is self-protecting in the event of shorts in the cabling, and also in over-voltage (over 32V DC on a 24V DC nominal voltage rating with a maximum of 50V DC) and reverse polarity conditions. If an electronic component is required to interface with other components, it shall not require external pull-up and/or pull-down resistors. Where this is not possible, the use of a pull-up or pull-down resistor shall be limited as much as possible and easily accessible and labeled.

## TS 41.1 Wiring and Terminals

Kinking, grounding at multiple points, stretching and reducing the bend radius below the manufacturer's recommended minimum shall not be permitted.

### TS 41.1.1 Discrete I/O (Inputs/Outputs)

All wiring to I/O devices, either at the harness level or individual wires, shall be labeled, stamped or color-coded in a fashion that allows unique identification at a spacing not exceeding 4 in. Wiring for each I/O device shall be bundled together. If the I/O terminals are the same voltages, then jumpers may be used to connect the common nodes of each I/O terminal.

### TS 41.1.2 Shielding

All wiring that requires shielding shall meet the following minimum requirements. A shield shall be generated by connecting to a ground, which is sourced from a power distribution bus bar or chassis. A shield shall be connected at one location only, typically at one end of the cable. However certain standards or special requirements, such as SAE J1939 or RF applications, have separate shielding techniques that also shall be used as applicable.

When using shielded or coaxial cable, upon stripping of the insulation, the metallic braid shall be free from frayed strands, which can penetrate the insulation of the inner wires. To prevent the introduction of noise, the shield shall not be connected to the common side of a logic circuit.

### TS 41.1.3 Communications

The data network cabling shall be selected and installed according to the selected protocol requirements. The physical layer of all network communication systems shall not be used for any purpose other than communication between the system components, unless provided for in the network specifications.

Communications networks that use power line carriers (e.g., data modulated on a 24 VDC power line) shall meet the most stringent applicable wiring and terminal specifications.

### TS 41.1.4 Radio Frequency (RF)

RF components, such as radios, video devices, cameras, global positioning systems (GPS), etc., shall use coaxial cable, as applicable to carry the signal. All RF systems require special design consideration for losses along the cable. Connectors shall be minimized, since each connector and crimp has a loss that will attribute to attenuation of the signal. Cabling should allow for the removal of antennas or attached electronics without removing the installed cable between them. If this cannot be done, then a conduit of sufficient size shall be provided for ease of attachment of antenna and cable assembly.

### TS 41.1.5 Audio

Cabling used for microphone level and line level signals shall be 22 AWG minimum with shielded twisted pair. Cabling used for amplifier level signals shall be 18 AWG minimum.

## TS 42. Multiplexing

### TS 42.1 General

**The MTA currently uses the Vansco multiplex system and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The primary purpose of the multiplexing system is control of components necessary to operate the vehicle. This is accomplished by processing information from input devices and controlling output devices through the use of an internal logic program.

Versatility and future expansion shall be provided for by expandable system architecture. The multiplex system shall be capable of accepting new inputs and outputs through the addition of new modules and/or the utilization of existing spare (10% minimum) inputs and (10% minimum) outputs. All like components in the multiplex system shall be modular and interchangeable with self-diagnostic capabilities. The modules shall be easily accessible for troubleshooting electrical failures and performing system maintenance. Multiplex input/output modules shall use solid-state devices to provide extended service life and individual circuit protection.

Ten percent of the total number of inputs and outputs, or at least one each for each voltage type utilized (0V, 12 VDC, 24 VDC), at each module location shall be designated as spares.

## **TS 42.2 System Configuration**

Multiplexing shall be distributed or centralized. A distributed system shall process information on multiple control modules within the network. A centralized system shall process the information on a single control module. Either system shall consist of several modules connected to form a control network.

### **TS 42.2.1 I/O Signals**

The input/output for the multiplex system may contain three types of electrical signals: discrete, analog or serial data.

Discrete signals shall reflect the on/off status of switches, levers, limit switches, lights, etc. Analog signals shall reflect numerical data as represented by a voltage signal (0-12 VDC, 10-24 VDC, etc.) or current signal (4-20 mA). Both types of analog signals shall represent the status of variable devices such as rheostats, potentiometers, temperature probes, etc. Serial data signals shall reflect ASCII or alphanumeric data used in the communication between other on-board components.

## **TS 43. Data Communications**

### **TS 43.1 General**

All data communication networks shall be either in accordance with a nationally recognized interface standard, such as those published by SAE, IEEE or ISO, or shall be published to the MTA with the following minimum information:

- a) Protocol requirements for all timing issues (bit, byte, packet, inter-packet timing, idle line timing, etc.) packet sizes, error checking and transport (bulk transfer of data to/from the device).
- b) Data definition requirements that ensure access to diagnostic information and performance characteristics.
- c) The capability and procedures for uploading new application or configuration data.
- d) Access to revision levels of data, application software and firmware.
- e) The capability and procedures for uploading new firmware or application software.
- f) Evidence that applicable data shall be broadcast to the network in an efficient manner such that the overall network integrity is not compromised.

Any electronic bus components used on a network shall be conformance tested to the corresponding network standard.

## **TS 43.2 Drivetrain Level**

Drivetrain components, consisting of the engine, hybrid drive, retarder, ABS and all other related components, shall be integrated and communicate fully with respect to bus operation with data using SAE Recommended Communications Protocols such as J1939 and/or J1708/J1587 with forward and backward compatibilities or other open protocols.

### **TS 43.2.1 Diagnostics, Fault Detection and Data Access**

Drivetrain performance, maintenance and diagnostic data, and other electronic messages shall be formatted and transmitted on the communications networks.

The drivetrain level shall have the ability to record abnormal events in memory and provide diagnostic codes and other information to service personnel. At a minimum, this network level shall provide live/fail status, current hardware serial number, software/data revisions and uninterrupted timing functions.

### **TS 43.2.2 Programmability (Software)**

The drivetrain level components shall be programmable by the MTA with limitations as specified by the sub-system Supplier.

## **TS 43.3 Multiplex Level**

### **TS 43.3.1 Data Access**

At a minimum, information shall be made available via a communication port on the multiplex system. The location of the communication port shall be easily accessible. A hardware gateway and/or wireless communications system are options if requested by the MTA. The communication port(s) shall be mounted to the radio cabinet with velcro for ease of access.

### **TS 43.3.2 Diagnostics and Fault Detection**

The multiplex system shall have a proven method of determining its status (system health and input/output status) and detecting either active (online) or inactive (offline) faults through the use of on-board visual/audible indicators.

In addition to the indicators, the system shall employ an advanced diagnostic and fault detection system, which shall be accessible via either a personal computer or a handheld unit. Either unit shall have the ability to check logic function. The diagnostic data can be incorporated into the information level network or the central data access system.

### **TS 43.3.3 Programmability (Software)**

The multiplex system shall have security provisions to protect its software from unwanted changes. This shall be achieved through any or all of the following procedures:

- a) password protection
- b) limited distribution of the configuration software
- c) limited access to the programming tools required to change the software
- d) hardware protection that prevents undesired changes to the software

Provisions for programming the multiplex system shall be possible through a PC or laptop. The multiplex system shall have proper revision control to ensure that the hardware and software are identical on each vehicle equipped with the system. Revision control shall be provided by all of the following:

- a) hardware component identification where labels are included on all multiplex hardware to identify components
- b) hardware series identification where all multiplex hardware displays the current hardware serial number and firmware revision employed by the module
- c) software revision identification where all copies of the software in service displays the most recent revision number
- d) a method of determining which version of the software is currently in use in the multiplex system

Revision control labels shall be electronic.

### **TS 43.4 Electronic Noise Control**

Electrical and electronic sub-systems and components on all buses shall not emit electromagnetic radiation that will interfere with on-board systems, components or equipment, telephone service, radio or TV reception or violate regulations of the Federal Communications Commission.

Electrical and electronic sub-systems on the buses shall not be affected by external sources of RFI/EMI. This includes, but is not limited to, radio and TV transmission, portable electronic devices including computers in the vicinity of or onboard the buses, ac or dc power lines and RFI/EMI emissions from other vehicles.

## **OPERATOR CONTROLS AND INSTRUMENTATION**

### **TS 44. Operator Area Controls**

#### **TS 44.1 General**

In general when designing the operator's area, it is required that SAE J833, "Human Physical Dimensions," be used.

Switches and controls shall be divided into basic groups and assigned to specific areas, in conformance with SAE Recommended Practice J680, Revised 1988, "Location and Operation of Instruments and Controls in Motor Truck Cabs," and be essentially within the hand reach envelope described in SAE Recommended Practice J287, "Driver Hand Control Reach."

#### **TS 44.2 Glare**

The operator's work area shall be designed to minimize glare to the extent possible. Objects within and adjacent to this area shall be matte black or dark gray in color wherever possible to reduce the reflection of light onto the windshield. The use of polished metal and light-colored surfaces within and adjacent to the operator's area shall be avoided.

#### **TS 44.3 Visors/Sun Shades**

##### **TS 44.3.1 Operators Window Sunscreens**

An adjustable scissor type sunscreen shall be provided over the operator's windshield and the operator's side window. The sunscreen shall be capable of being lowered to the midpoint of the operator's window. When deployed, the screen shall be secure, stable and shall not rattle, not contact other appendages, sway or intrude into the operator's field of view due to the motion of the bus or as a result of air movement. Once lowered, the screen shall remain in the lowered position until returned to the stowed position by the operator. Sunscreen shall be shaped to minimize light leakage between the visor and windshield pillars to the extent possible.

#### **TS 44.4 Operator's Controls**

Frequently used controls shall be in easily accessible locations. These include the door control, kneel control, windshield wiper/washer controls, ramp, and lift and run switch. Any switches and controls necessary for the safe operation of the bus shall be conveniently located and shall provide for ease of operation. They shall be identifiable by shape, touch and permanent markings. Controls also shall be located so that passengers may not easily tamper with control settings.

All panel-mounted switches and controls shall be marked with easily read identifiers. Graphic symbols shall conform to SAE Recommended Practice J2402, "Road Vehicles – Symbols for Controls, Indicators, and Tell Tales," where available and applicable. Color of switches and controls shall be dark with contrasting typography or symbols.

Mechanical switches and controls shall be replaceable, and the wiring at these controls shall be serviceable from a convenient location. Switches, controls and instruments shall be dust- and water-resistant.

#### **TS 44.5 Normal Bus Operation Instrumentation and Controls**

The following list identifies bus controls used to operate the bus. These controls are either frequently used or critical to the operation of the bus. They shall be located within easy reach of the operator. The operator shall not be required to stand or turn to view to actuate these controls unless specified otherwise.

Systems or components monitored by onboard diagnostics system shall be displayed in clear view of the operator and provide visual and/or audible indicators. The intensity of indicators shall permit easy determination of on/off status in bright sunlight but shall not cause a distraction or visibility problem at night. All indicators shall be illuminated using backlighting.

The indicator panel shall be located within easy view of the operator instrument panel. All indicators shall have a method of momentarily testing their operation. The audible alarm shall be tamper-resistant and shall have an outlet level between 80 and 83 dBA when measured at the location of the operator's ear.

On-board displays visible to the operator shall be limited to indicating the status of those functions described herein that are necessary for the operation of the bus. All other indicators needed for diagnostics and their related interface hardware shall be concealed and protected from unauthorized access. Table 6 represents instruments and alarms. The intent of the overall physical layout of the indicators shall be in a logical grouping of systems and severity nature of the fault.

Consideration shall be provided for future additions of spare indicators as the capability of onboard diagnostic systems improves. Blank spaces shall contain LEDs.

**TABLE 6**  
Transit Bus Instruments, Controls and Alarms

Device	Description	Location	Function	Visual/ Audible
Master run switch	Rotary, four-position detent	Side console	Master control for bus, off, day run, night run and night park positions	
Engine start, front	Approved momentary switch	Side console	Activates engine starter motor	
Engine start, rear	Approved momentary switch	Engine compartment	Activates engine starter motor	
Engine run, rear	Three-position toggle switch	Engine compartment	Permits running engine from rear start, normal front run position and off	Amber light
Drive selector	Touch panel switch	Dash	Provides selection of propulsion: forward, reverse and neutral	Gear selection
Marker light strobe	Two position switch	Destination sign cavity	Three center markers strobe when switch is in normal position	
Climate Control	Switch or switches to control HVAC	Side console	Two position switch: full automatic system with on/off only	
Operator's fan	Three-position toggle switch	Side console or Dash left wing	Permits supplemental ventilation: fan off, low or high	
Defroster fan	Rotary switch	Side console or Dash left wing	Permits variable defroster fan speed	
Defroster temperature	Variable position	Side console or Dash left wing	Adjusts defroster water flow and temperature	
Windshield wiper control	One-variable rotary position operating both wipers	Dash left wing	Variable speed control for both windshield wipers	
Windshield washer	Incorporated into wiper control	Dash left wing	Activates windshield washers	
Dash panel lights	Rotary rheostat	Side Console or Dash left wing	Provides adjustment for dash light intensity in night run position	
Interior lights	Three-position switch	Side console	Selects mode of passenger compartment lighting: off, on, normal	
Fast idle	Two-position switch	Side console	Selects high idle speed of engine	
Pedal adjustment	Spring loaded 3 position toggle or rocker switch	Side console	Allows adjustment of throttle and brake pedals. Forward, rearward and hold.	
Ramp control	Two position guarded switch	Right side of steering wheel	Master on/off for ramp operation	Blue dash light
Front door ramp	Three-position momentary switch	Right side of steering wheel	Actuates the deployment and stowage of ramp	Red light

**TABLE 6**  
Transit Bus Instruments, Controls and Alarms

Device	Description	Location	Function	Visual/ Audible
Front kneel	Three-position guarded momentary switch	Front door remote	Permits kneeling activation and raise and normal at front door remote location	Amber or red dash indicator. Ext alarm and Amber light
Silent alarm	Recessed push button, NO and NC contacts momentary	Left foot panel in front of high beam switch	Activates emergency radio alarm at dispatch and permits covert microphone and/or enables destination sign emergency message	
Video system event switch	Momentary on/off momentary switch with plastic guard	Side console	Triggers event equipment, triggers event light on dash	Amber light
Left exterior rear view remote mirror	Control switch for upper and lower mirrors, streetside	Side console	Permits two-axis adjustment of street side exterior mirrors	
Right exterior rear view remote mirror	Control switch for upper and lower mirrors, curbside	Side console	Permits two-axis adjustment of curb side exterior mirror	
Passenger door control	Five-position handle type detent	Side console, forward	Permits open/close control of front and rear passenger doors	Red light
Rear door control	Guarded two-position switch in approved location	Side console,	Allows operator to switch rear door control between passenger (default) and operator control	
Engine shutdown override	Momentary switch with operation protection	Side console	Permits operator to override auto engine shutdown	
Hazard flashers	Two-position switch with long handle	Side console or Dash right wing	Activates emergency flashers	Dash turn signal indicators, exterior front, side and rear lights to flash for hazard warning
Fire suppression	Controller for auto fire suppression system	Dash left wing or dash center	System status and permits operator to override and manually discharge fire suppression system	Green light OK, red light to indicate shutdown with audible alarm
Mobile data terminal	Mobile data terminal bus operator interface panel	Above right dash wing	Facilitates operator interaction with communication system and master log-on	LCD display with visual status and text messages
Farebox interface	Farebox bus operator interface panel	Near farebox	Facilitates operator interaction with farebox system	LCD display
Destination sign interface	Destination sign interface panel	In front destination sign cavity	Facilitates operator interaction with destination sign system, manual entry	LCD display
Turn signals	Momentary push button (two required) raised from other switches	Left foot panel	Activates left and right turn signals	Two green lights and optional audible indicator

**TABLE 6**  
Transit Bus Instruments, Controls and Alarms

Device	Description	Location	Function	Visual/ Audible
PA manual	Momentary push button	Heel switch to street side of operators area floor	Permits operator to manually activate public address microphone	
High beam	Push button detent	Left of steering column between and in front of turn signal switches	Permits operator to toggle between low and high beam	Blue light on dash
Parking brake	Pneumatic PPV-Yellow diamond knob	Side console or Dash left wing	Permits operator to apply and release parking brake	Red light on dash
Hill holder	Two-position momentary switch	Side console	Applies brakes to prevent bus from rolling	Red light on dash
Master door/ interlock	Two position toggle switch	Right lower dash behind door	Permits operator to disable door and brake / throttle interlock	Red light on dash
Regen brake disable switch	Two position switch	Destination sign cavity	Permits operator to disable hybrid regen system	Red light
Indicator/ alarm test	Momentary switch	Dash center	Permits operator to activate test of sentry, indicators and audible alarms	All visual and audible alarms
Speedometer	Speedometer, odometer, and diagnostic capability, 5-mile increments	Dash center panel	Visual indication of speed and distance traveled, accumulated vehicle mileage, fault condition display	Visual
Air pressure gauge	Primary, secondary air system with gauges in 5 psi increments	Dash center panel	Visual indication of primary and secondary air systems.	Visual and audible alarms for low air pressure
Door obstruction	Sensing of door obstruction (sensitive edge)	Dash center	Indication of rear door sensitive edge activation	Red light and buzzer
Door ajar	Door not properly closed	Dash center panel	Indication of rear door not properly closed	Red light and buzzer
Low system air pressure	Sensing low primary and secondary air tank pressure	Dash center panel	Indication of low air system pressure	Visual and audible alarms for low air pressure
Engine coolant indicator	Low coolant indicator may be supplied as audible alert and visual and/or text message	Within operator's sight	Detects low coolant condition	Amber light

**TABLE 6**  
Transit Bus Instruments, Controls and Alarms

Device	Description	Location	Function	Visual/ Audible
Hot engine indicator	Coolant temperature indicator may be supplied as audible alert and visual and/or text message	Within operator's sight	Detects hot engine condition and initiates time delay shutdown	Red light
Low engine oil pressure indicator	Engine oil pressure indicator may be supplied as audible alert and visual and/or text message	Within operator's sight	Detects low engine oil pressure condition and initiates time-delayed shutdown	Red light
ABS indicator	Detects system status	Dash center panel	Displays system failure	Amber light
HVAC indicator	Detects system status	Dash center panel	Displays system failure	Amber or red light
Charging system indicator (12/24 VDC)	Detect charging system status	Dash center panel	Detects no charge condition and optionally detects battery high, low, imbalance, no charge condition, and initiates time-delayed shutdown	Red light flashing or solid based on condition
Bike rack deployed indicator	Detects bike rack position	Dash center	Text message indication of bike rack not being in fully stowed position	Amber light on dash
Fuel tank level	Gauge, graduated based on type	Dash center	Indication of diesel fuel tank level	Visual message
DEF gauge	Level Indicator	Center dash	Displays level of DEF tank and indicates with warning light when low	Red light
Active regeneration	Detects Status	Dash center	Indication of electric regeneration	Amber or red light
Passenger Signal	Passenger Requested Stop	Dash Center	Indication of Request	Amber/Audible Single Bell Tone
Passenger Signal	Mobility Position requested Stop	Dash Center	Indication of Request	Red/Audible Double Bell Tone

### TS 44.6 Operator Foot Controls

The operator's foot accelerator and brake pedals shall be designed for ankle motion. Foot surfaces of the pedals shall be faced with wear-resistant, nonskid, replaceable material.

### TS 44.6.1 Pedal Angle

The vertical angle of the accelerator and brake pedals shall have the same angle determined from a horizontal plane regardless of the slope of the cab floor. The accelerator and brake pedals shall be positioned at an angle of 37 to 50 degrees at the point of initiation of contact and extend downward to an angle of 10 to 18 degrees at full throttle.

The location of the brake and accelerator pedals shall be determined by the contractor, based on space needs, visibility and lower edge of windshield.

### TS 44.6.2 Pedal Dimensions and Position

The floor-mounted accelerator pedal shall be 10 to 12 inches long and 3 to 4 inches wide. Clearance around the pedal shall allow for no interference precluding operation.

The accelerator and brake pedals shall be positioned such that the spacing between them, measured at the heel of the pedals, is between 1 and 2 inches. Both pedals should be located approximately on the same plane coincident to the surface of the pedals. A floor mounted wear plate shall also be provided.

### TS 44.6.3 Adjustable Brake and Accelerator Pedals

**The MTA currently uses Teleflex adjustable brake and accelerator pedals and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The pedals shall conform to the requirements of SAE J1455 and FMVSS 124. Both pedals shall be adjustable forward and rearward a minimum of 3 inches. The adjustment shall be made by use of a side console mounted toggle or rocker switch. The switch shall be clearly labeled to identify it as pedal adjustment and shall be within easy reach of the operator. Pedal adjustment shall be enabled only when the bus is stationary and the parking brake engaged.

The adjustable system shall assist operator's of shorter stature to move the accelerator, brake, and clutch pedals closer while permitting them to maintain normal or desired seating position and optimum body positioning, without altering pedal deployment action or angle. This allows for safety restraint system effectiveness, and steering wheel and instrument panel control access, while enhancing the operator's comfort.

### TS 44.7 Operator Foot Switches

The angle of the turn signal platform shall be determined from a horizontal plane, regardless of the slope of the cab floor. The turn signal platform shall be angled at a minimum of 10 degrees and a maximum of 37 degrees. The platform shall be located no closer to the operator seat front than the heel point of the accelerator pedal.

The control switches for the turn signals, high beam and silent alarm shall be mounted on an inclined, floor-mounted stainless steel enclosure or metal plate mounted to an incline integrated into the operator's platform, located to the left of the steering column. The location and design of this enclosure shall be such that foot room for the operator is not impeded. The inclined mounting surface shall be skid-resistant and the underside sealed to the floor protecting the switch terminals and wiring from moisture and dirt. All proposed signal switches locations and mounting shall have MTA review..

The foot switches shall be UL-listed, heavy-duty type, of a rugged, corrosion-resistant metal construction. The foot switches for the turn signals and PA system shall be momentary type, while the switch for the high beam shall be latching type. The spacing of the switches shall be such that inadvertent simultaneous deflection of switches is prevented.

## TS 45. Operator Amenities

### TS 45.1 Coat Hanger

A hook and loop shall be provided to secure the operator's coat.

### TS 45.2 INTENTIONALLY BLANK

### TS 45.3 Storage Box

An enclosed operator storage area, with access from the aisle, shall be provided with a positive latching door and/or lock. The minimum size of the storage box shall be 2,750 cubic inches. The location will be reviewed by the MTA at PPM.

## TS 46. Windshield Wipers and Washers

### TS 46.1 Windshield Wipers

**The MTA currently Sprague windshield wiper system and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The bus shall be equipped with an electric windshield wiper system having two speeds and intermittent capability. The windshield wiper blades shall have a wet arm to allow washer fluid flow where the wiper sweeps.

The bus shall be equipped with a windshield wiper for each half of the windshield. At 60 mph, no more than 10 percent of the wiped area shall be lost due to windshield wiper lift. The wipers shall park along the center edges of the windshield glass. Windshield wiper motors and mechanisms shall be easily accessible for repairs or service. The fastener that secures the wiper arm to the drive mechanism shall be corrosion-resistant.

A single-control, electric two-speed intermittent wiper system shall be provided. A variable-speed feature shall be provided to allow adjustment of wiper speed for both sides of the windshield between approximately 5 and 25 cycles per minute.

### TS 46.2 Windshield Washers

The windshield washer system, when used with the wipers, shall deposit washing fluid evenly and completely wet the entire wiped area. A wet-arm-type system is acceptable. The wash operation shall be controlled by the wiper control knob.

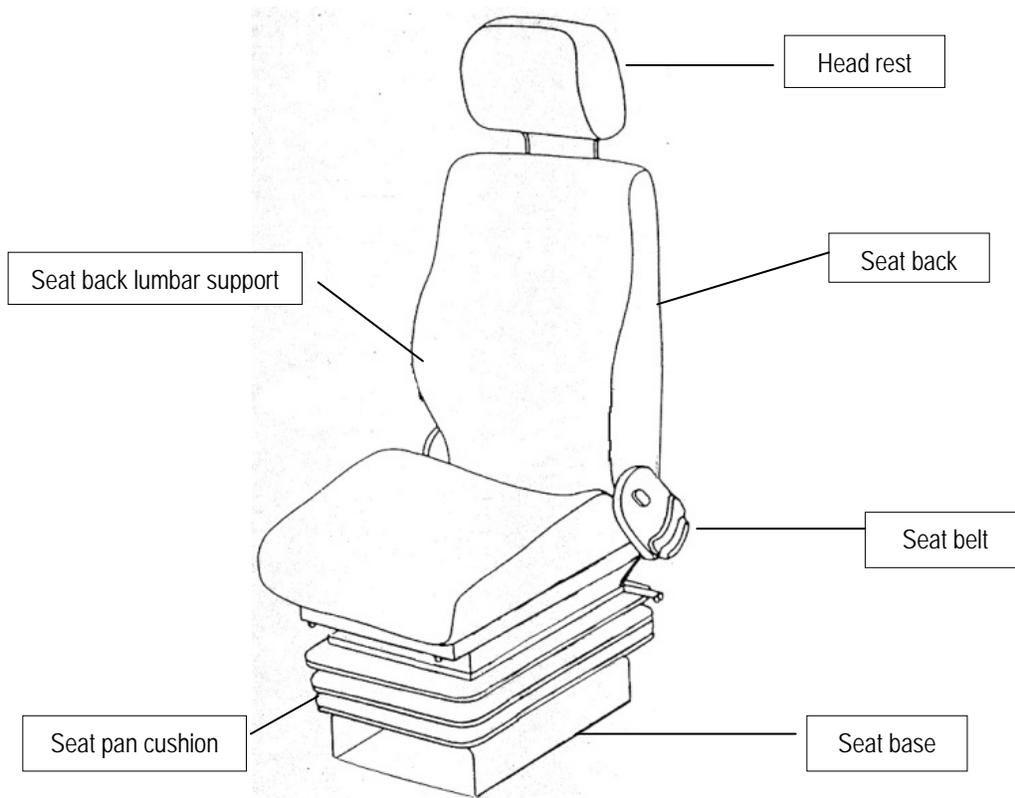
The windshield washer system shall have a minimum 5-gallon reservoir, located for easy refilling from outside of the bus. Reservoir pumps, lines and fittings shall be corrosion-resistant and must include a means to determine fluid level.

## TS 47. Operator's Seat and Security Door

**The MTA currently uses the Recaro Ergo Metro AM 80 operator's seat and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The operator's seat shall conform to the requirements of FMVSS 302, 207 and 210 and accordance with the Recommended Fire Safety Practices defined in FTA Docket 90A, dated October 20, 1993. The seat shall have an air suspension system with a 400 lb. lift capacity and 6.5 inches of height travel. The fore and aft travel shall be a minimum of 11.0 inches.

**FIGURE 6**  
Operator's Seat



### TS 47.1 Seat Dimensions

The operator's seat shall be comfortable and adjustable so that people ranging in size from a 95th-percentile male to a 5th-percentile female may operate the bus.

#### **TS 47.1.1 Seat Pan Cushion Length**

The seat pan cushion measurement shall be from the front edge of the seat pan to the rear at its intersection with the seat back. The adjustment of the seat pan length shall be no less than 16.5 inches at its minimum length and no more than 20.5 inches at its maximum length.

#### **TS 47.1.2 Seat Pan Cushion Height**

The seat pan cushion height measurement shall be from the cab floor to the top of the level seat at its center midpoint. The seat shall adjust in height from a minimum of 14 inches, with a minimum 6.5 inches vertical range of adjustment.

#### **TS 47.1.3 Seat Pan Cushion Width**

The seat pan cushion width measurement shall be the horizontal distance across the seat cushion. The seat pan cushion shall be 17 to 21 inches across at the front edge of the seat cushion and 20 to 23 inches across at the side bolsters.

#### **TS 47.1.4 Seat Pan Cushion Slope**

The seat pan cushion slope measurement shall be the slope of the plane created by connecting the two high points of the seat, one at the rear of the seat at its intersection with the seat back and the other at the front of the seat just before it waterfalls downward at the edge. The slope shall be measured using an inclinometer and shall be stated in degrees of incline relative to the horizontal plane (0 degrees). The seat pan shall adjust in its slope from no less than plus 12 degrees (rearward "bucket seat" incline), to no less than minus 5 degrees (forward slope).

#### **TS 47.1.5 Seat Base Fore/Aft Adjustment**

The seat base fore/aft adjustment measurement shall be the horizontal distance from the heel point to the front edge of the seat. The minimum and maximum distances shall be measured from the front edge of the seat when it is adjusted to its minimum seat pan depth (approximately 15 in.). The seat-base shall travel horizontally a minimum of 11 inches. It shall adjust no closer to the heel point than 6 in.

#### **TS 47.1.6 Seat Suspension**

The operator's seat shall be appropriately dampened to support a minimum weight of 400 lbs. The suspension shall be capable of dampening adjustment in both directions. The seat suspension shall incorporate an adjustable shock design allowing the operator to adjust the dampening.

Rubber bumpers shall be provided to prevent metal-to-metal contact.

#### **TS 47.1.7 Seat Back Width and Height**

The seat back width measurement shall be the distance between the outermost points of the front of the seat back, at or near its midpoint in height. The seat back width shall be no less than 19 in. The seat back will include dual recliner gears on both sides of the seat.

A standard height seat back shall be provided.

#### **TS 47.1.8 Headrests**

The operator's seat shall have an adjustable headrest.

### **TS 47.1.9 Seat Back Lumbar Support**

The seat back lumbar support measurement shall be from the bottom of the seat back at its intersection with the seat pan to the top of the lumbar cushioning. The seat back shall provide adjustable depth lumbar back support with at least three individual operating lumbar cells within a minimum range of 7 to 11 inches

### **TS 47.1.10 Seat Back Angle Adjustment**

The seat back angle shall be measured relative to a level seat pan, where 90 degrees is the upright position and 90 degrees-plus represents the amount of recline.

The seat back shall adjust in angle from a minimum of no more than 90 degrees (upright) to at least 105 degrees (reclined), with infinite adjustment in between.

### **TS 47.1.11 Seat Clearance**

In any position, the operator's seat shall not contact any part of the bus.

## **TS 47.2 Seat Belt**

The belt assembly should be an auto-locking retractor (ALR). All seat belts should be stored in automatic retractors on the left (street) side of the bus. The belts shall be mounted to the seat frame so that the operator may adjust the seat without resetting the seat belt.

The seat and seat belt assemblies as installed in the bus shall withstand static horizontal forces as required in FMVSS 207 and 210. The belt fabric shall be colored safety orange.

### **TS 47.2.1 Lap and Shoulder (Three-Point) Seat Belt**

Seat belts shall be provided across the operator's lap and diagonally across the operator's chest. The seat shall be equipped with a 2pt and a 3pt retractor with a single buckle on the right side of the seat cushion. The operator shall be able to use both belts by connecting a single buckle on the right side of the seat cushion. Three-point seatbelts shall be emergency locking retractor (ELR) in design. The seat shall have an integrated adjustable D ring that allows for 4 inch of horizontal / vertical adjustment to the shoulder belt. All seat belt assemblies shall come equipped with a warning switch device to remind operators to buckle up.

The lap and shoulder belt fabric shall be colored safety orange.

### **TS 47.2.2 Lap Belt Length**

The lap belt assembly shall be a minimum of 80 inches in length.

## **TS 47.3 Operator Seat Control Locations**

While seated, the operator shall be able to make seat adjustments by hand without complexity, excessive effort or being pinched. Adjustment mechanisms shall hold the adjustments and shall not be subject to inadvertent changes.

## **TS 47.4 Operator Seat Structure and Materials**

All foam and fabric cushions shall be in accordance with FMVSS Standard No. 302 and Recommended Fire Safety Practices defined in FTA Docket 90, dated October 20, 1993.

## TS 47.5 Operator Seat Options

The following seat options shall be provided:

- a) Seat belt alarm

## TS 47.6 Operator's Security Door

A two piece security door shall be provided that extends between the electrical cabinet at the rear of the operator's seat forward to an area beside the farebox. The structure of the door shall include black stanchions and grab rails and provide a buffer between the operator and passenger.

The bottom of the security door shall be solid metal and hinged towards the electrical cabinet. The upper part of the door shall be made of lexan, and sculptured to allow for the operator to converse with passengers entering the bus. A louvered opening in the glass shall be included at the operator's ear level designed so the operator can hear passengers but protecting the operator from assault. The two piece door when opened shall open to a 90 degree angle across the bus aisle way from the street to curb side wheelhouse. When closed the operator shall be able to latch the door sections preventing unwanted patrons from opening the security door.

Shown in the pictures below is the barrier type being specified.



## TS 47.7 Mirrors

### TS 47.7.1 Exterior Mirrors

**The MTA currently uses Hadley exterior mirrors and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The bus shall be equipped with corrosion-resistant, outside rearview mirrors mounted with stable supports to minimize vibration. Mirrors shall be firmly attached to the bus to minimize vibration and to prevent loss of adjustment with a breakaway mounting system. Mirrors shall permit the operator to view the roadway along the sides of the bus, including the rear wheels. Mirrors shall retract or fold sufficiently to allow bus washing operations and shall be designed to avoid contact with windshield. Mirror arms and heads shall be cast aluminum BRT style.

The bus shall be equipped with a combination of flat and convex mirrors referred to as transit-specific. The mirrors shall be located so as to provide the operator a view to the rear along both sides of the bus and shall be adjustable both in the horizontal and vertical directions to view the rearward scene. The roadside rearview mirror shall be positioned so that the operator's line of sight is not obstructed.

The mirrors shall incorporate turn signals on both the glass mirror and back of the mirror head. A red chevron signal arrow shall be incorporated in the mirror glass and on the back of the mirror head the turn signal shall be an LED strip light mounted to the mirror housing as shown in the photo below.



#### Curb and street side Mirrors

The curbside rearview mirror sized as 8" x 11" with a 2/1 split shall be mounted so that its lower edge is no less than 80 in. above the street surface.

The operator shall be able to adjust the curbside mirror remotely while seated in the driving position. The control for remote positioning of the mirror shall be a single switch or device.

#### Street-Side Mirrors

The street-side rearview mirror shall be sized as 8" x 11" with a 2/1 split.

The operator shall be able to adjust the street-side mirror remotely while seated in the driving position. The control for remote positioning of the mirror shall be a single switch or device.

#### TS 47.7.2 Interior Mirrors

**The MTA currently uses Hadley interior mirrors and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Interior mirrors shall be ball shaft mounted allowing for ease of adjustment. Standard safety glass shall be used for the mirrors. The mounting of mirrors shall be into steel structure, tapping plates or clamping to a stanchion. The interior mirrors shall not block the operator's exterior view or view of passengers in the bus.

Mirrors shall be provided for the operator to observe passengers throughout the bus without leaving the seat and without shoulder movement. The operator shall be able to observe passengers in the front/entrance and rear/exit areas, anywhere in the aisle, and in the rear seats. At a minimum, the interior mirrors to be provided shall include:

- a) Operator's rear view mirror – 8"x15"
- b) Spot mirror under destination sign – 6" round
- c) Convex mirror above front door to see first seat behind electronics box – 6" round
- d) Convex mirror mounted at ceiling above front doors to see doorway – 7"x10"
- e) Mirror at rear door area to see rear doorway – 12" round

## WINDOWS

### TS 48. General

There shall be a minimum of 10,000 sq. inches of window area, including operator and door windows, on each side of the bus.

### TS 49. Windshield

The windshield shall be two pieces and shall permit an operator's field of view as referenced in SAE Recommended Practice J1050. The vertically upward view shall be a minimum of 14 degrees, measured above the horizontal and excluding any shaded band. The vertically downward view shall permit detection of an object 3½ ft high no more than 2 ft in front of the bus. The horizontal view shall be a minimum of 90 degrees above the line of sight. Any binocular obscuration due to a center divider may be ignored when determining the 90-degree requirement, provided that the divider does not exceed a 3-degree angle in the operator's field of view. Windshield pillars shall not exceed 10 degrees of binocular obscuration. The windshield shall be designed and installed to minimize external glare as well as reflections from inside the bus.

The windshield shall be easily replaceable by removing zip-locks from the windshield retaining moldings. Bonded-in-place windshields shall not be used. Winglets may be bonded.

#### TS 49.1 Glazing

The windshield glazing material shall have a ¼ inch nominal thickness laminated safety glass conforming to the requirements of ANSI Z26.1 Test Grouping 1A and the Recommended Practices defined in SAE J673.

The upper portion of the windshield above the operator's field of view shall have a dark, shaded band with a minimum luminous transmittance of 5 percent when tested in accordance to ASTM D-1003.

## TS 50. Operator's Side Window

The operator's side window shall be the sliding type, requiring only the rear half of sash to latch upon closing, and shall open sufficiently to permit the seated operator to easily adjust the street-side outside rearview mirror. When in an open position, the window shall not rattle or close during braking. This window section shall slide in tracks or channels designed to last the service life of the bus. The operator's side window shall not be bonded in place and shall be easily replaceable. The glazing material shall have a single-density tint.

The operator's view, perpendicular through operator's side window glazing, shall extend a minimum of 33 inches to the rear of the heel point on the accelerator, and in any case shall accommodate a 5<sup>th</sup> percentile female and 95th percentile male operator. The view through the glazing at the front of the assembly should begin not more than 26 inches above the operator's floor to ensure visibility of an under-mounted convex mirror. The operator's window construction shall maximize ability for full opening of the window.

The operator's side window glazing material shall have a ¼ inch nominal thickness laminated safety glass conforming to the requirements of ANSI Z26.1-1996 Test Grouping 2 and the Recommended Practices defined in SAE J673.

The design shall prevent sections from freezing closed in the winter. Light transmittance shall be 75 percent on the glass area below 53 inches from the operator platform floor. On the top fixed over bottom slider configuration, the top fixed area above 53 inches may have a maximum 5 percent light transmittance.

## TS 51. Side Windows

**The MTA currently uses Arrow Global (Stormtite) flush mounted continuous passenger windows and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Bus windows shall be bonded to the frame appearing as a "continuous all glass" exterior. The bus windows shall be constructed and tested in accordance with FMVSS 217 and the materials conform to ANSI Z26.1 and recommended SAE J673 practices.

Windows shall have been designed and constructed with a water management system. The window seal and sash material shall be designed using UV stable material and of materials to prevent shrinkage, deterioration and water leakage. Window frame material shall be compatible with the bus structure and all fasteners shall be stainless steel.

Each glazing component including and window guards shall have the manufacturers DOT register identification "bug" applied according to DOT requirements and the "bug" shall include the date (month / year) of manufacturer applied.

### TS 51.1 Configuration

Side windows shall not be bonded in place, but shall be easily replaceable without disturbing adjacent windows and shall be mounted so that flexing or vibration from engine operation or normal road excitation is not apparent. All aluminum and steel material shall be treated to prevent corrosion.

Each side window shall incorporate an operable upper transom portion. The transom shall be between 25 and 35 percent of the total window area. The lower portion of the window shall be fixed. The transom portion shall be hinged along the lower edge, have a latch, support struts and designed to

open inward. The set screw for locking the transom window closed shall be removed, bagged along with the screws from the other windows and shipped in the curb side front utility box.

All passenger windows shall include clear window guards used to shield the window glass from graffiti and vandalism. The guards shall be able to be changed with minimal effort and not require the removal of the window assembly.

With the exception of the side destination sign window all windows shall be equipped with inward opening transom windows

### **TS 51.2 Emergency Exit (Egress) Configuration**

Emergency exit windows shall meet the requirements of 49 CFR 571.217 – FMVSS 217; Bus Emergency Exits and Window Retention and Release. All rectangle and square side windows shall be configured as emergency escape windows except the curbside window at the right front wheel house. Emergency escape windows shall be able to be opened with the use of durable release handles. Metal identification and instruction signs for opening the egress windows shall be installed by rivets on the inside of the window frame or between windows on the sidewall panel.

### **TS 51.3 INTENTIONALLY BLANK**

### **TS 51.4 Materials**

Side window glazing material shall have a minimum 1/4-inch nominal thickness. The material shall conform with the requirements of ANSI Z26.1-1996, “Standard for Type AS-5 Safety Glazing Materials,” except for Test Number 17, which shall subject the specimens to 100 cycles with less than 4 percent hazing and 500 cycles with less than 12 percent hazing. Windows shall be polycarbonate sheet with an abrasion resistant coating on both sides of the window.

Windows on the bus sides and in the rear door shall be tinted a neutral color, complementary to the bus exterior. The maximum solar energy transmittance shall not exceed 59 percent, as measured by ASTM E-424. Luminous transmittance shall be measured by ASTM D-1003. Windows over the destination signs shall not be tinted.

### **TS 51.5 INTENTIONALLY BLANK**

## **HEATING, VENTILATING AND AIR CONDITIONING**

### **TS 52. HVAC Capacity and Performance**

The MTA is specifying an all electric AC system powered from the Hybrid electrical system meeting the following requirements for the HVAC system:

The HVAC climate control system shall be capable of controlling the temperature and maintaining the humidity levels of the interior of the bus as defined in the following paragraphs. The system shall have programmable features to reduce the electrical load on the hybrid system.

The AC system shall use hermetically sealed variable speed compressor operating using 134a or R-407C refrigerant. The HVAC system shall utilize a microprocessor controller with a self diagnostic system. The system shall have maintenance free brushless motors with an expected bearing life of 36,000 hours.

With the bus running at the design operating profile with corresponding door opening cycle, and carrying a number of passengers equal to 150 percent of the seated load, the HVAC system shall control the

average passenger compartment temperature within a range between 65 and 80 °F, while maintaining the relative humidity to a value of 50 percent or less. The system shall maintain these conditions while subjected to any outside ambient temperatures within a range of 10 to 95 °F and at any ambient relative humidity levels between 5 and 50 percent.

When the bus is operated in outside ambient temperatures of 95 to 115 °F, the interior temperature of the bus shall be permitted to rise 0.5° for each degree of exterior temperature in excess of 95 °F.

When the bus is operated in outside ambient temperatures in the range of -10 to 10 °F, the interior temperature of the bus shall not fall below 55 °F while the bus is running on the design operating profile.

System capacity testing, including pull-down/warm-up, stabilization and profile, shall be conducted in accordance to the APTA's "Recommended Instrumentation and Performance Testing for Transit Bus Air Conditioning System." The recommended locations of temperature probes are only guidelines and may require slight modifications to address actual bus design. Care shall be taken to avoid placement of sensing devices in the immediate path of an air duct outlet. In general, the locations are intended to accurately represent the interior passenger area.

Additional testing shall be performed as necessary to ensure compliance to performance requirements stated herein.

### TS 52.1 Capacity and Performance Requirements

The air conditioning portion of the HVAC system shall be capable of reducing the passenger compartment temperature from 110 °F to 70 °F +/-3 °F in less than 30 minutes after system engagement. Engine temperature shall be within the normal operating range at the time of start-up of the cool-down test, and the engine speed shall be limited to fast idle at ¾ max governed speed that may be activated by an operator-controlled device. During the cool-down period, the refrigerant pressure shall not exceed safe high-side pressures, and the condenser discharge air temperature, measured 6 in. from the surface of the coil, shall be less than 45 °F above the condenser inlet air temperature. No simulated solar load shall be used. There shall be no passengers on board, and the doors and windows shall be closed.

The pull-up requirements for the heating system shall be in accordance with Section 9 of APTA's "Recommended Instrumentation and Performance Testing for Transit Bus Air Conditioning." With ambient temperature at -20 °F, and vehicle cold soaked at that temperature, the bus heating system shall warm the interior passenger compartment to an average temperature of 70 °F ±2 °F within 70 minutes.

### TS 53. Controls and Temperature Uniformity

**The MTA currently uses the Thermo King Intelligaire III control / diagnostic controller and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The operator shall have a single toggle switch to turn the HVAC system on or off. The HVAC system excluding the operator's heater/defroster shall be centrally controlled with an advanced electronic/diagnostic control system with provisions for extracting/reading data. The system shall be compliant with J1939 Communication Protocol for receiving and broadcasting of data. Hot engine coolant water shall be delivered to the HVAC system operator's defroster/heater and other heater cores by means of an auxiliary coolant pump, sized for the required flow, which is brushless and seal less having a

minimum maintenance free service life for both the brushless motor and the pump of at least 40,000 hours at full power.

***The climate control system shall be fully automatic and control the interior average temperature to within  $\pm 2$  °F of 68 degrees Fahrenheit.***

Interior temperature distribution shall be uniform to the extent practicable to prevent hot and/or cold spots. After stabilization with doors closed, the temperatures between any two points in the passenger compartment in the same vertical plane, and 6 to 72 inches above the floor, shall not vary by more than 5 °F with doors closed. The interior temperatures, measured at the same height above the floor, shall not vary more than  $\pm 5$  °F from the front to the rear from the average temperature determined in accordance with APTA's "Recommended Instrumentation and Performance Testing for Transit Bus Air Conditioning System." Variations of greater than  $\pm 5$  °F will be allowed for limited, localized areas provided the majority of the measured temperatures fall within the specified requirement.

## **TS 54. Air Flow**

### **TS 54.1 Passenger Area**

The cooling mode of the interior climate control system shall introduce air into the bus at or near the ceiling height at a minimum rate of 25 cfm per passenger based on the standard configuration bus carrying a number of passengers equal to 150 percent of the seated load. Airflow shall be evenly distributed throughout the bus, with air velocity not exceeding 100 ft per minute on any passenger. The ventilating mode shall provide air at a minimum flow rate of 20 cfm per passenger.

Airflow may be reduced to 15 cfm per passenger (150 percent of seated load) when operating in the heating mode. The fans shall not activate until the heating element has warmed sufficiently to ensure at least 70 °F air outlet temperature. The heating air outlet temperature shall not exceed 120 °F under any normal operating conditions.

The climate control blower motors and fan shall be designed such that their operation complies with the interior noise level requirements.

### **TS 54.2 Operator Area**

The bus interior climate control system shall deliver at least 100 cfm of air to the operator's area when operating in the ventilating and cooling modes. Adjustable nozzles shall permit variable distribution or shutdown of the airflow. Airflow in the heating mode shall be reduced proportionally to the reduction of airflow into the passenger area. The windshield defroster unit shall meet the requirements of SAE Recommended Practice J382, "Windshield Defrosting Systems Performance Requirements," and shall have the capability of diverting heated air to the operator's feet and legs. The defroster or interior climate control system shall maintain visibility through the operator's side window.

### **TS 54.3 Controls for the Operator's Climate Control System (CCS)**

The controls for the operator's compartment for heating, ventilation and cooling systems shall be integrated and shall meet the following requirements:

- a) The operator's heat/defrost system fan shall be controlled by a separate switch that has an "off" position and a low and high position for speed control. All switches and controls shall preclude the possibility of clothing becoming entangled, and shields shall be provided, if required. An "on-off" switch shall be located to the right of or near the main defroster switch.

- b) A manually operated control valve shall control the coolant flow through the defrost/heater core.
- c) If a cable-operated manual control valve is used, the cable length shall be kept to a minimum to reduce cable seizing. Heater water control valves shall be “positive” type, closed or open. The method of operating remote valves shall require the concurrence of the MTA Project Manager.

### TS 54.4 Operator Compartment Requirements

A separate heating, ventilation and defroster system for the operator’s area shall be provided and shall be controlled by the operator. The system shall meet the following requirements:

- The heater and defroster system shall provide heating for the operator and heated air to completely defrost and defog the windshield, operator’s side window, and the front door glasses in all operating conditions. Fan(s) shall be able to draw air from the bus body interior and/or the exterior through a control device and pass it through the heater core to the defroster system and over the operator’s feet. A minimum capacity of 100 cfm shall be provided. The operator shall have complete control of the heat and fresh airflow for the operator’s area.
- The defroster supply outlets shall be located at the lower edge of the windshield. These outlets shall be durable and shall be free of sharp edges that can catch clothes during normal daily cleaning. The system shall be such that foreign objects such as coins or tickets cannot fall into the defroster air outlets. Adjustable ball vents or louvers shall be provided at the left of the operator’s position to allow direction of air onto the side windows.

A ventilation system shall be provided to ensure operator comfort and shall be capable of providing fresh air in both the foot and head areas. Vents shall be controllable by the operator from the normal driving position. Decals shall be provided, indicating “operating instructions” and “open” and “closed” positions. When closed, vents shall be sealed to prevent the migration of water or air into the bus.

### TS 54.5 Operators Ventilation

A 6-inch round, 2-speed, ceiling mounted fan that provides 100 cfm of air shall be provided. The fan shall be mounted on the ceiling above the operator’s seat in a location reviewed by the MTA.

### TS 55. Air Filtration

Air shall be filtered before discharge into the passenger compartment. The filter shall meet the ANSI/ASHRAE 52.1 requirement for 5 percent or better atmospheric dust spot efficiency, 50 percent weight arrestance, and a minimum dust holding capacity of 120 g per 1000 cfm cell.

Air filters shall be disposable and easily removable for inspection and service.

### TS 56. Roof Ventilators / Emergency Escape Hatches

**The MTA currently uses Spheros Glass Hatches and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Two glass roof ventilator / emergency escape hatches shall be provided in the roof of the bus, one approximately over or just forward of the front axle and the other approximately over the rear axle. Each shall have operational instruction decals in English.

Each hatch shall be easily opened and closed manually. When open with the bus in motion, the hatches may be used as a ventilator providing fresh air inside the bus. The hatches shall cover an opening area no less than 425 sq in. to be used as an emergency exit and shall be capable of being positioned as a scoop with either the leading or trailing edge open no less than 4 in., or with all four edges raised simultaneously to a height of no less than 3½ in. The hatches shall be sealed to prevent entry of water when closed.

## TS 57. Maintainability

Manually controlled shut-off valves in the refrigerant lines shall allow isolation of the compressor and dehydrator filter for service. To the extent practicable, self-sealing couplings utilizing O-ring seals shall be used to break and seal the refrigerant lines during removal of major components, such as the refrigerant compressor. Shut-off valves may be provided in lieu of self-sealing couplings. The condenser shall be located to efficiently transfer heat to the atmosphere and shall not ingest air warmed above the ambient temperature by the bus mechanical equipment, or to discharge air into any other system of the bus. The location of the condenser shall preclude its obstruction by wheel splash, road dirt or debris. HVAC components located within 6 in. of floor level shall be constructed to resist damage and corrosion.

Electronic high and low refrigerant pressure gauges shall be located in the return air area as part of systems controller.

## TS 58. Entrance/Exit Area Heating

Heat shall be supplied to the entrance and exit areas to maintain a tread surface temperature no less than 35 °F in an ambient of -10 °F to prevent accumulation of snow, ice or slush with the bus operating under design operating profile and corresponding door opening cycle.

A floor level heater shall be located adjacent to the entrance door platform with warm air directed to the ramp and surrounding floor area with capacity to meet the requirements listed above. Two floor level heaters shall be mounted to the floor adjacent to the rear exit door(s). One heater shall be underneath the seat to the front of the exit door and the other across the aisle from the rear exit door underneath the seat.

## TS 59. Floor-Level Heating

**The MTA currently uses Mobile Climate Control floor heaters and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

24 VDC floor level heaters shall be provided to evenly supply heated forced air through floor ducts across the area of the bus at the rear exit door. The heaters shall be provided with low noise centrifugal brushless motors. Floor ducts may be discontinued at the upper level, but additional provisions to prevent cold floors and ensure temperature uniformity shall be included. Variable speed control of the floor-level heating shall be through the main HVAC system controller.

The floor level heater cores and blower motors shall be mounted in stainless steel cabinets secured to the bus floor. The cabinets shall be constructed and mounted in a manner preventing the passenger from contacting the heater element.

## EXTERIOR PANELS, FINISHES AND EXTERIOR LIGHTING

### TS 60. Design

The bus shall have a clean, smooth, simple design, primarily derived from bus performance requirements and passenger service criteria. The exterior and body features, including grilles and louvers, shall be shaped to facilitate cleaning by automatic bus washers without snagging washer brushes. Water and dirt

shall not be retained in or on any body feature to freeze or bleed out onto the bus after leaving the washer. The body and windows shall be sealed to prevent leaking of air, dust or water under normal operating conditions and during cleaning in automatic bus washers for the service life of the bus. All fasteners used on the exterior of the bus shall be stainless steel.

Exterior panels shall be sufficiently stiff to minimize vibration, drumming or flexing while the bus is in service. When panels are lapped, the upper and forward panels shall act as a watershed. However, if entry of moisture into the interior of the vehicle is prevented by other means, then rear cap panels may be lapped otherwise. The windows, hatches and doors shall be able to be sealed. Accumulation of spray and splash generated by the bus's wheels shall be minimized on windows and mirrors.

### **TS 60.1 Materials**

Body materials shall be selected and the body fabricated to reduce maintenance, extend durability and provide consistency of appearance throughout the service life of the bus. Detailing shall be kept simple, and add-on devices and trim shall be minimized and integrated into the basic design.

### **TS 60.2 Roof-Mounted Equipment**

A non-skid, clearly marked walkway or steps shall be incorporated on the roof to provide access to equipment without damaging any system or bus paneling. Adhesive backed non-slip grip tape may be used to provide a safe walkway on the roof of the bus.

## **TS 61. Pedestrian Safety**

Exterior protrusions along the side and front of the bus greater than ½ in. and within 80 in. of the ground shall have a radius no less than the amount of the protrusion. The exterior rearview mirrors, cameras and required lights and reflectors are exempt from the protrusion requirement. Grilles, doors, bumpers and other features on the sides and rear of the bus shall be designed to minimize toeholds or handholds.

Exterior protrusions shall not cause a line-of-sight blockage for the operator through the windshield or in using the rear view mirrors.

## **TS 62. Repair and Replacement**

### **TS 62.1 Side Body Panels**

Structural elements supporting exterior body panels shall allow side body panels below the passenger windows to be repaired in lengths not greater than 12-1/2 feet. The body side panels shall be aluminum or fiberglass requiring MTA review and equal. Dissimilar metals are to be protected from each other where they contact each other.

## **TS 63. Rain Gutters**

Rain gutters shall be provided to prevent water flowing from the roof onto the passenger doors and operator's side window. When the bus is decelerated, the gutters shall not drain onto the windshield, operator's side window or door boarding area. Cross-sections of the gutters shall be adequate for proper operation.

## **TS 64. License Plate Provisions**

Provisions shall be made to mount standard-size U.S./Canada license plates per SAE J686 on the front and rear of the bus. These provisions shall direct-mount or recess the license plates so that they can be cleaned by automatic bus-washing equipment without being caught by the brushes.

The rear license plate provision shall be illuminated per SAE J587. Stainless steel hardware shall be used in mounting the license plates and the rear license plate LED lamp.

**The MTA currently uses Super Brite LED, model LPC-C-W2 rear license plate lamp and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The license plate light(s) shall be LED meeting the illumination requirements. The light beam pattern shall be 90 degrees. A waterproof metallic housing with a polycarbonate lens shall be painted the color of the bus at that location.

## **TS 64.1 INTENTIONALLY BLANK**

### **TS 65. Fender Skirts**

Features to minimize water spray from the bus in wet conditions shall be included in wheel housing design. Any fender skirts shall be easily replaceable and the fasteners shall be protected from road spray and salt. The fender skirts shall be flexible if they extend beyond the allowable body width. Wheels and tires shall be removable with the fender skirts in place.

### **TS 66. Splash Aprons**

Splash aprons, composed of ¼ in. minimum composition or rubberized fabric, shall be installed behind and/or in front of wheels as needed to reduce road splash and protect underfloor components. The splash aprons shall extend downward to within 2 inches off the road surface at static conditions. Apron widths shall be no less than tire widths. Splash aprons shall be bolted to the bus understructure. Splash aprons and their attachments shall be inherently weaker than the structure to which they are attached. The flexible portions of the splash aprons shall not be included in the road clearance measurements. Splash apron shall be installed as necessary to protect the wheelchair loading device from road splash. Other splash aprons shall be installed where necessary to protect bus equipment.

### **TS 67. Service Compartments and Access Doors**

#### **TS 67.1 Access Doors**

Conventional or pantograph hinged doors shall be used for the engine compartment and for all auxiliary equipment compartments including doors for checking the quantity and adding to the engine coolant, engine lubricant and hybrid drive fluid. Access openings shall be sized for easy performance of tasks within the compartment, including tool operating space. Access doors shall be of rugged construction and shall maintain mechanical integrity and function under normal operations throughout the service life of the bus. They shall close flush with the body surface. All doors shall be hinged at the top or on the forward edge and shall be prevented from coming loose or opening during transit service or in bus washing operations. All access doors shall be assisted opened and retained in the open position by gas-filled springs without support locks and shall be easily operable by one person. Springs and hinges shall be corrosion resistant. Latch handles shall be flush with, or recessed behind, the body contour and shall be sized to provide an adequate grip for opening. Access doors, when opened, shall not restrict access for servicing other components or systems.

All exterior access doors shall be equipped with corrosion-resistant flush-mounted locks. All such access doors shall require a standardized nominal 5/16 inch square male tool to open or lock.

If precluded by design, the contractor shall provide door design information specifying how the requirements are met.

## **TS 68. Bumpers**

**The MTA currently uses Romeo Rim “Help” Energy Absorbing Bumpers and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Bumper assemblies shall be energy absorbing allowing for 5 mph barrier impact at curb weight, 6.5 mph center strike and 5.5 mph corner strike impact of a 4,000 pound impact sled all without damage to the bumper after repeated impact.

The front bumper shall protect the bus from damage as a result of 6.5 mph impacts at any point by the common carriage with contoured impact surface defined in Figure 2 of FMVSS 301 loaded to 4000 lbs parallel to the longitudinal centerline of the bus. It shall protect the bus from damage as a result of 5.5 mph impacts into the corners at a 30-degree angle to the longitudinal centerline of the bus.

The rear bumper shall protect the bus, when impacted anywhere along its width by the common carriage with contoured impact surface defined in Figure 2 of FMVSS 301 loaded to 4000 lbs, at 4 mph parallel to or up to a 30-degree angle to, the longitudinal centerline of the bus.

Bumpers are considered as a part of the styling aesthetics of the bus. The bumpers while being functional as described in the specification shall blend into the overall styling aesthetics package

### **TS 68.1 Location**

Bumpers shall provide impact protection for the front and rear of the bus with the top of the bumper being 27 in.,  $\pm$  2 in., above the ground. Bumper height shall be such that when one bus is parked behind another, a portion of the bumper faces will contact each other.

### **TS 68.2 Front Bumper**

No part of the bus, including the bumper, shall be damaged as a result of a 5 mph impact of the bus at curb weight with a fixed, flat barrier perpendicular to the bus's longitudinal centerline. The bumper shall return to its pre-impact shape within 10 minutes of the impact. The energy absorption system of the bumper shall be independent of every power system of the bus and shall not require service or maintenance in normal operation during the service life of the bus. The bumper may increase the overall bus length specified by no more than 7 inches.

The front bumper shall be designed to include mounting provisions for an integrated bike rack.

### **TS 68.3 Rear Bumper**

No part of the bus, including the bumper, shall be damaged as a result of a 2 mph impact with a fixed, flat barrier perpendicular to the longitudinal centerline of the bus. The bumper shall return to its pre-impact shape within 10 minutes of the impact. When using a yard tug with a smooth, flat plate bumper 2 ft wide contacting the horizontal centerline of the rear bumper, the bumper shall provide protection at speeds up to 5 mph, over pavement discontinuities up to 1 in. high, and at accelerations up to 2 mph/sec. The rear bumper shall be shaped to preclude unauthorized riders standing on the bumper. The bumper shall not require service or maintenance in normal operation during the service life of the bus. The bumper may increase the overall bus length specified by no more than 7 in.

## TS 68.4 Bumper Material

Bumpers shall have lightweight aluminum construction backing and high energy level absorbing material. The black energy level molded material shall be easily replaceable by one technician in the event of damage.

Bumper material shall be corrosion-resistant and withstand repeated impacts of the specified loads without sustaining damage. The bumper material shall not discolor when exposed to sunshine, normal road grit, exhaust, cleaning agents, bus fluids and other material contacted during normal bus operation. Visible surfaces shall be black. These bumper qualities shall be sustained throughout the service life of the bus.

## TS 69. Finish and Color

### TS 69.1 Appearance

All exterior surfaces shall be smooth and free of wrinkles and dents. Exterior surfaces to be painted shall be properly prepared as required by the paint system supplier prior to application of paint to assure a proper bond between the basic surface and successive coats of original paint for the service life of the bus. Drilled holes and cutouts in exterior surfaces shall be made prior to cleaning, priming and painting, where possible, to prevent corrosion. The bus shall be completely painted prior to installation of exterior lights, windows, mirrors and other items that are applied to the exterior of the bus. Body filler materials may be used for surface dressing, but not for repair of damaged or improperly fitted panels.

**The MTA currently uses DuPont Imron Elite Express, 3.5 VOC and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The MTA color codes are:

**White: # 830728 EG**

**Black: # 830730 EG**

Paint shall be applied smoothly and evenly with the finished surface free of visible dirt and the following other imperfections:

- a) Blisters or bubbles appearing in the topcoat film
- b) Chips, scratches, or gouges of the surface finish
- c) Cracks in the paint film
- d) Craters where paint failed to cover due to surface contamination
- e) Overspray
- f) Peeling
- g) Runs or sags from excessive flow and failure to adhere uniformly to the surface
- h) Chemical stains and water spots
- i) Dry patch due to incorrect mixing of paint activators
- j) Buffing swirls

All exterior finished surfaces shall be impervious to diesel fuel, gasoline and commercial cleaning agents. Finished surfaces shall resist damage by controlled applications of commonly used graffiti-removing chemicals.

Proper adhesion between the basic surface and successive coats of the original paint shall be measured using an Elcometer adhesion tester as outlined in ASTM D4541-85. Adhesion shall be a minimum 300 ft-lbs. The bus manufacturer during the painting process shall be requested to supply random panel samples of for each step of the painting process that may be subject to adhesion testing per ASTM G4541-87 and ASTM D4145-85. ASTM D4541-93 may be used for inspection testing during assembly of the bus.

## TS 70. Decals, Numbering and Signing

**The MTA currently uses 3M Scotchlite Reflective Material for external decals and bus numbering and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The decal material shall be a durable, flexible, retro reflective film. The black film shall have a black daytime appearance but reflect white at night. It will have a position-able, pressure-activated adhesive and have a total thickness of .007 to .008 inches.

Monograms, numbers and other special signing shall be applied to the inside and outside of the bus as required. Signs shall be durable and fade-, chip- and peel-resistant. They may be painted signs, decals or pressure-sensitive appliques. All decals shall be a high quality material installed per the decal Supplier recommendations. Decals shall be installed in a manner that protects them from patrons intentionally peeling, degrading or removing them. Signs shall be provided in compliance with the ADA requirements defined in 49 CFR Part, Subpart B, 38.27.

Interior signs relating safety and ADA information shall be aluminum, and riveted in place and incorporated in the fabric of the passenger seat covering in the ADA securement area.

All signs (including samples of all interior plates and locations) shall be presented during the PPM and the MTA shall have final approval on all aspects of numbering and signing.

### **Bus exterior signage shall be as follows:**

- a) Exterior Bus Numbers shall be 5-digits in a sequence. The MTA numbering is derived from the first two digits being the year of build and the last three is the build sequence of 001 to 0YY. Numbers shall be 4-inch (minimum) 3M, Black Scotchlite Reflective Material, or approved equal. Exterior bus numbers shall be installed in these approximate locations and be visible to patrons:
  1. One at the right front of the bus.
  2. One each on the right and left sides above the drip rail.
  3. One at the top rear of the bus vertically.
- b) One on the roof of the bus (front) 18 inches high, reading street side to curbside from the rear.

- c) One ADA Wheelchair Accessible Logo shall be installed on the curbside corner of the bus. The logo shall be a black outline, 6-inch high minimum.

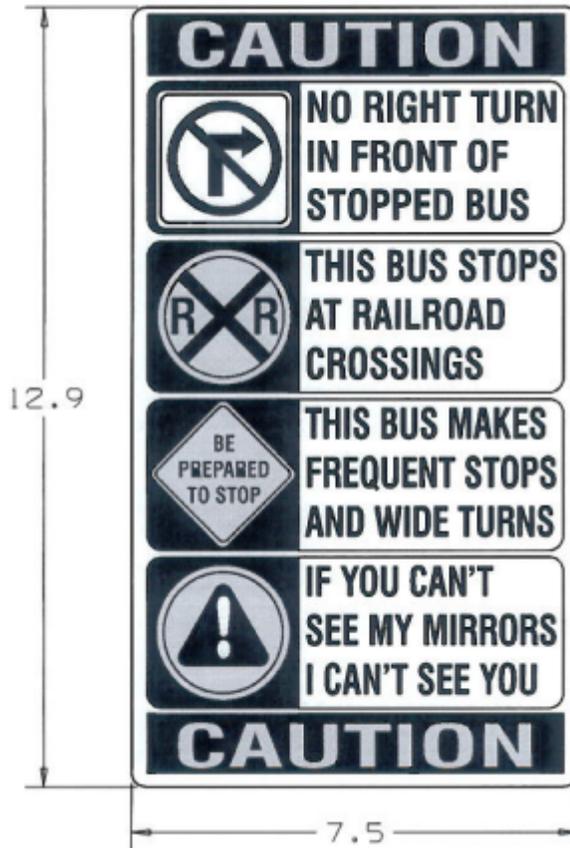


DESCRIPTION - DECAL HANDICAP SYMBOL  
 MATERIAL - 3M 180C-12 BLACK  
 - COATED WITH 3M 3650-114 CLEAR  
 - ADHESIVE BACKED AND KISS CUT  
 - APPLICATION PREMASK SCPM-44X  
 COLOR - BLACK

- d) One decal per bus, “This Bus Makes Wide Right Turns” shall be installed on the rear of the bus, in the lower right corner of the engine door. A second Caution decal shall be located on the panel above the engine door on the curb side indicating “No Right Turns in Front of the Bus”, “Bus Stops at Railroad Crossings”, “Bus Makes Frequent Stops and Wide Turns” and “If You Can’t See My Mirrors, I Can’t See You”.

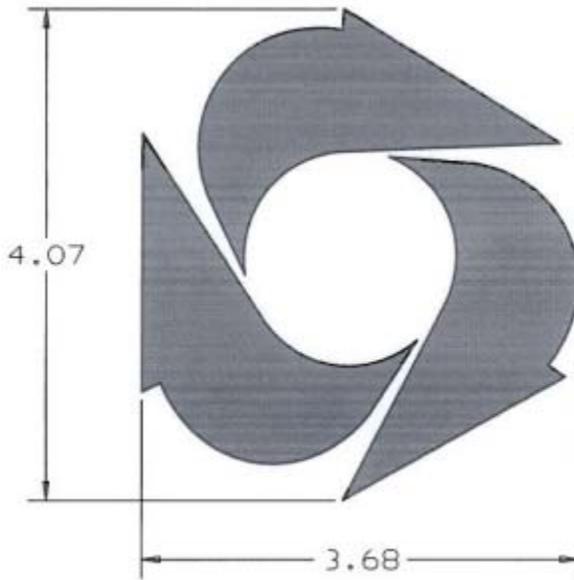


DESCRIPTION - DECAL WIDE RIGHTS  
 MATERIAL - 3M 680CR-10  
 - PREMASKED WITH SCPM-44X  
 COLOR - YELLOW/BLACK  
 AS PER SAMPLE



- DESCRIPTION - DECAL-CAUTION, ECT
- MATERIAL - 3M 680CR-10 WHITE
- COATED WITH 3M 3650-114 CLEAR
- COLOR - BLACK
- RED TO MATCH PMS 485
- YELLOW TO MATCH PMS PROCESS YELLOW
- FONT - AS SHOWN

- e) One decal per bus, “Maryland Department of Transportation” with MDOT logo shall be installed on the front of the bus, approximately in the center of the bus, under the windshield.



DESCRIPTION - DECAL MARYLAND DOT SYMBOL  
 MATERIAL - 3M 680CR-10 WHITE REFLECTIVE  
 - COATED WITH 3M 3650-114 CLEAR  
 - ADHESIVE BACKED AND KISS CUT  
 - PREMASKED WITH SCPM-44X  
 COLOR - ORANGE AS PER NFIL P/N 162607



DESCRIPTION - DECAL MARYLAND DOT  
 MATERIAL - 3M 680CR-85 BLACK REFLECTIVE  
 - PREMASKED WITH SCPM-44X  
 - ADHESIVE BACKED AND KISS CUT  
 COLOR - BLACK REFLECTIVE

f) Three “MTA Maryland” logo decals (see Drawing #1) per bus to be installed in the following locations:

1. One on the curb side above the drip rail, near the front of the bus
2. One on the street side above the drip rail, near the front of the bus
3. One on rear engine door in the lower left corner

**Drawing No. 1**



Colors:

PMS# 124 Gold

PMS# 193 Red



DESCRIPTION - DECAL MTA MARYLAND (REAR)  
MATERIAL - 3M 680CR-10  
- PREMASKED WITH SCPM-44X  
COLOR - WHITE/RED/BLACK/YELLOW  
- AS PER SAMPLE



DESCRIPTION - DECAL MTA MARYLAND (SIDE)  
MATERIAL - 3M 680CR-10 WHITE REFLECTIVE  
- PREMASKED WITH SCPM-44X  
COLOR - WHITE/RED/BLACK/YELLOW  
- AS PER SAMPLE

- g) One WWW.MTA.MARYLAND.GOV logo is to be installed on the rear of the bus, centered below the top rear marker lights.



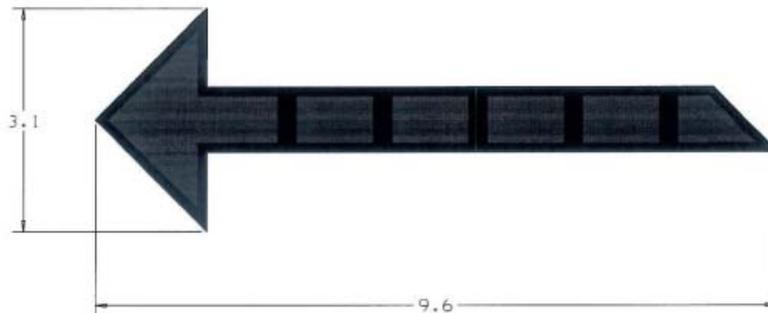
DESCRIPTION - DECAL-MTA WEBSITE  
 MATERIAL - 3M 680CR-85 BLACK REFLECTIVE  
 - PREMASKED WITH SCPM-44X  
 COLOR - BLACK REFLECTIVE

- h) Two “Kneeling Bus” decals to be installed, rear side of both the front and rear passenger doors, near the warning light.



DESCRIPTION - DECAL KNEELING BUS  
 MATERIAL - 3M 3650-114 CLEAR  
 - LAMINATED WITH 3M 3650-114 CLEAR  
 - APPLICATION PREMASK  
 COLOR - RED TEXT ON CLEAR BACKGROUND  
 FONT - HELVETICA MEDIUM

- i) Two red and black ‘Arrows’ to be installed, rear side of both the front and rear passenger doors, near the warning light and ‘Kneeling Bus’ decals.



DESCRIPTION - DECAL ARROW  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH 3M 3650-114 CLEAR  
 - ADHESIVE BACKED  
 COLOR - PRINTED BLACK AND RED AS SHOWN

- j) One 'RAMP' decal to be installed, rear side of the front passenger doors, near the warning light.

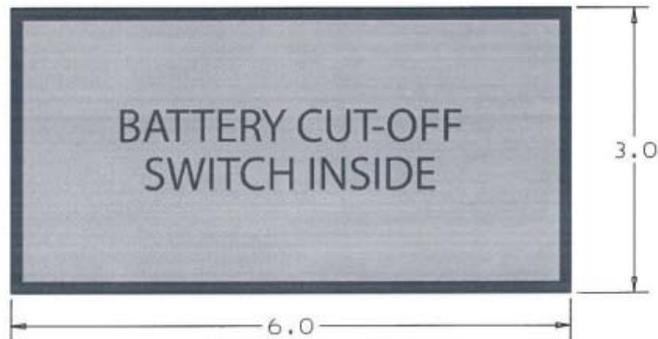


DESCRIPTION - DECAL RAMP  
 MATERIAL - 3M 3650-114 CLEAR  
 - LAMINATED WITH 3M 3650-114 CLEAR  
 - APPLICATION PREMASK  
 COLOR - RED TEXT ON CLEAR BACKGROUND  
 FONT - HELVETICA MEDIUM

- k) "Caution: Do Not Cross in Front of Standing Bus" decal to be installed on curbside front of bus adjacent to front headlights. Decal to be black lettering on yellow background, 4 inches by 6 inches.

- l) Two decals on the access door for the Battery Disconnect Switch as follows:

1. One decal 'BATTERY CUT OFF SWITCH INSIDE' with border

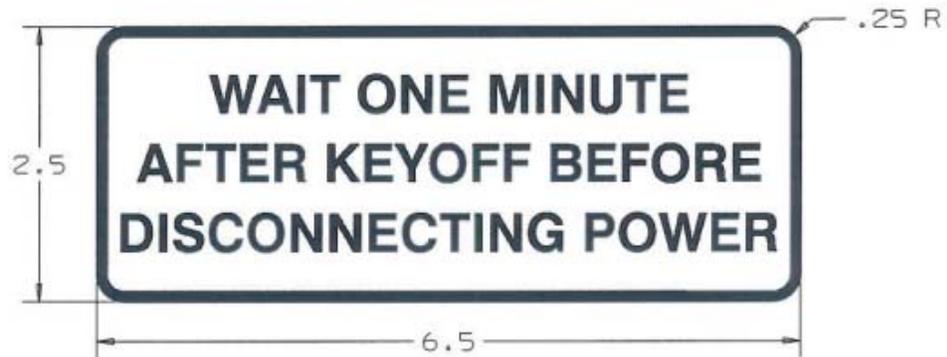


DESCRIPTION - DECAL-BATT CUTOFF SW INT  
 MATERIAL - 3M 3650-114 CLEAR  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED AND KISS CUT  
 COLOR - RED LETTERING AND .12 BORDER ON CLEAR  
 FONT - AS SHOWN

2. One decal 'KEY INSIDE FIRE EXTINGUISHER BOX' with border

Both decals shall be red die cut or red on clear background.

- m) One decal on inside of door for battery cut off switch with instructions “WAIT ONE MINUTE AFTER KEYOFF BEFORE DISCONNECTING POWER’.



DESCRIPTION - DECAL-WAIT 1 MINUTE  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED  
 FONT - HELVETICA MEDIUM  
 COLOR - RED TEXT ON WHITE BACKGROUND  
 - RED PMS 485

- n) Two decals, black lettering, shall be affixed to the roof mount battery compartment or roof shroud (one each streetside and curbside) that states: “Powered by CLEAN DIESEL ELECTRIC HYBRID TECHNOLOGY”.



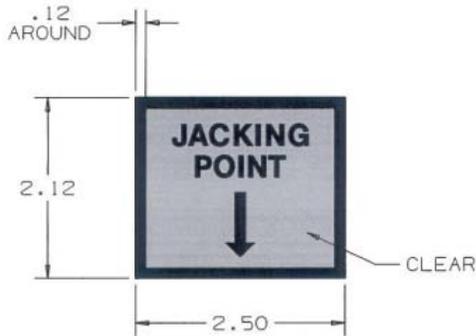
DESCRIPTION - DECAL-POWERED BY CLEAN  
 MATERIAL - 3M 680CR-85 BLACK REFL  
 - COATED WITH 3M 3650-114 CLEAR  
 - ADHESIVE BACKED AND KISS CUT  
 - APPLICATION PREMASK SCPM-44X  
 FONT - AS SHOWN  
 COLOR - BLACK

- o) Two decals, “Maryland – Smart, Green and Growing” to be installed above the drip rails on both sides of the bus.



DESCRIPTION - DECAL MARYLAND GREEN  
 MATERIAL - 3M 180C-10 WHITE W/CLEARCOAT  
 - ADHESIVE BACKED AND KISS CUT  
 - APPLICATION PREMASK SCPM-44X  
 COLORS - WHITE, LIGHT BLUE, DARK BLUE,  
 LIGHT GREEN, DARK GREEN, BLACK

- p) Four decals signifying the jacking points for the bus. The decal is labeled “JACKING POINT” with a downward arrow.



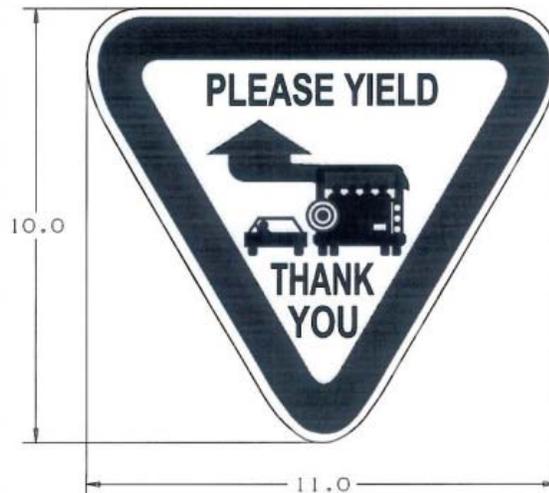
DESCRIPTION - DECAL JACKING POINTS  
 MATERIAL - 3M 3650-114 CLEAR  
 - ADHESIVE BACKED  
 - PREMASKED WITH SCPM 44X  
 - CLEARED WITH 3M 3650-114 CLEAR  
 COLOR - CLEAR WITH BLACK BORDER/ARROW  
 FONT COLOR - BLACK  
 FONT - HELVETICA MEDIUM

- q) Warning decal for hybrid system high voltage areas. Locations to be reviewed and approved by the MTA.



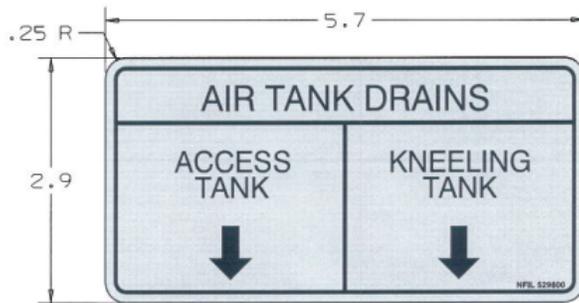
DESCRIPTION - DECAL WARNING HIGH VOLTAGE/DOOR LATCHES  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED  
 - APPLICATION PREMASK SCPM-44X  
 COLOR - RED/YELLOW/BLACK/ORANGE ON WHITE BACKGROUND AS SHOWN  
 - RED PANTONE 485C, YELLOW PANTONE 116C, ORANGE PANTONE 151C  
 FONT - HELVETICA MEDIUM

- r) Please yield triangle decal mounted on rear of bus street side near upper turn signal. Location to be reviewed and approved by the MTA.

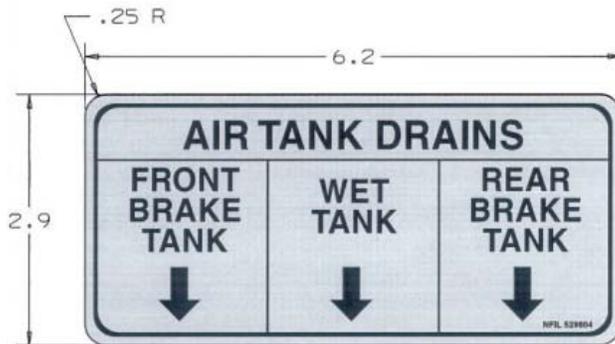


DESCRIPTION - DECAL-PLEASE YIELD, THANK YOU  
 MATERIAL - 3M 680CR-10 WHITE  
 - COATED WITH 3M 3650-114 CLEAR  
 COLOR - BLACK  
 - RED TO MATCH PMS 485  
 FONT - AS SHOWN/AS PER SAMPLE

- s) Decals indentifying air tank system drain locations. Decals will show the number of drains and the location of the quarter turn drain valves.

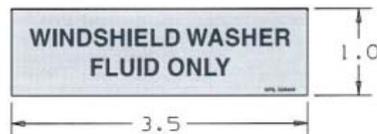


DESCRIPTION - DECAL-AIR TANK DRAIN X2  
 MATERIAL - 3M 3650-114 CLEAR  
 - COATED WITH 3M 3650-114 CLEAR  
 - ADHESIVE BACKED  
 COLOURS - BLACK ON CLEAR



DESCRIPTION - DECAL-AIR TANK DRAINS X3  
 MATERIAL - 3M 3650-114 CLEAR  
 - COATED WITH 3M 3650-114 CLEAR  
 - ADHESIVE BACKED  
 COLOURS - BLACK ON CLEAR

- t) Decal indentifying the windshield washer fill location.



DESCRIPTION - DECAL-WASHER FLUID ONLY (CLEAR)  
 MATERIAL - 3M 3650-114 CLEAR  
 - COATED WITH 3M 3650-114 CLEAR  
 - ADHESIVE BACKED  
 COLOURS - BLACK ON CLEAR

All logo materials, colors and installation locations are subject to MTA approval.

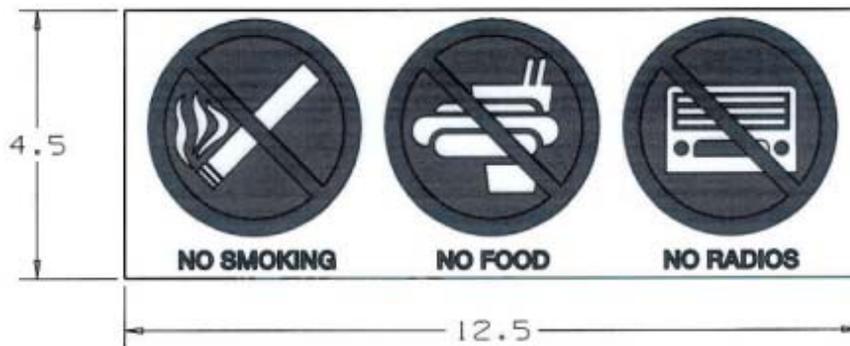
**Bus interior signage shall be as follows:**

- a) At least two signs shall be provided on each side of the bus interior at the forward most center-facing seats (curbside and street side) to indicate that seats at the front are priority seats for elderly and mobility-impaired passengers. The first forward facing seat on the street side of the bus shall also be designated as priority seating.



DESCRIPTION - DECAL-PRIORITY SEATING  
MATERIAL - 3M 180C-10 WHITE  
- COATED WITH NUMBER 1 CLEAR MYLAR  
- ADHESIVE BACKED

- b) An interior bus number shall be displayed at the front of the bus, to the right of the centerline on the face of the access door for the front destination sign. A second bus number shall be installed on the rear bulkhead. The interior bus numbers shall be 3-inches high and of white or black decal material, as appropriate.
- c) Two decals per bus, “No Smoking, Drinking or Radios” with symbols shall be installed in a location approved by the MTA.



DESCRIPTION - DECAL NO SMOKING ETC  
MATERIAL - 3M 180C-10 WHITE  
- COATED WITH 3M 3650-114 CLEAR  
- ADHESIVE BACKED AND KISS CUT  
COLOURS - WHITE  
- RED PANTONE 032C  
- BLUE PANTONE 287C  
FONT - AS SHOWN

- d) Two decals per bus, “Wheelchair Priority” with logo shall be installed in a location approved by the MTA. Decal has blue background with white lettering.



DESCRIPTION - DECAL - WHEELCHAIR SECUREMENT  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED

- e) One sign in Braille, which includes the bus number and other information, shall be installed in a location approved by the MTA.



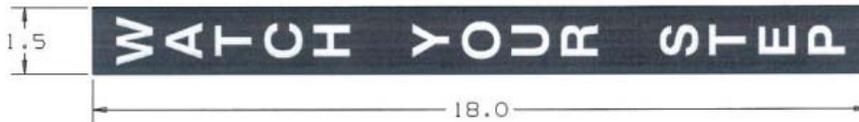
**Specification**

Size:	7.75 x 3.75 inches	
Cutout Area:	3.0 x 2.12 inches	
Material:	10 mil TransGrafix® PVF/PC	
	Sub-surface screen printed, not overlaminated	
Finish:	Velvet/Matte Low Glare	
Colors:	Background	White
	Text	Black
	Logo	MTA Black, Yellow & Red
Raised Letters:	5/8 inch, & 7/8 inch, ADA Compliant	
Braille:	Grade 2, ADA Compliant	
Bonded Adhesive:	3M™ #4920 VHB (Extreme Performance Acrylic Foam)	
Corner Radius:	.25 inches	
Application Tape:	To aid, protect, and identify during installation	
Design:	©2002 Globe Transportation Graphics	

- f) Two “Watch Your Step” (white lettering on red background) to be installed on the face of the step riser in the rear center aisle and on the side of the operator’s riser facing the front door.



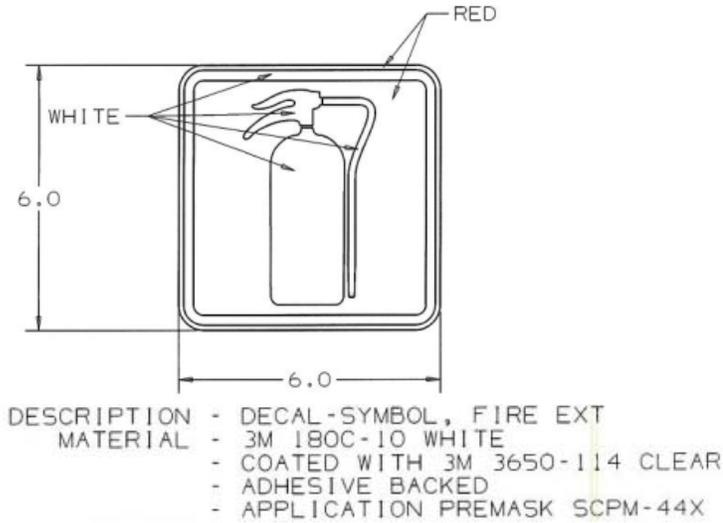
DESCRIPTION - DECAL WATCH YOUR STEP  
 MATERIAL - 3M 680CR-10 WHITE REFLECTIVE  
 - COATED WITH 3M 3650-114 CLEAR  
 - SPLIT BACKING PAPER  
 FONT - HELVETICA MEDIUM 2.75" HIGH  
 - CENTERED ON DECAL AS SHOWN  
 COLOR - WHITE TEXT ON RED BACKGROUND



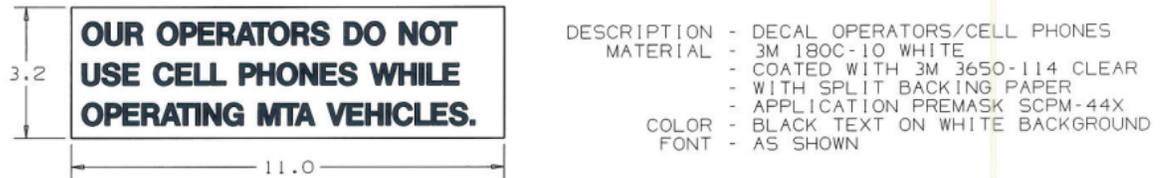
DESCRIPTION - DECAL WATCH YOUR STEP VERTICAL  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH 3M 3650-114 CLEAR  
 - ADHESIVE BACKED WITH SPLIT BACKING PAPER  
 - APPLICATION PREMASK SCPM-44X  
 COLOR - WHITE TEXT ON RED BACKGROUND  
 FONT - HELVETICA MEDIUM 0.85" HIGH

- g) Roof hatches to be labeled in black “Emergency Exit.” Unless provided with clear Plexiglas in which case this lettering shall be Red.

- h) Two decals with Fire Extinguisher Outline to be installed on emergency equipment box on top of lid and side facing the aisle.



- i) One decal located on the destination sign closure door labeled “Thank You For not: Smoking, Drinking, Eating or Playing Radio’s Without Earphones...It’s the Law.” Decal to be black letters on white background.
- j) One decal located on the destination sign closure door labeled: “**OUR OPERATORS DO NOT USE CELL PHONES WHILE OPERATING MTA VEHICLES**”. Decal to be black letters on white background.



- k) Two decals ‘For Your Safety, This Vehicle is Equipped With Video Surveillance’, with a camera logo and the MTA logo shall be installed in locations approved by the MTA.

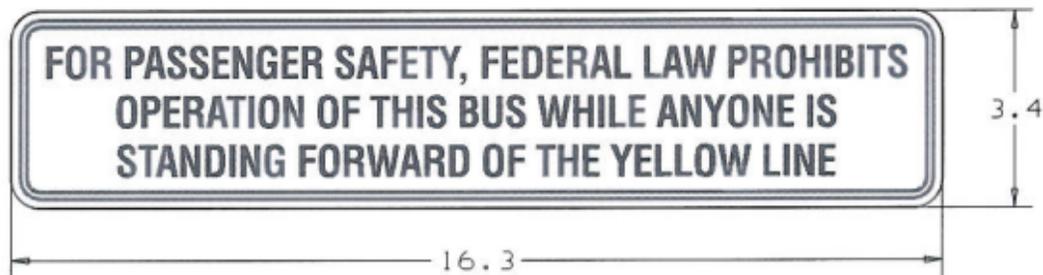


- l) Emergency exit signs and wheelchair securement signs to be provided as required.
- m) One bus height decal located over the front door, easily visible to the operator (in feet and inches, i.e. 10' 8"). Decal to be black letters on white background.



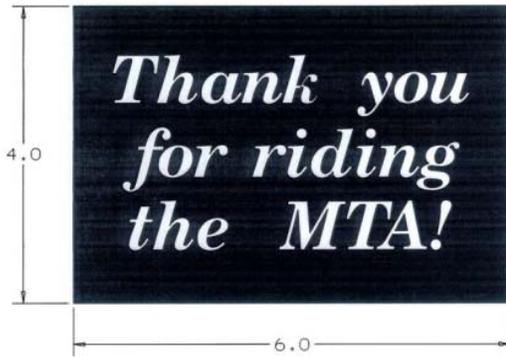
DESCRIPTION - DECAL-CAUTION, BUS HEIGHT  
 MATERIAL - 3M 680CR-10 WHITE REFLECTIVE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED

- n) One decal stating “FOR PASSENGER SAFETY, FEDERAL LAW PROHIBITS OPERATION OF THE BUS WHILE ANYONE IS STANDING FORWARD OF THE YELLOW LINE” applied to the destination sign cover door.



DESCRIPTION - DECAL-BEHIND YELW LINE  
 MATERIAL - 3M 180CR-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED

- o) One decal “*Thank you for riding the MTA!*” applied at the exit door.



DESCRIPTION - DECAL THANK YOU FOR RIDING  
 MATERIAL - 3M 180C-10 WHITE  
 - PREMASK WITH SCPM-44X  
 - WITH SPLIT BACKING PAPER  
 COLOR - BLUE WITH WHITE TEXT  
 AS PER SAMPLE

- p) One decal “WELCOME ABOARD” applied to the panel facing the front entrance door above the operator’s head.



DESCRIPTION - DECAL WELCOME ABOARD  
 MATERIAL - 3M 180C-10 WHITE  
 - PREMASK WITH SCPM-44X  
 - WITH SPLIT BACKING PAPER  
 COLOR - WHITE WITH RED TEXT

- q) One decal “Please Do Not Place Items On Top Of Box” applied to the emergency equipment box on top of lid and side facing the aisle.



DESCRIPTION - DECAL-DO NOT PLACE ITEMS ON BOX  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED

- r) Emergency window release instructions located in close proximity to the window release handle. Material, graphics and location are subject to MTA review and approval.



- DESCRIPTION - DECAL-WINDOW RELEASE  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH 3M 3650-114 CLEAR  
 - ADHESIVE BACKED AND PREMASKED  
 COLOR - WHITE TEXT AND BORDER/RED GRAPHICS ON  
 BLACK BACKGROUND  
 - RED TO MATCH PANTONE 186C  
 FONT - HELVETICA MEDIUM

- s) Caution decal for passengers when bus is in motion in English and Spanish. Decal states “**CAUTION PLEASE HOLD ON WHILE THE BUS IS IN MOTION. ALWAYS BE PREPARED FOR SUDDEN STOPS**”. Location and amount of decals subject to MTA review and approval

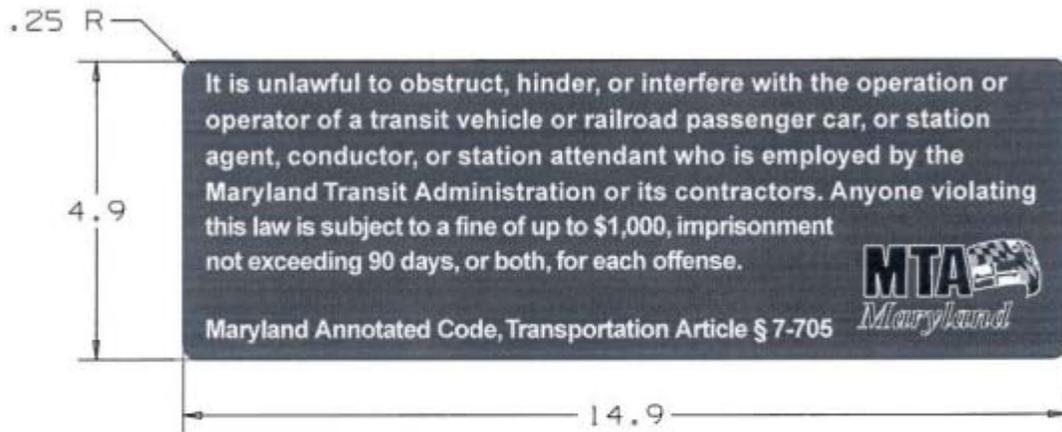


DESCRIPTION - DECAL-CAUTION, HOLD ON  
 MATERIAL - 3M 180C-15 BRIGHT YELLOW  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED  
 COLOURS - BLACK TEXT ON YELLOW

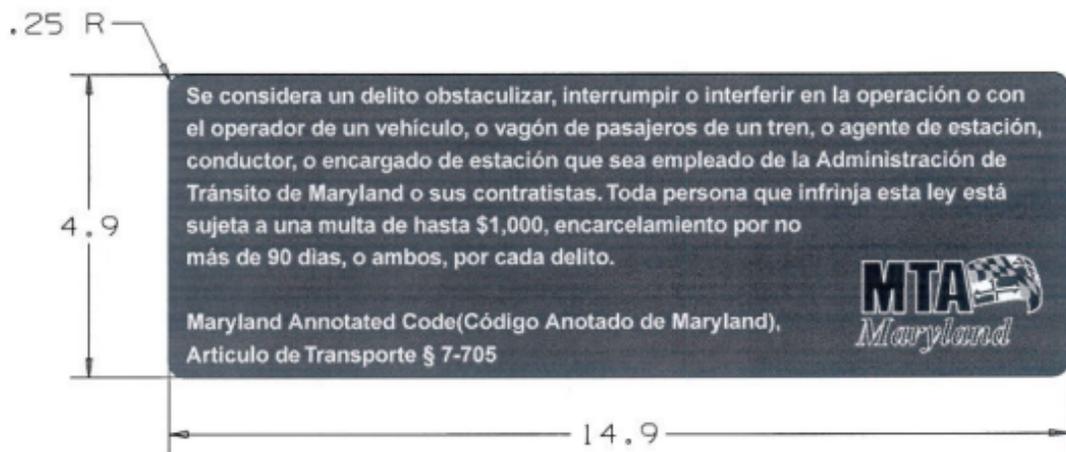


DESCRIPTION - DECAL-CAUTION, HOLD ON (SPN)  
 MATERIAL - 3M 180C-15 BRIGHT YELLOW  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED  
 FONT - AS SHOWN  
 COLOR - BLACK PRINT AND BORDER  
 - YELLOW BACKGROUND

- t) Decal with Maryland Transportation Code 7-705 in English and Spanish regarding obstruction of the operator. Location to be reviewed and approved by the MTA.

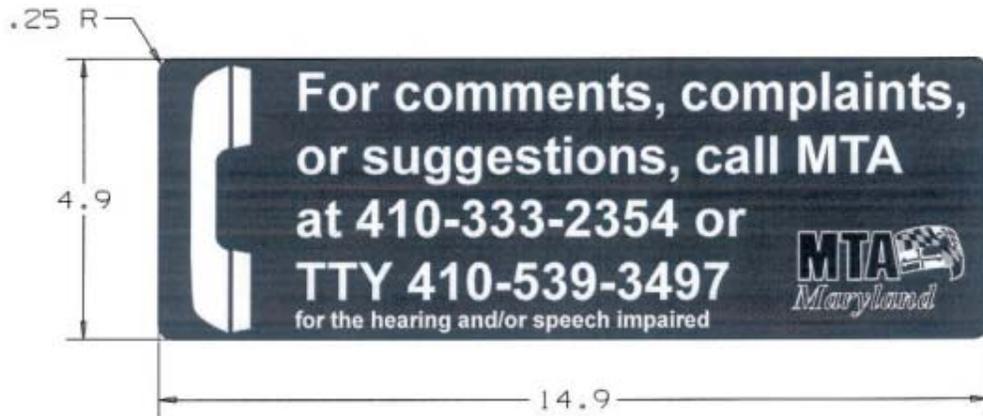


DESCRIPTION - DECAL - IT IS UNLAWFUL  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED

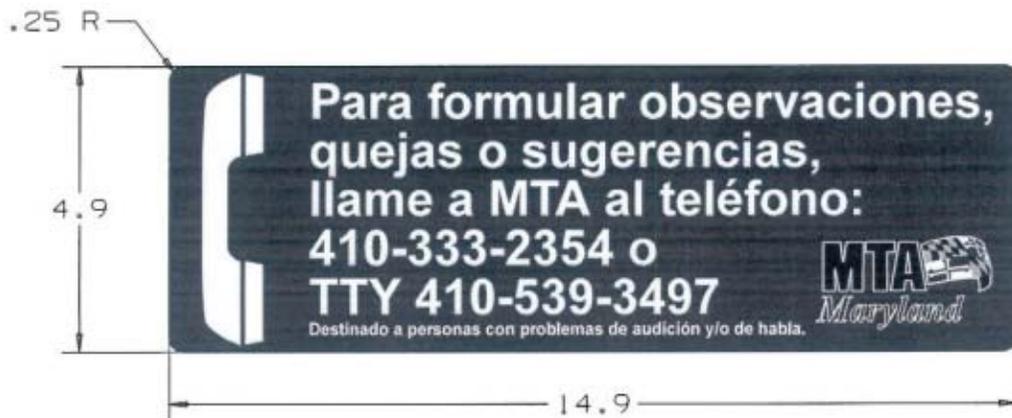


DESCRIPTION - DECAL - IT IS UNLAWFUL (SPN)  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED

- u) Decal for Comments, Complaints and Suggestions in English and Spanish advising where to contact the MTA. Location to be reviewed and approved by the MTA.

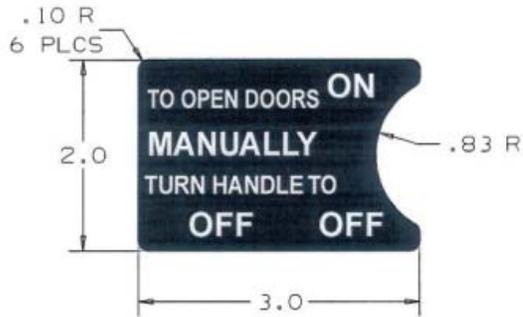


DESCRIPTION - DECAL-FOR COMMENTS  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED



DESCRIPTION - DECAL-FOR COMMENTS (SPN)  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED

- v) Decal providing instructions turn off power to the door valves to allow for manual open/close of the doors. Location to be reviewed and approved by the MTA. Example provided.



DESCRIPTION - DECAL - TO OPEN DOORS MANUALLY  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED  
 COLOURS - WHITE ON BLACK BACKGROUND

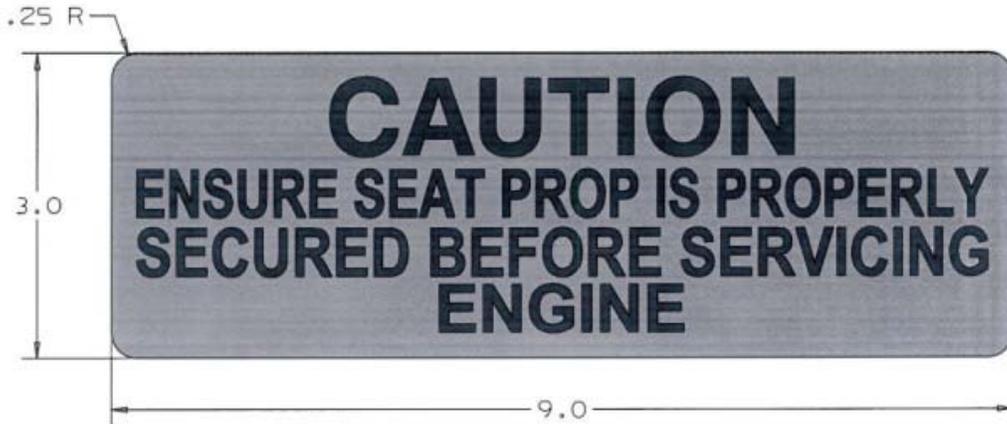
- w) Decal providing fare information applied to the exterior curbside of the bus adjacent to the front entrance door. Fares and phone numbers to be supplied by the MTA prior to bus production. Location to be reviewed by the MTA. Example provided.



All logo materials, colors and installation locations are subject to MTA approval.

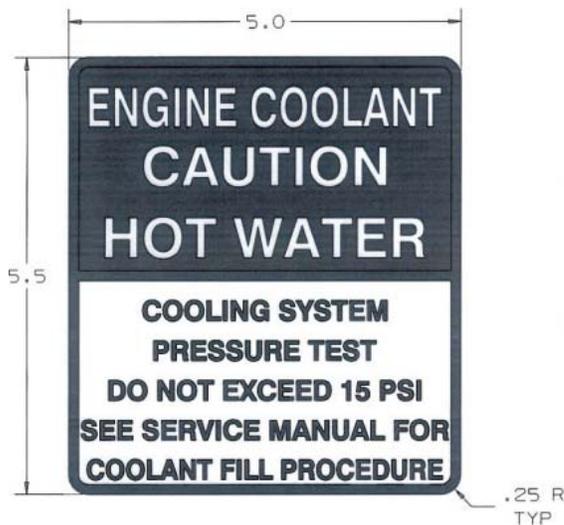
**Bus service and maintenance area signage shall be as follows:**

- a) Decal on underside of rear center seat stating **CAUTION ENSURE SEAT PROP IS PROPERLY SECURED BEFORE SERVICING ENGINE.**



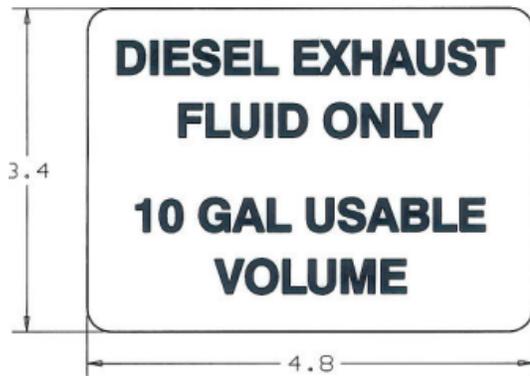
DESCRIPTION - DECAL-SEAT PROP  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED  
 COLOURS - RED (PMS 485) TEXT ON WHITE

- b) Decal on the inside of the door for the coolant fill that warns of coolant temperature and pressures testing system. Decal shall state: **ENGINE COOLANT CAUTION HOT WATER / COOLING Ssystem PRESSURE TEST DO NOT EXCEED 15 PSI SEE SERVICE MANUAL FOR COOLANT FILL PROCEDURE.**



DESCRIPTION - DECAL-COOLING SYS TEST  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED  
 COLOURS - RED (PMS 485) TEXT ON WHITE  
 - WHITE TEXT ON RED (PMS 485)

- c) Decal on inside door for the Diesel Exhaust Fill port. The decal shall state: DIESEL EXHAUST FLUID ONLY / XX GAL USABLE VOLUME.



DESCRIPTION - DECAL-DIESEL EXHAUST FLUID  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED  
 COLOURS - BLACK TEXT ON WHITE

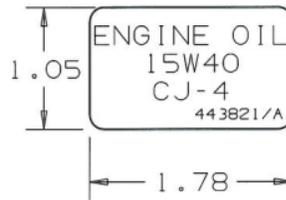
- d) Decals in critical locations throughout the bus to warn of where service personnel should not drill because of hidden electrical cables. Example decal provided.



DESCRIPTION - DECAL-DO NOT DRILL  
 MATERIAL - 3M 180C-10 WHITE  
 - COATED WITH NUMBER 1 CLEAR MYLAR  
 - ADHESIVE BACKED  
 COLOURS - WHITE ON BLACK BACKGROUND

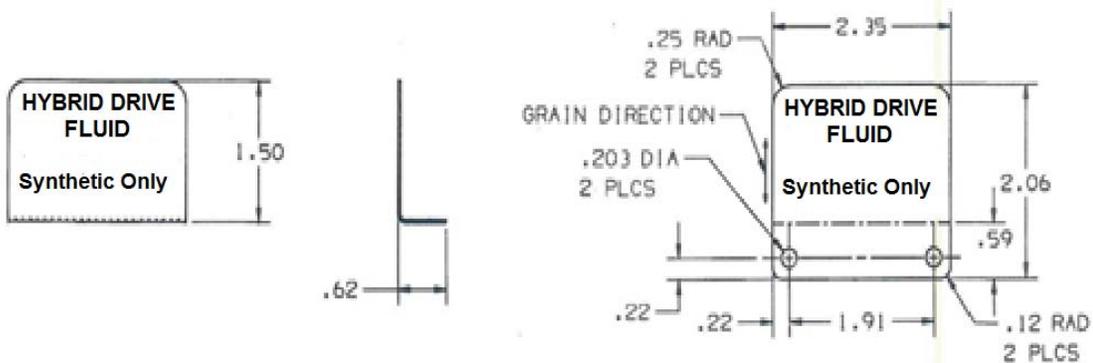
- e) Metallic instruction plate mounted near the engine coolant fill location providing instructions on the procedure for filling the coolant system.

- f) Metallic plate mounted to the engine oil fill location with decal identifying that the fill port is for engine oil and specifying the API category and weight required.



DESCRIPTION: DECAL-ENGINE OIL  
 MATERIAL: 3M 180-10 WHITE  
 COLOUR: BLACK LETTERS ON WHITE BACKGROUND  
 FONT: HELVETICA MEDIUM  
 ADHESIVE BACKING  
 COATED WITH 3M 3650-114 CLEAR

- g) Metallic plate mounted to the hybrid drive fluid fill location with decal identifying that the fill port is for hybrid drive fluid and specifying that synthetic fluid is required.



MATERIAL - ANODIZED ALUMINUM 14GA. 10641  
 LETTERING- RED ON METALLIC BACKGROUND

- h) Decal identifying the engine oil cleaning centrifuge at its location in the engine compartment is required.



### TS 70.1 Passenger Information

ADA priority seating signs as required and defined by 49 CFR, Part 38.27 shall be provided to identify the seats designated for passengers with disabilities.

Equipment for public announcements in compliance with 49 CFR, Part 38.35 shall be provided.

### TS 71. Exterior Lighting

**The MTA currently uses Dialight LED lamps for all exterior lighting and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Exterior LED lighting shall conform to all FMVSS requirements. The lamps shall have a lifetime warranty with a minimum 100,000 life. Lamps shall have potted construction and integral wiring. The lens shall be hard coated polycarbonate and the light assembly shall be mounted and sealed to the bus exterior using a foam gasket and the correct fasteners.

Exterior lighting and reflectors shall comply, as applicable, with Part 393, Subpart B of the FMCSA and FMVSS 108. All exterior lighting including headlamps shall be LED-type meeting the above requirements. All LED lamps shall be standard installation of the manufacturer. The entire assembly shall be specifically coated to protect the light from chemical and abrasion degradation.

All exterior lights shall be designed to prevent entry and accumulation of moisture or dust. Commercially available LED-type lamps shall be utilized at all exterior lamp locations except headlights. Lamps, lenses and fixtures shall be interchangeable to the extent practicable. Two hazard lamps at the rear of the bus shall be visible from behind when the engine service doors are opened. Light lenses shall be designed and located to prevent damage when running the vehicle through an automatic bus washer. Front marker (clearance) lights along with lights located on the roof and sides of the bus shall have protective shields or be of the flush mount type to protect the lens against minor impacts.

The bus shall be equipped with an exterior lamp test feature. Simultaneously depressing both floor mounted turn signal switches will enable this test feature. The exterior lamp test feature shall be active for five (5) minutes or until the parking brakes are released or the hybrid drive is taken out of the neutral position.

The front three center marker (clearance) lights shall be designed and configured to be used as strobe lights providing timed intermittent illumination. A two position toggle control switch shall be mounted in the front destination sign cavity to turn the lights from normal operation to the strobe feature.

### **TS 71.1 Backup Light/Alarm**

Visible and audible warnings shall inform following buses or pedestrians of reverse operation. Visible reverse operation warning shall conform to SAE Standard J593. Audible reverse operation warning shall conform to SAE Recommended Practice J994 Type C or D.

### **TS 71.2 Doorway Lighting**

LED strip lamps at the front and rear passenger doorways shall comply with ADA requirements and shall activate only when the doors open. These strip lamps shall illuminate the street surface to a level of no less than 1 foot-candle for a distance of 3 ft outward from the outboard edge of the door threshold. The lights may be positioned above or below the lower daylight opening of the windows and shall be shielded to protect passenger's and operator's eyes from glare.

### **TS 71.3 Turn Signals**

Turn-signal lights shall be provided on the front, rear, curb and street sides (2 per side, amber with guards) of the bus in accordance with FMVSS 108 and Part 393, Subpart B of the FMCSA as applicable. The front turn signals may be integrated with the buses headlamp assemblies. The rear lower amber LED turn signal lamps shall be 7-inch diameter. Two upper amber LED turn signal lamps shall be oval shaped and located on each rear corner of the bus approximately 12-18 inches below the roof line.

Two white curbside cornering lamps shall be provided that illuminate when the master switch is in night run and the right turn signal switch is activated and go out when the turn signal switch is released. One forward facing lamp shall be located on the lower side panel rearward of the front axle with the second forward facing lamp located on the lower side panel rearward of the rear drive axle providing a lighted area for the operator to view any obstructions through the mirror.

One white street side cornering lamp shall be provided that illuminates when the master switch is in night run and the left turn signal switch is activated and goes out when the turn signal switch is released. The forward facing lamp shall be located on the lower side panel rearward of the front axle providing a lighted area for the operator to view any obstructions through the mirror.

### **TS 71.4 Headlights**

The manufacturer's standard headlight installation using LED lamps for low and high beams shall be provided in accordance with FMVSS 108 and Part 393, Subpart B of the FMCSA as applicable. Headlamps shall incorporate a daytime running light feature.

### **TS 71.5 Tail / Brake Lights**

Tail and brake lights shall be provided in accordance with FMVSS 108 and Part 393, Subpart B of the FMCSA as applicable. The tail and brake lights shall be red and 7 inches in diameter.

The bus shall include red center mount brake lamp(s) along the rear of the bus above the engine door in addition to the 7 inch lower brake lamps required under FMVSS 108. The center mount brake lamps shall illuminate steady with brake application as well as when the regenerative braking is in effect. The center mount brake lamps shall be two 18-inch x1-inch LED strip lamps.

The rear red tail, brake and amber turn signal lights shall be 7-inches diameter, the white back-up light shall 4-inch diameter and be arranged in a vertical configuration from the top down (amber, red, white), located on the rear corner panel and not on the engine door. All exterior lights except the center mounted stop lights shall remain visible from the rear of the bus with the engine doors open.

### TS 71.6 Service Area Lighting (Interior and Exterior)

LED strip lamps shall be provided in the engine and all other compartments where service may be required to generally illuminate the area for night emergency repairs or adjustments. These service areas shall include, but not be limited to, the engine compartment, the communication box, junction/apparatus panels and passenger door operator compartments. Lighting shall be adequate to light the space of the service areas to levels needed to complete typical emergency repairs and adjustments. The service area lamps shall be suitable for the environment in which they are mounted.

There shall be a minimum of 4 strip lamps in the engine compartment controlled by a switch mounted near the rear start controls. All other service area lamps shall be controlled by switches mounted on or convenient to the lamp assemblies. Power to the service area lighting shall be programmable. Power shall latch on with activation of the switch and shall be automatically discontinued (timed out) when the bus multiplex system goes to sleep preventing damage caused by inadvertently leaving the service area lighting switch in the on position after repairs are made.

## INTERIOR PANELS AND FINISHES

### TS 72. General Requirements

Materials shall be selected on the basis of maintenance, durability, appearance, safety, and tactile qualities. Materials shall be strong enough to resist everyday abuse and be vandalism and corrosion resistant. Trim and attachment details shall be kept simple and unobtrusive. Interior trim shall be secured to avoid resonant vibrations under normal operational conditions.

Interior surfaces more than 10 in. below the lower edge of the side windows or windshield shall be shaped so that objects placed on them fall to the floor when the bus is parked on a level surface. Any components and other electrical components within close proximity to these surfaces shall also be resistant to this cleaning method.

### TS 73. Interior Panels

Panels shall be easily replaceable and tamper-resistant. They shall be reinforced, as necessary, to resist vandalism and other rigors of transit bus service. Individual trim panels and parts shall be interchangeable to the extent practicable.

Materials shall comply with the Recommended Fire Safety Practices defined in FTA Docket 90-A, dated October 20, 1993 and **FMVSS Standard No. 302** - Flammability of Interior Materials - Passenger Cars, Multipurpose Passenger Vehicles, Trucks, and Buses.

#### TS 73.1 Operator Area Barrier

A barrier or bulkhead between the operator's seat and the street-side front wheelhouse shall be provided. The barrier shall minimize glare and reflections in the windshield directly in front of the barrier from interior lighting during night operation. The barrier may be a part of the communications cabinet. Location and shape shall permit full seat travel and reclining possibilities that can accommodate the shoulders of a 5<sup>th</sup> percentile female and 95<sup>th</sup>-percentile male. The partition shall have a side return and stanchion to prevent passenger from reaching the operator by standing behind the operator's seat. The lower area between the seat and panel shall be accessible to the operator. The

partition must be strong enough in conjunction with entire partition assembly for mounting of such equipment as flare kits, 10 pound fire extinguishers, microcomputer, public address amplifier, etc. Dark or black panels are preferred behind the operator's head. The panel should be isolated for noise control and attached with rubber grommets. Provisions for the two piece operator's security barrier shall be integrated with this barrier.

The operator's barrier shall extend from the top of the wheel well to the ceiling the level of the seated operator and shall fit close to the bus side windows and wall to prevent passengers from reaching the operator or the operator's personal effects.

A chrome plated grab handle providing a handhold assist so the operator can pull themselves up and into the operator's seat shall be mounted to the ceiling above the operator's head.

### **TS 73.2 Safety Locker**

A sturdy locker located on top of the curbside front wheelhouse shall store the portable fire extinguisher, the safety triangles and unused wheelchair restraint belts. The locker shall have a top cover, hinged on the curbside, with a latch that secures the cover in the closed position. The top of the locker shall be designed to prevent items to be stored on the cover. The locker shall be splash proof when the cover is closed and made of a minimum of 14 gauge stainless steel or 12-gauge aluminum suitably reinforced to sustain a passenger sitting on the locker. The locker shall be painted with black polyurethane enamel.

A 10-pound dry chemical fire extinguisher shall be mounted inside the locker, with appropriate clamps to preclude rattles and the fill gauge visible when the cover is open. The fire extinguisher shall be engraved with MTA in letters not less than 1-inch high and shall include an inspection expiration date.

A safety kit containing three triangles shall be secured with Velcro straps inside the locker to preclude rattles.

Sufficient space shall be available inside the locker for storage of MTA safety equipment.

A square key for all interior and exterior access doors along with provisions for a retainer shall be included inside the safety locker.

### **TS 73.3 Modesty Panels**

Sturdy medium grey modesty panels constructed of durable, unpainted, corrosion-resistant material complementing the interior shall be provided to act as both a physical and visual barrier for seated passengers.

Design and installation of modesty panels located in front of forward-facing seats shall include a handhold or grab handle along its top edge. These panels shall be mounted on the sidewall and shall project toward the aisle no farther than passenger knee projection in longitudinal seats or the aisle side of the transverse seats. Modesty panels shall extend from at least the window opening of the side windows, and those forward of transverse seats shall extend downward to 1½ in. above the floor. Panels forward of longitudinal seats shall extend to below the level of the seat cushion. Dividers positioned at the doorways shall provide no less than a 2½ in. clearance between the modesty panel and a fully open, inward opening door, or the path of a deploying flip-out ramp to protect passengers from being pinched. Modesty panels installed at doorways shall be equipped with grab rails if passenger assists are not provided by other means.

The modesty panel and its mounting shall withstand a static force of 250 lbs applied to a 4 × 4 in. area in the center of the panel without permanent visible deformation.

A clear non-glass panel shall be provided from above the modesty panel to the top of the daylight opening of the passenger windows and attached to the stanchion.

#### **TS 73.4 Front End**

The entire front end of the bus shall be sealed to prevent debris accumulation behind the dash and to prevent the operator's feet from kicking or fouling wiring and other equipment. The front end shall be free of protrusions that are hazardous to passengers standing at the front of the standee line area of the bus during rapid decelerations. Paneling across the front of the bus and any trim around the operator's compartment shall be formed metal or composite material. Composite dash panels shall be reinforced as necessary, vandal-resistant and replaceable. All colored, painted and plated parts forward of the operator's barrier shall be finished with a black matte surface that reduces glare. Surfaces designated for mounted equipment shall have provisions to securely fasten and support the weight of equipment.

#### **TS 73.5 Rear Bulkhead**

The rear bulkhead and rear interior surfaces shall be covered with fabric to match the seats and trimmed with stainless steel, aluminum or composite.

The rear bulkhead shall be contoured to fit the ceiling, side walls and seat backs so that any litter or trash will tend to fall to the floor or seating surface when the bus is on a level surface. Any air vents in this area shall be louvered to reduce airflow noise and to eliminate the possibility of trash or litter being thrown or drawn through the grille. If it is necessary to remove the panel to service components located on the rear bulkhead, the panel shall be hinged or shall be able to be easily removed and replaced. Grilles where access to or adjustment of equipment is required shall be heavy-duty and designed to minimize damage and limit unauthorized access.

Tamper proof fasteners are to be used in retaining any service panels attached to the rear interior bulkhead. The rear settee is to be sealed to the rear bulkhead and if required a trash guard installed that insures no debris is able to get behind the settee.

#### **TS 73.6 Headlining**

Ceiling panels shall be made of durable, corrosion resistant, easily cleanable material. Headlining shall be supported to prevent buckling, drumming or flexing and shall be secured without loose edges. Headlining materials shall be treated or insulated to prevent marks due to condensation where panels are in contact with metal members. Moldings and trim strips, as required to make the edges tamperproof, shall be stainless steel, aluminum or plastic, colored to complement the ceiling material. Sealant or caulking used around moldings and trim strips shall be the same color as the molding or strip and applied evenly and professionally. Headlining panels covering operational equipment that is mounted above the ceiling shall be on hinges for ease of service but retained to prevent inadvertent opening.

#### **TS 73.7 Fastening**

Interior panels shall be attached so that there are no exposed unfinished or rough edges or rough surfaces. Fasteners shall be corrosion resistant. Panels and fasteners shall not be easily removable by passengers. Exposed interior fasteners should be minimized, and shall be tamper-proof.

## TS 73.8 Insulation

Any insulation material used between the inner and outer panels shall minimize the entry and/or retention of moisture. Insulation properties shall be unimpaired during the service life of the bus. Any insulation material used inside the engine compartment shall not absorb or retain oils or water and shall be designed to prevent casual damage that may occur during maintenance operations.

The combination of inner and outer panels on the sides, roof, wheel wells and ends of the bus, and any material used between these panels, shall provide a thermal insulation sufficient to meet the interior temperature requirements. The bus body shall be thoroughly sealed so that the operator or passengers cannot feel drafts during normal operations with the passenger doors closed.

All insulation materials shall comply with the Recommended Fire Safety Practices defined in FTA Docket 90-A, dated October 20, 1993. **FMVSS Standard No. 302** - Flammability of Interior Materials - Passenger Cars, Multipurpose Passenger Vehicles, Trucks, and Buses.

## TS 73.9 Floor Covering

**The MTA currently uses Altro Transflor Chroma 2.7 TFCR 2772 Phantom color and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The floor covering shall be slip resistant, durable and easy to clean. The floor cover shall be a minimum of 2.7 mm in thickness. and shall have an integrated bacteriostat to prevent the growth of bacteria. The flooring shall be resistant to impact indentation and have heat welded seams. The flooring shall be impervious to water and spillages and have a 15 year warranty.

The floor covering shall have a non-skid walking surface that remains effective in all weather conditions. The floor covering, as well as transitions of flooring material to the main floor and to the entrance and exit area, shall be smooth and present no tripping hazards. Seams shall be sealed/welded per manufacturer's specifications. The standee line shall be yellow and approximately 2 in. wide and shall extend across the bus aisle. The color and pattern shall be consistent throughout the floor covering. The floor shall be easily cleaned and shall be arranged to minimize debris accumulation.

Any areas on the floor that are not intended for standees, such as areas "swept" during passenger door operation, shall be clearly and permanently marked. The entire area by the rear door, back to the inboard edge of the modesty panel, shall be yellow with the words 'PLEASE NO STANDEES IN THIS AREA' inlaid in black lettering. Shown below is an example of the passenger message described previously.



A one-piece center strip shall extend from the vertical wall of the rear settee between the aisle sides of transverse seats to the standee line. The floor covering center strip shall be one piece at each level. The covering between the center strip and the wheel housings may be separate pieces. At the rear door, however, a separate strip as wide as the door shall extend from the center strip to the outboard edge of the rear/exit area.

Any area of the aisle with an elevation change, such as over the front axle, shall have diagonal yellow stripes in the floor covering in that area as shown below.



The floor under the seats shall be covered with smooth surface flooring material. The floor covering shall closely fit the sidewall in a fully sealed butt joint or extend to the top of the cove.

### TS 73.10 Interior Lighting

**The MTA currently uses Pretoria LED 24 volt lighting with concave profile and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The interior LED lighting system shall be cool white with the exception of the number 2 position as described below. The lighting fixture can be adjusted to extinguish or dim at 10%, 20%, 40%, 60% or 80% light output. The light output shall be equivalent to 400 lumens per foot. The system shall have individual power supplies per fixture, under/over voltage protection, have resettable circuit breakers

and be SAE J1455 compliant. The lenses, ductwork and peripherals shall meet FMVSS 302 flammability requirements. The system shall have a 12 year warranty on materials and workmanship.

The light source shall be located to minimize windshield glare, with distribution of the light focused primarily on the passengers' reading plane while casting sufficient light onto the advertising display. The lighting system may be designed to form part of or the entire air distribution duct. All interior passenger lighting shall be comprised of LED lights. All components mounted in the air distribution ducts shall be segregated from the main air flow by velcro sealed blankets to insure the air flow is not impeded by the components while protecting the components from air borne particles.

The lens material shall be translucent polycarbonate. Lenses shall be designed to effectively "mask" the light source. Street and curbside lenses in the number 2 position from the front of the bus shall be colored light blue. Lenses shall be sealed to inhibit incursion of dust and insects yet be easily removable for service. Access panels shall be provided to allow servicing of components located behind light panels. If necessary, the entire light fixture shall be hinged. Tamper proof screws shall be used for any passenger lighting joiner strips. Lenses shall be retained by retention brackets a maximum of every 4 feet to insure the lens cannot be pried away from its mounting base and fall on passengers.

### **TS 73.11 Passenger Area Lighting**

The first two banks of lights on the curbside and the first bank of lights on the streetside (behind the operator and the front door) are normally turned on only when the front door is opened, in "night run" and "night park." As soon as the door closes, these lights shall extinguish. These lights shall be turned on at any time if the toggle switch is in the "on" position.

All interior lighting shall be extinguished whenever the hybrid drive selector is in reverse and the engine run switch is in the "on" position.

All interior LED lights and included components (power supplies, controllers, etc.) shall have a 12-year warranty. The interior lighting shall have a concave profile and the design shall require the review of the MTA.

### **TS 73.12 Operator Area Lighting**

The operator area shall have an LED overhead light to provide general illumination, and shall illuminate the half of the steering wheel nearest the operator to a level of 5 to 10 foot-candles.

### **TS 73.13 Passenger Seating Area Lighting**

The interior lighting system shall provide a minimum 15 foot-candle illumination on a 1 sq ft plane at an angle of 45 degrees from horizontal, centered 33 in. above the floor and 24 in. in front of the seat back at each seat position. Allowable average light level for the rear bench seats shall be 7 foot-candles.

### **TS 73.14 Vestibules/Doors Lighting**

Floor surface in the aisles shall be a minimum of 10 foot-candles, and the vestibule area a minimum of 4 foot-candles with the front doors open and a minimum of 2 foot-candles with the front doors closed. The front entrance area and curb lights shall illuminate when the front door is open and master run switch is in the "Lights" positions. Rear exit area and curb lights shall illuminate when the rear door is unlocked.

### **TS 73.15 Step Lighting**

Step lighting for the intermediate steps between lower and upper floor levels shall be a minimum of 4 foot-candles and shall illuminate in all engine run positions. The step lighting shall be low-profile to minimize tripping and snagging hazards for passengers and shall be shielded as necessary to protect passengers' eyes from glare.

### **TS 73.16 Ramp Lighting**

Exterior and interior ramp lighting shall comply with CFR Part 49, Sections 19.29 and 19.31.

### **TS 73.17 INTENTIONALLY BLANK**

### **TS 73.18 Farebox Lighting**

An LED light fixture shall be mounted in the ceiling above the farebox location. The fixture shall be capable of projecting a concentrated beam of light on the farebox. This light will automatically come on whenever the front doors are opened and the run switch is in the "night run" or "night park" position.

## **TS 74. Fare Collection**

Provisions for MTA to install a GFI-Cubic Odyssey electronic farebox and OCU shall be provided in an area immediately adjacent to the operator as approved by MTA. Final location of the OCU shall insure a minimum of 3 inches of knuckle clearance from the steering wheel. Location of the fare collection device shall not restrict traffic in the vestibule, including mobility aid devices and shall allow the operator to reach the OCU and view the coin escrow. The farebox shall not restrict access to the operator's area and shall not restrict operation of operator controls. Farebox location shall permit accessibility to the cashbox door for easy manual removal of cashbox for extraction of revenue. Farebox communication requirements shall be included as part of the Bus –USA program.

No passenger stanchions or bus structure shall inhibit the opening of the farebox maintenance doors. The top of the farebox shall be illuminated from overhead with an LED light when the front doors are open and the master switch is in the NIGHT RUN or NIGHT PARK positions. A 10-amp, 24-VDC breaker, protected exclusive circuit shall power the farebox along with a wire grounded to the bus framing. This power service shall include the pair of wires enclosed in a flexible conduit with connections compatible to the farebox and control keypad and shall be wired independently of the master battery switch. A J-1708 and Ethernet cable shall be provided between the farebox and the EC.

The floor under the farebox shall be 1/4-inch stainless steel and shall be reinforced, as necessary, to provide a sturdy mounting platform and to prevent shaking of the farebox. The mounting provisions for the OCU to the farebox shall ensure a built-in appearance and shall not restrict the operator's visibility. Provisions shall be made to ensure that an MTA-installed wiring harness connecting the OCU to the farebox shall be concealed behind the dash and grommeted at the exit to the farebox.

The Contractor shall be responsible for installation of the following components associated with the fare collection system. With the exception of the farebox pedestal, all components are to be supplied by the Contractor.

- a) Farebox pedestal: GFI #D22581-0001. MTA will supply the farebox pedestals (only) to the Contractor for installation.

- b) Ground Strap Mounting Kit: CTS/GFI #B00756-002.
- c) Ground Strap: CTS/GFI #B22274-0001.
- d) External Power Cable: CTS/GFI #B22749-0001.
- e) All required miscellaneous hardware and fasteners.

The Contractor shall present farebox installation drawings, including space and mounting provisions for mounting of the OCU, for MTA review at the PPM to ensure an acceptable configuration and ADA compliance.

Upon request from the Contractor, the MTA may make a sample farebox and OCH available to the Contractor.

Fareboxes will be installed by MTA after delivery of the completed bus by the Contractor to MTA.

### TS 74.1 Farebox Communications

- a) The VCPU shall interface to the fare box and support common log-on hardware and software utilizing SAE J1708 or other available standard data interface.
- b) Upon normal bus start up, all on-board systems and components shall be initialized by turning the master run switch to one of the non-off positions and logging in. One and only one login shall be required to the GFI Fare box. Fare box logon information shall be transmitted from the VCPU after operator logon at the primary AVL interface unit (OIT). Logon information shall be transmitted to the fare box whether the operator logs on from the OIT or is remotely logged on from dispatch. The fare box control head unit shall be the backup logon location, should the OIT be unavailable.
- c) The common Farebox log-in shall allow the on-board systems to perform their respective functions for the duration of the assigned work without further operator intervention until the operator or work assignment changes.
- d) Upon receipt of fare box alarms during normal bus operation, the VCPU shall forward the Farebox alarm to the control center via the cellular data path or log the data for subsequent upload via the Wireless LAN networks located at the divisions. Critical alarms shall be immediately forwarded via the cellular data path for display and annunciation in the bus control center. Critical alarms are listed below. The numbers are PID number of the J1708 protocol for Fare Collection Unit alarms. When critical alarm information is forwarded, the message shall also include probe id, probe type and cashbox id, parameters that shall be gathered from the developed interface.
  - 1. Ticket Transport Jam (305)
  - 2. Trim Bypass (322)
  - 3. Bill Unit Jam (401)
  - 4. General Fault
  - 5. Cashbox Removed (378)
  - 6. Cashbox opened in service (378)

7. Fare box set in manual bypass (378)
  8. Maintenance Access in service (378)
- e) The fare box interface shall also be used to pass GPS time from the VCPU unit to the Cubic fare box at least one time per day and during system startup. A single GPS time source shall be utilized to synchronize all on-board equipment to one common time point. The VCPU unit shall pass longitude and latitude information to the fare box at every stop during the work period. It shall also pass Bus Stop ID or similar unique ID at each stop so that passenger count information can be correlated with stop information.
  - f) The Operator ID, Route, Trip, Run, Block and Fare Set information shall be transmitted to the fare box as part of the normal transfer of single-point logon information.
  - g) The fareboxes will continue to utilize a separate WAN for offloading fare collection data independent of data collected and stored by the on-board VCPU.

## TS 75. Interior Access Panels and Doors

Access for maintenance and replacement of equipment shall be provided by panels and doors that appear to be an integral part of the interior. Access doors shall be hinged with gas props or over-center springs, where practical, to hold the doors out of the mechanic's way. Panels shall prevent entry of mechanism lubricant into the bus interior. All fasteners that retain access panels shall be captive in the cover.

Access doors shall be secured with locks that shall be standardized so that only one tool is required to open access doors in the bus.

### TS 75.1 Floor Hatches

Access openings in the floor shall be sealed to prevent entry of fumes and water into the bus interior. Flooring material at or around access hatches shall be flush with the floor and shall be edge-bound with stainless steel to prevent the edges from coming loose. Access openings shall be asymmetrical so that when the floor access hatches are reinstalled the hatch and flooring shall be properly aligned. Fasteners shall tighten flush with the floor.

One type of fastener shall be used for attachment of the floor panel and interior fasteners that require removal for routine maintenance and repair (i.e. Torx) so one tool may be used for all.

## PASSENGER ACCOMMODATIONS

### TS 76. Passenger Seating

**The MTA currently uses American Seating Insight passenger seating and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

#### TS 76.1 Arrangements and Seat Style

The passenger seating arrangement in the bus shall be such that seating capacity is maximized and in compliance to the following requirements. The seating layout shall be presented to the MTA in the proposal for consideration.

Passenger seats shall be arranged in a transverse, forward-facing configuration with due regard for passenger access and comfort. Other areas where aisle-facing seats may be provided are at wheelchair securement areas and platforms (such as for fuel tank storage space). All forward facing passenger

seats excepting any center rear seats above the engine access shall have either another set of seats in front of it or a securely mounted panel.

Seating materials shall meet Docket 90 requirements and **FMVSS Standard No. 302** - Flammability of Interior Materials - Passenger Cars, Multipurpose Passenger Vehicles, Trucks, and Buses.

### **TS 76.2 Rearward Facing Seats**

Rearward facing seats are not allowed.

### **TS 76.3 INTENTIONALLY BLANK**

### **TS 76.4 Padded Inserts/Cushioned Seats**

The passenger seats shall be equipped with vandal-resistant inserts throughout the bus. The seating shall have features to improve passenger comfort while being protected for service in an urban environment. The insert seat material shall be waterproof, stain resistant including anti bacterial and fungal protection while not supporting microbial growth. Materials shall have high resistance to tearing, flexing and wetting.

Seats, back cushions and other pads shall be securely attached and shall be detachable by means of a simple release mechanism so that they are easily removable by the maintenance staff but not by passengers. To the extent practicable, seat cushions and pads shall be interchangeable throughout the bus.

### **TS 76.5 Drain Hole in Seats**

There are no requirements for drain hole provision in seat inserts.

### **TS 76.6 Hip-to-Knee Room**

Hip-to-knee room measured from the center of the seating position, from the front of one seat back horizontally across the highest part of the seat to vertical surface immediately in front, shall be a minimum of 29 in.

### **TS 76.7 Foot Room**

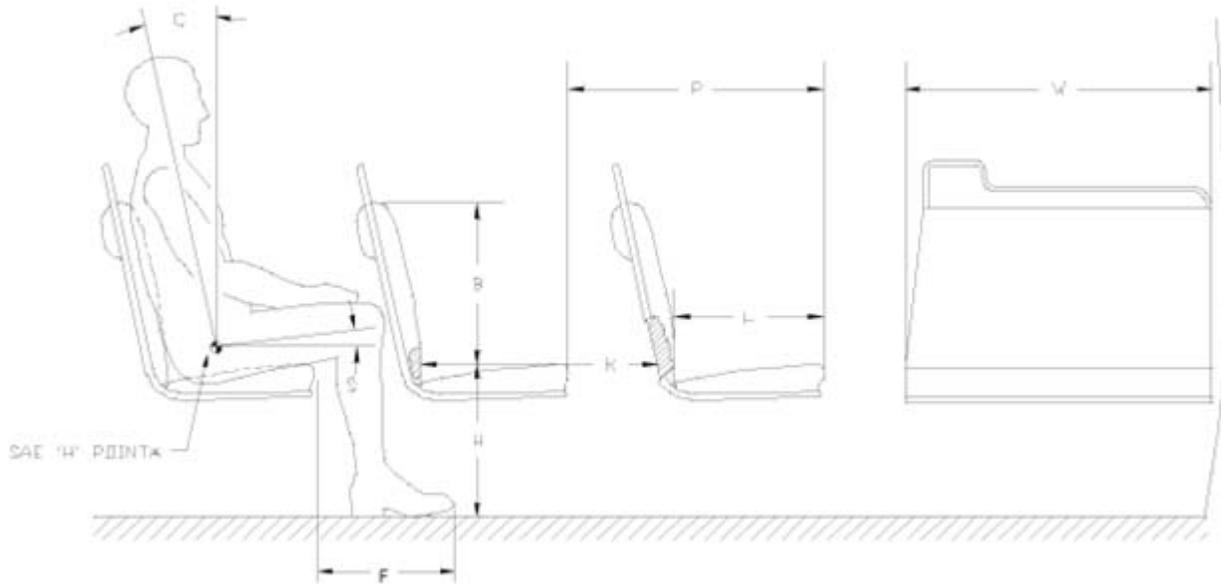
Foot room, measured at the floor forward from a point vertically below the front of the seat cushion, shall be no less than 14 in.

### **TS 76.8 Aisles**

The aisle between the seats shall be no less than 20 inches wide at seated passenger hip height. Seat backs shall be shaped to increase this dimension to no less than 24 in. at 32 in. above the floor (standing passenger hip height). The aisle between modesty panels that are located in front of forward facing seats shall be no less than 20 inches wide.

## TS 76.9 Dimensions

**FIGURE 7**  
Seating Dimensions and Standard Configuration



Seat dimensions for the various seating arrangements shall have the dimensions as follows (refer to Figure 7):

- a) The width, W, of the two-passenger transverse seat shall be a minimum 36 inches.
- b) The length, L, shall be 17 inches,  $\pm 1$ -inch.
- c) The seat back height, B, shall be a minimum of 15 inches.
- d) The seat height, H, shall be 17 inches,  $\pm 1$ -inch For the rear lounge (or settee) and longitudinal seats, and seats located above raised areas for storage of under-floor components, a cushion height of up to 18 inches,  $\pm 2$ -inches, will be allowed. This shall also be allowed for limited transverse seats, but only with the expressed approval of the MTA.
- e) Foot room = F.
- f) The seat cushion slope, S, shall be between 5 and 11 degrees.
- g) The seat back slope, C, shall be between 8 and 17 degrees.
- h) Hip to knee room = K.
- i) The pitch, P, is shown as reference only.

## TS 76.10 Structure and Design

The T-pedestal passenger seat frame and its supporting structure shall be constructed and mounted so that space under the seat is maximized and is free of obstructions to facilitate cleaning.

Seats, structures and restraints around the securement area should not infringe into the mobility device envelope or maneuverability.

The transverse seat structure shall be 'T' Pedestal mounted with sufficient strength for the intended service. The lowest part of the seat assembly that is within 12 inches of the aisle shall be at least 10 inches above the floor.

All transverse objects — including seat backs, modesty panels, and longitudinal seats — in front of forward-facing seats shall not impart a compressive load in excess of 1000 lbs onto the femur of passengers ranging in size from a 5th-percentile female to a 95th-percentile male during a 10g deceleration of the bus. This deceleration shall peak at 0.05 to 0.015 seconds from initiation. Permanent deformation of the seat resulting from two 95th-percentile males striking the seat back during this 10g deceleration shall not exceed 2 inches, measured at the aisle side of the seat frame at height H. The seat back should not deflect more than 14 inches, measured at the top of the seat back, in a controlled manner to minimize passenger injury. Structural failure of any part of the seat or sidewall shall not introduce a laceration hazard.

The seat assembly shall withstand static vertical forces of 500 lbs applied to the top of the seat cushion in each seating position with less than 1/4-inch permanent deformation in the seat or its mountings. The seat assembly shall withstand static horizontal forces of 500 lbs evenly distributed along the top of the seat back with less than 1/4-inch permanent deformation in the seat or its mountings. The seat backs at the aisle position and at the window position shall withstand repeated impacts of two 40-lb sandbags without visible deterioration. One sandbag shall strike the front 40,000 times and the other sandbag shall strike the rear 40,000 times. Each sandbag shall be suspended on a 36-inch pendulum and shall strike the seat back 10,000 times each from distances of 6, 8, 10 and 12 inches. Seats at both seating positions shall withstand 4,000 vertical drops of a 40-lb sandbag without visible deterioration. The sandbag shall be dropped 1,000 times each from heights of 6, 8, 10 and 12 inches. Seat cushions shall withstand 100,000 randomly positioned 3-1/2-inch drops of a squirming, 150-lb, smooth-surfaced, buttocks-shaped striker with only minimal wear on the seat covering and no failures to seat structure or cushion suspension components.

The back of each transverse seat shall incorporate a yellow handhold no less than 7/8-inch in diameter for standees and seat access/egress; and shall have a diamond design stainless steel back panel. The handhold shall not be a safety hazard during severe decelerations. The handhold shall extend above the seat back near the aisle so that standees shall have a convenient vertical assist, no less than 4 inches long that may be grasped with the full hand. This handhold shall not cause a standee using this assist to interfere with a seated 50th-percentile male passenger. The handhold shall also be usable by a 5th-percentile female, as well as by larger passengers, to assist with seat access/egress for either transverse seating position. The upper rear portion of the seat back and the seat back handhold immediately forward of transverse seats shall be padded and/or constructed of energy absorbing materials. During a 10g deceleration of the bus, the HIC number (as defined by SAE Standard J211a) shall not exceed 400 for passengers ranging in size from a 5th percentile female through a 95th percentile male.

Seat back handholds shall be provided on all transverse seats and in appropriate locations connect with stanchions.

Longitudinal seats shall be the same general design as transverse seats but without seat back handholds. Clear space above the top of the longitudinal seat backs shall be a minimum of 28 inches to prevent passengers from head contact with fixed material. Armrests are not required on longitudinal seats located in the wheelchair parking area that fold up.

Seat back handholds shall withstand static horizontal and vertical forces of 250 lbs applied anywhere along their length with less than 1/4-inch permanent deformation. Seat back handhold and armrests shall withstand 25,000 impacts in each direction of a horizontal force of 125 lbs with less than 1/4-inch permanent deformation and without visible deterioration.

## TS 76.11 Seat Materials and Construction

**The MTA currently uses American Seating VR-50 seat inserts with Bus Tex 2273724 fabric and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The seating inserts shall be vandal resistant absorbing cuts, slashes and abuse to the material.

Selected materials shall minimize damage from vandalism and shall reduce cleaning time. The seats shall be attached to the frame with tamper-resistant fasteners. Coloring shall be consistent throughout the seat material, with no visually exposed portion painted. Any exposed metal touching the sides or the floor of the bus shall be stainless steel. The seat onset shall be contoured for individuality, lateral support and maximum comfort and shall fit the framework to reduce exposed edges.

The minimum radius of any part of the seat back, handhold or modesty panel in the head or chest impact zone shall be a nominal ¼-in. The seat back and seat back handhold immediately forward of transverse seats shall be constructed of energy-absorbing materials to provide passenger protection and, in a severe crash, allow the passenger to deform the seating materials in the impact areas. Complete seat assemblies shall be interchangeable to the extent practicable.

The insert for the flip-up seats in the Priority Seating Area shall have the wording ‘PRIORITY SEATING, For Persons With Disabilities & Seniors, YIELD THESE SEATS’ with an ADA wheelchair logo in the fabric as shown in the example below:



## TS 77. Passenger Assists

Passenger assists in the form of full grip, vertical stanchions or handholds shall be provided for the safety of standees and for ingress/egress. Passenger assists shall be convenient in location, shape, and size for both the 95th-percentile male and the 5th-percentile female standee. Starting from the entrance door and moving anywhere in the bus and out the exit door, a vertical assist shall be provided either as the vertical portion of seat back assist or as a separate item so that a 5th-percentile female passenger may easily move

from one assist to another using one hand and the other without losing support. All handholds and stanchions shall be powder-coated in a high-contrast yellow color.

### **TS 77.1 Assists**

Excluding those mounted on the seats and doors, the assists shall have a cross-sectional diameter between 1¼ and 1½ in. or shall provide an equivalent gripping surface with no corner radii less than ¼ in. All passenger assists shall permit a full hand grip with no less than 1½ in. of knuckle clearance around the assist. Passenger assists shall be designed to minimize catching or snagging of clothes or personal items.

Any joints in the assist structure shall be underneath supporting brackets and securely clamped to prevent passengers from moving or twisting the assists. Seat handholds shall be of the same construction and finish as the seat frame. Door mounted passenger assists shall be of powder-coated metal in high-contrast yellow color. Connecting tees and angles shall be high-contrast yellow color powder-coated metal castings with mechanical fasteners and shall not be bonded in place. Assists shall withstand a force of 300 lbs applied over a 12-in. lineal dimension in any direction normal to the assist without permanent visible deformation. All passenger assist components, including brackets, clamps, screw heads and other fasteners used on the passenger assists shall be designed to eliminate pinching, snagging and cutting hazards and shall be free from burrs or rough edges.

### **TS 77.2 Front Doorway**

Front doors, or the entry area, shall be fitted with ADA-compliant assists. Assists shall be as far outward as practicable, but shall be located no farther inboard than 6 in. from the outside edge of the entrance step and shall be easily grasped by a 5th-percentile female boarding from street level. Door assists shall be functionally continuous with the horizontal front passenger assist and the vertical assist and the assists on the wheel housing or on the front modesty panel. Assists shall be of powder-coated metal in high-contrast yellow color.

### **TS 77.3 Vestibule**

The aisle side of the operator's two piece security door between the EC and fare box, the wheel housings, and when applicable the modesty panels shall be fitted with vertical passenger assists that are functionally continuous with the overhead assist and that extend to within 36 in. of the floor. These assists shall have sufficient clearance from the barrier to prevent inadvertent wedging of a passenger's arm.

A horizontal passenger assist shall be located across the front of the bus and shall prevent passengers from sustaining injuries on the fare collection device or windshield in the event of a sudden deceleration. Without restricting the vestibule space, the assist shall provide support for a boarding passenger from the front door through the fare collection procedure. The assist shall be no less than 36 in. above the floor. The assists at the front of the bus shall be arranged to permit a 5th-percentile female passenger to easily reach from the door assist, to the front assist, to vertical assists on the operator's barrier, wheel housings or front modesty panel.

### **TS 77.4 Rear Doorway(s)**

Vertical assists that are functionally continuous with the overhead assist shall be provided at the aisle side of the transverse seat immediately forward of the rear door and on the aisle side of the rear door modesty panel(s). Passenger assists shall be provided on modesty panels that are functionally continuous with the rear door assists. Rear doors, or the exit area, shall be fitted with assists having a cross-sectional diameter between 1¼ and 1½ inch or providing an equivalent gripping surface with no

corner radii less than ¼ in., and shall provide at least 1½ inch of knuckle clearance between the assists and their mounting. The assists shall be designed to permit a 5th-percentile female to easily move from one assist to another during the entire exiting process. The assists shall be located no farther inboard than 6 inches from the outside edge of the rear doorway step.

### TS 77.5 Overhead

Except forward of the standee line and at the rear door, a continuous, full grip, overhead assist shall be provided. This assist shall be located over the center of the aisle seating position of the transverse seats. The assist shall be no less than 70 inches above the floor.

Grab straps or other extensions as necessary shall be provided for sections where vertical assists are not available and for the use by passengers that cannot reach to 70 inches. Fourteen (14) passenger grab straps made of yellow plastic are required to be mounted to the overhead assists.

Overhead assists shall simultaneously support 175 lbs on any 12-inch length. No more than 5 percent of the full grip feature shall be lost due to assist supports.

### TS 77.6 Longitudinal Seat Assists

Longitudinal seats shall have vertical assists located between every other designated seating position, except for seats that fold/flip up to accommodate wheelchair securement. Assists shall extend from near the leading edge of the seat and shall be functionally continuous with the overhead assist. Assists shall be staggered across the aisle from each other where practicable and shall be no more than 52 in. apart or functionally continuous for a 5th percentile female passenger.

### TS 77.7 Wheel Housing Barriers/Assists

Unless passenger seating is provided on top of wheel housing, passenger assists shall be mounted around the exposed sides of the wheel housings (and propulsion compartments if applicable), which shall also be designed to prevent passengers from sitting on wheel housings. Such passenger assists shall also effectively retain items, such as bags and luggage, placed on top of wheel housing.

## TS 78. Passenger Doors

**The MTA currently uses Vapor Bus International Door System with Pneumatic ActivAir Differential Engine and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The passenger door system shall use air operated motors for the opening and closing of doors. The systems shall use DOT approved material for air lines and fittings. The door engine shall be adjustable without service tools. The door motors shall require operating pressure between 90 and 120 psi. The closing and opening times of the doors shall be adjustable between 1.5 and 3.5 seconds. Sensors shall be solid state or proximity. The design life of the door system shall be 1,000,000 door cycles, 500,000 miles or 12 years.

Cabling shall be provided to allow monitoring of the Open/Close cycles and status by the VCPU.

Doorways will be provided in the locations and styles as follows. Passenger doors and doorways shall comply with ADA requirements.

Two doors shall be provided in the curbside of the bus for passenger ingress and egress. The front door shall be forward of the front wheels and located so that the operator is able to collect or monitor the

collection of fares of boarding passengers and shall incorporate the necessary accessibility equipment for mobility devices. The rear door centerline shall be rearward of the point midway between the front door centerline and the rearmost seat back. Passenger doors shall be air operated, Slide Glide in the front and Vapor Class controlled open/close in the rear. The rear door shall be an air open and air closed configuration.

Entrance doors shall be two leaf slide glide type driven by a single pneumatic air differential engine. This door engine shall be controlled by a single three-way "poppet type" solenoid valve. The use of four way valves, double solenoid valves or "spool type valves" shall not be allowed. Main door bearings shall be of the "maintenance free, sealed ball bearing type" and shall support the weight of the door system. Doors shall be provided with snag-proof yellow powder coated door handles.

Exit doors shall be wide style with two leaf slide glide type doors driven by a single pneumatic air differential engine. The door engine shall be controlled by a single three-way "poppet type" solenoid valve. The use of four way valves, double solenoid valves or "spool type valves" shall not be allowed. Main door bearings shall be of the "maintenance free, sealed ball bearing type" and shall support the weight of the door system.

### **TS 78.1 Door Materials and Construction**

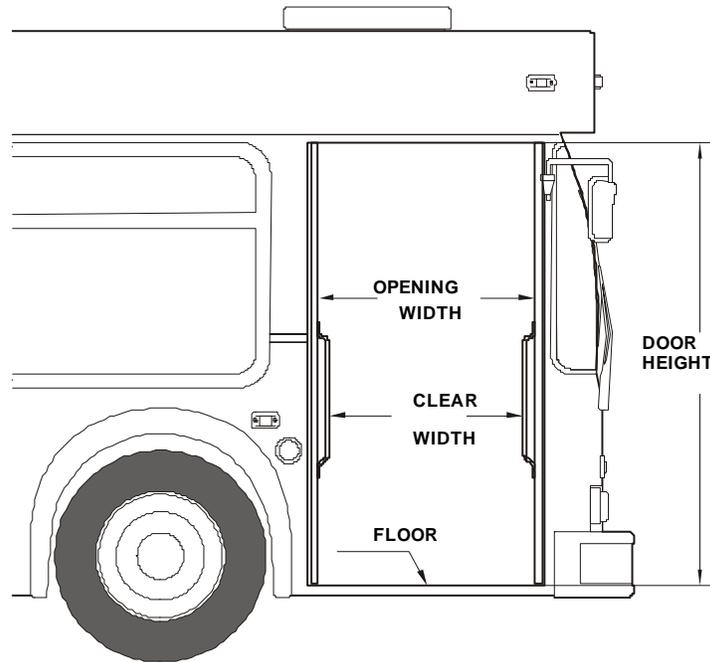
**The MTA currently uses Vapor Bus Ameriview type doors with full view quick change glazing and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Front entrance door shall have full length one piece glazing. Rear exit doors shall have one window at the top of door and aluminum panel on the lower portion. Door panels shall have full view quick change glazing and the panels shall be repairable with the use of common hand tools.

Door panels, associated trim and their attachment points shall be constructed of corrosion resistant materials. Doors when open shall provide a firm support for passengers entering or exiting the vehicle. Doors when closed shall be non-rattling and effectively sealed to preclude entry of water dirt and debris under normal operating conditions. When closed the doors shall provide a minimum of a four-inch gap between the hard edges of the doors. Door panel center seals shall be of resilient rubber of the overlapping type with the forward seal overlapping the aft seal. The combined weather seal and window glazing elements of the front door shall not exceed 10 degrees of binocular obstruction of the operator's view through the closed door.

## TS 78.2 Dimensions

**FIGURE 8**  
Transit Bus Minimum Door Opening



When open, the doors shall leave an opening no less than 75.3 inches in height.

The front door clear width shall be a minimum of 32 inches with the doors fully opened.

The rear door clear width shall be a minimum of 42 inches with the doors fully opened.

### TS 78.3 Door Glazing

The upper section of both front and rear doors shall be glazed for no less than 45 percent of the respective door opening area of each section. The lower section of the front door shall be glazed for no less than 25 percent of the door opening area of the section. The lower section of the rear door panels shall not have glazing and shall be constructed of corrosion resistant material and finished within the aesthetics of the overall bus paint design.

Door glazing shall be easily replaceable. Zip type glazing rubber shall be used.

The front door panel glazing material shall have a nominal 1/4-inch thick laminated safety glass conforming to the requirements of ANSI Z26.1 Test Grouping 2 and the Recommended Practices defined in SAE J673.

### TS 78.4 Door Projection

The exterior projection of the front doors beyond the side of the bus shall be minimized and shall not block the line of sight of the rear exit door via the curb side mirror when the doors are fully open. The exterior projection of both doors shall be minimized and shall not exceed 2 inches during the opening or closing cycles or when doors are fully opened.

Projection inside the bus shall not cause an obstruction of the rear door mirror or cause a hazard for standees.

### **TS 78.5 Door Height Above Pavement**

It shall be possible to open and close either passenger door when the bus loaded to gross vehicle weight rating is not knelt and parked with the tires touching an 8-inch high curb on a street sloping toward the curb so that the street side wheels are 5 inches higher than the right side wheels.

### **TS 78.6 Closing Force**

Closing door edge speed shall not exceed 12 inches per second, and opening door speed shall not exceed 19 inches per second. The doors shall not slam closed under any circumstance, even if the door is obstructed during the closing cycle. If a door is obstructed during the closing cycle, the pressure exerted on the obstruction shall not increase once initial contact has been made.

The rear doors shall be equipped with an obstruction sensing system such that if an obstruction is within the path of the closing doors, the doors shall stop and reverse direction prior to imparting a 10-lb force on 1 sq in. of that obstruction and alert the operator if an obstruction is detected between the closing doors. The contactless obstruction sensing system shall be capable of discriminating between the normal doorway environment and passengers or other obstructions within the doorway, and of altering the zones of detection based upon the operating state of the door system.

Whether or not the obstruction sensing system is functional, it shall be possible to withdraw a 1½ inch diameter cylinder from between the center edges of a closed and locked door with an outward force not greater than 35 lbs.

### **TS 78.7 Actuators**

Doors shall open or close completely in not more than 3.5 seconds from the time of control actuation and shall be subject to the closing force requirements.

Door actuators shall be adjustable so that the door opening and closing speeds can be independently adjustable to satisfy the above requirements. Actuators and the complex door mechanism shall be concealed from passengers but shall be easily accessible for servicing. The door actuators shall be rebuildable. Exhaust from the door system shall be routed below the floor of the bus to prevent accumulation of any oil that may be present in the air system and to muffle sound.

Door actuators and associated linkages shall maximize door holding forces in the fully open and fully closed positions to provide firm, non-rattling, non-fluttering door panels while minimizing the force exerted by the doors on an obstruction midway between the fully open and closed positions.

The rear doors shall be Passenger or operator controlled. A two position toggle switch located within reach of the seated operator shall permit the operator to select either:

- a) The default is the rear doors shall be passenger controlled for rear door activation (contactless sensing device or manually pushing the doors open) or
- b) Operator full control over opening and closing of the rear door. The switch shall have a red spring loaded safety cover installed over the switch retaining the toggle in the passenger control position.

For passenger controlled opening of the rear door(s), the bus operator shall unlock and enable the opening mechanism using the operator door control handle. This shall be annunciated by illumination of a green light above the door. After enabling and unlocking the doors, the doors shall be opened by the contactless sensing system.

For operator controlled opening, the operator shall open the rear door using the operator door control handle, and this action shall be annunciated by illumination of a green light above the door with the opening of the doors.

Locked doors shall require a force of more than 300 lbs to open manually. When the locked doors are manually forced to open, damage shall be limited to the bending of minor door linkage with no resulting damage to the doors, actuators or complex mechanism.

### **TS 78.8 Rear Door Interlocks**

Rear door throttle and brake interlocks shall be provided.

### **TS 78.9 Emergency Operation**

In the event of an emergency, it shall be possible to manually open doors designated as emergency exits from inside the bus using a force of no more than 25 lbs to access the doors emergency release mechanism and actuating an unlocking device. The unlocking device shall be clearly marked as an emergency-only device and shall require two distinct actions to actuate. The respective door emergency unlocking device shall be accessible from the doorway area. The unlocking device shall be easily reset by the operator without special tools or opening the door mechanism enclosure. Doors that are required to be classified as “Emergency Exits” shall meet the requirements of FMVSS 217.

### **TS 78.10 Door Control**

The door control shall be located in the operator’s area within the hand reach envelope described in SAE Recommended Practice J287, “Driver Hand Control Reach.” The operator’s door control shall provide tactile feedback to indicate commanded door position and resist inadvertent door actuation.

The front door shall remain in commanded state position even if power is removed or lost.

### **TS 78.11 Door Controller**

The control device shall be protected from moisture. Mounting and location of the door control device handle shall be designed so that it is within comfortable, easy arm’s reach of the seated operator. The door control device handle shall be free from interference by other equipment and have adequate clearance so as not to create a pinching hazard.

Position of the door control handle shall result in the following operation of the front and rear doors:

- **Center position:** Front door closed, rear door closed or set to lock.
- **First position forward:** Front door open, rear door closed or set to lock.
- **Second position forward:** Front door open, rear door open or set to open.
- **First position back:** Front door closed, rear door open or set to open.
- **Second position back:** Front door open, rear door open or set to open.

### **TS 78.12 Door Open/Close**

Operation of, and power to, the front passenger doors shall be completely controlled by the operator. Power to open the rear doors shall be controlled by operator enabling the door system and the door

opening by the passenger using the acoustic sensing system. A two position toggle switch shall be provided to enable the operator to obtain full control of the rear doors.

A control or valve in the operator's compartment shall shut off the power to, and/or dump the power from, the front door mechanism to permit manual operation of the front door with the bus shut down. A master door switch, which is not within reach of the seated operator, when set in the "off" position shall close the rear doors, deactivate the door control system, release the interlocks, and permit only manual operation of the rear doors.

**The MTA currently uses Vapor CLASS Acoustic Sensing System for the passenger rear door control and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Closing of the rear door after being opened by the recognition of a passenger exiting via the contactless sensing system shall be automatically initiated once the door area is clear. When the rear door has been opened, the contactless system shall monitor the entire passenger door exit area. The rear exit doors shall remain open when passengers or other objects are in the exit area and the system will not allow closure until the area is cleared.

### **TS 78.13 Door and Interlock Master Switch**

A Door and Interlock Master Switch, which is not within reach of a seated operator when set in the "OFF" position, shall lock the rear doors, deactivate the rear door control system, release the interlocks, and permit continued operation of the bus without rear door service. This switch shall also release and disable the interlocks associated with the emergency opening of the front or rear door, wheelchair ramp, and kneeling system.

Location of this switch is recommended to be enclosed in the dash and accessible by a door. The location shall be reviewed by the MTA during the PPM.

### **TS 78.14 Door Voice Annunciator**

**The MTA currently uses Vapor Bus International Voice Annunciation System and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The rear door shall be equipped with a voice annunciation system. Message input shall be provided directly from the door controller system. The annunciator shall be packaged to fit in the header space or the doorway area using digitally recorded messages for clear announcements with a choice of languages. It shall be solid-state using low maintenance be controlled via the latest windows based diagnostics.

The appropriate message shall be played when the following door conditions are met:

<b>Rear Door Condition</b>	<b>Message</b>
Rear doors authorized ( door closed operator control to rear door open position green light on)	“Touch Yellow Tape to Open”
Doors begin to open (passenger has touched yellow tape while doors were authorized 5 degree switch de-actuates)	“Doors Opening”
Doors begin to close (Door full open sensor de-actuates after being actuated)	“Warning” “Doors Closing”
Doors reach full closed position while still authorized	“Touch Yellow Tape to Open”
Rear doors de-authorized, but does not begin to close in 5 seconds due to an obstruction	“Please Move Away From Rear Door”

## TS 79. Accessibility Provisions

Space and body structural provisions shall be provided at the front door of the bus to accommodate a wheelchair loading system.

### TS 79.1 Accessibility Loading System

**The MTA currently uses Ricon Wheelchair Ramp and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

An automatically-controlled, power-operated ramp system compliant to requirements defined in 49 CFR Part 38, Subpart B, §38.23c shall provide ingress and egress quickly, safely and comfortably, both in forward and rearward directions, for a passenger in a wheelchair from a level street or curb. The system shall be a full electric drive system with water resistant mechanism and controls. The ramp shall be a service proven product that has ease of service and operation.

The wheelchair loading system shall be located at the front door, with the ramp being of a simple hinged, flip-out type design being capable of deploying to the ground at a maximum 1:6 slope. The ramp shall be rated for 1,000 pound capacity. Whenever the loading system is operated, the Kneeling light located at the front door shall be illuminated and flashing.

Cabling shall be provided from the loading system sensors to allow wheelchair deployment cycles to be monitored and recorded by the VCPU.

### TS 79.2 INTENTIONALLY BLANK

### TS 79.3 INTENTIONALLY BLANK

### TS 79.4 Wheelchair Accommodations

**The MTA currently requires a fully integrated forward facing wheelchair securement station with the following specifications;**

The ADA restraint system shall include positive locking devices providing safe, easy and quick securement of passengers and their mobility aid device. The system shall be modular in design, with auto tensioning and auto locking retractors. The passenger restraint shall be a minimum 3 point system with occupant restraint lap and shoulder belt.

Two, forward-facing, ADA-compliant mobility-aid securement positions shall be provided, as close to the front door ramp system as practical. Passenger seats in these positions shall be visually similar to other seats in the bus, but operable to provide parking space and secure tie-downs for passengers with disabilities. The securement device shall be compatible with the passenger seating hardware and supplied by the passenger seating manufacturer. The front securement belts shall store under the aisle facing seat when not in use. Restraint belts shall be of sufficient length to accommodate electrically powered mobility aids. The system shall have a seatbelt able to secure around the mobility aid device and its occupant. The seatbelts shall include a retracting device positioned to keep belts off the floor and allow for maneuvering of the mobility aid device into position.

The rear securement belts shall be a remote system. The system shall be mechanically operated without the use of electrical wiring. No cables shall be allowed to operate the release of the rear belts. The system shall attach to the legs of the barrier or flip seats. The system shall employ a mechanical timer which when activated will release the belts and shall lock automatically.

A wheelchair-turning diagram should be included with the Proposer's interior seating diagrams as a submission in their proposal.

### TS 79.5 Interior Circulation

Maneuvering room inside the bus shall accommodate easy travel for a passenger in a wheelchair from the loading device and from the designated securement area. The travel area shall be designed so that no portion of the wheelchair protrudes into the aisle of the bus when parked in the designated parking space(s). When the positions are fully utilized, an aisle space of no less than 20 in. shall be maintained. As a guide, no width dimension should be less than 34 in. Areas requiring 90-degree turns of wheelchairs should have a clearance arc dimension no less than 45 in., and in the parking area where 180-degree turns are expected, space should be clear in a full 60-in.-diameter circle. A vertical clearance of 12 in. above the floor surface shall be provided on the outside of turning areas for wheelchair footrest.

## SIGNAGE AND COMMUNICATION

### TS 80. Destination Signs

**The MTA currently uses Twin Vision Smart Silver destination signs and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The destination sign system shall have control and processing ability to operate and monitor the electronic destination sign system. The signage fonts and graphics shall conform to all ADA requirements and have full readability for a total 130 degrees. Signs shall be readable for a distance up to 350 feet. Signs shall have the ability to display emergency messages. The destination sign system shall have a minimum operating life of 100,000 hours. The system shall have open architecture for J1708, J1939 and RS232. The control shall have the ability to integrate with the buses on-board IT systems.

A destination sign system shall be furnished on the front, on the curb side near the front door, as well as a route sign on the rear of the bus. Lettering shall appear as silver on a black background for all signs. The signs shall be lighted using high intensity LED lamps which shall have an automatic brightness adjustment.

The VCPU shall interface to the electronic destination sign system.

The interface shall include the ability to automatically initialize the destination sign system when single-point logon is initiated, to share route/trip/destination information and triggers, and to download updated

sign message content and related data from the fixed end, via the common secure router and the VCPU, without the need for manual and/or human interaction with the destination sign system. This will be accomplished via SAE J1708 interface from the VCPU to the destination sign system.

The destination sign compartments shall meet the following minimum requirements:

- a) Compartments shall be designed to prevent condensation and entry of moisture and dirt.
- b) Compartments shall be designed to prevent fogging of both compartment window and glazing on unit itself.
- c) Access shall be provided to allow cleaning of inside compartment window and unit glazing. Doors shall be locked via 5/16 inch square key locks.
- d) Front destination window shall have an exterior display area of no less than 8.5 inches high by 65 inches wide and shall have an electrical grid window defroster.

The system shall have the ability to sequentially display multi-line destination messages, with the route number portion remaining in a visible constant "ON" mode at all times, if so programmed. It shall provide the means of adjusting the length of time messages are displayed, from one-tenth (0.10) second to twenty-five (25) seconds duration.

The sign sets shall operate off a nominal 24-volt power source. The system shall operate at sustained voltages from 18 to 32 VDC. If voltage falls below the minimum, the system shall stop operating.

A "self-test" capability shall be provided to aid system troubleshooting shall indicate that each LED is functioning.

### **TS 80.1 Front Destination Sign**

The front destination sign shall have a minimum of 16 rows by 160 columns, in a display 63 inches wide by 8 inches high. The destination message shall be readable by a person with 20/20 vision from a distance of not less than 275 feet.

### **TS 80.2 Side Destination Sign**

The side destination sign shall be located at the top of the forward most curbside window and shall have a minimum of 16 rows by 160 columns, in a display 47 inches wide by 6 inches high. The side destination message shall be readable by a person with 20/20 vision from a distance of not less than 110 feet. The side sign shall use the same programming as the front sign.

The side destination sign shall be encased in a durable box designed for use in the transit environment.

### **TS 80.3 Rear Destination Sign**

The rear destination sign shall be located as high as practicable and to the curbside of center on the rear of the bus and shall have a minimum of 16 rows by 48 columns, in a display 17 inches wide by 6 inches high. The rear sign shall be capable of independently displaying alphanumeric characters. The rear destination sign message shall be readable by a person with 20/20 vision from a distance of not less than 225 feet.

## TS 80.4 Run Number Sign

Buses shall be equipped with a lightweight and serviceable front dash mounted run number sign box with white LED's and a glare guard. The box shall be mounted with a minimum amount of obstruction to defrosting the windshield and allow maximum operator's view of people crossing in close proximity to the front of the bus. The mounting area of the dash shall be reinforced to avoid dashboard cracking or damage. The penetration in the dashboard for the sign wiring shall be grommeted. Knife or sealed wiring connections for the sign shall be in an accessible area below the dashboard and sign.

## TS 80.5 Operator's Control Console

The Operator's Control Console (OCC) shall be inside in the front destination sign compartment and shall not be within reach of the seated operator. The OCC shall be easily viewed and operated with the destination sign compartment open. The OCC shall control all the destination and block number signs.

The OCC shall contain a display of at least two lines of 20-character capability to monitor the status of the destination sign system. The OCC shall incorporate an audio annunciator that beeps to indicate that a key is depressed. The OCC shall utilize a multi-key keyboard that is designed for transit use. The OCC shall continuously display the message that the front signs are displaying, except the emergency message, when initiated.

Buses shall be delivered with a pre-programmed list of destination sign messages supplied by the MTA. The various signs on a bus shall be programmable to display independent messages or the same messages. The destination sign system shall allow two destination messages and one public relations message to be pre-selected and the operator shall be able to change between the pre-selected destination messages without entering a new message code. Public relations messages shall be capable of being displayed alternately with the regular text and route messages or displayed separately.

## TS 80.6 Silent Alarm

A silent alarm switch located in the operator's compartment shall activate an emergency message on the destination signs and send an emergency message on the mobile radio. The switch shall be a momentary contact switch located forward and above the turn signal switches, which triggers both the destination sign and radio systems. The emergency message shall be displayed on signs facing outside the bus, while signs inside the bus (including the OCC display) shall remain unchanged or display a special message specified by the MTA.

The emergency message for the:

Front destination Sign: EMERGENCY CALL 911

Side Destination Sign: EMERGENCY CALL 911

Rear Destination Sign: CALL 911

In order to reset the destination signs to non-emergency status, the bus master switch shall have to be shut off for a maximum of 10 seconds and then the bus restarted. The signs shall return to the destination settings programmed prior to the emergency situation.

## **TS 80.7 Message Programming Capability**

The electronic destination sign system shall be capable of receiving wireless transmissions through the bus communications system to provide for reprogramming and shall be reprogrammable with the use of an industry-standard Flash PC card. The system shall be capable of accepting control and changes to the message lists via J-1708, J-1939, RS232, RS435 or Ethernet. A hardware/software package necessary for wireless message transfer shall be provided to generate message lists for the destination sign system. A software package to program the PC cards shall be provided and the Contractor shall supply six PC cards. The software package shall be installed on the Contractor-supplied laptop computers (inclusive of the quantity specified) and shall run on an MTA-approved version of Microsoft Windows.

The programming software shall be “user-friendly” in that the user interface is designed to have the following features:

- a) Rational prompts for user input
- b) A tree or menu structure
- c) Require minimal printed documentation
- d) Facilitate ease of training
- e) Incorporate context-sensitive help features

The programming software shall provide the capability for custom message writing by selecting pre-programmed standard variable-width fonts, and by creating custom fonts by varying spacing between characters, words, or other message elements. Graphic displays, with or without text, shall be capable of being created by selecting pre-programmed graphic sign images and by the use of multiple fonts within the same message (allowing graphic symbols to be placed anywhere within the display area.

## **TS 81. Passenger Information and Advertising**

### **TS 81.1 Interior Displays**

Provisions of 21 inches X 22 inches shall be made on the rear of the EC located on the wheel well for a frame to retain information such as routes and schedules.

Advertising media 11 in. high and 0.09 in. thick shall be retained near the juncture of the bus ceiling and sidewall. The retainers may be concave and shall support the media without adhesives. The media shall be illuminated by the interior light system.

A Next Stop display shall be provided.

### **TS 81.2 INTENTIONALLY BLANK**

## **TS 82. Passenger Stop Request/Exit Signal**

A passenger “Stop Requested” signal system that complies with applicable ADA requirements defined in 49 CFR, Part 38.37 shall be provided. The system shall consist of a series of passenger touch strips, chime and interior sign message. The touch strips shall be located vertically between each passenger window the full length of the bus on the sidewalls at the level where the transom is located and shall be easily accessible to all passengers, seated or standing. Touch strips shall activate an adjustable volume

chime located in the operator's station. At each wheelchair passenger position and at priority seating positions, additional provisions shall be included to allow a passenger in a mobility aid to easily activate the "stop request" signal. Touch strips shall not be located where passengers would inadvertently activate the passenger signal by their shoulder or head.

Two auxiliary passenger stop request signal switches shall be installed at the rear door to provide passengers standing in the rear door/exit area a convenient means of activating the stop request signal system. The switch shall be a heavy-duty push button type located in the rear door vicinity. The button shall be clearly identified with "STOP" cut in the button. A second heavy-duty "stop request" signal button shall be installed on the modesty panel stanchion immediately forward of the rear door and clearly identified with "STOP" cut in the button". The stanchion mounted switch shall be located 63 inches above the bus floor to avoid passengers inadvertently bumping the switch button. Both switches shall be constructed to mitigate the opportunity for passengers to inadvertently activate the switch by brushing past or laying their hand on it.

A single "Stop Requested" signal shall sound with a dash indicator light when the system is activated from the wall or stanchion mounted positions. A double "Stop Requested" signal shall sound with a mobility request dash indicator anytime the system is activated from wheelchair passenger areas.

Stop request Touch Strips located in the ADA wheelchair passenger area shall be no higher than 4 feet above the floor. Touch strips for patrons in the wheelchair passenger area shall also be located on the underside of the flip up seats as shown below:



Instructions printed on the touch strips shall clearly indicate function and operation of these signals as illustrated below:



Interior message signs shall be supplied that illuminate when the passenger signal is activated by one of the touch strips or stanchion mounted buttons. The red LED sign message shall read STOP REQUESTED. Once activated the passenger stop request sign shall stay illuminated with the stop requested message until the bus entrance or exit door has been cycled. Passengers shall not be able to activate the passenger signal again until the passenger door has been cycled and the system reset. An interior stop request message sign shall be installed facing the rear in front of the furthest front forward facing seat visible to all passengers. A similar sign shall be located on the rear bulkhead facing forward allowing those passengers either facing or walking towards the rear of the bus to view the passenger request status.

## TS 83. Communications Systems

### TS 83.1 Communications Systems Work

- a) The bus shall be equipped with a unified system as outlined in this section including furnishing all materials, tools, equipment, and testing and performing all labor and services to equip each bus in accordance with these Specifications.
- b) The Communications Systems shall comply with the intent of the National ITS architecture and shall support Transit Communication Interface Profiles (APTA TCIP-S-001 3.0.3) compliant data interface to share CAD/AVL data with other authorized and compliant business systems.
- c) The onboard communications system shall support single-point logon, where required, for the onboard subsystems, including but not limited to fare box, OIT and Destination Signs.

### TS 83.2 Radio / AVL System

- a) The automatic vehicle location subsystem shall provide real-time vehicle location updates for use by the onboard subsystem for vehicle location reporting, route and schedule adherence, automatic passenger counting, and automatic vehicle announcements.
- b) The system shall include a vehicle central processing unit (VCPU) and operator interface terminal (OIT).
- c) The VCPU shall be the central control and processing unit for all on-board equipment. The VCPU design shall be based on Commercial-Off-The-Shelf (COTS) industrial computer components.

- d) The VCPU shall mount in existing bus equipment racks, which vary in size and layout by model year.
- e) The OIT shall serve as the complete, single user interface to the CPU and all of its resident functions.
- f) The Contractor shall provide an equipment layout for each model. The OIT shall be mounted in the bus operator's area over head, or at another MTA-approved location in the operator's area that is accessible and does not significantly obstruct lines of sight.
- g) All radio voice communication controls shall be presented to the operator via the OIT. There shall be no need for the operator to control voice radio communications directly on the voice radio, or anywhere else other than the control head, except for picking up the handset for actually speaking and listening. This shall still be possible in the event of a CPU failure. In the event of a OIT failure, it shall be possible for the operator to use the handset and radio directly to make a radio call.
- h) Velocity, time, and direction of travel solutions shall also be provided. The AVL subsystem shall utilize GPS technology. The AVL subsystem shall utilize information from the odometer for vehicle location when the GPS signal is unavailable.
- i) The algorithm used for location shall take into account the expected GPS solution accuracy including number of satellites tracked and the distance traveled since the last known position to develop the position solution from the GPS and odometer data.
- j) The VCPU shall handle all on-board Computer Aided Dispatch/Automatic Vehicle Location (CAD/AVL) functions.
- k) The VCPU shall monitor route and schedule adherence for all vehicles operating on a defined route with a defined schedule. Route deviations that are beyond pre-defined, adjustable thresholds shall produce an off-route message that is sent to dispatch and shall produce a message that is displayed for the operator. Once the vehicle returns to its scheduled route, a back on route message shall be sent to dispatch and displayed for the operator.
- l) The system shall provide a means of preventing repeated off-route/back-on-route events when a vehicle is operating near the set thresholds.
- m) The VCPU shall accurately monitor the schedule adherence of vehicles operating on defined schedules, as obtained from the required Trapeze FX interface under this project.
- n) At a minimum, the schedule adherence shall be calculated at each time-point on the assigned route.
- o) Schedule deviations beyond a pre-defined maximum shall trigger messages to be sent to dispatch and display on the operator terminal.
- p) Early and Late messages shall also include the amount of deviation.
- q) The VCPU unit shall have enough non-volatile memory to store schedule data and vehicle logged operational data.
  - 1. The unit shall store the current schedule file.
  - 2. The on-board unit shall have the capability to store vehicle operational data including but not limited to schedule adherence status messages, time of time point encounters, pull-out/pull-in times, APC data, door open/close events and bus stop arrival/departure events and times.

3. The unit shall store up to one week of data before requiring an upload to the MTA fixed-end database. However, data will normally be uploaded whenever a vehicle enters a depot and has access to the WLAN.
  4. The on-board system shall be able to continue bus operations independent of communications status.
  5. Operator logon shall enable the on-board unit to perform all normal on-board functions including schedule and route adherence, AVA functions, APC functions and data logging for future data upload.
  6. The VCPU shall have 100% spare capacity for future upgrades in volatile memory, non-volatile memory, and processing capabilities.
- r) The VCPU shall have ports to communicate to on-bus systems as follows, with the quantity of ports of at least one (1) unused port or 100% spare above what is used:
1. SAE J1939 Networks
  2. SAE J1708 Information Networks
  3. SAE J1708 Drive Train Networks
  4. SAE J1587 Networks
  5. RS 232
  6. RS 485
  7. Ethernet
  8. USB (minimum 2)
  9. Serial interface(s) to be used to communicate with the existing Vansco on-board multiplex system (a spare multiplex interface is not required).
- s) The VCPU shall be integrated with all SAE J1708/J1939/J1587 compliant on-vehicle systems, providing a single, common source of any diagnostic information available. All necessary gateways and programming required to externalize data in a manner compatible with the VCPU shall be provided.
- t) Discrete wiring shall be provided from the instrument, diagnostic light, and main electrical panels, terminated in the electronic cabinet, and provided to the VCPU. 100% spare capacity for discrete signals shall be provided along their paths, in cables, on terminal strips, VCPU connectors, and elsewhere. The discrete signals shall be 12VDC, 24VDC, or ground.
- u) The VCPU shall have self diagnostic and monitoring capabilities for itself and all peripheral system equipment.
- v) The VCPU shall annunciate faults automatically to the bus operator and to the fixed end. Fault annunciation and response parameters shall be system administrator configurable.
- w) If a router fails, the OIT shall clearly indicate that data comms are down so that if there is an emergency, the operator knows that the EA data message is not being sent to dispatch. However, the voice fallback channels shall be used to send a EA to the Dispatcher console.
- x) The on-board unit shall support voice communications using the Motorola XTL5000 radio. Further radio details can be found in the "Voice and Data Communications" section of this RFP.

- y) The on-board unit shall support data communications using the cellular communication capability provided by the Contractor on this contract. Further cellular communication details can be found in the “Voice and Data Communications” section of this RFP.
1. The AVL unit shall support periodic reporting of location and status on a 30-second interval for normal operations and 15-second interval for buses operating under EA conditions.
  2. The location and status message shall include as a minimum, date/time, vehicle ID, Operator ID, Route and Block number, location, route and schedule adherence status, alarm status, current passenger load and other standard information as described throughout the RFP requirements for the various systems.
  3. The system shall also support real-time polling initiated by a Dispatcher and shall return the same information as described for periodic reporting. When polled, the vehicle unit shall respond immediately and not wait for next scheduled update.
  4. Incident and operator text messages shall be immediate and not wait for a scheduled update.
  5. The system shall poll for specific, system administrator configured information. An example would include polling for current passenger load without any other status information being transmitted.
- z) The system shall support WLAN data communications using the WLAN capability incorporated in the Contractor provided Mobile Router detailed elsewhere in the RFP.
- aa) The VCPU and all peripheral equipment shall accept software, firmware, configuration, schedule and route database, and other data updates via the WLAN and router without personnel physically having to visit the bus.
- bb) The WLAN shall be the primary means of receiving complete schedule and route database updates as bulk downloads or database change transactions wherever necessary.
- cc) As a backup, it shall also be possible to perform piecemeal updates of on-board schedule and route data via cellular communication or from a portable memory drive.
1. A wireless laptop with all programming software shall be provided that can be used to load software for the vehicles at remote locations or vehicle out of range of the WLAN.
  2. The laptop shall be provided with the latest compatible Windows operating system and shall meet the following minimum requirements:
    - a. Intel®Core™ i7 (2820QM, 2720QM, 2620M)
    - b. 16GB DDR3 SDRAM at 1600Mhz - 4 DIMMS
    - c. 17.3” Display
    - d. 750GB Hard Drive
    - e. DVD+/-RW; Blu-ray Disc™ writer
    - f. Integrated 10/100/1000 Gigabit Ethernet
    - g. Wireless LAN and WiMAX included
    - h. Bluetooth Capable
    - i. Ports to include – 2 USB 2.0, 1 IEEE 1394, 1 Microphone, 1 Headphone, 1 10-in-1 Media Card Reader, 1 Smart Card Reader, 1 54mm ExpressCard

Slot, 1 HDMI, 1 VGA, 1 RJ45, 2 USB 3.0, 1 Display Port, 1 Wireless Switch, 1 eSATA/USB 2.0.

- dd) The system shall interface multiple on-board sub-systems, utilizing a Contractor supplied and installed vehicle area network (VAN), and equipment as listed below and detailed in respective section of the RFP:
1. Voice and data communications management, interfaces, and user functions.
  2. Existing Cubic fareboxes
  3. AVA system, utilizing existing signs and speakers.
  4. The Contractor-provided APC system.
  5. Existing Destination Signs.
  6. Existing Block Heaters
  7. AVM System utilizing existing engine modules
- ee) The system shall provide a means to interface various hard-wired inputs, including but not limited to:
1. Wheel-chair lift status
  2. Left Turn Signal initiation
  3. Right Turn Signal initiation
  4. Door sensors (front and rear)
  5. Bike rack cycling
- ff) The system shall monitor the communications and status of other on-board sub-systems including but not limited to radio, farebox, AVA, AVM, APC, Destination Signs and router and provide indication of loss of communication or failure at both the VCPU unit and fixed-end CAD/AVL system.
- gg) The Contractor shall be responsible for surveying the MTA bus fleet to determine other interfaces required for each bus type. The interfacing capabilities of the system shall be detailed in the proposal.
- hh) The on-board system shall support fully automated single-point logon of other on-board systems.
1. Upon normal bus start up, all on-board systems and components shall be initialized by turning the master run switch to one of the non-off positions and logging into a single device, with interface to the VCPU.
  2. This single log-in shall allow the onboard systems to perform their respective functions for the duration of the assigned work without further operator intervention until the operator or work assignment changes.
  3. The CAD/AVL system shall receive operator ID, route and block information from Trapeze Ops and pass this information to the VCPU unit.
  4. This information shall be displayed on the OIT. Operator acknowledgement of the displayed information shall constitute logon to the VCPU and all connected subsystems.

5. Manual override of logon information shall be allowed if the displayed information is incorrect.
6. The operator shall be able to input Operator ID as well as assigned route and block information. If manual override is utilized, a notification shall be sent to dispatch.
7. The system shall also support remote logon from dispatch should a vehicle appear to the Dispatcher as not logged on.
8. Remote logon shall also logon the VCPU as well as all connected subsystems.
9. Vehicles that have been remotely logged on shall be uniquely displaced in the CAD/AVL System at dispatch.
10. The operator shall be allowed a limited number (system configurable) of failed logon attempts. If this number is reached, a notification shall be presented to dispatch in the fixed-end CAD/AVL system. The OIT shall specifically display what information being provided is Invalid.
11. Log-in validity checks shall be performed primarily on-board the bus by the VCPU so that the time required to perform the validity checking is minimized. Correct real-time log-in, operator ID, bus ID, and work assignment data shall be synchronized between the VCPU and the CAD/AVL fixed end. This would typically be done after the on-board log-in is complete, but in certain instances there may be a requirement for VCPU communications with the fixed end during the log-in and initialization process.
12. If the automatic synchronization fails and the operator does not correct the log-in, the CAD/AVL fixed end shall allow for Dispatcher manual intervention to achieve correct log-in and synchronization as quickly as possible.
13. It shall be possible for supervisors and maintainers to override log in validity checks. The system shall contain ancillary data to support this, with pre-defined override privileges for designated personnel IDs, with password protection. Similarly there shall be override codes for route, block, and any other data needed to allow for a valid log in indication, under special circumstances and with proper authorization, even if the entered log in data does not match pre-loaded operator and work assignment data.
14. The system shall allow for relief operator logon allowing the new operator to logon to the same route/block without having to input information other than Operator ID.
15. The Single Point Log-in shall include all systems on the bus that require a logon including: AVL, Fare box, Radio, AVA, AVM, APC, Destination Signs.
16. Log-in information shall be automatically checked for validity and shared among all systems as needed for proper functioning, so that it is not necessary for the operator to log in to multiple devices and that log in key stroke errors are mitigated.
17. Likewise, de-initialization of all on-board systems and components shall be accomplished by turning the master run switch to off and logging off of a single device.
18. Any other required operator interfaces to these systems, such as end-of-trip trigger, shall only need to be entered once on a single device.

19. In the event of one or more device failures, it shall be possible, as a backup, to log in separately to the individual devices such as the farebox, CAD/AVL OIT, and the Destination Sign System.
  20. It shall be required to log in to the CAD/AVL on-board system for any bus movement whether by operators, maintainers, or other authorized personnel. The system shall capture the unique personnel ID regardless of who is operating the bus.
  21. Blanket/dummy route and block codes are acceptable for maintainers and other non-revenue movements; the destination signs shall automatically display an out-of-service message. Bus movement without a valid log in shall be annunciated as an incident to the CAD/AVL fixed end.
  22. All logon alarms and indications shall be displayed simultaneously on the OIT for the Operator and at BOCC for the Controller.
  23. The Contractor shall develop, configure, and install the Single Point Logon function. The Contractor shall install any new or additional conduit or wiring required for Single Point Logon.
  24. The Contractor shall ensure that the on-board system properly interfaces with other on-board systems as indicated in this and other sections of this specification and that it communicates with the fixed-end system, where applicable, without degradation to any existing features or functions.
- ii) The VCPU unit shall support Dispatcher controlled communications requiring operators to request voice communications either as “Request to Talk” (RTT) or “Priority Request to Talk” (PRTT) data messages.
- jj) Dispatcher response to either RTT or PRTT messages shall enable the transmit and receive audio paths of the voice radio system and shall remain enabled until terminated by Dispatcher, operator or a timeout.
- kk) A message shall be displayed on the OIT once dispatch has established a call.
- ll) The unit shall support two-way and one-way radio communications as initiated by dispatch to a single vehicle or group of vehicles. Voice calls shall be limited to 3 minutes.
1. The VCPU unit shall provide dedicated RTT and PRTT keys that are always available to the operator for initiation of communications request messages to the fixed-end CAD/AVL system. The OIT shall display confirmation that the call is established and also provide an audible alert.
  2. The operator shall be able to terminate the call by hanging up the handset.
  3. Two-way voice calls shall be via the operator handset.
  4. One-way voice calls shall be initiated by dispatch and be supported by the VCPU for group and all calls.
  5. The OIT shall indicate whether a one-way call is a group call or all call. The audio shall be directed to the operator speaker but redirected if the operator picks up the handset. One-way calls shall be terminated by dispatch or timeout.
  6. The VCPU unit shall support a voice fallback mode on loss of data communications.
  7. In this event, the voice radio system shall allow microphone initiated calls on a default talk-group allowing the operator to make voice calls without the need for RTT or PRTT message response. The fallback conversation shall be allowed to

continue until completed whether data communications is re-established during the call or not.

mm) The OIT shall support multiple functions and displays.

1. The system shall support operator messaging with the ability to receive, view, store, clear and respond to messages from a Dispatcher and the ability to send messages to dispatch.
2. The OIT shall provide indications that the message queue is empty, a new message has been received or a message is stored and can be viewed.
3. The operator shall be able to view incoming messages and the unit shall provide a scroll feature for long messages.
4. The operator shall be able to store up to 20 messages for viewing at a later time, and the stored messages shall be easily retrievable from a queue. Operator shall be able to delete stored messages from this queue.
5. The VCPU unit and operator OIT shall allow the operator to easily respond to message from dispatch. The operator shall be able to respond with “Yes”, “No” or “Ack” as appropriate.
6. The VCPU system and operator OIT shall allow the operator to send “canned” messages to dispatch.
7. The system shall allow at least 128 pre-formatted messages to be selected and transmitted to the fixed end via the VCPU.
8. Canned messages shall be configurable. Entry shall be menu driven, covering mechanical, medical, and other urgent, notification, and log/documentation items for the operator. Menu screens shall be configurable and mutually agreed between MTA and the Contractor.
9. A set of menus and sub-menus shall clearly identify message types and allow messages to be selected and sent.
10. The operator shall be provided with feedback that the message has been sent and that it has been successfully received at the CAD/AVL fixed-end.
11. The on-board system shall support the receipt of detour messages.
12. The operator OIT shall receive and display the detour messages at each vehicle logon as long as the detour is active.

nn) The VCPU unit and operator OIT shall support a number of different types of messages including but not limited to the following.

oo) Messages shall be presented in a series of menus and sub-menus as required for operator ease of navigation to the appropriate message.

1. Emergency Alarm – EA message sent when the covert emergency button is activated.
2. PRTT – priority two-way request-to-talk
3. RTT – two-way request-to-talk
4. Wheel Chair Information – provides a sub-menu of available messages related to the wheel-chair lift
5. Accident Reporting – sub-menu of messages related to accidents.

6. Vehicle Change – sub-menu related to the need for a vehicle replacement (bus breakdown, breaks, etc.) The following information shall be included in the message: Line, Block, Operator, Location, Direction, Standing or Due, Load.
  7. On-Board Emergency – sub-menu related to emergency issues with need for EA (disturbance, passenger hurt, etc.)
  8. Incident Reporting – sub-menu for messages related to incidents
  9. Service Performance Issues –sub-menu for messages related to various service issues such as traffic, un-expected detours, water-main breaks, weather, etc.
  10. Operator Issues – sub-menu for messages related to operator issues (sick, break, etc.)
- pp) The VCPU CAD/AVL system shall perform real-time route and schedule adherence monitoring.
- qq) The on-board route and schedule information along with operator logon information shall be used to perform this monitoring.
- rr) The system shall support the following basic route and schedule adherence functions at a minimum.
1. The system shall accurately monitor the route adherence of vehicles operating on defined routes.
  2. Route deviations that are beyond pre-defined, adjustable thresholds shall produce an off-route condition and a message shall be sent to dispatch. Once the vehicle returns to its scheduled route, a back on route message shall be sent to dispatch.
  3. The system shall provide a means of preventing repeated off-route/back-on-route events when a vehicle is operating near the set thresholds.
  4. The system shall accurately monitor the schedule adherence of vehicles operating on defined schedules.
  5. The on-board schedule and operator logon information shall be used to monitor schedule adherence.
  6. At a minimum, the schedule adherence shall be calculated at each time-point on the assigned route. If the vehicle is early by more than the pre-defined “early” threshold, an EARLY message shall be displayed on the operator OIT and be transmitted to the fixed-end CAD/AVL system.
  7. If the vehicle is late by more than the pre-defined “late” threshold, a LATE message shall be displayed on the operator OIT and be transmitted to the fixed-end CAD/AVL system.
  8. Bus position shall be continuously calculated and logged on board at no more than one-second processing intervals.
  9. Bus position shall be reported to the fixed end and updated in the AVL display at least every 30 seconds for normal operations.
  10. Buses experiencing emergencies and selected events, as configured by MTA, shall automatically go into a fast report mode, where the fixed end AVL map display zooms to the bus and position is updated at least every 15 seconds.
  11. Fast report mode may be applied to any bus, whether logged on or not, by the Dispatcher selecting the vehicle and manually initiating the fast report mode.

12. The VCPU shall be the single master on-board source for bus AVL system navigation and positioning based on GPS, odometer, and any other positioning related inputs.
  13. The VCPU shall house a gyroscope and any other supplemental equipment needed to provide required location accuracy, beyond the inputs available from other existing bus equipment and the common GPS source from the router.
  14. RSA incidents shall be easily identified for on-time performance calculations and reporting.
- ss) The VCPU system shall support data logging of operational data including but not limited to logon/off events, bus stop and time-point encounters, message retrieve/send events, wheel chair lift cycles and incident message events. Logged data shall be maintained until uploaded to the CAD/AVL system via the WLAN or transmitted via cellular data communications after an outage. Operational data including on-time performance shall continue to be collected when the bus is in a communication failure mode.
  - tt) The VCPU system shall provide a layover countdown with display on the operator OIT. When the timer reaches zero (0), a pullout message shall be displayed and an optional audible alarm shall activate.
  - uu) The system shall allow creation of location-based trigger boxes for each bus division that are stored in the system. Based on the trigger box, the VCPU shall annunciate to the fixed end its pull-out/pull-in status for both its assigned division and other bus divisions and storage locations. The fixed end system shall display the status for the bus.
  - vv) Each bus shall be equipped with a covert emergency button that can be discreetly activated by the operator. The emergency button is a momentary contact switch.
  - ww) Upon activation, the system shall send an Emergency Alarm message to the fixed-end CAD/AVL system.
    1. When an Emergency Alarm situation is initiated as described above, the operator shall be provided with notification that the message has been sent and acted upon. Both states shall be indicated separately and shall be very subtle on-screen such that a layperson would not be aware.
    2. In addition, the destination signs shall display a message as defined by MTA such as "Call Police" or "Call 911".
    3. The on-board system shall allow for covert voice monitoring from dispatch when initiated by the Dispatcher.
    4. If EA is initiated while data communications are not active, the Dispatcher shall hear a beep through the voice communications path. The Dispatcher will use the Motorola commands to communicate with the vehicle. When data communication is restored, the VCPU will transmit the normal silent alarm message to the CAD. This redundancy ensures that the message is acknowledged by the CAD, and the silent alarm incident is properly recorded for reporting purposes.
  - xx) The OIT shall display system error messages any time a system error is detected. Messages shall remain on the display until cleared by the operator.
  - yy) The OIT shall have a color display and soft key graphical and text based user interface, supporting all required system functions with an on-board user interface.

- zz) The OIT shall provide a complete user interface for operators to complete paperless pre-trip inspection data entry.
- aaa) The VCPU shall perform processing of the paperless pre-trip inspection data including transmission to the fixed-end CAD/AVL systems. Inspection items shall be equivalent to the current paper carbon forms used by MTA; samples can be provided upon request. All automatically detected faults and inspection items available in the VCPU shall be auto-filled in the paperless pre-trip data. The system shall detect whether the wheelchair ramp was cycled as part of the pre-trip inspection and generate a pre-trip exception flag if it was not.
- bbb) The control head shall provide a pre-trip form display at any time requested and it shall comply with all legal and safety requirements for operating a heavy duty vehicle, in the event of a law enforcement stop.
- ccc) The OIT shall provide GPS based real-time turn-by-turn driving directions for the assigned route and for deadheading to and from revenue service. Directions shall be given visually on the control head and audibly.
- ddd) This is needed to assist operator's who may not be completely familiar with the assigned trip and route. The operator shall be able to disable the audible for turn-by-turn directions independent of other volume and audio settings.
- eee) The VCPU shall include configurable power management functions, including power-off delay timer keyed to the bus master run switch. Power management shall provide tools for managing data communications, controls, and other on-board functions that might need to be activated when the master run switch is off.
- fff) This shall be optimized against battery capacity and the need to avoid excessive battery discharge and damage due to deep cycling.
- ggg) The on-board system shall provide a diagnostics capability to check internal functions as well as status of interfaced systems. Maintenance personnel shall be able to access diagnostic information from separate, password-protected screens, menus and sub-menus.

### **TS 83.3 On Board Video Surveillance System (OBVSS)**

- a) The On-Board Video Surveillance System (OBVSS) shall be comprised of a Digital Video Recording System (DVRS) consisting of a Digital Video Recording Unit (DVURU), a System Status Display (SSD), 11 digital video cameras, and associated peripheral and communication equipment. The OBVSS shall monitor and digitally record video images.
- b) The DVURU shall be March Networks 5412 or approved equal (Apollo RR-MRH12-2000 or Dedicated Micros AD/TV2/1612/A).
- c) All installations shall be consistent and uniform in quality, equipment, location, and wire routing.
- d) The OBVSS shall be compliant with the following standards:
  1. FCC CFR47 Part 15, EN55022, CISPR22 (radiated emissions)
  2. J1113-42, EN55022, CISPR22 (conducted emissions)
  3. J1113-21, J1113-26, EN50130-4 (radiated immunity)
  4. J1113-2, J1113-4, J1113-11, J1455, EN50130-4 (conducted immunity)
  5. J1113-12, EN50130-4 (electrical transient)
  6. EN50130-4: Surge (I/O signals)

7. J1113-13, EN50130-4 (electrostatic discharge)
  8. IEC 60529, IP65
  9. SAE J1455, 30g shock, test condition J. (MIL-STD202G, 213B)
  10. SAE J1455, 100g shock, test condition C. (MIL-STD202G)
  11. MIL-STD810D, random vibration
  12. SAE J2496 (cable, connectors, wiring, power, implementation)
  13. The OBVSS shall also be compliant, where applicable, to the SAE J1708 standard family.
- e) The following environmental performance requirements shall apply:
1. Operating temperature: -5°F to 115°F (-20°C to + 45°C)
  2. Storage temperature: -10°F to 150°F (-23°C to + 65°C).
- f) Power Requirements
1. The DVRS and system components shall have protective and filtering devices to protect the system and its memories from electrical fluctuations. The fluctuations may include, but not be limited to: over-voltage; under-voltage; transients; or power surges, dips or drop-outs.
  2. The DVRU shall have the capability of withstanding a momentary voltage drop to as low as 9 volts for less than 30 seconds. In addition, the DVRU shall withstand a momentary complete loss of input voltage for less than 2 seconds during events such as engine cold start or re-start. The DVRU shall not require re-initialization, re-log-ins, or lose internal data during such events. If internal batteries are used to accomplish these objectives, the batteries shall:
    - a. Be comprised of rugged non-spillable sealed-lead-acid (SLA) type cells and recognized components under UL 1989.
    - b. Support DVRU operation for up to 2 minutes.
    - c. Have a minimum 3-year life under normal operating conditions.
    - d. Be field replaceable.
  3. The DVRU shall have the capability of withstanding an over-voltage surge of 100 percent of the nominal applied voltage.
  4. The DVRU shall support standard vehicle 12-VDC and 24-VDC power input, in accordance with SAE J1455 specifications. The unit shall also supply current-limited and software-monitored DC power for each supported camera.
  5. The DVRU shall be connected directly to the vehicle “hot bus” through the protective device.
  6. Power source wiring shall be sized to meet specified requirements for unit start-up and normal operation and shall prevent unacceptable line voltage drop. The power supply shall be tested and the voltage levels at the DVRU input terminals shall be confirmed at the time of installation.
- g) Digital Video Recording System (DVRS)
1. The DVRS which shall consist of a DVRU, an SSD, and 11 digital video cameras, shall meet the following design criteria:

- a. Recording
  - 1) The system shall capture, digitize, authenticate, encrypt, compress, and record high-quality motion video images.
  - 2) The DVRS shall commence recording when the vehicle ignition is switched on (i.e., before engine start) and continue recording for a user configurable interval of one (1) to thirty (30) minutes after the vehicle ignition is switched off.
- b. Compression technique – the video compression protocol used by the DVRS unit shall be of a highly efficient and high quality design. The Contractor shall provide a written description to the MTA of the selected compression technique, together with sample video clips under various lighting conditions.
- c. Input/output ports – the following input/output ports shall be provided as a minimum:
  - 1) A minimum of twelve (12) ports for up to twelve (12) cameras (with appropriate camera power)
  - 2) One (1) port for possible use for an in-vehicle NTSC video monitor display
  - 3) Two (2) bi-directional half/duplex audio input/output ports with 12VDC/250mA device power included for possible use for internal microphones/loudspeakers.
  - 4) Six (6) two-state, dry contact current loop inputs
  - 5) One (1) port for reception of GPS signal from the on-board GPS unit (supplied by others)
  - 6) One (1) port for connection to a portable maintenance computer (laptop)
  - 7) One (1) port that shall provide a signal that appears on the System Status Display (SSD).
- d. GPS Capability:
  - 1) The DVRS shall receive reference Global Positioning Satellite (GPS) signals from the on-board GPS antenna/receiver (provided by others). The output of the GPS antenna/receiver is NMEA 0183.
  - 2) The DVRS shall provide means to integrate vehicle location, speed, direction and other telemetry data into the user interface, such that this data is synchronized with vehicle video image recorded in stored images, and has the capability to be used for displays of vehicle positioning.

- e. Accelerometer – the DVRS shall be provided with inputs from an accelerometer that shall be installed in a location approved by the Administration. The accelerometer shall meet the following minimum requirements:
  - 1) The same environmental specifications as the OBVSS
  - 2) The Impact Detection range shall be adjustable over the range of 2g to 15g
  - 3) Whenever the accelerometer detects and acceleration or deceleration beyond the selected level, the DVRU shall tag the activity as an “incident.”
  
- f. Wireless capabilities:
  - 1) The DVRS shall include a capability to connect to an on-board wireless router, which contains an integrated Wireless Access Point (WAP) based on the 802.11n specifications. The WAP provides upload and download capabilities to buses within the four MTA bus maintenance and storage yards using the existing 802.11n wireless systems installed at the yards. In turn, the yard 802-11n wireless system is connected to a Dedicated Virtual Private Network (DVPN) residing on the existing extensive fiber optic system used by the MTA. The DVPN connects to all MTA users of the DVRS.
  - 2) The DVRS shall include a capability to download video images using 802.11n wireless protocol. This capability, as a minimum, shall provide a capability of downloading 2 hours of stored video images in not more than 30 minutes.
  - 3) The manufacturer of the DRVS shall advise the MTA, in writing, of the maximum download speed, expressed in bits per second (bps), that the DVRS can provide in a configuration selected by the manufacturer.
  - 4) The DVRS shall include a capability to upload data messages by means of the established garage 802.11n wireless systems.
  - 5) The DVRS shall include a capability to download video images by means of this 802-11n wireless to a police vehicle equipped with a compatible WAP and associated laptop.
  - 6) In order to maintain system security integrity, the complete DVRS shall be certified by the MDOT as being acceptable for use with the state-wide communication system known as Network Maryland.
  
- g. Maintenance and performance monitoring:

- 1) The DVRS shall include the capability of monitoring, originating, and storing system maintenance and performance records.
- 2) The stored maintenance and performance records shall be available for transfer, by both end-of-day wireless transmissions or by a direct connection to a laptop computer. The Contractor shall provide MTA with the details of the scope and extent of this feature.

h. Other design criteria:

- 1) In the event of a component or function failure, the DVRS shall generate an alarm or similar signal that appears on the SSD.
- 2) The DVRS shall include a port to allow the connection and use of a portable computer (laptop), for maintenance purposes, or for transfer of stored images.
- 3) The DVRS shall allow remote maintenance monitoring, i.e., any failure of any component or function within the DVRS shall generate a message that is sent to a remote maintenance facility.

h) Digital Video Recording Unit (DVRU)

1. The DVRU shall have the following design criteria:

- a. The MTA prefers that the DVRU Operating System (OS) shall be UNIX based Linux or equivalent. In the event that some other form of OS is proposed, a full explanation of the advantages of the proposed system shall be provided to the MTA with the Technical Proposal. The OS shall include means to prevent system crashes and re-boots as a cause of power failures, and shall be permanently stored in a flash drive or equivalent device.
- b. The DVRU shall include a system clock with automatic winter and summer time adjustments, and yearly calendar adjustments. The clock battery shall have a minimum life of five (5) years.
- c. The DVRU chassis shall provide a field-removable hard-drive subsystem that supports one or more hard drives. The hard-drive subsystem shall have a self-contained shock and vibration isolation system, shall provide electro-mechanical protection to the mobile drive when the hard-drive subsystem is out of the DVRU, shall contain a temperature monitoring and control subsystem, shall contain a key-lock system for removal/insertion, and shall have a sealing mechanism to maintain IP65 ratings for the main DVRU chassis.
- d. The storage capacity of the removable hard-drive sub-system shall be sufficient to provide storage for ten cameras, with appropriate camera frame rates and image resolutions, in order to provide thirty (30) days of stored video images. The Contractor shall provide a calculation, based on a 20 hour day, 7 day/week, and the appropriate frame rates, resolution, and compression index required to achieve this goal.

- e. The DVRU shall have the capability of exchanging Self-Monitoring Analysis and Reporting Technology (SMART) messages with each internal hard drive, such that the recorder is able to detect and pre-emptively warn MTA personnel about an impending hard drive failure.
  - f. The DVRU shall include means to provide date and time stamps, indexing, and authentication of stored videos. The DVRU shall mark the recorded video during an external alarm or event activation. Unique marks shall be provided to provide searchable criteria for video viewing and verification of incidents.
  - g. The DVRU shall include a function to allow remote adjustment of all adjustable system operating parameters (such as camera frame rate).
  - h. The DVRU shall be mounted in each vehicle as determined by the vehicle design. The location shall be approved by the MTA.
  - i. DVRU shall accept 4-6 IP addressable cameras.
2. Recording capabilities:
- a. The DVRU shall have the capability of recording images from twelve (12) cameras. Eleven (11) cameras will be installed on the vehicle.
  - b. The DVRU shall have the capability to record frames up to the rate of 30 frames per second (fps) on each camera, with the capability to adjust each camera to between 1 fps to 30 fps. In normal operation, the rate shall be set at 8 fps for all cameras except the camera observing areas in front vehicle. This camera shall record at a rate of 15 fps.
  - c. The DVRU video images from each camera shall be recorded at rates between 1CIF to 4CIF resolution, with the resolution of each camera to be selected by the MTA.
3. Authenticity:
- a. Recorded video shall be provided with means to ensure that the authenticity of the recorded images is established and maintained throughout the entire process of obtaining the images, recording and duplicating the images, and displaying the images in accordance with established legal procedures.
  - b. The DVRU shall secure recorded video with a Secure Hash Technology and through the Viewing Software have the ability to check the authentication seal of the video to ensure it has not been tampered with.
  - c. It shall not be possible to change or modify the vehicle number and/or location data encoded on recorded video under any circumstances.
4. Obstructed or blocked images – the DVRU shall have the capability of recognizing an obstruction or a blocked or missing video image from any on-board camera, and shall have the capability of reporting such image errors to a remote maintenance facility by a data transmission instituted as soon as wireless connectivity has been established with the bus.

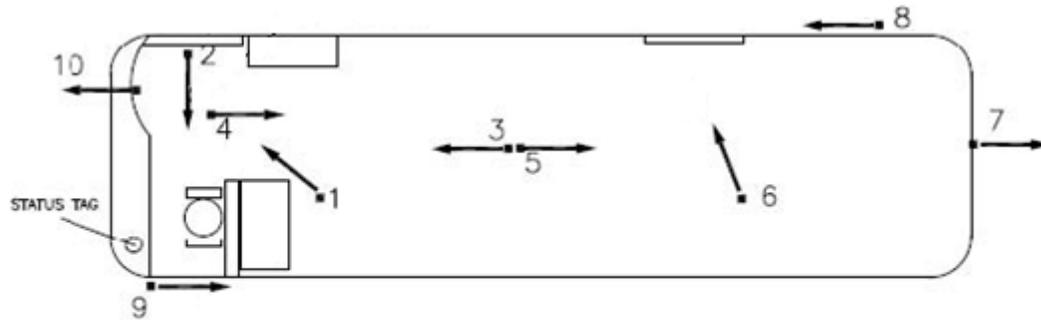
i) Video Cameras

The following video camera features are mandatory:

1. All video cameras shall be from the same manufacturer. Subject to MTA approval, different models or mounting styles may be used if appropriate justification is provided to the MTA. All video cameras shall be infra-red illuminated
2. The video cameras shall be supplied as the latest model available from the manufacturer selected by the Contractor, at the time of placing the order for the cameras.
3. The video cameras and housings and mountings shall be waterproof (IP65), shall withstand high impacts, be vandal-proof, and compact to allow unobtrusive mounting inside and outside the vehicle.
4. The external cameras shall withstand the water pressures encountered during high-velocity wash-down procedures, including water pressures up to 80 psi.
5. The external cameras shall be mounted on reinforced or protective shields to prevent camera damage from tree branches. This particularly applies to curb-side cameras.
6. The external cameras shall be fitted with tempered glass lenses, and shall be securely mounted by at least four (4) mounting screws to the vehicle structure.
7. Where practicable, each camera shall be sited such that the camera view shall overlap with one or more other camera views.
8. The camera frame rate may be set, by remote means, to any number of frames per second (fps) between 1 fps to 30 fps.
9. The camera image size may be set, by remote means, at any range between 1 CIF resolution to 4 CIF resolution.
10. The minimal acceptable light sensitivity shall be:
  - a. Color: 30 IRE 0.3 lux (F1.2)
  - b. B&W: 30 IRE 0.1 lux (F1.2)
  - c. Data stating the actual light sensitivities of the selected cameras shall be made available to the MTA for approval.
11. The minimal acceptable signal to noise ratio of the camera shall be 50 dB. The actual signal to noise level of the selected cameras shall be made available to the MTA for approval.
12. The cameras shall contain: automatic day/night Color/BW switching, automatic exposure control, automatic iris, built-in IR lights and other features such that the camera provides clear images under varying light and environmental conditions.
13. The cameras shall allow the MTA to adjust, by remote means, operating parameters such as camera resolution, compression ratio, fps, and similar camera operating features.
14. The MTA prefers that the cameras be IP addressable.
15. All camera installations shall be consistent and uniform in quality, equipment, location, and wire routing to the MTA's approved first installation.

All actual locations for the cameras shall be approved by the MTA:

**Figure 1  
Camera Locations**



PROVISIONAL CAMERA LAYOUT FOR REFERENCE ONLY  
FINAL LAYOUT SUBJECT TO MTA APPROVAL

Camera #	Location
1	– Ceiling mounted, with a view towards the front door.
– 2	– Mounted above the inside of the front door, with a view towards the fare box and driver.
– 3	– Ceiling mounted, at the centre of the bus, with a view towards the front seats.
– 4	– Ceiling mounted, operator’s compartment, with a view towards the rear seats.
– 5	– Ceiling mounted, center of bus, with a view towards the rear seats.
– 6	– Ceiling mounted, with a view towards the rear door.
– 7	– Horizontally mounted outside the rear of the bus, view to the rear.
– 8	– Mounted on the curb side, rear of the bus, view to the front
– 9	– Mounted on the street side, front of the bus, view to the rear
– 10	– Mounted inside the front window, with the view to the front
– 11	– Mounted above the operator’s seat, with view to entrance door

Camera mounting requirements shall include the following:

1. Hardware shall be tamper-proof and shall provide a firm and fixed attachment to the cameras. Each camera shall be attached to the vehicle with not less than three (3) attachment points.
2. Once each camera is aimed and set in position, the mounting shall permanently secure the camera in place with no requirement for any periodic or random readjustment of the mounting fasteners.
3. The Contractor shall provide a flat surface for mounting exterior cameras and a reinforced plate for securing the cameras.
4. The Contractor shall install the cameras with riv-nuts (not nuts and bolts) using tamper-proof screws, such that the cameras can be removed without moving headliner or bus panels.

5. Mounting hardware shall be of stainless steel fabrication, or as otherwise appropriate to the mounting surface. Electrolytic and rust corrosion shall be prevented.

j) System Status Display (SSD)

1. The SSD unit shall be located in an area adjacent to and in view of the vehicle operator. The location shall be approved by the MTA for each vehicle type or model.
2. The SSD shall have a continuous display showing that the DVRU is on-line.
3. The SSD shall display an alarm in the event that the removable hard drive has been removed, or the DVRU system is not working properly.
4. Associated with, or integral to the SSD display, shall be a button clearly marked "Record." Operation of this button shall illuminate the button, and automatically flag the recorded video as an "incident."
5. The button shall remain lit until operated again, when the button shall be unlit. SSD shall report individual camera obstructions.

k) Docking Station

The Contractor shall provide five (5) Hard Drive Docking Stations and an associated software program that will allow the MTA to insert removable hard drives, extract and copy video files from the hard drives, and prove the authenticity of recorded images. Each Hard Drive Docking Station shall be provided with Viewing Software to MTA enable operators to review stored images, and make appropriate copies.

l) Provided Software

The MTA shall be provided with all the software required to configure, operate, and maintain the OBVSS. The Contractor shall provide 5 copies (on CDs) of the required software in addition to any software loaded during the installation process. The following is a minimum list of the software functions that shall be provided:

1. Administrator software
2. DVR configuration software (IP address, serial numbers, etc.)
3. Maintenance monitoring software. (fault records, repairs, etc.)
4. Software Update tools
5. Data download/upload management
6. DVR recording software (construct video disks)
7. DVR viewer software (restrict playing of video disks) – the DVR view software shall prevent unauthorized users from viewing video disks)
8. DVR player software for external users – authorized users must configure the viewing PC with the DVR player software, provided by the MTA, prior to viewing video files.

m) System Reliability

1. The entire DVRS shall be of high reliability, expressed in terms of the minimum failures experienced over any one calendar year. The MTA has established that a failure rate of 2 percent per year for any single item of the DVRS is desirable, and a

failure rate of 5 percent is the maximum acceptable failure rate. For example, if 100 hard drives are used, then the failure rate shall not exceed five (5) per year.

2. The vendor shall certify the system presented for testing is exact in every detail to the system offered in their bid package.
3. The DVRS manufacturer shall supply the MTA with appropriate evidence that the maximum acceptable 5% failure rate is achievable with their product.
4. In order to ascertain the actual equipment failure rate, the MTA will require the selected vendor to provide and install one (1) DVRU unit with one (1) installed camera on an MTA bus, and the bus will then be placed into revenue service for one month within 60 days from NTP. This test period is called the "30- Day Operational Test" (30DOT).
5. In accordance with the statistical 5 percent maximum failure rate, there shall be no failures of the DVRU and camera during the 30DOT.
6. As appropriate, the MTA may ask selected vendors to meet a specified installation date and start date for the 30DOT.

n) Equipment Mounting

1. The DVRU shall be installed at or near the bottom of the bus equipment cabinet.
2. The DVRU shall be mounted on the slide-out tray provided as part of the bus equipment cabinet.
3. The DVRU shall be attached to the slide-out tray by stainless steel riv-nut fasteners (or equivalent) of a size and quantity sufficient to withstand bus movements. The RIV-NUT bolts shall be hex-head such that a standard nut-driver tool can be used. The Contractor shall specify the tightness (or torque) required to install the bolt securely.
4. The DVRU wiring harness shall be firmly attached to the equipment cabinet, with a maintenance loop allowing the DVR to be pulled forward for maintenance. The end of the maintenance loop shall be firmly attached to the DVRU chassis.
5. After the DVRU is installed on the tray, the tray shall be firmly and securely locked in place. If appropriate and feasible, closing the cabinet access door shall also press a non-rigid bumper onto the front end of the tray. By these actions, the tray, and also the DVRU shall be firmly locked in place.

o) Wiring

1. All wiring runs shall be continuous.
2. Wires and cables shall be color-coded and tagged at the entrance to the DVRS.
3. All wires and cables shall be secured and protected against movement, chafing, and contact with any conductive, sharp, or abrasive objects.
4. The Contractor shall provide a minimum of #10 AWG wire to supply power and ground leads, and #14 AWG wire for ignition lead.
5. Coaxial or Cat-5 cables shall be color-coded and identified at the plugs at each end.
6. Fuses or circuit breakers shall protect all power circuits. Circuit breakers shall be manually re-set.

7. The MTA prefers that all cables attached to DVRS cameras and the DVRU shall utilize plugs and sockets such that cable movements will not cause the internal wire connectors to work free. Coaxial cables shall be solid core and be terminated in plugs and sockets.
8. The main power circuit from the vehicle to the DVRS shall be protected by a circuit breaker provided by the vehicle manufacturer, and of the same type as used for similar equipment power connections.
9. All circuit breakers and fuses shall be permanently labeled to show their functions.

p) Installation

1. The DVRS installation shall be in accordance with all national, state, and local codes and regulations in effect.
2. Camera system shall be wired so that it has access to power after the bus has been turned off so that downloads can be completed.
3. The Contractor shall establish quality control standards, and provide an effective quality control procedure during the installation phase to ensure compliance with the quality standards.
4. All installations will be checked by the MTA Resident Inspector, and will be accepted only upon resolution of any problems found by the MTA Resident Inspector during or after each installation.
5. All DVRS equipment shall be mounted in such a way to allow easy maintenance and removal.
6. All DVRS equipment shall be rigidly mounted to prevent movement and rattle during vehicle operation.
7. Locations of the cameras and equipment enclosures shall be approved by the MTA.
8. The Contractor shall establish an installation and maintenance spreadsheet in an MS Excel format. The database shall include as a minimum but not be limited to: vehicle number, vehicle type, vehicle division, equipment models and serial numbers, camera locations, DVRU location, SSD location, tests performed, test results, date of testing, installation details, re-work details, MTA acceptance initials and dates, fields to track on-going activities and blank fields for MTA use. The installation and maintenance database shall be provided to the MTA in MS Excel format.
9. One set of final as-built drawings for each vehicle type shall be provided by the Contractor in MicroStation format.
10. One set of final as-built documentation for each vehicle type shall be provided by the Contractor in .pdf file format.

**DVRS Warranty**

The rights and remedies of the MTA under this Part are not intended to be exclusive and shall not preclude the exercise of any other rights or remedies provided for in this specification, or by any subsequent contract, or by law or otherwise.

The Contractor shall warrant that all goods supplied, systems, equipment, designs, and work covered by this Scope of Work and subsequent contract shall be satisfactory for its intended purpose, shall

conform to and perform as called for in the Contract requirements specifications and shall be free from all defects and faulty materials and workmanship. Any goods supplied, systems, equipment, designs, or work found to be defective within the time specified below shall be repaired, remedied, or replaced, hereinafter called “corrective work”, by the Contractor, free of all charges including transportation.

The warranty period for all Contractor-provided goods supplied, systems, and equipment except spare parts, shall extend to 24 months after Final Acceptance.

The warranty period for spare parts shall extend for 24 months from the placement of each spare part into regular service.

The Contractor shall provide the formal signed warranty(s) no later than 90 days after the placement into operation of the first DVRS unit.

Replacement parts and repairs provided, pursuant to corrective work hereunder, shall be subject to prior approval by the MTA and shall be tendered and performed in the same manner and extent as items originally delivered in accordance with this SOW.

#### **DVRS Technical Manuals**

Manuals shall be provided in accordance with the following:

- a) Manufacturer's standard manuals will be acceptable, subject to the approval of the MTA. Each manual must contain specific identification of products by model and part and number supplied under this contract. A detailed list of manuals to be provided shall be submitted.
- b) Documentation shall be provided for all system software, utilities, compilers, assemblers, linkers, editors, maintenance software, and other packages used to develop, debug and load software.
- c) Revisions to any manual shall be reflected in a revision index that is part of each handbook or manual and is revised according to a revision control method approved by the MTA. Revisions shall be made for all design changes, retrofits, and errors.
- d) Maintenance and Repair Manuals: These manuals shall provide sufficient information, including schematics, layout drawings, test and alignment procedures, inter-cabling diagrams, and parts lists, to permit quick and efficient maintenance and repair of the equipment by a qualified technician.
- e) Manual Types and Quantity: The Contractor shall supply complete documentation of the entire system provided. The Table 6 indicates the level and quantities required. In addition to hard copy versions of the manuals, provide five (5) CD-R copies in Microsoft Word 2007 format of every manual supplied.

Manuals shall be provided within 30 days of the delivery of the first DVRS

TABLE 6

Manual Types and Quantities

Item	Document Title or Description	Quantity Required
1	– Operator Manual (quick guide)	– 100
– 2	– Operations and Maintenance Manual	– 10
– 3	– Other Manuals (as appropriate)	– 10

**DVRS Training**

The Contractor shall provide a program to train MTA personnel in all aspects of the operation and maintenance (O&M) of the systems and equipment provided, as follows:

- a) Design the program such that the MTA may assume control and accomplishment of the training.
- b) Submit five (5) complete sets of printed training program materials on two CDs and five complete hard copies. In addition, provide copies required for implementation of the training program. For example, if there are eight (8) in the class, then supply thirteen (13) hard copies and two (2) CD-Rs in Microsoft Word 2000 format.
- c) All training course program materials, including training manuals and audio/video tapes or disks, shall become the property of the MTA and for use by the MTA for internal training purposes.

Table 7 lists the required training courses.

**TABLE 7**

No.	Course Title	Description	Recipients, Class Size/ Sessions/Hours
1	Management	High level system overview	MTA senior personnel: 5/1/4
2	Operator	Operations (train the trainer)	Operators, MTA training staff: 5/4/4 or as required (see Note 1).
3	System Administrator	Host administration, Statistics and data capabilities	System Administrator: 2/2/8
4	Maintenance	Technician training	Technicians: 4/2/8
5	Docking Station	Operation (train the trainer)	TIG Operators: 4/2/4

Note 1 The operator training should be based on a course assuming that the operators know nothing about the operation of the CCTV Surveillance system.

Training course delivery: All training shall be completed no later than thirty (30) days prior to the commencement of operation of the first equipped vehicle.

**DVRS Spare Components and Parts**

- a) Parts List: Provide a complete Parts Cross Reference List of all parts and components used in the equipment delivered in accordance with this contract. This list shall include as a minimum, equipment manufacturers part number and part name, and as appropriate the part number of the Original Equipment Manufacturer (OEM) part or component, in addition the part unit price. This information shall be furnished no later than ninety (90) days after the placement into operation of the first DVRS unit.
- b) Provide an Initial Spare Parts kit as follows with each bus delivery:
  - For each individual internal camera type (complete): five (5) units
  - For each individual external camera type (complete): five (5) units.
  - DVRU units (complete): five (5) units)
  - DVRU Hard Disk Drive Removable Cartridges: ten (10).
- c) Recommended Parts: In addition to the deliverable equipment and initial spare parts required to fully implement the system, the Contractor shall identify all recommended on-site spare

parts required to fully support the entire system over the long term, and after the warranty period. This information shall be furnished prior to Final Acceptance of the system. The MTA reserves the right to purchase any, all or none of the identified replacement parts at the published spare parts price list as current at the time of placing the spare parts order.

### **DVRS Tools**

The contractor shall supply the MTA with a tool kit tailored specifically for the maintenance activities associated with the OBVSS. The following is an example of a satisfactory list of tools, and the contractor may add or amend this list according to the specific requirements of the OBVSS system that is being provided. Six maintenance tool kits shall be provided as shown in Table 8.

**TABLE 8**

<b>Item</b>	<b>Description</b>	<b>Remarks</b>
1	– Coaxial cable Repair kit, containing tools to strip/prepare coaxial cables, assemble/crimp connectors.	– For RG-179. If RG 179 is not used, provide details of suggested coaxial cable type Note: the use of BNC type connectors is discouraged
– 2	– Riv-Nut inserts and bolts, Crimp tool and Mandrel. With appropriate hand ratchet tool and sockets.	–
– 3	– Power and other cable plug repair kit, containing tools to strip/prepare power and signal cables, assemble plugs/sockets.	–
– 4	– Torx or similar special tools for special screws	–
– 5	– Ethernet RJ-45 in-line coupler.	–
– 6	– Other recommended tools	–

### **TS 83.4 Public Address System**

An Americans With Disabilities Act (ADA)-compliant digital Public Address (PA) system shall be installed that enables the operator to address passengers either inside or outside the bus or both. The announcements shall be generated through a hands-free microphone system. The system shall be capable of recording announcements of up to 30 seconds in length. Announcements shall be initiated by depressing a foot switch in a MTA approved location near the turn signal switches. Playback shall be initiated immediately upon release of the foot switch. The system shall incorporate active noise cancellation to ensure minimum background noise and feedback.

Inside speakers shall broadcast, in a clear tone to enable announcements to be clearly perceived from all seat positions at approximately the same volume level. A speaker shall be provided so announcements can be clearly heard by passengers outside the bus near the front door. operator controls shall include an “Internal,” “External,” and “Both” speaker select switch; independent volume controls for internal and external speakers; and “External Record” and “Mute Functions.” Operator controls shall be located on the device to ensure ease of use and to maximize operator safety. LEDs shall be provided to indicate speaker selection, record, and mute status.

The PA system shall include the hands-free microphone, PA amplifiers(s), power filtering, noise filtering, and all required electronics for all external interfaces. The system shall be packaged in a single tamper-resistant, high-impact polymer housing that shall be mounted to the streetside A-pillar within easy reach of the operator. The PA system shall interface to the VCPU system to allow sharing

of the inside and outside speakers and shall be wired to act as a back up to the VCPU PA System in the event of a failure.

#### TS 83.4.1 Speakers

**The MTA currently uses TCB interior loudspeakers and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Six (6) interior loudspeakers shall be provided, semi-flush mounted, on alternate sides of the bus passenger compartment, and installed with proper phasing. Total impedance seen at the input connecting end shall be 8 Ohms. Mounting shall be accomplished with riv-nuts and machine screws. Speaker grilles shall be black and mounted using Torx screws.

**The MTA currently uses an REI exterior loudspeaker, part number 230058 and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

One (1) exterior loudspeaker shall be provided, semi-flush mounted, on top of the front door and installed with proper phasing. Total impedance seen at the input connecting end shall be 8 Ohms. Mounting shall be accomplished with riv-nuts and machine screws. Exterior speakers shall be insulated to minimize the sound leak to passenger compartment and the cover baffled to prevent water damage / intrusion.

#### TS 83.5 Automatic Passenger Counter (APC)

a) Integrated within the VCPU, the APC system shall collect raw and correlated on-board passenger count data. The APC system shall consist of APC sensors at each doorway and VCPU-resident application software and data storage. The system shall transmit APC data off-board via the router automatically as part of daily operations.

b) The APC system shall provide full state-of-the-art functionality and shall be integrated into the existing MTA operations and maintenance environment and network architecture. The system shall provide a comprehensive suite of APC data collection, management, analysis, and reporting capabilities.

c) APC Configuration

Passenger count sensors shall be installed at the front and rear doors and interface with the VCPU. The sensors shall sense and accurately count passenger boardings and alightings simultaneously. The mounting location and mounting provisions shall be optimized for passenger count accuracy, reliability, and maintainability, and shall be subject to MTA approval.

d) APC Minimum Performance and Accuracy Requirements

1. The accumulated count of both boarding and alighting passengers shall be within 5% for each 100 consecutive boarding and alighting passengers.
2. For 85% of all stops, the boarding and alighting counts shall be exact when compared to actual. For 90% of the stops, the counts shall be within 1 of actual. For 97% of the stops, the counts shall be within 2 of actual. This will include stops for which there was no observed boarding or alighting activity.
3. 95% of the time, the APC system shall correctly identify a bus stop. 97% of the time, APC shall correctly identify a bus stop or an adjacent bus stop for the bus run after correlation.

4. The system shall store and retain 14 days of recorded APC data.
  5. APC data shall be available for immediate transfer to the database as needed.
- e) Minimum Required APC Features and Functions
1. The APC system shall have the ability to effectively manage the large volume of data typically generated by such systems.
  2. The system shall include configurable validity checks, to eliminate, reduce, and mitigate erroneous data. Validity checks and filter shall be run automatically, semi-automatically, or manually.
  3. The system shall automatically correlate raw passenger count data against all available and relevant data such as route, trip, latitude and longitude, stop ID, stop name, wheelchair deployment, time of day, scheduled time, RSA status, day of week, fare class, fare collected, operator, and bus number. The system shall take into account the status of the bus operation such as in-service, out-of-service, on-route, off-route, detoured, and interlined. Data shall be correlated accordingly.
  4. Based on the raw passenger count data, the system shall calculate and record the number of passengers by stop-to-stop segment, trip, and route. Distance traveled for each segment shall also be calculated and recorded.
  5. The system shall record all door open/close cycles for each stop with a time stamp. The first door open shall be correlated as the arrival and the last door close as the departure. Based on this the dwell time at each stop shall be calculated and recorded. Counts of door open and close cycles at unscheduled locations or detours shall also be recorded.
  6. The system shall record the number of wheelchair ramp cycles and wheelchair passenger boarding and alighting at each stop the bus makes for each bus run and trip on a line.
  7. The system shall provide a comprehensive suite of APC data collection, management, analysis and reporting capabilities.
  8. The system shall include a wide range of standard tabular and graphical reports, both summary and detailed, including the ability to chart APC data on a map. The APC reporting shall be included in Management Reporting System section requirements detailed below.
  9. The APC shall produce reports that are integrated with Fare Box data by route, and/or block, and/or stop. The user shall be able to create reports on-demand of passenger counts by time period, and/or block, and/or route, and/or stop, and/or route segment. APC data shall be automatically exported and imported to Trapeze Plan on a user scheduled basis. Further reporting requirements are detailed in Section 3.014.
  10. The system shall export formatted APC data to the existing MTA Trapeze FX Plan module via the MTA network infrastructure.
  11. The system shall produce passenger related National Transit Database (NTD) data as required by the FTA, such as revenue passenger miles.

#### **TS 83.5.1 APC Sensors**

Sensors shall be mounted in the optimal locations, subject to MTA approval, to detect passenger boarding's and alightings at each doorway but shall not be mounted on the floor or steps. The

Contractor shall submit, for MTA approval, calculations showing expected accuracy of the APC in determining counts of passengers

## TS 83.6 Radio Handset and Control System

### TS 83.6.1 Operators Speaker

Each bus shall have a recessed speaker in the ceiling panel above the operator. This speaker shall be the same component used for the speakers in the passenger compartment. It shall have 8 Ohms of impedance.

### TS 83.6.2 Handset

The Contractor will install a handset for the operator's use.

### TS 83.6.3 Emergency Alarm

The Contractor shall install an emergency alarm that is accessible to the operator but hidden from view.

## TS 83.7 Mobile Radio System

Procure and install Motorola APX 7500 Multiband Radios.

Integrate the Motorola APX 7500 RF Radio for voice communications.

Program the radios to work with MTA's existing 490 MHz trunked radio system.

Include all design, engineering, wiring and cabling, antenna (if required), power, testing, and programming required for successful installation and operation in proposed system.

Provide manuals and training for maintenance and operation.

The voice and data radio system must be compatible with the MTA's current trunked radio system. The MRS shall consist of the following, as shown in Table 9.

**TABLE 9**

<b>Item</b>
Handset
– Handset cable
– Handset Mount
– Radio Equipment Tray (Including)
– Radio trunnion fixturing
– Fuses
– Power Filter
– Odometer Interface Unit

\*Part numbers and cable lengths may vary and will be determined during the pre-production meeting. The Contractor shall supply preliminary installation drawings prior to the pre-production meeting.

## TS 83.8 Automatic Voice Annunciation System (AVA)

- a) An Americans with Disabilities Act (ADA) compliant Automatic Voice and Visual Annunciation System shall be provided that automatically provides audible and visual passenger information inside the bus and audible passenger information outside the bus.

- b) The AVA provided shall be an integrated component of the on-board system, requiring no additional operator interface, and shall interface to the installed LED signs and speakers.
- c) The system shall record announcements of up to 30 seconds in length. The system shall incorporate active noise cancellation to ensure minimum background noise and feedback. The system shall provide the alternative of producing announcements via a computer generated, natural sounding human voice from text data supplied to the system. Operator controls shall include an “Internal,” “External,” and “Both” speaker select switch; independent volume controls for internal and external speakers; and “External Record” and “Mute” functions. Operator controls shall be located on the OIT to ensure ease of use and to maximize Operator safety. LEDs shall be provided to indicate speaker selection, record, and mute status.
- d) The system shall provide a customer service message window allowing the BOCC Dispatcher to send public service messages to bus operators for them to announce to passengers. Information to be sent shall include public service message description and purpose, effected routes, start and end locations, start and end dates/times, etc. The Dispatcher shall be able to specify the transit day and start and end date/time that the public service message will be stored and forwarded.
- e) The system shall provide the ability for dispatch to be able to make PA announcements from BOCC utilizing the radio or p data messages.
- f) Existing signs shall be J1708 compatible.
- g) The integrated AVA sub-system shall support but not be limited to the following standard feature and functions:
  1. Automated interior next-stop audible and visual announcements for all stops based upon vehicle location along a stored schedule and route to aid the transit authority in complying with ADA requirements found in 49CFR Parts 37.167 and 38.35
  2. Automated interior audible and visual transfer announcements.
  3. Interior audible and visual “Stop Requested” announcement.
  4. Automated audio and visual public service announcements, at programmable intervals, to riders on-board and audio to those waiting curbside. Public service announcement shall not over-ride automated stop announcements, which shall be accomplished by prioritization control of P/A announcement and automated AVA announcements.
  5. Prioritization and sequencing control of PA announcements and AVA announcements.
- h) The system shall use a human-sounding voice for announcing route and stop information. Robotic sounding voices shall not be used.
- i) The system shall provide for a microphone input for driver initiated announcements both inside and outside the vehicle.
- j) For automatic announcements, the system shall automatically adjust the audio output level for ambient noise levels both inside and outside the vehicle.
- k) The system shall support automatic volume control of both interior and exterior speakers.
- l) The integrated AVA sub-system shall support remote updates of destination and announcement information via the WLAN.

- m) The Contractor shall supply all equipment, wiring, necessary appurtenances, installation, configuration and interfacing to provide a complete and integrated AVA sub-system.
- n) The amount and rate of automatic volume change shall be programmable by the system administrator via parameters accessible via on-board system.

### TS 83.9 Automatic Vehicle Monitoring (AVM)

Integrated within the VCPU, the AVM system shall collect a comprehensive set of on-board data related to vehicle health, maintenance, and alarms (critical and non-critical, as defined by the system administrator). The AVM system shall consist of VCPU interfaces to the existing Vansco multiplex system, SAE J1939 network interfaces, SAE J1708 information and drive train network interfaces, and discrete and other interfaces. MTA Buses requiring interface under this contract all have Cummings Engines. The system shall transmit AVM data off-board via the router automatically as part of daily operations and shall transmit critical alarms in real-time.

AVM data shall be continuously acquired and stored on-board. The VCPU shall utilize compression algorithms to minimize stored data while still capturing real changes of state and data change thresholds. Data shall be stored for download via existing WLAN to the Contractor-provided storage database for further analysis and processing. The table below indicates minimum data items to be acquired and stored. The AVM system shall collect at a minimum 500 separate raw data elements; the "Approx. No. of Data Elements" column indicates the approximate number to actually be populated in the bus implementation. To fulfill this, the Contractor shall propose a listing of data elements to be populated for MTA's approval. Data collection parameters shall include collection of the count, minimum, maximum, and average of values observed during configurable capture time periods.

On-Board System/Component	Approx. No. of Data Elements	Example Data Elements
Engine	- 170	- Performance Data, Ambient Air Temperature, Warning Indicator Lamp Status, Battery Voltage, Engine Coolant Temperature, Engine Oil Pressure, Total Engine Hours, Total Fuel Used, Total Mileage, Trip Fuel, Trip Miles
- Transmission	- 10	- Performance Data, Warning Indicator Lamps Status, Hydraulic Retarder Oil Temperature, Retarder Status, Transmission Oil Level High/Low, Transmission Oil Temperature
- ABS/Other Brake Signal	- 175	- Brake Stroke - Axle 1 Left - Over-Stroke, 10% Brake Lining Remaining - Axle 1 Left, Brake Stroke - Axle 1 Right - Dragging Brake, Brake Monitor Pressure Transducer Fault, Change Of Wheel Circumference Detected, Data Communication Faults
- Destination Sign System	- 4	- Destination Sign Fault
- Fare Box	- 10	- Fare Box Fault, Alarm Status
- On-Board Video Surveillance System	- 4	- Accelerometer Triggered, Record Incident Triggered

<ul style="list-style-type: none"> <li>- Multiplex/Warning Light/Discrete/Other Signals</li> </ul>	<ul style="list-style-type: none"> <li>- 30</li> </ul>	<ul style="list-style-type: none"> <li>- Air Conditioning Failed, Fire, Fire Suppression Activated/Fault, Wheelchair Ramp Deployed/Stowed, Wheelchair Ramp Fault, Emissions System Fault/Temp., External/Interior Light Faults, Engine Coolant Low, Alternator Charging Fault, Odometer, Fuel Leak, Check Engine, Hot Engine, Low Oil, Hydraulic Fault, HVAC Fault, Low Air, Wiper Motor Fault, Safety/Restraint Fault, J1708 and Other Comms Faults, Other Multiplex Alarms</li> </ul>
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The VCPU AVM features shall include but not be limited to:

- a) The VCPU shall capture information for all faults by the on-board systems and components and stamp each fault with date and time.
- b) The VCPU shall capture aggregated operational performance data from the on-board systems. The fixed end AVM system shall provide state-of-the-art display, analysis, and reporting capabilities for all of the AVM data.
- c) It shall be possible to create unique faults triggered by operational performance data points crossing user-defined high/low thresholds.
- d) A self-diagnostic “Roll-Call” feature shall be included to verify active communication between all monitored sub-systems and components and the VCPU.
- e) The AVM system shall interrogate the discrete signals for all diagnostic lights, which shall indicate the operational status of the bus including: fire, check engine, hot engine, low coolant, low oil, generator stop, hydraulic, air conditioning, low air pressure, anti-skid braking, brake fault, and fire suppression system fault.
- f) The AVM system shall perform automatic communication of vehicle ID, delta mileage, delta engine hours, all fault codes, and any other collected operational performance data to the fixed end AVM system. It shall also be possible for a fixed end CAD/AVL user to interrogate selected bus(es) at any time for available data.
- g) The fixed end AVM system shall automatically generate alert notifications based on configurable parameters. Configurable alert destinations shall include email addresses, mobile phones, and pagers.
- h) The AVM system shall automatically distribute periodic daily/weekly/monthly reports via email in a configurable manner. All AVM reports shall be available to users of the AVM system and their delegates. Reports shall be made available on a pre-determined, schedulable, and repeatable basis.
- i) The AVM system shall be integrated with the paperless pre-trip inspection function required under this contract. All automatically detected faults and inspection items available in the VCPU, such as tail light fault, shall be auto-filled in the paperless pre-trip data.

A subset of alarms shall be designated as critical by the system administrator, and these critical alarms shall be annunciated as an event to the CAD/AVL fixed end in real time, regardless of the bus’ location within or outside of the bus division facility. Critical alarms shall also be annunciated to the AVL fixed end in real time. Critical alarm annunciations shall contain bus number, location, and other information that may be useful to street supervisors and on-street maintenance and other

responders. The system shall allow for at least 30 configurable critical alarms, from the available data, including but not limited to the following:

- Engine Battery Voltage
- Engine Coolant Temperature High
- Engine Oil Pressure High/Low
- Transmission Level Low
- Transmission Temperature High
- Brakes Dragging
- Faulty Brakes
- Fire Indication
- DVR Accelerometer/Record Trigger
- Low Fuel
- Windshield Wiper Motor Problem
- Farebox Fault
- Excessive Passenger Count
- Safety Feature Fault
- Engine Coolant Low
- Fuel Leak
- AC Failed
- Radiator Fan Failure
- Hybrid System Warning Status

Critical alarms may also include alarms from other on-board systems. The system shall allow the MTA's System Administrator or their delegate to specify which Alarms are critical and which are not critical. A method of displaying and managing alarms based on their critical or not critical nature shall be provided. A filter for displaying and managing alarms based on their critical or not critical nature shall be provided. Likewise, the user shall be able to create alarm groups for the purpose of display on the user console.

The CAD/AVL system shall be able to display alarms filtered by severity level determined by each user or by a group of users (ex. Dispatchers, Supervisors, Police). This applies to alarms not just those listed in this section.

## **TS 83.10 Pedestrian / Bus Warning System**

The bus shall be equipped with a warning system that provides an audible message warning pedestrians that the bus is turning. The system shall sense when the steering of the bus is being turned to a preset angle indicating the bus is making a turn. When reaching the adjustable steering angle the system shall announce an external voice message and illuminate guide way lighting.

Speakers shall be located on both the curb and street side of the bus. Speaker shall be replaceable and external louvers provided that protect the speakers from the elements. The system shall sense the ambient noise level and adjust the audible warning to a level 5 decibels above. The system shall also enact the external guide way lighting for the direction the bus is turning.

The system shall not require operator intervention to activate and shall shut off automatically once the steering is returned past the preset point. The preset point shall be adjustable by qualified and trained technicians.

The system shall interface with the GPS, AVM and On board video surveillance system

## **TS 83.11 Other Intelligent Onboard Electronics**

The Contractor must work with the selected suppliers to ensure that the equipment, cabling and software supplied meets the MTA's requirements. The Contractor shall assure that all supplied buses are equipped with the same revision software for all components. During the course of this contract, should improved versions of any software or operating systems become available, a listing and description of the changes must be submitted to the MTA for approval complete with a procedure for updating any previously provided. A listing of all software part number and revision shall be identified for each component that is software controlled.

### **TS 83.11.1 Electronics Cabinet (EC)**

A full-sized electronics cabinet (EC) shall be securely mounted on top of the streetside front wheelhouse to accommodate the Intelligent Onboard Electronics, except the farebox, operator control units and bus multiplex electrical control system. At a minimum, the cabinet shall meet NEMA 1 standards, be designed built to last the life of the bus with minimal repair and without replacement. The cabinet design shall require MTA review and approval.

The electronics cabinet shall be splash-proof when the service door(s) is secured and shall be made of a minimum of 18-gauge stainless steel or 12-gauge 5052 H32 aluminum construction, suitably reinforced. The cabinet shall be painted with black polyurethane enamel exterior and white interior. Access to the cabinet shall be from lockable-hinged doors opening into the passenger aisle area that includes a sturdy hold-open device. The cabinet door shall have a recessed paddle latches and GM key lock with four keys per vehicle. There shall be no sharp edges or corners on the enclosures. Inside of the cabinet shall be illuminated using two (2) 12" LED strip lights controlled by an inside the cabinet toggle switch. The electronics cabinet shall provide adequate ventilation for 1000 watts of equipment operating within the range of -20°F to +140°F.

The cabinet shall provide a minimum of 48 inches of free height that shall accommodate four heavy duty shelves of 19-inch electronic racks of 18-inch depth. These shelves shall consist of modular slide out trays that are removable and can be repositioned to accommodate changes in equipment position as needed. The slide out trays shall incorporate heavy-duty slide or roller mechanism to support a minimum of 150 lbs. of loading and shall be able to withstand the normal shock and vibration, (under full load) experienced in MTA revenue service, without damage to

the slide or roller mechanisms. The trays shall lock in both the in and out positions and resilient material shall be used to prevent the trays from moving when the cabinet is closed.

Power provisions shall be made for the radio and electronics inside the cabinet. Circuits and wiring for each shelf shall be independent of one another at 30 amps 12VDC and 24VDC supplies and a chassis ground provided on four independent terminal strips with a minimum of six terminal mounting locations. Terminal strips shall be clearly identified. Terminal strips and associated wiring shall not interfere with shelf operation. All terminals shall be protected from accidental shorts. Wiring and cabling required between devices in the EC shall be protected by loom tubing to protect it from abrasion and must not interfere with the independent operation of the trays. The cabinet shall be provided with a terminal of the VAN system(s). A 3-inch inside diameter conduit, with a pull wire, shall connect the cabinet with the main bus wiring harnesses above the streetside lighting fixtures and the destination sign compartment. A 2-1/4-inch inside diameter metallic conduit, with a pull wire, shall connect the radio control head and control unit located within the electronics cabinet.

To support the Automated Vehicle Monitoring (AVM) system, provisions shall be made to allow the VCPU access to the bus multiplex system status through a serial communications interface. Discrete wiring shall be provided from the instrument and diagnostic light panels into the electronic cabinet to support the Automated Vehicle Monitoring (AVM) system. The AVM system shall interrogate the discrete signals for all diagnostic lights, which shall indicate the operational status of the bus including, but not limited to; fire, check engine, hot engine, low coolant, low oil, generator stop, hydraulic, air conditioning, low air pressure, anti-skid braking, brake fault, and fire suppression system fault. In addition the odometer and “wheelchair ramp deployed” signals shall be wired to the VCPU in the electronics cabinet. The discrete signals shall be 12VDC, 24VDC, or ground and shall be terminated on a terminal strip and continue to the VCPU. All wires and cables shall be clearly labeled and identified on the schematic decal attached to the electronics cabinet door. During the bus build, cable conduits shall be routed at the discretion of the MTA to ease in cable replacement on a case-by-case basis. These conduits should be 3/4-inch ID or larger as noted and be routed in a continuous fashion. The conduits shall have bend radiuses that will permit the ease of replacing and adding cables or wires (no sharp or right angles). In general, conduits exposed to the interior of the bus shall be watertight and shall be terminated at the EC enclosure using suitable reusable watertight fittings. Conduit installation shall follow best commercial practices with regard to drip loops and routing to avoid moisture problems.

Table 11 lists the minimum conduit runs required.

**TABLE 11  
Conduit Runs**

<b>From</b>	<b>Termination</b>
IVN, GPS Receiver	EC Enclosure
ACS Antenna, GPS Receiver	EC Enclosure
ACS Antenna, Radio Transceiver (2)	EC Enclosure
GFI Odyssey Farebox	EC Enclosure
Automatic Passenger Counter controller	EC Enclosure
IVN Transit Control Head	EC Enclosure
Front Dash	EC Enclosure
Display Control Monitor.	EC Enclosure, 2 ¼-inch ID
Destination Sign Controller Operator's Control Console (OCC) defined in section 79.4	EC Enclosure
Cameras	EC Enclosure

Proposed conduit runs shall be submitted to the MTA for approval prior to the PDMR.

### TS 83.11.2 Vehicle Area Networks

The Contractor shall install and verify the operability of a Vehicle Area Network (VAN) in accordance with SAE Recommended Practice J1939, Serial Data Communications between Microcomputer Systems in Heavy-Duty Applications and SAE Recommended Practice J2496, Transport Area Network Cabling. Not all devices on the vehicle may support the J1939 standard so a second VAN to support older J1708 devices may be required. In some cases, specific J1708 cabling is required to or within the EC.

The VAN shall provide connectivity between the Electronics Cabinet and Device Access Boxes in strategic locations throughout the bus including the engine compartment, front electrical junction box, front destination sign compartment and over both passenger doors.

The VAN shall provide the inter connectivity of all elements of the Communication System, and other equipment on the bus with microprocessor controls. Functionally, the VAN shall support an environment where all components, modules, and systems installed on the bus shall have built-in diagnostics capability. The diagnostic system shall be capable of checking the communications between all components of the installed systems. In some cases direct cabling between components may be required.

In preparation for future Transit Communication Interface Profiles (TCIP) compatible components, A Cat 5e cable shall be installed between the Electronics Cabinet and major systems components detailed throughout this section.

### TS 83.11.3 Wireless Local Area Network (WLAN) Router

MTA buses shall be outfitted with a secure mobile router for interconnecting the various networks on the bus and providing a common means of interconnection to the MTA network via a wireless interface that complies with the IEEE 802.11 g/n specifications. This device shall also support all data communications via a commercial cellular telephone network.

- a) The router shall integrate and optimize the data communications on-board the bus and to off-board wireless infrastructure. The Mobile Router shall be the InMotion on-board mobile gateway (oMG) model # IMTOMG2040101MT or approved equivalent and shall

be compliant with the 802.11 a/b/g/n standards. Table 1 in Appendix A indicates those buses requiring a new fully-equipped router and those requiring upgrade to 802.11n and cellular communications.

- b) The DVR and the VCPU (including all on-board applications) shall use the router for data uploads and downloads to and from the bus. Existing, dedicated farebox infrared and short-range Wireless Local Area Network (WLAN) paths shall be left in place.
- c) Bulk data transfers shall be required for AVM data uploads, APC data uploads, DVR data uploads, and software updates. This shall be accomplished via WLAN at the assigned bus division. This shall be via the existing MTA Aruba secure wireless infrastructure at each division. In the event that not all data is uploaded while the bus is in the range of the WLAN, the VCPU shall continue uploading data from where the previous uploaded data stopped when the vehicle is again in the range of the WLAN.
- d) The Router shall provide an interface to a cellular provider for long-distance real-time data communications.
- e) As purchased and installed, the router shall include the following:
  - 1. embedded mobile access point
  - 2. embedded wide area 802.11n radio module with 2x2 MIMO
  - 3. integrated 4-port Ethernet switch
  - 4. embedded GPS receiver
  - 5. DC power cable
  - 6. incremental license fee for on-Board Mobility Manager server
  - 7. one year of premium support service
- f) The router shall provide IP routing in support of all on-board electronics.
- g) The router shall provide state-of-the-art wireless service management and optimization functions for all communications services mentioned throughout the contract documents.
- h) The router shall support wireless streaming video to authorized devices such as laptops in close proximity to the bus and longer distance via VPN authentication.
- i) The router shall be manageable and all functions and parameters shall be configurable through the existing InMotion mobile gateway server located in the Washington Boulevard Radio Shop.
- j) The router shall include state-of-the-art self diagnostic capabilities that can be accessed and used locally and remotely at the mobile gateway server.
- k) The router shall support the following protocols:
  - l) Wireless Area Network (WAN) backhaul communications of the router shall be compliant with the IEEE 802.11a/b/g/n standard (latest version), with Multiple Input Multiple Output (MIMO) high bandwidth communications implemented on at least two WLAN antennae.
  - m) Local Area Network (LAN) Access Point (AP) communications of the router shall be compliant with the IEEE 802.11g/n standard.
  - n) The router security protocols shall be WPA2 and WPA2-PSK with 128-bit encryption.
  - o) The router shall include the following ports at minimum. It is expected that some but not all will be used in this bus implementation:

- p) Four (4) 10/100MB Ethernet CAT5 ports.
- q) Two (2) Wide Area Network (WAN) coaxial ports.
- r) Two (2) Local Area Network (LAN) coaxial ports.
- s) Three (3) additional antenna coaxial ports.
- t) Two (2) USB ports.
- u) One (1) RS 232 port for local configuration, data exchange, and diagnostics.
- v) One (1) power plug.
- w) All modems in the router shall be of the highest power available and permissible by the FCC.
- x) The router shall have a minimum of six (6) internal expansion slots, including at least two (2) Express, two (2) miniPCI and two (2) miniExpress. It is expected that some but not all will be used in the bus implementation.
- y) The wireless router power shall be connected to the vehicle's 24V Ignition power (24 VDC continuous power) through a protective device.
- z) The router shall include a GPS receiver which will be used to provide a common GPS source suitable for all on-board applications requiring positioning and/or time synchronization.
- aa) The GPS receiver shall be the time source for on-vehicle time used for operator display, to time-tag all recorded events and for all on-board subsystems.
- bb) It is preferred that the GPS information be shared on board using standard GPS data words per the NMEA 2000 standard via UDP packet over Ethernet and via RS 232 serial link. Splitting of the GPS antenna signal upstream of the receiver is not preferred.
- cc) The Contractor shall minimize the number of antennae and roof penetrations, while still maintaining the manufacturers' recommendations for antenna spacing, ground plane, and other installation details.
- dd) Transmission EIRP and reception strength shall be the maximum possible and allowable within applicable FCC regulations.
- ee) The GPS receiver housing shall be an integrated receiver/antenna module, in a non-metallic housing and mounted on the roof of the vehicle.
- ff) The antenna shall be a surface-mounted multiband antenna supporting LTE MIMO 700 MHz, AWS, WiFi and GPS. Existing antenna shall be new installation, replacement or upgrade as required.
- gg) Antenna shall be supplied and installed with all pigtail leads, RF extension cables and connectors.
- hh) An antenna grounding plane shall also be provided.

#### **TS 83.11.4 Communications Antennas**

The Contractor shall install GPS, WLAN and Radio Antenna reinforcing plates in the roof sections as required. These plates shall be at least 3 feet apart and shall be located such that:

- a) The cable distance to radio box shall be kept to a minimum and less than 25 feet.

- b) The underside of the reinforcement plate area is accessible for service of the antenna connector. The Contractor shall install interior ceiling cover plates in a design approved by the MTA at the pre-production meeting.
- c) The location of the reinforcement plate for the antennas shall not be more than 10 degrees from horizontal.
- d) The GPS antenna/receivers shall be located at least 1 meter from other radiating elements.

**TS 83.11.5 Bus Mounted Data Recorders**

**The MTA currently uses FLEETWATCH (S&A Systems) Model JX55 Data Logger and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

The Contractor shall provide Data Loggers for each bus. Each data logger shall be suitable for mounting on a transit bus and connecting directly to a J1708 connector on the bus. The mounting of the data recorder shall be presented for review and requires MTA approval during the PPM.

Bus-mounted data recorders shall be programmable by the MTA with vehicle number and codes for defining the set of data to be recorded and reported. Programming software and hardware shall be provided to allow the MTA to program or re-program the bus-mounted data recorder units at any time.

Bus-mounted data recorders provided shall include a minimum 1-year warranty on all parts, including batteries, if applicable.

Bus-mounted data recorders shall be programmed to respond to a beacon signal sent from a Receiver Unit and upon receipt of such beacon signal shall transmit via radio frequency the bus number and other defined data to the Receiver Unit. Bus-mounted data recorders shall as a minimum provide the following capabilities:

- a) Collect and report Vehicle Number, Vehicle Total Mileage, and Vehicle Total Engine Hours
- b) Capture and report fault indicators. Fault Codes reported shall include Subsystem ID and Failure Mode Identifier as defined in SAEJ1587 documentation. The last 10 unique Active Fault Codes shall be recorded and reported with the Date and Time of the beginning and ending of the last occurrence observed.
- c) Last value observed. The Bus-mounted data recorder shall report the last value observed for 10 items. The user shall be able to define these 10 items using M.I.D. and P.I. D. codes as defined in SAEJ1587 documentation.

Examples:	M.I.D.	P.I.D.
Engine Idle Hours	128	235
Idle Fuel Used	128	346

- d) Maximum and minimum value observed in 24 hours. The bus-mounted data recorder shall report the maximum and minimum values observed during the

previous 24 hour time period for 10 items defined using M.I.D. and P.I.D. codes. The date and time of the minimum and maximum occurrences shall also be reported. The user shall be able to define the codes for the items to be reported.

Examples:	M.I.D.	P.I.D.
Engine Coolant Temperature	128	110
Engine Oil Pressure	128	100
Engine Oil Temperature	128	175
Hybrid drive Oil Temperature	130	177
Ambient Air Temperature	128	171

#### TS 83.11.6 Engine Auxiliary Heater Control

The engine auxiliary heater specified in TS 9.3 shall be controlled via the integrated WLAN. These heaters shall be started by the MTA dispatcher as described in the specification.

#### TS 84. Bicycle Racks

**The MTA currently uses Sportworks Velo Porter 2 position Bicycle Rack and shall allow for the use of a similar component so long as the functionality and following specifications are met;**

Each bus shall be equipped with a bicycle rack capable of accommodating two bicycles. The bicycle rack shall be located at the buses front bumper and shall not obstruct or require removal to access the exterior defroster box. The operation of the bicycle rack shall be performed by passengers and shall not require operator's assistance or tools.

The mounting of the bicycle racks shall not interfere with the FMVSS lighting requirements for the bus or the vision of the operator.

The racks, located on the front of the bus above the bumper, shall be constructed of durable material and fold up when not in use. The rack shall be capable of being raised and lowered with one hand and both racks shall load or unload independently of the other. The rack shall only contact the bicycle tires and will by design prevent contact between the two bicycles.

A "bike rack deployed" message shall be on the center dash message center and a red warning light within the operator's sight when the bicycle rack is not stowed.