



Request for Proposal

Lead Agency: Piedmont Authority for Regional Transportation

Participating Agencies

City of Burlington (Link Transit)

City of High Point (HPTS)

City of Winston-Salem (WSTA)

RFP 01-Rolling Stock-2025

Low Floor 30' 35' 40' Heavy Duty Bus

RFP 01-Rolling Stock-2025

RFP's must be received at PART by 4:00p.m. Eastern Standard Time. Friday, January 16, 2026.

Submittals must be in a sealed envelope, marked with the name and address of the offeror, the due date, and

RFP# 01-Rolling Stock-2025, and addressed to:

Piedmont Authority for Regional Transportation

107 Arrow Rd.

Greensboro, NC 27409

Attention: Andrew Sowers, Procurement

SECTION 1: NOTICE OF REQUEST FOR PROPOSALS

NR 1 Description of the Work To Be Done

The Agency requests Proposals for the manufacture and delivery of heavy duty low-floor buses in accordance with the terms and conditions set forth in RFP 01-Rolling Stock-2025. The Contract shall be a firm-fixed-price Contract.

Specifically, the Agency is requesting the following types of buses: 30', 35', and 40' diesel and hybrid low-floor buses.

NR 2 Obtaining Proposal Documents

Proposal documents may be obtained from purchasing@partnc.org or electronically at [Bid Postings • PART, NC • CivicEngage](#)

NR 3 Proposal Due Date and Submittal Requirements

Proposals must be received by January 16, 2026 at 5:00 PM EST.

Sealed Proposals shall be submitted to either of the following addresses:

- a. For courier delivery, U.S. mail, or hand delivery: 107 Arrow Road, Greensboro, NC, 27409
- b. Envelopes or boxes containing Proposals shall be sealed and clearly labeled with the Agency's Proposal number and the solicitation title: 01-Rolling Stock-2025 Low Floor 30' 35' 40' Heavy Duty Bus

Proposers are requested to submit to the Agency the following:

- a. One (1) hard copy marked "Original-PART". In the case of any discrepancies, the hard copy marked "Original-PART" will be considered by the Agency in evaluating the Proposal. Additional copies and electronic versions are provided for administrative convenience only.
- b. One (1) hard copy marked "Original - High Point"
- c. Four (4) additional printed copies marked "Administrative Copy"
- d. Four (4) USB devices each containing an electronic PDF copy of the Proposal.

NR 4 Validity of Proposals

Proposals and subsequent offers shall be valid for a period of 120 days from receipt.

NR 5 Pre-Proposal Meeting Information (Optional)

A Pre-Proposal Meeting will be held on Tuesday, December 2, 2025 at 10:00 AM at 107 Arrow Road, Greensboro, NC 27409. Proposers may also participate via conference call. The call-in number and instructions will be made available at [Bid Postings • PART, NC • CivicEngage](#) or may be requested from purchasing@partnc.org by 9:00 AM on December 2, 2025.

Following this meeting, agency vehicles will be made available to proposers to view. This option will not be available for remote participants.

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

Contracting Officer's Contact Information:

Name: Andrew Sowers
 Title: Grants and Procurement Specialist
 Address: 107 Arrow Road, Greensboro NC, 27409
 Phone number: 336-291-4327
 Email: purchasing@partnc.org

Identification of Source of Funding

Financial support of this project is provided through financial assistance grants from the Federal Transit Administration (FTA), State of North Carolina, and local sources.



SECTION 2: INSTRUCTIONS TO PROPOSERS

IP 1 Quantities

The Work under these Contract documents consists of the manufacture and delivery of a base order of Twelve (12) 30' Diesel or Clean Diesel, Fifteen (15) 35' Diesel or Clean Diesel, Ten (10) 40' Diesel or Clean Diesel, Six (6) 30' Hybrid, Twenty One (21) 35' Hybrid, and zero (0) 40' Hybrid buses.

This anticipated base order will be spread over the life of the contract and is dependent upon local, state, and federal funding.

There will be ten (10) option vehicles for each of the 30', 35', and 40' heavy-duty buses.

IP 2 Proposed Schedule for the Procurement

The following is the solicitation schedule for Proposers:

Activity	Deadline
RFP Release	Monday, November 17, 2025
Pre-proposal Meeting (Virtual)	Tuesday, December 2, 2025 @ 10:00 AM EST
On-Site Vehicle Visit	Tuesday, December 2, 2025 @ 11:00 AM EST
Deadline for Questions / Approved Equals Submission	Friday December 12, 2025 @ 4:00 PM EST
Response to Questions and Addendum(s) Distributed	Friday, December 19 2025 @ 5:00 PM EST
RFP Due Date	Friday, January 16, 2026 @ 5:00 PM EST
Interviews for Competitive Range and Vehicle Demo (if requested)	February 9 - February 13, 2026
Best and Final Offer (BAFO) - Tentative	Friday, February 20, 2026 @ 4:00 PM EST
Issue of Notice of Intent to Award	February - March 2026

IP 3 Obtaining Proposal Documents

Proposal documents may be obtained from Andrew Sowers, PART, in person at 107 Arrow Rd., Greensboro, NC 27409 or electronically at www.partnc.org/bids.aspx. Documents can also be requested electronically from purchasing@partnc.org

IP 4 Proposal Security Requirements (Reserved)

No Proposal Bond is required.

IP 5 Pre-Proposal Meeting/Information for Proposers

A Pre-Proposal Meeting will be held on Tuesday, December 2, 2025. The meeting will convene at 10:00 AM in the PART board room, located at 107 Arrow Road, Greensboro, NC, 27409. Proposers may also participate via conference call. Meeting information will be posted to <https://partnc.org/bids.aspx> or can be requested by email from purchasing@partnc.org. Requests submitted by email must be received by 4:00 PM on Monday, October 6, 2025.

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

IP 6 Questions, Clarifications and Omissions

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

At any time during this procurement up to the time specified in "Proposed Schedule for the Procurement," Proposers may request, in writing, a clarification or interpretation of any aspect, a change to any requirement of the RFP, or any addenda to the RFP. Requests may include suggested substitutes for specified items and for any

brand names, which whenever used in this solicitation shall mean the brand name or approved equal. Such written requests shall be made to the Contracting Officer. The Proposer making the request shall be responsible for its proper delivery to the Agency as identified on the form Request for Pre-Offer Change or Approved Equal. Any request for a change to any requirement of the Contract documents must be fully supported with technical data, test results or other pertinent information showing evidence that the exception will result in a condition equal to or better than that required by the RFP, without a substantial increase in cost or time requirements.

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

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

IP 7 Addenda to RFP

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

If the Agency determines that the addenda may require significant changes in the preparation of Proposals, the deadline for submitting the Proposals may be postponed no fewer than ten (10) days from the date of issuance of addenda or by the number of days that the Agency determines will allow Proposers sufficient time to revise their Proposals. Any new Due Date shall be included in the addenda.

All relevant information, data, forms associated with this procurement will be posted at www.partnc.org/bids.aspx

IP 8 DBE Requirements for Transit Vehicle Manufacturers

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

IP 9 Buy America Certification

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

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

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

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

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



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

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

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

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

IP 10 Conditions, Exceptions, Reservations or Understandings

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

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

The Form for Proposal Deviation shall be included in the Technical package.

IP 11 Protest Procedures

All protests must be in writing, stating the name and address of the protestor, a contact person, Contract number and title. Protests shall specify in detail the grounds of the protest and the facts supporting the protest.

IP 11.1 Address

All protests must be addressed as follows:

- Agency contact: Scott W. Rhine, PART CEO / General Manager
 - For special delivery or hand delivery: 107 Arrow Rd., Greensboro, NC 27409
 - For U.S. mail: 107 Arrow Rd., Greensboro, NC 27409
- Protests not properly addressed to the address shown above may not be considered by the Agency.

Copies of the Agency's protest procedures and the protest provisions of FTA Circular 4220.1G or its successor may be obtained from Andrew Sowers, PART, 107 Arrow Rd., Greensboro, NC 27409. Purchasing@partnc.org. Proposals will be opened and a Notice of Award will be issued by the Agency in accordance with the Agency's protest procedures and the protest provisions of FTA Circular 4220.1G or its successor.

IP 11.2 Pre-Proposal Protests

Pre-Proposal protests are protests based upon the content of the solicitation documents. Three copies of Pre-Proposal protests must be received by the Agency's office no later than fifteen (15) calendar days prior to the Due Date. Protests will be considered and either denied or sustained in part or in whole, in writing, in a manner that provides verification of receipt, prior to the Due Date for Proposals. A written decision specifying the grounds for sustaining all or part of or denying the protest will be transmitted to the protestor prior to the Due Date for Proposals in a manner that provides verification of receipt prior to the Due Date for Proposals. If the protest is sustained, then the Proposal Due Date may be postponed and an addendum issued to the solicitation documents or, at the sole discretion of the Agency, the solicitation may be canceled. If the protest is denied, then Proposals will be received and opened on the scheduled date unless a protest is filed with the FTA. See "FTA Review," below.

IP 11.3 Protests on the Recommended Award

All Proposers will be notified of the recommended award. This notice will be transmitted to each Proposer at the address contained in its Proposal form in a manner that provides verification of receipt. Any Proposer whose



Proposal has not lapsed may protest the recommended award on any ground not specified in “Pre-Proposal Protests,” above. Three (3) copies of a full and complete written statement specifying in detail the grounds of the protest and the facts supporting the protest must be received by the Agency at the appropriate address in “Address,” above, no later than fifteen (15) calendar days after the date such notification is received. Prior to the issuing of the Notice of Award, a written decision stating the grounds for allowing or denying the protest will be transmitted to the protestor and the Proposer recommended for award in a manner that provides verification of receipt.

IP 11.4 FTA Review

After such administrative remedies have been exhausted, an interested party may file a protest with the Federal Transit Administration of the U.S. Department of Transportation pursuant to the procedures provided in FTA C 4220.1G or its successor. FTA review is limited to the alleged failure of the Agency to have written protest procedures, the alleged failure of the Agency to follow those procedures, the alleged failure of the Agency to review a protest, or the alleged violation of federal law or regulation.

IP 12 Preparation of Proposals

IP 12.1 Use of Proposal Forms

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

IP 12.2 Not Used

IP 12.3 Proposal Format Requirements

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

Proposers are requested to submit to the Agency the following:

- a. One (1) hard copy marked “Original-PART”. In the case of any discrepancies, the hard copy marked “Original-PART” will be considered by the Agency in evaluating the Proposal. Additional copies and electronic versions are provided for administrative convenience only.
- b. One (1) hard copy marked “Original - High Point”
- c. Four (4) additional printed copies marked “Administrative Copy”
- d. Four (4) USB devices each containing an electronic PDF copy of the Proposal.

The hard-copy Proposals shall be prepared double-sided on 8½ × 11 in. paper in at least 11-point font. The hard copies shall be contained in three-ring binders, the contents of which are identified on the outside. Use of 11 × 17 in. foldout sheets for large tables, charts or diagrams is permissible but should be limited. Elaborate formatting is not necessary. Do not provide promotional or advertising information, unless this information is requested and/or is necessary to support the technical submittal.

Package 1: Technical Proposal Requirements

1. Letter of Transmittal
2. Technical Proposal
3. Acknowledgment of Addenda
4. Contractor Service and Parts Support Data
5. Form for Proposal Deviation (without price data)
6. Vehicle Questionnaire
7. References and Non-Priced Information
8. Engineering organization chart, engineering change control procedure, field modification process
9. Manufacturing facilities plant layout, other contracts, staffing
10. Production and delivery schedule and other Contract commitments for the duration of this Contract
11. Management Plan

Package 2: Price Proposal Requirements

Each Price Proposal shall be on the prescribed Proposal form(s) and shall be for the entire Contract, including all Proposal items.

1. Letter of Transmittal
2. Pricing Schedule, (including but not limited to such pricing elements as option buses, spare parts package, manuals, training, special tools and test equipment)



3. An electronic (PDF) copy of Package 2 should be provided matching the original printed copy as well as an electronic copy submitted in a spreadsheet format.

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

Package 3: Qualification Package Requirements

1. Pre-Award Evaluation Data Form
2. 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 Agency
3. Letter for insurance, indicating the Contractor's ability to obtain the insurance coverage in accordance with the RFP requirements
4. Letter from a surety for a Performance Guarantee, if required, indicating the Contractor's ability to obtain financial guarantees in accordance with the RFP requirements
5. Form for Proposal Deviation, if applicable (without price data)
6. Proposal Form
7. All federal certifications: Buy America Certification, Debarment and Suspension Certification for Prospective Contractor, Debarment and Suspension Certification (Lower-Tier Covered Transaction), Non-Collusion Affidavit, Lobbying Certification, Certificate of Compliance with Bus Testing Requirement, DBE Approval Certification, and Federal Motor Vehicle Safety Standards
8. Altoona Testing confirmation documents.

Package 4: Proprietary/Confidential Information Package Requirements

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

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

IP 12.4 Agency Treatment of Proprietary/Confidential Information

Access to government records is governed by North Carolina Open Records law. Except as otherwise required to be disclosed by applicable state law, the Agency will exempt from disclosure proprietary information identified in Package 4.

Upon a request for records from a third party regarding this Proposal, the Agency will notify the Proposer in writing. The Proposer must respond within 7 business days with the identification of any and all "proprietary, trade secret, or confidential commercial or financial" information. Failure to respond within the allowed period shall be deemed an approval to release. The Proposer shall indemnify the Agency's defense costs associated with its refusal to produce such identified information; otherwise, the requested information may be released. Proposers must respond with specific references to state statute substantiating exemptions from public record law.

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

IP 12.5 Signing of Proposal Forms

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



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

IP 12.6 Modification or Withdrawal of Proposals

A modification of a Proposal already received will be accepted by the Agency only if the modification is received prior to the Proposal Due Date, is specifically requested by the Agency or is made with a requested BAFO. All modifications shall be made in writing and executed and submitted in the same form and manner as the original Proposal.

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

IP 12.7 Ownership and Cost of Proposal Development

All proposals will become the property of the Agency. Proposals are subject to North Carolina Public Record laws and to disclosure under those statutes.

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

IP 13 Proposal Evaluation, Negotiation and Selection

Proposals will be evaluated, negotiated, selected and any award made in accordance with the criteria and procedures described below. The approach and procedures are those 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, after which BAFOs may be requested.

However, the Agency may select a Proposal for award without any discussions or negotiations or request for any BAFOs. Subject to the Agency's right to reject any or all Proposals, the Proposer whose Proposal is found to be most advantageous to the Agency will be selected, based upon consideration of the criteria of "Proposal Selection Process," below. PART and participating agencies reserve the right to award to a single vendor, multiple vendors, or to reject all proposals and award to no vendors, depending on the best interest of the Agency.

IP 13.1 Confidentiality of Proposals

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

IP 13.2 Duration of the Validity of Proposals

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

IP 13.3 Evaluation Committee

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

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

IP 13.4 Review of Proposals for Responsiveness and Proposers for Responsibility

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



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

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

Any Proposal found to be non-responsive 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 Agency reserves the right to request that a Proposer provide additional information and/or clarify information. The Agency's determination regarding the responsiveness of a Proposal and the responsibility of a Proposer shall be final.

IP 13.5 Proposal Selection Process

The following describes the process by which Proposals will be evaluated and a selection made for a potential award. Any such selection of a Proposal shall be made by consideration of only the criteria set forth below.

"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.

"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 Agency'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.

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 to be not responsible and the Proposal rejected. The requirements are as follows:

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

Proposal Evaluation Criteria

The following are the complete criteria, listed in their relative order of importance, 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 Agency to consider a Proposal to be outside the Competitive Range, will be evaluated according to the respective evaluation criteria and sub-criteria that they affect.

The criteria are listed numerically by their relative order of importance. However, certain criteria may have sub-criteria identified that are listed by their relative order of importance within the criterion they comprise. Also, certain sub-criteria may have sub-criteria that are listed by their relative degree of importance within the specific sub-criterion they comprise.

Evaluation / Selection Committee

An Evaluation/Selection Committee (“Committee”), which may include Agency staff, consortium members, and possibly one or more outside experts, will review and screen the Proposals submitted according to the pre-established criteria as set forth below.

Pre-Proposal Meeting (maximum of 5 points)

Attendance at the Pre-Proposal Meeting on Tuesday, December 2, 2025, at 10:00 AM EST. Virtual or In-Person attendance will award 5 points.

Technical Evaluation Criteria (maximum of 80 points)

Proposals will be evaluated using the following principal selection criteria:

Product Design and Performance (maximum of 30 points) 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, and cost of normal operation for the bus design and system components proposed may be considered in determining a final value for this factor.

Proposer’s Reputation and Performance (maximum of 30 points) The Committee will consider the capability and reputation of the Proposer as presented in the Proposal, or 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, training and parts support, response time, product capabilities, ability to furnish multiple bus configurations, 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 has taken to resolve these concerns, in assessing the overall reputation of the manufacturer.

Delivery Schedule (maximum of 20 points) The Committee will review the proposed delivery schedule for the Agency’s minimum purchase of coaches. Delivery schedules that fulfill the delivery requirements, with evidence that the schedule can be accomplished, may receive higher points for this category.

Cost Proposal Evaluation (maximum of 20 points)

As described below, the proposed cost as submitted by the Proposer on the Agency’s form will be assigned a maximum of 20 points. The Contractor is required to use the Agency’s form, without alteration, for submittal of its cost Proposal. Price evaluation will be completed separately for each agency and bus size.

Cost Proposal Criteria

The Cost Proposal criteria will be based on the total price per Bus.

The lowest average Cost Proposal will receive 20 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; the result will then be multiplied by the maximum weight for price (20 points) to arrive at a Cost Proposal score.

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



Evaluation Methodology	
Attendance at Pre-Proposal Meeting	0-5 Points
Product Design and Performance	0-30 Points
Manufacturer's Reputation and Performance	0-30 Points
Delivery Schedule	0-20 Points
Cost Proposal	0-20 Points

IP 13.6 Evaluation Procedures

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

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

IP 13.7 Evaluations of Competitive Proposals

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

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

3. **Proposals not within the Competitive Range.** Proposers of any Proposals that have been determined by the Agency as not in the Competitive Range, and that cannot be reasonably made to be within the Competitive Range, will be notified in accordance with the Agency's policies.
4. **Discussions with Proposers in the Competitive Range.** The Proposers whose Proposals are found by the Agency to be within the Competitive Range, or that may be reasonably made to be within the Competitive Range, will be notified and any questions or requests for clarifications provided to them in writing. Each such Proposer may be invited for an interview and discussions with the Agency to discuss answers to written or oral questions, clarifications and any facet of its Proposal.

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

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

5. **Factory and site visits.** The Agency reserves the right to conduct factory visits of the Proposer's facilities and/or the facilities of major sub-suppliers included in the Proposal.
6. **Best and final offers.** After all interviews have been completed, the Proposers in the Competitive Range may be afforded the opportunity to amend their Proposals and make their BAFOs. The Request for BAFOs shall include the following:
 - Notice that discussions and negotiations are concluded.
 - A complete listing of the conditions, exceptions, reservations or understandings that have been approved.
 - A common date and time for submission of written BAFOs, allowing a reasonable opportunity for preparation of the written BAFOs.
 - Notice that if any modification to a BAFO is submitted, it must be received by the date and time specified for the receipt of BAFOs.
 - Notice to Proposers that do not submit a notice of withdrawal or a BAFO that their immediately previous Proposal will be construed as their BAFO.

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

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

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

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

IP 14 Response to Proposals

IP 14.1 Single Proposal Response

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

IP 14.2 Availability of Funds

This procurement is subject to the availability of funding.

IP 14.3 Agency Contract Approval Process

The PART Board of Trustees will approve the initial award to a vendor or vendors under this contract. Once a vendor is awarded contract, each participating agency will work directly with the vendor or vendors to issue purchase orders based on their needs. Participating agencies may require additional governing body approval and may require their own contracts with vendors.

IP 14.4 Agency Rights

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

The Agency reserves the right to reject any or all Proposals, to undertake discussions with one or more Proposers, and to accept that Proposal or modified Proposal which, in its judgment, will be most advantageous to the Agency, considering price and other evaluation criteria. The Agency reserves the right to determine any specific Proposal that is conditional or not prepared in accordance with the instructions and requirements of this RFP to be

nonresponsive. The Agency reserves the right to waive any Defects, or minor informalities or irregularities in any Proposal that do not materially affect the Proposal or prejudice other Proposers.

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 Agency.

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

IP 14.5 Execution of Contract

The acceptance of a Proposal for award, if made, shall be evidenced in writing by a notice of award of Contract delivered to the Proposer whose Proposal is accepted. Upon notice of award of the Contract to a Proposer, the Proposer shall commence performance under the Contract by furnishing any required bonds, and by furnishing copies of the certificates of insurance required to be procured by the Contractor pursuant to the Contract documents within 30 calendar days after the date of receipt of the notice of award. Failure to fulfill these requirements within the specified time is cause for termination of the Contract under "Termination for Default" in Section 3, "General Conditions".

IP 15 Conflicts of Interests and Gratuities

Proposers are prohibited from engaging in any practice that may be considered a conflict of interest under existing Agency policies and/or state law, and to refrain from participating in any gifts, favors or other forms of compensation that may be viewed as a gratuity in accordance with existing policies and laws.

IP 16 Agency-Specific Provisions

WSTA - Additional Provisions

The City of Winston-Salem has establish guidelines for ethical standards of conduct for City representatives and to provide guidance in determining what conduct is appropriate in particular cases. City representatives should maintain high standards of personal integrity, truthfulness, honesty, and fairness in carrying out public duties; avoid any improprieties in their roles as public servants including the appearance of impropriety; and never use their position or power for improper personal gain. In establishing an ethics policy, the City of Winston-Salem desires to protect the public against decisions that are affected by undue influence, conflicts of interest, or any other violation of these policies as well as promote and strengthen the confidence of the public in their governing body. For a complete review of the City Policy click the following link.

<http://www.cityofws.org/Home/Departments/Purchasing/Articles/Bids>

COMPLIANCE WITH RULES AND REGULATIONS: The equipment furnished must comply with all applicable provisions of the Occupational Safety and Health Act (OSHA), the American National Standard Institute (ANSI) and the Federal Motor Vehicle Standards of the U. S. Department of Transportation. The conversion equipment must also be certified by either the US Environmental Protection Agency (EPA) or California Air Resources Board (CARB). EPA Certificates are not required at time of bid, but are required upon delivery of vehicle(s). The equipment furnished shall be capable of passing any applicable N. C. State motor vehicle inspection.

INDEMNIFICATION: The successful bidder/vendor agrees to indemnify and hold harmless the City of Winston-Salem against any and all claims or causes of action for property damage or personal injury arising out of or relating to the negligence of the successful bidder/vendor, its officers, employees or agents during the test period for the operation of the vehicle prior to acceptance of the vehicle by the City of Winston-Salem.

ADDITIONAL UNITS: The City reserves the right to acquire additional quantities for a period of 1 year following this bid due date, subject to dealer acceptance of orders, at the same unit price, terms and conditions as bid.

TERMS AND CONDITIONS: The undersigned guarantees all parts against defects and agrees to replace and to install at his own expense any part or parts of the apparatus damaged by reason of defective material, design, or imperfect workmanship during manufacturer's standard warranty period.



SECTION 3: GENERAL CONDITIONS

GC 1 Definitions

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

Agency: The Piedmont Authority for Regional Transportation (PART)

Participating Agency: Those agencies listed as participants of this RFP.

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

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

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

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

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

Contract: The Proposal and its acceptance by the Agency, as manifested by the Contract documents specified in Section 10, "Contract."

Contracting Officer: The person who is executing this Contract on behalf of the Agency and who has complete and final authority, except as limited herein.

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

Days: Calendar days, unless otherwise stated.

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

Deviation: Variance from a requirement or specification that does not alter the basis of a Contract or adversely affect its performance.

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

Extended Warranty: An additional warranty available for purchase above the standard warranty offered.

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

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

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

Proposer: A legal entity that makes a Proposal.

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

Solicitation: An Agency's Request for Proposals.

Subcontractor: Any manufacturer, company or Agency that provides services (such as component installation or testing) and that may also provide units, components or subassemblies for inclusion in the bus. Subcontractor items provided shall require qualification by type and acceptance tests in accordance with the requirements defined in Section 8, "Quality Assurance" and the technical specifications.



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

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

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

GC 2 Materials and Workmanship

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

GC 3 Conformance with Specifications and Drawings

Materials furnished and work performed by the Contractor shall conform to the requirements of the technical specifications and other Contract documents. Notwithstanding the provision of drawings, technical specifications or other data by the Agency, the Contractor shall have the responsibility of supplying all parts and details required to make the bus complete and ready for service, even if such details are not specifically mentioned in the drawings and specifications. Items that are installed by the Agency shall not be the responsibility of the Contractor unless they are included in this Contract.

Addition of any Third-Party equipment requested by the Agency, to be added to the base bus, shall require written technical specifications for the equipment. This includes, but is not limited to, a detailed description of the equipment’s functionality, installation instructions and unit cost at the time of order. This requirement shall be clearly communicated, outlined and agreed upon in writing prior to the placement of an Order with the Contractor.

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

GC 4 Inspection, Testing and Acceptance

GC 4.1 General

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

The pre-delivery tests and inspections shall be performed at the Contractor’s plant; they shall be performed in accordance with the procedures defined in Section 8, “Quality Assurance” subsection entitled “Pre-Delivery Tests,” and they may be witnessed by the resident inspector. Once a bus passes these tests and inspections, the resident inspector shall authorize the release of the bus.

Within fifteen (15) calendar days after arrival at the designated point of delivery, the bus shall undergo the Agency tests defined in Section 8, “Quality Assurance” subsection entitled “Post-Delivery Tests.” If the bus passes these tests, or if the Agency does not notify the Contractor of nonacceptance within 15 calendar days after delivery, then acceptance of the bus by the Agency occurs on the 15th day after delivery. If these post-delivery tests have not been completed for the bus because of infrastructure or other delays that are not the responsibility of the Contractor, then the Agency may issue a change to the Contract to modify the delivery schedule or extend the post-delivery test period. The equitable compensation provision in Section 3, “General Conditions” subsection entitled “Suspension of Work” for suspensions and delays shall apply. If the bus fails these tests, it shall not be accepted until the repair procedures defined in Section 4, “Special Provisions” subsection entitled “Repairs After Nonacceptance” have been carried out and the bus retested until it passes. Acceptance occurs earlier if the Agency notifies the Contractor of early acceptance or places the bus in revenue service.

GC 4.2 Risk of Loss

The Agency shall assume risk of loss of the bus upon 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.

GC 5 Title and Warranty of Title

Adequate documents for registering each bus in North Carolina shall be provided to the Agency not fewer than ten (10) business days before delivery. Regardless of the documents provided, title shall not pass from the Contractor to the agency until the Buy America Post Delivery Audit required by 49 CFR Part 663 is complete, and the Agency accepts the bus. Upon acceptance of each bus, the Contractor warrants that the title shall pass to the Agency free and clear of all encumbrances. encumbrances.

GC 6 Intellectual Property Warranty

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

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

GC 7 Data Rights

GC 7.1 Proprietary Rights/Rights in Data

The term "Subject Data" used in this clause means recorded information, whether or not copyrighted, and includes:

- Contractor-created specifications, engineering drawings (including shop drawings and working drawings);
- Technical data, including manuals or instruction materials, and computer or microprocessor software delivered or specified to be delivered under the Contract;
- Patented materials, equipment, devices or processes;
- License requirements necessary or desirable for operation or maintenance of the equipment;
- Records and reports delivered, or specified to be delivered, under the Contract; and
- Any rights of copyright to which the Contractor, Subcontractor or Supplier purchases ownership for the purpose of performance of the Contract, and which are specifically paid for as such under the Contract.

The Subject Data shall remain the property of the Contractor; the Agency, however, shall have a perpetual, royalty-free, non-exclusive and irrevocable license to reproduce, publish or otherwise use (and authorize others to use) the Subject Data for the purposes of operating and maintaining the buses.

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.

The Agency shall protect from disclosure the Contractor's proprietary information included in the Subject Data provided by the Contractor to the fullest extent of the law. In the event that the Contractor no longer supports the Subject Data, the Agency has the right to reverse-engineer the Subject Data and associated hardware.

GC 7.2 Access to Onboard Operational Data

The Agency grants to the Contractor the right to inspect, examine, download and otherwise obtain any information or data available from components provided by the Contractor, including but not limited to electronic control modules, video or audio devices or software, and/or other data-collection devices (collectively, "Onboard Operational Data"). This will be to the extent necessary to enable the Contractor to perform reliability maintenance analysis, corrective action and/or other engineering-type Work for the bus, the fleet or, more generally, for similar analysis across agencies. This right expressly excludes access to information or data collected on any equipment not provided and installed by the Contractor. The Contractor shall treat all Onboard Operational Data as confidential and protect it to the same or greater extent that it does its own confidential information. The Contractor shall not disclose Onboard Operational Data to any person or entity without the express written consent of the Agency. The Contractor shall not access, download, utilize or retain any personally identifiable information, as defined in 49 CFR Part 1520. The Contractor shall promptly notify the Agency upon learning of any unauthorized disclosure of the Onboard Operational Data.

GC 8 Changes

GC 8.1 Contractor Changes

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

GC 8.2 Agency Changes

The Agency may initiate changes to the Contract by notifying the Contractor in writing, and the notification shall indicate the Agency approval necessary to change the contract. The Agency and the Contractor shall work together to accomplish the change with as little delay and additional cost as possible. The Agency and the Contractor will avoid any actions and any omissions that would unnecessarily increase the cost of the change. As soon as reasonably possible, but no later than thirty (30) calendar days after receipt of the notification of change, the Contractor shall submit to the Contracting Officer a detailed price and schedule Proposal for the Work to be performed. This Proposal shall be accepted or modified by negotiations between the Contractor and the Contracting Officer with the objective of reaching a bilateral agreement on price and other terms as soon as possible.

The parties may reach agreement on elements but not all of the initiated changes. The parties may execute a detailed modification of the contract, including those elements of the change on which they have reached agreement; the modification shall include any changes in time and price. The Contractor shall begin work on those changes and the Agency may request a detailed proposal on the remaining changes on which agreement has not yet been reached.

When the negotiations are successful, a detailed modification shall be executed in writing by both parties. If at any time the Contracting Officer determines it is necessary to proceed even though complete agreement has not been reached, the Contracting Officer may issue a change order requiring the Contractor to proceed, stating an equitable change in compensation, and binding both parties to the changed contract. Disagreements that cannot be resolved within negotiations shall be resolved in accordance with "Disputes," below. Regardless of any disputes, the Contractor shall proceed with the Work ordered.

GC 9 Legal Clauses

GC 9.1 Indemnification

GC 9.1.1 The Contractor shall, to the extent permitted by law: (1) protect, indemnify, and hold the Agency and its officers, employees and agents (including consultants) harmless from and against any and all liabilities, damages, claims, demands, liens, encumbrances, judgments, awards, losses, costs, expenses, and suits/actions/proceedings (including reasonable expenses, costs and attorneys' fees incurred by the Agency and its officers, employees and/or agents [including consultants]) in the defense, settlement or satisfaction thereof, of any injury, death, loss or damage to persons or property of any kind whatsoever, resulting from the misconduct or negligent acts, errors or omissions of the Contractor in the performance of the Contract (including misconduct, negligent acts and errors or omissions of its officers, employees, servants, agents, Subcontractors and Suppliers); (2) upon receipt of notice, and if given authority, the Contractor shall settle or undertake at its own expense the defense of any such suit, action or proceeding, including appeals, against the Agency and its officers, employees and agents (including consultants), relating to such injury, death, loss or damage. Each party shall promptly notify the other in writing of the notice or assertion of such claim, demand, lien, encumbrance, judgment, award, suit, action or other proceeding hereunder. The Contractor shall have sole charge and direction of the defense of such suit, action or proceeding. The Agency shall not make any admission that might be materially prejudicial to the Contractor unless the Contractor has failed to take over the conduct of any negotiations or defense within a reasonable time after receipt of the notice and authority above provided. The Agency shall, at the request of the Contractor, furnish to the Contractor all reasonable assistance that may be necessary for the purpose of defending such suit, action or proceeding; and shall be repaid all reasonable costs incurred in doing so. The Agency shall have the right to be represented therein by an advisory council of its own selection at its own expense.

GC 9.1.2 The obligations of the Contractor under the above paragraph shall not extend to circumstances where the injury, death or damages are caused solely by the negligent acts, errors or omissions of the Agency, its officers, employees, agents or consultants. This includes, without limitation, negligence in: (1) the preparation of the Contract documents, or (2) the giving of directions or instructions with respect to the requirements of the Contract by written order. The obligations of the Contractor shall not extend to circumstances where the injury, death or damages were caused, in whole or in part, by the negligence of any third-party operator, not including an assignee or Subcontractor of the Contractor, subject to the right of contribution. In case of joint or concurrent negligence of the parties giving rise to a claim or loss against either one or both, each shall have full rights of contribution from the other.

GC 9.2 Suspension of Work

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

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

GC 9.2.3 The Contractor shall be allowed an equitable adjustment in the Contract price 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 the period of time agreed to by the parties) after receipt of the written suspension of work notice, the Contractor shall submit to the Contracting Officer a detailed price and schedule Proposal for the suspension, delay or interruption.

GC 9.3 Excusable Delays/Force Majeure

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

- a. The cause of the delay arises after the Notice of Award and 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 an act of God; earthquake, flood and any other natural disaster; civil disturbance, strike or labor dispute; fire or explosion; war or other hostilities; embargo; or a delay caused by a failure of a Supplier or Subcontractor to provide supplies or services necessary to continue or complete the Work, where the failure was beyond the control of both the Contractor and Supplier or Subcontractor and without fault or negligence of either, and the supplies or services were not reasonably available from another source;
- b. The Contractor demonstrates that the completion of the Work and/or any affected deliveries will be actually and necessarily delayed;
- c. The Contractor has taken measures to avoid and/or mitigate the delay by the exercise of all reasonable precautions, efforts and measures, whether before or after the occurrence of the cause of delay; and
- d. The Contractor makes written request and provides other information to the Agency as described in paragraph GC 9.3.4 below.

A delay in meeting all of the conditions of this section shall be deemed an excusable delay. Any concurrent delay that does not constitute an excusable delay will not be the sole basis for denying a request hereunder. A delay that would have occurred even in the absence of the force majeure event shall not be excusable.

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

GC 9.3.3 The Agency reserves the right to rescind or shorten any extension previously granted, if subsequently the Agency determines that any information provided by 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 Agency will not rescind or shorten any extension previously granted if the Contractor acted in reliance upon the granting of such extension; and such extension was based on information that, although later found to have been erroneous, was submitted in good faith by the Contractor.

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

GC 9.4 Termination

GC 9.4.1 Termination for Convenience

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

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

GC 9.4.2 Stop Work under the Contract on the date and to the extent specified in the notice of termination.

GC 9.4.3 Place no further orders or subcontracts for materials, services or facilities, except as may be necessary for completion of such portion of the Work under the Contract as is not terminated.

GC 9.4.4 Terminate all orders and subcontracts to the extent that they relate to the performance of work terminated by the notice of termination; assign to the Agency in the manner, at the times, and to the extent directed by the Contracting Officer, all of the right, title and interest of the Contractor under the orders and subcontracts so terminated, in which case the Agency shall have the right, in its discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts.

GC 9.4.5 Settle all outstanding liabilities and all claims arising out of such termination of orders and subcontracts, with the approval or ratification of the Contracting Officer, to the extent he or she may require, which approval or ratification shall be final for all the purposes of this clause.

GC 9.4.6 Transfer title to the Agency and deliver in the manner, at the times and to the extent, if any, directed by the Contracting Officer the fabricated or unfabricated parts, Work in process, completed Work, supplies and other material produced as part of, or acquired in connection with the performance of, the Work terminated, and the completed or partially completed plans, drawings, information and other property which, if the Contract had been completed, would have been required to be furnished to the Agency.

GC 9.4.7 Use its best efforts to sell, in the manner, at the times, to the extent, and at the price(s) directed or authorized by the Contracting Officer, any property of the types referred to above, provided, however, that the Contractor shall not be required to extend credit to any purchaser, and may acquire any such property under the conditions prescribed by and at prices approved by the Contracting Officer, and provided further that the proceeds of any such transfer or disposition shall be applied in reduction of any payments to be made by the Agency to the Contractor under this Contract or shall otherwise be credited to the price or cost of the Work covered by this Contract or paid in such other manner as the Contracting Officer may direct.

GC 9.4.8 Complete performance of such part of the Work as shall not have been terminated by the notice of termination.

GC 9.4.9 Take such action as may be necessary, or as the Contracting Officer may direct, for the protection or preservation of the property related to this Contract that is in the possession of the Contractor and in which the Agency has or may acquire an interest.

GC 9.4.10 The Contractor shall be paid its cost, including contract closeout costs, and profit on work performed up to the time of termination. The Contractor shall promptly submit its termination claim to the Agency to be paid. Settlement of claims by the Contractor under this termination-for-convenience clause shall be in accordance with the provisions set forth in Part 49 of the Federal Acquisition Regulations (48 CFR 49), except that wherever the word "government" appears, it shall be deleted and the word "Agency" shall be substituted in lieu thereof.

GC 9.4.11 Termination for Default

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

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

Except with respect to defaults of Subcontractors, the Contractor shall not be liable for any excess costs if the failure to perform the Contract arises out of a cause beyond the control, and without the fault or negligence, of the Contractor. If the failure to perform is caused by the default of a Subcontractor, and if such default arises out of causes beyond the control of both the Contractor and Subcontractor, and without the fault or negligence of either of them, then the Contractor shall not be liable for any excess costs for failure to perform, unless the supplies or

services to be furnished by the Subcontractor were obtainable from other sources and in sufficient time to permit the Contractor to meet the required delivery schedule.

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

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

GC 9.5 Compliance with Laws and Regulations

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 Agency and FTA that funds any part of this Contract, as they may be amended or promulgated from time to time during the term of this Contract. Contractor's failure to so comply shall constitute a material breach of this Contract.

GC 9.6 Changes of Law

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

GC 9.7 Governing Law and Choice of Forum

This Contract shall be governed by the laws of North Carolina without regard to conflict of law rules. The Contractor consents to the jurisdiction of North Carolina, County of Guilford.

GC 9.8 Disputes

Except as otherwise provided in this Contract, any dispute concerning a question of fact arising under or related to this Contract, that is not disposed of by agreement, shall be decided in accordance with the following steps. However, by mutual agreement the matter may be taken immediately to any higher step in the dispute resolution process, or through a mutually agreed-upon alternative dispute resolution process (which may include structured negotiations, mediation or arbitration) or litigation. Pending final resolution of a dispute hereunder, the Contractor shall proceed diligently with the performance of the Contract, and in accordance with the contracting officer's or chief executive officer's decision, as the case may be.

1. **Notice of dispute.** All disputes shall be initiated through a written dispute notice submitted by either party to the other party within ten (10) calendar days of the determination of the dispute.
2. **Negotiation between Contracting Officers.** The parties shall attempt in good faith to resolve any dispute arising out of, or relating to, this Contract promptly by negotiation between executives who have the authority to settle the controversy, and who are at a higher level of management than the people with direct responsibility for administration of this Contract. Any party may give the other party written notice of any dispute not resolved in the normal course of business as provided in paragraph 1 above. Within fourteen (14) calendar days after delivery of the dispute notice, the receiving party shall submit to the other party a written response. The dispute notice and written response shall include (a) a statement of the party's position and a summary of the arguments supporting that position, (b) any evidence supporting the party's position, and (c) the name of the executive who will represent that party and of any others who will accompany the executive in negotiations. Within twenty-eight (28) calendar days after delivery of the dispute notice, the Contracting Officer of both parties shall meet at a mutually acceptable time and place, and thereafter as they reasonably deem necessary to attempt to resolve the dispute. All reasonable requests for information by one party to the other shall be honored.

If the matter has not been resolved by these people within forty-two (42) calendar days of the dispute notice, then the dispute may be referred to more senior executives of both parties who have authority to settle the dispute and who shall likewise meet to attempt to resolve the dispute.

3. **Chief executive officer's decision.** Should the dispute not be resolved by negotiation between Contracting Officers as provided in paragraph 2 above, the Agency's Contracting Officer shall submit a written request for decision to the Agency's chief executive officer along with all documentation and minutes from the negotiations. The CEO shall issue a written decision within fourteen (14) days of receipt of a request.

- a. For disputes involving \$50,000 or less, the decision of the CEO shall be administratively final and conclusive. For disputes involving \$50,000 or less, it is the intent of the parties that such administratively final and conclusive decision pursuant to either this paragraph or paragraph 4 shall be overturned only if determined by a court of competent jurisdiction to be fraudulent, arbitrary, capricious, unsupported by the evidence or so grossly erroneous as to imply bad faith. For disputes greater than \$50,000, the decision of the CEO shall be administratively final and conclusive unless, within thirty (30) days from the date of delivery of the written decision, the Contractor appeals the decision in writing to the Agency's CEO or designee, who shall render a written decision within fourteen (14) days of delivery of such written appeal. Such decision by the CEO or their designee shall be administratively final and conclusive.
 - Within thirty (30) days of the issuance of any administratively final and conclusive decision under this paragraph, the Contractor shall notify the Agency in writing of the Contractor's agreement with the final decision. Failure to provide such written notice of agreement shall indicate an intent by the Contractor to litigate the claim.
Any dispute that is not resolved by the parties through the operation of the provisions of this paragraph, or any mutually agreed-upon alternative dispute resolution process pursuant to paragraph 4, may be submitted to any court in North Carolina.
 - Pending final resolution of a dispute hereunder, the Contractor shall proceed diligently with the performance of its obligations under the Contract, in accordance with the written directions of the Agency.
- **Alternative dispute resolution.** If agreed upon by both parties, disputes may be resolved by a mutually agreed-upon alternative dispute resolution process that may include structured negotiations different from paragraph 2 above, mediation or arbitration.
4. **Arbitration.** Disputes appealed to arbitration involving more than \$50,000, but less than \$250,000, shall be decided by a qualified and disinterested arbitrator, selected through the American Arbitration Association and mutually agreed upon by both parties. The arbitrator shall conduct all proceedings in accordance with the rules of the American Arbitration Association, and shall consider the Contract, equity, prevailing law and established commercial practices in rendering a decision.

Disputes appealed to arbitration involving \$250,000 or more shall be decided by three (3) qualified and disinterested arbitrators selected through the American Arbitration Association. One arbitrator shall be selected by each of the parties, and the two selected arbitrators shall select a third arbitrator within ten (10) calendar days of their selection. The arbitrators shall conduct all proceedings in accordance with the rules of the American Arbitration Association and shall consider the Contract, equity, the prevailing law and established commercial practice in rendering a decision.

The decision by the arbitrators shall be final and enforceable in any court having jurisdiction over the parties.

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

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

1. In the event of a sole-source Contract, single Proposal, single responsive Proposal, or competitive negotiated procurement, the Contractor shall maintain—and the Contracting Officer, the USDOT (if applicable) or representatives thereof shall have the right to examine—all books, records, documents, and other cost and pricing data related to the Contract price, unless such pricing is based on adequate price competition, established catalog or market prices of commercial items sold in substantial quantities to the public, or prices set by law or regulation, or combinations thereof. Data related to the negotiation or performance of the Contract shall be made available for the purpose of evaluating the accuracy, completeness and currency of the cost or pricing data. This right of examination shall extend to all documents necessary for adequate evaluation of the cost or pricing data, along with the computations and projections used therein, including review of accounting principles and practices that properly reflect all direct and indirect costs anticipated for the performance of the Contract.
2. For Contract modifications or change orders, the Contracting Officer, the USDOT, if applicable, or their representatives, shall have the right to examine all books, records, documents, and other cost and pricing data related to a Contract modification, unless such pricing is based on adequate price competition, established catalog or market prices of commercial items sold in substantial quantities to the public, prices set by law or regulation, or combinations thereof. Data related to the negotiation or performance of the Contract modification or change order shall be made available for the purpose of evaluating the accuracy, completeness and currency of the cost or pricing data. The right of examination shall extend to all documents necessary for adequate evaluation of the cost or pricing data, along with the computations and projections used therein, either before or after execution of the Contract modification or change order, for

the purpose of conducting a cost analysis. If an examination made after execution of the Contract modification or change order reveals inaccurate, incomplete or out-of-date data, the Contracting Officer may renegotiate the Contract modification or change order price adjustment, and the Agency shall be entitled to any reductions in the price that would have resulted from the application of accurate, complete or up-to-date data.

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

GC 9.10 Confidential Information

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

Upon a request for records from a third party regarding the Contract, the Agency will notify the Contractor in writing. The Contractor must respond within twenty (20) days with the identification of any and all proprietary, trade secret, or confidential commercial or financial information, and the Contractor shall indemnify the Agency's defense costs associated with its refusal to produce such identified information; otherwise, the requested information may be released.

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

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

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

GC 9.11 Conflicts of Interest, Gratuities

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

GC 9.12 General Nondiscrimination Clause

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

GC 9.13 Amendment and Waiver

GC 9.13.1 Amendment

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



GC 9.13.2 Waiver

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

GC 9.14 Remedies Not Exclusive

The rights and remedies of the Agency provided herein shall not be exclusive and are in addition to any other rights and remedies provided by law or under the Contract.

GC 9.15 Counterparts

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

GC 9.16 Severability

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

GC 9.17 Third-Party Beneficiaries

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

GC 9.18 Assignment of Contract

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

GC 9.19 Independent Parties

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

GC 9.20 Survival

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

- GC 6. Intellectual Property Warranty
- GC 7. Data Rights
- GC 9.1 Indemnification
- GC 9.7 Governing Law and Choice of Forum
- GC 9.8 Disputes
- GC 9.10 Confidential Information
- SP 7.3 Parts Availability Guarantee
- FR 1. Access to Records
- TS 5.6 Training

GC 10 Not Used

SECTION 4: SPECIAL PROVISIONS

SP 1 Inspection, Tests and Repairs

SP 1.1 Repair Performance

SP 1.1.1 Repairs by Contractor

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

The Contractor shall be responsible for completing the required repairs. In its "notification of failure" of acceptance tests, the Agency may specify that space is available with the dates of availability for the Contractor to perform repairs, provided that this space will not generally include utilizing hoists, lifts or pits. The Contractor shall provide, at its own expense, all spare parts and tools required to complete the repairs. At the Agency's option, the Contractor may be required to remove the bus from the Agency's property while repairs are being made. If the bus is removed from the Agency's property, 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.

SP 1.1.2 Repairs by the Agency

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

1. **Parts used.** If the Agency performs the repairs after nonacceptance of the bus, it shall correct or repair the Defect and any Related Defects using Contractor-specified parts available from its own stock or those supplied by the Contractor specifically for this repair. Reports of all repairs covered by this procedure shall be submitted by the Agency to the Contractor for reimbursement or replacement of parts monthly, or at a period to be mutually agreed upon. The Contractor shall provide forms for these reports.
2. **Contractor-supplied parts.** If the Contractor supplies parts for repairs being performed by the Agency after nonacceptance of the bus, then these parts shall be shipped prepaid to the Agency.
3. **Return of defective components.** The Contractor may request that parts covered by this provision be returned to the manufacturing plant. The total costs for this action shall be paid by the Contractor.
4. **Reimbursement for labor.** The Agency shall be reimbursed by the Contractor for labor. The amount shall be determined by the Agency for a qualified mechanic at a straight time wage rate of \$110, which includes fringe benefits and overhead, adjusted for the Agency's most recently published rate in effect at the time the Work is performed, plus the cost of towing in the bus, if such action was necessary. These wage and fringe benefits rates shall not exceed the rates in effect in the Agency's service garage at the time the Defect correction is made.
5. **Reimbursement for parts.** The Agency shall be reimbursed by the Contractor for defective parts that must be replaced to correct the Defect. The reimbursement shall include taxes where applicable and 20% handling costs.

SP 1.2 Pilot Bus

The Contractor shall produce one pilot vehicle for any single order of ten or more buses for each type of vehicle with respect to the base order by the participating Agency. This vehicle shall be one of the ultimate quantities of the base vehicle order. The pilot vehicle shall demonstrate that the vehicles fully meet all requirements of the Contract. The pilot vehicle shall be produced and delivered to the Agency for a minimum of thirty (30) days prior to initiation of any production activities for the remaining vehicles, unless otherwise authorized in writing by the Agency. In the event that noncompliance is identified, the Agency shall, to the extent practicable, notify the Contractor of said noncompliance. No later than seven (7) days after the end of the 30-day test, the Agency shall issue a written report to the Contractor that advises the Contractor of any noncompliance issues and/or any proposed modifications or changes required to the remaining vehicles.

In the event that the pilot vehicle does not initially comply with all performance criteria contained in the Technical Specifications, a compromise has not been reached, and progress payment has been established, the Agency 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 vehicle. This amount shall be withheld until compliance is demonstrated. In the event that compliance is subsequently determined to be impossible to achieve, the Agency may require all or a portion of the progress payment for the pilot vehicle to be forfeited as damages agreed to by the parties for the noncompliance. The amount of the damages shall be negotiated by the parties.

SP 1.3 Configuration and Performance Approval

In order to assess the Contractor's compliance with the Technical Specifications, the Agency and the Contractor shall, at the pre-production meeting, jointly develop a configuration and Performance Review Document for review of the pilot vehicle. This document shall include appropriate performance standards for each test that is required, and the document shall become part of the official record of the pre-production meeting.

SP 1.4 First Article Inspection – Production

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

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

SP 1.5 Post-Delivery Tests

The Agency will conduct acceptance tests as set out in in Section 8, “Quality Assurance” subsection entitled “Post Delivery Tests” on each delivered bus. These tests shall be completed within fifteen (15) days after bus delivery and shall be conducted in accordance with written test plans. The purpose of these tests is to identify Defects that have become apparent between the time of bus release and delivery to the Agency. 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 an analogous pre-delivery test (if any).

Buses that fail to pass the post-delivery tests are subject to nonacceptance. The Agency shall record details of all Defects on the appropriate test forms and shall notify the Contractor of acceptance or nonacceptance of each bus according to “Inspection, Testing and Acceptance” after completion of the tests. The Defects detected during these tests shall be repaired according to the procedures defined in Special Provisions subsection entitled “Repairs After Nonacceptance.”

SP 1.6 Repairs After Nonacceptance

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

SP 2 Deliveries

SP 2.1 Bus Delivery

Delivery of buses shall be determined by signed receipt of the Agency’s designated agent(s), designated point(s) of delivery, and may be preceded by a cursory inspection of the bus. The agents name and address should be detailed in the issuing PO for each order.

SP 2.2 Delivery Schedule

Delivery shall be completed within 54 weeks after receipt of a purchase order. Hours of delivery shall be 8 AM – 5 PM on the following days of the week: Monday - Friday.

SP 2.3 Contract Deliverables

Contract deliverables associated with this Contract are set forth in **Table 1**, along with other pertinent information. Contract deliverables shall be submitted in accordance with Section 6, “Technical Specifications.” 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. The reference section designates the appropriate specification section(s) where the requirement is referenced.

TABLE 1
Contract Deliverables

	Deliverable	Agency Action	Reference Section	Due Date	Format	Quantity Due
1.	Bus Testing— Altoona Test Report	Review		Prior to pilot bus delivery	Hard copy	1
2.	List of serialized units installed on each bus	Review		With each delivered bus	Electronic media	1 per bus
3.	Copy of Manufacturers’ formal Quality Assurance Program	Review		Pre-award site visit	Hard copy	1
4.	QA manufacturing certificate	Review		With each delivered bus	Hard copy	1 per bus

TABLE 1
Contract Deliverables

Deliverable		Agency Action	Reference Section	Due Date	Format	Quantity Due
5.	QA purchasing certifications acknowledging receipt of applicable specification	Review		30 days following first pre-production meeting	Hard copy	1 per major Supplier
6.	Pre-Delivery Bus Documentation Package	Review		With each delivered bus	Hard copy	1 per bus
7.	Motor Vehicle Pollution Requirements Certificate	Review		With each bus	Hard copy	1
8.	Engine Emissions Certificate—NOx levels	Review		Prior to completion of pilot bus	Hard copy	1
9.	Pre-production meeting minutes	Approval		30 days after each meeting	Hard copy	2 originals
10.	Driver's log and incident report	Review		With each bus delivery if drive-away service is used	Hard copy	1 per bus
11.	Title documentation	Review		10 days prior to bus delivery	Hard copy	1 per bus
12.	Performance bond	Review		30 days following execution of Contract	Hard copy	1
13.	Insurance certificates	Approval		Before Work commences	Hard copy	1
14.	Engineering support	Review		During pre-production meeting	Contracts	1
15.	Training instructor information	Approval		30 days prior to delivery of pilot bus		
16.	Training curriculum	Approval		30 days prior to delivery of pilot bus	Electronic media	
17.	Teaching materials	Review		During classroom instruction	Hard copy	1
18.	Professionally prepared mechanics' "Bus Orientation" training video	Review		30 days prior to first production bus	Electronic media	20 each
19.	Final preventative maintenance manuals	Review		90 days after Agency written approval	Hard copy Electronic media	10/100 buses 20
20.	Final diagnostic procedures manuals	Review		90 days after Agency written approval	Hard copy Electronic media	10/100 buses 20
21.	Final parts manuals	Approval		90 days after Agency written approval	Hard copy Electronic media	10/100 buses 20
22.	Component repair manuals (Agency approval/review period of 90 days from date of receipt)	Approval		90 days after Agency written approval of OEM component repair list	Hard copy Electronic media	2 2
23.	Draft preventative maintenance manuals (Agency approval/review period of 90 days from date of receipt)	Approval		With pilot bus	Hard copy	10
24.	Draft diagnostic procedures manuals (Agency approval/review period of 90 days from date of receipt)	Approval		With pilot bus	Hard copy	10
25.	Draft parts manuals (Agency approval/review period of 90 days from date of receipt)	Approval		With pilot bus	Hard copy	10
26.	List of OEM component repair manuals	Approval		With pilot bus	Hard copy	10
27.	Draft operators' manuals (Agency approval/review period of 90 days from date of receipt)	Approval		With pilot bus or maximum of 30 days prior to start of production	Hard copy	10
28.	Final operators' manuals	Review		30 days following Agency approval of draft manual	Hard copy	1 per bus

TABLE 1
Contract Deliverables

Deliverable		Agency Action	Reference Section	Due Date	Format	Quantity Due
29.	Recommended spare parts list, including bill of materials	Review		60 days prior to shipment of first bus	Hard copy	1
30.	Part number index	Approval		60 days prior to shipment of first bus	Hard copy Spreadsheet	1 1
31.	Current price list	Review		90 days after Agency written approval of draft parts manual	Hard copy	20
32.	In-process drawings	Review		30 days prior to production	Scale drawings	1
33.	Electrical and air schematics	Review		30 days prior to production	Hard copy	1
34.	As-built drawings	Review		Within 60 days after final bus delivery	Electronic media	1
35.	Material samples	Review		By conclusion of pre-production meetings		1
36.	Undercoating system program	Approval		First pre-production meeting	Hard copy	1
37.	Flooring certificate	Review		First pre-production meeting	Certificate/ copy of purchase order	1
38.	Interior features – fire-resistance certificates	Review		Prior to pilot bus completion	Certificates	1
39.	Crashworthiness	Review		Pre-award audit	Certificate	1
40.	Technical review of electronic functionality	Approval		Prior to production	Hard copy	1
41.	Interior security camera layout	Approval		Prior to pilot bus completion	Copies of interior views	1 each
42.	Technical review of powerplant			Prior to production		
43.	Powerplant certifications	Review		Prior to pilot bus completion	Hard copy	1 each
44.	Striping layout	Approval		Prior to production	Hard copy	1
45.	Resolution of issues “subject to Agency approval”	Approval		Prior to production	Hard copy	1

SP 3 Vehicle Options and Option Pricing

The Contractor hereby grants the Agency and any permissible assignee options (“Options”) to purchase up to ten (10) additional vehicles (“Option Vehicles”) per vehicle length and type. These Options shall be valid for a period of five years from the effective date of the Contract. There shall be no minimum order quantity for any permissible assignee. Subject to the Agency’s right to order modifications, the Option Vehicles shall have the same specifications as the vehicles purchased under this Contract. The Agency may exercise the Options by written notice to the Contractor (“Notice of Exercise of Option”) at any time on or before five years following the effective date of the Contract (“Option Date”).

Within thirty (30) days after delivery of an intent to exercise Option to the Contractor, the Contractor shall submit a proposed delivery schedule. Along with the proposed delivery schedule, the Contractor will provide the Agency with access to its production capacity forecast for the purpose of the parties verifying available production capacity. The production capacity forecast shall include 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. The production capacity forecast need not disclose specific order or customer information and shall contain a representation that the gross capacity, committed quantities and available net production capacity in the production capacity forecast are a reasonable basis for obligating the Option Vehicle delivery dates under the terms of the Contract. 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 Notice of Exercise of Option. The Agency, or any permissible assignee, may issue a Notice of Exercise of Option at any time after the Contractor submits its proposed delivery schedule. The Contractor shall not commence production of Option Vehicles prior to the issuance of the Notice of Exercise of Option by either the Agency or any permissible assignee of the Agency for the Option Vehicles. The Notice of Exercise of Option shall incorporate the agreed production delivery schedule or the fourteen (14) -month maximum term, and shall constitute a notice to proceed with Option Vehicle production.

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

The price of each Option Vehicle shall be the unit price of the base order vehicles (“Base Order Price”) adjusted as required by the terms of this Contract, including escalation as required under “Escalation.”

SP 4 Assignability of Options

If the Agency does not exercise the option(s) as listed in “Options and Option Pricing,” then the Agency reserves the right to assign the Option(s) to other grantees of FTA funds in accordance with FTA Circular 4220.1G or its successors. Assignment of options under this contract shall require the permission of all participating agencies.

SP 5 Payment

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

SP 5.1 Payment Terms

All payments shall be made as provided herein, less any amounts for liquidated damages in accordance with Section 6, “Special Conditions” subsection entitled “Liquidated Damages for Late Delivery of the Bus.”

The Agency shall make payments to the Contractor for buses at the times and in the manner set forth below.

Title to material included in any progress payment request shall pass to the Agency upon payment by the Agency. Said title shall be free of all encumbrances. However, such transfer of title shall not relieve the Contractor of its responsibility for the furnishing, installation, fabrication or inclusion of said materials as a deliverable element of buses procured in accordance with the requirements of the Contract. If FTA funds are being used, a post-delivery review must be completed before a bus title is transferred to the recipient, or before a bus is placed into revenue service, whichever is first.

Payments upon Acceptance / Delivery

The Agency shall make payments for buses at the unit prices itemized in the price schedule (with any required escalation added) within 45 calendar days after the delivery and acceptance of each bus and receipt of a proper invoice and the following:

Delivery and acceptance of all Contract deliverables, including manuals and other documentation required by the Contract, excluding training.

Contractor provision of any certifications as required by law and/or regulations.

Completion of post-delivery audits required under the Contract.

SP 5.2 Performance Guarantee

No liquid or surety Performance Guarantee is required, but the Contractor shall fulfill all obligations under the Contract.

SP 5.3 Escalation

Agency Bears Escalation Risk Until Production

The Agency shall bear the risk of escalation to the extent provided in this section. The price of each vehicle shall be the unit price in the Price Schedule increased by the ratio of the last preliminary price index published before the first vehicle is scheduled to be placed on the production line, according to a schedule mutually agreed by the parties and divided by the price index as of the award of the Contract.

The Index shall be the “Producer Price Index for Truck and Bus Bodies, Series No. 1413,” published by the U.S. Department of Labor, Bureau of Labor Statistics; or, if such index is no longer in use, then such replacement as is most comparable to the Index designated by the Bureau of Labor Statistics, or as agreed by the parties.

SP 5.4 Payment of Taxes

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

SP 6 Liquidated Damages for Late Delivery of the Bus

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 Agency will be damaged thereby. As the amount of said damages would be difficult, if not impossible, to be definitively ascertained and proven, it is hereby agreed that the amount of such damages due to the Agency shall be fixed at Two Hundred Fifty (\$250) dollars per operating day per bus, not delivered in substantially good condition, as inspected by the Agency at the time released for shipment.

The total amount of such liquidated damages shall not exceed 10% of the total Contract amount. If the total amount of the liquidated damages has reached this maximum, the Contractor shall not be relieved of any obligations under this Contract but shall continue to carry out and complete the work without delay.

The Contractor hereby agrees to pay the aforementioned amounts as fixed, agreed and liquidated damages, and not by way of penalty, to the Agency, and further authorizes the Agency to deduct the amount of the damages from money due the Contractor under the Contract, computed as aforesaid. If the money due the Contractor is insufficient, or no money is due the Contractor, then the Contractor shall pay the Agency the difference or the entire amount, whichever may be the case, within thirty (30) days after receipt of a written demand by the Contracting Officer.

The payment of aforesaid fixed, agreed and liquidated damages shall be in lieu of any damages for any loss of profit, loss of revenue, loss of use, or for any other direct, indirect, special or consequential losses or damages of any kind whatsoever that may be suffered by the Agency and arising at any time from the failure of the Contractor to fulfill the obligations referenced in this clause in a timely manner.

SP 7 Service and Parts

SP 7.1 Contractor Service and Parts Support

The Contractor shall state on the form “Contractor Service and Parts Support Data” which representatives are responsible for assisting the Agency.

All prices quoted for parts and parts cost computations in the proposal shall be free on board (FOB) destination prices, and parts shall be furnished to the Agency FOB destination.

SP 7.2 Documentation

The Contractor shall provide an electronic copy and two (2) printed current maintenance manual(s)—to include preventative maintenance procedures; diagnostic procedures or troubleshooting guides; major component service manuals; an electronic copy and two (2) printed current parts manual(s); and an electronic copy and two (2) printed standard operator’s manual(s)—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.

SP 7.3 Parts Availability Guarantee

The Agency and Contractor agree that the vehicles shall be designed and constructed to remain in service for twelve years.

Availability Guarantee

The Contractor hereby guarantees to provide, within reasonable periods of time, the spare parts, software and all equipment necessary to maintain and repair the buses supplied under this Contract for a period of at least twelve (12) years after the date of acceptance. Parts shall be interchangeable with the original equipment and shall be manufactured in accordance with the quality assurance provisions of this Contract. Prices shall not exceed the Contractor’s published catalog prices.

Where the parts ordered by the Agency are not received within two (2) working days of the agreed-upon time and date, and a bus procured under this Contract is out of service due to the lack of said ordered parts, then the Contractor shall provide the Agency, within eight (8) hours of the Agency’s verbal or written request, the original Suppliers’ and/or manufacturers’ part numbers, company names, addresses, telephone numbers and contact people’s names for all the specific parts not received by the Agency.

Where the Contractor fails to honor this parts guarantee, or parts ordered by the Agency are not received within thirty (30) days of the agreed-upon delivery date, then the Contractor shall provide to the Agency, within seven (7) days of the Agency’s verbal or written request, the design and manufacturing documentation for those parts

manufactured by the Contractor and the original Suppliers' and/or manufacturers' part numbers, company names, addresses, telephone numbers and contact people's names for all the specific parts not received by the Agency. The Contractor's design and manufacturing documentation provided to the Agency shall be for its sole use in regard to the buses procured under this Contract, and for no other purpose.

SP 7.4 Agency-Furnished Property

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

- The Agency shall furnish the equipment, goods or materials in a timely manner so as not to delay Contract delivery or performance dates. If Agency-furnished property is received in a condition not suitable for the intended use, then the Contractor shall promptly notify the Agency, detailing the facts, and at the Agency's expense repair, modify, return or take such other action as directed by the Agency. The parties may conduct a joint inspection of the property before the Contractor takes possession to document its condition.
- The Agency retains title to all Agency-furnished property. Upon receipt of the Agency-furnished property, the Contractor assumes the charge and care of the property and bears the risk of loss or damage due to action of the elements or from any other cause. The Contractor shall provide appropriate protection for all such property during the progress of the Work. Should any Agency-furnished equipment or materials be damaged, such property shall be repaired or replaced at the Contractor's expense to the satisfaction of the Agency. No extension of time will be allowed for repair or replacement of such damaged items. Should the Contractor not repair or replace such damaged items, the Agency shall have the right to take corrective measures itself and deduct the cost from any sums owed to the Contractor.

Warranty administration and enforcement for Agency-furnished equipment are the responsibility of the Agency, unless the parties agree to transfer warranty responsibility to the Contractor. In the event that equipment or other goods or materials are specified in the Technical Specifications to be furnished by the Agency to the Contractor for incorporation in the Work, the following provisions shall apply:

1. The Agency shall furnish the equipment, goods or materials in a timely manner so as not to delay Contract delivery or performance dates. If Agency-furnished property is received in a condition not suitable for the intended use, then the Contractor shall promptly notify the Agency, detailing the facts, and at the Agency's expense repair, modify, return or take such other action as directed by the Agency. The parties may conduct a joint inspection of the property before the Contractor takes possession to document its condition.
2. The Agency retains title to all Agency-furnished property. Upon receipt of the Agency-furnished property, the Contractor assumes the charge and care of the property and bears the risk of loss or damage due to action of the elements or from any other cause. The Contractor shall provide appropriate protection for all such property during the progress of the Work. Should any Agency-furnished equipment or materials be damaged, such property shall be repaired or replaced at the Contractor's expense to the satisfaction of the Agency. No extension of time will be allowed for repair or replacement of such damaged items. Should the Contractor not repair or replace such damaged items, the Agency shall have the right to take corrective measures itself and deduct the cost from any sums owed to the Contractor.
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.

SP 8 Federal Motor Vehicle Safety Standards

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

SP 9 Insurance

The Contractor shall maintain in effect during the term of this Contract, including any warranty period, at its own expense, at least the following coverage and limits of insurance:

- Statutory Workers Compensation and Employers Liability insurance and/or qualified self-insurance program covering Supplier's employees while on Agency property.
- Commercial General Liability Insurance:
 - Bodily Injury and Property Damage, including Contractual Liability covering the indemnification contained herein, \$10,000,000 combined single limits per occurrence, \$10,000,000 aggregate, where applicable.
 - Product Liability: \$5,000,000 per occurrence, for a period of five (5) years after acceptance of the last bus delivered under this Contract (product liability coverage may be effected through one or more excess liability policies).
- Automobile Liability Insurance: Bodily Injury and Property Damage, \$1,000,000 combined single limits per occurrence.



The Contractor shall deliver to the Agency, within ten (10) days after receiving Notice of Award of this Contract, evidence of the above. Prior to the expiration of any insurance during the time required, the Supplier shall furnish evidence of renewal to the Agency's Contract Administrator.

SP 10 Sustainability

The Agency recognizes that being sustainable (environmentally, economically and in terms of social responsibility) involves everyone, both internal and external to the Agency. The Agency expects its Contractors to have their own sustainability policies and programs in place and to provide services in line with the principles established therein. Implementation of sustainable practices may include maximizing the use of environmentally and socially responsible materials and services; using energy-efficient and non-polluting vehicles, equipment, and processes; and/or ensuring employee awareness of sustainability initiatives.

The Agency has a sustainability policy that includes a responsibility to make sure that all of its Contractors are informed of this policy. The Contractor will provide the Agency with a statement indicating that responsible parties have read and understand the Agency's sustainability policies and that it agrees to use reasonable efforts to conduct its work and operations in a manner that is consistent with them. In addition, the Contractor will provide the Agency with a copy of its corporate sustainability policy.

SP 11 Agency-Specific Provisions

No additional Agency-Specific Provisions.



SECTION 5: FEDERAL REQUIREMENTS

FR 1 Access to Records

The Contractor agrees to maintain all books, records, accounts and reports required under this Contract for a period of not less than three (3) 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 the Contractor agrees to maintain same until the Agency, the FTA Administrator, the Comptroller General of the United States or any of their duly authorized representatives have disposed of all such litigation, appeals, claims or exceptions related thereto. Reference 2 CFR 200.337 (a).

The following access-to-records requirements apply to this Contract.

FR 1.1 Local Governments

In accordance with 2 CFR 200.337 (a), the Contractor agrees to provide the Agency, the FTA Administrator, the Comptroller General of the United States, or any of their authorized representatives, access to any books, documents, papers and/or records of the Contractor that are directly pertinent to this Contract, for the purposes of making audits, examinations, excerpts and transcriptions. Contractor also agrees, pursuant to 49 CFR 633.17, to provide the FTA Administrator or their authorized representatives, including any PMO Contractor, access to the Contractor's records and construction sites pertaining to any major capital project (defined at 49 USC 5302(a)1), that is receiving federal financial assistance through the programs described at 49 USC 5307, 5309 or 5311.

FR 1.2 State Governments

In accordance with 49 CFR 633.17, the Contractor agrees to provide the Agency, the FTA Administrator or their authorized representatives, including any PMO Contractor, access to the Contractor's records and construction sites pertaining to a major capital project (defined at 49 USC 5302(a)1) that is receiving federal financial assistance through the programs described at 49 USC 5307, 5309 or 5311. By definition, a major capital project excludes contracts of less than the simplified acquisition threshold currently set at \$250,000.

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.

FR 2 Federal Funding, Incorporation of FTA Terms and Federal Changes

The preceding provisions include, in part, certain standard terms and conditions required by the U.S. Department of Transportation (USDOT), whether or not expressly set forth in the preceding Contract provisions. All contractual provisions required by the USDOT, as set forth in FTA Circular 4220.1G or its successors, are hereby incorporated by reference. Anything to the contrary herein notwithstanding, all FTA-mandated terms shall be deemed to control in the event of a conflict with other provisions contained in this agreement. The Contractor shall not perform any act, fail to perform any act, or refuse to comply with any Agency requests that would cause the Agency to be in violation of FTA terms and conditions.

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

FR 3 Federal Energy Conservation Requirements

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

FR 4 Civil Rights Requirements

The following requirements apply to the underlying Contract:

1. **Nondiscrimination:** In accordance with Title VI of the Civil Rights Act, as amended, 42 USC § 2000d; section 303 of the Age Discrimination Act of 1975, as amended, 42 USC § 6102; section 202 of the Americans with Disabilities Act of 1990, 42 USC § 12132; and federal transit law at 49 USC § 5332, the Contractor agrees that it will not discriminate against any employee or applicant for employment because of race, color, creed, national origin, sex, age or disability. In addition, the Contractor agrees to comply with applicable federal implementing regulations and other implementing requirements that the FTA may issue.
2. **Equal Employment Opportunity:** The following equal employment opportunity requirements apply to the underlying Contract:
 - a. **Race, Color, Creed, National Origin, Sex:** In accordance with Title VII of the Civil Rights Act, as amended, 42 USC § 2000e, and federal transit laws at 49 USC § 5332, the Contractor agrees to comply with all applicable equal employment opportunity requirements of U.S. Department of Labor (U.S. DOL) regulations, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor," 41 CFR Parts 60 *et seq.*, (which implement



Executive Order No. 11246, "Equal Employment Opportunity," as amended by Executive Order No. 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," 42 USC § 2000e note), and with any applicable federal statutes, executive orders, regulations and federal policies that may in the future affect construction activities undertaken in the course of the Project. The Contractor agrees to take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, creed, national origin, sex or age. Such action shall include, but not be limited to, the following: employment; upgrading; demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. In addition, the Contractor agrees to comply with any implementing requirements that the FTA may issue.

- b. **Age:** In accordance with section 4 of the Age Discrimination in Employment Act of 1967, as amended, 29 USC § 623 and federal transit law at 49 USC § 5332, the Contractor agrees to refrain from discrimination against present and prospective employees for reason of age. In addition, the Contractor agrees to comply with any implementing requirements that the FTA may issue.
 - c. **Disabilities:** In accordance with section 102 of the Americans with Disabilities Act, as amended, 42 USC § 12112, the Contractor agrees that it will comply with the requirements of U.S. Equal Employment Opportunity Commission, "Regulations to Implement the Equal Employment Provisions of the Americans with Disabilities Act," 29 CFR Part 1630, pertaining to employment of persons with disabilities. In addition, the Contractor agrees to comply with any implementing requirements that the FTA may issue.
3. The Contractor also agrees to include these requirements in each subcontract financed in whole or in part with federal assistance provided by the FTA, modified only if necessary to identify the affected parties.

FR 5 No Government Obligation to Third Parties

1. The Agency and Contractor acknowledge and agree that, notwithstanding any concurrence by the federal government in, or approval of the Solicitation or award of the underlying Contract, absent the express written consent by the federal government, the federal government is not a party to this Contract and shall not be subject to any obligations or liabilities to the Agency, Contractor or any other party (whether or not a party to that Contract) pertaining to any matter resulting from the underlying Contract.
2. The Contractor agrees to include the above clause in each subcontract financed in whole or in part with federal assistance provided by the FTA. It is further agreed that the clause shall not be modified, except to identify the Subcontractor who will be subject to its provisions.

FR 6 Program Fraud and False or Fraudulent Statements or Related Acts

1. The Contractor acknowledges that the provisions of the Program Fraud Civil Remedies Act of 1986, as amended, 31 USC §§ 3801 *et seq.* and U.S. DOT regulations, "Program Fraud Civil Remedies," 49 CFR Part 31, apply to its actions pertaining to this Project. Upon execution of the underlying Contract, the Contractor certifies or affirms the truthfulness and accuracy of any statement it has made, it makes, it may make or it 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 that the federal government deems appropriate.
2. The Contractor also acknowledges that if it makes, or causes to be made, a false, fictitious or fraudulent claim, statement, submission or certification to the federal government under a Contract connected with a project that is financed in whole or in part with federal assistance, originally awarded by FTA under the authority of 49 USC § 5307, the government reserves the right to impose the penalties of 18 USC § 1001 and 49 USC § 5307(n)(1) on the Contractor, to the extent the federal government deems appropriate.
3. The Contractor agrees to include the above two clauses in each subcontract financed in whole or in part with federal assistance provided by the FTA. It is further agreed that the clauses shall not be modified, except to identify the Subcontractor who will be subject to the provisions.

FR 7 Suspension and Debarment

This Contract is a covered transaction for purposes of 2 CFR Part 1200. As such, the Contractor is required to verify that none among the Contractor, its principals (as defined at 2 CFR 180.995) or its affiliates (as defined at 2 CFR 180.905) are excluded or disqualified (as defined at 2 CFR 180.935 and 180.940).

The Contractor is required to comply with 2 CFR Part 1200, Subpart C, and must include the requirement to comply with 2 CFR Part 1200, Subpart C, in any lower-tier covered transaction that 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 Agency. If it is later determined that the Bidder or Proposer knowingly rendered an erroneous certification, in addition to remedies



available to the Agency, the federal government may pursue available remedies, including but not limited to suspension and/or debarment. The Bidder or Proposer agrees to comply with the requirements of 2 CFR Part 1200, Subpart C, while this Proposal is valid and throughout the period of any Contract that may arise from this Proposal. The Bidder or Proposer further agrees to include a provision requiring such compliance in its lower tier covered transactions.

FR 8 Disadvantaged Business Enterprise (DBE)

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

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

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

FR 9 Clean Water Requirements

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

FR 10 Clean Air Requirements

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

FR 11 Compliance with Federal Lobbying Policy

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

FR 12 Buy America

The Contractor agrees to comply with 49 USC 5323(j) and 49 CFR Part 661, which provide that federal funds may not be obligated unless steel, iron and manufactured products used in FTA-funded projects are produced in the United States, unless a waiver has been granted by the FTA or the product is subject to a general waiver. General waivers are listed in 49 CFR 661.7.

A general public interest waiver from the Buy America requirements applies to microprocessors, computers, microcomputers, software or other such devices, which are used solely for the purpose of processing or storing data. This general waiver does not extend to a product or device that merely contains a microprocessor or microcomputer and is not used solely for the purpose of processing or storing data.

Separate requirements for rolling stock are set out at 49 USC 5323(j)(2)(C) and 49 CFR 661.11. Rolling stock must be final assembled in the United States and have 70% domestic content.

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



FR 13 Testing of New Bus Models

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

1. A manufacturer of a new bus model, or a bus produced with a major change in components or configuration, shall provide a copy of the final test report to the recipient at a point in the procurement process specified by the recipient, which will be prior to the recipient's final acceptance of the first vehicle.
2. A manufacturer who releases a report under paragraph 1 above shall provide notice to the operator of the testing facility that the report is available to the public.
3. If the manufacturer represents that the vehicle was previously tested, the vehicle being sold should have the identical configuration and major components as the vehicle in the test report, which must be provided to the recipient prior to the 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.

If the manufacturer represents that the vehicle is "grandfathered" (i.e., 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.

FR 14 Pre-Award and Post-Delivery Audits

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

1. **Buy America requirements:** The Contractor shall complete and submit a declaration certifying either compliance or noncompliance with Buy America. If the recommended Bidder/Proposer certifies compliance with Buy America, it shall submit documentation that lists (1) the component and subcomponent parts of the rolling stock to be purchased identified by the manufacturer of the parts, their country of origin and their percentage of costs; and (2) the location of the final assembly point for the rolling stock, including a description of the activities that will take place at the final assembly point and the cost of final assembly.
2. **Solicitation specification requirements:** The Contractor shall submit evidence that it will be capable of meeting the bid specifications.
3. **Federal Motor Vehicle Safety Standards:** The Contractor shall submit (1) a manufacturer's Federal Motor Vehicle Safety Standards (FMVSS) self-certification that the vehicle complies with relevant FMVSS, or (2) a manufacturer's certified statement that the contracted buses will not be subject to FMVSS regulations.

FR 15 Cargo Preference

The Contractor agrees to the following:

- To use privately owned U.S.-flag commercial vessels to ship at least 50% of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners and tankers) involved, whenever shipping any equipment, material or commodity pursuant to the underlying Contract, to the extent that 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 loading 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, D.C. 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.

FR 16 Fly America

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



FR 17 Contract Work Hours and Safety Standards Act

1. **Overtime requirements:** No Contractor or Subcontractor contracting for any part of the Contract Work that may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic, in any workweek in which they are employed on such Work, to work in excess of 40 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 40 hours in such a workweek.
2. **Violation; liability for unpaid wages; liquidated damages:** In the event of any violation of the clause set forth in paragraph 1 of this section, the Contractor and any Subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such Contractor and Subcontractor shall be liable to the United States for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph 1 of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of 40 hours without payment of the overtime wages as required by the clause set forth in paragraph 1 of this section.
3. **Withholding for unpaid wages and liquidated damages:** The Agency shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any monies payable on account of work performed by the Contractor or Subcontractor under any such contract or any other federal contract with the same Prime Contractor, or any other federally assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same Prime Contractor, such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or Subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph 2 of this section.
4. **Subcontracts:** The Contractor or Subcontractor shall insert in any subcontracts the clauses set forth in paragraphs 1 through 4 of this section and also a clause requiring the Subcontractors to include these clauses in any lower-tier subcontracts. The Prime Contractor shall be responsible for compliance by any Subcontractor or lower-tier Subcontractor with the clauses set forth in paragraphs 1 through 4 of this section.

SECTION 6: TECHNICAL SPECIFICATIONS

GENERAL

Scope

Technical specifications state requirements for heavy-duty transit buses and commuter coaches, which, by the selection of specifically identified alternative configurations, may be used for both suburban express service and general service on urban arterial streets. Buses shall have a minimum expected life of twelve (12) years or 500,000 miles, whichever comes first, and are intended for the widest possible spectrum of passengers, including children, adults, the elderly and people with disabilities.

Definitions

Ackerman Design: A geometric arrangement of linkages in the steering of a vehicle designed to solve the problem of wheels on the inside and outside of a turn needing to trace out circles of different radii.

Agency Operating Profile: The operational requirements under Agency-specific operating conditions that the bus must be able to achieve.

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

Ambient Temperature: The temperature of the surrounding air. For testing purposes, ambient temperature must be between 16 and 38 °C (50 and 100 °F).

Analog Signal: A continuously variable signal that is solely dependent upon magnitude to express information content.

Audible Discrete Frequency: An audible discrete frequency is determined to exist if the sound power level in any 1/3-octave band exceeds the average of the sound power levels of the two adjacent 1/3-octave bands by 4 decibels (dB) or more.

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

Battery Management System (BMS): Monitors energy, as well as temperature, cell or module voltages, and total pack voltage. The BMS adjusts the control strategy algorithms to maintain the batteries at uniform state of charge and optimal temperatures.

Battery Pack: An electrical equivalent of a collection of cells or modules or physical sub-packs forming the highest-level energy storage system. Often multiple physical sub-packs are connected in series, and these may also be connected in parallel.

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

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

Capacity (fuel container): The water volume of a container in gallons (liters).

Capacitor: A device that stores electrical energy in an electric field. It is a passive electronic component with two terminals.

Cell: Simplest discrete component of the energy storage system, such as a battery or a capacitor.

Charging Equipment: The equipment that encompasses all the components needed to convert, control and transfer electricity from the grid to the vehicle for the purpose of charging batteries. May include chargers, controllers, couplers, transformers, ventilation, etc. See *Electric Vehicle Supply Equipment (EVSE)*.

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

Charging Station: The location that houses the charging equipment connected to a utility's electric service to provide electricity to a vehicle's battery system through a charging interface.

Class A Voltage: Electric component or circuit with a maximum working voltage of less than 30 VAC (rms) or 60 VDC (ISO 6469-3), also referred to as "low voltage" (LV).

Class B Voltage: Electric component or circuit with a working voltage greater than 30 VAC (rms) and 60 VDC (ISO 6469-3), also referred to as “high voltage” (HV).

Code: A legal requirement.

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

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

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

dBa: Decibels with reference to 0.0002 microbar as measured on the “A” scale.

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

Diesel Exhaust Fluid (DEF): A solution of urea in water, used to reduce engine emissions of nitrogen oxides (NOx) in conjunction with a selective catalytic reduction system (SCR).

Default Configuration Bus: The bus described if no alternatives are selected. Signing, colors, the destination sign reading list and other information must be provided by the Agency.

Defueling: The process of removing fuel from a tank.

Defueling Port: A device that allows for vehicle defueling, or the point at which this occurs.

Design Operating Profile: The operational requirements under standard operating conditions that the bus must be able to achieve.

Destroyed: Physically made permanently unusable.

Discrete Signal: A signal that can take only predefined values, usually of a binary 0 or 1 nature, where 0 is battery ground potential and 1 is a defined battery positive potential.

DPF: Diesel particulate filter.

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

Electrical Pack: See *Battery Pack*.

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

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

Energy Density: The relationship between the weight of an energy storage device and its power output in units of watt-hours per kilogram (Wh/kg).

Energy Storage 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.

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

Fire-Resistant: Materials that have a flame spread index less than 150 as measured in a radiant panel flame test per ASTM-E 162-90.

Fireproof: Materials that will not burn or melt at temperatures less than 2000 °F.

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

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

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

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

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

Generator (Electric): A device that converts mechanical energy into electrical energy.

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

Gross Load: 150 lb for every designed passenger seating position, for the driver, and for each 1.5 sq.ft of free floor space.

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

Gross Vehicle Weight Rated (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.

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

High Voltage (HV): Electric component or circuit with a working voltage greater than 30 VAC (rms) and 60 VDC (ISO 6469-3), also referred to as “Class B voltage.”

Hose: A flexible line.

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

Hybrid System Controller (HSC): Regulates energy flow throughout hybrid system components in order to provide motive performance and accessory loads, as applicable, while maintaining critical system parameters (voltages, currents, temperatures, etc.) within specified operating ranges.

Hybrid Drive System: The mechanical and/or electromechanical components, including the engine, traction motors and energy storage system, that comprise the traction drive portion of the hybrid propulsion system.

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

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

Labeled: Equipment or materials to which has been attached a label, symbol or other identifying mark of an organization, which is acceptable to the authority having jurisdiction and concerned with product evaluation, which maintains periodic inspection of production labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

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

Line: Any tube-- flexible and hard -- that carries fluids.

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

Local Regulations: Regulations below the state level.

Low-Floor Bus: A bus that, between at least the front (entrance) and rear (exit) doors, has a floor sufficiently low and level so as to remove the need for any steps.

Low Voltage (LV): Electric component or circuit with a maximum working voltage of less than 30 VAC (rms) or 60 VDC (ISO 6469-3), also referred to as “Class A voltage.”

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

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

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

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

Module: A collection of cells forming a physical and electrical subassembly contained within an enclosure.

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

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

Nameplate Capacity (or Nominal Capacity): The total amount of energy available between 0% state of charge (SoC) and 100% SoC.

Non-Drive Axle: a drive axle without the drive gear with a load rating sufficient for the load to GVWR.

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

Pack: A collection of cells or modules described on the basis of electrical or physical attributes, to include *Battery Pack* and *Physical Pack*.

Physical Layer: The first layer of the seven-layer International Standards Organization (ISO) Open Systems Interconnect 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.

Physical Pack: An enclosure consisting of a collection of cells or modules at a location or multiple locations. Physical packs differ from battery packs, as they are defined by layout rather than electrical equivalent.

Pipe: Nonflexible line.

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

Power: Work or energy divided by time.

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

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

Ramp: A device deployed by the bus operator to enable riders with disabilities, including wheeled mobility device users, to board and alight at a 1:6 maximum slope.

Real-Time Clock: Computer clock that keeps track of the current time.

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

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

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

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

Seated Load: 150 lb for every designed passenger seating position and for the driver.

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

Serial Data Signals: A current loop-based representation of ASCII or alphanumeric data used for transferring information between devices by transmitting a sequence of individual bits in a prearranged order of significance.

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

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

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

Sources of Ignition: Devices or equipment that because of their modes of use or operation, are capable of providing sufficient thermal energy to ignite flammable compressed natural gas–air mixtures when introduced into such a mixture, or when such a mixture comes into contact with them.

Special Tools: Tools manufactured or customized for a specific purpose applicable to work associated with the vehicle and not commercially available off the shelf from sources such as a hand tool vendor.

Specification: A particular or detailed statement, account or listing of the various elements, materials, dimensions, etc. involved in the manufacturing and construction of a product.

Square Cubic Foot: A standard cubic foot defines an amount of gas contained in a volume of 1 cubic foot at standard temperature and pressure.

Standard: A firm guideline from a consensus group. Standards referenced in Section 6, “Technical Specifications” are the latest revisions unless otherwise stated.

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

State of Charge (SoC): Quantity of electric energy remaining in the battery relative to the maximum rated amp-hour (Ah) capacity of the battery expressed in 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.

Stress Loops: The “pigtailed” commonly used to absorb flexing in piping.

Structure: The basic body, including floor deck material and installation, loadbearing external panels, structural components, axle mounting provisions, suspension beams and attachment points.

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

Traction Control System (TCS): Typically (but not necessarily) a secondary function of the electronic stability control (ESC) designed to prevent loss of traction (i.e., wheel spin) of the driven road wheels. TCS is activated when throttle input and engine power and torque transfer are mismatched to the road surface conditions.

Transit Vehicle Manufacturer: As defined by the FTA, any manufacturer whose primary business purpose is to build vehicles specifically for public mass transportation.

Useable Capacity: Nameplate Capacity × Allowable Depth of Discharge (for example, 95%).

Valve: A device or natural object that regulates, directs or controls the flow of a fluid (gases, liquids, fluidized solids or slurries) by opening, closing or partially obstructing various passageways.

Warrantable End of Life (WEOL): A measure of battery degradation determined as the point at which the batteries can no longer provide the energy or power required to meet the design operating profile. It is expressed as a percentage of remaining battery capacity as compared with 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.

Wheeled Mobility Device: A mobility aid belonging to any class of three- or four-wheeled devices, usable indoors or outdoors, designed for and used by individuals with mobility impairments, whether operated manually or powered. A “common wheeled mobility device” is such a device that does not exceed 30 in width and 48 in length measured 2 in above the ground, and does not weigh more than 600 lb when occupied.

Zero-Emission Vehicle: A vehicle that emits no tailpipe emissions from the onboard source of power.

TS 1 Referenced Publications

The documents or portions thereof referenced within this specification shall be considered part of the requirements of the specification. The edition indicated for each referenced document is the current edition, as of the date of the issuance of this specification. The Contractor is responsible for complying with current referenced documents.

Any inconsistency in compliance with this Technical Specification and its referenced documents shall be resolved by giving precedence in the following order:

- Federal requirements (Title 49 CFR, FMVSS, etc.)
- State requirements (ex. G.S. Chapter 20)
- Local requirements
- Technical content of this Technical Specification section
- Referenced standards, practices and codes (APTA, SAE, ASTM, UL, ISO, etc.)

As an attachment to this RFP, CER 9.3 identifies the specifications, standards, regulations and references used within the RFP. The form must be returned with a proposal and requires an indication of the state of compliance and an opportunity for listing other pertinent references. Please indicate “compliance” as full, partial or N/A (not applicable). If “partial” or “N/A,” please describe.

TS 2 Legal Requirements

The Contractor shall comply with all applicable federal, state and local regulations. These shall include but not be limited to the Americans with Disabilities Act (ADA), as well as state and local accessibility, safety and security requirements. Local regulations are defined as those below the state level.

Buses shall meet all applicable Federal Motor Vehicle Safety Standards (FMVSS) regulations and shall accommodate all applicable Federal Motor Carrier Safety Administration (FMCSA) regulations in effect at the location of the Agency and the date of manufacture. Unless stated otherwise, any forecasted regulatory changes are not to be considered for this procurement.

In the event of any conflict between the requirements of this specification and any applicable legal requirement, the legal requirement shall prevail. Technical requirements that exceed the legal requirements are not considered to conflict.

TS 3 Overall Requirements

The Contractor shall ensure that the application and installation of major bus subcomponents and systems are compliant with all such subcomponent vendors’ requirements and recommendations. Contractor and Agency shall identify subcomponent vendors that shall submit installation/application approval documents with the completion of a pilot or lead bus. Components used in the vehicle shall be of heavy-duty design and proven in transit service.

TS 3.1 Weight

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

Buses at gross vehicle weight (GVW) shall not exceed the tire factor limits, brake test criteria, structural design criteria or the gross vehicle weight rating (GVWR).

TS 3.2 Capacity

The vehicle shall be designed to operate at gross load, which shall not exceed the bus GVWR nor any individual GAWR.

TS 3.3 Service Life

The minimum useful design life of a heavy-duty bus in transit service shall be at least 12 years or 500,000 miles. It shall be capable of operating at least 40,000 miles per year, including the 12th year.

TS 3.4 Maintenance and Inspection

Scheduled maintenance tasks for buses shall be related and shall be in accordance with the manufacturer’s recommended preventive maintenance schedule (along with routine daily service performed during the servicing). The overall PM schedule for buses shall be based upon a minimum of a 6000 mi interval and/or multiples of same.

The 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.

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

The Offeror shall give prime consideration to the routine problems of maintaining the vehicle. All vehicle components and systems, both mechanical and electrical, that will require periodic physical work or inspection processes, shall be installed so that a minimum of time is consumed in gaining access to the critical repair areas. It shall not be necessary to disassemble portions of the bus structure and/or equipment, such as seats and flooring under seats, in order to gain access to these areas. Each bus shall be designed to facilitate disassembly, reassembly, servicing or maintenance, using tools and equipment normally available as standard commercial items.

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

The Contractor shall provide an itemized list of all special tools and pricing for maintaining this equipment as a supplement to the Pricing Schedule.

Tools such as compartment door keys, bellows gauges, and other tools required for daily maintenance and inspection shall not be included in the special tools list and shall be furnished for each bus.

TS 3.5 Interchangeability

Unless otherwise agreed, to the maximum extent possible, all units and components procured under this Contract, whether provided by Suppliers or manufactured by the Contractor, shall be duplicates in design, manufacture and installation to ensure interchangeability among buses in each order group or production run in this procurement. This interchangeability shall extend to the individual components, as well as to their locations in the buses. These components shall include, but are not limited to, passenger window hardware, interior trim, lamps, lamp lenses and seat assemblies. Components with non-identical functions shall not be, or appear to be, interchangeable.

Any one component or unit used in the construction of these buses shall be an exact duplicate in design, manufacture and assembly for each bus in each order group in this Contract. Contractor shall identify and secure approval for any changes in components or unit construction provided within a Contract that has a different fit, form or function.

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

Regulatory changes may impact Manufacturer's ability to maintain interchangeability for a production run or order, including options, and are outside the control of the Manufacturer. Manufacturer will inform the customer of any impacts of regulatory changes.

TS 3.6 Training

The Contractor shall provide visual and other teaching aids (such as manuals, training mock-ups [if required], slide presentations, and literature) for use by the Agency's own training staff, which become the property of the Agency.

The Contractor shall price on-site training as an itemized option. Training shall not be included in the base price of the vehicle.

All Agencies – No Requirements for mock-up board.

LINK Transit Option– A mock-up board, where key components of the multiplexing system are replicated on a functional model, shall be provided as a tool for diagnostic, design verification and training purposes. If required, the mock-up board should be priced separately in the Pricing Schedule.

TS 3.6.1 Technical/Service Representatives

The Contractor shall, at its own expense, have one or more competent technical service representatives available on request to assist the Agency in the solution of engineering or design problems within the scope of the specifications that may arise during the warranty period. This does not relieve the Contractor of responsibilities under the provisions of Section 7, "Warranty Requirements."

TS 3.7 Operating Environment

The bus shall be capable of satisfying the requirements of this specification while operating in ambient temperature ranges of 10 to 115 °F, at relative humidity between 5% and 100%, and at altitudes up to 3000 ft above sea level. Degradation of performance due to atmospheric conditions shall be minimized at temperatures below 10 °F, above 115 °F or at altitudes above 3000 ft. Speed, gradeability and acceleration performance requirements shall be met at, or corrected to, 77 °F, 29.31 inHg, dry air per SAE J1995.Noise

The Contractor is expected to meet the interior and exterior noise requirements specified in TS 5.8.1, “Interior Noise”, and TS 5.8.2, “Exterior Noise”. Furthermore, it shall be a design goal to minimize noise. Component layout and packaging, material selection, and build quality shall reflect that goal.

TS 3.8 Noise

TS 3.8.1 Interior Noise

The combination of inner and outer panels and any material used between them shall provide sufficient sound insulation so that a sound source with a level of 80 dBA measured at the outside skin of the bus shall have a sound level of 65 dBA or lower at any point inside the bus, except in proximity to passenger door brush seals. These conditions shall prevail with all openings, including doors and windows, closed and with the propulsion/drive system and accessories switched off.

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.

TS 3.8.2 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 shall comply with the exterior noise requirements defined in local laws and ordinances identified by the Agency and SAE J366.

TS 3.8.3 Fire Safety

The bus shall be designed and manufactured in accordance with all applicable fire safety and smoke emission regulations.

TS 3.8.4 Materials

PART, High Point Transit, Link Transit

All materials used in the construction of the passenger compartment of the bus shall be in accordance with the Recommended Fire Safety Practices defined in FMVSS 302.

WSTA

All materials used in the construction of the passenger compartment of the bus shall be in accordance with the Recommended Fire Safety Practices defined in FTA Docket 90-A, dated October 20, 1993. Materials entirely enclosed from the passenger compartment, such as insulation within the sidewalls and subfloor, need not comply. In addition, smaller components and items, such as seat grab rails, switch knobs, small light lenses, door seals, window seals, steering wheel, steering column and escape hatches shall be exempt from this requirement.

TS 3.9 Fire Suppression

All Agencies – Base

The bus shall have a fire suppression system in areas requested by the Agency and installed per system manufacturer’s recommendations.

Link Transit, WSTA – Option

The bus shall be equipped with a suitable means of automatically detecting and extinguishing fires and/or overtemperature situations that may cause unreliable or unsafe operation. If a combustible gas is used as a fuel source, then this same system shall incorporate an integrated gas detection and alarm feature. This system shall employ intrinsically safe detectors capable of reliable operation, alert and shutdown to ensure safe operation. Gas alerts shall occur at a trace level (approximately 20% of the lower flammability limit) and at a significant level (approximately 50% of the lower flammability limit). Shutdowns shall occur at a significant gas alert level. This system shall be connected to an uninterruptable power source and remain uninterrupted regardless of “run”/“ign” position of the vehicle. The quantity, location and technology for sensors, suppression, agents, etc. shall be best practice for the intended application and environment. Fire suppression piping located in the immediate area(s) being protected

shall be fireproof and capable of surviving gross thermal events. The subject piping shall include the flow path between the fire suppression bottle and nozzles, with metalized rigid/flexible stainless steel preferred.

TS 3.10 Respect for the Environment

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

The Contractor shall provide a plan for reuse or recycling of replaced battery cells, modules and/or physical packs.

TS 4 Physical Size

With exceptions such as exterior mirrors, marker and signal lights, fender skirts, washers, wipers, ad frames, cameras, object detection systems, bicycle racks, feelers, and rubrails, the bus shall have the overall dimensions specified in the following sections, using **Figure 1** as a reference, at static conditions and design height.

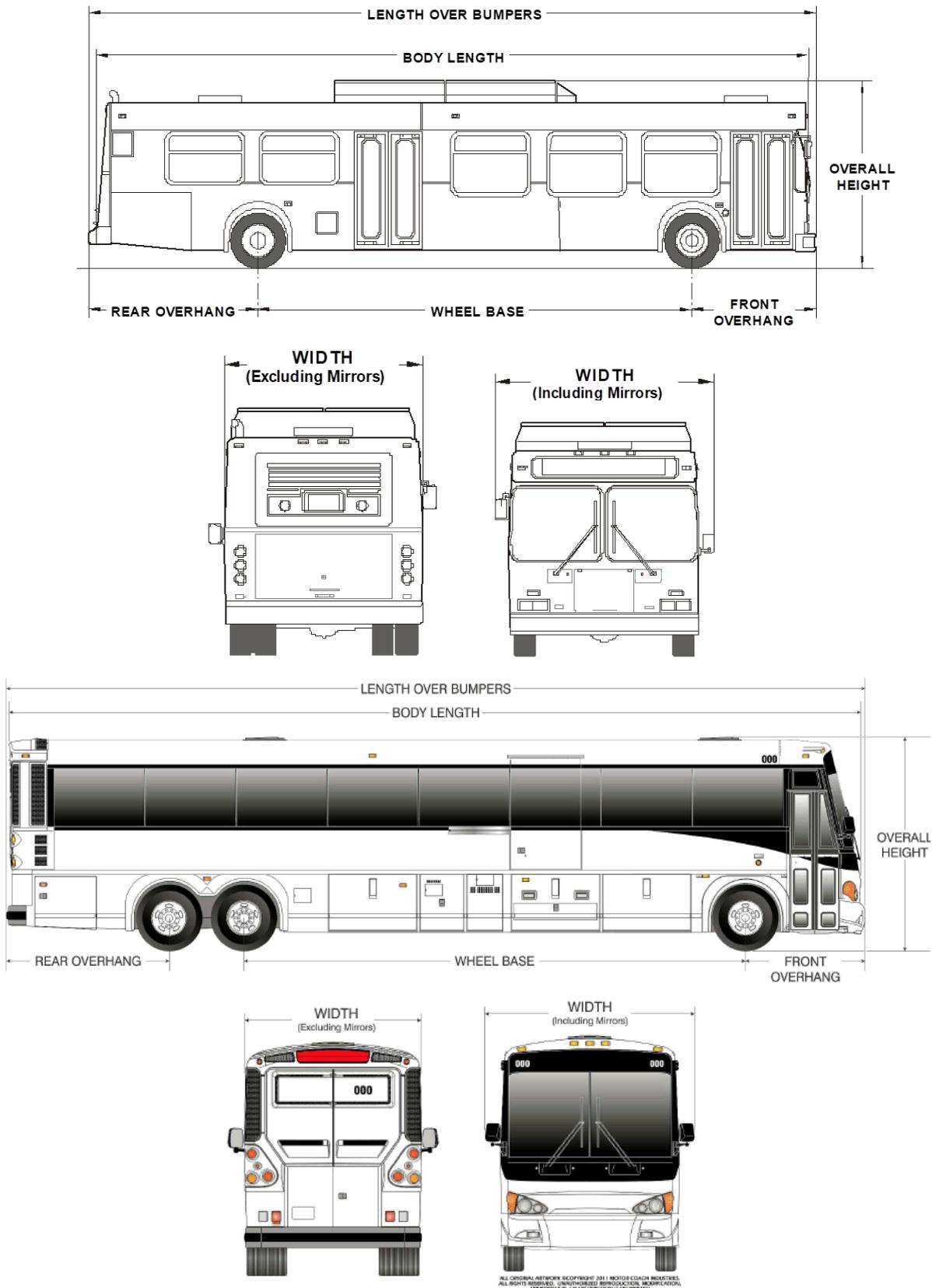
TS 4.1 Bus Length

For ease of use, the following tolerances will be allowable for each given bus length. Bus length is determined as the measurement from bumper to bumper.

- **30 ft bus:** less than or equal to 30 ft
- **35 ft bus:** 30 ft 1 in. to 39 ft, 11 in.
- **40 ft bus:** 40 ft to 44 ft, 11 in.

TS 4.2 Bus Width

FIGURE 1
Transit Bus Exterior Dimensions



TS 4.2.1 Transit Coach

PART, High Point Transit, WSTA – Base

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

Link Transit – Base

96 in. Width Bus
Body width shall be 96 in. (+0, -1 in.).

Link Transit – Option

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

TS 4.3 Bus Height

Maximum Overall Height

Maximum overall height shall be 140 in., including all rigid, roof-mounted items such as A/C, antenna arrays, exhaust, fuel system and cover, etc.

TS 4.4 Underbody Clearance

The bus shall maintain the minimum clearance dimensions as defined and shown in Figure 22 of SAE J1100, regardless of load up to the gross vehicle weight rating.

TS 4.5 Ramp Clearances

The approach angle is the angle measured between a line tangent to the front tire static loaded radius arc and the initial point of structural interference forward of the front tire to the ground.

The departure angle is the angle measured between a line tangent to the rear tire static loaded radius arc and the initial point of structural interference rearward of the rear tire to the ground.

The breakover angle (see **Table 2**) is the angle measured between two lines tangent to the front and rear tire static loaded radius and intersecting at a point on the underside of the vehicle that defines the largest ramp over which the vehicle can roll.

TABLE 2
 Breakover Angle – Approach and Departure

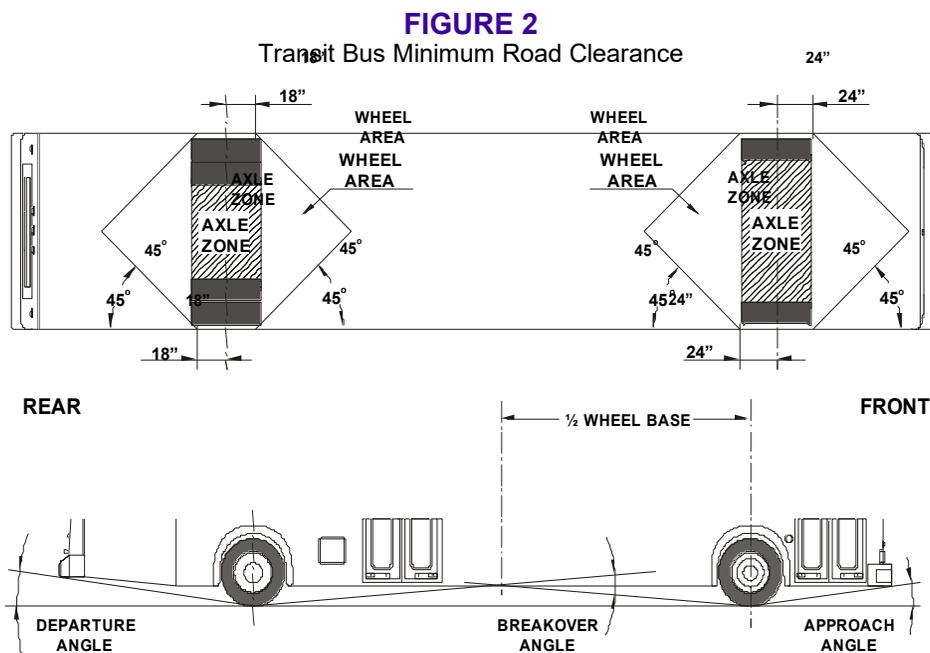
Angle	30 to 45 ft Bus (Default)
Approach	8.6 deg (min.)
Front breakover	8 deg (min.)
Rear breakover (60-ft articulated only)	N/A
Departure	8.6 deg (min.)

TS 4.6 Ground Clearance

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

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

Wheel area clearance shall be no less than 8 in. for parts fixed to the bus body and 6 in. for parts that move vertically with the axles. See **Figure 2**.



TRANSIT BUS MINIMUM ROAD CLEARANCE



TS 4.7 Floor Height

TS 4.7.1 Transit Coach

Height of the step above the street shall be no more than 16 in. 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 specified installed tires.

A maximum of two steps are allowed to accommodate a raised aisle floor in the rear of the bus.

TS 4.7.2 Interior Headroom

Headroom above the aisle and at the centerline of the aisle seats shall be no less than 76.75 in. in the forward half of the bus, tapering to no less than 74 in. forward of the rear settee. At the centerline of the window seats, headroom shall be no lower than 65 in., except for parcel racks and reading lights, if specified. Headroom at the back of the rear bench seat may be reduced to a minimum of 56 in., but it shall increase to the ceiling height at the front of the seat cushion. In any area of the bus directly over the head of a seated passenger and positioned where a passenger entering or leaving the seat is prone to strike their head, padding shall be provided on the overhead paneling.

TS 5 Power Requirements

The system shall be sized to provide sufficient power to enable the bus to meet the defined acceleration, top speed, route, mileage, GVWR and gradeability requirements, while operating all accessories. This shall be verified using actual road test results and/or simulated 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.

TS 5.1 Top Speed

High Point Transit, Link, WSTA – Base

The bus shall be capable of achieving a top speed of **65 mph** on a straight, level road at a weight equal to the bus GVWR with all accessories operating. Manufacturer shall supply the Agency with data if there is a variance between peak performance and sustained vehicle performance.

PART – Base

The bus shall be capable of achieving a top speed of **70 mph** on a straight, level road at a weight equal to the bus GVWR with all accessories operating. Manufacturer shall supply the Agency with data if there is a variance between peak performance and sustained vehicle performance.

Link Transit – Option

The bus shall be capable of achieving a top speed of **75 mph** on a straight, level road at a weight equal to the bus GVWR with all accessories operating. Manufacturer shall supply the Agency with data if there is a variance between peak performance and sustained vehicle performance.

TS 5.2 Startability and Gradeability

Startability and 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 enable the bus to start from a full stop and achieve and maintain a speed of 40 mph on a 2.5% ascending grade continuous and 10 mph on a 10% ascending grade continuous. Unless otherwise noted, values are assumed to be sustained. Manufacturer shall supply Agency with data if there is a variance between peak performance and sustained vehicle performance.

TS 5.3 Acceleration

The acceleration shall meet the requirements in **Table 3**, regardless of propulsion type. Acceleration measurement shall commence when the accelerator is depressed. The maximum, instantaneous acceleration rate of the vehicle shall never exceed 0.130g. The rate of change of acceleration (jerk) shall be minimized throughout the acceleration/deceleration range and shall never exceed 0.30 g/s. This requirement shall be achieved regardless of operator action.

TABLE 3Maximum Start Acceleration Times on a Level Surface¹

Speed (mph)	Maximum time (seconds)
10	5
20	10
30	18
40	30
50	60
Top speed	

1. Vehicle weight = GVWR

Link – Alternative

The Contractor shall provide performance scans to the Agency based on the Agency’s specific drivetrain configuration.

High Point Transit, WSTA – Alternative

The system shall be programmable to allow optimization of acceleration and deceleration rate. Performance may be affected when reprogramming. The manufacturer shall supply the new performance data.

TS 5.4 Operating Range

The operating range of the coach shall be designed to meet the operating profile as stated in Section TS 8.

The operating range of any heavy-duty bus, regardless of fuel system, when run on the FTA cycle shall be at least 350 miles or 20 hours when starting with a full fuel tank.

TS 6 Fuel Economy/Range and Design Operating Profile

The bus must be able to achieve operational requirements under standard operating conditions and in Agency-specific conditions. These conditions make up the design operating profile. The standard operating conditions are defined by the Bus Research Testing Center at Altoona, Pennsylvania (“Altoona”), and are used as a benchmark and as a means to compare the performance of various buses across a standard. The Agency-specific conditions are established to ensure that the bus will be able to meet the unique operational requirements of the Agency.

TS 6.1 Altoona Fuel Economy Tests

The Altoona Energy Economy and Range Test for buses is an energy consumption and range test for battery electric buses under Altoona’s pass/fail procedures. Buses are tested using the Manhattan cycle (a low average speed, highly transient urban cycle), the Orange County cycle (consists of urban and highway driving segments), and the EPA HD-UDDS cycle test results from the Energy Economy and Range Test or other applicable test procedures. Results shall include vehicle configuration and test environment information. Energy economy data shall be provided for each duty cycle.

TS 7 Engine**TS 7.1 Engine Heavy-Duty Bus (Diesel)**

The engine shall comply with applicable local, state and/or federal emissions and useful life requirements. The engine shall have a design life of not less than 300,000 miles without replacement or major service. The lifetime estimate is based on the design operating profile.

The engine shall be a Cummings ISL 280 H.P. diesel or approved equal and equipped with an electronically controlled management system, compatible with either 12 or 24 V power distribution. The engine control system shall be capable of transmitting and receiving electronic inputs and data from other drivetrain components and broadcasting that data to other vehicle systems. Communication between electronic drivetrain components and other vehicle systems shall be made using the communication networks. The engine’s electronic management system shall monitor operating conditions and provide instantaneous adjustments to optimize both engine and bus performance. The system shall be programmable to allow optimization of programmable features.

The engine starting system shall be protected by an interlock that prevents its engagement when the engine is running. Special equipment or procedures may be employed to start the bus when exposed to temperatures lower than 30 °F (–1 °C) for a minimum of four hours without the engine in operation. All cold-weather starting aids, engine heating devices and procedures shall be of the type recommended by the engine manufacturer and

approved by the Agency. The integration of all systems on the vehicle relative to engine idle speed shall be the responsibility of the vehicle manufacturer to meet the requirements of the transit property.

The engine control system shall protect the engine against progressive damage. The system shall monitor conditions critical for safe operation and automatically derate power and/or speed and initiate engine shutdown as needed. A

Automatic Engine Protection/Shutdown Override Feature

A control shall be available to the operator/driver that when constantly depressed and released will delay the engine shutdown or allow the bus to be moved. Override action shall be recorded. This data shall be retrievable by the Agency.

TS 7.2 Not Used

TS 7.3 Propulsion System (Hybrid or Battery Electric)

TS 7.3.1 Propulsion System Description (Hybrid Only)

The bus shall be powered by a hybrid propulsion system. The vehicle manufacturer shall ensure that the bus structure can successfully accept the installation of the propulsion system and be operated on the stated duty cycle for a period of 12 years without a structural failure. At a minimum, the propulsion system shall comply with applicable local, state and/or federal emissions and useful life requirements.

The hybrid drive system shall be rated for the GVWR or greater of the bus.

Labels should be posted on high-voltage devices to identify them as components containing high-voltage potential. These labels shall be applied in such a way that they can be seen when access doors are opened or closed, so as to protect both emergency and maintenance personnel.

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, an 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. Proposer is required to provide a list of applicable industry standards that the proposed propulsion system meets.

TS 7.3.2 Not Used

TS 7.3.3 Propulsion System Service

The propulsion system shall be arranged so that accessibility for all routine maintenance is ensured. No special tools, other than dollies and hoists, shall be required to remove the propulsion system or any subsystems. The Agency recognizes that properly rated test equipment and safe electrical work practices are essential when servicing high-voltage components. The Contractor shall identify safe electrical work practices that are essential when servicing high-voltage components. The Contractor shall provide all specialty tools and diagnostic equipment required for maintaining the propulsion system in accordance with the Special Tools List.

TS 7.3.4 Not Used

TS 7.3.5 Propulsion System Controller (PSC)

The PSC regulates energy flow throughout hybrid or electric system components in order to provide motive performance, accessory loads and load-shedding, 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.

Energy storage system SoC correction methods stated in SAE J2711 shall be used (for all-electric or hybrid only.)

PSC shall comply with Technical Specifications subsection, "Load-shedding and De-rating (Battery Electric Bus)" for the HVAC system.

TS 7.3.6 Engine (Hybrid Only)

The engine and related emission systems shall meet all applicable emissions and design/durability guidelines and standards.

The Contractor shall provide the Agency with expected durability of the engine and related emission systems.

Link, WSTA – Base

Supplier shall recommend power plant.



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

The engine shall have onboard diagnostic capabilities, be able to monitor vital functions, store out-of-parameter conditions in memory, and communicate faults and vital conditions to service personnel. Diagnostic reader device connector ports, suitably protected against dirt and moisture, shall be provided in the operator's area and near or inside the engine compartment. The onboard diagnostic system shall inform the operator via visual and/or audible alarms when out-of-parameter conditions exist for vital engine functions.

The engine starting system shall be protected by an interlock that prevents its engagement when the engine is running. Special equipment or procedures may be employed to start the engine when exposed to temperatures less than 30 °F (-1 °C) for a minimum of four hours without the engine in operation. All cold-weather starting aids, engine heating devices and procedures shall be of the type recommended by the engine manufacturer and approved by the Agency.

Automatically Activated Fast Idle as Required

The hybrid control system shall automatically manage engine speed as required to maintain optimum operation of all accessories, proper SoC and maximize fuel efficiency.

TS 7.4 Charge Air Piping

Charge air piping and fittings shall be designed to minimize air restrictions and leaks. Piping shall be as short as possible, and the number of bends shall be minimized. Bend radii shall be maximized to meet the pressure drop and temperature rise requirements of the engine manufacturer. The cross-section of all charge air piping shall not be less than the cross-section of the intake manifold inlet. Any changes in pipe diameter shall be gradual to ensure a smooth passage of air and to minimize restrictions. Piping shall be routed away from heat sources as practicable and shielded as required to meet the temperature rise requirements of the engine manufacturer.

Charge air piping shall be constructed of stainless steel, aluminized steel, or anodized aluminum rated at minimum 1000 hours of salt spray according to ASTM B117, except between the air filter and turbocharger inlet, where piping may be constructed of flexible, heat-resistant material. Connections between all charge air piping sections shall be sealed with a short section of reinforced hose and secured with stainless steel constant tension clamps that provide a complete 360 deg seal.

TS 8 Cooling Systems

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. The Contractor 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. The Contractor 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.

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 during operation. Thermal management shall be continuously monitored during all periods of charge and discharge with appropriate safety interlocks installed to react to adverse conditions.

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

In the event of a failure of the battery thermal management system (BTMS) subsequently resulting in battery temperature outside the allowable limits, the BMS shall limit, in a manner appropriate to the situation, the operation of the bus including charging. A diagnostic indicator shall accompany any BTMS failure.

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

TS 8.1 Component Thermal Management

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

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 the motor area 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 of TS 9.1.

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

High Point Transit, Link – Base

A means of determining satisfactory component coolant level shall be provided.

PART, WSTA – Base

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.

All Agencies – Base

The head exchanger shall be of durable, corrosion-resistant construction.

TS 8.1.1 Radiator Screen

The radiator input shall be protected by an easily cleanable screen designed to collect large debris. The radiator and charge air cooler cores shall be easily cleaned (to include engine side core surface) with standard pressure-washing equipment.

TS 8.1.2 Coolant

Coolant shall be compliant with the thermal management system manufacturer's requirements.

TS 8.1.3 Drive Design

- **Standard control and drive design:** Control and drive of the radiator and charge air cooler fan(s) shall be the Contractor's standard design.
- **Electric fans:** The bus shall be equipped with an electric fan drive bus cooling system, including fan reversal (automatic at system start) as well as maintenance switch.

TS 8.1.4 Mounting

Standard Mounting Design

Mounting location of radiator and charge air cooler shall be the Contractor's standard design.

TS 8.2 Charge Air Cooling

The charge air cooling system, also referred to as after-coolers or inter-coolers, shall provide maximum air intake temperature reduction with minimal pressure loss. The charge air radiator shall be sized and positioned to meet engine manufacturer's requirements. The charge air radiator shall not be stacked ahead of or behind the engine radiator and shall be positioned as close to the engine as possible unless integrated with the radiator. Air ducting and fittings shall be protected against heat sources and shall be configured to minimize restrictions and maintain sealing integrity.

TS 8.3 Transmission Cooling

If a transmission is present in the bus, the transmission shall be cooled by a heat exchanger sized to maintain operating fluid within the transmission manufacturer's recommended parameters of flow, pressure and temperature. Where applicable, the transmission cooling system shall be matched to the retarder and engine cooling systems to ensure that all operating fluids remain within recommended temperature limits established by each component manufacturer. Where applicable, the engine cooling system should provide coolant bypass flow to the transmission cooling system with the engine thermostats closed.

TS 9 Transmission

The transmission shall be Allison B-400R, latest GEN with multiple speed, automatic shift with torque converter, retarder and electronic controls or approved equal. If multiple-speed transmission is used, the transmission shall be automatic shift with torque converter, retarder and electronic controls. Gross input power, gross input torque and rated input speed shall be compatible with the propulsion system. The transmission shall be designed to operate for not less than 300,000 miles on the design operating profile without replacement or major service. The transmission should be easily removable without disturbing the engine and accessible for service.

The electronic controls shall 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 communication networks. Electronic

controls shall be compatible with either 12 or 24 V power distribution, provide consistent shift quality, and compensate for changing conditions, such as variations in vehicle weight and engine or motor power. At a minimum, drivetrain components consisting of the motor(s), motor inverter(s), engine, transmission, retarder, TCS and anti-lock braking systems shall be powered by a dedicated and isolated ignition supply voltage to ensure that data communication among components exists when the vehicle ignition is switched to the “on” position.

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

An electronic transmission fluid level monitoring and protection system shall be provided.

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

No Automatic Neutral Function

The transmission shall not incorporate an automatic neutral shift function.

TS 10 Hydraulic Retarder (Transit Coach)

The powertrain shall be equipped with a retarder designed to extend brake lining service life. The application of the retarder shall cause a smooth blending of both retarder and service brake function and shall not activate the brake lights.

Actuation of antilock braking system (ABS) and/or automatic traction control (ATC) shall override the operation of the brake retarder.

Brake lights shall not illuminate when the retarder is activated.

Standard Requirement for Retarder Activation

The retarder shall be adjustable within the limits of the powertrain and activated when the brake pedal is depressed. The Agency will work with the OEM/drive system manufacturer to determine retarder performance settings.

Accessible Retarder Disable Switch

The retarder disable switch shall be accessible to the seated driver.

TS 10.1 Additional Hybrid Acceleration Requirements (Hybrid or Battery Electric)

Braking application and performance shall remain consistent across the highest possible range of battery system SoC or other variances related to regenerative braking. At no time should the application and performance of the mechanical friction brakes be affected by these conditions.

TS 11 Not Used

TS 12 Mounting of Powerplant

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

TS 12.1 Service

All systems requiring routine maintenance shall be arranged for ease of access and maintenance. The Contractor shall list all special tools, fixtures or facility requirements recommended for servicing. All fillers shall be easily accessible with standard funnels, pour spouts and automatic dispensing equipment.

The propulsion system shall be arranged for ease of access and maintenance. The Contractor shall list all special tools, fixtures or facility requirements recommended for servicing. The muffler, exhaust system, air cleaner, air compressor, starter, alternator, radiator(s), all accessories, and any other component requiring service or replacement shall be easily removable and independent of the engine and transmission removal, or removal of electric traction system components (hybrid and battery electric buses). An engine oil pressure gauge and coolant temperature gauge(s) shall be provided in the engine compartment. These gauges shall be easily read during service and mounted in an area where they shall not be damaged during minor or major repairs.

An air cleaner with a dry filter element and a graduated air filter restriction indicator shall be provided. The location of the air intake system shall be designed to minimize the entry of dust and debris and to maximize the life of the air filter. The engine air duct shall be designed to minimize the entry of water into the air intake system. Drainage provisions shall be included to allow any water/moisture to drain prior to entry into the air filter.

Engine oil and the radiator filler caps shall be mounted to the filler neck and closed with spring pressure or positive locks to prevent leakage per manufacturer's specifications. All fluid fill locations shall be properly labeled with permanent metal tags to help ensure that correct fluid is added. All fillers shall be easily accessible with standard funnels, pour spouts and automatic dispensing equipment. All lubricant sumps shall be fitted with magnetic-type drain plugs or magnets in pan.

PART, Link – Base

No engine bypass oil filter

High Point Transit, WSTA – Base

Centrifugal, non-disposable engine bypass oil filter.

All Agencies - Base

Engine Oil Pressure and Coolant Temperature Display

Engine oil pressure and coolant temperature gauges required in engine compartment.

TS 13 Hydraulic Systems

Hydraulic system service tasks shall be minimized and scheduled no more frequently than those of other major coach systems. All elements of the hydraulic system shall be easily accessible for service or unit replacement. The hydraulic system shall be fitted with service ports so that portable diagnostic equipment may be connected or sensors for an off-board diagnostic system permanently attached to monitor system operation when applicable. A tamperproof priority system shall prevent the loss of power steering during operation of the bus if other devices are also powered by the hydraulic system.

The hydraulic system shall operate within the allowable temperature range as specified by the lubricant manufacturer.

No requirement for hydraulic fluid level sensors.

TS 13.1 Fluid Lines

All lines shall be rigidly supported to prevent chafing damage, fatigue failures, degradation and tension strain. Lines should be sufficiently flexible to minimize mechanical loads on the components. Lines passing through a panel, frame or bulkhead shall be protected by grommets (or similar devices) that fit snugly to both the line and the perimeter of the hole that the line passes through to prevent chafing and wear. Pipes and fluid hoses shall not be bundled with or used to support electrical wire harnesses.

Lines shall be as short as practicable and shall be routed or shielded so that failure of a line shall not allow the contents to spray or drain onto any component operable above the auto-ignition temperature of the fluid.

All hoses, pipes, lines and fittings shall be specified per the vehicle manufacturer's recommendations. Installation of these fluid lines shall be in accordance with the vehicle manufacturer's standards. Vehicle manufacturer recommendations and standards must comply with all required USDOT or industry standards.

TS 13.2 Fittings and Clamps

All clamps shall maintain a constant tension at all times, expanding and contracting with the line in response to temperature changes and aging of the line material. The lines shall be designed for use in the environment where they are installed (for example, high-temperature resistant in the engine compartment, resistant to road salts near the road surface and so on).

Compression fittings shall be standardized to prevent the intermixing of components. Compression fitting components from more than one manufacturer shall not be mixed, even if the components are known to be interchangeable.

TS 14 Radiator

If liquid cooling is used, the radiator(s) and/or heat exchanger shall be a heavy-duty metal unit, designed and constructed for transit duty. The Contractor shall demonstrate the reliability and durability of the proposed heat exchanger. The radiator(s) shall be accessible for cleaning. Any radiator shall be easily removable from the bus.

Radiator piping shall be stainless steel, aluminum, brass tubing or painted steel rated at 1000 hours of salt spray according to ASTM B117. Where practicable, hoses shall be eliminated. Necessary hoses shall be impervious to all bus fluids. All hoses shall be secured with stainless steel clamps that provide a complete 360 deg seal. The clamps shall maintain a constant tension at all times, expanding and contracting with the hose in response to temperature changes and aging of the hose material.

TS 15 Oil and Hydraulic Lines

All systems requiring lubrication shall meet or exceed component manufacturer's recommendation for installation, operation and maintenance. The fluid transfer lines shall be designed and intended for use in the environment where they are installed (for example, high-temperature resistant in the engine compartment, resistant to road salts near the road surface and so on). No fluid lines shall be below the frame line of the bus.

TS 16 Fuel

TS 16.1 Fuel Lines

Fuel lines shall be securely mounted, braced and supported as designed by the vehicle manufacturer to minimize vibration and chafing and shall be protected against damage, corrosion or breakage due to strain or wear.

Manifolds connecting fuel containers shall be designed and fabricated to minimize vibration and shall be installed in protected locations to prevent line or manifold damage from unsecured objects or road debris.

Fuel hose and hose connections, where permitted, shall be made from materials resistant to corrosion and fuel and protected from fretting and high heat. Fuel hoses shall be accessible for ease of serviceability.

TS 16.1.1 Fuel Lines, (Diesel)

Fuel lines shall be capable of carrying the type of fuel specified by the Agency (i.e., up to B20 type fuel) and meet all USDOT standards and guidelines for diesel fuel transfer. Fuel lines shall not be used to secure other components (wires, air lines, etc.).

TS 16.2 Fuel Tank – Design and Construction

TS 16.2.1 Design and Construction, (Diesel)

Fuel Tank(s)

Link – Base

The fuel tank(s) shall be of the vehicle manufacturer's standard design.

PART – Base

The fuel tank(s) shall be made of corrosion-resistant stainless steel. The fuel tank shall be made of sufficiently heavy gauge 300 series or ASTM A240 stainless steel.

High Point Transit, Link, WSTA – Base PART – Option

The fuel tank(s) shall be made of high-density cross-linked polyethylene plastic material with or without baffles.

Installation

The fuel tank(s) shall be securely mounted to the bus per manufacturer's standards and any applicable federal regulations/guidelines.

The fuel tank(s) shall be equipped with an external, hex-head drain plug. It shall be at least $\frac{3}{8}$ in. size and shall be located at the lowest point of the tank(s). The fuel tank(s) shall have an inspection plate or easily removable filler neck to permit cleaning and inspection of the tank(s) without removal from the bus. The tank(s) shall be baffled internally to prevent fuel sloshing regardless of fill level. The baffles or fuel pickup location shall ensure continuous full-power operation on a 6% upgrade for 15 minutes starting with no more than 25 gal of fuel over the unusable amount in the tank(s). The bus shall operate at idle on a 6% downgrade for 30 minutes starting with no more than 10 gal of fuel over the unusable amount in the tank(s).

The materials used in mounting shall withstand the adverse effects of road salts, fuel oils and accumulation of ice and snow for the life of the bus.

Labeling

The capacity, date of manufacture, manufacturer name, location of manufacture and certification of compliance to FMCSA regulations shall be permanently marked on the fuel tank(s). The markings shall be readily visible and shall not be covered with an undercoating material.

Fuel Filler

The fuel filler shall be located a minimum of 7 ft behind the centerline of the front door on the curb side of the bus. The filler cap shall be retained to prevent loss and shall be recessed into the body so that spilled fuel will not run onto the outside surface of the bus. Fuel filler doors shall not interfere with other components on the bus (i.e., passenger doors, egress windows, side compartment doors).

The fuel lines forward of the engine bulkhead shall be in conformance to SAE standards.

OEM to designate height of fuel filler.

PART, Link – Base

Dry-Break Fuel Filler

The fuel filler shall accommodate a nozzle that forms a locked and sealed connection during the refueling process to eliminate spills. Fuel shall not be allowed to flow into the tank unless the nozzle has been properly coupled, locked and sealed to the filler. With the nozzle open, fuel shall enter the tank at a fill rate of not less than 40 gal per minute of foam-free fuel without causing the nozzle to shut off before the tank is full. The nozzle shall automatically shut off when the tank is essentially full. Once disconnected, fuel shall not be allowed to flow through the nozzle at any time. Any pressure over 3 psi shall be relieved from the fuel tank automatically. An audible signal shall indicate when the tank is essentially full. The dry break system shall be compatible with the Agency's system. The fuel filler cap shall be hinged.

High Point Transit, WSTA – Base Link – Option

The fuel filler shall accommodate a standard diesel fuel nozzle. The nozzle shall automatically shut off when the tank is essentially full. An audible signal shall indicate when the tank is essentially full. The fuel filler cap shall be a screw-on cap.

PART – Base

The fuel filler cap shall be hinged.

TS 17 Emissions and Exhaust

TS 17.1 Not Used

TS 17.2 Exhaust Emissions (All except Battery Electric)

The engine and related systems shall meet all applicable emission and engine design guidelines and standards at date of manufacture.

TS 17.3 Exhaust System

The exhaust pipe shall be of sufficient height to prevent exhaust gases and waste heat from discoloring or causing heat deformation to the bus. The entire exhaust system shall be adequately shielded to prevent heat damage to any bus component, including the exhaust aftertreatment compartment area. The exhaust outlet shall be designed to minimize rain, snow or water generated from high-pressure washing systems from entering into the exhaust pipe.

Exhaust gases and waste heat shall be discharged from the street side rear corner of the roof.

TS 17.4 Exhaust Aftertreatment

An exhaust aftertreatment system will be provided to ensure compliance to all applicable EPA regulations in effect at date of manufacture.

TS 17.4.1 Diesel Exhaust Fluid (DEF) Injection

If required by the engine manufacturer to meet NO_x level requirements specified by the EPA, a DEF injection system will be provided. The DEF system will minimally include a tank, an injector, a pump, an engine control module and a selective catalytic converter. The tanks shall be designed to store DEF in the operating environment described in Section 6, "Technical Specifications" subsection entitled "Operating Environment."

The DEF filler shall accommodate a standard nozzle. The nozzle shall automatically shut off when the tank is full. The DEF filler cap shall be a screw-on cap and located on the curb side. Construction and size of DEF reservoir should follow all OEM specifications.

The DEF lines shall be designed to prevent the DEF from freezing. The DEF injection system shall not be damaged from a cold soak at 10 °F (-12 °C).

TS 17.5 Particulate Aftertreatment

If required by the engine manufacturer to meet particulate matter (PM) emission limits specified by the EPA, a diesel particulate filter (DPF) will be provided. The DPF system shall be designed to periodically remove accumulated carbonaceous particulate via oxidation (regenerate). Regeneration cycles and conditions will be defined by the engine manufacturer. Vehicle shall be equipped with a manual regeneration inhibit switch for utilization during maintenance operations.

TS 18 Structure

TS 18.1 Design

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

TS 19 FTA Required New Model Bus Testing

Prior to acceptance of the first production bus, the vehicle must have completed the FTA-required New Model Bus Testing. Any items that required repeated repairs or replacement must undergo the corrective action with supporting test and analysis prior to production of series buses. A report clearly describing and explaining the failures and corrective actions taken to ensure that any and all such failures will not occur shall be submitted to the Agency.

Any bus delivered under the Contract is a production bus unless the parties have agreed that it is a pilot bus to be used for preproduction purposes.

FTA New Model Bus Test Report Provided to Agency Prior to Start of Bus Production

Prior to the start of any bus manufacturing or assembly processes, the structure of the proposed bus model shall have undergone appropriate structural testing and/or analysis, including the complete regimen of FTA New Model Bus Tests. Prior to assembly of the first production bus, the vehicle manufacturer shall provide the Agency with a completed report of FTA New Model Bus Testing for the proposed bus model, along with a plan of corrective action to address deficiencies, breakdowns and other issues identified during FTA New Model Bus Testing. The bus model tested shall match the bus model proposed for procurement, including structure, axles and drivetrain.

Base model and partial FTA New Model Bus Test reports are acceptable when the combination of these tests adequately represents the proposed bus model.

TS 19.1 Structural Validation

Baseline Structural Analysis

The structure of the bus shall have undergone appropriate structural testing and/or analysis. At minimum, appropriate structural testing and analysis shall include FTA New Model Bus Testing or finite element analysis (FEA).

TS 20 Distortion

The bus, loaded to GVWR and under static conditions, shall not exhibit deflection or deformation that impairs the operation of the steering mechanism, doors, windows, passenger escape mechanisms or service doors. Static conditions shall include the vehicle at rest with any one wheel or dual set of wheels on a 6 in. curb or in a 6 in. deep hole.

TS 21 Resonance and Vibration

All structure, body and panel-bending mode frequencies, including vertical, lateral and torsional modes, shall be sufficiently removed from all primary excitation frequencies to minimize audible, visible or sensible resonant vibrations during normal service.

TS 21.1 Propulsion Compartment Bulkheads

The passenger and propulsion system compartments shall be separated by a fire-resistant bulkhead. This bulkhead shall preclude or retard propagation of exhaust gasses and/or a propulsion compartment fire into the passenger compartment. The bulkhead shall be in accordance with the Recommended Fire Safety Practices defined in FMVSS 302. Only necessary openings shall be allowed in the bulkhead, and these shall be fire-resistant. Any passageways for the climate control system air shall be separated from the propulsion compartment by fire-resistant material. Piping through the bulkhead shall have fire-resistant fittings sealed at the bulkhead. Wiring may pass through the bulkhead only if connectors or other means are provided to prevent or retard fire propagation through the bulkhead. Propulsion access panels in the bulkhead shall be fabricated of fire-resistant material and secured with fire-resistant fasteners. These panels, their fasteners and the bulkhead shall be constructed and reinforced to minimize warping of the panels during a fire that will compromise the integrity of the bulkhead.

TS 21.2 Crashworthiness (Transit Coach)

The bus body and roof structure shall withstand a static load equal to 150% of the curb weight evenly distributed on the roof with no more than a 6 in. reduction in any interior dimension. Windows shall remain in place and shall not open under such a load. These requirements must be met without the roof-mounted equipment installed.

The bus shall withstand a 25 mph impact by a 4000 lb automobile at any side, excluding doorways, along either side of the bus and the articulated joint, if applicable, with no more than 3 in. of permanent structural deformation at seated passenger hip height. This impact shall not result in sharp edges or protrusions in the bus interior.

Exterior surfaces below 35 in. from ground level shall withstand a static load of 2000 lb applied perpendicular to the bus by a pad no larger than 5 in.². This load shall not result in deformation that prohibits restoration of original appearance of the bus.

WSTA – Base Link - Option

The vehicle manufacturer shall conduct crashworthiness finite element analysis (FEA)

TS 22 Corrosion

The bus flooring, sides, roof, understructure and axle suspension components shall be designed to resist corrosion, including deterioration from environmental conditions and deicing materials for a period of 12 years or 500,000 miles, whichever comes first. It shall maintain structural integrity and nearly maintain original appearance throughout its service life, with the Agency's use of proper cleaning and neutralizing agents.

All materials that are not inherently corrosion-resistant shall be protected with corrosion-resistant coatings. All joints and connections of dissimilar metals shall be corrosion-resistant and shall be protected from galvanic corrosion. Representative samples of all materials and connections shall withstand a two-week (336-hour) salt spray test in accordance with ASTM Procedure B-117. Samples tested shall meet Criterion 10 of ASTM D610 and, if painted, have no perceptible blistering in accordance with ASTM D714.

Corrosion-Resistance Requirements

All exposed surfaces and the interior surfaces of tubing and other enclosed members below the lower window line shall be corrosion-resistant through application of a corrosion protection system.

TS 23 Towing

Each towing device shall withstand, without permanent deformation, tension loads up to 1.2 times the curb weight of the bus within 20 deg of the longitudinal axis of the bus. If applicable, the rear towing device(s) shall not provide a toehold for unauthorized riders. The method of attaching the towing device shall not require the removal or disconnection of front suspension or steering components. Removal of the bike rack is permitted for attachment of towing devices. The OEM shall provide a towing procedure that ensures that the traction motor does not generate high voltage during towing.

Lifted (Supported) Front Axle and Flat Towing Capability

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

Two rear recovery towing provision locations 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 method of attaching the tow bar or adapter shall require the specific approval of the Agency. Any tow bar or adapter exceeding 60 lb should have means to maneuver or allow for ease of use and application. Each towing provision location shall accommodate a towing adaptor or a crane hook with a 1 in. Throat.

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.

No Provision of Glad-Hand-Type Connectors for Towing

No glad-hand-type connector shall be provided.

TS 24 Jacking

It shall be possible to safely jack up the bus, at curb weight, with a common 10-ton floor jack with or without special adapter, when a tire or dual set is completely flat and the bus is on a level, hard surface, without crawling under any portion of the bus. Jacking from a single point shall permit raising the bus sufficiently high to remove and reinstall any wheel and tire assembly. Jacking pads located on the axle or suspension near the wheels shall permit easy and safe jacking with the flat tire or dual set on a 6 in. high run-up block not wider than a single tire. The bus shall withstand such jacking at any one or any combination of wheel locations without permanent deformation or damage.

Yellow Pads

Jacking pads shall be painted safety yellow.

Link – Base

Decals

Apply decals to identify location of jacking pads.

TS 25 Hoisting

The bus axles or jacking plates shall accommodate the lifting pads of a two-post hoist system.

Jacking plates, if used as hoisting pads, shall be designed to prevent the bus from falling off the hoist. Other pads or the bus structure shall support the bus on jack stands independent of the hoist.

The vehicle shall be capable of lifting by the wheels and, as necessary to meet tire load requirements, the proper number for wheel lifts and/or adapters must be used.

TS 26 Floor

TS 26.1 Design (Transit Coach)

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 deg to allow for drainage.

Bi-Level Floor Design

The floor design shall consist of two levels (bi-level construction). Aft of the rear door extending to the rear settee riser, the floor height may be raised to a height no more than 21 in. above the lower level, with equally spaced steps. An increased slope shall be allowed on the upper level, not to exceed 3.5 deg (± 0.3 deg) off the horizontal.

A rear step area shall be provided along the center aisle of the bus to facilitate passenger traffic between the upper and lower floor levels. This step area shall be cut into the rear platform and shall be approximately the aisle width, a minimum 12 in. deep and approximately half the height of the upper level relative to the lower level. The horizontal surface of this platform shall be covered with skid-resistant material with a visually contrasting nosing and shall be sloped slightly for drainage. A sign shall be provided at the immediate platform area to alert passengers to the change in floor level.

PART, Link – Base

Warning Decal for Change in Floor Level

If the vehicle is of a bi-level floor design, a warning decal shall be provided at the immediate platform area to alert passengers to the change in floor level.

Link – Base

Floor Drain

A floor drain of noncorrosive materials shall be provided on the bus behind the front, curbside wheelhouse near the wall to help drain any water that may accumulate due to ice, snow, rain, etc. The drain pipe shall be approximately 1½ in. in diameter and shall extend no more than 5 in. below the floor. The drain pipe shall be fitted with a rubber drain spout to minimize or prevent air drafts to the interior of the bus. The strainer shall be firmly retained but also removable to allow flushing of any accumulated debris.

TS 26.2 Not Used

TS 26.3 Not Used

TS 26.4 Strength

The floor deck may be integral with the basic structure or mounted on the structure securely to prevent chafing or horizontal movement and designed to last the life of the bus. Sheet metal screws shall not be used to retain the floor, and all floor fasteners shall be serviceable from one side only. Any adhesives, bolts or screws used to secure the floor to the structure shall last and remain effective throughout the life of the coach. Tapping plates, if used for the floor fasteners, shall be no less than the same thickness as a standard nut, and all floor fasteners shall be secured and protected from corrosion for the service life of the bus.

The floor deck shall be reinforced as needed to support passenger loads. At GVWR, the floor shall have an elastic deflection of no more than 0.60 in. from the normal plane. The floor shall withstand the application of 2.5 times gross load weight without permanent detrimental deformation. The floor, with coverings applied, shall withstand a static load of at least 150 lb applied through the flat end of a ½ in. diameter rod, with ¼ in. radius, without permanent visible deformation.

TS 26.5 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.

Pressure-Preserved Plywood Panel

Plywood shall be certified at the time of manufacturing by an industry-approved third-party inspection agency such as APA – The Engineered Wood Association (formerly the American Plywood Association). Plywood shall be of a thickness adequate to support design loads, shall be manufactured with exterior glue, shall satisfy the requirements of a Group I Western panel as defined in PS 1-95 (Voluntary Product Standard PS 1-95, “Construction and Industrial Plywood”) and shall be of a grade manufactured with a solid face and back. Plywood shall be installed with the highest grade, veneer side up. Plywood shall be pressure-treated with a preservative chemical and process that prevents decay and damage by insects. Preservative treatments shall use no EPA-listed hazardous chemicals. The concentration of preservative chemicals shall be equal to or greater than required for an above-ground-level application. Treated plywood will be certified for preservative penetration and retention by a third-party inspection agency. Pressure-preservative treated plywood shall have a moisture content at or below 15%.

Link – Option

Composite flooring



TS 27 Platforms

TS 27.1 Driver's Area

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

High Point Transit, Link, WSTA – Base

No specific trim material specified

PART – Base

Stainless steel trim

TS 27.2 Driver's Platform

The driver's platform shall be of a height such that, in a seated position, the driver can see an object located at an elevation of 42 in. above the road surface, 24 in. from the leading edge of the bumper or bike rack. Notwithstanding this requirement, the platform height shall not position the driver such that the driver's vertical upward view is less than 15 deg.

All Agencies – Base

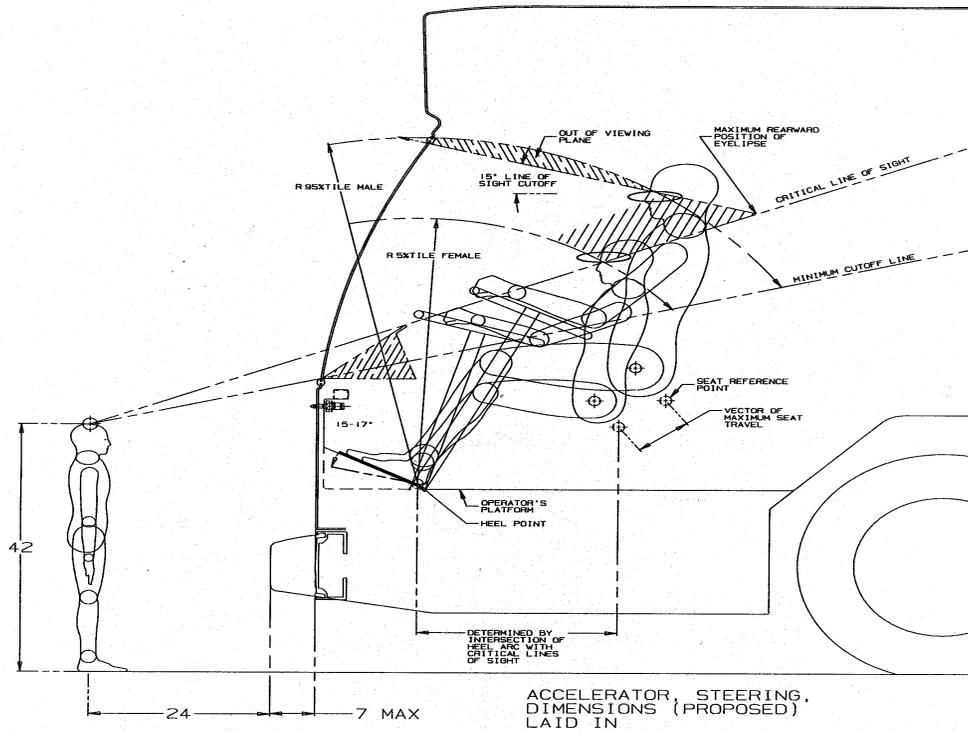
A warning decal or sign shall be provided to alert the driver to the change in floor level.

Link – Base PART – Option

Yellow edge shall be provided to alert the driver to the change in floor level.

Figure 3 illustrates a means by which the platform height can be determined, using the critical line of sight.

FIGURE 3
Determining Platform Height



TS 27.3 Farebox

Farebox placement should minimize impact to passenger access and minimize interference with the driver's line of sight. The floor under the farebox shall provide a sturdy mounting platform to prevent shaking of the farebox. Farebox installation shall not interfere with the driver's protection barrier or door.

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

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

Stanchions

Stanchions shall be located around the farebox.

PART – Base

Stanchions shall be stainless steel trim.

TS 28 Wheel Housing

TS 28.1 Design and Construction

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

Wheel housings, as installed and trimmed, shall withstand impacts of a 2 in. steel ball with at least 200 ft-lb of energy without penetration.

TS 28.2 Design and Construction (Transit Coach)

Interference between the tires and any portion of the bus shall not be possible in maneuvers up to the limit of tire adhesion with weights from curb weight to GVWR. Wheel housings shall be adequately reinforced where seat pedestals are installed. Wheel housings shall have sufficient sound insulation to minimize tire and road noise and meet all noise requirements of this specification.

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

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.

The lower portion extending above the floor shall be equipped with scuff-resistant coating or stainless steel trim.

Wheel housings not equipped with seats or equipment enclosure shall have a horizontal assist mounted on the top portion of the housing no more than 4 in. higher than the wheel well housing.

Where wheel housings are equipped with seats or equipment enclosures, all fasteners passing through to the outside of the coach shall be fully sealed to prevent the intrusion of water into the coach.

No provision shall be made to apply tire chain on buses.

Link – Option

The wheel housing shall be designed to have the ability to apply tire chains on buses.

TS 28.3 Not Used

TS 28.4 Not Used

TS 28.5 Bellows

Replacement fabric-type bellows with draft-free, no-sag bottom closure and water drains shall be provided between the lead and trailing sections to seal the bus interior and keep it free of water, dirt and drafts. Bellows hardware shall be corrosion-resistant, and the underfloor area of the bellows shall be easy to clean when necessary. The passageway between the lead unit and trailing unit shall have an inside cross-section that is as nearly equal as possible to the inside cross-section of the bus bodies, with no tripping or pinching hazards created by the turntable cross-section or closeouts. The bellows shall be durable, and its supporting structure and stiffeners shall support the bellows material in a neat, sag-free manner. The Contractor shall supply information on the actual service life achieved by the type of bellows being proposed. A sample of the bellows and attaching hardware may be requested for evaluation at the Agency's option. Bellows shall be approved by the Agency.

No bellows liner required.

TS 29 Suspension

TS 29.1 General Requirements

The front, rear and mid (if articulated) suspensions shall be pneumatic type. The basic suspension structure shall last the service life of the bus without major overhaul or replacement, with the exception of hoses, shock absorbers, air bellows and other items defined within the "Warranty Requirements" section. Adjustment points shall be minimized and shall not be subject to a loss of adjustment in service. Routine adjustments shall be easily accomplished by limiting the removal or disconnecting the components.

TS 29.2 Alignment

All axles should be properly aligned for even tire wear and for the vehicle to track accurately within the size and geometry of the vehicle.

TS 29.3 Springs and Shock Absorbers

TS 29.3.1 Suspension Travel

The suspension system shall permit a minimum wheel travel of 2.75 in. jounce-upward travel of a wheel when the bus hits a bump (higher than street surface), and 2.75 in. rebound-downward travel when the bus comes off a bump and the wheels fall relative to the body. Elastomeric bumpers shall be provided at the limit of jounce travel. Rebound travel may be limited by elastomeric bumpers or hydraulically within the shock absorbers. Suspensions shall incorporate appropriate devices for automatic height control so that regardless of load the bus height relative to the centerline of the wheels does not change more than ½ in. at any point from the height required. The safe operation of a bus cannot be impacted by ride height up to 1 in. from design normal ride height.

TS 29.3.2 Damping

Vertical damping of the suspension system shall be accomplished by hydraulic shock absorbers mounted to the suspension arms or axles and attached to an appropriate location on the chassis. Damping shall be sufficient to control coach motion to three cycles or fewer after hitting road perturbations. The shock absorber bushing shall be made of elastomeric material that will last the life of the shock absorber. The damper shall incorporate a secondary hydraulic rebound stop.

TS 29.3.3 Lubrication

Standard Grease Fittings

All elements of steering, suspension and drive systems requiring scheduled lubrication shall be provided with grease fittings conforming to SAE 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 fewer than every 6000 miles.

TS 29.3.4 Kneeling

A kneeling system shall lower the entrance(s) of the bus a minimum of 2 in. during loading or unloading operations regardless of load up to GVWR, measured at the longitudinal centerline of the entrance door(s) by the driver. The kneeling control shall provide the following functions:

- Downward control must be held to allow downward kneeling movement.
- Release of the control during downward movement must completely stop the lowering motion and hold the height of the bus at that position.
- Upward control actuation must allow the bus to return to normal floor height without the driver having to hold the control.

The brake and throttle interlock shall prevent movement when the bus is kneeled. The kneeling control shall be disabled when the bus is in motion. The bus shall kneel at a maximum rate of 1.25 in. per second at essentially a constant rate. After kneeling, the bus shall rise within 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 0.3g/second.

An indicator visible to the driver shall be illuminated until the bus is raised to a height adequate for safe street travel. An audible warning alarm will sound simultaneously with the operation of the kneeler to alert passengers and bystanders. A warning light mounted near the curbside of the front door, a minimum 2.5 in. diameter amber lens, shall be provided that will blink when the kneel feature is activated. Kneeling shall not be operational while the wheelchair ramp is deployed or in operation.

Link – Option

Automatic raising as door closes.

TS 30 Wheels and Tires

TS 30.1 Wheels

All wheels shall be interchangeable and shall be removable without a puller. Middle axle of articulated buses may utilize a super single if alternative is selected. Wheels shall be compatible with tires in size and load-carrying capacity. Front wheels and tires shall be balanced as an assembly.

PART – Base

One-sided polished aluminum. Tire-pressure monitoring system. Three-piece captive locking lug nut.

PART – Option

Two-sided polished aluminum rims. Alcoa Aluminum Polished finish (both sides) aluminum wheels without Durabrite. Loose lug nut indicator.

High Point Transit – Base

Two-sided polished aluminum rims. No tire-pressure monitoring system. Standard non-locking lug nut.

Link – Base

Brushed aluminum. Tire-pressure monitoring system. Loose lug nut indicator. Standard non-locking lug nut.

WSTA – Base

Two-sided polished aluminum rims. No tire-pressure monitoring system. Standard non-locking lug nut.

TS 30.2 Tires

Tires shall be suitable for the conditions of transit service and sustained operation at the maximum speed capability of the bus. Load on any tire at GVWR shall not exceed the tire supplier's rating.

PART – Base

The tires shall be supplied by the Contractor.

High Point Transit – Base

The tires shall be provided under a lease agreement between the Agency and the tire supplier and shall be the appropriate size and load range for the vehicle.



Link – Base

The tires shall be supplied by the Contractor.

WSTA – Base

The tires shall be supplied by the agency.

TS 31 Steering

Hydraulically assisted steering shall be provided. The steering gear shall be an integral type with the number and length of flexible lines minimized or eliminated. Engine-driven hydraulic pump shall be provided for power steering. A loss of power to the bus shall not cause the driver to lose steering. The bus shall be able to be safely brought to a controlled stop.

Link – Base

On battery electric and hybrid coaches capable of supporting it, electrically driven hydraulic power steering may be used.

TS 31.1 Steering Axle (Transit Coach)**Solid Beam Axle and Grease-Type Front Bearings and Seals**

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

All friction points on the front axle shall be equipped with replaceable bushings or inserts and, if needed, lubrication fittings easily accessible from a pit or hoist.

Ackermann design shall reduce tire wear, minimize turn radius and optimize driver control during all operating conditions.

WSTA – Base**Oiled-Type Front Bearings**

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

Independent Suspension Axle

The front axle shall be of an independent suspension design, non-driving, with a load rating sufficient for the bus loaded to GVWR and shall be equipped with sealed, oiled or grease-type front wheel bearings.

TS 31.2 Not Used**TS 31.3 Steering Wheel****TS 31.3.1 Turning Effort**

Steering effort shall be measured with the bus at GVWR, stopped with the brakes released and propulsion system engaged and, as appropriate, in idle on clean, dry, level, commercial asphalt pavement and the tires inflated to recommended pressure.

Under these conditions, the torque required to turn the steering wheel 10 deg 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.

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.

Caster angle shall be selected to provide a tendency for the return of the front wheels to the straight-ahead position with minimal assistance from the driver.

TS 31.3.2 Steering Wheel, General

The steering wheel diameter shall be approximately 18 to 20 in.; the rim diameter shall be $\frac{7}{8}$ to $1\frac{1}{4}$ in. and shaped for firm grip with comfort for long periods of time.

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

TS 31.3.3 Steering Column Tilt

The steering column shall have full tilt capability with an adjustment range of no less than 40 deg from the vertical and easily adjustable by the driver and shall be accessible by a 5th-percentile female and 95th-percentile male. Driver's knees shall not contact wheel spokes at any adjustment or driving position.

TS 31.3.4 Steering Wheel Telescopic Adjustment

The steering wheel shall have full telescoping capability and have a minimum telescopic range of 1.75 in. and a minimum low-end adjustment of 29 in., measured from the top of the steering wheel rim in the horizontal position to the cab floor at the heel point. See [Table 4](#).

TABLE 4
Steering Wheel Height¹ 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.

TS 32 Drive Axle

The bus shall be driven by a heavy-duty axle(s) 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 design operating profile without 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. The axle and driveshaft components shall be rated for both propulsion and retardation modes with respect to duty cycle. If a planetary gear design is employed, then the planetary gear drain plugs shall also be magnetic. Proper venting shall be provided, and it shall be sufficiently well constructed so as to not plug, kink or become otherwise degraded.

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.

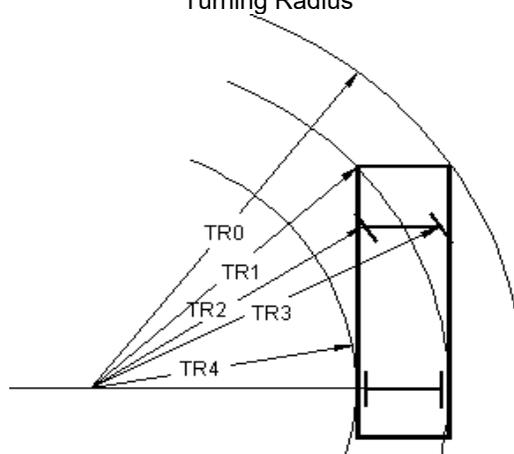
TS 33 Not Used

TS 34 Turning Radius

TABLE 5
Maximum Turning Radius

Bus Length (approximate)	Maximum Turning Radius (see Figure 4)	Agency Requirement
30 ft	34 ft (TR0)	
35 ft	39 ft (TR0)	
40 ft	44 ft (TR0)	

FIGURE 4
Turning Radius



TS 35 Brakes

TS 35.1 Service Brake

Brakes shall be self-adjusting. Brake wear indicators (visible brake sensors) shall be provided. A loss of power to the bus shall not cause the driver to lose braking. The bus shall be able to be safely brought to a controlled stop.

Link – Option

Electronic brake monitoring system that includes a brake pad and wear sensor and alarm to notify driver and maintenance of unsafe brake conditions shall be provided.

TS 35.1.1 Regenerative Braking (Battery Electric or Hybrid)

In addition to traditional mechanical friction service braking, the bus shall be equipped with regenerative braking designed to improve energy efficiency and extend brake lining service life. The application of regenerative braking shall cause a smooth blending of both regenerative and service brake function. Actuation of ABS and/or automatic traction control (ATC) shall override the operation of the regenerative brake. The ESS system should be designed to prevent overcharge during regenerative braking.

TS 35.2 Actuation

Service brakes shall be controlled and actuated by a compressed air system. Force to activate the brake pedal control shall be a linear function of the bus deceleration rate and shall not exceed 80 lb at a point 7 in. above the heel point of the pedal to achieve maximum braking. The heel point is the location of the driver's heel when their foot is rested flat on the pedal and the heel is touching the floor or heel pad of the pedal. The electronic control unit 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 among 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.

No automatic traction control.

WSTA - BASE

Advance driver assistance system provides emergency braking system for protection of pedestrians and collision mitigation.

TS 35.3 Friction Material

The brake linings shall be made of non-asbestos material. In order to aid maintenance personnel in determining extent of wear, a provision such as a scribe line or a chamfer indicating the thickness at which replacement becomes necessary shall be provided on each brake lining. The complete brake lining wear indicator shall be clearly visible from the hoist or pit without removing backing plates.

No remote brake wear indicator shall be required.

TS 35.4 Hubs and Drums/Discs)

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

Disc Brakes on All Axles

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

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

TS 35.5 Parking/Emergency Brake

Air Brakes

The parking brake shall be a spring-operated system, actuated by a valve that exhausts compressed air to apply the brakes, per FMVSS 121.

TS 36 Pneumatic System

TS 36.1 General

The bus air system shall operate the air-powered accessories and the braking system with reserve capacity. New buses shall not leak down more than 5 psi over a 15-minute period of time as indicated on the dash gauge(s).

Provision shall be made to apply shop air to the bus air systems. A quick disconnect fitting shall be easily accessible and located in the powertrain compartment and near the front bumper area for towing. Retained caps shall be installed to protect fitting against dirt and moisture when not in use. Air for the compressor shall be filtered. The air system shall be protected per FMVSS 121.

TS 36.2 Air Compressor

The air compressor shall be sized to charge the air system from 40 psi to the governor cutoff pressure in less than 4 minutes while not exceeding the fast idle speed setting of the engine, if equipped.

TS 36.3 Air Lines and Fittings

Air lines, except necessary flexible lines, shall conform to the installation and material requirements of SAE J1149 for copper tubing with standard, brass, flared or ball sleeve fittings, or SAE J844 for nylon tubing if not subject to temperatures over 200 °F. The air on the delivery side of the compressor where it enters nylon housing shall not be above the maximum limits as stated in SAE J844. Nylon tubing shall be installed in accordance with the following color-coding standards:

- Green: Indicates primary brakes and supply.
- Red: Indicates secondary brakes.
- Brown: Indicates parking brake.
- Yellow: Indicates compressor governor signal.
- Black: Indicates accessories.

Line supports shall prevent movement, flexing, tension, strain and vibration. Copper lines shall be supported to prevent the lines from touching one another or any component of the bus. To the extent practicable and before installation, the lines shall be pre-bent on a fixture that prevents tube flattening or excessive local strain. Copper lines shall be bent only once at any point, including pre-bending and installation. Rigid lines shall be supported at no more than 5 ft intervals. Nylon lines may be grouped and shall be supported at 30 in. intervals or less. The compressor discharge line between 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 fittings. Flexible hoses shall be as short as practicable and individually supported. They shall not touch one another or any part of the bus except for the supporting grommets. Flexible lines shall be supported at 2 ft intervals or less.

Air lines shall be clean before installation and shall be installed to minimize air leaks. All air lines shall be routed to prevent water traps to the extent possible. Grommets or insulated clamps shall protect the air lines at all points where they pass through understructure components.

TS 36.4 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.

TS 36.5 Air System Dryer

An air dryer shall prevent accumulation of moisture and oil in the air system. An air dryer in the new condition shall provide a minimum dew point depression from ambient of 25 °F at ambient temperatures below 100 °F and operating at nominal full system pressure. This assumes the air temperature at the inlet of the air dryer is within 15 °F of ambient. The dew point depression from ambient shall be no less than 20 °F under those conditions at any time before recommended overhaul provided that the air dryer is serviced properly. The air dryer shall be able to provide these levels of dew point depression with the compressor running continuously. The air dryer system shall include one or more replaceable desiccant cartridges.

PART, Link – Base

No requirements for additional oil separator provision.



High Point Transit, WSTA – Base

The air system shall be equipped with an air dryer located before the No. 1 air tank and as far from the compressor as possible to allow air to cool prior to entering the air dryer.

TS 37 Electrical, Electronic and Data Communication Systems

TS 37.1 Overview

The electrical system will consist of vehicle battery systems and components that generate, distribute and store power throughout the vehicle (e.g., generator, voltage regulator, wiring, relays and connectors).

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

The data communication system consists of the bidirectional communication 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.

Data communication systems are divided into three levels for the use of multiple data networks (see **Figure 5** and **Figure 6**):

- Powertrain level
- Information level
- Multiplex level

FIGURE 5
Data Communication Systems Levels – Diesel Powertrain

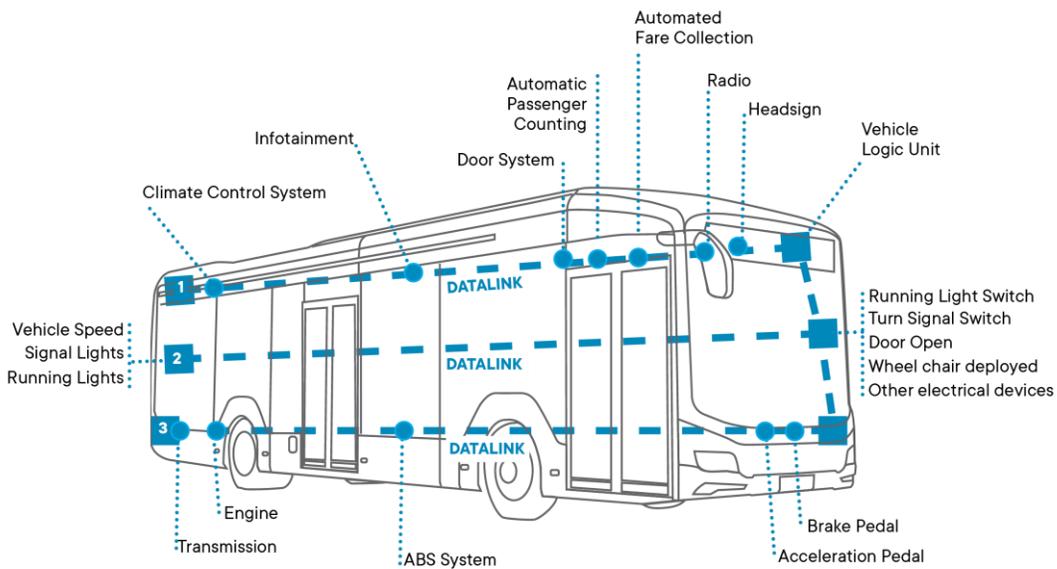
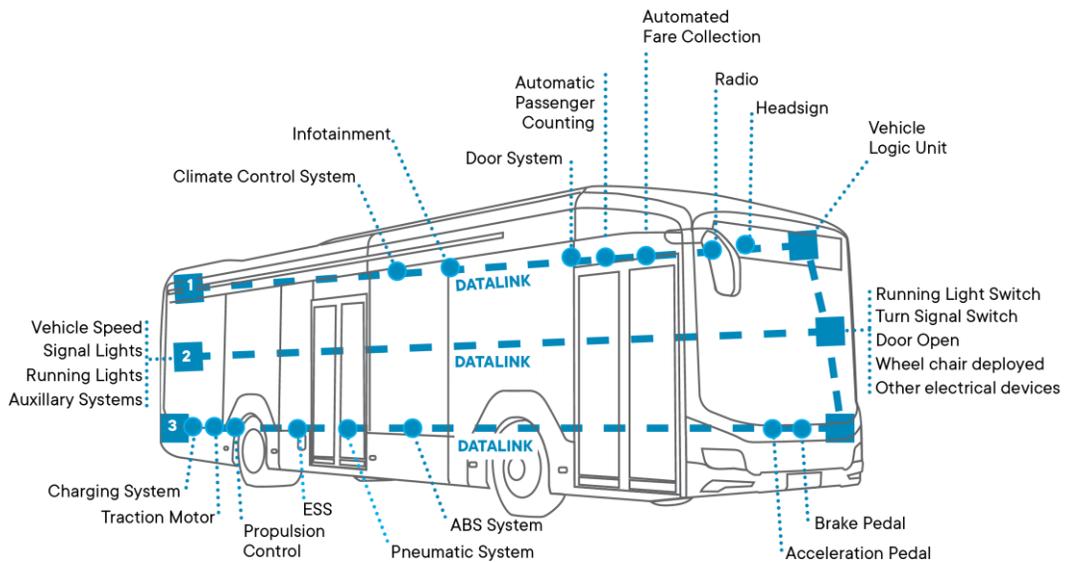


FIGURE 6
Data Communication Systems Levels – Battery Electric Powertrain



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

TS 37.2 Data Communications Systems

Table 6 lists the minimum performance data signals that each system is required to make available to the ITS vehicle logic unit controller for a traditional diesel bus.

The lists represent commonly monitored signals by the vehicle monitoring system. These lists are not to be referred to or be construed as being the only data points required from components at any time, but the minimum data set required in addition to every other data element described within this document. All data, including faults, performance points, and subsystem controller firmware versions, are to be externalized by any onboard computer or component shall be provided to the ITS vehicle logic unit specified. All data must be configured in a nonproprietary format compliant with an industry standard protocol.

TABLE 6
Performance Data Signals

Vehicle Signal Names	
1	Vehicle Speed (mph)
2	Engine Speed (RPM)
3	Brake Pedal Position (applied or not applied)
4	Engine Load (%)
5	Throttle Position (%)
6	Odometer Pulse – square wave (must be delivered as a discrete voltage signal to vehicle logic unit)
7	Front Door Open – discrete signal
8	Rear Door Open – discrete signal (if there is a center door, this signal should be combined with the rear door)
9	Wheeled mobility device Deployed – discrete signal
10	Stop Request – discrete signal (include wheeled mobility device stop request)
11	Reverse – discrete signal (active high)
Engine Signal Names	
1	All Diagnostic Fault Codes
2	Software Identification
3	Boost Pressure
4	Electrical Potential (Voltage)
5	Engine Average Fuel Economy
6	Engine Coolant Level
7	Engine Coolant Temperature
8	Engine Crankcase Pressure
9	Engine Fuel Rate – High Resolution
10	Engine Idle Shutdown has Shutdown Engine
11	Engine Intake Manifold 1 Temperature
12	Engine Oil Level
13	Engine Oil Pressure
14	Engine Protection System Has Shutdown Engine
15	Engine Shutdown Override Switch
16	Exhaust Gas Temp 1 = DPF Inlet Gas Temp
17	Exhaust Gas Temp 3 = DPF Outlet Gas Temp
18	Particulate Trap Active Regeneration Inhibited Due to Inhibit Switch
19	Particulate Trap Active Regeneration Status
20	Total Vehicle Distance
21	Wheel-Based Vehicle Speed
22	Vehicle Identification Number
23	Particulate Trap Outlet Gas Temperature
24	Unit Number (Power Unit)
25	Trip Distance – High Resolution
26	Maximum Vehicle Speed Limit
27	Intake Manifold Pressure
28	Engine Turbocharger Boost Pressure
29	Engine Trip Fuel – High Resolution
30	Engine Total Idle Hours
31	Engine Total Idle Fuel Used
32	Engine Total Hours of Operation
33	Engine Total Fuel Used – High Resolution signal
34	Engine Speed
35	Component Identification (Engine Serial Number)
36	Engine Exhaust Temperature

37	Catalyst Tank Temperature
38	Catalyst Tank Level
39	Engine Air Inlet Pressure
40	Number of Emergency Stops
41	Software Identification (Calibration Version)
42	Road Speed PGN65265 SPN84 at a consistent 100 ms broadcast rate
43	Calibration Information (DM19)
44	Engine Total Hours of Operation
45	Engine Air Inlet Temperature
46	Engine Serial Number
Transmission Signal Names	
1	All Diagnostic Fault Codes
2	Software Identification
3	Battery Potential (Voltage)
4	Hydraulic Retarder Oil Temperature
5	Transmission Input Shaft Speed
6	Transmission Output Shaft Speed
7	Transmission Oil Temperature
8	Transmission Oil Level High/Low
9	Transmission Oil Life Remaining
10	Transmission Shift Position
Multiplex System Broadcast via J1939 CAN Network Signal Names	
1	Exhaust Regen Off
2	IVN Regen Enable
3	IVN Status
4	Reverse
5	Network Failure – Individual Modules
6	Engine Fuel Filter Clogged
7	Engine Air Filter Clogged
8	ABS Indicator
9	Alternator Charge Indicator
10	Coolant Level (as a percentage 0% to 100%)
11	Low Air Pressure
12	Check Engine
13	Stop Engine
14	Kneeling Active
15	Throttle Malfunction
16	A/C Failure
17	Wheeled mobility device Ramp Deployed – J1939
18	Wheeled mobility device Stop Request
19	Passenger Stop Request (does not include Wheeled mobility device Stop Request) – J1939
20	Fire Suppression System Active
21	Fire Shutdown Engine
22	Software Identification (if applicable)
23	Parking Brake Engaged
24	Air Compressor Status (Duty Cycle)
25	Wheeled mobility device – rate of deployment or system health (for example, amp draw of motor)
26	Charging System Monitor – Low Charge Indicator
27	Front Door Open Signal – J1939
28	Rear Door Open Signal – J1939
29	Wheeled mobility device Cycle Counts
30	Bus Battery Voltage
31	Seat Belt Status (if applicable)
32	Seat Alarm (pressure switch status) – if applicable
33	All Available Diagnostic Fault Codes
34	Air Pressure API (Each Tank Reporting Individually)
ABS System Signal Names	
1	All Diagnostic Fault Codes
2	Road Speed
3	ABS Active
4	Software Identification
5	Wheel Speed PGN65215 SPN904 at a consistent 100 ms broadcast rate

Door Systems Signal Names	
1	Diagnostic Fault Codes
2	Software Identifications
3	Front Door Open
4	Front Door Close
5	Rear Door #1 Open (bus with two or three doors only)
6	Rear Door #1 Close (bus with two or three doors only)
7	Rear Door #2 Open (bus with three doors only)
8	Rear Door #2 Close (bus with three doors only)
Climate Control System Signal Names	
1	All Diagnostic Fault Codes
2	Software Identification
3	Ambient Air Temperature
4	Discharge Air Temperature
5	Discharge Air #2 Temperature (if applicable on artic bus)
6	Return Air Temperature
7	Return Air All Zones Temperature (only apply to artic bus)
8	Water Inlet Temperature
9	Discharge Pressure
10	Suction Pressure
11	Operating Mode
12	Performance Data
13	Configuration File
14	Compressor Clutch Cycles
15	Compressor Hours
Artic Joint System Signal Names (Applies to Articulated Bus Only)	
1	All Diagnostic Fault Codes
2	Software Identification
Vehicle Logic Unit Signal Names	
1	All Diagnostic Fault Codes
2	Software Identification
Electric Vehicle Data Elements Signal Names	
1	All Diagnostic Fault Codes
2	Software Identification

For a battery electric bus, the items listed in **Table 6** which are applicable to an electric vehicle drive system, and the items in **Table 7** are the *minimum* performance data signals that each system is required to make available to the ITS vehicle logic unit controller for a battery electric bus.

The lists represent commonly monitored signals by the vehicle monitoring system. These lists are not to be referred to or be construed as being the only data points required from components at any time, but the minimum data set required in addition to every other data element described within this document. All data, including faults, performance points and subsystem controller firmware versions, are to be externalized by any onboard computer or component and shall be provided to the ITS vehicle logic unit specified. All data must be configured in nonproprietary format compliant with an industry standard protocol.

TABLE 7
Performance Data Signals for Battery Electric Buses

Powertrain System (Traction Motor/Propulsion Control/ESS) Signal Names	
1	Odometer
2	Trip Odometer
3	Vehicle Speed
4	ESS Operational SoC
5	ESS Current
6	ESS Voltage
7	ESS Charging Activity
8	Minimum and Maximum ESS Cell Temperature
9	Minimum and Maximum ESS Cell SoC
10	Minimum and Maximum ESS Cell Voltage

11	ESS Power Discharged
12	Master Run Switch Status
13	Accelerator Pedal Position
14	Brake Pedal Position
15	Parking or Emergency Brake Application
16	J1939 Health and Diagnostic Messages
17	Propulsion and Ancillary Systems Health and Diagnostic Messages
18	Visual/Audible Indications/Alarms
19	Traction Motor Power Input
20	Traction Motor Torque Percentage
21	Traction Motor RPM
22	Propulsion Inverter Power Input
23	Low Propulsion System Coolant Level
24	Regenerative Braking Power Recovered
25	Miles to 0% of Usable SoC
26	SoC per Unit of Distance
27	SoC per Unit of Elapsed Time
28	SoC per X Completed Stops
29	SoC Below X% When Returning to the Garage
30	Idle Time (foot brake applied)
31	Idle Time (parking brake applied)
Charging System Signal Names	
1	Charging system power input
2	Charging system performance
3	Garage charger power Input
4	Opportunity charger power input
5	Time to complete a full charge
Electric Vehicle Pneumatic System Signal Names	
1	Primary Pneumatic System Pressure
2	Secondary Pneumatic System Pressure
3	Auxiliary Pneumatic System Pressure (if applicable).
4	Air Compressor Inverter Power Input
Electric Vehicle HVAC System Signal Names	
1	HVAC Power Input
2	HVAC Status On/Off
3	HVAC Supply Air Temperature
4	HVAC Return Air Temperature
5	HVAC Wattage Consumption
6	HVAC Cabin Temperature Setpoint
7	Outside Air Temperature
8	Front Door Position
9	Exit Door Position
10	Diesel Fuel Fired Heater Fuel Consumption
11	Diesel Fuel Fired Heater Fuel Level
12	Low HVAC Systems Coolant Level
13	Primary HVAC Heat Source Fuel Supply Below X% When Returning to the Garage
Electric Vehicle Auxiliary Systems Signal Names	
1	Wheeled mobility device Ramp Position
2	Hydraulic Pump Inverter Power Input
3	DC to DC Converter Power Input

TS 37.3 Design

The electrical, electronic and data communication systems shall be easily separable from their interconnects by means of connectors.

TS 38 Environmental and Mounting Requirements

All electrical/electronic hardware mounted in the interior of the vehicle shall be resistant to tampering from passengers.

All electrical/electronic hardware mounted on the exterior of the vehicle that is not designed to be installed in an exposed environment shall be mounted in a protective enclosure. The hardware shall be mounted in such a manner as to protect it from the environment.

The electrical system and its electronic components shall be capable of operating in the area of the vehicle in which they will be installed and comply with the shock and vibration requirements as recommended in SAE J1455, to the extent practical.

Electrical and electronic equipment shall not be located in an environment that will reduce the performance or shorten the life of the component or electrical system when operating within the design operating profile.

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

All electrical/electronic hardware and its mounting shall comply with the shock and vibration requirements of published industry standards (SAE, ISO, etc.).

TS 39 General Electrical Requirements

TS 39.1.1 Low-Voltage (Starting, Lighting and Ignition or “SLI”) Batteries

The batteries shall be selected with sufficient cold-cranking amps (CCA) and have enough reserve capacity (RC) based on the small accessory electrical loads when the bus is parked/shut down. In order to maintain the SoC of the 24 VDC batteries during long periods when a bus is parked, a low SoC disconnect system is required. If the SoC drops below a preset value (e.g., 70% SoC), the system will pulse a bistable relay that opens the circuits of the small accessories, thereby isolating the 24 VDC batteries. When the bus driver turns the main switch to “ON,” the relay is pulsed again, reconnecting the 24 VDC batteries to the vehicle loads. Low-Voltage Batteries (24 V)

Four Group 31 Maintenance-Free Batteries

Four Group 31 Series deep-cycling maintenance-free battery units shall be provided. Each battery shall have a minimum of 700 cold-cranking amps and minimum reserve capacity of 190 minutes at 80 °F. Each battery shall have a purchase date no more than one year from the date of release for shipment to the Agency.

TS 39.1.2 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 starter 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.

Link – Base

No color code for voltage is required

High Point Transit, WSTA – Base

Color-code each voltage.

PART – Base

Color-code each voltage. Voltage should be color coded in the battery compartment and at the multiplex module connections. As well as any bus bars installed on the vehicle should be color coded or have voltage labels.

TS 39.1.3 Jump-Start Connector

PART, Link – Base

No requirements for jump-start connector.

High Point Transit, WSTA – Base

A jump-start connector shall be located next to the battery disconnect switch.

TS 39.1.4 Battery Compartment

The battery compartment shall prevent accumulation of snow, ice and debris on top of the batteries and shall be vented and self-draining. It shall be accessible only from the outside of the vehicle. All components within the battery compartment, and the compartment itself, shall be protected from damage or corrosion from the

electrolyte. The inside surface of the battery compartment's access door shall be electrically insulated, as required, to prevent the battery terminals from shorting on the door if the door is damaged in an accident or if a battery comes loose. The battery compartment temperature should not exceed battery manufacturer's specification.

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 switch(es). A lockout/tagout means shall be provided to safeguard maintenance from the unexpected startup or power-on high voltage.

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.

PART, Link – Base**Non-Locking Access Door**

The 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.

High Point Transit, WSTA – Base**Locking Access Door**

The access door shall require an Agency-specified locking device (e.g., square key) to gain access to the switch, and it shall be accessible without removing or lifting the panel.

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 or swing 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 compartment, the same fire-resistant properties must apply to the battery compartment. No sparking devices should be located within the battery box.

TS 39.1.5 Auxiliary Electronic Power Supply

If required, gel-pack or any form of sealed (non-venting) batteries used for auxiliary power are allowed to be mounted on the interior of the vehicle if they are contained in an enclosed, non-airtight compartment and accessible only to maintenance personnel. This compartment shall contain a warning label prohibiting the use of vented (flooded) lead-acid batteries.

TS 39.1.6 Master Battery Switch

The location of the master battery switch shall be clearly identified on the exterior access panel, be accessible in less than 10 seconds for deactivation, and prevent corrosion from fumes and battery acid when the batteries are washed off or are in normal service.

The master switch shall be capable of carrying and interrupting the total circuit load.

High Point Transit, Link, WSTA – Base**Single Switch**

The batteries shall be equipped with a single switch for disconnecting both 12 V and 24 V power.

PART – Base**Separate Switches**

The batteries shall be equipped with separate switches for disconnecting 12 V and 24 V power.

TS 39.1.7 Low-Voltage Generation and Distribution

The low-voltage generating system shall maintain the charge on fully charged batteries within battery supplier's specifications.

Voltage monitoring and overvoltage output protection (recommended at 32 V) shall be provided. Charging profile shall be maintained within battery manufacturer's guidelines or specifications.

Dedicated power and ground shall be provided as specified by the component or system manufacturer. Cabling to the equipment must be sized to supply the current requirements with no greater than a 5% volt drop across the length of the cable.

TS 39.1.8 Low-Voltage Circuit Protection

All branch circuits, except battery-to-starting-motor and battery-to-generator/alternator circuits, shall be protected by current-limiting devices such as circuit breakers, fuses or solid-state devices sized to the requirements of the circuit. The circuit breaker fuses shall be easily accessible for authorized personnel. Fuses shall be used only where it can be demonstrated that circuit breakers are not practicable. This requirement applies to inline fuses supplied by either the Contractor or a Supplier. Fuse holders shall be constructed to be rugged and shall be rated at appropriate IP rating for location of fuse holder based on manufacturer's recommendations. All manual reset circuit breakers critical to the operation of the bus shall be mounted in a location convenient to the Agency mechanic with visible indication of open circuits. The Contractor shall show all in-line fuses in the final harness drawings.

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

PART – Base

The use of automatic reset circuit breakers shall require Agency approval.

TS 39.2 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 adequate 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.

TS 39.3 Low-Voltage and High-Voltage Wiring and Terminals

All power and ground wiring shall conform to specification requirements of SAE J1127, J1128 and J1292, except for the color code of J1292. All high-voltage power and ground wiring shall conform to specification requirements of SAE J1654 and 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.

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 practicable. Cabling and wiring must be installed damage-free. Additionally, parallel runs of high-voltage cabling and low-voltage control wiring shall be minimized.

Wiring shall be grouped, numbered and/or color-coded. Wiring harnesses shall not contain wires of different voltage classes unless all wires within the harness are insulated for the highest voltage present in the harness. Kinking, grounding at multiple points, stretching and exceeding minimum bend radius shall be prevented.

Strain-relief fittings shall be provided at all points where wiring enters electrical compartments. Grommets or other protective material shall be installed at points where wiring penetrates metal structures outside of electrical enclosures. Wiring supports shall be protective and 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 or near high heat sources. Wiring and electrical equipment necessarily located under the vehicle shall be insulated from water, heat, corrosion and mechanical damage. Where feasible, front-to-rear electrical harnesses should be installed above the window line of the vehicle.

All wiring harnesses over 5 ft long and containing at least five wires shall include 10% (minimum one wire) excess wires for spares. This requirement for spare wires does not apply to data links and communication cables. Wiring harness length shall allow end terminals to be replaced twice without pulling, stretching or replacing the wire. Terminals shall be crimped to the wiring according to the connector manufacturer's recommendations for techniques and tools. All cable connectors shall be locking type, keyed and sealed, unless enclosed in watertight cabinets or the 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.

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.

Ultrasonic 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.
- All splices shall be identified by placards or permanent labels in their appropriate location within the harness.

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

The instrument panel and wiring shall be easily accessible for service from the driver's seat or top of the panel. The instrument panel shall be separately removable and replaceable without damaging the instrument panel or gauges. Wiring shall have sufficient length and be routed to permit service without stretching or chafing the wires.

TS 39.4 Electrical Components

All electrical components, including switches, relays, flashers and circuit breakers, shall be heavy-duty designs with either a successful history of application in heavy-duty vehicles or design specifications for an equivalent environment.

All electric motors shall be heavy-duty brushless type where practical and have a continuous duty rating of no fewer than 40,000 hours (except cranking motors, washer pumps and wiper motors). All electric motors shall be easily accessible for servicing.

TS 39.5 Electrical Compartments

All relays, controllers, flashers, circuit breakers and other electrical components shall be mounted in easily accessible electrical compartments. All compartments exposed to the outside environment shall be corrosion-resistant and sealed according to SAE J1455. The components and their functions in each electrical compartment shall be identified and their location permanently recorded on a drawing attached to the inside of the access panel or door. The drawing shall be protected from oil, grease, fuel and abrasion.

The front compartment shall be completely serviceable from the driver's seat, the vestibule or the outside. For vehicles with an internal combustion engine, "Rear start and run" controls shall be mounted in an accessible location in the engine compartment and shall be protected from the environment.

TS 39.6 Terminals

Same Size Terminal Ends

Positive and negative terminal ends shall be the same size.

TS 40 General Electronic Requirements

If an electronic component has an internal real-time clock, it shall provide its own battery backup to monitor time when battery power is disconnected, and/or it may be updated by a network component. If an electronic component has an hour meter, it shall record accumulated service time without relying on battery backup.

All electronic component suppliers shall ensure that their equipment is self-protecting in the event of shorts in the cabling, and also in overvoltage (over 32 VDC on a 24 VDC nominal voltage rating with a maximum of 60 VDC) and reverse polarity conditions. If an electronic component is required to interface with other components, it shall not require external pull-up and/or pull-down resistors. Where this is not possible, the use of a pull-up or pull-down resistor shall be limited as much as possible and be easily accessible and labeled.

TS 40.1 Wiring and Terminals

Kinking, grounding at multiple points, stretching and reducing the bend radius below the manufacturer's recommended minimum shall not be permitted according to SAE J1127. Proper work instructions, including for regular internal audits and calibration of tools, shall be provided.

TS 40.1.1 Discrete I/O (Inputs/Outputs)

All wiring to I/O devices, either at the harness level or individual wires, shall be labeled or color-coded in a fashion that allows unique identification at a spacing not exceeding 4 in. Wiring for each I/O device shall be bundled together. If the I/O terminals are the same voltages, then jumpers may be used to connect the common nodes of each I/O terminal.

TS 40.1.2 Shielding

All wiring that requires shielding shall meet the following minimum requirements. A shield shall be generated by connecting to a ground, which is sourced from a power distribution bus bar or chassis. A shield shall be connected at one location only, typically at one end of the cable. However, certain standards or special requirements, such as SAE J1939 or radio frequency applications, have separate shielding techniques that also shall be used as applicable.

When using shielded or coaxial cable, upon stripping of the insulation, the metallic braid shall be free from frayed strands, which can penetrate the insulation of the inner wires. To prevent the introduction of noise, the shield shall not be connected to the common side of a logic circuit.

TS 40.1.3 Communications

The data network cabling shall be selected and installed according to the selected protocol requirements. The physical layer of all network communications systems shall not be used for any purpose other than communication among the system components, unless provided for in the network specifications.

Communications networks that use power line carriers (e.g., data modulated on a 24 V power line) shall meet the most stringent applicable wiring and terminal specifications.

TS 40.1.4 Radio Frequency (RF)

RF components, such as radios, video devices, cameras, GPS, etc., shall use coaxial cable to carry the signal where applicable. 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 contribute 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 the antenna and cable assembly. The corresponding component vendors shall be consulted for proper application of equipment, including installation of cables.

TS 40.1.5 Audio

Cabling used for microphone level and line level signals shall meet EMC requirements per SAE J1113/1.

TS 41 Multiplexing

TS 41.1 General

Versatility and future expansion shall be provided for by expandable system architecture. The multiplex system shall be capable of accepting new inputs and outputs through the addition of new modules and/or the utilization of existing spare inputs and outputs. All like components in the multiplex system shall be modular and interchangeable with self-diagnostic capabilities. The modules shall be easily accessible for troubleshooting electrical failures and performing system maintenance. Multiplex input/output modules shall use solid-state devices to provide extended service life and individual circuit protection.

10% of the total number of inputs and outputs, or at least one each for each voltage type utilized (0 V, 12 V, 24 V) at each module location shall be designated as spares.

TS 41.2 System Configuration

Multiplexing may either be distributed or centralized. A distributed system shall process information on multiple control modules within the network. A centralized system shall process the information on a single control module. Either system shall consist of several modules connected to form a control network.

TS 41.2.1 I/O Signals

The input/output for the multiplex system may contain four types of electrical signals: discrete, modulating, analogue and serial data.

Discrete signals shall reflect the on/off status of switches, levers, limit switches, lights, etc. Analog signals shall reflect numerical data as represented by a voltage signal (0 to 12 V, 10 to 24 V, etc.) or current signal (4 to 20 mA). Both types of analog signals shall represent the status of variable devices such as rheostats, potentiometers, temperature probes, etc. Serial data signals shall reflect ASCII or alphanumeric data used in the communication between other onboard components.

TS 42 Data Communications

TS 42.1 General

All data communications networks shall be either in accordance with a nationally recognized interface standard, such as those published by SAE, IEEE or ISO, or shall be published to the Agency with the following minimum information:

- Protocol requirements for all timing issues (bit, byte, packet, inter-packet timing, idle line timing, etc.) packet sizes, error checking and transport (bulk transfer of data to/from the device).
- Data definition requirements that ensure access to diagnostic information and performance characteristics.
- The capability and procedures for uploading new application or configuration data.
- Access to revision level of data, application software and firmware.
- The capability and procedures for uploading new firmware or application software.
- Evidence that applicable data shall be broadcast to the network in an efficient manner such that the overall network integrity is not compromised.
- Data communication initialization and after run time for components after the MRS is turned on or off—what the standard is and how the OEM defines it.

Any electronic vehicle components used on a network shall be conformance tested to the corresponding network standard.

TS 42.2 Drivetrain Level

Drivetrain components, consisting of the motor(s), motor inverter(s), engine, transmission, retarder, antilock 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 and/or J1708/J1587, with forward and backward compatibilities or other open protocols. At a minimum, drivetrain

components shall be powered by a dedicated and isolated ignition supply voltage to ensure that data communication among components exists when the vehicle ignition is switched to the “on” position.

TS 42.2.1 Diagnostics, Fault Detection and Data Access

Drivetrain performance, maintenance and diagnostic data, and other electronic messages shall be formatted and transmitted on the communication networks.

The drivetrain level shall have the ability to record abnormal events in memory and provide diagnostic codes and other information to service personnel. At a minimum, this network level shall provide live/fail status, current hardware serial number, software/data revisions and uninterrupted timing functions.

TS 42.2.2 Programmability (Software)

The drivetrain-level components shall be programmable by the Agency with limitations as specified by the subsystem Supplier.

TS 42.3 Multiplex Level

TS 42.3.1 Data Access

At a minimum, information shall be made available via a communication port on the multiplex system. The location of the communication port shall be easily accessible. A hardware gateway and/or wireless communication system are options if requested by the Agency. The communication port(s) shall be located as specified by the Agency.

TS 42.3.2 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 onboard visual/audible indicators.

In addition to the indicators, the system shall employ an advanced diagnostic and fault detection system, which shall be accessible via either a personal computer or a handheld unit. Either unit shall have the ability to check logic function. Vendor shall provide any diagnostic software needed to read ladder logics.

TS 42.3.3 Programmability (Software)

The multiplex system shall have security provisions to protect its software from unwanted changes. This shall be achieved through any or all of the following procedures:

- password protection
- limited distribution of the configuration software
- limited access to the programming tools required to change the software
- hardware protection that prevents undesired changes to the software

Provisions for programming the multiplex system shall be possible through a PC, laptop or portable device. The multiplex system shall have proper revision control to ensure that the hardware and software are identical on each vehicle equipped with the system. Revision control shall be provided by all of the following:

- hardware component identification where labels are included on all multiplex hardware to identify components
- hardware series identification where all multiplex hardware displays the current hardware serial number and firmware revision employed by the module
- software revision identification where all copies of the software in service 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.

TS 42.4 Electromagnetic Compatibility (EMC)

Electrical and electronic subsystems and components on all buses shall not emit electromagnetic radiation that will interfere with onboard systems, components or equipment, telephone service, radio or TV reception, or violate regulations of the Federal Communications Commission.

Electrical and electronic subsystems 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 RFI/EMI that can disturb the performance of electrical/electronic equipment as defined in CAN/CSA-CISPR 12-10, SAE J1113, SAE J1455 or UNECE Council Directive 95/54 (R10).

TS 43 Driver's Area Controls

TS 43.1 General

In general, when designing the driver's area, it is recommended that SAE J833, "Human Physical Dimensions," be used.

Switches and controls shall be divided into basic groups and assigned to specific areas, in conformance with customer requirements and Manufacturer input. Switches and controls shall be essentially within the hand reach envelope of a 95th-percentile male and 5th-percentile female.

TS 43.2 Glare

The driver's work area shall be designed to minimize glare to the extent possible. The driver's work area includes all forward areas that reflect lighted objects to show reflection in windshield, as well as side window and door glass. 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. Such objects include dash panels, switches and controls, cowlings, windshield wipers and arms, barriers and modesty panels, fare stanchions, access panels and doors, fasteners, flooring, ventilation and heating ducting, window and door frames, and visors. Interior lighting located ahead of the standee line shall be controllable by the driver. Transit vehicle manufacturers shall make every effort to reduce glare and shall provide a plan response for how they mitigate glare on reflective materials to be reviewed by the Agency.

TS 43.3 Visors/Sun Shades

Front and Side Sun Shade/Visor

Full-width adjustable sun visors shall be provided for the driver's windshield and the driver's-side window. Visors shall be shaped to minimize light leakage between the visor and windshield pillars. Visors shall store out of the way and shall not obstruct airflow from the climate control system or interfere with other equipment, such as the radio handset or the destination control. Deployment of the visors shall not restrict vision of the rearview mirrors. Visor adjustments shall be able to be made easily by the operator. Sun visor construction and materials shall be strong enough to resist breakage during adjustments. Visors shall be opaque, and when deployed, shall be adjustable downward to plain at the elevation of a 5th-percentile female seated eye height.

TS 43.4 Driver's Controls

Frequently used controls must be in easily accessible locations. These include the door control, kneel control, windshield wiper/washer controls, ramp, and lift and run switch. Any switches and controls necessary for the safe operation while underway shall be conveniently located and shall be tactilely identifiable or illuminated. For ease of night time operation to the extent possible.

All panel-mounted switches and controls shall be easily identifiable. 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.

TS 43.5 Normal Bus Operation Instrumentation and Controls

Table 8 identifies common controls and indicators used to operate the bus. This table is for reference only and is not meant to be all inclusive. Controls shall be placed as conveniently as possible based on frequency of use and operator ergonomic considerations.

Systems or components monitored by onboard diagnostics system shall be displayed in clear view of the operator and provide visual and/or audible indicators. The intensity of indicators shall permit easy determination of on/off status in bright sunlight but shall not cause a distraction or visibility problem at night. All indicators shall be illuminated using backlighting.

The indicator panel shall be located in Area 1 or Area 5, within easy view of the operator instrument panel. All indicators shall have a method of momentarily testing their operation. The audible alarm shall be tamper-resistant and shall have an outlet level between 80 and 83 dBA when measured at the location of the operator's ear.

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.

All switches and controls shown in **Table 8** shall be placed based on frequency of use and ergonomic considerations.

TABLE 8.1 (Transit Coach)
Transit Bus Instruments and Alarms

Device	Function	Visual/Audible
Master run switch	Master control for bus, off, day run, night run and clearance ID lights	
System start, front	Activates vehicle systems	
System start, rear	Activates vehicle systems	
System run, rear	Permits activating vehicle system from rear start, normal front run position and off	Amber light
Drive selector	Provides selection of propulsion: forward, reverse and neutral	Gear selection
HVAC	Permits selection of passenger ventilation: off, cool, heat, low fan, high fan, or full auto with on/off only	
Driver's ventilation	Permits supplemental ventilation: fan off, low or high	
Defroster fan	Permits defroster: fan off, low, medium or high	
Defroster temperature	Adjusts defroster water flow and temperature	
Windshield wiper	Variable speed control of left and right windshield wipers	
Windshield washer	Activates windshield washers	
Dash panel lights	Provides adjustment for light intensity in night run position	
Interior lights	Selects mode of passenger compartment lighting	
WC ramp/kneel enable	Permits operation of ramp and kneel operations at each door remote panel	Amber light
Front door ramp/kneel enable	Permits ramp and kneel activation from front door area, key required ¹	Amber light
Front door ramp	Permits deploy and stow of front ramp	Red light
Front kneel	Permits kneeling activation and raise and normal at front door remote location	Amber or red dash indicator exterior alarm and amber light
Rear door ramp/kneel enable	Permits ramp and kneel activation from rear door area; key required ¹	Red light
Rear door ramp	Permits deploy and stow of rear ramp	
Rear kneel	Permits kneeling activation and raise and normal at rear door remote location	
Silent alarm	Activates emergency radio alarm at dispatch and permits covert microphone and/or enables destination sign emergency message	
Video system event switch	Triggers event equipment and event light on dash	Amber light
Left remote mirror	Permits two-axis adjustment of left exterior mirror	
Right remote mirror	Permits two-axis adjustment of right exterior mirror	
Mirror heater	Permits heating of outside mirrors when required	
Passenger door control	Permits open/close control of front and rear passenger doors	Red light
Rear door override	Allows driver to override activation of rear door	
System shutdown override	Permits driver to override auto system shutdown	
Hazard flashers	Activates emergency flashers	Two green lights
Fire suppression	Permits driver to override and manually discharge fire suppression system	Red light
Mobile data terminal	Facilitates driver interaction with communication system and master log-on	LCD display with visual status and text messages
Farebox interface	Facilitates driver interaction with farebox system	LCD display
Destination sign interface	Facilitates driver interaction with destination sign system, manual entry	LCD display
Turn signals	Activates left and right turn signals	Two green lights and optional audible indicator
PA manual	Permits driver to manually activate public address microphone	
Low-profile microphone	Permits driver to make announcements with both hands on the wheel and focusing on road conditions	
High beam	Permits driver to toggle between low and high beam	Blue light

TABLE 8.1 (Transit Coach)
Transit Bus Instruments and Alarms

Device	Function	Visual/Audible
Parking brake	Permits driver to apply and release parking brake	Red light
Hill holder	Applies brakes to prevent bus from rolling	
Master door/interlock	Permits driver override to disable door and brake/throttle interlock	Red light
Warning interlocks deactivated	Illuminates to warn driver that interlocks have been deactivated	Red light
Retarder disable	Permits driver override to disable brake retardation/regeneration	Red light
Rear door passenger sensor disable	Permits driver to override rear door passenger sensing system	
Indicator/alarm test button	Permits driver to activate test of sentry, indicators and audible alarms	All visuals and audibles
Auxiliary power	Property to specify what function to supply	
Speedometer	Visual indication of speed and distance traveled, accumulated vehicle mileage, fault condition display	Visual
Air pressure gauge	Visual indication of primary and secondary air systems	Visual
Fire detection	Indication of fire detection activation by zone/location	Buzzer and red light
Door obstruction	Indication of rear door sensitive edge activation	Red light and buzzer
Door ajar	Indication of rear door not properly closed	Buzzer or alarm and red light
Low system air pressure	Indication of low air system pressure	Buzzer and red light
System coolant indicator	Detects low coolant condition	Amber light
Hot system indicator	Detects system overheat condition and initiates time delay shutdown	Red light
ABS indicator	Displays system failure	Amber light
HVAC indicator	Displays system failure	Amber or red light
LV charging system indicator (12/24 V)	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	Indicates bike rack not being in fully stowed position	Amber or red light
HV charging system indicator (ESS)	Indicates when bus is connected to off-board charger and ESS is accepting charge	Visual
State of charge indicator	Indicates usable SoC of ESS	Visual
Low fuel indicator	Indicates low fuel level	Visual
Low DEF indicator	Indicates low DEF level	Visual
Turntable (articulated buses only)	Warning indication for hinge locking	Audible and amber warning and red light if locked
Turntable (articulated buses only)	Momentarily release interlock brakes due to overangled condition	

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

TS 43.6 Driver Foot Controls

Accelerator and brake pedals shall be designed for ankle motion. Foot surfaces of the pedals shall be faced with wear-resistant, nonskid, replaceable material.

TS 43.6.1 Pedal Angle

The vertical angle of the accelerator and brake pedals shall be determined from a horizontal plane regardless of the slope of the cab floor. The accelerator and brake pedals shall be positioned at an angle of 37 to 50 deg at the point of initiation of contact and extend downward to an angle of 10 to 27 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.

TS 43.6.2 Pedal Dimensions and Position

The floor-mounted accelerator pedal shall be 9 to 12 in. long and 3 to 4 in. 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 in. Both pedals should be located approximately on the same plane coincident to the surface of the pedals.



TS 43.7 Brake and Accelerator Pedals**High Point Transit, Link, WSTA – Base****Brake Pedal**

Non-adjustable brake pedal.

PART – Base Link - Option**Adjustable Brake and Accelerator Pedals**

Both pedals shall be adjustable forward and rearward a minimum of 3 in. The adjustment shall be made by use of a toggle or rocker switch. Location of the rocker switch shall be approved by the Agency. The switch shall be clearly labeled to identify it as 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.

PART – Base

Konsber adjustable pedals or approved equal.

TS 43.8 Driver Foot Switches**Floor-Mounted Foot Control Platform**

The angle of the turn signal platform shall be determined from a horizontal plane, regardless of the slope of the cab floor. The turn signal platform shall be angled at a minimum of 10 deg and a maximum of 37 deg. It shall be located no closer to the seat front than the heel point of the accelerator pedal.

Turn Signal Controls

Turn signal controls shall be floor-mounted, foot-controlled, water-resistant, heavy-duty, momentary contact switches.

Foot Switch Control

The control switches for the turn signals shall be mounted on an inclined, floor-mounted stainless steel enclosure or metal plate mounted to an incline integrated into the driver's platform, located to the left of the steering column. The location and design of this enclosure shall be such that foot room for the operator is not impeded. All other signals, including high beam and public address system, shall be in approved locations.

The foot switches shall be UL-listed, heavy-duty type, of a rugged, corrosion-resistant metal construction. The foot switches for the directional signals shall be momentary type, while those for the PA system and the high beam shall be latching type. The spacing of the switches shall be such that inadvertent simultaneous deflection of switches is prevented.

Link – Option**Turn Signal Controls**

Adjustable turn signal platform.

PART – Base

Other Floor-Mounted Controls - silent alarm

TS 44 Driver's Amenities

TS 44.1 Coat Hanger

High Point Transit, Link, WSTA – Base

Coat Hanger

A suitable hanger shall be installed in a convenient location for the driver's coat.

PART – Base

Coat Hook

A hook and loop shall be provided to secure the driver's coat.

TS 44.2 Drink Holder

PART, High Point Transit, Link – Base

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 easy removal of the container. When the container is in the device, the driver's view of the road must not be obstructed, and leakage from the container must not fall on any switches, gauges or controls. A cup holder shall not be mounted in a location that, if a spill were to occur, damage to electrical and/or mechanical components would be imminent.

WSTA – Base

No drink holder.

TS 44.3 Storage Box

Storage Box

An enclosed driver storage area shall be provided with a positive latching door and/or lock.

PART – Base

Curbside Front Wheel Housing Storage Box 8.25"H x 22.5" W x 13"D or approved equal

TS 45 Windshield Wipers and Washers

TS 45.1 Windshield Wipers

The bus shall be equipped with a windshield wiper for each half of the windshield and shall comply with FMVSS 104. 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 fasteners that secure any of the wiper system serviceable components shall be corrosion-resistant.

Single-control, electric two-speed intermittent wiper.

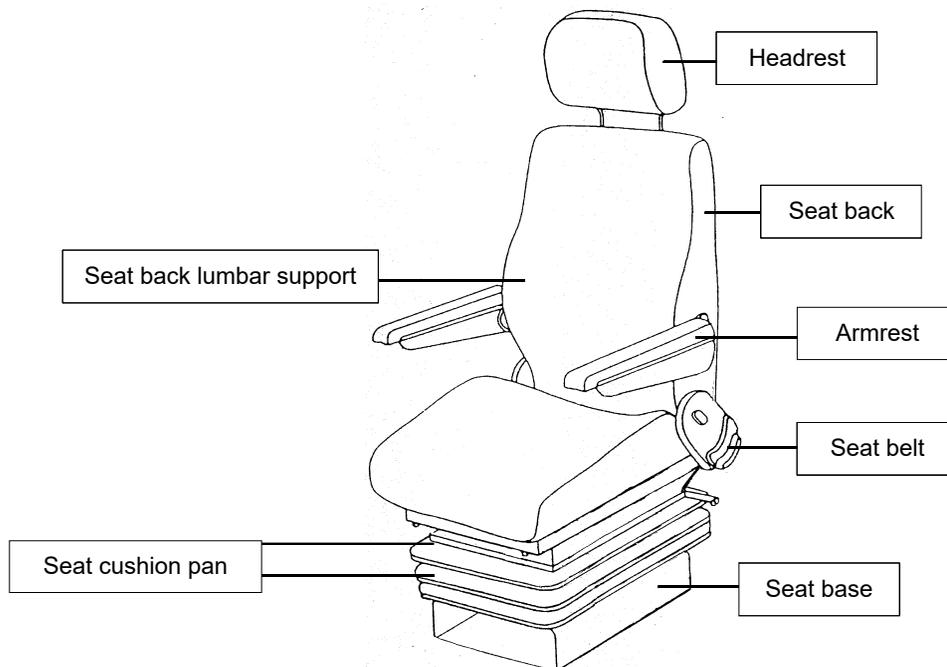
TS 45.2 Windshield Washers

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 gal reservoir, located for easy refilling from outside the bus. Reservoir pumps, lines and fittings shall be corrosion-resistant and must include a means to determine fluid level.

TS 46 Driver's Seat

FIGURE 7
Driver's Seat



TS 46.1 Dimensions

The driver's seat shall be comfortable and adjustable so that people ranging in size from a 95th-percentile male to a 5th-percentile female may operate the bus, based on Hybrid III ADT MIL-STD-1472E.

TS 46.1.1 Seat Cushion Pan Length

Measurement shall be from the front edge of the seat pan to the rear at its intersection with the seat back. The adjustment of the seat pan length shall be no less than 16.5 in. at its minimum length and no more than 20.5 in. at its maximum length.

TS 46.1.2 Seat Height Adjustment

Dimensions

Suspension adjustment minimum of 6 in. of height adjustment.

TS 46.1.3 Seat Pan Cushion Slope

The cushion should have an upward angle of at least 12 deg and cannot have a downward angle less than -5 deg.

TS 46.1.4 Seat Base Fore/Aft Adjustment

Seat shall have minimum of 9 in. of fore/aft travel. Seat shall be conformed and installed to accommodate people ranging in size from a 95th-percentile male to a 5th-percentile female to allow easy access to the operator's station. Seat shall be supplied with seat locking tracks with positive latching.

WSTA – Base

Minimum fore/aft travel of 11 in.

TS 46.1.5 Seat Pan Cushion Width

Measurement is the horizontal distance across the seat cushion. The seat pan cushion shall be 17 to 21 in. across at the front edge of the seat cushion and 20 to 23 in. across at the side bolsters.

TS 46.1.6 Seat Suspension

The driver's seat shall be appropriately dampened to support a minimum weight of 380 lb. The suspension shall be capable of dampening in both directions in the Z axis.

Rubber bumpers shall be provided to prevent metal-to-metal contact. Seat suspension shall have a manually adjustable suspension.

TS 46.1.7 Seat Back**Width**

Measurement is the distance between the outermost points of the front of the seat back, at or near its midpoint in height. The seat back width shall be no less than 19 in. Seat back will include dual recliner gears on both sides of the seat.

Height

Standard height seat back.

TS 46.1.8 Headrests

Adjustable headrest.

TS 46.1.9 Seat Back Lumbar Support

Measurement is from the bottom of the seat back at its intersection with the seat pan to the top of the lumbar cushioning. The seat back shall provide adjustable-depth lumbar back support with three individual operating lumbar cells or functional equivalent to fit people ranging from the 5th percentile female to 95th percentile male.

TS 46.1.10 Seat Back Angle Adjustment

The seat back angle shall be measured relative to a level seat pan, where 90 deg is the upright position and 90 deg-plus represents the amount of recline.

The seat back shall adjust in angle from a minimum of no more than 90 deg (upright) to at least 105 deg (reclined), with infinite adjustment in between.

TS 46.2 Seat Belt

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 seatbelt assemblies as installed in the bus shall withstand static horizontal forces as required in FMVSS sections 207, 209 and 210.

Lap and Shoulder (Three-Point) Seat Belt

Seat belts shall be provided across the driver's 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. Three-point seatbelts must be emergency locking retractor in design.

PART – Base

One belt with a standard buckle.

PART, Link – Base

Seatbelt webbing shall be black in color.

High Point Transit - Base

Seatbelt webbing shall be orange in color.

WSTA – Base

Shoulder belt shall be high visibility.

TS 46.2.1 Lap Belt Length

The lap belt assembly shall be a minimum of 72 in. in length.

TS 46.3 Adjustable Armrest**High Point Transit, WSTA – Base Link - Option**

No armrests.

Link – Base

One armrest, right side.

PART – Base

Two armrests.

TS 46.4 Seat Control Locations

While seated, the driver shall be able to make seat adjustments by hand without complexity, excessive effort or being pinched. Adjustment mechanisms shall hold the adjustments and shall not be subject to inadvertent changes.

TS 46.5 Seat Structure and Materials**Cushions**

Cushions shall be fully padded with at least 3 in. of materials in the seating areas at the bottom and back.

Cushion Materials

Open-cell polyurethane (FMVSS 302).

TS 46.6 Pedestal**High Point Transit, Link, WSTA – Base**

Powder-coated steel.

PART – Base Link - Option

Stainless steel.

TS 46.7 Seat Options

Choose among the following:

- heated seat
- occupant seat sensor
- fabric options
- seat air ventilation/cooling
- side bolsters adjustments
- Docket 90-compliant silicone foam cushion
- removable seat cushions for maintenance exchangeability

TS 46.8 Mirrors**TS 46.8.1 Exterior Mirrors**

The bus shall be equipped with corrosion-resistant, outside rearview mirrors mounted with stable supports to minimize vibration. Mirrors shall be firmly attached to the bus to minimize vibration and to prevent loss of adjustment. 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 be mounted to allow the head and shoulders of a 95th-percentile male/5th-percentile female to be unobstructed.

Mirrors shall comply with FMVSS 111.

Mirrors shall retract or fold sufficiently to allow bus-washing operations but avoid contact with glazing or bus body.

All Agencies – Base

Heated mirrors.
Remote-controlled mirrors.

PART – Base

Exterior mirrors shall be installed without a breakaway mounting system.

High Point Transit, Link, WSTA – Base

Exterior mirrors shall be installed with a breakaway mounting system with a spring-loaded auto-return feature.

PART, Link – Base**Flat Mirrors on Both Sides**

The bus shall be equipped with two flat outside mirrors, each with not less than 50 in.2 of reflective surface. The mirrors shall be located so as to provide the driver a view to the rear along both sides of the bus and shall be adjustable both in the horizontal and vertical directions to view the rearward scene. The roadside rearview mirror shall be positioned so that the driver's line of sight is not obstructed.

High Point Transit, WSTA – Base

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

Link – Base**Combination of Mirrors and CCTV Cameras**

The bus shall be equipped with a combination of mirrors and CCTV cameras

Curbside Mirrors

The curbside rearview mirror shall be mounted so that its lower edge is no less than 76 in. above the street surface. A lower mount may be required due to mirror configuration requests.

Remote Adjustment of Curbside Mirror

The driver shall be able to adjust the curbside mirror remotely while seated in the driving position. The control for remote positioning of the mirror shall be a single switch or device.

Link – Base PART - Option

Add blind spot detection indicator.

Street-Side Mirrors**Remote Adjustment of Street-Side Mirror**

The driver shall be able to adjust the street-side mirror remotely while seated in the driving position. The control for remote positioning of the mirror shall be a single switch or device. The remote switch shall be a membrane-protected switch to mitigate moisture intrusion. Switch shall be IP66 rated.

Heated Street-Side Mirrors

The street-side mirrors shall have heaters that energize whenever the driver's heater and/or defroster is activated, or can be activated independently.

Link – Base PART - Option

Add blind spot detection indicator.

Mirrors with integrated turn signal imbedded in the glass.

Mirrors with external mountain turn signal on the exterior mirror housing.

TS 46.8.2 Interior Mirrors

Mirrors shall be provided for the driver to observe passengers throughout the bus without leaving the seat and without shoulder movement. The driver shall be able to observe passengers in the front/entrance and rear/exit areas (if applicable), anywhere in the aisle, and in the rear seats.

Link – Base

Include embedded monitor behind the mirror glass to display multiple camera feeds. Mirror shall have full-size reflectivity with a smaller screen that is activated by a bus input (like a backup camera, or interior or exterior camera view to be displayed by a temporary bus input).

TS 47 WINDOWS

TS 47.1 General

30' Bus: A minimum of 6000 in.² of window area, including operator and door windows, shall be required on each side of the standard configuration bus.

35' Bus: A minimum of 8000 in.² of window area, including operator and door windows, shall be required on each side of the standard configuration bus.

40' Bus: A minimum of 10,000 in.² of window area, including operator and door windows, shall be required on each side of the standard configuration bus.

TS 48 Windshield

The windshield shall permit an operator's field of view as referenced in SAE J1050. The vertically upward view shall be a minimum of 14 deg, measured above the horizontal and excluding any shaded band. The vertically downward view shall permit detection of an object 3½ ft high no more than 2 ft in front of the bus. The horizontal view shall be a minimum of 90 deg above the line of sight. Any binocular obscuration due to a center divider may be ignored when determining the 90 deg requirement, provided that the divider does not exceed a 3 deg angle in the operator's field of view. Windshield pillars shall not exceed 10 deg of binocular obscuration. The windshield shall be designed and installed to minimize internal and external glare and reflections.

The windshield shall be easily replaceable by removing zip-locks from the windshield retaining moldings. Bonded-in-place windshields shall not be used. Winglets may be bonded.

TS 48.1 Glazing

The windshield glazing material shall have a ¼ in. nominal thickness laminated safety glass conforming to the requirements of ANSI Z26.1 Test Grouping AS-1 and the recommended practices defined in SAE J673.

Shaded Band

The upper portion of the windshield above the driver's field of view shall have a dark, shaded band and marked AS-3, with a minimum luminous transmittance of 5% when tested in accordance to ASTM D1003.

Two-piece windshield.

TS 49 Glare

The windshield, operator-side window and door glass shall be designed to minimize glare to the extent possible. This includes all forward areas that reflect lighted objects to show reflection in the windshield, as well as side window and door glass. Transit vehicle manufacturers shall make every effort to reduce glare and shall provide a plan response for how they mitigate glare on reflective materials to be reviewed by the Agency.

TS 50 Driver's-Side Window

The driver's-side window shall be the sliding type, requiring only the rear half of the sash to latch upon closing, and shall open sufficiently to permit the seated operator to easily access and/or adjust the street-side outside rearview mirror. When in an open position, the window shall not rattle or close during braking. This window section shall slide in tracks or channels designed to last the service life of the bus. The operator's side window shall be easily replaceable. The glazing material shall have a single-density tint.

The driver's view, perpendicular through the operator's-side window glazing, should extend a minimum of 33 in. (840 mm) to the rear of the heel point on the accelerator, and in any case must accommodate a 95th-percentile male operator. The view through the glazing at the front of the assembly should begin not more than 26 in. (560 mm) above the operator's floor to ensure visibility of an under-mounted convex mirror. Driver's window construction shall maximize ability for full opening of the window.

The driver's-side window glazing material shall have a ¼ in. nominal thickness laminated safety glass conforming to the requirements of ANSI Z26.1-1996 Test Grouping AS-2 and the recommended practices defined in SAE J673.

The design shall prevent sections from freezing closed in the winter. Light transmittance shall be 75% on the glass area below 53 in. from the operator platform floor. On the top-fixed-over-bottom-slider configuration, the top fixed area above 53 in. may have a maximum 5% light transmittance.

Standard Driver's-Side Window, Traditional Frame

PART – Base

Full slider

TS 51 Side Windows

TS 51.1 Configuration

Side windows shall not be bonded in place, but shall be easily replaceable without disturbing adjacent windows and shall be mounted so that flexing or vibration from engine operation or normal road excitation is not apparent. All aluminum and steel material will be treated to prevent corrosion.

TS 51.2 Emergency Exit (Egress) Configuration

PART, Link – Base

Minimum Egress

All side windows shall be fixed in position, except as necessary to meet the emergency escape requirements.

High Point Transit, WSTA – Base

Maximum Egress

Every window shall be capable of being made an egress window to be determined by the Transit vehicle manufacturer.

TS 51.3 Configuration

Standard Passenger Side Window Configurations

Choose from the following options:

- traditional frame
- full fixed
- openable windows with inward-opening transom panels
- openable windows with sliding transom panels
- openable windows with a fixed transom panel and sliding lower panels
- hidden frame (flush)
- full fixed
- openable windows with inward-opening transom panels

PART – Base

Framed Transom

TS 51.4 Materials

Safety Glass Glazing Panels

Side windows glazing material shall have a minimum of 3/16 in. nominal thickness tempered safety glass. The material shall conform to the requirements of ANSI Z26.1-1996 Test Grouping 2 and the recommended practices defined in SAE J673.

High Point Transit, Link, WSTA – Base

Windows on the bus sides and in the rear door shall be tinted a neutral color, complementary to the bus exterior. The maximum solar energy transmittance shall not exceed 37%, as measured by ASTM E424. Luminous transmittance shall be measured by ASTM D1003. Windows over the destination signs shall not be tinted.

PART – Base

All side and door windows shall be heat-rejecting glass with a solar heat gain coefficient (SHGC) of no greater than 40% and a visible light transmission of no less than 72%. Lower light transmission may be considered if SHGC values of less than 40% can be attained.

SHGC and light transmission performance shall be defined by the National Fenestration Rating Council.

TS 51.5 Rear Window

No requirement for rear window.

TS 52 HVAC Capacity and Performance

The HVAC climate control system shall be capable of controlling the temperature and maintaining the humidity levels of the interior of the bus as defined in the following paragraphs.

HVAC equipped. See below for configuration.

Link, WSTA – Base

Allow Either Roof- or Rear-Mounted HVAC Unit

The HVAC unit may be either roof- or rear-mounted. Note that a rear-mounted unit will preclude a rear window and that the term “roof-mounted unit” includes units mounted on top of or beneath the roof surface.

PART, High Point Transit – Base

Require Roof-Mounted HVAC Unit

The HVAC unit shall be roof mounted.

PART– Option

AC or DC electrically driven air conditioning system with hermetic or semi-hermetic AC compressor(s), condenser fan, evaporator blower motors and brushless AC generators.

Heat Pump System

The HVAC system shall be able to function as a heat pump system when needed.

With the bus running at the design operating profile with corresponding door opening cycle, and carrying a number of passengers equal to 150% 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% 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%.

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 °F for each degree of exterior temperature in excess of 95 °F.

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

Additional testing shall be performed as necessary to ensure compliance to performance requirements stated herein.

TS 52.1 Pull-Down/Pull-Up Test Requirements

The requirements of this section shall be subject to APTA BTS-HVAC-RP-003-04, “Transit Bus HVAC System Instrumentation and Performance Testing.”

Pull-Down Test Capacity and Performance Requirements

The air-conditioning portion of the HVAC system shall be capable of reducing the passenger compartment temperature from 115 to 95 °F in less than 20 minutes after engine startup. Engine temperature shall be within the normal operating range at the time of startup of the cooldown test, and the engine speed shall be limited to fast idle, which may be activated by a driver-controlled device. During the cooldown period, the refrigerant pressure shall not exceed safe high-side pressures, and the condenser discharge air temperature, measured 6 in. from the surface of the coil, shall be less than 45 °F above the condenser inlet air temperature.

TS 53 HVAC Controls and Temperature Uniformity

The HVAC system excluding the driver’s heater/defroster shall be centrally controlled with an advanced electronic/diagnostic control system with provisions for extracting/reading data. The system shall be compliant with SAE J1939 for receiving and broadcasting of data. The system shall comply with relevant portions of “Electrical, Electronic and Data Communication Systems” regarding data communication.

HVACs that use coolant pumps for driver’s defroster/heat shall be sized for the required flow and be brushless, having a minimum maintenance-free service life for both the brushless motor and the pump of at least 40,000 hours at full power.

Manual Mode Selection of Climate Control System

After manual selection and/or activation of climate control system operation mode, all interior climate control system requirements for the selected mode shall be attained automatically to within ± 2 °F of specified temperature control setpoint.

Single Control Setpoint at 70 °F

The temperature control setpoint for the system shall be 70 °F.

PART – Option

HVAC unit with reheat and recool.

Manually Adjustable Temperature Control Setpoint (Driver Control)

The climate control system shall have the provision to allow the driver to adjust the temperature control setpoint. After the driver has made the adjustment, all interior climate control system requirements shall be attained automatically, unless readjusted by the driver.

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

Interior temperature distribution shall be uniform to the extent practicable to prevent hot and cold spots. After stabilization with doors closed, the temperatures between any two points in the passenger compartment in the same vertical plane, and 6 to 72 in. above the floor, shall not vary by more than 5 °F with doors closed. The interior temperatures, measured at the same height above the floor, shall not vary more than ± 5 °F from the front to the rear from the average temperature determined in accordance with APTA BTS-HVAC-RP-003-04, “Transit Bus HVAC System Instrumentation and Performance Testing.” Variations of greater than ± 5 °F will be allowed for limited, localized areas provided that the majority of the measured temperatures fall within the specified requirement.

TS 53.1 Auxiliary Heater

PART, High Point Transit, WSTA – Base

No auxiliary heater.

Link – Base

Hybrid Electricity/Fuel Auxiliary Heater

The auxiliary heating system will be of the hybrid electricity/fuel type.

TS 54 HVAC Airflow

TS 54.1 Passenger Area

The cooling mode of the interior climate control system shall introduce air into the bus at or near the ceiling height at a minimum rate of 25 cubic feet per minute (cfm) per passenger based on the standard configuration bus carrying a number of passengers equal to 150% of the seated load. Airflow shall be evenly distributed throughout the bus, with air velocity not exceeding 100 ft per minute on any passenger. The ventilating mode shall provide air at a minimum flow rate of 20 cfm per passenger.

Airflow may be reduced to 15 cfm per passenger (150% of seated load) when operating in the heating mode. The fans shall not activate until the heating element has warmed sufficiently to ensure at least 70 °F air outlet temperature. The heating air outlet temperature shall not exceed 120 °F under any normal operating conditions.

The climate control blower motors and fan shall be designed such that their operation complies with the interior noise level requirements.

Requirement for 10% “Fresh Air” Mixture

The air shall be composed of no less than 10% outside air.

Link – Option

Air Purification System

The Contractor shall provide an air purification system and shall detail system efficacy in its Proposal.

Ultraviolet system.

TS 54.2 Driver’s Area

The bus interior climate control system shall deliver no less than 100 cfm of air to the driver’s area when operating in the heating, ventilating and cooling modes. Adjustable vents 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 J382, “Windshield Defrosting Systems Performance Requirements,” and shall have the capability of diverting heated air to the driver’s feet and legs. The defroster or interior climate control system shall maintain visibility through the driver’s-side window.

TS 54.3 Controls for the Climate Control System

The controls for the driver’s compartment for heating, ventilation and cooling systems shall be integrated and shall meet the following requirements:

- The heat/defrost system fan shall be controlled by a separate switch that has an “off” position and at least two positions for speed control. All switches and controls shall preclude the possibility of clothing becoming entangled, and shields shall be provided, if required. If the fans are approved by the Agency, an “on/off” switch shall be located to the right of or near the main defroster switch.
- Manually operated control.
- If a cable-operated manual control valve is used, then the cable length shall be kept to a minimum to reduce cable seizing.
- Heater water control valves shall be “positive” type, closed or open. The method of operating remote valves shall require the concurrence of the Agency project manager.

TS 54.4 Driver’s Compartment Requirements

A separate heating, ventilation and defroster system for the driver’s area shall be provided and shall be controlled by the driver. The system shall meet the following requirements:

- The heater and defroster system shall provide heating for the driver and heated air to completely defrost and defog the windshield, driver’s-side window and the front door glasses in all operating conditions.

Fans shall be able to draw air from the bus body interior and/or exterior through a control device and pass it through the heater core to the defroster system and over the driver's feet. A minimum capacity of 100 cfm shall be provided. The driver shall have complete control of the heat and fresh airflow for the driver's area.

- APTA BTS-HVAC-RP-003-04, "Transit Bus HVAC System Instrumentation and Performance Testing," shall apply as applicable.
- The defroster supply outlets shall be located at the lower edge of the windshield. These outlets shall be durable and shall be free of sharp edges that can catch clothes during normal daily cleaning. The system shall be such that foreign objects such as coins or tickets cannot fall into the defroster air outlets. Adjustable ball vents or louvers shall be provided at the left of the driver's position to allow direction of air onto the side windows.
- A ventilation system shall be provided to ensure driver comfort and shall be capable of providing fresh air in both the foot and head areas. Vents shall be controllable by the driver from the normal driving position. Decals shall be provided, indicating "operating instructions" and "open" and "closed" positions. When closed, vents shall be sealed to prevent the migration of water or air into the bus.

TS 54.5 Driver's Cooling

High Point Transit, WSTA – Base

No dedicated evaporator.

Air from the evaporator shall be provided to the driver's area through vents located overhead, or on the dash in front of the driver.

PART, Link – Base

Separate Dedicated Evaporator

Using a separate, dedicated evaporator, the climate control system shall be designed to maintain the driver's compartment temperatures within the range specified for the passenger compartment. The unit shall operate when the climate control switch is in the "Cool" position. It shall have a separate thermostatic control.

A separate fan unit shall provide 100 cfm of air to the driver's area through directionally adjustable nozzles and a variable fan control, both of which shall be located above and ahead of the driver.

Link – Base

Driver's booster blower.

TS 55 HVAC Air Filtration

Air shall be filtered before entering the AC system and being discharged into the passenger compartment. The filter shall meet ANSI/ASHRAE 52.2 for the maximum possible MERV rating based upon the Manufacturer's design and the design operating environment. Air filters shall be easily removable for service.

High Point Transit, WSTA – Base

Disposable Type Filters

Air filters shall be of disposable type.

PART, Link – Base

Cleanable Filters

Air filters shall be cleanable.

TS 56 Roof Ventilators

Each ventilator shall be easily opened and closed manually. When open with the bus in motion, this ventilator shall provide fresh air inside the bus. The ventilator shall cover an opening area no less than 425 sq.in. and shall be capable of being positioned as a scoop with either the leading or trailing edge open no less than 3 in., or with all four edges raised simultaneously to a height of no less than 33 in. An escape hatch shall be incorporated into the roof ventilator. Roof ventilator(s) shall be sealed to prevent entry of water when closed.

High Point Transit, WSTA – Base

Two Roof Ventilators

Two 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.

Link – Base

One Roof Ventilator

One ventilator shall be provided in the roof of the bus.

PART – Base

Two Roof Ventilators

Two 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.

Both roof ventilators shall be glass

PART – Option

An electronically controlled hatch shall be installed.

TS 57 HVAC Maintainability

High Point Transit, Link, WSTA – Base

Maintainability

The HVAC system shall be designed for cost-effective servicing and maintenance.

PART – Base

Maintainability and Valves

The HVAC system shall be designed for cost-effective servicing and maintenance. Manually controlled shutoff valves in the refrigerant lines shall allow isolation of the compressor and dehydrator filter for service. To the extent practicable, self-sealing couplings using O-ring seals shall be used to break and seal the refrigerant lines during removal of major components, such as the refrigerant compressor. Shutoff valves may be provided in lieu of self-sealing couplings.

All Agencies – Base

Condenser Location

The condenser shall be located to efficiently transfer heat to the atmosphere and shall not ingest air warmed above the ambient temperature by the bus mechanical equipment, or discharge air into any other system of the bus. The location of the condenser shall preclude its obstruction by wheel splash, road dirt

or debris. HVAC components located within 6 in. of floor level shall be constructed to resist damage and corrosion.

High Point Transit, Link, WSTA – Base

Refrigerant pressures shall be accessible with diagnostic equipment.

PART – Base

High and low refrigerant pressure electronic or analog gauges shall be located in an easily accessible area.

TS 58 HVAC Entrance/Exit Area Heating

No requirements for entrance/exit area heating.

Link – Option

Entrance/Exit Area Heating

Heat shall be supplied to the entrance and exit areas to maintain a tread surface temperature no less than 35 °F in an ambient temperature of –10 °F to prevent accumulation of snow, ice or slush with the bus operating under design operating profile and corresponding door opening cycle.

TS 59 Floor-Level Heating

TS 59.1 Transit Coach

PART, High Point Transit, WSTA – Base

No requirements for floor-level heating.

Link – Base

Warm Wall Heating

Sufficient heaters shall be provided with ducting to blow warm air upward through a cavity in the wall and discharge the warm air at the base of the windows. Control of the warm wall heating should be through the main heating system electronic control.

Link – Option

Floor-Level Heating

Sufficient floor-level heaters shall be provided. Control of the floor-level heating shall be through the main heating system.

TS 60 Exterior Panels and Finishes: 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.

TS 60.1 Materials

Body materials shall be selected and the body fabricated to reduce maintenance, extend durability and provide consistency of appearance throughout the service life of the bus. Detailing shall be kept simple, and add-on devices and trim shall be minimized and integrated into the basic design.

PART, High Point Transit, WSTA – Base

No requirement for protection against graffiti/vandalism for body material surfaces.

Link – Base

Requirements for protection against graffiti/vandalism for body material surfaces.

TS 60.2 Roof-Mounted Equipment (Transit Coach)

Coaches with roof mounted equipment shall install a nonskid, clearly marked walkway, or steps shall be incorporated on the roof, to provide access to equipment without damaging any system or bus paneling.

TS 61 Pedestrian Safety

Exterior protrusions along the side and front of the bus greater than ½ in. and within 80 in. of the ground shall have a radius no less than the amount of the protrusion. The exterior rearview mirrors, cameras and required lights and reflectors are exempt from the protrusion requirement. Advertising frames shall protrude no more than ⅞ in. from the body surface. Grilles, doors, bumpers and other features on the sides and rear of the bus shall be designed to minimize toeholds or handholds.

Exterior protrusions shall not cause a line-of-sight blockage for the driver.

TS 62 Side Body Panel Repair and Replacement (Transit Coach)

TS 62.1 Transit Coach

Structural elements supporting exterior body panels shall allow side body panels below the windows to be repaired.

Standard attachment of side body panels.

TS 63 Rain Gutters

Rain gutters shall be provided to prevent water flowing from the roof onto the passenger doors and driver's-side window. When the bus is decelerated, the gutters shall not drain onto the windshield, driver's-side window or door boarding area. Cross-sections of the gutters shall be adequate for proper operation.

TS 64 License Plate Provisions

Provisions shall be made to mount standard-size U.S. license plates per SAE J686 on the front and rear of the bus. These provisions shall direct-mount or recess the license plates so they can be cleaned by automatic bus-washing equipment without being caught by the brushes. The rear license plate provision shall be illuminated per SAE J587.

PART, High Point Transit, WSTA – Base

No plate or holder provision is required.

Link – Base

Front and rear plate

TS 64.1 Rub rails

No requirement for rub rails.

TS 65 Fender Flares

Features to minimize water spray from the bus in wet conditions shall be included in the wheel housing design. Any fender flares shall be easily replaceable. They shall be flexible if they extend beyond the allowable body width. Wheels and tires shall be removable with the fender skirts in place.

TS 66 Wheel Covers (Transit Coach)

Wheel covers not required.

TS 66.1 Splash Aprons

Standard Splash Aprons

Splash aprons, composed of ¼ in. minimum composition or rubberized fabric, shall be installed behind and/or in front of wheels as needed to reduce road splash and to protect underfloor components. The splash aprons shall extend downward to within 6 in. off the road surface at static conditions. Apron widths shall be no less than tire widths. Splash aprons shall be bolted to the bus understructure. Splash aprons and their attachments shall be inherently weaker than the structure to which they are attached. The flexible portions of the splash aprons shall not be included in the road clearance measurements. Splash apron shall be installed as necessary to protect the wheeled mobility device loading device from road splash. Other splash aprons shall be installed where necessary to protect bus equipment.

TS 67 Service Compartments and Access Doors

TS 67.1 Access Doors (Transit Coach)

Access openings shall be sized for easy performance of tasks within the compartment, including tool operating space. Access doors shall be of rugged construction and shall maintain mechanical integrity and function under normal operations throughout the service life of the bus. They shall close flush with the body surface. All doors shall be hinged at the top or on the forward edge and shall be prevented from coming loose or opening during transit service or in bus-washing operations. All access doors shall be retained in the open position by props or counterbalancing with overcenter or gas-filled springs with safety props and shall be easily operable by one person. Springs and hinges shall be corrosion-resistant. Latch handles shall be flush with, or recessed behind, the body contour and shall be sized to provide an adequate grip for opening. Access doors, when opened, shall not restrict access for servicing other components or systems.

If precluded by design, the Manufacturer shall provide door design information specifying how the requirements are met.

TS 67.2 Not Used

TS 67.3 Access Door Latch/Locks

Requirement for Latches on Access Doors

Access doors larger than 100 sq.in. in area shall be equipped with corrosion-resistant flush or surface-mounted latches or locks except for coolant and fuel fill access doors. All such access doors that require a tool to open shall be standardized throughout the vehicle and will require a nominal 5/16 in. square male tool to open or lock.

TS 68 Bumpers

TS 68.1 Location

Bumpers shall provide impact protection for the front and rear of the bus with the top of the bumper being 27 in., ± 3 in., above the ground. Bumper height shall be such that when one bus is parked behind another, a portion of the bumper faces will contact each other.

TS 68.2 Front Bumper

No part of the bus, including the bumper, shall be damaged as a result of a 5 mph impact of the bus at curb weight with a fixed, flat barrier perpendicular to the bus's longitudinal centerline. The bumper shall return to its pre-impact shape within 10 minutes of the impact. The bumper shall protect the bus from damage as a result of 6.5 mph impacts at any point by the common carriage with contoured impact surface defined in Figure 2 of FMVSS 301 loaded to 4000 lb 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 deg angle to the longitudinal centerline of the bus. The energy absorption system of the bumper shall be independent of every power system of the bus and shall not require service or maintenance in normal operation during the service life of the bus. The bumper may increase the overall bus length specified by no more than 7 in.

High Point Transit, WSTA – Base

Integrated Design with Recessed Middle Portion

The bumper shall be an integrated design with the coach styling and be recessed in the middle portion to provide for mounting of a bike rack if necessary.

PART – Base

Mounting provisions for an integrated bike rack. - Sportworks DL2, Power Coated or approved equal.

Link – Base

Mounting provisions for integrated bike rack.

TS 68.3 Rear Bumper

No part of the bus, including the bumper, shall be damaged as a result of a 2 mph impact with a fixed, flat barrier perpendicular to the longitudinal centerline of the bus. The bumper shall return to its pre-impact shape within 10 minutes of the impact. When using a yard tug with a smooth, flat plate bumper 2 ft wide contacting the horizontal centerline of the rear bumper, the bumper shall provide protection at speeds up to 5 mph, over pavement discontinuities up to 1 in. high, and at accelerations up to 2 mph per 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 lb, at 4 mph parallel to or up to a 30 deg angle to the longitudinal centerline of the bus. The rear bumper shall be shaped to prevent unauthorized riders standing on the bumper. The bumper shall not require service or maintenance in normal operation during the service life of the bus. The bumper may increase the overall bus length specified by no more than 7 in.

TS 68.4 Bumper Material

Bumper material shall be corrosion-resistant and shall withstand repeated impacts of the specified loads without sustaining damage. These bumper qualities shall be sustained throughout the service life of the bus.

TS 69 Finish and Color

TS 69.1 Appearance

All exterior surfaces shall be smooth and free of wrinkles and dents. Exterior surfaces to be painted shall be properly prepared as required by the paint system Supplier prior to application of paint to 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 and other items that are applied to the exterior of the bus. Body filler materials may be used for surface dressing, but not for repair of damaged or improperly fitted panels.

Paint shall be applied smoothly and evenly with the finished surface free of visible dirt and the following other imperfections:

- blisters or bubbles appearing in the topcoat film
- chips, scratches or gouges of the surface finish
- cracks in the paint film
- craters where paint failed to cover due to surface contamination
- overspray
- peeling
- runs or sags from excessive flow and failure to adhere uniformly to the surface
- chemical stains and water spots
- dry patches due to incorrect mixing of paint activators
- buffing swirls

All exterior finished surfaces shall be impervious (rubber components shall be resistant) to diesel fuel, gasoline and commercial cleaning agents. Finished surfaces shall resist damage by controlled applications of commonly used graffiti-removing chemicals.

Proper adhesion between the basic surface and successive coats of the original paint shall be measured using an Elcometer Adhesion Tester as outlined in ASTM D4541-85. Adhesion shall be a minimum 300 ft-lb. The vehicle 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.

Standard Contractor exterior paint finish quality.

Base coat/clear coat paint system.

PART – Option

High Gloss External Paint Finish Quality

Painted surfaces shall have a minimum 95 gloss and an orange peel rating of 7 or more on the Advanced Coating Technologies Inc. orange peel standard panels set #APR 14941 or Agency-accepted wave scan equipment. Paint shall last a minimum of six years with a minimum gloss of 90 as measured in ASTM E9792, Standard Test Method For Directional Reflectance.

Standard OEM exterior paint system.

PART – Base

Maintenance-Free Exterior Finish, Color Impregnated Panels or Unpainted Panels



Except for periodic cleaning, exterior surfaces of the bus shall be maintenance free, permanently colored and not require refinish/repaint for the life of the vehicle. In general, the exterior surfaces shall be white. Durable, peel-resistant, pressure-sensitive appliques shall be used for any striping and coloring required.

All Agencies – Base

Most recent decals will be provided as an addendum.

TS 70 Decals, Numbering and Signing

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 appliques. All decals shall be installed per the decal Supplier recommendations. Signs shall be provided in compliance with the ADA requirements defined in 49 CFR Part 38, Subpart B, 38.27.

PART – Base

Roof numbers required. Bus numbers should be white.

TS 70.1 Passenger Information

ADA priority seating signs as required and defined by 49 CFR 38.27 shall be provided to identify the seats designated for passengers with disabilities.

Requirements for a public information system in accordance with 49 CFR 38.35 shall be provided.

TS 71 Exterior Lighting

All exterior lights shall be designed to prevent entry and accumulation of moisture or dust. Lamps, lenses and fixtures shall be interchangeable to the extent practicable. Two hazard lamps at the rear of the bus shall be visible from behind when the engine service doors are opened. Light lenses shall be designed and located to prevent damage when running the vehicle through an automatic bus washer.

Commercially available LED-type lamps shall be used at all exterior lamp locations.

Standard Lamps

All LED lamps shall be standard installation of the OEM. The entire assembly shall be specifically coated to protect the light from chemical and abrasion degradation.

Standard Size

Size of LED lamps used for tail, brake and turn signal lamps shall be standard installation of OEM

PART – Base

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 or low-profile type to protect the lens against minor impacts.

PART – Option

Larger Size

LED lamps used for tail, brake and turn signal lamps shall be a minimum of 7 sq.in.

TS 71.1 Backup Light/Alarm

Visible and audible warnings shall inform following vehicles or pedestrians of reverse operation. Visible reverse operation warning shall conform to SAE J593. Audible reverse operation warning shall conform to SAE J994 Type C or D.

TS 71.2 Doorway Lighting

Lamps at the front and rear passenger doorways (if applicable) shall comply with ADA requirements and shall activate only when the doors open. These lamps shall illuminate the street surface to a level of no less than 1 fc for a distance of 3 ft outward from the outboard edge of the door threshold. The lights may be positioned above or below the lower daylight opening of the windows and shall be shielded to protect passengers' eyes from glare.

TS 71.3 Turn Signals

Turn-signal lights, including any wraparound turn signals, shall be provided on the front, rear, curb and street sides of the bus in accordance with federal regulations.

TS 71.4 Headlamps

Headlamps shall be designed for ease of replacement.

Standard Installation

Standard OEM headlamp installation shall be provided in accordance with federal regulations.

Daytime Running Lights

Headlamps shall incorporate a daytime running light feature.

Link – Base**LED**

Headlamps shall be LED, sealed beam.

PART – Option**LED**

Headlamps shall be LED, sealed beam.

Halogen

Headlamps shall be halogen, sealed beam.

TS 71.5 Brake Lamps**TS 71.5.1 Transit Coach**

Brake lamps shall be provided in accordance with federal regulations.

PART, High Point Transit, Link, WSTA – Base**High and Center Mount Red Brake Lamp**

Bus shall include high and center mount red brake lamp(s) along the back side of the bus in addition to the lower brake lamps required under FMVSS. The high and center mount brake lamp(s) shall illuminate steadily with brake application.

Link – Base**High and Center Mount Amber Lamp**

Bus shall include high and center mount amber lamp(s) along the back side of the bus that illuminate steadily when the transmission is in forward mode and when the throttle is completely released (0% engagement). The amber lamps shall automatically extinguish, regardless of transmission and throttle condition, with brake application. Operation of the amber lamps shall be programmable with the multiplex system.

TS 71.6 Service Area Lighting (Interior and Exterior)

LED lamps shall be provided in the engine and all other compartments where service may be required to generally illuminate the area for night emergency repairs or adjustments. These service areas shall include, but not be limited to, the engine compartment, the communication box, junction/apparatus panels and passenger door operator compartments. Lighting shall be adequate to light the space of the service areas to levels needed to complete typical emergency repairs and adjustments. The service area lamps shall be suitable for the environment in which they are mounted.

Engine compartment lamps shall be controlled by a switch mounted near the rear start controls or in an approved location. 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. Power shall be automatically discontinued (timed out) after 30 minutes or turned off when the PLC is shut down after a predetermined time to prevent damage caused by inadvertently leaving the service area lighting switch in the “on” position after repairs are made.

TS 72 Interior Panels and Finishes: General Requirements

Materials shall be selected on the basis of maintenance, durability, appearance, safety, noise reduction, flammability and tactile qualities. Materials shall be strong enough to resist everyday abuse and be vandalism- and corrosion-resistant. Trim and attachment details shall be kept simple and unobtrusive. Interior trim shall be secured to avoid resonant vibrations under normal operational conditions.

Interior surfaces more than 10 in. below the lower edge of the side windows or windshield shall be shaped so that objects placed on them fall to the floor when the 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.

PART, High Point Transit, WSTA – Base

No requirement for anti-graffiti/vandalism surface treatments.

Link – Base PART – Option

Internal surfaces, as possible, to be stainless steel or other resistant material.

PART – Option

Internal surfaces, as possible, to be stainless steel.

TS 73 Interior Panels

Panels shall be easily replaceable and tamper-resistant. They shall be reinforced, as necessary, to resist vandalism and other rigors of transit bus service. Individual trim panels and parts shall be interchangeable to the extent practicable.

Interior panel required to meet FMVSS 302.

PART – Option

Textured stainless steel.

TS 73.1 Driver Area Barrier

TS 73.1.1 Transit Coach

A barrier or bulkhead between the driver and the street-side front passenger seat shall be provided. The barrier shall minimize glare and reflections in the windshield directly in front of the barrier from interior lighting during night operation. Location and shape must permit full seat travel and reclining possibilities that can accommodate the shoulders of a 95th-percentile male. The partition shall have a side return and stanchion to prevent passengers from reaching the driver by standing behind the driver’s seat. The lower area between the seat and panel must be accessible to the driver. The partition must be strong enough in conjunction with the entire partition assembly for optional mounting of such equipment as flare kits, fire extinguishers (1.2 kg), microcomputer, public address amplifier, etc. The panel should be properly attached to minimize noise and rattles.

The driver’s barrier shall extend from the ceiling to the surface below (e.g., floor or wheel well) and shall fit close to the bus-side windows and wall to prevent passengers from reaching the driver or the driver’s personal effects. The driver’s barrier shall extend continuously from the bus wall to the first stanchion immediately behind the driver to provide security to the driver and to limit passenger conversation.

TS 73.1.2 Driver Protection Door

The bus operator’s area shall be isolated from passengers by a protective barrier. The barrier should be glazed on the upper section with a 3/8 in. laminated safety glass compliant to the latest requirements of ANSI/SAE Z26.1. The barrier shall be glazed on the upper section with a 3/8 in. AS2 type laminated safety glass or equivalent. The

glass shall have anti-glare, nonreflective coating on both sides. The barrier shall not obscure the driver's vision of the side windows or the rearview mirror. The barrier shall be mounted securely to the bus structure with a single hinge post. Individual strap hinges or piano-type hinges shall not be allowed. The barrier shall not interfere with access to the farebox or other devices mounted to the farebox pedestal. The barrier shall latch securely in the closed position. The latch shall be of a non-rattling type with a paddle handle release located such that the driver may reach over a closed barrier to open and gain access to the driver's area.

When mounted, the barrier shall comply with all ADA accessibility regulations for wheeled mobility device access.

PART – Option

PART – Bus operator protective barrier should be priced as an option. Queen City or approved equal.

Link – Base

The barrier shall incorporate two ventilation fans with variable speed control. These fans shall be capable of being configured as exhaust out of the driver area or ventilation into the driver area at the time of manufacture. There shall be a feature to quickly return the fans to the last speed setting when they are stopped.

High Point Transit, WSTA – Base Link – Option

The barrier shall incorporate two ventilation fans with variable speed control. These fans shall be capable of being configured as exhaust out of the driver area or ventilation into the driver area at the time of manufacture. There shall be a feature to quickly return the fans to the last speed setting when they are stopped. The barrier shall have a power window to allow interaction between the driver and passengers. The window shall have express-up and express-down functions whereby a single push of the window control switch will fully open or close the window.

TS 73.2 Modesty Panels

Sturdy divider panels constructed of durable, unpainted, corrosion-resistant material complementing the interior shall be provided to act as both a physical and visual barrier for seated passengers.

Design and installation of modesty panels located in front of forward-facing seats shall include a handhold or grab handle along their 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 1½ in. and no more than 8.25 in. above the floor. At doorways, the panels shall extend downward to no more than 2 in. above the floor. Panels forward of longitudinal seats shall extend to below the level of the seat cushion. To prevent passengers from being pinched, dividers positioned at the doorways, where applicable, 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. At the aft of the exit door, clearance shall be no less than 1.9 in. between the modesty panel and an inward opening door. Modesty panels installed at doorways shall be equipped with grab rails if passenger assists are not provided by other means.

The modesty panel and its mounting shall withstand a static force of 250 lb applied to a 4 × 4 in. area in the center of the panel without permanent visible deformation.

Modesty panels shall be installed as stated.

TS 73.3 Front End

The entire front end of the bus shall be sealed to prevent debris accumulation behind the dash and to prevent the driver's feet from kicking or fouling wiring and other equipment. The front end shall be free of protrusions that are hazardous to passengers standing at the front of the standee line area of the bus during rapid decelerations. Paneling across the front of the bus and any trim around the driver's compartment shall be formed metal or composite material. Composite dash panels shall be reinforced as necessary, vandal-resistant and replaceable. All colored, painted and plated parts forward of the driver's barrier shall be finished with a surface that reduces glare. Any mounted equipment must have provision to support the weight of equipment.

TS 73.4 Rear Bulkhead

The rear bulkhead (and articulated bus joint if applicable) and rear interior surfaces shall be of material suitable for exterior skin; painted and finished to exterior quality; or paneled with melamine-type material, composite, scratch-resistant plastic or carpeting and trimmed with stainless steel, aluminum or composite.

The rear bulkhead paneling shall be contoured to fit the ceiling, sidewalls 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 litter being thrown or drawn through the grille. If it is necessary to remove the panel to service components located on the rear bulkhead, then the panel shall be hinged or shall be able to be easily removed and replaced. Grilles where access to or adjustment of equipment is required shall be heavy-duty and designed to minimize damage and limit unauthorized access.

TS 73.5 Headlining

Ceiling panels shall be made of durable, corrosion-resistant, easily cleanable material. Headlining shall be supported to prevent buckling, drumming or flexing and shall be secured without loose edges. Headlining materials shall be treated or insulated to prevent marks due to condensation where panels are in contact with metal members. Moldings and trim strips, as required to make the edges tamperproof, shall be stainless steel, aluminum or plastic, colored to complement the ceiling material. Headlining panels covering operational equipment that is mounted above the ceiling shall be on hinges for ease of service but retained to prevent inadvertent opening.

TS 73.6 Fastening

Interior panels shall be attached so that there are no exposed unfinished, 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 shall be tamper-resistant where required by the Agency.

TS 73.7 Insulation

Any insulation material used between the inner and outer panels shall minimize the entry and/or retention of moisture. Insulation properties shall be unimpaired during the service life of the bus. Any insulation material used inside the engine compartment shall not absorb or retain oils or water and shall be designed to prevent casual damage that may occur during maintenance operations.

The combination of inner and outer panels on the sides, roof, wheel wells and ends of the bus, and any material used between these panels, shall provide a thermal insulation sufficient to meet the interior temperature requirements. The bus body shall be thoroughly sealed so that the driver or passengers cannot feel drafts during normal operations with the passenger doors closed.

High Point Transit, Link, WSTA – Base

Insulation shall meet the requirements of FMVSS 302.

PART – Base

FTA Docket 90-A

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

TS 73.8 Floor Covering

The floor covering shall have a nonskid 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 and shall not extend into the aisle. The color and pattern shall be consistent throughout the floor covering. The standee line shall be approximately 2 in. wide and shall extend across the bus aisle and contrast with the rest of the floor covering.

Additional Standee Marking

In addition to providing the standee line, any areas on the floor that are not intended for standees, such as areas "swept" during passenger door operation, shall be clearly and permanently marked.

The floor shall be easily cleaned and shall be arranged to minimize debris accumulation.

A one-piece center strip shall extend from the vertical wall of the rear settee between the aisle sides of transverse seats to the standee line. If the floor is of a bi-level construction, then the center strip shall be one piece at each level. The covering between the center strip and the wheel housings may be separate pieces. At the rear door, however, a separate strip as wide as the door shall extend from the center strip to the outboard edge of the rear/exit area. In the case of prefabricated floors with an integrated floor covering, the number of sections shall be minimized.

The floor under the seats shall be covered with smooth surface flooring material. The floor covering shall closely fit the sidewall. Flooring may fit the sidewall with a fully sealed butt joint, extend to the top of the cove, or be captured by the seat rail.

TS 74 Interior Lighting

The light source shall be located to minimize windshield glare, with distribution of the light focused primarily on the passengers' reading plane while casting sufficient light onto the advertising display. The lighting system may be designed to form part of or the entire air distribution duct.

The lens material shall be translucent polycarbonate. Lenses shall be designed to effectively "mask" the light source. Lenses shall be sealed to inhibit incursion of dust and insects yet be easily removable for service. Access panels shall be provided to allow servicing of components located behind light panels. If necessary, the entire light fixture shall be hinged.

TS 74.1 Passenger Area Lighting

First Row Lights Extinguish

The first light on each side (behind the driver and the front door) is normally turned on only when the front door is opened, in "night run" and "night park." As soon as the door closes, these lights shall go out. These lights shall be turned on at any time if the switch is in the "on" position.

PART – Option Link – Base

Second Row Lights

To help eliminate windshield reflection on suburban roads where street lighting is at a low level, the second light on each side, when "night run" or "night park" is selected, shall be controlled by the switch; off in "off" and on in "normal." These lights shall be turned on at any time if the switch is in the "on" position.

Link - Base

First Light Modules Dim When Front Door Is Closed

When the master switch is in the "run" or "night/run" mode, the first light module on each side of the coach shall automatically dim when the front door is in the closed position and illuminate when the door is opened. The amount of dimming shall be programmable by the Agency (to reduce glare at night)

All interior lighting shall be turned off whenever the vehicle is in reverse and the engine run switch is in the "on" position.

Interior passenger area lights shall be LED. The interior lighting design, including color or brightness, shall require the approval of the Agency.

TS 74.2 Driver's 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 10 to 30 fc.

TS 74.3 Seating Area Lighting (Transit Coach)

The interior lighting system shall provide a minimum 15 fc illumination on a 1 ft² plane at an angle of 45 deg 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 fc.

TS 74.4 Not Used**TS 74.5 Vestibules/Doors Lighting (Transit Coach)**

Floor surface in the aisles shall be a minimum of 10 fc, and the vestibule area a minimum of 4 fc with the front doors open and a maximum of 2 fc with the front doors closed. The front entrance area and curb lights shall illuminate when the front door is open and the master run switch is in the “lights” or “night run” position. Rear exit area and curb lights shall illuminate when the rear door is unlocked.

TS 74.6 Not Used**TS 74.7 Step Lighting**

Step lighting for the intermediate steps between lower and upper floor levels shall be a minimum of 4 fc and shall illuminate in all vehicle run positions. The step lighting shall be low-profile to minimize tripping and snagging hazards for passengers and shall be shielded as necessary to protect passengers’ eyes from glare.

TS 74.8 Ramp Lighting (Transit Coach)

Exterior and interior ramp lighting shall comply with federal regulations.

TS 74.9 Not Used**TS 74.10 Farebox/Card Reader Lighting****TS 74.10.1 Transit Coach****Farebox Light**

A light fixture shall be mounted in the ceiling above the farebox location. The fixture shall be capable of projecting a concentrated beam of light on the farebox. This light will automatically come on whenever the front doors are opened and the run switch is in the “night run” or “night park” position.

PART – Base**Card Reader Light**

A light fixture shall be mounted in the ceiling above the card reader location. The fixture shall be capable of projecting a concentrated beam of light on the card reader. This light will automatically come on whenever the front doors are opened and the run switch is in the “night run” or “night park” position.

TS 74.10.2 Not Used

TS 75 Fare Collection

Space and structural provisions shall be made for installation of currently available fare collection devices, including card readers or validators as specified by the Agency, which shall be as far forward as practicable. Location of the fare collection device shall not restrict traffic in the vestibule, including wheeled mobility devices 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.

Link – Base

Transfer Equipment

Transfer mounting, cutting and punching equipment shall be located in a position convenient to the driver.

Contractor shall provide fare collection installation layout to the Agency for approval.

PART– Base

Contractor will install diamond dropbox model RV or approved equal. Agency will install card reader.

High Point Transit – Base

Agency will specify a farebox/card reader for Contractor to install.

Link – Base

Contractor will install diamond dropbox model XV.

WSTA – Base

Contractor will prewire for farebox installation. Agency will install its own farebox / card reader.

TS 76 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.

Link – Base

Access Doors That Do Not Require Tools or Keys to Open

Access doors shall be secured with hand screws or latches. All fasteners that retain access panels shall be captive in the cover.

PART, High Point Transit, WSTA – Base

Access Doors with Locks

Access doors shall be secured with locks. The locks shall be standardized so that only one tool is required to open access doors on the bus.

TS 76.1 Floor Panels

Access openings in the floor shall be sealed to prevent entry of fumes and water into the bus interior. Flooring material at or around access openings shall be flush with the floor and shall be edge-bound with stainless steel or another material or sealant that is acceptable to the Agency to prevent the edges from coming loose. Access openings shall be asymmetrical or have distinct surface features or surface finishes indicating the proper part orientation so that reinstalled flooring shall be properly aligned. Fasteners protrusion shall be minimized, or flush with the floor.

The number of special fastener tools required for panel and access door fasteners shall be minimized.

TS 77 Passenger Seating

TS 77.1 Arrangements and Seat Style (Transit Coach)

The passenger seating arrangement in the bus shall be such that seating capacity is maximized and in compliance with the following requirements.

Forward-Facing Seat Configuration

Passenger seats shall be arranged in a transverse, forward-facing configuration, except at the wheel housings and turntable, if applicable, where aisle-facing seats may be arranged as appropriate with due regard for passenger access and comfort. Other areas where aisle-facing seats may be provided are at wheeled mobility device securement areas and platforms (such as for fuel tank storage space).

PART – Base

Freeman high-back reclining seats, fabric level 5, foot rest, side grab rail on aisle seat. USB ports integrated.
Reclining seats.

TS 77.2 Not Used

TS 77.3 Rearward Facing Seats (Transit Coach)

PART, High Point Transit, **WSTA** – Base

Rearward facing seats not allowed.

Link – Base

Allow rearward facing seats.

TS 77.4 Not Used

TS 77.5 Seat USB

PART, High Point Transit, **Link**, **WSTA** – Base

Where feasible, USBs for each seat shall be placed within seat assemblies such that passengers may charge their portable device while in transit. Depending on location within the bus, the USB assembly should be located in either the front or back of a seat assembly and be easily reachable by a passenger without infringing on the space of other passengers within the bus. At a minimum the specifications for the USB assembly should have an IP64 rating and be a USB Type A receptacle with a 12 VDC input with an output of 5 V and a 2.4 A per charging port or a or Dual port Type A/C.

High Point Transit – Base

No USB.

TS 77.6 Padded Inserts/Cushioned Seats (Transit Coach)

PART – Base

Fabric, Padded Inserts

The passenger seats shall be equipped with fabric, padded inserts throughout the bus (measure to uncompressed surface).

Freeman seating: “Plush Incense Rainbow”

High Point Transit – Base

Fabric, Unpadded Inserts

The passenger seats shall be equipped with fabric, unpadded inserts throughout the bus.

Link – Base

Vinyl, Padded Inserts

The passenger seats shall be equipped with vinyl, padded inserts throughout the bus (measured to uncompressed surface).

Alternative teal and lime green colors.

WSTA – Option

Vinyl, Padded Inserts

The passenger seats shall be equipped with vinyl, padded inserts throughout the bus (measured to uncompressed surface).

TS 77.7 Seat Back Configuration**PART, Link – Base****Cushioned Backs**

Seating and interior trim shall have features to improve passenger comfort. The seat cushion and back shall be padded with a cellular foam product and be no less than ½ in. thick in areas contacted and loaded by passengers in the normal seated position and shall be covered with vinyl and/or fabric material.

Seats, back cushions and other pads shall be securely attached and shall be detachable by means of a simple release mechanism so they are easily removable by the maintenance staff but not by passengers.

To the extent practicable, seat cushions and pads shall be interchangeable throughout the bus. Materials shall have high resistance to tearing, flexing and wetting.

High Point Transit, WSTA – Base**Back Insert Seat Configuration**

The seat back insert thickness shall not exceed 1 in. in the knee room area.

TS 77.8 Drain Hole in Seats**PART, High Point Transit – Base**

No requirements for drain hole provision in seat inserts.

Link, WSTA – Base**Requirement for Drain Hole Provision in Seat Inserts**

Provision, such as a small grommited hole, to allow drainage shall be incorporated into seat insert. (Drain through hole, ¼ in. through hole, bottom seat only, one per seat.)

TS 77.9 Hip-to-Knee Room

Hip-to-knee room measured from the center of the seating position, from the front of one seat back horizontally across the highest part of the seat to a 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 26.5 in.

TS 77.10 Foot Room

Foot room, measured at the floor forward from a point vertically below the front of the seat cushion, shall be no less than 14 in. Seats immediately behind the wheel housings and modesty panels may have foot room reduced (Agency will approve acceptable dimensions).

TS 77.11 Aisles (Transit Coach)

The aisle between the seats shall be no less than 20 in. wide at seated passenger hip height. Seat backs shall be shaped to increase this dimension to no less than 24 in. at 32 in. above the floor (standing passenger hip height).

TS 77.12 Not Used

TS 77.13 Dimensions (Transit Coach)

DEFAULT

Seat dimensions for the various seating arrangements shall have dimensions as follows (refer to Figure 8):

- The width, W, of the two-passenger transverse seat shall be a minimum 35 in.
- The length, L, shall be 17 in., ± 1 in.
- The seat back height, B, shall be a minimum of 15 in.
- The seat height, H, shall be 17 in., ± 1 in. For the rear lounge (or settee) and longitudinal seats, and seats located above raised areas for storage of underfloor components, a cushion height of 18 in., ± 2 in., will be allowed. This shall also be allowed for limited transverse seats, but only with the express approval of the Agency.
- Foot room, F – see Section 6 “Technical Specifications” subsection entitled “Foot Room”.
- The seat cushion slope, S, shall be between 5 and 11 deg.
- The seat back slope, C, shall be between 8 and 17 deg.
- Hip to knee room, K – see Section 6 “Technical Specifications” subsection entitled “Hip to Knee Room”.
- The pitch, P, is shown as reference only.

WSTA – Option

American seating

TS 77.14 Structure and Design (Transit Coach)

Seating shall meet all acceptance criteria in [Table 9](#).

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.

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

The transverse seat structure shall be fully cantilevered from the sidewall with sufficient strength for the intended service. The lowest part of the seat assembly that is within 12 in. of the aisle shall be at least 10 in. above the floor.

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

The back of each transverse seat shall incorporate a handhold no less than $\frac{7}{8}$ in. in diameter for standees and seat access/egress. The handhold shall not be a safety hazard during severe decelerations. The handhold shall extend above the seat back near the aisle so that standees shall have a convenient vertical assist, no less than 4 in. long, that may be grasped with the full hand. This handhold shall not cause a standee using this assist to interfere with a seated 50th-percentile male passenger. The handhold shall also be usable by a 5th-percentile female, as well as by larger passengers, to assist with seat access/egress for either transverse seating position. The upper rear portion of the seat back and the seat back handhold immediately forward of transverse seats shall be padded and/or constructed of energy-absorbing materials. During a 10g deceleration of the bus, the HIC number (as defined by SAE J211a) shall not exceed 400 for passengers ranging in size from a 5th-percentile female through a 95th-percentile male.

The seat back handhold may be deleted from seats that do not have another transverse seat directly behind and where a vertical assist is provided.

Longitudinal seats shall be the same general design as transverse seats but without seat back handholds. Longitudinal seats may be mounted on the wheelhouses. Armrests shall be included on the ends of each set of longitudinal seats except on the forward end of a seat set that is immediately to the rear of a transverse seat, the driver’s barrier or a modesty panel, when these fixtures perform the function of restraining passengers from sliding forward off the seat. Armrests are not required on longitudinal seats located in the wheeled mobility device parking area that fold up when the armrest on the adjacent fixed longitudinal seat is within $3\frac{1}{2}$ in. of the end of the seat cushion. Armrests shall be located from 7 to 9 in. above the seat cushion surface. The area between the armrest and the seat cushion shall be closed by a barrier or panel. The top and sides of the armrests shall have a minimum width of 1 in. and shall be free from sharp protrusions that form a safety hazard.

Armrests as specified above shall be provided on longitudinal seats.

TABLE 9
Passenger Seating Tests

Test	Description	Acceptance Criteria
Pendulum	Mass of two 95th-percentile males striking seat back during 10g deceleration	Permanent deformation <2 in. measured at aisle side seat frame; seat back deflection <14 in. measured at top of seat back
Vertical load	500 lb applied to top of each seat cushion	Permanent deformation <¼ in. in seat or mountings
Horizontal	500 lb evenly distributed along the top of the seat back of seat assembly	Permanent deformation <¼ in. in seat or mountings
Swing	Two 40 lb sandbags, suspended on 36 in. pendulum, strike seat back from front and rear, 10,000 times from distances of 6, 8, 10 and 12 in. (40,000 total impacts)	No visible deterioration
Drop Bag	40 lb sandbag, dropped on seat cushions 1000 times from heights of 6, 8, 10 and 12 in. (4000 total impacts)	No visible deterioration
Grabrail/Armrest Load	250 lb applied anywhere along the length, in both horizontal and vertical direction	Permanent deformation <¼ in.
Grabrail/Armrest Cyclic	125 lb horizontal force for 25,000 impacts in both directions	Permanent deformation <¼ in. and no visible deterioration
Jounce and Squirm	100,000 randomly positioned 3.5 in. drops of squirming, 150 lb, smooth surfaced, buttocks-shaped striker	Minimal wear of seat coverings, no failures to seat structure
HIC	Defined by SAE J211a for 10g deceleration	HIC number <400
Knee Impact	10g deceleration of 5th-percentile female to 95th-percentile male	Compressive load <1000 lb on femur

TS 77.15 Not Used

TS 77.16 Construction and Materials (Transit Coach)

Selected materials shall minimize damage from vandalism and shall reduce cleaning time. The seats shall be attached to the frame with tamper-resistant fasteners. Coloring shall be consistent throughout the seat material, with no visually exposed portion painted. Any exposed metal touching the sides or the floor of the bus shall be stainless steel. The seat, pads and cushions shall be contoured for individuality, lateral support and maximum comfort and shall fit the framework to reduce exposed edges.

The minimum radius of any part of the seat back, handhold or modesty panel in the head or chest impact zone shall be a nominal ¼ in. The seat back and seat back handhold immediately forward of transverse seats shall be constructed of energy-absorbing materials to provide passenger protection and, in a severe crash, to allow the passenger to deform the seating materials in the impact areas. Complete seat assemblies shall be interchangeable to the extent practicable.

TS 78 Passenger Assists (Transit Coach)

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 5th-percentile female standee and the 95th-percentile male standee and shall comply with most current, relevant regulations set forth in the ADA Accessibility Guidelines for Transportation Vehicles. 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 the 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 then the other without losing support. All handholds and stanchions at the front doorway, around the farebox, and at interior steps for bi-level designs shall be powder-coated in a high-contrast yellow color.

Link – Base

The forward-most vertical stanchions on either side of the aisle immediately behind the driver's area shall be powder-coated yellow.

PART, High Point Transit, WSTA – Base

The forward-most vertical stanchions on either side of the aisle immediately behind the driver's area shall be a stainless steel finish.

TS 78.1 Assists (Transit Coach)

Excluding those mounted on the seats and doors, the assists shall have a cross-sectional diameter between 1¼ and 1½ in. or shall provide an equivalent gripping surface with no corner radii less than ¼ in. All passenger assists shall permit a full hand grip with no less than 1½ in. of knuckle clearance around the assist. Passenger assists shall be designed to minimize catching or snagging of clothes or personal items and shall be capable of passing the National Highway Traffic Safety Administration 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 lb applied over a 12 in. lineal dimension in any direction normal to the assist without permanent visible deformation. All passenger assist components, including brackets, clamps, screw heads and other fasteners used on the passenger assists, shall be designed to eliminate pinching, snagging and cutting hazards and shall be free from burrs or rough edges.

TS 78.2 Front Doorway

Front doors, or the entry area, shall be fitted with ADA-compliant assists. Assists shall be as far outward as practicable, but shall be located no farther inboard than 6 in. from the outside edge of the entrance step and shall be easily grasped by a 5th-percentile female boarding from street level. Door assists shall be functionally continuous with the horizontal front passenger assist, the vertical assist, and the assists on the wheel housing or on the front modesty panel.

TS 78.3 Vestibule (Transit Coach)

The aisle side of the driver's barrier, the wheel housings, and when applicable the modesty panels shall be fitted with vertical passenger assists that are functionally continuous with the overhead assist and that extend to within 36 in. of the floor. These assists shall have sufficient clearance from the barrier to prevent inadvertent wedging of a passenger's arm.

A horizontal passenger assist shall be located across the front of the bus and shall prevent passengers from sustaining injuries on the fare collection device or windshield in the event of a sudden deceleration. Without restricting the vestibule space, the assist shall provide support for a boarding passenger from the front door through the fare collection procedure. The assist shall be no less than 36 in. above the floor. The assists at the front of the bus shall be arranged to permit a 5th-percentile female passenger to easily reach from the door assist, to the front assist, to vertical assists on the driver's barrier, wheel housings or front modesty panel.

TS 78.4 Rear Doorway(s) (Transit Coach)

Vertical assists that are functionally continuous with the overhead assist shall be provided at the aisle side of the transverse seat immediately forward of the rear door and on the aisle side of the rear door modesty panel(s). Passenger assists shall be provided on modesty panels that are functionally continuous with the rear door assists. Rear doors, or the exit area, shall be fitted with assists having a cross-sectional diameter between 1¼ and 1½ in. or providing an equivalent gripping surface with no corner radii less than ¼ in., and shall provide at least 1½ in. of knuckle clearance between the assists and their mounting. The assists shall be designed to permit a 5th-percentile female to easily move from one assist to another during the entire exiting process. The assists shall be located no farther inboard than 6 in. from the outside edge of the rear doorway step.

For an articulated bus, passenger assists will be provided to aid in the transition between the front and rear sections of the bus.

TS 78.5 Overhead (Transit Coach)

Except forward of the standee line and at the rear door, a continuous, full-grip, overhead assist shall be provided. This assist shall be located over the center of the aisle seating position of the transverse seats. The assist shall be no less than 70 in. above the floor. In the case of rear podium sections where headroom is constrained, the assist shall be no less than 67 in. above the floor.

PART– Base

No requirements for overhead grab straps/extensions.
Grab straps shall be stainless steel

PART, High Point Transit, Link, WSTA – Base

Grab straps or other extensions as necessary shall be provided for sections where vertical assists are not available and for use by passengers who cannot reach the continuous overhead assist.
Grab straps shall be fabric.

Overhead assists shall simultaneously support 150 lb on any 12 in. length. No more than 5% of the full grip feature shall be lost due to assist supports.

TS 78.6 Longitudinal Seat Assists (Transit Coach)

Longitudinal seats shall have vertical assists located between every other designated seating position, except for seats that fold/flip up to accommodate wheeled mobility device securement. Assists shall extend from near the leading edge of the seat and shall be functionally continuous with the overhead assist. Assists shall be staggered across the aisle from each other where practicable and shall be no more than 52 in. apart or functionally continuous for a 5th-percentile female passenger.

TS 78.7 Wheel Housing Barriers/Assists (Transit Coach)

Unless passenger seating is provided on top of wheel housings, 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 housings.

TS 79 Passenger Doors

TS 79.1 Transit Coach

Doorways will be provided in locations and styles as follows. Passenger doors and doorways shall comply with ADA requirements.

TS 79.1.1 Front door

Door shall be forward of the front wheels and under direct observation of the driver.

TS 79.1.2 Rear Door(s)

PART, WSTA 29' – Base

No Rear Door.

High Point Transit, Link, WSTA 35' – Base

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

In cases where street-side and curbside doors are chosen, provisions shall be made for operating the front door, curbside rear door(s) and street-side rear door(s) independently or in the combinations shown in **Table 10** while providing positive tactile feedback to the operator identifying the door control selection.

TABLE 10
Door Operating Combinations

Front	Curbside Rear	Street-Side Rear
Closed	Closed	Closed
Open	Closed	Closed
Open	Open	Closed
Open	Closed	Open
Open	Open	Open
Closed	Open	Closed
Closed	Closed	Open
Closed	Open	Open

High Point Transit, Link, WSTA 35' – Base

Air Powered

The door system shall operate per specification at air pressures between 90 and 130 psi.

TS 79.2 Not Used

TS 79.3 Materials and Construction

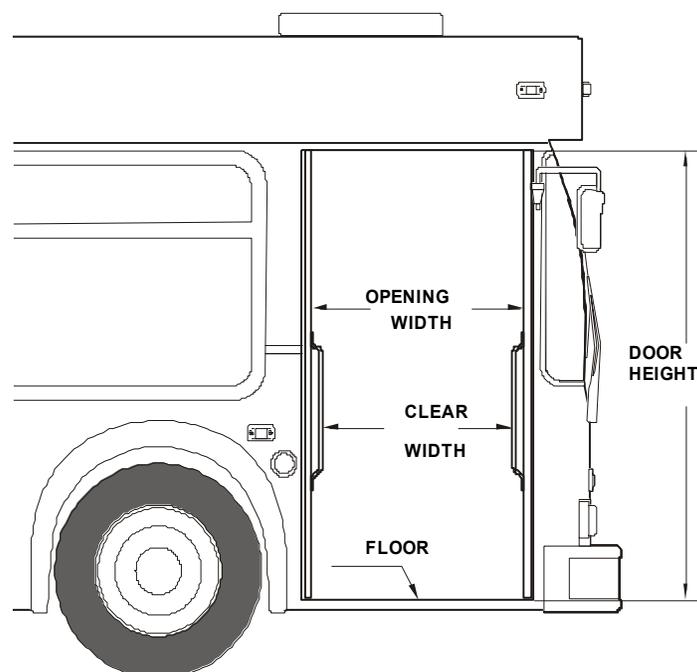
Structure of the doors, their attachments, inside and outside trim panels, and any mechanism exposed to the elements shall be corrosion-resistant. Door panel construction shall be of corrosion-resistant metal or reinforced nonmetallic composite materials. When fully opened, the doors shall provide a firm support and shall not be damaged if used as an assist by passengers during ingress or egress. Door edges shall be sealed to minimize infiltration of exterior moisture, noise, dirt and air elements from entering the passenger compartment, to the maximum extent possible based on door types.

The closing edge of each door panel shall have no less than 2 in. of soft weather stripping. The doors, when closed, shall be effectively sealed, and the hard surfaces of the doors shall be at least 4 in. apart (not applicable to single doors). The combined weather seal and window glazing elements of the front door shall not exceed 10 deg of binocular obstruction of the driver's view through the closed door.

TS 79.4 Dimensions

TS 79.4.1 Transit Coach

FIGURE 9
Transit Bus Minimum Door Opening



When open, the doors shall leave an opening no less than 75 in. in height.

High Point Transit, Link, WSTA – Base

31¼ in. Minimum Doorway Clear Width

Front door clear width shall be a minimum of 31¾ in. with the doors fully opened. Rear door opening clear width shall be a minimum of 24 in. with the doors fully opened. If a rear door ramp or lift is provided, then the clear door opening width shall be a minimum of 31¾ in. with door fully opened.

PART- Base

Doorway Clear Width Greater Than 31¾ in.

The front door clear width shall be a minimum of 34 ½ in. with the doors fully opened.

TS 79.4.2 Not Used

TS 79.5 Door Glazing

The upper section of both front and rear doors shall be glazed for no less than 45% of the respective door opening area of each section. The lower section of the front door shall be glazed for no less than 25% of the door opening area of the section. Glazing material in the rear doorway door panels shall be defined by the Agency.

Door glazing shall be easily replaceable.

PART, Link – Base

Zip-type glazing rubber.

High Point Transit, WSTA – Base

Quick-change glazing exterior frame.

All Agencies – Base

Laminated Glass

The front door panel glazing material shall have a nominal ¼ in. thick laminated safety glass conforming with the requirements of ANSI Z26.1 Test Grouping 2 and the recommended practices defined in SAE J673.

TS 79.6 Door Projection (Transit Coach)

TS 79.6.1 Exterior

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

TS 79.6.2 Interior

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

TS 79.7 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 is parked with the tires touching an 8 in. high curb on a street sloping toward the curb so that the street-side wheels are 5 in. higher than the right-side wheels.

TS 79.8 Closing Force

Closing door edge speed shall not exceed 12 in. per second, and opening door speed shall not exceed 19 in. per second. Power doors shall not slam closed under any circumstance, even if the door is obstructed during the closing cycle. If a door is obstructed during the closing cycle, the pressure exerted on the obstruction shall not increase once initial contact has been made.

Power-close front and rear doors shall be equipped with an obstruction-sensing system. If a contactless obstruction sensing system is employed, then it shall be capable of discriminating between the normal doorway environment and passengers or other obstructions within the doorway, and of altering the zones of detection based upon the operating state of the door system.

Doors closed by a return spring or counterweight-type device shall be equipped with an obstruction-sensing device that, at a minimum, alerts the driver if an obstruction is detected between the closing doors. Doors closed by a return spring or counterweight type device, when unlocked, shall be capable of being pushed to the point where the door starts to open with a force not to exceed 25 lb applied to the center edge of the forward door panel.

Whether or not the obstruction-sensing system is present or functional, it shall be possible to withdraw a 1½ in. diameter cylinder from between the center edges of a closed and locked door with an outward force not greater than 35 lb.

TS 79.8.1 Rear Door Closing Force (Transit Coach)

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 in.² of that obstruction.

TS 79.9 Actuators

Doors shall open or close completely in not more than 3.5 seconds from the time of initial door movement and shall be subject to the closing force requirements.

Control algorithms shall ensure satisfaction of the above requirements while maintaining safe door operation. In cases where these requirements are mutually exclusive, the safety requirement must be prioritized. Actuators and the complex door mechanism shall be concealed from passengers but shall be easily accessible for servicing. The door actuators shall be rebuildable. If powered by compressed air, exhaust from the door system shall be routed below the floor of the bus to prevent accumulation of any oil that may be present in the air system and to muffle sound.

Door actuators and associated linkages shall maximize door holding forces in the fully open and fully closed positions to provide firm, non-rattling, non-fluttering door panels while minimizing the force exerted by the doors on an obstruction midway between the fully open and closed positions.

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.

Doors that employ a "swing" or pantograph geometry and/or are closed by a return spring or counterweight-type device shall be equipped with a positive mechanical holding device that automatically engages and prevents the actuation mechanism from being back-driven from the fully closed position. The holding device shall be overcome only when the driver's door control is moved to an "Exit Door Enable" position and the vehicle is moving at a speed of less than 2 mph, or in the event of actuation of the emergency door release.

Locked doors shall require a force of more than 300 lb to open manually. When the locked doors are manually forced to open, damage shall be limited to the bending of minor door linkage with no resulting damage to the doors, actuators or complex mechanism.

TS 79.10 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 lb 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.

TS 79.11 Door Control

The door control shall be located in the operator's area toward the street side of the operator's controls 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 command state position even if power is removed or lost.

TS 79.12 Door Controller

TS 79.12.1 Transit Coach

High Point Transit, WSTA – Base Five-Position Driver's Door Controller

The control device shall be protected from moisture. Mounting and location of the door control device handle shall be designed so that it is within comfortable, easy arm's reach of the seated driver. The door control device handle shall be free from interference by other equipment and have adequate clearance so as not to create a pinching hazard.

Position of the door control handle shall result in the following operation of the front and rear doors:

- Center position: Front door closed, rear door(s) closed or set to lock.
- First position forward: Front door open, rear door(s) closed or set to lock.
- Second position forward: Front door open, rear door(s) open or set to open.
- First position back: Front door closed, rear door(s) open or set to open.
- Second position back: Front door open, rear door(s) open or set to open.

Link – Base

Push-Button Door Controls

Doors shall be operated by push-button controls, conveniently located and operable within the driver's reach. The push buttons shall be labeled. There shall be a separate set of push-button controls for the front and rear door(s), as needed.

PART – Base

Two-position switch for front door only.

TS 79.13 Door Open/Close

PART, Link – Base

Operator-Controlled Front and Rear Doors (if Applicable)

Operation of, and power to, the passenger doors shall be completely controlled by the operator.

PART, High Point Transit, WSTA – Base

A control or valve in the operator's compartment shall shut off the power to, and/or dump the power from, the front door mechanism to permit manual operation of the front door with the bus shut down. A master door switch, which is not within reach of the seated operator, when set in the "off" position shall close the rear/center doors (if applicable), deactivate the door control system, release the interlocks and permit only manual operation of the rear/center doors.

TS 79.14 Passenger Door Interlocks

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

A positive brake application shall be required to engage or disengage the interlock system.

Doors shall not open until the bus is less than 2 mph and the brake interlock is engaged. Once the vehicle has come to a full stop, to preclude movement of the bus, an accelerator interlock shall lock the accelerator in the closed position, and a brake interlock shall engage the service brake system to stop movement of the bus when the driver's door control is moved to a mid/rear door enable or open position, or a mid or rear door panel is opened more than 3 in. from the fully closed position (as measured at the leading edge of the door panel from the door closed position). Sensors will be used to sense the closed position of each door panel. The interlock engagement shall be capable of holding a fully loaded bus on a 6% grade until the interlocks are released; for diesel and CNG propulsion, this holding capability on a 6% grade may be met with the transmission in gear. These interlock functions shall be active whenever the vehicle master run switch is in any run position.

See [Table 11](#).

Non-adjustable brake interlock regulator.

All door systems employing brake and accelerator interlocks shall be supplied with supporting failure mode effects analysis documentation, which demonstrates that failure modes are of a fail-safe 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.

PART – Option

All door systems employing brake and accelerator interlocks shall be supplied with supporting failure mode effects analysis documentation, which demonstrates that failure modes are of a fail-safe 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.

All Agencies – Base

Require Accelerator Interlock Whenever Front Doors Are Open

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 whenever front doors are open.

PART – Base

Require Positive Brake Activation

To prevent vehicle braking using only the door controls as vehicle speed drops below 2 mph, a positive brake application is required to engage accelerator and brake interlocks as the bus is coming to a full stop. To ensure that it is safe to move the bus from a full stop, a positive brake application by the driver is required to disengage the interlocks after doors close and lock.

TABLE 11
Passenger Door Interlocks

Brake Pedal	Vehicle Speed	Rear Door Controller Position	Brake/Accelerator Interlocks	Service Brakes	Doors	Remarks
Normal Driving						
OFF	>2 mph	Closed	Off	Off	Closed	
ON	>2 mph	Closed	Off	Off	Closed	
OFF	<2 mph	Closed	Off	Off	Closed	
ON	<2 mph	Closed	Off	Off	Closed	
Accidental or Intentional Door Control Actuation						
OFF	>2 mph	Open	Off	Off	Closed	Driver accidentally places door controller in open position.
ON	>2 mph	Open	Off	Off	Closed	
OFF	<2 mph	Open	Off	Off	Closed	Bus coasts below 2 mph.
ON	<2 mph	Open	On	Off	Open	Interlocks turn on and doors start to open <i>after</i> brake application when speed is below 2 mph.
ON	<2 mph	Open	On	On	Open	Full stop. Doors fully open.
OFF	<2 mph	Open	On	On	Open	Driver releases brake pedal.
OFF	<2 mph	Close	On	On	Open	Driver commands door to close. Doors start to close.
OFF	<2 mph	Close	On	On	Closed	Doors fully closed and locked. Interlocks remain on. Brake application required to cancel.
ON	<2 mph	Close	Off	Off	Closed	Positive brake application cancels interlocks. Bus can now move.

TS 80 Accessibility Provisions

Space and body structural provisions shall be provided at the front or rear door of the bus to accommodate a wheeled mobility device loading system and shall comply with ADA regulations on mobility aid accessibility.

TS 80.1 Loading Systems

Low floor ramp. Lift U—Ramp (LU-18 Dual Mode Front Door Ramp) or approved equal.

TS 80.2 Loading System for 30 to 60 ft Low-Floor Bus

The wheeled mobility device ramp control system must be capable of receiving multiplex commands from vehicle interlocks.

An automatically controlled, power-operated ramp system compliant to requirements defined in 49 CFR Part 38, Subpart B, §38.23c, shall provide ingress and egress quickly, safely and comfortably, both in forward and rearward directions, for a passenger in a wheeled mobility device from a level street or curb. This ramp system shall allow manual deployment when necessary.

Wheeled mobility device ramp mounted in front step well.

TS 80.3 Configuration

Front Door Location of Loading System, Flip-Out Design Ramp with 6:1 Slope

The wheeled mobility device 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.

TS 80.4 Not Used

TS 80.5 Wheeled Mobility Device Accommodations

All passenger securement devices must be stowed off the floor and out of the way when not in use.

Two Forward-Facing Wheeled Mobility Device Securement Locations

Two forward-facing locations, as close to the wheeled mobility device loading system as practical, shall provide parking space and securement system compliant with ADA requirements for a passenger in a wheeled mobility device. The default securement system shall be a four-point, universal and adjustable belt system that attaches to floor-mounted and/or seat-stanchion connection points. The belt system shall be installed in such a manner that it does not interfere with the ability of the passenger to maneuver into the securement area. Automated wheeled mobility device securement systems may be proposed for Agency approval as an optional replacement to the traditional four-point securement system. All securement systems must fully comply with all ADA requirements.

TS 80.6 Interior Circulation

Maneuvering room inside the bus shall be compliant with 49 CFR Part 38, Subpart B, §38.29, and accommodate easy travel for a passenger in a wheeled mobility device from the loading device and from the designated securement area. It shall be designed so that no portion of the wheeled mobility device 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 22 in. shall be maintained. As a guide, no width dimension should be less than 34 in. Areas requiring 90 deg turns of wheeled mobility devices should have a clearance arc dimension no less than 45 in., and in the parking area where 180 deg turns are expected, space should be clear in a full 60 in. diameter circle. A vertical clearance of 12 in. above the floor surface should be provided on the outside of turning areas for wheeled mobility device footrests.

TS 81 Not Used

TS 82 Destination Signs

PART – Base

A destination sign system shall be furnished on the front, on the right side near the front door, and right rear of the bus and shall comply with the ADA. Hanover 100% White LED Sign (17 x 16) -- Front, Side (Standard), Rear (standard) or approved equal.

Route sign on the rear of the vehicle.

High Point Transit – Base

A destination sign system shall be furnished on the front, on the right side near the front door and shall comply with the ADA.

Route sign on the rear of the vehicle.

Street and Curbside Route Sign

The sign located near the front door shall not block the driver's critical horizontal line of sight. Display areas of destination signs shall be clearly visible in direct sunlight and/or at night. Parts shall be commercially available.

Link – Base



A destination sign system shall be furnished on the front, on the right side near the front door and shall comply with the ADA.

Route sign on the rear of the vehicle.

WSTA – Base

A destination sign system shall be furnished on the front, on the right side near the front door and shall comply with the ADA. Hanover Headsigns.

Route sign on the rear of the vehicle.

Street and Curbside Route Sign

The sign located near the front door shall not block the driver’s critical horizontal line of sight. Display areas of destination signs shall be clearly visible in direct sunlight and/or at night. Parts shall be commercially available.

All signs shall be controlled via a single human-machine interface (HMI). In the absence of a single mobile data terminal, the HMI shall be conveniently located for the bus driver within reach of the seated driver.

PART, Link – Base

The driver shall be able to access the sign controller while seated.

High Point Transit – Base WSTA – Option

The sign controller shall not be located within reach of the seated driver.

All Agencies – Base

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 in. High by 56 in. Wide.

High Point Transit – Base

Run number sign shall be installed.

TS 83 Passenger Information and Advertising (Transit Coach)

TS 83.1 Interior Displays

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 information such as routes and schedules.

Advertising media 11 in. high and 0.09 in. thick shall be retained near the juncture of the bus ceiling and sidewall. The retainers may be concave and shall support the media without adhesives. The media shall be illuminated by the interior light system.

PART – Base

Interior Sign – Audible and programable. Hanover or approved equal.

TS 83.2 Exterior Displays

Provisions shall be made to integrate advertising into the exterior design of the bus. Advertising media, frames or supporting structures shall not detract from the readability of destination signs and signal lights, and shall not compromise passenger visibility. Advertising provisions shall not cause pedestrian hazards or foul automatic bus-washing equipment, and shall not cover or interfere with doors, air passages or vehicle fittings, or in any other manner restrict the operation or serviceability of the bus.

TS 84 Passenger Stop Request/Exit Signal

TS 84.1 Transit Coach

PART, High Point Transit, WSTA – Base

Touch Tape Passenger Signal

A passenger “stop requested” signal system that complies with applicable ADA requirements defined in 49 CFR, Part 38.37, shall be provided. The system shall consist of a touch tape, chime and interior sign message. The touch tape shall be accessible to all seated passengers, with provisions for standees. It shall



be easily accessible to all passengers, seated or standing. Vertical touch tape shall be provided at each window mullion and adjacent to each wheeled mobility device parking position and in priority seating positions. In addition, each wheeled mobility device area shall have a stop request device that is activated through the application of broad physical pressure, such as a button with a large surface area, which can be activated without the need of grasping, pulling or fine motor skills.

Link – Base PART – Option

Pull Cord Passenger Signal

A passenger “stop requested” signal system that complies with applicable ADA requirements defined in 49 CFR, Part 38.37, shall be provided. The system shall consist of a heavy-duty pull cable, chime and interior sign message. The pull cable shall be located the full length of the bus on the sidewalls at the level where the transom is located. If no transom window is required, then the height of the pull cable shall approximate this transom level and shall be no greater than 63 in. as measured from the floor surface. It shall be easily accessible to all passengers, seated or standing. Pull cable(s) shall activate one or more solid state or magnetic proximity switches. At each wheeled mobility device passenger position and at priority seating positions, additional provisions shall be included to allow a passenger using a mobility aid to easily activate the “stop requested” signal without having to grasp or pull.

An auxiliary passenger “stop requested” signal shall be installed at the rear door to provide passengers standing in the rear door/exit area a convenient means of activating the signal system. The signal shall be a heavy-duty push button type located in the rear door vicinity. Button shall be clearly identified as STOP.

PART, High Point Transit, WSTA – Base

No requirements for additional “stop request” button on rear door stanchion.

Link – Base

Additional “Stop Request” Button on Rear Door Stanchion

A heavy-duty “stop request” signal button shall be installed on the modesty panel stanchion immediately forward of the rear door and clearly identified as “STOP.”

TS 84.2 Not Used

TS 84.3 Signal Chime

A single “stop requested” chime shall sound when the system is first activated. A double chime shall sound anytime the system is activated from wheeled mobility device passenger areas. Audible chimes shall be accompanied by a visual display/signal that indicates to passengers inside the bus that a stop has been requested.

Exit signals located in the wheeled mobility device passenger area shall be no higher than 4 ft above the floor. Instructions shall be provided to clearly indicate function and operation of these signals.

TS 85 Communications

TS 85.1 Camera Surveillance System

Link – Base

Provide all wiring and mounting locations for a multi-camera surveillance system for the later provision of and installation of cameras, recorder, microphone, etc. Seon.

WSTA – Option

Provide all wiring and mounting locations for a multi-camera surveillance system for the later provision of and installation of cameras, recorder, microphone, etc. TSI Camera System

WSTA – Option

Provide all wiring and mounting locations for a multi-camera surveillance system, including the installation of cameras, recorder, microphone, etc. TSI Camera System

PART – Base

Provide all wiring and mounting locations for a multi-camera surveillance system, including the installation of cameras, recorder, microphone, etc. Seon Video Surveillance System or approved equal.

Currently, 8AHD / 2IP Cameras Quantity of cameras sufficient to provide coverage for driver, vehicle interior, and front, curb side, street side, and rear exterior.

High Point Transit – Base

Provide all wiring and mounting locations for a multi-camera surveillance system, including the installation of cameras, recorder, microphone, etc.

- Safefleet "nh16v2" (installed by oem)
- Located in the equipment box
- Nh16v2 dvr (with 16-position poe switch)
- 2tb dual drive
- Event marker button with rgy status light
- Audio on interior cameras
- Gps connectivity
- Wireless connectivity from mikrotik groove bridge
- Battery power
- Ignition switched power
- Chassis ground
- Left/right turn signals
- Service brake signal
- Night run mode signal
- Silent alarm
- ransmission in reverse gear
- Rear camera displays on dash display
- When rear door enabled to be open until door completely closed camera facing rear exit door and camera on curb side facing forward will split display on dash display
- Install 12 cameras

TS 85.2 Public Address System

A public address system shall be provided on each bus for facilitating automated stop announcements and driver-originated announcements to passengers.

TS 85.2.1 Speakers

PART – Base

6 interior loudspeakers shall be provided, semi-flush mounted, on alternate sides of the bus passenger compartment, installed with proper phasing. Speaker impedance shall match load requirements of the amplifier.

Link – Base

Interior loudspeakers shall be provided, semi-flush mounted, on alternate sides of the bus passenger compartment, installed with proper phasing. Speaker impedance shall match load requirements of the amplifier.

TS 85.3 Automatic Passenger Counter (APC)

PART – Base

No APC system shall be installed

High Point Transit – Base

An infrared APC system shall be installed. Urban Transportation Associates (UTA, Hella APS-B System)

- Entrance Door Apc Sensor, Hella APS-B #1
- Rear Exit Door Apc Sensor, Hella APS-B #2
- Cable-APC Interface
- APC Wifi Model 31, CPU Module
- All System Required Cables
- Multiband Antenna

Link – Base

An infrared APC system shall be installed. GMV



WSTA – Base

An infrared APC system shall be installed.

TS 85.4 Radio Handset and Control System Options**TS 85.4.1 Driver’s Speaker**

Each bus shall have a recessed speaker in the ceiling panel above the driver. This speaker shall be the same component used for the speakers in the passenger compartment. It shall have 8 ohms of impedance.

TS 85.4.2 Handset

Contractor shall install a handset for driver use.

TS 85.4.3 Driver Display Unit

Contractor shall install a driver display unit as close to the driver’s instrument panel as possible.

TS 85.4.4 Emergency Alarm

Contractor shall install an emergency alarm that is accessible to the driver but hidden from view.

TS 86 Event Data Recorder

No event data recorder shall be installed.

TS 87 Approved Equals

Table 12 lists products that have been approved for the bus procurement. The list contains products that are of interest to the Agency and is not intended to be a comprehensive listing of every product required for the manufacture of the subject buses. Product categories not listed are left to the discretion of the Contractor so long as the product complies with the specifications. Product specification information is for reference only and may not reflect the latest or future improvements by manufacturers. Any change, revision or substitution of specified products requires approval of the Agency. To add to or revise this list, the Contractor must submit a written request per the Specification by the due date found in the RFP for approved equals. Proposers must utilize CER 2 Request for Pre-Offer Change or Approved Equal. Request for approved equals must be submitted by Friday December 12, 2025 at 5:00 PM EST.

TABLE 12
Approved Equals Products

Product	Manufacturer	Product Specification
Destination Sign	Hanover	Front / side / rear destination
Destination Sign	Twin Vision	Front / side / rear destination
Destination Sign	Luminator	Front / side / rear destination
Passenger Seating	Freeman Seating	High Back Reclining / armrest/USB
Passenger Seating	American Seating	High Back Reclining / armrest/USB
Passenger Seating	4One	High Back Reclining / armrest/USB
Passenger Seating	American Seating	Citiseat
Cameras	Seon	Interior / Exterior Cameras
Cameras	Apollo	Interior / Exterior Cameras
Cameras	AngelTrax	Interior / Exterior Cameras
Cameras	MobileView	Interior / Exterior Cameras
Fire Suppression	Kiddie	Engine Compartment Area
Fire Suppression	Amerex	Engine Compartment Area
Fire Suppression	FogMaker	Engine Compartment Area
Floor covering	Altro	Interior floor
Seat Fabric	Lantal Textiles Inc	Seat Covering fabric
APC	Urban Transportation Associates	Passenger Counters
Front Bike Rack	Sportsworks	Bike rack

TS 88 Life Cycle Cost

Manufacturer shall provide a 12-year life cycle cost projection based on the Agency’s duty cycle with its cost proposal.

Fuel or energy consumption, all preventive and corrective maintenance labor, parts and supplies expense, and any rehabilitation or other required investment to maintain the bus in a state of good repair for 12 years, shall be included. Bus operator labor and daily servicing labor shall not be included.



SECTION 7: WARRANTY REQUIREMENTS

WR 1 Basic Provisions

WR 1.1 Warranty Requirements

WR 1.1.1 Contractor Warranty

Warranties in this document are in addition to any statutory remedies or warranties imposed on the Contractor. Consistent with this requirement, the Contractor warrants and guarantees to the Agency each complete bus and specific subsystems and components as follows. Performance requirements based on design criteria shall not be deemed a warranty item.

WR 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.

WR 1.1.3 Not Used

WR 1.1.4 Body and Chassis Structure

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

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.

WR 1.1.5 Propulsion System

Propulsion system components, including the engine, transmission or drive motors, and generators (for hybrid technology) and drive and non-drive axles, shall be warranted to be free from Defects and Related Defects for the standard five (5) years or 300,000 miles, whichever comes first. An optional reduced warranty of two (2) years, or 100,000 miles, whichever comes first, may be offered for a reduced cost. The propulsion system manufacturer's standard warranty, delineating items excluded from the Extended Warranty, should be submitted in accordance with the Request for Pre-Offer Change or Approved Equal, or with the Form for Proposal Deviation.

WR 1.1.6 Not Used

WR 1.1.7 Energy Storage System (Hybrid)

In its proposal, the Contractor shall provide information on standard warranties and available extended warranties options.

WR 1.1.8 Emission Control System (ECS)

The Contractor warrants the emission control system (ECS) for five years or 200,000 miles, whichever comes first. The ECS shall include, but is not limited to, the following components:

- complete exhaust system, including catalytic converter (if required)
- aftertreatment device
- components identified as emission control devices

WR 1.1.9 Subsystems

The following subsystems shall be warranted to be free from Defects and Related Defects for the below standards. When years and mileage are referenced, the warranty shall apply until whichever comes first.

- Brake system: Foundation brake components, including advancing mechanisms, as supplied with the axles, excluding friction surfaces – 1 year or 50,000 miles
- Destination signs: All destination sign equipment for the front, side and rear signs, power modules and operator control – 10 years
- Heating, ventilating: Roof and/or rear main unit only, excluding floor heaters and front defroster – 5 years
- AC unit and compressor: Roof and/or rear main unit only, excluding floor heaters and front defroster – 5 years
- Door systems: Door operating actuators and linkages – 5 years or 200,000 miles
- Air compressor – 5 years or 200,000 miles
- Air dryer – 3 years or 150,000 miles

- Wheeled mobility device lift and ramp system: Lift and/or ramp parts and mechanical only 5 years or 200,000 miles
- Starter – 5 years or 200,000 miles
- Alternator: Alternator only; does not include the drive system – 5 years or 200,000 miles
- Charge air cooler: Charge air cooler, including core and tanks, and including related surrounding framework and fittings – 5 years or 200,000 miles
- Fire suppression: Fire suppression system, including tank and extinguishing agent dispensing system – 5 years or 200,000 miles
- Hydraulic systems, including radiator fan drive and power steering as applicable – 5 years or 200,000 miles
- Propulsion system cooling systems: Radiator, including core, tanks and related framework, surge tank and transmission cooler – 5 years or 200,000 miles
- Power electronics: DC/DC converters, inverters, if supplied
- Passenger seating: Excluding upholstery – 7 years
- Fuel storage and delivery system – 7 years or 300,000 miles
- Surveillance system: Including cameras and video recorders – 7 years or 300,000 miles

The following subsystems shall be warranted to be free from Defects and Related Defects for twelve (12) years or 500,000 miles, whichever comes first:

- Low-voltage and high-voltage electrical wiring and harnesses

WR 1.1.10 Not Used

WR 1.1.11 Serial Numbers

Upon delivery of each bus, the Contractor shall provide a complete electronic list of serialized units installed on each bus to facilitate warranty tracking. If supplied with the bus, the list shall include, but not be limited to, the following:

- Engine or traction motor(s)
- Propulsion system controller/inverter(s)
- Energy storage pack(s) or module(s)
- Power electronics: DC/DC converters, inverters
- Transmission
- Alternator
- Starter
- HVAC system and major components
- Drive axle
- Power steering unit
- Fuel cylinders (if applicable)
- Air compressor
- Wheeled mobility device ramp (if applicable)

The Contractor shall provide updated serial numbers resulting from warranty campaigns. The format of the list shall be approved by the Agency prior to delivery of the first production bus.

WR 1.1.12 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.

WR 1.2 Voiding of Warranty

The warranty shall not apply to the failure of any part or component of the bus that directly results from misuse, negligence, accident or repairs not conducted in accordance with Contractor-provided maintenance manuals and 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 causes the part or component failure. The Agency shall maintain documentation, auditable by the Contractor, verifying service activities in conformance with the Contractor's maintenance manuals.

WR 1.3 Exceptions and Additions to Warranty

The warranty shall not apply to the following items:

- scheduled maintenance items
- normal wear-out items
- items furnished by the Agency

Should the Agency require the use of a specific product and has rejected the Contractor's request for an alternate product, then the standard Supplier warranty for that product shall be the only warranty provided to the Agency. This product will not be eligible under the subsection entitled "Fleet Defects."

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

WR 1.3.1 Pass-Through Warranty

Agency and Contractor agree that the warranty terms of this Contract apply in general to systems, components, and parts supplied by suppliers and subcontractors, and that the Contractor will generally be the exclusive point of contact and administer the Agency's warranty claims under this Contract. The Contractor hereby guarantees to provide, within reasonable periods of time, the completed warranty work or reimbursement required by this Contract for all systems, components and parts, software, and all equipment necessary to maintain and repair the buses supplied under this Contract.

Should the Contractor elect to not administer warranty claims on certain components, and wish to transfer this responsibility to the sub-suppliers or to others, the Contractor shall request this waiver.

Contractor Administration of Warranty with Best Efforts for Supplier or Subcontractor Exceptions

If a Supplier or Subcontractor will not allow the Contractor to administer the warranty, a Contractor may request an exception in their proposal (1) for parts for which the Agency specified a brand name, the Contractor requested an approved equal, and the Agency denied approval; and (2) for parts where the Agency's specification was a sole source specification, the Contractor requested an approved equal or modification, and the Agency denied the request. The Agency may include the exception requests in its evaluation of proposals, and may request revised offers.

For each system, component, part, software module or item of equipment for which the Contractor does not promise full Contractor administration of the warranty ("Excepted Parts"), the Contractor shall list each item with the Contractor's and Supplier's part number in its proposal and the reason that full, required warranty administration is not promised by the Contractor.

If the Contract includes Excepted Parts, and the Contractor requests approval from the Agency to assign its warranty obligation to a third party, the Contractor shall certify to the Agency that the Contractor has attempted in good faith to administer the component supplier's warranty program, and that the component supplier will not allow the Contractor to administer its warranty program. The Agency shall approve the transfer of warranty administration responsibility.

If the Agency approves the transfer of administration for warranty claim responsibility from the Contractor to a Supplier or Subcontractor, then:

- a. The Contractor shall supply adequate documentation that the component Supplier affirmatively accepts responsibility for warranty service;
- b. The Contractor shall state in writing that the Agency's warranty reimbursements will not be impacted. The Contractor also shall state in writing any exceptions and reimbursement, including all costs incurred in transport of vehicles and/or components. The Contractor shall supply all information necessary to enforce the warranty;
- c. The Contractor shall agree to assist the Agency in any actions to enforce the warranty; and
 - The Agency shall agree to accept this pass-through warranty and relieve the Contractor of further responsibility for that warranty, except as detailed herein.

WR 1.3.2 Superior Warranty

The Contractor shall pass on to the Agency any warranty offered by a component Supplier that is superior to that required herein. The Contractor shall provide a list to the Agency noting the conditions and limitations of the Superior Warranty no later than the start of production. The Superior Warranty shall not be administered by the Contractor.

WR 1.4 Fleet Defects

WR 1.4.1 Occurrence and Remedy

A Fleet Defect is defined as "cumulative failures of 25% of the same components in the same or similar application in a minimum fleet size of twenty (20) or more buses, where such items are covered by warranty." A Fleet Defect shall apply only to the base warranty period in sections entitled "Complete Bus," "Propulsion System" and "Major Subsystems." When a Fleet Defect is declared, the remaining warranty on that item/component stops. The warranty period does not restart until the Fleet Defect is corrected.

For the purpose of Fleet Defects, each option order shall be treated as a separate bus fleet. In addition, should there be a change in a major component within either the base order or an option order, the buses containing the new major component shall become a separate bus fleet for the purposes of Fleet Defects.

The Contractor shall correct a Fleet Defect under the warranty provisions defined in “Repair Procedures.” After correcting the Defect, the Agency and the Contractor shall mutually agree to, and the Contractor shall promptly undertake and complete a work program reasonably designed to, prevent the occurrence of the same Defect in all other buses and spare parts purchased under this Contract. Where the specific Defect can be solely attributed to particular identifiable part(s), the work program shall include redesign and/or replacement of only the defectively designed and/or manufactured part(s). In all other cases, the work program shall include inspection and/or correction of all the buses in the fleet via a mutually agreed-to arrangement. The Contractor shall update, as necessary, technical support information (parts, service and operator’s manuals) due to changes resulting from warranty repairs. The Agency may immediately declare a Defect in design resulting in a safety hazard to be a Fleet Defect. The Contractor shall be responsible for furnishing, installing and replacing all defective units.

WR 1.4.2 Exceptions to Fleet Defect Provisions

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

WR 2 Repair Procedures

WR 2.1 Repair Performance

The Contractor is responsible for all warranty-covered Repair Work. To the extent practicable, the Agency will allow the Contractor, or its designated representative, to perform such Work. At its discretion, the Agency may perform such Work if it determines it needs to do so based on transit service or other requirements. Such Work shall be reimbursed by the Contractor.

WR 2.2 Repairs by the Contractor

If the Agency detects a Defect within the warranty periods defined in this section, it shall, within thirty (30) days, notify the Contractor’s designated representative. The Contractor or its designated representative shall, if requested, begin Work on warranty-covered repairs within five (5) calendar days after receiving notification of a Defect from the Agency. The Agency shall make the bus available to complete repairs timely with the Contractor’s repair schedule.

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

WR 2.3 Repairs by the Agency

WR 2.3.1 Parts Used

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

WR 2.3.2 Contractor-Supplied Parts

The Agency may require that the Contractor supply parts for warranty-covered repairs being performed by the Agency. Those parts may be remanufactured but shall have the same form, fit and function, and warranty. The parts shall be shipped prepaid to the Agency from any source selected by the Contractor within fourteen (14) days of receipt of the request for said parts, and shall not be subject to an Agency handling charge.

WR 2.3.3 Defective Component Return

The Contractor may request that parts covered by the warranty be returned to the manufacturing plant. The freight costs for this action shall be paid by the Contractor. Materials should be returned in accordance with the procedures outlined in “Warranty Processing Procedures.”

WR 2.3.4 Failure Analysis

The Contractor shall, upon specific request of the Agency, provide a failure analysis of Fleet Defect or safety-related parts, or major components, removed from buses under the terms of the warranty, that could affect fleet operation. Such reports shall be delivered within sixty (60) days of the receipt of failed parts.

WR 2.3.5 Reimbursement for Labor and Other Related Costs

The Agency shall be reimbursed by the Contractor for labor. The amount shall be determined by the Agency for a qualified mechanic at a straight time wage rate of \$110 per hour, which includes fringe benefits and overhead, adjusted for the Agency’s most recently published rate in effect at the time the Work is performed, plus the cost of towing the bus if such action was necessary and if the bus was in the normal service area. These wage and fringe benefit rates shall not exceed the rates in effect in the Agency’s service garage at the time the Defect correction is made.

WR 2.3.6 Reimbursement for Parts

The Agency shall be reimbursed by the Contractor for defective parts and parts that must be replaced to correct the Defect. The reimbursement shall be at the current price at the time of repair and shall include taxes where applicable, plus 15% handling costs. Handling costs shall not be paid if parts are supplied by the Contractor and shipped to the Agency.

WR 2.3.7 Reimbursement Requirements

The Contractor shall respond to the warranty claim with an accept/reject decision, including necessary failure analysis, no later than sixty (60) days after the Agency submits the claim and defective part(s), when requested. Reimbursement for all accepted claims shall occur no later than sixty (60) days from the date of acceptance of a valid claim. The Agency may dispute rejected claims or claims for which the Contractor did not reimburse the full amount. The parties agree to review disputed warranty claims during the following quarter to reach an equitable decision to permit the disputed claim to be resolved and closed. The parties also agree to review all claims at least once per quarter throughout the entire warranty period to ensure that open claims are being tracked and properly dispositioned.

WR 2.4 Warranty After Replacement/Repairs

If any component, unit or subsystem is repaired, rebuilt or replaced by the Contractor, or by the Agency with the concurrence of the Contractor, then that 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 (5) days, in accordance with “Repairs by the Contractor.”

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, the item(s) shall have three (3) months or the remaining time and/or miles of the original warranty, whichever is greater. This remaining warranty period shall begin on the repair/replacement date for corrected items on each bus if the repairs are completed by the Contractor, or on the date that the Contractor provides all parts to the Agency.

WR 2.4.1 Warranty Processing Procedures

The following list represents requirements by the Contractor to the Agency for processing warranty claims. One failure per bus per claim is allowed.

- 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), such as for:
 - labor
 - materials
 - parts
 - handling
- Association with component failure eligible for warranty for costs claimed, such as:
 - towing
 - road calls
 - troubleshooting time

WR 2.5 Forms

The Agency’s forms will be accepted by the Contractor if all of the above information is included. Electronic submittal may be used if available between the Contractor and the Agency.

WR 2.6 Return of Parts

When returning defective parts to the Contractor, the Agency shall tag each part with the following:

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

WR 2.7 Timeframe

Each claim must be submitted no more than thirty (30) days from the date of failure and/or repair, whichever is later. All defective parts must be returned to the Contractor, when requested, no more than forty-five (45) days from the date of repair.

WR 2.8 Reimbursements

Reimbursements are to be transmitted to the address of the Transit Agency that placed the order.



SECTION 8: QUALITY ASSURANCE

QA 1 Contractor's In-Plant Quality Assurance Requirements

QA 1.1 Quality Assurance Organization

QA 1.1.1 Organization Establishment

The Contractor shall establish and maintain an effective in-plant quality assurance organization. It shall be a specifically defined organization and should be directly responsible to the Contractor's top management.

QA 1.1.2 Control

The quality assurance organization shall exercise quality control over all phases of production, from initiation of design through manufacture and preparation for delivery. The organization shall also control the quality of supplied articles.

QA 1.1.3 Authority and Responsibility

The quality assurance organization shall have authority over and responsibility for reliability, quality control, inspection planning, establishment of the quality control system, and acceptance/rejection of materials and manufactured articles in the production of the transit buses.

QA 1.2 Quality Assurance Organization Functions

QA 1.2.1 Minimum Functions

The quality assurance organization shall include the following minimum functions:

- **Work instructions:** The quality assurance organization shall verify inspection operation instructions to ascertain that the manufactured product meets all prescribed requirements.
- **Records maintenance:** The quality assurance organization shall maintain and use records and data essential to the effective operation of its program. These records and this data shall be available for review by the resident inspectors. Inspection and test records for this procurement shall be available for a minimum of one year after inspections and tests are completed.
- **Corrective action:** The quality assurance organization shall detect and promptly ensure correction of any conditions that may result in the production of defective transit buses. These conditions may occur in designs, purchases, manufacture, tests or operations that culminate in defective supplies, services, facilities, technical data or standards.

QA 1.2.2 Basic Standards and Facilities

The following standards and facilities shall be basic in the quality assurance process:

- **Configuration control:** The Contractor shall maintain drawings, assembly procedures and other documentation that completely describe a qualified bus that meets all of the options and special requirements of this procurement. The quality assurance organization shall verify that each transit bus is manufactured in accordance with these controlled drawings, procedures and documentation.
- **Measuring and testing facilities:** The Contractor shall provide and maintain the necessary gauges and other measuring and testing devices for use by the quality assurance organization to verify that the buses conform to all specification requirements. These devices shall be calibrated at established periods against certified measurement standards that have known, valid relationships to national standards.
- **Production tooling as media of inspection:** When production jigs, fixtures, tooling masters, templates, patterns and other devices are used as media of inspection, they shall be proved for accuracy at formally established intervals and adjusted, replaced or repaired as required to maintain quality.
- **Equipment use by resident inspectors:** The Contractor's gauges and other measuring and testing devices shall be made available for use by the resident inspectors to verify that the buses conform to all specification requirements. If necessary, the Contractor's personnel shall be made available to operate the devices and to verify their condition and accuracy.

QA 1.2.3 Maintenance of Control

The Contractor shall maintain quality control of purchases:

- **Supplier control:** The Contractor shall require that each Supplier maintains a quality control program for the services and supplies that it provides. The Contractor's quality assurance organization shall inspect and test materials provided by Suppliers for conformance with specification requirements. Materials that have been inspected, tested and approved shall be identified as acceptable to the point of use in the manufacturing or assembly processes. Controls shall be established to prevent inadvertent use of nonconforming materials.
- **Purchasing data:** The Contractor shall verify that all applicable specification requirements are properly included or referenced in purchase orders of articles to be used on transit buses.

QA 1.2.4 Manufacturing Control

- **Controlled conditions:** The Contractor shall ensure that all basic production operations, as well as all other processing and fabricating, are performed under controlled conditions. Establishment of these controlled conditions shall be based on documented Work instructions, adequate production equipment, and special working environments if necessary.
- **Completed items:** A system for final inspection and testing 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 analyses, tests and other quality control procedures may be used when appropriate in the quality assurance process.
- **Inspection status:** A system shall be maintained by the quality assurance organization for identifying the inspection status of components and completed transit buses. Identification may include cards, tags or other normal quality control devices.

QA 1.2.5 Inspection System

The quality assurance organization shall establish, maintain and periodically audit a fully documented inspection system. The system shall prescribe inspection and test of materials, Work in process and completed articles. At 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 a bus. Articles that become obsolete as a result of engineering changes or other actions shall be controlled to prevent unauthorized assembly or installation. Unusable articles shall be isolated and then scrapped. Discrepancies noted by the Contractor or resident inspectors during assembly shall be entered by the inspection personnel on a record that accompanies the major component, subassembly, assembly or bus from start of assembly through final inspection. Actions shall be taken to correct discrepancies or deficiencies in the manufacturing processes, procedures or other conditions that cause articles to be in nonconformity with the requirements of the Contract specifications. The inspection personnel shall verify the corrective actions and mark the discrepancy record. If discrepancies cannot be corrected by replacing the nonconforming materials, then the Agency shall approve the modification, repair or method of correction to the extent that the Contract specifications are affected.
- **Quality assurance audits:** The quality assurance organization shall establish and maintain a quality control audit program. Records of this program shall be subject to review by the Agency.

QA 2 Inspection

QA 2.1 Inspection Stations

Inspection stations shall be at the best locations to provide for the Work content and characteristics to be inspected. Stations shall provide the facilities and equipment to inspect structural, electrical, hydraulic and other components and assemblies for compliance with the design requirements.

Stations shall also be at the best locations to inspect or test characteristics before they are concealed by subsequent fabrication or assembly operations. These locations shall minimally include underbody structure completion, body framing completion, body prior to paint preparation, water test, 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.

QA 2.2 Resident Inspectors

An on-site resident inspector is **not required** for (1) procurements of 10 or fewer buses; or (2) procurements of 20 or fewer vehicles serving rural (other than urbanized) areas, or urbanized areas of 200,000 people or fewer; or (3) procurements of any number of primary manufacturer standard production or unmodified vans. For the purposes of this exception, vehicle count will be considered on a per-agency and per-production run basis.

QA 2.2.1 Resident Inspector's Role

The Agency shall be represented at the Contractor's plant by resident inspectors. Resident inspectors may be Agency employees or outside contractors. The Agency shall provide the identity of each inspector and shall also identify their level of authority in writing. They shall monitor, in the Contractor's plant, the manufacture of transit buses built under this 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. The Agency shall designate a primary resident inspector, whose duties and responsibilities are delineated in "Pre-Production Meetings,"

“Authority,” and “Pre-Delivery Tests.” Contractor and resident inspector relations shall be governed by the guidelines included as Attachment A to this section.

QA 2.2.2 Pre-Production Meetings

The primary resident inspector may participate in design review and pre-production meetings with the Agency. At these meetings, the configuration of the buses and the manufacturing processes shall be finalized, and all Contract documentation provided to the inspector. If the final configuration includes any changes, the Agency and the Contractor shall work together to accomplish the change with as little delay as possible. These changes cannot be done within thirty (30) calendar days before production.

No less than thirty (30) calendar days prior to the beginning of bus manufacture, the primary resident inspector may meet with the Contractor’s quality assurance manager and may conduct a pre-production audit meeting. They shall review the inspection procedures and finalize inspection checklists. The resident inspectors may begin monitoring bus construction activities two weeks prior to the start of bus fabrication.

QA 2.2.3 Authority

Records and data maintained by the quality assurance organization shall be available for review by the resident inspectors. Inspection and test records for this procurement shall be available for a minimum of one year after inspections and tests are completed.

The Contractor’s gauges and other measuring and testing devices shall be made available for use by the resident inspectors to verify that the buses conform to all specification requirements. If necessary, the Contractor’s personnel shall be made available to operate the devices and to verify their condition and accuracy.

Discrepancies noted by the resident inspector during assembly shall be entered by the Contractor’s inspection personnel on a record that accompanies the major component, subassembly, assembly or bus from start of assembly through final inspection. Actions shall be taken to correct discrepancies or deficiencies in the manufacturing processes, procedures or other conditions that cause articles to be in nonconformity with the requirements of the Contract specifications. The inspection personnel shall verify the corrective actions and mark the discrepancy record. If discrepancies cannot be corrected by replacing the nonconforming materials, then the Agency shall approve the modification, repair or method of correction to the extent that the Contract specifications were affected.

The primary resident inspector shall remain in the Contractor’s plant for the duration of bus assembly Work under this Contract. Only the primary resident inspector or designee shall be authorized to release the buses for delivery. The resident inspectors shall be authorized to approve pre-delivery acceptance tests. Upon request to the quality assurance supervisors, the resident inspectors shall have access to the Contractor’s quality assurance files related to this procurement. These files shall include drawings, assembly procedures, material standards, parts lists, inspection processing and reports, and records of Defects.

QA 2.2.4 Support Provisions

The Contractor shall provide office space for the resident inspectors in close proximity to the final assembly area. This office space shall be equipped with desks, outside and inter-plant telephones, internet access, file cabinet(s) and chairs.

QA 2.2.5 Compliance with Safety Requirements

At the time of the pre-production meeting, the Contractor shall provide all safety and other operational restrictions that govern the Contractor’s facilities. These issues will be discussed and the parties will agree which rules/restrictions will govern the Agency’s inspector(s) and any other Agency representatives during the course of the Contract.

QA 3 Acceptance Tests

QA 3.1 Responsibility

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

QA 3.2 Pre-Delivery Tests

The Contractor shall conduct acceptance tests at its plant on each bus following completion of manufacture, and before delivery to the Agency. These pre-delivery tests shall include visual and measured inspections, as well as testing the total bus operation—and, if electric drive, the charging operation. The tests shall be conducted and documented in accordance with written test plans approved by the Agency.

Additional tests may be conducted at the Contractor’s discretion to ensure that completed buses have attained the required quality and have met the requirements in Section 6, “Technical Specifications.” The Agency may, prior to commencement of production, demand that the Contractor demonstrate compliance with any requirement in

that section if there is evidence that prior tests have been invalidated by a Contractor 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 configurations. Any additional testing shall be recorded on appropriate test forms provided by the Contractor and shall be conducted before acceptance of the bus.

The pre-delivery tests shall be scheduled and conducted with thirty (30) days' notice so that they may be witnessed by the resident inspectors, who may accept or reject the results of the tests. The results of pre-delivery tests, and any other tests, shall be filed with the assembly inspection records for each bus. The underfloor equipment shall be available for inspection by the resident inspectors, using a pit or bus hoist provided by the Contractor. A hoist, scaffold or elevated platform shall be provided by the Contractor to easily and safely inspect bus roofs. Delivery of each bus shall require written authorization of the primary resident inspector. Authorization forms for the release of each bus for delivery shall be provided by the Contractor. An executed copy of the authorization shall accompany the delivery of each bus.

QA 3.2.1 Visual and Measured Inspections

Visual and measured inspections shall be conducted with the bus in a static condition. The purpose of the inspection testing includes verification of overall dimensions and weight requirements, that required components are included and are ready for operation, and that components and subsystems designed to operate with the bus in a static condition do function as designed.

QA 3.2.2 Total Bus Operation

Total bus operation shall be evaluated during road tests. The purpose of the road tests is to observe and verify the operation of the bus as a system, and to verify the functional operation of the subsystems that can be operated only while the bus is in motion.

Each bus shall be driven for a minimum of fifteen (15) miles during the road tests. If requested, computerized diagnostic printouts or electronic files showing the performance of each bus shall be produced and provided to the Agency. Observed Defects shall be recorded on the test forms. The bus shall be retested when Defects are corrected and adjustments are made. This process shall continue until Defects or required adjustments are no longer detected.

QA 3.2.3 Pre-Delivery Tests Required

The Contractor shall conduct pre-delivery testing necessary to ensure vehicles will pass post-delivery testing.

QA 3.3 Post-Delivery Tests

The Agency and Contractor shall conduct post-delivery tests within the required time after the delivery of each bus to the designated point of delivery, as set out in sections GC 4 and GC 5. The Agency and Contractor shall complete the following post-delivery tests:

QA 4 Agency-Specific Requirements

No additional Requirements

Attachment A: New Bus Manufacturing Inspection Guidelines

Pre-Production Meeting Responsibilities

Agency

- Provides conformed copy of technical requirements.
- Recommended staff to be involved may include the following:
 - project manager
 - technical engineer
 - contract administrator
 - quality assurance administrator
 - warranty administrator
- Process for inspector's role (to deal with Agency) for negotiated changes after freeze date.
- Contractual requirements:
 - milestones
 - documentation
 - title requirements
 - deliverables
 - payments
 - reliability tracking

Manufacturer

- Identifies any open issues.
- Recommended staff to be involved may include the following:
 - project manager
 - technical engineer(s)
 - contract administrator
 - quality assurance administrator
 - warranty administrator
- Production flow (buses/week, shifts).
- Delivery schedule and off-site component build-up schedule.
- Bus QA documentation (including supplier application approvals and/or any certifications required for the specific production).
- Communication flow/decision-making.

Inspector

- Agrees on decisions inspectors can and cannot make.
- Primary contact for problems, etc.
- Production flow process (description of manufacturing by station).
- Factory hours (manage inspection schedule based on production hours).
- Plant rules.
- Safety requirements.
- Orientation requirements.
- Work environment.
- Inspector's office space (per contract).

Build Schedule

The bus manufacturer's contract administrator shall supply a fleet build production schedule based on the dates in the Notice to Proceed, and a description of the manufacturer's schedule for plant operations.

The production schedule should contain specific milestone dates, such as the following:

- First vehicle on production line (date on which any work will begin)
- First vehicle off production line
- First vehicle through manufacturer's quality assurance inspections
- First vehicle shipped to the Agency
- Last vehicle on production line
- Last vehicle off production line
- Last vehicle shipped to the Agency

Plant Tour (if Meeting at Manufacturer's Location)

The Agency will review the entire process from start to finish and review the work completed at each line station, including quality control measures.

Prototype/Pilot Vehicle Production

The Contractor shall conduct acceptance tests at its plant on each bus following completion of manufacture, and before delivery to the Agency. These pre-delivery tests shall include visual and measured inspections, as well as testing of the total bus operation. The tests shall be conducted and documented in accordance with written test plans approved by the Agency. The underfloor equipment shall be available for inspection by the resident inspectors, using a pit or bus hoist provided by the Contractor. A hoist, scaffold or elevated platform shall be provided by the Contractor to easily and safely inspect bus roofs. Delivery of each bus shall require written authorization of the primary resident inspector. Authorization forms for the release of each bus for delivery shall be provided by the Contractor. An executed copy of the authorization shall accompany the delivery of each bus.

Additional tests may be conducted at the Agency's discretion to ensure that the completed buses have attained the required quality and have met the requirements in Section 6, "Technical Specifications." The Agency may, prior to commencement of production, demand that the Contractor demonstrate compliance with any requirement in that section if there is evidence that prior tests have been invalidated by the Contractor's change of Supplier or change in manufacturing process. Such demonstration shall be by actual test, or by supplying a report of a previously performed test on similar or like components and configuration. Any additional testing shall be recorded on appropriate test forms provided by the Contractor and shall be conducted before acceptance of the bus.

The pre-delivery tests shall be scheduled and conducted with 30 days' notice so that they may be witnessed by the resident inspectors, who may accept or reject the results of the tests. The results of pre-delivery tests, and any other tests, shall be filed with the assembly inspection records for each bus.

Visual and Measured Inspections

Visual and measured inspections shall be conducted with the bus in a static condition. The purpose of the inspection testing includes verification of overall dimension and weight requirements, that required components are included and are ready for operation, and that components and subsystems designed to operate with the bus in a static condition do function as designed.

Total Bus Operation

Total bus operation shall be evaluated during road tests. The purpose of the road tests is to observe and verify the operation of the bus as a system and to verify the functional operation of the subsystems that can be operated only while the bus is in motion.

Each bus shall be driven for a minimum of 15 miles during the road tests. If requested, computerized diagnostic printouts showing the performance of each bus shall be produced and provided to the Agency. Observed defects shall be recorded on the test forms. The bus shall be retested when defects are corrected and adjustments are made. This process shall continue until defects or required adjustments are no longer detected.

Post-Delivery Tests

The Agency shall conduct acceptance tests on each delivered bus. These tests shall be completed within 15 days after bus delivery and shall be conducted in accordance with the Agency's written test plans. The purpose of these tests is to identify defects that have become apparent between the time of bus release and delivery to the Agency. The post-delivery tests shall include visual inspection and bus operations. No post-delivery test shall apply new criteria that are different from criteria applied in a pre-delivery test.

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

Prototype/Pilot Vehicle Acceptance

In order to assess the Contractor's compliance with the Technical Specifications, the Agency and the Contractor shall, at the pre-production meeting, jointly develop a Configuration and Performance Review document for review of the pilot vehicle. This document shall become part of the official record of the pre-production meeting.

Potential dimensional/performance tests that may be included in the Configuration and Performance Review include the following:

- complete electrical system audit
- dimensional requirements audit
- seating capacity
- water test
- water runoff test
- function test of systems/subsystems and components
- sound/noise level tests
- vehicle top speed

- acceleration tests
- brake stop tests
- airflow tests
- PA function tests
- air/brake system audit
- individual axle weight
- standee capacity
- body deflection tests
- silent alarm function test
- interior lighting
- exterior lighting
- gradeability test
- kneeling system function
- HVAC pull-down/heat
- speedometer
- outside air infiltration (smoke)
- wheeled mobility device ramps
- propulsion system performance qualification
 - This test shall be jointly conducted by the Contractor and the propulsion system manufacturer (including, but not limited to, charge air cooler performance, air to boil test, loss of coolant, fuel system, electrical inputs and protection systems).
- transmission performance qualifications
 - This test shall be jointly conducted by the Contractor and the transmission manufacturer (including, but not limited to, retarder operation, heat exchanger, interface with ABS and electrical inputs).

Buy America Audit

A post-delivery Buy America audit is required for federally funded bus procurements (see 49 CFR Part 663 for additional information). The on-site resident inspectors are to monitor the production processes to verify compliance with final assembly requirements identified by the Buy America pre-award audit. This audit is to verify compliance with final assembly requirements and final documentation of Buy America compliance, and must be completed prior to title transfer.

QA 4.1.1 Resident Inspection Process for Serial Production

At the discretion of the Agency, a decision will be made to perform resident inspection using the Agency's personnel, a contract inspector or a combination of both. This decision is based on factors such as the availability of personnel, knowledge/expertise in bus build project management, the size of the bus order, etc.

QA 4.1.2 Inspector Responsibilities

The resident inspection process for the serial production of the buses begins following the completion and acceptance of the prototype or pilot vehicle if required, or according to the serial bus production schedule. Resident inspectors should represent the Agency for all build-related issues (quality, conformance, etc.). Resident inspectors can also address contractual-type issues but should only do so under the consult of the Agency's contracts administrator.

Resident inspectors are sent to the manufacturer's facility according to a Resident Inspection Schedule. Typically, one or two inspectors arrive on-site at the manufacturing facility about one week prior to actual production to setup the resident inspection process and to begin preliminary quality assurance inspections for items such as powerplant build-up and wire harness production; as well as to inspect incoming parts, fasteners, fluids, etc., that will be used in the production of the buses. During the serial production of the buses, the resident inspectors should monitor the production of each bus, verifying the quality of materials, components, subassemblies and manufacturing standards. In addition, the configuration of each vehicle should be audited using the vehicle manufacturer's build specification and other documents to ensure contract compliance and uniformity.

Inspector Rotation/Scheduling

During the resident inspection phase, a single inspector or multiple inspectors can be used. If it is decided to use multiple inspectors, then the inspectors can be rotated on a biweekly-to-monthly basis as required. During the rotation of inspectors, a sufficient period of overlap should be provided to guarantee the consistency of the resident inspection process.

Resident Inspector Orientation

A resident inspector orientation by the bus manufacturer should take place upon the arrival of the initial inspection team. The orientation should include expectations for the use of personal protective equipment (safety shoes, safety glasses, etc.), daily check-in and check-out requirements, lines of communication, use of production documents (such as speed memos and line movement charts), inspector/production meetings, inspector office arrangements, and anything else pertinent to the inspection team's involvement during the build. Many of the above items should already have been formalized during the pre-production meeting.

Audits, Inspections and Tests

The resident inspection process monitors the production of each vehicle. Inspection stations should be strategically placed to test or inspect components or other installations before they are concealed by subsequent fabrication or assembly operations. These locations are typically placed for the inspection of underbody structure, body framing, electrical panels and harnesses, air and hydraulic line routings, installation of insulation, powerplant build-up and installation, rust inhibitor/undercoating application, floor installation, front suspension alignment, and other critical areas.

Vehicle Inspections

Each bus is subjected to a series of inspections after it reaches the point of final completion on the assembly line. Typically, the vehicle manufacturer performs its own quality assurance inspections following assembly line completion before releasing each bus to the resident inspectors. The inspections for each vehicle are documented, signed off upon passing and included in the vehicle record.

These are the typical inspections performed on each bus by the resident inspectors:

- water test inspection
- road test inspection
- interior inspection (including functionality)
- hoist/undercarriage inspection
- exterior inspection (including roof)
- electrical inspection
- wheeled mobility device ramp/lift inspection

Water Test Inspection

The water test inspection checks the integrity of the vehicle's body seams, window frame seals and other exterior component closeouts for their ability to keep rainwater, road splash, melting snow and slush, and other exterior water from entering the inside of the vehicle. The vehicle's interior is inspected for signs of moisture and water leaks. To perform the leak inspection, interior ceiling and side panels are removed, and access doors are opened. If any moisture or water is detected, then the source of the leak will be located and repaired by the manufacturer, and the vehicle will be tested again.

Road Test Inspection

The road test inspection checks all the vehicle's systems and subsystems while the vehicle is in operation. Typically, the road test inspection is performed immediately following the water test inspection to reveal any standing water that may be present due to a leak, but was not noticed during the "static" water test. Objectionable vibrations, air leakage and other factors that affect ride quality are recorded and reported to the vehicle manufacturer for resolution. Vehicle stability, performance, braking and interlock systems, HVAC, and other critical areas are checked to ensure that the vehicle is complete and ready to provide safe and reliable service.

The following tests may be performed and recorded during the road test:

- acceleration test
- top speed test
- gradeability test
- service brake test
- parking brake test
- turning effort test
- turning radius test
- shift quality
- quality of retarder or regenerative braking action

During the road test, a vehicle may be taken to a weigh station to record the vehicle's front axle weight, rear axle weight and total vehicle (curb) weight.

Interior Inspection

The interior inspection checks the fit and finish of the interior installations. In addition, the inspection also verifies the installation and function of systems and subsystems according to the build specification. All systems and functions accessed from the interior are inspected for functionality, appearance and safety.

Examples of systems/functions inspected include the following:

- interior and exterior lighting controls
- front and rear door systems
- flooring installation
- passenger and operator's seat systems
- wheeled mobility device securement and ramp systems
- fire suppression system

- electrical installations (multiplex, telltale wiring, panels, etc.)
- window systems and emergency escape portals
- operator dash/side panel controls/indicators

Hoist/Undercarriage Inspection

The hoist/undercarriage inspection checks the installation of components, wiring, air lines, presence of fluid leaks, etc., located under the vehicle. Typically, this inspection is performed following the road test. The vehicle is lifted onto a hoist or pulled over a pit for the inspection. Areas inspected are the front suspension, air bags, air line routings, electrical connections and routings, drivetrain components, linkages, and any other system or component that may be prone to early failure due to inadequate installation techniques. All lines, cables, hoses, etc., are inspected for proper securement and protection to prevent rubbing, chafing or any other condition that could result in a failure. The engine/powerplant and HVAC compartments are also inspected during this time.

Exterior Inspection

The exterior inspection checks the fit and finish of components installed on the exterior of the vehicle. Access panels are opened and accessories are inspected for proper installation. In addition, vehicle paint, graphics and proper decals are also inspected. Acceptable paint finish quality (orange peel, adhesion, etc.) should be agreed on with the vehicle manufacturer prior to production to ensure consistency of inspections.

Electrical Inspection

The vehicle's main electrical panels and other subpanels are inspected for proper components, to include relays, fuses, modules, terminal strips, decals, etc. In addition, electrical harnesses are inspected for proper wiring and termination techniques, bulkhead protection, looming, and other items that could result in future electrical failure. Onboard vehicle compartment schematics are verified for accuracy.

Wheeled mobility device Ramp Inspection

The wheeled mobility device ramp assembly is inspected for proper installation and performance. Clearances critical to the operation of the ramp are verified, and the ramp's electrical systems are inspected to ensure appropriate wire routings and protection. The successful integration of the ramp assembly into the vehicle is verified, and the vehicle interlocks are checked during automatic and manual ramp operation.

Audits

During serial production of the bus's quality assurance inspection, tests may be performed to ensure that the manufacturer's quality standards are being followed. These inspection audits could be on items such as torque wrench calibrations, proper techniques for fastener installations, proper use and type of adhesives, use of correct installation drawings on the production line, etc.

Communication

The lines of communication, formal and informal, should be discussed and outlined in the pre-production meeting. As previously discussed, resident inspectors should represent the Agency for all bus-build related issues (quality, conformance, etc.). Resident inspectors can relay communications addressing contractual type issues but should do so only under the consult of the Agency's contract administrator. Actual personnel contacts for the manufacturing facility should be established during resident inspector orientation. These contacts could include quality assurance, production, material handling, engineering and buy-off area personnel.

Documentation

The following documents/reports are typically generated during the bus build process:

- Vehicle build specification
- Sales order
- Pre-production meeting notes
- Prototype and production correspondence (vehicle build file)
- Manufacturer's vehicle record (warranty file):
 - Vehicle line documents
 - Serialization documents (warranty file)
 - Alignment verification
 - Brake testing
 - HVAC testing and checkout
 - Manufacturer's QA checklist and sign-off
 - Weight slip (prototype and warranty file)
 - Prototype performance tests document (vehicle build file):
 - Acceleration Test
 - Top Speed Test
 - Gradeability Test
 - Interior Noise Test A – Stationary
 - Interior Noise Test B – Dynamic
 - Exterior Noise Test A – Pull Away

- Exterior Noise Test B – Pass-By
- Exterior Noise Test C – Curb Idle
- Turning Radius Test
- Turning Effort Test
- Parking Brake Test
- Service Brake Test
- Vehicle acceptance inspections – production (warranty file)
 - Water Test Inspection Report
 - Road Test Inspection Report
 - Interior Inspection Report
 - Hoist/Undercarriage Inspection Report
 - Exterior Inspection Report
 - Electrical Inspection Report
 - Wheeled mobility device Inspection Report
- Speed memos (warranty file)
- Agency vehicle inspection record (warranty file)
- Release for delivery documentation (warranty file)
- Post-production acceptance – Certificate of Acceptance (accounting)
- Post-Delivery Inspection Report – (fleet management and warranty files)

Vehicle Release for Delivery

Upon satisfactory completion of all inspection, audit and test criteria, and resolution of any outstanding issues affecting the purchase of any or all buses, proper documentation (the Release for Delivery) is signed by the designated resident inspector authorizing the bus manufacturer to deliver the vehicle to the Agency's facility, where it will undergo a post-delivery inspection process and final acceptance. The satisfactory sign-off of the Release for Delivery should complete the resident inspector's duties for each bus. In final preparation for delivery, the bus manufacturer may request the resident inspector to do a final walk-through of the bus after it has been cleaned and prepped for shipping.

Post-Delivery and Final Acceptance

The Agency shall conduct acceptance tests on each delivered bus. These tests shall be completed within 15 days after bus delivery and shall be conducted in accordance with the Agency's written test plans. The purpose of these tests is to identify defects that have become apparent between the time of bus release and delivery to the Agency. The post-delivery tests shall include visual inspection, along with a verification of system(s) functionality and overall bus operations. No post-delivery test shall apply new criteria that are different from criteria applied in a pre-delivery test.

Buses that fail to pass the post-delivery tests are subject to nonacceptance. The Agency shall record details of all defects on the appropriate test forms and shall notify the Contractor of acceptance or nonacceptance of each bus within five days after completion of the tests. The defects detected during these tests shall be repaired according to procedures defined in the contract after nonacceptance.

Certificate of Acceptance

- **Accepted**
- **Not accepted:** In the event that the bus does not meet all requirements for acceptance, the Agency must identify reasons for nonacceptance and work with the OEM to develop a timeline of addressing the problem for satisfactory resolution and redelivery.
- **Conditional acceptance:** In the event that the bus does not meet all requirements for acceptance, the Agency may conditionally accept the bus and place it into revenue service pending receipt of Contractor furnished materials and/or labor necessary to address the identified issue(s).