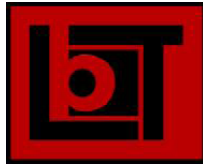


# REQUEST FOR PROPOSAL



## LONG BEACH PUBLIC TRANSPORTATION COMPANY

1963 E. Anaheim Street, Long Beach, CA 90813  
(562) 591-8753

### Battery Electric Bus Project RFP 15-001

The Long Beach Public Transportation Company (“Agency” or “LBT”) invites and encourages your response to this Request for Proposal (RFP) for the provision of all equipment, labor, materials and management necessary for the Battery Electric Bus Project at Long Beach Transit, located at 1963 E Anaheim St., Long Beach, California, 90813. This is a joint procurement that also includes Anaheim Transportation Network (“Agency” or “ATN”) and Gardena Municipal Bus Lines (“Agency” or “GMBL”). Other transit properties may elect to participate as members of the joint procurement and may become “listed” participants up to the date of submittal of the proposal.

***This RFP package is divided into the following sections:***

- Section 1 Notice of Request for Proposal
- Section 2 Instructions to Proposer
- Section 3 General Conditions
- Section 4 Special Provisions
- Section 5 Federal Requirements
- Section 6 Technical Specifications
- Section 7 Warranty Requirements
- Section 8 Quality Assurance
- Section 9 Forms & Certifications
- Section 10 Contract
- Section 11 Appendices
- Section 12 RFP Variations for Anaheim Transportation Network
- Section 13 RFP Variations for Gardena Municipal Bus Lines

***For the purpose of this RFP:***

1. “Agency” or “Agencies” shall mean Buyer, Purchaser, or Owner, which includes Long Beach Public Transportation Company (“LBT”), Anaheim Transportation Network (“ATN”) and/or Gardena Municipal Bus Lines (“GMBL”)
2. “Proposer” shall mean Proposing Company, Seller, Bidder, or Offeror,
3. “FTA” means Federal Transit Administration.

***Key RFP Dates***

|                                   |  |
|-----------------------------------|--|
| RFP Issue Date:                   | September 23, 2014                           |
| Pre-Proposal Conference:          | October 3, 2014, 10:00 AM PDT                |
| Written Questions / Requests Due: | October 17, 2014, 3:00 PM PDT                |
| Response to Questions set out by: | October 29, 2014, 5:00 PM PDT                |
| Submit Proposal By (Due Date):    | November 26, 2014, 2:00 PM PST               |
| Award / P.O. / Contract:          | Within 180 calendar days of Proposal Opening |

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## **REQUEST FOR PROPOSAL**



**LONG BEACH PUBLIC TRANSPORTATION COMPANY**  
1963 E. Anaheim Street, Long Beach, CA 90813  
(562) 591-8753

**Battery Electric Bus Project  
RFP 15-001**

## **Section 1**

# **Notice of Request for Proposals**

## **SECTION 1: NOTICE OF REQUEST FOR PROPOSALS**

### **NR 1. Battery Electric Bus Project**

The Long Beach Public Transportation Company (“Agency”), Anaheim Transportation Network (“ATN”), and Gardena Municipal Bus Lines (“GMBL”) entering into a joint procurement, requests Proposals for an all-electric transit bus solution to service one or more designated transit routes. The Proposal shall include the manufacture and delivery of up to ten (10) forty-foot, battery electric transit buses with options for up to an additional fifty (50) buses over a five year period. Delivery and oversight of installation of supporting charging infrastructure are also required, both in accordance with the terms and conditions set forth in this RFP 15-001. The Contract shall be a firm-fixed price Contract.

The proposed heavy-duty battery electric transit buses, which, by the selection of specifically identified alternative configurations, may be used for both suburban express service and general 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 term of this contract shall be 5 years. Pricing for the optional buses and/or charging equipment exercised in year 1 shall be based on the base quantity. Following the base quantity, option pricing shall be adjusted per SP-3, Options and Option Pricing.

Proposals are requested for battery electric buses and supporting charging equipment, which may include multiple charging stations for on route charging and/or overnight charging at the depot. Funding for this project is specific to battery electric and does not include options for on-board range extenders such as turbines, hydrogen, fuel cells, etc. The conceptual intent is that the “charging” infrastructure be “open” and capable of supporting buses of varying type / model, such that the system of buses and chargers would be scalable for future growth without proprietary constraint.

The intent of this RFP is to solicit proposals for a transportation solution that incorporates battery electric buses and the necessary charging infrastructure with a data management system (DMS) capable of monitoring the equipment state of health, performance, state of charge, etc. The DMS shall have the capability to manage the “charger” equipment for consideration of utility economics. It is further assumed that this DMS shall include the necessary data communications to support near real-time access to the subject equipment (buses and chargers), via wired and/or wireless communications.

Also, at a high conceptual level due to the inherent sensitivities of all electric vehicle performance relative to mass and energy efficiency, particular considerations shall be given to vehicle weight, component weight, parasitic loads, power management, thermal / solar loads, etc.

In support of the above requested buses and equipment, the Agency is requesting a solution that includes the following:

- Review of the design of the charging stations and support of installation of charging equipment;
- Operator training and manuals for the operation of buses and charging equipment;
- Maintenance plan, training and manuals for the maintenance of buses and charging equipment;

**Long Beach Public Transportation Company  
Request for Proposal  
RFP 15-001**

- An operational and maintenance performance assessment of proposed buses and charging equipment, as well as a performance assessment of Agency's trained operators and maintenance staff, at the end of the first complete year and third year of service; and
- Maintenance support for the charging equipment for the first three years with options for nine more years.

## **NR 2. Obtaining Proposal Documents**

Proposal documents may be obtained from William "Chip" Henderson (Manager, Purchasing / Buyer), in person at 1963 E. Anaheim St. Long Beach, CA. 90813 or electronically, if available, at [whenderson@lbtransit.com](mailto:whenderson@lbtransit.com). Documents requested by mail will be packaged and sent postage paid.

## **NR 3. Proposal Due Date and Submittal Requirements**

1. All proposals must be submitted in strict compliance with the Proposal Instructions and requirements as prescribed in the RFP, and must be received at the Agency's reception lobby no later than 2:00 pm PST, on or before November 26, 2014. Sealed Proposals shall be submitted by courier delivery or hand delivery to the following addresses:

Long Beach Public Transportation Company  
1963 E. Anaheim St.  
Long Beach, CA. 90813  
Attn: William "Chip" Henderson, Purchasing Dept.

2. Envelopes or boxes containing Proposals shall be sealed and clearly labeled with the Agency's Proposal number and the solicitation title: RFP 15-001, Battery Electric Bus Project, along with vendor name.
3. Proposers are requested to submit to the Agency one hard copy marked "Original," plus additional printed copies and CDs as specified in CER 01 Proposer's Checklist. In case of any discrepancies, the original hard copy will be considered by the Agency in evaluating the Proposal. Additional hard copies and CDs are required for the Agency's administrative convenience only. A Proposal is deemed to be late if it is received by the Agency after the deadline stated above. Proposals received after the submission deadline may be rejected.

## **NR 4. Validity of Proposals**

Proposals and subsequent offers shall be valid for a period of 180 days.

## **NR 5. Pre-Proposal Meeting Information**

An optional Pre-Proposal Meeting will be held on Friday, October 3, 2014. The meeting will convene at 10:00 AM PDT in the Mezzanine Conference Room at Long Beach Transit, located at 1963 E. Anaheim Street, Long Beach, CA 90813. Attendance is highly recommended but not required to submit a proposal.

Proposers may also participate via webinar and/or conference call. To join the webinar, please send an e-mail request for instructions to [whenderson@lbtransit.com](mailto:whenderson@lbtransit.com) by Thursday, October 2, 2014 at 2:00 PM PDT. The webinar uses WebEx. You may be required to download and install WebEx software to run

**Long Beach Public Transportation Company**  
**Request for Proposal**  
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the webinar on your computer. We suggest you join the webinar early to complete the download and installation prior to the start of the webinar.

To join the conference call, dial 1-650-479-3208 and follow the instructions. Enter the access code 626 375 513 when prompted.

Prospective Proposers are requested to submit written questions to the Agency's Purchasing Manager, identified below, in advance of the Pre-Proposal Meeting. In addition, questions may be submitted up to the date specified in "Proposed Schedule for the Procurement." Responses will be shared with all prospective Proposers. Prospective Proposers are reminded that any changes to the RFP will be by written addenda only, and nothing stated at the Pre-Proposal Meeting shall change or qualify in any way any of the provisions in the RFP and shall not be binding on the Agency.

**NR 6. Contracting Officer's Contact Information:**

|                     |  |
|---------------------|--|
| Name:               | William "Chip" Henderson                                 |
| Title:              | Manager, Purchasing                                      |
| Address:            | 1963 E. Anaheim St. Long Beach, CA, 90813                |
| Phone number:       | 562-599-8505   |
| E-mail:             | whenderson@lbtransit.com                                 |
| Fax number:         | 562-591-2083   |
| Additional contact: | John Van Leeuwen 562-599-8546, Jvanleeuwen@lbtransit.com |

**NR 7. Identification of Source of Funding**

Financial support of this project is provided through a financial assistance TIGGER grant from the Federal Transit Administration (FTA). See Section 2 IP 14.2 Availability of funds.

**NR 8. Equal Opportunity to Submit Proposals**

The Agency hereby notifies potential Proposers that all firms will be afforded equal opportunity to submit proposals in response to this request and will not be discriminated against in consideration for award on the basis of race, religion, color, sex, creed, marital status, ancestry, physical or mental disability, medical condition, sexual orientation, national origin, age, or any other consideration made unlawful by federal, state or local laws.

**NR 9. Labor Employment Compliance**

All Proposers must be compliant with applicable requirements relating to minimum wage, Workmen's Compensation and conditions of employment.

## **REQUEST FOR PROPOSAL**



**LONG BEACH PUBLIC TRANSPORTATION COMPANY**  
1963 E. Anaheim Street, Long Beach, CA 90813  
(562) 591-8753

**Battery Electric Bus Project  
RFP 15-001**

## **Section 2**

# **Instructions to Proposers**

## **SECTION 2: INSTRUCTIONS TO PROPOSERS**

### **IP 1. Quantities**

The Scope of Work, as defined in Section 1, NR1 Battery Electric Bus Project, includes, but is not limited to, the manufacture and delivery of up to ten (10), 40 foot, battery electric transit buses, and related charging equipment in the base year, with options for up to an additional fifty (50) buses and related charging equipment over a five year period.

### **IP 2. Proposed Schedule for the Procurement**

The following is the solicitation schedule for Proposers:

- |  |                               |
|--|-------------------------------|
| • Pre-Proposal Meeting/teleconference:                   | October 3, 2014, 10:00 AM PDT |
| • Proposer questions and requests are due by:            | October 17, 2014, 3:00 PM PDT |
| • Responses to Proposer's questions will be returned by: | October 29, 2014, 5:00 PM PDT |
| • Proposal Due Date:                                     | November 26, 2014 2:00 PM PST |

### **IP 3. Obtaining Proposal Documents**

Proposal documents may be obtained from William "Chip" Henderson (Manager, Purchasing / Buyer), in person at 1963 E. Anaheim St. Long Beach, CA 90813 or electronically at [whenderson@lbtransit.com](mailto:whenderson@lbtransit.com). Documents requested by mail will be packaged and sent postage paid. Documents requested by courier will be packaged and sent only at the Proposers' expense.

### **IP 4. Proposal Security Requirements**

Not Applicable

### **IP 5. Pre-Proposal Meeting/Information for Proposers**

An optional Pre-Proposal Meeting will be held on Friday, October 3, 2014. The meeting will convene at 10:00 AM PDT in the Mezzanine Conference Room at the Agency's facility located at 1963 E. Anaheim St. Long Beach, CA 90813. Attendance is highly recommended but not required to submit a proposal.

Proposers may also participate via webinar and/or conference call. To join the webinar, please send an e-mail with a request for instructions to [whenderson@lbtransit.com](mailto:whenderson@lbtransit.com) by Thursday, October 2, 2014 at 2:00 PM PDT. The webinar uses WebEx. You may be required to download and install WebEx software to run the webinar on your computer. We suggest you join the webinar early to complete the download and installation prior to the start of the webinar.

To join the conference call, dial 1-650-479-3208 and follow the instructions. Enter the access code 626 375 513 when prompted.

Prospective Proposers are requested to submit written questions to the Contracting Officer (Buyer), identified above, in advance of the Pre-Proposal Meeting. In addition, questions may be submitted up to the date specified in "Proposed Schedule for the Procurement." Responses will be shared with all prospective Proposers. Prospective Proposers are reminded that any changes to the RFP will be by written addenda only, and nothing stated at the Pre-Proposal Meeting shall change or qualify in any way any of the provisions in the RFP and shall not be binding on the Agency.

## **IP 6. Questions, Clarifications and Omissions**

All correspondence, communication and contact in regard to any aspect of this solicitation or offers shall be only with the Contracting Officer (Buyer) identified above. Unless otherwise instructed by the Contracting Officer, Proposers and their representatives shall not make any contact with or communicate with any member of the Agency's Board of Directors, its employees or consultants, other than the designated Contracting Officer, in regard to any aspect of this solicitation or offers.

At any time during this procurement, up to the due date for proposer questions specified in "Proposed Schedule for the Procurement," Proposers may request, in writing, a clarification or interpretation of any aspect of the RFP, a change to any requirement of the RFP, or any addenda to the RFP. Requests may include suggested substitutes for specified items and for any brand names, which whenever used in this solicitation shall mean the brand name or approved equal. Brand names mentioned are known acceptable products. Such written requests shall be made to the Contracting Officer. The Proposer making the request shall be responsible for its proper delivery to the Agency as identified on the form CER02 Request for Pre-Offer Change or Approved Equal. Any request for a change to any requirement of the Contract documents must be fully supported with technical data, test results or other pertinent information showing evidence that the exception will result in a condition equal to or better than that required by the RFP, without a substantial increase in cost or time requirements. Agency shall be the sole judge in approving or denying each request.

Please Note: The Agency will not be responsible for postal, express mail, or e-mail delays or malfunctions.

All responses to CER02 Request for Pre-Offer Change or Approved Equal shall be provided to all Proposers. Any response that is not confirmed by a written addendum shall not be official or binding on the Agency.

If it should appear to a prospective Proposer that the performance of the Work under the Contract, or any of the matters relating thereto, is not sufficiently described or explained in the RFP or Contract documents, or that any conflict or discrepancy exists between different parts of the Contract or with any federal, state, local or Agency law, ordinance, rule, regulation or other standard or requirement, then the Proposer shall submit a written request for clarification to the Agency within the time period specified above.

## **IP 7. Addenda to RFP**

The Agency reserves the right to amend the RFP at any time in accordance with "Proposed Schedule for the Procurement." Any amendments to the RFP shall be described in written addenda. Notification of or the addenda also will be distributed to all such prospective Proposers officially known to have received the RFP. Failure of any prospective Proposer to receive the notification or addenda shall not relieve the Proposer from any obligation under the RFP therein. All addenda issued shall become part of the RFP. Prospective Proposers shall acknowledge the receipt of each individual addendum in their proposals on the form Acknowledgement of Addenda. Failure to acknowledge in the proposal receipt of addenda may at the Agency's sole option disqualify the proposal.

If the Agency determines that the addenda may require significant changes in the preparation of proposals, the deadline for submitting the proposals may be postponed no less than ten (10) days from the

**Long Beach Public Transportation Company**  
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date of issuance of addenda or by the number of days that the Agency determines will allow Proposers sufficient time to revise their proposals. Any new Due Date shall be included in the addenda.

### **IP 8. DBE Requirements for Transit Vehicle Manufacturers**

Pursuant to Title 49, Code of Federal Regulations, Part 26.49, a Proposer, as a condition of being authorized to respond to this solicitation, must certify by completing the form DBE Approval Certification that it has on file with the Federal Transportation Administration (FTA) an approved or not disapproved annual disadvantaged business enterprise (DBE) subcontracting participation goal.

### **IP 9. Buy America Certification**

This Contract is subject to the “Buy America” requirements of 49 United States Code (USC) §5323(j) and 49 Code of Federal Regulations (CFR) Part 661, as may be amended from time to time, and applicable federal regulations. Prospective Proposers’ attention is directed to 49 CFR §661.11, “Rolling Stock Procurements” for the buses and 49 CFR §661.11 “General Requirements” for the charging equipment. Prospective Proposers have the responsibility to comply with the cited and any governing statutes and regulations, including official interpretations.

A Proposer shall submit to the Agency the appropriate Buy America certifications for rolling stock and for manufactured products, included in Section 9 of this document, with all offers on FTA-funded contracts. Proposals that are not accompanied by properly completed Buy America certifications are subject to the provisions of 49 CFR 661.13 and will be rejected as nonresponsive.

The two signature blocks on the Buy America certificate for Rolling Stock Procurements are mutually exclusive. Proposers shall sign only one signature block on the certificate. Signing both signature blocks will make the proposal nonresponsive. A false certification is a criminal act in violation of 18 USC §1001.

The two signature blocks on the Buy America certificate for Manufactured Product Procurements are mutually exclusive. Proposers shall sign only one signature block on the certificate. Signing both signature blocks will make the proposal nonresponsive. A false certification is a criminal act in violation of 18 USC §1001.

A Proposer who has submitted an incomplete Buy America certificates or incorrect certificates of noncompliance through inadvertent or clerical error (but not including failure to sign the certificates, submission of certificates of both compliance and noncompliance, or failure to submit any certification), may submit to the FTA chief counsel within ten (10) days of proposal opening a written explanation of the circumstances surrounding the submission of the incomplete or incorrect certification in accordance with 28 USC §1746, sworn under penalty of perjury, stating that the submission resulted from inadvertent or clerical error. The Proposer will also submit evidence of intent, such as information about the origin of the product, invoices, or other working documents. The Proposer will simultaneously send a copy of this information to the Agency.

The FTA Chief Counsel may request additional information from the Proposer, if necessary. The Agency may not make Contract award until the FTA Chief Counsel issues his or her determination, except as provided in 49 CFR Part 661.15(m).



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

A waiver from the Buy America provisions will be sought by the Agency from the FTA, for the proposed awardee, if the grounds for a waiver exist. All Proposers seeking a waiver must submit to the Agency a timely request in writing, which shall include the facts and justification to support the granting of the waiver. Such waiver from the Buy America provisions may be granted if the FTA determines the following:

1. Their application would be inconsistent with the public interest;
2. Materials are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or
3. Inclusion of domestic material will increase the cost of the overall Contract by more than 25 percent.

Any party may petition the FTA to investigate a successful Proposer's compliance with the Buy America certification. The procedures are set out in 49 CFR Part 661.15. If the FTA determines the evidence indicates noncompliance, the FTA will require the Agency to initiate an investigation. The successful Proposer has the burden of proof to establish compliance with its certification. If the successful Proposer fails to so demonstrate compliance, then the successful Proposer will be required to substitute sufficient domestic materials without revision of the original Contract terms. Failure to do so will be a breach of the Contract and may lead to the initiation of debarment proceedings under 49 CFR Part 29.

## **IP 10. Conditions, Exceptions, Reservations or Understandings**

Proposers are cautioned to limit exceptions, conditions and limitations to the provisions of this RFP, as they may be determined to be so fundamental as to cause rejection of the proposal for not responding to the requirements of the RFP.

Any and all deviations must be explicitly, fully and separately stated in the proposal by completing CER 05 Form for Proposal Deviation, setting forth at a minimum the specific reasons for each deviation so that it can be fully considered and, if appropriate, evaluated by the Agency. All deviations shall be evaluated in accordance with the appropriate evaluation criteria and procedures and may result in the Proposer receiving a less favorable evaluation than without the deviation.

## **IP 11. Protest Procedures**

Protests concerning the specifications or bidding procedures, requests for clarification of the specifications and requests for the substitution of "approved equal" items must be submitted in writing and addressed to the Agency's Contracting Officer, 1963 E. Anaheim St., Long Beach, CA 90813, within five (5) business days after the Agency's Notice of Decision. Any protest relating to restrictive specifications must be fully supported by evidence that the substitute offered is equal to or better than the specification requirement.

The Agency will accept or reject any protest or respond to any request under the foregoing subparagraph, in writing, within ten (10) business days of receipt of the protest. Any changes in the specifications will be effected by issuance of an addendum.

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Any appeal from the decision of the Agency must be submitted, in writing, to the Agency's President/Chief Executive Officer, 1963 E. Anaheim St., Long Beach, CA 90813, five (5) business days after the Agency's Notice of Decision. Appeals received by the President/Chief Executive Officer later than five (5) business days after the Notice of Decision will not be considered. The Agency's President/Chief Executive Officer, or designee, shall provide a written response of the final decision.

The procedures and time limits set forth in this section are mandatory and are the exclusive protest remedies. Failure to comply with these procedures shall constitute a failure to exhaust administrative remedies and a waiver of any right to pursue a bid protest, including filing of causes of action arising under California law and Federal law.

All protests must be sent via certified regular U.S. mail and/or hand-delivery. The Agency's Contracting Officer shall deem protests received upon their receipt dates.

## **IP 12. Preparation of Proposals**

### **IP 12.1 Use of Proposal Forms**

Proposers are advised that the forms contained in this RFP are required to be used for submission of a proposal.

### **IP 12.2 Alternate and Multiple Proposals**

Not Applicable.

### **IP 12.3 Proposal Format Requirements**

Proposals shall be submitted in five separately sealed packages identified below. Each package shall be marked as specified below and shall contain all of the proposal documents for which the package is required to be marked and shall include no other documents. These same requirements shall apply to any best and final offers (BAFOs) that may be requested.

Proposers shall submit one original set of RFP Deliverables (marked clearly as such), additional hard copy sets and CD's for each package as specified in the Agency RFP Deliverables Checklist provided in CER 01 Proposer's Checklist. Each hardcopy and CD package shall be separate from all other packages. CDs shall contain PDF's of all specified package deliverables. CD's shall also include original file formats of Agency provided files as requested, i.e., the Agency provided Excel forms must be submitted in both PDF and Excel file format, as requested. In the case of any discrepancies, the original set will be considered by the Agency in evaluating the proposal. Proposer's digital files are submitted for the Agency's administrative convenience only.

The hard-copy proposals shall be prepared double-sided on 8½ × 11 in. paper in at least 11-point font. The hard copies shall be contained in three-ring binders, the contents of which are identified on the outside. Use of 11 × 17 in. foldout sheets for large tables, charts or diagrams is permissible but should be limited. Elaborate formatting is not necessary. Do not provide promotional or advertising information, unless this information is requested and/or is necessary to support the technical submittal. Material shall be presented in the order of the format below. **Please ensure the RFP deliverable requirements below are placed in the proper packages / binders. Also ensure that requirements are placed in the order requested. All submittals are mandatory and considered part of the evaluation process. Failure to comply with these requirements may result in disqualification.**

**Package 1 – Proposal Summary**

**1. Letter of Transmittal:**

The Letter of Transmittal should identify the proposer and demonstrate the firm's understanding of the scope of work and services. Specifically, the Letter of Transmittal shall be addressed to the Buyer as indicated in Section 2, IP 3, of these instructions and must, at a minimum, contain the following:

- A. Identification of the Proposer, including name, address and telephone.
- B. Proposed working relationship between the Proposer and subcontractors, if applicable.
- C. Name, title, address and telephone number of contact person during period of proposal evaluation.
- D. A statement to the effect that the proposal shall remain valid for a period of not less than 180 days from the date of submittal.
- E. A statement that the Proposer's insurance carrier has reviewed the attached insurance requirements and that the Proposer will comply with the insurance as stated in this RFP.
- F. Signature of a person authorized to bind the Proposer to the terms of the proposal.

**2. Executive Summary:**

In addition to any introductory remarks, the Proposer shall state its understanding of the overall project objectives and the skill levels required to successfully accomplish the project objectives. Key points of the proposal should be summarized including: primary tasks or events, the approach to be employed, any innovative techniques or solutions, insights, resources, requirements and etc

This summary shall also state whether the proposal does or does not fully comply with the requirements as defined in this RFP, noting any exceptions, and shall be signed by an authorized representative of the company.

- 3. CER 03 - Acknowledgement of Addenda:** Complete form to acknowledgment receipt of all RFP addenda, if any.
- 4. CER 05 - Form for Proposal Deviation** (as needed, without pricing information)

**Package 2: Technical Proposal**

The Proposer shall provide a narrative, which addresses the Scope of Work and shows the Proposer understands of the Agency's needs and requirements. A list of required proposal submittals can be found on CER 01, to at a minimum consist of the following items:

**1. Technical Description of Project**

- a. Bus: Description of Operations and Specifications
- b. Description of propulsion system, validation and testing
- c. Charging Infrastructure: Description of Operations and Specification
- d. Data System: Description of Operation and Specifications
- e. Energy Storage: Description of the battery and thermal management systems
- f. Battery Manufacturer Application Approval and Certification for Intended Use
- g. Energy / Load Analysis Profile, Battery Life Cycle Testing description, results, and certification agency
- h. Assessment of Battery Safety / Environmental Considerations, Battery Safety Standards, Description of Testing Procedures, Documentation of Results, and certification by independent agency

**2. Work Plan**

- a. Describe the approach to completing the tasks specified in the Scope of Work. Understanding there are two major elements to this project (bus and charging equipment) – these areas must easily be separated for evaluation.
- b. 52 week maintenance plan and long term plan
- c. Special tools
- d. Outline sequentially the activities that would be undertaken in completing the tasks and specify who would perform them.
- e. Furnish a milestone schedule for completing the tasks in terms of elapsed weeks from the project commencement date to projected completion. This detailed schedule must reconcile to the minimum milestones required in Section 9, CER 12.
- f. Identify methods that the Proposer will use to ensure quality control as well as budget and schedule control for the project.
- g. Describe Risk Management procedures used to identify, assess, prioritize, and mitigate project risks, i.e., technical, schedule, budget, personnel, etc.

The Proposer may also propose procedural or technical enhancements/innovations to the Scope of Work, which do not materially deviate from the objectives or required content of the project.

**3. CER10 - Vehicle Attributes Summary**

**4. CER11 - Infrastructure Attribute Summary**

**5. Passenger and Community Considerations**

This section of the proposal should present the Proposer's vision of the battery electric bus and how it will be presented to the industry and our greater community in partnership with the Agency. This is the place to present any images, drawings, marketing materials so in order to understand the Proposer's vision of their product. The Agency is interested in creating a strong partnership with the contractor to present the future within our service area. As part of the requirements, the Agency seeks to understand the Proposer's concepts on how this partnership will be accomplished. The Proposer shall provide, at a minimum, a narrative and documentation to support:

- Photos or concept drawings of the proposed bus (interior and exterior) and supporting infrastructure.
- Marketing Plan / Vision on how product can be presented to our community/industry, including personnel and experience of staff / sub-contractor performing this function.

**6. Maintainability / Product Support**

This section of the proposal should present the Proposer's plan in supporting the bus and charging stations. The Agency understands the unique nature of the technology requested in this RFP; however, the project has a required minimum useful life of 12 years. The Agency anticipates that the contractor has considered how they intend to support and ensure the life of the project. Any history of the equipment in other applications should also be presented in this section.

Another factor that must be considered is the Agency's new Federal-based requirement to maintain a written asset management plan. This requires the Agency to maintain a strong preventive maintenance plan and a long-term strategy for rehabbing/replacing major components to keep the equipment in a state of good repair. As part of this section, life cycle projections of major components should be presented. At a minimum, the Proposer shall provide a narrative and documentation to support:

- a. If they intend to support the bus and charging station during the warranty period, including engineering and field support. This section should include the plan for training and whether any maintenance / training manuals and material already exist or will be created uniquely for this project. The location of support should also be included.
- b. A plan for providing parts, describing location and availability of parts required to support the bus and the charging equipment.
- c. Any known maintenance requirements of existing bus and charging equipment. Advise if the product is new and has no history or maintenance plans.
- d. Maintenance proposal for charging equipment for the first three (3) years and the three (3) 3-year options (years 4 – 12).

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- e. A schedule for major component replacements. This will support the Federal requirements in supporting long-term capital planning as part of the asset management plan. This section must include a narrative describing the basis for the projected replacement schedule. The list of major components should be consistent with the Capital Replacement Plan included with the Pricing Schedule in Package 3.
- 7. Engineering organization chart, engineering change control procedure, field modification process**
- 8. Manufacturing facilities plant layout,**
- 9. Altoona Test Report** (only required with Original hardcopy and on CD)
- 10. Structural Testing**
- 11. Crash Testing**
- 12. Door System FMEA**
- 13. Optional Drivers air conditioning**
- 14. Sample Service and Parts Manual** (only required with Original hardcopy and on CD)
- 15. Description of Training Plan**
- 16. Seating Layout**
- 17. Sample interior / exterior / dash photos**
- 18. Copy of CA ARB Executive Order, Zbus**
- 19. CER 9.4 Electric Vehicle and Infrastructure Codes and Standards**
- 20. Quality Assurance Plan**
- 21. Rendering of en-route charger enclosure**
- 22. Written Response to Partnering Agencies Variances** (do not include pricing)

**Package 3: Price Proposal Requirements**

Each Price Proposal shall be on the prescribed proposal form(s) and shall be for the entire Contract, including all proposal items. **Proposer shall submit the pricing schedule in both PDF and original Excel file formats on the Package 3 CD.**

- 1. CER 06 Proposal Pricing**, (including but not limited to such pricing elements as option buses, spare parts package, manuals, training, special tools and test equipment) - See Section 9, CER 6 – Pricing Schedule.
- 2. CER 05 - Form for Proposal Deviation** (as needed, with pricing information)
- 3. Description of Methodology for Price Adjustment (PPI)**
- 4. CER 9.1 Proposal Form**

The Proposer is required to complete and execute the Agency's Pricing Schedule, contained as part of the proposal documents, and provide the same in the Price Proposal. The Contractor shall be liable for payment of all local taxes applicable to the complete bus as delivered and should add these amounts to the proposal price.

**Package 4: Qualifications:**

**1. Qualifications, Related Experience and References of the Proposer**

This section of the proposal should establish the ability of the Proposer to satisfactorily perform the required work by reasons of experience in performing work of a similar nature, demonstrated competence in the services to be provided, strength and stability of the firm, staffing capability, work load, record of meeting schedules on similar projects, and supportive client references. It is essential that the proposer identify both the bus and charging station experience as separate elements.

The Proposer shall:

- a. Provide a brief profile of the prime firm including: the types of services offered, the year founded, form of the organization (corporation, partnership, sole proprietorship) number, size and location of offices, and number of employees.
- b. Provide a general description of the firm's financial condition and identify any conditions (e.g., bankruptcy, anticipated or pending litigation, planned office closures, impending merger) that may impede, affect, or impact The Proposer's ability to complete the project.
- c. Describe the firm's experience in performing work of a similar nature to that solicited in this RFP, and highlight the participation in such work by the key personnel proposed for assignment to this project. Describe experience in similar projects, particularly in the transit and public sector environments. The Proposer must demonstrate to the satisfaction of the Agency that it has sufficient resources, capabilities and experience to meet the business needs as stated in this document. The Proposer shall state and identify its involvement with other clients for both past and present projects. The Proposer shall state the client's name, and references (See 5 below) for similar projects, particularly those conducted for public transit in particular and the public sector in general. Be specific with respect to past and current assignments elaborating on those projects of similar type, magnitude and complexity. The Proposer's involvement and responsibility should be defined for each project.
- d. Identify any subcontractors by company name, address, contact person, and telephone number and project function. If the sub-contractor is responsible for one of the key elements (i.e. bus body build, bus propulsion, charging equipment, charging station etc...), please provide supporting documentation for points 1, 2 and 3 above.

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- e. Provide references (in the United States if possible) for each project cited as related experience in the past two years. Furnish the name, title, address and telephone number of the person(s) at the client organization who is most knowledgeable about the work performed. The Proposer may also supply references from other work not cited in this section as related experience.
- f. Summarize other committed projects and impact on available capacity for proposed production.

**2. Proposed Staffing and Project Organization / Resumes**

This section of the proposal should establish the method that will be used by the Proposer to manage the project as well as identify key personnel assigned. The Proposer shall:

- a. Indicate adequacy of labor resources.
- b. Identify key personnel proposed to perform the work in the specified tasks and include major areas of any subcontract work.
- c. Include the name and roles of the Proposer's Project Manager and other key managerial and technical personnel to be assigned to the project. Thoroughly explain project organization and control measures, including the proposed quality assurance plan.
- d. Include a statement signed by a duly authorized officer of the Proposer to the effect that all personnel offered in the proposal are either employed full-time by the firm or contractually obligated to the firm and available for the duration of the project at the person-hour level shown.
- e. Provide a project or staffing organization chart that clearly delineates the proposed organization of key personnel and professional staff by name, title, tasks assigned and reporting relationship. Attach resumes of key personnel as an Appendix.

**3. Insurances**

**4. CER 04 – Contractor Service and Parts Support Data**

**5. CER 07 – Pre-Award Evaluation Data Form**

- a. Schedule One – Demonstration of Capacity
- b. Schedule Two – Demonstration of Technical Proficiency
- c. Schedule Three – Terminations and Defaults
- d. Schedule Four – Financial Statements
- e. Schedule Five – Principal Contractors

**6. CER 08 - Federal Certifications**

- 8.1.1 Buy America Certification – Rolling Stock
- 8.1.2 Buy America Certification – Manufactured Products



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- 8.2 Debarment and Suspension Certification for Prospective Contractor
- 8.3 Debarment and Suspension Certification (Lower-Tier Covered Transaction)
- 8.4 Non-Collusion Affidavit
- 8.5 Lobbying Certification
- 8.6 Certificate of Compliance with Bust Testing Requirements (Altoona)
- 8.7 DBE Approval Certification
- 8.8 Federal Motor Vehicle Safety Standards

**7. CER 9.3 – Sustainability Requirements, Form and Checklist**

**Package 5: Proprietary/Confidential Information Package Requirements**

The Proposer is directed to collect and submit any information it deems to be proprietary or confidential in nature in a separate marked and sealed package. If there is no confidential information, then the Proposer should include a statement to that effect. Subject package shall be submitted in accordance with the terms and conditions governing the submittal of Proposer's proposal to this RFP. Blanket-type identification by designating whole pages or sections as containing proprietary information, trade secrets or confidential commercial and financial information will not ensure confidentiality. The specific proprietary information, trade secrets or confidential commercial and financial information must be clearly identified as such.

The Proposer is advised that the Agency is public and as such may be subject to Federal, State and/or local Freedom of Information Act and Public Records Act provisions regarding the release of information concerning this RFP. If a request is received by the Agency for the release of Proposer's propriety/confidential information, subject request will be referred to the Proposer for review and consideration. If Proposer chooses to declare the information proprietary/confidential and withhold it from release, it shall defend and hold harmless the Agency from any legal action arising from such a declaration including reasonable attorneys' fees and costs.

There may be items in the first four packages that are included in Package 5 because they are considered to be proprietary/confidential information. When this occurs, the Proposer must note that fact in packages 1 through 4.

**IP 12.4 Agency Treatment of Proprietary/Confidential Information**

Access to government records and this RFP are governed by the California Public Records Act and the Federal Freedom of Information Act. Except as otherwise required to be disclosed by applicable State or Federal law, the Agency will exempt from disclosure proprietary information identified in Package 5 above.

Upon a request for records from a third party regarding this proposal, the Agency will notify the Proposer in writing. The Proposer must respond within five business days with the identification of any and all "proprietary, trade secret, or confidential commercial or financial" information. Failure to respond within the allowed period shall be deemed an approval to release. The Proposer shall indemnify, with counsel of the Agency's choosing, the Agency's defense costs associated with its refusal to produce such identified information; otherwise, the requested information may be released.

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The Agency shall employ sound business practices no less diligent than those used for the Agency's own confidential information to protect the confidence of all licensed technology, software, documentation, drawings, schematics, manuals, data and other information and material provided by the Proposer. THE AGENCY shall protect against disclosure confidential commercial or financial information, trade secrets or proprietary information as defined in or pursuant to the California Public Records Act to third parties, except as permitted by the Contract. The Proposer shall be responsible for ensuring that confidential commercial or financial information, trade secrets or proprietary information — with such determinations to be made by the Agency in its sole discretion — bears appropriate notices relating to its confidential character.

### **IP 12.5 Signing of Proposal Forms**

Proposals shall include firm name (and, in the event that the Proposer is a joint venture, the names of the individual firms comprising the joint venture); business address; and the name, title and business address of the responsible individual(s) with their telephone, facsimile (fax) numbers and email address who may be contacted during the Proposal evaluation period for scheduling oral presentations and for receiving notices from the Agency. The Proposer shall submit with their proposal a copy of the joint venture agreement.

Proposals shall be signed by those individual(s) authorized to bind the Proposer. The Proposer shall submit evidence of the official's authority to act for and bind the Proposer in all matters relating to the Proposal. (In the event the Proposer is a joint venture or consortium, a representative of each of the members of the joint venture or consortium shall execute the Proposal. Each joint venture or consortium member is jointly and severally liable for the joint venture or consortium.)

### **IP 12.6 Modification or Withdrawal of Proposals**

A modification of a proposal for this RFP will be accepted by the Agency only if the modification is received prior to the proposal due date, is specifically requested by the Agency, or is made with a requested BAFO. All modifications shall be made in writing and executed and submitted in the same form and manner as the original.

A Proposer may withdraw a proposal already received prior to the proposal due date by submitting to the Agency, in the same manner as the original proposal, a written request for withdrawal executed by the Proposer's authorized representative. After the proposal due date, a proposal may be withdrawn only if the Agency fails to award the Contract within the proposal validity period prescribed in "Duration of the Validity of Proposals," or any agreed-upon extension thereof. The withdrawal of a proposal does not prejudice the right of a Proposer to submit another proposal within the time set for receipt of proposals.

### **IP 12.7 Ownership and Cost of Proposal Development**

All proposals will become the property of the Agency.

This RFP does not commit the Agency to enter into a Contract, to pay any costs incurred in the preparation or presentation of a proposal, nor to procure or contract for the equipment.

## **IP 13. Proposal Evaluation, Negotiation and Selection**

Proposals will be evaluated, negotiated, selected and any award made in accordance with the criteria and procedures described below. The approach and procedures are those that are applicable to a competitive negotiated procurement whereby proposals are evaluated to determine which proposals are within a

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Competitive Range. Discussions and negotiations may then be carried out with Proposers within the Competitive Range, after which BAFOs may be requested.

However, the Agency may select a proposal for award without any discussions or negotiations or request for any BAFOs. Subject to the Agency's right to reject any or all proposals, the Proposer whose proposal is found to be most advantageous to the Agency will be selected, based upon consideration of the criteria of "Proposal Selection Process," below.

**IP 13.1 Confidentiality of Proposals**

Proposals will not be publicly opened. All proposals and evaluations will be kept strictly confidential throughout the evaluation, negotiation and selection process, except as otherwise required by applicable law. Only the members of the Selection Committee and Evaluation Team and other Agency officials, employees and agents having a legitimate interest will be provided access to the proposals and evaluation results during this period.

**IP 13.2 Duration of the Validity of Proposals**

Proposals and subsequent offers shall be valid for the period stated in "Section 1: Notice of Request for Proposals." The Agency may request Proposers to extend the period of time specified herein by written agreement between the Agency and the Proposer(s) concerned.

**IP 13.3 Evaluation Committee**

An Evaluation Committee, which will include officers, employees and agents of the Agency, will be established. The Evaluation Committee will carry out the detailed evaluations, including establishing the Competitive Range, carrying out negotiations and making the selection of the Proposer, if any, that may be awarded the Contract.

The Evaluation Committee will report its recommendations and findings to the appropriate Agency individual or body responsible for awarding the Contract.

**IP 13.4 Review of Proposals for Responsiveness and Proposers for Responsibility**

Each proposal will be reviewed to determine if the proposal is responsive to the submission requirements outlined in this RFP and if the Proposer is responsible.

A responsive proposal is one that follows the requirements of this RFP, includes all documentation, is submitted in the format outlined in this RFP, is of timely submission, and has the appropriate signatures as required on each document. Failure to comply with these requirements may result in the proposal being deemed nonresponsive.

A responsible Proposer is one that demonstrates the capability to satisfy the commercial and technical requirements set forth in the Solicitation. A Proposer's failure to demonstrate that it is responsible may result in the proposal being rejected.

Any proposal found to be nonresponsive or Proposer that is found to be non-responsible will not be considered further for award. Proposals that do not comply with the RFP instructions and requirements or do not include the required information may be rejected as insufficient and may not be further considered. The Agency reserves the right to request a Proposer to provide additional information and/or to clarify

information. The Agency's determination regarding the responsiveness of a proposal and the responsibility of a Proposer shall be final.

### **IP 13.5 Proposal Selection Process**

The following describes the process by which proposals will be evaluated and a selection made for a potential award. Any such selection of a proposal shall be made by consideration of researched information, information submitted within proposals and the criteria set forth below. An award, if made, will be to a responsible Proposer for a proposal that is found to be the most advantageous to the Agency based on price and other evaluation criteria considered.

The evaluation process will be conducted in three phases, as follows:

1. **Responsiveness and Responsibility Review.** Proposers may be eliminated from further consideration based on "Qualification Requirements" if the proposal does not meet the responsiveness criteria or if the proposer does not meet the responsibility criteria. "Qualification Requirements" specifies the requirements for determining responsible Proposers, all of which must be met by a Proposer to be found qualified. Final determination of a Proposer's qualification will be made based upon all information received during the evaluation process and as a condition for award.
2. **Technical Review.** "Proposal Evaluation Criteria" contains all the evaluation criteria by which a proposal from a qualified Proposer will be considered for selection including the criteria used during the Technical Review. A technical evaluation and life-cycle cost analysis may be conducted only on those proposals in the competitive range. Proposers may be eliminated from further consideration if they do not meet the technical performance criteria.
3. **Final Assessment.** "Proposal Evaluation Criteria" contains the evaluation criteria by which a proposal from a qualified Proposer will be considered for selection including the criteria used during the Final Assessment. A life-cycle cost analysis may be conducted only on those proposals that merit further evaluation based on the previous procurement evaluation steps. Proposers may be eliminated from further consideration if they do not fall within the competitive range based on the life cycle cost analysis. This step also includes discussions, demonstrations, negotiations, request revised proposals, best and final offers, etc. with selected vendors.

### **Qualification Requirements**

The following are the requirements for qualifying responsible Proposers. All of these requirements should be met; therefore, they are not listed by any particular order of importance. Any proposal that the Evaluation Committee finds not to meet these requirements, and cannot be made to meet these requirements, may be determined by the Evaluation Committee not to be responsible and the proposal rejected. The requirements are as follows:

1. Sufficient financial strength, resources and capability to finance the Work to be performed and to complete the Contract in a satisfactory manner, as measured by the following:
  - Proposer's financial statements prepared in accordance with generally accepted accounting principles of the jurisdiction in which the Proposer is located, and audited by

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an independent certified public accountant; or a statement from the Proposer regarding how financial information may be reviewed by the Agency.

- Proposer's ability to secure financial guarantees, if required, as evidenced by a letter of commitment from an underwriter, surety or other guarantor confirming that the Proposer can provide the required guarantee.
  - Proposer's ability to obtain required insurance with coverage values that meet minimum requirements evidenced by a letter from an underwriter confirming that the Proposer can be insured for the required amount.
  - Certification that the proposer has the legal, financial and technical capacity to carry out the Agency's Battery Electric Bus project as certified in CER07.
2. Evidence that the human and physical resources are sufficient to perform the Contract as specified and to ensure delivery of all equipment within the time specified in the Contract, to include the following:
- Engineering, management and service organizations with sufficient personnel and requisite disciplines, licenses, skills, experience and equipment to complete the Contract as required and to satisfy any engineering or service problems that may arise during the warranty period.
  - Adequate manufacturing facilities sufficient to produce and factory-test equipment on schedule.
  - A spare parts procurement and distribution system sufficient to support equipment maintenance without delays and a service organization with skills, experience and equipment sufficient to perform all warranty and on-site Work.
3. Evidence that Proposer is qualified in accordance with the provisions of "Section 8: Quality Assurance."
4. Evidence of satisfactory performance and integrity on contracts in making deliveries on time, meeting specifications and warranty provisions, parts availability and steps Proposer took to resolve any judgments, liens, Fleet Defects history or warranty claims. Evidence shall be by client references.

**Proposal Evaluation Criteria**

The following are the complete criteria by which proposals from responsive and responsible Proposers within the competitive range will be evaluated and ranked to make any selection of a proposal for a potential award. Any exceptions, conditions, reservations or understandings explicitly, fully and separately stated on CER 05 Form for Proposal Deviation, which do not cause the Agency to consider a proposal to be outside the Competitive Range, will be evaluated according to the respective evaluation criteria and sub-criteria that they affect.

**I. Overall Proposal**

**5%**

- Understanding of the Project
- Product Demonstration / Responsiveness
- Ability to meet the schedule

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- II. Experience of firm and Response to Inquiry 20%**
- Prime Contractor Company Background / Qualifications as a Bus Contractor
  - References and previous projects completed
  - Bus Design Experience
  - Propulsion System Experience
  - Battery Electric Bus Experience (# of buses built, Altoona status)
  - Major Sub-Contractor background / Qualifications
  - Verification of certifications
- III. Technical Design / Bus Operational Considerations: 15%**
- General Characteristics of Bus
  - Operational Characteristics (turning radius, smoothness of ride, start/stopping etc.)
  - Propulsion System (Motor, energy storage, BMS, etc...)
  - Operator Considerations / Driver Area
  - Operational Performance (Route Modeling, etc.)
- IV. Technical Design / Charging Station Operational Considerations: 15%**
- General Characteristics of Station Design
  - Environmental Considerations (impact to our sites, size, etc...)
  - Flexibility / Standardized Technology
  - Operational Considerations (impact on service)
- V. Passenger and Community Considerations: 10%**
- Overall Appearance (look and feel; flexibility for design)
  - Passenger Boarding (floor height, kneeling, etc...)
  - Passenger Amenities (seating, standing room, height of ceiling etc.)
  - ADA Accessibility (w/chair ramp, aisle ways,
- VI. Maintainability / Product Support: 10%**
- Maintenance Familiarity / Training required
  - Parts Familiarity
  - Maintenance Access
  - Samples of Manuals / Parts Catalogue / Schematics
  - Link-one / Electronic manuals capability
  - Parts Support (location, parts availability etc...)
  - Technical Support (engineers, field service, etc...)
  - Warranty
  - Training
  - Diagnostics / Tooling
- VII. Pricing and Life Cycle Costs: 25%**
- Cost of Buses
  - Cost of Charging
  - Bus Maintenance
  - Energy costs as calculated using Route and Rate model

- Projected Life Cycle Cost of Buses
- Cost of Charging Station
- Charging Equipment Maintenance
- Projected Life Cycle Costs of Station
- Contract Options

### **IP 13.6 Evaluation Procedures**

Proposals will be analyzed for conformance with the instructions and requirements of the RFP and Contract documents. Proposals that do not comply with these instructions and do not include the required information may be rejected as insufficient or not be considered for the Competitive Range. The Agency reserves the right to request that a Proposer provide any missing information and make corrections. Proposers are advised that the detailed evaluation forms and procedures will follow the same proposal format and organization specified in "Preparation of Proposals." Therefore, Proposers should pay close attention to and strictly follow all instructions. Submittal of a proposal will signify that the Proposer has accepted the whole of the Contract documents, except such conditions, exceptions, reservations or understandings explicitly, fully and separately stated on the forms and according to the instructions of CER 05 Form for Proposal Deviation. Any such conditions, exceptions, reservations or understandings that do not result in the rejection of the proposal are subject to evaluation under the criteria set forth in "Proposal Selection Process."

Evaluations will be made in strict accordance with all of the evaluation criteria specified in "Proposal Selection Process," above. The Agency will choose the proposal that it finds to be most advantageous to the Agency, based upon the evaluation criteria.

### **IP 13.7 Evaluations of Competitive Proposals**

- 1. Qualification of responsible Proposers.** Proposals will be evaluated to determine the responsibility of Proposers. A final determination of a Proposer's responsibility will be made upon the basis of initial information submitted in the proposal, any information submitted upon request by the Agency, information submitted in a BAFO and information resulting from Agency inquiry of Proposer's references and its own knowledge of the Proposer.
- 2. Detailed evaluation of proposals and determination of Competitive Range.** The Agency will carry out and document its evaluations in accordance with the criteria and procedures set forth in "Proposal Selection Process." Any proposal deficiencies that may render a proposal unacceptable will be documented. The Agency will make specific note of questions, issues, concerns and areas requiring clarification by Proposers and to be discussed in any meetings with Proposers that the Agency finds to be within the Competitive Range.

Rankings of the proposals against the evaluation will then be made for determining which proposals are within the Competitive Range, or may reasonably be made to be within the Competitive Range.

- 3. Proposals not within the Competitive Range.** Proposers of any proposals that have been determined by the Agency as not in the Competitive Range, and that cannot be reasonably made to be within the Competitive Range, will be notified in accordance with the Agency's policies.

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- 4. Discussions with Proposers in the Competitive Range.** The Proposers whose proposals are found by the Agency to be within the Competitive Range, or that may be reasonably made to be within the Competitive Range, will be notified and any questions or requests for clarifications provided to them in writing. Each such Proposer may be invited for an interview, demonstrations, and discussions with the Agency to discuss answers to written or oral questions, clarifications and any facet of its proposal.

In the event that a proposal that has been included in the Competitive Range contains conditions, exceptions, reservations or understandings to any Contract requirements as provided in CER 05Form for Proposal Deviation, said conditions, exceptions, reservations or understandings may be negotiated during these meetings. However, the Agency shall have the right to reject any and all such conditions and exceptions, and instruct the Proposer to amend its proposal and remove said conditions and exceptions; and any Proposer failing to do so may cause the Agency to find such proposal to be outside the Competitive Range.

No information, financial or otherwise, will be provided to any Proposer about any of the proposals from other Proposers, to the extent permitted by applicable law. Proposers will not be given a specific price or specific financial requirements they must meet to gain further consideration, except that proposed prices may be considered to be too high with respect to the marketplace or unacceptable. Proposers will not be told of their rankings among the other Proposers prior to Contract award.

- 5. Factory and site visits.** The Agency reserves the right to conduct factory visits of the Proposer's facilities and/or the facilities of major sub-suppliers included in the proposal.
- 6. Best and final offers.** After all interviews have been completed, the Proposers in the Competitive Range may be afforded the opportunity to amend their proposals and make their BAFOs.

Any modification to the initial proposal made by a Proposer in its BAFO shall be identified in its BAFO. BAFOs will be evaluated by the Agency according to the same requirements and criteria as the initial proposals, ("Proposal Selection Process"). The Agency will make appropriate adjustments to the initial scores for any sub-criteria and criteria that have been affected by any proposal modifications made by the BAFOs. These final scores and rankings within each criterion will again be arrayed by the Agency and considered according to the relative degrees of importance of the criteria defined in "Proposal Selection Process."

The Agency will then choose the proposal that it finds to be most advantageous to the Agency, based upon the evaluation criteria. The results of the evaluations and the selection of a proposal for any award will be documented.

The Agency reserves the right to make an award to a Proposer whose proposal it judges to be most advantageous to the Agency based upon the evaluation criteria, without conducting any written or oral discussions with any Proposers or solicitation of any BAFOs.

- 7. Debriefing.** Subsequent to the award, the unsuccessful Proposers will be notified and may request a debriefing. Proposers will be debriefed in accordance with Agency policies, including information regarding the evaluation of their proposal.



## **IP 14. Response to Proposals**

### **IP 14.1 Single Proposal Response**

If only one proposal is received in response to this RFP and it is found by the Agency to be acceptable, a price or cost analysis, or both, possibly including an audit, may be performed by or for the Agency. The Proposer has agreed to such analysis by submitting a proposal in response to this RFP.

### **IP 14.2 Availability of Funds**

This procurement is contingent upon the availability of appropriated federal, state and local funds. The Agency shall have no obligation to purchase, nor liability for any demands for payment submitted by the Contractor, or its subcontractors, vendors, manufacturers, or suppliers if sufficient federal, state and local funds are not available to purchase the rolling stock, materials, equipment, supplies, nor pay the Agency's claims. The sufficiency of said funds shall solely be determined by the Agency.

### **IP 14.3 Agency Contract Approval Process**

Once the evaluation process, discussions and negotiations have been completed, a recommendation will be made to the Agency's Board of Directors. Upon approval by the Board of Directors a contract and Purchase Order will be issued to the approved Proposer.

### **IP 14.4 Agency Rights**

The Agency reserves the right to cancel the procurement in whole or in part, at its sole discretion, at any time before the Contract is fully executed and approved on behalf of the Agency.

The Agency reserves the right to reject any or all proposals, to undertake discussions with one or more Proposers, and to accept that proposal or modified proposal which, in its judgment, will be most advantageous to the Agency, considering price and other evaluation criteria. The Agency reserves the right to determine any specific proposal that is conditional or not prepared in accordance with the instructions and requirements of this RFP to be nonresponsive. The Agency reserves the right to waive any Defects, or minor informalities or irregularities in any proposal which do not materially affect the proposal or prejudice other Proposers.

All Proposers are required to sign a non-collusion certification. If there is any evidence indicating that two or more Proposers, companies, or individuals are in collusion to restrict competition or are otherwise engaged in anti-competitive practices, the proposals of all such Proposers shall be rejected, and such evidence may be a cause for disqualification of the participants in any future solicitations undertaken by the Agency.

The Agency may reject a proposal that includes unacceptable Deviations as provided in CER 05Form for Proposal Deviation.

### **IP 14.5 Execution of Contract**

The acceptance of a proposal for award, if made, shall be evidenced in writing by a notice of award of Contract delivered to the Proposer whose proposal is accepted. Upon notice of award of the Contract to a Proposer, the Proposer shall commence performance under the Contract by furnishing any required bonds, and by furnishing copies of the certificates of insurance with endorsements, required to be procured by the Contractor pursuant to the Contract documents within 10 calendar days after the date of

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receipt of the notice of award. Failure to fulfill these requirements within the specified time is cause for termination of the Contract under “Termination for Default” in Section 3.

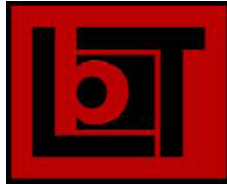
**IP 15. Conflicts of Interests and Gratuities**

Proposers are prohibited from engaging in any practice that may be considered as a conflict of interests under existing Agency policies and/or Federal and State law, consistent with FTA Curricular No. 4220. 1F, California Political Reform Act of 1974 (Government Code 8100, et seq.) and implementing regulations, as interpreted by the Fair Political Practices Commission, and to refrain from participating in any gifts, favors or other forms of compensation that may be viewed as a gratuity in accordance with existing policies and laws.

**IP 16. Agency-Specific Provisions**

Not Applicable

## **REQUEST FOR PROPOSAL**



### **LONG BEACH PUBLIC TRANSPORTATION COMPANY**

1963 E. Anaheim Street, Long Beach, CA 90813  
(562) 591-8753

**Battery Electric Bus Project  
RFP 15-001**

## **Section 3**

### **General Conditions**

## **SECTION 3: GENERAL CONDITIONS**

### **GC 1. Definitions**

The following are definitions of special terms used in this document:

**Agency:** Long Beach Public Transportation Co. aka: LBPTC, Long Beach Transit, and LBT. This term shall include joint procurement partners.

**Authorized Signer:** The person who is executing this Contract on behalf of the Contractor and who is authorized to bind the Contractor.

**Best And Final Offer (BAFO):** The last Proposal made by a Proposer. If a BAFO is not specifically requested by the Agency, or if the Proposer does not promptly respond to a request for BAFO, then the most recent, current Proposal is the BAFO.

**Class 1 Failure (physical safety):** A failure that could lead directly to passenger or operator injury and represents a severe crash situation.

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

**Competitive Range:** The range of proposals that are identified as the most highly rated, unless the range is further reduced for purposes of efficiency.

**Contract:** The Proposal and its acceptance by the Agency as manifested by the Contract documents specified in “Section 10: Contract.”

**Contracting Officer:** Also referred to as the “Buyer”. The person who is executing this Contract on behalf of the Agency and who has complete and final authority except as limited herein.

**Contractor:** The successful Proposer who is awarded a Contract for providing all buses and equipment described in the Contract documents.

**Days:** Unless otherwise stated, “days” shall mean calendar days.

**Defect:** Patent or latent malfunction or failure in manufacture, installation or design of any component or subsystem.

**Deviation:** Variance from a requirement or specification that does not alter the basis of a contract or adversely affects its performance.

**Due Date:** The date and time by which Proposals must be received by the Agency as specified in “Section 1: Notice of Request for Proposals.”

**Extended Warranty:** A warranty available for purchase above the standard warranty.

**Fatigue Failure (Corrosion Fatigue):** The mechanical degradation of a material under the joint action of corrosion and cyclic loading.

**Pass-Through Warranty:** A warranty provided by the Contractor but administered directly with the component Supplier.

**Proposal:** A promise, if accepted, to deliver equipment and services according to the underlying solicitation of the Agency documented using the prescribed form in the solicitation, including any Proposal or BAFO.

**Proposer:** A legal entity that makes a Proposal.

**Related Defect:** Damage inflicted on any component or subsystem as a direct result of a separate Defect.

**Solicitation:** Agency's request for proposals.

**Superior Warranty:** A warranty still in effect after all contractually required warranties have expired. The remaining warranty is administered directly between the sub-Supplier and the Agency.

**Supplier:** Any manufacturer, company or Agency providing units, components or subassemblies for inclusion in the bus that are installed by the Contractor. Supplier items shall require qualification by type and acceptance tests in accordance with requirements defined in "Section 8: Quality Assurance."

**Subcontractor:** Any manufacturer, company or Agency providing units, components or subassemblies for inclusion in the bus that are installed by a Subcontractor. Subcontractor items shall require qualification by type and acceptance tests in accordance with requirements defined in "Section 8: Quality Assurance."

**Work:** Any and all labor, supervision, services, materials, machinery, equipment, tools, supplies and facilities called for by the Contract and necessary to the completion thereof.

## **GC 2. Materials and Workmanship**

The Contractor shall be responsible for all materials and workmanship in the construction of the bus and all accessories used, whether the same are manufactured by the Contractor or purchased from a Supplier. This provision excludes any equipment leased or supplied by the Agency, except insofar as such equipment is damaged by the failure of a part or component for which the Contractor is responsible, or except insofar as the damage to such equipment is caused by the Contractor during the manufacture of the buses.

## **GC 3. Conformance with Specifications and Drawings**

Materials furnished and Work performed by the Contractor shall conform to the requirements of the Technical Specifications and other Contract documents. Notwithstanding the provision of drawings, technical specifications or other data by the Agency, the Contractor shall have the responsibility of supplying all parts and details required to make the bus complete and ready for service even though such

details may not be specifically mentioned in the drawings and specifications. Items that are installed by the Agency shall not be the responsibility of the Contractor unless they are included in this Contract.

Omissions from the Contract specifications, or the inaccurate description of details of Work that are manifestly necessary to carry out the intent of the Contract specifications, or that are customarily performed, shall not relieve the Contractor from performing such omitted Work or inaccurately described details of the Work, and they shall be performed as if fully and correctly set forth and described.

## **GC 4. Inspection, Testing and Acceptance**

### **GC 4.1 General**

The Agency's Representative shall at all times have access to the Work, the Contractor and, through the Contractor, its Suppliers. The Contractor and its Suppliers shall furnish every reasonable facility for ascertaining that the materials and the workmanship are in accordance with the requirements of the Contract Documents. All Work done shall be subject to the Agency Representative's inspection and approval in accordance with the approved Work products developed as a result of the Contract Documents.

The pre-delivery tests and inspections shall be performed at the Contractor's plant; they shall be performed in accordance with the procedures defined in "Section 8: Quality Assurance", and they may be witnessed by the resident inspector. When a bus passes these tests and inspections, the resident inspector shall authorize release of the bus.

Within fifteen (15) calendar days after arrival at the designated point of delivery, the bus shall undergo the Agency tests defined in "Post-Delivery Tests." If the bus passes these tests or if the Agency does not notify the Contractor of non-acceptance within 15 calendar days after delivery, then acceptance of the bus by the Agency occurs on the 15th day after delivery. If the bus fails these tests, it shall not be accepted until the repair procedures defined in "Repairs After Non-acceptance" have been carried out and the bus retested until it passes. Acceptance occurs earlier if the Agency notifies the Contractor of early acceptance or places the bus in revenue service.

### **GC 4.2 Risk of Loss**

The Agency shall assume risk of loss of the bus on delivery, as defined in "Bus Delivery." Prior to this delivery, the Contractor shall have risk of loss of the bus, including any damages sustained during the delivery regardless of the status of title or any payments related to the bus. Drivers shall keep a maintenance log en route, and it shall be delivered to the Agency with the bus. If the bus is released back to the Contractor for any reason, the Contractor has the risk of loss upon such release.

## **GC 5. Title and Warranty of Title**

Adequate documents for registering the bus in the State of California shall be provided to the Agency not less than 10 business days before delivery to the Agency. Upon acceptance of each bus, the Contractor warrants that the title shall pass to the Agency free and clear of all encumbrances.

## **GC 6. Intellectual Property Warranty**

The Agency shall advise the Contractor of any impending patent suit related to this Contract against the Agency and provide all information available. The Contractor shall defend any suit or proceeding brought

against the Agency, with counsel of Agency's choice, based on a claim that any equipment, or any part thereof, furnished under this Contract constitutes an infringement of any patent, and the Contractor shall pay all damages and costs awarded therein, excluding incidental and consequential damages, against the Agency. In case said equipment, or any part thereof, is in such suit held to constitute infringement and use of said equipment or parts is enjoined, the Contractor shall, at its own expense and at its option, either procure for the Agency the right to continue using said equipment or part, or replace same with non-infringing equipment, or modify it so it becomes non-infringing.

The Contractor's obligations under this section are discharged and the Agency shall hold the Contractor harmless with respect to the equipment or part if it was specified by the Agency and all requests for substitutes were rejected, and the Contractor advised the Agency under "Questions, Clarifications and Omissions" of a potential infringement, in which case the Contractor shall be held harmless.

## **GC 7. Data Rights**

### **GC 7.1 Proprietary Rights/Rights in Data**

The term "subject data" used in this clause means recorded information, whether or not copyrighted, that is delivered or specified to be delivered under the Contract. It includes the proprietary rights of the following:

- Shop drawings and working drawings
- Technical data including manuals or instruction materials, computer or microprocessor software
- Patented materials, equipment, devices or processes
- License requirements

The Agency shall protect proprietary information provided by the Contractor to the fullest extent of the law. The Contractor shall grant a non-exclusive license to allow the Agency to utilize such information in order to maintain the vehicles. In the event that the Contractor no longer provides the information the Agency has the right to reverse engineer patented parts and software.

The Agency reserves a royalty-free, non-exclusive and irrevocable license to reproduce, publish or otherwise use, and to authorize others to use, the following subject data for its purposes: (1) any subject data required to be developed and first produced in the performance of the Contract and specifically paid for as such under the Contract, whether or not a copyright has been obtained; (2) any rights of copyright to which the Contractor, Subcontractor or Supplier purchases ownership for the purpose of performance of the Contract and specifically paid for as such under the Contract; and (3) any operational data required for Agency reporting to FTA in support of TIGGER reporting requirements. The Contractor agrees to include the requirements of this clause, modified as necessary to identify the affected parties, in each subcontract and supply order placed under the Contract.

### **GC 7.2 Access to Onboard and Charging Operational Data**

The Agency grants to the Contractor the right to inspect, examine, download, and otherwise obtain any information or data available from components provided by the Contractor, including, but not limited to, any electronic control modules or other data-collection devices, to the extent necessary to enable Contractor to perform reliability maintenance analysis, operational reporting, corrective action and/or other engineering type Work for the bus. This right expressly excludes access to information or data collected on any equipment not provided and installed by the Contractor.

The Contractor grants to the Agency the right to inspect, examine, download, and otherwise obtain any information or data available from components provided by the Contractor, including, but not limited to, any electronic control modules or other data-collection devices, to the extent necessary to enable Agency to perform reliability maintenance analysis, operational reporting, corrective action and/or other engineering type Work for the bus. This right expressly excludes access to information or data collected on any equipment not provided and installed by the Contractor.

## **GC 8. Changes**

### **GC 8.1 Contractor Changes**

Any proposed change in this Contract shall be submitted to the Agency for its prior approval. Oral change orders are not permitted. No change in this Contract shall be made without the prior written approval of the Contracting Officer. The Contractor shall be liable for all costs resulting from, and/or for satisfactorily correcting, any specification change not properly ordered by written modification to the Contract and signed by the Contracting Officer.

### **GC 8.2 Agency Changes**

The Agency or Contractor may obtain changes to the Contract by use of the Agency's Request for Change Order (RFCO) process and forms (See Appendix D). As soon as reasonably possible, and along with the RFCO, the Contractor shall submit to the Contracting Officer a detailed price and schedule Proposal for the Work to be performed. This Proposal shall be accepted or modified by negotiations between the Contractor and the Contracting Officer. At that time, a detailed modification shall be executed in writing by both parties. Disagreements that cannot be resolved within negotiations shall be resolved in accordance with "Disputes," below. Regardless of any disputes, the Contractor shall proceed with the Work ordered.

## **GC 9. Legal Clauses**

### **GC 9.1 Indemnification**

See Section SP9, Indemnification and Insurance.

#### **GC 9.1.1 Not Applicable**

#### **GC 9.1.2 Not Applicable**

### **GC 9.2 Suspension of Work**

**GC 9.2.1.** The Agency may at any time and for any reason within its sole discretion issue a written order to the Contractor suspending, delaying or interrupting all or any part of the Work for a specified period of time.

**GC 9.2.2.** The Contractor shall comply immediately with any such written order and take all reasonable steps to minimize costs allocable to the Work covered by the suspension during the period of work stoppage. Contractor shall continue the Work that is not included in the suspension and shall continue such ancillary activities as are not suspended. The Contractor shall resume performance of the suspended Work upon expiration of the notice of suspension, or upon direction from the Agency.



**GC 9.2.3.** The Contractor shall be allowed an equitable adjustment in the Contract price (excluding profit) and/or an extension of the Contract time, to the extent that cost or delays are shown by the Contractor to be directly attributable to any suspension. However, no adjustment shall be made under this section for any suspension, delay or interruption due to the fault or negligence of the Contractor, or for which an equitable adjustment is provided for, or excluded under any other term or condition of the Contract. As soon as reasonably possible but no later than forty-five (45) calendar days, or any other period of time agreed to by the parties, after receipt of the written suspension of work notice, the Contractor shall submit to the Contracting Officer a detailed price and schedule Proposal for the suspension, delay or interruption.

### **GC 9.3 Excusable Delays/Force Majeure**

**GC 9.3.1.** If the Contractor is delayed at any time during the progress of the Work by the neglect or failure of the Agency or by a cause as described below, then the time for completion and/or affected delivery date(s) shall be extended by the Agency subject to the following cumulative conditions:

- a. The cause of the delay arises after the Notice of Award and was not nor could have been anticipated by the Contractor by reasonable investigation before such award. Such cause may also include force majeure events such as any event or circumstance beyond the reasonable control of the Contractor, including but not limited to acts of God; earthquake, flood and any other natural disaster; civil disturbance, strikes and labor disputes; fires and explosions; war and other hostilities; embargo; or failure of third parties, including Suppliers or Subcontractors, to perform their obligations to the Contractor;
- b. The Contractor demonstrates that the completion of the Work and/or any affected deliveries will be actually and necessarily delayed;
- c. The Contractor has taken measures to avoid and/or mitigate the delay by the exercise of all reasonable precautions, efforts and measures, whether before or after the occurrence of the cause of delay; and
- d. The Contractor makes written request and provides other information to the Agency as described in GC 9.3.4 below.

A delay in meeting all of the conditions of this section shall be deemed an excusable delay. Any concurrent delay that does not constitute an excusable delay shall not be the sole basis for denying a request hereunder.

**GC 9.3.2.** None of the above shall relieve the Contractor of any liability for the payment of any liquidated damages owing from a failure to complete the Work by the time for completion that the Contractor is required to pay pursuant to “Liquidated Damages for Late Delivery of the Bus” for delays occurring prior to, or subsequent to the occurrence of an excusable delay.

**GC 9.3.3.** The Agency reserves the right to rescind or shorten any extension previously granted, if subsequently the Agency determines that any information provided by Contractor in support of a request for an extension of time was erroneous; provided, however, that such information or facts, if known, would have resulted in a denial of the request for an excusable delay. Notwithstanding the above, the Agency will not rescind or shorten any extension previously granted if the Contractor acted in reliance upon the granting of such extension and such extension was based on information which, although later found to have been erroneous, was submitted in good faith by the Contractor.

**GC 9.3.4.** No extension or adjustment of time shall be granted unless: (1) written notice of the delay is filed with the Agency within fourteen (14) calendar days after the commencement of the delay and (2) a written application therefore, stating in reasonable detail the causes, the effect to date and the probable future effect on the performance of the Contractor under the Contract, and the portion or portions of the Work affected, is filed by the Contractor with the Agency within thirty (30) calendar days after the commencement of the delay. No such extension or adjustment shall be deemed a waiver of the rights of either party under this Contract. The Agency shall make its determination within thirty (30) calendar days after receipt of the application.

## **GC 9.4 Termination**

### **GC 9.4.1. Termination for Convenience**

The performance of Work under this Contract may be terminated by the Agency in accordance with this clause in whole, or from time to time in part, whenever the contracting officer shall determine that such termination is in the best interest of the Agency. Any such termination shall be effected by delivery to the Contractor of a notice of termination specifying the extent to which performance of Work under the Contract is terminated, and the date upon which such termination becomes effective.

After receipt of a notice of termination, and except as otherwise directed by the Contracting Officer, the Contractor shall do the following:

- Stop Work under the Contract on the date and to the extent specified in the notice of termination.
- Place no further orders or subcontracts for materials, services or facilities, except as may be necessary for completion of such portion of the Work under the Contract as is not terminated.
- Terminate all orders and subcontracts to the extent that they relate to the performance of work terminated by the notice of termination; assign to the Agency in the manner, at the times, and to the extent directed by the Contracting Officer, all of the right, title and interest of the Contractor under the orders and subcontracts so terminated, in which case the Agency shall have the right, in its discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts.
- Settle all outstanding liabilities and all claims arising out of such termination of orders and subcontracts, with the approval or ratification of the Contracting Officer, to the extent he or she may require, which approval or ratification shall be final for all the purposes of this clause.
- Transfer title to the Agency and deliver in the manner, at the times and to the extent, if any, directed by the Contracting Officer the fabricated or non-fabricated parts, Work in process, completed Work, supplies and other material produced as part of, or acquired in connection with the performance of, the Work terminated, and the completed or partially completed plans, drawings, information and other property which, if the Contract had been completed, would have been required to be furnished to the Agency.
- Use its best efforts to sell, in the manner, at the times, to the extent, and at the price(s) directed or authorized by the Contracting Officer, any property of the types referred to above, provided, however, that the Contractor shall not be required to extend credit to any purchaser, and may acquire any such property under the conditions prescribed by and at a price(s) approved by the Contracting Officer, and provided further that the proceeds of any such transfer or disposition shall be applied in reduction of any payments to be made by the Agency to the Contractor under this Contract or shall otherwise be credited to the price or cost of the Work covered by this Contract or paid in such other manner as the Contracting Officer may direct.

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- Complete performance of such part of the Work as shall not have been terminated by the notice of termination.
- Take such action as may be necessary, or as the Contracting Officer may direct, for the protection or preservation of the property related to this Contract that is in the possession of the Contractor and in which the Agency has or may acquire an interest.

The Contractor shall be paid its costs, including Contract closeout costs, and profit on Work performed up to the time of termination. The Contractor shall promptly submit its termination claim to Agency to be paid the Contractor. Settlement of claims by the Contractor under this termination for convenience clause shall be in accordance with the provisions set forth in Part 49 of the Federal Acquisition Regulations (48 CFR 49) except that wherever the word “Government” appears, it shall be deleted and the word “Agency” shall be substituted in lieu thereof.

**GC 9.4.2. Termination for Default**

The Agency may, by written notice of default to the Contractor, terminate the whole or any part of this Contract if the Contractor fails to make delivery of the supplies or to perform the services within the time specified herein or any extension thereof; or if the Contractor fails to perform any of the other material provisions of the Contract, or so fails to make progress as to endanger performance of this Contract in accordance with its terms, and in either of these two circumstances does not cure such failure within a period of ten (10) business days, or such longer period as the Contracting Officer may authorize in writing, after receipt of notice from the Contracting Officer specifying such failure.

If the Contract is terminated in whole or in part for default, the Agency may procure, upon such terms and in such manner as the Contracting Officer may deem appropriate, supplies or services similar to those so terminated. The Contractor shall be liable to the Agency for any excess costs for such similar supplies or services, and shall continue the performance of this Contract to the extent not terminated under the provisions of this clause.

Except with respect to defaults of Subcontractors, the Contractor shall not be liable for any excess costs if the failure to perform the Contract arises out of a cause beyond the control and without the fault or negligence of the Contractor. If the failure to perform is caused by the default of a Subcontractor, and if such default arises out of causes beyond the control of both the Contractor and Subcontractor, and without the fault or negligence of either of them, the Contractor shall not be liable for any excess costs for failure to perform, unless the supplies or services to be furnished by the Subcontractor were obtainable from other sources and in sufficient time to permit the Contractor to meet the required delivery schedule.

Payment for completed supplies delivered to and accepted by the Agency shall be at the Contract price. The Agency may withhold from amounts otherwise due the Contractor for such completed supplies such sum as the Contracting Officer determines to be necessary to protect the Agency against loss because of outstanding liens or claims of former lien holders.

If, after notice of termination of this Contract under the provisions of this clause, it is determined for any reason that the Contractor was not in default under the provisions of this clause, or that the default was excusable under the provisions of this clause, the rights and obligations of the parties shall be the same as if the notice of termination had been issued pursuant to termination for convenience of the Agency.

### **GC 9.5 Compliance with Laws and Regulations**

Contractor shall at all times comply with all applicable laws, regulations, policies, procedures and directives (together, the “Law”), including without limitation, FTA regulations, policies, procedures and directives, including those listed directly or by reference in the agreement between the Agency and FTA that funds any part of this Contract, 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.

### **GC 9.6 Changes of Law**

Changes of Law that become effective after the Proposal Due Date may result in price changes. If a price adjustment is indicated, either upward or downward, it shall be negotiated between the Agency and the Contractor and the final Contract price will be adjusted upwards or downwards to reflect such changes in Law. Such price adjustment may be audited, where required.

### **GC 9.7 Governing Law and Choice of Forum**

This Contract shall be governed by the laws of California without regard to conflict of law rules. The Contractor consents to the jurisdiction of the identified State, County of Los Angeles.

### **GC 9.8 Disputes**

Except as may otherwise be provided in the formal Contract, any controversy or dispute arising under or related to this Contract that is not disposed of by agreement shall be decided in accordance with the following steps. However, by any future mutual written agreement this matter may be taken immediately to any higher step in the dispute resolution process, or mutually agreed to alternative dispute resolution process (which may include structured negotiations, mediation or arbitration) or litigation. The laws and equitable principles of the State of California shall apply to all of these proceedings.

- 1. Notice of dispute.** All disputes shall be initiated through a written notice submitted by either party to the other party.
- 2. Negotiation between contracting officers.** The parties shall attempt in good faith to resolve any dispute arising out of or relating to the contract promptly by negotiation between executives who have authority to settle the controversy (Contracting Officer). Either party may give the other party written notice of any dispute not resolved in the normal course of business as provided in Section 1 above. Within 14 (fourteen) calendar days after delivery of the dispute notice, the receiving party shall submit to the other party a written response. The dispute notice and written response thereto shall include: (a) a statement of each such party’s summary of the arguments supporting that position; (b) any evidence supporting the party’s position; and (c) the name of the executive who will represent that party and the names of any other persons who will accompany that executive in these negotiations. Within 28 (twenty-eight) calendar days after the delivery of the dispute notice, the Contracting Officer of both parties shall meet at a mutually acceptable time and place, and thereafter as they reasonably deem necessary, to attempt to resolve the dispute. All reasonable requests for information by one party to the other shall be honored. These negotiations shall be governed by California Evidence Code section 1152. The parties’ failure to strictly comply with the above time frames shall not waive any dispute for purposes of this section. However, the parties agree to act promptly and in good faith so as to mitigate any delays.

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If this matter has not been resolved by these individuals within 42 (forty-two) calendar days of the dispute notice, then the dispute shall proceed to the Chief Executive Officer as set forth in section 3 below.

- 3. Chief Executive Officer's decision.** Should the dispute not be resolved by negotiation between Contracting Officers, as provided in section 2 above, then the Agency's Contracting Officer from section 2 shall submit a written request for decision to the Agency's Chief Executive Officer (CEO) along with all documentation and minutes from the negotiations. The Chief Executive Officer or his/her designee shall issue a written decision within 14 (fourteen) days of receipt of request.
- a. For disputes involving \$50,000 or less, the decision of the CEO shall be administratively final and conclusive upon the issuance of such a decision. For disputes involving \$50,000 or less, it is the intent of the parties that such administratively final and conclusive decision pursuant to either this section shall only be overturned if determined by a court of competent jurisdiction to be fraudulent, arbitrary, capricious, unsupported by the evidence or so grossly erroneous as to imply bad faith. For disputes greater than \$50,000, the decision of the CEO shall be administratively final and conclusive unless, within 30 (thirty) days from the date of delivery of the written decision, the Contractor appeals the decision in writing to the Agency's Chief Executive Officer or designee who shall render a written decision within 14 (fourteen) days of delivery of such written appeal. Such decision by the Chief Executive Officer or his or her designee shall be administratively final and conclusive, upon the issuance of such a decision.
  - b. Within 30 (thirty) days of the issuance of any administratively final and conclusive decision under this section, the Contractor shall notify the Agency in writing of the Contractor's agreement with the final decision. Failure to provide such written notice of agreement shall indicate an interest by the Contractor to proceed with mediation and/or arbitration as set for in the sections 4 and 5 below.
  - c. Pending final resolution of a dispute hereunder, the Contractor shall proceed diligently with the performance of its obligations under the Contract in accordance with the written directions of the Agency.
- 4. Mediation.** Any and all matters not resolved by negotiation shall proceed to mediation, utilizing the services of American Arbitration Association (AAA), Judicate West (JW), ADR Services, Inc. (ADR), Judicial Arbitration and Mediation Services, Inc. (JAMS), or any other mutually agreeable mediation / arbitration service or their successors to be held within the County of Los Angeles, California.

Either party may commence mediation by providing the other party with a written request for mediation after satisfying the requirements in Section 2 and 3 above unless waived in writing by the parties. The parties will cooperate with each other in the selection of a mediator and in scheduling the mediation proceedings. The parties agree to participate in the mediation in good faith and that they will all share equally in its costs. The mediation proceedings shall be governed by California Evidence Code sections 1115-1128.

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If this matter is not resolved through mediation, then it shall be submitted for final binding arbitration pursuant to Paragraph 5 (below).

- 5. Arbitration.** Except for the provisional remedies which are expressly reserved for the Superior Courts of California and as may otherwise be provided in the formal Contract, any controversy or dispute arising out of this Contract, and the interpretation of any of the provisions hereof that cannot be resolved by Sections 1, 2, 3 and/or 4 above, shall be submitted to binding arbitration in the County of Los Angeles, California before a retired California Superior Court judge or Court of Appeal justice. The arbitrator(s) shall be selected by mutual agreement of the parties, from a panel of proposed retired judges or justices from AAA, JW, ADR and/or JAMS, or any other mutually agreeable arbitration service.

If the parties cannot agree upon an arbitrator, the parties may petition the Los Angeles Superior Court for the appointment of an arbitrator, consistent with the requirements set forth herein, from one of the above-referenced services. The arbitration shall be held before a single arbitrator. However, if the amount in controversy is greater than \$250,000, then one arbitrator shall be selected by each party, and the two selected arbitrators shall then select a third arbitrator within 10 (ten) calendar days of their selection.

This arbitration process shall be conducted pursuant to the California Arbitration Act as set forth in California Code of Civil Procedure sections 1280-1294.2. The arbitration shall be binding. The parties waive their right to a trial of the disputed issue whether by a jury trial or by a court trial. The costs of the arbitration, including the arbitrator's fee, shall be borne equally by the parties to the arbitration.

In addition to any other rights hereunder, each party to the Contract shall have the right to make a demand for and to receive an offset against any amounts due from the other party.

The decision of the arbitrator(s) shall be final and enforceable in any court having jurisdiction over the parties.

### **GC 9.9 Maintenance of Records; Access by Agency; Right to Audit Records**

In accordance with 49 CFR § 18.36(d), 49 CFR § 19.48(d), and 49 USC § 5325(a), provided the Agency is the FTA recipient or a sub-grantee of the FTA recipient, the Contractor agrees to provide the Agency, FTA, the Comptroller General of the United States, the Secretary of the U.S. Department of Transportation, the State of California, or any of their duly authorized representatives access to any books, documents, papers and records of the Contractor that are directly pertinent to or relate to this Contract (1) for the purpose of making audits, examinations, excerpts and transcriptions and (2) when conducting an audit and inspection.

1. In the event of a sole source Contract, single Proposal, single responsive Proposal, or competitive negotiated procurement, the Contractor shall maintain and the Contracting Officer, the U.S. Department of Transportation (if applicable) or the representatives thereof shall have the right to examine all books, records, documents and other cost and pricing data related to the Contract price, unless such pricing is based on adequate price competition, established catalog or market prices of commercial items sold in substantial quantities to the public, or prices set by law or

regulation, or combinations thereof. Data related to the negotiation or performance of the Contract shall be made available for the purpose of evaluating the accuracy, completeness and currency of the cost or pricing data. The right of examination shall extend to all documents necessary for adequate evaluation of the cost or pricing data, along with the computations and projections used therein, including review of accounting principles and practices that reflect properly all direct and indirect costs anticipated for the performance of the Contract.

2. For Contract modifications or change orders the Contracting Officer, the U.S. Department of Transportation, if applicable, or their representatives shall have the right to examine all books, records, documents and other cost and pricing data related to a Contract modification, unless such pricing is based on adequate price competition, established catalog or market prices of commercial items sold in substantial quantities to the public, or prices set by law or regulation, or combinations thereof. Data related to the negotiation or performance of the Contract modification or change order shall be made available for the purpose of evaluating the accuracy, completeness and currency of the cost or pricing data. The right of examination shall extend to all documents necessary for adequate evaluation of the cost or pricing data, along with the computations and projections used therein, either before or after execution of the Contract modification or change order for the purpose of conducting a cost analysis. If an examination made after execution of the Contract modification or change order reveals inaccurate, incomplete or out-of-date data, the Contracting Officer may renegotiate the Contract modification or change order price adjustment, and the Agency shall be entitled to any reductions in the price that would result from the application of accurate, complete or up-to-date data.

The requirements of this section are in addition to other audit, inspection and record-keeping provisions specified elsewhere in the Contract documents.

### **GC 9.10 Confidential Information**

Access to government records is governed by the State of California Public Records Act and the Federal Freedom of Information Act. Except as otherwise required by the Public Records Act and the Freedom of Information Act, the Agency will exempt from disclosure proprietary information, trade secrets and confidential commercial and financial information submitted or disclosed during the Contract period. Any such proprietary information, trade secrets or confidential commercial and financial information that a Contractor believes should be exempted from disclosure shall be specifically identified and marked as such. Blanket-type identification by designating whole pages or sections as containing proprietary information, trade secrets or confidential commercial and financial information will not ensure confidentiality. The specific proprietary information, trade secrets or confidential commercial and financial information must be clearly identified as such.

Upon a request for records from a third party regarding the Contract, the Agency will notify the Contractor in writing. The Contractor must respond within five (5) days with the identification of any and all “proprietary, trade secret or confidential commercial or financial” information, and the Contractor shall indemnify the Agency’s defense costs including reasonable attorneys’ fees and costs from any and all legal actions associated with its refusal to produce such identified information with counsel of the Agency’s choosing; otherwise, the requested information may be released.

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The Agency shall employ sound business practices no less diligent than those used for the Agency's confidential information to protect the confidence of all licensed technology, software, documentation, drawings, schematics, manuals, data and other information and material provided by the Contractor pursuant to the Contract that contain confidential commercial or financial information, trade secrets or proprietary information as defined in or pursuant to the California Public Records Act and the Freedom of Information Act against disclosure of such information and material to third parties except as permitted by the Contract. The Contractor shall be responsible for ensuring that confidential commercial or financial information, trade secrets or proprietary information, with such determinations to be made by the Agency in its sole discretion, bears appropriate, blatantly obvious and clear notices relating to its confidential character.

During the performance of the Work under the Contract, it may be necessary for either party (the "Discloser") to make confidential information available to the other party (the "Recipient"). The Recipient agrees to use all such information solely for the performance of the Work under the Contract and to hold all such information in confidence and not to disclose it to any third party without the prior written consent of the Discloser. Likewise, the Recipient agrees that all information developed in connection with the Work under the Contract shall be used solely for the performance of the Work under the Contract, and shall be held in confidence and not disclosed to any third party without the prior written consent of the Discloser.

This Confidentiality section shall survive the termination or expiration of the Contract.

### **GC 9.11 Conflicts of Interest, Gratuities**

No member, officer, or employee of the Agency or of a local public body during his or her tenure, or one year thereafter, shall have any interest, direct or indirect, in this Contract or the proceeds thereof.

### **GC 9.12 General Nondiscrimination Clause**

In connection with the performance of Work provided for under this Contract, the Contractor agrees that it will not, on the grounds of race, religious creed, color, national origin, ancestry, physical disability, medical condition, marital status, sex, sexual orientation or age, discriminate or permit discrimination against any person or group of people in any manner prohibited by federal, state or local laws.

### **GC 9.13 Amendment and Waiver**

#### **GC 9.13.1. Amendment**

Any modification or amendment of any provisions of any of the Contract documents shall be effective only if in writing, signed by authorized representatives of both the Agency and Contractor, and specifically referencing the respective Contract.

#### **GC 9.13.2. Waiver**

In the event that either party elects to waive its remedies for any breach by the other party of any covenant, term or condition of this Contract, such waiver shall not limit the waiving party's remedies for any succeeding breach of that or of any other term, covenant or condition of this Contract.

### **GC 9.14 Remedies not Exclusive**



The rights and remedies of the Agency provided herein are in addition to any other rights and remedies provided by law.

### **GC 9.15 Counterparts**

This Contract may be executed in any number of counterparts. All such counterparts shall be deemed to constitute one and the same instrument, and each of said counterparts shall be deemed an original thereof.

### **GC 9.16 Severability**

Whenever possible, each provision of the Contract shall be interpreted in a manner as to be effective and valid under applicable law. However, if any provision, or part of any provision, should be prohibited or invalid under applicable law, such provision, or part of such provision, shall be ineffective to the extent of such prohibition or invalidity without invalidating the remainder of such provision or the remaining provisions of the Contract.

### **GC 9.17 Third-Party Beneficiaries**

No provisions of the Contract shall in any way inure to the benefit of any third party, including the public at large, so as to constitute such person a third-party beneficiary of the Contract or of any one or more of the terms and conditions of the Contract or otherwise give rise to any cause of action in any person not a party to the Contract, except as expressly provided elsewhere in the Contract.

### **GC 9.18 Assignment of Contract**

Neither party will assign or subcontract its rights or obligations under the Contract without prior written permission of the other party, and no such assignment or subcontract will be effective until approved in writing by the other party.

### **GC 9.19 Independent Parties**

The Contractor is an independent contractor with respect to the performance of all Work hereunder, retaining control over the detail of its operations, and the Contractor shall not be considered the agent, employee, partner, fiduciary or trustee of the Agency.

### **GC 9.20 Survival**

The following sections shall survive the nominal expiration or discharge of other Contract obligations, and the Agency may obtain any remedy under law, Contract or equity to enforce the obligations of the Contractor that survive the manufacturing, warranty and final payment periods:

- “Intellectual Property Warranty”
- “Data Rights”
- “Indemnification”
- “Governing Law and Choice of Forum”
- “Disputes”
- “Confidential Information”
- “Parts Availability Guarantee”
- “Maintenance, Access to Records”
- “Training”

**GC 10. Agency-Specific Provisions**

Not Applicable

## **REQUEST FOR PROPOSAL**



**LONG BEACH PUBLIC TRANSPORTATION COMPANY**  
1963 E. Anaheim Street, Long Beach, CA 90813  
(562) 591-8753

**Battery Electric Bus Project  
RFP 15-001**

## **Section 4**

### **Special Provisions**

## **SECTION 4: SPECIAL PROVISIONS**

### **SP 1. Inspection, Tests and Repairs**

#### **SP 1.1 First Article Bus**

The First Article bus shall be the first bus produced under this contract. The Contractor shall produce a First Article bus and a temporary provision for charging after receiving a notice to proceed. The First Article bus and temporary charging station shall be produced and inspected in two stages, each requiring a validation test and approval as a requirement to proceed with production units and the permanent infrastructure. The first stage shall include the necessary mock-up of the EV hardware to simulate the duty cycle, loads, charge / discharge profiles and a temporary provision for charging. The second stage shall be to install the EV hardware into the proposed bus and simulate the actual duty cycle as described in the technical specification. Stage 1 simulation and testing shall be done at the bus Contractor's site, witnessed by the Agency and stage 2 shall be pre-inspected at the Contractor's site by the Agency and then delivered and final inspection / approval conducted at the Agency's site.

In the event that the First Article bus does not initially comply with all performance criteria contained in the Technical Specifications, the Agency shall have the right to retain a portion of any progress payment that may have been established for the First Article bus. The amount to be withheld shall be based on the lack of compliance and may equal up to the entire progress payment amount for the First Article bus. This amount shall be withheld until compliance is demonstrated as determined in the sole direction of the Agency. In the event that the compliance is subsequently determined to be impossible to achieve, the Agency may require all or a portion of the progress payment for the First Article bus to be forfeited as a penalty for the noncompliance. The amount of the penalty shall be negotiated by the parties.

The First Article Bus shall be produced and delivered to the Agency for a minimum of thirty (30) days prior to initiation of any production activities for the remaining vehicles unless otherwise authorized in writing by the Agency. The Agency shall have a minimum of 30 days in which to inspect and test the bus. If the bus successfully "passes", a full Notice to Proceed may be issued for the remainder of the base order. In the event that noncompliance is identified, the Agency shall to the extent practicable notify the Contractor of said noncompliance. No later than seven (7) days after the end of the 30-day test, the Agency shall issue a written report to the Contractor that advises the Contractor of any noncompliance issues and/or any proposed modifications or changes required on the remaining vehicles.

#### **SP 1.2 Configuration and Performance Approval**

To assess the Contractor's compliance with the Technical Specifications, the Agency and the Contractor shall, at the Pre-Production Meeting, jointly develop a configuration and performance review document for review of the First Article bus. This document shall include appropriate performance standards for each test that is being required and the document shall become part of the official record of the pre-production meeting.

#### **SP 1.3 First Article Inspection – Production**

The purpose of a First Article inspection is to confirm that any components, systems, subsystems, major assemblies, subassemblies, products, parts, apparatuses, articles and other materials comply with the Technical Specifications and other Contract documents.

Where required by the Contract documents or requested by the Agency, the Contractor shall cause First Article inspections to be conducted. A First Article inspection may include both a physical configuration inspection and a functional demonstration. First article inspections shall be conducted at the Contractor or Subcontractor's facility. The Contractor shall furnish to the Agency prior to each first article inspection a written inspection and demonstration plan for each item for review. The Agency's inspectors will attend each first article inspection unless the Agency provides a written waiver of its right to attend any such inspection. The results of each first article inspection shall be documented by the Contractor in a format deemed acceptable by the Agency, and all documents relating to the inspection shall be forwarded to the Agency.

### **SP 1.4 Post-Delivery Tests**

The Agency will conduct acceptance tests on each delivered bus. These tests shall be completed after commissioning and acceptance of the proposed on route and/or depot charging stations and within fifteen (15) days after bus delivery and shall be conducted in accordance with written test plans. The purpose of these tests is to identify defects that have become apparent between the time of bus release and delivery to the Agency and to validate bus performance on Agency designated routes. The post-delivery tests shall include visual inspection and bus operations. No post-delivery test shall apply criteria that differs from the criteria applied in an analogous pre-delivery test (if any).

Buses that fail to pass the post-delivery tests are subject to non-acceptance. The Agency shall record details of all defects on the appropriate test forms and shall notify the Contractor of acceptance or non-acceptance of each bus according to "Inspection, Testing and Acceptance" after completion of the tests. The defects detected during these tests shall be repaired according to procedures defined in "Repairs after Non-Acceptance."

### **SP 1.5 Repairs after Non-Acceptance**

The Contractor, or its designated representative, shall perform the repairs after non-acceptance. If the Contractor fails or refuses to begin the repairs within five (5) days, then the Work may be done by the Agency's personnel with reimbursement by the Contractor.

### **SP 1.6 Repair Performance**

#### **SP 1.6.1 Repairs by Contractor**

After non-acceptance of the bus, the Contractor must begin Work within five (5) working days after receiving notification from the Agency of failure of acceptance tests. The Agency shall make the bus available to complete repairs timely with the Contractor repair schedule.

The Contractor shall provide, at its own expense, all spare parts, tools and space required to complete the repairs. At the Agency's option, the Contractor may be required to remove the bus from the Agency's property while repairs are being made. If the bus is removed from the Agency's property, repair procedures must be diligently pursued by the Contractor's representatives, and the Contractor shall assume risk of loss while the bus is under its control.

#### **SP 1.6.2 Repairs by the Agency**

The Agency will not take responsibility to correct Defects, except to replace defective parts as instructed by the Contractor.

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1. **Parts used.** If the Agency performs the repairs after non-acceptance of the bus, it shall correct or repair the Defect and any Related Defects using Contractor-specified parts available from its own stock or those supplied by the Contractor specifically for this repair. Reports of all repairs covered by this procedure shall be submitted by the Agency to the Contractor for reimbursement or replacement of parts monthly, or at a period to be mutually agreed upon. The Contractor shall provide forms for these reports.
2. **Contractor-supplied parts.** If the Contractor supplies parts for repairs being performed by the Agency after non-acceptance of the bus, these parts shall be shipped prepaid to the Agency.
3. **Return of defective components.** The Contractor may request that parts covered by this provision be returned to the manufacturing plant. The total costs for this action shall be paid by the Contractor.
4. **Reimbursement for labor.** The Agency shall be reimbursed by the Contractor for labor. The amount shall be determined by the Agency for a qualified mechanic at a straight time wage rate of \$75 per hour, which includes fringe benefits and overhead adjusted for the Agency's most recently published rate in effect at the time the Work is performed, plus the cost of towing in the bus, if such action was necessary. These wage and fringe benefits rates shall not exceed the rates in effect in the Agency's service garage at the time the Defect correction is made.
5. **Reimbursement for parts.** The Agency shall be reimbursed by the Contractor for defective parts that must be replaced to correct the Defect. The reimbursement shall include taxes where applicable and fifteen (15) percent handling costs.

## **SP 2. Deliveries**

### **SP 2.1 Bus & Charging Equipment Delivery**

Delivery of buses shall be determined by signed receipt of the Agency or the Agency's designated agent(s), Delivery location to be determined 30 days prior to scheduled delivery.

### **SP 2.2 Delivery Schedule**

The buses and charging equipment shall be delivered and installed in accordance with the milestones listed in CER12.

Hours of bus delivery shall be between 8am and 3pm on the following days of the week: Monday through Friday.

### **SP 2.3 Contract Deliverables**

Contract deliverables associated with this Contract are set forth in CER 6 Proposal Pricing, and Table 1 below along with other pertinent information. Contract deliverables shall be submitted in accordance with Section 6: Technical Specifications. Due dates shown on Table 1 Contract Deliverables note the last acceptable date for receipt of Contract deliverables. The Agency will consider early receipt of Contract deliverables on a case-by-case basis.

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**Table 1**  
**Contract Deliverables**

| <b>Name / Description of Deliverable</b>  | <b>Contractor Action</b> | <b>Agency Action</b> | <b>Qty in Hardcopy Original</b> | <b>Qty in Hardcopy</b> | <b>Qty Digital File</b> |
|---|--------------------------|----------------------|---------------------------------|------------------------|-------------------------|
| <b>The following Deliverables Shall Be Due in Advance of Contract Issue</b>                   |                          |                      |                                 |                        |                         |
| Insurance   |                          |                      | 1                               |                        |                         |
| Copy of Contractor's formal quality assurance program   | Provide                  | Review               |                                 | 1                      | 1                       |
| Crashworthiness   | Provide                  | Review               |                                 | 1                      | 1                       |
| Bonds, if applicable  |                          |                      | 1                               |                        |                         |
| <b>The following Deliverables Shall Be Due in Advance of or at the Pre-Production Meeting</b> |                          |                      |                                 |                        |                         |
| Template for MRL (Master Resolution List)   | Provide                  | Review               | 1                               | 1                      | 1                       |
| RFCO's (Request for Change Order), if any   | Provide                  | Review               | 1                               | 1                      | 1                       |
| Drawings of interior, exterior, dash, camera layout, seating layout                           | Provide                  | Review / Return      | 1                               | 1                      | 1                       |
| List of Systems / Major Components (BOM)  | Provide                  | Review               | 1                               | 1                      | 1                       |
| Draft of Service / Parts Manuals  | Provide                  | Review / Return      | 1                               | 1                      | 1                       |
| Draft of Training Program   | Provide                  | Review / Return      | 1                               | 1                      | 1                       |
| Production / Delivery Schedule for First Article  | Provide                  | Review               | 1                               | 1                      | 1                       |
| Charging Station Equipment Plan & Draft Drawing   | Provide                  | Review               | 1                               | 1                      | 1                       |
| Charging Station Equipment Layout and BOM   | Provide                  | Review               | 1                               | 1                      | 1                       |
| Material Samples  | Provide                  | Review               |                                 |                        |                         |
| <b>The following Deliverables Shall Be Due prior to Final Assembly of First Article Bus</b>   |                          |                      |                                 |                        |                         |
| Bus Testing - Altoona Report, if not previously provided                                      | Provide                  | Review               |                                 | 1                      | 1                       |
| <b>The following Deliverables Shall Be Due prior to delivery of the First Article Bus</b>     |                          |                      |                                 |                        |                         |
| Provision for temporary depot charging  | Provide                  | Install              |                                 |                        |                         |
| <b>The following Deliverables Shall Be Due Upon Delivery of the First Article Bus</b>         |                          |                      |                                 |                        |                         |
| First Article Bus   | Provide                  | Inspect / Test       |                                 |                        |                         |
| Inspection Punchlist  | Correct                  | Provide              | 1                               | 1                      | 1                       |
| In-Plant QA records   | Provide                  | Review               |                                 | 1 per bus              | 1                       |

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| <b>Name / Description of Deliverable</b>   | <b>Contractor Action</b> | <b>Agency Action</b> | <b>Qty in Hardcopy Original</b> | <b>Qty in Hardcopy</b> | <b>Qty Digital File</b> |
|--|--------------------------|----------------------|---------------------------------|------------------------|-------------------------|
| Component serial numbers   | Provide                  | Review               |                                 | 1 per bus              | 1                       |
| If drive-away service is used, Driver's log and incident report                                      | Provide                  | Review               |                                 | 1 per bus              |                         |
| Bus Documentation  | Provide                  | Process              | 1                               | 1                      |                         |
| Basic Operator / Mechanic Familiarization Training   | Provide                  | Attend               |                                 |                        |                         |
| Revised Service / Parts Manuals  | Provide                  | Review / Return      | 1                               | 1                      |                         |
| Revised Training Program   | Provide                  | Review / Return      | 1                               | 1                      |                         |
| List of OEM component repair manuals   | Provide                  | Review               | 1                               | 1                      | 1                       |
| Draft operators' manuals (Agency approval/review period of 90 days from date of receipt)             | Provide                  | Approve              | 1                               | 1                      | 1                       |
| Field Service Support Throughout Inspection  | Provide                  | Review               | 1                               | 1                      | 1                       |
| Draft Preventative maintenance manuals   | Provide                  | Review               | 1                               | 1                      | 1                       |
| Draft diagnostic procedures manuals  | Provide                  | Review               | 1                               | 1                      | 1                       |
| Draft Component repair manuals (Agency review period of 90 days from date of receipt)                | Provide                  | Review               | 1                               | 1                      | 1                       |
| Draft In-process drawings  | Provide                  | Review               | 1                               | 1                      | 1                       |
| Draft Electrical and air schematics  | Provide                  | Review               | 1                               | 1                      | 1                       |
| Draft As-built drawings  | Provide                  | Review               | 1                               | 1                      | 1                       |
| <b>The following Deliverables Shall Be Due in Advance of or at the Second Pre-Production Meeting</b> |                          |                      |                                 |                        |                         |
| Revised MRL and RFCO's   | Provide                  | Review               |                                 | 1                      | 1                       |
| Updated In-Process Drawings  | Provide                  | Review               |                                 | 1                      | 1                       |
| Electrical and air schematics  | Provide                  | Review               |                                 | 1                      | 1                       |
| Notice to Proceed with Production  | Confirm                  | Provide              |                                 |                        |                         |
| <b>The following Deliverables Shall Be Due prior to delivery of Production Buses</b>                 |                          |                      |                                 |                        |                         |
| Charging Equipment   | Deliver                  | Install              |                                 |                        |                         |
| Charging Station   | Commission               | Accept               |                                 |                        |                         |
| <b>The following Deliverables Shall Be Due Upon Delivery of the Production Run</b>                   |                          |                      |                                 |                        |                         |
| Buses per schedule   | Provide                  | Inspect / Process    |                                 | Lot                    |                         |
| Bus Documentation  | Provide                  | Registration         |                                 | Lot                    | Lot                     |
| Spare Components   | Provide                  | Receive              |                                 | Lot                    |                         |



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| <b>Name / Description of Deliverable</b>   | <b>Contractor Action</b> | <b>Agency Action</b> | <b>Qty in Hardcopy Original</b> | <b>Qty in Hardcopy</b> | <b>Qty Digital File</b> |
|--|--------------------------|----------------------|---------------------------------|------------------------|-------------------------|
| Diagnostic Equipment   | Provide                  | Receive              |                                 | Lot                    |                         |
| Training Classes & Materials   | Provide                  | Attend               |                                 | Lot                    |                         |
| Field Service Support Throughout Inspection  | Provide                  |                      |                                 |                        |                         |
| Inspection Punchlist   | Correct                  | Provide              |                                 | Lot                    |                         |
| Final service and parts manuals (Link-One format for electronic)                                     | Provide                  | Review               |                                 | 1                      | 1                       |
| In-Plant QA records  | Provide                  | Review               |                                 | 1 per bus              | 1                       |
| Component serial numbers   | Provide                  | Review               |                                 | 1 per bus              | 1                       |
| Final Preventative maintenance manuals   | Provide                  | Review               |                                 | 10                     | 2                       |
| Final diagnostic procedures manuals  | Provide                  | Review               |                                 | 10                     | 2                       |
| Final Component repair manuals (Agency review period of 90 days from date of receipt)                | Provide                  | Review               |                                 | 2                      | 1                       |
| Final Comprehensive Maintenance Plan (buses & charging equipment; including battery recycling)       | Provide                  | Review               |                                 | 1                      | 1                       |
| Final operators' manuals   | Provide                  | Review               |                                 | 1 per bus              |                         |
| Recommended spare parts list, including bill of materials  | Provide                  | Review               |                                 | 2                      | 1                       |
| Part number index  | Provide                  | Review               |                                 | 1                      | 1                       |
| Current price list   | Provide                  | Review               |                                 | 2                      | 1                       |
| If drive-away service is used, Driver's log and incident report                                      | Provide                  | Review               |                                 | 1 per bus              |                         |
| As-Built Drawings  | Provide                  | Review               |                                 | 1                      | 1                       |
| <b>The following Deliverables Shall Be Due Upon Completing the First and Third Year of Operation</b> |                          |                      |                                 |                        |                         |
| Conditional Assessment, report   | Provide                  | Review               | 1                               | 1                      | 1                       |

Note, Final Electronic Version Service and Parts Manuals above are assumed in Linkone

### **SP 3. Options and Option Pricing**

This is a joint procurement between the Long Beach Public Transportation Company, Anaheim Transportation Network, and Gardena Municipal Bus Lines that includes the manufacture and delivery of up to ten (10), forty foot, battery electric transit buses with options for up to fifty (50) additional buses and necessary charging equipment. The Contractor hereby grants the Agencies and any permissible assignee options ("Options") as may be identified in the RFP or by addendum. The Options shall be valid for a period of five years from the effective date of the Contract. There shall be no minimum order quantity for any permissible assignee. Subject to the Agency's right to order modifications, the Option

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Vehicles shall have the same specifications as the vehicles purchased under this Contract. The Agency may exercise the Options by written notice to the Contractor (“Notice of Exercise of Option”) at any time on or before five years following the effective date of the Contract (“Option Date”).

The price of the Option Vehicles shall be the unit price of the base order vehicles, (“Base Order Price”) adjusted by multiplying the base order price by the following fraction:

$$\frac{\{Latest\ Published\ Preliminary\ Index\ Number\ Prior\ to\ Notice\ of\ Exercise\ of\ Option\}}{\{Index\ Number\ on\ Effective\ Date\ of\ the\ Contract\}}$$

The Index Number shall be the Producer Price Index for Truck and Bus Bodies, Series No. 1413, published by the United States Department of Labor Bureau of Labor Statistics, or if such Index is no longer in use, then such replacement that is most comparable to the Index as may be designated by the Bureau of Labor Statistics, or as agreed by the parties.

Within thirty (30) days after delivery of the Notice of Exercise of Option to the Contractor, the Contractor shall submit a proposed delivery schedule. Along with the proposed delivery schedule, the Contractor will provide the Agency with access to its production schedule for the purpose of the parties verifying available production capacity. The production schedule shall include a reasonable time for mobilization and for coordinating with other vehicle orders, and it shall be based upon a production rate at least equal to the production rate actually realized with respect to the base order vehicles. If the parties are unable to agree on a production schedule, the maximum term for the production of the Option Vehicles shall not exceed a total of 12 months after the date of Notice to Proceed with Option Vehicle production. The Agency or any permissible assignee may issue a Notice to Proceed at any time after the Contractor submits its proposed delivery schedule. The Contractor shall not commence production of the Option Vehicles prior to issuance of the Notice to Proceed by the Agency or any permissible assignee of the Agency for the Option Vehicles incorporating the agreed production delivery schedule or the 12 month maximum term.

Except as otherwise provided in this Contract, all other terms of the Contract shall apply to the Option Vehicles.

#### **SP 4. Assignability of Options**

If the Agency does not exercise the option(s) as listed in “Options and Option Pricing,” then the Agency reserves the right to assign the option(s) to other grantees of FTA funds in accordance with FTA Circular 4220.1F or its successors.

#### **SP 5. Payment**

The Agency shall pay and the Contractor shall accept the amounts set forth in the price schedule as full compensation for all costs and expenses of completing the Work in accordance with the Contract, including but not limited to all labor, equipment and material required, overhead, expenses, storage and shipping, risks and obligations, taxes (as applicable), fees and profit, and any unforeseen costs.

##### **SP 5.1 Payment Terms**

All payments shall be made as provided herein, less a retention of 10% plus any additional amount retained as provided below and less any amounts for liquidated damages in accordance with “Liquidated Damages for Late Delivery of the Bus and/or EV equipment.”

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The Agency shall make payments for buses at the unit prices itemized in the price schedule 30 calendar days after the delivery and acceptance of each bus and receipt of a proper invoice.

The Agency shall make payments for spare parts and/or equipment at the unit prices itemized in the price schedule within 30 calendar days after the delivery and acceptance of said spare parts and/or equipment and receipt of a proper invoice.

The Agency shall make a final payment for all retained funds within 30 calendar days of receipt of a final proper invoice and the following:

1. Delivery and acceptance of all Contract deliverables, including manuals and other documentation required by the Contract, excluding training.
2. Contractor provision of any certifications as required by law and/or regulations.
3. Completion of post-delivery audits required under the Contract.

The Contractor may charge interest for late payment if payment is delayed more than ten (10) days after the payment Due Date set forth above. Interest will be charged at a rate not to exceed the prime rate of interest published by The Wall Street Journal on the 10th day.

## **SP 5.2 Performance Bond Requirements**

Not Required.

## **SP 5.3 Payment of Taxes**

Unless otherwise provided or directed by the Agency in this Contract, the Contractor shall pay all federal, state and local taxes, and duties applicable to and assessable against any Work, goods, services, processes and operations incidental to or involved in the Contract, including but not limited to retail sales and use, transportation, export, import, business and special taxes. The Contractor is responsible for ascertaining and paying the taxes when due. The total Contract price shall include compensation for all taxes the Contractor is required to pay by laws in effect on the Proposal Due Date. The Contractor will maintain auditable records, subject to the Agency reviews, confirming that tax payments are current at all times.

## **SP 6. Liquidated Damages for Late Delivery**

It is mutually understood and agreed by and between the parties to the Contract that time is of the essence with respect to the completion of the Work and that in case of any failure on the part of the Contractor to deliver the buses and charging equipment within the times agreed to and specified in "Delivery Schedule," except for any excusable delays as provided in "Excusable Delays/Force Majeure" or any extension thereof, the Agency 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 to the Agency shall be fixed at:

- A. \$300.00 per day per bus for every calendar day beyond the specified delivery date as agreed upon and laid out in the bus production schedule at the pre-production meeting. The date cannot be beyond the dates laid out in the Contract, unless agreed upon by both parties.

- B. On-Route Chargers: \$1,500 per day per complete set of on-route charging equipment (per station location) for every calendar day beyond the specified equipment delivery date noted on the CPM schedule for Charging Station construction. Charging Station construction shall be performed by a third party Agency General Contractor. Depot Chargers: \$500 per day per complete set of charging equipment & pedestals for every calendar day beyond the specified equipment delivery date noted on the CPM schedule for Charging Station construction. Charging Station construction shall be performed by a third party Agency General Contractor. The Contractor hereby agrees to pay the aforementioned amounts as fixed, agreed and liquidated damages, and not by way of penalty, to the Agency and further authorizes the Agency to deduct the amount of the damages from money due the Contractor under the Contract, computed as aforesaid. If the money due the Contractor is insufficient or no money is due the Contractor, then the Contractor shall pay the Agency the difference or the entire amount, whichever may be the case, within thirty (30) days after receipt of a written demand by the Contracting Officer.

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 the Agency arising at any time from the failure of the Contractor to fulfill the obligations referenced in this clause in a timely manner.

## **SP 7. Service and Parts**

### **SP 7.1 Contractor Service and Parts Support**

The Contractor shall state on the form Contractor Service and Parts Support Data the representatives responsible for assisting the Agency, as well as the location of the nearest distribution center, which shall furnish a complete supply of parts and components for the repair and maintenance of the buses to be supplied. The Contractor also shall state below, or by separate attachment, its policy on transportation charges for parts other than those covered by warranty.

### **SP 7.2 Documentation**

The Contractor shall provide all current maintenance manual(s) to include preventative maintenance procedures, diagnostic procedures or trouble-shooting guides and major component service manuals, current parts manual(s), and standard operator's manual(s) as part of this Contract and outlined in Table 1 Section SP2.3. The Contractor also shall exert its best efforts to keep maintenance manuals, operator manuals and parts books up to date for a period of fifteen (15) years. The supplied manuals shall incorporate all equipment ordered on the buses covered by this procurement. In instances where copyright restrictions or other considerations prevent the Contractor from incorporating major components information into the bus parts and service manuals, separate manual sets as published by the subcomponent Supplier will be provided, otherwise the contractor must merge all manuals into one supporting document. The contractor shall also provide a written Preventive Maintenance Plan and a Long-Term capital rehab/replacement plan for the life of the bus.

### **SP 7.3 Parts Availability Guarantee**

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 twelve (12) years after the date of acceptance. Parts shall be interchangeable with the original

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equipment and shall be manufactured in accordance with the quality assurance provisions of this Contract. Prices shall not exceed the Contractor's then-current published catalog prices.

Where the parts ordered by the Agency are not received within two working days of the agreed-upon time and date and a bus procured under this Contract is out of service due to the lack of said ordered parts, then the Contractor shall provide the Agency, within eight (8) hours of the Agency's verbal or written request, the original Suppliers' and/or Contractor's parts numbers, company names, addresses, telephone numbers and contact persons' names for all of the specific parts not received by the Agency.

Where the Contractor fails to honor this parts guarantee or parts ordered by the Agency are not received within thirty (30) days of the agreed-upon delivery date, then the Contractor shall provide to Agency, within seven (7) days of the Agency's verbal or written request, the design and manufacturing documentation for those parts manufactured by the Contractor and the original Suppliers' and/or Contractor's parts numbers, company names, addresses, telephone numbers and contact persons' names for all of the specific parts not received by the Agency. The Contractor's design and manufacturing documentation provided to the Agency shall be for its sole use in regard to the buses procured under this Contract and for no other purpose. Contractor must relinquish any mutually exclusive rights, allowing the agency to directly purchase required parts.

#### **SP 7.4 Agency-Furnished Property**

In the event that equipment or other goods or materials are specified in the Technical Specifications to be furnished by the Agency to the Contractor for incorporation in the Work, the following provisions shall apply:

The Agency shall furnish the equipment, goods or materials in a timely manner so as not to delay Contract delivery or performance dates. If Agency-furnished property is received in a condition not suitable for the intended use, then the Contractor shall promptly notify the Agency, detailing the facts, and at the Agency's expense repair, modify, return or take such other action as directed by the Agency. The parties may conduct a joint inspection of the property before the Contractor takes possession to document its condition.

The Agency retains title to all Agency-furnished property. Upon receipt of the Agency-furnished property, the Contractor assumes the charge and care of the property and bears the risk of loss or damage due to action of the elements or from any other cause. The Contractor shall provide appropriate protection for all such property during the progress of the Work. Should any Agency-furnished equipment or materials be damaged, such property shall be repaired or replaced at the Contractor's expense to the satisfaction of the Agency. No extension of time will be allowed for repair or replacement of such damaged items. Should the Contractor not repair or replace such damaged items, the Agency shall have the right to take corrective measures itself and deduct the cost from any sums owed to the Contractor.

Warranty administration and enforcement for Agency-furnished equipment are the responsibility of the Agency, unless the parties agree to transfer warranty responsibility to the Contractor.

#### **SP 8. Federal Motor Vehicle Safety Standards (FMVSS)**

The Contractor shall submit Pre-Award FMVSS self-certification with their proposal, stating that the vehicle complies with relevant FMVSS. The self-certification shall state the specific industry standard used for FMVSS certification.

## **SP 9. Indemnity and Insurance**

1. This is a Summary of Indemnity and Insurance Requirements for Contractors providing services or supplies to Long Beach Transit (Agency). By agreeing to perform the work or submitting a proposal, you verify that you comply with and agree to be bound by these requirements. If any additional Contract documents are executed, the actual Indemnity language and Insurance Requirements may include additional provisions as deemed appropriate by Agency.
2. You should check with your Insurance advisors to verify compliance and determine if additional coverage or limits may be needed to adequately insure your obligations under this agreement. These are the minimum required and do not in any way represent or imply that such coverage is sufficient to adequately cover the Contractor's liability under this agreement. The full coverage and limits afforded under Contractor's policies of Insurance shall be available to Agency and these Insurance Requirements shall not in any way act to reduce coverage that is broader or includes higher limits than those required.
3. Contractor shall provide Agency with Certificates of Insurance including all required endorsements and a copy of the Endorsement and/or Declarations Page of the CGL policy listing all policy endorsements to Agency before work begins. Agency reserves the right to require full-certified copies of all Insurance coverage and endorsements.

### **I. INDEMNIFICATION:**

To the fullest extent permitted by law, Contractor shall defend, with counsel of Agency's choice, indemnify and hold harmless the Agency, other members of the joint procurement, their employees, agents and officials, from any liability, claims, suits, actions, arbitration proceedings, administrative proceedings, regulatory proceedings, losses, expenses or costs of any kind whatsoever without restriction or limitation, incurred in relation to, as a consequence of or arising out of or in any way attributable actually, allegedly or impliedly, in whole or in part, to the performance of this Agreement. The Contractor shall defend any suit or action brought against Agency embraced by the Indemnity regardless of the actual negligence of the Contractor. All obligations under this provision are to be paid by Contractor as they are incurred by Agency. Contractor has no obligation under this Indemnification agreement for liability proven in a court of competent jurisdiction or by written agreement between the parties to be the sole or willful fault of Agency, or the liability attributable to negligence or fault of Agency.

This obligation to indemnify and defend Agency as set forth herein is binding on the successors, assigns, or heirs of Contractor and shall survive the termination of this agreement. By execution of this Contract, Contractor acknowledges and agrees that it has read and understands the provisions hereof and that this paragraph is a material element of consideration. These Indemnification provisions are independent of and shall not in any way be limited by the Insurance requirements of this agreement. Agency approval of the Insurance contracts required by this Agreement does not in any way relieve the Contractor or subcontractors from liability under this section. The parties agree that if any part of this Indemnification is found to conflict with applicable laws, such part shall be unenforceable only insofar as it conflicts with said laws, and that this Indemnification shall be judicially interpreted and rewritten to provide the broadest possible Indemnification legally allowed and shall be legally binding upon Contractor.

## **II. INSURANCE**

Contractor shall procure and maintain for the duration of the contract insurance against claims for injuries to persons or damages to property, which may arise from or in connection with the performance of the work hereunder by the Contractor, the Contractor's agents, representatives, or employees.

**A. Coverage shall be at least as broad as:**

1. Insurance Services Office Commercial General Liability coverage (occurrence form CG 0001 12.04 or equivalent) that includes Unmodified Contractual Liability Coverage and Unmodified Products and Completed Operations Liability. No "Prior Work" Exclusions are allowed. Non-standard (non-ISO) Endorsements require approval from Agency. Contractor must maintain the Commercial General/Business Liability (CGL) coverage for at least five years after the expiration of this Agreement.
2. Insurance Services Office form number CA 0001 (Ed. 1/87) covering Business Automobile Liability, code 1 (any auto).
3. If non-standard Insurance forms are used rather than the standard Insurance Services Office (ISO) forms shown, Contractor agrees to pay Agency for an Independent Expert evaluation and opinion as needed to determine whether or not they are at least equivalent in coverage to the standard ISO forms. The charge shall be \$150 for each non-standard endorsement and \$575 for each non-standard policy.
4. Workers' Compensation insurance as required by the State of California and Employer's Liability Insurance. The policy shall be endorsed to waive any right of subrogation as respects Agency, its employees or agents and such endorsement shall be provided to Agency with the Certificate of Insurance.
5. Professional liability or errors and omissions liability insurance as appropriate to the Contractor's profession as shown below.

**B. MINIMUM LIMITS OF INSURANCE: Contractor shall maintain limits no less than:**

1. General Liability: \$10,000,000 per occurrence / \$10,000,000 aggregate limits for bodily injury, personal injury, property damage, and product liability.
2. Automobile Liability: \$1,000,000 per accident for bodily injury and property damage.
3. Garage Liability: If seller's work involves maintenance, repair, or custody of vehicles, including Garage Keeper's liability, not less than \$5,000,000.
4. Workers' Compensation to statutory limits.
5. Employer's Liability: \$1,000,000 per accident for bodily injury or disease.
6. Professional Liability: If Contractor's work involves professional services, not less than \$5,000,000.00 each claim and \$5,000,000.00 aggregate. Contractor must maintain Profession-

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al/Errors & Omissions Liability coverage for a period of five years after the expiration of this Agreement.

7. Products/Completed Operations Liability: \$5,000,000 per occurrence for a period of five years after acceptance of the last bus delivered under this contract (Products Liability coverage may be effected through one or more excess liability policies).
8. The limits of Insurance required in this agreement may be satisfied by a combination of primary and umbrella or excess Insurance. Any umbrella or excess Insurance shall contain or be endorsed to contain a provision that such coverage shall also apply on a primary and non contributory basis to an additional insured (if agreed to in a written contract) *before* the additional insured's own primary CGL policy or self Insurance shall be called upon to protect it as a named insured.

#### C. DEDUCTIBLES AND SELF-INSURED RETENTIONS

Any deductibles or self-insured retentions must be declared to and approved by Agency and shall not reduce the limits of liability. At the option of Agency, either: the insurer shall reduce or eliminate such deductibles or self-insured retentions as respects Agency, its officers, officials, employees and volunteers; or the Contractor shall procure acceptable alternative risk financing to assure payment of such deductibles or self-insured retentions.

The policy shall provide that the self-insured retention may be satisfied by either the named insured or Agency.

Agency reserves the right to obtain a full-certified copy of any Insurance policy and endorsements.

#### D. OTHER INSURANCE PROVISIONS

The liability policies are to contain, or be endorsed to contain, the following provisions:

1. Agency, other members of the joint procurement, their officers, officials, employees and volunteers are to be covered as an additional insured as respects: liability arising out of activities performed by or on behalf of the Contractor; products and completed operations of the Contractor; premises owned, occupied or used by the Contractor; or automobiles owned, leased, hired or borrowed by the Contractor. For service, repair, or construction work the Additional Insured endorsements shall provide coverage at least as broad as:
  - a. ISO Form CG 20 10 10 01 or earlier edition; or CG 20 33 10 01 or earlier edition
  - b. ISO Form CG 20 37 10 01 edition for Products & Completed Operations Liability coverage (or equivalent endorsement at least as broad. ISO CG 20 10 11 85 is acceptable.)
2. For any claims related to this project, the Contractor's insurance coverage shall be primary insurance as respects Agency, its officers, officials, employees or volunteers. Any insurance or self-insurance maintained by Agency, its officers, officials, employees or volunteers shall be excess of the Contractor's insurance and shall not contribute with it.



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3. Any failure to comply with reporting or other provisions of the policies including breaches of warranties shall not affect coverage provided to Agency, its officers, officials, employees or volunteers.
4. The Contractor's insurance shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability.
5. Each insurance policy required by this clause shall be endorsed to state that coverage shall not be suspended, voided, canceled by either party, reduced in coverage or in limits except after thirty (30) days' prior written notice by certified mail, return receipt requested, has been given to Agency.
6. The Insurance obligations under this agreement shall be the greater of 1—the Insurance coverage and limits carried by the contractor or 2—the minimum Insurance requirements shown in this agreement. Any insurance proceeds in excess of the specified limits and coverage required, which are applicable to a given loss, shall be available to Agency. No representation is made that the minimum Insurance requirements of this agreement are sufficient to cover the obligations of the Contractor under this agreement.

**E. ACCEPTABILITY OF INSURERS**

Insurance is to be placed with insurers with a current A. M. Best's rating of no less than A-: VII, and shall be "California-admitted carriers," unless otherwise acceptable to Agency.

**F. VERIFICATION OF INSURANCE**

Contractor shall furnish Agency with original endorsements effecting coverage required by this Section including the required (1) Additional Insured Endorsement(s), (2) Worker's Compensation waiver of subrogation endorsement, and (3) General liability declarations or endorsement page listing all policy endorsements. All endorsements are to be received and approved by Agency before work commences. Certificates of Insurance are requested for information only, and shall not be accepted as substitutes for endorsements required herein, except for errors and omissions liability insurance. Agency reserves the right to require a full-certified copy of any policy and all endorsements.

Failure by Agency to enforce any of the Contractor's obligations shall not constitute a waiver of Agency's right to enforce them at a later time. If any portion of these requirements shall be found to be unenforceable, it shall be severed and the remaining portions shall continue to apply.

**SP 10. Escrow Accounts**

**SP 10.1 Software Escrow Account**

Upon execution of the Contract, the Contractor shall provide the Agency a list of all OEM software and communication protocols comprising proprietary works ("Proprietary Software") for all major vehicle and charging equipment subsystems. From time to time and only upon request, information contained within the listed software may be made available to the Agency through the OEM of the vehicle and charging equipment subsystems. The Contractor and OEM are not obligated to provide copies of source code, as this is proprietary intellectual property; however, the Contractor is obligated to assist the Agency with any technical assistance for the duration of the life of the vehicle and charging equipment. It is the

Agency's prerogative to evaluate the long-term viability of the Contractor and its Subcontractors and Suppliers based upon the criteria set forth in "Qualification Requirements."

Contractor shall place copies of the above source codes and unprotected application software in an escrow account to the benefit of the Agency. An escrow agreement is required should the contractor become in poor financial condition; changes ownership; declares bankruptcy or is about to declare bankruptcy; or if the Contractor fails to perform its obligation to either manufacture, support and maintain the product being produced for the Agency. If any of these events occur, the escrow agent shall release the source code and unprotected application software to the Agency so that the Agency can have the products completed, produced and maintained. Contractor also grants Agency full use, royalty free license of the escrowed source code and application software and documentation to support the purchased vehicles and equipment. Agency shall not reproduce or modify source code, applications, or documentation for distribution outside of the Agency. (See sample agreement in Appendix)

### **SP 10.2 Manufacturing Data Escrow Account**

Upon execution of the Contract, the Contractor shall provide the Agency a list of all manufacturing data comprising proprietary works ("Proprietary Data") for all major vehicle and charging equipment subsystems Agency has contracted for. From time to time and only upon request, information contained within the listed data may be made available to the Agency through the OEM of the vehicle and charging equipment subsystems. The Contractor is obligated to assist the Agency with any technical assistance for the duration of the life of the vehicle and charging equipment. It is the Agency's prerogative to evaluate the long-term viability of the Contractor and its Subcontractors and Suppliers based upon the criteria set forth in "Qualification Requirements."

Contractor shall place copies of the above manufacturing data in an escrow account to the benefit of the Agency. An escrow agreement is required should the contractor become in poor financial condition; changes ownership; declares bankruptcy or is about to declare bankruptcy; or if the Contractor fails to perform its obligation to either manufacture, support and maintain the product being produced for the Agency. If any of these events occur, the escrow agent shall release the manufacturing data to the Agency so that the Agency can have the products completed, produced and maintained. Contractor also grants Agency full use, royalty free license of the escrowed data and documentation to support the purchased vehicles and equipment. Agency shall not reproduce or modify source code, applications, or documentation for distribution outside of the Agency. (See sample agreement in Appendix).

### **SP 11. Sustainability**

The Agency has adopted a policy on Environmental Sustainability, making a commitment to comply with all Federal, State and local environmental regulations. The Agency is committed to being a leader and a model for other organizations in environmental preservation and resource efficiency by using sustainable materials, methods and technology to improve the environmental, social and economic health of our region. The Agency recognizes that being sustainable (environmentally, economically and socially responsible) involves everyone, both internal and external to the Agency. The Agency expects its contractors to have their own sustainability policies and programs in place and to provide services in line with the principles established therein. Implementation of sustainable practices may include maximizing the use of environmentally and socially responsible materials and services, utilizing energy-efficient and non-polluting vehicles, equipment and processes, and ensuring that employee awareness of sustainability initiatives.

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The Agency has a sustainability policy that includes the responsibility to make sure all of its contractors are informed of this policy. The Agency has established a formal Environmental Sustainability Management System (ESMS) modeled on ISO-14001. An ESMS is a process with procedures that allow the Agency to reduce the impact of its activities and operate with greater efficiency. A copy of the Agency's Sustainable Plan and ESMS will be made available to the contractor. The Contractor will review and complete CER 9.3 Sustainability Requirements, Form and Checklist, verifying that responsible parties have read and understand the Agency's sustainability policies and that it agrees to use reasonable efforts to conduct its work and operations in a manner which is consistent with them. In addition the Contractor will provide the Agency with a copy of its corporate sustainability policy. The Agency's forms can be found in Section 9.

**SP 12. Agency-Specific Provisions**

Not Applicable

## **REQUEST FOR PROPOSAL**



**LONG BEACH PUBLIC TRANSPORTATION COMPANY**  
1963 E. Anaheim Street, Long Beach, CA 90813  
(562) 591-8753

**Battery Electric Bus Project  
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## **Section 5**

# **Federal Requirements**

## **SECTION 5: FEDERAL REQUIREMENTS**

### **FR 1. Access to Records**

The Contractor agrees to maintain all books, records, accounts and reports required under this Contract for a period of not less than three years after the date of termination or expiration of this Contract, except in the event of litigation or settlement of claims arising from the performance of this Contract, in which case Contractor agrees to maintain same until the Agency, the FTA Administrator, the Comptroller General or any of their duly authorized representatives have disposed of all such litigation, appeals, claims or exceptions related thereto. Reference 49 CFR 18.39(i)(11).

Contractor shall at all times comply with all applicable FTA regulations, policies, procedures and directives, including without limiting those listed directly or by reference in the Master Agreement between the Agency 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.

The following access to records requirements apply to this Contract:

#### **FR 1.1 Local Governments**

In accordance with 49 CFR 18.36(i), the Contractor agrees to provide the Agency, the FTA Administrator, the Comptroller General of the United States or any of their authorized representatives access to any books, documents, papers and records of the Contractor that are directly pertinent to this Contract for the purposes of making audits, examinations, excerpts and transcriptions. Contractor also agrees, pursuant to 49 CFR 633.17 to provide the FTA Administrator or his authorized representatives including any PMO Contractor access to Contractor's records and construction sites pertaining to a major capital project, defined at 49 USC 5302(a)1, which is receiving federal financial assistance through the programs described at 49 USC 5307, 5309 or 5311.

#### **FR 1.2 State Governments**

Not Applicable.

### **FR 2. Federal Funding, Incorporation of FTA Terms and Federal Changes**

The preceding provisions include, in part, certain standard terms and conditions required by the Department of Transportation, whether or not expressly set forth in the preceding Contract provisions. All contractual provisions required by DOT, as set forth in FTA Circular 4220.1F or its successors 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 Agency requests that would cause Agency to be in violation of the FTA terms and conditions.

The 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 Agency 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.

### **FR 3. Federal Energy Conservation Requirements**

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

### **FR 4. Civil Rights Requirements**

The following requirements apply to the underlying Contract:

1. **Nondiscrimination:** In accordance with Title VI of the Civil Rights Act, as amended, 42 USC § 2000d, section 303 of the Age Discrimination Act of 1975, as amended, 42 USC § 6102, section 202 of the Americans with Disabilities Act of 1990, 42 USC § 12132, and Federal transit law at 49 USC § 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 USC § 2000e, and Federal transit laws at 49 USC § 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 CFR 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 USC § 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 USC §§ 623 and Federal transit law at 49 USC § 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 USC § 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,"

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29 CFR 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.

#### **FR 5. No Government Obligation to Third Parties**

1. The Agency 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 Agency, 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.

#### **FR 6. Program Fraud and False or Fraudulent Statements or Related Acts**

1. The Contractor acknowledges that the provisions of the Program Fraud Civil Remedies Act of 1986, as amended, 31 USC §§ 3801 *et seq.* and U.S. DOT regulations, "Program Fraud Civil Remedies," 49 CFR 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 USC § 5307, the Government reserves the right to impose the penalties of 18 USC § 1001 and 49 USC § 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.

#### **FR 7. Suspension and Debarment**

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.

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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 Proposer certifies as follows:

The certification in this clause is a material representation of fact relied upon by the Agency. If it is later determined that the Proposer knowingly rendered an erroneous certification, in addition to remedies available to the Agency, the federal government may pursue available remedies, including but not limited to suspension and/or debarment. The Proposer agrees to comply with the requirements of 49 CFR 29, Subpart C, while this Proposal is valid and throughout the period of any Contract that may arise from this Proposal. The Proposer further agrees to include a provision requiring such compliance in its lower tier covered transactions.

## **FR 8. Disadvantaged Business Enterprise (DBE)**

This Contract is subject to the requirements of Title 49, Code of Federal Regulations, Part 26, Participation by Disadvantaged Business Enterprises in Department of Transportation Financial Assistance Programs.

The Contractor shall maintain compliance with “DBE Approval Certification” throughout the period of Contract performance.

The Contractor shall not discriminate on the basis of race, color, national origin or sex in the performance of this Contract. The Contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of this DOT-assisted Contract. Failure by the Contractor to carry out these requirements is a material breach of this Contract, which may result in the termination of this Contract or such other remedy as the Agency deems appropriate. Each subcontract the Contractor signs with a Subcontractor must include the assurance in this paragraph (see 49 CFR 26.13(b)).

The Contractor is required to pay its Subcontractors performing work related to this Contract for satisfactory performance of that work no later than 30 days after the Contractor’s receipt of payment for that work from the Agency. In addition, the Contractor may not hold retainage from its Subcontractors and is required to return any retainage payments to those Subcontractors within 30 days after the Subcontractor's work related to this Contract is satisfactorily completed.

## **FR 9. Clean Water Requirements**

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 USC 1251 *et seq.* The Contractor agrees to report each violation to the Agency and understands and agrees that the Agency 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.

## **FR 10. Clean Air Requirements**

1. The Contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act, as amended, 42 USC §§ 7401 *et seq.* The Contractor agrees to



report each violation to the Agency and understands and agrees that the Agency 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.

## **FR 11. Compliance with Federal Lobbying Policy**

Contractors who apply or bid for an award of \$100,000 or more shall file the certification required by 49 CFR Part 20, "New Restrictions on Lobbying." Each tier certifies to the tier above that it will not and has not used federal appropriated funds to pay any person or organization 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 obtaining any federal Contract, grant or any other award covered by 31 USC 1352. Each tier shall also disclose the name of any registrant under the Lobbying Disclosure Act of 1995 who has made lobbying contacts on its behalf with non-federal funds with respect to that federal Contract, grant or award covered by 31 USC 1352. Such disclosures are forwarded from tier to tier up to the recipient.

## **FR 12. Buy America**

The Contractor agrees to comply with 49 USC 5323(j) and 49 CFR Part 661, which provide that federal funds may not be obligated unless steel, iron and manufactured products used in FTA-funded projects are produced in the United States, unless a waiver has been granted by FTA or the product is subject to a general waiver. General waivers are listed in 49 CFR 661.7. A general public interest waiver from the Buy America requirements applies to microprocessors, computers, microcomputers, 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 that merely contains a microprocessor or microcomputer and is not used solely for the purpose of processing or storing data.

Under this procurement, charging equipment is considered a manufactured product and are subject to the requirements set out at 49 USC 5323(j)(2)(C) and 49 CFR 661.5. Manufactured products must be produced in the United States where all of the manufacturing processes for the product must take place in the United States; and 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.

Separate requirements for rolling stock are set out at 49 USC 5323(j)(2)(C) and 49 CFR 661.11. Rolling stock must be assembled in the United States and have a 60 percent domestic content.

A Proposer must submit to the Agency the appropriate Buy America Certifications with all offers on FTA-funded contracts, except those subject to a general waiver. Proposals that are not accompanied by properly completed Buy America certifications are subject to the provisions of 49 CFR 661.13 and may be rejected as nonresponsive.

## **FR 13. Testing of New Bus Models**

The Contractor agrees to comply with 49 USC A 5323(c) and FTA's implementing regulation at 49 CFR Part 665 and shall perform the following:

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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.
5. If the manufacturer is in the middle of the tests required to comply with this contract, the manufacturer must make all data available to the agency as it becomes available for review.

#### **FR 14. Pre-Award and Post-Delivery Audits**

The Contractor agrees to comply with 49 USC § 5323(l) and FTA's implementing regulation at 49 CFR Part 663 and to submit the following certifications:

1. **Buy America requirements:** The Contractor shall complete and submit a declaration certifying either compliance or noncompliance with Buy America. If the recommended Proposer certifies compliance with Buy America, it shall submit documentation that 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. This list shall be provided prior to contract award.
2. **Solicitation specification requirements:** The Contractor shall submit evidence that it will be capable of meeting the bid specifications.
3. **Federal Motor Vehicle Safety Standards (FMVSS):** The Contractor shall submit one (1) manufacturer's FMVSS self-certification with their proposal, Federal Motor Vehicles Safety Standards, stating that the vehicle complies with relevant FMVSS. The self-certification shall state the specific industry standard used for FMVSS certification.

## **FR 15. Cargo Preference**

The Contractor agrees to the following:

1. To use privately owned U.S.-flag commercial vessels to ship at least fifty (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 U.S.-flag commercial vessels;
2. To furnish within twenty (20) working days following the date of loading for shipments originating within the United States or within thirty (30) working days following the date of loading 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.)
3. 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.

## **FR 16. Fly America**

The Contractor agrees to comply with 49 USC 40118 (the "Fly America" Act) in accordance with the General Services Administration's regulations at 41 CFR Part 301-10, which provide that recipients and sub recipients of federal funds and their contractors are required to use U.S. flag air carriers for U.S. government-financed international air travel and transportation of their personal effects or property, to the extent such service is available, unless travel by foreign air carrier is a matter of necessity, as defined by the Fly America Act. The Contractor shall submit, if a foreign air carrier was used, an appropriate certification or memorandum adequately explaining why service by a U.S. flag air carrier was not available or why it was necessary to use a foreign air carrier and shall, in any event, provide a certificate of compliance with the Fly America requirements. The Contractor agrees to include the requirements of this section in all subcontracts that may involve international air transportation.

## **FR 17. Contract Work Hours and Safety Standards Act**

1. **Overtime requirements:** No Contractor or Subcontractor contracting for any part of the Contract Work that may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any work week in which he or she is employed on such Work to work in excess of 40 hours in such work week unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of 40 hours in such workweek.
2. **Violation; liability for unpaid wages; liquidated damages:** In the event of any violation of the clause set forth in paragraph 1 of this section, the Contractor and any Subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such Contractor and Subcontractor shall be liable to the United States for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph 1 of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the

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standard work week of 40 hours without payment of the overtime wages required by the clause set forth in paragraph 1 of this section.

3. **Withholding for unpaid wages and liquidated damages:** The Agency 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 any monies payable on account of work performed by the Contractor or Subcontractor under any such contract or any other Federal contract with the same Prime Contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same Prime Contractor, such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or Subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph 2 of this section.
4. **Subcontracts:** The Contractor or Subcontractor shall insert in any subcontracts the clauses set forth in paragraphs 1 through 4 of this section and also a clause requiring the Subcontractors to include these clauses in any lower tier subcontracts. The Prime Contractor shall be responsible for compliance by any Subcontractor or lower-tier Subcontractor with the clauses set forth in paragraphs 1 through 4 of this section.

## **FR 18 ADA Access**

The Contractor and any of its Subsuppliers under this Contract agree to comply with all applicable requirements of the Americans with Disabilities Act of 1990 (ADA), 42 USC §§ 12101 *et seq.*; Section 504 of the Rehabilitation Act of 1973, as amended, 29 USC § 794; 49 USC § 5301(d); and the following regulations and any amendments thereto:

1. DOT regulations, "Transportation Services for Individuals with Disabilities (ADA)," 49 CFR Part 37;
1. DOT regulations, "Nondiscrimination on the Basis of Handicap in Programs and Activities Receiving or Benefiting from Federal Financial Assistance," 49 CFR Part 27;
2. Joint U.S. Architectural and Transportation Barriers Compliance Board (U.S. ATBCB)/U.S. DOT regulations, "American With Disabilities (ADA) Accessibility Specifications for Transportation Vehicles," 36 CFR Part 1192 and 49 CFR Part 38;
3. Department of Justice (DOJ) regulations, "Nondiscrimination on the Basis of Disability in State and Local Government Services," 28 CFR Part 35;
4. DOJ regulations, "Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities," 28 CFR Part 36;
5. General Services Administration regulations, "Accommodations for the Physically Handicapped," 41 CFR Subpart 101-19;
6. Equal Employment Opportunity Commission, "Regulations to Implement the Equal Employment Provisions of the Americans with Disabilities Act," 29 CFR Part 1630;
7. Federal Communications Commission regulations, "Telecommunications Relay Services and Related Customer Premises Equipment for Persons with Disabilities," 47 CFR Part 64, Subpart F;
8. FTA regulations, "Transportation for Elderly and Handicapped Persons," 49 CFR Part 609;
9. U.S. ATBCB regulations, "Electronic and Information Technology Accessibility Standards," 36 CFR Part 1194; and
10. Any implementing requirements FTA may issue.

## **REQUEST FOR PROPOSAL**



**LONG BEACH PUBLIC TRANSPORTATION COMPANY**  
1963 E. Anaheim Street, Long Beach, CA 90813  
(562) 591-8753

**Battery Electric Bus Project  
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## **Section 6**

# **Technical Specifications**

## **SECTION 6: TECHNICAL SPECIFICATIONS**

### **GENERAL**

#### **TS 1. Scope**

These Technical Specifications (“Specifications”) define requirements for heavy-duty battery electric transit buses, which, by the selection of specifically identified alternative configurations, may be used for both suburban express service and general 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 Scope of Work, as defined in Section 1, NR1 Battery Electric Bus Project, includes, but is not limited to, the manufacture and delivery of battery electric transit buses, and related charging equipment in the base year, with options for additional buses and relative charging equipment over a five year period. The options may or may not require supporting charging equipment, to be determined at the time of executing said options, which may include multiple on route charging stations and/or depot charging stations for overnight charging. Pricing for the optional buses and/or charging equipment exercised in year one shall be based on the base year and annually adjusted per the established PPI index.

This specification is customized for a unique zero-emission, all-electric transit service at Long Beach Transit. This specification defines requirements for a battery electric bus fleet and supporting charging equipment, which may include multiple on route charging stations, if required, and/or depot charging stations for overnight charging. Funding for this project is specific to battery electric and does not include options for on-board range extenders such as turbines, hydrogen, fuel cells, etc. The conceptual intent is that the “charging” infrastructure be “open” and capable of supporting buses of varying type / model, such that the system of buses and chargers would be scalable for future growth without proprietary constraint.

The intent of this RFP is to solicit proposals for a transportation solution that incorporates battery electric buses and the necessary charging infrastructure with a data management system (DMS) capable of monitoring the equipment state of health, performance, state of charge, etc. The DMS shall have the capability to manage the “charger” equipment for consideration of utility economics. It is further assumed that this DMS shall include the necessary data communications to support near real-time access to the subject equipment (buses and chargers), via wired and/or wireless communications.

Also, at a high conceptual level due to the inherent sensitivities of all electric vehicle performance relative to mass and energy efficiency, particular considerations shall be given to vehicle weight, component weight, parasitic loads, power management, thermal / solar loads, etc.

#### **TS 2. Definitions**

**Agency.** The governmental, quasi-governmental or for commercial fleets, private entity issuing these Specifications.

**Alternative.** An alternative specification condition to the default bus configuration. The Agency may define alternatives to the default configuration to satisfy local operating requirements. Alternatives for the default configuration will be clearly identified.

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**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 continuously 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.

**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.

**Battery Compartments.** Designated area for placement of high- or low-voltage energy storage, i.e. 12/24 VDC batteries. Battery Compartments shall be separately designated as High Voltage Compartments, Low Voltage Compartment, and Backup Battery Compartment.

**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.** Device that converts electrical energy into heat, typically used as a retarder to supplement or replace the regenerative braking.

**Burst Pressure.** The highest pressure reached in a container during a burst test.

**Capacity (liquid container).** The water volume of a container in gallons (liters).

**Capacity (electrical energy storage device).** Two levels of capacity shall be defined, gross and useable. Gross Capacity shall be the capacity energy (kWh) of the entire battery pack and shall include usable, unusable, and/or reserve capacity energy. Useable Capacity shall be the capacity energy between the design operating range within the battery management system for normal operation.

**Cells.** Individual components ( i.e., battery or capacitor cells).

**Charger.** The equipment required to convert Alternating Current (AC) to Direct Current (DC), for the purpose of charging the battery and/or operating vehicle electrical systems while connected. The Charger may be on-board the vehicle or off-board the vehicle. Off-board Chargers may be built as part of the charging station.

**Charging Interface.** The equipment and/or coupler used to create a connection between the charging equipment and the vehicle for the purpose of recharging a vehicle's batteries.

**Charging Equipment.** The equipment that encompass all the components needed to convert, control, and transfer electricity from the grid to the vehicle for purpose of charging batteries and may include chargers, controllers, couplers, transformers, ventilation, etc.

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**Charging Station.** Location that houses the charging equipment that is connected to a utility's high voltage service, to provide electricity to a vehicle's battery system through a charging interface.

**Code.** A legal requirement.

**Contract.** The agreement binding upon Agency and Contractor to which these Specifications apply.

**Contractor.** The entity delivering vehicles compliant with these Specifications to the Agency.

**Combination Gas Relief Device.** A relief device that is activated by a combination of high pressures or high temperatures, acting either independently or together.

**Composite Container for CNG.** A container fabricated of two or more materials that interact to facilitate the container design criteria.

**Compressed Natural Gas (CNG).** Mixtures of hydrocarbon gases and vapors consisting principally of methane in gaseous form that has been compressed for use as a vehicular fuel.

**Conductive Charging Interface.** A charging interface that creates a physical connection between the EVSE and vehicle's Energy Storage System to recharge the vehicle.

**Container.** A pressure vessel, cylinder, or cylinders permanently manifolded together used to store CNG.

**Container Appurtenances.** Devices connected to container openings for safety, control or operating purposes.

**Container Valve.** A valve connected directly to a container outlet.

**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 driver.

**dBA.** Decibels with reference to 0.0002 microbar as measured on the "A" scale.

**DC to DC Converter.** A module that converts a source of direct current (DC) from one voltage level to another. In a completely battery electric bus this typically converts High Voltage from the drive train battery system to 28 VDC in lieu of a conventional engine driven alternator.

**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 Agency.

**Defueling.** The process of removing fuel from a tank.

**Defueling Port.** Device that allows for vehicle defueling, or the point at which this occurs.

**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.

**DPF.** Diesel particulate filter.

**Driver'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.

**Drive System Controller (DSC).** Regulates energy flow throughout 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.

**Electric Drive System (EDS).** The mechanical and/or electromechanical components, including the motor and energy storage system.

**Electric Vehicle Supply Equipment (EVSE).** The conductors, including the ungrounded, grounded, and equipment grounding conductors, the electric vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatuses installed specifically for the purpose of delivering energy from the premises wiring to the battery electric vehicle.

**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).

**Engine.** Internal combustion power plant used in a conventional bus or hybrid as the main source of drive power. Not to be confused with 'motor,' which refers to an electric device.

**Energy Storage System (ESS) / Energy Storage Device (ESD).** A component or system of components that stores energy and for which its supply of energy is rechargeable by the on-vehicle system(engine/regenerative braking/ generator)or an off-vehicle energy source.

**Energy System Controller (ESC).** The ESC regulates energy flow throughout the electric system components in order to provide motive performance and accessory loads, as applicable, while maintaining critical system parameters (e.g., voltages, currents, temperatures, etc.) within specified operating ranges.

**Fill Pressure for CNG.** The pressure attained at the actual time of filling. Fill pressure varies according to the gas temperatures in the container, which are dependent on the charging parameters and the ambient conditions. The maximum dispensed pressure shall not exceed 125 percent of service pressure.

**Flow Capacity.** For natural gas flow, this is the capacity in volume per unit time (normal cubic meters/minute or standard cubic feet per minute) discharged at the required flow rating pressure.

**Fuel Line.** The pipe, tubing or hose on a vehicle, including all related fittings, through which natural gas passes.

**Fusible Material.** A metal, alloy or other material capable of being melted by heat.

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**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 the Contractor as non-standee areas such as, the floor space “swept” by passenger doors during operation. Floor area of 1.5 sq ft shall be allocated for the feet of each seated passenger that protrudes into the standee area.

**Fuel Management System.** Natural gas fuel system components that control or contribute to engine air fuel mixing and metering, and the ignition and combustion of a given air-fuel mixture. The fuel management system would include, but is not limited to, reducer/regulator valves, fuel metering equipment (e.g. carburetor, injectors), sensors (e.g., main throttle, wastegate).

**GAWR (Gross Axle Weight Rated).** 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 Battery Capacity.** Gross capacity would be measured in kWh and would be the energy available from the entire battery pack.

**Gross Load.** 150 lbs for every designed passenger seating position, for the driver, and for each 1.5 square feet of free floor space.

**GVW (Gross Vehicle Weight).** Curb weight plus gross load.

**GFD/GFI (Ground Fault Detector / Ground Fault Interrupt).** A system capable of detecting and interrupting a measurable resistance below that required by SAE J1766 between Isolated High Voltage and Low Voltage systems.

**GVWR (Gross Vehicle Weight Rated).** The maximum total weight as determined by the vehicle manufacturer, at which the vehicle can be safely and reliably operated for its intended purpose. This value is determined by the component in the suspension system with the lesser carrying capacity rating such as tires or axles.

**High Pressure.** Those portions of the CNG fuel system that experience full container or cylinder pressure.

**High Voltage (HV).** Greater than 50 volts (AC and DC).

**Hose.** Flexible line.

**Hybrid.** A vehicle that uses two or more distinct power sources to propel the vehicle.

**Hybrid System Controller (HSC).** Regulates energy flow throughout the **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 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.

**Inductive Charging Interface.** A charging interface that uses an electromagnetic field to transfer energy between the EVSE and vehicle's Energy Storage System to recharge the vehicle.

**Intermediate Pressure.** The portion of a CNG system after the first pressure regulator, but before the engine pressure regulator. Intermediate pressure on a CNG vehicle is generally from 3.5 to 0.5 MPa (510 to 70 psi).

**Inverter.** A module that converts DC to and from AC sometimes known as "motor controller".

**I/O.** Input/Output for electrical systems

**kVA.** Kilovolt-Amps – A unit of power generally associated with electrical devices.

**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*.

**Legal Requirements.** All federal, state and local statutes, laws, ordinances, rules and regulations applicable to the vehicles to which these Technical Specifications apply.

**Line.** All tubes, flexible and hard, that carry fluids.

**Liner.** Inner gas-tight container or gas container to which the overwrap is applied.

**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).

**Lower Explosive Limit.** The lowest concentration of gas where, given an ignition source, combustion is possible.

**Maximum Service Temperature.** The maximum temperature to which a container/cylinder will be subjected in normal service.

**Maximum Standard Operating State of Charge.** The maximum design operating state of charge as recommended by the propulsion system integrator and battery manufacturer.

**Minimum Standard Operating State of Charge.** The minimum design operating state of charge as specified by the propulsion system integrator and battery manufacturer.

**Metallic Hose.** A hose whose strength depends primarily on the strength of its metallic parts; it can have metallic liners or covers, or both.

**Metering Valve.** A valve intended to control the rate of flow of natural gas.

**Module.** Assembly of individual components

**Motor (Electric).** A device that converts electrical energy into mechanical energy.

**Motor (Traction).** An electric motor used to power the driving wheels of the bus.

**Operating Pressure.** The varying pressure developed in a container during service.

**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.

**Pressure Relief Device (PRD).** A pressure and/or temperature activated device used to vent the container/cylinder contents and thereby prevent rupture of a NGV fuel container/cylinder, when subjected to a standard fire test as required by fuel container/cylinder standards.

**NOTE:** Since this is a pressure-activated device, it may not protect against rupture of the container when the application of heat weakens the container to the point where its rupture pressure is less than the rated burst pressure of the relief device, particularly if the container is partially full.

**Power.** Work or energy divided by time

**Power Density.** Power divided by mass, volume or area.

**Propulsion System.** System that provides propulsion for the vehicle proportional to operator commands. Includes, as applicable, the EDS or HDS, energy storage system and the ESC or HSC.

**Propulsion Power Unit (PPU).** System of components that provide tractive power, such as traction motor.

**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.

**Rejectable Damage.** In terms of NGV (Natural Gas Vehicle) fuel containers/cylinders, this is damage as outlined in CGA C-6.4, "Methods for External Visual Inspection of Natural Gas Vehicle Fuel Containers and Their Installations," and in agreement with the manufacturer's recommendations.

**Retarder.** Device used to augment or replace some of the functions of primary friction based braking systems of the bus.

**Rupture.** Sudden and unstable damage propagation in the structural components of the container resulting in a loss of contents. See *Leakage*.

**Seated Load.** 150 lbs for every designed passenger seating position and for the driver.

**SLW (Seated Load Weight).** 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.

**Service Pressure.** The settled pressure at a uniform gas temperature of 21 °C (70 °F) and full gas content. It is the pressure for which the equipment has been constructed, under normal conditions. Also referred to as the nominal service pressure or working pressure.

**Settled Pressure.** The gas pressure when a given settled temperature, usually 21 °C (70 °F), is reached.

**Settled Temperature.** The uniform gas temperature after any change in temperature caused by filling has dissipated.

**Solid State Alternator.** A module that converts high-voltage DC to low-voltage DC (typically 12/24 volt systems). Also referred to as a DC/DC converter.

**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 compressed natural gas-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 Agency.

**Specific Energy.** The amount of energy per unit mass.

**Specific Power.** The amount of power per unit mass.

**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.

**Standard.** A firm guideline from a consensus group.

**Standards.** Standards referenced in “Part 5: Technical Specifications” are the latest revisions unless otherwise stated.

**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. An absolute SOC is based on total battery capacity at the beginning of useful life. A relative SOC is based on total degraded capacity at the time of measurement. The actual relationship between the SOC and energy stored expressed as a percentage shall be linear.

**Stress Loops.** The “pig-tails” commonly used to absorb flexing in piping.

**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.

**Thermally Activated Gas Relief Device.** A relief device that is activated by high temperatures and generally contains a fusible material.

**NOTE:** Since this is a thermally activated device, it does not protect against over-pressure from improper charging practices.

**Usable Battery Capacity.** Usable battery capacity is measured in kWhr and would be the energy available for normal operations. Usable Battery Capacity would be the usable energy from the ESD as managed through the BMS, assumed to be less than the gross capacity. It is calculated based on a useful range of something above 0% SOC and something less than 100% SOC, i.e., as an example, if the range was between 10% and 90% SOC, then the usable battery capacity would be 80% of gross battery capacity.

**Warrantable End of Life (WEOL):** WEOL is a measure of battery degradation determined as the point at which the batteries can no longer provide the energy or power required to meet the design operating profile. It is expressed as a percentage of remaining battery capacity as compared to gross capacity at the beginning of useful life. For purposes of this specification, WEOL shall be a measure of the useful and intended life of the energy storage device. This measure shall be a percentage of remaining useful capacity based on degradation from the beginning capacity, i.e. kWhr and is used in the overall calculation of mileage range. WEOL shall be used as a condition for battery replacement and to potentially initiate warranty claims.

**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 in. in width and 48 in. in length measured 2 in. above the ground, and does not weigh more than 600 lbs when occupied.

### **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 this RFP.

## **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 (Americans with Disabilities Act), 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 (Federal Motor Vehicle Safety Standards) and shall accommodate all applicable FMCSR (Federal Motor Carrier Safety Regulations) regulations in effect at location of the Agency and 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. Contractor and Agency shall identify subcomponent vendors that shall submit installation/application approval documents with the completion of a first article bus. Components used in the vehicle shall be of heavy-duty design and proven in transit service. At a minimum, the following systems shall be subject to the provision of supplier review and application approval:

- Energy Storage System
- Axles, suspension, foundation brakes
- Fire Suppression (gas detection, if required)
- HVAC
- Trapeze Radio

The Contractor shall not make any substantive or material changes that would differentiate one bus from another bus. If the Contractor identifies a change during the manufacturing process that would materially improve the design, safety and/or performance of the bus, this change must (1) be discussed with the Agency and (2) be considered as a retrofit (if possible) to any previous bus(es) manufactured or assembled. Any such changes must be approved by the Agency in accordance with the communication requirements of this RFP.

The loss of power to the bus shall not cause the driver to lose control of the bus or to lose steering or braking. The bus shall be able to be safely brought to a controlled stop.

### **TS 5.1 Weight**

It shall be a design goal to construct each bus as light in weight as possible without degradation of safety, appearance, comfort, traction or performance.

Buses at a capacity load shall not exceed the tire factor limits, brake test criteria or structural design criteria.

The design goal for this project shall be a maximum gross load of 20,500 lb at the rear axle.

## **TS 5.2 Capacity**

The vehicle shall be designed to carry the gross vehicle weight, which shall not exceed the bus GVWR.

## **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 40,000 miles per year, including the 12th year.

The minimum useful life of the charging infrastructure components shall be presented in the proposal.

## **TS 5.4 Maintenance and Inspection**

Scheduled maintenance tasks shall be related and shall be, in accordance with the Contractor's recommended preventative maintenance schedule (along with routine daily service performed during the servicing and overnight charging operations). The overall PMI (Preventative Maintenance Inspection) schedule for rolling stock shall be based upon a 6,000 mile interval and/or multiples of same.

The Contractor is responsible for providing a written comprehensive 52-week and long term rehab/replacement maintenance plan encompassing buses and charging infrastructure for its entire useful life.

Test ports, as required, shall be provided for commonly checked functions on the bus, such as, hydraulic, pneumatic, cooling, temperature, voltage, current and state of charge (SOC).

The proposer shall give prime consideration to the routine problems of maintaining the vehicle and charging equipment. All vehicle and charging station 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 and charging station 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 will be minimized. The body and structure of the bus and charging equipment 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.

The proposer shall provide a list of all special tools and pricing for maintaining this equipment.

**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 5.4.1 Cost of Ownership**

The Agency is interested in the long term cost of ownership, particularly the maintenance requirements that are routine, scheduled and/or reasonably predictable. In addition to the Proposers submittals describing and defining the service and maintenance requirements for the equipment, a "Cost of Ownership" template has been developed and included in the forms to be filled out by the Proposer as an



element of the submittal package. This form itemizes tasks in three areas, PMI, scheduled maintenance and major component replacement.

#### **TS 5.4.2 Conditional Assessments**

The Agency would like a high level of confidence ensuring that the Agency's maintenance practice is in harmony with the recommended requirements of maintaining the subject buses, to include PMI, diagnostics and repair. The Proposer shall incorporate two audits (Conditional Assessments) into their proposal to be conducted on-site (Agency) approximately one year and 3 years after the average in-service date of each delivery lot. These audits shall include a review of maintenance records, inspection of the buses and overall review of the Agency's operating and maintenance practices. Proposers are encouraged to elaborate on the detail of their audit strategy within the technical bid submittal. At a minimum, the following shall be included in these conditional assessments:

- General inspection of all buses delivered
- Random Detailed inspection of a representative sample, 25% minimum
- Data review for reliability, road calls, repeat problems, trends, etc.
- Assessment of Agency skill, quality, workmanship, training
- Review of parts, on-hand stock, consumption, trends, premature replacement
- Availability and adequacy of support documentation, service manuals, parts manuals, schematics, drawings, inspection guidelines
- Warranty processes, recovery, fleet defects

In addition to the bus conditional assessment, this review shall include a conditional assessment at one year and three years of the high voltage energy storage system and any charging equipment provided in the proposal.

As a contractual obligation, the Contractor shall be responsible for the above conditional assessments. The Agency encourages the Contractor to solicit assistance and participation amongst the major system and component suppliers. In addition, the Agency assumes a level of participation by reasonably making available the subject equipment, shop space, support equipment and staff. See WR 4.2 and WR 5.5

#### **TS 5.5 Interchangeability**

Unless otherwise agreed, all units and components procured under this Contract, whether provided by Suppliers or manufactured by the Contractor, 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. These components shall include, but are not limited to, passenger window hardware, interior trim, lamps, lamp lenses and seat assemblies. 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.

In the event that the Contractor is unable to comply with the interchangeability requirement, the Contractor must notify the Agency and obtain the Agency's prior written approval, including any changing in pricing.

Agency 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 as least as well as the originally supplied products.

## **TS 5.6 Training**

The Contractor shall offer a training package as a deliverable within the scope of the bus proposal and include the necessary skills level classes such that Agency Operators and Mechanics are able to operate, diagnose, repair and maintain all equipment provided within this specification. The Contractor shall describe the detail of the proposed training deliverable within their bid submittal, to include, subject matter, sample curriculum and approximation of training hours required. The Agency reserves the right to review, make recommendations and approve the actual deliverable prior to its use for training. The Agency shall have the ability to reallocate training hours from one subject matter to another to best serve the Agency's needs. The pricing schedule reflects Agency's requirements for a minimum expectation and for purposes of bid evaluation.

### **Technical/Service Representatives**

The Contractor shall, at its own expense, have one or more competent technical service representatives available on request to assist the Agency in the solution of engineering or design problems within the scope of the specifications that may arise during the warranty period. 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 30 °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 30 °F, above 115 °F or at altitudes above 3000 feet. Altitude requirements above 3000 feet will need separate discussions with the engine manufacturer to ensure that performance requirements are not compromised. 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 driver area shall not experience a noise level of more than 75 dBA.

### **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 Agency and SAE J366.

## **TS 5.9 Fire Safety**

The bus and charging equipment 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.

The buses shall be equipped with a suitable means of automatically detecting and extinguishing fires and/or over temperature situations which may cause unreliable or unsafe operation. If the energy storage device is capable of releasing combustible gas, then this same system shall incorporate an integrated gas detection and alarm feature. This system shall employ intrinsically safe detectors capable of reliable operation, alert and shutdown to insure safe operation, alert and shutdown shall respectively occur at approximately 25 and 50% LFL (Lower Flammability Limit). This system shall include a UPS (Uninterruptable Power Supply) capable of sustaining operation for a period of at least 72 hours regardless of the primary energy source SOC and remain uninterrupted regardless of “run” / “ign” position. The system controller shall include a means of data logging and storage such that incident data is recoverable and periodic system health checks. The quantity, location and technology for sensors, suppression, agents, etc. shall be best practice for the intended application and environment. Fire suppression piping located in the immediate area (s) being protected shall be fireproof and capable of surviving gross thermal events, the subject piping shall include the flow path between the fire suppression bottle and nozzles, metalized rigid / flexible, stainless steel preferred. The preferred supplier for the system shall be Amerex.

The system design, hardware location and access shall be such that those items required for periodic inspection are readily available for ease of access and viewing.

All materials used in the construction of the passenger compartment of the bus shall be in accordance with the Recommended Fire Safety Practices defined in FMVSS 302 and FTA Docket 90, dated October 20, 1993. 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, shall be exempt from this requirement.

## **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 and charging equipment.

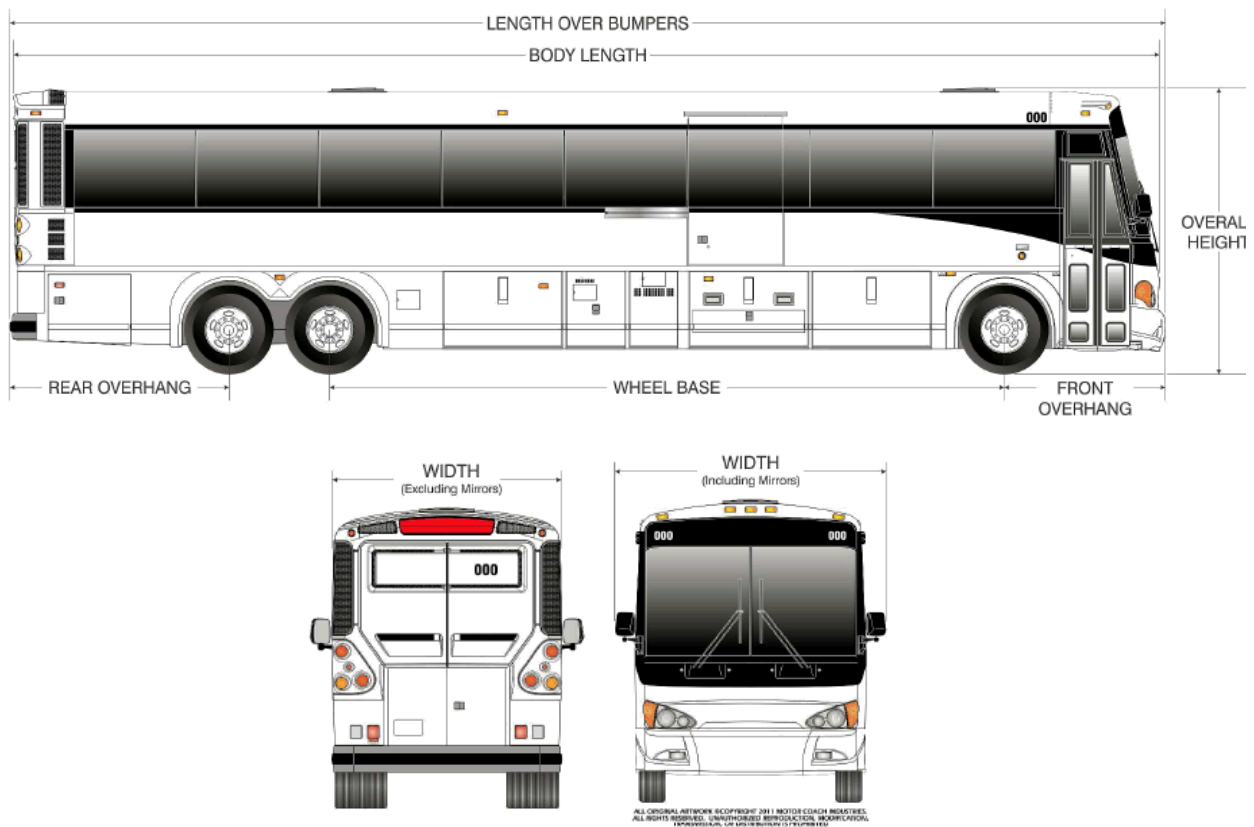
The Contractor shall provide a plan for reuse or recycling of replaced battery cells and/or battery packs both during and after the warranty period. See WR 3.3.

## 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, bicycle racks, feelers and rub rails, 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.

- **40-ft bus:** 40 ft to 44 ft, 11 in.

#### TS 6.2 Bus Width

Body width shall be 102 in. (+0, -1 in.).

### **TS 6.3 Bus Height**

#### **Maximum Overall Height**

Maximum overall height shall be 140 in., including all rigid, roof-mounted items such as A/C, energy storage system, charging interface, covers, etc.

### **TS 6.4 Step Height**

The step height shall not exceed 16.5 in. at either doorway without kneeling and shall not exceed 15.5 in. at the step. A maximum of two steps is allowed to accommodate a raised aisle floor in the rear of the bus.

### **TS 6.5 Underbody Clearance**

The bus shall maintain the minimum 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 Ramp Clearances**

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.

**TABLE 1**  
Breakover Angle

| Angle                             | 40ft Bus           |
|-----------------------------------|--------------------|
| Approach                          | 8.6 degrees (min.) |
| Front breakover                   | 8 degrees (min.)   |
| Rear breakover (articulated only) | n/a                |
| Departure                         | 8.7 degrees (min.) |

### **TS 6.7 Ground Clearance**

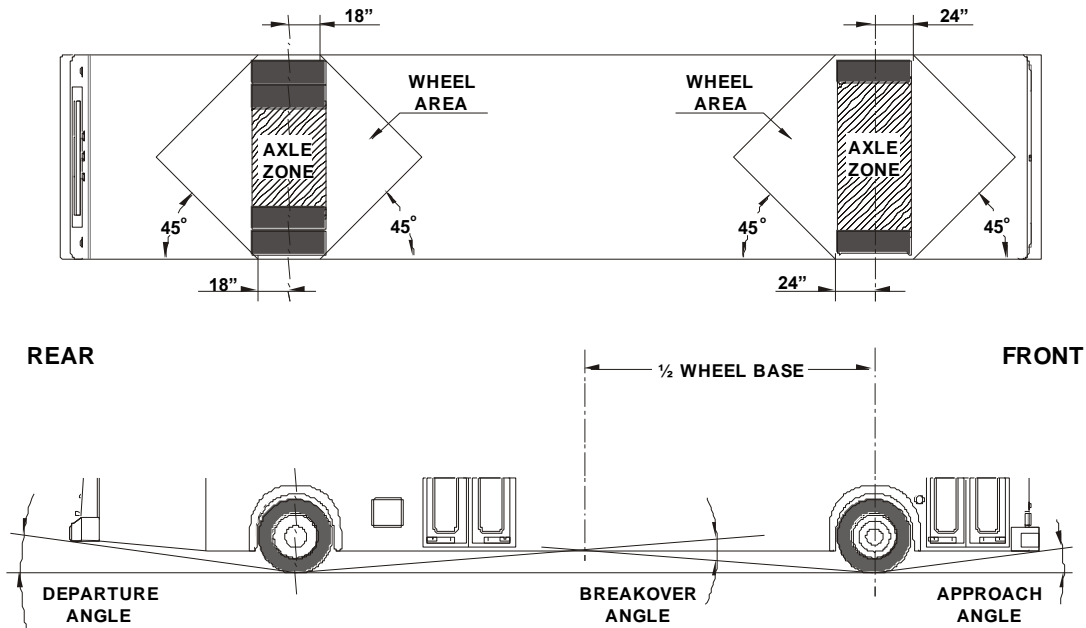
Ground clearance shall be no less than 9 in., (8 in. at jacking pad) except within the axle zone and wheel area.

Axle zone clearance, which is the projected area between tires and wheels on the same axial centerline, shall be no less than 5.4 in.

Wheel area clearance shall be no less than 8 in. for parts fixed to the bus body and 6 in. for parts that move vertically with the axles.

**FIGURE 2**

Transit Bus Minimum Road Clearance



### TS 6.8 Floor Height

Height of the step above the street shall be no more than 16 in. 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 in. in the forward half of the bus tapering to no less than 74 in. forward of the rear settee. At the centerline of the window seats, headroom shall be no lower than 65 in., except for parcel racks and reading lights, if specified. Headroom at the back of the rear bench seat may be reduced to a minimum of 56 in., 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 with all attached hardware shall be at least 22 in.

The aisle width between the front wheelhouses shall be at least 38 in., 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, route, mileage, GVWR and gradability requirements, and operate all propulsion-driven accessories using actual road test results and computerized vehicle performance data.

The loss of power to the bus shall not cause the driver to lose control of the bus or to lose steering or braking. The bus shall be able to be safely brought to a controlled stop.

#### **TS 7.1 Top Speed**

The bus shall be capable of achieving a top speed of 55 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.

#### **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 1) to achieve (from a stop position) and maintain a speed of 40 mph on a 2½ percent ascending grade and 2) to achieve (from a stop position) and maintain a speed of 15 mph on a 10 percent ascending grade continuous over a distance of 2/10 of a mile.

#### **TS 7.3 Acceleration**

The acceleration shall meet the 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.

**TABLE 2**

Maximum Start Acceleration Times on a Level Surface<sup>1</sup>

| <b>Speed (mph)</b> | <b>Maximum time (seconds)</b> |
|--------------------|-------------------------------|
| 10                 | 5                             |
| 20                 | 10                            |
| 30                 | 18                            |
| 40                 | 30                            |
| 50                 | 60                            |
| Top speed, 55 MPH  | 75                            |

1. Vehicle weight = GVWR

### **All Electric Propulsion**

The propulsion and braking systems shall meet the performance requirements of the Duty Cycle.

Braking application and performance shall remain consistent regardless of system State of Charge (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 Contractor 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 “LBT Design Operating Profile” section.

### **TS 7.4.1 Diesel**

Not Applicable

### **TS 7.4.2 CNG**

Not Applicable

### **TS 7.4.3 Hybrid**

Not Applicable

### **TS 7.4.4 Battery Electric**

The operating range of the bus shall be capable of meeting the Agency Design Operating Profile under full GVWR and auxiliary loads at a condition as defined by “useful” capacity.

## **TS 8. Fuel Economy (Design Operating Profile)**

### **TS 8.1 Altoona Fuel Economy Tests**

Contractor must have started Altoona testing of their proposed bus by the time proposal submission are due to the Agency as specified in IP 2. Proposed Schedule for the Procurement. Test results from all applicable Altoona test procedures shall be provided to the Agency prior to the final assembly of the first article. The final report issued by Altoona and Remedy Letters responding to Altoona findings must be delivered to the Agency prior to vehicle acceptance

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 assumed to be defined by the Bus Research Testing Center at Altoona, Pennsylvania (“Altoona”) fuel duty cycle which includes simulated central business district, arterial, and commuter courses.

Altoona fuel economy tests shall be run on these four duty cycles using maximum auxiliary loads and GVRW. Results shall be reported in kWh per mile.

Duty Cycles (average speed)

- Manhattan: 6.8 mph



- Orange County: 12.7 mph
- UDDS: 19 mph
- Idle time

## **TS 8.2 LBT Design Operating Profile**

At a minimum, the bus must have a design operating profile that meets the requirements of the route model presented in Exhibits 1 through 7 below, including speed, elevation, and grade. It is assumed that buses will start daily duty cycle at Maximum Standard Operating SOC. Batteries shall not be depleted below Minimum Standard Operating SOC during normal operations. Minimum Standard Operating SOC shall allow for reserve battery capacity from which the bus can draw upon to return to the depot from the furthest point on the route. Charging of the batteries during normal operations shall not exceed Maximum Standard Operating SOC at any time during charging. An Excel file with time, speed, and grade data points for the selected route is available on the Agency RFP CD.

The route model data provided may be used as an approximation of the actual route for modeling purposes only. The data was collected with a GPS data logger, filtered, and augmented with elevation data from the U.S. Geological Survey and NASA to determine grades. If selected, the Contractor shall use the Agency Design Operating Profile for the required bench test of the proposed propulsion system.

The Contractor shall provide the following narratives with their Technical Proposal:

- Description of proposed propulsion system
- Description of the methods used to validate that the proposed system will meet the Agency Design Operating Profile and the results of that validation
- Description of the Bench Test that Contractor will use to confirm propulsion system performance
- Description of prior Bench Test experience with demonstration of vehicle performance including, but not limited to duty cycle, efficiency, battery SOC, acceleration, gradability, etc.

Simulated testing shall be run for the duty cycle identified by the Agency Design Operating Profile below using maximum auxiliary loads and GVWR. Results shall be reported in kWh per mile.

**Long Beach Public Transportation Company**  
**Request for Proposal**  
**RFP 15-001**

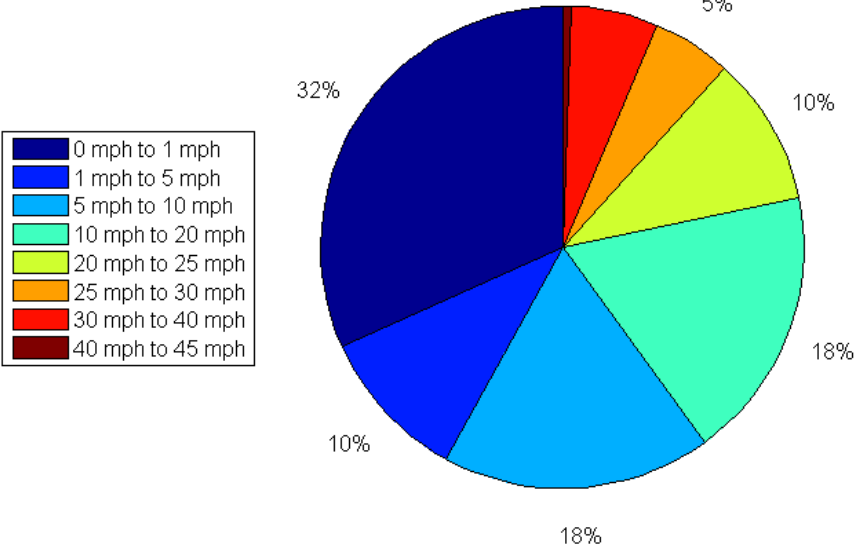
**Exhibit 1**  
**Minimum Operating Profile**  
**Data Summary**

|  |         |
|--|---------|
| <b>Maximum Speed</b>                         | 40 MPH  |
| <b>Maximum Grade</b>                         | 9%      |
| <b>Route Distance</b>                        | 8 miles |
| <b>Route Duration</b>                        | 1 hour  |
| <b>Distance from Depot to Start of Route</b> | 4 Miles |
| <b>Furthest Distance from Depot</b>          | 5 miles |

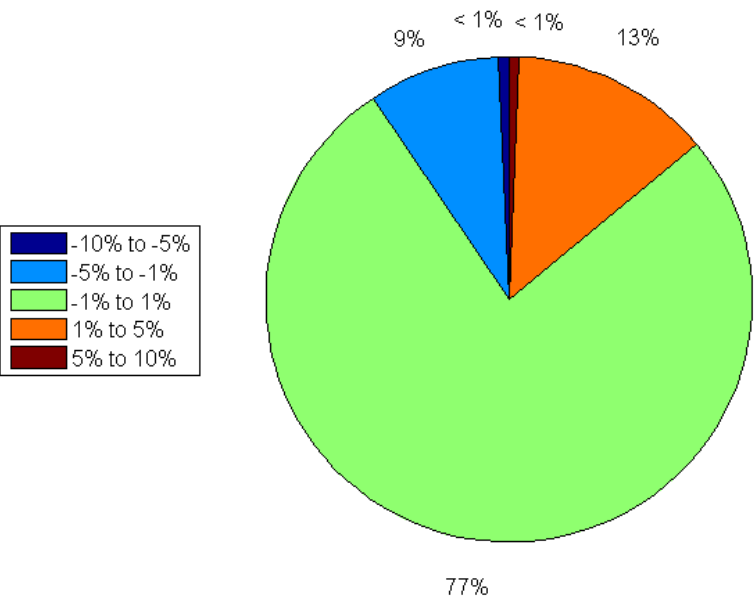
**Exhibit 2**  
**Minimum Operating Profile**  
**Aerial View of Route**



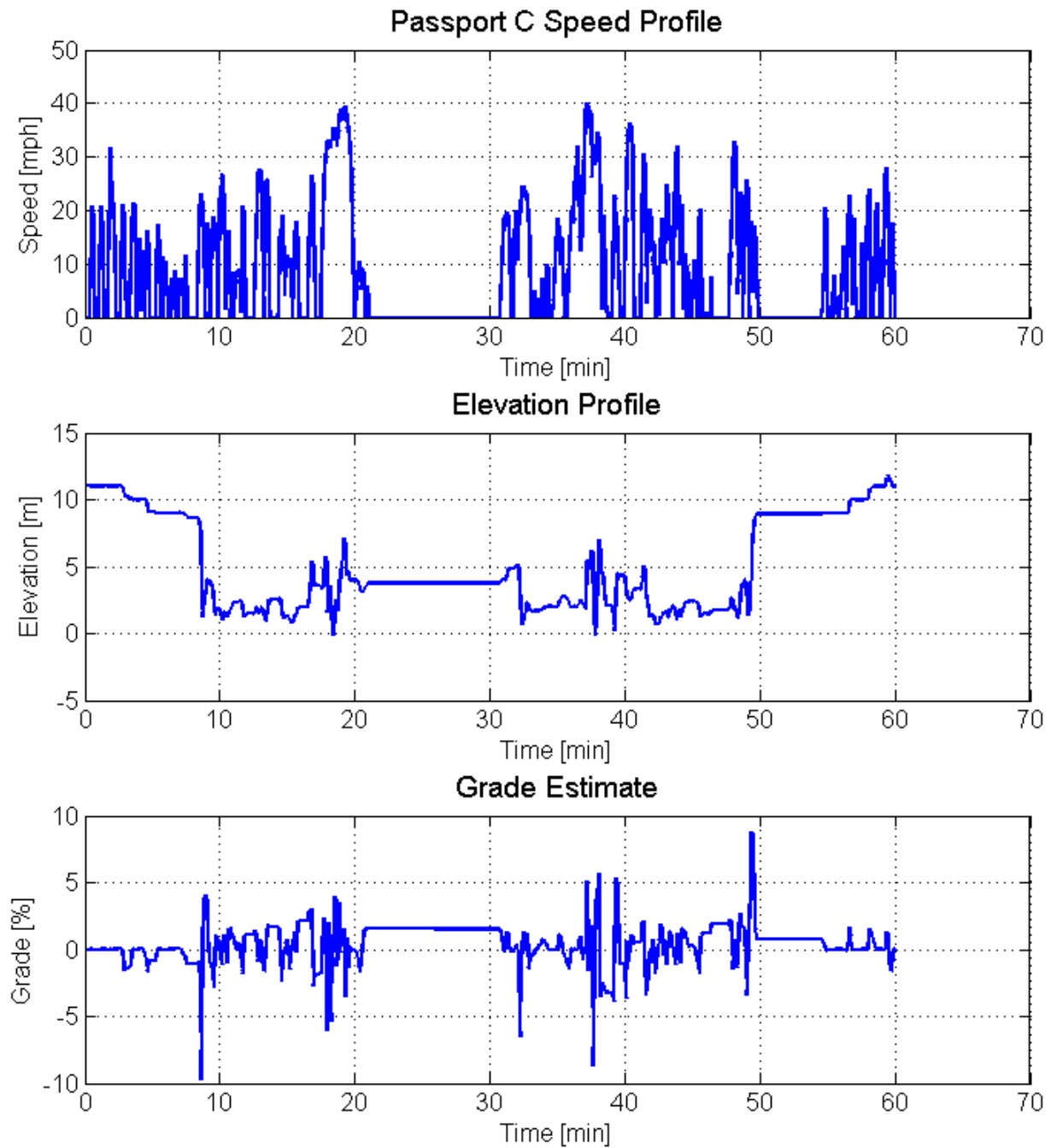
**Exhibit 3**  
**Minimum Operating Profile**  
**Route Speed Breakdown**  
Long Beach Passport Route Speed Breakdown



**Exhibit 4**  
**Minimum Operating Profile**  
**Route Grade Breakdown**  
Grade Analysis Passport Route



**Exhibit 5**  
**Minimum Operating Profile**  
**Speed, Elevation, and Grade Profiles**



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**Exhibit 6**  
**Minimum Operating Profile**  
**Current Weekday Blocking Profile**

| Block              | # Trips    | Bus No. | Start | End   | Duration     |              |             |              | Mileage      |             |              |
|--------------------|------------|---------|-------|-------|--------------|--------------|-------------|--------------|--------------|-------------|--------------|
|                    |            |         |       |       | In-Service   | Layover      | Pull        | Total        | In-Service   | Pull        | Total        |
| 30-1               | 36         | Bus 1   | 5:04  | 0:40  | 15h30        | 3h50         | 0h16        | 19h36        | 154.6        | 3.2         | 157.8        |
| 30-2               | 24         | Bus 2   | 5:34  | 19:22 | 10h30        | 3h02         | 0h16        | 13h48        | 103.1        | 3.2         | 106.3        |
| 30-3               | 22         | Bus 3   | 8:24  | 21:20 | 9h42         | 2h58         | 0h16        | 12h56        | 94.5         | 3.2         | 97.7         |
| 30-4               | 28         | Bus 4   | 9:20  | 1:09  | 12h09        | 3h24         | 0h16        | 15h49        | 120.3        | 3.2         | 123.5        |
| 30-5               | 14         | Bus 5   | 10:02 | 18:21 | 6h16         | 1h47         | 0h16        | 8h19         | 60.1         | 3.2         | 63.3         |
| <b>Route Total</b> | <b>124</b> |         |       |       | <b>54h07</b> | <b>15h01</b> | <b>1h20</b> | <b>70h28</b> | <b>532.6</b> | <b>16.0</b> | <b>548.6</b> |

**Exhibit 7**  
**Minimum Operating Profile**  
**Current Weekend Blocking Profile**

| Block              | # Trips    | Bus No. | Start | End   | Duration     |              |             |              | Mileage      |             |              |
|--------------------|------------|---------|-------|-------|--------------|--------------|-------------|--------------|--------------|-------------|--------------|
|                    |            |         |       |       | In-Service   | Layover      | Pull        | Total        | In-Service   | Pull        | Total        |
| 30-1               | 26         | Bus 1   | 5:06  | 19:17 | 11h08        | 2h47         | 0h16        | 14h11        | 111.7        | 3.2         | 114.9        |
| 30-2               | 30         | Bus 2   | 5:36  | 22:22 | 12h55        | 3h35         | 0h16        | 16h46        | 128.9        | 3.2         | 132.1        |
| 30-3               | 20         | Bus 3   | 8:24  | 19:47 | 8h46         | 2h21         | 0h16        | 11h23        | 85.9         | 3.2         | 89.1         |
| 30-4               | 28         | Bus 4   | 9:14  | 0:39  | 12h06        | 3h03         | 0h16        | 15h25        | 120.3        | 3.2         | 123.5        |
| 30-5               | 18         | Bus 5   | 9:39  | 20:07 | 7h56         | 2h16         | 0h16        | 10h28        | 77.3         | 3.2         | 80.5         |
| 30-6               | 18         | Bus 6   | 10:09 | 20:32 | 7h56         | 2h11         | 0h16        | 10h23        | 77.3         | 3.2         | 80.5         |
| 30-7               | 24         | Bus 7   | 11:38 | 1:09  | 10h26        | 2h49         | 0h16        | 13h31        | 103.1        | 3.2         | 106.3        |
| <b>Route Total</b> | <b>164</b> |         |       |       | <b>71h13</b> | <b>19h02</b> | <b>1h52</b> | <b>92h07</b> | <b>704.4</b> | <b>22.4</b> | <b>726.8</b> |

LBT maintains the practice of continually reviewing and modifying their route blocking schedule to maximize operational efficiency of their fleet. Thus, the blocking profiles presented may not be the same profile that is implemented with the battery electric bus fleet. Please provide recommendations for blocking profiles that will maximize the efficiency of the proposed battery electric buses and charging equipment.

### TS 8.3 Alternate Operating Profiles

LBT's primary goal is to place the proposed battery electric buses on the Passport route, as indicated in TS 8.2. However, LBT has a secondary goal to demonstrate the same proposed buses on alternate routes within LBT's network. Thus, it is critical that the proposed bus and charging solution have the flexibility to be placed on alternate routes at LBT's discretion. The proposer shall provide a narrative in the Technical Proposal describing the flexibility of their proposed bus and charging solution to meet this goal.

## **POWERPLANT**

### **TS 9. Engine**

#### **TS 9.1 Engine (CNG)**

Not Applicable.

#### **TS 9.2 Propulsion System (Electric)**

##### **Propulsion System Description**

The bus shall be powered by a battery electric propulsion system. Function and operation of the bus shall be transparent to the Bus Operator and passengers. The Contractor shall assure that the bus structure can successfully accept the installation of the propulsion system and be operated on the stated duty-cycle for a period of 12 years without a structural failure. At a minimum, the propulsion system shall comply with applicable local, state, and/or federal emissions and useful life requirements, as a zero emission bus. The propulsion system shall comply with local, state, and federal (maintenance) and other applicable sections.

The Electric Drive System shall be rated for the GVWR or greater of the bus.

##### **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 Agency shall recognize that properly rated test equipment and safe electrical work practices are essential when servicing high voltage components. Contractor shall provide all specialty tools and diagnostic equipment required for maintaining the Propulsion System in accordance with Special Tools List.

##### **Primary Propulsion Unit and Traction Motor**

The PPU and traction motor(s) may be configured in a variety of methods dependent upon type of drive, i.e. conventional drive rear axle, wheel motors, etc.. The definition of motor in the context of this specification assumes the device can provide or consume electrical energy as well as provide or retard mechanical motion.

##### **Propulsion System Controller (PSC)**

The PSC regulates energy flow throughout system components in order to provide 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.

The overall propulsion system and PSC shall include and manage support systems such as, steering, air, HVAC, defroster, etc.

The propulsion system shall be managed via a PSC. This PSC is assumed to be the hub for all propulsion system device to device communication, to include traction motors, energy storage, charging equipment and power switching electronics, and interface to other vehicle systems via J1708, J1939, etc. The PSC shall provide the following functionality:

- Storage of the application file necessary to execute propulsion system commands

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- Storage of the buses data file generated on a day to day basis, to include:
  - At a minimum, duty cycle information (time stamp, vehicle speed, elevation, location, ambient temperature, etc.), and energy profile information (i.e., voltage and current from the traction motor, auxiliary systems, ESS, power electronics, onboard charging system, etc.) at 1 sec intervals
  - History of charging sessions, energy in, time stamp, SOC, etc.
  - Incidents and alarms
  - Health monitoring and diagnostics information
- Expert level software such that the bus is optimized per duty cycle on the fly, i.e. “adaptive learning” to consider, route, time of day, etc. The objective is to maintain the buses level of expected performance, meanwhile minimize the cost of the electric utility used for charging. If the proposed PSC controller does not have the capability to perform “adaptive learning”, the Contractor must perform parameter tuning to help optimize the efficiency of the vehicle to the given route.
- A means of executing “limp home” instruction such that the bus is able to return to the depot from the furthest point on the route without charge assistance.
- A wireless means of communication to the on route and depot charging stations, and/or if probed via a WLAN in close proximity
- The system is assumed to include current / power sensors at strategic locations throughout the propulsion system components such that real time comparisons can be made between anticipated power flow and actual power. This feature shall facilitate health checking of components to indicate, “open”, “shorted” and/or components that have considerable variance.
- The system is assumed to include the necessary sensor inputs at strategic locations, such as, temperature, voltage, pressure, etc. such that the entire array of devices are monitored in real time. This feature shall be able to execute commands for the self preservation of component life, health, reliability and safety. The on-board diagnostic system shall trigger a visual and audible alarm to the operator when the motor controller detects a malfunction and the protection systems are activated.
- The system shall protect the traction motor(s) against progressive damage. The system shall monitor conditions critical for safe operation and automatically derate power and/or speed.
- The system shall include a sub-system capable of monitoring the level of connectivity between all propulsion components and associated cabling / connectors to the buses chassis and low (12/24 vdc) systems to insure isolation. The energy storage module shall have at least two automatic means / devices of disconnect and one manual capable of interrupting the positive and negative connections within the module enclosure, and rated for disconnect at maximum current.
- The system shall have an interlock that prevents engagement when the charger is connected to the traction battery.

The PSC shall be equipped with an electronically controlled management system, compatible with multiplex wiring systems and either 12- or 24-volt electrical systems.

#### **Power Electronics / Inverter**

The previously mentioned PSC shall execute instructions and system commands to the propulsion system components via a power electronics switching module, assumed to be an “inverter”. This power module shall be the hub for the traction motor, energy storage, charger and all motors / devices necessary for periphery support systems, such as, HVAC, power steering, air system, bus low voltage battery charging, etc. Circuitry for this device (s) shall include all necessary fuses / breakers such that the conductors, com-

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ponents and bus are adequately protected and safe. Connection points shall be keyed / identified such that mismatch is not physically possible. In addition these connection points shall be interlocked, such that a disconnect is automatically accompanied by an interruption at the energy storage module, both + and -. Reconnecting the subject connector (s) will not automatically restore the connection to the energy storage module; a system reset will be required.

**Traction System**

The traction system shall include the necessary motors, gearing and connection to the drive axle and /or wheel motor driven.

**Energy Storage System**

Design and performance shall be provided to the Agency. The Energy Storage System (ESS) shall be of a commercial design capable of operating in the Agency transit environment. The ESS shall be designed, sized, and selected to ensure that the vehicle performance specifications, compatibility with charging, and other related requirements are met or exceeded, bearing in mind cost benefit and reliability variables as they relate to the characteristics of the different battery types. The power source for the vehicle shall be derived from established battery technology that has a field-proven track record of safe, reliable, and durable operation in similar traction applications.

The primary charging of the energy storage system shall be accomplished by conductive or inductive charging as needed to meet the required duty cycle. If the primary charging system uses any type of automated service to initiate charging, secondary charging shall be provided from a stationary charging station via a mechanical or manual conductive interface, i.e., plug. The energy storage system shall also make use of regenerative braking. The Energy Storage System shall comply with UN/DOT 38.3 requirements for lithium batteries or similar standards for non-lithium batteries.

The Contractor shall deliver the buses with an installed, fully-charged, functioning ESS. The ESS shall be fully formed, installed and tested in accordance with the battery manufacturer's recommended practices. The ESS design, including containers, module bracing systems, thermal-management systems, battery-management systems, watering/venting systems, interconnections, fusing, and traction-controller and charger interfaces shall be completely described in the proposal. The proposal shall include a detailed analysis of expected battery performance in the Design Operating Profile. The proposal shall also include a comprehensive statement of the warranty terms relating to the battery, including explanation of all disclaimers within the warranty. The charge cycle and cycle life shall be stated in the proposal and a life-cycle cost analysis of the proposed battery system in the specified application shall be provided.

The battery system shall be capable of withstanding the high current and voltage profiles necessary to accomplish daily recharge events without reducing the life of the battery. Thermal management will be provided to ensure optimal life and performance of the ESS over the environmental operating range. Battery thermal management system shall be adequate to maintain the battery within the battery manufacturer's recommended temperature range during operation in the specified duty cycle and climatic conditions.

Proposals shall include complete descriptions of all life-cycle testing procedures used to validate the life of batteries used this application at the proposed charging rates, charge durations, and expected ambient temperatures and operating profiles. Proposers shall include documented results of life cycle testing. Proposers shall include certification of battery life cycle testing by independent testing agency.

**Energy Storage System Safety**



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The Energy Storage System shall be placed on the bus to optimize both interior space and vehicle weight distribution. The batteries shall be load distributed within the bus to equalize weight between the wheels on the same axles and to achieve appropriate weight distribution between axles so as not to adversely affect handling of the bus.

The bus body shall be designed and constructed to ensure passengers and the operator will not be exposed to electrical current either in normal operation or in the event of a vehicle accident. Analysis and test data shall be provided to the Agency. The energy storage system shall be designed and constructed to prevent gassing or fumes from the energy storage system from entering the interior of the bus, i.e., a vent path to the exterior, preferably at or above the roof, rearward.

Written confirmation from the battery manufacturer attesting to the safety of the proposed battery system in the specified application and charging profile shall be submitted as part of the proposal, and shall include full disclosure and discussion of any and all issues or prior incidents relating to safety.

Proposals shall include complete descriptions of all safety standards followed in the design and manufacture of the battery system, safety testing procedures used to validate the safety of battery operation in this application, and documented results of safety testing to confirm that standards have been met. Proposers shall include certification of battery safety testing by independent testing agency.

#### **Battery Containers**

Battery containers shall be constructed to withstand the rigors of transit service for the design life of the buses. Construction shall be of materials compatible with the battery electrolyte. All electrical connections shall be fully shielded and hand operable. Connector and cabling design shall be such that inappropriate or unsafe connections are not possible. The system shall be designed to allow a single mechanic using a 2-ton capacity forklift to remove and replace the battery within 15 minutes. Vent-and-fill system components for individual packs or containers shall not require any disassembly on removal or installation of the battery packs or containers. Pack design must ensure the protection of battery cabling and vent/watering system components during pack removal and installation. The batteries, when installed, shall be secured to prevent any movement while the vehicle is in operation.

Battery containers shall be supplied by the battery manufacturer. Battery containers supplied by the Contractor are also acceptable provided that such containers are certified by battery manufacturer; such certification shall be submitted to procuring agency concurrent with or prior to delivery of the first bus.

#### **Battery Management System**

As a minimum, the battery management system (BMS) must perform the following functions:

- A. The BMS system must be capable of monitoring the voltage level of cells within each battery pack. The BMS must be able to read and store individual battery or block voltages at a frequency of 1 data point per block every 15 seconds. The system must also monitor battery pack temperatures using no fewer than 2 thermocouples placed in and around each battery pack sampled at the same 4 samples per minute frequency.
- B. The BMS system must be capable of communicating when a battery fault (as defined by the battery manufacturer) has occurred and must be able to identify and communicate the faulty battery in order to perform maintenance.

- C. The BMS system must be capable of engaging prudent safety interlocks when an unsafe battery condition has been detected.
- D. The BMS system must be able to monitor the battery state-of charge and update a gauge viewed by the operator at least once every 15 seconds.
- E. The BMS system must be able to communicate all data to the bus level information system (reference TS 84) for storage and communication.

### **Battery Thermal Management**

Battery thermal management must be powered from an onboard source at all times. Thermal management must be continuously monitored at all times with appropriate safety interlocks installed to react to adverse conditions as stated in SAE J1772.

Battery temperatures must never exceed the manufacturer's recommended range during operation in the design operating profile and specified ambient conditions. Battery cooling must be sufficient to prevent the temperature from exceeding the battery manufacturer's recommended maximum temperature when the ambient temperature is above 105 degrees F for a period of 16 hours.

## **TS 10. Cooling Systems**

The cooling systems shall be of sufficient size to maintain all motor, power electronics and traction batteries at safe continuous operating temperatures during the most severe operations and conditions possible and in accordance with battery and drive system component manufacturers' cooling system requirements and recommendations. The cooling system fan/fans control should sense the temperatures of the operating fluids and intake air and if either is above recommended operating conditions the cooling fan should be engaged. The fan control system shall be designed with a fail-safe mode of "fan on." The cooling system shall have an ambient capacity of at least 110° F with water as coolant at sea level operation.

Operation of required battery thermal management systems shall be automatically controlled under all normally encountered operating and charging conditions and shall be powered by an onboard source at all times. Thermal management shall be continuously monitored during all periods of charge and discharge with appropriate safety interlocks installed to react to adverse conditions as stated in SAE-J1772.

Air intakes shall be properly positioned and configured to minimize the intake of water, road dust, and debris and shall be adequately filtered.

In the event of a failure of the battery thermal management system while charging, the charge system shall be disabled and a visual alert shall be activated on the dashboard, the reset of which shall require the deliberate action of maintenance personnel. In the event of a failure of the battery thermal management system during bus operation, an audible and visual alert shall be activated on the dashboard, the reset of which shall require the deliberate action of maintenance personnel. In the event of a fire onboard a bus, thermal management fans shall be automatically turned off.

A complete description of the battery thermal management systems shall accompany the bid package. Written confirmation from the battery manufacturer attesting to the suitability of the battery thermal management system shall be submitted to the Procuring Agency concurrent with or prior to delivery of the first bus.

The cooling system fan controls should sense the temperatures of the operating fluids and the intake air, and if either is above safe operating conditions, the cooling fan should be engaged. The fan control system shall be designed with a fail-safe mode of “fan on.” The cooling system shall meet the requirements stated in Operating Environment, Section 5.7 above. The cooling system is assumed for all temperature control required for the propulsion system, heating and/or cooling, further assuming that heat from this system will also be used to provide thermal energy as required for vehicle functions, as HVAC and defroster. Coolant shall be Fleetguard ES Compleat, 50/50 premix, OATS / NAPS free, filtered by an inhibitor free spin-on replaceable filter, further serviced by two quarter turn shut-off valves for ease of replacement.

### **TS 10.1 Motor Cooling**

Motor temperature sensors shall be easily accessible for replacement. Motor temperature sensors shall not disable the bus at any time.

Motor cooling fans shall be of durable corrosion-resistant construction, bolted-on and designed so a mechanic can gain access, remove and replace fan in fifteen minutes or less. The cooling fan and mounting bracket shall be designed to withstand thermal fatigue and vibration associated with the installed configuration.

The cooling fan shall be temperature controlled, operating only when the motor has reached the manufacturer’s maximum allowable temperature.

### **TS 10.2 Charge Air Cooling**

Not Applicable

### **TS 10.3 Transmission Cooling**

The transmission shall be cooled in order to maintain operating fluids within the transmission manufacturer’s recommended parameters of flow, pressure and temperature. The cooling system shall be able to cool the transmission while operating continuously at highway speeds.

### **TS 10.4 Electric Drive System Cooling**

Thermal management system shall maintain electric drive system components within design operating temperature limits in all driving conditions.

## **TS 11. Transmission (if required)**

If multiple speed, the transmission shall be automatic shift with torque converter, retarder and electronic controls. Gross input power, gross input torque and rated input speed shall be compatible with the propulsion system. The transmission shall be designed to operate for not less than 300,000 miles on the design operating profile without replacement or major service. The transmission should be easily removable without disturbing the propulsion system and accessible for service.

The electronic controls 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. Electronic controls shall be compatible with either 12- or 24-volt power distribution, provide

consistent shift quality and compensate for changing conditions such as variations in vehicle weight and engine power.

A nominal brake pedal application of 6 to 10 psi shall be required by the driver to engage forward or reverse range from the neutral position to prevent sudden acceleration of the bus from a parked position.

The electronically controlled transmission shall have on-board diagnostic capabilities, be able to monitor functions, store and communicate faults and vital conditions to service personnel. The transmission shall contain built-in protection software to guard against severe damage. The on-board diagnostic system shall trigger a visual alarm to the driver when the electronic control unit detects a malfunction.

## **TS 12. Regenerative Braking**

### **TS 12.1 Regenerative Braking**

The powertrain shall be equipped with regenerative braking designed to improve energy efficiency and extend brake lining service life. The application of regenerative braking shall cause a smooth blending of both regenerative and service brake function.

Actuation of ABS and/or automatic traction control (ATC) shall override the operation of the regenerative brake.

The system shall be designed whereby increasing the pressure on the brake pedal increases the amount of regenerative capability up until a preset point is reached within the brake pedal travel whereby the mechanical brake is engaged. Regenerative braking shall continue to operate during mechanical braking.

The regenerative braking shall be adjustable within the limits of the powertrain and activated when the brake pedal is depressed or upon release of accelerator pedal.

### **TS 12.2 Braking Resistors**

The system shall include a means of maintaining dynamic braking (braking retardation) as the energy storage system approaches 100% SOC, i.e., such as the use of braking resistors to prevent overcharging of the batteries. This same feature may be a component of the overall liquid cooling system loop and offer a means of supplementing heat for use at the main HVAC heater core and/or defroster.

## **TS 13. Mounting**

All power plant mounting shall be mechanically isolated to minimize transfer of vibration to the body structure and provide a minimum clearance of 0.75 in. Mounts shall control the movement of the power plant so as not to affect performance of belt-driven accessories or cause strain in piping and wiring connections to the power plant.

### **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 air cleaner, air compressor, radiator, all accessories and any other component requiring service or replacement shall be easily removable.

Radiator filler caps shall be 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.

## **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.

### **TS 14.1 Fluid Lines**

All lines shall be rigidly supported to prevent chafing damage, fatigue failures, degradation and tension strain. Lines should be sufficiently flexible to minimize mechanical loads on the components. Lines passing through a panel, frame or bulkhead shall be protected by 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.

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. Hose clamps shall be as manufactured by Breeze.

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**

Not Applicable

## **TS 15. Radiator**

If equipped with a radiator system, radiator piping shall be stainless steel or brass tubing, and if practicable, hoses shall be eliminated. Necessary hoses shall be impervious to all bus fluids. All hoses shall be secured

with stainless steel clamps that provide a complete 360-degree seal. The clamps shall maintain a constant tension at all times, expanding and contracting with the hose in response to temperature changes and aging of the hose material.

## **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**

Not Applicable

### **TS 17.2 Design and Construction**

#### **TS 17.2.1 Design and Construction, Diesel**

Not Applicable

#### **TS 17.2.2 Design and Construction, CNG**

Not Applicable

## **TS 18. Emissions and Exhaust**

### **TS 18.1 Exhaust Emissions**

The vehicle shall not have any exhaust emissions.

### **TS 18.2 Exhaust System**

Not Applicable

### **TS 18.3 Exhaust Aftertreatment**

Not Applicable

### **TS 18.4 Particulate Aftertreatment**

Not Applicable

## **STRUCTURE**

### **TS 19. General Design**

The structure of the bus shall be designed to withstand the transit service conditions typical of an urban duty cycle throughout its service life. The vehicle structural frame shall be designed to operate with minimal maintenance throughout the 12-year design operating profile. The design operating profile specified by the Agency shall be considered for this purpose.

### **TS 20. Altoona Testing**

Prior to final assembly of the first article, the Contractor shall provide results of Altoona testing indicating the completion of any FTA-required testing. Any items that required repeated repairs or replacement must undergo the corrective action with supporting test and analysis. Remedy Letters clearly describing and explaining the failures and corrective actions taken to ensure that any and all such failures will not occur again shall be submitted to the Agency prior to acceptance of the first article.

If available, the Altoona Test Report shall be provided to the Agency with the Proposal submittal. If not available, Altoona testing must have started on the proposed bus prior to the submittal of proposal and the report shall be provided prior to final assembly of the first article.

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 the final assembly of the first article, the Contractor shall provide the Agency with a completed report 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 drivetrain. 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**

##### **Detailed Structural Analysis**

The structure of the proposed bus model shall have undergone structural testing prior to assembly of the first article. The Contractor shall provide the Agency with completed reports of other structural tests as requested by the Agency.

### **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 Motor Compartment Bulkheads**

The passenger and motor compartment shall be separated by fire-resistant bulkheads. The motor compartment shall include areas where the motor and transmission are housed. This bulkhead shall preclude or retard propagation of a motor 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 motor 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. Motor compartment 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.

## **TS 22.2 Crashworthiness**

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 and without the roof-mounted equipment installed and if roof mounted, shall include the structural integrity, mounting and safety of the energy storage device (s).

The bus shall withstand a 25 mph impact by a 4000-pound automobile at any side, excluding doorways, along either side of the bus with no more than 3 in. 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 in. from ground level shall withstand a static load of 2000 lbs applied perpendicular to the bus by a pad no larger than 5 sq in. This load shall not result in deformation that prevents installation of new exterior panels to restore the original appearance of the bus.

Test reports or detailed engineering reports validating the crashworthiness shall be provided prior to assembly of the first bus. If a Finite Element Analysis FEA is provided as proof of crashworthiness for the proposed vehicle, it must include a qualified engineering analysis and report for crashworthiness.

## **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 for a period of 12 years or 500,000 miles, whichever comes first. It shall maintain structural integrity and nearly maintain original appearance throughout its service life, with the Agency's use of proper cleaning and neutralizing agents.

All materials that are not inherently corrosion resistant shall be protected with corrosion-resistant coatings. All joints and connections of dissimilar metals shall be corrosion resistant and shall be protected from galvanic corrosion. 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 1 percent.



### **Additional Corrosion Resistance Requirements**

The vehicle shall be constructed using only inherently corrosion-resistant materials and fasteners such as stainless steel or composites to minimize deterioration. The structure shall not require corrosion-preventive coatings or after-treatments, either during construction or throughout the service life of the vehicle.

## **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. Removal of the bike rack is permitted for attachment of towing devices.

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 vehicle. The connector shall include a spring-loaded dust- and water-resistant cap. Shop air connectors 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 location of these shop air connectors shall facilitate towing operations.

### **Lifted (Supported) Front Axle and Flat Towing Capability**

The front towing devices shall allow attachment of adapters for a rigid tow bar and shall permit the lifting of the bus until the front wheels are clear off the ground in order to position the bus on the towing equipment by the front wheels. These devices shall also permit common flat towing.

### **ALTERNATIVE**

### **Lifted (Unsupported) Front Axle and Flat Towing Capability**

The front towing devices shall allow attachment of adapters for a rigid tow bar and shall permit the lifting and towing of the bus, at curb weight, while the front wheels are clear off the ground. These devices shall also permit common flat towing.

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 Agency. 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 in. throat.

## **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 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.

### **Yellow Pads**

Jacking pads shall be painted safety yellow.

## **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 vehicle 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 covering shall be Altro Transflor customized layout as follows:

|                                |   |                                      |
|--------------------------------|---|--------------------------------------|
| Aisle                          | = | TFM 2774 (Red)                       |
| Under Passenger Seats          | = | TFM 2706 (Blue)                      |
| Wheelchair Ramp                | = | TFM 27892 (Black) w/ LBT custom logo |
| Wheelchair Securement Stations | = | TFM 2706 (Blue) w/ ADA logos         |
| Drivers Platform               | = | TFM 27892 (Black)                    |
| Nosing and Standee Line        | = | Yellow                               |

The above is LBT's customized layout for the sole purpose of the proposal. The actual layout and color detail will be subject to the Agency's review and final approval.

### **Bi-level Floor Design**

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 21 in. 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 in. 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 in. 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.

#### **PREFERRED**

As composite flooring is designed to lower the weight and improve the durability of the bus, this would be preferred

#### **PREFERRED**

Flooring with manufactured noise-reduction characteristics is preferred.

## **TS 28. Platforms**

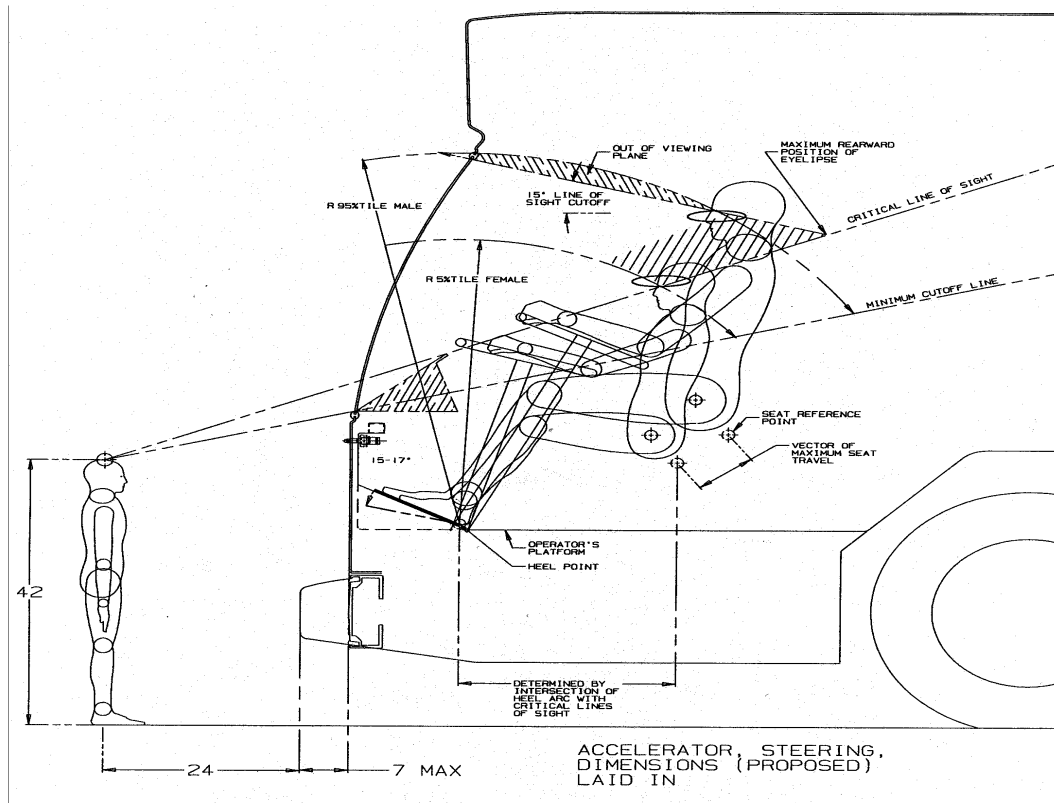
### **TS 28.1 Driver's Area**

The covering of platform surfaces and risers, except where otherwise indicated, shall be the same material as specified for floor covering. Trim shall be provided along top edges of platforms unless integral nosing is provided.

### **TS 28.2 Driver's Platform**

The driver's platform shall be of a height such that, in a seated position, the driver can see an object located at an elevation of 42 in. above the road surface, 24 in. from the leading edge of the bumper. Notwithstanding this requirement, the platform height shall not position the driver such that the driver's vertical upward view is less than 15 degrees. A warning decal or sign shall be provided to alert the driver 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 should minimize impact to passenger access and minimize interference with the driver's line of sight. The Agency shall supply and install the actual farebox, GFI Odyssey post-delivery. The Contractor shall pre-wire and drill the base holes.

### Driver Interface Required; Platform Needed to Bring Height to Driver Access

If the driver's platform is higher than 12 in., then the farebox is to be mounted on a platform of suitable height to provide accessibility for the driver without compromising passengers' access.

### TS 28.4 Rear Step Area to Rear Area

If the vehicle is of a bi-level floor design, a 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 in. 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 decal or 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 or electronic equipment storage compartment on the interior top surface, or its use as a luggage rack.

The finish of the 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 lower portion extending to approximately 10 to 12 in. 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 in. 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 in. higher than the wheel well housing.

### **TS 29.2 Articulated Joint**

Not Applicable

### **TS 29.3 Raceway**

Not Applicable

### **TS 29.4 Bellows**

Not Applicable

## **CHASSIS**

### **TS 30. Suspension**

#### **TS 30.1 General Requirements**

The front, rear and mid (if articulated) 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 2.75 in. jounce-upward travel of a wheel when the bus hits a bump (higher than street surface), and 2.75 in. 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. Suspensions shall incorporate appropriate 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 in. at any point from the height required. The safe operation of a bus cannot 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 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 will last the life of the shock absorber. The damper shall incorporate a secondary hydraulic rebound stop.

##### **TS 30.3.3 Lubrication**

###### **Standard Grease Fittings**

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 6000 miles.

##### **TS 30.3.4 Kneeling**

A kneeling system shall lower the front and rear of the bus as low as physically possible and a minimum of 2.5 in. during loading or unloading operations regardless of load up to GVWR, measured at the longitudinal centerline of the entrance door(s) by the driver. The kneeling control shall provide the following functions:

- Downward control must be held to allow downward kneeling movement.
- Release of the control during downward movement must completely stop the lowering motion and hold the height of the bus at that position.
- Upward control actuation must allow the bus to return to normal floor height without the driver 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 1.25 in. 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 driver shall be illuminated until the bus is raised to a height adequate for safe street travel. An audible warning alarm will 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 in. diameter amber lens, shall be provided that will 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**

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.

All wheels shall be two-sided polished aluminum rims from Alcoa.

### **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 Supplier's rating.

The tires shall be provided under a lease agreement between the Agency and the tire Supplier. LBT's current supplier, as of the date of this RFP, is Michelin.

## **TS 32. Steering**

### **PREFERRED**

Power steering hydraulic pump shall be electrically driven.

### **ALTERNATIVE**

Electrically assisted steering shall be provided to reduce steering effort.

## **TS 32.1 Steering Axle**

### **Solid Beam Axle and Grease-Type Front Bearings and Seals**

The front axle shall be solid beam, non-driving with a load rating sufficient for the bus loaded to GVWR and shall be equipped with grease type front wheel bearings and seals.

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 Wheel**

### **TS 32.2.1 Turning Effort**

Steering effort shall be measured with the bus at GVWR, stopped with the brakes released and 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 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 driver.

### **TS 32.2.2 Steering Wheel, General**

The steering wheel diameter shall be 18in.; the rim diameter shall be  $\frac{7}{8}$  in. to  $1\frac{1}{4}$  in. and shaped for firm grip with comfort for long periods of time.

Steering wheel spokes and wheel thickness shall ensure visibility of the dashboard so that vital instrumentation is clearly visible at center neutral position (within the range of a 95th-percentile male, as described in SAE 1050a, Sections 4.2.2 and 4.2.3). Placement of steering column must be as far forward as possible, but either in line with or behind the instrument cluster.

### **TS 32.2.3 Steering Column Tilt**

The steering column shall have full tilt capability with an adjustment range of no less than 40 degrees from the vertical and easily adjustable by the driver.

### **TS 32.2.4 Steering Wheel Telescopic Adjustment**

The steering wheel shall have full telescoping capability and have a minimum telescopic range of 2 in. and a minimum low-end adjustment of 29 in., measured from the top of the steering wheel rim in the horizontal position to the cab floor at the heel point.



**TABLE 3**  
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 driver.

### **TS 33. Drive Axle**

The bus shall be driven by a heavy-duty axle with a load rating sufficient for the bus loaded to GVWR. The drive axle shall have a design life to operate for not less than 500,000 miles on the design operating profile without replacement or major repairs. The lubricant drain plug shall be magnetic type. If a planetary gear design is employed, the oil level in the planetary gears shall be easily checked through the plug or sight gauge. The axle and driveshaft components shall be rated for both propulsion and retardation modes with respect to duty cycle. Drive axle oil shall be synthetic, extended service life.

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.

#### **TS 33.1 Non-Drive Axle**

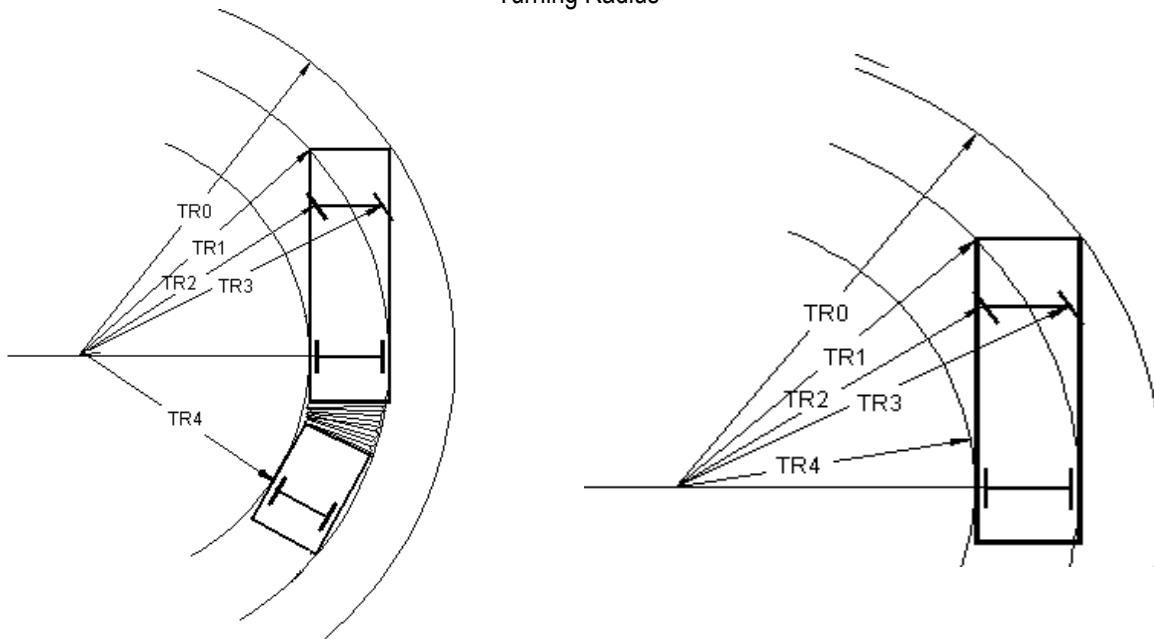
Not Applicable

## TS 34. Turning Radius

**TABLE 4**  
Maximum Turning Radius

| Bus Length<br>(approximate) | Maximum Turning Radius<br>(see Figure 4) |
|-----------------------------|--|
| 40 ft                       | 44 ft (TR0)                              |

**FIGURE 4**  
Turning Radius



## TS 35. Brakes

### TS 35.1 Service Brake

Brakes shall be self-adjusting. Brake wear indicators (visible brake sensors) shall be provided on exposed push rods.

#### ALTERNATIVE

Visible stroke indicators may be combined with electronic brake monitoring system and vehicle brake warning system to notify driver and maintenance of unsafe brake conditions.

### TS 35.2 Actuation

#### 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 in. above the heel point of the pedal to achieve maximum braking. The heel point is the location of the driver'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 (Electronic Control Unit) for the ABS (Antilock Brake System) system shall be protected, yet in an accessible location to allow for ease of service.

The total braking effort shall be distributed between all wheels in such a ratio as to ensure equal friction material wear rate at all wheel locations. Manufacturer shall demonstrate compliance by providing a copy of a thermo dynamic brake balance test upon request.

#### **Automatic Traction Control**

Microprocessor controlled automatic traction control (ATC) shall be provided.

### **TS 35.3 Friction Material**

The brake linings 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.

### **TS 35.4 Hubs and Drums**

Replaceable wheel bearing seals shall run on replaceable wear surfaces or be of an integral wear surface sealed design. Wheel bearing and hub seals and unitized hub assemblies shall not leak or weep lubricant when operating on the design operating profile for the duration of the initial manufacturer's warranty.

#### **Disc Brakes on All Axles**

The bus shall be equipped with disc brakes on all axles, and the brake discs shall allow machining of each side of the disc to obtain smooth surfaces per manufacturer's specifications.

The brake system material and design shall be selected to absorb and dissipate heat quickly so that the heat generated during braking operation does not glaze brake linings.

### **TS 35.5 Parking/Emergency Brake**

#### **Air Brakes**

The parking brake shall be a spring-operated system, actuated by a valve that exhausts compressed air to apply the brakes. The parking brake may be manually enabled when the air pressure is at the operating level per FMVSS 121.

#### **Emergency Brake**

An emergency brake release shall be provided to release the brakes in the event of automatic emergency brake application. The driver 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 driver releases the emergency brake release valve, the brakes shall engage to hold the bus in place.

### **TS 36. Interlocks**

#### **TS 36.1 Passenger Door Interlocks**

To prevent opening mid and rear passenger doors while the bus is in motion, a speed sensor shall be integrated with the door controls to prevent the mid/rear 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 lock the accelerator in the closed position, and a brake interlock shall engage the service brake system to stop movement of the bus when the driver's door control is moved to a rear door enable or open position, or rear door panel is opened more than 3 in. 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, until the interlocks are released. These interlock functions shall be active whenever the vehicle Master Run Switch is in any run position.

All door systems employing brake and accelerator interlocks shall be supplied with supporting failure mode effects analysis (FEMA) 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 and unsecured condition, unless the door master switch has been actuated to intentionally release the interlocks.

## **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 15-minute period of time as indicated on the dash gauge.

Provision shall be made to apply shop air to the bus air systems. 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. Air for the compressor shall be filtered. The air system shall be protected per FMVSS 121.

### **TS 37.2 Air Compressor**

The electrically driven air compressor shall be sized to charge the air system from 40 psi to the governor cut-off pressure in less than 4 minutes.

### **TS 37.3 Air Lines and Fittings**

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.

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 in. intervals or less.

The compressor discharge line between power plant and body-mounted equipment shall be flexible convoluted copper or stainless steel line, or may be flexible Teflon 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 (Society of Automotive Engineers) or JIC (Joint Industry Council) 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-ft intervals or less.

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 37.4 Air Reservoirs**

All air reservoirs shall meet the requirements of FMVSS Standard 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 37.5 Air System Dryer**

An air dryer shall prevent accumulation of moisture and oil in the air system. The air dryer system shall include one or more replaceable desiccant cartridges.

#### **Requirement for Additional Oil Separator Provision**

A provision shall be included to collect/remove oil from the air system to prevent affecting function and/or damaging pneumatic system components.

The air system shall be equipped with an air dryer located before the no. 1 air tank and as far from the compressor as possible to allow air to cool prior to entering the air dryer.

## **ELECTRICAL, ELECTRONIC AND DATA COMMUNICATION SYSTEMS**

### **TS 38. Overview**

The electrical system will consist of vehicle battery systems and components that generate, distribute and store power throughout the vehicle. (e.g., generator, voltage regulator, wiring, relays, and connectors).

Electronic devices are individual systems and components that process and store data, integrate electronic information or perform other specific functions.

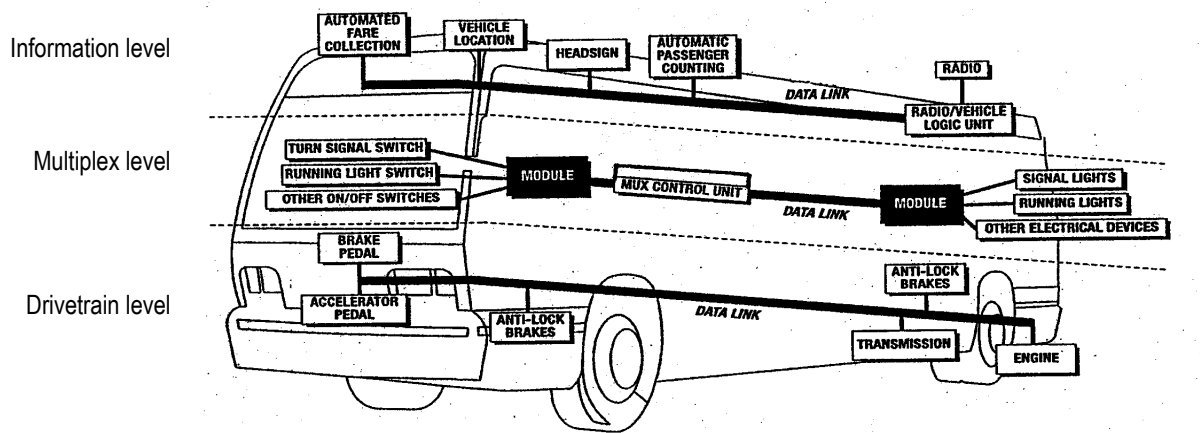
The data communication system consists of the bi-directional communications networks that electronic devices use to share data with other electronic devices and systems. Communication networks are essential to integrating electronic functions, both onboard the vehicle and off.

Information level systems that require vehicle 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:

- **Propulsion System level:** Components related to the drivetrain including the propulsion system components, (electric energy storage, motors, inverters/converters), and anti-lock braking system (ABS), to include traction control. (ATC).
- **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 vehicle 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.

Propulsion system wiring shall be an independent wiring harness. Replacement of the propulsion system 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 vehicle 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 Agency shall follow recommendations from the Contractor 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 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.

All electrical/electronic hardware mounted on the exterior of the vehicle that is not designed to be installed in an exposed environment shall be mounted in a sealed enclosure.

All electrical/electronic hardware and its mounting shall comply with the shock and vibration requirements of SAE J1455.

## **TS 40. General Electrical Requirements**

### **TS 40.1 Batteries**

#### **TS 40.1.1 Low-Voltage Batteries (24V)**

##### **Four Group 31 Maintenance-Free Batteries**

Four Group 31 Series deep cycling maintenance-free battery units shall be provided. Each battery shall have a minimum of 700 cold cranking amps. Each battery shall have a purchase date no more than one year from the date of release for shipment to the Agency.

#### **TS 40.1.2 Low Voltage 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. 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 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.

#### **PREFERRED**

Color code each voltage.

#### **TS 40.1.3 Jump Start**

Not Applicable

#### **TS 40.1.4 Low Voltage 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. It shall be accessible only from the outside of the vehicle. 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.

The vehicle shall be equipped with a 12VDC and 24VDC quick disconnect switch(es). The battery compartment door shall conveniently accommodate operation of the 12VDC and 24VDC quick disconnect switch(es).

The battery quick disconnect access door shall be identified with a decal. The decal size shall not be less than  $3.5 \times 5$  in. ( $8.89 \times 12.7$  cm).



The battery hold-down bracket shall be constructed of a non-metallic material (plastic or fiberglass).

This access door shall not require any special locking devices 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 or equal to retain the door in a closed position when not in use.

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.

If not located in the engine compartment, the same fire-resistant properties and fire suppression system must apply to the battery compartment. No sparking devices should be located within the battery box.

#### **TS 40.1.5 Auxiliary Electronic Power Supply**

If required, gel-pack, or any form of sealed (non-venting) batteries used for auxiliary power are allowed to be mounted on the interior of the vehicle if they are contained in an enclosed, non-airtight compartment and accessible only to maintenance personnel. This compartment shall contain a warning label prohibiting the use of lead-acid batteries.

#### **TS 40.1.6 Master Battery Switch**

A single master switch shall be provided near the battery compartment for the disconnecting of all battery positives (12V and 24V), except for safety devices such as the fire suppression system and other systems as specified. 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.

Turning the master switch off with the power plant operating shall shut off the propulsion system and disconnect the high voltage energy storage device. The master switch shall be capable of carrying and interrupting the total circuit load.

##### **Single Switch**

The batteries shall be equipped with a single switch for disconnecting both 12V and 24V power.

#### **ALTERNATIVE**

##### **Solenoid Battery Cutoff**

A multiplex system activated battery cutoff solenoid to disconnect battery except critical items.

#### **TS 40.1.7 Low-Voltage Generation and Distribution**

The low-voltage generating system shall maintain the charge on fully charged batteries.

Voltage monitoring and over-voltage output protection (recommended at 32V) shall be provided.

Dedicated power and ground shall be provided as specified by the component or system manufacturer. Cabling to the equipment must be sized to supply the current requirements with no greater than a 5 percent volt drop across the length of the cable.

#### **TS 40.1.8 Circuit Protection**

All branch circuits, except battery-to-starting motor and battery-to-generator/alternator circuits, shall be protected by current-limiting devices such as circuit breakers, fuses or solid state devices sized to the requirements of the circuit. Electronic circuit protection for the cranking motor shall be provided to prevent engaging of the motor for more than 30 seconds at a time to prevent overheating. 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. This requirement applies to in-line fuses supplied by either the Contractor or a Supplier. 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 Agency mechanic with visible indication of open circuits. The Agency 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. Any manually resettable circuit breakers shall provide a visible indication of open circuits. Any 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.

Multiplex system shall be capable of monitoring loads via distribution branch circuits and at components to provide detection of “shorts”, “opens” and or loads exhibiting abnormal current behavior that would be indicative of a fault.

#### **TS 40.2 Low Voltage Grounds**

The low voltage (12/24 vdc) battery shall be grounded to the vehicle chassis/frame at one location only, 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/spade 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.

The high voltage propulsion system shall be isolated from the low voltage system at all levels, AC and or DC, to include “ground”.

#### **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.

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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.

To the extent practicable, wiring shall not be located in environmentally exposed locations under the vehicle. Wiring and electrical equipment necessarily located under the vehicle shall be insulated from water, heat, corrosion and mechanical damage. Where feasible, front to rear electrical harnesses should be installed above the window line of the vehicle.

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 vehicle 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:

- It shall include a mechanical clamp in addition to solder on the splice.
- The wire shall support no mechanical load in the area of the splice.
- 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 motor 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 driver'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 vehicles 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 compartment shall be completely serviceable from the driver's seat, vestibule or from the outside. "Rear start and run" controls shall be mounted in an accessible location in the engine compartment and shall be protected from the environment.

## **TS 40.6 High-Voltage Electrical System**

There shall be no exposed conductors, terminals, contacts or other energized parts with a high-voltage potential to any other exposed conductive material or person on the bus in normal operating charging configurations.

Non-conductive covers must prevent inadvertent human contact including service personnel working on or inside the vehicle. All HV (High Voltage) enclosures must be finger-proof (impossible to touch an HV terminal with a finger), tool-proof (impossible to touch an HV terminal with a tool (screwdriver, wrench, etc), and drop-proof (small (e.g. #10) nut dropped on the enclosure cannot cause a short circuit, ground fault, or other hazardous condition). HV systems and containers must be protected from moisture.

The use of a key to unlock or removal of at least one threaded fastener to open covers or panels shall be required in order to gain access to high-voltage components. The access panels or covers limiting access to high-voltage components shall be clearly labeled as such.

No single point failure of hardware, or of software, or of trained personnel to follow documented procedure shall result in an unreasonably safety risk to any person.

### **TS 40.6.1 High Voltage Disconnect System**

The high-voltage system shall be fitted with automatic disconnecting contactors located as closely as possible to the positive and negative battery output terminals so as to minimize the external circuitry that is not de-energized when the devices open. These contractors shall be in addition to any such devices incorporated in the motor controller, and shall not require electrical power to operate (that is, they shall be normally open when unpowered). The contactors shall be rated as capable of interrupting the maximum normally encountered charging or operating current at the highest voltage likely to be encountered (maximum charger-output voltage, or charger-input

voltage, whichever is greater). Contactors shall be controlled by the “High Voltage Disconnect” switch, and any safety-critical interlocks and interlock loops, motor-controller overcurrent-protection functions, and vehicle crash and/or fire sensors. Reset of the contactors shall require the deliberate action of the operator or maintenance personnel. Contactors should provide a visual or electrical indication of their status (open or closed) or of a failure to function.

Lids to high voltage enclosures must be interlocked, such that opening an enclosure automatically disconnects the high voltage system. Any high voltage cable of 5 amps or greater must also have an interlock such that disconnecting any cable of this type will disconnect the high voltage system.

This feature could be part of the emergency shutdown system, providing an organized / fail safe method for shutting the high voltage system down by manual activation of an emergency switch (red palm button), sensed isolation fault between high voltage and chassis, opening an interlocked panel, or disconnecting high voltage cables of 5 amps or greater.

#### **TS 40.6.2 High Voltage Wiring**

High-voltage wiring shall conform in all respects to SAE recommended practices J1654 (High-voltage Primary Cable), J1673 (High-Voltage Automotive Wiring), and J1742 (High Voltage On-Board Connectors). The outer layer of insulation on high-voltage wiring shall be bright orange or yellow in color.

High-voltage wiring shall be protected from road hazards and collision damage by major structural members. Wiring shall be continuous cables with connections secured using suitable vibration resistant fasteners such as nylocks or lock washers on bolted terminals. Terminals shall be rated for the expected current, corrosion-resistant, and crimped or secured with setscrews. Wiring length shall allow replacement of end terminals without pulling, stretching, or replacing the wire. Double insulation shall be maintained as close to the terminals as practicable. Terminal shanks and cable ends shall be protected by shrink tubing or vulcanized covers. Shrink tubing or vulcanized covers shall be the color coded to indicate polarity; black to indicate terminals normally negative, red for terminals normally positive. Red or black shall not be used for protective covers of terminals on wiring normally carrying high-voltage alternating currents. All high-voltage wiring shall be durably labeled and numbered to be identical from one bus to the next.

All HV wiring that runs through areas where rotating or moving components might cause abrasion must be enclosed in orange or yellow non-conductive conduit. The conduit must be securely anchored at least at each end, and must be located out of the way of possible snagging or damage. Wiring inside of battery enclosures is not required to be covered, but must be adequately secured and protected from abrasion and mechanical stress.

All external heat sinks or metal housings for HV components (i.e. motors, inverters, etc...) must be securely grounded. Within an enclosure, exposed (un-insulated) HV terminals and conductors of opposing polarities must be spaced with an adequate air gap to prevent arcing due to dielectric breakdown. It is strongly recommended that the spacing is significantly larger than this to reduce the risk of accidental short circuit during service.

High-voltage wiring shall not be bundled with low-voltage wiring (except appropriately fused and distinctively marked high-voltage instrumentation-signal wires may be routed with other instrumentation-signal wires if the conduit or bundle is also distinctively marked as carrying high voltage). Grommets of elastomeric material shall be provided at points where wiring penetrates metal or rigid structures. Wiring supports shall be non-conductive. Precautions shall be taken to avoid damage from heat, water, solvents, commonly encountered automotive fluids, and chafing. Wire shall support no mechanical loads in the area of terminals and the wires shall be supported to prevent flexing. All wiring shall be numbered to be identical from one bus to the next.

#### **TS 40.6.3 High Voltage Overcurrent Protection**

All wiring and connected devices and equipment shall be protected against overcurrent by fuses or circuit breakers. Fuses and circuit breakers shall be rated to protect against prolonged overloads and short circuit conditions. The time-current characteristics of overcurrent protective devices and functions shall minimize hazard to personnel and equipment in the event of failure of any single protective device or function.

#### **TS 40.6.4 High Voltage Grounding**

The bus chassis and all conductive structural elements of the vehicle shall be electrically interconnected by means of low-resistance mechanical connections, ground straps, wires, or welded connections. Buses with a nonconductive chassis shall be provided with a low-impedance grounding system suitably sized for the level and duration of possible fault currents. Ground paths shall not exhibit an electrical potential in excess of 0.1-volt relative to each other while the bus is off or in normal operating or charging configurations. The high-voltage electrical system shall not, in any normally encountered operational or charging configuration, make use of the vehicle chassis or of the low voltage grounding system as a current path. The high-voltage electrical system shall not, in any normally encountered operation or charging configuration, induce any detectable electrical current in the vehicle chassis, in the low-voltage grounding system, or in the low-voltage electrical systems except as a design feature of instrumentation circuits.

HV and low-voltage (chassis-grounded) circuits must be physically segregated. If both HV and grounded circuits are present within an enclosure, they must be separated by insulating barriers or other moisture resistant, UL recognized insulating materials, or well separated so that there is no risk of arcing due to dielectric breakdown or contact due to slight shifting of components during use.

If hazardous voltages are contained within a conductive exterior case or enclosed that may be exposed to human contact as installed in the vehicle, such case or enclosure shall be provided with a conductive connection to the vehicle chassis or grounding system.

Energy storage components (including batteries) and major power electronics components shall have their conductive external cases connected to the vehicle chassis or grounding system by a ground strap, wire, welded connection or other suitable low resistance mechanical connection. This grounding connection shall provide a low impedance path, sized appropriately for the level and duration of possible fault currents. Ground paths shall not be carried through hinges, bolted joints (except those specifically designed as electrical connectors), body or power plant mountings.

Other components that receive hazardous voltages from sources outside their enclosures may have their cases grounded either directly (as above) or indirectly through the wiring harness that carries the voltage(s) from the external source. Disconnecting the wiring harness used to provide indirect case grounding shall also disconnect the source of hazardous voltages.

Loss of isolation of the high-voltage electrical system from the chassis grounding system shall cause a dashboard-warming lamp to illuminate and automatic disconnect of the high-voltage system.

#### **TS 40.6.5 DC-DC Converters and DC-AC Inverters**

The buses shall be fitted with a device or controller function to maintain the low-voltage batteries at a full state-of-charge using energy drawn from the traction battery.

The high-voltage inputs to individual DC-to-AC and DC-to-DC conversion devices shall be protected by circuit breakers or fuses. The output circuits of DC-to-AC and DC-to-DC conversion devices shall also be protected by appropriately rated circuit breakers or fuses.

Verify that the charger/charge function works throughout the acceptance testing. Verify that the fuses or circuit breakers are appropriately sized by consulting the conversion devices maker's literature in the contractors engineering files.

### **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.

**NOTE:** A shield grounded at both ends forms a ground loop, which can cause intermittent control or faults.

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 24V-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 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. The corresponding component vendors shall be consulted for proper application of equipment, including installation of cables.

### **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 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 inputs and 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, 12V, 24V), at each module location shall be designated as spares.

## **TS 42.2 System Configuration**

Multiplexing may either 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. The preferred supplier shall be Dinex I/O Controls or Vansco.

### **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 (0-12V, 10-24V, 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 Agency with the following minimum information:

- 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).
- Data definition requirements that ensure access to diagnostic information and performance characteristics.
- The capability and procedures for uploading new application or configuration data.
- Access to revision levels of data, application software and firmware.
- The capability and procedures for uploading new firmware or application software.
- 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 vehicle components used on a network shall be conformance tested to the corresponding network standard.

### **TS 43.2 Propulsion System Level**

Propulsion system components, consisting of the electric motors, energy storage, power electronics, ABS and ATC and all other related components, shall be integrated and communicate fully with respect to

vehicle 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**

Propulsion system performance, maintenance and diagnostic data, and other electronic messages shall be formatted and transmitted on the communications networks.

The propulsion system 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 propulsion system level components shall be programmable by the Agency 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 Agency. The communication port(s) shall be located as specified by the Agency.

#### **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.

#### **Provide Mock-Up Board**

A mock-up board, where key components of the multiplexing system are replicated on a functional model, shall be provided as a tool for diagnostic, design verification and training purposes. If required, the mock-up board should be priced separately in the Pricing Schedule, under the tools section.

#### **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:

- password protection
- limited distribution of the configuration software
- limited access to the programming tools required to change the software
- hardware protection that prevents undesired changes to the software

Provisions for programming the multiplex system shall be possible through a PC and 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:

- hardware component identification where labels are included on all multiplex hardware to identify components
- hardware series identification where all multiplex hardware displays the current hardware serial number and firmware revision employed by the module
- software revision identification where all copies of the software in service displays the most recent revision number
- 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.

## **DRIVER PROVISIONS, CONTROLS AND INSTRUMENTATION**

### **TS 44. Driver's Area Controls**

#### **TS 44.1 General**

In general when designing the driver's area, it is recommended 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 driver'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 driver's area shall be avoided.

#### **TS 44.3 Visors/Sun Shades**

##### **Driver's Window Sunscreens**

An adjustable roller type sunscreen shall be provided over the driver's windshield and the driver's side window. The sunscreen shall be capable of being lowered to the midpoint of the driver's window. When deployed, the screen shall be secure, stable and shall not rattle, sway or intrude into the driver'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 driver. Sunscreen shall be shaped to minimize light leakage between the visor and windshield pillars to the extent possible.

#### **TS 44.4 Driver's Controls**

Frequently used controls must 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 or 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 in Area 1 or Area 5, 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 5 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 (Light Emitting Diode).

**TABLE 5**  
Transit Bus Instruments and Alarms

| <b>Device</b>        | <b>Description</b>                 | <b>Location</b>                | <b>Function</b>  | <b>Visual/<br/>Audible</b> |
|----------------------|------------------------------------|--------------------------------|--|----------------------------|
| Master run switch    | Rotary, four-position detent       | Side console                   | Master control for bus, off, day run, night run and clearance ID lights                                      |                            |
| Drive selector       | Touch panel switch                 | Side console                   | Provides selection of propulsion: forward, reverse and neutral   |                            |
| HVAC                 | Switch or switches to control HVAC | Side console                   | Permits selection of passenger ventilation: off, cool, heat, low fan, high fan or full auto with on/off only |                            |
| Driver's ventilation | Rotary, three-position detent      | Side console or Dash left wing | Permits supplemental ventilation: fan off, low or high   |                            |

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| Device                             | Description  | Location                                      | Function   | Visual/<br>Audible   |
|------------------------------------|--|---|--|--|
| Defroster fan                      | Rotary, three-position detent                      | Side console<br>or Dash left<br>wing          | Permits defroster:<br>fan off, low,<br>medium or high  |  |
| Defroster<br>temperature           | Variable position                                  | Side console<br>or Dash left<br>wing          | Adjusts defroster<br>water flow and<br>temperature   |  |
| Windshield<br>wiper                | One-variable rotary position operating both wipers | Dash left wing                                | Variable speed<br>control of left and<br>right windshield<br>wipers  |  |
| Windshield<br>washer               | Push button  | Dash left wing                                | Activates<br>windshield<br>washers   |  |
| Dash panel<br>lights               | Rotary rheostat or stepping switch                 | Side Console<br>or Dash left<br>wing          | Provides<br>adjustment for light<br>intensity in night<br>run position   |  |
| Interior lights                    | Three-position switch                              | Side console                                  | Selects mode of<br>passenger<br>compartment<br>lighting: off, on,<br>normal  |  |
| WC ramp/<br>kneel enable           | Two-position switch <sup>1</sup>                   | Side console<br>or Dash right<br>wing         | Permits operation<br>of ramp and kneel<br>operations at each<br>door remote panel  | Amber light  |
| Front door<br>ramp/kneel<br>enable | Two-position keyed switch <sup>1</sup>             | Front door<br>remote or<br>Dash right<br>wing | Permits ramp and<br>kneel activation<br>from front door<br>area, key required <sup>1</sup>   | Amber light  |
| Front door<br>ramp                 | Three-position momentary switch                    | Right side of<br>steering<br>wheel            | Permits deploy and<br>stow of front ramp   | Red light  |
| Front kneel                        | Three-position momentary switch                    | Front door<br>remote                          | Permits kneeling<br>activation and raise<br>and normal at front<br>door remote<br>location   | Amber or red<br>dash<br>indicator. Ext<br>alarm and<br>Amber light |
| Silent alarm                       | Recessed push button, NO and NC contacts momentary | Side console                                  | Activates<br>emergency radio<br>alarm at dispatch<br>and permits covert<br>microphone and/or<br>enables destination<br>sign emergency<br>message |  |

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| Device                              | Description  | Location                        | Function   | Visual/<br>Audible                               |
|-------------------------------------|--|---------------------------------|--|--|
| 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 remote mirror                  | Four-position toggle type                            | Side console                    | Permits two-axis adjustment of left exterior mirror                                  |  |
| Right remote mirror                 | Four-position toggle type                            | Side console                    | Permits two-axis adjustment of right exterior mirror                                 |  |
| Mirror heater                       | Switch or temperature activated                      | Side console                    | Permits heating of outside mirrors when required                                     |  |
| 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 override                  | Two-position switch in approved location             | Side console, forward           | Allows driver to override activation of rear door passenger tape switches            |  |
| Propulsion system shutdown override | Momentary switch with operation protection           | Side console                    | Permits driver to override auto propulsion shutdown for other than safety situations |  |
| Hazard flashers                     | Two-position switch                                  | Side console or Dash right wing | Activates emergency flashers   | Two green lights                                 |
| Fire suppression                    | Red push button with protective cover                | Dash left wing or dash center   | Permits driver to override and manually discharge fire suppression system            | Red light  |
| Mobile data terminal                | Mobile data terminal bus operator interface panel    | Above right dash wing           | Facilitates driver interaction with communication system and master log-on           | LCD display with visual status and text messages |
| Farebox interface                   | Farebox bus operator interface panel                 | Near                            | Facilitates driver interaction with farebox system                                   | LCD display                                      |

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| Device                         | Description   | Location   | Function  | Visual/<br>Audible                              |
|--------------------------------|---|--|---|---|
| Destination sign interface     | Destination sign interface panel                                | in approved location                             | Facilitates driver 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 |
| PA manual                      | Momentary push button   | In approved location                             | Permits driver to manually activate public address microphone             |   |
| High beam                      | Detented push button  | In approved location                             | Permits driver to toggle between low and high beam                        | Blue light                                      |
| Parking brake                  | Pneumatic PPV   | Side console or Dash left wing                   | Permits driver to apply and release parking brake                         | Red light                                       |
| Park brake release             | Pneumatic PPV   | Vertical side of the side console or dash center | Permits driver to push and hold to release brakes                         |   |
| Hill holder                    | Two-position momentary switch                                   | Side console                                     | Applies brakes to prevent bus from rolling                                |   |
| Master door/interlock          | Multi-pole toggle, detented                                     | Out of operator's reach                          | Permits driver override to disable door and brake/throttle interlock      | Red light                                       |
| Warning interlocks deactivated | Red indicator light   | Dash panel center                                | Illuminates to warn driver that interlocks have been deactivated.         | Red light                                       |
| Retarder disable               | Multi-pole switch detented                                      | Within reach of Operator or approved location    | Permits driver override to disable brake retardation/regeneration         | Red light                                       |
| Alarm acknowledge              | Push button momentary   | Approved location                                | Permits driver to acknowledge alarm condition                             |   |



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| Device                             | Description   | Location  | Function   | Visual/<br>Audible              |
|------------------------------------|---|---|--|---------------------------------|
| Rear door passenger sensor disable | Multi-pole toggle, detented   | In sign compartment or Driver's barrier compartment | Permits driver to override rear door passenger sensing system  |                                 |
| Indicator/ alarm test button       | Momentary switch or programming   | Dash center panel                                   | Permits driver to activate test of sentry, indicators and audible alarms                               | All visuals and audibles        |
| Auxiliary power                    | 110-volt power receptacle   | Approved location                                   | Property to specify what function to supply  |                                 |
| Speedometer                        | Speedometer, odometer, and diagnostic capability, 5-mile increments, to include programmable Trip A / B functionality | Dash center panel                                   | Visual indication of speed and distance traveled, accumulated vehicle mileage, fault condition display | Visual                          |
| Air pressure gauge                 | Primary ,and secondary, 5 psi increments  | Dash center panel                                   | Visual indication of primary and secondary air systems   | Red light and buzzer            |
| Fire detection                     | Bus operator display  | Property specific or dash center                    | Indication of fire detection activation by zone/location   | Buzzer and red light            |
| Door obstruction                   | Sensing of door obstruction   | Dash center   | Indication of rear door sensitive edge activation  | Red light and buzzer            |
| Door ajar                          | Door not properly closed  | Property specific or dash center                    | Indication of rear door not properly closed  | Buzzer or alarm and red light   |
| Low system air pressure            | Sensing low primary and secondary air tank pressure   | Dash center   | Indication of low air system pressure  | Buzzer and red light            |
| Combustible Gas detection function | Detection of system integrity   | Property specific or dash center                    | Detects system failure   | No start condition, amber light |
| Combustible Gas detection          | Indication of 20% LFL   | Property specific or dash center                    | Detects levels of combustible gas  | Flashing red at 20% LFL         |
| Combustible Gas detection          | Indication of 50% LFL   | Property specific or dash center                    | Detects levels of combustible gas  | Solid red at 50% LFL            |
| coolant indicator                  | Low coolant indicator may be supplied as audible alert and visual and/or text message                                 | Within driver's sight                               | Detects low coolant condition  | Amber light                     |

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| Device                                    | Description   | Location              | Function  | Visual/<br>Audible                             |
|---|---|-----------------------|---|--|
| High Coolant temperature indicator        | Coolant temperature indicator may be supplied as audible alert and visual and/or text message | Within driver's sight | Detects high coolant temperature condition and initiates time delay shutdown  | Red light                                      |
| ABS indicator                             | Detects system status   | Dash center           | Displays system failure   | Amber light                                    |
| HVAC indicator                            | Detects system status   | Dash center           | Displays system failure   | Amber or red light                             |
| Charging system indicator (12/24 V)       | Detect charging system status   | Dash center           | 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           | Indication of bike rack not being in fully stowed position  | Amber or red light                             |
| Range                                     | Digital gauge   | Dash center           | Indicates mileage range based remaining usable charge   |  |
| SOC                                       | Analog gauge  | Dash center           | Indication of Energy Storage System State of Charge, percentage   |  |
| Low SOC level indicator                   | Low SOC indicator and alert   | Dash Center           | Detects low energy storage SOC and alerts driver to recharge. Shall be programmable based on remaining mileage range                      | Red or amber indicator and warning tone        |
| Air Compressor over-temperature indicator | High air compressor temperature indicator as visual alert                                     | Within driver's sight | Detects high temperature in air compressor or air compressor motor and alerts driver  | Red indicator                                  |

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| Device                                       | Description   | Location              | Function   | Visual/<br>Audible |
|--|---|-----------------------|--|--------------------|
| Derate active indicator                      | Control system has derated powertrain power indicator as visual alert lights.         | Within driver's sight | Notifies driver control system has initiated derate to protect components        | Red indicator      |
| Transmission failure detected indicator      | Controls system has detected a transmission failure indicator as visual alert         | Within driver's sight | Notifies driver transmission failure has been detected                           | Red indicator      |
| Traction motor failure detected indicator    | Controls system has detected a traction motor failure indicator as visual alert       | Within driver's sight | Notifies driver traction motor failure has been detected                         | Red indicator      |
| High voltage ground fault detected indicator | Controls system has detected a ground fault indicator as visual alert                 | Within driver's sight | Notifies driver that ground fault has been detected                              | Red indicator      |
| Light/bulb failure detected indicator        | Controls system has detected an open circuit (bulb failure) indicator as visual alert | Within driver's sight | Notifies driver that a light/bulb failure has been detected                      | Amber indicator    |
| Wheelchair stop requested indicator          | Stop request in wheelchair area has been requested visual alert                       | Within driver's sight | Notifies driver that stop request requiring wheelchair assist has been requested | Blue indicator     |
| Roof Enclosures not fully closed indicator   | Roof enclosures are not in the fully closed position visual alert                     | Within driver's sight | Notifies driver that roof enclosure (s) is / are not fully closed                | Amber indicator    |

1. Indicate area by drawing. Break up switches control from indicator lights.

## **TS 44.6 Driver Foot Controls**

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 be 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, lower edge of windshield, and vertical H-point.

#### **TS 44.6.2 Pedal Dimensions and Position**

The floor-mounted accelerator pedal shall be 10 to 12 in. long and 3 to 4 in. wide. Clearance around the pedal must allow for no interference precluding operation.

#### **1 to 2 in. Between Brake and Accelerator Pedals**

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 in. Both pedals should be located approximately on the same plane coincident to the surface of the pedals.

#### **TS 44.7 Brake and Accelerator Pedals**

##### **Brake Pedals**

Non-adjustable brake pedals.

#### **TS 44.8 Driver Foot Switches**

##### **Floor-Mounted Foot Control Platform**

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. It shall be located no closer to the seat front than the heel point of the accelerator pedal.

##### **Turn Signal Controls**

Turn signal controls shall be floor-mounted, foot-controlled, water-resistant, heavy-duty, momentary contact switches.

##### **Foot Switch Control**

The control switches for the turn signals shall be mounted on an inclined, floor-mounted stainless steel enclosure or metal plate mounted to an incline integrated into the driver'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. All other signals, including high beam and public address system shall be in approved location.

The foot switches shall be UL-listed, heavy-duty type, of a rugged, corrosion-resistant metal construction. The foot switches for the directionals shall be momentary type, while those for the PA system and 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. Driver's Amenities**

##### **TS 45.1 Coat Hanger**

A suitable hanger shall be installed in a convenient, approved location for the driver's coat.

##### **TS 45.2 Drink Holder**

Do Not Install or Provide.

### **TS 45.3 Storage Box**

#### **Storage Box**

An enclosed driver storage area shall be provided with a positive latching door and/or lock. The minimum size is 2750 cubic in.

### **TS 46. Windshield Wipers and Washers**

#### **TS 46.1 Windshield Wipers**

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. For two- piece windshields, both wipers shall park along the center edges of the windshield glass. For single-piece windshields, wipers shall park along the bottom edge of the windshield. 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.

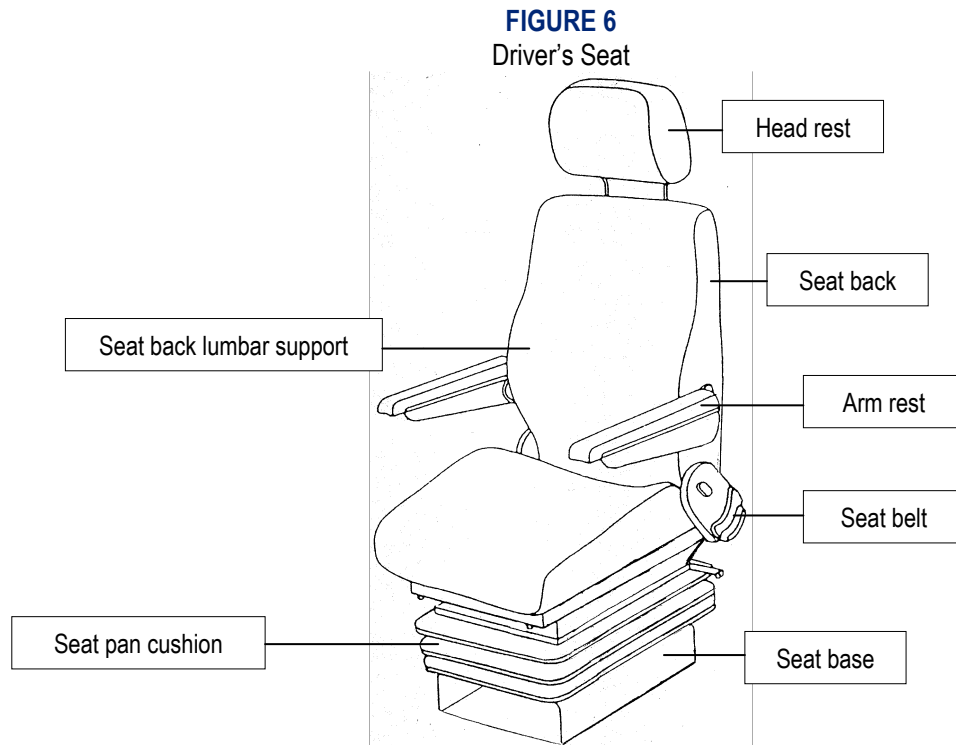
Single-control, electric two-speed intermittent wiper.

#### **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.

The windshield washer system shall have a minimum 3-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. Driver's Seat



### TS 47.1 Dimensions

The driver'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

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 in. at its minimum length and no more than 20.5 in. at its maximum length.

#### TS 47.1.2 Seat Pan Cushion Height

##### Dimensions

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 in., with a minimum 6 in. vertical range of adjustment.

### ALTERNATIVE

#### H-Point

The reference point for seat height shall be determined by establishing the H-point.

#### TS 47.1.3 Seat Pan Cushion Slope

Measurement is 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 can 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 47.1.4 Seat Base Fore/Aft Adjustment**

Measurement is 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.). On all low-floor buses, the seat-base shall travel horizontally a minimum of 9 in. It shall adjust no closer to the heel point than 6 in. On all high-floor buses, the seat base shall travel a minimum of 9 in. and adjust no closer to the heel-point than 6 in.

#### **TS 47.1.5 Seat Pan Cushion Width**

Measurement is the horizontal distance across the seat cushion. The seat pan cushion shall be 17 to 21 in. across at the front edge of the seat cushion and 20 to 23 in. across at the side bolsters.

#### **TS 47.1.6 Seat Suspension**

The driver’s seat shall be appropriately dampened to support a minimum weight of 380 lbs. The suspension shall be capable of dampening adjustment in both directions.

Rubber snubbers shall be provided to prevent metal-to-metal contact.

#### **TS 47.1.7 Seat Back**

##### **Width**

Measurement is 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. Seat back will include dual recliner gears on both sides of the seat.

##### **Height**

Standard height seat back.

#### **TS 47.1.8 Headrests**

Adjustable headrest.

#### **TS 47.1.9 Seat Back Lumbar Support**

Measurement is 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 three individual operating lumbar cells within a minimum range of 7 to 11 in.

#### **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 47.2 Seat Belt**

The belt assembly should be an auto-locking retractor (ALR). All seat belts should be stored in automatic retractors. The belts shall be mounted to the seat frame so that the driver 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.

Lap seat belt only.

Seatbelt webbing shall be black in color.

The lap belt assembly shall be a minimum of 72 in. in length.

## **TS 47.3 Adjustable Armrest**

Not Applicable

## **TS 47.4 Seat Control Locations**

While seated, the driver 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 47.5 Seat Structure and Materials**

### **Cushions**

Cushions shall be fully padded with at least 3 in. of materials in the seating areas at the bottom and back.

## **TS 47.6 Pedestal**

Powder-coated steel.

## **TS 47.7 Seat Detail**

- USSC model G2A
- Silicon Foam
- Black Leather
- 10 inch slide, min

## **TS 47.8 Mirrors**

### **TS 47.8.1 Exterior Mirrors**

The bus shall be equipped with a 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 driver to view the roadway along the sides of the bus, including the rear wheels. Mirrors should be positioned to prevent blind spots.



Mirrors shall retract or fold sufficiently to allow bus washing operations but avoid contact with windshield.

Spring loaded mirror heads auto return.

Combination of flat and convex mirrors referred to as transit-specific.

#### **Curbside Mirrors**

The curbside rearview mirror shall be mounted so that its lower edge is no less than 76 in. above the street surface. A lower mount may be required due to requested mirror configuration requests.

#### **Remote Adjustment of Curbside Mirror**

The driver 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**

#### **Remote Adjustment of Curbside Mirror**

The driver 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.

Mirrors with integrated turn signal, both sides.

Mirrors shall be B&R, 8 x 11 inch flat.

#### **TS 47.8.2 Interior Mirrors**

Mirrors shall be provided for the driver to observe passengers throughout the bus without leaving the seat and without shoulder movement. The driver shall be able to observe passengers in the front/entrance and rear/exit areas, anywhere in the aisle, and in the rear seats.

## **WINDOWS**

### **TS 48. General**

A minimum of 10,000 sq in. of window area, including operator and door windows, shall be required on each side of the standard configuration bus.

### **TS 49. Windshield**

The windshield 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 in. nominal thickness laminated safety glass conforming to the requirements of ANSI Z26.1 Test Grouping 1A and the Recommended Practices defined in SAE J673.

#### **Shaded Band**

The upper portion of the windshield above the driver'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.

One-piece windshield.

### **TS 50. Driver's Side Window**

The driver'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 driver's view, perpendicular through operator's side window glazing, should extend a minimum of 33 in. (840 mm) to the rear of the heel point on the accelerator, and in any case must accommodate a 95th percentile male operator. The view through the glazing at the front of the assembly should begin not more than 26 in. (560 mm) above the operator's floor to ensure visibility of an under-mounted convex mirror. Driver's window construction shall maximize ability for full opening of the window.

The driver's side window glazing material shall have a ¼ in. nominal thickness laminated safety glass conforming with 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 in. from the operator platform floor. On the top fixed over bottom slider configuration, the top fixed area above 53 in. may have a maximum 5 percent light transmittance.

## **TS 51. Side Windows**

### **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 will be treated to prevent corrosion.

#### **Standard Passenger Side Window Configurations**

- Side windows shall be Ricon (Transit Care), with bonded frames
- Hidden frame (flush "Euro-look")
- Operable windows with inward-opening transom panels
- Fixed lower panes with upper transom, tip-in
- Glazing shall be 1/4 inch tempered glass, tint at 50% gray
- Transit Care liners installed at all windows rearward of the rear door

### **TS 51.2 Emergency Exit (Egress) Configuration**

#### **Minimum Egress**

All side windows shall be fixed in position, except as necessary to meet the emergency escape requirements.

### **TS 51.3 Configuration**

Not Applicable

### **TS 51.4 Materials**

#### **Anti-Vandalism Sacrificial Liner ("Quick Change")**

All glazing material aft of the rear door shall be equipped with necessary bracketry, fasteners and clear acrylic liner that shall be easily removable in the event of vandalism. The acrylic liner shall be clear and shall have minimal effect on the transmittance of the underlying glazing. This material shall not be adversely affected by ultraviolet rays and shall withstand normal cleaning practices. The installation of the liner shall prevent clouding or fogging. This acrylic sacrificial liner must be replaced without removing the window from its installed position on the bus, without removing the tempered glazing from the sash, and without the removal or manipulation of the window assembly's rubber molding. A mechanic shall be able to easily remove and replace the acrylic liner without the use of any specialized tools in 5 minutes or less.

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 37 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.

Windows shall be RICON (Transit Care), quick change w/ hidden / bonded frames.

**TS 51.5 Rear Window**

No requirement for rear window.

## **HEATING, VENTILATING AND AIR CONDITIONING**

### **TS 52. Capacity and Performance**

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. HVAC shall be ThermoKing, full electric.

#### **Allow Either Roof- or Rear-Mounted HVAC Unit**

The HVAC unit may either be roof or rear-mounted.

Fully AC high-voltage electric-driven A/C system with full hermetic AC compressor, condenser fan and evaporator blower motors.

The Agency anticipates the ambient temperature range for vehicle operation will be between 40°F and 100°F. 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 75 °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 40 to 100 °F and at any ambient relative humidity levels between 5 and 50 percent.

When the bus is operated in outside ambient temperatures above or below the anticipated ambient temperature range, the interior temperature of the bus shall be permitted to rise or fall 0.5° for each degree of exterior temperature above or below the anticipated ambient temperature range, respectively.

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." Using this protocol, the interior temperature of the bus must reach 70°F within 30 minutes when subjected to any outside ambient temperatures within a range of 40 to 100 °F and at any ambient relative humidity levels between 5 and 50 percent.

The recommended locations of temperature probes are only guidelines and may require slight modifications to address actual bus design. Care must 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.

#### **Capacity and Performance Requirements**

The air-conditioning portion of the HVAC system shall be capable of reducing the passenger compartment temperature from 110 to 90 °F in less than 20 minutes. 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. The appropriate solar load as recommended in the APTA "Recommended

Instrumentation and Performance Testing for Transit Bus Air Conditioning System,” representing 4 p.m. on August 21, shall be used. There shall be no passengers on board, and the doors and windows shall be closed.

**R407C**

The air conditioning system shall meet these performance requirements using R407C.

## **TS 53. Controls and Temperature Uniformity**

The HVAC system excluding the driver’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 propulsion system coolant water shall be delivered to the HVAC system driver’s defroster/heater and other heater cores by means of an auxiliary coolant pump, sized for the required flow, which is brushless and sealless having a minimum maintenance free service life for both the brushless motor and the pump of at least 40,000 hours at full power.

### **Manual Mode Selection of Climate Control System**

After manual selection and/or activation of climate control system operation mode, all interior climate control system requirements for the selected mode shall be attained automatically to within  $\pm 2$  °F of specified temperature control set-point.

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 in. 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 cubic ft per minute (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.

## **No “Fresh Air” Requirements**

### **TS 54.2 Driver’s Area**

The bus interior climate control system shall deliver at least 100 cfm of air to the driver’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 driver’s feet and legs. The defroster or interior climate control system shall maintain visibility through the driver’s side window.

### **TS 54.3 Controls for the Climate Control System (CCS)**

The controls for the driver’s compartment for heating, ventilation and cooling systems shall be integrated and shall meet the following requirements:

- The heat/defrost system fan shall be controlled by a separate switch that has an “off” position and at least two positions for speed control. All switches and controls shall preclude the possibility of clothing becoming entangled, and shields shall be provided, if required. If the fans are approved by the Agency, an “on-off” switch shall be located to the right of or near the main defroster switch.
- A manually operated control valve shall control the coolant flow through the heater core.
- 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 Agency project manager.

### **TS 54.4 Driver’s Compartment Requirements**

A separate heating, ventilation and defroster system for the driver’s area shall be provided and shall be controlled by the driver. The system shall meet the following requirements:

- The heater and defroster system shall provide heating for the driver and heated air to completely defrost and defog the windshield, driver’s side window, and the front door glasses in all operating conditions. The defroster shall be capable of defogging the windshield within 5 minutes of a cold start. 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 driver’s feet. A minimum capacity of 100 cfm shall be provided. The driver shall have complete control of the heat and fresh airflow for the driver’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 driver’s position to allow direction of air onto the side windows.

A ventilation system shall be provided to ensure driver comfort and shall be capable of providing fresh air in both the foot and head areas. Vents shall be controllable by the driver 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 Driver's Cooling**

A separate fan unit shall provide 100 cfm of air to the driver's area through directionally adjustable nozzles and an infinitely variable fan control. , both of which shall be located above and ahead of the driver.

#### **OPTION**

The driver shall be provided with an independent air conditioning system to include fan, evaporator and thermostat for the purpose of cooling the immediate area. This system shall be provided with refrigerant via the main HVAC systems condenser. This option shall be priced separately as an option and shall be reconciled into the overall mileage calculation as an option such that the Agency can determine the full impact, i.e., cost / performance.

### **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 easily removable for service.

#### **Disposable Type Filters**

Air filters shall be of disposable type.

### **TS 56. Roof Ventilators**

#### **One Roof Ventilator**

One ventilator shall be provided in the roof of the bus.

Each ventilator shall be easily opened and closed manually. When open with the bus in motion, this ventilator shall provide fresh air inside the bus. The ventilator shall cover an opening area no less than 425 sq in. 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. An escape hatch shall be incorporated into the roof ventilator. Roof ventilator(s) 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 and dryers. 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.



**TS 58. Entrance/exit area heating**

No requirements for entrance/exit area heating.

**TS 59. Floor-Level Heating**

No requirements for floor-level heating.

## **EXTERIOR PANELS, FINISHES AND EXTERIOR LIGHTING**

### **TS 60. Design**

The bus shall have a clean, smooth, modern looking, 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.

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.

### **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. Advertising frames shall protrude no more than ⅞ in. from the body surface. 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 driver.

### **TS 62. Repair and Replacement**

#### **TS 62.1 Side Body Panels**

Structural elements supporting exterior body panels shall allow side body panels below the windows to be repaired in lengths not greater than 12.5 ft.

##### **Easily Replaceable Lower Side Body Panels**

The lower section (approximately 17.5 in.) of the side body panels (low-floor buses) or skirt panels (high-floor buses) shall be made of impact-resistant material and shall be easily and quickly replaceable.

### **TS 63. Rain Gutters**

Rain gutters shall be provided to prevent water flowing from the roof onto the passenger doors and driver's side window. When the bus is decelerated, the gutters shall not drain onto the windshield, driver'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.

#### **TS 64.1 Rub rails**

No requirement for rub rails.

### **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. They 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. Wheel covers**

Fender skirting shall be required at the rear wheels and incorporate a hinged design at the top of the skirt attachment to the body for ease of inspection and maintenance.

#### **TS 66.1 Splash Aprons**

##### **Standard 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 6 in. 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.

Full width rear splash apron.

### **TS 67. Alternative Service Compartments and Access Doors**

#### **TS 67.1 Access Doors**

Conventional or pantograph hinged doors shall be used for the motor compartment and for all auxiliary equipment compartments including doors for checking the quantity and adding to the coolant, lubricants and transmission 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 retained in the open position by props or counterbalancing with over-center or gas-filled springs with safety props 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.

If precluded by design, the Contractor shall provide door design information specifying how the requirements are met.

### **TS 67.2 Access Door Latch/Locks**

Access doors larger than 100 sq in. in area shall be equipped with corrosion-resistant flush-mounted latches or locks except for coolant and fuel fill access doors. All such access doors that require a tool to open shall be standardized throughout the vehicle and will require a nominal 5/16 in. square male tool to open or lock.

## **TS 68. Bumpers**

### **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 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 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 in.

Mounting provisions for integrated bike rack on front bumper to include installation of Trilogy bike rack by Sportsworld, 3 position bike rack to include warning light and sensors.

### **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 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. 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**

Bumper material shall be corrosion-resistant and withstand repeated impacts of the specified loads without sustaining damage. 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.

Paint shall be applied smoothly and evenly with the finished surface free of visible dirt and the following other imperfections:

- blisters or bubbles appearing in the topcoat film
- chips, scratches, or gouges of the surface finish
- cracks in the paint film
- craters where paint failed to cover due to surface contamination
- overspray
- peeling
- runs or sags from excessive flow and failure to adhere uniformly to the surface
- chemical stains and water spots
- dry patch due to incorrect mixing of paint activators
- 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 Contractor shall supply test samples of the exterior surface 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 vehicle.

These buses will be used on a unique downtown route and branded to suit this purpose. Once the body of the bus is defined, the Agency will work with the successful proposer in coming up with a unique design to highlight this unique bus. The bus design should be different enough to draw

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intrigue and excitement, however, elements should also tie in with the current brand of Long Beach Transit so that it isn't a complete departure from the fleet as a whole. The Agency will review and approve the final design. The Agency's exterior configuration is relatively "stylish" employing a variety of colors, curved designs, using a variety of paint colors and decals. The Agency's standard paint requirement is Dupont Elite. Our current colors are, Coke Red (N0252D EXD), White (N0624B EXB), Black (N0001A EXA) and Gold (857673B EXB). Any decals being used must last a minimum of 6 years. Currently, the Agency uses decals manufactured by 3M and must match our standard color pallet, which are comparable to the color of paint above. Exhibits 8 and 9 are photos of recent designs on Agency's CNG buses manufactured in 2012.

**Exhibit 8  
Current Agency Exterior Bus Design**



**Exhibit 9  
Current LBT Exterior Bus Design**



**High Gloss External Paint Finish Quality**

Painted surfaces shall have a minimum 95 gloss and an orange peel rating of 7 or more on the Advanced Coating Technologies, Inc., orange peel standard panels set #APR 14941 or Agency accepted wave scan equipment. Paint shall last a minimum of six years with a minimum gloss of 90 as measured in ASTM E97-92, "Standard Test Method For Directional Reflectance."

Standard Contractor exterior paint system. The final paint finish and colors shall be subject to final approval by LBT based on the engineering drawing of the vehicle and paint samples.

**TS 70. Decals, Numbering and Signing**

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 installed per the decal Supplier recommendations. Signs shall be provided in compliance with the ADA requirements defined in 49 CFR Part, Subpart B, 38.27 and FMVSS and CFR.

LBT maintains a standard set of decals for the interior of the bus and shall provide a full detail (including size and location) of current decals to the contractor. Should the proposer require this information to complete their proposal, please contact LBT's Purchasing Manager.

**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.

Requirements for a public information system in accordance with 49 CFR, Part 38.35 shall be provided.

## **TS 71. Exterior Lighting**

Exterior lighting and reflectors shall comply, as applicable, with Part 393, Subpart B of the FMCSA and FMVSS 108. All lights shall be Dialite.

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. 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.

### **Potted Lamps**

LED lamps shall be potted type and designed to last the life of the bus.

### **Larger Size**

LED lamps used for tail, brake and turn signal lamps shall be a minimum of 7 in. in diameter.

## **TS 71.1 Backup Light/Alarm**

Visible and audible warnings shall inform following vehicles 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**

Lamps at the front and rear passenger doorways shall comply with ADA requirements and shall activate only when the doors open. These 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 passengers' eyes from glare.

## **TS 71.3 Turn Signals**

### **Standard Turn Signals**

Turn-signal lights shall be provided on the front, rear, curb and street sides of the bus in accordance with FMVSS 108 and Part 393, Subpart B of the FMCSA as applicable.

## **TS 71.4 Headlights**

Headlamps shall be designed for replacement without removing the headlamp bezel.

### **Daytime Running Lights**

Headlamps shall incorporate a daytime running light feature.

### **LED/Halogen**

Headlamps shall be LED/halogen, sealed beam.



## **TS 71.5 Brake Lights**

Brake lights shall be provided in accordance with FMVSS 108 and Part 393, Subpart B of the FMCSA as applicable.

### **High and Center Mount Red Brake Lamp**

Bus shall include red, high and center mount brake lamp(s) along the backside of the bus in addition to the lower brake lamps required under FMVSS 108. The high and center mount brake lamp(s) shall illuminate steady with brake application.

## **TS 71.6 Service Area Lighting (Interior and Exterior)**

LED lamps shall be provided in the motor 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 motor 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.

Motor compartment lamps shall be 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) after 30 minutes to prevent 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, flammability 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.

The overall interior shall be material and color coordinated with the look of the flooring and seating, typically consisting of panels such as melamine, bulkhead carpeting, etc. The Agency shall approve the final material and color. See photo below for interior of LBT buses.

**Exhibit 10**  
**Current LBT Interior Bus Design**



### **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.

### **Fire Resistance**

Materials shall comply with the Recommended Fire Safety Practices defined in FTA Docket 90-A, dated October 20, 1993.

LBT is open to discussion and would currently consider composite or melamine-type material for the side panels

### **TS 73.1 Driver Area Barrier**

A barrier or bulkhead between the driver and the street-side front passenger seat 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. Location and shape must permit full seat travel and reclining possibilities that can accommodate the shoulders of a 95th-percentile male. The partition shall have a side return and stanchion to prevent passenger from reaching the driver by standing behind the driver's seat. The lower area between the seat and panel must be accessible to the driver. The partition must be strong enough in conjunction with entire partition assembly for mounting of such equipment as flare kits, fire extinguishers (1.2 kg), microcomputer, public address amplifier, etc. Dark or black panels are preferred behind the driver's head. The panel should be isolated for noise control and attached with rubber grommets.

### **Wheel-Well-to-Ceiling Configuration of Driver's Barrier**

The driver's barrier shall extend from the top of the wheel well to the ceiling the level of the seated driver and shall fit close to the bus side windows and wall to prevent passengers from reaching the driver or the driver's personal effects.

### **TS 73.2 Modesty Panels**

Sturdy divider 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 dividers 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 1 and 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 passengers assist 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.

Clear non-glass panel from above the modesty panel to the top of the daylight opening and attached to the stanchion at the rear door exit. LBT's current color is Coca Cola Red.

### **TS 73.3 Front End**

The entire front end of the bus shall be sealed to prevent debris accumulation behind the dash and to prevent the driver'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 driver'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 driver's barrier shall be finished with a surface that reduces glare. Any mounted equipment must have provision to support the weight of equipment.

### **TS 73.4 Rear Bulkhead**

The rear bulkhead and rear interior surfaces shall be material suitable for exterior skin; painted and finished to exterior quality; or paneled with melamine-type material, composite, scratch-resistant plastic or carpeting and trimmed with stainless steel, aluminum or composite.

The rear bulkhead paneling 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 reduce the probability of trash or liter 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.

### **TS 73.5 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. 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 73.6 Fastening**

Interior panels shall be attached so that there are no exposed unfinished or rough edges or rough surfaces. Fasteners should be corrosion resistant. Panels and fasteners shall not be easily removable by passengers. Exposed interior fasteners should be minimized, and where required shall be tamper-resistant.

### **TS 73.7 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 driver or passengers cannot feel drafts during normal operations with the passenger doors closed.

**FTA Docket 90-A**

All insulation materials shall comply with the Recommended Fire Safety Practices defined in FTA Docket 90-A, dated October 20, 1993.

**TS 73.8 Floor Covering**

The floor covering shall be Altro Transflor or approved equal and 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 approximately 2 in. wide and shall extend across the bus aisle. The color and pattern shall be consistent throughout the floor covering. Final material color to be approved by the Agency.

**Additional Requirements**

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 floor shall be easily cleaned and shall be arranged to minimize debris accumulation.

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. If the floor is of a bi-level construction, then the 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.

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 73.9 Interior Lighting**

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.

The lens material shall be translucent polycarbonate. Lenses shall be designed to effectively "mask" the light source. 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.

**TS 73.10 Passenger****Automatically Dimming First Row Lights**

The first light on each side (behind the driver and the front door) is 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 go out. These lights shall be turned on at any time if the toggle switch is in the "on" position.

All interior lighting shall be turned off whenever the transmission selector is in reverse and the engine run switch is in the "on" position.

The interior lighting design shall require the approval of the Agency.

LED lights.

### **TS 73.11 Driver Area**

The driver's area shall have a light to provide general illumination, and it shall illuminate the half of the steering wheel nearest the driver to a level of 5 to 10 foot-candles.

### **TS 73.12 Seating Areas**

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 73.13 Vestibules/Doors**

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 73.14 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 73.15 Ramp Lighting**

Exterior and interior ramp lighting shall comply with CFR Part 49, Sections 19.29 and 19.31.

### **TS 73.16 Farebox Lighting**

#### **Farebox Light**

A 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**

Space and structural provisions shall be made for installation of currently available fare collection devices and shall be as far forward as practicable. Location of the fare collection device shall not restrict traffic in the vestibule, including wheelchairs if a front door loading device is used, and shall allow the driver to easily reach the farebox controls and to view the fare register. The fare box shall not restrict access to the driver area, shall not restrict operation of driver controls and shall not — either by itself or in combination with stanchions, transfer mounting, cutting and punching equipment, or route destination signs — restrict the driver's field of view per SAE Recommended Practice J1050. The location and mounting of the fare collection device shall allow use, without restriction, by passengers. The fare box location shall permit accessibility to the vault for easy manual removal or attachment of suction devices. Meters and counters on the fare box shall be readable on a daily basis. The floor under the fare box shall be reinforced as necessary to provide a sturdy mounting platform and to prevent shaking of the fare box.

Transfer mounting, cutting and punching equipment shall be located in a position convenient to the driver.

Agency will install its own fare box. Contractor will provide all wiring for power and drilling of base plate holes for connection to LBT's Transmart system.

## **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 with Locks**

Access doors shall be secured with locks. The locks shall be standardized so that only one tool is required to open access doors on the bus.

### **TS 75.1 Floor Panels**

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 openings shall be flush with the floor and shall be edge-bound with stainless steel or another material that is acceptable to the Agency to prevent the edges from coming loose. Access openings shall be asymmetrical so that reinstalled flooring shall be properly aligned. Fasteners shall tighten flush with the floor.

The number of special fastener tools required for panel and access door fasteners shall be minimized.

## **PASSENGER ACCOMMODATIONS**

### **TS 76. Passenger Seating**

#### **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.

Passenger seating shall be 4ONE / USSC, model Gemini, stainless steel frames, charcoal gray with LBT customized fabric, Holdsworth, BML649 with wave pattern.

Note: The Agency recognizes that ramp location, foot room, hip-to-knee room, doorway type, width, seat construction, floor level type, seat spacing requirements, ramp or lift, number of wheelchair positions, etc. ultimately affect seating capacity and layout.

#### **Forward-Facing Seat Configuration**

Passenger seats shall be arranged in a transverse, forward-facing configuration, except at the wheel housings and turntable, if applicable, where aisle-facing seats may be arranged as appropriate 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 energy storage space). All forward facing seats shall be accompanied with a barrier, this barrier shall act as a means of confining forward seated passenger movement and the barrier can be the back of a forward facing seat immediately ahead or a barrier such as at the rear of each wheelchair securement area. These two subject barrier positions shall be 4ONE / QStraint, model QPod.

#### **TS 76.2 Rearward Facing Seats**

Rearward facing seats not allowed.

#### **TS 76.3 Turntable Seating**

Not Applicable

#### **TS 76.4 Padded Inserts/Cushioned Seats**

##### **Padded Inserts**

The passenger seats shall be equipped with vandal-resistant ½” padded inserts throughout the bus.

#### **TS 76.5 Drain Hole in Seats**

No requirement 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 26 in. At all seating positions in paired transverse seats immediately behind other seating positions, hip-to-knee room shall be no less than 27 in.



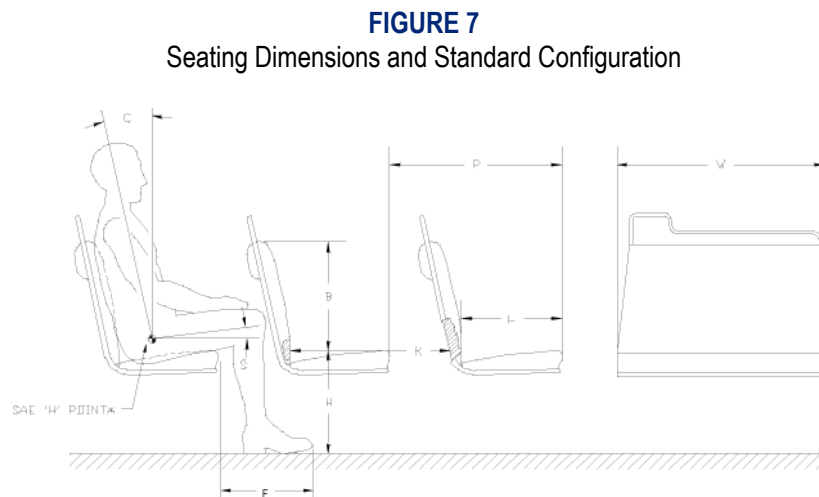
### **TS 76.7 Foot Room**

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. Seats immediately behind the wheel housings and modesty panels may have foot room reduced.

### **TS 76.8 Aisles**

The aisle between the seats shall be no less than 20 in. 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).

### **TS 76.9 Dimensions**



Seat dimensions for the various seating arrangements shall have the dimensions as follows (refer to Figure 7):

- The width, W, of the two-passenger transverse seat shall be a minimum 35 in.
- The length, L, shall be 17 in.,  $\pm 1$  in.
- The seat back height, B, shall be a minimum of 15 in.
- The seat height, H, shall be 17 in.,  $\pm 1$  in. 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 in.,  $\pm 2$  in., will be allowed. This shall also be allowed for limited transverse seats, but only with the expressed approval of the Agency.
- Foot room = F.
- The seat cushion slope, S, shall be between 5 and 11 degrees.
- The seat back slope, C, shall be between 8 and 17 degrees.
- Hip to knee room = K.
- The pitch, P, is shown as reference only.

### **TS 76.10 Structure and Design**

The passenger seat frame and its supporting structure shall be constructed and mounted so that space under the seat is maximized and is completely free of obstructions to facilitate cleaning.

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Seats, structures and restraints around the securement area should not infringe into the mobility device envelope or maneuverability.

The transverse seat structure shall be fully cantilevered from the sidewall with sufficient strength for the intended service. The lowest part of the seat assembly that is within 12 in. of the aisle shall be at least 10 in. above the floor.

In locations at which cantilevered installation is precluded by design and/or structure, other seat mounting may be allowed.

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 in., measured at the aisle side of the seat frame at height H. The seat back should not deflect more than 14 in., 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 ¼-in. 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 ¼-in. 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-in. pendulum and shall strike the seat back 10,000 times each from distances of 6, 8, 10 and 12 in. Seats at both seating positions shall withstand 4000 vertical drops of a 40-lb sandbag without visible deterioration. The sandbag shall be dropped 1000 times each from heights of 6, 8, 10 and 12 in. Seat cushions shall withstand 100,000 randomly positioned 3½-in. 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 handhold no less than 7/8 in. in diameter for standees and seat access/egress. 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 in. 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.

The seat back handhold may be deleted from seats that do not have another transverse seat directly behind and where a vertical assist is provided.

Longitudinal seats shall be the same general design as transverse seats but without seat back handholds. Longitudinal seats may be mounted on the wheelhouses. Armrests shall be included on the ends of each set of longitudinal seats except on the forward end of a seat set that is immediately to the rear of a transverse seat, the driver's barrier, or a modesty panel, when these fixtures perform the function of restraining passengers from sliding forward off the seat. Armrests are not required on longitudinal seats located in the wheelchair parking area that fold up when the armrest on the adjacent fixed longitudinal seat is within 3½ in. of the end of the seat cushion. Armrests shall be located from 7 to 9 in. above the seat cushion surface. The area between the armrest and the seat cushion shall be closed by a barrier or panel. The top and sides of the armrests shall have a minimum width of 1 in. and shall be free from sharp protrusions that form a safety hazard.

Seat back handhold and armrests shall withstand static horizontal and vertical forces of 250 lbs applied anywhere along their length with less than ¼-in. 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 ¼-in. permanent deformation and without visible deterioration.

### **TS 76.11 Construction and Materials**

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, pads and cushions 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.

Seat fabric shall be Holdsworth, BML649 (LBT Wave Design).

### **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 at front doorway, around farebox, and at interior steps for bi-level designs shall be powder-coated in a high-contrast yellow color. The forward-most vertical stanchions on either side of the aisle immediately behind the driver's area shall be Powder-coated yellow.

#### **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 and shall be capable of passing the NHTSA Drawstring Test.

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 may be of the same construction and finish as the seat frame. Door mounted passenger assists shall be of anodized aluminum, stainless steel or powder-coated metal. Connecting tees and angles may be powder-coated metal castings. 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.

### **TS 77.3 Vestibule**

The aisle side of the driver's barrier, 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 driver'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 in. or providing an equivalent gripping surface with no corner radii less than ¼ in., and shall provide at least 1½ in. 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 in. 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 in. 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 in.

Grab straps shall be Plastic.

Overhead assists shall simultaneously support 150 lbs on any 12-in. 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**

Doorways will be provided in the locations and styles as follows. Passenger doors and doorways shall comply with ADA requirements.

Front and rear doors shall be Vapor, slide glide, pneumatic assist.

#### **OPTION**

Electric Doors shall be priced separately as an option and shall be reconciled into the overall mileage calculation as an option such that the Agency can determine the full impact, i.e., cost / performance.

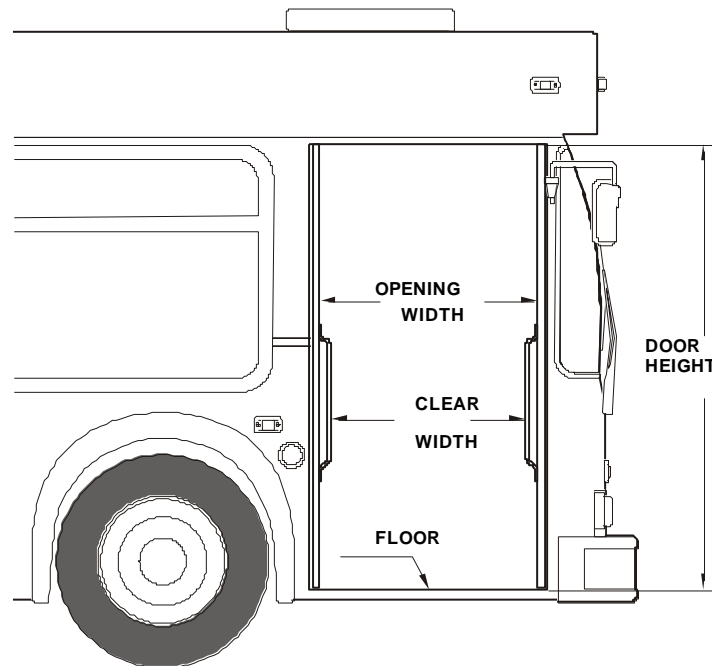
### **TS 78.1 Materials and Construction**

Structure of the doors, their attachments, inside and outside trim panels and any mechanism exposed to the elements shall be corrosion-resistant. Door panel construction shall be of corrosion-resistant metal or reinforced non-metallic composite materials. When fully opened, the doors shall provide a firm support and shall not be damaged if used as an assist by passengers during ingress or egress. Door edges shall be sealed to prevent infiltration of exterior moisture, noise, dirt and air elements from entering the passenger compartment, to the maximum extent possible based on door types.

The closing edge of each door panel shall have no less than 2 in. of soft weather stripping. The doors, when closed, shall be effectively sealed, and the hard surfaces of the doors shall be at least 4 in. apart. The combined weather seal and window glazing elements of the front door shall not exceed 10 degrees of binocular obstruction of the driver's view through the closed door.

## TS 78.2 Dimensions

**FIGURE 7**  
Transit Bus Minimum Door Opening



When open, the doors shall leave an opening no less than 75.3 in. in height.

### REQUIREMENT

#### Doorway Clear Width Greater than 31¾ in.

The front door clear width shall be a minimum of 34 in. with the doors fully opened.

The rear door clear width shall be a minimum of 34 in. with the doors fully opened.

If the Agency requires a minimum rear door clear width of 31¾ in. or greater and an outward opening (swing) door is specified, then the maximum outboard excursion of 13 in. may be exceeded.

## 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.

Door glazing shall be easily replaceable.

**REQUIREMENT**

Zip type glazing rubber.

**REQUIREMENT**

The front and rear door panel glazing material shall have a nominal ¼ in. thick laminated safety glass conforming with the requirements of ANSI Z26.1 Test Grouping 2 and the Recommended Practices defined in SAE J673.

**TS 78.4 Door Projection**

**Exterior**

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 13 in. during the opening or closing cycles or when doors are fully opened

**Interior**

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-in.-high curb on a street sloping toward the curb so that the street side wheels are 5 in. higher than the right side wheels.

**TS 78.6 Closing Force**

Closing door edge speed shall not exceed 12 in. per second, and opening door speed shall not exceed 19 in. per second. Power 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.

Power-close 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 will stop and/or reverse direction prior to imparting a 10-lb force on 1 sq in. of that obstruction. If a contactless obstruction sensing system is employed, it 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.

Doors closed by a return spring or counterweight-type device shall be equipped with an obstruction-sensing device that, at a minimum, alerts the driver if an obstruction is detected between the closing doors. Doors closed by a return spring or counterweight type device, when unlocked, shall be capable of being pushed to the point where the door starts to open with a force not to exceed 25 lbs applied to the center edge of the forward door panel.

Whether or not the obstruction sensing system is present or functional, it shall be possible to withdraw a 1½ in. 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. If powered by compressed air, 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.

#### **REQUIREMENT**

The rear doors shall be passenger-controlled. The vehicle operator shall unlock and enable the opening mechanism, which shall be annunciated by illumination of a green light near the door. After enabling and unlocking, the doors shall be opened by either the passenger manually pushing the door open, or by a powered mechanism actuated by passenger activation of a touch bar or touch switch, or by passenger activation of a contactless sensing system. The door controller shall be Vapor, CLASS.A switch located within reach of the seated operator shall, when actuated, restore rear door function to complete operator control, as described in the “Default.”

Doors that employ a “swing” or pantograph geometry and/or are closed by a return spring or counterweight-type device shall be equipped with a positive mechanical holding device that automatically engages and prevents the actuation mechanism from being back-driven from the fully closed position. The holding device shall be overcome only when the driver’s door control is moved to an “Exit Door Enable” position and the vehicle is moving at a speed of less than 2 mph, or in the event of actuation of the emergency door release.

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**

See “Hardware Mounting” for door system interlock requirements.

### **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 after 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. The emergency door opening mechanism (s) shall be within a hinged compartment.

### **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 driver’s door control shall provide tactile feedback to indicate commanded door position and resist inadvertent door actuation.

Door control located on street side.

The front door shall remain in commanded state position even if power is removed or lost.

### **TS 78.11 Door Controller**

#### **REQUIREMENT**

##### **Five-Position Driver’s 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 driver. 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(s) closed or set to lock.
- **First position forward:** Front door open, rear door(s) closed or set to lock.
- **Second position forward:** Front door open, rear door(s) open or set to open.
- **First position back:** Front door closed, rear door(s) open or set to open.
- **Second position back:** Front door open, rear door(s) open or set to open.

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. This front door dump valve shall automatically allow the front door to be manually opened and closed when the master switch is in other than the “run” position. A master door switch, which is not within reach of the seated operator, when set in the “off” position shall close the rear/center doors, deactivate the door control system, release the interlocks, and permit only manual operation of the rear/center doors.

### **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.

In addition to the typical flip up seating to provide a space for wheelchair securement, individual flip up seating shall be provided at one forward facing dual seat module for storage of carts, strollers, walkers, etc. This area shall be as close to the front door as practicable and the actual dimensional space shall be maximized without negatively impacting coincident hip to knee dimensions within the affected row of forward facing seats.

### **TS 79.1 Loading Systems**

Front door ramp shall be Ricon, selection to be based on configuration and model exhibiting the least degree of slope without having a “slope” inherent to the interior floor. Note, a sloped floor at the front leading from the edge of the doorway to the main floor is not permitted.

### **TS 79.2 Lift**

Not Applicable

### **TS 79.3 Loading System for 30- to 60-ft Low-Floor Bus**

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.

### **TS 79.4 Loading System for Level Boarding on a 45- to 60-ft Low-Floor BRT**

Not Applicable

### **TS 79.5 Wheelchair Accommodations**

#### **Two Forward-Facing Wheelchair Securement Locations**

Two forward-facing locations, as close to the wheelchair loading system as practical, shall provide parking space and securement system compliant with ADA requirements for a passenger in a wheelchair. Each wheelchair securement station shall be 60 inches in length, belts to be Q Straint (blue). The subject unitized barrier / securement stations shall be 4ONE / QStraint, model QPod.

### **TS 79.6 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. It 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 36 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 should be provided on the outside of turning areas for wheelchair footrest.

## **SIGNAGE AND COMMUNICATION**

### **TS 80. Destination Signs**

A destination sign system shall be furnished on the front, on the right side near the front door and rear

The sign system shall be Twin Vision, model Smart Series, 100% Amber LED, to include an OCU, front sign (16 rows x 160 columns), right side sign (14 rows x 108 columns) and rear sign (16 rows x 48 columns). The OCU shall be located above the Driver, in the left side overhead or front sign access panel.

Route sign on the rear of the vehicle.

The destination sign compartments shall meet the following minimum requirements:

- Compartments shall be designed to prevent condensation and entry of moisture and dirt.
- Compartments shall be designed to prevent fogging of both compartment window and glazing on unit itself.
- Access shall be provided to allow cleaning of inside compartment window and unit glazing.
- Front window shall have an exterior display area of no less than 8.5 in. high by 56 in. wide.

### **TS 81. Passenger Information and Advertising**

#### **TS 81.1 Interior Displays**

Provisions shall be made on the rear of the driver's barrier or equipment box located on the wheel well for an Interior Information Center, as manufactured by Transit Information Products (# LBT OBIC 2), of Concord, Calif. 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.

Next stop display as specified in 83.4.1.

#### **TS 81.2 Exterior Displays**

Provisions shall be made to integrate advertising into the exterior design of the bus. Advertising media, frames or supporting structures shall not detract from the readability of destination signs and signal lights, and shall not compromise passenger visibility. Advertising provisions shall not cause pedestrian hazards or foul automatic bus washing equipment, and shall not cover or interfere with doors, air passages, vehicle fittings, or in any other manner restrict the operation or serviceability of the bus. LBT's current contract requires a minimum spacing of 21" x 72" for vinyl advertisement.

### **TS 82. Passenger Stop Request/Exit Signal**

#### **Pull Cord Passenger 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 heavy-duty pull cable, chime and interior sign message. The pull cable shall be located the full length of the bus on the sidewalls at the level where the transom is located. If no transom window is required, the height of the pull cable shall approximate this transom level and shall be no greater than 63 in. as measured from the floor surface. It

shall be easily accessible to all passengers, seated or standing. Pull cable(s) shall activate one or more solid state or magnetic proximity switches. 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 requested” signal.

An auxiliary passenger “stop requested” signal shall be installed at the rear door to provide passengers standing in the rear door/exit area convenient means of activating the signal system. The signal shall be a heavy-duty push button type located in the rear door vicinity. Button shall be clearly identified as “passenger signal.”

A single “stop requested” chime shall sound when the system is first activated. A double chime shall sound anytime the system is activated from wheelchair passenger areas.

Exit signals located in the wheelchair passenger area shall be no higher than 4 feet above the floor. Instructions shall be provided to clearly indicate function and operation of these signals.

## **TS 83. Communications**

### **TS 83.1 Camera Surveillance System**

A camera surveillance system shall be provided, GE Kalatel by UTC, model Penta w/ a 1 TB removable hard drive. The system shall include 7 color cameras, 1 day / night camera (total of 8 cameras) and 2 microphones. The Agency shall provide final locations for cameras and microphones to the Contractor. The system shall include wireless communication to the site via WiMAX and 3 inputs to initiate a “flag”, an event button, an impact sensor and interface to the silent alarm / emergency button. Note, camera models to include IR lighting and location will be subject to Agency approval of which will occur during the prototype design and final acceptance testing. Camera system shall be equipped with 2 available spare inputs for future use.

### **TS 83.2 Public Address System**

A unique public address system is not required. LBT utilizes the radio system for driver-originated announcements to passengers.

#### **TS 83.2.1 Speakers**

Six to eight (6 to 8) interior loudspeakers shall be provided, semi-flush mounted, on alternate sides of the bus passenger compartment, 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. One exterior loudspeaker shall be provided, semi-flush mounted near the front door of the bus for announcement and arrival information.

The speaker cable shall terminate at the instrument panel area on the curb side with a minimum of 3 feet of extra speaker cable. An end connector shall be supplied so a lead can be connected from the radio control head in order to make announcements directly from the transit control center to passengers through the PA system.

### **TS 83.3 Automatic Passenger Counter (APC)**

No APC system shall be installed.

## **TS 83.4 Radio and On-Board ITS Systems**

### **TS 83.4.1 Wireless Communication System – LBT Transmart**

A fully integrated on-board ITS system shall be provided, Trapeze by Siemens.

This ITS system also interfaces with a variety of on-board systems and controllers, to include the passenger information systems (next stop / audio and visual), fare box, covert microphones, handset, speakers, PA (interior / exterior), camera system and other information systems, such as, discrettes from the propulsion system, multi-plex system, fire / gas detection system, etc.

LBT recommends that the Proposer consult with Trapeze such that the detail of a LBT specified system is known and understood, consisting of the major hardware presented in the table below:

**TABLE 6**  
Trapeze Hardware

| <b>Qty</b> | <b>Trapeze Part #</b> | <b>Description</b>                              |
|------------|-----------------------|---|
| 1          | 10T0014-001           | SIGN, 1-LINE ADAPTIVE                           |
| 1          | 10T0490-001           | VI IVLU Assembly, WiPort, W/ CDM-1250 & XPR4350 |
| 1          | 24T0016-001           | Covert Mic                                      |
| 2          | 24T0028-005           | ANTENNA, 488-512 MHz, N CONNECTOR               |
| 1          | 24T0058-001           | COVERT SWITCH                                   |
| 1          | 24T0486-002           | ANTENNA, DUAL-BAND, GPS / WLAN                  |
| 1          | 25T0128-104           | HANDSET, 48" ARMORED                            |
| 1          | 50T0009-001           | DRIVERS SPEAKER                                 |
| 1          | 50T0035-001           | J1708 DISTRIBUTION BOX                          |
| 1          | 50T0147-001           | MDT Touch, Ram Mount                            |
| 1          | 61T0773-001           | MOUNT, HANDSET                                  |
| 1          | 65T0125-003           | Arm, Double Socket, "C" Ball, 4.5"              |
| 1          | 65T0125-010           | Ram Flanged Ball Mount, 3.68"                   |
| 1          | 75T0016-005           | CABLE, MDT, LVDS, 5M                            |
| 1          | 75T0417-025           | CABLE, J1708 BOX TO FARE BOX, 25 FT             |
| 1          | 75T0462-001           | Cable, Ext, J1708 to Luminator Dest Sign        |
| 2          | 75T0553-025           | CABLE, RF, MINI UHF TO RT ANGLE N MALE, 25 FT   |
| 1          | 75T0793-025           | CABLE, GPS, FAKRA CONN, 25 FT                   |
| 1          | 75T0793-125           | CABLE, WLAN, FAKRA CONN, 25 FT                  |
| 1          | 75TXXXX-W2            | CABLE, HARNESS, W2, VI IVLU POWER, 2-RADIO, OEM |
| 1          | 75TXXXX-W1A           | CABLE, HARNESS, W1A, VI IVLU, OEM               |
| 1          | 75TXXXX-W1C           | CABLE, HARNESS, W1C, VI IVLU, OEM               |
| 1          | 75TXXXX-W1D           | CABLE, HARNESS, W1D, VI IVLU, OEM               |

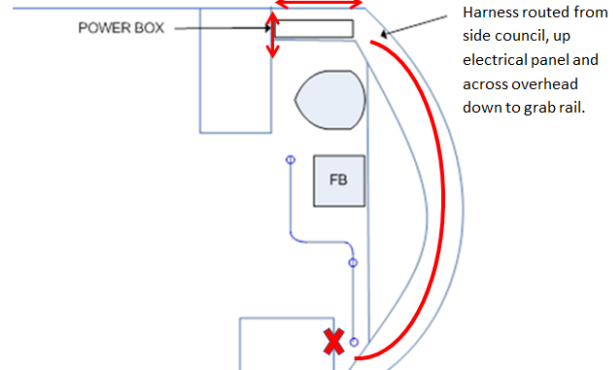
### **TS 83.4.2 Mobile Card Validator**

Provisions shall be provided to facilitate the installation of a mobile validator unit as manufactured by Cubic, to include mounting at the horizontal tubing forward of the right-side front wheel housing, separation from stanchion mount will be assessed and determined upon receiving the first article as indicated in (example 1). Wiring circuit (example 2) for 24vdc power via ignition will need to be protected by a 6amp breaker and have a delay of 2 Hrs. after the ignition is switched off. The actual validator unit shall be provided and installed by Cubic.

**Example 1**



**Example 2**



### **TS 83.4.3 Transponder**

Bus shall be equipped with a Fleetwatch transponder capable of transmitting bus ID, odometer and any data available on the J1939 CAN

## **TS 84. Management / Control and Data Systems**

Three (3) data systems shall be provided by the Contractor:

- High Level System: located at the central depot facility that serves as the data hub for charging of the energy storage system. The high level data system shall be in communication with the charging stations and buses;
- Charging Station System: located at each of the on route charging stations; and,
- Bus System: one on-board each bus.

Information level systems that require vehicle information for their operations or provide information shall adhere to J1939 data standard.

### **TS 84.1 High Level System**

The high level system shall collect data from each component within the system and provide summary reports, such as utility, energy, charging profiles, health checks, alarms, mileage, etc. The high level controller shall also be the point of transferring instruction and re-programming to

the charging station and buses. The proposer shall provide a complete list of data elements reportable from charging stations and buses, respectively.

### **TS 84.2 Charging Station System**

The charging station level system shall be the control point for each on route charging stations and provide site specific utility, duty cycle and incident monitoring. The system shall manage a store records on each charge event, including, but not limited to bus ID, charger status, faults, beginning SOC, ending SOC, energy consumption at the Utility Service Supply, energy consumption at the charger interface, max power, ambient temperature, etc. The system shall be in communication with the high-level site controller in real time.

### **TS 84.3 Bus System**

The bus level system shall manage the propulsion system instruction on board each bus and store data records representing the propulsion system activity at 1 second intervals, such as duty cycle information (time, location, altitude, speed), voltage and current input and output for major electrical components (ESS, power converters, HVAC, etc), traction motor input voltage and current, traction motor output torque and rotational speed, system health, BMS information, and faults. The on-board system shall be capable of profiling energy consumption, tractive energy, regenerative braking and hotel loads, such as, lighting, HVAC and support system loads, such as, steering, fans, cooling, air, system faults, etc. Bus data shall be communicated to each on route charging system throughout the day during the charging session, and to the high level site system upon returning to the depot for overnight charging of the batteries. . This on-board system shall also be capable of storing one week of all data and reports in memory that can be downloaded from the bus using a standard laptop computer.

## **CHARGING STATIONS**

### **TS 85. Charging Infrastructure**

These general requirements apply to all charging stations that may be delivered under the Contract. The Contractor shall provide Charging Equipment and Charger Interface and the control and data system needed to recharge the bus propulsion system batteries. The subject equipment deliverables shall begin downstream of the SC Edison Service Meter, and shall include the main service panel, sub-panels, step/down transformers, and all circuit breakers and disconnect switches. The Contractor shall provide all Charging Equipment and Charger Interface design requirements and specifications to the Agency and their designated architectural, civil, electrical, and mechanical engineering contractors to enable Charging Station site design, permitting, and construction.

The Contractor shall provide close coordination with the Agency and its engineering contractors during site design and construction of the charging stations. The Contractor shall be responsible for equipment start-up and testing to ensure that the charging equipment meets all stated specifications and functionality prior to site acceptance.

The chargers shall be UL Classified for the intended purpose and location environment. The charging systems shall be capable of delivering the optimal battery charge profile as specified by the battery manufacturer and charging the installed traction battery to a fully charged state from the minimum recommended state-of-charge including necessary cool-down time as specified by the battery manufacturer. The chargers shall be capable of connection to a 480-volt, 3-phase, 60-Hz electrical supply. The chargers shall be equipped with an E-Mon Class 3200 submeter (or approved equal) that:

- measures and displays kWh consumed and real time load in KW within 1% accuracy,
- is capable of RS-485 communications, and,
- records kWh and kVARh delivered, kWh and kVARh received. Data stored in 15-minute intervals for up to 72 days or 5-minute intervals for up to 24 days. Maintains interval data storage in a first-in, first-out format.

Battery chargers shall be configured to automatically apply a charging protocol appropriate to the battery's state-of-charge (SOC), in accordance with the battery manufacturer's recommended practices. Battery charger shall be configured to automatically initiate and sustain charging at any battery state-of-charge if properly connected when so signaled by an external timing circuit or control input. The battery charger shall be configured to automatically terminate the charge on attainment of a full state-of-charge or in the event of hazardous or anomalous conditions. Battery chargers shall be able to apply commissioning, equalization or conditioning charges according to the battery manufacturer's recommended practices when so configured by operation of keyboard or switch panel inputs. The battery charger shall be configured to automatically restart after unintended interruption of a charging episode due to interruption or temporary degradation of electrical service. The battery chargers shall be configured to interface with on-board battery management and interlock systems.



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The actual charge profiles that the subject chargers deliver while charging, commissioning, equalizing, and conditioning the battery systems of the subject buses shall be recorded by the Contractor and shall be submitted to the battery manufacturer for review and approval. Written confirmation from the battery manufacturer attesting to the appropriateness of the delivered charge profile shall be submitted to Procuring Agency concurrent with or prior to delivery of the first bus.

The buses must be immobilized during all charging operations. Upon successful engagement of the charging interface, the bus shall be interlocked such that propulsion is rendered non-tractive and the brakes applied.

Conductive cabling connecting depot and convenience chargers to the bus shall be of fifteen-foot (max) length and shall connect to a receptacle at the front of the bus, curb side. The connectors shall be industry standard and of simple design and heavy-duty construction and shall not be energized except when mated with the bus mounted receptacle. A single bus mounted receptacle shall serve both the depot charging station and the opportunity charging station. The bus mounted receptacle shall be of simple and ergonomic design, of not more than 25 pounds (plug and cord), not more than two plugs, and heavy-duty construction, and shall not be energized except when mated with the charger connectors.

Chargers shall not produce harmonic distortion in excess of 5% THD. Charging circuits shall be isolated from the vehicle chassis such that ground current from the grounded chassis does not exceed 5 mA.

The bid package shall contain a complete description of the charging systems (including anticipated AC energy consumption for buses operating on the specified operating profile, power factors, harmonic distortion, and accuracy of charge parameters).

### **TS 85.1 On route Charging Stations**

If required by proposed battery electric bus service solution, Contractor's charging equipment shall be installed at Charging Stations on the selected routes to enable charging of the bus while exchanging passengers at a scheduled stop(s). Contractor shall provide charging equipment for a minimum of two Charging Stations for each selected route. Each charging station will be limited to charging one electric bus at a time.

Buses shall stop for a maximum of 10 minutes at each Charging Station, including time to engage and disengage the charging interface. Charging Equipment must be sized to recharge the batteries to allow buses to operate on the selected route described in Section TS8 Design Operating Profile. It is assumed that buses will start daily duty cycle at 100% SOC. Operation of the Charging Stations must be programmable to control charging based on user specified time periods. This feature must be available through the data management system.

Termination of the charging process shall be executed either:

- by the bus driver;
- automatically upon reaching a user specified SOC or Maximum Standard Operating SOC.

The Charging Interface may be conductive or inductive. The Charging Interface, which supplies electricity between the charging equipment and the bus, shall be a design that is considered "industry

standard” with respect to the connector to the charging equipment, connector to the bus, connection methods, communications protocol, and data exchanged between the charging equipment and the vehicle. In the event that no industry standard exists, the Agency shall have the right to license the design of the Charging Interface to allow for the Charging Interface to be used with alternate charging equipment and bus manufacturers.

The Charging System must include the following protections and driver alerts: (i) dynamic state of charge of the Energy Storage System, (ii) charge rate, and (iii) fault codes for Charging System failure alerting the operator to the severity of the fault..

The bus must be immobilized during all charging operations and hotel loads must be capable of operation. Upon successful engagement of the charging interface, the bus shall be interlocked such that propulsion is rendered non-tractive and the brakes applied.

Contractor shall provide alternative manual charging capability in the event of failure of the primary charging interface. The bus should be equipped with at least one manual charger port connection suitable for use in emergency situations at the on route Charging Station.

The Charging Station, including the Charging Interface, Charging Equipment, and supporting components and systems shall not interfere with the normal operation of the bus, passengers, pedestrians, or other vehicular traffic. Any equipment associated with the Charging Station must be vandal-resistant and weatherproof.

Charging Station equipment must be compliant with public right-of-way regulations.

The bid package shall contain a complete description of the Charging System including principle of operation, equipment components, component specifications, IP/UL protection classes, industry standard testing protocols and results, environmental requirements, general installation requirements, etc.

#### **TS 85.1.1 Wireless Communication System**

The Charging Stations shall be equipped with a wireless communication system to transmit information on each charge event, including, but not limited to bus ID, charger status, faults, beginning SOC, charge amount, ending SOC, charge duration, energy consumption at the Mains Supply, energy consumption at the charge interface, max power, ambient temperature, etc.

#### **TS 85.2 Depot Charging Stations**

Contractor’s charging equipment shall be installed at the Agency bus depot for overnight charging and conditioning of the batteries. Contractor shall provide charging equipment to allow for simultaneous charging of all buses. Any equipment associated with the Charging Station must be vandal-resistant and weatherproof.

Contractor may vary the size of the Charging Equipment at the Agency bus depot to allow for overnight charging and battery conditioning with a maximum charge time of four hours, per bus. Buses shall be charged to Maximum Standard Operating SOC at a rate that maximizes life of the batteries.

The Charging Interface may be conductive or inductive. The Charging Interface shall be a design that is considered “industry standard” with respect to the connector to the charging equipment, connector to the

bus, connection methods, communications protocol, and data exchanged between the charging equipment and the vehicle. In the event that no industry standard exists, the Agency shall have the right to license the design of the Charging Interface to allow for the Charging Interface to be used with alternate charging equipment and bus manufacturers.

The bus must be immobilized during all charging operations. Upon successful interface to the charging interface, the bus shall be interlocked such that propulsion is rendered non-tractive and the brakes applied.

The depot chargers shall be capable of discharging the on-board energy storage system to facilitate making repairs, preferred means of discharge shall be to return the power to the utility grid.

### **TS 85.2.1 Charge Management System**

The Depot Charging Stations shall be capable of being controlled and scheduled by a centralized charger management system that allows a user to control charging start and stop times, charging SOC, etc. for each charger on the system.

### **TS 85.3 Operating Environment**

Both on route and depot charging station equipment shall be capable of operating continuously without performance or safety degradations in environmental conditions typically found at the Agency location.

For the purposes of these Specifications such environmental conditions shall mean:

- Storage temperature when not in service: -25 to +60 Deg C
- Ambient service temperature: 0 to 40 Deg C
- Maximum service altitude: 1000m above sea level @40 Deg C w/o de-rating
- Relative humidity range: 5 to 95%, no condensation allowed

### **TS 86. Appearance**

If proposed, on route charging equipment will be used on a uniquely branded downtown route. LBT's bus stop configuration is relatively "stylish" employing curved designs and structures. It is essential that charging infrastructure and any related housing operate properly within the chosen aesthetic. During the design phase of the charging station deployment, the contractor shall work with the Agency's architectural and engineering contractor to validate that the Agency's design elements will not interfere with the operation of the charging equipment. Furthermore, the successful proposer shall ensure that any publically visible components of supplied charging equipment are designed to be consistent with the Agency's chosen aesthetics. The Agency will review and approve the final design prior to delivery of contractor's charging equipment.

Exhibit 11 is a photo of an LBT bus in front of an LBT bus stop. The design of publically visible components of the charging station shall be consistent with the theme of the Agency's bus stops.

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**Exhibit 11  
LBT Bus Stop**



## **REQUEST FOR PROPOSAL**



**LONG BEACH PUBLIC TRANSPORTATION COMPANY**  
1963 E. Anaheim Street, Long Beach, CA 90813  
(562) 591-8753

**Battery Electric Bus Project  
RFP 15-001**

## **Section 7**

# **Warranty and Maintenance Requirements**

## **SECTION 7: WARRANTY AND MAINTENANCE REQUIREMENTS**

### **WR 1. Basic Provisions**

#### **WR 1.1 Warranty Requirements**

##### **WR 1.1.1 Contractor Warranty**

Warranties in this document are in addition to any statutory remedies or warranties imposed on the Contractor. Consistent with this requirement, the Contractor warrants and guarantees to the original Agency each complete bus, charging equipment, and specific subsystems and components as indicated in the Warranty Spreadsheet included in CER 06 Pricing. Performance requirements based on design criteria shall not be deemed a warranty item.

The Agency recognizes the proposed propulsion technology may be considered “leading edge” and prefers to conduct the project as a partnership with the Contractor and will collaborate with the Contractor to address product deficiencies and continued product development throughout the project life.

##### **WR 1.1.2 Serial Numbers**

Upon delivery of each bus, the Contractor shall provide a complete electronic list of serialized units installed on each bus to facilitate warranty tracking. The list shall include, but is not limited to:

- Electric Drive Motor (s)
- Energy Storage Module(s)
- Propulsion System Controller / Inverter(s)
- HVAC System, major components
- Steering Axle
- Drive Axle
- Power Steering Unit
- Air Compressor
- Wheelchair Ramp
- Video Surveillance System
- Transmart Radio System
- Charger/Controller/EVSE
- Charger Interface

The Contractor shall provide updated serial numbers resulting from warranty campaigns. The format of the list shall be approved by the Agency prior to delivery of the first production bus.

##### **WR 1.1.3 Extension of Warranty**

If, during the warranty period, repairs or modifications on any bus are made necessary by defective design, materials or workmanship but are not completed due to lack of material or inability to provide the proper repair for thirty (30) calendar days, the applicable warranty period shall be extended by the number of days equal to the delay period.

#### **WR 1.2 Voiding of Warranty**

The warranty shall not apply to the failure of any part or component of the bus that directly results from misuse, negligence, accident or repairs not conducted in accordance with the Contractor-provided maintenance manuals and with workmanship performed by adequately trained personnel in accordance

with recognized standards of the industry. The warranty also shall be void if the Agency fails to conduct normal inspections and scheduled preventive maintenance procedures as recommended in the Contractor's maintenance manuals and if that omission caused the part or component failure. The Agency shall maintain documentation, auditable by the Contractor, verifying service activities in conformance with the Contractor's maintenance manuals.

### **WR 1.3 Exceptions and Additions to Warranty**

The warranty shall not apply to the following items:

- scheduled maintenance items
- normal wear-out items
- items furnished by the Agency

Should the Agency require the use of a specific product and has rejected the Contractor's request for an alternate product, then the standard Supplier warranty for that product shall be the only warranty provided to the Agency. This product will not be eligible under "Fleet Defects," below.

The Contractor shall not be required to provide warranty information for any warranty that is less than or equal to the warranty periods listed.

#### **WR 1.3.1 Pass-Through Warranty**

Should the Contractor elect to not administer warranty claims on certain components and wish to transfer this responsibility to the sub-Suppliers, or to others, the Contractor shall request this waiver.

Contractor shall state in writing that the Agency's warranty reimbursements will not be impacted. The Contractor also shall state in writing any exceptions and reimbursement including all costs incurred in transport of vehicles and/or components. At any time during the warranty period, the Contractor may request approval from the Agency to assign its warranty obligations to others, but only on a case-by-case basis approved in writing by the Agency. Otherwise, the Contractor shall be solely responsible for the administration of the warranty as specified. Warranty administration by others does not eliminate the warranty liability and responsibility of the Contractor.

#### **WR 1.3.2 Superior Warranty**

The Contractor shall pass on to the Agency any warranty offered by a component Supplier that is superior to that required herein. The Contractor shall provide a list to the Agency noting the conditions and limitations of the Superior Warranty not later than the start of production. The Superior Warranty shall not be administered by the Contractor.

### **WR 1.4 Fleet Defects**

#### **WR 1.4.1 Occurrence and Remedy**

A Fleet Defect is defined as cumulative failures of the greater of twenty-five (25) percent of the same components in the same or similar application or four (4) or more buses where such items are covered by warranty. A Fleet Defect shall apply only to the base warranty period in sections entitled "Complete Bus," "Propulsion System" and "Major Subsystems." When a Fleet Defect is declared, the remaining warranty on that item/component stops. The warranty period does not restart until the Fleet Defect is corrected.

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For the purpose of Fleet Defects, each option order shall be treated as a separate bus fleet. In addition, should there be a change in a major component within either the base order or an option order, the buses containing the new major component shall become a separate bus fleet for the purposes of Fleet Defects.

The Contractor shall correct a Fleet Defect under the warranty provisions defined in “Repair Procedures.” After correcting the Defect, the Agency and the Contractor shall mutually agree to and the Contractor shall promptly undertake and complete a work program reasonably designed to prevent the occurrence of the same Defect in all other buses and spare parts purchased under this Contract. Where the specific Defect can be solely attributed to particular identifiable part(s), the work program shall include redesign and/or replacement of only the defectively designed and/or manufactured part(s). In all other cases, the work program shall include inspection and/or correction of all of the buses in the fleet via a mutually agreed-to arrangement. The Contractor shall update, as necessary, technical support information (parts, service and operator’s manuals) due to changes resulting from warranty repairs. The Agency may immediately declare a Defect in design resulting in a safety hazard to be a Fleet Defect. The Contractor shall be responsible to furnish, install and replace all defective units.

#### **WR 1.4.2 Exceptions to Fleet Defect Provisions**

The Fleet Defect warranty provisions shall not apply to Agency-supplied items, such as radios, fare collection equipment, communication systems and tires.

### **WR 2. Repair Procedures**

#### **WR 2.1 Repair Performance**

The Contractor is responsible for all warranty-covered repair Work. To the extent practicable, the Agency will allow the Contractor or its designated representative to perform such Work. At its discretion, the Agency may perform such Work if it determines it needs to do so based on transit service or other requirements. Such Work shall be reimbursed by the Contractor.

#### **WR 2.2 Repairs by the Contractor**

If the Agency detects a Defect within the warranty periods defined in this section, it shall, within thirty (30) days, notify the Contractor’s designated representative. The Contractor or its designated representative shall, if requested, begin Work on warranty-covered repairs within five calendar days after receiving notification of a Defect from the Agency. The Agency shall make the bus available to complete repairs timely with the Contractor’s repair schedule.

The Contractor shall provide at its own expense all spare parts, tools and space required to complete repairs. At the Agency’s option, the Contractor may be required to remove the bus from the Agency’s property while repairs are being affected. If the bus is removed from the Agency’s property, repair procedures must be diligently pursued by the Contractor’s representative.

#### **WR 2.3 Repairs by the Agency**

##### **WR 2.3.1 Parts Used**

If the Agency performs the warranty-covered repairs, it shall correct or repair the Defect and any Related Defects utilizing parts supplied by the Contractor specifically for this repair. At its discretion, the Agency may use Contractor-specified parts available from its own stock if deemed in its best interests.



### **WR 2.3.2 Contractor-Supplied Parts**

The Agency may require that the Contractor supply parts for warranty-covered repairs being performed by the Agency. Those parts may be remanufactured but shall have the same form, fit and function, and warranty. The parts shall be shipped prepaid to the Agency from any source selected by the Contractor within fourteen (14) days of receipt of the request for said parts and shall not be subject to an Agency handling charge.

### **WR 2.3.3 Defective Component Return**

The Contractor may request that parts covered by the warranty be returned to the manufacturing plant. The freight costs for this action shall be paid by the Contractor. Materials should be returned in accordance with the procedures outlined in "Warranty Processing Procedures."

### **WR 2.3.4 Failure Analysis**

The Contractor shall, upon specific request of the Agency, provide a failure analysis of Fleet Defect or safety-related parts, or major components, removed from buses under the terms of the warranty that could affect fleet operation. Such reports shall be delivered within 60 days of the receipt of failed parts.

### **WR 2.3.5 Reimbursement for Labor and Other Related Costs**

The Agency shall be reimbursed by the Contractor for labor. The amount shall be determined by the Agency for a qualified mechanic at a straight time wage rate of \$75 per hour, which includes fringe benefits and overhead adjusted for the Agency's most recently published rate in effect at the time the Work is performed, plus the cost of towing the bus if such action was necessary and if the bus was in the normal service area. These wage and fringe benefit rates shall not exceed the rates in effect in the Agency's service garage at the time the Defect correction is made.

### **WR 2.3.6 Reimbursement for Parts**

The Agency shall be reimbursed by the Contractor for defective parts and for parts that must be replaced to correct the Defect. The reimbursement shall be at the current price at the time of repair and shall include taxes where applicable, plus fifteen (15) percent handling costs. Handling costs shall not be paid if part is supplied by the Contractor and shipped to the Agency.

### **WR 2.3.7 Reimbursement Requirements**

The Contractor shall respond to the warranty claim with an accept/reject decision including necessary failure analysis no later than sixty (60) days after the Agency submits the claim and defective part(s), when requested. Reimbursement for all accepted claims shall occur no later than sixty (60) days from the date of acceptance of a valid claim. The Agency may dispute rejected claims or claims for which the Contractor did not reimburse the full amount. The parties agree to review disputed warranty claims during the following quarter to reach an equitable decision to permit the disputed claim to be resolved and closed. The parties also agree to review all claims at least once per quarter throughout the entire warranty period to ensure that open claims are being tracked and properly dispositioned.

## **WR 2.4 Warranty after Replacement/Repairs**

If any component, unit or subsystem is repaired, rebuilt or replaced by the Contractor or by the Agency with the concurrence of the Contractor, the component, unit or subsystem shall have the unexpired warranty period of the original. Repairs shall not be warranted if the Contractor-provided or authorized

parts are not used for the repair, unless the Contractor has failed to respond within five days, in accordance with “Repairs by the Contractor.”

If an item is declared to be a Fleet Defect, the warranty stops with the declaration of the Fleet Defect. Once the Fleet Defect is corrected, the item(s) shall have three (3) months or remaining time and/or miles of the original warranty, whichever is greater. This remaining warranty period shall begin on the repair/replacement date for corrected items on each bus if the repairs are completed by the Contractor or on the date the Contractor provides all parts to the Agency.

#### **WR 2.4.1 Warranty Processing Procedures**

The following list represents requirements by the Contractor to the Agency for processing warranty claims. One failure per bus per claim is allowed.

- Unique ID number (bus number and VIN or serial #)
- total vehicle life mileage at time of repair
- date of failure/repair
- acceptance/in-service date
- Contractor part number and description
- component serial number
- description of failure
- all costs associated with each failure/repair (invoices may be required for third-party costs):
  - towing
  - road calls
  - labor
  - materials
  - parts
  - handling
  - troubleshooting time

#### **WR 2.5 Forms**

The Agency’s forms will be accepted by the Contractor if all of the above information is included. Electronic submittal may be used if available between the Contractor and the Agency.

#### **WR 2.6 Return of Parts**

When returning defective parts to the Contractor, the Agency shall tag each part with the following:

- bus number and VIN
- claim number
- part number
- serial number (if available)

#### **WR 2.7 Timeframe**

Each claim must be submitted no more than thirty (30) days from the date of failure and/or repair, whichever is later. All defective parts must be returned to the Contractor, when requested, no more than forty-five (45) days from date of repair.

## **WR 2.8 Reimbursements**

Reimbursements are to be transmitted to the following address.

Long Beach Transit  
P. O. Box 731  
Long Beach, CA 90801-0731  
Attn: Accts Receivable / Warranty

## **WR 3. Battery Warranty and Lease Option**

### **WR 3.1 Battery Definitions**

**Capacity (electrical energy storage device).** Two levels of capacity shall be defined, gross and useable. Gross Capacity shall be the capacity energy (kWh) of the entire battery pack and shall include usable, unusable, and/or reserve capacity energy. Useable Capacity shall be the capacity energy between the design operating range within the battery management system for normal operation.

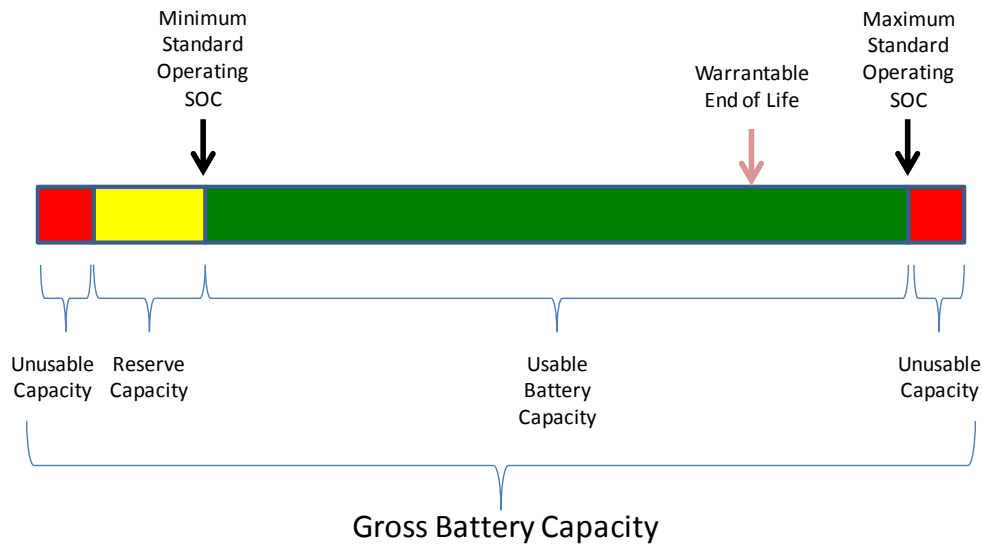
**Maximum Standard Operating State of Charge:** The maximum design operating state of charge as recommended by the propulsion system integrator and battery manufacturer.

**Minimum Standard Operating State of Charge:** The minimum design operating state of charge as specified by the propulsion system integrator and battery manufacturer.

**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. An absolute SOC is based on total battery capacity at the beginning of useful life. A relative SOC is based on total degraded capacity at the time of measurement. The actual relationship between the SOC and energy stored expressed as a percentage shall be linear.

**Usable Battery Capacity.** Usable battery capacity is measured in kWhr and would be the energy available for normal operations. Usable Battery Capacity would be the usable energy from the ESD as managed through the BMS, assumed to be less than the gross capacity. It is calculated based on a useful range of something above 0% SOC and something less than 100% SOC, i.e., as an example, if the range was between 10% and 90% SOC, then the usable battery capacity would be 80% of gross battery capacity.

**Warrantable End of Life (WEOL):** WEOL is a measure of battery degradation determined as the point at which the batteries can no longer provide the energy or power required to meet the design operating profile. It is expressed as a percentage of remaining battery capacity as compared to gross capacity at the beginning of useful life. For purposes of this specification, WEOL shall be a measure of the useful and intended life of the energy storage device. This measure shall be a percentage of remaining useful capacity based on degradation from the beginning capacity, i.e. kWhr and is used in the overall calculation of mileage range. WEOL shall be used as a condition for battery replacement and to potentially initiate warranty claims.



### **WR 3.2 Battery Degradation**

The Contractor shall provide a plan for replacing or reconditioning batteries if it has been determined that the batteries have degraded beyond their Warrantable End of Life (WEOL). The Contractor must clearly define WEOL and the method by which battery capacity is measured to determine WEOL. The Contractor must define the capacity to which the entire battery pack is restored such that it will remain above the WEOL for the remainder of the warranty.

### **WR 3.3 Battery End of Life**

The Contractor shall provide a plan for battery packs and/or cells that are removed from service over the 12 year life of the bus. The plan may include, but is not limited, recycling, repurposing, etc.

### **WR 3.4 Battery Cycle and Safety Testing**

Proposals shall include complete descriptions of all life-cycle testing procedures used to validate the life of batteries used this application at the proposed charging rates, charge durations, and expected ambient temperatures and operating profiles. Proposers shall include documented results of life cycle testing. Proposers shall include certification of battery life cycle testing by independent testing agency.

Proposals shall include complete descriptions of all safety standards followed in the design and manufacture of the battery system, safety testing procedures used to validate the safety of battery operation in this application, and documented results of safety testing to confirm that standards have been met. Proposers shall include certification of battery safety testing by independent testing agency.

### **WR 3.5 Battery Lease Option**

The Proposal shall include an option to battery ownership and use other than being purchased as part of the bus, i.e. a “lease” or other alternative. This option (s) shall be described in detail and accompanied by an itemization of cost, i.e. \$\$ per mile, \$\$ per month, etc. The lease terms should define the minimum

requirements of replacing the battery pack that is in alignment to the warrantable end of life. Two possible considerations could include:

The first obvious option that could be considered is separating the costs of the high-voltage battery pack from the cost of the bus and providing a lease cost during the life of the bus. A second option that could be considered is providing a monthly lease cost to the Agency beyond the fixed warranty period offered by the proposer. This would be more like a post-warranty battery assurance program offering options to exchange entire packs and / or partial cells.

## **WR 4. Bus Maintenance Procedures**

### **WR 4.1 Preventative and Scheduled Maintenance**

The Contractor shall work with the Agency to collaboratively ensure that a maintenance program is created that includes all sub-component manufacturer requirements to include both preventative and predictive maintenance tasks. This task is specifically called out as the Agency understands with new technology there is a need to constantly monitor and change the maintenance program based on its performance. These tasks shall be identified to help reduce operation costs and extending the useful life of the vehicles, while improving safety for employees and the riding public.

Maintenance tasks shall include scheduled instructions that:

- aim at the failure process of individual sub-components,
- are specific on time and detailed,
- and should include specifications or tolerances

### **WR 4.2 Conditional Assessment**

The Contractor shall be responsible for conducting a conditional assessment of the buses at the end of one year and three years of service life as called out in TS 5.4.2. A condition assessment is the process of inspecting, analyzing or testing the assets to collect data that is used to measure condition and performance. The condition assessment process involves a general inspection of all buses delivered, review of past performance/repair records, testing or analysis that evaluate an asset's visual and physical conditions (for example, structural issues, faulty components). Additionally, we look toward the proposer to assess our internal procedures, training, inventory etc., as outlined in TS5.4.2.

This process addresses risk, ensures that the asset can meet its level-of-service requirements, and provides information from which assets can be managed across their lifecycles. The condition assessment will measure the anticipated condition of the asset, relative to its useful life. Condition assessment and performance monitoring may lead to the following activities:

- Address immediate issues by completing reactive maintenance activities.
- Proactively identify any predictive and preventive maintenance or rehabilitation necessary, including modifying existing practices.
- Collect condition and performance data for scenario evaluation and performance modeling.
- Consider any engineering changes to retrofit existing equipment or improve future models of said equipment.

There are varying degrees of consensus and industry standards of practice for inspecting and monitoring condition. The Agency is requesting that the contractor agree to collaboratively select an independent third party to design and implement a plan to perform the condition assessment that includes active participation by the contractor and the Agency. The final report will be shared with the contractor and the Agency.

## **WR 5. Charger Maintenance Procedures**

### **WR 5.1 Preventative and Scheduled Maintenance**

The Contractor shall provide a three (3) year service / maintenance contract for the routine maintenance and repair of the charging equipment (both en -route and depot charges). This three year period shall correspond to the warranty period in start and end date as outlined in section WR 1.1.6.1.

- This service contract shall include all maintenance required or recommended by the equipment and component manufacturers and all work that is normally provided by current industry best practice.
- A written maintenance plan and training must be provided to the Agency prior to acceptance. The plan shall include at a minimum a 52 week preventative and scheduled maintenance and Long-term capital rehab / replacement plan for the life of the system.
- The Agency will use its own staff to provide weekly inspections as required to check fluids, drain filters and perform other similar light inspection and service as documented in the maintenance plan.
- Contractor shall visit the site not less frequently than once per month to perform inspections and maintenance as required. These visits must be coordinated with the Agency to ensure that there are buses that can be charged to allow operational testing.
- Contractor shall maintain a clean facility and shall dispose off-site of all waste material in an environmentally responsible and legal manner, being compliant with the Agency's Environmental Sustainability Management System (ESMS). Documentation of proper disposal shall be provided to the Agency. This material will include but not be limited to oil, used filters, desiccant, and dryer and filter condensate.
- Contractor shall maintain detailed records of all inspections, calibrations, tests, maintenance and repairs. Information shall be provided to the Agency on a timely basis for storage within the Agency's Enterprise Asset Management and Work Order System (Ellipse for LBT).

### **WR 5.2 Maintenance Materials and Licenses**

- The Contractor shall supply all parts and consumables included within the cost of the contract.
- The Contractor shall maintain an inventory of all required parts including consumables and major repair parts during the terms of this contract.
- The Agency will pay the cost of all gas, electric power, and communications to the station.
- The Agency will provide insurance on the property. Contractor will provide other insurance as indicated elsewhere in this document.
- Contractor shall keep all operating permits current. Contractor shall at their own expense provide any documentation and/or testing required and pay any fees required for these permits.
- Contractor shall pay any upgrade or annual license fees as required to keep all copies of software current.

### **WR 5.3 Unscheduled Repairs**

The Contractor shall be responsible for maintaining and keeping the system operational 24 hours a day 7 days a week. The contractor is responsible for monitoring the performance of the system and be automatically notified when the system requires maintenance or becomes non-operational. Any non-emergency repairs can be scheduled as needed.

- The Contractor shall supply 60 minute call back and four hour on site response time (from time of a fault shutdown being transmitted either electronically or by phone whichever occurs first). At no time shall the equipment deliver less than 75 percent of firm capacity for more than 12 hours.
- If the contractor does not respond within the 1 to 4 hours, the Agency may have the problem repaired at their discretion and charge the contractor back the repair costs with a 15% markup against the monthly service billing.
- Callouts that are the result of Agency actions shall be charged to the Agency at regular time rates as proposed herein with no additional charges for overtime, premium, time, equipment or mileage charges.
- Cost of maintenance program shall be invoiced monthly.

### **WR 5.4 Performance Reporting**

The Contractor shall be responsible for monitoring the performance of the EVSE and reporting the condition to the Agency on a monthly basis. The report should include any recommendations for improvements that improve the charging of the buses or reduce the overall operational costs during the duration of the contract.

### **WR 5.5 Conditional Assessment**

The Contractor shall be responsible for conducting a conditional assessment of the charging equipment at the end of one year and three years of service life as called out in TS 5.4.2. A condition assessment is the process of inspecting, analyzing or testing the assets to collect data that is used to measure condition and performance. The condition assessment process involves a review of past performance/repair records, inspections, testing or analysis that evaluate an asset's visual and physical conditions (for example, structural issues, faulty components).

This process addresses risk, ensures that the asset can meet its level-of-service requirements, and provides information from which assets can be managed across their lifecycles. The condition assessment will measure the anticipated condition of the asset, relative to its useful life. Condition assessment and performance monitoring may lead to the following activities:

- Address immediate issues by completing reactive maintenance activities.
- Proactively identify any predictive and preventive maintenance or rehabilitation necessary, including modifying existing practices.
- Collect condition and performance data for scenario evaluation and performance modeling.
- Consider and engineering changes to retrofit existing equipment or improve future models of said equipment.

There are varying degrees of consensus and industry standards of practice for inspecting and monitoring condition. The Agency is requesting that the contractor agree to collaboratively select an independent third party to design and implement a plan to perform the condition assessment that includes active

participation by the contractor and the Agency. The final report will be shared with the contractor and the Agency.

### **WR 5.6 Three – Three Year Maintenance Options**

The Proposal shall include an option to extend this three year maintenance program for three, three-year options, beginning year four (4) through end of twelve (12).

- All terms shall remain the same as the three year program,
- All parts that fail or are no longer covered by Warranty and shall be included in the cost of the contract such that the Agency will have no costs beyond the maintenance program charge.
- Any scheduled major component replacements must be identified in a separate line item in the year of occurrence and only paid out upon the replacement.



## **REQUEST FOR PROPOSAL**



**LONG BEACH PUBLIC TRANSPORTATION COMPANY**  
1963 E. Anaheim Street, Long Beach, CA 90813  
(562) 591-8753

**Battery Electric Bus Project  
RFP 15-001**

## **Section 8**

# **Quality Assurance**

## SECTION 8: QUALITY ASSURANCE

### QA 1. Contractor's In-Plant Quality Assurance Requirements

#### QA 1.1 Quality Assurance Organization

##### QA 1.1.1 Organization Establishment

The Contractor shall establish and maintain an effective in-plant quality assurance organization. It shall be a specifically defined organization and should be directly responsible to the Contractor's top management.

##### QA 1.1.2 Control

The quality assurance organization shall exercise quality control over all phases of production, from initiation of design through manufacture and preparation for delivery. The organization shall also control the quality of supplied articles.

##### QA 1.1.3 Authority and Responsibility

The quality assurance organization shall have the authority and responsibility for reliability, quality control, inspection planning, establishment of the quality control system, and acceptance/rejection of materials and manufactured articles in the production of the transit buses.

#### QA 1.2 Quality Assurance Organization Functions

##### QA 1.2.1 Minimum Functions

The quality assurance organization shall include the following minimum functions:

- **Work instructions:** The quality assurance organization shall verify inspection operation instructions to ascertain that the manufactured product meets all prescribed requirements.
- **Records maintenance:** The quality assurance organization shall maintain and use records and data essential to the effective operation of its program. These records and data shall be available for review by the resident inspectors. Inspection and test records for this procurement shall be available for a minimum of one year after inspections and tests are completed.
- **Corrective action:** The quality assurance organization shall detect and promptly ensure correction of any conditions that may result in the production of defective transit buses. These conditions may occur in designs, purchases, manufacture, tests or operations that culminate in defective supplies, services, facilities, technical data or standards.

##### QA 1.2.2 Basic Standards and Facilities

The following standards and facilities shall be basic in the quality assurance process:

- **Configuration control:** The Contractor shall maintain drawings, assembly procedures, and other documentation that completely describe a qualified bus that meets all of the options and special requirements of this procurement. The quality assurance organization shall verify that each transit bus is manufactured in accordance with these controlled drawings, procedures, and documentation.
- **Measuring and testing facilities:** The Contractor shall provide and maintain the necessary gauges and other measuring and testing devices for use by the quality assurance organization to verify that the buses conform to all specification requirements. These devices shall be calibrated at

established periods against certified measurement standards that have known, valid relationships to national standards.

- **Production tooling as media of inspection:** When production jigs, fixtures, tooling masters, templates, patterns, and other devices are used as media of inspection, they shall be proved for accuracy at formally established intervals and adjusted, replaced, or repaired as required to maintain quality.
- **Equipment use by resident inspectors:** The Contractor's gauges and other measuring and testing devices shall be made available for use by the resident inspectors to verify that the buses conform to all specification requirements. If necessary, the Contractor's personnel shall be made available to operate the devices and to verify their condition and accuracy.

### **QA 1.2.3 Maintenance of Control**

The Contractor shall maintain quality control of purchases:

- **Supplier control:** The Contractor shall require that each Supplier maintains a quality control program for the services and supplies that it provides. The Contractor's quality assurance organization shall inspect and test materials provided by Suppliers for conformance to specification requirements. Materials that have been inspected, tested, and approved shall be identified as acceptable to the point of use in the manufacturing or assembly processes. Controls shall be established to prevent inadvertent use of nonconforming materials.
- **Purchasing data:** The Contractor shall verify that all applicable specification requirements are properly included or referenced in purchase orders of articles to be used on transit buses.

### **QA 1.2.4 Manufacturing Control**

- **Controlled conditions:** The Contractor shall ensure that all basic production operations, as well as all other processing and fabricating, are performed under controlled conditions. Establishment of these controlled conditions shall be based on the documented Work instructions, adequate production equipment and special working environments if necessary.
- **Completed items:** A system for final inspection and test of completed transit buses shall be provided by the quality assurance organization. It shall measure the overall quality of each completed bus.
- **Nonconforming materials:** The quality assurance organization shall monitor the Contractor's system for controlling nonconforming materials. The system shall include procedures for identification, segregation and disposition.
- **Statistical techniques:** Statistical analysis, tests and other quality control procedures may be used when appropriate in the quality assurance processes.
- **Inspection status:** A system shall be maintained by the quality assurance organization for identifying the inspection status of components and completed transit buses. Identification may include cards, tags or other normal quality control devices.

### **QA 1.2.5 Inspection System**

The quality assurance organization shall establish, maintain and periodically audit a fully documented inspection system. The system shall prescribe inspection and test of materials, Work in process and completed articles. As a minimum, it shall include the following controls:

- **Inspection personnel:** Sufficient trained inspectors shall be used to ensure that all materials, components and assemblies are inspected for conformance with the qualified bus design.

- **Inspection records:** Acceptance, rework or rejection identification shall be attached to inspected articles. Articles that have been accepted as a result of approved materials review actions shall be identified. Articles that have been reworked to specified drawing configurations shall not require special identification. Articles rejected as unsuitable or scrap shall be plainly marked and controlled to prevent installation on the bus. Articles that become obsolete as a result of engineering changes or other actions shall be controlled to prevent unauthorized assembly or installation. Unusable articles shall be isolated and then scrapped. Discrepancies noted by the Contractor or resident inspectors during assembly shall be entered by the inspection personnel on a record that accompanies the major component, subassembly, assembly, or bus from start of assembly through final inspection. Actions shall be taken to correct discrepancies or deficiencies in the manufacturing processes, procedures or other conditions that cause articles to be in nonconformity with the requirements of the Contract specifications. The inspection personnel shall verify the corrective actions and mark the discrepancy record. If discrepancies cannot be corrected by replacing the nonconforming materials, then the Agency shall approve the modification, repair or method of correction to the extent that the Contract specifications are affected.
- **Quality assurance audits:** The quality assurance organization shall establish and maintain a quality control audit program. Records of this program shall be subject to review by the Agency.

## **QA 2. Inspection**

### **QA 2.1 Inspection Stations**

Inspection stations shall be at the best locations to provide for the Work content and characteristics to be inspected. Stations shall provide the facilities and equipment to inspect structural, electrical, hydraulic and other components and assemblies for compliance with the design requirements.

Stations shall also be at the best locations to inspect or test characteristics before they are concealed by subsequent fabrication or assembly operations. These locations shall minimally include underbody structure completion, body framing completion, body prior to paint preparation, water test, engine installation completion, underbody dress-up and completion, bus prior to final paint touchup, bus prior to road test and bus final road test completion.

### **QA 2.2 Resident Inspectors**

#### **QA 2.2.1 Resident Inspector's Role**

The Agency shall be represented at the Contractor's plant by resident inspectors, as required by FTA. Resident inspectors may be Agency employees or outside contractors. The Agency shall provide the identity of each inspector and shall also identify their level of authority in writing. They shall monitor, in the Contractor's plant, the manufacture of transit buses built under the procurement. The presence of these resident inspectors in the plant shall not relieve the Contractor of its responsibility to meet all of the requirements of this procurement. The Agency shall designate a primary resident inspector, whose duties and responsibilities are delineated in "Pre-Production Meetings," "Authority" and "Pre-Delivery Tests," below. Contractor and resident inspector relations shall be governed by the guidelines included as Attachment A to this "Section 8: Quality Assurance."

### **QA 2.2.2 Pre-Production Meetings**

The primary resident inspector may participate in design review and pre-production meetings with the Agency. At these meetings, the configuration of the buses and the manufacturing processes shall be finalized, and all Contract documentation provided to the inspector.

No less than thirty (30) days prior to the beginning of bus manufacture, the primary resident inspector may meet with the Contractor's quality assurance manager and may conduct a pre-production audit meeting. They shall review the inspection procedures and finalize inspection checklists. The resident inspectors may begin monitoring bus construction activities two weeks prior to the start of bus fabrication.

### **QA 2.2.3 Authority**

Records and data maintained by the quality assurance organization shall be available for review by the resident inspectors. Inspection and test records for this procurement shall be available for a minimum of one year after inspections and tests are completed.

The Contractor's gauges and other measuring and testing devices shall be made available for use by the resident inspectors to verify that the buses conform to all specification requirements. If necessary, the Contractor's personnel shall be made available to operate the devices and to verify their condition and accuracy.

Discrepancies noted by the resident inspector during assembly shall be entered by the Contractor's inspection personnel on a record that accompanies the major component, subassembly, assembly or bus from start of assembly through final inspection. Actions shall be taken to correct discrepancies or deficiencies in the manufacturing processes, procedures or other conditions that cause articles to be in nonconformity with the requirements of the Contract specifications. The inspection personnel shall verify the corrective actions and mark the discrepancy record. If discrepancies cannot be corrected by replacing the nonconforming materials, the Agency shall approve the modification, repair or method of correction to the extent that the Contract specifications are affected.

The primary resident inspector shall remain in the Contractor's plant for the duration of bus assembly Work under this Contract. Only the primary resident inspector or designee shall be authorized to release the buses for delivery. The resident inspectors shall be authorized to approve the pre-delivery acceptance tests. Upon request to the quality assurance supervisors, the resident inspectors shall have access to the Contractor's quality assurance files related to this procurement. These files shall include drawings, assembly procedures, material standards, parts lists, inspection processing and reports, and records of Defects.

### **QA 2.2.4 Support Provisions**

The Contractor shall provide office space for the resident inspectors in close proximity to the final assembly area. This office space shall be equipped with desks, outside and interplant telephones, Internet access, file cabinet and chairs.

### **QA 2.2.5 Compliance with Safety Requirements**

At the time of the Pre-Production meeting, the Contractor shall provide all safety and other operational restrictions that govern the Contractor's facilities. These issues will be discussed and the parties will agree

which rules/restrictions will govern the Agency's inspector(s) and any other Agency representatives during the course of the Contract.

### **QA 3. Acceptance Tests**

#### **QA 3.1 Responsibility**

Fully documented tests shall be conducted on each production bus following manufacture to determine its acceptance to the Agency. These acceptance tests shall include pre-delivery inspections and testing by the Contractor and inspections and testing by the Agency after the buses have been delivered.

#### **QA 3.2 Pre-Delivery Tests**

The Contractor shall conduct acceptance tests at its plant on each bus following completion of manufacture and before delivery to the Agency. These pre-delivery tests shall include visual and measured inspections, as well as testing the total bus operation. The tests shall be conducted and documented in accordance with written test plans approved by the Agency.

Additional tests may be conducted at the Contractor's discretion to ensure that the completed buses have attained the required quality and have met the requirements in Section 6: Technical Specifications. The Agency may, prior to commencement of production, demand that the Contractor demonstrate compliance with any requirement in that section if there is evidence that prior tests have been invalidated by the Contractor's change of Supplier or change in manufacturing process. Such demonstration shall be by actual test, or by supplying a report of a previously performed test on similar or like components and configuration. Any additional testing shall be recorded on appropriate test forms provided by the Contractor and shall be conducted before acceptance of the bus.

The pre-delivery tests shall be scheduled and conducted with thirty (30) days notice so that they may be witnessed by the resident inspectors, who may accept or reject the results of the tests. The results of pre-delivery tests, and any other tests, shall be filed with the assembly inspection records for each bus. The underfloor equipment shall be available for inspection by the resident inspectors, using a pit or bus hoist provided by the Contractor. A hoist, scaffold or elevated platform shall be provided by the Contractor to easily and safely inspect bus roofs. Delivery of each bus shall require written authorization of the primary resident inspector. Authorization forms for the release of each bus for delivery shall be provided by the Contractor. An executed copy of the authorization shall accompany the delivery of each bus.

##### **QA 3.2.1 Visual and Measured Inspections**

Visual and measured inspections shall be conducted with the bus in a static condition. The purpose of the inspection testing includes verification of overall dimension and weight requirements, that required components are included and are ready for operation, and that components and subsystems designed to operate with the bus in a static condition do function as designed.

##### **QA 3.2.2 Total Bus Operation**

Total bus operation shall be evaluated during road tests. The purpose of the road tests is to observe and verify the operation of the bus as a system and to verify the functional operation of the subsystems that can be operated only while the bus is in motion.

Each bus shall be driven for a minimum of fifteen (15) miles during the road tests. If requested, computerized diagnostic printouts showing the performance of each bus shall be produced and provided

to the Agency. Observed Defects shall be recorded on the test forms. The bus shall be retested when Defects are corrected and adjustments are made. This process shall continue until Defects or required adjustments are no longer detected.

#### **QA 4. Agency-Specific Requirements**

The subject acquisition is for the purpose of a system, to include buses and a charging infrastructure, consequently this Quality Assurance guideline shall apply to deliverables in both areas. This project is assumed to be a sequence of steps and milestones such that each is accompanied by producing products, testing and validation.

##### **QA 4.1 First Article**

Contractor shall produce and deliver one bus, referred to as the first article bus, prior to starting final assembly on all remaining buses, such that the first article bus can be viewed by Agency and a route performance and actual duty cycle can be validated. At a minimum, the first article bus shall be delivered with a temporary provision to charge the bus at the depot to validate charging capability, connectivity, and energy and operational profile. Agency will test the bus for a minimum of 30 days after acceptance. The contractor cannot commence production of next buses until they receive notice from Agency.

##### **QA 4.2 Depot Charging Station**

Contractor shall produce and demonstrate charging equipment that is proposed for use at the depot charging station. Demonstration's shall take place at the bus Contractor's facility and will include all modes of charging connectivity with the bus (i.e., primary charge interface, manual charge interface, etc.). The Contractor shall validate connect/disconnect times, charging times, rates, etc.

##### **QA 4.3 On route Charging Equipment**

If on route charging stations are proposed as part of the Contractor's solution, Contractor shall produce and demonstrate charging equipment that is proposed for use at the on route charging stations. Demonstration's shall take place at the bus Contractor's facility and will include all modes of charging connectivity with the bus (i.e., primary charge interface, manual charge interface, etc.). The Contractor shall validate connect/disconnect times, charging times, rates, etc.

## **Attachment A: New Bus Manufacturing Inspection Guidelines**

### **Pre-production meeting**

#### **Responsibilities**

##### **Agency**

- Provides conformed copy of technical requirements.
- Recommended staff to be involved may include the following:
  - Project manager
  - Technical engineer
  - Contract administrator
  - Quality assurance administrator
  - Warranty administrator
- Process for inspector's role (to deal with agency) for negotiated changes after freeze date.
- Contractual requirements:
  - Milestones
  - Documentation
  - Title requirements
  - Deliverables
  - Payments
  - Reliability tracking

##### **Contractor**

- Identifies any open issues.
- Recommended staff to be involved may include the following:
  - Project manager
  - Technical engineer(s)
  - Contract administrator
  - Quality assurance administrator
  - Warranty administrator
- Production flow (buses/week, shifts).
- Delivery schedule and offsite component build-up schedule.
- Bus QA documentation (including supplier application approvals and/or any certifications required for the specific production).
- Communication flow/decision making.

##### **Inspector**

- Agree on decisions inspectors can and cannot make.
- Primary contact for problems, etc.
- Production flow process (description of manufacturing by station).
- Factory hours (manage inspection schedule based on production hours).
- Plant rules.
- Safety requirements.
- Orientation requirements.
- Work environment.
- Inspector's office space (per contract).



**Long Beach Public Transportation Company**  
**Request for Proposal**  
**RFP 15-001**

**NOTE:** As a result of this meeting, documentation should be produced detailing final production requirements and the planned configuration of the bus.

### **Build schedule**

The bus Contractor's contract administrator shall supply a fleet build production schedule based on the dates in the Notice to Proceed, and a description of the Contractor's schedule for plant operations.

The production schedule should contain specific milestone dates, such as:

- First Article vehicle on production line (date on which any work will begin);
- First Article vehicle off production line;
- First Article vehicle through Contractor's quality assurance inspections;
- First Article vehicle shipped to the agency;
- Start of production of remaining vehicles
- Last vehicle on production line;
- Last vehicle off production line; and
- Last vehicle through Contractor's quality assurance inspections;
- Last vehicle shipped to the agency.

### **Plant tour (if meeting at OEM's location)**

The agency will review the entire process from start to finish and review the work completed at each line station, including quality control measures

### **Bus production**

The contractor shall conduct acceptance tests at its plant on each bus following completion of manufacture and before delivery to the agency. These pre-delivery tests shall include visual and measured inspections, as well as testing the total bus operation. Pre-delivery tests shall include a system integration test that includes charging the battery system using the same type of charging equipment and interfaces that will be installed at the Agency's on route (if applicable) and depot charging stations. The tests shall be conducted and documented in accordance with written test plans approved by the agency. The underfloor equipment shall be available for inspection by the resident inspectors, using a pit or bus hoist provided by the contractor. A hoist, scaffold or elevated platform shall be provided by the contractor to easily and safely inspect bus roofs. Delivery of each bus shall require written authorization of the primary resident inspector. Authorization forms for the release of each bus for delivery shall be provided by the contractor. An executed copy of the authorization shall accompany the delivery of each bus.

Additional tests may be conducted at the agency's discretion to ensure that the completed buses have attained the required quality and have met the requirements in the Agency's Battery Electric Bus RFP," Section 6: Technical Specifications. The agency may, prior to commencement of production, demand that the contractor demonstrate compliance with any requirement in that section if there is evidence that prior tests have been invalidated by the contractor's change of supplier or change in manufacturing process. Such demonstration shall be by actual test, or by supplying a report of a previously performed test on similar or like components and configuration. Any additional testing shall be recorded on appropriate test forms provided by the contractor and shall be conducted before acceptance of the bus.

The pre-delivery tests shall be scheduled and conducted with 30 days' notice so that they may be witnessed by the resident inspectors, who may accept or reject the results of the tests. The results of pre-delivery tests, and any other tests, shall be filed with the assembly inspection records for each bus.

### **Visual and measured inspections**

Visual and measured inspections shall be conducted with the bus in a static condition. The purpose of the inspection testing includes verification of overall dimension and weight requirements, that required components are included and are ready for operation, and that components and subsystems designed to operate with the bus in a static condition do function as designed.

### **Total bus operation**

Total bus operation shall be evaluated during road tests. The purpose of the road tests is to observe and verify the operation of the bus as a system and to verify the functional operation of the subsystems that can be operated only while the bus is in motion.

Each bus shall be driven for a minimum of 100 miles during the road tests. If requested, computerized diagnostic printouts showing the performance of each bus shall be produced and provided to the agency. Observed defects shall be recorded on the test forms. The bus shall be retested when defects are corrected and adjustments are made. This process shall continue until defects or required adjustments are no longer detected.

### **Post-delivery tests**

The agency shall conduct acceptance tests on each bus. These tests shall be completed within 15 days after bus delivery and shall be conducted in accordance with the agency's written test plans. The purpose of these tests is to identify defects that have become apparent between the time of bus release and delivery to the agency. The post-delivery tests shall include visual inspection and bus operations. No post-delivery test shall apply new criteria that are different from criteria applied in a pre-delivery test.

Buses that fail to pass the post-delivery tests are subject to non-acceptance. The agency shall record details of all defects on the appropriate test forms and shall notify the contractor of acceptance or non-acceptance of each bus, after completion of the tests. The defects detected during these tests shall be repaired according to procedures defined in the contract.

### **Bus Acceptance**

In order to assess the contractor's compliance with the Technical Specifications, the agency and the contractor shall, at the pre-production meeting, jointly develop a Configuration and Performance Review document for review of the First Article vehicle. This document shall become part of the official record of the pre-production meeting.

Potential dimensional/performance tests that may be included in the Configuration and Performance Review include the following:

- Complete electrical system audit
- Dimensional requirements audit
- Seating capacity
- Water test
- Water runoff test

- Function test of systems/subsystems and components
- Sound/noise level tests
- Vehicle top speed
- Acceleration tests
- Brake stop tests
- Airflow tests
- PA function tests
- Air/brake system audit
- Individual axle weight
- Standee capacity
- Body deflection tests
- Silent alarm function test
- Interior lighting
- Exterior lighting
- Gradability test
- Kneeling system function
- HVAC pulldown/heat
- Speedometer
- Outside air infiltration (smoke)
- Wheelchair ramps
- Propulsion System performance qualification
  - This test shall be jointly conducted by the contractor and engine manufacturer (including but not limited to energy storage charge acceptance, battery management system, electrical inputs and engine protection system).
- Transmission performance qualifications
  - This test shall be jointly conducted by the Contractor and transmission manufacturer (including but not limited to retarder operation, heat exchanger, interface with ABS and electrical inputs).

### **Buy America audit**

A post-delivery Buy America audit is required for federally funded bus procurements (see 49 CFR Part 663 for additional information). The onsite resident inspectors are to monitor the production processes to verify compliance with final assembly requirements identified by the Buy America pre-award audit. This audit is to verify compliance with final assembly requirements and final documentation of Buy America compliance and must be completed prior to title transfer.

**NOTE:** If there is not a pilot/prototype/first article bus, then the Buy America post-delivery audit should be performed following completion of the first serial production bus. In addition to monitoring of the production processes, the agency must verify compliance that more than 60 percent of the costs of all components are produced in the United States. Finally, the agency must execute the required certificates.

### **Resident inspection process for serial production**

At the discretion of the agency, a decision is made to perform resident inspection using the agency's personnel, a contract inspector, or a combination of both. The decision is based on factors such as the availability of personnel, knowledge/expertise in bus build project management, the size of the bus order, etc.

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**NOTE:** The decision to have the resident inspection performed by agency personnel results in a firm understanding and knowledge of the bus and affords the opportunity to identify parts that will be needed for general maintenance down the road.

### **Inspector responsibilities**

The resident inspection process for the serial production of the buses begins following the completion and acceptance of the prototype or First Article vehicle if required, or according to the serial bus production schedule. Resident inspectors should represent the agency for all build-related issues (quality, conformance, etc.). Resident inspectors can also address contractual type issues but should only do so under the consult of the agency's contracts administrator. Resident inspectors are sent to the Contractor's facility according to a Resident Inspection Schedule. Typically, one or two inspectors arrive on site at the manufacturing facility about one week prior to actual production to set up the resident inspection process and to begin preliminary quality assurance inspections for items such as power plant build-up and wire harness production, and to inspect incoming parts, fasteners, fluids, etc., that will be used in the production of the buses. During the serial production of the buses, the resident inspectors should monitor the production of each bus, verifying the quality of materials, components, sub-assemblies and manufacturing standards. In addition, the configuration of each vehicle should be audited using the vehicle Contractor's Build Specification and other documents to ensure contract compliance and uniformity.

### **Inspector rotation/scheduling**

During the resident inspection phase, a single inspector or multiple inspectors could be used. If it is decided to use multiple inspectors, then the inspectors could be rotated on a biweekly to monthly basis as required. During the rotation of inspectors, a sufficient period of overlap should be provided to guarantee the consistency of the resident inspection process.

### **Resident inspector orientation**

A resident inspector orientation by the bus Contractor should take place upon the arrival of the initial inspection team. The orientation should include expectations for the use of personal protective equipment (safety shoes, safety glasses, etc.), daily check-in and check-out requirements, lines of communication, use of production documents such as speed memos and line movement charts, inspector/production meetings, inspector office arrangements, and anything else pertinent to the inspection team's involvement during the build. Many of the above items should already be formalized during the pre-production meeting.

### **Audits, inspections and tests**

The resident inspection process monitors the production of each vehicle. Inspection stations should be strategically placed to test or inspect components or other installations before they are concealed by subsequent fabrication or assembly operations. These locations typically are placed for the inspection of underbody structure, body framing, electrical panels and harnesses, air and hydraulic line routings, installation of insulation, power plant build-up and installation, rust inhibitor/undercoating application, floor installation, front suspension alignment, and other critical areas.

### **Vehicle inspections**

Each bus is subjected to a series of inspections after the bus reaches the point of final completion on the assembly line. Typically, the vehicle Contractor performs its own quality assurance inspections following

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assembly line completion before releasing each bus to the resident inspectors. The inspections for each vehicle are documented, signed off upon passing and included in the vehicle record.

These are the typical inspections performed on each bus by the resident inspectors:

- Water test inspection
- Road test inspection
- Interior inspection (including functionality)
- Hoist/undercarriage inspection
- Exterior inspection (including roof)
- Electrical inspection
- Wheelchair ramp/lift inspection

**Water test inspection**

The water test inspection checks the integrity of the vehicle's body seams, window frame seals and other exterior component close-outs for their ability to keep rainwater, road splash, melting snow and slush, and other exterior water from entering the inside of the vehicle. The vehicle's interior is inspected for signs of moisture and water leaks. To perform the leak inspection, interior ceiling and side panels are removed, and access doors are opened. If any moisture or water is detected, then the source of the leak will be located and repaired by the Contractor, and the vehicle will be tested again.

**Road test inspection**

The road test inspection checks all the vehicle's systems and sub-systems while the vehicle is in operation. Typically, the road test inspection is performed immediately following the water test inspection to reveal any standing water that may be present due to a leak, but was not noticed during the "static" water test. Objectionable vibrations, air leakage and other factors that affect ride quality are recorded and reported to the vehicle Contractor for resolution. Vehicle stability, performance, braking and interlock systems, HVAC, and other critical areas are checked to ensure that the vehicle is complete and ready to provide safe and reliable service.

The following tests may be performed and recorded during the road test:

- Acceleration test
- Top speed test
- Gradability test
- Service brake test
- Parking brake test
- Turning effort test
- Turning radius test
- Shift quality
- Quality of retarder or regenerative braking action
- Engaging Charging Station

During the road test, a vehicle may be taken to a weigh station to record the vehicle's front axle weight, rear axle weight and total vehicle (curb) weight.

### **Interior inspection**

The interior inspection checks the fit and finish of the interior installations.

In addition, the inspection also verifies the installation and function of systems and subsystems according to the Build Specification. All systems and functions accessed from the interior are inspected for functionality, appearance and safety.

Examples of systems/functions inspected include the following:

- Interior and exterior lighting controls
- Front and rear door systems
- Flooring installation
- Passenger and operator's seat systems
- Wheelchair securement and ramp systems
- Fire suppression system
- Electrical installations (multiplex, tell-tale wiring, panels, etc.)
- Window systems and emergency escape portals
- Operator dash/side panel controls/indicators

### **Hoist/undercarriage inspection**

The hoist/undercarriage inspection checks the installation of components, wiring, air lines, presence of fluid leaks, etc., located under the vehicle. Typically, this inspection is performed following the road test. The vehicle is lifted onto a hoist or pulled over a pit for the inspection. Areas inspected are the front suspension, air bags, air line routings, electrical connections and routings, drive-train components, linkages, and any other system or component that may be prone to early failure due to inadequate installation techniques. All lines, cables, hoses, etc., are inspected for proper securement and protection to prevent rubbing, chafing or any other condition that could result in a failure. The engine/power plant and HVAC compartments are also inspected during this time.

### **Exterior inspection**

The exterior inspection checks the fit and finish of components installed on the exterior of the vehicle. Access panels are opened and accessories are inspected for proper installation. In addition, vehicle paint, graphics and proper decals are also inspected. Acceptable paint finish quality (orange peel, adhesion, etc.) should be agreed on with the vehicle Contractor prior to production to ensure consistency of inspections.

### **Electrical inspection**

The vehicle's main electrical panels and other sub-panels are inspected for proper components, to include relays, fuses, modules, terminal strips, decals, etc. In addition, electrical harnesses are inspected for proper wiring and termination techniques, bulkhead protection, looming and other items that could result in future electrical failure. Onboard vehicle compartment schematics are verified for accuracy.

### **Wheelchair ramp inspection**

The wheelchair ramp assembly is inspected for proper installation and performance. Clearances critical to the operation of the ramp are verified, and the ramp's electrical systems are inspected to ensure appropriate wire routings and protection. The successful integration of the ramp assembly into the vehicle is verified, and the vehicle interlocks are checked during automatic and manual ramp operation.

## **Audits**

During serial production of the bus's quality assurance inspection, tests may be performed to ensure that the Contractor's quality standards are being followed. These inspection audits could be on items such as torque wrench calibrations, proper techniques for fastener installations, proper use and type of adhesives, use of correct installation drawings on the production line, etc.

## **Communications**

The lines of communications, formal and informal, should be discussed and outlined in the pre-production meeting. As previously discussed, resident inspectors should represent the agency for all bus-build related issues (quality, conformance, etc.). Resident inspectors can relay communications addressing contractual type issues but should do so only under the consult of the agency's contracts administrator. Actual personnel contacts for the manufacturing facility should be established during resident inspector orientation. These contacts could include quality assurance, production, material handling, engineering, and buy-off area personnel.

## **Documentation**

The following documents/reports are typically generated during the bus build process:

- Vehicle Build Specification
- Sales Order
- Pre-production meeting notes
- Prototype and production correspondence (vehicle build file)
- Contractor's Vehicle Record (Warranty file)
  - Vehicle line documents
  - Serialization documents (Warranty file)
  - Alignment verification
  - Brake testing
  - HVAC testing and checkout
  - Contractor's QA checklist and signoff
- Weight Slip (Prototype and Warranty file)
- Prototype Performance Tests document (vehicle build file)
  - Acceleration Test
  - Top Speed Test
  - Gradability Test
  - Interior Noise Test A – Stationary
  - Interior Noise Test B – Dynamic
  - Exterior Noise Test A – Pull Away
  - Exterior Noise Test B – Pass-By
  - Exterior Noise Test C – Curb Idle
  - Turning Radius Test
  - Turning Effort Test
  - Parking Brake Test
  - Service Brake Test
- Vehicle Acceptance Inspections – Production (Warranty file)
  - Water Test Inspection Report
  - Road Test Inspection Report
  - Interior Inspection Report

- Hoist/Undercarriage Inspection Report
- Exterior Inspection Report
- Electrical Inspection Report
- Wheelchair Inspection Report
- Speed Memos (Warranty file)
- Agency Vehicle Inspection record (Warranty file)
- Release for Delivery documentation (Warranty file)
- Post-Production Acceptance – Certificate of Acceptance (Accounting)
- Post-Delivery Inspection Report – (Fleet Management and Warranty files)

### **Vehicle release for delivery**

Upon satisfactory completion of all inspection, audit and test criteria, and resolution of any outstanding issues affecting the purchase of any or all buses, proper documentation (the Release for Delivery) is signed by the designated resident inspector authorizing the bus Contractor to deliver the vehicle to the agency's facility, where it will undergo a post-delivery inspection process and final acceptance. The satisfactory sign-off of the Release for Delivery should complete the resident inspector's duties for each bus. In final preparation for delivery, the bus Contractor may request the resident inspector to do a final walk-through of the bus after it has been cleaned and prepped for shipping.

### **Post-delivery and final acceptance**

The agency shall conduct acceptance tests on each delivered bus. These tests shall be completed within 15 days after bus delivery and shall be conducted in accordance with the agency's written test plans. The purpose of these tests is to identify defects that have become apparent between the time of bus release and delivery to the agency. The post-delivery tests shall include visual inspection, along with a verification of system(s) functionality and overall bus operations. No post-delivery test shall apply new criteria that are different from criteria applied in a pre-delivery test.

Buses that fail to pass the post-delivery tests are subject to non-acceptance. The agency shall record details of all defects on the appropriate test forms and shall notify the contractor of acceptance or non-acceptance of each bus within five days after completion of the tests. The defects detected during these tests shall be repaired according to procedures defined in the contract after non-acceptance.

### **Certificate of Acceptance**

- **Accepted**
- **Not accepted:** In the event that the bus does not meet all requirements for acceptance. The agency must identify reasons for non-acceptance and work with the OEM to develop a timeline of addressing the problem for a satisfactory resolution and redelivery.
- **Conditional acceptance:** In the event that the bus does not meet all requirements for acceptance, the agency may conditionally accept the bus and place it into revenue service pending receipt of contractor furnished materials and/or labor necessary to address the identified issue(s).



## **Attachment B: Charging Station Inspection Guidelines**

### **Charging Station Construction and Charging Equipment Installation Schedule**

The Contractor shall work with the Agency to develop a schedule for charging station construction and installation of charging equipment and charge interface for the on route and depot charging stations. The construction and installation schedule should contain specific milestone and task dates, such as:

- Contractor provides Agency Engineer with charging equipment specifications ,requirements, shop drawings, and general layout drawings
- Agency Engineer develops site plans and civil, mechanical, and electrical drawings for on route and/or depot charging stations for City of Long Beach plan check and permit issuance.
- Contractor reviews and approves site plans and civil, mechanical, and electrical drawings for on route and depot charging stations prior to COLB plan check submittal.
- Agency solicits bids from General Contractors (GC) for the site construction and installation of charging equipment and SCE utility service.
- Contractor oversees the (GC) installation of charging equipment and charge interface at on route and depot charging stations
- Contractor responsible for station start-up, testing, and commissioning of completed charger station

All charging stations must be commissioned and operational prior to the delivery of the final Agency project buses.

### **Buy America audit**

A post-delivery Buy America audit is required for federally funded procurements (see 49 CFR Part 663 for additional information). Rolling Stock must be at least 60% U.S. content with final assembly in the U.S. Manufactured products must be 100% U.S. components and manufactured in the U.S.

### **Post-delivery and final acceptance**

The agency shall conduct acceptance tests on charging equipment. These tests shall be completed within 30 days after delivery and installation of equipment and delivery of the First Article bus and shall be conducted in accordance with the agency's written test plans. The purpose of these tests is to identify defects that have become apparent between the time of equipment release and delivery and installation at the agency's designated charging stations. The post-delivery tests shall include visual inspection, along with a verification of system(s) functionality and overall operations. No post-delivery test shall apply new criteria that are different from criteria applied in a pre-delivery test.

Equipment that fails to pass the post-delivery tests is subject to non-acceptance. The agency shall record details of all defects on the appropriate test forms and shall notify the contractor of acceptance or non-acceptance of charging equipment within five days after completion of the tests. The defects detected during these tests shall be repaired according to procedures defined in the contract after non-acceptance.

### **Certificate of Acceptance**

- **Accepted**
- **Not accepted:** In the event that the equipment does not meet all requirements for acceptance. The agency must identify reasons for non-acceptance and work with the Contractor to develop a timeline of addressing the problem for a satisfactory resolution and redelivery.
- **Conditional acceptance:** In the event that the charging equipment does not meet all requirements for acceptance, the agency may conditionally accept the equipment pending receipt of contractor furnished materials and/or labor necessary to address the identified issue(s).

## **REQUEST FOR PROPOSAL**



**LONG BEACH PUBLIC TRANSPORTATION COMPANY**  
1963 E. Anaheim Street, Long Beach, CA 90813  
(562) 591-8753

**Battery Electric Bus Project  
RFP 15-001**

## **Section 9**

### **Forms & Certifications**

## **SECTION 9: FORMS AND CERTIFICATIONS**

### **CER 1. Proposer's Checklist**

The Proposer's Checklist provides a listing of RFP Deliverables. The proposer must submit all items requested in the RFP Deliverables Checklist in the appropriate package and order specified. Each hardcopy and CD package shall be clearly labeled and remain separate from other packages. For example, digital versions of Package 1 and Package 2 shall be submitted on separate CD's. Digital responses to LBT forms provided in Excel Format shall be submitted on CD in their original Excel format.

The RFP Deliverables Checklist can be found in the file "*CER01 Proposers Checklist.xls*" located on the LBT RFP CD.

### **CER 2. Request for Pre-Offer Change or Approved Equal**

This form must be used for requested clarifications, changes, substitutes or approval of items equal to items specified with a brand name and must be submitted by the Due Date for written questions, as specified in "IP 6 Questions, Clarifications and Omissions." Requests should be accompanied by supporting detail for consideration and understanding of the resulting impact to the bus, i.e., impact to weight, energy efficiency, performance, etc. Agency shall be the sole judge in approving or denying each request.

This form can be found in the file "*CER02 Request for Pre-Offer Change or Approved Equal.doc*" located on the LBT RFP CD.

### **CER 3. Acknowledgement of Addenda**

Failure to acknowledge receipt of all addenda may cause the Proposal to be considered nonresponsive to the Solicitation. Acknowledged receipt of each addendum must be clearly established and included with the Proposal.

This form can be found in the file "*CER03 Acknowledgement of Addenda.doc*" located on the LBT RFP CD.

### **CER 4. Contractor Service and Parts Support Data**

Proposers are required to provide the Agency with location information of the Technical Service Representative and Parts Distribution Center that will be utilized in support of the proposed buses and charging equipment.

This form can be found in the file "*CER04 Contractor Service and Parts Support Data.doc*" located on the LBT RFP CD.

### **CER 5. Form for Proposal Deviation**

This form shall be completed for each condition, exception, reservation or understanding (i.e., deviation) in the proposal according to "Conditions, Exceptions, Reservations or Understandings." One copy without any price/cost information is to be placed in the Proposal Summary and a separate copy with any price/cost information placed in the Price Proposal.

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This form can be found in the file “*CER05 Form for Proposal Deviation.doc*” located on the LBT RFP CD.

## **CER 6. Pricing Schedule**

The Pricing Schedule is provided in Excel Format. The Proposer must complete each worksheet in Pricing Schedule completely. Do not manually complete these forms as handwritten forms will not be accepted. Printed versions of each completed Excel form must be included in the hardcopy version of the Price Proposal. In addition, the completed Excel forms must be included as an attached Excel file with the Contractor’s electronic response.

For each form, fill in the yellow highlighted sections. The form is protected and will not allow entries outside of the yellow highlighted sections. If you have any difficulty in completing these forms, please contact the Buyer.

The Pricing Schedule also contains worksheets to capture the pricing and variances for buses and charging equipment for ATN and GMBL, based on the variances specified in “Section 12: RFP Variations for Anaheim Transportation Network” and “*Section 13: RFP Variations for Gardena Municipal Bus Lines.*”

This form, with all related worksheets, can be found in the file “*CER06 Proposal Pricing.xls*” located on the LBT RFP CD.

## **CER 7. Pre-Award Evaluation Data Form**

This form is to be completed and included in the Qualification Package. Attach additional schedules as requested. This form can be found in the file “*CER07 Pre-Award Evaluation Data Form.doc*” located on the LBT RFP CD.

## **CER 8. Federal Certifications**

All Federal Certifications must be completed and included with the Qualifications package. These forms can be found in the file “*CER08 Federal Certifications.doc*” located on the LBT RFP CD.

## **CER 9. Other Certifications**

### **CER 9.1 Proposal Form**

Proposer shall complete the enclosed form and include it in the Price Proposal. This form can be found in the file “*CER09.1 Proposal Form.doc*” located on the LBT RFP CD.

### **CER 9.2 Notice of Award**

Not Applicable

### **CER 9.3 Sustainability Requirements, Form & Checklist**

The form and checklist can be found in the file “*CER09.3 Sustainability Form & Checklist.doc*” located on the LBT RFP CD.

Prior to completing the form and checklist, please review LBT’s Sustainability Policy provided below.

**LONG BEACH PUBLIC TRANSPORTATION COMPANY**  
1963 E Anaheim St., Long Beach Ca. 90801-0731

**Environmental Sustainability Policy & Procedures**

**1.0 Sustainability Introduction**

- 1.1 The following information is supplied to contractors and suppliers who perform work on site for the Long Beach Public Transportation System (Agency). The information presented in these guidelines has been developed in response to the Environmental Sustainability Management System (ESMS). The intent of this information is to make contractors and suppliers aware of the EMS and to ensure conformance to applicable ESMS procedures and work instructions.
- 1.2 An important part of the ESMS relates to the control of contractors, subcontractors and persons working for or on behalf of Agency who are required to comply with relevant environmental policies and procedures. The nature of these activities is such that their personnel have significant potential to affect environmental performance and regulatory compliance within the Agency. Contractor personnel and our personnel therefore must work together to achieve the goals of the environmental policy, objectives and targets and the protection of the environment. Contractors must be aware of the importance of compliance with relevant environmental legislation and regulations, and of the consequences of non-compliance.
- 1.3 The Agency operates an ESMS that meets the requirements of the ISO 14001 standard. Conformance with the environmental policy and all requirements noted in this document is expected of all contractors, subcontractors, suppliers and their employees while working on site. Failure to follow these requirements can be grounds for termination of the contract work.
- 1.4 For further information, please contact the Agency's Risk Management, Health and Safety Office at 562-599-8520.

**2.0 General Environmental Management Procedures**

- 2.1 Contractors will not transport hazardous chemicals on site without having prior knowledge of the associated Material Safety Data Sheets (MSDS). These materials include but are not limited to sealers, adhesives, paints, coatings, fuels, oils, acids and caustics. All sizes of containers require review and approval before their use on site.
- 2.2 Contractors will provide adequate control of fugitive dust emissions during all operations and activities.
- 2.3 Contractors will not discharge anything to drains and or sewers without the prior approval of the Agency Risk Management office, Purchasing Manager or designee.
- 2.4 Contractors will provide adequate spill/release prevention for all bulk materials.
- 2.5 Contractors will immediately notify the Agency, Risk Management, Health and Safety Officer of any reportable spills, releases or other environmental incidents. Contractors will follow up by submitting a completed Tracking of Spills and Releases form.
- 2.6 Contractors will properly label, store and dispose of all waste materials.
- 2.7 Contractors will be sensitive to the effects of noise, odor, light, and traffic movement to the local community.

- 2.8 All contractors shall practice good housekeeping. Removal of trash, etc. generated by the contractor's activities or the activities of its employees is the contractor's responsibility.
- 2.9 Contractors are responsible for keeping the site clean and orderly.
- 2.10 Contractors will not engage in any excavation activities on site without the prior approval of the Agency Project Manager.

### **3.0 Waste Disposal**

- 3.1 All waste disposal (i.e. construction debris, scrap metal, non-hazardous waste, municipal solid waste, etc.) will be the responsibility of the contractor, the originator of the waste, unless otherwise pre-approved.
- 3.2 The Agency Project Manager must be informed of all generated hazardous waste streams before a waste is generated and collected on site.
- 3.3 The Agency Project Manager must be informed of the location of all generated hazardous waste storage areas, maximum quantities and the container type.
- 3.4 Containers must be labeled with their contents and the responsible contractor's name and contact information. NO UNLABELED CONTAINERS ARE PERMITTED ON SITE.
- 3.5 Shipping information and paperwork (MSDS, Waste Profiles, Bills of Lading and inventory) must be provided upon request.
- 3.6 Contractors will be contractually responsible for all regulated wastes.

### **4.0 Equipment Decommissioning**

- 4.1 All equipment will be thoroughly inspected by the Contractor for fluids and other hazardous material leaks prior to removal.
- 4.2 All fluids and other hazardous materials (other than equipment fuel and lubrication) in the equipment will be removed prior to decommissioning and disposal of any waste generated will be handled in accordance with the above instructions in 3.0.

### **5.0 Water Discharges**

- 5.1 Discharge of materials to ANY sewer system, other than sanitary sewage, is prohibited without the prior consent of the Agency Risk Management Health and Safety Office or the Project Manager.
- 5.2 Discharges of ANY material to outside drains other than storm water are prohibited under the established guidelines of the CLEAN WATER ACT.
- 5.3 In the event that the Agency Risk Management Health and Safety Officer or the Project Manager approves the discharges to sewers, the wastewater treatment plant must still be notified prior to discharges of any significant volume or any discharges that could affect the operations of the wastewater treatment plant.

### **6.0 Material Storage / Spills**

- 6.1 There will be no outside storage of any materials without the consent of the Agency Project Manager.

- 6.2 Approved outside storage areas for chemical materials must be equipped with **non-earthen** secondary containment equal to 150% of the capacity of the largest container by the contractor.
- 6.3 The contractor will ensure that all material containers owned or managed by the contractor will be properly labeled in accordance with the OSHA HAZARD COMMUNICATION STANDARD (i.e., contents, primary hazard).
- 6.4 The contractor will have available the material safety data sheets (MSDS) for all chemical products in use at all times that their employees are working on site. MSDS's will be made available to personnel, medical personnel, environmental personnel or their representatives upon request.
- 6.5 The contractor will ensure that chemical containers are closed except when in use.
- 6.6 Contractors will maintain spill kits to contain and clean up small spills generated by their employees or from their materials. Spill kits will be kept on site and will be easily accessible during an emergency.
- 6.7 THE CONTRACTOR WILL IMMEDIATELY REPORT ALL SPILLS OR RELEASES OF MATERIALS OTHER THAN INCIDENTAL SPILLS to the Agency Risk Management Health and Safety Office or the Project Manager. Contractors will follow up by submitting a completed Tracking of Spills and Releases form.

## **7.0 Storm Water Management**

- 7.1 No process materials or any other sources of water pollutant shall be co-mingled with storm water.
- 7.2 Solids must be prevented from entering sewer drains. Roadways and outside areas must be kept clean.
- 7.3 It is the contractor's responsibility to install storm water control measures such as silt fences, straw bales, etc. to control the solids entering storm drains from erosion or other processes if necessary.
- 7.4 All dirt piles must be covered to prevent solids from entering storm drains unless otherwise directed.
- 7.5 Vehicle maintenance shall not be performed near storm drains unless provisions have been made to contain any spills of vehicle fluids, including oil, gasoline and antifreeze.
- 7.6 In the event that a storm water management plan is required (i.e. greater than 1 acre of land is disturbed), the plan will be submitted to the Agency Project Manager for approval.

## **8.0 PCBs**

- 8.1 If a material is suspected to have PCB contamination, the Agency Risk Management Health and Safety Office or the Project Manager is to be notified.
- 8.2 All PCB removals shall be coordinated by the Agency Risk Management Health and Safety Office or the Project Manager.
- 8.3 Any lighting ballast that does not state that it is a non-PCB containing ballast must be disposed of as PCB containing.



## **9.0 Asbestos**

- 9.1 Contractors will contact the Agency Project Manager prior to any construction or demolition work that could disturb existing structures or equipment.
- 9.2 All asbestos removal and disposal activities will be conducted in accordance with procedures approved by the Agency Risk Management Health and Safety Office or the Project Manager.

## **10.0 Lead**

- 10.1 Contractors are responsible for testing for the presence of lead-based paints when grinding or welding on building or building structural steel. Testing will be done by an approved lab as directed by the Agency Risk Management Health and Safety Office or the Project Manager
- 10.2 All lead removal and disposal activities will be conducted in accordance with procedures approved by the Agency Risk Management Health and Safety Office or the Project Manager.

## **11.0 CFCs**

- 11.1 Contractors will provide copies of employee training certificates to the Agency Risk Management Health and Safety Office or the Project Manager upon request.
- 11.2 Intentional venting of CFCs to the atmosphere is prohibited.

## **12.0 Contractor / Supplier Environmental Review**

- 12.1 Upon request, contractors are to submit the following "Contractor Environmental Form", Attachment E2a, which contains written information outlining their activities and procedures for minimizing and managing the actual or potential environmental impacts of their operations. This must include an assessment of the potential risks to the environment, contractors, employees and other personnel associated with on-site activities and proposed measures for minimizing these risks.

### **CER 9.4 Electric Vehicle Codes and Standards**

The Proposer and (if selected) Contractor shall submit manufacturer's certified statements that the proposed buses and charging equipment comply with all applicable electric vehicle and infrastructure codes and standards.

This form can be found in the file "*CER09.4 Electric Vehicle Codes and Standards.doc*" located on the LBT RFP CD.

### **CER 10. Vehicle Questionnaire**

The Excel version of this form included on the CD must be used to complete the Vehicle Questionnaire. Do not manually complete this form as it will not be accepted. A printed version of the completed Excel form must be included in the hardcopy version of the Contractor's Technical Proposal. The completed Excel form must be included as Excel file with the Contractor's electronic response.

This form can be found in the file "*CER10 Vehicle Attribute Summary.xls*" located on the LBT RFP CD.

### **CER 11. Charging Station Questionnaire**

The Excel version of this form included on the CD must be used to complete the Charging Station Questionnaire. Do not manually complete this form as it will not be accepted. A printed version of the completed Excel form must be included in the hardcopy version of the Contractor's Technical Proposal. The completed Excel form must be included as an attached Excel file with the Contractor's electronic response.

This form can be found in the file "*CER11 Infrastructure Attribute Summary.xls*" located on the LBT RFP CD.

### **CER 12. Minimum Project Milestones**

The Excel version of this form included on the CD must be used to complete the Minimum Project Milestones. Do not manually complete this form as it will not be accepted. A printed version of the completed Excel form must be included in the hardcopy version of the Contractor's Technical Proposal. The completed Excel form must be included as an attached Excel file with the Contractor's electronic response.

This form can be found in the file "*CER12 Minimum Milestone Plan.xls*" located on the LBT RFP CD.

## **REQUEST FOR PROPOSAL**



**LONG BEACH PUBLIC TRANSPORTATION COMPANY**  
1963 E. Anaheim Street, Long Beach, CA 90813  
(562) 591-8753

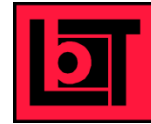
**Battery Electric Bus Project  
RFP 15-001**

## **Section 10**

## **Sample Contract**

**SECTION 10: CONTRACT**

**AGREEMENT NO. 15-001**



**BETWEEN**

**LONG BEACH PUBLIC TRANSPORTATION COMPANY**

**ANAHEIM TRANSPORTATION NETWORK**

**GARDENA MUNICIPAL BUS LINES**

**AND**

\_\_\_\_\_

**THIS AGREEMENT** is made and entered into this \_\_\_\_ day of Month, 20\_\_, by and between the LONG BEACH PUBLIC TRANSPORTATION COMPANY (LBT), a Non-Profit corporation of the state of California, (hereinafter referred to as “Buyer”, and \_\_\_\_\_, (Hereinafter referred to as “Seller”).

**WITNESSETH:**

**WHEREAS**, LBT has entered into a Joint Procurement with ANAHEIM TRANSPORTATION NETWORK (ATN) and GARDENA MUNICIPAL BUS LINES (GMBL) to procure Battery Electric Buses and charging station equipment and;

Whereas, the parties require the services of a Seller to provide Battery Electric Buses and charging station equipment; and

**WHEREAS**, said work cannot be performed by the regular employees of LBT or the members of the joint procurement; and

**WHEREAS**, Seller has represented that it has the requisite personnel and experience,  
and is capable of performing such services; and

**WHEREAS**, Seller wishes to perform these services;

**NOW, THEREFORE**, it is mutually understood and agreed by LBT as the Lead Agency  
for the joint procurement and Seller as follows:

## **ARTICLE 1. COMPLETE AGREEMENT AND PRECEDENT OF DOCUMENTS**

This Agreement, including Exhibits, RFP 15-001 Package Documents, and Proposal Documents constitute the complete and exclusive statement of the terms and conditions of the agreement between Lead Agency and Seller and it supersedes all prior representations, understandings and communications. The invalidity in whole or in part of any term or condition of this Agreement shall not affect the validity of other terms or conditions. Lead Agency's failure to insist in any one or more instances upon Seller's performance of any term(s) or condition(s) of this Agreement shall not be construed as a waiver or relinquishment of Lead Agency's right to such performance or to future performance of such term(s) or condition(s) and Seller's obligation in respect thereto shall continue in full force and effect. Changes hereto shall not be binding upon Lead Agency except when specifically confirmed in writing by an authorized representative of Lead Agency.

The Agreement consists of the documents listed below which are either attached or incorporated by reference. In case of any conflict among these documents, the order of precedence shall be:

1. Form of Agreement

2. "Section 4: Special Provisions"
3. "Section 3: General Conditions," and "Section 5: Federal Requirements"
4. "Section 6: Technical Specifications," "Section 7: Warranty Requirements," and "Section 8: Quality Assurance"
5. Contractor's Best and Final Offer (including Contractor Proposal)

A Modification or Change to any Agreement Document shall take its precedence from the term it amends. All other documents and terms and conditions shall remain unchanged.

## **ARTICLE 2. LEAD AGENCY DESIGNEE**

The President & CEO of the Lead Agency, or his designee, shall have the authority to act for and exercise any rights of the Lead Agency as set forth in this Agreement subsequent to, and in accordance with the authorizations granted by Lead Agency's Board of Directors.

## **ARTICLE 3. SCOPE OF WORK**

Seller shall perform the work necessary to complete in a manner satisfactory to Lead Agency and participating Agencies the services set forth in the Scope of Work and related addendums, exhibits, RFP and proposal documents attached hereto and incorporated herein by reference and made a part of this Agreement. Seller shall also perform in accordance with its proposal dated \_\_\_\_\_, 20\_\_.

#### **ARTICLE 4. TERM OF AGREEMENT**

This Agreement shall be valid for a period of five years effective on the date first set forth on this Agreement. The Seller shall commence work after the effective date of the Agreement, upon receipt of a Notice to Proceed.

#### **ARTICLE 5. NOTICE TO PROCEED**

The Notice to Proceed shall be issued within twenty (20) working days of the Contract execution following receipt of any required post-award documentation include the required certificate of insurance. Should there be reasons why the Notice to Proceed cannot be issued within such period, the time may be extended by mutual agreement between Lead Agency and Seller.

The Agreement will have a delivery date for all vehicles in the base order by XXXXX. Said delivery date shall be automatically extended on a day-for-day basis if the Notice to Proceed is not executed by Lead Agency on or before (insert date). If any Option is exercised, the Option Vehicles or other Option items shall be delivered in accordance with the schedule contained in the Notice of Exercise of Option.

#### **ARTICLE 6. PURCHASE ORDERS**

At the time of issuance of the RFP, Anaheim Transportation Network (ATN) and Gardena Municipal Bus Lines are members of the joint procurement. As a participating Agency, each member of the joint procurement shall place orders under this agreement using the individual Agency's Purchase Orders. All Purchase Orders shall reference the Agreement and shall incorporate all terms and conditions of the Agreement and all documents either attached or incorporated by

**Long Beach Public Transportation Company**  
**Request for Proposal**  
**RFP 15-001**

reference. Orders placed are the responsibility of the participating Agency. Long Beach Public Transportation Company as the Lead Agency will not be responsible for coordination, administration, or payment of orders placed by other Agencies.

**ARTICLE 7. AGREEMENT TYPE AND PAYMENT - BASE ORDER**

A. This is a firm fixed unit rate Agreement.

B. Lead Agency shall pay \_\_\_\_\_ (\$ \_\_\_\_\_ ) for  
\_\_\_ buses as required by the Agreement. ATN shall pay \_\_\_\_\_  
(\$ \_\_\_\_\_) for \_\_\_buses as required by the Agreement. GMBL shall pay  
\_\_\_\_\_ (\$ \_\_\_\_\_) for \_\_\_buses as required by the Agreement. And  
the Seller shall accept the amount as full compensation for all cost and expenses of completing the Work in accordance with the Agreement, including but not limited to all labor and material required, overhead, storage and shipping risks and obligations, taxes, fees and profit and any unforeseen costs.

C. Lead Agency

| Item Description                    | No. of Units | Unit Price | Total Price |
|-------------------------------------|--------------|------------|-------------|
| Battery Electric Buses              |              |            |             |
| Delivery Charge                     |              |            |             |
| Charging Station(s)                 |              |            |             |
| Other Equipment                     |              |            |             |
| TOTAL PRICE, Electric Base Vehicles |              |            |             |



**Long Beach Public Transportation Company**  
**Request for Proposal**  
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D. ATN

| Item Description                    | No. of Units | Unit Price | Total Price |
|-------------------------------------|--------------|------------|-------------|
| Battery Electric Buses              |              |            |             |
| Delivery Charge                     |              |            |             |
| Charging Station(s)                 |              |            |             |
| Other Equipment                     |              |            |             |
| TOTAL PRICE, Electric Base Vehicles |              |            |             |

E. GMBL

| Item Description                    | No. of Units | Unit Price | Total Price |
|-------------------------------------|--------------|------------|-------------|
| Battery Electric Buses              |              |            |             |
| Delivery Charge                     |              |            |             |
| Charging Station(s)                 |              |            |             |
| Other Equipment                     |              |            |             |
| TOTAL PRICE, Electric Base Vehicles |              |            |             |

F. Invoices shall be submitted by Seller in duplicate to the appropriate Accounts Payable Office.

Each invoice shall reference, the Purchase Order No. assigned for that specific project, and the amount of payment requested. Buyer shall remit payment less retention within thirty (30) days of receipt and approval of each correct invoice for such services.

G. **Special Note:** Invoices for this project are only processed once a month by the appropriate Agency. Invoices must be submitted in the first week of a month in order to be paid in the

same month. Buyer will not be responsible for late receipt of invoices that will cause a delay in payment of approximately one month.

**H. [OTHER PRICING AND CORRECTIONS, IF ANY, WILL BE ADDED FOLLOWING COMPLETION OF NEGOTIATIONS AND RECOMMENDATION FOR CONTRACT AWARD.]**

**ARTICLE 8. MAXIMUM OBLIGATION – BASE ORDER**

Notwithstanding any provisions of this Agreement to the contrary, Lead Agency and Seller mutually agree that Lead Agency, ATN's and GMBL's maximum cumulative payment obligation hereunder (including obligation for Seller's profit) shall be (\$ \_\_\_\_\_ ), including all amounts payable to Seller for its subcontracts, leases, materials and costs arising from, or due to termination of this Agreement.

**ARTICLE 9. NOTICES**

All notices hereunder and communications regarding the interpretation of the terms of this Agreement, or changes thereto, shall be effected by delivery of said notices in person or by depositing said notices in the U.S. mail, registered or certified mail, return receipt requested, postage prepaid and addressed as follows:

**To: SELLER**

Seller Address

**To: LONG BEACH PUBLIC  
TRANSPORTATION COMPANY**

P.O. Box 731

1963 E. Anaheim Street

Long Beach, CA 90801

**Long Beach Public Transportation Company  
Request for Proposal  
RFP 15-001**

ATTENTION: Name

ATTENTION: Chip Henderson

To: ANAHEIM RESORT TRANSPORTATION

To: GARDENA MUNICIPAL BUS LINES

**ARTICLE 10. OWNERSHIP OF REPORTS AND DOCUMENTS**

The originals of all custom letters, documents and reports produced under this Agreement shall be delivered to, and become upon payment in full for all services rendered, the property of, Buyer. Copies may be made for Seller's records. Such deliverables shall be deemed works made for hire and all rights in copyright therein shall be retained by Buyer.

This Agreement shall be made effective upon execution by both parties.

**IN WITNESS WHEREOF**, the parties hereto have caused this Agreement No. **15-001** to be executed on the date first written above.

\_\_\_\_\_

**LONG BEACH PUBLIC  
TRANSPORTATION COMPANY**

By\_\_\_\_\_

By\_\_\_\_\_

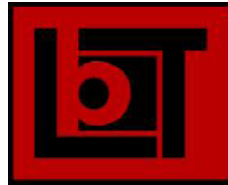
Name\_\_\_\_\_

Name\_\_\_\_\_

Title\_\_\_\_\_

Title\_\_\_\_\_

## **REQUEST FOR PROPOSAL**



**LONG BEACH PUBLIC TRANSPORTATION COMPANY**  
1963 E. Anaheim Street, Long Beach, CA 90813  
(562) 591-8753

**Battery Electric Bus Project  
RFP 15-001**

## **Section 11**

## **Appendices**

## **APPENDIX A: Sample Assignment of an Option to Purchase Agreement**

[Insert Agency name], "Assignor", hereby assigns to \_\_\_\_\_ of \_\_\_\_\_, "Assignee", its option to purchase from of, "Seller", \_\_\_\_\_ floor transit Vehicles ("Option Vehicles") at a price and under the terms and conditions contained in Assignor's Contract No. [Insert Contract number], dated with Seller ("Contract").

Such option commenced, per terms of Contract, on , and may be exercised at any time on or before .

With respect to the Option Vehicles assigned hereunder and this Assignment, Assignee agrees to perform all covenants, conditions and obligations required of Assignor under said Contract and agrees to defend, indemnify and hold Assignor harmless from any liability or obligation under said Contract. Assignee further agrees to hold Assignor harmless from any deficiency or Defect in the legality or enforcement of the terms of said Contract or option to purchase thereunder. Assignee agrees and understands that Assignor is not acting as a broker or agent in this transaction and is not representing Seller or Assignee, but rather is acting as a principle in assigning its interest in the above-referenced option to purchase the Option Vehicles under the Contract to Assignee.

Assignee hereby unconditionally releases and covenants not to sue Assignor upon any claims, liabilities, damages, obligations or judgments whatsoever, in law or in equity, whether known or unknown, or claimed, which they or either of them have or claim to have or which they or either of them may have or claim to have in the future against Assignor, with respect to the Option Vehicles or any rights whatsoever assigned hereunder.

Dated this \_\_\_\_ day of \_\_\_\_\_, 20\_\_

\_\_\_\_\_  
Assignor

\_\_\_\_\_  
Assignee

I hereby accept and approve the terms of this agreement and agree to hold Assignor harmless from any further liability or obligation under our agreement.

\_\_\_\_\_  
Seller

**APPENDIX B: Certificate as to Deposit of Additional Source Codes**

\_\_\_\_\_ (“Licensor”) hereby certifies to  
\_\_\_\_\_ (“Licensee”) that Licensor has delivered to Escrow  
Agent on \_\_\_\_\_, 20\_\_, to be held in escrow pursuant to the terms of the Escrow  
Agreement dated as of \_\_\_\_\_, 20\_\_, among Licensor, Licensee and Escrow  
Agent, one copy of each of the following Source Codes:

*(Describe Source Codes)*

Dated: \_\_\_\_\_, 20\_\_

CONTRACTOR  
as Licensor: \_\_\_\_\_  
Name and title

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

**Long Beach Public Transportation Company**  
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## APPENDIX C: LBT Contractor's Request for Change Order



**Long Beach Transit**  
**Contractor's Request for Change Order (RFCO)**

|                   |  |
|-------------------|--|
| Project: _____    | RFCO#: _____                             |
| Contract #: _____ | <input type="checkbox"/> Check if Urgent |

### Section 1- Description of Change

|                          |             |
|--------------------------|-------------|
| C/O Title: _____         | Date: _____ |
| Reason For Change: _____ |             |
| _____                    |             |
| _____                    |             |

### Section 2- Estimated Time Impact

|  |  |
|--|--|
| Explain Any Delay: _____<br>_____<br>_____<br>_____<br>_____ | <b>Due To This Change The Contract Schedule:</b><br><input type="checkbox"/> Will be Increased by an Estimated _____ Working Days<br><input type="checkbox"/> Will be Decreased by an Estimated _____ Working Days<br><input type="checkbox"/> Will Not Change (Will not affect Critical Path) |
|--|--|

### Section 3- Estimated Cost Impact (Attach Quotes or details if available)

| <table border="1" style="width: 100%; text-align: center;"> <tr> <th colspan="3">Cost Breakdown Table</th> </tr> <tr> <th style="width: 15%;"></th> <th style="width: 65%;">Description</th> <th style="width: 20%;">Amount</th> </tr> <tr> <td>Labor</td> <td>_____</td> <td>\$ _____</td> </tr> <tr> <td>Materials</td> <td>_____</td> <td>\$ _____</td> </tr> <tr> <td>Other</td> <td>_____</td> <td>\$ _____</td> </tr> <tr> <td>Credits</td> <td>_____</td> <td>-\$ _____</td> </tr> <tr> <td colspan="2">Total Cost or Reduction:</td> <td>\$ _____</td> </tr> </table> | Cost Breakdown Table  |           |  |  | Description | Amount | Labor | _____ | \$ _____ | Materials | _____ | \$ _____ | Other | _____ | \$ _____ | Credits | _____ | -\$ _____ | Total Cost or Reduction: |  | \$ _____ | <b>Due To This Change The Contract Cost:</b><br><input type="checkbox"/> Will be Increased by \$ _____<br><input type="checkbox"/> Will be Decreased by \$ _____<br><input type="checkbox"/> Will Not Change (No Cost Increase / Decrease)<br><input type="checkbox"/> Impact is Unknown, Not to Exceed Amount \$ _____ |
|---|---|-----------|--|--|-------------|--------|-------|-------|----------|-----------|-------|----------|-------|-------|----------|---------|-------|-----------|--------------------------|--|----------|---|
| Cost Breakdown Table  |   |           |  |  |             |        |       |       |          |           |       |          |       |       |          |         |       |           |                          |  |          |   |
|   | Description   | Amount    |  |  |             |        |       |       |          |           |       |          |       |       |          |         |       |           |                          |  |          |   |
| Labor   | _____   | \$ _____  |  |  |             |        |       |       |          |           |       |          |       |       |          |         |       |           |                          |  |          |   |
| Materials   | _____   | \$ _____  |  |  |             |        |       |       |          |           |       |          |       |       |          |         |       |           |                          |  |          |   |
| Other   | _____   | \$ _____  |  |  |             |        |       |       |          |           |       |          |       |       |          |         |       |           |                          |  |          |   |
| Credits   | _____   | -\$ _____ |  |  |             |        |       |       |          |           |       |          |       |       |          |         |       |           |                          |  |          |   |
| Total Cost or Reduction:  |   | \$ _____  |  |  |             |        |       |       |          |           |       |          |       |       |          |         |       |           |                          |  |          |   |
| <b>Name and Signature Of Submitting Contractor:</b><br>Name: _____<br>Company: _____<br>Date: _____<br>Signature: _____   | <b>Name And Signature, LBT Receipt Acknowledgement:</b><br>Name: _____<br>Date: _____<br>Signature: _____ |           |  |  |             |        |       |       |          |           |       |          |       |       |          |         |       |           |                          |  |          |   |

### Section 4- Scope of Approval/Denial - (LBT Use Only)

| <input type="checkbox"/> Denied <input type="checkbox"/> Approved (Project Manager / Director Signature Required)<br>Reason / Comments: _____<br>_____<br>_____<br>Signature: _____      Date: _____ | <table border="1" style="width: 100%;"> <tr> <th colspan="2">Encumbrance</th> </tr> <tr> <td style="width: 50%;">Budget Dollar Amount \$ _____</td> <td style="width: 50%;">_____</td> </tr> <tr> <td>Original PO Dollar Amount \$ _____</td> <td>_____</td> </tr> <tr> <td>To Date Dollar Amount \$ _____</td> <td>_____</td> </tr> <tr> <td>Actual \$ _____</td> <td>Date: _____</td> </tr> </table> | Encumbrance |  | Budget Dollar Amount \$ _____ | _____ | Original PO Dollar Amount \$ _____ | _____ | To Date Dollar Amount \$ _____ | _____ | Actual \$ _____ | Date: _____ |
|--|--|-------------|--|-------------------------------|-------|------------------------------------|-------|--------------------------------|-------|-----------------|-------------|
| Encumbrance  |  |             |  |                               |       |                                    |       |                                |       |                 |             |
| Budget Dollar Amount \$ _____  | _____  |             |  |                               |       |                                    |       |                                |       |                 |             |
| Original PO Dollar Amount \$ _____   | _____  |             |  |                               |       |                                    |       |                                |       |                 |             |
| To Date Dollar Amount \$ _____   | _____  |             |  |                               |       |                                    |       |                                |       |                 |             |
| Actual \$ _____  | Date: _____  |             |  |                               |       |                                    |       |                                |       |                 |             |

**Long Beach Public Transportation Company**  
**Request for Proposal**  
**RFP 15-001**

**Request For Change Order (RFCO) Processing**

A Request for Change Order (RFCO) is generated whenever a project change occurs which adds, deletes, or modifies the content of an original, approved Statement of Work. RFCO's are typically generated by a Contractor to request a change of project scope from LBT.

The intent of the form is to document the change requested, the impact to the budget and project schedule, and LBT's approval or refusal of the requested change. Approved RFCO's are issued to provide authorization to a Contractor or Supplier to proceed with the Change indicated along with any change in cost, and/or time.

The form consists of a Header and four sections. The Header identifies the Project and RFCO number. This is followed by a description of the change, the impact on the schedule, the impact on the cost, and LBT's approval or refusal of the Change.

The RFCO form is initiated and processed as follows:

**Header:**

The Contractor fills out the Header; stating the Project Name (Such as BSAP III), the Request for Change Order sequential number (i.e. RFCO# 1, 2, 3, 4....etc.), the contract number (often the RFP or IFB#), and checking the "Urgent" box if the request requires immediate attention. "Urgent" or immediate attention would be defined as anything which causes work to stop, costly delays, or health and safety issues.

**Section 1 – Description of the Change:**

Section 1 provides fields for: the title of the Change Order (C/O Title) or subject of the change, such as "Transmart Sign, Anaheim & Orange", and the date the change was requested. The Contractor must then describe the reason for the requested Change.

**Section 2 – Estimated Time Impact:**

If the schedule is impacted, the Contractor must explain the reason for the delay. Typical reasons might include; "Waiting for permit approval", "Old foundation found under surface" or "Gas line must be re-routed before work can continue." The Contractor will then check off whether or not the schedule is impacted and if so, by how much.

**Section 3 – Estimated Cost Impact:**

The Contractor shall list the costs of the Change in terms of labor, material and other expenses as indicated on the "Cost Breakdown Table". Special attention should be given to subtract any credits due for items originally bid but replaced or deleted by the requested Change. Upon calculation, the Contractor shall check the appropriate box on the right and enter the total amount of the change. If the amount can not be determined, and estimated Time and Material amount may be entered in the last check box. Copies of any supporting documentation, such as additional calculations or quotes, should be attached to the back of the form.

Upon completion of the Cost Impact, the Contractor will print his/her name and sign the request for the company represented. The RFCO must then be sent or given to the LBT Project Engineer for processing.

Upon receipt, the LBT Project Engineer signs the RFCO acknowledging the request, logs the request, and presents the RFCO to the Project Manager or Director for review and approval.

**Section 4 – Scope of Approval / Denial (For LBT use only)**

Upon Approval (or refusal), the signed RFCO is returned to the Project Engineer for the Project file and a copy is given to the Contractor. If approved, the signed RFCO acts as an authorization to proceed with the requested change. If the RFCO is denied, the RFCO provides documentation that the requested change was considered and the reason the request was denied.



**Long Beach Public Transportation Company**  
**Request for Proposal**  
**RFP 15-001**

**APPENDIX D: References**

| SAE # | Title  | Date Published |
|-------|--|----------------|
| J10   | Methods of Test for Paints - Part J10: Determination of Deposition Efficiency of Coating Powders                                 | Sep 15, 1998   |
| J211  | Instrumentation for Impact Test—Part 2: Photographic Instrumentation   | May 1, 2001    |
| J287  | Driver Hand Control Reach  | Feb 1, 2007    |
| J366  | Exterior Sound Level for Heavy Trucks and Buses  | Feb 1, 1987    |
| J382  | Windshield Defrosting Systems Performance Requirements - Trucks, Buses, and Multipurpose Vehicles.                               | Jan 1, 1994    |
| J534  | Lubrication Fittings   | May 1, 2008    |
| J537  | Storage Batteries  | Sep 1, 2000    |
| J541  | Voltage Drop for Starting Motor Circuits   | Oct 1, 1996    |
| J587  | License Plate Illumination Devices (Rear Registration Plate Illumination Devices)  | Sep 1, 2003    |
| J593  | Backup Lamps (Reversing Lamps)   | Sep 1, 2005    |
| J673  | Automotive Safety Glasses  | Oct 1, 2005    |
| J680  | Location and Operation of Instruments and Controls in Motor Truck Cabs, Recommended Practice                                     | Sep 1, 1988    |
| J686  | Motor Vehicle License Plates   | Oct 1, 1999    |
| J689  | Curbstone Clearance, Approach, Departure, and Ramp Breakover Angles—Passenger Car and Light Truck                                | Aug 1, 2009    |
| J833  | Human Physical Dimensions  | May 1, 2003    |
| J844  | Nonmetallic Air Brake System Tubing  | Nov 1, 2004    |
| J941  | Motor Vehicle Drivers' Eye Locations   | Mar 1, 2010    |
| J994  | Alarm—Backup—Electric Laboratory Performance Testing   | Mar 1, 2009    |
| J1050 | Describing and Measuring the Driver's Field of View  | Jan 1, 2003    |
| J1113 | Electromagnetic Compatibility Component Test Procedure Part 42, Conducted Transient Emissions                                    | Oct 1, 2006    |
| J1127 | Low Voltage Battery Cable  | Mar 1, 2010    |
| J1128 | Low Voltage Primary Cable  | Dec 1, 2005    |
| J1149 | Metallic Air Brake System Tubing and Pipe  | Aug 1, 2007    |
| J1292 | Automobile and Motor Coach Wiring  | Jan 1, 2008    |
| J1455 | Recommended Environmental Practices for Electronic Equipment Design in Heavy-Duty Vehicle Applications                           | Jun 1, 2006    |
| J1587 | Joint SAE/TMC Electronic Data Interchange between Microcomputer Systems in Heavy-Duty Vehicle Applications, Recommended Practice | Jan 1, 1996    |
| J1708 | Serial Data Communications Between Microcomputer Systems in Heavy-Duty Vehicle Applications                                      | Oct 1, 2008    |
| J1986 | Balance Weight and Rim Flange Design Specifications, Test Procedures, and Performance Recommendations                            | Jan 1, 2006    |
| J1939 | Data Link Layer  | Dec 1, 2006    |
| J1995 | Engine Power Test Code - Spark Ignition and Compression Ignition - Gross Power Rating, Standard;                                 | Jun 1, 1990    |
| J2402 | Road Vehicles—Symbols for Controls, Indicators, and Tell-tales   | Jan 1, 2010    |
| J2711 | Recommended Practice for Measuring Fuel Economy and Emissions of Hybrid-Electric and Conventional Heavy-Duty Vehicles            | Sept 1, 2002   |

## **APPENDIX E: Abbreviation and Acronyms**

|              |   |
|--------------|---|
| <b>A/C</b>   | air conditioning  |
| <b>ABS</b>   | anti-lock braking system  |
| <b>AC</b>    | alternating current   |
| <b>ACQ</b>   | alkaline copper quaternary  |
| <b>ADA</b>   | Americans with Disabilities Act   |
| <b>Ah</b>    | amp hour  |
| <b>ALR</b>   | auto-locking retractor  |
| <b>APA</b>   | The Engineered Wood Association, formerly the American Plywood Association  |
| <b>APC</b>   | automatic passenger counter   |
| <b>APTA</b>  | American Public Transportation Association                                  |
| <b>ASTM</b>  | ASTM International, formerly the American Society for Testing and Materials |
| <b>ATC</b>   | automatic traction control  |
| <b>AVL</b>   | automatic vehicle location  |
| <b>AWG</b>   | American Wire Gauge   |
| <b>BAFO</b>  | Best and Final Offer  |
| <b>BMS</b>   | Battery Management System   |
| <b>BRT</b>   | bus rapid transit   |
| <b>CARB</b>  | California Air Resources Board  |
| <b>CCS</b>   | climate control system  |
| <b>CCTV</b>  | closed-circuit television   |
| <b>cfm</b>   | cubic feet per minute   |
| <b>CGA</b>   | Compressed Gas Association  |
| <b>CNG</b>   | compressed natural gas  |
| <b>dB</b>    | decibel   |
| <b>DBE</b>   | disadvantaged business enterprise   |
| <b>DC</b>    | direct current  |
| <b>DDU</b>   | driver display unit   |
| <b>DEF</b>   | diesel exhaust fluid  |
| <b>DOT</b>   | Department of Transportation  |
| <b>DPF</b>   | diesel particulate filter   |
| <b>ECM</b>   | Engine Control and Monitoring   |
| <b>ECS</b>   | emission control system   |
| <b>ELR</b>   | emergency locking retractor   |
| <b>EMI</b>   | electromagnetic interference  |
| <b>EPA</b>   | Environmental Protection Agency   |
| <b>ESS</b>   | energy storage system   |
| <b>FEA</b>   | Finite Element Analysis   |
| <b>FEMA</b>  | failure mode effects analysis   |
| <b>FMCSA</b> | Federal Motor Carrier Safety Administration                                 |
| <b>FMCSR</b> | Federal Motor Carrier Safety Regulations                                    |
| <b>FMVSS</b> | Federal Motor Vehicle Safety Standards                                      |
| <b>FTA</b>   | Federal Transit Administration  |
| <b>GAWR</b>  | gross axle weight rated   |
| <b>GPS</b>   | global positioning system   |
| <b>GVW</b>   | gross vehicle weight  |
| <b>GVWR</b>  | gross vehicle weight rated  |

|                |   |
|----------------|---|
| <b>H-point</b> | hip-point   |
| <b>HDS</b>     | hybrid drive system   |
| <b>HMI</b>     | human-machine interface   |
| <b>HSC</b>     | hybrid system controller  |
| <b>HV</b>      | high voltage  |
| <b>HVAC</b>    | heating, ventilation and air conditioning                       |
| <b>I/O</b>     | input/output  |
| <b>IEEE</b>    | Institute of Electrical and Electronics Engineers               |
| <b>ISO</b>     | International Standards Organization                            |
| <b>LEL</b>     | LED emergency light   |
| <b>LV</b>      | low voltage   |
| <b>mA</b>      | milliamperes  |
| <b>MDT</b>     | mobile data terminal  |
| <b>MPa</b>     | mega-Pascal   |
| <b>NC</b>      | normally closed   |
| <b>NFPA</b>    | National Fire Protection Association                            |
| <b>NGV</b>     | natural gas vehicle   |
| <b>NOx</b>     | nitrogen oxide  |
| <b>NO</b>      | normally open   |
| <b>NTP</b>     | notice to proceed   |
| <b>OEM</b>     | original equipment manufacturer                                 |
| <b>OSI</b>     | Open Systems Interconnect                                       |
| <b>PA</b>      | public address  |
| <b>PMO</b>     | project management oversight                                    |
| <b>PPU</b>     | primary propulsion unit   |
| <b>PPU</b>     | prime power unit  |
| <b>PPV</b>     | price per vehicle   |
| <b>PRD</b>     | pressure relief device  |
| <b>psi</b>     | pounds per square inch  |
| <b>RF</b>      | radio frequency   |
| <b>RFI</b>     | radio frequency interference                                    |
| <b>RTC</b>     | real-time clock   |
| <b>SAE</b>     | SAE International, formerly the Society of Automotive Engineers |
| <b>scf</b>     | standard cubic feet   |
| <b>SLW</b>     | seated load weight  |
| <b>SOC</b>     | state of charge   |
| <b>UL</b>      | Underwriters Laboratories                                       |
| <b>UNECE</b>   | United Nations Economic Commission for Europe                   |
| <b>VDC</b>     | volts of direct current   |
| <b>Wh</b>      | watt-hours  |
| <b>VIN</b>     | vehicle information number                                      |