CITY OF KNOXVILLE
REQUEST FOR PROPOSALS
ZERO EMISSION ELECTRIC BUS SOLUTION

Proposals to be received by 11:00 a.m., Eastern Time
May 4, 2018

Submit Proposals to:
City of Knoxville
Office of the Purchasing Agent
City/County Building
Room 667 – 674
400 Main Street
Knoxville, Tennessee 37902

Request for Proposals
Zero Emission Electric Bus Solution

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SECTION I – NOTICE OF REQUEST FOR PROPOSALS.

1.1 **Statement of Intent.**

The City of Knoxville is seeking proposals from responsible firms to provide newly manufactured buses, equipment and technical support services required for a zero emission electric lowfloor bus solution for routes operated by Knoxville Area Transit. The proposed solution shall consist of new manufactured, heavy-duty, all-electric buses with turnkey depot charging stations, robust manufacturer's product support, and energy storage system options designed to best support the fixed-route defined in the route operating profile stated within this document. The City of Knoxville intents to award an Indefinite Delivery Indefinite Quantity (IDIQ), firm-fixed price five-year contract to the proposer who provides the solution that best meets the City's needs.

Minimum quantity is one (1) lowfloor electric bus with twenty-four (24) option lowfloor electric buses for a contract maximum of twenty-five (25) over a five year period. Note that all bus purchases, to include the base quantity, are subject to availability of funds.

1.2 **RFP Timeline.**

Availability of RFP ..... **January 12, 2018**

Pre-proposal meeting ..... **January 19, 2018**

Requests for clarification due ..... **February 2, 2018**

Responses to requests for clarification ..... **February 23, 2018**

Requests for approved equals due..... **March 16, 2018**

Responses to requests for approved equals..... **April 6, 2018**

Proposals due date .....May 4, 2018

This timeline is for the information of submitting entities. These dates are subject to change. **However, in no event shall the deadline for submission of the proposals be changed except by written modification from the City of Knoxville Purchasing Division.**

SECTION II – INSTRUCTIONS TO PROPOSERS.

2.1 The following data is intended to form the basis for submission of proposals to provide a zero emission electric bus solution for the City of Knoxville.

2.2 This material contains general conditions for the procurement process and instructions for submissions of proposals. The RFP should be read in its entirety before preparing the proposal.

2.3 All materials submitted pursuant to this RFP shall become the property of the City of Knoxville.

2.4 **Confidentiality.** To the extent permitted by law, all documents pertaining to this Request for Proposals shall be kept confidential until the proposal evaluation is complete and a recommendation submitted to City Council for review. No information about any submission of proposals shall be released until the process is complete, except to the members of the evaluation committee and other appropriate City staff. All information provided shall be considered by the evaluation committee in making a recommendation to enter into an agreement with the selected proposer.

2.5 **Pre-Proposal Meeting.**

2.5.1 A Pre-Proposal Meeting will be held on **January 19, 2018 at 2:00 PM** (EST) in Room 662 (Finance conference room), 6th floor, City/County Building, Knoxville TN 37902. Proposers may also participate via conference call. The call-in number is (865) 215-4916 and you will be immediately connected to the conference call. Please limit calls to one line per company due to the limitations of our conference bridge limitations. Prospective proposers are urged to make every effort to attend this meeting.

2.5.2 Prospective proposers are requested to submit written questions to the Purchasing Agent representative, identified above, in advance of the Pre-Proposal Meeting. In addition, questions may be submitted up to the date specified in "RFP Timeline" above. 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 during 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 City nor KAT.

2.6 **Questions, Clarifications and Additional Information.** Any inquiries, suggestions or requests concerning interpretation, clarification or additional information pertaining to the RFP shall be made **in writing and be in the hands of Purchasing Agent's office by the close of the business day on February 2, 2018**. Questions can be submitted by letter, fax (865-215-2277), or email to **powens@knoxvilletn.gov**. The City of Knoxville is not responsible for oral interpretations given by any City employee, KAT representative, or others. The issuance of written addenda is the only official method whereby interpretation, clarification, or additional information can be given. If any addenda are issued to this Request for Proposals, the Purchasing Division will post them to the City's website at **www.knoxvilletn.gov/bids**. Submitting organizations are strongly encouraged to view this website often to see if addenda are

posted. Failure of any proposer to receive such addendum or interpretation shall not relieve such proposer from any obligation under his proposal as submitted. All addenda so issued shall become part of the contract documents.

2.7 The City of Knoxville reserves the right to (a) accept or reject any and/or all submissions of proposals; (b) to waive irregularities, informalities, and technicalities; and (c) to accept any alternative submission of proposals presented which, in its opinion, would best serve the interests of the City. The City shall be the sole judge of the proposals, and the resulting negotiated agreement that is in its best interest, and its decision shall be final. The City also reserves the right to make such investigation as it deems necessary to determine the ability of any submitting entity to perform the work or service requested. Information the City deems necessary to make this determination shall be provided by the submitting entity. Such information may include, but is not limited to, current financial statements by an independent CPA, verification of availability of equipment and personnel, and past performance records.

2.8 Included in the contract documents is an affidavit that the undersigned has not entered into any collusion with any person with respect to this proposal. The proposer is required to submit this affidavit with their proposal submission.

2.9 Subsequent to the evaluation committee's review and the Mayor's recommendation of a firm, Knoxville City Council approval will be required before the final contract may be executed.

2.10 All expenses for making a submission of proposal shall be borne by the submitting entity.

2.11 Any submission of proposals may be withdrawn up until the date and time for opening of the submissions. **Any submission not so withdrawn shall, upon opening, constitute an irrevocable offer for a period of 120 days to the City of Knoxville for the services and products set forth in the Request for Proposals until one or more of the submissions have been duly accepted by the City.**

2.12 Prior to submitting their proposals, proposers are to be registered with the Purchasing Division through the City of Knoxville's online Vendor Registration system. Instructions for registering on-line are available at **www.knoxvilletn.gov/purchasing**. **Proposals from un-registered proposers may be rejected.**

2.13 **No Contact Policy:** After the posting of this solicitation to the Purchasing Division's website, any contact initiated by any proposer with any City of Knoxville or KAT representative concerning this proposal is strictly prohibited, unless such contact is made with the Purchasing Division representative listed herein or with said representative's authorization. **Any unauthorized contact may cause the disqualification of the proposer from this procurement transaction.** Proposals must include a notarized No Contact/No Advocacy Affidavit (to be found in the "Submission Forms" section of this document).

2.14 **Inclement Weather:** During periods of inclement weather, the Purchasing Division will enact the following procedures with regard to solicitations and weather delays:

- If City offices are closed due to inclement weather on the date proposals are due to the Purchasing Office, all solicitation due that same day will be moved to the next operational business day.
- The City of Knoxville shall not be liable for any commercial carrier's decision regarding deliveries during inclement weather.

2.15 **Conditions, Exceptions, Reservations or Understandings.**

2.15.1 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.

2.15.2 Any and all Deviations must be explicitly, fully and separately stated in the Proposal by completing the 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.

2.15.3 The Form for Proposal Deviation shall be included in the Technical Submission section.

2.16 **Proposal Submission Instructions.** All submissions of proposals shall comply with the following instructions. These instructions ensure that (1) submissions contain the information and documents required by the City RFP and (2) the submissions have a degree of uniformity to facilitate evaluation.

2.16.1 **General**. Submission forms and RFP documentation may be obtained on or after **January 12, 2018**, at no charge from:

City of Knoxville Purchasing Division
City/County Building
400 Main Street, Room 667
Knoxville, Tennessee 37902

between 8:30 a.m. and 4:30 p.m. (Eastern Time), Monday through Friday or by calling 865/215-2070. Forms and RFP information are also available on the City web site at **www.knoxvilletn.gov/bids** where it can be read or printed using Adobe Acrobat Reader software.

2.16.2 **Submission Information.** Proposals shall include six (6) hard copies (one original and five duplicates—mark the original as such) and one electronic copy of the proposal (.pdf format on CD only—mark the storage device with the company name); the electronic version shall be an exact duplicate of the original, and the electronic version will be the official document exhibited in the contract. Electronic submissions must be included with the sealed

submissions; do not email your submission. These same requirements shall apply to any best and final offers (BAFOs) that may be requested.

IMPORTANT NOTE: A minimum of one of the submitted proposals must bear an original signature, signed in ink (duplicated signatures substituted for original ink signatures may result in rejection of the proposals). This document is the official, original submission; the required copies may have copied signatures. The signature must be entered above the typed or printed name and title of the signer. All proposals must be signed by an officer of the company authorized to bind the firm to a contract. **Proposals will be received until 11:00:00 a.m. (Eastern Time) on May 4, 2018**. Each proposal must be submitted in a sealed envelope addressed to:

City of Knoxville Purchasing Division
City/County Building
400 Main Street, Room 667
Knoxville, TN 37902

IMPORTANT NOTE: Each mailing envelope or carton containing a proposal or multiple copies of the proposal must be sealed and plainly marked on the outside "**Zero Emission Electric Bus Solution**." Proposers are reminded that the Purchasing Division receives many bids and proposals for any number of solicitations; unlabeled submissions are extremely difficult to match to their appropriate solicitations and therefore may be rejected.

2.16.3 Any proposals received after the time and date on the cover sheet will not be considered. It shall be the sole responsibility of the submitting entity to have the proposal delivered to the City of Knoxville Purchasing Division on or before that date.

2.16.4 Late proposals will not be considered. Proposals that arrive late due to the fault of United States Postal Service, United Parcel Service, DHL, FEDEX, any delivery/courier service, or any other carrier of any sort are still considered late and shall not be accepted by the City. Such proposals shall remain unopened and will be returned to the submitting entity upon request.

2.17 **Format of Proposals.** The City is committed to reducing waste. Submissions of qualifications must be typed on 8.5 x 11 inch wide white paper, printed on both sides. DO NOT BIND the document; instead, staple or binder clip the submission together and place in a sealed envelope. Pages must be consecutively numbered. A table of contents must be included in the proposal immediately after the title page, and each of the following numbered sections must be tabbed.

Proposals shall be structured as follows. Numbered items listed below should have a numbered tab page:

Section I - Submission Forms and Certifications:

1. Title Page
2. Table of Contents
3. Submission Forms:

a. Form S-1
b. Non-Collusion Affidavit
c. No Contact/No Advocacy Affidavit
d. Iran Divestment Act Certification of Noninclusion
e. Buy America Certification
f. Buy America Domestic Content Worksheet
g. Federal Motor Vehicle Safety Standards Certification
h. ADA Compliance Certification
i. Bus Testing Certification
j. Lobbying Certification
k. Certification of Primary Participant Regarding Debarment, Suspension, and Other Responsibility Matters.
l. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – Lower Tier Covered Transactions.
m. Transit Vehicle Manufacturers (TVM) Certificate of Compliance with Disadvantaged Business Regulations

4. Acknowledgement of Addenda

Section II - Technical Submission:

5. Technical Proposal (narrative description of proposed bus and charging system and how they meet the technical specifications listed within this RFP).
6. A narrative description of how the design will enable the proposed bus to meet KAT's minimum required operating distance on the route operating profile, on a single charge, and the methods used to validate these claims.
7. Contractor Service and Parts Support Data information
8. Form for Proposal Deviation
9. List of all clients for the past 5 years with contact information.
10. Engineering organization chart
11. Production and delivery schedule specifically addressing delivery requirements of this RFP and other contract commitments for the duration of this contract.
12. Manufacturer's formal Quality Assurance Program

Section III - Price Proposal Requirements:

13. Pricing Schedule

Section IV - Qualifications:

14. A copy of the three (3) most recent financial statements audited by an independent third party or a statement from the proposer regarding how financial information may be reviewed by the City.
15. Letter for insurance, indicating the proposer's ability to obtain the insurance coverage in accordance with the RFP requirements.
16. Letter from a surety for a Performance Guarantee indicating the Contractor's ability to obtain financial guarantees in accordance with the RFP requirements.

NOTE: All above mentioned required forms are provided in these solicitation documents.

Section V (Proprietary/Confidential Information): NOTE THIS SECTION IS OPTIONAL.

Proposers may submit, at their own risk, any information deemed to be proprietary or confidential in nature if, in the proposer's opinion, it may increase their chance of entering into the competitive range. (See "Proposal Evaluation, Negotiation and Selection" below.) Proposers are advised, however, that the City of Knoxville and K-Trans Management, Inc (KAT) are public entities and as such are subject to **state open records provisions**. Subject package shall be submitted in accordance with the terms and conditions governing the submittal of proposer's proposal to this RFP.

2.20 **Treatment of Proprietary/Confidential Information.** Access to government records is governed by Tennessee Code Annotated open records law. Proposers shall be aware that the City of Knoxville and K-Trans Management, Inc. (KAT) must abide by State of Tennessee open records law, and upon receipt of an open records request, must disclose the requested information which may contain confidential information. Proposers submit confidential information at their own risk, and shall indemnify and hold harmless the City of Knoxville and/or K-Trans Management, Inc. (KAT) from any damages incurred from disclosure of confidential information in accordance with an open records request.

2.21 **Modification or Withdrawal of Proposals.**

2.21.1 A modification of a Proposal already received will be accepted by the City only if the modification is received prior to the Proposal Due Date 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 Proposal.

2.21.2 A proposer may withdraw a proposal already received prior to the Proposal Due Date by submitting to the City, 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 City of Knoxville fails to award the contract within the proposal validity period in paragraph 2.11 above 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.

2.22 **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 applicable to a competitive negotiated procurement whereby Proposals are evaluated to determine which Proposals are within a Competitive Range. Discussions and negotiations may then be carried out with Proposers within the Competitive Range, and possibly demonstrations of bus performance (at proposers' expense), after which BAFOs may be requested. The City may select a proposal for award, however, without any discussions, negotiations, demonstrations or requests for any BAFOs. Subject to the City's right to reject any or all Proposals, the proposer whose proposal is found to be most advantageous to

the City of Knoxville and KAT will be selected, based upon consideration of the criteria of "Proposal Selection Process," below.

2.22.1 **Confidentiality of Proposals.** All Proposals and evaluations will be kept strictly confidential throughout the evaluation, negotiation and selection process. Only the members of the Selection Committee and Evaluation Team and other City or KAT officials, employees and agents having a legitimate interest will be provided access to the Proposals and evaluation results during this period.

2.23 **Evaluation Committee.** The City Purchasing Agent will establish an evaluation committee which will include officers, employees and agents of the City and KAT. The evaluation committee will carry out the detailed evaluations, including establishing the competitive range, carrying out negotiations and making recommendation of the proposer, if any, that may be awarded the contract. Award of the contract must be approved by City Council and signed by the Mayor.

2.24 **Review of Proposal for Responsiveness and Proposers for Responsibility.**

2.24.1 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.

2.24.2 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.

2.24.3 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.

2.24.4 Any Proposal found to be nonresponsive or Proposer 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 City of Knoxville reserves the right to request that a Proposer provide additional information and/or to clarify information. The City's determination regarding the responsiveness of a Proposal and the responsibility of a Proposer shall be final.

2.25 **Proposal Selection Process.**

2.25.1 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 only the criteria set forth below.

2.25.2 "Qualification Requirements" specifies the requirements for determining responsible proposers, all of which must be met by a proposer for it 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.

2.25.3 "Proposal Evaluation Criteria" contains all the evaluation criteria, and their relative order of importance, by which a Proposal from a qualified Proposer will be considered for selection. An award, if made, will be to a responsible proposer for a proposal that is found to be in the City of Knoxville's best interests, based on price and other evaluation criteria considered. The procedures to be followed for these evaluations are provided in "Evaluation Procedures," below.

2.26 **Qualification Requirements.** The following are the requirements for qualifying responsible proposers. All of these requirements should be met; therefore, they are not listed in any particular order of importance. Any proposal that the evaluation committee finds does not 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:

2.26.1 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 an independent certified public accountant.
- Proposer's ability to secure financial guarantees, if required, as evidenced by a letter of commitment from an underwriter, surety or other guarantor confirming the proposer can provide the required guarantee.
- Proposer's ability to obtain required insurance with coverage values that meet minimum requirements set forth in the RFP, evidenced by a letter from an underwriter confirming the proposer can be insured for the required amount.

2.26.2 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.

2.26.3 Evidence that the proposer is qualified in accordance with the provisions of Section VII – Quality Assurance.

2.26.4 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.

2.27 **Proposal Evaluation Criteria.**

2.27.1 The following are the complete criteria by which proposals from responsible proposers will be evaluated and ranked for the purposes of determining any competitive range and to make any selection of a proposal for a potential award. Any exceptions, conditions, reservations or understandings explicitly, fully and separately stated on the Form for Proposal Deviation, which do not cause the City of Knoxville 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.

CRITERIA DESCRIPTION	MAXIMUM POINT VALUE
Cost Proposal Criteria (Up to 30 Points Possible)	
Total Pricing of Base and Option Buses	30
Technical Evaluation Criteria (Up to 70 Points Possible)	
Product Design and Performance	30
Proposer's Reputation and Performance	20
Delivery Schedule	20
TOTAL POSSIBLE POINTS	**100**

2.27.2 **Evaluation Methodology.**

2.27.2.1 **Total Pricing of Base and Option Buses**. The lowest cost proposal will receive 30 points. Every other proposal previously found to be in the competitive range will be given points proportionately in relation to the lowest price. This point total will be calculated by dividing the lowest price by the total price of the proposal being evaluated and the result multiplied by the maximum point value for price (30 points) to arrive at a cost proposal score.

Example: Lowest cost proposal price / proposer's price X 30 = proposal score.

The application of the above formula will result in a uniform assignment of points relative to the criterion of price.

2.27.2.2 **Product Design and Performance.** The information provided by the proposer in its technical submittal relating to the buses to be provided will be utilized to evaluate the proposal in relation to this factor. Vehicle construction and system design, as well as documented reliability, may be used in this evaluation, as well as other design and performance elements of the components that comprise those systems. At a minimum, test results, safety and

maintenance factors, evidence of the vehicle's ability to meet KAT's route service needs based upon the route operating profile, how well the proposed bus meets the technical specifications, and cost of normal operation for the bus design and system components proposed, may be considered in determining a final value for this factor.

2.27.2.3 **Proposer's Reputation and Performance.** The Committee will consider the capability and reputation of the proposer for supporting their product as presented in the proposal and as is determined by review of information available from references or other resources. The evaluation may look at the proposer's overall organizational and financial capabilities and consider key components such as organizational reporting structure, quality control, quality assurance, research and development, technical support provided throughout the bus service life and responsiveness of technical support to clients, responsiveness of parts support, warranty, training, product capabilities, bus systems health monitoring, bonding capacity, and financial history, as well as other considerations, in reaching a final point determination. The committee may also look at judgments, liens, Fleet Defect history, warranty claims and the steps that the manufacturer took to resolve these concerns in assessing the overall reputation of the manufacturer.

2.27.2.4 **Delivery Schedule.** The Committee will review the proposed delivery schedule for the planned purchase of buses. Delivery schedules that fulfill the delivery requirements, with evidence that the schedule can be accomplished, may receive higher points for this category. Proposers who appear to be unable to meet the first purchase order delivery requirement may fall outside of the competitive range.

2.27.3 **Evaluation Procedures.**

2.27.3.1 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 City 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 the 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."

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

2.27.4 **Evaluation of Competitive Proposals.**

2.27.4.1 **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 City, information submitted in a BAFO, and information resulting from the City's inquiry of proposer's references and its own knowledge of the proposer

2.27.4.2 **Discussions with Proposers in the Competitive Range.**

2.27.4.2.1 The proposers whose proposals are found by the City to be within the competitive range may be invited for an interview if the evaluation committee deems it necessary.

2.27.4.2.2 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 the Form for Proposal Deviation, said conditions, exceptions, reservations or understandings may be negotiated during these meetings. However, the City 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 City to find such proposal to be outside the competitive range.

2.27.4.2.3 **Factory, Site Visits and Demonstrations.** The City reserves the right to conduct factory visits of the proposer's facilities and/or the facilities of major sub-suppliers included in the proposal. Additionally, the City may require a proposer or proposers to demonstrate their bus can meet performance requirements outlined within the technical specifications.

2.27.4.2.4 **Best and Final Offers (BAFO).** After all interviews and demonstrations (if required) 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 City according to the same requirements and criteria as the initial proposals ("Proposal Selection Process"). The City will then choose the proposal that it finds to be most advantageous to the City, based upon the evaluation criteria. The results of the evaluations and the selection of a proposal for any award will be documented. The City reserves the right to make an award to a proposer whose proposal it judges to be most advantageous to the City based upon the evaluation criteria, without conducting any written or oral discussions with any proposers or solicitation of any BAFOs.

2.28 **Response to Proposals.**

2.28.1 **Single Proposal Response.** If only one proposal is received in response to this RFP and it is found by the City to be acceptable, then a price or cost analysis, or both, possibly including an audit, may be performed by or for the City. The proposer has agreed to such analysis by submitting a proposal in response to this RFP.

2.28.2 **Availability of Funds.** This procurement is subject to the availability of funding.

2.28.3 **City of Knoxville Rights.**

2.28.3.1 The City 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 City.

2.28.3.2 The City 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 the City's judgment, will be most advantageous to the City, considering price and other evaluation criteria. The City 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 City reserves the right to waive any defects, or minor informalities or irregularities in any proposal that do not materially affect the proposal or prejudice other proposers.

2.28.3.3 If there is any evidence indicating that two or more proposers 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 City.

2.28.3.4 The Agency may reject a Proposal that includes unacceptable deviations as provided in the Form for Proposal Deviation.

2.28.4 **Execution of Contract.** The acceptance of a proposal for award, if made, shall be evidenced in writing by a notice of intent to award contract delivered to the proposer whose proposal is accepted. Upon notice of intent to award contract to a proposer, the proposer shall commence furnishing any required documents and commence furnishing copies of the certificates of insurance and endorsements.

SECTION III – GENERAL CONDITIONS

3.1 **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 City, 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.

3.2 **Conformance with Specifications and Drawings.**

3.2.1 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 City, 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 KAT shall not be the responsibility of the Contractor unless they are included in this contract.

3.2.2 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.

3.3 **Inspection, Testing and Acceptance.**

3.3.1 **Resident Inspector.** KAT's representative (plant resident inspector) 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 KAT representative's inspection and approval in accordance with the approved work products developed as a result of the contract documents.

3.3.2 **Pre-Delivery Tests.** 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 VII - 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.

3.3.3 **Acceptance.** Within fifteen (15) business days after arrival at the designated point of delivery, the bus shall undergo KAT's tests defined in "Post-Delivery Tests." If the bus passes these tests or if KAT does not give initial notification of non-acceptance to the Contractor within 15 business days after delivery, then acceptance of the bus by the City occurs on the 15th business day after delivery. Acceptance occurs earlier if KAT notifies the Contractor of early acceptance or places the bus in revenue service. If the bus fails these tests, it shall not be accepted until the repair procedures defined in "Post-Delivery Tests" have been carried out and the bus shall be retested until it passes. The City of Knoxville reserves the right to withhold payment of non-accepted buses until faults are corrected. Additionally, in the case of first bus delivery, payment will be withheld until receipt of the recommended spare parts list.

3.3.4 **Post Delivery Tests.**

3.3.4.1 KAT will conduct acceptance tests on each delivered bus. These tests shall be completed within fifteen (15) business 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 KAT. The post-delivery tests shall include visual inspection and bus operations. No post-delivery test shall apply criteria that are different from the criteria applied in a similar pre-delivery test.

3.3.4.2 Buses that fail to pass the post-delivery tests are subject to non-acceptance. KAT shall provide initial notice of non-acceptance within fifteen (15) business days and shall provide Contractor details of all defects within thirty (30) business days. 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) business days of receiving defect details, then the work may be done by KAT personnel with reimbursement by the Contractor.

3.4 **Risk of Loss.** The City 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, then the Contractor has the risk of loss upon such release.

3.5 **Title and Warranty of Title.** Adequate documents for registering the bus in Knox County, Tennessee shall be provided to KAT not fewer than 10 business days before delivery to KAT. All buses shall be titled to the City of Knoxville. Upon acceptance of each bus, the Contractor warrants that the title shall pass to the City free and clear of all encumbrances.

3.6 **Intellectual Property Warranty.** The City shall advise the Contractor of any impending patent suit related to this contract against the City and provide all information available. The Contractor shall defend any suit or proceeding brought against the City 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 hold the City of Knoxville and K-Trans management, Inc. harmless from and pay all damages and costs awarded therein, excluding incidental and consequential damages against the City. 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 City the right to continue using said equipment or part, or replace same with non-infringing equipment, or modify it so it becomes non-infringing.

3.7 **Data Rights.**

3.7.1 **Proprietary Rights/Rights in Data.**

3.7.1.1 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

3.7.1.2 The City and KAT 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 KAT to utilize such information in order to maintain the vehicles. In the event that the

Contractor no longer provides the information, KAT has the right to reverse-engineer patented parts and software.

3.7.1.3 KAT 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; and (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. 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.

3.7.2 **Access to Onboard Operational Data.** The City 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 the Contractor to perform reliability maintenance analysis, health monitoring, 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.

3.8 **Changes.**

3.8.1 **Contractor Changes.** Any proposed change in this contract shall be submitted to the City for its prior approval. Oral change orders are not permitted. No change in this contract shall be made without the prior written approval by the City. 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 Purchasing Agent.

3.8.2 **Changes by the City.** The City may obtain changes to the contract by notifying the Contractor in writing. As soon as reasonably possible but no later than thirty (30) calendar days after receipt of the written change order to modify the contract, the Contractor shall submit to the Purchasing Agent 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 City. 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.

3.9 **Contract Requirements.** Submitting entities, if selected, must be willing to sign a contract with the City which will include certain provisions, among which are the following:

3.9.1 **Contract Documents.** The contract shall consist of (1) the RFP; (2) the proposal submitted by the Contractor to this RFP; and (3) the contract. In the event of a discrepancy between the contract, the RFP and the submitted proposal, the terms that provide the greater benefit to the City and/or impose the greater obligation to the Contractor will prevail.

3.9.2 **Administration.** The contract will be administered by the City of Knoxville's Knoxville Area Transit (KAT).

3.9.3 **Invoices.** Invoices for services will be submitted to the City in accordance with the contract terms.

3.9.4 **Independent Contractor**. The relationship of Contractor to the City will be that of independent contractor. The Contractor will be solely and entirely responsible for its acts and for the acts of its agents, employees, servants and subcontractors done during the performance of the contract. All services performed by the Contractor shall be provided in an independent contractor capacity and not in the capacity of officers, agents, or employees of the City.

3.9.5 **Assignment.** The Contractor shall not assign or transfer any interest in this contract without prior written consent of the City of Knoxville.

3.9.6 **Insurance.** When applicable and prior to the commencement of the contract, Contractor must, at its sole expense, obtain and maintain in full force and effect for the duration of the Agreement and any extension hereof at least the following types and amounts of insurance for claims which may arise from or in connection with this agreement. Contractor shall furnish the City of Knoxville with properly executed certificates of insurance which shall clearly evidence all insurance required by the City. All insurance must be underwritten by insurers with an A.M. Best rating of A-VIII or better. **Note the City will not move forward with awarding a contract until after obtaining the required certificates of insurance and required endorsements. The proposer who has received a "Notice to Award Contract" should expedite obtaining and submitting these required documents as this process can take a great deal of time.** Such insurance shall be at a minimum the following:

A. **Commercial General Liability Insurance**; occurrence version commercial general liability insurance, and if necessary umbrella liability insurance, with a limit of not less than $2,000,000 each occurrence for bodily injury, personal injury, property damage, and products and completed operations. If such insurance contains a general aggregate limit, it shall apply separately to the work/location in this agreement or be no less than $5,000,000.

Such insurance shall:

- Contain or be endorsed to contain a provision that includes the City, its officials, officers, employees, and volunteers as additional insureds with respect to liability arising out of work or operations performed by or on behalf of the Contractor including materials, parts, or equipment furnished in connection with such work or operations. The coverage shall contain no special limitations on the scope of its protection afforded to the above-listed insureds. Proof of additional insured status up to and including copies of endorsements and/or policy wording will be required.
- For any claims related to this project, Contractor's insurance coverage shall be primary insurance as respects the City, its officers, officials, officers, employees, and volunteers. Any insurance or self-insurance programs covering the City, its officials,

officers, employees, and volunteers shall be excess of Contractor's insurance and shall not contribute with it.

- At the sole discretion of the City, dedicated limits of liability for this specific project may be required.

B. **Automobile Liability Insurance**; including vehicles owned, hired, and non-owned, with a combined single limit of not less than $1,000,000 each accident. Such insurance shall include coverage for loading and unloading hazards. Insurance shall contain or be endorsed to contain a provision that includes the City, its officials, officers, employees, and volunteers as additional insureds with respect to liability arising out of automobiles owned, leased, hired, or borrowed by or on behalf of Contractor.

C. **Workers' Compensation Insurance.** Contractor shall maintain workers' compensation insurance with statutory limits as required by the State of Tennessee or other applicable laws and employers' liability insurance with limits of not less than $500,000. Contractor shall require each of its subcontractors to provide Workers' Compensation for all of the latter's employees to be engaged in such work unless such employees are covered by Contractor's workers' compensation insurance coverage.

D. **Other Insurance Requirements.** Contractor shall:

- Prior to commencement of services, furnish the City with original certificates and amendatory endorsements effecting coverage required by this section and provide that such insurance shall not be cancelled, allowed to expire, or be materially reduced in coverage except on 30 days' prior written notice to the City Attorney of Knoxville; P.O. Box 1631; Knoxville, Tennessee 37901. Proof of policy provisions regarding notice of cancellation will be required.

- Upon the City's request, provide certified copies of endorsements and policies if requested by the City in lieu of or in addition to certificates of insurance. Copies of policies will only be requested when contracts are deemed to be extremely or uniquely hazardous, include a dollar amount that is significant to the overall budget of the City or a City department, or the coverage(s) may not follow standard insurance forms. A policy will only be requested after the City's risk manager has reviewed the contract and proof of coverage has been provided. Should the certificate of insurance refer to specific coverage wording or endorsements(s), proof of such policy wording or endorsement(s) will be required.

- Replace certificates, policies, and endorsements for any such insurance expiring prior to completion of services.

- Maintain such insurance from the time services commence until services are completed. Failure to maintain or renew coverage or to provide evidence of renewal may be treated by the City as a material breach of contract.

- If Contractor cannot procure insurance through an insurer having an A.M. Best rating of A-VIII, Contractor may, in the alternative, place such insurance with insurer licensed to do business in Tennessee and having A.M. Best Company ratings of no less than A. Modification of this standard may be considered upon appeal to the City law director.

- Require all subcontractors to maintain during the term of the Agreement Commercial General Liability insurance, Business Automobile Liability insurance, and Workers' Compensation/Employer's Liability insurance (unless subcontractor's employees are covered by Contractor's insurance) in the same manner as specified for Contractor. Contractor shall furnish subcontractors' certificates of insurance to the City without expense immediately upon request.

- Large Deductibles; Self-Insured Retentions. Any deductibles and/or self-insured retentions greater than $50,000 must be disclosed to and approved by the City of Knoxville prior to the commencement of services. Use of large deductibles and/or self-insured retentions may require proof of financial ability as determined by the City.

- Waiver of Subrogation Required. The insurer shall agree to waive all rights of subrogation against the City, its officers, officials, and employees for losses arising from work performed by Contractor for the City. Proof of waiver of subrogation up to and including copies of endorsements and/or policy wording will be required.

- Occurrence Basis Requirement. All general liability policies must be written on an occurrence basis, unless the risk manager determines that a claims made basis is reasonable in the specific circumstance. Use of policies written on a claims made basis must be approved by the City. Risk Manager and retroactive dates and/or continuation dates must be provided to the City prior to commencement of any work performed. Professional Liability and Environmental Liability (Pollution Coverage) are most commonly written on a claims made basis and are generally acceptable in that form.

3.9.7 **Indemnification and Hold Harmless.** The successful proposer will be required to sign a contract with the City which contains the following indemnification clause. This indemnification clause will not be altered in any way. Failure to agree with this indemnification clause in the contract may result in the City moving to the next responsible responsive proposer.

3.9.7.1 Contractor shall defend, indemnify and hold harmless the City, its officers, employees and agents from any and all liabilities which may accrue against the City, its officers, employees and agents or any third party for any and all lawsuits, claims, demands, losses or damages alleged to have arisen from an act or omission of Contractor in performance of this agreement or from Contractor's failure to perform this agreement using ordinary care and skill, except where such injury, damage, or loss was caused by the sole negligence of the City, its agents or employees.

3.9.7.2 Contractor shall save, indemnify and hold the City harmless from the cost of the defense of any claim, demand, suit or cause of action made or brought against the City alleging liability referenced above, including, but not limited to, costs, fees, attorney fees, and other expenses of any kind whatsoever arising in connection with the defense of the City; and Contractor shall assume and take over the defense of the City in any such claim, demand, suit, or cause of action upon written notice and demand for same by the City. Contractor will have the right to defend the City with counsel of its choice that is satisfactory to the City, and the City will provide reasonable cooperation in the defense as Contractor may request. Contractor will not consent to the entry of any judgment or enter into any settlement with respect to an indemnified claim without the prior written consent of the City, such consent not to be unreasonably withheld or delayed. The City shall have the right to participate in the defense against the indemnified claims with counsel of its choice at its own expense.

3.9.7.3 Contractor shall save, indemnify and hold City harmless and pay judgments that shall be rendered in any such actions, suits, claims or demands against City alleging liability referenced above.

3.9.7.4 The indemnification and hold harmless provisions of this agreement shall survive termination of the Agreement.

3.9.8 **Termination.** The City may terminate this Agreement at any time, with or without cause, by written notice of termination to the Contractor.

If the City terminates this Agreement, and such termination is not a result of a default by the Contractor, the Contractor shall be entitled to receive as its sole and exclusive remedy the following amounts from the City, and the City shall have no further or other obligations to the Contractor: the amount due to the Contractor for work executed through the date of termination, not including any future fees, profits, or other compensation or payments which the Contractor would have been entitled to receive if this Agreement had not been terminated.

The City may, by written notice of default to the Contractor, terminate the whole or any part of this Agreement if the Contractor fails to perform any provisions of this Agreement and does not cure such failure within a period of ten (10) days (or such longer period as the Purchasing Agent may authorize in writing) after receipt of said notice from the Purchasing Agent specifying such failure. If this Agreement is terminated in whole or in part for default, the City may procure, upon such terms and in such manner as the Purchasing Agent may deem appropriate, supplies or services similar to those terminated.

3.9.9 **Suspension of Work.**

3.9.9.1 The City 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.

3.9.9.2 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 City.

3.9.9.3 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 Purchasing Agent a detailed price and schedule proposal for the suspension, delay or interruption.

3.9.10 **Excusable Delays/Force Majeure.**

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

- The cause of the delay arises after the Notice of Award and neither was 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;
- The Contractor demonstrates that the completion of the work and/or any affected deliveries will be actually and necessarily delayed;
- 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
- The Contractor makes written request and provides other information to the City as described in paragraph 3.9.10.4 below.

A delay in meeting all 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.

3.9.10.2 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.

3.9.10.3 The City reserves the right to rescind or shorten any extension previously granted, if subsequently the City determines that any information provided by the 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 City 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 that, although later found to have been erroneous, was submitted in good faith by the Contractor.

3.9.10.4 No extension or adjustment of time shall be granted unless: (1) written notice of the delay is filed with the City 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 City 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 City shall make its determination within thirty (30) calendar days after receipt of the application.

3.9.11 **Compliance with Laws and Regulations.** The 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 City 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.

3.9.12 **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 City and the Contractor, and the final contract price will be adjusted upward or downward to reflect such changes in Law. Such price adjustment may be audited, where required.

3.9.13 **Governing Law and Venue.** This Agreement shall be governed by and construed in accordance with the substantive laws of the State of Tennessee and its conflict of laws provisions. Venue for any action arising between the City and the Contractor from the agreement shall lie in Knox County, Tennessee.

3.9.14 **Ethical Standards.** Attention of all firms is directed to the following provisions contained in the Code of the City of Knoxville: Chapter 24, Article II, Section 24-33 entitled

"Debts owed by persons receiving payments other than Salary;" Chapter 2, Article VIII, Division 11. the Contractor hereby takes notice of and affirms that it is not in violation of, or has not participated, and will not participate, in the violation of any of the following ethical standards prescribed by the Knoxville City Code:

A. Section 2-1048. Conflict of Interest.

It shall be unlawful for any employee of the city to participate, directly or indirectly, through decision, approval, disapproval, recommendation, preparation of any part of a purchase request, influencing the content of any specification or purchase standard, rendering of advice, investigation, auditing or otherwise, in any proceeding or application, request for ruling or other determination, claim or controversy or other matter pertaining to any contract or subcontract and any solicitation or proposal therefore, where to the employee's knowledge there is a financial interest possessed by:

(1) the employee or the employee's immediate family;

(2) A business other than a public agency in which the employee or member of the employee's immediate family serves as an officer, director, trustee, partner or employee; or

(3) Any person or business with whom the employee or a member of the employee's immediate family is negotiating or has an arrangement concerning prospective employment.

B. Section 2-1049. Receipt of Benefits from City Contracts by Council Members, Employees and Officers of the City.

It shall be unlawful for any member of council, member of the board of education, officer or employee of the city to have or hold any interest in the profits or emoluments of any contract, job, work or service, either by himself or by another, directly or indirectly. Any such contract for a job, work or service for the city in which any member of council, member of the board of education, officer or employee has or holds any such interest is void.

C. Section 2-1050. Gratuities and Kickbacks Prohibited.

It is unlawful for any person to offer, give or agree to give to any person, while a city employee, or for any person, while a city employee, to solicit, demand, accept or agree to accept from another person, anything of a pecuniary value for or because of:

(1) An official action taken, or to be taken, or which could be taken;

(2) A legal duty performed, or to be performed, or which could be performed; or

(3) A legal duty violated, or to be violated, or which could be violated by such person while a city employee.

Anything of nominal value shall be presumed not to constitute a gratuity under this section.

Kickbacks. It is unlawful for any payment, gratuity, or benefit to be made by or on behalf of a subcontractor or any person associated therewith as an inducement for the award of a subcontract or order.

D. Section 2-1051. Covenant Relating to Contingent Fees.

(a) Representation of Contractor. Every person, before being awarded a contract in excess of ten thousand dollars ($10,000.00) with the city, shall represent that no other person has been retained to solicit or secure the contract with the city upon an agreement or understanding for a commission, percentage, brokerage or contingent fee, except for bona fide employees or bona fide established commercial, selling agencies maintained by the person so representing for the purpose of securing business.

(b) Intentional Violation Unlawful. The intentional violation of the representation specified in subsection (a) of this section is unlawful.

E. Section 2-1052. Restrictions on Employment of Present and Former City Employees.

Contemporaneous employment prohibited. It shall be unlawful for any city employee to become or be, while such employee, an employee of any party contracting with the particular department or agency in which the person is employed.

For violations of the ethical standards outlined in the Knoxville City Code, the City has the following remedies:

(1) Oral or written warnings or reprimands;

(2) Cancellation of transactions; and

(3) Suspension or debarment from being a Contractor or subcontractor under city or city-funded contracts.

The value of anything transferred in violation of these ethical standards shall be recoverable by the City from such person. All procedures under this section shall be in accord with due process requirements, included but not limited to a right to notice and hearing prior to imposition of any cancellation, suspension or debarment from being a Contractor or subcontractor under a city contract.

3.9.15 **Nondiscrimination.** Firms must comply with the President's Executive Order No. 11246 and 11375 which prohibit discrimination in employment regarding race, color, religion, sex or national origin. Firms must also comply with Title VI of the Civil Rights Act of 1964, Copeland Anti-Kick Back Act, the Contract Work Hours and Safety Standards Act, Section 402 of the Vietnam Veterans Adjustment Act of 1974, Section 503 of the Rehabilitation Act of 1973, and the Americans with Disabilities Act of 1990, all of which are herein incorporated by reference.

3.9.16 **Inclusion of Minority Firms.** Firms shall give consideration to the inclusion of minority firms or individuals in this project, and shall advise the city in this proposal of their efforts to do so.

3.9.17 **Sustainability.** Firms shall give consideration to the use of environmentally sustainable best practices, and shall advise the city in this submittal of qualifications of their efforts to do so.

3.9.18 **Licenses.** Before a contract is signed by the City, the submitting entity, if selected, must provide the City Purchasing Division with a copy of its valid business license or with an affidavit explaining why it is exempt from the business licensure requirements of the city or county in which it is headquartered. If a contract is signed, the Contractor's business license shall be kept current throughout the duration of the contract, and the Contractor shall inform the City of changes in its business name or location. The Contractor must be a licensed professional as required by the state of Tennessee, see T.C.A. Sections 62-2-101 et. seq., for any services in this contract requiring such licensure.

3.9.19 **Funding.** The City's performance and obligation to pay under this contract is subject to funding contingent upon an annual appropriation and award of federal grants from the Federal Transit Administration.

3.9.20 **Subcontracts to the Agreement.** Contractor shall not enter into a subcontract for any of the services performed under this agreement without obtaining the prior written approval of the City.

3.9.21 **Amendments.** This agreement may be modified only by a written amendment or addendum that has been executed and approved by the appropriate officials shown on the signature page of the agreement.

3.9.22 **Captions.** The captions appearing in the agreement are for convenience only and are not a part of the agreement; they do not in any way limit or amplify the provisions of the agreement.

3.9.23 **Severability.** If any provision of the agreement is determined to be unenforceable or invalid, such determination shall not affect the validity of the other provisions contained in the agreement. Failure to enforce any provision of the agreement does not affect the rights of the parties to enforce such provision in another circumstance, nor does it affect the rights of the parties to enforce any other provision of this agreement at any time.

3.9.24 **No Benefit for Third Parties.** The services to be performed by the Contractor pursuant to the Agreement with the City are intended solely for the benefit of the City, and no benefit is conferred hereby, nor is any contractual relationship established herewith, upon or with any person or entity not a party to the Agreement. No such person or entity shall be entitled to rely on the Contractor's performance of its services hereunder, and no right to assert a claim against the City or the Contractor, its officers, employees, agents, or contractors shall accrue to the Contractor or to any subcontractors, independently retained professional consultant, supplier,

fabricator, manufacturer, lender, tenant, insurer, surety, or any other third party as a result of this Agreement or the performance or non-performance of the Contractor's services hereunder.

3.9.25 **Non-Reliance of Parties.** Parties explicitly agree that they have not relied upon any earlier or outside representations other than what has been included in the Agreement. Furthermore, neither party has been induced to enter into this Agreement by anything other than the specific written terms set forth herein.

3.9.26 **EEO/AA.** The City of Knoxville is an EE/AA/Title VI/Section 504/ADA/ADEA Employer.

3.9.27 By submitting a proposal, the submitting entity agrees to all terms and conditions established in this RFP, including its contract requirements.

SECTION IV – SPECIAL PROVISIONS.

4.1 Inspection, Tests and Repairs.

4.1.1 Repair Performance

4.1.1.1 **Repair by Contractor.** After non-acceptance of a bus and receipt of defect details from KAT, the Contractor must begin work within five (5) business days after receiving notification from KAT of failure of acceptance tests. KAT 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. KAT will provide maintenance bay space within their Operations and Maintenance facility if practical. At KAT's option, the Contractor may be required to remove the bus from KAT property while repairs are being made. If the bus is removed from KAT property, then 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.

4.1.1.2 **Repairs by KAT.** KAT will not take responsibility to correct defects, except to replace defective parts if agreed upon between the Contractor and KAT.

4.1.1.2.1 **Parts used.** If KAT 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. Work order reports of all repairs covered by this procedure shall be submitted by KAT to the Contractor for reimbursement or replacement of parts within a period to be mutually agreed upon.

4.1.1.2.2 **Contractor-supplied parts.** If the Contractor supplies parts for repairs being performed by KAT after non-acceptance of the bus, then these parts shall be shipped prepaid to KAT.

4.1.1.2.3 **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.

4.1.1.2.4 **Reimbursement for labor.** KAT 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 $65.00 per hour, which includes fringe benefits and overhead adjusted for KAT'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.

4.1.1.2.5 **Reimbursement for parts.** The City 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.

4.1.2 **Pilot Bus.** The City shall have the option to require the Contractor to produce a pilot bus which shall be one of the ultimate quantity of the base vehicle order. Should this option be exercised, the pilot vehicle shall demonstrate that the bus fully meets all requirements of the Contract and meets the performance requirements of the route operating profile.

4.1.2.1 The pilot vehicle shall be produced and delivered to KAT 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 City. In the event that noncompliance is identified, KAT shall to the extent practicable notify the Contractor of said noncompliance. No later than seven (7) calendar days after the end of the 30-day test, KAT 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.

4.1.2.2 In the event the pilot bus does not initially comply with all performance criteria contained in the Technical Specifications, the City shall have the right to retain a portion of any progress payment that may have been established for the pilot vehicle. 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 pilot bus. This amount shall be withheld until compliance is demonstrated. Additionally, the contract may be subject to termination.

4.1.3 **Configuration and Performance Approval.** In order to assess the Contractor's compliance with the Technical Specifications, KAT and the Contractor shall, at the Pre-Production Meeting, jointly develop a configuration and performance review document for review of the pilot bus, if the City exercises the pilot bus option. 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.

4.1.4 **First Article Inspection – Production.**

4.1.4.1 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.

4.1.4.2 Where required by the Contract documents or requested by KAT, 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 KAT prior to each first article inspection a written inspection and demonstration plan for each item for review. KAT's inspectors will attend each first article inspection unless KAT 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 KAT, and all documents relating to the inspection shall be forwarded to the City.

4.1.5 **Post Delivery Tests.**

4.1.5.1 KAT will conduct acceptance tests on each delivered bus. These tests shall be completed within fifteen (15) business 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 KAT. The post-delivery tests shall include visual inspection and bus operations. No post-delivery test shall apply criteria that are different from the criteria applied in a similar pre-delivery test.

4.1.5.2 Buses that fail to pass the post-delivery tests are subject to non-acceptance. KAT shall provide initial notice of non-acceptance within fifteen (15) business days and shall provide Contractor details of all defects within thirty (30) business days. 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) business days of receiving defect details, then the work may be done by KAT personnel with reimbursement by the Contractor.

4.2 **Deliveries.**

4.2.1 **Bus Delivery.** Delivery of buses shall be determined by signed receipt of a KAT maintenance supervisor at the following point of delivery and may be preceded by a cursory inspection of the bus:

Knoxville Area Transit
1135 E. Magnolia Avenue
Knoxville, Tennessee 37917

4.2.2 **Delivery Schedule.** The buses shall be delivered at a rate not to exceed six (6) buses per week. Delivery of all buses ordered on the first purchase order shall be delivered within twelve (12) months from the date the purchase order is submitted to the Contractor **OR** no later than August 1, 2019, **whichever comes first**. The first order shall include the pilot bus (if the pilot bus option is exercised) plus other bus quantities, base and options, up to six (6) buses. Thereafter, deliveries shall not exceed fourteen (14) months from the date each purchase order is submitted to the Contractor. Hours of delivery shall be as depicted below:

Monday through Thursday – 24 hours
Friday – 12:01 AM through 7:00 PM
Saturday – 8:00 AM through 3:00 PM
Sunday – 2:00 PM through midnight

4.2.3 **Contract Deliverables.** Contract deliverables associated with this Contract are set forth in the table below, along with other pertinent information. Due dates shown 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.

Deliverable		KAT/City Action	Due Date	Format	Quantity Due
1.	Insurance certificates and endorsements	Approval	Following notice of intent to contract and prior to contract award	Electronic	1
2.	Pre-production meeting minutes	Approval	Two weeks following each meeting	Electronic	1
3.	Post pre-production meeting price adjustments	Approval	Two weeks following each meeting	Electronic	1
4.	Passenger seat layout drawing	Approval	30 days prior to bus production	Electronic	1
5.	Operator controls layout drawing	Approval	30 days prior to bus production	Electronic	1
6.	Bus external paint and decal drawing	Approval	30 days prior to bus production	Electronic	1
7.	Security camera layout	Approval	30 days prior to bus production	Electronic	1
8.	Drivers log and incident report	Review and file	With each delivered bus	Hardcopy	1
9.	Vehicle weigh ticket (measured at curb weight)	Review, record and file	With each delivered bus	Hardcopy	1
10.	Vehicle Certificate of Origin	Process and file	One week following delivery	Hardcopy	1
11.	Odometer Certificate	Process and file	One week following delivery	Hardcopy	1
12.	Invoice	Approve, process and file	One week following delivery	Hardcopy	1 per bus
13.	Post Delivery Audit documentation (FMVSS certificate, Buy America certificate, Buy America worksheet, description of final assembly activities,	Approve and Certify	One week following delivery	Hardcopy	1 of each

	actual cost of final assembly				
14.	List of serialized components installed on each bus	Review, record and file	With each delivered bus	Hardcopy	1
15.	Training instructor information	Review	30 days prior to delivery of first/pilot bus	Electronic	1
16.	Training curriculum	Approval	30 days prior to delivery of first/pilot bus	Electronic	1
17.	Student training materials	Review	During instruction	Hardcopy and Electronic	1 per student & 1 electronic
18.	Recommended spare parts list	Approval	With delivery of first bus (delivery of 2nd bus if pilot bus option is exercised)	Electronic	1
19.	Draft operators' manuals	Approval	With delivery of pilot bus (if exercising pilot bus option)	Hardcopy	1
20.	Draft preventative maintenance manual	Approval	With delivered pilot bus (if exercising pilot bus option)	Hardcopy	1
21.	Draft preventative maintenance manual	Approval	With delivered pilot bus (if exercising pilot bus option)	Hardcopy	1
22.	Draft diagnostic procedures manuals	Approval	With delivered pilot bus (if exercising pilot bus option)	Hardcopy	1
23.	Draft schematics (all systems)	Approval	With delivered pilot bus (if exercising pilot bus option)	Hardcopy	1
24.	Draft parts manual	Approval	With delivered pilot bus (if exercising pilot bus option)	Hardcopy	1
25.	Final operators' manuals	Approval	With delivery of 1st bus (2nd bus if pilot option is exercised)	Hardcopy and Electronic	2 hardcopies per bus and 1 electronic
26.	Final preventative maintenance manual	Approval	30 days following delivery of 2nd bus	Electronic	1
27.	Final diagnostic procedures manuals	Approval	30 days following delivery of 2nd bus	Electronic	1

28.	Final schematics (all systems)	Approval	30 days following delivery of 2nd bus	Electronic	1
29.	Final parts manual	Approval	30 days following delivery of 2nd bus	Hardcopy and Electronic	2 hardcopy and 1 electronic
30.	Component repair manuals	Approval	30 days following delivery of 2nd bus	Electronic	1

4.3 **Options and Option Pricing.**

4.3.1 The Contractor hereby grants the City of Knoxville and any permissible assignee options ("Options") to purchase up to twenty-four (24) additional vehicles ("Option Vehicles"). The Options shall be valid for a period of five (5) years from the effective date of the Contract. Option Vehicle quantities for assignees shall be specified and authorized in writing by the City of Knoxville. Subject to the City's right to order modifications, the Option Vehicles shall have the same specifications as the vehicles purchased under this Contract. The City may exercise the Options by written notice to the Contractor ("Notice of Exercise of Option") via purchase order at any time on or before five years following the effective date of the Contract ("Option Date").

4.3.2 Pricing for Options. Vehicles ordered within the first year of the contract shall be the same as base order vehicles. After the contract's first year, the Contractor may adjust the contract price per bus in accordance with the increase or decrease, if any based on the most recently published following "Producer Price Index (PPI)," published by the U.S. Department of Labor:

Series ID: PCU3361203361203
Not Seasonally Adjusted
Industry: Heavy duty truck mfg
Product: Buses, including military and firefighting vehicles (chassis of own manufacture)

Excepting that the maximum annual increase shall not exceed 3.5%. The new rate will be calculated as per the following example:

PPI for current period (Current August Index):	128.1
-PPI for previous period (Prior year August Index):	125.5
= Index point change	2.6

Index point change (2.6) ÷ Prior year August Index (125.5) = 0.021 x 100 = 2.1% index change
2.1% index change x current contract bus price = New contract bus price

The increase in the Contract Price may occur after Contractor has given the City written notice of such change and the City approves the calculation.

4.3.3 Within thirty (30) days after delivery of the Option Vehicle(s) purchase order to the Contractor, the Contractor shall submit a proposed delivery schedule. Along with the proposed delivery schedule, the Contractor will provide the City 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, then the maximum term for the production of the Option Vehicles shall not exceed a total of fourteen (14) months after the date of the Option Vehicle purchase order. The City 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 City or any permissible assignee of the City for the Option Vehicles incorporating the agreed production delivery schedule or the fourteenth-month maximum term.

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

4.4 **Assignability of Options.** If the City of Knoxville does not exercise the options as listed in the "Options and Option Pricing," then the City reserves the right to assign the options to other grantees of FTA funds in accordance with FTA Circular 4220.1f or its successors and state law. All option assignments will be authorized in writing between the City of Knoxville and assignees.

4.5 **Payment.** The City 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.

4.5.1 **Payment Terms.**

4.5.1.1 All payments shall be made as provided herein, less any additional amount withheld as provided below and less any amounts for liquidated damages in accordance with "Liquidated Damages for Late Delivery of the Bus."

4.5.1.2 The City shall make payments for buses, spare parts and/or equipment at the unit prices itemized in the price schedule within 30 calendar days after the delivery and acceptance of each bus/spare parts/equipment, completion of post-delivery audits, and receipt of a proper invoice. A proper invoice must include the items listed below.

- Name and address of Contractor.
- Invoice date and invoice number (The contractor should date invoices and close as possible to the date of the mailing or transmission.)
- City's purchase order number.
- Description, quantity, unit of measure, unit price, and extended price.

- Shipping and payment terms (e.g., shipment number and date of shipment, discount for prompt payment terms).
- Name and address to whom payment is to be sent.
- Name (where practical), title, phone number, and mailing address of person to notify in the event of a defective invoice.
- Any other information or documentation required by the contract (e.g., post-delivery audit supporting documents, certification of origin for motor vehicle, odometer statement)

4.5.2 **Payment of Taxes.** Unless otherwise provided 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.

4.6 **Liquidated Damages for Late Delivery of the Bus.**

4.6.1 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 within the time specified in "Delivery Schedule," except for any excusable delays as provided in "Excusable Delays/Force Majeure" or any extension thereof, the City 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 City shall be fixed at $100.00 per calendar day per bus not delivered in substantially good condition as inspected by KAT's resident inspector at the time released for shipment.

4.6.2 The Contractor hereby agrees to pay the aforementioned amounts as fixed, agreed and liquidated damages, and not by way of penalty, to the City of Knoxville and further authorizes the City 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 City the difference or the entire amount, whichever may be the case, within thirty (30) days after receipt of a written demand by the City Purchasing Agent.

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

4.7 **Service and Parts.**

4.7.1 **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.

4.7.2 **Documentation.** The Contractor shall provide an electronic copy of current maintenance manuals to include preventative maintenance procedures, diagnostic procedures or troubleshooting guides, schematics and major component service manuals; an electronic copy and two (2) printed current parts manuals, and an electronic copy and two (2 per bus) printed standard operator's manuals as part of this Contract. The Contractor also shall exert its best efforts to keep maintenance manuals, operator's 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; electronic copies are preferred.

4.7.3 **Parts Availability Guarantee.**

4.7.3.1 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 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.

4.7.3.2 Where the parts ordered by KAT are not received within seven (7) calendar days and a bus procured under this Contract is out of service due to the lack of said ordered parts, then the Contractor shall provide KAT, within eight (8) hours of KAT's verbal or written request, the original Suppliers' and/or manufacturers' part numbers, company names, addresses, telephone numbers and contact persons' names for all the specific parts not received by KAT.

4.7.3.3 Where the Contractor fails to honor this parts guarantee or parts ordered by KAT are not received within fourteen (14) calendar days, then the Contractor shall provide to KAT, within seven (7) days of KAT's verbal or written request, the design and manufacturing documentation for those parts manufactured by the Contractor and the original Suppliers' and/or manufacturers' part numbers, company names, addresses, telephone numbers and contact persons' names for all of the specific parts not received by KAT. The Contractor's design and manufacturing documentation provided to KAT shall be for its sole use in regard to the buses procured under this Contract and for no other purpose.

4.7.4 **KAT-Furnished Property.**

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

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

4.7.1.2 The City retains title to all KAT-furnished property. Upon receipt of the KAT-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 KAT-furnished equipment or materials be damaged, such property shall be repaired or replaced at the Contractor's expense to the satisfaction of KAT. 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 City shall have the right to take corrective measures itself and deduct the cost from any sums owed to the Contractor.

4.7.1.3 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.

4.8 **Federal Motor Vehicle Safety Standards (FMVSS).** The Contractor shall submit a manufacturer's FMVSS self-certification, Federal Motor Vehicles Safety Standards, that the vehicle complies with relevant FMVSS or manufacturer's certified statement that the contracted buses will not be subject to FMVSS regulations.

V. TECHNICAL SPECIFICATIONS.

NOTE: These technical specifications were written after careful review of zero-emission bus information available to KAT staff. We realize manufacturers may have differing designs that enable the desired buses to achieve longer route service distance performance on a single battery charge. Many of these designs are expected to relate to lighter materials or different components than depicted within the technical specifications. We encourage all proposers to address these differences through the "requests for approved equals" process and "Form for Proposal Deviations".

5.1 **Scope**. Technical specifications define requirements for thirty-five foot (35') heavy-duty, zero emission electric transit buses designed for general service on urban arterial streets. Buses shall have a minimum service 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.

5.2 **Definitions.**

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

5.2.2 **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).

5.2.3 **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.

5.2.4 **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.**

5.2.5 **Baseline Configuration Bus**: The bus described by the Technical Specifications if no alternatives are selected.

5.2.6 **Battery Compartment**: Low-voltage energy storage, i.e. 12/24 VDC batteries.

5.2.7 **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.

5.2.8 **Cells:** Simplest discrete component of the battery storage system, such as a battery or a capacitor.

5.2.9 **Class of Failures**: Classes of failures are described below.

5.2.9.1 Class 1: Physical Safety. A failure that could lead directly to passenger or operator injury or represents a severe crash situation.

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

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

5.2.9.4 Class 4: Bad Order. A failure that does not require removal of the bus from service during its assignments but does degrade bus operation. The failure shall be reported by operating personnel.

5.2.10 **Code**: A legal requirement.

5.2.11 **Curb Weight:** Weight of vehicle, including maximum fuel, oil and coolant, and all equipment required for operation and required by this Specification, but without passengers or operator.

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

5.2.13 **DC to DC Converter**: A module that converts a source of direct current from one voltage level to another.

5.2.14 **Destroyed**: Physically made permanently unusable.

5.2.15 **Discrete Signals**: A signal which 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.

5.2.16 **Drive System**: Consists of Drive Motor, Drive Motor Controller (Inverter), gearbox or transmission and drive shaft along with related mounting hardware.

5.2.17 **Driver's Eye Range**: The 95th-percentile ellipse defined in SAE J941, except that the height of the ellipse shall be determined from the seat at its reference height.

5.2.18 **End of Life (EOL)**: A condition reached when an energy storage system fails to meet specified capacity, power or function in specified use conditions.

5.2.19 **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).

5.2.20 **Energy Storage System (ESS)**: 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.

5.2.21 **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.

5.2.22 **Fireproof**: Materials that will not burn or melt at temperatures less than 2,000° F.

5.2.23 **Free Floor Space**: Floor area available to standees, excluding the area under seats, area occupied by feet of seated passengers, the vestibule area forward of the standee line, and any floor space indicated by manufacturer as non-standee areas such as, the floor space "swept" by passenger doors during operation. Floor area of 1.5 square feet shall be allocated for the feet of each seated passenger that protrudes into the standee area.

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

5.2.25 **Gross Axle Weight Rating (GAWR)**: The maximum total weight as determined by the axle manufacturer, at which the axle can be safely and reliably operated for its intended purpose.

5.2.26 **Gross Load:** One hundred fifty pounds for every designed passenger seating position, for the operator, and for each 1.5 square feet of free floor space.

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

5.2.28 **Gross Vehicle Weight Rating (GVWR)**: The maximum total weight as determined by the vehicle manufacturer, at which the vehicle can be safely and reliably operated for its intended purpose.

5.2.29 **Human Dimensions**: The human dimensions used in the Technical Specifications are defined in "Humanscale 1/2/3", (by Niels Diffrient, Alvin. R. Tilley, and Joan. C. Bardagjy; MIT Press, 1974).

5.2.30 **Inverter**: A module that converts DC to and from AC.

5.2.31 **Labeled**: Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization, that is acceptable to the authority having jurisdiction and concerned with product evaluation, that 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.

5.2.32 **Leakage**: Release of contents through a defect or crack.

5.2.33 **Low Floor Bus**: A bus which, 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.

5.2.34 **Low Voltage**: 50 volts or less (AC and DC).

5.2.35 **Maintenance Personnel Skill Levels**: Defined below are maintenance personnel skill levels used in the technical specification.

5.2.35.1 5M: Specialist Mechanic or Class A Mechanic Leader

5.2.35.2 4M: Journeyman or Class A Mechanic

5.2.35.3 3M: Service Mechanic or Class B Servicer

5.2.35.4 2M: Mechanic Apprentice

5.2.35.5 1M: Cleaner, Fueler, Oiler, Hostler, or Shifter

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

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

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

5.2.39 **Operator's Eye Range**: The 95th-percentile ellipse defined in SAE Recommended Practice J941, except that the height of the ellipse shall be determined from the seat at its reference height.

5.2.40 **Pack**: A collection of cells or modules described on the basis of electrical or physical attributes, to include but not limited to *Electrical Pack* and *Physical Pack.*

5.2.41 **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.

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

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

5.2.44 **Propulsion System**: System that provides propulsion for the vehicle proportional to operator commands. Includes, as applicable, engine, transmission, traction motors, energy storage system (ESS), and system controllers including all wiring and converter/inverter.

5.2.45 **Regenerative Braking:** Deceleration of the bus by switching motors to act as generators, which return vehicle kinetic energy to the energy storage system.

5.2.46 **Retarder**: A device used to augment or replace some of the functions of the primary friction based braking system of the bus.

5.2.47 **Seated Load:** One hundred fifty pounds for every designed passenger seating position and for the operator.

5.2.48 **Seated Load Weight (SLW)**: Curb weight plus seated load.

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

5.2.50 **Standards**: Standards are the latest revisions unless otherwise stated.

5.2.51 **Standee Line**. A line marked across the bus aisle to designate the forward area that passengers may not occupy when the bus is moving.

5.2.52 **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 a percentage. This is a dynamic measurement used for the energy storage system. A full SOC indicates that the energy storage system cannot accept further charging from the engine-driven generator or the regenerative braking system.

5.2.53 **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.

5.2.54 **Usable Battery Capacity:** Usable Battery capacity is measured in kWh 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

5.2.55 **Warrantable End of Life (WEOL):** WEOL is measure of battery degradation determined as the point at which the batteries can no longer provide the energy or power required to meet the route 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.

5.2.56 **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 in. above the ground, and does not weigh more than 600 lbs when occupied.

5.3 **Referenced Publications.** The documents or portions thereof referenced within this specification will be considered part of the requirements of the specification. The edition indicated for each referenced document is the current edition, as of the date of the issuance of the APTA bus procurement guidelines.

5.4 **Legal Requirements.**

5.4.1 The Contractor will comply with all applicable federal, state and local regulations. These will include but not be limited to ADA, as well as state and local accessibility, safety and security requirements. Local regulations are defined as those below the state level and are incorporated within this document. Many ADA requirements specific to the bus are addressed in the ADA requirements checklist section of this RFP.

5.4.2 Buses will meet all applicable FMVSS regulations and will accommodate all applicable FMCSR regulations in effect at the date of manufacture.

5.4 3 In the event of any conflict between the requirements of these specifications and any applicable legal requirement, the legal requirement will prevail. Technical requirements that exceed the legal requirements are not considered to conflict.

5.5 **Overall Requirements.** All buses will be of new construction; no reused parts or components. The Contractor shall ensure that the application and installation of major bus sub-components and systems are compliant with all such sub-component vendors' requirements and recommendations. Components used in the vehicle shall be of heavy-duty design and proven in transit service. Whenever a specific trade or product name is used within this specification, the following statement applies "…or approved equal with the same standards of quality, design and performance." All requests for approved equals must be submitted to the City for review and approval. Additionally, all requests for approved equals must include documentation proving why it is equal to the requested component.

5.6 **Weight.**

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

5.6.2 Buses at a capacity load will not exceed the tire factor limits, brake test criteria, structural design criteria or the gross vehicle weight rating (GVWR).

5.7 **Capacity.** The vehicle shall be designed to carry the Gross Vehicle Weight as defined at paragraph 5.2.27, which shall not exceed the bus GVWR. The vehicle shall not exceed the individual gross axle weight rating (GAWR) at curb weight plus gross load.

5.8 **Minimum Service Life.** The minimum useful design life of the bus in transit service will be at least twelve (12) years or 500,000 miles. It will be capable of operating at least 40,000 miles per year, including the 12th year.

5.9 **Maintenance and Inspection.**

5.9.1 Scheduled maintenance tasks will be related and in accordance with the manufacturer's recommended preventative maintenance schedule (along with routine daily service performed during the fueling operations). The overall PM schedule for buses shall be based upon a minimum of a 6000 mile interval and/or multiples of the same.

5.9.2 The bus manufacturer is responsible for providing a written comprehensive 52-week and long-term rehab/replacement maintenance plan encompassing buses for their entire useful life. The plan should include times (in hours) to complete the jobs.

5.9.3 Diagnostic test ports, as required, will be provided for commonly checked functions on the bus, such as multiplex communication, gearbox, drive motor, battery management system, ESS cooling system, passenger A/C system, ABS, etc.

5.9.4 The bus manufacturer will give prime consideration to the routine problems of maintaining the vehicle. All bus components and systems, both mechanical and electrical, requiring periodic maintenance servicing or inspection must be installed such that a minimum of time and effort is consumed in gaining access to the critical maintenance areas. It shall not be necessary to disassemble portions of the coach structure and/or equipment, such as seats and flooring under seats for example, in order to gain access to these areas. Each coach will be designed to facilitate the disassembly, reassembly, servicing or maintenance, using tools and equipment that are commonly available as standard commercial items.

5.9.5 Requirements for the use of unique specialized tools must be minimized. As indicated above, the body and structure of the bus must be designed for ease of maintenance and repair. Individual panels or other equipment that may be damaged in normal service shall be repairable or replaceable. Ease of repair will be related to the vulnerability of the item to damage in service.

5.9.6 Proposers shall provide a list of all special tools and pricing required for maintaining the electric bus. Said list will be submitted as a supplement to the Pricing Schedule.

5.10 **Interchangeability.**

5.10.1 Unless otherwise agreed, all buses and components procured under the resulting contract, whether provided by the awarded Contractor's 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 extends to the individual components as well as to their locations in the buses. These components include, but are not limited to, passenger window hardware, interior trim, lamps, lamp lenses, seat assemblies, etc. Components with non-identical functions will not be, or appear to be, interchangeable.

5.10.2 Any one component or unit used in the construction of these buses will be an exact duplicate in design, manufacture and assembly for each bus in each order group in the resulting contract. The awarded Contractor will identify and secure approval for any changes in components or unit construction provided within the contract.

5.10.3 In the event that the awarded Contractor is unable to comply with the interchangeability requirement, the Contractor must notify KAT and obtain the City of Knoxville's prior written approval, including any changes in pricing.

5.10.4 KAT will review proposed product changes on a case-by-case basis and has the right to require extended warranties to ensure that product changes perform at least as well as the originally supplied products.

5.11 **Training.**

5.11.1 The awarded Contractor must have at least one qualified instructor who will be available at KAT's Operations and Maintenance Facility at times and for durations mutually agreed to by both parties. Instructor(s) will conduct training and advise KAT personnel on proper operation and maintenance of the bus and supporting infrastructure. The Contractor shall also provide visual and other teaching aids (such as manuals, slide presentations and literature) for use by KAT's own training staff, which become the property of KAT.

5.11.2 Bus manufacturer's training courses, at a minimum, shall be designed around the following subjects.

- Efficient and safe operation of the bus.
- First responder actions.
- Mechanic energy storage system health monitoring.
- Comprehensive diagnostics and repair of the propulsion, ESS and battery management systems.
- Diagnostics and repair of the electric bus charging system.
- Preventative Maintenance processes.
- Collision repair for both minor and major body damage.
- Hydraulic and Pneumatic system troubleshooting and repair.
- Other maintenance related courses the manufacturer makes available and not listed above.

5.11.3 Bus manufacturer's training courses listed above shall be available throughout the life of the bus and listed on the proposal pricing schedule supplement.

5.11.4 Proposers shall provide information on available bus manufacturer's training courses in addition to those listed above and include course duration, optimum class size, classroom/facility and equipment requirements.

5.11.5 At a minimum, the Contractor shall provide the full range of training courses listed above and offered within the proposal at no additional charge for the first year starting with delivery of the first order of buses. Appropriate courses within this first year's training shall be provided, at a minimum, for the following.

- 13 operations supervisors
- 2 driver trainers.
- 12 bus operators
- 12 mechanics
- 5 maintenance shop supervisors/maintenance director
- 5 paint & body mechanics

5.11.6 Proposals shall also provide a list of training available from component OEM manufacturers and contact information KAT will need to make training arrangements.

5.12 **Technical/Service Representatives.** The Contractor will, at its own expense, have one or more competent technical service representatives available on request to assist KAT 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 Warranty Requirements."

5.13 **Operating Environment.** The bus must achieve normal operation in ambient temperature ranges of 10 ºF to 115 ºF, at relative humidity between 5 percent and 100 percent, and at altitudes up to 3000 ft above sea level. Degradation of performance due to atmospheric conditions must be minimized at temperatures below 10 °F, above 115 °F, or at altitudes above 3000 ft. Speed, gradeability and acceleration performance requirements must be met at, or corrected to, 77 °F, 29.31 inHg, dry air per SAEJ1995.

5.14 **Interior Noise.**

5.14.1 The combination of inner and outer panels and any material used between them must provide sufficient sound insulation so that a sound source with a level of 80 dBA measured at the outside skin of the bus has a sound level of 65 dBA or less at any point inside the bus. These conditions prevail with all openings, including doors and windows, closed and with the propulsion system and accessories switched off.

5.14.2 Maximum internal noise level shall not exceed 75 dBA in the operator's area near normal operator ear level and 80 dBA in all other areas in the interior of the vehicles under all normal operating conditions at locations inside the bus in adherence with the standards of ISO 5128.

5.15 **Exterior Noise.** Airborne noise generated by the bus and measured from either side shall not exceed 80 dBA under full power acceleration when operated at 0 to 35 mph at curb weight. The Contractor will comply with the exterior noise requirements defined in local laws and ordinances and SAEJ366.

5.16 **Fire Safety.** The bus is designed and manufactured in accordance with all applicable fire safety and smoke emission regulations. These provisions include the use of fire-retardant/low-smoke materials, fire detection systems, bulkheads and facilitation of passenger evacuation.

5.17 **Materials.** All materials used in the construction of the passenger compartment of the bus shall meet the requirements of FMVSS 302.

5.18 **Fire Suppression.** No fire suppression system shall be required so long as the battery management system is capable of thermally monitoring the internal temperature with redundant sensors internal to the battery packs. If the temperatures become high enough to affect performance, the Battery Management System shall be required to de-rate power until the temperature is reduced. If the temperatures were to continue rising, the control system shall be required to disable the vehicle.

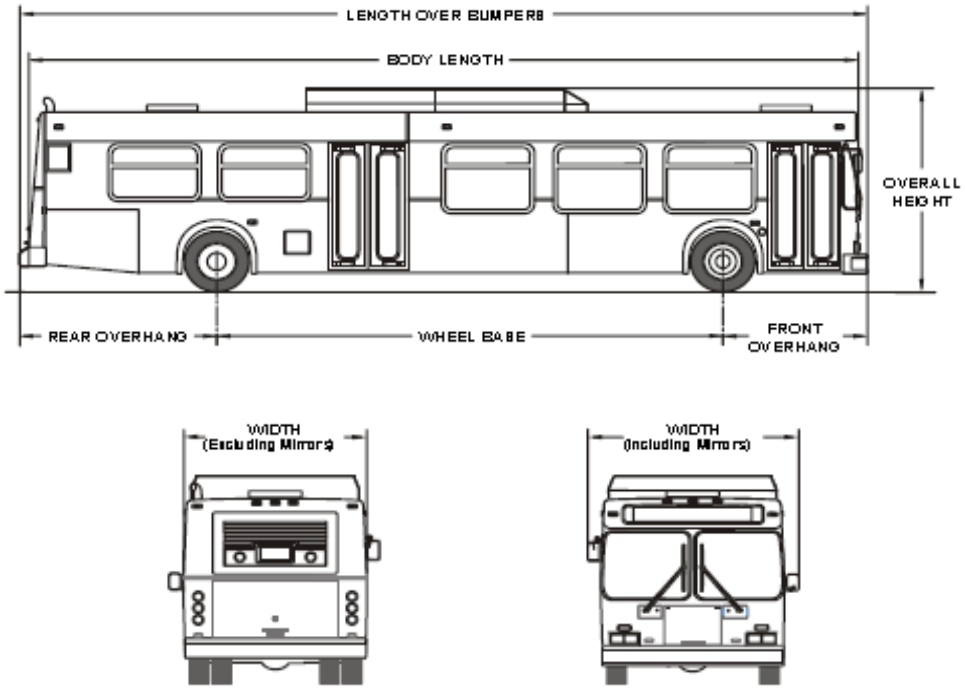
5.19 **Respect for the Environment.**

5.19.1 In the design and manufacture of the bus, the awarded Contractor shall make every effort to reduce the amount of potentially hazardous waste generated. In accordance with Section 6002 of the Resource Conservation and Recovery Act (RCRA), the Contractor shall use, whenever possible and allowed by the specifications, recycled materials in the manufacture of the bus.

5.19.2 The awarded Contractor shall provide a plan for reuse or recycling of replaced battery cells and/or battery packs.

5.20 **Physical Size and Clearances.** 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 rubrails, the bus shall have the following overall dimensions as depicted within the sub-paragraphs below and shown in the figure below at static conditions and design height.

Transit Bus Exterior Dimensions



5.20.1 **Bus Length.** For ease of use, the following tolerances will be allowable for the required bus length. Bus length is determined as the measurement from bumper to bumper.

35-Foot Electric Bus: 34 ft to 36 ft, 11 in.

5.20.2 **Bus Width.** Body width shall be 102 inches (+0”/-1”).

5.20.3 **Bus Maximum Overall Height.** Maximum overall height shall be 140 inches, including all rigid, roof-mounted items such as A/C, ESS, etc.

5.20.4 **Step Height.** The step height shall not exceed 16.5 inches at either doorway without kneeling and shall not exceed 15.5 inches at the step. A maximum of two steps are allowed to accommodate a raised aisle floor in the rear of the bus, if so designed.

5.20.5 **Underbody Clearance.** The bus shall maintain the minimum clearance dimensions as defined and shown in Figure 2 of SAE Standard J689, regardless of load up to the gross vehicle weight rating.

5.20.6 **Ramp Clearances.**

5.20.6.1 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.

5.20.6.2 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.

5.20.6.3 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.

5.20.6.4 The proposed electric bus shall comply with the ramp angles depicted in the table below.

Ramp Angle Clearances

Angle	35-ft Bus
Approach	8.6 deg (min.)
Breakover	8.0 deg (min.)
Departure	8.6 deg (min.)

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

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

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

5.20.10 **Floor Height.** Height of the step above the street shall be no more than 16 inches measured at the centerline of the front and rear doorway. 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 are allowed to accommodate a raised aisle floor in the rear of the bus.

5.20.11 **Interior Headroom.** Headroom above the aisle and at the centerline of the aisle seats shall be no less than 78 inches forward of the rear raised area tapering to no less than 74 inches forward of the rear settee. At the centerline of the window seats, headroom shall be no lower than 65 inches. Headroom at the back of the rear bench seat may be reduced to a minimum of 56 inches, but it shall increase to the ceiling height at the front of the seat cushion. In any area of the bus directly over the head of a seated passenger and positioned where a passenger entering or leaving the seat is prone to strike his/her head, padding shall be provided on the overhead paneling.

5.20.12 **Aisle Width.** The minimum clear aisle width between pairs of transverse seats with all attached hardware shall be at least 22 inches. The aisle width between the front wheelhouses shall be at least 35.5 inches, and the entire area between the front wheelhouses shall be available for passengers and mobility aid devices.

5.21 **Power Requirements.** The electric propulsion system shall be sized to provide sufficient power to enable the bus to meet the defined acceleration, top speed, and gradability requirements, and operate all propulsion system powered accessories using actual road test results and computerized vehicle performance data. A 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.

5.22 **Top Speed.** The bus shall be capable of achieving a top speed of 65 mph on a straight, level road at GVWR with all accessories operating. The bus shall be capable of safely maintaining the vehicle speed according to the recommendations by the tire manufacturer.

5.23 **Gradeability.** Gradeability requirements shall be met on grades with a dry commercial asphalt or concrete pavement at GVWR with all accessories operating. The propulsion system shall be required to enable the bus to achieve a speed of 40 mph on a 2.5% ascending grade and 10 mph on a 10% ascending grade continuous.

5.24 **Acceleration.** The acceleration shall meet the requirements listed in the table below and shall be sufficiently gradual and smooth to prevent throwing standing passengers off-balance. Acceleration measurement shall commence when the accelerator is depressed.

Maximum Start Acceleration Times on a Level Surface

Speed (mph)	**Maximum time (seconds)**
10	5
20	10

30	18
40	30
50	60
Top speed	

5.25 **Fuel Economy/Range.** The bus must be able to achieve operational requirements under standard operating conditions and under the route operating profile. The standard operating conditions are defined by the Bus Research Testing Center at Altoona, Pennsylvania ("Altoona") and will be used as a benchmark and as a means to compare the performance of various proposed buses across a set standard. The agency-specific conditions are established in the route operating profile. Proposers shall address in the technical proposal how the proposed bus is designed to meet, and even exceed, the minimum range requirement of **140 miles** on a single charge under the conditions of the route operating profile below. Proposers that offer convincing evidence, through sound mathematical modeling and documented bus testing, that the proposed bus will achieve more than the minimum **140 miles** under similar conditions of the route operating profile may receive higher scoring.

5.25.1 **Altoona Fuel Economy Tests.** The Altoona On-Road Energy Consumption and Range Test for buses is based on a Transit Coach Operating Duty Cycle (ADB cycle) and includes a mix of central business district (CBD), arterial (ART) and commuter (COM) cycles. Test results from the ADB cycle economy tests shall be provided to the City. Results shall include vehicle configuration and test environment information. Fuel economy data shall be provided for each duty cycle.

5.25.2 **Agency Minimum Operating Range.** Minimum operating range shall be **140 miles on the route operating profile on a single charge at the depot**. Note proposals shall only provide for electric buses designed to operate with depot charging only. The City of Knoxville is not considering electric buses requiring en-route fast charging at layover locations. Buses designed to achieve greater distances, based upon the route operating profile and an average driver may receive higher scoring within the proposal evaluation process.

5.26 **Route Operating Profile.** The bus must meet the route operating profile for the route KAT intends to operate the buses as outlined below. The proposer must demonstrate and validate, using sound mathematical modeling and simulation or empirical methods, that the bus will meet the performance requirements needed to meet this route operating profile. The performance needs must be met under maximum auxiliary energy loads and at GVWR. It is assumed buses will start daily duty cycle at maximum standard operating state of charge (SoC). Batteries shall not be depleted below minimum standard operating SoC during operations. Minimum standard operating SoC shall allow for reserve battery capacity from which the bus can draw upon to return to the depot charging point in degraded mode.

5.26.1 **Current Environment.** According to the United States Census Bureau, Knoxville has a total of 104.2 square miles of which 98.5 square miles is land and 5.6 square miles is water. Elevations range from just over 800 feet above sea level along the riverfront to just over 1000 feet on various hilltops in West Knoxville, with the downtown area resting at just

over 900 feet. Knoxville falls in the humid subtropical climate zone although it is not quite as hot as areas to the south and west due to the higher elevations. Summers are the warmest time of year with daily average temperature in July at 78.4°F, and an average of 36 days per year with temperatures reaching 90°F. Winters are generally much cooler and less stable with occasional small amounts of snow. January has a daily average temperature of 38°F, although in most years there is at least one day where the high remains at or below freezing. The record high for Knoxville is 105°F on June 30 and July 1, 2012, while the record low is -24°F on January 21, 1985. Annual precipitation averages just under 48 inches, and normal seasonal snowfall is 6.5 inches; however, usually no snow occurs outside of January and February.

5.26.2 **Route Information.**

5.26.2.1 A map depiction of the electric bus route can be viewed here: https://platform.remix.com/map/b0288c6?latlng=35.94886,-83.94027,z14&layer=elevation

5.26.2.2 Distance from KAT bus lot to Transit Center (start of route) = 1.1 miles.

5.26.2.3 Total route distance, outbound and inbound = 13 miles (+/- nominal)

5.26.2.4 Bus average speed = 13 mph.

5.26.2.5 Average trip duration (outbound and inbound) = 1 hour (+/- nominal).

5.26.2.6 Average number of passengers per hour = 20

5.26.2.7 Average number of stops per trip (outbound and inbound) = 50. This includes anticipated stops for passengers and traffic control devices (stop signs/traffic lights).

5.26.2.8 Time available at night for depot charging = 4 to 6 hours.

5.26.2.9 Time available during the day, between runs, is estimated at 3 to 4 hours.

5.26.2.10 Changes in route elevation are depicted in the chart below.

Location	Distance from start	Elevation		Location	Distance from Start	Elevation
Outbound				***Inbound***		
Knoxville Station	0	875		Sutherland Ave @ Forest Hills Blvd	7.23	953
Cumberland Ave @ Market St	0.4	930		Sutherland Ave @ Hollywood Rd	7.5	931
Cumberland Ave @ Locust St	0.54	917		Sutherland Ave @ Jade Rd	7.66	922
Cumberland Ave @ 11th	0.85	847		Sutherland Ave @ Cox St	8.29	857
Cumberland Ave @ James Agee	1.07	907		Sutherland Ave @ Varner St	9.04	884
Cumberland Ave @ 16th	1.19	913		Sutherland Ave @ Portland St	9.23	889
16th St @ Clinch	1.31	960		Sutherland Ave @ Concord St	9.33	885
16th St @ Highland Ave	1.45	962		Sutherland Ave @ Ailor Ave	9.73	882
Highland Ave @ 17th	1.59	969		Middlebrook Pike @ 21st St	10.1	896
17th St @ Dale Ave	1.82	913		Middlebrook Pike @ Clyde St	10.24	897
Middlebrook Pike @ Clyde St	2.29	897		17th St @ Dale Ave	10.71	913
Middlebrook Pike @ 21st St	2.43	896		Highland Ave @ 17th	10.94	969
Sutherland Ave @ Ailor Ave	2.8	882		16th St @ Highland Ave	11.08	962
Sutherland Ave @ Concord St	3.2	885		16th St @ Clinch	11.22	960
Sutherland Ave @ Portland St	3.3	889		Cumberland Ave @ 16th	11.34	913
Sutherland Ave @ Varner St	3.49	884		Cumberland Ave @ James Agee	11.46	907
Sutherland Ave @ Cox St	4.24	857		Cumberland Ave @ 11th	11.68	847
Sutherland Ave @ Jade Rd	4.87	922		Main St @ Locust St	11.99	928
Sutherland Ave @ Hollywood Rd	5.03	931		Main St @ Market St	12.13	921
Sutherland Ave @ Forest Hills Blvd	5.3	953		Knoxville Station	12.53	875
Sutherland Ave @ Forest Heights Rd	5.44	967				
Sutherland Ave @ Highland Hills Rd	5.56	956				
Sutherland Ave @ Mohican St	5.68	945				
Sutherland Ave @ Westwood Rd	6.09	904				
Kingston Pike past Westwood	6.22	894				
Kingston Pike @ Mohican St	6.58	924				
Kingston Pike @ Homberg Dr	6.71	927				
Kingston Pike @ Newcomb Ave	6.86	931				
Forest Park	7.03	920				

5.26.2.11 Graphical depiction of changes in route slope:

5.26.2.12 Slope summary:

Slope Summary			
Cumulative Elevation Gain	1076 ft.	Avg. Slope Gain	2.6%
Cumulative Elevation Loss	-1077 ft.	Avg. Slope Loss	-2.6%
Max. Slope Gain	11.4%		
Max. Slope Loss	-10.4%	Distance	12.53 Miles

5.26.2.13 **Auxiliary Electrical Loads.** Anticipated auxiliary electrical loads from accessories are as follows.

- Hannover Destination Signs
  - Front – max LED's on and 100% brightness = 48W, 1.1 Amps
  - Side – max LED's on and 100% brightness = 30W, 1.25 Amps
  - Rear – max LED's on and 100% brightness = 12W, .48 Amps
- Cell phone USB charging ports – 12 VDC input; output = 5 VDC, 4.2 Amps
- Motorola Radio
  - Standby = 13.8 VDC, 0.85 Amps
  - Receive = 13.8 VDC, 3.2 Amps
  - Transmit = 13.8 VDC, 13 Amps
- GFI Odyssee Farebox
  - 12 VDC
  - 0.6 Amps idle; 15 Amps peak (during transactions)
- AVL and WIFI equipment
  - AVL DR700 = 24 VDC, 100W max
  - WR44R Digi Router = 12 or 24 VDC, 15W max
- Apollo Roadrunner Camera System = 24 VDC, 4 Amps
- Infotainment 24" LCDs (2 each)
  - 24 VDC
  - Primary display = 75 W max
  - Secondary display = 65 W max

5.26.3 Proposers shall provide the following narratives with its Technical Proposal:

- Narrative description of the methods used to validate the proposed system will meet KAT's route operating profile under summer and winter conditions. Details shall include expected bus range under both seasonal conditions.
- Projected performance on KAT's route operating profile when the battery reaches end-of-life (EOL) state. The proposer will provide specific details on EOL criteria. Detailed results should include, at a minimum, the following – expected battery life from factory delivery under normal conditions (months), EOL battery capacity (kWh), EOL bus range (miles).
- Description of any required or recommended charge strategies or other bus operation strategies that are necessary to meet KAT's route operating profile. Note that KAT requires operational impacts be minimized.

- Description of the flexibility and considerations necessary to place the proposed bus and its charging solution on any KAT route at KAT's discretion.

5.27 **Electric Propulsion System.**

5.27.1 **Propulsion System Description.**

5.27.1.1 The bus shall be powered by an electric propulsion system. To the greatest extent practical, the electric propulsion system shall conform to SAE J2910 and SAE J2344.

5.27.1.2 The propulsion system shall not be supplemented by any onboard range extenders, including but not limited to internal combustion engines, gas turbines and/or hydrogen fuel cells.

5.27.1.3 The OEM shall ensure the bus structure is suitable for the electric propulsion system and can be operated safely on the route operating profile for the service life of the bus without a structural failure. The propulsion system shall comply with applicable local, state and/or federal emissions and useful life requirements.

5.27.1.4 Labels shall be posted on high-voltage devices to identify them as components conducting high voltage potential.

5.27.1.5 A detailed description of the propulsion system shall be provided with the proposal. The description shall include a written narrative, a block diagram showing major propulsion system components, and illustration showing the physical layout of propulsion components and high-voltage wire routing within the vehicle, and a detailed wiring diagram and/or electrical schematic for the high-voltage system. Proposers are required to provide a list of applicable industry standards that the proposed propulsion system meets.

5.27.2 **Propulsion System Controller.**

5.27.2.1 The propulsion system controller shall regulate 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. The controller shall monitor and process inputs and execute outputs as appropriate to control the operation of all propulsion system components.

5.27.2.2 The electric drive system shall have onboard diagnostic capabilities able to monitor vital motor functions, store and time stamp parameter conditions in memory, and communicate faults and vital conditions to maintenance personnel through the multiplex system. Diagnostic reader device multiplex connector ports, suitably protected against dirt and moisture, shall be provided in the operator's area. The onboard diagnostic system shall inform the operator via visual and/or audible alarms when out of parameter conditions exist for vital motor functions. The on-board diagnostic system shall have capabilities for storing hard and soft codes and

processing data and provide detailed information/reports on various aspects of fleet usage. The information shall be retrievable via cabling or wireless transmission to a laptop.

5.27.2.3 The propulsion control system shall protect the drive system against progressive damage. The system shall monitor conditions critical for safe operation and automatically de-rate power and/or speed and initiate system shutdown as needed. The on-board diagnostic system shall trigger a visual and audible alarm to the operator when the propulsion control system detects a malfunction and the drive protection system is activated.

5.27.2.4 Automatic shutdown shall only occur when parameters established for the functions below are exceeded:

- Over Temperature
- Inverter Fault
- Over Voltage
- Broken Wire
- Loss of Electrical Communications
- Communications Safety
- No redundant bus manufacturer and/or component manufacturer "detection and shutdown" circuits. By default, the component manufacturer's software shall be used to record fault codes. A control shall be available to the operator to allow a 30-second override which, when depressed, will allow the operator to delay the drive system shutdown but not the activation and alarm system.

5.27.3 **Propulsion System Mounting.** The propulsion system mounting shall be mechanically isolated to minimize transfer of vibration to the body structure and provide a minimum clearance of 0.75 inches. Mounts shall control propulsion system movement so as not to cause strain in piping and wiring nor their connections to the propulsion system.

5.27.4 **Propulsion System Service.**

5.27.4.1 The propulsion system motor should be designed to operate for not less than 300,000 miles without major failure or significant deterioration. Components of the control system should be designed to operate for not less than 150,000 miles without replacement or major service.

5.27.4.2 The propulsion system shall be arranged so that easy 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, KAT recognizes properly rated test equipment and safe electrical work practices are essential when servicing high voltage components. The proposer shall identify safe electrical work practixes that are essential when servicing high-voltage components. The awarded Contractor shall provide all specialty tools and diagnostic equipment required for maintaining the Propulsion System in accordance with Special Tools List.

5.27.5 **Energy Storage System and Controller.**

5.27.5.1 The Energy Storage System (ESS) shall be of a commercial design capable of operating in KAT's transit environment and route operating profile. The ESS shall use battery technology with a field-proven track record of safe, reliable and durable operation in similar traction applications. 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.

5.27.5.2 The ESS shall comply with UN/DOT 38.3 and/or SAE J2464 requirements for lithium batteries or similar standards for non-lithium batteries.

5.27.5.3 The Contractor shall deliver the buses with an installed, functioning ESS charged with at least 25 kWh usable energy. 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 adequately described in the proposal. The proposal shall include a description of all battery maintenance requirements including any periodic charge requirements necessary for cell balancing. 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.

5.27.5.4 The battery system shall be capable of withstanding the current and voltage profiles necessary to accomplish daily recharge events within the defined operating profile.

5.27.5.5 Thermal management will be provided as needed to ensure optimal life and performance of the ESS over the environmental operating range. The 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.

5.27.5.6 Proposals shall include complete descriptions of all life-cycle testing procedures used to validate the life of batteries used for 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 an independent testing agency.

5.27.6 **Energy Storage System Capacity**.

5.27.6.1 The ESS shall have sufficient energy storage to meet the requirements of the intended duty cycle when new and up until the degradation has reached warrantable end of life (WEOL), as defined within the warranty terms of this RFP by percent remaining capacity.

As an example, if the capacity when new is 300 kWh and the WEOL is at 80 percent, then the useable capacity range shall be from 300 to 240 kWh.

5.27.6.2 The ESS shall be measured periodically during the 12-year design life of the buses following protocol below by a bus manufacturer representative at an interval of once per year.

5.27.6.2 The test protocol shall be to charge the ESS at a rate approximating the actual depot charge rate via the grid. Instrumentation and data logging shall measure the energy consumed in units of kilowatt-hours from 0 to 100 percent SoC. The ESS will then be discharged to a steady load or returned to the grid at a rate approximating the average rate of the duty cycle. Instrumentation and data logging shall measure the energy discharged in units of kilowatt-hours from 100 to 0 percent SoC. These tests shall be used to determine overall efficiency and, in comparison to the as-new capacity in kilowatt-hours, the remaining percent capacity.

5.27.7 **Energy Storage System Safety.**

5.27.7.1 The ESS battery packs shall be located outside the passenger compartment and in a position outside of a direct side or rear impact zone. Additionally, the ESS 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.

5.27.7.2 The bus body shall be purpose-design 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 City. The ESS shall be designed and constructed to prevent gassing or fumes from the ESS from entering the interior of the bus, i.e., a vent path to the exterior, preferably at or above the roof, rearward.

5.27.7.3 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 relevant issues or prior incidents relating to safety.

5.27.7.3 Proposals shall include complete descriptions of all safety standards followed in the design and manufacture of the battery system, such as SAE J 2929 and SAE J 2464, 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. Both automatic and manual battery disconnect devices must be included and documented. Service and emergency manual disconnects must be included and their usage documented.

5.27.7.4 Proposers shall provide a means to isolate the high-voltage battery during maintenance operations. Manual and automatic disconnects should open both poles of each physical battery pack.

5.27.7.5 The high voltage and energy storage system shall include isolation protection between the high voltage and bus chassis system, to include automatic detection of isolation faults, alerts to the operator, diagnostic system and appropriate action to prevent personnel from high voltage exposure. Detection shall be provided for at least two levels – trace and significant. Detection of trace chassis exposure shall be alerted to the operator and maintenance personnel. Significant chassis exposure shall initiate the same alerts as trace and additionally initiate a safe and organized shutdown of the high voltage system, with full disconnects of the high voltage contactors. This described system shall also be an integral part of the overall emergency shutdown system with functions to include the following:

- A quick, safe and organized means for the operator, maintenance personnel and/or first responders to shut down the high voltage system.
- Shutting down the system shall include at least:
    - "opening" all high voltage circuits;
    - discharging capacitors (if used); and
    - disconnecting any devices that could provide high voltage during normal operation and during charging.
- Devices used to initiate shutdown shall be located within and outside the bus and be clearly marked as to location and use.
- In addition to manual use, this same functionality shall extend to the charging operation in the event of a fault sensed by the ground-fault-interrupt circuit (GFI), to also include termination of charge.

2.27.8 **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 components. All electrical connections shall be fully shielded and hand-operable. Connector and cabling design shall be such that inappropriate or unsafe connections are unlikely. 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 comprehend the protection of battery cabling and vent/watering system components during pack removal and installation. The batteries, when installed, shall be secured to the chassis to prevent any movement that may cause damage or personal harm while the vehicle is in operation.

5.27.9 **Battery Management System.**

5.27.9.1 The battery management system must be designed to ISO 26262 safety principles to control state of charge, voltage, current and temperatures on a cell-to-cell level and provide diagnostic output at the lowest field-serviceable element. The diagnostic output must easily be available to mechanics.

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

- The BMS must be capable of monitoring the voltage of cells within each battery pack. The BMS must be able to read individual battery or block voltages at a frequency of one data point per block every 15 seconds.
- The BMS must be capable of monitoring battery temperatures, mitigating damage to the battery and surroundings, and preventing thermal runaway.\
- The BMS 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 location of the faulty battery in order to perform maintenance.
- The BMS must be capable of engaging prudent safety interlocks when an unsafe battery condition has been detected.
- The BMS must be able to monitor the battery SoC and provide information to the rest of the vehicle.
- The BMS must be able to communicate all data to the bus level information system (reference Electrical, Electronic and Data Communication Systems) for storage and communication.

5.27.10 **ESS Charging System.**

5.27.10.1 The bus shall support an SAE-approved depot charging standard. The bus manufacturer shall provide a detailed description of their charging system and specify its compliance with the appropriate SAE standard. Proposers shall include a description of the utility district infrastructure required for depot charging equipment.

5.27.10.2 Proposers shall include turnkey installation of the bus charging system from connection to utility district power at ground conduit level to the bus charge receptacles. This includes all equipment and labor, connection to utility power, mounting poles, outdoor cover for weather protection, interface devices, cabling, plugs, charging devices, and any other devices required for charging the bus **outdoors** in the bus depot parking lot. Six outside charging stations shall be included with the initial order plus two charging stations inside KAT's maintenance shop. Additional charging stations must be included in option pricing.

5.27.10.3 The charging system provided for use with the bus must comply with the battery manufacturer's electrical and thermal limits.

5.27.10.4 Charge system receptacles **must** be located on the front and rear of the bus.

5.28 **Cooling Systems**.

5.28.1 **Cooling System Design**.

5.28.1.1 The bus shall be equipped with an electric fan drive bus cooling system. A screen guard must installed on electric motor fans per SAE J1308. The EMP electric cooling system is preferred if the bus design allows.

5.28.1.2 The capacity of the cooling system shall be adequate to maintain design component temperatures under all operating conditions for the design life of the vehicle in the service area and environment of the agency. Proposers shall provide evidence that the cooling system selected has the capability to handle peak heat rejection from the traction motor, energy storage system, propulsion control system, and the intermediate and low-voltage power supply with a partially clogged radiator at maximum ambient temperature plus heat reflected off the pavement. Proposers shall submit an analysis verifying cooling system capabilities. The entire cooling system shall be equipped with an electronic detection device to indicate overheating on the driver's control panel.

5.28.1.3 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.

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

5.28.1.5 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.

5.28.1.6 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 KAT concurrent with or prior to delivery of the first bus.

5.28.2 **Component Thermal Management**.

5.28.2.1 Under the vehicle operating temperature range, the thermal management system shall be designed such that each component will remain in its allowed operating range.

5.28.2.2 Component temperature sensors may be used for monitoring, control or component/system protection. If equipped and serviceable, component temperature sensors shall be easily accessible. Under typical failure modes or out-of-limit conditions, component temperature sensors shall not disable the bus unless there is an immediate risk of hazardous fault propagation (e.g., temperature levels in an area at a level known to start fires). In the event that a component temperature sensor must disable the bus, the component/system must comply with the automatic propulsion system protection/shutdown override feature requirement addressed in the Propulsion System Controller section above.

5.28.2.3 Motor cooling fans shall be of durable, corrosion-resistant construction and designed so a mechanic can easily gain access. The cooling fan and mounting bracket shall be designed to withstand the thermal fatigue and vibration associated with the installed configuration.

5.28.2.4 A means of determining satisfactory component coolant level shall be provided. A spring-loaded, push-button type valve or lever shall be provided to safely release pressure or vacuum in the cooling system with both it and the water filler no more than ±60 in. above the ground. Both shall be accessible through the same access door.

5.28.3 **Radiator Screen**. The radiator input shall be protected by an easily cleanable screen designed to collect large debris. The radiator core shall be easily cleaned (to include from the propulsion system side) with standard pressure-washing equipment.

5.28.4 **Coolant Filtration.** The cooling system shall be equipped with a properly sized water filter with a spin-on element. The filter shall not release or contain supplemental coolant additives.

5.28.5 **Coolant System Mounting.** Mounting location of the radiator shall be the proposer's standard design.

5.28.6 **Coolant System Service.** The coolant system shall be arranged so that accessibility for all routine maintenance is easily assured. Radiator fillers shall be arranged so as to ensure simple, efficient filling while tethering the cap and ensuring the filler is closed when filling is completed. All fluid fill locations shall be properly and permanently labeled to help ensure correct fluid is added and all fillers shall be easily accessible with standard funnels, pour spouts, and automatic dispensing equipment.

5.28.7 **Coolant System Piping and Hoses.** Minimize collection of trapped air

5.28.7.1 Installation design for all coolant system piping and hoses shall be such that collection of trapped air is minimized. By design, any air that is trapped shall naturally accumulate in the coolant fill reservoir.

5.28.7.2 Radiator piping shall be stainless steel, brass tubing, or powder coated steel.

5.28.7.3 Hoses shall be eliminated to the maximum extent practical. All hoses that are required shall be secured with constant tension spring clamps made from high tensile spring steel (51CrV4 grade steel) and treated for 1000 hour ASTM B-117 corrosion resistance. 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.

5.29 **Transmission.**

5.29.1 The transmission, if so equipped, should be a multiple-speed, automatically shifted transmission with electronic controls. A torque converter and retarder should not be needed. Gross input power, gross input torque and rated input speed shall be compatible with the traction motor. The transmission must be designed to operate for no less than 300,000 miles for the route operating profile without replacement or major service. The transmission must be easily removable without disturbing the traction motor and shall be easily accessible for service.

5.29.2 The electronic controls must be capable of transmitting and receiving electronic inputs and data from other drivetrain components and of broadcasting that data to other vehicle systems. Communication between electronic drivetrain components and other vehicle systems shall be made using the multiplex communications network. Electronic controls must be compatible with 24 V power distribution, provide consistent shift quality, and compensate for changing conditions, such as variations in vehicle weight and traction motor power. At a minimum, drivetrain components consisting of the motor, transmission and anti-lock braking systems must be powered to ensure data communication among components exists when the vehicle propulsion system is switched to the "on" position.

5.29.3 The transmission must have on-board diagnostic capabilities, be able to monitor functions, store and time-stamp out-of-parameter conditions in memory, and communicate faults and vital conditions to maintenance personnel. The transmission must contain built-in protection software to guard against severe damage. The on-board diagnostic system shall be required to trigger a visual alarm to the driver when the electronic control unit detects a malfunction.

5.29.4 The transmission must be an automatically shifted unit with manual transmission architecture, i.e. gears, shafts and shift collars but with no clutches or torque converter; therefore there is not a need to monitor the fluid on an ongoing basis. The fluid will remain at a constant level between specified fluid change intervals.

5.30 **Regenerative Braking.**

5.30.1 The bus shall have a regenerative braking system to aid in the reduction of wear on the brakes and to help extend the range of the vehicle through energy recapture to the ESS. The vehicle will employ regenerative braking as the accelerator pedal is completely released. Regenerative braking shall be additionally increased as the brake pedal is applied.

5.30.2 Proposers shall provide design information within the technical proposal to describe the minimum and maximum percentage of braking kinetic energy captured and used in recharging the ESS. Proposers must also describe how these systems are adjusted to increase or decrease the percentage of recaptured energy, and the impact to passenger discomfort when the regenerative braking system is adjusted to maximum limits. Proposals that capture higher percentages that do not negatively impact passenger discomfort may receive higher scores from the evaluation committee.

5.30.3 The bus shall also include a regenerative braking system override/deactivation switch within reach of the bus operator with "system deactivated" indicator light for use during inclement weather road conditions.

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

5.31 **Hydraulic Systems.**

5.31.1 **System Design**.

5.31.1.1 The hydraulic pump should be powered by an electric motor unless the bus manufacturer has a more efficient design that increases the electric bus operating range.

5.31.1.2 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 must be easily accessible for service or unit replacement. Critical points in the hydraulic system should be fitted with service ports so 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.

5.31.1.3 The hydraulic system shall have sensors to indicate to the driver conditions of low hydraulic fluid level.

5.31.2 **Fluid Lines**.

5.31.2.1 All fluid lines and piping shall be supported to prevent chafing damage, fatigue failures, and tension strain. All hydraulic line routings shall be supported by click-bond supported Hellermann-Tyton fittings and clamps designed for this application. Lines passing through a panel, frame, or bulkhead shall be protected by grommets (or similar device) that fit snugly to both the line and the perimeter of the hole that the line passes through to prevent chafing and/or wear. Fluid lines shall not be the lowest point of the bus undercarriage.

5.31.2.2 All flexible lines shall be as short as practicable, no greater than 6 feet in length, unless demonstrated inappropriate for a given application, and shall be routed or shielded to deter spraying or draining onto any component operable above the auto-ignition temperature of the line's contents in case of line failure. Flexible hoses and fluid lines shall not touch one another, or any part of the bus.

5.31.2.3 Flexible lines shall be compatible with the fluids they are intended to carry, at all expected temperatures and pressures and shall have standard SAE, JIC or ORS brass or steel, swivel, end fittings. Flexible hoses over 1 inch in diameter shall be in conformance with SAE J100R5. Flexible hoses and fluid lines shall not abrade one another, or any part of the bus.

5.31.3 **Fittings and Clamps**.

5.31.3.1 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.

5.31.3.2 Compression fittings shall be standardized as much as practicable 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.

5.31.4 **Oil and Hydraulic Lines**. Oil and hydraulic lines (if included in the bus design) shall be compatible with the substances they carry. The lines must be designed and intended for use in the environment where they are installed. Hydraulic lines of the same size and with the same fittings as those on other piping systems of the bus, but not interchangeable, are tagged or marked for use on the hydraulic system only.

5.32 **Bus Structure.**

5.32.1 **Design**. The bus structure 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 route operating profile.

5.32.2 **Altoona Testing.** Prior to acceptance of the first bus, the vehicle must have successfully completed FTA-required Altoona testing. Any items that required repeated repairs or replacement will undergo corrective action with supporting test and analysis. A report clearly describing and explaining the failures and corrective actions taken to ensure any and all such failures will not continue to occur will be submitted to the City. The Altoona Test Report shall be provided to the City with the proposal submittal.

5.32.3 **Structural Validation.** The bus structure shall have undergone appropriate structural testing and/or analysis. At a minimum, appropriate structural testing and analysis shall include Altoona testing and/or Finite Element Analysis (FEA).

5.32.4 **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 include the vehicle at rest with any one wheel or dual set of wheels on a 6 inch curb or in a 6 inch deep hole.

5.32.5 **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.

5.32.6 **Propulsion Compartment Bulkheads.** The passenger and motor drive component compartments shall be separated by fire-resistant bulkheads or means that precludes or retards a fire from entering the passenger area. This bulkhead (or equivalent) shall be compliant with FTA Docket 90A, dated October 20, 1993 and FMVSS 302. Only necessary

openings are allowed in the bulkhead, and these must be fire-resistant. Climate controlled air shall not pass through the motor compartment that then passes in to the passenger compartment. Wiring passing through the bulkhead must use connectors or other means to prevent or retard fire propagation through the bulkhead.

5.32.7 **Crashworthiness.**

5.32.7.1 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 inch reduction in any interior dimension. Windows shall remain in place and shall not open under such a load. These requirements must be met without the roof-mounted equipment installed.

5.32.7.2 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 inches of permanent structural deformation at seated passenger hip height. This impact shall not result in sharp edges or protrusions in the bus interior.

5.32.7.3 The bus body below 35 inches from ground level shall withstand a static load of 2000 lbs applied perpendicular to the bus by a pad no larger than 5 square inches. This load shall not result in deformation that prevents repair of the body to the original appearance of the bus.

5.32.7.4 The crashworthiness requirements may be met by either test or Finite Element Analysis (FEA).

5.33 **Corrosion.**

5.33.1 The bus flooring, sides, roof, understructure, and axle suspension components shall resist corrosion or deterioration from atmospheric conditions and road salts 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, provided it is maintained by KAT in accordance with the procedures specified in the Contractor's service manual. With the exception of periodically inspecting the visible coatings applied to prevent corrosion and reapplying these coatings in limited spots, the Contractor shall not require the complete reapplication of corrosion compounds over the life of the bus.

5.33.2 All materials 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 2-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.

5.33.3 In the event the bus body is made from corrosion resistant composite materials, it shall not need any undercoating spray. All exposed metal surfaces under the bus shall be both E-coated and powder coated.

5.34 **Towing.**

5.34.1 The awarded proposer shall provide, as an option, a tow bar designed to tow the bus for short distances with the KAT maintenance department heavy-duty shop truck (F-450).

5.34.2 Each towing device built within the bus 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. Rear towing device(s) shall not provide a toehold for unauthorized riders. The method of attaching the tow-bars to the towing device shall not require the removal, or disconnection, of front suspension or steering components. When towing is required from the front, removal of the bike rack is permitted for attachment of towing devices.

5.34.3 Rear towing device(s) 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 the bus. The OEM shall provide the towing procedure.

5.34.4 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.

5.35 **Jacking.** The bus shall be designed 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 permits 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 inch 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. Jacking pads shall be painted safety yellow and permanent decals applied to identify locations.

5.36 **Lifting.** The bus axles or jacking plates shall accommodate the lifting pads of a two-post below-ground lift system. Jacking plates, if used as hoisting pads, are designed to prevent the bus from falling off the lift. Other pads or the bus structure shall support the bus on jack stands independent of the lift. The vehicle shall also be capable of being lifting by the wheels by a mobile column lift.

5.37 **Floor.**

5.37.1 **Floor Design.**

5.37.1.1 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.

5.37.1.2 The floor design may 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 approximately 21 inches above the lower level. An increased slope shall be allowed on the upper level not to exceed 3½° off the horizontal.

5.37.2 **Floor Strength.**

5.37.2.1 The floor deck may be integral with the basic structure or mounted on the structure securely to prevent chafing or horizontal movement and shall be designed to last the life of the bus. Sheet metal screws shall not be used to retain the floor, and all floor fasteners must 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. All floor fasteners shall be secured and protected from corrosion for the service life of the bus.

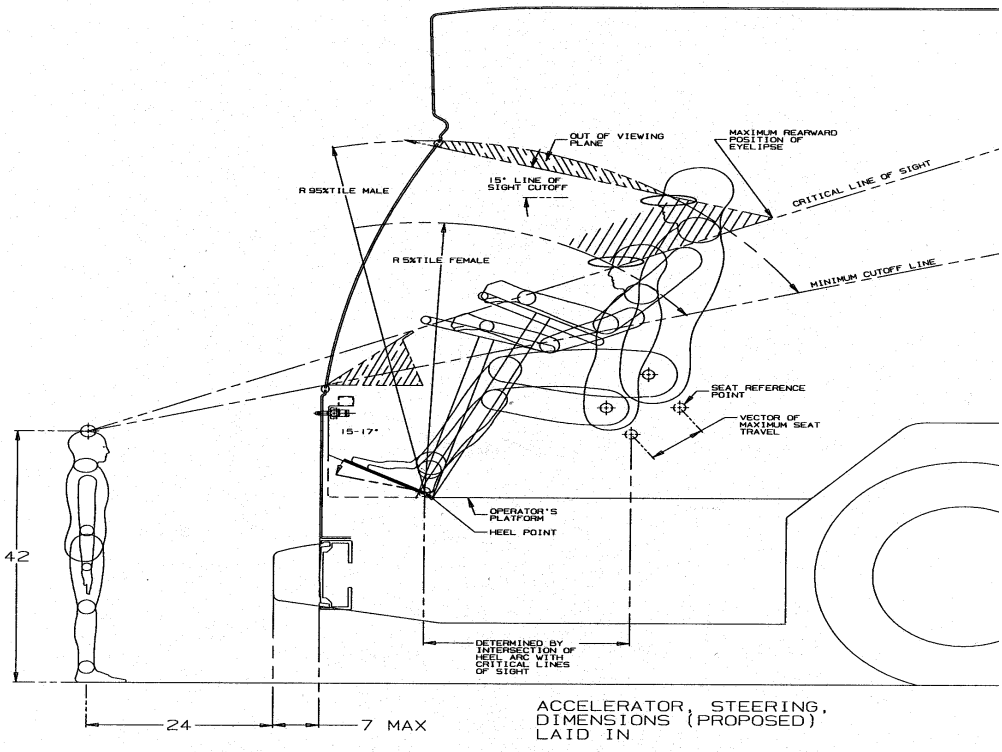
5.37.2.2 The floor deck shall be reinforced as needed to support passenger loads. At GVWR, the floor shall have an elastic deflection of no more than 0.60 inches from the normal plane. The floor must withstand the application of 2.5 times gross load weight without permanent detrimental deformation. The floor, with coverings applied, shall withstand a static load of at least 150 lbs applied through the flat end of a ½ inch diameter rod, with 1/32 inch radius, without permanent visible deformation.

5.37.3 **Floor 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.

5.38 **Platforms.** 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.

5.38.1 **Operator's Platform.** The operator's platform shall be of a height that, in a seated position, the driver can see an object located at an elevation of 42 inches above the road surface and 24 inches from the leading edge of the bumper or bike rack. Notwithstanding this requirement, the platform height shall not position the operator such that the operator's vertical upward view is less than 15 degrees. A warning decal or sign shall be provided to alert the operator to the change in floor level. The following schematic diagram illustrates a means by which the platform height can be determined, using the Critical Line of Sight.

Determining Platform Height



5.38.2 **Farebox Platform.** Farebox placement should minimize impact to passenger access and minimize interference with the driver's line of sight. If the drivers platform is higher than 12 inches, then the farebox is to be mounted on a platform of suitable height to provide accessibility for the driver without compromising passengers' access. KAT's GFI Oddysee fareboxes from floor to top are 41 inches.

5.38.3 **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 inches deep and approximately half the height of the upper level relative to the lower level. The horizontal surface of this platform shall be covered with skid-resistant material with a visually contrasting nosing and shall be sloped slightly for drainage. A warning decal or sign shall be provided at the immediate platform area to alert passengers to the change in floor level.

5.39 **Wheel Housing Design and Construction.**

5.39.1 Sufficient clearance and air circulation shall be provided around the tires, wheels and brakes to preclude overheating when the bus is operating on the route operating profile. Wheel housings shall be constructed of corrosion-resistant and fire-resistant material.

5.39.2 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 have sufficient sound insulation to minimize tire and road noise and meet all noise requirements of this specification.

5.39.3 Design and construction of front wheel housings shall allow for the installation of an electronic equipment storage compartment on the interior top surface.

5.39.4 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 inches above the floor shall be equipped with scuff-resistant coating or stainless steel trim.

5.40 **Chassis.**

5.40.1 **Chassis Suspension.** The front and rear suspensions shall be pneumatic type. The basic suspension system shall last the service life of the bus without major overhaul or replacement. Adjustment points shall be minimized and shall not be subject to a loss of adjustment in service. Necessary adjustments shall be easily accomplished without removing or disconnecting the components.

5.40.2 **Suspension Alignment.** All axles shall be properly aligned so the vehicle tracks accurately within the size and geometry of the vehicle.

5.40.3 **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. Suspension 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 inch at any point from the height required. The safe operation of a bus will not be impacted by ride height up to 1 inch from design normal ride height.

5.40.4 **Suspension 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 is sufficient to control coach 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 incorporates a secondary hydraulic rebound stop.

5.40.5 **Chassis Lubrication.** All elements of steering, suspension and drive systems requiring scheduled lubrication will 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.

5.40.6 **Kneeling.**

5.40.1.1 A kneeling system shall lower the entrance(s) of the bus a minimum of 2 inches 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 switch at any time shall completely stop the lowering motion and hold height of the bus at that position.
- Upward control actuation must allow the bus to return to normal height without the driver having to hold the control.

5.40.1.2 The brake and throttle interlock shall prevent movement when the bus is kneeled. The bus shall kneel at a maximum rate of 1.25 inches per second at essentially a constant rate. After kneeling, the bus shall reise within 4 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 0.3 g per second.

5.40.1.3 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 inch diameter amber lense, 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.

5.41 **Wheels and Tires.**

5.41.1 **Wheels.** All wheels shall be interchangeable. Wheels shall be compatible with tires in size and load-carrying capacity. Front wheels and tires shall be balanced as an assembly per SAE J1986. Wheels shall be hub-piloted, brushed aluminum, and shall resist rim flange wear. Wheels shall have a low maintenance special finish, Alcoa Dura-Bright, or approved equal.

5.41.2 **Tires.** Tires shall be provided under a lease agreement between the City of Knoxville and the tire manufacturer. Tires will be Bridgestone 315/80R22.5 load range H. Load on any tire at GVWR shall not exceed the tire supplier's rating. If the bus design requires a different tire size and load range to meet FMVSS, the Contractor shall provide details within the technical proposal.

5.42 **Steering.** Hydraulically assisted steering should be provided. The steering gear shall be an integral type with the number and length of flexible lines minimized or eliminated. The

hydraulic pump should be electrically driven unless the bus manufacturer has a more efficient design that increases the electric bus operating range.

5.43 **Steering Axle.** The front axle should be of an independent suspension design, 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 lubrication fittings easily accessible from a pit or hoist. The steering geometry of the outside (front lock) wheel shall be within 2 degrees of true Ackerman up to 50 percent lock measured at the inside (back lock) wheel. The steering geometry shall be within 3 degrees of true Ackerman for the remaining 100 percent lock measured at the inside (back lock) wheel.

5.44 **Steering Wheel.**

5.44.1 **Turning Effort.**

5.44.1.1 Steering effort shall be measured with the bus at GVWR, stopped with the brakes released and the engine at normal idling speed on clean, dry, level, commercial asphalt pavement and the tires inflated to recommended pressure.

5.44.1.2 Under these conditions, the torque required to turn the steering wheel 10 degrees shall be no less than 5 ft-lb and no more than 10 ft-lb. Steering torque may increase to 70 ft-lb when the wheels are approaching the steering stops, as the relief valve activates.

5.44.1.3 Power steering failure shall not result in loss of steering control. With the bus in operation, the steering effort shall not exceed 55 lb 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.

5.44.1.4 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.

5.44.2 **Steering Wheel, General.**

5.74.2.1 The steering wheel diameter shall be approximately 18 to 20 inches; the rim diameter shall be ⅞ to 1¼ inches and shaped for firm grip with comfort for long periods of time.

5.74.2.2 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). Placement of the steering column must be as far forward as possible, but either in line with or behind the instrument cluster.

5.44.3 **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 and shall be accessible by a 5th percentile female and 95th percentile male.

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

Steering Wheel Height[1] 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 deg	29 in.	0 deg	34 in.
15 deg	26.2 in.	15 deg	31.2 in.
25 deg	24.6 in.	25 deg	29.6 in.
35 deg	22.5 in.	35 deg	27.5 in.

1. Measured from bottom portion closest to driver.

5.45 **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 300,000 miles on the route operating profile without replacement or major repairs. The lubricant drain plug shall be magnetic type. If a planetary gear design is employed, then 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 brake regeneration modes with respect to duty cycle.

NOTE: The regenerative braking duty cycle can be more aggressive than propulsion.

The drive shaft shall be guarded to prevent hitting any critical systems, including brake lines, coach floor or the ground, in the event of a tube or universal joint failure.

5.46 **Turning Radius.** Outside body corner-turning radius for a standard 35 foot long bus shall not exceed 39 feet.

5.47 **Brakes.**

5.47.1 **Service Brake.** Four wheel disc brakes shall be self-adjusting. Brake wear indicators shall be provided on exposed push rods.

5.47.2 **Regenerative Braking.**

5.47.2.1 The bus shall have a regenerative braking system to aid in the reduction of wear on the brakes and to help extend the range of the vehicle through energy recapture to the

ESS. The vehicle will employ regenerative braking as the accelerator pedal is completely released. Regenerative braking shall be additionally increased as the brake pedal is applied.

5.47.2.2 Proposers shall provide design information within the technical proposal to describe the minimum and maximum percentage of braking kinetic energy captured and used in recharging the ESS. Proposers must also describe how these systems are adjusted to increase or decrease the percentage of recaptured energy, and the impact to passenger discomfort when the regenerative braking system is adjusted to maximum limits. Proposals that capture higher percentages that do not negatively impact passenger discomfort may receive higher scores from the evaluation committee.

5.47.2.3 The bus shall also include a regenerative braking system override/deactivation switch within reach of the bus operator with "system deactivated" indicator light for use during inclement weather road conditions.

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

5.47.3 **Actuation.** 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 75 pounds at a point 7 inches above the heel point of the pedal to achieve maximum braking. The heel point is the location of the driver's heel when foot is rested flat on the pedal and the heel is touching the floor or heel pad of the pedal. A microprocessor controlled Automatic Braking System (ABS) shall be provided. The microprocessor for the ABS 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. The manufacturer shall demonstrate compliance by providing a copy of a thermodynamic brake balance test upon request.

5.47.4 **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 indicating the thickness at which replacement becomes necessary shall be provided on each disc brake lining. The complete brake lining wear indicator shall be clearly visible from the pit or hoist without removing wheels or backing plates.

5.47.5 **Hubs and Discs.**

5.47.5.1 Replaceable wheel bearing seals shall run on replaceable wear surfaces or be of an integral wear surface sealed design. Wheel bearing and hub seals shall not leak or weep lubricant for 100,000 miles when running on the route operating profile.

5.47.5.2 The bus shall be equipped with disc brakes on both the front and rear axles and the brake discs shall allow machining the surfaces up to ¼ inch each side to obtain smooth surfaces.

5.47.5.3 The brake system material and design shall be selected to absorb and dissipate heat quickly so the heat generated during braking operation does not glaze brake linings. The heat generated shall not increase the temperature of tire beads and wheel contact area to more than that allowed by the tire manufacturer.

5.47.6 **Parking/Emergency Brake.** 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. An emergency brake release shall be provided to release the brakes in the event of automatic emergency brake application. The parking brake valve button will pop out when air pressure drops below requirements of FMVSS 121. 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 operator releases the emergency brake release valve, the brakes shall engage to hold the bus in place.

5.48 **Passenger Door Interlocks.**

5.48.1 To prevent opening rear passenger doors while the bus is in motion, a speed sensor shall be integrated with the door controls to prevent the rear door from being enabled or opened unless the bus speed is less than 2 mph.

5.48.2 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 an open position, or the rear door panel is opened more than 3 inches from the fully closed position (as measured at the leading edge of the door panel). The interlock engagement shall bring the bus to a smooth stop and will 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.

5.48.3 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 an unsecured condition, unless the door master switch has been actuated to intentionally release the interlocks.

5.48.4 The brake interlock regulator shall be non-adjustable.

5.49 **Pneumatic System.**

5.49.1 **General.**

5.49.1.1 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 as

indicated on the instrument panel mounted air gauges, within 15 minutes from the point of governor cut-off.

5.49.1.2 Provision shall be made to apply shop air to the bus air systems using a quick-disconnect fitting. A quick disconnect fitting specified herein shall be easily accessible and located in the drive system 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. A quarter (¼) turn manual shutoff valve shall be added behind the fitting. Air for the compressor shall be filtered separately and specifically for the air compressor/intake.

5.49.1.3 The air system shall be protected by a pressure relief valve set at 150 psi and shall be equipped with check valve and pressure protection valves to assure partial operation in case of line failures.

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

5.49.3 **Air Lines and Fittings.**

5.49.3.1 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 doors, hill hold, and accessories.

5.49.3.2 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 foot intervals. Nylon lines may be grouped and shall be supported at 30 inch intervals or less.

5.49.3.3 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 or JIC brass or steel, flanged, swivel-type fittings. Flexible hoses shall be as short as

practicable and individually supported. They shall not touch one another or any part of the bus except for the supporting grommets. Flexible lines shall be supported at 2 foot intervals or less.

5.49.3.4 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.

5.49.4 **Air Reservoirs.** All air reservoirs shall meet the requirements of FMVSS 121 and SAE 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.

5.49.5 **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. A 2M/3M mechanic shall be able to replace the desiccant in less than 15 minutes.

5.50 Electrical, Electronic and Data Communication Systems.

5.50.1 Electrical System Overview

5.50.1.1 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).

5.50.1.2 Electronic devices are individual systems and components that process and store data, integrate electronic information or perform other specific functions.

5.50.1.3 The data communication system consists of the bidirectional 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.

5.50.1.4 Information level systems that require information for their operations or provide information shall adhere to J1939 data standard.

5.50.1.5 Data communications systems area divided into three levels to reflect the use of multiple data networks. See figure 4.

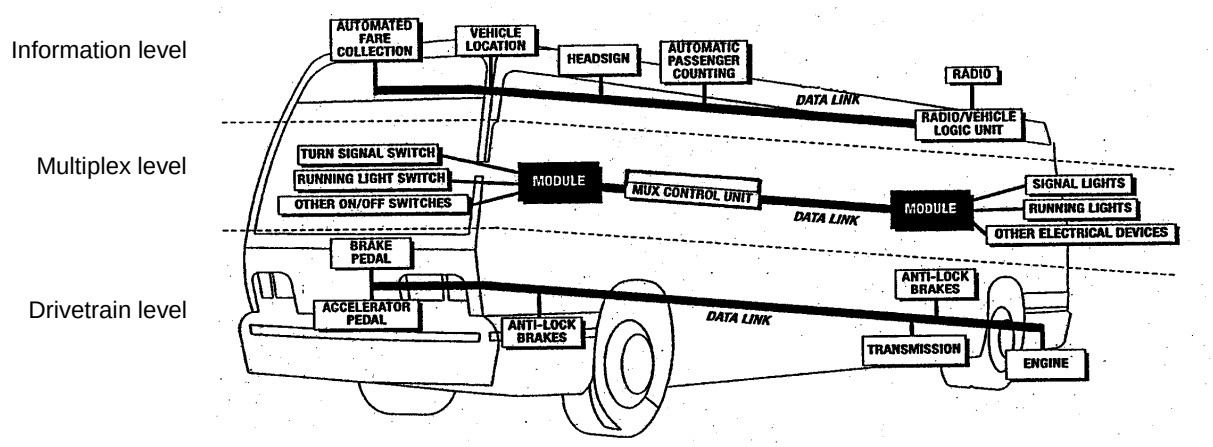
- **Drivetrain Level:** Components related to the drivetrain including the drive motor, transmission, and anti-lock braking system (ABS), which may include traction control.
- **Information Level:** Components whose primary function is the collection, control or display of data that is not necessary to the safe drivability of the

vehicle; i.e., the vehicle will continue to operate when those functions are inoperable. These components typically consist of those required for automatic vehicle location (AVL) systems, destination signs, fareboxes, 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), and gateway devices.

FIGURE 4

Data Communications Systems Levels



5.50.2 **Modular Design.**

5.50.2.1 Design of the electrical, electronic and data communication systems shall be modular so each major component, apparatus panel, or wiring bundle is easily separable with standard hand tools or by means of connectors. Each module, except the main body wiring harness, shall be removable and replaceable in less than 1 hour by a 3M mechanic.

5.50.2.2 Power plant wiring shall be an independent wiring module. Replacement of the drive system compartment wiring module(s) shall not require pulling wires through any bulkhead or removing any terminals from the wires.

5.50.3 **Environmental and Mounting Requirements.**

5.50.3.1 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.

5.50.3.2 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 route operating profile. No vehicle component shall be able to 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 (R10).

5.50.3.3 KAT shall follow recommendations from bus manufacturers and subsystem suppliers regarding methods to prevent damage from voltage spikes generated from welding, jump-starts, shorts, etc.

5.50.3.4 All electrical/electronic hardware mounted on the interior and exterior of the vehicle and not designed to be installed in an exposed environment shall be protected/mounted in a sealed enclosure, shall be inaccessible to passengers and hidden from view unless intended to be viewed.

5.50.3.5 All electrical/electronic hardware and its mounting shall comply with the shock and vibration requirements of SAE J1455.

5.50.4 **Low-Voltage Batteries.** The system shall supply a nominal 12V and/or 24V of direct current (DC). Batteries shall be easily accessible for inspection and servicing from the outside of the vehicle only. Two (2) Group 31 Series sealed nonspillable maintenance-free absorbed glass matt (AGM) battery units shall be provided. Each battery shall have a minimum of 1000 cold cranking amps (ACC) at 0°F. Each battery shall have a purchase date no more than one year from the date of release from shipment to the customer.

5.50.5 **Low-Voltage Battery Cables.** The battery terminal ends and cable ends 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, shall be flexible, shall be sufficiently long to reach the batteries with the tray in the extended position without stretching or pulling on any connection, and shall not lie directly on top of the batteries. Except as interrupted by the master battery switch, battery and starting system wiring, where applicable, shall be continuous cables with connections secured by bolted terminals and shall conform to specification requirements of SAE J1127–Type SGR, SGT, SGX or GXL and SAE J541 as applicable.

5.50.6 **Jump Start.** If jump starting is within the electric bus design, such as for propulsion system initiation, a jump-start connector shall be located next to the battery disconnect switch.

5.50.7 **Low-Voltage Battery Compartment.**

5.50.7.1 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 battery compartment temperature should not exceed manufacturer's specification.

5.50.7.2 The vehicle shall be equipped with one or more 12 VDC and 24 VDC quick disconnect switches. The battery compartment door shall conveniently accommodate operation of 12 VDC and 24 VDC quick disconnect switches.

5.50.7.3 The battery quick disconnect access door shall be identified with a decal. The decal size shall not be less than 3.5 × 5 in. (8.89 × 12.7 cm). 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. 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.

5.50.7.4 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, if applicable, 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. A locking device shall retain the battery tray to the stowed position.
If not located in the engine/drive motor compartment, the same fire-resistant properties must apply to the battery compartment. No sparking devices should be located within the battery box.

5.50.8 **Auxiliary Electronic Power Supply.** As a means to provide electrical power to additional accessories and as a means to minimize accessory drain upon the ESS, proposers are encouraged to include an auxiliary power supply within the bus design. Auxiliary power supplies, if included in the bus design, should only be accessible from the bus exterior by maintenance personnel. All auxiliary electronic power supplies should be recharged through the ESS depot charging system; not the bus ESS unless their SOC reach an unacceptable level (level where accessories are not adequately powered).

5.50.9 **Master Battery Switch.** A single master switch shall be provided near the battery compartment for the disconnecting of all battery positives (12V & 24V) except for safety devices such as 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 de-activation, 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 not damage any component of the electrical system. The master switch shall be capable of carrying and interrupting the total circuit load.

5.50.10 **Low-Voltage Generation and Distribution.**

5.50.10.1 The Propulsion System Batteries shall maintain the charge on the low voltage batteries.

5.50.10.2 The vehicle shall be equipped with a 300-AMP minimum, 24 VDC DC-DC power converter, suitably rated to handle the electrical load requirements. The high output DC amps shall be achieved at the DC-DC Power converter's designed maximum output.

5.50.10.3 Power distribution shall be accomplished by means of conductive bus-bars, terminal strips, or stud-terminal blocks that are sized for the cumulative total current of connected branch circuits and for the physical securement of them. One such arrangement is to exist for each voltage potential level and ground. These points to all equipment requiring dedicated power and ground wiring to the batteries shall be accomplished by using power bus bars consisting of either a solid copper bar or heavy-duty terminal strip. One bus bar for each voltage potential, including ground, shall be located as close, electrically speaking, to the source of the potential (the battery source) as physically practical, based on recommendations of the vehicle manufacturer. Terminal stack-up is not to exceed a quantity of four (4) per each individual screw, post, or stud block. All cabling and wiring associated with an individual circuit will be sized to ensure a voltage drop figure of no more than 5% of the source voltage. This figure is to cover the total loop from source potential to source ground.

5.50.11 **Circuit Protection.**

5.50.11.1 All branch circuits shall be protected by circuit breakers or fuses sized to the requirements of the load. 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. Any manually re-settable circuit breakers shall provide visible indication of open circuits.

5.50.11.2 Fuses shall be located adjacent to power source, and in a fuse block except as specifically approved by the customer after contract award.

5.50.11.3 Circuit breakers or fuses shall be sized to a minimum of 15 percent larger than the total circuit load current. The current rating for the wire used for each circuit must exceed the size of the circuit protection being used.

5.50.12 **Grounds.** The 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 three ring terminal connections shall be made per ground stud with spacing between studs ensuring conductivity and serviceability. Electronic equipment requiring an isolated ground of the battery (i.e., electronic ground) shall not be grounded through the chassis.

5.50.13 **Low Voltage/Lo Current Wiring and Terminals.**

5.50.13.1 All power and ground wiring shall conform to specification requirements of SAE J1127, J1128 and J1292. All high-voltage power and ground wiring shall conform to specification requirements of SAE J1763, J1654 J2910. In the case of conflicts with the requirements below, SAE standards shall apply. Double insulations shall be maintained as

close to the junction box, electrical compartment or terminals as possible. The requirement for double insulations shall be met by wrapping the harness with plastic electrical tape or by sheathing all wires and harnesses with nonconductive, rigid or flexible conduit.

5.50.13.2 The bus shall be manufactured so that high-voltage systems and cabling do not interfere with the operation of low-voltage control systems. To this end, high-voltage cabling and low-voltage control wiring must be separated as far as practical. Additionally, parallel runs of high-voltage cabling and low-voltage control wiring shall be minimized.

5.50.13.3 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 presenting the harness. Kinking, grounding at multiple points, stretching, and exceeding minimum bend radius shall be prevented.

5.50.13.4 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 nonconductive 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.

5.50.13.5 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 datalinks 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 use either different inserts or different insert orientations to prevent incorrect connections.

5.50.13.6 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.

5.50.13.7 Ultra-sonic and T-splices may be used with 8 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.

5.50.13.8 All splicing shall be staggered in the harness so that no two splices are positioned in the same location within the harness.

5.50.13.9 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.

5.50.14 **Electrical Components.**

5.50.14.1 All electrical components, including switches, relays, flashers, and circuit breakers, shall be heavy-duty designs with either a successful history of application to heavy-duty vehicles, or design specifications for an equivalent environment. These components shall be replaceable in less than 5 minutes by a 3M mechanic.

5.50.14.2 All electric motors shall be either heavy-duty brushless type where practical, or have a constant duty rating of no less than 40,000 hours. All electric motors shall be easily accessible for servicing.

5.50.15 **Electrical Compartments.**

5.50.15.1 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 circuits 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.

5.50.15.2 Junction boxes shall have laminated schematics and the front compartment shall be completely serviceable from the operator's seat, vestibule, or from outside. "Rear Start and Run" controls shall be mounted in an accessible location in the engine/drive motor compartment and shall be protected from the environment.

5.50.16 **General Electronic Requirements.**

5.50.16.1 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.

5.50.16.2 The Contractor shall ensure all electronic equipment is self-protecting in the event of shorts in the cabling, and also in over-voltage 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 pull-up or pull-down resistor must be limited as much as possible and if used, must be easily accessible and labeled appropriately.

5.50.17 **Wiring and Terminals.** Kinking, grounding at multiple points, stretching, and reducing the bend radius below the manufacturer's recommended minimum shall not be permitted.

5.50.18 **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.

5.50.19 **Shielding.**

5.50.19.1 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 shall also be used as applicable.

NOTE: A shield grounded at both ends forms a ground loop, which can cause intermittent control or faults.

5.50.19.2 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.

5.50.20 **Communications.** The data network cabling shall be 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.

5.50.21 **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.

5.50.22 **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.

5.51 Multiplexing.

5.51.1 **General.** Versatility and future expansion shall be provided for by an 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 at each zone location shall be designated as spares.

5.51.2 **Multiplexing 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 be managed by a master vehicle controller. Either system shall consist of several modules connected to form a control network.

5.51.3 **I/O Signals.** The input/output for the multiplex system shall contain four types of electrical signals: discrete, analog, serial data, and modulating. Discrete signals shall reflect the on/off status of switches, levers, limit switches, lights, etc. Analog signals reflect numerical data as represented by a voltage signal (for example 0–5V) or resistance signal (for example NTC thermistor). Both types of analog signals shall represent the status of variable devices such as rheostats, op-amps, potentiometers, temperature probes, etc.

5.52 Data Communications.

5.52.1 **General.**

5.52.1.1 All data communications networks shall be in accordance with a nationally recognized interface standard such as those published by SAE, IEEE, or ISO.

5.52.1.2 A vehicle data logger must be provided to monitor the J1939 communications system. It shall provide:

- Continuous monitoring and recording of the CAN J1939 data bus.
- Software that can generate structured reports using the gathered data.
- Software to create tools for incident definition, data import/export, analysis and presentation.

- Software for recording of user selected J1939 fault codes.

5.52.2 **Drivetrain Level Communications.** Drivetrain components, consisting of motor(s), the drive motor inverters, regenerative braking system, anti-lock braking system 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. Drivetrain components shall be powered by a supply voltage to ensure data communication among components exists when the vehicle is switched to the "on" position.

5.52.2.1 **Diagnostics, Fault Detection and Data Access**. Drivetrain performance, maintenance and diagnostic data, and other electronic messages shall be formatted and transmitted on the communications networks. The drivetrain level shall have the ability to record abnormal events in memory and provide diagnostic codes and other information to service personnel. These codes shall be available from the driver's digital display or on the diagnostic tool. The communication ports shall be located at the front and rear interior of the vehicle.

5.52.2.2 **Programmability (Software).** The drivetrain level components shall be programmable by KAT with limitations as specified by the sub-system supplier.

5.52.3 **Multiplex Level Communications.**

5.52.3.1 **Data Access.** At a minimum, information shall be made available via communication ports on the multiplex system at the front and rear interior of the vehicle. The location of the communication ports shall be easily accessible.

5.52.3.2 **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 the diagnostic tool. The diagnostic tool shall have the ability to check logic function.

5.52.3.3 **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 the diagnostic tool. The multiplex system shall have proper revision control to insure the hardware and software is 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 display 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.

5.52.4 **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 coaches 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. As a recommendation, no vehicle component shall generate or be affected by EMI/RFI that can disturb the performance of electrical/electronic equipment as defined in SAE J1113 and UNECE Council Directive 95/54(R10).

5.53 **Drivers Area Controls.** 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 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 J287, "Drivers Hand Control Reach."

5.53.1 **Glare.** The driver's work area shall be designed to minimize glare to the greatest 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.

5.53.2 **Driver's Window Sunscreens.** An adjustable roller type sunscreen shall be provided over the driver's windshield and/or 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.

5.53.3 **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 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. All switches/controls in the driver's control area shall be mounted in an angled panel steep enough to discourage drivers from using it as a personal storage area for items like food, drinks, cell phones, etc.

5.53.4 **Normal Bus Operation Instrumentation and Controls.**

5.53.4.1 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.

5.53.4.2 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.

5.53.4.3 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.

5.53.4.4 Onboard 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. The table below 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.

5.53.4.5 Consideration shall be provided for future additions of spare indicators as the capability of onboard diagnostic systems improves. Blank spaces shall contain LEDs.

Transit Bus Instruments and Alarms

Device	Description	Location	Function	Visual/Audible
Master run switch	Rotary, four-position detent	Side console	Master control for bus, off, day run, night run and clearance ID lights	
System start, front	Approved momentary switch	Side console	Activates vehicle systems	

Transit Bus Instruments and Alarms

Device	Description	Location	Function	Visual/Audible
System start, rear	Approved momentary switch (not required for vehicles without an ICE)	Engine compartment	Activates vehicle systems	
System run, rear	Three-position toggle switch (not required for vehicles without an ICE)	Rear system compartment	Permits activating vehicle system from rear start, normal front run position and off	Amber light
Drive selector	Touch panel switch	Side console	Provides selection of propulsion: forward, reverse and neutral	Gear selection
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	
Defroster fan	Switch or switches to control defroster fan	Side console or dash left wing	Permits defroster: fan off, low, medium or high	
Defroster temperature	Variable position	Side console or dash left wing	Adjusts defroster temperature	
Windshield wiper	One-variable position switch operating both wipers	Dash left wing	Variable speed control of left and right windshield wipers	
Windshield washer	Push button	Dash left wing	Activates windshield washers	
Dash panel lights	Rotary rheostat or stepping switch	Side console or dash left wing	Provides adjustment for light intensity in night run position	
Interior lights	Three-position switch	Side console	Selects mode of passenger compartment lighting: off, on or reduced lighting	
Front door ramp/kneel enable	Two-position keyed switch[1]	Front door remote or dash right wing	Permits ramp and kneel activation from front door area, key required[1]	Amber light
Front door ramp	Three-position momentary switch	Right side of steering wheel	Permits deploy and stow of front ramp	Red light
Front kneel	Three-position momentary switch	Front door remote	Permits kneeling activation and raise and normal at front door remote location	Amber or red dash indicator exterior alarm and amber light
AVL silent alarm	Recessed momentary push button	Side console	Activates emergency radio alarm at dispatch and permits covert microphone and/or enables destination sign emergency message	
Video system event switch	Momentary on/off switch with plastic guard	Side console	Triggers event equipment and 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	
Passenger door control	Five-position handle type detent or two momentary push buttons	Side console, forward	Permits open/close control of front and rear passenger doors	Red light

Transit Bus Instruments and Alarms

Device	Description	Location	Function	Visual/Audible
Rear door override	Two-position switch in approved location	Side console, forward	Allows driver to override activation of rear door passenger tape switches	
System shutdown override	Momentary switch with operation protection	Side console	Permits driver to override auto system shutdown	
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 coach 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 coach operator interface panel	Near farebox	Facilitates driver interaction with farebox system	LCD display
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	
Low-profile microphone	Low-profile discrete mounting	Steering column	Permits driver to make announcements with both hands on the wheel and focusing on road conditions	
High beam	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
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
Regenerative brake disable	Two-position switch	Within reach of operator or approved location	Permits driver override to disable brake regeneration	Red light
Alarm acknowledge	Push button momentary	Approved location	Permits driver to acknowledge alarm condition	
Rear door passenger sensor disable	Two-position switch	In sign compartment or driver's barrier compartment	Permits driver to override rear door passenger sensing system	

Transit Bus Instruments and Alarms

Device	Description	Location	Function	Visual/Audible
Indicator/ alarm test button	Momentary switch or programming[1]	Dash center panel	Permits driver to activate test of sentry, indicators and audible alarms	All visuals and audibles
Auxiliary power	110 V power receptacle	Approved location	Property to specify what function to supply	
Speedometer	Speedometer, odometer, and diagnostic capability, 5-mile increments	Dash center panel	Visual indication of speed and distance traveled, accumulated vehicle mileage, fault condition display	Visual
Air pressure gauge	Primary and secondary, 5 psi increments	Dash center panel	Visual indication of primary and secondary air systems	Red light and buzzer
Fire detection	Coach 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	Monitors primary and secondary air tank pressure	Dash center	Indication of low air system pressure	Buzzer and red light
System 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
Hot system indicator	Temperature indicator may be supplied as audible alert and visual and/or text message	Within driver's sight	Detects system overheat 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
LV 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	Indicates bike rack not being in fully stowed position	Amber or red light
HV charging system indicator (ESS)	Detects charging system status	Dash center	Indicates when bus is connected to off-board charger and ESS is accepting charge	Visual
State of charge indicator	Gauge, graduated based on SoC	Dash center	Indicates SoC of ESS	Visual
Regenerative braking indicator	Detects status	Dash center	Indicates when regenerative braking is being used	Visual
State of charge	Gauge, graduated based on SoC	Dash center	Indicates traction batteries SoC	

Transit Bus Instruments and Alarms

Device	Description	Location	Function	Visual/Audible

1. Indicate area by drawing. Break up switch control from indicator lights.

5.53.5 **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.

5.53.5.1 **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 deg at the point of initiation of contact and extend downward to an angle of 10 to 25 deg at full throttle. The location of the brake and accelerator pedals shall be determined by the manufacturer, based on space needs, visibility, lower edge of windshield and vertical H-point.

5.53.5.2 **Pedal Dimensions and Position.** The floor-mounted accelerator pedal shall be 10 to 12 inches long and 3 to 4 inches wide. Clearance around the pedal must allow for no interference precluding operation. The accelerator and brake pedals shall be positioned such that the spacing between them, measured at the heel of the pedals, is between 1 and 2 inches. Both pedals should be located approximately on the same plane coincident to the surface of the pedals.

5.53.5.3 **Adjustable Brake and Accelerator Pedals.** Both pedals shall be adjustable forward and rearward a minimum of 3 inches. The adjustment shall be made by use of a dash-mounted toggle or rocker switch. The switch shall be clearly labeled to identify it as a pedal adjustment and shall be within easy reach of the driver. Pedal adjustment shall be enabled only when the bus is stationary and the parking brake engaged.

5.53.6 **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 is 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.

5.53.7 **Turn Signal, PA and High Beam Foot Controls.** Turn signal controls shall be floor-mounted, foot-controlled, water-resistant, heavy-duty, momentary contact switches. The control switches for the turn signals are mounted on an inclined, floor-mounted inclined metal plate mounted to the driver's platform, located to the left of the steering column. The location and design of this plate is such that foot room for the operator is not impeded. The inclined mounting surface is skid-resistant. All other signals, including high beam and public address system, are in approved locations. The foot switches are UL-listed, heavy-duty type, of a rugged, corrosion-resistant metal construction. The foot switches for the turn signals and PA system are momentary type, while the high beam is latching type. The spacing of the switches are such that inadvertent simultaneous deflection of switches is prevented.

5.54 **Driver's Amenities.**

5.54.1 **Coat Hanger.** A suitable hook and loop style hanger shall be provided in a convenient, approved location for the driver's coat.

5.54.2 **Drink Holder.** A device shall be provided to securely hold the driver's drink container, which may vary widely in diameter. It must be mounted within easy reach of the driver and must have sufficient vertical clearance for esy removal of the container. When the container is in the device, the drive's view of the road must not be obstructed, and leakage from the container must not fall on any switches, gauges or controls.

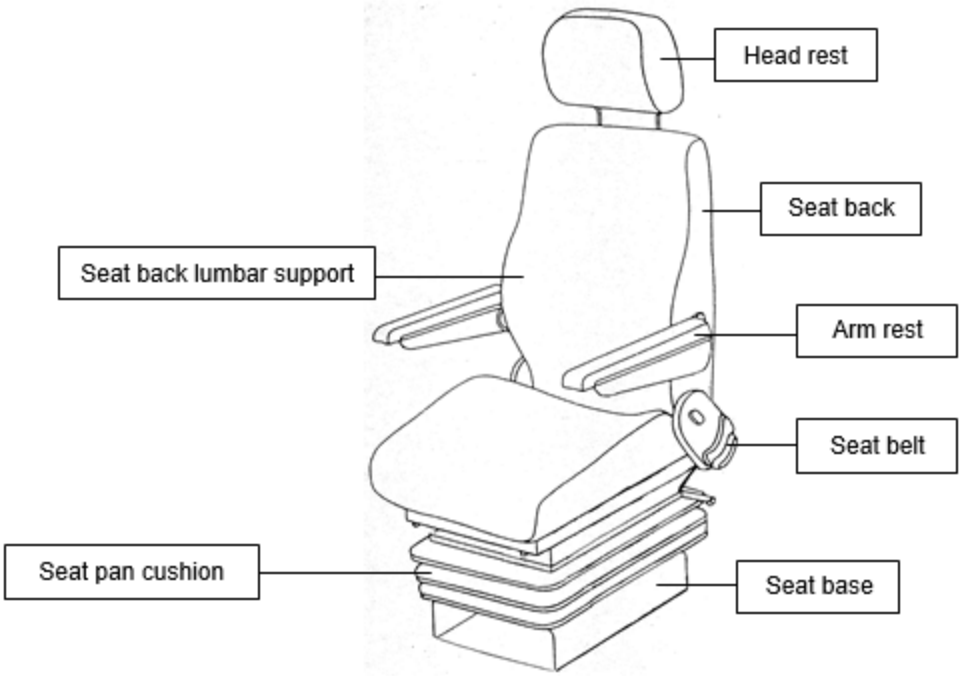
5.54.3 **Storage Box.** An enclosed dirver storage area shall be provided with a positive latching door and/or lock. The minimum size is 2750 cubic inches.

5.55 **Windshield Wipers and Washers.**

5.55.1 **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. A variable-speed feature shall be provided to allow adjustment of wiper speed for each side of the windshield between approximately five and 25 cycles per minute.

5.55.2 **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 include a means to determine fluid level.

5.56 **Drivers Seat.** The driver's seat shall be a Recaro Ergo Metro AM80 driver's seat (or approved equal) with black vinyl with vinyl trim, with fore and aft isolator and adjust seat tilt; recliner back and lumbar adjust, with heavy duty damper, with a molded suspension cover attached. The driver's seat shall be constructed with "FR" coated foam cushion foam cushion material, and the driver's headrest shall be vinyl covered.



5.56.1 **Dimensions.** The driver's seat shall be comfortable and adjustable so people ranging ni size from a 95th-percentile male to a 5th-percentile female may operate the bus.

5.56.1.1 **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 inches at its minimum length and no more than 20.5 inches at its maximum length.

5.56.1.2 **Seat Pan Cushion Height.** Measurement shall be from the cab floor to the top of the level seat at its center midpoint. The seat shall adjust in height from a minimum of 14 inches vertical range of adjustment.

5.56.1.3 **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 deg). The seat pan shall adjust in its slope from no less than plus 12 deg (rearward "bucket seat" incline) to no less than minus 5 deg (forward slope).

5.56.1.4 **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.

5.56.1.5 **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.

5.56.1.6 **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.

5.56.1.7 **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.

5.56.1.8 **Seat Back Height.** Standard height seat back.

5.56.1.9 **Headrests.** Adjustable headrest.

5.56.1.10 **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.

5.56.1.11 **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.

5.56.1.12 **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.

- Seat belts shall be provided across the drivers lap and diagonally across the driver's chest. The driver shall be able to use both belts by connecting a single buckle on the right side of the seat cushion. 3-point seatbelts must be emergency locking retractor (ELR) in design
- Adjustable-height D-ring.
- All seatbelt assemblies shall come equipped with a warning switch device to remind operators to buckle up.
- Orange 3-point seatbelt webbing.
- The lap portion of the 3-point belt assembly shall be 72 inches in length with an 8-inch extension.
- No armrests.

5.56.2 **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.

5.56.3 **Seat Structure and Materials.** Cushions shall be fully padded with at least 3 inches of materials in the seating areas at the bottom and back. Foam and fabric that meets FTA Docket 90A.

5.56.4 **Pedestal.** Either powder-coated steel or stainless steel.

5.57 **Mirrors.**

5.57.1 **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. Combination of flat and convex mirrors referred to as transit-specific.

5.57.2 **Curbside Mirrors.** The curbside rearview mirror shall be mounted so that its lower edge is no less than 76 in. above the street surface. 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. Turn signals shall be integrated into the mirrors.

5.57.3 **Street-Side Mirrors.** 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. Turn signals shall be integrated into the mirrors. The street-side mirror must be mounted towards the top of the bus.

5.57.4 **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.

5.58 **Windows.** A minimum of 8000 square inches of window area, including operator and door windows, shall be required on each side of the standard configuration bus.

5.58.1 **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 15 degrees, measured above the horizontal and excluding any shaded band. The vertically downward view shall permit detection of an object 3-1/2 feet high no more than 2 feet 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 windshield shall not be used. Winglets may be bonded.

5.58.2 **Glazing.** The windshield glazing material shall have a nominal thickness laminated safety glass conforming to the requirements of ANSI Z26.1 Test Grouping 1A and the Recommended Practices defined in SAE J673.

5.58.3 **Driver's Side Window.**

5.58.3.1 The operator's side window shall be the sliding type, requiring only the rear half of sash to latch upon closing and shall open sufficiently to permit the seated operator to easily adjust the street side outside rearview mirror. When in an open position, the window shall not rattle or close during braking. 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.

5.58.3.2 The operator's view, perpendicular through operator's side window glazing, should extend a minimum of 33 inches (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 560 mm (26 inches) above the operator's floor to ensure visibility of an under-mounted convex mirror.

5.58.3.3 The operator's side window glazing material shall have a 1/4 inch nominal thickness tempered safety glass conforming with the requirements of ANSI Z26.1-1996 Test Grouping AS-2 and the Recommended Practices defined in SAE J673.

5.58.4 **Side Window 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. All side windows shall be seamless (hidden frame) with inward-opening transom (fixed bottom, tip-in top). The inward-opening transom shall be between 25 and 35 percent of the total window area. The lower portion of the window shall be fixed. The transom portion shall be hinged along the lower edge and open inward. All side windows shall be fixed in position, except as necessary to meet the emergency escape requirements.

5.58.5 **Materials.**

5.58.5.1 Window glazing shall be 5mm (+/- nominal) tempered safety glass. Windows shall meet the requirements of ANSI Z26.1-1996 Test Grouping 2 and the Recommended Practices defined in SAE J673.

5.58.5.2 Windows shall be tinted 50% gray. Window glazing shall have 50% light transmittance as measured by ASTM D-1003 and 45% solar transmittance as measured by ASTM E-424. The window at the destination sign shall not be tinted in the vicinity of the sign.

5.58.5.3 All proposers shall provide an option for anti-vandalism polyester sacrificial film or other feature that prevents effects from vandalism for side windows aft of the standee line. This material shall be easily installed and removed without the use of specialized tools. Polyester film shall adhere to the window and be resistant to peeling, curling and discoloration by ultraviolet rays and not be effected by a nightly drive-through mechanical bus wash.

5.58.6 **Rear Window.** No requirement for a rear window.

5.59 **Heating, Ventilating and Air Conditioning (HVAC).**

5.59.1 **Capacity and Performance.**

5.59.1.1 The HVAC climate control system shall be capable of controlling bus interior temperature and humidity levels as defined below.

5.59.1.2 The HVAC unit should be roof-mounted; ThermoKing all electric preferred. The HVAC shall provide an integrated solution for passenger heating and cooling along with required cooling capacity to be used for the vehicle battery cooling loop.

5.59.1.3 With the bus running at the route operating profile with corresponding door opening cycle, and carrying a number of passengers equal to 150 percent of the seated load, the HVAC system shall control the average passenger compartment temperature within a range between 65 and 80 °F, while maintaining the relative humidity to a value of 50 percent or less. The system shall maintain these conditions while subjected to any outside ambient temperatures within a range of 10 to 95 °F and at any ambient relative humidity levels between 5 and 50 percent.

5.59.1.4 When the bus is operated in outside ambient temperatures of 95 to 115 °F, the interior temperature of the bus shall be permitted to rise 0.5° for each degree of exterior temperature in excess of 95 °F.

5.59.1.5 When the bus is operated in outside ambient temperatures in the range of -10 to 10 °F, the interior temperature of the bus shall not fall below 55 °F while the bus is running on the route operating profile.

5.59.1.6 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 after system startup in a 100 °F ambient temperature. During the cooldown period, the refrigerant pressure shall not exceed safe high-side pressures, and the condenser discharge air temperature, measured 6 inches 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 Aug. 21, shall be used. There shall be no passengers on board, and the doors, windows and fresh air opening shall be closed.

5.59.1.7 The system must be designed such that, through automated means, the HVAC system can be turned on to bring the passenger compartment to route service operating temperature while the bus is still receiving power from the depot charging system. The intent of this design is to avoid utilizing battery Kwh to bring the bus to proper temperature after pull-out thereby conserving available Kwh for longer route service.

5.59.2 **Controls and Temperature Uniformity.**

5.59.2.1 The HVAC system excluding the operator's heater/defroster shall be centrally controlled with an advanced electronic/diagnostic control system with provisions for extracting/reading data. The system shall be compliant with J1939 Communication Protocol for receiving and broadcasting of data.

5.59.2.2 The operator shall have full control over the defroster and operator's heater. The operator shall be able to adjust the temperature in the operator's area through HVAC air distribution. The interior climate control system shall switch automatically to the ventilating mode if the refrigerant compressor or condenser fan fails.

5.59.2.3 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 inches to 72 inches above the floor, shall not vary by more than 5 ºF with doors closed. The interior temperatures, measured at the same height above the floor, shall not vary more than ± 5 ºF, from the front to the rear, from the average temperature determined in accordance to APTA Recommended Instrumentation and Performance Testing for Transit Bus Air Conditioning System. Variations of greater than ± 5 ºF will be allowed for limited, localized areas provided the majority of the measured temperatures fall within the specified requirement.

5.59.2.4 HVAC control must include a method to provide multistage load shedding when required to conserve battery power. The HVAC system may be operated with reduced performance to allow the bus to operate when the high voltage batteries are below critical levels.

5.59.3 **Auxiliary Heater.** Proposers may include an auxiliary heater system that may consist of one or more fuel fired heat exchangers to supplement or replace heat provided by the electric grid HVAC system. Since these systems introduce emissions into the atmosphere, however, proposals that include these systems may receive lower scores during evaluation.

5.59.4 **Passenger Area Air Flow.**

5.59.4.1 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 feet 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 feet per minute on any passenger. The ventilating mode shall provide air at a minimum flow rate of 20 cfm per passenger.

5.59.4.2 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 assure at least 70 ºF air outlet temperature. The heating air outlet temperature shall not exceed 120 ºF under any normal operating conditions.

5.59.5 **Driver's Area Air Flow.** The bus interior climate control system shall deliver at least 100 cfm of air to the operator's area when operating in the ventilating and cooling modes. Adjustable nozzles shall permit variable distribution or shutdown of the airflow. Airflow in the heating mode shall be reduced proportionally to the reduction of airflow into the passenger area. The windshield defroster unit shall meet the requirements of SAE Recommended Practice J382, Windshield Defrosting Systems Performance Requirements, and shall have the capability of diverting heated air to the operator's feet and legs. The defroster or interior climate control system shall maintain visibility through the operator's side window.

5.59.6 **Controls for the Climate Control System (CCS).** The controls for the operator's compartment for heating, ventilation, and cooling systems 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. An "on-off" switch shall be located to the right of or near the main defroster switch.

5.59.7 **Driver's Compartment Requirements.**

5.59.7.1 The heater and defroster system shall provide heating for the operator and heated air to completely defrost and defog the windshield, operator's side window, and the front door glass in all operating conditions. Fan(s) shall be able to draw air from the bus body interior and pass it through the defroster system and to the operator's area. A minimum capacity of 100 cfm shall be provided. The operator shall have complete control of heat for their area.

5.59.7.2 The defroster supply outlets shall be located at the lower edge of the windshield. These outlets shall be durable and 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 cannon fall into the defroster air outlets. Adjustable ball vents shall be provided at the left of the operator's position to allow direction of air onto the side windows.

5.59.7.3 A ventilation system shall be provided, which can be integrated as part of the defroster system, to ensure operator comfort and shall be capable of providing fresh air in the foot and/or head areas. Vents shall be controllable by the operator from the normal driving position. Decals shall be provided indicating "operating instructions" and "open" and "closed" positions as well. When closed, vents shall be sealed to prevent the migration of water or air into the bus.

5.59.8 **Driver's Cooling.** The requirements for operator's cooling shall be consistent with specifications noted in 5.59.1 above. There shall be no dedicated evaporator for driver's cooling. A driver's booster blower, however, must be available.

5.59.9 **Air Filtration.** Air shall be filtered before entering the AC system and being discharged 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 and cleanable.

5.59.10 **Roof Ventilators.** Two manually operated roof ventilators shall be provided in the roof of the bus, one approximately over or just forward of the front axle and the other, approximately over the rear axle. Each ventilator shall be easily opened and closed manually by a 50th percentile female. If roof ventilator(s) cannot be reached by a 50th percentile female, then a tool shall be provided to allow this. When open with the bus in motion, this ventilator shall provide fresh air inside the bus. Ventilator shall cover an opening area no less than 425 square inches and shall be capable of being positioned as a scoop with either the leading or trailing edge open no less than 4 inches, or with all four edges raised simultaneously to a height of no less than 3-1/2 inches. An escape hatch shall be incorporated into the roof ventilator. Roof ventilator(s) shall be sealed to prevent entry of water when closed. A bilingual (English/Spanish) decal giving operating instructions shall be affixed to the interior of the hatch and emergency instructions for opening from the exterior shall be affixed to the outside of the hatch.

5.59.11 **Maintainability.** Manual or automatically controlled shutoff valves in the refrigerant lines shall allow isolation of the compressor and dehydrator filter for service. To the extent practicable, 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. The refrigerant compressor shall be semi-hermetic and rebuildable. The condenser shall be located on the roof 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. All access shall be hinged with captive fasteners.

5.59.12 **Entrance/Exit Area Heating.** There are no requirements for entrance and exit area heating.

5.59.13 **Floor-Level Heating.** There is no requirement for floor-level heating.

5.60 **Exteriors.**

5.60.1 **Design.** The bus shall have a clean, smooth, simple design, primarily derived from bus performance requirements and passenger service criteria. The exterior and body features, including grilles and louvers, shall be shaped to facilitate cleaning by automatic bus washers without snagging washer brushes. Water and dirt shall not be retained in or on any body feature to freeze or bleed out onto the bus after leaving the washer. The body and windows shall be sealed to prevent leaking of air, dust or water under normal operating conditions and during cleaning in automatic bus washers for the service life of the bus. 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.

5.60.2 **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 are minimized and integrated into the basic design.

5.60.3 **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.

5.60.4 **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 shall be exempt from the protrusion requirement. Advertising frames shall not protrude 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.

5.60.5 **Side Body Panel Repair and Replacement.** The bus side body panels shall be easily repairable by either applying common composite body repair techniques or by having side body panels that are made of impact-resistant material and easily and quickly replaceable.

5.60.6 **Rain Gutters.** Rain gutters shall either be provided or designed as an integral part of the bus body. The rain gutters shall prevent water flowing from the roof onto the passenger doors, operator's side window, and exterior mirrors. When the bus is decelerated, the gutters shall not drain onto the windshield, or operator's side window, or into the door boarding area. Cross sections of the gutters shall be adequate for proper operation.

5.60.7 **License Plate Provisions.** A provision shall be made to mount a standard-size U.S. license plate per SAE J686 on the rear of the bus. This provision shall direct-mount or recess the license plate so it 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.

5.60.8 **Rub Rails.** No requirement for rub rails.

5.60.9 **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.

5.60.10 **Wheel Covers.** No requirement for wheel covers.

5.60.11 **Splash Aprons.** Splash aprons, composed of ¼ inch 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 inches off the road surface at static conditions. Apron widths shall be no less than tire widths. Splash aprons shall be bolted to the bus understructure. Splash aprons and their attachments shall be inherently weaker than the structure to which they are attached. The flexible portions of the splash aprons shall not be included in the road clearance measurements. A splash apron shall be installed as necessary to protect the wheelchair loading device from road splash.

5.60.12 **Service Compartments and Access Doors.** Conventional or pantograph hinged doors shall be used for the drive system compartment and for all auxiliary equipment compartments including doors (if so equipped) for checking the quantity and adding to the drive system (motor and controller) coolant, power steering fluid, windshield washer fluid 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. Doors with top hinges shall have safety props stored behind the door or on the doorframe or employ gas shocks of sufficient size to support the weight of the door when opened. All access doors shall be retained in the open position by props or counterbalancing with over-center or gas-filled springs 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.

5.60.13 **Access Door Latches/Locks.** Access doors larger than 100 sq in. are equipped with corrosion-resistant flush-mounted latches or locks. All such access doors that require a tool to open are standardized throughout the vehicle and will require a nominal 5/16 in. square male tool to open or lock.

5.61 **Bumpers.**

5.61.1 **Location.** Romeo Rim, or equal, bumpers shall provide impact protection for the front and rear of the bus with the top of the bumper being 27 inches (+/- 2 inches) 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.

5.61.2 **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 4000lbs 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° 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 will not require service or maintenance in normal operation during the service life of the bus. The bumper may increase the overall bus length specified by no more than 7 inches. The bumper shall provide mounting provisions for a bike rack.

5.61.3 **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 foot 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 inches high, and at accelerations up to 2 mph/second. 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 inches.

5.61.4 **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.

5.62 **Finish and Graphics.**

5.62.1 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 ensure 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 painted prior to installation of exterior lights, windows, mirrors, decals 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.

5.62.2 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
- 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 patches due to incorrect mixing of paint activators

- Buffing swirls

5.62.3 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.

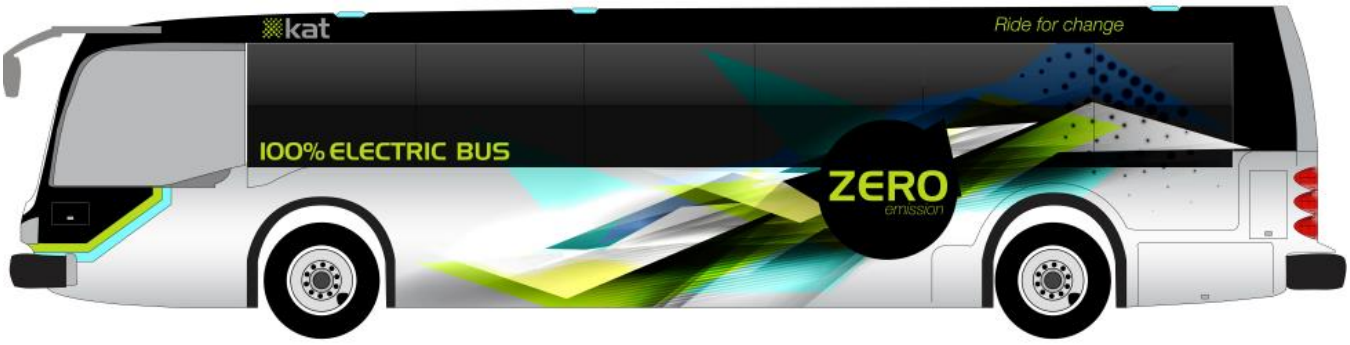
5.62.4 Proper adhesion between the basic surface and successive coats of the original paint shall be measured using an Elcometer adhesion tester as outlined in ASTM D4541-85. Adhesion shall be a minimum 300 ft-lb. The bus manufacturer shall supply test samples of the exterior surface for each step of 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.

5.62.5 Paint shall be a single-stage, high-gloss enamel with a mil thickness consistent with the paint manufacturer's specifications that enables the finish to last the service life of the bus. The awarded bus manufacturer must submit test spray-out panels with selected colors for approval prior to painting the first bus.

5.62.6 **Bus Exterior Color.** Color codes for the bus exterior paint scheme are as follows. Clarifications and equals shall be discussed during the pre-production meeting.

- PPG Delfleet FDGH 303769 Gray.
- PPG Delfleet FDGH 9700 Black.
- PPG Delfleet FDGH Ford YZ White

5.62.7 **Bus Exterior Graphics.** Proposers shall provide pricing based upon the graphics concept below.



5.63 **Signs and Decals.** Energy storage and delivery systems shall be identified in accordance with federal, state and local requirements, codes and standards. 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 appliqués. All graphics and decals shall be installed per the graphics/decal Supplier recommendations. Signs shall be provided in compliance with the ADA requirements defined in 49 CFR Part 38, Subpart B, 38.27. Required graphics and decals are listed in the table below.

Additional decal layout and location details shall be provided and approved during the pre-production meeting.

REQUIRED DECALS

QTY	DESCRIPTION	TYPE	LOCATION
4	Bus ID Number, 4”	Reflective Decal	Exterior Front, Rear, Sides
	“BATTERY DISCONNECT” black letters in yellow background	Reflective Decal	Where Applicable
1	“THIS VEHICLE STOPS AT ALL RAILROAD CROSSINGS”	Reflective Decal	Exterior Rear
1	“WATCH FOR PEDESTRIANS” black letters in yellow background, reversed for pictograph	Decal	Operator’s side window interior
	“HIGH VOLTAGE” (Text with pictograph)	Decal	Where Applicable
1	“Kneeling”	Reflective Decal	Exterior adjacent to front passenger door
1	“Ramp”	Reflective Decal	Exterior adjacent to front passenger door
1	“CAUTION, CLEARANCE HEIGHT Xft. Xin.” with appropriate height in feet and inches	Decal	Interior above operator
	“PULL TO SIGNAL” in English and Spanish	Sign	Interior appropriately placed adjacent to passenger stop request pull cords
	“PUSH TO SIGNAL” in English and Spanish	Sign	Interior appropriately placed adjacent to passenger stop request pads
2	“PLEASE OFFER THESE SEATS TO THE ELDERLY AND PERSONS WITH DISABILITIES” in English and Spanish, characters on these signs must have a width-to-height ratio between 3:5 and 1:1; a stroke width-to-height ratio between 1:5 and 1:10; minimum height (using an uppercase “X”) of 5/8 inch; wide spacing (generally, the space between letters must be 1/16 the height of uppercase letters); and contrast with the background, either light-on-dark or dark-on-light. (Reference – 49CFR38.2(a) and 38.27(c))	Sign or Window Decal as appropriate	Interior adjacent to two sets (double seats on each side of bus) adjacent to each wheelchair station
2	“WHEEL CHAIR SEATING AREA”	Sign or Window	Interior adjacent to

	Characters on these signs must have a width-to-height ratio between 3:5 and 1:1; a stroke width-to-height ratio between 1:5 and 1:10; minimum height (using an uppercase "X") of 5/8 inch; wide spacing (generally, the space between letters must be 1/16 the height of uppercase letters); and contrast with the background, either light-on-dark or dark-on-light. (Reference – 49CFR38.27(b) and (c))	Decal as appropriate	each wheelchair station
	"WATCH YOUR STEP" in English and Spanish, white letters on red background	Decal	On each vertical stanchion within raised floor platforms if so equipped
2	"EMERGENCY EXIT" with operating instructions in English and Spanish	Decal	Interior on each roof ventilator escape hatch
	"EMERGENCY EXIT" with operating instructions in English and Spanish	Sign and/or Decal	Interior on/or adjacent to each emergency egress passenger window
	"EMERGENCY MANUAL RELEASE" with instructions	Sign or Decal	Interior on/or adjacent to passenger door manual release controls
1	"Watch Your Step" or "Caution"	Sign or Decal	Edge of operator's platform (to alert driver of the raised operator's platform from passenger floor height).
1	"Watch Your Step" or "Caution"	Decal	Rear step to rear upper platform in passenger compartment, if of bi-level floor design.

5.64 **Lighting.** All lighting shall be LED to the extent possible.

5.64.1 **Exterior Lighting.** Exterior lighting and reflectors shall comply, as applicable, with Part 393, Subpart B of the FMCSA and FMVSS 108. 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. 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.

5.64.2 **Backup Light/Alarm.** Visible and audible warnings inform following vehicles or pedestrians of reverse operation. Visible reverse operation warning conforms to SAE Standard J593. Audible reverse operation warning conforms to SAE Recommended Practice J994 Type C or D.

5.64.3 **Doorway Lighting.** Lamps at the front and rear passenger doorways comply with ADA requirements and activate only when the doors open. These lamps illuminate the street surface to a level of no less than 1 foot-candle for a distance of 3 feet outward from the outboard edge of the door threshold. The lights are positioned below the lower daylight opening of the windows and are shielded to protect passengers' eyes from glare.

5.64.4 **Turn Signals.** Turn-signal lights are provided on the front, rear, curb and street sides of the bus in accordance with federal regulations.

5.64.5 **Headlights.** Standard OEM headlight installation shall be provided in accordance with FMVSS 108 and Part 393, Subpart B of the FMCSA as applicable. All headlights shall be LED.

5.64.6 **Brake Lights.** Brake lights shall be provided in accordance with FMVSS 108 and Part 393, Subpart B of the FMCSA as applicable. A high and center mounted brake light is required.

5.64.7 **Service Area Lighting (Exterior and Interior).**

5.64.7.1 LED lamps are provided in the motor compartment and communication box to generally illuminate the area for night emergency repairs or adjustments. The passenger door operator compartments and junction/apparatus panels shall have adequate light to illuminate 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.

5.64.7.2 Motor compartment lamps shall be controlled by a switch mounted in the motor compartment. 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.

5.65 **Interior Panels and Finishes.**

5.65.1 **General Requirements.**

5.65.1.1 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.

5.65.1.2 Interior surfaces more than 10 inches 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 coach 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.

5.65.2 **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. Interior panels are required to meet FMVSS 302.

5.65.3 **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 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.

5.65.4 **Modesty Panels.**

5.65.4.1 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.

5.65.4.2 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.

5.65.4.3 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.

5.65.4.4 Modesty panels shall provide additional floor clearances for cleaning and toe clearance.

5.65.5 **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.

5.65.6 **Rear Bulkhead.**

5.65.6.1 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.

5.65.6.2 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.

5.65.7 **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.

5.65.8 **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.

5.65.9 **Insulation.**

5.65.9.1 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.

5.65.9.2 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.

5.65.9.3 All insulation materials shall comply with the Recommended Fire Safety Practices defined in FTA Docket 90-A, dated October 20, 1993.

5.65.10 **Interior Colors.** Interior color scheme shall be discussed and finalized during the pre-production meeting.

5.66 **Floor Covering.**

5.66.1 Altro non-skid floor covering or approved equal shall be provided.

5.66.2 The floor covering shall have a non-skid walking surface that remains effective in all weather conditions. The floor covering, as well as transitions of flooring material to the main floor and to the entrance and exit area, shall be smooth and present no tripping hazards. Seams shall be sealed/welded per manufacturer's specifications. The standee line shall be approximately 2 in. wide and shall extend across the bus aisle. The color and pattern shall be consistent throughout the floor covering.

5.66.3 The area of the front ramp platform as well as the floor area under and around the ramp in the vestibule area may be LineX sprayed-on polyurethane, non-skid surface. The step edge shall be LineX yellow.

5.66.4 Any areas on floor, which are not intended for standees, such as areas "swept" during passenger door operation, shall be clearly and permanently marked. The floor in the operator's compartment shall be easily cleaned and shall be arranged to minimize debris accumulation.

5.66.5 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.

5.66.6 The floor under the seats shall be covered with smooth surface flooring material. The floor covering shall closely fit the sidewall cove or extend to the top of the cove.

5.66.7 Color shall be discussed and finalized during the pre-production meeting.

5.67 **Interior Lighting.**

5.67.1 **General Requirements.** Interior lighting shall be LED to the maximum extent possible. 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.

5.67.2 **Passenger Lighting.**
The operator shall be able to select either dim, off or bright for interior lighting. When in "day run" mode, all interior lights shall be as selected by the driver. In "night run" mode, the front most lights on each side (behind the driver and the front door) shall be turned on only when either door is opened. With both doors closed, the front most lights shall be off to minimize light reflection and glare on the windshield. The rear lights shall be on in the setting selected by the driver (off, dim or bright). All interior lighting shall be turned off whenever the transmission selector is in reverse.

5.67.3 **Driver Area Lighting.** 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.

5.67.4 **Seating Area Lighting.** The interior lighting system shall provide a minimum 15 foot-candle illumination on a 1 sq ft plane at an angle of 45 degrees from horizontal, centered 33 in. above the floor and 24 in. in front of the seat back at each seat position. Allowable average light level for the rear bench seats shall be 7 foot-candles.

5.67.5 **Vestibules/Doors Lighting.** Floor surface in the aisles shall be a minimum of 10 foot-candles, and the vestibule area a minimum of 4 foot-candles with the front doors open and a minimum of 2 foot-candles with the front doors closed. The front entrance area and curb lights shall illuminate when the front door is open and master run switch is in the "lights" positions. Rear exit area and curb lights shall illuminate when the rear door is unlocked.

5.67.6 **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.

5.67.7 **Ramp Lighting.** Exterior and interior ramp lighting shall comply with CFR Part 49, Sections 19.29 and 19.31.

5.67.8 **Farebox Lighting.** Sufficient farebox lighting shall be provided and automatically come on whenever the front doors are opened and the run switch is in the "night run" or "night park" position.

5.67.9 **Fare Collection.** Space and structural provisions shall be made for installation of currently available fare collection devices, which 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 farebox shall not restrict access to the driver's 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 J1050. The location and mounting of the fare collection device shall allow use, without restriction, by passengers. The farebox location shall permit accessibility to the vault for easy manual removal or attachment of suction devices. Meters and counters on the farebox shall be readable on a daily basis. The floor under the farebox shall be reinforced as necessary to provide a sturdy mounting platform and to prevent shaking of the farebox. Contractor shall provide fare collection installation layout to KAT for approval. KAT will install its own farebox.

5.67.10 **Interior Access Panels and Doors.** Access for maintenance and replacement of equipment shall be provided by panels and doors that appear to be an integral part of the interior. Access doors shall be hinged with gas props or over-center springs, where practical, to hold the doors out of the mechanic's way. Panels shall prevent entry of mechanism lubricant into the bus interior. All fasteners that retain access panels shall be captive in the cover. Access doors shall be secured with locks. The locks shall be standardized so that only one tool is required to open access doors on the bus.

5.67.11 **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 KAT 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.

5.68 **Passenger Accommodations.**

5.68.1 **Passenger Seats.** Proposers shall price both USSC Gemini (and American Seating Insight Prime+ passenger seats as an option) with hard-shell inserts; no drain holes. Approximately 32 passenger seats shall be arranged in a transverse, forward-facing configuration, except at the wheel housings and wheelchair securement areas. Final approval for seat arrangements shall be given following pre-production meeting. The seats frame color should be black with a lime green (color code: HEX #C4D600) hard plastic inset or approved equal.

5.68.2 **USB Cell Phone Charging Stations.** USB charging stations for charging of cell phones and other portable devices should be built in to the passenger seats. Other designs for these charging stations are acceptable, bus must be included in proposals. The charging stations may be powered by the auxiliary electronic power supply addressed in paragraph 5.50.8 above and not from the bus ESS system.

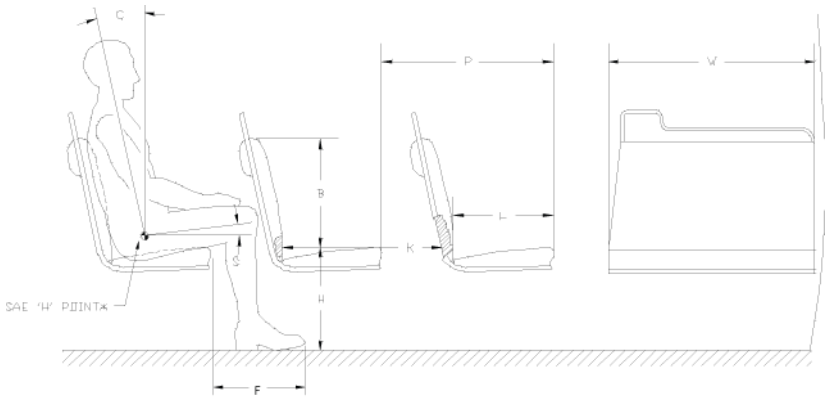
5.68.2 **Hip-to-Knee and Foot Room.** Hip-to-knee room measured from the center of the seating position, from the front of one seat back horizontally across the highest part of the seat to vertical surface immediately in front, shall be a minimum of 26 in. At all seating positions in paired transverse seats immediately behind other seating positions, hip-to-knee room shall be no less than 27 in. Foot room, measured at the floor forward from a point vertically below the front of the seat, shall be no less than 14 inches. Seats immediately behind the wheel housings and modesty panels may have foot room reduced.

5.68.4 **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).

5.68.5 **Seat Dimensions.** Seat dimensions for the various seating arrangements shall have the dimensions as follows (see figure below).

- The width, W, of the two-passenger transverse seat shall be a minimum of 35 inches.
- The length, L, shall be 17 inches, +/- 1 inch.
- The seat back height, B, shall be a minimum of 15 inches.
- The seat height, H, shall be 17 inches, +/- 1 inch. For the rear lounge (or settee) and longitudinal seats, and seats located above raised areas for storage of underfloor components, a cushion height of up to 18 inches, +/- 2 inches, will be allowed. This shall also be allowed for limited transverse seats, but only with the express approval of KAT.
- Foot room = F.
- The seat hard-shell cushion slop, S, shall be between 5 and 11 degrees.
- The seat back slop, C, shall be between 8 and 17 degrees.
- Hip to knee room = K.
- The pitch, P, is shown as reference only.

Seating Dimensions and Standard Configuration



5.68.6 **Structure and Design.**

5.68.6.1 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.

5.68.6.2 Seats, structures and restraints around the securement area should not infringe into the mobility device envelope or maneuverability.

5.68.6.3 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 inches of the aisle shall be at least 10 inches above the floor.

5.68.6.4 In locations at which cantilevered installation is precluded by design and/or structure, other seat mounting may be allowed.

5.68.6.5 All transverse objects—including seat backs, modesty panels and longitudinal seats—in front of forward-facing seats shall not impart a compressive load in excess of 1000 lbs onto the femur of passengers ranging in size from a 5th-percentile female to a 95th-percentile male during a 10g deceleration of the bus. This deceleration shall peak at 0.05 to 0.015 seconds from initiation. Permanent deformation of the seat resulting from two 95th-percentile males striking the seat back during this 10g deceleration shall not exceed 2 inches, measured at the aisle side of the seat frame at height H. The seat back should not deflect more than 14 inches, measured at the top of the seat back, in a controlled manner to minimize passenger injury. Structural failure of any part of the seat or sidewall shall not introduce a laceration hazard.

5.68.6.6 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 inch permanent deformation in the seat or its mountings. The seat assembly shall withstand static horizontal forces of 500 lbs evenly distributed along the top of the seat back with less than ¼ inch permanent deformation in the seat or its mountings. The seat backs at the aisle position and at the window position shall withstand repeated impacts of two 40 lb sandbags without visible deterioration. One sandbag shall strike the front 40,000 times and the other sandbag shall strike

the rear 40,000 times. Each sandbag shall be suspended on a 36 inch pendulum and shall strike the seat back 10,000 times each from distances of 6, 8, 10 and 12 inches. Seats at both seating positions shall withstand 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 inches. Seat hard-shell 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.

5.68.6.7 The back of each transverse seat shall incorporate a handhold no less than ⅞ inches 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 inches long, that may be grasped with the full hand. This handhold shall not cause a standee using this assist to interfere with a seated 50th-percentile male passenger. The handhold shall also be usable by a 5th-percentile female, as well as by larger passengers, to assist with seat access/egress for either transverse seating position. The upper rear portion of the seat back and the seat back handhold immediately forward of transverse seats shall be padded and/or constructed of energy-absorbing materials. During a 10g deceleration of the bus, the HIC number (as defined by SAE J211a) shall not exceed 400 for passengers ranging in size from a 5th percentile female through a 95th percentile male.

5.68.6.8 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.

5.68.6.9 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 inches of the end of the seat cushion. Armrests shall be located from 7 to 9 inches above the seat hard-shell cushion surface. The area between the armrest and the seat hard-shell cushion shall be closed by a barrier or panel. The top and sides of the armrests shall have a minimum width of 1 inch and shall be free from sharp protrusions that form a safety hazard.

5.68.6.10 Seat back handhold and armrests shall withstand static horizontal and vertical forces of 250 lbs applied anywhere along their length with less than ¼ inch permanent deformation. Seat back handhold and armrests shall withstand 25,000 impacts in each direction of a horizontal force of 125 lbs with less than ¼ inch permanent deformation and without visible deterioration.

5.68.7 **Passenger Seat Construction and Materials.**

5.68.7.1 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 hard-shell inserts shall be contoured for individuality, lateral support and maximum comfort and shall fit the framework to reduce exposed edges.

5.68.7.2 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-inch. 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.

5.68.8 **Passenger Assists.**

5.68.8.1 **General.** 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 304/312 stainless steel. The forward-most vertical stanchions on either side of the aisle immediately behind the driver's area shall also be 304/312 stainless steel.

5.68.8.2 **Design.** Excluding those mounted on the seats and doors, the assists shall have a cross-sectional diameter between 1¼ and 1½ inches or shall provide an equivalent gripping surface with no corner radii less than ¼ inch. All passenger assists shall permit a full hand grip with no less than 1½ inches 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-inch 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.

5.68.8.3 **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 inches 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.

5.68.8.4 **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 inches 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 inches 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.

5.68.8.5 **Rear Doorway.** 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 inches or providing an equivalent gripping surface with no corner radii less than ¼ inch, and shall provide at least 1½ inches 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.

5.68.8.6 **Overhead.** Except forward of the standee line and at the rear door, a continuous, full grip, overhead assist shall be provided. This assist shall be located over the center of the aisle seating position of the transverse seats. The assist shall be no less than 70 inches above the floor. Grab straps or other extensions as necessary shall be provided for sections where vertical assists are not available and for the use by passengers that cannot reach to 70 inches. Grab straps shall be fabric. Overhead assists shall simultaneously support 150 lob on any 12-inch length. No more than 5 percent of the full grip feature shall be lost due to assist supports.

5.68.8.7 **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 inches apart or functionally continuous for a 5th percentile female passenger.

5.68.8.8 **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.

5.68.9 **Passenger Doors.** Doors shall be pneumatically powered. Doors will be provided in the locations and styles as listed below. Passenger doors and doorways shall comply with ADA requirements.

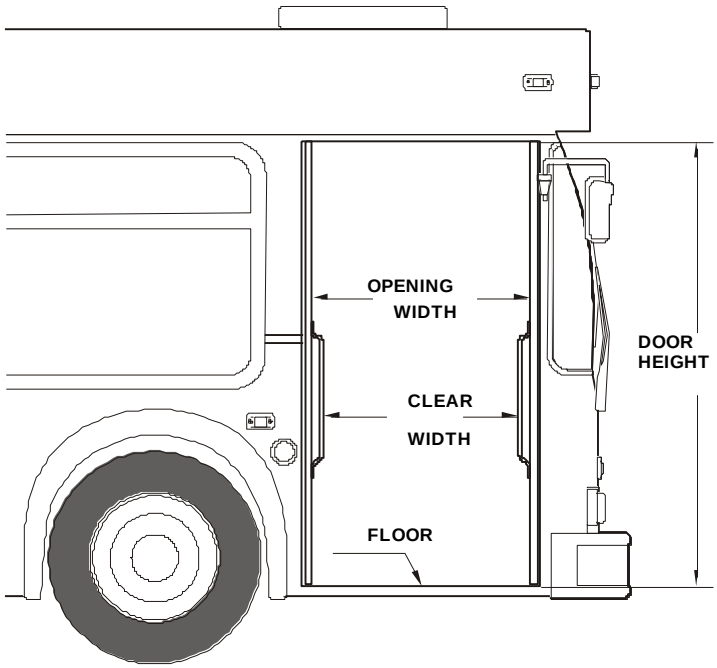
5.68.9.1 **Front Door.** The front door shall be forward of the front wheels and under direct observation of the driver.

5.68.9.2 **Rear Door.** Curbside doorway centerline located rearward of the point midway between the front door centerline and the rearmost seat back.

5.68.9.3 **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 inches of soft weather stripping. The doors, when closed, shall be effectively sealed, and the hard surfaces of the doors shall be at least 4 inches 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.

5.68.9.4 **Dimensions.** When open, the front doors shall leave an opening no less than 75 inches in height. The front door clear width shall be a minimum of 33 inches with the doors fully open. The rear doors shall leave an opening height of 75.75 inches and the clear width shall be a minimum of 38 inches with the doors fully open.

Transit Bus Minimum Door Opening.



5.68.9.5 **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. The edge of a 6 inch high curb shall be visible to the seated driver through the closed front door when the bus is more than 12 inches from the curb.

5.68.9.6 **Door Exterior Projection.** The exterior projection of the front doors beyond the side of the bus shall be minimized and shall not block the line of sight of the rear exit door via the curb side mirror when the doors are fully open. The exterior projection of both doors shall be minimized and shall not exceed 14 inches during the opening or closing cycles or when doors are fully opened.

5.68.9.7 **Door Interior Projection.** Projection inside the bus shall not cause an obstruction of the rear door mirror or cause a hazard for standees.

5.68.9.8 **Door Height Above Pavement.** It shall be possible to open and close either passenger door when the bus loaded to gross vehicle weight rating is not knelt and parked with the tires touching an 8 inch-high curb on a street sloping toward the curb so that the street side wheels are 5 inches higher than the right side wheels.

5.68.9.9 **Closing Force.**

5.68.9.9.1 Closing door edge speed shall not exceed 12 inches per second, and opening door speed shall not exceed 19 inches 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.

5.68.9.9.2 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 square inch 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.

5.68.9.9.3 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.

5.68.9.9.4 Whether or not the obstruction sensing system is functional, it shall be possible to withdraw a 1½ inch diameter cylinder from between the center edges of a closed and locked door with an outward force not greater than 42 lbs.

5.68.9.10 **Actuators.**

5.67.9.10.1 Door actuators shall be Vapor Corporation pneumatic door 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.

5.68.9.10.2 Door actuators shall be adjustable so 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.

5.68.9.10.3 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.

5.68.9.10.4 The rear door actuator(s) shall be under the complete control of the vehicle operator and shall open and close in response to the position of the driver's door control.

5.68.9.10.5 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.

5.68.9.10.6 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.

5.68.9.11 **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.

5.68.9.12 **Door Control.** The door control shall be located in the operator's area on the street side within the hand reach envelope described in SAE J287, "Driver Hand Control Reach". The driver's door control shall provide tactile feedback to indicate commanded door position and resist inadvertent door actuation. The front door shall remain in commanded state position even if power is removed or lost.

5.68.9.13 **Door controller.** Operation of, and power to, the passenger doors shall be completely controlled by the operator. 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 closed.
- **First position:** Front door open, rear door closed.
- **Second position forward:** Front door open, rear door open.
- **First position back:** Front door closed, rear door open.
- **Second position back:** Front door open, rear door open.

5.68.9.14 **Master Door Switch.** A control in the operator's compartment shall shut off the pneumatic power to the front door mechanism to permit manual operation of the front door with the bus shut down. A master door switch, which is not within reach of the seated operator, when set in the "off" position shall close the rear doors, deactivate the door control system, release the interlocks and permit only manual operation of the rear door.

5.69 **Accessibility Provisions.** Space and body structural provisions shall be provided at the front door of the bus to accommodate a wheelchair loading system.

5.69.1 **Low-Floor Ramp.**

5.69.1.1 Lift-U ramp system, most current model available.

5.69.1.2 The wheelchair lift control system must be capable of receiving multiplex commands from vehicle interlocks. The ramp must be automatically controlled, power-operated ramp system compliant to requirements defined in 49 CFR Part 38, Subpart B, 38.23c and shall provide ingress and egress quickly, safely and comfortably, both in forward and rearward directions, for a passenger in a wheelchair from a level street or curb. The wheelchair loading system shall be located at the front door, with the ramp being of a simple hinged, flip-out type design being capable of deploying to the ground at a maximum 6:1 slope.

5.69.1.3 When the system is not in use, the passageway shall appear normal. In the stored position of the ramp, no tripping hazards shall be present, and any resulting gaps shall be minimized. The controls shall be simple to operate with no complex phasing operations required, and the loading system operation shall be under the surveillance and complete control of the driver. The bus shall be prevented from moving during the loading or unloading cycle by a throttle and brake interlock system. The loading system shall be inhibited from stowing/deploying when a passenger is on the ramp/platform. A passenger departing or boarding via the ramp shall be able to easily obtain support by grasping the passenger assist located on the doors or other assists provided for this purpose. The platform shall be designed to protect the ramp from damage and persons on the sidewalk from injury during the extension/retraction or lowering/raising phases of operation.

5.69.1.4 The loading platform shall be covered with a replaceable or renewable nonskid material and shall be fitted with devices to prevent the wheelchair from rolling off the sides during loading or unloading.

5.69.1.5 Deployment or storage of the ramp shall require no more than 15 seconds. The device shall function without failure or adjustment for 500 cycles or 5000 miles in all weather conditions on the route operating profile when activated once during the idle phase. A manual override system shall permit unloading a wheelchair and storing the device in the event of a primary power failure. The manual operation of the ramp shall not require more than 35 lbs of force.

5.69.2 **Wheelchair Accommodations.** VPRO 2 wheelchair restraint system by USSC. All passenger securement devices must be stowed off the floor and out of the way when not in use. 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.

5.69.3 **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 inches shall be maintained. As a guide, no width dimension should be less than 34 inches. Areas requiring 90-degree turns of wheelchairs should have a clearance arc dimension no less than 45 inches, and in the parking area where 180-degree turns are expected, space should be clear in a full 60-inch-diameter circle. A vertical clearance of 12 inches above the floor surface should be provided on the outside of turning areas for wheelchair footrest.

5.70 **Signage and Communication.**

5.70.1 **Destination Sign.** A Hanover destination sign shall be furnished on the front (amber 17 row X 160 column), rear (amber 15 row X 48 column without wheelchair symbol), and on the right side near the front door (amber 8 row X 96 column exterior viewable). All signs shall be controlled via a single human-machine interface (HMI) and capable of receiving electronic control through on-board AVL systems. In the absence of a single mobile data terminal (MDT), the HMI shall be conveniently located for the bus driver within reach of the seated driver. 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 the unit itself.
- Access shall be provided to allow cleaning of inside compartment window and unit glazing.
- The front window shall have an exterior display area of no less than 8.5 inches high by 56 inches wide.

5.70.2 **Interior Displays.**

5.70.2.1 Provisions shall be made on the rear of the driver's barrier or equipment box located on the wheel well for a frame to retain two 8 ½" x 11" information sheets and four sets of route schedules.

5.70.2.2 Advertising media 11 inches high and 0.09 inches 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.

5.71 **Passenger Stop Request 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 inches as measured from the floor surface. It shall be easily accessible to all passengers, seated or standing. Pull cables 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. The button shall be clearly identified as "passenger signal".

5.72 **Communications.**

5.72.1 **Camera Surveillance System.** A fully installed Apollo High-Definition RoadRunner camera system shall be provided. The system shall include the following:

- RoadRunner HD 8 Camera Mobile Recorder with removable 4.0TB hard disk drive with event switch.
- Spare 4.0TB hard disk drive.
- RoadRecorder environmental protective heater,
- GPS antenna.
- One RoadRunner HD Camera – forward-facing interior HD, day/night, color w/ varifocal lense and adjustable mount.
- Five interior mounted RoadRunner HD cameras, IP addressable, high definition tapered color domed with infra-red illumination and audio recording.
- One exterior mounted RoadRunner HD camera, IP addressable, high definition tapered UV-coated color dome.
- One RoadRunner HD power loss protector.

5.72.2 **Public Address System.** A public address system shall be provided on each bus for facilitating driver-originated announcements to passengers.

5.72.3 **Speakers.** Six interior loudspeakers shall be provided, semi-flush mounted, on alternate sides of the bus passenger compartment, installed with proper phasing. Additionally, one exterior speaker shall be provided adjacent to the front passenger door. Total impedance seen at the input connecting end shall be 8 Ohms. Mounting shall be accomplished with rivnuts and machine screws.

5.72.4 **Radio Prewire.** Two-way radio communication equipment prewire shall be provided. A 12VDC power and antenna cables shall terminate to the right and adjacent to the drivers dash. Power cable and antenna with cable shall be provided by KAT. Exact locations for installation shall be finalized during the pre-production meeting.

5.72.5 **Driver Display Unit (DDU).** The Contractor shall install a driver display unit as close to the driver's instrument panel as possible. Exact location for installation shall be finalized during the pre-production meeting.

5.72.6 **Emergency Alarm.** The Contractor shall install an emergency alarm that is accessible to the driver but hidden from view. Exact location for installation shall be finalized during the pre-production meeting.

5.72.7 **Event Data Recorder (EDR).** No EDR shall be installed.

5.72.8 **Intelligent Transportation Systems.** Pricing for two intelligent transportation system options must be provided for a complete "plug and play" pre-wire for on-board intelligent transportation systems.

5.72.8.1 First option shall provide pre-wire with limited component installation for the currently utilized Digital Recorders DR-600 technology (provided by Clever Devices) for automatic vehicle location (AVL), ADA automatic voice announcement, and passenger WIFI through Digi WR44R router. Limited component installation shall include GPRS antenna, interior ambient microphone and stop-request visual indicator sign (Sunrise 1-line 16 character amber LED). Vendor contact information is:

Clever Devices
ATTN: Chris Cates
ccates@cleverdevices.com
919.622.8505

5.72.8.2 Second option shall provide a pre-wire pricing allowance for a new advanced intelligent transportation system that replaces the Digital Recorders technology. This system has yet to be identified but should include automatic vehicle location, ADA voice announcements, passenger WIFI, and automatic passenger counter technology.

5.72.9 **Infotainment LCD Display System (Two Screen System).** Proposers shall offer, as an option, a 24" (+/- nominal) LCD display infotainment system with the capacity to integrate to existing Digi WR44R router for WLAN and/or cellular communication. This system must also be designed to accept an API from a CAD/AVL ITS system. This optional system must also include a content management software application to be able to configure LCD content via WLAN and/or cellular as desired by KAT.

5.72.9 **Communications Equipment Storage Compartment.** A storage compartment that houses communication and electronic equipment components shall be provided. This compartment shall be lockable and should contain slide-out trays for which components are mounted. Components within this compartment include KAT's AVL device with associated devices normally mounted within close proximity, WIFI router, automatic passenger counter device, and bus manufacturer provided Apollo camera system DVR.

SECTION VI – WARRANTY

6.1 Basic Provisions.

6.1.1 **Warranty Requirements**.

6.1.1.1 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 City each complete bus and specific subsystems

and components as follows. Performance requirements based on design criteria shall not be deemed a warranty item.

6.1.1.2 **Complete Bus.** The complete bus, propulsion system, components, major subsystems and body and chassis structure are warranted to be free from Defects and Related Defects for one year or 50,000 miles, whichever comes first, beginning on the date of revenue service but not longer than 15 days after acceptance under "Inspection, Testing and Acceptance." The warranty is based on regular operation of the bus under the operating conditions prevailing in the Agency's locale.

6.1.1.3 **Body and Chassis Structure.**

6.1.1.3.1 Body, body structure, structural elements of the suspension and propulsion system are warranted to be free from Defects and Related Defects for three years or 150,000 miles, whichever comes first.

6.1.1.3.2 Primary load-carrying members of the bus structure, including structural elements of the suspension, are warranted against corrosion failure and/or Fatigue Failure sufficient to cause a Class 1 or Class 2 Failure for a period of 12 years or 500,000 miles, whichever comes first.

6.1.1.4 **Propulsion System (except ESS).** Proposers shall define all components that make up their propulsion system design. The complete propulsion system (except ESS) shall be warranted to be free from Defects and Related Defects for the standard two years or 100,000 miles, whichever comes first. An Extended Warranty to a maximum of five years or 300,000 miles, whichever comes first, may be purchased at an additional cost. Proposers must delineate items excluded from the Extended Warranty. Additionally, proposers shall provide optional manufacturer warranty programs, if available, as an option to the City.

6.1.1.5 **Energy Storage System and Charging System.** Proposers shall define all components that make up their Energy Storage System, and Charging System, and provide information on all warranty programs proposers can make available to the City. Additionally, information shall also be provided for optional ESS service programs where the Contractor retains ownership of the ESS system (similar to leasing programs) if available.

6.1.1.6 **Major Subsystems.** Major subsystems shall be warranted to be free from Defects and Related Defects for two years or 100,000 miles, whichever comes first. Major subsystems are listed below:

- **Brake system:** Foundation brake components, including advancing mechanisms, as supplied with the axles, excluding friction surfaces.
- **Destination signs:** All destination sign equipment for the front, side and rear signs, power modules and operator control.
- **Heating, ventilating:** Roof main unit (less front defroster) and auxiliary heating unit if so equipped.
- **A/C unit and compressor:** Roof main unit.

- **Door systems:** Door operating actuators and linkages.
- **Electric air compressor.**
- **Air dryer.**
- **Wheelchair ramp system:** Ramp parts and mechanical only.
- **Alternator:** If so equipped; does not include the drive system or regenerative braking.
- **Fire suppression:** If so equipped, including tank and extinguishing agent dispensing system.
- **Hydraulic systems:** Including electric hydraulic pump, hoses/lines, power steering and any other connected hydraulic system.
- **Propulsion drive and ESS cooling system:** If separate from the A/C system.
- **Passenger seating excluding upholstery.**
- **Surveillance system including cameras and video recorders.**

6.1.1.7 **Extended Warranty.** Extended warranties available from component and subcomponent OEMs must be provided as an option.

6.1.1.8 **Serial Numbers.** Upon delivery of each bus, the Contractor shall provide a complete list of serialized units installed on each bus to facilitate warranty tracking. The list shall include, at a minimum, the following:

- Propulsion system components.
- ESS components.
- Alternator (if equipped).
- A/C compressor, condenser and evaporator unit.
- Drive axle.
- Power steering unit.
- Electric air compressor.
- Electric hydraulic pump.
- Wheelchair ramp.

6.1.1.9 **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, then the applicable warranty period shall be extended by the number of days equal to the delay period.

6.1.2 **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.

6.1.3 **Exceptions and Additions to Warranty.**

6.1.3.1 The warranty shall not apply to the following items:

- Scheduled maintenance items.
- Normal wear-out items.
- Items furnished by KAT.

6.1.3.2 Should the City require the use of a specific product and has rejected the Contractor's request for an alternate product, then the standard Supplier warranty (and Supplier's extended warranty as appropriate) for that product shall be the only warranty provided to the City. This product will not be eligible under "Fleet Defects," below.

6.1.3.3 The Contractor shall not be required to provide warranty information for any warranty that is less than or equal to the warranty periods listed.

6.1.3.4 **Pass-Through Warranty.**

6.1.3.4.1 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.

6.1.3.4.2 Contractor shall state in writing that the City'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 City to assign its warranty obligations to others, but only on a case-by-case basis approved in writing by the City. 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.

6.1.3.5 **Superior Warranty.** The Contractor shall pass on to the City any warranty offered by a component Supplier that is superior to that required herein. The Contractor shall provide a list to the City 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.

6.2 **Fleet Defects.**

6.2.1 **Occurrence and Remedy.**

6.2.1.1 A Fleet Defect is defined as the failure of identical items or sub-systems covered by the warranties of this contract, in proportion to the total number of buses delivered.

Deliveries of four buses, the proportion shall be three buses or 75%. Deliveries of five (5) buses, the proportion shall be three buses or 60%. Deliveries of six (6) buses, the proportion shall be three buses or 50%. Deliveries of seven (7) buses, the proportion shall be four buses or 57%. A Fleet Defect shall apply only to the base warranty period in sections entitled "Complete Bus," "Propulsion System," "Energy Storage System" and "Major Subsystems."

6.2.1.2 The Contractor shall promptly, upon notification, correct all fleet defects as defined above2and undertake a work program designed to prevent the occurrence and reoccurrence of the same defect in all buses and related repair parts purchased under this contract. Detailed instructions for any work program must be submitted to KAT, in writing, before any work commences. 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 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 warranty on repairs to items or sub-systems determined to be fleet defects shall be extended for one year or 50,000 miles to assure the corrections made are not a temporary fix, beginning on the repair/replacement date for the correction on the last bus in the fleet covered by the warranty of this contract. If the fleet defect failure reoccurs during this period the fleet defect status will again be applied until there is no reoccurrence. If the Contractor does not start the work program within thirty (30) calendar days after being notified of the fleet defect, KAT reserves the right to start the repairs unless the Contractor has an agreement with KAT (in writing) that the thirty (30) calendar days is not sufficient and an agreement (in writing) has been made on the time frame.

6.2.1.3 Labor hours performed by KAT for Fleet defect work will be charged back to the Contractor at the then current per hour ―A-Mechanic, straight hourly wage rate plus forty (40) percent fringe benefits, plus cost of vehicle towing if such action was necessary and if the vehicle was within the normal service area.

6.2.2 **Exceptions to Fleet Defect Provisions.** The Fleet Defect warranty provisions shall not apply to KAT-supplied items, such as radios, fare collection equipment, communication systems and tires. In addition, Fleet Defects shall not apply to interior and exterior hoses, fittings and fabric.

6.3 **Repair Procedures.**

6.3.1 **Repair Performance.** The Contractor is responsible for all warranty-covered repair Work. To the extent practicable, KAT will allow the Contractor or its designated representative to perform such Work. At its discretion, KAT 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.

6.3.2 **Repairs by the Contractor.**

6.3.2.1 If KAT 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 (5) calendar days after receiving notification of a Defect from KAT. KAT shall make the bus available to complete repairs timely with the Contractor's repair schedule.

6.3.2.2 The Contractor shall provide at its own expense all spare parts, tools and space required to complete repairs. At KAT's option, the Contractor may be required to remove the bus from the KAT's property while repairs are being effected. If the bus is removed from KAT's property, then repair procedures must be diligently pursued by the Contractor's representative.

6.3.3 **Repairs by KAT.**

6.3.3.1 **Parts Used.** If KAT performs the warranty-covered repairs, then it shall correct or repair the Defect and any Related Defects utilizing parts supplied by the Contractor specifically for this repair. At KAT's discretion, KAT may use Contractor-specified parts available from its own stock if deemed in its best interests.

6.3.3.2 **Contractor-Supplied Parts.** KAT may require that the Contractor supply parts for warranty-covered repairs being performed by KAT. Those parts may be remanufactured but shall have the same form, fit and function, and warranty. The parts shall be shipped prepaid to KAT from any source selected by the Contractor in accordance with the provisions in "Parts Availability Guarantee". These parts shall not be subject to a KAT handling charge.

6.3.3.3 **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."

6.3.3.4 **Failure Analysis.** The Contractor shall, upon specific request of KAT, 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.

6.3.3.5 **Reimbursement for Labor and Other Related Costs.** KAT shall be reimbursed by the Contractor for labor. The amount shall be determined by KAT for a qualified mechanic at the current, straight time, per hour wage rate plus 40% for fringe benefits and overhead adjusted for KAT'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 KAT's maintenance shop at the time the Defect correction is made.

6.3.3.6 **Reimbursement for Parts.** KAT 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 15 percent handling costs. Handling costs shall not be paid if parts are supplied by the Contractor and shipped to KAT.

6.3.3.7 **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 KAT 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. KAT 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.

6.3.4 **Warranty after Replacement/Repairs.**

6.3.4.1 If any component, unit or subsystem is repaired, rebuilt or replaced by the Contractor, or by KAT with the concurrence of the Contractor, then the component, unit or subsystem shall have the unexpired warranty period of the original. Repairs shall not be warranted if 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."

6.3.4.2 If an item is declared to be a Fleet Defect, then the warranty stops with the declaration of the Fleet Defect. Once the Fleet Defect is corrected, warranty on the item(s) determined to be fleet defects shall be extended for one year or 50,000 miles to assure the corrections made are not a temporary fix, beginning on the repair/replacement date for the correction on the las bus in the fleet covered by the warranty of this contract.

6.3.5 **Warranty Processing Procedures.** The following list represents requirements by the Contractor to KAT for processing warranty claims. One failure per bus per claim is allowed.

- bus number and VIN
- 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

6.3.6 **Forms.** KAT's forms will be accepted by the Contractor if all of the above information is included. Electronic submittal shall be used for forms.

6.3.7 **Return of Parts.** When returning defective parts to the Contractor, KAT shall tag each part with the following:

- bus number and VIN
- claim number
- part number
- serial number (if available)

6.3.8 **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 the date of repair.

6.3.9 **Reimbursements.** Reimbursements are to be transmitted to the following address:

Knoxville Area Transit
ATTN: Maintenance Department
301 Church Street
Knoxville, Tennessee 37915

SECTION VII – QUALITY ASSURANCE.

7.1 Contractor's In-Plant Quality Assurance Requirements.

7.1.1 Quality Assurance Organization.

7.1.1.1 **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.

7.1.1.2 **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.

7.1.2 Quality Assurance Organization Functions.

7.1.2.1 **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.

7.1.2.2 **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.

7.1.2.3 **Maintenance of Control.** The Contractor shall maintain quality control of purchases:

- **Supplier control:** The Contractor shall require each Supplier to maintain 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.

7.1.2.4 **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.

7.1.2.5 **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 KAT 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 KAT.

7.2 **Inspection.**

7.2.1 **Inspection Stations.**

7.2.1.1 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.

7.2.1.2 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, propulsion system installation completion, underbody dress-up and completion, bus prior to final paint touchup, bus prior to road test and bus final road test completion.

7.2.2 **Resident Inspectors.**

7.2.2.1 **Resident Inspector's Role.** KAT shall be represented at the Contractor's plant by resident inspectors, as required by FTA. Resident inspectors may be KAT employees or outside contractors. KAT shall provide the identity of each inspector and shall also identify his or her 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 the requirements of this procurement. KAT shall designate a primary resident inspector, whose duties and responsibilities are delineated in "Pre-Production Meetings," "Authority" and "Pre-Delivery Tests," below.

7.2.2.2 **Pre-Production Meeting.**

7.2.2.2.1 The primary resident inspector may participate in design review and Pre-Production Meetings with KAT. At these meetings, the configuration of the buses and

the manufacturing processes shall be finalized, and all Contract documentation provided to the inspector.

7.2.2.2.2 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.

7.2.2.3 **Authority.**

7.2.2.3.1 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.

7.2.2.3.2 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.

7.2.2.3.3 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, then KAT shall approve the modification, repair or method of correction to the extent that the Contract specifications are affected.

7.2.2.3.4 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.

7.2.2.4 **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.

7.2.2.5 **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 KAT's inspector(s) and any other KAT representatives during the course of the Contract.

7.3 **Acceptance Tests.**

7.3.1 **Responsibility.** Fully documented tests shall be conducted on each production bus following manufacture to determine its acceptance to KAT. These acceptance tests shall include pre-delivery inspections and testing by the Contractor and inspections and testing by KAT after the buses have been delivered.

7.3.2 **Pre-Delivery Tests.**

7.3.2.1 The Contractor shall conduct acceptance tests at its plant on each bus following completion of manufacture and before delivery to KAT. 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 KAT.

7.3.2.2 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 the Technical Specifications. KAT 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.

7.3.2.3 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.

7.3.2.4 **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.

7.3.2.5 **Total Bus Operation.**

7.3.2.5.1 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.

7.3.2.5.2 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 are no longer detected or required adjustments needed.

SECTION VIII – FEDERAL REQUIREMENTS

8.1 **No Government Obligation to Third Parties.**

8.1.1 The City of Knoxville 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 City of Knoxville, Contractor, or any other party (whether or not a party to that contract) pertaining to any matter resulting from the underlying contract.

8.1.2 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.

8.2 **Program Fraud and False or Fraudulent Statements and Related Acts.**

8.2.1 The Contractor acknowledges that the provisions of the Program Fraud Civil Remedies Act of 1986, as amended, 31 U.S.C. § 3801 et seq. and U.S. DOT regulations, "Program Fraud Civil Remedies," 49 C.F.R. Part 31, apply to its actions pertaining to this Project. Upon execution of the underlying contract, the Contractor certifies or affirms the truthfulness and accuracy of any statement it has made, it makes, it may make, or causes to be made, pertaining to the underlying contract or the FTA assisted project for which this contract work is being performed. In addition to other penalties that may be applicable, the Contractor further acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification, the Federal Government reserves the right to impose the penalties of the Program Fraud Civil Remedies Act of 1986 on the Contractor to the extent the Federal Government deems appropriate.

8.2.2 The Contractor also acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification to the Federal Government under a contract connected with a project that is financed in whole or in part with Federal assistance originally awarded by FTA under the authority of 49 U.S.C. § 5307, the Government

reserves the right to impose the penalties of 18 U.S.C. § 1001 and 49 U.S.C. § 5307(n)(1) on the Contractor, to the extent the Federal Government deems appropriate.

8.2.3 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.

8.3 **Access to Records and Reports.** The following access to records requirements apply to this contract.

8.3.1 Where the Purchaser is a local government and is the FTA Recipient or a subgrantee of the FTA Recipient in accordance with 49 C.F.R. 18.36(i), the Contractor agrees to provide the Purchaser, 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 which are directly pertinent to this contract for the purposes of making audits, examinations, excerpts and transcriptions. Contractor also agrees, pursuant to 49 C.F.R. 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 U.S.C. 5302(a)1, which is receiving federal financial assistance through the programs described at 49 U.S.C. 5307, 5309 or 5311.

8.3.2 Where any Purchaser which is the FTA Recipient or a subgrantee of the FTA Recipient in accordance with 49 U.S.C. 5325(a) enters into a contract for a capital project or improvement (defined at 49 U.S.C. 5302(a)1) through other than competitive bidding, the Contractor shall make available records related to the contract to the Purchaser, the Secretary of Transportation and the Comptroller General or any authorized officer or employee of any of them for the purposes of conducting an audit and inspection.

8.3.3 The Contractor agrees to permit any of the foregoing parties to reproduce by any means whatsoever or to copy excerpts and transcriptions as reasonably needed.

8.3.4 The Contractor agrees comply with the record retention requirements in accordance with 2 CFR 200.333. The Contractor further 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 Purchaser, 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).

8.3.5 FTA does not require the inclusion of these requirements in subcontracts.

8.4 **Federal Funding, Incorporation of FTA Terms and Federal Changes.**

8.4.1 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 City of Knoxville requests that would cause the City of Knoxville to be in violation of the FTA terms and conditions.

8.4.2 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 the City of Knoxville 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.

8.5 **Civil Rights Requirements.** The City of Knoxville is an Equal Opportunity Employer. As such, the City agrees to comply with all applicable Federal civil rights laws and implementing regulations. Apart from inconsistent requirements imposed by Federal laws or regulations, the City agrees to comply with the requirements of 49 U.S.C. § 5323(h) (3) by not using any Federal assistance awarded by FTA to support procurements using exclusionary or discriminatory specifications. Under this Agreement, the Contractor shall at all times comply with the following requirements and shall include these requirements in each subcontract entered into as part thereof.

8.5.1 **Nondiscrimination.** In accordance with Title VI of the Civil Rights Act, as amended, 42 U.S.C. § 2000d, section 303 of the Age Discrimination Act of 1975, as amended, 42 U.S.C. § 6102, section 202 of the Americans with Disabilities Act of 1990, 42 U.S.C. § 12132, and Federal transit law at 49 U.S.C. § 5332, the Contractor agrees that it will not discriminate against any employee or applicant for employment because of race, color, creed, national origin, sex, age, or disability. In addition, the Contractor agrees to comply with applicable Federal implementing regulations and other implementing requirements FTA may issue.

8.5.2 **Equal Employment Opportunity.** The following equal employment opportunity requirements apply to the underlying contract:

8.5.2.1 Race, Color, Creed, National Origin, Sex - In accordance with Title VII of the Civil Rights Act, as amended, 42 U.S.C. § 2000e, and Federal transit laws at 49 U.S.C. § 5332, the Contractor agrees to comply with all applicable equal employment opportunity requirements of U.S. Department of Labor (U.S. DOL) regulations, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor," 41 C.F.R. Parts 60 et seq., (which implement Executive Order No. 11246, "Equal Employment Opportunity," as amended by Executive Order No. 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," 42 U.S.C. § 2000e note), and with any applicable Federal statutes, executive orders, regulations, and Federal policies that may in the future affect construction activities undertaken in the course of the Project. The Contractor agrees to take affirmative

action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, creed, national origin, sex, or age. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

8.5.2.2 Age - In accordance with section 4 of the Age Discrimination in Employment Act of 1967, as amended, 29 U.S.C. § § 623 and Federal transit law at 49 U.S.C. § 5332, the Contractor agrees to refrain from discrimination against present and prospective employees for reason of age. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

8.5.2.3 Disabilities - In accordance with section 102 of the Americans with Disabilities Act, as amended, 42 U.S.C. § 12112, the Contractor agrees that it will comply with the requirements of U.S. Equal Employment Opportunity Commission, "Regulations to Implement the Equal Employment Provisions of the Americans with Disabilities Act," 29 C.F.R. Part 1630, pertaining to employment of persons with disabilities. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

8.6 **Disadvantaged Business Enterprise.**

8.6.1 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.

8.6.2 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 City of Knoxville 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 shall comply with the requirements of 49 CFR Part 26.49, Participation by Disadvantaged Business Enterprises in DOT Programs, and have submitted it goal to the Federal Transit Administration and it's goal must either be approved or not dis-approved.

8.6.3 Transit Vehicle Manufacturers (TVM) must submit a certification with their proposal that they are in compliance with FTA's DBE requirements at 49 CFR 26.49.

8.6.4 The contractor is required to pay all of 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 City of Knoxville. In addition, the contractor may not hold retainage from its subcontractors.

8.7 **Government-Wide Debarment and Suspension.**

8.7.1 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.

8.7.2 The contractor is required to comply with 49 CFR 29, Subpart C and must include the requirement to comply with 49 CFR 29, Subpart C in any lower tier covered transaction it enters into. By signing and submitting its bid or proposal, the bidder or proposer certifies as follows:

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

8.8 **Buy America.**

8.8.1 The contractor agrees to comply with 49 U.S.C. 5323(j) and 49 C.F.R. 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 C.F.R. 661.7.

8.8.2 Separate requirements for rolling stock are set out at 49 U.S.C. 5323(j)(2)(C) and 49 C.F.R. 661.11. Rolling stock must be assembled in the United States and have a 70 percent domestic content.

8.8.3 A bidder or offeror must submit to the City of Knoxville the appropriate Buy America certification (below) with all bids or offers on FTA-funded contracts, except those subject to a general waiver. Bids or offers that are not accompanied by a completed Buy America certification will be rejected as nonresponsive. This requirement does not apply to lower tier subcontractors.

8.9 **Pre-Award and Post Delivery Audit Requirement.** The Contractor agrees to comply with 49 U.S.C. § 5323(l) and FTA's implementing regulation at 49 C.F.R. Part 663 and to submit the following certifications:

8.9.1 **Buy America Requirements.** The Contractor shall complete and submit a declaration certifying either compliance or noncompliance with Buy America. If the proposer certifies compliance with Buy America, it shall submit documentation which lists the following.

- Component and subcomponent parts of the rolling stock to be purchased identified by manufacturer of the parts, their country of origin and costs; and
- 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.

8.9.2 **Solicitation Specification Requirements.** The Contractor shall submit evidence that it will be capable of meeting the bid specifications.

8.9.3 **Federal Motor Vehicle Safety Standards (FMVSS).** The Contractor shall submit 1) manufacturer's FMVSS self-certification sticker information that the vehicle complies with relevant FMVSS or 2) manufacturer's certified statement that the contracted buses will not be subject to FMVSS regulations.

8.10 **Breaches and Dispute Resolution.**

8.10.1 **Disputes.** Disputes arising in the performance of this Contract which are not resolved by agreement of the parties shall be decided in writing by the authorized representative of the City of Knoxville Purchasing Agent. This decision shall be final and conclusive unless within ten (10) days from the date of receipt of its copy, the Contractor mails or otherwise furnishes a written appeal to the Purchasing Agent. In connection with any such appeal, the Contractor shall be afforded an opportunity to be heard and to offer evidence in support of its position. The decision of the Purchasing Agent shall be binding upon the Contractor and the Contractor shall abide be the decision.

8.10.2 **Performance During Dispute.** Unless otherwise directed by the City of Knoxville, Contractor shall continue performance under this Contract while matters in dispute are being resolved.

8.10.3 **Claims for Damages.** Should either party to the Contract suffer injury or damage to person or property because of any act or omission of the party or of any of his employees, agents or others for whose acts he is legally liable, a claim for damages therefor shall be made in writing to such other party within a reasonable time after the first observance of such injury of damage.

8.10.4 **Remedies.** Unless this contract provides otherwise, all claims, counterclaims, disputes and other matters in question between the City of Knoxville and the Contractor arising out of or relating to this agreement or its breach will be decided by arbitration if the parties mutually agree, or in a court of competent jurisdiction within the State of Tennessee in Knox County.

8.10.5 **Rights and Remedies.** The duties and obligations imposed by the Contract Documents and the rights and remedies available thereunder shall be in addition to and not a limitation of any duties, obligations, rights and remedies otherwise imposed or available by law. No action or failure to act by the City of Knoxville, Architect or Contractor shall constitute a waiver of any right or duty afforded any of them under the Contract, nor shall any such action or

failure to act constitute an approval of or acquiescence in any breach thereunder, except as may be specifically agreed in writing.

8.11 **Lobbying.** 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, 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 U.S.C. 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 U.S.C. 1352. Such disclosures are forwarded from tier to tier up to the recipient.

8.12 **Clean Air Act Requirements.**

8.12.1 The Contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. §§ 7401 et seq. The Contractor agrees to report each violation to the City of Knoxville and understands and agrees that the Purchaser will, in turn, report each violation as required to assure notification to the FTA and the appropriate EPA Regional Office.

8.12.2 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 the FTA.

8.13 **Clean Water Requirements.**

8.13.1 The Contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Federal Water Pollution Control Act, as amended, 33 U.S.C. 1251 et seq. The Contractor agrees to report each violation to the City of Knoxville and understands and agrees that the City of Knoxville will, in turn, report each violation as required to assure notification to the FTA and the appropriate EPA Regional Office.

8.13.2 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 the FTA.

8.14 **Cargo Preference Requirements.** The Contractor agrees to the following:

- 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;
- 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 leading for shipments originating outside the United States, a legible copy of a rated,

"onboard" 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.)

- 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.

8.15 **Fly America Requirements.** The Contractor agrees to comply with 49 U.S.C. 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.

8.16 **Contract Work Hours and Safety Standards Act Requirements.**

8.16.1 **Overtime Requirements.** No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek 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 forty hours in such workweek.

8.16.2 **Violation; Liability for Unpaid Wages; Liquidated Damages.** In the event of any violation of the clause set forth in paragraph (8.16.1) of this section the contractor and any subcontractor responsible therefor 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 (8.16.1) 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 standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (8.16.1) of this section.

8.16 3 **Withholding for Unpaid Wages and Liquidated Damages.** The City of Knoxville 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 moneys 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 (8.16.2) of this section.

8.16.4 **Subcontracts.** The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraphs (8.16.1) through (8.16.4) 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 (8.16.1) through (8.16.4) of this section.

8.17 **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.

8.18 **Bus Testing.** The Contractor agrees to comply with 49 U.S.C. A 5323(c) and FTA's implementing regulation at 49 CFR Part 665 and shall perform the following: (NOTE – Written certification required.)

8.18.1 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.

8.18.2 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.

8.18.3 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.

8.18.4 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.

8.19 **Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973**. The Contractor agrees to comply with all applicable requirements of the Americans with Disabilities Act of 1990, as amended, 42 USC §12101, et seq.; section 504 of the Rehabilitation Act of 1973, as amended, 29 USC §794; 49 USC §5301(d); and any implementing requirements FTA may issue. These regulations provide that no handicapped individual, solely by reason of

his or her handicap, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity included in or resulting from this Agreement.

8.20 **Conformance with ITS National Architecture.** The Contractor shall conform, to the extent applicable, to the National Intelligent Transportation Standards architecture as required by SAFETEA-LU Section 5307(c), 23 U.S.C. Section 512 and as amended by MAP-21 23 U.S.C. § 517(d), note and follow the provisions of FTA Notice, "FTA National Architecture Policy on Transit Projects," 66 Fed. Reg.1455 etseq., January 8, 2001, and any other implementing directives FTA may issue at a later date, except to the extent FTA determines otherwise in writing.

SECTION IX – SUBMISSION FORMS AND CERTIFICATIONS

CITY OF KNOXVILLE

REQUEST FOR PROPOSALS

ZERO EMISSION ELECTRIC BUS

SUBMISSION FORM S-1

Proposals to be Received by 11:00:00 a.m., Eastern Time; May 4, 2018; in Room 667-674, City/County Building; Knoxville, Tennessee.

IMPORTANT: Proposals shall include six (6) hard copies (one original and five duplicates—**mark the original as such**) and one electronic copy of the proposal (.pdf format on CD only—**mark the storage device with the company name**); the electronic version shall be an exact duplicate of the original, and the electronic version will be the official document exhibited in the contract. **Electronic submissions must be included with the sealed submissions; do not email your submission.**

Please complete the following:

Legal Name of Proposer:_____

Address: _____

Telephone Number: _____

Fax Number: _____

DUNS Number: _____

Contact Person: _____

Email Address: _____

Signature: _____

Name and Title of Signer:_____

Note: Failure to use these response sheets may disqualify your submission.

NON-COLLUSION AFFIDAVIT

State of _____

County of _____

_____, being first duly sworn, deposes and says that:

(1) He/She is the _____ of _____, the firm that has submitted the attached Proposal;

(2) He/She is fully informed respecting the preparation and contents of the attached Proposal and of all pertinent circumstances respecting such Proposal;

(3) Such Proposal is genuine and is not a collusive or sham Proposal;

(4) Neither the said firm nor any of its officers, partners, owners, agents, representatives, employees or parties in interest, including this affiant, has in any way colluded, conspired, connived or agreed, directly or indirectly, with any other vendor, firm or person to submit collusive or sham proposal in connection with the contract or agreement for which the attached Proposal has been submitted or to refrain from making a proposal in connection with such contract or agreement, or collusion or communication or conference with any other firm, or, to fix any overhead, profit, or cost element of the proposal price or the proposal price of any other firm, or to secure through any collusion, conspiracy, connivance, or unlawful agreement any advantage against the City of Knoxville or any person interested in the proposed contract or agreement; and

(5) The proposal of service outlined in the Proposal is fair and proper and is not tainted by collusion, conspiracy, connivance, or unlawful agreement on the part of the firm or any of its agents, representatives, owners, employees, or parties including this affiant.

(Signed): _____

Title: _____

Subscribed and sworn to before me this _____ day of _____, 20__.

_____
NOTARY PUBLIC

My Commission expires _____

No Contact/No Advocacy Affidavit

State of _____

County of _____, being first duly sworn, deposes and says that:

(1) He/She is the owner, partner, officer, representative, or agent of _____

_____, the Proposer that has submitted the attached Proposal;

(2) The Proposer _____ swears or affirms that he/she will abide by the following "No Contact" and "No Advocacy" clauses:

a) NO CONTACT POLICY**:** After the posting of this solicitation to the Purchasing Division's website, any contact initiated by any proposer with any City of Knoxville representative concerning this proposal is strictly prohibited, unless such contact is made with the Purchasing Agent (Boyce H. Evans) or Assistant Purchasing Agent (Penny Owens). Any unauthorized contact may cause the disqualification of the proposer from this procurement transaction.

b) NO ADVOCATING POLICY**:** To ensure the integrity of the review and evaluation process, companies and/or individuals submitting proposals for any part of this project, as well as those persons and/or companies representing such proposers, may not lobby or advocate to the City of Knoxville staff including, but not limited to, members of City Council, Office of the Mayor, KAT, or any other City staff.

Any company and/or individual who does not comply with the above stated "No Contact" and "No Advocating" policies may be subject to having their proposal rejected from consideration.

Signed:_____

Title:_____

Subscribed and sworn to before me this _____ day of _____, 2_____.

_____

NOTARY PUBLIC

My commission expires:_____

IRAN DIVESTMENT ACT

Certification of Noninclusion

NOTICE: Pursuant to the Iran Divestment Act, Tenn. Code Ann. § 12-12-106 requires the State of Tennessee Chief Procurement Officer to publish, using creditable information freely available to the public, a list of persons it determines engage in investment activities in Iran, as described in § 12-12-105. Inclusion on this list makes a person ineligible to contract with the state of Tennessee; if a person ceases its engagement in investment activities in Iran, it may be removed from the list. A list of entities ineligible to contract in the State of Tennessee Department of General Services or any political subdivision of the State may be found here:

https://www.tn.gov/content/dam/tn/generalservices/documents/cpo/cpo-library/public-information-library/List_of_persons_pursuant_to_Tenn._Code_Ann._12-12-106_Iran_Divestment_Act_updated_7.7.17.pdf

By submission of this bid, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of its knowledge and belief that each bidder is not on the list created pursuant to T.C.A. § 12-12-106.

Vendor Name (Printed)	Address
By (Authorized Signature)	Date Executed
Printed Name and Title of Person Signing	

NOTARY PUBLIC:

Subscribed and sworn to before me this _____ day of _____, 2_____.

My commission expires:_____

BUY AMERICA CERTIFICATION

Certification requirement for procurement of buses, other rolling stock and associated equipment:

Certificate of Compliance with 49 U.S.C. 5323(j)(2)(C) and 49 CFR 661.11:

The bidder or offeror hereby certifies that it will comply with the requirements of 49 U.S.C. Section 5323(j)(2)(C), Section 165(b)(3) of the Surface Transportation Assistance Act of 1982, as amended, and the regulations of 49 C.F.R. 661.11 and FTA Policy Guidance on Domestic Content Increases for Rolling Stock:

Date _____

Signature _____

Company Name _____

Title _____

Certificate of Non-Compliance with 49 U.S.C. 5323(j)(2)(C) and 49 CFR 661.11:

The bidder or offeror hereby certifies that it cannot comply with the requirements of 49 U.S.C. Section 5323(j)(2)(C), 49 C.F.R. 661.11 and Section 165(b)(3) of the Surface Transportation Assistance Act of 1982, as amended, but may qualify for an exception to the requirements consistent with 49 U.S.C. Sections 5323(j)(2)(A), 5323(j)(2)(B) or (j)(2)(D), Sections 165(b)(2) or (b)(4) of the Surface Transportation Assistance Act, as amended, and regulations in 49 C.F.R. 661.7.

Date _____

Signature _____

Company Name _____

Title _____

PRE-AWARD BUY AMERICA WORKSHEET INFORMATION

1. Law Regarding Compliance with Buy America Regulations (49 CFR 661.11)

a. The cost of components produced in the U.S. is more than 70% of the cost of all components.

1) Component is of domestic origin if more than 70% of the subcomponents of that component by cost, are of domestic origin and component is manufactured in U.S. (49 CFR 661.11(j)).

2) A subcomponent is of domestic origin if manufactured in the U.S. (49 CFR 661.11(j)).

b. Final assembly occurs in the U.S. (defined as creation of the end product from individual elements brought together for that purpose through application of manufacturing processes (49 CFR 661.11(t)).

2. Procedure for Showing Buy America Compliance (Utilizing Proposing Company Form)

a. Step 1. Show information for components, listing as many components needed to reach a cost percentage greater than 70% of the cost of all of the components. Example (assuming the bid price is $200, the fully allocated cost of all components is $100 and the cost of final assembly is $100):

Component	Manufacturer	Location	Cost		OR	Percentage of Cost of All Components of the Rolling Stock
Seating	XYZ	Canton, OH	$40			40%
HVAC	ABC	Tampa, FL	$31			31%

The cost information can be shown as a dollar amount or as the percentage of the cost of a specific component in relation to the cost of all components for the rolling stock.

b. Step 2. Show information for subcomponents for each component, listing as many subcomponents needed to reach a cost percentage greater than 70% of the cost of all subcomponents of that component. Example (assuming the fully allocated cost of all subcomponents for the component, which excludes the manufacturing cost, is $30).

Seating component:

Subcomponent	Manufacturer	Location	Cost		OR	Percentage of Cost of All Components of the Rolling Stock
Cushions	LMT	Burbank, CA	$10			30%
Metal Frame	ARE	Lexington, KY	$15			50%
						(Total greater than 70%)

The cost information can be shown as a dollar amount or as the percentage of the cost of the specific subcomponent in relation to the cost of all of the subcomponents of the component.

c. Step 3. Final assembly occurs in the U.S.

1) State location of final assembly.

2) Briefly describe activities to occur during final assembly; and

3) State estimated total cost of final assembly.

FEDERAL MOTOR VEHICLE
SAFETY STANDARDS CERTIFICATION

This is to certify that the heavy-duty lowfloor electric bus model proposed, complies with all applicable Federal Motor Vehicle Safety Standard as required by the FTA and DOT, and described with Title 49 CFR, Chapter V, Part 571 FMVSS, as currently revised.

BY: _____

TITLE: _____

DATE: _____

ADA COMPLIANCE CERTIFICATION

This is to certify that the heavy-duty lowfloor electric bus model proposed, will be manufactured to comply with accessibility requirements of DOT regulations, "Transportation Services for individuals with Disabilities (ADA)", 49 CFR Part 37, and Joint ATBCB/DOT regulations, "Americans with Disabilities (ADA) Accessibility Specifications for Transportation Vehicles", 36 CFR Part 1192 and 49 CFR Part 38.

BY: _____

TITLE: _____

DATE: _____

BUS TESTING CERTIFICATION

Certification of Compliance with FTA's Bus Testing Requirements:

The undersigned [Contractor/Manufacturer] certifies that the vehicle offered in this procurement complies with 49 U.S.C. Section 5318, as amended by MAP-21, and FTA's implementing regulations "Bus Testing" at 49 CFR Part 665.

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

Date _____

Signature _____

Company Name _____

Title _____

LOBBYING CERTIFICATION
(APPENDIX A, 49 CFR PART 20)

Certification for Contracts, Grants, Loans, and Cooperative Agreements *(To be submitted with each bid or offer exceeding $100,000)*:

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

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for making lobbying contacts to an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form--LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions [as amended by "Government wide Guidance for New Restrictions on Lobbying," 61 Fed. Reg. 1413 (1/19/96). Note: Language in paragraph (2) herein has been modified in accordance with Section 10 of the Lobbying Disclosure Act of 1995 (P.L. 104-65, to be codified at 2 U.S.C. 1601, *et seq.*)]

3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31, U.S.C. § 1352 (as amended by the Lobbying Disclosure Act of 1995). Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

[Note: Pursuant to 31 U.S.C. § 1352(c)(1)-(2)(A), any person who makes a prohibited expenditure or fails to file or amend a required certification or disclosure form shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such expenditure or failure.]

The Contractor, _____, certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Contractor understands and agrees that the provisions of 31 U.S.C. A 3801, *et seq.*, apply to this certification and disclosure, if any.

_____ Signature of Contractor's Authorized Official

_____ Name and Title of Contractor's Authorized Official

_____ Date

CERTIFICATION OF PRIMARY PARTICIPANT REGARDING DEBARMENT, SUSPENSION, AND OTHER RESPONSIBILITY MATTERS

The Primary Participant/Contractor, certifies to the best of its knowledge and belief, that it and its principals:

1. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency,

2. Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction,- violation of Federal or state antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

3. Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State, or local) with commission of any of the offenses enumerated in paragraph (2) of this certification; and

4. Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default. If the primary participant (potential third party contractor) is unable to certify to any of the statements in this certification, the participant shall attach an explanation to this certification.

THE PRIMARY PARTICIPANT/CONTRACTOR _____
CERTIFIES OR AFFIRMS THE TRUTHFULNESS AND ACCURACY OF THE CONTENTS OF THE STATEMENTS SUBMITTED ON OR WITH THIS CERTIFICATION AND UNDERSTANDS THAT THE PROVISIONS OF 31 U.S.C. SECTIONS 3801 ET. SEQ. ARE APPLICABLE THERETO.

_____ _____
Signature of Contractor's Authorized Official Date

_____
Typed Name and Title of Contractor's Authorized Official

CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION--LOWER TIER COVERED TRANSACTIONS

The potential lower tier participant _____certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

Where the potential lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

_____	_____
Signature/Authorized Certifying Official Typed Name	Title
_____	_____
Applicant/Organization	Date Signed

TRANSIT VEHICLE MANUFACTURERS (TVM)
CERTIFICATE OF COMPLIANCE
WITH DISADVANTAGED BUSINESS REGULATIONS

This procurement is subject to the provisions of 49 CFR Section 26.49. Accordingly, the following certification must be completed and submitted with the proposal as a condition of proposing. A proposal that does not include this certification will not be considered.

TVM Certification

I hereby certify that the Proposer has complied with the requirements of 49 CFR 26, Participation by Disadvantaged Business Enterprises in DOT Programs, and it has submitted a goal to the Federal Transit Administration and it has not been disapproved.

The proposer, if a non-vehicle manufacturer supplier, hereby certifies that the manufacturer of the transit vehicle to be supplied has complied with the above-referenced requirements of 49 CFR Section 26.

Manufacturer: _____

Manufacturer Representative Signature: _____

Dealer: _____

Dealer Representative Signature: _____

Date: _____

PRICING SCHEDULE

ITEM DESCRIPTION	RFP REFERENCE	UNIT OF MEASURE	COST
Base (& Option) Vehicle and Related Equipment			
Heavy-Duty 35' Lowfloor Electric Transit Bus	1.1; 4.3	Each	
Depot Charging Equipment	5.27.10.2	Each	
Depot Charging Equipment Installation	5.27.10.2	Set of Eight	
Optional Items			
Additional Depot Charging Equipment (outdoors)	5.27.10.2	Each	
Additional Depot Charging Equipment Installation (outdoors)	5.27.10.2	Each	
Additional Depot Charging Equipment (indoors)	5.27.10.2	Each	
Additional Depot Charging Equipment Installation (indoors)	5.27.10.2	Each	
Electric Bus Tow Bar	5.34.1	Each	
Window Anti-Vandalism Polyester Sacrificial film	5.58.5.3	Per Bus	
American Seating Insight Prime+	5.67.1	Per Bus	
Intelligent Transportation Systems Pre-Wire DR-600	5.71.8.1	Each	
Intelligent Transportation Systems Pre-Wire Advanced System	5.71.8.2	Each	
Infotainment LCD Display System (two screen system)	5.71.9	Each	
Warranties			
Propulsion System Extended Warranty	6.1.1.4	Each	
ESS Optional Warranty Programs:	6.1.1.5	Each	
1.	6.1.1.5	Each	
2.	6.1.1.5	Each	
3.	6.1.1.5	Each	
4.	6.1.1.5	Each	
Component & Subcomponent OEM Extended Warranties			
1.	6.1.1.7	Each	
2.	6.1.1.7	Each	
3.	6.1.1.7	Each	
4.	6.1.1.7	Each	
5.	6.1.1.7	Each	
6.	6.1.1.7	Each	
7.	6.1.1.7	Each	
8.	6.1.1.7	Each	
9.	6.1.1.7	Each	
10.	6.1.1.7	Each	
11.	6.1.1.7	Each	
12.	6.1.1.7	Each	
13.	6.1.1.7	Each	
14.	6.1.1.7	Each	
15.	6.1.1.7	Each	

PRICING SCHEDULE SUPPLEMENT

SPECIAL TOOLS LISTING	RFP REFERENCE	UNIT OF MEASURE	COST
1.	5.9.6		
2.	5.9.6		
3.	5.9.6		
4.	5.9.6		
5.	5.9.6		
6.	5.9.6		
7.	5.9.6		
8.	5.9.6		
9.	5.9.6		
10.	5.9.6		
11.	5.9.6		
12.	5.9.6		
13.	5.9.6		
14.	5.9.6		
15.	5.9.6		
16.	5.9.6		
17.	5.9.6		
18.	5.9.6		
19.	5.9.6		
20.	5.9.6		
21.	5.9.6		
22.	5.9.6		
23.	5.9.6		
24.	5.9.6		
25.	5.9.6		

BUS MANUFACTURER TRAINING COURSE DESCRIPTION	RFP REFERENCE	OPTIMUM CLASS SIZE	COURSE DURATION	COST
1.	5.11.3			
2.	5.11.3			
3.	5.11.3			
4.	5.11.3			
5.	5.11.3			
6.	5.11.3			
7.	5.11.3			
8.	5.11.3			
9.	5.11.3			
10.	5.11.3			
11.	5.11.3			
12.	5.11.3			
13.	5.11.3			
14.	5.11.3			
15.	5.11.3			

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" (paragraph 2.15). One copy of each deviation without any price/cost information is to be included in the proposal (Section II - Technical Submission) and a separate copy with any price/cost information included with the proposal's pricing schedule (Section III – Price Proposal Requirements).

City of Knoxville
Zero Emission Electric Bus Solution

Deviation #:	**Manufacturer:**	**RFP Section:**	**Page ____ of ____**
Complete Description of Deviation:			
Rationale (pros and cons):			